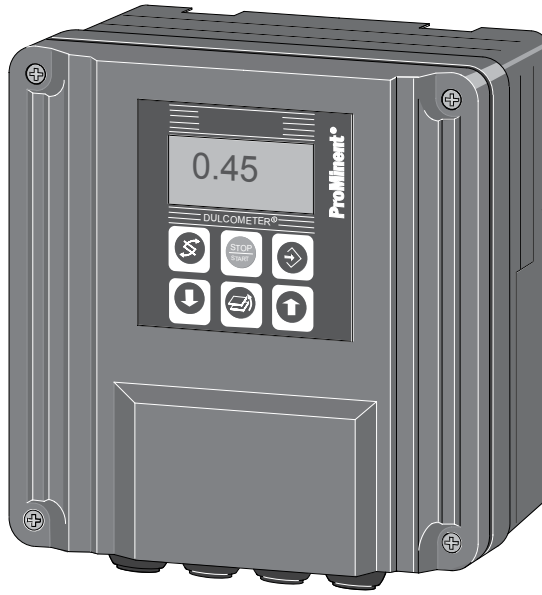
Instructions for assembly and use

DULCOMETER ® D1Cb



Please carefully read these operating instructions before use! · Do not discard!
The operator shall be liable for any damage caused by installation or operating errors!
Technical changes reserved.

Part no. 986362

BA DM 176 07/09 EN

ProMinent Dosiertechnik GmbH
Im Schuhmachergewann 5-11
69123 Heidelberg
Telephone: +49 6221 842-0
Fax: +49 6221 842-419
email: info@prominent.com
Internet: www.prominent.com

986362, 2, en_GB

Table of contents

1 Introduction

This operating manual provides information on the technical data and functions of the DULCOMETER. ® control series D1Cb.

1.1 Explanation of the Safety Information

Introduction

These operating instructions provide information on the technical data and functions of the product. These operating instructions provide detailed safety information and are provided as clear step-by-step instructions.

The safety information and notes are categorised according to the following scheme. A number of different symbols are used to denote different situations. The symbols shown here serve only as examples.

DANGER!

Nature and source of the danger

Consequence: Fatal or very serious injuries.

Measure to be taken to avoid this danger.

Danger!

– Denotes an immediate threatening danger. If this is disregarded, it will result in fatal or very serious injuries.

WARNING!

Nature and source of the danger

Possible consequence: Fatal or very serious injuries.

Measure to be taken to avoid this danger.

Warning!

– Denotes a possibly hazardous situation. If this is disregarded, it could result in fatal or very serious injuries.

CAUTION!

Nature and source of the danger

Possible consequence: Slight or minor injuries. Material damage.

Measure to be taken to avoid this danger.

Caution!

– Denotes a possibly hazardous situation. If this is disregarded, it could result in slight or minor injuries. May also be used as a warning about material damage.

NOTICE!

Nature and source of the danger

Damage to the product or its surroundings.

Measure to be taken to avoid this danger.

Note!

– Denotes a possibly damaging situation. If this is disregarded, the product or an object in its vicinity could be damaged.

Type of information

Hints on use and additional information.

Source of the information. Additional measures.

Information!

– *Denotes hints on use and other useful information. It does not indicate a hazardous or damaging situation.*

1.2 Users' Qualifications

WARNING!

Danger of injury with inadequately qualified personnel!

If inadequately qualified personnel work on the unit or loiter in the hazard zone of the unit, this could result in dangers that could cause serious injuries and material damage.

– All work on the unit should therefore only be conducted by qualified personnel.
– Unqualified personnel should be kept away from the hazard zone.

Activity	Training
Assembly / Installation	trained qualified personnel
Commissioning	technical experts
Operation	instructed personnel
Maintenance / Repair	Customer service department
Decommissioning / Disposal	technical experts
Troubleshooting	instructed personnel

Explanation of the terms:

- A technical expert is deemed to be a person who is able to assess the tasks assigned to him and recognise possible hazards based on his/her technical training and experience, as well as knowledge of pertinent regulations.

  Note: A technical qualification is typically proven by the required completion of a technical training course. The assessment of a person's technical training can also be based on several years of work in the relevant field.
- A qualified employee is deemed to be a person who is able to assess the tasks assigned to him and recognise possible hazards based on his/her technical training, knowledge and experience, as well as knowledge of pertinent regulations.

  Note: The assessment of a person's technical training can also be based on several years of work in the relevant field.
- An instructed person is deemed to be a person who has been instructed and, if required, trained in the tasks assigned to him/her and possible dangers that could result from improper behaviour, as well as having been instructed in the required protective equipment and protective measures.
- Customer service department refers to service technicians, who have received proven training and have been authorised by ProMinent to work on the system.

Note for the system operator

The pertinent accident prevention regulations, as well as all other generally acknowledged safety regulations, must be adhered to!

1.3 General Safety Information

WARNING!

Live parts!

Possible consequence: Fatal or very serious injuries

– Measure: Disconnect the mains power supply prior to opening the housing
– De-energise damaged, defective or manipulated units by disconnecting the mains plug

WARNING!

Unauthorised access!

Possible consequence: Fatal or very serious injuries

– Measure: Ensure that there can be no unauthorised access to the unit

WARNING!

Operating errors!

Possible consequence: Fatal or very serious injuries

– The unit should only be operated by adequately qualified and technically expert personnel
– Please also observe the operating instructions for controllers and fittings and any other component groups, such as sensors, measuring water pumps ...
– The operator is responsible for ensuring that personnel are qualified

CAUTION!

Electronic malfunctions

Possible consequence: Material damage to destruction of the unit

- The mains connection cable and data cable should not be laid together with cables that are prone to interference
- Measure: Take appropriate interference suppression measures

NOTICE!

Correct and proper use

Damage to the product or its surroundings

- The unit is not intended to measure or regulate gaseous or solid media
- The unit may only be used in accordance with the technical details and specifications provided in these operating instructions and in the operating instructions for the individual components

NOTICE!

Correct sensor operation / Run-in time

Damage to the product or its surroundings

- Correct measuring and dosing is only possible if the sensor is working perfectly
- It is imperative that the run-in times of the sensors are adhered to
- The run-in times should be allowed for when planning initial operation
- It may take a whole working day to run-in the sensor
- Please read the operating instructions for the sensor

NOTICE!

Correct sensor operation

Damage to the product or its surroundings

- Correct measuring and dosing is only possible if the sensor is working perfectly
- Check and calibrate the sensor regularly

NOTICE!

Compensation of control deviations

Damage to the product or its surroundings

- This controller cannot be used in control circuits which require rapid compensation (< 30 s)

1.4 Correct and Proper Use

NOTICE!

Compensation for control deviations

Damage to the product or its surroundings

– The controller can be used in processes, which require compensation of > 30 seconds

NOTICE!

Correct and Proper Use

The unit is intended to measure and regulate liquid media.

The unit may only be used in accordance with the technical details and specifications provided in this operating manual and in the operating manuals for the individual components (such as, for example, sensors, fittings, calibration devices, metering pumps etc.).

Any other uses or modifications are prohibited.

1.5 ID Code

Device identification / Identcode

DULCOMETER® control series D1Cb			
D1Cb			
Type of assembly			
W	Wall mounted (IP 65)		
Version			
00	with LCD and keypad / with ProMinent logo		
Operating voltage			
6	90...253 V, 50/60 Hz (wide voltage power unit)		
Certification			
01	CE mark		
Hardware extension I			
0	none		
Hardware extension II			
0	none		
1	Protective RC circuit for power relay		
External connection			
0	none		
Software default setting			
U	Default setting		
V	Software preset		
Default setting - measured variable			
0	Universal	I	Chlorite
A	Peracetic acid	P	pH
B	Bromine	R	Redox

DULCOMETER® control series D1Cb																				
										C	Chlorine			S	0/4...20 mA standard signal general					
										D	Chlorine dioxide			X	Dissolved oxygen					
										F	Fluoride			Z	Ozone					
										H	Hydrogen peroxide			L	Conductivity					
											Connection of measured variable										
											1	mA input (standard signal 0/4-20 mA, all measured variables)									
											5	mV input (pH/redox)									
												Correction variable									
												0	none								
												2	Temperature Pt 100/PT1000 (for pH, conductivity, fluoride, ClO_2 CDP sensor)								
												4	Manual temperature input (for pH, conductivity, fluoride, ClO_2 CDP sensor)								
													Control input								
													0	none							
													1	Pause							
													2	Pause or interference variable flow via frequency							
														Signal output							
														0	none						
														1	Analogue signal output 0/4...20 mA						
															Power activation						
															G	Alarm and 2 limit relays					
															M	Alarm and 2 solenoid valve relays					

DULCOMETER ® control series D1Cb																	
															Pump activation		
															0	none	
															2	2 pumps via pulse frequency	
																Control behaviour	
																0	none
																1	Proportional control
																2	PID control

2 Functional Description

Brief functional description

The DULCOMETER ® D1Cb 4-wire measuring transducer/control is a device designed to measure/control a measured variable.

In the mA measuring version, the measured variable can be changed without restrictions in the menu of the device. In the mV measuring version, it is only possible to select between pH and redox in the menu of the DULCOMETER ® D1Cb .

Depending on the measured variable, sensors for pH or redox potential or amperometric sensors can only be connected to the measured variables in line with the *Table "Table of measured variables: Assignment of the measured variable to the measuring input of the DULCOMETER ® D1Cb " on page 14*. The temperature measurement serves as a correction variable and can be measured using a Pt 100/1000. This means that automatic temperature compensation is possible with pH-value, conductivity and fluoride measured variables. Temperature compensation is performed in the sensor (with the exception of the chlorine dioxide sensor type CDP) with amperometric measured variables (chlorine etc.). The DULCOMETER ® D1Cb is operated using menu keys and the data is displayed by means of an illuminated LCD display. The LCD display ensures that the reading, correction variable, actuating variable and error messages can be clearly read.

Table of measured variables: Assignment of the measured variable to the measuring input of the DULCOMETER ® D1Cb

		Connection of the measured variable to:	
Character	**Measured variable**	**mV input**	**mA input**
0	No default setting of the measured variable (pH and redox can be selected)	X	
A	PES (peracetic acid)		X
B	Bromine		X
C	Chlorine		X
D	Chlorine dioxide		X
F	Fluoride		X
***with reading transducer**			

		Connection of the measured variable to:	
Character	Measured variable	mV input	mA input
H	H_2O_2 (Hydrogen peroxide)		X
I	Chlorite		X
P	pH	X	X*
R	Redox	X	X*
S	0/4...20 mA standard signal general		X
X	O_2		X
Z	O_3		X
L	Conductivity		X
*with reading transducer			

Description of the terminal connections for mA and mV: refer to Fig. 11 and Fig. 12

Description of the operating menu of the measured variables via mV connection: refer to ↳ *Chapter 7 “Measured Variables and Operating Menus for Potentiometric Sensors ” on page 62*

Description of the operating menu of the measured variables via mA connection: refer to ↳ *Chapter 6 “Measured Variables and Operating Menus for Amperometric Sensors ” on page 51*

Description of the operating menu of the measured variables via mA standard signal: refer to ↳ *Chapter 8 “Measured Variables and Operating Menus for the Standard Signal General ” on page 81*

2.1 Wall Mounted/Control Panel Mounted

The DULCOMETER ® D1Cb W is suitable both for wall-mounting, as well as for mounting on a control panel (with additional control panel fixing set).

The plastic housing comprises a housing upper section and lower section. The LCD display and membrane keypad are accommodated in the upper section of the housing.

The lower section of the housing accommodates the processor and power units and any optional assemblies. A ribbon cable connects to the LCD display and the membrane keypad.

The electrical connection is made through originally sealed, push-out cable cut-outs on the underside of the lower section of the housing.

A wall bracket for wall mounting is located on the rear of the lower section of the housing.

2.2 Electrical Design

The device does not have a mains power switch. It is therefore immediately ready for operation once connected to the power supply.

The device processes an input signal whilst taking into consideration operator inputs. The result is displayed and made available to other devices via a standard signal. When equipped with actuators, the device can also provide control functions. It is designed to activate metering pumps, solenoid valves, as well as an mA standard signal output. The activation variable is recalculated every second.

2.2.1 Block circuit diagram

NOTICE!

Connection of mV or mA sensors

The DULCOMETER® D1Cb is suitable for the connection of mV or mA sensors. It is not possible to connect mV and mA sensors simultaneously.

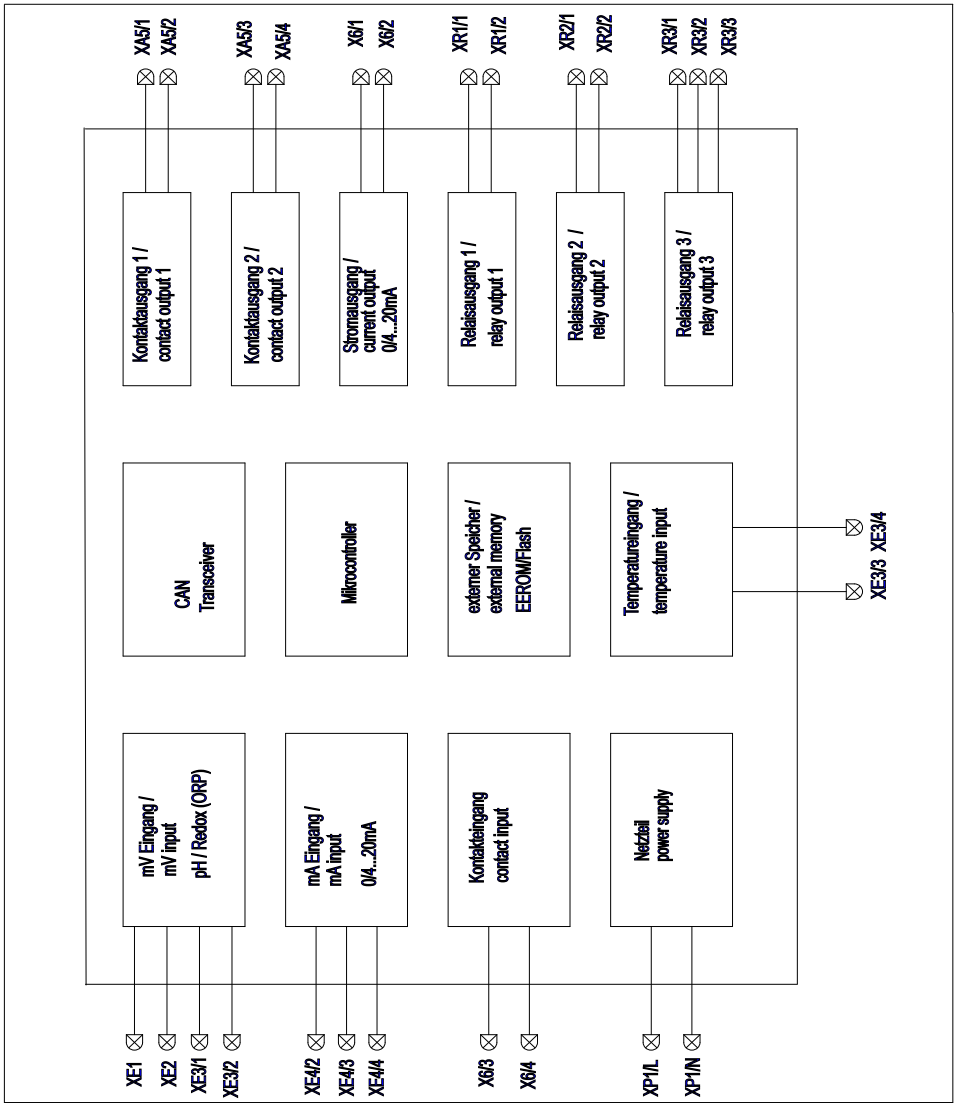


Fig. 1: Block circuit diagram

2.2.2 Galvanic Isolation

WARNING!

Protective low voltage/Mains voltage

Possible consequence: Fatal or very serious injuries

If relay 1 or 2 is operated with protective low voltage, no mains voltage may be connected to the other relay.

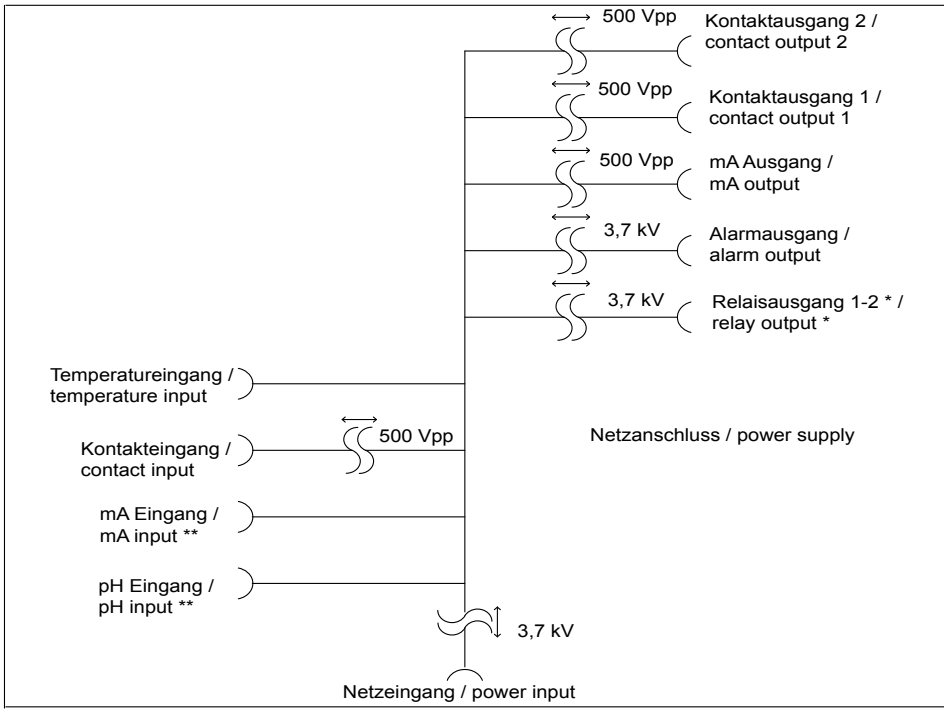


Fig. 2: Galvanic Isolation

* If relay 1 or 2 is operated with protective low voltage, no mains voltage many be connected to the other relay.

** No galvanic isolation between mA and mV input and temperature input.

3 Assembly

NOTICE!

Installation position and conditions

- Ensure that there is unimpeded access for operation
- Secure, low-vibration fixing
- Avoid direct sunlight
- Permissible ambient temperature at fixing position: 0 ... 50°C at max. 95% relative air humidity (non-condensing)

Reading and operating position

- *Install the device at a favourable position for reading and operating (preferably at eye level)*

Installation position

- *Provide adequate clearance for the cable*
- *Allow at least 120 mm clearance above the control in its "parked position"*

3.1 Scope of Delivery

The following components are included as standard with a DULCOMETER® control series D1Cb.

Description	Number
Assembled device	1

Description	Number
Half screw connection, complete (set)	1
M12 x 1.5 screw connection, complete (set)	1
Assembly material, complete, 3P Universal (set)	1
Check kit (only with "inductive conductivity" measured variable)	1
Measured variable labels D1C/ D2C	1
Operating manual	1
General safety instructions	1
CD-ROM with additional information and instructions	1

3.2 Installation (Wall Mounted)

The device can be installed directly on the wall with the aid of the wall bracket.

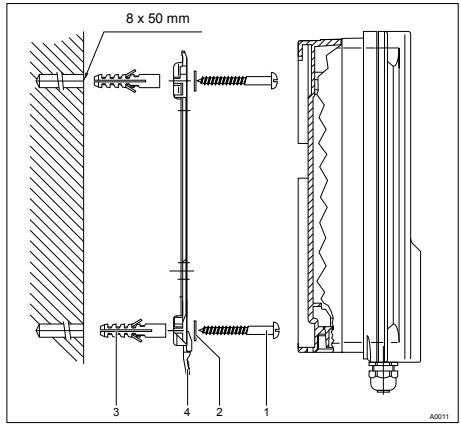


Fig. 3: Fixing material for wall mounting

1. 3 x Round head screws 5x45	2. 3 x Washers 5.3
3. 3 x Plastic wall plugs d8	4. Wall bracket

1. Mark the holes using the wall bracket and drill them
2. Insert wall plugs
3. Secure wall bracket in place with washers and round head screws
4. Place the device from above onto the wall bracket
5. Press the device gently against the wall bracket and slide it approx. 4 mm upwards until you hear it engage in position

3.3 Installation - Control Panel Mounted (Optional)

CAUTION!

Dimensional variations

Possible consequence: material damage

- Photocopying the punched template can result in dimensional deviations
- Use the dimensions shown in Fig. 4 and mark on the control panel

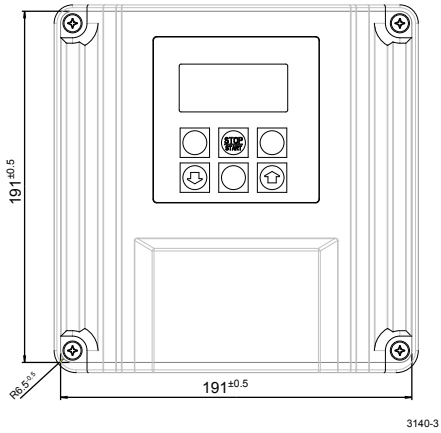


Fig. 4: Punched template, drawing number 3140-3 /not to scale

CAUTION!

