Assembly and operating instructions

DULCOMETER®, Compact Controller
Measured variable: pH / ORP

EN

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.
The latest version of the operating instructions are available on our homepage.

Part no.: 986214

BA DM 207 08/15 EN

General non-discriminatory approach

In order to make it easier to read, this document uses the male form in grammatical structures but with an implied neutral sense. It is aimed equally at both men and women. We kindly ask female readers for their understanding in this simplification of the text.

Supplementary information

Please read the supplementary information in its entirety.

Information

This provides important information relating to the correct operation of the unit or is intended to make your work easier.

Safety Information

The safety information includes detailed descriptions of the hazardous situation, see
↳ *Chapter 2.1 'Explanation of the safety information' on page 8*

The following symbols are used to highlight instructions, links, lists, results and other elements in this document:

More symbols

Symbol	Description
1. ▶	Action, step by step
⇨	Outcome of an action
↳	Links to elements or sections of these instructions or other applicable documents
■	List without set order
[Button]	Display element (e.g. indicators) Operating element (e.g. button, switch)
'Display /GUI'	Screen elements (e.g. buttons, assignment of function keys)
`CODE`	Presentation of software elements and/or texts

Table of contents

1 Identity code

DCCa	DULCOMETER® Compact,									
	Mounting type									
	E	Spare part units								
	W	Wall/pipe mounting IP 67								
	S	With fitting kit for control panel mounting IP 54								
		Design								
		00	With ProMinent® logo							
		E1	Spare part unit, controller housing lower part (processor/PCB), fully assembled							
		E2	Spare part unit, controller housing top part (processor/PCB), fully assembled							
			Operating voltage							
			6	90 … 253 V, 48/63 Hz						
				Measured variable						
				C0	Free chlorine					
				NG	pH/ORP (switchable)					
				L3	Conductive conductivity (designation: COND_C)					
				L6	Inductive conductivity (designation: COND_I)					
					Hardware extension					
					0	None				
					Approvals					
					01	CE (Standard)				
						Certificates				
						0	None			
							Operating instructions language			
							EN	German	KR	Korean

DCCa	DULCOMETER® Compact,									
							EN	English	LT	Lithuanian
							ES	Spanish	LV	Latvian
							IT	Italian	NL	Dutch
							FR	French	PL	Polish
							FI	Finish	PT	Portuguese
							BG	Bulgarian	RO	Romanian
							ZH	Chinese	SV	Swedish
							CZ	Czech	SK	Slovakian
							EL	Greek	SL	Slovenian
							HU	Hungarian	RU	Russian
							YES	Japanese	TH	Thai

2 Introduction

Data and functions

These operating instructions describe the technical data and functions of the DULCOMETER® Compact Controller, measured variable pH / ORP.

2.1 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.*

2.2 Users' qualifications

WARNING!

Danger of injury with inadequately qualified personnel!

The operator of the plant / device is responsible for ensuring that the qualifications are fulfilled.

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

Training	Definition
Instructed personnel	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.
Trained user	A trained user is a person who fulfils the requirements made of an instructed person and who has also received additional training specific to the system from ProMinent or another authorised distribution partner.
Trained qualified personnel	A qualified employee is deemed to be a person who is able to assess the tasks assigned to him and recognize possible hazards based on his/her training, knowledge and experience, as well as knowledge of pertinent regulations. The assessment of a person's technical training can also be based on several years of work in the relevant field.

Training	Definition
Electrician	Electricians are deemed to be people, who are able to complete work on electrical systems and recognize and avoid possible hazards independently based on his/her technical training and experience, as well as knowledge of pertinent standards and regulations. Electricians should be specifically trained for the working environment in which the are employed and know the relevant standards and regulations. Electricians must comply with the provisions of the applicable statutory directives on accident prevention.
Customer Service department	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!

3 Safety and responsibility

3.1 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)

3.2 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 marking of the measured variables is located on the controller and is absolutely binding.

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.

4 Functional description

Brief functional description

The DULCOMETER® Compact Controller for pH and redox measured variables provides basic functions for water treatment applications. It has a fixed configuration with the following features:

- Measured variables pH and redox (can be switched over on the DULCOMETER® Compact Controller)
- Language independent operation (use of abbreviations, such as *[INPUT]*, *[OUTPUT]*, *[CONTROL]*, *[ERROR]*)
- Illuminated display
- 3 LEDs indicate the operating states (*[f-REL]* active, *[P-REL]* active, error)
- Sensor monitoring of pH
- P or PID control characteristics
- Selectable control direction (raise or lower measured value)
- Impulse frequency relay *[f-REL]* for metering pump control
- Power relay *[P-REL]*, configurable as alarm, limit value or pulse width modulated (PWM) control output for metering pumps
- Analogue output 0/4…20 mA, can be configured as a measured value or correction variable
- Suction function for all actuators
- Digital input to switch off the DULCOMETER® Compact Controller or to process a sample water limit contact by remote control
- Temperature sensor input (Pt 1000) for temperature compensation of the pH value
- Protection class IP67 (wall/pipe mounting), protection class IP54 (control panel mounting)

Applications:

- Waste water treatment
- Treatment of drinking water
- Swimming pool water treatment

4.1 Flow diagram

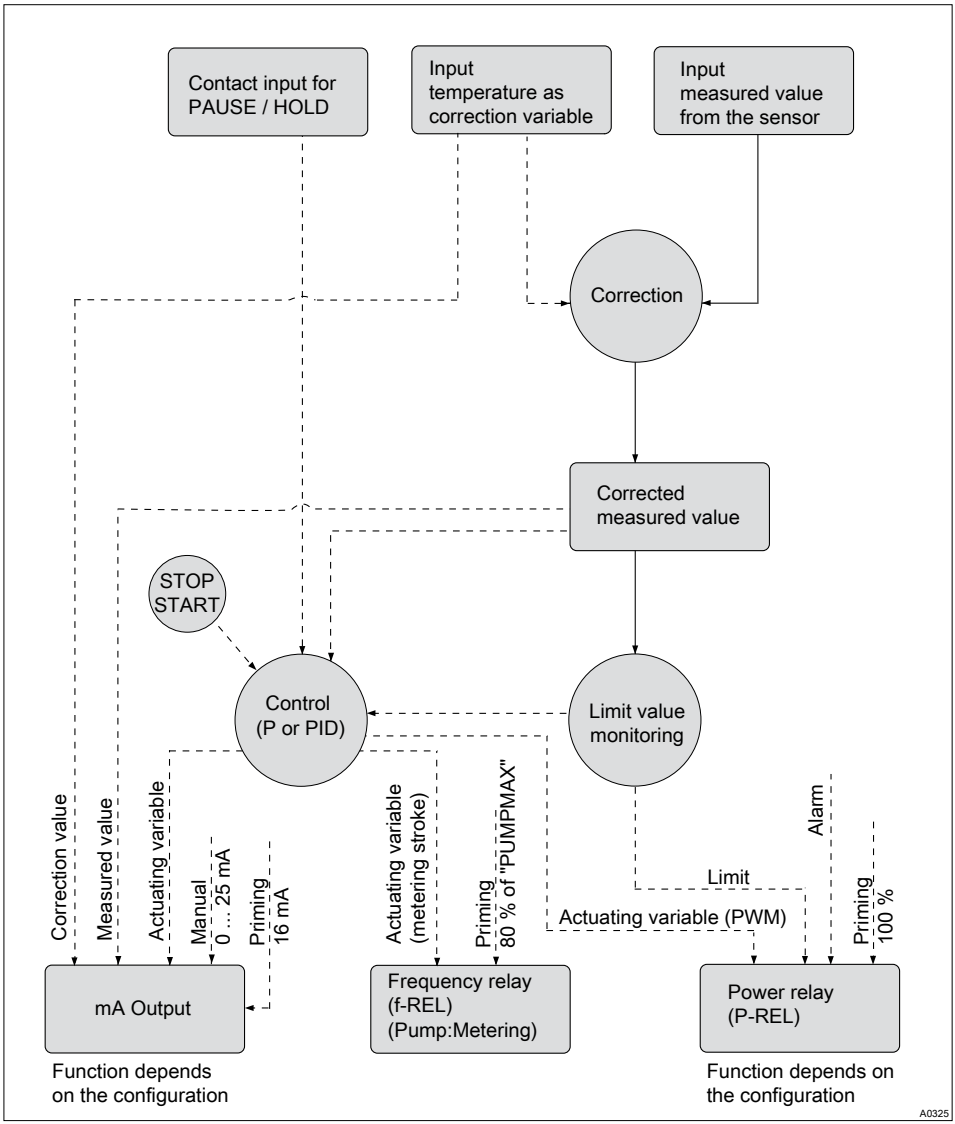


Fig. 1: Flow diagram

4.2 Overview of the first level menu

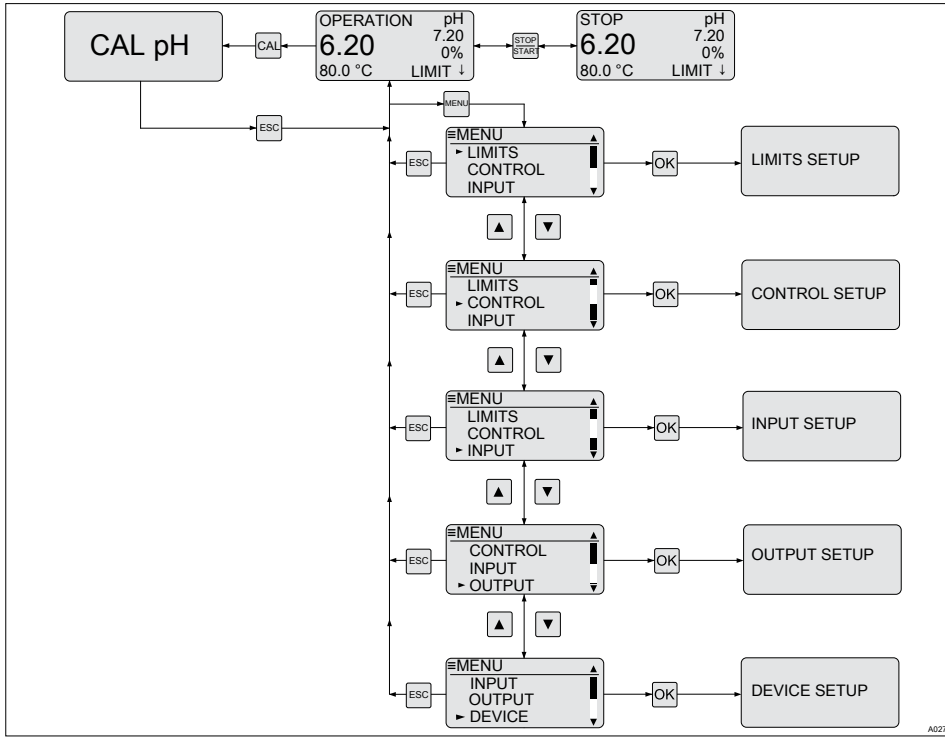
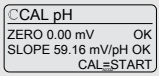
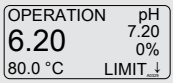
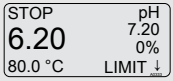
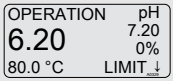
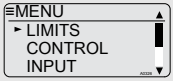
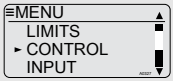
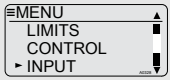
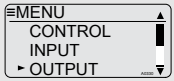
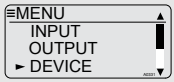


Fig. 2: Overview of the first level menu; shown for pH

Display view	Selection with:	Reference	Function
OPERATION pH 6.20 7.20 0% 80.0 °C LIMIT ↓		*Chapter 7 'Operating diagram' on page 43*	
CAL			Changes to the calibration menu.

Display view	Selection with:	Reference	Function
	CAL	*Chapter 8.1 'pH sensor calibration (CAL)' on page 48*	The calibration menu enables calibration of controller and sensor.
			
STOP START			Stop/Start the control and metering function.
	STOP START	*Chapter 9.2 'STOP/START key' on page 73*	By pressing the STOP key, the control is stopped. The STOP key can be pressed independently of the currently displayed menu. However the STOP state is only shown in the continuous display.
	MENU	*Chapter 7.3 'Continuous display' on page 45*	Changes from the continuous display to the setting menu.
	OK	*Chapter 8.3 'Setting limit values [LIMITS]' on page 58*	Enables the setting of the limit value for limit value monitoring.
			
	OK	*Chapter 8.4 'Setting the control [CONTROL]' on page 60*	Enables parameter setting for the control.
			

Display view	Selection with:	Reference	Function
	OK	*Chapter 8.5 'Input setting (INPUT)' on page 63*	Enables setting of the measured value input parameter.
			
	OK	*Chapter 8.6 ' Output setting (OUTPUT)' on page 66*	Enables setting of the mA output parameter.
			
	OK	*Chapter 8.7 'DEVICE setting' on page 70*	Enables adjustment of the password and the controller *[RESTART]* function.

5 Assembly and installation

- **User qualification, mechanical installation:** trained qualified personnel, see ↳ *Chapter 2.2 'Users' qualifications' on page 10*
- **User qualification, electrical installation:** Electrical technician, see ↳ *Chapter 2.2 'Users' qualifications' on page 10*

CAUTION!

Possible consequence: Material damage.

The hinge between the front and rear part of the housing cannot absorb high levels of mechanical loading. When working on the DULCOMETER® Compact Controller, firmly hold the top section of the controller housing.

CAUTION!

Check band for strain relief

Possible consequence: Material damage.

The ribbon cable and its socket cannot be mechanically loaded. Hence it is essential that when mounting the controller in the control panel mounting, the check strap (part number 1035918) is fitted for strain relief and mechanical securing. Without the check strap, the ribbon cable or its socket could be damaged if they were to fall out of the controller upper housing.

NOTICE!

Mounting position and conditions

- The controller conforms to IP 67 degree of protection (wall/pipe mounting) or IP 54 (control panel mounting) requirements. This degree of protection is only achieved if all seals and cable glands are correctly fitted.
- The (electrical) installation should only take place after (mechanical) installation
- Ensure that there is unimpeded access for operation
- Ensure safe and low-vibration fastening
- Avoid direct sunlight
- Permissible ambient temperature of the controller at the installation location: -10 ... +60 °C at max. 95% relative air humidity (non-condensing)
- Take into consideration the permissible ambient temperature of the sensors and other components connected
- The controller is only suitable for operation in closed rooms. If operated outside, the controller must be protected against the environment by a suitable protective enclosure

Read-off and operating position

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

Mounting position

– *Leave sufficient free space for the cables*

Packaging material

Dispose of packaging material in an environmentally responsible way. All packaging components carry the corresponding recycling code ♻.

5.1 Scope of delivery

The following parts belong to the standard scope of delivery of a DULCOMETER® Compact Controller.

Description	Quantity
Assembled device	1
Cable connection set DMTa/DXMa (metr.)	1
Operating instructions	1

5.2 Mounting (mechanical)

The DULCOMETER® Compact Controller is suitable for mounting on a wall, pipe or control panel.

Mounting materials (contained in the scope of supply):

Description	Quantity
Wall/tube retaining bracket	1
Round head screws 5x45 mm	2
Washer 5.3	2
Rawlplug Ø 8 mm, plastic	2

5.2.1 Wall mounting

Mounting (mechanical)

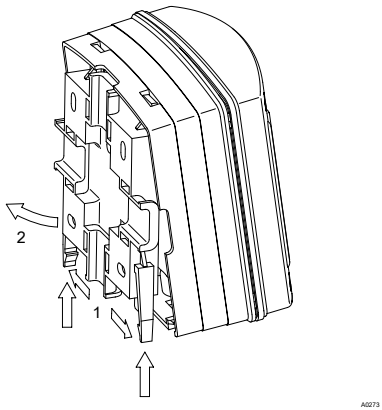


Fig. 3: Removing the wall/pipe bracket

1. Remove the wall/pipe bracket. Pull the two snap-hooks (1) outwards and push upwards
2. Fold out the wall/pipe bracket (2) and pull out in a downwards direction
3. Mark two drill holes diagonal to each other by using the wall/pipe bracket as a drilling template
4. Drill holes: Ø 8 mm, d = 50 mm

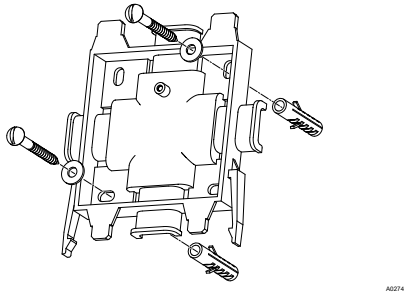


Fig. 4: Screwing on the wall/pipe bracket using washers

5. Screw on the wall/pipe bracket using the washers
6. Suspend the DULCOMETER® Compact Controller at the top in the wall/pipe bracket and push using light pressure at the bottom against the wall/pipe bracket. Then press upwards until the DULCOMETER® Compact Controller audibly snaps into position.

