

# Operating Instructions

## DULCOMETER® D2C

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

D2C2-001-pH/ORP-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!**

## 1 Device Identification / Identity Code

D2C A		controller DULCOMETER® D2C Series	
		<b>Installation</b>	
D		Control panel installation 96 x 96 mm (IP 54)	
W		Wall mounted (IP 65)	
		<b>Power supply</b>	
0		230 V, 50/60 Hz	
1		115 V, 50/60 Hz	
4		24 V, AC/DC	
		<b>Measured variables (measured variable 1/ measured variable 2)</b>	
PC		pH/chlorine (pH 0-14; 0-0.5/2/5/10/20 ppm)	
PR		pH/redox (pH 0-14; 0-1000 mV)	
PP		pH/pH (0-14 pH) <sup>1)</sup>	
		<b>Measured variable 1 connector (m.v. 2 always via 4-20 mA)</b>	
1		Standard 0/4-20 mA terminal (measuring transducer, see section 5.5.1 or 5.2.1)	
2		SN6 plug	
5		mV terminal	
		<b>Correction variable (temperature compensation for pH)</b>	
0		None	
2		Temperature for P via terminal (Pt 100) for pH only	
4		Manual temperature input for P for pH only	
		<b>Disturbance signal</b>	
0		None	
		<b>Signal output</b>	
0		None	
4		2 programmable 0/4-20 mA standard signal outputs	
		<b>Relay control</b>	
G		Alarm and 2 limit relay	
M		Alarm and 2 solenoid valve relay (pulse length control)	
		<b>Control characteristic</b>	
1		Proportional control	
2		PID control	
		<b>Protocol output</b>	
0		None	
		<b>Language</b>	
D		German	
E		English	
F		French	
S		Spanish	
A		Swedish	
N		Dutch	

**Please enter the identity code of your device here!**

**NOTE**

<sup>1)</sup> The pH/pH version contains only a 2-way controller. Measured variable 2 can only be used for monitoring tasks.

The identity code shown describes a wall-mounted DULCOMETER® D2C A proportional controller, 230 V, operating dosing pumps.


The measured variables are the pH value and the chlorine concentration: these are transmitted via a mA signal.

The controller contains 2 limit value relays.

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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.



**IMPORTANT**

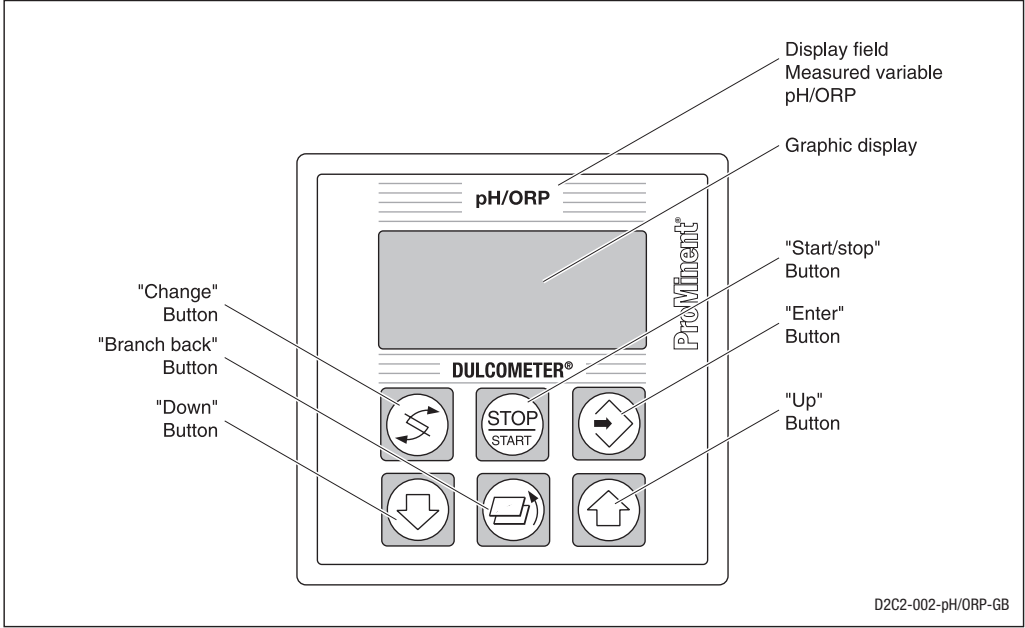
- *Please observe the parts of these operating instructions applicable to your particular version! This is indicated in the Section “Device Identification / Identity Code”.*
- *Correct measuring and dosing is only possible in the case of impeccable operation of the probe. The probe has to be calibrated / checked regularly!*

*In the event of a probe failure, uncontrolled chemicals addition may result. We therefore recommend urgently to activate “check out time limits” with automatic control shut-off!*

**NOTE**

A form “Documentation of controller settings Type D2C” is available under [www.prominent.com/documentation\\_D2C](http://www.prominent.com/documentation_D2C) for the purpose of documenting the controller settings.

