Two sets of operating instructions are required for the safe, correct and proper operation of the metering pumps: The product-specific operating instructions and the "General Operating Instructions for ProMinent® motor-driven metering pumps and hydraulic accessories". Both sets of operating instructions are only valid when read together.

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!
Technical changes reserved.
<table>
<thead>
<tr>
<th>Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
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<tr>
<td>3</td>
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<tr>
<td>4</td>
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<td>5</td>
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<td>10</td>
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<tr>
<td>11</td>
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<tr>
<td>12</td>
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</tbody>
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- **2 Safety chapter** ................................................................. 8
- **3 Storage, transport and unpacking** ..................................... 11
- **4 Overview of equipment and control elements** ....................... 13
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<tr>
<td>13 Decommissioning</td>
<td>64</td>
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<td>14 Technical data</td>
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<tr>
<td>14.1 Performance data</td>
<td>66</td>
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<tr>
<td>14.2 Shipping weight</td>
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<td>75</td>
</tr>
<tr>
<td>19 Index</td>
<td>76</td>
</tr>
</tbody>
</table>
# Identity code S2Ca

**S2Ca Sigma 2, Control Type, Version a**

## Product range

<table>
<thead>
<tr>
<th>Drive type</th>
<th>Type</th>
<th>Performance</th>
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<tbody>
<tr>
<td>H</td>
<td></td>
<td>Main power end, diaphragm</td>
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</table>

<table>
<thead>
<tr>
<th>bar</th>
<th>l/h****</th>
</tr>
</thead>
<tbody>
<tr>
<td>16050</td>
<td>10* 60</td>
</tr>
<tr>
<td>16090</td>
<td>10* 95</td>
</tr>
<tr>
<td>16130</td>
<td>10* 136</td>
</tr>
<tr>
<td>07120</td>
<td>7 148</td>
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<td>07220</td>
<td>7 232</td>
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<tr>
<td>04350</td>
<td>4 350</td>
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## Dosing head material

<table>
<thead>
<tr>
<th>Dosing head material</th>
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<tbody>
<tr>
<td>PV</td>
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<tr>
<td>SS</td>
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</table>

## Seal material

<table>
<thead>
<tr>
<th>Seal material</th>
</tr>
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<tbody>
<tr>
<td>T</td>
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</table>

## Displacement

<table>
<thead>
<tr>
<th>Displacement</th>
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<tbody>
<tr>
<td>S</td>
</tr>
<tr>
<td>A</td>
</tr>
<tr>
<td>B</td>
</tr>
<tr>
<td>H</td>
</tr>
</tbody>
</table>

## Dosing head version

<table>
<thead>
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<th>Dosing head version</th>
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</thead>
<tbody>
<tr>
<td>0</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>4**</td>
</tr>
<tr>
<td>5**</td>
</tr>
<tr>
<td>6**</td>
</tr>
<tr>
<td>7**</td>
</tr>
<tr>
<td>H</td>
</tr>
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</table>

## Hydraulic connector

<table>
<thead>
<tr>
<th>Hydraulic connector</th>
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<tbody>
<tr>
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</tr>
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</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>4</td>
</tr>
</tbody>
</table>
## S2Ca Sigma 2, Control Type, Version a

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>Union nut and PVDF hose nozzle</td>
</tr>
<tr>
<td>8</td>
<td>Union nut and SS hose nozzle</td>
</tr>
</tbody>
</table>

### Version

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>With ProMinent® Logo</td>
</tr>
<tr>
<td>1</td>
<td>Without ProMinent® Logo</td>
</tr>
</tbody>
</table>

### Electric power supply

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

### Cable and plug

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>2 m European</td>
</tr>
<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

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No relay</td>
</tr>
<tr>
<td>1</td>
<td>Fault indicating relay N/C</td>
</tr>
<tr>
<td></td>
<td>1x changeover contact 230 V- 2 A</td>
</tr>
<tr>
<td>3</td>
<td>Fault indicating relay magnetic</td>
</tr>
<tr>
<td></td>
<td>1x changeover contact 230 V- 2 A</td>
</tr>
<tr>
<td>4</td>
<td>as 1 + pacing relay 2x N/O 24 V - 100 mA</td>
</tr>
<tr>
<td>5</td>
<td>as 3 + pacing relay 2x N/O 24 V - 100 mA</td>
</tr>
</tbody>
</table>

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Cut-off and warning relays N/C 2x N/ O 24 V - 100 mA</td>
</tr>
<tr>
<td>C</td>
<td>4-20 mA output = stroke length x-frequency, 1x fault indicating relay N/O 24 V - 100 mA</td>
</tr>
<tr>
<td>F</td>
<td>Power relay N/C 1x changeover contact 230 V- 8 A</td>
</tr>
</tbody>
</table>

### Control versions

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Manual + external with pulse control</td>
</tr>
<tr>
<td>1</td>
<td>Man. + external + pulse control + analog</td>
</tr>
<tr>
<td>4</td>
<td>as 0 + process timer</td>
</tr>
<tr>
<td>5</td>
<td>as 1 + process timer</td>
</tr>
<tr>
<td>R***</td>
<td>As 1 + PROFIBUS® interface, M12</td>
</tr>
<tr>
<td>C***</td>
<td>As 1 + CANopen</td>
</tr>
</tbody>
</table>

### Access code

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>no access code</td>
</tr>
<tr>
<td>1</td>
<td>with access code</td>
</tr>
<tr>
<td>2</td>
<td>As 0 + message in the event of a manual stop</td>
</tr>
</tbody>
</table>
### S2Ca Sigma 2, Control Type, Version a

<table>
<thead>
<tr>
<th>Stroke length adjustment</th>
<th>0</th>
<th>Manual</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>Manual + calibration</td>
<td></td>
</tr>
</tbody>
</table>

| Dosing monitor | 3 | As 1 + message in the event of a manual stop |

* FPM = fluorine rubber
* for SST = 16 bar
** Standard with tube nozzle in the bypass Threaded connection on request.
*** With the options PROFIBUS® and CANopen no relay can be selected
**** Exact values - see "Technical Data" chapter

---

**ProMinent**
2 Safety chapter

Explanation of the safety information

The following signal words are used in these operating instructions to identify different severities of a hazard:

<table>
<thead>
<tr>
<th>Signal word</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>WARNING</td>
<td>Denotes a possibly hazardous 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 hazardous 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></td>
<td>Warning – high-voltage.</td>
</tr>
<tr>
<td><img src="image" alt="Warning sign" /></td>
<td>Warning – danger zone.</td>
</tr>
</tbody>
</table>

Correct and proper use

- The pump may only be used to dose liquid metering chemicals.
- Only SST design pumps may be used with combustible feed chemicals.
- The pump may only be started up after it has been correctly installed and commissioned in accordance with the technical data and specifications contained in the operating instructions.
- The general limitations with regard to viscosity limits, chemical resistance and density must be observed - see also ProMinent resistance list (In the product catalogue or at www.prominent.com)!
- Any other uses or modifications are prohibited.
- The pump is not intended for the metering of gaseous media or solids.
- The pump is not intended for operation in hazardous locations.
- The pump is not intended for exterior applications without use of suitable protective equipment.
- The pump should only be operated by trained and authorised personnel, see the following “Qualifications” table.
- You are obliged to observe the information contained in the operating instructions at the different phases of the device's service life.
WARNING!
Warning of hazardous or unknown feed chemical
Should a hazardous or unknown feed chemical be used, it may escape from the hydraulic components when working on the pump.

– Take appropriate protective measures before working on the pump (protective eyewear, protective gloves, ...). Read the safety data sheet on 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.

CAUTION!
Warning of feed chemical spraying around
An unsuitable feed chemical can damage the parts of the pump contacted by the chemical.

– Take into account the resistance of the material contacted by the chemical when selecting the feed chemical - refer to the ProMinent® resistance list in the product equipment catalogue or at www.prominent.com.

CAUTION!
Danger of personal and material damage
The use of untested third party parts can result in damage to personnel and material damage.

– Only fit parts to dosing 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.

CAUTION!
Warning of illegal operation
Observe the regulations that apply where the unit is to be installed.
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.

### Qualification of personnel

<table>
<thead>
<tr>
<th>Activity</th>
<th>Qualification level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storage, transport, unpacking</td>
<td>Instructed person</td>
</tr>
<tr>
<td>Assembly, installation of hydraulic system</td>
<td>Technical personnel, service</td>
</tr>
<tr>
<td>Installation, electrical</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 terms:

#### 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/her technical training, knowledge and experience, as well as knowledge of pertinent regulations.

**Note:**

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

#### Electrical technician

Electrical technicians are deemed to be people, who are able to complete work on electrical systems and recognize and avoid possible dangers independently based on their technical training and experience, as well as knowledge of pertinent standards and regulations.

