

Operating instructions

Solenoid Metering Pump

delta® DLTa

with controlled optoDrive® solenoid drive



Two sets of operating instructions are required for the safe, correct and proper operation of the metering pumps: The product-specific operating instructions and the "General Operating Instructions for ProMinent® Solenoid Metering Pumps". Both sets of operating instructions are only valid when read together.

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

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Supplementary information



Fig. 1: Please read!

Read the following supplementary information in its entirety! Should you already know this information, you have an even greater need of the Operating Instructions.

The following are highlighted separately in the document:

■ Enumerated lists

➔ Instructions

⇒ Outcome of the instructions

Information



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

Safety notes

Safety notes are identified by pictograms - see Safety Chapter.

General user instructions

Two sets of operating instructions are required for the safe, correct and proper operation of the metering pumps: The product-specific operating instructions and the "General Operating Instructions for ProMinent® Solenoid Metering Pumps".

Both sets of operating instructions are only valid when read together.

Please read these operating instructions carefully before use! Do not discard!

State the identity code and serial number

Please state identity code and serial number, which you can find on the nameplate when you contact us or order spare parts. This enables the device type and material versions to be clearly identified.

General non-discriminatory approach

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

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1 Identity code

Product range delta[®], version a

DLTa	Type	Performance	
		bar	l/h
	2508	25	7.5
	1608	16	7.8
	1612	16	11.3
	1020	10	19.1
	0730	7	29.2
	0450	4	49.0
	0280	2	75.0
		Material of dosing head/valves	
	TT	PTFE/PTFE	
	SS	Stainless steel 1.4404/1.4404	
	PV	PVDF/PVDF	
	NP	Clear acrylic/PVDF. With the self-bleeding version (SEK): Clear acrylic/PVC	
		Material of seals/diaphragm	
	T	PTFE/PTFE coated	
	S	Diaphragm additionally with FPM coating for media containing silicate	
	B	FPM-B/PTFE coated, only for PP and NP self-bleeding (SEK)	
	E	EPDM/PTFE coated, only for PP and NP self-bleeding (SEK)	
		Dosing head version	
	0	Without bleed valve, without valve spring	
	1	Without bleed valve, with valve spring	
	2	With bleed valve, without valve spring	
	3	With bleed valve, with valve spring	
	4	HV version for media of higher viscosity	
		Hydraulic connection	
	0	Standard connection in line with technical data	
	5	Connection for 12/6 tube, suction side standard	
		Diaphragm rupture reporter	
	0	Without diaphragm rupture reporter	
	1	Diaphragm rupture reporter	
		Version	
	0	With ProMinent logo	
		Electrical connection	
	U	Universal control 100-230 V ±10 %, 50/60 Hz	
		Cable and plug	
	A	2 m European	
	B	2 m Swiss	

Product range delta®, version a

										C	2 m Australian	
										D	2 m USA	
										
											Relay	
										0	No relay	
										1	Fault indicating relay N/C	1 x changeover contact 230 V – 8 A
										3	Fault indicating relay magnetic	1 x changeover contact 230 V – 8 A
										4	As 1 + pacing relay	2 x N/O 24 V – 100 mA
										5	As 3 + pacing relay	2 x N/O 24 V – 100 mA
										A	Cut-off and warning relays N/C	2 x N/O 24 V – 100 mA
										C	As 1 + 4-20 mA mA output	1 x N/O 24 V – 100 mA
										F	With automatic bleed valve	not for pump type 2508
										
											Accessories	
										0	No accessories	
										1	With foot and injection valve, 2 m suction line, 5 m metering line	
										2	As 0 + measuring cup	
										3	As 1 + measuring cup	
											Control versions	
										0	Manual + external contact with pulse control	
										3	Manual + external contact with pulse control + analog 0/4-20mA	
										4	As 0 +14-day process timer	
										5	As 3 +14-day process timer	
										C	CANopen	
										R	As 3 + PROFIBUS® interface, M12	
											Access code	
										0	No access code	
										1	With access code	
											Language	
										DE	German	
										EN	English	
										FR	French	
										ES	Spanish	

Product range delta® , version a

													
															Pause / level
															0 Pause N/ C, level N/C

2 About this pump

Properties of the device

The solenoid metering pumps belonging to the delta® product range with controlled optoDrive® solenoid drive are microprocessor-controlled solenoid metering pumps with the following characteristics:

- Continuous or pulsing operation
- Adaptation of the pump to the feed chemical
- Detection of blocked points of injection, broken metering lines and trapped air or gas bubbles in the dosing head by the integral injection point monitor optoGuard.
- Output range 7.5 l/h, 25 - 2 bar
- Stroke length continuously adjustable between 0 - 100 % (recommended 30 - 100 %)
- Material versions PVDF and stainless steel
- Patented coarse/fine adjustment
- Diaphragm rupture detection and signalling (optional)
- Adjustment and display of the feed rate, either as strokes/min or l/h via the keyboard
- Large illuminated graphic display
- External activation via potential-free contacts with optional pulse step-up and step-down
- Option of external activation by standard signal 0/4-20 mA
- Interface for PROFIBUS® or CANopen (optional)
- 14-day process timer* for time- and event-dependent metering tasks
- Connection for 2-stage level switch
- 3 LED display for operation, warning and fault messages in plain text
- Concentration input for volume-proportional metering
- Automatic bleed
- Pump type 2508 with 7.5 l/h at 25 bar
- Material version NP for pump types 2508, 1612, 1608, 1020 and 0730

3 Safety chapter




Explanation of the safety instructions

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 – high-voltage.
	Warning – danger zone.

Correct and proper use

- The pump may only be used to dose liquid metering chemicals.
- The pump may only be started up after it has been correctly installed and commissioned 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 equipment catalogue or at www.prominent.com)!
- Any other uses or modifications are prohibited.
- The pump is not intended for the metering of gaseous media or solids.
- The pump is not intended for the metering of explosive media.
- The pump is not intended for operation in hazardous locations.
- The pump is not intended for exterior applications without use of suitable protective equipment.
- The pump should only be operated by trained and authorised personnel, see the following "Qualifications" table.
- You are obliged to observe the information contained in the operating instructions at 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!

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!

Fire danger

Combustible media may only be transported using stainless steel dosing heads. In exceptional cases where this is not possible, PTFE with carbon can be used, whereby our TT_ versions are manufactured from this conducting plastic. Here, the operator is urged to take special care due to the low mechanical strength.



WARNING!

Warning of hazardous or unknown feed chemical

Should a hazardous or unknown feed chemical be used, it may escape from the hydraulic components when working on the pump.

- Take appropriate protective measures before working on the pump (protective eyewear, protective gloves, ...). Read the safety data sheet on 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.



CAUTION!

Warning of feed chemical spraying around

An unsuitable feed chemical can damage the parts of the pump contacted by the chemical.

- Take into account the resistance of the materials which will come into contact with the chemical when selecting the feed chemical - refer to the ProMinent resistance list in the product equipment catalogue under www.prominent.com.



CAUTION!

Warning of feed chemical spraying around

The metering pump can generate a multiple of its rated pressure. If a discharge line is blocked, hydraulic parts may burst.

- Correctly install a back pressure valve in the discharge line behind the metering pump.



CAUTION!

Danger of personnel injury and material damage

The use of untested third party parts can result in personnel injuries and material damage.

- Only fit parts to metering pumps, which 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!

Danger from incorrect metering

Should a different liquid end size be fitted, this will change the metering behaviour of the pump.

- Have the pump reprogrammed in the works.



CAUTION!

Warning of illegal operation

Observe the regulations that apply where the unit is to be installed.

Information in the event of an emergency

In the event of an electrical accident, disconnect the mains cable from the mains or press the emergency cut-off switch fitted on the side of the system!

If feed chemical exits, switch off the pump by pressing the *[Stop/Start]* key. If necessary depressurise the hydraulic system around the pump. Observe the safety data sheet for the feed chemical.

Qualification of personnel

Activity	Qualification level
Storage, transport, unpacking	Instructed person
Assembly, installation of hydraulic system	Technical personnel, service
Installation, electrical	Electrical technician
Operation	Instructed person
Maintenance, repair	Technical personnel, service
Decommissioning, disposal	Technical personnel, service
Troubleshooting	Technical personnel, electrical technician, instructed person, service

Explanation of the terms:
Technical personnel

A qualified employee is deemed to be a person who is able to assess the tasks assigned to him and recognise possible dangers based on his/her 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 employment in the relevant work area.

Electrical technician

Electrical technicians are deemed to be people, who are able to complete work on electrical systems and recognize and avoid possible dangers independently based on their technical training and experience, as well as knowledge of pertinent standards and regulations.

Electrical technicians should be specifically trained for the working environment in which they are employed and know the relevant standards and regulations.

Electrical technicians 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.

Customer Service department

Customer Service department refers to service technicians, who have received proven training and have been authorised by ProMinent or ProMaqua to work on the system.

Sound pressure level

Sound pressure level $L_{pA} < 70$ dB in accordance with EN ISO 20361:2010-10

at maximum stroke length, maximum stroke rate, maximum back pressure (water)

4 Storage, transport and unpacking

Safety information



WARNING!

The pump can tip over when lifting

The pump can tip over when lifting, as the centre of gravity of the pump is quite a distance from the liquid end.

- Grip the pump quite close to the liquid end.

Safety information



WARNING!

The transporting of pumps which have been used with radioactive feed chemicals is forbidden!

They will also not be accepted by ProMinent!



WARNING!

Only return the metering pump for repair in a cleaned state and with a flushed liquid end - refer to the section on decommissioning!

Only send metering pumps with a filled in Decontamination Declaration form. The Decontamination Declaration constitutes an integral part of an inspection / repair order. A unit can only be inspected or repaired if a Decontamination Declaration 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 in the General Operating Instructions or under www.prominent.com.



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.

Personnel:

■ Technical personnel

Ambient conditions

Data	Value	Unit
Minimum storage and transport temperature	-10	°C
Maximum storage and transport temperature	+50	°C

Data	Value	Unit
Air humidity	< 95	% rel. humidity*

* non-condensing

Scope of supply

Compare the delivery note with the scope of supply:

- Metering pump with mains power cable
- Connector kit for hose/pipe connection
- Product-specific operating instructions with EC Declaration of Conformity
- CD with order information, exploded diagrams and data sheets
- Optional accessories if ordered
- Relay cable, as necessary

5 Device overview and control elements

5.1 Device overview

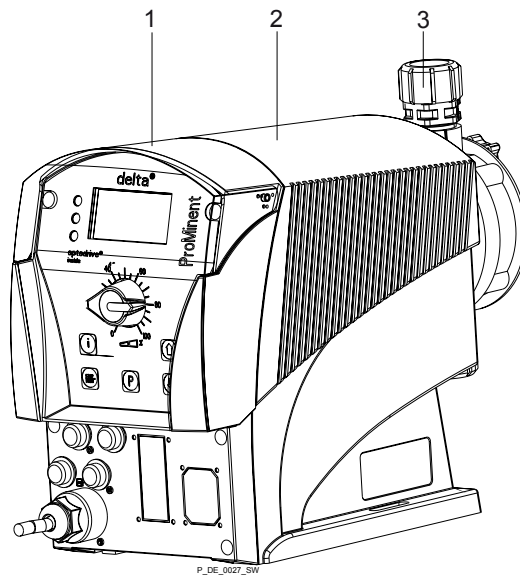


Fig. 2

- 1 Control unit
- 2 Drive Unit
- 3 Liquid end

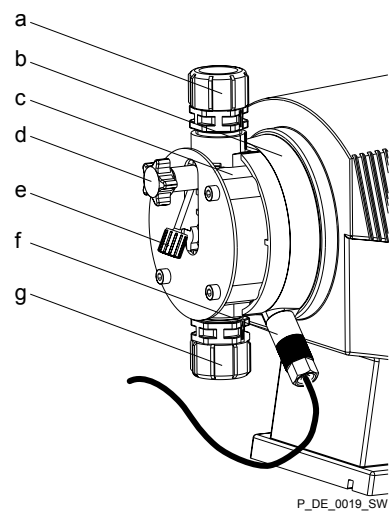


Fig. 3

- a Discharge valve
- b End disc
- c Dosing head
- d Bleed valve
- e Bypass hose nozzle
- f Diaphragm rupture sensor
- g Suction valve

5.2 Control elements

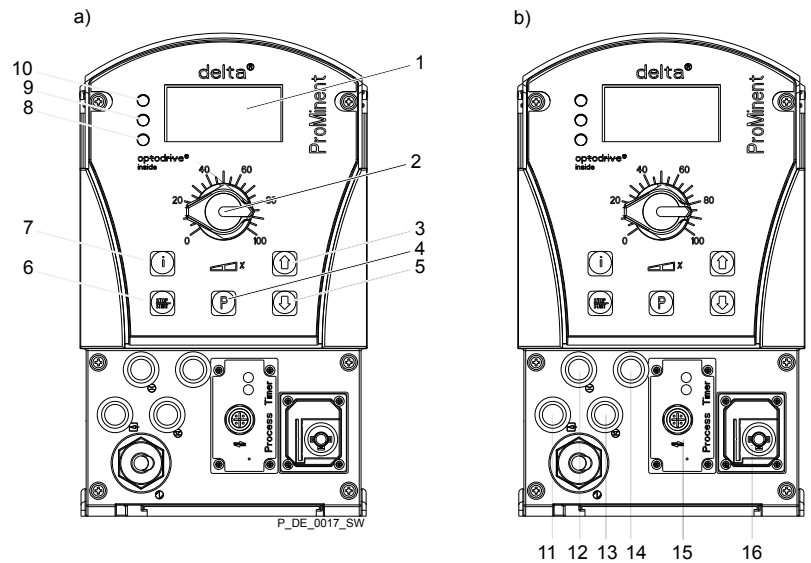







Fig. 4: a) Displays and keys, b) Electrical control connections

- 1 LCD display
- 2 Stroke length adjustment knob
- 3 Key [UP]
- 4 Key [P]
- 5 Key [DOWN]
- 6 Key [STOP/START]
- 7 Key [i]
- 8 Operating indicator (green)
- 9 Warning indicator (yellow)
- 10 Fault indicator (red)
- 11 "External control" jack
- 12 "Dosing monitor" jack
- 13 "Level Switch" jack
- 14 "Diaphragm rupture reporter" jack
- 15 Optional module slot (timer, PROFIBUS®, CAN-Bus)
- 16 Relay and mA-output (option)

5.2.1 Key functions

Key	Application	In continuous displays (operation)	In adjustment mode (set up)
			
[STOP/START]	Pressed briefly	Stop pump,	Stop pump,
		start pump	start pump
			
[P]	Pressed briefly	Start batch (only in 'Batch' operating mode), acknowledge fault	Confirm entry - jump to next menu point or to continuous display
	Pressed for 2 s	Change to adjustment mode	-
	Pressed for 3 s	-	Jump to continuous display
 B0098			

Key	Application	In continuous displays (operation)	In adjustment mode (set up)
[/]	Pressed 1x	Change between the continuous displays	Change between "Changing individual numbers" and "Changing a number"
	Pressed 2x	-	Under "Changing individual numbers": jump to the first number
	Press and hold	Change to the secondary display	-
 			
[UP], [DOWN]	Individually pressed (until double arrow appears)	Changing directly changeable variables	Select another setting, change individual number or number. At the top end of a selection, effect similar to an ESC key.
	Pressed simultaneously	Suction (in continuous display "Stroke rate")	-

5.2.2 Stroke length adjustment knob

The stroke length can be adjusted using the stroke length adjustment knob and with it the volume per stroke.

5.2.3 Identifiers

The LCD screen supports the operation and adjustment of the pump with different identifiers:

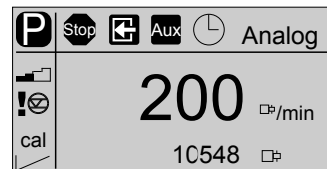












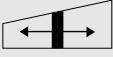












Fig. 5

The identifiers have the following meanings:

Symbol	Additional symbol	Name	Meaning
		Priming:	The pump is currently priming (both arrow keys pressed).
		Symbol for P-key:	The pump is in adjustment mode.
		Lock symbol:	Lock (if a code was set. Flashes).
		Double arrow symbol:	The value in the continuous display can be changed with the arrow keys.
		Info symbol:	It is possible to change between continuous displays.
		Stop:	The pump was stopped using the [STOP/START] key (i.e. manually).

Symbol	Additional symbol	Name	Meaning
		Pause:	The pump was externally stopped by the Pause contact.
		Aux:	The pump is currently pumping with the auxiliary rate as the stroke rate. During this time, the pump is in operating mode <i>'Manual.'</i>
		Fault:	A fault has occurred, which has stopped the system.
		Stroke length:	The pump is set to <i>'Dosing' 'slow'</i> and this metering mode is also active (less than 61 stroke/min). Below 30 strokes/min the operating indicator flashes during operation and illuminates for slightly longer at the end of each stroke. The symbol relates to the symbol, which is located beneath the stroke adjustment dial.
		Stroke length adjustment:	Deviation in the stroke length from the value set at the time of the last locking of the adjustment menu.
		Diaphragm rupture:	The diaphragm is broken. The message appears as a warning or fault, dependent upon the setting. The symbol represents a section through the membrane.
		Air lock:	There is air in the liquid end. The message appears as a warning or fault, dependent upon the setting. The symbol represents a liquid end with air bubbles in it.
		Level:	The "Warning" level in the storage tank was undershot. If the symbol flashes, the level has fallen below the "Fault" level in the storage tank and the pump stops.
		Flow:	A flow control is connected. Together with a call sign, the symbol indicates problems with the flow.
		Contact:	The pump is in operating mode <i>'Contact'</i> . The symbol closes every time a contact signal is generated.
		Contact signal:	The pump is in operating mode <i>'Batch'</i> . The symbol flashes every time a contact signal is generated.
p+		Overpressure monitoring:	A constriction or a closed shut-off valve on the discharge side allows the pressure to increase above the maximum permissible operating pressure. The message appears as a warning or fault, dependent upon the setting.
p -		Low pressure:	There is a leak or a burst or torn line on the discharge side. The message appears as a warning or fault, dependent upon the setting.
m		Memory:	The pump is in operating mode <i>'Contact'</i> or <i>'Batch'</i> : the auxiliary function "Memory" has been set.
0..20		0...20 mA:	The pump is in operating mode <i>'Analog'</i> . The processing type <i>'0...20'</i> is set.
4..20		4...20 mA:	The pump is in operating mode <i>'Analog'</i> . The processing type <i>'4...20'</i> is set.
i < 4		i less than 4 mA:	Problems with the standard signal at the standard signal input e.g. broken cable.