Material thickness of control panel

Possible consequence: material damage

- The material thickness of the control panel must be at least 2 mm to ensure secure fixing

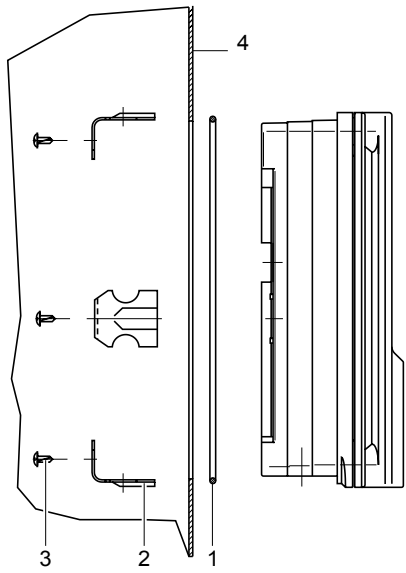


Fig. 5: The material thickness of the control panel must be at least 2 mm to ensure secure fixing

1. 1 x Foam rubber caulk strip d3	2. 6 x Galvanised steel retaining brackets
3. 6 x Galvanised PT cutting screws	4. Control panel

For the part number of the assembly set, refer to *Table on page 123*

1. Using the dimensions shown in Fig. 4 mark the precise position of the device on the control panel
2. Mark the corner points and drill (drill diameter 12 - 13 mm)
3. With a punching tool or jigsaw make the opening as per the punched template drawing
4. Chamfer the cut edges and check whether the sealing surfaces are smooth for the caulk strip
   ⇨ Otherwise the seal cannot be guaranteed
5. Press the caulk strip evenly into the groove running around the device
6. Place the device into the control panel and fix in place at the rear by means of the retaining brackets and PT cutting screws
   ⇨ The device should project approx. 35 mm from the control panel

3.4 Wall Mounted Installation of D1Cb (Electrical)

WARNING!

Electrical voltage

Possible consequence: Fatal or very serious injuries

- The electrical connection to the device should only be made once it has been fitted to the wall or control panel
- The device must be electrically disconnected before it is opened
- Ensure that the device cannot be reconnected accidentally

NOTICE!

Opening the device

Damage to the product or its surroundings

- The device may only be opened by qualified personnel
- The device should only be opened when fitted to the wall or control panel

3.4.1 Opening the device

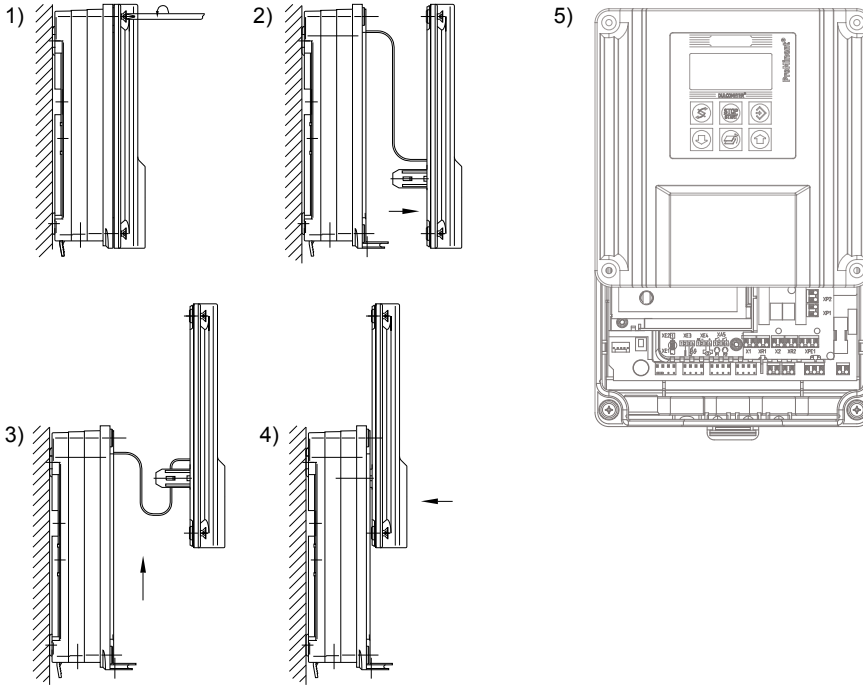


Fig. 6: Opening the device

1. Loosen the 4 captive screws (1).
2. Lift the upper section of the device from the lower section (2). A wide flathead screwdriver may be of assistance.
3. Insert the upper section with both guide rails into the lower section (3 and 4) (parked position)

3.4.2 Electrical Installation (Wall Mounted)

! NOTICE!

Threaded holes

Using a suitable tool, punch out the threaded holes according to the number of cables (∅ approx. 4 mm).

– Punch aids are provided to punch out the threaded holes

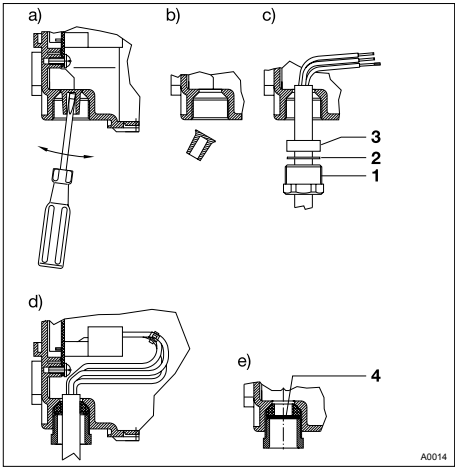


Fig. 7: Punching out the threaded holes

1. Screw connection M20 x 1.5	2. Pressure ring M20
3. Pressure ring M20	4. Dummy washer M20

1. Remove cable sheathing over a sufficient length
2. Fit screw connection (1), pressure ring (2) and seal (3) onto cable
3. Insert cable and fittings into the threaded hole
4. Align the cable and push in until enough cable is in the control housing
5. Screw in screw connection and tighten firmly
6. Shorten cable wires to the precise overall length and strip off approx. 8 mm insulation
7. Fit cable end sleeves to the wires. Refer to *on page 29*
8. Connect up the wires to the terminals according to the electrical wiring diagram Fig. 11

Punched out threaded holes can be resealed with the M20 dummy washers (4) provided.

The M12 x 1.5 screw connections and brass lock nuts are used for the 4 openings in the front row.

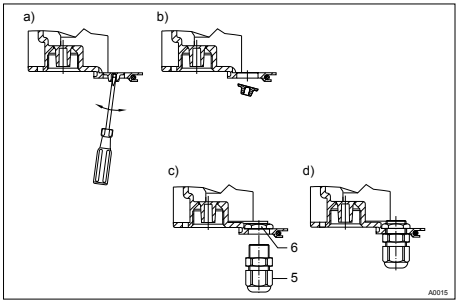


Fig. 8: M12x1.5 screw connections

5. Screw connection M12 x 1.5	6. Lock nut M12x1.5

1. Fit lock nut M12x1.5 (6) on the inside
2. Fit screw connection M12x1.5 (5) from the outside and tighten firmly

3.4.3 Electrical Installation (Control Panel Mounted)

Proceed as described under "Electrical Installation (Wall Mounted)". Refer to *Chapter 3.4.2 “ Electrical Installation (Wall Mounted) ” on page 25*

Only the rear row of threaded holes (M20x1.5) should be used when the device is mounted in a control panel. The front row (M12x1.5) lies outside of the control panel.

Connect up as per the electrical terminal wiring diagram. Refer to *Chapter 3.4.7 “Terminal Wiring Diagram ” on page 31*

3.4.4 Installation of Coaxial Cable to Guard Terminal XE1

CAUTION!

Maximum length of the coaxial cable 10 m

Incorrect reading due to too long a coaxial cable

Possible consequence: Slight or minor injuries, material damage

The maximum length of the coaxial cable may not exceed 10 m when using redox or pH sensors. The measured signal can otherwise be falsified by the effects of interference.

If the gap between the pH/redox measuring point and the DULCOMETER ® D1Cb is more than 10 metres, then the use of an interposed DULCOTEST ® transducer 4-20 mA pH V1, rH V1 is recommended. The connection is then made via terminal XE4 of the DULCOMETER ® D1Cb.

The XE4 (mA input) terminal is a chargeable additional function!

When installing the coaxial cable for the guard terminal XE 1, the allowances shown on the diagram for stripping insulation from the coaxial cable should be adhered to. Fig. 9

The guard terminal should be tightened until "hand-tight".

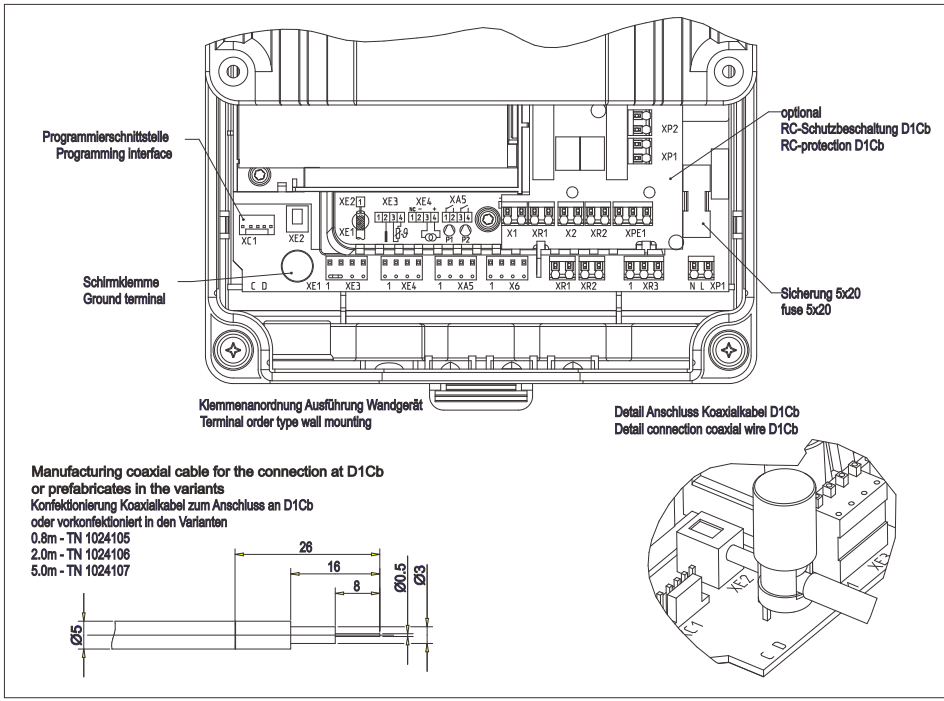


Fig. 9: Preparation of coaxial cable

3.4.5 Cable Cross-Sections and Cable End Sleeves

	Minimum cross-section	Maximum cross-section	Stripped insulation length
Without cable end sleeve	0.25 mm²	1.5 mm²	
Cable end sleeve without insulation	0.20 mm²	1.0 mm²	8 - 9 mm
Cable end sleeve with insulation	0.20 mm²	1.0 mm²	10 - 11 mm

3.4.6 Protective RC Circuit (Optional)

A protective RC circuit is recommended for operation with consumers, which present an inductive load (e.g. motor metering pumps or solenoid metering pumps). In these applications a protective RC circuit prevents wear and tear of the relay contacts. Refer to *Table on page 123*

