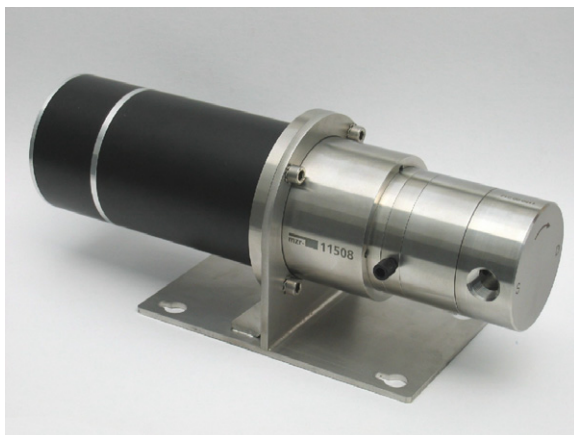


Operation manual for micro annular gear pump
mzr-11508



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1 General Information

Please read the »manual for micro annular gear pump« carefully before initial operation of the pump. The manual for the controller have to be seen as part of the pump manual. For missing manuals please call your distributor or HNP Mikrosysteme directly.

We like to *draw your attention* especially to the following *safety instructions*.

1.1 Use

The Micro annular gear pump mzr-11508 is capable of pumping lubricating and non-lubricating liquids. The pump can not be used with highly corrosive liquids such as strong acids.



You are obliged to take care for suitable safety measures according to the legal regulations when you intend to pump aggressive, poisonous, radioactive etc. liquids. All liquids must be non corrosive for the used materials.



The pumps may not be used for medical applications at humans and animals.



HNP Mikrosysteme makes details on liquid resistance known according its best knowledge. A guarantee for these details cannot, however, be taken on due to the parameters varying of application case to application case.

Should you require any additional information regarding the pump, contact HNP Mikrosysteme GmbH or its local authorized distributor. Please state the pump model and the date of manufacture in your correspondence.

1.2 Pump Model Designation

This manual is valid for the micro annular gear pump mzr-11508, manufactured by HNP Mikrosysteme GmbH, Juri-Gagarin-Ring 4, D-19370 Parchim, Germany.

The bottom line of this manual shows the issue and date of issue of this operating instruction.

1.3 Technical data of the micro annular gear pump mZR-11508

The following table shows the technical data of the micro annular gear pump head mZR-11508.

Constructive Specifications	
Displacement volume	192 µl
Measurements (L x W x H)	309 x 108 x 124 mm
Weight	approx. 8 kg
Internal volume	8,5 ml
Material case	stainless steel 1.4435 (316L)
Material rotor	tungsten carbide Ni-based
Material bearing	tungsten carbide Ni-based
Shaft seal	graphite-reinforced PTFE, spring Alloy C276 (2.4819)
Static seals	FPM (fluoroelastomer), optional: EPDM, FFPM
Fluid connections	3/8" NPT internal thread, lateral
Tubes D / ID	6 / 4 mm
Technical data	
Flow rate	0,192 – 1152 ml/min (= 69,1 l/h)
Smallest dosage volume	30 µl
Operating pressure range	0 – 60 bar (by Viskosity 1 mPas) 0 – 150 bar (by Viskosity 16 mPas)
Max. inlet pressure	10 bar
Viscosity range	0,5 – 150.000 mPas
Precision	< 1 %
Pulsation	6 % (theoretical)
Operating temperature	-5 ... +60 °C (120 °C*)
Ambient temperature	-5 ... +50 °C
Store temperature	5 ... +40 °C

caption: * Differing specifications on request

table 1

Technical data of the micro annular gear pump head mZR-11508

Warning

The material property of a liquid (e.g. viscosity, lubricating property, particle content, corrosiveness) impacts the technical data and the service life of pumps.

At appropriate conditions the characteristic values may be increased or decreased.