Electrical technicians should be specifically trained for the working environment in which the are employed and know the relevant standards and regulations.

Electrical technicians 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/her and possible dangers that could result from improper behaviour, as well as having been instructed in the required protective equipment and protective measures.

#### Customer Service department

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.

### Sound pressure level

Sound pressure level $L_{pA} < 70$ dB in accordance with EN ISO 20361:2010-10

at maximum stroke length, maximum stroke rate, maximum back pressure (water)
3 Storage, transport and unpacking

Safety information

WARNING!
Only return metering pumps for repair in a cleaned state and with a flushed liquid end - refer to the section on decommissioning!

Only send metering pumps with a filled in 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 in the Appendix or at www.prominent.com.

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 supply

Compare the delivery note with the scope of supply:
- Metering pump with mains power cable
- If necessary, connector kit for hose/pipe connection
- Product-specific operating instructions with EC Declaration of Conformity and supplementary information CD for ProMinent pump operating instructions.
- As necessary, documents for options and accessories

Storage

Personnel: Technical personnel

1. Place 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, closed shop under the following ambient conditions.
<table>
<thead>
<tr>
<th>Data</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum storage and transport temperature</td>
<td>-10</td>
<td>°C</td>
</tr>
<tr>
<td>Maximum storage and transport temperature</td>
<td>+50</td>
<td>°C</td>
</tr>
<tr>
<td>Maximum air humidity *</td>
<td>95</td>
<td>% rel. humidity</td>
</tr>
</tbody>
</table>

* non-condensing
4 Overview of equipment and control elements

Overview of equipment

Fig. 1: Overview of equipment S2Ca
1 Drive motor
2 Drive unit
3 Control unit
4 Liquid end

Control elements

Fig. 2: Sigma control elements
1 Relief valve
2 Diaphragm rupture sensor (visual)
Fig. 3: Block diagram Sigma Control 1
1 Stroke adjustment dial
2 LCD screen
3 Operating indicator (green)
4 Warning indicator (yellow)
5 Fault indicator (red)
6 [key]
7 [START/STOP] key
8 [P] key
9 [DOWN] key
10 [UP] key

Fig. 4: Block diagram Sigma Control 2
1 Mains switch
2 "Diaphragm rupture" terminal
3 Mains Cable
4 "External control" terminal
5 "Dosing monitor" terminal
6 "Level Switch" terminal
7 Relay cable
5 Functional description

5.1 Drive unit

The metering pump is an diaphragm pump, the stroke length of which can be adjusted. An electric motor (1) drives the pump. A worm gear (2) steps down its drive rotation A cam (3), in conjunction with the uptake fork (8) converts this into an oscillation movement of the slide rod (4). A return spring (5) presses the uptake fork together with the slide rod positively against the cam thus producing the reciprocal stroke. The stroke length can be adjusted using the stroke adjustment dial (6) and the axle (7). The different stroke lengths are in effect caused by a limitation of the reciprocal strokes (see “Illustration of the stroke movement” on page 15). The slide rod transmits the stoke motion to the metering diaphragms.

Fig. 5: Section through the drive unit Sigma 2

1 Electric motor
2 Worm gear
3 Eccentric cam
4 Slide rod
5 Return spring
6 Stroke adjustment dial
7 Axle
8 Uptake fork

Illustration of the stroke movement

Fig. 6: Stroke movement at a) maximum stroke length and b) reduced stroke length.

s Stroke velocity
ω Cam rotational angle
+ Discharge stroke
- Suction stroke
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.

![Cross-section through the liquid end](image)

**Fig. 7: Cross-section through the liquid end**

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

5.3 Integral relief valve

The integral relief valve normally operates as a simple, directly controlled **bleeder valve**. As soon as the pressure exceeds the pressure value, which is set using the large spring (1), it lifts the ball (2). The feed chemical then 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** if the rotary dial (3) is turned clockwise up to the "open" stop: This relieves the high force caused by the large spring (1) which was acting on the ball (2) - the ball is now controlled by the low force of the small spring (4). The integral relief valve is, when used in this way, a priming aid for starting up the pump against pressure.
5.4 Multi-layer safety diaphragm

The multi-layer safety diaphragm has the same function as the conventional double diaphragm system with working and safety diaphragms; however it also has the advantage that both diaphragms are joined together in a single unit.

If the working layer (1) breaks, the feed chemical penetrates between the working and safety (2) layers and spreads out. The safety layer ensures that not feed chemical penetrates to the outside.

As soon as the feed chemical reaches the flap (3) on the edge of the multi-layer safety diaphragm, it inflates it. The flap presses a piston (4) in the membrane rupture sensor (5), so that this triggers.

With the visual diaphragm rupture sensor, the lowered red cylinder (6) springs forward beneath the transparent cover (7) so that it then becomes clearly visibleFig. 9.

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

The electrical diaphragm rupture sensor is connected to the "diaphragm rupture indicator" terminal. If a diaphragm rupture occurs, the red LED "Fault" indicator illuminates on the pump, the identifier "Error" and "DIAPH" flash on the LCD screen. Dependent on the identity code variant selected under "Displacement body", the pump either continues metering ( "Pump emits alarm") or stops ( "Pump stops").
5.5 Operating modes

The operating modes are selected via the “MODE” menu (dependent on the identity code, some operating modes may not be present):

**“Analog” operating mode** (Identity code, control variant: analog). The stroke rate is controlled using an analog current signal via the "External control" terminal. Processing of the current signal can be preselected via the control unit.

**“Manual” operating mode** The stroke rate is set manually via the control unit. 100 % corresponds to 180 strokes/min.

**“Contact” operating mode**: This operating mode provides the option of making fine adjustments using small scaling or transfer factors. The metering can be triggered either by a pulse received via the "External control" terminal or through a contact or a semiconductor switching element. A metering quantity (batch) or a number of strokes (scaling or transfer factor 0.01 to 99.99) can be pre-selected via the control unit using the “Pulse Control” option.

**“Batch” operating mode**: This operating mode provides the option of working with large transfer factors (up to 65535). The metering can be triggered either by pressing the [P] key or by a pulse received via the "External control" terminal or through a contact or a semiconductor switching element. It is possible to pre-select a metering quantity (batch) or a number of strokes via the control unit.

**“BUS” operating mode** (Identity code, control variant: CANopen or PROFIBUS®). This operating mode provides the option of controlling the pump via a BUS (see "Supplementary instructions for ProMinent® gamma/ L and ProMinent Sigma versions with PROFIBUS®").
5.6 Functions

The following functions can be selected using the SET menu:

"Calibrate" function: (Identity code, stroke length adjustment: manual +
calibration) The pump can also be operated in the 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 within a stroke rate range of 0 - 180 strokes/min. The calibra‐
tion is also maintained when the stroke length is altered by up to ±10 %
scale divisions.

"Auxiliary frequency" function: Enables a freely selectable and program‐
mable stroke rate to be switched on in the “SET” 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
dosing monitor is connected. The number of defective strokes, after which
the pump is switched off, can be set in the “SET” menu.

The following functions are available as standard:

"Level switch" function: Information about the liquid level in the chemical
feed container is reported to the pump control. To do so, a two-stage level
switch must be fitted; it 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 Con‐
trol" terminal.

The following functions are triggered by a key press:

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

"Prime" function: Priming (short-term transport at maximum frequency) can
be triggered by simultaneous pressing of the two arrow keys in the "Stroke
rate" continuous display.

5.7 Options

Relay option

The pump has two connecting options (not with PROFIBUS® or timer):

Option "Fault indicating relay" or "Power relay": In the event of fault sig‐
nals, warning signals or tripped level switches, the relay connects to com‐
plete an electric circuit (for alarm horns etc.). The relay can be retrofitted
via a knock-out in the drive unit.

"Fault indicating and pacing relay" option In addition to the fault indicating
relay, the pacing relay can be used to make a contact every stroke. The
relay can be retrofitted via a knock-out in the drive unit.
5.8 Function and fault Indicator

The operating and fault statuses are indicated by the three LED indicators and the “Error” identifier on the LCD screen, see also the “Trouble-shooting” chapter.

5.9 LCD screen

If a fault occurs, the identifier “Error” appears and an additional error message.

5.10 LED indicators

Operating indicator (green): The operating indicator illuminates if during pump operation there are no incoming fault or warning messages. It goes out briefly with every stroke.

Warning indicator (yellow): The warning indicator illuminates, if the pump electronics detect a condition which may lead to a fault, e.g. “liquid level low 1st stage”.

Fault indicator (red): The fault indicator illuminates, if a fault occurs e.g. liquid level low 2nd stage.

