Controllable
Multi layer diaphragm pump
Series C 410.2 ML

Operating instructions

Product: Multi-layer diaphragm pump

Type:
- C 410.2 - 70 ML
- C 410.2 - 135 ML
- C 410.2 - 500 ML
- C 410.2 - 1200 ML

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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CAUTION!
Keep the operating instructions for future application!
Controllable
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1 Quickstart

"Quickstart" is used to start-up the pump quickly without having read the operating instructions in detail.

CAUTION !
The Quickstart does not claim to be complete and does not relieve the user from reading the complete instructions!

1.1 Mains connections

The sera – diaphragm pump is delivered ready for connection with a 2m mains cable and a CEE-socket/ 16A 5-poles 6h. The diaphragm pump is designed for an operating voltage range of 380 – 420 V, 50/60 Hz.

Fig. 01 Mains Connections

The mains connection requires 3~ 400V + neutral conductor + protective conductor.
The leakage current against earth amounts to approx. 7 mA. Recommended protection: 3-poles automatic fuse C10A

CAUTION !
Only operate the pump when it is connected to an earthed power supply!

CAUTION !
The pump restarts in the selected operating mode after the power supply was switched on or a power supply recovery following a mains failure!

1.2 Operating elements

1.3 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. 09). 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. 09). The fault is not only indicated by the LED but also as plain text in the LCD display.

Fig. 02  (Electronics control panel)
1.4 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.

1.5 Factory settings

The factory setting of the pump electronics is specified in Chapter 11.4.

1.6 Control inputs and outputs

1.6.1 Control via a contact signal

1.6.2 Control via an analog signal

1.7 Selecting the operating mode

Proceed as follows to select the operating mode:

1. Input the password PW01 (factory setting 9990) to release the programming levels.
2. Change the operating mode.

Operation Menu

PW01
PW02

PW01
PW02

Locking by Password 01
(pre setting ex work: 9990, not activated)

Locking by Password 02
(pre setting ex work: 9021)

Fig. 03 (Control of digital inputs via a potential-free contact signal and control of a relay via an output of the dosing pump)

Fig. 04 (Control of analog/digital inputs via an analog signal, potential-free contact signal and control of a relay via an output of the dosing pump)
2 Allgemein

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

The sera – multi-layer 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.

3 Types

3.1 Type code

Example:
Multi-layer diaphragm pump type C 410.1-70 ML

<table>
<thead>
<tr>
<th>C</th>
<th>410.2</th>
<th>70</th>
<th>ML</th>
</tr>
</thead>
</table>

Pump control
C controllable

C 410.2 70 ML

Indication of model range/stroke mechanism

ML Multi-layer diaphragm pump

3.2 Type plate

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

- **Typ**
- **Nr.**
- **Qₜₐₙ** [l/h]
- **Pₐₜₐₜₜ.** [bar]
- **P₂ₜₐₜₜ.** [bar]
- **Hydrfl. [cm³]**

![Type plate](image)

Fig. 05 Type plate

### Explanation of the indications on the type plate

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Type</td>
<td>Pump type</td>
</tr>
<tr>
<td>2</td>
<td>No.</td>
<td>Serial number of the pump</td>
</tr>
<tr>
<td>3</td>
<td>Pₐₜₐₜₜ./max [bar]</td>
<td>Minimum/maximum permissible pressure in the pump inlet</td>
</tr>
<tr>
<td>4</td>
<td>P₂ₜₐₜₜ. [bar]</td>
<td>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.</td>
</tr>
<tr>
<td>5</td>
<td>Qₜₐₙ [l/h]</td>
<td>Nominal delivery rate</td>
</tr>
<tr>
<td>6</td>
<td>n₉ [1/min]</td>
<td>Nominal stroke frequency</td>
</tr>
<tr>
<td>7</td>
<td>Hydrfl. [cm³]</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

Table 01 Explanation of type plate
3.3 Materials

The materials used are stated in the order confirmation.

3.4 Viscosity, pumped medium

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

3.5 Dosing range

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

3.6 Noise measurement

According to DIN 45635 the sound pressure level measured of the multi-layer diaphragm pumps is between 50 and 60 dB (A).

4 Safety instructions

4.1 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 system is certified according to ISO 9001:2000.
The sera – multi-layer 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!

4.2 Marking of notes

4.2.1 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 DIN 4844 – W9)

The safety sign appears in the following cases:

- If improper observance or non-observance of the operating manual, work instructions, specified operating procedures and similar can lead to personal injury or accidents.
- If improper observance or non-observance of the operating manual, work instructions, specified operating procedures and similar can lead to damage to property.
- Due to danger of causticization personnel must wear protective clothing (safety goggles, safety gloves and safety apron) for maintenance and repair work on parts which come into contact with hazardous products or for changing the containers.
Subject to technical modifications!

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4.2.2 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.

4.3 Personnel qualification and training
The personnel who operate, maintain, inspect and install the multi-layer 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.

4.4 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

4.5 Safety conscious working
The safety instructions specified in this operating manual, the national regulations for accident prevention, the safety regulations for the pumped medium valid at the place of installation as well as internal working-, operating-, and safety instructions of the owner are to be observed.

4.6 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 electric energy are to be precluded.

4.7 Safety instructions for maintenance-, inspection and installation work
The owner must ensure that all maintenance-, inspection- and installation work are exclusively carried out by authorized and qualified personnel who have read the operating instructions carefully.
The spare parts and utilities used must comply with the requirements of the respective operating conditions.
All screwed connections and connections may only be removed when the system is not under pressure.

4.8 Arbitrary modification and spare parts production
Modification to and changement of the pump are only permitted after previous agreement of the manufacturer. Original spare parts and accessories approved by the manufacturer increase safety.

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

4.9 Improper operation
Operational reliability of the supplied multi-layer diaphragm pump is only guaranteed if the product is used as intended, according to the descriptions in Chapter 4.10 of these operating instructions.
4.10 Intended use

The sera – diaphragm pump is only to be deployed according to the intended purpose stated in the product description and the acceptance test certificate.

If the multi-layer 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!

Criteria for the proper use of the multi-layer diaphragm pump

- 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 in contact with the pumped medium
- Operating conditions at the place of installation
- Pressure and temperature of the pumped medium
- Voltage supply

4.11 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.

4.12 Utilities

If not agreed otherwise in the contract conditions, the Sefar multi-layer diaphragm pump is always supplied with the necessary utilities.

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

5 Transport and intermediate storage

5.1 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 responsible carrier and the supplier.

**CAUTION !**

The packaging material must be disposed of appropriately!

5.2 Transport

Select a hoist which is adapted to the weight of the pump and attach it to the motor flange of the pump

5.3 Storage

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

Proper storage increases the service life of the multi-layer 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%.
- The maximum storage time for the standard system is 12 months.

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.
6 Components of the multi-layer diaphragm pump

The multi-layer diaphragm pump may be assembled of the following (main) components:

- Stroke mechanism with drive
- Stroke length adjustment
- Built-in pump
- Pump body
- Valves

Optionales Zubehör:
- Actuator

Drive motor with electronics
Pressure valve
Manual stroke length adjustment
Manual stroke length adjustment with position indicator
Stroke length adjustment with actuator
Suction valve
Pump body, diaphragm rupture indication by means of pressure switch
Built-in pump
Fig. 06 Overview of the components

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7 Technical data

7.1 Dimensions

Subject to technical modifications!
## Controllable Multi layer diaphragm pump
### Series C 410.2 ML

