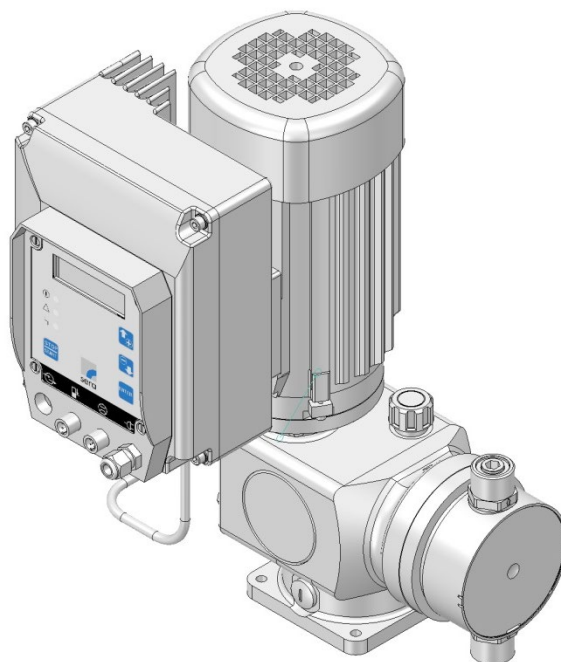


Operating Instructions

Product: Controllable diaphragm pump

Type: C 409.2 – 1,6 e
C 409.2 – 2,4 e
C 409.2 – 7,0 e
C 409.2 – 12 e
C 409.2 – 18 e
C 409.2 – 25 e
C 409.2 – 50 e
C 409.2 – 75 e
C 409.2 – 90 e
C 409.2 – 115 e
C 409.2 – 140 e
C 409.2 – 180 e
C 409.2 – 250 e
C 409.2 – 350 e



Please state here the exact type and serial number of your pump.
(can be read off the type plate on the pump)

Type:

Serial No.:

These data are important in case of queries or for ordering spare and wearing parts and must absolutely be stated.

Manufacturer:

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sera Straße 1
34376 Immenhausen
Germany
Tel. +49 5673 999-00
Fax. +49 5673 999-01
www.sera-web.com
info@sera-web.com

Translation of the original operating instructions!

CAUTION !



Carefully read and understand all precautions before installing or servicing any metering pump.

Operating Instructions

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Operating Instructions

1 General

Before commissioning and during operation of the **sera** diaphragm pump the respective regulations valid at the place of installation are to be observed.

The **sera** diaphragm pump is delivered ready for installation. Carefully read these instructions and especially the safety instructions herein contained before installation and initial start-up of the pump.

Please review this manual carefully. Pay particular attention to warning and precautions. Always follow good safety procedures, including the use of proper clothing, eye and face protection.

2 Types

2.1 Type code

Example:

Diaphragm pump type **C 409.2-25e**

C	409.2	25	e
----------	--------------	-----------	----------

Pump control

C controllable

C	409.2	25	e
----------	--------------	-----------	----------

Indication of model range/stroke mechanism

C	409.2	25	e
----------	--------------	-----------	----------

Indication of nominal delivery rate

This number states the nominal delivery rate in litres/hour.
(standard version referring to water)

C	409.2	25	e
----------	--------------	-----------	----------

Indication of the pump design

E single diaphragm pump

2.2 Type plate

Each **sera** diaphragm pump is factory provided with a type plate. The following information can be found on this type plate.

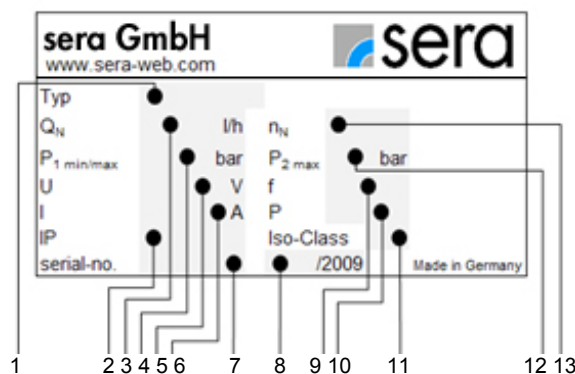


Fig. 01 Type plate

Explanation of the indications on the type plate		
1	Type	Pump type
2	IP	Protection category / Protection class
3	Q_N l/h	Nominal delivery rate Delivery rate which the pump was ordered for, based on the nominal rotation speed n_N , the nominal delivery height p_{2max} and the delivery medium stated in the supply contract.
4	$P_{1min/max}$ [bar]	Minimum/maximum permissible pressure in the pump inlet Minimum/maximum permissible pressure in the inlet cross section which the pump can be used for. Please consider that pressure depends on rotation speed, delivery rate, temperature and static pressure at the inlet.
5	U [V]	Operating voltage range
6	I [A]	max. charging rate
7	No.	Serial number of the pump
8	Date	Date of manufacture
9	f	Supply frequency
10	P	Average power input
11	Iso-Class	Isolation class of drive
12	P_{2max} [bar]	Maximum permissible pressure in the pump outlet Maximum permissible pressure in the outlet cross section which the pump can be used for. Please consider that pressure depends on rotation speed, delivery rate, temperature and static pressure at the outlet.
13	n_N 1/min	Nominal stroke frequency

Table 01 Explanation of type plate

Operating Instructions

2.3 Materials

The materials used are stated in the order confirmation and the product description.

2.4 Viscosity, pumped medium

The diaphragm pump is suitable for fluids with viscosities < 100 mPas.

2.5 Dosing range

The delivery rate of the diaphragm pump can be set manually via the stroke length adjustment (0...100%).
The linear dosing range is between 20% and 100%.

2.6 Noise measurement

Compliance with ISO 3746 or ISO 9614-1, Instruments (type 1) according to IEC 60651 or IEC 60804 (in UL 61010-1).

3 Safety instructions

3.1 Note on quality

Observance of these operating instructions and, in particular, the safety instructions, helps to

- avoid dangers to persons, machines, and environment
- increase the reliability and service life of the pump and the entire system
- reduce repair cost and downtime.

The **sera** quality management and quality assurance system for pumps, systems, fittings, and compressors is certified according to DIN EN ISO 9001:2015.

The **sera** diaphragm pump complies with the valid safety requirements and accident prevention regulations.

CAUTION !



Always keep these operating instructions within reach at the place of installation of the pump.

CAUTION !



**Pay attention to the safety data sheet of the pumped medium! The owner must take corresponding accident prevention measures to protect operating personnel from danger through the pumped media used!
Danger of breach / Danger of poisoning**

3.2 Marking of notes

3.2.1 Marking of notes in these operating instructions

Special notes in these operating instructions are marked with the general danger symbol



(safety symbol in compliance with ANSI Z 535.4 or ISO 3864-2)

3.2.2 Marking of notes on the product

Symbols which are directly attached to the pump, e.g. arrows for direction of rotation or symbols for fluid connections are to be observed and kept in legible condition.

3.3 Personnel qualification and training

The personnel who operate, maintain, inspect and install the diaphragm pump must be suitably qualified. Range of responsibility, and supervision of the personnel are to be clearly defined by the owner. If the personnel do not have the knowledge required it is to be trained and instructed accordingly. If required such a training can be carried out by the manufacturer /supplier upon order of the owner. The owner must also ensure that the personnel have understood the operating instructions.

3.4 Dangers in case of inobservance of the safety instructions

Inobservance of these safety instructions can result in danger to persons, hazards to the environment and damage to the pump.

Inobservance can result in:

- Failure of important functions of the pump/system
- Inobservance of prescribed methods for maintenance and servicing
- Danger to persons through electrical, mechanical and chemical influences
- Hazards to the environment through leaking dangerous media

3.5 Safety conscious working

The safety instructions specified in these operating instructions, the national regulations concerning accident prevention as well as internal working-, operating-, and safety instructions of the owner are to be observed.

Operating Instructions

3.6 Safety instructions for the owner / operator

Leaking pumped media and utilities must be disposed off in such a way that any danger to persons and hazards to the environment are excluded. The legal regulations are to be observed.

Dangers through electrical energy are to be precluded.

3.7 Safety instructions for maintenance-, inspection and installation work

The owner must ensure that all maintenance-, inspection- and installation work are exclusively carried out by trained people / engineer who have read the operating instructions carefully.

The spare parts and utilities used must comply with the requirements of the respective operating instructions.

All screwed connections and connections may only be removed when the system is not under pressure.

3.8 Arbitrary modification and spare parts production

Modification to and changement of the pump is only permitted after previous agreement of the manufacturer. Original spare parts and accessories approved by the manufacturer increase safety.

NOTE!

If non-approved parts are used or if the pump (e.g. drive motors) is modified arbitrarily the manufacturer refuses any liability claims.

3.9 Improper operations

Operating safety of the supplied diaphragm pump is only guaranteed if the product is used as intended, according to the descriptions in Chapter 3.10 of these operating instructions.

3.10 Intended use

The **sera** diaphragm pump is only to be deployed according to the intended purpose stated in the order confirmation and the acceptance test certificate.

If the diaphragm pump is to be used for other applications, then the suitability of the pump for the new operating conditions must be discussed with **sera** beforehand!

CAUTION !



- Acceptable for indoor use only!
- Non submersible pump!

CAUTION!



- Pump not authorized for operation in Ex-Areas!
- Only for temperatures of medium +2...+40°C!
- Standard design not suitable for drinking water!

Criteria for the proper use of the diaphragm pump are:

- Observe characteristics of the pumped medium (please see safety- and product data sheet of the pumped medium used – the safety data sheet is to be provided by the supplier / owner of the pumped medium)
- Resistance of the materials which come into contact with the pumped medium
- Operating conditions at the place of installation
- Pressure and temperature of the pumped medium
- Voltage supply
- Using of the pump in non hazardous area

3.11 Personal protection for maintenance and service

In order to avoid risks to health, the provisions of the German Ordinance on Hazardous Substances (GefStoffV) (§14 Safety Data Sheet) and relevant national safety regulations for the pumped medium must strictly be adhered to.

In case of an incident pay attention to the following leaking media:

- fluids
- vapours
- noise emissions (sound level)

Emissions are to be monitored by corresponding monitoring systems.

WARNING!



Wear protective clothing, gloves, and a face protecting and breathing mask.
Danger of breach / Danger of poisoning

NOTE!

Personal protective equipment must be provided by the owner!

Operating Instructions

3.12 Utilities

If not agreed otherwise in the contract conditions, the **sera** diaphragm pump will always be supplied with the necessary utilities.

(For type and quantity of utilities/lubricants, see Chapter 12)

3.13 Pre-Installation and maintenance instructions

The following precautions should be taken when working with **sera** dosing pumps. Please read this section carefully prior to installation.

CAUTION !



Protective Clothing

ALWAYS wear protective clothing, face shield, safety glasses and gloves when working on or near your metering pump. Additional precautions should be taken depending on the solution being pumped. Refer to MSDS precautions from your solution supplier.

CAUTION !



Water Pre-Prime

All **sera** pumps are pre-primed with water when shipped from the factory. If your solution is not compatible with water, disassemble the pump head assembly. Thoroughly dry the pump head, valves, seal rings, balls and Liqui-fram™ (diaphragm). Reassemble head assembly tightening screws in a crisscross pattern. Refill the pump head with the solution to be pumped before priming the pump. (This will aid in priming.)

CAUTION !



Solution Compatibility

Determine if the materials of construction included in the liquid handling portion of your pump are adequate for the solution (chemical) to be pumped. Always refer to the solution supplier for compatibility of your specific **sera** dosing pump. Contract your local **sera** distributor for further information.

4.2 Storage

An undamaged packaging protects the unit during subsequent storage and should only be opened when the diaphragm pump is installed.

Proper storage increases the service life of the diaphragm pump and comprises prevention of negative influences such as heat, humidity, dust, chemicals etc.

The following storage instructions are to be observed:

- Storage place: cool, dry, dust-free and slightly ventilated
- Storage temperatures between +2°C and +40°C
- Relative air humidity not more than 50%.

If these values are exceeded, metal products should be sealed in foil and protected from condensation water with a suitable desiccant.

Do not store solvents, fuels, lubricants, chemicals, acids, disinfectants and similar in the storage room.

4 Transport and intermediate storage

4.1 General

Before shipment **sera** products are checked for proper condition and functioning.

The customer has to check the product for transport damage immediately after receipt. Any damage detected is to be reported immediately to the carrier and the supplier.

Operating Instructions

5 Components of the diaphragm pump

5.1 C 409.2

The diaphragm pump may be composed of the following (main) components:

- Stroke mechanism
- Drive with electronics
- Stroke length adjustment
- Assembly pump
- Pump body
- Valves

Optional accessories:

- Diaphragm rupture electrode
- Manual stroke length adjustment with position indicator
- Actuator

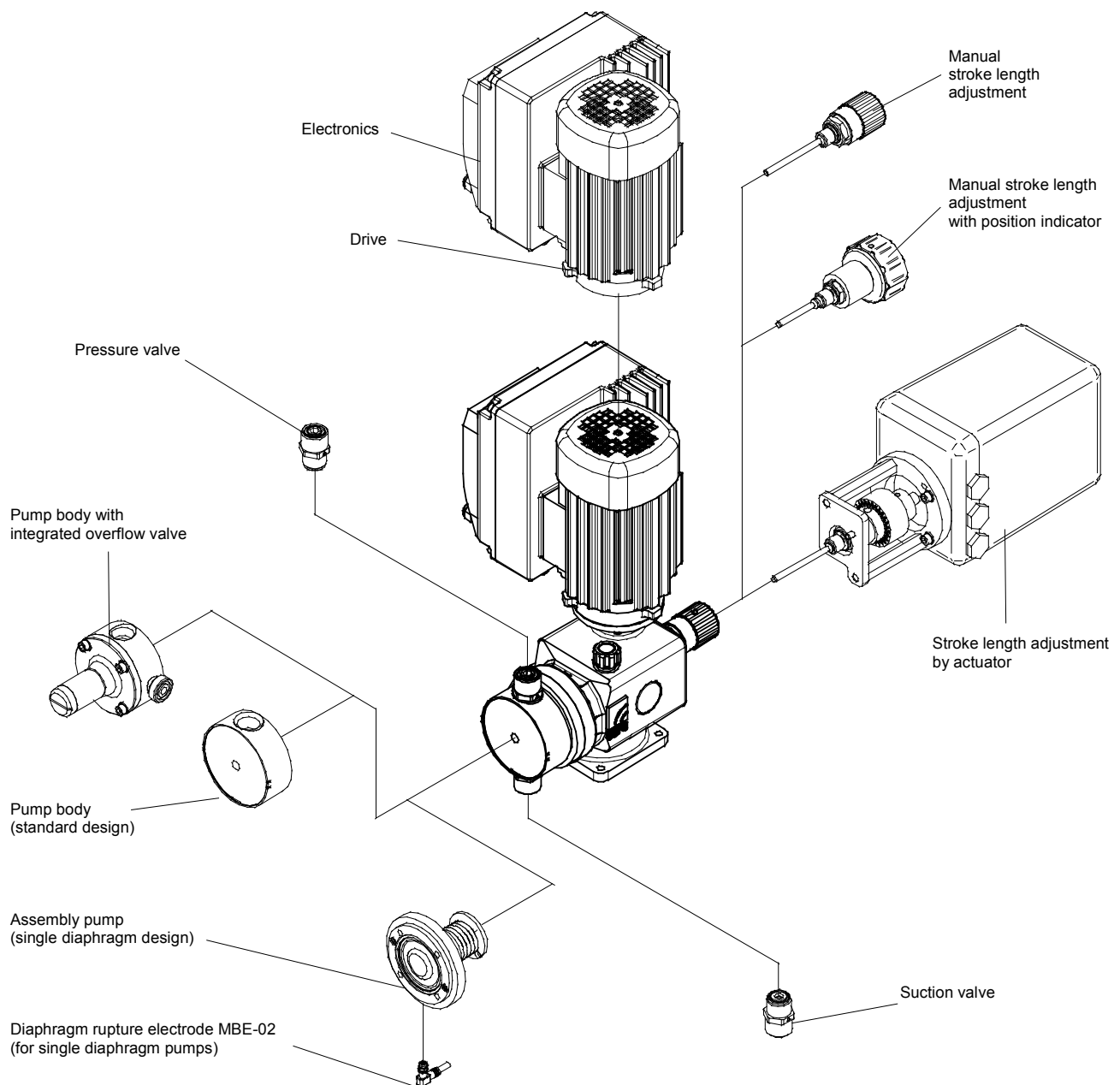


Fig. 06 Overview of the components C 409.2

Operating Instructions

6 Technical specifications

6.1 Dimensions

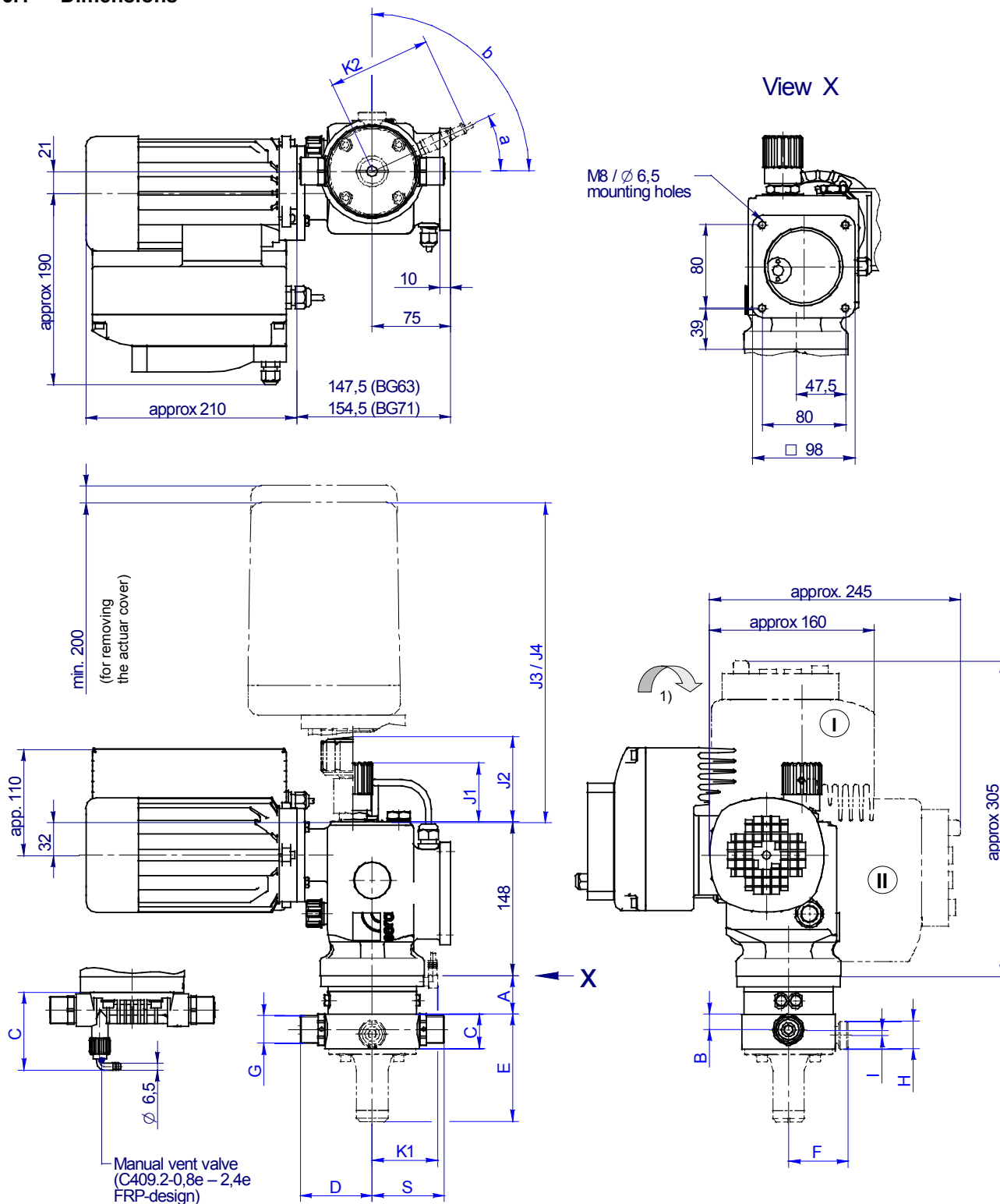


Fig. 08 Dimensions

- 1) Drive with electronics can be rotated throughout 90° each and can be put to the positions I and II.
(release the motor fastening screws, put the motor carefully to the desired position and fasten with screws again).

Operating Instructions

Table 02
Dimensions

All dimensions in mm!

			C 409.2-1,6 e	C 409.2-2,4 e	C 409.2-7,0 e	C 409.2-12 e
Valves	S	Single valves PVC	---	---	52	52
		Double valves PP- FRP, PVDF- FRP PK (PP- FRP / PVDF- FRP)	80	80	56	56
		Double valves PP- FRP, PVDF- FRP PK (PP / PVDF)	---	---	57	60
		Double valves 1.4571/1.4581	---	---	57	61
		Chamber valves PVC, PP, PVDF, 1.4571	70	70	---	---
		Chamber valves PVC, PP, PVDF, 1.4571	70	70	---	---
	D	Single valves PVC	---	---	65	65
		Double valves PP- FRP, PVDF- FRP PK (PP- FRP / PVDF- FRP)	80	80	64	64
		Double valves PP- FRP, PVDF- FRP PK (PP / PVDF)	---	---	57	60
		Double valves 1.4571/1.4581	---	---	57	61
		Chamber valves PVC, PP, PVDF, 1.4571	70	70	---	---
		Chamber valves PVC, PP, PVDF, 1.4571	70	70	---	---
	G	Connection thread Suction/pressure valve	G ¾	G ¾	G ¾	G ¾
Assembly pump	A	Assembly pump	16	16	17	14
Pump body (PB)	B	Centre of valve thread	17	17	15	16
	C	Pump body standard design (without front plate)	43	43	36	36
		Pump body (with front plate)	45	45	38	38
		Pump body (FRP-design)	---	---	33	35
		Pump body (FRP-design) with manual vent valve	75	75	---	---
	E	Pump body with integrated overflow valve	---	---	97	97
	F	Overflow valve socket (PVC, PP, PVDF) max.	---	---	47	47
		Overflow valve socket (1.4571) max.	---	---	52	52
	H	Connection thread socket overflow valve ¹⁾	---	---	G ¾	G ¾
SLA	I	Distance: centre of valve thread – centre of overflow valve socket	---	---	0	0
	J1	Manual stroke length adjust- ment (SLA) (max.)	70	70	70	70
	J2	Manual SLA with position indi- cator	110	110	110	110
	J3	Electrical actuator	240	240	240	240
Option	J4	Electrical actuator with PMR3	320	320	320	320
	K1	Diaphragm rupture signalling MBE-02	67	67	67	67
	b	Angle, socket overflow valve	---	---	90°	90°
Stroke mechanism	a. o. Dimensions for fastening of the pump		see Fig. 08			

Operating Instructions

Table 03
Dimensions

All dimensions in mm!