5.11 Hierarchy of operating modes, functions and fault statuses

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

The following list shows the order:

1. - Priming
2. - Fault, Stop, Pause
3. - Auxiliary frequency (external frequency changeover)
4. - Manual, external contact

Comments:

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

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

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

**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.

**CAUTION!**  
**Warning about personal and material damage**  
Personal and material damage may be caused if the unit is operated outside of the permissible ambient conditions.  
- Please observe the permissible ambient conditions - refer to the chapter entitled “Technical Data”.

**WARNING!**  
**Risk of electric shock**  
If water or other electrically conducting liquids penetrate into the drive housing, an electric shock may occur.  
- Position the pump so that drive housing cannot be flooded.

**WARNING!**  
**The pump can break through the supporting floor or slide off it**  
- The supporting floor must be horizontal, smooth and permanently load-bearing.

**Capacity too low**  
_Vibrations can disturb the valves of the liquid end._  
- _The supporting floor must not vibrate._

---

Supporting floor

![Fig. 11](P_MOZ_0016_SW)
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 ...).

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.

CAUTION!
Capacity too low
If the valves of the liquid end do not stand upright, they cannot close correctly.
- The discharge valve must be upright.

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

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

Fasten the pump base to the supporting floor using suitable screws.
7 Installation

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

7.1 Installation, hydraulic

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 an advantage when working with highly aggressive or hazardous feed chemicals:
- Install a bleed valve with recirculation in the storage tank.
- Install an additional shut-off valve on the discharge or suction ends.

CAUTION!
Warning about personal and material damage
Also observe the "General Operating Instructions for ProMinent® Motor-Driven Metering Pumps and Hydraulic Accessories"!

CAUTION!
Suction problems possible
For feed chemicals with a particle size greater than 0.3 mm, the valves may no longer close properly.
- Install a suitable filter in the suction line.
CAUTION!
Warning against the discharge line bursting
With a closed discharge line (e.g. due to a clogged discharge line or by closing a valve), the pressure that the metering pump generates can reach several times the permissible pressure of the system or the metering pump. This could lead to lines bursting resulting in dangerous consequences with aggressive or toxic 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 bursting of the suction or discharge lines
Hose lines with insufficient pressure rating may burst.
- Only use hose lines with the required pressure rating.

CAUTION!
Warning against lines disconnecting
With suction, discharge and relief lines installed incorrectly can loosen / disconnect from the pump connection.
- Only use original hoses with the specified hose diameter and wall thickness.
- Only use clamping rings and hose nozzles that correspond with the respective hose diameter.
- Always connect the lines without mechanical tension.

CAUTION!
Warning against 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 connections. They seal the connections between grooved pump valves and the grooved inserts from ProMinent - see Fig. 15.
- In the event that an unflared insert is used (e.g. third party part), an elastomer flat seal must be used - see Fig. 16.

Numerous installation instructions with drawings are contained in the “General Operating Instructions for ProMinent® metering pumps and hydraulic accessories”.

- 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, spring-loaded injection valve, relief valve, foot valve or a liquid end do not represent absolutely leak-tight closing elements.
- For this purpose use a shut-off valve, a solenoid valve or a vacuum breaker.

**CAUTION!**

**Warning of illegal operation**
Observe the regulations that apply where the unit is to be installed.

**CAUTION!**

To check the pressure conditions in the piping system it is recommended that connecting options are provided for a manometer 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 pipeline
2. Flexible pipe section
3. Plastic liquid end

**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!
Warning of feed chemical spraying around
If no relief valve was connected to the overflow line, the feed chemical sprays out of the hose connection as soon as the relief valve opens.
- An overflow line must always be connected to the integral relief valve and be fed back to the storage tank or - if required by the regulations - into a special storage tank.

CAUTION!
Danger of cracking
Cracking of the PVT liquid end can occur if a metal overflow line is connected to the relief valve.
- Never connect a metal overflow line to the relief valve.

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.

CAUTION!
Warning against leaks
Feed chemical which remains in the overflow line at the relief valve, can attack the valve or cause it to leak
- Route the overflow line with a continuous slope and moreover with the tube nozzle pointed downwards - see Fig. 19.

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 (no seal necessary).
7.2 Installation, electrical

General safety notes

**CAUTION!**
*Warning of unnoticed diaphragm rupture*
Only above approximately 2 bar system back pressure is a signal generated upon a diaphragm rupture.
- Only rely on the diaphragm rupture sensor at back pressures greater than 2 bar.

**WARNING!**
*Danger of electric shock*
Unprofessional installation may lead to electric shocks.
- All cable cores cut to length must be provided with cable end sleeves.
- The Installation, electrical of the device may only be undertaken by technically trained personnel.

**CAUTION!**
*Warning about personal and material damage*
Also observe the "General Operating Instructions for ProMinent® Motor-Driven Metering Pumps and Hydraulic Accessories"!

**What requires electrical installation?**
- Level switch
- Diaphragm rupture sensor (Option)
- Dosing monitor (Option)
- Relay (option)
- External control
- mA output (option)
- Bus connector (option)
- Timer (option)
- 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 dosing monitor (option)**
Connect the plugs of the level switch, diaphragm rupture sensor and dosing monitor to the corresponding sockets on the front side of the control. In case of uncertainty - see chapter "Overview of equipment and control elements"
Pacing relay (option)

1. Install the cable which originates from the pacing relay - see the figure in the chapter entitled "Overview of equipment and control elements": Cable A, left.

   The cable polarity is unimportant.

2. Install the power supply cable to the pacing relay PCB - see the figure in the chapter entitled "Overview of equipment and control elements": Cable B, right.

   CAUTION!
   Warning of overload
   If the current through the relay becomes too high, both it and the pump could be destroyed by overheating.
   – Fit a circuit breaker.

Relay technical data

The contacts are potential-free.

As a NC fault indicating relay the relay closes immediately after the power is switched on and opens in the event of a fault.

As a N/O fault indicating relay, the relay closes in the event of a fault.

Use suitable interference suppression (e.g. RC members) when connecting inductive loads.

Fault indicating relay

Data | Value | Unit
---|---|---
Maximum voltage | 250 | VDC (50/60 Hz)
Maximum current | 2 | A (resistive)
Closing duration | - | |
Service life * | > 200 000 | Play

* at rated load

Behaviour: - see identity code

The contacts are potential-free.

Pin assignment
### Fault indicating relay

**Data**

<table>
<thead>
<tr>
<th>Data</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum voltage</td>
<td>24</td>
<td>VAC (50/60 Hz)</td>
</tr>
<tr>
<td>Maximum current</td>
<td>100</td>
<td>mA</td>
</tr>
<tr>
<td>Closing duration</td>
<td>100</td>
<td>ms</td>
</tr>
<tr>
<td>Service life *</td>
<td>&gt; 200 000</td>
<td>Play</td>
</tr>
</tbody>
</table>

* at rated load

Behaviour: - see identity code

The contacts are potential-free.

### Pacing relay

**Data**

<table>
<thead>
<tr>
<th>Data</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum voltage</td>
<td>24</td>
<td>VDC</td>
</tr>
<tr>
<td>Maximum current</td>
<td>100</td>
<td>mA</td>
</tr>
<tr>
<td>Closing duration</td>
<td>100</td>
<td>ms</td>
</tr>
<tr>
<td>Service life *</td>
<td>$50 \times 10^6$ (10 V, 10 mA)</td>
<td>Play</td>
</tr>
</tbody>
</table>

* at rated load

Behaviour: - see identity code

The contacts are potential-free.

### 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>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>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>

---

**Fig. 21: Cable conductor assignments**

**Fig. 22: Cable conductor assignments**
As a NC fault indicating relay - the relay closes immediately after the power is switched on and opens in the event of a fault.

As a N/O fault indicating relay, the relay closes in the event of a fault.

### Output relay

**Data**

<table>
<thead>
<tr>
<th>Data</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum voltage</td>
<td>250</td>
<td>VDC (50/60 Hz)</td>
</tr>
<tr>
<td>Maximum current</td>
<td>16</td>
<td>A (resistive)</td>
</tr>
<tr>
<td>Closing duration</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Service life *</td>
<td>&gt; 30 000</td>
<td>Play</td>
</tr>
</tbody>
</table>

* at rated load

Behaviour: - see identity code

The contacts are potential-free.