5.2.2 Pipe mounting

Mounting (mechanical)

> ***Pipe diameter***
>
> *Pipe diameter: 25 mm to 60 mm.*

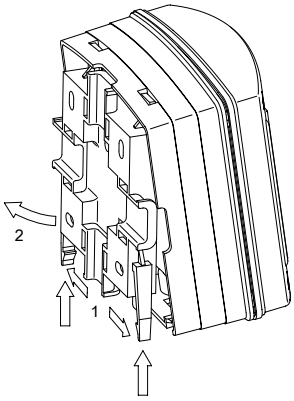


Fig. 5: Removing the wall/pipe bracket

1. Remove the wall/pipe bracket. Pull the two snap-hooks (1) outwards and push upwards
2. Fold out the wall/pipe bracket (2) and pull out in a downwards direction
3. Secure the wall/pipe bracket using cable ties (or pipe clips) to the pipe

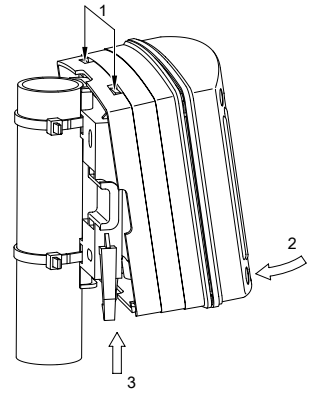


Fig. 6: Suspend and secure the DULCOMETER® Compact Controller

4. Suspend the DULCOMETER® Compact Controller at the top (1) in the wall/pipe bracket and push using light pressure at the bottom (2) against the wall/pipe bracket. Then press upwards (3) until the DULCOMETER® Compact Controller audibly snaps into position

5.2.3 Control panel mounting

Mounting kit for control panel installation of the DULCOMETER® Compact Controller: Order number 1037273

Description	Quantity
Drilling template sheet 3872-4	1
PT screw (3.5 x 22)	3
Profile seals	2
Strain relief strip DF3/DF4	1
PT screw (3.5 x 10)	2
Individual parts packed in transparent cover / Mounting kit is not contained in the standard scope of supply	

CAUTION!

Material thickness of control panel

Possible consequence: material damage

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

In the mounted state, the DULCOMETER® Compact Controller extends approx. 30 mm from the control panel.

Preparing the control panel

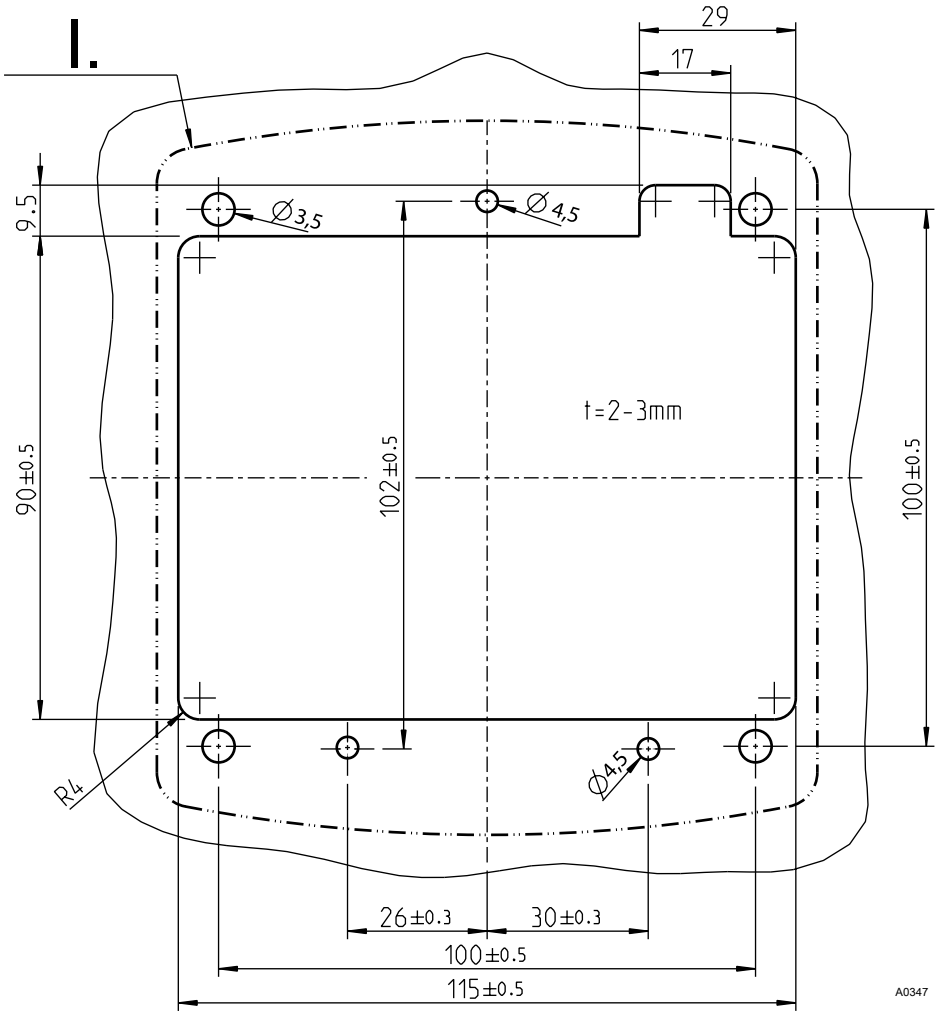


Fig. 7: The drawing is not to scale and is intended for information purposes only.

I. Outline contour of the DULCOMETER® Compact Controller housing

1. Mark the exact position of the DULCOMETER® Compact Controller on the control panel using the drilling template

2.

Core hole

Adhere to the 3.5 mm Ø as the core hole diameter for screwing in the fixing bolts.

Drill four holes for the bolts for the top section of the controller housing using a 3.5 mm Ø drill bit

3. Drill three holes for the bolts for the bottom section of the controller housing using a 4.5 mm Ø drill bit

4. Drill four holes using an 8 mm Ø drill bit and use a jigsaw to cut the cut-out

⇨ Deburr all the edges.

Fitting the DULCOMETER® Compact Controller into the cut-out in the control panel

! NOTICE!

Ribbon cable base

The base for the ribbon cable is firmly soldered onto the PCB. The base cannot be removed. Open the base lock (3) to loosen the ribbon cable, see Fig. 8

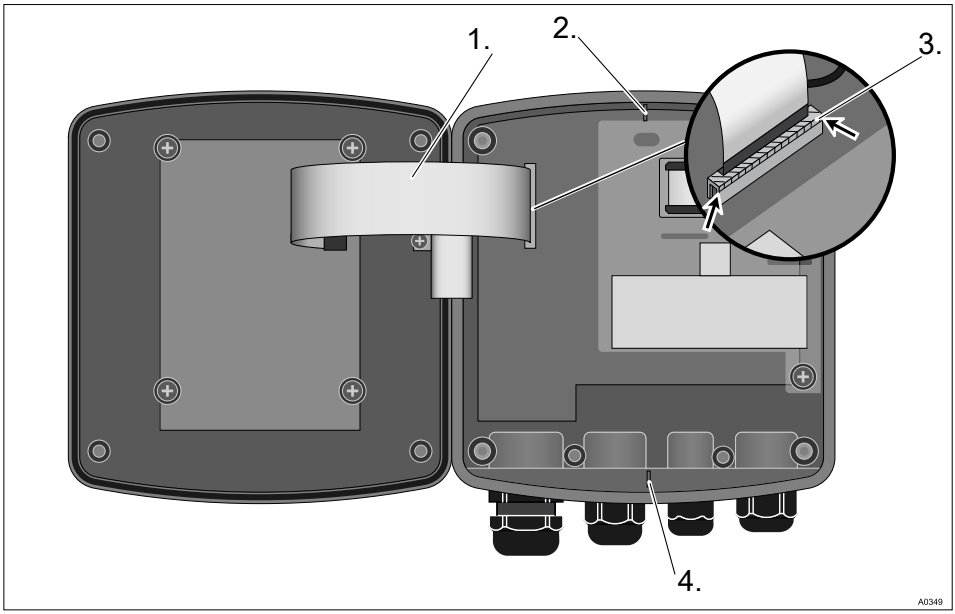


Fig. 8: Loosening the ribbon cable

1. Undo four screws and open the DULCOMETER® Compact Controller
2. Open the right and left lock (3) (arrows) on the base and pull the ribbon cable (1) out of the socket
3. Use pliers to break off the catches (2 and 4). These are not needed for control panel installation

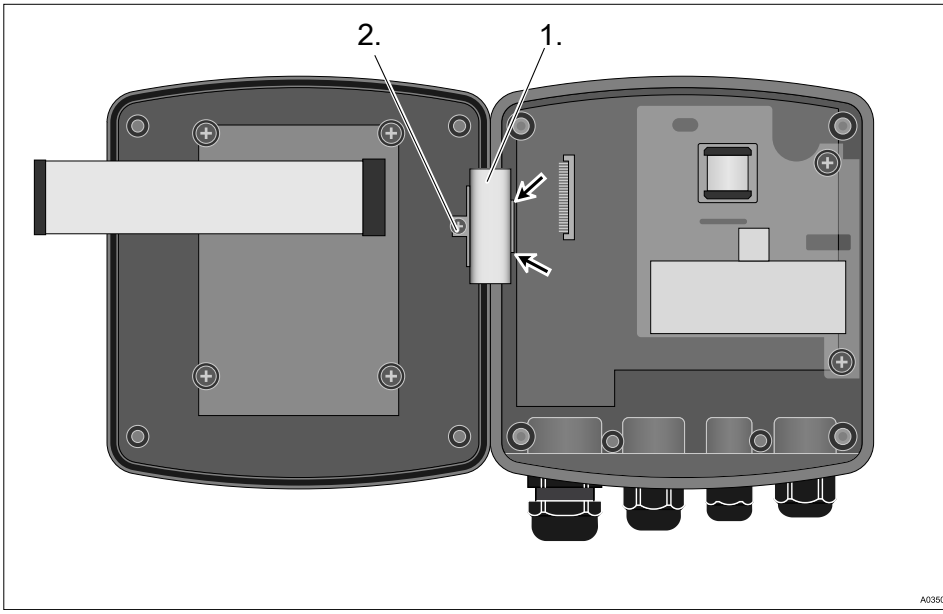


Fig. 9: Dismantle the hinge

4. Remove the screw (2), unclip the hinge (1) on the bottom section of the controller housing (arrows) and remove the hinge

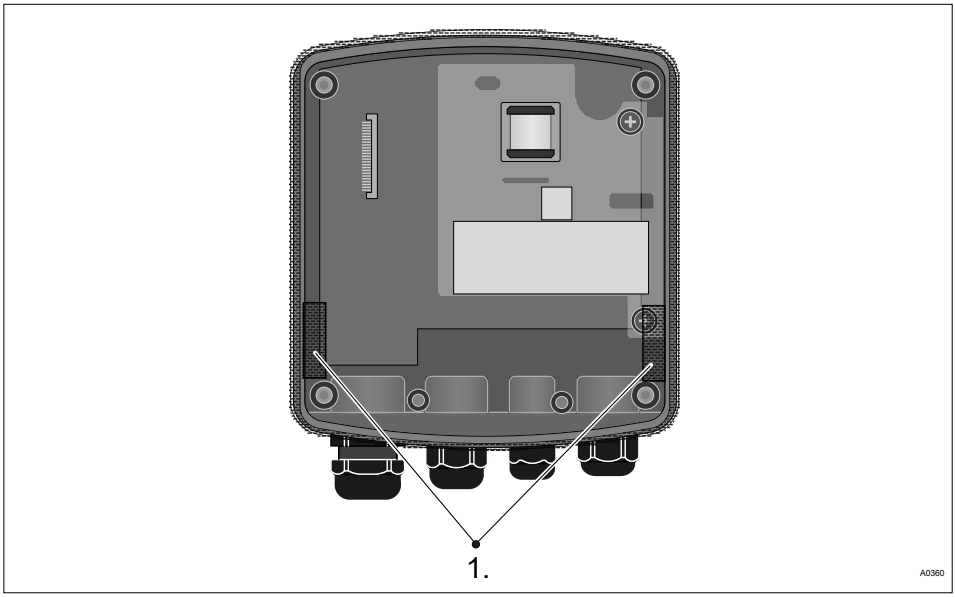


Fig. 10: Fitting the profile seal on the bottom section of the controller housing

5. Position the profile seal evenly around the upper edge of bottom section of the DULCOMETER® Compact Controller housing. Arrange the clips (1) as shown in the figure

   ⇨ Ensure that the profile seal evenly surrounds the upper edge of the housing.

6. Insert the bottom section of the DULCOMETER® Compact Controller housing with the profile seal from behind into the cut-out and use three screws to secure it in place

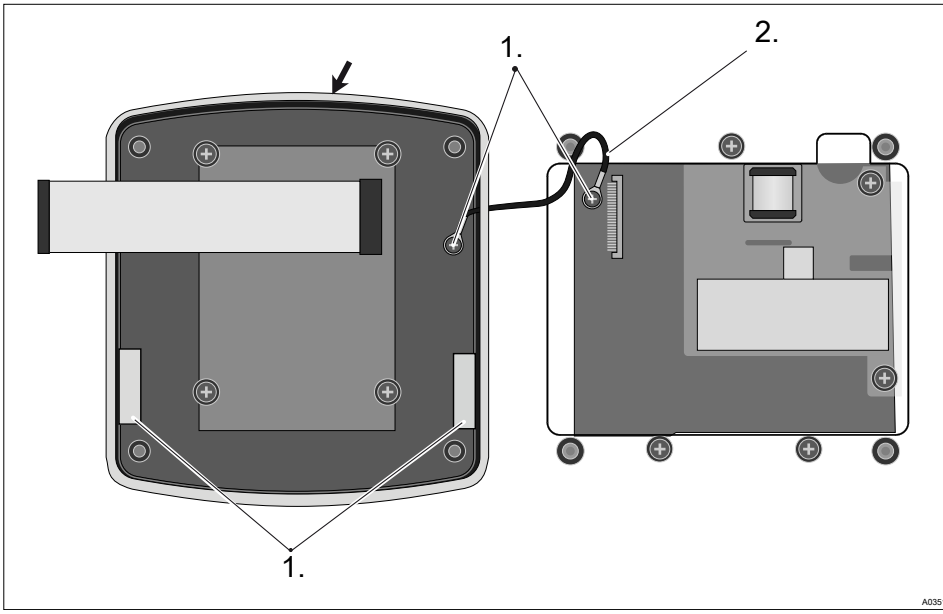


Fig. 11: Fitting the profile seal onto the top section of the controller housing

7. Position the profile seal (arrow) evenly into the groove in the top section of the DULCOMETER® Compact Controller housing. Arrange the clips (3) as shown in the figure

8. Secure the strain relief (2) using two screws (1)

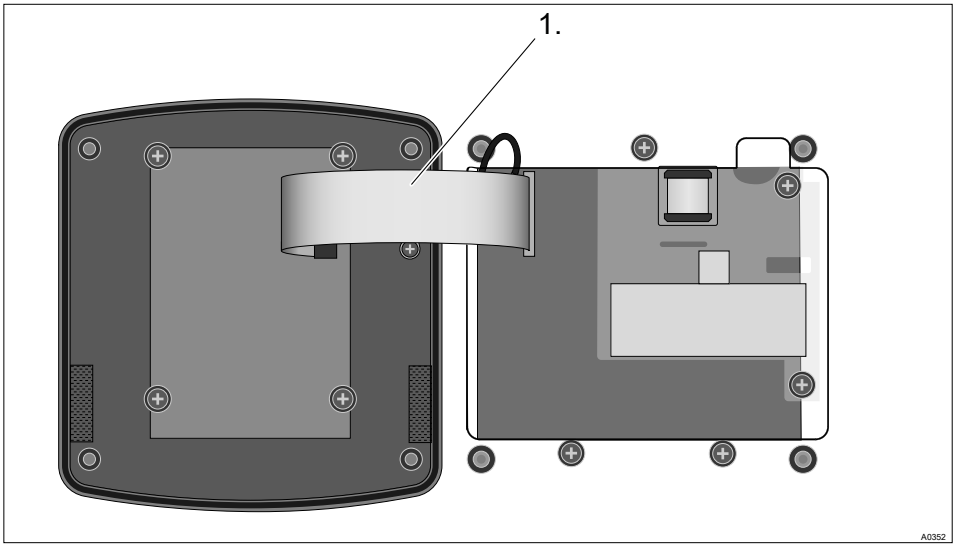


Fig. 12: Push and lock the ribbon cable in its base

9. Push and lock the ribbon cable (1) in its base

10. Screw the top section of the controller housing onto the bottom section of the DULCOMETER® Compact Controller housing

11. Once again check that the profile seals are fitted properly

    ⇨ IP 54 degree of protection can only be provided if the control panel is mounted correctly

5.3 Installation (electrical)

WARNING!

