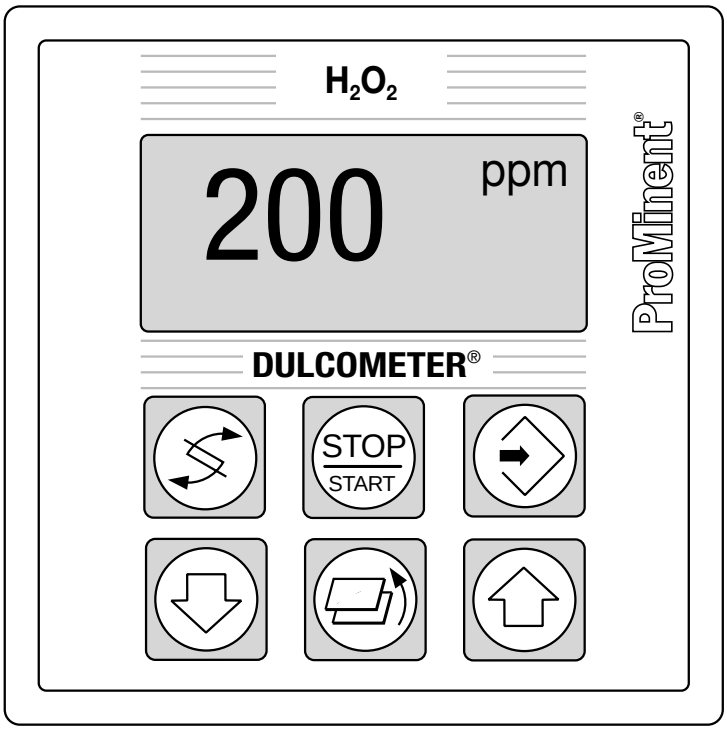
Operating Instructions

DULCOMETER® D1C

Part 2: Adjustment and Operation
Measured variable H_2O_2 and peracetic acid (PAA)

DIN EN ISO 9001
70 100 M 502

D1C Schr H2O2



Please attach device label here!

Please first read the operating instructions completely! Do not discard!
Warranty becomes void in the case of damage caused by operating errors!

Part No. 987934 **ProMinent Dosiertechnik GmbH · 69123 Heidelberg · Germany** BA DM 058 5/99 GB

1 Device Identification / Identity Code

D1C A	DULCOMETER® Controller Series D1C / Version A
	Type of mounting
D	control panel installation 96 x 96 mm
W	wall mounting
	Operating voltage
0	230 V 50/60 Hz
1	115 V 50/60 Hz
2	200 V 50/60 Hz
3	100 V 50/60 Hz
4	24 V AC/DC
	Measured variable
H	H_2O_2
A	peracetic acid
	Connection of measured variable
1	terminal, standard signal 0/4-20 mA
	Correction variable
2	temperature via terminal
3	temperature via standard signal
4	manual temperature entry
	Feed forward control
0	none
1	via standard signal 0/4-20 mA
2	via frequency 0-500 Hz
3	via frequency 0-10 Hz
	Control input
0	none
1	pause
	Signal output
0	none
1	standard signal 0/4-20 mA measured value
2	standard signal 0/4-20 mA control variable
3	standard signal 0/4-20 mA correction variable
	Power control
A	alarm-Relay
G	alarm- and 2 limit value relays
M	alarm- and 2 solenoid value relays
R	alarm-relay and servomotor with feedback
	Pump control
0	none
2	two pumps
	Control characteristic
0	none
1	proportional control
2	PID-control
	Log output
0	none
	Language
D	German
E	English
F	French
N	Dutch

D1C A	___	___	___	___	___	___	___	___	___	___	___	**0**	**E**

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® D1C controller, provide detailed information and are devided into clear steps. The activities to be carried out are identified by bold bullets (•).

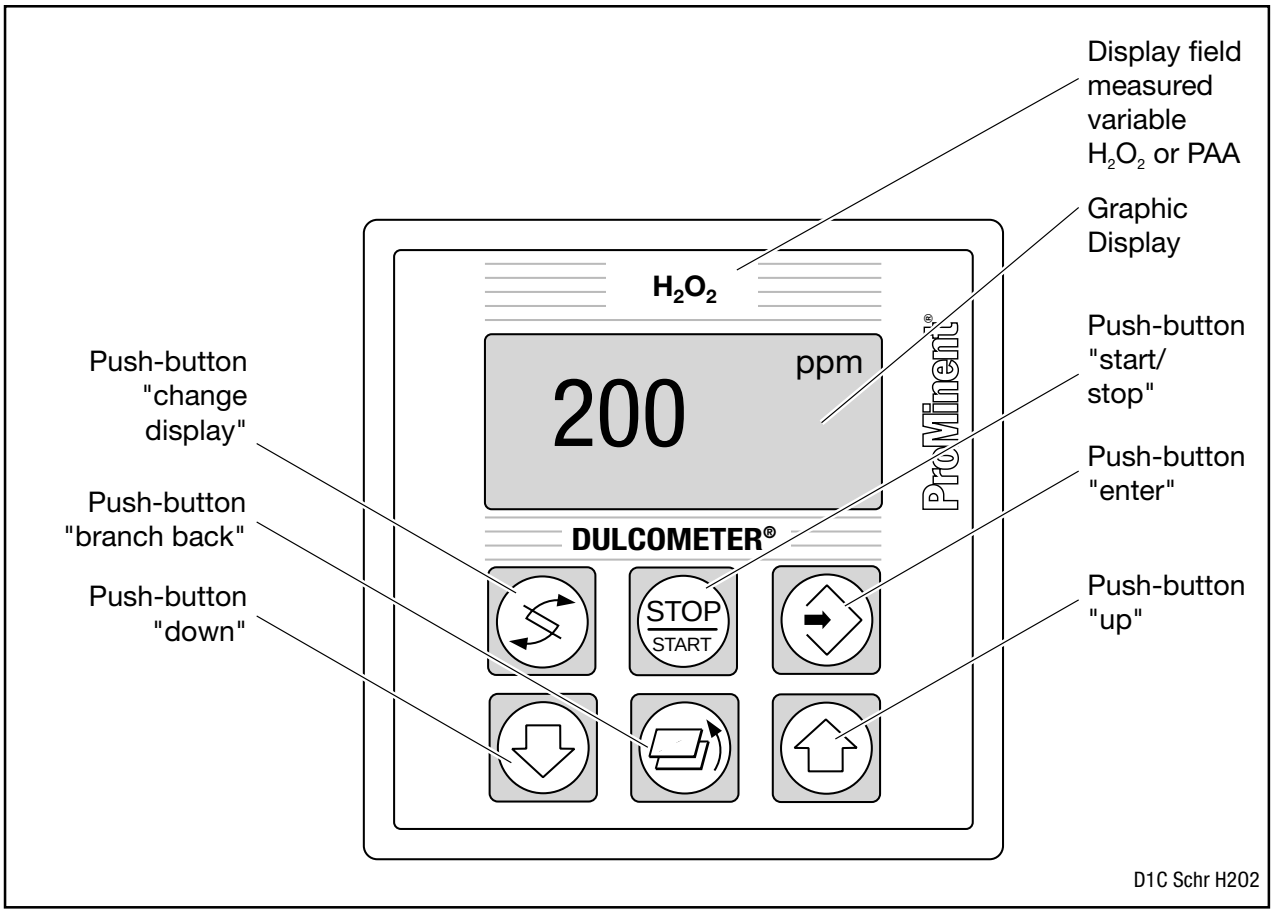
IMPORTANT:

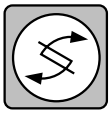
Please observe the parts of these operating instructions applicable to your particular version! This is indicyted in the section "Device Identification / Identity Code"!

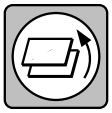
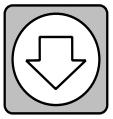
IMPORTANT:

Correct measuring and dosing is only possible in the case of impeccable operation of the probe. The probe has to be calibrated / checked regulary!

3 Device Overview / Controls



	CHANGE DISPLAY menu button To change over within a menu level and to change from one variable to another withion a menu point.
	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 display numerical value and to change variables (flashing display).

NOTE
Please refer to the description of the complete operating menu in section 8 for a detailed description of the individual characteristics of the D1C controller!

4 Functional Description

4.1 Operating Menu

The DULCOMETER® D1C 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 D1C controller can be used effectively in many applications from the very onset. If adaptions 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 D1C 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 D1C 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 the setpoint deviations (less than approx. 30 seconds) cannot be processed with this controller. The cycle times must be taken into considerstion when activating solenoid valves (pulse length) in the same way as their running times when activating servomotors (3-point).

Via the control input pause, the control function (selection of controlled variable) can be switched off. The calculation of the controlled variable starts again after cessation of "pause".

4.4 Feed Forward Control

The D1C controller can process a signal of a feed forward control. Depending on the device version (see identity code) and the setting, this signal can be obtained in any form of a 0...20 mA or 4...20 mA signal or as a digital contact signal with the maximum frequencies 10 Hz or 500 Hz.

During start up, the zero point has to be checked. The multiplicative feed forward control is not designed for switching off permanently the actuating variable (signal ≈ 0).

The signal can be used, for example, for flow-proportional metering (multiplicative effect) or feed forward-dependent basic load metering (additive effect). The result of control variable calculation from the proportional or PID control is multiplied by or added to the feed forward signal. A multiplicative feed forward variable at the level of the set rated value carries over the calculated control variable unchanged into the controlled variable:

Controlled variable = feed forward variable/rated value x calculated control variable

An additive feed forward variable at the level of the rated value results in maximum controlled variable:

Controlled variable (max. 100 %) = feed forward variable/rated value x max. controlled variable + calculated control variable

