Operating instructions

Peristaltic metering pump
DULCO flex Control, DFXa

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. 981953 **Original operating instructions (2006/42/EC)** BA DX 027 07/19 EN

Supplementary information

Fig. 1: Please read!

Read the following supplementary information in its entirety! Should you already know this information, you will benefit more from referring to the operating instructions.

The following are highlighted separately in the document:

- Enumerated lists

→ Instructions

⇨ Outcome of the instructions

↳ *'State the identity code and serial number' on page 2*: Links to points in this chapter

- refer to ... : References to points in this document or another document

[Keys]

'Menu level 1 ➔ *Menu level 2* ➔ *Menu level ...*': Menu paths

'Software interface text'

Information

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

Safety Information

Safety information is identified by pictograms - see "Safety Chapter".

State the identity code and serial number

Please state the identity code and serial number, which you can find on the nameplate or in the menu under *'Setting / Menu* ➔ *Information'* when you contact us or order spare parts. This enables the unit type and material versions to be clearly identified.

Table of contents

1 Identity code

Product identification

This identity code serves to identify the product.

Use the identity code from the Product Catalogue for orders.

Product range DULCO flex Control										
DFXa										
	Regional design									
	EU	Europe								
	US	USA								
	CN	China								
		Pump type								
		0730	7 bar, 30 l/h							
		0530	5 bar, 30 l/h							
			Hose material / connections / O-rings							
			SP	TPV / PVDF / PTFE						
			VP	PUR / PVDF / PTFE						
				Seal material						
				F	FDA-compliant (PTFE)					
				T	PTFE					
					Dosing head orientation (orientation of hydraulic connectors - viewed from behind)					
					R	right				
					L	left				
					O	top				
					U	bottom				
						Hydraulic connector				
						0	Standard connector (12x9)			
						2	8x5 connector			
						5	12x6 connector, discharge side			
						7	without connector kit			
						8	9x5 connector			
						E	DN10 connector, with nozzle			
							Hose rupture indicator			
							0	none		
							1	Optical hose rupture indicator		
								Design		
								0	Housing RAL5003 / Hood RAL2003	
								2	Housing RAL5003 / Hood RAL3001	
								M	modified	

Product range DULCO flex Control																					
									Logo												
									0	with ProMinent logo											
									2	without ProMinent logo											
										Version of power unit											
										U	100-240 V										
											Cable and plug										
											A	2 m, Europe									
											B	2 m, Switzerland									
											C	2 m, Australia									
											D	2 m, USA / 115 V									
											1	2 m, open end									
											..	...									
												Relay function									
												0	no relay	-							
												1	1 x changeover contact 230 V AC – 6 A	Fault indicating relay (N/C)							
												4	1 x N/O 24 V DC – 1 A 1 x N/O 24 V DC – 100 mA	as 1 + pacing relay							
												C	1 x N/O 24 V DC – 100 mA, and 1 x 4-20 mA output	As 1 + 4-20 mA output							
												..	...								
													Accessories								
													0	no accessories							
													1	with 1/2” injection valve and foot valve							
													2	as 0 + measuring cup							
													3	as 1 + measuring cup							
														Control version							
														0	Manual + external contact with pulse control						
														3	Manual + external contact with pulse control + analog 0/4-20mA						
														C	As 3 + CANopen						
														E	As 3 + PROFINET						
														R	As 3 + PROFIBUS® M12 plug						
														M	As 3 + Modbus RTU						
															Communication						
															0	none					
															W	with Wi-Fi					
															B	Bluetooth					
															Language						
																DE	German				

Product range DULCO flex Control																
															EN	English
															ES	Spanish
															FR	French
															...	...

2 About this pump

About this pump

Pumps in the DULCO flex Control product range are microprocessor-controlled peristaltic metering pumps with the following characteristics:

- simple adjustment of the capacity directly in l/h or in gph
- flow reversal possible
- simpler hose replacement supported by software
- only the medium comes into contact with the hose
- CIP-compatible - when pump is running
- direct input of the required final concentration with volume-proportional metering tasks in concentration mode
- external control via potential-free contacts with pulse step-up and step-down
- external control via 0/4-20 mA standard signal, scalable
- integrated 1-week/1-month timer
- connection to process control systems via a BUS interface, such as PROFINET, Modbus RTU or CAN bus
- DULCOnneX-compatible

3 Safety chapter

Identification of safety notes

The following signal words are used in these operating instructions to denote different severities of danger:

Signal word	Meaning
WARNING	Denotes a possibly dangerous situation. If this is disregarded, you are in a life-threatening situation and this can result in serious injuries.
CAUTION	Denotes a possibly dangerous situation. If this is disregarded, it could result in slight or minor injuries or material damage.

Warning signs denoting different types of danger

The following warning signs are used in these operating instructions to denote different types of danger:

Warning signs	Type of danger
	Warning – automatic start-up.
	Warning – hand injuries.
	Warning – high-voltage.
	Warning – danger zone.

Intended use

- Only use the pump to meter liquid feed chemicals.
- The pump may only be started up after it has been correctly installed and started up in accordance with the technical data and specifications contained in the operating instructions.
- Observe the general limitations with regard to viscosity limits, chemical resistance and density - see also ProMinent resistance list in the Product Catalogue or at www.prominent.com! Use the "Chemical Resistance List DFXa" available at www.prominent.com for the pump hose.
- All other uses or modifications are prohibited.
- The pump is not intended for the metering of gaseous media and solids.
- The pump is not intended to meter flammable media.
- The pump is not intended for the metering of explosive media.
- The pump is not intended for use outdoors without appropriate protective measures.
- The pump should only be operated by trained and authorised personnel - see the following "Qualifications" table.
- You have a duty to observe the information contained in the operating instructions during the different phases of the device's service life.

Safety information

WARNING!

Warning about personal and material damage

The pump can start to pump, as soon as it is connected to the mains voltage.

– Install an emergency cut-off switch in the pump power supply line or integrate the pump in the emergency cut-off management of the system.

WARNING!

Warning of personal injury and material damage

The pump can start pumping as soon as it has cooled down after the error *'temperature'*.

– Take this into account with the pump and your installation.

WARNING!

Danger of electric shock

A mains voltage may exist inside the pump housing.

– If the pump housing has been damaged, you must disconnect it from the mains immediately. It may only be returned to service after an authorised repair.

WARNING!

Warning of hazardous feed chemical

Should a dangerous feed chemical be used: it may escape from the hydraulic components when working on the pump, material failure or incorrect handling of the pump.

– Take appropriate protective measures before working on the pump (e.g. safety glasses, safety gloves, ...). Adhere to the material safety data sheet for the feed chemical.
– Drain and flush the liquid end before working on the pump.

WARNING!

Fire danger

The pumping of flammable media is prohibited.

WARNING!

Danger from hazardous substances!

Possible consequence: Fatal or very serious injuries.

Please ensure when handling hazardous substances that you have read the latest safety data sheets provided by the manufacture of the hazardous substance. The actions required are described in the safety data sheet. Check the safety data sheet regularly and replace, if necessary, as the hazard potential of a substance can be re-evaluated at any time based on new findings.

The system operator is responsible for ensuring that these safety data sheets are available and that they are kept up to date, as well as for producing an associated hazard assessment for the workstations affected.

CAUTION!

Warning of feed chemical spraying around

Feed chemical can spray out of the hydraulic components if they are manipulated or opened due to pressure in the liquid end and adjacent parts of the system.

- Disconnect the pump from the mains power supply and ensure that it cannot be switched on again by unauthorised persons.
- Depressurise the system before commencing any work on hydraulic parts.

CAUTION!

Warning of body parts being drawn in

The rotor running in the liquid end may draw in and trap body parts.

- Do not reach into the running rotor.
- Only take off bearing cover once prompted to do so by the operating instructions or operating software.

CAUTION!

Warning of feed chemical spraying around

An unsuitable feed chemical can damage the parts of the pump that come into contact with the chemical.

- Take into account the resistance of the wetted materials and the ProMinent Resistance List when selecting the feed chemical - see the ProMinent Product Catalogue or visit ProMinent.

CAUTION!

Warning of feed chemical spraying around

An unsuitable feed chemical may cause premature wear to the pump hose.

- Observe the pump hose's resistance and "Chemical Resistance List DFXa" available at www.prominent.com when selecting the feed chemical.

CAUTION!

Danger of injury to personnel and material damage

The use of untested third party components can result in injury to personnel and material damage.

- Only fit parts to metering pumps that have been tested and recommended by ProMinent.

CAUTION!

Danger from incorrectly operated or inadequately maintained pumps

Danger can arise from a poorly accessible pump due to incorrect operation and poor maintenance.

- Ensure that the pump is accessible at all times.
- Adhere to the maintenance intervals.

CAUTION!

Warning against illegal operation

Observe the regulations that apply where the device is installed.

Isolating protective equipment

- Cover for the slot for relays and optional modules - see the chapter entitled "Overview of Equipment and Control Elements"
- Bearing cover for liquid end - see "Overview of equipment and control elements" chapter

Customers should only remove the cover for the slot for relays and optional modules and/or a relay or optional module in line with the supplementary instructions for the relays and optional modules.

Customers should only remove the bearing cover for the liquid end in accordance with the "Repair" chapter.

Only the ProMinent service department is authorised to open the housing and hood (housing the control elements).

Other protective equipment

Adhesive labels

WARNING!

– A warning sign indicating "Warning of injury to hands" is stuck on the pump and warns of rotating parts and the risk of being drawn into the liquid end.
– Ensure that the label is always fitted and legible.

Information in the event of an emergency

In an emergency, either disconnect the mains plug, press [Start/Stop] or press the Emergency Stop switch installed on the customer's side or disconnect the pump from the mains/power supply in line with the Emergency Stop management guidelines for your system.

If feed chemical escapes, also ensure that the pump's hydraulic environment is at atmospheric pressure. Adhere to the material safety data sheet for the feed chemical.

Qualification of personnel

Task	Qualification
Storage, transport, unpacking	Instructed person
Assembly	Technical personnel, service
Planning the hydraulic installation	Technical personnel who have a thorough knowledge of peristaltic pumps
Hydraulic installation	Technical personnel, service
Electrical installation	Electrical technician
Initial commissioning	Technical personnel, service
Operation	Instructed person
Maintenance, repair	Technical personnel, service
Decommissioning, disposal	Technical personnel, service
Troubleshooting	Technical personnel, electrical technician, instructed person, service

Explanation of the table:

Technical personnel

Technical personnel are deemed to be people who are able to assess the tasks assigned to them and recognise possible dangers based on their technical training, knowledge and experience, as well as knowledge of pertinent regulations.

Note:

A qualification of equal validity to a technical qualification can also be gained by several years of employment in the relevant field of work.

Electrical technician

An electrical technician is able to complete work on electrical systems and recognise and avoid possible dangers independently based on his or her technical training and experience as well as knowledge of pertinent standards and regulations.

The electrical technician must be specifically trained for the working environment in which he or she is employed and be conversant with the relevant standards and regulations.

The electrical technician must comply with the provisions of the applicable statutory directives on accident prevention.

Instructed person

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.

Service

The service department refers to service technicians, who have received proven training and have been authorised by ProMinent to work on the device / system.

Sound pressure level

Sound pressure level LpA < 70 dB according to EN ISO 20361

at maximum feed rate and maximum back pressure (water)

4 Storage, transport and unpacking

User qualification: Instructed person - see *'Qualification of personnel' on page 12*

Safety information

WARNING!

Only return metering pumps for repair in a cleaned state and with a flushed liquid end - refer to "Decommissioning!

Only return metering pumps with a completed Decontamination Declaration form. The Decontamination Declaration constitutes an integral part of an inspection / repair order. A unit can only be inspected or repaired when a Declaration of Decontamination Form is submitted that has been completed correctly and in full by an authorised and qualified person on behalf of the pump operator.

The "Decontamination Declaration Form" can be found on our homepage.

CAUTION!

Danger of material damage

The device can be damaged by incorrect or improper storage or transportation!

- The unit should only be stored or transported in a well packaged state - preferably in its original packaging.
- The packaged unit should also only be stored or transported in accordance with the stipulated storage conditions.
- The packaged unit should be protected from moisture and the ingress of chemicals.

Ambient conditions

Ambient conditions - see "Technical Data" chapter.

Storage period, max.

Storage period of pump hose non-condensing, max.: 2 years

Scope of delivery

Compare the delivery note with the scope of delivery:

- Metering pump with mains cable
- Pump hose
- Rotor half
- Connector kit for hose/pipe connection (option)
- Product-specific operating instructions with EU Declaration of Conformity
- Optional accessories

5 Overview of equipment and control elements

5.1 Overview of equipment

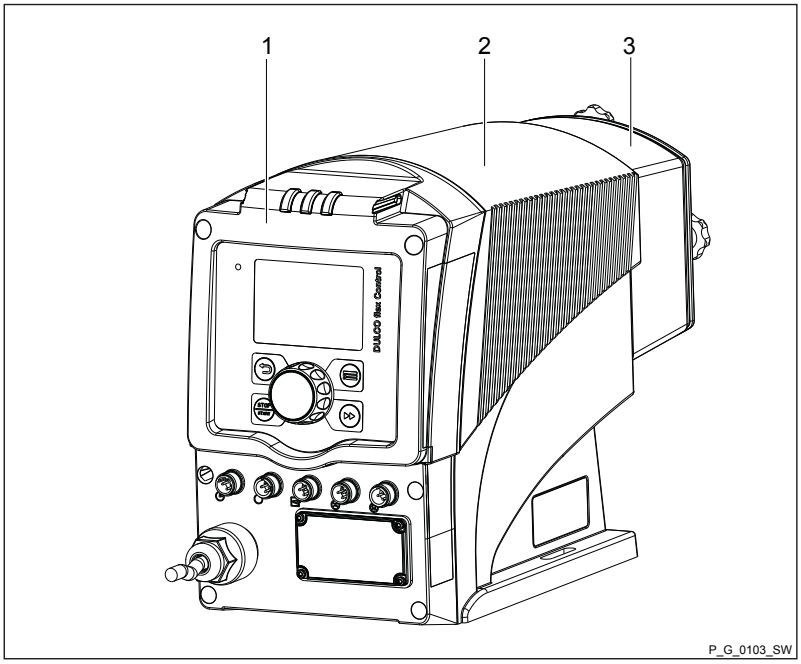


Fig. 2: Overview of equipment DFXa, complete

1 Control unit
2 Drive unit
3 Liquid end

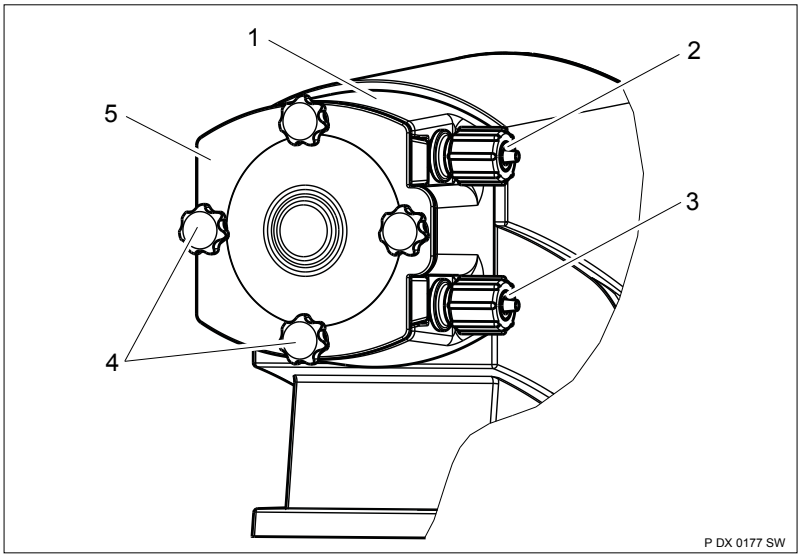


Fig. 3: Liquid end DFXa

1 Dosing head
2 Pressure connector (delivery status)
3 Suction connector (delivery status)
4 Star screws
5 Bearing cover

5.2 Control elements

Control elements, overview

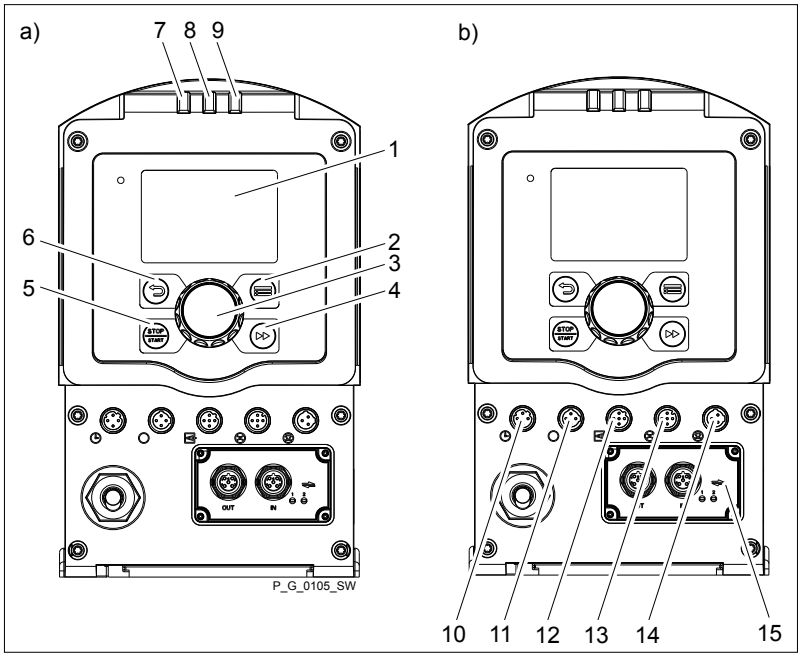


Fig. 4

1 LCD screen
2 *[Menu]* key
3 Clickwheel
4 *[Priming]* key
5 *[STOP/START]* key
6 *[Back]* key
7 Fault indicator (red)
8 Warning indicator (yellow)
9 Operating indicator (green)
10 "Config I/O" terminal
11 "Hose rupture indicator" terminal
12 "External control" terminal
13 "Metering monitor" terminal (no function)
14 "Level switch" terminal
15 Slot for relays and optional modules

5.2.1 Control elements

Use this overview to familiarise yourself with the keys and other control elements on the pump!

Identifier and fault displays on the LCD screen

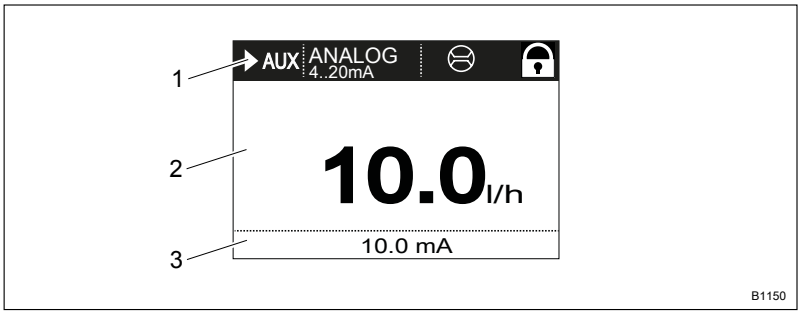


Fig. 5: Structure of continuous display

1 Status bar
2 Continuous display, central area
3 Secondary display

Refer to the chapter entitled "Main displays and secondary displays" in the Appendix for the different main displays and secondary displays.

The LCD screen supports the operation and adjustment of the pump using various information and identifiers:

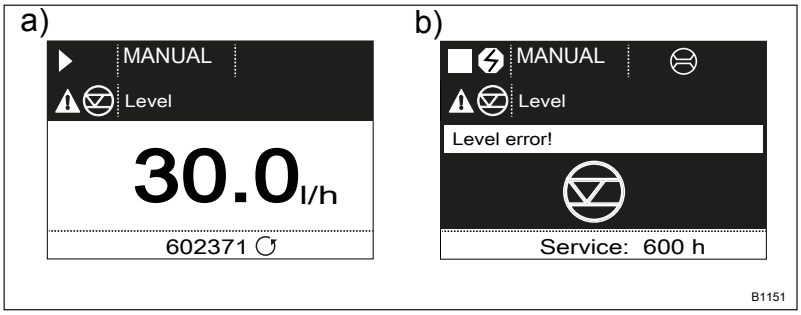


Fig. 6: a) Continuous display with warning message; b) Continuous display with fault message. Explanation of the symbols in the following tables.

The above Figure, Part a) shows that:

- the pump is in operation
- is in *'Manual'* operating mode
- a *'level'* warning message is pending
- the capacity of 30.0 l/h has been set
- the pump has performed 602371 revolutions to date

Tab. 1: Identifiers and error displays:

Identifier	Meaning
	The pump is working or waiting for a starting signal.
	The pump was manually stopped using the [STOP/START] key.
	The pump was remotely stopped (Pause) - via the "External" terminal.
	The pump was stopped by an error.
	Only with cyclical batch metering: the pump is waiting for the next cycle.

Identifier	Meaning
	Only with *'Access protection'*: the pump software is locked.
'AUX'	The pump is currently pumping at auxiliary capacity.
'memory'	Only in *'CONTACT'* and *'BATCH'* operating modes: the auxiliary function "Memory" has been set.
	The pump is in *'ANALOG'* operating mode. The *'Curve ➔ linear'* type of processing is set.
	The pump is in *'ANALOG'* operating mode. The *'Curve ➔ Upper side band'* type of processing is set.
	A hose rupture indicator is connected.
	The pump is in the *'Menu'* (Set up).

Further explanations can be found in the "Trouble-shooting" chapter.

The pump only shows the metering volume and the capacity in the calibrated state in l or l/h or in gal or gal/h (US gallons).

5.2.2 Key functions

Key	Application	In the continuous displays	In the menu
[Back]	press	-	Go back to the previous menu item (or a continuous display) - without saving
[STOP/ START]	press	Stop pump,	Stop pump,
		Start pump	Start pump
[Menu]	press	Go to the menu	Go back to a continuous display
[Priming]	press	Priming *	Priming *
[Clickwheel]	press	Start batch (only in *'Batch'* operating mode), Acknowledge errors	Go to next menu item (or a continuous display) Confirm entry and save
[Clickwheel]	turn	Switch between the continuous displays	Change figure or change selection

** When priming the pump does not run at maximum number of revolutions.*

If ⏩ [Priming] is pressed in 'Stop' state, then [Priming] has top priority as long as the button is pressed.

Refer to the "Set-up basics" chapter for how to adjust figures

6 Functional description

6.1 Device

An electric motor drives a rotor. Rollers are fitted to the ends of the rotors, which press the pump hose against the inner curvature of the dosing head. The peristaltic pump operates by the rollers driving the feed chemical through the pump hose. The feed chemical is primed by the pump hose automatically returning to its initial position.

6.2 Capacity

The capacity that has been set regulates the pump itself.

6.3 Operating modes

Operating modes are selected via the "Operating modes" menu.

Refer to the "Hierarchy of Operating Modes, Functions and Fault Statuses" for the order of the various operating modes, functions and fault statuses.

"Manual" operating mode

'Manual' operating mode permits you to operate the pump manually.

"Contact" operating mode

This operating mode provides the option of controlling the pump externally by means of potential-free contacts (e.g. by means of a contact water meter). “Pulse Control” can be used to preselect the metering volume in the *'Settings'* menu.

"Batch" operating mode

This operating mode provides the option of working with large metering volumes. Metering can be triggered either by pressing the *[Clickwheel]* or by a pulse received via the "External control" terminal via a contact or a semiconductor switching element. It is possible to pre-select a metering volume (batch) and a metering time using the *[Clickwheel]* in the *'Settings'* menu.

