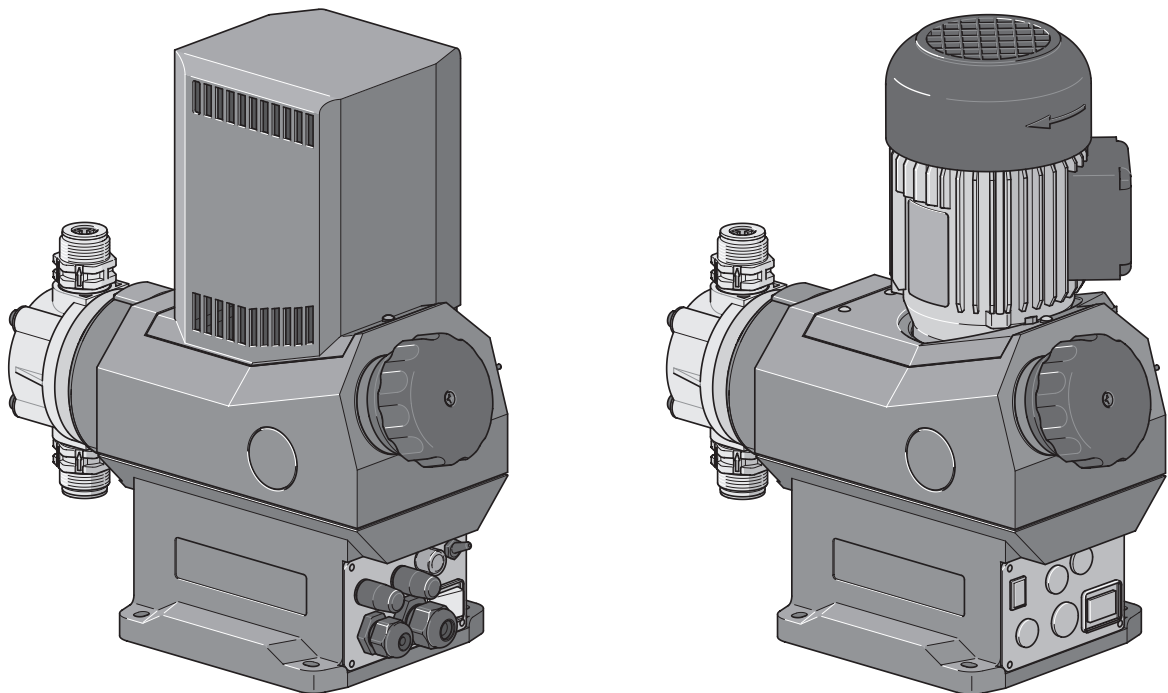


# Operating Instructions

## ProMinent® Vario Metering Pumps



VAMb

Please enter ident code of the device here.

For safe and correct operation of ProMinent® Vario metering pumps,  
two sets of Operating Instructions are required:  
The product-specific Vario Operating Instructions  
and ProMinent® motor-driven dosing pump. Operating Instructions must be read together!

**Please completely read through these operating instructions first! • Do not discard!**  
**The warranty shall be invalidated by damage caused by operating errors!**

**Publishing details:**

Operating Instructions ProMinent® Vario  
© ProMinent Dosiertechnik GmbH

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Subject to technical modifications.

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## Product Identification/Identity Code

The device label on the title page is identical to that supplied with the pump in order to facilitate matching the correct operating instructions manual to the pump.

Please enter the identity code given on the device label into the grey boxes below.

VAMb	Vario Diaphragm Dosing Pump, Version b									
	12017*	12026*	<b>Pump type:</b> (figures 1 + 2 = back pressure [bar], figures 3, 4, 5 = feed rate [l/h]) * = for PV, PP, NP and TT versions, max. 10 bar							
	12042*	10025								
	09039	07063								
	06047	05075								
	04120									
	PVT	<b>Liquid end materials:</b> PVDF, PTFE seal Stainless steel with PTFE seal PP1, NP1 and TT1 versions are still available (only for use with hydraulic connector: "0")								
	SST									
	0	<b>Liquid end version:</b> No valve springs								
	1	With 2 valve springs, Hastelloy C4, 0.1 bar								
	4	With pressure relief valve, Viton® seal, no valve spring (PVT version only)								
	5	With pressure relief valve, Viton® seal and valve spring (PVT version only)								
	0	<b>Hydraulic connectors:</b> Standard connector according to technical data								
	1	Union nut and PVC insert								
	2	Union nut and PP insert								
	3	Union nut and PVDF insert								
	4	Union nut and stainless steel insert								
	7	Union nut and PVDF hose connector								
	8	Union nut and stainless steel hose connector								
	0	<b>Version:</b> With ProMinent label (standard)								
	2	Without ProMinent label								
	A	<b>Electrical power supply:</b> 1 ph., 230 V 50/60 Hz Euro plug								
	B	1 ph., 230 V 50/60 Hz Swiss plug								
	C	1 ph., 230 V 50/60 Hz Austral. plug								
	D	1 ph., 115 V 60 Hz USA plug								
	S	3 ph., 230/400 V 50/60 Hz (basic type only)								
	0	<b>Control type:</b> Basic type with 1 ph. or 3 ph. motor								
	1	Mains switch and fuse + two stage float switch input + external contact input + pause function as N/C contact + dosing monitor input + two colour function display.								
	2	As 1 but with additional memory function								
	3	Mains switch and fuse + two stage float switch input + analogue input + pause function as N/C contact + dosing monitor input + two colour function display.								
	4	Basic type with Hall sensor								
	5	Basic type with Namur stroke sensor								
	0	<b>Control variants:</b> For control option 0/5 (basic type) control options 1 + 2 only								
	1	6000 pulse/h								
	2	2000 pulse/h								
	3	4000 pulse/h								
	4	8000 pulse/h								
	5	10000 pulse/h								
	6	12000 pulse/h								
	A	control type 3 only								
	B	0...20 mA								
	H	4...20 mA								
	I	automatic stroke positioning for control type 0/5 (basic type)								
	J	With stroke positioning motor, 230 V/50/60 Hz								
	K	With stroke positioning motor, 115 V/50/60 Hz								
	L	With stroke control motor, 0...20 mA, 230 V/50/60 Hz								
	M	With stroke control motor, 4...20 mA, 230 V/50/60 Hz								
	0	<b>Switch mode relay:</b> No relay (basic type)								
	1	With fault indicating relay (N/C)								
	2	With pacing relay (N/O)								
	3	With fault indicating relay (N/O)								
VAMb										

# 1 Safety relevant instructions for ProMinent® metering pumps

Safety precautions and important operating instructions are divided into classes and provided with symbols. Please familiarise yourself with the following designations and symbols.



## **WARNING:**

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



## **CAUTION:**

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



## **TAKE CARE:**

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

## **GUIDELINES:**

*Guidelines are intended to make your work easier.*

## 1.1 General notes

### **Correct use**

- The Vario must be used for liquids only!
- The Vario may be used only in compliance with the technical data and specifications given in the operating instructions!
- The device may be used only in the domestic, business and commercial area, i.e. by small firms or in industry. For other applications, approval must be sought from the manufacturer.
- It is forbidden to use the Vario for any other purpose, or to modify it in any way!
- The Vario is not suitable for dosing gases or solids!
- The Vario must be used by trained and authorised personnel only!



## **CAUTION:**

- **Assembly of ProMinent® metering pumps with foreign parts which are not tested or recommended by ProMinent is not permissible and can lead to injury to persons or damage for which no responsibility is accepted!**
- **Pumps must be accessible for operating and servicing at all times. Accesses must not be obstructed or blocked!**
- **For servicing and repair work where dangerous or unknown dosing media are being used, first empty and flush out the liquid end! Observe the safety data sheets for the dosing liquid!**
- **When metering dangerous or unknown liquids those working on the liquid ends must wear protective clothing (goggles, gloves)!**

### **Sound intensity level**

The sound intensity level is < 70 dB (A)  
at maximum stroke, maximum stroke rate, maximum back pressure (water) in accordance with:  
DIN EN ISO 3744 (Reproducibility 2 Determining Sound Intensity Level)  
PR DIN EN 12639 (Metering Pump Noise Measurement)  
DIN 45635-24 (Machine Noise Measurement)

## 1.2 Notes for installation, commissioning and operation



### CAUTION:

- *The metering pump may still contain residual water in the liquid end from testing in the factory.*
- *In the case of media which must not come into contact with water, the liquid end must be cleared of all water before commissioning. To do this rotate the pump 180° and empty the liquid end and then flush from above through the intake connection using a suitable medium.*
- *Do not connect mains voltage to the control cable!*
- *When operating the metering pump against a closed isolator at the pressure end, the backpressure can reach several times the maximum permissible backpressure. This can cause the delivery line to burst!  
To avoid this, a pressure relief valve is recommended which limits the backpressure!*



### TAKE CARE:

- *Design the pressure lines so that pressure peaks on the discharge stroke do not exceed the maximum permissible pressure (fit a pressure relief valve if necessary)!*
- *Adjustments to the stroke length should only be carried out with the pump running!*

### GUIDELINE:

- *The pump shall be secured in such a way that no vibration can occur!  
The valves of the liquid end must always be vertical to ensure correct operation!*
- *Intake and delivery pipes must always be arranged such that strain-free connection to the liquid end is guaranteed!  
Pipes shall be secured in such a way that no vibration can occur!*
- *Use only the locking rings and hose fittings designed for the particular hose diameter and also use original hoses with the specified hose dimensions and wall thickness, otherwise the security of the connection is not guaranteed!  
Reductions in hose sizes are to be avoided!  
The permissible pressure stress of the hoses is to be observed.*
- *When dosing extremely aggressive or dangerous media an arrangement which relieves back into the tank is advisable!  
Moreover, an shut-off valve should be fitted on the pressure and suction sides!*

## 1.3 Notes on servicing and repair



### CAUTION:

- *Metering pumps and their peripherals may only be serviced by expert and authorised persons!*
- *When carrying out servicing or repairs where dangerous or unknown media are used, always flush the liquid end first!*
- *When metering dangerous or unknown liquids, those working on the liquid end must wear protective clothing (goggles, gloves)!*
- *The pressure in the metering pipe must first be released before working on the pump.  
Always empty and flush the liquid end!  
Observe the safety data sheets for the metering liquid!*