3    **Device Overview / Controls**



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

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

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## 4 Functional Description

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### **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 via control variable) can be switched off via the Pause function and the sample 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**

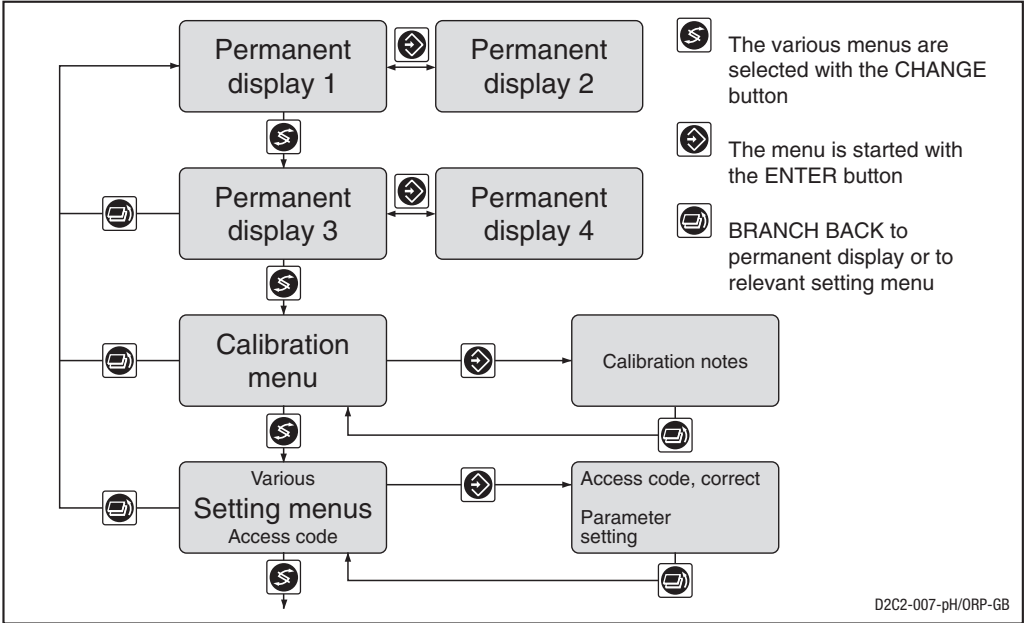
Faults to be acknowledged are shown in the permanent displays 1, 3 and 4 by the symbol "E". The corresponding fault messages and notes are shown in the permanent display 2. Faults/notes continuing after acknowledgement are shown alternatively. Faults automatically remedied through changing operating 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
	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
	Control ON	Symbol right
	Solenoid valve measured value 1 Control OFF	Symbol left
	Control ON	Symbol left
	Solenoid valve measured value 2 Control OFF	Symbol right
	Control ON	Symbol right
	Stop button pressed	
	Manual metering	
pause 	Delay time "td"	Control starts after expiry of "td"
	Fault	