### Operating instructions

### All dimensions in mm !

<table>
<thead>
<tr>
<th>Valve type</th>
<th>Pump type</th>
<th>C-410.2 - 70 ML</th>
<th>C-410.2 - 135 ML</th>
<th>C-410.2 - 500 ML</th>
<th>C-410.2 - 1200 ML</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>Connection thread</td>
<td>G ¾</td>
<td>G 1</td>
<td>G 1 ¼</td>
<td>G 1</td>
</tr>
<tr>
<td>DN</td>
<td>Nominal width</td>
<td>8</td>
<td>15</td>
<td>20</td>
<td>15</td>
</tr>
<tr>
<td>A</td>
<td>Single valves PVC</td>
<td>104</td>
<td>143</td>
<td>---</td>
<td>151</td>
</tr>
<tr>
<td>A</td>
<td>Single valves 1.4571/1.4581</td>
<td>---</td>
<td>---</td>
<td>127</td>
<td>---</td>
</tr>
<tr>
<td>A</td>
<td>Double valves PP-FRP, PVDF-FRP</td>
<td>94</td>
<td>---</td>
<td>127</td>
<td>---</td>
</tr>
<tr>
<td>A</td>
<td>Double valves 1.4571/1.4581</td>
<td>95</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>B</td>
<td>Single valves PVC</td>
<td>97</td>
<td>124</td>
<td>---</td>
<td>132</td>
</tr>
<tr>
<td>B</td>
<td>Single valves 1.4571/1.4581</td>
<td>---</td>
<td>---</td>
<td>127</td>
<td>---</td>
</tr>
<tr>
<td>B</td>
<td>Double valves PP-FRP, PVDF-FRP</td>
<td>94</td>
<td>---</td>
<td>127</td>
<td>---</td>
</tr>
<tr>
<td>B</td>
<td>Double valves 1.4571/1.4581</td>
<td>95</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>D</td>
<td>Built-in pump</td>
<td>59</td>
<td>58</td>
<td>39</td>
<td>43</td>
</tr>
<tr>
<td>E</td>
<td>Centre of valve thread (1.4571)</td>
<td>21</td>
<td>33</td>
<td>33</td>
<td>34</td>
</tr>
<tr>
<td>E</td>
<td>Centre of valve thread (PP, PVC, PVDF)</td>
<td>27</td>
<td>33</td>
<td>33</td>
<td>37</td>
</tr>
<tr>
<td>F</td>
<td>PK, 1.4571 (without front plate)</td>
<td>54</td>
<td>80</td>
<td>80</td>
<td>84</td>
</tr>
<tr>
<td>F</td>
<td>PK, PP, PVC, PVDF (with front plate)</td>
<td>65</td>
<td>83</td>
<td>90</td>
<td>109</td>
</tr>
<tr>
<td>H</td>
<td>Pump body with pressure switch (1.4571)</td>
<td>148</td>
<td>161</td>
<td>171</td>
<td>186</td>
</tr>
<tr>
<td>H</td>
<td>Pump body with pressure switch (PP, PP, PVDF)</td>
<td>146</td>
<td>161</td>
<td>171</td>
<td>185</td>
</tr>
<tr>
<td>K₁</td>
<td>Blind flange for pump without SLA</td>
<td>14</td>
<td>14</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>K₂</td>
<td>Manual stroke length adjustment (max.)</td>
<td>79</td>
<td>79</td>
<td>79</td>
<td>100</td>
</tr>
<tr>
<td>K₃</td>
<td>Manual SLA with position indicator</td>
<td>110</td>
<td>110</td>
<td>110</td>
<td>115</td>
</tr>
<tr>
<td>K₄</td>
<td>Electric actuator</td>
<td>260</td>
<td>260</td>
<td>260</td>
<td>260</td>
</tr>
<tr>
<td>K₅</td>
<td>Electric actuator with PMR3</td>
<td>340</td>
<td>340</td>
<td>340</td>
<td>340</td>
</tr>
</tbody>
</table>

### Drive motor
- see Fig. 07

### Stroke mechanism
- a. o. Dimensions for fastening of the pump

Table 02 Dimensions

---

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### 7.2 Performance data

<table>
<thead>
<tr>
<th>Type</th>
<th>Pump data</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Nominal delivery rate ( Q_N ) adjustable by stroke length adjustment</td>
</tr>
<tr>
<td></td>
<td>Maximum permissible pressure in the pump outlet ( p_2 ) max.</td>
</tr>
<tr>
<td></td>
<td>Minimum permissible pressure in the pump inlet ( p_1 ) min. / max.</td>
</tr>
<tr>
<td></td>
<td>Maximum suction height ( h_1 )</td>
</tr>
<tr>
<td></td>
<td>Interchangeable nominal width ( WC )</td>
</tr>
<tr>
<td></td>
<td>Nominal stroke frequency ( n )</td>
</tr>
<tr>
<td></td>
<td>Maximum stroke length ( WC )</td>
</tr>
<tr>
<td></td>
<td>Motor size</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>C 410.2 – 70 ML</td>
<td>0-70</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>C 410.2 – 135 ML</td>
<td>0-135</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>C 410.2 – 500ML</td>
<td>0-500</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>C 410.2 – 1200 ML</td>
<td>0-1200</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 03 Performance data

**Notes:**
1. Achievable height with media similar to water and filled suction line
2. Linear dosing range at a stroke length between 20% and 100%
3. Maximum pressure for pump bodies made of plastic

### Motor data

<table>
<thead>
<tr>
<th>Type</th>
<th>Motor data</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Antriebsleistung</td>
</tr>
<tr>
<td></td>
<td>kW</td>
</tr>
<tr>
<td>C 410.2 – 70 ML</td>
<td>0,75</td>
</tr>
<tr>
<td>C 410.2 – 135 ML</td>
<td>0,75</td>
</tr>
<tr>
<td>C 410.2 – 500 ML</td>
<td>0,75</td>
</tr>
<tr>
<td>C 410.2 – 1200 ML</td>
<td>1,50</td>
</tr>
</tbody>
</table>

Tab. 04 Motor data

### Additional data of electronics

<table>
<thead>
<tr>
<th>Type</th>
<th>Electrical data</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Input voltage / Control input</td>
</tr>
<tr>
<td></td>
<td>5...30 V DC</td>
</tr>
</tbody>
</table>

Tab. 05 Elektrische Daten

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8 Functional description

8.1 General

sera - multi-layer 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 multi-layer diaphragm.

Multi-layer diaphragm pumps consist of the following (main) components:

- Drive motor
- Stroke mechanism
- Stroke length adjustment
- Built-in pump
- Pump body
- Suction and pressure valve

8.2 Components of the multi-layer diaphragm pump 410.2

8.2.1 Stroke mechanism

Function

Multi-layer 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).

8.2.2 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. 10). 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 10.3.2).
8.2.3 Stroke length adjustment

General
The delivery rate of the pump is regulated by changing the stroke length. The stroke length is infinitely variable between 20% and 100%.

Stroke length below 20% results in display „OUT OFF RANGE CALIBRATE!”

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

8.2.3.1 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. 11).
With the 20-steps adjustment on the scale knob, the stroke length can be set individually with a tolerance of 0.5%.

Turning counterclockwise ➔ 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.

8.2.3.2 Manual stroke length adjustment by means of percent scale (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 counterclockwise ➔ the effective stroke length is increased, the delivery rate increases.

(see Fig. 12)

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. 12 Stroke length adjustment with position indicator

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

CAUTION!
The percent scale may get misadjusted during transport. If the pointer does not match the 50%-setting the percent scale is to be readjusted with the pump running!

CAUTION!
The locking (see Fig. 11 and 13) is to be released (using a spanner SW3) before the stroke length is changed.
Then the locking must be tightened again.
This ensures that the set stroke length does not change during operation.
Controllable
Multi layer diaphragm pump
Series C 410.2 ML

Operating instructions

In case of dosing pumps with electric actuator, the stroke length can no longer be adjusted manually on the pump.
(Except: actuator with hand wheel)

The actuator is equipped with two integrated limit switches as standard as well as with a position potentiometer for position feedback.
Both limit switches are factory set so that the drive switches 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).
The set stroke length can be read off on the pump (percent scale).

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

**CAUTION !**
The adjustment is only possible when the pump is running!

8.2.3.4 Automatic stroke length adjustment by means of an electric actuator with integrated positioner (PMR3)

same as Chapter 8.2.3.3, in addition:

- PMR3 positioner

This PMR3 positioner which is 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 fault signal.

Information on the electrical connection is given inside the cover of the actuator.
8.2.4 Built-in pump

General

Function
The diaphragm consists of three layers and is linked with the connecting rod. Only the front layer, the so-called working diaphragm, comes in direct contact with the pumped medium.

The middle layer functions as a signal diaphragm. In case of rupture of the working diaphragm, the medium is fed to the diaphragm rupture signalling device in a controlled manner.

The third membrane functions as protective diaphragm and ensures that no pumped medium will leak out, even in case of a diaphragm rupture.

A diaphragm rupture is indicated by a pressure switch (electrical).

8.2.4.1 Multi-layer Diaphragm

The multi-layer diaphragm consists of a package of a total of three individual diaphragms.

Fig. 15 Functional principle of the multi-layer diaphragm pump

8.2.5 Pump body

Depending on the applied backpressure, movements of the plastic pump body in elastic materials are possible. This does not affect the pump's service life or operational reliability.
8.2.6 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. 17).

**CAUTION !**
Pressure valve above, suction valve below!

8.2.7 Diaphragm rupture monitoring (with pressure switch)

**sera** - multi-layer diaphragm pumps of the 410.2 ML series are equipped with a diaphragm rupture monitoring device.

**CAUTION!**
For more detailed information about the indicators of the diaphragm rupture monitoring, please see Chap. 18!

8.3 Drive motor

A **sera** – diaphragm pump of series C 410.2 ML is driven by a threephase-motor controlled by the electronics.

8.3.1 Start-up

Preconditions:

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

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

Suitable for “moderate” group of climates according to IEC 721-2-1.

**CAUTION !**
The drive motor will heat by operation of the pump. Do not touch the motor during operation!

8.3.2 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.
8.3.3 Maintenance of the drive motor

The electric motor must 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.

8.3.4 Restart

Restart the system as described in Chapter 8.3.1 after maintenance work of after longer periods of standstill.

9 Assembly / Installation

9.1 Installation instructions

- 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, permitted humidity until approx. 90%, altitude 1000 m above sea level
- For dimensions of the pump connections and fixing holes, see Fig. 07, Table 02
- Install the pump in such a way that there is no vibration and no tension and that it is aligned precisely.
- CAUTION ! When the C 410.2 is installed next to a pump of series 204.1 and C/CS 409.2 a minimum distance of 100 mm between the pumps (motor housings) has to be kept!