### 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>

### Fault indicating and pacing relay option

**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>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>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>

**Fig. 23: Cable conductor assignments**

**Fig. 24: Cable conductor assignments**
External control

Wiring diagram
View of the cable plug from the front

Level switch cable
- blue + black: open
  -> Alarm message
- brown + black: open
  -> Alarm message + Pump stopped

Dosing monitor cable
- 1 brown / 5 V
- 2 white / Cod.
- 3 blue / Analog +
- 4 black / GND

Diaphragm rupture sensor cable
- Contact open -> Alarm message +
  For control type 0: Pump stopped

Universal control wire (5-core)
- 1 brown / Stop
- 2 white / Contact
- 3 blue / Analog +
- 4 black / GND
- 5 grey / Auxiliary

Pause function:
- brown + black: closed
  -> Pump dosing
- brown + black: open
  -> Pump stopped

External/Contact:
- white + black: close
  -> Start contact for pump

(Pause function inactive?:
  brown + black: closed)

Analog:
- blue, black
  -> Analog input 0/4-20 mA

(Pause function inactive?:
  brown + black: closed)

Auxiliary rate:
- grey + black: closed
  -> Pump dosing with preset stroke rate

→ Wiring example - see next page

External/Contact cable (2-core)
- 2 brown
- 4 white

Close contact -> Metering stroke

Contact open -> Alarm message +
For control type 0: Pump stopped

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>Input resistance:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>approx. 5 V</td>
<td>10 kΩ</td>
</tr>
<tr>
<td>2</td>
<td>approx. 5 V</td>
<td>10 kΩ</td>
</tr>
<tr>
<td>3</td>
<td>approx. 5 V</td>
<td>10 kΩ</td>
</tr>
<tr>
<td>4</td>
<td>GND</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>auxiliary input</td>
<td></td>
</tr>
</tbody>
</table>

Control type 0 (see identity code)

<table>
<thead>
<tr>
<th>Pin</th>
<th>Voltage with open contacts:</th>
<th>Input resistance:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>approx. 5 V</td>
<td>10 kΩ</td>
</tr>
<tr>
<td>2</td>
<td>approx. 5 V</td>
<td>10 kΩ</td>
</tr>
<tr>
<td>3</td>
<td>approx. 5 V</td>
<td>10 kΩ</td>
</tr>
<tr>
<td>4</td>
<td>GND</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>auxiliary input</td>
<td></td>
</tr>
</tbody>
</table>

### Control type 0 (see identity code)

<table>
<thead>
<tr>
<th>Pin</th>
<th>Voltage with open contacts:</th>
<th>Input resistance:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 = Pause input (activating function)</td>
<td>approx. 5 V</td>
<td>10 kΩ</td>
</tr>
<tr>
<td>2 = contact input</td>
<td>approx. 5 V</td>
<td>10 kΩ</td>
</tr>
<tr>
<td>3 = not assigned</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 = GND</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 = auxiliary input</td>
<td>approx. 5 V</td>
<td>10 kΩ</td>
</tr>
</tbody>
</table>

Control:
- Potential-free contact (approx. 0.5 mA)
- Semiconductor switch (residual voltage < 0.7 V)

**Technical data**

- min. contact duration: 20 ms
- Max. pulse frequency: 25 pulses/s
## Control type 1 (see identity code)

<table>
<thead>
<tr>
<th>Pin</th>
<th>Voltage with open contacts:</th>
<th>approx. 5 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pin 1 = Pause input (activating function)</td>
<td>Input resistance:</td>
<td>10 kΩ</td>
</tr>
<tr>
<td></td>
<td>Control:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>■ Potential-free contact (approx. 0.5 mA)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>■ Semiconductor switch (residual voltage &lt; 0.7 V)</td>
<td></td>
</tr>
<tr>
<td>2 = contact 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></td>
</tr>
<tr>
<td></td>
<td>■ Potential-free contact (approx. 0.5 mA)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>■ Semiconductor switch (residual voltage &lt; 0.7 V)</td>
<td></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 = Analog input*</td>
<td>Input apparent ohmic resistance</td>
<td>approx. 120 Ω</td>
</tr>
<tr>
<td>4 = GND</td>
<td>Voltage with open contacts:</td>
<td>approx. 5 V</td>
</tr>
<tr>
<td>5 = auxiliary input</td>
<td>Input resistance:</td>
<td>10 kΩ</td>
</tr>
<tr>
<td></td>
<td>Control:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>■ Potential-free contact (approx. 0.5 mA)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>■ Semiconductor switch (residual voltage &lt; 0.7 V)</td>
<td></td>
</tr>
</tbody>
</table>

* The metering pump makes its first metering stroke at approx. 0.4 mA (4.4 mA) and starts continuous operation at approx. 19.2 mA.
Fig. 25: Block diagram Sigma 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"  
0/4-20 mA

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

Site end  |  Cable  |  Pump, Inside
---|---|---
2 white / Contact  | External activation  | X
4 brown / GND  |  | X

2 white / Contact  | External activation  | X
1 brown / Pause  |  | X
4 black / GND  |  | X
5 grey / Auxiliary  |  | X

3 blue / Analog  | External activation  | X
2 white / Contact  |  | X
1 brown / Pause  |  | X
4 black / GND  |  | X
5 grey / Auxiliary  |  | X

ProMinent®
Installation

7.2.2 Pump, power supply

1. Install an emergency cut-off switch or include the pump in the emergency cut-off management of the system.

2. Install the pump cable.

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

7.2.3 Other units

Install the other units according to their supplied documentation.
8 Adjustment

For supplementary information see "Control elements and key functions" in the chapter "Overview of equipment and control elements" and "Operating/setting overview" in the appendix.

The pump control returns to the continuous display, as soon as no key has been pressed for one minute.

8.1 Basic principles of pump adjustment

Briefly press the [P] key

The display simultaneously changes to the next menu option or into a continuous display.

Press and hold the [P] key for 3 seconds

Entry is cancelled and you jump back to a continuous display.

Press the [i] key once.

You can toggle between altering the digits of a value ("change individual digits" = standard) and incremental changing of a value ("change a number").
8.2 Checking adjustable values

Before you adjust the pump control, you can check the actual settings of the adjustable values:

Press the [i] key ("i" for "Info"), if the LCD screen shows a continuous display (The display does not contain the [P] key symbol).

⇒ Each press of the [i] key toggles the continuous display output to the screen to another continuous display.

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

8.3 Changing to adjustment mode

1. In a continuous display press the [P] key for at least 2 seconds.
   ⇒ The pump control changes to adjustment mode.

2. If "CODE 1" was set, then after pressing the [P] key, the code must first be entered.

The following menus can initially be chosen in adjustment mode - see also "Operating/setting overview" in the appendix:

- "MODE" menu
- "CODE" menu (option)
- "SET" menu
- "CLEAR" window
To match the pump to your process requirements, you must observe the following procedure:

1. In the "MODE" menu select the operating mode.
2. If necessary make the settings for this operating mode in the "SET" menu.

Exceptions: Timer and PROFIBUS®.

Note the diagram.

8.4 Operating mode selection (MODE menu)

In the "MODE" menu (dependent on the identity code, some operating modes may not be present):

- "Analog": for current control (identity code control variant: "Analog current")
- "Contact": for contact operation (identity code control variant: "External 1:1" / "External with pulse control")
- "Batch": for batch operation (identity code control variant: "External with pulse control")
8.5 Operating mode settings (SET menu)

First in the "MODE" menu select the operating mode!
Exceptions: Timer and PROFIBUS®.

In the "SET" menu, you can make various settings dependent on the selected operating mode.
Adjustment menus are available in all operating modes for the following programmable functions:
- Calibrate ("CALIB" menu)
- Auxiliary rate ("AUX" menu)
- Flow ("FLOW" menu; only available if a dosing monitor is connected)
  - see also the chapter "Programmable function settings (SET menu)".

As to whether or not a further setting menu is available, depends on the selected operating mode.

8.5.1 "Manual" operating mode settings

Other than those described in more detail in the chapter "Programmable function settings (SET menu)" there are no other setting menus available in "Manual" operating mode via the "SET" menu.

8.5.2 "Analog" operating mode settings (ANALG menu)

Overview

Alongside those described in more detail in the chapter "Programmable function settings (SET menu)" the "ANALG" menu is also available in "Analog" operating mode via the "SET" menu.

The stroke rate is controlled using an analog current signal via the "External control" terminal
You can select three types of current signal processing:

- **"0 - 20 mA"**:
  - At 0 mA the pump is stationary.
  - At 20 mA the pump works at the maximum stroke rate.
  - Between these values, the stroke rate is proportional to the current signal.

- **"4 - 20 mA"**:
  - At 4 mA the pump is stationary.
  - At 20 mA the pump works at the maximum stroke rate.
  - Between these values, the stroke rate is proportional to the current signal.
  - For current signals less than 3.8 mA a fault message appears and the pump stops (e.g. if a cable has broken).

- **"Curve"**: Under the "Curve" processing type, you can freely program the pump behaviour. There are three options:
  - Line
  - Lower sideband
  - Upper sideband

**Fig. 30**

The symbol appears on the LCD screen. You can enter any stroke rate- behaviour of the pump proportional to the current signal. For this purpose, enter any two points P1 (I1, F1) and P2 (I2, F2) (F1 is the stroke rate at which the pump is to operate at current I1); this defines a straight line and thus the behaviour is specified:

**Fig. 31**

**Line**

The symbol appears on the LCD screen. You can enter any stroke rate- behaviour of the pump proportional to the current signal. For this purpose, enter any two points P1 (I1, F1) and P2 (I2, F2) (F1 is the stroke rate at which the pump is to operate at current I1); this defines a straight line and thus the behaviour is specified:
Upper/lower sideband

Using these processing types, you can control a metering pump using the current signal as shown in the diagrams below.

