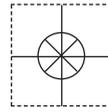


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PHP-200/210 SERIES Solenoid Dosing Pump



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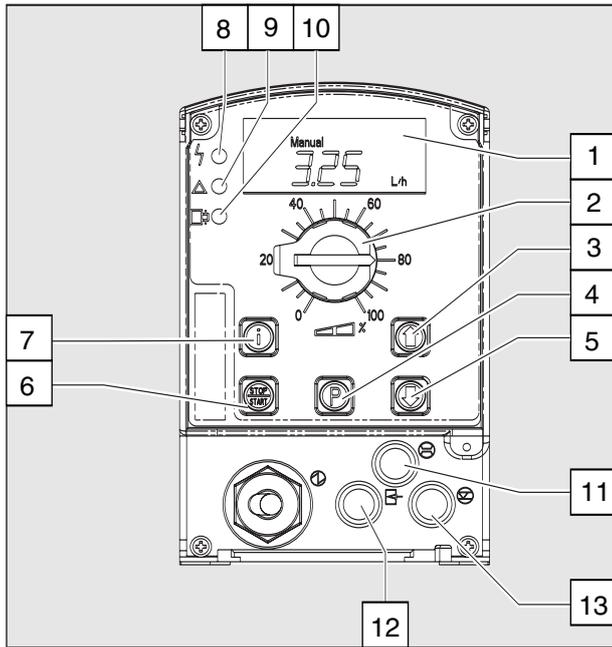
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The information contained in this document is believed to be correct, but OMEGA accepts no liability for any errors it contains, and reserves the right to alter specifications without notice.

WARNING: These products are not designed for use in, and should not be used for, human applications.

Control elements and key functions

Control elements: overview

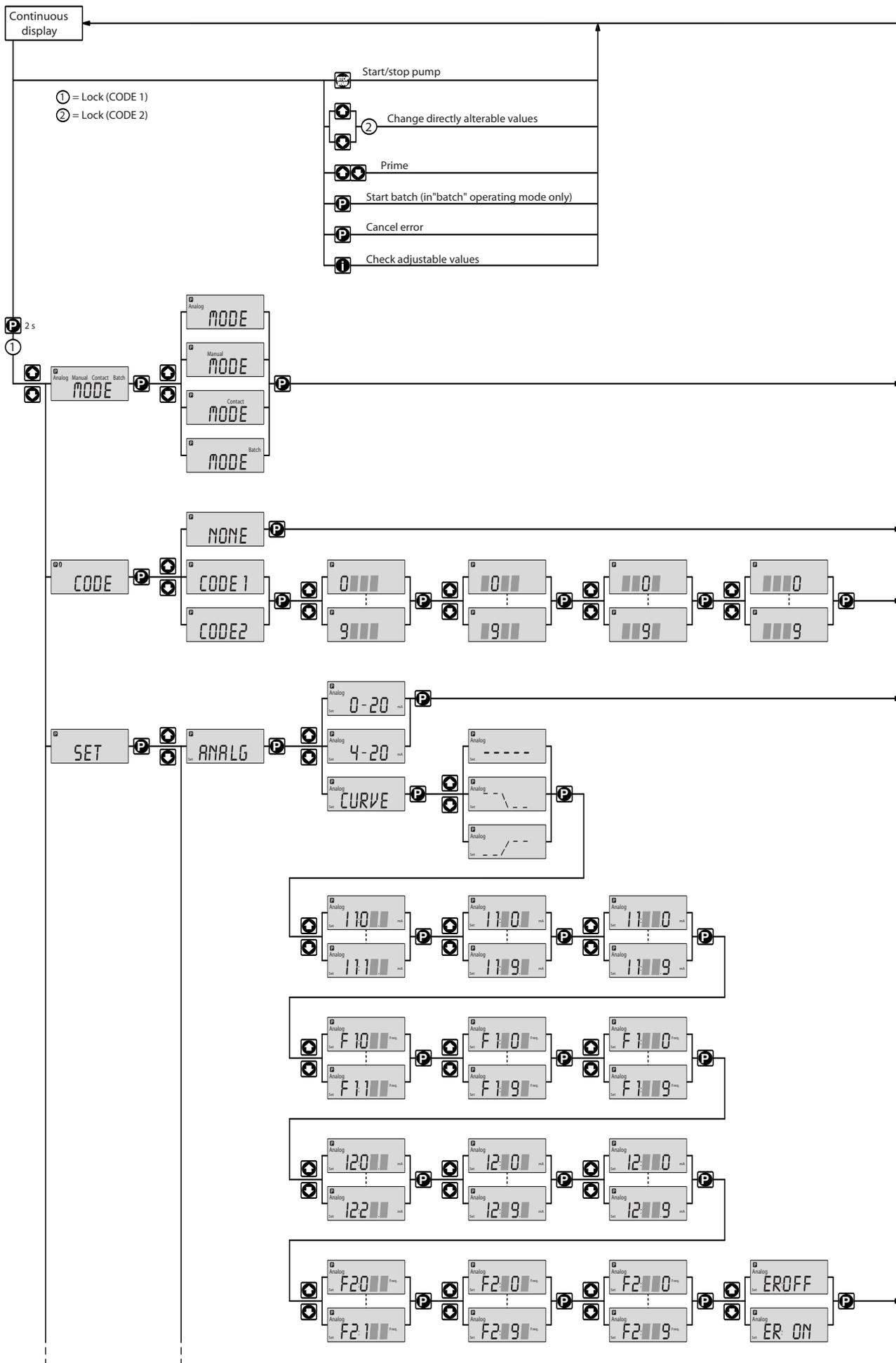


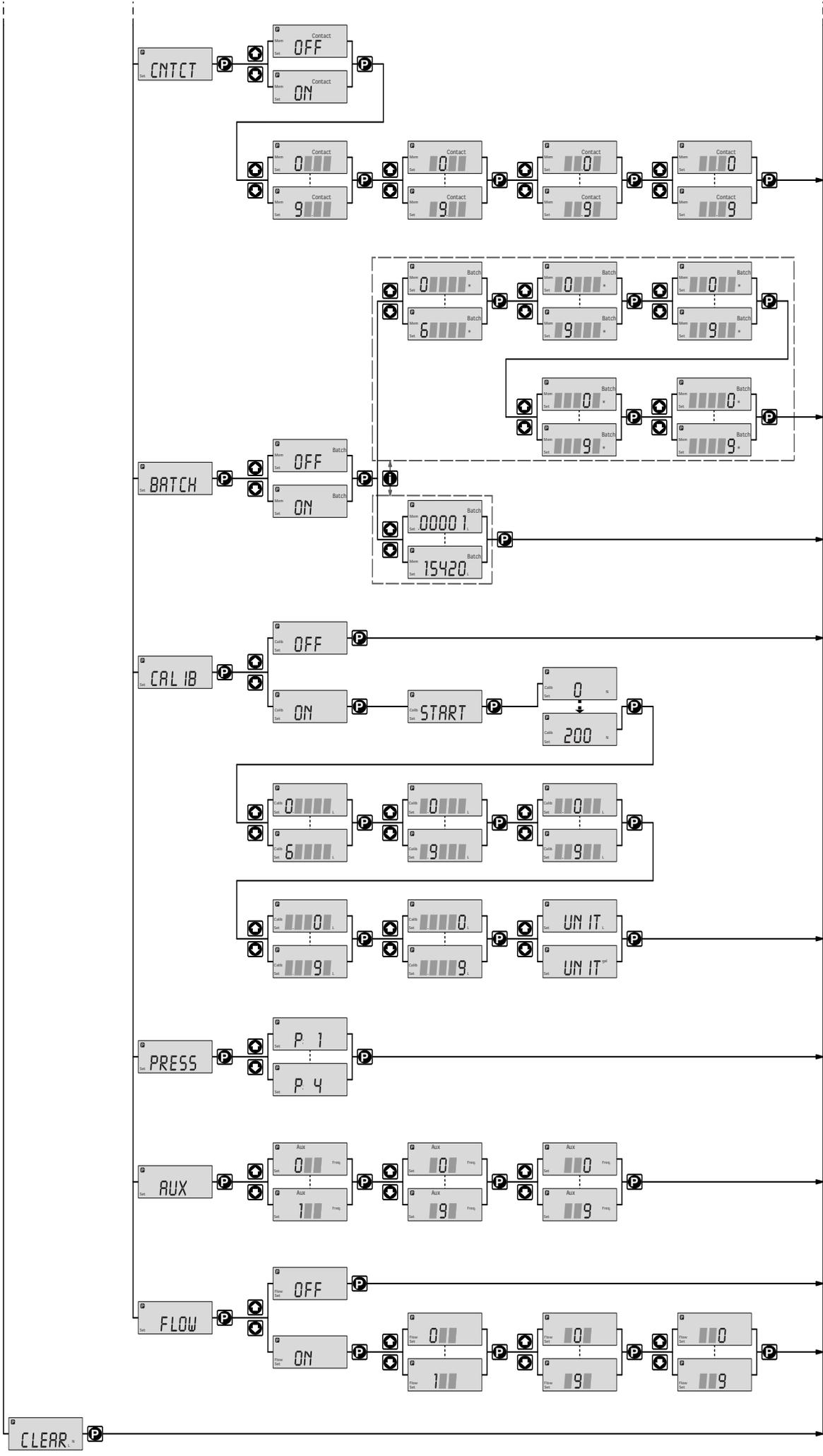
- 1 LCD display
- 2 Stroke length adjusting knob
- 3 UP key
- 4 P key
- 5 DOWN key
- 6 STOP/START key
- 7 i key
- 8 Fault indicator (red)
- 9 Warning indicator (yellow)
- 10 Operating indicator (green)
- 11 "Dosing monitor" terminal
- 12 "External control" terminal
- 13 "Float switch" terminal

Key functions

	In continuous display mode (operating)	In settings mode (settings)
STOP/START key		
		
Press briefly	Stop pump, start pump	Stop pump, start pump
P key		
		
Press briefly	Start batch (in " batch" operating mode only), Cancel error	Confirm entry- jump to next menu option or continuous display
Press for 2 s	Change to settings mode	---
Press for 3 s	---	Jump to continuous display
Press for 15 s	Load factory settings (calibration)	---
i key		
		
Press x1	Toggle between continuous displays	Toggle between "change individual digits" and change a figure"
Press x2	---	For "change individual digits": jumps to first digit
Arrow keys UP and DOWN		
		
Press x1 (until "Set" appears)	Change directly alterable values	Select other settings, change individual digit or figure
Press simultaneously	Prime	---

Operating-/Settings Diagram





Continuous display

Continuous display	Operating mode "Analog" 0-20 mA	Operating mode "Manual"	Operating mode "Contact" with memory and transfer factor 5	Operating mode "Batch" with memory and transfer factor 5
Stroke rate				
Feed rate				
Total stroke number				
Total litres (feed quantity)				
"External" display				
Signal current				
Strokes remaining				
Batch size/ Litres remaining				
Factor				
Stroke length				
	"Mem" appears only when "memory" function activated			

⬆️ ⬇️ = UP and/or DOWN arrow keys, directly alterable values

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General User Guidelines

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

On the fold-out page after the title page you will find the overviews “control elements and key functions” and “operating/settings diagrams”.

You will find it useful to open out the “control elements and key functions” overview as you read this instructions manual.

Key points in the text are indicated as follows:

- Enumerated points
- ▶ Hints

Working guidelines:

GUIDELINES

Guidelines are intended to make your work easier.

Safety guidelines:



WARNING

Describes a potentially dangerous situation. Could result in loss of life or serious injury if preventative measures are not taken.



CAUTION

Describes a potentially dangerous situation. Could result in lesser injuries or damage to property if preventative measures are not taken.



TAKE CARE

Describes a potentially threatening situation. Could result in damage to property if preventative measures are not taken.

The name plate affixed to the title page is identical to that on the pump supplied.

This facilitates matching the correct operating instructions manual to the correct pump.

Please quote the identity code and the serial number, which you will find on the name plate, in any subsequent correspondence or when ordering spare parts. This will ensure accurate identification of the pump type and material version.

1 About This Pump

The pumps in the PHP-200/210 pump series are microprocessor controlled solenoid dosing pumps with the following special features:

- The feed rate can be displayed in l/h and/or gal/h (calibrated), or in strokes/min.
- The stroke rate is continuously adjustable and is displayed in the LCD display.
- Stroke rate adjustment is digitally accurate and is displayed in the LCD display.
- The rated pressure of the pump can be adapted to individual systems.
- Two pumps can be controlled in different ways via the same standard signal.
- Large, illuminated LCD display

The hydraulic parts of the PHP-200A Series are identical to those of the PHP-200 Series.

2 Safety

Correct use

The pump must be used for liquids only!

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

It is forbidden to use the pump for any other purpose, or to modify it in any way!

The pump is not suitable for dosing gases or solids!

The pump must be used by trained and authorised personnel only!

Safety guidelines



WARNING

- As soon as the pump is connected to the electricity supply it may commence pumping!
Avoid leakage of hazardous chemicals in this case!
If this should occur, then press the STOP/START key or disconnect the pump from the power supply immediately!
- The pump cannot be switched to a current-free status! In the event of an electrical accident, disconnect cable from the mains power supply!
- Disconnect cable from the mains power supply before commencing work on the pump!
- Always depressurise liquid end before commencing work on the pump!
- Empty and rinse out the liquid end before commencing work on the pump after use with hazardous or unknown chemicals!
- Pumps for radioactive materials may not be returned to OMEGA after use!



CAUTION

- It is not permitted to assemble and install OMEGA dosing pumps with non-original parts unless these have been checked and recommended by OMEGA. It can result in harm to persons and property for which no liability will be accepted!
- When dosing aggressive materials, check the resistance of the pump materials
- If another liquid end size is installed the pump must be reprogrammed on factory premises!
- Observe applicable national directives during installation!

Sound intensity level

The sound intensity level is < 70 dB (A) at maximum stroke, maximum stroke rate, maximum back pressure (water) in accordance with:

DIN EN ISO 3744 (Reproducibility 2 Determining Sound Intensity Level)

PR DIN EN 12639 (Metering Pump Noise Measurement)

DIN 45635-24 (Machine Noise Measurement)

3 Storage, Transport and Unpacking

Transport and store the pump in the original packaging!

Protect the packed pump from moisture and the effects of chemicals!

Environmental conditions for storage and transport:

Storage and transport temperature: -10 bis +50 °C

Humidity: < 92 % relative humidity

Check that the delivery is complete:

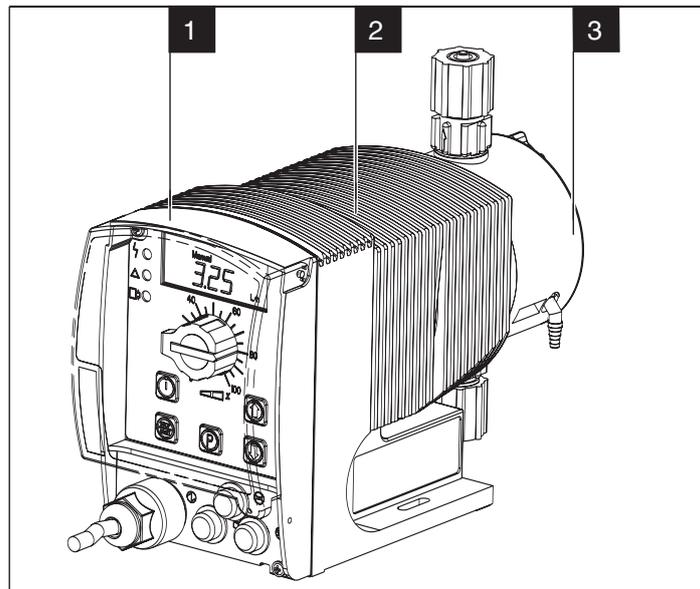
Delivery range

- Dosing pump with mains lead
- Operating instructions manual
- Accessories if applicable

4 Device Overview and Control elements

When reading this section it is helpful to fold out the overview "Control elements and key functions"!

4.1 Device overview



- 1 Control unit
- 2 Power end
- 3 Liquid end

Fig. 01

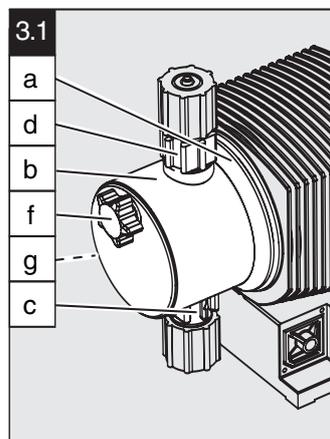


Fig. 02

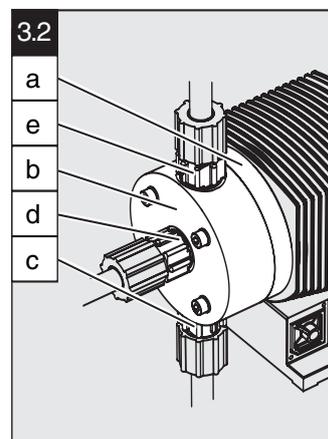


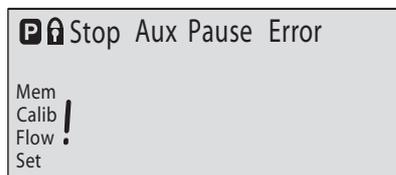
Fig. 03

- a Backplate
- b Liquid end
- c Suction valve
- d Discharge valve
- e Bleed valve
- f Coarse/fine bleed valve
- g Bypass hose nozzle

4.2 Control elements

Please acquaint yourself with the pump control elements with the help of the “control elements and key functions” overview!