3.4.7 Terminal Wiring Diagram

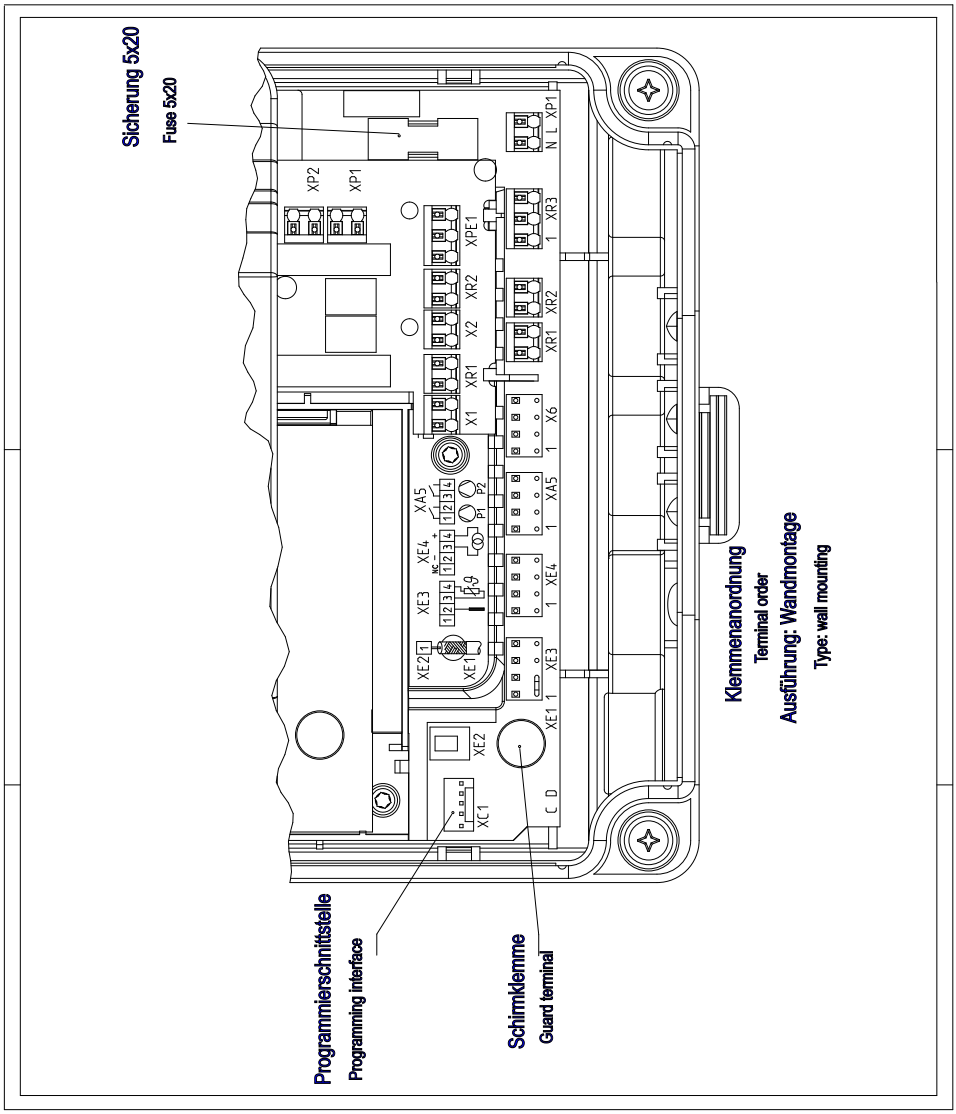


Fig. 10: Terminal layout

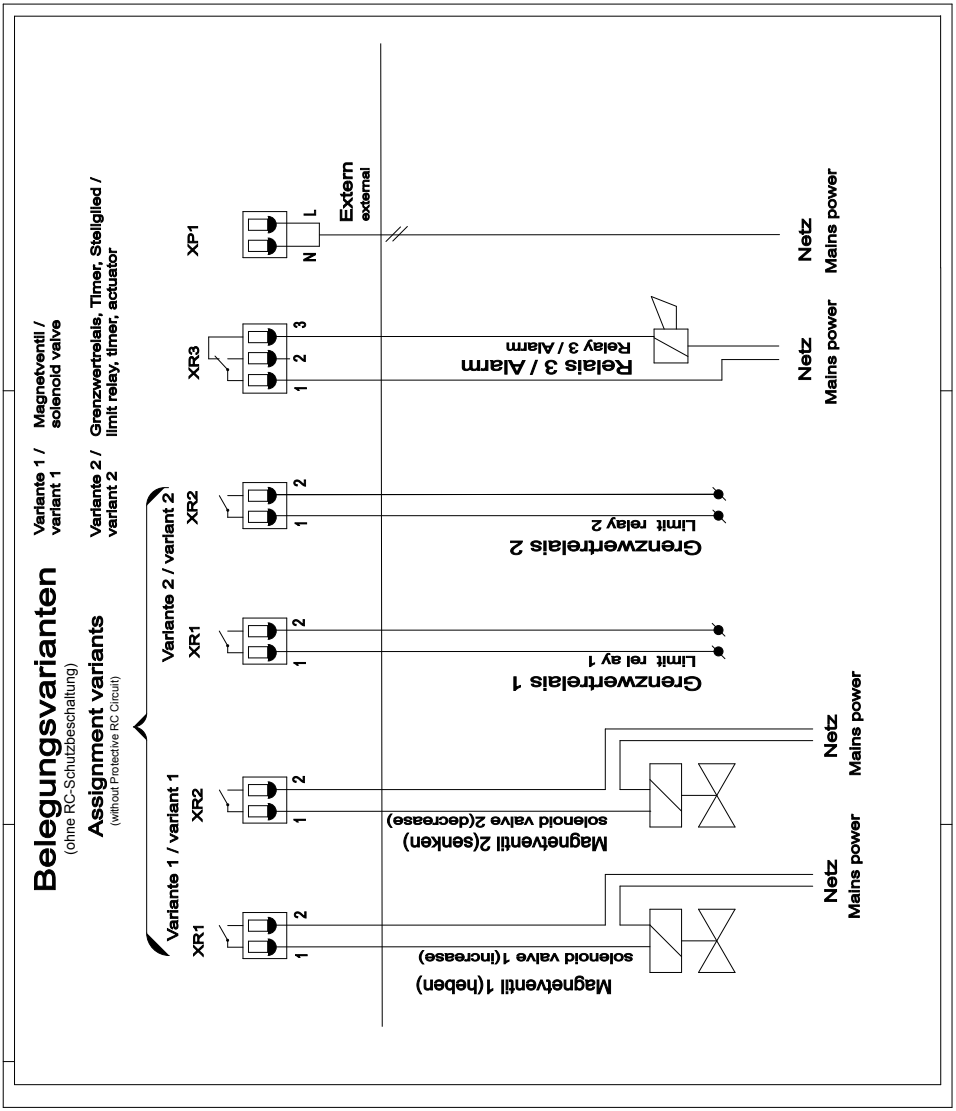


Fig. 11: Terminal diagram with assignment options 1

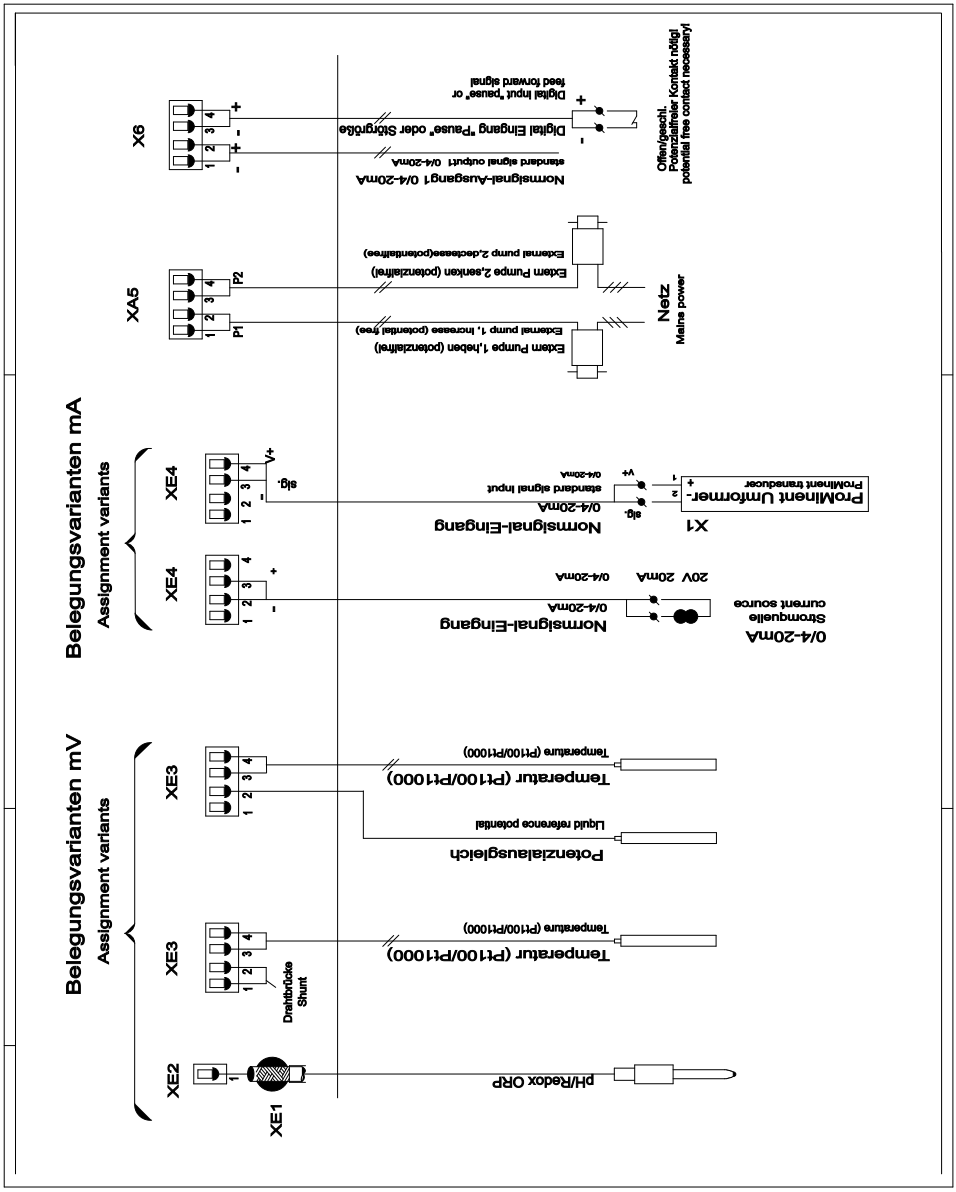


Fig. 12: Terminal diagram with assignment options 2

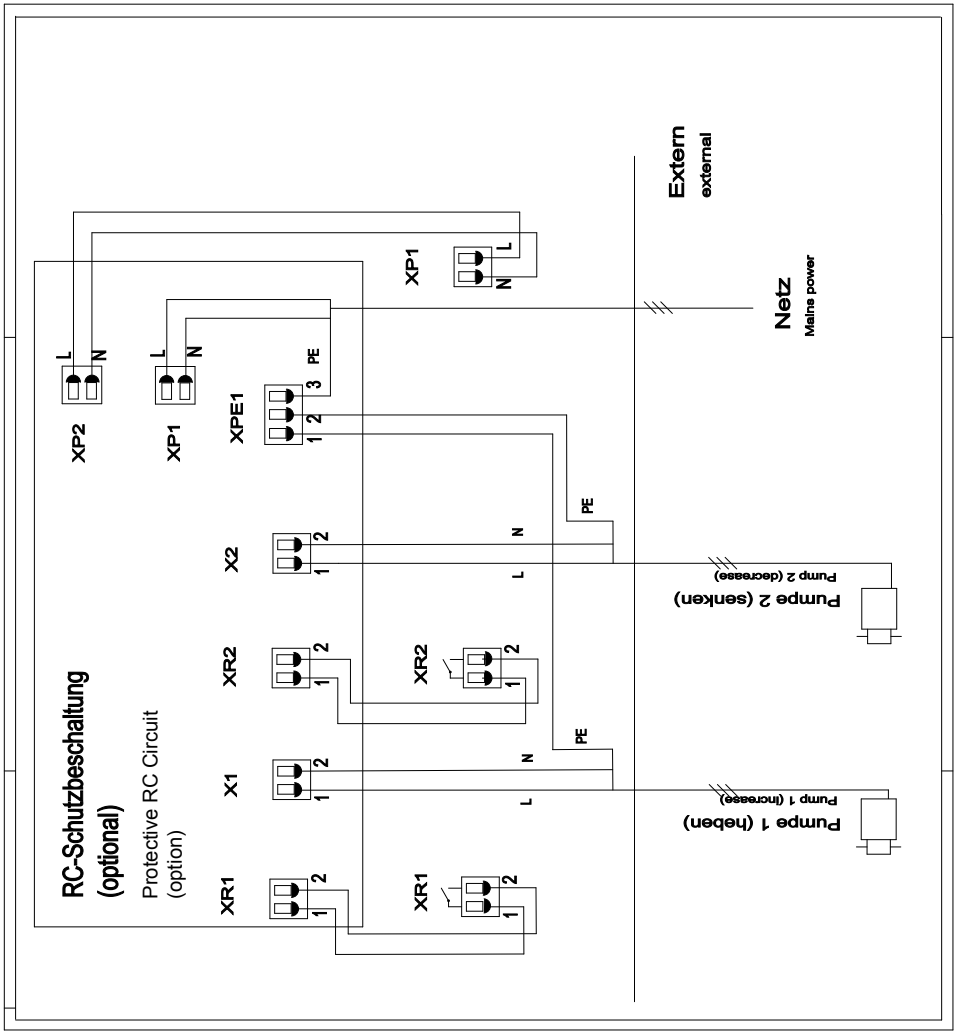


Fig. 13: Protective RC circuit terminal diagram

4 Commissioning

WARNING!

Run-in time of sensors

This can result is hazardous incorrect metering

Take into consideration run-in times when commissioning

- Correct measuring and metering is only possible if the sensor is working perfectly
- It is imperative that the run-in times of the sensors are adhered to
- The run-in times should be allowed for when planning initial operation
- It may take a whole working day to run-in the sensor
- Please read the operating manual for the sensor

Following completion of mechanical and electrical assembly, the control should be integrated into the measuring point.

4.1 Initial Commissioning

During initial commissioning the device's display will be in "English". The display will show "language english". The exception to this is if the language has been factory-preset to the customer's requirement.

Start menu during initial commissioning

The "Language setting during initial commissioning" menu appears only once.

Later changes to the operating language can then be made via the "General Settings/Information" menu item.

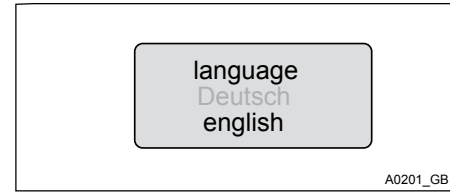


Fig. 14: Initial commissioning display

This is followed by the selection of the measured variable and the measuring range in the "General Settings/Information" menu item.

4.1.1 Selection of the Operating Language

With devices, which have not been preconfigured to the customer's specific requirement, the operating language required has to be selected in the "General Settings / Operating Menu/" menu. Refer to *Chapter 9.7 “General Settings ” on page 109*

! NOTICE!

Resetting the operating language

In the event that a foreign and thus incomprehensible operating language has been set, the DULCOMETER® D1Cb can be reset to its default setting of "English".

If you find yourself in the permanent display 1, then by simultaneously pressing the keys  ,  ,  the DULCOMETER® D1Cb can be made to ask again for the operating language. Refer to *Chapter 5.3 “Permanent Display 1 ” on page 44*

Should you no longer know where you are in the operating menu, because you cannot read the strange operating language, then press key  10 times. Then you will definitively find yourself in the permanent display 1.

4.1.2 Selection of the Measured Variable and Measuring Range

WARNING!

Incorrect metering due to incorrect metering range

Possible consequence: Fatal or serious injuries

- **The measuring range of the sensor is essential for the measuring range!**
- If the assignment of the measuring range is modified, the settings must be checked in all menus
- If the assignment of the measuring range is changed, the sensor must be recalibrated

With devices, which have not been preconfigured to the customer's specific requirement, the measured variable required has to be selected in the complete operating menu "General Settings / Change Measured Variable". The DULCOMETER® D1Cb then has to be labelled with the label corresponding to the measured variable selected. The relevant labels are enclosed with the DULCOMETER® D1Cb .

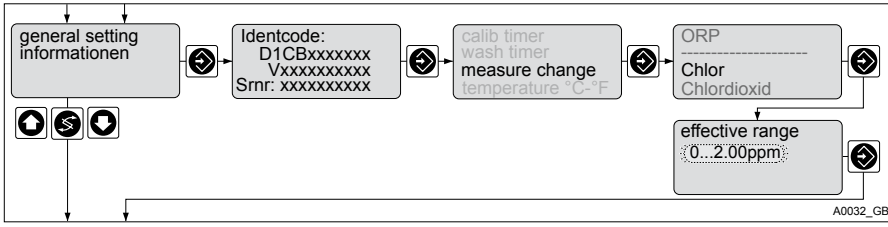


Fig. 15: Selection of measured variable and measuring range

The measuring range required has to be selected and set in the full operating menu "General Settings / Change Measured Variable/", see *Chapter 9.7.1 “Setting the Measured Variable/Measuring Range ” on page 109*.

4.2 Activation Code for Extended Functions

Activation code

Access to further functions can optionally be provided by means of an activation code.

Should you require additional operating literature for these functions, this can be obtained on the homepage of ProMinent Dosiertechnik, Heidelberg.

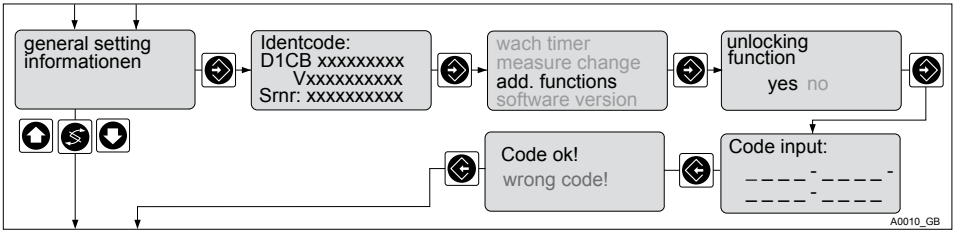


Fig. 16: Activation code / Serial number

The activation code is entered one digit at a time using the and key. Move to the next position with the key.

The newly activated functions must be configured or parameterised in the relevant menu or new measured variables must be calibrated. Information on this can be found in the relevant complete operating menu.

4.2.1 Extended Functions Obtainable with the Activation Code

Extended functions

The DULCOMETER® D1Cb control unit can be extended or modified by means of a 16-digit activation code. Functions can be enabled several times.

D1Cb software upgrade

To provide an activation code, ProMinent requires the 10-digit serial number (Srnr) and the required software upgrade identcode, which can both be found in the table below.

NOTICE!

Activation code

When ordering the activation code, it is imperative that you ensure that the serial number (Srnr) corresponds exactly to that of the DULCOMETER ® D1Cb to be extended. Otherwise a chargeable activation code will be provided, which will not work.

NOTICE!

"Incorrect code" message

If the code has been entered incorrectly then the "Incorrect code" message will appear. You can enter the activation code as many times as you need to. If this is still not successful, then check the serial number of the control.

DULCOMETER ® D1Cb software upgrade				
D1Ub	**Software default setting**			
V	Software preset			
	Default setting - measured variable			
	0	Universal		
	A	Peracetic acid		
	B	Bromine		
	C	Chlorine		
	D	Chlorine dioxide		
	F	Fluoride		
	H	Hydrogen peroxide		
	I	Chlorite		
	P	pH		
	R	Redox		
	S	0/4-20 mA standard signal general		
	X	Oxygen		
	Z	Ozone		
	L	Conductivity		
		Connection of the measured variable		
		1*	Standard signal 0/4-20 mA, all measured variables	
		5	mV input for pH/redox via guard terminal	
			Correction variable	
			0	none
			2*	Temperature Pt100/PT1000 (for pH and conductivity)
			4*	Manual temperature input (for pH and conductivity)
*** = chargeable option**				

DULCOMETER ® D1Cb software upgrade											
				Control input							
				0	none						
				1*	Pause						
				2*	Pause or interference variable flow via frequency						
					Signal output						
					0	none					
					1*	Analogue signal output 0/4-20 mA					
						Power activation					
						G	Alarm and 2 limit relays				
						M*	Alarm and 2 solenoid valve relays				
							Pump activation				
							0	none			
							2*	2 pumps via pulse frequency			
								Control behaviour			
								0	none		
								1*	Proportional control		
								2*	PID control		
									Language		
									00	no default setting	

*** = chargeable option**

5 Operating Schematics / Display Symbols

5.1 Overview of device /Operating elements

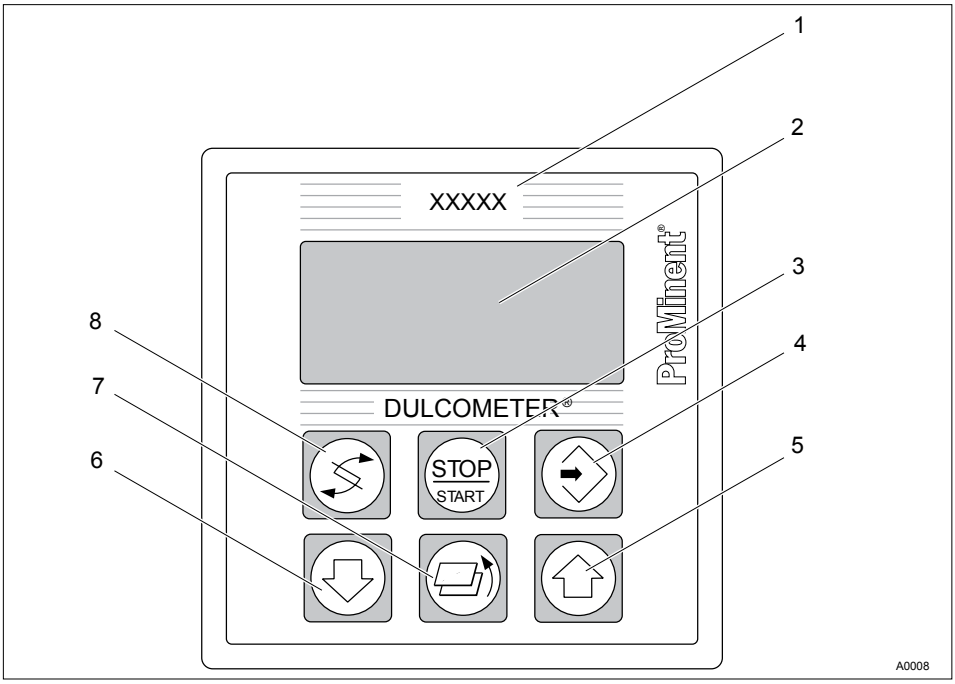


Fig. 17: Overview of device /Operating elements

Function	Description
1. Measured variable	Affix the measured variable label here
2. Display	
3. START/STOP key	Start/Stop the control and metering functions
4. INPUT key	To apply, confirm or save a displayed value or status or to acknowledge alarm

Function	Description
5. UP key	To increase a displayed numerical value and to change the variables (flashing display) and to move up in the operating menu
6. DOWN key	To lower a displayed numerical value and to change the variables (flashing display) and to move down in the operating menu
7. BACK KEY	Back to the permanent display or to the start of the respective setting menu
8. CHANGE key	To change within a menu level and to move from a changeable variable to another changeable variable within a menu option. When inputting numerical values, the cursor moves one space on.

5.2 Display Symbols

The display of the DULCOMETER® D1Cb uses the following symbols:

Meaning	Comment	Symbol
Limit transgression - relay 1 upper	Symbol left	
Limit transgression - relay 1 lower	Symbol left	
Limit transgression - relay 2 upper	Symbol right	
Limit transgression - relay 2 lower	Symbol right	
Metering pump 1 activation off	Symbol left	
Metering pump 1 activation on	Symbol left	
Metering pump 2 activation off	Symbol right	
Metering pump 2 activation on	Symbol right	
Solenoid valve 1 activation off	Symbol left	

Meaning	Comment	Symbol
Solenoid valve 1 activation on	Symbol left	◿
Solenoid valve 2 activation off	Symbol right	◣
Solenoid valve 2 activation on	Symbol right	◺
Stop key pressed		O
Manual metering		M
Fault		Ɛ
Reading rises very quickly	Trend of reading display	⬆
Reading rises quickly	Trend of reading display	⇧
Reading rises slowly	Trend of reading display	⇧
Reading falls very quickly	Trend of reading display	⬇
Reading falls quickly	Trend of reading display	⇩
Reading falls slowly	Trend of reading display	⇩
Reading steady	Trend of reading display	⇳

5.3 Permanent Display 1

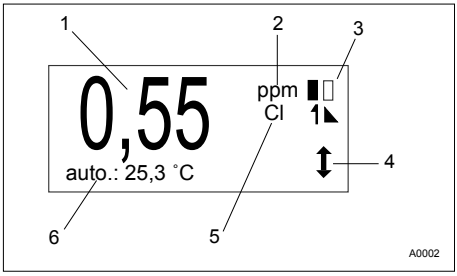


Fig. 18: Permanent Display 1

1. Reading
2. Mass unit ("ppm" in this example)
3. Status of the actuators
4. Display of reading trend - falling / rising
5. Measured variable ("chlorine" in this example)
6. Status line

Not all symbols are visible simultaneously in the permanent display 1. The scope of the symbols depends on what is required.

5.4 Permanent Display 2

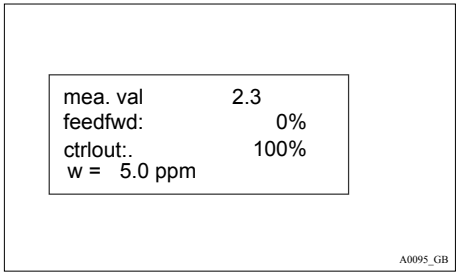


Fig. 19: Permanent Display 2

The permanent display 2 shows all information on the DULCOMETER® D1Cb that is needed at this time. Switch to other displays by pressing ⇩ or ⇧ or S.

5.5 Permanent Display 3

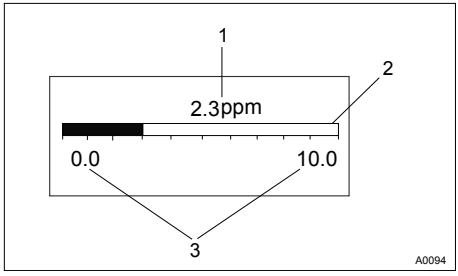


Fig. 20: Permanent Display 3

1. Current reading in plain text
2. Bar graph display shows the current reading in relation to the lower and upper reading limits
3. Displays the upper and lower limit of the display

Switch to other displays by pressing ⇩ or ⇧ or S.

To set the lower and upper value (3) press ⇨. The left-hand value will flash and can be set using the ⇩ or ⇧ keys. Confirm the entry with ⇨. Switch between the left-hand and right-hand value (3) by pressing ⇨.

This setting only changes the display range of the bar graph, as it were "zooming in" to a smaller range to obtain a better resolution of the display in the main display range of the measurement.

This setting only changes the display range of the bar graph! It is not possible to change the measured range of the DULCOMETER® D1Cb with this function.

5.6 Operating Schematics

Access code

- *Access to the setting menu can be blocked with an access code*
- *If the access code has been correctly selected for a setting menu, then all of the other setting menus are also accessible*

  Fundamentally the permanent displays 1 - 3 and the calibration menu are freely accessible. All of the other menus can be disabled by the access code in such a way that the set values are displayed but cannot be changed. The default value of the access code is "5000".
- *If no key is pressed within 60 seconds, the device will return to the permanent display 1, the access code is re-enabled and access is restricted*

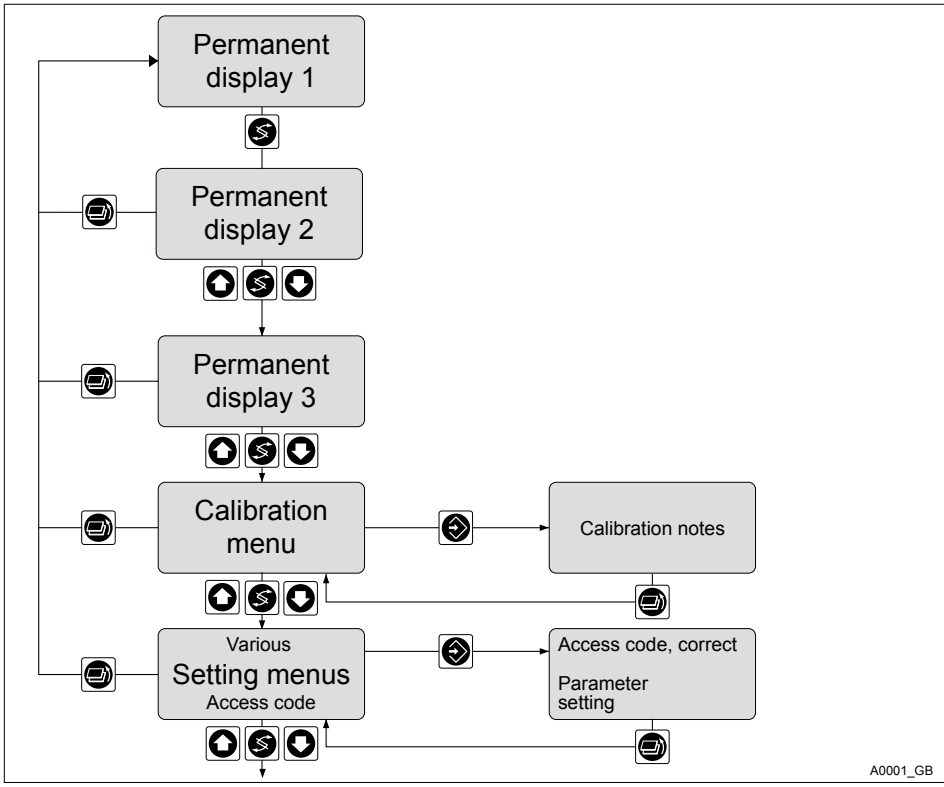


Fig. 21: Access code

The number and scope of the setting menus depends on the design of the device.

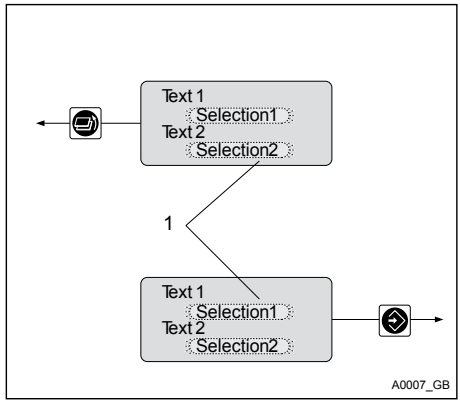


Fig. 22: Settable values flash on and off

1. Settable values flash on and off

Switch to other settable values by pressing the key.

5.7 Reduced / Complete Operating Menu

The DULCOMETER® D1Cb allows settings to be made in two different comprehensive menus (reduced / complete). All of the parameters of the control unit are preset and can be changed in the complete operating menu.

The controller is delivered with a reduced operating menu. If adjustments are necessary, the parameters can be changed by switching to the complete operating menu.

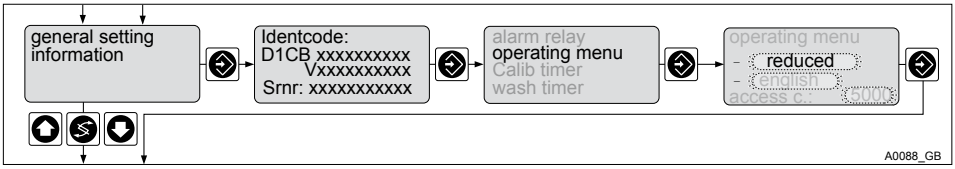


Fig. 23: Reduced / complete changeover

5.8 Fault Messages

Any fault messages and notes which arise are shown in the bottom line of the permanent display 1. Faults which have to be acknowledged (acknowledging them switches the alarm relay off) are shown by the Ɛ symbol.