Symbol	Additional symbol	Name	Meaning
i > 23		i greater than 23 mA:	The standard signal at the standard signal input indicates a fault with the connected unit.
		Line:	The pump is in operating mode ' <i>Analog</i> '. The processing type ' <i>Curve</i> '- ' <i>Line</i> ' is set.
		Upper sideband:	The pump is in operating mode ' <i>Analog</i> '. The processing type ' <i>Curve</i> '- ' <i>Upper sideband</i> ' is set.
		Lower sideband:	The pump is in operating mode ' <i>Analog</i> '. The processing type ' <i>Curve</i> '- ' <i>Lower sideband</i> ' is set.



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.

6 Functional description

6.1 Liquid End

The dosing process is performed as follows: The diaphragm is pressed into the dosing head; the pressure in the dosing head closes the suction valve and the feed chemical flows through the discharge valve out of the dosing head. The diaphragm is now drawn out of the dosing head; the discharge valve closes due to the negative pressure in the dosing head and fresh feed chemical flows through the suction valve into the dosing head. One cycle is completed.

6.2 Drive unit

The displacement body is driven by an electromagnet, which is controlled by an electronic control.

optoDrive® drive technology

The optoDrive® drive technology means the variation over time of the metering flow can be precisely matched to the requirements of the particular application. Hence the user can, dependent on requirements, set a slow discharge stroke for nearly continuous metering or a quick stroke e.g. for quick clocked filling processes. In both operating modes it is possible, to selectively also slow the suction stroke, see figure. In this way, it is possible to prevent the main cause for imprecise metering with high viscosity feed chemicals, namely the incomplete filling of the liquid end. For the case of gaseous feed chemicals, the slow suction stroke prevents cavitation and consequently increases metering accuracy. Oscillations in the back pressure in the metering line, which could lead to undesirable variations in the metering volume, are automatically compensated for by the drive. Consequently, a dosing precision is attained, which otherwise could only be achieved using a complex control circuit.

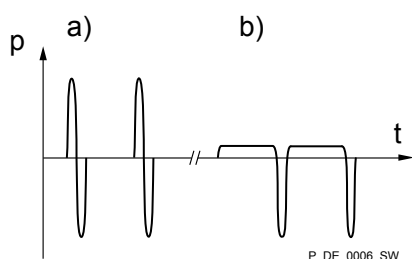


Fig. 6: Metering types: a) pulsing, b) nearly continuous

p Pressure
t Time

The integral injection point monitoring of the hydraulic metering parameters, optoGuard® is integrated in the drive. It automatically detects blocked points of injection or broken metering lines. Consequently, dependent on the hydraulic installation situation, separate relief valves and pressure sensors need not be used, and no uncontrolled metering through a broken line occurs. It also detects air or gases (airlock) trapped in the liquid end. This prevents metering of incorrect quantities and thus increases process reliability. The relevant messages are shown on the pump's display. The system operator can determine, depending on the type of fault, whether a message is to be sent to the process control system via the fault signal relay and whether metering is automatically stopped.

6.3 Capacity

The capacity is determined by the stroke length and rate.

The stroke length is adjusted by the stroke length adjustment knob within a range of 0 ... 100 %. A stroke length of between 30 ... 100 %) is recommended to achieve the specified reproducibility.

The stroke rate can be set using the arrow keys (not in "Analog" operating mode) in the range 0 - 200 strokes/min (200 strokes/min \pm 12,000 strokes/h). The "Stroke rate (strokes / min)" continuous display shows decimal places if a stroke frequency is set in the "Stroke rate (strokes / h)" continuous display, which cannot be divided by 60 without a remainder.

Data	Value	Unit
Recommended stroke length	30 ... 100	%

The stroke speed can be set in the "Dosing" menu.

6.4 Operating modes

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

"Manual" operating mode

The stroke rate is set manually via the control unit.

"Batch" operating mode

This operating mode provides the option of working with large transfer factors (up to 65535). Metering can be triggered by pressing the button *[P]* or by a pulse received via the "External control" jack through a contact or a semiconductor switching element. A metering volume (batch) or a number of strokes can be selected in the 'Settings' menu using the *[arrow keys]*.

Operating mode "Contact"

This operating mode offers the option of activating the pump externally by means of potential-free contacts (e.g. by means of a contact water gauge). The number of strokes (reducing or transfer factor 0.01 to 99.99) can be pre-selected in the 'Settings' menu using the *[arrow keys]*.

"Analog" operating mode

The stroke rate is controlled using an analog current signal via the "External control" jack. Processing of the current signal can be preselected via the control unit.

6.5 Functions

The following functions can be selected via the menu 'Settings':

"Calibrate" function

The stroke rate is controlled using an analog current signal via the "External control" jack. Processing of the current signal can be preselected via the control unit.

The pump can also be operated in the calibrated state in all operating modes. The corresponding continuous displays can then either display the metering volume or the capacity (in the 2nd level continuous display). The calibration remains valid over the entire stroke rate range and over a stroke length range from 0 - 100 %.

"Auxiliary rate" function

This enables switching to an adjustable stroke rate which can be fixed in the 'Settings' menu via the "External control" jack. This auxiliary frequency has priority over the operating mode stroke rate settings.

"Flow" function

This monitors the flow in "pulsing" dosing mode after every individual stroke, if a dosing monitor is connected. The number of sequential faulty strokes above which it is to be stopped, can be set in the 'Settings' menu.

The following functions are available as standard:

"Level switch" function

Information about the liquid/powder level in the feed chemical container is reported to the pump. To do so, a two-stage level switch must be fitted; it is connected to the "Level switch" jack.

"Pause" function

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

The following functions are triggered by a key press:

"Stop" function

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

"Priming" function

Priming (short-term transport at maximum frequency) can be triggered by simultaneous pressing of the two *[arrow keys]*.

6.6 Relay (options)

The pump has several connection options for:

"Fault indicating relay" option

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

The relay can be retrofitted through a knock-out opening in the pump foot - refer to "Retrofitting relays".

"Fault indicating and pacing relay" option

This combined relay can generate a contact with each stroke via its pacing relay in addition to its function as a fault indicating relay.

The relay can be retrofitted through a knock-out opening in the pump foot - refer to "Retrofitting relays".

"Automatic bleed" option

The function "Bleeding" is used for controlled bleeding of the liquid end, if the pump is provided with the option "Automatic bleed". The "Automatic bleed" option can be retrofitted, i.a. via a knock-out in the control unit.

There are two versions:

- version with only 1 relay - to control the bleed valve.
- Version with only 2 relays - one relay to control the bleed valve and one relay free for other uses.

"mA output" option

The I signal of the current output signals the currently calculated pump metering volume. The option "mA output" can be retrofitted via a knock-out in the control unit.

The option additionally always provides a fault indicating relay or a pacing relay.

6.7 Functional and fault Indicator

The operating and fault statuses are indicated by the three LED indicators and the "Fault" identifier of the LCD screen, see also the "Troubleshooting" chapter.

6.8 LCD display

If a fault occurs, the identifier "Fault" appears as well as an additional, explanatory symbol.

6.9 LED indicators

Fault indicator (red)

The fault indicator lights up if the liquid level in the chemical feed container falls below the second switching point of the level switch (20 mm residual filling level in the chemical feed container).

This LED flashes in the event of an undefined operating mode.

Warning indicator (yellow)

The warning indicator lights up if the fluid level in the chemical feed container falls below the first switching point of the level switch.

Operating indicator (green)

The operating indicator lights up if the pump is ready for operation and there are no fault or warning alerts. It goes out quickly as soon as the pump has performed a stroke. It starts to flash as soon as the stroke rate falls below 30 strokes / min.

6.10 Hierarchy of operating modes, functions and fault statuses

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

The following list shows the order:

1. - Priming
2. - Fault, Stop, Pause
3. - Auxiliary rate
4. - Manual, Analog, Contact, Batch

Comments:

- re 1 - "Priming" can take place in any mode of the pump (providing it is functioning).
- re 2 - "Fault", "Stop" and "Pause" stop everything apart from "Priming".
- re 3 - The stroke rate of "Auxiliary rate" always has priority over the stroke rate specified by an operating mode or priority 4.

7 Hydraulic installation

Safety notes

**CAUTION!****Warning of feed chemical spraying around**

An unsuitable feed chemical can damage the parts of the pump contacted by the chemical.

- Take into account the resistance of the materials which will come into contact with the chemical when selecting the feed chemical - see the ProMinent product catalogue or under www.prominent.com.

**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 from rupturing hydraulic components**

Peak loads during the dosing stroke can cause the maximum permissible operating pressure of the system and pump to be exceeded.

- The discharge lines are to be properly designed.

**CAUTION!****Danger of personnel injury and material damage**

The use of untested third party parts can result in personnel injuries and material damage.

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

**CAUTION!****Warning of illegal operation**

Observe the regulations that apply where the unit is to be installed.

7.1 Install hose lines

7.1.1 Installation for metering pumps without bleed valve

Safety information



CAUTION!

Warning of feed chemical spraying around

If the pipes are improperly installed, they can come loose or burst.

- 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.
- To ensure high durability of the connections, only use clamp rings and hose nozzles that are intended for the hose diameter in question.



CAUTION!

Danger resulting from rupturing hydraulic components

Hydraulic components can rupture if the maximum permissible operating pressure is exceeded.

- Always maintain the maximum permissible operating pressure of all hydraulic components - please refer to the product specific operating instructions and system documentation.
- Never allow the metering pump to run against a closed shut-off device.
- Install a relief valve.



CAUTION!

Hazardous feed chemicals can escape

Hazardous or extremely aggressive feed chemicals can leak out when using conventional bleeding procedures with metering pumps.

- Install a bleed line with recirculation into the storage tank.



CAUTION!

Hazardous feed chemicals can escape

Hazardous or extremely aggressive feed chemicals can leak out in the event that the metering pump is removed from the installation.

- Shut-off valves must be installed on the metering pump's pressure and discharge sides.



CAUTION!

Uncontrolled flowing feed chemicals

Feed chemicals can leak through a stopped metering pump in the event of back pressure.

- For this purpose, use an injection valve or vacuum breaker.

**CAUTION!****Uncontrolled flowing feed chemicals**

Feed chemicals can leak through the metering pump in an uncontrolled manner in the event of excessive priming pressure.

- The maximum priming pressure for the metering pump may not be exceeded - please refer to the product-specific operating instructions.



The pipes are to be aligned in such a way as the metering pump and the liquid end can be removed from the side, if necessary.

Install hose lines - design PP, NP, PV, TT

1. ➤ Cut off the ends of the hoses at right angles.
2. ➤ Pull the union nut (2) and clamp ring (3) over the hose (1) - see figure .
3. ➤ Push the hose end (1) up to the stop over the nozzle (4). Widen it, if necessary.



Ensure that the O-ring and flat seal (5) is properly fitted to the valve (6).



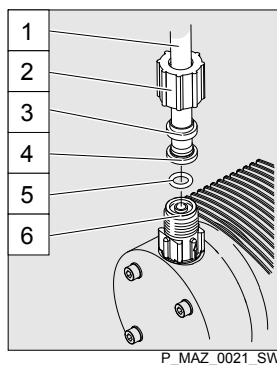
Used PTFE seals may never be re-used. An installation sealed in this way will not be watertight.

The reason for this is that this type of seal is permanently distorted when subjected to pressure.



In order to enable it to be distinguished from the EPDM flat seal, the FPM flat seal design PV has a dot.

4. ➤ Place the hose (1) with the nozzle (4) onto the valve (6).
5. ➤ Clamp the hose connector: Screw the union nut (2) tight while simultaneously pressing on the hose (1).
6. ➤ Re-tighten the hose connector: Pull on the hose (1) briefly, which is fastened to the dosing head, and tighten up the union nut (2) once more.

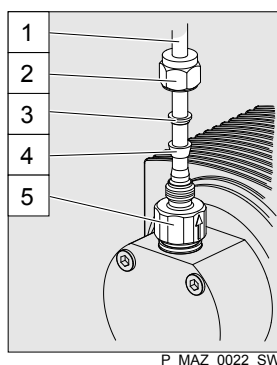


- 1 Hose
- 2 Union nut
- 3 Clamp ring
- 4 Nozzle
- 5 O-ring and flat seal
- 6 Valve

Fig. 7: Designs PP, NP, PV, TT

Installing stainless steel pipe - design SS

1. ➤ Pull the union nut (2) and clamp rings (3, 4) over the pipe (1) with approx. 10 mm overhang - see .
2. ➤ Insert the pipe (1) up to the stop in the valve (5).
3. ➤ Tighten the union nut (2).



- 1 Pipe
- 2 Union nut
- 3 Rear clamp ring
- 4 Front clamp ring
- 5 Valve

Fig. 8: Design SS

Installing hose lines - design SS



CAUTION!

Warning of feed chemical spraying around

Connections can come free in the event that hose lines are installed incorrectly on stainless steel valves.

- Only use PE or PTFE hose lines.
- In addition, insert a stainless steel support insert into the hose line.

7.1.2 Installation for metering pumps with bleed valve

Safety information




CAUTION!

- All of the installation and safety notes for metering pumps without bleed valves also apply.

Installation of the return line

A return line is connected in addition to the suction and discharge lines.

1. ➤ Fasten the tube line to the return line tube nozzle or to the liquid end bleed valve. PVC hose, soft, 6x4 mm is recommended for this.
2. ➤ Feed the free end of the return line back to the storage tank.

3.  Shorten the return line hose so that it cannot submerge into the feed chemical in the storage tank.

8 Electrical installation



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.

- Knock-out openings in the pump housing must be equipped with matching modules or be sealed 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 controller when it is switched off.

- Provide the pump with its own contacts and supply with voltage via a contactor relay or relay.

Personnel: ■ Electrician

→ Install the pump technically correctly and in accordance with the operating instructions and applicable regulations.

8.1 Supply voltage connector

**WARNING!****Unexpected startup is possible**

As soon as the pump is connected to the mains, the pump may start pumping and consequently feed chemical may escape.

- Prevent dangerous feed chemicals from escaping.
- If you have not successfully prevented this, immediately press the *[STOP/START]* key or disconnect the pump from mains, e.g. via an emergency cu-off switch.

**CAUTION!**

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

Connect the pump to the mains power supply using the mains cable.

Parallel connection to inductive consumers

Should the pump be connected to the mains in parallel to inductive consumers (e.g. solenoid valves, motor), the pump must be electrically isolated when these consumers are switched off.

- Supply the pumps with voltage via a contactor relay or relay using separate contacts for the pump.
- If this is not possible then connect a varistor (part no. 710912) or an RC member, 0.22 µF / 220 Ω in parallel.

Interference suppression aids

Product	Part no.
Varistor:	710912
RC Gate, 0.22 µF / 220 Ω:	710802

8.2 Description of the jacks

8.2.1 "External control" terminal

The "external control" jack is a five-pin panel jack. It is compatible with two- and four-conductor cables.

The "Auxiliary frequency" and "mA-output" functions can only be used with a five conductor cable.

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

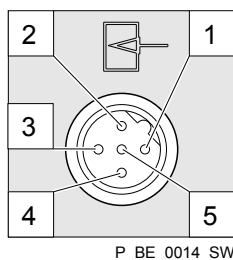


Fig. 9: Pump pin assignments

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

Control via:

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

Electrical interface for pin 3 "mA output" (identity code characteristic "Control variant": 3, 5 and R)¹

Data	Value	Unit
Input apparent ohmic resistance, approx.	120	Ω

¹ The metering pump makes its first metering stroke at approx. 0.4 mA (4.4 mA) and starts continuous operation at approx. 19.2 mA.

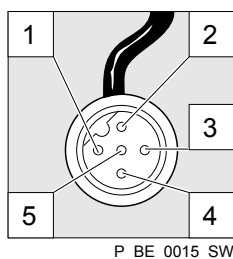


Fig. 10: Cable conductor assignments

Pin	Function	5-conductor cable	2-conductor cable
1	Pause	brown	bridged at pin 4
2	External contact	white	brown
3	mA output*	blue	-
4	Earth / GND	black	white
5	Auxiliary frequency	grey	-

* with identity code characteristic "Control version": 3, 5 and R



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

"Pause" function

The pump does not work if:

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

The pump works if:

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

"External contact" operating mode

The pump performs one or more strokes 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.

"Auxiliary frequency" operating mode

The pump works at a preset stroke rate 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 frequency is factory-preset to the maximum stroke rate.

8.2.2 "Level Switch" terminal

There is a connecting option for a 2-stage level switch with pre-warning and limit stop.

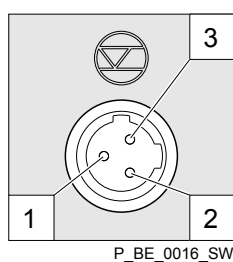


Fig. 11: Pump pin assignments

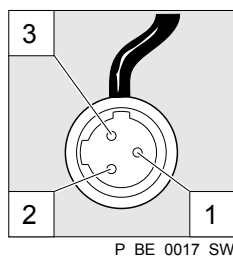


Fig. 12: Cable conductor assignments

Electrical interface

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

Control via:

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

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

8.2.3 "Dosing monitor" terminal

There is a connecting option for a dosing monitor.

Electrical interface

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

Control via:

- potential-free connection contact (load: 0.5 mA at 5 V) or

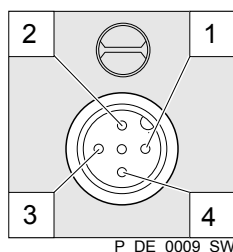


Fig. 13: Pump pin assignments

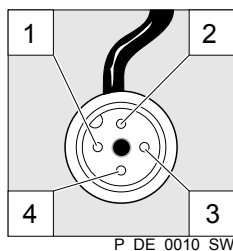


Fig. 14: Cable conductor assignments

8.2.4 "Diaphragm rupture sensor" terminal

There is a connecting option for a diaphragm rupture sensor.

Electrical interface

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

Control via:

- potential-free connection contact (load: 0.5 mA at 5 V) or

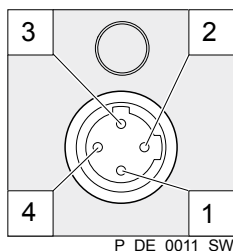


Fig. 15: Pump pin assignments

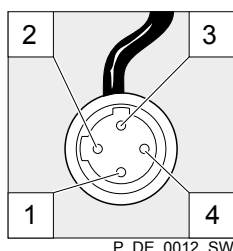


Fig. 16: Cable conductor assignments

8.3 Relay

8.3.1 "Fault indicating relay" output (identity code 1 + 3 or 6 + 7)

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 alert and "Liquid level low, 2nd stage".

A cut-off relay works when there are fault alerts from the pump and in the event of the "Liquid level low 2nd stage" alert.

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 programmed ex factory. If another switching function is required, the pump can be reprogrammed in the 'Relay' menu.