### WARNING:

- *Isolate the supply cable or withdraw the mains plug before opening the pump.  
If the optional relay is fitted, also isolate this!  
Check for freedom from voltage!  
Always secure the pump against unauthorised restarting during repair work!*
- *Pumps which are used for dosing radioactive media must not be shipped!*

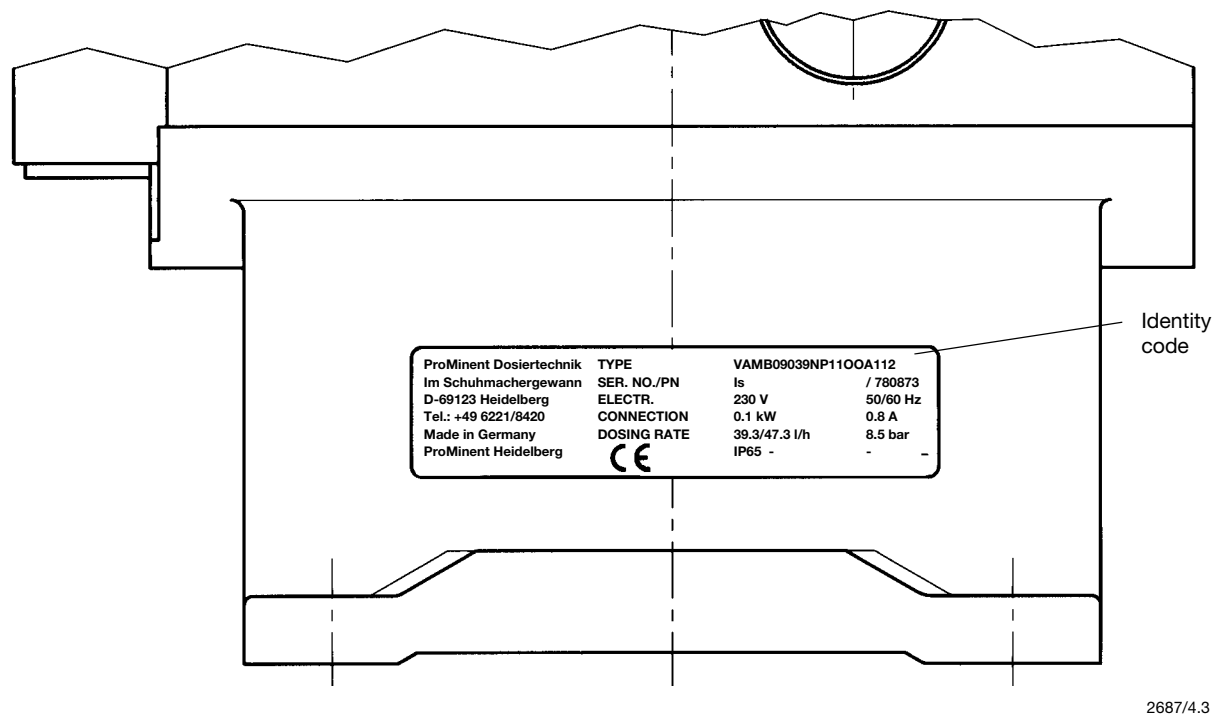
### GUIDELINE:

- *Pumps must only be returned for repair in a clean condition and with the liquid end flushed out!*

2 Product Description

2.1 Marking/Identification of pump type

Each Vario metering pump shall be provided with an identification plate on the side of the foot.



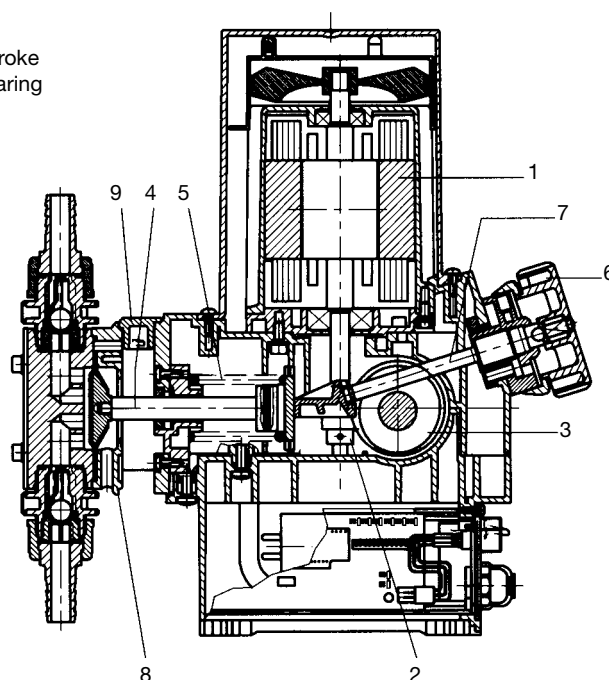
The identity code and serial number shall be given in addition to the normal technical data. Both these numbers are to be used in all enquiries as they enable the type of metering pump to be clearly identified. The meaning of the identity code in the individual pump functions is given in the product catalogue (refer also to Chapter 5 Technical Data).

Technical modifications reserved.

## 2.2 Construction and functional description of drive unit

The ProMinent® Vario is an oscillating displacement metering pump whose stroke length can be adjusted in steps of 1%. It is driven by a special custom built single phase AC motor or a standard three phase motor (1). Its drive rotation is reduced by the worm gearing (2) and transmitted via the eccentric roller (3) to the connecting rod (4) and therefore changed to an oscillating motion. A powerful return spring (5) holds the connecting rod against the eccentric roller to provide a return stroke. The length of the stroke is adjusted by using the stroke adjustment knob (6) and shaft (7) to limit the return stroke. The stroke is transmitted directly to the piston. In conjunction with the valves, this generates the pressure or vacuum in the liquid end which is necessary for delivery. The delivery flow is pulsating.

- 1 Motor
- 6 Adjustment of stroke
- 3 Housing with gearing
- 8 Discharge unit
- 9 Protective plug

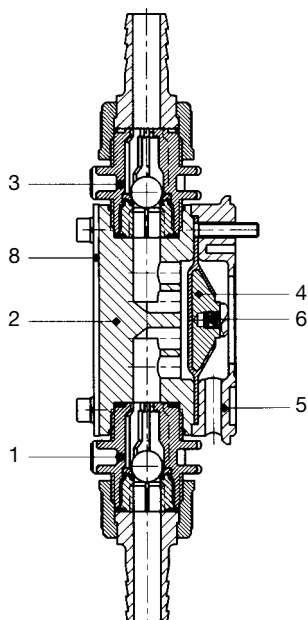
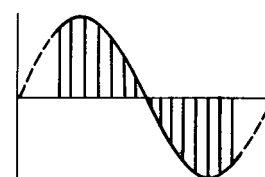
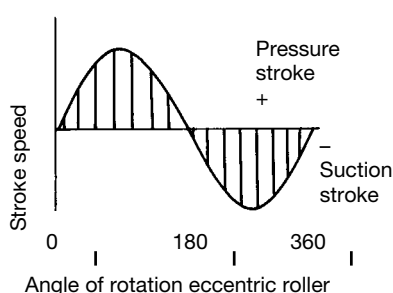


2095-4.2

### 2.2.1 Diagram showing operation of stroke

a) Stroke during max. number and length of strokes

b) with reduced stroke length



2096-4.1

## 2.3 Construction and functional description of diaphragm delivery unit

The heart of the delivery unit is the DEVELOPAN® metering diaphragm (4). It hermetically seals the delivery chamber of the liquid end (2) and effects the displacement in the liquid end (2). The end washer (5) of chemically-resistant plastic separates the drive housing from the delivery part and protects the drive from corrosion in the event rupture of the diaphragm. The suction valve (1) and pressure valve (3) which are of identical construction, operate in conjunction with movement of the diaphragm to provide the delivery operation. The valve balls can be spring-loaded for metering viscous media.

The connecting dimensions of valves and liquid ends which are the same size but of different material are the same. The parts can be interchanged as required. An integrated bypass-/bleed valve may be optionally installed in the PVT version (see page 9).



### 2.3.1 Integrated overflow valve with bleeder function

#### Task

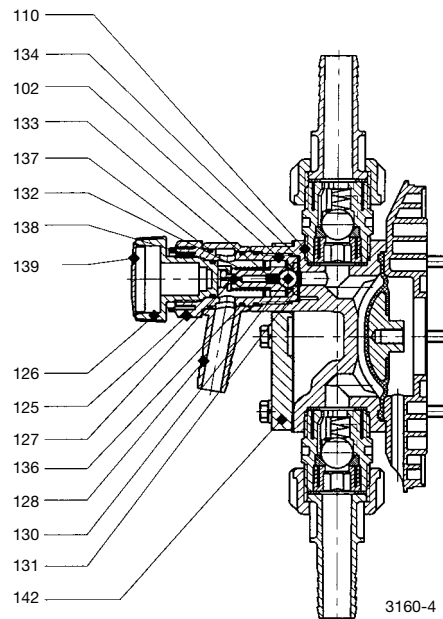
The task of the overflow valve is to protect the motor and gear unit against impermissible overpressure caused by the metering pump.

This function is produced by a spring-loaded ball.

A pressure relief mechanism for the bleeder function is provided.

#### Design and Functional Description

Initially, the overflow valve illustrated under Item 102 operates as a simple directly control safety valve. As soon as the pressure set with spring Item 132 is exceeded, the effective pressure raises ball Item 130. The liquid then flows off into the tank via hose connection Item 128.



#### TAKE CARE:

- Knob Item 139 must be turned in clockwise direction as far as it will go „close“.
- The bypass line must always be closed and must be routed back into the supply tank. Connection via hose connection Item 128.
- Minimal overflow can occur in the bypass line when the valve operates close to the overpressure function.

The bleeder function is achieved by turning knob Item 139 in counterclockwise direction as far as it will go „open“: Priming aid for starting up pump against pressure. The force of spring Item 132 relieves ball Item 130 which is controlled by the lower spring force of bleeder spring Item 133.



