Operating instructions
Diaphragm Motor-driven Metering Pump
Sigma X Control type — Sigma/ 2 - S2Cb

Please carefully read these operating instructions before use. Do not discard.
The operator shall be liable for any damage caused by installation or operating errors.
The latest version of the operating instructions are available on our homepage.
Supplementary information

Read the following supplementary information in its entirety! Should you already know this information, you will benefit more from referring to the operating instructions.

The following are highlighted separately in the document:

- Enumerated lists

Handling instructions

⇒ Outcome of the operation guidelines

- see (reference)

Information

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

Safety notes

Safety notes are identified by pictograms - see Safety Chapter.

Validity

At the time of going to press, these operating instructions conformed to the current EU regulations.

State the identity code and serial number

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

1. **Identity code** ................................................................. 5
2. **Safety Chapter** ............................................................ 8
3. **Storage, Transport and Unpacking** ................................. 12
4. **Overview of equipment and control elements** .................. 13
   4.1 Control elements.......................................................... 15
   4.2 Key functions.............................................................. 17
5. **Functional description** .................................................. 18
   5.1 Pump........................................................................... 18
   5.2 Liquid end..................................................................... 19
   5.3 Bleed valve and integrated relief valve .............................. 19
   5.4 Multi-layer safety diaphragm.......................................... 20
   5.5 Operating modes.......................................................... 20
   5.6 Functions...................................................................... 21
   5.7 Options......................................................................... 22
   5.8 Function and fault indicator.......................................... 22
   5.8.1 LCD screen............................................................... 23
   5.8.2 LED displays............................................................. 23
   5.9 Hierarchy of operating modes, functions and fault statuses... 23
6. **Assembly** ........................................................................ 25
7. **Installation** ..................................................................... 27
   7.1 Installation, hydraulic.................................................... 27
   7.1.1 Basic installation notes.............................................. 31
   7.2 Installation, electrical.................................................... 32
   7.2.1 Control connectors................................................... 33
   7.2.2 HMI operating unit.................................................... 40
   7.2.3 Pump, power supply.................................................. 41
   7.2.4 Other units............................................................... 42
8. **Basic set-up principles** ................................................. 43
   8.1 Basic principles for setting up the control.......................... 43
   8.2 Checking adjustable variables......................................... 45
   8.3 Changing to Setting mode............................................. 45
9. **Set up / ‘Menu’** ............................................................... 46
   9.1 ‘Information’.................................................................. 46
   9.2 ‘Operating mode’.......................................................... 46
   9.3 ‘Settings’....................................................................... 46
   9.3.1 ‘Operating mode’...................................................... 47
   9.3.2 ‘Metering’................................................................. 51
   9.3.3 ‘Calibration’............................................................. 53
   9.3.4 ‘Inputs/outputs’........................................................ 54
   9.3.5 ‘System’.................................................................... 56
   9.3.6 ‘Set time’................................................................. 57
   9.3.7 ‘Date’......................................................................... 57
   9.4 ‘Timer’.......................................................................... 57
   9.4.1 Timer ‘activation’....................................................... 57
   9.4.2 ‘Setting the timer’....................................................... 58
   9.4.3 ‘Clear all’................................................................. 59
   9.4.4 Example.................................................................... 60
   9.5 ‘Service’.................................................................... 60
   9.5.1 ‘Password’................................................................. 60
   9.5.2 ‘Clear counter’........................................................... 60
   9.5.3 ‘Log book’.................................................................. 61
<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.5.4</td>
<td>61</td>
</tr>
<tr>
<td>9.5.5</td>
<td>61</td>
</tr>
<tr>
<td>9.5.6</td>
<td>61</td>
</tr>
<tr>
<td>9.5.7</td>
<td>62</td>
</tr>
<tr>
<td>9.6</td>
<td>62</td>
</tr>
<tr>
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<td>14.5.2</td>
<td>82</td>
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<td>14.5.3</td>
<td>83</td>
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<td>15</td>
<td>84</td>
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<td>16</td>
<td>87</td>
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<td>16.1</td>
<td>87</td>
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<td>16.2</td>
<td>88</td>
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<td>16.3</td>
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<td>16.5.1</td>
<td>88</td>
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<td>16.5.2</td>
<td>89</td>
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<td>16.5.3</td>
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<td>16.5.4</td>
<td>89</td>
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<td>16.6</td>
<td>89</td>
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<td>16.7</td>
<td>90</td>
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<td>16.8</td>
<td>90</td>
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<td>16.9</td>
<td>91</td>
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<td>16.10</td>
<td>91</td>
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<td>16.11</td>
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<td>92</td>
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<td>18</td>
<td>94</td>
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<td>19</td>
<td>95</td>
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<tr>
<td>20</td>
<td>101</td>
</tr>
<tr>
<td>20.1</td>
<td>101</td>
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<tr>
<td>20.2</td>
<td>101</td>
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<tr>
<td>21</td>
<td>103</td>
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<tr>
<td>22</td>
<td>104</td>
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<tr>
<td>23</td>
<td>105</td>
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<tr>
<td>24</td>
<td>106</td>
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<td>25</td>
<td>110</td>
</tr>
<tr>
<td>26</td>
<td>112</td>
</tr>
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</table>
1 Identity code

Sigma X Control type – Sigma/2 - S2Cb

Product range

<table>
<thead>
<tr>
<th>S2Cb</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Power end type</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>H Main power end, diaphragm</td>
<td></td>
</tr>
</tbody>
</table>

Performance data at maximum back pressure and type: refer to nameplate on the pump housing

<table>
<thead>
<tr>
<th>Dosing head material</th>
</tr>
</thead>
<tbody>
<tr>
<td>PV PVDF</td>
</tr>
<tr>
<td>PC PVC</td>
</tr>
<tr>
<td>SS Stainless steel</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Seal material</th>
</tr>
</thead>
<tbody>
<tr>
<td>T PTFE</td>
</tr>
<tr>
<td>F Physiological safety with regard to wetted materials</td>
</tr>
<tr>
<td>FDA No. 21 CFR §177.1550 (PTFE)</td>
</tr>
<tr>
<td>FDA No. 21 CFR §177.2510 (PVDF)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Displacement body</th>
</tr>
</thead>
<tbody>
<tr>
<td>S Multi-layer safety diaphragm with optical rupture indicator</td>
</tr>
<tr>
<td>A Multi-layer safety diaphragm with rupture signalling by electrical signal</td>
</tr>
<tr>
<td>H Diaphragm for hygienic pump head</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dosing head design</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 without bleed valve, without valve springs</td>
</tr>
<tr>
<td>1 without bleed valve, with valve springs</td>
</tr>
<tr>
<td>2 with bleed valve, without valve springs</td>
</tr>
<tr>
<td>3 with bleed valve, with valve springs</td>
</tr>
<tr>
<td>4 with relief valve, FPM, without valve springs***</td>
</tr>
<tr>
<td>5 with relief valve, FPM, with valve springs***</td>
</tr>
<tr>
<td>6 with relief valve, EPDM, without valve springs***</td>
</tr>
<tr>
<td>7 with relief valve, EPDM, with valve springs***</td>
</tr>
<tr>
<td>8 with bleed valve, EPDM, without valve springs***</td>
</tr>
<tr>
<td>9 with bleed valve, EPDM, with valve springs***</td>
</tr>
<tr>
<td>H Hygienic pump head with tri-clamp connectors (max. 10 bar)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hydraulic connector</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 Standard threaded connector (in line with technical data)</td>
</tr>
<tr>
<td>1 Union nut and PVC insert</td>
</tr>
<tr>
<td>2 Union nut and PP insert</td>
</tr>
<tr>
<td>3 Union nut and PVDF insert</td>
</tr>
<tr>
<td>4 Union nut and SS insert</td>
</tr>
<tr>
<td>7 Union nut and PVDF hose nozzle</td>
</tr>
<tr>
<td>8 Union nut and SS hose nozzle</td>
</tr>
</tbody>
</table>
### Sigma X Control type – Sigma/ 2 - S2Cb

<table>
<thead>
<tr>
<th>Column</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>Union nut and SS welding sleeve</td>
</tr>
</tbody>
</table>

#### Design

<table>
<thead>
<tr>
<th>0</th>
<th>With ProMinent® logo</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Without ProMinent® logo</td>
</tr>
</tbody>
</table>

#### Leak-tightness according to NEMA 4x

#### Electric power supply

| U | 1-phase, 100-230 V ± 10%, 50/60 Hz |

#### Cable and plug

<table>
<thead>
<tr>
<th>A</th>
<th>2 m European</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>2 m Swiss</td>
</tr>
<tr>
<td>C</td>
<td>2 m Australian</td>
</tr>
<tr>
<td>D</td>
<td>2 m USA</td>
</tr>
</tbody>
</table>

#### Relay

<table>
<thead>
<tr>
<th>0</th>
<th>no relay</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Fault indicating relay (230 V - 8 A)</td>
</tr>
<tr>
<td>3</td>
<td>Fault indicating relay + pacing relay (24 V - 100 mA)</td>
</tr>
<tr>
<td>8</td>
<td>0/4-20 mA analogue output + fault indicating / pacing relay (24 V - 100 mA)</td>
</tr>
</tbody>
</table>

#### Control version

<table>
<thead>
<tr>
<th>0</th>
<th>Manual + External contact with PulseControl + Timer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Manual + External contact with PulseControl + Analogue</td>
</tr>
<tr>
<td>2</td>
<td>Manual + External contact with PulseControl + Analogue + Metering profiles</td>
</tr>
<tr>
<td>5</td>
<td>as 1 + timer</td>
</tr>
<tr>
<td>6</td>
<td>as 1 + PROFIBUS® DP interface (M12 plug)</td>
</tr>
<tr>
<td>7</td>
<td>as 1 + CANopen (M12 plug) **</td>
</tr>
</tbody>
</table>

#### Overload shut-down

<table>
<thead>
<tr>
<th>0</th>
<th>without overload shut-down</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>with overload shut-down</td>
</tr>
</tbody>
</table>

#### Operating unit (HMI)

<table>
<thead>
<tr>
<th>0</th>
<th>HMI (0.5 m cable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>HMI + 2 m cable</td>
</tr>
<tr>
<td>5</td>
<td>HMI + 5 m cable</td>
</tr>
<tr>
<td>6</td>
<td>HMI + 10 m cable</td>
</tr>
<tr>
<td>X</td>
<td>without HMI</td>
</tr>
</tbody>
</table>

#### Safety options

| 0 | without access control, dynamic metering monitor |

---

*Identity code*
| Sigma X Control type – Sigma/ 2 - S2Cb | 1 | with access control, dynamic metering monitor |
| | B | HMI with Bluetooth |
| | W | HMI with Wi-Fi |
| **Language** | **EN** | German |
| | **EN** | English |
| | **ES** | Spanish |
| | **FR** | French |
| | **IT** | Italian |
| | ... | ...

FPM = fluorine rubber

** Pump without HMI control unit
2 Safety Chapter

Identification of safety notes

The following signal words are used in these operating instructions to denote different severities of danger:

<table>
<thead>
<tr>
<th>Signal word</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>WARNING</td>
<td>Denotes a possibly dangerous situation. If this is disregarded, you are in a life-threatening situation and this can result in serious injuries.</td>
</tr>
<tr>
<td>CAUTION</td>
<td>Denotes a possibly dangerous situation. If this is disregarded, it could result in slight or minor injuries or material damage.</td>
</tr>
</tbody>
</table>

Warning signs denoting different types of danger

The following warning signs are used in these operating instructions to denote different types of danger:

<table>
<thead>
<tr>
<th>Warning signs</th>
<th>Type of danger</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Warning sign" /></td>
<td>Warning – high-voltage.</td>
</tr>
<tr>
<td><img src="image" alt="Warning sign" /></td>
<td>Warning – danger zone.</td>
</tr>
</tbody>
</table>

Intended use

- Only use the pump to meter liquid feed chemicals.
- Only use the pump after it has been correctly installed and started up in accordance with the technical data and specifications contained in the operating instructions.
- Only pumps with the identity code option "Multi-layer safety diaphragm with rupture signalling by electrical signal" are approved for use with flammable feed chemicals, at back pressures of over 2 bar, software setting 'Diaphragm rupture' - 'Error' and if the operator takes appropriate safety measures.
- Only pumps with the design "F - Physiological safety with regard to wetted materials" are approved for use with physiologically harmless applications.
- Only "H - Hygienic head" design pumps may be used for applications in accordance with the hygienic requirements of the EHEDG (www.ededg.org).
- Observe the general limitations with regard to viscosity limits, chemical resistance and density - see also the ProMinent Resistance List (in the Product Catalogue or at www.prominent.com)!
- All other uses or modifications are prohibited.
- The pump is not intended for the metering of gaseous media and solids.
- The pump is not intended for operation in areas at risk from explosion.
- The pump is not intended for unprotected outside use.
- The pump is only intended for industrial use.
- The pump should only be operated by trained and authorised personnel, see the following "Qualifications" table.
- You have a responsibility to adhere to the information contained in the operating instructions at the different phases of the unit's service life.
### Qualification of personnel

<table>
<thead>
<tr>
<th>Task</th>
<th>Qualification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storage, transport, unpacking</td>
<td>Instructed person</td>
</tr>
<tr>
<td>Assembly</td>
<td>Technical personnel, Service</td>
</tr>
<tr>
<td>Planning the hydraulic installation</td>
<td>Qualified personnel who have a thorough knowledge of oscillating diaphragm pumps.</td>
</tr>
<tr>
<td>Hydraulic installation</td>
<td>Technical personnel, Service</td>
</tr>
<tr>
<td>Electrical Installation</td>
<td>Electrical technician</td>
</tr>
<tr>
<td>Operation</td>
<td>Instructed person</td>
</tr>
<tr>
<td>Maintenance, repair</td>
<td>Technical personnel, Service</td>
</tr>
<tr>
<td>Decommissioning, disposal</td>
<td>Technical personnel, Service</td>
</tr>
<tr>
<td>Troubleshooting</td>
<td>Technical personnel, electrical technician, instructed person, service</td>
</tr>
</tbody>
</table>

**Explanation of the table:**

**Technical personnel**

A qualified employee is deemed to be a person who is able to assess the tasks assigned to him and recognise possible dangers based on his technical training, knowledge and experience, as well as knowledge of pertinent regulations.

**Note:**

A qualification of equal validity to a technical qualification can also be gained by several years of employment in the relevant field of work.

**Electrical technician**

An electrical technician is able to complete work on electrical systems and recognise and avoid possible dangers independently based on his technical training and experience as well as knowledge of pertinent standards and regulations.

The electrical technician must be specifically trained for the working environment in which he is employed and be conversant with the relevant standards and regulations.

The electrical technician must comply with the provisions of the applicable statutory directives on accident prevention.

**Instructed person**

An instructed person is deemed to be a person who has been instructed and, if required, trained in the tasks assigned to him and any possible dangers that could result from improper behaviour, as well as having been instructed in the required protective equipment and protective measures.

**Service**

Customer Service department refers to service technicians, who have received proven training and have been authorised by ProMinent or ProMaqua to work on the system.
WARNING!
Warning of hazardous feed chemical
Should a dangerous feed chemical be used: it may escape from the hydraulic components when working on the pump, material failure or incorrect handling of the pump.
- Take appropriate protective measures before working on the pump (e.g. safety glasses, safety gloves, ...). Adhere to the material safety data sheet for the feed chemical.
- Drain and flush the liquid end before working on the pump.

WARNING!
Danger from hazardous substances!
Possible consequence: Fatal or very serious injuries.
Please ensure when handling hazardous substances that you have read the latest safety data sheets provided by the manufacture of the hazardous substance. The actions required are described in the safety data sheet. Check the safety data sheet regularly and replace, if necessary, as the hazard potential of a substance can be re-evaluated at any time based on new findings.
The system operator is responsible for ensuring that these safety data sheets are available and that they are kept up to date, as well as for producing an associated hazard assessment for the workstations affected.

CAUTION!
Warning of feed chemical spraying around
Feed chemical can spray out of the hydraulic components if they are manipulated or opened due to pressure in the liquid end and adjacent parts of the system.
- Disconnect the pump from the mains power supply and ensure that it cannot be switched on again by unauthorised persons.
- Depressurise the system before commencing any work on hydraulic parts.

CAUTION!
Warning of feed chemical spraying around
An unsuitable feed chemical can damage the parts of the pump that come into contact with the chemical.
- Take into account the resistance of the wetted materials and the ProMinent Resistance List when selecting the feed chemical - see the ProMinent Product Catalogue or visit ProMinent.

CAUTION!
Danger of personnel injury and material damage
The use of untested third party parts can result in personnel injuries and material damage.
- Only fit parts to metering pumps, which have been tested and recommended by ProMinent.
CAUTION!

Danger from incorrectly operated or inadequately maintained pumps

Danger can arise from a poorly accessible pump due to incorrect operation and poor maintenance.

- Ensure that the pump is accessible at all times.
- Adhere to the maintenance intervals.

WARNING!

An on/off switch may not be fitted on the pump, dependent on the identity code and installation.

Isolating protective equipment

All isolating protective equipment must be installed for operation:

- Drive front cover
- Motor fan cowling
- Motor terminal box cover
- Hood

In exactly the same way, plug all relays, modules and options into the hood - if available.

Only remove them when the operating instructions request you to do so.

Information in the event of an emergency

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

If feed chemical escapes, also depressurise the hydraulic system around the pump as necessary. Adhere to the safety data sheet for the feed chemical.

Sound pressure level

Sound pressure level $L_{pA} < 70$ dB according to EN ISO 20361

at maximum stroke length, maximum stroke rate, maximum back pressure

(water)
3 Storage, Transport and Unpacking

Safety information

**WARNING!**
Only return the metering pump for repair in a cleaned state and with a flushed liquid end - refer to the chapter "Decommissioning"!

Only return metering pumps with a completed Decontamination Declaration form. The Decontamination Declaration constitutes an integral part of an inspection / repair order. A unit can only be inspected or repaired when a Declaration of Decontamination Form is submitted that has been completed correctly and in full by an authorised and qualified person on behalf of the pump operator.

The "Decontamination Declaration Form" can be found at www.prominent.com.

**WARNING!**
Slings can tear
ProMinent only supplies "non-reusable slings" in accordance with DIN EN 60005. They can tear with repeated use.

- Destroy and remove the slings as soon as the pump has been lifted into its final position.

**CAUTION!**
Danger of material damage
The device can be damaged by incorrect or improper storage or transportation!

- The unit should only be stored or transported in a well packaged state - preferably in its original packaging.
- Only transport the unit when the red gear bleeding plug is pushed in.
- The packaged unit should also only be stored or transported in accordance with the stipulated storage conditions.
- The packaged unit should be protected from moisture and the ingress of chemicals.

**Scope of delivery**

Compare the delivery note with the scope of supply:

**Storage**

Personnel:  ■ Technical personnel

1. Plug the caps on the valves.
2. Check if the red gear bleeding plug is pushed in.
3. Preferably place the pump standing vertically on a pallet and secure against falling over.
4. Cover the pump with a tarpaulin cover - allowing rear ventilation.

Store the pump in a dry, sealed place under the ambient conditions according to chapter "Technical Data".
4 Overview of equipment and control elements

Overview of equipment

![Sigma X - S2Cb equipment](image1)

**Fig. 2: Overview of Sigma X - S2Cb equipment**

1. HMI control unit
2. Frequency converter
3. Drive unit
4. Stroke length adjustment wheel
5. Drive motor
6. Liquid end
7. Diaphragm rupture sensor

Control elements

![Sigma control elements](image2)

**Fig. 3: Sigma control elements**

1. Bleed valve (optional)
2. Diaphragm rupture sensor (visual)
Overview of equipment and control elements

Fig. 4: Control elements for HMI Sigma X Control type

1. LCD screen
2. [Menu] key
3. Clickwheel
4. [Priming] key
5. [STOP/START] key
6. [Back] key
7. "Bluetooth active" display (blue)
8. Fault indicator (red)
9. Warning indicator (yellow)
10. Operating indicator (green)

Fig. 5: Connector cover control elements

1. Relay and mA-output (option)
2. Slot for optional module (PROFIBUS®, ...)
3. "Diaphragm rupture" socket
4. "External control" terminal
5. "Metering monitor" terminal
4.1 Control elements

Use this overview to familiarise yourself with the keys and the other control elements on the pump!

Pressure display, identifier and fault displays on the LCD screen

Fig. 6: Construction of continuous display
1 Status bar
2 Continuous display, central area
3 Secondary display

Refer to the chapter entitled "Main displays and secondary displays" in the Appendix for the different main displays and secondary displays.