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

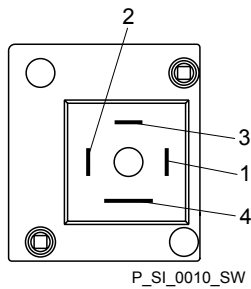


Fig. 17: Pump pin assignments

Identity code 1 + 3 or 6 + 7

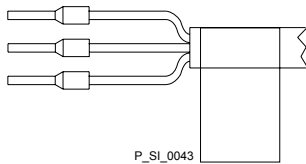


Fig. 18: Cable conductor assignments

Electrical interface

Data	Value	Unit
Maximum contact load at 230 V and 50/60 Hz:	8	A
Minimum mechanical lifespan:	200 000	Switching operations

To pin	VDE cable	Contact	CSA cable
1	white	NO (normally open)	white
2	green	NC (normally closed)	red
4	brown	C (common)	black

8.3.2 Output for other relays (identity code 4 + 5, 8 + 9, A + B)

A fault indicating and a pacing relay can optionally be ordered - 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.

The behaviour is programmed ex factory. If another switching function is required, 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 "Retrofitting Relays" supplementary operating instructions.

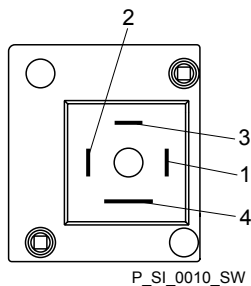


Fig. 19: Pump pin assignments

Electrical interface

for fault indicating relay output:

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

for semiconductor switch pacing relay:

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

Identity code 4 + 5, 8 + 9, A + B

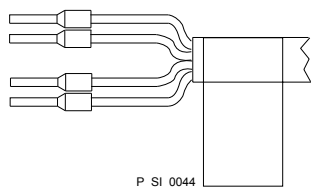


Fig. 20: Cable conductor assignments

To pin	VDE cable	Contact	Relay
1	yellow	NO (normally open)	Other relay
4	green	C (common)	Other relay
3	white	NO (normally open)	Pacing relay
2	brown	C (common)	Pacing relay

8.3.3 Output "Current output plus relay" (identity code C + D + E)

A relay combined with a current output can be optionally ordered. The relay switches either as a fault indicating relay when there is a fault with the pump and with "Liquid level low, 1st stage" warning alert and "Liquid level low 2nd stage" fault alert or is used as a pacing relay.

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

In the 'ANALOG OUTPUT' menu, the variable to be signalled by the current output can be selected.

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

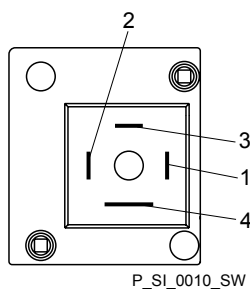


Fig. 21: Pump pin assignments

Electrical interface
for current output

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

for semiconductor switch ("relay"):

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

Identity code C + D + E

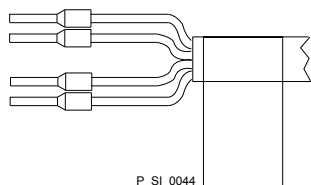


Fig. 22: Cable conductor assignments

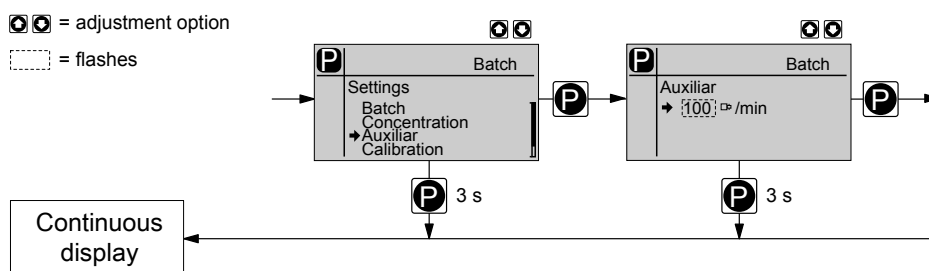
To pin	VDE cable	Contact	Relay
1	yellow	"+"	Current output
4	green	"-"	Current output
3	white	NC (normally closed) or NO (normally open)	Relay
2	brown	C (common)	Relay

9 Set-up



- Please read the overviews in the appendix, "Control elements and key functions" and "Operating/setting diagram" for supplementary information.
- If no key is pressed for a 1 minute duration, the pump returns to a continuous display.

9.1 Basic principles of control adjustment



Confirming an entry

Quickly press key **[P]**.

The display simultaneously changes to the next selection, to the next menu option or into a continuous display.

Quitting a menu option without confirming it

Press the **[UP]** key in the top menu selection, if no entry has been started (flashing beam).

You will jump back to the previous menu point or menu, at most back to the main menu.

Jumping back to a continuous display

Press and hold the **[P]** key for 3 seconds.

Entry is cancelled and you jump back to a continuous display.

Changing adjustable values

Press the arrow keys **[UP]** or **[DOWN]**.

In this way the number between the flashing bars counts upwards or downwards.

Confirming adjustable values

Under "Changing a number": press key **[P]** 1x.

The display simultaneously changes to the next selection, to the next menu option or into a continuous display.

9.2 Checking adjustable values

Continuous displays

Before you adjust the pump, you can check the actual settings of the adjustable variables:

➔ Press the key **[i]** ("i" for "Info"), if the pump is displaying a continuous display (The display does not contain the symbol for the **[P]** key).

⇒ Each time you press the **[i]** key, you see another continuous display, an "i" can be seen at the top left.



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

Secondary displays

The lowest line of the Info displays (2nd level continuous display) various information, which cannot, however, be adjusted here, see overview "Secondary displays" in the appendix...

If you are in a continuous display, you can access the bottom line of the info displays by:

1. ➤ pressing key *[i]*, provided that the top left double arrow is not visible.
2. ➤ Keep key *[i]* pressed down until a small arrow appears and glides into the bottom line of the LCD display.
3. ➤ As soon as it has reached it, quickly release the *[i]* key and immediately page through the info displays in the bottom line by quickly pressing the *[i]* key.

9.3 Changing to adjustment mode

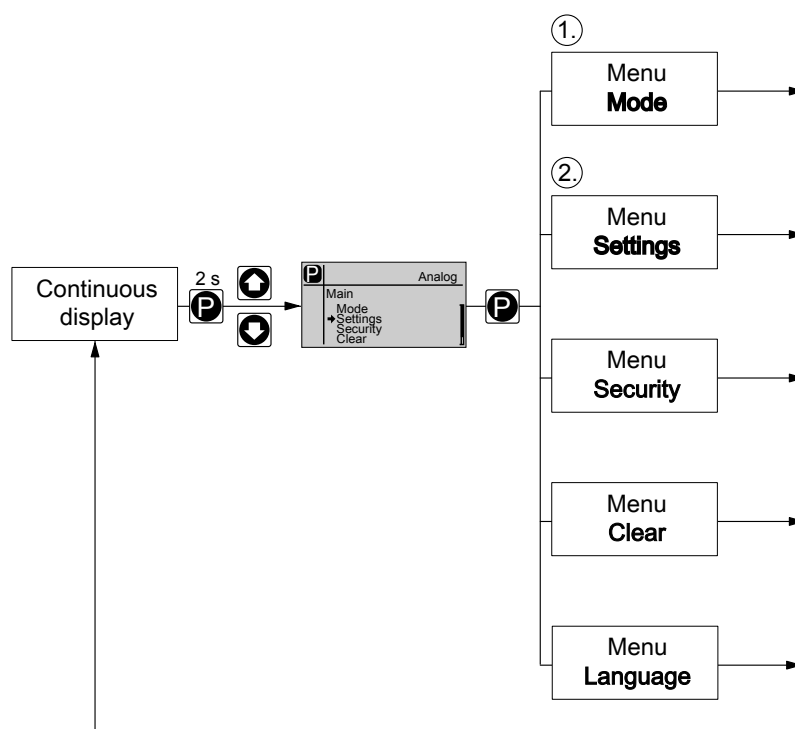
If the *[P]* key is pressed for 2 seconds in a continuous display, the pump changes to adjustment mode. If *[Lock menu]* or *'Lock all'* have been set under *'Security'* (top left lock symbol), the *[P]* key must be pressed and then the access code entered (*[arrow keys]*).

The following menus can be initially chosen in adjustment mode - see also the overview "Operating/setting diagram":

- Menu *'Operation'*
- Menu *'Settings'*
- Menu *'Security'* (option)
- Menu *'Delete'*
- Menu *'Language'*

To adapt the pump to your process requirements, you must:

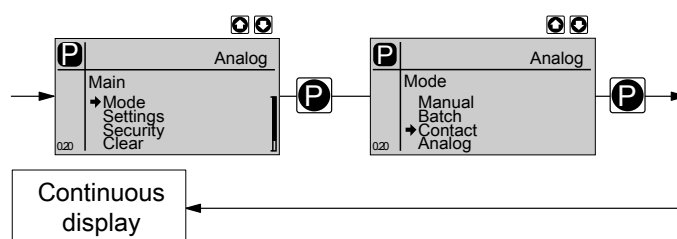
1. ➤ Select the operating mode in the *'Operation'* menu.
2. ➤ Carry out the adjustment for this operating mode under the *'Settings'* menu.



9.4 Selecting the operating mode (Menu "Operation")

In the 'Operation' menu (dependent on the identity code, some operating modes may not be present) the following operating modes can be selected:

- 'Manual': for manual operation
- 'Batch': for batch operation
- 'Contact': for contact operation
- 'Analog': for current control



9.5 Operating mode settings (menu "Settings")

Various settings can be adjusted in the 'Settings' menu dependent on the selected operating mode.

Setting menus are available in all operating modes for the following programmable functions:

- 'Concentration'
- 'Auxiliary frequency'
- 'Calibrate'
- 'Dosing'
- 'System'

For further details, see [Chapter 9.6 'Programmable function settings \('Settings' menu \)'](#) on page 46

As to whether or not a further setting menu is available, depends on the selected operating mode and the connected devices or modules.

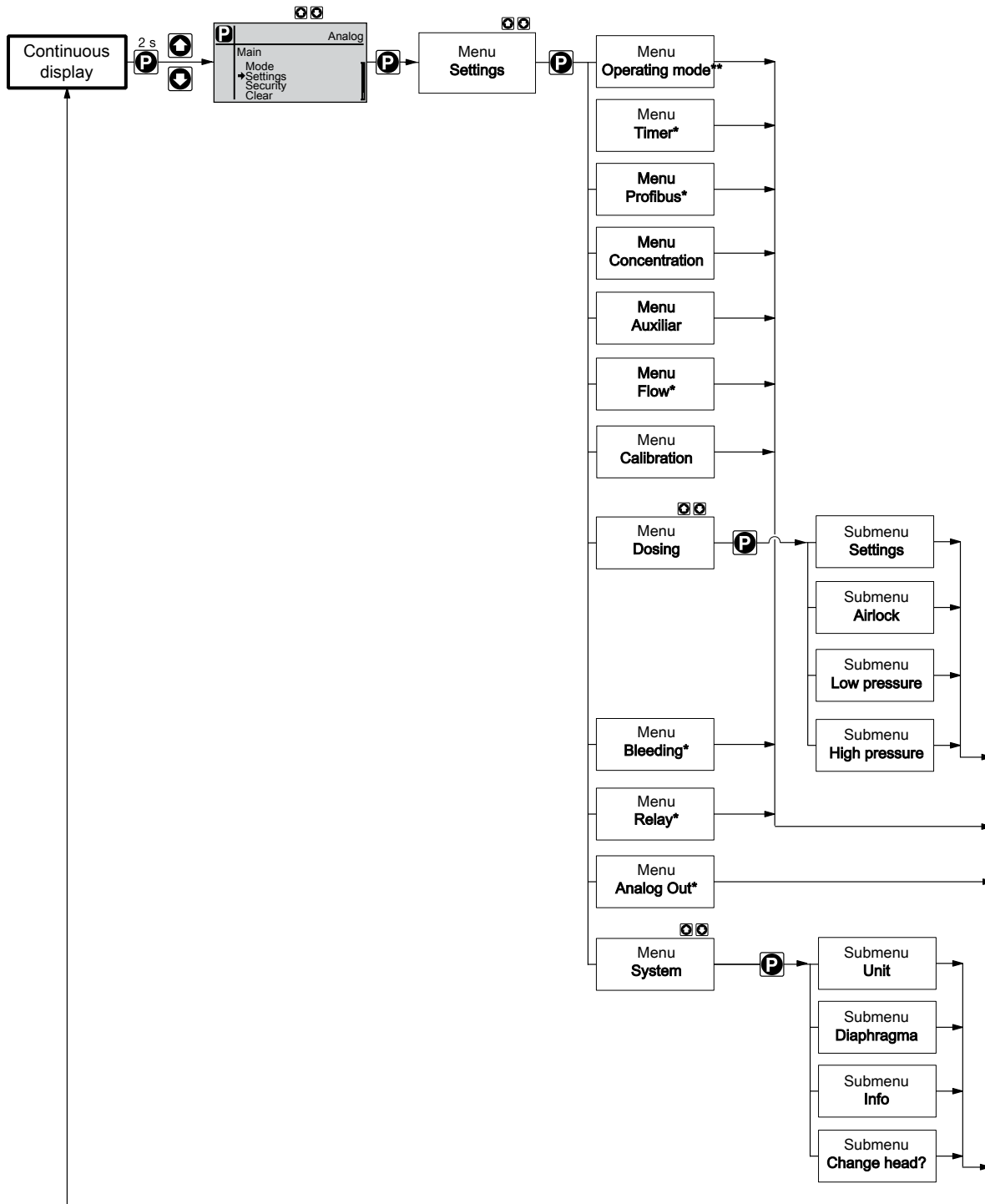


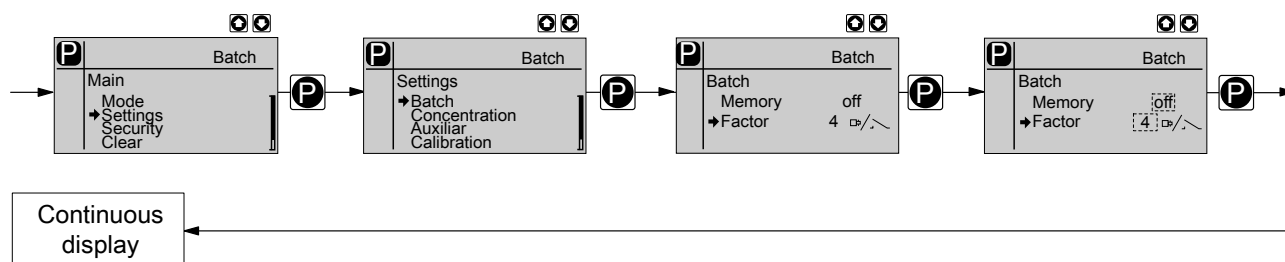
Fig. 23: "Settings" menu branch

9.5.1 "Manual" operating mode settings

Alongside the setting menu, which are described in more detail in *Chapter 9.6 'Programmable function settings ("Settings" menu)' on page 46*, in 'Manual' operating mode in the 'Settings' menu there is no further setting menu available.

9.5.2 Settings for the "Batch" operating mode (BATCH menu)

Alongside the setting menus, which are described in more detail in *Chapter 9.6 'Programmable function settings ("Settings" menu)' on page 46*, in 'Batch' operating mode in the 'Settings' menu, the 'BATCH' menu is also available.



The operating mode 'Batch' is one variant of the 'Contact' operating mode - see the following chapter. Here also, you can select a number of strokes (no fractions, only integers from 1 to 65535).

Operating mode 'Batch' is intended for large metering quantities.

Metering can be triggered by pressing the *[P]* key or via an pulse received via the "External Control" jack.

The number of received pulses, which could not yet be processed, is stored by the pump in the stroke memory.



CAUTION!

When changing over from the "Manual" operating mode to the "Batch" operating mode, the pump maintains the stroke rate.



The stroke rate can also be set in 'Contact' operating mode. It should normally be set to 200 strokes / min.



In operation, the batch size can be changed more easily by using 'Batch size' in the continuous display:

1. ➤ Using the *[i]* key, select the "Batch size" continuous display (displays an '*↑L*' after the number).
2. ➤ Hold down an *[arrow key]* until the variable is flanked by two flashing bars.
3. ➤ Change the batch size as required using the *[arrow keys]*.

"Memory" function extension

Additionally, you can activate the "Memory" function extension (Identifier "m"). When "Memory" is activated, the pump adds up the remaining strokes, which could not be processed, up to the maximum capacity of the stroke memory of 65,535 strokes. If this maximum capacity is exceeded, the pump goes into fault mode.

9.5.3 "Contact" operating mode settings

Alongside the setting menus, which are described in more detail in [Chapter 9.6 'Programmable function settings' \('Settings' menu\)](#) on page 46, in 'Contact' operating mode in the 'Settings' menu, the 'Contact' menu is also available.

'Contact' operating mode allows you to trigger individual strokes or a stroke series.

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

The purpose of this operating mode is to convert the incoming pulses with a reduction (fractions) or small step-up into strokes.

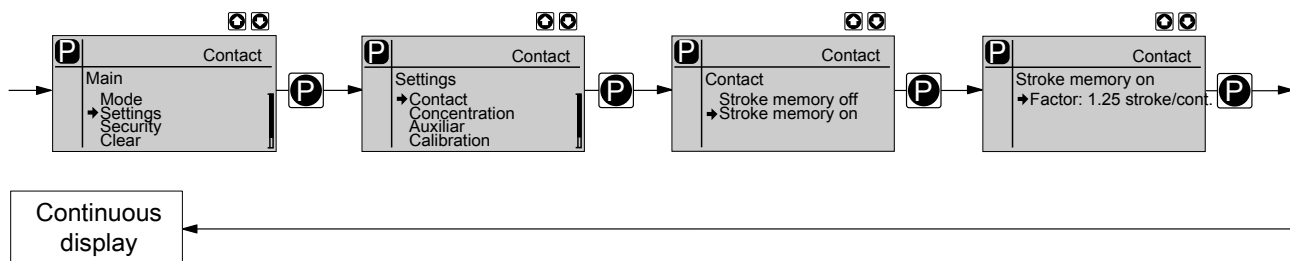


CAUTION!

When changing over from 'Manual' operating mode to 'Contact' operating mode, the pump maintains the stroke rate.



The stroke rate can also be set in 'Contact' operating mode. It should normally be set to 200 strokes / min.



The number of strokes per pulse depends on the factor which you input. By use of the factor you can multiply incoming pulses by a factor between 1.01 and 99.99 or reduce them by a factor of 0.01 to 0.99.

Number of strokes executed = factor x number of incoming pulses

Example table

	Factor	Pulse (sequence)	Number of strokes (sequence)
Step-up*			
	1	1	1
	2	1	2
	25	1	25
	99.99	1	99.99
	1.50	1	1.50 (1 / 2)
	1.25	1	1.25 (1 / 1 / 1 / 2)
Reduction**			
	1	1	1
	0.50	2	1
	0.10	10	1
	0.01	100	1
	0.25	4	1
	0.40	2.5 (3 / 2)	(1 / 1)
	0.75	1.33 (2 / 1 / 1)	(1 / 1 / 1)

*** Explanation of the conversion ratio**

With a factor of 1,	... 1 stroke is executed per 1 pulse.
With a factor of 2,	... 2 strokes are executed per 1 pulse.
With a factor of 25,	... 25 strokes are executed per 1 pulse.