¹⁾ Connection thread G1
for single valves PVC

Table 03 Dimensions			C 409.2-18 e	C 409.2-25 e	C 409.2-50 e	C 409.2-75 e	C 409.2-90 e	C 409.2-115 e	C 409.2-140 e	C 409.2-180 e	C 409.2-250 e		C 409.2-350 e	
All dimensions in mm!														
1) Connection thread G1 for single valves PVC														
Valves	S	Single valves PVC	52	52	70	70	78	78	78	78	---	119	---	119
		Single valves PP- FRP, PVDF- FRP PB (PP-FRP / PVDF-FRP)	---	---	69	69	76	76	76	76	---	---	---	---
		Single valves PP-FRP, PVDF-FRP PB (PP / PVDF)	---	---	67	67	75	75	75	75	122	---	122	---
		Single valves 1.4571/1.4581	---	---	---	---	---	---	---	---	122	---	122	---
		Double valves PP-FRP, PVDF-FRP PB (PP-FRP / PVDF-FRP)	56	56	69	69	76	76	76	76	---	---	---	---
		Double valves PP-FRP, PVDF-FRP PB (PP / PVDF)	60	60	67	67	75	75	75	75	152	---	152	---
		Double valves 1.4571/1.4581	61	61	68	68	76	76	76	76	152	---	152	---
		Single valves PVC	65	65	77	77	85	85	85	85	---	138	---	138
	D	Single valves PP-FRP, PVDF-FRP PB (PP-FRP / PVDF-FRP)	---	---	69	69	76	76	76	76	---	---	---	---
		Single valves PP-FRP, PVDF-FRP PB (PP / PVDF)	---	---	67	67	75	75	75	75	122	---	122	---
		Single valves 1.4571/1.4581	---	---	---	---	---	---	---	---	122	---	122	---
		Double valves PP-FRP, PVDF-FRP PB (PP-FRP / PVDF-FRP)	64	64	69	69	76	76	76	76	---	---	---	---
		Double valves PP-FRP, PVDF-FRP PB (PP / PVDF)	60	60	67	67	75	75	75	75	152	---	152	---
		Double valves 1.4571/1.4581	61	61	68	68	76	76	76	76	152	---	152	---
	G	Connection thread Suction/pressure valve	G ¾	G ¾	G ¾	G ¾	G ¾	G ¾	G ¾	G ¾	G1¼	G1	G1 ¼	G1
Assembly pump	A	Assembly pump	14	14	15	15	19	19	19	19	32		32	
Pump body (PB)	B	Centre of valve thread	16	16	15	15	15	15	15	15	30		30	
	C	Pump body standard design (without front plate)	36	36	38	38	37	37	37	37	74		74	
		Pump body (with front plate)	38	38	40	40	39	39	39	39	77		77	
		Pump body (FRP-design)	35	35	33	33	33	33	33	33	---		---	
	E	Pump body with integrated overflow valve	97	97	102	102	109	109	109	109	158		158	
	F	Overflow valve socket (PVC, PP, PVDF) max.	47	47	57	57	73	73	73	73	102		102	
		Overflow valve socket (1.4571) max.	52	52	62	62	77	77	77	77	110		110	
	H	Connection thread socket overflow valve 1)	G ¾	G ¾	G ¾	G ¾	G1	G1	G1	G1	G1 ¼ 1)		G1 ¼ 1)	
	I	Distance: centre of valve thread – centre of overflow valve socket	0	0	0	0	5	5	5	5	0		0	
SLA	J1	Manual stroke length adjustment (SLA) (max.)	70	70	70	70	70	70	70	70	70		70	
	J2	Manual SLA with position indicator	110	110	110	110	110	110	110	110	110		110	
	J3	Electrical actuator	240	240	240	240	240	240	240	240	240		240	
	J4	Electrical actuator with PMR3	320	320	320	320	320	320	320	320	320		320	
Option	K1	Diaphragm rupture signalling MBE-02	67	67	67	67	67	67	67	67	102		102	
	b	Angle, socket overflow valve	90°	90°	90°	90°	90°	90°	90°	90°	45°		45°	
Stroke mechanism	a. o. Dimensions for fastening of the pump		see Fig. 08											

Operating Instructions

Type	Pump data							
	Nominal delivery ²⁾ rate adjustable by stroke length ad- justment and stroke frequency adjustment		Maximum permis- sible pressure in the pump outlet	Minimum / maxi- mum permissible pressure in the pump inlet	Maximum suction height ¹⁾	recommended nominal diameter of the connecting pipes	Nominal stroke frequency	Maximum stroke length
	Q _N l/h	Q _N ml/stroke	p ₂ max.	p ₁ min. / max.	WC	DN	min ⁻¹	h100
	60 Hz		bar	bar	m	mm	60 Hz	mm
C 409.2 – 1,6 e	0-1,6	0-0,27	10	-0,3/0	3	5	100	1,6
C 409.2 – 2,4 e	0-2,4	0-0,27	10	-0,3/0	3	5	150	1,6
C 409.2 – 7,0 e	0-7,0	0-0,78	10	-0,3/0	3	5	150	4
C 409.2 – 12 e	0-12	0-3,0	10	-0,3/0	3	10	67	6
C 409.2 – 18 e	0-18	0-3,0	10	-0,3/0	3	10	100	6
C 409.2 – 25 e	0-25	0-2,8	10	-0,3/0	3	10	150	6
C 409.2 – 50 e	0-50	0-8,3	10	-0,3/0	3	10	100	8
C 409.2 – 75 e	0-75	0-8,3	10	-0,3/0	3	15	150	8
C 409.2 – 90 e	0-90	0-15,0	8	-0,3/0	3	15	100	10
C 409.2 – 115 e	0-115	0-19,2	4	-0,3/0	3	15	100	10
C 409.2 – 140 e	0-140	0-15,6	8	-0,3/0	3	15	150	10
C 409.2 – 180 e	0-180	0-20,0	4	-0,3/0	3	15	150	10
C 409.2 – 250 e	0-250	0-41,7	3	-0,3/0	3	15	100	10
C 409.2 – 350 e	0-350	0-38,9	3	-0,3/0	3	15	150	10

Table 09 Technical data / Pump data

¹⁾ Achievable height with media similar to water and filled suction line

²⁾ Linear dosing range at a stroke length between 20% and 100% and at a stroke frequency between 5 and 100%

Operating Instructions

Type	Drive				Weight ¹⁾ kg
	Output	Frequency	Nominal voltage	Nominal current	
	kW	Hz	V	A	
C 409.2 – 1,6 e	0,37	60	100-120	6,0	10,7
C 409.2 – 2,4 e	0,37	60	100-120	6,0	10,7
C 409.2 – 7,0 e	0,37	60	100-120	6,0	10,6
C 409.2 – 12 e	0,37	60	100-120	6,0	10,7
C 409.2 – 18 e	0,37	60	100-120	6,0	10,7
C 409.2 – 25 e	0,37	60	100-120	6,0	10,7
C 409.2 – 50 e	0,37	60	100-120	6,0	10,5
C 409.2 – 75 e	0,37	60	100-120	6,0	12,6
C 409.2 – 90 e	0,37	60	100-120	6,0	14,1
C 409.2 – 115 e	0,37	60	100-120	6,0	14,1
C 409.2 – 140 e	0,37	60	100-120	6,0	14,1
C 409.2 – 180 e	0,37	60	100-120	6,0	14,1
C 409.2 – 250 e	0,37	60	100-120	6,0	16,6
C 409.2 – 350 e	0,37	60	100-120	6,0	16,6

Table. 10 Technical data / drive

¹⁾ standard-design

Operating Instructions

Additional data for electronics

Type	Electronics data					
	Inlet voltage / Control input	Min. contact signal time Min. distance between pulses	Analogue input resistance	Digital output	Protection category	Thermal class
C 409.2-...	5...30 V DC	55 ms	100 Ω	PNP, internal supply max. 15V DC, 50 mA external supply max. 30V DC, 350 mA	IP 55	F

Table. 12 Electronics data

Operating Instructions

7 Functional description

7.1 General

sera diaphragm pumps are run-dry safe oscillating displacement pumps that are characterised by high tightness of the dosing head. The liquid is conveyed by a deformable drive diaphragm.

Controllable diaphragm pumps consist of the following (main) components:

- Drive motor with electronics
- Stroke mechanism
- Stroke length adjustment
- Assembly pump
- Pump body
- Suction and pressure valve

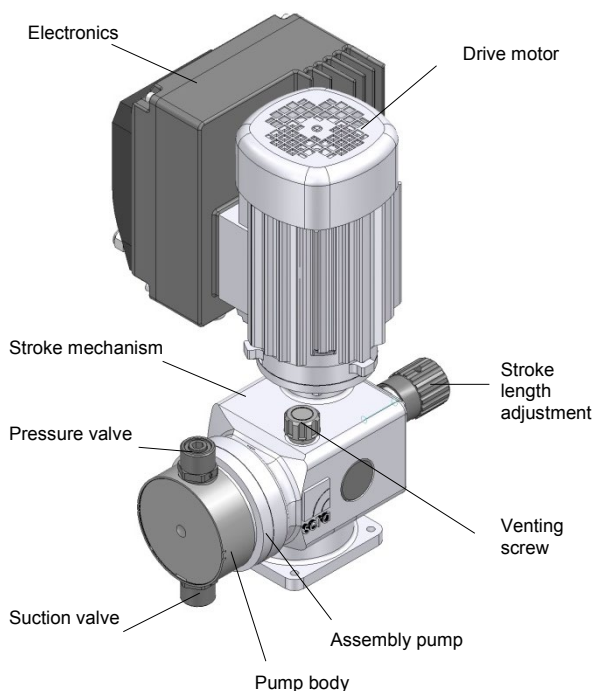


Fig. 06 Components

7.2 Components of the diaphragm pump C 409.2

7.2.1 Stroke mechanism

Function

Diaphragm pumps of this type series use a rotary cam drive to transmit the rotation of the drive motor to the displacement body.

In case of the rotary cam drive, the eccentric provides the pressure stroke while the suction stroke is performed by a pressure spring (return spring).

The effective stroke length can be changed by means of an adjustable scale knob which prevents the connecting rod from following the rotary cam up to the rear dead centre during suction stroke (see stroke length adjustment).

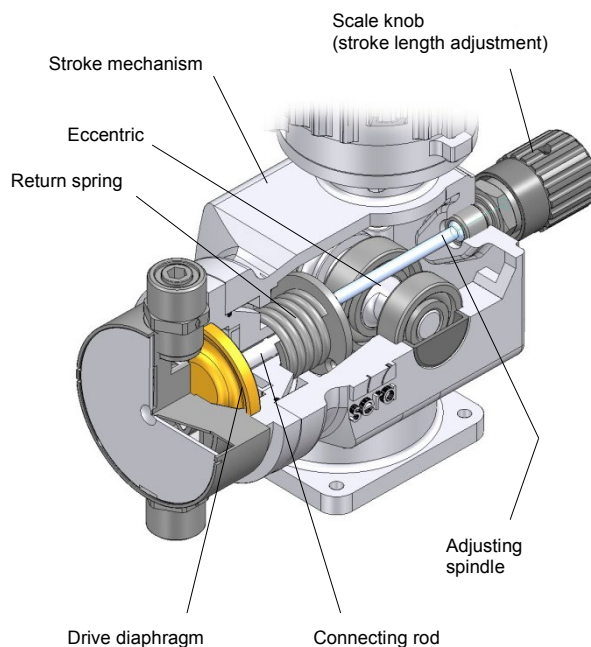


Fig. 06 Stroke mechanism

Operating Instructions

7.2.2 Electronics (operating panel)

The electronics permit proportional volumetric dosing via analogue signals 0/4 ... 20 mA or contact signals with the option of dividing or duplicating the pulse.

An integrated LCD display and three LED's for warning and fault display indicate the current status of the dosing pump (see Fig. 08).

A connection for flow monitoring or flow measurement as well as an empty signal with pre-alarm and dry operation alarm are installed as standard (see Chapter 9.1).

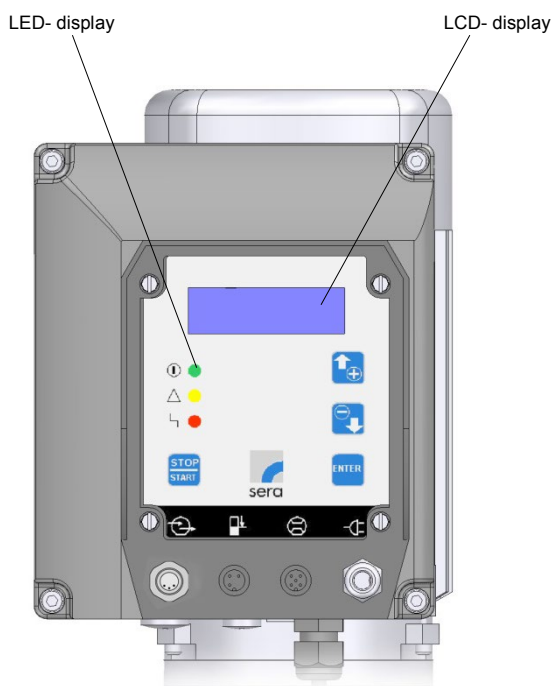


Fig. 08 Electronics

7.2.3 Stroke length adjustment

The delivery rate of the pump is regulated by changing the stroke length. The stroke length is infinitely variable between 0% and 100%.

A linear dosing behaviour is achieved with stroke length adjustments between 20% and 100%

7.2.3.1 Manual stroke length adjustment (standard)

The effective stroke length of the connecting rod is changed by turning the scale knob.

The stroke length can be adjusted both during operation and at standstill of the pump (system not under pressure).

The set stroke length can be read off a scale, e.g. 75% (see Fig. 09).

With the 20-steps adjustment on the scale knob, the stroke length can be set individually with a tolerance of 0.5%.

Turning counter-clockwise (see Fig. 09) → the effective stroke length is enlarged, the delivery rate increases.

Turning clockwise → the effective stroke length is reduced, the delivery rate reduces.

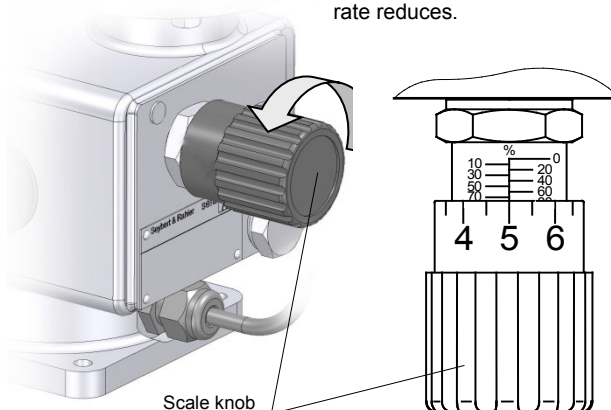


Fig. 09 Stroke length adjustment / Scale knob

Protection for stroke length adjustment (option)

A protecting cap can be provided for the protection of the stroke length adjustment against unintentional adjustment.

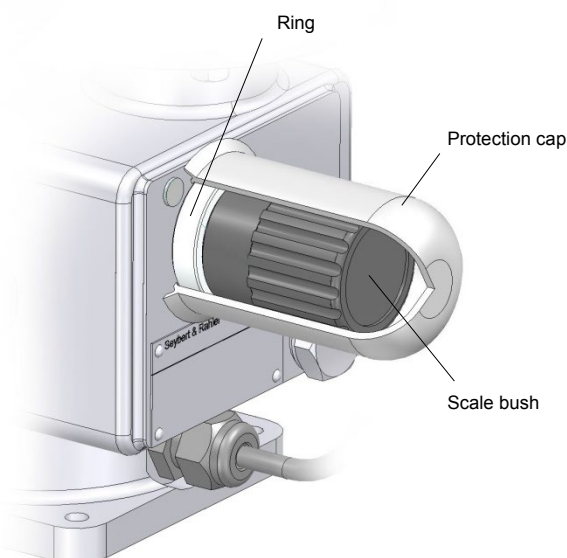


Fig. 10 Stroke length adjustment with protection

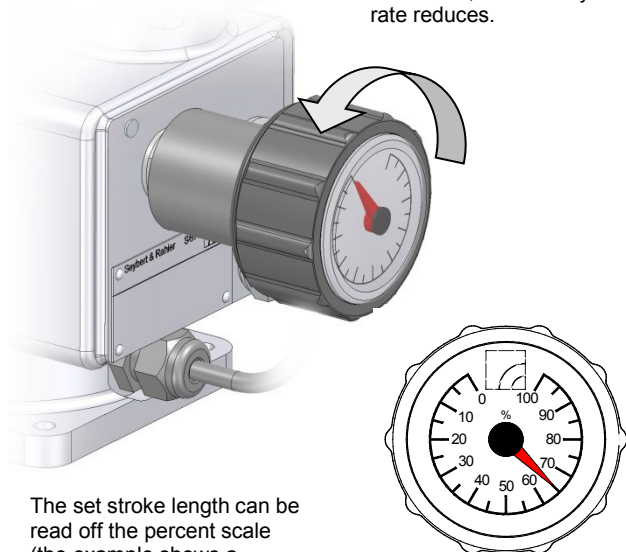
Operating Instructions

7.2.3.2 Manual stroke length adjustment by a dial scale with indication of percent (option)

The stroke length is adjusted by turning the hand wheel. The stroke length can be adjusted both during operation and at standstill of the pump (not under pressure).

Turning counter-clockwise → the effective stroke length is increased, the delivery rate increases (see Fig. 11)

Turning clockwise → the effective stroke length is reduced, the delivery rate reduces.



The set stroke length can be read off the percent scale (the example shows a set stroke length of 65%).

Fig. 11 Stroke length adjustment with position indicator

In delivery state, the stroke length adjustment is factory set to 50%.

NOTE !

The dial scale with indication of percent may become misadjusted during transport
If the pointer does not match the 50%-setting the percent scale is to be readjusted with the pump running!

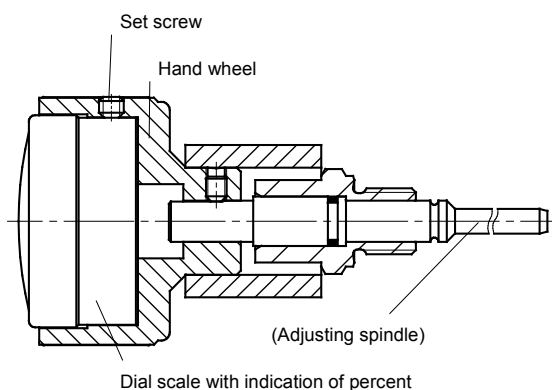


Fig. 12 Stroke length adjustment with position indicator

Adjusting the percent scale:

- Switch the diaphragm pump on
- Loosen the set screw
- Remove the percent scale from the hand wheel
- Manually turn the percent scale to 0% setting
- Use the hand wheel to set the stroke length to 0%. Turn hand wheel clockwise until there is no further stroke movement (connecting rod does no longer hit the adjusting spindle)
- Insert percent scale again
- Use set screw to secure the percent scale to the hand wheel
- Adjust desired stroke length

7.2.3.3 Automatic stroke length adjustment by an electrical actuator

The electrical actuator is directly mounted to the stroke mechanism of the dosing pump. A clutch transmits the rotary motion of the actuator driveshaft to the adjusting spindle. The axial displacement is compensated in the clutch.

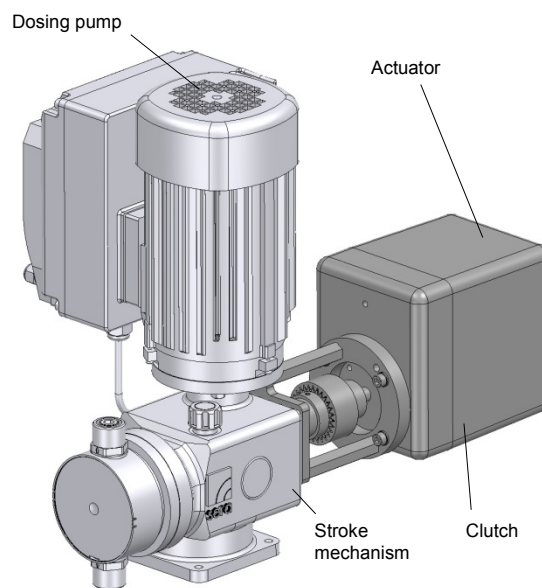


Fig. 13 Stroke length adjustment by actuator

In case of dosing pumps with electrical actuator, a manual adjustment of the stroke length on the pump is no longer possible. (Exception: actuator with hand wheel)

The actuator is standardly equipped with two integrated limit switches and a position potentiometer for position feedback. Both limit switches are factory set so that the drive will switch off at a stroke length of 0% and 100%, even if a control voltage is applied.

This guarantees that adjustments can only be made within the permissible range. The position potentiometer is driven by a safety clutch which prevents damage caused by incorrectly adjusted limit switches.

Activation is performed by appropriate control units (see sera - accessories).

Operating Instructions

The set stroke length can be read off on the pump (percent scale).
Information about the electrical connection is given inside the cover of the actuator.

CAUTION !



The adjustment is only possible when the pump is running.

7.2.3.4 Automatic stroke length adjustment by an electrical actuator with integrated positioner

This positioner integrated in the actuator enables an actuator setting from 0...100% that is proportional to the connected input signal.

As an option, the actuator can also be provided with a collective interference signal.

Information about the electrical connection is given inside the cover of the actuator.

7.2.4 Assembly pump

Function

The drive diaphragm connected to the drive via the connecting rod transmits the stroke movement directly to the pumped medium.

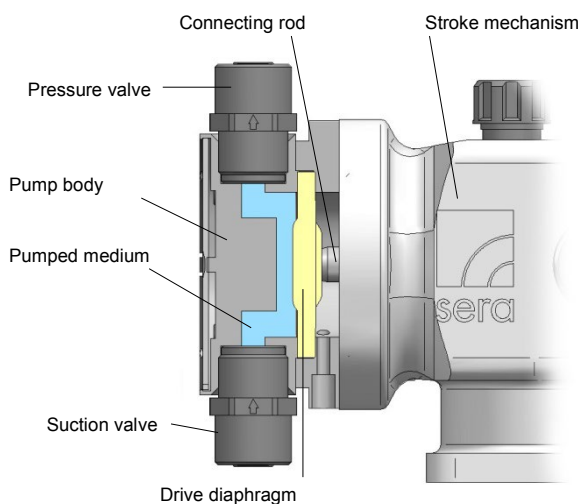


Fig. 14 Functional principle of the diaphragm pump

7.2.5 Pump body

Depending on the applied backpressure, movements of the plastic pump body in elastic materials are possible. This does not affect the pumps's service life or operational reliability.

7.2.6 Pump body with integrated overflow valve

The integrated diaphragm overflow valve protects the pump from unacceptable overpressure at closed pressure line. Pipes and fittings, however, are not protected and have to be protected separately, if necessary. It can be used for liquid media without solid matters according to the manufacturer specifications.

Operating Instructions

Pump bodies with integrated overflow valve are equipped with an additional relief channel through which the pumped medium is drained in case of an unacceptable overpressure.

The relief channel is closed by the mechanically prestressed diaphragm of the overflow valve.

The mechanical prestress which is executed by a pressure spring can be adjusted with a set screw. If the pressure of the pumped medium on the diaphragm exceeds the set pressure, the diaphragm is lifted and the pumped medium flows into the relief channel.

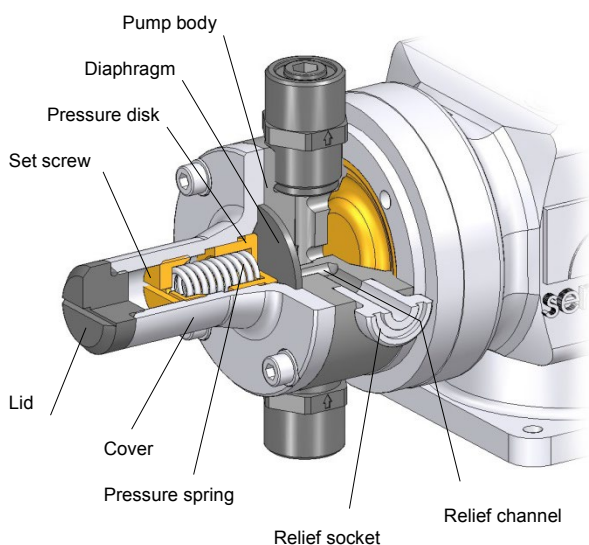


Fig. 16 Pump body with integrated overflow valve

When the pressure in the pump body falls below the pressure set the diaphragm closes the inlet channel again.

NOTE !

The integrated overflow valve is always set to the maximum pump pressure ($P_2 \text{ max.}$) if no other value is specified.

7.2.7 Manual vent valve (only FRP-execution C 409.2-1,6e - ...-2,4e)

Function

The vent valve is used to release the manual pressure in the pump body during commissioning. Open vent valve when pump primes first time.

When vent valve is opened gas including medium escapes into the feedback line. The vent valve must be closed again as soon as only medium without gas constituent escapes. The pump now feeds the medium into the pressure line.

Open again for another ventilation. The vent valve consists of a vent screw with integrated hose nozzle, which must be fitted with a hose (inside diameter 6 mm) as feedback line (see Fig. 17). The leaking medium incl. the gas admixtures must be disposed off properly.

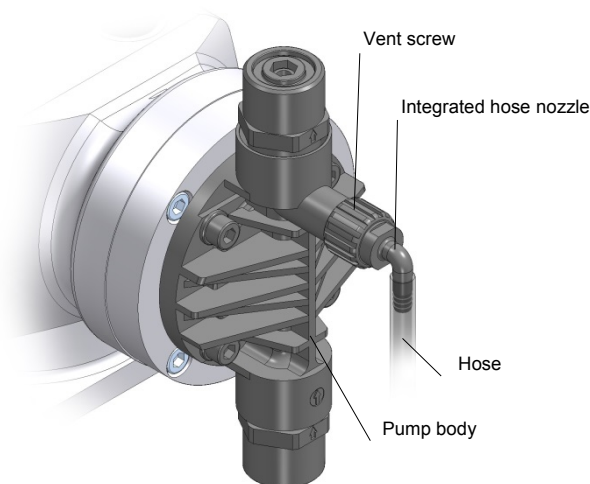


Fig. 17 Vent valve

The vent screw is inserted during normal operation.

CAUTION!



Open vent screw with great caution and perform max. 1 turn. Take care that the tightness of the thread is still guaranteed.
Danger of leaking medium!

CAUTION !



The vent screw must always be closed during the driving process.

Operating Instructions

7.2.8 Suction/pressure valve

The pump valves are always ball valves which can only function properly when they are installed in a vertical position. The condition of the valves is decisive for the operational behaviour of the pump. The valves should only be exchanged completely. Pay attention to the flow direction when installing the valves (see Fig. 18).

NOTE !

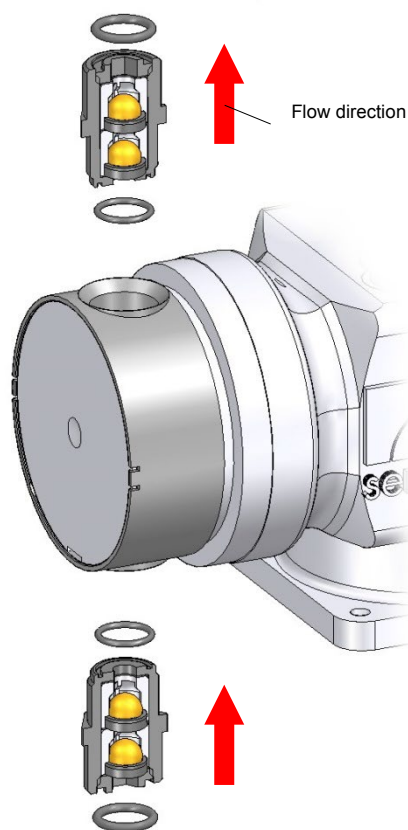
Pressure valve above, suction valve below!

7.2.9 Diaphragm rupture monitoring device (option)

sera diaphragm pumps of the 409.2 series can be equipped with a conductive diaphragm rupture monitoring device as option.

NOTE !

The sensitivity of the diaphragm rupture electrode can be adapted to the conductivity of the medium via the electronics (see Chapter 10.15.3).
Preset ex works to 50% approx. 10 µS/cm.



The diaphragm rupture electrode type MBE-02 is put in the base ring of the dosing pump from below (please see Fig. 02/03)

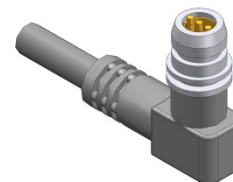


Fig. 20 MBE-02

NOTE !

Maintenance of the diaphragm rupture electrode (MBE) is limited to cleaning when the diaphragm is exchanged. The MBE must only be replaced if it was destroyed by the pumped medium.

Fig. 18 Double valves, GFK design (standard design only for 409.2-18(e) / 25(e))

Operating Instructions

7.3 Drive motor

A **sera** diaphragm pump of series C 409.2 is driven by a threephase-motor controlled by the electronics.

7.3.1 Start-up

Preconditions:

Make sure that voltage and frequency correspond with the specifications on the type plate of electrics.

The nominal motor power on the type plate of the motor refers to an ambient temperature of 40°C and an installation site below 1000m above sea level. Motor output will be reduced if these values are exceeded (see VDE 0530).