The LCD screen supports the operation and adjustment of the pump by providing different information and identifiers:

Fig. 7: a) Continuous display with warning message; b) Continuous display with fault message. Explanation of the symbols in the following tables.

The above Figure, Part a) shows that:
- The pump is in operation
- It is in ‘Contact’ operating mode with "memory” stroke memory
- A metering monitor is connected
- A log entry has been made
- A warning message for the ‘metering monitor’ is pending
- The capacity of 12.0 l/h has been set
- The stroke rate is 12,000 strokes / h
### Tab. 1: Identifier and error displays:

<table>
<thead>
<tr>
<th>Identifier</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>🔄</td>
<td>The pump is working or waiting for a starting signal.</td>
</tr>
<tr>
<td>🔄👍</td>
<td>The pump was manually stopped using the [STOP/START] key.</td>
</tr>
<tr>
<td>🔄⏸️</td>
<td>The pump was remotely stopped (Pause) - via the &quot;External&quot; socket.</td>
</tr>
<tr>
<td>🔄💡</td>
<td>The pump was stopped by an error.</td>
</tr>
<tr>
<td>🔄 ⇤</td>
<td>Only with cyclical batch metering: the pump is waiting for the next cycle.</td>
</tr>
<tr>
<td>'memory'</td>
<td>Only in &quot;CONTACT&quot; and &quot;BATCH&quot; operating modes: The &quot;Stroke memory&quot; auxiliary function has been set.</td>
</tr>
<tr>
<td>🔄📏</td>
<td>The pump is in &quot;ANALOGUE&quot; operating mode. The 'Curve ➔ linear' type of processing is set.</td>
</tr>
<tr>
<td>🔄🪝</td>
<td>The pump is in &quot;ANALOGUE&quot; operating mode. The 'Curve ➔ Upper side band' type of processing is set.</td>
</tr>
<tr>
<td>'AUX'</td>
<td>The pump is currently pumping at auxiliary capacity and/or auxiliary frequency.</td>
</tr>
<tr>
<td>🔄/svg</td>
<td>The diaphragm rupture warning system is disabled.</td>
</tr>
<tr>
<td>🔄🔍</td>
<td>A &quot;Flow Control&quot; metering monitor is connected.</td>
</tr>
<tr>
<td>🔄⏰</td>
<td>The timer is active.</td>
</tr>
<tr>
<td>🔄🔒</td>
<td>Only with 'Password': the pump software is locked.</td>
</tr>
<tr>
<td>🔄🗝️</td>
<td>Only with 'Password': the pump software has been temporarily unlocked.</td>
</tr>
<tr>
<td>🔄🚀</td>
<td>The pump is in the 'Menu' (Set up).</td>
</tr>
</tbody>
</table>

Further explanations can be found in the "Trouble-shooting" chapter.
4.2 Key functions

<table>
<thead>
<tr>
<th>Key</th>
<th>Application</th>
<th>In the continuous displays</th>
<th>In the menu</th>
</tr>
</thead>
<tbody>
<tr>
<td>⬇️[Back]</td>
<td>press</td>
<td>-</td>
<td>Move back to the previous menu point (or a continuous display) - without saving</td>
</tr>
<tr>
<td>⌨️[STOP/START]</td>
<td>press</td>
<td>Stop pump</td>
<td>Stop pump,</td>
</tr>
<tr>
<td>***</td>
<td></td>
<td>Start pump</td>
<td>Start pump</td>
</tr>
<tr>
<td>⬇️[Menu]</td>
<td>press</td>
<td>Move to the menu</td>
<td>Move back to a continuous display</td>
</tr>
<tr>
<td>⬤[Priming]</td>
<td>press</td>
<td>Priming *</td>
<td>Priming *</td>
</tr>
<tr>
<td>⬤[Clickwheel]</td>
<td>press</td>
<td>Start batch (only in ‘Batch’ operating mode), Acknowledge errors</td>
<td>Move to next menu option (or a continuous display) Confirm entry and save</td>
</tr>
<tr>
<td>⬤[Clickwheel]</td>
<td>turn</td>
<td>Switch between the continuous displays</td>
<td>Change figure or change selection</td>
</tr>
</tbody>
</table>

* When priming the pump does not run at maximum stroke rate.

If ⬤[Priming] is pressed in ‘Stop’ state, then ⬤[Priming] has top priority as long as the button is pressed.

Refer to the “Set-up basics” chapter to adjust figures.
5 Functional description

5.1 Pump

The metering pump is an oscillating diaphragm pump, the stroke length of which can be adjusted. An electric motor drives it. The slide rod transmits the stroke motion to the diaphragms.

Illustration of the stroke movement

The stroke movement of the displacement body is continuously detected and regulated so that the stroke is performed according to a previously set metering profile - see chapter ‘Metering’ ‘setting’.

The following metering profiles are available:
- Normal
- Metering optimised
- Priming optimised

Every metering profile is ineffective below the switch-over frequency for Start/Stop mode.

Fig. 8: Stroke movement at a) maximum stroke length and b) reduced stroke length.

- Stroke velocity
- Cam rotational angle
- Discharge stroke
- Suction stroke

Metering optimised

With a metering optimised metering profile, the discharge stroke is elongated and the suction stroke is executed as quickly as possible. This setting is for example suitable for those applications that require optimum mixing ratios and the most continuous chemical mixing possible.

Priming optimised
With a priming optimised metering profile, the suction stroke is elongated as much as possible, which facilitates the precise and problem-free metering of viscous and gaseous media. Select this setting to minimise the NPSH value as well.

5.2 Liquid end

The diaphragm (2) hermetically shuts off the pump volume of the dosing head (4) towards the outside. The suction valve (1) closes as soon as the diaphragm (2) is moved in to the dosing head (4) and the feed chemical flows through the discharge valve (3) out of the dosing head. The discharge valve (3) closes as soon as the diaphragm (2) is moved in the opposite direction due to the vacuum pressure in the dosing head and fresh feed chemical flows through the suction valve (1) into the dosing head. One cycle is thus completed.

5.3 Bleed valve and integrated relief valve

Bleed valve

Turning the rotary dial (3) on the bleed valve to "open" causes it to open and the liquid end can be bled. Or it is used as a priming aid for priming against pressure. The feed chemical flows out through the hose connection (5), e.g. into a storage tank.

Integral relief valve

The integral relief valve operates in the "close" position as a simple, directly controlled relief valve. As soon as the pressure exceeds the pressure value, which is preset using the large spring (1), it lifts the ball (2). The feed chemical flows out through the hose connection (5), e.g. into a storage tank.
The integral relief valve can only protect the motor and the gear, and then only against impermissible positive pressure that is caused by the metering pump itself. It cannot protect the system against positive pressure.

The integral relief valve works as a **bleed valve** as soon as the rotary dial (3) is turned to “open”: The valve opens and the liquid end can be bled. Or it is used as a priming aid for priming against pressure.

![Diagram of relief valve and integrated relief valve](image)

**Fig. 10: Relief valve and integrated relief valve**

1. Spring, large
2. Ball
3. Rotary dial
4. Hose connection

5.4 Multi-layer safety diaphragm

With the **visual** diaphragm rupture sensor, the lowered red cylinder (6) springs forward beneath the transparent cover (7) so that it then becomes clearly visible Fig. 11.

With the **electrical** diaphragm rupture sensor, a switch is switched. A connected signalling device must signal the diaphragm rupture.

![Visual diaphragm rupture sensor, triggered and untriggered](image)

**Fig. 11: Visual diaphragm rupture sensor, triggered and untriggered**

The electrical diaphragm rupture sensor is connected to the "diaphragm rupture indicator" terminal. If a diaphragm ruptures, the red LED "Fault" display lights up on the pump and the identifier "Error" and ‘dia’ flash on the LCD screen.

5.5 Operating modes

The operating modes are selected via the ‘**Operating mode**’ menu (some operating modes may not be present depending on the identity code.)
**Manual** operating mode: The stroke rate is set manually on the control unit.

**Batch** operating mode
This operating mode provides the option of working with large transfer factors (up to 99,999). Metering can be triggered either by pressing the [Clickwheel] or by a pulse received via the “External control” terminal or via a contact or a semiconductor switching element. It is possible to preselect a metering volume (batch) or a number of strokes using the [Clickwheel] in the ‘Settings’ menu.

**Contact** operating mode
This operating mode provides the option of controlling the pump externally by means of potential-free contacts (e.g. by means of a contact water meter). The “Pulse Control” option enables you to preselect the number of strokes (a scaling or transfer factor of 0.01 to 99.99) in the ‘Settings’ menu.

**Analogue** operating mode
The stroke rate is controlled using an analogue current signal via the “External control” terminal. The processing of the current signal can be preselected using the control unit.

**BUS** operating mode: (Identity code, control version: CANopen or PROFIBUS® DP interface). This operating mode provides the option of controlling the pump via BUS – see “Supplementary instructions for Sigma Control type SxCb pumps with Can connector” or “Supplementary instructions for delta® DLTa and Sigma SxCb with PROFIBUS™.”

### 5.6 Functions

The following function can be ordered via the identity code:

**Overload switch-off (optional):** The pump can issue an electronic warning and switch off if a defined tolerance range is exceeded. The overload shutdown is used to protect the pump, not the system. In the event of overloading, the pump signals an error via the LED displays, the LCD screen (‘p+’ or ‘blockade’) and - if fitted – the fault indicating relay.

The following functions can be selected using the ‘Settings’ menu:

**“Calibrate” function:** The pump can also be operated in a calibrated state in all operating modes. In this case, the corresponding continuous displays can then indicate the metering volume or the capacity directly. Calibration is maintained throughout the stroke rate range. The calibration is also maintained when the stroke length is altered by up to ±10% scale divisions.

**“Auxiliary frequency” function:** Enables a freely selectable and programmable stroke rate to be switched on in the ‘Settings’ menu, which can be controlled via the "External control" terminal. This auxiliary frequency has priority over the operating mode stroke rate settings.

**“Flow” function:** Stops the pump when the flow is insufficient, provided a metering monitor is connected. The number of defective strokes, after which the pump is switched off, can be set in the ‘Settings’ menu.
The following functions are available as standard:

"Level switch" function: Information about the liquid level in the dosing tank is reported to the pump control. To do this, a two-stage level switch must be fitted, which is connected to the "Level switch" terminal.

"Pause" function: The pump can be remotely stopped via the "External control" terminal. The "Pause" function only works via the "External control" terminal.

The following functions are triggered by a key press:

"Stop" function: The pump can be stopped without disconnecting it from the mains/power supply by pressing [STOP/START].

"Priming" function

Priming can be triggered by pressing [Prim].

5.7 Options

Relay option

The pump has several connection possibilities for the following options:

"Output relay" option: In the event of fault signals, warning signals, stopping of the pump or tripped level switches, the relay connects to complete an electric circuit (for alarm horns etc.).

The relay can be retrofitted via a knock-out in the drive unit.

The various functions can be adjusted – see "Settings" - "Relays" chapters.

"Fault indicating relay and semiconductor relay" option: In the event of fault signals, warning signals, stopping of the pump or tripped level switches, the fault indicating relay connects to complete an electric circuit (for control panel etc.).

In addition to the fault indicating relay, the pacing relay can be used to make a contact every stroke.

Other functions can be adjusted – see "Settings" - "Relays" chapters. The option can be retrofitted via a knock-out in the drive unit.

"0/4-20 mA analogue current output and fault indicating relay" option

The current output I signal indicates the pump’s actual calculated metering volume.

The "0/4-20 mA analogue current output and fault indicating relay" option can be retrofitted via a knock-out in the control unit.

The option also always includes a semiconductor relay - see above. Other functions can be adjusted – see "Settings" - "Relays" chapters.

5.8 Function and fault indicator

The operating and fault statuses are indicated by the three or four LED displays and the ‘Error’ identifier on the LCD screen:
5.8.1 LCD screen

If a fault occurs, the identifier ‘Error’ appears and an additional error message – see “Troubleshooting” chapter.

5.8.2 LED displays

Pump device LEDs - see “Troubleshooting” chapter

Fault indicator (red)

The fault indicator lights up if the fluid level in the dosing tank falls below the second switching point of the level switch (20 mm residual filling level in the dosing tank).

It also lights up with all other faults - refer to “Troubleshooting” chapter.

Warning indicator (yellow)

The warning indicator lights up if the fluid level in the dosing tank falls below the first switching point of the level switch.

It also lights up with all other warnings - refer to “Troubleshooting” chapter.

Operating indicator (green)

The operating indicator lights up if the pump is ready for operation and there are no fault or warning alerts. It briefly goes out as soon as the pump has performed a stroke.

CAN bus status LED (external)

This LED on the power end is the top one in the row of 4 LEDs.

<table>
<thead>
<tr>
<th>Colour</th>
<th>Flash code</th>
<th>Cause</th>
<th>Consequence</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>green</td>
<td>lit</td>
<td>Bus status OPERATIONAL</td>
<td>Normal bus mode</td>
<td>-</td>
</tr>
<tr>
<td>green</td>
<td>flashing</td>
<td>Bus status PRE-OPERATIONAL</td>
<td>currently no measured value communication</td>
<td>wait briefly. Disconnect HMI then reconnect</td>
</tr>
<tr>
<td>red</td>
<td>any</td>
<td>Bus error</td>
<td>no measured value transmission</td>
<td>Check whether the CAN connection is faulty. Notify Service</td>
</tr>
</tbody>
</table>

5.9 Hierarchy of operating modes, functions and fault statuses

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

The following list shows the order:

1. - Priming
2. - Fault, Stop, Pause
3. - Auxiliary frequency (external frequency changer)
4. - Manual, External contact, Batch, External analogue
Comments:

re 1 - "Priming" can take place in any mode of the pump (providing it is working).

re 2 - "Fault", "Stop" and "Pause" stop everything apart from "Priming".

re 3 - The "Auxiliary frequency" stroke rate always has priority over the stroke rate specified by an operating mode listed under 4.
6 Assembly

Compare the dimensions on the dimension sheet with those of the pump.

**WARNING!**
**Danger of electric shock**
If water or other electrically conducting liquids penetrate into the drive housing, in any other manner than via the pump’s suction connection, an electric shock may occur.

– Position the pump so that it cannot be flooded.

**WARNING!**
The pump can break through the base or slide off it

– Ensure that the base is horizontal, flat and permanently load-bearing.

**CAUTION!**
If your Sigma S2Cb is to be installed in place of a Sigma S2Ca, a base plate order no. 1044841 is possibly needed to lift the liquid end.

**Capacity too low**
Vibrations can disturb the liquid end valves.

– Do not allow the base to vibrate.

**CAUTION!**
Danger from incorrectly operated or inadequately maintained pumps

Danger can arise from a poorly accessible pump due to incorrect operation and poor maintenance.

– Ensure that the pump is accessible at all times.

– Adhere to the maintenance intervals.

Position the pump so that control elements, such as the stroke length adjustment knob, the indicating dial A or the oil inspection window, are accessible.

In so doing, ensure there is enough space to carry out an oil change (vent screws, oil drain plugs, oil trough ...).

If the HMI is mounted remotely from the pump: a clearly marked Stop mechanism must be installed in the direct vicinity of the pump for emergencies!
1 Discharge valve
2 Dosing head
3 Suction valve

Ensure there is sufficient free space (f) around the dosing head as well as the suction and discharge valve so that maintenance and repair work can be carried out on these components.

**Fig. 14**

**Liquid end alignment**

- **Capacity too low**
  The liquid end valves cannot close correctly if they are not upright.
  - Ensure that the discharge valve is upright.

**Fastening**

- **Capacity too low**
  Vibrations can disturb the liquid end valves.
  - Secure the metering pump so that no vibrations can occur.

Take the dimensions (m) for the fastening holes from the appropriate dimensions- or data sheets.

Use appropriate bolts to fix the pump base to the supporting floor.

**Fig. 15**

**Mounting the HMI user control**

If ordered with the wall mounting, the HMI can be mounted directly on a wall.

Install the HMI in the immediate vicinity of the pump. If not provided for, fit a circuit breaker there - refer to the "Installation, electrical" chapter. Ensure that the system is arranged ergonomically.

When doing so, consider the available cable length.

Prevent tripping hazards.

Refer to the relevant dimensional drawing for the dimensions of the HMI and fixing holes.

**CAUTION!**

**Warning of faulty operation**

- Do not install the HMI and cable too close to devices and cabling that emit strong electrical interference.
7 Installation

CAUTION!
Danger of injury to personnel and material damage
Disregard of technical data during installation may lead to personal injuries or damage to property.
- Observe the technical data - refer to the “Technical data” chapter and, where applicable, the operating instructions for the accessories.

7.1 Installation, hydraulic

WARNING!
Danger of fire with flammable feed chemicals
- Only metering pumps with the identity code option "Multi-layer safety diaphragm with rupture signalling with electrical signal" are permitted to meter flammable media, with back pressures over 2 bar and if the operator puts in place the appropriate safety precautions.

WARNING!
Warning of feed chemical reactions to water
Feed chemicals that should not come into contact with water may react to residual water in the liquid end that may originate from works testing.
- Blow the liquid end dry with compressed air through the suction connector.
- Then flush the liquid end with a suitable medium through the suction connector.

WARNING!
The following measures are beneficial when working with highly aggressive or hazardous feed chemicals:
- Install a bleed valve with recirculation in the storage tank.
- Install a shut-off valve on the discharge or suction side.

CAUTION!
Warning of feed chemical spraying around
PTFE seals, which have already been used / compressed, can no longer reliably seal a hydraulic connection.
- New, unused PTFE seals must always be used.
CAUTION!
Suction problems are possible
The valves may no longer close properly with feed chemicals with a particle size of greater than 0.3 mm.
- Install a suitable filter in the suction line.

CAUTION!
Warning of the discharge line rupturing
With a closed discharge line (e.g. from a clogged discharge line or by closing a valve), the pressure that the metering pump generates can reach several times more than the permissible pressure of the system or the metering pump. This could lead to lines rupturing resulting in dangerous consequences with aggressive or hazardous feed chemicals.
- Install a relief valve that limits the pressure of the pump to the maximum permissible operating pressure of the system.

CAUTION!
Warning against rupturing of suction or discharge lines
Hose lines with insufficient pressure rating may rupture.
- Only use hose lines with the required pressure rating.

CAUTION!
Uncontrolled flow of feed chemical
Feed chemical can press through the metering pump in an uncontrolled manner in the event of excessive priming pressure on the suction side of the metering pump.
- Do not exceed the maximum permissible priming pressure for the metering pump or
- Set up the installation properly.

CAUTION!
Warning about lines coming loose
If suction, discharge and relief lines are installed incorrectly, they can loosen / disconnect from the pump connection.
- Only use original hoses with the specified hose diameter and wall thickness.
- Only use clamp rings and hose nozzles that fit the respective hose diameter.
- Always connect the lines without mechanical tension.
CAUTION!
Warning of leaks
Leaks can occur on the pump connection depending on the insert used.
- The pump is supplied with PTFE moulded composite seals with a flare, which are used for the pump connectors, which seal the connectors between grooved pump valves and ProMinent grooved inserts - see Further information on page 27.
- Use an elastomer flat seal in the event that an unflared insert is used (e.g., third party part) - see Further information on page 27.
- Precise metering is only possible when the back pressure is maintained above 1 bar at all times.
- If metering at atmospheric pressure, a back pressure valve should be used to create a back pressure of approx. 1.5 bar.

CAUTION!
Warning of backflow
A back pressure valve, a spring-loaded injection valve, a relief valve, a foot valve or a liquid end do not represent absolutely leak-tight closing elements.
- Use a shut-off valve, a solenoid valve or a vacuum breaker for this purpose.

CAUTION!
To check the pressure conditions in the piping system it is recommended that connecting options for a manometer are provided close to the suction and pressure connector.

| 1 | Manometer socket |
| 2 | Discharge line (pipe) |
| 3 | Discharge valve |
| 4 | Suction valve |
| 5 | Suction line (pipe) |

CAUTION!
Connect the pipelines to the pump so that no residual forces act on the pump, e.g., due to the offsetting, weight or expansion of the line.