## 6 Operation



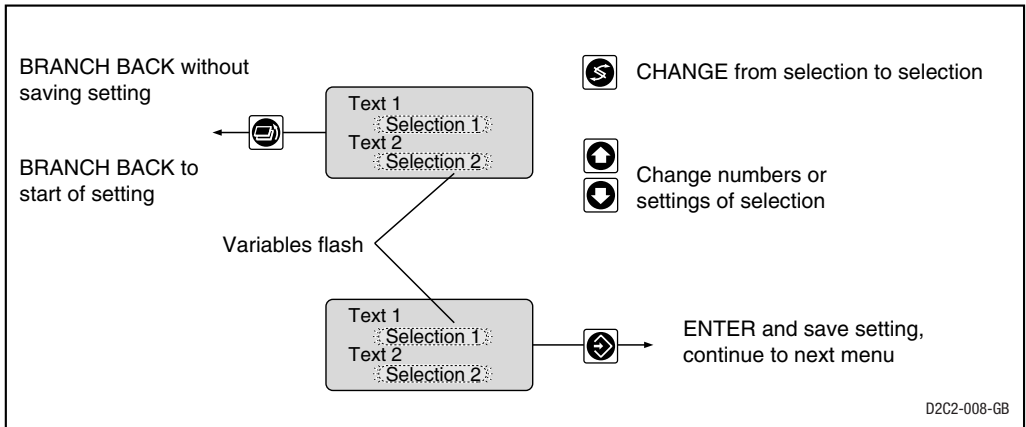
### NOTE

**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!**

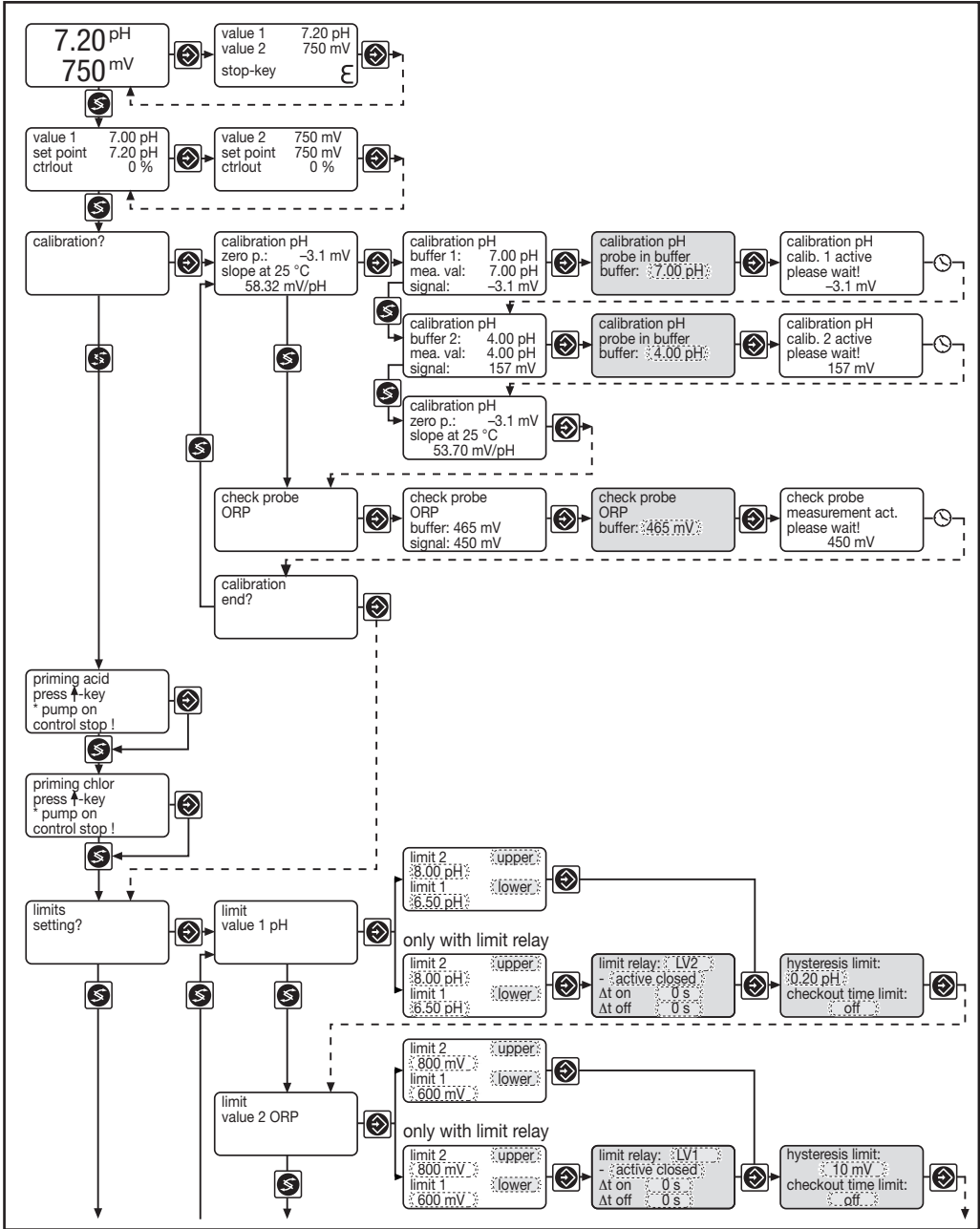
**If the access code is selected correctly in a setting menu, then the following setting menus are also accessible!**