- 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, indicator scale and visual diaphragm rupture signalling device must be easily accessible and readable.
- 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 nozzles.
- Drain cocks are to be provided.
- Prior to connecting the pipes, remove the plastic caps on the suction and pressure nozzles of the pump.
- Check that the fixing screws for the pump body are tightly fitted and, if necessary, retighten.
- CAUTION ! 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.
- If the pump is equipped with an actuator provide for sufficient space to remove the cover (please see Chapter 7.1 "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.

<table>
<thead>
<tr>
<th>Pump type</th>
<th>Pump body without front plate</th>
<th>Pump body with front plate</th>
</tr>
</thead>
<tbody>
<tr>
<td>C 410.2 – 70 ML</td>
<td>15 Nm</td>
<td>15 Nm</td>
</tr>
<tr>
<td>C 410.2 – 135 ML</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C 410.2 – 500 ML</td>
<td>20 Nm</td>
<td>20 Nm</td>
</tr>
<tr>
<td>C 410.2 – 1200 ML</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 06 Tightening torques
CAUTION!
Mount the multi-layer 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 signalling device) in the supply pipe so that the container does not drain off in case of a diaphragm rupture.

9.1.1 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 an overflow valve

When using an external 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 (see Fig. 20)
- 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) (see Fig. 21).

CAUTION!
Shut-off valves must not be closed when the pump is running!

CAUTION!
Provide an overpressure protection (e.g. overflow valve) if the permissible operating pressure may be exceeded.

CAUTION!
If the permissible operating pressure is exceeded and the pump is not equipped with an overpressure protection the pump may be damaged.

Diaphragm overflow valve
Pressure line
Return line
Tank
Shut-off valve
Suction line

Fig. 20 System with (external) overflow valve

Diaphragm relief valve
Pressure line
Return line
Shut-off valve
Suction line

Fig. 21 System with (external) overflow valve
9.1.2 Prevent a backflow of the pumped medium

if the dosing line is linked with a main pipe:

- install an injection fitting (dosing valve).

9.1.3 Eliminate undesired siphoning

when dosing in a main pipe with negative pressure:

- install a pressure keeping valve in the dosing line.

CAUTION !

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

CAUTION !

Note / avoid chemical reactions during a backflow.
9.1.4 How to ensure an air-free suction

if, due to a falling fluid level in the tank, air may be drawn in and delivered to a pressurised line or against a pressure keeping valve:

- install a vent valve in the pressure line.

**CAUTION !**
The delivery flow may be interrupted if air remains in the suction line!

---

9.1.5 Install the empty-tank alarm

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

---

**Fig. 24 Installing a vent valve**

**Fig. 25 Installing an empty-tank alarm**

---

**CAUTION !**
The delivery flow may be interrupted if air remains in the suction line!
9.1.6 How to avoid draining 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 in consideration of mass acceleration and viscosity of the medium.

9.1.7 Line strainer

- Connect 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).

**CAUTION!**

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

Fig. 26 Avoid draining of the suction line

Fig. 27 Installing a line strainer
9.1.8 Suction via a siphon pipe

for use with high tanks without connection at the tank bottom:

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

9.1.9 In case of easily degassing pumped media

- Install the pump so that it can be operated with afflux.

Fig. 28 Installing a siphon tank (sera - fitting)

9.1.10 Damping of the pulsation

by installing pulsation dampers if:

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

Fig. 29 Installation with supply line

Fig. 30 Installing a pulsation damper (I)
Controllable Multi layer diaphragm pump
Series C 410.2 ML

Operating instructions

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

![Diagram of Controllable Multi layer diaphragm pump Series C 410.2 ML](image)

**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.

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.

---

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10 Electric connections

10.1 Mains connections

**CAUTION!**
Avoid short switch off and restart of the dosing pump!

The sera – diaphragm pump is delivered ready for connection with a 2m mains cable and a CEE-socket/16A 5-poles 6h. The diaphragm pump is designed for an operating voltage range of 380 – 420 V, 50/60 Hz.

**CAUTION!**
The pump restarts in the selected operating mode after the power supply was switched on or a power supply recovery following a mains failure!

CAUTION!
Activities of any kind should only be carried out by qualified employees.

**CAUTION!**
After the partition of the mains you have to wait at least 4 minutes before carry out work at the pump again.

Open the electronic housing

Fig. 34
The mains connection requires 3~ 400V + neutral conductor + protective conductor.

The leakage current against earth amounts to approx. 7 mA.

Recommended protection: 3-poles automatic fuse C10A

**CAUTION!**
Only operate the pump when it is connected to an earthed power supply!

Fig. 35 Opening of electronic housing

Disengage the four hexagon socket screw keys for 3mm and pull the electronic forward carefully to get access to the mains connections on the reverse side.

Tip the electronic softly forward but pay attention that meanwhile no other connections will be damaged or pulled out.

Fig. 36 Rear view of the electronic

---

Controllable
Multi layer diaphragm pump
Series C 410.2 ML
Insert the mains pipe through the cable fitting M20 from below into the housing.

Core strip length: 5 - 6 mm
Cross section: 1 - 2.5 mm²

For the connection to the cage clamp a screw driver with 3.5 x 0.5 mm is required.

10.3.1 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 11.8.2). When leaving the factory, the inputs and outputs are preset as described in Tab. 07.

Connect the three mains phases with the clamps L1, L2, L3. Connect the neutral conductor in N and the protective earth to PE.

Afterwards fix the electronic back on the housing.

The direction of rotation of the drive can not be changed by changing the phases.

The direction of rotation of the drive is preset to anticlockwise rotation ex works.

10.3 Electrical interfaces

The connectors for the electrical interfaces are located on the back of the pump below the control panel.
Controllable
Multi layer diaphragm pump
Series C 410.2 ML

Operating instructions

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. 07 shows the identification of the individual leads of the control cable.

<table>
<thead>
<tr>
<th>Lead colour</th>
<th>Pin</th>
<th>Function (ex works setting)</th>
</tr>
</thead>
<tbody>
<tr>
<td>WH (white)</td>
<td>1</td>
<td>Eingang 01 (Impuls)</td>
</tr>
<tr>
<td>BN (brown)</td>
<td>2</td>
<td>Eingang 02 (Analog 01)</td>
</tr>
<tr>
<td>GN (green)</td>
<td>3</td>
<td>Eingang 03 (Extern EIN)</td>
</tr>
<tr>
<td>YE (yellow)</td>
<td>4</td>
<td>Ausgang + / Signal + / 15 V DC</td>
</tr>
<tr>
<td>GY (grey)</td>
<td>5</td>
<td>Ausgang 01 (Sammelstörung)</td>
</tr>
<tr>
<td>PK (pink)</td>
<td>6</td>
<td>Ausgang 02 (Hubsignal)</td>
</tr>
<tr>
<td>RD (red)</td>
<td>7</td>
<td>Masse</td>
</tr>
<tr>
<td>BU (blue)</td>
<td>8</td>
<td>Masse</td>
</tr>
</tbody>
</table>

Table 07 (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). This enables, for example, the direct connection of a programmable logic controller to the dosing pump.

**CAUTION !**

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.
- Connect the anode with 24V DC.
- Connect the cathode with the yellow lead of a cable. Use the diode type 1N4007 or the like.

Fig. 39 shows exemplarily the control of the digital inputs 01 and 03 via a potential-free contact signal.

**CAUTION !**

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.

**CAUTION !**

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)

**CAUTION !**

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. 40 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.

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)

**CAUTION !**

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. 40 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. 39 Control of digital inputs via a potential-free contact signal
Controllable
Multi layer diaphragm pump
Series C 410.2 ML

Operating instructions

10.3.2 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.

Symbol:
![Jack for level input](image)

Fig. 41 Connection for leader contact / main contact

<table>
<thead>
<tr>
<th>Pin</th>
<th>Description</th>
<th>Color of wire</th>
<th>Standard cable</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Pre-alarm</td>
<td>brown</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Ground</td>
<td>blue</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Dry run</td>
<td>black</td>
<td></td>
</tr>
</tbody>
</table>

Table 08 Pins

10.3.3 Input for flow control and flow meter

CAUTION!
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](image)

Fig. 42 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.

