

Operating Instructions

Solenoid metering pump delta® with controlled solenoid drive optoDrive®



DLTA _____

Please enter the identcode of your device here.

Two sets of operating instructions are required for the safe and correct use of the metering pumps:

The product specific operating instructions manual
and the "General Operating Instructions ProMinent® Solenoid Metering Pumps".

The two are valid only when read in conjunction with one another.

Please read through operating instructions manual carefully before use. Do not discard.

The guarantee is void if the equipment is subject to misuse.

Imprint:

Operating Instructions
Solenoid metering pump delta®
with controlled solenoid drive optoDrive®
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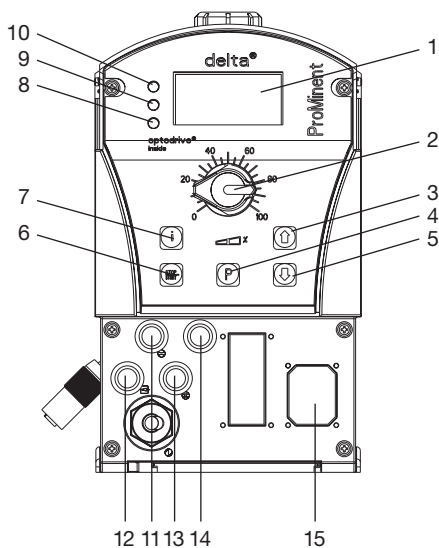
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Controls and key functions

Controls, Overview



- 1 LCD display
- 2 Stroke length adjustment knob
- 3 UP key
- 4 P key
- 5 DOWN key
- 6 STOP / START key
- 7 i key
- 8 Fault indicator (red)
- 9 Alarm indicator (yellow)
- 10 Operating indicator (green)

- 11 Socket "Dosing monitor"
- 12 Socket "External control"
- 13 Socket "Level switch"
- 14 Socket "Diaphragm failure monitor"
- 15 Relay (option)

Key functions

In continuous displays (operation)

In setting mode (settings)

STOP / START key



briefly pressed

stop pump,
start pump

stop pump,
start pump

P key



briefly pressed

start batch (only in operating mode "Batch"),
acknowledge error

Confirm entry - jump to the next
menu option or to continuous display

2 s pressed

go to setting mode

3 s pressed

jump to continuous display

i key



briefly pressed

toggle between the continuous displays

long pressed

go to the second level of the continuous display

briefly pressed

toggle between the continuous displays

Arrow keys UP or DOWN



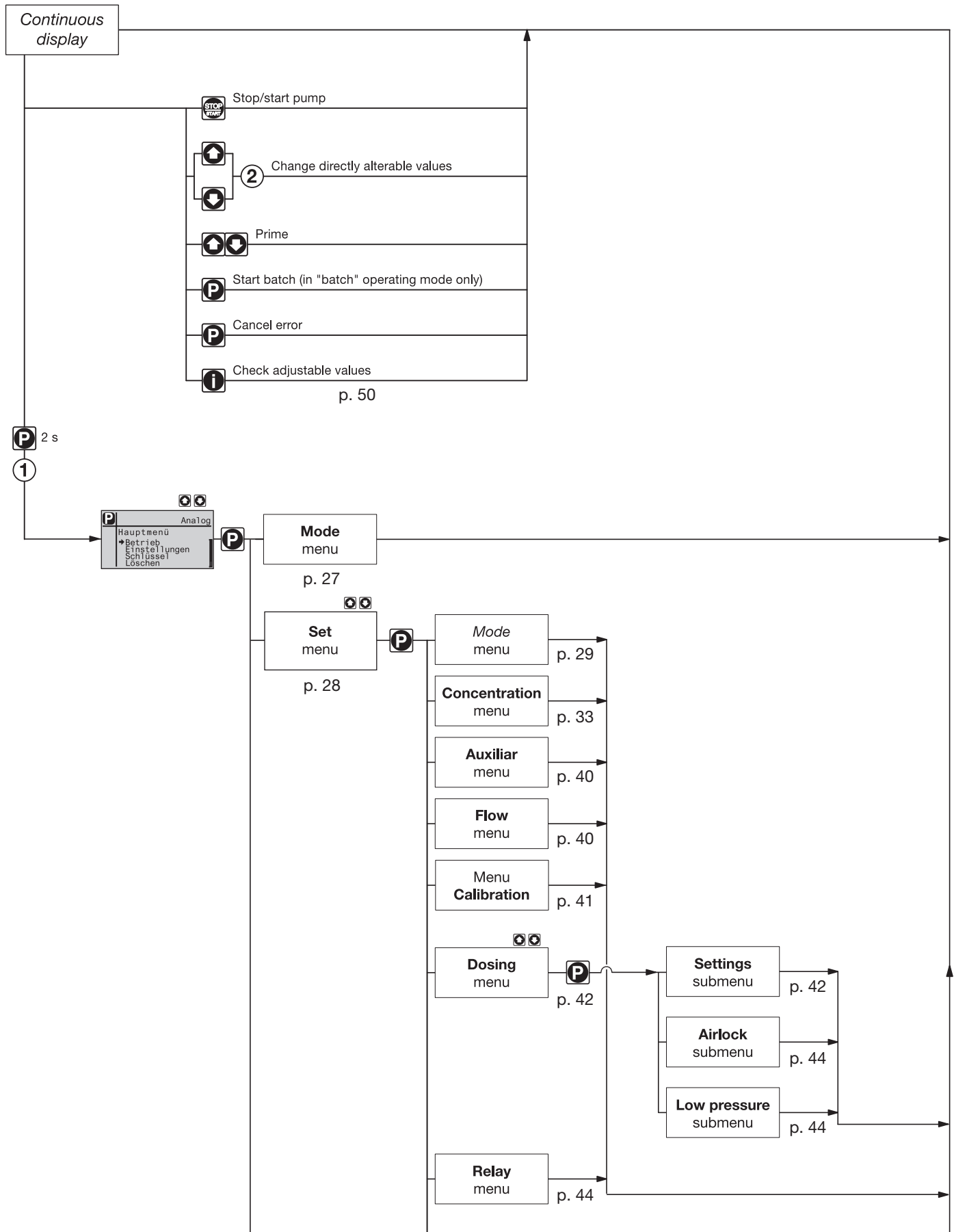
individually pressed
(until "Double arrow"
is displayed)

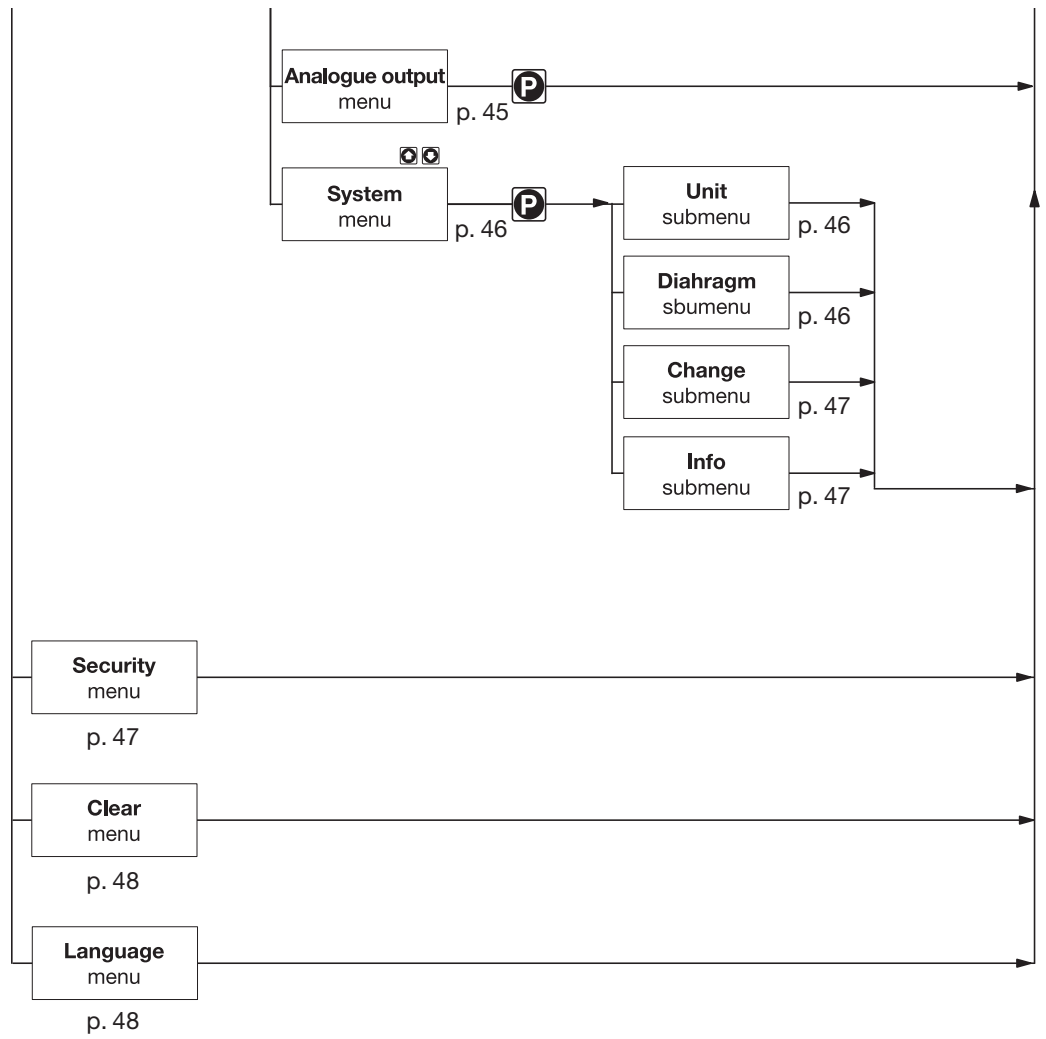
change directly adjustable variables

select another setting,
change individual figure or number
at the upper end of a selection,
effect like ESC key

simultaneously pressed

suction (in continuous display "stroke frequency")





Permanent displays

	Operating mode "Analog" 0-20 mA	Operating mode "Contact" with memory and transformation factor 5	Operating mode "Batch" with memory and transformation factor 5	Operating mode "Manual"
Stroke frequency (strokes/ h)	Analog 12000 $\frac{\text{strokes}}{\text{h}}$	Contact 12000 $\frac{\text{strokes}}{\text{h}}$	Batch 12000 $\frac{\text{strokes}}{\text{h}}$	Manual 12000 $\frac{\text{strokes}}{\text{h}}$
Stroke frequency (strokes/ min)	Analog 200 $\frac{\text{strokes}}{\text{min}}$	Contact 200 $\frac{\text{strokes}}{\text{min}}$	Batch 200 $\frac{\text{strokes}}{\text{min}}$	Manual 200 $\frac{\text{strokes}}{\text{min}}$
Metering output	Analog 80,00 $\frac{\text{t}}{\text{h}}$	Contact 80,00 $\frac{\text{t}}{\text{h}}$	Batch 80,00 $\frac{\text{t}}{\text{h}}$	Manual 80,00 $\frac{\text{t}}{\text{h}}$
Display "External"		Contact 5 $\frac{\text{t}}{\text{h}}$	Batch	
Factor		Contact 0,220 %	Batch 0,220 %	Manual 0,220 %
Concentration	Analog 0,220 %	Contact 0,220 %	Batch 0,220 %	Manual 0,220 %
		Identifier "m" only if function extension "Stroke memory" is activated		

☒ = variables which can be directly changed using the arrow keys UP or DOWN

Secondary displays in the permanent display

Secondary display	Operating mode "Manual"	Operating mode "Batch" with memory and transfer factor 5	Operating mode "Contact" with memory and transfer factor 5	Operating mode "Analog" 0-20 mA
Stroke frequency (strokes/h)	12000	12000	12000	12000
Stroke frequency (strokes/min)	200	200	200	200
Metering output	80,00	1	1	80,00
Factor			5	
Remaining strokes		25,00		
Batch size/remaining litres		000,833	1, 2	
Total number of strokes	86500	86500	86500	86500
Total litres (metering volume)	576,67	576,67	576,67	576,67
Stroke length	65 %	65 %	65 %	65 %
Signal current (at input)				12,7 mA
Metering mode	: slow,	: slow,	: slow,	: slow,
Concentration	12,5 %	12,5 %	12,5 %	12,5 %

1 = only after completion of the CALIBRATION menu – also after each change of the operating mode
 2 = only with function extension "Memory"
 3 = only with current output
 4 = only after completion of the CALIBRATION menu – also after each change of the operating mode

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Identcode

Please enter the Identcode listed on the rating plate under "Type" into the space below

DLTA	delta® series	
	Pump type 1612 Capacity: 16 bar; 11,3 l/h 1020 10 bar; 19,1 l/h 0730 7 bar; 29,2 l/h 0450 4 bar; 49,0 l/h 0280 2 bar; 75,0 l/h	
	Dosing head material SS Stainless steel PV PVDF	
	Seals/diaphragm material T PTFE/PTFE coated S PTFE/diaphragm additionally with FPM coating for silica-laden media	
	Dosing head version 0 Without ventilation, without valve spring 1 Without ventilation, with valve spring 2 With ventilation, without valve spring 3 With ventilation, with valve spring	
	Hydraulic connector 0 Standard connectors as per technical data 5 Discharge-side connector for 12/6 hose, suction-side standard	
	Diaphragm failure indication 0 Without diaphragm failure indication 1 Diaphragm failure indication	
	Version 0 with ProMinent Logo	
	Supply U Universal controller 100-240 V	
	Cord and plug A 2m Europe B 2m Switzerland C 2m Australia D 2m USA / 115 V 1 2 m without plug	
	Relais 0 Without relay 1 Alarm relay dropping out 1 x changeover 230V – 8A 3 Alarm relay picking up 1 x changeover 230V – 8A 4 As 1 + clock generator relay picking up 2 x make contact 24V – 100mA 5 As 3 + clock generator relay picking up 2 x make contact 24V – 100mA 6 Cut-off relay dropping out 1 x changeover 230V – 8A 7 Cut-off relay picking up 1 x changeover 230V – 8A 8 Cut-off rel.drop.+clockgen.pick. 2 x make contact 24V – 100mA 9 Cut-off rel.pick.+clockgen.pick. 2 x make contact 24V – 100mA A Cut-off rel. + warning relay dropping out 2 x make contact 24V – 100mA B Cut-off.rel.pick.+warning.rel.pick. 2 x make contact 24V – 100mA C Current outp.4-20mA + alarm rel. dropping out 1 x make contact 24V – 100mA D Current outp.4-20mA +fault indic. 1 x make contact 24V – 100mA E Current outp.4-20mA +clock gen. indic. 1 x make contact 24V – 100mA	
	Accessories 0 Without accessories 1 With foot valve and dosing valve, 2 m suction line and 5 m discharge line 2 As 0 + for measuring cylinder (only for types 1612, 1020, 0780) 3 As 1 + for measuring cylinder (only for types 1612, 1020, 0780))	
	Control variants 0 Manual + external contact 1:1 with pulse control 3 Manual + external contact with pulse control + analog 0/4-20 mA extended	
	Access code 0 Without access code 1 With access code	
	Language DE German EN English	
	Pause/Level 0 Pause N.C. contact level, N.C. contact	
DLTA	_ _ _ _ _	_ _ _ _ _

General User Information

Please read through the following user guidelines! Familiarity with these points ensures optimum use of the operating instructions.

On the folding page behind the title page, the overviews for “Controls and key functions” and “Operating/setting diagram” are listed.

The overview “Controls and key functions” can be left unfolded when reading the operating instructions.

Key points in the text are indicated as follows:

- Enumerated points
- ▶ Instructions

Working guidelines:

NOTE

A note is to facilitate your work.

and safety guidelines:



WARNING

Characterizes a possibly hazardous situation. Your life is in danger and there is a danger of serious injury if these notes are disregarded!



CAUTION

Characterizes a possibly hazardous situation. There is a danger of slight or minor injury or damage to property if these notes are disregarded!



IMPORTANT

Characterizes a possibly endangering situation. There is a danger of damage to property if these notes are disregarded.

The rating plate affixed to the title page is identical to the rating plate of the delivered pump such that a clear connection between the operating instructions and the pump is guaranteed.

Please state the Identcode and the serial number shown on the rating plate during any contact or order of replacement parts. Thus, the pump type and the material variants can be clearly identified.

1 About this pump

The solenoid metering pumps of the series delta® with controlled solenoid drive optoDrive® are microprocessor-controlled solenoid metering pumps with the following particularities:

- Continuous or pulsing operation
- Programmable duration of the pressure and suction stroke
- Adaptation of the pump to the dosing medium
- Output range 11 l/h - 75 l/h, 16 - 2 bar
- Stroke length adjustment continuously from 0 - 100 % (30-100 % recommended)
- Low-noise operation
- Detection of blocked metering points, broken metering lines and enclosed air and gas bubbles in the delivery unit by the integrated injection control optoGuard®.
- Option concentration input for quantity-proportional metering
- Port for 2-phase level switch
- Material versions PVDF and stainless steel
- Patented coarse / fine ventilation
- Diaphragm failure detection and signalling
- Adjustment and display of the output alternatively as strokes/min or l/h via the keyboard
- Large, illuminated graphic display
- External control through potential-free contacts with optimum impulse transfer and reduction
- Option of external control via standard signal 0/4-20mA
- Port for 2-phase level switch
- 3 LED display for operation, warning and error messages in full text

2 Safety chapter

Proper use The pump may only be used for the dosing of liquid media!

The pump may only be used in compliance with the technical data and specifications stated in the operating instructions!

All other uses or modifications are prohibited!

The pump must not be used to dose gaseous media or solids!

The pump may only be operated by specially trained and authorised personnel!

You are obliged to observe the information in the operating instructions on the various life phases of the system!

Notes on safety



WARNING

- **As soon as the pump has been connected to the mains, it may be that the device starts pumping!
Please take care that no hazardous dosing media can leak!
If you did not take any precautions, press the STOP/START key or immediately disconnect delta® from the mains!**
- **The pump cannot be de-energised!
Disconnect the mains cable from the mains in the event of an electrical accident!**
- **Disconnect the mains cable from the mains before commencing any work at the pump!**
- **Always relieve the pressure from the delivery unit first before commencing any work at the pump!**
- **Empty and rinse the liquid end before commencing any work at the pump if hazardous or unknown dosing media have been used!**
- **Pumps for radioactive media may not be shipped!**



CAUTION

- The assembly and installation of ProMinent® metering pumps using third-party components which are not verified and recommended by ProMinent are not permitted and may result in personal injury and damage to property for which ProMinent will not be liable!
- When dosing aggressive media, the resistance of the pump materials used is to be observed (see ProMinent® Chemical Resistance List in the equipment catalogue or visit www.prominent.com)!
- If a different liquid end size is installed, the pump must be entered as other pump type in the settings menu!
- Please observe the relevant local regulations for the installation!!

Sound pressure level The sound pressure level is < 70 B (A)
at maximum stroke, maximum stroke frequency, maximum backpressure (water) pursuant to:
DIN EN 12639 (noise measurement at liquid pumps)

3 Storage, transport, and unpacking



IMPORTANT

- The centre of gravity of the pump is positioned quite at the back!
When lifting, the pump may tilt to the back if this note is disregarded!
- Only transport and store the pump in its original packaging!
- Protect the packaged pump also against moisture and exposure to chemicals!

Environmental conditions for storage and transport:

Storage and transport temperature: -10 to +50°C
relative humidity: < 92 % relative humidity, non-condensing

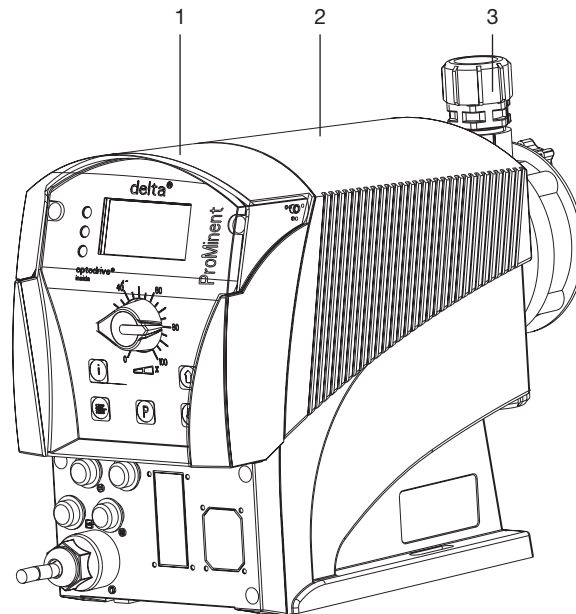
Please check the delivered unit for completeness:

- Scope of delivery*
- Metering pump with mains cable
 - Connecting kit for hose/pipe connection
 - Operating instructions including EC Conformity declaration
 - accessories, if any

4 Pump layout and controls

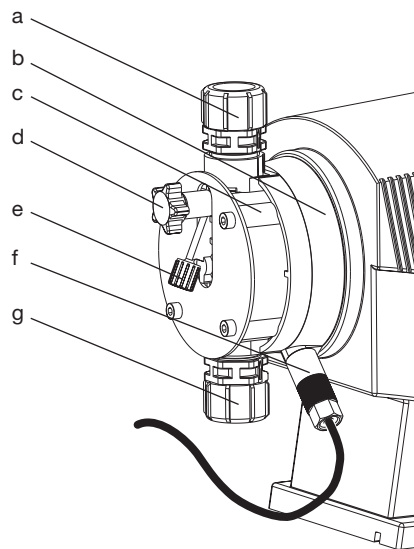
Please unfold the overview “Controls and key functions” on the folding page as supplement to this chapter.

4.1 Pump overview



- 1 Control unit
- 2 Drive unit
- 3 Delivery unit

Fig. 01



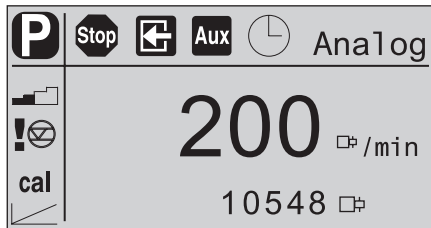
- a Pressure valve
- b End disc
- c Liquid end
- d Coarse-/fine ventilation valve
- e Bypass hose grommet
- f Diaphragm failure monitor
- g Suction valve

Fig. 02















4.2 Controls








Get familiar with the controls of delta® using the overview “Controls and key functions”!