Faults/notes, which remain after acknowledgement, will be displayed alternately. If a correction variable is being processed, the value will be displayed in the same line as the faults/notes. Faults, which are rectified automatically by changing operating situations, are removed from the permanent display 1 without the need for acknowledgement.

5.8.1 Fault display

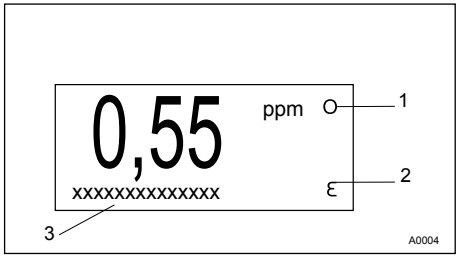


Fig. 24: Fault display

1. Stop function
2. Fault
3. Fault in plain text

5.9 General settings

5.9.1 Access code

Access to the setting menu can be prevented by an access code. The DULCOMETER® D1Cb is delivered with the access code "5000". Even if disabled by the access code, the calibration menu remains freely accessible.

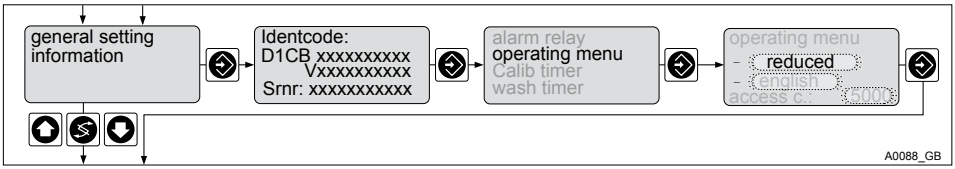


Fig. 25: Access code

		Possible values			
	Factory setting	**Increment**	**Lower value**	**Upper value**	**Remarks**
Access code	5000	1	0000	9999	

6 Measured Variables and Operating Menus for Amperometric Sensors

6.1 Reduced / Complete Operating Menu

The DULCOMETER ® D1Cb allows settings to be made in two different comprehensive menus (reduced / complete). All of the parameters of the control unit are preset and can be changed in the complete operating menu.

The controller is delivered with a reduced operating menu. If adjustments are necessary, the parameters can be changed by switching to the complete operating menu.

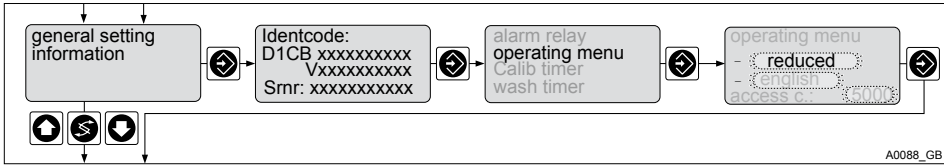


Fig. 26: Reduced / complete changeover

6.2 Description of All Amperometric Measured Variables

WARNING!

Danger of incorrect metering

This can result in hazardous incorrect metering

During initial commissioning, the measured variable and the measuring range of the sensor must be set prior to calibration. Refer to *Chapter 4.1.2 “Selection of the Measured Variable and Measuring Range ” on page 37*

Measured variable	Default measuring range
Chlorine, chlorine dioxide, ozone	2 ppm
Bromine	10 ppm
Oxygen	20 ppm
Peracetic acid	2000 ppm

Measured variable	Default measuring range
Hydrogen peroxide	200 ppm
Chlorite	0.5 ppm

The measuring ranges can be selected in the following ppm increments: 0.5, 2, 5, 10, 20, 50, 100, 200, 1000, 2000, 5000, 10000, 20000.

6.3 Reduced Operating Menu

The reduced operating menu allows the key parameters to be set. The following overview shows the settings that can be selected:

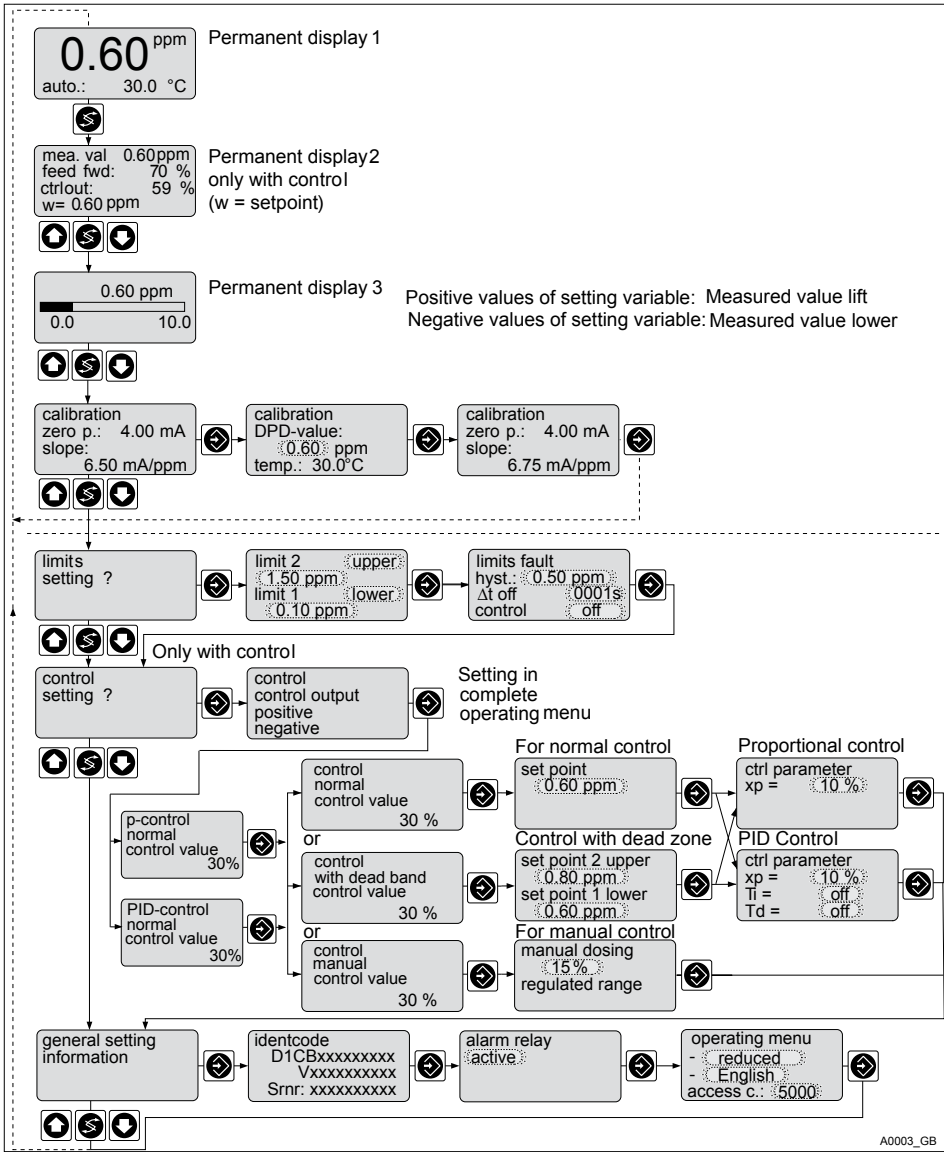


Fig. 27: Reduced operating menu

6.4 Complete Operating Menu / Description of All Measured Variables

The complete operating menu allows all controller parameters to be set. The following overview shows the settings that can be selected:

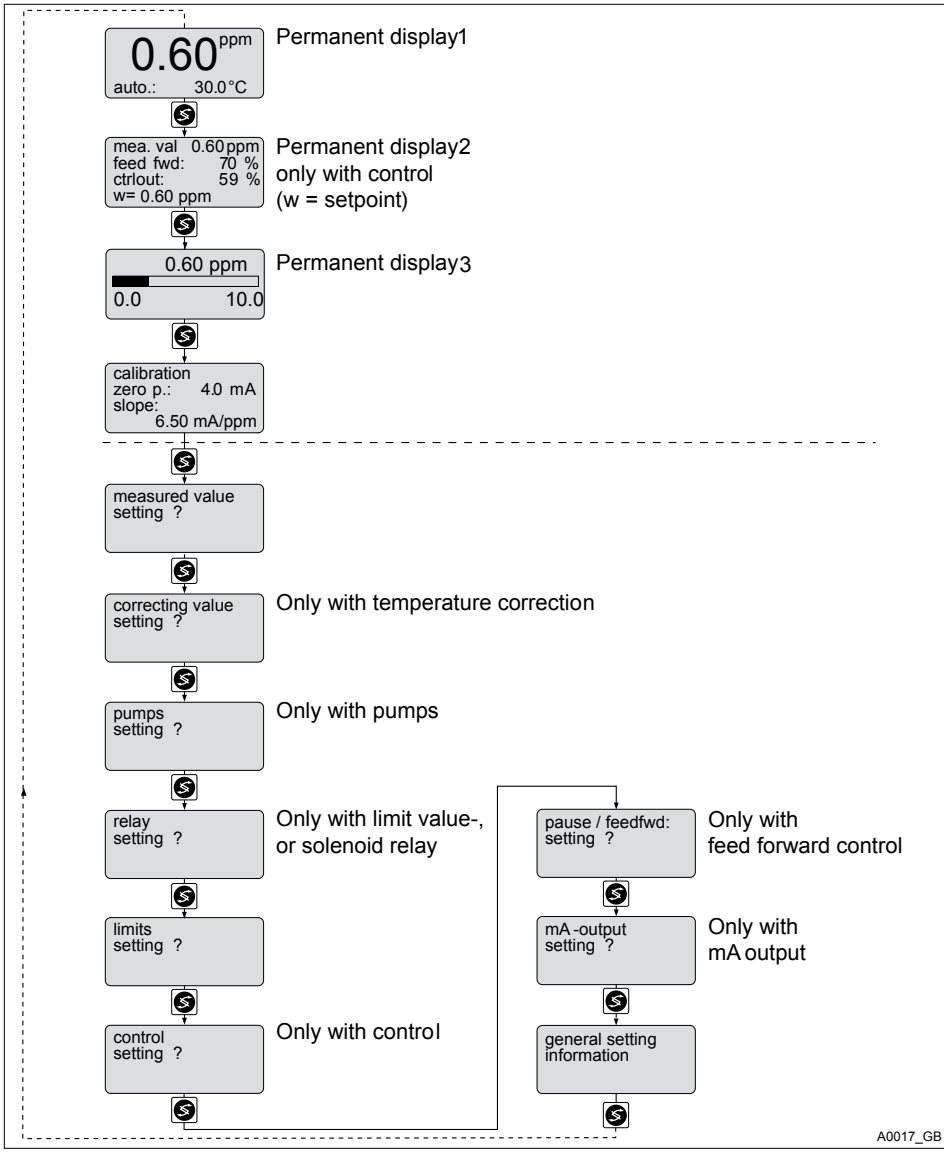


Fig. 28: Complete operating menu

6.5 Calibration of All Amperometric Measured Variables

WARNING!

Danger of incorrect metering

This can result in hazardous incorrect metering

During initial commissioning, the measured variable and the measuring range of the sensor must be set prior to calibration. Refer to *Chapter 4.1.2 "Selection of the Measured Variable and Measuring Range " on page 37*

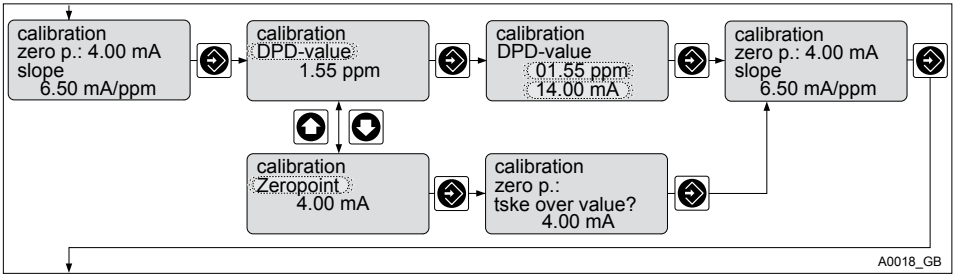


Fig. 29: Calibration of All Amperometric Measured Variables

Error message	Condition	Remarks *
Calibration not possible! Gradient too low	Gradient too low (< 20 % of standard gradient)	Repeat calibration
Calibration not possible! Gradient too high	Gradient too high (> 300 % of standard gradient)	Repeat calibration
DPD value too low DPD > x.xx ppm	DPD < 2 % of measuring range	Repeat calibration after addition of metering medium or fit sensor suitable for the process
Calibration not possible!	< 3 mA	Check sensor/cable
*** Please also note the operation manual for the respective sensor**		

Error message	Condition	Remarks *
Zero point low	(only with 4 - 20 mA sensors)	Repeat calibration in water without metering medium
Calibration not possible!	> 5 mA	Check sensor/cable
Zero point high	> 6 mA for 0.5 ppm chlorite	Repeat calibration in water without metering medium

*** Please also note the operation manual for the respective sensor**

6.6 Calibration of the Sensor for Amperometric Measured Variables

In the reduced operating menu of the DULCOMETER ® D1Cb only the gradient can be calibrated.

In the complete operating menu of the DULCOMETER ® D1Cb the zero point and the gradient can be calibrated.

6.6.1 Preparation for Calibration of the Sensors for Amperometric Measured Variables

CAUTION!

Correct sensor operation / Run-in time

Damage to the product or its surroundings

- Correct measuring and metering is only possible if the sensor is working perfectly
- Please read the operating manual for the sensor
- Please also read the operating manuals for the fittings and other components used
- It is imperative that the run-in times of the sensors are adhered to
- The run-in times should be allowed for when planning initial operation
- It may take a whole working day to run-in the sensor

Necessity of calibrating the zero point

Calibration of the zero point is not generally necessary. Calibration of the zero point is only necessary if the sensor is operated at the lower limit of the measuring range or if the 0.5 ppm sensor version is used.

During calibration, the DULCOMETER ® D1Cb sets the actuating outputs to "0". The exception to this is if a basic load or a manual actuating variable has been set, this remains active. The mA standard signal outputs are frozen. The reading frozen at the start of calibration is suggested as a DPD value. The DPD value can be set using the arrow keys. Calibration is only possible if the DPD value is ≥ 2 % of the measuring range of the sensor.

6.6.2 Calibration of Zero Point and Gradient

NOTICE!

Prerequisites for correct calibration of the sensor gradient

- The DPD method required by the metering medium employed will be used
- The run-in time for the sensor has been adhered to
- There is permitted and constant flow at the flow gauge
- There is temperature equalisation between the sensor and the sample water
- There is a constant pH value in the permitted range

Calibration of amperometric sensors: gradient (in the reduced and complete operating menu)

The sensor is fitted, flushed with sample water and connected electrically to the DULCOMETER ® D1Cb and run in.

There has to be adequate metering medium in the sample water for calibration (> 2% of the measuring range of the sensor).

Remove sample water directly at the measuring point and determine the content of metering medium in the sample water in "ppm" using an appropriate reference method (e.g. DPD, titration etc.) Enter this value as follows into the DULCOMETER ® D1Cb :

1. Select Calibration menu. Then press 
   ⇨ The current reading will now be frozen.
2. Take a sample of water and perform a reference measurement within 15 minutes.
3. Select "DPD value" of unit to be calibrated using the  key
4. Continue with 
5. If necessary adjust the flashing ppm value using keys  ,  and  to the value determined by the measurement
   ⇨ The mA value of the sensor shown in this display now corresponds to the reading in "ppm"
6. Then press the following key twice 
   ⇨ The display now shows the value determined for the zero point and gradient. Refer to the Error Message table should an error be displayed *Table on page 56*

Necessity of calibrating the zero point

Calibration of the zero point is not generally necessary. Calibration of the zero point is only necessary if the sensor is operated at the lower limit of the measuring range or if the 0.5 ppm sensor version is used.

Calibration of amperometric sensors: Zero point (only in the complete operating menu)

A container with water, which is free of additives that could falsify the measured result, is needed for calibration. Immerse the dismantled sensor, which is nevertheless still electrically connected to the DULCOMETER® D1Cb in this water. Stir the sensor around the water for approx. 5 minutes until the reading on the DULCOMETER® D1Cb is displayed steady and close to 0".

1. Select Calibration menu. Then press
2. Select "Zero point" of unit to be calibrated using the key
3. Continue with
   ⇨ A prompt is shown in the display
4. Confirm prompt with
5. Continue with
6. Apply the "zero point" displayed during calibration with the key
7. Then press
   ⇨ Display shows the values recorded
8. Then press
   ⇨ Refer to the Error Message table should an error be displayed
   Table on page 56

NOTICE!

Then definitively calibrate the gradient with a suitable reference method (e.g. DPD. titration etc.).

6.7 Setting the Reading

WARNING!

Incorrect metering due to incorrect metering range

Possible consequence: Fatal or serious injuries

- **The measuring range of the sensor is essential for the measuring range!**
- If the assignment of the measuring range is modified, the settings must be checked in all menus
- If the assignment of the measuring range is changed, the sensor must be recalibrated
- The relevant information can be found in the operating manual for the sensor/measuring equipment

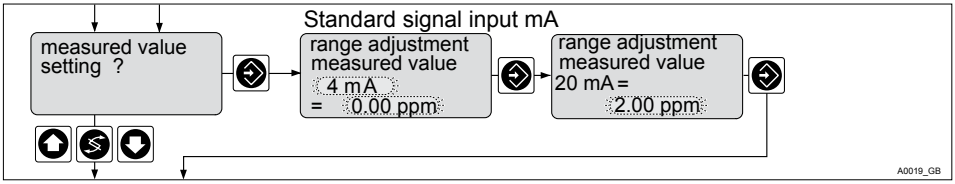


Fig. 30: Reading

This setting is solely used to adapt the DULCOMETER® D1Cb to the sensors provided by third party providers. Sensors provided by third party providers may have measuring ranges, which deviate from the DULCOMETER® D1Cb standard specification.

In order to adapt a ProMinent sensor to the DULCOMETER® D1Cb only use the menu to be found in "General Settings", see *Chapter 4.1.2 “Selection of the Measured Variable and Measuring Range ” on page 37*

6.8 Correction Value

Only necessary when using the DULCOTEST® CDP sensor for chlorine dioxide ClO_2 .

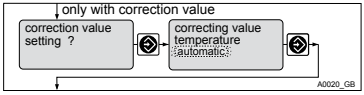


Fig. 31: Correction Value

The correction variable compensates for the effect of the temperature of the medium on the reading. The correction variable is the temperature of the medium to be measured. The temperature of the medium affects the value to be measured. With amperometric sensors it is only necessary when using the DULCOTEST ® CDP sensor for chlorine dioxide ClO_2 .

Operating modes

- Off: No temperature compensation takes place.
  - For measurements which do not require temperature compensation.
- Automatic: The DULCOMETER ® D1Cb analyses the temperature signal from the temperature sensor connected.
  - For measurements with temperature sensors, which provide a temperature signal (Pt100/Pt1000) (0 -100 °C) that can be used by the DULCOMETER ® D1Cb .
- Manual: The temperature of the medium to be measured has to be measured by the user. Using keys  ,  and  the value recorded can then be inputted into the DULCOMETER ® D1Cb and saved with  .
  - For measurements where the medium to be measured has a constant temperature, which has to be taken into account in the control process.

7 Measured Variables and Operating Menus for Potentiometric Sensors

Measured variables: pH, redox, fluoride

CAUTION!

Influence of temperature on the pH or fluoride measurement

Possible consequence: Slight or minor injuries, material damage

Temperature changes in the sample water lead to a change in the gradient of the calibration lines (pH, fluoride) and to a displacement of the zero point with pH sensors or the standard potential E_S with fluoride sensors.

Measure to be taken to avoid this danger:

- The pH or fluoride measurement should only be carried out in the *[Temperature Correction Value automatic]* setting
- The DULCOMETER ® D1Cb then automatically compensates for both effects when a temperature sensor (Pt 100/Pt 1000) is connected

7.1 Reduced / Complete Operating Menu

The DULCOMETER ® D1Cb allows settings to be made in two different comprehensive menus (reduced / complete). All of the parameters of the control unit are preset and can be changed in the complete operating menu.

The controller is delivered with a reduced operating menu. If adjustments are necessary, the parameters can be changed by switching to the complete operating menu.

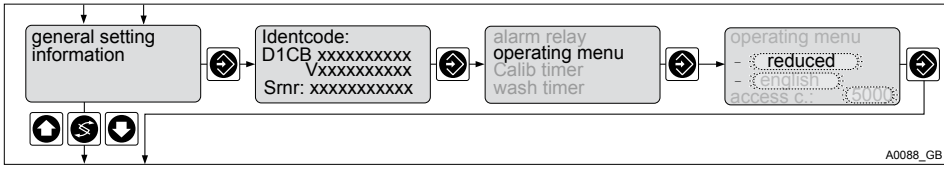


Fig. 32: Reduced / complete changeover

7.2 Description of pH, Redox and Fluoride Measured Variables

WARNING!