**** Explanation of reduction**

With a factor of 1,	... 1 stroke is executed per 1 pulse.
With a factor of 0.5,	... 1 stroke is executed after 2 pulses.
With a factor of 0.1,	... 1 stroke is executed after 10 pulses.
With a factor of 0.75,	... 1 stroke is executed once after 2 pulses, then 1 stroke is executed after 1 pulse two times, and then again 1 stroke after 2 pulses etc.



If a remainder is obtained when dividing by the factor, then the device adds the remainders together. As soon as this sum reaches or exceeds "1", the pump executes an additional stroke. Therefore on average during the metering operation, the resultant number of strokes precisely matches the factor.

Non-processed pulses

The number of received pulses, which could not yet be processed, is stored by the pump in the stroke memory. When the [STOP/START] key is pressed or the "Pause" function is activated, the stroke memory is deleted. You can avoid this with the "Memory" function extension:

"Memory" function extension

Additionally, you can activate the "Memory" function extension (Identifier "m"). When "Memory" is activated, the pump adds up the remaining strokes, which could not be processed, up to the maximum capacity of the stroke memory of 65,535 strokes. If this maximum capacity is exceeded, the pump goes into fault mode.

Contact water meter

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

9.5.4 "Analog" operating mode settings

Alongside the setting menus, which are described in more detail in [Chapter 9.6 'Programmable function settings \("Settings" menu\)'](#) on page 46, in 'Analog' operating mode in the 'Settings' menu, the 'ANALOG' menu is also available. The stroke rate is controlled using an analog current signal via the "External control" terminal. The continuous display "Signal current" of the 2nd level indicates the incoming current.

You can select three types of current signal processing:

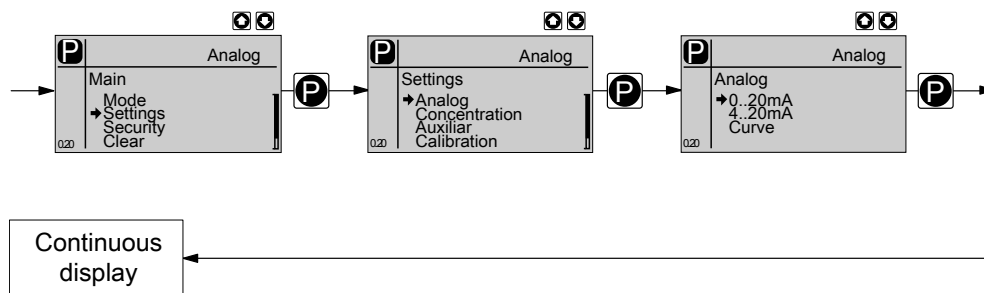
- '0 - 20 mA'
- '4 - 20 mA'
- 'Curve'

0 - 20 mA

At 0 mA the pump is stationary -

At 20 mA the pump works at the maximum stroke rate.

Between these values, the stroke rate is proportional to the current signal.



4 - 20 mA

At 4 mA the pump is stationary -

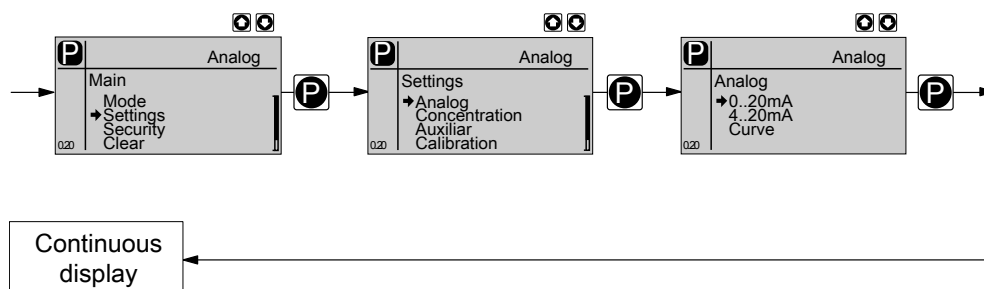
At 20 mA the pump works at the maximum stroke rate.

Between these values, the stroke rate is proportional to the current signal.

For current signals less than 3.8 mA a fault message appears and the pump stops (e.g. if a cable has broken).



The maximum stroke rate can only be reduced under processing type 'Curve', not under processing types "0 .. 20" and "4 .. 20".



Curve

In the processing type 'Curve' you can freely program the pump behaviour.

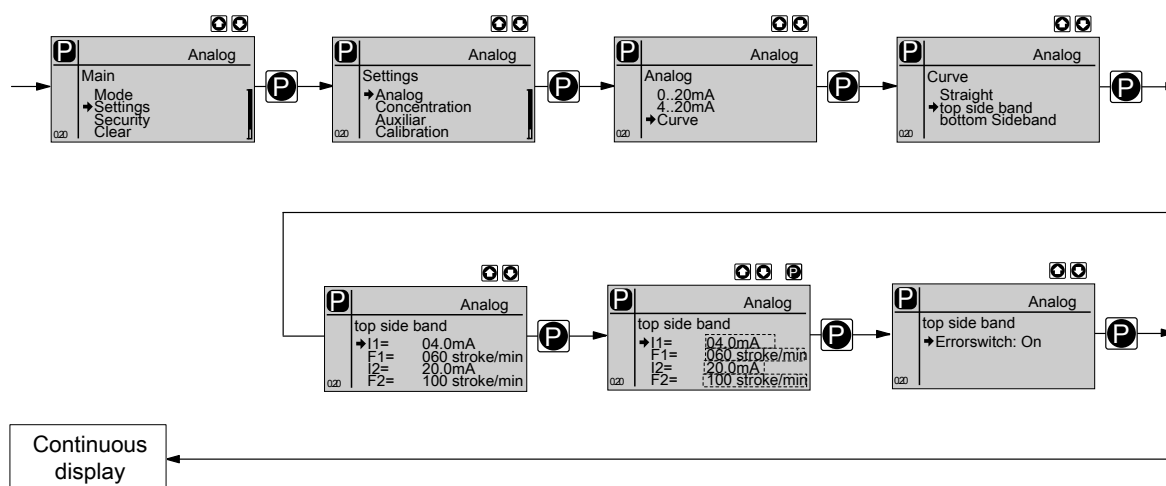
There are three options:

- Linear
- Lower sideband
- Upper sideband



The following applies to all three options:

The smallest processable difference between I1 and I2 is 4 mA (If $I1 - I2 \geq 4 \text{ mA}$).



Linear

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

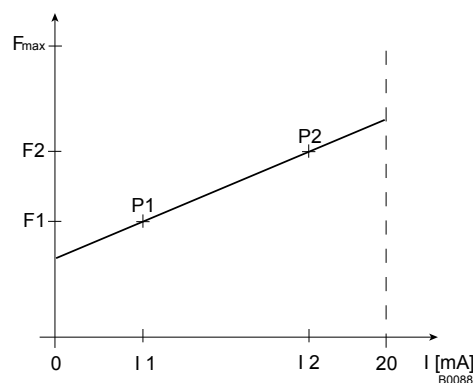


Fig. 24: Rate(frequency)-Current Diagram for Linear control



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!

Fault processing

Under the menu option 'Alarm message' (fault) you can activate a fault processing sequence for the 'Curve' processing type. For current signals below 3.8 mA, a fault message appears and the pump stops.

Lower sideband

Using this processing type, 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, you must connect the pumps electrically in series, - see the wiring diagram in [Chapter 8 'Electrical installation'](#) on page 30.

The "Lower sideband" symbol appears in the LCD display. Below I1, the pump works at a rate of F1 - above I2 it stops. Between I1 and I2 the stroke rate varies between F1 and F2 in proportion to the signal current.

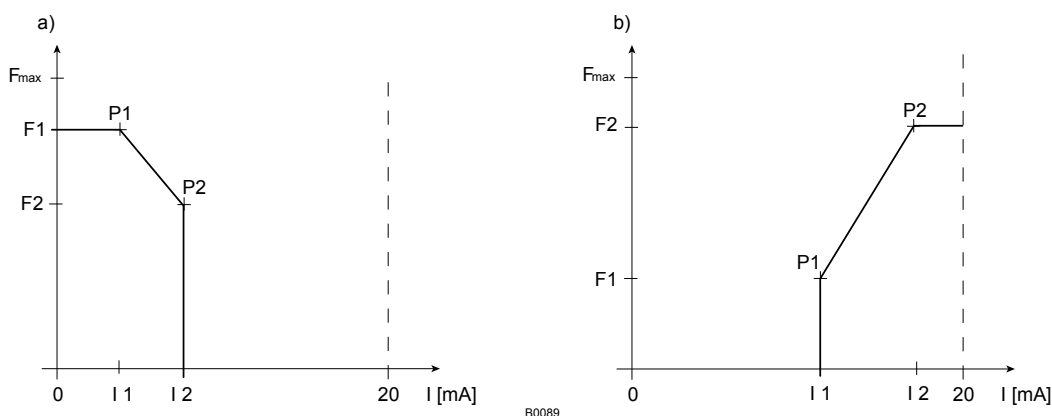


Fig. 25: Frequency-current diagram for a) Lower sideband, b) Upper sideband

Upper sideband

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

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, you must connect the pumps electrically in series, - see the wiring diagram in [Chapter 8 'Electrical installation'](#) on page 30.

The "Upper sideband" symbol appears in the LCD display. Below I1, the pump is stationary - above I2 the pump works at rate F2. Between I1 and I2 the stroke rate varies between F1 and F2 in proportion to the signal current.

9.6 Programmable function settings ("Settings" menu)

Setting menus are available in all operating modes in the menu "SETTINGS" for the following programmable functions:

- Concentration (menu 'CONCENTRATION')
- Auxiliary frequency (menu 'AUX')
- Flow (menu 'FLOW') (only available if a dosing monitor is connected)
- Calibrate (menu 'CALIBRATE')
- Metering (menu 'METERING')
- Relay (menu 'RELAY') (only available if a relay is fitted)
- System (menu 'SYSTEM')

9.6.1 Settings for the "Concentration" function (CONCENTRATION menu)

The 'CONCENTRATION' menu appears as soon as the pump has been calibrated. The desired mass concentration of the feed chemical which will subsequently be required in the dissolving medium (e.g. the main flow) can be entered directly in the "Concentration" continuous display.

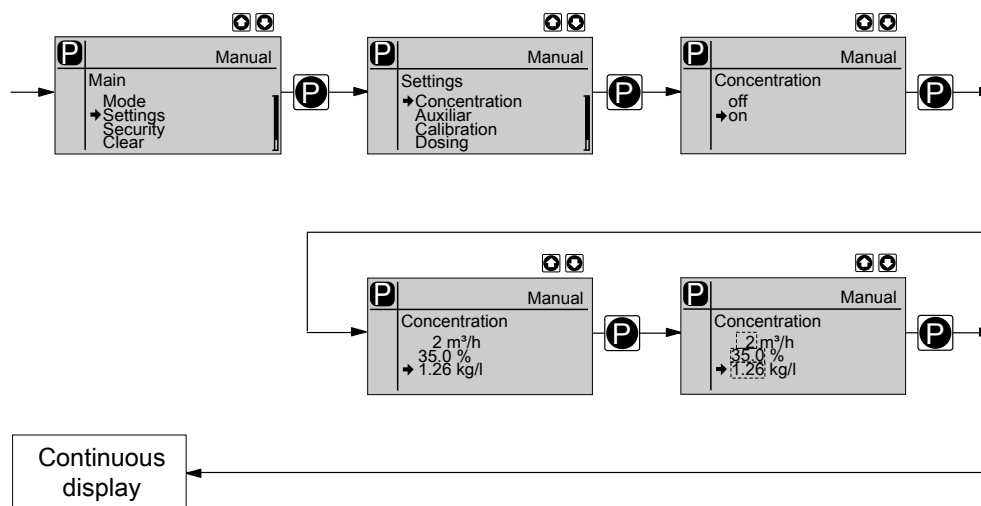
To enter the concentration principle:

1. ➔ Select the operating mode.
2. ➔ Set the data for the feed chemical and dissolving medium in the 'ADJUSTMENT' menu.
3. ➔ 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 being used.
 - and 'Concentration' was switched to 'On' - in the operating mode being used.
- The "Concentration" continuous display switches to the display mode "%" at concentrations above 999.9 ppm.
- When changing between operating modes, the pump saves the settings for each operating mode.
- If the pump is to display the concentration as a volume concentration, then enter "1.00" kg/l for the density of the feed chemical.

9.6.1.1 MANUAL operating mode (Settings for the "Concentration" function)



The "Concentration input" in operating mode 'MANUAL', is intended for metering of a substance into a pipeline containing a medium flowing at a constant rate in such a way that it exists in the flow with a specific mass concentration.



CAUTION!

Danger of too high concentrations

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

- System precautions must be taken to prevent the metering pump from continuing to dose in such circumstances.

The prerequisites are that:

- the flowing medium has the same density as water ($1 \text{ kg/L} \triangleq \text{g/cm}^3$)
- the mass concentration of the feed chemical is known - see the feed chemical safety data sheet (e.g. with 35 % sulphuric acid: 35 %)
- the density of the feed chemical is known - see the feed chemical safety data sheet (e.g. with 35 % sulphuric acid: $1.26 \text{ kg/L} \triangleq \text{g/cm}^3$)
- The measurement unit for liquid volume is set in the 'System' menu in the 'Unit' submenu, see chapter "Settings under the 'System' menu".

Procedure



CAUTION!

The accuracy of the concentration is strongly dependent on:

- the accuracy of the metering pump calibration.
- the accuracy of the entries.

1. ➤ Calibrate the metering pump if it is not yet calibrated - see chapter "Settings for the "Calibrate" function".
2. ➤ Select 'MANUAL' operating mode (settings which may already exist from other operating modes remain saved.).
3. ➤ From the 'ADJUSTMENT' menu, select the 'CONCENTRATION' menu.
4. ➤ Under the first menu option, set 'On' for working with the concentration display and press the key [P].
5. ➤ Set the flow and press key [P].
6. ➤ Set the mass concentration for the feed chemical and press key [P].
7. ➤ Set the density of the feed chemical - after pressing key [P], the continuous display appears.
8. ➤ Using key [i] change to the "Concentration" continuous display (ppm or %).

9. You can enter the desired mass concentration using the [Arrow keys].

**CAUTION!**

- Observe the decimal point.
- The mass concentration is affected by both changes in the stroke rate and the stroke length.

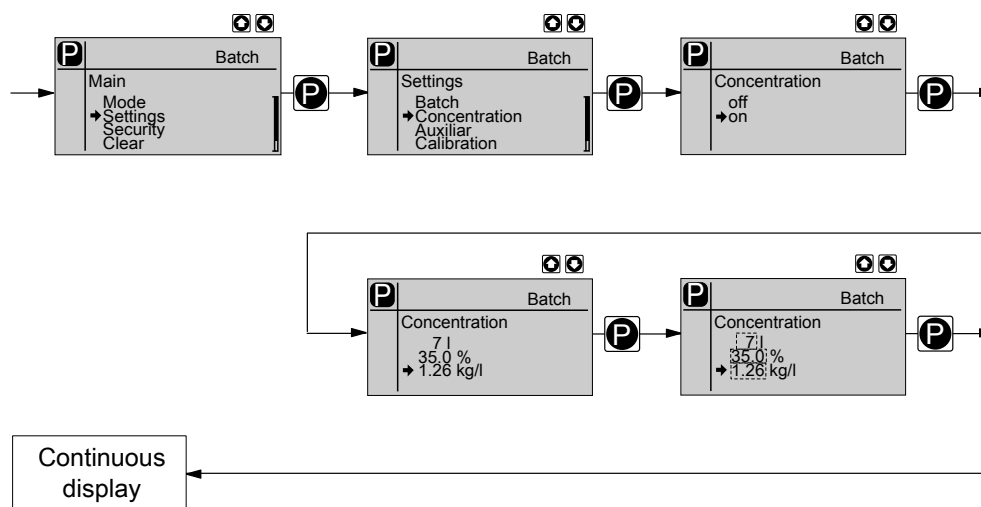


The value in the continuous display cannot be freely changed using the [Arrow keys] as the least significant figure values changes in jumps, the value of which depends on the input data.

Possible values of the adjustable variables

Adjustable variable	Lower value	Upper value	Increment
Flow in m ³ /h	1	1000	1
Mass concentration in %	0.5	100	0.1
Density in kg/l	0.5	2.0	0.1

9.6.1.2 BATCH operating mode (Settings for the "Concentration" function)



The "Concentration input" in 'BATCH' operating mode, is intended for metering a substance into a storage tank so that it then exists in the container with a defined mass concentration (batching of a solution. Do not forget to stir!).

The prerequisites are that:

- the medium in the storage tank has the same density as water (1 kg/L $\hat{=}$ g/cm³)
- the mass concentration of the feed chemical is known - see the feed chemical safety data sheet (e.g. with 35 % sulphuric acid: 35 %)

- the density of the feed chemical is known - see the feed chemical safety data sheet (e.g. with 35 % sulphuric acid: 1.26 kg/L $\hat{=}$ g/cm³)
- The measurement unit for liquid volume is set in the 'System' menu in the 'Unit' submenu, see chapter "Settings under the 'System' menu".

Procedure



CAUTION!

The accuracy of the concentration is strongly dependent on:

- the accuracy of the metering pump calibration.
- the accuracy of the entries.

1. ➔ Calibrate the metering pump if it is not yet calibrated - see chapter "Settings for the "Calibrate" function".
2. ➔ Select 'BATCH' operating mode (possibly existing settings from other operating modes remain saved.).
3. ➔ From the 'ADJUSTMENT' menu, select the 'CONCENTRATION' menu.
4. ➔ Under the first menu option, set 'On' for working with the concentration display and press the key [P].
5. ➔ Set the volume of the medium in the storage tank and press key [P].
6. ➔ Set the mass concentration for the feed chemical and press key [P].
7. ➔ Set the density of the feed chemical - after pressing key [P], the continuous display appears.
8. ➔ Using key [/] change to the "Concentration" continuous display (ppm or %).
9. ➔ You can enter the desired mass concentration using the [Arrow keys].



CAUTION!

- Observe the decimal point.
- The mass concentration is affected by both changes in the stroke rate and the stroke length.