"Analog" operating mode

The capacity is controlled using an analogue current signal via the "External control" terminal. Processing of the current signal can be preselected using the control unit.

6.4 Functions

Refer to the "Hierarchy of Operating Modes, Functions and Fault Statuses" for the order of the various operating modes, functions and fault statuses.

The following functions can be selected using the *'Settings'* menu:

"Calibrate" function

The pump can also be operated in a calibrated state in all operating modes if it is to meter extremely precisely. This can be useful with high-viscosity feed chemicals but less so with feed chemicals with a similar consistency to water.

"Auxiliary capacity" function

This facilitates the switch-over to a fixed adjustable capacity in the *'menu'* via the "External control" terminal.

"Timer" function

This permits a simple timer program to be set up without the need for an additional timer module.

The following functions are available as standard:

"Level switch" function

Information about the liquid level in the dosing tank is reported to the pump. A two-stage level switch has to be fitted for this purpose, which is connected to the "Level switch" terminal. A suction lance with continuous level measurement can also be connected to the pumps.

"Pause" function

The pump can be remotely stopped via the "External control" terminal.

"Stop" function

The pump can be stopped without disconnecting it from the mains/power supply by pressing *[STOP/START]*.

"Priming" function

Priming can be triggered by pressing *[Priming]*.

6.5 Relay (options)

The pump has several connecting options available:

"Fault indicating relay" option

The relay can close a connected power circuit (e.g. for an alarm horn) in the event of warnings or fault messages (e.g. *'Warning level'*).

The relay can be retrofitted through the slot in the front of the pump – refer to the installation instructions for "Retrofitting relays".

"Fault indicating and pacing relay" option

This combined relay can generate a contact for an adjustable volume via its pacing relay in addition to functioning as a fault indicating relay.

The relay can be retrofitted through the slot in the front of the pump.

“mA-Output" option

The current output signal I indicates the pump's actual calculated metering volume. The relay can be retrofitted through the slot in the front of the pump.

The option also always includes a fault indicating relay or a pacing relay.

6.6 LED displays

LED display	Colour	lit	lights up	flashes
Fault indicator	red	A fault message is pending	-	undefined operating status
Warning indicator	yellow	A warning message is pending	-	-

LED display	Colour	lit	lights up	flashes
Operating display	green	The pump is ready for operation	-	-
			During every revolution: Capacity greater than 10 l / h	-
			During every 1/2 revolution: Capacity less than 10 l / h	-
			During every 1/8 revolution: Capacity less than 1 l / h	-
			every 4 s: Capacity less than 500 ml / h	-

6.7 Hierarchy of operating modes, functions and fault statuses

The different operating modes, functions and fault statuses have a different impact on whether and how the pump reacts.

The following list shows the order:

1. - Priming
2. - Stop
3. - Error, Pause
4. - Auxiliary capacity
5. - Manual, Analog, Contact, Batch, Fieldbus

Comments:

re 1. - “Priming" can take place in any pump mode (providing it is working).

re 2. - "Stop" stops everything.

re 3. - "Error", and "Pause" stop everything apart from "Priming".

re 4. - "Auxiliary capacity" always has priority over the capacity specified by an operating mode listed under 5 or the fieldbus.

7 Assembly

User qualification: Technical personnel and service - see *'Qualification of personnel' on page 12*

Refer to the correct dimensional drawings for the pump from the online version of the operating instructions on our website. www.prominent.com

Compare the dimensions on the dimensional drawing with those of the pump.

CAUTION!

Danger from incorrectly operated or inadequately maintained pumps

Danger can arise from a poorly accessible pump due to incorrect operation and poor maintenance.

- Ensure that the pump is accessible at all times.
- Adhere to the maintenance intervals.

7.1 Changing dosing head alignment

The dosing head can be aligned in 4 directions:

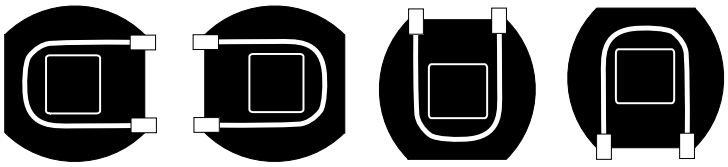


Fig. 7: Alignment of dosing head: to the right, to the left, up, down

To change the dosing head alignment, proceed as follows:

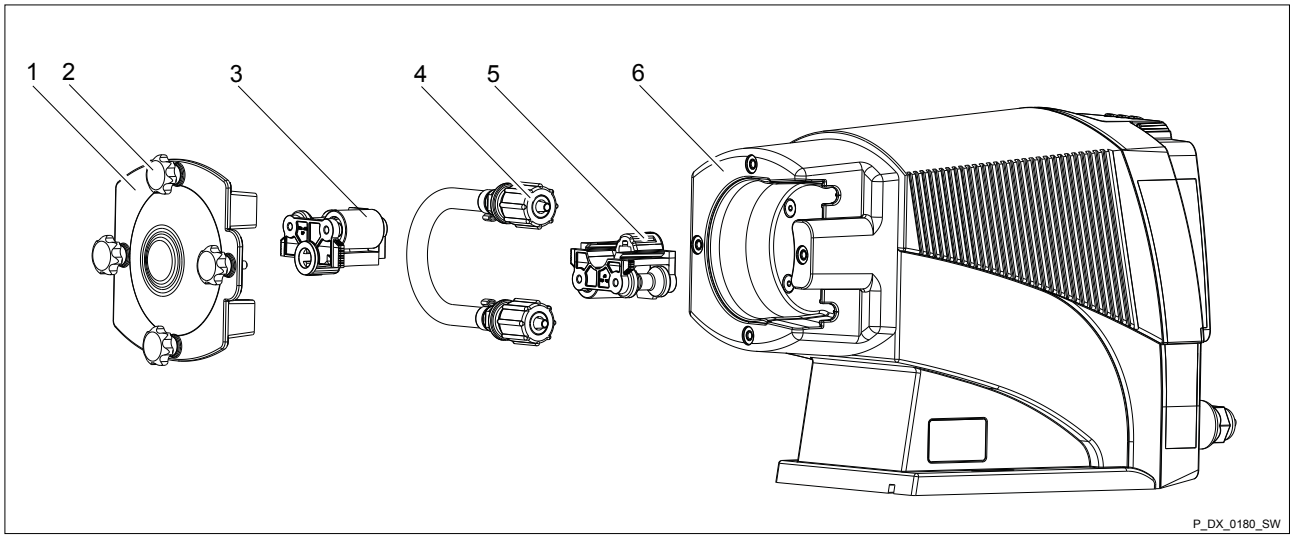


Fig. 8

- Ensure that the system is at atmospheric pressure.
- Adhere to the material safety data sheet for the feed chemical.
- Prevent the escape of feed chemical.
- If necessary take protective measures.

1. Press [STOP/START] *[STOP/START]* to bring the pump to a stop (manually).
2. Empty the liquid end (turn the liquid end upside down and allow the feed chemical to run out; flush out with a suitable medium; flush the liquid end thoroughly when using hazardous feed chemicals!).
3. Go to the ☰ ➔ *'Hose replacement'* menu.
   ⇨ *'Go to change position?'* appears.

WARNING!
The rotating rotor may crush things or draw them in.
– The bearing cover must not be removed yet.

4. Confirm the question with *'Yes'*.
   ⇨ The rotor turns slowly and the following appears:
   'Please wait...'.
   The rotor stops and *'Remove cover and take out the rotor!'* appears (the corresponding rotor half flashes in the animation).
5. Loosen 4 star screws (2) on dosing head (6) and remove with bearing cover (1).
6. Pull rotor half (3) flashing in LCD screen out of dosing head (6) (if required, use plastic tool to release it).
7. Press the Clickwheel.
   ⇨ The rotor turns slowly and the following appears:
   'Please wait...'.
   The rotor stops and *'Please change the tube!'* appears.
8. Snap two hydraulic connectors out of dosing head (5) - away from pump - and remove along with hose (4).
9. Also pull 2nd rotor half (5) out of dosing head (6).
10. Remove 4 Torx screws from rear of dosing head.
11. Align dosing head as desired (to left, to right, up, down).
12. Put 4 Torx screws back in and manually tighten.

13. Place 2nd rotor half (5) on drive axle in dosing head with "This side DOWN" surface being located first - the rollers must point towards the recesses for the hydraulic connectors.
14. Insert hose (4) in dosing head (5) and snap the two hydraulic connectors into place - round side in dosing head (5).
15. Press the Clickwheel.
    ⇨ The rotor turns slowly and the following appears:

    ' Please wait!' .

    The rotor stops and *'Insert rotor again!'* appears.
16. Re-insert 1st rotor half (3) - the surfaces of the two rotor halves must be perfectly flush.
17. Press the Clickwheel.
    ⇨ The rotor turns and the following appears:

    'Please wait...' .

    The rotor stops and *'Install Cover again!'* appears.
18. Place bearing cover (1) on dosing head (6).
19. Initially only loosely screw all 4 star screws (2) into dosing head (6).
20. Manually tighten the 4 star screws (2).
21. Press the Clickwheel.
    ⇨ *'Run in tube?'* appears.

    'Yes' / *'No'*
22. Selecting *[No]* exits this macro.
23. You can return to the continuous display by pressing the ☰➔ key.

If the dosing direction is also to be reversed, this can be done by going to 'Settings ➔ Dosing direction ➔ ...'.

8 Installation, hydraulic

User qualification: Technical personnel and service - see *'Qualification of personnel' on page 12*

Safety information

CAUTION!

Warning of feed chemical spraying around

An unsuitable feed chemical can damage the parts of the pump that come into contact with the chemical.

– Take into account the resistance of the wetted materials and the ProMinent Resistance List when selecting the feed chemical - see the ProMinent Product Catalogue or visit ProMinent.

CAUTION!

Warning of feed chemical spraying around

An unsuitable feed chemical may cause premature wear to the pump hose.

– Observe the pump hose's resistance and "Chemical Resistance List DFXa" available at www.prominent.com when selecting the feed chemical.

CAUTION!

Warning of feed chemical spraying around

Pumps which are not fully installed hydraulically can eject feed chemicals from the outlet openings of the discharge valves as soon as they are connected to the mains.

– The pump must first be hydraulically installed and then electrically.
– In the event that you have failed to do so, press the *[STOP/START]* button or press the emergency-stop switch.

CAUTION!

Warning of feed chemical spraying around

Feed chemical can spray out of the hydraulic components if they are manipulated or opened due to pressure in the liquid end and adjacent parts of the system.

– Disconnect the pump from the mains power supply and ensure that it cannot be switched on again by unauthorised persons.
– Depressurise the system before commencing any work on hydraulic parts.

CAUTION!

Danger of injury to personnel and material damage

The use of untested third party components can result in injury to personnel and material damage.

– Only fit parts to metering pumps that have been tested and recommended by ProMinent.

CAUTION!

Warning of feed chemical spraying around

The pipes can loosen or rupture if they are not installed correctly.

- Route all hose lines so they are free from mechanical stresses and kinks.
- Only use original hoses with the specified hose dimensions and wall thicknesses.
- Only use clamp rings and hose nozzles that are intended for the hose diameter in question to ensure the long service life of the connections.

Align the lines so that the metering pump and the liquid end can simply be removed if necessary.

Installing hose lines

Installing suction and metering lines:

1. First test which is the suction connector and which is the pressure connector:

   In *'' 'Manual'* operating mode, briefly press *[STOP/START]* and observe the rotor:

   The rotor turns away from the suction connector and towards the pressure connector.

   If this arrangement is inappropriate, you can change it via the dosing direction - go to *'Settings ➔ Dosing direction ➔ ...'*.

2. Connect the suction line and discharge line as described below.

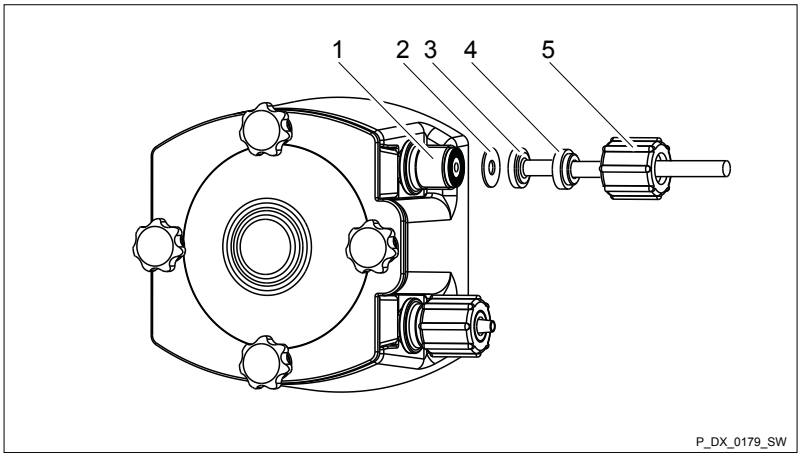


Fig. 9: Installing suction and metering lines

3. Shorten the end of the hose at right angles.
4. Unscrew union nut (2) and slide union nut over hose (3).
5. Push hose end over hose connector (4) as far as the stop.

Never re-use used PTFE seals.

An installation sealed in this way is not watertight. This type of seal is permanently distorted when subjected to pressure.

6. Tighten the union nuts.

7. If you are only using a hose line and not a suction lance: Shorten the free end of the suction line so that the end of the suction line hangs just above the base of the feed chemical storage tank.

9 Installation, electrical

User qualification: Electrical technician - see *'Qualification of personnel' on page 12*

WARNING!

Danger of electric shock

A mains voltage may exist inside the device.

– Before any work, disconnect the device's mains cable from the mains.

WARNING!

Risk of electric shock

This pump is supplied with a grounding conductor and a grounding-type attachment plug.

– To reduce the risk of electric shock, ensure that it is connected only to a proper grounding-type receptacle.

WARNING!

Risk of electric shock

In the event of an electrical accident, the pump must be quickly disconnected from the mains.

– Install an emergency cut-off switch in the pump power supply line or
– Integrate the pump in the emergency cut-off management of the system and inform personnel of the isolating option.

WARNING!

Danger of electric shock

Incompletely installed electrical options can allow moisture into the inside of the housing.

– Fit appropriate modules into the slot on the front of the pump or use the original blank cover to seal it in a leak-tight manner.

WARNING!

Danger of electric shock

A mains voltage may exist inside the pump housing.

– If the pump housing has been damaged, you must disconnect it from the mains immediately. It may only be returned to service after an authorised repair.

CAUTION!

Risk of short circuiting caused by moist pins

No moisture must reach the pins of the PROFIBUS® jack.

– A suitable PROFIBUS® plug or protective cap must be screwed onto the PROFIBUS® jack.

CAUTION!

Material damage possible due to power surges

Should the pump be connected to the mains power supply in parallel to inductive consumers (such as solenoid valves, motors), inductive power surges can damage the control when it is switched off.

- Provide the pump with its own contacts (Phase) and supply with voltage via a contactor relay or relay.
- Should this not be possible, then switch a varistor (part no. 710912) or an RC gate (0.22 µF/220 Ω, part no. 710802) in parallel.

CAUTION!

Bonding of the contacts of your switching relay

The high starting current can cause the contacts of the on-site switching relay to bond together if the mains voltage switches a solenoid metering pump on and off in a process.

- Use the switching options offered by the external socket to control the pump (functions: Pause, Auxiliary frequency or Operating modes: Contact, Batch, Analogue).
- Use a starting current limiter if it is impossible to avoid switching the pump on and off via a relay.

→ Install the pump in line with best working practice and in accordance with the operating instructions and applicable regulations.

9.1 Supply voltage connector - mains voltage

WARNING!

Unexpected start-up is possible

The pump can start pumping and consequently feed chemical may escape as soon as the pump is connected to the mains/power supply.

- Avoid the escape of feed chemical.
- If you have not done so, immediately press *[STOP/START]* or disconnect the pump from the mains voltage e.g. using an Emergency Stop switch.
- Refer to the material safety data sheet for your feed chemical.

CAUTION!

If the pump is integrated into a system: Design the system so that potential hazardous situations are avoided by pumps starting up automatically subsequent to unintended power interruptions.

Simply disconnect the pump from the mains/power supply for repair or maintenance work, among other things.

- *With cables with plug: Provide adequate room around the socket provided.*
- *With cables without plug: Provide an appropriate, easily accessible On/Off switching option in your building installation.*

Highlight the disconnection option as such and inform staff about the electrical isolation option.

Connect the pump to the mains voltage using the mains cable.

9.2 Description of the terminals

9.2.1 "Config I/O" terminal

There is an option to transmit the signals of 3 potential-free contacts as inputs I: to the pump via the “Config I/O” terminal or issue contact signals as Outputs O:.

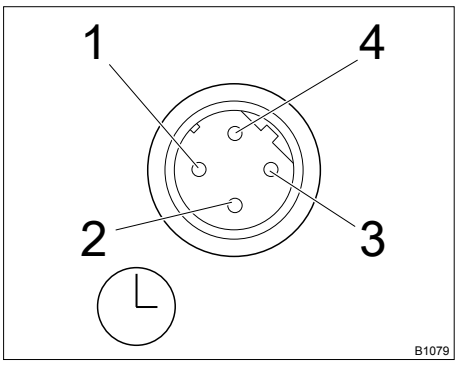


Fig. 10: "Config I/O" terminal, pin assignment

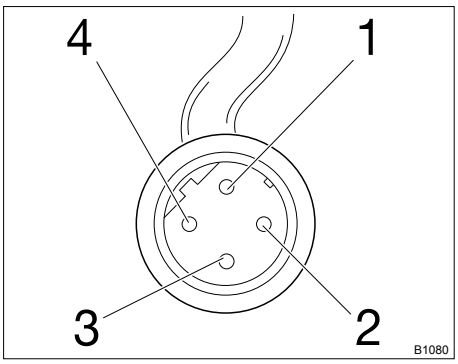


Fig. 11: Plug to "Config I/O" terminal, pin assignment

Tab. 2: Assignment of pins

Pin	Assignment	4-wire cable
1	Config I/O 1	brown
2	Config I/O 2	white
3	Config I/O 3	blue
4	GND	black

Configured as an input

Parameter	Value
Voltage with open contacts	5 V
Input resistance	10 kΩ
Max. pulse frequency	50 pulses/s
Min. pulse duration	10 ms

Tab. 3: Control via:

Switching element	Specification
potential-free contact	Load: 0.5 mA at 5 V
Semiconductor switch	Residual voltage < 2 V

Configured as an output

Parameter	Value
Max. pulse frequency	50 pulses/s
Min. pulse duration	10 ms

Tab. 4

Switching element	Specification
NPN output (Open Drain)	30 V max. voltage and 300 mA max. current load per pin

CAUTION!
No protection provided for inductive loads.

– Provide a free-running diode when controlling a delay.

9.2.2 "External control" terminal

The "external control" terminal is a 5-pole panel terminal. It is compatible with 2- and 4-pin cables.

Only use a 5-pin cable with the "Auxiliary capacity" and "mA input" functions.

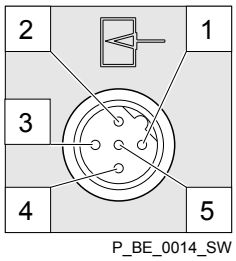


Fig. 12: Assignment on pump

Electrical interface for pin 1 "Pause" - pin 2 "External contact" - pin 5 "Auxiliary capacity"

Data	Value	Unit
Voltage with open contacts	5	V
Input resistance	10	kΩ
Max. pulse frequency	25	pulse/s
Min. pulse duration	20	ms

Control via:

- potential-free contact (load: 0.5 mA at 5 V) or
- semiconductor switch (residual voltage < 0.7 V)

Electrical interface for pin 3 "mA input" (with identity code characteristic "Control version": 2 and 3)[1]

Data	Value	Unit
Input load, approx.	120	Ω

[1] The metering pump starts running at approx. 0.4 mA (4.4 mA) and reaches maximum capacity at approx. 19.6 mA.

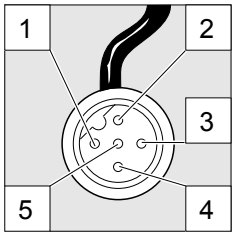


Fig. 13: Assignment on cable

Pin	Function	5-wire cable	2-wire cable
1	Pause	brown	bridged at pin 4
2	External contact	white	brown
3	mA input*	blue	-
4	Earth GND	black	white
5	Auxiliary capacity	grey	-

*with identity code characteristic "Control version": 3

Refer to the functional description for the sequence of functions and operating modes.

"Pause" function

The pump works if:

- pin 1 and pin 4 are connected to each other and the cable is connected.
- no cable is connected.

The pump does not work if:

- pin 1 and pin 4 are open and the cable is connected.

Acknowledge fault with 'Pause'

Certain errors requiring acknowledgement can also be acknowledged using 'Pause' instead of using the Quickwheel.

"External contact" operating mode

The pump performs one or more revolutions if:

- Pin 2 and pin 4 are connected to each other for at least 20 ms. At the same time, pin 1 and pin 4 must also be connected to each other.

"Analog" operating mode

The pump capacity and/or number of revolutions can be controlled by a current signal. The current signal is connected between pin 3 and pin 4.

Pin 1 and pin 4 must also be connected.

"Auxiliary capacity" operating mode

The pump works at a pre-set capacity if:

- Pin 5 and pin 4 are connected to each other. At the same time, pin 1 and pin 4 must also be connected to each other. The auxiliary capacity is factory-preset to maximum capacity.

9.2.3 "Level switch" terminal

There is an option for connecting a 2-stage level switch with pre-warning and limit stop or a suction lance with continuous level measurement.

9.2.3.1 Suction lance with 2-stage level switch

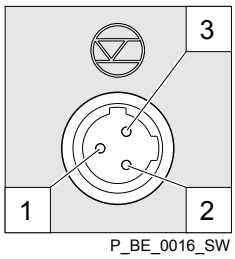


Fig. 14: Assignment on pump

Electrical interface

Data	Value	Unit
Voltage with open contacts	5	V
Input resistance	10	kΩ

Control via:

- potential-free contact (load: 0.5 mA at 5 V) or
- semiconductor switch (residual voltage < 0.7 V)

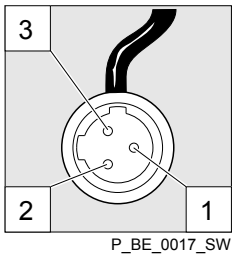


Fig. 15: Assignment on cable

Pin	Function	3-wire cable
1	Earth GND	black
2	Minimum pre-warning	blue
3	Minimum limit stop	brown

9.2.3.2 Suction lance with continuous level measurement

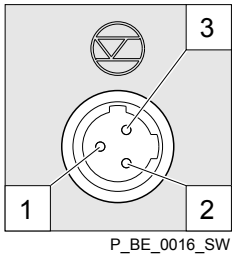


Fig. 16: Assignment on pump

Electrical interface

Pin	Designation	Function
1	5 V supply Sensor + RX	5 V (4.85 V…5.25 V DC) feed to the sensor and RX communication interface (viewed from sensor). Interruption to the power supply for a communication command max. 10 ms.
2	GND	Reference potential
3	Sensor TX	TX communication interface (viewed from sensor)

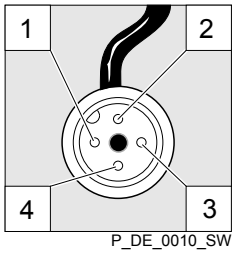


Fig. 17: Assignment on cable

The cable between the suction lance and pump is an adapter cable

- with 5 pins at the suction lance end and 3 pins at the pump end.

9.2.4 "Metering monitor" terminal

This terminal has no function in the DFXa.

9.2.5 "Hose rupture indicator" terminal

There is an option to connect a hose rupture indicator.

Plug cable from hose rupture indicator into “Hose rupture indicator" terminal.