Only connect steel or stainless steel piping via a flexible piping section to a plastic liquid end.

| 1 | Steel piping |
| 2 | Flexible pipe section |
| 3 | Plastic liquid end |
### Integral relief valve or integral bleeder valve

<table>
<thead>
<tr>
<th><strong>WARNING!</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Product can be dangerously contaminated</strong></td>
</tr>
<tr>
<td>Only with &quot;Physiologically safety with regard to wetted materials&quot; version:</td>
</tr>
<tr>
<td>If the integral bleed valve or the integral relief valve opens, the feed chemical comes into contact with physiologically harmful seals.</td>
</tr>
<tr>
<td>- Do not route feed chemical that escapes from the integral bleed valve or the integral relief valve back into the process.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>CAUTION!</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Danger due to incorrect use of the integral relief valve</strong></td>
</tr>
<tr>
<td>The integral relief valve can only protect the motor and the gear, and then only against impermissible positive pressure that is caused by the metering pump itself. It cannot protect the system against positive pressure.</td>
</tr>
<tr>
<td>- Protect the motor and gear of the system against positive pressure using other mechanisms.</td>
</tr>
<tr>
<td>- Protect the system against illegal positive pressure using other mechanisms.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>CAUTION!</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Warning of feed chemical spraying around</strong></td>
</tr>
<tr>
<td>If no overflow line is connected to the integral relief valve or the integral bleeder valve, feed chemical will spray out of the hose connector as soon as the relief valve opens.</td>
</tr>
<tr>
<td>- Always connect an overflow line to the integral relief valve or the integral bleeder valve and feed it back into the storage tank or - if required by the regulations - into a special storage tank.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>CAUTION!</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Danger of cracking</strong></td>
</tr>
<tr>
<td>Cracks on the PVT liquid end can occur if a metal overflow line is connected to the relief valve.</td>
</tr>
<tr>
<td>- Never connect a metal overflow line to the relief valve.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>CAUTION!</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Danger of the integral relief valve failing</strong></td>
</tr>
<tr>
<td>The integral relief valve no longer operates reliably with feed chemicals that have a viscosity of greater than 200 mPa s.</td>
</tr>
<tr>
<td>- Only use the integral relief valve with feed chemicals that have a viscosity of up to 200 mPa s.</td>
</tr>
</tbody>
</table>
CAUTION!
Warning of leaks
Feed chemical, which remains in the overflow line at the relief valve or bleeder valve, can attack the valve or cause it to leak.
- Route the overflow line with a continuous slope and moreover with the hose nozzle pointed downwards - see .

If the overflow line is fed into the suction line, the bleed function is blocked. Therefore lead the overflow line back into the storage tank.

When operating the integral relief valve close to the opening pressure, a minimal overflow into the overflow line can occur.

CAUTION!
Danger resulting from unnoticed diaphragm rupture
If the pump has been ordered with an electric diaphragm rupture sensor, it still has to be installed.
- Screw the enclosed diaphragm rupture sensor into the liquid end.

CAUTION!
Warning of unnoticed diaphragm rupture
Only above approximately 2 bar system back pressure is a signal generated in the event of the rupture of a diaphragm.
- Only rely on the diaphragm rupture sensor with back pressures of greater than 2 bar. Or install a back pressure valve and set it to a minimum of 2 bar – if the installation permits this.

7.1.1 Basic installation notes
Safety notes

CAUTION!
Danger resulting from rupturing hydraulic components
Hydraulic components can rupture if the maximum permissible operating pressure is exceeded.
- Never allow the metering pump to run against a closed shut-off device.
- With metering pumps without integral relief valve: Install a relief valve in the discharge line.

Fig. 20: Permissible alignment of the relief valve
CAUTION!
Hazardous feed chemicals can escape
With hazardous feed chemicals: Hazardous feed chemical can leak out when using conventional bleeding procedures with metering pumps.
- Install a bleed line with a return into the storage tank.

Shorten the return line so that it does not dip into the feed chemical in the storage tank.

Fig. 21: (A) standard installation, (B) with pulsation damper

Legend for hydraulic diagram

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Explanation</th>
<th>Symbol</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Symbol" /></td>
<td>Metering pump</td>
<td><img src="image2" alt="Symbol" /></td>
<td>Foot valve with filter meshes</td>
</tr>
<tr>
<td><img src="image3" alt="Symbol" /></td>
<td>Injection valve</td>
<td><img src="image4" alt="Symbol" /></td>
<td>Level switch</td>
</tr>
<tr>
<td><img src="image5" alt="Symbol" /></td>
<td>Multifunctional valve</td>
<td><img src="image6" alt="Symbol" /></td>
<td>Manometer</td>
</tr>
</tbody>
</table>

7.2 Installation, electrical

General safety notes

WARNING!
Danger of electric shock
Unprofessional installation may lead to electric shocks.
- Crimp cable end sleeves onto all shortened cable cores.
- Only technically trained personnel are authorised to undertake the electrical installation of the device.
WARNING!
Danger of electric shock
A mains voltage may exist inside the motor or electrical ancillaries.
- If the housing of the motor or electrical ancillaries has been damaged, you must disconnect it from the mains immediately. Only return the pump to service after an authorised repair.

CAUTION!
Use ProMinent cables to avoid unnecessary problems.

What requires electrical installation?
- Level switch
- Diaphragm rupture sensor, electrical (optional)
- Metering monitor (optional)
- Relay (optional)
- External control
- mA output (optional)
- Bus connector (optional)
- Pump, power supply

7.2.1 Control connectors

CAUTION!
Incoming signals can remain without effect
If the universal control wire, the external/pacing cable or the level monitoring cable is shortened below 1.20 m, the pump does not detect that it is connected. Consequently a warning message (for example) can be suppressed.
- Do not shorten this cable below 1.20 m.

Level switch, diaphragm rupture sensor (option) and metering monitor (option)
Connect the plugs of the level switch, diaphragm rupture sensor and metering monitor to the corresponding sockets on the front side of the control. If in doubt - refer to the "Overview of equipment and control elements" chapter.

CAUTION!
Danger resulting from unnoticed diaphragm rupture
If the pump has been ordered with an electric diaphragm rupture sensor, it must also be electrically installed.
- Electrically connect the enclosed diaphragm rupture sensor.
Only with flammable media:

**WARNING!**

*Fire danger*

The electric diaphragm rupture sensor must stop the pump immediately after a diaphragm rupture and trigger an alarm.

The pump must only be returned to Service once a new diaphragm has been fitted.

---

### 7.2.1.1 Relay

#### 7.2.1.1.1 Fault indicating relay 230 V

If another switching function is required, the pump can be reprogrammed in the ‘Relay’ menu.

The relay can be retrofitted and is operational once it has been plugged into the relay board.

---

**Fig. 22: Pump assignment**

**Fault indicating relay 230 V**

---

**Fig. 23: Cable assignment**

**Pin assignment**

<table>
<thead>
<tr>
<th>To pin</th>
<th>VDE cable</th>
<th>Contact</th>
<th>CSA cable</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>white</td>
<td>NO (normally open)</td>
<td>white</td>
</tr>
<tr>
<td>2</td>
<td>green</td>
<td>NC (normally closed)</td>
<td>red</td>
</tr>
<tr>
<td>4</td>
<td>brown</td>
<td>C (common)</td>
<td>black</td>
</tr>
</tbody>
</table>

---

**Data**

<table>
<thead>
<tr>
<th>Data</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum contact load at 230 V and 50/60 Hz:</td>
<td>8</td>
<td>A (resistive)</td>
</tr>
<tr>
<td>Minimum mechanical service life:</td>
<td>200,000</td>
<td>switching operations</td>
</tr>
</tbody>
</table>
7.2.1.2 Fault indicating and pacing relay option

The first switch is a relay. The pacing output is electrically-isolated by means of an optocoupler with a semiconductor switch.

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

The relay can be retrofitted and is operational once it has been plugged into the relay board.

**Fig. 24: Pump assignment**

**Fault indicating relay (24 V)**

<table>
<thead>
<tr>
<th>Data</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum contact load at 24 V and 50/60 Hz</td>
<td>100</td>
<td>mA</td>
</tr>
<tr>
<td>Minimum mechanical service life:</td>
<td>200,000</td>
<td>switching operations</td>
</tr>
</tbody>
</table>

**Pacing relay**

<table>
<thead>
<tr>
<th>Data</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residual voltage max. at I_{off, max} = 1 µA</td>
<td>0.4</td>
<td>V</td>
</tr>
<tr>
<td>Maximum current</td>
<td>100</td>
<td>mA</td>
</tr>
<tr>
<td>Maximum voltage</td>
<td>24</td>
<td>VDC</td>
</tr>
<tr>
<td>Closing time</td>
<td>100</td>
<td>ms</td>
</tr>
</tbody>
</table>

**Fig. 25: Cable assignment**

**Pin assignment**

<table>
<thead>
<tr>
<th>To pin</th>
<th>VDE cable</th>
<th>Contact</th>
<th>Relay</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>yellow</td>
<td>NC (normally closed) or NO (normally open)</td>
<td>Fault indicating relay</td>
</tr>
<tr>
<td>4</td>
<td>green</td>
<td>C (common)</td>
<td>Fault indicating relay</td>
</tr>
<tr>
<td>3</td>
<td>white</td>
<td>NC (normally closed) or NO (normally open)</td>
<td>Pacing relay</td>
</tr>
<tr>
<td>2</td>
<td>brown</td>
<td>C (common)</td>
<td>Pacing relay</td>
</tr>
</tbody>
</table>
7.2.1.1.3 Current output and fault indicating / pacing relay (24 V)

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

The variable to be signalled for the current output can be selected in the ‘ANALOGUE OUTPUT’ menu.

If another switching function is required, the relay can be reprogrammed in the ‘Relay’ menu.

Fig. 26: Pump assignment

<table>
<thead>
<tr>
<th>Data</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open circuit voltage:</td>
<td>8</td>
<td>V</td>
</tr>
<tr>
<td>Current range:</td>
<td>4 ... 20</td>
<td>mA</td>
</tr>
<tr>
<td>Ripple, max.:</td>
<td>80</td>
<td>μA ss</td>
</tr>
<tr>
<td>Load, max.:</td>
<td>250</td>
<td>Ω</td>
</tr>
</tbody>
</table>

Fault indicating / pacing relay (24 V)

<table>
<thead>
<tr>
<th>Data</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residual voltage max. at ( i_{off,\text{max}} ) = 1 μA</td>
<td>0.4</td>
<td>V</td>
</tr>
<tr>
<td>Maximum current</td>
<td>100</td>
<td>mA</td>
</tr>
<tr>
<td>Maximum voltage</td>
<td>24</td>
<td>VDC</td>
</tr>
<tr>
<td>Closing time</td>
<td>100</td>
<td>ms</td>
</tr>
</tbody>
</table>

Current output and fault indicating / pacing relay (24 V)

<table>
<thead>
<tr>
<th>To pin</th>
<th>VDE cable</th>
<th>Contact</th>
<th>Relay</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>yellow</td>
<td>&quot;+&quot;</td>
<td>Current output</td>
</tr>
<tr>
<td>4</td>
<td>green</td>
<td>&quot;-&quot;</td>
<td>Current output</td>
</tr>
<tr>
<td>3</td>
<td>white</td>
<td>NC (normally closed) or NO (normally open)</td>
<td>Fault indicating / pacing relay</td>
</tr>
<tr>
<td>2</td>
<td>brown</td>
<td>C (common)</td>
<td>Fault indicating / pacing relay</td>
</tr>
</tbody>
</table>
7.2.1.2 External control

External control

Universal control wire connection diagram

Function "External Contact"
(ProMinent external/contact cable)
2-core

Function "External Contact"
(ProMinent universal control wire)
5-core

"Pause" function

"Auxiliary rate" function

Function "External Contact"

Pulse frequency,
e.g. contact water meter, PLC etc.

Pulse frequency,
e.g. contact water meter, PLC etc.

Continuous contact (potential-free)
E.g. external on/off of control panel

Continuous contact (potential-free)
e.g. of control panel

Analog signal,
e.g. of magnetic inductive
Flow meter

ProMinent
Semi-conductor switch elements with a residual voltage of -0.7 V (e.g. transistors in open-collector circuits) or contacts (relays) can be used as input switch elements.

## Technical data “External control”

<table>
<thead>
<tr>
<th>Pin</th>
<th>Voltage with open contacts:</th>
<th>approx. 5 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 = Pause input (activating function)</td>
<td>Input resistance:</td>
<td>10 kΩ</td>
</tr>
<tr>
<td></td>
<td>Control:</td>
<td>Potential-free contact (approx. 0.5 mA)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Semiconductor switch (residual voltage &lt; 0.7 V)</td>
</tr>
<tr>
<td>2 = contact input</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Voltage with open contacts:</td>
<td>approx. 5 V</td>
</tr>
<tr>
<td></td>
<td>Input resistance:</td>
<td>10 kΩ</td>
</tr>
<tr>
<td></td>
<td>Control:</td>
<td>Potential-free contact (approx. 0.5 mA)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Semiconductor switch (residual voltage &lt; 0.7 V)</td>
</tr>
<tr>
<td></td>
<td>min. contact duration:</td>
<td>20 ms</td>
</tr>
<tr>
<td></td>
<td>Max. pulse frequency:</td>
<td>25 pulses/s</td>
</tr>
<tr>
<td>3 = Analogue input</td>
<td>Input load:</td>
<td>approx. 120 Ω</td>
</tr>
<tr>
<td>4 = GND</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 = Auxiliary input</td>
<td>Voltage with open contacts:</td>
<td>approx. 5 V</td>
</tr>
<tr>
<td></td>
<td>Input resistance:</td>
<td>10 kΩ</td>
</tr>
<tr>
<td></td>
<td>Control:</td>
<td>Potential-free contact (approx. 0.5 mA)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Semiconductor switch (residual voltage &lt; 0.7 V)</td>
</tr>
</tbody>
</table>

The metering pump makes its first metering stroke at approx. 0.4 mA (4.4 mA) and enters into continuous operation at approx. 19.2 mA.
Fig. 28: Sigma Control block switching diagram
7.2.2 HMI operating unit

The HMI must be connected to the CAN socket above the LEDs of the pump base if the pump is operated via the HMI.
If the pump is operated without the HMI, the sealing cap supplied must be plugged into the CAN socket above the LEDs of the pump base.

**CAUTION!**
Risk of short circuit
A short circuit may occur in the pump if liquid penetrates into the CAN socket.
- Always plug a CAN plug or the sealing cap supplied into the CAN socket.

**CAUTION!**
Danger of malfunctions
Incorrect operation via the CAN bus leads to malfunctions.
- Do not connect any other control (e.g. DXCa) to the CAN socket when operating with the HMI connected.

### 7.2.3 Pump, power supply

**WARNING!**
Risk of electric shock
This pump is supplied with a grounding conductor and a grounding-type attachment plug.
- To reduce the risk of electric shock, ensure that it is connected only to a proper grounding-type receptacle.

**WARNING!**
Danger of electric shock
In the event of an electrical accident, it must be possible to quickly disconnect the pump, and any electrical ancillaries which may possibly be present, from the mains.
- Install an emergency cut-off switch in the mains supply line to the pump and any electrical ancillaries which may be present or
- Integrate the pump and electrical ancillaries which may be present in the emergency cut-off management of the system and inform personnel of the isolating option.

**WARNING!**
If the HMI cannot be operated directly from the pump (specifically with versions with a cable longer than 2 m), provide an option to disconnect the pump from the mains power supply in the event of an emergency. Clearly assign and label this option to the pump.

**WARNING!**
An on/off switch may not be fitted on the pump, dependent on the identity code and installation.
CAUTION!
Pump can be damaged

The pump can only be stopped when running via an:
- External cable
- [Stop] key.

Use a relay or a contactor if the pump is to be definitively actuated via the mains cable. However, take into account the pump's starting current.

To be able to switch off the pump (to a zero-volts state) independently from the entire installation (e.g. for repair), use an electrical isolating device in the mains supply cable, e.g. a mains switch or a plug / socket combination. Clearly identify this isolating device as such.

Install the pump cable. Use the original cable supplied!

- Key electrical data can be found on the pump’s nameplate.

7.2.4 Other units

Other units

Install the other units on the basis of the documentation supplied.
8 Basic set-up principles

- Please also refer to all the overviews covering “Operating/set-up overview for Sigma X Control types” and “Operating menu for Sigma X Control types, complete” in the appendix and the “Overview of equipment and control elements” and “Control elements” chapters.

- The pump exits the menu and returns to a continuous display if [Menu] is pressed or no key is pressed for 60 seconds.

8.1 Basic principles for setting up the control

shows using the “Language” example how to set up something - in turn:

- Sequence of displays
- The path derived from this
- The path as presented in the operating instructions

Fig. 29: Please read

---

Tab. 2: Legend:

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>[Menu]</td>
<td>Press [Menu]</td>
</tr>
<tr>
<td>[Clickwheel]</td>
<td>Turn the [Clickwheel]</td>
</tr>
<tr>
<td>[Clickwheel]</td>
<td>Press the [Clickwheel]</td>
</tr>
</tbody>
</table>

"Setting up the language" in detail

1. To access the ‘Menu’: press the [Menu] key.
   - The cursor immediately points to ‘Information’.

2. To switch from ‘Information’ to ‘Language’: turn the [Clickwheel].

3. To return to the ‘Language’ menu: press the [Clickwheel].
   - The cursor points to a language.

4. To switch to ‘Deutsch’: turn the [Clickwheel].

5. To save: press the [Clickwheel].
   - The software shows a display by way of confirmation.

After 2 seconds, it returns to the higher-level ‘Menu’.

Fig. 30: "Setting up the language": As an example of set-up and path displays
Basic set-up principles

6. To complete the setting: press [Menu].
   Alternatively: wait 60 seconds or exit the 'Menu' via the [Menu] key or using 'End'.

Confirming an entry

Briefly press the [Clickwheel].
⇒ The software switches to the next menu point or back to the menu and saves the entry.

Exiting a menu option without confirming it

Press [Back].
⇒ The software switches to the next menu point or back to the menu without saving anything.

Returning to a continuous display

Press [Menu].
⇒ The software cancels the entry and switches to a continuous display without saving anything.

Changing adjustable variables

![Fig. 31: a) Changing from one figure to its initial figures; b) Changing the figure; c) Returning from the last figure to the (complete) figure (to correct a wrong figure, for example).](image)

Changing a (complete) number

Turn the [Clickwheel].
⇒ The value of the figure highlighted is raised or lowered.

Changing figures

1. To adjust the value of a figure digit-by-digit, press [Priming].
   ⇒ The first figure is highlighted - see Figure above, point a)
2. To adjust the value of a figure, turn the [Clickwheel].
3. To move to the next figure, press [Priming] - see above Figure, point b).
4. To run through the figures again, if necessary (possibly because of an incorrect figure), when you get to the last figure press \textit{[Priming]} again - see above Figure, point c).

\( \Rightarrow \) Now you can start from the beginning again.

Confirming adjustable variables

Press the \textit{[Clickwheel]} 1x.

\( \Rightarrow \) The software saves the entry.

8.2 Checking adjustable variables

Continuous displays

Before adjusting the pump, you can check the current settings of the adjustable variables:

\( \Rightarrow \) Simply turn the \textit{[Clickwheel]} if the pump is showing a continuous display.

\( \Rightarrow \) Each time the \textit{[Clickwheel]} engages when you turn it, you will see a different continuous display.

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

Secondary displays

The lowest line of a continuous display shows different information (which cannot be adjusted in the secondary display) - see "Continuous displays and secondary displays" overview in the appendix.

You can access secondary displays via any continuous display as follows:

1. Press the \textit{[Clickwheel]} for 3 seconds.

\( \Rightarrow \) A frame appears around the secondary display.

2. Providing there is a frame, you will see a different secondary display each time the \textit{[Clickwheel]} engages when turned.

When you reach the secondary display you wish, leave the \textit{[Clickwheel]} and wait briefly.

8.3 Changing to Setting mode

In a continuous display, if you press \textit{\[Menu\]}, the pump in Setting mode changes to \textit{\[Menu\]}. For more information refer to the following chapter entitled “Set up / Menu”.

If under ‘Access protect.’ only ‘Menu’ or ‘All’ has been set up (top right \textit{\[lock\]} lock symbol), then after pressing the \textit{[Clickwheel]}, first enter the ‘Password’.
9 Set up / ‘Menu’

- Please also refer to all overviews covering "Operating/set up overview" and "Operating menu for Sigma X Control type, complete" in the appendix and the "Overview of equipment" and "Control elements" chapters.
- The pump exits the menu and returns to a continuous display if [Menu] is pressed or no key is pressed for 60 seconds.

The ‘Menu’ is sub-divided as follows:
1 - ‘Information’
2 - ‘Operating mode’
3 - ‘Settings’
4 - ‘Timer’
5 - ‘Service’
6 - ‘Language’

9.1 ‘Information’

You can find out different information about your pump in the ‘Information’ menu. The number and type can depend on the pump settings.