Adapted for "moderate" group of climates according to IEC 721-2-1.

7.3.2 Motor protection

A protective motor switch is not necessary due to the fact that a thermic overload protection is integrated in the pump for the protection of the motor.

7.3.3 Maintenance of the drive motor

The electric motor should always be kept clean so that neither dust, dirt, oil nor other contaminates may affect the correct operation.

In addition, we recommend to ensure that:

- the motor does not produce strong vibrations
- suction and blowing openings for the supply of cooling air are not closed or restricted (may lead to unnecessary high temperatures in the windings).

The ball bearings inserted in the motor are lubricated for life.

8 Assembly / Installation

8.1 Installation instructions

CAUTION !



The standard model of the pump is only approved for installation in dry rooms in a non-aggressive atmosphere, at temperatures between +2°C and +40°C

- For dimensions of the pump connections and fixing holes,
- Protect the pump against any sources of heat and against the direct irradiation of sun and ultraviolet light

IMPORTANT NOTE !

When the C 409.2 is installed next to a pump of series 204.1 a minimum distance of 100 mm between the pumps (motor housings) has to be kept!

- Install the pump in such a way that there is no vibration and no tension and that it is aligned precisely.
- Install the pump at the optimum possible operating height. Mount the pump in such a way that the valves are vertical.
- Ensure that there is sufficient space around the pump body and the suction and pressure valve so that these parts may be easily dismantled, if required.
- The stroke length adjustment and indicator scale must be easily accessible and readable.
- Mount the pump in such a way that electronics, operating panel and electric connections are easy accessible.
- Design the nominal diameters of the downstream pipes and of the connections built into the system to be the same size or larger than the nominal inlet and outlet diameters of the pump.
- To check the pressure ratios in the pipe system, we recommend to provide for connections for pressure gauges (e.g. manometers) near the suction and pressure sockets.
- Drain cocks are to be provided.
- Prior to connecting the pipes, remove the plastic caps on the suction and pressure sockets of the pump.
- Check that the fixing screws for the pump body are tightly fitted and, if necessary, retighten.
- Fixing of pump with 4 Fixing screws M6 (without thread using in pump feed) or with 4 Fixing screws M8 with thread using in pump feed. Non-fixing with plastic screws!

Operating Instructions

Tightening torques of the fixing screws		
Pump type	Pump body without front plate	Pump body with front plate
...409.2-1,6 e	5,0 Nm	4,5 Nm
...409.2-2,4 e		
...409.2-7,0 e	4,0 Nm	4,5 Nm
...409.2-12 e		
...409.2-18 e		
...409.2-25 e		
...409.2-50 e		
...409.2-75 e	7,0 Nm	8,0 Nm
...409.2-90 e		
...409.2-115 e		
...409.2-140 e		
...409.2-180 e		
...409.2-250 e	15,0 Nm	15,0 Nm
...409.2-350 e		

Tab. 13 Tightening torques

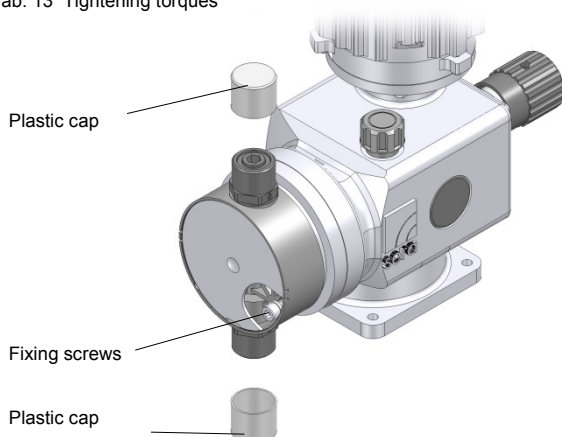


Fig. 22 Diaphragm pump with plastic caps

- For models with a built-on actuator, ensure sufficient space for removal of the cover (see Chapter 6.1 "Dimensions")
- Connect pipes to the pump in such a way that there are no forces acting on the pump, such as e.g. misalignment, weight or stress of the pipe.
- Keep the suction lines as short as possible.
- Use pressure- and medium-resistant hoses / pipes.
- All pipes and containers connected to the pump must comply with the regulations and must be cleaned, tension-free and intact.

WARNING !



If toxic, crystallizing or corrosive liquids are conveyed the pipe system is to be equipped with facilities for emptying, cleaning and rinsing with an appropriate medium, if necessary.
Danger of breach / Danger of poisoning

CAUTION !



Mount the diaphragm pump in such a way that leaking medium cannot cause any damage.

In order to avoid cavitation, overloading and excessive delivery, the following points should be noted:

- avoid high suction heights
- keep pipes as short as possible
- choose sufficiently large nominal diameters
- avoid unnecessary choke points
- install a pulsation damper
- install a pressure relief
- install a pressure keeping valve, if necessary
- in the case of degassing media, provide for a supply

CAUTION !



The operator must provide for appropriate protective measures (collecting basin, diaphragm rupture electrode) in the supply pipe so that the container does not drain off in case of a diaphragm rupture.

8.1.1 Provide overpressure protection

if the permissible pressure in the pump head may be exceeded, e.g. when a shut-off valve is closed or if the line is blocked:

- install overflow valve (Fig. 23)
- use sera diaphragm pump with integrated overflow valve (Fig. 24).

When using an overflow valve, please note for the return line:

- lead the overflow line with descending gradient in the storage tank which is under atmospheric pressure or in an open drain gutter
- or connect the overflow line directly to the pump suction line, but only if there is no check valve inside the suction line (e.g. foot valve of a suction lance) (please see Fig. 25 / 26).

WARNING !



Shut-off valves must not be closed when the pump is running!
Danger of breach / Danger of poisoning by leaking medium in case of diaphragm- or pipe break.

WARNING !



Provide an overpressure protection (e.g. overflow valve) if the permissible operating pressure may be exceeded.
Danger of breach / Danger of poisoning by leaking medium in case of diaphragm- or pipe break.

Operating Instructions

WARNING !



If the permissible operating pressure is exceeded and the pump is not equipped with an overpressure protection the pump can get damaged.
Danger of breach / Danger of poisoning by leaking medium in case of diaphragm- or pipe break.

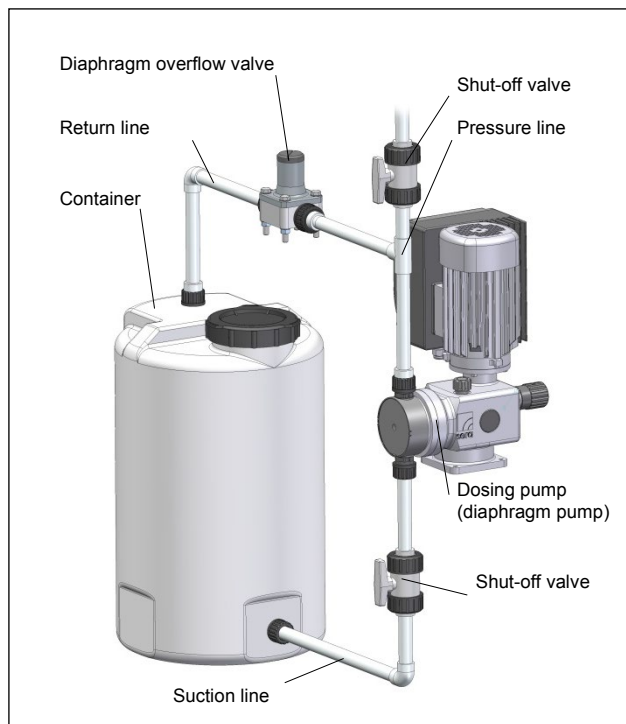


Fig. 23 System with (external) overflow valve

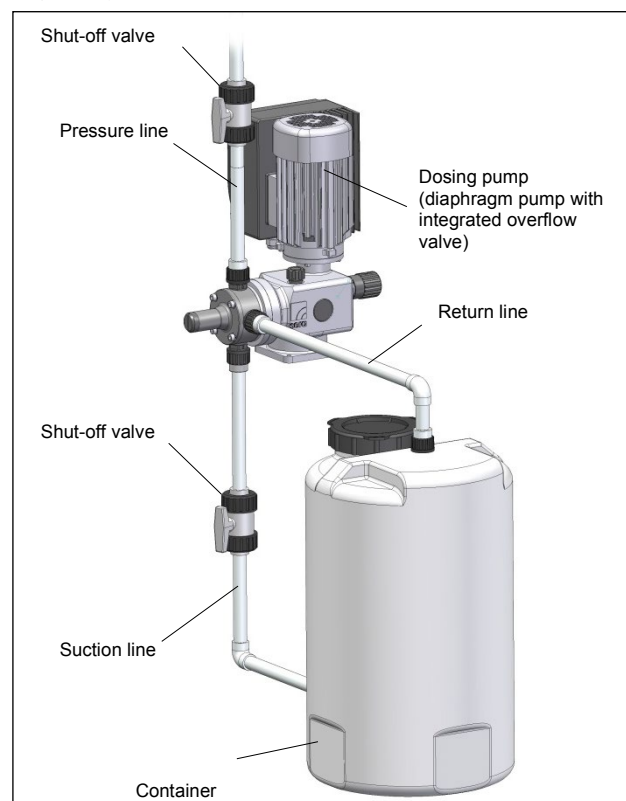


Fig. 24 System with integrated overflow valve

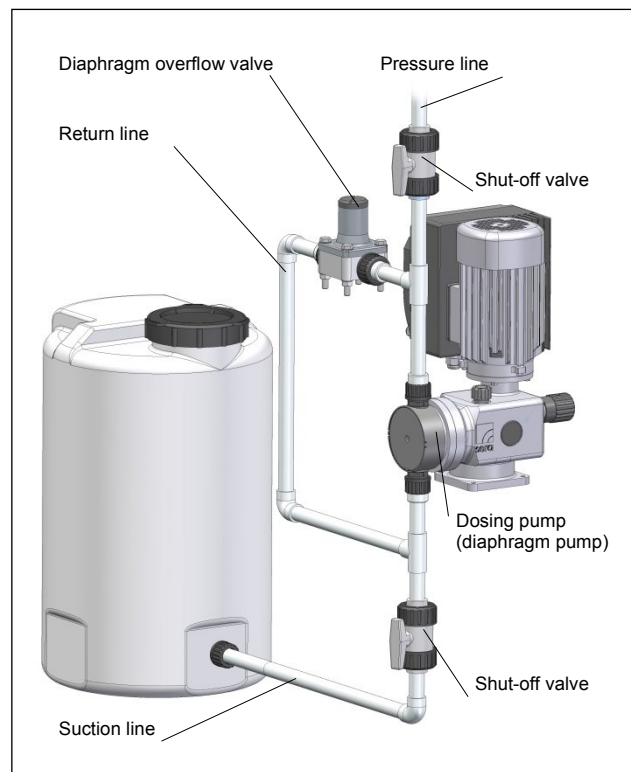


Fig. 25 System with (external) overflow valve

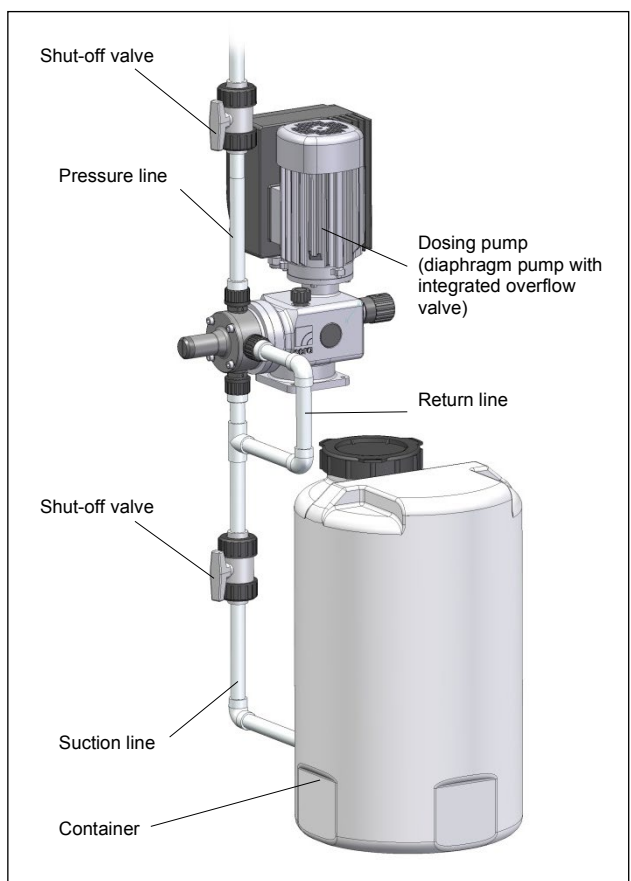


Fig. 26 System with integrated overflow valve

Operating Instructions

8.1.2 Prevent a backflow of the pumped medium

if the dosing line is linked with a main line:

- install an injection fitting (dosing valve).

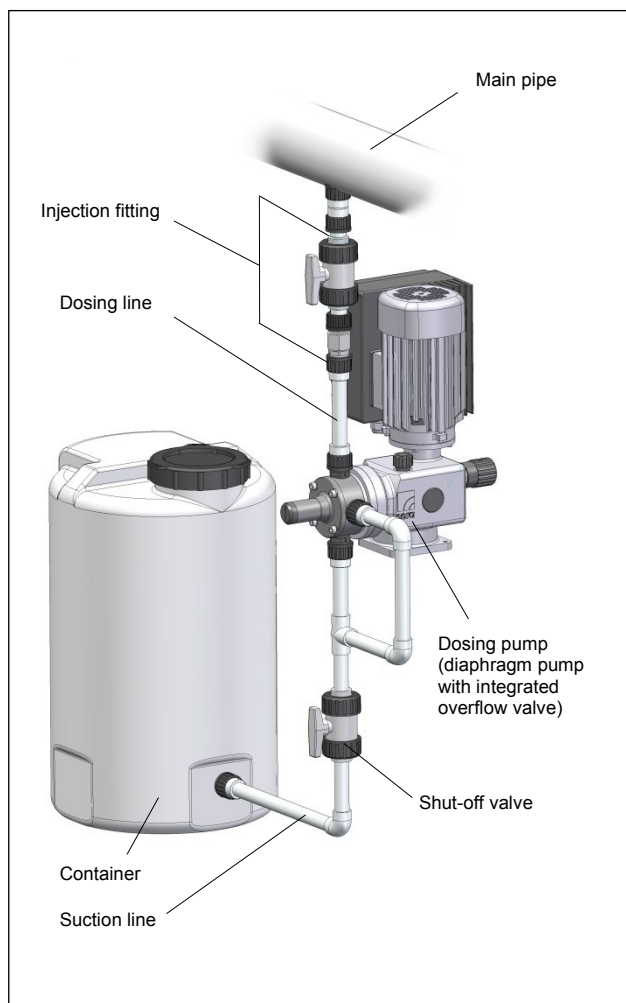


Fig. 27 Installing an injection fitting

CAUTION !



The contents in the dosing line is mixed unintentionally if a backflow from the main pipe is not prevented.

WARNING !



Note / avoid chemical reactions during a backflow.

8.1.3 Eliminate undesired siphoning

when dosing into a main line with negative pressure:

- install a pressure keeping valve in the dosing line.

CAUTION !



When installing the pump it is to be ensured that an excess supply (due to a positive pressure difference ≥ 1 bar) between pressure and suction side) is avoided. Danger of incorrect dosing!

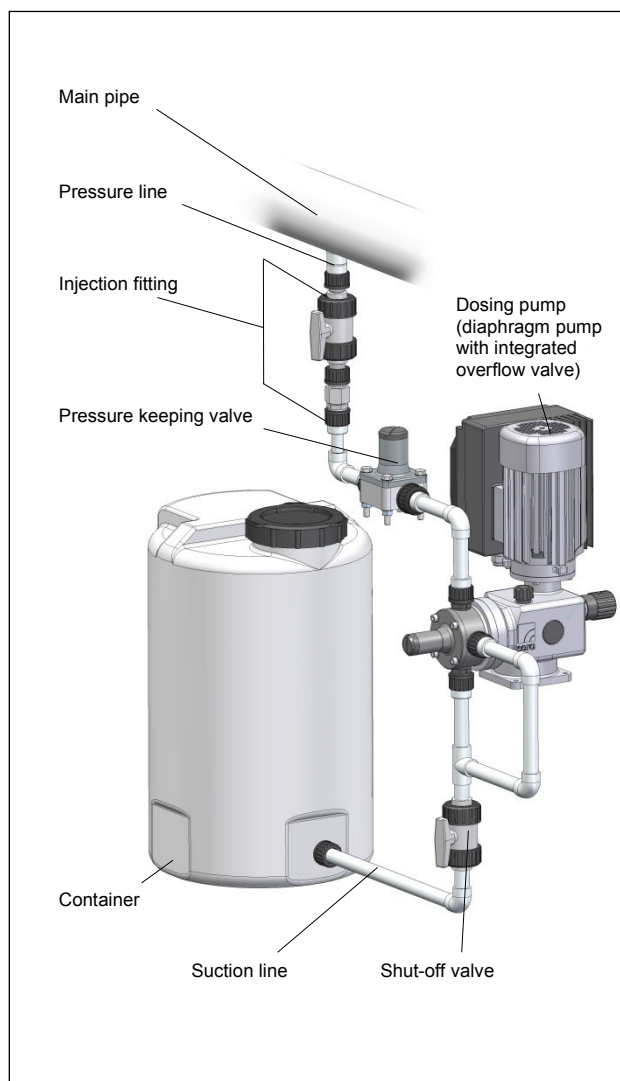


Fig. 28 Installing a pressure keeping valve

Operating Instructions

8.1.4 How to ensure an gas-free suction

If slightly degassing media are conveyed and the medium is pumped in a pressurised pipe or against a pressure keeping valve:

- install a ventilation valve in the pressure line (see Fig. 30)

NOTE !

The delivery flow may be interrupted if air/gas enters the suction line!

NOTE !

In the case of media which are lightly crystallizing when they come in contact with air, the return line should be laid with a loop. Thus a contact between the medium and air in the outlet area of the vent valve is prevented..

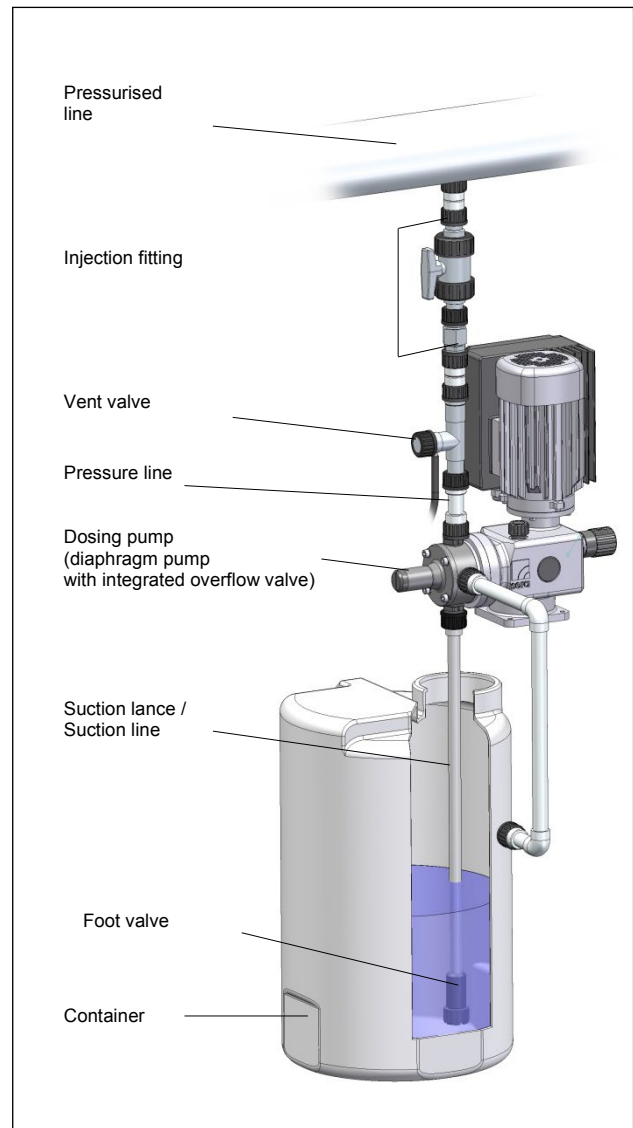


Fig. 30 Installing a ventilation valve

Operating Instructions

8.1.5 Install the empty-tank alarm

so that the tank is refilled before air is drawn in.

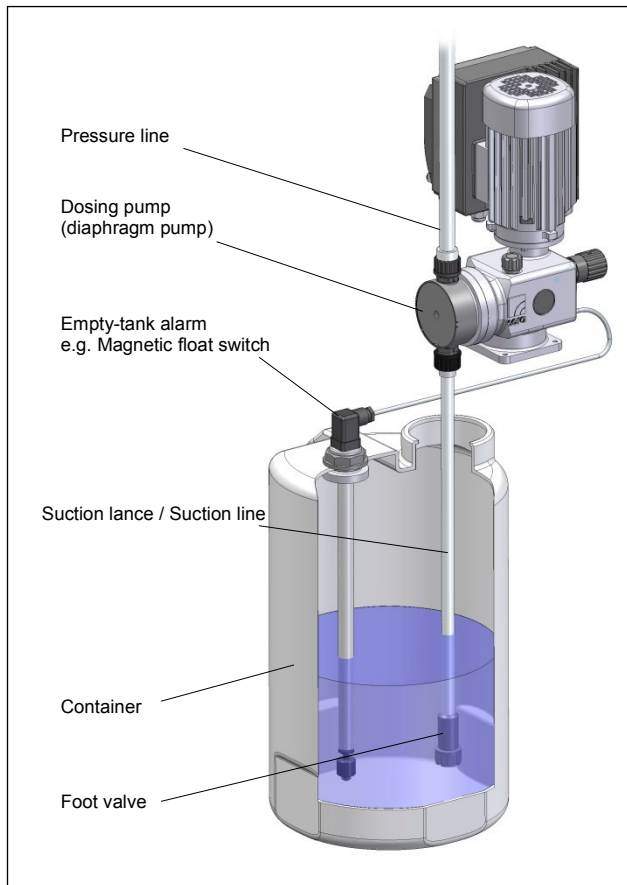


Fig. 31 Installing an empty-tank alarm

NOTE !

The delivery flow may be interrupted if air enters the suction line!

8.1.6 How to avoid an emptying of the suction line

- Install a foot valve at the end of the suction line.

Based on calculations, the dimension 'H' may not exceed the number that is equal to the specified maximum suction height of the pump divided by the density of the pumped medium and under consideration of mass acceleration and viscosity of the medium.

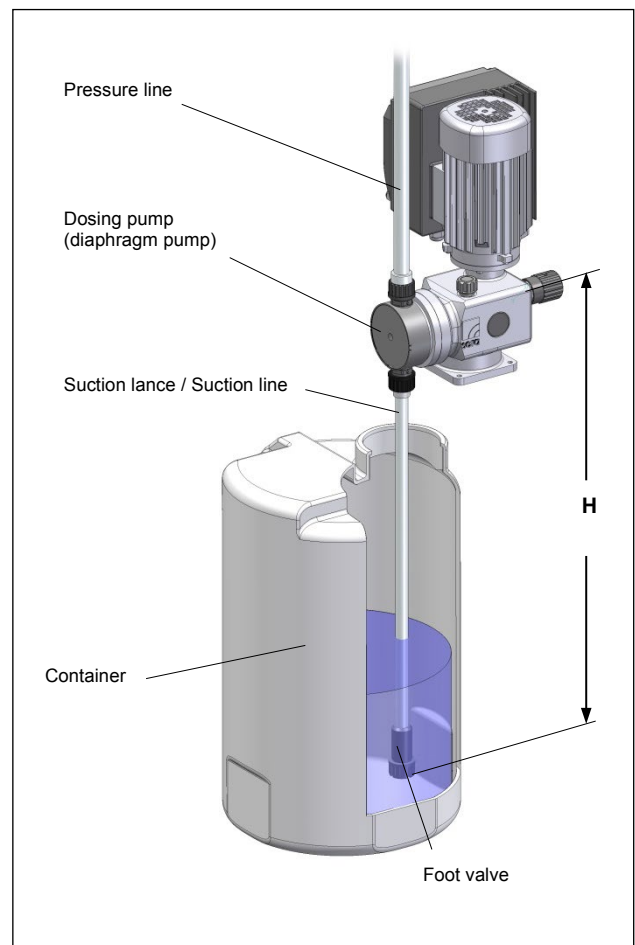


Fig. 32 Avoiding an emptying of the suction line

Operating Instructions

8.1.7 Line strainer

- Connect the suction line slightly above the bottom of the tank and install a line strainer (0.1 – 0.5mm aperture size – depending on nominal width of the valve).