Warning

If you intend to operate the pump out of the range of the above given specification, please consult the manufacturer. Modifications may be necessary to ensure successful operation. Otherwise the pump or the system may be damaged seriously.

1.4 Measurements

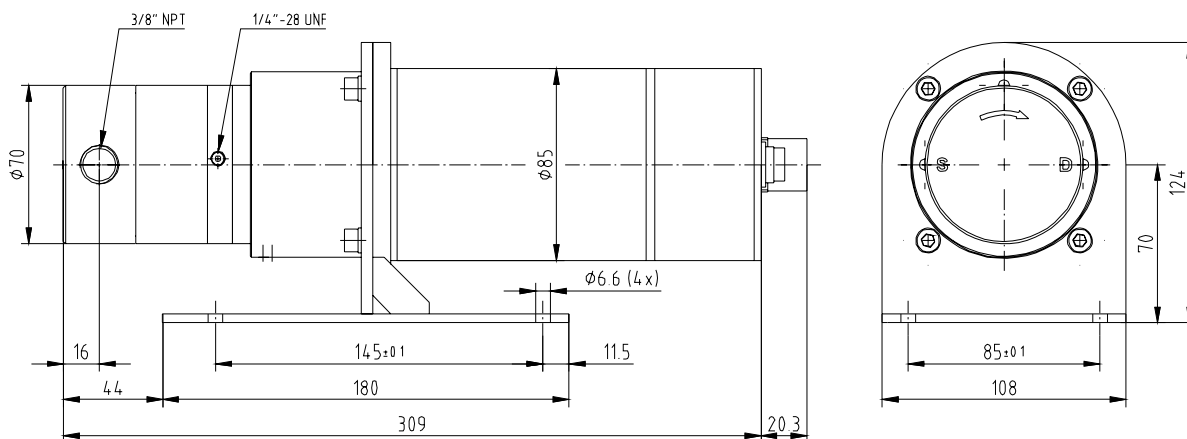
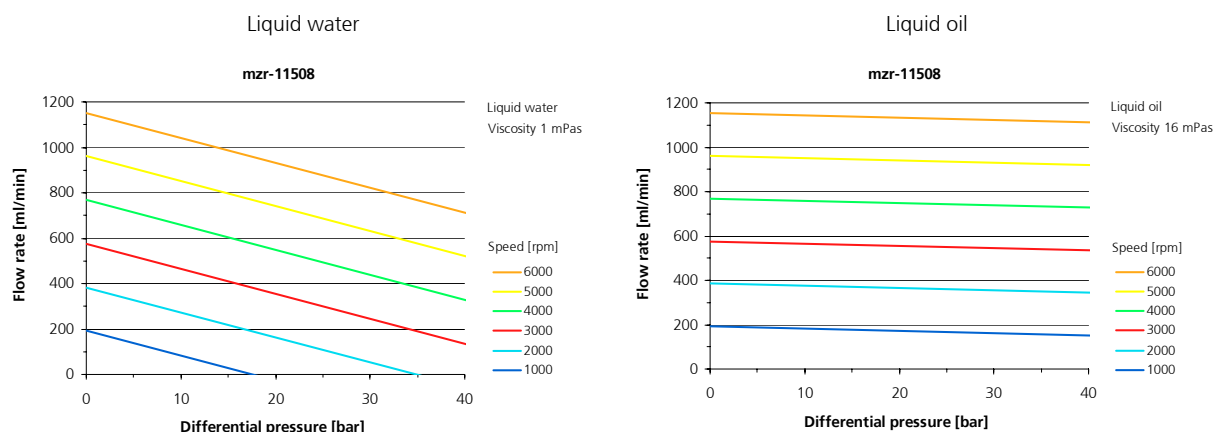


figure 1 Dimensions of the micro annular gear pump mzr-11508

1.5 Flow charts



1.6 Technical data of the standard motor

The micro annular gear pump mZR-11508 is provided with an actuator equipped with an 2 pole brushless DC-motor. The DC motor uses a high dynamic and is recommendable for programmed dosage operations of the micro annular gear pump. With a control unit it is possible to manage lower speed ranges down to 10 RPM. The accuracy of dosage can be achieved better than 0.5 %. The connection of the motor to a control unit is simple.