9.2 ‘Operating mode’

You can switch between the operating modes in the ‘Operating mode’ menu. You can enter the settings for this in the ‘Settings’ menu.
- ‘Manual’
- ‘Batch’
- ‘Contact’
- ‘Analog’

9.3 ‘Settings’

You can enter the settings for the ‘Operating mode’ menu. You can switch between the operating modes in the ‘Operating mode’ menu. You can enter the settings for this in the ‘Settings’ menu.
- ‘Manual’
- ‘Batch’
- ‘Contact’
- ‘Analog’
The ‘Settings’ menu generally includes these setting menus:

1 - The operating mode set (exception: ‘Manual’)
2 - ‘Metering’
3 - ‘Calibrate’
4 - ‘Inputs/outputs’
5 - ‘System’
6 - ‘Set time’
7 - ‘Date’

9.3.1 ‘Operating mode’

9.3.1.1 ‘Manual’

‘Manual’ operating mode allows you to operate the pump manually. The stroke rate can be set in the continuous display of this operating mode.

9.3.1.2 ‘Batch’

The ‘Batch’ operating mode enables you to pre-select large metering volumes. You can only select whole numbers but no fractions as the number of strokes (figures 1 to 99,999).

You can trigger the strokes using the [Clickwheel] if you have already switched to the ‘Push’ continuous display. You can also trigger them via a pulse using the "External control" terminal.

Memory - remaining strokes not yet processed

You can also activate the ‘Memory’ function extension (“memory” identifier). When ‘Memory’ is activated, the pump adds up the remaining strokes, which could not be processed, up to the maximum capacity of the stroke memory of 99,999 strokes. If this maximum capacity is exceeded, the pump goes into fault mode.

CAUTION!

- The pump maintains its stroke rate when changing over from ‘Manual’ operating mode to ‘Batch’ operating mode.
- When you press [STOP/START] or the “Pause” function is activated, the ‘Memory’ is cleared.

9.3.1.3 ‘Contact’

9.3.2 ‘Menu / Information’

47
'Contact' operating mode allows you to trigger individual strokes or a series of strokes.

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

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

**CAUTION!**
The pump maintains the stroke rate when changing over from 'Manual' operating mode to 'Contact' operating mode.

**Memory - Pulses not yet processed**

You can also activate the 'Memory' function extension ("memory" identifier). When 'Memory' is activated, the pump adds up the remaining strokes, which could not be processed, up to the maximum capacity of the stroke memory of 99,999 strokes. If this maximum capacity is exceeded, the pump goes into fault mode.

**CAUTION!**
– Only with 'Memory' - 'off': If you press [STOP/START] or empty the contact memory ('Menu / Information ➔ Service ➔ Clear counters') or the "Pause" function is activated, the 'Memory' is cleared.

**Factor**

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

Number of strokes executed = factor x number of incoming pulses
### Table of examples

<table>
<thead>
<tr>
<th>Factor</th>
<th>Pulse (sequence)</th>
<th>Number of strokes (sequence)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step-up</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>25</td>
<td>1</td>
<td>25</td>
</tr>
<tr>
<td>99.99</td>
<td>1</td>
<td>99.99</td>
</tr>
<tr>
<td>1.50</td>
<td>1</td>
<td>1.50 (1 / 2)</td>
</tr>
<tr>
<td>1.25</td>
<td>1</td>
<td>1.25 (1 / 1 / 1 / 2)</td>
</tr>
<tr>
<td><strong>Step-down</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>0.50</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>0.10</td>
<td>10</td>
<td>1</td>
</tr>
<tr>
<td>0.01</td>
<td>100</td>
<td>1</td>
</tr>
<tr>
<td>0.25</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>0.40</td>
<td>2.5 (3 / 2)</td>
<td>(1 / 1)</td>
</tr>
<tr>
<td>0.75</td>
<td>1.33 (2 / 1 / 1)</td>
<td>(1 / 1 / 1)</td>
</tr>
</tbody>
</table>

**Tab. 3: *Explanation of the conversion ratio***

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

**Tab. 4: **Explanation of step-down**

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

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

### 9.3.1.4 ‘Analogue’ (optional)

- **Menu / Information** ➔ **Settings** ➔ **Operating mode** ➔ **Analogue** ➔...
The secondary display "Signal current" indicates the incoming current. You can select 5 types of current signal processing:

- '0 - 20 mA'
- '4 - 20 mA'
- 'Linear curve'
- 'Lower side band'
- 'Upper side band'

'Standard'

'0 - 20 mA'
At 0 mA the pump is stationary –
At 20 mA the pump works at maximum stroke rate.

'4 - 20 mA'
At 4 mA the pump is stationary –
At 20 mA the pump works at maximum stroke rate.

'Extended'

Curve

'Linear curve'
The symbol "Linear curve" appears on the LCD screen. You can enter any pump stroke rate behaviour proportional to the current signal. You can enter the curve points I and F in the 'Curve points' menu. You define a straight line here and thus the behaviour:

\[ \frac{F_i}{I_i} = \frac{F_e}{I_e} \]

[Diagram of linear curve]

Fig. 32: Frequency-current diagram for "Linear curve"

Plot a diagram similar to the one above – with values for \((I_1, F_1)\) and \((I_2, F_2)\) – so that you can set the pump as desired!

The smallest processable difference between \(I_1\) and \(I_2\) is 4 mA (\(||I_1-I_2|| \geq 4\) mA).

'Lower side band'
Using this type of processing, you can control a metering pump using the current signal as shown in the diagram below. You can enter the curve points I and F in the ‘Curve points’ menu.

However, you can also control two metering pumps for different feed chemicals via a current signal (e.g. one acid pump and one alkali pump using the signal of a pH sensor). To do this, connect the pumps electrically in series.

Fig. 33: Frequency-current diagram for a) Lower side band, b) Upper side band

'Upper side band'

Using this processing type, you can control a metering pump using the current signal as shown in the diagram above. You can enter the curve points I and F in the ‘Curve points’ menu.

Everything functions according to the ‘Lower side band’ type of the processing.

Curve points

To define the above curves, enter any two points P1 (I1, F1) and P2 (I2, F2) in the ‘Curve points’ menu (F1 is the stroke rate at which the pump is to operate at current I1, F2 is the stroke rate at which the pump is to operate at current I2...).

Error mess. i < 4 mA

You can select in the ‘Error message i < 4 mA’ menu item whether the pump should issue an error message and stop with current signals below 3.8 mA (Standard).

9.3.2 ‘Metering’

‘Menu / Information’ ➔ ‘Settings’ ➔ ‘Metering’ ➔ ‘...’

9.3.2.1 ‘Metering profile’

‘Menu / Information’ ➔ ‘Settings’ ➔ ‘Metering’ ➔ ‘Metering profile’ ➔ ‘...’

Under ‘Metering’ ➔ ‘Metering profile’ you can precisely match the pump metering flow over time against the requirements of the particular application - see “Functional description” chapter.
**Metering optimised**

With ‘metering optimised’, the discharge stroke is elongated, the suction stroke is executed as quickly as possible. This setting is suitable, among other things, for applications that require optimum mixing ratios and chemical mixing that is as continuous as possible.

**Priming optimised**

Under ‘metering profile’ - ‘priming optimised’, the suction stroke is elongated as much as possible, which makes possible the precise and problem-free metering of viscous and gaseous media. Select this setting to minimise the NPSH value as well.

**Standard**

With ‘metering profile’ - ‘Standard’ the pump meters as usual.

If the pump has been ordered with an ‘Overload shut-down’, then ‘Standard’ is the only possible ‘Metering profile’.

**9.3.2.2 ‘Pressure stage’**

With ‘metering profile’ - ‘Pressure stage’ you can reduce the nominal pressure of the pump via the pressure stages – refer to the “Functional description” chapter.

When selecting a pressure stage, you are simultaneously selecting the error behaviour.

**Tab. 5: Nominal pressures depending on the size of the liquid ends and the pressure stages**

<table>
<thead>
<tr>
<th>Pressure stage</th>
<th>4</th>
<th>7</th>
<th>10</th>
<th>16</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size of liquid end</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16050 *</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>16090 *</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>16130 *</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>07120</td>
<td>X</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>07220</td>
<td>X</td>
<td>X</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>04350</td>
<td>X</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

* the pressure of the plastic liquid ends is reduced to 10 bar.

**Overload shut-down**

The switch-off pressure of the active overload shut-down falls at the same time as the pressure stage - refer to the “Functional description” chapter.

The overload shut-down is used to protect the pump, not the system. It does not replace a relief valve.

In the event of an overload, the pump signals an error via the LED displays, the LCD screen and - if fitted – the fault indicating relay.

There are two types of overload shut-down:

- the pump stops immediately at a sudden rise in pressure (e.g. shut-off valve closed). It displays the error 60 “line block” and 59 “p+”.
- the pump stops with a delay with a slow rise in pressure (e.g. crystals in lines causing them to slowly close up). It displays the error 59 “p+”.

You can also select ‘Error’ and ‘Warning’ as a reaction in the menu: then the pump issues a warning but continues to run.
9.3.3 ‘Calibration’

You can disable the overload shut-down by selecting ‘Pressure stage’ - ‘none’. Like other critical settings, this setting is also recorded in the internal error memory.

Accuracy of calibration

Normally the pump does not have to be calibrated. The pump can be calibrated if viscous feed chemicals are used or extremely high accuracy is required.

WARNING!

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

Preparation

1. Use the [Clickwheel] to scroll through the continuous display to check whether litres or gallons have been selected.
2. If the incorrect volume unit has been selected, correct it in the ‘Menu / Information ➔ Settings ➔ System ➔ Unit’ menu.
3. Check whether the stroke rate in the continuous display is not too low for calibration.
4. Lead the suction hose into a measuring cylinder containing the feed chemical – make sure that the discharge hose is installed permanently (operating pressure, ...!).
5. Prime the feed chemical (press [Priming]) if the suction hose is empty.

Calibration process

1. Record the level in the measuring cylinder.
2. Select the ‘Menu / Information ➔ Settings ➔ Calibrate’ menu and press the [Clickwheel].

⇒ The ‘Start calibration’ (PUSH) menu item appears.
3. To start calibration, press the [Clickwheel]:
   ⇒ The ‘Calibrate …’ menu item appears, the pump starts to pump and indicates the number of strokes.

4. After a reasonable number of strokes (a minimum of 200), use the [Clickwheel] to stop the pump.
   ⇒ The ‘Calibration ended’ menu item appears. It requests you to enter the calibration volume.

5. Determine the required metering volume (difference between initial volume - remaining volume in the measuring cylinder).

6. Use the [Clickwheel] to enter this volume in the ‘Calibration ended’ menu items and close.
   ⇒ The pump switches to the ‘Calibration result’ menu item - the pump is calibrated.

7. Press the [Clickwheel]:
   ⇒ The pump returns to the ‘Menu / Information ➔ Settings’ menu.

9.3.4 ‘Inputs/outputs’

   ⇒ ‘Menu / Information ➔ Settings ➔ Inputs/outputs ➔ …’

The ‘Inputs/outputs’ menu splits into the following sub-menus:

1. ‘Auxiliary frequency’
2. ‘Relay1’ (optional)
3. ‘Relay2’ (optional)
4. ‘mA-Output’ (optional)
5. ‘Flow monitor’ (only if connected)
6. ‘Diaphragm rupture’ (only if connected)

9.3.4.1 ‘Auxiliary frequency’

   ⇒ ‘Menu / Information ➔ Settings ➔ Inputs/outputs ➔ Auxiliary frequency ➔ …’

The programmable function ‘Auxiliary frequency’ facilitates the switchover to an auxiliary stroke rate, which can be set in the ‘Auxiliary frequency’ menu.

It can be activated via the "External control" terminal. If the ‘Auxiliary frequency’ is present, then the identifier “AUX” appears on the LCD screen.

Refer to the "Hierarchy of Operating Modes, Functions and Fault Statuses" for the order of the various operating modes, functions and fault statuses.

9.3.4.2 ‘Relay1 (optional)’

   ⇒ ‘Menu / Information ➔ Settings ➔ Inputs/outputs ➔ Relay1 ➔ …’

The setting options for the ‘Relay’ function only exist if a relay is fitted.
Tab. 6: Relay, physical and pre-set to ...

<table>
<thead>
<tr>
<th>Identity code specification</th>
<th>Relay, physical</th>
<th>Pre-set to ...</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1 x changeover contact 230 V – 8 A</td>
<td>Fault indicating relay, N/C</td>
</tr>
<tr>
<td>3</td>
<td>2 x N/O 24 V – 100 mA</td>
<td>Fault indicating relay, N/C, and pacing relay</td>
</tr>
<tr>
<td>8</td>
<td>1 x N/O 24 V – 100 mA, + 4...20 mA output</td>
<td>Fault indicating relay, N/C</td>
</tr>
</tbody>
</table>

Relay type

You can reprogram the relays to these types:

Tab. 7: Relay type / relay reactions setting

<table>
<thead>
<tr>
<th>Menu setting</th>
<th>Warning message</th>
<th>Error message</th>
<th>Manual stop</th>
<th>Stop via bus</th>
<th>Pause</th>
<th>Stroke rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>‘Warning’</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>‘Error’</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>‘Warning + error’</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>‘Warning + error + stop’</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>‘Stop’</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>‘Stroke rate’ **</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>‘Pump inactive’</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

* see the "Troubleshooting" chapter

** only use ‘Relay 2’ for this relay type (semiconductor relay). The relay switches with every stroke.

Relay polarity

You can set here how a relay is to switch.

<table>
<thead>
<tr>
<th>Menu setting</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>normally-closed (NC)</td>
<td>The relay is closed in normal mode and opens with a triggering event.</td>
</tr>
<tr>
<td>normally-open (NO)</td>
<td>The relay is open in normal mode and opens with a triggering event.</td>
</tr>
</tbody>
</table>

9.3.4.3 ‘Relay2 (optional)’

Menu / Information ➔ Settings ➔ Inputs/outputs ➔ Relay2 ➔ ...

Relay cycle quantity

You can set the metering volume for which the pacing relay is to switch once here.

For more information on ‘Relay2’ - see Chapter 9.3.4 ‘Inputs/outputs’ on page 54.
9.3.4.4 ‘mA-Output (optional)’

You can set which current range is to be used at the mA output here.

Under ’Function’, you can then set whether the current stroke rate (‘strokes / minute’) is to be signalled at the mA output or the capacity (litres / hour).

9.3.4.5 ‘Flow control’

A metering monitor, such as a Flow Control (also DulcoFlow®), can register the individual pressure impacts of the pump and report them back to the pump.

It is possible to switch the function on and off under ‘Activation’. The pump switches to fault mode if this feedback isn’t provided a certain number of times in succession as set under ‘Tolerance / strokes’.

Under ‘at Auxiliary’, it is possible to set whether the function is to be deactivated with auxiliary frequency.

Under ‘Signalling’, you can set whether the control is to trigger an error or a warning when the tolerance is exceeded.

9.3.4.6 ‘Diaphragm rupture’

In the ‘Diaphragm rupture’ sub-menu you can select whether the pump generates a warning message or an error message in the event of a diaphragm rupture.

9.3.5 ‘System’

The ‘System’ menu splits into the following sub-menus:
1 - ‘Bluetooth’
2 - ‘Volume unit’
9.3.5.1 ‘Bluetooth’

![image]

You can switch the pump’s Bluetooth communication on and off in the ‘Bluetooth’ sub-menu. The blue “Bluetooth active” LED lights up on the HMI.

9.3.5.2 ‘Volume unit’

![image]

You can select another unit for the volume in the ‘Volume unit’ sub-menu.

9.3.6 ‘Set time’

![image]

You can set the time in the ‘Set time’ menu.

1. Use the dial to adjust a figure.

2. Use [Priming] to move to the next figure.

Under ‘Auto. Summertime’ you can select whether you wish to change over to ‘Summertime’.

You can also input when the pump is to change to and from ‘Summertime’.

Check under ‘Location’ whether the pump is also set to its own ‘hemisphere’ of the world.

9.3.7 ‘Date’

![image]

You can set the date in the ‘Date’ menu.

9.4 ‘Timer’

![image]

The process timer can do the following to the pump at a predefined time:

- start
- stop
- change operating mode
- open the relay (with "CTRL software" higher than 01.01.03.01)
- close the relay (with "CTRL software" higher than 01.01.03.01)

9.4.1 Timer ‘activation’

![image]

To activate the timer, set ‘Activation’ to ‘active’.
9.4.2 ‘Setting the timer’

You can create commands (program lines) for a timer program in the ‘Set timer’ menu.

You can create up to 32 commands (program lines).

You can then use the administration functions to manage the commands - see Chapter 9.4.2 ‘Setting the timer’ on page 58.

Use the ‘Clear all’ function to clear all commands (the program).

Create the command as follows:

1. Create a command (program line)
2. Select the triggering event and time
3. Select the action and value
4. Check the command
5. Save command by pressing the Clickwheel
6. Create the next command if necessary

9.4.2.1 Administration functions for commands

The following administration functions are available to manage the commands (program lines):

- ‘Display’ (only if commands entered)
- ‘Change’ (only if commands entered)
- ‘Clear’ (only if commands entered)
- ‘New’

Use ‘New’ to create a new command.

9.4.2.2 ‘Init’ Initial conditions

Use ‘Init’ to specify initial conditions at the start of the program - see Chapter 9.4.2.4 ‘Select the action and value’ on page 59.

9.4.2.3 Selecting the ‘Time event’ and Time

You can select a time event (cycle) and a time as well:

<table>
<thead>
<tr>
<th>Time event</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>‘Hourly’</td>
<td>hourly at the x minute</td>
</tr>
<tr>
<td>‘Daily (Mon-Sun)’</td>
<td>daily at the time mm.ss, Monday to Sunday</td>
</tr>
<tr>
<td>‘Weekdays1 (Mo-Fr)’</td>
<td>daily at the time mm.ss, Monday to Friday</td>
</tr>
<tr>
<td>‘Weekdays1 (Mo-Sa)’</td>
<td>daily at the time mm.ss, Monday to Saturday</td>
</tr>
<tr>
<td>‘Weekend (Sa+Su)’</td>
<td>daily at the time mm.ss, Saturday and Sunday</td>
</tr>
</tbody>
</table>
9.4.2.4 Select the action and value

You can select an action and also a value:

<table>
<thead>
<tr>
<th>Action</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manual</td>
<td>Strokes/h</td>
</tr>
<tr>
<td>Stop</td>
<td>-</td>
</tr>
<tr>
<td>Frequency</td>
<td>Strokes/h</td>
</tr>
<tr>
<td>Contact</td>
<td>-</td>
</tr>
<tr>
<td>Batch (input)</td>
<td>-</td>
</tr>
<tr>
<td>Batch (time)</td>
<td>hh:mm</td>
</tr>
</tbody>
</table>

9.4.2.5 Checking the finished command

The pump displays the finished command (program line) as soon as you have finished programming the command:

```
Command 01/05
monthly
10:48   on 21st
Manual
0.25 l/h
```

9.4.3 ‘Clear all’

Use the ‘Clear all’ menu to clear all commands (the program).
9.4.4 Example

The pump is to meter 2 litres every half hour every weekday (Mon-Fri) between 8:00 and 11:00:

<table>
<thead>
<tr>
<th>Command</th>
<th>Time event</th>
<th>Time of day</th>
<th>Action</th>
<th>Capacity</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Init</td>
<td>-</td>
<td>Stop</td>
<td>-</td>
<td>// Ensure that the pump is at a standstill at the start.//</td>
</tr>
<tr>
<td>02</td>
<td>workdays 1 (Mo-Fr)</td>
<td>08:30</td>
<td>Manual</td>
<td>12,000 l/h</td>
<td>//Meter with 12,000 l/h//</td>
</tr>
<tr>
<td>03</td>
<td>workdays 1 (Mo-Fr)</td>
<td>08:40</td>
<td>Stop</td>
<td>-</td>
<td>//Stop//</td>
</tr>
<tr>
<td>04</td>
<td>workdays 1 (Mo-Fr)</td>
<td>09:30</td>
<td>Manual</td>
<td>12,000 l/h</td>
<td>//Meter with 12,000 l/h//</td>
</tr>
<tr>
<td>05</td>
<td>workdays 1 (Mo-Fr)</td>
<td>09:40</td>
<td>Stop</td>
<td>-</td>
<td>//Stop//</td>
</tr>
<tr>
<td>06</td>
<td>workdays 1 (Mo-Fr)</td>
<td>10:30</td>
<td>Manual</td>
<td>12,000 l/h</td>
<td>//Meter with 12,000 l/h//</td>
</tr>
<tr>
<td>07</td>
<td>workdays 1 (Mo-Fr)</td>
<td>10:40</td>
<td>Stop</td>
<td>-</td>
<td>//Stop//</td>
</tr>
</tbody>
</table>

Explanation: At a capacity of 12 l/h, the pump has to work for 10 minutes to meter 2 litres.