Indicators The LCD display supports the operation and setting of the pump with a range of indicators:



The indicators are interpreted as follows:

Symbol for P key:	The pump is in settings mode.
Close symbol:	In a continuous display: lock (if code has been set). In settings mode: indicates access to code menu.
Stop:	The pump has been stopped using the STOP/START key.
Pause:	The pump has been stopped using the “pause” function (external).
Aux:	The pump is pumping at the auxiliary frequency. In AUX menu: the pump is in the AUX menu.
Error:	A fault has occurred and the pump has been stopped.
Auto:	The pump is in “Auto” operating mode.
Mem:	An additional “memory” function has been set in the “contact” and “batch” operating modes. In CNTCT or BATCH menus (“mem” flashes): the memory function can be set
Calib:	The pump is in the CALIB menu. In a continuous display (“calib” flashes): more than $\pm 10\%$ deviation of stroke rate from value at the moment of calibration.
Flow:	The pump is in the FLOW menu.
Set:	The pump is in the SET menu.
Command symbol:	The number of strokes reached is above the maximum value (99999) that can be shown in the LCD display

IMPORTANT

The pump pump only displays the metering output in l or l/h when calibrated

5 Function Description

Function principle Dosing takes place as follows: the dosing diaphragm is forced into the liquid end; the pressure in the liquid end causes the suction valve to close and the chemical flows out of the liquid end through the discharge valve. The dosing diaphragm is then forced back out of the liquid end. The vacuum in the liquid end causes the discharge valve to close and fresh chemical flows into the suction valve in the liquid end. This concludes one operating cycle.

The dosing diaphragm is driven by an electronically controlled electrical solenoid.

Feed rate The feed rate is determined by the stroke length and the stroke rate.

The stroke length is set between 0 - 100 % using the stroke length adjusting knob. Optimum dosing reproducibility is achieved by setting the stroke length to between 30 - 100 % (SEK type: 50 - 100 %)!

The stroke rate is set using the arrow keys (not in “analogue” operating mode) to between 0 - 180 strokes/min.

Self-bleed function Pumps with self-bleed function (= SEK types) can operate a prime action even when the discharge tubing is closed, discharging existing air through a bypass valve. These pumps can release gas even during operation, irrespective of the actual operating pressure.

An in-built pressure maintenance valve allows accurate dosing even in depressurised states.

Operating modes	<p>Operating modes are selected using the MODE menu (depending upon identity code, some operating modes may be absent).</p> <p>“ Analogue” operating mode: (Identity code, control variant: analogue current) The stroke rate is controlled via an analogue electrical signal via the “external control” terminal. Signal processing is pre-selected at the controller.</p> <p>“ Manual” operating mode: (Identity code, control variant: manual, standard function) The stroke rate is controlled manually via the controller.</p> <p>“ Contact” operating mode: (Identity code, control variant: external 1:1 / external with pulse control) This operating mode offers the opportunity to make fine adjustments with small increase/ decrease factors. Dosing can be activated by a pulse via the “external control” terminal or by a semiconductor element. With the “pulse control” option it is possible to pre-set a feed quantity (batch) or number of strokes (factor 0.01 to 99.99) via the control unit.</p> <p>“ Batch” operating function: (identity code, control variant, external 1:1 / external with pulse control) This operating mode offers the option of working with larger transfer factors (up to 65535). Metering can be triggered by pressing the P key or a pulse from the “external control” terminal via a contact or semiconductor element. A batching quantity or number of strokes can be pre-selected via the control unit.</p>
Functions	<p>The following functions can be selected using the SET menu:</p> <p>“ Calibrate” function: The pump can be operated in all operating modes including in calibrating mode. The corresponding continuous displays can show the actual feed quantity or the feed rate. Calibration is maintained within the stroke frequency range 0 - 180 strokes/ min. Calibration is also maintained when a stroke frequency is altered up to $\pm 10\%$.</p> <p>“ Pressure level” function: It is possible to set different pressure levels.</p> <p>“ Auxiliary frequency” function: It is possible to set a stroke rate in the SET menu, which may be activated via the “external control” terminal. This auxiliary frequency overrides all other pre-set stroke rate frequencies.</p> <p>“ Flow” function: Stops the pump when the flow is insufficient. In the SET menu, the number of failed strokes is entered after which the pump will be turned off.</p> <p>The following functions are available as standard:</p> <p>“ Float switch” function: Information on the liquid level in the feed chemical container is transmitted to the pump. This option requires the installation of a 2-stage float switch. This is connected to the “float switch” terminal.</p> <p>“ Pause” function: The gamma/ L can be stopped by remote control via the “external control” terminal. The pause” function operates only via the “external control” terminal.</p> <p>The following functions are activated by keystrokes:</p> <p>“ Stop” function: The pump can be stopped by pressing the STOP/START key without disconnecting from the mains power supply.</p>

“Prime” function:

Priming (short term feed at maximum frequency) is activated by pressing both arrow keys at the same time.

Optional relay The pump has two connection options.

“Fault indicating relay” option:

In the event of fault signals, warning signals or float switch activation signals, connects an electrical circuit to trigger alarm sirens etc. The relay is retrofitted via an aperture in the power end.

“Fault indicating and pacing relay” option:

Along with the fault indicating relay, the pacing relay produces an electrical impulse for every stroke. The relay is retrofitted via an aperture in the power end.

Function and error indicators

The operating and error status is shown via the three LEDs and the “error” indicator on the LCD (see also section 12):

LCD indicator If a fault occurs “error” will appear along with an additional fault warning.

LED indicator

Operating indicator (green)

This indicator is lit as long as the pump is operating correctly.

Warning indicator (yellow)

This warning light appears if the pump electronics detect a situation that could lead to a fault, e.g. “liquid levels low 1st stage”.

Warning indicator (red)

This warning light appears if a fault occurs, e.g. “liquid levels low 2nd stage”.

Hierarchy of operating modes, functions and fault statuses

The different operating modes, functions and fault statuses each have a differing effect on whether and how the pump functions. These effects are given below:

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

to:

1. “Prime” can be activated in any pump status (as long as it is operable)
2. “Fault”, “stop” and “pause” stop all system parts up to “prime”.
3. The stroke rate of the “auxiliary frequency” always overrides the existing operating stroke rate.

6 Assembly and Installation



WARNING

- The pump series dosing pumps must be commissioned exactly as described in the operating instructions manual!
- It is not permitted to assemble and install OMEGA dosing pumps with non-original parts unless these have been checked and recommended by OMEGA.
- Always depressurise tubing before working on the dosing pump. Empty and rinse out the liquid end!
- Never allow the dosing pump to operate when an discharge tube stop tap is closed ! It may burst!
- Remove all water from liquid end before commissioning or rinse with a suitable cleaning agent if using chemicals that should not come into contact with water!
- Before unscrewing the control unit disconnect the mains lead from the power supply!
- Observe applicable national directives during installation!

6.1 Assembling dosing pump



TAKE CARE

- The pump should be fixed in such a way as to prevent vibration!
- Suction and discharge valve must be upright (bleed valve in self-bleed liquid ends)!
- Ensure free access for operation and maintenance!

Assembling dosing pump

The base of the dosing pump must be mounted on a firm, horizontal surface.

6.2 Assembling tubing

6.2.1 Installation for non-self bleeding pumps



CAUTION

- Tubing must be free from stress and kinks when fitted!
- When dosing extremely aggressive or hazardous chemicals it is advisable to install a bleed valve that feeds back to the container and isolation valves on the prime and discharge sides.
- In order to ensure connections are fast, use correctly sized clamping rings and nozzle unions!
- Use only original hoses with specified dimensions and wall-thicknesses!
- Do not exceed maximum permissible priming pressure (see section 14)!
- It is imperative that the maximum permissible operating pressure is not exceeded (see section 14 and appendix documentation)!

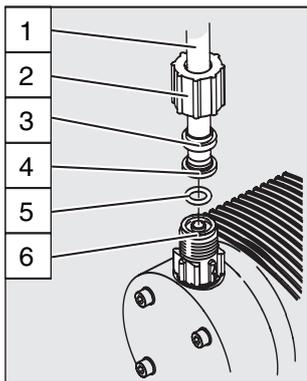
GUIDELINE

The tubing should be attached in such a way as to allow lateral detachment of the pump and the liquid end if necessary!

PP, PC, NP, TT versions

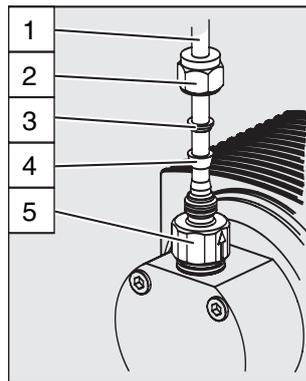
Assembling tubing to plastic valves (see fig. 04)

- ▶ Cut hose ends straight across
- ▶ Push union nut (2) and clamping ring (3) onto hose (1)
- ▶ Push the hose end (1) over the nozzle (4) to the stop. Widen if necessary
- ▶ Make sure that the O-ring (5) is sitting correctly in the valve (6)
- ▶ Place the hose (1) with the nozzle (4) onto the valve (6)
- ▶ Clamp the hose connector:
Tighten the union nut (2) while pressing in the hose (1)
- ▶ Retighten the hose connector:
Pull the tubing (1) connected to the liquid end briefly and then retighten the union nut (2)



- 1 Hose
- 2 Union nut
- 3 Clamping ring
- 4 Nozzle
- 5 O-ring
- 6 Valve

Fig. 04



- 1 Tube
- 2 Union nut ring
- 3 Rear clamping ring
- 4 Front clamping ring
- 5 Valve

Fig. 05

SS Version

Assembling stainless steel tube connectors to stainless steel valves (see fig. 05)

- ▶ Push union nut (2) and clamping rings (3, 4) onto tube (1) leaving approx. 10 mm distance between them
- ▶ Push tube (1) up to the stop in the valve (5)
- ▶ Tighten union nut (2)

SS Version

Assembling tubing to stainless steel valves



TAKE CARE

Assemble only PE or PTFE tubing to stainless steel valves!

- ▶ Insert an additional support (stainless steel) into PE or PTFE tubing

Installing suction tubing



TAKE CARE

Do not exceed maximum permissible priming pressure on the prime side (see section 14)!

GUIDELINE

- Make suction tubing as short as possible.
- Suction tubing should be rising in order to prevent air bubbles forming!
- As far as possible use swept bends for bends rather than right angle bends!
- Measure the length and cross section to ensure that the vacuum created by the priming action does not reach the vaporising pressure of the feed chemical! In extreme cases excess vacuum on the priming side can cause breaks in the liquid column or incomplete return stroke!
- Please note: "Priming lift x density of feed chemical ≤ max. priming lift" (in m WG)

Assembly of foot valve

- ▶ Cut the free suction end so that the foot valve hangs just above the container base; for chemicals with impurities or sedimentation at the bottom, the foot valve should be positioned well above this layer.

Installing pressure tubing



TAKE CARE

- The discharge tubing should be laid in such a way as to ensure that the pressure surge of the discharge stroke does not exceed the maximum operating pressure. As overload protection for the discharge tubing, it is advisable to fit a relief valve feeding back into the chemical supply container, e.g. a OMEGA multifunction valve.
- Check that the length and cross section of the tubing are correct!

6.2.2 Installation of self-bleeding pumps



CAUTION

- Observe all installation and safety guidelines for standard pumps!
- Do not exceed tubing cross section, priming lift, priming pressure or viscosity of feed chemical!

In addition to the suction and discharge tubing, a bypass tube should be connected. This is attached to the bleed valve on the upper side of the liquid end (red packing, see fig. 06).

GUIDELINE

The discharge valve is located on the front of the liquid end in the SEK type!

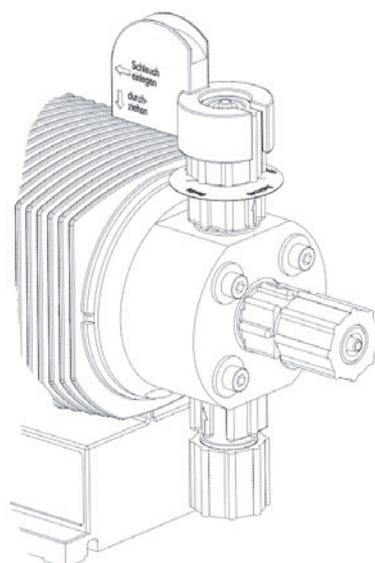
Installation of by-pass tubing

GUIDELINE

When the suction side is primed, at least equal pressure must exist in the bypass tubing!

The pump can operate when the bypass is primed and the suction side is depressurised.

- ▶ Place the tube onto the bypass nozzle and/or bleed valve of the self-bleed function liquid end (recommended: flexible 6x4 PVC hose)
- ▶ Push the free end of the tube back into the dosing container
- ▶ Cut the bypass tube so that it does not enter the feed chemical.



Bleed valve for the bypass tube to the supply container, 6/4 mm

Discharge valve for discharge tubing to injection point, 6/4 - 12/9 mm

Suction valve for suction tubing in supply container, 6/4 - 12/9 mm

Fig. 06

6.3 Electrical installation



WARNING

- Installation must be carried out by a trained engineer!
- Disconnect pump from mains power supply during 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.
- Observe applicable national directives when installing the dosing pumps!
- When connecting with parallel inductive power consumers a switch contact must be fitted, e.g. relay or contactor!

Connection to mains power supply

Connect the pump to the mains power supply using the mains lead

Parallel connection to inductive power consumers

If the pump is connected to the mains in parallel with inductive power consumers (e.g. solenoid valve, motor) they must be electrically isolated. This will avoid damage caused by induction and voltage surges when switching off.

- ▶ Fit individual contacts for the pump and supply power via auxiliary contactor or relay. If this is not possible, then:
- ▶ Connect a varistor in parallel (order number *710912) or an RC circuit, 0.22 $\mu\text{F}/220 \Omega$ (order number *710802). *(Contact OMEGA's spare parts department)

Power element (in base of pump)

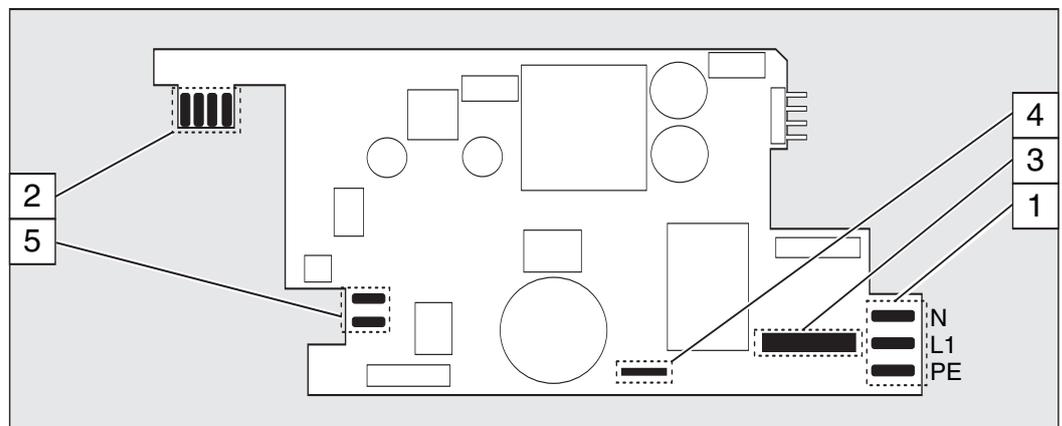


Fig. 07

- 1 Mains terminal
- 2 Relay circuit terminal
- 3 Fuse
- 4 Solenoid earth lead terminal
- 5 Solenoid terminal

“External control” terminal

The “external control” terminal is a five pin in-built terminal. It is compatible with the two and four core cables used previously. The “auxiliary frequency” function is only available with a five core cable.

Configuration

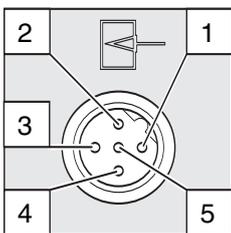
Electrical interface for “external contact” - “pause” - “auxiliary frequency”:

- Voltage when contacts open: approx. 5 V
- Input resistance: 10 k Ω
- Control: voltage free contact (load: 0.5 mA at 5 V),
or: Semiconductor switch (residual voltage < 0.7 V)
- Maximum pulse frequency: 25 pulses/s
- Required pulse duration: ≥ 20 ms

Electrical interface for “external analogue”:

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

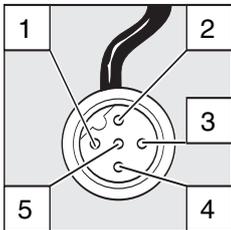
Configuration



Pin	Function	2 core cable	4 core cable	5 core cable
Pin 1	Pause	Jumped at pin 4	Brown	Brown
Pin 2	External contact	Brown	White	White
Pin 3	External analogue	–	Blue	Blue
Pin 4	Earth	White	Black	Black
Pin 5	Auxiliary frequency	–	–	Grey

Fig. 08

Plug configuration



“Pause” function

The pump is not operating when

- The cable is connected and pins 1 and 4 are free.

The pump is operating when

- The cable is connected and pins 1 and 4 are connected.
- There is no cable connected (pin 1 is free).

Fig. 09

“Contact” und “Batch” operating modes

One or more discharge strokes are triggered when pin 2 and pin 4 are connected to one another for at least 20 ms.

Otherwise, pin 1 and pin 4 must be connected.

“Analogue” operating mode

The stroke frequency of the gamma/ L is controlled via an electrical signal. The electrical signal is applied between pins 3 and 4.

Otherwise, pin 1 and pin 4 must be connected.

“Auxiliary frequency” function

The pump runs at a pre-set stroke rate when pin 5 and pin 4 are connected to one another. Otherwise, pin 1 and pin 4 must be connected.

The factory setting for this function is 180 strokes.

IMPORTANT

For function and operating mode hierarchy, see section 5!

Connecting two pumps in series

Connect two pumps in series as follows if you wish to control both via an electrical signal in the "analogue" operating mode (see section 7.4.2):

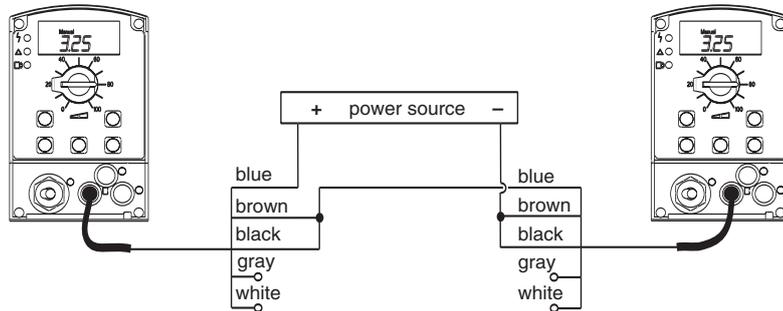


Fig. 10

"Float switch" terminal

Optional fitting of a 2-stage float switch with prior warning and limit switch capacity.