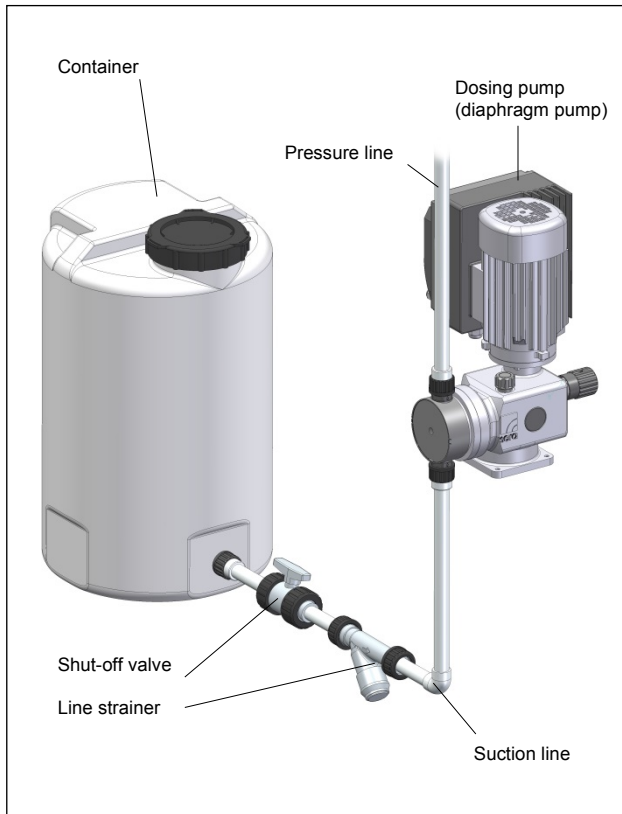


Fig. 33 Installing a line strainer

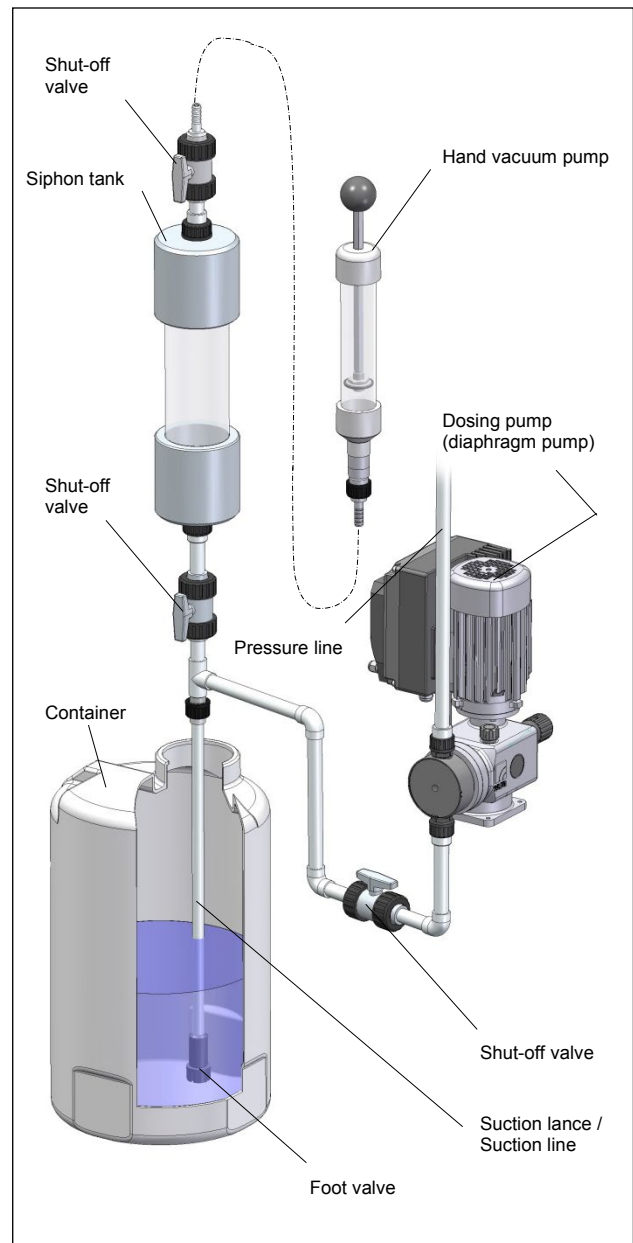
NOTE !

If contaminations are not removed this may result in malfunctions of the pump and the system.

8.1.8 Suction via a siphon pipe

for use with high tanks without connection on the bottom of the tank:

- Install a siphon tank.
- Pay attention to acceleration pressures which may be generated in a long suction line.



34 Installing a siphon tank (sera - fitting)

Operating Instructions

8.1.9 In case of slightly degassing dosing media

- Install the pump in such a way that it can be operated with a supply line.

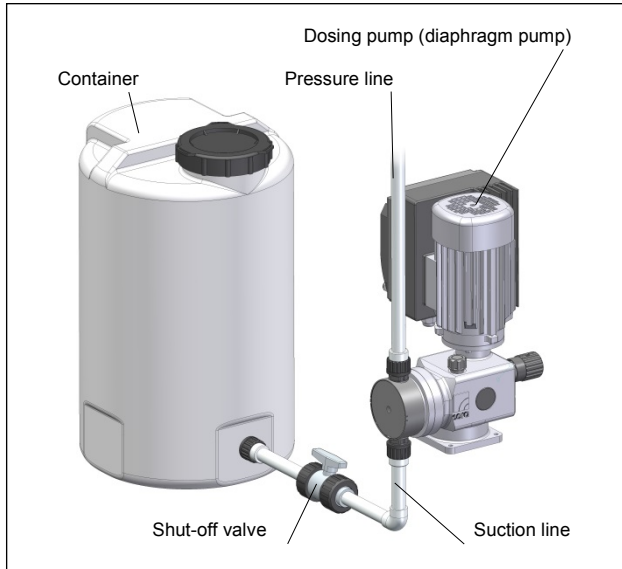


Fig. 35 Installation with supply line

8.1.10 Dosing of suspensions

requires that the pump head is rinsed to prevent precipitations. The following methods are recommended:

- intermittent rinsing
- or
- rinsing when the pump was switched off

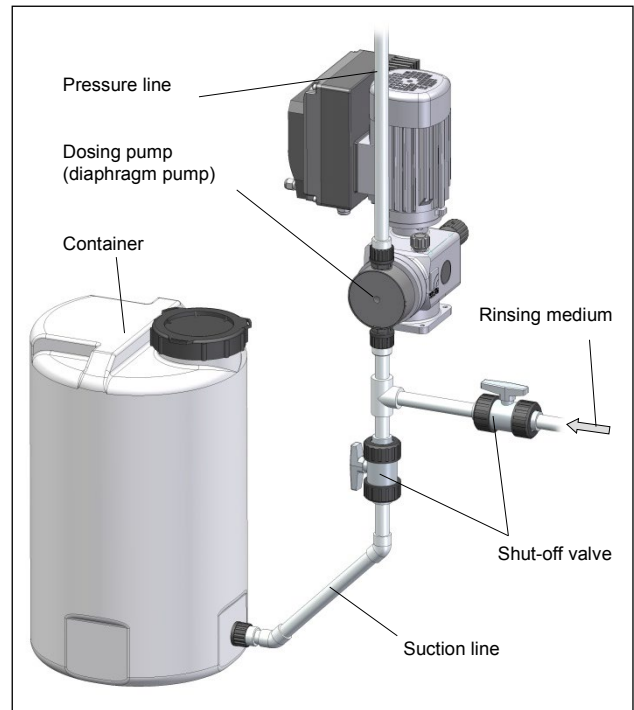


Fig. 37

Operating Instructions

8.1.11 Damping of the pulsation

by installing pulsation dampers if:

for procedural reasons, a pulsation-poor delivery rate is desired.

Acceleration forces which arise due to the pipe geometry must be reduced.

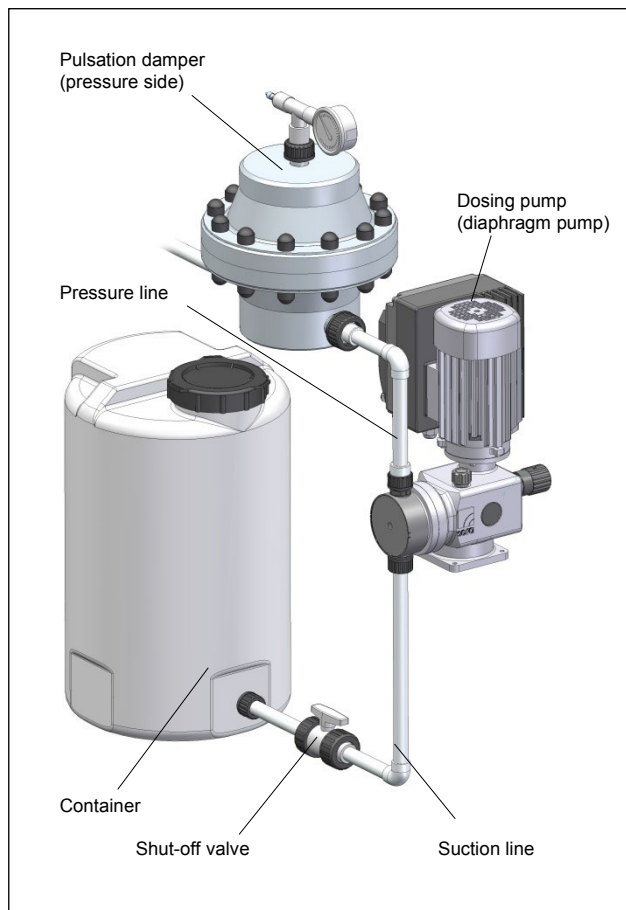


Fig. 38 Installing a pulsation damper (I)

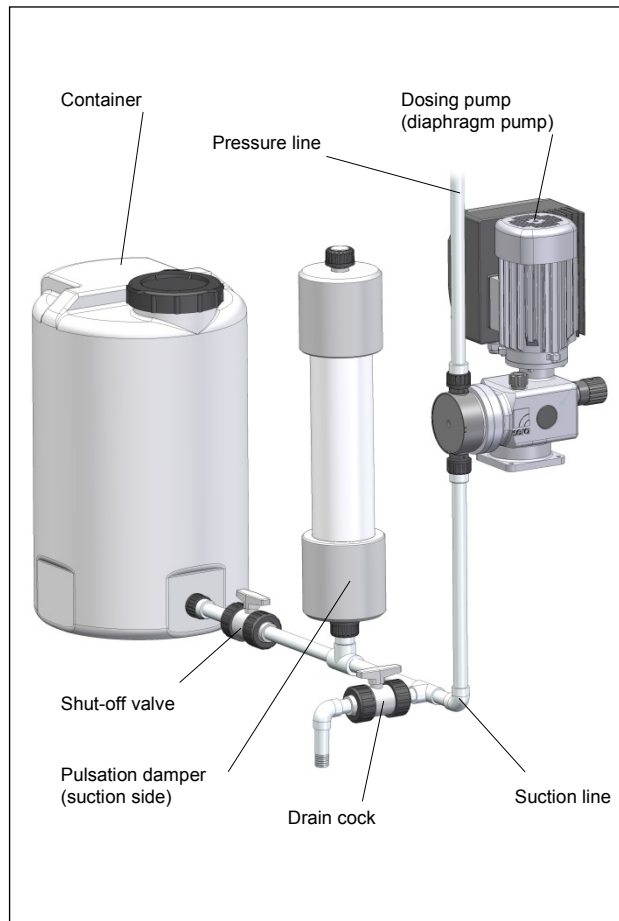


Fig. 39 Installing a pulsation damper (II)

Operating Instructions

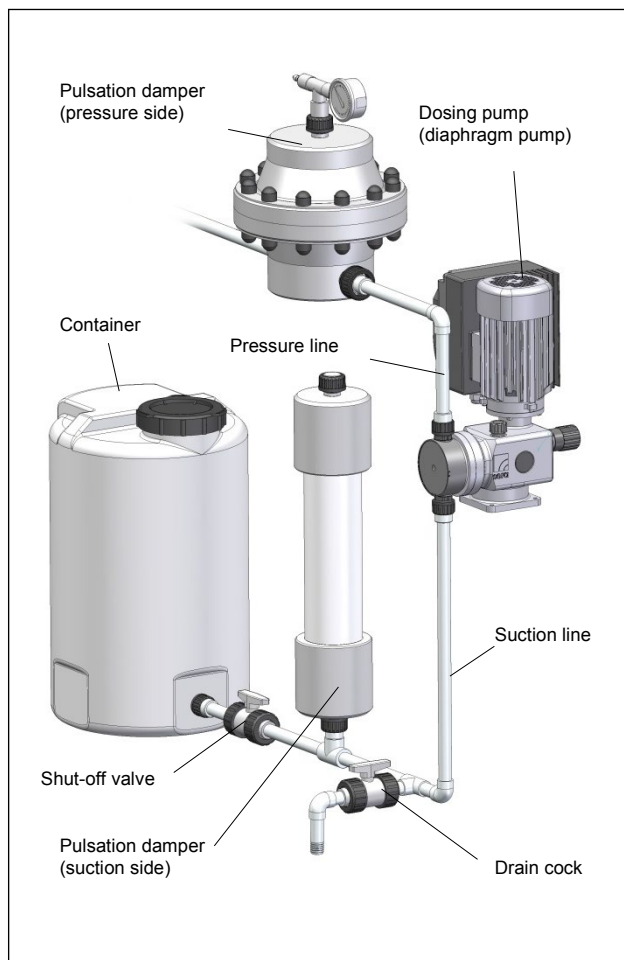


Fig. 40 Installing a pulsation damper (III)

CAUTION !



Undamped acceleration forces may lead to the following faults / damage:

delivery rate fluctuations
dosing errors
pressure surges
valve wobbles
increased wear on the suction- and pressure side of the pump;

mechanical damage of the pump
leakage and valve wobbles if the permissible maximum pressure on the pump pressure side is exceeded.

Danger of breath / Danger of poisoning by leaking of medium

Installation of suction and/or pressure pulsation damper near the pump head.

- If both pulsation damper and pressure keeping valve should be integrated install the pressure keeping valve between pump and pulsation damper.

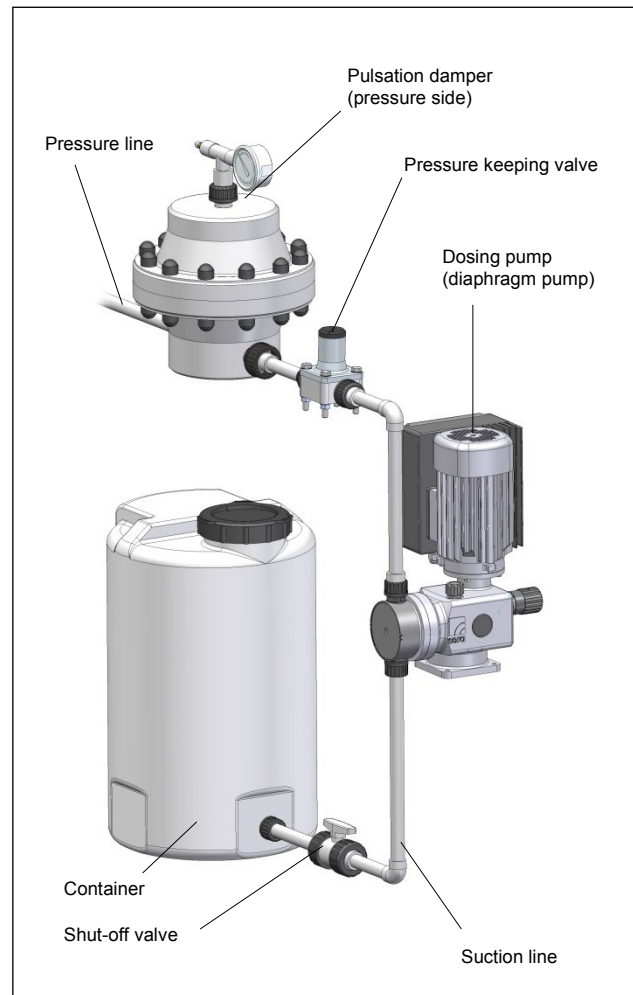


Fig. 41

Operating Instructions

9 Electrical connections

9.1 Electric supply

The **sera** motor driven diaphragm pump is delivered ready for installation. Standard delivery includes a 2m power cable with plug. The **standard version C 409.2** is designed for an operating voltage range of 100 – 120 V, 60 Hz.

NOTE !

Temporary activate and deactivate of supply voltage is to be avoided!

CAUTION !



The pump must only be connected to the power supply with the mains plug.
The mains plug should always be accessible.
For safety reasons the pump must be disconnected from the power supply by pulling the mains plug (e.g. for maintenance work).

Symbol:

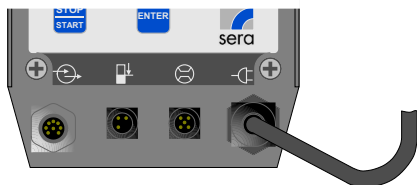


Fig. 42 (Electric supply)

If connected to a circuit protected by Fuse, use type C 10 A Fuses as supplementary protector acc. to UL 1077, CSA 22.2 No. 235.

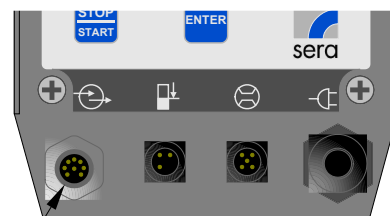
9.2 Electrical interfaces

The connectors for the electrical interfaces are located on the back of the pump below the control panel.

9.2.1 Control inputs and outputs

The pump is equipped with three control inputs and two control outputs. They can be programmed with different functions. All three inputs can be used as digital inputs, whereas two of them can optionally be configured as analog inputs (inputs 02 and 03, see Chapter 10.8.2). When leaving the factory, the inputs and outputs are preset as described in Tab. 14.

Symbol:



Connector socket for control inputs and outputs

43 (Connection of control inputs and outputs)

Standard delivery of the dosing pump includes a 5m control cable, which is to be connected to the 8-pin socket of the control inputs and outputs. Tab. 14 shows the identification of the individual leads of the control cable.

Lead colour	Pin	Function (ex works setting)
WH (white)	1	Input 01 (pulse)
BN (brown)	2	Input 02 (analogue 01)
GN (green)	3	Input 03 (external ON)
YE (yellow)	4	Output + / signal + / 15 V DC
GY (grey)	5	Output 01 (collective fault)
PK (pink)	6	Output 02 (stroke signal)
RD (red)	7	Ground
BU (blue)	8	Ground

Table. 14 (Identification of the leads of the control cable)

The digital inputs can not only be switched by a potential-free contact signal but also **directly via a control voltage signal** (e.g. 24V DC) (see Fig. 44).

This enables, for example, the direct connection of a programmable logic controller to the dosing pump.

IMPORTANT NOTE !

When an external supply (for example, 24 V DC) is connected to the pin output + (colour of cable lead: yellow) the following has to be considered:

A protective diode is necessary in the feeding pipe of the external supply in order to exclude a feeding back of the pump (see fig. 45).

Connect the anode with 24V DC.

Connect the cathode with the yellow lead of a cable.

Use the diode type 1N4007 or the like.

Operating Instructions

Fig. 44 shows exemplarily the control of the digital inputs 01 and 03 via a potential-free contact signal.

IMPORTANT NOTE !

The outputs 01 and 02 are not potential-free! In order to enable a potential-free switching via the outputs, the use of a relay is necessary (see example in fig. 44). Possible damage of electric

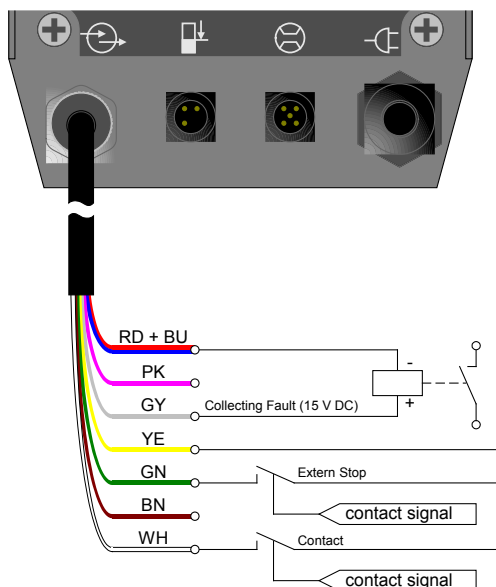


Fig. 44 (Control of digital inputs via a potential-free contact signal)

NOTE !

The maximum voltage/maximum current withstand capability of the control inputs and outputs is as follows:

Inputs: 30V DC / 50mA
Outputs: 15V DC / 50mA (internal supply)
30V DC / 350mA (external supply)

NOTE !

The output + / signal + connection pin (lead colour: yellow) is not short-circuit proof! In case of a short-circuit, the control electronics may get damaged! Therefore, please make absolutely sure that the signal + connection pin is not directly connected with the earth connections (lead colour: red and blue)!

Fig. 45 shows exemplarily the direct activation of the digital inputs 01 and 03 via a control voltage signal (in this example: 24V DC) of a programmable logic controller.

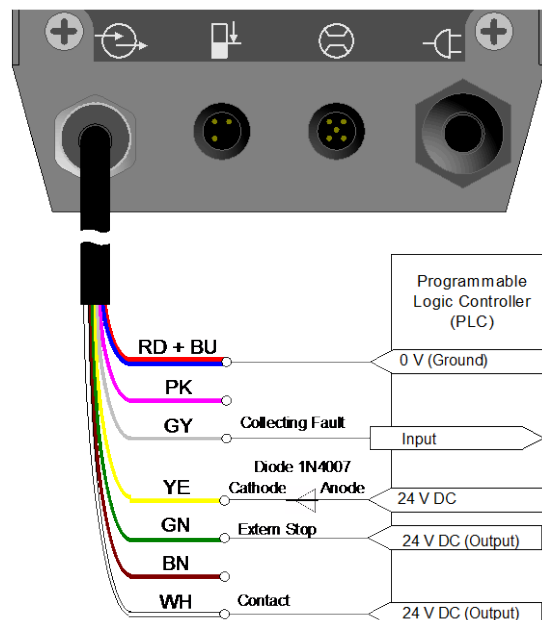


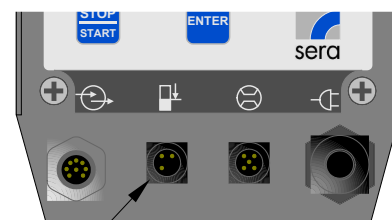
Fig. 45 (Direct activation of digital inputs via a control voltage signal of a programmable logic controller)

9.2.2 Level input with pre-alarm and dry run

NOTE !

Pre-alarm and dry run are connected to the same jack. When leaving the factory, both inputs are preset to "closing when floating down". However, if necessary, they can be freely configured (see Chapter. 10.15.4).

Symbol:



Jack for level input

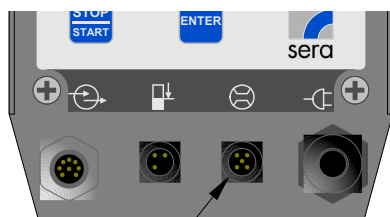
Fig. 46 (Connection for leader contact / main contact)

9.2.3 Input for flow control and flow meter

IMPORTANT NOTE !

Only flow controllers and flow meters made by sera may be connected to the dosing pump.
If you use other than sera products, the electronics might get damaged.

Symbol:



Jack for flow control /
flow meter

Fig. 47 (Connection for flow control / flow meter)

sera flow controllers and flow meters are delivered completely with cable and plug. Electrical connection is made directly to the 5-pin socket.

Operating Instructions

10 Operation

10.1 Operating elements

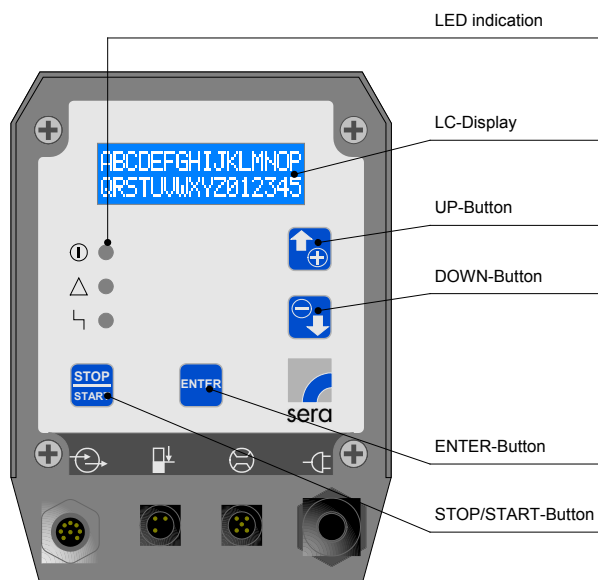
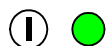


Fig. 48 (Electronics control panel)

10.2 LED operation indicators

Three light-emitting diodes (LED) indicate the status of the pump.

Green: Operation and stroke indicator



When switching on the pump, the green LED lights steadily. The operation indicator works in combination with a stroke indicator; during pump operation, the LED flashes in accordance with the current stroke frequency.

Yellow: Warning indicator



The yellow LED indicates all occurring warning messages (see Tab. 15). The warning is not only indicated by the LED but also as plain text in the LCD display.

Red: Fault indicator



The red LED indicates all occurring faults (see Tab. 15). The fault is not only indicated by the LED but also as plain text in the LCD display.

	Green LED	Yellow LED	Red LED
Ready	On		
Stroke confirmation	Flashes		
Internal error			On
Supply voltage too low / too high		On	
No mains			
Level monitoring:			
Level pre-alarm		Flashes	
Dry run			Flashes
Dosing control (flow controller or flow meter):			
No flow - with warning message		On	
No flow - with shut-off			On
Flow too low - with warning message		On	
Flow too low - with shut-off			On
Optional diaphragm rupture monitoring:			
Diaphragm rupture			On
Analog mode:			
mA signal < 3.5mA			On
mA signal > 20.5mA			On

Table. 15 (Overview of LED indicators)

NOTE !

The "dry run" fault message suppresses the "pre-alarm" warning. This means that if the pump runs dry while the 2-stage level monitoring is activated, then only the red LED will flash.

10.3 Key operation

Operation of the pump is performed with 4 keys:



STOP/START key

After connection to the power supply, the pump is switched ON/OFF using the STOP/START key.



ENTER key

You can use the ENTER key to open and confirm value input fields and to select menu items.



UP / DOWN key

Using the UP/DOWN key, you can scroll the different menu items / menu levels and select the display of various operating messages.

During parameter adjustment, the UP key is used to increase the parameter value and the DOWN key is used to decrease the parameter value.

Operating Instructions

10.4 Parameter table

Tab. 16 shows the factory settings of the controllable diaphragm pump. With these defaults, the user can start standard applications such as manual operation, analog operation with 4-20mA, 1/1 pulse operation and external operation with External ON, without having to make further adjustments. It is only necessary to select the operation mode from the respective menu (see Chapter 10.6) and, in case of external control, to connect the respective input (see Chapter 9.2.1).

The references to the respective chapters facilitate the adjustment of the settings to special applications and dosing tasks.

In addition, the parameter table offers the possibility to document the changes that have been made in the settings. Thus, the current settings of the pump can be viewed quickly at any time.