Live parts!

Possible consequence: Fatal or very serious injuries

- Measure: Disconnect the electrical power supply to the device before opening the housing and secure to prevent unintentional reconnection
- Disconnect damaged or defective devices or devices that have been tampered with and prevent unintended reconnection
- The provision of a suitable isolating device (emergency-off switch, etc.) is the responsibility of the plant operator

The signal leads of the DULCOMETER® Compact Controller must not be routed alongside interference-prone cabling. Faults could lead to malfunctions of the DULCOMETER® Compact Controller.

5.3.1 Cable Cross-Sections and Cable End Sleeves

	Minimum cross-section	Maximum cross-section	Stripped insulation length
Without cable end sleeve	0.25 mm^2	1.5 mm^2	
Cable end sleeve without insulation	0.20 mm^2	1.0 mm^2	8 - 9 mm
Cable end sleeve with insulation	0.20 mm^2	1.0 mm^2	10 - 11 mm

5.3.2 Installation of coaxial cable to guard terminal XE1

CAUTION!

Maximum length of the coaxial cable 10 m

Incorrect measured value 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 measurement signal can otherwise be falsified by the effects of interference.

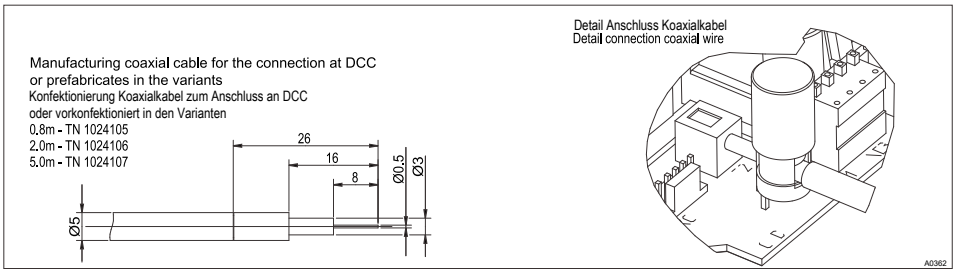


Fig. 13: Installation of Coaxial Cable to Guard Terminal XE1

When installing the coaxial cable for the guard terminal XE 1, the lengths of insulation to be removed from the coaxial cable must be adhered to. The guard terminal *'is tightened'* by hand.

5.3.2.1 Terminal diagram / wiring

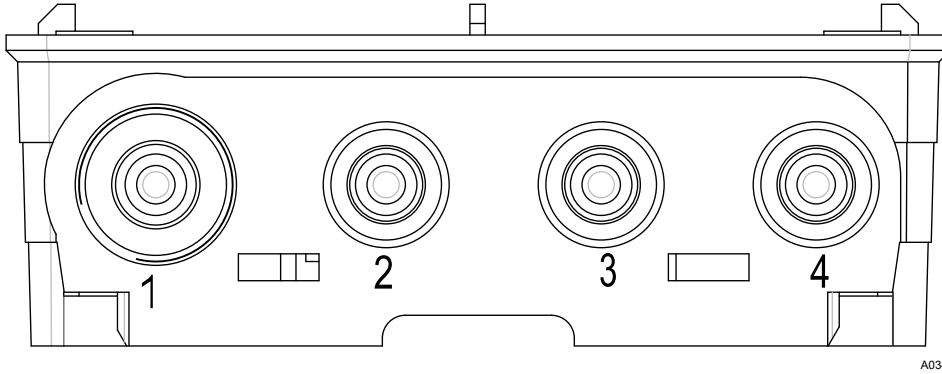


Fig. 14: Threaded connector number

Wiring

Threaded connector no. Size	Description	Terminal Description	Terminal number	Pol	Function	Recommended cable ⌀	Remarks
1 / M20	ph/redox Input 1		XE 1	Ref. El.	pH/ redox sensor	⌀ 5	Guide cable through multiple M20 / 2x**5** mm seal inserts
			XE 2	meas. sig			
	Temp. input Pt 1000	XE 4	1	+	Temp. sensor	⌀ 5	
			2	-			
2 / M16	Wire jumper **or** potential equaliser	XE 3			] Short circuit	⌀ 4,5 *	Guide 4-core cable through multiple M 16 / 2x**4,5** mm seal inserts
		XE 3	1	free	Potential equaliser***		

Threaded connector no. Size	Description	Terminal Description	Terminal number	Pol	Function	Recommended cable ⌀	Remarks
			2	Ref. volt.			
	Standard signal output	XA 1	1	+ 15 V	e.g. recorder / actuator		
			2	-			
	Contact input	XK 1	1	+	Pause	⌀ 4,5 *	Guide 4-core cable through multiple M 16 / 2x**4,5** mm seal inserts
			2	-			
	Relay output (f-relay)	XR 2	1		Frequency controlled metering pump		
			2				
*** To achieve protection class IP 67 please use original Prominent cable, part number 1036759**							
***** When using as a potential equaliser, the short circuit bridge ⌋ must be removed!**							
3 / M16	Relay output **or** Relay output **or** Relay output (P-relay)	XR1	1	COM	Solenoid valve / metering pump ** raise / lower	⌀ 5	Guide cable through single M16 seal insert
			2	NO			
		XR1	1	COM	Limit relay		
			2	NO			
		XR1	1	COM	Alarm relay		
			3	NC			

Threaded connector no. Size	Description	Terminal Description	Terminal number	Pol	Function	Recommended cable ⌀	Remarks
** An RC suppressor must be connected (not part of the scope of delivery)							
4 M16	Mains connection	XP 1	1	N	85 ... 253 V eff.	⌀ 6,5	Guide cable through single M16 seal insert
			2	L			

Legend to the "Wiring" table

Abbreviation	Meaning
Pol.	Polarity
Ref. El.	Reference electrode
meas sig.	Measurement signal (glass electrode)
Ref. pot.	Internal reference potential
f-relay	Pump frequency relay
P-relay	Power relay
COM	Common relay contact (root)
NO	Contact *'normally opened'*
NC	Contact *'normally closed'*

Terminal diagram

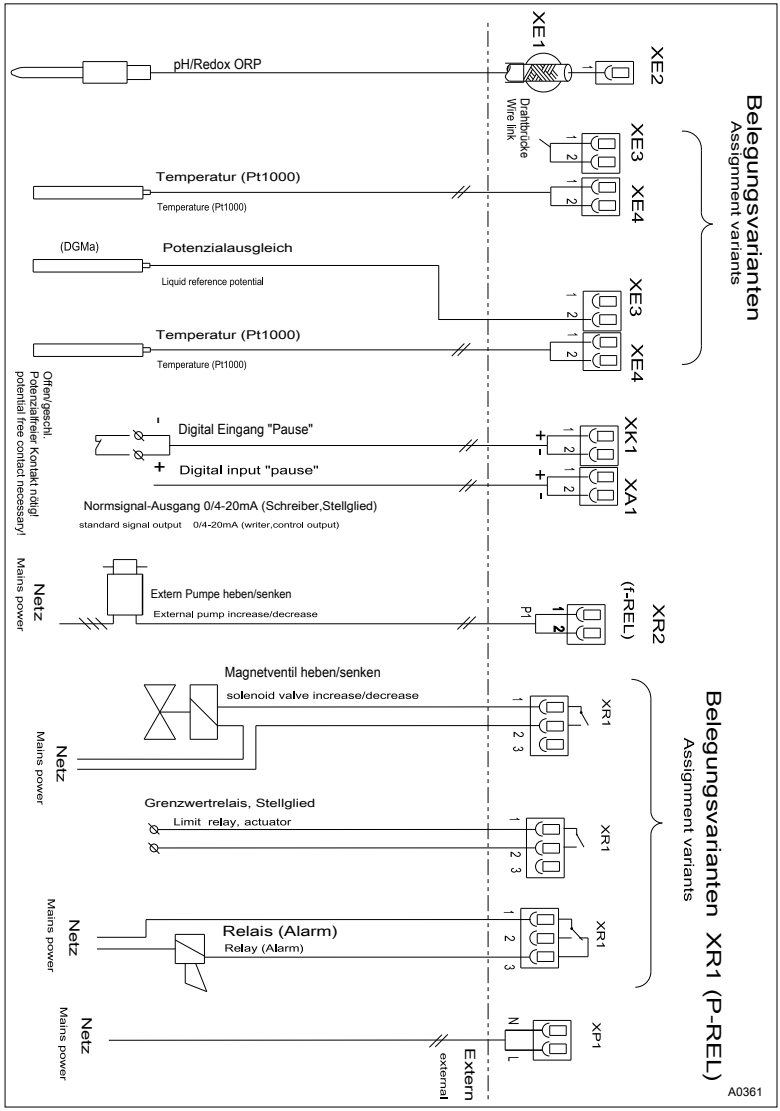


Fig. 15: Terminal diagram

5.3.3 Installation (electrical)

The cable must be routed in a site-provided cable duct to ensure strain relief

1. Undo the four housing screws
2. Slightly lift the controller housing top section forwards and fold it to the left

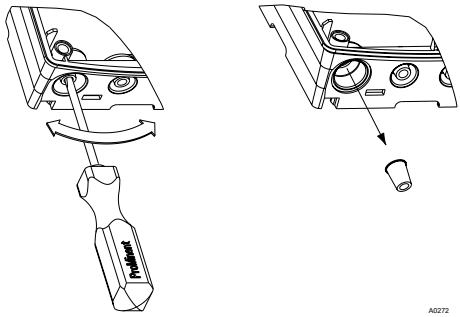


Fig. 16: Punch out threaded holes

3.

Large threaded connection (M 20 x 1.5)

Small threaded connection (M 16 x 1.5)

Punch out as many threaded connections on the bottom side of the controller housing bottom section as required

4. Guide the cable into the respective reducing inserts.
5. Insert the reducing inserts into the threaded connectors
6. Guide the cable into the controller.
7. Connect the cable as indicated in the terminal diagram
8. Screw the required threaded connections in and tighten
9. Tighten the clamping nuts of the threaded connections so that they are properly sealed
10. Click the controller housing top section on to the controller housing bottom section
11. Manually tighten the housing screws
12. Once again check the seating of the seal. Only if the mounting is correct, is protection class IP 67 (wall/pipe mounting) or IP 54 (control panel mounting) achieved

5.4 Switching of inductive loads

If you connect an inductive load, i.e. a consumer which uses a coil (e.g. an alpha motorised pump), then you must protect your controller with a protective circuit. If in doubt, consult an electrical technician for advice.

The RC member protective circuit is a simple, but nevertheless very effective, circuit. This circuit is also referred to as a snubber or Boucherot member. It is primarily used to protect switching contacts.

When switching off, the connection in series of a resistor and capacitor means that the current can be dissipated in a damped oscillation.

Also when switching on, the resistor acts as a current limiter for the capacitor charging process. The RC member protective circuit is highly suitable for AC voltage supplies.

The magnitude of the resistance R of the RC member is determined according to the following equation:

$R=U/I_L$

(Where U= Voltage across the load and I_L = current through the load)

The magnitude of the capacitor is determined using the following equation:

$C=k * I_L$

k=0,1...2 (dependent on the application).

Only use capacitors of class X2.

Units: R = Ohm; U = Volt; I_L = Ampere; C = µF

If consumers are connected which have a high starting current (e.g. plug-in, switched mains power supplies), then a means of limiting the starting current must be provided.

The switching-off process can be investigated and documented using an oscilloscope. The voltage peak at the switch contact depends on the selected RC combination.

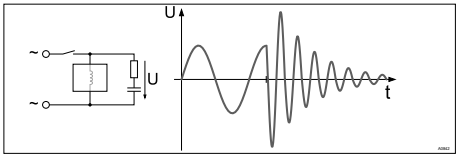


Fig. 17: Switching-off process shown on the oscillogram.

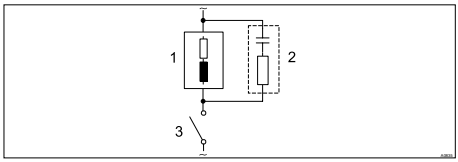


Fig. 18: RC protective circuit for the relay contacts

Typical AC current application with an inductive load:

- 1) Load (e.g. alpha motor-driven pump)
- 2) RC-protective circuit
  - Typical RC protective circuit at 230 V AC:
  - Capacitor *[0.22µF/X2]*
  - Resistance *[100 Ohm / 1 W]* (metal oxide (pulse resistant))
- 3) Relay contact (XR1, XR2, XR3)

6 Commissioning

- **Users' qualification:** trained user, see ↳ *Chapter 2.2 'Users' qualifications' on page 10*

⚠ WARNING!

Sensor run-in periods

This can result in hazardous incorrect metering

- Correct measuring and metering is only possible if the sensor is working perfectly
- Please read the operating manual for the sensor
- The sensor must be calibrated after commissioning

Following completion of mechanical and electrical assembly, the DULCOMETER® Compact Controller should be integrated into the measuring point.

6.1 Initial commissioning

When first switching on the DULCOMETER® Compact Controller the DULCOMETER® Compact Controller is in a STOP state.

Selection of the measurement variable, controller setting and setting of the various, process-dependent, parameters takes place next. ↳ *Chapter 8 'Operating menus for the measured variables pH and ORP' on page 48*.

6.2 Selection of the measured variable

The pH and redox measurement variables are set in the *'INPUT'* menu.

! NOTICE!

Reset to factory settings

If you set or switch the measurement variable, all parameters in the controller are reset to the factory settings for the selected measurement variable.

You must then reset all the controller functions.

6.3 Setting the controller during commissioning

! NOTICE!

Reset to factory settings

When switching over the metering direction, all actuators in the DULCOMETER® Compact Controller are reset to the factory settings for the selected metering direction.

For safety reasons, all actuators are deactivated. The base load is reset to 0 %. All parameters relating to the actuator, are reset to the factory setting.

Consequently all parameters relating to the actuator, must be reset.

The DULCOMETER® Compact Controller only controls *'one-way'*. Only one position or one negative control variable can be calculated. The direction of the control variable is set in the *'PUMP'* menu. There is no dead zone. In this sense, control cannot be *'switched off'* (except with *'STOP'* or *'PAUSE'*).

The value of the P-proportion of the control (Xp) is specified with the DULCOMETER® Compact Controller in the units of the corresponding measurement variable (e.g. 1.5 pH).

For pure P-control and a separation between the set and actual values, which corresponds to the Xp value, the calculated control variable is +100 % (with the setting *'raise'*) or -100 % (with the setting *'lower'*).

7 Operating diagram

7.1 Overview of equipment/Control elements

- **User qualification:** instructed user, see *Chapter 2.2 'Users' qualifications' on page 10*

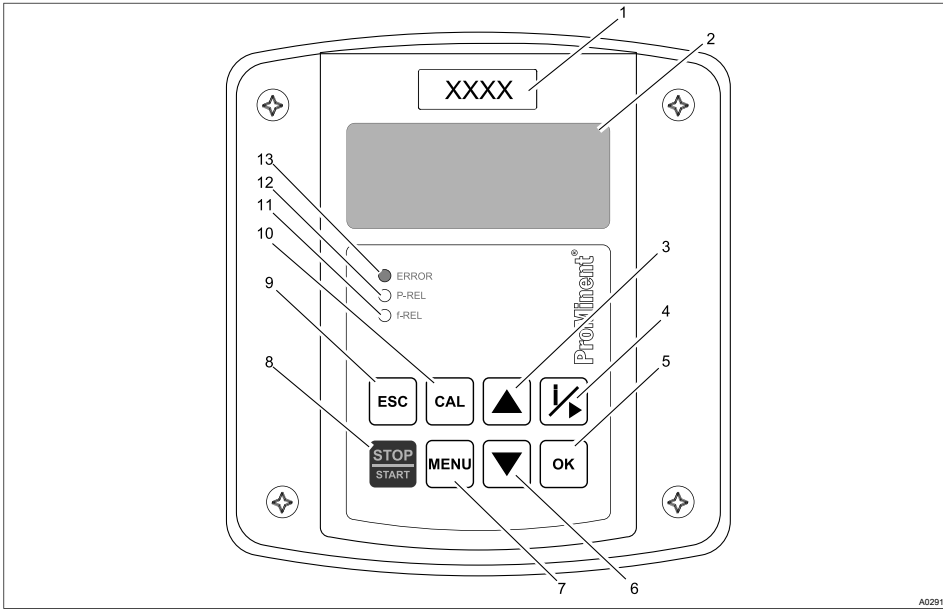


Fig. 19: Overview of equipment/Control elements

Function	Description
1st respective measured variable	Affix the measured variable label here
2. LCD display	
3. UP key	Too increase a displayed number value and to jump upwards in the operating menu
4. INFO/RIGHT key	Opens the info menu or moves the cursor one place to the right

Function	Description
5. OK key	To apply, confirm or save a displayed value or status or to acknowledge an alarm
6. DOWN key	Too decrease a displayed number value and to jump down in the operating menu
7. MENU key	Accesses the controller operating menu
8. STOP/START key	Starts and stops control and metering function
9. ESC key	Jumps a level back in the operating menu, without storage or changing entries or values
10. CAL key	For accessing the calibration menu and navigating within the calibration menu.
11. f-REL LED	Shows the activated state of the f-relay
12. P-REL LED	Shows the activated state of the P-relay
13. ERROR LED	Indicates a controller error state. A text message is displayed simultaneously in the LCD continuous display

7.2 Adjusting display contrast

If the DULCOMETER® Compact Controller is set to *'continuous display'* , you can set the contrast of the LCD-display. By pressing the ▲ key you can adjust the LCD display contrast so it is darker. By pressing the ▼ key you can adjust the LCD display contrast so it is lighter. Here each key press represents a contrast level. I.e. the key must be pressed once for each contrast level.