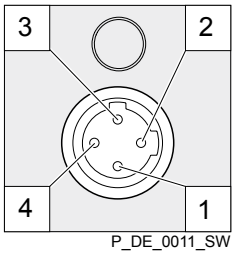


Fig. 18: Assignment on pump

Electrical interface

Specification	Value
Supply voltage, approx.:	+5 V, can be loaded to 20 mA (current limitation 150 mA)
Power consumption:	min. 10 mA, max. 20 mA (sensor presence detection)
Sensor signal:	potential-free contact (load: 0.5 mA at +5 V) or semiconductor switch (residual voltage < 0.3 V)

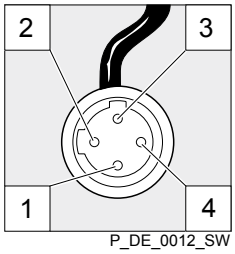


Fig. 19: Assignment on cable

Pin	Function	4-wire cable
1	Power supply (5 V)	brown
2	not assigned	white
3	Sensor signal	blue
4	Earth GND	black

9.2.6 Relay

9.2.6.1 Relay functions

Tab. 5: DULCO flex Control DFXa

Identity code	Designation	Type	Maximum voltage	Maximum current
0	no relay	-	-	-
1	Fault indicating relay	Changeover contact	230 V AC	6 A
4	Fault indicating relay + Pacing relay	Releasing (N/C) Energizing (NO)	24 V DC 24 V DC	1 A 100 mA
C	Fault indicating relay + 4-20 mA output	Releasing (N/C)	24 V DC	100 mA

Tab. 6: Relay type switches in the event of...

Relay type*	Level warning	Level low	Processor fault
Fault indicating relay:	X	X	X
Warning relay:	X	-	-

* Can be reprogrammed in the *'Relay'* menu.

9.2.6.2 "Fault indicating relay" output (identity code 1)

A fault indicating relay can be ordered as an option - refer to ordering information in the appendix. It is used to emit a signal when there is a fault with the pump and for the "Liquid level low, 1st stage" warning message and "Liquid level low 2nd stage" fault message.

The fault indicating relay can be retrofitted and is operational once attached to the relay board - refer to "Retrofitting relays" supplementary operating instructions.

The behaviour is factory-programmed. If another switching function is desired, the pump can be reprogrammed in the *'Relay'* menu.

The relay can be retrofitted and is operational once it has been plugged into the relay board.

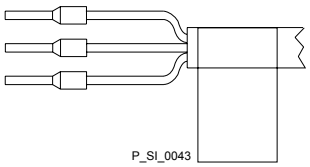


Fig. 20: Assignment on cable

Electrical interface

Data	Value	Unit
Maximum contact load at 230 V and 50/60 Hz:	8	A
Minimum mechanical service life:	200,000	switching operations

Identity code 1

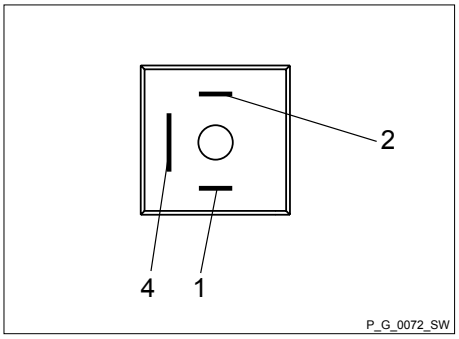


Fig. 21: Assignment on pump

To pin	VDE cable	Contact	CSA cable
1	white	N/O (normally open)	white
2	green	N/C (normally closed)	red
4	brown	C (common)	black

9.2.6.3 Output for other relays (identity code 4)

A fault indicating and a pacing relay can be ordered as options - refer to ordering information in the appendix. The pacing output is electrically isolated by means of an optocoupler with a semiconductor switch. The second switch is a relay (also electrically isolated).

The behaviour is factory-programmed. If another switching function is desired, the pump can be reprogrammed in the *'Relay'* menu.

The fault indicating/pacing relay can be retrofitted and is operational once attached to the relay board - refer to the "Retrofitting relays" supplementary instructions.

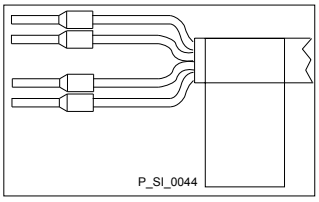


Fig. 22: Assignment on cable

Electrical interface

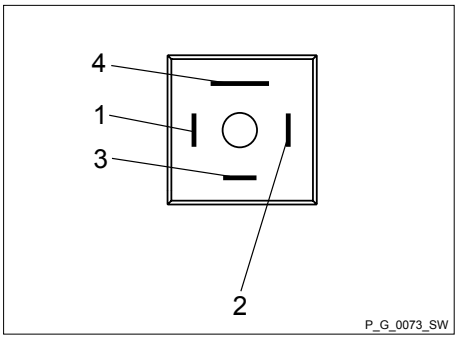
for fault indicating relay output:

Data	Value	Unit
Maximum contact load at 24 V and 50/60 Hz:	2	A
Minimum mechanical service life:	20,000,000	switching operations

for semiconductor switch pacing relay:

Data	Value	Unit
Max. residual voltage at $I_{off\ max}$ = 1 µA	0.4	V
Maximum current	100	mA
Maximum voltage	24	VDC
Pacing pulse duration, approx.	100	ms

Identity code 4



To pin	VDE cable	Contact	Relay
1	yellow	N/O (normally open)	other relay
4	green	C (common)	other relay
3	white	N/O (normally open)	Pacing relay
2	brown	C (common)	Pacing relay

Fig. 23: Assignment on pump

9.2.6.4 "Current output plus relay" output (identity code C)

A relay combined with a current output can be ordered as an option. The relay either switches as a fault indicating relay in the event of a fault on the pump and with "Liquid level low 1st stage" warning messages and "Liquid level low 2nd stage" fault messages or is used as a pacing relay.

The behaviour is factory-programmed. If another switching function is desired, the pump can be reprogrammed in the *'Relay'* menu.

The variable to be signalled for the current output can be selected in the *'ANALOG OUTPUT'* menu.

The current output plus relay can be retrofitted and operates once it is plugged into the board.

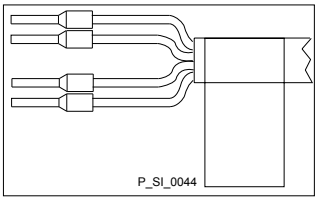


Fig. 24: Assignment on cable

Electrical interface

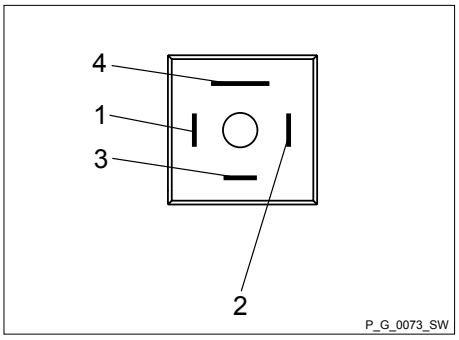
for current output

Data	Value	Unit
Open circuit voltage:	8	V
Current range:	4 ... 20	mA
Ripple, max.:	80	µA ss
Load, max.:	250	Ω

for semiconductor switch ("relay"):

Data	Value	Unit
Max. residual voltage at $I_{off\ max}$ = 1 µA	0.4	V
Maximum current	100	mA
Maximum voltage	24	VDC
Pacing pulse duration, approx.	100	ms

Identity code c



To pin	VDE cable	Contact	Relay
1	yellow	"+"	Current output
4	green	"-"	Current output
3	white	N/C (normally closed) or N/O (normally open)	Relay
2	brown	C (common)	Relay

Fig. 25: Assignment on pump

10 Basic set-up principles

- *Please also refer to all the overviews covering "Operating/set-up overview" and "Operating menu for DULCO flex Control, complete" in the appendix and the "Overview of equipment and control elements" and "Control elements" chapters.*
- *The pump exits the menu and returns to a continuous display if [Menu] is pressed or no key is pressed for 60 seconds.*

10.1 Basic principles for setting up the control

Fig. 26: Please read

Fig. 27 shows using the "Language" example how to set up something - in turn:

- Sequence of displays
- The path derived from this
- The path as presented in the operating instructions

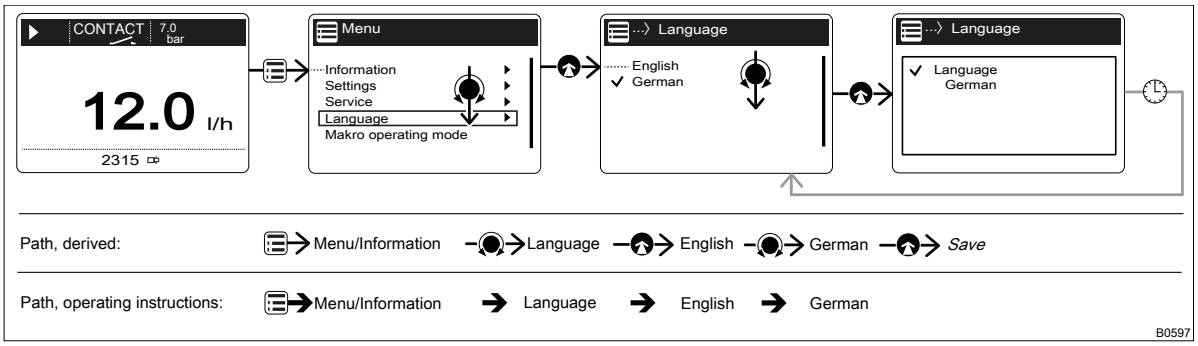


Fig. 27: "Setting up the language": As an example of set-up and path displays

Tab. 7: Legend:

Symbol	Explanation
	Press *[Menu]*
	Turn the *[Clickwheel]*
	Press the *[Clickwheel]*

"Setting up the language" in detail

1. To access the *'Menu'*: press the *[Menu]* key.
   ⇨ The cursor immediately points to *'Information'*.
2. To switch from *'Information'* to *'Language'*: turn the *[Clickwheel]*.
3. To return to the *'Language'* menu: press the *[Clickwheel]*.
   ⇨ The cursor points to a language.
4. To switch to *'Deutsch'*: turn the *[Clickwheel]*.
5. To save: press the *[Clickwheel]*.
   ⇨ The software shows a display by way of confirmation.
   After 2 seconds, it returns to the higher-level *'Menu'*.
6. To complete the setting: press *[]* Menu.
   Alternatively: wait 60 seconds or exit the *'Menu'* via the *[Menu]* key or using *'End'*.

Confirming an entry

Briefly press the *[Clickwheel]*.

⇨ The software switches to the next menu point or back to the menu and saves the entry.

Exiting a menu option without confirming it

Press *[Back]*.

⇨ The software switches to the next menu point or back to the menu without saving anything.

Returning to a continuous display

Press *[Menu]*.

⇨ The software cancels the entry and switches to a continuous display without saving anything.

Changing adjustable variables

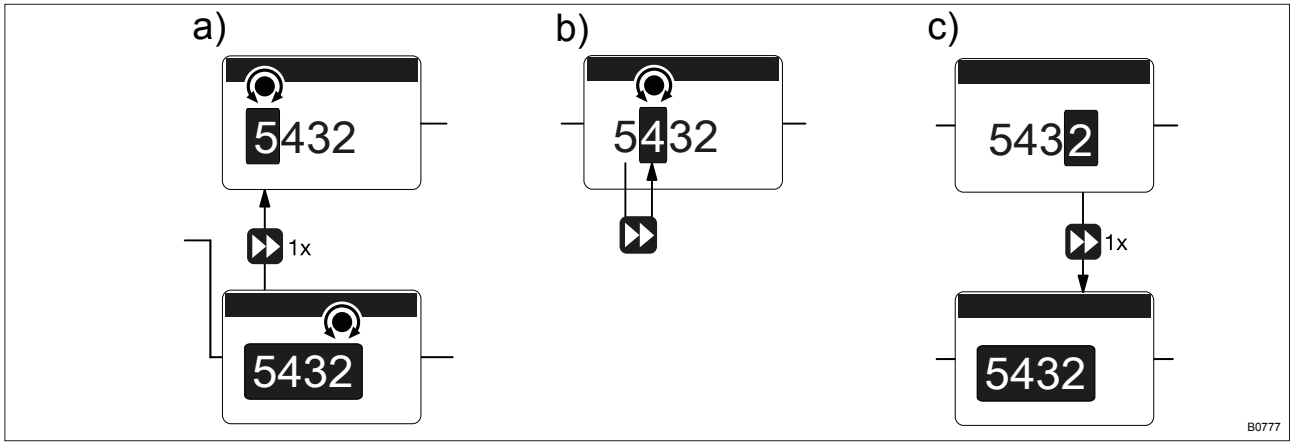


Fig. 28: a) Changing from one figure to its initial figures; b) Changing the figure; c) Returning from the last figure to the (complete) figure (to correct a wrong figure, for example).

Changing a (complete) number

Turn the *[Clickwheel]*.

⇨ The value of the figure highlighted is raised or lowered.

Changing figures

1. To adjust the value of a figure digit-by-digit, press *[Priming]*.

   ⇨ The first figure is highlighted - see Figure above, point a)

2. To adjust the value of a figure, turn the *[Clickwheel]*.
3. To move to the next figure, press *[Priming]* - see above Figure, point b).
4. To run through the figures again, if necessary (possibly because of an incorrect figure), when you get to the last figure press *[Priming]* again - see above Figure, point c).

   ⇨ Now you can start from the beginning again.

Confirming adjustable variables

Press the *[Clickwheel]* 1x.

⇨ The software saves the entry.

10.2 Checking adjustable variables

Continuous displays

Before adjusting the pump, you can check the current settings of the adjustable variables:

Simply turn the *[Clickwheel]* if the pump is showing a continuous display.

⇨ Each time the *[Clickwheel]* engages when you turn it, you will see a different continuous display.

The number of continuous displays depends on the identity code, the selected operating mode and the connected additional devices – see overview of "Continuous displays" in the appendix.

Secondary displays

The lowest line of a continuous display shows different information (which cannot be adjusted in the secondary display) - see "Continuous displays and secondary displays" overview in the appendix.

You can access secondary displays via any continuous display as follows:

1. Press the *[Clickwheel]* for 3 seconds.

   ⇨ A frame appears around the secondary display.

2. Providing there is a frame, you will see a different secondary display each time the *[Clickwheel]* engages when turned.

   When you reach the secondary display you wish, leave the *[Clickwheel]* and wait briefly.

10.3 Changing to Setting mode

In a continuous display, if you press *'Menu'*, the pump in Setting mode changes to *'Menu'*. For more information refer to the following chapter entitled "Set up / Menu".

If under *'Access protect.'* only *'Menu'* or *'All'* has been set up (top right lock symbol), then after pressing the *[Clickwheel]*, first enter the *'Password'*.

11 Initial commissioning

User qualification: Technical personnel and service - see *'Qualification of personnel' on page 12*

WARNING!
The rotating rotor may catch and trap body parts.
– Only use the pump hose in the dosing head as outlined in the instructions provided below.

The user should only now install the rotor half supplied - this will extend the bearing service life of the pump hose.

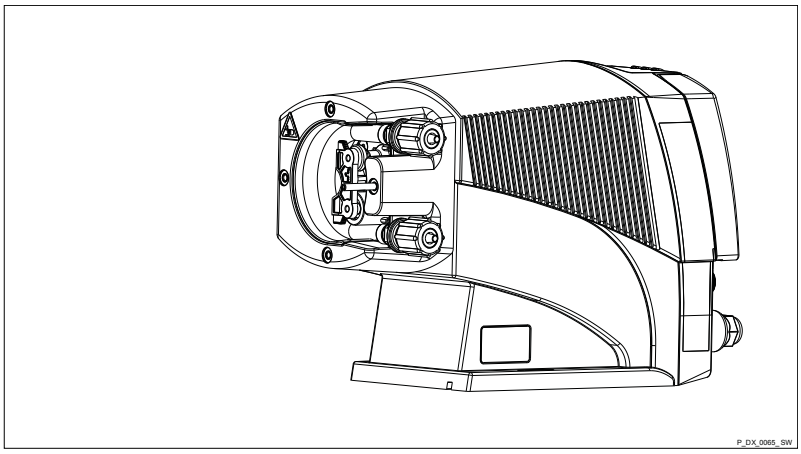
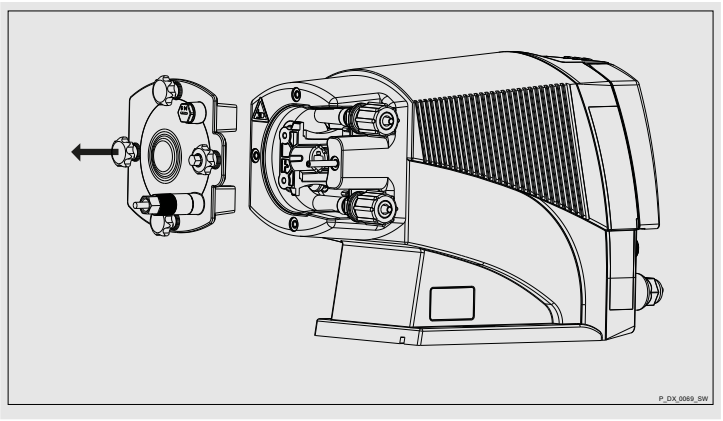


Fig. 29: Starting state of rotor (bearing cover not shown)

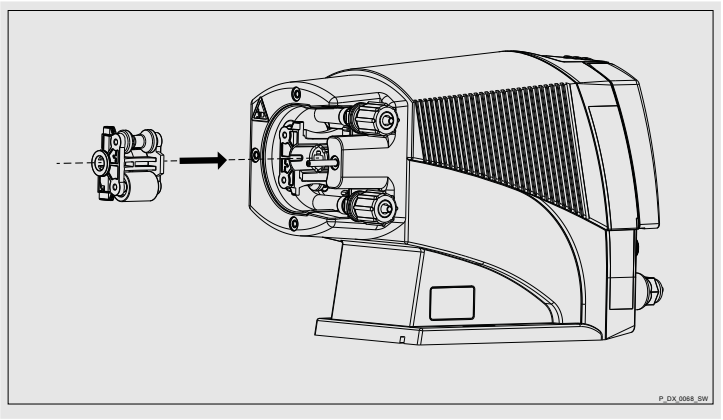
1. If still necessary: Press *[STOP/START]* to bring the pump to a stop (manually).
2. Go to ➔ *'Hose replacement'* menu - used here to fit the hose.
   ⇨ *'Go to change position?'* appears.

WARNING!
The rotating rotor may catch and trap body parts.
– Only take off bearing cover once the pump prompts you to do so.
– Refit bearing cover once prompted to do so by the operating instructions.

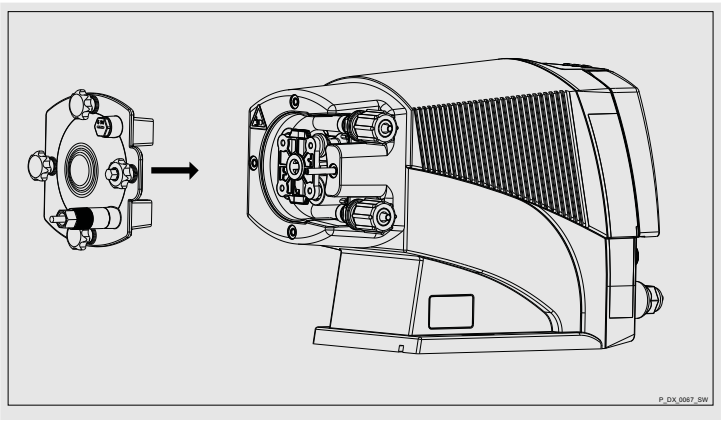
3. Confirm the question with *'Yes'*.
   ⇨ The rotor turns slowly and the following appears:
   ' Please wait... '.
   The rotor stops and *'Please remove cover and take out the Rotor!'* appears.

4. 

Loosen 4 star screws on dosing head and remove with bearing cover.

5. 

Insert the rotor half supplied.

6. 

If the surfaces of the two rotor halves are perfectly flush, place bearing cover on dosing head.

7. Initially only loosely screw all 4 star screws into dosing head.

8. Manually tighten the 4 star screws. The domed nut must again be screwed onto the 4th star screw and tightened to provide a locking function.

9. Press the Clickwheel.

⇨ The rotor turns slowly and the following appears:

' Please wait...'.

The rotor stops and *'Please change the tube!'* appears. Please ignore this.

10. Press the Clickwheel

⇨ The rotor turns slowly and the following appears:

' Please wait!' .

The rotor stops and *'Insert rotor again!'* appears. Please ignore this.

11. Press the Clickwheel.

⇨ The rotor turns and the following appears:

'Please wait...' .

The rotor stops - this time standing on its tip - and *'Install Cover again!'* appears. Please ignore this.

12. Press the Clickwheel.

⇨ *'Run in tube?'* appears.

'Yes' | *'No'*

13. Selecting *'No'* exits this macro.

The pump draws in the pump hose (4) if *'Yes'* is selected.

⇨ *'Run in tube...'* appears.

The rotor turns slowly a couple of times.

14. The *'Tube change interval'* menu appears.

In the first *'Revolutions'* menu item, you have the option of extending or shortening the warning time for the next hose replacement. You can do this by changing the *'Revolutions'* - also refer to *'Service ➔ Hose'*.

15. To reset the warning time, press the *[Clickwheel]*.

⇨ *'Reset interval now!'* appears.

16. To complete the hose replacement, press the *[Clickwheel]* again.

⇨ *'Complete!'* and a hand symbol appear. This is a reminder that the pump still needs to be stopped manually. If necessary, now restart the pump using the *[STOP/START]* key.

12 Set up / *'Menu'*

User qualification: Technical personnel and service - see *'Qualification of personnel' on page 12*

- *Refer to all overviews covering "Operating/set up overview" and "Operating menu DULCO flex Control, complete" in the appendix and in the chapters "Overview of equipment" and "Control elements".*
- *The pump exits the menu and returns to a continuous display if [Menu] is pressed or if no key is pressed for 60 seconds.*

The *'Menu'* is sub-divided as follows:

1 - *'Information'*

2 - *'Settings'*

3 - *'Hose replacement'*

4 - *'Timer'*

5 - *'Service'*

6 - *'Language'*

12.1 *'Information'*

→ *'Menu / Information → ...'*

The *'Information'* menu provides information on your pump and certain parameters and counters. The number and type can depend on the pump settings.

12.2 *'Settings'*

→ *'Menu / Information → Settings → ...'*

The *'Settings'* menu generally includes these setting menus:

1 - *'Operating mode'*

2 - *'Dosing direction'*

3 - *'Concentration'*

4 - *'Calibrate'*

5 - *'System'*

6 - *'Inputs/outputs'*

7 - *'Priming time'*

8 - *'Set time'*

9 - *'Date'*

12.2.1 *'Operating mode'*

→ *'Menu / Information → Settings → Operating mode → ...'*

12.2.1.1 *'Manual'*

☰ ➔ *'Menu / Information* ➔ *Settings* ➔ *Operating mode* ➔ *Manual'*

'Manual' operating mode allows you to operate the pump manually.

The capacity can be set in the continuous displays of this operating mode.

12.2.1.2 *'Contact'*

☰ ➔ *'Menu / Information* ➔ *Settings* ➔ *Operating mode* ➔ *Contact* ➔ *...'*

The *'Contact'* operating mode enables you to meter metering volumes, which you can preset.

You can trigger metering via a pulse sent via the "External control" terminal.

The purpose of this operating mode is to convert the incoming pulses into a metering volume, which you can preset.

CAUTION!
The pump maintains the capacity when changing over from *'Manual'* operating mode to *'Contact'* operating mode.