Identifier The LCD display assists in the operation and adjustment of the pump with the following identifiers:



The identifiers have the following meanings:

	Suction:	The pump is presently taking in (both arrow keys pressed).
	Symbol for P key:	The pump is in the setting mode.
	Key symbol:	Locking (if a code was set. Flashes.).
	Double arrow symbol:	The value in the continuous display can be changed by pressing the arrow keys.
	Info icon:	Switching between the continuous displays is possible.
	Stop:	The pump was stopped with the STOP/START key (thus manually).
	Pause:	The pump was stopped using the pause contact.
	Aux:	The pump is presently pumping with the auxiliary frequency as stroke frequency. During this time, the pump is in the mode “Manual”.
	Error:	An error has occurred and the pump has stopped.
	Stroke length:	The pump is set to “Dosing” “slow” and this dosing mode is also active (below 61 strokes/min). Below 30 strokes/min, the operating indicator flashes in operation and is illuminated a bit longer at each completed stroke. The symbol refers to the symbol located below the stroke adjustment knob.
	Stroke length adjustment:	Deviation from the stroke length from the value at the time of last locking of the setting menu.
	Diaphragm failure:	The diaphragm is fractured. The message is sent as warning or fault, depending on the setting. The symbol shows the diaphragm in section.
	Airlock:	Air is in the delivery unit. The message is sent as warning or fault, depending on the setting. The symbol shows the delivery unit with enclosed air bubbles.
	Level:	The level “Warning” in the store tank was undershot. When the symbol flashes, the level “Error” in the store tank was undershot and the pump stops.

	or		Flow:	A flow monitor is connected. Together with the exclamation mark, the symbol signals problems with the flow.
			Contact:	The pump is in the mode "Contact". The symbol closes with each contact signal.
			Contact signal:	The pump is in the mode "Batch". The symbol flashes with each contact signal.
		p+	Excess pressure monitoring:	A narrowing or a closed shut-off valve on the pressure side results in an increase of the pressure exceeding the maximum permissible operating pressure. The message is sent as warning or fault, depending on the setting.
		p-	no pressure:	There is a leakage on the pressure side, a line has burst or is broken. The message is sent as warning or fault, depending on the setting.
		m	Memory:	The pump is in the mode "Contact" or "Batch": the additional function "Memory" was set.
	0..20	0...20 mA:		The pump is in the mode "Analog". The processing type "0...20" is set.
	4..20	4...20 mA:		The pump is in the mode "Analog". The processing type "4...20" is set.
			Straight:	The pump is in the mode "Analog". The processing type "Curve"- "Straight" is set.
			Upper sideband:	The pump is in the mode "Analog". The processing type "Curve"- "Upper sideband" is set.
			Bottom sideband:	The pump is in the mode "Analog". The processing type "Curve"- "Bottom sideband" is set.

NOTE

The pump shows the dosing quantity and the dosing output only in the calibrated state in l or l/h or in gal or gal/h.

5 Functional description

Functional principle

Dosing is made as following: The metering diaphragm is pressed to the liquid end; due to the pressure in the metering head, the suction valve closes and the dosing medium flows from the liquid end through the pressure valve. Now, the metering diaphragm is removed from the liquid end; due to the vacuum in the liquid end, the pressure valve closes and fresh dosing medium flows into the liquid end through the suction valve. One work cycle is completed.

The metering diaphragm is driven by a solenoid which is controlled by an electronic control.

Thanks to the optoDrive® drive technology, the time sequence of the dosing flow can be exactly matched to the requirements of the relevant application. Thus, the user can set a slow pressure stroke for almost continuous dosing or a quick stroke e.g. for quickly clocked filling as needed. In both operating modes it is possible to decelerate the suction stroke alternatively (Fig. 3). For dosing media of higher viscosity, the main reason for inaccurate dosing can thus be prevented, viz an incomplete filling of the liquid end. In case of outgassing dosing media, the slow suction stroke prevents cavitation and thus increases the dosing accuracy. Fluctuations of the back-pressure in the dosing line which might result in undesired variations of the dosing quantity are automatically compensated for by the drive. Thus, a dosing accuracy is obtained which otherwise could only be obtained by using complex control circuits.

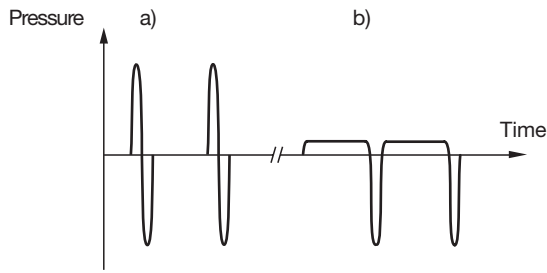


Fig. 3: Dosing modes: a) pulsating, b) almost continuous

The integrated injection control of the hydraulic metering parameters, optoGuard®, is integrated in the drive. It automatically detects blocked metering points or broken metering lines. Depending on the hydraulic installation situation, separate overflow valves and pressure sensors become superfluous and uncontrolled metering is prevented in case of broken lines. The guard also detects air or gasses (airlock) enclosed in the delivery unit. Thus, metering of incorrect quantities is prevented and the process safety is increased. The pertaining messages are shown on the pump's display. The plant operator can determine depending on the type of fault whether a message is to be sent to the process control system via the alarm relay and whether the metering is to be stopped automatically.

Dosing output The dosing output is determined by the stroke length, the stroke frequency as well as the stroke speed. The stroke length is adjusted in the range of 0 - 100% using the stroke length knob. The set dosing quantity is reproduced in a technically meaningful way only between 30 - 100%! The stroke frequency can be set in the range of 0 - 200 strokes using the arrow keys (not in the mode "Analog").

The continuous display "Stroke frequency (strokes / min)" includes decimal places if a stroke frequency is set in the continuous display "Stroke frequency" (strokes / min) which cannot be divided by 6 without remainder.

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

Operating modes The operating modes are selected in the menu "Mode".

Operating mode "Manual":

The stroke frequency is adjusted manually via the control unit.

Operating mode "Batch":

This operating mode offers the option to work with large transfer factors (up to 65535). The dosing can be activated by pressing the P key or by an impulse via the socket "external control" through a contact or a semiconductor switching element. A dosing quantity (batch) or a number of strokes can be preselected via the control unit.

Operating mode "Contact":

This operating mode offers the option to fine-tune with small reducing or transfer factors. The dosing can be activated by an impulse via the socket "external control" through a contact or a semiconductor switching element. With the option "Pulse Control", a dosing amount (batch) or a number of strokes (reducing or transfer factor 0.01 - 99.99) can be preselected via the control unit.

Operating mode "Analog":

The stroke frequency is controlled by an analogue current signal via the socket "external control". The processing of the current signal can be preselected via the control unit.

Functions The following functions can be selected in the menu "Set":

Function "Calibration":

The delta® can be operated in a calibrated state in all operating modes.

The corresponding continuous displays may then directly display the dosing quantity or the dosing output (in the secondary display). The calibration is maintained in the stroke frequency range between 0 - 200 strokes/min.

Function "Auxiliary frequency":

Facilitates the activation of a fixedly adjustable stroke frequency in the menu "Set" which can be activated via the socket "external control". This auxiliary frequency has priority over the stroke frequency settings of the operating modes.

Function “Flow”:

It stops the pump at very low flow in the dosing mode “pulsating”, if a dosing monitor is connected. The number of faulty strokes from which it is to be stopped can be set in the SET menu.

The following functions are available as standard:

Function “Level switch”:

Information about the fill level in the dosing tank is sent to the pump. For this purpose, a two-phase level switch must be installed; this switch is connected to the socket “Level switch”.

Function “Pause”:

The pump can be remotely stopped via the socket “external control”.
The function “Pause” has only an effect if operated via the socket “external control”.

The following functions are triggered by pressing a key:

Function “Stop”:

The pump can be stopped without being disconnected from the mains by pressing the STOP/START key.

Function “Prime”:

By simultaneously pressing both arrow keys, suctioning (short-time delivery at maximum frequency) can be activated.

Option relay The delta® has ports for two options.

Option “alarm relay”:

In the event of error messages, alarm messages or triggered level switch, a circuit can be closed (for alarm horn etc.) via the relay. The relay can be refitted through a recess in the control unit.

Option “alarm and clock generator relay”:

In addition to the alarm relay, a contact can be triggered with each stroke via the clock generator relay. The relay can be refitted through a recess in the control unit.

Function and fault indicator

The three LED indicators and the identifier “Error” of the LCD display show the status and error modes (see also chapter 11):

LCD display

An error is shown by the identifier “Error” and an additional, explaining symbol.

LED indicators

Operating indicator (green)

The operating indicator is illuminated if no fault or alarm messages are received during the operation of the pump. It briefly extinguishes during each stroke.

Below 30 strokes/min, the operating indicator flashes in operation and is illuminated a bit longer at each completed stroke.

Alarm indicator (yellow)

The alarm indicator is illuminated if the electronics of the pump detects a condition which may result in a fault, e.g. “Level shortage 1st stage”.

Fault indicator (red)

The fault indicator is illuminated if an error occurs, e.g. “Level shortage 2nd stage”.

Hierarchy of operating modes, functions, and faults

The various operating modes, functions, and faults have different influences on whether and how the pump is dosing. The following list shows the influence:

1. Prime
2. Error, stop, pause
3. Auxiliary frequency
4. Manual, analogue, contact, batch

re:

1. “Prime” can be made in any mode of the pump (as long as it is functioning).
2. “Error”, “Stop”, and “Pause” stop everything but “Suction”.
3. The stroke frequency of the “auxiliary frequency” has always priority over the stroke frequency which specified an operating mode listed in item 4.

6 Mounting and Installation

6.1 Hydraulic installation



IMPORTANT

Please observe the notes in the “General Operating Instructions ProMinent® Solenoid Metering Pumps”!

Install the diaphragm failure monitor

- ▶ If a diaphragm failure monitor already exists, remove the plastic cap with the hexagonal head from the end disc.
- ▶ screw in the diaphragm failure monitor fingertight and liquid-tight into the hole (do not use any tools).

6.2 Electrical installation



WARNING

- The installation may only be performed by a specialist!
- Disconnect the pump from the mains during the installation!
- Risk of electric shock – This pump is supplied with a grounding conductor and grounding-type attachment plug. To reduce the risk of electric shock, be certain that it is connected only to a properly grounding-type receptacle.
- Please observe the relevant local regulations when installing the metering pump!
- When paralleling with inductive consumers, an own switching contact, e.g. a relay or contactor, must be installed!



IMPORTANT

The universal control cable, the external/contract cable and the level monitor cable must not be cut below a length of 1.20m! Otherwise, the cable detection for the cable will fail!

Mains connection The pump is to be connected to the mains using the mains cable.

Paralleling to inductive consumers

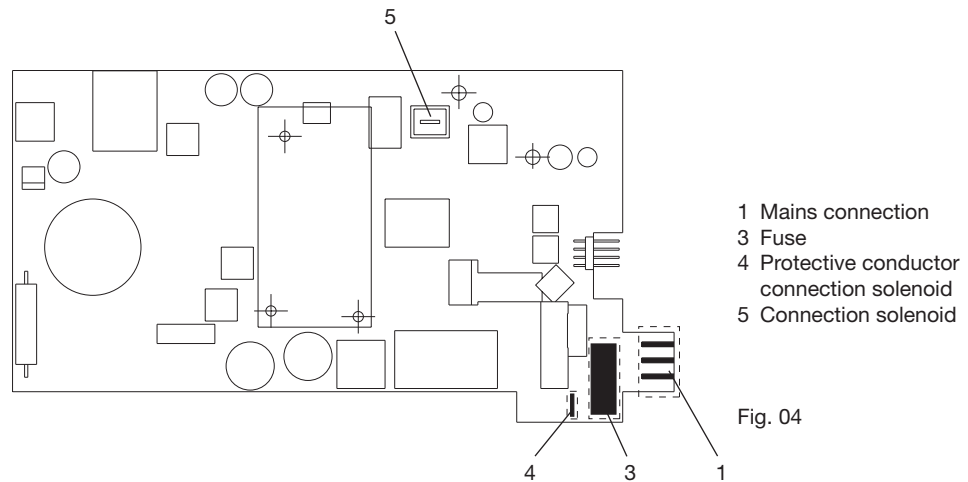
If the pump is connected to the mains in parallel to inductive consumers (e.g. solenoid valve, motor), it must be electrically separated from these consumers. Thus, damages by inducted voltage peaks are avoided when switching off.

- ▶ Install own contacts for the pump and supply with voltage through auxiliary contactor or relay.

If this is not possible, then:

- ▶ Connect in parallel a varistor (order no. 710912) or a RC element 0.22 μ F/220 Ω (order no. 710802).

Power module
(in pump base)



Socket “External control” The socket “External control” is a five-pole mounting socket. It is compatible with the hitherto used two- and four-pole cables. The function “Auxiliary frequency” can only be used with a five-pole cable.

Assignments at the pump Electrical interface for “External Contact” - “Pause” - “Auxiliary frequency”:

- Voltage at open contacts: approx. 5 V
- Input resistance: 10 kΩ
- Control: potential-free contact (load: 0.5 mA at 5 V),
or: semiconductor switch (residual voltage < 0.7 V)
- maximum impulse frequency: 25 impulses/s
- required impulse duration: > 20 ms

Electrical interface for “External Analog”:

- Input load resistance (load): approx. 120 Ω
- Maximum current at input: 50 mA

Assignments at the pump

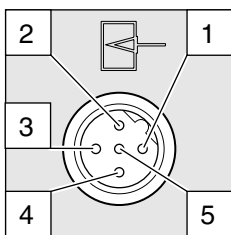


Fig. 05

Pin	Function	2-wire cable	5-wire cable
Pin 1	Pause	jumpered at Pin 4	brown
Pin 2	External Contact	brown	white
Pin 3	External Analog	–	blue
Pin 4	Ground	white	black
Pin 5	Auxiliary frequency	–	grey

Assignments at the plug **Function “Pause”:**

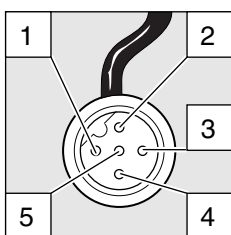


Fig. 06

The pump does not function if

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

The pump runs if

- the cable is connected and Pin 1 and Pin 4 are connected.
- no cable is connected (and Pin 1 is free).

Operating modes “Contact” and “Batch”

One or several dosing strokes are performed if Pin 2 and Pin 4 are connected for at least 20 ms. In addition, Pin 1 and Pin 4 must be connected.

Operating mode “Analog”

The stroke frequency of the pump can be controlled via a current signal. The current signal is applied between Pin 3 and Pin 4.

In addition, Pin 1 and Pin 4 must be connected.

Function “Auxiliary frequency”

The pump runs with a preset stroke frequency, if Pin 5 and Pin 4 are connected.

In addition, Pin 1 and Pin 4 must be connected.

This function is factory-programmed to 200 strokes.

NOTE

For a hierarchy of the functions and operating modes see chapter 5!

Serial connection of two delta®

Connect in series two delta® as follows if you want to control through a current signal in the operating mode “Analog” (see paragraph 7.4.4):

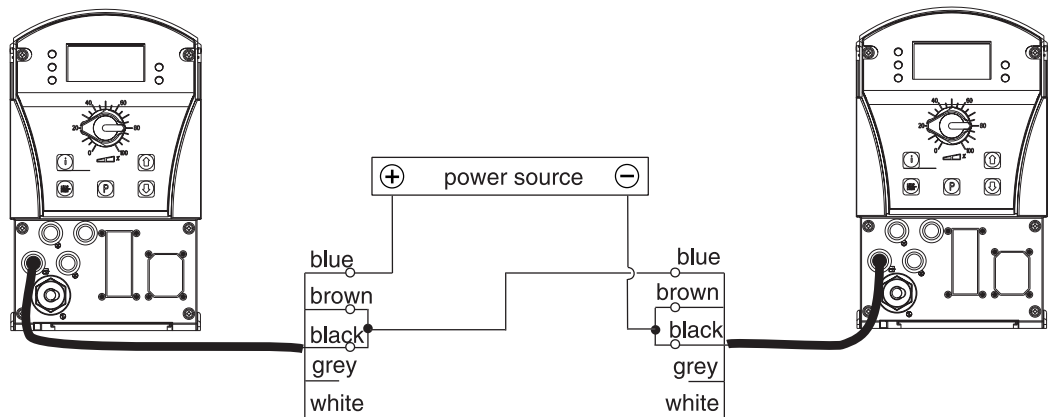


Fig. 07

Socket “Level switch” A 2-phase level switch with pre-alarm and switch-off at limit can be connected.

Assignments at the pump Electrical interface:

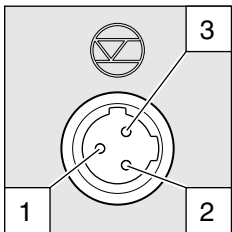


Fig. 08

- Voltage at open contacts: approx. +5 V
- Input resistance: 10 kΩ
- Control: potential-free contact (load: 0.5 mA at +5 V)
or: semiconductor switch (residual voltage < 0.7 V)

Assignments at the plug

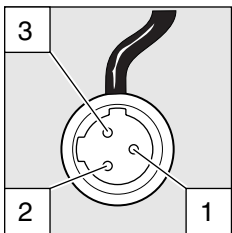
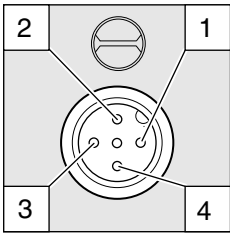


Fig. 09

	Function	3-wire cable
Pin 1	Ground	black
Pin 2	minimum pre-alarm	blue
Pin 3	minimum switch-off.	brown

Socket
 "Dosing monitor" A dosing monitor can be connected.

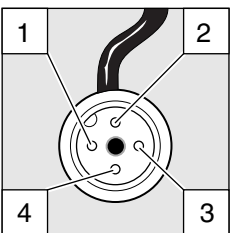
Assignments at the pump Electrical interface:



- Voltage at open contacts: approx. +5 V
- Input resistance: 10 kΩ
- Control: potential-free contact (load: 0.5 mA at +5 V)

Fig. 10

Assignments at the plug

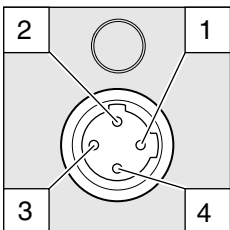


	Function	4-wire cable
Pin 1	Voltage supply (5 V)	brown
Pin 2	Coding	white
Pin 3	Feedback	blue
Pin 4	Ground	black

Fig. 11

Socket
 "Diaphragm failure sensor" A diaphragm failure sensor can be connected.

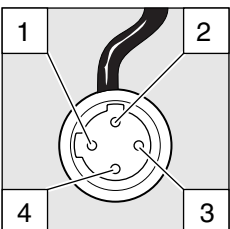
Assignments at the pump Electrical interface:



- Voltage at open contacts: approx. +5 V
- Input resistance: 10 kΩ
- Control: potential-free contact (load: 0.5 mA at +5 V)

Fig. 12

Assignments at the plug



	Function	4-wire cable
Pin 1	Voltage supply (5 V)	brown
Pin 2	Coding	white
Pin 3	Feedback	blue
Pin 4	Ground	black

Fig. 13

Relay

Output "Alarm relay" (Identcode 1 and 3 or 6 and 7)

An alarm relay can be ordered as an option. It is used to send a signal in case of error messages of the pump and for the alarm message "Level shortage 1st stage" and the error message "Level shortage 2nd stage".

A cut-off relay is used to switch off in case of alarm messages of the pump and the error message "Level shortage 2nd stage".

The assignment of the messages to the relay states "dropping out" or "picking up" can be selected via the Identcode.

This behaviour is factory-programmed. If another switching function is required, the delta® can be reprogrammed in the RELAY menu (Chap. 7.5.6).

The relay can be refitted and is operative after insertion of the relay board (see "General Operating Instructions ProMinent® Solenoid Metering Pumps").

- Electrical interface*
- Contact load: 230 V/8 A 50/60 Hz
 - Life cycle: > 200,000 switching cycles

Output "other relay" (Identcode 4 + 5, 8 + 9, A+B)

An alarm and a clock generator output can be ordered as an option. The clock generator output is electrically isolated to a semiconductor switch through an optocoupler. The second switch is a relay.

This behaviour is factory-programmed. If another switching function is required, the delta® can be reprogrammed in the RELAY menu (Chap. 7.5.6).

The alarm/clock generator relay can be refitted (see "General Operating Instructions ProMinent® Solenoid metering Pumps").

- | Electrical interface | for relay output | for semiconductor switch |
|----------------------|---|---|
| | <ul style="list-style-type: none">• Contact load: 24 V/100 mA 50/60 Hz• Mechan. life: > 20 million switching cycles | <ul style="list-style-type: none">• Residual voltage: RDSon < 8 Ohm, I off max. = 1 µA• Maximum current: < 100 mA• Max. voltage: 24 V/DC• Clock generator impulse duration: approx. 100 ms |

Output "Power output plus relay"

As an option, a relay combined with a power output can be ordered. The relay switches either as alarm relay in case of error messages of the pump and for the alarm message "Level shortage 1st stage" and the error message "Level shortage 2nd stage".

The power output can signal one of the following variables to another device:

This behaviour is factory-programmed. If another switching function is required for the relay, the delta® can be reprogrammed in the RELAY menu (Chap. 7.5.6.5).

For the power output, the variable to be signalled can be selected in the ANALOGUE OUTPUT menu (Chap. 7.5.5).

The power output plus relay can be refitted and is operative after insertion of the board (see "General Operating Instructions ProMinent® Solenoid Metering Pumps").