9.5 ‘Service’

‘Menu / Information → Service → ...’

9.5.1 ‘Password’

‘Menu / Information → Service → Password → ...’

You can lock the setting options here.

If you have set a ‘Password’ - see below, then the identifier appears after 1 minute in the top left and the setting options are locked - if no key has been pressed in the meantime.

In the meantime, a key appears there and a small progress bar.

9.5.2 ‘Clear counter’

‘Menu / Information → Service → Clear counter → ...’

You can reset the counter to "0" in the ‘Clear counter’ menu:

- ‘All’
- ‘Stroke counter’ (total number of strokes)
- ‘Volume counter’ (total litres)
- ‘Contact memory’
To clear: exit the menu by briefly pressing the [Clickwheel].

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

9.5.3 ‘Log book’

You can view the list of ‘Log entries’ here.
A ‘Filter’ helps with the overview.


<table>
<thead>
<tr>
<th>Tab. 8: Input information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Line</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>5</td>
</tr>
</tbody>
</table>

9.5.4 ‘Display’

You can set the ‘Contrast’ and the ‘Brightness’ of the LCD screen here.

9.5.5 ‘HMI logout’

You can log off the HMI from the internal pump CAN bus here.

9.5.6 ‘Diaphragm part number: XXXXXXX’

You can read off the part number (order number) of the correct diaphragm here.
9.5.7 ‘Spare parts kit part number: XXXXXXX’

You can read off the part number (order number) of the correct spare parts kit here.

9.6 ‘Language’

You can select the desired operating language in the ‘Language’ menu.
10 Start up

Safety information

---

**WARNING!**

Fire hazard with flammable media

Only with flammable media: They can be ignited by oxygen.

- The pump may not work if there is a mixture of feed chemical with oxygen in the liquid end. A specialist may need to take appropriate actions (using inert gas, ...).

---

**WARNING!**

Only motors with a frequency converter: Danger of electric shock

The danger of electric shock remains for 3 minutes after the mains voltage has been switched off on conducting parts of the motor with an integrated frequency converter and on the lines themselves.

- After switching off, allow the device to stand for 3 minutes before opening the terminal box.

---

**CAUTION!**

Warning of personal injury and material damage

The metering pump may only be operated by trained personnel. The operator is responsible for ensuring that under the given operating conditions (pressure, temperature, corrosiveness, etc.) danger to the operating personnel is avoided by use of appropriate accident prevention measures.

---

**CAUTION!**

Only motors with a frequency converter: The motor can be damaged

The input current limiter could be damaged if a motor with an integrated frequency converter is restarted within 3 minutes of the mains voltage being switched off.

- After switching off, allow the device to stand for at least 3 minutes before restarting.

---

**CAUTION!**

Feed chemical could escape

- Check suction and discharge lines, and liquid end with valves, for leak-tightness and tighten if necessary.
- Check whether the necessary flushing pipes or bleed lines have been connected.

---

**CAUTION!**

Liquid end may be damaged

- Always fit a filter in the suction line with feed chemicals with a particle size greater than 0.3 mm
Start up

**CAUTION!**
Prior to commissioning, check that the pump and corresponding ancillary equipment is connected in compliance with the regulations!

**Observe the technical data**

**CAUTION!**
Danger of material damage
Observe the details in the chapter "Technical data" (pressure, viscosity, resistance, etc.).

**Checking for regulation-compliant installation**

Check that the installation complies with the regulations

**Diaphragm rupture sensor**

**CAUTION!**
Danger resulting from unnoticed diaphragm rupture
If the pump has been ordered with an electric diaphragm rupture sensor, it still has to be installed.

- Screw the enclosed diaphragm rupture sensor into the liquid end.

**CAUTION!**
Warning of unnoticed diaphragm rupture
Only above approximately 2 bar system back pressure is a signal generated in the event of the rupture of a diaphragm.

- Only rely on the diaphragm rupture sensor with back pressures of greater than 2 bar.
  Or install a back pressure valve and set it to a minimum of 2 bar – if the installation permits this.

**CAUTION!**
Possible environmental and material damage
In event the red gear bleeding plug is sealed, during operation it prevents any pressure compensation between the drive housing and the surroundings. This ensures that oil can be pushed from the drive housing.

- Remove the gear bleeding plug before commissioning.

**Remove the gearbox vent stopper**
Before start up, remove the red gearbox vent stopper, see "Overview of equipment and control elements" chapter.

**Checking the oil level**
When the pump is idle, check whether the oil level in the pump is in the middle of the oil level indicator.

This will rule out the pump losing oil and suffering damage.
Avoid particles

The valves may no longer close properly with feed chemicals with a particle size of greater than 0.3 mm.
- Install a suitable filter in the suction line.

Using the integral relief valve

CAUTION!
Danger due to incorrect use of the integral relief valve
The integral relief valve can only protect the motor and the gear, and then only against impermissible positive pressure that is caused by the metering pump itself. It cannot protect the system against positive pressure.
- Protect the motor and gear of the system against positive pressure using other mechanisms.
- Protect the system against illegal positive pressure using other mechanisms.

CAUTION!
Danger of the integral relief valve failing
The integral relief valve no longer operates reliably with feed chemicals having a viscosity of greater than 200 mPa s.
- Only use the integral relief valve with feed chemicals having a viscosity up to 200 mPa s.

Priming against pressure

1. Hydraulically isolate the discharge line from the pump using an isolation device.
2. Turn the rotary dial on the integral relief valve in a counter-clockwise direction as far as the "open" stop.
   ⇨ The excess pressure escapes through the hose connector.
3. Run the pump until the feed chemical coming out of the hose connector is free from bubbles.
4. Turn the rotary dial on the integral relief valve in a clockwise direction up to the "close" stop.
   ⇨ The pump can be started.

When operating the integral relief valve close to the opening pressure, a minimal overflow into the overflow line can occur.
Adjusting the stroke length

Only adjust the stroke length when the pump is running. This is easier and also better for the pump.

Fig. 34: Adjusting the stroke length

- 100% = 4 rotations
- 25 % = 1 rotation
- 0.5 % = 1 scale mark on stroke adjustment dial

Earthing lines
Check whether the earthing lines in the pump's electrical units are correctly connected and connected to a clean earth wire - see earthing diagrams in the appendix.

Potential equalisation lines (mandatory with ATEX)
Check whether the potential equalisation lines are sitting correctly on the pump and connected to a clean potential equalisation point.

Auxiliary equipment
Check for the correct function of the auxiliary equipment and for correct interplay.
11 Operation

WARNING!
Fire hazard with flammable media
Only with flammable media: They can be ignited by oxygen.
- The pump may not work if there is a mixture of feed chemical with oxygen in the liquid end. A specialist may need to take appropriate actions (using inert gas, ...).

This chapter describes all the operating options in a continuous display (several symbols and the pressure display appear at the top in the black bar) for the trained person at the pump.

- Please also refer to the “Operating/Setting overview” and “Continuous displays and secondary displays” overviews at the end of the operating instructions and also the “Overview of equipment and control elements” chapter.

11.1 Manual operation

Stop/start pump
Stop the pump: Press [STOP/START].
Start the pump: Press [STOP/START] again.

Priming
Press [Priming].

Starting a batch
In ‘Batch’ operating mode: Turn the [Clickwheel] in a continuous display until the ‘Push’ continuous display appears and then press the [Clickwheel].

Acknowledge errors
Press the [Clickwheel] to acknowledge error messages that require acknowledgement.

Check adjustable variables
In a continuous display: Another continuous display appears each time the [Clickwheel] engages when turned. (The number depends on the configuration).

Change directly adjustable variables

Changing a variable in the relevant continuous display:
1. Press the [Clickwheel].
   ⇔ The variable can be changed (highlighted).
2. Turn the [Clickwheel].
   ⇔ The variable is changed.
3. Press the [Clickwheel].
   ⇔ The variable is saved (the dark highlighting disappears).

If the "lock" - "lock all" has been set - see ‘Set-up overview of the Sigma X Control type’ on page 68, first enter the “Password” after pressing the [Clickwheel].
List of directly changeable variables:
- Capacity
- Stroke rate
- Factor
- Contact volume
- Batch volume

Set-up overview of the Sigma X Control type

Fig. 35: Control options using the keys
- Press the [Clickwheel]
- Turn the [Clickwheel]
  ① "Lock menu"
  ② "Lock all"
12 Maintenance

Safety information

**WARNING!**
**Fire hazard with flammable media**
Only with flammable media: They can be ignited by oxygen.
- The pump may not work if there is a mixture of feed chemical with oxygen in the liquid end. A specialist may need to take appropriate actions (using inert gas, ...).

**WARNING!**
It is mandatory that you read the safety information and specifications in the “Storage, Transport and Unpacking” chapter prior to shipping the pump.

**CAUTION!**
**Warning of feed chemical spraying around**
Feed chemical can spray out of the hydraulic components if they are manipulated or opened due to pressure in the liquid end and adjacent parts of the system.
- Disconnect the pump from the mains power supply and ensure that it cannot be switched on again by unauthorised persons.
- Depressurise the system before commencing any work on hydraulic parts.

**WARNING!**
**Warning of hazardous feed chemical**
Should a dangerous feed chemical be used: it may escape from the hydraulic components when working on the pump, material failure or incorrect handling of the pump.
- Take appropriate protective measures before working on the pump (e.g. safety glasses, safety gloves, ...). Adhere to the material safety data sheet for the feed chemical.
- Drain and flush the liquid end before working on the pump.

**WARNING!**
**Danger of an electric shock**
When working on the motor or electrical auxiliary equipment, there is a danger of an electric shock.
- Before working on the motor, take note of the safety instructions in its operating instructions!
- Should external fans, servomotors or other auxiliary equipment be installed, these should also be disconnected and checked that they are voltage free.
Third-party spare parts for the pumps may lead to problems when pumping.

- Only use original spare parts.
- Use the correct spare parts kits. In the event of doubt, refer to the exploded views and ordering information in the appendix.

### Standard liquid ends:

<table>
<thead>
<tr>
<th>Interval</th>
<th>Maintenance work</th>
<th>Personnel</th>
</tr>
</thead>
<tbody>
<tr>
<td>After approx. 5,000 operating hours</td>
<td>Change gear oil - refer to &quot;Changing gear oil&quot; in this chapter.</td>
<td>Instructed personnel</td>
</tr>
<tr>
<td>Quarterly</td>
<td>Check the oil level.</td>
<td></td>
</tr>
</tbody>
</table>
| Quarterly*             | - Check that the metering lines are tight at the liquid end and check for leak-tightness.  
                          | - Check that the suction valve and discharge valve are firmly fixed in place.          
                          | - Check that the dosing head screws are tight.                                        
                          | - Check the condition of the metering diaphragm - see § 'Check the condition of the metering diaphragm' on page 70. 
                          | - Check that the flow is correct: Allow the pump to prime briefly.                    
                          | - Check that the electrical connections are intact.                                    | Technical personnel |

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

Under heavy loading (e.g. continuous operation, aggressive feed chemicals etc.): shorter intervals.

### Check the condition of the metering diaphragm

The diaphragm is a wearing part, the service life of which is dependent on the following parameters:

- System back pressure
- Operating temperature
- Feed chemical properties

When using abrasive feed chemicals, the diaphragm service life is reduced. In these cases, more frequent checking of the diaphragm is recommended.

### Tightening torques

<table>
<thead>
<tr>
<th>Data</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tightening torque for screws</td>
<td>7.5±0.5</td>
<td>Nm</td>
</tr>
</tbody>
</table>

### Liquid ends with integral relief valve

**WARNING!**

**Warning of eye injuries**

When opening the relief valve, a spring under high tension can jump out.

- Wear protective glasses.
Draining gear oil

1. Remove the vent screw (1).
2. Place an oil trough under the oil drainage plug (2).
3. Unscrew the oil drainage plug (2) from the power end housing.
4. Allow the gear oil to run out of the power end.
5. Screw in the oil drainage plug (2) with a new seal.

Filling with gear oil

Prerequisit: Gear oil in line with the "Ordering information" chapter is available.

1. Start the pump.
2. Slowly pour gear oil through the vent screw (1) opening until the oil inspection window (3) is half covered.
3. Allow the pump to run slowly for a further 1... 2 minutes
4. Replace the vent screw (1).
13 Carrying out repairs

Safety information

**WARNING!**
Fire hazard with flammable media
Only with flammable media: They can be ignited by oxygen.

- The pump may not work if there is a mixture of feed chemical with oxygen in the liquid end. A specialist may need to take appropriate actions (using inert gas, ...).

**WARNING!**
It is mandatory that you read the safety information and specifications in the “Storage, Transport and Unpacking” chapter prior to shipping the pump.

**CAUTION!**
Warning of feed chemical spraying around
Feed chemical can spray out of the hydraulic components if they are manipulated or opened due to pressure in the liquid end and adjacent parts of the system.

- Disconnect the pump from the mains power supply and ensure that it cannot be switched on again by unauthorised persons.
- Depressurise the system before commencing any work on hydraulic parts.

**WARNING!**
Warning of hazardous feed chemical
Should a dangerous feed chemical be used: it may escape from the hydraulic components when working on the pump, material failure or incorrect handling of the pump.

- Take appropriate protective measures before working on the pump (e.g. safety glasses, safety gloves, ...). Adhere to the material safety data sheet for the feed chemical.
- Drain and flush the liquid end before working on the pump.

13.1 Cleaning valves

Unsuitable spare parts for the valves may lead to problems for the pumps.

- Only use new components that are especially adapted to fit your valve (both in terms of shape and chemical resistance).
- Use the correct spare parts kits. In the event of doubt, refer to the exploded views and ordering information in the appendix.
Only with the "Physiologically safe" design:

**WARNING!**
Product can be dangerously contaminated
Only use the spare parts from the "Physiologically safe" spare parts kits.

Personnel:

- Technical personnel

### Repairing ball valves

**CAUTION!**
Warning of personal injury and material damage
Feed chemical may escape from the liquid end, for example, if ball valves not repaired correctly.

- Only use new components which fit your valve - both in terms of shape and chemical resistance!
- Note the flow direction of the discharge and suction connectors when fitting the valve.

**CAUTION!**
Warning of feed chemical spraying around
PTFE seals, which have already been used / compressed, can no longer reliably seal a hydraulic connection.

- New, unused PTFE seals must always be used.

![Fig. 37: Simple cross-section through ball valve](p_b_0025_sw)

1 Flat seal
2 Valve body
3 Valve ball
4 Valve seat
5 Valve cap
13.2 Replacing the diaphragm

Third-party spare parts for the pumps may lead to problems when pumping.
- Only use original spare parts.
- Use the correct spare parts kits. In the event of doubt, refer to the exploded views and ordering information in the appendix.

Personnel: Technical personnel

Requirements:
- If necessary take protective measures.
- Adhere to the material safety data sheet for the feed chemical.
- Ensure that the system is at atmospheric pressure.

1. Drain the liquid end: Place the liquid end on its head and allow the feed chemical to run out; flush out with a suitable medium; flush the liquid end thoroughly when using hazardous feed chemicals!

2. With the pump running, move the stroke adjustment dial to the stop at 0% stroke length.
   ⇒ The drive axle is now difficult to turn.

3. Switch off the pump.

4. Unscrew the hydraulic connectors on the discharge and suction side.

5. Unscrew the diaphragm rupture sensor from the dosing head.

6. Remove the 6 screws on the dosing head.

7. Remove the dosing head.

8. Check the condition of the diaphragm rupture sensor - see 'Checking the condition of the diaphragm rupture sensor' on page 75.

9. Loosen the diaphragm from the drive axle with a gentle backwards turn in an anti-clockwise direction.

10. Completely unscrew the diaphragm from the drive axle.

11. Tentatively screw the new diaphragm anticlockwise up to the stop on the drive axle.
   ⇒ The diaphragm now is now seated against the stop of the thread while the diaphragm flap is within the tolerance range.

Fig. 38: Tolerance range of the flap on the backplate

1 Diaphragm
2 Backplate
3 Flap
A Tolerance range
12. Should this not work, remove dirt or swarf out of the thread and screw the diaphragm correctly onto the drive axle this time.
   ⇐ If this is still unsuccessful, contact ProMinent-ProMaqua customer service.

13. Place the dosing head with the screws onto the diaphragm - the suction connector should be pointing downwards in the pump's fitting position.

14. Tighten the screws gently to start with.

15. Screw the diaphragm rupture sensor into the dosing head.

16. Start up the pump and adjust the stroke length to 100%.

17. Stop the pump and tighten the screws crosswise. Tightening torque - see .

18. Start the pump and check for leaks at maximum pressure.

---

CAUTION!
Warning of escaping feed chemical
The liquid end may leak should it not be possible to check the tightening torque of the screws.
- Check the tightening torque of the screws after 24 hours of operation!
- With PP, PC and TT dosing heads also re-check the tightening torques quarterly!

---

Checking the condition of the diaphragm rupture sensor

1. If the inside of the diaphragm rupture sensor has become damp or dirt has penetrated it: replace.

---

Fig. 39: Section through the Sigma diaphragm rupture warning system ("Visual break indicator" version)

1. Working layer (≠ operating diaphragm)
2. Safety layer (≠ safety diaphragm)
3. Flap
4. Plunger
5. Diaphragm rupture sensor
6. Cylinder, red
7. Cover, transparent

2. If the piston of the diaphragm rupture sensor - see Fig. 39, item 4 - should have become dirty or damp, clean both it and the hole in which it runs.
Carrying out repairs

3. Check whether it can move freely in the hole.
4. Refit the clean diaphragm rupture sensor with the clean piston.
5. Test the diaphragm rupture sensor.

Optical diaphragm rupture sensor

1. Unscrew the transparent cover from the diaphragm rupture sensor.
2. Press the red cylinder into the diaphragm rupture sensor until it engages.
3. Press the piston on the other side of the diaphragm rupture sensor with a blunt, smooth object into the dosing head (approximately 4 mm) until it triggers.

**CAUTION!**

*Feed chemical may escape*

If the expandable flap of the diaphragm is damaged, then feed chemical can escape when there is a diaphragm rupture.

The piston must not be scratched, it must remain completely smooth so that during operation it does not damage the expandable flap of the diaphragm.

4. Press the red cylinder into the diaphragm rupture sensor again and repeat the test.
5. If it does not trigger both times, replace the membrane rupture sensor.
6. After a successful test, screw the transparent cover onto the diaphragm rupture sensor and then continue at the top by fitting the diaphragm.

Electrical diaphragm rupture sensor

1. Press the piston of the diaphragm rupture sensor with a blunt, smooth object into the dosing head (approximately 4 mm) until the monitor triggers alarm.

**CAUTION!**

*Feed chemical may escape*

If the expandable flap of the diaphragm is damaged, then feed chemical can escape when there is a diaphragm rupture.

The piston must not be scratched, it must remain completely smooth so that during operation it does not damage the expandable flap of the diaphragm.

2. Repeat the test.
3. If the monitor does not trigger an alarm both times, replace the membrane rupture sensor.
4. After a successful test, continue at the top by fitting the diaphragm.
Fig. 40: Cross-section through the liquid end

1 Suction valve
2 Diaphragm
3 Discharge valve
4 Dosing head
5 Backplate
13 Safety diaphragm
14 Troubleshooting

Safety information

WARNING!
Fire hazard with flammable media
Only with flammable media: They can be ignited by oxygen.
- The pump may not work if there is a mixture of feed chemical with oxygen in the liquid end. A specialist may need to take appropriate actions (using inert gas, ...).

WARNING!
Danger of an electric shock
Personnel working on electrical parts can be electrocuted if all electrical lines carrying current have not been disconnected.
- Disconnect the supply cable before working on the motor and prevent it from being reconnected accidentally.
- Any separately driven fans, servo motors, speed controllers or diaphragm rupture sensors fitted should also be disconnected.
- Check that the supply cables are de-energised.

WARNING!
Warning of hazardous feed chemical
Should a dangerous feed chemical be used: it may escape from the hydraulic components when working on the pump, material failure or incorrect handling of the pump.
- Take appropriate protective measures before working on the pump (e.g. safety glasses, safety gloves, ...). Adhere to the material safety data sheet for the feed chemical.
- Drain and flush the liquid end before working on the pump.

CAUTION!
Warning of feed chemical spraying around
Feed chemical can spray out of the hydraulic components if they are manipulated or opened due to pressure in the liquid end and adjacent parts of the system.
- Disconnect the pump from the mains power supply and ensure that it cannot be switched on again by unauthorised persons.
- Depressurise the system before commencing any work on hydraulic parts.