The maximum capacity can be set in 'Contact' operating mode.

Memory - Pulses not yet processed

You can also activate the *'Memory'* function extension ("memory" identifier). When *'Memory'* is activated, the pump adds up the remaining volume, which could not be processed, up to the maximum capacity of the memory of 99,999 l. If this maximum capacity is exceeded, the pump goes into fault mode.

CAUTION!
– Only with *'Memory'* - *'off'*: If you press [STOP/START] *[STOP/START]* or empty the contact memory (*'Menu / Information* ➔ *Service* ➔ *Clear counters'*) or the "Pause" function is activated, the *'Memory'* is cleared.

Contact water meter

Using "Pulse control" you can ideally adapt the pump to the relevant process, for example in conjunction with contact water meters.

12.2.1.3 *'Batch'*

☰ ➔ *'Menu / Information* ➔ *Settings* ➔ *Operating mode* ➔ *Batch* ➔ *...'*

The *'Batch'* operating mode enables you to pre-select large metering volumes or metering times.

You can trigger the metering volume using the *[Clickwheel]* if you have already switched to the *'Push'* continuous display. You can also trigger them via a pulse using the "External control" terminal.

Memory - remaining volume not yet processed

You can also activate the *'Memory'* function extension ("memory" identifier). When *'Memory'* is activated, the pump adds up the remaining volume, which could not be processed, up to the maximum capacity of the memory of 99,999 l. If this maximum capacity is exceeded, the pump goes into fault mode.

CAUTION!

– The pump maintains the capacity when changing over from *'Manual'* operating mode to *'Batch'* operating mode.
– When you press [STOP/START] or the "Pause" function is activated, the *'Memory'* is cleared.

In operation, the batch size can be changed more easily by using the "Batch size" continuous display.

12.2.1.4 *'Analog'* (option)

➔ *'Menu / Information* ➔ *Settings* ➔ *Operating mode* ➔ *Analog* ➔ *...'*

The secondary display "Signal current" indicates the incoming current.

You can select 5 types of current signal processing:

- *'0 - 20 mA'*
- *'4 - 20 mA'*
- *'Linear curve '*
- *'Lower side band'*
- *'Upper side band'*

'0 - 20 mA'

At 0 mA the pump is stationary –

At 20 mA the pump works at maximum speed.

'4 - 20 mA'

At 4 mA the pump is stationary –

At 20 mA the pump works at maximum speed.

With current signals of less than 3.8 mA, an error message appears and the pump stops (e.g. if a cable has broken).

'Linear curve'

The "Linear curve" symbol appears on the LCD screen. You can enter any speed behaviour proportional to the current signal. For this purpose, enter any two points P1 (I1, F1) and P2 (I2, F2) (F1 is the speed at which the pump is to operate at current I1, F2 is the speed at which the pump is to operate at current I2...); this defines a straight line and thus the behaviour is specified:

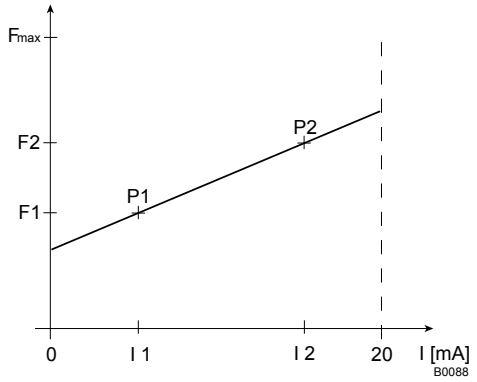


Fig. 30: Speed-current diagram for "Linear curve"

Plot a diagram similar to the one above – with values for (I1, F1) and (I2, F2) – so that you can set the pump as desired!

The smallest processable difference between I1 and I2 is 4 mA (|I1-I2| ≥4 mA).

Error processing

In the *'Error message'* menu item, you can activate error processing for these types of processing.

'Lower side band'

Using this type of processing, you can control a metering pump using the current signal as shown in the diagram below.

However, you can also control two metering pumps for different feed chemicals via a current signal (e.g. one acid pump and one alkali pump using the signal of a pH sensor). To do this, connect the pumps electrically in series.

Error processing

In the *'Error message'* menu item, you can activate error processing for these types of processing.

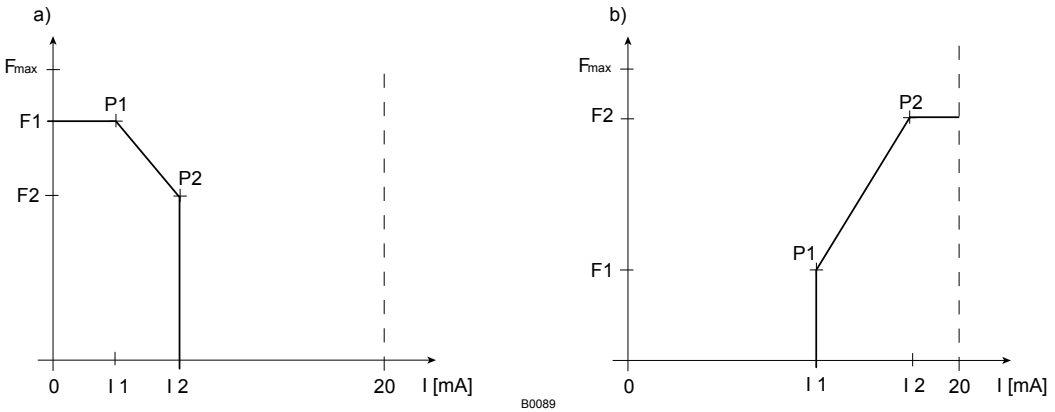


Fig. 31: Speed-current diagram for a) Lower side band, b) Upper side band

'Upper side band'

Using this processing type, you can control a metering pump using the current signal as shown in the diagram above.

Everything functions according to the *'Lower side band'* type of the processing.

12.2.2 Dosing direction

➔ *'Menu / Information ➔ Settings ➔ Dosing direction'*

The *'Dosing direction'* menu enables you to select the pump's dosing direction:

- clockwise
- anti-clockwise

12.2.3 Concentration

➔ *'Menu / Information ➔ Settings ➔ Concentration ➔ ...'*

The desired mass concentration of feed chemical that will subsequently be required in the dissolving medium (e.g. the main flow) can be entered directly in the "Concentration" continuous display.

The principle of entering the concentration:

1. Select the operating mode.
2. Go to *'Set up'- 'Concentration'- 'Concentration control'* and set to *'Active'*.
3. Then set the data required for the feed chemical and dissolving medium.
4. Set the desired concentration in the "Concentration" continuous display.

- *The "Concentration" continuous display only appears, if:*
  - *the pump is calibrated.*
  - *the 'Concentration' menu was run through in the operating mode used.*
  - *and 'Concentration control' was switched to 'active' - in the operating mode being used.*
- *The "Concentration" continuous display switches to the "%" display mode at concentrations above 999.99 ppm.*
- *When changing between operating modes, the pump saves the settings for each operating mode - provided it is connected to supply voltage.*
- *If the pump is to display the concentration as a volume concentration, enter "1.00" kg/l for the density of the feed chemical.*

12.2.3.1 *'Manual'* operating mode (settings for the *'Concentration'* function)

➔ *'Menu / Information ➔ Settings ➔ Concentration ➔ Concentration control ➔ Flow of main medium ➔ ...'*

The "Concentration input" in *'Manual'* operating mode is intended for metering a substance into pipework containing a medium flowing at a constant rate (*'main flow'*) in such a way that it has a specific mass concentration in the flow.

CAUTION!
Danger of concentrations being too high
The metering pump can continue to meter if the flow falls or stops entirely.

– Take system-based precautions to prevent the metering pump from continuing to meter in these circumstances.

The prerequisites are that:

- the flowing medium has the same density as water (1 kg/l ≙ g/cm³)
- the mass concentration of the feed chemical is known - see the feed chemical safety data sheet (e.g. with 35% sulfuric acid: 35 %)
- the density of the feed chemical is known - see the feed chemical safety data sheet (e.g. with 35% sulfuric acid: 1.26 kg/l ≙ g/cm³)
- The measurement unit for the liquid volume is set in the *'System* ➔ *Volume unit'* menu.

Procedure

CAUTION!
The precision of the concentration is strongly dependent on:

– the precision of the metering pump calibration.
– the precision of the inputs.

1. Calibrate the metering pump if it is not yet calibrated - see chapter *'Set up'*- *'Calibration'* chapter.
2. Select *'Manual'* - *'Operating mode'* (settings potentially configured in other operating modes remain saved).
3. Select *'Concentration'* in the *'Set up'* menu.
4. Set *'active'* in the *'Concentration control'* menu item and press the *[Clickwheel]*.
5. Set the *'Main medium flow'* (in the pipework) and then press the *[Clickwheel]*.
6. Set the *'Feed chemical mass concentration'* and press the *[Clickwheel]*.
7. Set the (mass) *'Feed chemical density'* and press the *[Clickwheel]*.
   ⇨ The *'Concentration'* menu appears.
8. Press *[Menu]*.
   ⇨ A continuous display appears.
9. Turn the *[Clickwheel]* to go to the "Concentration" continuous display (ppm or %).
10. Enter the required mass concentration of feed chemical in the main flow by pressing and turning the *[Clickwheel]*.

Tab. 8: Possible values of adjustable variables

Adjustable variable	Lower value	Upper value	Increment
Flow in m³/h	0000.1	9999.9	0000.1
Mass concentration in %	000.01	100.00	000.01
Mass density in kg/l	0.50	2.00	0.01

12.2.3.2 *'Contact'* operating mode (settings for *'Concentration'* function)

☰ ➔ *'Menu / Information* ➔ *Settings* ➔ *Concentration* ➔ *Concentration control* ➔ *Contact distance* ➔ *...'*

The "Concentration input" in *'CONTACT'* operating mode is intended for metering a substance into pipework containing a medium flowing at a variable rate in such a way that there is a specific mass concentration in the flow.

CAUTION!
Danger of concentrations being too high
The metering pump can continue to meter if the flow falls or stops entirely.

– Take system-based precautions to prevent the metering pump from continuing to meter in these circumstances.

The prerequisites are that:

- the flowing medium has the same density as water (1 kg/l ≙ g/cm^3)
- the mass concentration of the feed chemical is known - see the feed chemical safety data sheet (e.g. with 35% sulfuric acid: 35 %)
- the density of the feed chemical is known - see the feed chemical safety data sheet (e.g. with 35% sulfuric acid: 1.26 kg/l ≙ g/cm^3)
- a contact water meter is hydraulically installed and connected to the external input of the metering pump.
- The measurement unit for the liquid volume is set in the *'System* ➔ *Volume unit'* menu.

Procedure

CAUTION!
The precision of the concentration is strongly dependent on:

– the precision of the metering pump calibration.
– the precision of the inputs.

1. Calibrate the metering pump if it is not yet calibrated - see chapter *'Set up'- 'Calibration'* chapter.
2. Select *'Contact'* - *'Operating mode'* and simply confirm the associated menu items with the *[Clickwheel]* (settings potentially configured in other operating modes remain saved).
3. Select *'Concentration'* in the *'Set up'* menu.
4. Set *'active'* in the *'Concentration control'* menu item and press the *[Clickwheel]*.
5. Set the *'Contact distance'* and press the *[Clickwheel]*.
6. Set the (mass) *'Feed chemical concentration'* and press the *[Clickwheel]*.
7. Set the (mass) *'Density dosing medium'* and press the *[Clickwheel]*.
   ⇨ The *'Concentration'* menu appears.
8. Press *[Menu]* ☰.
   ⇨ A continuous display appears.
9. Turn the *[Clickwheel]* to go to the "Concentration" continuous display (ppm or %).
10. You can enter the desired mass concentration using the *[Clickwheel]*.

Tab. 9: Possible values of adjustable variables

Adjustable variable	Lower value	Upper value	Increment
Contact distance in l/contact	000.10	999.99	000.01
Mass concentration in %	000.01	100.00	000.01
Mass density in kg/l	0.50	2.00	0.01

12.2.3.3 *'Batch'* operating mode (settings for the *'Concentration'* function)

☰ ➔ *'Menu / Information* ➔ *Settings* ➔ *Concentration* ➔ *Concentration control* ➔ *Volume main medium* ➔ *...'*

The "Concentration input" in *'Batch'* operating mode is intended for metering a substance into the medium in a storage tank so that there is then a defined mass concentration in the storage tank (when batching a solution – do not forget to stir!).

The prerequisites are that:

- the medium in the storage tank has the same mass density as water (1 kg/l ≙ g/cm³)
- the mass concentration of the feed chemical is known - see the feed chemical safety data sheet (e.g. with 35% sulfuric acid: 35 %)
- the density of the feed chemical is known - see the feed chemical safety data sheet (e.g. with 35% sulfuric acid: 1.26 kg/l ≙ g/cm³)
- The measurement unit for the liquid volume is set in the *'System* ➔ *Volume unit'* menu.

Procedure

CAUTION!
The precision of the concentration is strongly dependent on:
– the precision of the metering pump calibration.
– the precision of the inputs.

1. Calibrate the metering pump if it is not yet calibrated - see *'Set up'*- *'Calibration'* chapter.
2. Select *'Batch'* - *'Operating mode'* and simply confirm the associated menu items with the *[Clickwheel]* (settings potentially configured in other operating modes remain saved).
3. Select *'Concentration'* in the *'Set up'* menu.
4. Set *'active'* in the *'Concentration control'* menu item and press the *[Clickwheel]*.
5. Set the *'Volume main medium'* of the medium in the storage tank and press the *[Clickwheel]*.
6. Set the (mass) *'Feed chemical concentration'* and press the *[Clickwheel]*.
7. Set the (mass) *'Feed chemical density'* and press the *[Clickwheel]*.
   ⇨ The *'Concentration'* menu appears.
8. Press *[Menu]* ☰.
   ⇨ A continuous display appears.
9. Turn the *[Clickwheel]* to go to the "Concentration" continuous display (ppm or %).
10. You can enter the desired mass concentration using the *[Clickwheel]*.

Tab. 10: Possible values of adjustable variables

Adjustable variable	Lower value	Upper value	Increment
Volume in l	0000.1	9999.9	0000.1
Mass concentration in %	000.01	100.00	000.01
Mass density in kg/l	0.50	2.00	0.01

12.2.3.4 *'Analog'* operating mode (settings for the *'Concentration'* function)

☰ ➔ *'Menu / Information* ➔ *Settings* ➔ *Concentration* ➔ *Concentration control* ➔ *Max.throughput main medium* ➔ *...'*

The "Concentration input" in *'Analog'* operating mode is intended for metering a substance into pipework containing a medium flowing at a variable rate in such a way that there is a specific mass concentration in the flow.

CAUTION!

Danger of concentrations being too high

The metering pump can continue to meter if the flow falls or stops entirely.

– Take system-based precautions to prevent the metering pump from continuing to meter in these circumstances.

CAUTION!

Risk of incorrect concentrations

– After adjusting, check whether the concentrations at various flows correspond to the desired result.

The prerequisites are that:

- the flowing medium has the same density as water (1 kg/l ≙ g/cm³)
- the mass concentration of the feed chemical is known - see the feed chemical safety data sheet (e.g. with 35% sulfuric acid: 35 %)
- the density of the feed chemical is known - see the feed chemical safety data sheet (e.g. with 35% sulfuric acid: 1.26 kg/l ≙ g/cm³)
- a flow meter with analogue output is hydraulically installed and connected to the external input of the metering pump.
- The measurement unit for the liquid volume is set in the *'System* ➔ *Volume unit'* menu.

Procedure

CAUTION!

The precision of the concentration is strongly dependent on:

– the precision of the metering pump calibration.
– the precision of the inputs.

1. Calibrate the metering pump if it is not yet calibrated - see chapter *'Set up'- 'Calibration'* chapter.
2. Check whether the metering pump is set to *'Automatic'* - *'on'* metering mode.
3. Select *'Analog'* operating mode and confirm with the *[Clickwheel]*.
4. Set *'0...20 mA'* or *'4..20 mA'* in the *'Select analog'* menu item and press the *[Clickwheel]*.

5. Select *'Concentration'* in the *'Set up'* menu.
6. Set *'active'* in the *'Concentration control'* menu item and press the *[Clickwheel]*.
7. Set the *'Max.throughput main medium'* (in the pipework) and press the *[Clickwheel]*. (It is then assigned to the current value of 20 mA.)
8. Set the (mass) *'Feed chemical concentration'* and press the *[Clickwheel]*.
9. Set the (mass) *'Feed chemical density'* and press the *[Clickwheel]*.

   ⇨ The *'Concentration'* menu appears.
10. Press *[Menu]*.

    ⇨ A continuous display appears.
11. Turn the *[Clickwheel]* to go to the "Concentration" continuous display (ppm or %).
12. You can enter the desired mass concentration using the *[Clickwheel]*.

CAUTION!
- Note the decimal point.
- The mass concentration is affected by changes to the capacity.
- The pump limits the upper value for the mass concentration, because otherwise the incremental jumps when adjusting would be unacceptably large.

The least significant figures of the value in the continuous display cannot be changed at will using the [Arrow keys], rather only in incremental jumps resulting from the input data.

If necessary, change the capacity and adjust the concentration; as you do this, the pump compensates via the speed.

Tab. 11: Possible values of adjustable variables

Adjustable variable	Lower value	Upper value	Increment
Max. flow in m^3/h	0000.1	9999.9	0000.1
Mass concentration in %	000.01	100.00	000.01
Mass density in kg/l	0.50	2.00	0.01

12.2.4 Calibrate

☰ ➔ *'Menu / Information* ➔ *Settings* ➔ *Calibration* ➔ *...'*

Accuracy of calibration

Normally the pump does not have to be calibrated.

However, the pump can be calibrated if viscous feed chemicals are used or extremely high accuracy is required.

There are 2 options for calibrating the pump:

- Calibrate using *'Calibr. factor'*
- *'Calibrate'* using a calibration procedure

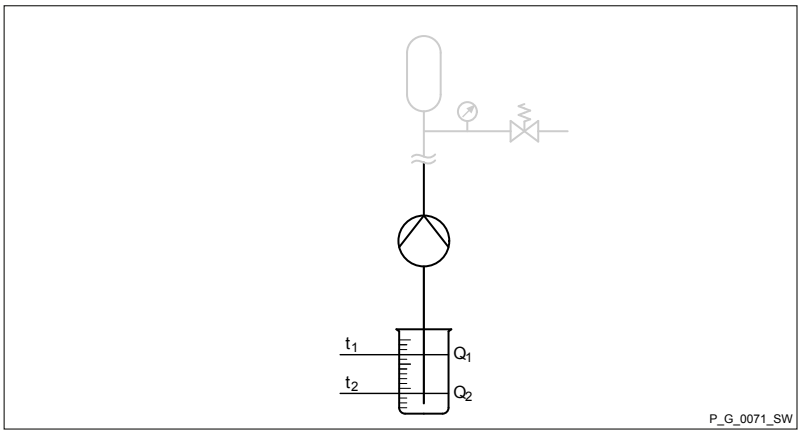
12.2.4.1 Calibrate using calibr. factor

If you already know what calibration factor is needed for the pump to achieve the desired accuracy, go to *'Calibrate'* - *'Calibr. factor'* and enter the appropriate calibration factor as a %.

12.2.4.2 Calibrate using a calibration procedure

If you don't know which calibration factor you need, use this calibration procedure.

WARNING!
If the feed chemical is hazardous, take appropriate safety precautions when performing the following calibration instructions. Observe the material safety data sheet for the feed chemical!



Preparation

1. Use the *[Clickwheel]* to scroll through the continuous displays to check whether litres or gallons have been selected.
2. If the incorrect volume unit has been selected, correct it in the *'Menu / Information* ➔ *Settings* ➔ *System* ➔ *Volume unit'* menu.
3. Check whether the capacity in the continuous display is not too low for calibration.
4. Lead the suction hose into a measuring cylinder containing the feed chemical – make sure that the discharge hose is installed permanently (operating pressure, ...!).
5. Prime the feed chemical (press ⏭) *[Priming]*) if the suction hose is empty.

Calibration procedure

1. Record the level in the measuring cylinder.
2. Select the *'Menu / Information* ➔ *Settings* ➔ *Calibrate'* ' menu and press the *[Clickwheel]*.
   ⇨ The *'Start calibration'* (PUSH) menu item appears.
3. To start calibration, press the *[Clickwheel]*.
   ⇨ The *'Calibrate ...'* menu item appears, the pump starts to pump and indicates the number of revolutions.

4. After a reasonable number of revolutions (a minimum of 200), use the *[Clickwheel]* to stop the pump.

   ⇨ The *'Calibrate ended'* menu item appears. It asks you to enter the calibration volume.

5. Determine the required metering volume (difference between initial volume - remaining volume in the measuring cylinder).

6. Use the *[Clickwheel]* to enter this volume in the *'Calibrate ended'* menu item and close.

   ⇨ The pump switches to the *'Calibration result'* menu item - the pump is calibrated.

7. Press the *[Clickwheel]*.

   ⇨ The pump returns to the *'Menu / Information ➔ Settings'* menu.

12.2.5 System

☰ ➔ *'Menu / Information ➔ Settings ➔ System ➔ ...'*

The *'System'* menu is split into the following sub-menus:

2 - *'Configure dosing head'*

3 - *'Volume unit'*

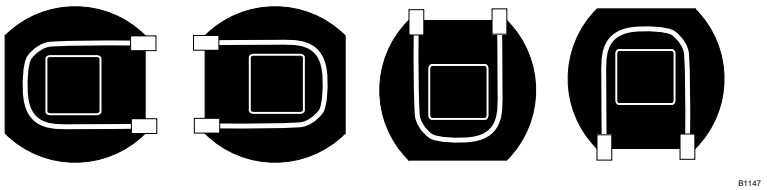
4 - *'Start behaviour'*

12.2.5.1 *'Configure dosing head'*

☰ ➔ *'Menu / Information ➔ Settings ➔ System ➔ Configure dosing head ➔ ...'*

In the *'Configure dosing head'* menu, you have to set the dosing head's position for if you have turned it

because you can turn the dosing head as follows:



CAUTION!
Whenever the dosing head's alignment has been changed, the new alignment must be correctly stated otherwise the *'Tube Service'* will no longer work properly.

12.2.5.2 Volume unit

☰ ➔ *'Menu / Information ➔ Settings ➔ System ➔ Volume unit ➔ ...'*

You can select another unit for the volume in the *'Volume unit'* sub-menu.

12.2.5.3 Start behaviour

➔ *'Menu / Information ➔ Settings ➔ System ➔ Start behaviour ➔ ...'*

You can specify the start behaviour of the pump once the supply voltage has been switched on in the *'Behaviour on start'* sub-menu.

Start behaviour	Description
'always STOP'	The pump always wakes up in “Manual stop via the [STOP/START] key" mode. It can only be started by pressing [STOP/START].
'always on'	The pump always starts immediately.
'last status'	The pump always adopts the last status it had before the supply voltage was switched off.

12.2.6 Inputs/outputs

➔ *'Menu / Information ➔ Settings ➔ Inputs/outputs ➔ ...'*

The *'Inputs/outputs'* menu is split into the following sub-menus:

1 - *'Auxiliary capacity'*

2 - *'Relay1'* (option)

3 - *'Relay2'* (option)

4 - *'mA-Output'* (option)

7 - *'Pause input'* (option)

6 - *'Level monitoring'*

12.2.6.1 *'Auxiliary capacity'*

➔ *'Menu / Information ➔ Settings ➔ Inputs/outputs ➔ Auxiliary capacity ➔ ...'*

The programmable *'Auxiliary capacity'* function enables the pump to be switched over to an additional capacity that can be fixed in the *'Auxiliary capacity'* menu.