Danger of incorrect metering

This can result in hazardous incorrect metering

During initial commissioning, the measured variable and the measuring range of the sensor must be set prior to calibration. Refer to *Chapter 4.1.2 “Selection of the Measured Variable and Measuring Range ” on page 37*

pH Measured variable	Typical measuring range
Measuring range	- 500 mV … + 500 mV
Display range	At least pH -1.45 … 15.45
Reference temperature	+25°C
Resolution	0.01 pH

Redox measured variable	Typical measuring range
Measuring range	-1000 mV … + 1000 mV
Resolution	1 mV

Fluoride measured variable	Measuring range
Measuring range	0....10 ppm 0.... 99.99 ppm
Resolution	0.01 ppm

7.3 Reduced pH / Redox / Fluoride Operating Menu

The reduced operating menu allows the key parameters to be operated. The following overview shows the settings that can be selected (shown here for pH as the measured variable):

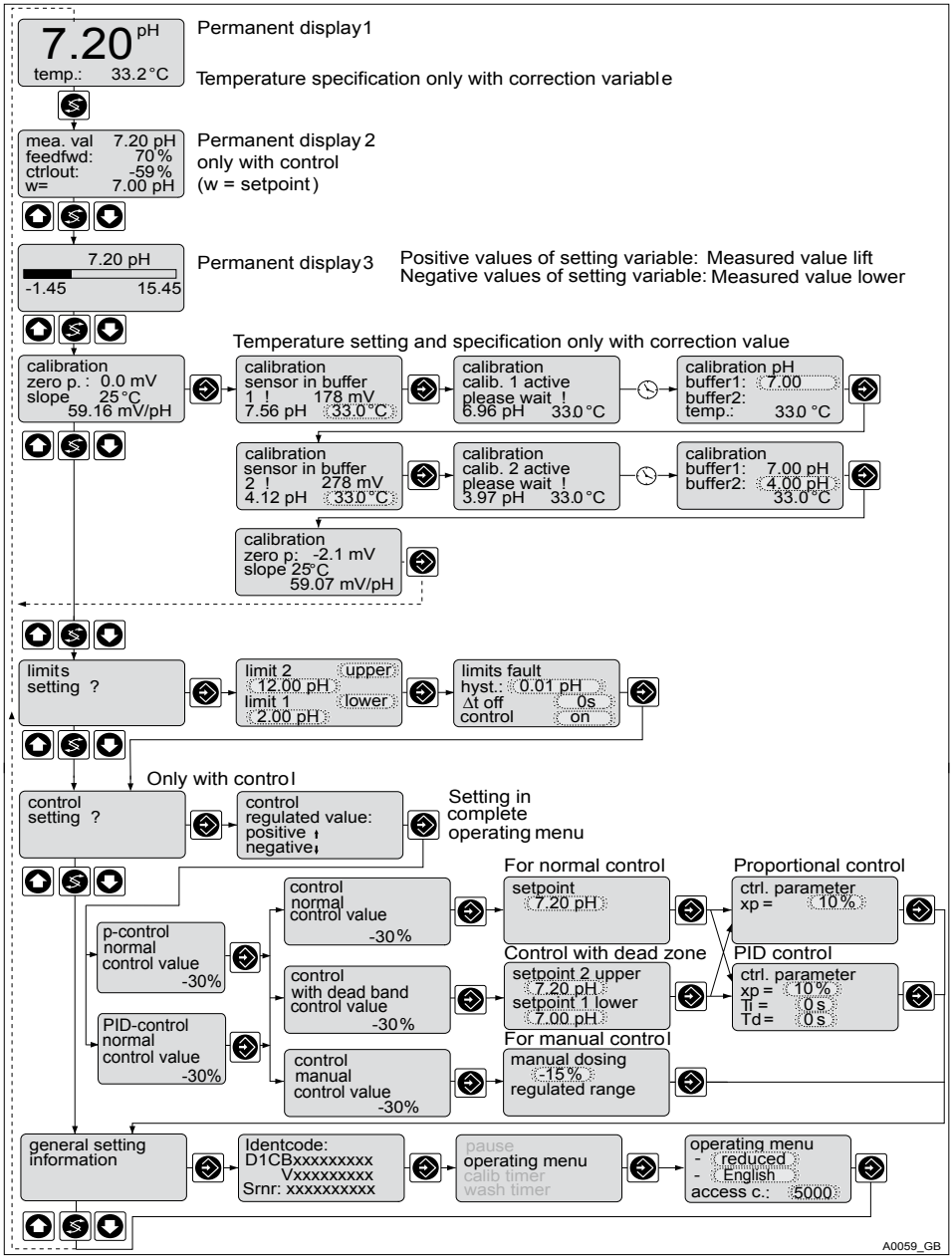

7.20 pH
temp.: 33.2 °C
Permanent display 1
Temperature specification only with correction variable
mea. val 7.20 pH
feedfwd: 70 %
ctrlout: -59 %
w= 7.00 pH
Permanent display 2
only with control
(w = setpoint)
7.20 pH
-1.45 15.45
Permanent display 3
Positive values of setting variable: Measured value lift
Negative values of setting variable: Measured value lower
Temperature setting and specification only with correction value
calibration
zero p. : 0.0 mV
slope 25 °C
59.16 mV/pH
calibration
sensor in buffer
1 ! 178 mV
7.56 pH 33.0 °C
calibration
calib. 1 active
please wait !
6.96 pH 33.0 °C
calibration pH
buffer1: 7.00
buffer2:
temp.: 33.0 °C
calibration
sensor in buffer
2 ! 278 mV
4.12 pH 33.0 °C
calibration
calib. 2 active
please wait !
3.97 pH 33.0 °C
calibration
buffer1: 7.00 pH
buffer2: 4.00 pH
33.0 °C
calibration
zero p: -2.1 mV
slope 25°C
59.07 mV/pH
limits
setting ?
limit 2 upper
12.00 pH
limit 1 lower
2.00 pH
limits fault
hyst.: 0.01 pH
Δt off 0s
control on
Only with control
control
setting ?
control
regulated value:
positive
negative
Setting in
complete
operating menu
For normal control
Proportional control
p-control
normal
control value
-30%
control
normal
control value
-30%
setpoint
7.20 pH
ctrl. parameter
xp = 10 %
Control with dead zone
PID control
control
with dead band
control value
-30%
setpoint 2 upper
7.20 pH
setpoint 1 lower
7.00 pH
ctrl. parameter
xp = 10 %
Ti = 0 s
Td = 0 s
PID-control
normal
control value
-30%
For manual control
control
manual
control value
-30%
manual dosing
-15 %
regulated range
general setting
information
Identcode:
D1CBxxxxxxxxx
Vxxxxxxxxx
Srnr: xxxxxxxxxx
pause
operating menu
calib timer
wash timer
operating menu
- reduced
- English
access c.: 5000
A0059_GB

Fig. 33: Reduced pH / redox / fluoride operating menu (shown with the example of pH)

7.4 Complete Operating Menu/Description of pH / Redox / Fluoride

The complete operating menu enables the setting of all parameters of the DULCOMETER ® D1Cb . The following overview shows the settings that can be selected (shown here for pH as the measured variable):

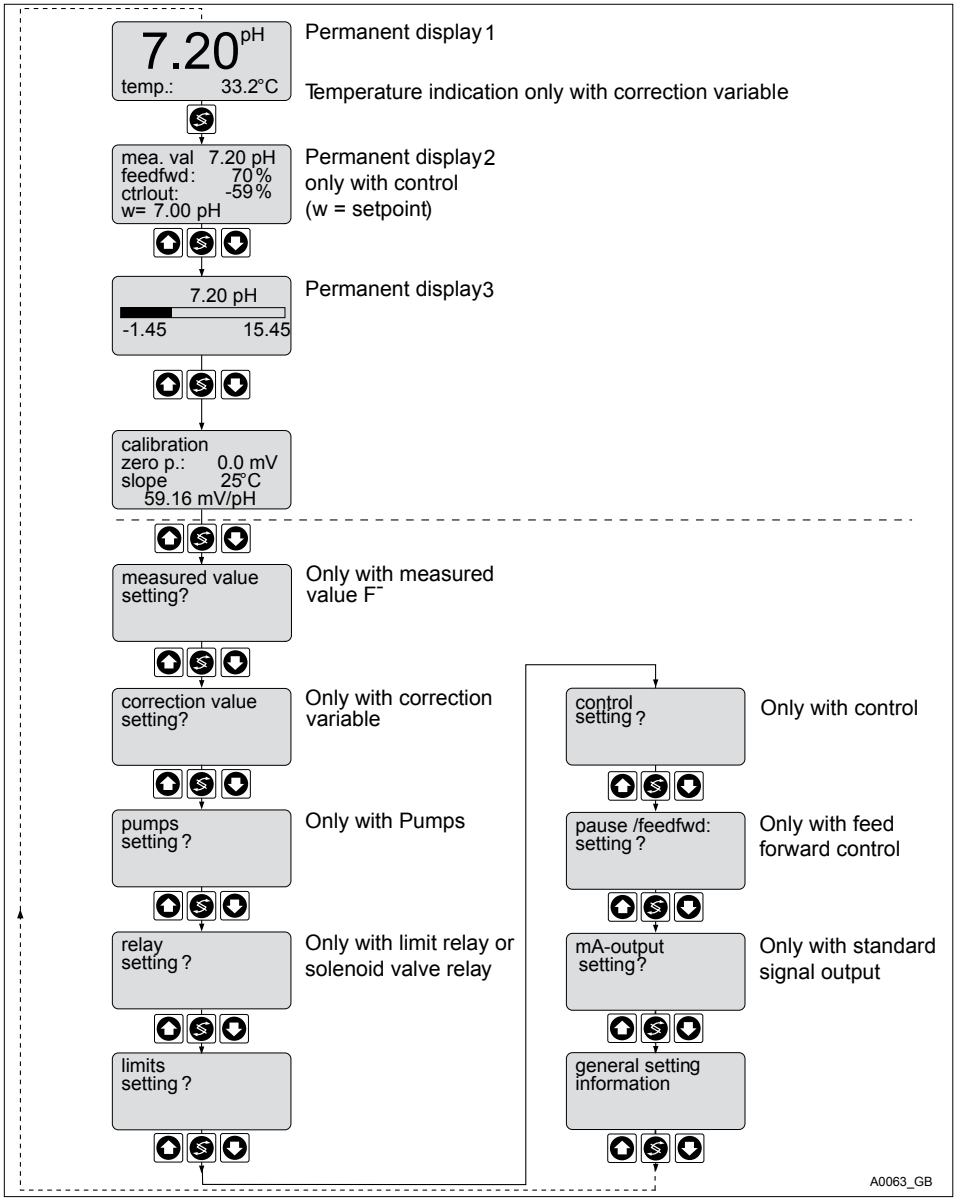


Fig. 34: Complete pH / redox / fluoride operating menu

7.5 Calibration of pH, Redox and Fluoride Sensors

WARNING!

Incorrect metering due to incorrect metering range

Possible consequence: Fatal or serious injuries

- **The measuring range of the sensor is essential for the measuring range!**
- If the assignment of the measuring range is modified, the settings must be checked in all menus
- If the assignment of the measuring range is changed, the sensor must be recalibrated

CAUTION!

Correct sensor operation / Run-in time

Damage to the product or its surroundings

- Correct measuring and metering is only possible if the sensor is working perfectly
- Please read the operating manual for the sensor
- It is imperative that the run-in times of the sensors are adhered to
- The run-in times should be allowed for when planning initial operation

During calibration, the the DULCOMETER ® D1Cb sets the actuating outputs to "0". The exception to this is if a basic load or a manual actuating variable has been set. This remains active. The mA standard signal outputs are frozen.

When calibration/testing has been completed successfully, all of the error checks relating to the reading are restarted. The DULCOMETER ® D1Cb stores the recorded zero point and gradient data. Refer to *Chapter 9.7.2.7 “Calibration Logbook ” on page 111*

7.5.1 Description of the Calibration of pH Sensors

7.5.1.1 2-Point Calibration

2-Point Calibration

Recommended as the standard method

Calibration of pH sensors with temperature as the correction variable

When calibrating with temperature as the correction variable, the temperature of the buffer solution must be set in "manual" operating mode before calibration. Refer to

In "Automatic" operating mode, the temperature sensor must be immersed in the buffer solution. The calibration values are then calculated whilst taking into consideration the buffer temperature.

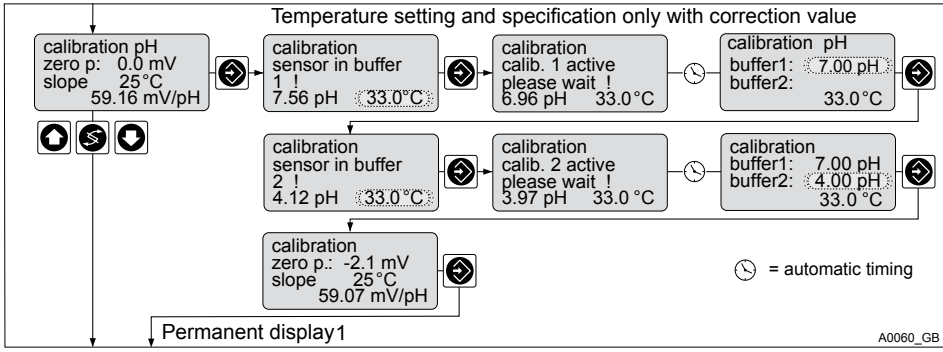


Fig. 35: Calibration of pH sensors

Two test containers with a buffer solution are required for calibration. The pH value of the buffer solutions should be at least 2 ph values apart. The sensor should be rinsed thoroughly with water when changing the buffer solution.

1. Select Calibration menu 
2. Immerse sensor in test container 1 with buffer solution (e.g. pH 7)
3. Move the sensor gently until the pH value displayed no longer changes
4. Then press 

   ⇨ Calibration is running

   A buffer value is suggested once the waiting time has expired.
5. If necessary adjust the pH value displayed using keys  ,  and  to the actual value of the buffer solution in test container 1
6. Then press 
7. Remove the sensor, rinse thoroughly in water and then dry with a cloth (pad dry, don't rub!)
8. Immerse sensor in test container 2 with buffer solution (e.g. pH 4)
9. Move the sensor gently until the pH value displayed no longer changes
10. Then press 

    ⇨ Calibration is running

    A buffer value is suggested once the waiting time has expired.
11. If necessary adjust the pH value displayed using keys  ,  and  to the actual value of the buffer solution in test container 2
12. Then press 

    ⇨ The settings recorded will be displayed.
13. If the calibration result is correct, confirm with 

    ⇨ The new calibration is now applied.

Should the result of the calibration lie outside of the specified error limits, an error message will appear, see *Chapter 7.5.3 “Calibration of pH Sensors. Description of the Error Messages ” on page 72*. In this case the current calibration will not be applied.

7.5.1.2 1-Point Calibration

1-Point Calibration

Recommended only for special applications e.g swimming pool water

Calibration of pH sensors with temperature as the correction variable

When calibrating with temperature as the correction variable, the temperature of the buffer solution must be set in "manual" operating mode before calibration. Refer to

In "Automatic" operating mode, the temperature sensor must be immersed in the buffer solution. The calibration values are then calculated whilst taking into consideration the buffer temperature.

One test container with a buffer solution is required for calibration.

1. Select Calibration menu 
2. Immerse the sensor in the test container with buffer solution (e.g. pH 7)
3. Move the sensor gently until the pH value displayed no longer changes
4. Then press 
   ⇨ Calibration is running

   A buffer value is suggested once the waiting time has expired.
5. If necessary adjust the pH value displayed using keys ,  and  to the actual value of the buffer solution in the test container
6. Then press 
7. Then press 
   ⇨ The settings recorded will be displayed.
8. If the calibration result is correct, confirm with 
   ⇨ The new calibration is only now applied.

Should the result of the calibration lie outside of the specified error limits, an error message will appear, see *Chapter 7.5.3 “Calibration of pH Sensors. Description of the Error Messages ” on page 72*. In this case the current calibration will not be applied.

7.5.2 Calibration of pH Sensors. Description of the Setting Ranges

Setting		Possible values			
	Starting value	Increment	Lower value	Upper value	Remarks
Calibration temperature	Reading	0.1 °C	0 °C	100 °C	
Buffer values	Reading (whole digit rounded up)	0.01 pH	-1.45 pH	15.45 pH	Error message if the two buffers lie too close to each other (<2 pH values)

7.5.3 Calibration of pH Sensors. Description of the Error Messages

Error message	Condition	Effect	
Buffer gap too small	∆buffer <2 pH	During the calibration process: recalibrate buffer 2! Back to the permanent display	
pH zero point low	< -60 mV	Basic load metering	Note: old zero point and gradient remain
pH zero point high	> +60 mV	Basic load metering	Note: old zero point and gradient remain
pH gradient low	< 40 mV/pH	Basic load metering	Note: old zero point and gradient remain
pH gradient high	> 65mV/pH	Basic load metering	Note: old zero point and gradient remain
pH reading unsteady			Note: old zero point and gradient remain
°C reading unsteady			Note: old zero point and gradient remain
The following applies to all error messages: eliminate the source of the error and repeat calibration.			

7.5.4 Testing the Redox Sensor

CAUTION!

Correct sensor operation / Run-in time

Damage to the product or its surroundings

- Correct measuring and metering is only possible if the sensor is working perfectly
- Please read the operating manual for the sensor
- It is imperative that the run-in times of the sensors are adhered to
- The run-in times should be allowed for when planning initial operation

NOTICE!

Testing the Redox Sensor

With redox measured variables, the sensor is not calibrated but tested according to its design

- Observe any notification of abnormal behaviour when testing the redox sensor
- Should the test not be successful, replace the redox sensor

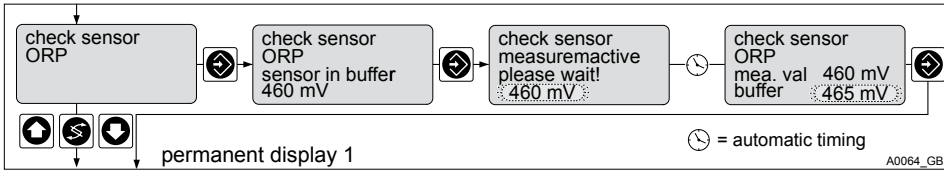


Fig. 36: Testing redox sensors

7.5.4.1 Description of the Testing of Redox Sensors

A container with a redox buffer solution (e.g. 465 mV) is needed for testing.

1. Select the Test menu
2. Immerse redox sensor in the test container with redox buffer solution (e.g. 465 mV)

3. Start test with 

   ⇨ Test is running.

   A buffer value is suggested once the waiting time has expired.

4. Adjust displayed value of "buffer" (flashing) using  ,  and  to the mV value of the redox buffer solution in the test container and confirm the value with 

   ⇨ The D1Cb displays the status message of the redox sensor in plain text. If the redox sensor is functioning correctly, permanent display 1 will be displayed directly

5. If the redox sensor is unclean or defective, the redox sensor should be cleaned, as described in the redox sensor operating manual, or alternatively replaced

Should the result of the calibration lie outside of the specified error limits, an error message will appear, see *Chapter 7.5.4.3 "Testing Redox Sensors. Description of the Error Messages" on page 75*

7.5.4.2 Testing Redox Sensors Buffer Values Tables

Table: Possible buffer values

		Possible values			
Setting	**Starting value**	**Increment**	**Lower value**	**Upper value**	**Remarks**
Buffer values	Reading	1 mV	-1,500 mV	+1,500 mV	
185-265 mV	220 mV				
425-505 mV	465 mV				

7.5.4.3 Testing Redox Sensors. Description of the Error Messages

Table: Possible error messages when testing redox sensors

Error message	Condition	Effect
Reading high	Reading 40 mV> buffer	Back to the permanent display Basic load metering
Reading low	Reading 40 mV< buffer	Back to the permanent display Basic load metering

7.5.5 Description of the Calibration of Fluoride Sensors

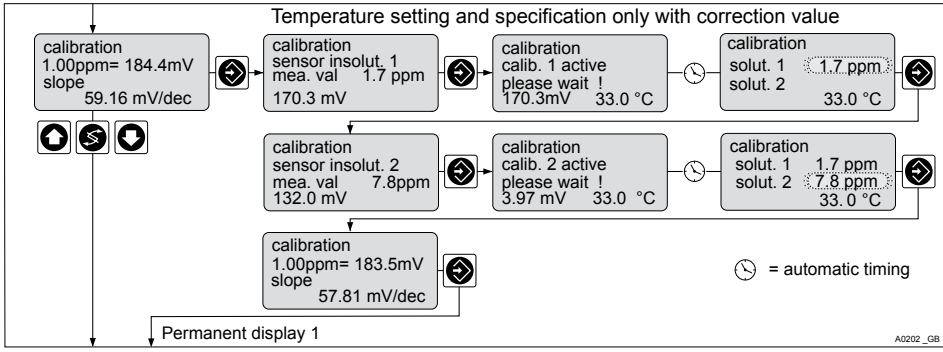


Fig. 37: Calibrating the fluoride sensor

7.5.5.1 Description of the Calibration of Fluoride Sensors

Calibration with temperature as the correction variable

When calibrating with temperature as the correction variable, the temperature of the buffer solution has to be set in "manual" operating mode before calibration. Refer to ↳ Chapter 7.6 "Temperature Correction Value for pH and Fluoride Sensors " on page 79

In "Automatic" operating mode, the temperature sensor must be immersed in the buffer solution. The calibration values are then calculated whilst taking into consideration the buffer temperature.

7.5.5.1.1 Description of 2-Point Calibration for Fluoride Sensors

Material required for calibration of fluoride sensors

- Two test containers with calibrating solution
- A thermometer for measuring in fluids (in "Temperature Correction Value manual" operating mode)

Two test containers with calibrating solution are required for calibration. The fluoride content of the calibrating solutions should be at least 0.5 ppm F apart from each other. The sensor should be rinsed thoroughly with fluoride-free water when changing the calibrating solution.

1. Select Calibration menu

   ⇨ In "Temperature Correction Value manual" operating mode, the calibration display appears and the value for temperature flashes.

   In "Temperature Correction Value automatic" operating mode: the calibration display appears.