- | Electrical interface | for power output | for relay output |
|----------------------|---|--|
| | <p>Off-load voltage: 8 V</p> <p>Current range: 0 / 4 ... 20 mA</p> <p>max. ripple: 80 µA ss</p> <p>max. load: 250 Ohm</p> | <ul style="list-style-type: none">• RDSon < 8 Ohm, I off max. = 1 µA• Maximum current: < 100mA• Max. voltage: 24 VDC• Clock generator impulse duration: approx. 100ms |

Contact assignment at relay cable

*Option "alarm relay"
(Identcode 1 and 2
or 6 and 7)*

VDE cable	CSA cable	Contact
white	white	NO (normally open)
green	red	NC (normally closed)
brown	black	C (common)

*other relays
(Identcode 4 + 5,
8 + 9, A + B)*

VDE cable	Contact	Relay
yellow	NO (normally open)	Alarm relay
green	C (common)	Alarm relay
white	NO (normally open)	clock generator relay
brown	C (common)	clock generator relay

*Option "Power output
plus relay"*

VDE cable	Contact	Output
yellow	Current +	Power output
green	Current -	Power output
white	NO (normally open) or NC (normally closed)	Relay
brown	C (common)	Relay


7 Settings

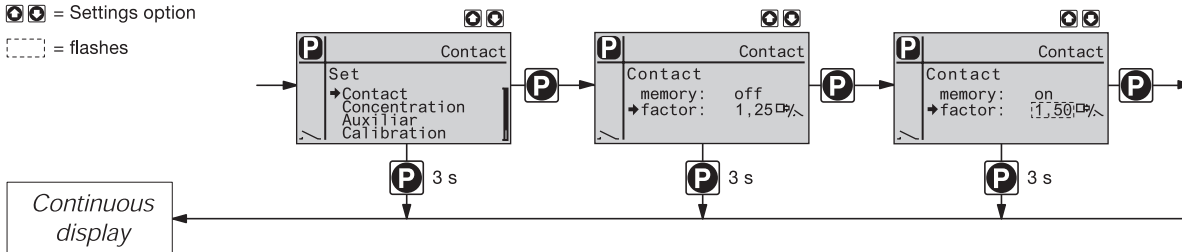
NOTE

- **Unfold the folding page behind the cover page for assistance! There, you will find the overviews for “Controls and key functions” and “Operating/setting diagram”.**
- **The pump will return to a continuous display if no key is pressed for 1 min.**

General information on the settings for delta®

 = Settings option

 = flashes



Confirm entry Briefly press the P key;
at the same time you will go to the next selection, the next menu option or to a continuous display.

Exit menu option without confirmation Press the UP key in the upper selection if no entry has been started (flashing bars);
You will return to the previous menu option or the previous menu – up to the main menu at the most.

Return to a continuous display Press the P key for 3 s;
the entry is cancelled and you will return to a continuous display.

Change adjustable variables Press the arrow keys UP or DOWN;
the figure between the flashing bars is counted up or down.

Confirm adjustable variables At “Changing of a figure”: press the P key 1x;
at the same time you will go to the next selection, the next menu option or to a continuous display.

7.1 Verification of adjustable variables

Before making any pump settings, the present settings of the adjustable variables can be checked:

Press the i key (“i” for “info”) when the pump shows a continuous display (the LCD display does not show the symbol for the P key).

After each activation of the i key, a different continuous display is shown; a double arrow is displayed on the top left. The number of continuous displays depends on the Identcode, the selected operating mode, and the connected additional devices (see overview “Continuous displays”).

The bottom line of the info displays (secondary displays) shows various information which, however, cannot be modified here.

The bottom line of the info display is accessed through a continuous display by pressing the i key when no double arrow is displayed on the top left. Keep the i key pressed until a small arrow appears and goes into the bottom line of the LCD display. Having reached the bottom line, release the i key briefly, then press the i key briefly to browse the info displays of the bottom line.

7.2 Accessing the setting mode

Press the P key for 2 seconds in any continuous display, and the pump goes to the setting mode.

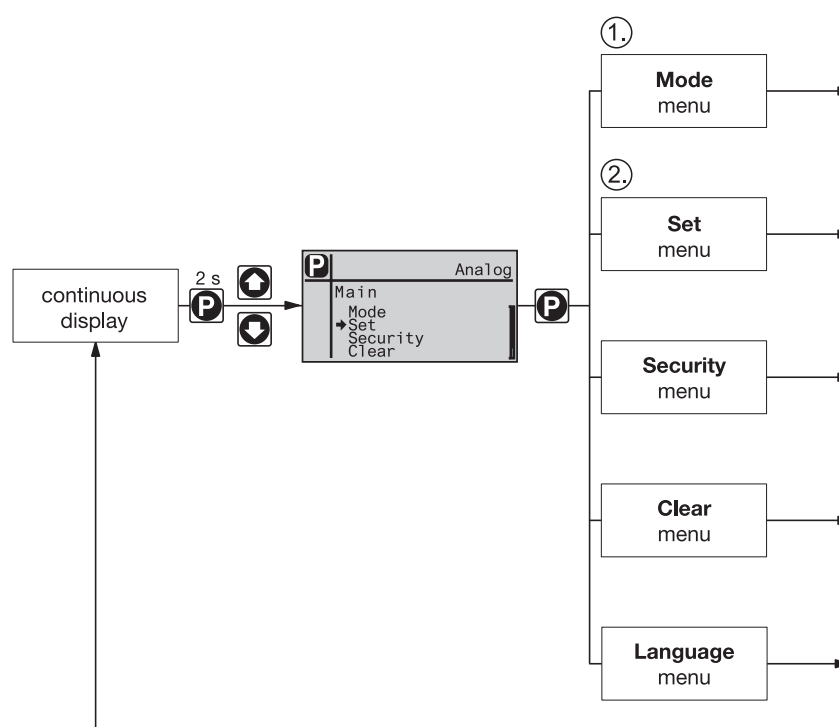
If in "Security" "Lock menu" or "Lock all" was set (key symbol top left), the access code has to be entered first after pressing the P key (arrow keys).

The following menus can be selected at first in the setting menu (see also overview "Operating/setting diagram"):

- Menu "Mode":
- Menu "Set":
- Menu "Security" (option)
- Menu "Clear"
- Menu "Language"

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

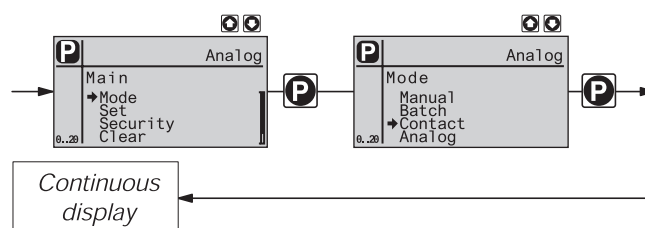
1. Select the operating mode in the menu "Mode".
2. Make the settings for this operating mode in the menu "Set".



7.3 Selection of the operating modes (menu "Mode")

The following operating modes can be selected in the menu "Mode" (some operating mode may be missing depending on the Identcode):

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



7.4 Settings for the operating mode (menu "Set")

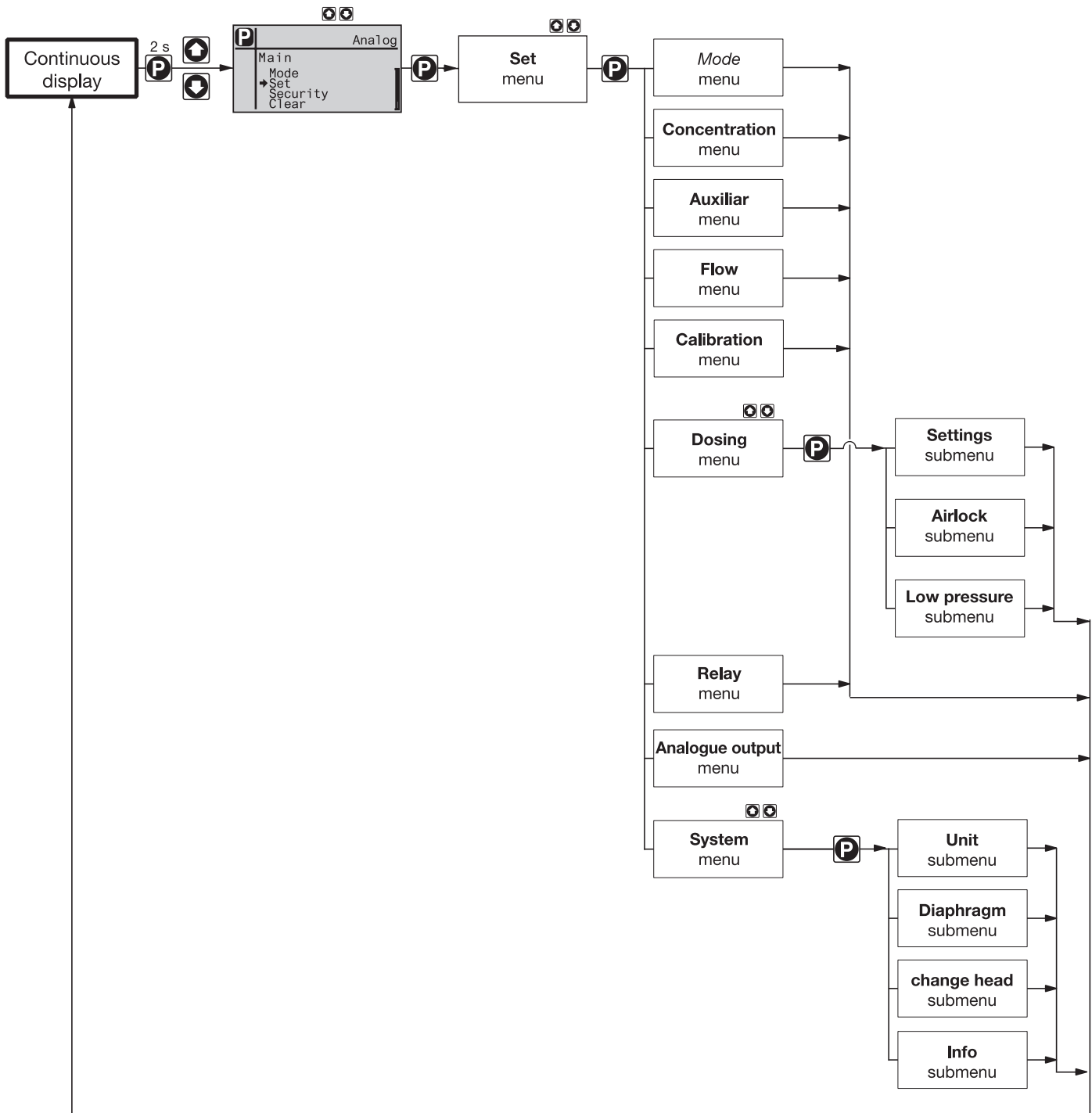
Depending on the selected operating mode, various settings can be made in the menu "Set".

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

- Concentration
- Auxiliary frequency
- Calibration
- Dosing
- System

See also Chapter 7.5!

Whether a further settings menu is available depends on the selected operating mode and the connected devices or modules.

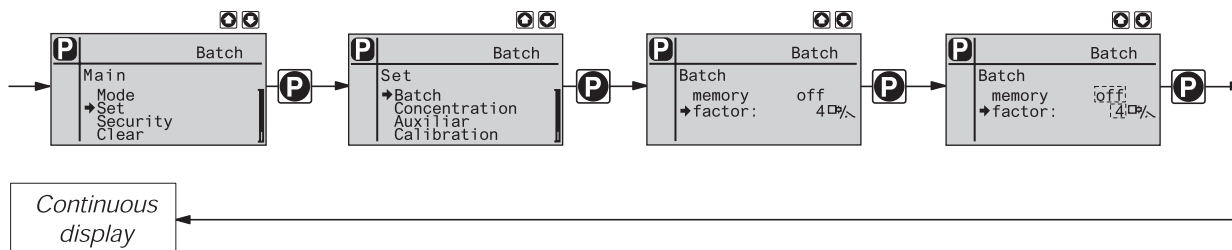


7.4.1 Settings for the operating mode “Manual”

Apart from the setting menus described in detail in Chapter 7.5, no further setting menus are available in the operating mode “Manual” in the menu “Set”.

7.4.2 Settings for the operating mode “Batch” (BATCH menu)

Apart from the setting menus described in detail in Chapter 7.5, the BATCH menu is available in addition in the operating mode “Batch” in the menu “Set”.



The operating mode “Batch” is a variant of the operating mode “Contact” (see first Chapter 7.4.3). Here, a stroke number can be preselected, too (no fractions, only integers between 1 and 65535). The operating mode “Batch” is designed for large dosing quantities.

The dosing can be activated by pressing the P key or by an impulse via the socket “external control”.

The number of the received impulses which could not yet be processed is stored by delta® in the stroke memory.



IMPORTANT

- When switching from the operating mode “Manual” to the operating mode “Batch”, the pump maintains the stroke frequency!
- The stroke frequency can also be adjusted in the operating mode “Batch”. It should be typically set to 200 strokes/min.

Function extension “Memory”

The function extension “Memory” (identifier “m”) can be activated in addition. With activated “Memory”, the delta® adds remaining strokes which could not be processed.

7.4.3 Settings for the operating mode “Contact”

Apart from the setting menus described in detail in Chapter 7.5, the menu “Contact” is additionally available in the operating mode “Contact” in the menu “Set”.

The operating mode “Contact” facilitates the triggering of individual strokes or a series of strokes.

The strokes can be triggered by an impulse via the socket “external control”.

This operating mode is designed to implement the received impulses into strokes with a reduction (fractions) or a small transfer.



IMPORTANT

- When switching from the operating mode “Manual” to the operating mode “Contact”, the pump maintains the stroke frequency!
- The stroke frequency can also be adjusted in the operating mode “Contact”. It should be typically set to 200 strokes/min.

The following types exist:

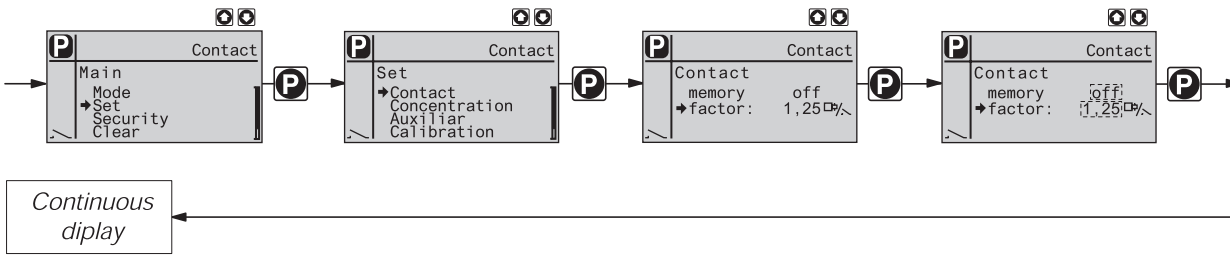
- Contact - Identcode: External contact 1:1 with pulse control
- Contact - Identcode: External contact with pulse control

Contact - Identcode: External contact 1:1 with pulse control

For the type “Contact - Identcode: external contact 1:1 with pulse control, the pump performs exactly one stroke with each impulse (Identcode: external contact 1:1 with pulse control). No entry can be made.

Contact - Identcode: external contact with pulse control

For the type “Contact - Identcode: external contact with pulse control”, the number of impulses a stroke is to follow can be entered. “Contact - Identcode: external contact with pulse control” was designed for small dosing quantities.



The number of strokes per impulse depends on the factor that can be entered. Thus, incoming impulses can be multiplied by a factor from 1.01 to 99.00 or reduced by a factor from 0.01 to 0.99: “Number of performed strokes = factor x number of received impulses”.

Traditional pumps can only perform complete strokes. If no complete strokes result in the operating mode “Contact”, these are added in a memory until a complete stroke is given and then this stroke is performed (see e.g. pump gamma/L).

Thanks to its controlled solenoid, the delta® pump can also perform incomplete strokes.

Example: Setting: factor F = 0.5 and stroke length H = 80%.
 Then, one single impulse from the contact requires a stroke with a stroke length of $f \times H$
 $= 0.5 \times 0.80 = 0.40$ (Δ 40 %)
 The delta® thus performs half a stroke with a stroke length of 40% for one single impulse!

Stroke length above 30% If a stroke length above 30% is set, the delta® does not perform any strokes with a calculated stroke length below 15% because of the accuracy. If strokes with a stroke length below 15% result, the pump adds these in a memory – even without “Memory” – until a stroke with a stroke length above 15% is given and then performs this stroke.

Example: Setting: factor F = 0.1 and stroke length H = 100 %.
 Then, one single impulse from the contact would require a stroke with a stroke length of $f \times H$
 $= 0.1 \times 1.00 = 0.10$ (Δ 10 %)
 The calculated stroke length would be 10%, the delta® thus skips this stroke and waits for the next impulse. The delta® then performs a stroke with a stroke length of 20 % for a total of two impulses!

Calculated stroke length	Impulses (sequence)	Number of strokes (proportioning)
10 %	2 (1 / 1)	1 (- / 20 %)

From this, a further strategy for a processing of the contact signals follows:

If the product of factor f and stroke length H for one single impulse results in a number of complete strokes and in addition in an incomplete stroke below 15% which cannot be performed, the delta® then performs the number of complete strokes, with the exception of the last complete stroke. This stroke and the incomplete stroke which cannot be performed is divided into two equal incomplete strokes which can be performed.

Example: Setting: factor $F = 4.1$ and stroke length $H = 100\%$.
Then, one single impulse from the contact would require the following strokes with a total stroke length of $= f \times H$
 $= 4.1 \times 1.00 = 4.10 (\hat{=} 410\%)$

This results in 4 complete strokes (here with a stroke length of 100%) and 1 incomplete stroke of 10%.

Instead, the delta® performs 3 complete strokes (with a stroke length of 100%) and 2 incomplete strokes with a stroke length of 55% for one single impulse: 100 %, 100 %, 100 %, 55 %, 55 %!

Calculated stroke length	Impulses (sequence)	Number of strokes (proportioning)
410 %	1 (1)	5 (100 % / 100 % / 100 % / 55 % / 55 %)

The number of the received impulses which could not yet be processed is stored by delta® in the memory for strokes. When the STOP/START key is pressed or the function “Pause” is activated, the memory for the strokes is cleared.

For the type “Contact - Identcode: external contact with pulse control”, the pump, e.g. in connection with contact water gauges, can be optimally adapted to the relevant process.

Function extension “Memory”

The function extension “Memory” (identifier “m”) can be activated in addition. With activated “Memory”, the delta® adds remaining strokes which could not be processed.

7.4.4 Settings for the operating mode “Analog”

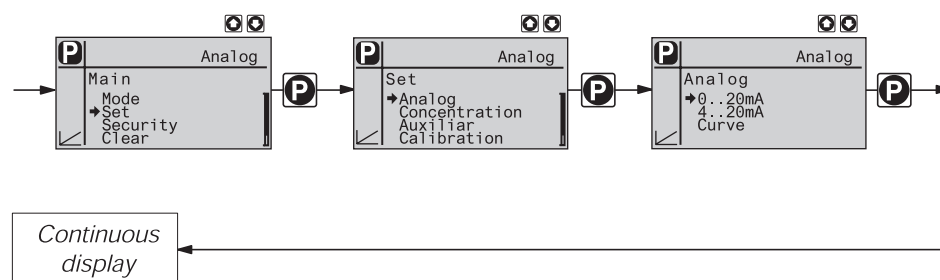
Apart from the setting menus described in detail in Chapter 7.5, the ANALOG menu is in addition available in the operating mode “Analog” in the menu “Set”.

The stroke frequency is controlled by an analogue current signal via the socket “external control”.

The continuous display “Signal current” of the 2nd level shows the incoming current.

Three processing types for the current signal can be selected:

- 0 - 20 mA: at 0 mA, the pump is idle -
at 20 mA, the pump operates at maximum stroke frequency.
Between these values, the stroke frequency is proportional to the current signal.



- 4 - 20 mA: at 4 mA, the pump is idle -
at 20 mA, the pump operates at maximum stroke frequency.
Between these values, the stroke frequency is proportional to the current signal.

For current signals below 3.8 mA, an error message is displayed and the pump stops (e.g. in case of cable break).

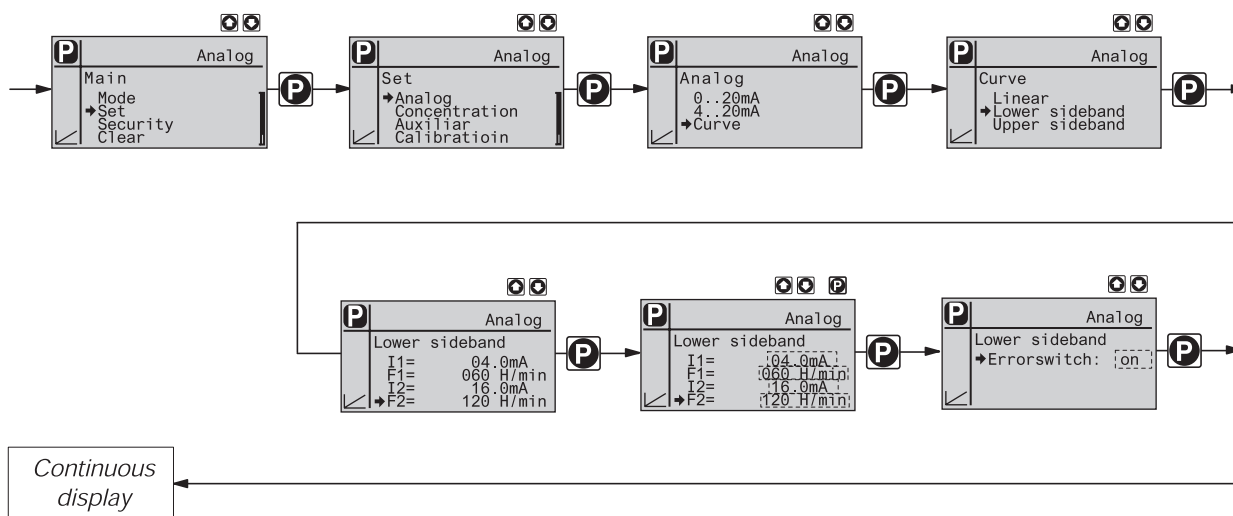
NOTE

The maximum stroke frequency can only be reduced in the processing mode “Curve”, not in the processing modes “0 .. 20” and “4 .. 20”.

- Curve: In the processing mode “Curve”, the behaviour of the pump can be freely programmed.

There exist three options:

- Straight
- Bottom sideband
- Upper sideband



Straight:

The LCD display shows the symbol “Straight”. Any stroke frequency behaviour of the pump proportional to the current signal can be entered. For this purpose, enter any two points P1 (I1, F1) and P2 (I2, F2) (F1 is the stroke frequency at which the pump is to operate at current I1); thus, a straight line and thus the behaviour is specified.