It can be activated via the "External control" terminal. If *'Auxiliary capacity'* is being used, then the "AUX” identifier appears on the LCD screen.

Refer to the "Hierarchy of Operating Modes, Functions and Fault Statuses" for the order of the various operating modes, functions and fault statuses.

12.2.6.2 *'Relay1 (option)'*

➔ *'Menu / Information ➔ Settings ➔ Inputs/outputs ➔ Relay1 ➔ ...'*

The setting options for the 'Relay' function only exist if a relay is fitted.

DULCO flex Control, DFXa

Tab. 12: Relay, physical and pre-set to ...

Identity code specification	Relay, physical	Pre-set to ...
1	1 x changeover contact 230 V – 8 A	Fault indicating relay, N/C
4	2 x N/O 24 V – 100 mA	Fault indicating relay, N/C, and pacing relay
C	1 x N/O 24 V – 100 mA, + 4...20 mA output	Fault indicating relay, N/C

Relay type

You can reprogram the relays to these types:

Menu setting	Effect
Timer	The relay is available for the timer.
Fault	The relay switches in the event of a fault message (red LED*).
Warning	The relay switches in the event of a warning message (yellow LED*).
Warning + error	The relay switches in the event of a warning message (yellow LED*) or a fault message (red LED*).
Warning + error + stop	The relay switches in the event of a warning message (yellow LED*) or a fault message (red LED*) or a stop.
Pump active	The relay switches as soon as the pump is in standby and not in a state like *'Pause'*.
Speed	The relay switches with every revolutions.
Metering / Batch	The relay changes its state as soon as a metering volume / batch is being processed.

* see the "Troubleshooting" chapter

Relay polarity

You can set here how a relay is to switch.

Menu setting	Effect
normally-closed (NC)	The relay is closed in normal mode and opens with a triggering event.
normally-open (NO)	The relay is open in normal mode and opens with a triggering event.

12.2.6.3 *'Relay2 (option)'*

☰ ➔ *'Menu / Information ➔ Settings ➔ Inputs/outputs ➔ Relay2 ➔ ...'*

For more information on *'Relay2'* - see ↳ *Chapter 12.2.6 'Inputs/outputs' on page 57*.

12.2.6.4 *'mA-Output (option)'*

☰ ➔ *'Menu / Information ➔ Settings ➔ Inputs/outputs ➔ mA-Output ➔ ...'*

You can set which current range is to be used at the mA output here.

You can then set whether, for example, the current capacity (litres / hour) is to be signalled at the mA output and set the desired value for 20 mA.

You can also set the state which the mA output is to signal at 23 mA:

- Passive
- Fault
- Warning
- Warning + error
- Warning + error + stop

12.2.6.5 *'Pause input'*

☰ ➔ *'Settings ➔ Inputs/outputs ➔ Pause ➔ ...'*

In the *'Pause'* menu, you can select whether the pump switches to *'Pause'* with a *'normally-open'* (NO) or *'normally-closed'* (NC) input contact signal.

12.2.6.6 *'Level monitoring'*

☰ ➔ *'Settings ➔ Inputs/outputs ➔ Level monitoring ➔ ...'*

In the *'Level monitoring'* menu, you can select whether the pump is to run with standard 2-stage level monitoring or a continuous form.

12.2.7 *'Priming time'*

☰ ➔ *'Menu / Information ➔ Settings ➔ Priming time ➔ ...'*

In the *'Priming time'* menu, you can select how long the metering pump is to prime once ⏭ *[Priming]* has been pressed.

12.2.8 *'Set time'*

☰ ➔ *'Menu / Information ➔ Settings ➔ Set time ➔ ...'*

You can set the time in the *'Set time'* menu.

1. Use the dial to adjust a figure.
2. Use ⏭) *[Priming]* to move to the next figure.

Under *'Auto. Summertime'* you can select whether you wish to change over to *'Summertime'*.

You can also state when the pump is to change to and from *'Summertime'*.

Check under *'Location'* whether the pump is also set to your *'hemisphere'* of the world.

12.2.9 *'Date'*

☰➔ *'Menu / Information ➔ Settings ➔ Date ➔ ...'*

You can set the date in the *'Date'* menu.

12.3 *'Hose replacement'*

☰➔ *'Menu / Information ➔ Service ➔ Hose replacement ➔ ...'*

This menu only appears once a manual stop has been performed using [STOP/START].

Here you can replace a hose following the guidance provided. For the detailed description - see *Chapter 15.1 'Replacing pump hose' on page 86*

12.4 Timer

☰➔ *'Menu / Information ➔ Timer ➔ ...'*

– *Please first read this chapter to get an overview. You will then understand the timer better when working through the chapter.*

The timer DULCO flex Control can do the following at predefined times and intervals or event-dependent:

- open / close the relays
- switch the level of a Config I/O output
- be triggered by the level at a Config I/O input
- start a delayer
- switch operating mode
- allow the pump to work at a defined capacity
- stop / start the pump
- trigger a batch (*'Batch (time)'*)

12.4.1 Activation / deactivation

☰➔ *'Menu / Information ➔ Timer ➔ Activation ➔ ...'*

You can only program the timer when 'Activation' is set to 'inactive'.

To program the timer, set *'Activation'* to *'inactive'*.

⇨ The first line of the timer menu *'Timer status'* then shows *'Inactive'*.

To activate the timer, set *'Activation'* to *'active'*.

⇨ The first line of the timer menu *'Timer status'* then displays *'active'*.

The timer starts working - the timer identifier ◷ is visible in the continuous display.

When 'Activation' is set to 'active', the timer software generates the state of the pump which the pump would have precisely had at this time if it had been set to 'active' without any interruption.

Delayed, linked actions are unaffected by this.

12.4.2 Setting the timer

'Menu / Information ➔ Timer ➔ Set timer ➔ ...'

You can create commands (also known as "program lines") for a timer program in the *'Set timer'* menu.

You can create up to 99 commands (program lines).

Create the command as follows:

1 - Create a *'new'* command (program line)

2 - Select the *'Triggering event'* (trigger) and the time and/or interval if necessary

3 - Select *'Action'* and a value, if necessary

4 - Check the command

5 - Create the next command – if necessary

The following administration functions are available to manage the commands (program lines):

1 - Reprogram program line (*'New'*)

2 - Check program line (*'Show'*)

3 - Change program line (*'Change'*)

4 - Delete individual program line (*'Delete'*)

(5 - Delete the entire program (*'Clear all'* one level higher))

CAUTION!

The pump does not perform any plausibility check.

Please ensure before using that the timer actually does what you expect of it. Please consider the consequences for your system.

CAUTION!

If you wish to use automatic summer time adjustment (*'Settings'* - *'Time'*) avoid any triggering events between 02:00 a.m. and 03:00 a.m.

Restriction with day numbers

If you wish to start an action of a certain day of each month, note that the timer only permits days 01 - 28.

Using Config I/Os

If you wish to use Config I/Os as inputs or outputs, you first need to configure them as a 'Timer input' or 'Timer output' under 'Menu / Information ➔ Settings ➔ Config I/Os ➔ ...'.

12.4.2.1 Reprogram program line (*'new'*)

CAUTION!

If the *'Timer status'* is set to *'active'*, the pump can neither be set nor programmed!

To do so, set the *'Timer status'* under *'Activation'* to *'inactive'*.

12.4.2.1.1 Principle design of a program line

In principle, an (imaginary) program line / instruction is set up as follows:

Time event (trigger)		Action	
workdays 1 (Mo-Fr)	Time of day 12:00	Manual	20.00 l/h

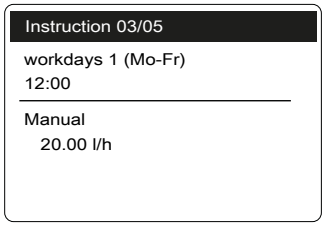
This corresponds to the following instruction:

```
WHEN triggering event, THEN action
```

The **time event (trigger)** defines what action or at what time an action is to take place.

The **action** defines which type of action is to take place.

The finished program line/ instruction looks like this:



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Example

Time event (trigger)		Action	
workdays 1 (Mo-Fr)	Time of day 12:00	Manual	20.00 l/h

The example means:

When it is 12:00 on a workday, then the pump is to work in *'Manual'* mode at 20.00 l/h.

Tab. 13: Time events (triggers)

Time events (triggers)	Description	Remark
Time	Switching time reached	For more information - see *Chapter 12.4.2.1.3 'Selecting time events and switching point' on page 64*
'Init'	Thus declared is started at the beginning of the program process	Defined starting conditions - see *Chapter 12.4.2.1.2 ' 'Init' Initial conditions' on page 64*
'Delayer'	Delay time of delayer D: xx expired	-
' Config I/O' input	0/1 contact at input I: x	Connector pins on the very left of the pump *

*refer to "Overview of equipment" chapter

The *' Config I/O'* inputs first need to be assigned to the timer under *'Menu / Information ➔ Settings ➔ Config I/Os ➔ ...'*.

You can select an action and also a value:

Tab. 14: Action

Action	Description	Value
'Manual'	Switch over in this operating mode	Litre/h (*'Capacity'*)
'Stop'	Stop pump	--
*'Relay 1 **'*	Have the relay switch to status ...	open closed
*'Relay 2 **'*	Have the relay switch to status ...	open closed
'Contact'	Switch over in this operating mode	--
'Batch (input)'	Switch over in this operating mode	--
'Analogue'	Switch over in this operating mode	--
' Start delayer'	Activate a delayer	
'Config I/O 1'	Switch the level of the Config I/O 1 output to ...	open closed
'Config I/O 2'	Switch the level of the Config I/O 2 output to ...	open closed
'Config I/O 3'	Switch the level of the Config I/O 3 output to ...	open closed

* refer to the "Overview of equipment" chapter and *'Menu / Information ➔ Settings ➔ Config I/Os ➔ ...'*

** Option; needs to be assigned to the *'Timer'* (under *'Settings ➔ Inputs/Outputs ➔ Relay ➔ Relay type'* - refer to this chapter of the operating instructions under *'Settings'*)

Tab. 15: Selected value ranges

Description	Value range
Line numbers	01 ... 99
Day (date)	01 ... 28
Time of day (hours)	00 ... 23

Description	Value range
seconds	0001 ... 9999
No. of delayer D:	01 ... 15

12.4.2.1.2 *'Init'* Initial conditions

Using the triggering event *'Init'* initial conditions can be set at the beginning of a program sequence.

Example

triggering event (trigger)		Action	
Init	-	Relay 2	closed
Init	-	Contact	-

The example means:

As soon as the programme is started (via *'Timer* ➔ *Activation* ➔ *active'* or mains voltage on), *'Init'* sets *'Relay 2'* to *'closed'* and the *'Operating mode'* to *'Contact'*.

12.4.2.1.3 Selecting time events and switching point

The cyclic time events periodically trigger actions. That is why a program line consists of a cycle and a switching point.

The **cycle** specifies after which time the action is to be repeated.

The **switching time** specifies when the action is to take place.

Example

Time events (triggers)		Action
Cycle	Switching time	
workdays 1 (Mo-Fr)	Time of day 12:00	Manual

Tab. 16: Cyclic time events

Cycle	Time
'hourly'	hourly at mm Minute
'daily'	daily at the time mm.ss, Monday to Sunday
'workdays 1 (Mo-Fr)'	daily at the time mm.ss, Monday to Friday
'workdays 2 (Mo-Sa)'	daily at the time mm.ss, Monday to Saturday
'Weekend (Sa+Su)'	daily at the time mm.ss, Saturday and Sunday
'weekly'	weekly at the time mm.ss on day xxxxxx.
'monthly'	monthly at the time mm.ss on the day dd. Day* of the month

* Value range is restricted to 01 to 28 days.

CAUTION!
If you wish to use automatic summer time adjustment (*'Settings'* - *'Time'*) avoid in principle any time events between 02:00 and 03:00.

A time event lets you trigger an action precisely to the minute.

If the action is to be triggered precisely to the second, then you need to set up your programming on a delayer.

12.4.2.1.4 Delayer

A delayer allows you to delay an action with regard to a time event (trigger).

Delayers can be both time events and also actions.

Example of a program

No.	Time event (trigger)		Action	
01	Config I/O 1	close	Start Delayer 1	-
02	Config I/O 1	close	Start Delayer 2	-
03	Config I/O 1	close	Start Delayer 3	-
04	Init	-	Stop	-
05	Delayer 1	after 60 sec	Config I/O 2	close
06	Delayer 2	after 120 sec	Manual	10 l/h
07	Delayer 3	after 180 sec	Stop	-
08	Delayer 3	after 180 sec	Config I/O 2	open

The example means:

A flank at *'Config I/O 1'* means that ...: :

- after 60 s output *'Config I/O 2'* is closed,
- after a further 60 s, the pump pumps in *'Manual'* operating mode at 10 l/h,
- stops after a further 60 s and output *'Config I/O 2'* opens again.

A program line with a time event *'Delayer'* X thus also includes the element *'Delay time'*.

The *'Delay time'* specifies by which time the start of the selected action is to be delayed (1 s 9,999 s = approx. 2 h 45 min).

The delayer itself must first have been called up by a time event as an action. You can use 15 different delayers.

- *With the time event 'Delayer' X, you can trigger an action precisely to the second.*
- *The clock of the DULCO flex Control has an accuracy of ±1 s/24 h.*

12.4.2.1.5 Inputs

A 0/1 contact signal, for example at pin 1 of the *'Config I/O'* terminal can be a triggering event.

Example

Time events (triggers)	Action	
Config I/O 1	Relay 2	open

The example means:

If an 0/1 contact signal is closed between Pin 1 of the *'Config I/O'* connector and Pin 4, then the *'Relay 2'* should switch to *'open'* status.

12.4.2.1.6 Outputs

The timer can output a 1/0 contact signal e.g. between pin 3 of the *'Config I/O'* connector and pin 4.

Example

Time events (triggers)		Action
Cycle	Switching time	
workdays 1 (Mo-Fr)	Time of day 12:00	Config I/O 3

The example means:

At 12:00 on workdays, the timer outputs a 1/0 contact signal e.g. between pin 3 of the *'Config I/O'* connector and pin 4

12.4.2.2 1 time event - several actions

You can assign 1 time event to several actions. To do so, always use the same cycle and the same switching time! :

Example

No.	Time event (trigger)		Action	
01	workdays 1 (Mo-Fr)	Time of day 12:00	Stop	-
02	workdays 1 (Mo-Fr)	Time of day 12:00	Batch (input)	500 ml
03	workdays 1 (Mo-Fr)	Time of day 12:00	Relay 1	-closed
04	-	-	...	.

- *For details on the sorting sequence of the program lines see 'Sorting sequence' on page 67.*
- *The timer program can have a maximum of 99 program lines.*

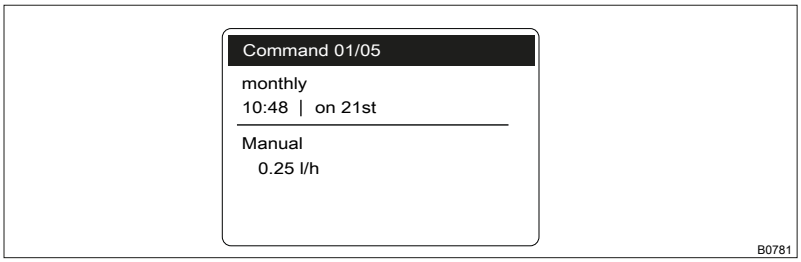
12.4.2.3 Check program lines (*'Show'*)

➔ *'Menu / Information* ➔ *Timer* ➔ *Set timer* ➔ *Show'*

'Show' lets you check individual program lines / instructions.

1. Press the *[Clickwheel]* on a program line / instruction.

   ⇨ This display appears:



Above the line Time event (trigger) and possible value
Below the line Action and value, if required

2. Turn the *[Clickwheel]*.

   ⇨ Scroll from instruction to instruction.

   The number of the program line or instruction (and the number of the last program line or instruction) appears at the top in the dark bar.

3. Pressing the *[Clickwheel]* returns you to *'Set timer'*.

As the timer software automatically sorts the program lines, the numbers of the program lines can change if you change something.

Sorting sequence

The timer software automatically sorts every newly programmed program line / instruction after completing it (press the *[Clickwheel]*) below the other program lines.

The 1st sorting criterion is the type of **time event (trigger)** (for the sequence refer to *Further information on page 63* and *Further information on page 64*).

Time-dependent program lines are ordered below each other initially after the **Switching point** (2nd sorting criterion)

then after the length of the **Cycle** (3rd sorting criterion).

The 4th sorting criterion is the type of **action** (see also the programming examples at the end of these instructions).

A purely time-controlled timer program will also run in this sequence.

12.4.2.4 Change program lines (*'Change'*)

➔ *'Menu / Information* ➔ *Timer* ➔ *Set timer* ➔ *Change'*

1. Use the *[Clickwheel]* to select the required program line / instruction according to its number and press the *[Clickwheel]*.

2. Click through the instruction and change it.

   ⇨ The timer software sorts a changed program line / instruction after completion with the *[Clickwheel]* possibly differently in between the other program lines (Rules - see *'Sorting sequence' on page 67*).

12.4.2.5 Delete individual program lines (*'Delete'*)

☰ ➔ *'Menu / Information* ➔ *Timer* ➔ *Set timer* ➔ *Delete'*

1. Use the *[Clickwheel]* to select the required program line / instruction according to its number.
2. The program line will be deleted as soon as you press the *[Clickwheel]*.

   ⇨ The timer software re-sorts the remaining programme lines (Rules - see *'Sorting sequence' on page 67*).

Delete all program lines

The option to delete all program lines is to be found one level higher in the menu:

☰ ➔ *'Menu / Information* ➔ *Timer* ➔ *Clear all'*

12.4.3 Clear all

☰ ➔ *'Menu / Information* ➔ *Timer* ➔ *Clear all* ➔ *...'*

Use the *'Clear all'* menu to clear all instructions (the entire program).

12.4.4 Examples

Requirements:

- You have already worked with the pump type
- The time has been set (possible set under *'Settings* ➔ *Set time* ➔ *Time'* Only possible with *'Timer status'*- *'Inactive'*).

Example of "Weekday metering"

Task:

The pump is to meter 2 litres every half hour every weekday (Mon-Fri) between 8:00 and 11:00:

Solution:

As you define switching times with the timer, you need to first define the switching points at 08:30, 09:30 and 10:30.

To meter 2 litres, the pump needs to work in *'Manual' 'operating mode'* for 10 min at a *'Capacity'* of 12,000 l/h. A *'Capacity'* of 12,000 l/h is thereby added to the switching points.

You also need to define the switching times to stop the pump at 08:40, 09:40 and 10:40 - paired with the *'Halt'* action.

Tab. 17: Program as program lines / instructions

No.	Time event		Action		Comment
		Switching time		Capacity	
01	workdays 1 (Mo-Fr)	08:30	Manual	12,000 l/h	Meter at 12,000 l/h
02	workdays 1 (Mo-Fr)	08:40	Stop	-	Stop
03	workdays 1 (Mo-Fr)	09:30	Manual	12,000 l/h	Meter at 12,000 l/h
04	workdays 1 (Mo-Fr)	09:40	Stop	-	Stop
05	workdays 1 (Mo-Fr)	10:30	Manual	12,000 l/h	Meter at 12,000 l/h
06	workdays 1 (Mo-Fr)	10:40	Stop	-	Stop

How to enter the program lines / instructions:

1. To program the timer, set ☰ ➔ *'Menu / Information* ➔ *Timer* ➔ *Activation'* to *'inactive'*.

   ⇨ The first line of the timer menu *'Timer status'* then shows *'Inactive'*.

2. Always enter the program / instructions from the table, above, into the newly created instruction under *'Timer* ➔ *Set timer* ➔ *new* ➔ *...'* (Do not get irritated: the timer program automatically sorts the instructions).

3. To activate the timer, set *'Activation'* to *'active'*.

   ⇨ The first line of the timer menu *'Timer status'* then displays *'active'*.

   The timer starts working - the timer identifier ◷ is visible in the continuous display.

4. Test your programming!

   The secondary display “Timer” can help here, which shows the next instruction and the remaining time. (To access this secondary display, press the *[Clickwheel]* in a continuous display until a long series of small circles appears below - immediately turn the *[Clickwheel]* to navigate to the last circle and press the *[Clickwheel]*.)

   The continuous display itself shows information on the current status of the pump in the dark bar.

If something has been entered incorrectly:

- *Either press ⮌ in the current program line and enter the correct values*
- *or search for the program line in 'CHANGE' (automatic sorting!). Now press the [Clickwheel], allow the program to run through the program lines again and enter the values correctly*
- *or use 'delete' to select the program line and delete*
- *or delete everything using 'clear all' (one level higher)*

Example - to avoid errors

The example is intended to provide the programmer with a couple of "programming obstacles" that he might not immediately see:

Com-mand	Time event	Additional param-eter	Action	Additional param-eter	Comment
01	Config I/O 1	Input, reacts when closing	Start Delayer 1		When a contact closes between pins 1 and 4 at "Config I/O" con-nector, this starts delayer 1
02	Config I/O 1	Input, reacts when closing	Start Delayer 2		When a contact closes between pins 1 and 4 at "Config I/O" con-nector, this starts delayer 2
03	Config I/O 1	Input, reacts when closing	Start Delayer 3		When a contact closes between pins 1 and 4 "Config I/O" con-nector, this starts delayer 3
04	Init		Stop		Pump stops as soon as the timer is activated
05	Delayer 1	after 60 sec	Close Config I/O 2		Pins 2 and 4 of the "Config I/O" connector act like a normally closed contact – enabling you to control a device
06	Delayer 2	after 120 sec	Manual	12,000 l/h and 80% stroke length	Pump runs after 120 s at 12 l/h
07	Delayer 3	after 180 sec	Stop		Pump stops after 180 s
08	Delayer 3	after 180 sec	Open Config I/O 2		Pins 2 and 4 of the "Config I/O" connector act like a normally open contact – enabling you to control a device

Explanations:

- If 1 time event (trigger) is to trigger 3 actions that are to have delays of different lengths, then you need to start 3 delayers and not just 1 - see instructions 01 to 03.
- If several actions are to be performed after the same delay time, then you need to write exactly as many instructions – with the same time event (instructions 07 and 08).
- If, for example, you are using *'Delayer 1'* - *'60 s'* and *'Delayer 1'* - *'120 s'*, then the action is never performed after the second (longer delay time because the delayer has been activated after the smaller delay time and becomes inactive.
- Without *'Init'* - *'Halt'* (instruction 04) it would remain unclear whether the pump alone runs by *'Activation'* of the timer.

Activating the timer namely deletes all causes for stop: If the pump has previously been manually stopped, for example in *'Manual'* operating mode at 12 l / h, then it suddenly pumps at 12 l/h when the timer is activated, which cannot be seen from the timer program.

- If a contact at *'Config I/O 1'* cannot start the program, then it may be due to the fact that the contact is not defined as a "Timer input" (in the *'Menu / Information* ➔ *Settings* ➔ *Inputs/Outputs* ➔ *...'* menu).
  In the same way, *'Config I/O 2'* (instruction 08) would have to be defined here as a "Timer output".

12.4.5 Timer information

"Config I/O" terminal

There is an option to feed the signals of up to 3 external potential-free contacts as inputs to the pump via the "Config I/O" connector or issue up to 3 contact signals as outputs (total of inputs + outputs = 3).

Pin assignment - see chapter entitled "Installation, electrical" - "Description of the connectors".

The function of the pins must be assigned under *'Settings* ➔ *Config I/Os'*.

Status as soon as the programmed pump is connected to the mains voltage:

The timer software now generates the state of the pump which the pump would have precisely had at this time if it had not been disconnected from the mains voltage.