2. Measure the temperature of the calibrating solution 1 using the thermometer (only in "Temperature Correction Value manual" operating mode).

3. Enter the temperature value of the calibrating solution determined using the keys , and into the DULCOMETER ® D1Cb

4. Confirm the entry with

   ⇨ The DULCOMETER ® D1Cb takes into consideration during calibration the actual temperature of the calibrating solution.

5. Immerse the fluoride sensor in calibrating solution 1 and wait until the mV value displayed remains steady (fluctuation of < 0.05 mV/min).

6. Start the calibration process by pressing  .

   ⇨ Calibration is running

7. Enter the concentration of the calibrating solution determined using the keys  ,  and  into the DULCOMETER ® D1Cb in ppm.

8. Confirm the ppm value using 

   ⇨ In "Temperature Correction Value manual" operating mode, the calibration display appears and the value for temperature flashes.

   In "Temperature Correction Value automatic" operating mode: the calibration display appears.

9. Measure the temperature of the calibrating solution 2 using the thermometer (only in "Temperature Correction Value manual" operating mode)

10. Prepare for calibration in calibrating solution 2

11. Enter the temperature value of the calibrating solution determined using the keys  ,  and  into the DULCOMETER ® D1Cb

12. Confirm the entry with 

    ⇨ The DULCOMETER ® D1Cb takes into consideration during calibration the actual temperature of the calibrating solution.

13. The fluoride sensor should be rinsed thoroughly with fluoride-free water when changing the calibrating solution

14. Immerse the fluoride sensor in calibrating solution 2 and wait until the mV value displayed remains steady (fluctuation of < 0.05 mV/min).

15. Start the calibration process by pressing 

    ⇨ Calibration is running

16. Enter the concentration of the calibrating solution determined using the keys  ,  and  into the DULCOMETER ® D1Cb in ppm

17. Confirm the ppm value using 

    ⇨ The DULCOMETER ® D1Cb display shows the result of calibration. If the calibration result is correct, confirm with 

7.5.5.1.2 1-Point Calibration of the Fluoride Sensor

Calibration of fluoride. Description of 1-point calibration

One container with a calibrating solution is required for calibration.

1. Select Calibration menu

   ⇨ In "Temperature Correction Value manual" operating mode, the calibration display appears and the value for temperature flashes.

   In "Temperature Correction Value automatic" operating mode: the calibration display appears

2. Measure the temperature of the calibrating solution 1 using the thermometer (only in "Temperature Correction Value manual" operating mode)

3. Enter the temperature value of the calibrating solution determined using the keys , and into the DULCOMETER ® D1Cb

4. Confirm the entry with

   ⇨ The DULCOMETER ® D1Cb takes into consideration during calibration the actual temperature of the calibrating solution.

5. Immerse the fluoride sensor in calibrating solution 1 and wait until the mV value displayed remains steady (fluctuation of < 0.05 mV/min)

6. Start the calibration process by pressing

   ⇨ Calibration is running

7. Enter the concentration of the calibrating solution determined using the keys , and into the DULCOMETER ® D1Cb in ppm

8. Confirm the ppm value using

7.6 Temperature Correction Value for pH and Fluoride Sensors

CAUTION!

Influence of temperature on the pH or fluoride measurement

Possible consequence: Slight or minor injuries, material damage

Temperature changes in the sample water lead to a change in the gradient of the calibration lines (pH, fluoride) and to a displacement of the zero point with pH sensors or the standard potential E_S with fluoride sensors.

Measure to be taken to avoid this danger:

- The pH or fluoride measurement should only be carried out in the *[Temperature Correction Value automatic]* setting
- The DULCOMETER® D1Cb then automatically compensates for both effects when a temperature sensor (Pt 100/Pt 1000) is connected

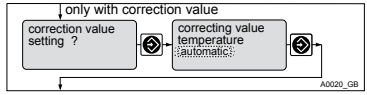


Fig. 38: Temperature Correction Value for pH and Fluoride Sensors

Temperature correction value for pH and fluoride sensors in line with the identcode:

	Possible values		
As per identcode	Increment	Lower value	Upper value
0	Off		
2	Off Manual Automatic		
4	Off Manual		

Temperature correction value for pH and fluoride sensors

		Possible values		
	Factory setting	Increment	Lower value	Upper value
Manual temperature compensation	25 °C	0.1 °C	0 °C	100 °C

8 Measured Variables and Operating Menus for the Standard Signal General

8.1 Explanation of the Standard Signal General

The "Standard Signal General" measured variable of the DULCOMETER® D1Cb is used to connect sensors from third party providers, which emit a linear mA signal, to the DULCOMETER® D1Cb. The DULCOMETER® D1Cb is thus preconditioned with appropriate sensors to measure and regulate a number of physical measured variables, see *Table on page 85*.

Adjusting the sensor output signal

The following steps must be taken in order to adapt the DULCOMETER® D1Cb to the output signal from the sensor or measuring device:

NOTICE!

Linear characteristic line

As the DULCOMETER® D1Cb can only process linear characteristic lines, only sensors/measuring devices can be connected, which emit a linear signal.

1. Change the DULCOMETER® D1Cb to the complete operating menu
2. Set the required physical unit (measured variable)

Display tolerances

With sensors or with output signals of measuring devices, which do not have to be calibrated or with which calibration has to be done in the sensor/measuring device, the display tolerances must then be calibrated between the sensor or measuring device and the DULCOMETER® D1Cb.

3. To do so, select the menu "Set Reading", see *Chapter 8.4 “Setting the Reading ” on page 84*.
4. The measuring range limit of 0/4 mA and 20 mA can be adjusted by raising and/or lowering the readings

⇨ The limits of the measuring range are adjusted in order to calibrate the display tolerance between the sensor or measuring device and the DULCOMETER® D1Cb.

! NOTICE!

Calibration

ProMinent also offers the possibility of one-point or two-point calibration of the "standard signal general" measured variable. This calibration option should only be used if the manufacturer of the sensor or measuring equipment describes or permits this in the operating manual for the sensor or measuring equipment.

8.2 Changing the Measured Variable

WARNING!

Incorrect metering due to incorrect measured variable

Possible consequence: Fatal or serious injuries

- **The measured variable/measuring range of the sensor is essential for the measured variable/measuring range!**
- If the measured variable/measuring range is changed, the sensor must be recalibrated
- If the measured variable/measuring range is changed, the set points and limit values will be changed to the associated starting values!
- If the measured variable/measuring range is changed, the settings in all of the menus must be checked

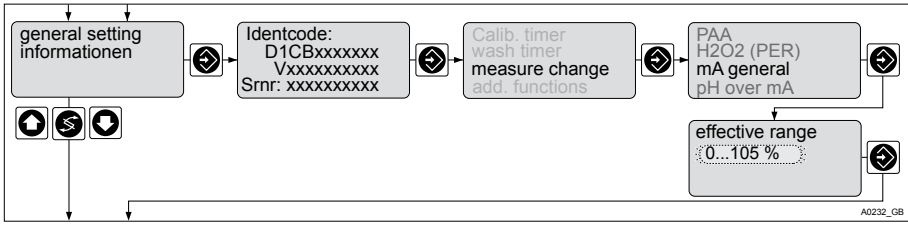


Fig. 39: Changing "Standard signal general" measured variable

For possible measured variables see *Table on page 85*.

8.3 Reduced / Complete Operating Menu

The DULCOMETER ® D1Cb allows settings to be made in two different comprehensive menus (reduced / complete). All of the parameters of the control unit are preset and can be changed in the complete operating menu.

The controller is delivered with a reduced operating menu. If adjustments are necessary, the parameters can be changed by switching to the complete operating menu.

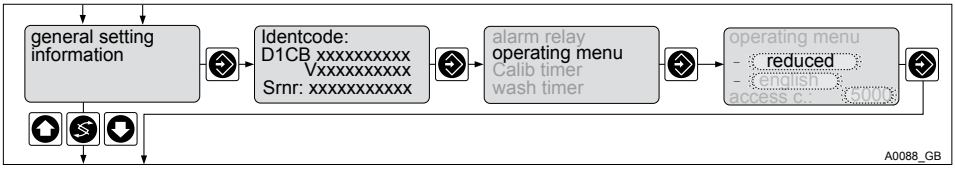


Fig. 40: Reduced / complete changeover

8.4 Setting the Reading

WARNING!

Incorrect metering due to incorrect measured variable

Possible consequence: Fatal or serious injuries

- **The measured variable/measuring range of the sensor/measuring device is essential for the measured variable/measuring range!**
- If the measured variable/measuring range is changed, the sensor must be recalibrated
- If the measured variable/measuring range is changed, the set points and limit values will be changed to the associated starting values!
- If the measured variable/measuring range is changed, the settings in all of the menus must be checked

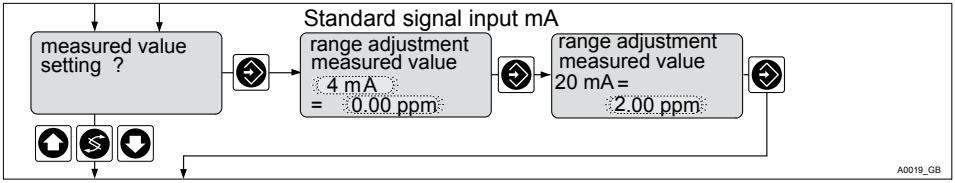


Fig. 41: Reading

Range assignment table

	Starting value	Possible values		
		Increment	Lower value	Upper value
Lower signal limit	4 mA	0 mA		
		4 mA		
Assigned measuring range*	0 - 100.0 %	0.1 %	-5 %	105 %
	0 - 20.00 mA	0.01 mA	-1.00 mA	21.00 mA

***= for other measuring ranges see** *Table on page 85*

8.5 Description of All Standard Signal Measured Values/Measured Variables

	Possible values			
Measured variable	**Increment**	**Lower value**	**Upper value**	**Measuring range***
Measuring signal	0.1%	-5,0 %	105,0 %	100 %
	0.01 mA	-1.00 mA	21.00 mA	20 mA
Filling level	0.01 m	0.00 m	31.50 m	30 m
	0.1 %	0.0 %	105,0 %	100 %
Pressure	0.001 bar	0.000 bar	1.050 bar	1.000 bar
	0.001 bar	0.000 bar	5.250 bar	5.000 bar
	0.01 bar	0.00 bar	10.50 bar	10.00 bar
	0.1 bar	0.0 bar	105.0 bar	100.0 bar
	0.1 psi	0.0 psi	105.0 psi	100 psi
	1 psi	0 psi	1050 psi	1000 psi

*** Maximum set point that can be set**

	Possible values			
Measured variable	**Increment**	**Lower value**	**Upper value**	**Measuring range***
Flow rate	0.001 m^3/h	0.000 m^3/h	10.00 m^3/h	9.999 m^3/h
	0.1 m^3/h	0.0 m^3/h	105.0 m^3/h	100 m^3/h
	1 m^3/h	0 m^3/h	1,050 m^3/h	1,000 m^3/h
	0.1 gal/h	0.0 gal/h	105.0 gal/h	100 gal/h
	1 gal/h	0 gal/h	1050 gal/h	1000 gal/h
Concentration	1 ppm	0 ppm	1050 ppm	1000 ppm
Relative humidity	0.1 % rel. humidity	0.0 % rel. humidity	105.0 % rel. humidity	100 % rel. humidity
mA signal	0.01 mA	0.00 mA	21.00 mA	20 mA
	0.01 mA	4.00 mA	21.00 mA	20 mA
Turbidity value	1 NTU	0 NTU	10 NTU	10 NTU
	1 NTU	0 NTU	105 NTU	100 NTU
	1 NTU	0 NTU	2100 NTU	2000 NTU
*** Maximum set point that can be set**				

8.6 Reduced Operating Menu

The reduced operating menu allows the key parameters to be set. The following overview shows the settings that can be selected:

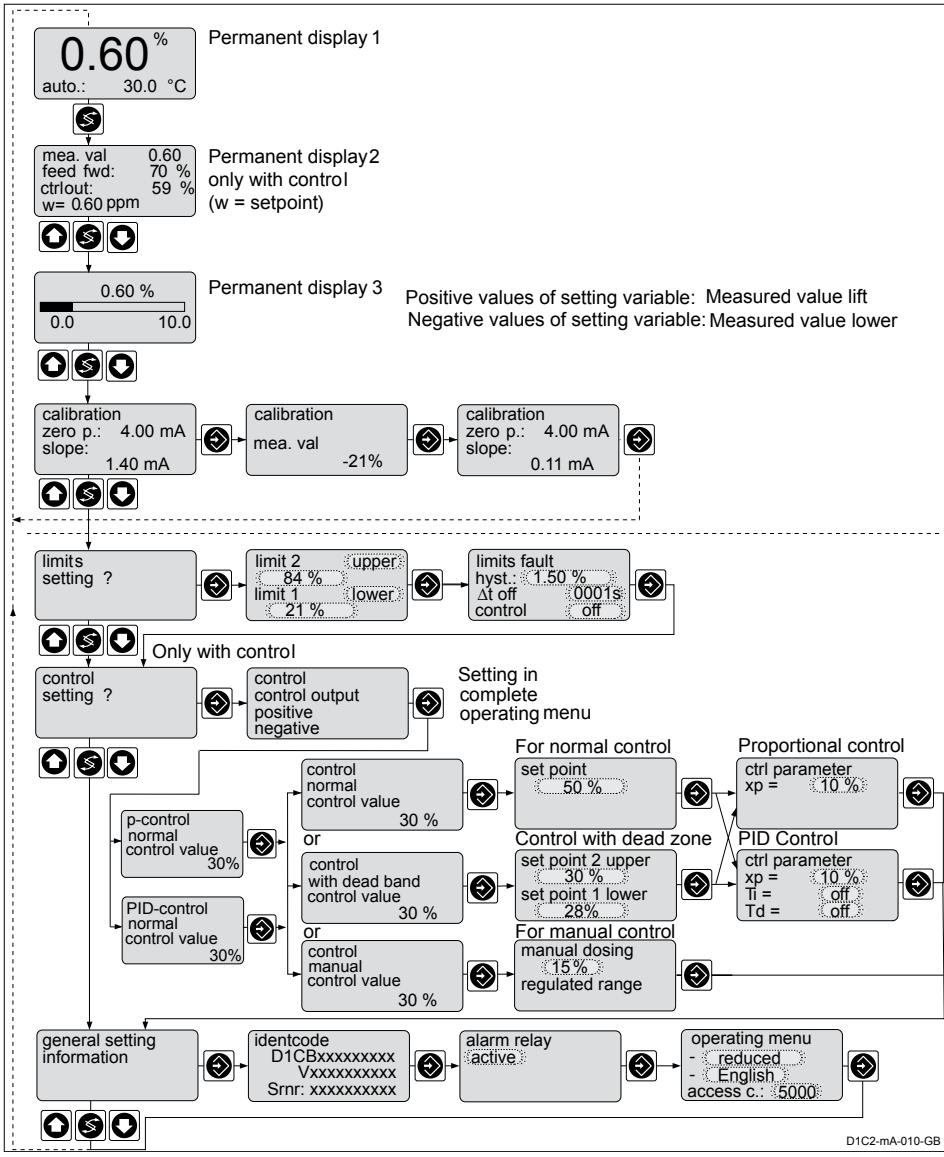


Fig. 42: Reduced operating menu / Shown with measured variable % and the measuring range 0%.... 100%

8.7 Complete Operating Menu / Description of All Measured Variables

The complete operating menu allows all control unit parameters to be set. The following overview shows the settings that can be selected:

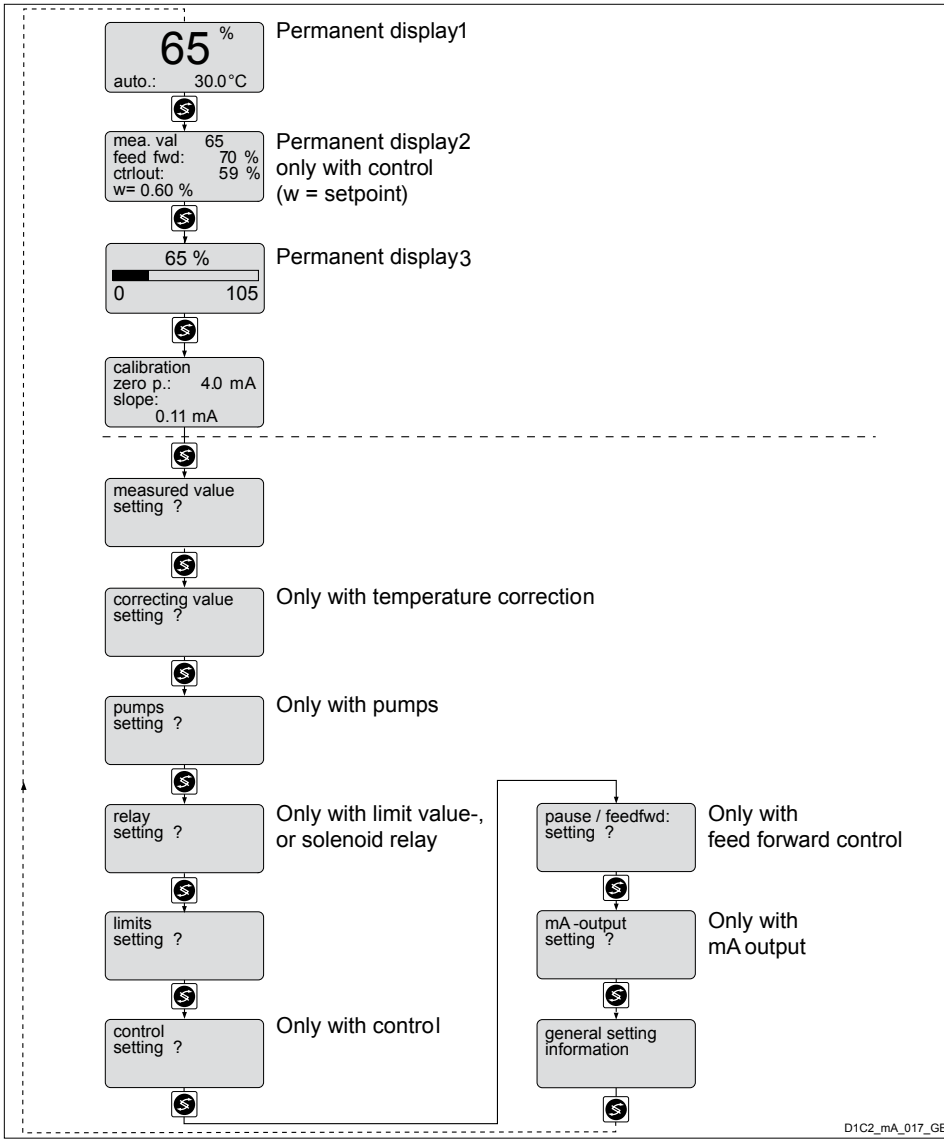


Fig. 43: Complete operating menu / Shown with measured variable % and the measuring range 0%....100%

8.8 Calibrating the Standard Signal

In the reduced operating menu the DULCOMETER ® D1Cb calibrates the zero point.

In the complete operating menu the DULCOMETER ® D1Cb performs a two-point calibration.

WARNING!

Incorrect metering due to incorrect metering range

Possible consequence: Fatal or serious injuries

- **The measuring range of the sensor or the measuring device is essential for the measuring range!**
- If the assignment of the measuring range is modified, the settings must be checked in all menus
- If the assignment of the measuring range is changed, the sensor or the measuring device must be recalibrated

CAUTION!

Correct sensor operation / Run-in time

Damage to the product or its surroundings

- Correct measuring and metering is only possible if the sensor is working perfectly
- Please read the operating manual for the sensor or the measuring device
- It is imperative that the run-in times of the sensors or the measuring device are adhered to
- The run-in times should be allowed for when planning initial operation
- It may take a whole working day to run-in the sensor or the measuring device

During calibration, the DULCOMETER ® D1Cb sets the actuating outputs to "0". The exception to this is if a basic load or a manual actuating variable has been set. This remains active. The mA standard signal outputs are frozen. The reading frozen at the start of calibration is suggested as a value. This value can be set using the arrow keys. Calibration is only possible if the value is ≥ 2 % of the measuring range of the sensor or the measuring device.

Error messages in the calibration menu

Error message	Condition	Effect
Reading gap too small	Δ Value < 5.0 %*	Reading is rejected
	Δ Value < 1.00 mA*	Repeat calibration of the measuring point!

Refer to the operating manual of the respective sensor for all error messages and use for troubleshooting.

*** of the measuring range and measured value, see** *Table on page 85*

8.8.1 Calibration of the Zero Point of the Standard Signal General

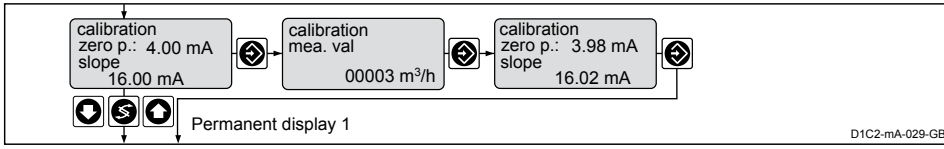


Fig. 44: Zero point calibration menu / shown with flow as the measured variable and the measuring range 0...100 m³/h

The gradient in the calibration menu is given as an mA value. This value should be regarded as the mA/selected measuring unit.

Calibration in the reduced operating menu

1. Select the calibration menu. Then press 

2. Enter the actual value suitable for the respective measured variable determined using the measuring method with the keys  ,  and  into the DULCOMETER ® D1Cb. Confirm the entry with 

3. Then press  . Should an error be displayed, see ↳ *Table "Error messages in the calibration menu " on page 91*

   ⇨ Calibration is completed.