Data of capacity	
Nominal voltage	42 V DC
Max. continuous current	10 A
Assigned power rating	386 W
Max. Stall torque	500 mNm
Encoder	HP, Typ HEDL 5640
Cycles per revolution and channel	500
Operation range	1 – 6.000 rpm
Max speed by 24 V	4.000 rpm
operation range 42 V	7.000 rpm
Protection class	IP 54
Weight	3,1 kg
Male socket for motor supply	Binder series 623 Type: 99-4637-20-06
Female cable connector for motor supply	Binder series 623 Type: 99-4636-00-06
Male socket for Encoder/Hall sensor	Binder series 423 Type: 99-0131-00-12
Female cable connector for Encoder/Hall sensor	Binder series 423 Type: 99-5130-15-12
length of the cable	3 m lengthen to max. 10 m

table 2 Technical data of the motor

Pin	Description
1	motor phase A
2	n.c.
3	motor phase B
4	n.c.
5	motor phase C
6	n.c.

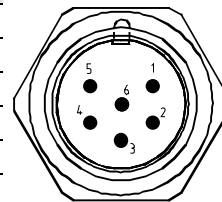


table 3 Pin configuration of the motor supply

Pin	Description
A	Encoder voltage +5 V
B	Encoder/Hall sensor GND
C	Encoder channel A
D	Encoder channel A neg.
E	Encoder channel B
F	Encoder channel B neg.
G	Encoder channel I
H	Encoder channel I neg.
J	Hall sensor voltage +5 V
K	Hall sensor A
L	Hall sensor B
M	Hall sensor C

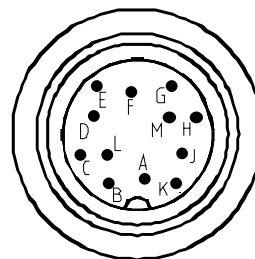


table 4 Pin configuration of the motor connector (Encoder/Hall)

wire colour	Description
brown	motor phase A
green	motor phase B
white	motor phase C
black	screen (optional)

table 5 Motor supply cable 3 poles

wire colour	Description	pin Controller S-HV
red	Encoder voltage +5 V	6
pink	Hall sensors voltage +5 V	6
yellow	Encoder channel B	7
green	Encoder channel A	8
blue	Encoder/Hall sensor GND	9
brown	Hall sensor A	10
grey	Hall sensor B	11
white	Hall sensor C	12
black	screen	earth screw

table 6 Encoder/Hall sensors cable 8 poles with controller S-HV



The encoder channel A and B are change together on the controller S-HV!

1.7 Technical data of the optional motor with analog hall sensors (option)

The micro annular gear pump mzs-11508 can alternatively be driven with a brushless DC-motor with analog hall sensors. It is characterized by higher dimensions and a wider speed range, which covers entirely the speed range of the micro annular gear pump and shows a longer service life than a brushed DC-motor.

Performance parameters	
Nominal voltage	36 V
Max. continuous torque	191,9 mNm
Power	201 W
No-load speed at 9 V	10,450 rpm
Max. continuous current	6.29 A
Terminal resistance, phase-phase	0.445 Ω
Terminal inductance, phase-phase	143 μH
Speed	1 – 6000 rpm
Ambient temperature	-30 ... +125 °C
Type of Hall effect sensor	analog

table 7 Technical data of the brushless DC-motor

pin	Description
1	motor phase A
2	n.c.
3	motor phase B
4	n.c.
5	motor phase C
6	n.c.