7.3 Continuous display

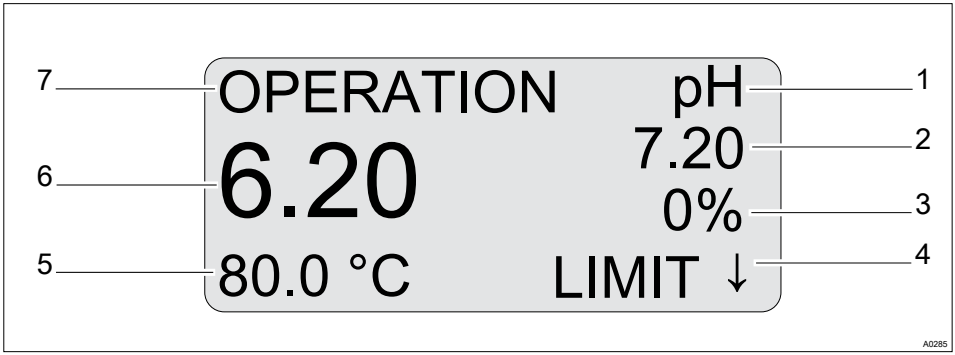


Fig. 20: Continuous display

1 Measured variable
2 Setpoint
3 Control variable
4 Possible error text: e.g. "Limit↓" (Direction of the limit value transgression, e.g. here lower limit value transgression)
5 Temperature (Correction variable)
6 Measured value (actual value)
7 Mode

7.4 Info display

In the info display, the most important parameters for each menu item of the first menu level are displayed.

Access to the info display from the continuous display is by pressing the key. Pressing the key again calls the next info display. Pressing the ESC key recalls the continuous display again.

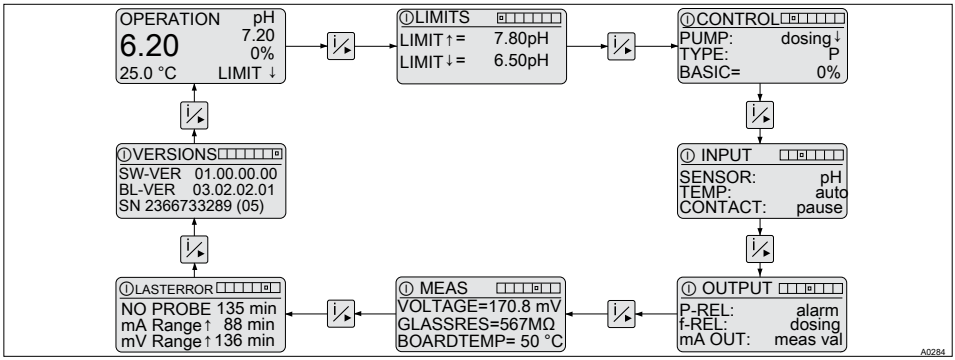


Fig. 21: Info display

Using the OK key you can jump from the currently displayed info display directly to the selection menu of this info display.

Using the ESC key you can jump back to the info display.

Info display "MEAS"

The "MEAS" info display shows the following measured values:

- *[VOLTAGE]: currently measured sensor mV value*
- *[GLASSRES]: measured glass resistance of connected pH sensors for media temperatures of 15 °C to 80 °C. The displayed value is only valid when used with ProMinent pH sensors*
- *[BOARDTEMP]: Current housing interior temperature*

7.5 Password

Access to the setting menu can be limited using a password. The DULCOMETER® Compact Controller is supplied with the password *'5000'*. Using the preset password *'5000'* the DULCOMETER® Compact Controller is setup so that all menus can be accessed without any limitations.

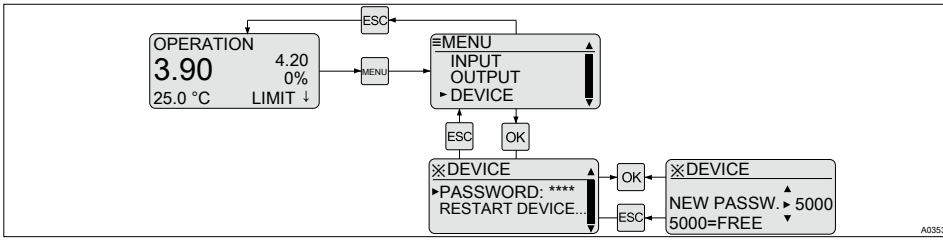


Fig. 22: Password setting

Password	Possible values			
Factory setting	**Increment**	**Lower value**	**Upper value**	**Remarks**
5000	1	0000	9999	5000 = *[FREE]*

8 Operating menus for the measured variables pH and ORP

- **User qualification:** instructed user, see *Chapter 2.2 'Users' qualifications' on page 10*

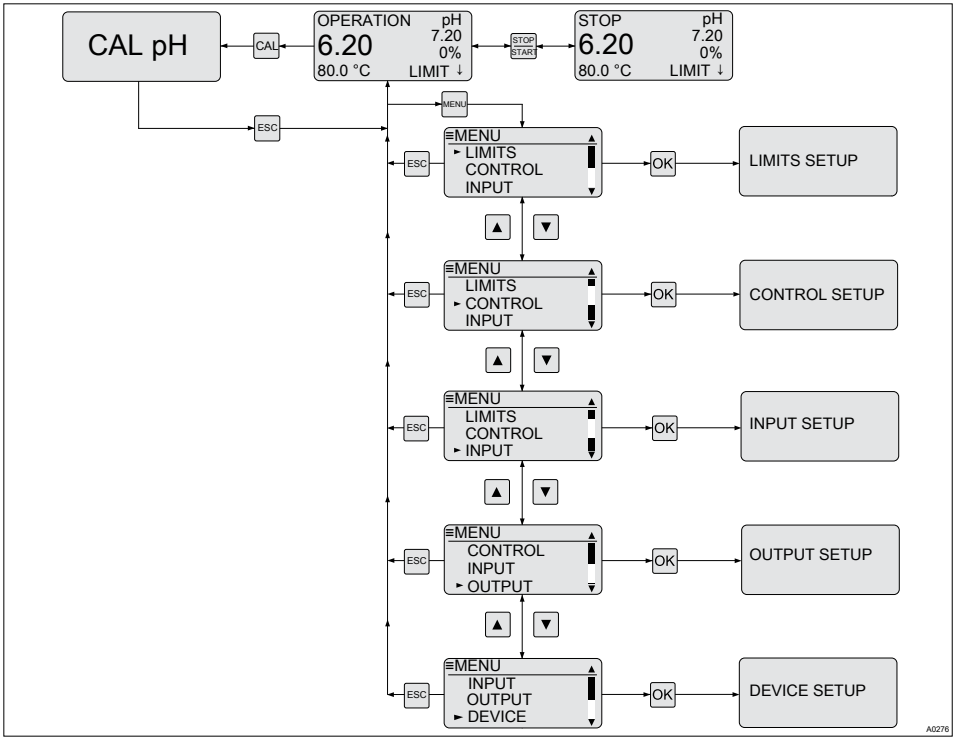


Fig. 23: Operating menu overview

8.1 pH sensor calibration (CAL)

Correct sensor operation

- *Correct measuring and metering is only possible if the sensor is working perfectly*
- *Observe the sensor operating instructions*
- *The carrying out of a 2-point calibration is strongly recommended and is to be preferred to a single point calibration*

During calibration, the DULCOMETER® Compact Controller sets the control outputs to *'0'*. Exception to this: a basic load or a manual control variable has been set. This remains active. The mA standard signal output is frozen.

When calibration/testing has been completed successfully, all of the error checks relating to the reading are restarted. The DULCOMETER® Compact Controller saves all the determined data for zero point and slope when the calibration is successful.

Used buffer

Dispose of the used buffer solution. Related info: see buffer solution safety data sheet.

Setting		Possible values			
	Starting value	Increment	Lower value	Upper value	Remarks
Buffer temperature	Measured value	0.1 °C	0 °C	120 °C	The temperature can only be adjusted under *'TEMP'* *'auto'* or *'manual'*
Buffer values	Start value = 7.00 pH (ZERO) 4.00 pH (SLOPE)	0.01 pH	0.00 pH	14.00 pH	Limit value ZERO = 6..8 pH Limit value SLOPE = < 6 pH; > 8 pH

2-Point Calibration

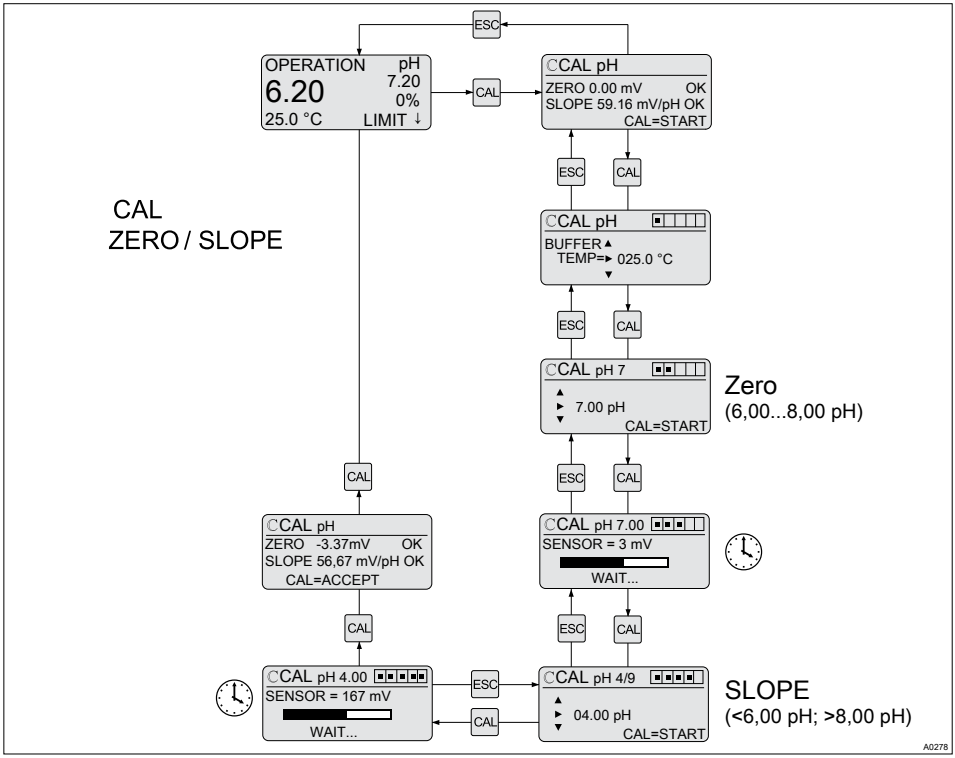


Fig. 24: 2-Point calibration pH sensor

Valid calibration values

Valid calibration:

- *Zero point -60 mV…+60 mV*
- *Slope 40 mV/pH…65 mV/pH*

Two test containers with a buffer solution are required for calibration. The pH value of the buffer solutions should be at least 1.5 pH units apart. Thoroughly rinse the sensor with water when changing the buffer solution.

1. Select the calibration menu CAL
2. Start the calibration CAL
3. If temperature has been selected (only if *'TEMP'* is set to *'auto'* or *'manual'*), then set the buffer temperature with the keys ▲, ▼ and ↵
4. Confirm the entry by pressing the OK key
5. Set the pH-value of the buffer *'ZERO'* using the keys ▲, ▼ and ↵
6. Immerse sensor in the buffer solution containing test container 1 (e.g. pH 7). In so doing, slightly move the sensor
7. Then press CAL
   ⇨ Calibration is running 🕒.
8. Then press CAL to accept the value
   ⇨ if CAL=ACCEPT is shown in the display and the displayed mV value is stable.
9. Remove the sensor from the buffer solution, rinse thoroughly in water and then dry with a cloth (pad dry, don't rub!)
10. Set the pH-value of the buffer *'SLOPE'* using the keys ▲, ▼ and ↵
11. Immerse sensor in the buffer solution containing test container 2 (e.g. pH 4). In so doing, slightly move the sensor
12. Then press CAL
    ⇨ Calibration is running 🕒.
13. Then press CAL to accept the value
    ⇨ if CAL=ACCEPT is shown in the display and the displayed mV value is stable.
14. The determined values for the zero point and slope are displayed

⇨ The calibration is now saved as successful if the values for *'ZERO'* and *'SLOPE'* are both *'OK'*.

Incorrect calibration

Should the result of the calibration lie outside the specified tolerance limits, an error message appears 'ERR'. In this case the current calibration will not be applied.

Check the prerequisites for the calibration and clear the error. Then repeat the calibration

15. Then press CAL to confirm the result or to terminate the calibration (if necessary, as unsuccessful)

1-Point slope calibration

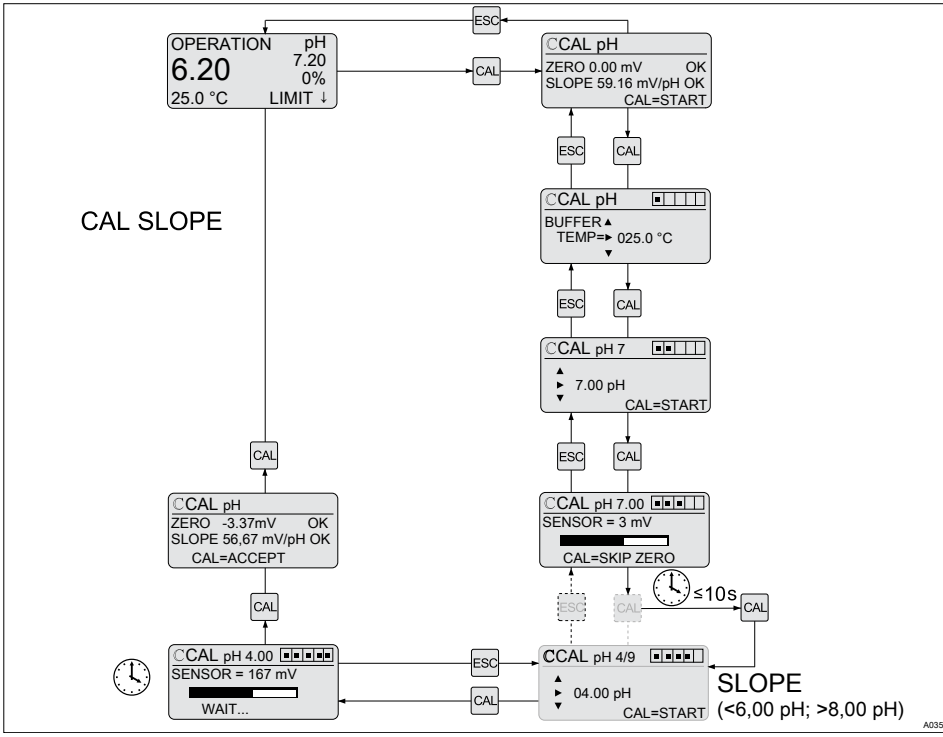


Fig. 25: Single point slope calibration

Valid calibration values

Valid calibration:

– *Slope 40 mV/pH…65 mV/pH*

One test container with a buffer solution is required for calibration. Again with the single point calibration the buffer values for *'ZERO'* and *'SLOPE'* must be at least 1.5 pH units apart. If these buffer values are not recognised, then you must carry out a 2-point calibration.

1. Select the calibration menu CAL
2. Start the calibration CAL

3. If temperature has been selected (only if *'TEMP'* is set to *'auto'* or *'manual'*), then set the buffer temperature with the keys ▲, ▼ and 1/x

4. Confirm the entry by pressing the OK key or CAL key

5. Do not set the pH-value of the buffer *'ZERO'* . Press the CAL key to confirm and if *'CAL=SKIP ZERO'* appears (within no more than 10 s), press the CAL key again

   ⇨ You have skipped the zero point calibration and are now in the slope calibration screen

6. Set the pH-value of the buffer *'SLOPE'* using the keys ▲, ▼ and 1/x

7. Immerse sensor in the buffer solution containing test container (e.g. pH 4). In so doing, slightly move the sensor

8. Then press CAL

   ⇨ Calibration is running 🕘.