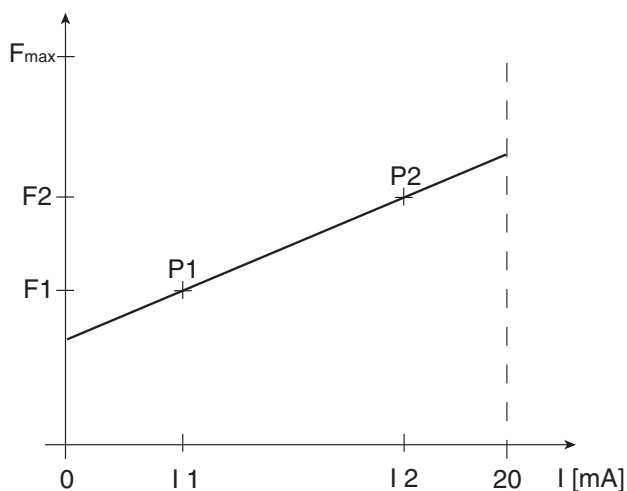


Fig. 14

NOTE

Draw a diagram similar to the one above - with values for (I1, F1) and (I2, F2) - to set the pump as desired!

Bottom/upper sideband:

With these processing modes, a metering pump can be controlled via the current signal as shown in the diagrams below.

However, two metering pumps for different dosing media can also be controlled via a current signal (e.g. an acid pump and an alkali pump via the signal of a pH sensor). The pumps must be electrically connected in series (see wiring diagram in Chapter 6.2).

Bottom sideband

e.g. alkali pump

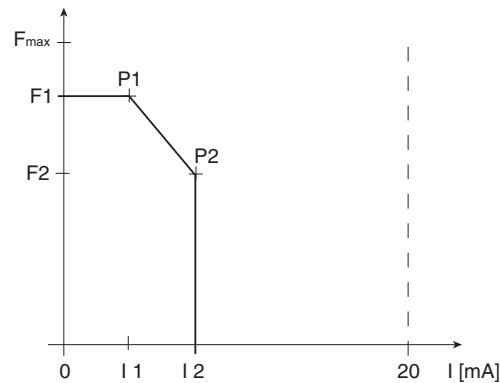


Fig. 15

Upper sideband

e.g. acid pump

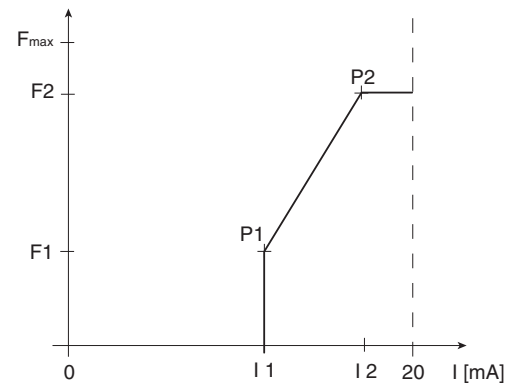


Fig. 16

Bottom sideband:

The LCD display shows the symbol “Bottom sideband“. Below I1, the pump operates with F1 - above I2, the pump stops. Between I1 and I2, the stroke frequency between F1 and F2 is proportional to the signal current.

Upper sideband:

The LCD display shows the symbol “Upper sideband“. Below I1, the pump stops - above I2, the pump operates with F2. Between I1 and I2, the stroke frequency between F1 and F2 is proportional to the signal current.

The smallest processable difference between I1 and I2 is 4 mA.

Error processing An error processing can be activated for the processing mode “Curve” in the menu option “alarm signalling” (error). For current signals below 3.8 mA, an error message is displayed and the pump stops.

7.5 Settings for programmable functions (menu “Set”)

In the SET Menu, setting menus are available in all operating modes for the following programmable functions:

- Concentration (CONCENTRATION menu)
- Auxiliary frequency (AUX menu)
- Flow (FLOW menu) (only available if metering monitor connected)
- Calibration (CALIBRATION menu)
- Metering (DOSING menu)
- Relay (RELAY menu) (only available if relay connected)

and the menu

- System (SYSTEM menu)

7.5.1 Settings for the function “Concentration” (CONCENTRATION menu)

When pumping with concentration input, the desired concentration of the metering medium, which is desired later in the solving medium (e.g. the main flow), can be directly entered in the continuous display “mass concentration”.

- Entering of concentration:*
1. Select the mode
 2. In the SET menu, enter the data of the metering medium and the solving medium
 3. Enter the desired concentration in the continuous display “concentration”

NOTE

- The continuous display “concentration” will only be available if:
 - the pump is calibrated
 - the CONCENTRATION menu has been gone through in the mode used
 - and “concentration” was set to “on” (in the mode used).
- The continuous display “concentration” switches to the display mode “%” in case of concentrations exceeding 999.9ppm.
- When switching between the modes, the pump saves the settings for each mode.
- If the pump is to display the concentration as volume concentration, “1.00” kg/l is to be entered for the mass density of the metering medium.

7.5.1.1 Operating mode MANUAL

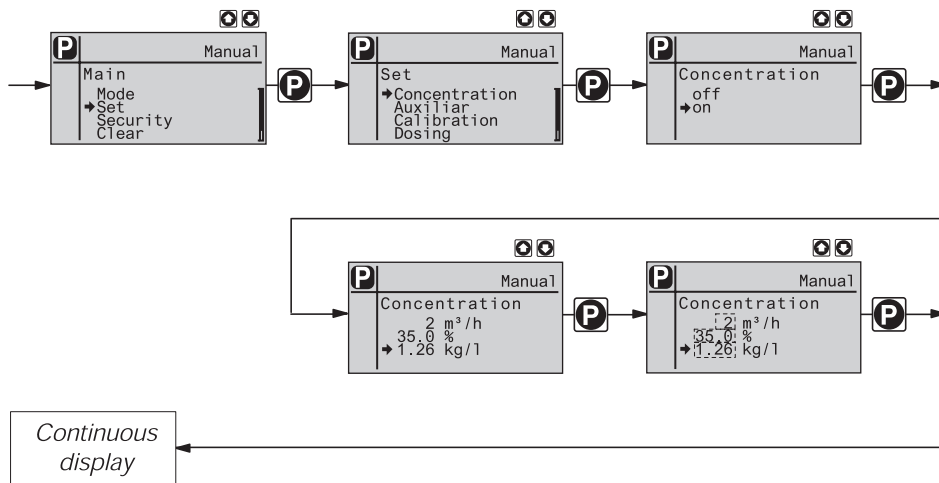


Fig. 17: Section of the SET menu

The “concentration input” in the mode MANUAL is meant to meter a substance into a piping with a continuously flowing medium such that the substance is present there with a given mass concentration.



IMPORTANT

Risk of excessive concentrations!
System-technical precautions must be taken to prevent that the metering pump does not meter when the flow drops or stops!

Prerequisites Prerequisites are that:

- the flowing medium has the mass density of water ($1 \text{ kg/L} \hat{=} \text{g/cm}^3$)
- the mass concentration of the metering medium is known (see safety data sheet of the metering medium, e.g. for 35 % sulphuric acid: 35 %)
- the mass density of the metering medium is known (see safety data sheet of the metering medium, e.g. for 35 % sulphuric acid: $1.26 \text{ kg/L} \hat{=} \text{g/cm}^3$)

The unit for the liquid volume must be set in the submenu “Unit” in the menu “System” (see Chap. 7.5.6.1)



IMPORTANT

The accuracy of the concentration heavily depends on the accuracy of the calibration of the metering pump and the accuracy of the data entered for the flow!

- ▶ Calibrate the metering pump if not already calibrated (see Chap. 7.5.4).
- ▶ Select the mode MANUAL (any existing settings from other modes remain stored)
- ▶ Select the CONCENTRATION menu in the SET menu
- ▶ Set “on” in the first menu option for working with the concentration display and then press the P key
- ▶ Set the flow and press the P key
- ▶ Set the mass concentration for the metering medium and press the P key
- ▶ Set the density of the metering medium – after pressing the P key, a continuous display appears
- ▶ Press the i key in the continuous display to switch to the concentration (ppm or %)
- ▶ Use the arrow keys to enter the desired concentration.

**IMPORTANT**

- Observe the decimal point!
- The value of the mass concentration is influenced both by changing the stroke frequency and the stroke length!

NOTE

The value in the continuous display cannot be changed arbitrarily at the last figures using the arrow keys but only in increments which result from the initial data.

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

Tab. 1: Possible values for adjustable parameters

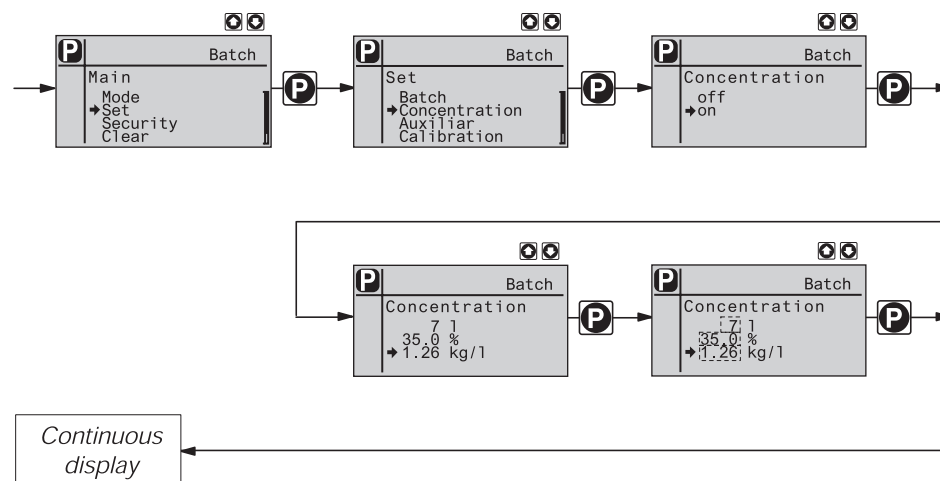
7.5.1.2 Operating mode BATCH

Fig. 18: Section of the SET menu

The “concentration input” in the mode BATCH is meant to meter a substance into a medium in a tank such that the substance is present there with a given mass concentration (preparation of a solution. Remember to mix!).

Prerequisites Prerequisites are that:

- the medium in the tank has the mass density of water (1kg/L)
- the mass concentration of the metering medium is known (see safety data sheet of the metering medium, e.g. for 35 % sulphuric acid: 35 %)
- the mass density of the metering medium is known (see safety data sheet of the metering medium, e.g. for 35 % sulphuric acid: 1.26 kg/L $\hat{=}$ g/cm³)

The unit for the liquid volume must be set in the submenu "Unit" in the menu "System" (see Chap. 7.5.6.1)



IMPORTANT

The accuracy of the concentration heavily depends on the accuracy of the calibration of the metering pump and the accuracy of the entered volume of the medium!

- ▶ Calibrate the metering pump if not already calibrated (see Chap. 7.5.4).
- ▶ Select the mode BATCH (any existing settings from other modes remain stored)
- ▶ Select the CONCENTRATION menu in the SET menu
- ▶ Set "on" in the first menu option for working with the concentration display and then press the P key
- ▶ Set the volume of the medium in the tank and press the P key
- ▶ Set the mass concentration for the metering medium and press the P key
- ▶ Set the density of the metering medium – after pressing the P key, a continuous display appears
- ▶ Press the i key in the continuous display to switch to the "Concentration" (ppm or %)
- ▶ Use the arrow keys to enter the desired mass concentration.



IMPORTANT

- **Observe the decimal point!**
- **The value of the mass concentration is influenced both by changing the stroke frequency and the stroke length!**

NOTE

The value in the continuous display cannot be changed arbitrarily at the last figures using the arrow keys but only in increments which result from the initial data.

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

Tab. 2: Possible values for adjustable parameters

7.5.1.3 Operating mode CONTACT

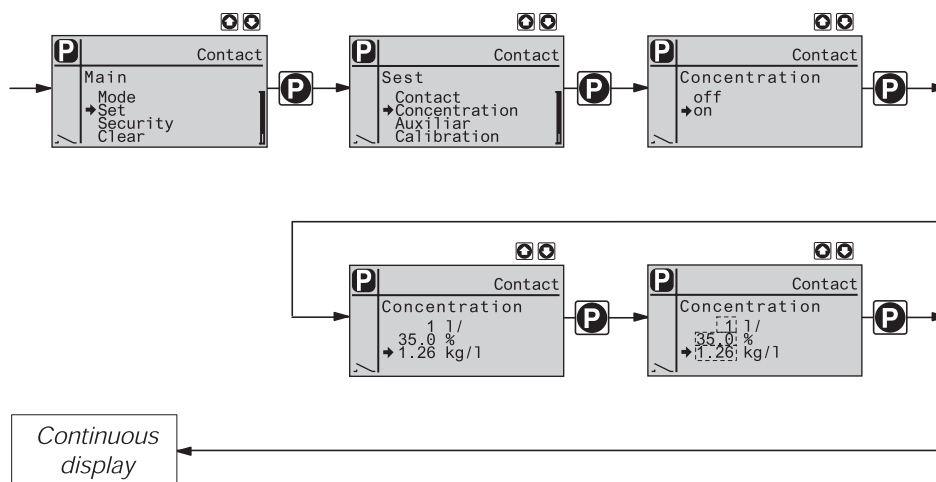


Fig. 19: Section of the SET menu

The “concentration input” in the mode CONTACT is meant to meter a substance into a piping with a variably flowing medium such that the substance is present there with a given mass concentration.



IMPORTANT

Risk of excessive concentrations!

System-technical precautions must be taken to prevent that the metering pump does not meter when the flow drops or stops!

Prerequisites Prerequisites are that:

- the flowing medium has the mass density of water (1kg/L)
- the mass concentration of the metering medium is known (see safety data sheet of the metering medium, e.g. for 35 % sulphuric acid: 35 %)
- the mass density of the metering medium is known (see safety data sheet of the metering medium, e.g. for 35 % sulphuric acid: 1.26 kg/L $\hat{=}$ g/cm³)
- a contact water meter has been installed hydraulically and has been connected to the external input of the metering pump.

The unit for the liquid volume must be set in the submenu “Unit” in the menu “System” (see Chap. 7.5.6.1)



IMPORTANT

The accuracy of the concentration heavily depends on the accuracy of the calibration of the metering pump and the accuracy of the data entered for the flow!

- ▶ Calibrate the metering pump if not already calibrated (see Chap. 7.5.4).
- ▶ Select the mode CONTACT (any existing settings from other modes remain stored)
- ▶ Select the CONCENTRATION menu in the SET menu
- ▶ Set “on” in the first menu option for working with the concentration display and then press the P key
- ▶ Set the contact distance and press the P key
- ▶ Set the mass concentration for the metering medium and press the P key
- ▶ Set the density of the metering medium – after pressing the P key, a continuous display appears
- ▶ Press the i key in the continuous display to switch to “Concentration” (ppm or %)
- ▶ Use the arrow keys to enter the desired mass concentration.



IMPORTANT

- Observe the decimal point!
- The value of the mass concentration is influenced both by changing the stroke frequency and the stroke length!

NOTE

The value in the continuous display cannot be changed arbitrarily at the last figures using the arrow keys but only in increments which result from the initial data.

Adjustable value	Lower value	Upper value	Increment
Contact distance in l/contact	0.1	100	0.1
Mass concentration in %	0.1	100	0.1
Mass density in kg/l	0.5	2.0	0.1

Tab. 3: Possible values for adjustable parameters

7.5.1.4 Operating mode ANALOG

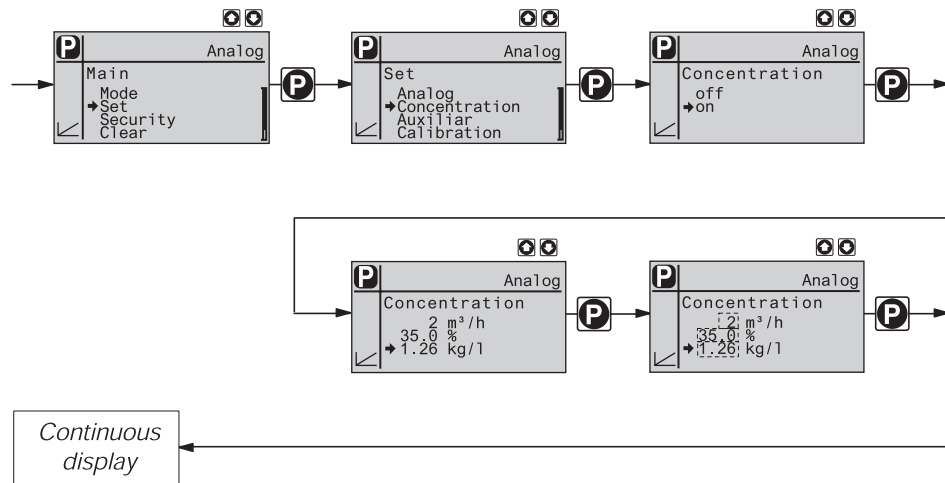


Fig. 20: Section of the SET menu

The “concentration input” in the mode ANALOG is meant to meter a substance into a piping with a variably flowing medium such that the substance is present there with a given mass concentration.



IMPORTANT

- Risk of excessive concentrations!
System-technical precautions must be taken to prevent that the metering pump does not meter when the flow drops or stops!
- Verify after the setting whether the concentrations at different flows correspond to the desired result!

Prerequisites Prerequisites are that:

- the flowing medium has the mass density of water (1kg/L)
- the mass concentration of the metering medium is known (see safety data sheet of the metering medium, e.g. for 35 % sulphuric acid: 35 %)
- the mass density of the metering medium is known (see safety data sheet of the metering medium, e.g. for 35 % sulphuric acid: 1.26 kg/L $\hat{=}$ g/cm³)
- a flow meter with analogue output has been installed hydraulically and has been connected to the external input of the metering pump.

The unit for the liquid volume must be set in the submenu “Unit” in the menu “System” (see Chap. 7.5.6.1)

Preparatory settings:

- ▶ Select the mode ANALOG (any existing settings from other modes remain stored)
- ▶ Set the type of processing for the current signal to “Curve” in the option ANALOG in the SET menu (see Chap. 7.4.4).
- ▶ Set the behaviour of the pump to “Straight”.
- ▶ Set $I_1 = 0\text{mA}$ and for $F_1 = 0$ strokes/min because the straight line has to pass through zero (0/0) (see Fig. 21).
- ▶ Set $I_2 = 20\text{mA}$ and $F_2 = 200$ strokes/min.
- ▶ Set “Error message” to “on” or “off” as desired.

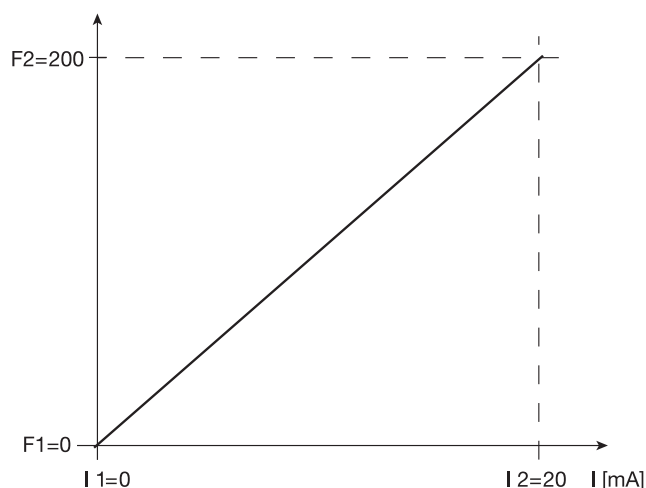


Fig. 21: How the straight line for “Concentration input” in the mode “Analog” has to look like



IMPORTANT

The accuracy of the concentration heavily depends on the accuracy of the calibration of the metering pump and the accuracy of the data entered for the flow!

- ▶ Calibrate the metering pump if not already calibrated (see Chap. 7.5.4).
- ▶ Select the CONCENTRATION menu in the SET menu
- ▶ Set “on” in the first menu option for working with the concentration display and then press the P key
- ▶ Set the maximum flow and press the P key
- ▶ Set the mass concentration for the metering medium and press the P key
- ▶ Set the density of the metering medium – after pressing the P key, a continuous display appears (ppm or %)
- ▶ Press the i key to switch to the continuous display for “Concentration”
- ▶ Use the arrow keys to enter the desired mass concentration.



IMPORTANT

- Observe the decimal point!
- The value of the mass concentration is influenced both by changing the stroke frequency and the stroke length!
- The adjustable value of the mass concentration limits the pump to a maximum because otherwise the increments for setting would be unacceptably high. If needed, change the stroke length (do not set below 30%)!

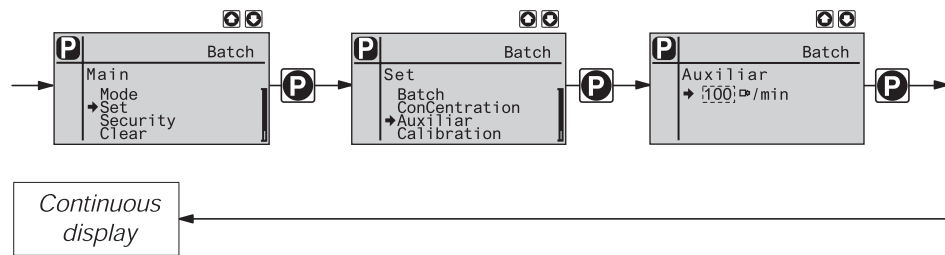
NOTE

The value in the continuous display cannot be changed arbitrarily at the last figures using the arrow keys but only in increments which result from the initial data. If needed, change the stroke length and re-adjust the concentration (the pump compensates through the stroke frequency).