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



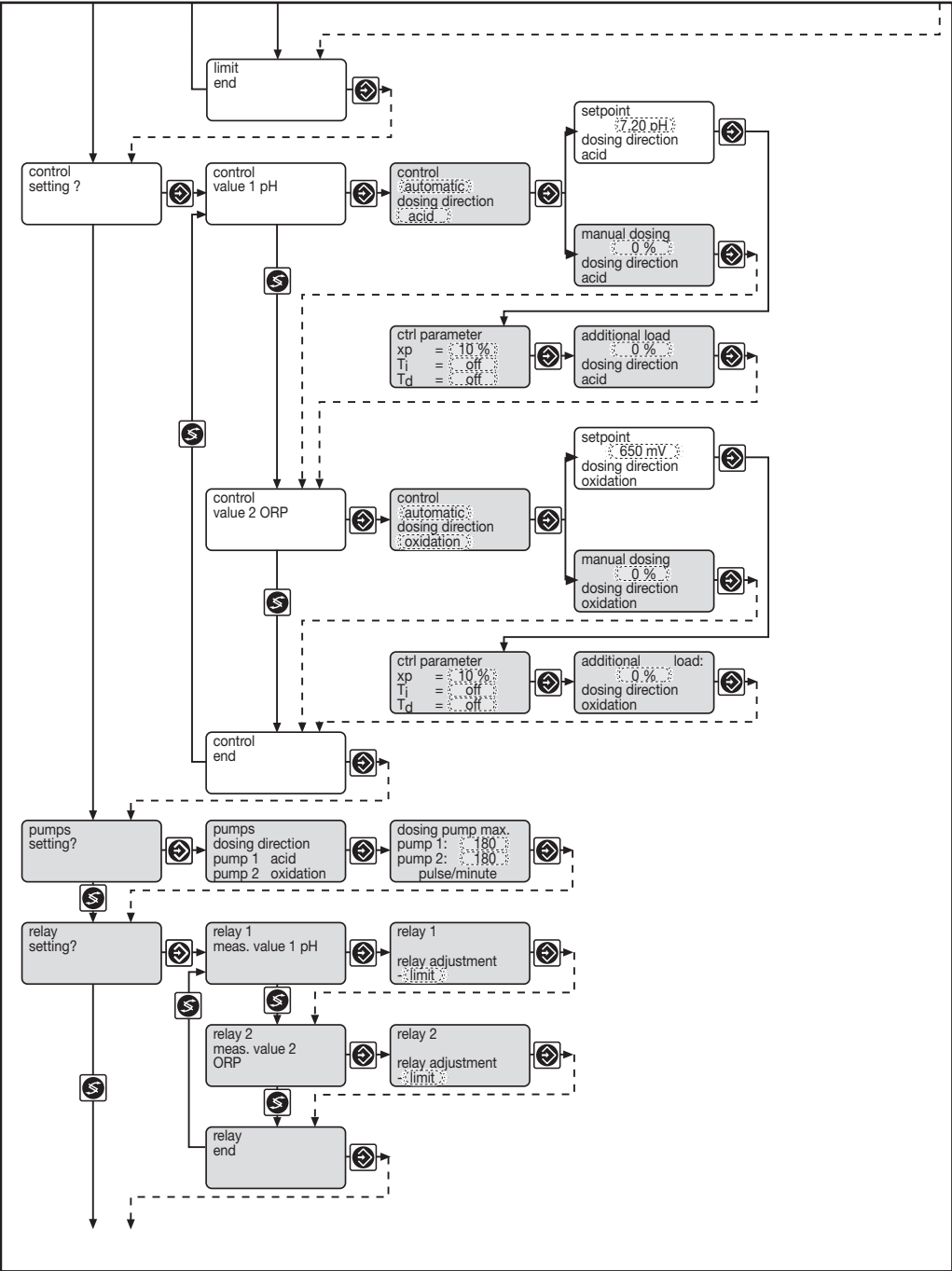
## 7 Operating Menu / Overview

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

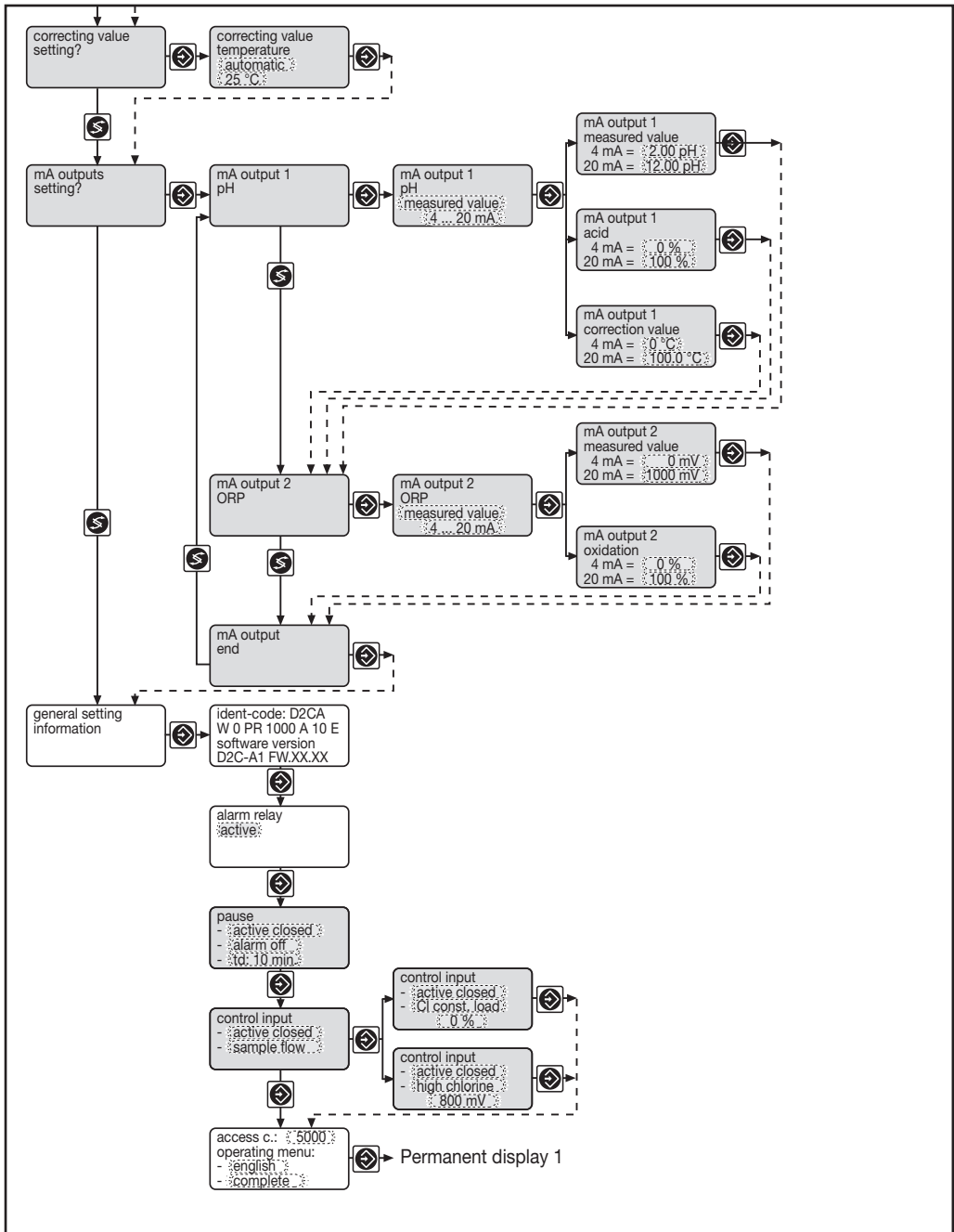




# Operating Menu / Overview

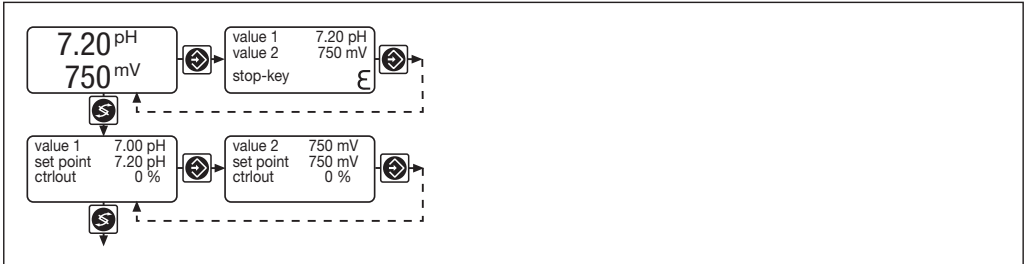


## Operating Menu / Overview



# 8    Operating Menu / Description

## Permanent displays

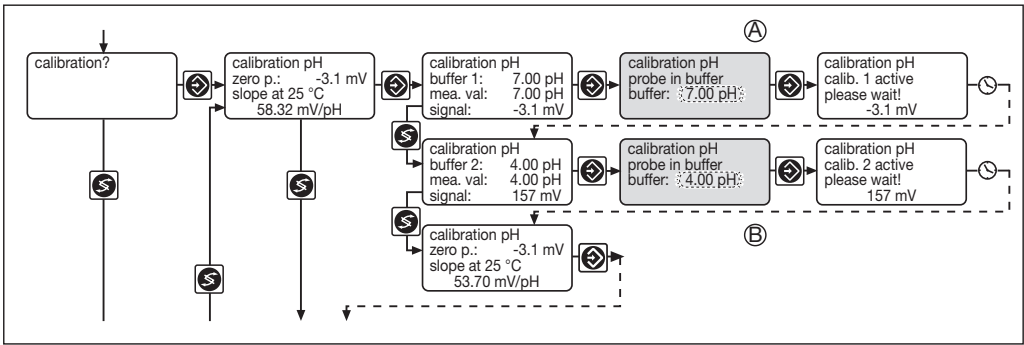


The permanent displays 1 to 4 serve information on fault messages/causes (see also table on page 24) as well as on operating values/settings.

## 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.



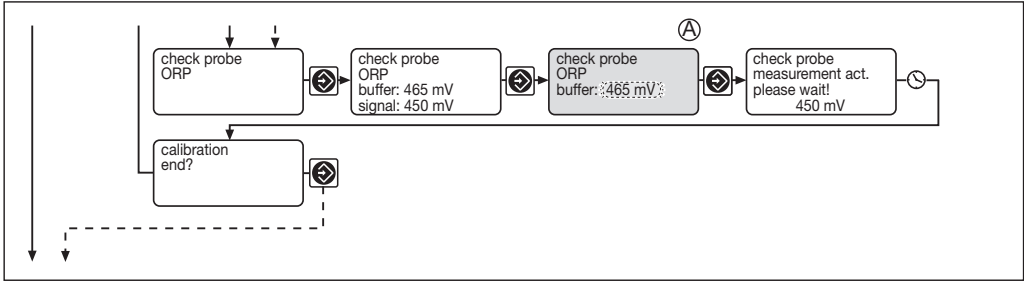
	Initial value	Possible values			Remarks
		Increment	Lower value	Upper value	
Buffer values	pH 7 pH 4	pH 0.01	pH -2	pH 16	Error messages when both buffers too close (<2 pH-values)

# Operating Menu / Description

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

## 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			Remarks
		Increment	Lower value	Upper value	
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

## 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!)

# Operating Menu / Description

To carry out this function, see priming menu.

Priming:

priming acid  
press ↑-key  
\* pump on  
control stop !

or

priming chlor  
press ↑-key  
\* pump on  
control stop !