#### TAKE CARE:

- Once the pump has primed, turn knob Item 139 in clockwise direction as far as it will go „close“! The pump can now be placed into operation.

#### Technical data

Corresponding to the type of pump, overflow valves are available for pressure stages pnom 3.5/ 4.5/5.5/6.5/8.5/10 bar with (1.05...1.4) xpnom opening pressure.

#### Materials in contact with metered medium

Liquid end:	Overflow valve:	Seals in overflow valve:	Balls:	Springs:
PVDF	PVDF	Viton® O-rings, PTFE	Ceramic	Hastelloy C4

Viton® is a registered trademark of DuPont Dow Elastomers.

### Use for intended purpose / Use not for intended purpose

#### Use for intended purpose

To protect the motor and gear unit against impermissible overpressure caused by the metering pump.

If the pump is the only pressure generator in the system, the overflow valve will also protect the system automatically.



#### TAKE CARE:

- *Only for liquids with a viscosity of up to 100 mPa · s.*
- *On pumps with a 1 ph AC motor, the motor is protected by an integrated thermal cutout.*
- *The ceramic ball and ball seat of the overflow valve are wearing parts. Slight leakage can occur at the safety valve after a prolonged period of operation. The ball and ball seat should be replaced if leaks occur.*
- *The bypass line must always be connected and must be routed back into the supply tank.*
- *Refer to the installation notes in the operating instructions for „Motor Driven Metering Pumps“.*

#### Use not for intended purpose

To protect the system from impermissible overpressure which has other causes than the pressure generated by the metering pump.

The pump must not be operated without the bypass line connected.

Connection of the bypass line in the intake line is not permitted as this would impair the effectiveness of the bleeder function.



#### WARNING:

***When carrying out maintenance work on the overcurrent valve, pay attention to the tensioning state of the pressure spring Item 132! Wear safety goggles!***

## 2.4 The drive motor and the types of control

### 1-phases motor

The single phase drive motor has integrated thermal overload protection. This activates to switch off the motor if the maximum permitted temperature is reached during operation.

#### **GUIDELINE:**

- After the stationary motor has cooled down, the thermal overload automatically resets.



#### **TAKE CARE:**

- After the motor has been shutdown by the thermal overload, check that the pump is not being permanently overloaded. Constant switching on and off of the motor by the terminal overload is to be avoided (refer also to Chapter 5.3 Technical Data).

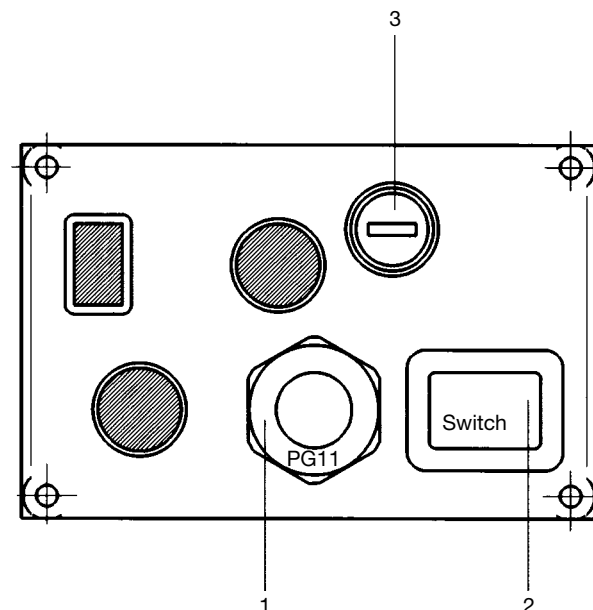
### Standard 3-phase motor

The Vario basic type (controller type 0) is optionally available with a 3-phase dual wound motor, 3-pH. 230/400 V, 50/60 Hz. It can be connected directly to the terminal box on site (see also section 5.3, Technical Data).

#### **Controller type 0: (basic type with 1-pH. motor)**

This controller type is fitted with a mains connector (1), an externally accessible fine-wire fuse (3) and an illuminated mains switch (2). Dosing is continuous.

- Mains cable (1)
- On/Off switch (2)
- Safety switch (3)



2132-4.2

### Miniature fuse

The miniature fuse is triggered by electrical defects in the control system of the motor or by overload.

Fuse data: (refer to spare parts list)

The fuse can be changed without opening the pump control unit. All that is required is to open the screwed cap on fuse holder (3) and replace the defective fuse by a new one of the same type.



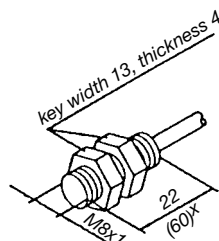
#### **WARNING:**

- Before changing a fuse, switch off the pump and disconnect from the mains.

#### **Controller type 4 (basic type with stroke sensor)**

This type of control unit has a mains connection (1), a miniature fuse accessible from the outside (3) and an illuminated 2-pole mains switch (2). Metering is continuous. Furthermore, the stroke sensor is fitted in the pump so that it is possible to change the control unit for a different type.

## Controller type 5 (basic type with Namur-type stroke sensor)



Material stainless steel

**Switch aperture  $s_n$  inset**

1.5 mm flush  
See figure above

**Electrical cabling:**

DC, two wire, as DIN 19 234 (NAMUR)

**Fixtures:**

as DIN 19 234 (NAMUR)

NJ 1.5-8GM-N

**Features:**

Operating switch apertures  $s_a$

$0 \leq s_a \leq 0.81 s_n$

Reduction factor at

V2A 0.85; Al 0.4; Cu 0.3

Reproducibility R

$\leq 0.01$  mm

Switch hysteresis H

approx. 10 %

Standard measurement plate

1 mm Fe

8 mm x 8 mm

Operating voltage  $U_B$

5 bis 25 V DC

Residual ripple

$\leq 5$  %

Switch frequency f

5 kHz

**Electrical Data:**

Standard voltage

8 V DC (Ri approx. 1 k/ohm)

Individual inductivity

20  $\mu$ H

Individual capacity

16 nF

Output/power uptake

active surface free

$\leq 3$  mA

active surface covered

$\leq 1$  mA

**Mechanical Data:**

Ambient temperature

248 - 373 Kelvin  
(-25 °C bis +100 °C)

Enclosure rating as DIN 40 050

IP 67

Permissible impact and

$b \leq 30g$ ,  $T \leq 11$  ms

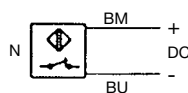
Oscillation stress

$f \leq 55$  Hz,  $a \leq 1$  mm

Connector

2 m, PVC lead, 0.14 mm<sup>2</sup>

Standard symbol/connection:



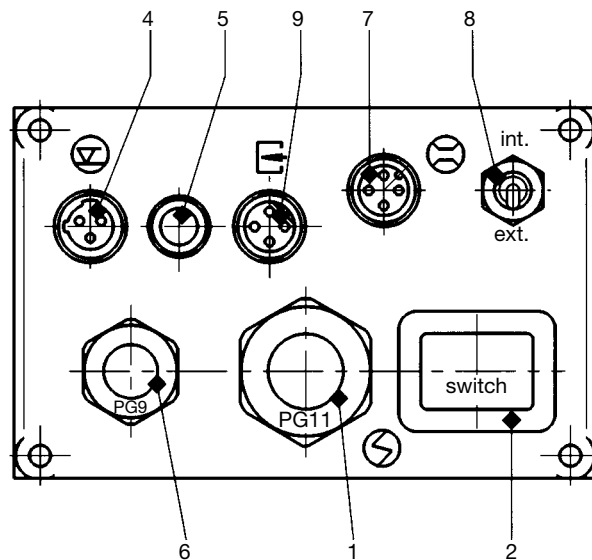
**Control unit Type 1: (contact type)**

This type of control unit has a mains connection, an illuminated 2-pole mains switch, a multi-coloured operating/fault indicator, a 2-stage level input, a metering monitoring input, an external contact input and a mode changeover switch. The operation of the motor is additionally monitored by means of an electronic safety device.

The contact type of control unit can also be supplied with a fault relay with a normally-closed or normally-open contact or a timer relay as an option. Where the fault relay or timer relay is used with a normally-open contact, the relay closes for approximately 4 seconds when the power is switched on, before it changes to its selected operating state.

**Controls:**

- Mains cable (1)
- On/Off switch (2)
- Socket for level switch (4)
- LED indicator (5)
- PG 9 blanking plug or, where there is fault/timer relay ident code choice, a 3-core cable – with a PG 9 union (6)
- Socket for monitoring dosing (7)
- Internal/external changeover switch (8)
- Socket for external control/interval function (9)



2624-4

**GUIDELINE:**

- The connecting sockets (4 and 9) must always be occupied, either by functional plugs or level switches or contact/control cables! Always keep removed functional plugs for re-use!

**Level input**

The level input (4) is arranged as a normally-closed switch as standard and has both functions, early warning and shutdown. In the event of level early warning the function indicator changes from dark to red or from green to orange. If a fault relay is fitted its state changes. In the event of a level shutdown the function indicator changes to red and the motor is stopped in the O-stroke position, and if a fault relay is fitted the switching state changes.

**Metering monitoring input**

The metering monitoring input (7) is used to monitor the metering process. ProMinent metering monitoring sensors can be connected to the input. If the feedback from a connected metering monitoring sensor is absent for at least eight metering strokes, the pump goes to a fault condition. The function indicator changes to red, the motor is stopped in the O-stroke position, and if a fault relay is fitted it changes the switching state. The fault can only be reset by switching the mains power (on/off switching) or by a brief level change at the input pin of the contact input.

### External input

The external input (9) is used for external contact control of the pump or for a floating on/off switching (interval function) of the pump. The interval input operates as a normally-closed contact, i.e. when the input is open the pump is shutdown and when it is closed it is ready for operation. In the contact mode the number of motor switch-ons is limited to approximately 2000 switch-ons per hour. If the number of strokes to be carried out exceeds 2000, then multiple strokes are performed. The factor (can be set inside the pump) is selected such that the motor is operated continuously where there is the maximum number of input pulses (exception 60 Hz operation). Matching to the maximum incoming, external pulses is possible in principle, except for the possibilities (6000; 2000; etc) indicated in the ident code.