Adjustable value	Lower value	Upper value	Increment
max. flow in m ³ /h	0.1	100	0.1
Mass concentration in %	0.1	100	0.1
Mass density in kg/l	0.5	2.0	0.1

Tab. 4: Possible values for adjustable parameters

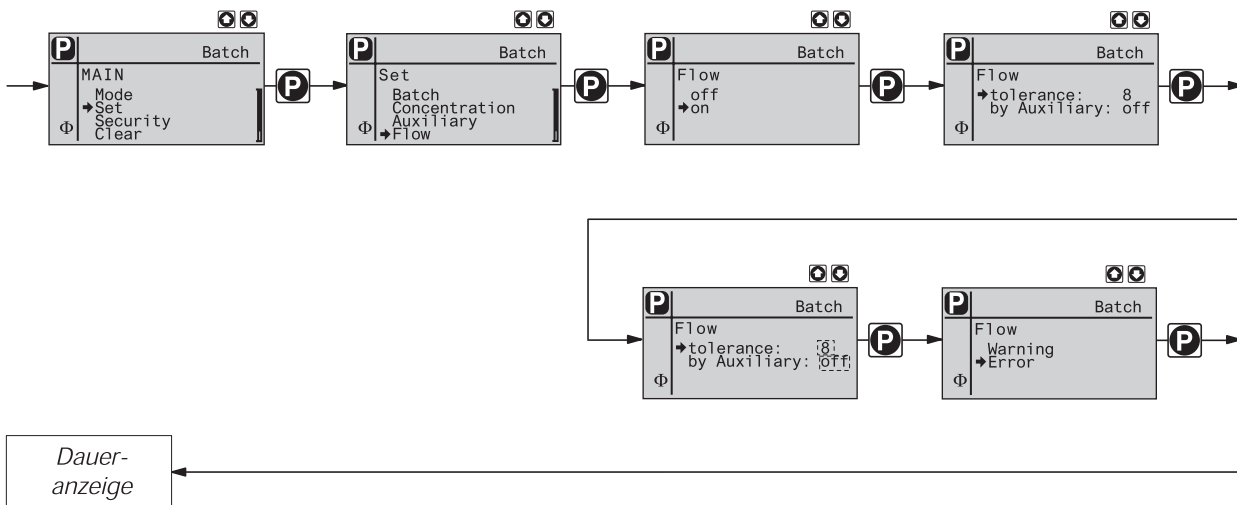
7.5.2 Settings for the function “Auxiliary frequency” (AUX menu)



The programmable function “Auxiliary frequency” facilitates the activation of an additional stroke frequency which can be fixedly set in the AUX menu. It can be activated via the socket “external control”. The identifier “AUX” is displayed in the LCD display if the auxiliary frequency is applied.

This auxiliary frequency has priority over the stroke frequency which is determined by the presently selected operating mode (see also Chap. 5 “Hierarchy of the Operating Modes”).

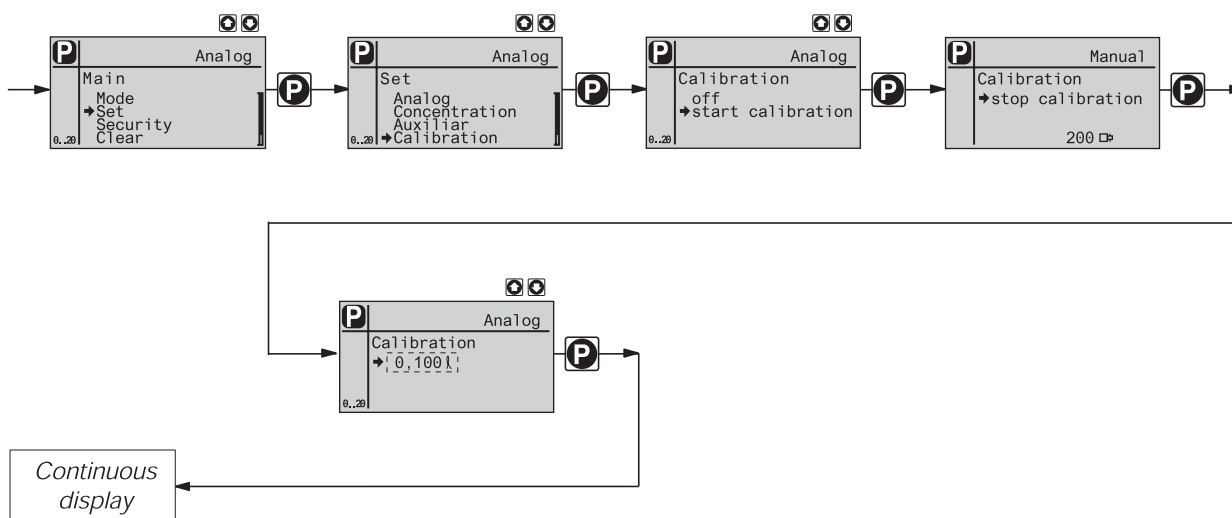
7.5.3 Settings for the function “Flow” (FLOW menu)



The FLOW menu is only displayed if a dosing monitor has been connected to the socket “Dosing monitor“. The dosing monitor registers the individual pressure strokes of the delta® at the pressure port given pulsed dosing (“Dosing” “Quick”, DOSING menu) and reports them back to the delta®. If this feedback is missing consecutively as often as set in the FLOW menu in “Tolerance” (because of failure or insufficient dosing), this function stops the delta®. In the last menu option it can be selected whether this case is to result in an error or a warning.

The function “Flow” can only be deactivated for the operating mode “AUX” (auxiliary frequency).

7.5.4 Settings for the function “Calibration” (CALIBRATION menu)



The pump can also be operated in a calibrated state. The corresponding continuous displays then directly display the dosing quantity or the dosing output.

NOTE

- **Do not fall below 30 % stroke length!**
Otherwise, the calibration will be extremely inaccurate.
- **The calibration gets the more accurate the more strokes the pump performs during calibration (recommendation: at least 200 strokes).**



WARNING

If the dosing medium is a hazardous medium, the corresponding safety measures are to be taken during performance of the following settings instructions!

- Calibration**
- ▶ Insert the suction hose into a measuring cylinder with the dosing medium – the pressure hose must be connected finally (operating pressure, ...!)
 - ▶ take in the dosing medium (press both arrow keys simultaneously) if the suction hose is empty
 - ▶ note the filling height of the measuring cylinder
 - ▶ browse the continuous displays with the i key and check whether litres or gallons have been selected
 - ▶ if the wrong volume unit has been selected, select the SYSTEM menu and then the submenu UNIT
 - ▶ select the correct unit with the arrow keys and confirm by pressing the P key
 - ▶ select the CALIBRATION menu and access the first menu option by pressing the P key
 - ▶ select “Start Calibration” with the DOWN key
 - ▶ press the P key to start the calibration: the next menu option “Stop Calibration” is displayed, the pump begins to pump and shows the stroke number (the pump operates at the stroke frequency set in “MANUAL”)

- ▶ stop the pump after a reasonable number of strokes (e.g. 200) by pressing the P key
- ▶ determine the delivered dosing quantity (difference initial quantity - residual quantity)
- ▶ enter this quantity in the displayed menu option and then press the P key – the pump goes to the continuous display

The pump is calibrated.
The relevant continuous displays show the calibrated values.

7.5.5 Settings for the function “Dosing” (DOSING menu)

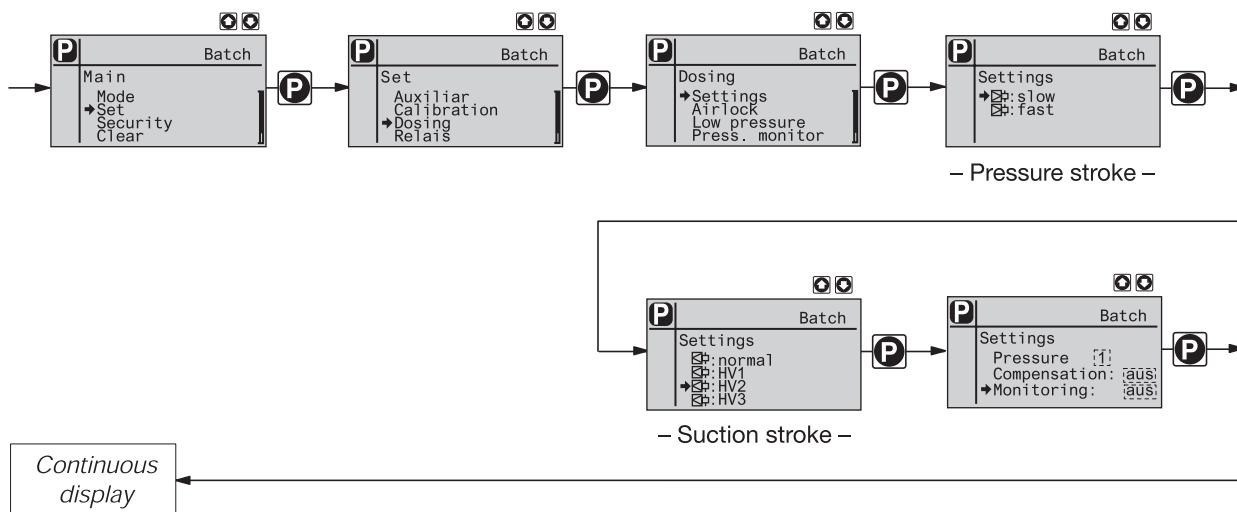
The menu “Dosing” branches into the following submenus:

1. Settings (metering)
2. Airlock
3. Low pressure

The last menu option of “Settings” offers the following functions:

- Pressure (stages)
- Compensation

7.5.5.1 Settings in the submenu “Settings” (dosing)



In the submenu “Settings” (metering), the time sequence of the metering flow of delta® can be exactly matched to the requirements of the relevant application.

Thus, the user can set a slow **pressure stroke** (“Dosing” “fast”) for pulsed dosing, e.g. for quickly clocked filling (Fig. 22a) or a slow pressure stroke (“Dosing”, “slow”) for quasi-continuous dosing, e.g. for processes requiring a good mixing (Fig. 22b) as needed.

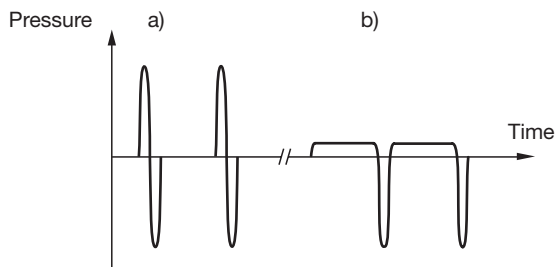


Fig. 22: a) pulsed dosing (fast pressure stroke - “Dosing” “fast”),
b) quasi-continuous dosing (slow pressure stroke - “Dosing” “slow”)

NOTE

Set a stroke length as large as possible to achieve a high accuracy during quasi-continuous dosing!

In both dosing modes it is possible to alternatively decelerate the **suction stroke**. In case of outgassing dosing media, the slow suction stroke prevents cavitation and thus increases the dosing accuracy (Fig. 23 b) and c). For dosing media of higher viscosity, the main reason for inaccurate dosing can thus be prevented, viz an incomplete filling of the delivery unit.

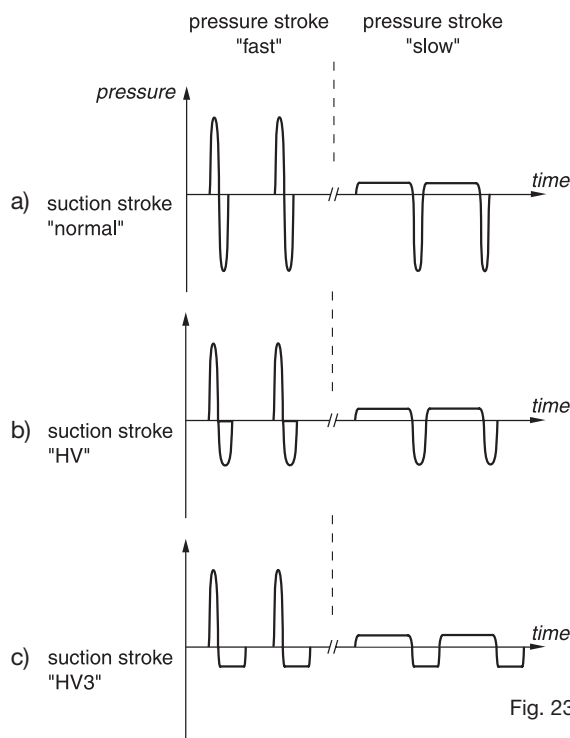


Fig. 23: pulsed and quasi-continuous operation with
a) standard suction stroke,
b) slightly delayed suction stroke,
c) maximum delayed suction stroke

Viscosity in mPa	Setting "Dosing"	Deceleration suction stroke	Max. stroke frequency	Remark
0...50	„normal“	none	200	
50...200	„HV1“	slight	160	
200...500	„HV2“	medium	120	for valves with spring
500...1000	„HV3“	maximum	80	for valves with spring

Tab. 5: Setting to decelerate the suction stroke depending on the viscosity of the dosing medium

The last menu option offers the following functions:

- Pressure (stages)
- Compensation

Pressure stages The nominal pressure of the pump can be reduced using the programmable function "Pressure stages".

Together with the pressure stage, the threshold of the permanently active excess pressure monitoring drops (responds at approx. 30 % excess of the nominal pressure, also pressure stage).



CAUTION

- If a different delivery unit size is installed, the pump must be switched to the corresponding type (see Chap. 7.5.6.4)!
- Select the nominal pressure as high as required and as low as possible! You will thus increase the safety of your system (reduced risk that lines will burst in case of obstruction)!

The following nominal pressure can be selected for these delivery unit sizes through the pressure stages:

Pressure stage/ delivery unit size	1	2	3	4
1612	4 bar	7 bar	10 bar	16 bar
1020	4 bar	7 bar	10 bar	-
0730	4 bar	7 bar	-	-

For the pump types 0450 and 0280, no setting is possible.

Compensation With the programmable function “Compensation”, you may minimise the effect of backpressure fluctuations and thus achieve a high metering accuracy.

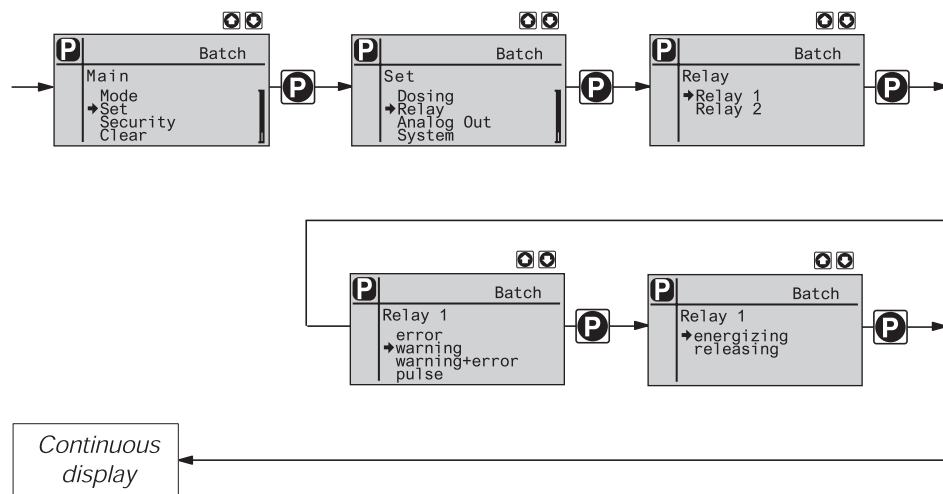
7.5.5.2 Settings in the submenu “Airlock”

If a message appears, this may mean that air is locked in the delivery unit (if a different option than “Never” was set in the submenu “Airlock”). Then, either no intake took place or gas bubbles are present in the delivery unit. These might have been taken in or created by outgassing or cavitation.

7.5.5.3 Settings in the submenu “Low pressure”

If a message appears, the delta[®] determined because of missing backpressure that leakage possibly occurred on the pressure side, a line burst or broke (if a different option than “Never” was set in the submenu “Low pressure”).

7.5.6 Settings for the function “Relay” (RELAY menu)



With the programmable function “Relay”, you can adapt the relays of the delta[®] to your requirements.

The relay can be reprogrammed to almost any setting using the function “Relay”. Exception: The two 8 A alarm relays (1 and 2 in the Identcode) and the 8 A cut-off relays (6 and 7 in the Identcode) can only be reprogrammed from “picking up” to “dropping out” and vice versa.

Identcode feature		“Relay 1” (Relay with mechanical contacts)	“Relay 2” (Semiconductor relay)
4 + 5	Alarm relay and clock generator relay	Alarm relay	Clock generator relay
8 + 9	Cut-off relay and clock generator relay	Cut-off relay	Clock generator relay
A + B	Cut-off relay and warning relay	Alarm relay	Warning relay

Tab. 6: Allocations of relay combinations

You can determine whether the relevant relay is to be switched in response to a triggering event of the timer, in case of an alarm message, an error message or a stroke of the pump:

Settings in the RELAY menu	Effect
Alarm	The relay switches at an alarm message (yellow LED*).
Fault	The relay switches at an error message (red LED*).
Alarm+fault	The relay switches at an alarm message (yellow LED*) or an error message (red LED*).
Clock generator	The relay switches with every stroke.

Tab. 7: Selectable types of behaviour:

* see Chap. 11 “Troubleshooting”

You can also determine how the relevant relay is to behave when switched by the delta®. This can be influenced by you by setting PICKING UP / DROPPING OUT.

NOTE

The setting options for the function “Relay” are only given if a relay exists.

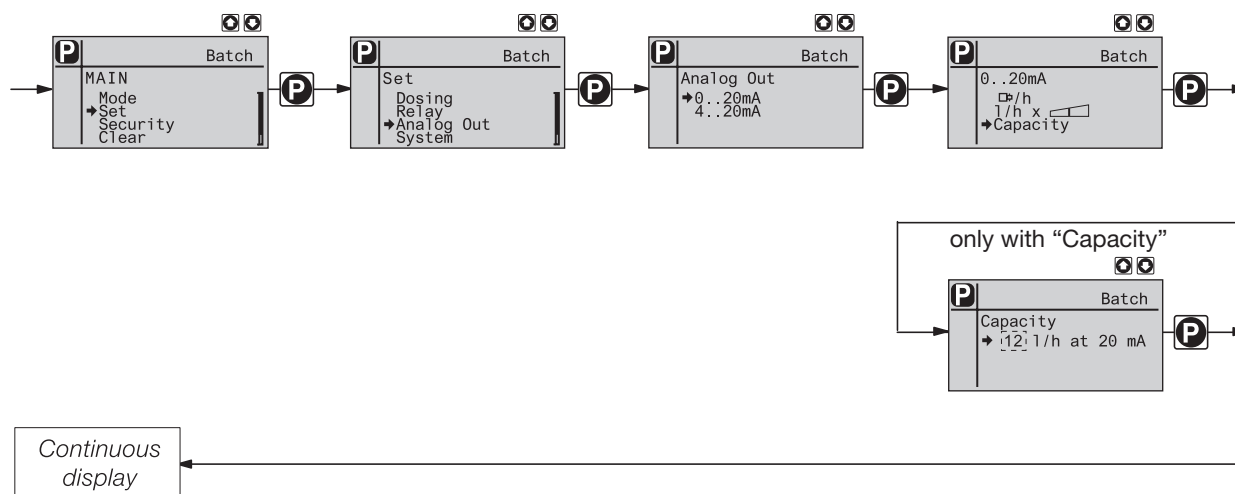
The following table summarised the behaviour of the available relay types according to Identcode as delivered:

Relay type	Behaviour
Warning relay	switches at an alarm message (yellow LED*).
Alarm relay	switches at an alarm message (yellow LED*) or an error message (red LED*).
Cut-off relay	switches at an error message (red LED*).
Clock generator relay	switches with every stroke of the pump.

Tab. 8: Behaviour of the relay types according to Identcode

* see Chap. 11 “Troubleshooting”

7.5.7 Settings for the function “Analogue output” (ANALOGUE OUTPUT menu)



With the programmable function “Analogue output”, you can adapt the signal of the power output of the delta® to your requirements.

The signal I of the power output signals one of the three following variables:

- Strokes / h
- Litres / h x stroke length (= present, mathematical metering output)
- Output (=metering output, value adjustable at 20mA)

In the status “Stop” (because of fault or operation) or “Pause”, the power output delivers a current of 4mA (0mA).

The delta[®] calculates the signal for the present mathematical metering output “Litre / h*” based on the following formula (for the range 4-20mA):

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

I = output current in mA

f = stroke frequency in strokes/ min

L = stroke length in %

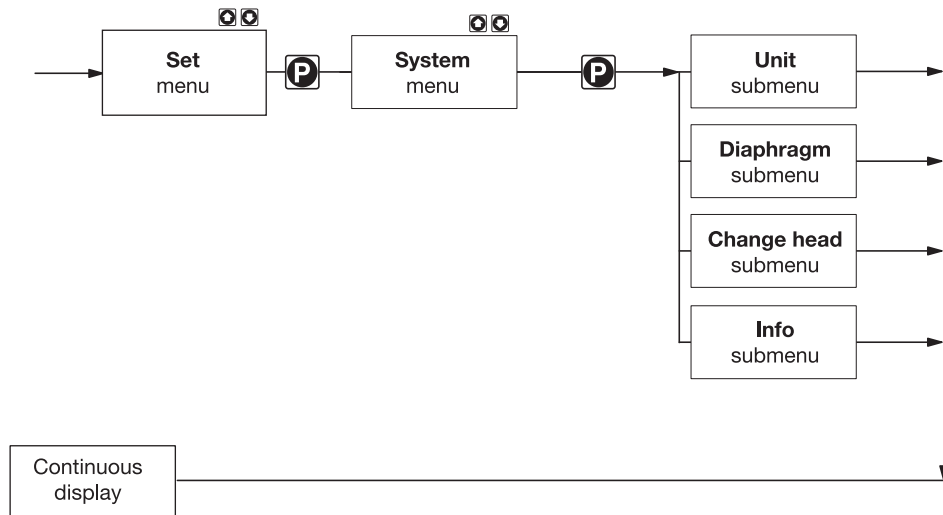
f_{max} = maximum frequency in strokes/ min

In the operating modes “Contact” and “Batch”, f is the stroke frequency which was set in the continuous display “Stroke frequency”.

7.5.8 Setting in the menu “System” (SYSTEM menu)

The menu “System“ branches into the following submenus:

- Unit
- Diaphragm
- Info
- Change head?



7.5.8.1 Settings in the submenu “Unit”

In the submenu “Unit”, either litres or gallons (US) can be selected as unit of measure for the delta[®].

7.5.8.2 Settings in the submenu “Diaphragm”

In the submenu “Diaphragm”, you may choose whether the delta[®] is to send an alarm message or an error message in case of diaphragm failure.