This relates to linked or non-delayed actions.

Effective settings after switching between Timer *'active'* and *'inactive'*:

The timer settings are saved and become effective again when *'inactive'* switches to *'active'*.

The operating mode settings are saved and become effective again when *'active'* is switched to *'inactive'*.

Storage period of your programming:

The pump stores your programming for up to 20 years.

(The calibration and timer data are maintained for up to 100 years).

The time is retained without mains voltage for approx. 2 years.

12.4.6 Typical pitfalls Timer functional faults

Problem	Possible cause of fault	Remedy
The pump starts pumping unexpectedly.	The timer deletes every "Manual" stop when activated - see "Timer behaviour on start"	Enter an *'Init'* instruction with *'Halt'* action.
The timer does not react to a contact signal at the corresponding pin of the "Config I/O" terminal.	Config I/O was not configured as "Config I/O" - "Input" in the *'Menu / Information* ➔ *Settings* ➔ *Inputs/Outputs* ➔ *...'* menu.	Configure Config I/O as "Config I/O" - "Input" in the *'Menu / Information* ➔ *Settings* ➔ *Inputs/Outputs* ➔ *...'* menu.

Problem	Possible cause of fault	Remedy
The timer does not set a Config I/O output.	Config I/O was not configured as "Timer I/O" - "Input" in the *'Menu / Information* ➔ *Settings* ➔ *Inputs/Outputs* ➔ *...'* menu.	Configure Config I/O as a "Timer" - "Input" in the *'Menu / Information* ➔ *Settings* ➔ *Inputs/Outputs* ➔ *...'* menu.
A *'Delayer'* does not trigger an *'Action'*.	Different delay times have been defined for the same *'Delayer'* but this delayer is stopped and becomes inactive after the shortest delay time.	Create a further *'Delayer'* for the longer delay time.

12.4.7 Brief explanation of selected functions

Time event (trigger)

An event can be triggered either time-dependent or event-controlled.

1 - Time events (really time-dependent) are processed precisely to the minute.

2 - Initialisation (*'Init'*) is executed at the start of the program (*'Timer* ➔ *Activation* ➔ *active'* or when mains voltage is connected) to obtain a defined status of the system.

3 - "Config I/O" inputs can trigger something if the input potential changes from 1 to 0 or with a falling edge or if the potential-free contact is closed.

4 - Delayers can trigger an action as soon as their time has expired.

Actions

These are the *'Actions'* which the timer executes as soon as a *'time event'* has occurred.

Initialisation

When *'Activation'* is set to *'active'*, the timer software generates the state of the pump which the pump would have precisely had at this time if it would have been set to *'active'* without any interruption.

This does not relate to delayed, linked actions.

Using the initial commands (*'Init'*), a defined switch-on state can be programmed. Initial commands have priority over time commands.

Outputs

Those relays which were connected with the relay option are designated as outputs. Up to 2 relays can be fitted.

Pins 1 - 3 of the "Config I/O" terminal can be inputs and outputs. That can be programmed.

Inputs

Pins 1 - 3 of the "Config I/O" terminal can be inputs and outputs. That can be programmed.

Delayer

Delayers are started event- or time-controlled. Upon expiry of the delay time, the delayer itself can trigger any actions.

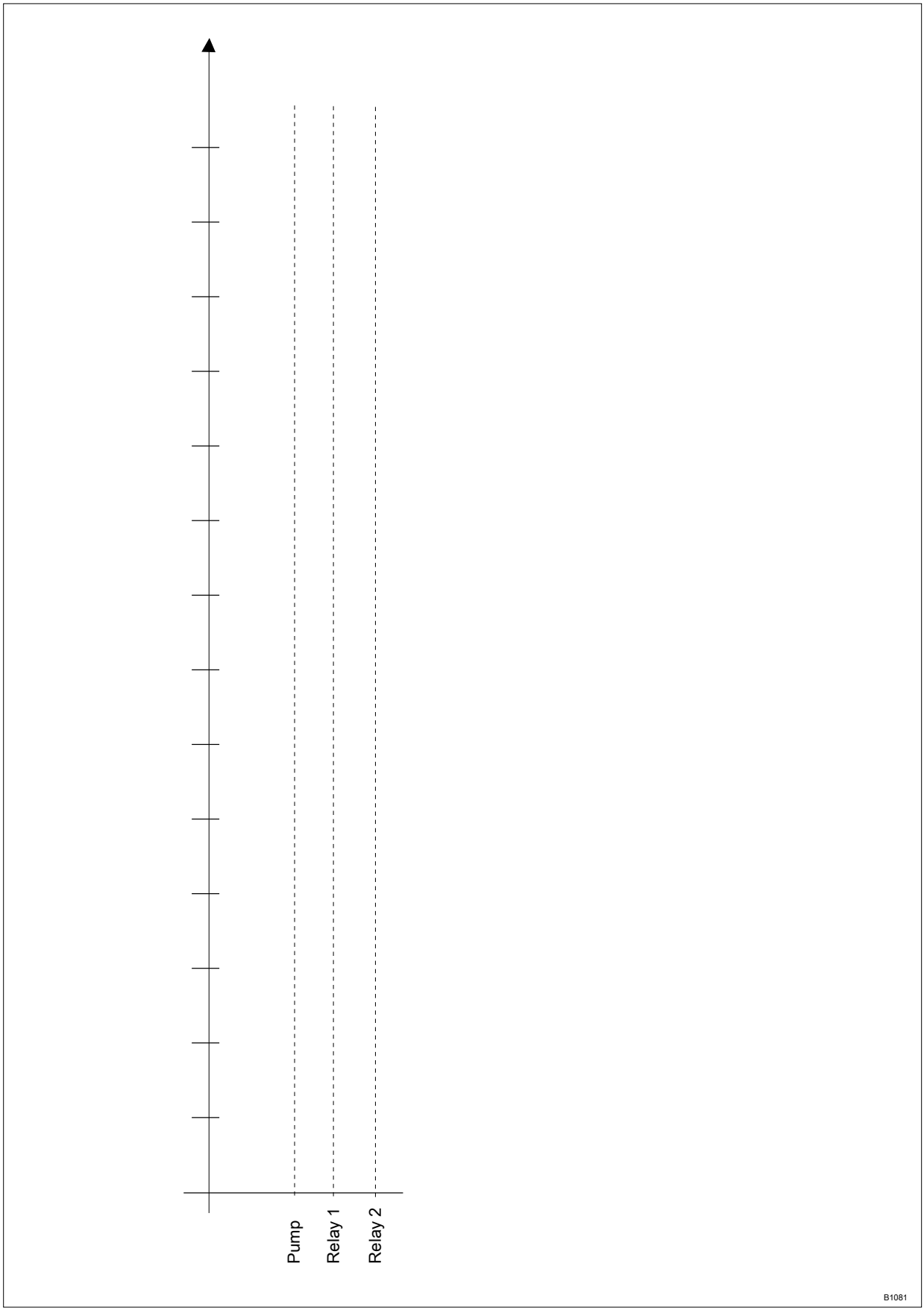


Fig. 32: Bar chart - Template

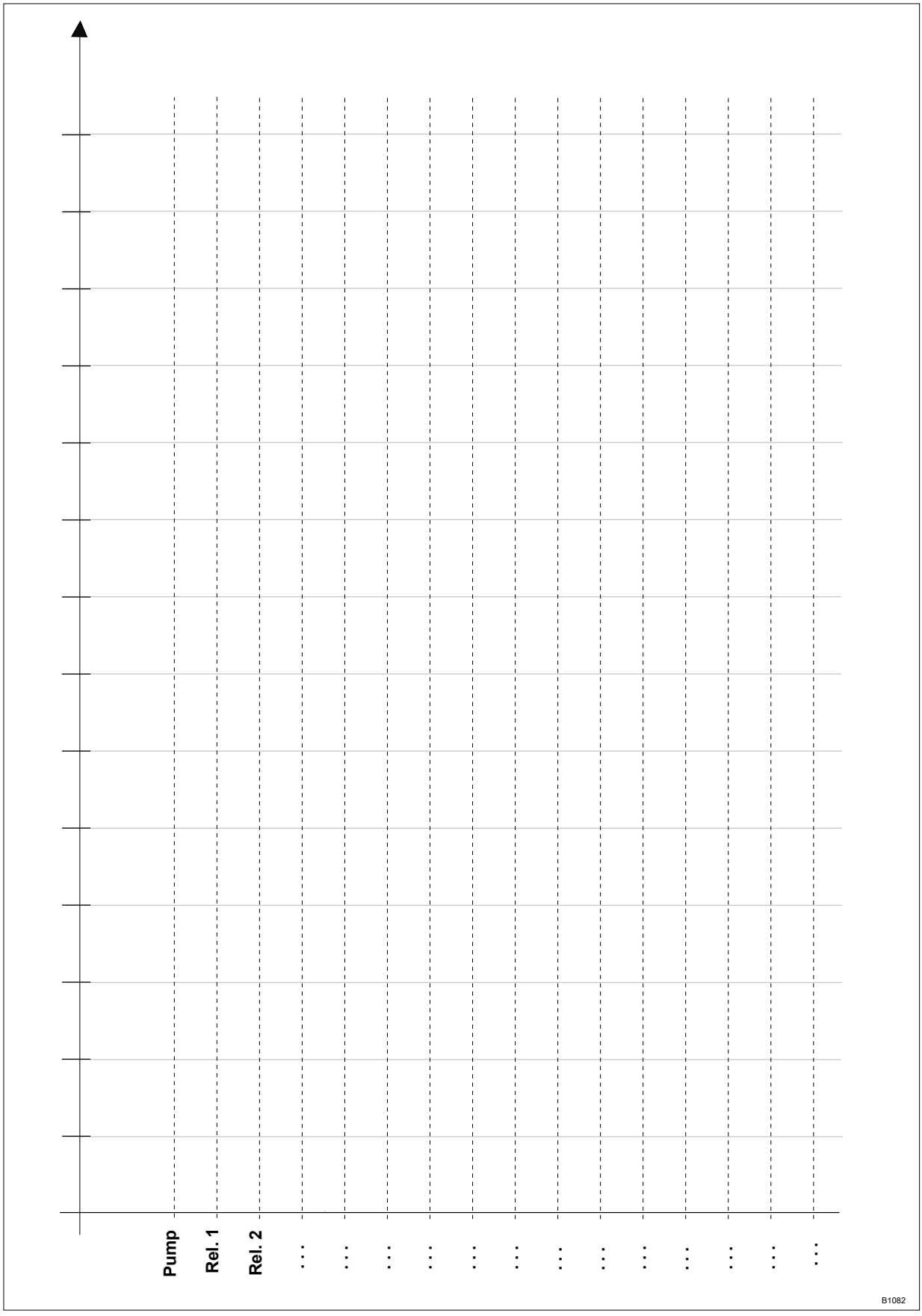


Fig. 33: Switching times - Template

Tab. 18: Discard program lines / instructions about the program (Line 09 = example)

Instruction no.	Time event		Action	
09	workdays (Mo-Fr)	15:23	Contact	50

12.5 *‘Service’*

☰ ➔ *‘Menu / Information ➔ Service ➔ ...’*

The *'Service'* menu is split into the following sub-menus:

1 - *'Access protection'*

2 - *'Password'*

3 - *'Clear counters'*

4 - *'Hose'*

5 - *'Error log book'*

6 - *'Display'*

7 - *'Factory setting'*

8 - *'Spare parts kit number'*

12.5.1 *'Access protection'*

'Menu / Information ➔ Service ➔ Access protection ➔ ...'

You can lock parts of the setting options here.

The following locking options are available:

Selection	Point ①	Point ②
'None'	-	-
' Lock menu'	X	-
'Lock all'	X	X

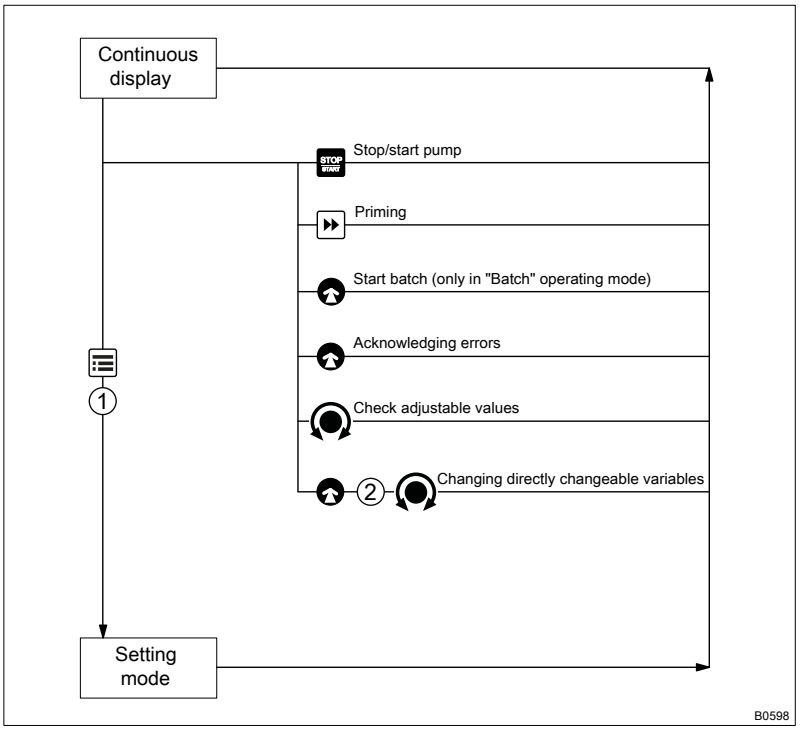


Fig. 34

If you have set a *'Password'* - see below, then the identifier will appear after 1 minute in the top left and the specified areas will be locked, if no key has been pressed in the meantime.

Both locks use the same *'Password'*.

12.5.2 *'Password '*

☰ ➔ *'Menu / Information ➔ Service ➔ Password ➔ ...'*

You can enter a password of your choice in the *'Change password'* menu.

12.5.3 *'Clear counters'*

☰ ➔ *'Menu / Information ➔ Service ➔ Clear counters ➔ ...'*

You can reset the counters to "0" in the *'Clear counters'* menu:

- *'Number of revolutions'*
- *'Volume counter'* (total litres)
- *'All'*

→ To clear: exit the menu by briefly pressing the *[Clickwheel]*.

The values have increased since commissioning the pump, the last calibration or the last deletion.

The "Hose service maintenance" counter can only be reset by going to the 'Tube Service' menu.

12.5.4 *'Hose'*

☰ ➔ *'Menu / Information ➔ Service ➔ Hose ➔ ...'*

For this menu to appear, press STOP/START *[STOP/START]* to bring the pump to a stop (manually).

You can read or set various counters for hose operation in the *'Tube'* menu:

- *'Hose interval'*
- *'Hose service in'*
- *'Revolutions since service'*
- *'Interval counter'*

The values have increased since pump commissioning or since they were last deleted.

Hose interval

Here you can change the interval for the hose replacement - the revolutions are counted in thousands.

As soon as the counter has counted down to "0", the LCD screen displays the *'Tube Service'* warning. From this point on, the "Hose service maintenance" secondary display shows the revolutions counted as a negative figure so that the operator is able to better adapt the interval to the circumstances.

Expected service life of the pump hose

> ***Determining the service life of the pump hose***
> *When starting to pump, regularly check the pump hose for wear - do this several times a day if necessary. The service life and thus the replacement interval for the pump hose can be derived from the collected information and experience.*

The service life of the pump hose is between approx. 600 and 1200 operating hours.

The following have a negative impact on the service life of the pump hose:

- high back pressure
- high speed
- high temperature
- abrasive feed chemicals
- exposure to chemicals
- long switching-on period.

Hose service in

Here you can see the number of hours in which the hose is to be replaced. The value displayed depends on the value in *'Tube interval'*.

Revolutions since service

Here you can see how many revolutions the pump has performed since its last maintenance.

Interval counter

Here you can see the total number of hose replacement intervals the pump has experienced.

12.5.5 *'Error log book'*

➔ *'Menu / Information ➔ Service ➔ Error log book ➔ ...'*

You can view the list of *'Error log books'* here.

A *'Filter'* helps with the overview.

12.5.5.1 Log book entry - detailed view

For more information about a log book entry, press the *[Clickwheel]*.

Tab. 19: Information on the detailed view

Line	Information
1	Date, time
2	Type of entry (fault, warning ...)
3	Total operating time, total revolutions
4	Switching-on duration, revolutions since switching on
5	Room temperature, additional information on the error (for developers)

12.5.6 *'Display'*

➔ *'Menu / Information* ➔ *Service* ➔ *Display* ➔ *...'*

You can set the *'Contrast'* and the *'Brightness'* of the LCD screen here.

12.5.7 *'Factory setting'*

➔ *'Menu / Information* ➔ *Service* ➔ *Factory setting* ➔ *...'*

For this menu to appear, press *[STOP/START]* to bring the pump to a stop (manually).

You can reset the pump to its factory settings here by selecting *'Yes'*.

The password is 1812.

12.5.8 Spare parts kit number: XXXXXXX

➔ *'Menu / Information* ➔ *Service*
➔ *Spare parts kit part number: XXXXXXX* ➔ *...'*

You can read the order number (part number) of the correct spare parts kit here.

12.6 *'Language'*

➔ *'Menu / Information* ➔ *Language* ➔ *...'*

You can select the desired operating language in the *'Language'* menu.

13 Operation

User qualification: Instructed person - see *'Qualification of personnel' on page 12*

This chapter describes all the operating options in a continuous display (several symbols and the pressure display appear at the top in the black bar) for the trained person at the pump.

– *Please also refer to the "Operating/Setting overview" and "Continuous displays and secondary displays" overviews at the end of the operating instructions and also the "Overview of equipment and control elements" chapter.*

13.1 Manual operation

Stop/start pump

Stop the pump: Press [STOP/START].

Start the pump: Press [STOP/START] again.

Priming

Press [Priming].

Turn the *[Clickwheel]* to extend or shorten the priming time during priming.

Starting a batch

In *'Batch'* operating mode: Press the *[Clickwheel]* in the *'Push'* continuous display.

Acknowledge errors

Press the *[Clickwheel]* to acknowledge error messages that require acknowledgement.

Check adjustable variables

In a continuous display: Another continuous display appears each time the *[Clickwheel]* engages when turned. (The number depends on the configuration.)

Change directly adjustable variables

Changing a variable in the relevant continuous display:

1. Press the *[Clickwheel]*.
   ⇨ The variable can be changed (highlighted).
2. Turn the *[Clickwheel]*.
   ⇨ The variable is changed.
3. Press the *[Clickwheel]*.
   ⇨ The variable is saved (the highlighting disappears).

If the "lock" - "lock all" has been set - see *'Set-up overview DULCO flex Control' on page 82*, first enter the *'Password'* after pressing the *[Clickwheel]*.

List of directly changeable variables:

- Capacity
- Contact volume
- Batch dosing time

- Concentration
- Time

Set-up overview DULCO flex Control

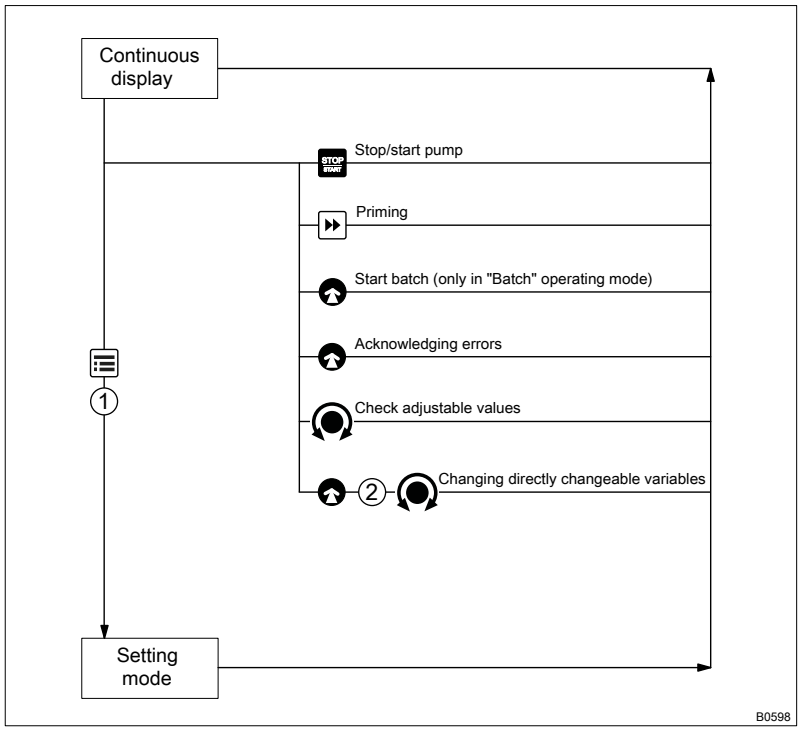


Fig. 35: Control options using keys and locking options

Press *[Clickwheel]*
Turn *[Clickwheel]*
① "Lock menu"
② "Lock all"

14 Maintenance

User qualification: Technical personnel and service - see *'Qualification of personnel' on page 12*

WARNING!
It is mandatory that you read the safety information and specifications in the "Storage, Transport and Unpacking" chapter prior to shipping the pump.

CAUTION!
Warning of feed chemical spraying around
Feed chemical can spray out of the hydraulic components if they are manipulated or opened due to pressure in the liquid end and adjacent parts of the system.

- Disconnect the pump from the mains power supply and ensure that it cannot be switched on again by unauthorised persons.
- Depressurise the system before commencing any work on hydraulic parts.

Third-party spare parts for the pumps may result in problems when pumping.

- *Only use original spare parts.*
- *Use the correct spare parts kits - see order no. in 'Service' menu. If in doubt, refer to the ordering information in the Appendix.*

Interval	Maintenance work	Personnel
Quarterly*	■ Check the pump hose for damage** - refer to "Repair". ■ Clean running surface in dosing head and rotor rollers. ■ Check that the hydraulic lines are fixed firmly to the liquid end. ■ Check the leak-tightness of the entire liquid end. ■ Remove the hose rupture sensor (option) and test with water. ■ Check that the flow is correct: Press ⏩ *[Priming]* to allow the pump to prime briefly. ■ Check that the electrical connectors are intact. ■ Check the integrity of the housing.	Technical personnel

* Under normal loading (approx. 30% of continuous operation).

Under heavy-duty loading (e.g. continuous operation): Shorter intervals.

** With feed chemicals that put particular pressure on the pump hose, e.g. those containing abrasive additives or oxidation agents, check the pump hose more frequently.

Expected service life of the pump hose

Determining the service life of the pump hose
When starting to pump, regularly check the pump hose for wear - do this several times a day if necessary. The service life and thus the replacement interval for the pump hose can be derived from the collected information and experience.

The service life of the pump hose is between approx. 600 and 1200 operating hours.

The following have a negative impact on the service life of the pump hose:

- high back pressure
- high speed
- high temperature
- abrasive feed chemicals
- exposure to chemicals
- long switching-on period.

15 Repair

User qualification: Qualified personnel and service - see *'Qualification of personnel' on page 12*

Safety information

WARNING!

Danger of electric shock

Unauthorised repairs inside the pump may result in an electric shock.

For this reason, only allow a ProMinent branch or representative to perform repairs inside the pump, in particular the following:

- Replacement of damaged mains connection lines
- Replacement of fuses
- Replacement of electronic controller

WARNING!

It is mandatory that you read the safety information and specifications in the "Storage, Transport and Unpacking" chapter prior to shipping the pump.

WARNING!

Contact with the feed chemical

Parts that come into contact with the feed chemical are exposed and touched during repair work.

- Protect yourself against the feed chemical if it is hazardous. Read the safety data sheet on the feed chemical.

CAUTION!

Warning of feed chemical spraying around

Feed chemical can spray out of the hydraulic components if they are manipulated or opened due to pressure in the liquid end and adjacent parts of the system.

- Disconnect the pump from the mains power supply and ensure that it cannot be switched on again by unauthorised persons.
- Depressurise the system before commencing any work on hydraulic parts.

15.1 Replacing pump hose

User qualification: Technical personnel and service - see *'Qualification of personnel' on page 12*

WARNING!
The rotating rotor may catch and trap body parts.
– Only replace hose as outlined in the instructions below.

The order no. (part number) of the appropriate spare parts kit can be found at the end of the 'Service' menu, for example.

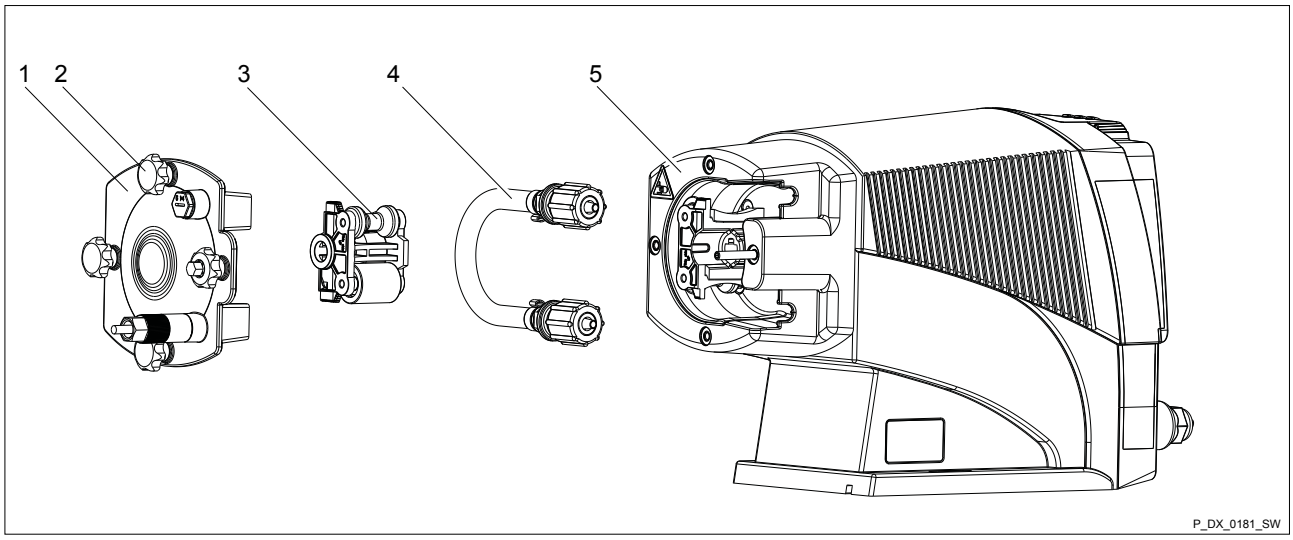


Fig. 36

- Ensure that the system is at atmospheric pressure.
- Adhere to the material safety data sheet for the feed chemical.
- Prevent the escape of feed chemical.
- If necessary take protective measures.

1. Press [STOP/START] to bring the pump to a stop (manually).
2. Empty the liquid end (turn the liquid end upside down and allow the feed chemical to run out; flush out with a suitable medium; flush the liquid end thoroughly when using hazardous feed chemicals!).
3. Go to the ☰ ➔ *'Hose replacement'* menu.
   ⇨ *'Go to change position?'* appears.

WARNING!
The rotating rotor may catch and trap body parts.
– Only take off bearing cover once the pump prompts you to do so.
– Refit bearing cover once prompted to do so by the pump.

4. Confirm the question with *'Yes'*.
   ⇨ The rotor turns slowly and the following appears:

   ' Please wait... '.

   The rotor stops and *'Please remove cover and take out the Rotor!'* appears (the corresponding rotor half flashes in the animation).

5. Loosen 4 star screws (2) on dosing head (5) and remove with bearing cover (1).
6. Pull rotor half (3) flashing in LCD screen out of dosing head (5) (if required, use plastic tool to release it).
7. Press the Clickwheel.
   ⇨ The rotor turns slowly and the following appears:

   ' Please wait...'.

   The rotor stops and *'Please change the tube!'* appears.
8. Snap two hydraulic connectors out of dosing head (5) - away from pump - and remove along with pump hose (4).
9. If the pump hose (4) was leaking, clean the liquid end.
10. Check whether the liquid end's running surface is level and smooth.
11. Insert new pump hose (4) in dosing head (5) and snap the two hydraulic connectors into place - round side in dosing head (5).
12. Press the Clickwheel
    ⇨ The rotor turns slowly and the following appears:

    ' Please wait!'.

    The rotor stops and *'Insert rotor again!'* appears.
13. Reinsert the removed rotor half (3) - the surfaces of the two rotor halves must be perfectly flush.
14. Press the Clickwheel.
    ⇨ The rotor turns and the following appears:

    'Please wait...'.

    The rotor stops - this time standing on its tip - and *'Install Cover again!'* appears.
15. Place bearing cover (1) on dosing head (5).
16. Initially only loosely screw all 4 star screws (2) into dosing head (5).
17. Manually tighten the 4 star screws (2). The domed nut must again be screwed onto the 4th star screw and tightened to provide a locking function.
18. Press the Clickwheel.
    ⇨ *'Run in tube?'* appears.

    'Yes' / *'No'*
19. Selecting *[No]* exits this macro.

    The pump hose (4) is drawn in if *'Yes'* is selected.
    ⇨ *'Run in tube ...'* appears.

    The rotor turns a couple of times.
20. The *'Tube change interval'* menu appears.

    In the first *'Revolutions'* menu item, you have the option of extending or shortening the warning time for the next hose replacement. You can do this by changing the *'Revolutions'* - also refer to *'Service ➔ Hose'*.
21. To reset the warning time, press the *[Clickwheel]*.
    ⇨ *'Reset interval now!'* appears.
22. To complete the hose replacement, press the *[Clickwheel]* again.
    ⇨ *'Complete!'* and a hand symbol appear. This is a reminder that the pump still needs to be stopped manually. If necessary, now restart the pump using the *[STOP/START]* key.
23. If the pump hose was broken, clean the hose rupture indicator (option).

15.2 Cleaning hose rupture indicator (option)

WARNING!

Warning of unnoticed escape of feed chemical

After the hose rupture indicator has been triggered, any residue of feed chemical may affect its function.

– After the hose rupture indicator has been triggered, clean and test it.

1. Unscrew the hose rupture indicator using an SW 14 open-ended spanner.
2. Clean the hose rupture indicator with a suitable liquid - if possible using water.
3. Test the connected hose rupture indicator: fully immerse the tapered section at the front in water.

   ⇨ The continuous display indicates a hose rupture.
4. Thoroughly dry the hose rupture indicator.

   ⇨ The continuous display no longer indicates a hose rupture.
5. Screw the clean and dry hose rupture indicator into the hole until hand-tight and liquid-tight.

16 Troubleshooting

User qualifications - see following table and *'Qualification of personnel' on page 12*

Safety information

WARNING!

Warning of hazardous feed chemical

Should a dangerous feed chemical be used: it may escape from the hydraulic components when working on the pump, material failure or incorrect handling of the pump.

- Take appropriate protective measures before working on the pump (e.g. safety glasses, safety gloves, ...). Adhere to the material safety data sheet for the feed chemical.
- Drain and flush the liquid end before working on the pump.

CAUTION!

Warning of feed chemical spraying around

Feed chemical can spray out of the hydraulic components if they are manipulated or opened due to pressure in the liquid end and adjacent parts of the system.

- Disconnect the pump from the mains power supply and ensure that it cannot be switched on again by unauthorised persons.
- Depressurise the system before commencing any work on hydraulic parts.

16.1 Faults without a fault message

Faults without a fault message

Fault description	Cause	Remedy	Personnel
Fluid escaping from the liquid end.	The pump hose has a leak.	Replace the pump hose - refer to the "Repair" chapter. If a pump hose rupture has been indicated, clean the hose rupture indicator - refer to the "Repair" chapter.	Technical personnel
Green LED display (operating indicator) not lighting up.	The wrong mains voltage or no mains voltage is connected.	The specified mains voltage as per the voltage specification can be found on the nameplate.	Electrician

16.2 Faults with error message

16.2.1 Fault messages on the LCD screen

In the event of a fault:

- the red LED display lights up.
- an identifier and a message appear on the LCD screen.
- the pump stops.

Fault description	Cause	Remedy	Personnel
No. 0: The identifier appears followed by the message *'System error'*.	System or EPRom error	Return the pump to ProMinent.	Instructed personnel
No. 1: The identifier I < 4 mA appears followed by the message *'Input signal < 4 mA'*.	The pump is in *'Analog'* operating mode, a fault behaviour has been programmed in the *'Analog'* menu and the control current has fallen below 4 mA.	Eliminate the cause of the low control current or switch the programming of the fault behaviour to *'off'* - see chapter "Set Up"-"Settings"-"Operating mode"-"Analog".	Technical personnel
No. 2: The identifier I > 20 mA appears followed by the message *'Input signal > 20 mA'*.	The pump is in *'Analog'* operating mode, a fault behaviour has been programmed in the *'Analog'* menu and the control current has risen above 20 mA.	Eliminate the cause of the high control current or switch the programming of the fault behaviour to *'off'* - see chapter "Set Up"-"Settings"-"Operating mode"-"Analog".	Technical personnel
No. 3: The identifier appears followed by the message *'Level error!'*.	The fluid level in the storage tank has reached "Liquid level low 2nd stage".	Top up the storage tank.	Technical personnel
No. 4: The identifier and the message *'Tube rupture'* appear.	The pump hose has a leak.	Press the *[Clickwheel]*. Replace the pump hose and clean the hose rupture indicator, refer to the "Repair" chapter.	Technical personnel
No. 5: The identifier and the message *'Dosing monitor fault'* appear.	The state of the dosing monitor is not as expected.	Press the *[Clickwheel]*. Investigate and clear the cause.	Technical personnel
No. 7: The identifier "Temperature" appears followed by the message *'Temperature'* and the pump remains idle.	The ambient temperature is too high or too low.	Change the ambient temperature. The pump starts up automatically.	Technical personnel
	The temperature is too high.	Rectify the cause. The pump starts up automatically.	Technical personnel
No. 8: The identifier and the message *'Initialisation'* appear.	Pump restart, initialisation incomplete.	Rectify the cause. The pump starts up automatically.	Technical personnel
No. 10: The identifier and the message *'Parameter'* appear.	An incorrect parameter has been entered.	Correct the parameter.	Technical personnel
No. 13: The identifier and the message *'Mains/power supply / overvoltage'* appear.	The mains voltage is too low or not connected.	Rectify the cause.	Technical personnel
No. 16: The identifier and the message *'Memory overflow'* appear.	The amount of memory space reserved for the stack is no longer sufficient.	Perform a reset (briefly disconnect from the mains/power supply).	Technical personnel
No. 17: The identifier I < Imin and the message *'Control signal < Imin'* appear.	The pump is in *'Analog'*-"xx. side band" operating mode, a fault behaviour has been programmed in the *'Analog'* menu and the control current has fallen below 4 mA.	Eliminate the cause of the low control current or switch the programming of the fault behaviour to *'off'* - see chapter "Set Up"-"Settings"-"Operating mode"-"Analog".	Technical personnel
No. 18: The identifier I > Imax and the message *'Control signal > Imax'* appear.	The pump is in *'Analog'*-"xx. side band" operating mode, a fault behaviour has been programmed in the *'Analog'* menu and the control current has risen above 20 mA.	Eliminate the cause of the high control current or switch the programming of the fault behaviour to *'off'* - see chapter "Set Up"-"Settings"-"Operating mode"-"Analog".	Technical personnel

Fault description	Cause	Remedy	Personnel
No. 20: The identifier and the message *'Module communication'* appear.	The bus contact between the optional module and control room has been disconnected.	Return the pump to ProMinent.	Technical personnel
No. 21: The identifier and the message *'Module communication'* appear.	Communication between the optional module and pump electronics is not working.	Rectify the cause.	Technical personnel
No. 22: The identifier (internal) and the message *'Internal CAN bus'* appear.	The associated heartbeat message was no longer received by the front assembly for a certain period of time.	Rectify the cause.	Technical personnel
No. 23: The identifier and the message *'Version error'* appear.	Problems with compatibility with the assemblies' firmware.	Return the pump to ProMinent.	Instructed personnel
No. 24: The identifier appears followed by the message *'System error'*.	System or EPRom error	Return the pump to ProMinent.	Instructed personnel
No. 25: The identifier and the message *'Initialisation'* appear.	Pump restart, initialisation incomplete.	Rectify the cause.	Technical personnel
No. 26: The identifier and the message *'Motor Error'* appear.	The motor indicates a fault.	Rectify the cause.	Technical personnel
No. 27: The identifier and the message *'Fan warning'* appear.	The fan is faulty or not connected.	Return the pump to ProMinent.	Instructed personnel
No. 28: The identifier (drive) and the message *'Communication interrupted'* appear.	RS485 communication is interrupted.	Rectify the cause.	Technical personnel
No. 29: The identifier and the message *'Motor state'* appear.	The motor indicates a fault.	Return the pump to ProMinent.	Instructed personnel
No. 30: The identifier and the message *'Motor blockade'* appear.	The motor is blocking.	Return the pump to ProMinent.	Instructed personnel

16.2.2 Warning messages on the LCD screen

In the event of a warning:

- the yellow LED display lights up!
- an identifier and a message appear on the LCD screen.

Fault description	Cause	Remedy	Personnel
No. 0: *'Level'* and the identifier appear.	The fluid level in the storage tank has reached "Liquid level low 1st stage".	Top up the storage tank.	Instructed personnel
No. 1: The identifier and the message *'Tube Service'* appear.	The set pump hose service life has elapsed. (Adjust - *Chapter 12.5.4 ''Hose'' on page 78*.).	Replace the pump hose - refer to the "Repair" chapter.	Technical personnel
No. 2: The identifier and the message *'Dosing monitor fault'* appear.	The state of the dosing monitor is not as expected.	Press the *[Clickwheel]*. Investigate and clear the cause.	Technical personnel
No. 3: The identifier and the message *'Invalid metering volume'* appear.	The set metering volume in concentration mode cannot be metered.	Adapt the metering parameters.	Technical personnel
No. 4: The identifier and the message *'Invalid parameter'* appear.	A set parameter is invalid.	Adjust the parameter.	Technical personnel

Fault description	Cause	Remedy	Personnel
No. 5: The identifier and the message *'Fan warning'* appear.	The fan is faulty or not connected.	Return the pump to ProMinent.	Instructed personnel
No. 12: The identifier and the message *'Invalid metering volume'* appear.	The set metering volume in concentration mode cannot be metered.	Adapt the metering parameters.	Technical personnel
No. 13: The identifier "Temperature" and the message *'Temperature'* appear.	The temperature is too high.	Rectify the cause. The pump starts up automatically.	Technical personnel

16.2.3 All other faults

Please contact the responsible ProMinent branch or representative!

16.3 Log book

16.3.1 Fault messages in the log book

For more information on the 'ERROR' messages - refer to the chapter "Fault messages on the LCD screen".

Tab. 20: Errors

Log book no.	Description	Acknowledge?
0	System, EEProm error*	X
1	The pump is in *'Analog'* operating mode, a fault behaviour has been programmed in the *'Analog'* menu and the control current has fallen below 4 mA.	-
2	The pump is in *'Analog'* operating mode, a fault behaviour has been programmed in the *'Analog'* menu and the control current has risen above 20 mA.	-
3	The fluid level in the storage tank has reached "Liquid level low 2nd stage".	-
4	The pump hose has a leak.	-
5	The state of the dosing monitor is not as expected.	X
6	-	-
7	The ambient temperature is too high or too low.	-
8	-	-
9	-	-
10	An incorrect parameter has been entered.	X
11	-	-
12	-	-
13	The mains voltage is too low or not connected.	-
14	-	-
15	-	-
16	The memory for revolutions, which have not yet been processed, has overflowed.	X

Log book no.	Description	Acknowledge?
17	The pump is in *'Analog'*-"xx. side band" operating mode, a fault behaviour has been programmed in the *'Analog'* menu and the control current has fallen below 4 mA.	-
18	The pump is in *'Analog'*-"xx. side band" operating mode, a fault behaviour has been programmed in the *'Analog'* menu and the control current has risen above 20 mA.	-
19	-	X
20	The bus contact between the optional module and control room has been disconnected. *	-
21	Communication between the optional module and pump electronics is not working.	-
22	The associated heartbeat message was no longer received by the front assembly for a certain period of time.	-
23	Problems with compatibility with the assemblies' firmware. *	X
24	System or EPRom error	X
25	Pump restart, initialisation incomplete.	-
26	The motor indicates a fault.	-
27	The fan is faulty or not connected. *	-
28	RS485 communication is interrupted.	-
29	The motor indicates a fault. *	-
30	The motor is blocking. *	X

* Please get in touch with the ProMinent head office should this fault occur.

16.3.2 Warning messages in the log book

For more information on the 'WARNING' messages - refer to the chapter "Warning messages on the LCD screen".

Tab. 21: Warnings

Log book no.	Description
0	The fluid level in the storage tank has reached "Liquid level low 1st stage".
1	The pump hose has a leak.
2	The state of the dosing monitor is not as expected.
3	The set metering volume in concentration mode cannot be metered.
4	A set parameter is invalid.
5	The fan is faulty or not connected.
6	-
...	...
11	-
12	The set metering volume in concentration mode cannot be metered.
13	The temperature is too high.

16.3.3 Event messages in the log book

Tab. 22: Events

Log book no.	Description
0	Head installation changed
1	Parameter menu called up – dongle was inserted.
2	-
3	-
4	-
5	-
6	-
7	The pump was reset to factory settings.
8	The pump was calibrated.
9	*[START/STOP]* was pressed.
10	*[Priming]* was pressed.
11	The *[Clickwheel]* was pressed.
12	The pump hose was replaced.
13	The timer performed an action.
14	A relay has triggered.
15	-
16	CRC error has been detected in the EEProm data. Log book: [hh ll 00 00] hh – MSB address ll – LSB address [00 00 rr ss] ss – Structure rr – Result
17	-
18	The metering volume cannot be metered.
19	The pump has been booted and is operational.
20	-
21	The dosing direction was changed.

16.3.4 Log book entry - detailed view

For more information about a log book entry, press the *[Clickwheel]*.

Tab. 23: Information on the detailed view

Line	Information
1	Date, time
2	Type of entry (fault, warning ...)
3	Total operating time, total revolutions

Line	Information
4	Switching-on duration, revolutions since switching on
5	Room temperature, additional information on the error (for developers)

17 Decommissioning and disposal

User qualification: Technical personnel and service - see *'Qualification of personnel' on page 12*

Decommissioning

WARNING!

Danger from chemical residue

There is normally chemical residue in the liquid end and on the housing after operation. This chemical residue could be hazardous to people.

- It is mandatory that the safety information in the "Storage, transport and unpacking" chapter are read before shipping or transport.
- Thoroughly clean the liquid end and the housing of chemicals and dirt. Adhere to the material safety data sheet for the feed chemical.

WARNING!

Warning of hazardous feed chemical

Should a dangerous feed chemical be used: it may escape from the hydraulic components when working on the pump, material failure or incorrect handling of the pump.

- Take appropriate protective measures before working on the pump (e.g. safety glasses, safety gloves, ...). Adhere to the material safety data sheet for the feed chemical.
- Drain and flush the liquid end before working on the pump.

CAUTION!

Warning of feed chemical spraying around

Feed chemical can spray out of the hydraulic components if they are manipulated or opened due to pressure in the liquid end and adjacent parts of the system.

- Disconnect the pump from the mains power supply and ensure that it cannot be switched on again by unauthorised persons.
- Depressurise the system before commencing any work on hydraulic parts.

Danger of damage to the device

Take into account the information in the "Storage, transport and unpacking" chapter if the system is decommissioned for a temporary period.

1. Disconnect the pump from the mains.
2. Drain the liquid end by turning the pump upside down and allowing the feed chemical to run out.
3. Flush the liquid end with a suitable medium; flush the dosing head thoroughly when using hazardous feed chemicals!

Disposal

CAUTION!

Risk to the environment from the battery

There is a battery in the pump, which can have a toxic effect on the environment.

- Disconnect the battery from the remaining parts.
- Note the pertinent regulations currently applicable in your country!

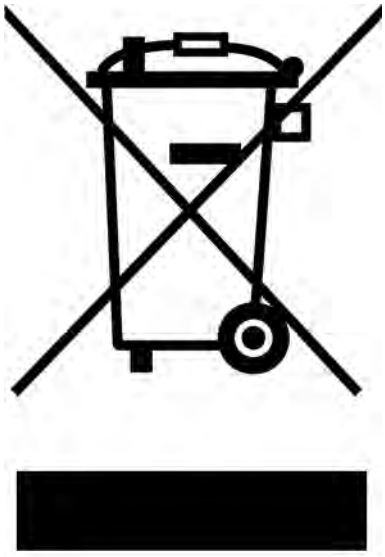
CAUTION!

Environmental hazard due to electronic waste

There are components in the pump, which can have a toxic effect on the environment.

- Note the pertinent regulations currently applicable in your country!

Sign indicating EU collection system



In accordance with the European Directive 2012/19/EU on waste electrical and electronic equipment, this device features the symbol showing a waste bin with a line through it. The device must not be disposed of along with domestic waste. To return the device, use the return and collection systems available and observe the local legal requirements.

18 Technical data

18.1 Performance data

DULCO flex Control at 100 rpm

Liquid end type	Minimum capacity at maximum back pressure		Speed, max.	Connector size Outside ∅ x inside ∅	Suction lift* = priming lift	Permissible priming pressure on suction side	Weight
	bar	l/h	rpm	mm	m water column	bar	kg
0730	7 *	30 **	100	12x9	9	1	5.8
0530	5 *	30 **	100	12x9	9	1	5.8

Data calculated with water at 20°C.

* - Depending on hose material

** - Minimum capacity: 10 ml / h

18.2 Precision

Parameter	Value
Capacity range of the product range	-5 ... + 5 %
Reproducibility	± 2 % *

* with pump hose drawn in (after approx. 200 revolutions)

18.3 Viscosity

The liquid ends are suitable for the following viscosity ranges:

Design	Range	Unit
Standard	0.7 ... 10,000	mPas

18.4 Material specifications

Part	Material
Pump hose *	TPV or PUR
Hose connection *	PVDF
O-rings *	PTFE
Dosing head	PA6 50 % GB
Rotor	PPS 40 % GF
Rollers on the rotor	PA66
Bearing cover	PC
Housing upper part	PPE + 20 % GF
Housing lower part	PPE + 20 % GF
Cable threaded connectors	PA6
Metal parts (screws, etc.)	A2

* wetted

18.5 Electrical data

Design: 100 - 230 V ±10%, 50/60 Hz

Data	Value	Unit
Nominal power, approx.	45	W
Current I_{eff}	0.45 ... 0.20	A
Fuse	1.6	AT

Fuses must have VDE, UL and CSA certification. E.g. series SPT, 1.6 A supplied by Schurter Order. No. 0001.2506 according to IEC Publ. 127 - 2/3.

18.6 Temperatures

Pump, fully assembled

Data	Value	Unit
Storage and transport temperature:	- 10 ... +50	°C
Ambient temperature in operation (power end/drive and control):	-10 ... +45	°C
Feed chemical temperature	-10 ... +45	°C
Feed chemical temperature, briefly (5 min)	+80	°C

18.7 Climate

Data	Value	Unit
Maximum air humidity *:	95	% rel. humidity

* non-condensing

Exposure in a humid and alternating climate:

FW 24 according to DIN 50016

18.8 Altitude of site

Data	Value	Unit
Altitude of site , max.:	2000	m above NHN

18.9 Degree of Protection and Safety Requirements

Degree of protection

Protection against contact and humidity:

IP 66 according to DIN EN 60529 with contamination level 2

NEMA 4X / indoor as per NEMA 250

Safety Requirements

Degree of protection:

1 - mains power connection with protective earth conductor

18.10 Sound pressure level

Sound pressure level

Sound pressure level LpA < 70 dB according to EN ISO 20361

at maximum feed rate and maximum back pressure (water)

18.11 Suction lance, continuous

The suction lance with continuous level measurement is configured for 30-litre standard canisters and the DULCO flex Control.

It works very well with correct feed chemicals containing water. The dielectric constant must be high.

Hose connector mm	Order no.	Dimensions* approx. Ø x Length mm
6 x 4 mm	1094379	74.5 x 571
8 x 5 mm	1094382	74.5 x 571
12 x 9 mm	1094380	74.5 x 571

* without cable and hose (3 m)

Specification	Value
Precision (based on measuring section):	5%

Specification	Value
Storage and transport temperature:	-10 ... +50 °C
Ambient temperature during operation:	-10 ... +45 °C
Medium temperature:	-10 ... +50 °C

Specification	Value
Protection against contact and moisture: according to EN 60529	IP67
Rel. humidity, max:	95% *

* Non-condensing

Component	Materials
Suction lance	
Pipe, hose and screw cap	PE
Adapter, valve insert, clamping ring, hose nozzle, valve seat, distance sleeve, screen plate	PVDF
Electronics	Electronic components
Flat seal	PTFE
Valve ball	Ceramic
Level measurement	
Heat shrink hose	PLG / PVDF
Housing parts	PP GF30
Seal	TPE

19 Dimensional drawings

- *Compare the dimensions on the dimensional drawing with those of the pump.*
- *All dimensions are in mm.*

Dimensional drawing DULCO flex Control

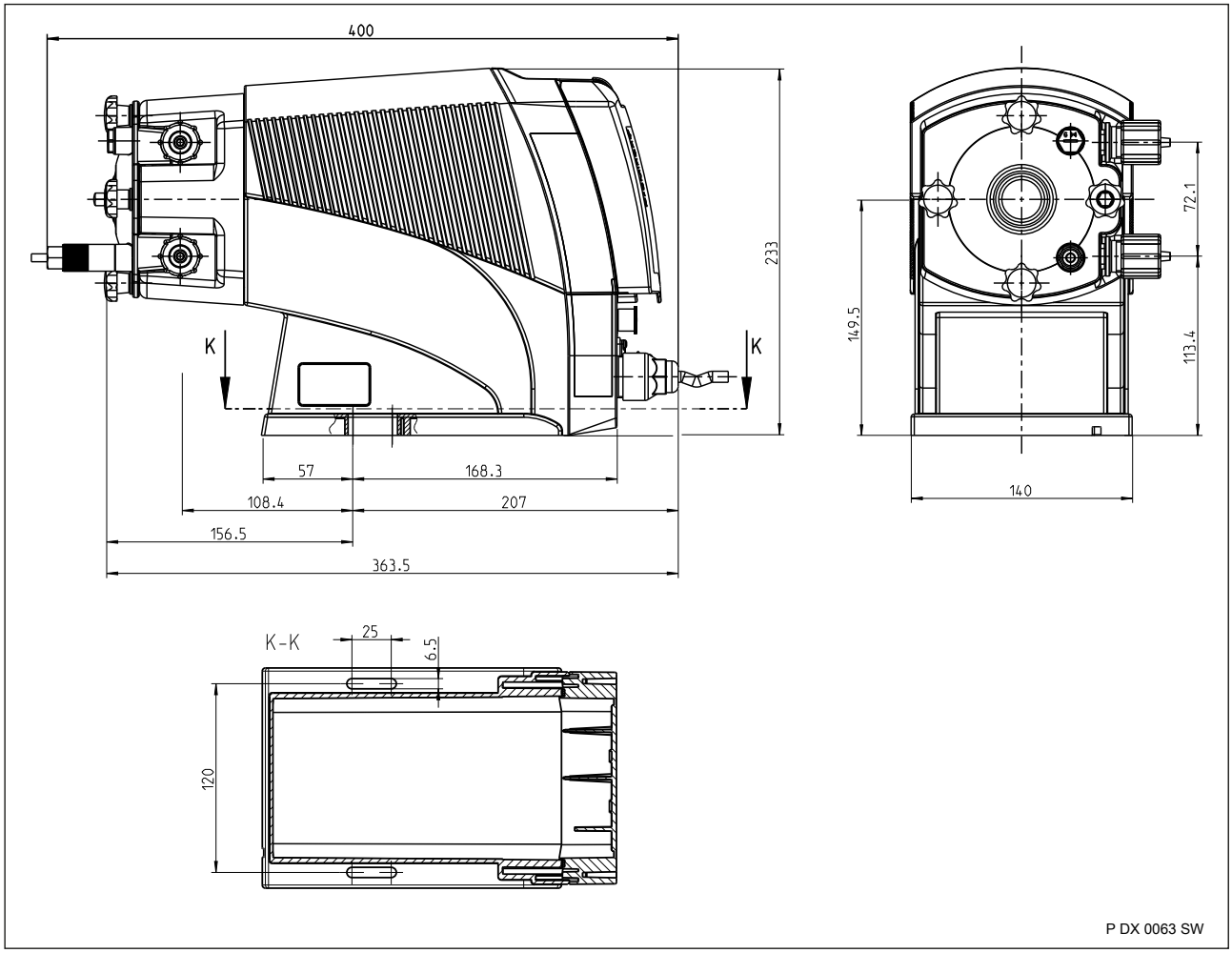


Fig. 37: Diagram is not strictly binding

20 Declaration of Conformity for Machinery

In accordance with DIRECTIVE 2006/42/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL, Appendix I, BASIC HEALTH AND SAFETY REQUIREMENTS, section 1.7.4.2. C.

We,

- ProMinent GmbH
- Im Schuhmachergewann 5 - 11
- D - 69123 Heidelberg, Germany,

hereby declare that the product specified below complies with the relevant basic health and safety requirements of the EC Directive on the basis of its functional concept and design and in the version marketed by us.

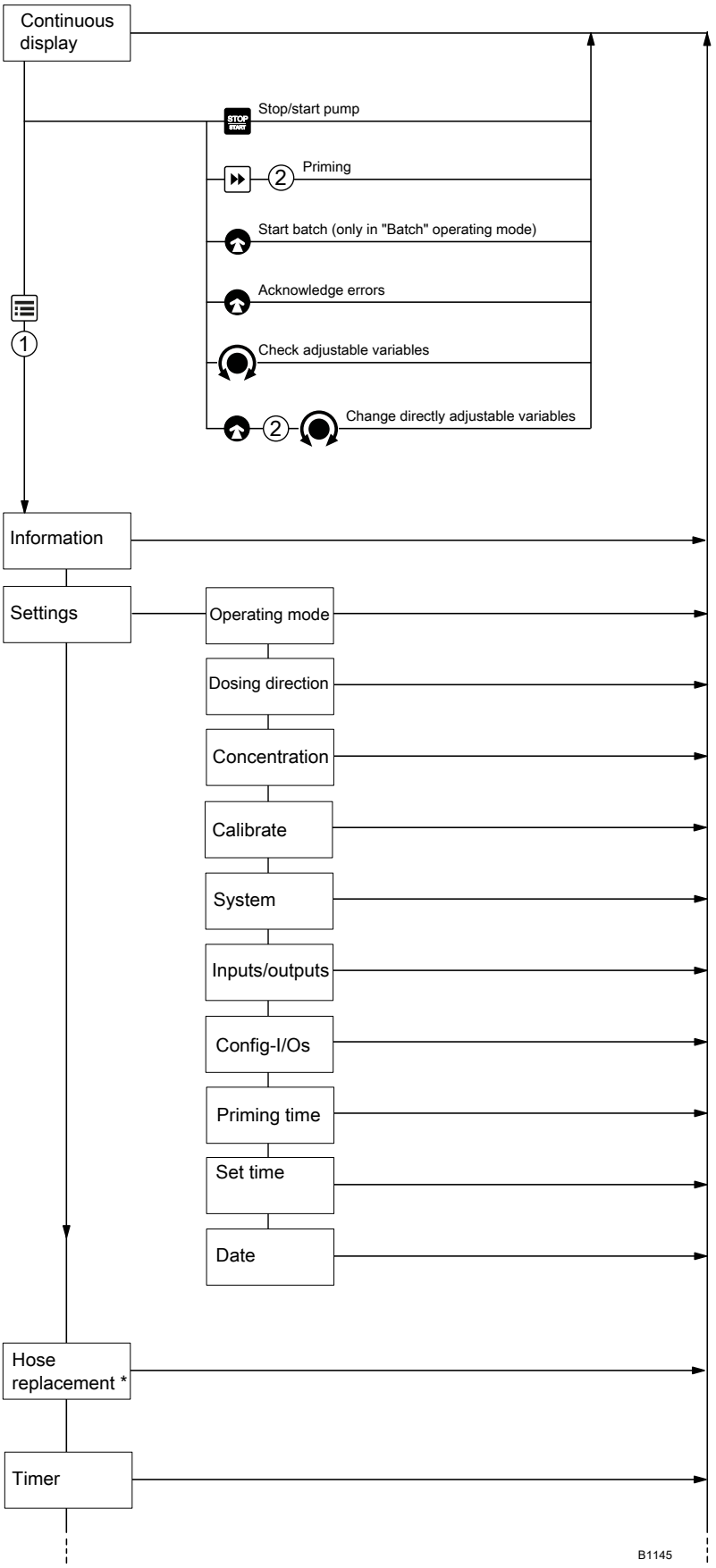
Any modification to the product not approved by us invalidates this declaration.

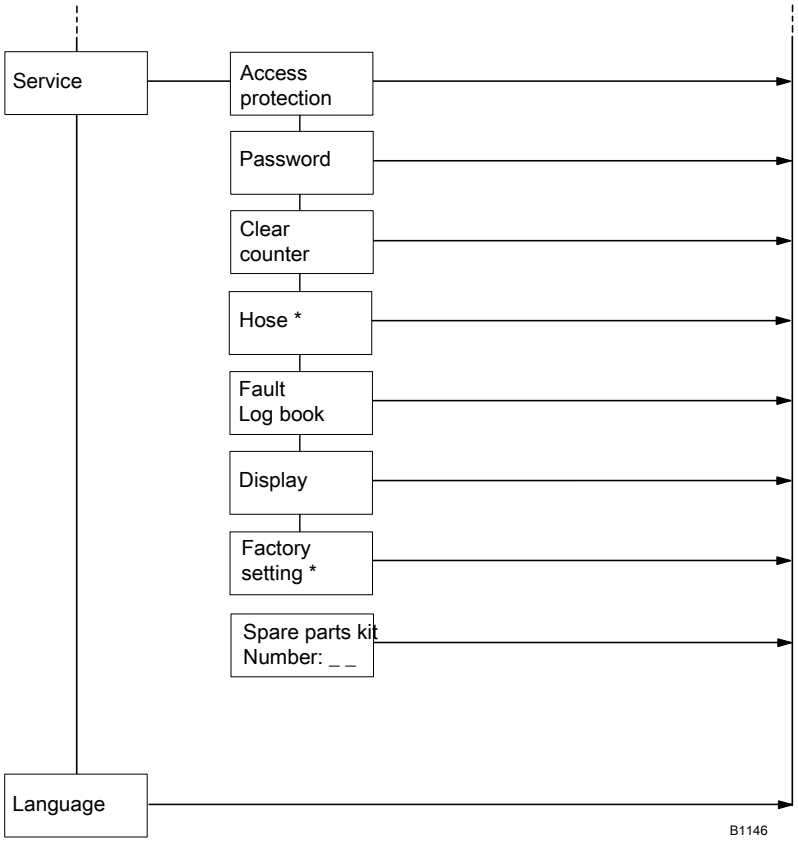
Tab. 24: Excerpt from the Declaration of Conformity

Designation of the product:	Peristaltic metering pump DULCO flex Control
Product type:	DFXa...
Serial number:	see nameplate on the device
Relevant directives:	Machinery Directive (2006/42/EC) Compliance with the protection targets of the Low Voltage Directive according to Annex I, No. 1.5.1 of the Machinery Directive (2006/42/EC) EMC Directive (2014/30/EU) RoHS Directive (2011/65/EU)
Harmonised standards applied, in particular:	EN ISO 12100: 2010 EN 809:1998 + A1:2009 + AC:2010 EN 61010-1:2010 EN 61000-6-2:2005 + AC:2005 EN 61000-6-4:2007 + A1:2011 EN 50581:2012
Date:	01.08.2019

You can download the Declaration of Conformity at www.prominent.com.

21 Operating / set-up overview DULCO flex Control





* For this menu to appear, press [STOP/START] to bring the pump to a “Stop (manually)”.

22 DULCO flex Control operating menu, overall

1st level	2nd	3rd	4th	5th	xth
Information	Versions	Control	Hardware Software Bootloader		
		Power	Hardware Software Bootloader		
		HMI data			
	Time				
	Date				
	Serial number				
	Identity code				
	Max. metering capacity				
	Switch-on counter				
	Total operating time				
	Total number of revol.				
	Total metering volume				
	Current volume per revolution				
Settings	Operating mode	Manual			
		Contact	*Memory* On Off	Metering volume *1	..
		Batch	*Memory* On Off	Metering volume *1	...
		Analog	0...20 mA		
			4...20 mA		
			Linear curve Lower side band Upper side band	Curve point 1 (I1,F1)	...
	Dosing direction	Clockwise Anti-clockwise			
	Concentration	Concentration control active inactive	Flow of main medium (for Manual)	Concentration of feed chemical	...
			Contact distance (for Contact)	Concentration of feed chemical	...
			Volume of main medium (for Batch)	Concentration of feed chemical	...

1st level	2nd	3rd	4th	5th	xth
			Max. flow of main medium (for Analog)	Concentration of feed chemical	...
	Calibrate	Calibration factor	Calibration factor		
		Calibrate	Start calibration	Calibration ended	Calibra-tion result
	System	Configure dosing head	right left top bottom		
		Volume unit	Litres Gallons		
		Start behaviour	always STOP always on last status		
	Inputs/outputs	Auxiliary mode	Auxiliary capacity	...	
		Relay 1	Relay1 type	Timer Fault Warning Warning + error Warning + error + stop Pump active Metering / Batch	
			Relay 1 polarity	energizing (N/O) releasing (N/C)	
		Relay 2	Relay type	Timer Fault Warning Warning + error Warning + error + stop Pump active Cycle quantity Speed Metering / Batch	
			Polarity	energizing (N/O) releasing (N/C)	
		mA-Output	0...20 mA 4...20 mA	Capacity at 20 mA	...
		Flow monitoring	Flow Control	Tolerance / revolu-tions Activation if auxiliary	...

1st level	2nd	3rd	4th	5th	xth
		Pause input	N/C N/O		
		Level monitoring	2-stage continuous		
	Config-I/Os	Set Config I/Os	Config I/O 1 Config I/O 2 Config I/O 3	off Timer input Timer output AUX Selective fault Selective warning Cycle quantity Metering / Batch Fault Warning Warning + error Warning, error + stop Pump active	...
		Config I/O 1 xxxxxx Config I/O 2 xxxxxx Config I/O 3 xxxxxx			
	Priming time	0 ... 60 s			
	Set time	Time	Set	hh.mm.ss	
		Auto. summer time	Yes No		
		Summer time begins in	February March April		
		Sunday the	1st, 2nd, 3rd, 4th, 5th		
		Summer time ends in	August September October November		
		Sunday the	1st, 2nd, 3rd, 4th, 5th		
		Location	Northern hemi-sphere Southern hemi-sphere		
	Date	dd.mm.yyyy			
Hose replacement *	Go to change posi-tion?	No Yes	...		
Timer	Timer status				

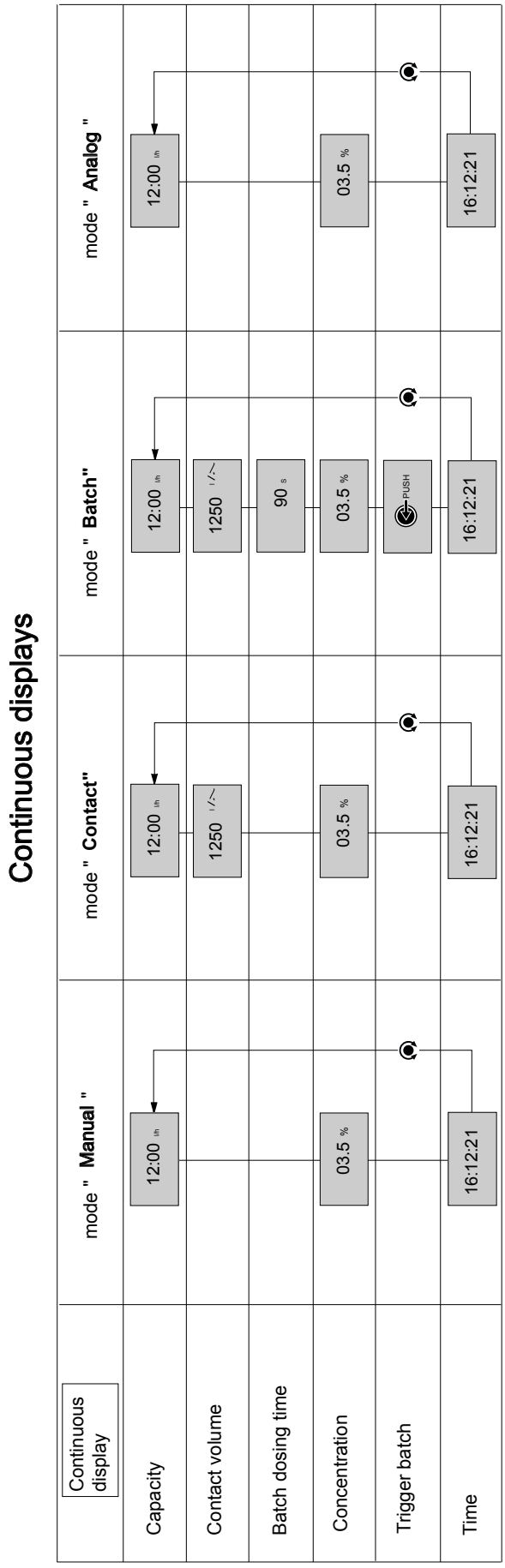
1st level	2nd	3rd	4th	5th	xth
	Activation	Active Inactive			
	Set the timer	New Displays Change Clear	Command 01 Command 2 …	Hourly Daily (Mon-Sun) Weekdays1 (Mo-Fr) Weekdays2 (Mo-Sa) Weekend (Sa+Su) Weekly Monthly Init Delayer Config I/O 1 Config I/O 2 Config I/O 3	...
	Clear all	No Yes			
Service	Access protection	*Password?*	None Lock menu Lock all		
	Password	*Password?*	0000		
	Clear counters	Number of revolutions Volume counter All			
	Hose *	Hose interval Hose service in xxx h Revolutions since service Interval counter			
	Error log book	Error log book	...		
		Filter	None Warn.+error only Error only Warnings only Events only		
	Display	Brightness			
		Contrast			
	Factory setting *	*Password?*	Yes No		

1st level	2nd	3rd	4th	5th	xth
	Spare parts kit number: XXXXXXX				
Language (*Language*)	English German French Spanish Italian ...				

Menus may be missing or added depending on the design and equipment on the pump.

* For this menu to appear, press [STOP/START] *[STOP/START]* to bring the pump to a “Stop (manually)”.

23 Continuous displays and secondary displays



Auxiliary displays in the continuous display

Secondary display	mode " **Manual** "	mode " **Contact** "	mode " **Batch** "	mode " **Analog** "
Capacity	12.00 L / h			12.00 L / h
Remaining litres			000,833↓ l [1]	
Hose service Warning	1613 h	1613 h	1613 h	1613 h
Total number of revol.	602371 ↻	602371 ↻	602371 ↻	602371 ↻
Total litres	2949.6 l	2949.6 l	2949.6 l	2949.6 l
Signal current (at the input)				12,7 mA [2]
Time	16:12:21	16:12:21	16:12:21	16:12:21
Date	2015 - 03 - 27	2015 - 03 - 27	2015 - 03 - 27	2015 - 03 - 27
Relay status	Relay 1: on | Relay 2: off [3]	Relay 1: on | Relay 2: off [3]	Relay 1: on | Relay 2: off [3]	Relay 1: on | Relay 2: off [3]

1 = only with "Storage tank" function extension
2 = only with current output
3 = only with relay

24 Installation instructions: Retrofitting Relays

These installation instructions apply to:

	Order No.
Fault indicating relay GMXa	1050643
Fault indicating and pacing relay GMXa	1050654

WARNING!

Danger of electrocution.

Live parts can be accessed if the slot for the relay has been opened.

- Disconnect the pump from the mains/power supply prior to commencing work.
- Only operate the pump with a liquid-tight screwed slot for the relay and connector for the relay cable.

Scope of delivery

1 - Relay board, fully ass.

1 - Relay cable, fully assembled, with connector

1 - Seal

Materials

Torx spanner T 25

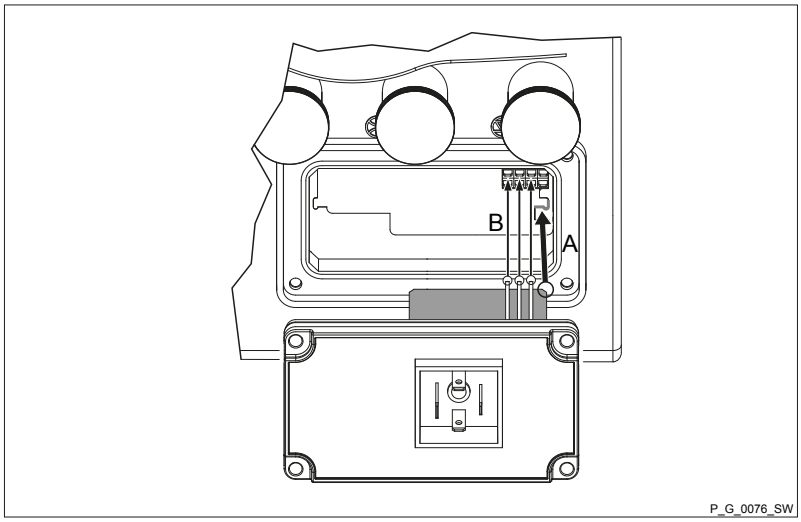
A small bright pocket torch can help to find the 4x2 contact in the slot for the relays more easily.

Personnel: ■ Electrician

Prerequisite:

The pump is electrically disconnected.

1. Remove the cover of the slot.
2. Hold the relay board by the edge of the relay cover.
3. Carefully insert the relay board into the slot for the relay - the opening in the board in the slot will help with this (A); at the same time make sure that the 3x2 pins on the relay board are sitting correctly and on the left contacts of the 4x2 contact in the slot (B) - see Figure
4. Push the relay board with gentle pressure into the slot.
5. Use the screws to screw the relay cover until liquid-tight with the housing.
6. Insert the seal of the connector of the relay cable into the relay cover.
7. Push the connector onto the pins of the relay cover and then tighten the screw into the connector until liquid-tight.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