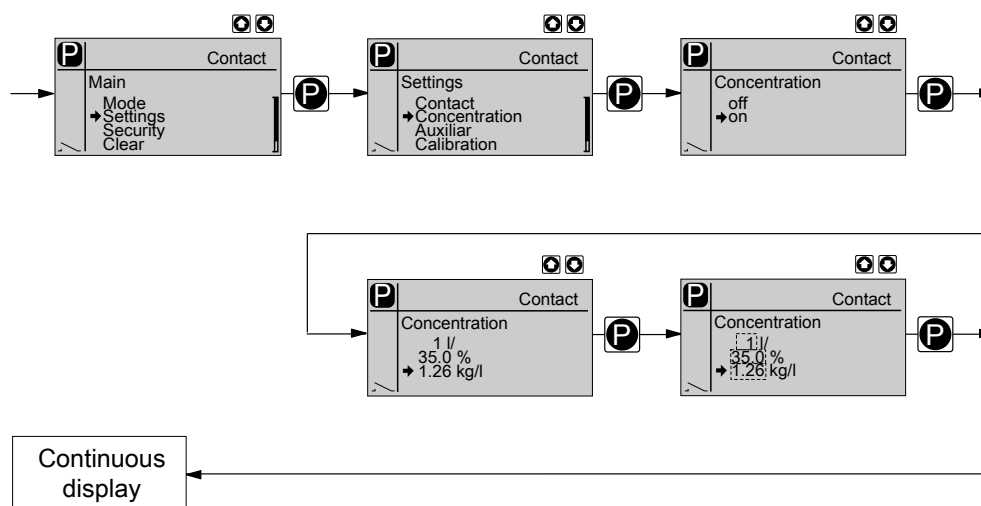


The value in the continuous display cannot be freely changed using the [Arrow keys] as the least significant figure values changes in jumps, the value of which depends on the input data.

Possible values of the adjustable variables

Adjustable variable	Lower value	Upper value	Increment
Volume in l	1	1000	1
Mass concentration in %	0.5	100	0.1
Density in kg/l	0.5	2.0	0.1

9.6.1.3 CONTACT operating mode (Settings for the "Concentration" function)



The "Concentration input" in operating mode 'CONTACT', is intended for metering of a substance into a pipeline containing a medium flowing at a constant rate in such a way that it exists in the flow with a specific mass concentration.

**CAUTION!****Danger of too high concentrations**

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

- System precautions must be taken to prevent the metering pump from continuing to dose in such circumstances.

The prerequisites are that:

- the flowing medium has the same density as water ($1 \text{ kg/L} \triangleq \text{g/cm}^3$)
- the mass concentration of the feed chemical is known - see the feed chemical safety data sheet (e.g. with 35 % sulphuric acid: 35 %)
- the density of the feed chemical is known - see the feed chemical safety data sheet (e.g. with 35 % sulphuric acid: $1.26 \text{ kg/L} \triangleq \text{g/cm}^3$)
- a contact water meter is hydraulically installed and connected to the external input of the metering pump.
- The measurement unit for liquid volume is set in the 'System' menu in the 'Unit' submenu, see chapter "Settings under the 'System' menu".

Procedure**CAUTION!**

The accuracy of the concentration is strongly dependent on:

- the accuracy of the metering pump calibration.
- the accuracy of the entries.

1. ➤ Calibrate the metering pump if it is not yet calibrated - see chapter "Settings for the 'Calibrate' function".
2. ➤ Select 'CONTACT' operating mode (possibly existing settings from other operating modes remain saved.).
3. ➤ From the 'ADJUSTMENT' menu, select the 'CONCENTRATION' menu.
4. ➤ Under the first menu option, set 'On' for working with the concentration display and press the key [P].
5. ➤ Adjust the contact gap and press key [P].

6. ➤ Set the mass concentration for the feed chemical and press key *[P]*.
7. ➤ Set the density of the feed chemical - after pressing key *[P]*, the continuous display appears.
8. ➤ Using key *[i]* change to the "Concentration" continuous display (ppm or %).
9. ➤ You can enter the desired mass concentration using the *[Arrow keys]*.



CAUTION!

- Observe the decimal point.
- The mass concentration is affected by both changes in the stroke rate and the stroke length.

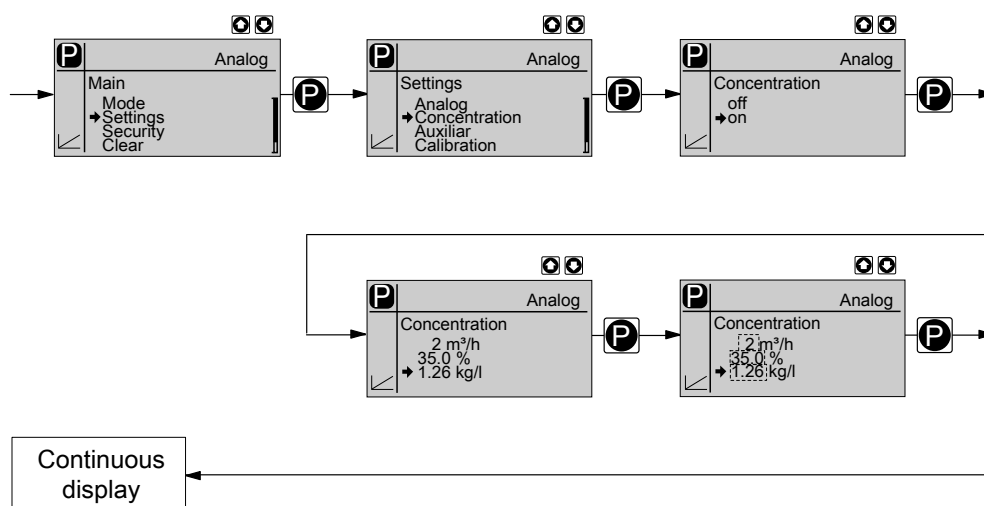


*The value in the continuous display cannot be freely changed using the *[Arrow keys]* as the least significant figure values changes in jumps, the value of which depends on the input data.*

Possible values of the adjustable variables

Adjustable variable	Lower value	Upper value	Increment
Contact separation in l/contact	1	1000	1
Mass concentration in %	0.5	100	0.1
Density in kg/l	0.5	2.0	0.1

9.6.1.4 ANALOG operating mode (Settings for the "Concentration" function)



The "Concentration input" in operating mode 'ANALOG', is intended for metering of a substance into a pipeline containing a medium flowing at a constant rate in such a way that it exists in the flow with a specific mass concentration.

**CAUTION!****Danger of too high concentrations**

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

- System precautions must be taken to prevent the metering pump from continuing to dose in such circumstances.

**CAUTION!****Risk of incorrect concentrations**

- After the adjustment, check whether the concentration at various flows corresponds to the required result.

The prerequisites are that:

- the flowing medium has the same density as water ($1 \text{ kg/L} \triangleq \text{g/cm}^3$)
- the mass concentration of the feed chemical is known - see the feed chemical safety data sheet (e.g. with 35 % sulphuric acid: 35 %)
- the density of the feed chemical is known - see the feed chemical safety data sheet (e.g. with 35 % sulphuric acid: $1.26 \text{ kg/L} \triangleq \text{g/cm}^3$)
- a flow meter with analog output is hydraulically installed and connected to the external input of the metering pump.
- The measurement unit for liquid volume is set in the 'System' menu in the 'Unit' submenu, see chapter "Settings under the 'System' menu".

Preparatory settings

1. ➤ Select 'ANALOG' operating mode (possibly already existing settings from other operating modes remain saved.).
2. ➤ In the 'SETTINGS' menu under 'ANALOG' set the type of processing of the current signal to 'Curve', see chapter "'Analog' operating mode settings"
3. ➤ Set the pump behaviour to 'Linear'.
4. ➤ In the processing type for the current signal, enter '4 .. 20' for I1 = 4 and for F1 = 0 strokes / min - see , dashed line.

In the processing type for the current signal, enter '0 .. 20' for I1 = 0 mA and for F1 = 0 strokes / min, because the straight line must pass through the zero point (0/0) see , dashed line.
5. ➤ Enter I2 = 20 mA and F2 = 200 strokes/min.
6. ➤ As required set 'Error message' to 'on' or 'off'.

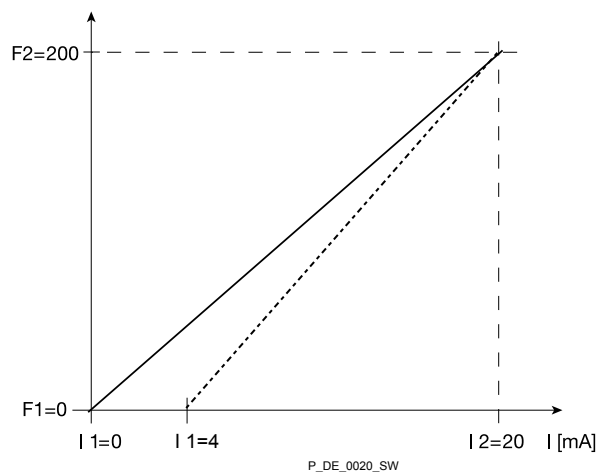


Fig. 26: How the line for "Concentration input" must appear in "Analog" operating mode

Procedure



CAUTION!

The accuracy of the concentration is strongly dependent on:

- the accuracy of the metering pump calibration.
- the accuracy of the entries.

1. ➤ Calibrate the metering pump if it is not yet calibrated - see chapter "Settings for the "Calibrate" function".
2. ➤ From the 'ADJUSTMENT' menu, select the 'CONCENTRATION' menu.
3. ➤ Under the first menu option, set 'On' for working with the concentration display and press the key [P].
4. ➤ Set the maximum flow and press key [P].
5. ➤ Set the mass concentration for the feed chemical and press key [P].
6. ➤ Set the density of the feed chemical - after pressing key [P], the continuous display appears.
7. ➤ Using key [/] change to the "Concentration" continuous display (ppm or %).

8. You can enter the desired mass concentration using the [Arrow keys].

**CAUTION!**

- Observe the decimal point.
- The mass concentration is affected by both changes in the stroke rate and the stroke length.
- The pump limits the upper value of the mass concentration, because otherwise the incremental jumps when adjusting would be unacceptably large. As necessary, adjust the stroke length - do not set it under 30 %.

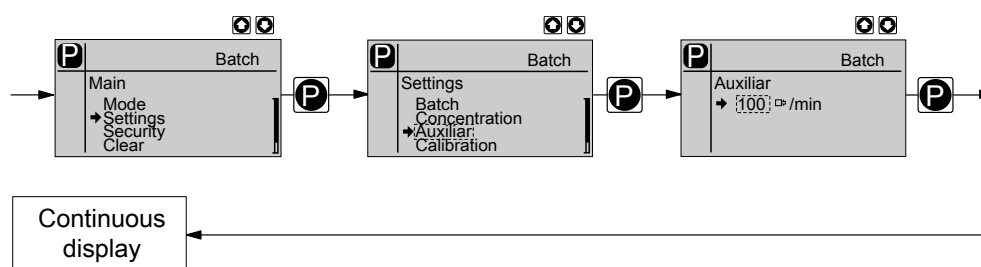


The value in the continuous display cannot be freely changed using the [Arrow keys] as the least significant figure values changes in jumps, the value of which depends on the input data.

As necessary, change the stroke length and adjust the concentration; in doing so the pump compensates via the stroke rate.

Possible values of the adjustable variables

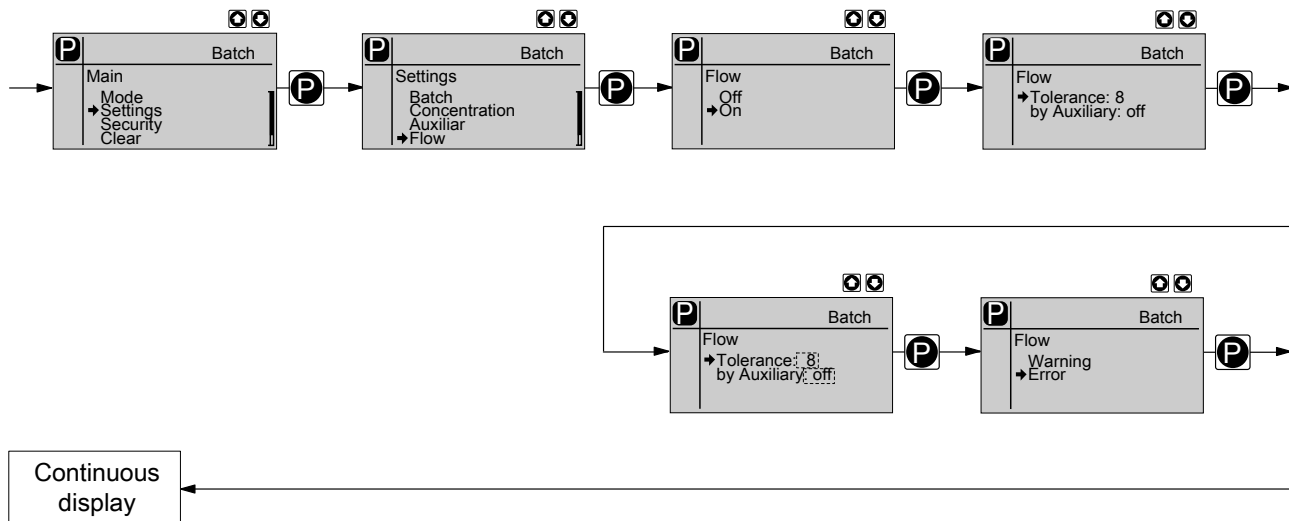
Adjustable variable	Lower value	Upper value	Increment
Max. flow in m ³ /h	1	1000	1
Mass concentration in %	0.5	100	0.1
Density in kg/l	0.5	2.0	0.1

9.6.2 Settings for the "Auxiliary frequency" function (AUX menu)

The programmable function "Auxiliary rate" facilitates the switchover to an auxiliary stroke rate, which can be fixed in the 'AUX' menu. It can be activated via the "External control" terminal. If the auxiliary rate applies, then the identifier "Aux" appears in the LCD display.

This auxiliary rate has priority over the stroke rate, which is specified by the currently selected operating mode - see also the chapter "Function description" - "Hierarchy of operating modes".

9.6.3 Settings for the “Flow” function (FLOW menu)



The menu 'FLOW' only appears if a dosing monitor is connected to the "Dosing monitor" jack. The dosing monitor records the individual pressure surges of the pump at the discharge connector during pulsed metering ('Metering' 'fast', menu 'METERING') and immediately reports it back to the pump. In the event that this feedback message remains missing in a sequence as often as set in the menu 'FLOW' under 'Tolerance' (due to a failure or too low a metering level), then this function stops the pump. The last menu option provides the choice, of whether this case should lead to a 'Fault' or a 'Warning'.

The function 'Flow' can be deactivated for the 'AUX' operating mode (auxiliary rate).

9.6.4 Settings for the “Calibrate” function (CALIBRATE menu)

The pump can also be operated in the calibrated state. In this case, the corresponding continuous displays then indicate the metering volume or the capacity directly.

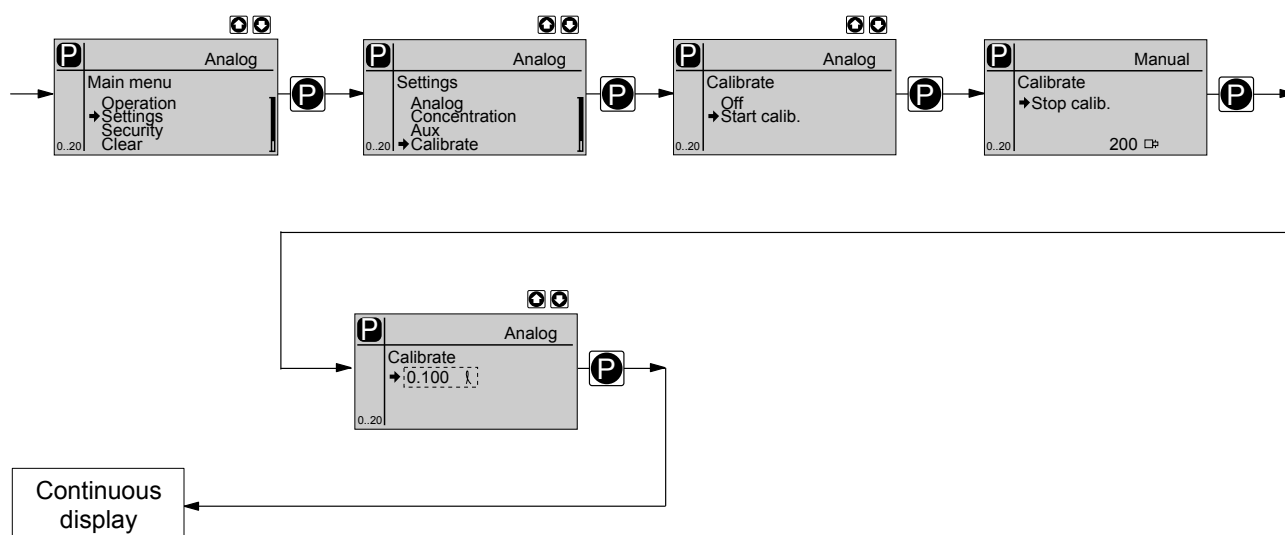


Accuracy of the calibration

The calibration will not be accurate, if these conditions are not adhered to:

- do not allow the stroke length to fall below 30 %
- The pump should execute at least 200 strokes.

Calibrate

**WARNING!**

If the feed chemical is dangerous, take appropriate safety precautions when executing the following calibration instructions. Observe the safety data sheet for the feed chemical!

1. Lead the suction hose into a measuring cylinder containing the feed chemical - the discharge hose must be installed in a permanent manner (operating pressure, ...!).
2. Prime using the feed chemical (simultaneously press the two *[arrow keys]*, should the suction hose be empty).
3. Record the level in the measuring cylinder.
4. Using the *[i]* key scroll through the continuous display and check whether litres or gallons are selected.
5. If the incorrect volume units are selected, select the 'SYSTEM' menu and then the 'UNITS' sub-menu.
6. Using the *[arrow keys]*, select the correct units and confirm by pressing the *[P]* key.
7. Select the 'CALIBRATE' menu and then use the *[P]* key to change to the first menu option.
8. Use the *[DOWN]* key to select 'Start calib.'.
9. To start the calibration, press the *[P]* key: The next menu option, 'Stop calib.' appears, the pump starts to pump and indicates the stroke rate (the pump works at the stroke rate, which is set under 'MANUAL').
10. After a reasonable number of strokes (e.g. 200), stop the pump by pressing the *[P]* key.
11. Determine the required metering volume (difference initial volume - residual volume).
12. Enter this volume in the menu option which appears and then press the key *[P]* - the pump changes to continuous display.
 - ⇒ The pump is calibrated.

The corresponding continuous displays indicate the calibrated values.