11 Operation

11.1 Operating elements

Symbol:
![Electronics control panel](image)

Fig. 43 Electronics control panel

11.2 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. 09). 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. 09). The fault is not only indicated by the LED but also as plain text in the LCD display.
Controllable
Multi layer diaphragm pump
Series C 410.2 ML

Operating instructions

<table>
<thead>
<tr>
<th>Green LED</th>
<th>Yellow LED</th>
<th>Red LED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ready</td>
<td>On</td>
<td></td>
</tr>
<tr>
<td>Stroke confirmation</td>
<td>Flashes</td>
<td></td>
</tr>
<tr>
<td>Internal error</td>
<td>On</td>
<td></td>
</tr>
<tr>
<td>Supply voltage too low / too high</td>
<td>On</td>
<td></td>
</tr>
<tr>
<td>No mains</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Level monitoring:**
- Level pre-alarm: On
- Dry run: On

**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
- Vent valve (CS 409.2): Flashes
- Analog mode:
  - mA signal < 3.5mA: On
  - mA signal > 20.5mA: On

Table 09  Overview of LED indicators

### 11.3 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.

**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.
11.4 Parameter table

Tab. 10 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 11.6) and, in case of external control, to connect the respective input (see Chapter 10.3.1). 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.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Factory settings</th>
<th>Modification 1</th>
<th>Modification 2</th>
<th>Modification 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pulse operation:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pulse mode</td>
<td>1/1</td>
<td>11.7.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pulse factor</td>
<td>1</td>
<td>11.7.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pulse memory</td>
<td>ON</td>
<td>11.7.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Analog mode:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Analog mode</td>
<td>Auto</td>
<td>11.7.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Analog signal</td>
<td>4-20mA</td>
<td>11.7.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjustment: Analog I1</td>
<td>4 mA</td>
<td>11.7.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjustment: Frequency f1</td>
<td>0 %</td>
<td>11.7.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjustment: Analog I2</td>
<td>20 mA</td>
<td>11.7.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjustment: Frequency f2</td>
<td>100 %</td>
<td>11.7.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Batch mode:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Batch control</td>
<td>Manual</td>
<td>11.7.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Batch quantity</td>
<td>0 strokes</td>
<td>11.7.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Batch start</td>
<td>00:00 h</td>
<td>11.7.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>External mode:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stroke freq.</td>
<td>100 %</td>
<td>11.7.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Input 01:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Function E1</td>
<td>Pulse</td>
<td>11.8.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contact E1</td>
<td>Normally open</td>
<td>11.8.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Input 02:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Function E2</td>
<td>Analog 01</td>
<td>11.8.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contact E2</td>
<td>Normally open</td>
<td>11.8.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Input 03:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Function E3</td>
<td>External ON</td>
<td>11.8.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contact E3</td>
<td>Normally open</td>
<td>11.8.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Output 01:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Function A1</td>
<td>Collective fault</td>
<td>11.8.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contact A1</td>
<td>Normally closed</td>
<td>11.8.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Output 02:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Function A2</td>
<td>Stroke signal</td>
<td>11.8.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contact A2</td>
<td>Normally open</td>
<td>11.8.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Dosing monitor:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sensor</td>
<td>OFF</td>
<td>11.12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Function</td>
<td>Message</td>
<td>11.12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fault stroke</td>
<td>10</td>
<td>11.12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alarm limit</td>
<td>80 %</td>
<td>11.12</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Level:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-alarm</td>
<td>Normally open</td>
<td>11.15.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dry run</td>
<td>Normally open</td>
<td>11.15.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>System:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Language</td>
<td>German</td>
<td>11.11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calibration</td>
<td>OFF</td>
<td>11.11</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>SLOW-Mode:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Slow-Mode</td>
<td>OFF</td>
<td>11.15.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Speed</td>
<td>80 %</td>
<td>11.15.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Password:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PW01 mode</td>
<td>OFF</td>
<td>11.13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Password 01</td>
<td>9990</td>
<td>11.13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Password 02</td>
<td>9021</td>
<td>11.13</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Diaphragm rupture indication</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input signal</td>
<td>Normally open</td>
<td>11.15.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sensitivity</td>
<td>50%</td>
<td>11.15.3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Tab. 10 Parameter
11.5 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.

11.5.1 Screen “Operating messages”

Display of current mode

Flow indicator

Display of 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 11.15.1).

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. 11). 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. 11). The value input is described in Chapter 11.5.4.

<table>
<thead>
<tr>
<th>Operating messages</th>
<th>Operation mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current stroke frequency</td>
<td>Manual Analog Pulse Batch External</td>
</tr>
<tr>
<td>Current dosing performance</td>
<td></td>
</tr>
<tr>
<td>Total strokes</td>
<td></td>
</tr>
<tr>
<td>Total dosing quantity</td>
<td></td>
</tr>
<tr>
<td>Current control current</td>
<td></td>
</tr>
<tr>
<td>Pulse factor</td>
<td></td>
</tr>
<tr>
<td>Memory</td>
<td></td>
</tr>
<tr>
<td>Dosing quantity / strokes</td>
<td></td>
</tr>
<tr>
<td>Remaining dosing quantity / remaining strokes</td>
<td></td>
</tr>
<tr>
<td>Manual start</td>
<td></td>
</tr>
</tbody>
</table>

Tab. 11 Operating messages in dependence on the selected operation mode

11.5.2 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.
11.5.3 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 example). 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.

---HAUPTMENUE---
---PARAMETER---
(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 definite value or setting. The >OPERATION MODE< can, for example, be assigned the ANALOG setting (see example).

---BETRIEBSART---
ANALOG SIGNAL
4-20mA
(Example for the display of parameters)

11.5.4 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)

>OPERATION MODE<
MANUAL

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.

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.
11.5.5 Menu guide

- Operation Menu
  - Manual
  - Pulse
  - Analog
  - Batch
  - Extern

- Parameter
  - Pulse-Mode
    - 1:1 Division
    - Multiplication
    - preset value 0...999
  - Pulse Mode
    - preset value 0...999
  - Pulse Memory
    - OFF
    - ON
  - Analog Mode
    - Stroke Frequency
      - Auto
    - preset value [mA]
    - preset value [%]
  - Analog Signal
    - preset value [mA]
    - preset value [%]
  - Batch Control
    - Batch Start
      - preset value [h]
      - preset value [%]
    - Batch Quantity
      - preset value
  - Extern Mode
    - Stroke Frequency
      - preset value [%]

- Input 01
  - Function E1
    - Contact
      - Extern ON
      - Extern Stop
      - Batch Start
      - Analog 01/02
      - OFF
    - preset value
  - Contact E1
    - NC
    - NO

- Example: current stroke frequency (depending on chosen operation mode)
Controllable
Multi layer diaphragm pump
Series C 410.2 ML

Operating instructions
Controllable
Multi layer diaphragm pump
Series C 410.2 ML

Operating instructions
Controllable Multi layer diaphragm pump
Series C 410.2 ML

Operating instructions

Subject to technical modifications!

---

Totalizer
- Total Quantity
- Total Strokes
- Operation Hours

Calibration
- Calibration of dosing pump (11.10)

System
- Language:
  - German
  - English
  - Spanish
- Calibration:
  - ON
  - OFF
- Factory Reset:
  - YES
  - NO
- System Time:
  - preset value [h]

Password
- PW01-Modus:
  - OFF
  - ON
- Password 01:
  - preset value (9990*)
- Password 02:
  - preset value (9021*)

Info
- HW-Version
- SW-Version
11.6 Selecting the operation mode

You can select among five different operation modes:

- MANUAL
- PULSE
- ANALOG
- BATCH
- EXTERNAL

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 11.7.4).

11.7 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.

11.7.1 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 11.8.2). Input 02 (see Chapter 10.3.1) is factory preset to analog input (ANALOG 01).

Choose the ANALOG MODE

Two different analog modes can be chosen:

- Auto
- Stroke frequency

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

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

You can select among three different analog signals:

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

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. 45).

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.

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. 44).

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 45.

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

Fig. 45 (Exemplary adjustment of the analog signal)

CAUTION!

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. 46 (Connection of two analog signals with switch-over)
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 \((I_1, f_1)\)
Point 2 \((I_2, f_2)\)

The following diagram shows the procedure to determine the points.

Setting diagram:

1. Go to the ---PARAMETER--- menu and select the ANALOG MODE menu item using the ENTER key.
2. Use the DOWN key to skip the selection of the ANALOG SIGNAL.
3. Select the ---ADJUSTMENT--- submenu using the ENTER key.
4. Enter the value for current \(I_1\). To do so, proceed as described in Chapter 11.5.4.
5. Enter the value for stroke frequency \(f_1\) which is assigned to current \(I_1\). To do so, proceed as described in Chapter 11.5.4.
6. Enter the value for current \(I_2\). To do so, proceed as described in Chapter 11.5.4.
7. Enter the value for stroke frequency \(f_2\) which is assigned to current \(I_2\). To do so, proceed as described in Chapter 11.5.4.
8. The adjustment is then completed.

11.7.2 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 11.8). Input 01 (see Chapter 10.3.1) is factory preset to pulse input (ANALOG 01).

Selecting the PULSE MODE

You can select among three different pulse modes:

- 1/1
- DIVISION
- MULTIPLICATION

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

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.

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.

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.

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 11.5.4 (Assignment of values).
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.

11.7.3 Additional settings for the BATCH mode

Selecting the type of CONTROL

You can select among three different types of control:

- MANUAl
- TIMER
- PULSE INPUT

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

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.

CAUTION!

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

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 11.8).

Determining the BATCH QUANTITY

The type of entry for the batch quantity depends on the calibration (see Chapter 11.10):

- Entry in strokes if the pump is not calibrated
- Entry in liters if the pump is calibrated
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 11.5.4.

Determining the **BATCH START**

![Batch Start Input](image)

The pump 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 11.5.5.

**NOTE!**

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

---

### 11.7.4 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 11.8). Input 03 (see Chapter 10.3.1) is factory preset to External ON.

![External Operation Mode](image)

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 11.5.5.

---

### 11.8 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 fulfills the condition.

Exception: Pulse input with pulse memory. If the pulse memory is switched on, then the received pulses will be summed up.
Controllable Multi layer diaphragm pump
Series C 410.2 ML

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.

11.8.1 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 for externally starting the batch via the respective input.

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. 10.