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.

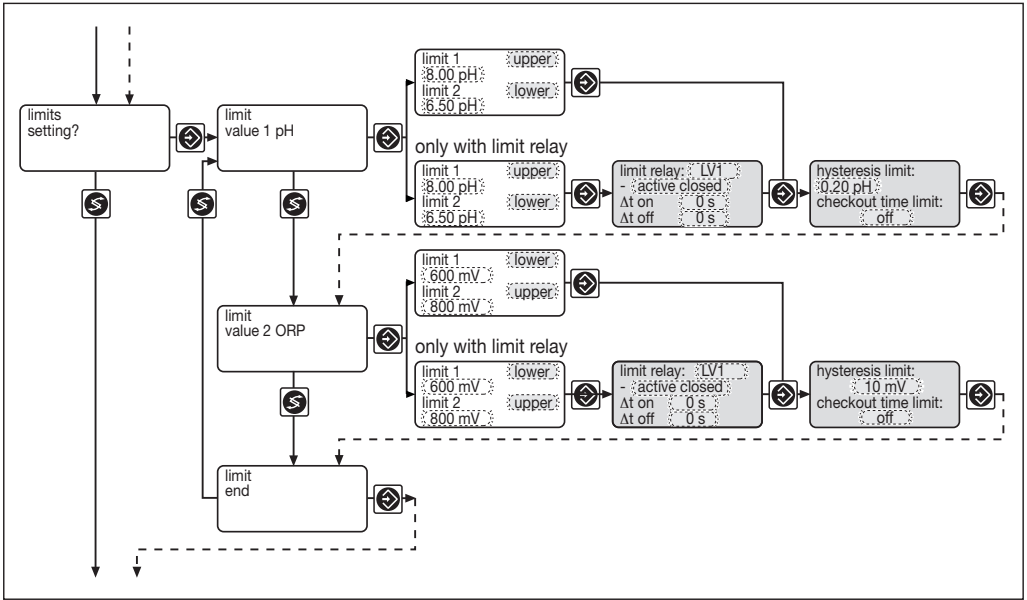
Recommence control:

- 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.

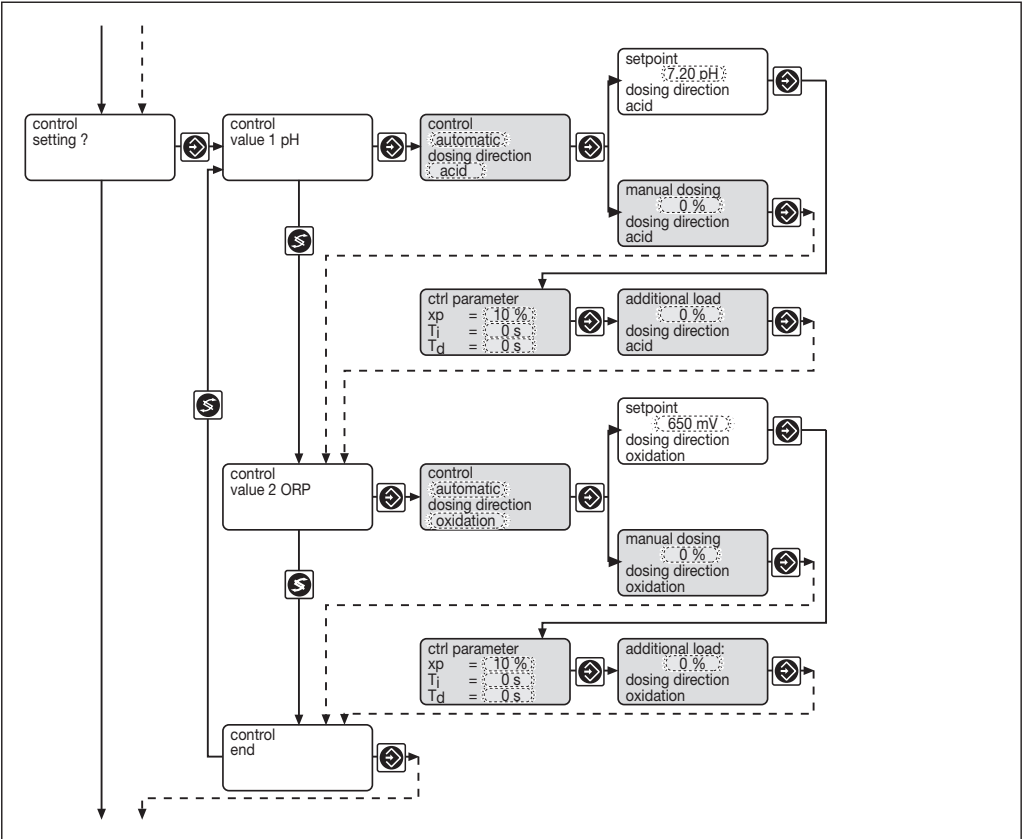


## Operating Menu / Description

	Initial value	Possible values		Upper value	Remarks
		Increment	Lower value		
Type of limit transgression					Limit transgression when exceeding or dropping below value.          *With regard to the setting "zone", the difference between the limits and the set hysteresis should be $\geq 3x$ .
Measured value 1 pH	upper	upper			
Measured value 2 ORP	lower	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 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			
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* $\Delta t$ on	0 s	1 s	0 s	9999 s	
Switch-off delay* $\Delta t$ 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.