Configuration

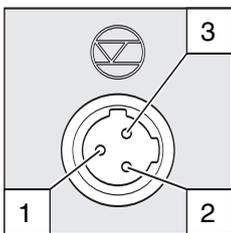


Fig. 11

Electrical interface:

- Voltage when contacts open: approx. +5 V
- Input resistance: 10 k Ω
- Controller: voltage free contact (load: 0.5 mA at + 5V),
or: semiconductor switch (residual voltage < 0.7 V)

Plug configuration

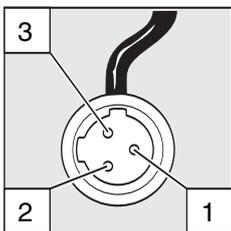


Fig. 12

Function

Pin	Function	3 core cable
Pin 1	Earth	black
Pin 2	Minimum prior warning	blue
Pin 3	Minimum limit switch	brown

"Dosing monitor" terminal

Optional connection of dosing monitor.

Configuration

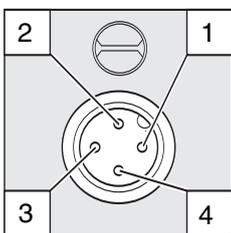


Fig. 13

Electrical interface:

- Voltage when contacts open: approx. +5 V
- Input resistance: 10 k Ω
- Controller: voltage free contact (load: 0.5 mA at + 5V)

Plug configuration

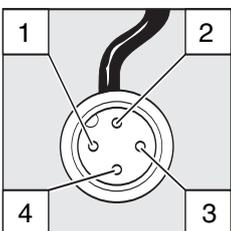


Fig. 14

Function

Pin	Function	4 core cable
Pin 1	Power supply (5V)	brown
Pin 2	Encoding	white
Pin 3	Response	blue
Pin 4	Earth	black

	Relay		
"Fault indicating relay" output	<p>A fault indicating relay may be ordered optionally. It is used as the signal output when a pump fault has been detected and to indicate the prior warning signal "liquid level low, stage 1" and the fault signal "liquid level low, stage 2".</p> <p>Allocation of signal types to "N/O" and "N/C" relay states is selected on the basis of the identity code descriptors.</p> <p>The relay can be retrofitted and is ready to operate after inserting the relay component (see section 6.4).</p> <p>The pump is delivered ex works with default settings for a N/C relay. If an alternative switch function is required the pump can be reprogrammed at OMEGA.</p>		
Electrical interface	<ul style="list-style-type: none"> • Contact load: 250 V/2 A 50/60 Hz • Operating life: > 200.000 switch cycles 		
"Fault indicating relay and pacing relay" output	<p>A fault indicating relay and pacing relay output may be ordered optionally. The pacing relay output is electrically isolated via an optical coupler with a semiconductor switch. The second switch is a relay as for the "fault indicating relay" variant.</p> <p>The fault indicating / pacing relay can be retrofitted (see section 6.4).</p> <p>The pump is delivered ex works with default settings for a N/C fault indicating relay and a N/O pacing relay. If an alternative switch function is required the pump can be reprogrammed at OMEGA.</p>		
Electrical interface	For semiconductor switch		For relay output
	<ul style="list-style-type: none"> • Residual voltage: < 0,4 Volt at $I_c = 1 \text{ mA}$ • Maximum voltage: < 100 mA • Maximum current: 24 V/DC • Pacing relay pulse duration: approx. 100 ms 		<ul style="list-style-type: none"> • Contact load: 24 V/100 mA 50/60 Hz • Operating life: > 200.000 switch cycles
"Fault indicating relay" option	Relay cable contact configuration		
	VDE cable	CSA cable	Contact
	white	white	NO (normally open)
	green	red	NC (normally closed)
	brown	black	C (common)
"Fault indicating relay and pacing relay" option	VDE cable	Contact	Relay
	yellow	NO (normally open)	Fault indicating relay
	green	C (common)	Fault indicating relay
	white	NO (normally open)	Pacing relay
	brown	C (common)	Pacing relay

6.4 Retrofitting relays

Delivery range:

- 1 relay circuit set with 2 screw fasteners
- 1 relay cable set with socket
- 1 seal

Press-out relay opening



WARNING

Disconnect pump from the mains power supply and rinse liquid end before commencing work (see section 13)!



TAKE CARE

When preparing the opening, ensure that the punch is not forced through the entire pump base!
Pump circuits may become damaged.

- ▶ Place the pump on a firm surface with the relay opening press-out section at the top (see fig. 15:a)
- ▶ Place a punch (dia. 8-15 mm) in the centre of the relay opening press-out section , and strike briefly and sharply with a hammer (approx. 250 g)
- ▶ If necessary clean up the edges of the opening
- ▶ Remove the pressed out section from the pump

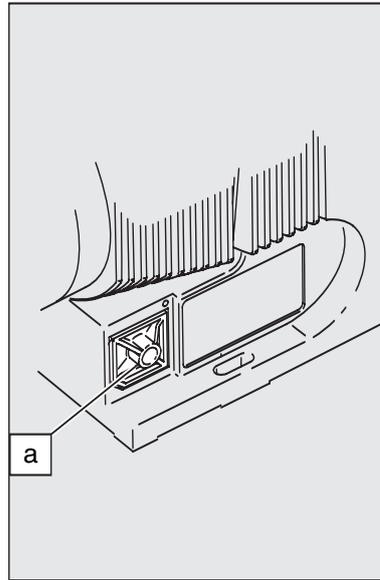


Fig. 15

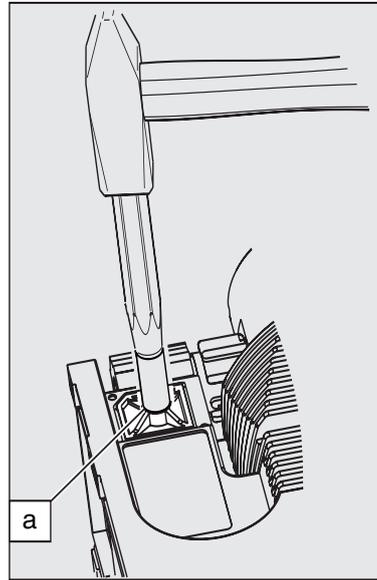


Fig. 16

Inserting the relay component

- ▶ Hold the relay component with your right hand gripping the left and right hand edges of the relay cover, and tilt the front end slightly to the left (see fig. 17)
- ▶ Push the relay component through the relay opening, holding the upper corner of the lower edge against the guide rail on the pump base, until the contact of the relay component has reached the controller contact. (See fig. 18: test: can you still move the end of the circuit back and forth?)
- ▶ Gently push the relay component right into the opening.
- ▶ Screw the relay cover firmly onto the housing using the screws provided.
- ▶ Insert the relay cable plug seal into the relay cover and screw on the plug (see fig. 19)

The pump is delivered ex works with default settings for a N/C fault indicating relay and a N/O pacing relay. If an alternative switch function is required the pump can be reprogrammed at OMEGA.

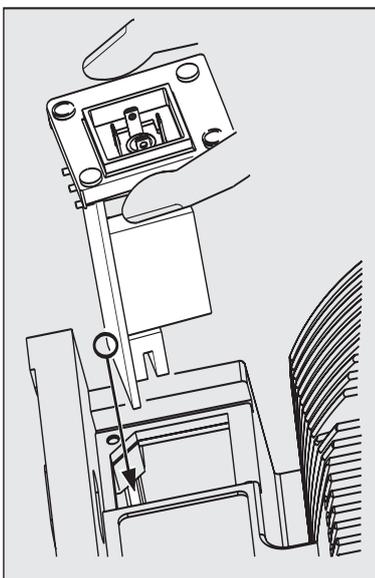


Fig. 17

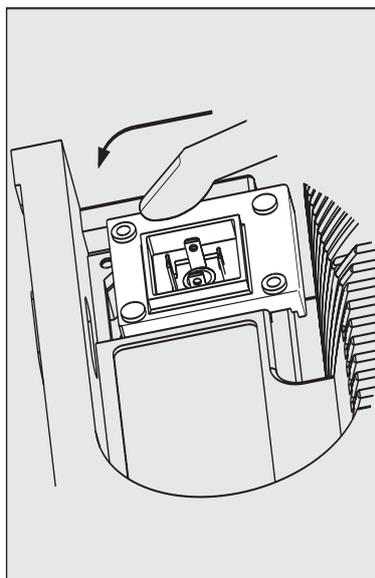


Fig. 18

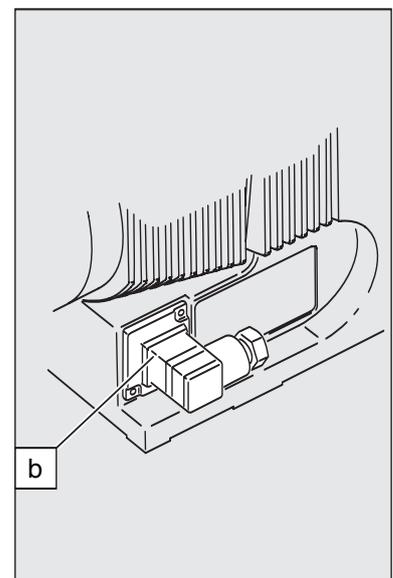


Fig. 19

7 Settings

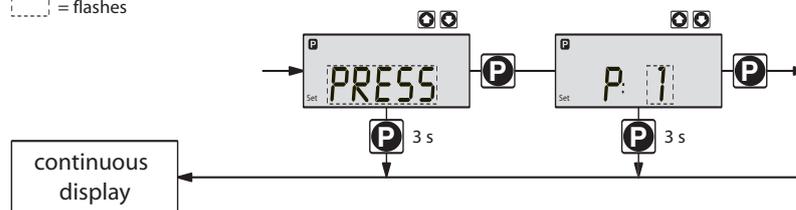
GUIDELINE

- Open out the fold-out page following the title page fully! There you will find the overviews “control elements and key functions” and “operating/settings diagram”.
- If no keys are pressed within a period of 1 minute, the pump will return to a continuous display.

Basic information for setting up the pump

= Settings option

= flashes

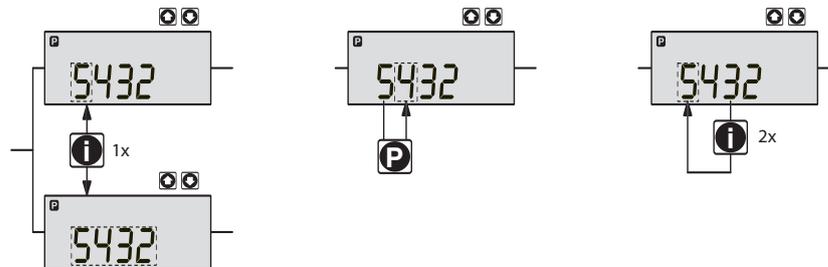


Confirm entries

Press the P key briefly;
you will automatically move to the next menu option or to a continuous display.

Exit menu option
without confirming

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



Incremental change
of a value

Press the i key 1x;
you can toggle between altering the digits of a value (“change individual digits” = standard) or incremental alteration of a value (“change a figure”).

Change adjustable values

Press UP or DOWN arrow key;
The flashing digit or figure will start to increase or decrease incrementally.

Confirm adjustable values

For “change individual digits”: confirm each digit using the P key. When the last digit has been confirmed you will automatically move to the next menu option or to a continuous display.
For “change a figure”; press the P key 1x; you will simultaneously move to the next menu option or to a continuous display.

Correct wrongly set digits

Press the i key 2x;
you will go back to the first digit.

7.1 Check adjustable values

Before setting up the pump you can check the current settings of adjustable values.

Press the i key ("i" as in "info") when the pump is in continuous display mode (There is no P key symbol in the LCD display):

Each time you press the i key you will see a different continuous display. The number of continuous displays depends upon the identity code, the selected operating mode and the connected accessories (see overview "continuous displays").

7.2 Change to settings mode

If you hold down the P key for 2 seconds in any continuous display, the pump will change to the settings mode.

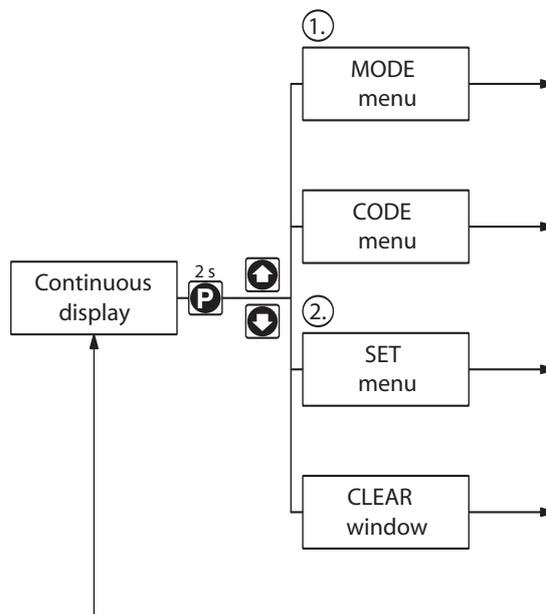
If CODE 1 is set, the code must be entered after pressing the P key.

The following menu options appear first in the settings mode (see also overview "operating/ settings diagram"):

- MODE menu
- CODE menu (optional)
- SET menu
- CLEAR window

In order to adapt the pump to your process requirements you must:

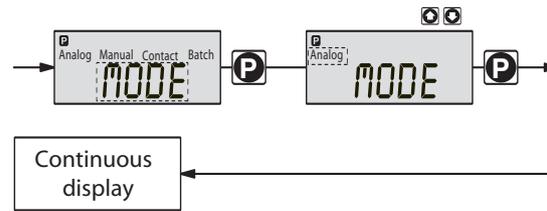
1. Select the operating mode in the MODE menu
2. Adjust settings to this operating mode in the SET menu



7.3 Select operating mode (MODE menu)

The following operating modes are selected via the MODE menu (depending upon identity code, some operating modes may be absent):

- Manual: for operation by hand
(Identity code, control variant: manual, standard option)
- Analogue: for electronic control
(Identity code, control variant: analogue current)
- Contact: for contact operation
(Identity code, control variant: external 1:1 / external with pulse control)
- Batch: for batch operation
(Identity code, control variant: external with pulse control)



7.4 Settings for operating mode (SET menu)

In the SET menu you can adjust various settings depending upon the selected operating mode.

The following programmable function settings menus appear in all operating modes:

- Calibrate (CALIB menu)
- Pressure levels (PRESS menu)
- Auxiliary frequency (AUX menu)
- Flow (FLOW menu, available only if flow monitor is connected)

See also section 7.5!

Further settings menus depend upon the selected operating mode.

7.4.1 Settings for "manual" operating mode

There are no other settings menus in the overall SET menu for the "manual" operating mode apart from those described in 7.5.

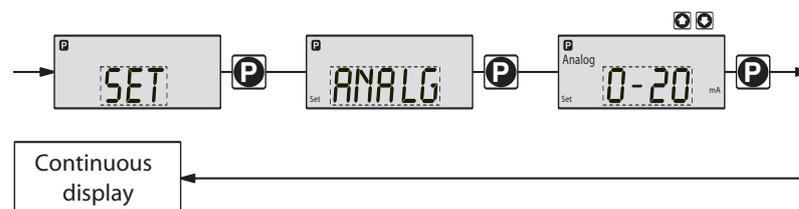
7.4.2 Settings for "analogue" operating mode (ANALG menu)

In addition to those settings menus described in 7.5, there is an additional ANALG menu in the overall SET menu for the "analogue" operating mode.

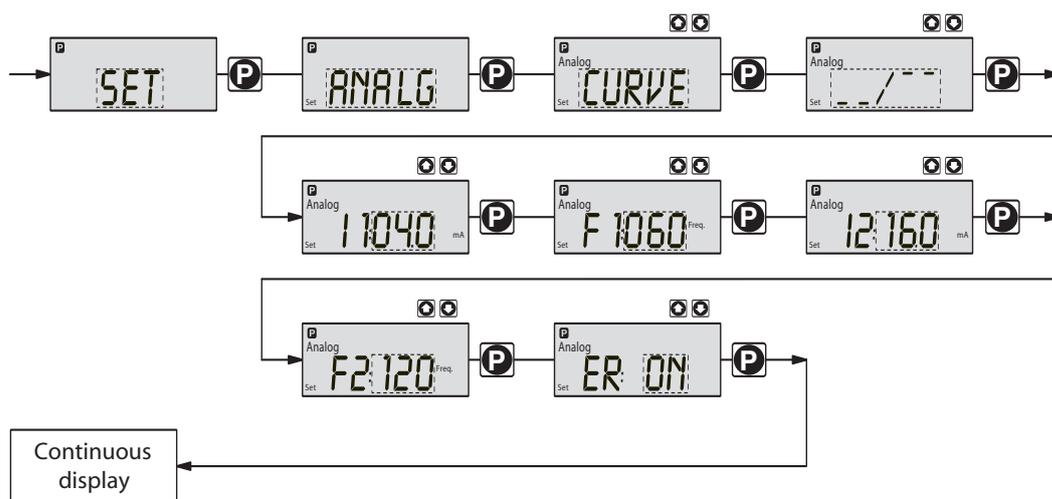
The stroke rate is controlled by an analogue electrical signal via the "external control" terminal.

You can select three signal-processing methods:

- 0 - 20 mA: at 0 mA the pump does not operate
at 20 mA the pump operates at 180 strokes/min.
Between these two extremes the stroke rate is proportional to the electrical signal.



- 4 - 20 mA: at 4 mA the pump does not operate
at 20 mA the pump operates at 180 strokes/min.
Between these two extremes the stroke rate is proportional to the electrical signal.
For signals of below 3.8 mA a fault will be detected and the pump will stop (e.g. cable break).
- Curve: In the "curve" processing mode you can programme the pump ratios.
There are 3 options available:
 - ----- = straight line
 - - - - \ - - - = lower band
 - - - - / - - - = upper band



Straight line:

The following symbol appears in the LCD display: ----- .

You can enter any stroke frequency ratio for the pump in proportion to the electrical signal. You must enter two points P1 (I1, F1) and P2 (I2, F2). F1 is the stroke rate at which the pump should operate at current I1: the straight line and the ratio are fixed accordingly:

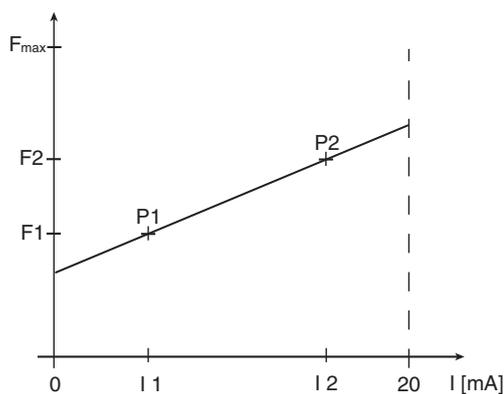


Fig. 20

GUIDELINE

Draw a diagram like the one above - with values for (I1, F1) and (I2, F2) - in order to set the pump to your required stroke rate !