The control algorithm which takes place in the microprocessor guarantees that the incoming external signal is converted to the corresponding number of stroke within the control period of one minute.

### Electronic safety device

The electronic safety device (rotation monitoring) is fitted as standard to control unit types 1, 2 and 3. The control unit registers each discharge stroke by means of a sensor. If longer than the previous control time of approximately 1 s is required for a discharge stroke, this stroke is regarded as not performed and the control unit indicates a fault (red LED).

The electronic safety device serves mainly to protect against overload during startup of the drive (e.g. on commissioning) or to provide a rapid shutdown of the pump if the gears or any parts of the motor are jammed.



#### **CAUTION:**

- ***The pressure conditions in the metering system are to be checked and corrected as necessary before initial commissioning.***  
***A functional check of the metering pump is also to be carried out. The fault can only be reset if the mains is switched (off/on switching of the mains switch) or if there is a brief level change at the switching pin of the external input.***

### Miniature fuse

The miniature fuse is triggered by electrical defects in the control system or motor. Because in the case of most defects (e.g. motor overload) the electronic safety device (rotation monitoring) respond first, the miniature fuse reacts only in exceptional cases. The miniature fuse is located on the board inside the pump control unit.

Fuse data: (refer to spare parts list).



#### **CAUTION:**

- ***The fuse may only be changed by an authorised Customer Service.***

### Control unit Type 2: (contact memory control unit)

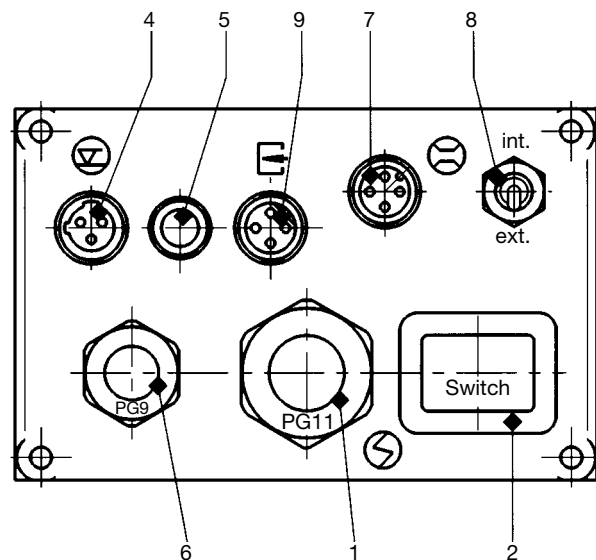
The type 2 control unit is the same as the type 1 control unit except for the contact mode. In the contact mode incoming impulses which arrive faster than the pump can perform discharge strokes can be buffer stored in an internal memory with a maximum memory capacity of 655355 discharge strokes, and then performed.

### Control unit Type 3: (analogue type of control unit)

This type of control unit has a mains connection, an illuminated 2-pole mains switch, multi-coloured operating/fault indicator, a 2-stage level input, a metering monitoring input, an external analogue input and a mode changeover switch. The operation of the motor is additionally monitored by means of an electronic safety device.

The analog type of control unit can be supplied with a fault relay or timer relay as an option.

- Controls:**
- Mains cable (1)
  - On/Off switch (2)
  - Socket for level switch (4)
  - LED indicator (5)
  - PG 9 blanking plug or, where there is fault/timer relay ident code choice, a 3-core cable with a PG 9 union (6)
  - Socket for monitoring dosing (7)
  - Internal/external changeover switch (8)
  - Socket for external control/interval function (9)



2624-4

### GUIDELINE:

- The connecting sockets (4 and 9) must always be occupied, either by functional plug or level switches or contact/control cables. Always keep removed functional plugs for re-use.

### Level input

The level input (4) is arranged as a normally-closed switch as standard and has both functions, early warning and shutdown. In the event of level early warning the function indicator changes from dark to red or from green to orange. If a fault relay is fitted its state changes. In the event of a level shutdown the function indicator changes to red and the motor is stopped in the O-stroke position, and if a fault relay is fitted the switching state changes.

### Metering monitoring input

The metering monitoring input (7) is used to monitor the metering process. ProMinent metering monitoring sensors can be connected to the input. If the feedback from a connected metering monitoring sensor is absent for at least eight metering strokes, the pump goes to a fault condition. The function indicator changes to red, the motor is stopped in the O-stroke position, and if a fault relay is fitted it changes the switching state. The fault can only be reset by switching the mains power (on/off switching) or by a brief level change at the input pin of the contact input.

### External input

The external input (9) is used for external analog control of the pump or for floating switch-on and switch-off (interval function) of the pump. The interval input operates as a normally-closed switch, i.e. when the input is open the pump is stationary and when the input is closed it is ready for operation.

The control algorithm ensures that within the control period of one minute the incoming external signal is correctly converted to the corresponding number of strokes.

### Electronic safety device

The electronic safety device (rotation monitoring) is fitted as standard to control unit types 1, 2 and 3. The control unit registers each discharge stroke by means of a sensor. If longer than the previous control time of approximately 1 s is required for a discharge stroke, this stroke is regarded as not performed and the control unit indicates a fault (red LED).

The electronic safety device serves mainly to protect against overload during startup of the drive (e.g. on commissioning) or to provide a rapid shutdown of the pump if the gears or any parts of the motor are jammed.



#### CAUTION:

- ***The pressure conditions in the metering system are to be checked and corrected as necessary before initial commissioning.***

***A functional check of the metering pump is also to be carried out.***

***The fault can only be reset if the mains is switched (off/on switching of the mains switch) or if there is a brief level change at the switching pin of the external input.***

### Miniature fuse

The miniature fuse is triggered by electrical defects in the control system or motor. Because in the case of most defects (e.g. motor overload) the electronic safety device (rotation monitoring) respond first, the miniature fuse reacts only in exceptional cases. The miniature fuse is located on the board inside the pump control unit.

Fuse data: (refer to spare parts list).



#### CAUTION:

- ***The fuse may only be changed by an authorised Customer Service.***

## 2.5 Standards and approvals

### EC guidelines

EC Pump Guideline (89/392/EEC) as amended by 93/44/EEC

EC Low Voltage Guideline (73/23/EEC)

EC EMC Guideline (89/336/EEC) as amended by 92/31/EEC

### International standards

EN 292-1	Safety of pumps
EN 292-2	Safety of pumps
EN 60335-1 A6	Safety of electrical equipment for household use
EN 60335-2-41	Safety of electrical equipment, special pumps

The 100 V and 115 V version corresponds to the following:

CSA Standard C22.2No. O-M91	General requirements
CSA Standard C22.2No. 108-M89	Liquid pumps

### National standards

#### Safety of electrical equipment in accordance with the following:

DIN VDE 0700, Part 1	Corresponding to EN 60335.1 and IEC335.1
DIN VDE 0700, Part 41	Corresponding to EN 60335-2-41 and IEC 335-2-41
DIN VDE 0700, Part 500	Routine testing of equipment
DIN VDE 0530, Part 5	Rotating electrical pumps
DIN VDE 0110 b	Clearances and creepage distances

#### Radio suppression

DIN VDE 0871 B	Radio suppression of high frequency equipment
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### Tests and approvals of components used

a) Pumps	VDE 0551	Mains transformer
	VDE 0565, Part 1	Interference suppression capacitors
	VDE 0611, Part 1	Series terminals for mains power connection
	VDE 0820, Part 1	Equipment protective devices
	VDE 0560-8	Motor capacitor
	VDE 0435	Electrical relays (optional)
	VDE 0530	Motor



### 3 Commissioning

#### 3.1 General notes

The pulsating operation of the ProMinent® Vario as an oscillating displacement metering pump causes high pressure differences in the pipes on each discharge stroke. If these pressure differences are too great because of unsatisfactory lines, it can lead to high metering errors or to failure of the metering pump. When dosing very viscous media or where the metering lines are very long, a larger internal diameter for the pipe should be chosen if necessary and/or a compressed air chamber or diaphragm pulsation damper should be fitted.



**CAUTION:**

- **Check that the materials used can withstand the chemicals which are being metered (refer to ProMinent® Resistance List in the Product Catalogue).**



**CAUTION:**

- **The safety notes in Chapter 1 must be observed.**

#### 3.2 Installing and connecting

- The metering pump must not be restrained by the cover (recognisable by the ventilation slots) for transport or packing. Danger of damage.
- The metering pump must be installed vertically with its base on a horizontal support.
- The intake and delivery lines shall be laid in such a way that the coupling to the liquid end is free of mechanical strain.
- The pumps and pipes shall be secured so that no vibration can occur.
- The pipes shall be attached in such a way that the pump and liquid end can be moved sideways if necessary.
- When metering extremely aggressive or dangerous media it is advisable to have a relief back to the tank and to have an isolating valve on both the delivery and intake side.
- If the installation instructions are complied with and the stroke length is greater than 30%, a reproducible metering accuracy of more than  $\pm 2\%$  is obtained.

**Delivery line**

- The delivery line shall be designed in such a manner that pressure peaks on the discharge stroke do not exceed the maximum permissible operating pressure.
- To protect against overload, a pressure relief valve with a return to the feed tank is to be provided on the pressure side.
- A pressure relief valve shall always be fitted in conjunction with a compressed air chamber or pulsation damper.



**CAUTION:**

- **Motorised metering pumps may under certain circumstances work against a substantially increased operating pressure for short periods without the electrical safety devices responding.**

**For this reason the maximum permissible operating pressure must be complied with to protect against accidents and premature wear.**

**Intake line**

- The intake line must always be laid vertically.
- It should be as short as possible.
- It shall be dimensioned with regard to cross-section and length such that vacuum which occurs on suction does not reach the vapour pressure of the medium to be metered.
- Curves should be used where possible instead of angles for bends.
- Excessive vacuum on the intake side leads in extreme cases to a break in the column of liquid or to an incomplete return stroke (the return stroke can no longer be detected at the stroke adjusting knob).
- The product  $h \cdot \rho$  shall not exceed the specified maximum suction head.