4.5 Error messages

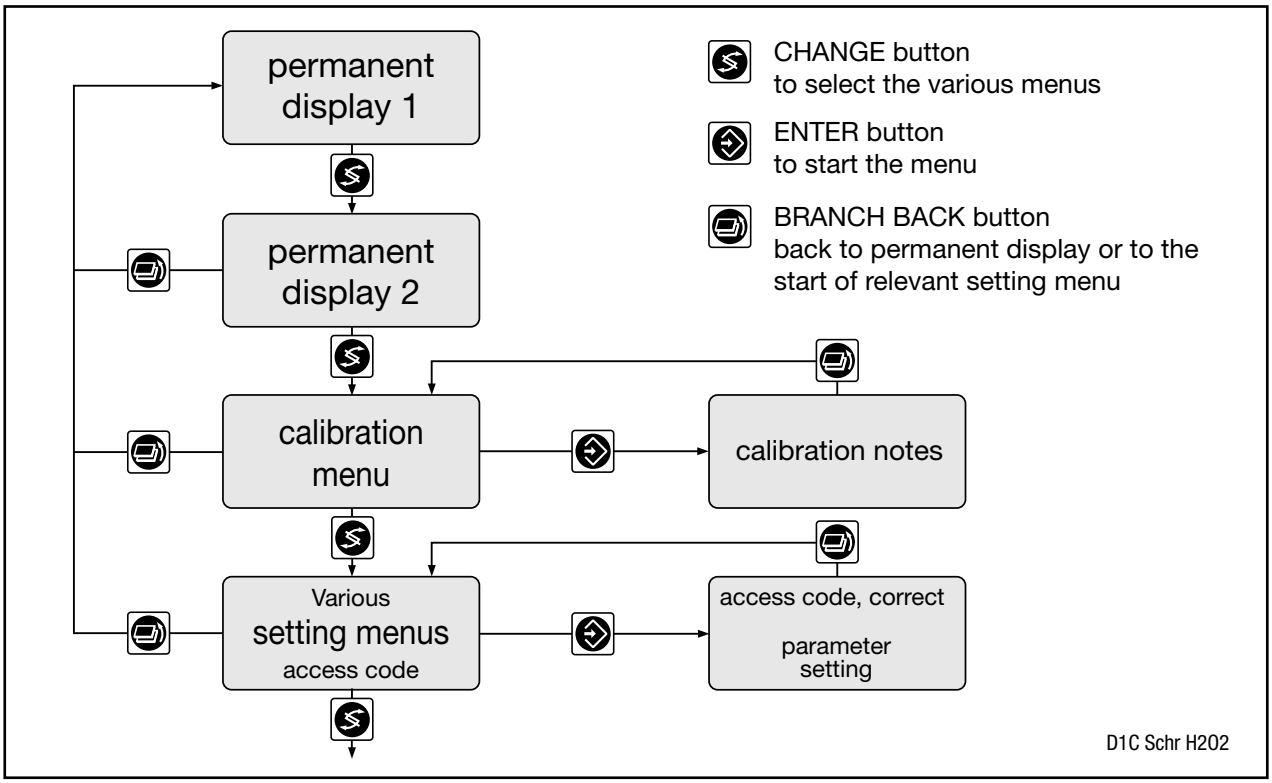
Error messages and information are indicated on the bottom line in the permanent display 1. Errors to be acknowledged (acknowledgement switches off the alarm relay) are indicated by the symbol "ε". Errors/notes which still apply after acknowledgement are indicated alternately. Faults which are rectified of their own accord due to changed operating situations are removed from the permanent display without the need for acknowledgement.

5 Display Symbols

The display of the D1C controller uses the following symbols:

Description	Comment	Symbol
Limit value transgression Relay 1 upper	symbol left	
Relay 1 lower	symbol left	
Relay 2 upper	symbol right	
Relay 2 lower	symbol right	
Metering pump 1 (PER) Control OFF	symbol left	
Control ON	symbol left	
Metering pump 2 (De-PER) Control OFF	symbol right	
Control ON	symbol right	
Solenoid valve 1 (PER) Control OFF	symbol left	
Control ON	symbol left	
Solenoid valve 2 (De-PER) Control OFF	symbol right	
Control ON	symbol right	
Servomotor Control, open relay		
Control, close relay		
without control		
Position feedback	The bar increases from left to right during opening	
Stop button pressed		
Manual metering		
Fault		

6 Operation



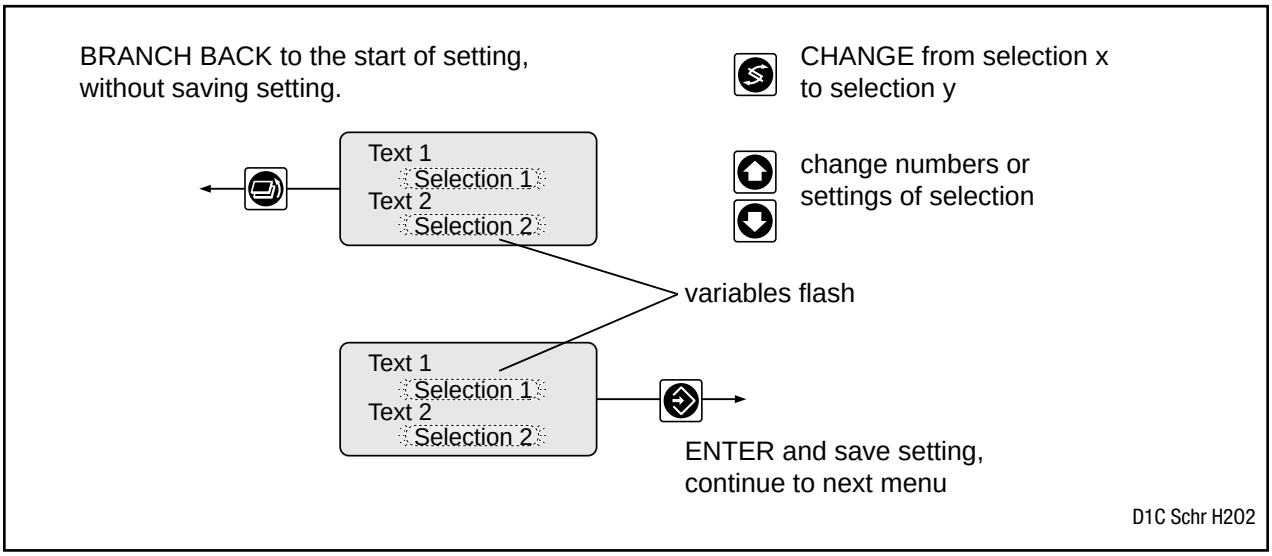
NOTE

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!

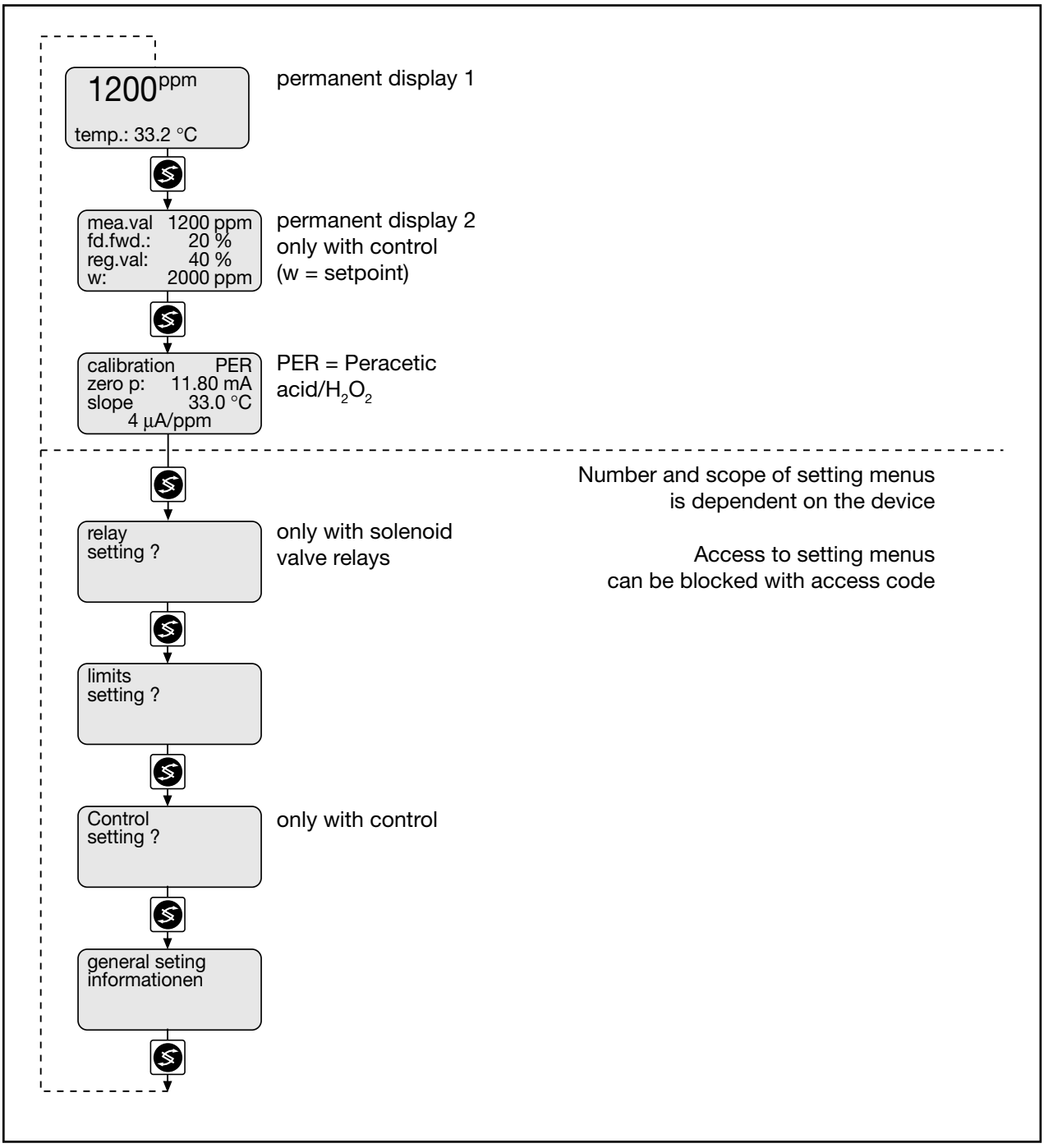
If the access code is selected correctly in a setting menu, then the following setting menus are also accessible!