Lower/upper band:

This processing mode allows you to control a pump via an electrical signal as shown in the diagrams below.

You may also control two pumps for different feed chemicals from a single signal (e.g. one acid pump and one alkali pump from a pH sensor signal). The pumps must be connected electrically in series (see wiring plan in section 6.3).

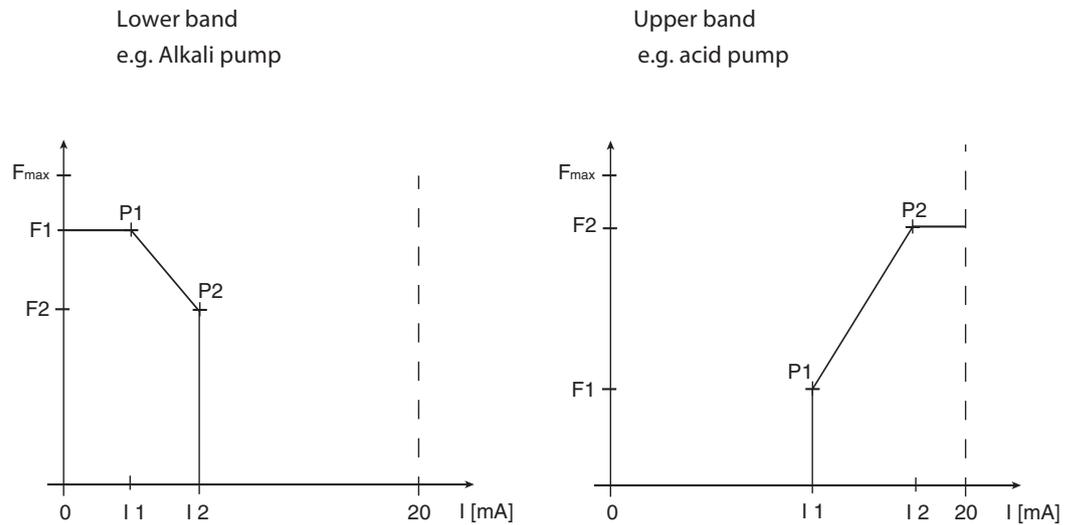


Fig. 21

Fig. 22

Lower band:

The symbol $\text{---}\backslash\text{---}$ appears in the LCD display. pump will operate below I1 at F1. Above I2, the pump ceases to operate. Between I1 and I2 the stroke rate is between F1 and F2, proportional to the signal current.

Upper band:

The signal $\text{---}/\text{---}$ appears in the LCD display. The pump will cease to operate below I1. Above I2, the pump will operate at F2. Between I1 and I2 the stroke rate between is F1 and F2, proportional to the signal current.

Above I2 the pump will continue to operate at F2.

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

Error processing

In the "ER" (error) menu option you can activate an error processing function for the "curve" mode. An error message appears for signals below 3.8 mA and the pump stops.

7.4.3 Settings for "contact" operating mode (CONTCT menu)

In addition to those settings menus described in 7.5, there is an additional CONTCT in the overall SET menu for the "contact" operating mode.

The operating mode "contact" allows you to activate a single stroke or a series of strokes. The strokes can be activated by a pulse or via the "external control" terminal. This operating mode is intended to transfer input pulses into a reduction (break) or small increase in strokes.

The following versions are available:

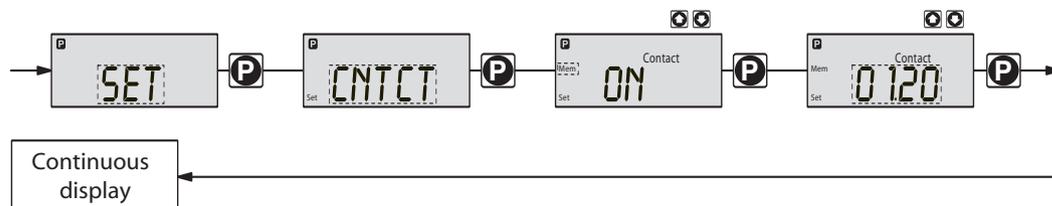
- Contact - identity code: external 1:1
- Contact - identity code: external with pulse control

Contact – identity code: external 1:1

In the “contact - identity code: external 1:1” version the pump makes precisely 1 stroke per pulse (identity code: external 1:1). No entry possible.

Contact – identity code: external with pulse control

In the “contact - identity code: external with external pulse control” you can enter the number of pulses after which a stroke should be carried out. “Contact - identity code: external with external pulse control” is intended for small dosing quantities.



The number of strokes per pulse depends upon the factor, which you can enter. This allows you to vary to a certain extent the input pulses by a factor of 1.01 to 99.99 and/or reduce by a factor of 0.01 to 0.99:

“Number of strokes activated = factor x number of input pulses”

Examples	Factor	Pulse (sequential)	Stroke number (sequential)
Increase	1	1	1
	2	1	2
	25	1	25
	9999	1	9999
	1.50	1	1.5 (1 / 2)
	1.25	1	1.25 (1 / 1 / 1 / 2)
Reduction	1	1	1
	0.50	2	1
	0.10	10	1
	0.01	100	1
	0.25	4	1
	0.40	2.5 (3 / 2)	(1 / 1)
	0.75	1.33 (2 / 1 / 1)	(1 / 1 / 1)

Explanation of increase

- At a factor of 1 For every 1 pulse, 1 stroke is activated
- At a factor of 2 For every 1 pulse, 2 strokes are activated
- At a factor of 25 For every 1 pulse, 25 strokes are activated

Explanation of decrease

- At a factor of 1 After 1 pulse, 1 stroke is activated
- At a factor of 0.5 After 2 pulses, 1 stroke is activated
- At a factor of 0.1 After 10 pulses, 1 stroke is activated
- At a factor of 0.75 After 2 pulses, 1 stroke is activated, then after 1 pulse, 1 stroke is activated, then after 2 pulses, 1 stroke is activated etc.

GUIDELINE

If a remainder occurs when the factor is processed, the pump counts up the remainder values. When the sum reaches or exceeds “1” the pump will activate a stroke. This ensures that the stroke number corresponds exactly to the factor throughout the dosing operation .

The number of input pulses which have not been processed are stored by the pump in the stroke memory. When the STOP/START key is pressed or the "pause" function is activated, the stroke memory is deleted (this can be avoided using the "memory" extension function, see below).

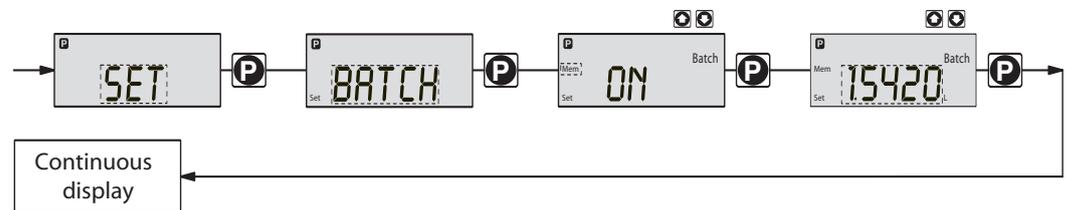
The "contact - identity code: external with pulse control" version allows optimum adaptation of the pump, in conjunction with e.g. water contact meters, to any process.

"Memory" extension function

The "memory" extension function can be optionally activated ("mem" appears in the LCD display). When "Memory" is activated, the pump adds up the unused excess strokes, up to the stroke memory's maximum capacity of 65535 strokes. If the maximum capacity is exceeded the pump will malfunction.

7.4.4 Settings for "batch" operating mode (BATCH menu)

In addition to those settings menus described in 7.5, there is an additional BATCH menu in the overall SET menu for the "batch" operating mode.



The "batch" operating mode is a variant of the "contact" operating mode (see 7.4.3).

You can pre-select a stroke number (no breaks, whole numbers only from 1 to 65535) as well as a feed quantity (batch). To switch between entries for "stroke number" and "feed quantity" press the i key 1x in the corresponding menu option (see also overview "operating/settings diagram", fold-out page).

The "batch" operating mode is intended for large dosing quantities.

Metering is activated by pressing the P key or via a pulse from the "external control" terminal. The number of input pulses which have not been processed are stored by the pump in the stroke memory. When the STOP/START key is pressed or the "pause" function is activated, the stroke memory is deleted (this can be avoided using the "memory" extension function, see below).

"Memory" extension function

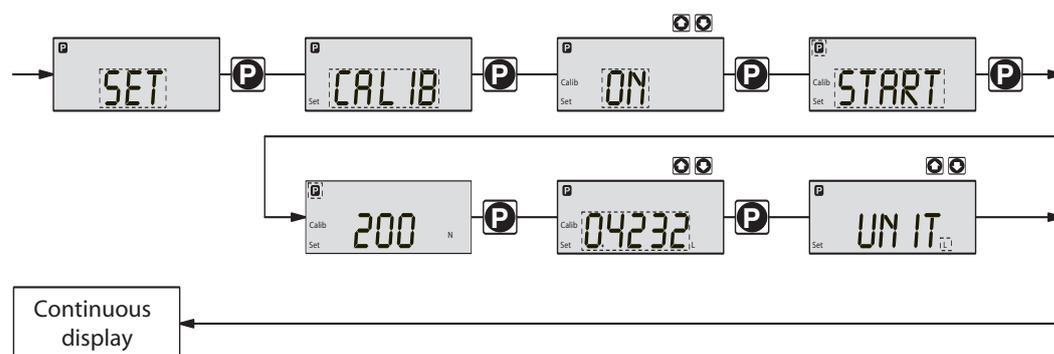
The "memory" extension function can be optionally activated ("mem" appears in the LCD display). When "Memory" is activated, the pump adds up the unused excess strokes, up to the stroke memory's maximum capacity of 65535 strokes. If the maximum capacity is exceeded the pump will malfunction.

7.5 Settings for programmable functions (SET menu)

The following programmable function settings menus appear in all operating modes:

- Calibrate (CALIB menu)
- Pressure levels (PRESS menu)
- Auxiliary frequency (AUX menu)
- Flow (FLOW menu, available only if flow monitor is connected)

7.5.1 Settings for "calibration" function (CALIB menu)



The pump can also run in calibration mode. The corresponding continuous displays show the current dosing quantities or the feed rate.

Calibration is maintained when a stroke rate is altered up to $\pm 10\%$. If the stroke rate is altered more than $\pm 10\%$ the yellow warning light is lit, the continuous display flashes and the flashing message "calib" appears.

GUIDELINE

- Do not go below 30 % stroke length (SEK type: 50%). This will significantly affect accuracy of calibration.
- Calibration becomes increasingly accurate the more strokes made by the pump during calibration (recommended: at least 200 strokes).



WARNING

- If using a hazardous feed chemical, the following setting instructions ensure adequate safety precautions have been taken!

- Calibration
- ▶ Insert the suction tube into a measuring cylinder containing the feed chemical - the discharge tubing must also be correctly installed (operating pressure,...!)
 - ▶ Suck up the feed chemical (press both arrow keys at the same time) when the suction tube is empty
 - ▶ Note the liquid level in the measuring cylinder and the stroke length
 - ▶ Select the CALIB menu and go the first menu option using the P key
 - ▶ Select "ON" using an arrow key and change to the next menu option using the P key
 - ▶ To commence calibration, press the P key. The pump starts to pump and displays the number of strokes ("STOP" appears at regular intervals) (the pump works at the stroke frequency set under "MANUAL").
 - ▶ After a sufficient number of strokes, stop the pump with the P key
 - ▶ Calculate the dosed quantity (difference between the original quantity and the quantity remaining)
 - ▶ Enter this quantity in the menu and then go to the next menu option using the P key
 - ▶ Select the unit ("L" or "gal") in the "UNIT" menu with an arrow key

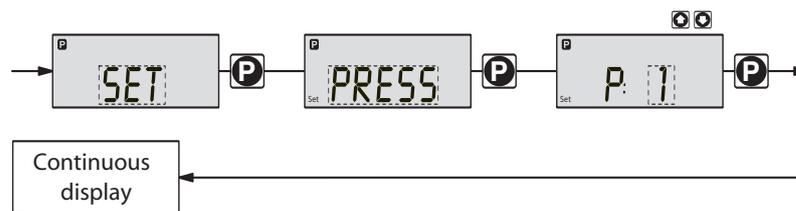
The pump is calibrated.

The corresponding continuous displays show the calibrated values.

The total stroke number and total litres are set during calibration to "0".

The pump is in the STOP state.

7.5.2 Settings for the “pressure levels” function (PRESS menu)



The programmable function “pressure levels” is used to reduce the rated pressure of the pump.



CAUTION

- The rated pressure can be considerably exceeded at stroke lengths of below 100 %! The rated pressure relates to a stroke length of 100 %.
- If another liquid end size is installed the pump must be reprogrammed on factory premises!
- Select as large a rated pressure as required and as small as possible! This will increase system safety (reduces the risk of the tubing bursting when blocked)! This also protects the diaphragm and saves electricity.

GUIDELINE

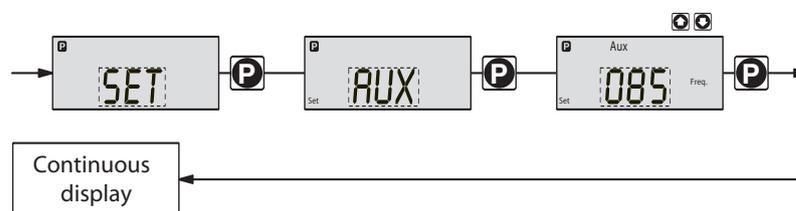
If installing another liquid end size the pump must be reprogrammed on factory premises.

The following rated pressures can be selected for these liquid end sizes (rated pressure in bar):

Liquid end size	Pressure level 1	Pressure level 2	Pressure level 3	Pressure level 4
PHP-202A/203A/ 205A/212A/213A/215A	4	7	10	16
PHP-201A/204A/ 211A/214A	4	7	10	
PHP-206A/216A	4	7		

No adjustments can be made for pump types PHP-207A/217A.

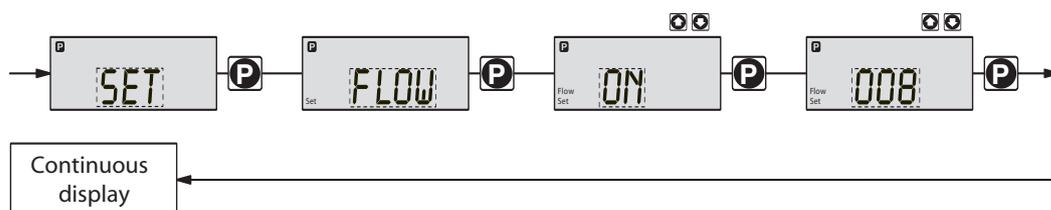
7.5.3 Settings for “auxiliary frequency” function (AUX menu)



The programmable function “auxiliary frequency” allows switching to a different stroke frequency, which can be set in the AUX menu. It can be activated via the “external control” terminal. When the auxiliary frequency is activated, “aux” appears in the LCD display.

This auxiliary frequency overrides the current stroke frequency set for the selected operating mode.

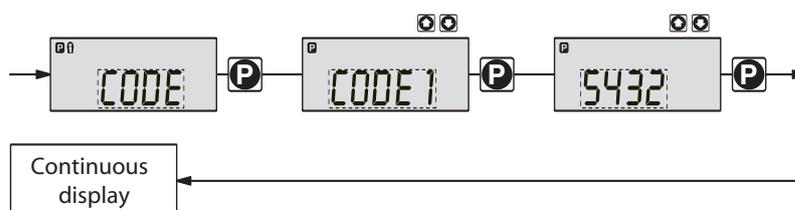
7.5.4 Settings for the “flow” function (FLOW menu)



The flow menu only appears when a dosing monitor is connected to the “dosing monitor” terminal. This dosing monitor registers each discharge stroke of the pump at the discharge connector and transmits it back to the pump. If this response transmission is serially omitted for a period set in the FLOW menu (due to failure or below-minimum dosing) the pump stops.

7.6 Setting code (CODE menu)

The code menu is used to select whether you want to prevent access to parts of the settings options.



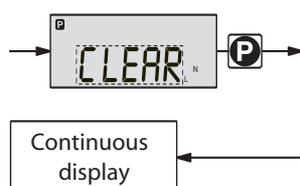
In the first menu option you can choose CODE 1 or CODE 2 (both use the same number).

- Select CODE 1 to prevent access to the settings mode (• in the overview “operating/ settings diagram”, fold-out page). In the next menu option, enter the number you wish to use as the code.
- Select CODE 2 to prevent access to the settings options for directly alterable values in the continuous displays (• in the overview “operating/settings diagram”, fold-out page). In the next menu option, enter the number you wish to use as the code.
- Select NONE to remove a pre-set security lock.

7.7 Cancel total stroke number or total litres (CLEAR window)

In the CLEAR window you can delete the stored total stroke number and simultaneously the total litres (= set to “0”). You may then press the P key briefly to exit this window.

The values displayed are counted incrementally from the point of commissioning the pump, or from the last delete action.



8 Commissioning



WARNING

- Protect yourself from contact with hazardous feed chemicals!
- Remove all water from liquid end before commissioning or rinse out with a suitable material if using chemicals that should not come into contact with water! (Proceed as described below. The liquid end may contain water left over from factory testing.)
- After long periods out of commission the pump is not guaranteed to meter absolutely reliably, as feed chemicals in the valves and diaphragm can crystallise! Check valves and diaphragm regularly (see section 10)!
- Check the seals of the pump connections and connectors.
- Check whether coarse or fine bleed vent is closed (see also fine bleed function).

GUIDELINE

- Set stroke length only while pump is running!
- The pump should prime at 100 % stroke length as the suction lift is dependent upon lift volume when the liquid end is empty. If the pump is required to prime at less than 100 % stroke length, and fails to do so, then select a correspondingly smaller suction lift.
- SEK type: priming capacity is diminished if discharge takes place against pressure!
- Retighten screws in liquid end after 24 hours (see section 10)!