$h$  = geodetic height  
 $\rho$  = density

e.g.:  $h = 2 \text{ m}$        $\rho = 1.48$        $2 \cdot 1.48 = 2.96 \text{ mWS (mWG)}$

For details of the suction head refer to Chapter 5.1, page 22 „Performance data“.

- It must also be guaranteed that no overload of the drive unit occurs on the suction side. Where there is a positive suction head the above limits shall be observed.
- The suction line shall be dimensioned such that no overload occurs at the end of the suction stroke due to mass lag.

## Pipe calculations

The necessary lines can be calculated in accordance with the „Calculations of metering lines“ instructions.

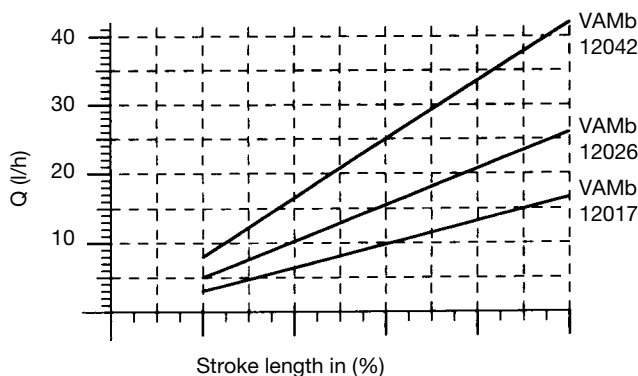
If all the necessary data in accordance with the Data Sheet (refer to annex) is submitted, the metering lines can be quickly checked in the works free of charge.

## 3.3 Commissioning

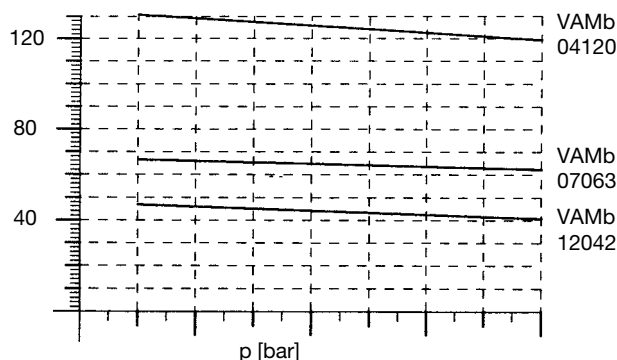
- Check correct installation in accordance with the aforementioned points and installation notes.
- Bleed the pressure side. Switch on the pump and allow to operate at maximum stroke length until the liquid end is charged. Switch off the pump.
- Close the bleed on the pressure side, if necessary open the shut off valve in the discharge line and allow the pump to operate.
- Check the response pressure of the pressure relief valve.
- Set the required meter rate in accordance with the „Meter rate relative to stroke length“ diagram.
- Check the meter rate and correct if necessary.

### Diagram for setting the meter rate

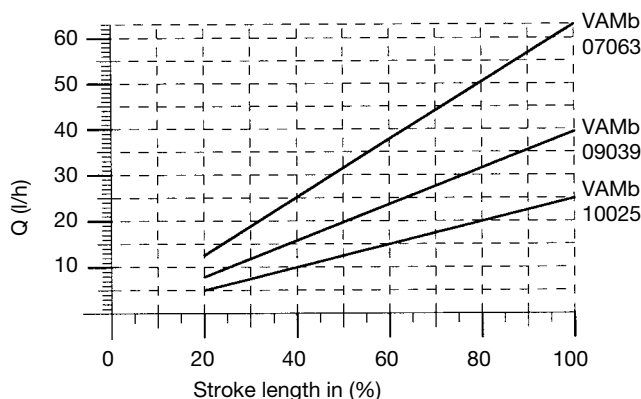
Meter rate relative to stroke length  
(Vario with FM 042)



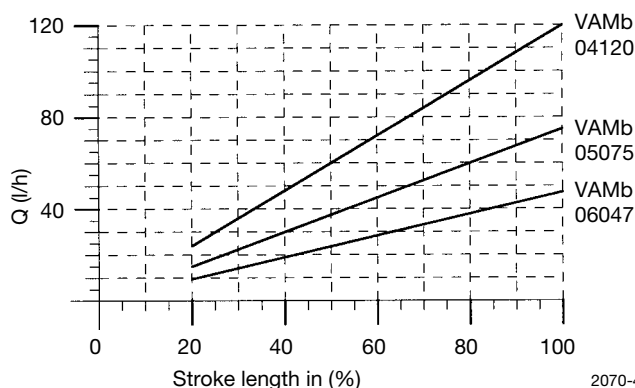
2100-4



Meter rate relative to stroke length  
(Vario with FM 063)

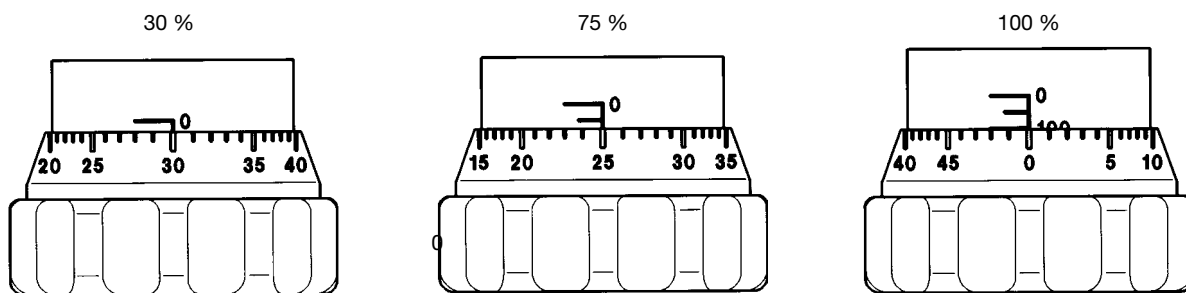


Meter rate relative to stroke length  
(Vario with FM 120)



2070-4

### Setting the stroke length



1 rotation (360 °)  $\hat{=}$  50 % stroke length

2625-4.1

### 3.4 Troubleshooting

Symptom	Possible cause	Remedy
<ul style="list-style-type: none"> <li>- Metering pumps does not suck (on commissioning)</li> </ul>	<ul style="list-style-type: none"> <li>- Suction head too high</li> <li>- Back pressure in the injection line (pressure side)</li> </ul>	<ul style="list-style-type: none"> <li>- Install pump closing to feed tank</li> <li>- Remove backpressure, (e.g. via bypass line)</li> </ul>
<ul style="list-style-type: none"> <li>- No metering even though the drive is running (after long operation)</li> </ul>	<ul style="list-style-type: none"> <li>- Stroke setting 0%</li> <li>- Feed tank empty</li> <li>- Gas bubble in intake line and liquid end</li> </ul>	<ul style="list-style-type: none"> <li>- Increase stroke length (↔100 %)</li> <li>- Replenish metering medium and restart system</li> <li>- Bleed intake line, check for leaks and restart system</li> </ul>
<ul style="list-style-type: none"> <li>- Leakage of metering liquid at the leak outlet of the liquid end</li> </ul>	<ul style="list-style-type: none"> <li>- Defective diaphragm</li> </ul>	<ul style="list-style-type: none"> <li>- Replace diaphragm (refer to Chapter 4.2)</li> </ul>
<ul style="list-style-type: none"> <li>- Loss of metering performance (after long operation)</li> </ul>	<ul style="list-style-type: none"> <li>- Defective wear parts in the valves</li> <li>- Deposits in the valves</li> </ul>	<ul style="list-style-type: none"> <li>- Replace (refer to Chapter 4.2)</li> <li>- Clean or replace valve parts (refer to Chapter 4.2)</li> </ul>
<ul style="list-style-type: none"> <li>- Dosing pump stops (1 ph. motor) (controller types 0, 4 and 5)</li> </ul>	<ul style="list-style-type: none"> <li>- Temperature monitor on motor has switched off due to ambient temperature being too high or due to overload</li> <li>- Miniature fuse defective due to overload or electrical defect</li> </ul>	<ul style="list-style-type: none"> <li>- Check pressure in metering line and correct as necessary. Check ambient temperature and reduce as necessary. Motor switches off automatically in operation after cooling.</li> <li>- Check pressure in the metering line and correct as necessary. Replace fuse (refer to Chapter 2.4 Type 0 control unit).</li> </ul>
<ul style="list-style-type: none"> <li>- Dosing pump stops (1 ph. motor) Red LED is lit (controller types 1, 2 and 3)</li> </ul>	<ul style="list-style-type: none"> <li>- Temperature monitor on motor has switched off because ambient temperature is too high</li> <li>- The rotation monitoring of the drive has switched off due to overload</li> </ul>	<ul style="list-style-type: none"> <li>- Check ambient temperature and reduce as necessary. After cooling down, clear the fault by switching the mains switch off and on</li> <li>- Check pressure conditions in the metering pipeline and correct as necessary. Clear the fault by switching the mains switch off and on.</li> </ul>

## 4 Servicing/Maintenance

### 4.1 General servicing notes

- The servicing of Vario metering pumps is limited to checking the metering line and checking for leaks.
- The gearing is lubricated for life by packing with grease.  
(Type 1: Klüber ISOFLEX Topas NB 5051), capacity 24 ml).
- Spare parts are given in the accompanying spare parts list.
- The individual parts given in the spare parts list are regarded as wear parts.

#### CAUTION:

- *The safety precautions given in Chapter 1 must be complied with.*

### 4.2 Replacement of wear parts

#### Replacement of diaphragm

Flush the line (in the case dangerous media wear protective gloves and goggles). Switch off the pump and disconnect from the mains. Undo the unions on the valve and slacken the head bolts until free but do not remove. Hold the connecting rod against rotation by using an open-ended spanner through the opening in the head washer (5). Detach the diaphragm (4) from the head/diaphragm/head washer (8/2/4/5) assembly by turning sharply counter-clockwise.