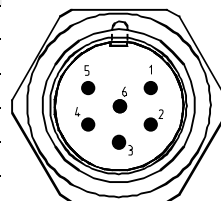


table 8 Pin configuration of the motor supply

wire colour	Description
brown	motor phase A
green	motor phase B
white	motor phase C

table 9 Cable 3 poles of the motor supply

pin	Description
A	Hall sensor GND
B	Hall sensor sensor voltage +5 V
C	Hall sensor A
D	Hall sensor B
E	Hall sensor C

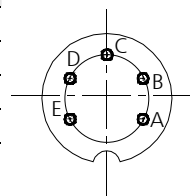


table 10 Pin configuration of the hall sensor connector

wire colour	Description
blue	Hall sensor GND
red	Hall sensor voltage +5 V
brown	Hall sensor A
grey	Hall sensor B
white	Hall sensor C

table 11 Motor cable 3 poles

Function	Connection	Color
Hall sensor	A	green
Phase	A	brown
Hall sensor	B	blue
Phase	B	orange
Hall sensor	C	gray
Phase	C	yellow
Voltage	+5 V	red
Mass	GND	black

table 12 Pin configuration of the motor (cable version)






Please notice that the brushless DC motors must imperatively be operated with an adapted control unit! The micro annular gear pump mzr-7208 can be delivered for this purpose with optional control units S-BL.

2 Safety

Comply with the general safety instructions listed in this safety section and also with the special safety instructions listed under the other main sections.

2.1 Labelling of instructions in the operating manual

The safety instructions are listed in this operating manual which, if not complied with, can cause danger, are specially labelled by

Danger symbol		Non-compliance poses danger for persons.
High voltage symbol		Non-compliance poses danger of electrical shock.
Warning symbol		Non-compliance poses a risk to the machines

The name plate mounted on the pump must be complied with and be maintained in a clearly readable condition.

2.2 Staff qualification and training

The operational, maintenance, inspection and assembly staff must evidence the appropriate qualifications for these works. Areas of responsibility, competencies and monitoring of the staff must be precisely regulated by the operator. If the personnel do not have the necessary knowledge, they must be trained and instructed accordingly. This can be implemented, if necessary, by the manufacturer / supplier on behalf of the machine operator. In addition, the operator must ensure that the content of this operating manual is fully understood by the personnel.

2.3 Dangers from non-compliance with safety instructions

Non-compliance with safety instructions can pose a danger not just to personnel, but also to the environment and machinery. Non-compliance with the safety instructions can lead to the loss of all claims for compensation.

In detail, non-compliance can cause the following dangers (examples):

- Failure of important machine/system functions
- Failure of prescribed methods for maintenance and servicing
- Danger to persons from electrical, mechanical and chemical effects
- Danger to the environment from escaping hazardous substances

2.4 Safety-conscious work

The safety instructions listed in this operating manual, the applicable national regulations for accident prevents and all internal working, operating and safety regulations of the operator must be complied with.

2.5 Safety instructions for the operator

- If hot or cold machine parts pose any danger, these parts must be protected on site against contact.
- Leaks (e.g. from the shaft seal) of dangerous conveyed goods (e.g. explosive, toxic, hot) must be guided away in such a manner that no danger is present for persons and the environment. Legal requirements must be complied with.
- Danger posed by electrical energy must be excluded

2.6 Safety instructions for maintenance, inspection and assembly work

The operator must ensure that all maintenance, inspection and assembly work is carried out by authorised and qualified specialist personnel, who are sufficiently familiar with this operating manual.



In general, work on the machine should only be implemented when it is at a standstill. The procedure described in this operating manual to stop the machine must be complied with in full.



Pumps or aggregates that convey media hazardous to health must be decontaminated. Immediately after work is complete, all safety and protection equipment must be remounted/restarted.



Before commissioning, the points listed in the Initial start-up section must be noted.