9. Then press CAL to accept the value

10. The determined values for the zero point and slope are displayed

    ⇨ The calibration is now saved as successful if the values for *'ZERO'* and *'SLOPE'* are both *'OK'*.

Incorrect calibration

Should the result of the calibration lie outside the specified tolerance limits, an error message appears 'ERR'. In this case the current calibration will not be applied.

Check the prerequisites for the calibration and clear the error. Then repeat the calibration

11. Then press CAL to confirm the result or to terminate the calibration (if necessary, as unsuccessful)

Single point zero point calibration

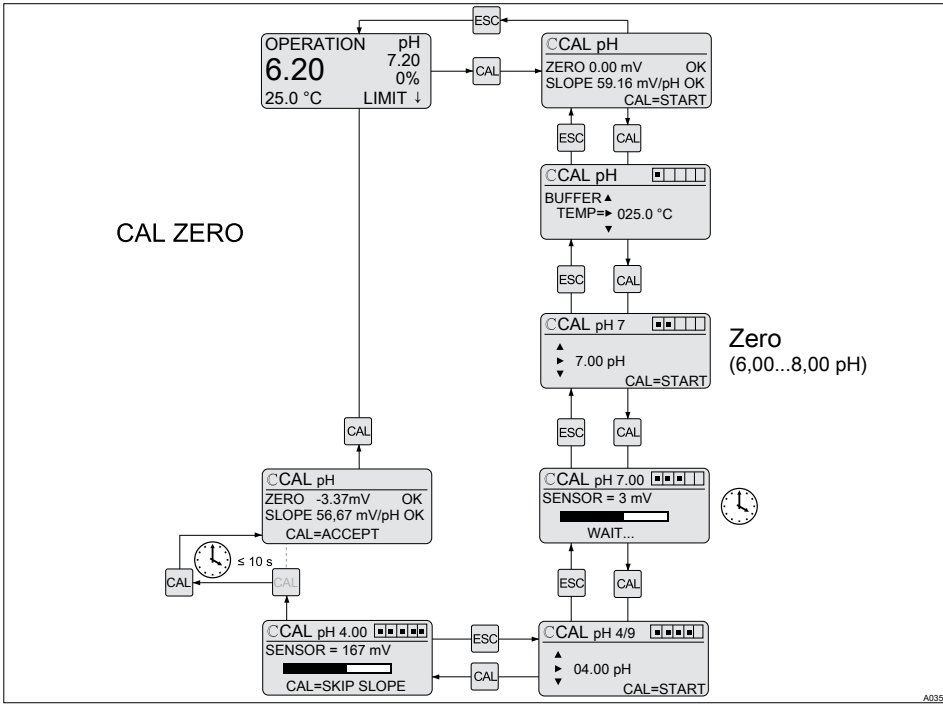


Fig. 26: Single point zero point calibration

Valid calibration values

Valid calibration:

– *Zero point -60 mV…+60 mV*

One test container with a buffer solution is required for calibration. Again with the single point calibration the buffer values for *'ZERO'* and *'SLOPE'* must be at least 1.5 pH units apart. If these buffer values are not recognised, then you must carry out a 2-point calibration.

1. Select the calibration menu CAL
2. Start the calibration CAL

3. If temperature has been selected (only if *'TEMP'* is set to *'auto'* or *'manual'*), then set the buffer temperature with the keys ▲, ▼ and ↱
4. Confirm the entry by pressing the OK key again
5. Set the pH-value of the buffer *'ZERO'* using the keys ▲, ▼ and ↱
6. Immerse sensor in the buffer solution containing test container (e.g. pH 7). In so doing, slightly move the sensor
7. Then press CAL

   ⇨ Calibration is running 🕒.
8. Then press CAL to accept the value
9. Do not set the pH-value of the buffer *'SLOPE'*. Press the CAL key to confirm and if *'CAL=SKIP SLOPE'* appears (within no more than 10 s), press the CAL key again

   ⇨ The calibration is now saved as successful if the values for *'ZERO'* and *'SLOPE'* are both *'OK'*.

Incorrect calibration

Should the result of the calibration lie outside the specified tolerance limits, an error message appears 'ERR'. In this case the current calibration will not be applied.

Check the prerequisites for the calibration and clear the error. Then repeat the calibration

10. Then press CAL to confirm the result or to terminate the calibration (if necessary, as unsuccessful)

8.2 Redox sensor calibration (CAL)

Redox sensor calibration

The redox sensor cannot be calibrated. It is only possible to set an 'OFFSET' of the order of ± 40 mV and then make a comparison using this value. Should the redox sensor differ by more than ± 40 mV from the reference value, then it must be checked in accordance with the requirements of the sensor operating instructions.

Correct sensor operation

– *Correct measuring and metering is only possible if the sensor is working perfectly*
– *Observe the sensor operating instructions*

During the calibration: the DULCOMETER® Compact Controller sets the control outputs to *'0'*. Exception to this: a basic load or a manual control variable has been set. This remains active. The mA standard signal output is frozen.

Used buffer

Dispose of the used buffer solution. Related info: see buffer solution safety data sheet.

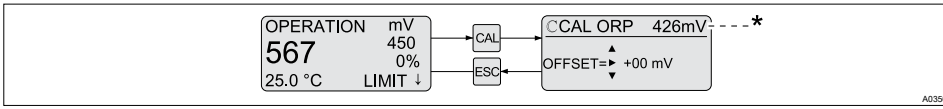


*Fig. 27: Redox sensor calibration (CAL) * corrected value*

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

1. Select the Test menu CAL
2. Immerse redox sensor in the redox buffer solution containing test container (e.g. 465 mV)
3. Wait until the mV value has stabilised
4. Adjust the displayed mV values using the keys ▲, ▼ and 1/x to the mV value of the redox buffer solution in the test container. Confirm the value by pressing CAL . The OFFSET value is transferred into the measuring parameters

   ⇨ ESC quits the test menu without transferring the OFFSET value into the measuring parameters.
5. If the redox sensor is unclean or defective, it must be cleaned as described in the redox sensor operating instructions, or alternatively replaced

8.3 Setting limit values *[LIMITS]*

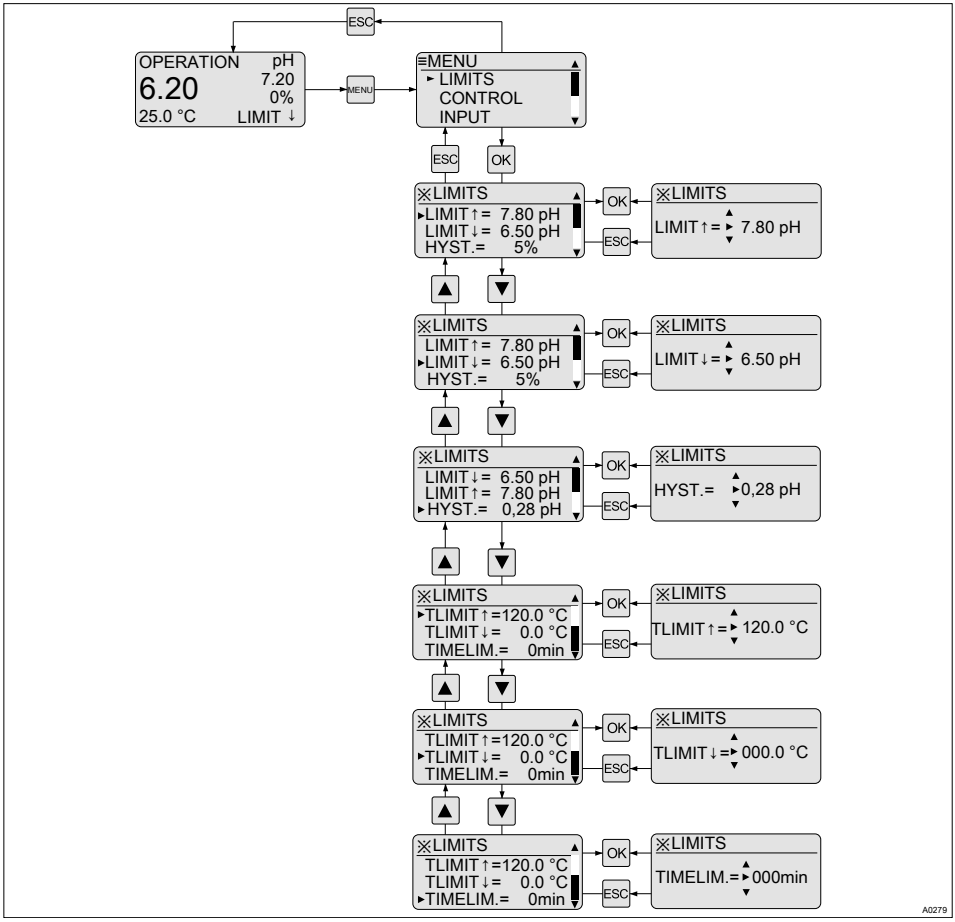


Fig. 28: Setting limit values [LIMITS]

Setting		Possible values			
Display	Starting value	Increment	Lower value	Upper value	Remark
[LIMIT ↑ pH]	8.50 pH	0.01 pH	0.00	14.00	upper pH limit value
[LIMIT ↓ pH]	6.50 pH	0.01 pH	0.00	14.00	lower pH limit value
[LIMIT ↑ ORP]	800	1 mV	-1000 mV	1000 mV	upper ORP limit value
[LIMIT ↑ ORP]	600	1 mV	-1000 mV	1000 mV	lower ORP limit value
[HYST.]	0.28 pH	0.01 pH	0.00	14.00	hysteresis for pH
	20 mV	1 mV	-1000 mV	1000 mV	hysteresis for ORP
[TLIMIT ↑ °C]	120.0 °C	0.1 °C	0.0 °C	120.0 °C	upper limit correction value °C
[TLIMIT ↓ °C]	0.0 °C	0.1 °C	0.0 °C	120.0 °C	lower limit correction value °C
[TLIMIT ↑ °F]	248.0 °F	0.1 °F	32.0 °F	248.0 °F	upper limit correction value °F
[TLIMIT ↓ °F]	32.0 °F	0.1 °F	32.0 °F	248.0 °F	lower limit correction value °F
[TIMELIM.]	0 min = OFF	1 minute	0	999	Checktime after a limit value has been exceeded or undershot pH / ORP

Hysteresis = *[HYST.]*

If the value has fallen below a limit value, then the limit value criteria are reset when the measured value has reached the value of the limit value plus hysteresis.

If the value has fallen below a limit value, then the limit value criteria are reset when the measured value has reached the value of the limit value minus hysteresis.

If the limit value criteria no longer exist on expiry of *[TIMELIM]* , then the control is automatically reactivated.

8.4 Setting the control *[CONTROL]*

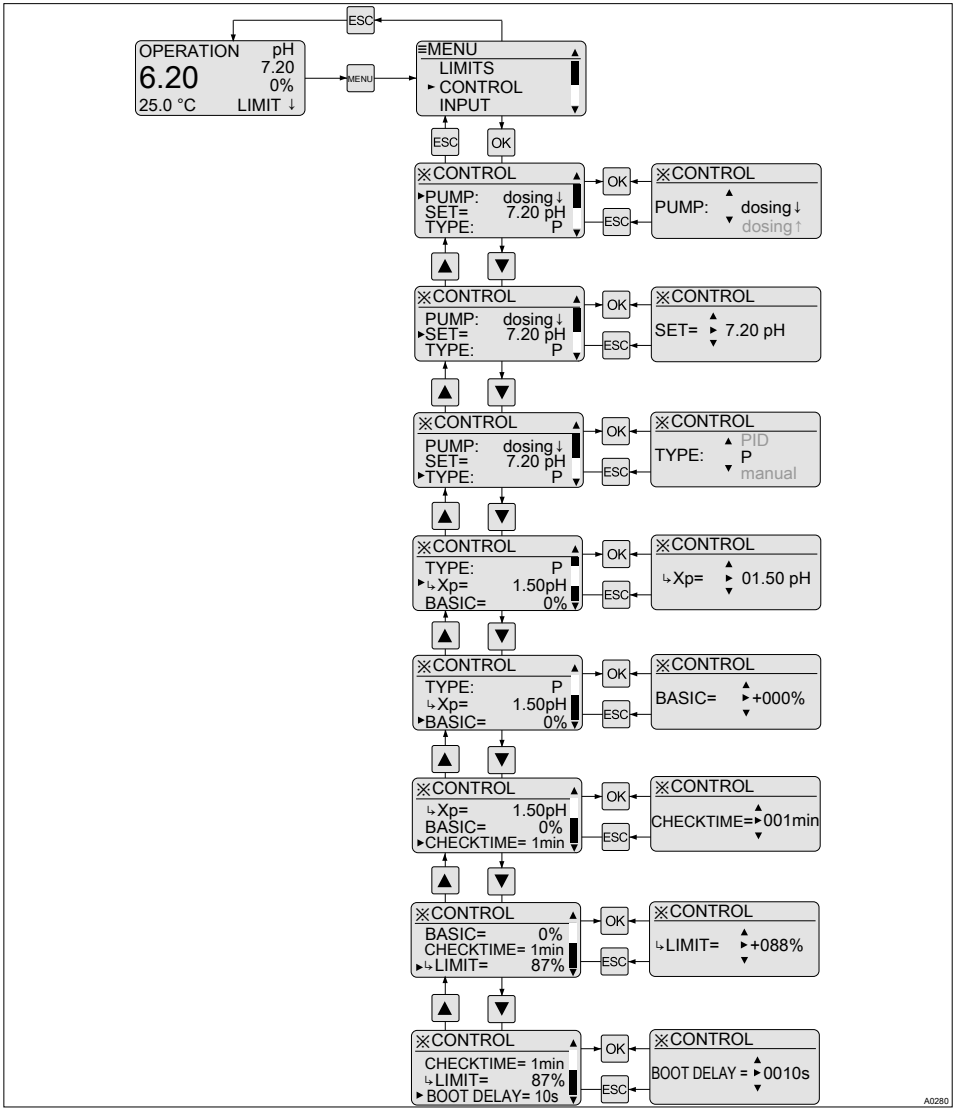


Fig. 29: Setting the control [CONTROL]

Setting		Possible values			
	Starting value	Increment	Lower value	Upper value	Remark
[PUMP]	dosing ↓	dosing ↓ dosing ↑			Mono-directional control direction [2]
[SET]	7.20 pH	0.01 pH	0.00 pH	14.00 pH	pH setpoint
[SET]	750 mV	1 mV	-1000 mV	1000 mV	ORP voltage set-point
[TYPE]	P	P Manual PID			Controller type
[↳Xp]	1.50 pH	0.01 pH	0.01 pH	70.00 pH	P-proportion of the pH control variable
[↳Xp]	100 mV	1 mV	1 mV	3000 mV	P-proportion of the ORP control variable
[↳Ti]	0 s	1 s	0 s	9999 s	PID control integral action time (0 seconds = no I-proportion)
[↳Td]	0 s	1 s	0 s	2500 s	PID control derivative action time (0 seconds = no D-proportion)
[BASIC] [1]	0%	1%	- 100%	100%	Basic load
[↳MANUAL] [1]	0%	1%	- 100%	100%	Manual control value
[CHECK-TIME]	0 min	1 min	0 min	999 min	Control checktime 0 minutes = off

Setting		Possible values			
	Starting value	Increment	Lower value	Upper value	Remark
[↳LIMIT][1]	0%	1%	- 100%	100%	Checktime limit. No basic load, only PID control value
[BOOT DELAY]	0 s	1 s	0 s	9999 s	Control delay period after the start of the measuring point. After it is switched on, the unit only measures but does not control during this period.

1 = in an upwards direction with mono-directional control: 0 .. +100% (setting with PUMP: dosing↑), in a downwards direction: -100..0% (setting with PUMP: dosing↓).

2 = When switching over the metering direction, all actuators in the DULCOMETER® Compact Controller are reset to the factory settings for the selected metering direction.