#### TAKE CARE:

- *Valves must be free of connecting pipes.*

Remove the diaphragm. Clean the sealing surfaces. Hold the head washer in front of connecting rod (6) (drain hole downwards) and screw a new diaphragm onto the connecting rod. After the diaphragm has reached its stop, continue turning until the hole pattern aligns with the threaded holes. Place the liquid end in position and tighten (ensure correct direction of flow). Connect the valves. Switch on the pump and check the liquid end for leaks.

#### Replacement of valve parts

Flush the line (in the case of dangerous media wear protective gloves and goggles). Switch off the pump and disconnect from the mains. Slacken the connecting unions. Unscrew valve (1) and remove. Where the „valve assembly“ is being changed clean the sealing surfaces and fit the new valve and seal in place and tighten. Connect up. Switch on the pump and check the connections for leaks.

If the internal parts of the valves are being exchanged, unscrew and remove the valve and slacken the valve seat bush using a special tool and unscrew. Replace the parts as necessary and reassemble in reverse order. Clean the sealing faces. Continue as before.

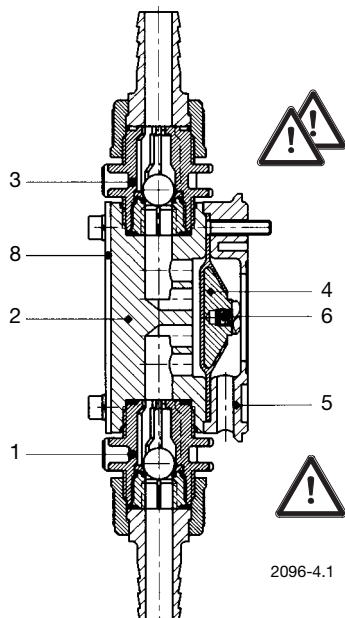
#### CAUTION:

- *Repairs to electrical equipment may only be carried by qualified electricians. Serious danger can arise to the user due to incorrect repairs. Repaired electrical equipment must be subjected to a function and safety inspection in accordance with the valid regulations of the consumer country.*

### 4.3 Disposal of old parts

#### WARNING:

- *Spring under pressure! Ensure that the return spring (pos. 5, section 2.2) is held under strong mechanical pressure when dismantling the pump.*
- For disposal please observe all locally applicable directives!



## 4.4 Spare parts set

The spare parts kit contains all components required for maintenance of liquid ends.

### PVT/TT1 Version

- 1 pump diaphragm
- 1 suction valve compl.
- 1 discharge valve compl.
- 2 valve balls
- 1 set of seals (jacket rings, ball seat discs)

### SST Version

- 1 pump diaphragm
- 2 valve balls
- 1 set of seals (jacket rings, flat seals, ball seat)

### PP1/NP1 Versions

- 1 pump diaphragm
- 1 suction valve compl.
- 1 discharge valve compl.
- 2 valve balls
- 1 set of seals (O rings, ball seat discs)

### Vario Spare Parts Kit

(Applies to identity code: Type VAMb 12017, 12026, 12042)

**Order No.**

<b>Liquid end FM 042 - DN</b>	PVT	1003641
	SST	910751
	SST (with 2 valve sets)	910750
	PP1	910753
	NP1	910754
	TT1	910752

(Applies to identity code: Type VAMb 10025, 09039, 07063)

**Order No.**

<b>Liquid end FM 063 - DN 10</b>	PVT	1003642
	SST	910756
	SST (with 2 valve sets)	910755
	PP1	910758
	NP1	910759
	TT1	910757

(Applies to identity code: Type VAMb 06047, 05075, 04120)

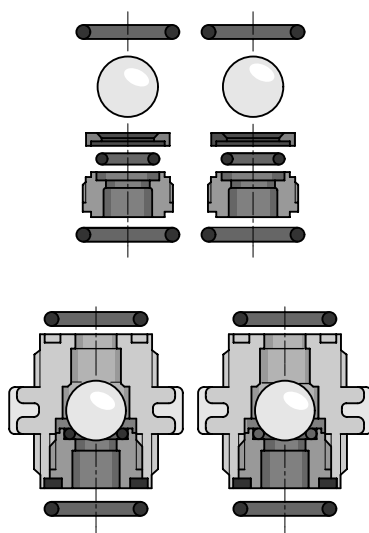
**Order No.**

<b>Liquid end FM 120 - DN 15</b>	PVT	1003643
	SST	910761
	SST (with 2 valve sets)	910760
	PP1	910763
	NP1	910764
	TT1	910762

### Pump diaphragms

**Order No.**

Vario with <b>FM 042</b> Typ VAMb 12017, 12026, 12042	811458
<b>FM 063</b> Typ VAMb 10025, 09039, 07063	811459
<b>FM 120</b> Typ VAMb 06047, 05075, 04120	811460



pk\_2\_002

## 5 Technical Data

### 5.1 Performance data

Pump Type Vario	at 50 Hz				at 60 Hz						
	Pump Capacity at Max. Back Pressure	Max. Stroke Freq.			Pump Capacity at Max. Back Pressure	Max. Stroke Freq.	Suction Lift	Perm. Admiss. Pressure Suction Side	Connector Suction/ Discharge Side	Shipping Weight	
	bar	l/h	ml/ stroke	strokes/ min.	psi	l/h/gph	strokes/ min.	mWG	bar	G - DN	kg
12017	10/12*	16.6	3.6	77	145	20 / 5.3	92	7	2.8	3/4 - 10	6.6/ 8.6*
12026	10/12*	26.2	3.6	122	145	31.4/ 8.3	146	7	2.8	3/4 - 10	6.6/ 8.6*
12042	10/12*	42.0	3.6	195	145	50.4/13.3	234	7	2.8	3/4 - 10	6.6/ 8.6*
10025	10	24.8	5.4	77	145	29.8/ 7.9	92	4	1.7	3/4 - 10	6.6/ 8.6*
09039	8.5	39.4	5.4	122	123	47.3/12.5	146	4	1.7	3/4 - 10	6.6/ 8.6*
07063	6.5	63.0	5.4	195	94	75.6/20	234	4	1.7	3/4 - 10	6.6/ 8.6*
06047	5,5	47.4	10.2	77	80	56.9/15	92	3	0.8	1 - 15	7.5/13.5*
05075	4,5	75.0	10.2	122	65	90 /23.8	146	3	0.8	1 - 15	7.5/13.5*
04120	3.5 (2.3**)	120.0	10.2	195	50 (33**)	144 /38	234	3	0.8	1 - 15	7.5/13.5*

\* Data for SST version

The maximum start up pressure when the 1 ph. AC motor is switched off at the mains is 20 - 50 % of the nominal maximum operating pressure.

\*\* The value in brackets gives the maximum permissible start up pressure at the use of the "pause" function or for a single stroke via an external controller.

In external contact mode (control options 1 + 2), at mains frequency 60 Hz the feed rate is the same as at 50 Hz. It is possible to adjust the settings to optimise feed rates at 60 Hz. Further details are available on request.

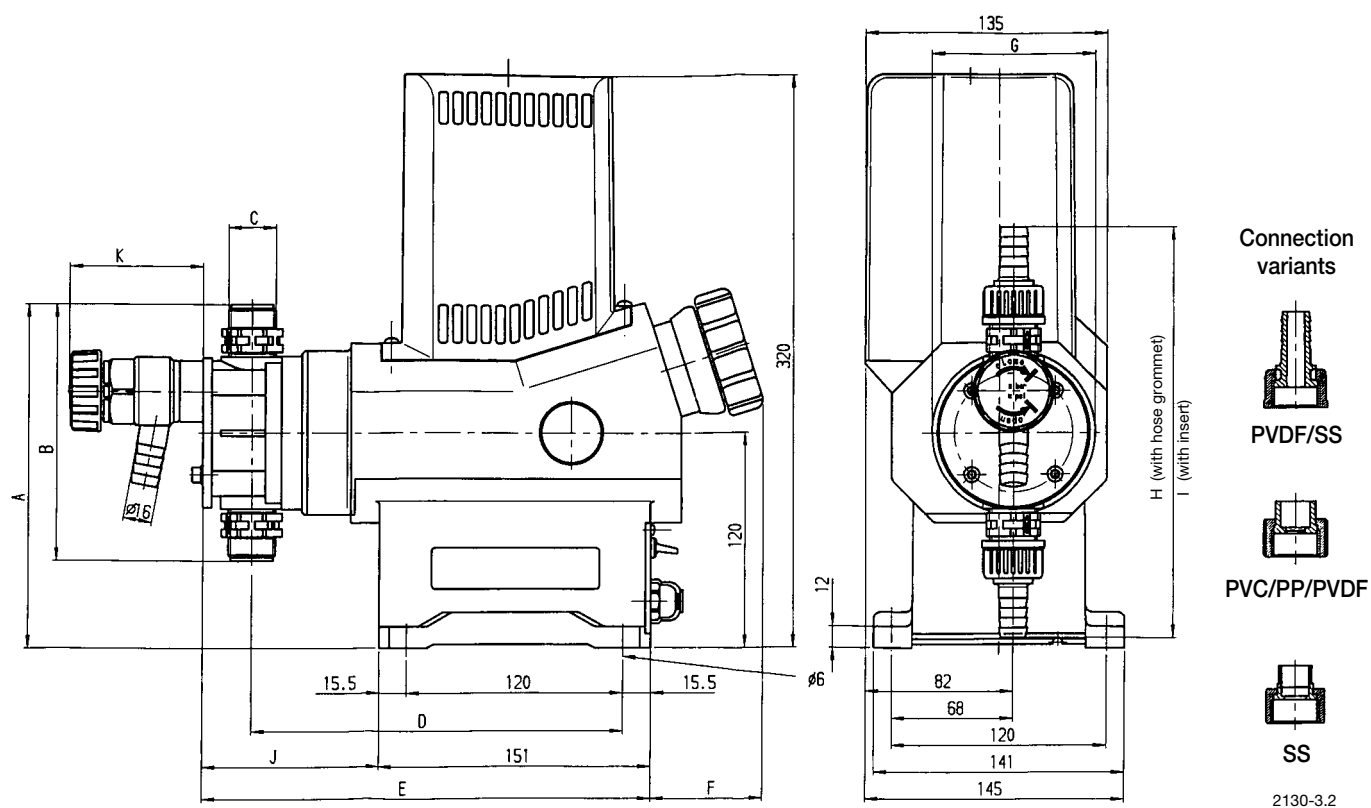
### Materials In Contact With Chemicals

	Liquid End	Suction/ Discharge	Seals	Valve Balls	Valve Seat	Standard connector
<b>PVT</b>	PVDF (Polyvinylfluoride)	PVDF	PTFE	ceramic	PTFE	choice, see identity code
<b>SST</b>	stainless steel no. 1.4571	stainless steel no. 1.4581	PTFE	stainless steel no. 1.4404	PTFE	choice, see identity code
<b>PP 1</b>	Polypropylene	Polypropylene	EPDM	Borosilicate glass	EPDM	PP hose connector
<b>NP 1</b>	Clear acrylic	PVC	Viton®	Borosilicate glass	Viton®	PVC hose connector
<b>TT 1</b>	PTFE with carbon	PTFE with carbon	PTFE	ceramic	PTFE	PVD insert

DEVELOPAN® pump diaphragm with PTFE coating.