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

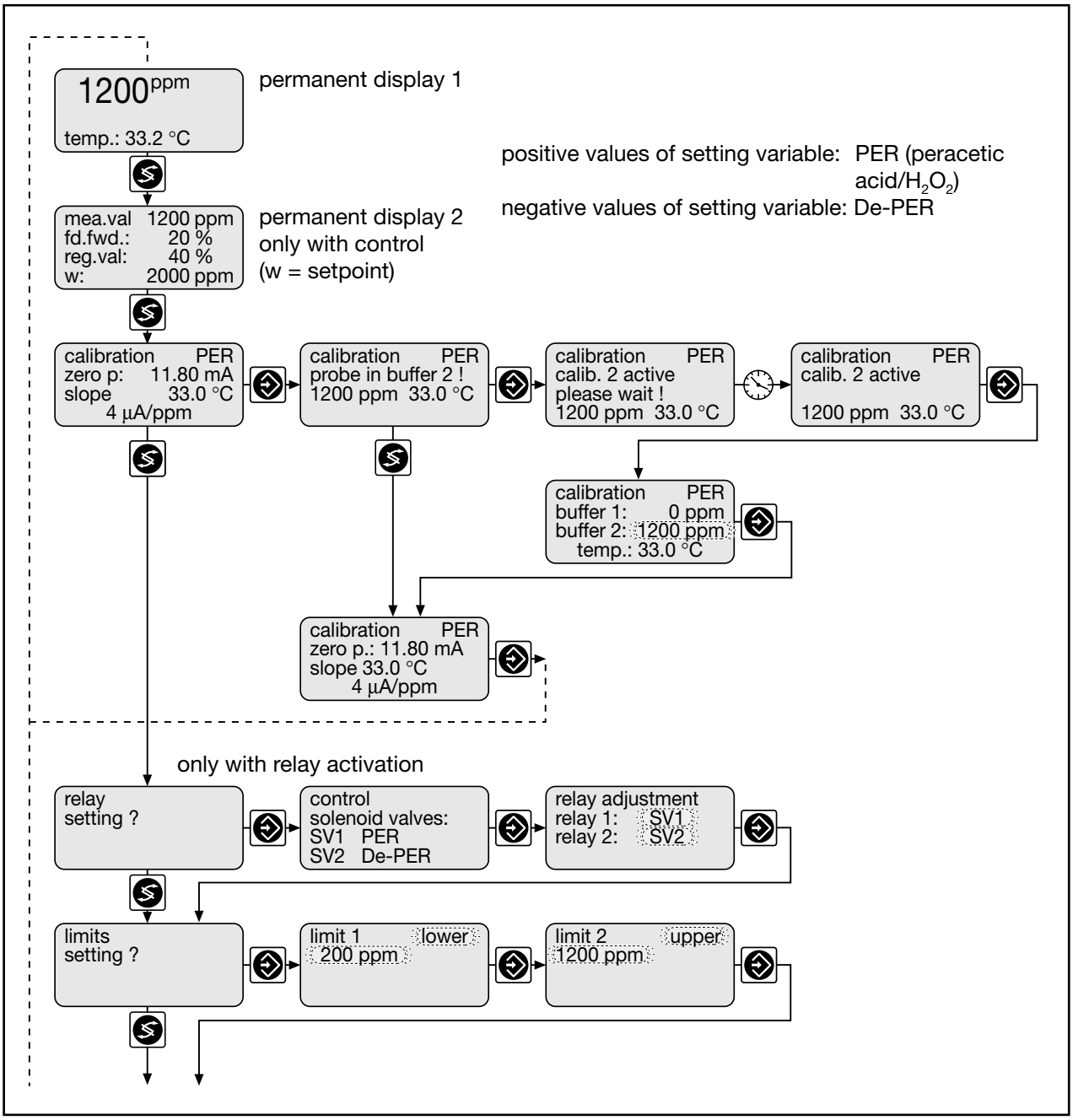


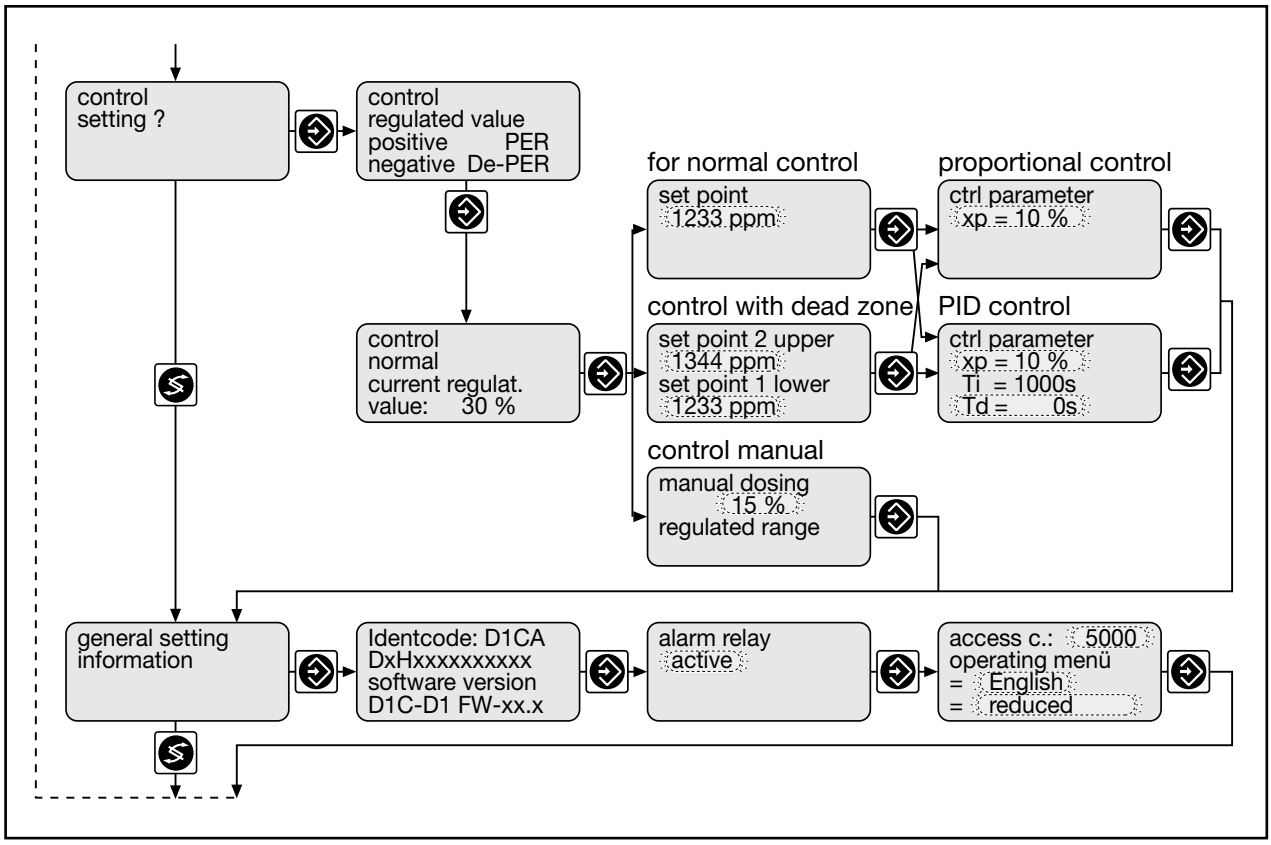
7 Restricted Operating Menu / Overview

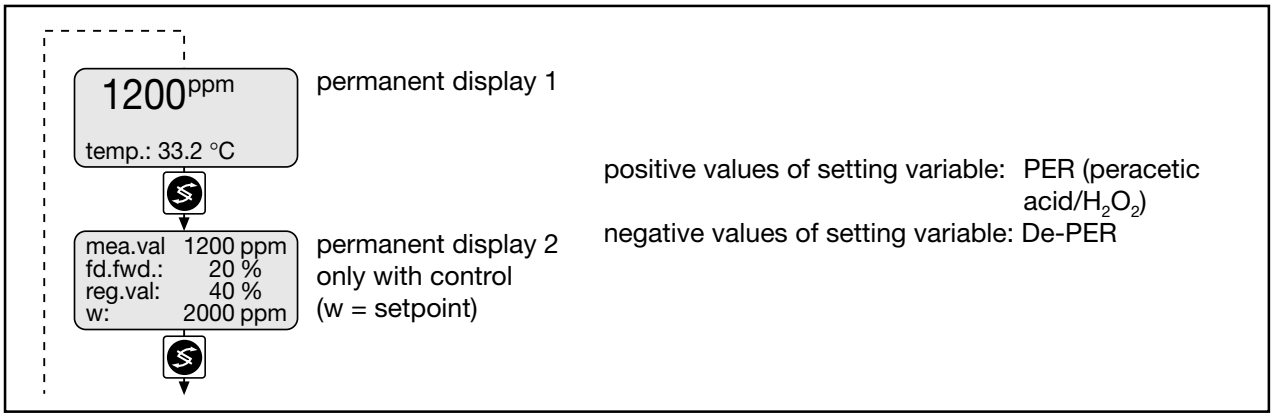
The restricted operating menu permits simple operation of the most important parameters. The following overview shows the settings which can be selected:



Restricted Operating Menu / Layout







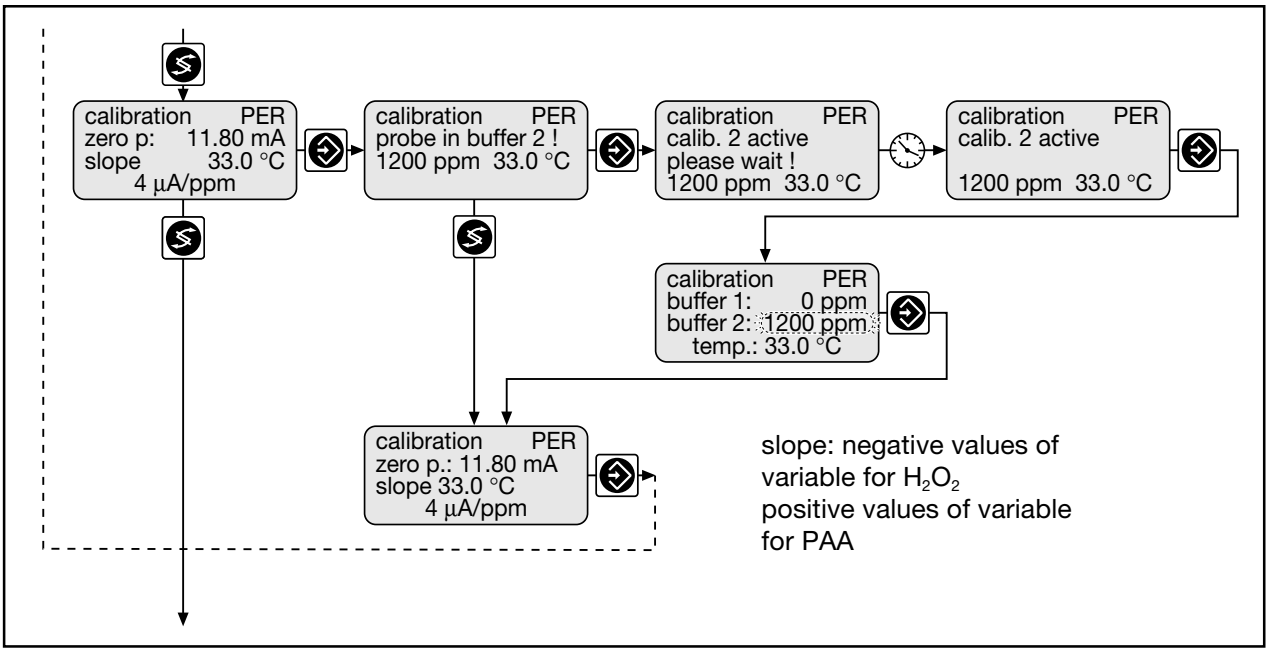
Calibrating the PEROX Probe

During calibration, metering is reduced to the set basic capacity. The standard signal of the output (measured value/correction value) is frozen. The rounded-off, whole number measured value or the last buffer value is suggested as the buffer value; this value is adjustable. On completition of calibration, all error checks which refer to the measured value are restarted. A calibration is only possible when the value is ≥ 2 % of the measuring range.