14.1 Faults without a fault message

<table>
<thead>
<tr>
<th>Fault description</th>
<th>Cause</th>
<th>Remedy</th>
<th>Personnel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pump does not prime in spite of full stroke motion and bleeding.</td>
<td>Minor crystalline deposits on the ball seat due to the valves drying out.</td>
<td>Take the suction hose out of the storage tank and thoroughly flush out the liquid end.</td>
<td>Technical personnel</td>
</tr>
</tbody>
</table>
### Fault description | Cause | Remedy | Personnel
--- | --- | --- | ---
Pump does not prime in spite of full stroke motion and bleeding. | Heavy crystalline deposits on the ball seat due to the valves drying out. | Dismantle the valves and clean them - refer to the “Repair” chapter. | Technical personnel
Fluid escapes from the backplate. | The screws in the dosing head are too loose. | Tighten the screws in the dosing head in a diagonal pattern - refer to the “Maintenance” chapter for the tightening torque. | Technical personnel
The CAN LED flickers after the HMI has been connected to the pump. | The software versions of the pump and HMI are different. | Wait. In the long term, arrange for Service to update the pump software. | Customer Service department
Green LED display (operating indicator) does not light up. | The wrong mains voltage or no mains voltage is connected. | Connect the pump correctly to the specified mains voltage - according to the specification on the nameplate. | Electrician

### 14.2 Fault messages

Red “Fault indicator” LED display lights up.

| Fault description | Cause | Remedy | Personnel
--- | --- | --- | ---
The "Level" symbol appears flashing on the LCD screen, plus the error message ‘Level error’ and the pump stops. | The fluid level in the storage tank has reached "Liquid level low 2nd stage". | Top up the storage tank. | Technical personnel
The "External" symbol appears flashing on the LCD screen plus the ‘Memory overflow’ error message, and the pump stops. | The stroke tank has overflowed. | Rectify the cause, then Press [P/OK] (think through the consequences for the process!). | Technical personnel
The i < 4mA symbol appears flashing on the LCD screen plus the error message ‘4 mA undershot’ and the pump stops. | The pump is in ‘Analogue’ operating mode, a fault behaviour has been programmed in the ‘ANALOGUE’ menu and the control current has fallen below 4 mA. | Eliminate the cause of the low control current or | Technical personnel
The i > 20mA symbol appears flashing on the LCD screen plus the error message ‘20 mA exceeded’ and the pump stops. | The pump is in ‘Analogue’ operating mode, a fault behaviour has been programmed in the ‘ANALOGUE’ menu and the control current has risen above 23 mA. | Eliminate the cause of the high control current or | Technical personnel
The symbol appears flashing on the LCD screen plus the error message ‘Defective metering strokes’ and the pump stops. | The metering monitor is not correctly connected. | Connect the metering monitor correctly and Press [P/OK]. | Electrician
The symbol appears flashing on the LCD screen plus the error message ‘Diaphragm rupture’ and the pump stops. | The metering monitor reported too few strokes – more than are set in the ‘FLOW’ menu. | Press [P/OK]. Investigate and clear the cause | Technical personnel
The “Diaphragm” symbol appears flashing on the LCD screen plus the ‘Diaphragm rupture’ error message, and the pump stops. | The diaphragm is broken. | Replace the diaphragm and check the diaphragm rupture sensor - refer to the “Repair” chapter. | Technical personnel
### Fault description

<table>
<thead>
<tr>
<th>Cause</th>
<th>Remedy</th>
<th>Personnel</th>
</tr>
</thead>
<tbody>
<tr>
<td>The STRK &quot;Stoke length adjustment&quot; symbol appears flashing on the LCD screen plus the error message 'Stroke length adjusted' 39, and the pump stops.</td>
<td>The stroke adjustment dial was rotated by more than 10% while the menu was locked.</td>
<td>Turn back the stroke adjustment dial or enter the password.</td>
</tr>
<tr>
<td>The 'Temperature' symbol appears flashing on the LCD screen plus the error message 'Temperature' 47, and the pump stops.</td>
<td>The pump is overloaded.</td>
<td>Rectify the cause, then Press [P/OK] (think through the consequences for the process!).</td>
</tr>
<tr>
<td>The BLC &quot;Blockage&quot; symbol appears flashing on the LCD screen plus the error message 'Pump blocked' 57, and the pump stops.</td>
<td>A constriction or a closed shut-off valve on the discharge side.</td>
<td>Open the shut-off valve or clear the constriction, then Press [P/OK] (think through the consequences for the process!).</td>
</tr>
<tr>
<td>The p+ &quot;Excess pressure&quot; symbol appears flashing on the LCD screen plus the error message 'Overload' 59 or 60, and the pump stops.</td>
<td>A constriction or a closed shut-off valve on the discharge side.</td>
<td>Open the shut-off valve or clear the constriction, then Press [P/OK] (think through the consequences for the process!).</td>
</tr>
<tr>
<td>The PWR &quot;Power&quot; symbol appears on the LCD screen plus the 'Mains voltage' 51 error message, and the pump stops.</td>
<td>No or incorrect mains voltage.</td>
<td>Connect the correct mains voltage.</td>
</tr>
<tr>
<td>The &quot;Level&quot; symbol appears flashing on the LCD screen, plus the error message 'Level warning' 1.</td>
<td>The fluid level in the storage tank has reached &quot;Liquid level low 1st stage&quot;.</td>
<td>Top up the storage tank.</td>
</tr>
<tr>
<td>The cal &quot;Calibration&quot; symbol appears on the LCD screen, plus the error message 'Calibration warning' 2.</td>
<td>The stroke adjustment dial of the calibrated pump was rotated by more than 10% when the menu was blocked.</td>
<td>Turn back the stroke adjustment dial or recalibrate the pump.</td>
</tr>
<tr>
<td>The &quot;Flow&quot; symbol appears flashing on the LCD screen, plus the error message 'Defective strokes metering' 3.</td>
<td>The metering monitor is not correctly connected.</td>
<td>Connect the metering monitor correctly and Press [P/OK].</td>
</tr>
<tr>
<td>The &quot;diaphragm&quot; symbol appears on the LCD screen, plus the error message 'Diaphragm rupture' 4.</td>
<td>The diaphragm is broken.</td>
<td>Replace the diaphragm and check the diaphragm rupture sensor - refer to the &quot;Repair&quot; chapter.</td>
</tr>
<tr>
<td>The &quot;Stroke length adjustment&quot; symbol appears flashing on the LCD screen, plus the error message 'Stroke length wrongly adjusted' 5.</td>
<td>The stroke adjustment dial was rotated by more than 10% while the menu was locked.</td>
<td>Turn the stroke adjustment dial back or enter the code.</td>
</tr>
</tbody>
</table>

### 14.3 Warning messages

Yellow LED "Warning indicator" display lights up:

<table>
<thead>
<tr>
<th>Cause</th>
<th>Remedy</th>
<th>Personnel</th>
</tr>
</thead>
<tbody>
<tr>
<td>The &quot;Level&quot; symbol appears flashing on the LCD screen, plus the error message 'Level warning' 1.</td>
<td>The fluid level in the storage tank has reached &quot;Liquid level low 1st stage&quot;.</td>
<td>Top up the storage tank.</td>
</tr>
<tr>
<td>The cal &quot;Calibration&quot; symbol appears on the LCD screen, plus the error message 'Calibration warning' 2.</td>
<td>The stroke adjustment dial of the calibrated pump was rotated by more than 10% when the menu was blocked.</td>
<td>Turn back the stroke adjustment dial or recalibrate the pump.</td>
</tr>
<tr>
<td>The &quot;Flow&quot; symbol appears flashing on the LCD screen, plus the error message 'Defective strokes metering' 3.</td>
<td>The metering monitor is not correctly connected.</td>
<td>Connect the metering monitor correctly and Press [P/OK].</td>
</tr>
<tr>
<td>The &quot;diaphragm&quot; symbol appears on the LCD screen, plus the error message 'Diaphragm rupture' 4.</td>
<td>The diaphragm is broken.</td>
<td>Replace the diaphragm and check the diaphragm rupture sensor - refer to the &quot;Repair&quot; chapter.</td>
</tr>
<tr>
<td>The &quot;Stroke length adjustment&quot; symbol appears flashing on the LCD screen, plus the error message 'Stroke length wrongly adjusted' 5.</td>
<td>The stroke adjustment dial was rotated by more than 10% while the menu was locked.</td>
<td>Turn the stroke adjustment dial back or enter the code.</td>
</tr>
</tbody>
</table>
Fault description | Cause | Remedy | Personnel
---|---|---|---
The p+ "Overload" symbol appears flashing on the LCD screen plus the error message 'Overload' 6. | A constriction or a closed shut-off valve on the discharge side. | Open the shut-off valve or rectify the constriction. | Technical personnel
The "Temperature" symbol | The frequency converter is overloaded. | Rectify the cause, then Press [P/OK] (think through the consequences for the process!). | Technical personnel
appears flashing on the LCD screen, plus the error message 'Temperature FC' 7. | The temperature is too high. | Rectify the cause, then Press [P/OK] (think through the consequences for the process!). | Technical personnel
The "Temperature" symbol | The pump is overloaded. | Rectify the cause, then Press [P/OK] (think through the consequences for the process!). | Technical personnel
appears flashing on the LCD screen, plus the error message 'Temperature PFC' 7. | The temperature is too high. | Rectify the cause, then Press [P/OK] (think through the consequences for the process!). | Technical personnel
The | The HMI was connected to a CANopen pump. | Disconnect the HMI from the pump. | Technical personnel
'BUS' symbol appears flashing on the LCD screen, plus the error message 'CANopen pump' 8.

14.4 All other faults

Please contact the responsible ProMinent branch or representative - see www.prominent.com - "Contact" - "Your contacts worldwide" or possibly the Legal Notices in these operating instructions.

14.5 Log book

Tab. 9: Input information

<table>
<thead>
<tr>
<th>Line</th>
<th>Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Line number</td>
</tr>
<tr>
<td>2</td>
<td>Date/time</td>
</tr>
<tr>
<td>3</td>
<td>Type of entry (fault, warning ...)</td>
</tr>
<tr>
<td>4</td>
<td>Input number</td>
</tr>
<tr>
<td>5</td>
<td>Explanation of the input</td>
</tr>
</tbody>
</table>

14.5.1 Warning messages in the log book

Tab. 10

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Float switch input reports feed chemical nearing an end</td>
</tr>
<tr>
<td>2</td>
<td>Calibration warning: Appears if the stroke length is adjusted above the tolerance and the pump therefore has to be recalibrated</td>
</tr>
</tbody>
</table>
### 14.5.2 Fault messages in the log book

<table>
<thead>
<tr>
<th>Message no.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>33</td>
<td>The float switch input reports no feed chemical</td>
</tr>
<tr>
<td>34</td>
<td>In ‘Batch’ or ‘Contact’ operating mode, a memory overload has been reached when the memory is switched on. (Memory counter ≥ 100 000)</td>
</tr>
<tr>
<td>35</td>
<td>The analogue current is ≤ 3.8 mA when current monitoring is switched on. (Monitoring is always switched on in Standard operating mode 4..20 mA).</td>
</tr>
<tr>
<td>36</td>
<td>The analogue current is &gt; 23 mA when current monitoring is switched on. (Monitoring is always switched on in Standard operating mode 4..20 mA).</td>
</tr>
<tr>
<td>37</td>
<td>The number of defective strokes permitted has been exceeded</td>
</tr>
<tr>
<td>38</td>
<td>The diaphragm rupture sensor reports a diaphragm rupture</td>
</tr>
<tr>
<td>39</td>
<td>The stroke length has been modified beyond the tolerance limit with the pump locked</td>
</tr>
<tr>
<td>40</td>
<td>Different version statuses of the CTRL, PFC and FC communication software</td>
</tr>
<tr>
<td>41</td>
<td>The HMI version is not compatible</td>
</tr>
<tr>
<td>42</td>
<td>System, EEPROM error</td>
</tr>
<tr>
<td>43</td>
<td>Communication between the pump and operating unit is not working although an operating unit has been configured</td>
</tr>
<tr>
<td>44</td>
<td>Missing ongoing connection to the optional module (Bus fail e.g. PROFIBUS or CANopen not active)</td>
</tr>
<tr>
<td>45</td>
<td>The optional module is missing or no communication is established with the optional module</td>
</tr>
<tr>
<td>46</td>
<td>One of the signals needed from the frequency converter (FC) is missing or no communication is established between the FC and CTRL</td>
</tr>
<tr>
<td>47</td>
<td>One of the signals needed from the power unit (PFC) is missing or no communication is established between the PFC and CTRL</td>
</tr>
<tr>
<td>48</td>
<td>Over-temperature error</td>
</tr>
<tr>
<td>49</td>
<td>Shut-down in the event of overpressure</td>
</tr>
<tr>
<td>50</td>
<td>Error in the power end</td>
</tr>
<tr>
<td>51</td>
<td>Missing or defective position sensor</td>
</tr>
<tr>
<td>52</td>
<td>Mains voltage missing and/or over-/undervoltage</td>
</tr>
<tr>
<td>53</td>
<td>Fan error</td>
</tr>
<tr>
<td>54</td>
<td>Error in the intermediate circuit voltage</td>
</tr>
<tr>
<td>55</td>
<td>The 5 V at the DFM input has short circuited</td>
</tr>
<tr>
<td>56</td>
<td>An optional module was inserted into the pump, which cannot be used.</td>
</tr>
<tr>
<td>57</td>
<td>Subscriber software is incompatible with the other subscribers</td>
</tr>
</tbody>
</table>
### Troubleshooting

<table>
<thead>
<tr>
<th>Message no.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>57</td>
<td>The pump is blocked and is not running</td>
</tr>
<tr>
<td>58</td>
<td>Missing or defective hall sensor</td>
</tr>
<tr>
<td>59</td>
<td>Shut-down in the event of overpressure, slow</td>
</tr>
<tr>
<td>60</td>
<td>Shut-down in the event of overpressure, fast</td>
</tr>
<tr>
<td>-</td>
<td>Missing data stored in the CTRL in the HMI</td>
</tr>
<tr>
<td>-</td>
<td>The data coming from the CTRL is faulty</td>
</tr>
</tbody>
</table>

### 14.5.3 Events in the log book

<table>
<thead>
<tr>
<th>Message no.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>The stroke length was adjusted by more than 5%</td>
</tr>
<tr>
<td>8</td>
<td>Calibration was performed</td>
</tr>
<tr>
<td>9</td>
<td>The pump was started or stopped by the HMI</td>
</tr>
<tr>
<td>13</td>
<td>The timer has performed a timer program step</td>
</tr>
</tbody>
</table>
Decommissioning

15 Decommissioning

**WARNING!**
**Fire hazard with flammable media**
Only with flammable media: They can be ignited by oxygen.
- The pump may not work if there is a mixture of feed chemical with oxygen in the liquid end. A specialist may need to take appropriate actions (using inert gas, ...).

**WARNING!**
**Danger of an electric shock**
When working on the motor or electrical auxiliary equipment, there is a danger of an electric shock.
- Before working on the motor, take note of the safety instructions in its operating instructions!
- Should external fans, servomotors or other auxiliary equipment be installed, these should also be disconnected and checked that they are voltage free.

**WARNING!**
**Danger from chemical residues**
There is normally chemical residue in the liquid end and on the housing after operation. This chemical residue could be hazardous to people.
- It is mandatory that the safety note relating to the "Storage, Transport and Unpacking" chapter is read before shipping or transporting the unit.
- Thoroughly clean the liquid end and the housing of chemicals and dirt. Adhere to the safety data sheet for the feed chemical.

**WARNING!**
**Warning of hazardous feed chemical**
Should a dangerous feed chemical be used: it may escape from the hydraulic components when working on the pump, material failure or incorrect handling of the pump.
- Take appropriate protective measures before working on the pump (e.g. safety glasses, safety gloves, ...). Adhere to the material safety data sheet for the feed chemical.
- Drain and flush the liquid end before working on the pump.
(Temporary) decommissioning

1. Disconnect the pump from the mains/power supply.
2. Depressurise and bleed the hydraulic system around the pump.
3. Drain the liquid end by turning the pump upside down and allowing the feed chemical to run out.
4. Flush the liquid end with a suitable medium - observe the material safety data sheet! Flush the dosing head thoroughly when using hazardous feed chemicals!
5. Possible additional work - refer to the “Storage, transport and unpacking” chapter.

Final decommissioning

Also drain the gear oil - refer to the “Maintenance” chapter.

Disposal

CAUTION!
Environmental hazard due to incorrect disposal
– Note the local guidelines currently applicable in your country, particularly with regard to electronic waste!
Decommissioning

CAUTION!

Environmental hazard due to gear oil

The pump contains gear oil, which can cause damage to the environment.
- Drain the gear oil from the pump.
- Note the local guidelines currently applicable in your country!

In accordance with the European Directive 2012/19/EU on waste electrical and electronic equipment, this device features the symbol showing a waste bin with a line through it. The device must not be disposed of along with domestic waste. To return the device, use the return and collection systems available and observe the local legal requirements.
16 Technical data

16.1 Performance data

<table>
<thead>
<tr>
<th>Type</th>
<th>Minimum pump capacity at maximum back pressure</th>
<th>Maximum stroke rate</th>
<th>Suction lift</th>
<th>Permissible priming pressure, suction side</th>
<th>Connector size</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>bar</td>
<td>psi</td>
<td>l/h</td>
<td>gph</td>
<td>Strokes/min</td>
</tr>
<tr>
<td>16050 PVT</td>
<td>10</td>
<td>145</td>
<td>61</td>
<td>16</td>
<td>90</td>
</tr>
<tr>
<td>16050 SST</td>
<td>16</td>
<td>232</td>
<td>56</td>
<td>14</td>
<td>90</td>
</tr>
<tr>
<td>16090 PVT</td>
<td>10</td>
<td>145</td>
<td>109</td>
<td>28</td>
<td>160</td>
</tr>
<tr>
<td>16090 SST</td>
<td>16</td>
<td>232</td>
<td>99</td>
<td>26</td>
<td>160</td>
</tr>
<tr>
<td>16130 PVT</td>
<td>10</td>
<td>145</td>
<td>131</td>
<td>34</td>
<td>200</td>
</tr>
<tr>
<td>16130 SST</td>
<td>16</td>
<td>232</td>
<td>129</td>
<td>33</td>
<td>200</td>
</tr>
<tr>
<td>07120 PVT</td>
<td>7</td>
<td>102</td>
<td>150</td>
<td>39</td>
<td>90</td>
</tr>
<tr>
<td>07120 SST</td>
<td>7</td>
<td>102</td>
<td>150</td>
<td>39</td>
<td>90</td>
</tr>
<tr>
<td>07220 PVT</td>
<td>7</td>
<td>102</td>
<td>271</td>
<td>71</td>
<td>160</td>
</tr>
<tr>
<td>07220 SST</td>
<td>7</td>
<td>102</td>
<td>271</td>
<td>71</td>
<td>160</td>
</tr>
<tr>
<td>04350 PVT</td>
<td>4</td>
<td>58</td>
<td>353</td>
<td>93</td>
<td>200</td>
</tr>
<tr>
<td>04350 SST</td>
<td>4</td>
<td>58</td>
<td>353</td>
<td>93</td>
<td>200</td>
</tr>
</tbody>
</table>

All figures refer to water at 20 °C.
The suction lift applies to filled suction line and filled liquid end - when installed correctly.

* For Sigma types 07120, 07220 and 04350 the valves in the dosing head are of type DN 25 (G1 1/2). As for these types of pipes, DN 20 is generally sufficient (see technical data, suction/discharge side connector), the connector parts that can be ordered under the identity code (e.g. inserts) are already reduced to DN 20, i.e. piping and accessories can be installed in DN 20.