Removing water from liquid end

When using with chemicals that should not come into contact with water:

- ▶ Turn the pump so that the discharge connector is pointing downwards.
- ▶ Allow water to run out of the liquid end.
- ▶ Rinse the suction connector from above with a suitable material.

Filling liquid end



WARNING

Protect yourself from contact with hazardous feed chemicals!

For liquid ends without coarse/fine bleed function:

- ▶ Connect suction tubing, but not discharge tubing, to liquid end
- ▶ Switch on the pump and allow to run at maximum stroke length and stroke rate, until the liquid end is full and free from air bubbles (a little feed chemical will seep out of the discharge valve)
- ▶ Switch off the pump
- ▶ Connect discharge tubing to liquid end

The pump is ready to operate.

For liquid ends with coarse/fine bleed function:

- ▶ Connect suction and discharge tubing to liquid end
- ▶ Connect bypass tubing
- ▶ Open the bleed valve by rotating the knob on the top anticlockwise. Opens access to the bypass tubing for coarse bleed function.
- ▶ Switch on the pump and allow to run at maximum stroke length and stroke rate, until the liquid end is full and free from air bubbles (the feed chemical is visible in the bypass and discharge tubing)
- ▶ Close the bleed valve (turn clockwise)
- ▶ Switch off the pump

The pump is ready to operate.

IMPORTANT

- For gaseous chemicals there must be a continuous partial flow back to the supply container. The return flow quantity should be approx. 20 % of the feed quantity.
- The feed chemicals should be non-viscous and free from suspended particles.
- The bypass tubing should end above the liquid level in the supply container. The fine bleed valve then acts as a vacuum breaker which prevents the possibility of a vacuum in the discharge tubing causing the container to be emptied.

Fine bleed function

When metering slightly gaseous chemicals the liquid end can be continuously de-aerated via the fine bleed vent, if a coarse/fine bleed vent is present.

Open fine bleed vent (see fig. 23):

- ▶ Pull off the cap (a) from the coarse/fine bleed vent (b).
- ▶ Turn the screw (c) in the coarse/fine bleed vent approx. 1 turn anticlockwise with a screwdriver.

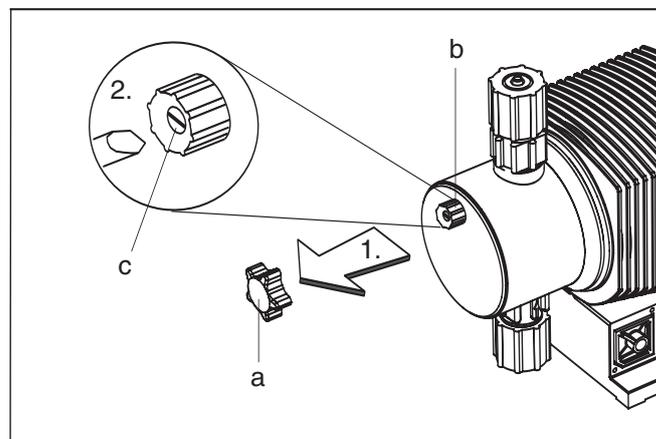


Fig. 23

For self-bleed dosing pumps (SEK type):

IMPORTANT

On this liquid end the discharge connector is horizontal - the bleed valve is at the top! (The bleed connector is identified on delivery with a red collar!)

- ▶ Connect the suction and discharge tubing to the liquid end
- ▶ Connect the bypass tubing to the liquid end
- ▶ Switch on the pump and allow to run at maximum stroke length and stroke rate until the liquid end is full and free from air bubbles (the feed chemical is visible in the bypass and discharge tubing)
- ▶ Switch off the pump

The pump is ready to operate.

8.1 Precision dosing settings

IMPORTANT

- For highly viscous and gaseous chemicals select a large stroke length and a low stroke rate!
- For good mixing action, select a low stroke length and high stroke rate!
- For precision dosing, set stroke length higher than 30 % (SEK type: higher than 50 %)!

8.2 Diagrams for setting feed capacity

General

- ▶ Open out the page showing the diagram of your pump type (see appendix).
- ▶ Calculate the correction factor. Mark the operating pressure for your application in the diagram "correction factor depending upon operating pressure".
- ▶ Trace a line from this value vertically up to the curve and then horizontally left. Read off the correction factor.
- ▶ Divide the required feed rate by the correction factor determined as above. Mark this value (l/h) on the "l/h" axis in the diagram "feed rate depending upon stroke length and stroke rate".
- ▶ Trace a line horizontally from this value to the left. Trace a line from the intersection with the straight line for the adjustable stroke frequencies vertically downwards to the "stroke length" axis.
- ▶ Set the pump to one of the stroke frequencies determined in this way, and the corresponding stroke length.

The measurements for determining the feed rate for the following diagrams were carried out using water and the correction factor was determined at a 70 % stroke length. Distribution of the feed rate across all material versions: -5 to +15 %.

9 Operating

This section describes all operating options available to you when the pump is in continuous display mode (no P key symbol in the LCD display).

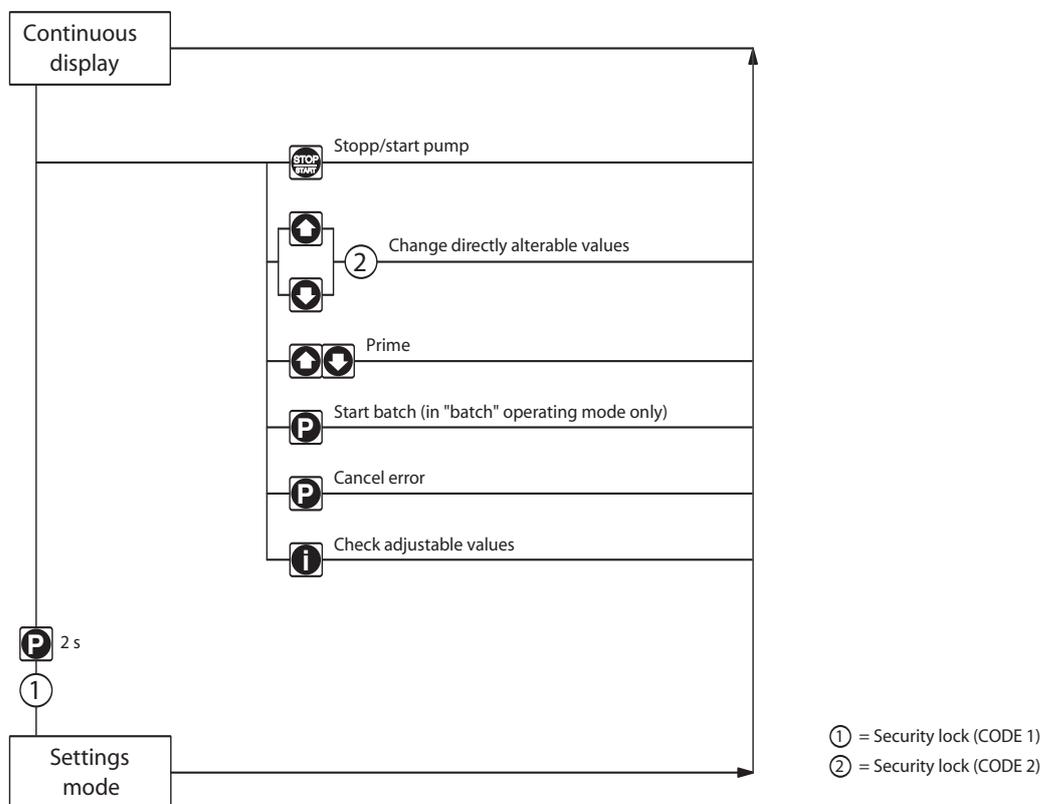
GUIDELINE

- Open out the fold-out page following the title page fully! There you will find the overviews "control elements and key functions" and "operating/settings diagram".
- Look at the overview "continuous displays". This page shows you which displays are available in which operating mode, and which values are directly alterable in the corresponding continuous displays.

9.1 Manual operation

Set stroke length	Stroke length is continually adjustable within a range of 0 - 100 %. The recommended stroke length range, which will practically guarantee technical reproducibility, is 30 - 100 % (SEK type: 50 - 100 %). The following operating options are available via the different keys (see also figure on the next page):
Stop/Start gamma/ L	To stop pump: press STOP/START key. To start pump: press STOP/START key.
Start batch	Press the P key briefly in "batch" operating mode.
Load factory settings	Press the P key for 15 s to load factory calibration settings! Current settings will be deleted.
Change to settings mode	Welf you press the P key for 2 s in any continuous display the pump will change to settings mode (see section 7). If CODE 1 is set, the code must be entered after pressing the P key.
Check adjustable values	Each time you press the i key you will see a different continuous display. The number of continuous displays depends upon the identity code, the selected operating mode and the connected accessories.
Change directly alterable values	To change a value (see below) directly in the corresponding continuous display, press one of the arrow keys until "set" appears in the LCD display. The delay has been programmed in to prevent inadvertent changing of values. If CODE 2 has been set, this code must be entered after pressing the arrow key. Directly alterable values are as follows:

- Stroke rate In "manual", "contact" and "batch" operating modes:
The stroke rate can be altered in the "stroke rate" display.
- Feed rate In "manual" operating mode
The feed rate can be altered in the "feed rate" display.
- Factor In "contact" and "batch" operating modes:
You can alter the factor from the "remaining strokes" display.
The pump returns to the original continuous display a few seconds after the factor has been reset.
- Batch size In "batch" operating mode:
The batch size can be changed from the "batch size/remaining litres" display.
The pump returns to the original continuous display a few seconds after the batch size has been reset.
- Priming The "priming" function is activated by pressing both arrow keys at the same time.
- Cancel error Error messages are cancelled by pressing the P key briefly.



9.2 Remote control

It is possible to control the pump remotely via a signal cable (see section 6.3 and 7).

10 Maintenance

- Maintenance intervals
- Every quarter, when subject to normal usage (continuous operation - approx. 30 %)
 - Shorter intervals when subject to heavier usage (e.g. continuous operation)
- Maintenance actions
- Standard liquid ends:
- ▶ Check the diaphragm for damage (see section 11)
 - ▶ Check chemical seepage at vent hole
 - ▶ Check that the discharge tubing is connected firmly to the liquid end
 - ▶ Check that discharge and suction valves are firmly fixed
 - ▶ Check that the liquid end is generally watertight (especially vent hole! See fig. 24)
 - ▶ Check for correct feed: run the pump run for a short period (press both arrow keys together)
 - ▶ Check electrical connections for wear
 - ▶ Check that liquid end screws are fastened tightly (on coarse/fine bleeding versions, first remove knob and cover)
- Screw fastening torque:
- Liquid end dia. 70 mm: 2,5 to 3 Nm
- Liquid end dia. 90 mm and dia. 100 mm: 4,5 to 5 Nm

IMPORTANT

- For PP liquid end, check fastening torque every quarter!

Additionally, for liquid ends with coarse/fine bleed function and SEK type:

- Check that the bypass tubing is connected firmly to the liquid end
- Check that the bleed valve is firmly fixed in place
- Examine the discharge and bypass tubing for kinks
- Check that the coarse/fine bleed function is working correctly

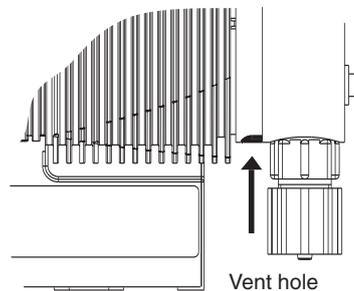


Fig. 24

11 Repairs

IMPORTANT

Repair work that may be carried out by authorised personnel only, or on factory premises:

- Replacement of damaged mains cables
- Replacement of fuses and electronic controller.

Please contact your OMEGA representative!

When sending the pump for repair make sure it is clean and that the liquid end has been thoroughly rinsed out (see section 13)! If, despite careful emptying and cleaning, safety precautions are still required for handling the pump, the necessary information must be entered in the safety declaration!

The safety declaration is a component of the inspection/repair order.

An inspection or repair can only be carried out when a safety declaration has been correctly and completely filled out by an authorised and qualified member of staff from the company operating the pump.

A form is available through OMEGA's Customer Service Department.

**WARNING**

Pumps used for radioactive materials cannot be returned to OMEGA after use! They will not be accepted by OMEGA!

Repairs: These should only be carried out by qualified personnel (in accordance with Safety section):

- Cleaning the valve
- Changing the diaphragm

**WARNING**

- Always take suitable precautions when using hazardous chemicals!
- Ensure equipment is de-pressurised

Cleaning the discharge valve (PP, PC, NP) for types PHP-201A/202A/203A/204A/205A/211A/212A/213A/214A/215A

IMPORTANT

- Discharge and suction valves are different! Dismantle one after the other to avoid confusion.
- Only use new parts, which fit your valve (in shape and chemical resistance)!
- The pump must be reset after replacing a valve.

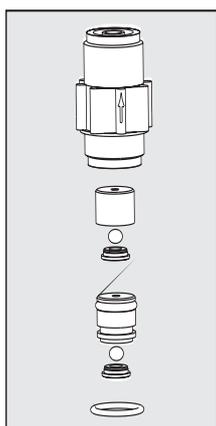


Fig. 25

- ▶ Loosen the hose.
- ▶ Unscrew the discharge valve from the liquid end and rinse thoroughly.
- ▶ Remove the O-ring from the liquid end with a small screw driver.
- ▶ Insert an Allen key or similar into the smaller hole of the pressure connector and push out the valve inserts.
- ▶ Remove the valve seats with a small screwdriver and allow the valve balls to drop out.
- ▶ Clean all parts
- ▶ Drop the valve balls into the valve seats and push on the valve inserts
- ▶ Press the valve seats into the pressure connector with their smaller hole in the direction of the flow (see direction of arrows on the fluting on the pressure connector)
- ▶ Insert the O-ring into the liquid end
- ▶ Screw the valve in as far as it will go
- ▶ Secure the hose

Cleaning the suction valve (PP, PC, NP) for types PHP-201A/202A/203A/204A/205A/211A/212A/213A/214A/215A

Dismantling, cleaning and reassembly of the suction valve is practically the same as for a discharge valve.

Take care however that:

- both valve inserts are actually identical
- an additional spacer is found under the valve inserts
- in the liquid end a shaped seal is used instead of an O-ring
- the flow direction of the suction connection is reversed as for the pressure connector.

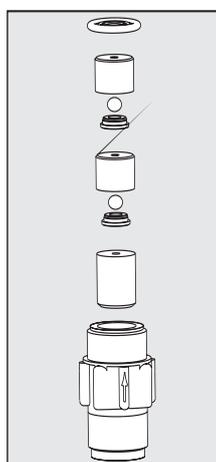


Fig. 26

Cleaning the discharge valve (PP, PC, NP) for types PHP-207A/217A

IMPORTANT

- Discharge and suction valves are different! Dismantle one after the other to avoid confusion!
- Only use new parts, which fit your valve (in shape and chemical resistance)!
- The pump must be reset after replacing a valve.

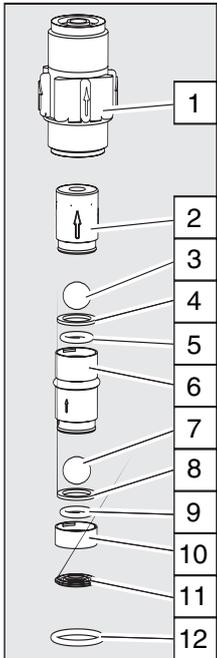


Fig. 27

- ▶ Loosen the hose.
- ▶ Unscrew the discharge valve from the liquid end and rinse thoroughly.
- ▶ Remove the O-ring (12) and the shaped seal (11) from the liquid end with a small screwdriver.
- ▶ Insert an Allen key or similar into the smaller hole of the pressure connector (1) and push out the valve inserts (2, 6).
- ▶ Separate the two valve inserts (2, 6) and let the valve ball (3) drop out.
- ▶ Remove the valve seat (10) from the "valve insert" (6) and let the valve ball (7) drop out.
- ▶ Remove the washers (4, 8) and the O-rings (5, 9) from the "valve insert" (8) and the valve cap (10) with a small screwdriver.
- ▶ Clean all parts.
- ▶ Put one of the washers (4, 8) and one of the O-rings (5, 9) into the "valve insert" (6) and the valve cap (10) respectively.
- ▶ Place the valve balls (3, 7) onto the washers (4, 8) in the "valve insert" and the valve cap (10) respectively.
- ▶ Push the valve cap (10) onto the "valve insert" (6) until it engages.
- ▶ Push the valve insert (2) onto the "valve insert" (6) until it engages.
- ▶ Insert both valve inserts into the pressure connector (1), (check that the directions of the arrows on the fluting of the pressure connector (1) and on the valve inserts (2, 6) are the same!)
- ▶ Insert the O-ring (12) and the shaped seal (11) into the liquid end.
- ▶ Screw the valve in as far as it will go.
- ▶ Secure the hose.

Cleaning the suction valve (PP, PC, NP) for types PHP-207A/217A

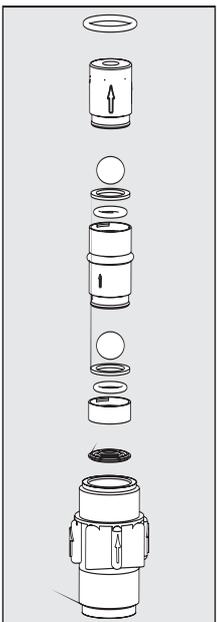


Fig. 28

Dismantling, cleaning and reassembling of a suction valve is practically the same as for a discharge valve. Please ensure, however, that:

- the shaped seal is placed in the suction connector
- only the O-ring is inserted into the liquid end and not the shaped seal
- the flow direction for the suction connector is reversed as for the pressure connector

Change diaphragm



WARNING

- Always take suitable precautions when using hazardous chemicals!
- Ensure that the equipment is de-pressurised!

- ▶ Empty the liquid end (turn the unit upside down and let the feed chemical run out, rinse with a suitable material: rinse the liquid end thoroughly after use with hazardous materials!).
- ▶ When pump is running set the stroke length to 0 % (the drive axis is then set).
- ▶ Switch off the pump.
- ▶ Unscrew the hydraulic connectors from the discharge and suction side.
- ▶ For versions with coarse/fine bleed function: firstly pull out the coarse/fine bleed (knob), then lift off the cover from the liquid end using a screwdriver.
- ▶ Remove the screws (1).