7.5.8.3 Submenu “Info”

In the submenu “Info”, the following identification numbers can be read:

- Identcode ID
- Serial number SN
- Software control SW
- Hardware control HW
- Software drive AS
- Hardware drive AH

7.5.8.4 Submenu “Change head?”

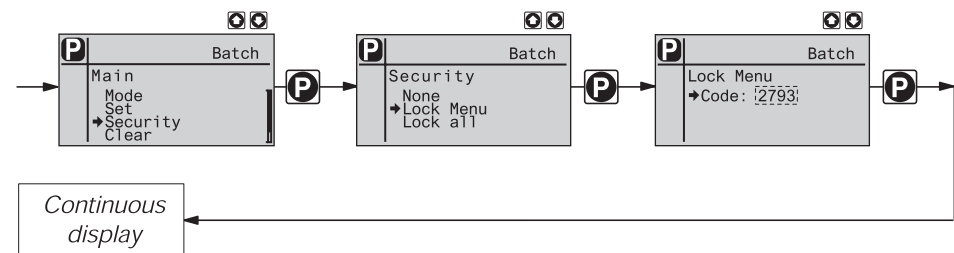


IMPORTANT

- If a different delivery unit size is installed, the pump must be re-programmed in the submenu “Change head?”!
- For demonstration purposes or when operating the pump without any metering medium, reprogramme to “Without liquid end”!

7.6 Setting of code (SECURITY menu)

In the SECURITY menu, it can be entered whether parts of the setting options are to be locked.



In the first menu option either “Lock menu” or “Lock all” or “none” can be set (both locks use the same number).

- Select “Lock menu” to lock the setting mode (item “1” in the overview “Operating/setting diagram”, folding page). In the next menu option, enter the number to be used as code.
- Select “Lock all” to lock the possibility to change directly adjustable variables in the continuous displays (item “2” in the overview “Operating/setting diagram”, folding page), in addition to the setting mode. In the next menu option, enter the number to be used as code.
- select “none” to cancel the set lock.

If a lock is set, the continuous display shows a padlock.

If you try to access a locked area, the LCD display shows a key and a flashing padlock. Enter the code using the arrow keys to bypass the lock.

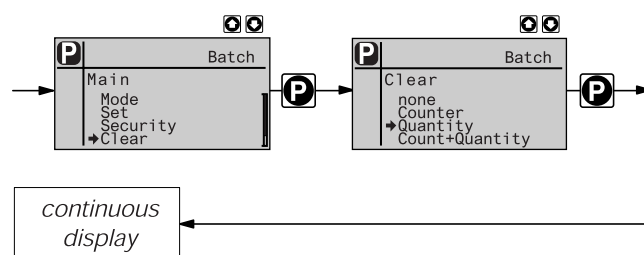
If the stroke adjustment knob was turned, the new stroke length will not be accepted, the padlock flashes and a key is displayed. When entering a code, the lock is cancelled and the delta® accepts an adjustment of the stroke length.

7.7 Clear total number of strokes or total number of litres (CLEAR menu)

In the CLEAR menu, either the stored total number of strokes or the total number of litres or both can be cleared (= reset to "0"). For this purpose, briefly press the P key to exit the menu.

- none
- counter (total number of strokes)
- quantity (total number of litres)
- count+quantity (both)

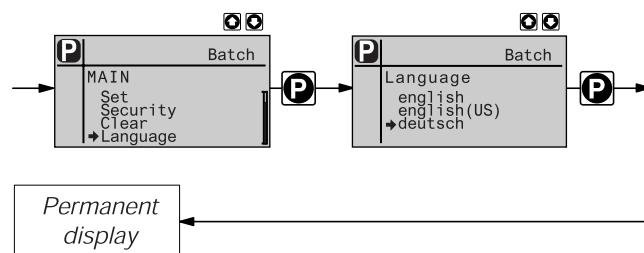
The values were counted up from commissioning of the pump or the last clearing.



7.8 Setting of language (LANGUAGE menu)

The desired operating language can be selected in the LANGUAGE menu.

When selecting "english(US)", the decimal comma in the display changes to a decimal point.



8 Operation

In this chapter all operating options available to you are described, provided the delta® is in a continuous display (the LCD display does not show the symbol for the P key).

NOTE

- **Unfold the folding page behind the cover page for assistance! There, you will find the overviews for “Controls and key functions” and “Operating/setting diagram”.**
- **Please also note the overview “Continuous displays”. It shows which continuous displays are available in which operating mode and which variables can be directly changed from the relevant continuous display.**

8.1 Manual operation

Adjust stroke length The stroke length can be continuously adjusted in the range of 0 - 100 % using the stroke length adjustment knob. The recommended stroke length range in which the set dosing quantity can be reproduced in a technically meaningful way, amounts to 30 - 100 %.

The following operating options are available using the keys (see 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 the operating mode “Batch”: briefly press the P key.

Accessing the setting mode Press the P key for 2 seconds in any continuous display, and the delta® goes to the setting mode (see Chapter 7).
If in “Security” an access code was set for “Lock menu”, the access code has to be entered first after pressing the P key.

Check adjustable variables After each pressing of the i key, a different continuous display appears. The number of continuous displays depends on the Identcode, the selected operating mode, and the connected additional devices.

Change directly adjustable variables In order to change a variable (see below) directly in the relevant continuous display, press one of the arrow keys until the identifier “double arrow” is displayed and the variable is flanked by two flashing lines. The delay was programmed to prevent an accidental modification of the variables.
If a code was set in “Security” for “Lock all”, the code has first to be entered after pressing one of the arrow keys.

The directly adjustable variables are in detail:

Stroke frequency In the operating modes “Manual”, “Contact” and “Batch”:
The stroke frequency can be changed in the continuous display “Stroke frequency”.

Dosing output In the operating mode “Manual”:
The dosing output can be changed in the continuous display “Dosing output”.

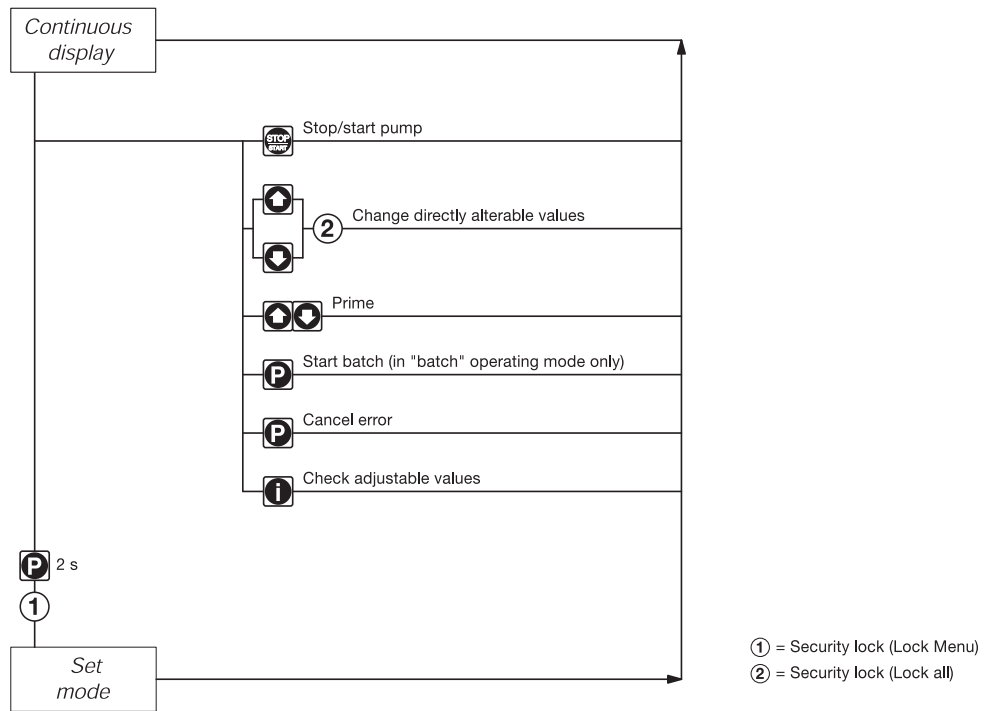
Factor The factor is the number of strokes which are triggered after an external impulse or by pressing the P key (only in the operating mode “Batch”).

In the operating mode “Batch”:
The factor can be changed from the continuous display “Remaining strokes”.
A few seconds after having set the factor, the delta® returns to the initial continuous display.

Batch size In the operating mode “Batch”:
The batch size can be changed from the continuous display “Batch size/residual litres”.
A few seconds after having set the batch size, the delta® returns to the initial continuous display.

Suction By simultaneously pressing both arrow keys, the function “Prime” is activated (in the continuous display “stroke frequency”).

Acknowledge errors Error indications are acknowledged by briefly pressing the P key.



8.2 Remote control

The pump can be remotely controlled via a control cable (see paragraph 6.2 and Chapter 7, as well as your system documentation).

9 Maintenance

- Maintenance intervals*
- Every four months, given normal load (approx. 30 % of continuous operation)
 - Shorter intervals in case of heavy load (e.g. continuous operation)

- Maintenance measures*
- Standard delivery units:
- ▶ Check the dosing diaphragm for damages (see Chap. 10)
 - ▶ Check the leakage holes for leaked dosing medium
 - ▶ Check the dosing lines at the delivery unit for tightness
 - ▶ Check the pressure and suction valve for tightness
 - ▶ Check the entire delivery unit for leakproofness (in particular the leakage hole! see Fig. 25)
 - ▶ Check for correct delivery: have the pump briefly take in (press both arrow keys simultaneously)
 - ▶ Check the electrical connections for integrity
 - ▶ Check the liquid end screws for tightness

Tightening torque for screws: 4.5 to 5 Nm

NOTE

For delivery units with coarse/fine valve:

- **Check the bypass line at the delivery unit for tightness.**
- **Check the vent valve for tightness.**
- **Check the pressure and bypass lines for kinks.**
- **Check the function of the coarse/fine valve.**

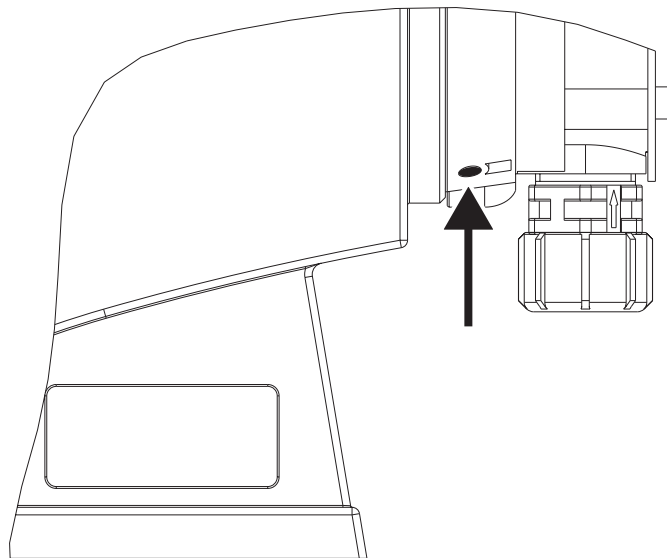


Fig. 25 Leakage hole

10 Repairs

NOTE

Repair measures which may only be performed by authorised persons or in the plant of the manufacturer:

- *Replacement of damaged mains connections*
- *Replacement of fuses and electronics controls*

Please contact your local ProMinent branch or agency!



WARNING

- Pumps for radioactive media may not be shipped!
They will not be accepted by ProMinent!
- Only return the metering pump for repair in a cleaned condition and with rinsed liquid end unit (see Chap. 12)! If despite thorough emptying and cleaning of the pump any safety precautions should be required, the necessary information must be listed in the "Safety declaration form"!

The "Safety declaration form" is material part of the inspection/repair order. An inspection or repair will only be made if the "Safety declaration form" has been correctly and fully completed by authorised and qualified personnel of the pump operator.

The form "Safety declaration form" is enclosed in the annex or can be downloaded from www.prominent.com.

Repair measures which may be performed by authorised persons (according to the safety chapter):

- Cleaning of a valve
- Replacement of the diaphragm



WARNING

- Protect yourself against the dosing medium if it is a hazardous one!
- Depressurise the system!

NOTE

Use the exploded views in the annex.

Cleaning of a pressure valve for types 0730, 1020, 1612

NOTE

- **Pressure and suction valves are different! Disassemble them one after each other to avoid any mistaking of the parts!**
- **Only use new parts which fit your valve (in form and chemicals resistance)!**
- **The pump must be newly set after the replacement of valves!**
- **Insert an Allen key or similar into the small hole of the pressure port and press out the valve inserts.**

Cleaning of a suction valve for types 0730, 1020, 1612

A suction valve is disassembled, cleaned and assembled almost similar to a pressure valve.

However, please observe that:

- both valve inserts are identical here
- there is a distance sleeve in addition below the valve inserts
- a pre-formed gasket instead of an O-ring is located in the liquid end
- the flow direction of the suction port is inverse to that of the pressure port.

Cleaning of a pressure valve for types 0280, 0450

NOTE

- **Pressure and suction valves are different! Disassemble them one after each other to avoid any mistaking of the parts!**
- **Only use new parts which fit your valve (in form and chemicals resistance)!**
For the material type PVT, the ball seat is integrated in the liquid end, thus has to be cleaned separately!
For the material type PVT, the pressure valve is a double-ball valve!
- **The pump must be newly set after the replacement of valves!**

Cleaning of a suction valve for types 0280, 0450

A suction valve is disassembled, cleaned and assembled almost similar to a pressure valve.

However, please observe that:

- the flow direction of the suction port is inverse to that of the pressure port.

Replacement of the diaphragm



WARNING

- **Protect yourself against the dosing medium if it is a hazardous one!**
- **Depressurise the system!**
- **Design-related several cubic centimetres of dosing medium could have accumulated after a leakage behind the diaphragm in the end disc!**
- ▶ Empty the delivery unit (turn the delivery unit upside down and let the dosing medium drain; rinse with a suitable medium; thoroughly rinse the liquid end if hazardous media have been used!)
- ▶ Adjust the stroke adjustment knob to below 0% stroke when the pump is operating (the drive axis is then fixed)
- ▶ Switch off the pump
- ▶ Remove the hydraulic connections from the pressure and suction side
- ▶ For the types with coarse/fine ventilation: First pull out the coarse/fine ventilation (star handle), then remove the covering screen of the delivery unit using a screwdriver
- ▶ Remove the screws (1).

- ▶ Remove the liquid end (2) with the screws (1) from the pump (see Fig. 26).
- ▶ Reposition the liquid end (2) with the screws - the screws (1) should be positioned in the holes of the diaphragm (3) but not in the pump housing!
- ▶ Grab the pump housing (6) with one hand and clamp the diaphragm (3) with the other hand between the liquid end (2) and the end disc (4). Loosen the diaphragm (3) from the drive axis by slightly and jerkily turning the liquid end (2) and the end disc (4) clockwise
- ▶ Remove the liquid end (2) with the screws (1) from the diaphragm (3) and unscrew them fully from the drive axis.
- ▶ Remove the end disc (4) from the pump housing (6)
- ▶ Check the condition of the safety diaphragm (5) and replace, if necessary.
- ▶ Push the safety diaphragm (5) onto the drive axis only until it is flush with the pump housing (6) - do not push further!
- ▶ Screw on the new diaphragm (3) onto the drive axis up to the stop by way of trial - this must be successful, otherwise the pump will not dose precisely later!
- ▶ Check whether the holes of the diaphragm are flush with those of the pump housing
- ▶ if not, start the pump and set the stroke length to 100%
- ▶ When the pump is running, slowly turn the diaphragm (3) clockwise until the 4 holes of the diaphragm are flush with those of the pump housing (6)
- ▶ Hold the diaphragm (3) in this position, set the stroke length to 0%, and stop the pump.
- ▶ Unscrew the diaphragm (3) again.
- ▶ Position the end disc (4) on the pump housing (6).

**IMPORTANT**

- **The leakage hole must show to the bottom in the later installation position of the delta® (see Fig. 25)!**
 - **Position the end disc (4) directly in the correct position on the pump housing (6)! Do not twist the end disc on the pump housing to prevent that the safety diaphragm (5) distorts!**
- ▶ Insert the diaphragm (3) into the end disc (4).
 - ▶ Hold the end disc (4) and tighten the diaphragm (3) clockwise until it is seated firmly (the turning resistance of the return spring becomes noticeable).

**IMPORTANT**

- **Do not excessively turn the diaphragm (3)!**
 - **The end disc (4) must remain in its position to prevent that the safety diaphragm distorts!**
- ▶ Position the liquid end (2) with the screws (1) onto the diaphragm (3) and the end disc (4) (the suction port must show to the bottom in the later installation position of the pump)
 - ▶ Screw down the screws (1) and tighten crosswise (tightening torques see above)
 - ▶ For the types with coarse/fine ventilation: Let the covering screen of the delivery unit engage into the liquid end, then press the coarse/fine ventilation (star handle) into the liquid end.

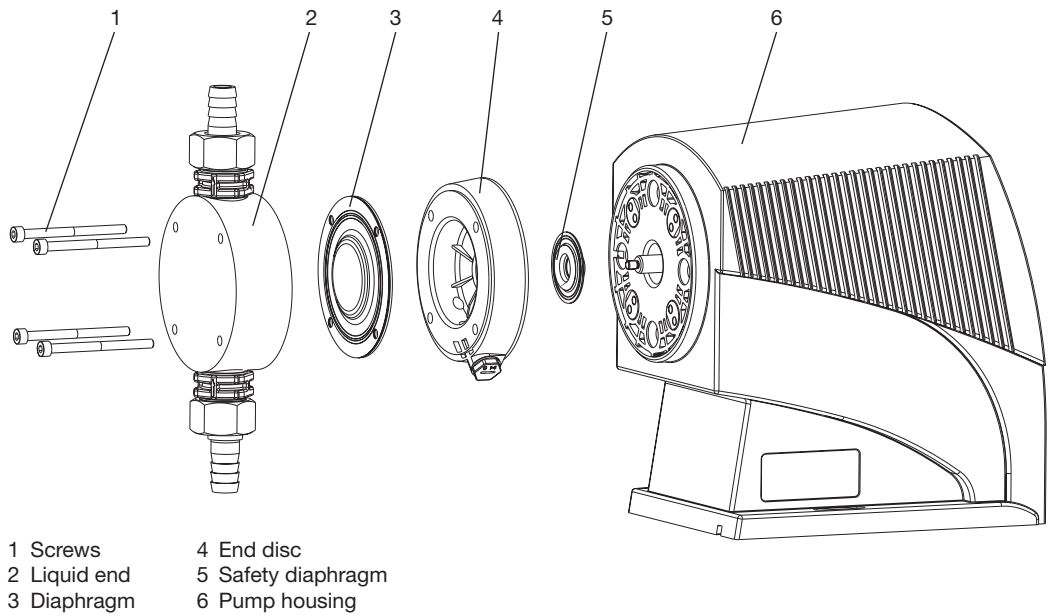


Fig. 26

NOTE

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

Tightening torques for screws: 4.5 to 5 Nm

Cleaning of diaphragm failure monitor



WARNING

If the diaphragm failure monitor triggered a signal, it must be cleaned subsequently!

- ▶ First replace the diaphragm of the delivery unit (see above)!
- ▶ Unscrew the diaphragm failure monitor (flat wrench AF 15 permitted)
- ▶ Clean the diaphragm failure monitor with a suitable liquid - if possible with water (material Polysulphone)
- ▶ Test the connected diaphragm failure monitor: Immerge the front of the hemisphere fully into water - the continuous display must show a diaphragm failure. Dry the diaphragm failure monitor well - the continuous display may no longer show a diaphragm failure
- ▶ screw in the dry and clean diaphragm failure monitor fingertight and liquidtight into the hole (do not use any tools).

11 Remedy of malfunctions



WARNING!

- **Protect yourself against the dosing medium if it is a hazardous one!**
- **Depressurise the system before commencing any work in the pump!**

delta® does not perform any suction despite full stroke movement and venting

Cause Crystalline depositions on the ball seat because of drying up of the valves.

- Remedy*
- ▶ Remove the suction hose from the store tank and thoroughly rinse the delivery unit.
 - ▶ If not successful, remove and clean the valves (see Chap. 9).

Liquid leaks at the end disc

Cause The delivery unit leaks at the dosing diaphragm.

- Remedy*
- ▶ Re-tighten the screws in the liquid end crosswise (see Chap. 9)
 - ▶ If not successful, replace the diaphragm (see Chap. 10).
 - ▶ If a diaphragm failure has been displayed, clean the diaphragm failure monitor (see Chap. 10).

Green LED indicator (status display) is not illuminated

Cause No or wrong supply voltage applied.

- Remedy*
- ▶ Use the prescribed supply voltage according to the voltage specifications on the rating plate.

Error messages

Red LED is illuminated, the LCD display shows the symbol “Level”, flashing, as well as the symbols for “Error” and “Stop”, and the pump stops.

Cause The liquid level in the store tank has reached “Level shortage 2nd stage”.

- Remedy*
- ▶ Refill the store tank.

„i < 4 mA“ Red LED is illuminated, the LCD display shows the symbol “i < 4 mA”, flashing, as well as the symbols for “Error” and “Stop”, and the pump stops.

Cause The delta[®] is in the operating mode “Analog”, an error behaviour was programmed in the ANALOG menu and the control current has dropped below 4 mA.

- Remedy*
- ▶ Remove the cause of the low control current or
 - ▶ Set the programming of the error behaviour to “OFF” (see paragraph 7.4.4).

„i < 23 mA“ Red LED is illuminated, the LCD display shows the symbol “i < 23 mA”, flashing, as well as the symbols for “Error” and “Stop”, and the pump stops.

Cause The delta[®] is in the operating mode “Analog”, an error behaviour was programmed in the ANALOG menu and the control current has exceeded 23 mA.

- Remedy*
- ▶ Remove the cause of the high control current or
 - ▶ Set the programming of the error behaviour to “OFF” (see paragraph 7.4.4).



Red LED is illuminated, the LCD display shows the symbols “m” and “External”, flashing, as well as the symbols for “Error” and “Stop”, and the pump stops.

Cause Stroke memory overflow

- Remedy*
- ▶ Remedy cause
 - ▶ Press the P key (Keep in mind the consequences for the process!)



Red LED is illuminated, the LCD display shows the symbol “Temperature”, flashing, as well as the symbols for “Error” and “Stop”, and the pump stops.

Cause The pump is overloaded or the temperature is too high

- Remedy*
- ▶ Remedy cause
 - ▶ Press the P key (Keep in mind the consequences for the process!)



Red LED is illuminated, the LCD display shows the symbol “Stroke length adjustment”, flashing, as well as the symbols for “Error” and “Stop”, and the pump stops.

Cause The stroke adjustment knob was turned given a locked menu

- Remedy*
- ▶ Reposition stroke adjustment knob or enter the code

Error messages / alarm messages

(Fault messages which are displayed either as error messages or alarm messages, depending on the settings in the setting menu.)



Either the yellow LED is illuminated, the LCD display shows the symbol “Flow”, flashing, - or the symbols for “Error” and “Stop” are displayed together with the illuminated red LED and the pump stops.

Cause The metering monitor is not correctly connected.

Remedy ▶ Correctly connect the metering monitor.
▶ Press the P key.

Cause The metering monitor reports more faulty strokes than set in the FLOW menu.

Remedy ▶ Press the P key.
▶ Examine and remedy the cause.



Either the yellow LED is illuminated, the LCD display shows the symbol “Diaphragm”, flashing, - or the symbols for “Error” and “Stop” are displayed together with the illuminated red LED and the pump stops.

Cause Diaphragm is fractured

Remedy ▶ Replace the diaphragm and clean the diaphragm failure monitor (see Chap. 10)



Either the yellow LED is illuminated, the LCD display shows the symbol “Airlock”, flashing, - or the symbols for “Error” and “Stop” are displayed together with the illuminated red LED and the pump stops.

Cause Gas bubbles in the delivery unit (leak, outgassing medium, cavitation)

Remedy ▶ With the red LED illuminated, press the P key (Keep in mind the consequences for the process!)
▶ Vent the delivery unit and remedy the cause (seal the unit or slow down suction stroke)

„p+“

Either the yellow LED is illuminated, the LCD display shows the symbol “p+”, flashing, - or the symbols for “Error” and “Stop” are displayed together with the illuminated red LED and the pump stops.

Cause A narrowing or a closed shut-off valve on the pressure side

Remedy ▶ With the red LED illuminated, press the P key (Keep in mind the consequences for the process!)
▶ Remedy the narrowing or open the shut-off valve

„p-“

Either the yellow LED is illuminated, the LCD display shows the symbol “p-”, flashing, - or the symbols for “Error” and “Stop” are displayed together with the illuminated red LED and the pump stops.

Cause There is a leakage on the pressure side, a line has burst or is broken

Remedy ▶ With the red LED illuminated, press the P key (Keep in mind the consequences for the process!)
▶ Repair leak, remedy cause

Alarm messages



Yellow LED is illuminated, the LCD display shows the symbol “Warning Level” and flashes

Cause The liquid level in the store tank has reached “Level shortage 1st stage”.

Remedy ▶ Refill the store tank.

All other errors

Please contact your local ProMinent® branch or agency!

12 Decommissioning and disposal

Decommissioning



WARNING

- When decommissioning a pump, the housing and in particular the liquid end must in principle be cleaned of any chemicals and contaminations.
 - Protect yourself against the dosing medium if it is a hazardous one!
 - Depressurise the system!
- ▶ Disconnect the pump from the mains
 - ▶ Empty the liquid end by turning the pump upside down and letting the dosing medium drain
 - ▶ Rinse the liquid end with a suitable medium; thoroughly rinse the liquid end if hazardous media have been used!

Observe the storage conditions in case of a temporary decommissioning:

Storage temperature: -10 to +50 °C

Relative humidity: < 92 % relative humidity, non-condensing

Disposal



IMPORTANT

Electronic waste is hazardous waste!
Please observe the relevant local regulations!

13 Technical data

13.1 Performance data

delta® with 200 strokes/minute and 100% stroke length

Liquid end type	min. output at maximum backpressure			min. output at medium backpressure			Stroke no.	Connection size ãØ x iØ mm	Suction lift* m Ws	Priming lift** m Ws	Admissible pre-pressure suction side bar	Shipping weight approx. kg
	bar	l/h	ml/stroke	bar	l/h	ml/stroke						
1612	16	11.3	0.94	8	12.24	1.02	200	8x5	5	3.0 / 2.51	8	10 / 11 ¹
1020	10	19.1	1.59	5	19.2	1.6	200	12x9	5	3.5 / 3.01	5	10 / 11 ¹
0730	7	29.2	2.43	3.5	29.4	2.45	200	12x9	4	4.0 / 3.51	3	10 / 11 ¹
0450	4	49.0	4.08	2	51.5	4.29	200	DN 10	3	2.5 / 2.51	2	10 / 11 ¹
0280	2	75.0	6.25	1	75.6	6.3	200	DN 10	2	3.0 / 3.01	1	10 / 11 ¹

* Suction lift with filled suction line and filled liquid end

** Priming lift with clean as well as moistened valves. Priming lift with 100 % stroke lengths and free drain or opened vent valve

¹ For material type SST

13.2 Accuracies

Standard delivery units

Dosing accuracy –5 to +10 % at max. stroke length and max. operating pressure for all material types.

Reproducibility ±2 % given constant conditions and min. 30 % stroke length.
Given the correct adaptation of the stroke speeds and if “Compensation” is set to “on” (see Chap. 7.5.5 “Metering”), the delta® ensures constant conditions.

13.3 Viscosity

The dosing behaviour of the pump can be adapted to the viscosity of the dosing medium.

Viscosity in mPa	Setting “Dosing”	Deceleration suction stroke	Max. stroke frequency	Remark
0...50	“standard”	none	200	
50...200	„HV1“	slight	160	
200...500	„HV2“	medium	120	for valves with spring
> 500	„HV3“	maximum	80	for valves with spring

Tab. 7: Setting to decelerate the suction stroke depending on the viscosity of the dosing medium (see Chap. 7.5.3)

13.4 Material data

Liquid end

Type	Liquid end	Suction/ pressure port	Gaskets	Valve balls
PV	PVDF	PVDF	PTFE	Ceramics
SS	Stainles steel 1.4404	Stainles steel 1.4404	PTFE	Ceramics

Pump

Housing Polyphenylether (PPE with fibre glass)
Cover Polycarbonate
Electronics Electronics components

13.5 Electrical data

Design: 100 - 230 V ±10 %, 50/60 Hz

Nominal rating	approx. 73 W
Nominal current	approx. 0.90 A / 0.55 A
Switch-on peak current	4 A / 8 A (recovering within approx. 50 ms)
Fuse	1.6 AT

Note Fuses must be approved according to VDE, UL, and CSA. E.g. Serie SPT , 1.6 A by the company of Schurter, order no. 0001.2506 according to IEC Publ. 127 - 2/3.

13.6 Environmental conditions

Temperatures Storage and transport temperature: –10 to +50 °C
Dosing medium temperature: –10 to +35 °C
Ambient temperature during function: –10 to +45 °C (drive and control)

Maximum ambient temperatures for delivery units depending on material type:

max. ambient temperature	PVT	SST
long-term at max. operating pressure	50 °C	50 °C
Short-term at max. 2 bar	120 °C	120 °C

Humidity admissible relative humidity: 92 % relative humidity, non-condensing
use in humid and alternating atmosphere: FW 24 pursuant to DIN 50016

13.7 System of protection and protection class

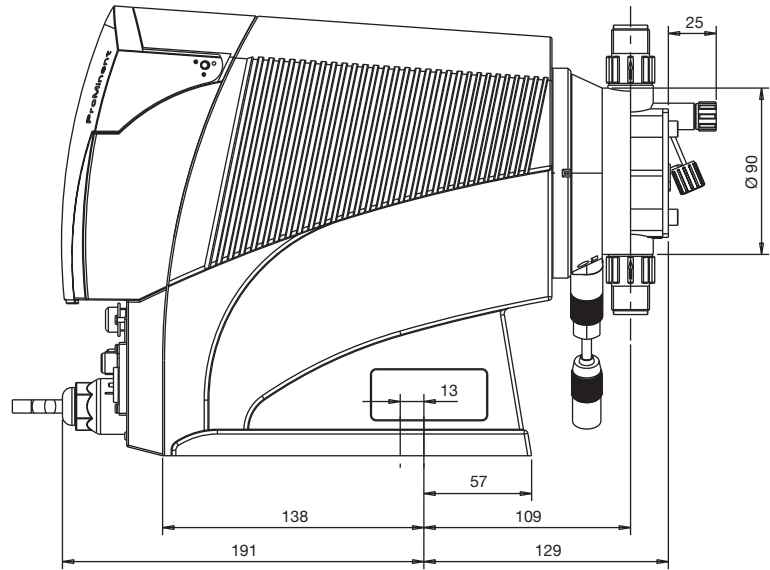
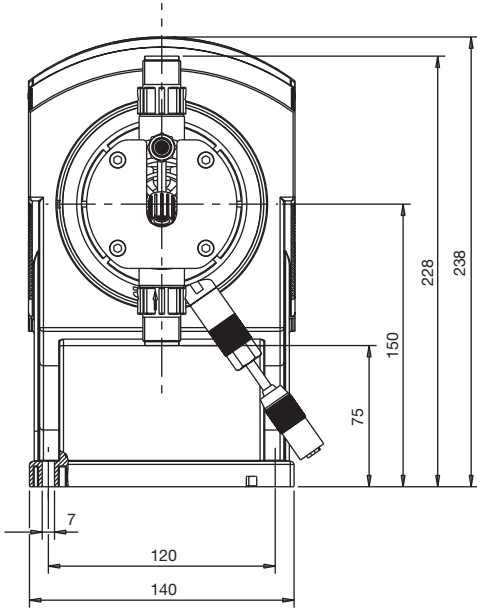
<i>System of protection</i>	Protection against contact and protection against moisture IP 65 pursuant to IEC 529, EN 60529, DIN VDE 0470 Part 1
<i>Safety requirements</i>	Protection class 1 - Mains connection with protective conductor

13.8 Compatibility

Some hydraulic components of delta® are identical with those of Beta® and gamma/L. The following components and accessories are largely compatible to the pumps of the series Beta® and gamma:

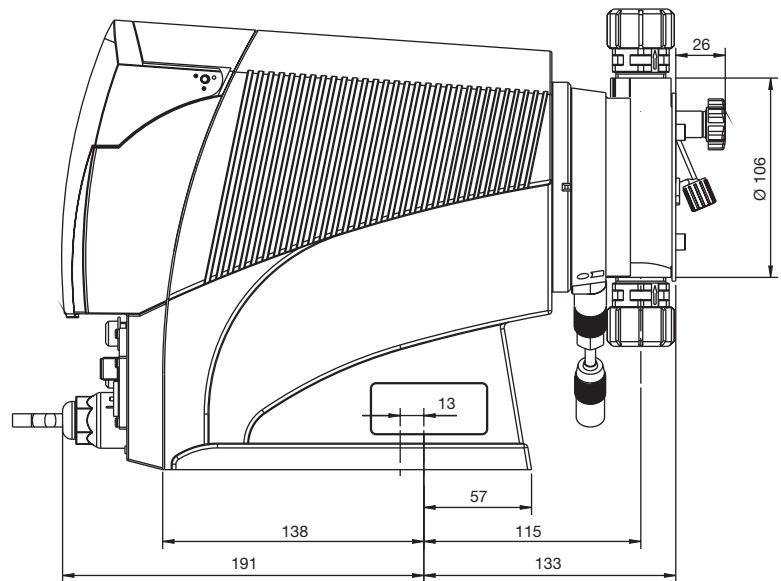
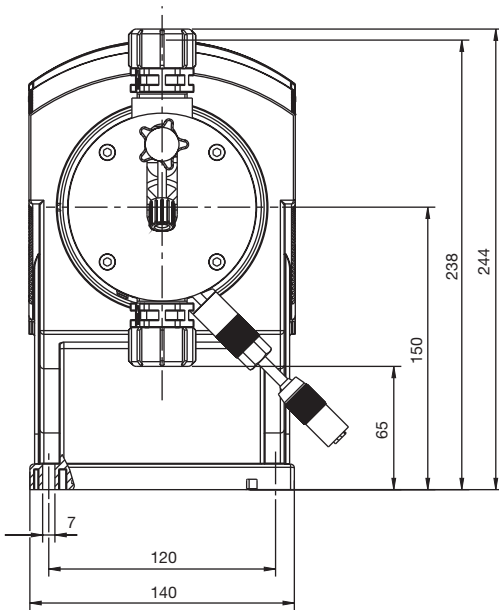
- Control cable gamma/Vario, 2-, 4- and 5 wire for the function “external”
- Level switch 2-phase (gamma/Vario/Beta®)
- Dosing line cross-sections
- Standard connecting kit gamma
- Dosing tank
- Total height (distance between suction and pressure port)
- Identical use of accessories such as pressure-retaining valve, multifunctional valve, dosing monitor, and rinsing unit

Dimensions of delta® type 1612 - 0730
Material PV



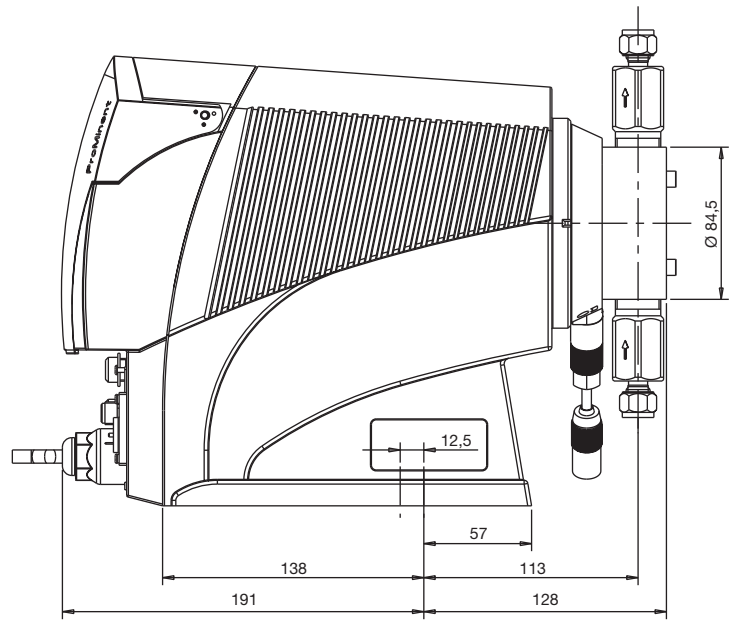
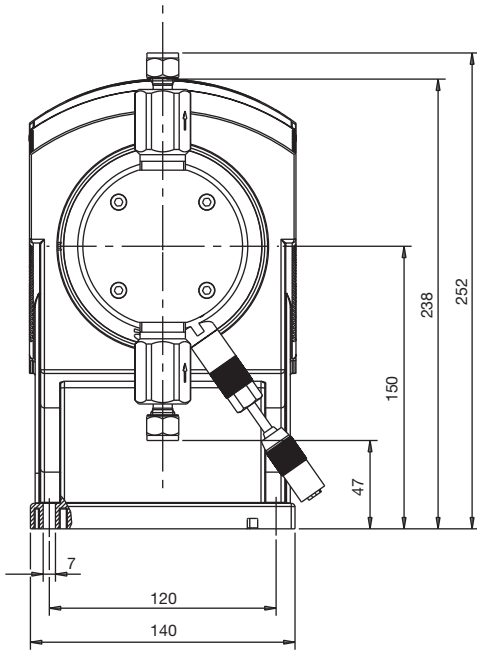
(dimensions in mm)

Dimensions of delta® type 0450 - 0280
Material PV



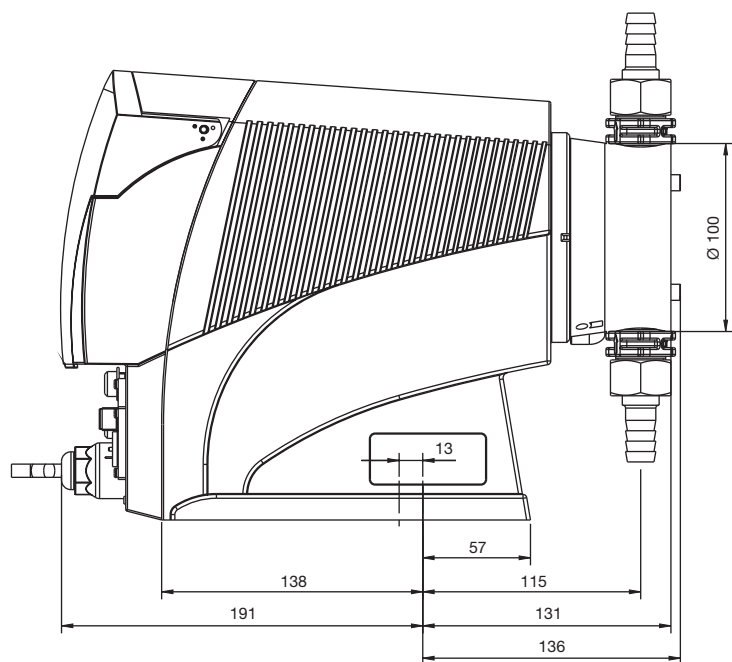
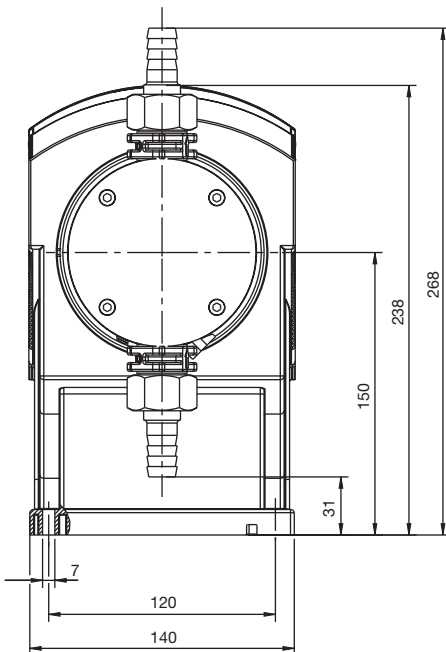
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Dimensions of delta® type 1612 - 0730
Material SS



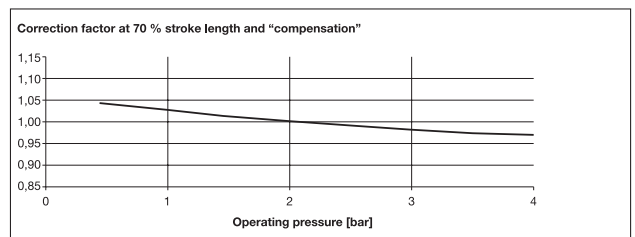
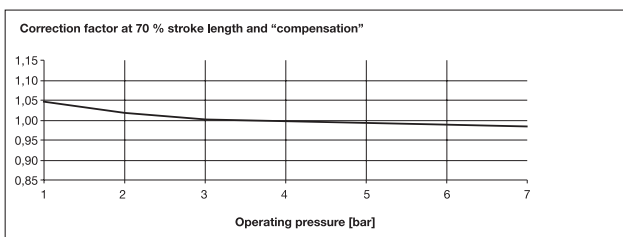
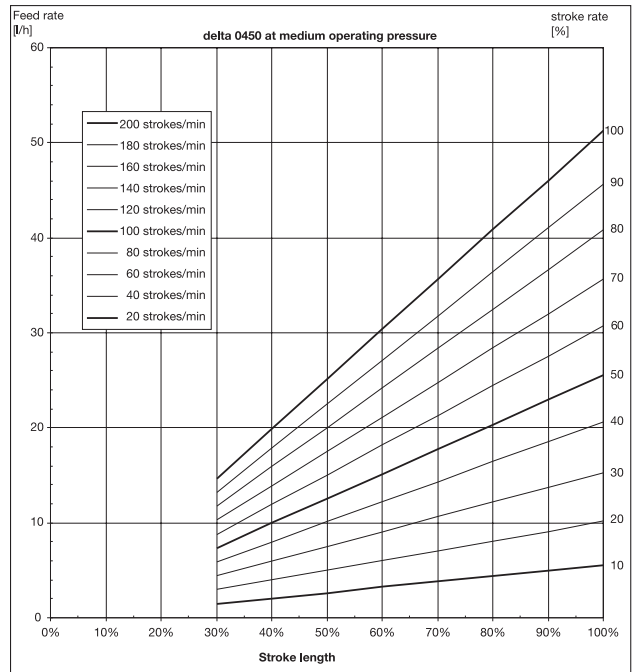
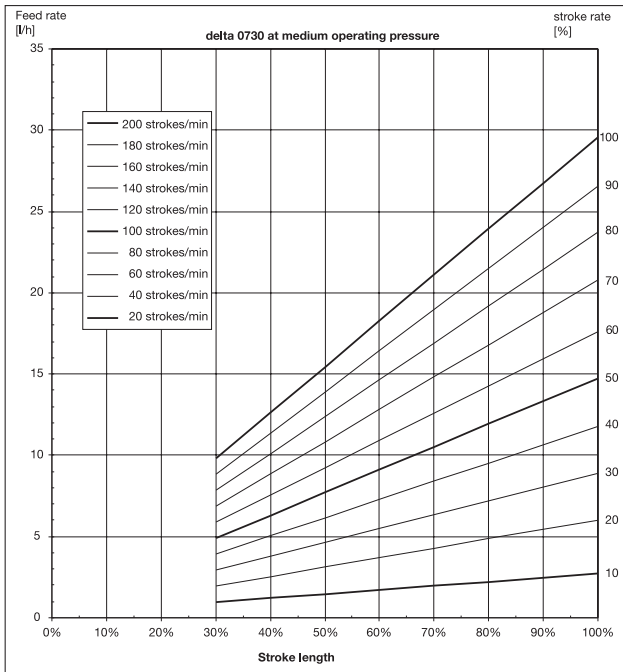
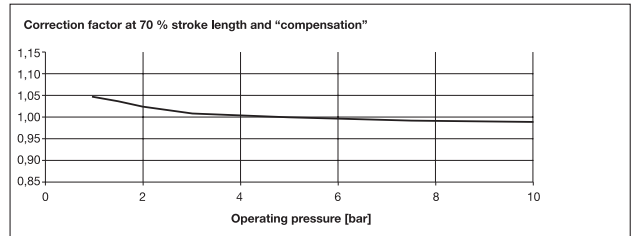
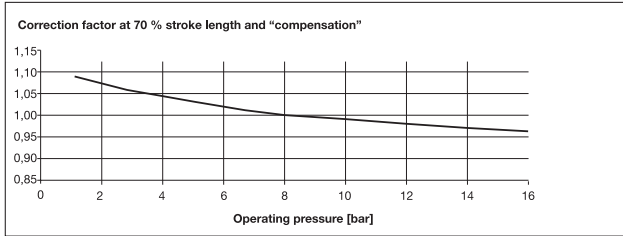
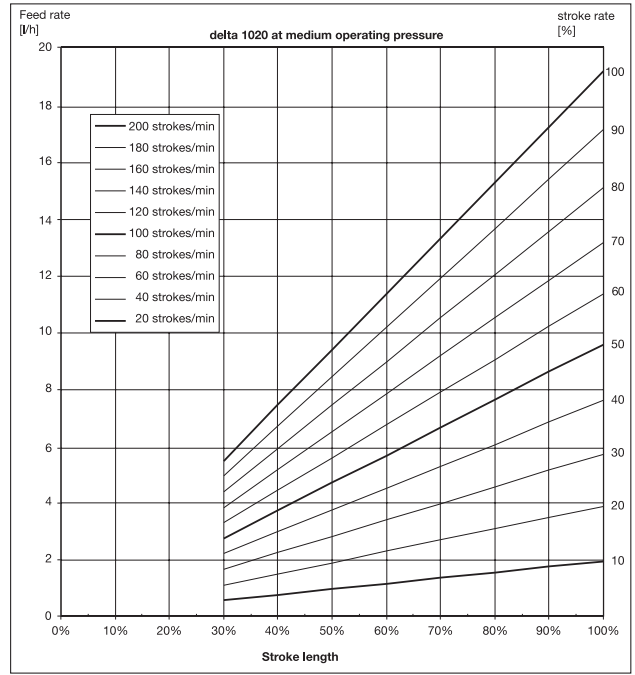
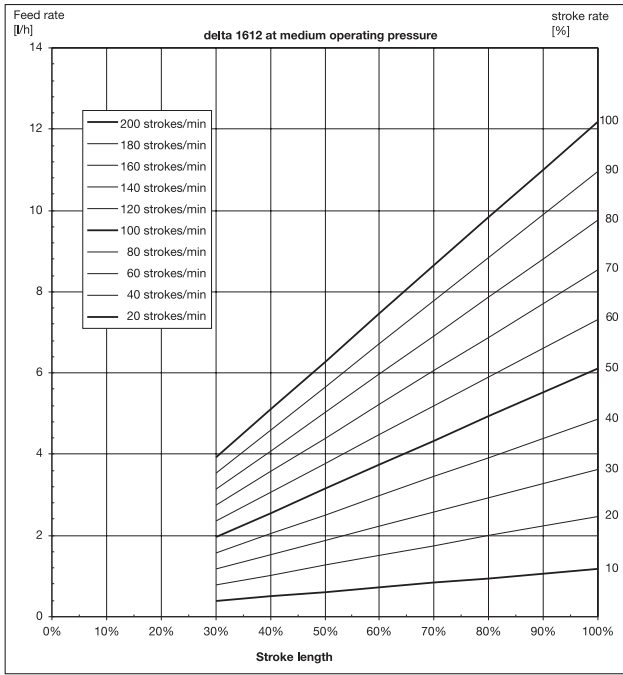
(dimensions in mm)

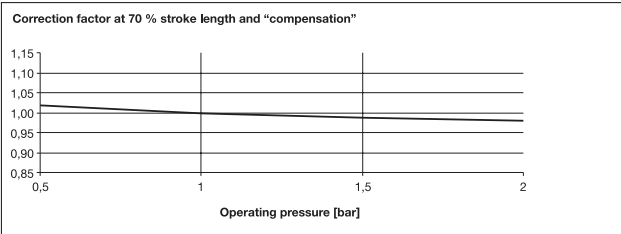
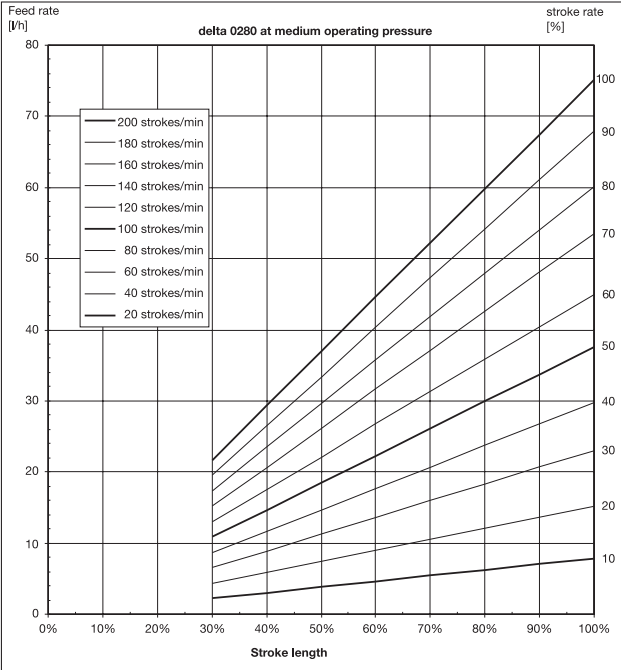
Dimensions of delta® type 0450 - 0280
Material SS



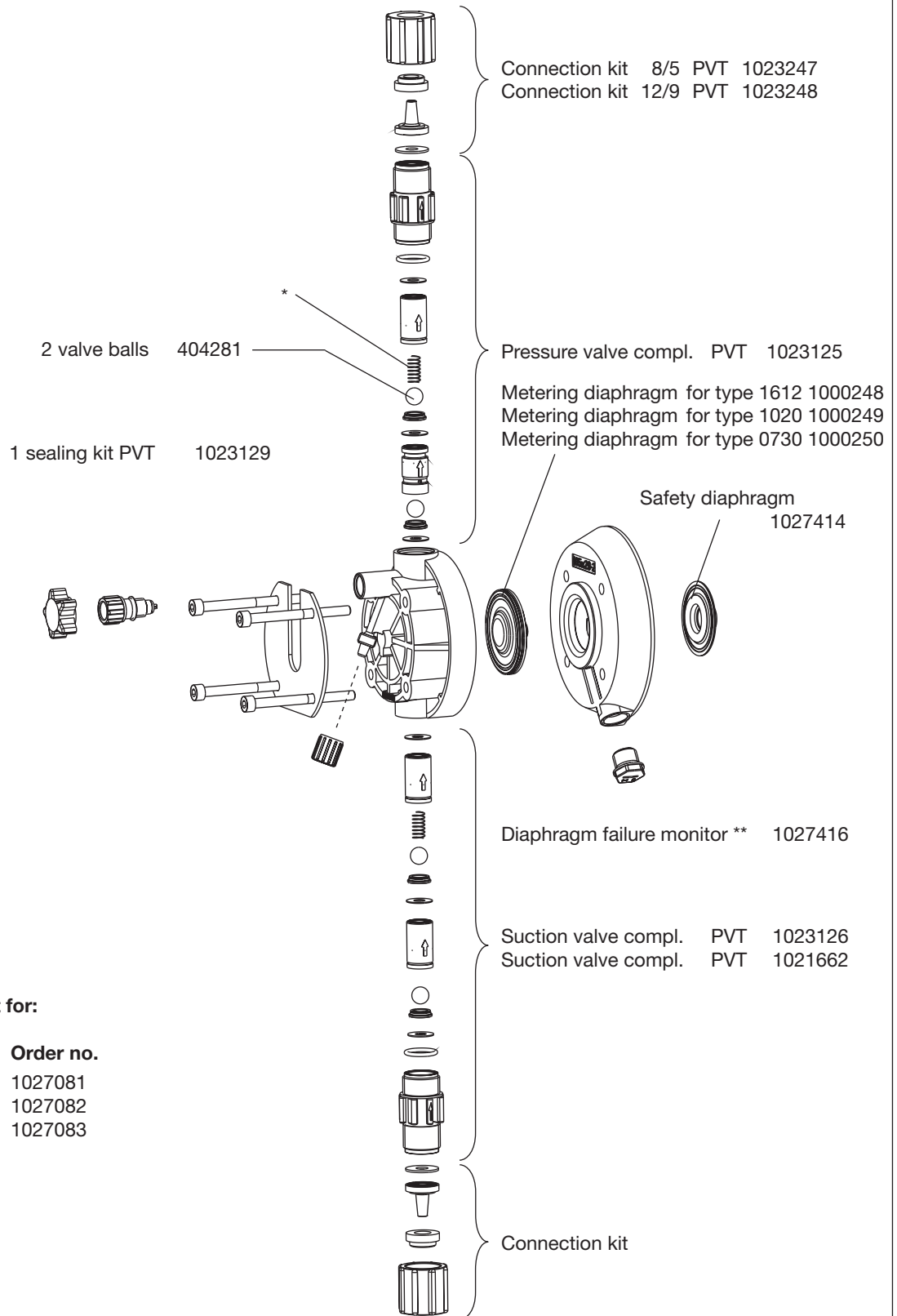
(dimensions in mm)

Diagrams for adjustment of the output





Delivery unit delta® for identcode type: 1612 - 0730 PV



Replacement parts kit for:

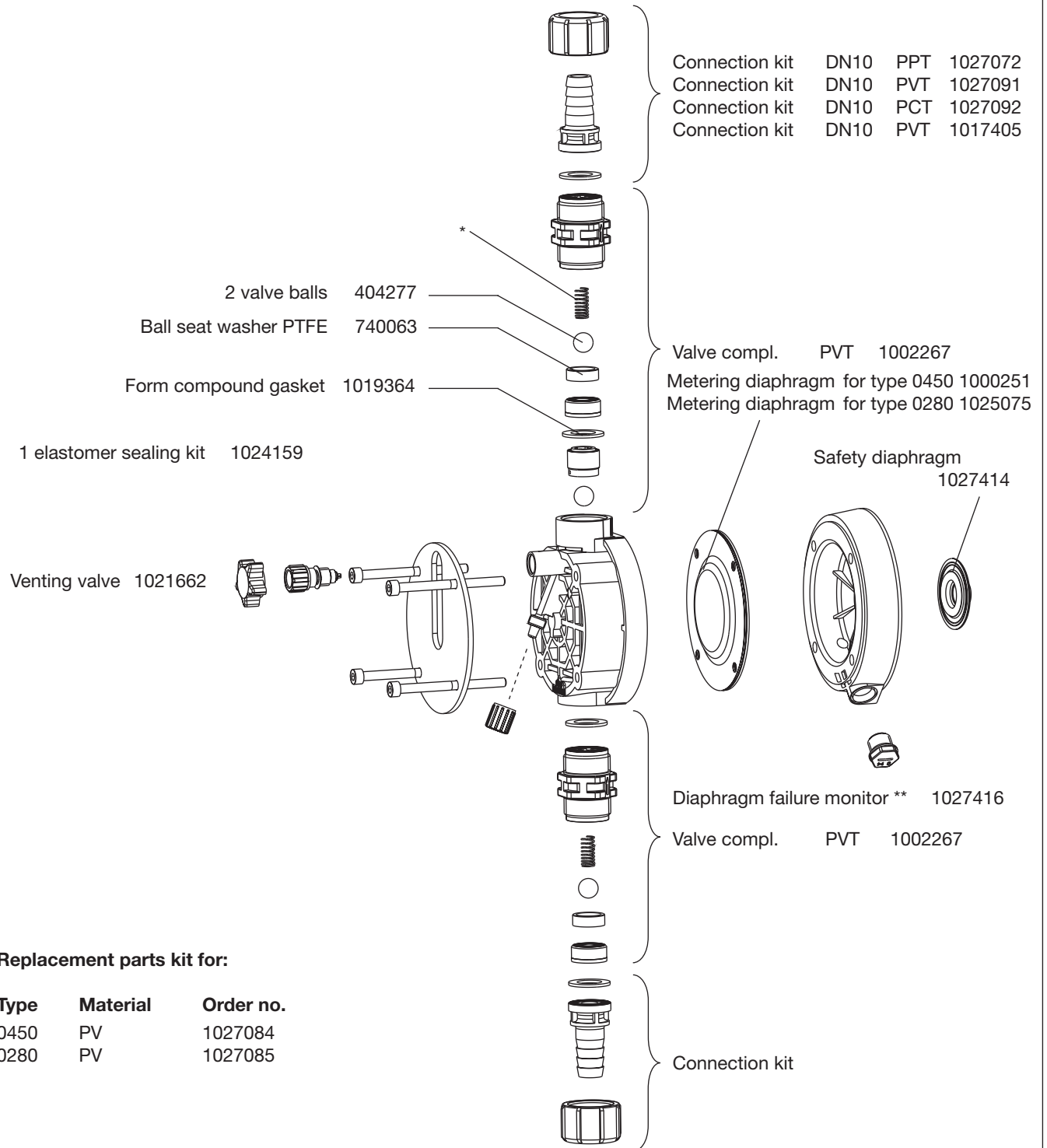
Type	Material	Order no.
1612	PV	1027081
1020	PV	1027082
0730	PV	1027083

The following items are included in the replacement parts kit.

* special accessories

** not included in replacement parts kit

Delivery unit delta® for identcode type: 0450 - 0280 PV



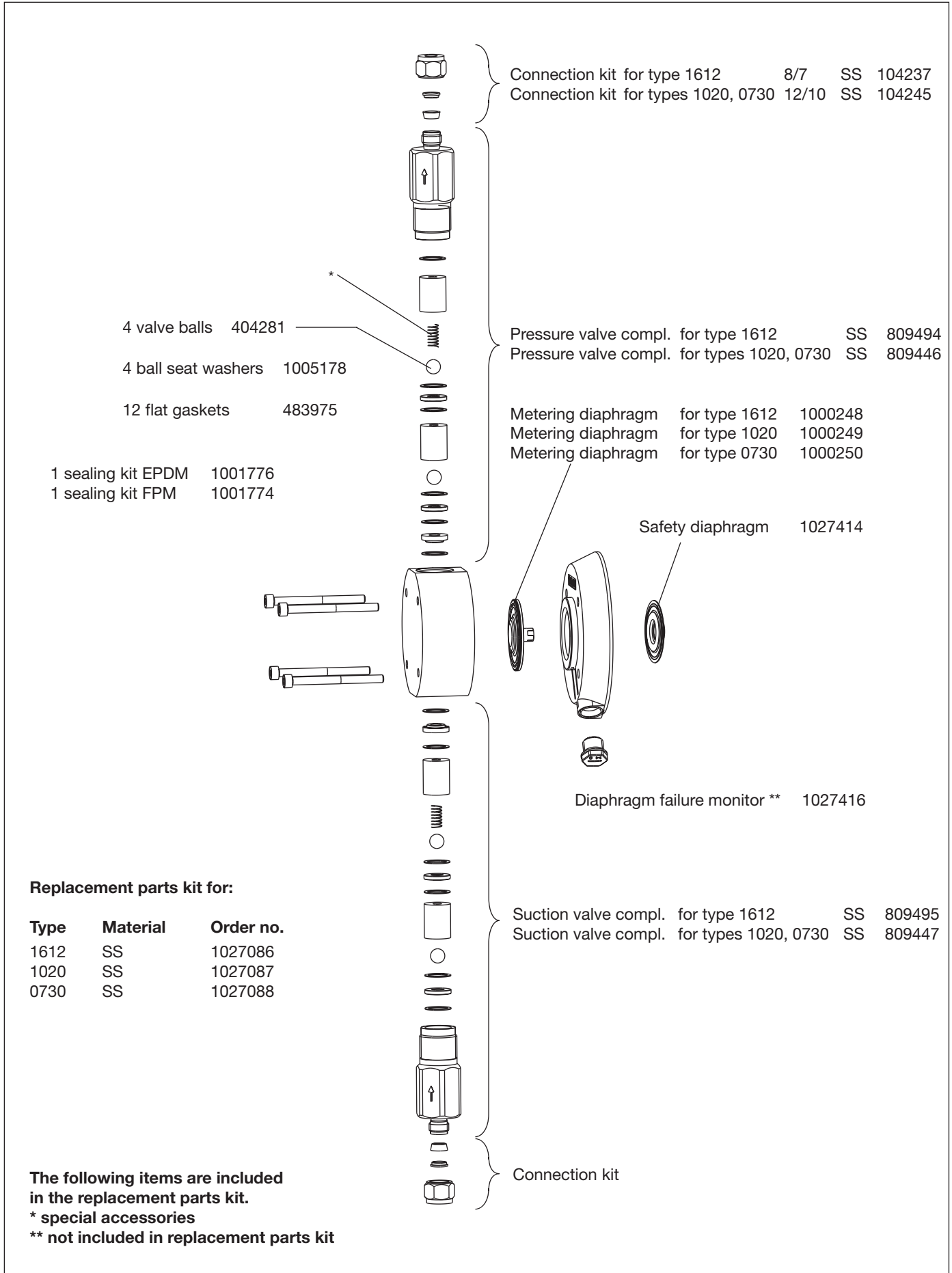
The following items are included in the replacement parts kit.

* special accessories

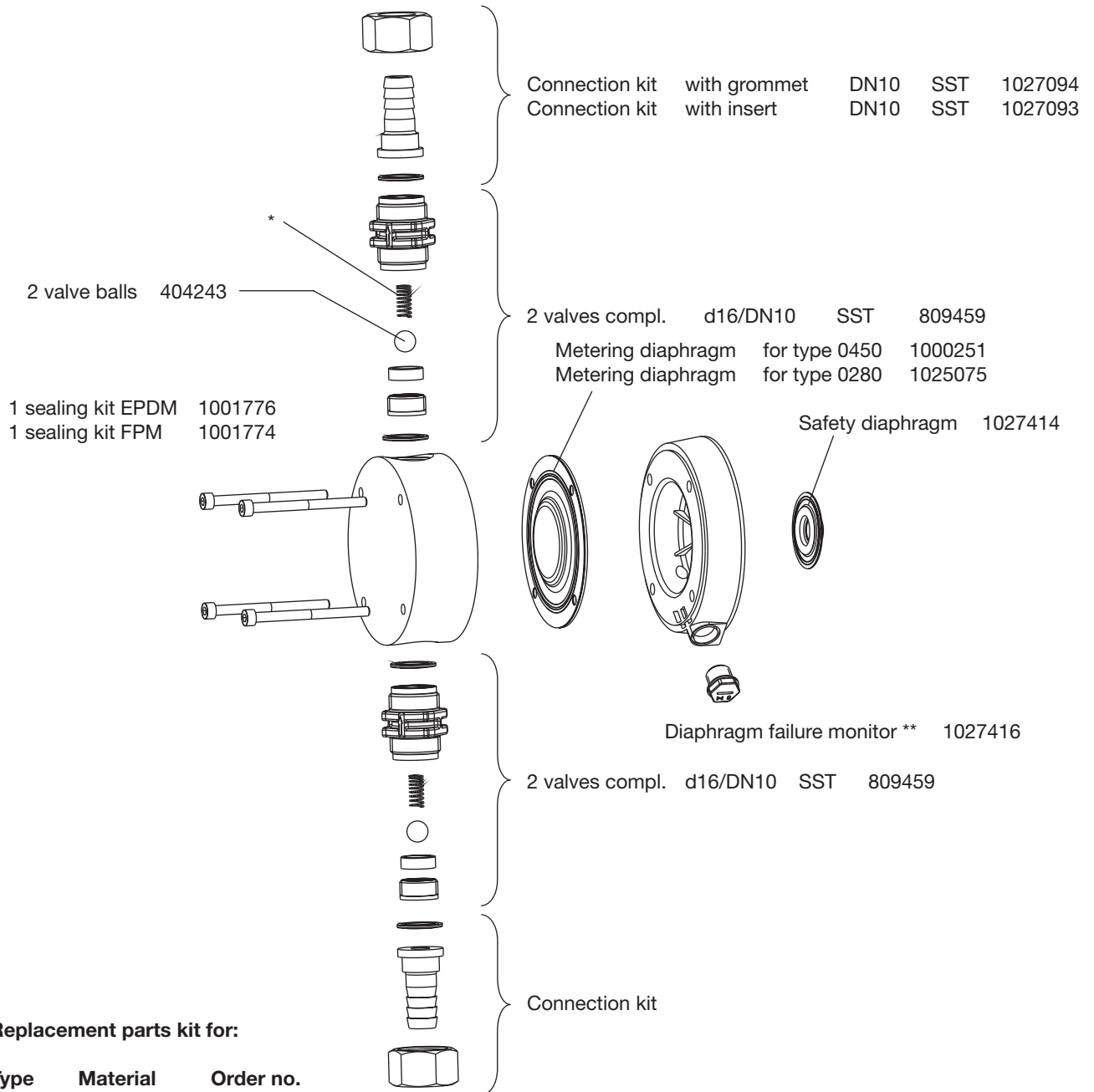
** not included in replacement parts kit

Exploded view of the delivery units

Delivery unit delta® for identcode type: 1612 - 0730 SS



Delivery unit delta® for identcode type: 0450 - 0280 SS



Replacement parts kit for:

Type	Material	Order no.
0450	SS	1027089
0280	SS	1027090

The following items are included in the replacement parts kit.

* special accessories

** not included in replacement parts kit

EC Declaration of Conformity

We,

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

hereby declare that, on the basis of its functional concept and design and in the version brought into circulation by us, the product specified in the following complies with the relevant, fundamental safety and health stipulations laid down by EC regulations.

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

Product description : *Metering pump, Series delta*

Product type : *DLTA...*

Serial number : *see type identification plate on device*

Relevant EC regulations : *EC - machine regulation (98/37/EC)*
EC - low voltage regulation (73/23/EEC, subsequently 93/68/EEC)
EC - EMC - regulation (89/336/EEC, subsequently 93/68/EEC)

Harmonised standards used,
in particular : *DIN EN ISO 12100-1, DIN EN ISO 12100-2, DIN EN 563, DIN EN 809,*
DIN EN 60335-1, DIN EN 60335-2-41,
DIN EN 61000-3-2/3, DIN EN 61000-6-1/2/3/4

Date/manufacturer's signature : 15.08.2006



The undersigned : *Dr. Andreas Höhler, director research and development*

Safety declaration form

**A completed form must always be returned with the equipment!
This declaration must only be completed and signed by an authorized member of the technical staff!**

The equipment or its parts will only be repaired or serviced if it is accompanied by a correctly completed and signed safety declaration form. The work could be delayed if no form is returned.

Legally binding declaration

We hereby assure that:

1. The enclosed equipment

Type: _____

Serial No.: _____

is free from any

- toxic
- corrosive
- microbiological
- carcinogenic
- explosive
- radioactive substances
- or other substances that may be harmful to health.

2. The equipment was thoroughly cleaned before being shipped.

3. There is no hazard due to residual contamination.

4. The details given in this form are correct and complete.

Company / Institute: _____

Street: _____ Postcode, Town: _____

Tel: _____ Fax: _____

Surname, First name: _____ Position: _____

Date: _____

Legally binding signature

Company stamp

Die ProMinent Firmengruppe / The ProMinent Group

Stammhaus / Head office

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