--

**Precision**

<table>
<thead>
<tr>
<th>Data</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reproducibility</td>
<td>±2</td>
<td>% *</td>
</tr>
</tbody>
</table>

* - when installed correctly, under constant conditions, at least 30% stroke length and water at 20 °C
16.2 Viscosity

The liquid ends are suitable for the following viscosity ranges:

<table>
<thead>
<tr>
<th>Version</th>
<th>Stroke rate, max.</th>
<th>Viscosity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Strokes/min</td>
<td>mPas</td>
</tr>
<tr>
<td>Standard</td>
<td>180</td>
<td>0 ... 200</td>
</tr>
<tr>
<td>With valve springs</td>
<td>130</td>
<td>200 ... 500</td>
</tr>
<tr>
<td>With valve springs and suction-side feed</td>
<td>90</td>
<td>500 ... 1000*</td>
</tr>
</tbody>
</table>

* Only when the installation is correctly adjusted

16.3 Shipping weight

<table>
<thead>
<tr>
<th>Types</th>
<th>Material version</th>
<th>Shipping weight kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>16050; 10090; 16130</td>
<td>PVT</td>
<td>17.2</td>
</tr>
<tr>
<td>07120; 07220; 04350</td>
<td>SST</td>
<td>20.0</td>
</tr>
</tbody>
</table>

16.4 Wetted materials

<table>
<thead>
<tr>
<th>Material version</th>
<th>Liquid end</th>
<th>Suction/pressure connector</th>
<th>Seals* / ball seat</th>
<th>Balls</th>
<th>Springs</th>
<th>Integral relief valve</th>
</tr>
</thead>
<tbody>
<tr>
<td>PVT</td>
<td>PVDF</td>
<td>PVDF</td>
<td>PTFE/PTFE</td>
<td>Ceramic / glass **</td>
<td>Hastelloy C</td>
<td>PVDF / FPM or EPDM</td>
</tr>
<tr>
<td>SST</td>
<td>Stainless steel 1.4404</td>
<td>Stainless steel 1.4581</td>
<td>PTFE/PTFE</td>
<td>Stainless steel 1.4404</td>
<td>Hastelloy C</td>
<td>Stainless steel / FPM or EPDM</td>
</tr>
</tbody>
</table>

* Diaphragm is PTFE-coated
** Types 07120, 07220, 04350

16.5 Ambient conditions

16.5.1 Ambient temperatures

<table>
<thead>
<tr>
<th>Data</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storage and transport temperature</td>
<td>-10 ... +50</td>
<td>°C</td>
</tr>
<tr>
<td>Ambient temperature in operation (drive + motor):</td>
<td>-10 ... +45</td>
<td>°C</td>
</tr>
</tbody>
</table>
16.5.2 Media temperatures

### PVT liquid end

<table>
<thead>
<tr>
<th>Data</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. temperature long-term at max. operating pressure</td>
<td>65</td>
<td>°C</td>
</tr>
<tr>
<td>Max. temperature for 15 min at max. 2 bar</td>
<td>100</td>
<td>°C</td>
</tr>
<tr>
<td>Minimum temperature</td>
<td>-10</td>
<td>°C</td>
</tr>
</tbody>
</table>

### SST liquid end

<table>
<thead>
<tr>
<th>Data</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. temperature long-term at max. operating pressure</td>
<td>90</td>
<td>°C</td>
</tr>
<tr>
<td>Max. temperature for 15 min at max. 2 bar</td>
<td>120</td>
<td>°C</td>
</tr>
<tr>
<td>Minimum temperature</td>
<td>-10</td>
<td>°C</td>
</tr>
</tbody>
</table>

16.5.3 Air humidity

<table>
<thead>
<tr>
<th>Data</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum air humidity*:</td>
<td>95</td>
<td>% relative</td>
</tr>
<tr>
<td></td>
<td></td>
<td>humidity</td>
</tr>
</tbody>
</table>

*non-condensing

16.5.4 Degree of Protection and Safety Requirements

**Degree of protection**

Protection against contact and humidity:

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

*A CAN plug or the supplied sealing cap must always be plugged into the CAN port for the HMI.*

**Safety Requirements**

Degree of protection:

1 - mains power connection with protective earth conductor

16.6 Installation height

<table>
<thead>
<tr>
<th>Data</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum installation height*:</td>
<td>1000</td>
<td>m above standard zero</td>
</tr>
</tbody>
</table>

* with standard pumps: Fit at higher installation heights at your own risk.

with ATEX pumps: We urgently advise that you contact a specialist for ATEX motors at higher installation heights!
16.7 Electrical connection

The electrical data do not relate to the motor, but the pump, which is connected as a whole unit. For the motor electrical data use the motor data sheet in the appendix.

**Electrical data S2Cb pump**

Identity code specification "power supply" - "U": 100 - 230 V ± 10%, 240 V ± 6%, 50/60 Hz

<table>
<thead>
<tr>
<th>Data</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacity</td>
<td>220</td>
<td>W</td>
</tr>
<tr>
<td>Max. starting current</td>
<td>8.5</td>
<td>A</td>
</tr>
</tbody>
</table>

**Electrical data at 100 V**

<table>
<thead>
<tr>
<th>Data</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effective current</td>
<td>3.3</td>
<td>A</td>
</tr>
<tr>
<td>Switch on peak current, (for approx. 100 ms)</td>
<td>4</td>
<td>A</td>
</tr>
</tbody>
</table>

**Electrical data at 230 V**

<table>
<thead>
<tr>
<th>Data</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effective current</td>
<td>1.5</td>
<td>A</td>
</tr>
<tr>
<td>Switch on peak current, (for approx. 100 ms)</td>
<td>8</td>
<td>A</td>
</tr>
</tbody>
</table>

* internal switchover

**Tab. 11: Fuses**

<table>
<thead>
<tr>
<th>Fuse</th>
<th>Value</th>
<th>Order No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuse, internal</td>
<td>6.3 AT - (1.5 kA)</td>
<td>732379</td>
</tr>
</tbody>
</table>

Only use the original fuses from ProMinent! It is not sufficient to use a fuse with the above fuse rating.

16.8 Diaphragm rupture sensor

**Contact (standard)**

**Tab. 12: Contact loading, max.**

<table>
<thead>
<tr>
<th>at voltage</th>
<th>Maximum current</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 V DC</td>
<td>1 A</td>
</tr>
</tbody>
</table>

The contact is an opener.
The contact is an potential-free.
Namur sensor (Specified for EX zones) 5–25 V DC, in accordance with Namur or DIN 19234, potential-free design.

<table>
<thead>
<tr>
<th>Data</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated voltage *</td>
<td>8</td>
<td>VDC</td>
</tr>
<tr>
<td>Power consumption - active surface</td>
<td></td>
<td></td>
</tr>
<tr>
<td>uncovered</td>
<td>&gt; 3</td>
<td>mA</td>
</tr>
<tr>
<td>Power consumption - active surface</td>
<td></td>
<td></td>
</tr>
<tr>
<td>covered</td>
<td>&lt; 1</td>
<td>mA</td>
</tr>
<tr>
<td>Rated switching distance</td>
<td>1.5</td>
<td>mm</td>
</tr>
</tbody>
</table>

* Ri ~ 1 kΩ

<table>
<thead>
<tr>
<th>Cable colour</th>
<th>Polarity</th>
</tr>
</thead>
<tbody>
<tr>
<td>blue</td>
<td>-</td>
</tr>
<tr>
<td>brown</td>
<td>+</td>
</tr>
</tbody>
</table>

16.9 Relay

The technical data for the relay are contained in the chapter "Installation, electrical".

16.10 Gear oil

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Name</th>
<th>Viscosity class (ISO 3442)</th>
<th>Order No.</th>
<th>Quantity</th>
<th>Quantity, required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mobil</td>
<td>Mobil Gear 634</td>
<td>VG 460</td>
<td>1004542</td>
<td>1.0 l</td>
<td>0.5 l</td>
</tr>
</tbody>
</table>

* or comparative gear oil

16.11 Sound pressure level

Sound pressure level LpA < 70 dB according to EN ISO 20361 at maximum stroke length, maximum stroke rate, maximum back pressure (water)
17 Dimensional drawings

- Compare the dimensions on the dimension sheet and pump.
- All dimensions are in mm.

Fig. 41: Dimensions in mm
Fig. 42: View is not strictly binding - dimensions in mm

<table>
<thead>
<tr>
<th>Type</th>
<th>Connector</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>ØG</th>
<th>I</th>
<th>K</th>
</tr>
</thead>
<tbody>
<tr>
<td>16050, 16090, 16130</td>
<td>DN 15</td>
<td>253</td>
<td>89</td>
<td>G1M</td>
<td>111</td>
<td>144</td>
<td>72</td>
<td>122</td>
<td>149</td>
<td>63</td>
</tr>
<tr>
<td>SST</td>
<td>DN 15</td>
<td>253</td>
<td>88</td>
<td>G1M</td>
<td>110</td>
<td>133</td>
<td>88</td>
<td>124</td>
<td>123</td>
<td>53</td>
</tr>
<tr>
<td>04350, 07120, 07220</td>
<td>DN 25</td>
<td>289</td>
<td>52</td>
<td>G11/2M</td>
<td>117</td>
<td>155</td>
<td>75</td>
<td>156</td>
<td>168</td>
<td>71</td>
</tr>
<tr>
<td>SST</td>
<td>DN 25</td>
<td>289</td>
<td>53</td>
<td>G11/2M</td>
<td>117</td>
<td>147</td>
<td>88</td>
<td>162</td>
<td>141</td>
<td>60</td>
</tr>
</tbody>
</table>

Tab. 13: Hose nozzle relief valve with thread

<table>
<thead>
<tr>
<th>Thread</th>
<th>ØS</th>
</tr>
</thead>
<tbody>
<tr>
<td>G 3/4 A</td>
<td>16</td>
</tr>
<tr>
<td>Motor Datenblatt / Motor data sheet / Fiche technique pour moteur</td>
<td></td>
</tr>
<tr>
<td>---------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Bestell Nr.</td>
<td>1040790</td>
</tr>
<tr>
<td>motor type</td>
<td>AF63/4E-11</td>
</tr>
<tr>
<td>power factor</td>
<td></td>
</tr>
<tr>
<td>facteur de puissance</td>
<td></td>
</tr>
<tr>
<td>Wirkungsgrad</td>
<td>86%</td>
</tr>
<tr>
<td>efficiency</td>
<td></td>
</tr>
<tr>
<td>rendement</td>
<td></td>
</tr>
<tr>
<td>Maschinenart</td>
<td>3-Ph. Motor</td>
</tr>
<tr>
<td>type of machine</td>
<td></td>
</tr>
<tr>
<td>designation</td>
<td></td>
</tr>
<tr>
<td>Schutzart</td>
<td>IP55</td>
</tr>
<tr>
<td>degree of protection</td>
<td></td>
</tr>
<tr>
<td>degré de protection</td>
<td></td>
</tr>
<tr>
<td>Bauform</td>
<td>IMB5</td>
</tr>
<tr>
<td>mounting</td>
<td></td>
</tr>
<tr>
<td>construction</td>
<td></td>
</tr>
<tr>
<td>Bemessungsspannung</td>
<td>40°C</td>
</tr>
<tr>
<td>rated voltage</td>
<td>380-420/220-240 V (50 Hz)</td>
</tr>
<tr>
<td>tension nominale</td>
<td>380-480/220-280 V (60 Hz)</td>
</tr>
<tr>
<td>Anzugsstrom</td>
<td>4,1/4,8 fach</td>
</tr>
<tr>
<td>courant de démarrage</td>
<td></td>
</tr>
<tr>
<td>Bemessungsstrom</td>
<td>2,4/2,9 fach</td>
</tr>
<tr>
<td>rated current</td>
<td>0,80/1,38 A</td>
</tr>
<tr>
<td>courant nominale</td>
<td>0,70/1,20 A</td>
</tr>
<tr>
<td>Anzugsmoment</td>
<td>2,5/3,0 fach</td>
</tr>
<tr>
<td>pull-out torque</td>
<td></td>
</tr>
<tr>
<td>Kippmoment</td>
<td></td>
</tr>
<tr>
<td>couple de décrochage</td>
<td></td>
</tr>
<tr>
<td>Geprüft nach</td>
<td>DIN EN 60034</td>
</tr>
<tr>
<td>tested in acc. with</td>
<td></td>
</tr>
<tr>
<td>contrôlé selon</td>
<td></td>
</tr>
<tr>
<td>Schaltung</td>
<td></td>
</tr>
<tr>
<td>connection</td>
<td></td>
</tr>
<tr>
<td>ATEX Nr.</td>
<td></td>
</tr>
<tr>
<td>Umgebungstemperatur</td>
<td></td>
</tr>
<tr>
<td>température ambiante</td>
<td></td>
</tr>
<tr>
<td>Ex-Schutzklasse</td>
<td></td>
</tr>
<tr>
<td>ex-protective system</td>
<td></td>
</tr>
<tr>
<td>Schaltungsmodul</td>
<td></td>
</tr>
<tr>
<td>branchement</td>
<td></td>
</tr>
<tr>
<td>Drehzahlregelbereich</td>
<td>speed adjustment range</td>
</tr>
<tr>
<td>Anmerkung</td>
<td>* auf Anfrage beim Hersteller</td>
</tr>
<tr>
<td>comments</td>
<td></td>
</tr>
<tr>
<td>* upon request at manufacturer</td>
<td></td>
</tr>
<tr>
<td>observation</td>
<td></td>
</tr>
<tr>
<td>* sur demande auprès du producteur</td>
<td></td>
</tr>
</tbody>
</table>
19 Liquid ends Sigma/2

Liquid end Sigma/2 130-DN 15 and 350-DN 25 PVT

Fig. 43: Liquid end Sigma/2 130-DN 15 and 350-DN 25 PVT

<table>
<thead>
<tr>
<th>Pos.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Spring *</td>
</tr>
<tr>
<td>2</td>
<td>Ball</td>
</tr>
<tr>
<td>3</td>
<td>Ball seat</td>
</tr>
<tr>
<td>4</td>
<td>Diaphragm rupture sensor, visual *</td>
</tr>
<tr>
<td>5</td>
<td>Valve</td>
</tr>
<tr>
<td>6</td>
<td>Multi-layer diaphragm</td>
</tr>
</tbody>
</table>

The items listed are included in the spare parts kit.

* Special accessories (not included in the spare parts kit). Technical changes reserved.
Tab. 14: Order no. for liquid end for Sigma/2, 130-DN 15 PVT

<table>
<thead>
<tr>
<th>Spare part</th>
<th>16050</th>
<th>16090</th>
<th>16130</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liquid end</td>
<td>1029763</td>
<td>1029763</td>
<td>1029763</td>
</tr>
<tr>
<td>Spare parts kit</td>
<td>1035951</td>
<td>1035951</td>
<td>1035951</td>
</tr>
<tr>
<td>Diaphragm rupture sensor, visual</td>
<td>1033323</td>
<td>1033323</td>
<td>1033323</td>
</tr>
<tr>
<td>Valve</td>
<td>792517</td>
<td>792517</td>
<td>792517</td>
</tr>
<tr>
<td>Multi-layer diaphragm</td>
<td>1029771</td>
<td>1029771</td>
<td>1029771</td>
</tr>
</tbody>
</table>

Tab. 15: Order no. for liquid end for Sigma/2, 350-DN 25 PVT

<table>
<thead>
<tr>
<th>Spare part</th>
<th>07120</th>
<th>07220</th>
<th>04350</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liquid end</td>
<td>1029762</td>
<td>1029762</td>
<td>1029762</td>
</tr>
<tr>
<td>Spare parts kit</td>
<td>1035953</td>
<td>1035953</td>
<td>1035953</td>
</tr>
<tr>
<td>Diaphragm rupture sensor, visual</td>
<td>1033323</td>
<td>1033323</td>
<td>1033323</td>
</tr>
<tr>
<td>Valve</td>
<td>740615</td>
<td>740615</td>
<td>740615</td>
</tr>
<tr>
<td>Multi-layer diaphragm</td>
<td>1033422</td>
<td>1033422</td>
<td>1033422</td>
</tr>
</tbody>
</table>

Sigma/2 PVT bleed valve

Fig. 44: Sigma/2 PVT bleed valve

<table>
<thead>
<tr>
<th>Pos.</th>
<th>Description</th>
<th>Order no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>Integrated bleed valve, complete, DN10 PVA</td>
<td>1041067</td>
</tr>
<tr>
<td>10</td>
<td>Integrated bleed valve, complete, DN10 PVE</td>
<td>1041068</td>
</tr>
</tbody>
</table>

* The items listed are included in the spare parts kit. Springs made from Hastelloy C, O-rings from FPM-A and EPDM. Technical changes reserved.
Sigma/ 2 PVA relief valve-A

**Fig. 45: Sigma/ 2 PVA relief valve-A**

<table>
<thead>
<tr>
<th>Pos.</th>
<th>Description</th>
<th>Type 16050, 16090, 16130</th>
<th>Type 07120, 07220</th>
<th>Type 04350</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>Relief valve, complete 10 bar PVA</td>
<td>1018947</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Relief valve, complete 7 bar PVA</td>
<td>740811</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Relief valve, complete 4 bar PVA</td>
<td>740812</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* The items listed are included in the spare parts kit. Springs made from Hastelloy C, O-rings from FPM-A and EPDM. Technical changes reserved.
### Fig. 46: Liquid end Sigma/2 130 and 350 SST

<table>
<thead>
<tr>
<th>Pos.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Spring *</td>
</tr>
<tr>
<td>2</td>
<td>Ball</td>
</tr>
<tr>
<td>3</td>
<td>Ball seat</td>
</tr>
<tr>
<td>4</td>
<td>Diaphragm rupture sensor, visual *</td>
</tr>
<tr>
<td>5</td>
<td>Valve *</td>
</tr>
<tr>
<td>6</td>
<td>Multi-layer diaphragm</td>
</tr>
</tbody>
</table>

The items listed are included in the spare parts kit.

* Special accessories (not included in the spare parts kit). Technical changes reserved.
### Tab. 16: Order no. for liquid end for Sigma/2, 130-DN 15 SST

<table>
<thead>
<tr>
<th>Spare part</th>
<th>16050</th>
<th>16090</th>
<th>16130</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liquid end</td>
<td>1029764</td>
<td>1029764</td>
<td>1029764</td>
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<tr>
<td>Spare parts kit</td>
<td>1035951</td>
<td>1035951</td>
<td>1035951</td>
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<tr>
<td>Diaphragm rupture sensor, visual</td>
<td>1033323</td>
<td>1033323</td>
<td>1033323</td>
</tr>
<tr>
<td>Valve</td>
<td>809404</td>
<td>809404</td>
<td>809404</td>
</tr>
<tr>
<td>Multi-layer diaphragm</td>
<td>1029771</td>
<td>1029771</td>
<td>1029771</td>
</tr>
</tbody>
</table>

### Tab. 17: Order no. for liquid end for Sigma/2, 350-DN 25 SST

<table>
<thead>
<tr>
<th>Spare part</th>
<th>07120</th>
<th>07220</th>
<th>04350</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liquid end</td>
<td>1029762</td>
<td>1029762</td>
<td>1029762</td>
</tr>
<tr>
<td>Spare parts kit</td>
<td>1035953</td>
<td>1035953</td>
<td>1035953</td>
</tr>
<tr>
<td>Diaphragm rupture sensor, visual</td>
<td>1033323</td>
<td>1033323</td>
<td>1033323</td>
</tr>
<tr>
<td>Valve</td>
<td>803708</td>
<td>803708</td>
<td>803708</td>
</tr>
<tr>
<td>Multi-layer diaphragm</td>
<td>1033422</td>
<td>1033422</td>
<td>1033422</td>
</tr>
</tbody>
</table>

#### Sigma/2 SST bleed valve

* The items listed are included in the spare parts kit. Springs made from Hastelloy C, O-rings from FPM-A and EPDM. Technical changes reserved.
### Sigma/2 SSA relief valve-A

![Diagram of Sigma/2 SSA relief valve-A](image)

*Fig. 48: Sigma/2 SSA relief valve-A*

<table>
<thead>
<tr>
<th>Pos.</th>
<th>Description</th>
<th>Type 16050, 16090, 16130</th>
<th>Type 07120, 07220</th>
<th>Type 04350, 04600</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>Relief valve, complete 16 bar SSA</td>
<td>1019246</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Relief valve, complete 7 bar SSA</td>
<td>740815</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Relief valve, complete 4 bar SSA</td>
<td>740814</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* The items listed are included in the spare parts kit. Springs made from Hastelloy C, O-rings from FPM-A and EPDM. Technical changes reserved.
20  Wearing parts for S2Cb

Refer also to the previous chapter.