8.5 Input setting (INPUT)

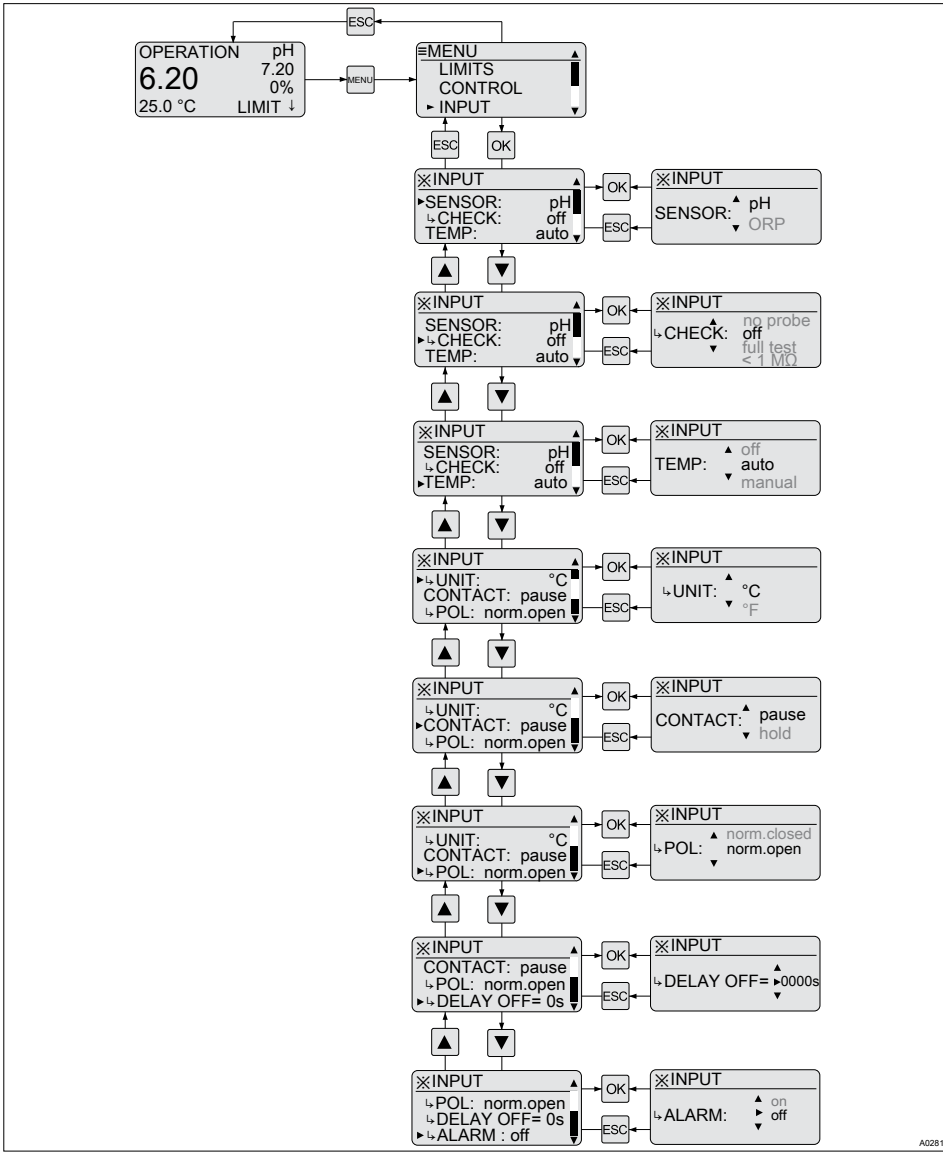


Fig. 30: Input setting (INPUT)

Setting		Possible values			
Display	Starting value	Increment	Lower value	Upper value	Remarks
Sensor	pH	pH			Process variables switchover pH <--> redox [1.]
		ORP			
↳CHECK	off	off			Sensor monitoring *'off'*
		< 1 MΩ			Sensor break check (glass break)
		no probe			Check for presence
		full test			Check for sensor break and presence
TEMP	off	auto			Pt 1000
		manual			manual
		off			Correction off
↳UNIT	°C	°C			Correction variable unit
		°F			
↳VALUE	25.0 °C	0.1 °C	0.0 °C	120.0 °C	Manual correction variable °C
↳VALUE	77.0 °F	0.1 °F	32 °F	248 °F	Manual correction variable °F
CONTACT	pause	pause			Configuration digital contact input
		hold			
↳POL	norm.open	norm.open			Polarity of the contact input
		norm.closed			

[1.] Attention: If this setting is changed, all parameters are reset to the corresponding factory settings

Setting		Possible values			
Display	Starting value	Increment	Lower value	Upper value	Remarks
↳DELAY OFF	0 s	1 s	0 s	1000 s	Contact input switch-off delay. Switching off of the contact input is delayed by this period.
↳ALARM	OFF	ON OFF			Switch on and off use of the alarm relay *'PAUSE/ HOLD'*
[1] Attention: If this setting is changed, all parameters are reset to the corresponding factory settings					

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

Monitoring for sensor breakage: The sensor breakage check (glass breakage) identifies a defective sensor due to its low internal resistance. Correctly functioning pH sensors have very high resistances with internal resistances in the high MΩ range. The DULCOMETER® Compact Controller is capable of recognising broken sensors from their internal resistance. This function should be deactivated if very low resistance sensors are used.

Check for presence: The "Presence check" 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.

8.6 Output setting (OUTPUT)

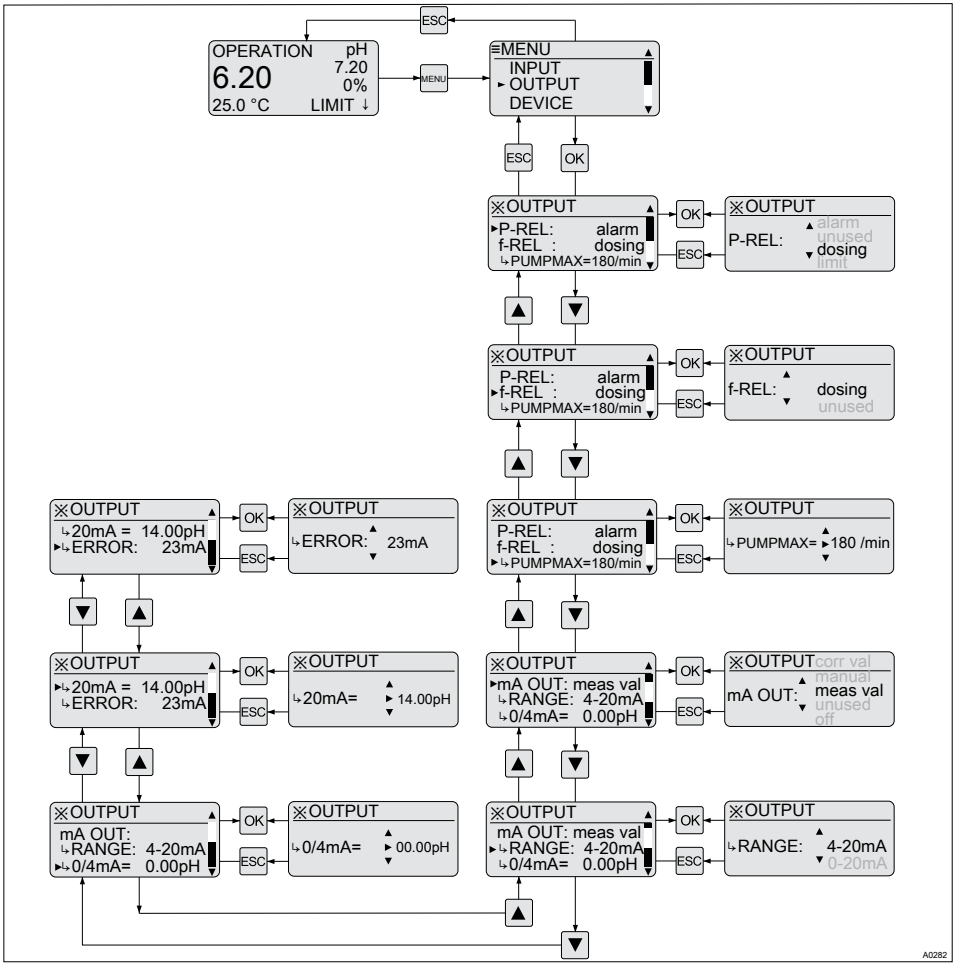


Fig. 31: Output setting (OUTPUT)

Setting		Possible values			
	Starting value	Increment	Lower value	Upper value	Remarks
P-REL (Power relay)	alarm	alarm			Alarm relay
		unused			off
		dosing			PWM relay
		limit			Limit relay
↳PERIOD	60 s	1 s	30 s	6000 s	Cycle time of the PWM control (P-REL = dosing)
↳MIN ON [1]	10 s	1 s	5 s	PERIOD/4 or 999	Minimum switch on period using PWM control (P-REL = dosing)
↳DELAY ON	0 s	1 s	0 s	9999 s	Switch-on delay limit value relay (P-REL = limit)
↳DELAY OFF	0 s	1 s	0 s	9999 s	Switch-off delay limit value relay (P-REL = limit)
f-REL	dosing	dosing			Activation of the low power relay (frequency relay)
		unused			

Setting		Possible values			
	Starting value	Increment	Lower value	Upper value	Remarks
↳PUMPMAX	1 rpm	1	1	500	Maximum stroke rate of the low power relay (frequency relay)
mA OUT (Output value of the mA standard signal output)	meas val	off			off
		meas val			meas val
		corr val			corr val
		dosing			dosing = control value
		manual			manual
↳RANGE	4 - 20 mA	0 - 20 mA			Range of the mA standard signal output
		4 - 20 mA			
↳0/4 mA	2.00 pH	0.01 pH	0.00 pH	14.00 pH	pH value assigned 0/4 mA
↳20 mA	12.00 pH	0.01 pH	0.00 pH	14.00 pH	pH value assigned 20 mA
↳0/4 mA	0 mV	1 mV	-1000 mV	1000 mV	Redox value assigned 0/4 mA
↳20 mA	1000 mV	1 mV	-1000 mV	1000 mV	Redox value assigned 20 mA
↳0/4 mA	0.0 °C	0.1 °C	0.0 °C	120.0 °C	Temp. value assigned 0/4 mA
↳20 mA	100.0 °C	0.1 °C	0.0 °C	120.0 °C	Temp value assigned 20 mA

Setting		Possible values			
	Starting value	Increment	Lower value	Upper value	Remarks
↳0/4 mA	32.0 °F	0.1 °F	32.0 °F	248.0 °F	Temp. value assigned 0/4 mA
↳20 mA	212.0 °F	0.1 °F	32.0 °F	248.0 °F	Temp value assigned 20 mA
↳20 mA [2]	- 100 %	1 %	10 %/ - 10 %	100 % / - 100 %	Control value assigned 20 mA (0/4 mA is fixed as 0%)
↳VALUE	4.00 mA	0.01 mA	0.00 mA	25.00 mA	Manual output current value
↳ERROR	off	23 mA			Output current value upon fault, 23 mA
		0/3.6 mA			Output current value upon fault, 0/3.6 mA
		off			off = no fault current is output

1 = The parameter maximum occurs at PERIOD/4 or 999, whichever is smaller

2 = dependent on metering direction, the limits are either -10% and -100% or +10% and +100%

8.7 DEVICE setting

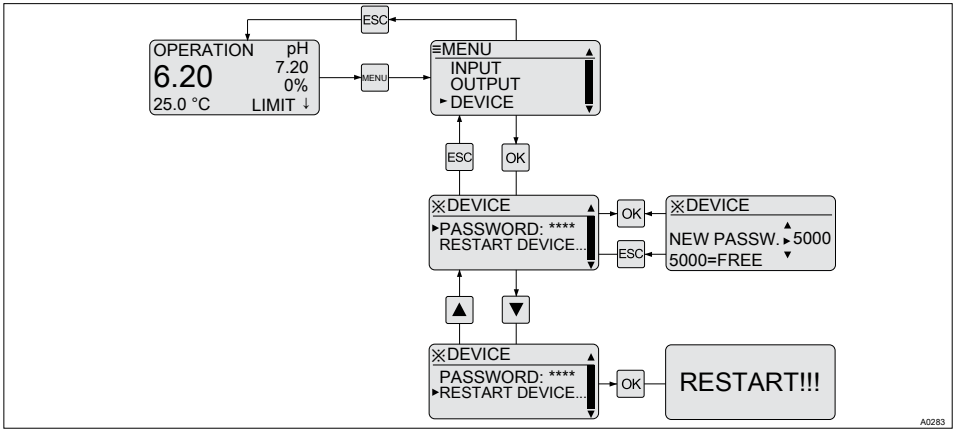


Fig. 32: Device setting

Setting		Possible values			
	Starting value	Increment	Lower value	Upper value	Remarks
Password	5000	1	0000	9999	5000 = no password protection
Restart device					Controller is restarted

9 Control parameters and functions

- **User qualification:** trained user, see ↳ *Chapter 2.2 'Users' qualifications' on page 10*

9.1 DULCOMETER® Compact Controller function states

DULCOMETER® Compact Controller function states have the following priority:

- 1. *'STOP'*
- 2. *'PAUSE/HOLD'*
- 3. *'CAL'* (calibration)
- 4. *'OPERATION'* (normal mode)

"CAL" (calibration) peculiarities

- Control goes to basic load, mA measurement outputs are frozen
- New faults are detected, however they have no effect on the alarm relay or the mA output
- Detection of measurement variable relevant faults during *'CAL'* (calibration process) are suppressed (e.g. LIMIT↑)

"PAUSE" peculiarities

- Control is switched to 0% control variable. The I-proportion is saved
- New faults are detected, however they have no effect on the alarm relay or the mA output
- Special case alarm relay in *'PAUSE'*: If activated the output relay switches to *'PAUSE'* (error message CONTACTIN)

"HOLD" peculiarities

- Control and all other outputs are frozen
- New faults are detected, however they have no effect on the alarm relay or the mA output. However the effect of already existing faults (e.g. fault current) remains
- Special case alarm relay: Activation of the frozen alarm relay is permitted (= no alarm), if all faults have been acknowledged or have disappeared
- Special case alarm relay in *'HOLD'*: If activated the output relay switches to *'HOLD'* (error message CONTACTIN)

"STOP" peculiarities

- Control OFF
- New faults are detected, however they have no effect on the alarm relay or the mA output
- The alarm relay is switched off in *'STOP'*

Peculiarities of the "START" event, i.e. switching from "STOP" to "OPERATION" (normal mode)

- Fault detection starts afresh, all existing faults are deleted

Generally applicable information

- If the cause of a fault disappears, then the fault message in the LCD footer disappears.
- A previously existing *'PAUSE/HOLD'* state is not influenced by starting a *'CAL'* (calibration) process. If during *'CAL'* (calibration) the functional state *'PAUSE/HOLD'* is released, then all states will remain frozen until the end of the *'CAL'* (calibration) process.

- If *'CAL'* (calibration) is started while functional state *'OPERATION'* (normal mode) is active, then the functional state *'PAUSE/HOLD'* is ignored until *'CAL'* (calibration) completes. However STOP/START is possible at any time
- An alarm can be acknowledged or removed as follows: By clearing all faults by pressing the STOP/START key and the OK key while the continuous display is visible

9.2 STOP/START key

The control function is started / stopped by pressing the STOP/START key. The STOP/START key can be pressed independently of the currently displayed menu. However, the [STOP]state is only shown in the continuous display.

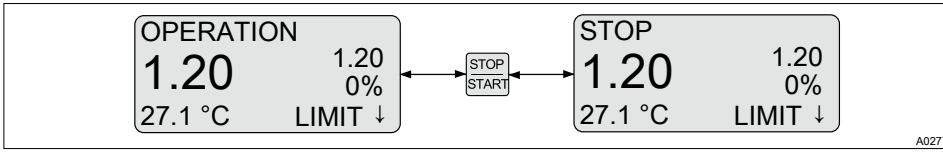


Fig. 33: STOP/START-Key

When the controller is first switched on, the controller is in *[STOP]*status.

Upon certain defined fault conditions, the controller switches to the *[STOP]*status. The control is then off (= 0 % control variable).

To differentiate between the fault-related *[STOP]* and the operating status *[STOP]* by pressing the STOP/START key, instead of *[STOP]*the identifier *[ERROR STOP]* is displayed.

Pressing the STOP/START key causes operating status *[ERROR STOP]* to change to operating status *[STOP]* . Pressing STOP/START once more causes the controller to be started again.

In *[STOP]*state, the controller must be started manually by pressing the STOP/START key.

[STOP] of the controller causes the following:

- Control is stopped
- The P-relay functioning as a limit value relay and a PWM relay are switched to the de-energised state
- The P-relay acting as an alarm relay activates (no alarm)

Restarting of the controller causes the following:

- If a *[STOP]*state existed, then the controller must be manually started after being switched back on.
- Fault detection starts afresh, all existing faults are deleted

9.3 Priming (PRIME)

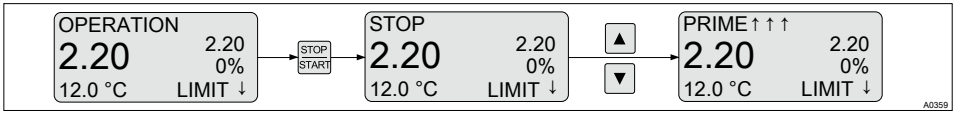


Fig. 34: Priming, e.g. to vent a pump

While the continuous display is visible and the states *'STOP'* or *'OPERATION'* are active, simultaneously pressing ▲ and ▼ causes the priming function *'PRIME'* to be started.

At the same time, dependent on the configuration of the controller, the output relay (P-REL) is actuated at 100 %, the frequency relay (f-REL) is actuated at 80 % of "PUMPMAX" and 16 mA is output at the mA output. However this is only the case if these outputs are set as actuator *'dosing'*.