	Factory settings	Chapter	Modification 1	Modification 2	Modification 3
Pulse operation:					
Pulse mode	1/1	10.7.2			
Pulse factor	1	10.7.2			
Pulse memory	ON	10.7.2			
Analog mode:					
Analog mode	Auto	10.7.1			
Analog signal	4-20mA	10.7.1			
Adjustment: Analog I1	4 mA	10.7.1			
Adjustment: Frequency f1	0 %	10.7.1			
Adjustment: Analog I2	20 mA	10.7.1			
Adjustment: Frequency f2	100 %	10.7.1			
Batch mode:					
Batch control	Manual	10.7.3			
Batch quantity	0 strokes	10.7.3			
Batch start	00:00 h	10.7.3			
External mode:					
Stroke freq.	100 %	10.7.4			
Input 01:					
Function I1	Pulse	10.8.1			
Contact I1	NO	10.8.1			
Input 02:					
Function I2	Analog 01	10.8.2			
Contact I2	NO	10.8.2			
Input 03:					
Function I3	External ON	10.8.2			
Contact I3	NO	10.8.2			
Output 01:					
Function O1	Collective fault	10.8.3			
Contact O1	NC	10.8.3			
Output 02:					
Function O2	Stroke signal	10.8.3			
Contact O2	NO	10.8.3			
Dosing monitor.:					
Sensor	OFF	10.15.1			
Function	Message	10.15.1			
Fault stroke	10	10.15.1			
Alarm limit	80%	10.15.1			
Level:					
Pre-alarm	NO	10.15.4			
Dry run	NO	10.15.4			
System:					
Language	German	10.11			
Calibration	OFF	10.11			
SLOW-Mode:					
Slow-Mode	OFF	10.15.1			
Speed	80 %	10.15.1			
Password:					
PW01 mode	OFF	10.13			
Password 01	9990	10.13			
Password 02	9021	10.13			
Diaphragm rupt. ⁽¹⁾:					
Input signal	NO	10.15.3			
Sensitivity	50%	10.15.3			
⁽¹⁾ only with MBE option					

Table. 16 (Overview of preset parameters)

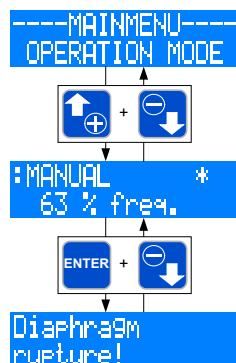
Operating Instructions

10.5 Menu

You can switch between the following three screens:

- Operating messages
- Main menu
- Fault and warning messages

A change to the screen "Fault and warning messages" is only possible when a fault or warning is present.



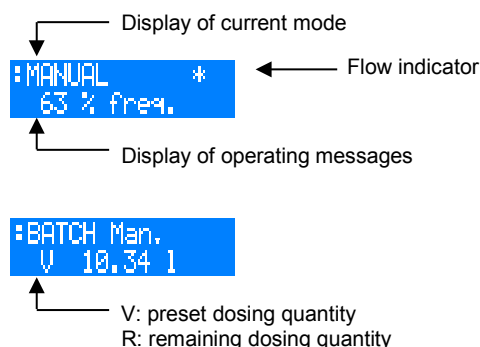
A change between the screens "Operating messages" and "Main menu" is done by simultaneously pressing the UP and DOWN keys.

A change between the screens "Operating messages" and "Fault and warning messages" is done by simultaneously pressing the ENTER and DOWN keys.

NOTE !

After, in the main menu, no key has been pressed for 3 min. the screen "Operating messages" is automatically displayed.

10.5.1 Screen "Operating messages"



Display of the current operation mode

The first line in the screen "Operating messages" shows the currently set operation mode.

Flow indicator

A star-symbol (*) in the first line on the right-hand side is used as flow indicator. The star symbol indicates the response of a connected dose monitoring instrument (flow control or flow meter).

NOTE !

The flow indicator (*) is only active when a flow control / flow meter is connected and the dosing monitoring is activated (see Chapter 10.15.1.1).

Display of operating messages

The second line of the display shows, dependent on the set operation mode, a variety of operating messages (e.g. the current stroke frequency, total strokes – see Tab. 17). The operating messages can be scrolled using the UP and DOWN keys.

You can use the ENTER key to open the value input fields of the editable operating messages (see Tab. 17). The value input is described in Chapter 10.5.3.

Operating messages	Operation mode				
	Manual	Analog	Pulse	Batch	External
Current stroke frequency	○ ⁽¹⁾	●	●	●	●
Current dosing performance ⁽²⁾	○	●			
Total strokes	○	○	○	○	○
Total dosing quantity ⁽²⁾	○	○	○	○	○
Current control current		●			
Pulse factor			●		
Memory			●	●	
Dosing quantity / strokes				●	
Remaining dosing quantity / remaining strokes				●	
Manual start				●	

● = Indication
○ = Indication and setting option
⁽¹⁾ = not with a calibrated pump
⁽²⁾ = only with a calibrated pump

Tab. 17 (Operating messages in dependence on theselected operation mode)

10.5.2 Fault and warning messages

When a fault or warning has occurred, the dosing pump shows a message in plain text format on the LCD display.

NOTE !

The message disappears automatically when the cause of the fault or warning has been eliminated.

Operating Instructions

10.5.3 Screen "Main menu"

The upper line shows the superordinate menu items or editable parameters. The lower line shows the subordinate menu items or selectable values and settings.

Superordinate menu items are marked with "----" (see examples in Fig. 49). Superordinate means that no values or settings can be assigned to this item.

It is, for example, possible to select a variety of subordinate menu items (e. g. ANALOG MODE) in the ---PARAMETER--- menu but these items cannot be assigned to the superordinate menu as a fixed value.



Fig. 49 (Example for the display of superordinate menu items)

Parameters which can be assigned different values or settings are marked with ">" and "<". Such parameters are, for example, the operation mode, the analog signal or the pulse mode. Each parameter should be assigned a definitive value or setting. The >OPERATION MODE< can, for example, be assigned the ANALOG setting (see examples in Fig. 50).



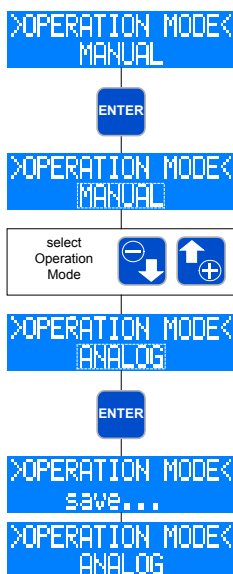
Fig. 50 (Example for the display of parameters)

10.5.4 Value entry

The assignment of values and settings to a parameter is described in the following, using two exemplary illustrations.

Assignment of settings

(Example: Selection of operation mode)



Display of the current setting (in this example: MANUAL operation mode).

Value entry is enabled after pressing the ENTER key.

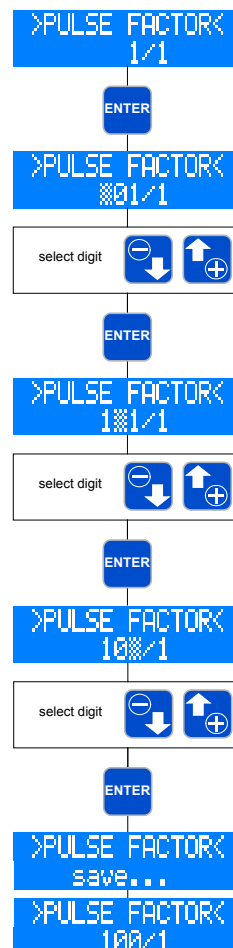
Then, the operation mode indicator flashes and a setting can be selected (in this example: operation modes) using the UP and DOWN keys.

After a setting has been selected (in this example: ANALOG mode), pressing the ENTER key will confirm and save the choice.

Display of the current setting (in this example: ANALOG mode)

Assignment of values

(Example: Selection of the pulse factor in case of division)



Display of the current value (in this example: pulse factor 1/1)

Value entry is enabled after pressing the ENTER key.

Then, the first digit of the pulse factor flashes.

The desired figure can be set using the UP and DOWN keys (in this example: 1).

After having selected the desired figure, pressing the ENTER key will confirm the choice.

Then, the second digit of the pulse factor starts to flash.

The desired figure can be set using the UP and DOWN keys (in this example: 0).

After having selected the desired figure, pressing the ENTER key will confirm the choice.

Then, the third digit of the pulse factor starts to flash.

The desired figure can be set using the UP and DOWN keys (in this example: 0).

After having selected the desired figure, pressing the ENTER key will confirm the choice. Afterwards, the entered value will be saved.

Display of current value (in this example: pulse factor 100/1)

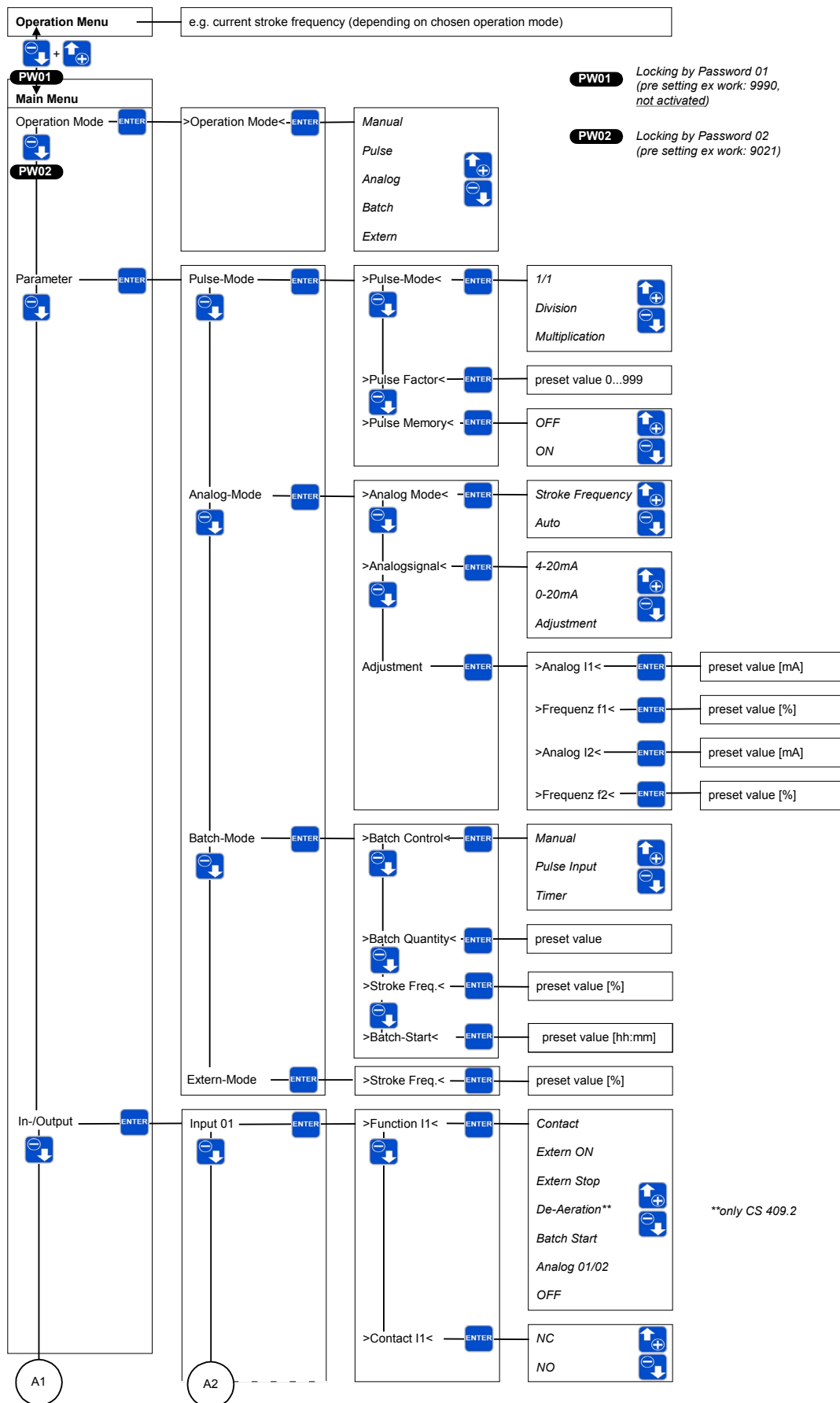
The value entry (flashing indication) can be exited by simultaneously pressing the UP and DOWN keys. In this case, the previous value / previous setting will be maintained.

NOTE !

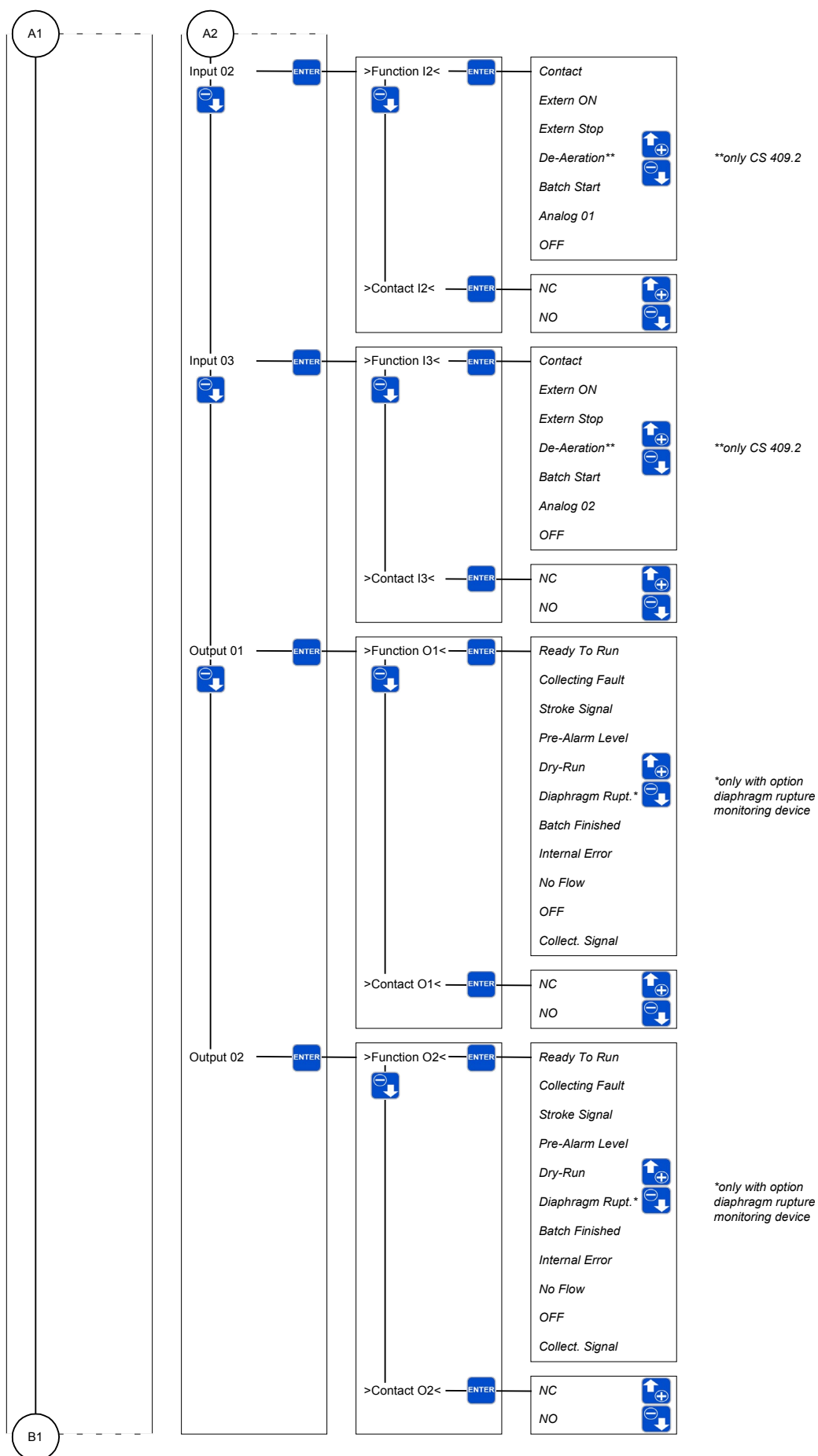
If, during the value entry (flashing indication), no key has been pressed for 30 sec. the entry mode is exited automatically and the previous value / previous setting is maintained.

Operating Instructions

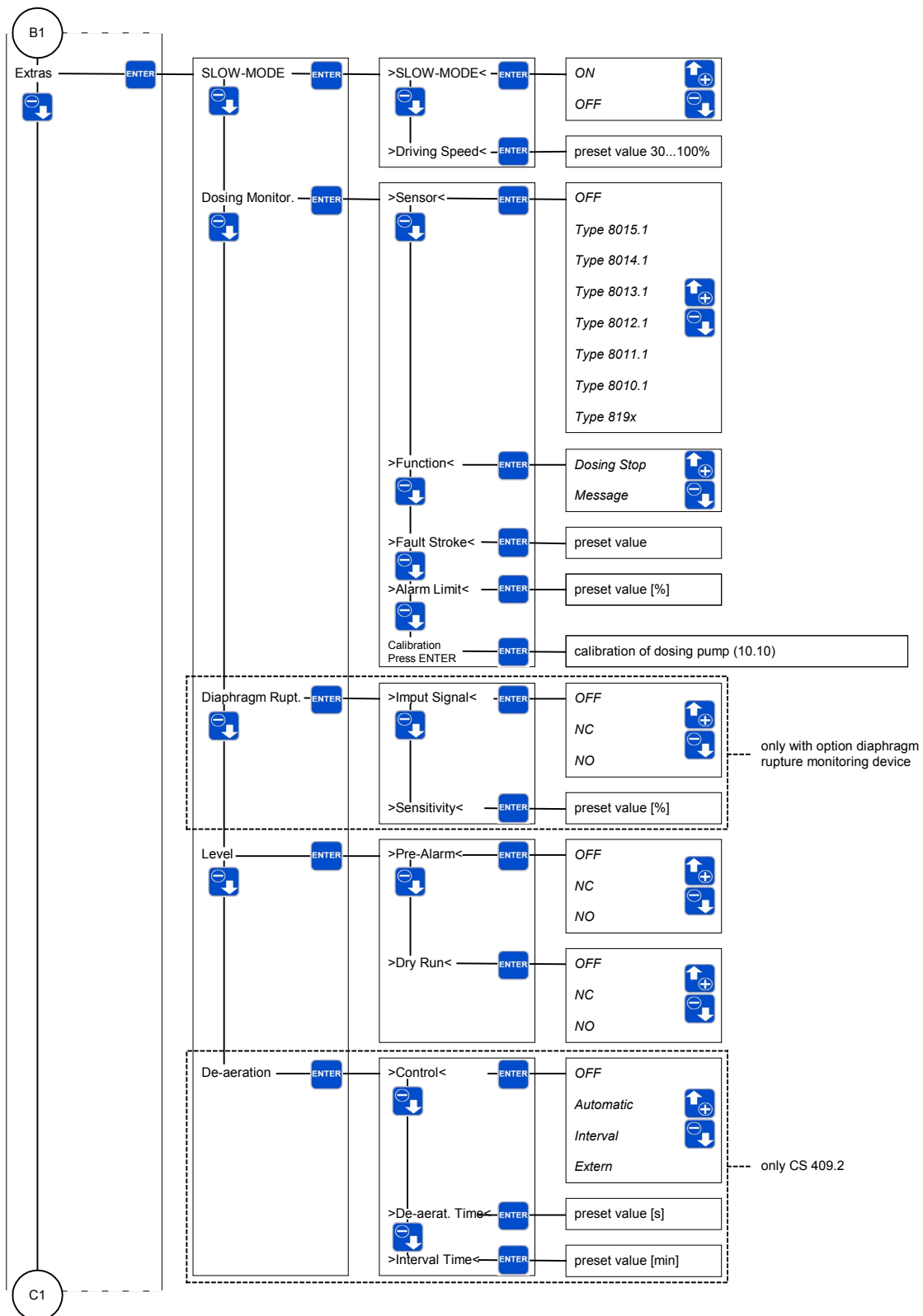
10.5.5 Menu guide



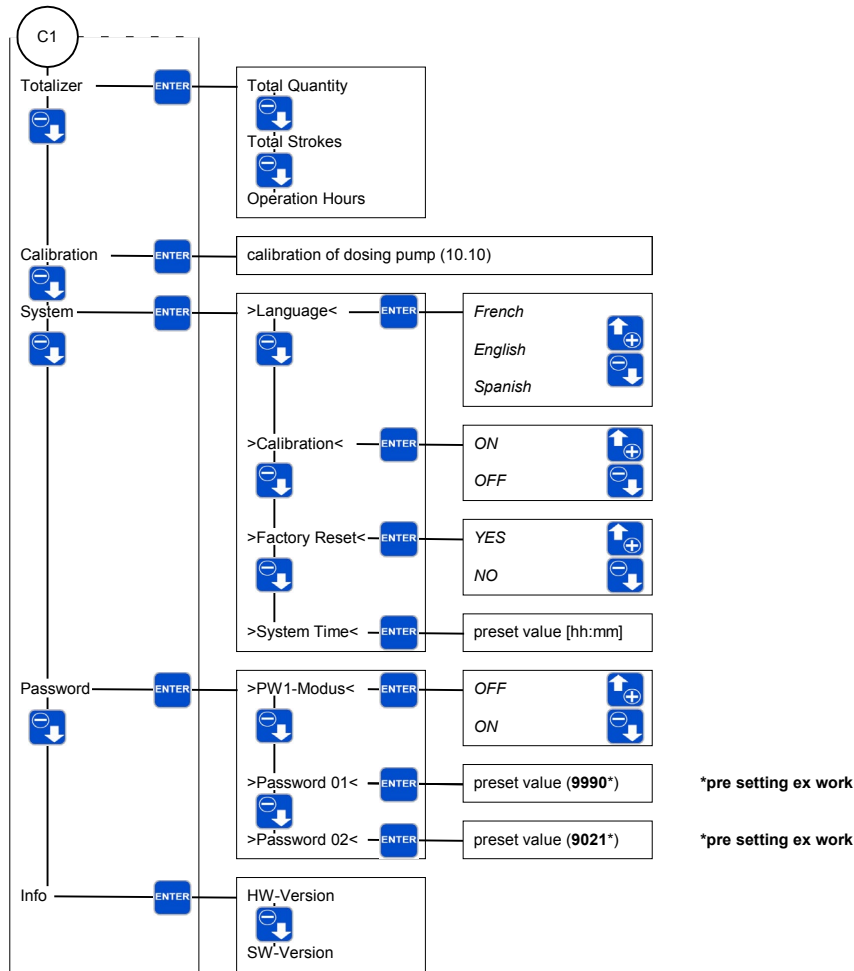
Operating Instructions



Operating Instructions



Operating Instructions



Operating Instructions

10.6 Selecting the operation mode

You can select among five different operation modes:

- MANUAL
- PULSE
- ANALOG
- BATCH
- EXTERNAL

>OPERATION MODE<
MANUAL

On-site operation and on-site control of the pump without external control. The flow rate can be set via the manual stroke length adjustment (10.16) and/or by presetting a stroke frequency. With a calibrated pump, the delivery rate is set in l/h instead of via the stroke frequency.

>OPERATION MODE<
EXTERN

The pump is released or blocked via an external switch. If the pump is released, it will run at the preselected stroke frequency (see Chapter 10.7.4).

>OPERATION MODE<
BATCH

Batch dosing that can either be started manually, via an external pulse signal or by time control. The batch quantity can be entered in strokes or in liters (only with a calibrated pump) (see Chapter. 10.7.3).

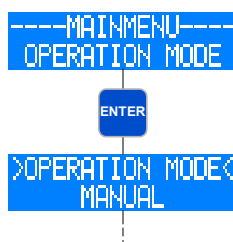
>OPERATION MODE<
ANALOG

The stroke frequency of the pump is controlled via the received analog signal. The pump can optionally be controlled with a control current of either 0...20mA or 4...20mA. In addition, there is the possibility to adjust the receiving analog signal according to needs (see Chapter. 0).

>OPERATION MODE<
PULSE

Three pulse modes are offered. The pump can either be operated in the 1/1 mode or with multiplication or division of the input pulses (see Chapter. 0).

Setting diagram:



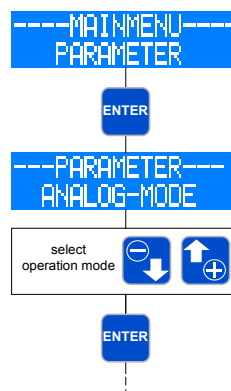
Go to the ---MAIN MENU--- and select the menu item OPERATION MODE (if necessary, use the UP / DOWN keys). Pressing the ENTER key will open the >OPERATION MODE< sub-menu.

Here, the currently set operation mode is indicated (in this example: MANUAL).

The adjustment of an operation mode is done in accordance with the description in Chapter 10.5.3.

10.7 Additional settings for the operation mode

Depending on the selected operation mode, specific settings can be made.



Go to the ---MAIN MENU--- and select the menu item PARAMETER (if necessary, use the UP / DOWN keys). Pressing the ENTER key will open the --- PARAMETER --- submenu.

Here, the currently set operation mode is indicated (in this example: ANALOG MODE).

The DOWN key is used to move to the respectively next operation mode. The UP key is used to move to the previous operation mode. When in the PULSE MODE, the UP key is used to move back to the ---MAIN MENU---.

After having selected the operation mode, the ENTER key can be used to move to the specific settings for the selected operation mode.

NOTE !

In the ---PARAMETER--- menu, there is no adjustment possibility for the MANUAL operation mode.

10.7.1 Additional settings for the ANALOG operation mode

NOTE !

In order to be able to use the ANALOG operation mode, at least one input must be assigned the ANALOG 01 or ANALOG 02 function (see Chapter 10.8.2). Input 02 (see Chapter 9.2.1) is factory preset to analog input (ANALOG 01).

Choose the ANALOG MODE

Two different analog modes can be chosen:

- Auto
- Stroke frequency

>ANALOG-MODE<
AUTO

The motor speed is adjusted corresponding to the stroke frequency. If the stroke frequency falls below 30% operation changes to Stop&Go..