20.1 Standard

**HMI spare parts**

<table>
<thead>
<tr>
<th>Spare part</th>
<th>Order no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>HMI wall bracket</td>
<td>1036683</td>
</tr>
<tr>
<td>HMI protective film</td>
<td>1083680</td>
</tr>
</tbody>
</table>

20.2 Physiological safety

**Spare parts kits**

*Tab. 18: Scope of delivery with PVT material version*

<table>
<thead>
<tr>
<th>Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 x diaphragm, 2 x valve balls, 1 x suction valve complete, 1 x discharge valve complete</td>
</tr>
<tr>
<td>1 x elastomer sealing set (EPDM)</td>
</tr>
<tr>
<td>2 x ball seat housings, 2 x ball seat discs, 4 x composite seals</td>
</tr>
<tr>
<td>1x sealing washer (for bleed valve or relief valve)</td>
</tr>
</tbody>
</table>

*Tab. 19: Scope of delivery with SST material version*

<table>
<thead>
<tr>
<th>Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 x diaphragm, 2 x valve balls</td>
</tr>
<tr>
<td>2 x cover rings</td>
</tr>
<tr>
<td>4 x composite seals</td>
</tr>
<tr>
<td>1x sealing washer (for bleed valve or relief valve)</td>
</tr>
</tbody>
</table>

**Ordering information**

*Tab. 20: Spare parts kits PVT (liquid ends)*

<table>
<thead>
<tr>
<th>Liquid end</th>
<th>Types 16050, 16090, 16130</th>
<th>Types 07120, 07220, 04350</th>
</tr>
</thead>
<tbody>
<tr>
<td>FM 130 - DN 15</td>
<td>1046472</td>
<td>-</td>
</tr>
<tr>
<td>FM 350 - DN 25</td>
<td>-</td>
<td>1046475</td>
</tr>
</tbody>
</table>

*Tab. 21: Spare parts kits SST (liquid ends)*

<table>
<thead>
<tr>
<th>Liquid end</th>
<th>Types 16050, 16090, 16130</th>
<th>Types 07120, 07220, 04350</th>
</tr>
</thead>
<tbody>
<tr>
<td>FM 130 - DN 15</td>
<td>1046473</td>
<td>-</td>
</tr>
<tr>
<td>FM 130 - DN 15 with 2 complete valves</td>
<td>1046474</td>
<td>-</td>
</tr>
<tr>
<td>FM 65 - DN 10</td>
<td>-</td>
<td>1046476</td>
</tr>
<tr>
<td>FM 65 - DN 10 with 2 complete valves</td>
<td>-</td>
<td>1046477</td>
</tr>
</tbody>
</table>

Wetted materials – "Physiologically safety with regard to wetted materials" design
### Wearing parts for S2Cb

<table>
<thead>
<tr>
<th>Material version</th>
<th>Liquid end</th>
<th>Suction / pressure connector</th>
<th>Seals* / ball seat</th>
<th>Balls</th>
<th>Integrated bleed valve or relief valve</th>
</tr>
</thead>
<tbody>
<tr>
<td>PVT</td>
<td>PVDF</td>
<td>PVDF</td>
<td>PTFE / PVDF</td>
<td>Ceramic / glass **</td>
<td>PVDF / EPDM</td>
</tr>
<tr>
<td>SST</td>
<td>Stainless steel 1.4404</td>
<td>Stainless steel 1.4581</td>
<td>PTFE / PVDF</td>
<td>Stainless steel 1.4404</td>
<td>Stainless steel / EPDM</td>
</tr>
</tbody>
</table>

* Metering diaphragm is PTFE-coated; seals are PTFE composite seals
  
PTFE: FDA No. 21 CFR §177.1550
  
PVDF: FDA No. 21 CFR §177.2510
  
** with 07120, 07220, 04350
Fig. 49: A) Capacity $C$ at maximum back pressure dependent on the stroke length $s$. B) Capacity $C$ dependent on the back pressure $p$. 
22 Declaration of Conformity for Machinery

In accordance with DIRECTIVE 2006/42/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL, Appendix I, BASIC HEALTH AND SAFETY REQUIREMENTS, section 1.7.4.2. C.

We,

ProMinent GmbH
Im Schuhmachergewann 5 - 11
D - 69123 Heidelberg, Germany,

hereby declare that the product specified in the following, complies with the relevant basic health and safety requirements of the Directive, on the basis of its functional concept and design and in the version distributed by us.

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

Tab. 22: Excerpt from the Declaration of Conformity

<table>
<thead>
<tr>
<th>Designation of the product:</th>
<th>Metering pump, Sigma product range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product type:</td>
<td>S2Cb...</td>
</tr>
<tr>
<td>Serial number:</td>
<td>see nameplate on the unit</td>
</tr>
<tr>
<td>Relevant directives:</td>
<td>Machinery Directive (2006/42/EC)</td>
</tr>
<tr>
<td></td>
<td>Compliance with the protection targets of the Low Voltage Directive (2014/30/EU) according to Appendix I, No. 1.5.1 of the Machinery Directive</td>
</tr>
<tr>
<td></td>
<td>EMC Directive (2014/35/EU)</td>
</tr>
<tr>
<td>Harmonised standards applied, in particular:</td>
<td>EN ISO 12100:2010</td>
</tr>
<tr>
<td></td>
<td>EN 61010-1:2010</td>
</tr>
<tr>
<td></td>
<td>EN 61000-6-2:2005 + AC:2005</td>
</tr>
<tr>
<td></td>
<td>EN 61000-6-4:2007 + AC:2011</td>
</tr>
<tr>
<td>Date:</td>
<td>20.04.2016</td>
</tr>
</tbody>
</table>

View the EC Declaration of Conformity at www.prominent.com.
Operating/Set-up overview of the Sigma X Control type

23

Continuous display

Stop/start pump

Priming

Start batch (only in "Batch" operating mode)

Acknowledge errors

Check adjustable variables

Change directly adjustable variables

Information

Operating mode

Settings

Batch, Contact, Analogue

Metering

Calibration

Inputs/outputs

System

Time set

Date

Timer

Service

Language
## Operating menu of Sigma X Control type, complete

<table>
<thead>
<tr>
<th>1st level</th>
<th>2nd</th>
<th>3rd</th>
<th>4th</th>
<th>5th</th>
<th>xth</th>
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</thead>
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<td>CTRL software</td>
<td></td>
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<td>HMI software</td>
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<td>...</td>
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<td>Serial number</td>
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<td>Identity code</td>
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<td></td>
<td>Contact</td>
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<td>Analogue</td>
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<td>Operating mode</td>
<td>Manual</td>
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<td>Off</td>
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<td></td>
<td>Batch</td>
<td>Memory</td>
<td>On</td>
<td>Off</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Analogue</td>
<td>Standard</td>
<td>0...20 mA</td>
<td>4...20 mA</td>
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<tr>
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<td></td>
<td>Extended</td>
<td>Curve</td>
<td>...</td>
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<td>Curve points</td>
<td>...</td>
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<td>Error message I &lt; 4 mA</td>
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<td>Metering</td>
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<td>Standard</td>
<td>Metering optimised</td>
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<td>Error</td>
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<td>Stufe_07</td>
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<td>Stufe_04</td>
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<td>Calibration</td>
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<td>Start calibration</td>
<td>Calibration ended</td>
<td>Calibration result</td>
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<td>Calibration factor</td>
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<td>Inputs/outputs</td>
<td>Auxiliary frequency</td>
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<td>4th</td>
<td>5th</td>
<td>6th</td>
</tr>
<tr>
<td>-----------</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
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</tr>
<tr>
<td>Relay 1</td>
<td>Relay1 type</td>
<td>Warning</td>
<td>Error</td>
<td>Warning + error</td>
<td>Warning + Error + Stop</td>
</tr>
<tr>
<td>Relay 2</td>
<td>Relay 2 type</td>
<td>Warning</td>
<td>Error</td>
<td>Warning + error</td>
<td>Warning + Error + Stop</td>
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<td>mA output</td>
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<td>0…20 mA</td>
<td>4…20 mA</td>
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<td>Function</td>
<td>Strokes / minute</td>
<td>Capacity</td>
<td>Capacity at 20 mA</td>
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<tr>
<td>Flow monitor</td>
<td>Activation</td>
<td>Off</td>
<td>On</td>
<td></td>
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</tr>
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<td>Tolerance / strokes</td>
<td>if auxiliary</td>
<td>Off</td>
<td>On</td>
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<td>Signalisation</td>
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<td>Error</td>
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<td>Diaphragm rupture</td>
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<td>Error</td>
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<td>Inactive</td>
<td>Active</td>
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<tr>
<td>Unit</td>
<td>Litres</td>
<td>Gallons (U.S.)</td>
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<td>Time</td>
<td>Setting</td>
<td>hh.mm.ss</td>
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<td>Auto. summer time</td>
<td>Yes</td>
<td>No</td>
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<td>1st level</td>
<td>2nd</td>
<td>3rd</td>
<td>4th</td>
<td>5th</td>
<td>xth</td>
</tr>
<tr>
<td>-----------</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
<td>-----</td>
</tr>
<tr>
<td>Summer time begins in</td>
<td>February</td>
<td>March</td>
<td>April</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sunday the</td>
<td>1st, 2nd, 3rd, 4th, 5th</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Summer time ends in</td>
<td>August</td>
<td>September</td>
<td>October</td>
<td>November</td>
<td></td>
</tr>
<tr>
<td>Sunday the</td>
<td>1st, 2nd, 3rd, 4th, 5th</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Town</td>
<td>Northern Hemisphere</td>
<td>Southern Hemisphere</td>
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<td>Date</td>
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<td>Timer</td>
<td>Activation</td>
<td>Active</td>
<td>Inactive</td>
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</tr>
<tr>
<td>Setting the timer</td>
<td>Displays</td>
<td>Change</td>
<td>Clear</td>
<td>New</td>
<td>Command 01</td>
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<tr>
<td>Clear all</td>
<td>No</td>
<td>Yes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Service</td>
<td>Password</td>
<td>Password?</td>
<td>0000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clear counter</td>
<td>All</td>
<td>Stroke counter</td>
<td>Volume counter</td>
<td>Contact memory</td>
<td></td>
</tr>
<tr>
<td>Log book</td>
<td>Displays</td>
<td>...</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Filter</td>
<td>None</td>
<td>Warn.+error only</td>
<td>Error only</td>
<td>Warnings only</td>
<td>Events only</td>
</tr>
<tr>
<td>Display</td>
<td>Contrast</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brightness</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HMI logout</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Diaphragm part number: XXXXXXX

Spare parts kit part number: XXXXXXX

### Language
- English
- German
- Frenchç
- Spanishñ
- Italian
- ...

Menus may be missing or added depending on the design and equipment on the pump.
### Continuous displays and secondary displays

<table>
<thead>
<tr>
<th>Continuous display</th>
<th>Mode</th>
<th>Stroke rate (h)</th>
<th>Stroke rate (min)</th>
<th>Factor</th>
<th>Contact volume</th>
<th>Trigger batch</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Manual</td>
<td>7200</td>
<td>120</td>
<td>5</td>
<td>1,250 L</td>
<td>17:12:21</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Contact</td>
<td>350</td>
<td>58</td>
<td>8</td>
<td>1,280 L</td>
<td>17:12:21</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Analogue</td>
<td>7200</td>
<td>120</td>
<td>5</td>
<td>1,250 L</td>
<td>17:12:21</td>
<td></td>
</tr>
</tbody>
</table>

* only with calibration
### Auxiliary displays in the continuous display

<table>
<thead>
<tr>
<th>Auxiliary display</th>
<th>mode &quot;Manual&quot;</th>
<th>mode &quot;Contact&quot; with transfer factor 5</th>
<th>mode &quot;Batch&quot; with transfer factor 5</th>
<th>mode &quot;Analogue&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacity</td>
<td>350 L/h</td>
<td>350 L/h</td>
<td>350 L/h</td>
<td>350 L/h</td>
</tr>
<tr>
<td>Stroke rate (h)</td>
<td>7200 D/h</td>
<td>7200 D/h</td>
<td>7200 D/h</td>
<td>7200 D/h</td>
</tr>
<tr>
<td>Stroke rate (min)</td>
<td>120 D/min</td>
<td>120 D/min</td>
<td>120 D/min</td>
<td>120 D/min</td>
</tr>
<tr>
<td>Factor</td>
<td>5 D/min</td>
<td>5 D/min</td>
<td>5 D/min</td>
<td>5 D/min</td>
</tr>
<tr>
<td>Remaining strokes</td>
<td></td>
<td>25,00 D</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Remaining litres</td>
<td></td>
<td>0,00 L</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Total number of strokes</td>
<td>86500 D</td>
<td>86500 D</td>
<td>86500 D</td>
<td>86500 D</td>
</tr>
<tr>
<td>Stroke length</td>
<td>50 %</td>
<td>50 %</td>
<td>50 %</td>
<td>50 %</td>
</tr>
<tr>
<td>Signal current</td>
<td></td>
<td></td>
<td>12,7 mA</td>
<td></td>
</tr>
<tr>
<td>Dosing mode</td>
<td>~ Standard</td>
<td>~ Standard</td>
<td>~ Standard</td>
<td>~ Standard</td>
</tr>
<tr>
<td>Time</td>
<td>17:12:21</td>
<td>17:12:21</td>
<td>17:12:21</td>
<td>17:12:21</td>
</tr>
</tbody>
</table>

1 = only with "Storage tank" function extension  
2 = only with current output
Index

1, 2, 3 ...
"External control" terminal 38
4 - 20 mA 49

A
Access code 60
Access protection 45
Acknowledge 67
Action 59
Administration functions for commands 58
Air humidity 89
Ambient conditions 88
Analogue 21, 23
Analogue current output 22
Analogue input 49
Analogue output 56
Applied harmonised standards 104
Assembly 25
AUX 54
Auxiliary frequency 21, 23, 38, 54

B
Basic principles for setting up the control 43
Batch 21, 23, 47, 55
Bleeder valve 30
Bleeding 55
Bluetooth 57
Bluetooth, display 13
Brightness 61
BT 57
BUS 21

C
Calibration 21, 53
CAN bus 13, 40
CAN bus status LED (external) 23
CAN bus status LED, internal 13
CAN-bus (external) 23
Capacity 87, 103
Carrying out repairs 72
Cavitation 52
Change 58
Checking adjustable variables 45, 67
Cleaning valves 72
Clear 58
Clear all 59
Clear counter 60
Clear, all 59
Clearing the program 59
Climate 89
Code 60
Connector size 87
Contact 21, 23, 47, 90
Contact memory 60
Continuous display 15
Continuous displays 45, 110
Contrast 61
Control elements 13
Creating a program 58
Current output 36
Curve 49
Curve points, Analogue 51

D
Date 46, 57
Decommissioning 84
Decontamination declaration 12
Degree of protection 89
Designation of the product 104
Diagrams 103
Diaphragm 19, 61
Diaphragm part number 61
Diaphragm rupture 56
Diaphragm rupture sensor 13, 90
Dimensional drawing of HMI + wall bracket 92
Dimensional drawings 92
Dimensional drawings of pump 93
Directly changeable variables 67
Discharge valve 19
Display 61
Displays 58
Disposal 85
Dosing head 19
Dosing monitor 56
Draining the liquid end 85
Drive motor 13
Drive unit 13
DulcoFlow® 56

E
Electrical data 90
Emergency 11
Error 23, 55
Error mess. i < 4 mA 51
Events, log book 83
Extended, Analogue 50
| External analogue | 23 |
| External contact | 23, 38 |
| External frequency changer | 23 |

**F**
- Factor | 47 |
- Fault indicating / pacing relay (24 V) | 36 |
- Fault indicating relay | 22 |
- Fault indicating relay (24 V) | 35 |
- Fault indicating relay 230 V | 34 |
- Fault indicator | 13, 22, 23 |
- Fault messages | 15 |
- Fault messages, log book | 82 |
- Fault statuses | 23 |
- Flow | 21 |
- Flow control | 56 |
- Flow Control | 56 |
- Function indicator | 22 |
- Functions | 21, 23 |

**G**
- Gaseous feed chemicals | 52 |
- Gear oil | 91 |
- Generating commands | 58 |

**H**
- Hardware | 46 |
- Hemisphere | 57 |
- Hierarchy of operating modes | 23 |
- HMI | 26, 40 |
- HMI logout | 61 |
- HMI operating unit | 40 |
- HMI version | 46 |
- Hygienic pump head | 26 |

**I**
- Identification of safety notes | 8 |
- Identifier | 15 |
- Identity code | 46 |
- Information | 46 |
- Information in the event of an emergency | 11 |
- Init | 58 |
- Inputs/outputs | 54 |
- Installation | 27 |
- Installation height | 89 |
- Integral bleeder valve | 30 |
- Integral relief valve | 30 |
- Intended use | 8 |
- IP | 89 |

| K |
| Keys | 13, 17 |

**L**
- Language | 62 |
- Leakage hole | 70 |
- LED | 13 |
- LED displays | 23 |
- Level switches | 22 |
- Linear curve | 50 |
- Liquid end | 13, 19 |
- Location | 57 |
- Lock | 60 |
- Log book | 61, 81 |
- Log book entries | 61 |
- Log book, events | 83 |
- Log book, fault messages | 82 |
- Log book, warning messages | 81 |
- Lost in hyperspace | 43, 46 |
- Lower side band | 51 |

**M**
- mA input | 49 |
- mA output | 13, 22 |
- mA-Output | 56 |
- Main display | 15 |
- Maintenance | 69 |
- Manual | 21, 23, 47 |
- Materials | 88 |
- memory | 47, 48 |
- Memory | 47 |
- Menu | 46 |
- Metering | 51, 55 |
- Metering optimised | 51, 52 |
- Metering profile | 51 |
- Metering pumps without integral relief valve | 31 |
- Metering timer | 60 |
- Mixing, optimum | 52 |

**N**
- Namur sensor | 91 |
- New | 58 |
- Nominal pressure | 52 |
- NPSH | 52 |

**O**
- Operating display | 13, 23 |
- Operating menu | 106 |
- Operating mode | 46 |
- Operating mode selection | 47 |
## Index

Operating modes ....................... 20, 23
Operating overview . .................. 105
Operation .................................. 67
Optional .................................. 55
Optional module .......................... 13
Options .................................... 22
Ordering information .................... 101
Output relay .............................. 22
Overload shut-down ............... 21, 52
Overview of equipment .......... 13

**P**
- Pacing relay ........................... 22, 35
- Part device address .................. 46
- Part name ................................ 46
- Password ............................. 45, 60
- Pause .................................... 22, 23, 38
- Power supply .......................... 41
- Precision ................................ 87
- Pressure ................................ 52
- Pressure stage .......................... 52
- Priming .................................. 22, 23, 67
- Priming optimised .................... 51, 52
- PROFIBUS® .............................. 13
- Protection against contact and humidity .......... 89
- Protection class .......................... 89
- Protection menu ........................ 60
- Pump active ............................. 55
- Pump capacity ........................... 87
- Pump device LEDs ........................ 23

**Q**
- Qualification of personnel ................. 9

**R**
- Radioactive ............................. 12
- Relay ..................................... 22, 54
- Relay output ............................. 13
- Relay polarity .......................... 54, 55
- Relay type ................................ 54
- Relevant directives ..................... 104
- Relief valve .............................. 13, 30
- Replacing the diaphragm .... 74
- Reproducibility .......................... 87
- Return line .............................. 31

**S**
- Safety Chapter ............................. 8
- Safety Requirements ....................... 89
- Scope of delivery ....................... 12
- Secondary display ....................... 15
- Secondary displays ...................... 45, 111
- Semiconductor relay .................. 22, 35, 111
- Serial number ........................... 22, 104
- Service .................................... 60
- Set time ................................... 57
- Set up, chapter ............................ 46
- Set-up overview .......................... 105
- Setting .................................... 43
- Setting mode ............................. 45
- Setting the timer ......................... 58
- Settings .................................... 46
- Shipping weight .......................... 88
- Side band .................................. 49, 51
- Sockets ..................................... 13
- Software ................................... 46
- Sound pressure level ..................... 11, 91
- Spare parts kit part number .... 62
- Spare parts kits ............................ 62, 95
- Standard .................................. 51, 52
- Standard installation .......................... 32
- Standard, Analogue .......................... 50
- Start up ..................................... 63
- Starting a batch ............................ 67
- Stop ...................................... 22, 23
- Storage ..................................... 12
- Storage and transport temperature .......... 88
- Stroke counter ............................. 60
- Stroke length .............................. 66
- Stroke length adjustment wheel ........ 13
- Stroke rate ................................ 55
- Suction lift ................................ 87
- Suction valve .............................. 19
- Summertime ............................... 57
- Sunday ..................................... 57
- Symbols ..................................... 32
- System ...................................... 56

**T**
- Temperatures .............................. 88
- Time ................................... 46, 58
- Time event ................................ 58
- Timer ...................................... 57
- Timer activation ........................... 57
- Timer example ............................. 60
- Tolerance .................................. 56
- Transport .................................. 12

**U**
- Unpacking ............................... 12
Upper side band ........................................ 51

V

Versions ............................................. 46
Viscosity ............................................... 52, 88
Volume counter ....................................... 60
Volume unit ........................................... 57

W

Wall bracket ........................................... 92
Warning ................................................. 55
Warning indicator ..................................... 13, 23
Warning messages ................................. 15
Warning messages, log book ...................... 81
Warning sign .......................................... 8
Wear parts ............................................. 101
Weight .................................................. 88
Wetted materials .................................... 88