CAUTION:

The measuring range of the micro-mA-transducer on the sensor must agree with the set measuring range (factory setting: 200 ppm for H_2O_2, 2000 ppm for PAA). The measuring range must be reset (see page 16) prior to calibration.

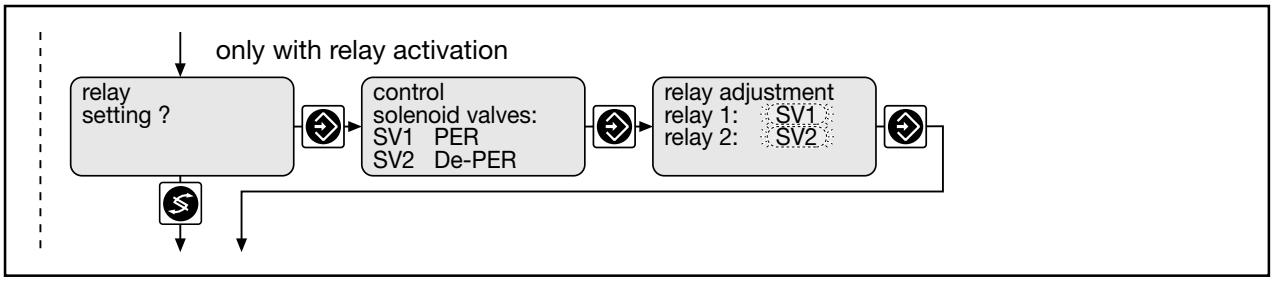
Restricted Operating Menu / Description



Error message	Condition	Effect
zero point low zero point high	< 10 mA > 14 mA	return to permanent display and automatically to basic metering load
slope low	< 20 % of standard slope	return to permanent display and
slope high	> 500 % vof standard slope	automatically to basic metering load
buffer distance too small	Δ Buffer < 2 % of meas. range	ignore buffer 2 and back to "calibration ... buffer 2"

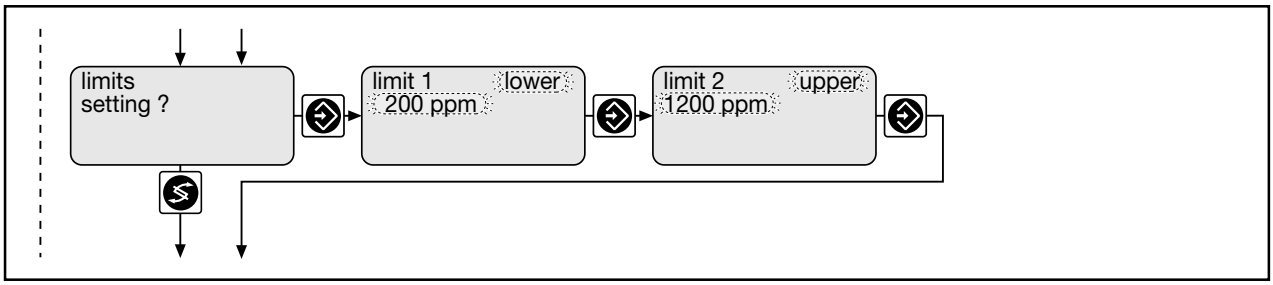
calibration PER:	initial value	possible values increment	lower value	upper value	remarks
calibration temperature	actual temp.	0.1°C	0°C	100°C	
buffer values	measured value	1ppb	-20 ppb	200 ppb	
		0.001 ppm	-0.20 ppm	2.000 ppm	
		0.01 ppm	-2.00 ppm	20.00 ppm	
		0.1 ppm	-20.0 ppm	200.0 ppm	
		1 ppm	-200 ppm	2000 ppm	
		0.001 %	-0.200 %	2.000 %	
		0.01 %	-2.00 %	20.00 %	
		0.1 %	-10.0 %	100.0 %	
fault check	with fault check	with fault check without f.check			no check during calibration of zero point slope, distance

Relays for Solenoid Valve Activation



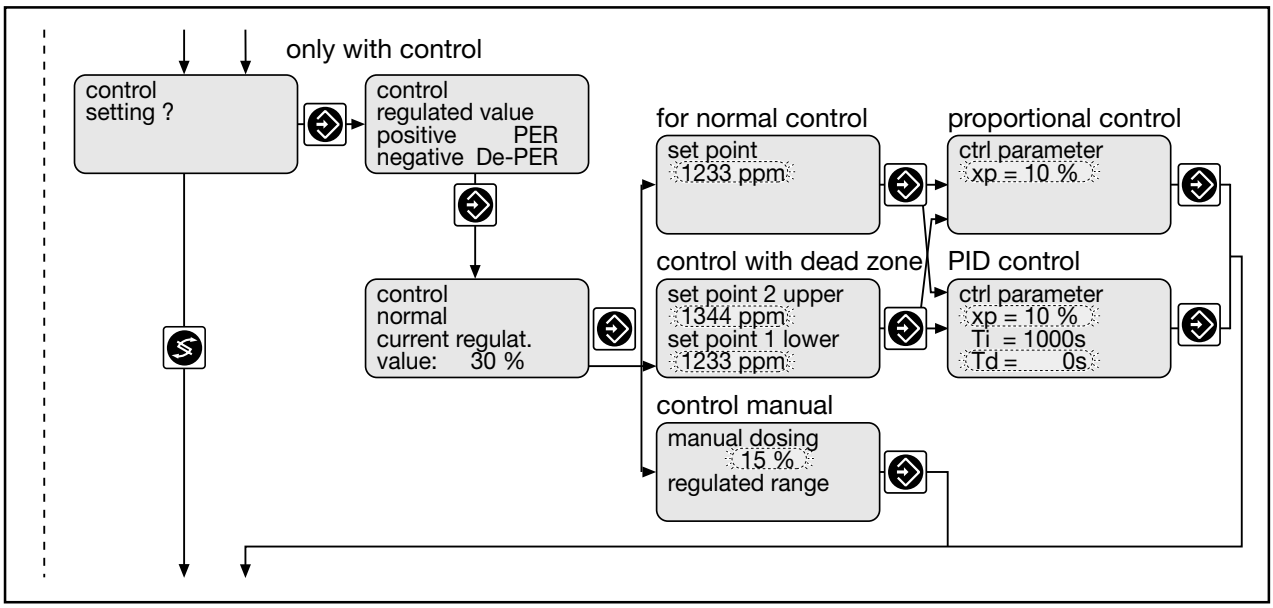
	initial value	possible values increment	lower value	upper value	remarks
relay adjustment	per identity code	solenoid valve limit off			

Limits



	transgression	initial value	possible values increment	lower value	upper value	remarks
type of limit	limit 1: limit 2:	lower upper	upper lower off*)			limit transgression for exceeding or dropping below limit
limit value	1.2	0...200 ppb 0...2.000 ppm 0...20.00 ppm 0...200.0 ppm 0...2000 ppm 0...2.000 % 0...20.00 % 0...100 %	1 ppb 0.001 ppm 0.01 ppm 0.1 ppm 1 ppm 0.001 % 0.01 % 0.1 %	0 ppb 0 ppm 0 ppm 0 ppm 0 ppm 0 % 0 % 0 %	200 ppb 2.000 ppm 20.00 ppm 200.0 ppm 2000 ppm 2.000 % 20.00 % 100 %	*)only with limit value relay

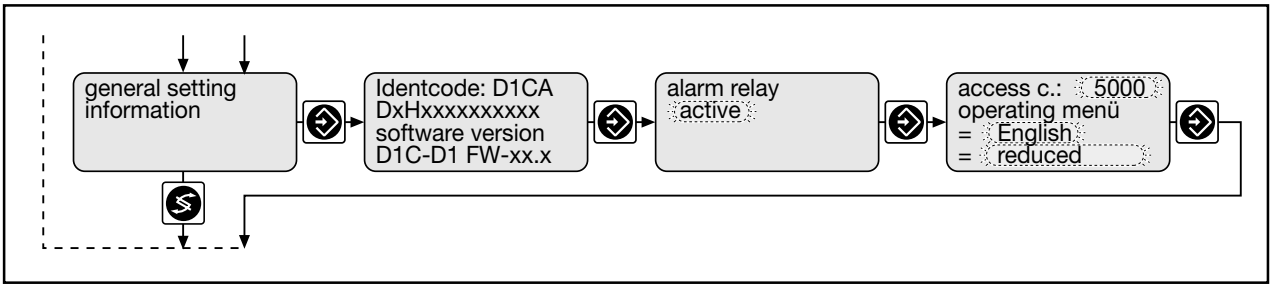
Control



Restricted Operating Menu / Description

	initial value	possible values increment	lower value	upper value	remarks
setpoint	100 ppb	1 ppb	lower limit 0 ppb	upper limit 200 ppb	2 setpoimt necassary for control with dead zone setpoint 1 < setpoint 2
	1.000 ppm	0.001 ppm	0 ppm	2.000 ppm	
	10.00 ppm	0.01 ppm	0 ppm	20.00 ppm	
	100.0 ppm	0.1 ppm	0 ppm	200.0 ppm	
	1000 ppm	1 ppm	0 ppm	2000 ppm	
	1.000 %	0.001 %	0 %	2.000 %	
	10.00 %	0.01 %	0 %	20.00 %	
	50.0 %	0.1 %	0 %	100 %	
					meas. range setting look page 16
ctrl. parameter xp	10 %	1 %	1 %	500 %	xp referred to meas. range
ctrl. parameter Ti	off	1 s	1 s	9999 s	function off = 0 s
ctrl. parameter Td	off	1 s	1 s	2500 s	function off = 0 s
manual metering	0 %	1 %	–100 %	+100 %	

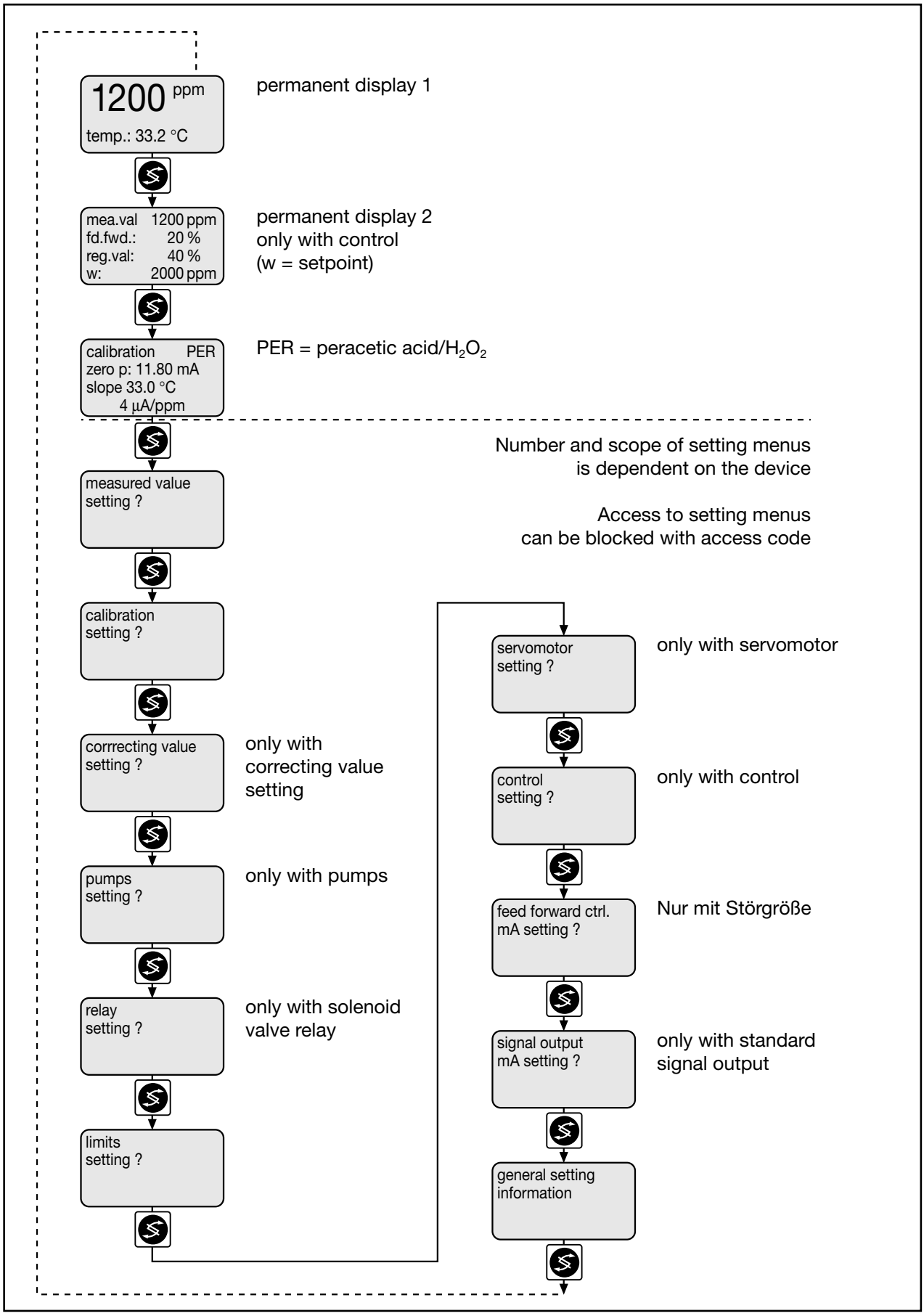
General Settings

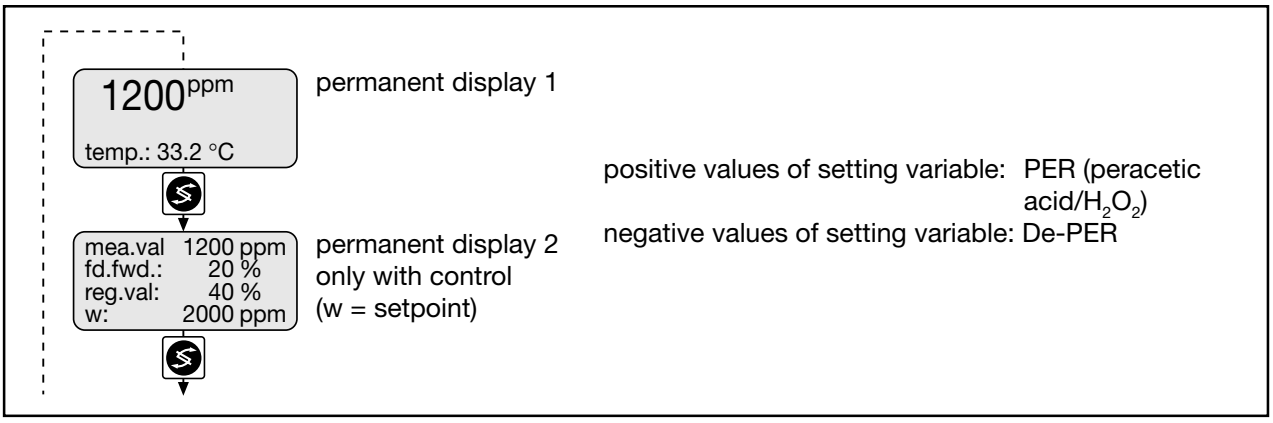


	initial value	possible values increment	lower value	upper value	remarks
alarm relay	active	active not active			
access code	5000	1	1	9999	
language	per identity code	German English French Dutch Italian (depending on identity code)			
operating menu	restricted	restricted complete			

8 Complete Operating Menu / Overview

All parameters of the controller can be set in the complete operating menu. The following overview shows the setting which can be selected:



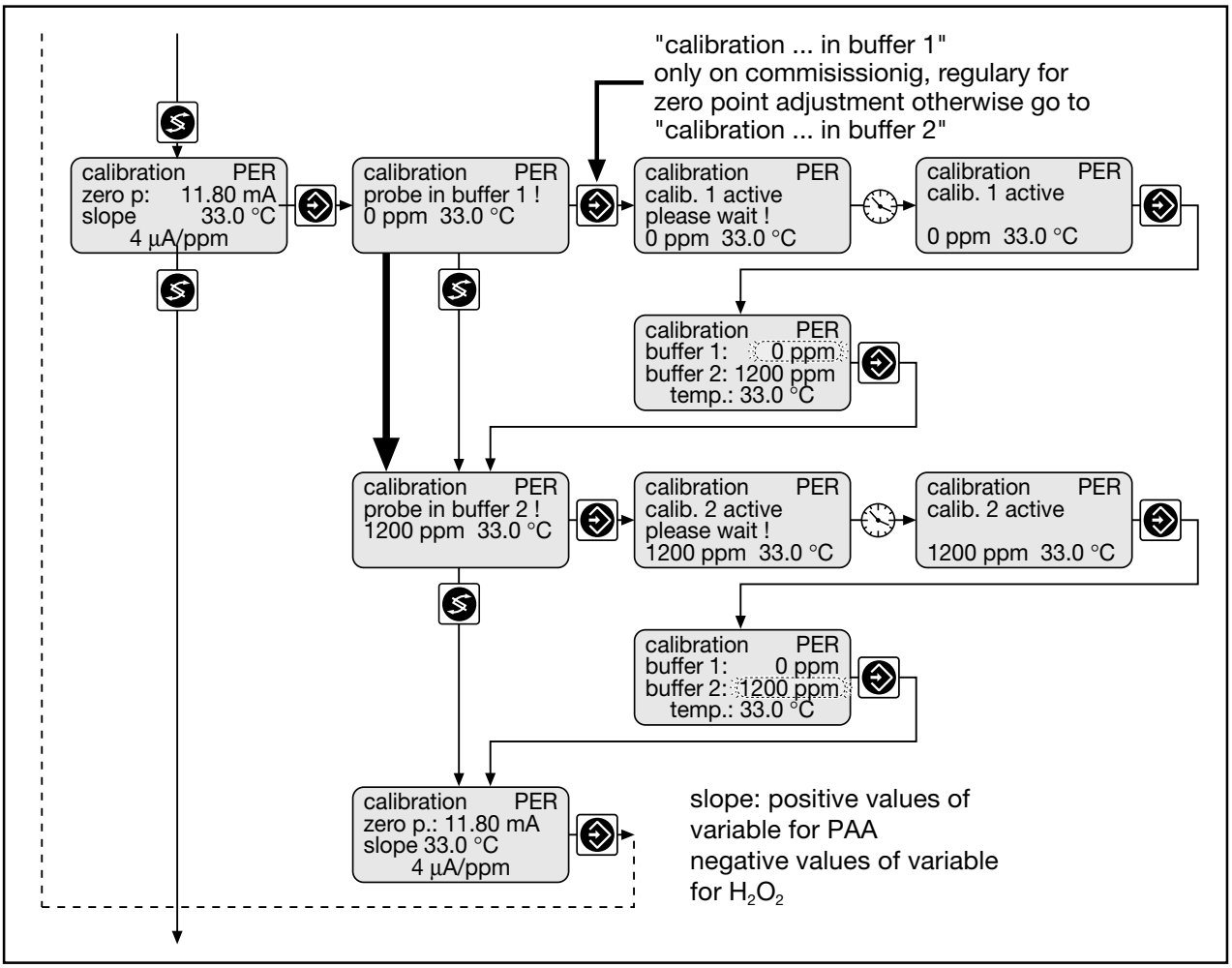


Calibrating the PEROX Probe

During calibration, metering is reduced to the set basic capacity. The standard signal of the output (measured value/correction value) is frozen. The rounded-off, whole number measured value or the last buffer value is suggested as the buffer value; this value is adjustable. On completition of calibration, all error checks which refer to the measured value are restarted. A Calibration is only possible when the value is ≥ 2 % of the measuring range.

CAUTION:

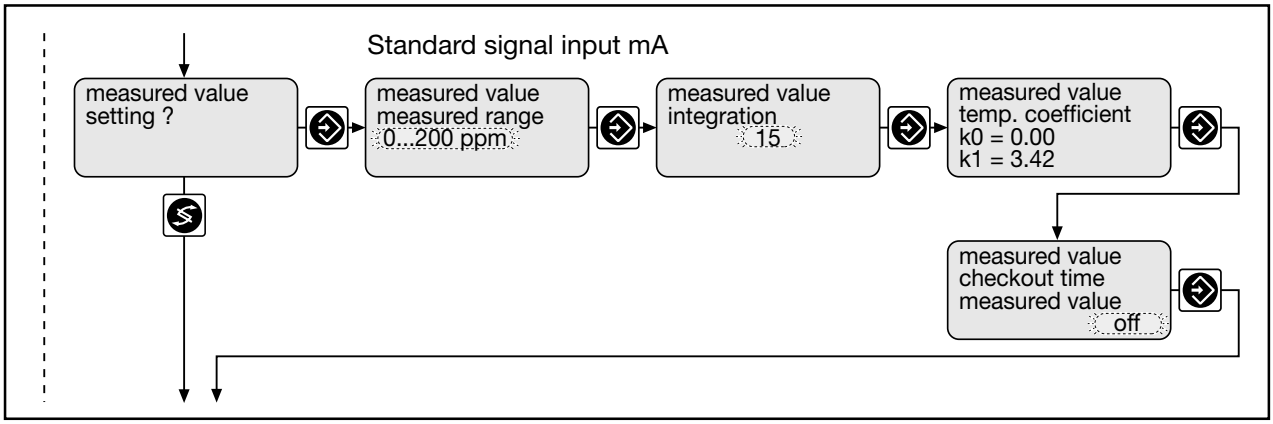
The measuring range of the micro-mA-transducer on the sensor must agree with the set measuring range (factory setting: 200 ppm for H_2O_2, 2000 ppm for PAA). The measuring range must be reset (see page 16) prior to calibration.



	initial value	possible values increment	lower value	upper value	remarks
calibration temperature	actual temp.	0.1°C	0°C	100°C	
buffer values	measured value	1ppb	-20 ppb	200 ppb	
		0.001 ppm	-0.20 ppm	2.000 ppm	
		0.01 ppm	-2.00 ppm	20.00 ppm	
		0.1 ppm	-20.0 ppm	200.0 ppm	
		1 ppm	-200 ppm	2000 ppm	
		0.001 %	-0.200 %	2.000 %	
		0.01 %	-2.00 %	20.00 %	
		0.1 %	-10.0 %	100.0 %	
fault check	with fault check	with fault check			
		without f.check			no check during calibration of zero point slope, distance

Error message	Condition	Effect
zero point low zero point high	< 10 mA > 14 mA	return to permanent display and automatically to basic metering load
slope low	< 20 % of standard slope	return to permanent display and
slope high	> 500 % of standard slope	automatically to basic metering load
buffer distance too small	Δ Buffer < 2 % of meas. range	ignore buffer 2 and back to "calibration ... buffer 2"

Measured Value

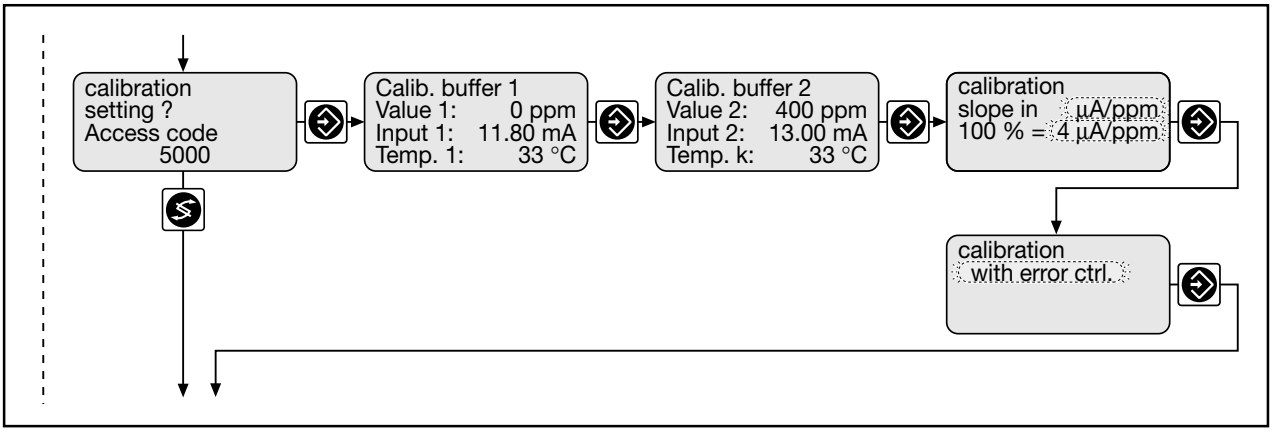


When changing the range adjustment, the adjustments in all menus have to be checked!

	initial value	possible values increment	lower value	upper value	remarks
meas. range	H_2O_2 200.0 ppm	200 ppb			
	PAA 2000 ppm	2.000 ppm			
		20.00 ppm			
		200.0 ppm			
		2000 ppm			
		2.000 %			
		20.00 %			
		100.0 %			
integration	20	1	2 / off	200	function switch-off-able
temperature PAA	k0=0; k1=3.0	0.01	0	10.00	K0 and K1 are separate
coefficient H_2O_2	k0=0; k1=1.6				for each measuring range
checkout time	off	1 s	1 s / off	999 s	function switch-off-able

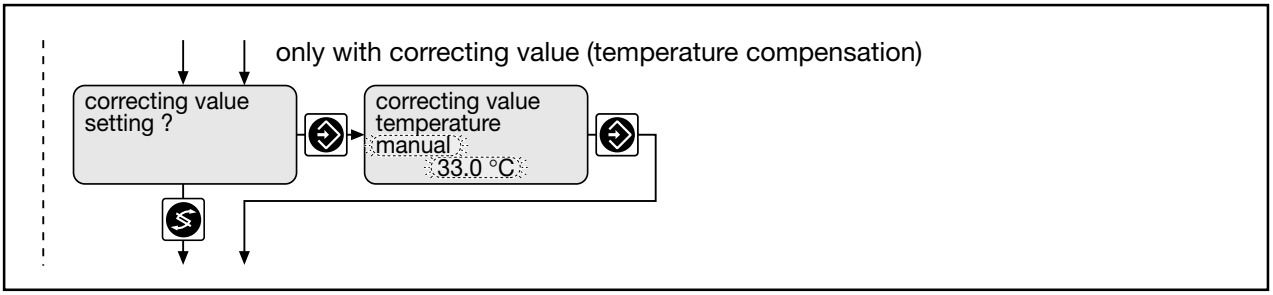
Complete Operating Menu / Description

Calibration



Calibration	initial value	possible values increment	lower value	upper value	remarks
slope	µA/ppm	µA/ppm %			
display	40 µA/ppb	1 µA/ppb	0 µA/ppb	200 µA/ppb	
	4.0 µA/ppb	0.1 µA/ppb	0 µA/ppb	20.0 µA/ppb	
	400 µA/ppm	1 µA/ppm	0 µA/ppm	2000 µA/ppm	
	40 µA/ppm	1 µA/ppm	0 µA/ppm	200 µA/ppm	
	4.0 µA/ppm	0.1 µA/ppm	0 µA/ppm	20.0 µA/ppm	
	0.40 µA/ppm	0.01µA/ppm	0 µA/ppm	2.00 µA/ppm	
	400 µA/%	1 µA/%	0 µA/%	2000 µA/%	
	40 µA/%	1 µA/%	0 µA/%	200 µA/%	
fault check	with fault check	with fault check without f.check			

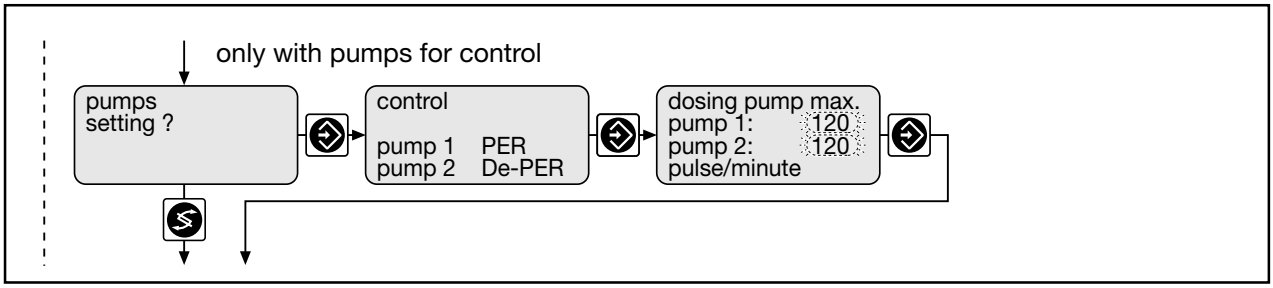
Correction Variable (temperature value)



	initial value	possible values increment	lower value	upper value	remarks
type of temperature compensation	per identity code	manual automatical			changeover only if identity code
manual temp. compensation	25°C	0.1°C	0°C	50°C	”correct. value” = 2.3

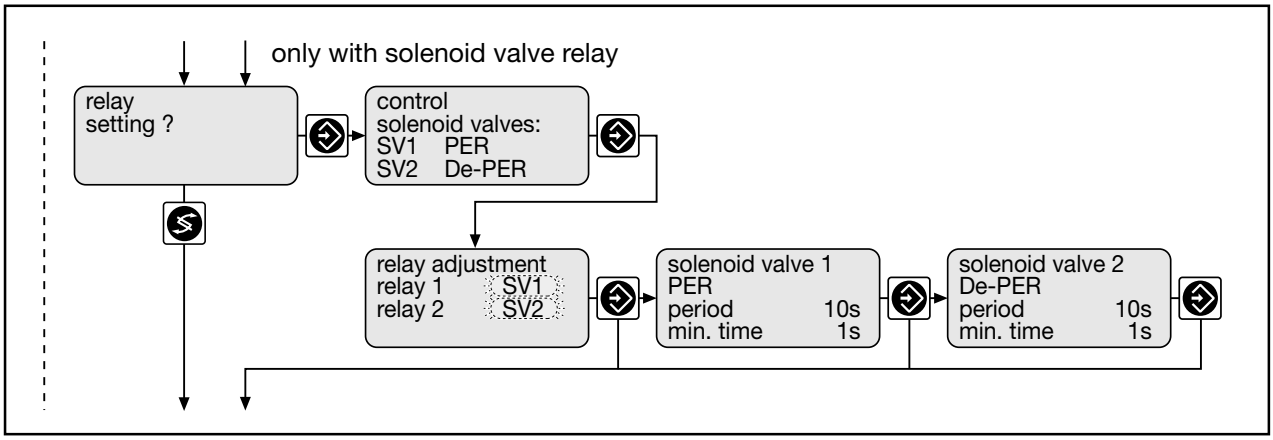
Complete Operating Menu / Description

Pumps



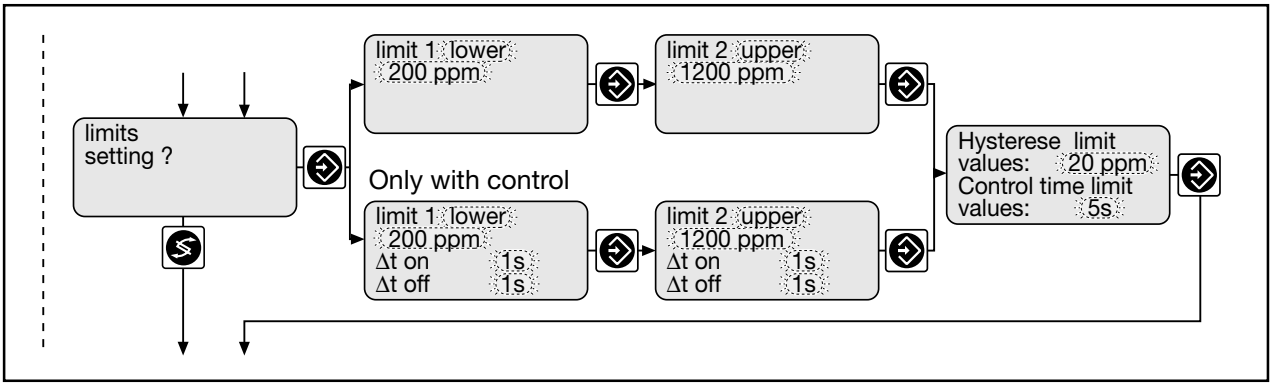
	initial value	possible values increment	lower value	upper value	remarks
max. stroke/minute pumps 1 and 2	120	1	1	500	off = 0 stroke/minute

Relays for Solenoid Valve Activation



	initial value	possible values increment	lower value	upper value	remarks
relay adjustment	per identity code	solenoid valve limit off			
cycle	10 s	1 s	10 s	9999 s	
min. time	1 s	1 s	1 s	cycle/2	

Limits



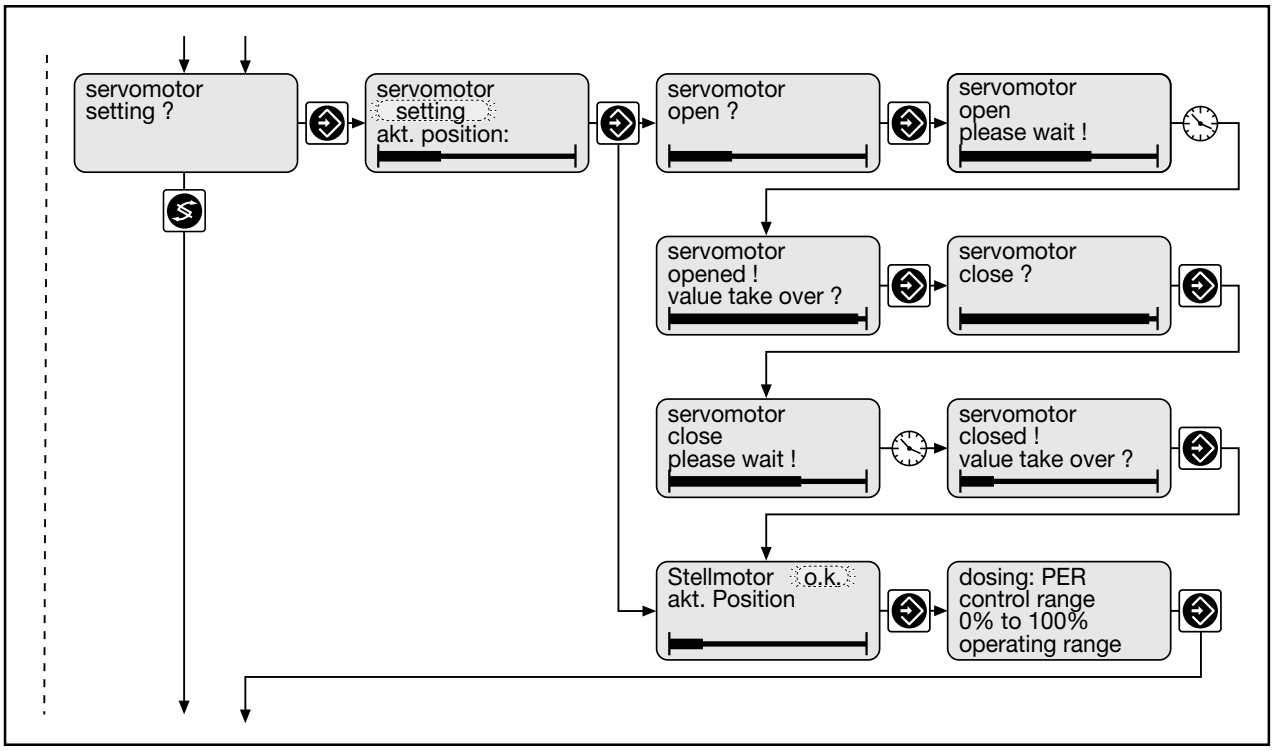
	initial value	possible values increment	lower value	upper value	remarks
type of limit limit 1: limit 2:	lower upper	upper lower off*)			limit transgression for exceeding or dropping below limit
limit value 1.2	0...200 ppb 0...2.000 ppm 0...20.00 ppm 0...200.0 ppm 0...2000 ppm 0...2.000 % 0...20.00 % 0...100 %	1 ppb 0.001 ppm 0.01 ppm 0.1 ppm 1 ppm 0,001 % 0.01 % 0.1 %	0 ppb 0 ppm 0 ppm 0 ppm 0 ppm 0 % 0 % 0 %	200 ppb 2.000 ppm 20.00 ppm 200.0 ppm 2000 ppm 2.000 % 20.00 % 100 %	*)only with limit value relay
switch-on delay Δt on switch-off delay Δt off	0 s 0 s	1 s 1 s	0 s 0 s	9999 s 9999 s	
type of temperature compensation temperature compensation manual temp. comp.	per identity code 25°C	manual automatical 0.1°C	0°C	50°C	changeover only if identity code correct. value = 2.3
hysteresis limits	2 ppb 0.02 ppm 0.2 ppm 2.0 ppm 20 ppm 0.02 % 0.2 % 1.0 %	1 ppb 0.001 ppm 0.01 ppm 0.1 ppm 1 ppm 0.001 % 0.01 % 0.1 %	0 ppb 0 ppm 0 ppm 0 ppm 0 ppm 0 % 0 % 0 %	200 ppb 2.000 ppm 20.00 ppm 200.0 ppm 2000 ppm 2.000 % 20.00 % 100 %	effective in direction of "cancelling limit transgression"
Control time limit	off	1 s	1 s	9999 s	results in message and alarm. off = 0 s: function switched off, no message, no alarm

Servomotor

Activation of the servomotor must be carried out with the same meticulous care as taken when calibrating a measuring probe. The operating range is defined by the total resistance range of the feedback potentiometer. The maximum limit of the range actually used is set by definig the control range.

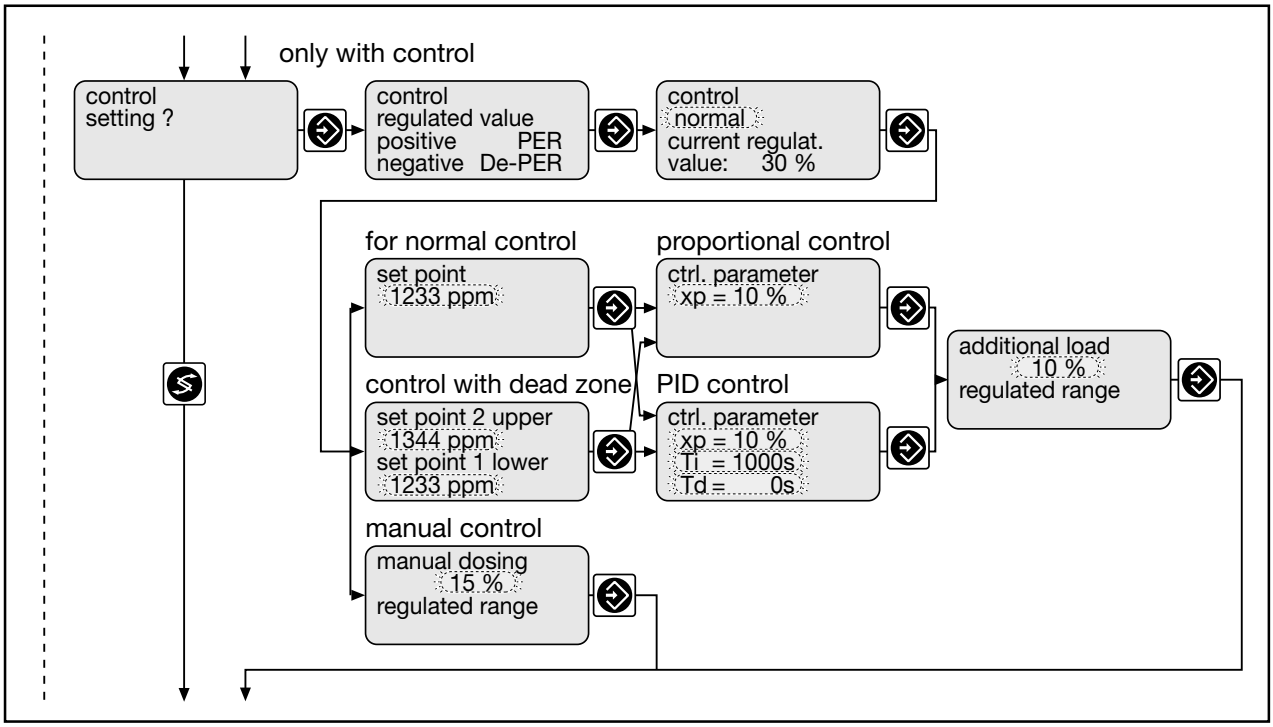
CAUTION:
To ensure correct operation, the activation time of the actuator used should not be less than 25 seconds for the control range from 0...100%!

Complete Operating Menu / Description



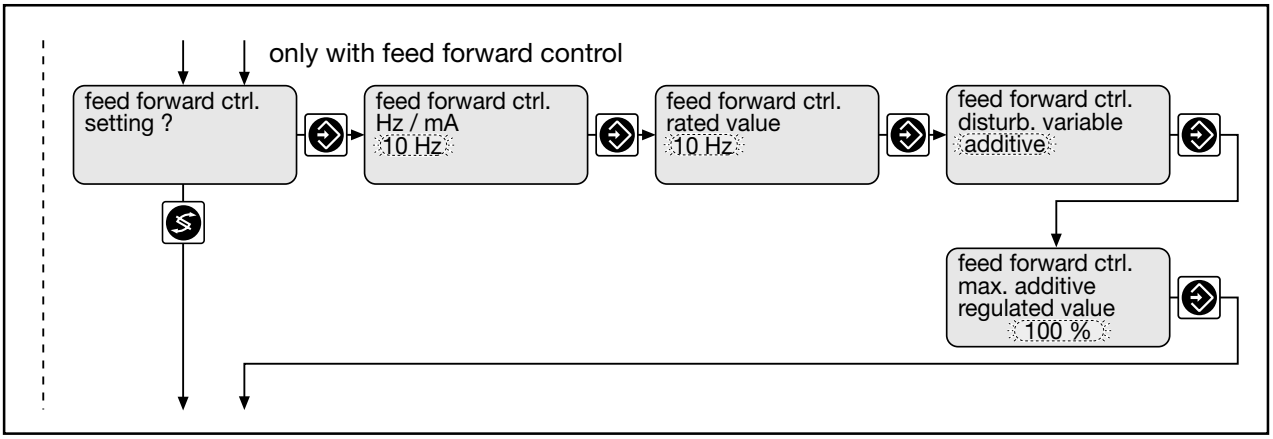
	initial value	possible values increment	lower value	upper value	remarks
servomotor	setting	setting ok Off			
control direction	PER	PER De-PER			
control range	100 %	1 %	10 %	100 %	in % of operating range

Control



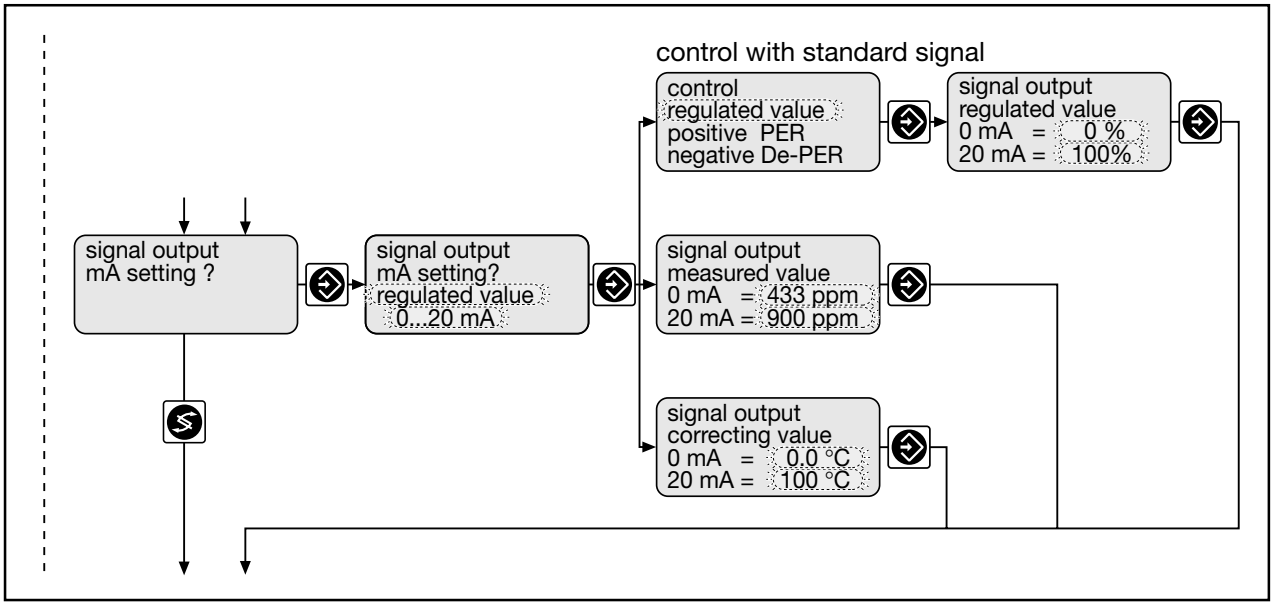
	initial value	possible values increment	lower value	upper value	remarks
control	normal	normal with dead- zone manual			when controlling with dead zone,feed forward control is not used for measured values within the dead zone
			lower limit	upper limit	2 setpoint necassary for control with dead zone
setpoint	100 ppb	1 ppb	0 ppb	200 ppb	setpoint 1 < setpoint 2
	1.000 ppm 10.00 ppm 100.0 ppm 1000 ppm 1.000 % 10.00 % 50.0 %	0.001 ppm 0.01 ppm 0.1 ppm 1 ppm 0.001 % 0.01 % 0.1 %	0 ppm 0 ppm 0 ppm 0 ppm 0 % 0 % 0 %	2.000 ppm 20.00 ppm 200.0 ppm 2000 ppm 2.000 % 20.00 % 100 %	
control parameter xp	10 %	1 %	1 %	500 %	xp referred to measuring range
control parameter Ti	off	1 s	1 s	9999 s	function off = 0 s
control parameter Td	off	1 s	1 s	2500 s	function off = 0 s
Additive basic load	0 %	1 %	–100 %	+100 %	
manual metering	0 %	1 %	–100 %	+100 %	

Feed forward Control



	initial value	possible values increment	lower value	upper value	remarks
feed forward control (flow)	identity code signal type standard signal: 4–20 mA	none 10 Hz 500 Hz 0…20 mA 4…20 mA			signal processing: signal <0.02 Hz = no flow signal <0.2 Hz = no flow signal <0.2 mA = no flow signal <4.2 mA = no flow
feed forward control rated value	10 Hz 500 Hz 20 mA	0.01 Hz 1 Hz 0.1 mA	0.1 Hz 1 Hz 0/4 mA	10 Hz 500 Hz 20 mA	depending on signal type maximum limitation of range used
feed forward control	multiplicative	additive multiplicative			
max.add.regul.value	100 %	1 %	-500 %	+ 500 %	only with additive feed forward control

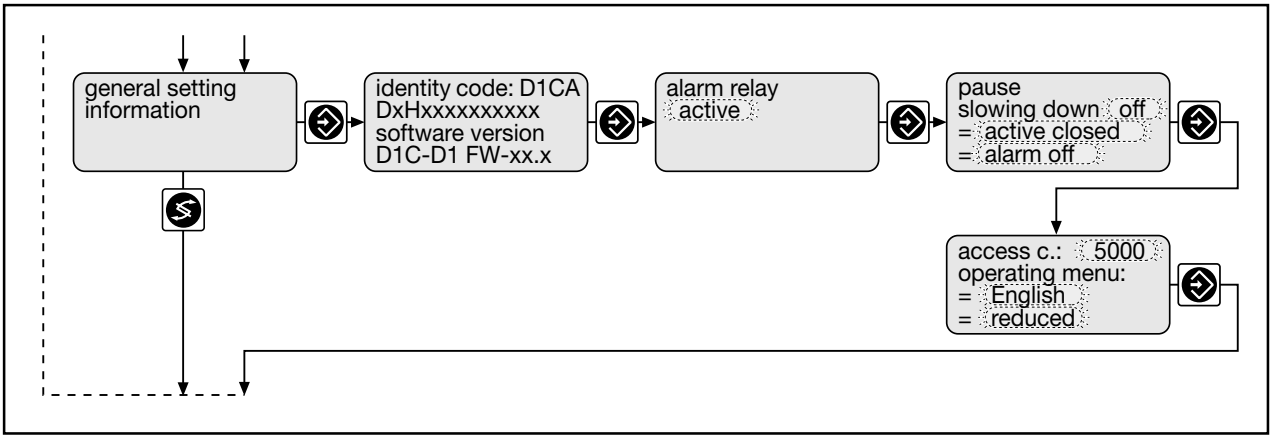
Standard Signal Output



	initial value	possible values increment	lower value	upper value	remarks
variable allocation	identity code	meas. value controll.variable correction value			if control applicable only with correction variable
output range	0…20 mA	0…20 mA 4…20 mA			
range measured value	0…200 ppb 0...2.000 ppm 0...20.00 ppm 0...200.0 ppm 0...2000 ppm 0...2.000 % 0...20.00 % 0...100%	1 ppb 0.001 ppm 0.01 ppm 0.1 ppm 1 ppm 0.001 % 0.01 % 0.1 %	-200 ppb -2.000 ppm -20.00 ppm -200.0 ppm -2000 ppm -2.000 % -20.00 % -100 %	200 ppb 2.000 ppm 20.00 ppm 200.0 ppm 2000 ppm 2.000 % 20.00 % 100 %	minimum range 1 %
range controlled variable	0 %…+100 %	1 %	–100 %	+100 %	minimum range 1 %
range correction value	0...100°C	0.1°C	-5.0°C	105°C	minimum range 1 %

Complete Operating Menu / Description

General Settings



	initial value	possible values increment	lower value	upper value	remarks
alarm relay	active	active not active			
Pause: slowing down	off	1 s	1 s / off	9999 s	
control input pause	active closed	active closed active open			
control input pause	alarm off	alarm off alarm on			
access code	5000	1	1	9999	
language	per identity code	German English French Dutch (depending on identity code)			
operating menu	complete	restricted complete			

9 Troubleshooting

Fault	Fault text	Symbol	Effect on metering	Effect on control	Alarm with acknowledgement	Remarks	Remedy
measured value checkout time meas. value exceeded[1]	check PER probe	ε	basic load	stop	yes	function defeatable	check function of probe
signal drops below value signal exceeded signal out of range	input <4 mA input >20 mA check PER input	ε	basic load	stop	yes	signal <4 ±0.2 mA signal>20 ±0.2 mA 3.8..23 mA	check probe, transducer and cable connection
calibration with error	PER calibration defect	ε	basic load	stop	no	metering continues in case of error with unsteady measured values	check probe, replace if neccessary, recalibrate if neccessary
correction variable signal exceeded 2) alarm limit	check Te input Te limit ↑	ε ε	basic load basic load	stop stop	yes yes	mA range: 3.8...23 mA temp. range: -0.1...100.1°C >50°C	lower temperature
feed forward control mA signal drops below value multipl. additive	check feed forward input	ε	stop carry on	carry on carry on	yes	<3.8 ±0.2 mA; feed forward control=0%	check probe, transducer and cabel connection
signal exceeded	check feed forward input	ε	carry on	carry on	yes	>23 ±0.2 mA; feed forward control=100%	check probe, transducer and cabel connection
limit transgression after checkout time limits	PER limit 1 ↑↓ PER limit 2 ↑↓	ε	carry on	carry on	yes	function defeatable	define cause, reset values if neccessary
servomotor position not reached	servomotor defect	ε	carry on	carry on	yes	servomotor closes	check servomotor
elektronic error	system error	ε O	stop	stop	yes	EEPROM defect	call in service
pause	pause	ε O	stop	stop	no/yes	slowing down time = 0 s slowing down time ≥ 1 s	3)
STOP button	stop	ε O	stop	stop	no	relays drop out	–
during calibration	zero point low zero point high		basic load	stop	no	< 10 mA > 14 mA	–
probe slope too low probe slope too high	PER slope low PER slope high	ε	basic load	stop	no	< 20% of standard slope >500% of standard slope	check probe, replace if neccessary
distance between buffers	distance too small					Δbuffer< 2% of meas. range	recalibrate
during servomotor setting position feed back wrong upper position <40 % max.value lower position >30 % range	check direction final value too small final value too big					without correct adjustment the last valid values are still used	check connection of relays, potentiometer adjust the operation region of the servomotor correctly

1) response condition: Δppm = +/- 1/819 of indicating range
2) the last valid value is still used.
3) on active pause no more faults will be made, the registered faults can be quitted and will disappear when reasons are eleminate.

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