9.6.5 Settings for the "Metering" function (DOSING menu)

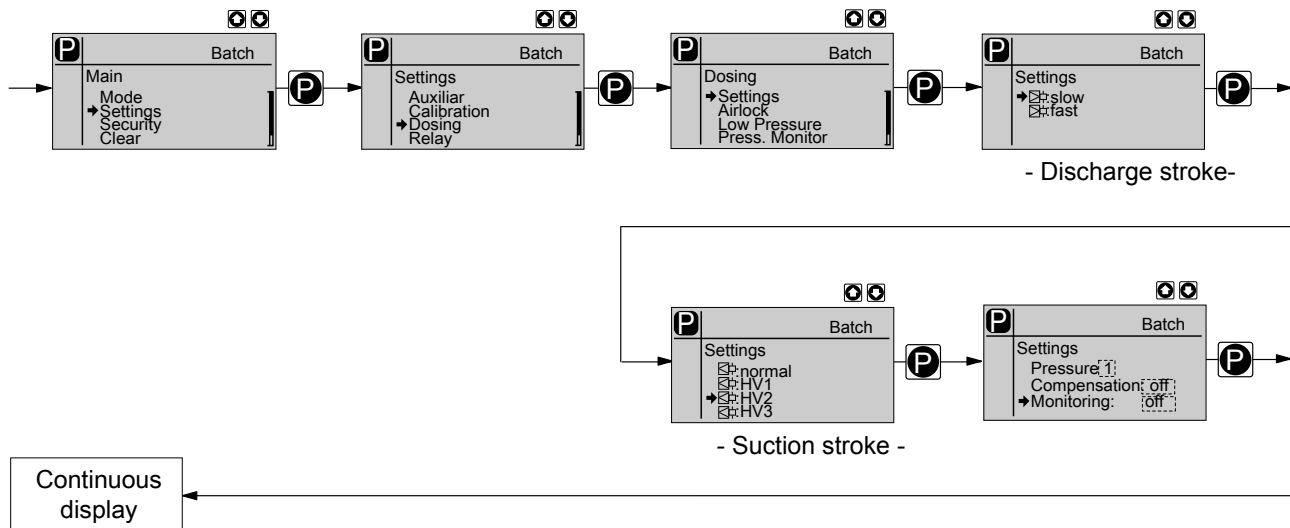
The "Metering" menu branches into the following sub-menus:

- 1 - 'Settings' (metering)
- 2 - 'Air lock'
- 3 - 'Low pressure'
- 4 - 'High pressure'

The last menu option of "Settings" offers the following functions:

- Pressure (ratings)
- Compensation

9.6.5.1 Settings in the sub-menu "Settings" (metering)



In the sub-menu 'Settings' (metering), you can precisely match the pump metering flow over time against the requirements of the particular application.

Discharge stroke

Hence the user can, dependent on requirements, set a fast discharge stroke ('Metering' - 'fast') for pulsed metering e.g. for quick clocked filling processes (a) or a slow discharge stroke ('Metering' - 'slow') for quasi-continuous metering, e.g. for processes requiring good mixing (b).

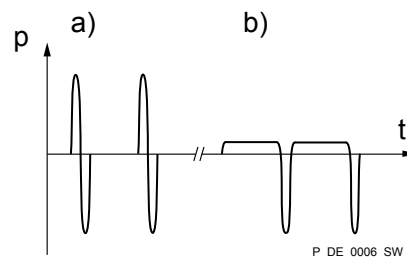


Fig. 27



- During quasi-continuous metering for high accuracy set as large as possible a stroke length.
- The slowing of the discharge stroke only becomes noticeable at lower stroke rates.
- At maximum stroke rate, 'slow' is identical to 'fast'!
- Slowing of the suction stroke leads to a lower capacity.

Suction stroke

In both metering modes it is possible, to selectively also slow the suction stroke. For the case of volatile feed chemicals, the slow suction stroke prevents cavitation and consequently increases metering precision (b) and c). In this way, it is possible to prevent the main cause for imprecise metering with high viscosity feed chemicals, namely the incomplete filling of the liquid end.

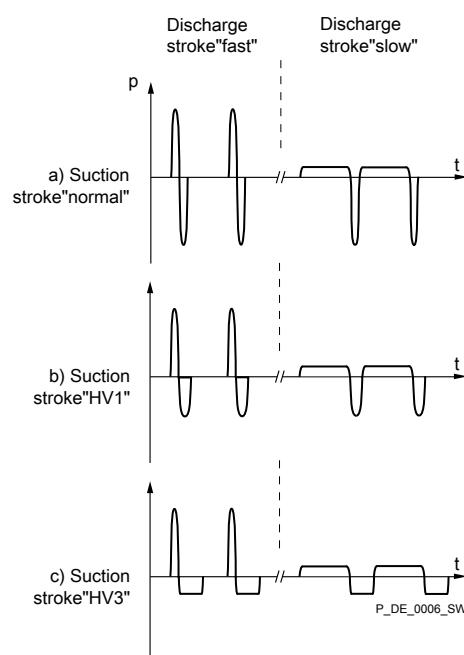


Fig. 28: Pulsed and quasi-continuous Mode with:

- normal suction stroke
- slightly slowed suction stroke
- maximally slowed suction stroke

The metering behaviour of the pump can be matched to the viscosity of the feed chemical.

Viscosity in mPa	"Dosing" setting	Suction stroke slowing	Max. stroke rate	Remarks
0...50	"normal"	none	200	
50...200	"HV1"	slight	160	
200...500	"HV2"	medium	120	for valves with springs
500...1000	"HV3"	Maximum	80	for valves with springs

For the adjustment for slowing the suction stroke dependent upon the feed chemical viscosity - see the "Adjustment" chapter.

Should "Settings" - "Intelligent" have been selected, a further menu option with the following functions appears:

- 'Pressure' (ratings)
- 'Compensation'

Pressure ratings

Using the "Pressure ratings" function, you can reduce the pump rated pressure.

The threshold of the permanently active overpressure monitoring falls simultaneously with the pressure rating (reacts at approx. 30 ... 50 % exceeding of the rated pressure, also pressure rating).



CAUTION!

If another liquid end size is fitted, then the pump must be converted to the corresponding type - see "Settings"- "System"- "Change head?".



CAUTION!

Warning of bursting lines

If a line becomes blocked, it could burst.

- Select the pump rated pressure only as large as necessary and as small as possible. This reduces the risk of bursting lines.

You can select the following rated pressures for these liquid end sizes via the pressure ratings:

Pressure rating/	1	2	3	4
Size of liquid end	[bar]	[bar]	[bar]	[bar]
2508	4	7	10	25
1608	4	7	10	16
1612	4	7	10	16
1020	4	7	10	-
0730	4	7	-	-
0450	4	-	-	-
0280	2	-	-	-

Compensation

Using the "Compensation" programmable function, you can minimise the influence of back pressure oscillations and thus achieve a high metering precision.



Under difficult hydraulic conditions, it can be better to switch off the "Compensation" function.

9.6.5.2 Settings in the "Air lock" sub-menu

Should a message appear, this may mean that there is air in the liquid end (if 'Warning' or 'Fault' was selected in the 'Air lock' sub-menu). Then either no suction has taken place or there are gas bubbles in the liquid end. These may have been sucked in or created by outgassing or cavitation.

9.6.5.3 "Low Pressure" sub-menu settings

Should a message appear, then, owing to a lack of back pressure, the delta® has established that there is possibly a leak, a burst line or a line ripped off on the pressure side (if 'Warning' or 'Error' has been selected in the 'No pressure' sub-menu).

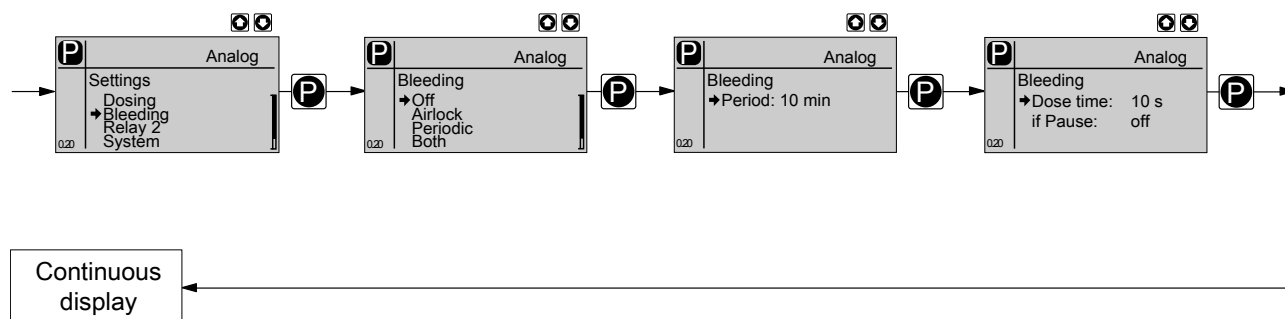


The 'No pressure' function can only function if the liquid end has been filled free from bubbles.

9.6.5.4 "High Pressure" sub-menu settings

If an alert appears, then the pump has identified a possible blockage or closed shut-off valve on the discharge side, owing to the back pressure being too high (if 'Warning' or 'Fault' has been set in the 'High Pressure' sub-menu).

9.6.6 Settings for the "Bleeding" function)



The menu 'BLEEDING' only appears, if a bleed module is plugged in. The module is also immediately recognised when the pump is running and the function is inserted in the operating menu (plug and play). The function "Bleeding" is used for controlled bleeding of the liquid end, if the pump has the option "Bleed module" (can be retrofitted).

There are two versions of the bleed module with different effects on the operating menu:

- Version with only 1 relay - to control the bleed valve. The menu 'BLEEDING' replaces the 'RELAY' menu.
- Version with 2 relays - one relay to control the bleed valve and one relay free for other uses. For this version, the additional menu 'RELAY 2' appears under the menu 'BLEEDING'.

The "Bleeding" function can be triggered in three ways:

- 1 - Only through the internal signal "Bleeding" from the pump drive unit.
- 2 - Only through the control unit - periodically for the set duration (both adjustable).
- 3 - If one of the two events occurs.

Detailed explanation:

- 1 - If *'Air lock'* has been selected in the menu, the internal signal "Air lock" triggers the bleed procedure.

If the signal appears again within 8 minutes of the bleed procedure being carried out, the control unit repeats the bleed procedure up to a maximum 3x. However if the signals still appear, then a fault alert is generated, which must be acknowledged via the *'STOP/START'* key. In the event of an *'Air lock'* there is no option for a direct fault or warning alert upon receipt of the "Air lock" signal. Also the corresponding menu branch in the menu *'METERING'* is hidden. The signal is only available for the "Bleeding" function.

- 2 - If *'Periodic'* was selected in the menu, then the control unit periodically triggers the bleed procedure with the adjustable period (10 ... 1440 min = 24 h) and the adjustable duration (*'Dose time'*: 0 ... 300 s = 5 min).

Triggering always occurs at the start of a period. Triggering also occurs if started using the *'STOP/START'* key or a mains voltage is applied arising from a bleed procedure. If under the menu the function *'Upon pause'*, is set to *'on'*, the bleed procedure also takes place during pauses.

- 3 - If *'Both'* has been selected in the menu, either the internal signal "Air lock" or the control unit triggers the bleed procedure. If one trigger occurs, while the other has already triggered a bleed procedure, this results in two sequential bleed procedures.

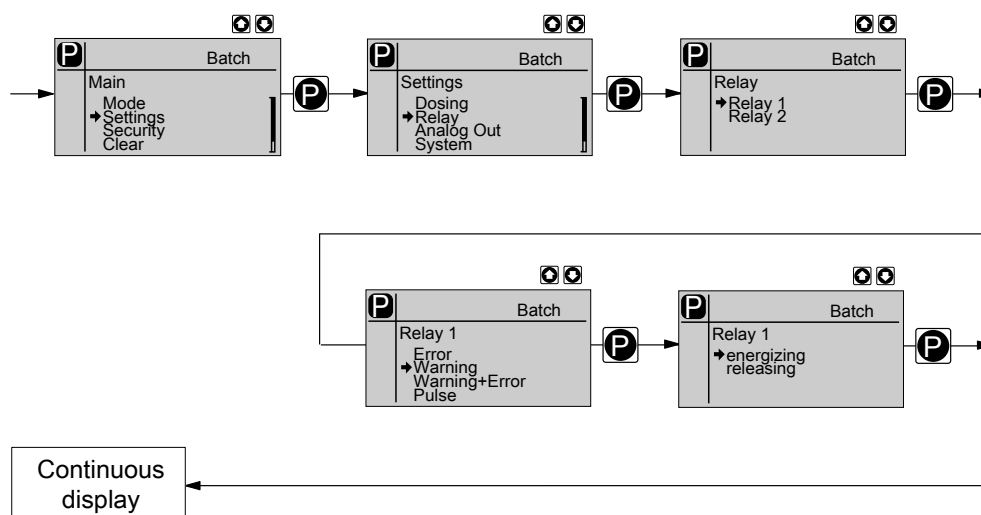
Sequence of the bleed procedure (automatic):

1. ➤ The pump control stops the running normal metering operation - the "Stop" symbol appears on the LCD screen.
2. ➤ After 1 s, it opens the bleed valve of the liquid end (via the bleed relay and the solenoid valve).
3. ➤ 1 s later, the pump starts to run at its maximum possible stroke rate (as during priming) - the symbol "Air lock" appears on the LCD screen instead of the "Stop" symbol.
4. ➤ The pump runs in this way for the total set time.
5. ➤ Once the set time has elapsed, the pump stops, the symbol "Stop" appears on the LCD screen again.
6. ➤ After 1 s the pump control closes the liquid end bleed valve.
7. ➤ After 1 s the "Stop" symbol disappears and the pump recommences normal operation.

If the pump was in the "Stop" state upon triggering (Key *'STOP/START'*, pause, fault), the start of the bleed procedure is delayed - until this state is cleared.

If the pump is placed in the "Stop" state during the bleed procedure, the pump control jumps immediately to phases 5 and 6. (see above) This definitely cancels the bleed procedure. As soon as the "Stop" state is cleared, the bleed procedure starts from the beginning.

9.6.7 Settings for the "Relay" function (RELAY menu)



Using the "Relay" programmable function, you can match the pump relays to your requirements.

You can reprogram the relays using the "Relay" function in an almost limited way. Exception: The two 8 A fault indicating relays (under identity code: 1 and 2) and the 8 A cut-off relays (under identity code: 6 and 7) can only be reprogrammed from 'NO' to 'NC' and vice versa.

Allocations for the relay combinations

Identity code specification	Relay type	"Relay 1"	"Relay 2"
		(Mechanical relay)	Semiconductor relay)
4 + 5	Fault indicating relay and pacing relay	Fault indicating relay	Pacing relay
8 + 9	Cut-off relay and pacing relay	Cut-off relay	Pacing relay
A + B	Cut-off relay and warning relay	Cut-off relay	Warning relay

You can set whether the respective relay is to switch due to a triggering event from the timer, upon a warning alert, a fault alert or a pump stroke:

Selectable behaviour types

Setting in the 'Relay' menu	Effect
Warning	The relay switches upon a warning alert (yellow LED*).
Error	The relay switches upon a fault alert (red LED*).
Warning + fault	The relay switches upon a warning alert (yellow LED*) or a fault alert (red LED*).
Pacing relay	The relay switches every stroke.
Option	The relay has the option of which module was plugged in (e.g. timer).
Warn. + Fault + Stop	The relay switches upon a warning alert (yellow LED*) or a fault alert (red LED*) or a stop (key 'STOP/START' or pause).

* see "Troubleshooting" chapter

You can also indicate how the respective relay should behave as soon as it switches. You can change this via the setting 'NO' / 'NC.'



The setting option for the "Relay" function only exists if a relay is present.

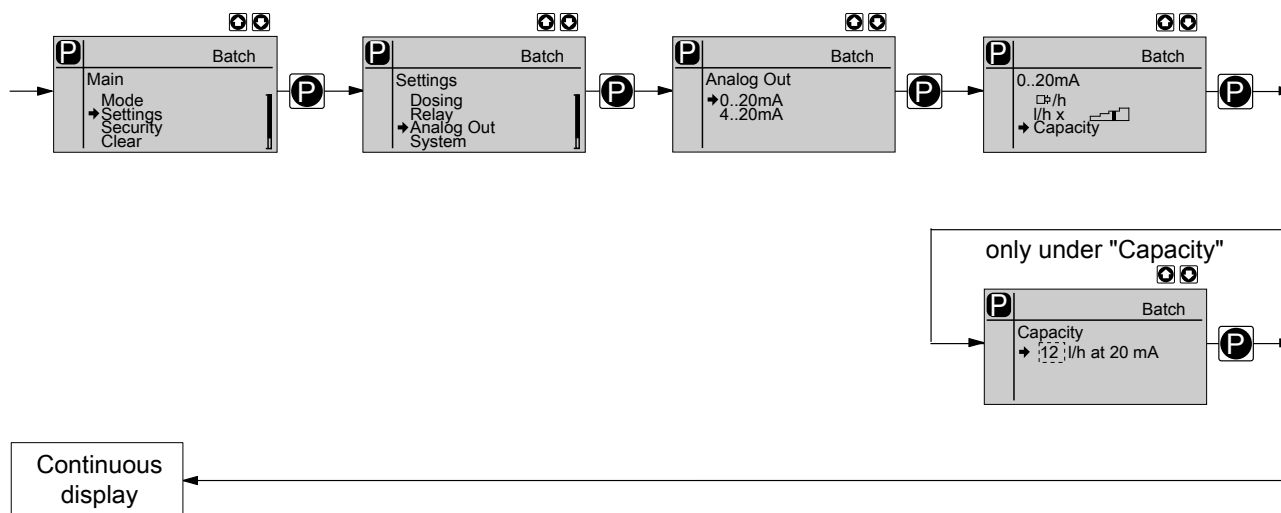
The following table summarises once more the behaviour of the deliverable relay types according to the identity code in the as-delivered condition:

Relay type behaviour according to identity code

Relay type	System response
Warning indicating relay	... switches upon a warning alert (yellow LED*).
Fault indicating relay	... switches upon a warning alert (yellow LED*) and / or a fault alert (red LED*).
Cut-off relay	... switches upon a fault alert (red LED*).
Pacing relay	... switches with every pump stroke.

* see "Troubleshooting" chapter

9.6.8 Settings for the "Analog output" function (ANALOG OUTPUT menu)



Using the "Analog output" programmable function, you can match the pump current output signal to your requirements.

The signal I of the current output signal one of the three following variables:

- Strokes /h
- Litre / h x stroke length (= current, calculated capacity)
- Performance (= capacity, value adjustable at 20 mA)

In the "Stop" or "Pause" states (either because of a fault or operation) or "Pause" the current output emits a current of 4 mA.