>ANALOG-MODE<
STROKE FREQUENCY

Stop&Go operation covering the whole stroke frequency range, that means every stroke is performed with full motor speed.

Operating Instructions

Selecting the ANALOG SIGNAL

You can select among three different analog signals:

- 4-20mA
- 0-20mA
- ADJUSTMENT

>ANALOGSIGNAL<
4-20mA

A signal with a control current of 4mA corresponds to 0% stroke frequency; a signal with 20mA corresponds to 100% stroke frequency. In this range, the stroke frequency behaves proportionally to the control current (Fig. 51).

If the input signal is < 3.5mA, then the pump emits the error message "Analogsignal < 4mA". Thus, a wire breakage (control current = 0mA) can be detected.

If the input signal is > 20.5mA, then the pump stops and the error message "Analogsignal > 20 mA" is emitted.

>ANALOGSIGNAL<
0-20mA

A signal with a control current of 0mA corresponds to 0% stroke frequency; a signal with 20mA corresponds to 100% stroke frequency. In this range, the stroke frequency behaves proportionally to the control current (Fig. 51).

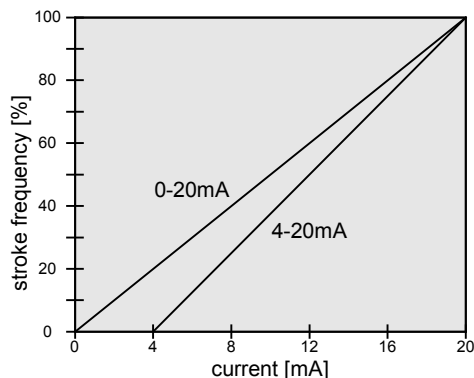


Fig. 51 Stroke frequency in dependency on the control current at 4-20mA / 0-20mA)

>ANALOGSIGNAL<
ADJUSTMENT

The analog control signal can be adjusted according to needs. This is, for example, necessary if a connected regulator provides a limited output signal.

Two points are given that reflect a proportional relation between control current and stroke frequency of the pump. In addition, these two points restrict the stroke frequency range of the pump as shown in Fig 52.

Example: Point 1: 15% stroke frequency at 5mA
Point 2: 80% stroke frequency at 15mA

If the control current is < 5mA, then the stroke frequency of the pump is 0%.

If the control current is > 15mA, then the stroke frequency of the pump is 80%.

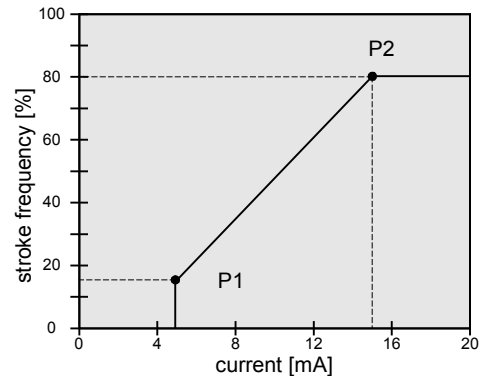


Fig. 52 (Exemplary adjustment of the analog signal)

NOTE !

If the input signal is greater than 25 mA, the pump stops and a fault indicator „analog signal > 25 mA“ is emitted. Additionally in this case, the appropriate input will be switched off as protective measure. The input is reactivated after the dosing pumps is switched off and started again via the button STOP/START.

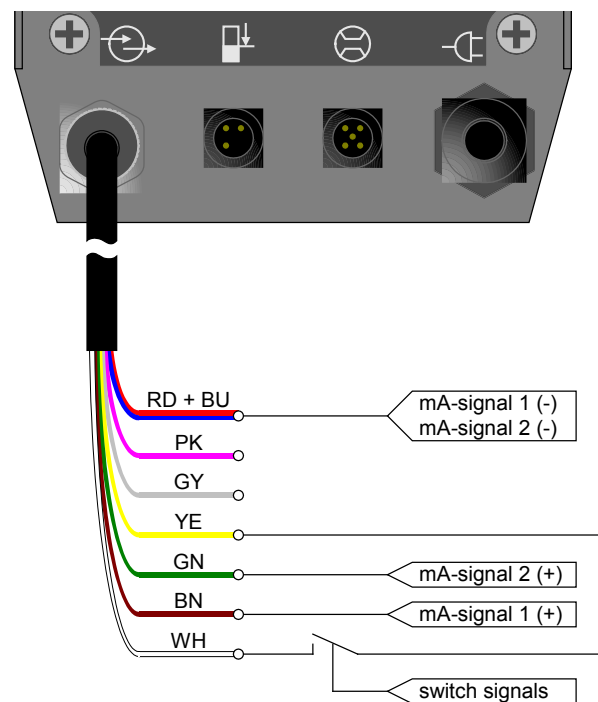


Fig. 53 (Connection of two analog signals with switch-over)

Operating Instructions

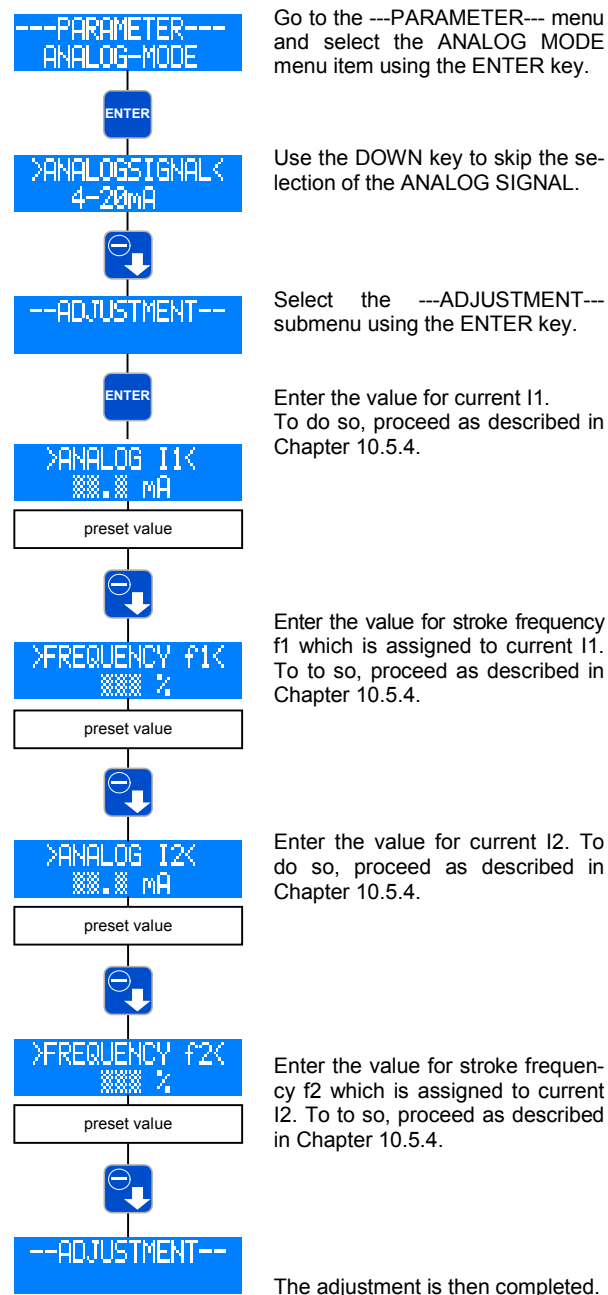
ADJUSTMENT of the analog signal

The adjustment of the analog signal is done under consideration of two default points. These two points are two value pairs which assign control currents to stroke frequencies:

Point 1 (I1, f1)
Point 2 (I2, f2)

The following diagram shows the procedure to determine the points.

Setting diagram:



10.7.2 Additional settings for the PULSE mode

NOTE !

In order to be able to use the PULSE operation mode, at least one input must be assigned the PULSE function (see Chapter 10.8). Input 01 (see Chapter 9.2.1) is factory preset to pulse input (ANALOG 01).

Selecting the PULSE MODE

You can select among three different pulse modes:

- 1/1
- DIVISION
- MULTIPLICATION

>PULSE MODE<
1/1

In this mode, the pump performs exactly one stroke for each received pulse.

>PULSE MODE<
DIVISION

In this mode, a division of the received pulses is performed. This means that a stroke will only be performed after an adjustable number of pulses (division factor) has been received.

>PULSE MODE<
MULTIPLICATION

In this mode, a multiplication of the received pulses is performed. This means that the pump will perform an adjustable number of strokes (multiplication factor) after every received pulse.

Selecting the PULSE FACTOR

Depending on the selected pulse mode, the pulse factor corresponds either to the division factor or the multiplication factor.

>PULSE FACTOR<
50/1

The **division** factor can be selected between 1 and 999. If, for example, the division factor is 50, then the pump will perform a stroke only with every 50th received pulse.

>PULSE FACTOR<
1/ 50

The **multiplication** factor can be selected between 1 and 999. If, for example, the multiplication factor is 50, then the pump will perform 50 strokes with every received pulse.

For setting the pulse factor, please see the description in Chapter 10.4.3 (Assignment of values).

Operating Instructions

Switching ON/OFF the PULSE MEMORY

The pump is equipped with a pulse memory, which can optionally be switched ON and OFF. 999 strokes max can be saved. If the number of received pulses exceeds the number that can be handled by the pump, then the pulses will be buffered and the strokes will be performed later.

Example: With the setting 1:50, 5 pulses are in the memory → perform. of 5 x 50 strokes = 250 strokes.

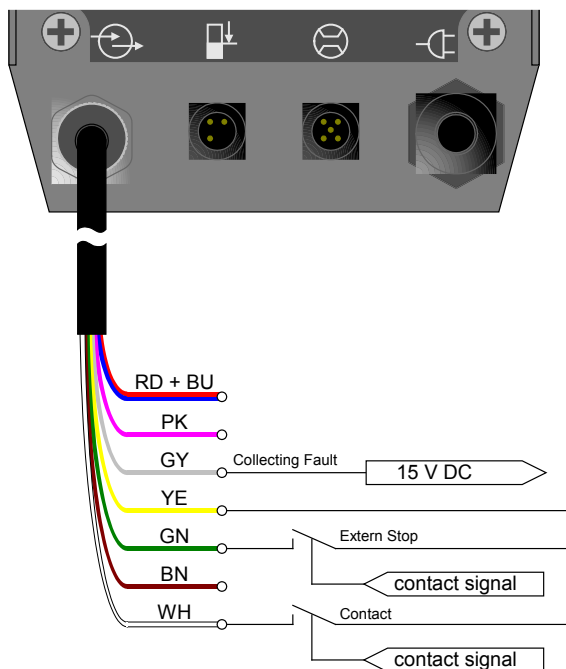


Fig. 54 (Connection of a pulse signal with External stop and response of the stroke signal)

10.7.3 Additional settings for the BATCH mode

Selecting the type of CONTROL

You can select among three different types of control:

- MANUAL
- TIMER
- PULSE INPUT

>CHARGE CONTROL<
MANUAL

With this type of control, the batch is started manually in the "operating messages" screen by pressing the ENTER key.

>CHARGE CONTROL<
TIMER

With this type of control, the batch is started **daily** at a fixed adjustable time (system time of the pump).

CAUTION !



The pump starts the batch when the preset time matches the system time of the pump. When the supply voltage is switched off, then the system time will be reset to 0:00.

Danger of abrupt pump start.

NOTE !

If the **TIMER** control is set, then the batch dosing will be repeated **daily** at the set time.

>CHARGE CONTROL<
PULSE INPUT

With this type of control, the batch is started via an external pulse at the pulse input.

NOTE !

In order to be able to use the **PULSE INPUT** control, at least one input must be assigned to the **START BATCH** function (see Chapter 10.8).

Determining the BATCH QUANTITY

The type of entry for the batch quantity depends on the calibration (see Chapter 10.10):

- Entry in strokes if the pump is not calibrated
- Entry in liters if the pump is calibrated

Operating Instructions

Adjusting the STROKE FREQUENCY

The stroke frequency at which the pump works during batch dosing can be adjusted.
The value input is described in Chapter 10.5.3.

Determining the BATCH START

>BATCH-START<
16:30 h

The pumps starts the batch dosing when the system time of the pump matches the value entered under BATCH START.

The value input is described in Chapter 10.5.5.

NOTE !

In order to enable time-controlled batch dosing, **TIMER control must be set under BATCH MODE.**

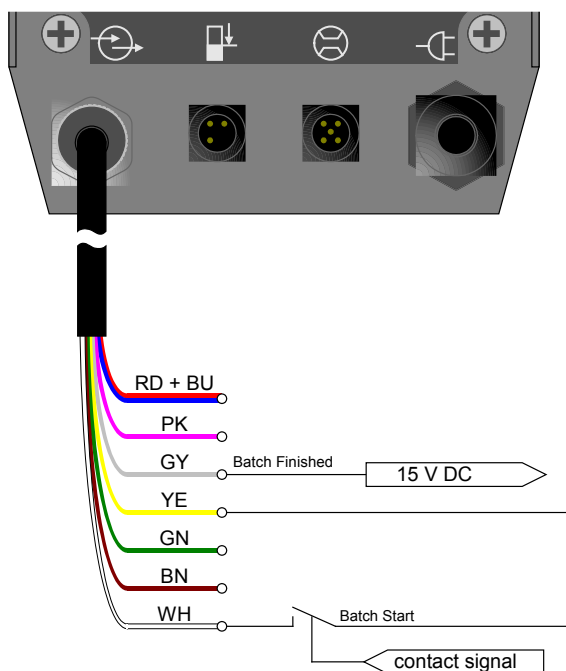


Fig. 55 (Possible connector pin assignment in batch mode)

10.7.4 Settings for the EXTERNAL operation mode

NOTE !

In order to be able to use the **EXTERNAL** operation mode, at least one input must be assigned the **EXTERNAL ON** function (see Chapter 10.8).
Input 03 (see Chapter 9.2.1) is factory preset to External ON.

>STROKE FREQ.<
63 %

In the EXTERNAL operation mode, only one stroke frequency (e.g. 63%) can be set. As soon as an external ON signal is received, the pump will start running at this stroke frequency.

The value input is described in Chapter. 10.5.5

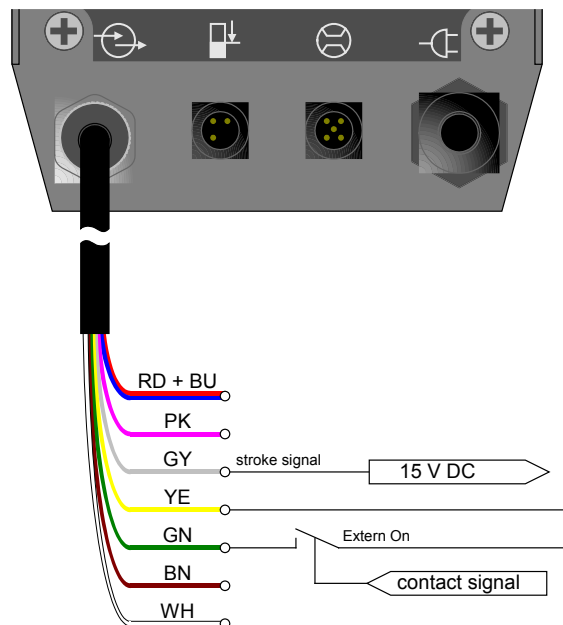


Fig. 56 (Possible connector pin assignment in External operation mode)

10.8 Configuring the inputs and outputs

The pump is equipped with three inputs and two outputs, which can be configured via a menu and thus be adapted to the given operating conditions.
It is possible to assign the same functions to all three inputs.

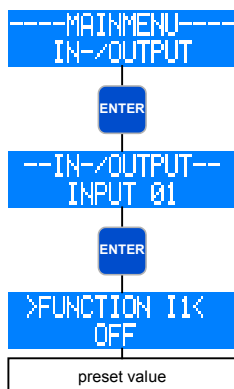
NOTE !

If several inputs are configured identically, then the input signals will be evaluated via **OR-operation**. This means that the function will be performed as soon as one of the inputs fulfils the condition.

Exception: Pulse input with pulse memory. If the pulse memory is switched on, then the received pulses will be summed up.

Operating Instructions

Setting diagram:



Go to the ---MAIN MENU--- and select the menu item IN-/OUTPUT (if necessary, use the UP / DOWN keys). Pressing the ENTER key opens the ---IN-/OUTPUT--- submenu.

Here, you can select among the individual inputs and outputs.

Pressing the ENTER key opens the menu level for setting the individual inputs and outputs.

>FUNCTION I1<
DE-AERATION

Function for the external control of the venting automatic via the respective input; this automatic is only installed in the self-venting version **CS 409.2**.

>FUNCTION I1<
BATCH START

Function for externally starting the batch via the respective input.

>FUNCTION I1<
ANALOG 01/02

This function is used to switch over between the two analog inputs Analog 01 and Analog 02 (input 02 and 03) via input 01. Selection of the analog input is done in accordance with the following Tab. 18.

Configuration Contact E1	Applied signal	Selected analog input
NC	High	Analog 01 (input 02)
NC	Low	Analog 02 (input 03)
NO	High	Analog 02 (input 03)
NO	Low	Analog 01 (input 02)

Table. 18 (Analog input switchover)

10.8.1 Digital input 01

Input 01 can be assigned one of six different functions. Optionally, it can also be switched off.

- Pulse
- External On
- External Stop
- Batch Start
- Analog 01/02
- OFF

In addition, it is possible to configure the contact signal of the input as NC or NO.

>FUNCTION I1<
PULSE

Configuration of the respective input as pulse input.

>FUNCTION I1<
EXTERN ON

Function for externally switching on the pump via the respective input (only with the EXTERNAL operation mode).

>FUNCTION I1<
EXTERN STOP

Function for externally switching off the pump via the respective input (independent of the operation mode).

NOTE !

If the dosing pump is switched off via External Stop, then an "S" will be indicated in the 1. line of the display on the right-hand side.

MANUELL S
63 % freq.

>FUNCTION I1<
OFF

The respective input is not assigned a function.

10.8.2 Digital/analog inputs 02 and 03

Basically, input 02 and input 03 have the same functions as input 01 (see Chapter 10.8.1). In addition, they can also be used as analog inputs. However, the function "Analog 01/02", which is used to switch over between the analog inputs is not available.

In addition, it is possible to configure the contact signals of the inputs as NC or NO.

>FUNCTION I2<
ANALOG 01

or. >FUNCTION I3<
ANALOG 02

Respective input is configured as analog input.

10.8.3 Outputs 01 and 02

Each of the outputs 01 and 02 can be assigned one of ten different functions. Optionally, they can also be switched off.

- Ready to run
- Collective fault
- Collect. signal
- Stroke signal
- Pre-alarm level
- Dry run
- Diaphragm rupt. (only with option MBE!)
- Batch finished
- Internal error
- No flow
- OFF

Operating Instructions

In addition, it is possible to configure the contact signals of the outputs as NC or NO.

>FUNCTION 01<
READY TO RUN

Message from the respective output indicating the readiness of the dosing pump.

>FUNCTION 01<
COLLECTING FAULT

Message if one of the following faults occurs:

- Diaphragm rupture
- Dry run
- Internal error
- No flow (with DOSING STOP function)

>FUNCTION 01<
COLLECT. SIGNAL

Message indicating that one of the following faults has occurred:

- All faults of the collective faults
- Pre-alarm level
- No flow (with MESSAGE function)

>FUNCTION 01<
STROKE SIGNAL

Message from the respective output indicating that a stroke has been performed.

>FUNCTION 01<
PRE-ALARM LEVEL

With activated 2-stage level monitoring, message from the respective output indicating a pre-alarm.

>FUNCTION 01<
DRY RUN

With activated level monitoring, message from the respective output indicating the dry run.

>FUNCTION 01<
DIAPHRAGM RUPT.

(only with MBE option!)

With activated diaphragm rupture monitoring, message from the respective output indicating a diaphragm rupture.

>FUNCTION 01<
BATCH FINISHED

With activated BATCH operation mode, message from the respective output indicating that the batch is finished.

>FUNCTION 01<
INTERNAL ERROR

Signal when one of the following listed faults occurs (fault analysis/- causes see chapter 13.1):

- Fault drive
- Fault stroke sensor
- No stroke recognition
- Set value not attained

>FUNCTION 01<
NO FLOW

With activated flow control, message from the respective output indicating that the permitted number of fault strokes has been exceeded.

10.9 Flow rate indicator

NOTE !

If the dosing pump has not been calibrated, then the flow rate indicator will not be activated.

The flow rate indicator is activated via the calibration of the pump (see Chapter 10.10). The display depends on the operation mode.

MANUAL operation mode

:MANUAL
7.2 l/h

:MANUAL
10.34 l

After calibration of the dosing pump, the flow rate is entered directly as target value in l/h instead of via the stroke frequency adjustment. In the screen "operating messages" (see Chapter 10.5.1), the stroke frequency indicator is replaced by the flow rate indicator. In addition, the total dosing quantity is indicated in litres.

ANALOG operation mode

:ANALOG
7.2 l/h

:ANALOG
10.34 l

The calibration of the pump activates the flow rate indicator and the stroke frequency remains also visible. In addition, the total dosing quantity is indicated in litres.

BATCH operation mode

:BATCH Man.
V 10.34 l

:BATCH Man.
R 10.34 l

After calibration of the dosing pump, dosing quantity and remaining dosing quantity are indicated in litres.

PULSE operation mode

:PULSE
10.34 l

After calibration of the dosing pump, the total dosing quantity is also indicated in litres.

Operating Instructions

Standard flow rate indicator

With the standard flow rate indicator, the entered target value is converted into the corresponding stroke frequency. The maximum adjustable target value is limited by the internally determined stroke length.

Example: The calibration at 50% stroke length results in a flow rate of 10l/h (at 100% stroke frequency). If a target value of 8l/h is entered, then the stroke frequency is accordingly reduced to 80%. The maximum target value in this case is 10l/h. It can be changed via the stroke length adjustment (+/- 10%).

Internal calculation:
100% stroke frequency → Measure in litres: 10l/h
Target value: 8l/h → 80% stroke frequency

Flow rate indicator with flow meter

The flow meter records the actual value, and if the flow rate deviates from the entered target value, the dosing pump will readjust it.

NOTE !

If the pump already works with 100% stroke frequency, there is no possibility of an additional capacity adjustment upwards. If the set value is fallen below, the warning signal "flow too low" appears.

The maximum adjustable target value is limited by the internally determined stroke length.

Example: The calibration at 50% stroke length results in a delivery rate of 10l/h (at 100% stroke frequency). If a target value of 8l/h is entered, then the stroke frequency is at first accordingly reduced to 80%. The flow meter measures a delivery rate of 7.9l/h. The internal control increases the stroke frequency to 81% in order to achieve 8l/h. The maximum target value in this case is 10l/h. It can be changed via the stroke length adjustment (+/- 10%).

Internal control:
100% stroke frequency → Measure in litres: 10l/h
Target value: 8l/h → 80% stroke frequency
80% stroke frequency → Actual value: 7.9l/h
8l/h → 81% stroke frequency

NOTE !

In order to enable an effective capacity adjustment, pay attention that the given set value is attained when having a stroke frequency of < 100 %. A max. nominal stroke frequency of approx. 80 % is recommended in order to enable an adjustment of the capacity when the set value is fallen below.

NOTE !

The set value in l/h can be preset manually (operating mode MANUAL) or by analog signal (ANALOG) as soon as the dosing pump is calibrated.

10.10 Calibration

The calibration is used to activate the flow rate indicator. Calibration is always done in the same way, no matter whether a flow meter is connected or not.

NOTE !

Calibration is performed with a fixed stroke length. The calibration remains valid even if the stroke length is changed by up to +/- 10%. If this calibration range is exceeded, then the warning message "Out of range" will be displayed.

Sequence of calibration:

NOTE !

Prior to the calibration of the flow rate indicator with connected flow meter, the sensor type (>SENSOR<) must be set (see Chapter 10.15.12). If no sensor type is set (OFF), then the calibration will only activate the standard flow rate indicator.

CAUTION !

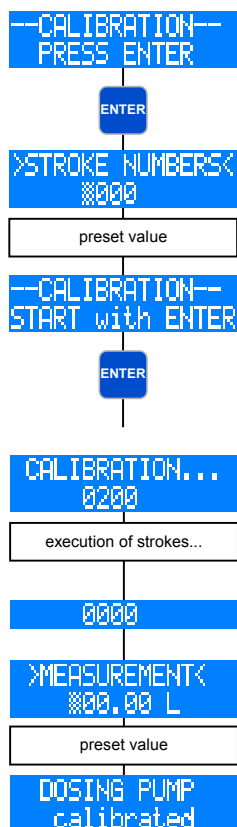


Pay attention to the safety data sheet relating to the dosing medium!

Danger of breath / Danger of poisoning by leaking medium.

Operating Instructions

1. Lead the suction line into a calibration pot filled with the dosing medium – the pressure line must be installed in final position, i.e. the operating conditions (backpressure, etc.) must be fulfilled.
2. When the suction line is empty the dosing medium must be drawn in (MANUAL operation mode, keep the pump running).
3. Set the stroke length with which the pump should be calibrated (can also be done via the manual stroke length adjustment)
4. Note the filling level in the calibration pot (= base quantity)
5. Go to the main menu and select the --CALIBRATION-- menu:



6. Press the ENTER key to access the field for entering the number of calibration strokes.
7. At first, enter the desired stroke number (at least 200!) → the higher the stroke number the more accurate the calibration!
8. To start the calibration, press the ENTER key.
9. The dosing pump performs the preset number of strokes.
10. Determination of the pumped quantity (= difference between base quantity and remaining quantity in the calibration pot).
11. Entry of the determined quantity.

Calibration of the dosing pump is then completed!

NOTE !

After the dosing pump has been calibrated, calibration (see Chapter 10.11) will automatically be set to ON.

NOTE !

If the operating conditions are changed (supply line, backpressure, etc.), then the dosing pump must be newly calibrated. Otherwise, the flow rate indicator might be inaccurate!

10.11 System

The system settings do not depend on the operation mode. These include:

- Language
- Calibration
- Factory reset
- System time

>LANGUAGE<

You can select between FRENCH; ENGLISH and SPANISH menu texts.

>CALIBRATION<

The calibration of the pump (see Chapter 10.10) can be switched ON and OFF. If the calibration is set to ON and the dosing pump has been calibrated, then the flow rate indicator is activated.

If the calibration is set to OFF and/or the pump has not been calibrated, then the flow rate indicator is not activated.

>FACTORY RESET<

The factory settings (see Tab. 16, Chapter 10.4) can be restored. To do so, adjust YES.

IMPORTANT NOTE !

After restoring the factory default settings, all previous user-defined settings are irrevocably overwritten.

>SYSTEM TIME<

The system time must be adjusted manually.

NOTE !

If the supply voltage is switched off, then the system time will be reset to 0:00. This means it must be set again.

Operating Instructions

10.12 Totalizer

The totalizer indicates the total quantity conveyed, the total strokes and the pump's operating hours. These values are for information purposes and cannot be reset.

10.13 Password

Two password levels are provided to increase the operating safety of the pump. The passwords for these levels consist of a four-digit number code and are individually selectable. Password 01 (PW01) is used to protect the setting of the operation mode (Level 01). This password can be activated and deactivated (when leaving the factory, it is deactivated). Password 02 (PW02) protects all further setting options of the main menu (Level 02, see "Menu guide"). This password protection cannot be deactivated.

NOTE !

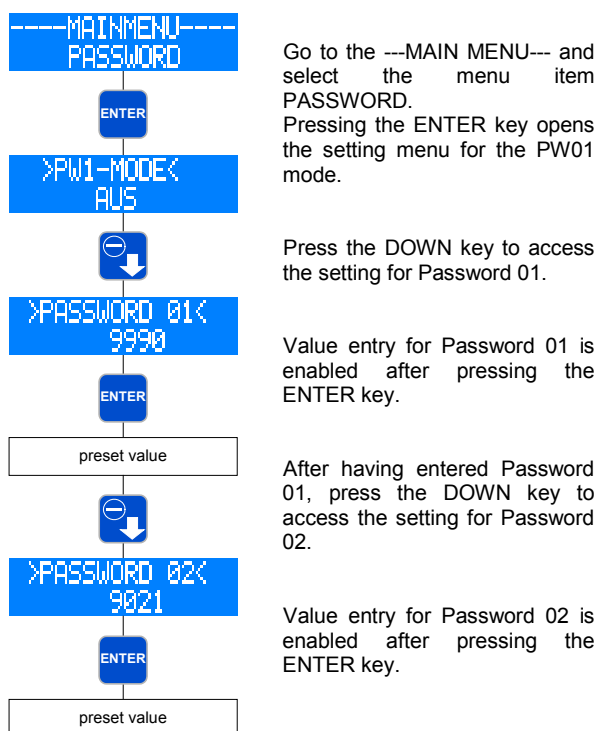
If, during the 1. password request (Level 01), password 02 has been entered, then Level 02 is also automatically activated.

NOTE !

The passwords are factory set as follows:

- Password 01: 9990 (deactivated)
- Password 02: 9021 (cannot be deactivated!)

Setting diagram:



NOTE !

There is an automatic "Logout" after 5 min of inactivity in the "operation modes" screen. Afterwards, the password must be entered again.

IMPORTANT NOTE !

Please write down the passwords and keep them in a safe place. When the passwords are lost the pump cannot be configured on site again. In this case, the pump must be sent to the manufacturer's works for configuration release.

10.14 Info

The Info menu item contains information about the hardware and software version of the pump.

10.15 Extras

10.15.1 Slow-Mode

---EXTRAS---
SLOW-MODE

In Slow Mode the pump is operated with reduced speed. This is, for example, reasonable for the feeding of very viscous media.

Adjustments can be made to the following points:

- SLOW-MODE
- Speed

>SLOW-MODE<

Switching-on/Switching-off of the Slow Mode.

> SPEED <

Input of the speed when Slow Mode is activated. The speed can be set between 100 and 30 %.

NOTE !

The entered speed in Slow Mode corresponds to the maximum stroke frequency the pump is operated. The maximal possible capacity is reduced correspondingly.

The following is valid for the pulse and analog operation: Every stroke is performed with this speed.

Operating Instructions

10.15.2 Dosing monitoring

--EXTRAS-- DOSING MONITOR.

The connection of a **sera** flow controller to the dosing pump will enable the monitoring of the flow rate.

The connection of a **sera** flow meter to the dosing pump will provide a more detailed flow rate indication with regulation of the flow rate (see Chapter 10.9).

NOTE !

Prior to the calibration of the flow rate indicator with connected flow meter, the sensor type (>SENSOR<) must be set.

If no sensor type is set (OFF), then the sensor signal will not be considered during calibration.

It is possible to make adjustments to following items:

- Sensor
- Function
- Fault stroke
- Alarm limit
- Calibration

SENSOR<

Selection of the connected **sera** flow controller or **sera** flow meter.

>FUNCTION<

Selection of the dosing monitoring function. It can be selected whether the dosing monitoring should trigger a warning message (MESSAGE) or a switch-off of the pump (DOSING STOP).

>FAULT STROKE<

Number of fault strokes at which a connected **flow controller** triggers the dosing monitoring.

The factory setting is 10 fault strokes. This means that the dosing monitoring will react if the flow controller does not give a stroke confirmation to the pump for the duration of ten consecutive strokes.

>ALARM LIMIT<

Alarm limit at which a connected **flow meter** triggers the dosing monitoring. The entered value corresponds to the percental part of the target flow rate.

The factory setting is 80%. This means that the dosing monitoring will react if a connected flow meter measures a flow rate which is lower than 80% of the set target flow rate.

---CALIBRATION---

see Chapter 10.10.

10.15.3 Diaphragm rupture detection (OPTION)

--EXTRAS-- DIAPHRAGM RUPT.

The diaphragm rupture detection (see also Chapter 7.2.9) is an optional feature for the dosing pump. It is used to monitor the diaphragm.

It is possible to make adjustments to following items:

- Input signal
- Sensitivity

>INPUT SIGNAL<

Selection between switch-off (OFF) of the diaphragm rupture electrode and a configuration as NO or NC.

NOTE !

The diaphragm rupture signalisation only functions with conductive media.

>SENSITIVITY<

Entry of the sensitivity of the diaphragm rupture electrode in percent. This enables an adaptation to the conductivity of the pumped medium. In case of poorly conductive media, the sensitivity must be set to a high value (e.g. 100% at approx. 4µS/cm); in case of highly conductive media, the sensitivity must be set to a low value (e.g. 10% at approx. 50µS/cm).

NOTE !

When leaving the factory, the sensitivity is preset to 50%. This corresponds to a minimum conductivity of the dosing medium of approx. 10 µS/cm. The minimum conductivity at 100% sensitivity is 4µS/cm.

Operating Instructions

10.15.4 Level monitoring

--EXTRAS-- LEVEL

The connection of a **sera** suction lance enables the monitoring of the filling level in the dosing tank.

It is possible to make adjustments to following items:

- Pre-alarm
- Dry run

>PRE-ALARM< or >DRY RUN< respectively

Configuration of the two level inputs. It can be selected between either the switch-off (OFF) of the input and a configuration as NC (opening when floating down) or NO (closing when floating down).

When leaving the factory, both level inputs are configured as NO.

Config.	Pre-alarm	Dry run
1	NO	NO
2	NO	NC
3	NC	NC

Tab. 19 (Configuration of the level input)

Config. 1

When leaving the factory, this configuration is preset. A 1- or 2-stage level monitoring with “closing when floating down” contacts (pre-alarm and dry run or dry run only) can be connected.

Config. 2

This configuration must be selected when a 1-stage level monitoring (dry run only) with “opening when floating down” contact is connected.

Config. 3

This configuration must be selected when a 2-stage level monitoring with “opening when floating down” contacts (pre-alarm and dry run) is connected.

Operating Instructions

11 Maintenance

WARNING !



Electronics and stroke mechanism shall only be repaired by sera! The pump shall only be opened by sera or after prior arrangement with sera.

Danger of a electric shock in case of opened electronic.
Danger of poisoning by incorrect decomposition of mechanics.

NOTE !

Before starting maintenance work make sure the the spare and wearing parts as well as the utilities required are available.
Place / deposit components in such a way that any damage is prevented.

NOTE !

Check the wearing parts for proper functioning at regular intervals and replace, if necessary.

The following checks should be carried out at regular intervals:

- tight fit of the the pipework
- tight fit of pressure and suction valve
- proper condition of the electrical connections
- tight fit of the screws for fastening the pump body (check this at least every three months)
For the tightening torques of the fixing screws, please see Chapter 8.1 "Installation instructions" Table 13.

NOTE !

Data of internal microfuse:
250 V AC 6,3A delay-action, 5x20mm
extra disconnect threshold, with UL-/CSA license

CAUTION !



Only use fuses with the same data and properties!
Exchange of fuses only by sera or sera authorized staff.

11.1 Wearing parts

Depending on their use and period of use, wearing parts must be replaced at regular intervals in order to ensure a safe function of the diaphragm pump.

We recommend to replace the drive- or intermediate diaphragms after 3000 operating hours or at least once a year.

In case of a premature diaphragm rupture caused by hard operating conditions, switch off the diaphragm pump and replace the diaphragms (see Chapter 11.4).

As an option, the diaphragm pump can be equipped with a diaphragm rupture monitoring device MBE-... (please see Chapter 7.2.9).

The following parts are considered as wearing parts of the diaphragm pump:

- Drive diaphragm
- Diaphragm of the integrated overflow valve (if installed)
- Suction valve
- Pressure valve

11.2 Spare parts

The following parts are considered as spare parts of the diaphragm pump:

- Pump body

11.3 Spare and wearing parts

11.3.1 Diaphragm pump C 409.2- 1,6 e ...-2,4 e

C 409.2 – 1,6 e
C 409.2 – 2,4 e

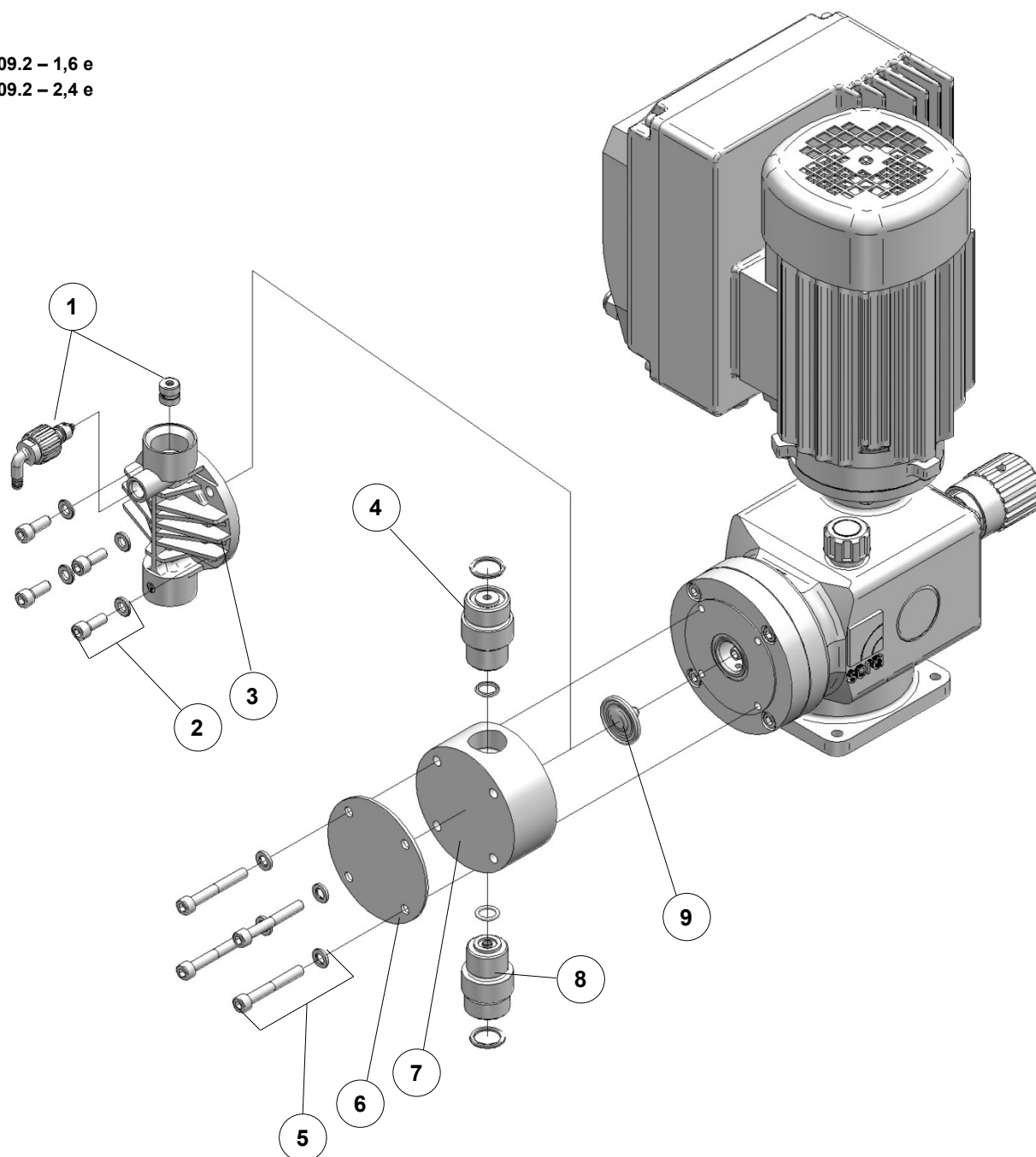


Fig. 58 Spare- and wearing parts (C 409.2- 1,6 e ...-2,4 e)

Operating Instructions

Overview of the spare and wearing part kits

Diaphragm pump C 409.2- 1,6 e ...-2,4 e

Suction valve (kit)	
Item	Designation
8	Suction valve (incl. o-rings)

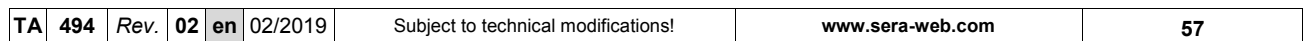
Pressure valve (kit)	
Item	Designation
4	Pressure valve (incl. o-rings)

Diaphragm kit	
Item	Designation
9	Drive diaphragm

Pump body kit (plastic, FRP-design)	
Item	Designation
1	Vent valve
2	Screws, complete
3	Pump body

Pump body kit (plastic)	
Item	Designation
5	Screws, complete
6	Front plate
7	Pump body

C 409.2 = 180 €



Operating Instructions

Overview of the spare and wearing part kits

Diaphragm pump C 409.2- 7,0 e ...-180 e

Suction valve (kit)	
Item	Designation
9	Suction valve (incl. o-rings)

Pressure valve (kit)	
Item	Designation
5	Pressure valve (incl. o-rings)

Diaphragm kit	
Item	Designation
12	Drive diaphragm
13	Pressure plate (not with a laminated drive diaphragm)

Pump body kit (plastic, FRP-design)	
Item	Designation
1	Cover plate
2	Screws, complete
3	Insertion plate(s), if applicable
4	Pump body

Pump body kit (plastic)	
Item	Designation
6	Screws, complete
7	Front plate
8	Pump body

Pump body kit (special steel)	
Item	Designation
6	Screws, complete
8	Pump body

11.3.3 Diaphragm pump C 409.2-250 e ...-350 e

C 409.2 – 250 e

C 409.2 – 350 e

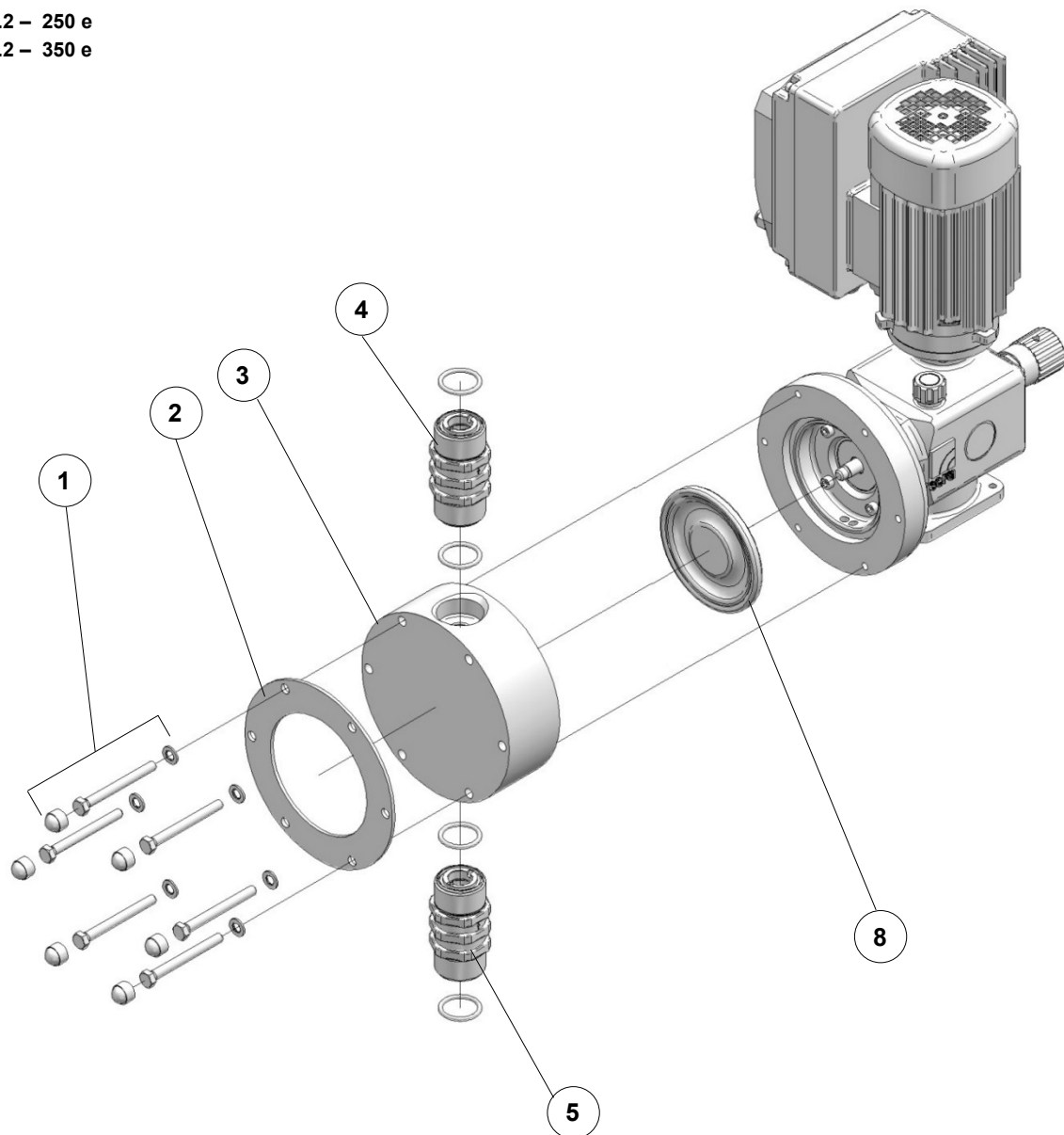


Fig. 60 Spare- and wearing parts (C 409.2-250 e ...-350 e)

Operating Instructions

Overview of the spare and wearing part kits

Diaphragm pump C 409.2-250 e ...-350 e

Suction valve (kit)	
Item	Designation
5	Suction valve (incl. o-rings)

Pressure valve (kit)	
Item	Designation
4	Pressure valve (incl. o-rings)

Diaphragm kit	
Item	Designation
8	Drive diaphragm

Pump body kit (plastic)	
Item	Designation
1	Screws, complete
2	Front plate
3	Pump body

Pump body kit (special steel)	
Item	Designation
1	Screws, complete
3	Pump body

11.3.4 Diaphragm pump C 409.2- 7,0 e ...-180 e with integrated overflow valve

C 409.2 – 7,0 e
C 409.2 – 12 e
C 409.2 – 18 e
C 409.2 – 25 e
C 409.2 – 50 e
C 409.2 – 75 e
C 409.2 – 90 e
C 409.2 – 115 e
C 409.2 – 140 e
C 409.2 – 180 e

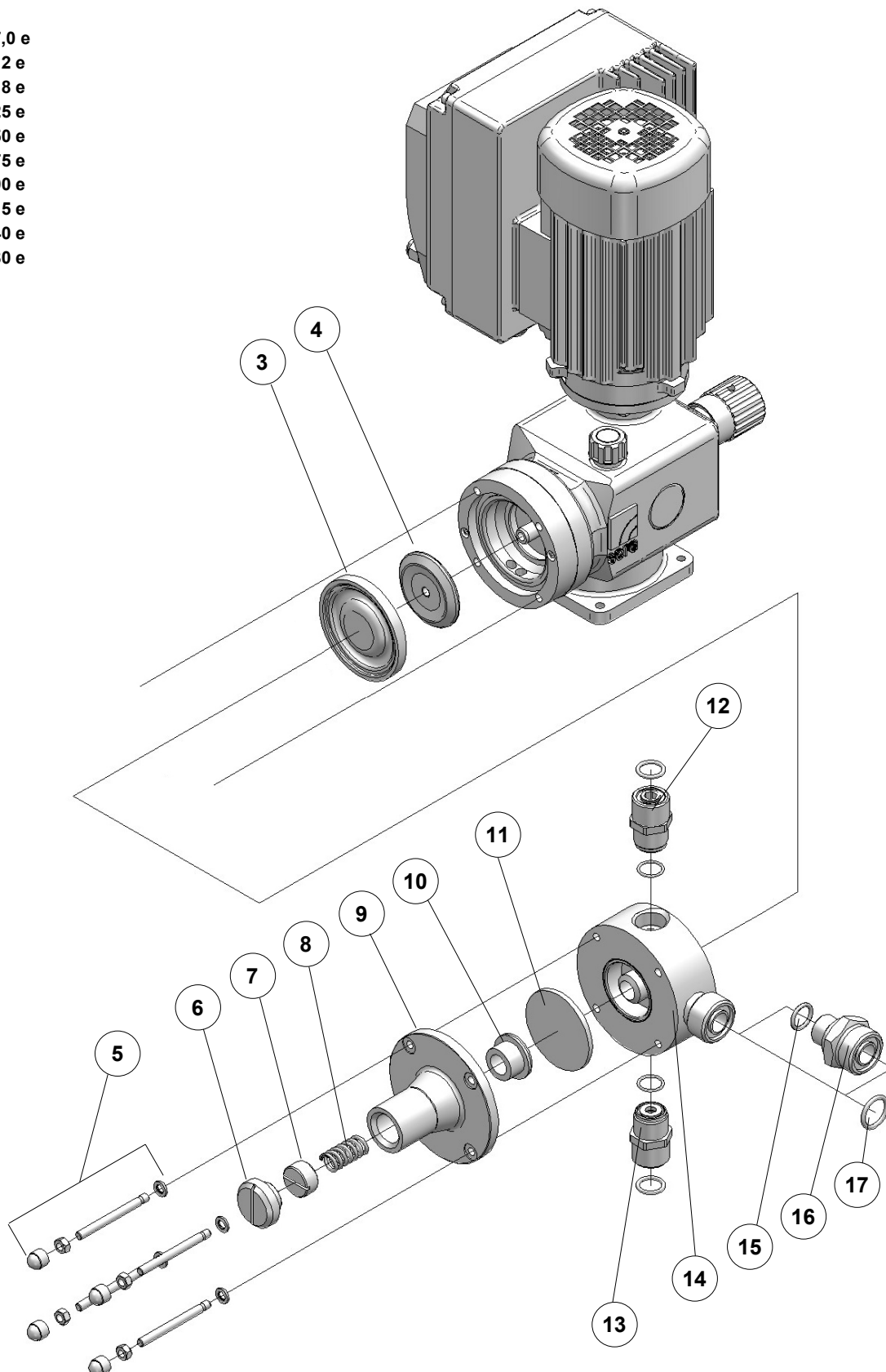


Fig. 61 Spare- and wearing parts (C 409.2- 7,0 e ...-180 e with integrated overflow valve)

Operating Instructions

Overview of the spare and wearing part kits

Diaphragm pump C 409.2- 7,0 e ...-180 e with integrated overflow valve

Suction valve (kit)	
Item	Designation
13	Suction valve (incl. o-rings)

Pressure valve (kit)	
Item	Designation
12	Pressure valve (incl. o-rings)

Diaphragm kit	
Item	Designation
3	Drive diaphragm
4	Pressure plate (not with a laminated drive diaphragm)
11	Diaphragm (overflow valve)

Overflow valve (kit)	
Item	Designation
6	Lid
7	Set screw
8	Pressure spring
9	Cover
10	Pressure disk

Pump body kit (plastic)	
Item	Designation
5	Screws, complete
14	Pump body
17	O-ring

Pump body kit (special steel)	
Item	Designation
5	Screws, complete
14	Pump body
15	O-ring
16	Socket
17	O-ring

11.3.5 Diaphragm pump C 409.2-250 e ...-350 e with integrated overflow valve

C 409.2 – 250 e
C 409.2 – 350 e

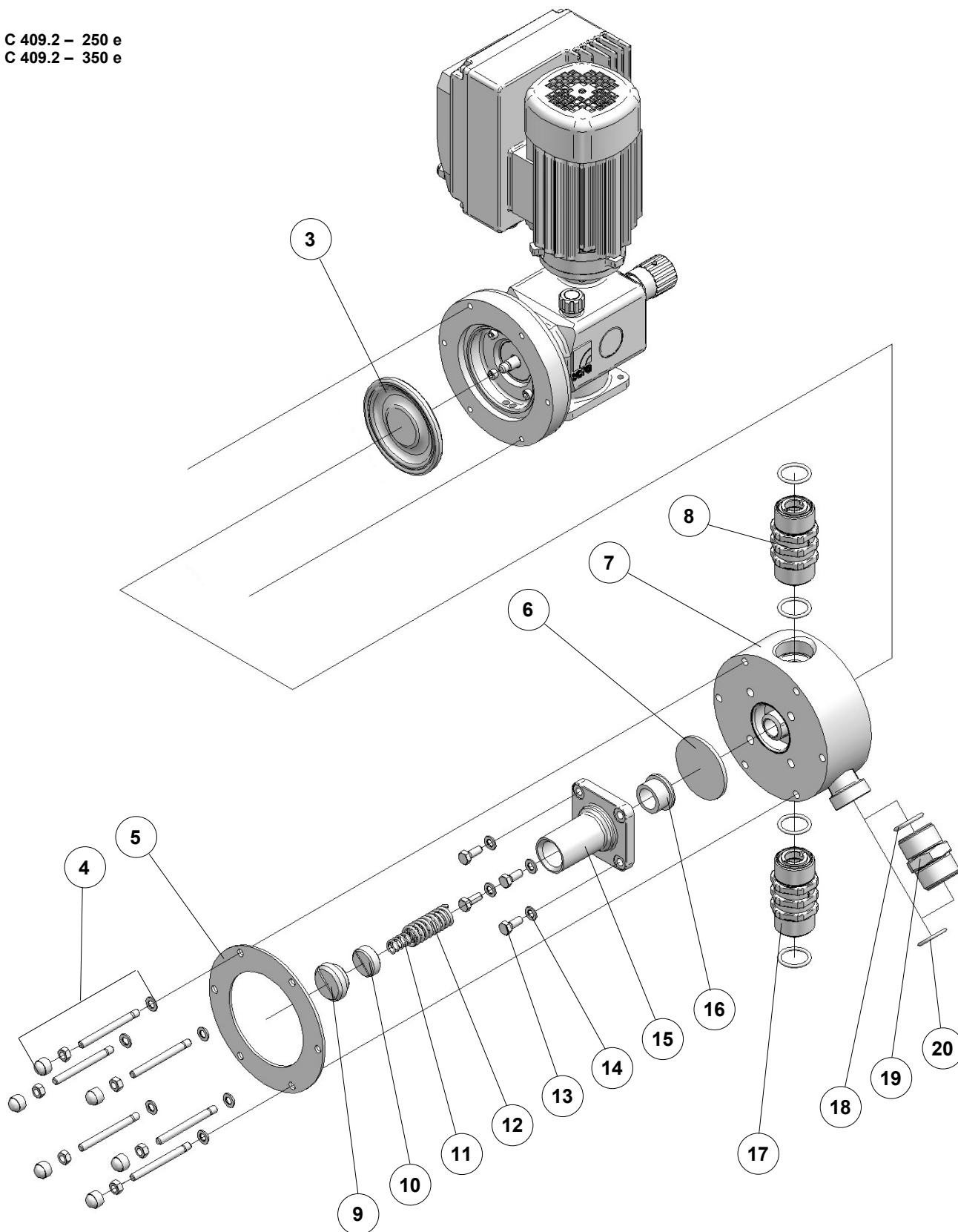


Fig. 62 Spare- and wearing parts (C 409.2-250 e ...-350 e with integrated overflow valve)

Operating Instructions

Overview of the spare and wearing part kits

Diaphragm pump C 409.2-250 e ...-350 e with integrated overflow valve

Suction valve (kit)	
Item	Designation
17	Suction valve (incl. o-rings)

Pressure valve (kit)	
Item	Designation
8	Pressure valve (incl. o-rings)

Diaphragm kit	
Item	Designation
3	Drive diaphragm
6	Diaphragm (overflow valve)

Overflow valve (kit)	
Item	Designation
9	Lid
10	Set screw
11	Pressure spring
12	Pressure spring
13	Hexagon screw(s)
14	Disk(s)
15	Cover
16	Pressure disk

Pump body kit (plastic)	
Item	Designation
4	Screws, complete
5	Front plate
7	Pump body
20	O-ring

Pump body kit (special steel)	
Item	Designation
4	Screws, complete
7	Pump body
18	O-ring
19	Socket
20	O-ring

Operating Instructions

11.4 Changing the Diaphragm

11.4.1 General

In order to ensure a correct function of the diaphragm pump and to fulfil the required safety and protective provisions it is absolutely necessary to check and replace the diaphragms at regular intervals.

WARNING !



For replacing the diaphragm, the system must be **depressurised!**

Danger of breath / Danger of poisoning by leaking medium.

WARNING !



Prior to replacing the diaphragm, empty the pump and, if necessary, rinse it with appropriate fluid in order to avoid contact with aggressive and/or toxic media!

Danger of breath / Danger of poisoning by leaking medium.

- During maintenance or repair work, switch off the drive motor of the diaphragm pump and secure it against inadvertent or unauthorised reactivation.
- Take appropriate protective measures: wear protective clothing, breathing mask and safety goggles. Prepare a container with appropriate fluid right beside the pump for being able to remove splashes of the pumped medium.
- Use an appropriate detergent to rinse the diaphragm pump until no residues of the pumped medium remain in the pump body. Otherwise, pumped medium may leak when disassembling the pump. Collect the rinsed liquid in a safe way (avoid contact with it) and dispose of it in an environmentally compatible way. This measure is also necessary if the diaphragm pump should be returned for repair.

11.4.2 Single diaphragm pump

- Set the stroke length adjustment to a stroke length of 0% (front position).
- Loosen fixing screws or –nuts on the pump body.
- Remove pump body and front plate (if installed) to the front.

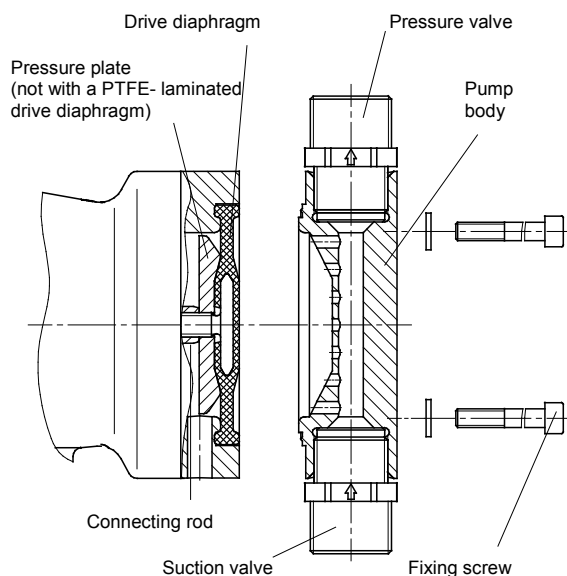


Fig. 66

- Screw the drive diaphragm out of the connecting rod.
- Unscrew pressure plate from the set screw of the diaphragm (not with a laminated drive diaphragm).
- Clean pressure plate and screw plate on the new diaphragm.

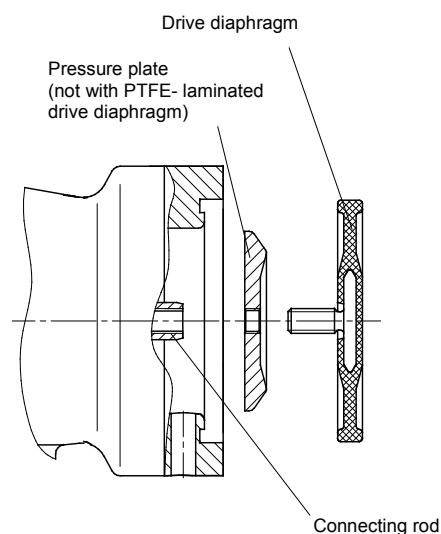


Fig. 67

Operating Instructions

Assemble the pump in reversed order

- Set the stroke length to 50%. Move diaphragm to the base ring – the diaphragm must be in the middle position (see Fig. 68).
- When assembling the pump body, please note: suction valve below, pressure valve above!

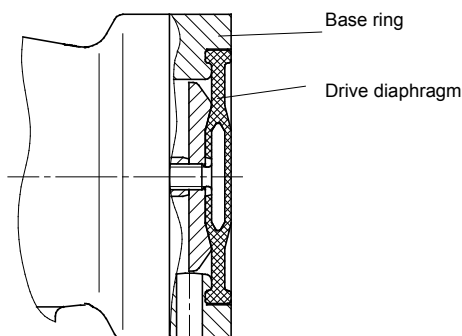


Fig. 68

Add the suction and pressure line and connect pump to the power supply. The diaphragm pump is then again ready for operation.

WARNING !



For replacing the diaphragm, the system must be **depressurised!**

Danger of breath / Danger of poisoning by leaking medium.

- Loosen and unscrew the lid of the overflow valve.

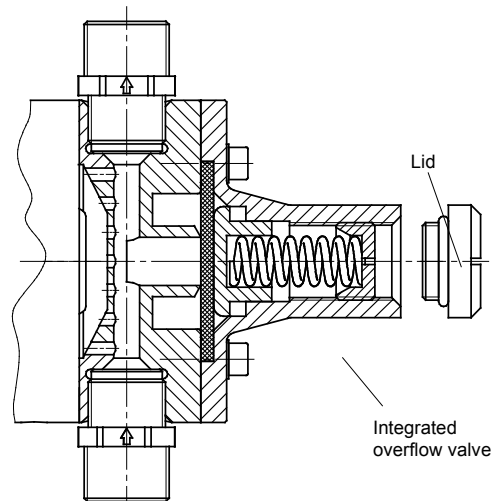


Fig. 73

CAUTION !



Before the set screw is unscrewed the dimension T (distance between top edge of the cover and the set screw) is to be determined and documented.

This ensures that the overflow valve can be reset to the same pressure during subsequent assembly.

Danger of over pressure by incorrect adjustment.

11.5 Diaphragm change of the overflow valve

Proceed as follows to change the diaphragm of the overflow valve (only dosing pumps with integrated overflow valve).

Note:

All diaphragms should be replaced completely (see Chapter 10.4).

WARNING !



Prior to replacing the diaphragm, empty the pump and, if necessary, rinse it with appropriate fluid in order to avoid contact with aggressive and/or toxic media!

Danger of breath / Danger of poisoning by leaking medium.

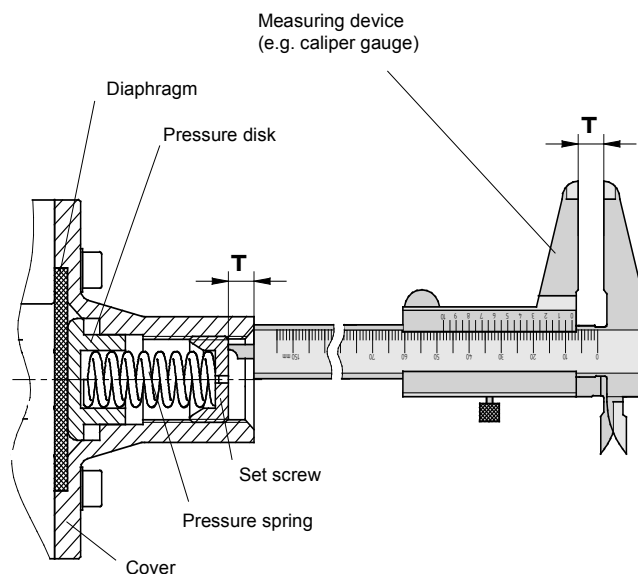


Fig. 74 Installation depth of the set screw

Operating Instructions

- Unscrew the set screw.
- Remove pressure spring.

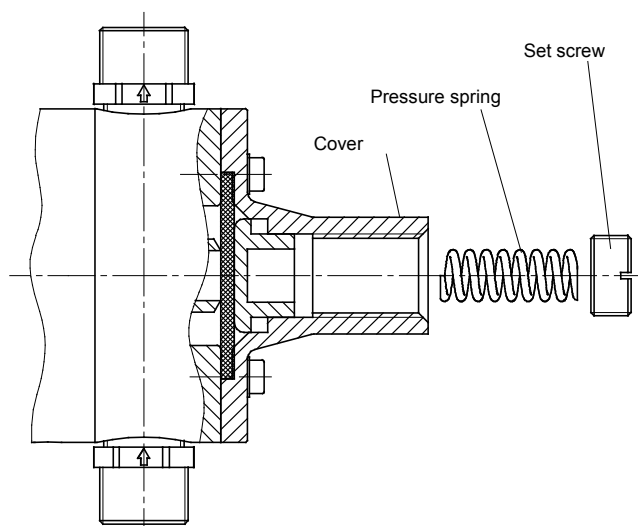


Fig. 75

- Loosen and unscrew fixing screws.
- Remove cover and pump body to the front.
- Remove pressure disk and diaphragm.

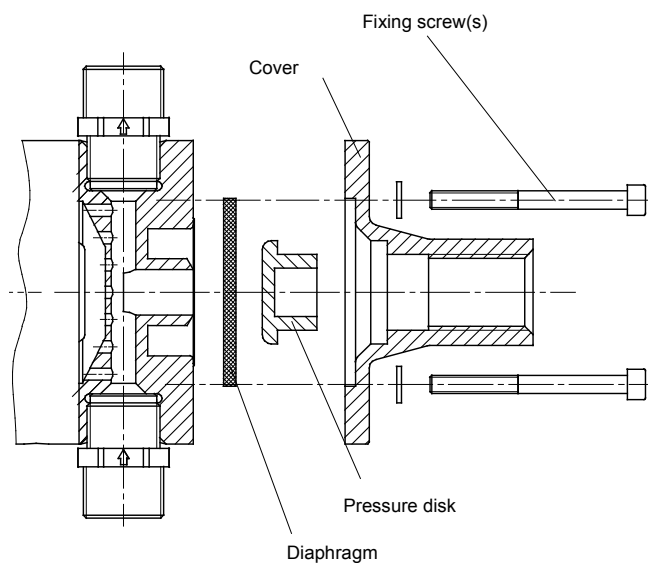


Fig. 76

- Check overflow valve for damage and contamination.
- Insert a new diaphragm. In case of PTFE-laminated diaphragms the PTFE-coated side must point towards the pump body.
- Assemble the pump in reversed order.

NOTE !

The individual components should be cleaned thoroughly before assembly!

CAUTION !



When the set nut is screwed in the dimension "T" which was determined beforehand is of great importance (see Fig. 74).

The initial opening pressure of the overflow valve is only reached when the set screw is screwed in exactly according to dimension "T"!

Danger of over pressure by incorrect adjustment.

CAUTION !



The screw-in depth of the set screw must not exceed the initial value. If the set pressure is increased, sera has to be consulted beforehand.

Danger of over pressure by incorrect adjustment.

CAUTION !



Never screw in the set screw to a depth so that the pressure spring is compressed to solid length!

Danger of losing the safety function in case of over pressure.

Operating Instructions

11.6 Oil change

- Check oil level at regular intervals (oil sight glass).

Perform an oil change once a year.

To do so, proceed as follows:

- Unscrew the venting screw (see Fig. 07).
- Prepare an appropriate container. Open the screw plug and drain off oil (see Fig. 77).

- Close hole with screw plug (pay attention to the sealing ring!).
- Fill oil in threaded hole of the venting screw.
- For type and quantity of the gear oil, please see Chapter 12.1.
- Screw in venting screw.

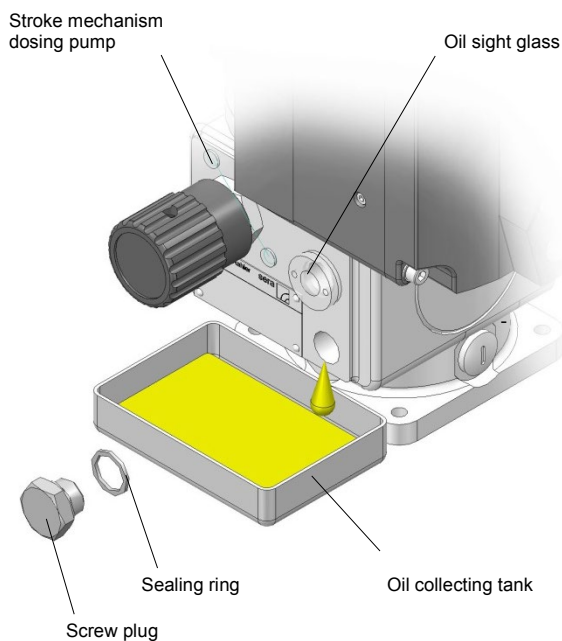


Fig. 77 Oil change

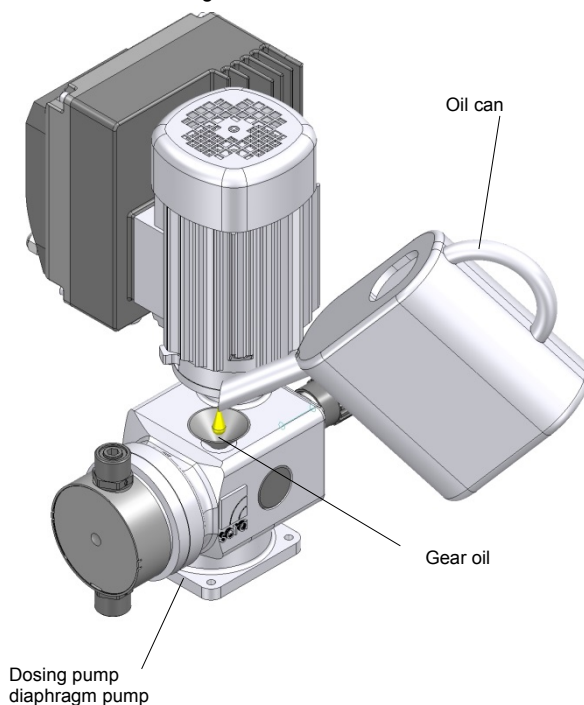


Fig. 78 Filling gear oil

12 Lubricants

12.1 Lubricant in the stroke mechanism

Pump type	Lubricant	Quantity
C 409.2-1,6e	ARAL DEGOL BG 220	0,3 liter
C 409.2-2,4e		
C 409.2-7,0 e		
C 409.2-12 e		
C 409.2-18 e		
C 409.2-25 e		
C 409.2-50 e		
C 409.2-75 e		
C 409.2-90 e		
C 409.2-115 e		
C 409.2-140 e		
C 409.2-180 e		
C 409.2-250 e		
C 409.2-350 e		

Table 20 Lubricant in the stroke mechanism



13 Fault analysis and corrective action

sera - products are sophisticated technical products which are only shipped after having been thoroughly tested and checked at our factory..

Should there be any faults, these can be – on account of fault announcement on LCD-display – detected and rectified easily and quickly if the steps in Tables 22 - 24 are carried out.

Operating Instructions

13.1 Analysis of the plain text error messages

Error message								Possible cause	Corrective action
Analog signal < 4 mA!	Analog signal > 20 mA!	Analog signal > 25 mA!	Flow too low!	Cycle-delay memory full!	Leave the calibration range!	No stroke recognition! (internal fault)	No flow!		
●								Wire break of the analog signal line	Check analog signal line and repair, if necessary
●								The set analog signal (e.g. 4-20mA) does not match the actual analog signal (e.g. 0-20mA).	Check the set analog signal and adapt to the actual analog signal, if necessary.
●	●	●						Fault of the analog signal transmitter (sensor, controller)	Check the analog signal transmitter and eliminate fault of the transmitter if necessary
			●				●	Drive diaphragm defective	Replace drive diaphragm
			●				●	Suction height too high	Reduce suction height or suction resistance.
			●				●	Suction line leaky	Check gaskets, tighten pipe connections
			●				●	Shut-off valves in pipe closed	Open shut-off valves or check opening – check pump for damage
			●				●	Few or no conveying medium in store tank	Fill store tank
			●				●	Pump valves leaky	Remove valves and clean
			●				●	Foreign matter in pump valves or Pump valves (ball seats) damaged	Remove and clean valves, check function; replace valves if necessary.
			●				●	Pump valves incorrectly mounted or valve balls missing	Check installation position and completeness – replace missing parts or install correctly
			●				●	Filter in suction line clogged	Clean filter
			●				●	No stroke movement of the drive diaphragm	Increase stroke frequency / stroke length; check connecting rod motion.
			●				●	Counter-pressure too high	Measure pressure with manometer directly above pressure valve and compare with permissible counter-pressure
			●				●	Acceleration height too high due to pipe geometry	Check acceleration height on suction- and pressure side and compare with design data – install a pulsation damper if necessary
			●				●	Too high viscosity of the pumped medium	Check viscosity of the pumped medium and compare with the design data – reduce concentration or increase temperature if necessary
			●				●	Pumped medium outgasses in suction line and/or pump body	Check geodetic conditions and compare with the data of the pumped medium. Operate pump with suction side supply, reduce temperature of the pumped medium.
			●				●	Air in suction line while pressure applied to the pressure valve ball	Vent pressure side resp. open vent valve (only FRP-design, see chap. 7.2.7).
			●				●	Pipe connections leaky	Tighten connection according to type of material. Be careful with plastic – risk of fracture
			●				●	Pumped medium frozen in pipe	Remove diaphragm pump and check for damage – increase temperature of the pumped medium
			●				●	Pump valves are dry	Moisten pump body and valves. Open vent valve.
				●				Frequency of the received pulses is (permanently) higher than the maximum stroke frequency of the dosing pump	Check process parameters.
				●				Pulse factor too high	Check process parameters.
					●			After calibration of the dosing pump the stroke length was adjusted by more than +/- 10%	Check the stroke length adjustment, set the set value again, calibrate again, if necessary
					●			Stroke length was set to below 15% approx., the stroke length is out of the linear dosing range.	Check the stroke length adjustment, increase the stroke length
						●		Sensory mechanism of dosing pump is defective	Contact the manufacturer

Table. 22 (Analyze and eliminate faults on the basis of the error messages – part I)

Operating Instructions

Error message								Possible cause	Corrective action
Time lost !	Diaphragm rupture!	Mains voltage too g too low!	Mains voltage too high!	Pre-alarm level!	Set value not attainable! (Internal fault!)	Fault drive! (Internal fault!)	Fault stroke sensor!! (Internal fault!)	Dry running of dosing pump!	
●								Drive diaphragm defective	Replace drive diaphragm
	●	●						Electric data of the dosing pump do not match mains data	Check order data. Check electric installation.
				●				Few or no conveying medium in store tank	Fill store tank
					●			Only for calibrated pump: Set stroke length is too low to attain the preset set value	Check the stroke length and the set value, calibrate the pump again, if necessary.
						●		Integrated excess temperature protection (posistor) of drive motor released.	Let the temperature of the drive motor go down. Check the ambient temperature
							●	No stroke movement of the drive diaphragm	Increase stroke frequency / stroke length; check connecting rod motion.
							●	Counter-pressure too high	Measure pressure with manometer directly above pressure valve and compare with permissible counter-pressure
							●	Shut-off valves in pipe closed	Open shut-off valves or check opening – check pump for damage
						●		Drive motor overloaded (example: excessive counter pressure)	Check counter pressure
●								Breakdown supply voltage by mode of operation „Charge-Timer“	Adjustment of system time

Table. 23 (Analyze and eliminate faults on the basis of the error messages – part II)

Operating Instructions

13.2 Analysis of other faults

Type of fault													Possible cause	Fault clearance
Diaphragm pump does not draw in	Diaphragm pump does not deliver	Delivery rate is not reached	Delivery height is not reached	Delivery rate fluctuates	Maximum delivery rate exceeded	Drive motor does not start	Pipe oscillates heavily	High noise development	Low service life of the drive diaphragm	Drive is overloaded	Damage in stroke mechanism / drive	Leakage on pump head		
●	●	●											Suction height too high	Reduce suction height or suction resistance
●	●	●		●									Suction line leaky	Check gaskets, tighten pipe connections
●	●					●					●		Shut-off valves in pipe closed	Open shut-off valves or check opening – check pump for damage
●	●	●											No conveying medium in store tank	Fill store tank
●	●	●	●	●									Pump valves leaky	Remove valves and clean
●	●		●	●									Pump valves (ball seats) damaged	Remove and clean valves, check function; replace valves if necessary
●	●												Pump valves incorrectly mounted or valve balls missing	Check installation position and completeness – replace missing parts or install correctly
●	●												Filter in suction line clogged	Clean filter
						●				●			Electric data of the electronics do not match mains data	Check order data. Check electric installation.
		●	●	●		●	●	●	●	●		●	Counter-pressure too high	Measure pressure with manometer directly above pressure valve and compare with permissible counter-pressure
●	●	●	●	●									Foreign matter in pump valves	Remove and clean valves
				●	●								Pressure on suction side higher than at the end of the pressure line	Check geodetic conditions, install float valve or pressure keeping valve if necessary
		●	●	●	●	●	●	●	●	●	●	●	Acceleration height too high due to pipe geometry	Check acceleration height on suction- and pressure side with manometer and compare with design data – install a pulsation damper if necessary
									●			●	Material which is in contact with the medium not suitable for the pumped medium	Check whether the pumped medium corresponds with the design data and select other materials if necessary
●		●	●	●									Too high viscosity of the pumped medium	Check viscosity of the pumped medium and compare with the design data – reduce concentration or increase temperature if necessary
	●	●		●									Pumped medium outgasses in suction line	Check geodetic conditions and compare with the data of the pumped medium. Operate pump with suction side supply, reduce temperature of the pumped medium.
●													Air in suction line while pressure applied to the pressure valve ball	Vent pressure side resp. open vent valve (only FRP-design C409.2-0,8e- ...2,4e)
●	●	●	●	●								●	Pipe connections leaky	Tighten connection according to type of material. Be careful with plastic – risk of fracture
●	●	●										●	Temperature too low	Check flowability of the pumped medium. Temperature of pumped medium and ambient temperature must not fall below -10°C
●	●					●					●	●	Pumped medium frozen in pipe	Remove diaphragm pump and check for damage – increase temperature of the pumped medium
●	●	●	●	●					●			●	Diaphragm rupture	Replace diaphragm according to Chapter 11.4.

Table 24 Fault analysis and corrective action

Operating Instructions

14 Shut-down

Switch the diaphragm pump off.

Rinse pump head to remove the pumped medium and make sure that the detergent is suitable for the pumped medium and the material of the pump head.

15 Disposal

Shut-down system. Please see “Shut-down”.

15.1 Dismantling and transport

- Remove all fluid residues, clean thoroughly, neutralize and decontaminate.
- Package unit and ship.

15.2 Complete disposal

- Remove all fluid residues from unit.
- Drain off lubricants and dispose of according to regulations!
- Dismount materials and send them to a suitable waste disposal company!

CAUTION !



The consignor is responsible for damage caused by leaking lubricants and fluids!

Danger of breath / Danger of poisoning in case of leaking medium.