# Operating Menu / Description

## Control

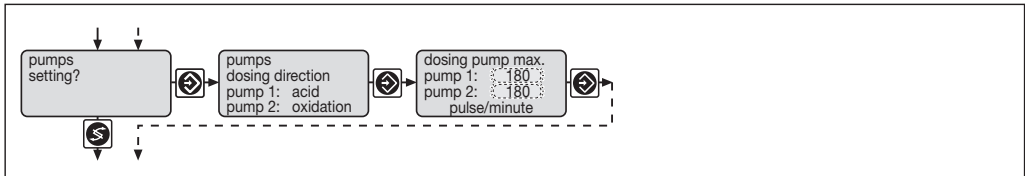


	Initial value	Possible values			Remarks
		Increment	Lower value	Upper value	
Control	normal	normal manual			xp referred to pH 14 (measured value 1) xp referred to 1000 mV (measured value 2)
Setpoint					
measured value 1 pH	pH 7.20	pH 0.01	pH 0	pH 14	
measured value 2 ORP	650 mV	1 mV	0 mV	1000 mV	
Control 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 %	

[illegible]

## Pumps

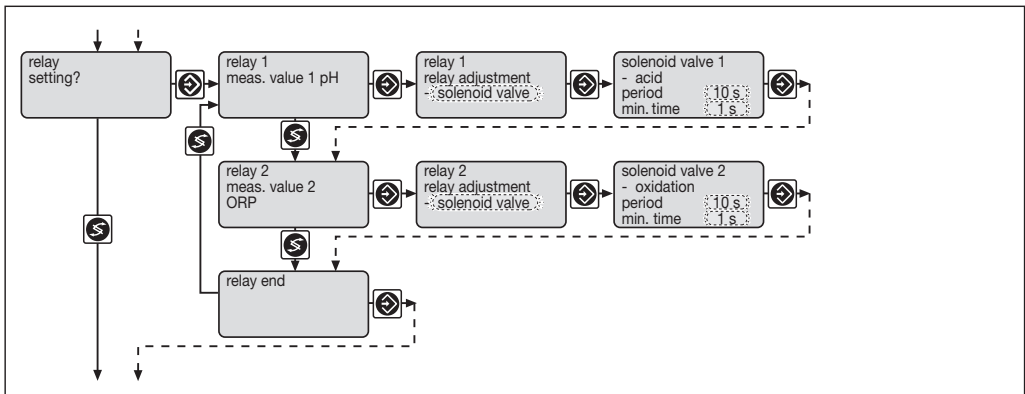
The maximum stroke value of the metering pumps should correspond to the stroke frequency of the metering pump used.



	Initial value	Possible value Increment	Lower value	Upper value	Remarks
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.





Operating Menu / Description

	Initial value	Possible values			Remarks
		Increment	Lower value	Upper value	
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 ORP 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	