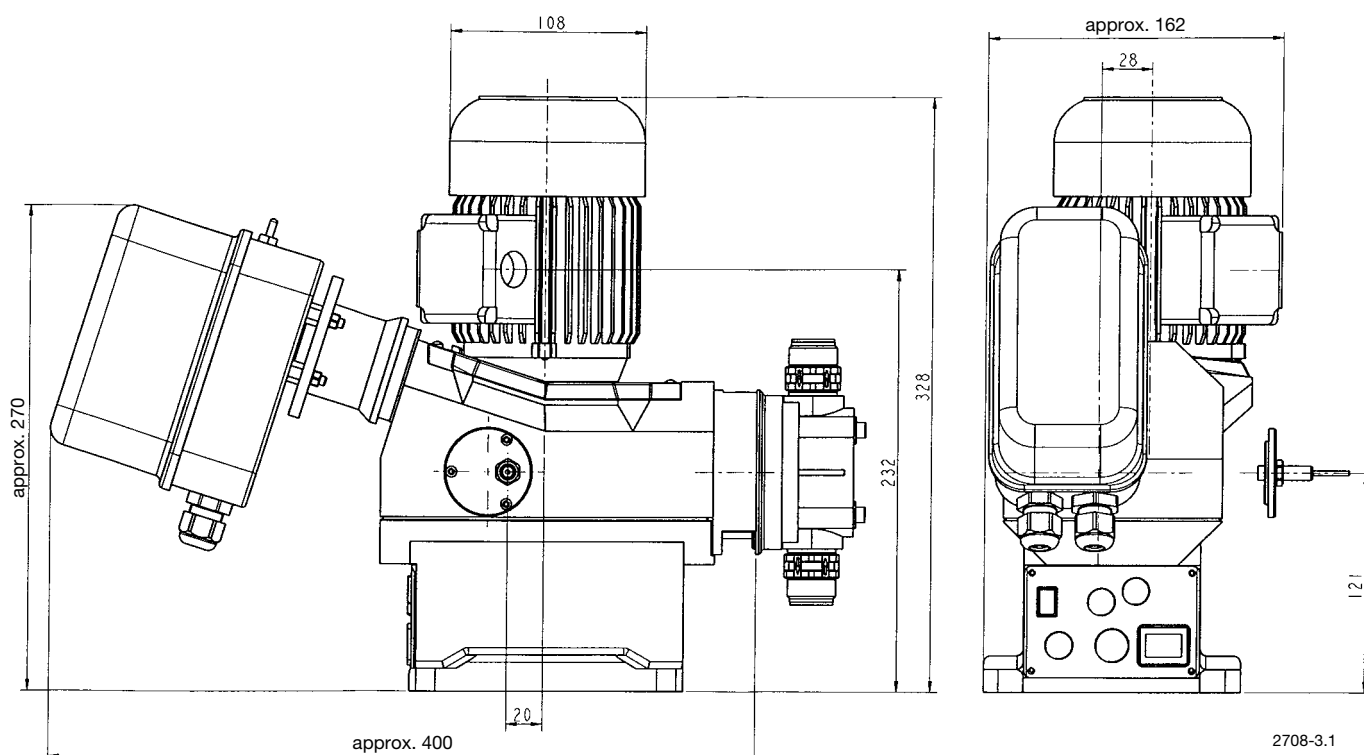
Viton® is a registered trademark of DuPont Dow Elastomers.

## 5.2 Dimensions sheet



Delivery unit	Connection	A	B	C	D	E	F	G	H	I	J	K
042 PVT	DN 10	191	142	G3/4A	208	246 (251*)	65	85	228	180	95 (100*)	74*
042 SST	DN 10	190	140	G3/4A	208	241	65	85	226	180	90	–
063 PVT	DN 10	191	142	G3/4A	208	246 (251*)	65	85	228	180	95 (100*)	74*
063 SST	DN 10	190	140	G3/4A	208	241	65	85	226	180	90	–
120 PVT	DN 15	218	195	G1A	210	256 (263*)	65	135	328	235	105 (112*)	69*
120 SST	DN 15	218	195	G1A	210	249	65	135	328	241	98	–

\* PVT with relief valve



**Temperature details**

Permissible storage temperature:	-10 to +50 °C
Permissible ambient temperature:	-10 to +40 °C for pump -10 to +50 °C for control part

Temperature compatibility of materials:

Material	Long term exposure at max. backpressure	Short term exposure max. 15 min, at max 2 bar
PVT	50 °C	100 °C
NP1	45 °C	60 °C
PP1	50 °C	100 °C
TT1	50 °C	120 °C
SST	50 °C	120 °C

A brief overshoot (see above) is permissible, e.g. for sterilisation or flushing with hot water.

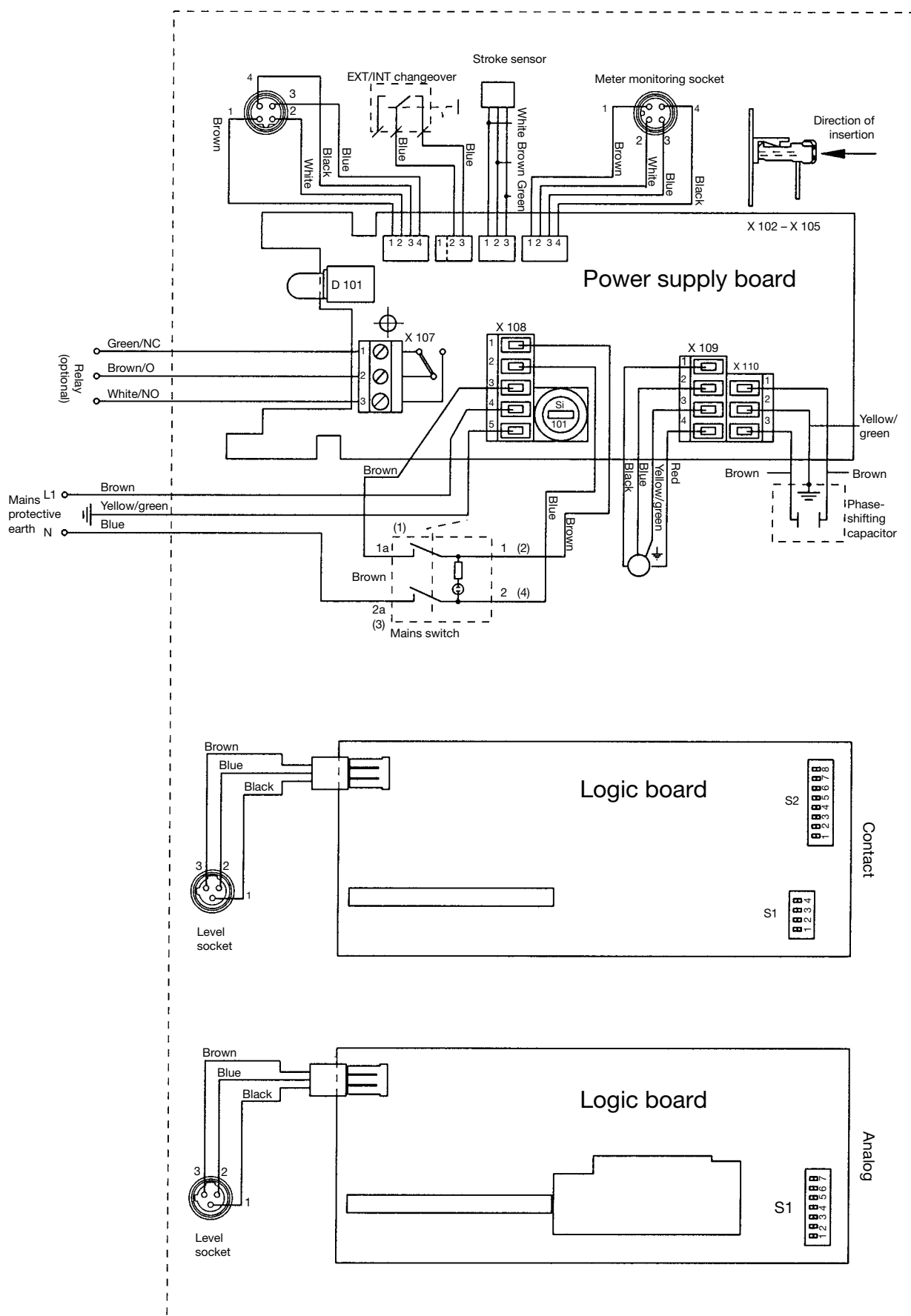
**5.3 Motor data**

Type:	<b>Single-phase a.c. motor with temperature sensor</b>
Power supply (according to type):	230 V ± 10 %, 50/60 Hz 115 V - 6 %, +15 %, 60 Hz
Output:	0.10 KW
Current consumption:	approx. 0.8 A (230 V/50 Hz) approx. 1.6 A (115 V/60 Hz) The start-up current is equal to approx. 2.5 times the nominal current
Speed:	2.830 rpm (50 Hz) 3.450 rpm (60 Hz)
Insulation class:	F