Table 12 Analog input switchover

<table>
<thead>
<tr>
<th>Configuration</th>
<th>Applied signal</th>
<th>Selected analog input</th>
</tr>
</thead>
<tbody>
<tr>
<td>NC</td>
<td>High</td>
<td>Analog 01 (input 02)</td>
</tr>
<tr>
<td>NC</td>
<td>Low</td>
<td>Analog 02 (input 03)</td>
</tr>
<tr>
<td>NO</td>
<td>High</td>
<td>Analog 02 (input 03)</td>
</tr>
<tr>
<td>NO</td>
<td>Low</td>
<td>Analog 01 (input 02)</td>
</tr>
</tbody>
</table>

The respective input is not assigned a function.

11.8.2 Digital/analog inputs 02 and 03
Basically, input 02 and input 03 have the same functions as input 01 (see Chapter 11.8.1). 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.

Respective input is configured as analog input.

11.8.3 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 rupture
- Batch finished
- Internal error
- No flow
- OFF

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
6.3 % freq.
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.**
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 14.1):
- 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.

### 11.9 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 11.10). The display depends on the operation mode.

**MANUAL operation mode**

<table>
<thead>
<tr>
<th>MANUAL</th>
<th>7.2 l/h</th>
<th>MANUAL</th>
<th>10.34 l</th>
</tr>
</thead>
</table>

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 Fehler! Verweisquelle konnte nicht gefunden werden.), the stroke frequency indicator is replaced by the flow rate indicator. In addition, the total dosing quantity is indicated in litres.

**ANALOG operation mode**

<table>
<thead>
<tr>
<th>ANALOG</th>
<th>7.2 l/h</th>
<th>ANALOG</th>
<th>10.34 l</th>
</tr>
</thead>
</table>

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**

<table>
<thead>
<tr>
<th>BATCH Man.</th>
<th>10.34 l</th>
<th>BATCH Man.</th>
<th>10.34 l</th>
</tr>
</thead>
</table>

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

**PULSE operation mode**

<table>
<thead>
<tr>
<th>PULSE</th>
<th>10.34 l</th>
</tr>
</thead>
</table>

After calibration of the dosing pump, the total dosing quantity is also indicated in litres.
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 correspondingly 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
- Target value: 8l/h
- Measure in litres: 10l/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.

**CAUTION !**

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
- Actual value: 7.9l/h
- 81% stroke frequency

**CAUTION !**

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.

**11.10 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.

**CAUTION !**

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:**

**CAUTION !**

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 calibration will only activate the standard flow rate indicator.

**CAUTION !**

Pay attention to the safety data sheet relating to the dosing 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 11.11) will automatically be set to ON.

   CAUTION !
   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!

11.11 System

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

- Language
- Calibration
- Factory reset
- System time

>LANGUAGE<
You can select between GERMAN; ENGLISH and SPANISH menu texts.

>CALIBRATION<
The calibration of the pump (see Chapter 11.10) 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. 10, Chapter 11.4) can be restored. To do so, adjust YES.

>SYSTEM TIME<
The system time must be adjusted manually.

CAUTION !
If the supply voltage is switched off, then the system time will be reset to 0:00. This means it must be set again.
11.12 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.

11.13 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.

**CAUTION !**
The passwords are factory set as follows:
- Password 01: 9990 (deactivated)
- Password 02: 9021 (cannot be deactivated!)

Setting diagram:

```
>---MAINMENU---<
> PASSWORD <
> PW01-MODE<
> PASSWORD 01<
> PASSWORD 02<
```

- Go to the ---MAIN MENU--- and select the menu item PASSWORD. Pressing the ENTER key opens the setting menu for the PW01 mode.
- Press the DOWN key to access the setting for Password 01.
- Value entry for Password 01 is enabled after pressing the ENTER key.
- After having entered Password 01, press the DOWN key to access the setting for Password 02.
- Value entry for Password 02 is enabled after pressing the ENTER key.

**CAUTION !**
There is an automatic “Logout” after 5 min of inactivity in the “operation modes” screen. Afterwards, the password must be entered again.

**CAUTION !**
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.

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

11.15 Extras

11.15.1 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.
- 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 maximum possible capacity is reduced correspondingly.

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

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 11.9).

**CAUTION!**
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 11.10.

11.15.3 Diaphragm rupture detection

The diaphragm rupture detection (see also Chapter 8.2.8) 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.

**CAUTION!**
When leaving the factory, the contact type is preset to “switch normally closed”.
This setting must not be changed!

**>SENSITIVITY<
NOTE!
When leaving the factory, the sensitivity is preset to 70%.
This value must not be changed!
11.15.4 Level monitoring

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.

<table>
<thead>
<tr>
<th>Config.</th>
<th>Pre-alarm</th>
<th>Dry run</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>2</td>
<td>NO</td>
<td>NC</td>
</tr>
<tr>
<td>3</td>
<td>NC</td>
<td>NC</td>
</tr>
</tbody>
</table>

Tab. 13 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.
12 Maintenance

**CAUTION !**

Before starting maintenance work make sure that 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.

**CAUTION !**

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

Check the following conditions 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 9.1, table 06

Repair on the stroke mechanism may only be performed by sera.

12.1 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 multi-layer diaphragm pump.

We recommend to replace multi-layer 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 multi-layer diaphragm pump and replace the multi-layer diaphragm.

As an option, the multi-layer diaphragm pump can be equipped with a diaphragm rupture signalling device by manometer or pressure switch (see Chapter 12.4).

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

- Multi-layer diaphragm
- Suction valve
- Pressure valve

12.2 Spare parts

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

- Pump body
- Pressure switch
12.3 Spare- and wearing parts

C 410.2 – 70 ML
C 410.2 – 135 ML
C 410.2 – 500 ML
C 410.2 – 1200 ML

Fig. 50  Spare- and wearing parts
Controllable
Multi layer diaphragm pump
Series C 410.2 ML

Operating instructions

Overview of the spare- and wearing part kits

![Diagram of diaphragm rupture signalling by pressure switch]

**Fig. 51** Spare- and wearing parts

<table>
<thead>
<tr>
<th>Pump body-Set (plastic)</th>
<th>Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pos.</td>
<td>Designation</td>
</tr>
<tr>
<td>3</td>
<td>Protection cap(s)</td>
</tr>
<tr>
<td>4</td>
<td>Hexagon head cap screw(s)</td>
</tr>
<tr>
<td>5</td>
<td>Disk(s)</td>
</tr>
<tr>
<td>6</td>
<td>Vorlegeplatte</td>
</tr>
<tr>
<td>7</td>
<td>Pump body</td>
</tr>
<tr>
<td>10</td>
<td>Pressure valve (check valve)</td>
</tr>
<tr>
<td>18</td>
<td>Transition piece</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pump body-Set (stainless steel)</th>
<th>Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pos.</td>
<td>Designation</td>
</tr>
<tr>
<td>3</td>
<td>Protection cap(s)</td>
</tr>
<tr>
<td>4</td>
<td>Hexagon head cap screw(s)</td>
</tr>
<tr>
<td>5</td>
<td>Disk(s)</td>
</tr>
<tr>
<td>7</td>
<td>Pump body</td>
</tr>
<tr>
<td>11</td>
<td>Pressure valve (check valve)</td>
</tr>
<tr>
<td>12</td>
<td>O-Ring</td>
</tr>
<tr>
<td>13</td>
<td>Joint</td>
</tr>
<tr>
<td>14</td>
<td>O-Ring</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Suction valve (Set)</th>
<th>Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pos.</td>
<td>Designation</td>
</tr>
<tr>
<td>8</td>
<td>Suction valve (incl. O-rings)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pressure valve (Set)</th>
<th>Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pos.</td>
<td>Designation</td>
</tr>
<tr>
<td>9</td>
<td>Pressure valve (incl. O-rings)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Diaphragm set</th>
<th>Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pos.</td>
<td>Designation</td>
</tr>
<tr>
<td>1</td>
<td>Multi-layer diaphragm package</td>
</tr>
<tr>
<td>(1.1)</td>
<td>Pressure plate (front, medium contacted)</td>
</tr>
<tr>
<td>(1.2)</td>
<td>Set screw</td>
</tr>
<tr>
<td>(1.3)</td>
<td>Working diaphragm</td>
</tr>
<tr>
<td>(1.4)</td>
<td>Signal diaphragm</td>
</tr>
<tr>
<td>(1.5)</td>
<td>Protection diaphragm</td>
</tr>
<tr>
<td>(1.6)</td>
<td>Pressure plate (behind)</td>
</tr>
<tr>
<td>2</td>
<td>O-Ring</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pressure switch</th>
<th>Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pos.</td>
<td>Designation</td>
</tr>
<tr>
<td>17</td>
<td>Pressure switch</td>
</tr>
</tbody>
</table>

Table 14  Spare- and wearing parts
12.4 Changing the diaphragm

12.4.1 General

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

**CAUTION !**

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

**CAUTION !**

For replacing the diaphragm, the system must be depressurised!

- During maintenance or repair work, switch off the drive motor of the multi-layer diaphragm pump and secure it against inadvertently 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 multi-layer diaphragm pump until no residuals of the dosing medium can be detected 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 multi-layer diaphragm pump should be returned for repair.