**Lower sideband:**

The symbol \( \sim \) appears on the LCD screen. Below I₁, the pump works at a rate of F₁ - above I₂ it stops. Between I₁ and I₂ the stroke rate varies between F₁ and F₂ in proportion to the signal current.

The smallest processable difference between I₁ and I₂ is 4 mA

**Upper sideband:**

The symbol \( \sim \) appears on the LCD screen. Below I₁, the pump is stationary - above I₂ the pump works at rate F₂. Between I₁ and I₂ the stroke rate varies between F₁ and F₂ in proportion to the signal current.

The smallest processable difference between I₁ and I₂ is 4 mA
Under menu option "ER" (Error) you can activate error processing for the "Curve" processing type. For current signals below 3.8 mA, a fault message appears and the pump stops.

8.5.3 "Contact" operating mode settings (CNTCT menu)

Alongside those described in more detail in the chapter "Programmable function settings (SET menu)" the "CNTCT" menu is also available in "Contact" operating mode via the "SET" menu.

"Contact" operating mode allows you to trigger individual strokes or a stroke series. 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 with a reduction (bridge) or small step-up into strokes.

**CAUTION!**

If you change into another operating mode, the factor is reset to "1".

With the identity code version "Contact - identity code: External with pulse control" you can enter after how many pulses a stroke should occur. "Contact - identity code: External with pulse control" is intended for small metering quantities.

The number of strokes per pulse depends on the factor which you input. By use of the 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
### Example Table

<table>
<thead>
<tr>
<th></th>
<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>
<td></td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>1</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>99.99</td>
<td>1</td>
<td>99.99</td>
<td></td>
</tr>
<tr>
<td>1.50</td>
<td>1</td>
<td>1.50 (1 / 2)</td>
<td></td>
</tr>
<tr>
<td>1.25</td>
<td>1</td>
<td>1.25 (1 / 1 / 1 / 2)</td>
<td></td>
</tr>
<tr>
<td><strong>Reduction</strong></td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>0.50</td>
<td>2</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>0.50</td>
<td>10</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>0.50</td>
<td>100</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>0.50</td>
<td>4</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>0.50</td>
<td>2.5 (3 / 2)</td>
<td>(1 / 1)</td>
<td></td>
</tr>
<tr>
<td>0.50</td>
<td>1.33 (2 / 1 / 1)</td>
<td>(1 / 1 / 1)</td>
<td></td>
</tr>
</tbody>
</table>

### Explanation of Step-up

<table>
<thead>
<tr>
<th>Factor</th>
<th>Pulse and strokes</th>
</tr>
</thead>
<tbody>
<tr>
<td>with a factor 1 ...</td>
<td>1 stroke is executed per pulse</td>
</tr>
<tr>
<td>with a factor 2 ...</td>
<td>2 strokes are executed per pulse</td>
</tr>
<tr>
<td>with a factor 25 ...</td>
<td>25 strokes are executed per pulse</td>
</tr>
</tbody>
</table>

### Explanation of Reduction

<table>
<thead>
<tr>
<th>Factor</th>
<th>Pulse and strokes</th>
</tr>
</thead>
<tbody>
<tr>
<td>with a factor 1 ...</td>
<td>1 stroke is completed after 1 pulse</td>
</tr>
<tr>
<td>with a factor 0.5 ...</td>
<td>1 stroke is completed after 2 pulses</td>
</tr>
<tr>
<td>with a factor 0.1 ...</td>
<td>1 stroke is completed after 10 pulses</td>
</tr>
<tr>
<td>with a factor 0.75 ...</td>
<td>1 stroke is completed after 2 pulses once, then 1 stroke is completed after 1 pulse twice and then (repeating) 1 stroke after 2 pulses, etc...</td>
</tr>
</tbody>
</table>

---

*If a remainder is obtained when dividing by the factor, then the pump software 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.*
You can also activate the "Memory" function extension (identifier "Mem" appears on the LCD screen; "Mem" = memory). When "Memory" is activated, the pump software adds up the remaining strokes, which could not be processed, up to the maximum capacity of the stroke memory of 65,535 strokes. If this maximum capacity is exceeded, the pump goes into fault mode.

You can thus optimally match the pump to the process in question, for example in conjunction with contact water meters.

8.5.4 "Batch" operating mode settings (BATCH menu)

Alongside those described in more detail in the chapter "Programmable function settings (SET menu)" the "BATCH" menu is also available in "Batch" operating mode via the "SET" menu.

Fig. 36

The operating mode "Batch" is a variant of the operating mode "Contact" - in the first place see "Contact" operating mode settings". Here also, you can select a number of strokes (no fractions, only integers from 1 to 65535), but also a metering quantity (Batch). To change between the input "Number of strokes" and "Metering quantity" press the [i] key 1x under the corresponding menu option (see "Operating / adjustment overview" in the appendix).

"Batch" operating mode is intended for large metering quantities.

The metering can be triggered either by pressing the [P] key or by a pulse received via the "External control" terminal.

The number of received pulses, which could not yet be processed, is stored by the pump control in the stroke memory. The stroke memory is limited to the Batch size if "Memory" is not activated, with "Memory" to 65535 strokes.

You can delete it by changing to another operating mode.

You can also activate the "Memory" function extension (identifier "Mem" appears on the LCD screen; "Mem" = memory). When "Memory" is activated, the pump software adds up the remaining strokes, which could not be processed, up to the maximum capacity of the stroke memory of 65,535 strokes. If this maximum capacity is exceeded, the pump goes into fault mode.

You can thus optimally match the pump to the process in question, for example in conjunction with contact water meters.

8.6 Programmable function settings (SET menu)

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

- Calibrate ("CALIB" menu)
- Auxiliary rate ("AUX" menu)
- Flow ("FLOW" menu; (only available if a dosing monitor is connected)
8.6.1 “Calibrate” function settings (CALIB menu)

The pump can also be operated in the calibrated state. In this case, the corresponding continuous displays then indicate the metering volume or the capacity directly. The calibration is maintained when the stroke length is altered by up to ±10 scale divisions (for a set stroke length of 40 % this corresponds to a range from 30 % ... 50 %). If the stroke length is changed by more than ±10 scale divisions, the yellow warning light illuminates, the continuous display flashes and the flashing identifier “Calib” appears.

- Do not allow the stroke length to fall below 20 %! Otherwise the calibration becomes inaccurate.
- The calibration becomes more accurate, the more strokes the pump makes during calibration. Recommendation: at least 200 strokes.

CAUTION!
Danger with dangerous feed chemicals
Provided the following handling instructions are followed, contact with the feed chemical is possible.
- If the feed chemical is dangerous, take appropriate safety precautions when carrying out the following handling instructions.
- Observe the feed chemical safety data sheet.

Calibration

1. Lead the suction hose into a measuring cylinder containing the feed chemical - the discharge hose must be installed in a permanent manner (operating pressure, ...!).
2. Prime the feed chemical (press both arrow keys simultaneously), should the suction hose be empty.
3. Record the level in the measuring cylinder and the stroke length.
4. Select the “CALIB” menu and press the [P] key to change to the first menu option.
5. With an arrow key select “ON” and press the [P] key to change to the next menu option.
6. To start the calibration, press the [P] key. The pump starts to pump and indicates the stroke rate - at certain intervals “STOP” appears. The pump works with the stroke rate set under “MANUAL”.
7. After a reasonable number of strokes, stop the pump with the [P] key.
8. Determine the required metering volume (difference initial volume - residual volume).
9. Enter this amount under the next menu option and then press the [P] key to change to the next menu option.
10. Under menu option “UNIT” select the units (“L” or “gal”) using the arrow keys and press the [P] key.

⇒ The pump is calibrated.
Consequence:
- The corresponding continuous displays indicate the calibrated values.
- Total number of strokes and total litres are set to "0" by calibrate.
- The pump is in the STOP state.

8.6.2 “Auxiliary frequency” function settings (AUX menu)

The programmable function “Auxiliary frequency” facilitates the activating of an auxiliary stroke rate, which can be set in the “AUX” menu. It can be activated via the "External control" terminal. If the auxiliary frequency is being used, then the identifier “Aux” appears in the LCD screen.

This auxiliary frequency has priority over the stroke rate, which is specified by the currently selected operating mode.