The power relay (P-REL) starts after priming in an activated state.

You can use this function, for example, to transport the feed chemical up to the pump to vent the metering line.

9.4 Hysteresis limit

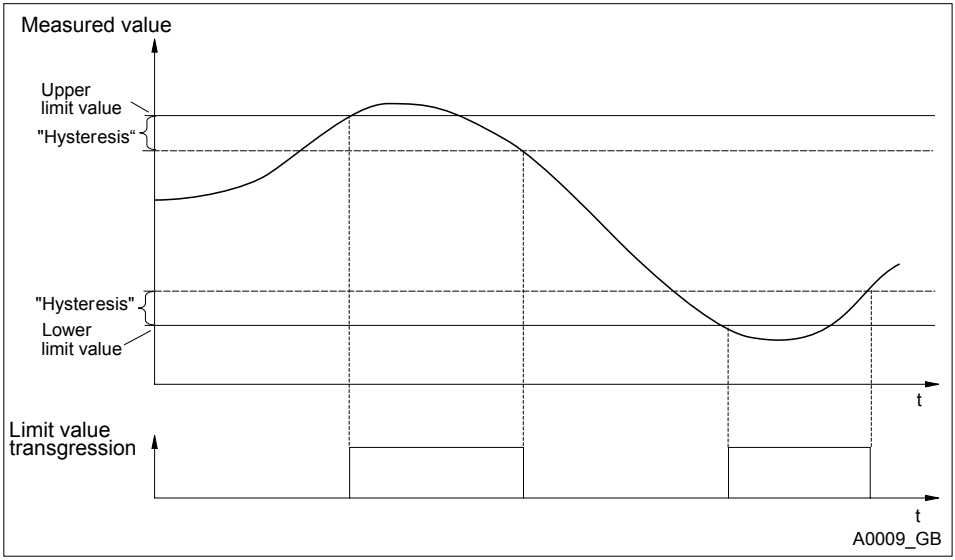


Fig. 35: Hysteresis

Upper limit value = LIMIT↑ Lower limit value = LIMIT↓

The range between LIMIT↑ and LIMIT↓ is the **valid measuring range.**

The DULCOMETER® Compact Controller has fixed *'hysteresis'*.

Measured variable	Hysteresis
pH	0.28 pH
Redox	20 mV

The *'Hysteresis'* acts to cause an increase in the limit value transgression, i.e. if the *'Limit↑'* of e.g. pH 7.5 was exceeded, then the criterion for a limit value transgression is only removed again when the value falls below pH 7.22. The hysteresis behaviour for a *'Limit↓'* functions in an analogue way (the hysteresis value is here added to the Limit↓), for example *'Limit↓'* pH 4.00, hysteresis pH 0.28, then the limit value transgression criterion is only removed again when the pH exceeds 4.28.

9.5 Temperature correction variable for pH

The correction variable compensates for the effect of the temperature of the medium on the measured value. The correction variable is the temperature of the medium to be measured. The temperature of the medium affects the pH value to be measured.

Operating modes

- *[off]*: No temperature compensation takes place
  - For measurements which do not require temperature compensation
- *[auto]*: The DULCOMETER® Compact Controller evaluates the temperature signal of the connected temperature sensor
  - For measurements using a temperature sensor (Pt1000) (0 -120 °C)
- *[manual]*: The temperature of the medium to be measured has to be measured by the user. The measured value is then entered using the keys ▼ and ▲ in the parameter *'VALUE'* in the DULCOMETER® Compact Controller and saved using the key OK
  - For measurements where the medium to be measured has a constant temperature, which has to be taken into account in the control process

9.6 Checkout time for measured variable and correction variable

Error text	Description
LIMIT ERR	Checkout time of the measured variable
TLIMITERR	Checkout time of the correction variable

If upon the expiry of the checkout time, the valid measuring range is not reached, then the DULCOMETER® Compact Controller exhibits the following behaviour:

- **LIMIT ERR:** The control is switched off. An error current is emitted, provided the output is configured as a measured variable output
- **TLIMITERR:** The control is switched off. An error current is emitted, provided the output is configured as a correction variable output or a measured variable output

Initially the transgression of a limit is only a limit value transgression. This leads to a *'WARNING'*. Switching on the control time *'TIMELIM'* (> 0 minutes), creates an alarm from the limit value transgression. In the event of a *[TLIMITERR]* a, the control switches to *[STOP]*.

9.7 Checkout time control

Monitoring of the control path

The checkout time monitors the control path. The checkout time mechanism permits detection of possible defective sensors.

Dead time determination

Each control path has a dead time. The dead time is the time, which the control path requires to detect a change or addition of metered chemicals using its own instrumentation.

You must select the checkout time so that it is greater than the dead time. You can determine the dead time, by operating the metering pump in manual mode and, for example, dosing acid.

NOTICE!

Dead time determination

You should only determine the dead time if the current process cannot be negatively influenced by the manual metering.

You must determine the time, which the control path (i.e. the entirety of controllers, sensors, measurement water, flow gauges, etc.) requires to detect a first change in the measured value starting from the beginning of dosing. This time is the *'dead time'*. A safety margin, e.g. 25%, must be added to this dead time. You must allocate an appropriate safety margin for your own particular process.

The parameter *'LIMIT'* can be used to set a limit for the control variable. If the control variable exceeds this limit value, the CHECKTIME fault is triggered (checkout time of the control has elapsed). The control is switched to basic load and a fault current output.

9.8 Power relay "P-REL" as limit value relay

The power relay *'P-REL'* can be configured as a limit value relay. It always act only on the measurement variable, whereby the limits are set in *'LIMITS'*. The relay is activated upon infringement of either the top or lower limit values.

Constant checking is carried out to determine whether a limit has been infringed and if this is interrupted with the power relay configured *'P-REL= limit'* for at least *'DELAY ON'* seconds, then the relay is activated. If the limit value transgression disappears for at least *'DELAY OFF'* seconds, then the limit value relay is again deactivated.

The limit value relay is deactivated immediately upon: *'STOP'*, user calibration, *'PAUSE'* and *'HOLD'*.

9.9 Setting and functional description of "Relay Used as a Solenoid Valve"

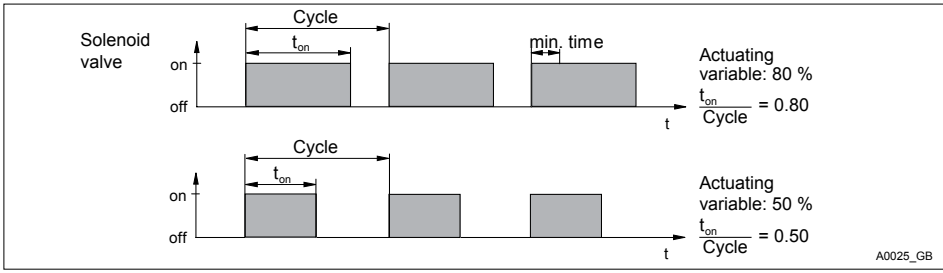


Fig. 36: Solenoid valve (= P-REL: dosing)

min. time *[MIN ON]* Cycle = *[PERIOD]* (in seconds)

Solenoid valve switching times

The switching times of the relay (solenoid valve) depend on the cycle time, the control variable and the 'min. time' (smallest permissible switch-on time for 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

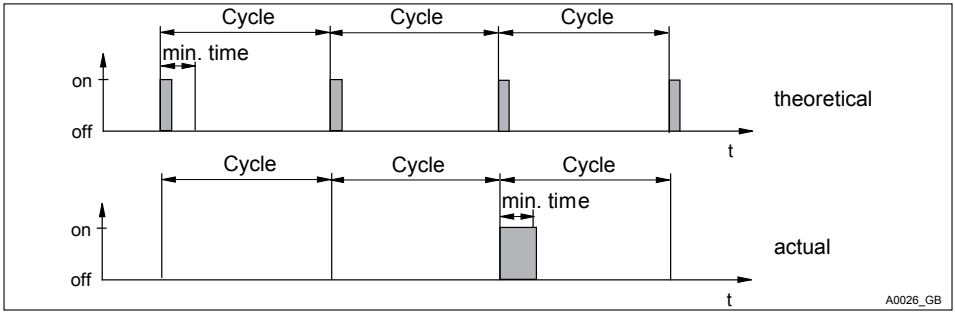


Fig. 37: Theoretical switching time < min. time

min. time *[MIN ON]*
Cycle = *[PERIOD]* (in seconds)

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

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

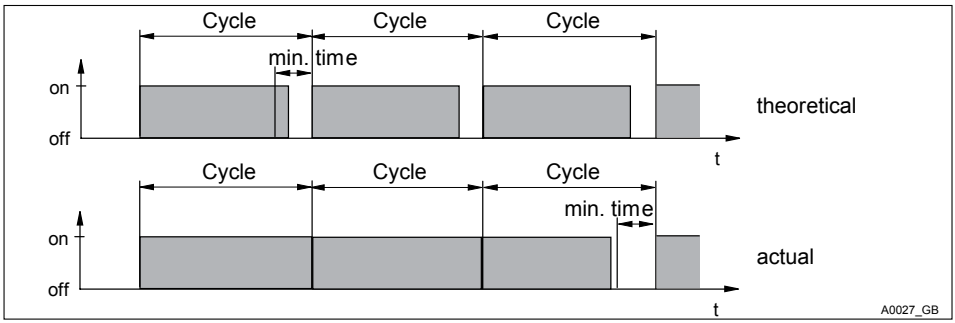


Fig. 38: Theoretical switching time > (cycle - min. time) and calculated switching time < cycle

min. time *[MIN ON]*
Cycle = *[PERIOD]* (in seconds)

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

9.10 Alarm relay

The alarm relay triggers in *'OPERATION'* (normal mode) if an error occurs which has been defined as *'ERROR'* and not just as *'WARNING'*.

The error message *'ALARM'* in the continuous display is marked with a ✻ (star) and can be acknowledged with the OK key. The alarm and the ✻ will then disappear.

9.11 "Error logger" operating mode

The last three errors are displayed. Also displayed is how long ago (in minutes) they occurred. When a new fault occurs, the oldest fault is deleted.

Faults are only shown which occur in operating status *'OPERATION'*, i.e. not in operating status *'STOP'*, *'CAL'* (user calibration), *'HOLD'* or *'PAUSE'*.

Only *'ERRORs'* are shown, not *'WARNINGS'*, e.g. a *'LIMIT ERR'* is shown, but not *'LIMIT↑'*.

A fault, whose display has lasted for 999 minutes is automatically deleted from the *'Error Logger'*. The *'Error Logger'* is neither saved nor backed up in the event of power loss.

10 Maintenance

- **Users' qualification:** trained user, see *Chapter 2.2 'Users' qualifications' on page 10*

The DULCOMETER® Compact Controller is maintenance free.

10.1 Changing the fuse, DULCOMETER® Compact Controller

WARNING!

Danger from electrical voltage

Possible consequence: Fatal or very serious injuries.

- The DULCOMETER® Compact Controller does not have a mains 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

NOTICE!

Use only 5 x 20 mm micro-fuses

Possible consequence: Damage to the product or its surroundings

- 5x20 T 0.315 A
- Part number 732404

Fuse change

The mains fuse is located in a sealed fuse holder in the inside of the device.

1. Disconnect the controller from the mains power
2. Open the controller and fold the controller housing top section to the left
3. Remove the PCB cover
4. Remove the micro-fuse using a suitable tool
5. Fit the micro-fuse using a suitable tool
6. Refit the PCB cover
7. Replace controller housing top section and close the controller

10.2 Fault reporting and troubleshooting

- **Users' qualification for diagnostics:** trained user, see *Chapter 2.2 'Users' qualifications' on page 10*. Further measures depend on the type and scope of possible troubleshooting measures to be carried out.

Fault reporting and troubleshooting

Display	Description / cause	Status[1]	Mode[2]	Measured variable output[3]	Correction variable output[4]
pH/mV RANGE ↓	Input voltage too low	Error	Basic load	Fault current	-
pH/mV RANGE↑	Input voltage too high	Error	Basic load	Fault current	-
T RANGE ↓	Measured temperature beneath measuring range	Error	Basic load	Fault current	Fault current
T RANGE ↑	Measured temperature above measuring range	Error	Basic load	Fault current	Fault current
CAL ERROR	No valid user calibration exists	Error	-	-	-
NO PROBE	If activated: pH sensor monitoring outputs: no sensor	Error	Basic load	Fault current	-
PROBE ERR	If activated: pH sensor monitoring outputs: sensor break	Error	Basic load	Fault current	-
CHECK-TIME	Control checkout time elapsed	Error	Basic load	Fault current	-
mA RANGE ↑	mA output current has an upper limit	Error	-	-	-

Display	Description / cause	Status[1]	Mode[2]	Measured variable output[3]	Correction variable output[4]
mA RANGE ↓	mA output current has a lower limit	Error	-	-	-
LIMIT ↑	Measured variable exceeds upper set limit	Warning	-	-	-
LIMIT ↓	Measured variable falls below lower set limit	Warning	-	-	-
T LIMIT ↑	Correction variable exceeds upper set limit	Warning	-	-	-
T LIMIT ↓	Correction variable falls below lower set limit	Warning	-	-	-
LIMIT ERR	Set checkout time for monitoring the measurement variable limits has elapsed	Error	Stop	Fault current	-
TLIMITERR	Set checkout time for monitoring the correction variable limits has elapsed	Error	Stop	Fault current	Fault current
NO CAL	No valid user calibration exists	Warning	-	-	-
CONTACTIN	If activated: Power relay is activated in *'PAUSE/HOLD'*	Error	-	-	-

1 = *[Status]* Error status after occurrence of the fault (error means: alarm relay deactivates, **'*'** is displayed before the error message, can be acknowledged with OK)

2 = *[Mode]* Resulting controller mode (relates to control variable and thus, as necessary, mA output)

3 = *[Measured variable output]* Consequence for the current output, if this is set as *'a measured variable output'*

4 = *[Correction variable output]* Consequence for the current output, if this is set as *'a correction variable output'*

11 Technical data DULCOMETER® Compact Controller

11.1 Permissible ambient conditions

Degree of protection (IP)

The controller fulfils the IP 67 degree of protection requirements (wall/pipe mounting) or IP 54 (control panel mounting). This degree of protection is only achieved if all seals and threaded connectors are correctly fitted.

Permissible ambient operating conditions

Temperature	-10 °C ... 60 °C
Air humidity	< 95 % relative air humidity (non-condensing)

Permissible ambient storage conditions

Temperature	-20 °C ... 70 °C
Air humidity	< 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	PC-GF10
Bracket rear side housing bottom section	PPE-GF20
Operating film	Polyester PET membrane
Seal	Expanded PUR
Cover screws	Stainless steel A2
Profile seal (control panel mounting)	Silicone

11.4 Chemical Resistance

The device is resistant to normal atmospheres in plant rooms

11.5 Dimensions and weights

Complete device:	128 x 137 x 76 mm (W x H x D)
Packaging:	220 x 180 x 100 mm (W x H x D)
Weight of device without packaging:	approx. 0.5 kg
Gross weight of device with packaging:	approx. 0.8 kg

12 Electrical data

Mains connection	
Nominal voltage range	100 – 230 VAC ±10 %
Frequency	50 – 60 Hz
Current consumption	50 – 100 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 (P-relay)	
Loading of switching contacts	5 A; no inductive loads

Outputs galvanically isolated from other switching parts by reinforced insulation.

Digital input	
Open circuit voltage	15 V DC max.
Short circuit current	approx. 6 mA
Max.switching frequency	Static For switching processes such as *'PAUSE'*, *'HOLD'*, etc.

! NOTICE!

Do not supply with voltage

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

mA Output	0 - 20 mA	4 - 20 mA	manual
Current range	0 – 20.5 mA	3.8 – 20.5 mA	0 - 25 mA
In the event of a fault	0 or 23 mA	3.6 or 23 mA	
Max. load	480 Ω at 20.5 mA		
Max. output voltage	19 V DC		
Overvoltage-resistant up to:	±30 V		
Output accuracy	0.2 mA		

Galvanically isolated from all other connections (500 V)

mV input	
Measuring range	-1 V ... + 1 V 0 pH ... 14 pH
Measurement accuracy	±0.25 % of the measuring range
Sensor monitoring of input (low resistance threshold) (can be switched off)	< 500 kΩ ... 1 MΩ (short circuit)
Sensor monitoring of input (high resistance threshold) (can be switched off)	no pH sensor connected
Display glass sensor resistance of ProMinent pH sensor	0 ... 5000 MΩ
Overvoltage-resistant up to:	±5 V

Pump control (f-relay)	
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	100 Hz

Digital output galvanically isolated from all other connections via OptoMos relay.