12.4.2 Changing the diaphragm

The multi-layer diaphragm pump is to be replaced as complete unit.

- Set the stroke length adjustment to a stroke length of 0% (front position).

- Loosen fixing screws on the pump body

- Remove pump body and front plate (if installed) to the front.

- **CAUTION !**

  For replacing the diaphragm, the system must be depressurised!

- During maintenance or repair work, switch off the drive motor of the multi-layer 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 multi-layer diaphragm pump until no residues of the dosing medium can be detected 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 multi-layer diaphragm pump should be returned for repair.

- **CAUTION !**

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

- **CAUTION !**

  For replacing the diaphragm, the system must be depressurised!

- During maintenance or repair work, switch off the drive motor of the multi-layer 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 multi-layer diaphragm pump until no residues of the dosing medium can be detected 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 multi-layer diaphragm pump should be returned for repair.
Assemble the pump in reversed order

- Insert new O-ring
- Screw new multi-layer diaphragm in the connecting rod until stop. If the holes in the diaphragm are not flush with the threaded holes in the base ring, then the diaphragm must again be screwed out until it is flush with the threaded holes.
- Set the stroke length to 50% (stroke length adjustment)
- Move diaphragm in the middle position. The middle position should be equal to a stroke length of 50%; this can for example be achieved by turning the fan blade of the motor.

Connect the signalling devices

Before reactivating the pump after a diaphragm replacement, remove the air between the diaphragm layers.

- Screw out the signalling device
- Let run pump for a short moment (30 seconds) with delivery pressure applied (vent)
- Switch off the pump
- Screw in signalling device

Fasten the pump body (tightening torques are mentioned in Chapter 9.1, table 06)

When assembling the pump body, please note: suction valve below, pressure valve above!
12.5 Oil change

- Check oil level at regular intervals (oil sight glass).
- Perform an oil change once a year.
- Unscrew the vent screw.
- Prepare an appropriate container.
- Open screw plug and drain off oil.
- Anschließend Bohrung mit Verschlusschraube (auf Dichtring achten!) wieder verschließen.
- Öl in Gewindebohrung der Entlüftungsschraube einfüllen.
- Art und Menge des Getriebeöls siehe Kap. 12.1
- Entlüftungsschraube wieder eindrehen.

Fig. 57 Draining oil

Fig. 58 Filling gear oil

13 Lubricants in stroke mechanism

<table>
<thead>
<tr>
<th>Pump type</th>
<th>Lubricant</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>410.2 – 70 ML</td>
<td></td>
<td></td>
</tr>
<tr>
<td>410.2 – 135 ML</td>
<td>Gear oil SAE 90</td>
<td>1,25 litres</td>
</tr>
<tr>
<td>410.2 – 500 ML</td>
<td>DIN 51512</td>
<td></td>
</tr>
<tr>
<td>410.2 – 1200 ML</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Tab. 15 Lubricant in stroke mechanism

14 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 detected and rectified easily and quickly if the steps in Table 16-18 are carried out.
### 14.1 Analysis of the plain text error messages (electronics)

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

Tab. 16 Analyze and eliminate faults on the basis of the error messages – part I
## Controllable Multi layer diaphragm pump
Series C 410.2 ML

### Operating instructions

<table>
<thead>
<tr>
<th>Error message</th>
<th>Possible cause</th>
<th>Corrective action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drive diaphragm defective</td>
<td></td>
<td>Replace drive diaphragm</td>
</tr>
<tr>
<td>Electric data of the dosing pump do not match mains data</td>
<td></td>
<td>Check order data. Check electric installation.</td>
</tr>
<tr>
<td>Few or no conveying medium in store tank</td>
<td></td>
<td>Fill store tank</td>
</tr>
<tr>
<td>Only for calibrated pump: Set stroke length is too low to attain the preset set value</td>
<td></td>
<td>Check the stroke length and the set value, calibrate the pump again, if necessary.</td>
</tr>
<tr>
<td>Integrated excess temperature protection (posistor) of drive motor released</td>
<td></td>
<td>Let the temperature of the drive motor go down. Check the ambient temperature</td>
</tr>
<tr>
<td>No stroke movement of the drive diaphragm</td>
<td></td>
<td>Increase stroke frequency / stroke length; check connecting rod motion.</td>
</tr>
<tr>
<td>Shut-off valves in pipe closed</td>
<td></td>
<td>Open shut-off valves or check opening – check pump for damage</td>
</tr>
<tr>
<td>Mains voltage breakdown at operation mode „Batch-Timer“</td>
<td></td>
<td>Adjust system time</td>
</tr>
</tbody>
</table>

Tab. 17 Analyze and eliminate faults on the basis of the error messages – part II
# Operating instructions

## 14.2 Analysis of other faults

<table>
<thead>
<tr>
<th>Error message</th>
<th>Possible cause</th>
<th>Fault clearance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diaphragm pump does not deliver</td>
<td>Suction height too high</td>
<td>Reduce suction height or suction resistance</td>
</tr>
<tr>
<td>Delivery rate is not reached</td>
<td>Suction line leaky</td>
<td>Check gaskets, tighten pipe connections</td>
</tr>
<tr>
<td>Delivery rate fluctuates</td>
<td>Shut-off valves in pipe closed</td>
<td>Open shut-off valves or check opening – check pump for damage</td>
</tr>
<tr>
<td>Drive motor does not start</td>
<td>No conveying medium in store tank</td>
<td>Fill store tank</td>
</tr>
<tr>
<td>Drive is overloaded</td>
<td>Pump valves leaky</td>
<td>Remove valves and clean</td>
</tr>
<tr>
<td>High noise developed</td>
<td>Pump valves (ball seats) damaged</td>
<td>Remove and clean valves, check function: replace valves if necessary</td>
</tr>
<tr>
<td>Damage in stroke mechanism / drive</td>
<td>Pump valves incorrectly mounted or valve balls missing</td>
<td>Check installation position and completeness – replace missing parts or install correctly</td>
</tr>
<tr>
<td>Leakage on pump head</td>
<td>Filter in suction line clogged</td>
<td>Clean filter</td>
</tr>
<tr>
<td></td>
<td>Electric data of the electronics do not match mains data</td>
<td>Check order data. Check electric installation.</td>
</tr>
<tr>
<td></td>
<td>Counter-pressure too high</td>
<td>Measure pressure with manometer directly above pressure valve and compare with permissible counter-pressure</td>
</tr>
<tr>
<td></td>
<td>Foreign matter in pump valves</td>
<td>Remove and clean valves</td>
</tr>
<tr>
<td></td>
<td>Pressure on suction side higher than at the end of the pressure line</td>
<td>Check geodetic conditions, install float valve or pressure keeping valve if necessary</td>
</tr>
<tr>
<td></td>
<td>Acceleration height too high due to pipe geometry</td>
<td>Check acceleration height on suction- and pressure side with manometer and compare with design data – install a pulsation damper if necessary</td>
</tr>
<tr>
<td></td>
<td>Material which is in contact with the medium not suitable for the pumped medium</td>
<td>Check whether the pumped medium corresponds with the design data and select other materials if necessary</td>
</tr>
<tr>
<td></td>
<td>Too high viscosity of the pumped medium</td>
<td>Check viscosity of the pumped medium and compare with the design data – reduce concentration or increase temperature if necessary</td>
</tr>
<tr>
<td></td>
<td>Pumped medium outgasses in suction line</td>
<td>Check geodetic conditions and compare with the data of the pumped medium. Operate pump with suction side supply, reduce temperature of the pumped medium.</td>
</tr>
<tr>
<td></td>
<td>Air in suction line while pressure applied to the pressure valve ball</td>
<td>Vent pressure side</td>
</tr>
<tr>
<td></td>
<td>Pipe connections leaky</td>
<td>Tighten connection according to type of material. Be careful with plastic – risk of fracture</td>
</tr>
<tr>
<td></td>
<td>Temperature too low</td>
<td>Check flowability of the pumped medium. Temperature of pumped medium and ambient temperature must not fall below -10°C</td>
</tr>
<tr>
<td></td>
<td>Pumped medium frozen in pipe</td>
<td>Remove diaphragm pump and check for damage – increase temperature of the pumped medium</td>
</tr>
<tr>
<td></td>
<td>Diaphragm rupture</td>
<td>Replace diaphragm according to Chapter 12.4.</td>
</tr>
<tr>
<td></td>
<td>Air between diaphragms</td>
<td>remove the air between the diaphragm layers</td>
</tr>
</tbody>
</table>

Tab. 18 Fault analysis and corrective action
15 Foreseeable misuse

The following misuse is assigned to the life cycles of the machine.

**CAUTION!**
Misuse can result in danger to the operating personnel!

15.1 Transport

- Tipping behavior during transport, loading and unloading ignored.
- Weight for lifting underestimated.