Correcting value measured value 1 pH

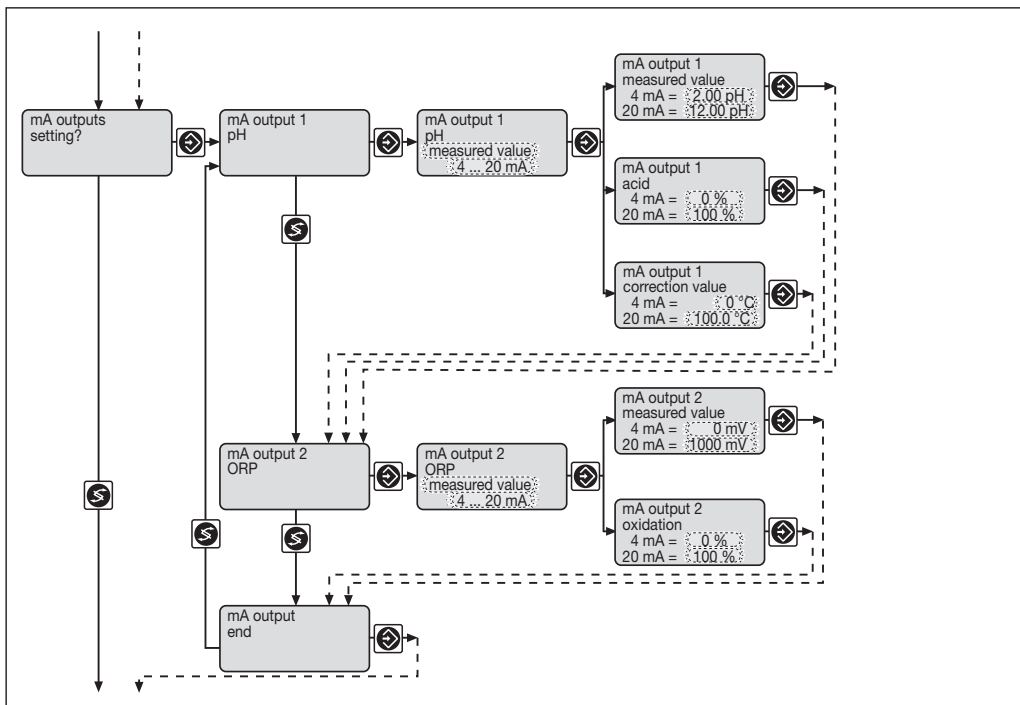


	Initial value	Possible values			Remarks
		Increment	Lower value	Upper value	
Type of temperature compensation	as per identity code	manual automatic off			Change-over only if pursuant to identity code = automatic
Manual temperature compensation	25 °C	0.1 °C	0 °C	100 °C	

[illegible]

### 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 Correction value off			
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

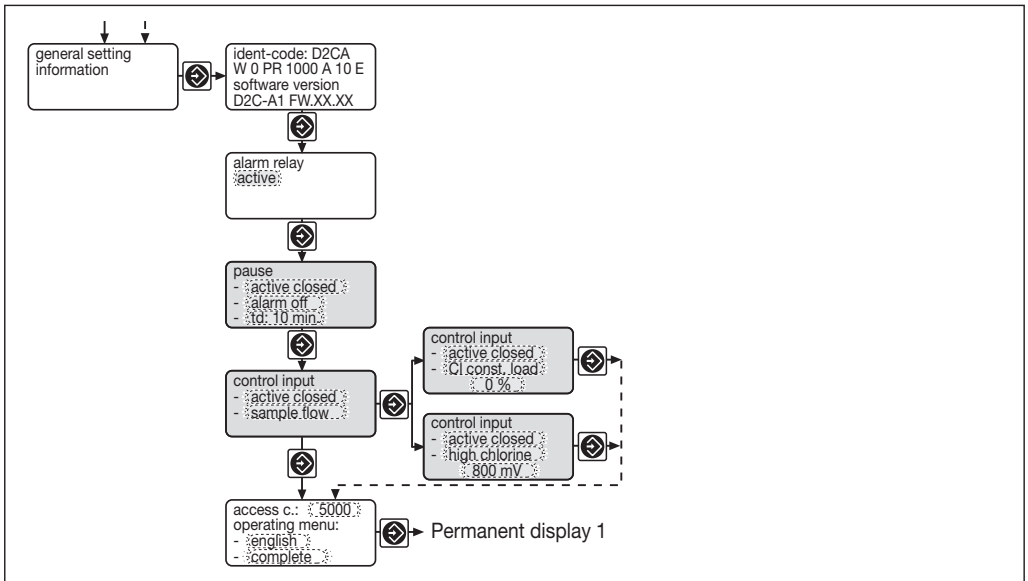
The control input may be used for fault messages for sample water, high chlorination or base load metering chlorine. In the event of fault message for sample water, control will be stopped, metering will be set to base load, and the alarm relay will be activated. If high chlorination is set, the control 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 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 calibration) may be carried out without entering the correct code.



Operating Menu / Description

	Initial value	Possible value Increment	Lower value	Upper value	Remarks
Alarm relay	active	active not active			
pause	active closed	active closed active open			
	Alarm off	Alarm off Alarm on			
	td: 10 min.	1 min.	0 min.	60 min.	
Control input	sample flow	sample flow high chlorine Cl const. load off			
Control input					
High chlorination	650 mV	1 mV	650 mV	1000 mV	
Basic load chlorine (Cl const. load)	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			

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## 9 Technical Terms

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

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## Technical Terms

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**Temperature  
correction:**

See correction value

**Ti (integral-  
action time):**

This term defines the integral (I) control response. The greater the Ti, 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  $\pm 25$  mV is acceptable.

The zero point of the chlorine probes is at 4 mA. Calibration is not necessary.

## 10 Troubleshooting

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

<b>Operation</b>	<b>Note text</b>	<b>Symbol</b>	<b>Effect on metering</b>	<b>on control</b>	<b>Alarm with acknowledgement</b>	<b>Remarks</b>	<b>Remedy</b>
<b>Stop button</b>	<i>Stop button</i>	☹ O	none	Stop	no		Start device
<b>Pause contact</b>	<i>Pause</i>	☹ O	none	Stop	yes, may be deactivated	delay time td adjustable, display elapsing „td“	deactivate interval deactivate delay time „td“
<b>Error sample flow</b>	<i>Error sample flow</i>	☹	none	Stop	yes	Function switchable	
<b>High chlorination</b>	<i>High chlorine</i>	☹	max. frequency	Stop	no	Function switchable	
<b>Basic load chlorine</b>	<i>Cl const. load</i>	☹	frequency adjustable		no	Function switchable	
<b>Electronic fault</b>	<i>EEPROM defective</i>	☹	none	Stop	yes		send in device

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Addresses and delivery information may be obtained from the manufacturer:  
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