Temperature input	
Temperature measuring range:	0...120 °C
Measuring flow:	approx. 1.3 mA
Measuring accuracy:	±0.8 % of measuring range
Overvoltage-resistant up to:	±5 V
Short circuit-resistant	Yes

For connection of a Pt1000 temperature sensor using a 2-wire system. Not galvanically isolated from the mV input

13 Spare parts and accessories

Spare parts	Part number
Fine fuse 5x20 T 0.315 A	732404
Wall/tube retaining bracket	1002502
Guard terminal top part (knurled nut)	733389
Measured variable labels	1002503
DMT fixing strap	1002498
Cable connection set DMTa/DXMa (metric)	1022312
Controller housing lower part (processor/PCB), fully assembled	Identity code DCCA_E_E1 ...
Controller housing top part (display/operating part), fully assembled	Identity code DCCA_E_E2 ...

Accessories	Part number
Mounting kit for control panel installation	1037273
Check strap	1035918

14 Replacing spare part units

- **User qualification, mechanical installation:** trained qualified personnel, see *Chapter 2.2 'Users' qualifications' on page 10*
- **User qualification, electrical installation:** Electrical technician, see *Chapter 2.2 'Users' qualifications' on page 10*

CAUTION!

Check strap for strain relief

Possible consequence: Material damage.

The ribbon cable and its base cannot be mechanically stressed. Hence it is essential when mounting the controller in the control panel, that the check strap (part number 1035918) is fitted for strain relief and mechanical fixing. Without the check strap, the ribbon cable or its base could be damaged if they were to fall out of the top part of the controller housing.

14.1 Replacing the top part of the housing

NOTICE!

Ribbon cable base

The base of the ribbon cable is firmly soldered onto the PCB. The base cannot be removed. Open the base lock (3) to loosen the ribbon cable, see Fig. 39

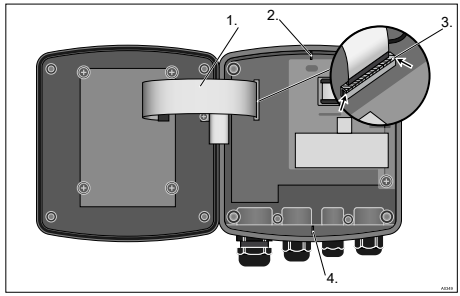


Fig. 39: Loosening the ribbon cable

1. Undo four screws and open the DULCOMETER® Compact Controller
2. Open the right and left lock (3) (arrows) on the base and pull the ribbon cable (1) out of the socket
3. The catches (2 and 4) are not needed with units for control panel installation.

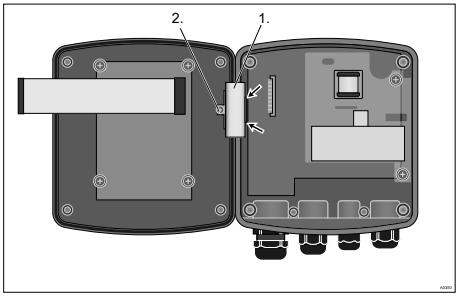


Fig. 40: Dismantling the hinge

4. Remove the screw (2), unclip the hinge (1) on the lower part of the controller housing (arrows) and remove the hinge

5. With control panel installation: Remove the two screws and remove the strain relief

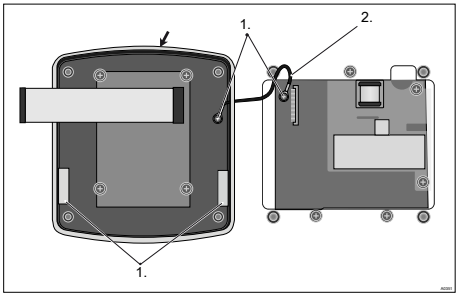


Fig. 41: With control panel installation: Fit the profile seal onto the top part of the controller housing

6. With control panel installation: Position the profile seal (arrow) evenly into the groove in the top part of the DULCOMETER® Compact Controller housing. Arrange the flaps (3) as shown in the figure

7. With control panel installation: Secure the strain relief (2) using two screws (1)

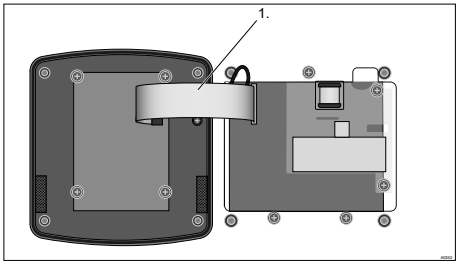


Fig. 42: Pushing and locking the ribbon cable in its base

8. Push and lock the ribbon cable (1) in its base

9. Fit the hinge

10. Screw the top part of the controller housing onto the lower part of the DULCOMETER® Compact Controller housing

11. With control panel installation: Re-check that the profile seals are fitted properly

    ⇨ Re-check that the seal is seated properly. Only if the mounting is correct, can IP 67 (wall/pipe mounting) or IP 54 (control panel mounting) degree of protection be achieved

14.2 Replacing the lower part of the housing (wall/tube retaining bracket)

Complete commissioning of the controller

Once the lower part of the housing has been replaced, it is necessary to fully commission the measuring and control point, as the new lower part of the housing does not have specific settings, only factory settings.

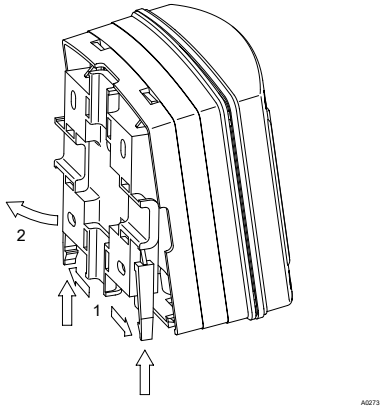


Fig. 43: Removing the wall/tube retaining bracket

1. Remove the wall/tube retaining bracket. Pull the two snap-hooks (1) outwards and push upwards

NOTICE!

Ribbon cable base

The base of the ribbon cable is firmly soldered onto the PCB. The base cannot be removed. Open the base lock (3) to loosen the ribbon cable, see Fig. 39

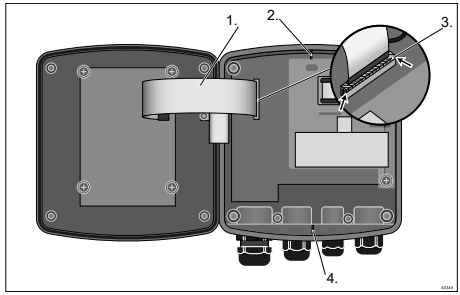


Fig. 44: Loosening the ribbon cable

2. Undo four screws and open the DULCOMETER® Compact Controller

3. Open the right and left lock (3) (arrows) on the base and pull the ribbon cable (1) out of the base. The catches (2 and 4) are used to aligned the two halves of the housing.

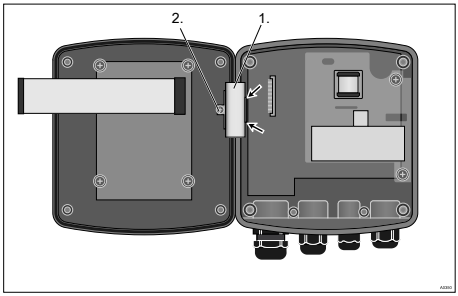


Fig. 45: Dismantling the hinge

4. Remove the screw (2), unclip the hinge (1) on the lower part of the controller housing (arrows) and remove the hinge

5. Label the cable connectors fitted to distinguish them and remove the cables from the lower part of the controller

Preparing the new lower part of the controller housing

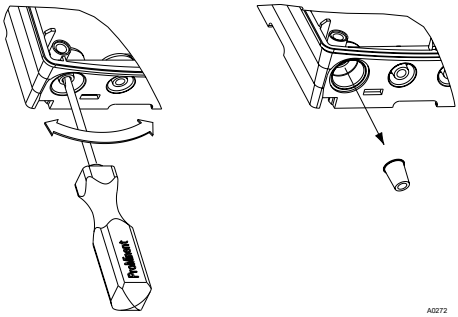


Fig. 46: Punching out the threaded holes

6.

Large threaded connection (M 20 x 1.5)

Small threaded connection (M 16 x 1.5)

Punch out as many threaded holes on the bottom of the lower part of the controller housing as required

Fit the cable and threaded connectors

7. Guide the cable into the respective reducing inserts

8. Insert the reducing inserts into the threaded connectors

9. Guide the cable into the controller

10. Connect the cable as indicated in the terminal diagram

11. Screw in the required threaded connectors and tighten

12. Tighten the threaded connector clamping nuts so that they are properly sealed

Refit the controller

13. Fit the hinge

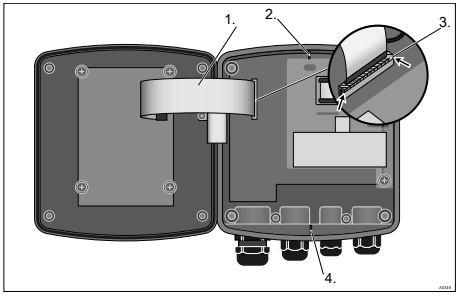


Fig. 47: Fix the ribbon cable

14. Push and lock the ribbon cable (1) in its base. The catches (2 and 4) are used to aligned the two halves of the housing.

15. Screw the top part of the controller housing onto the lower part of the DULCOMETER® Compact Controller housing

16. Re-check that the seal is seated properly. IP 67 degree of protection (wall/pipe-mounting) can only be provided if the installation is correct

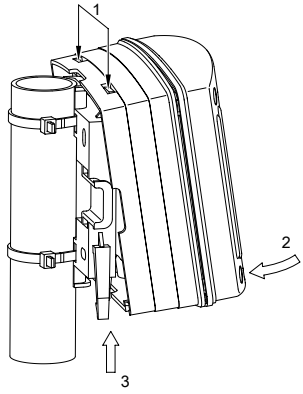


Fig. 48: Suspend and secure the DULCOMETER® Compact Controller

17. Suspend the DULCOMETER® Compact Controller at the top (1) in the wall/tube retaining bracket and push using light pressure at the bottom (2) against the wall/pipe retaining bracket. Then press upwards (3) until the DULCOMETER® Compact Controller audibly snaps into position

14.3 Replacing the lower part of the housing (control panel installation)

Complete commissioning of the controller

Once the lower part of the housing has been replaced, it is necessary to fully commission the measuring and control point, as the new lower part of the housing does not have specific settings, only factory settings.

NOTICE!

Ribbon cable base

The base of the ribbon cable is firmly soldered onto the PCB. The base cannot be removed. Open the base lock (3) to loosen the ribbon cable, see Fig. 39

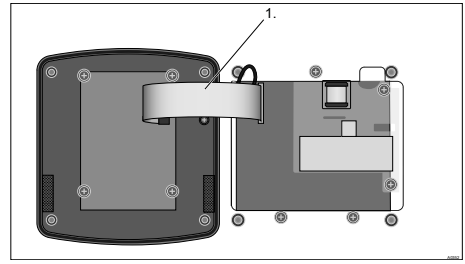


Fig. 49: Loosen the ribbon cable from the base

1. Undo four screws and open the DULCOMETER® Compact Controller

2. Open the right and left lock on the base and pull the ribbon cable (1) out of the base.

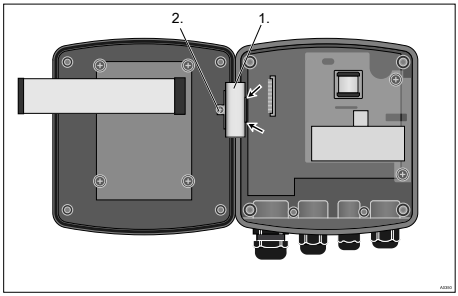


Fig. 50: Dismantling the hinge

3. Remove the screw (2), unclip the hinge (1) on the lower part of the controller housing (arrows) and remove the hinge

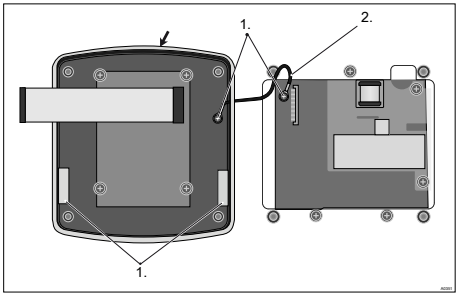


Fig. 51: Removing the strain relief

4. Remove the strain relief (2). Remove the screws (1) to do so.

5. Check the profile seal (arrow), then position the profile seal evenly into the groove in the top part of the DULCOMETER® Compact Controller housing. Arrange the flaps (3) as shown in the figure

6. Remove the top part of the controller housing (3 fixing bolts)

7. Label the cable connectors fitted to distinguish them and remove the cables from the lower part of the controller

Preparing the new lower part of the controller housing

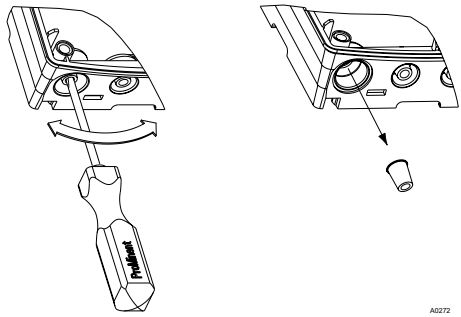


Fig. 52: Punching out the threaded holes

8.

Large threaded connection (M 20 x 1.5)

Small threaded connection (M 16 x 1.5)

Punch out as many threaded holes on the bottom of the lower part of the controller housing as required

Fit the cable and threaded connectors

9. Guide the cable into the respective reducing inserts

10. Insert the reducing inserts into the threaded connectors

11. Guide the cable into the controller

12. Connect the cable as indicated in the terminal diagram

13. Screw in the required threaded connectors and tighten

14. Tighten the threaded connector clamping nuts so that they are properly sealed

Refit the controller

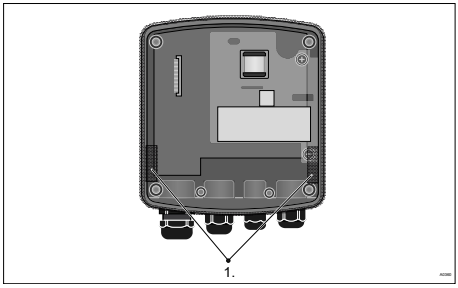


Fig. 53: Fitting the profile seal on the lower part of the controller housing

15. Use pliers to break off the catches. They are not needed for control panel installation

    Position the profile seal evenly around the top edge of the lower part of the DULCOMETER® Compact Controller housing. Arrange the flaps (1) as shown in the figure

    ⇨ Ensure that the profile seal evenly surrounds the top edge of the housing.

16. Insert the lower part of the DULCOMETER® Compact Controller housing with the profile seal from behind into the cut-out and use three screws to secure it in place

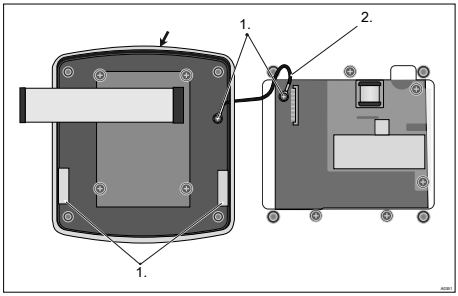


Fig. 54: Fit the profile seal onto the top part of the controller housing

17. Position the profile seal (arrow) evenly into the groove in the top part of the DULCOMETER® Compact Controller housing. Arrange the flaps (3) as shown in the figure

18. Secure the strain relief (2) using two screws (1)

19. Fit the hinge

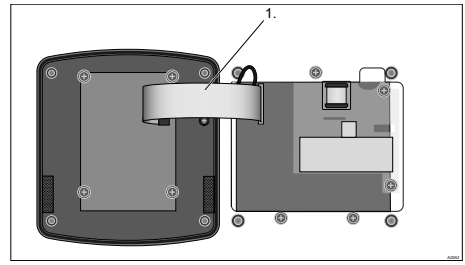


Fig. 55: Pushing and locking the ribbon cable in its base

20. Push and lock the ribbon cable (1) in its base

21. Screw the top part of the controller housing onto the lower part of the DULCOMETER® Compact Controller housing

22. Re-check that the profile seals are fitted properly

    ⇨ IP 54 degree of protection can only be provided if the control panel is mounted correctly

15 Standards complied with and Declaration of Conformity

The EC Declaration of Conformity for the controller is available to download on our homepage.

EN 60529 Specification for degrees of protection provided by housings (IP code)

EN 61000 Electromagnetic Compatibility (EMC)

EN 61010 Safety requirements for electrical equipment for measurement, control and laboratory use - Part 1: General requirements

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

16 Disposal of Used Parts

- **User qualification:** instructed user, see *Chapter 2.2 'Users' qualifications' on page 10*

NOTICE!

Regulations governing the disposal of used parts

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

The manufacturer will take back decontaminated used units providing they are covered by adequate postage.

Decontaminate the unit before returning it for repair. To do so, remove all traces of hazardous substances. Refer to the Material Safety Data Sheet for your feed chemical.

A current Declaration of Decontamination is available to download on the ProMinent website.

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