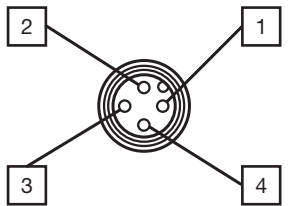
Type:	<b>Standard 230/400 V: 50/60 Hz 3 ph. motor</b>
Power supply (according to type):	Δ/Y 220-240 V/380-420 V; 50 Hz Δ/Y 220-265 V/380-460 V; 60 Hz
Output:	0.09 kW
Current consumption:	0.5 A (230 V) 0.32 A (400 V)
Speed:	approx. 2800 rpm (50 Hz) 3360 rpm (60 Hz)
Insulation class:	F; IP 55



# Wiring diagram, types 1, 2 and 3 control units



### View on socket



2628-4.2

### Technical data for external input: types 1 and 2 control units

Pin 1 = Interval input (switch on function)

Voltage level: approx. 5 V via 10 k Ohm  
Contact load: approx. 0.5 mA  
Residual voltage:  $\leq 0.7$  V

Pin 2 = Contact input

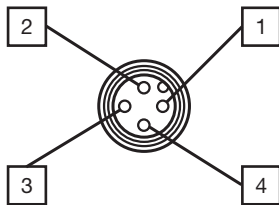
Voltage level: approx. 5 V via 10 k Ohm  
Contact load: approx. 0.5 mA  
Residual voltage:  $\leq 0.7$  V  
Pulse width:  $\geq 20$  ms  
Pulse frequency:  $\leq 25$  pulse/s

Pin 3 = Analog input (not active)

Pin 4 = GND

Contacts (relay) or semiconductor switching elements with residual voltage of  $\leq 0.7$  V (e.g. transistor in open collector circuit) can be used as input switching elements.

### View on socket



2628-4.2

### Technical data, external input: type 3 control unit

Pin 1 = Interval input (switching function)

Voltage level: approx. 5 V via 10 k Ohm  
Contact load: approx. 0.5 mA  
Residual voltage:  $\leq 0.7$  V

Pin 2 = Contact input (not active)

Pin 3 = Analog input

Input burden: 70 Ohm  $\pm 2$  % (for control variants A, B, F and G).

At approximately 0.4 mA (4.4 mA) the metering pump makes its first discharge stroke and at approximately 19.2 mA the pump goes into continuous operation. The precise values depend on the gearing and the frequency of the power supply.

Pin 4 = GND

### Technical data for fault/timer relays

For fault relays with a normally-closed contact the relay closes immediately the power is switched on and opens in the event of a fault.

For fault relays with a normally-open contact the relay closes for approximately 4 s after power is switched on (power down phase) before it again opens. In the event of a fault the relay closes.

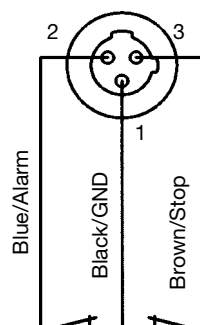
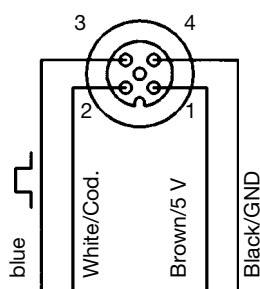
For timer relays with a normally-open contact the relay closes for approximately 4 s after power is switched on (power down phase) before it re-opens. The relay closes for approximately 100 ms on each discharge stroke.

- Contact load: at 250 V AC., 2 A (resistive consumer), 200,000 switching cycles.

When inductive loads are switched, suitable suppression devices (e.g. RC elements) are to be used.

# Wiring diagram, types 1, 2 and 3 control units

Pre-wired plug

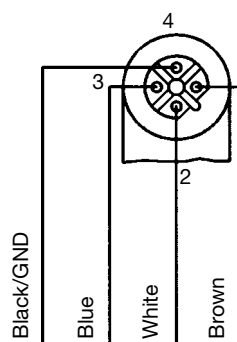
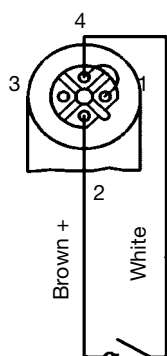


2628-4.2

## Dose monitoring

## Level switch

Contact open indicates empty



## External/contact cable

(for types 1 and 2 control units only)

Contact closed – discharge stroke

## Universal control cable:

External/contact: 2 white +  
4 black/GND  
(1 and 4 bridged)

Analog: 3 blue +  
4 black/GND  
(1 and 4 bridged)

On switching function: 1 brown +  
4 black/GND

Brown connected to black ⇒ pump dosing

Brown and black open ⇒ pump stationary

## GUIDELINE:

If using 5-core signal cable the grey wire is not connected (no function).

6 EC Declaration of Conformity

## EC Declaration of Conformity

We,

**ProMinent Dosiertechnik GmbH**  
**Im Schuhmachergewann 5 - 11**  
**D - 69123 Heidelberg**

hereby declare that, on the basis of its functional concept and design and in the version brought into circulation by us, the product specified in the following complies with the relevant, fundamental safety and health stipulations laid down by EC regulations.

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

Product description : ***Metering pump, Series Vario***

Product type : ***VAMb...***

Serial number : ***see type identification plate on device***

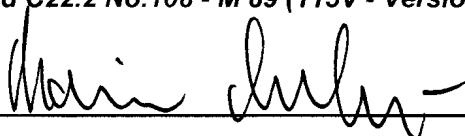
Relevant EC regulations : ***EC - machine regulation (98/37/EEC)***  
***EC - low voltage regulation (73/23/EEC)***  
***EC - EMC - regulation (89/336/EEC subsequently 92/31 EEC)***

Harmonised standards used,  
in particular : ***DIN EN 292-1, DIN EN 292-2, EN 809***  
***DIN EN 60335-1 A6, DIN EN 60335-2-41***  
***DIN EN 50081-1/2, DIN EN 50082-1/2, EN 55014***  
***DIN EN 61000-3-2, DIN EN 61000-3-3***

National standards and other  
technical specifications used,  
in particular : ***DIN VDE 0700 T1***  
***DIN VDE 0700 T41***  
***DIN VDE 0700 T500***  
***CSA Standard C22.2 No. 0 - M 91 (115V - Version)***  
***CSA Standard C22.2 No.108 - M 89 (115V - Version)***

Date/manufacturer's signature :

***08.06.1999***



The undersigned :

***Dr. Rainer V. Dulger, Executive Vice President R&D and Production***

No.: \_\_\_\_\_

**Please complete fully!**

Company: \_\_\_\_\_

Telephone No: \_\_\_\_\_ Date: \_\_\_\_\_

Address: \_\_\_\_\_

Specialist (customer): \_\_\_\_\_

Contract No: \_\_\_\_\_ Delivery date: \_\_\_\_\_

Pump type/  
Ident code: \_\_\_\_\_ Serial No: \_\_\_\_\_

**Short description of fault:** \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

**Type of fault:**

**1 Mechanical fault**

- ☐ Untypical wear
- ☐ Wear parts
- ☐ Fracture/other damage
- ☐ Corrosion
- ☐ Damaged in transit

**2 Electrical fault**

- ☐ Connections such as plugs or cables loose
- ☐ Controls (e.g. switches)
- ☐ Control system

**3 Leakage**

- ☐ Couplings
- ☐ Liquid end

**4 None or poor delivery rate**

- ☐ Defective diaphragm
- ☐ Other

**Operating conditions of ProMinent® pumps:**

Location/plant designation: \_\_\_\_\_

Pump accessories used: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Commissioning (date): \_\_\_\_\_

Running time (approx. running hours): \_\_\_\_\_

Installation date/sketch of installation (to be included by customer)

**(Please fully complete the accompanying „Data for metering line calculations“ form)**

## Data for dosing pipeline calculations

Customer: \_\_\_\_\_

Project No: \_\_\_\_\_ Date: \_\_\_\_\_

☐

Sketch/remarks on back

### Metering pumps

Type \_\_\_\_\_

Delivery rate l/h \_\_\_\_\_

No. of strokes S/min \_\_\_\_\_

Type of valve (ball/plate) \_\_\_\_\_

Valve spring pressure, suction side bar \_\_\_\_\_

Valve spring pressure, pressure side bar \_\_\_\_\_

Max. permissible operating pressure bar \_\_\_\_\_

### Medium

Designation, concentration % \_\_\_\_\_

Amount of solids/grain size %/mm \_\_\_\_\_

Material, solid/hardness Mohs \_\_\_\_\_

Dynamic viscosity mPas(cP) \_\_\_\_\_

Density kg/m<sup>3</sup> \_\_\_\_\_

Vapour pressure at operating temperature bar/°C \_\_\_\_\_

### System, suction side

Pressure in suction tank \_\_\_\_\_

Nominal diameter of suction pipe DN/mm \_\_\_\_\_

Suction head, min/max. m \_\_\_\_\_

Inlet height, min/max. m \_\_\_\_\_

Length of suction pipe m \_\_\_\_\_

Condition of pipeline \*\*  
☐ Plastic, smooth and clean  
☐ Steel, seamless smooth  
☐ Steel, galvanised

Number of angles/valves \_\_\_\_\_

Pulsation damper  
☐ Diaphragm storage tank \_\_\_\_\_ ltr.  
☐ Air chamber \_\_\_\_\_ ltr.

### System, pressure side

Static pressure of system min/max. bar \_\_\_\_\_

Nominal diameter of pressure pipe DN/mm \_\_\_\_\_

Length of pressure pipe m \_\_\_\_\_

Delivery head \* m \_\_\_\_\_

Condition of line \*\*  
☐ Plastic, smooth and clean  
☐ Steel, seamless smooth  
☐ Steel, galvanised

Number of angles/valves pulsation damper \_\_\_\_\_

☐ Diaphragm storage tank \_\_\_\_\_ ltr.  
☐ Air chamber \_\_\_\_\_ ltr.

\* When making calculations  
note the signs, tank level below liquid end = negative suction head H  
metering line - outlet level below liquid end = negative pressure head HD

\*\* For the precise calculation where viscosities are less than 50 mPas  
the condition of the line is to be given.

Customer:

Project no:

Date:

