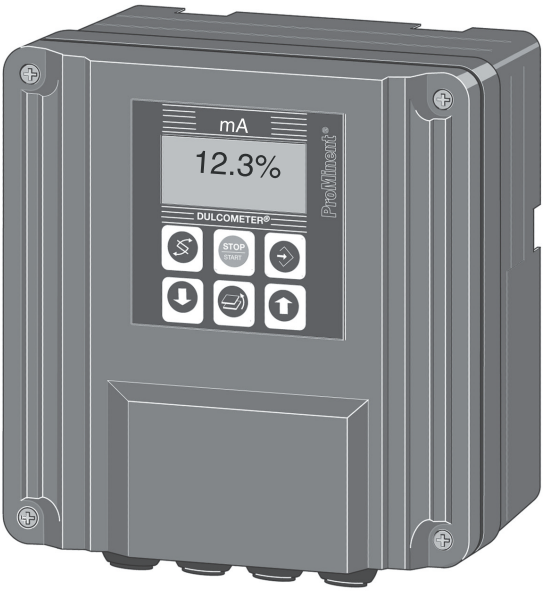
Operating Instructions
DULCOMETER® D1C
Part 2: Adjustment and Operation,
Measured Variable Standard Signal

ProMinent®

TÜV CERT DIN EN ISO 9001 70 100 M 502

D1C2-mA-001-D



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

Part no. 987528 **ProMinent Dosiertechnik GmbH · D-69123 Heidelberg · Germany** BA DM 066 02/00 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 (only with panel installation)
3	100 V 50/60 Hz (only with panel installation)
4	24 V AC/DC
	Measured variable
S	Standard signal 0/4-20 mA
	Connection of measured variable
1	Terminal, standard signal 0/4-20 mA
	Correction variable
0	None
	Feed forward control
0	None
1	As standard signal 0/4-20 mA
2	As frequency 0-500 Hz
3	As 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
4	2 standard signal 0/4-20 mA output, free programmable
	Power control
A	Alarm relay
G	Alarm and 2 limit value relays
M	Alarm and 2 solenoid valve relays
R	Alarm relay and servomotor with feedback
	Pump control
0	None
2	Two pumps
	Control characteristics
0	None
1	Proportional control
2	PID control
	Log output
0	None
	Language
D	German
E	English
F	French
I	Italian
N	Dutch
S	Spanish
P	Polish
A	Swedish
B	Portuguese
U	Hungarian
G	Czech

D1C A	___	___	S	___	___	___	___	___	___	___	___	0	E

Please enter the identity code of your device here!

2 Contents / General User Information

General User Information

These operating instruction describe the technical data and function of the series DULCOMETER® D1C controller, provide detailed safety information and are divided into clear steps. The activities to be carried out are identified by bold bullets (•).

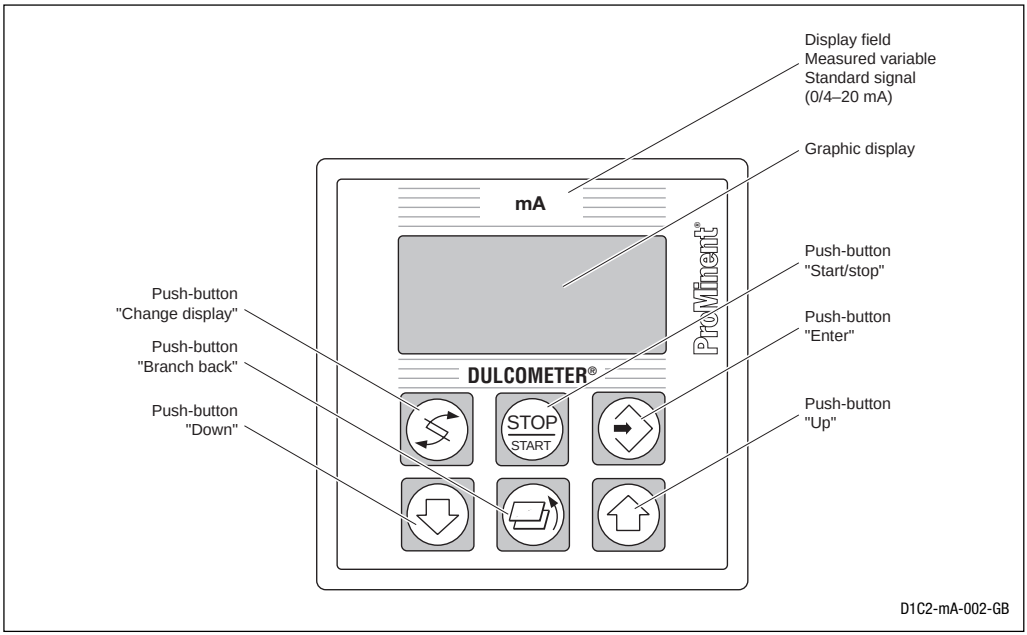
IMPORTANT:

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!

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.
	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 complete operating menu in Section 8 for a detailed description of the individual characteristics of the D1C controller!

4.1 Operating Menu

The 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 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 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 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).

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).

This signal can be used, for example, for flow-proportional metering (multiplicative effect) or feedforward-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 feedforward signal. A multiplicative feedforward variable at the level of the set rated value carries over the calculated control variable unchanged into the controlled variable:

Controlled variable = Feedforward variable/rated value x calculated control variable

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

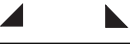
Controlled variable (max. 100 %) = Feedforward variable/rated value x max. controlled variable + calculated control variable

4.5 Error Messages

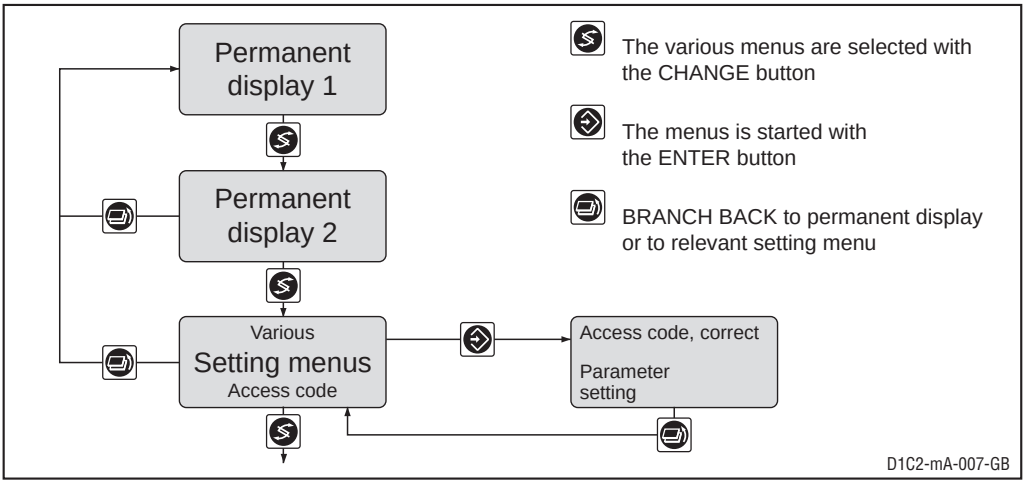
Error messages and information are indicated on the bottom line in the permanent display 1. Errors to be acknowledged (acknowledgement switches off the alarm relay) are indicated by the "Ɛ". Errors/notes which still apply after acknowledgement are indicated alternately. During correction variable processing (temperature for correction of pH-value), the value is indicated in the same line as the error/note. 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	
Relais 1, lower	Symbol left	
Relais 2, upper	Symbol right	
Relais 2, lower	Symbol right	
Metering pump 1 ↑ Control OFF	Symbol left	
Control ON	Symbol left	
Metering pump 2 ↓ Control OFF	Symbol right	
Control ON	Symbol right	
Solenoid valve 1 ↑ Control OFF	Symbol left	
Control ON	Symbol left	
Solenoid valve 2 ↓ 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



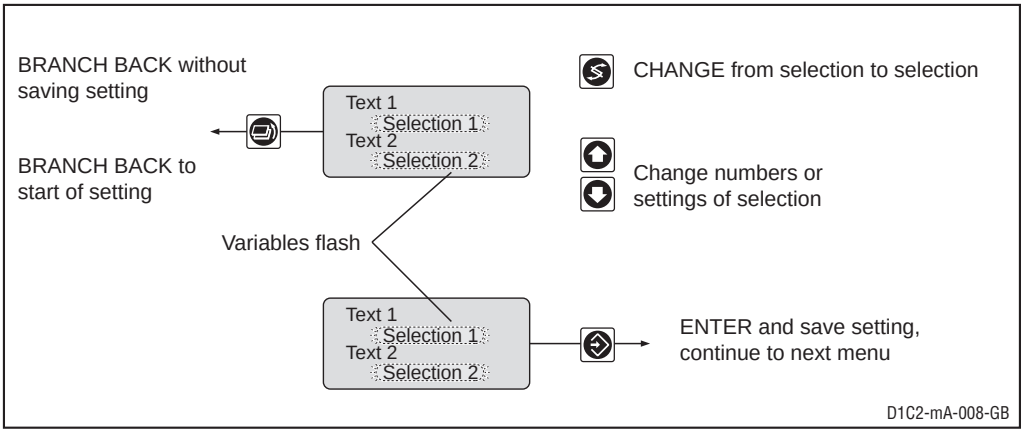
NOTE

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!

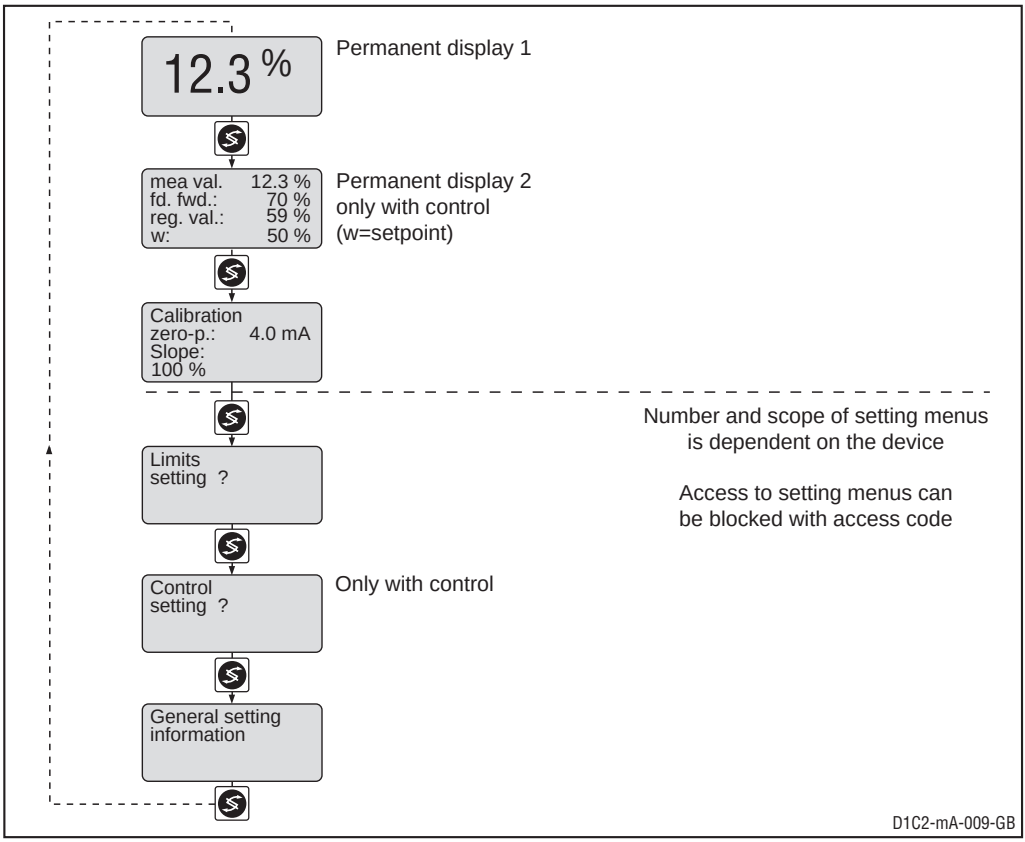
If the access code is selected correctly in a setting menu, then the following setting menus are also accessible!

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

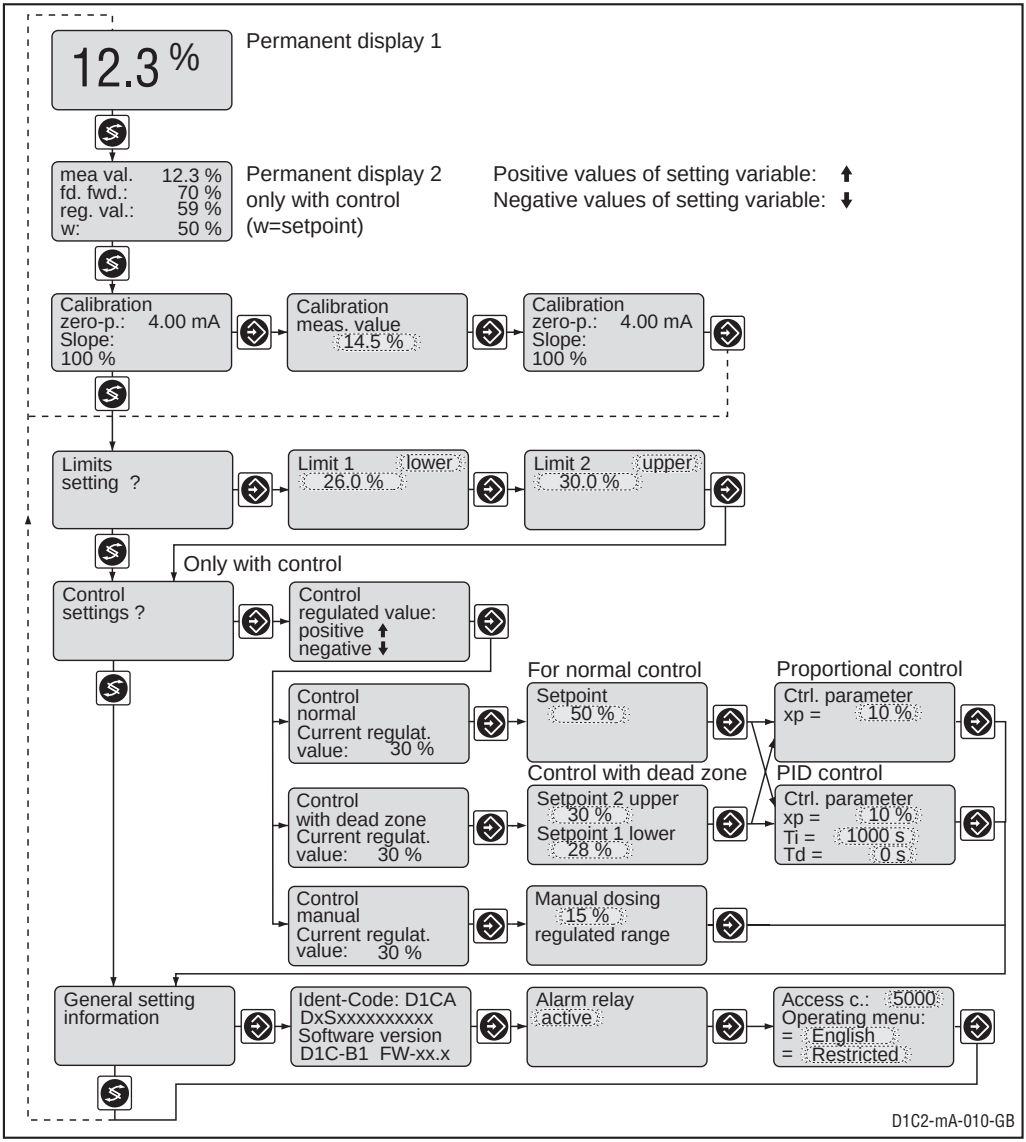


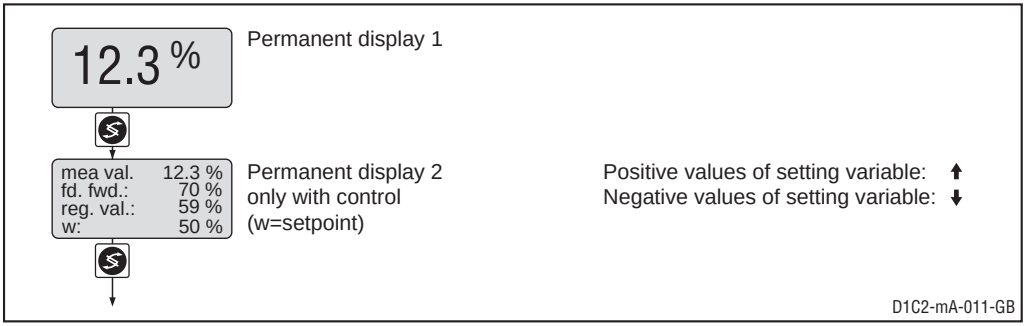
7 Restricted Operating Menu / Overview

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



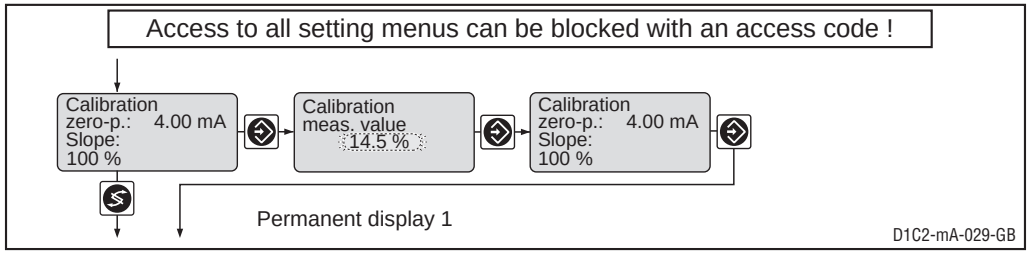


Calibration the Standard Signal (zero-point calibration):

During calibration, the control function persists. The standard signal of the output (measured value) remains unchanged. The measured value registered during the start of the calibration is proposed as value; this value is adjustable.

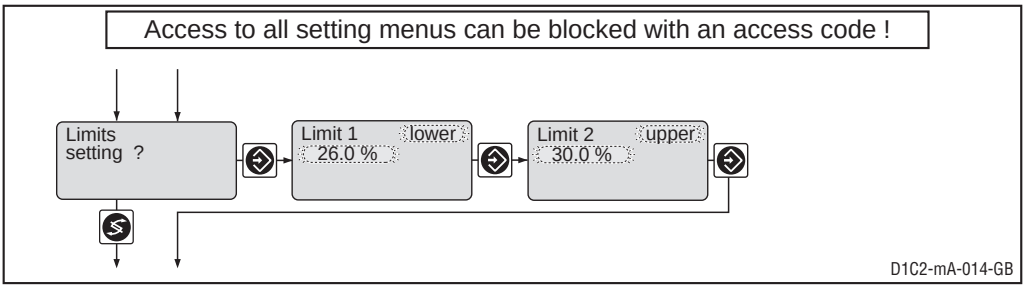
CAUTION:

A change of the measuring unit (see page 15) must be done before calibration!



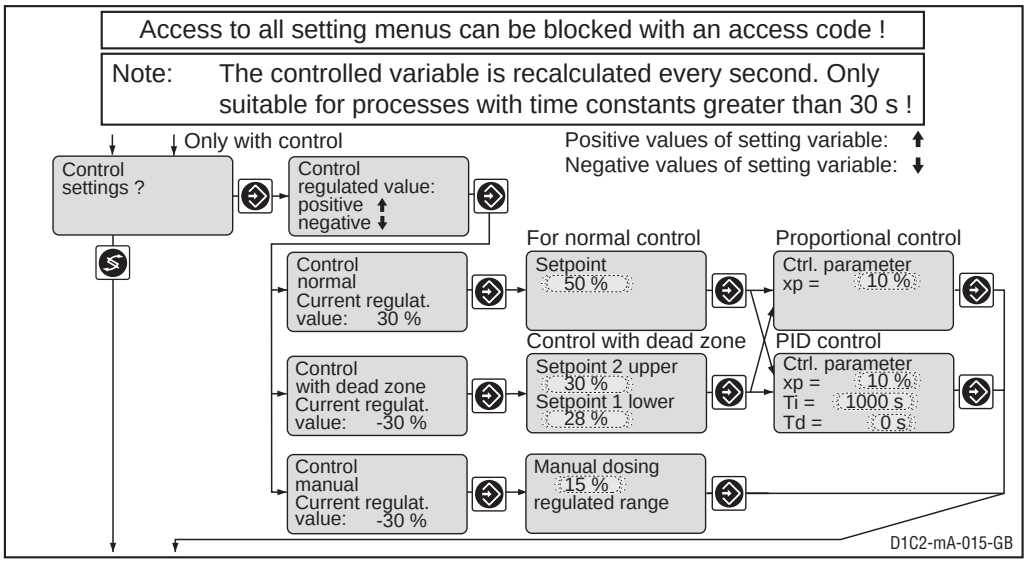
	Initial value	Possible Values Increment	Lower value	Upper value	Remarks
	Measured value	0.1 %	–5 %	105 %	
		0.01 mA	–1.00 mA	21.00 mA	
		0.01 m	0 m	31.50 m	30.00 m
		0.1 %	0 %	105 %	100 %
		0.001 bar	0 bar	1.050 bar	1.000 bar
		0.001 bar	0 bar	5.250 bar	5.000 bar
		0.01 bar	0 bar	10.50 bar	10.00 bar
		0.1 bar	0 bar	105 bar	100.0 bar
		0.1 psi	0 psi	105 psi	100 psi
		1 psi	0 psi	1050 psi	1000 psi
		0.001 m^3/h	0 m^3/h	9.999 m^3/h	9.999 m^3/h
		0.1 m^3/h	0 m^3/h	105 m^3/h	100 m^3/h
		1 m^3/h	0 m^3/h	1050 m^3/h	1000 m^3/h
		0.1 gal/h	0 gal/h	105 gal/h	100 gal/h
		1 gal/h	0 gal/h	1050 gal/h	1000 gal/h
		1 ppm	0 ppm	1050 ppm	1000 ppm
		0.1 %RF	0 %RF	105 %RF	100 %RF
		0.01 mA	0/4 mA	21 mA	20 mA
		0.1 %	0 %	105 %	100 %

Limits



		Initial value	Possible Values Increment	Lower value	Upper value	Remarks
Type of limit Trans-gression	Limit 1:	lower	upper lower			Limit transgression when exceeding or dropping below value
	Limit 2:	upper	off *)			*) only with limit value relay
Limit value	Limit 1:	0 %	0.1 %	–5 %	105 %	measuring unit %
	Limit 2:	100 %	0.1 %	–5 %	105 %	
	Limit 1:	0.00 mA	0.01 mA	–1.00 mA	21 mA	measuring unit mA
	Limit 2:	20.00 mA	0.01 mA	–1.00 mA	21 mA	

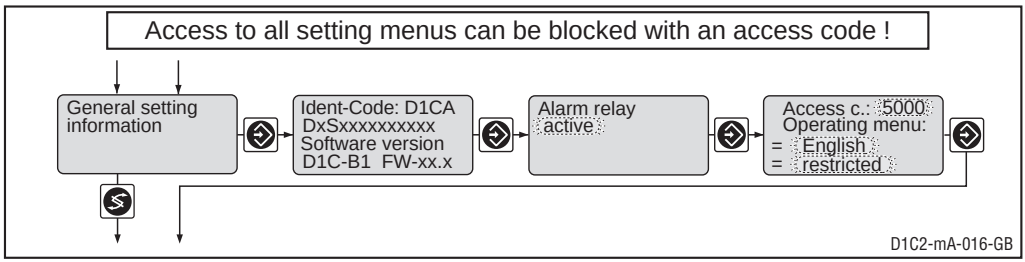
Control



Restricted Operating Menu / Description

	Initial value	Possible Values Increment	Lower value	Upper value	Remarks
Setpoint	50 % 10.00 mA	0.1 % 0.01 mA	–5.0 % –1.00 mA	105 % 21 mA	measuring unit: % measuring unit: mA 2 setpoints necessary for control with dead zone. Setpoint 1 > setpoint 2 Adjustment of measuring on page 14
Control parameter xp	10 %	1 %	1 %	500 %	xp referred to measuring range
Control parameter Tn	off	1 s	1 s	9999 s	
Control parameter Tv	off	1 s	1 s	2500 s	Function off = 0 s
Manual metering	0 %	1 %	–100 %	+100 %	Function off = 0 s

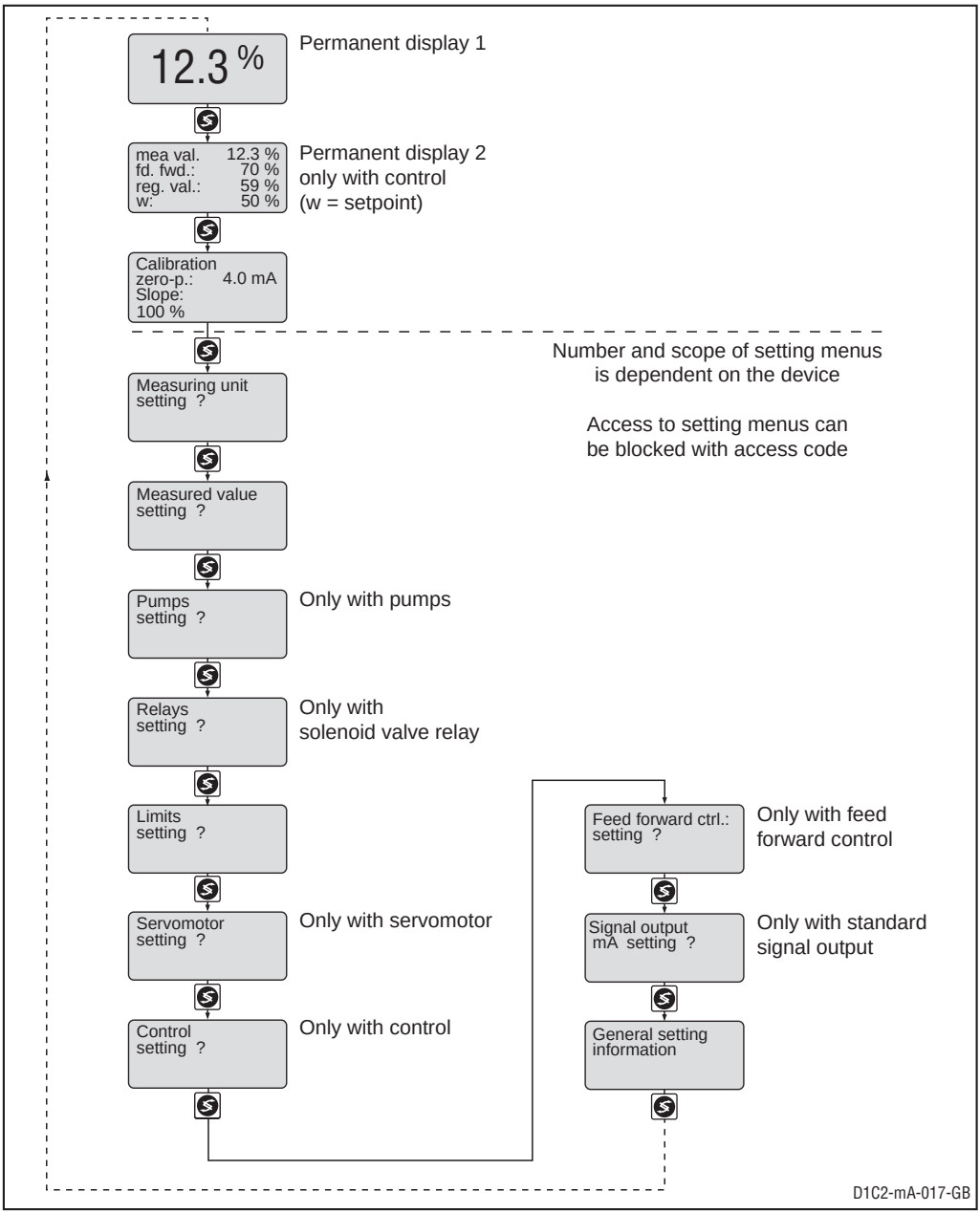
General Settings



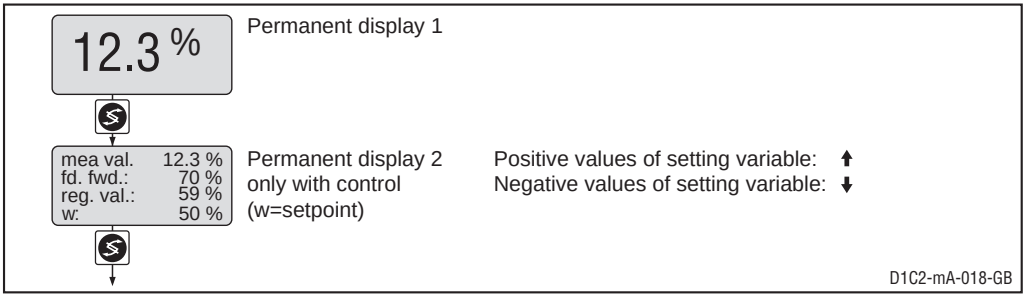
	Initial value	Possible Values Increment	Lower value	Upper value	Remarks
Alarm relay	active	active not active			
Access code	5000	1	1	9999	
Language	as per identity code	German English French Italian Spanish Dutch Polish Swedish Portuguese Czech Hungarian			
Operating menu	restricted	restricted complete			

8 Complete Operating Menu / Overview

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

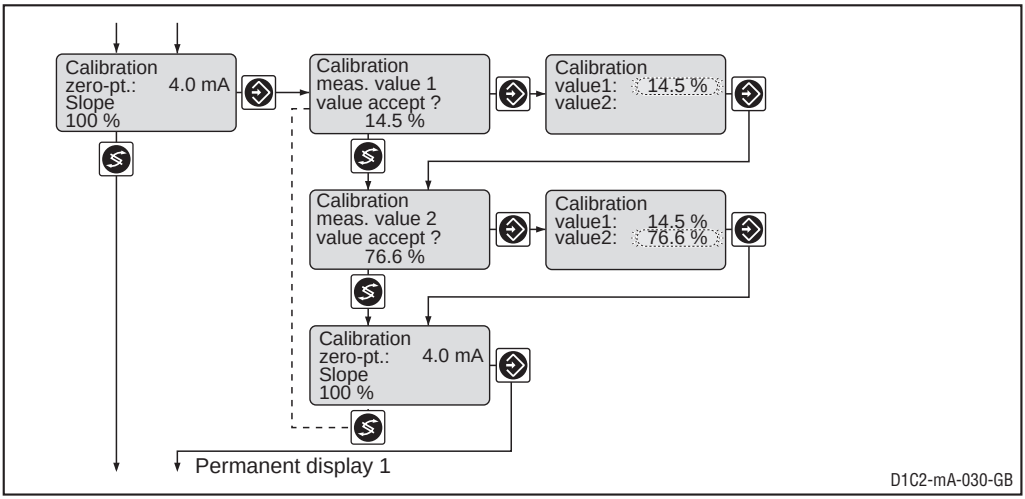


Complete Operating Menu / Overview



Calibration the Standard Signal (two-point calibration)

During calibration, metering is reduced to the set basic load. The standard signal of the output (measured value) is reduced to 0 mA or 4 mA. As value the measured value is proposed; this value is adjustable. (The slope is indicated as deviation measured slope to norm slope).

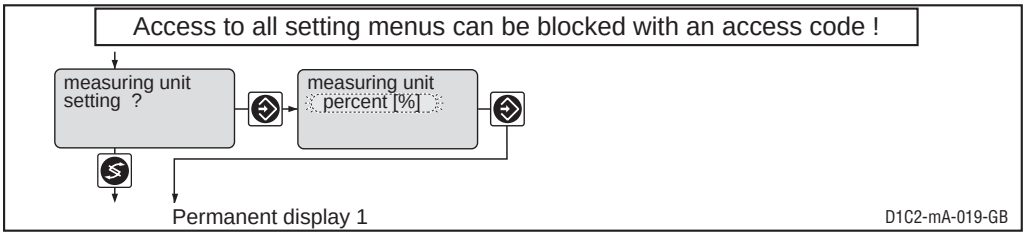


	Initial value	Possible Values Increment	Lower value	Upper value	Remarks
	Measured value*	0.1 % 0.01 mA	–5 % –1.00 mA	105 % 21.00 mA	*for possible measuring values see page 10

Error message	Condition	Effect
Value distance too small	Δ value > 5.0 % Δ value > 1.00 mA	measured value deleted repeat calibration

Complete Operating Menu / Overview

Measuring Unit

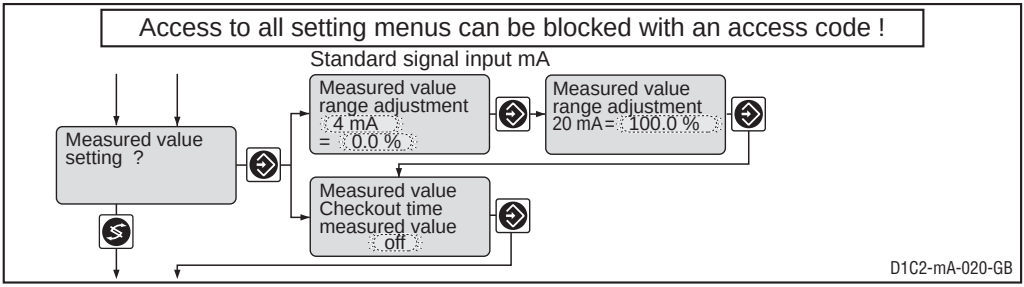


When changing the measuring unit the settings must be checked in all menues!

	Initial value	Possible Values Increment	Lower value	Upper value	Remarks
Measuring variable	Measurement signal	Level Pressure Water flow rate Turbidity Humidity Measurement signal			
Measuring unit	0 - 100 %	0 - 30 m 0 - 100 % 0 - 1.000 bar 0 - 5.000 bar 0 - 10.00 bar 0 - 100.0 bar 0 - 100.0 psi 0 - 1000 psi 0 - 9.999 m^3/h 0 - 100.0 m^3/h 0 - 1000 m^3/h 0 - 100.0 gal/h 0 - 1000 gal/h 0 - 1000 ppm 0 - 100.0 %RH 0/4 - 20 mA 0 - 100 %			Level Pressure Water flow rate Turbidity Humidity Measurement signal

Complete Operating Menu / Overview

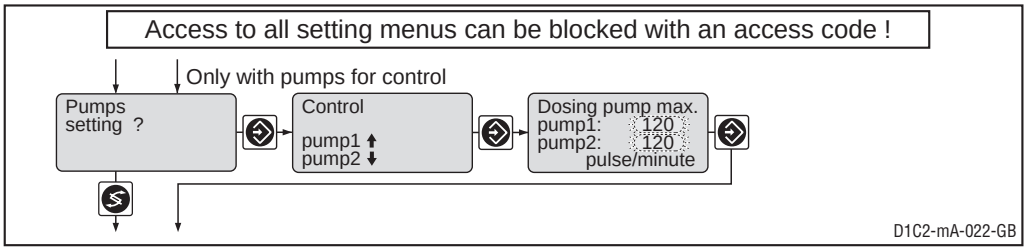
Measured value



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

	Initial value	Possible Values Increment	Lower value	Upper value	Remarks
Standard signal input lower signal limit	4 mA	0 mA 4 mA			
Allocated measuring range*	0–100.0 % 0–20.00 mA	0.1 % 0.01 mA	–5 % –1.00 mA	105 % 21.00 mA	Measurement signal *for other measuring ranges see page 10
Checkout time	off	1 s	1 s	9999 s	Constant measurement signal results in message and alarm. Function off = 0 s

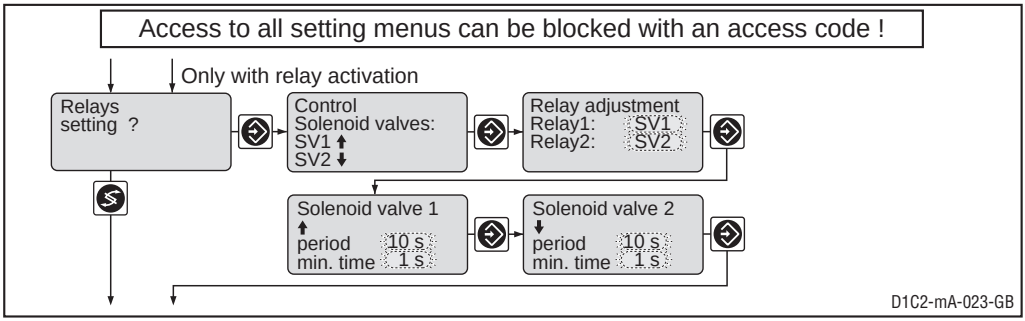
Pumps



	Initial value	Possible values Increment	Lower value	Upper value	Remarks
Max. stroke/minute of pumps 1 and 2	120	1	1	500	off = 0 strokes/min

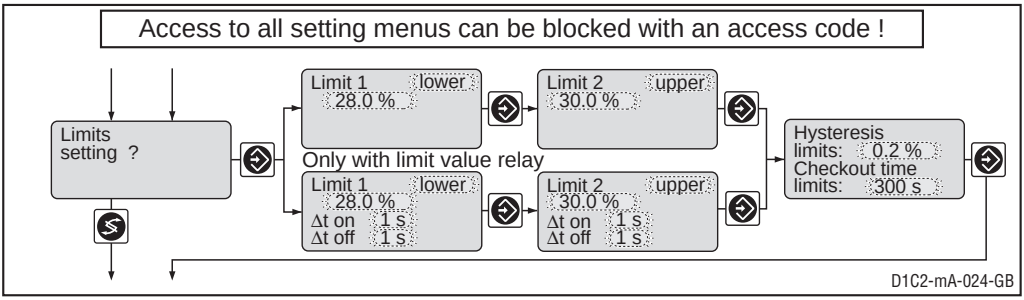
Complete Operating Menu / Overview

Relay for solenoid valve activation



	Initial value	Possible Values Increment	Lower value	Upper value	Remarks
Relay adjustment Relay 1	as per identity code	Solenoid valve 1 Limit value 1* Actuator 1 off			*When the setting is „Limit" the relays will not be disable during the pause or in case of a fault.
Relay 2		Solenoid valve 2 Limit value 2* Actuator 2 off			
Period	10 s	1 s	10 s	9999 s	
min. time	1 s	1 s	1 s	period/2	

Limits



	Initial value	Possible values Increment	Lower value	Upper value	Remarks
Type of limit transgression Limit 1: Limit 2:	lower upper	upper lower off *)			Limit transgression when exceeding or dropping below value *) only with limit value relay

Complete Operating Menu / Overview

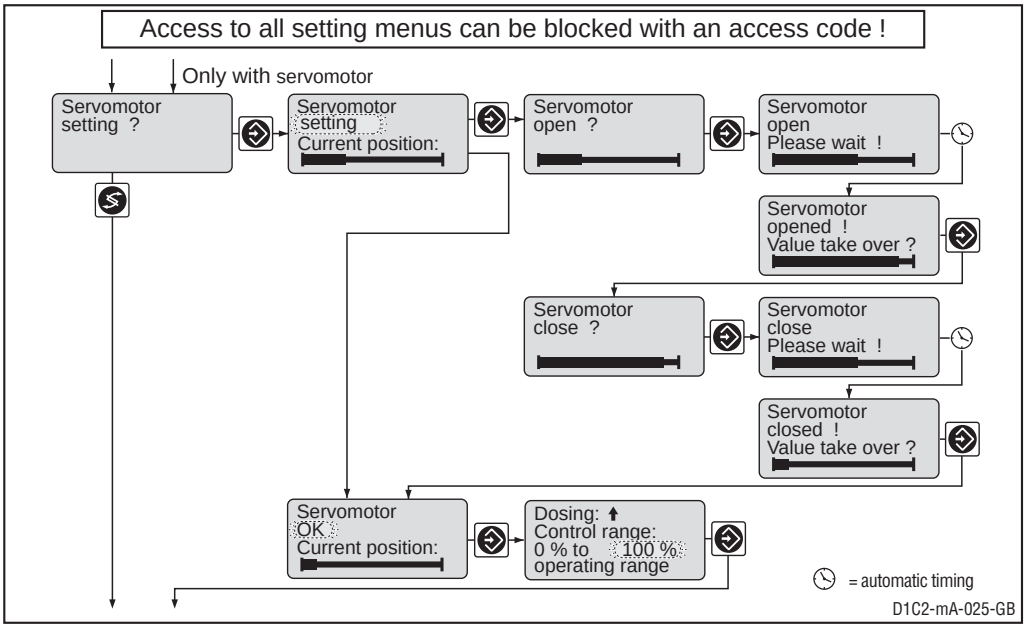
		Initial value	Possible values: Increment	Lower value	Upper value	Remarks
Limit value	Limit 1:	0 %	0.1 %	–5 %	105 %	measuring unit percent
	Limit 2:	100 %	0.1 %	–5 %	105 %	
	Limit 1:	0 mA	0.01 mA	–1.00 mA	21 mA	measuring unit milliampere
	Limit 2:	20 mA	0.01 mA	–1.00 mA	21 mA	
Switch-on delay Δt ON		0 s	1 s	0 s	9999 s	
Switch-off delay Δt OFF		0 s	1 s	0 s	9999 s	
Hysteresis limits		0.2 % 0.04 mA	0.1 % 0.01 mA	0.1 % 0.02 mA	105 % 21.00 mA	
Checkout time limits		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 defining the control range.

CAUTION:

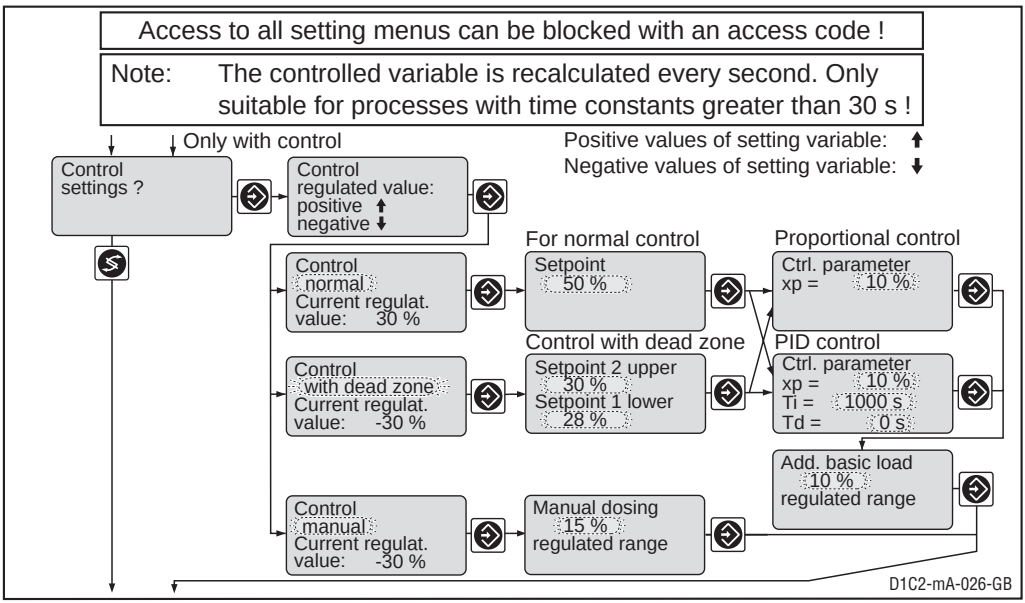
To ensure correct operation, the activation time of the actuator used should not be less than 25 seconds for the control range from 0...100 %!



Complete Operating Menu / Overview

	Initial value	Possible values Increment	Lower value	Upper value	Remarks
Servomotor	Setting	Setting OK off			
Controll direction	↑	↑ ↓			
Control range	100 %	1 %	10 %	100 %	in % of operating range

Control

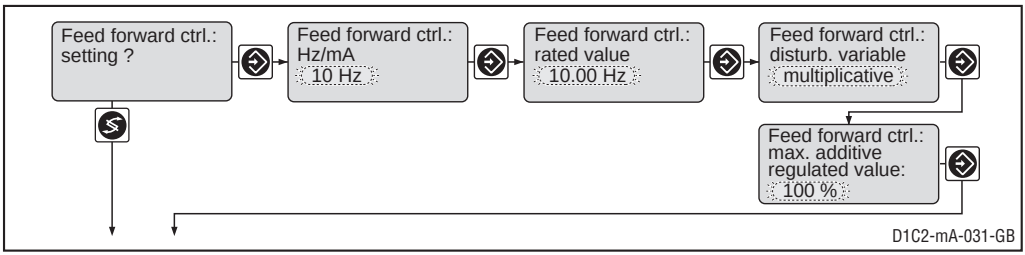


	Initial value	Possible values Increment	Lower value	Upper value	Remarks
Control	normal	normal with dead zone manual			When controlling with dead zone, the feed forward control is not used for measured values within the dead zone.
Setpoint	1.0 ppm 10 %	0.01 ppm 0.1 %	–3 ppm –30 %	63 ppm 630 %	When measuring range concentration When measuring range saturation 2 setpoints necessary for control with dead zone. Setpoint 1 > setpoint 2

Complete Operating Menu / Overview

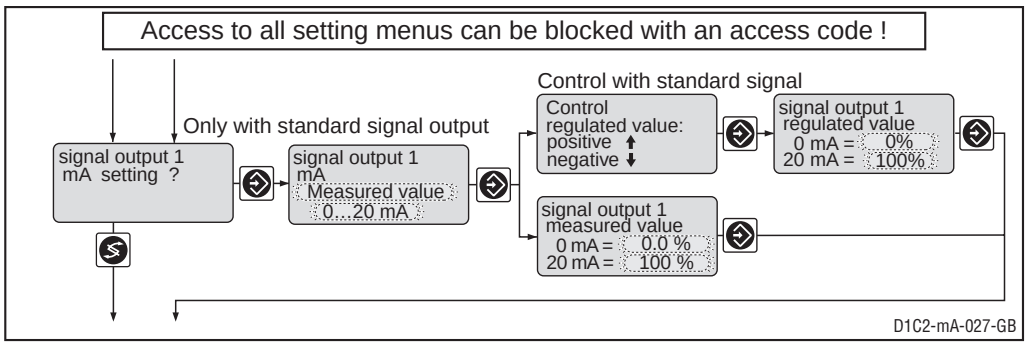
	Initial value	Possible values Increment	Lower value	Upper value	Remarks
Control parameter xp	10 %	1 %	1 %	500 %	xp referred to measuring range
Control parameter Tn	off	1 s	1 s	9999 s	Function off = 0 s
Control parameter Tv	off	1 s	1 s	2500 s	Function off = 0 s
Additional load	0 %	1 %	–100 %	+100 %	
Manual metering	0 %	1 %	–100 %	+100 %	

Feed forward control

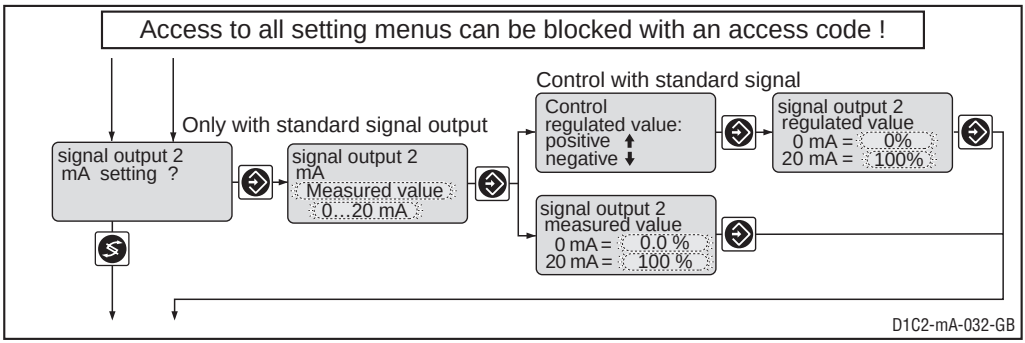


	Initial value	Increment	Lower value	Upper value	Remarks
Feed forward control (Flow)	as per identity code Standard signal 4–20 mA	None 10 Hz 500 Hz 0…20 mA 4…20 mA			Signal processing: Signal <0.02 Hz = No flow Signal <0.2 Hz = No flow Signal <0.2 mA = No flow Signal <4.2 mA = No flow
Feed forward control rated value	10 Hz 500 Hz 20 mA	0.01 Hz 1 Hz 0.1 mA	0.1 Hz 5 Hz 0.4 mA	10 Hz 500 Hz 20 mA	Depended on signal type. Maximum limitation of range used.
Feed forward control	multiplicative	multiplicative			
Feed forward control effect		additive			
Feed forward control add. regulated value	100 %	1 %	–500%	+500%	only with add. feed forward control

Standard Signal Output 1



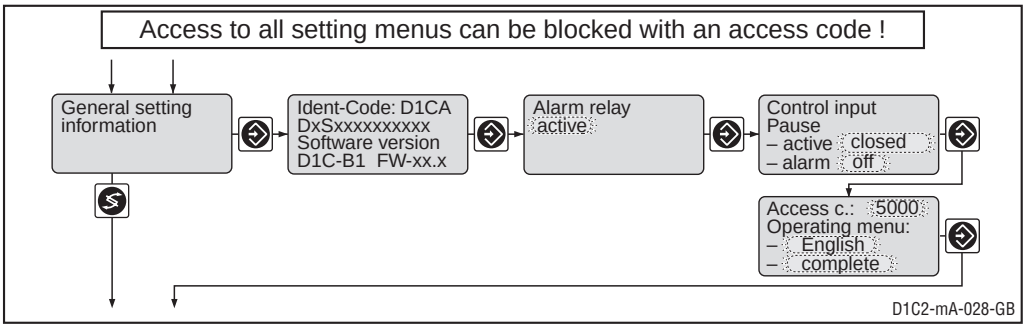
Standard Signal Output 2



	Initial value	Possible values Increment	Lower value	Upper value	Remarks
Variable allocation	as per identity code	Measured value Controlled variable			If control applicable
Output range	0…20 mA	0…20 mA 4…20 mA			
Range measured	0–100 % 0–20.00 mA	0,1 % 0,01 mA	–5 % –1,00 mA	105 % 21,00 mA	Minimum range 1 % of measured value
Range controlled variable	0 %…+100 %	1 %	–100 %	+100 %	Minimum range 1 %

Complete Operating Menu / Overview

General Setting



	Initial value	Possible values Increment	Lower value	Upper value	Remarks
Alarm relay	active	active not active			
Pause	Pause	Pause Pause/Hold*			*If Pause/Hold is active, the last valid regulated output signal (PI-part) is hold
Control input pause	closed	closed open			
Alarm Pause	off	off on			Alarm relay can be triggered by pause contact
Access code	5000	1	1	9999	
Language	as per identity code	as per identity code			
Operating menu	complete	restricted complete			

Fault	Fault text	Symbol	Effect on metering	Effect on control	Alarm with acknowledgement	Remarks	Remedy
Measured value Checkout time measured value exceeded	Check probe	Ɛ	Basic load	Stop	Yes	Function defeatable	Check function of probe
Signal exceeded/drops below value	Check input	Ɛ	Basic load	Stop	Yes	Signal <3.0 ±0.2 mA or >23 ±0.2 mA	Check probe, transducer and cable connection
Feed forward control Signal exceeded/drops below value	Check feed forward input	Ɛ			Yes	Signal <3.0 ±0.2 mA or >23 ±0.2 mA Value last valid is used	Check probe, transducer and cable connection
Limit transgression after checkout time limits	Limit 1 ▲▼ Limit 2 ▲▼	Ɛ	Basic load*	Stop*	Yes	Function defeatable	Define cause, reset values if necessary
Servomotor Position not reached	Servomotor defective	Ɛ			Yes	Servomotor closes	Check servomotor
Electronics error	System error	Ɛ O	Stop	Stop	Yes	Elektronic data defective	Call in service

Operation	Note text	Symbol	Effect on metering	Effect on control	Alarm with acknowledgement	Remarks	Remedy
Pause contact	Pause	Ɛ O	Stop	Stop	No	No further fault check	–
	Pause/Hold			PI-part frozen			
Stop button	Stop	Ɛ O	Stop	Stop	No	Relay drops out	–
During servomotor setting Position feed back wrong Upper position <40 % max. value Lower position >30 % range	Direction check Final value small Final value big					Without correct adjustment the last valid values are still used	Check connection of relay, potentiometer Adjust the operation region of the servomotor correctly

* at software version 4.63

Operating Instructions DULCOMETER® D1C, Part 2/S, Version 1.0, Issue 02/00
Subject to modifications · Printed in the F.R.Germany
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