8.6.3 “Flow” function settings (FLOW menu)

The “FLOW” menu only appears if a dosing monitor is connected to the “Dosing monitor” terminal. The dosing monitor records the individual metering strokes of the pump at the discharge connector and reports them back to the pump control. If this feedback is sequentially missing for as often as set in the “FLOW” menu (after a fault or too low metering), the pump is stopped.

8.7 Setting the code (CODE menu)

In the “CODE” menu, you can enter whether you want to block parts of the adjustment options.
8.8 Deleting the total number of strokes or total litres (CLEAR window)

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

- Select “CODE 1”, to block adjustment mode (① in “Operating / adjustment overview” in the appendix). In the next menu option, enter the number you want to use as the code.
- Select “CODE 2”, to block the option to adjust the directly changeable values in the continuous displays (① in “Operating / adjustment overview” in the appendix). In the next menu option, enter the number you want to use as the code.
- Select “NONE”, to clear a set security lock.

In the “CLEAR” window, you can delete the stored total number of strokes and simultaneously the total litres (= reset to “0”). To do this quit the Window by quickly pressing the [P] key.

The values have been counted since pump commissioning or since they were last deleted.
9 Operation

This chapter describes all the operating options available to you if the pump control is showing a continuous display - then the display does not contain the symbol for the \([P]\) key.

- For supplementary information, please read the overviews "Control elements and key functions" and see the "Operating/setting diagram" at the end of the operating instructions.
- Also take note of the overview "Continuous displays". It shows which continuous displays are available in which operating mode and which variables are directly changeable in the relevant continuous display.

9.1 Manual operation

Adjusting the stroke length

The stroke length can be continuously adjusted using the stroke length adjustment knob in the range 0 ... 100 %. The recommended stroke length range, in which the set metering quantity can, from a technical point of view, be accurately reproduced, is 30 ... 100 %

At low stroke rates the pump control switches to stop and go operation. This occurs with stroke rates, which are less than 1/3 of the maximum stroke rate. This ensures adequate cooling of the motor at low stroke rates.

The following operating options are available via the keys - see the figure on the next page:

- **Stopping/starting the pump**
  - Stop the pump: Press the \([START/STOP]\) key.
  - Start the pump: Press the \([START/STOP]\) key again.

- **Starting batch**
  - In operating mode "Batch": Briefly press the \([P]\) key.

- **Loading factory settings**
  - Press the \([P]\) key for 15 s, if you want to reload the factory settings prior to calibration!
    - This deletes the current settings.

- **Changing to adjustment mode**
  - In continuous display if you keep the \([P]\) key pressed for 2 s, the pump control switches into adjustment mode - see "Adjustment" chapter.
  - If "CODE 1" was set, then after pressing the \([P]\) key, the code must first be entered.

- **Checking adjustable values**
  - Each press of the \([i]\) key toggles the continuous display output to the screen to another continuous display. The number of continuous displays depends on the identity code, the selected operating mode and the connected additional devices.
Operation

Changing directly changeable variables

To change a value, see below, directly in the corresponding continuous display, press one of the [arrow keys] until the [Set] identifier appears.

(The delay period has been programmed in to prevent unintentional changing of values.)

If "CODE 2" was set, then after pressing an [arrow key], the code must first be entered.

The directly changeable variables are in detail:

Stroke rate

In operating modes "Manual", "Contact" and "Batch":
You can change the stroke rate in the "Stroke rate" continuous display.

Capacity

In operating mode "Manual":
You can change the capacity in the "Capacity" continuous display.

Factor

The factor is the number of strokes which are triggered upon an external pulse or pressing of key [P] (only in "Batch" operating mode).

In operating mode "Batch":
You can change the factor from the "Remaining strokes" continuous display. A couple of seconds after your have set the factor, the pump control jumps back to the initial continuous display.

Displaying the program versions

Press the [P]key for 10 s to display the program versions.

"V1052" + "X1010"

Under "LOAD3" release the [P] key immediately!

Batch size

In operating mode "Batch":
You can change the batch size from the "Batch size/Remaining litres" continuous display. A couple of seconds after your have set the factor, the pump control jumps back to the initial continuous display.

Priming

Simultaneous pressing of the two [arrow keys] triggers the "Priming" function.

Fault acknowledgement

Fault displays are acknowledged by brief pressing of the [P]key.
9.2 Remote operation

There is an option to control the pump remotely via a signal cable, PROFIBUS® or CAN bus - see chapter "Settings - selecting the operating mode (MODE menu)" and chapter "Operation", in the "Supplementary instructions for ProMinent® gamma/ L and ProMinent® Sigma versions with PROFIBUS®" as well as your system documentation.
10 Maintenance

Safety information

**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 or unknown feed chemical*
Should a hazardous or unknown feed chemical be used, it may escape from the hydraulic components when working on the pump.
- Take appropriate protective measures before working on the pump (protective eyewear, protective gloves, ...). Read the safety data sheet on 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.

---

*Place a spare parts kit in stock ready for maintenance work. You can find order numbers in the enclosed “Supplementary information CD for ProMinent pump operating instructions” under “Ordering information” - “Spare parts kits”.*

*Third party spare parts for the pumps may lead to problems when pumping.*
- Use only original spare parts.
- Use the correct spare part kits. In case of doubt, refer to the exploded views and ordering information contained in the “Supplementary information CD for ProMinent® pump operating instructions”.*
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 oper-</td>
<td>Change gear oil - refer to &quot;Changing gear oil&quot; in this chapter.</td>
<td>Instructed personnel</td>
</tr>
<tr>
<td>ating hours</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quarterly</td>
<td>Check the oil level.</td>
<td></td>
</tr>
<tr>
<td>Quarterly*</td>
<td>• Check that the metering lines are fixed firmly to the liquid end.</td>
<td>Technical personnel</td>
</tr>
<tr>
<td></td>
<td>• Check that the suction valve and discharge valve are correctly seated.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Check that the dosing head screws are tight</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Check the condition of the metering diaphragm - see § &quot;Check the condition of the metering diaphragm&quot; on page 53.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Check that the flow is correct: Allow the pump to prime briefly.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Check that the electrical connections are intact</td>
<td></td>
</tr>
</tbody>
</table>

* Under normal loading (approx. 30% of continuous operation).
Under heavy loading (e.g. continuous operation): shorter intervals.

Check the condition of the metering diaphragm

The metering diaphragm is a wear part, the service life of which is dependent upon the following parameters:

- System back pressure
- Operating temperature
- Feed chemical properties

When using abrasive feed chemicals, the diaphragm service life is reduced. In such 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 torques for dosing head screws:</td>
<td>4.5 ... 5.0</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.

Changing gear oil

**Draining gear oil**
1. Remove the vent screw (1).
2. Place an oil tray under the oil drain plug (2).
3. Unscrew the oil drain plug (2) out of the drive housing.
4. Allow the gear oil to run out of the drive.
5. Screw in the oil drain plug (2) with a new seal.

**Filling with gear oil**
Prerequisites: Gear oil according to the "Ordering information" chapter is available.

1. Start up 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 for a further 1... 2 minutes
4. Replace the vent screw (1).
11 Repairs

Safety information

**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 or unknown feed chemical**
Should a hazardous or unknown feed chemical be used, it may escape from the hydraulic components when working on the pump.
- Take appropriate protective measures before working on the pump (protective eyewear, protective gloves, ...). Read the safety data sheet on the feed chemical.
- Drain and flush the liquid end before working on the pump.

11.1 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 part kits. In case of doubt, refer to the exploded views and ordering information contained in the "Supplementary information CD for ProMinent® pump operating instructions".

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!
- Pay attention to the flow direction of the discharge and suction connectors when fitting the valve.
1. Unscrew the valve from the liquid end.

2. Screw the valve cap (5) on its suction side - see diagram.

3. Carefully remove the parts from the valve body (2).

4. Replace the worn parts.

5. Clean the remaining parts.

6. Check all parts.

7. Insert the valve ball (3) and the valve seat (4).

8. Screw on the valve cap (5).

Fig. 42: Simple cross-section through ball valve

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

Third party spare parts for the pumps may lead to problems when pumping.

- Use only original spare parts.
- Use the correct spare part kits. In case of doubt, refer to the exploded views and ordering information contained in the "Supplementary information CD for ProMinent® pump operating instructions".

Personnel:  
- Technical personnel

Requirements:
- If necessary take protective measures.
- Observe the safety data sheet for the feed chemical.
- Depressurise the system.

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 59.

9. Loosen the diaphragm from the drive axle with a gentle backwards turn in the 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. 43: Tolerance range of the flap on the backplate

1 Diaphragm
2 Backplate
Repairs

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 must 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 “Tightening torques” on page 53.

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

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.

2. If the piston of the diaphragm rupture sensor - see Fig. 44, item 4 - should have become dirty or damp, clean both it and the hole in which it runs.