The signal for the current, calculated capacity "Litre / h" is calculated by the pump according to the following formula (here for the range 4-20 mA):

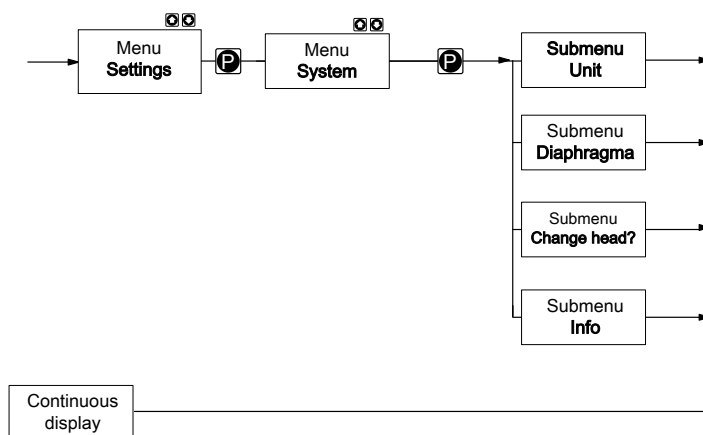
$$I(4 \dots 20) = 16 \times (f/f_{\max}) \times (L/100) + 4$$

with

- I - Output current in mA
- f - Stroke rate in strokes/min
- L - Stroke length in %
- fmax - Maximum stroke rate in strokes/min

In the '*Contact*' and '*Batch*' operating modes, f is the stroke rate which is set in the "Stroke rate" continuous display.

9.6.9 Settings in the "System" menu" (SYSTEM menu)



The "System" menu branches into the following sub-menus:

- Unit
- Diaphragm
- Info
- Change head?

9.6.9.1 Settings in the sub-menu "Units"

In the '*Units*' sub-menu, you can select whether the pump uses litres or gallons (US).

9.6.9.2 Settings in the sub-menu "Diaphragm"

In the '*Diaphragm*' sub-menu you can select whether the pump generates a warning or fault alert upon a diaphragm rupture.

9.6.9.3 "Info" sub-menu

In the "Info" sub-menu you can read off the following identification numbers:

- Identity code ID
- Serial number SN
- Software control SW
- Hardware control HW
- Software drive AS
- Hardware drive AH
- Name module-option (e.g. proTIME)
- Software option OS
- Hardware option OH

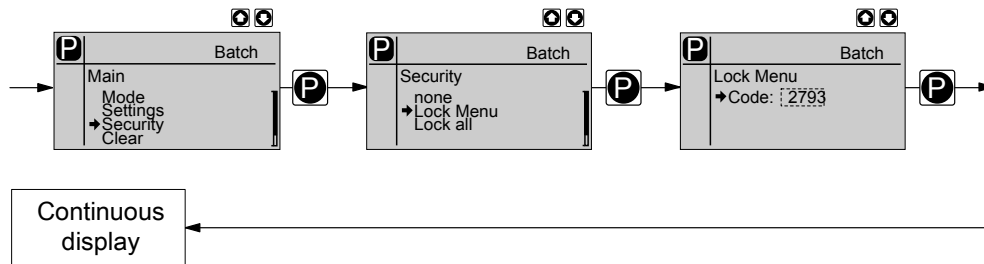
9.6.9.4 Sub-menu "Change head?"



CAUTION!

- Should a different liquid end size be fitted, then the pump must be reprogrammed in the sub-menu 'Change head?'.
- For demonstration purposes or if operating without feed chemical, reprogram the pump to 'Without head'.

9.7 Set code (SECURITY menu)



In the 'SECURITY' menu, you can enter whether you want to block sections of the adjustment options.

In the first menu option, you can either set 'None' or 'Lock menu' or 'Lock all' (both locks use the same code.):

- Select 'None', to clear a security lock.
- Select 'Lock menu' to lock the adjustment mode (point ① in the overview "Operating/setting diagram", in the appendix). In the next menu option, enter the number you want to use as the code.
- Select 'Lock all' to lock the adjustment option for the directly adjustable variables in the continuous displays and to lock the stroke length (point ② in the overview "Operating/setting diagram", in the appendix), in addition to the adjustment mode. In the next menu option, enter the number you want to use as the code.

If a lock is set, a padlock appears in the continuous display.

If you have set 'Lock all', a padlock will appear after 1 minute in the top left corner and the specified areas are locked, if no key has been pressed in the meantime.

If you have set 'Lock menu', the operating menu will be locked after 1 minute, if no key has been pressed in the meantime.

Test

To test whether the menu is locked, press the [P] key for 2 s.

If you try to change into a locked area, a key appears in the LCD display and the padlock flashes.

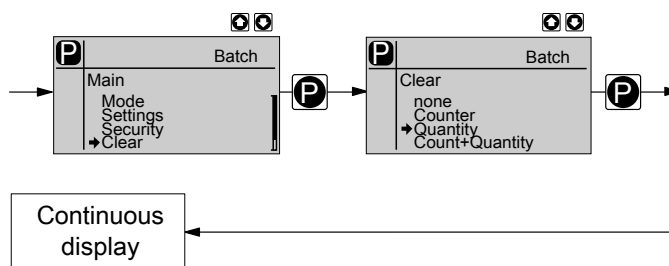
Overriding the lock

To override the lock, enter the code using the [arrow keys].

Changing the stroke length variable

In the stroke adjustment dial has been turned, the padlock flashes, the pump stops and a fault alert and key appear. If you enter the code, the pump continues metering and the fault alert clears.

9.8 Delete total number of strokes or total litres (CLEAR menu)



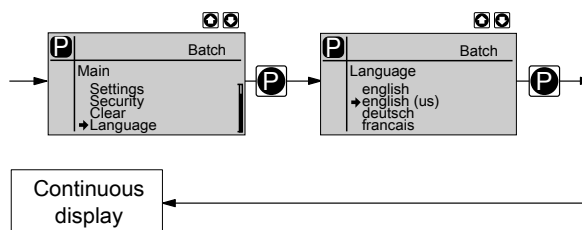
In the '*DELETE*' menu, you can either delete the stored total number of strokes or the total litres or both together (= reset to "0"):

- '*None*'
- '*Counter*' (total number of strokes)
- '*Quantity*' (total litres)
- '*all*' (both)

To do this quit the menu by quickly pressing the key *[P]* key.

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

9.9 Set language (LANGUAGE menu)



In the '*LANGUAGE*' menu, you can select the desired operating language.

The selection '*English (US)*' also changes the decimal comma to a decimal point in the displays.

10 Operation



WARNING!

Danger of electric shock

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

- Knock-out openings in the pump housing must be equipped with matching modules or be sealed 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.

This chapter describes all the operating options available to you if the pump is displaying a continuous display - the display does not contain the symbol for the *[P]* key.



- For supplementary information, see the overviews "Control elements and key functions" in the chapter "Device overview and control elements" and "Operating/setting diagram" in the appendix.
- Also take note of the overview "Continuous displays" in the appendix. It shows which continuous displays are available in which operating mode and which variables are directly changeable in the relevant continuous display.

10.1 Manual

Personnel: Instructed personnel

Adjusting the stroke length

The stroke length is adjusted by the stroke length adjustment knob within a range of 0 ... 100 %. A stroke length of between 30 ... 100 %) is recommended to achieve the specified reproducibility.

The following operating options are available via the keys - see the next figure:

Stop/start pump

Stop the pump: Press the *[STOP/START]* key.

Start the pump: press the *[STOP/START]* key again.

Start batch

In 'Batch' operating mode: briefly press key *[P]*.

Changing to adjustment mode

If the *[P]* key is pressed for 2 seconds in a continuous display, the delta® changes to adjustment mode - see chapter "Adjustment".

If an access code was set in the "Security" menu for 'Lock menu', then after pressing the *[P]* key the access code must first be entered.

Checking adjustable variables

After every press of the *[i]* key, a different continuous display is shown. The number of continuous displays depends on the identity code, the selected operating mode and the connected additional devices.

Changing directly changeable variables

To change a variable, see below, directly in the corresponding continuous display, press and hold one of the *[arrow keys]* (approx. 1/2 s) until the identifier "Double arrow" appears and the variable is flanked by two flashing lines. The delay has been programmed in to prevent variables from being unintentionally changed.

If an access code was set in the "Security" menu for 'Lock all', then after pressing the *[P]* key the access code must first be entered.

The directly changeable variables are in detail:

stroke rate

In operating modes 'Manual', 'Contact' and 'Batch':

You can change the stroke rate in the "Stroke rate" continuous display.



To change a precisely previously set feed rate (possibly specified in litres), there is an option of changing it via the stroke rate. As the stroke rate is digitally processed, there is no tolerance.

Changing using the stroke length interferes with the mechanical tolerance.

Capacity

In 'Manual' operating mode:

You can change the capacity in the "Capacity" continuous display.

Factor

The factor is the number of strokes which are triggered upon an external pulse or by pressing key *[P]* (only in 'Batch' operating mode).

Priming

Simultaneous pressing of the two *[arrow keys]* triggers the "Priming" function (in the "Stroke rate" continuous display).

Fault acknowledgement

Fault displays are acknowledged by brief pressing of the *[P]* key.

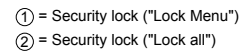


Fig. 29: Operating options with a locked operating menu

10.2 Remote operation

There is an option to control the pump remotely via a signal cable - refer to your system documentation and to the "Electrical Installation" chapter.

11 Maintenance

**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.

Standard liquid ends:

Interval	Maintenance work	Personnel
Quarterly*	<ul style="list-style-type: none"> ■ Check the diaphragm for damage - refer to the "Overhaul" chapter. ■ Check that the dosing lines are fixed firmly to the liquid end. ■ Check that the suction valve and discharge valve are tight. ■ Check the tightness of the entire liquid end - particularly around the leakage hole, see the following figure. ■ Check that the flow is correct: Allow the pump to prime briefly - quickly press both <i>[arrow keys]</i> simultaneously. ■ Check that the electrical connections are intact and check the pump housing. ■ Check that the dosing head screws are tight 	Technical personnel

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

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

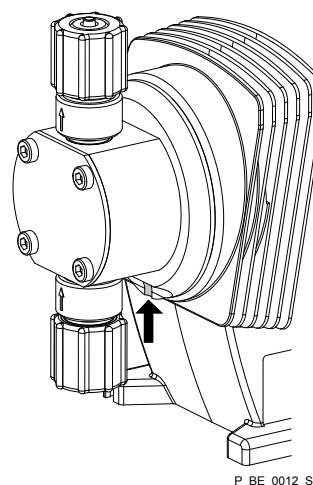


Fig. 30: Leakage hole

Maintenance

Liquid ends with bleed valve:

Interval	Maintenance work	Personnel
Quarterly*	<p>In addition:</p> <ul style="list-style-type: none">■ Check that the return line is fixed firmly to the liquid end.■ Check that the bleed valve is tight.■ Check the discharge and return line for kinks.■ Check that the bleed valve is operating correctly.	Technical personnel

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

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

Tightening torque

Data	Value	Unit
Tightening torque for screws:	4.5 ... 5.0	Nm

12 Repairs

Safety information

**WARNING!****Danger of an electric shock**

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

For this reason repairs inside the pump may only be performed by a ProMinent branch or representative, in particular the following:

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

**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 uncovered and handled during overhaul work.

- Protect yourself against the feed chemical in case 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.



The exploded views on the CD should be referred to when working on the unit.

12.1 Cleaning valves

Personnel: ■ Technical personnel



Warning of faulty operation

The exploded views on the CD should be referred to when working on the unit.

Cleaning a discharge valve for types 0730, 1020, 1612, 1608, 2508



Warning of faulty operation

- *Discharge and suction valves differ from each other! Only take them apart one after each other, so that you do not confuse the components!*
- *Only use new components which fit your valve - both in terms of shape and chemical resistance!*
- *Readjust the pump after replacing a valve!*
- *Using an Allen key or similar, insert it into the smaller hole of the discharge connector and push the valve inserts out of it.*

Cleaning a suction valve for types 0730, 1020, 1612, 1608, 2508

A suction valve is constructed in almost the same way as a discharge valve.

Please note, however, that:

- the two valve inserts are identical here
- There is an additional spacer between the valve inserts.
- There is a shaped seal in the dosing head instead of an O-ring.
- The flow direction of the suction connector is the opposite of that of the discharge connector.

Cleaning a discharge valve for types 0280, 0450



Warning of faulty operation

- *Discharge and suction valves differ from each other! Only take them apart one after each other, so that you do not confuse the components!*
- *Only use new components which fit your valve - both in terms of shape and chemical resistance!*
- *On the PVT material version, the ball seat is integrated in the dosing head and so has to be cleaned separately!*
- *On the PVT material version, the discharge valve is a double ball valve!*
- *Using an Allen key or similar, insert it into the smaller hole of the discharge connector and push the valve inserts out of it.*

Cleaning a suction valve for types 0280, 0450

A suction valve is constructed in almost the same way as a discharge valve.

Please note, however, that:

- The flow direction of the suction connector is the opposite of that of the discharge connector.

12.2 Replacing the metering diaphragm



WARNING!

A few cubic centimetres of feed chemical may have accumulated behind the metering diaphragm in the backplate following a leak - depending on the design!

- Take this feed chemical into consideration when you are planning a repair - especially if it is hazardous!

Personnel: ■ Technical personnel

- If necessary take protective measures.
- Observe the safety data sheet for the feed chemical.
- Depressurise the system.

1. ➤ 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!)
2. ➤ Turn the stroke adjustment dial up to the stop below 0 % stroke length if the pump is running (the drive axle is then difficult to turn).
3. ➤ Switch off the pump.
4. ➤ Unscrew the hydraulic connectors on the discharge and suction side.
5. ➤ For types with coarse/fine bleed valve: Firstly remove the coarse/fine bleed valve (knob), then lift off the cover of the liquid end with a screwdriver.

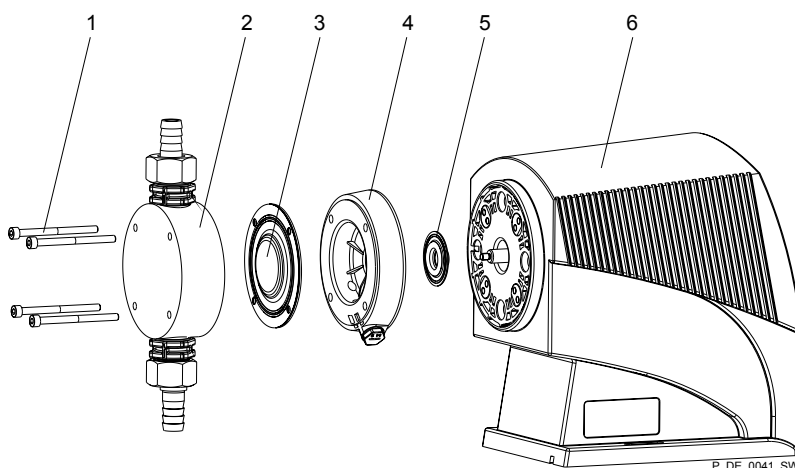


Fig. 31: Partially exploded view of liquid end

- 1 Screws
- 2 Dosing head
- 3 Diaphragm
- 4 Backplate
- 5 Safety diaphragm
- 6 Pump housing

6. ➤ Remove the screws (1).
7. ➤ Take the dosing head (2) plus screws (1) off from the pump - see figure Fig. 31
8. ➤ Replace the dosing head (2) and screws - the screws (1) should still extend into the holes in the diaphragm (3), but not into the pump housing!
9. ➤ Hold the pump housing (6) with one hand and clamp the diaphragm (3) with the other hand between the dosing head (2) and the backplate (4).
10. ➤ Loosen the diaphragm (3) from the drive axle with a gentle backwards turn of the dosing head (2), diaphragm (3) and backplate (4) in an anticlockwise direction.

11. ➤ Pull the dosing head (2) with the screws (1) out of the diaphragm (3) and completely unscrew this from the drive axle.
12. ➤ Remove the backplate (4) from the pump housing (6).
13. ➤ Check the condition of the safety diaphragm (5) and replace if necessary.
14. ➤ Push the safety diaphragm (5) onto the drive axle only until it lies flush with the pump housing (6) and no further!
15. ➤ Tentatively screw the new diaphragm (3) onto the drive axle up to the stop - this must be successful, otherwise the pump will subsequently not meter correctly!
16. ➤ Check whether the diaphragm holes align correctly with the pump housing.
17. ➤ If not, start the pump and adjust the stroke length to 100 %.
18. ➤ With the pump running, slowly turn the diaphragm (3) in the clockwise direction until the 4 diaphragm holes align correctly with the pump housing (6). Do not turn anticlockwise!
19. ➤ Clamp the diaphragm (3) in this position, adjust the stroke length to 0 % and stop the pump.
20. ➤ Unscrew the diaphragm (3) again.
21. ➤ Place the backplate (4) onto the pump housing (6).



CAUTION!

- The leakage hole must point downwards in the subsequent fitting position of the pump - see figure in the "Maintenance" chapter!
- Place the backplate (4) immediately into the correct position on the pump housing (6)! Do not twist the backplate on the pump housing so that the safety diaphragm (5) becomes warped!

22. ➤ Place the diaphragm (3) into the backplate (4).



CAUTION!

- Do not overtighten the diaphragm (3) in the following step!
- The backplate (4) must remain in its position so that the safety diaphragm does not become warped!

23. ➤ Hold the backplate (4) firmly and screw the diaphragm (3) in a clockwise direction until it is sitting tightly (the twisting resistance of the return spring can be felt).
24. ➤ Place the dosing head (2) with the screws (1) onto the diaphragm (3) and the backplate (4) - the suction connector must be pointing downwards in the pumps subsequent fitting position.
25. ➤ Gently tighten the screws (1) and then tighten in a diagonal pattern. See below for tightening torque.
26. ➤ For types with coarse/fine bleed valve: Allow the cover of the liquid end to rest in the dosing head, then press the knob of the bleed valve into the coarse/fine bleed valve.



Check the tightening torque of the screws after 24-hours of operation!

Tightening torques

Data	Value	Unit
Tightening torques for dosing head screws:	4.5 ... 5.0	Nm

12.3 Cleaning the diaphragm rupture indicator

**WARNING!****Warning of unnoticed escaping of feed chemical**

After triggering of the diaphragm rupture indicator, any feed chemical residues can be blocked.

- After triggering of the diaphragm rupture indicator, clean and test.

Personnel: ■ Technical personnel

1. ➤ First replace the liquid end diaphragm - see above!
2. ➤ Unscrew the diaphragm rupture indicator using a 15mm open ended spanner.
3. ➤ Clean the diaphragm rupture indicator with suitable liquid - if possible using water (polysulphone material).
4. ➤ Test the connected diaphragm rupture indicator: Immerse the forward hemisphere completely in water, a diaphragm rupture must be indicated in the continuous display.
 - ⇒ The continuous display indicates a diaphragm rupture.
5. ➤ Thoroughly dry the diaphragm rupture indicator.
 - ⇒ The continuous display no longer indicates a diaphragm rupture.
6. ➤ Screw the clean and dry diaphragm rupture indicator hand-tight and liquid tight into the hole - without using tools

13 Troubleshooting

Safety information



WARNING!