4. Then press 

   ⇨ The display now shows the values determined for the zero point and gradient.

8.8.2 Two-Point Calibration of the Standard Signal General

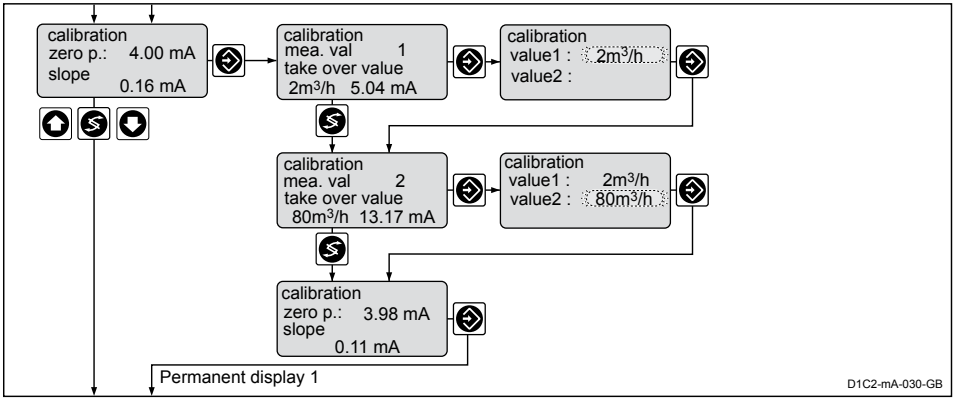


Fig. 45: Zero point calibration menu / shown with flow as the measured variable and the measuring range 0...100 m ³ /h

Calibration in the complete operating menu

1. Select the calibration menu. Then press 
2. Confirm prompt with 
3. Enter the actual value 1 suitable for the respective measured variable determined using the measuring method with the keys  ,  and  into the DULCOMETER ® D1Cb. Confirm the entry with  . The value flashes.
4. Then press 
5. Confirm prompt with 
6. Enter the actual value 2 suitable for the respective measured variable determined using the measuring method with the keys  ,  and  into the DULCOMETER ® D1Cb. Confirm the entry with  The value flashes
7. Continue with 

   ⇨ The display now shows the values determined for the zero point and gradient. Should an error be displayed, see *Table “Error messages in the calibration menu ” on page 91*

9 Operating Menus Independent of Measured Variables

Operating Menus Independent of Measured Variables

This section of the DULCOMETER® D1Cb describes the operating menus, which are independent of the measured variable.

9.1 Pumps

CAUTION!

Observe the operating manual for the pump

Possibility of damage to the pump. Faults in the process.

- The pump must be set to "External Control" operating mode
- Observe the maximum stroke rate for the pump
- Possibly switch off any stroke memories in the pump controller
- The maximum stoke rate for the pump can be found in the operating manual for the pump
  - Setting a stroke rate on the controller, which is higher than the actual possible maximum stroke rate of the pump, can lead to hazardous operating conditions

NOTICE!

Maximum pump frequency

The pumps are activated in accordance with the actuating variable up to the respective maximum frequency of the pump.

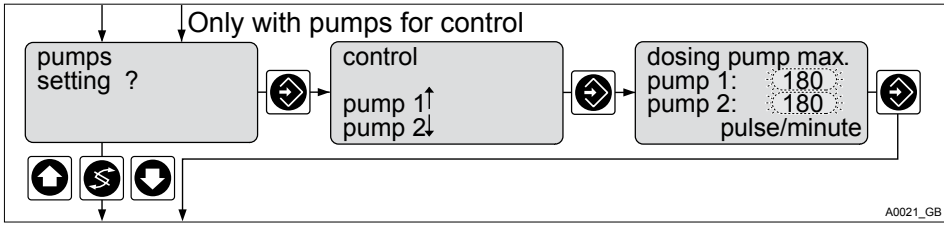


Fig. 46: Pumps

		Possible values			
	Factory setting	Increment	Lower value	Upper value	Remarks
Strokes	180	1	0	500	
Critical when setting the stroke rate is the flow rate of the pump in relation to the respective process. Observe the maximum pump frequency					

9.2 Setting the Relays

Relay combination

Relay 1 and relay 2 can be configured independently of each other. Thus any combination of "Off / Limit / Actuator / MV / Timer" is possible.

		Possible values			
	Factory setting	**Increment**	**Lower value**	**Upper value**	**Remarks**
Relay assignment	As per identcode	Solenoid valve (SV1, SV2) Limit value (limit 1/2)* Actuator 1/2 Timer 1/2 Off			*At the limit, the relays remain activated even in the event of a malfunction.
Cycle	10 s	1 s	10 s	9999 s	For solenoid valve
Min. time	1 s	1 s	1 s	Cycle/2	For solenoid valve: the smallest permissible switch-on period of the connected device should be set here
Cycle	Off	1 h	1 h/off	240 h	For timer
T On	1 minute	1 minute	1 minute	240 min	For timer

9.2.1 Setting and Functional Description of the Relays

9.2.1.1 Setting and Functional Description of "Relay Off"

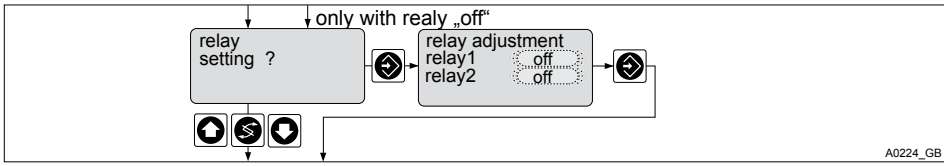


Fig. 47: Relay off

The functionality of the relays is switched off.

9.2.1.2 Setting and Functional Description of "Relay Used as a Limit Relay"

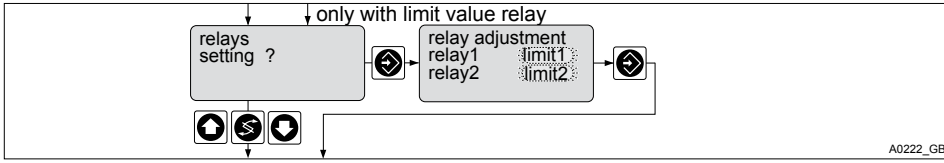


Fig. 48: Limit relay

Relay 1 and/or relay 2 can be configured as limit relays. The limit values can be set in the menu
↳ *Chapter 9.3 “Setting the Limit Values ” on page 101* .

9.2.1.3 Setting and Functional Description of "Relay Used as an Actuator"

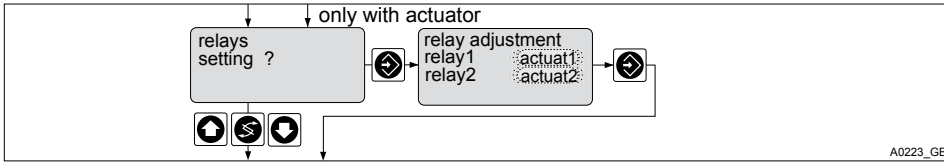


Fig. 49: Relay used as an actuator

Limit relay used as an actuator

Extended functions

– *The limit relays can also be defined in such a way that they react like an actuator. If, for example, a limit relay is activated, then it is deactivated if the pause contact is closed and for a subsequent time delay t_d (if t_d > 0 min is set under "General Settings").*

9.2.1.4 Setting and Functional Description of the Timer Relay

CAUTION!

The timer is reset when there is no supply voltage

Possible consequence: Slight or minor injuries, material damage

– Design the supply voltage in such a way that it cannot be interrupted
– With critical processes, the possible failure of the timer should be practically addressed

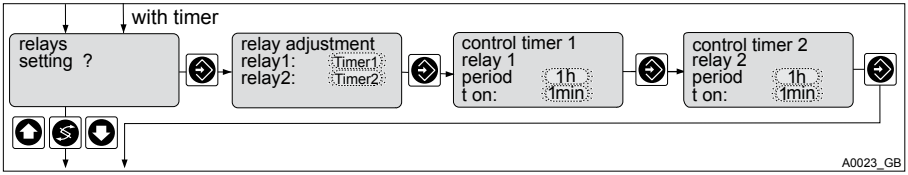


Fig. 50: Timer relay

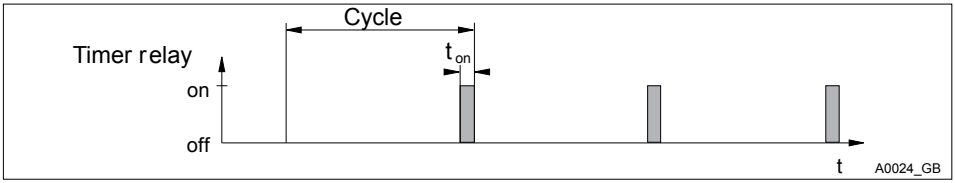


Fig. 51: Timer relay

At the end of the (timer) cycle time, the DULCOMETER ® D1Cb closes the assigned timer relay for the duration of "t on" (timer). "Pause" interrupts the timer. If the clock is visible on the LCD display, then the timer can be reset to the beginning of the cycle using the input key. The % specification on the LCD display indicates the remaining runtime.

9.2.1.5 Setting and Functional Description of "Relay Used as a Solenoid Valve"

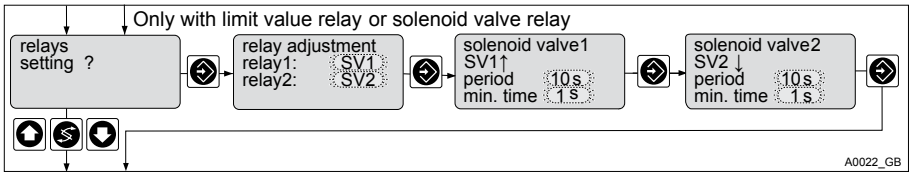


Fig. 52: Solenoid valve relay

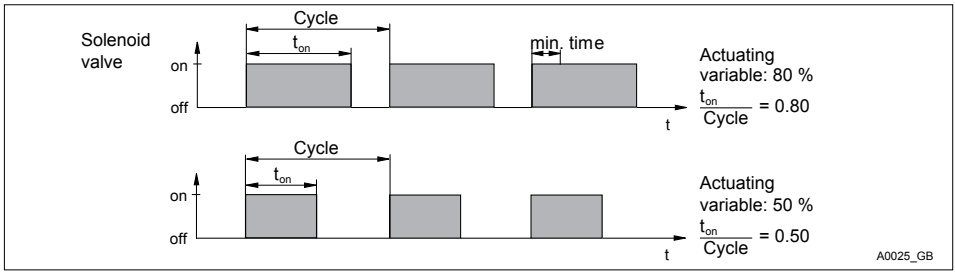


Fig. 53: Solenoid valves

The switching times of the relay (solenoid valve) depend on the actuating variable and on the "minimum time" (smallest permissible switching time of the connected device). The actuating variable determines the ratio ton/cycle and thus also the switching times.

9.2.1.5.1 Switching Times of the Solenoid Valves

The switching times of the DULCOMETER ® D1Cb (solenoid valve) depend on the cycle time and on the "minimum time" (smallest permissible switching time of the connected device). The actuating variable determines the ratio t_{on} /cycle and thus also the switching times. The "min. time" affects the switching times in two situations:

1. Theoretical switching time < min. time

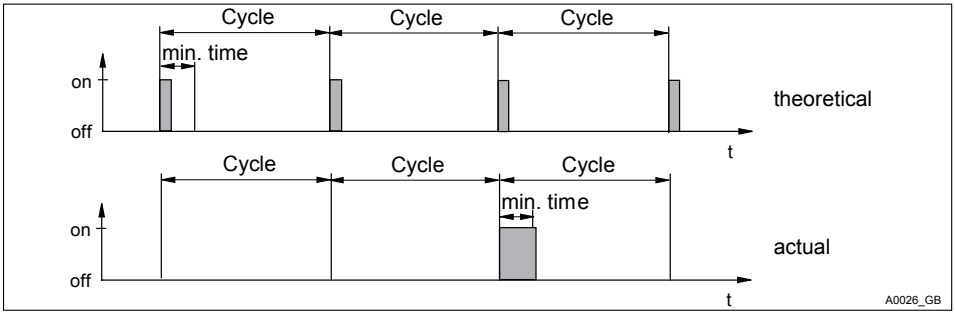


Fig. 54: Theoretical switching time < min. time

The DULCOMETER ® D1Cb does not switch on for a certain number of cycles until the sum of the theoretical switching times exceeds the "min. time". Then it switches for the duration of this total time.

2. Theoretical switching time > (cycle - min. time):

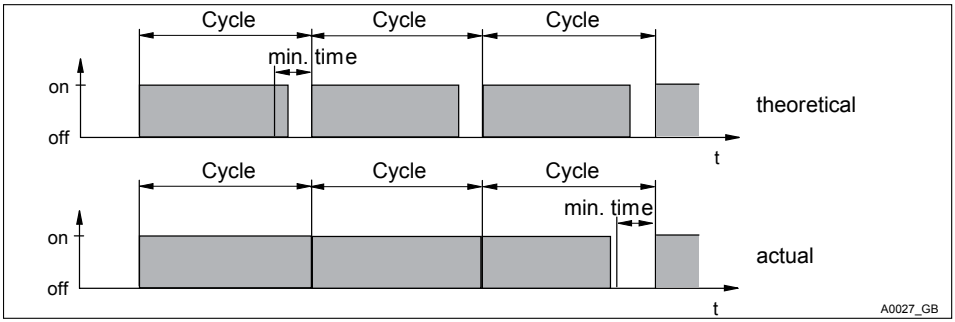


Fig. 55: Theoretical switching time > (cycle - min. time) and calculated switching time < cycle

The DULCOMETER ® D1Cb does not switch off for a certain number of cycles until the differences between the cycle and the theoretical switching time exceed the "min. time".

9.3 Setting the Limit Values

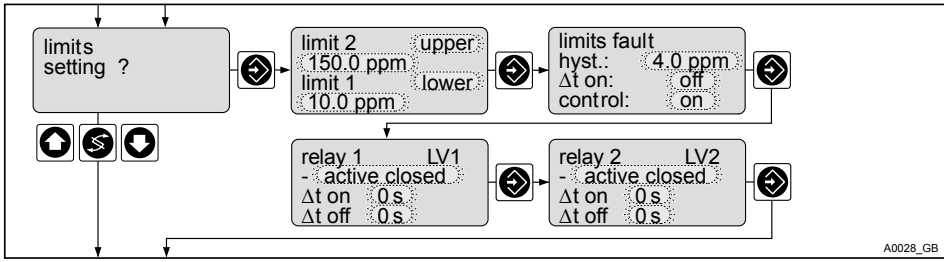


Fig. 56: Limit values

The lower display row in the diagram A0028 is only visible if the relays have been defined as limit relays or as actuators in the menu *Chapter 9.2 “Setting the Relays ” on page 96* .

Setting options in the "Set Limit Values" menu

		Possible values			
	Factory setting	**Increment**	**Lower value**	**Upper value**	**Remarks**
Type of limit transgression					Limit transgression by exceeding or dropping below limits
Limit 1	Lower	Lower / Upper / Off	Lower	Upper	
Limit 2	Upper				
Limit value Limit 1	20 %	1 %		Upper limit of reading	
Limit value Limit 2	80 %	1 %			
Hysteresis limit	2 %	1 %			Effective in the direction of cancelling limit transgression

		Possible values			
	Factory setting	Increment	Lower value	Upper value	Remarks
Control time limits ∆ t on	Off	1 s	1 s	9999 s	Results in message and alarm, Off = 0 s, function switched off No message, no alarm
Control	On	On Off			
Limit value 1 (GW1)	Active closed	Active closed / Active open			Reacts like a closer
Limit value 2 (GW2)	Active closed				
Switch on delay ∆ t on	0 s	1 s	0 s	9999 s	0 s = off

If the limit is exceeded for longer than the "Control time of limits (∆ t on)", then an error message will be triggered that has to be acknowledged and the alarm relay is deactivated. If the "controller" is also set to "Off" then the control process is stopped.

"Lower limit" means that the limit criterion has been transgressed by dropping below the lower limit

"Upper limit" means that the limit criterion has been transgressed by exceeding the upper limit

The DULCOMETER ® D1Cb has the option of defining "hysteresis limits".

The "hysteresis" works towards rectifying the limit transgression, i.e. if the "limit 1 upper" of, for example, pH 7.5 has been exceeded at a set hysteresis limit of, for example, pH 0.20, then the criterion for limit transgression is redundant when the value drops below the lower limit of pH 7.3. The hysteresis behaviour for a "lower limit" functions in a similar way (the hysteresis value is added to the limit value). In this way it is possible to forego an external relay in self-retaining mode.

If the limit is exceeded for longer than the "Delay time of limits (∆ t on)", then an error message will be triggered that has to be acknowledged and the alarm relay is deactivated. If the "controller" is also set to "Off" then the control process is stopped.

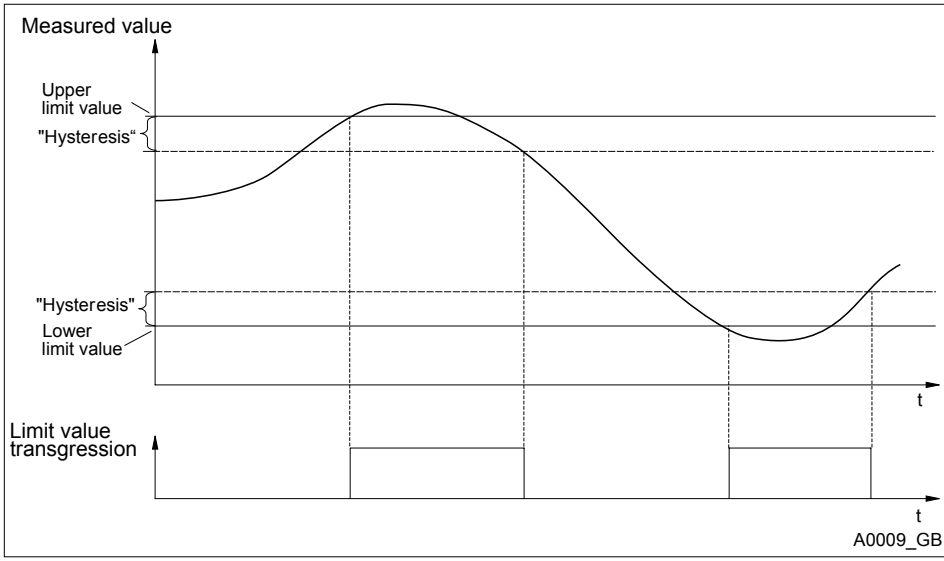


Fig. 57: Hysteresis

If the relays are defined as limit relays, they will also switch to the alarm relay when a limit is transgressed and the direction of the limit transgression will be shown on the display by the symbols ↑ or ↓.

Different on-delays (Δt On) and fall-delays (Δt Off) can be set for the limit relays for limit 1 and limit 2. These prevent the limit relay from switching back and forward if the limit is only exceeded for a short time (damping function).

If there are no limit relays, the limits can nevertheless be entered. The DULCOMETER® D1Cb shows the reactions described when a limit is transgressed

Limit relay used as an actuator

If the relays are defined as actuators, then they react like actuating outputs. Example: in the event of Pause being activated or in the event of an alarm, an activated limit relay will be deactivated.

9.4 Setting the Control

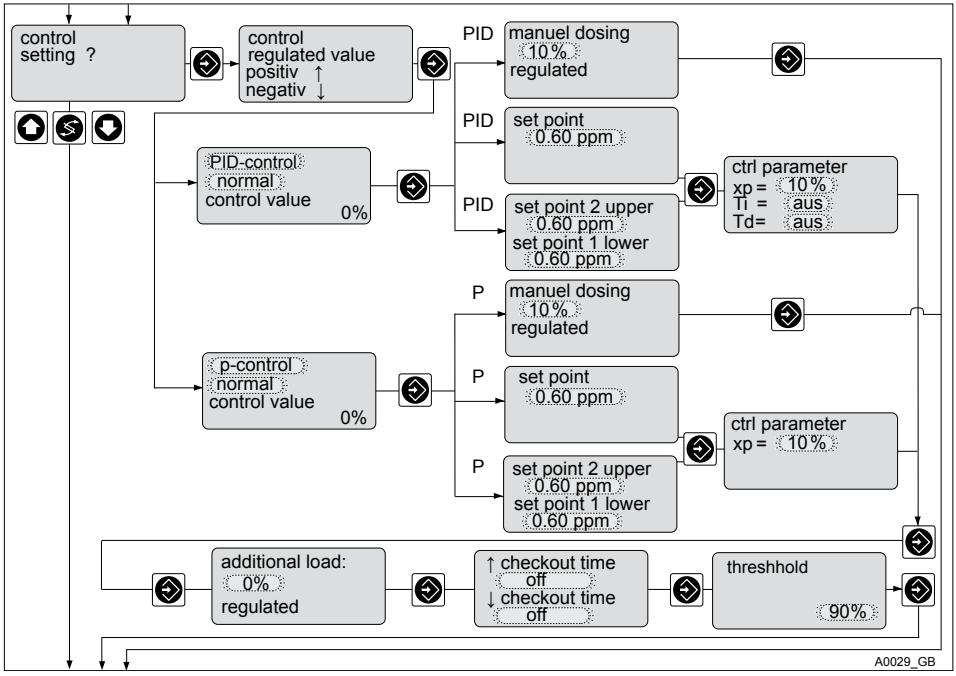


Fig. 58: Control

With control with a dead zone, the actuating variable does not change with readings within the dead zone. The setting ranges are specified by the DULCOMETER ® D1Cb .

Setting values of the control

		Possible values			
	Factory setting	**Increment**	**Lower value**	**Upper value**	**Remarks**
Control	normal	normal with dead zone Manual			With control with a dead zone, only the additive basic load is given

		Possible values			
	Factory setting	Increment	Lower value	Upper value	Remarks
					as the actuating variable for readings within the dead zone.
Set point	0.5 * measuring range	depending on the measured variable and measuring range	lower limit of measuring range	upper limit of measuring range	Set points are necessary with control with dead zone 2 Set point 1 > set point 2
Control parameter xp	10 % of the measuring range	depending on the measured variable and measuring range	1 % of the measuring range	120 % of the 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
Additive basic load	0 %	1 %	-100 %	+100 %	
Manual metering	0 %	1 %	- 100 %	+100 %	

9.5 Setting the Interference Variable

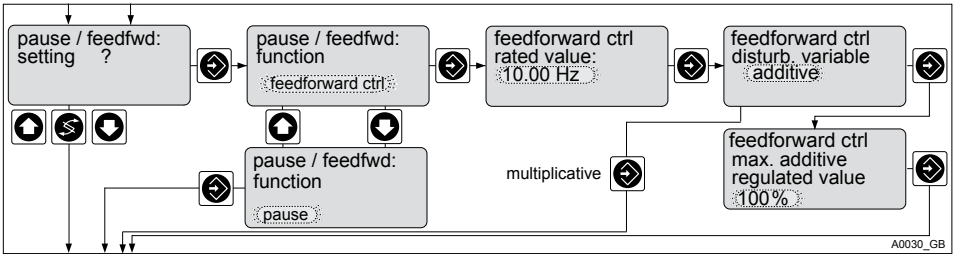


Fig. 59: Interference variable

The DULCOMETER ® D1Cb can, for example, process a signal of a flow measurement as an interference variable. This interference variable affects the actuating variable calculated by the DULCOMETER ® D1Cb as a function of this external signal.

Depending of the nature of the effect on the actuating variable, it is referred to either as a

- multiplicative interference variable or an
- additive interference variable

The interference variables input can process digital signals up to 500 Hz.

When "commissioning", the zero point signal of the flow gauge has to be checked without flow (must be ≥ 0).

Setting values of the actuating variable

		Possible values			
	Factory setting	**Increment**	**Lower value**	**Upper value**	**Remarks**
Interference variable nominal value	10 Hz	1	2* Hz	500 Hz	Depending on signal type
*** Values below 1 Hz are treated as "Pause". To remove the Pause status, the frequency has to exceed 2 Hz (hysteresis function)**					

		Possible values			
	Factory setting	Increment	Lower value	Upper value	Remarks
					Maximum limit of range used
Interference variable: interference effect	additive	multiplica-tive / additive			
Max. addi-tive actuating variable	100 %	1 %	-100 %	+100 %	Only with additive actuating variable

*** Values below 1 Hz are treated as "Pause". To remove the Pause status, the frequency has to exceed 2 Hz (hysteresis function)**

9.6 Setting the Standard Signal Output

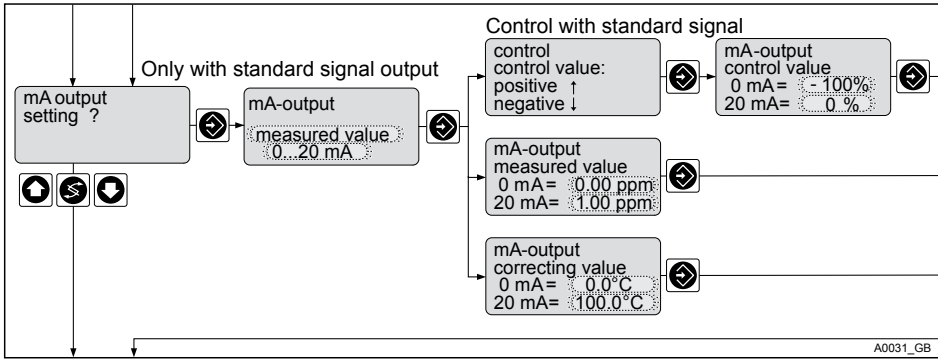


Fig. 60: Standard signal output

Setting values of the standard signal output

		Possible values			
	Factory setting	**Increment**	**Lower value**	**Upper value**	**Remarks**
Assignment of variable	Reading	Reading			
		Actuating variable			Possible if control unit present
		Correction value			Only available with correction variable
		Off			
Range	0 – 20 mA	0-20 mA			
		4-20 mA			
		3.6/4-20 mA			Reduction to 3.6 mA if alarm relay is switched
Reading range	0 ppm ...max. measuring range	0.01 ppm	0 ppm	Upper limit of measuring range	Minimum range 0.1 ppm
	- 1 pH...max. measuring range	0.01 pH	-1 pH		
	0 mV...max. measuring range	1 mV	- 1200 mV		
	0.0 °C...max. measuring range	0.1 °C	0.0 °C		
	mA	0.01 mA	- 1 mA		
Actuating variable range	-100 % - 0 %	1 %	-100 %	+ 100%	Minimum range 1 %
Correction value range	0 – 100 °C	0.1 °C	0 °C	100 °C	Minimum range 1 °C

9.7 General Settings

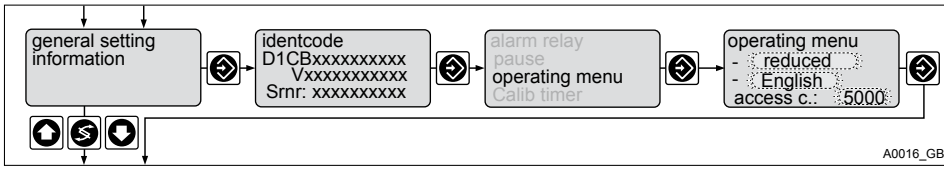


Fig. 61: General Settings

The functions described below can be selected in this menu.

9.7.1 Setting the Measured Variable/Measuring Range

WARNING!

Incorrect metering due to incorrect metering range

Possible consequence: Fatal or very serious injuries

- If the assignment of the measuring range is modified, the settings must be checked in all menus
- If the assignment of the measuring range is changed, the sensor or the measuring device must be recalibrated
- The measuring range of the sensor or the measuring device is essential for the measuring range!

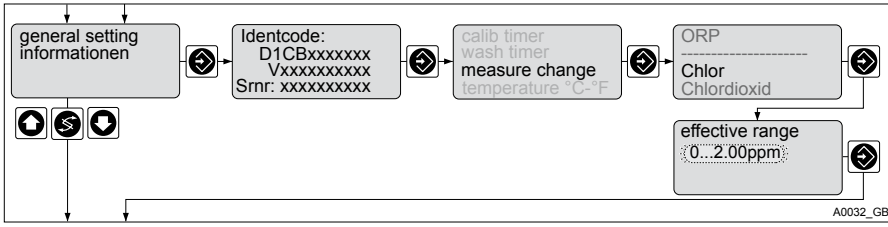


Fig. 62: Measuring range

In the "Change measured variable" setting range, it is possible to select the measured variable required for the respective process and suitable for the sensor or measuring device. Depending on the measured variable, different setting windows have to be completed, which are provided by the DULCOMETER ® D1Cb software. The values are set, selected and confirmed using keys  ,  ,  and  .

9.7.2 Sub-Functions of the "General Settings" Menu

The following sub-functions can be found in the "General Settings" menu item.

9.7.2.1 Operating Menu

In the "Operating Menu" menu item, the language in which the operating menu is displayed can be selected and it is also possible to select between a "reduced" and "complete" operating menu.

9.7.2.2 Calibration Timer

The calibration timer reminds the user of a routinely necessary calibration. The calibration timer is activated by inputting a number of days. Recalibration is necessary at the end of this period.

The calibration timer serves to remind the device operator that the connected sensors need to be recalibrated. The time is thus not based directly on the state of the sensors but on the expiry of a period of time set by the operator. If the calibration timer is enabled, an interval of between 1 and 100 days can be entered. If the calibration timer is activated and if the menu is called up again, the remaining period of time until the timer runs out is shown by way of information. A remaining time of less than one day is shown in "hours".

Resetting the timer: The calibration timer is automatically reset to its initial value following a successful calibration. Any possible display message disappears.

"Snooze" mode: If the calibration timer has expired, the message on the display can be acknowledged for a period of 15 minutes by pressing the  button. The message "Calibration timer" will reappear. The  key has to be pressed for as long as the "Calibration timer" message is visible. If another message is shown alternately, it is necessary to wait until the "Calibration timer" message reappears. Any fault messages have priority.

9.7.2.3 Washing Timer

The washing timer serves to remind the operator of the DULCOMETER® D1Cb that the connected sensors require cleaning. The time is thus not based directly on the state of the sensors but on the expiry of a period of time set by the operator.

The "Washing timer" entry can be found in the system menu. The washing timer can be enabled and disabled in this menu. If the washing timer is enabled, an interval of between 1 and 100 days can be entered. If the washing timer is enabled and if the menu is called up again, the remaining period of time until the timer runs out is shown for information. A remaining time of less than one day is shown in "hours".

Resetting the timer: once the washing timer period has expired, it can be reset in the associated menu.

"Snooze" mode: if the washing timer has expired, the message on the display can be acknowledged for a period of 15 minutes by pressing the button. The message "Washing timer" will reappear. The key has to be pressed for as long as the "Washing timer" message is visible. If another message is shown alternately, it is necessary to wait until the "Washing timer" message reappears. Any fault messages have priority.

9.7.2.4 Change Measured Variable

Change Measured Variable

In the "Change Measured Variable" menu item are listed all of the measured variables which can be enabled by the enabling code. *Chapter 9.7.1 "Setting the Measured Variable/Measuring Range " on page 109*

9.7.2.5 Additional Functions

Additional Functions

In the "Additional Functions" menu item, the scope of the DULCOMETER® D1Cb functions can be changed by inputting an optionally available enabling code. *"Extended functions " on page 38*

9.7.2.6 Operating Hour Counter

The DULCOMETER ® D1Cb has a non-resettable operating hour counter.

"Operating hours" menu item: The operating hour counter has a resolution of one minute and a maximum fault in the event of power failure of 5 minutes. The operating hour counter cannot be reset.

9.7.2.7 Calibration Logbook

The data on the successfully completed sensor calibrations are stored in the internal calibration logbook. Up to 30 calibrations can be stored. Thereafter the oldest entry is overwritten with the most recent entry.

The following data is stored:

- Time of calibration (as per the operating hour counter)
  - d = day
  - h = hour
  - m = minute
- Zero point (without unit)
- Gradient (without unit)

9.7.2.8 Software Version

Software Version

Under *["Software Version"]*, the version of the software currently installed and the revision of the DULCOMETER® D1Cb hardware is shown.

9.7.2.9 Alarm Relay

The alarm relay signals, together with the ε and an error message, that there is an error. This may consist of a:

- General device error
- Power failure: The relay is activated if voltage is supplied to the control unit and there is no error. If the voltage is disconnected, then the relay is deactivated
- Upper and lower limits of measuring range breached
- Limit transgression, even without limit relay, if the control time is set to "Limit value > 0 s" and is exceeded
- Sensor failure with pH (short circuit or no sensor connected)

- Overload/short circuit at mA sensor input
- If alarm relay "active" has been selected in the "Pause" menu item and pause is active

9.7.2.10 Sensor Monitoring (pH Sensor mV Only)

With configured pH measured variables, it is possible to monitor a sensor connected to the potentiometric input for fault statuses. This check is disabled as standard.

Monitoring for sensor breakage: The sensor breakage check (glass breakage) can identify a defective sensor by means of its low internal resistance. Correctly functioning pH sensors are highly ohmic with internal resistances in the high MΩ range. The DULCOMETER® D1Cb is capable of recognising broken sensors by means of their internal resistance. This function should be deactivated if very low ohmic sensors are used.

Refer also to: *Table on page 121*

Check for availability: The "Check for availability" identifies a disconnected sensor or a broken cable. This function should be disabled if pH sensors are used, which have a high internal resistance across their entire operating range.

9.7.2.11 Pause

"Hold" and "Normal" pause functions

Detailed explanations on the *["Hold"]* and *["Normal"]* pause functions can be found in the glossary accompanying these instructions.

9.7.2.12 Temperature

In the "Temperature" menu item, the unit in which the temperature is displayed can be switched between °C and °F.

10 Maintenance

The DULCOMETER® D1Cb is maintenance free.

10.1 Fuse Change on DULCOMETER® D1Cb

WARNING!

Danger from electrical voltage

Possible consequence: Fatal or very serious injuries

- The DULCOMETER® D1Cb does not have a mains power switch
- When working inside the control unit, disconnect the control unit from the mains power via an external switch or by removing the external fuse

WARNING!

Danger from electrical voltage

Possible consequence: Fatal or very serious injuries

- There may still be mains voltage on terminals XR 1 - 3 even after disconnection of the voltage supply
- These can be separately supplied externally with mains voltage
- Terminals XR 1 - 3 should be disconnected separately from the mains power supply

NOTICE!

Use only 5 x 20 mm micro-fuses

Possible consequence: Damage to the product or its surroundings

- 100 – 240 V *Table on page 123*

Fuse change

The mains fuse is located in a sealed fuse holder in the inside of the device, see Fig. 10.

1. Disconnect the control unit from the mains power
2. Open the control unit and put the upper section of the housing into its "parked position"
3. Remove cover of micro-fuse
4. Remove the micro-fuse using a suitable tool
5. Fit the micro-fuse using a suitable tool
6. Fit cover of micro-fuse
7. Replace upper section of housing and close the control unit

10.2 Summary of Error Texts

Error	Error text	Symbol	Effect on actuating variable	Effect on control	Alarm with acknowl-edgement	Remarks
Actuating variable exceeds control time of reading	Check sensor	Ɛ	Basic load	Stop	Yes	Function can be switched off
Upper and lower limits of signal breached (only with mA input)	Input	Ɛ	Basic load	Stop	Yes	Signal <3.0 ±0.2 mA or >23 ±0.2 mA
Calibration sensor has a fault	Compensa-tion defec-tive	Ɛ	Basic load	Stop	No	Metering continues with fault with unsteady readings
Correction variable - upper/lower signal breached	Temp. input	Ɛ	Basic load	Stop	Yes	Pt100 signal >138. 5 Ω signal, <100 Ω Pt1000 signal >1385 Ω signal, < 1000 Ω The last valid value will be reused
Limit value transgres-sion after control time of limit value	Limit value 1 Limit value 2	Ɛ Ɛ	Stop or basic load	Stop	Yes Yes	Function can be switched off

Operating step	Message text	Symbol	Effect on actuating variable	Effect on control	Alarm with acknowl-edgement	Remarks
Pause contact	Pause	Ɛ ƐO	Stop	Stop	No/Yes*	No further error check
	Pause/Hold	Ɛ		PI frozen		
Stop key	Stop	Ɛ ƐO	Stop	Stop	No	Relays drop out
During cali-bration of sensors			Basic load		No	No error treatment of measured variable
Sensor gradient too low		Ɛ	Basic load		No	25%> sensor gradient
Sensor gradient too high		Ɛ	Basic load		No	> 300% of standard gradient
DPD < 2 % of meas-uring range	DPD value too small					
Zero point	Zero point low Zero point high	Ɛ				Signal <3 mA Signal >5 mA

*Dependent on whether "Alarm Off" or "Alarm On" is set in "General Settings"

11 Technical Data

11.1 DULCOMETER® D1Cb

Permissible ambient conditions:

Wall mounted:	0° C – 50° C
Control panel mounted:	0° C – 50° C

All versions: 10 to 95% relative air humidity (non-condensing)

Permissible storage conditions:

All versions:	-10° C – 60° C

All versions: < 95% relative air humidity (non-condensing)

11.2 Sound Pressure Level

No noise generation measurable

11.3 Material Data

Part	Material
Housing lower and upper section	PPE-GF10
Bracket on rear of housing lower section	PPE-GF20
Membrane keypad	Polyester PET membrane
Seal	CR foam rubber
Angle bracket and screws	Galvanically galvanised steel
M5 screws	Stainless steel A2

11.4 Chemical Resistance

The device is resistant to normal atmospheres in plant rooms

11.5 Dimensions and Weights

Complete device:	198 x 200 x 76 mm (W x H x D)
Packaging:	390 x 295 x 155 mm (W x H x D)
Weight of device without packaging:	approx. 1.2 kg
Gross weight of device with packaging:	approx. 2.0 kg

12 Electrical Data

Mains connection	
Nominal voltage range:	100 – 230 VAC ± 10 %
Frequency	50 – 60 Hz
Current consumption	95 – 250 mA

The mains connection is isolated from other switching parts by reinforced insulation. The device has no mains switch; a fuse is fitted.

Power relay	
Loading of switching contacts:	5 A; no inductive loads
	Use protective RC circuit (optional) with inductive loads

Alarm Relay	
Loading of switching contacts:	5 A; no inductive loads
	Use protective RC circuit (optional) with inductive loads

Outputs galvanically isolated from other switching parts by reinforced insulation.

Digital input	
Open circuit voltage:	6 V DC max.
Short circuit current:	approx. 0.6 mA
Max.switching frequency:	500 Hz at 50% filling factor

NOTICE!

Do not supply with voltage

For the connection of an external semi-conductor or mechanical switch.

mA Output	
Current range:	0/3.8 – 23 mA
In the event of a fault:	3.6 or 21.5 mA
Max. apparent ohmic resistance:	450 Ω at 20.5 mA
Max. output voltage:	18 V DC
Overvoltage-resistant up to:	± 30 V
Output accuracy:	± 0.25 % of range

Galvanically isolated from all other connections (500 V)

Pump activation	
Max. switching voltage:	50 V (protective low voltage)
Max. switching current:	50 mA
Max. residual current (open):	10 µA
Max. resistance (closed):	60 Ω
Max. switching frequency (HW) at 50% filling factor	500 Hz

2 digital outputs isolated galvanically from each other and from all other connections via OptoMos relays.

mA Input	
Current measuring range	0...24 mA
Voltage output for passive transmitters:	approx. 21 V/max. 35 mA/ Ri min. 50 Ω
Measuring accuracy:	± 0.25 % of range up to 22 mA *
Overvoltage-resistant up to:	± 50 V
Short circuit-resistant	Yes

* Values above 22 mA only have an informative character

For the connection of active and passive power transmitters in 2- and 3-wire systems. Not galvanically isolated from the temperature and mV inputs.

Do not connect mV input and mA input simultaneously. Values will be falsified and the sensors and measuring devices connected will be damaged.

Switch off supply and current measuring resistance in the event of a fault; reactivate cyclically by means of software.

mV Input	
Measuring range:	-1 V...+1 V
Measuring accuracy:	± 0.25 % of range
Sensor monitoring of input (low ohmic threshold) (can be switched off):	< approx. 500 k Ω (short circuit)
Sensor monitoring of input (high ohmic threshold) (can be switched off):	> approx. 1.2 G Ω
Overvoltage-resistant up to:	± 5 V

For the connection of potentiometric sensors. Short circuit monitoring provided by software.

Do not connect mV and mA simultaneously. Values will be falsified.

Not galvanically isolated from the mA and temperature inputs. Terminal for the connection of an electrode for compensating for the potential of the measuring liquid

Temperature input	
Temperature measuring range:	0...100 °C
Measuring flow:	approx. 0.96 mA
Measuring accuracy:	± 0.5 % of measuring range
Overvoltage-resistant up to:	± 5 V
Short circuit-resistant	Yes

For the connection of Pt100 or Pt1000 temperature sensors in 2-wire systems. A switch is automatically made between Pt100 / Pt1000. Not galvanically isolated from the mA and mV inputs.

13 Spare Parts and Accessories DULCOMETER ® D1Cb

Spare Parts	Part number
Micro-fuse 5x20 T 1.6A	732411
Screw connection M12x1.5 compl. metric	1032245
Half screw connection compl. metric	1031506
Wall bracket	792713
Guard terminal top section (knurled nut)	733389
D1C/D2C measured variable labels	1030506

Accessories	Part number
Control panel assembly set	792908
Protective RC Circuit retrofitting set for D1Cb	1034238

14 Standards Complied With

DIN EN 61010 Safety requirements for electrical units for measuring, control, regulating and laboratory devices

DIN EN 61326 Electrical equipment for measuring, control and laboratory use - EMC requirements (for class A and B devices)

DIN EN 55014-1 EMC Requirements of household appliances Part 1 Emitted interference

DIN EN 55014-2 EMC Requirements of household appliances Part 2 Interference resistance

15 Disposal of Used Parts

NOTICE!

Regulations governing disposal of used parts

– Note the current national regulations and legal standards which apply in your country

ProMinent Dosiertechnik, Heidelberg/Germany is prepared to take back clean used parts.

16 Declaration of Conformity

EC Declaration of Conformity

We,

ProMinent Dosiertechnik GmbH
Im Schuhmachergewann 5 - 11
D - 69123 Heidelberg

hereby declare that, on the basis of its functional concept and design and in the version brought into circulation by us, the product specified in the following complies with the relevant, fundamental safety and health stipulations laid down by EC directives.
Any modification to the product not approved by us will invalidate this declaration.

Product description :	***Measurement and control system, DULCOMETER***
Product type :	***D1Cb...***
Serial number :	***see type identification plate on device***
Relevant EC regulations :	***EC - low voltage directive (2006/95/EC)*** ***EC - EMC - directive (2004/108/EC)***
Harmonized standards used, in particular :	***EN 61010, EN 61326-1***
Date/manufacturer´s signature :	***12.05.2009***
The undersigned :	*Joachim Schall, director research and development*

Fig. 63: EC Declaration of Conformity

17 Index