15.2 Assembly and installation

- Power supply not fuse protected (no fuse/fuse too large, power supply not conforming to standards).
- No or improper fastening material of the pump.
- Improper connection of the pressure pipes, wrong material i.e. PTFE tape and unsuitable connection pieces.
- Liquid pipes confused.
- Threads overturned/damaged.
- Pipes bent during connection in order to compensate for alignment errors.
- Supply voltage connected without earthed conductor.
- Socket for safe disconnection of the power supply difficult to reach.
- Mains plug cut off (direct connection), safe disconnection impossible. Safe disconnection e.g. by 2-pin main switch.
- Wrong connecting cables for supply voltage (cross-section too small, wrong insulation).
- Parts damaged (e.g. vent valve, flow meter broken off).
- Wrongly dimensioned pressure and suction pipe.
- Incorrect dimensioned and improperly fastened pump panel (panel broken off).
- Short circuit of the internal power supply (15V DC) at the control cable during installation.
- Admissible current load of the digital outputs exceeded. No sera sensors for flow or filling level → damage to the electronics.
- No diode for external control power supply connection → electronics overloaded/destroyed.
- Electronics opened in order to connect the mains cable directly to the power supply → electric shock or damage to the electronics.
- Connection of wrong supply voltage or mains frequency destroyed.

15.3 Start-up

- Cover on vent openings (e.g. motor).
- Suction or pressure pipes closed (i.e. foreign matters, particle size, stop valves).
- Sensor cable damaged (electronics ←→ stroke mechanism), wrong or no recognition of the stroke length → wrong dosing volume and resulting process error.
- Start-up with damaged system.
- Wrong parameterization of the pump → inadvertent start. Distance between dosing pump and other dosing pumps or electrical consumers insufficient → fault by electromagnetic radiation.
- Control cables too long > 30m → malfunctions due to EMC. Control cable and power cable laid in parallel → malfunctions due to EMC.

15.4 Operation

- Fault message ignored → faulty dosing / process error.
- Pipes hit, pulsation damper not used → damage to the pipes, medium is leaking.
- Pumped medium contains particles or is contaminated.
- External fuse bridged → no cut off in case of an error.
- Ground wire removed → no cut off by fuse in case of an error, supply voltage directly at the housing.
- Insufficient lighting of the working place.
- Suction height too high, pump capacity too low → process error.

15.5 Maintenance/Repair

- Works carried out which are not described in the operating instructions (works on the stroke mechanism and the built-in pump, electronics opened).
- Prescribed maintenance schedules ignored.
- Use of wrong spare parts/oils (e.g. no sera original spare parts, wrong viscosity).
- Improper mounting of spare and wearing parts (e.g. wrong tightening torque for pump body).
- Oil level not checked.
- Use of cables with damaged insulation.
- No shut down / no protection against a restart before maintenance work.
- Pumped medium or utilities during an oil change insufficiently removed.
- Restart without sufficient fastening.
- Valves confused.
- Sensor pipes confused.
- Pipes not connected (e.g. suction- and pressure pipes, gas pipes).
- Gaskets damaged, medium is leaking.
- Gaskets not fitted, medium is leaking.
- Wearing of unsuitable protective clothing / no protective clothing at all.
- Operation of an uncleaned system.
- Pumped medium contaminated with oil.
- Poorly ventilated room.
Operating instructions

15.6 Cleaning
- Wrong rinsing medium (material changed, reaction with the medium).
- Wrong cleaning agent (material changed, reaction with the medium).
- Cleaning agent remains in the system (material changed, reaction with the medium).
- Protective clothing insufficient or missing.
- Use of unsuitable cleaning utensils (material changed, mechanical damage by high pressure cleaner).
- Untrained personnel.
- Vent openings clogged.
- Parts torn off.
- Sensors damaged.
- Non-observance of the safety data sheet.
- Control elements actuated.
- Poorly ventilated room.

15.7 Shut-down
- Pumped medium not completely removed.
- Disassembly of pipes with the pump running/with residual pressure.
- Disconnection of the electrical connections in a wrong sequence (ground wire first).
- Disconnection from the power supply not ensured → danger through electricity.
- Poorly ventilated room.

15.8 Disassembly
- Residues of the pumped medium and utilities in the system.
- Use of wrong disassembly tools.
- Wrong or no protective clothing at all.
- Poorly ventilated room.

15.9 Disposal
- Improper disposal of the pumped medium, utilities and materials.
- No marking of hazardous media.
- Wrong disposal of the electronics.

16 Shut-down
Switch the multi-layer 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.

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

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

17.2 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!
Controllable
Multi layer diaphragm pump
Series C 410.2 ML
Diaphragm rupture monitoring:
- Pressure switch (Type 0186)

Operating instructions

Diaphragm-/Piston Pressure Switch
Series 0180 / 0181
Series 0186 / 0187
Installation and commissioning must be carried out in accordance with these operating instructions and by authorized, qualified personnel only.

The series 0180 / 0181 and 0186 / 0187 switch opens or closes an electrical circuit when a certain (adjustable) pressure is reached. A diaphragm or piston is moved by the increase in pressure. The amount of the diaphragm deflection or piston travel depends on the force of the pressure applied and the (adjustable) spring tension. At a predetermined deflection of the diaphragm or movement of the piston, a micro switch is actuated which opens or closes the electrical contacts (changeover).

The pressure switch monitors a preset pressure.

Conditions governing the use of the product

The following general instructions are to be observed at all times to ensure the correct, safe use of the pressure switch:
- Do not exceed the specified limits for e.g. pressures, forces, moments or temperatures under any circumstances.
- Give due consideration to the prevailing ambient conditions (temperatures, atmospheric humidity, atmospheric pressure, etc.).
- Observe the applicable safety regulations laid down by the regulatory bodies in the country of use.
- Observe without fail the warning notices and other instructions laid down in the operating instructions.
- Never subject pressure switch to intense blows or high vibrations.
- Never expose the pressure switch to severe side impacts or vibrations.
- Use the product only in its original condition. Do not carry out any unauthorized modifications.
- Remove all items providing protection in transit such as foils, caps or cartons.
- Disposal of the above-named materials in recycling containers is permitted.
Controllable Multi layer diaphragm pump
Series C 410.2 ML

Operating instructions

- Pressure switch (Type 0186)

Betriebsbedingungen

Bei Medientemperaturen außerhalb der Raumtemperatur (20°C):

Extreme Temperaturniedrigungen (abweichend von der Raumtemperatur) können zu einer starken Schaltpunktteilhun- dung oder zum Ausfall des Druckschalters führen.

Sachwerte: MPS

Die Typenprüfung ist nicht uneingeschränkt auf alle Umweltbedingungen übertragbar.

Die Überprüfung, ob die Steckverbindung anderen als den angegebenen Bestimmungen und Vorschriften entspricht, sollte, ob diese in speziellen, von uns nicht vorhergesehenen Anwendungen eingesetzt werden kann, obligatorisch dem Anwender überlassen werden.

Pumpeneinsatz:

Membrandruckschalter: Der Einsatz von Sauerstoff und die einschlägigen Umsetzungsvorschriften zu beachten. Außerdem empfehlen wir einen maximalen Betriebsdruck von 10 bar nicht zu über- schreiten.

Kolben- und Ventilschalter: Kolben- und Ventilschalter sind für gasförmige Medien, insbesondere für Sauerstoff nicht geeignet.

Überdruck sicherheit:

In den technischen Daten ist die statische Überdruck sicherheit angegeben. Sie bezieht sich auf den hydraulischen bzw. pneumatischen Teil des Druckschalters. Der dynamische Wert ist 30 bis 50 % niedriger.

Operating conditions

Media temperatures other than room temperature (20°C):

The effects of extreme temperatures (relative to the room temperature) can lead to pronounced variations in the switching point or failure of the pressure switch.

Type of protection IP55.

Type testing does not apply to all ambient conditions without limitations. The user is responsible for verifying that the plug-and-socket connection complies with the specific rules and regulations of CE, or whether it may be used for specialized purposes other than those intended by us.

Use with oxygen.

Diaphragm pressure switch:

If oxygen is used, the applicable accident prevention regulations must be observed. In addition, we recommend a maximum operating pressure of 10 bar, which should not be exceeded.

Piston pressure switch:

Piston pressure switches are not suitable for gaseous media, particularly oxygen.

Protection against overpressure:

The static overpressure safety is included in the technical data. The overpressure safety corresponds to the hydraulic, pneumatic part of the pressure switch. The dynamic rating of the overpressure safety is smaller than 30 to 50%.