For pump types PHP-207A/217A see the following page (4 holes on the diaphragm rim)!

Supply unit types,
except PHP-207A/
217A

- ▶ Loosen the liquid end (2) and the top plate (4) from the pump housing (6) (loosen only!).
- ▶ Hold the housing (6) in one hand and with the other, clamp the diaphragm (3) between the liquid end (2) and the top plate (4); release the diaphragm (3) from the drive spindle with a light anticlockwise turn of the liquid end (2) and top plate (4).
- ▶ Unscrew the diaphragm (3) completely from the drive spindle.
- ▶ Remove the top plate (4) from the housing (6).
- ▶ Check the condition of the safety diaphragm (5) and replace if necessary.
- ▶ Push the safety diaphragm (5) only as far onto the drive axis until it lies flat on the pump housing (6) – no further!
- ▶ Screw the new diaphragm (3) carefully up to the stop on the drive axis – this must be exact to ensure correct metering!
- ▶ Screw the diaphragm (3) tight once more.
- ▶ Position the top plate (4) on the pump housing (6).



TAKE CARE

- The leakage hole must point downwards when the pump is fully assembled (see fig. 24).
- Position the top plate (4) correctly on the pump housing (6). Do not distort the top plate on the pump housing, otherwise the safety diaphragm (5) will not fit.

- ▶ Lay the diaphragm (3) into the top plate (4).
- ▶ Hold the top plate (4) and screw the diaphragm (3) in a clockwise direction until it is firmly in position (you will feel the resistance of the return spring).



TAKE CARE

- Do not overtighten the diaphragm (3) (particularly on type 1601).
- The top plate (4) must remain in position to prevent the safety diaphragm (5) from distorting.

- ▶ Place the liquid end (2) with the screws (1) on the diaphragm (3) and the top plate (4) (the priming connector must point downwards once the pump is fully assembled).
- ▶ Screw on screws (1) lightly and tighten (starting torque, see below).
- ▶ For versions with coarse/fine bleed function, ensure that the liquid end cover engages in the liquid end, then push the coarse/fine bleed vent (knob) into the liquid end.

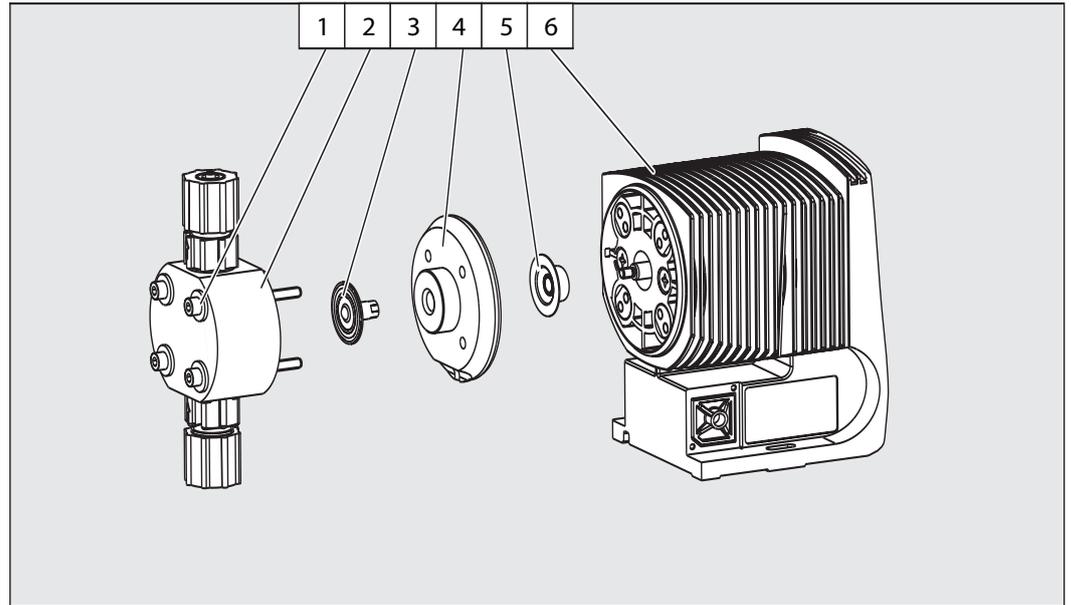


Fig. 29

- | | |
|--------------|--------------------|
| 1 Screws | 4 Top plate |
| 2 Liquid end | 5 Safety diaphragm |
| 3 Diaphragm | 6 Pump housing |

GUIDELINE

- Check the screw torques after 24 hours in operation
- For PP liquid ends check the screw torques again after three months.

Screw torques:

- | | |
|----------------------------------|-------------|
| Liquid end Ø 70 mm: | 2,5 to 3 Nm |
| Liquid end Ø 90 mm and Ø 100 mm: | 4,5 to 5 Nm |

Liquid ends - types PHP-207A/217A

- ▶ Remove the metering head (2) with the screw (1) from the pump (see fig. 30). Remount the metering head (2) with the screws (1).
- ▶ Hold the housing (6) in one hand and with the other hand, clamp the diaphragm (3) between the liquid end (2) and the top plate (4); release the diaphragm (3) from the drive spindle with a light anti-clockwise turn of the liquid end (2) and top plate (4).
- ▶ Remove the liquid end (2) with screws (1) from of the diaphragm and unscrew completely from the drive spindle.
- ▶ Remove the top plate (4) from the housing (6).
- ▶ Check the condition of the safety diaphragm (5) and replace it necessary.
- ▶ Push the safety diaphragm (5) only as far onto the drive axis until it lies flat on the pump housing (6) – no further!
- ▶ Screw the new diaphragm (3) carefully up to the stop on the drive axis – this must be exact to ensure correct metering!
- ▶ If not, start the pump and set the stroke length to 100 %.
- ▶ When the pump is running, turn the diaphragm (3) slowly in a clockwise direction until the four holes in the diaphragm are flush with those on the pump housing (6).
- ▶ Hold the diaphragm (3) in this position, set the stroke length to 0 % and stop the pump.
- ▶ Screw the diaphragm (3) tight once more.
- ▶ Position the top plate (4) on the pump housing (6).



TAKE CARE

- The leakage hole must point downwards when the pump is fully assembled (see fig. 24).
- Position the top plate (4) correctly on the pump housing (6). Do not distort the top plate on the pump housing, otherwise the safety diaphragm (5) will not fit.

- ▶ Lay the diaphragm (3) into the top plate (4).
- ▶ Hold the top plate and screw the diaphragm (3) in a clockwise direction until it is firmly in position (you will feel the resistance of the return spring).



TAKE CARE

- Do not overtighten the diaphragm (3).
- The top plate (4) must remain in position to prevent the safety diaphragm (5) from distorting.

- ▶ The top plate (4) must remain in position to prevent the safety diaphragm (5) from distorting.
- ▶ Position the liquid end (2) with the screws (1) on the diaphragm (3) and the top plate (4) (the priming connector must point downwards once the pump is fully assembled).
- ▶ Screw on screws (1) lightly and tighten (starting torque, see above).
- ▶ For coarse/fine bleed versions: ensure the liquid end cover engages in the liquid end, then push the coarse/fine bleed (knob) into the liquid end.

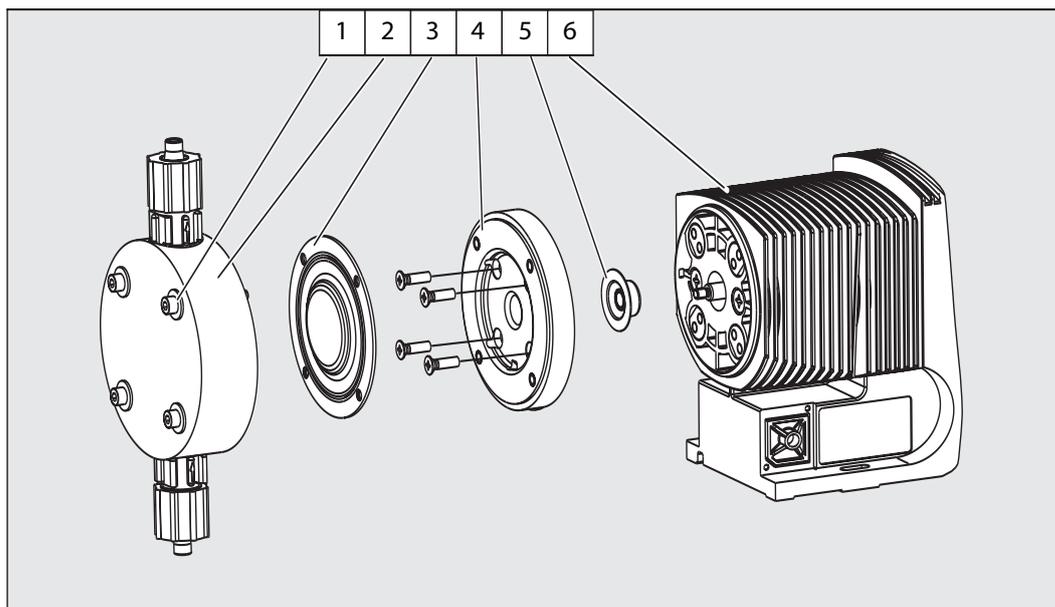


Fig. 30

- | | |
|--------------|--------------------|
| 1 Screws | 4 Top plate |
| 2 Liquid end | 5 Safety diaphragm |
| 3 Diaphragm | 6 Pump housing |

IMPORTANT

- Check the screw torque after 24 hours in operation!
- For PP liquid ends recheck the screw torque after three months!

12 Troubleshooting



WARNING

- Always take suitable precautions when using hazardous chemicals!
- Ensure the equipment is de-pressurised before working on the pump!

	Pump does not prime despite full stroke and bleed function
Cause	Crystalline deposits on the ball seat because valves have dried out
Remedy	<ul style="list-style-type: none">▶ Remove the suction sleeve from the chemical supply container and rinse out the liquid end thoroughly▶ If still unsuccessful, dismantle valves and clean (see section 10)
	Fluid is seeping from the top plate
Cause	The liquid end is not sealed against the pump diaphragm
Remedy	<ul style="list-style-type: none">▶ Tighten screws in the liquid end (see section 10)▶ If unsuccessful, replace the diaphragm (see section 11)
	Green LED indicator (operating display) is not lit
Cause	Incorrect or no mains voltage
Remedy	<ul style="list-style-type: none">▶ Use the recommended mains voltage as given in the voltage specification on the nameplate

Error Messages

	Red LED display is lit, "Error" and "MINIM" flash in the display
Cause	Fluid level in the chemical storage tank has reached "liquid level low, stage 2"
Remedy	<ul style="list-style-type: none">▶ Fill the chemical supply container
	Red LED display is lit, "Error" and "ANALG" flash in the display
Cause	Pump is in "analogue" operating mode, a fault routine has been programmed in the ANALOGUE menu and the operating current has fallen below 3.8 mA
Remedy	<ul style="list-style-type: none">▶ Remedy low operating current▶ Switch fault routine "OFF" (see Section 7.4.2.)
	Red LED display is lit, "Error" and "CNTCT" flash in the display
Cause	Pump is in "contact" or "batch" operating mode and the extended function "memory" has been set. In addition a very large factor has been entered, too many contacts have been input or the P-key has been pressed too often, resulting in an overflow of the stroke memory.
Remedy	<ul style="list-style-type: none">▶ Press the P-key, saved data will be deleted▶ Change pump set up
	Red LED display is lit, "Error" and "FLOW" flash in the display
Cause	Dosing monitor not properly connected
Remedy	<ul style="list-style-type: none">▶ Connect dosing monitor properly▶ Press P-key
Cause	Dosing monitor has reported more defective strokes than have been set in the FLOW menu
Remedy	<ul style="list-style-type: none">▶ Press P-key▶ Investigate the cause and remedy

All other Errors

Please contact OMEGA.

Fault Signals

Yellow LED display is lit

- Cause Liquid level in chemical storage tank has reached "liquid level low, stage 1"
- Remedy ▶ Fill chemical storage tank

Yellow LED Display is lit and "calib" flashes

- Cause The pump is calibrated and the stroke length deviates by more than $\pm 10\%$ from the value at the time of calibration.
- Remedy ▶ Reset the stroke length or calibrate the pump again to the desired stroke length

13 Decommissioning and Disposal

Decommissioning



WARNING

- When decommissioning the pump the housing and, in particular, the liquid end must be thoroughly cleaned to remove chemicals and dirt!
 - Always take suitable precautions when using hazardous chemicals!
 - Ensure that the equipment is de-pressurised!
- ▶ Disconnect the pump from the power supply
- ▶ Empty the liquid end by turning the pump upside down and allow the feed chemical to pour out
- ▶ Rinse the liquid end with a suitable material, thoroughly rinse the liquid end after use with hazardous materials!

If decommissioning is only temporary, maintain the correct storage conditions:

Storage temperature: -10 to $+50$ °C

Air humidity: < 92 % relative humidity

Disposal



TAKE CARE

Electronic waste is classified as special waste!

Please observe all locally applicable directives!

14 Technical Data

14.1 Performance data and weights

at 180 strokes/minute and 100% stroke length

Liquid end type	Max. feed rate at maximum operating pressure			Ma. feed rate at medium operating pressure			Connector size outer Ø x inner Ø	Suction lift*	Priming lift**	Admiss. priming pressure	Ship. Wt ¹
	bar	l/h	ml/str.	bar	l/h	ml/str.					
PHP-201A/211A	10	0.74	0.09	5	0.82	0.076	6x4	6	1.8	8	2.9 / 3.6
PHP-202A/212A	16	1.1	0.10	8	1.4	0.13	6x4	6	2	8	2.9 / 3.6
PHP-203A/213A	16	2.1	0.19	8	2.5	0.24	6x4	6	2	5.5	2.9 / 3.6
PHP-204A/214A	10	4.4	0.41	5	5.0	0.46	8x5****	5	3	3	3.1 / 4.5
PHP-205A/215A	16	4.1	0.38	8	4.9	0.45	8x5****	4	3	3	4.5 / 5.9
PHP-206A/216A	7	11.0	1.02	3.5	13.1	1.21	8x5	3	3	1.5	4.5 / 5.9
PHP-207A/217A	4	17.1	1.58	2	19.1	1.77	12x9	3	3	1	5.5 / 8.6

pump with self-degassing liquid end ***

at 180 strokes/minute and 100% stroke length

Liquid end type	Max. feed rate at maximum operating pressure			Max. feed rate at medium operating pressure			Connector size outer Ø x inner Ø	Suction lift*	Priming lift**	Admiss. priming pressure	Ship. Wt ²
	bar	l/h	ml/str.	bar	l/h	ml/str.					
PHP-202A/212A	16	0.59	0.055	8	0.78	0.072	6x4	–	1.8	0.5	2.9
PHP-203A/213A	16	1.4	0.13	8	1.74	0.16	6x4	–	2.1	0.5	2.9
PHP-204A/214A	10	3.6	0.33	5	4.0	0.37	8x5	–	2.7	0.5	3.1
PHP-205A/215A	16	3.3	0.31	8	3.8	0.35	8x5	–	3.0	0.5	4.5
PHP-206A/216A	7	10.5	0.97	3.5	12.3	1.14	8x5	–	2.5	0.5	4.5
PHP-207A/217A	4	15.6	1.44	2	17.4	1.61	12x9	–	2.5	0.5	4.5

* Lift when suction line and liquid end are full

** Priming lift with clean and wetted valves, priming lift at 100% stroke length and free flow or opened bleed valve

*** The feed rate values are for minimum feed rates, based on water

**** For material versions SST : 6 x 4 mm

¹ For material versions PPE, PPB, PCE, PCB, NPE, NPB, TTT/SST

² For material versions PPE, PPB, NPE, NPB

14.2 Dosing reproducibility

Standard Liquid ends
 Dosing precision -5 to +10 % at max. stroke length and max. operating pressure for all materials.
 Reproducibility ±2 % at constant conditions and minimum 30 % stroke length.

Self-degassing liquid ends

Since self-degassing liquid ends are filled with air bubbles when in contact with gaseous chemicals and when in operation, no dosing reproducibility values can be given.
 The recommended minimum stroke length with self-degassing liquid ends is 50 %.

14.3 Viscosity

The liquid ends are designed for liquids up to a maximum viscosity of

- 200 mPas for standard liquid ends
- 500 mPas for valves with springs
- 50 mPas for self-degassing liquid ends

14.4 Materials Data for Liquid ends

Version	Liquid end	Valves	Seals	Balls
PPE PPB	PP PP	PP PP	EPDM FPM (Viton®)	Ceramic Ceramic
PCE PCB	PVC PVC	PVC PVC	EPDM FPM (Viton®)	Ceramic Ceramic
NPE NPB	Acrylic glass Acrylic glass	PVC PVC	EPDM FPM (Viton®)	Ceramic Ceramic
TTT	PTFE with carbon	PTFE with carbon	PTFE	Ceramic
SST	Stainless steel 1.4571	Stainless steel 1.4571	PTFE	Ceramic

Viton® (FPM) is a registered trade mark of DuPont Dow Elastomers.

14.5 Electrical Data

Version: 100 - 230 V ±10 %, 50/60 Hz

Variants 100 - 230 V/AC	gamma/ L M70	gamma/ L M85
Power rating:	17 W	22 W
Rated current:	0.7 A	1 A
Switch on peak current:	15 A (for approx.1 ms)	15 A (for approx. 1 ms)
Fuse:	0.8 AT	0.8 AT

Note Fuses must display VDE, UL and CSA certification, e.g. type 19195 from Wickmann in accordance with IEC publication 127 - 2/3

14.6 Ambient conditions

Temperatures Storage and transport temperatures: -10 to +50 °C
 Feed chemical temperature: -10 to +35 °C
 Ambient temperature when in operation: -10 to +45 °C (drive and control)

Maximum ambient temperatures for liquid ends depending on material type:

Max. ambient temperature	PPE, PPB	PCE, PCB	NPE, NPB	TTT	SST
Long-term at max. operating pressure:	50 °C	45 °C*	45 °C	50 °C	50 °C
Short-term (max. 15 min) at max. 2 bar:	100 °C	60 °C	60 °C	120 °C	120 °C

* Under extreme conditions such as maximum dosing temperatures, maximum stroke frequency and maximum operating pressure, leakage can occur on the liquid end at an ambient temperature of 35 °C.

Climate Permissible air humidity: 92 % relative humidity, not condensing
 Moist and fluctuating air conditions: FW 24 in accordance with DIN 50016

14.7 Enclosure rating and safety class

Enclosure Rating Contact and moisture enclosure rating: IP 65 in accordance with IEC 529, EN 60529, DIN VDE 0470 Part 1
 Safety Requirements Safety Class 1 - Mains connection with earth lead

14.8 Compatibility

The hydraulic parts of the PHP-200A Series are identical to those of the PHP-200 Series.

The following components and accessories for pumps from the product ranges PHP-200 Series and PHP-200A Series are all compatible:

- Signal cable; 2-, 4- and 5 core for "external" function
- 2 stage float switch
- Discharge tubing diameters
- Standard connector set
- Wall bracket
- Chemical feed containers and mounting plates
- Total height (distance between suction and discharge connector)
- Distance between the connectors and locating holes on the pumps
- Accessories such as pressure back pressure valve, multifunctional valve, dosing monitor and rinsing equipment

15 Accessories



CAUTION

The fitting and installing of OMEGA dosing pumps using parts from other suppliers which have not been tested and recommended by OMEGA is inadmissible and can result in harm to personnel and equipment, for which no liability will be accepted.

Level switch

2-stage with 2m connection cable

Fault indicating relay

To signal faults

Fault indicating and pacing relay

For timing other equipment and for indicating faults.

Signal cable

Universal signal cable: 5 core / 2.5 and 10 m

External contact cable: 2 core / 2.5 and 10 m

Foot valves

With suction filter and non-return valve for connection at the end of the suction tubing.

Discharge valve

With spring-loaded non-return valve for dosing into open or closed systems and for connecting discharge tubing.

Discharge lances

For dosing into large pipes and to prevent blockage when dosing crystallising substances.

Back pressure valves

For precision dosing when operating pressure is low or as a relief valve.

Accumulator without diaphragm

For reducing pulsation, e.g. with long dosing lines.

Dosing monitors

For monitoring dosing. After pre-set number of failed strokes the error message displays and the dosing pump switches off.

Suction lances

With foot valve and float switch for disposable drums or chemical feed containers

Chemical feed container

To contain 35 to 1000 litres with lockable screw top and necessary accessories.

Manual/electronic stirrers

For mixing and batching of feed solutions.

Bracket

For stable pump mounting.

Dimensions

Polypropylene material versions

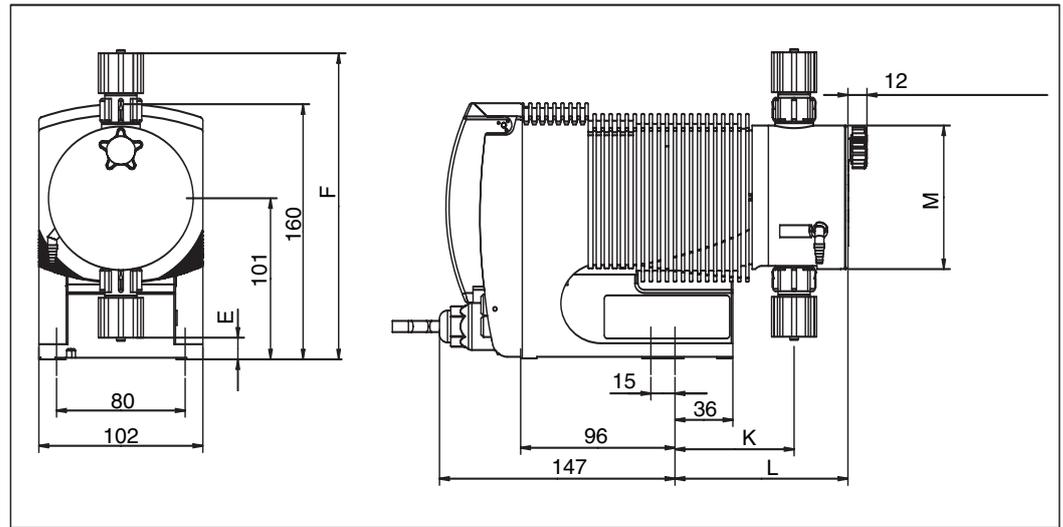


Fig. 31

Measurements in mm

	PHP-201A-203A	PHP-211A-213A	PHP-204A-214A	PHP-205A-215A	PHP-206A-216A	PHP-207A-217A
E	23		13	13	15	15
F	186		193	193	191	191
K	71		71	71	74	76
L	106		105	105	108	110
M	Ø 70		Ø 90	Ø 90	Ø 90	Ø 90

Teflon® material versions

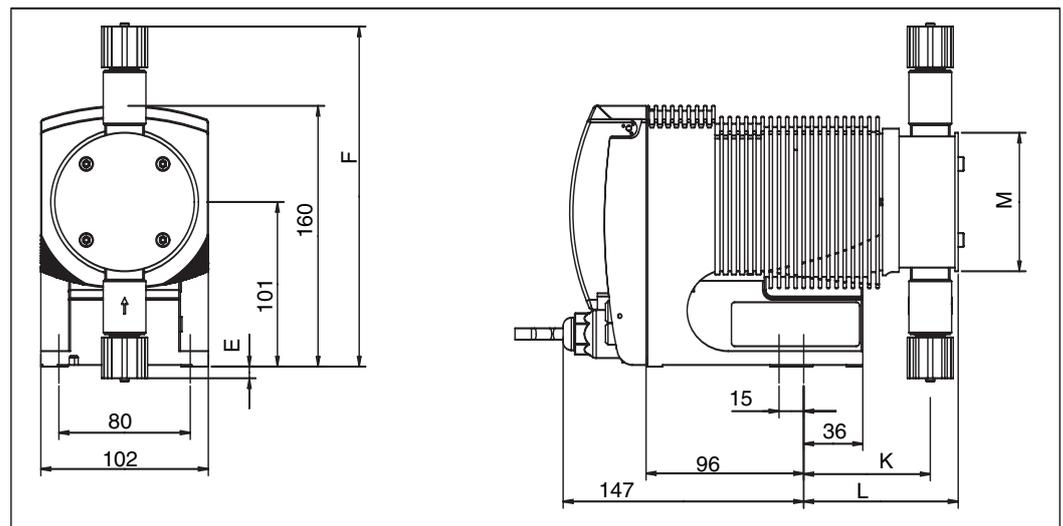


Fig. 36

Measurements in mm

	PHP-201A/202A	PHP-211A/212A	PHP-203A/213A	PHP-204A/214A	PHP-205A/215A	PHP-206A/207A	PHP-216A/217A
E	32		25	23	23	-7	
F	170		178	179	179		209
K	78		72	75	75		75
L	91		87	90	90		95
M	51 (Ø 60)		66 (Ø 70)	68 (Ø 80)	68 (Ø 80)		81 (Ø 85)

SST material versions

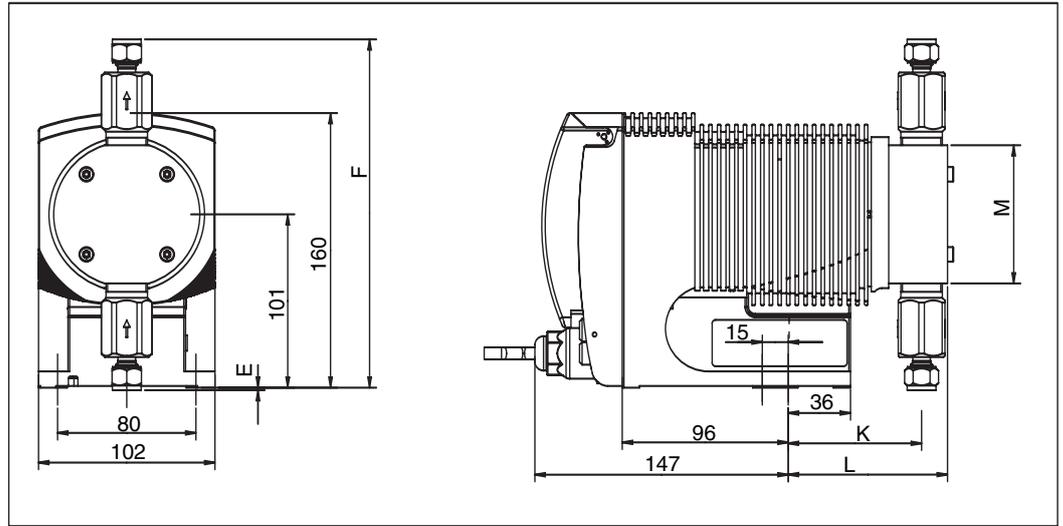
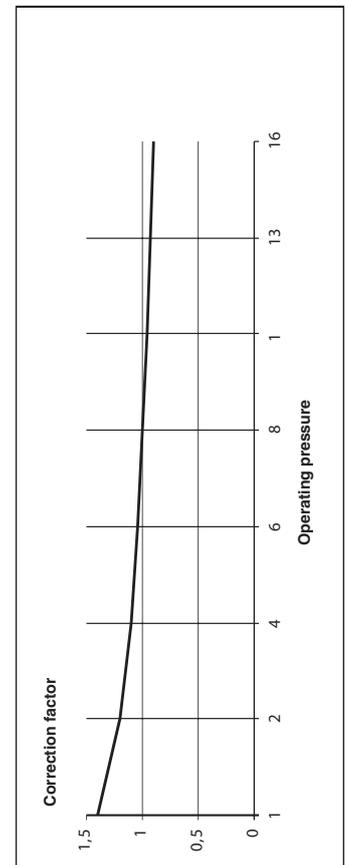
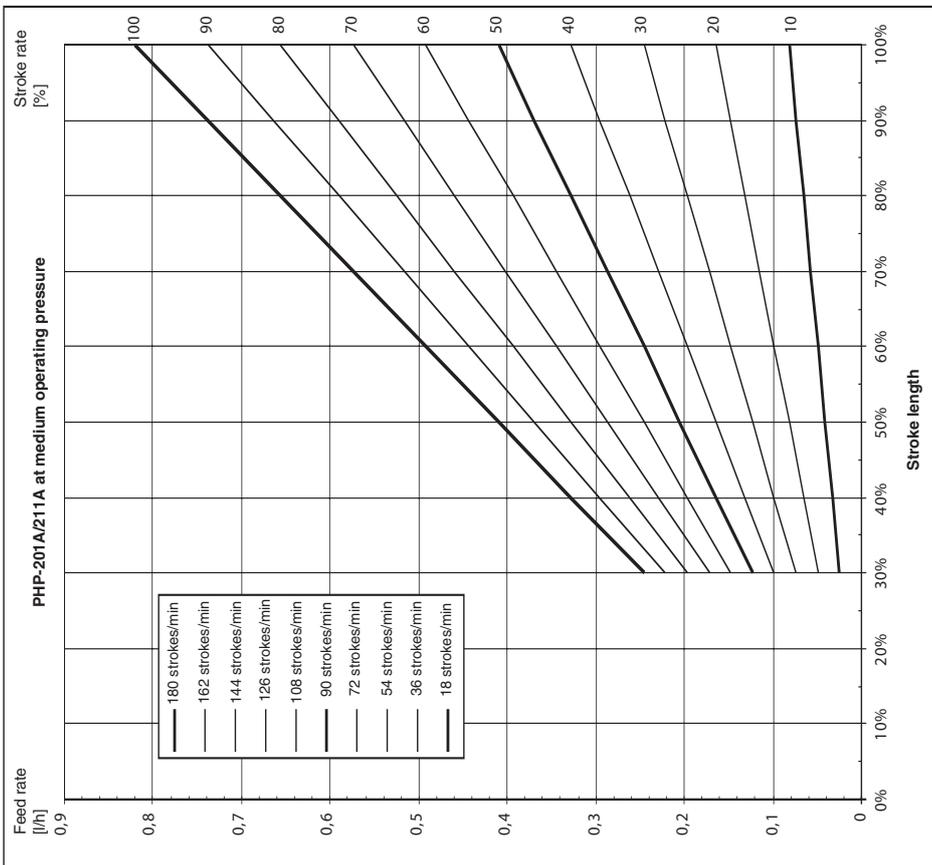
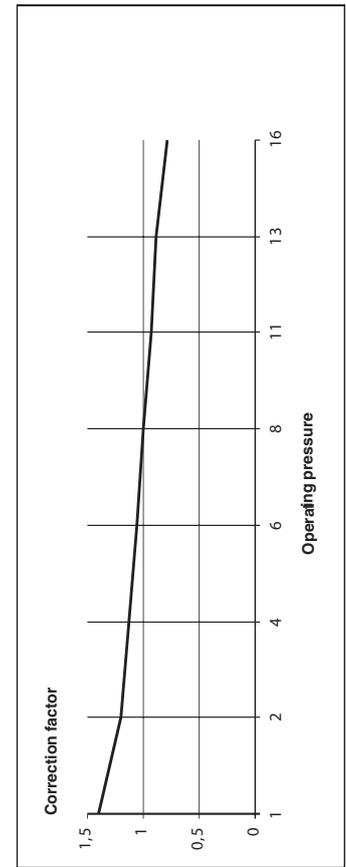
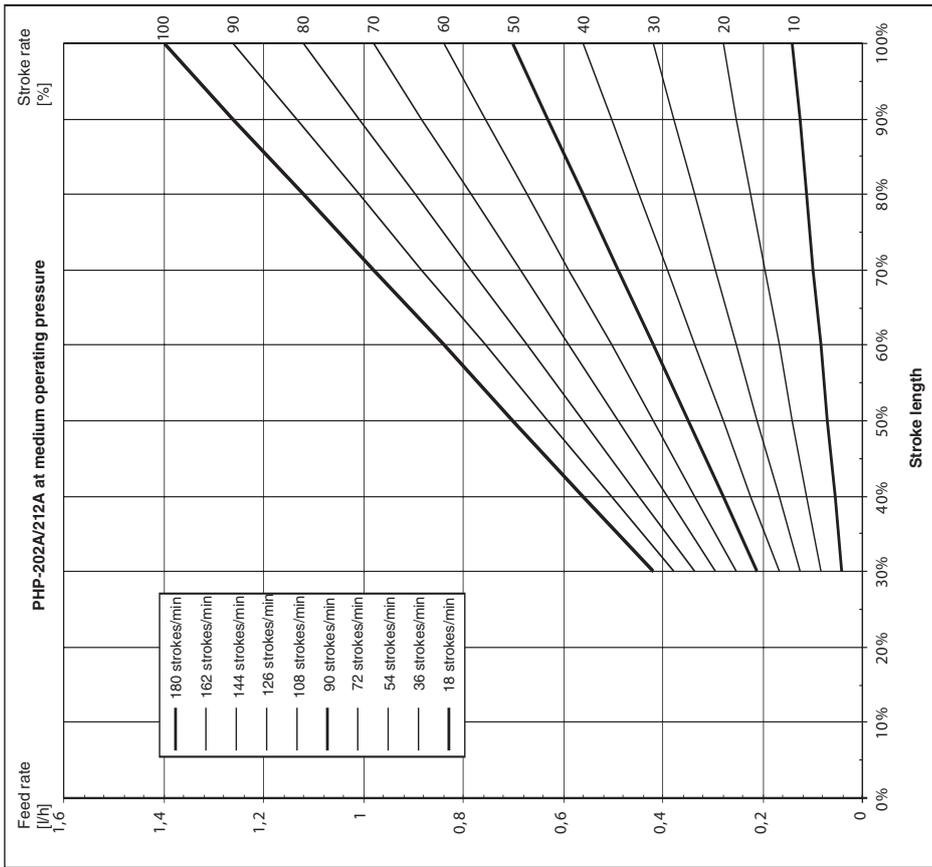


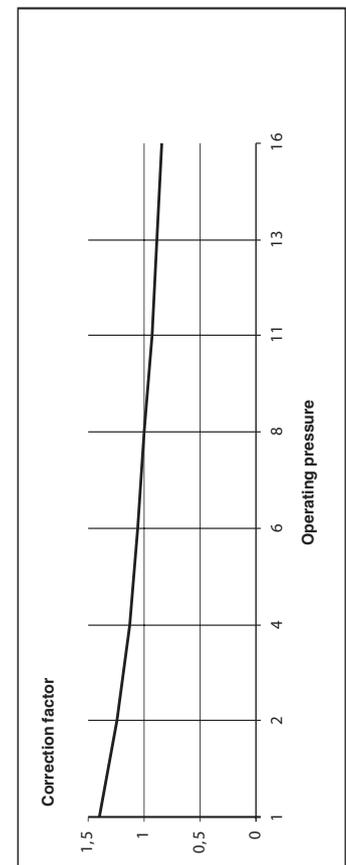
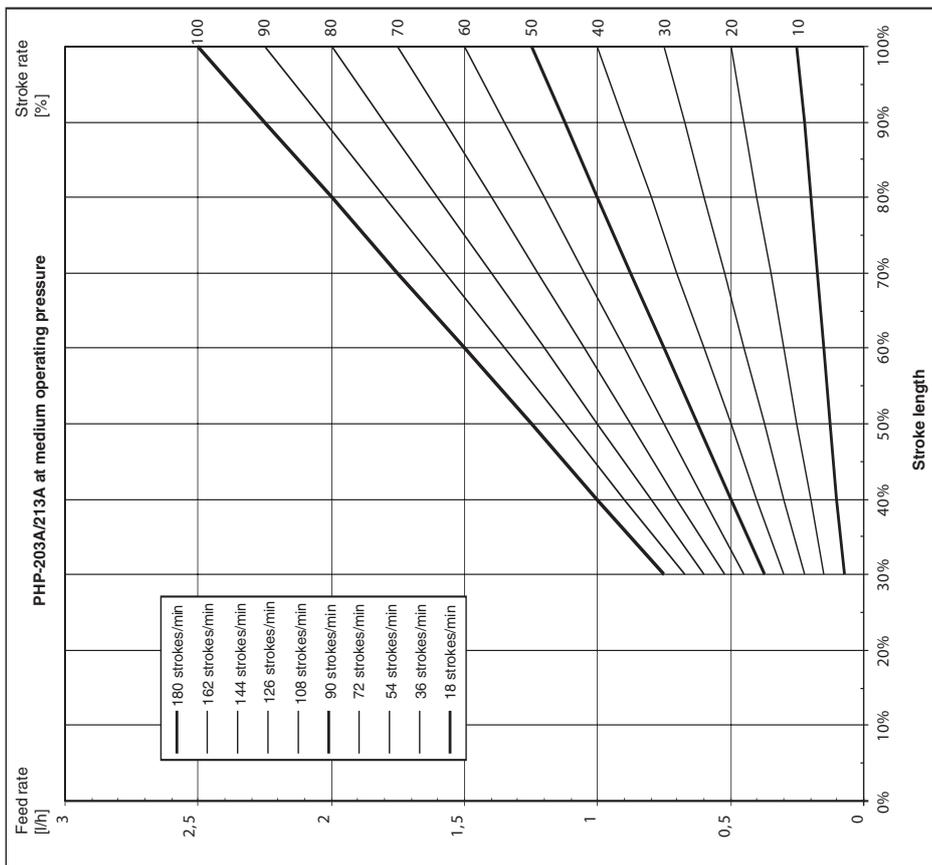
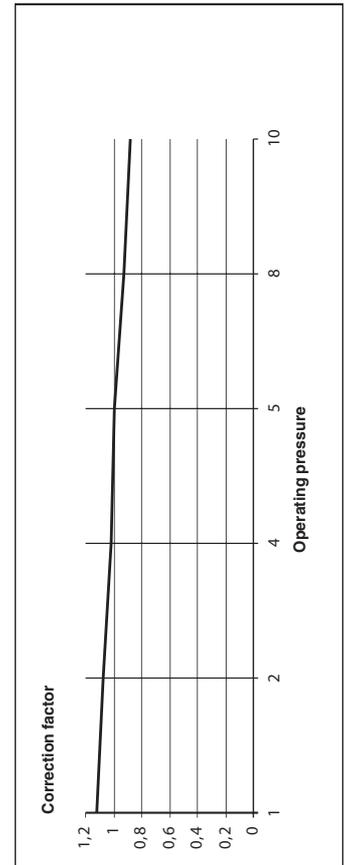
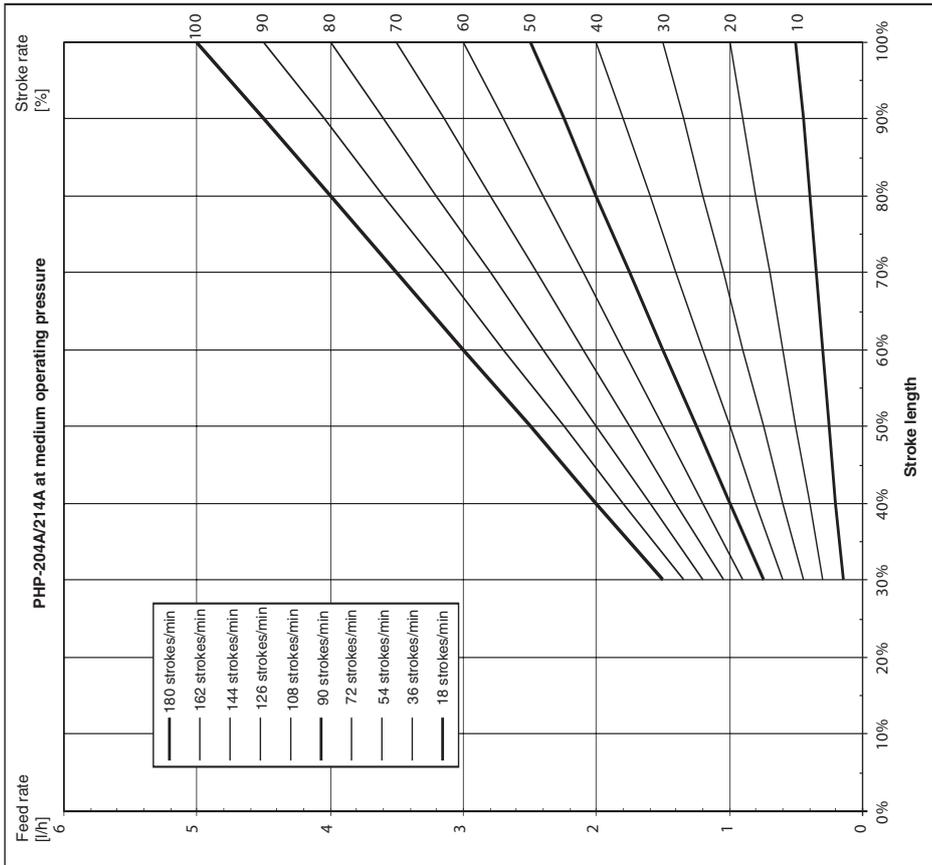
Fig. 37

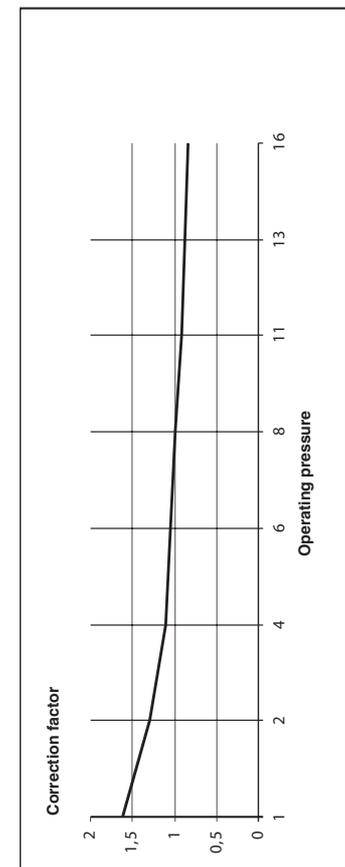
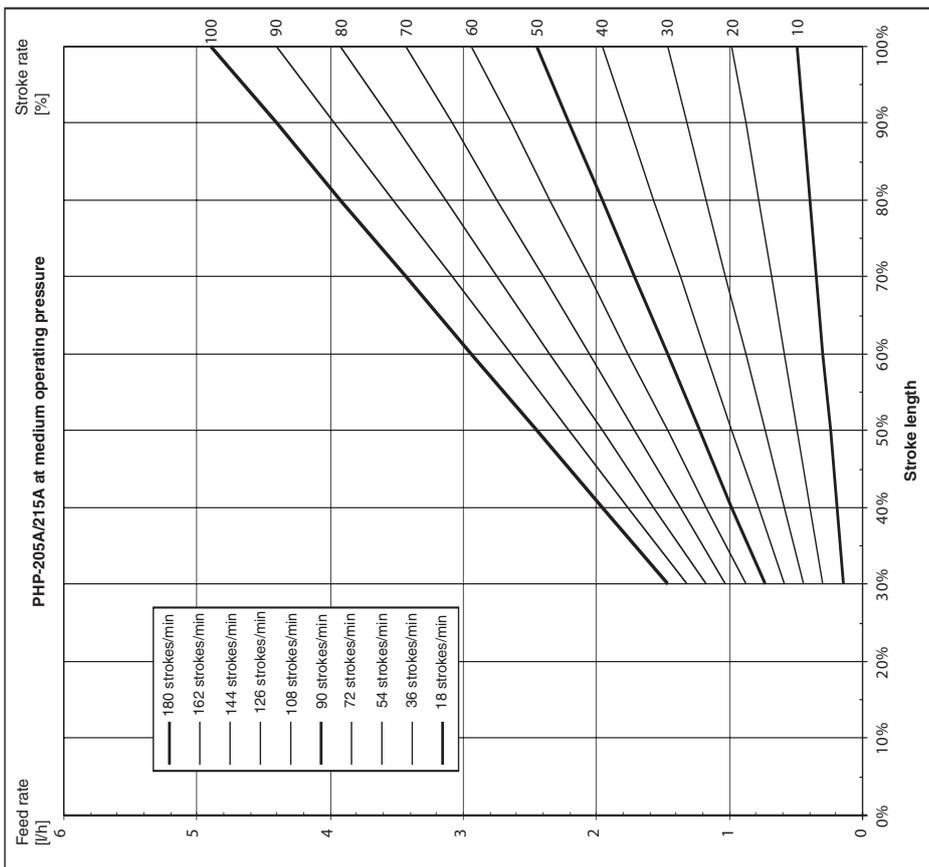
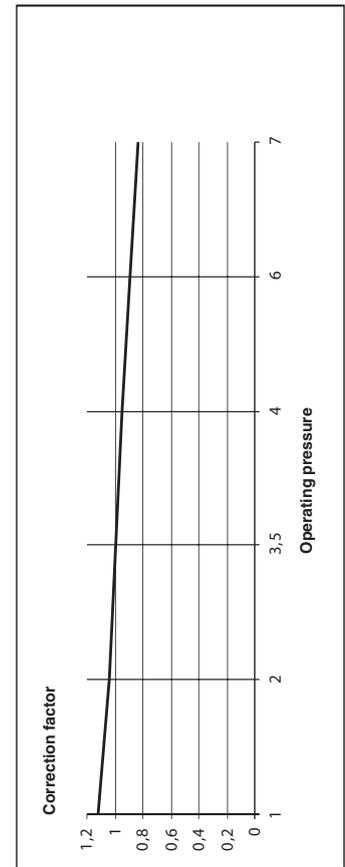
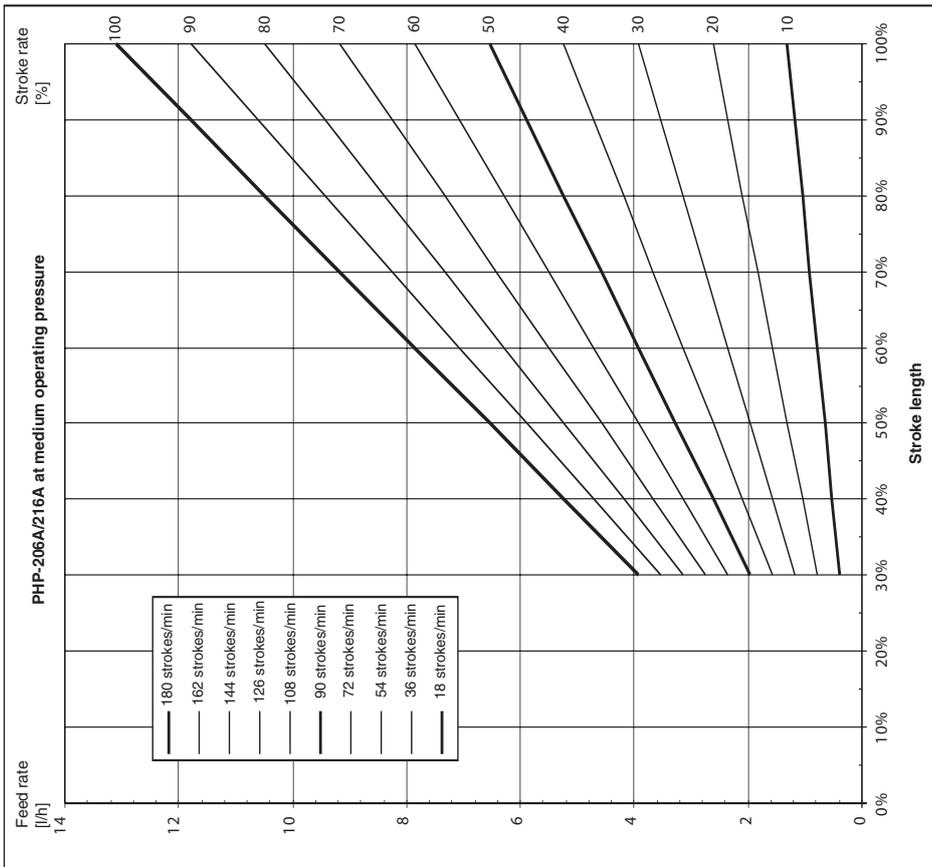
Measurements in mm

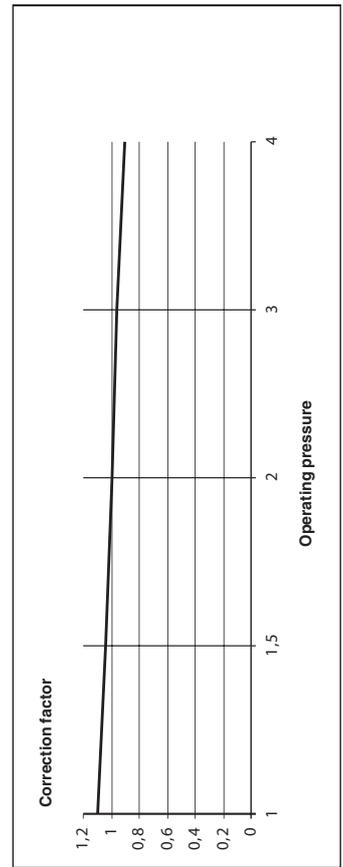
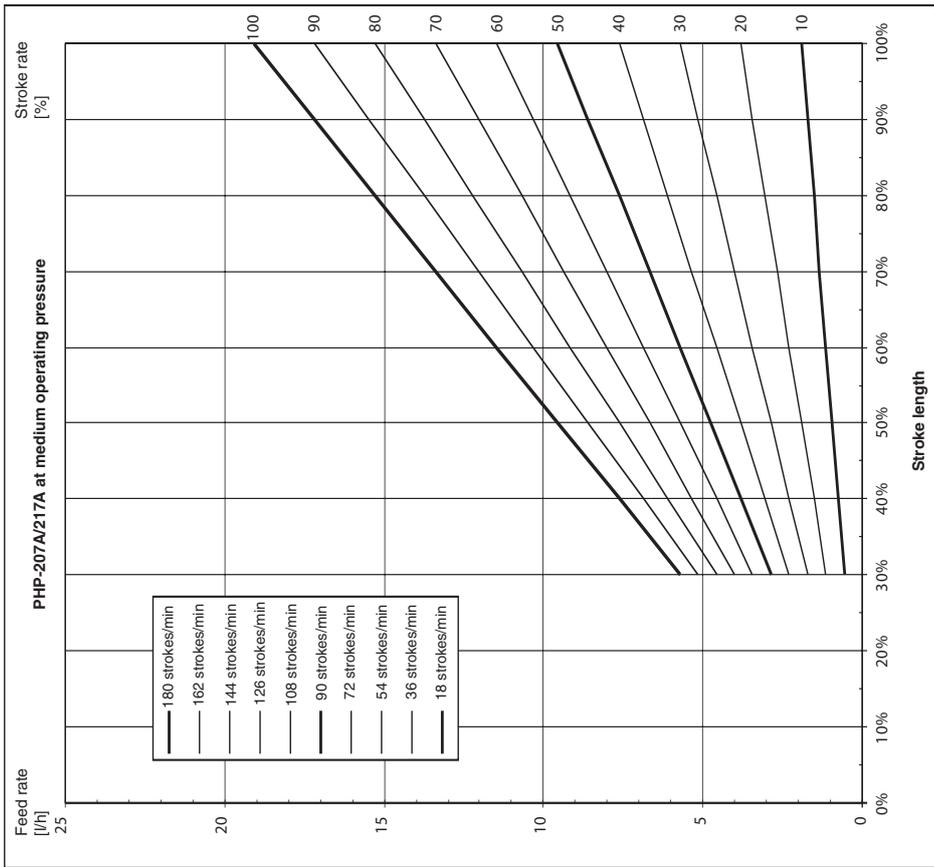
	PHP-201A/202A	PHP-211A/212A	PHP-203A/213A	PHP-204A/214A	PHP-205A/215A	PHP-206A/207A	PHP-216A/217A
E	40		33	31	31	-2	-3
F	162		170	171	171	203	204
K	78		72	75	75	77	77
L	89		85	88	88	93	93
M	51 (Ø 60)		66 (Ø 70)	68 (Ø 80)	81 (Ø 80)	81 (Ø 85)	81 (Ø 85)

Feed rate settings diagrams









WARRANTY/DISCLAIMER

OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of **13 months** from date of purchase. OMEGA's WARRANTY adds an additional one (1) month grace period to the normal **one (1) year product warranty** to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product.

If the unit malfunctions, it must be returned to the factory for evaluation. OMEGA's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective, it will be repaired or replaced at no charge. OMEGA's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of having been damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components in which wear is not warranted, include but are not limited to contact points, fuses, and triacs.

OMEGA is pleased to offer suggestions on the use of its various products. However, OMEGA neither assumes responsibility for any omissions or errors nor assumes liability for any damages that result from the use of its products in accordance with information provided by OMEGA, either verbal or written. OMEGA warrants only that the parts manufactured by it will be as specified and free of defects. OMEGA MAKES NO OTHER WARRANTIES OR REPRESENTATIONS OF ANY KIND WHATSOEVER, EXPRESS OR IMPLIED, EXCEPT THAT OF TITLE, AND ALL IMPLIED WARRANTIES INCLUDING ANY WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED. LIMITATION OF LIABILITY: The remedies of purchaser set forth herein are exclusive, and the total liability of OMEGA with respect to this order, whether based on contract, warranty, negligence, indemnification, strict liability or otherwise, shall not exceed the purchase price of the component upon which liability is based. In no event shall OMEGA be liable for consequential, incidental or special damages.

CONDITIONS: Equipment sold by OMEGA is not intended to be used, nor shall it be used: (1) as a "Basic Component" under 10 CFR 21 (NRC), used in or with any nuclear installation or activity; or (2) in medical applications or used on humans. Should any Product(s) be used in or with any nuclear installation or activity, medical application, used on humans, or misused in any way, OMEGA assumes no responsibility as set forth in our basic WARRANTY/DISCLAIMER language, and, additionally, purchaser will indemnify OMEGA and hold OMEGA harmless from any liability or damage whatsoever arising out of the use of the Product(s) in such a manner.

RETURN REQUESTS/INQUIRIES

Direct all warranty and repair requests/inquiries to the OMEGA Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence.

The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR **WARRANTY** RETURNS, please have the following information available BEFORE contacting OMEGA:

1. Purchase Order number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

FOR **NON-WARRANTY** REPAIRS, consult OMEGA for current repair charges. Have the following information available BEFORE contacting OMEGA:

1. Purchase Order number to cover the COST of the repair,
2. Model and serial number of the product, and
3. Repair instructions and/or specific problems relative to the product.

OMEGA's policy is to make running changes, not model changes, whenever an improvement is possible. This affords our customers the latest in technology and engineering.

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