Warning of hazardous or unknown feed chemical

Should a hazardous or unknown feed chemical be used, it may escape from the hydraulic components when working on the pump.

- Take appropriate protective measures before working on the pump (protective eyewear, protective gloves, ...). Read the safety data sheet on 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.

13.1 Faults without a fault alert

Fault description	Cause	Remedy	Personnel
Pump does not prime in spite of full stroke motion and bleeding	Minor crystalline deposits on the ball seat due to the valves drying out	Take suction tube out of the storage container and thoroughly flush out the liquid end	Technical personnel
	Major crystalline deposits on the ball seat due to the valves drying out	Dismantle the valves and clean them - refer to the "Overhaul" chapter.	Technical personnel
Fluid is escaping from the end disc	The screws in the dosing head are too loose	Tighten the screws in the dosing head in a diagonal pattern - refer to the "Repairs" chapter for tightening torque.	
	The diaphragm is not tight	Replace the diaphragm - refer to the "Overhaul" chapter. If a diaphragm rupture has been indicated, clean the diaphragm rupture reporter, refer to the "Overhaul" chapter.	Technical personnel
Green LED indicator (operating indicator) does not light up	The wrong mains voltage or no mains voltage is connected	Connect the pump correctly to the specified mains voltage - according to the specification on the nameplate.	Electrician




13.2 Fault alerts

Fault description	Cause	Remedy	Personnel
The red LED indicator illuminates, the "Level" symbol  flashes in the LCD display, the "Fault" and "Stop" symbols are also displayed and the pump stops.	The liquid level in the storage tank has reached "liquid level low 2nd stage".	Fill the storage tank	Technical personnel

Fault description	Cause	Remedy	Personnel
The red LED indicator illuminates, the symbol "i < 4 mA"  flashes in the LCD display, the "Fault" and "Stop" symbols are also displayed and the pump stops.	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.	Clear the cause of the low control current or switch the programming of the fault behaviour to "OFF" - see chapter "Settings for 'Analog' operating mode".	Technical personnel
The red LED indicator illuminates, the symbol "i > 23 mA"  flashes in the LCD display, the "Fault" and "Stop" symbols are also displayed and the pump stops.	The pump is in "Analog" operating mode, a fault behaviour has been programmed in the ANALOG menu and the control current has risen above 23 mA.	Clear the cause of the high control current or switch the programming of the fault behaviour to "OFF" - see chapter "Settings for 'Analog' operating mode".	Technical personnel
The red LED indicator illuminates, the symbols "m" and "External"  flashes in the LCD display, the "Fault" and "Stop" symbols are also displayed and the pump stops.	The stroke memory has overflowed.	Rectify the cause, then press the [P] key (think of the consequences for the process!).	Technical personnel
The red LED indicator illuminates, the "Temperature" symbol  flashes in the LCD display, the "Fault" and "Stop" symbols are also displayed and the pump stops.	The pump is overloaded.	Rectify the cause, then press the [P] key (think of the consequences for the process!).	Technical personnel
	The temperature is too high.	Rectify the cause, then press the [P] key (think of the consequences for the process!).	Technical personnel
The red LED indicator illuminates, the "Stroke length adjustment" symbol  flashes in the LCD display, the "Fault" and "Stop" symbols are also displayed and the pump stops.	The stroke adjustment dial was rotated while the menu was locked.	Turn the stroke adjustment dial back or enter the code.	Technical personnel


13.3 Fault alerts / warning alerts

At issue here are error alerts, which dependent on the setting in the setting menu are displayed as fault alerts or warning alerts.

Fault description	Cause	Remedy	Personnel
Either the yellow LED indicator illuminates and the "Flow" symbol  flashes in the LCD display, or, together with the red LED indicator, the symbols for "Fault" and "Stop" also appear and the pump stops.	The dosing monitor is not correctly connected.	Connect the dosing monitor correctly and press the [P] key.	Electrician
	The dosing monitor reported too few strokes, more that set in the FLOW menu.	press the [P] key. Investigate and clear the cause	Technical personnel
Either the yellow LED indicator illuminates and the "Diaphragm" symbol  flashes in the LCD display, or, together with the red LED indicator, the symbols for "Fault" and "Stop" also appear and the pump stops.	The diaphragm is broken.	Replace the diaphragm and clean the diaphragm rupture reporter, refer to the "Overhaul" chapter.	Technical personnel
Either the yellow LED indicator illuminates and the "Air lock" symbol  flashes in the LCD display, or, together with the red LED indicator, the symbols for "Fault" and "Stop" also appear and the pump stops.	Gas bubbles in the liquid end (leaks, gaseous medium, cavitation).	If the red LED indicator illuminates, press the [P] key, think of the consequences for the process! Bleed the liquid end and rectify the cause. Seal the system or slow the suction stroke.	Technical personnel

Fault description	Cause	Remedy	Personnel
Either the yellow LED indicator illuminates and the "p+" symbol p+ flashes in the LCD display, or, together with the red LED indicator, the symbols for "Fault" and "Stop" also appear and the pump stops.	A constriction or a closed shut-off valve on the discharge side.	If the red LED indicator illuminates, press the [P] key, think of the consequences for the process! Open the shut-off valve or rectify the constriction.	Technical personnel
Either the yellow LED indicator illuminates and the "p-" symbol p- flashes in the LCD display, or, together with the red LED indicator, the symbols for "Fault" and "Stop" also appear and the pump stops.	There is a leak or a burst or torn line on the discharge side.	If the red LED indicator illuminates, press the [P] key, think of the consequences for the process! Rectify the leak or clear the cause.	Technical personnel

13.4 Warning Alerts

Fault description	Cause	Remedy	Personnel
The yellow LED indicator illuminates, the "Level" symbol  appears flashing in the LCD display.	The liquid level in the storage tank has reached "liquid level low 1st stage".	Fill the storage tank	Instructed personnel

13.5 All Other Faults

Please contact the responsible ProMinent subsidiary or representative!

14 Decommissioning

Decommissioning



WARNING!

Danger from chemical residues

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 relating to the "Storage, transport and unpacking" chapter is read before shipping or transporting the unit.
- Thoroughly clean the liquid end and the housing of chemicals and dirt. Adhere to the safety data sheet for the feed chemical.



WARNING!

Warning of dangerous or unknown feed chemical

Should a dangerous or unknown feed chemical be used: It may escape from the hydraulic components when working on the pump.

- Take appropriate protective measures before working on the pump (e.g. safety glasses, safety gloves, ...). Observe the 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.

Personnel: Technical personnel

1. ➞ Disconnect the pump from the mains power supply.
2. ➞ Empty 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!

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.

Personnel:

■ Technical personnel



CAUTION!

Environmental hazard due to electronic waste

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

- Separate the electronic components from the remaining parts.
- Note the pertinent regulations currently applicable in your country!

15 Technical data

15.1 Performance data

delta® b operating at 200 strokes/minute
and 100 % stroke length

Liquid end type	Minimum pump capacity at maximum back pressure			Minimum pump capacity at medium back pressure		
	bar	l/h	ml/stroke	bar	l/h	ml/stroke
2508	25	7.5	0.62	12.5	8.0	0.67
1608	16	7.8	0.62	8	8.2	0.69
1612	16	11.3	0.94	8	12.2	1.02
1020	10	19.1	1.59	5	19.2	1.6
0730	7	29.2	2.43	3.5	29.4	2.45
0450	4	49.0	4.08	2	51.5	4.29
0280	2	75.0	6.25	1	75.6	6.3

Liquid end type	Stroke rate	Connector size outside Ø x inside Ø	Suction lift*	Priming lift**	Permissible priming pres- sure suction side	Weight
	Strokes/min	mm	m WS	m WS	bar	kg
2508	200	8x4 ¹	5	3.5 / 3.0 ²	8	10 / 11 ²
1608	200	8x5	5	3.5 / 3.0 ²	8	10 / 11 ²
1612	200	8x5	5	3.0 / 2.5 ²	8	10 / 11 ²
1020	200	12x9	5	3.5 / 3.0 ²	5	10 / 11 ²
0730	200	12x9	4	4.0 / 3.5 ²	3	10 / 11 ²
0450	200	DN 10	3	2.5 / 2.5 ²	2	10 / 11 ²
0280	200	DN 10	2	3.0 / 3.0 ²	1	10 / 11 ²

* - Suction lift with a filled suction line and filled liquid end.

** - Priming lift with clean and moist valves. Priming lift at 100 % stroke length and free outlet or opened bleed valve.

¹ - For the SST material version there is a 6 mm connector size

² - SST material version

15.2 Accuracy

15.2.1 Standard liquid ends

Data	Value	Unit
Product scatter	-5 ... 10	% *
Metering reproducibility	±2	% **

* - with max. stroke length and max. operating pressure for all material versions

** - under constant conditions and at least 30 % stroke length

The delta® ensures uniform conditions provided the stroke velocities are correctly adjusted and, if "Compensation" is set to "on" (see Chapter "Dosing").

15.3 Viscosity

The metering behaviour of the pump can be matched to the viscosity of the feed chemical.

Viscosity in mPa	"Dosing" setting	Suction stroke slowing	Max. stroke rate	Remarks
0...50	"normal"	none	200	
50...200	"HV1"	slight	160	
200...500	"HV2"	medium	120	for valves with springs
500...1000	"HV3"	Maximum	80	for valves with springs

For the adjustment for slowing the suction stroke dependent upon the feed chemical viscosity - see the "Adjustment" chapter.

15.4 Material data

Liquid ends

Version	Dosing head	Suction/discharge connector	Seals	Valve balls
NP	Clear acrylic	PVDF	PTFE	Ceramic
PV	PVDF	PVDF	PTFE	Ceramic
SS	Stainless steel 1.4404	Stainless steel 1.4404	PTFE	Ceramic

Pump

Version	Housing	Hood	Transparent cover	Electronics
All	Polyphenyl ether (PPE with fibreglass)	Polyphenyl ether (PPE with fibreglass)	Polycarbonate	Electronic components

15.5 Electrical data

Version: 100 - 230 V ±10 %, 50/60 Hz

Data	Value	Unit
Power rating, approx.	73	W
Nominal current, approx.	0.90 ... 0.55	A
Switch on peak current, (within approx. 50 ms falling	8 ... 4	A
Fuse	1.6	AT

Fuses must have VDE, UL and CSA approvals. e.g. Series SPT, 1.6 A supplied by Schurter Order no. 0001.2506 according to IEC Publ. 127 - 2/3.

15.6 Temperatures

Pump, compl.

Data	Value	Unit
Storage and transport temperature	-10 ... +50	°C
Ambient temperature in operation (drive and control):	-10 ... +45	°C

Liquid end, long-term*

Data	Value	Unit
Liquid end temperature	-10 ... +45	°C

* long term at max. operating pressure, dependent on ambient and feed chemical temperatures

Liquid end, short-term*

Material version	Value	Unit
NP_	60	°C
PVT	120	°C
SST	120	°C

* Temp. max., for 15 min at max. 2 bar, dependent on the ambient and feed chemical temperatures

15.7 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

15.8 Protection class and Safety Requirements

Degree of protection

Protection against contact and humidity:

IP 65 in accordance with IEC 529, EN 60529, DIN VDE 0470 Part 1

Safety requirements

Degree of protection:

1 - mains power connection with protective earth conductor

15.9 Compatibility

Some hydraulic parts of the delta® are identical to those of the Beta® and gamma/ L.

There is greatest compatibility with pumps of the Beta® and gamma series for the following components and accessories:

- Control wire gamma/Vario 2-, 4- and 5-wire for the "External" function
- Level switch 2-stage (gamma / Vario / Beta®)
- Metering line cross-sections
- Standard gamma connector kit
- Chemical feed container
- Overall height (distance between the suction and discharge connector)
- Same use of accessories, such as back pressure valves, multifunctional valves, dosing monitor and flushing assembly

15.10 Weight

Material version	Weight
	kg
SST	11
PVT	10
NP_	10

15.11 Sound pressure level

Sound pressure level

Sound pressure level LpA < 70 dB in accordance with EN ISO 20361:2010-10

at maximum stroke length, maximum stroke rate, maximum back pressure (water)

16 EC Declaration of Conformity

- Original - EC Declaration of Conformity for Machinery

We,

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

hereby declare that, the product specified in the following complies with the relevant basic health and safety rules of the EC Directive, on the basis of its functional concept and design and in the version marketed by us.
This declaration loses its validity in the event of a modification to the product not agreed with us.

Description of the product: ***Metering pump, delta series***

Product type: ***DLTA....***

Serial no.: ***Please refer to type plate on the device***

Pertinent EC Directives: ***EC - Machinery Directive (2006/42/EC)***
EC EMC Directive (2004/108/EC)
The safety objectives of the Low voltage Directive 2006/95/EC are complied with
in accordance with Appendix I, No. 1.5.1 of the Machinery Directive 2006/42/EC

Harmonised standards applied, in particular: ***EN ISO 12100, EN 809,***
EN 60335-1, EN 60529, EN 60335-2-41,
EN 61000-3-2, EN 61000-6-1/2/3/4

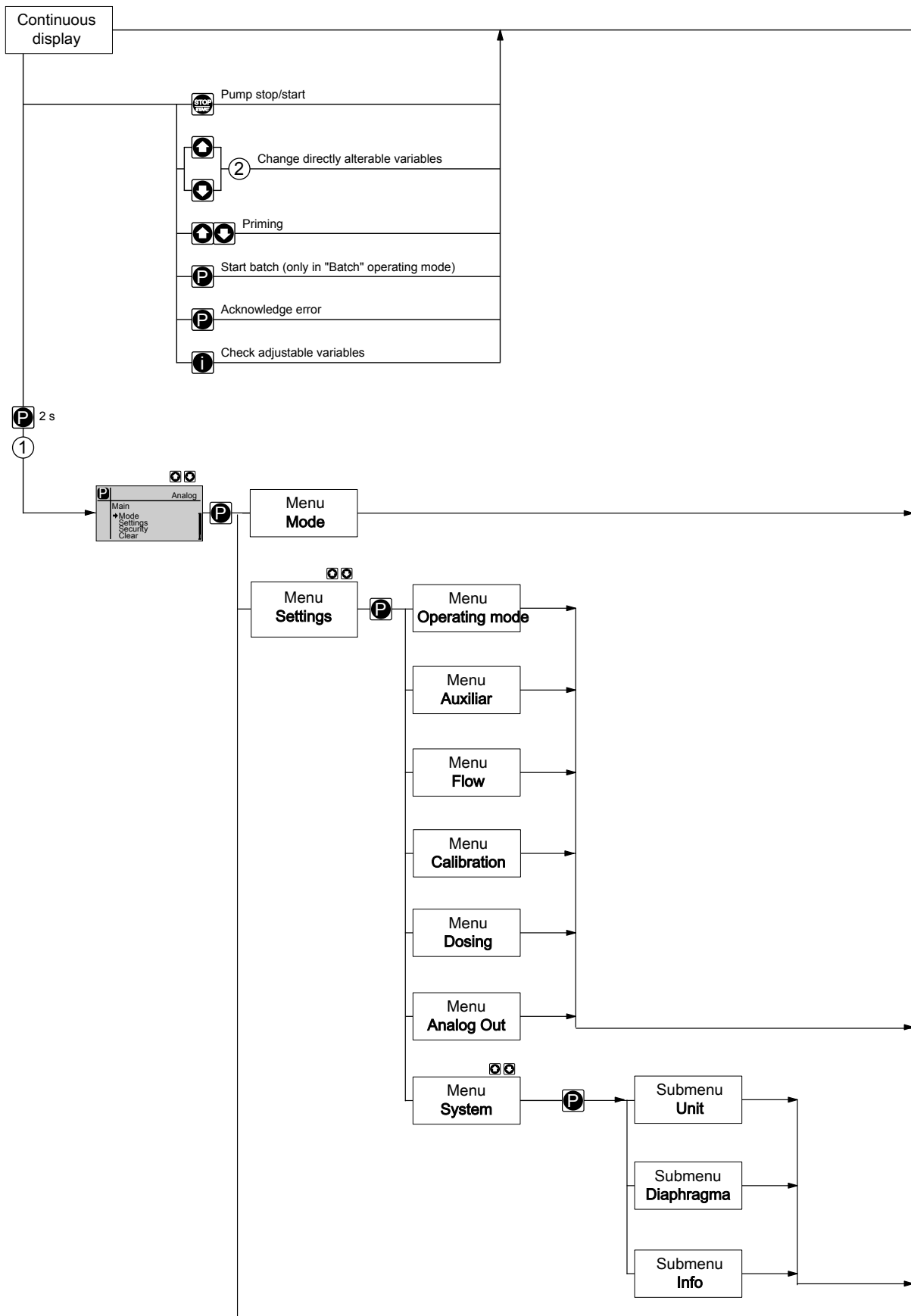
Technical documents have been compiled by documentation specialists: ***Norbert Berger***
Im Schuhmachergewann 5-11
DE-69123 Heidelberg

Date / manufacturer's signature: ***06.07.2011***



Details of the signatory: ***Joachim Schall, Head of Development***

17 Operating menu overview






































18 Continuous displays

Continuous display

Continuous display	Op. mode "Manual"	Op. mode "Batch" with Memory and transfer factor 5	Op. mode "Contact" with Memory and transfer factor 5	Op. mode "Analog"
Stroke rate (Strokes/h)				
Stroke rate (Strokes/min)				
Capacity				
Display "External"				
Factor				
Concentration				
= with the arrow keys [Up] and [Down] directly alterable variables				Identifier "m" only, should function extension "Stroke memory" be activated.

Auxiliary displays in the continuous display

Auxiliary display	Op. mode "Manual"	Op. mode "Batch" with Memory and transfer factor 5	Op. mode "Contact" with Memory and transfer factor 5	Op. mode "Analog"
Stroke rate (Strokes/h)	12000  /h	12000  /h	12000  /h	12000  /h
Stroke rate (Strokes/min)	200  /min	200  /min	200  /min	200  /min
Capacity	80,00  /h ¹			80,00  /h ¹
Factor			5 * 	
Remaining strokes		25,00  ²		
Batch size Remaining litres		000,833  ^{1, 2}		
Total strokes	86500 	86500 	86500 	86500 
Total litres (Dosing amount)	576,67  ¹	576,67  ¹	576,67  ¹	576,67  ¹
Stroke length	65 % 	65 % 	65 % 	65 % 
Signal current (at the input)				12,7 mA ³
Dosing mode	 : slow,  : HV1	 : slow,  : HV1	 : slow,  : HV1	 : slow,  : HV1
Concentration	12,5 %c ⁴	12,5 %c ⁴	12,5 %c ⁴	12,5 %c ⁴

1 = only after running through the CALIBRATION menu - also after every change of operating mode

2 = only with function extension "Memory"

3 = only with current output

4 = only after running through the CONCENTRATION menu - also after every change of operating mode

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