Technische Daten

<table>
<thead>
<tr>
<th>Benennungsspannung Ue</th>
<th>Benennungsstrom Ie</th>
<th>Gebrauchs-kategorie</th>
</tr>
</thead>
<tbody>
<tr>
<td>250 Volt AC 50/60 Hz</td>
<td>4 Ampere</td>
<td>AC12</td>
</tr>
<tr>
<td>250 Volt AC 50/60 Hz</td>
<td>1 Ampere</td>
<td>AC14</td>
</tr>
<tr>
<td>90 Volt DC</td>
<td>4 / 2 Ampere</td>
<td>DC12 / DC13</td>
</tr>
<tr>
<td>80 Volt DC</td>
<td>2 / 1 Ampere</td>
<td>DC12 / DC13</td>
</tr>
<tr>
<td>75 Volt DC</td>
<td>1 / 0,5 Ampere</td>
<td>DC12 / DC13</td>
</tr>
<tr>
<td>125 Volt DC</td>
<td>0,3 / 0,2 Ampere</td>
<td>DC12 / DC13</td>
</tr>
<tr>
<td>250 Volt DC</td>
<td>0,25 / 0,2 Ampere</td>
<td>DC12 / DC13</td>
</tr>
</tbody>
</table>

| Benennungsspannung Ue         | 300 Volt                  |
| Benennungsstromspannungfestigkeit Ue, | 2,6 kV                   |
| konventioneller thermischer Strom Ith, | 6 Ampere                 |
| Schaltspannung, | + 2,5 kV                   |
| Benennungsfrequenz, | DC und 50 / 60 Hz         |
| Betriebstemperatur, | bis 5 Ampere              |
| Bedingter Kurzschlussstrom, | < 360 Ampere              |
| IP-Schutzart nach EN 60 529-1991: | IP65 mit Stecker          |
| Anzugsmoment der Anschlussnuten, | < 0,35 Nm                 |
| Anschlussquerschnitt, | 0,6 bis 1,6 mm²           |
| Schaltdichte, | < 200 mm²                  |
| Schaltzyklen, | 10-50 im Werk, | erstellbar |

Mechanische Lebensdauer:

Membranausführung:

1/10 Schaltpiele (bei Schaltdrücken bis 40 bar)

Kolbenausführung:

1/10 Schaltpiele

Gehäusewerkstoff:

verzinnter Stahl (Fe02Ni12Co)

Temperaturbereich:

NBR: -30°C bis +100°C

EPDM: -30°C bis +120°C

PMI: -30°C bis +120°C

Überdruck sicherheit:

Membranraumdruckschalter:

100 bar (0,5 bis 1,6 bar, 1 bis 10 bar m. Endnummer 040, 041, 042, 043, 044, 045, 046 und rastlohe Druckanschluss)

Kolbenraumdruckschalter:

600 bar

Technische Daten

<table>
<thead>
<tr>
<th>Rated operating voltage Ue</th>
<th>Rated operating current Ie</th>
<th>Utilization category</th>
</tr>
</thead>
<tbody>
<tr>
<td>250 Volt AC 50/60 Hz</td>
<td>4 Ampere</td>
<td>AC12</td>
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<td>250 Volt AC 50/60 Hz</td>
<td>1 Ampere</td>
<td>AC14</td>
</tr>
<tr>
<td>90 Volt DC</td>
<td>4 / 4 Ampere</td>
<td>DC12 / DC13</td>
</tr>
<tr>
<td>80 Volt DC</td>
<td>2 / 1 Ampere</td>
<td>DC12 / DC13</td>
</tr>
<tr>
<td>75 Volt DC</td>
<td>1 / 0,5 Ampere</td>
<td>DC12 / DC13</td>
</tr>
<tr>
<td>125 Volt DC</td>
<td>0,3 / 0,2 Ampere</td>
<td>DC12 / DC13</td>
</tr>
<tr>
<td>250 Volt DC</td>
<td>0,25 / 0,2 Ampere</td>
<td>DC12 / DC13</td>
</tr>
</tbody>
</table>

| Rated insulation voltage Ul | 500 volts |
| Rated surge capacity U, | 2,6 kV |
| Rated thermal current Ith, | 6 Amps |
| Switching over voltage, | < 2,5 kV |
| Rated frequency, | DC und 50 / 60 Hz |
| Rated current of short-circuit protective device, | Up to 5 Amps |
| Rated short-circuit current, | < 350 Amps |
| IP protection to EN 60 529-1991, | IP65 with plug |
| Tightening torque for terminal screws, | < 0,35 Nm |
| Connection size, | 0,6 bis 1,6 mm² |
| Operating frequency, | > 200 per min |
| Switching hysteresis, | 10-50% adjustible by the factory |

Mechanical life:

Diaphragm type:

1/10 operation cycles

(at trip pressure up to 40 bars)

Piston type:

1/10 operation cycles

Material:

Zinc plated steel (Fe02Ni12Co)

Temperature range:

NBR: -30°C bis +100°C

EPDM: -30°C bis +120°C

PMI: -30°C bis +120°C

Pressure safety:

Diaphragm pressure switch:

100 bars (0,5 bis 1,6 bar, 1 bis 10 bar m. Endnumber 040, 041, 042, 043, 044, 045, 046 and rastlohe Druckanschluss)

Piston pressure switch:

600 bars

Bedienungsanleitung_0180-0181
Controllable Multi layer diaphragm pump
Series C 410.2 ML
Operating instructions

Diaphragm ruptur monitoring:
- Pressure switch (Type 0186)

Bedienteile und Anschlüsse

Operating controls and connections

Einbau

Mechanisch, pneumatisch, hydraulisch:
Drehen Sie den Druckschalter an dem sechskantförmigen Ansatz mit einem Maußschlüssel der Schlüsselweite 27 (nach DIN 984 o. ä.) in den vorgesehenen Druckanschluss (Anzugsmoment siehe nachfolgende Tabelle).


Anschlussgewinde | Drehmoment
--- | ---
M10x1kg und NPT1" | Einschrauben bis System abgedichtet ist
M10x1.25 | 35 Nm
Rasthöhe | 50 Nm

Elektrisch:
Verkabeln Sie den Druckschalter gemäß dem Schaltbild (Bild 2).

Verwenden Sie die Gerätesteckdose 1-1-80-652-002 (nicht im Lieferumfang enthalten).

Installation

Mechanical / pneumatic / hydraulic:
With a size 27 open-ended wrench (to DIN 894 or similar), install the pressure switch, by means of the hexagon connector, in the corresponding pressure socket (tightening torque G1/4"; 50 Nm).

For sealing the system use a standard copper gasket of the appropriate dimensions.

Connecting thread | Torque
--- | ---
M10x1kg and NPT1" | Tighten until system is hermetically sealed
M10x1 straight | 35 Nm
Others | 50 Nm

Elektrisch:
Connect up the pressure switch in accordance with the circuit diagram (Fig. 2).

Use a connector type 1-1-80-652-002 (not included in the delivery specification).
Controllable Multi layer diaphragm pump Series C 410.2 ML

Operating instructions

- Pressure switch (Type 0186)

---

**Inbetriebnahme**

1. Verbinden Sie die elektrischen Anschlüsse 1 und 4 mit einem Durchgangsprüfer (Bild 2).
   - Bei Verwendung einer Prüfleit als Durchgangsprüfer. Achten Sie auf die max. zulässige Schaltleistung (siehe technische Daten).
2. Drehen Sie die Einstellschraube (3) zunächst ganz ein. Verwenden Sie zum Einstellen des Druckschalters einen Schraubendreher mit 6,3 mm Klingenbreite.
   - Beachten Sie bitte, dass die Einstellschraube (3) nur beim Eindrehen einen Anschlag besteht.
4. Drehen Sie die Einstellschraube (3) so weit heraus, bis der Druckschalter umschaltet (Durchgangsprüfer reagiert).
5. Koppeln Sie gegebenenfalls den Schalldruck durch Verdrehen der Einstellschraube (3).

Beim Inbetriebnahme des Druckschalters beachten Sie bitte die entsprechenden Sicherheitsvorschriften der Berufsgenossenschaften oder die entsprechenden nationalen Bestimmungen.

Die Einstellung der Hysteres ist nur werkstatt durchführbar. Bei unsachgemäßer Vorgehensweise kann der Druckschalter beschädigt werden.

**Ausbau**

Beachten Sie folgende wichtige Punkte beim Ausbau des Druckschalters:

- Das Drucksystem, aus dem der Druckschalter ausgebaut werden soll, muss sich in drucksichem Zustand befinden.
- Es müssen alle relevanten Sicherheitsbestimmungen beachtet werden.
- Drehen Sie den Druckschalter mit einem Maulschlüssel der Schlüsselweite 27 (nach DIN 894 o.ä.) aus dem Druckschluss.

---

**Entry into service**

1. Using a continuity tester, wire up the electrical connections 1 and 4 (Fig. 2).
   - If using a testing lamp as a continuity tester, observe the maximum permissible switching capacity (see technical data).
2. First, screw in the adjustment screw (3) as far as it will go. To adjust the pressure switch, use a screwdriver with a 6.3 mm wide blade.
   - Take care to ensure that the adjusting screw (3) dose not seize at any point other than when it is fully tightened down.
3. Adjust the pressure switch to the desired actuating pressure (a test pressure gauge is required).
4. Ease off the adjusting screw (3) to a sufficient extent to cause the pressure switch to trip (continuity tester reacts).
5. If necessary, adjust the trip pressure setting by turning the adjusting screw (3).

---

**Removing the pressure switch**

When removing the pressure switch, observe the following important instructions:

- The pressurized system from which the pressure switch is intended to be removed must be entirely of pressure.
- All the relevant safety regulations must be observed.
- Use a size 27 open-ended wrench (to DIN 894 or similar), to remove the pressure switch.

---

**Zeichenerklärung**

<table>
<thead>
<tr>
<th>Symbole</th>
<th>Bedeutung</th>
</tr>
</thead>
<tbody>
<tr>
<td>!</td>
<td>Achtung</td>
</tr>
<tr>
<td>*</td>
<td>Hinweis, Bemerkung</td>
</tr>
<tr>
<td>🌿</td>
<td>Recycling</td>
</tr>
<tr>
<td>🚫</td>
<td>Gefahr</td>
</tr>
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Operating instructions

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