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. 45: Cross-section through the liquid end

1. Suction valve
2. Metering diaphragm
3. Discharge valve
4. Dosing head
5. Backplate
13. Safety diaphragm
## 12 Troubleshooting

### Safety information

**WARNING!**
**Warning of hazardous or unknown feed chemical**
Should a hazardous or unknown feed chemical be used, it may escape from the hydraulic components when working on the pump.
- Take appropriate protective measures before working on the pump (protective eyewear, protective gloves, ...). Read the safety data sheet on 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.

### 12.1 Faults without a fault alert

#### Faults without a fault alert

<table>
<thead>
<tr>
<th>Fault description</th>
<th>Cause</th>
<th>Remedy</th>
<th>Personnel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green LED indicator (operating indicator) does not light up</td>
<td>The wrong mains voltage or no mains voltage is connected.</td>
<td>The specified mains voltage can be found on the nameplate.</td>
<td>Electrician</td>
</tr>
<tr>
<td>The optical diaphragm rupture sensor has triggered.</td>
<td>The operating diaphragm of the metering diaphragm has ruptured.</td>
<td>Replace the metering diaphragm.</td>
<td>Technical personnel</td>
</tr>
</tbody>
</table>

**WARNING!**
**Warning of escaping feed chemical**
When metering critical or combustible feed chemicals or in hazardous locations, under no circumstances must the second diaphragm also rupture.
- If the pump membrane rupture sensor triggers, stop the pump immediately and only restart once a new multi-layer safety diaphragm is fitted.
<table>
<thead>
<tr>
<th>Fault description</th>
<th>Cause</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>The red LED indicator illuminates, on the display, the identifiers “Error” and “MINIM” flash.</td>
<td>The liquid level in the storage tank has reached “liquid level low 2nd stage”.</td>
<td>Fill storage tank.</td>
</tr>
<tr>
<td>The red LED indicator illuminates, on the display, the identifiers “Error” and “ANALG” flash.</td>
<td>The pump control is in “Analog” operating mode, a fault behaviour has been programmed in the “ANALG” menu and the control current has fallen below 3.8 mA.</td>
<td>Clear the cause of the low control current. Switch the programming of the fault behaviour to “OFF” - see chapter “Adjustment - Operating mode settings (SET menu)”.</td>
</tr>
<tr>
<td>The red LED indicator illuminates, on the display, the identifiers “Error” and “CNTCT” flash.</td>
<td>Pump control is in the operating mode “Contact” or “Batch” and the function extension “Memory” has been set. Also a very large factor was set, too many contacts have been received or the key [P] has been pressed too often: Consequently a stroke memory overflow has occurred!</td>
<td>Press the [P] key, the memory content is deleted. Set up the pump again.</td>
</tr>
<tr>
<td>The red LED indicator illuminates, on the display, the identifiers “Error” and “FLOW” flash.</td>
<td>Dosing monitor not correctly connected.</td>
<td>Connect the dosing monitor correctly. Press the [P] key.</td>
</tr>
<tr>
<td>The red LED indicator illuminates, on the display, the identifiers “Error” and “MOTOR” flash.</td>
<td>Due to too high back pressure, the motor cannot work accurately enough.</td>
<td>Reduce the back pressure. Press the [P] key (reset function).</td>
</tr>
<tr>
<td>The red LED indicator illuminates, on the display, the identifiers “Error” and “TEMPERATURE” flash.</td>
<td>The temperature inside the pump housing is too high due to too high outside temperature. Allow the pump to cool. Press the [P] key (reset function).</td>
<td>Ensure lower outside temperatures. Allow the pump to cool. Press the [P] key (reset function).</td>
</tr>
<tr>
<td>The red LED indicator illuminates, on the display, the identifiers “Error” and “DIAPH” flash.</td>
<td>Metering diaphragm is ruptured. Replace metering diaphragm according to chapter “Repairs”.</td>
<td></td>
</tr>
<tr>
<td>The red LED indicator illuminates, on the display, the identifiers “Error” and “FAN” flash.</td>
<td>Error in connection with fan in pump housing. Check the fan, replace if necessary. Press the [P] key (reset function).</td>
<td></td>
</tr>
<tr>
<td>The red LED indicator illuminates, on the display, the identifiers “Error” and “SYSTEM” flash.</td>
<td>Fault at the control. Disconnect the pump from the mains then reconnect. If the error message reappears, the send the pump into ProMinent.</td>
<td></td>
</tr>
</tbody>
</table>
### 12.2.2 Warning Alerts

<table>
<thead>
<tr>
<th>Fault description</th>
<th>Cause</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green LED indicator illuminates.</td>
<td>The liquid level in the storage tank has reached &quot;liquid level low 1st stage&quot;.</td>
<td>Fill storage tank.</td>
</tr>
<tr>
<td>Green LED indicator illuminates and the identifier “Calib” flashes.</td>
<td>The pump is calibrated and the stroke length varies by more than ±10 scale divisions from the value at the time of the calibration.</td>
<td>Reset the stroke length or recalibrate the pump at the desired stroke length.</td>
</tr>
</tbody>
</table>

### 12.3 All Other Faults

Please contact the responsible ProMinent branch or representative!
13 Decommissioning

Decommissioning

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 information 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 or unknown feed chemical
Should a hazardous or unknown feed chemical be used, it may escape from the hydraulic components when working on the pump.
- Take appropriate protective measures before working on the pump (protective eyewear, protective gloves, ...). Read the safety data sheet on 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.

WARNING!
Warning of eye injuries
When opening the relief valve, a spring under high tension can jump out.
- Wear protective glasses.
**CAUTION!**

**Danger of damage to the device**
The device can be damaged by incorrect and improper storage or transportation.

- Take into account the information in the "Storage, Transport and Unpacking" chapter if the system is decommissioned for a temporary period.

### (Temporary) decommissioning

**Personnel:**  
- Technical personnel

1. Disconnect the pump from the mains power supply.
2. Depressurise and bleed the hydraulic system around the pump.
3. Empty 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 safety data sheet! Flush the dosing head thoroughly when using hazardous feed chemicals!
5. Possible additional work - see chapter "Storage, Transport and Unpacking".

### Final decommissioning

**Personnel:**  
- Technical personnel

- Also drain the gear oil - refer to the chapter entitled "Maintenance".

### Disposal

**Personnel:**  
- Technical personnel

**CAUTION!**

**Environmental hazard due to incorrect disposal**
- Note the local guidelines currently applicable in your country, particularly in regard to electronic waste!

**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!
### 14 Technical data

#### 14.1 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>16090 PVT</td>
<td>10</td>
<td>145</td>
<td>109</td>
<td>29</td>
<td>150</td>
</tr>
<tr>
<td>16130 PVT</td>
<td>10</td>
<td>145</td>
<td>116</td>
<td>36</td>
<td>200</td>
</tr>
<tr>
<td>16130 SST</td>
<td>16</td>
<td>232</td>
<td>125</td>
<td>33</td>
<td>200</td>
</tr>
<tr>
<td>07120 PVT</td>
<td>7</td>
<td>100</td>
<td>148</td>
<td>39</td>
<td>90</td>
</tr>
<tr>
<td>07220 PVT</td>
<td>7</td>
<td>100</td>
<td>271</td>
<td>72</td>
<td>160</td>
</tr>
<tr>
<td>07220 SST</td>
<td>7</td>
<td>100</td>
<td>271</td>
<td>72</td>
<td>160</td>
</tr>
<tr>
<td>04350 PVT</td>
<td>4</td>
<td>58</td>
<td>352</td>
<td>93</td>
<td>200</td>
</tr>
<tr>
<td>04350 SST</td>
<td>4</td>
<td>58</td>
<td>352</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.

#### Accuracies

<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

#### 14.2 Shipping weight

<table>
<thead>
<tr>
<th>Types</th>
<th>Material version</th>
<th>Shipping weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>16050 ... 16130</td>
<td>PVT</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>SST</td>
<td>20</td>
</tr>
</tbody>
</table>

*Prominent*
### 14.3 Wetted materials

<table>
<thead>
<tr>
<th>Material version</th>
<th>Liquid end</th>
<th>Suction/discharge 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>

* Metering diaphragm is PTFE coated

** Types 07120, 07220, 04350

### 14.4 Ambient conditions

#### 14.4.1 Ambient temperatures

**Pump, compl.**

<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 ... +40</td>
<td>°C</td>
</tr>
</tbody>
</table>

#### 14.4.2 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>
14.4.3 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>% rel. humidity</td>
</tr>
</tbody>
</table>

* non-condensing

14.4.4 Degree of Protection and Safety Requirements

**Degree of protection**
Protection against contact and humidity:
IP 55 in accordance with IEC 529, EN 60529, DIN VDE 0470 Part 1

**Safety requirements**
Degree of protection:
1 - Mains power connection with protective earth conductor

14.5 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 1018455, 1018432, 1018433 in the appendix.*

**Electrical data S2Ca pump**

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

**Electrical data at 100 V**

<table>
<thead>
<tr>
<th>Data</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal power</td>
<td>250</td>
<td>W</td>
</tr>
<tr>
<td>Nominal current</td>
<td>3.2</td>
<td>A</td>
</tr>
<tr>
<td>Peak current during operation *</td>
<td>10</td>
<td>A</td>
</tr>
<tr>
<td>Switch on peak current, (for approx. 100 ms)</td>
<td>12</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>Nominal power</td>
<td>250</td>
<td>W</td>
</tr>
<tr>
<td>Nominal current</td>
<td>2.0</td>
<td>A</td>
</tr>
<tr>
<td>Peak current during operation *</td>
<td>5.5</td>
<td>A</td>
</tr>
<tr>
<td>Switch on peak current, (for approx. 100 ms)</td>
<td>24</td>
<td>A</td>
</tr>
</tbody>
</table>

* internal switchover

**Fuses**

<table>
<thead>
<tr>
<th>Fuse, internal</th>
<th>Value</th>
<th>Part no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.0 AT - (1.5 kV)</td>
<td>732497</td>
<td></td>
</tr>
</tbody>
</table>
14.6 Diaphragm rupture sensor

b) Reed switch (identity code specification "Stroke sensor": 2)

<table>
<thead>
<tr>
<th>Pin</th>
<th>Allocation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (white)</td>
<td>4.5 V ... 24 V, max. 10 mA</td>
</tr>
<tr>
<td>2 (brown)</td>
<td>OUT, open collector, 24 V, 20 mA</td>
</tr>
<tr>
<td>3 (green)</td>
<td>GND</td>
</tr>
</tbody>
</table>

**Data**

<table>
<thead>
<tr>
<th>Data</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pulse width (low)*</td>
<td>≥4 ms</td>
<td></td>
</tr>
</tbody>
</table>

* depending on the gear and mains frequency

The polarity is unimportant.

b) Namur sensor (identity code specification "Stroke sensor": 3)

5-25 V DC, in accordance with Namur or DIN 60947-5-6, potential-free design.

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

* $R_i \approx 1 \text{k}\Omega$

<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>

14.7 Relay

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

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Name</th>
<th>Viscosity class (ISO 3442)</th>
<th>Part no.</th>
<th>Volume</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

14.9 Sound pressure level

Sound pressure level LpA < 70 dB in accordance with EN ISO 20361:2010-10 at maximum stroke length, maximum stroke rate, maximum back pressure (water)
EC Declaration of Conformity

We hereby declare, ProMinent Dosiertechnik GmbH
Im Schuhmachergewann 5 - 11
D - 69123 Heidelberg

that the following designated product complies with the pertinent fundamental safety and health requirements of the EC Directive in terms of its design and construction and in terms of the version marketed by us. This declaration loses its validity in the event of a modification to the product not agreed with us.

Description of the product: **Metering pump, Series Sigma**

Product type: **S2Ba... / S2Ca...**

Serial no.: **refer to nameplate on the device**

Pertinent EC Directives:
- **EC Machinery Directive (2006/42/EC)**
- **EC Low Voltage Directive (2006/95/EC)**

Applied harmonised standards in particular:
- **EN ISO 12100-1, EN ISO 12100-2, EN 809, EN 60335-1, EN 60335-2-41, EN 60529, EN 61000-3-2, EN 61000-6-2**

technical documents have been compiled by: **Norbert Berger**
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Date / Manufacturer - Signature : 04.01.2010

Details of the signatory: **Joachim Schall, Head of Research and Development**
Decontamination declaration

Declarati

Because of legal regulations and for the safety of our employees and operation equipment, we need the "declaration of decontamination", with your signature, before your order can be handled. 
Please make absolutely sure to include it with the shipping documents, or – even better – attach it to the outside of the packaging.

Type of instrument / sensor: _____________________ Serial number: ___________________

Process data:
Temperature: ____________________ [°C] Pressure: ____________________ [bar]

Mediums and warnings:
Warnhinweise zum Medium:

<table>
<thead>
<tr>
<th>Medium/ Concentration</th>
<th>Identifi-</th>
<th>flammable</th>
<th>toxic</th>
<th>corrosive</th>
<th>harmful/ irritant</th>
<th>other*</th>
<th>harmless</th>
</tr>
</thead>
<tbody>
<tr>
<td>Process medium</td>
<td>Medium im Prozess</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medium for process- cleaning</td>
<td>Medium zur Prozessreinigung</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Returned part cleaned with medium zur Entfettung</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Please tick should one of the above be applicable, include security sheet and, if necessary, special handling instructions.

Reason for return:

Company data:
Company: _____________________ Phone number: _____________________
Contact person: ___________________ Fax: _____________________
Street: ___________________ E-Mail: _____________________
Address: ___________________ Your order No: _____________________

"We hereby certify that the returned parts have been carefully cleaned. To the best of our knowledge they are free from any residues in dangerous quantities."

Place, date ___________________ Company stamp and legally binding signature
Operating / adjustment overview

Continuous display

Stop/start pump

Change directly changeable variables

Prime

Start batch (only in "Batch" operating mode)

Acknowledge errors

Check adjustable values

1 = Lock (CODE 1)
2 = Lock (CODE 2)
## Continuous displays

### Continuous displays

<table>
<thead>
<tr>
<th>Continuous display</th>
<th>Operating mode “Analog” 0...20 mA</th>
<th>“Manual” operating mode</th>
<th>Operating mode “Contact” with memory and transfer factor 5</th>
<th>“Batch” operating mode with memory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stroke rate</td>
<td><img src="#" alt="Stroke rate diagram" /></td>
<td><img src="#" alt="Stroke rate diagram" /></td>
<td><img src="#" alt="Stroke rate diagram" /></td>
<td><img src="#" alt="Stroke rate diagram" /></td>
</tr>
<tr>
<td>Capacity</td>
<td><img src="#" alt="Capacity diagram" /></td>
<td><img src="#" alt="Capacity diagram" /></td>
<td><img src="#" alt="Capacity diagram" /></td>
<td><img src="#" alt="Capacity diagram" /></td>
</tr>
<tr>
<td>Total number of sti</td>
<td><img src="#" alt="Total number diagram" /></td>
<td><img src="#" alt="Total number diagram" /></td>
<td><img src="#" alt="Total number diagram" /></td>
<td><img src="#" alt="Total number diagram" /></td>
</tr>
<tr>
<td>Total litres (metering quantity)</td>
<td><img src="#" alt="Total litres diagram" /></td>
<td><img src="#" alt="Total litres diagram" /></td>
<td><img src="#" alt="Total litres diagram" /></td>
<td><img src="#" alt="Total litres diagram" /></td>
</tr>
<tr>
<td>“External” display</td>
<td><img src="#" alt="“External” display diagram" /></td>
<td><img src="#" alt="“External” display diagram" /></td>
<td><img src="#" alt="“External” display diagram" /></td>
<td><img src="#" alt="“External” display diagram" /></td>
</tr>
<tr>
<td>Signal current</td>
<td><img src="#" alt="Signal current diagram" /></td>
<td><img src="#" alt="Signal current diagram" /></td>
<td><img src="#" alt="Signal current diagram" /></td>
<td><img src="#" alt="Signal current diagram" /></td>
</tr>
<tr>
<td>Remaining strokes</td>
<td><img src="#" alt="Remaining strokes diagram" /></td>
<td><img src="#" alt="Remaining strokes diagram" /></td>
<td><img src="#" alt="Remaining strokes diagram" /></td>
<td><img src="#" alt="Remaining strokes diagram" /></td>
</tr>
<tr>
<td>Batch size / Remaining litres</td>
<td><img src="#" alt="Batch size diagram" /></td>
<td><img src="#" alt="Batch size diagram" /></td>
<td><img src="#" alt="Batch size diagram" /></td>
<td><img src="#" alt="Batch size diagram" /></td>
</tr>
<tr>
<td>Factor</td>
<td><img src="#" alt="Factor diagram" /></td>
<td><img src="#" alt="Factor diagram" /></td>
<td><img src="#" alt="Factor diagram" /></td>
<td><img src="#" alt="Factor diagram" /></td>
</tr>
<tr>
<td>Stroke length</td>
<td><img src="#" alt="Stroke length diagram" /></td>
<td><img src="#" alt="Stroke length diagram" /></td>
<td><img src="#" alt="Stroke length diagram" /></td>
<td><img src="#" alt="Stroke length diagram" /></td>
</tr>
</tbody>
</table>

- = values which can be changed directly using the UP or DOWN arrow keys

Identifier “Mem” only in the event that function extension “Memory” is activated.

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**ProMinent**

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