2.7 Unauthorised conversions and spare parts manufacturer

Conversions or modifications to the machine are only permitted following consultation with the manufacturer. Original spare parts and accessories authorised by the manufacturer ensure safety. The use of other parts may annul the liability for any resulting consequences.

2.8 Improper modes of Operation

The operating safety of the delivered machine is only ensured by its correct use as per chapter 1 in this operating manual. The limit values given in the manual must not be exceeded in any case.

2.9 General safety instructions



Skilled personnel may only do *mounting* and *initial operating* of micro annular gear pumps.



The pump can achieve *high pressures*. Use only the fluidic connections included in the delivery and be sure, that *fittings* and *tubes* are *permissible* and *specified* for these pressures.



Provide the *assembly* with a *pressure control valve* to decrease the pressure either by leading the excess media into the tank or to the induction side.



The micro annular gear pump is highly precise manufactured. Any kind of contamination on the inside of the pump can cause damages. Therefore, we may ask you, to ensure yourself, that all fluidic leading parts are absolutely free from any kind of dirt, dust or any other particles, as these impurities may affect the function of the pump.



For operating of the micro annular gear pump, the use of filters with a pore size of 10 µm or smaller is required.

Warning

To connect the tubes of the pump remove the transport plugs and adapt them to the fittings, which are found in the delivery volume (see: assembly instructions for fluidic connections).



Pay attention to the *correct assembly* of your *fluidic connections* on the micro annular gear pump head, to keep up the indicated *flow direction*. Should you intend to use the pump in reverse operation modus, we may ask you to contact one of our Applications Consultants at HNP Mikrosysteme, as this kind of operation is not possible in every range of application.



If you intend to use *aggressive, corrosive or poisonous, etc. pumping media*, you are obligated to take care of the appropriate safety precautions in accordance of law and regulations.



Information about *media constancy* is given by best knowledge of HNP Mikrosysteme. According to the variations of parameter referring to the variety applications, we are *not able* to take a *warranty* upon these specifications.



The *rotary shaft seals* used in the micro annular gear pump avoid in standard operation the leaking of media from the micro annular gear pump. Micro annular gear pumps are »technically sealed«, but *not hermetic sealed*, so that gases may escape from the pump or lead into the pump.



Take measures of precaution to avoid damages on close by equipment and avoid pollution of the environment, in case of disengagement. Be careful to assemble the micro annular gear pump, so that disengaging fluidic media may not leak into the motor or the control unit in case of malfunction.



In standstill, the medium in the pump may float in direction of the drop of pressure through the pump. If necessary provide *back pressure valves* (see: accessories).

Warning

Avoid in any case *dry running* of your *micro annular gear pump* as this may especially damage the seals. A short phase of dry running when setting the pump into operation is negligible.

Warning

Do not disassemble the micro annular gear pump in case of malfunction; contact our service personnel of HNP Mikrosysteme immediately to be helped.



Protect the micro annular gear pump and the electric actuator from *shock and at zero impact*.



The actuators may be protected against *moisture, dust and perspiration*.



The *permitted electrical data* of the actuators may *not be exceeded*. Notice that especially *the accurate set polarity* of the distribution voltage is required, if not the control unit can be destroyed.

Warning

The *surface temperature* of the actuators can exceed 60°C (140°F) in *full load*. You might want to *provide protection to avoid accidental contact*, which will cause burns on your skin.

3 Transportation and Storage

3.1 Shipping

The pumps are shipped from the factory in such a manner that they are protected against corrosion and against shocks.

In addition, inlets and outlets are plugged with protective plugs. This measure is necessary to securely prevent foreign bodies from penetrating into the pump's interior.

3.2 Transportation

To avoid transport damage, the transport packaging must be protected against shocks.

HNP Mikrosysteme guarantees that the shipped goods are in perfect condition at the time of delivery. The pumps must be immediately checked for transport damage once the pumps have been received. If damage is noted, the shipper responsible and the pump manufacturer must be informed immediately.

3.3 Interim storage

The following points must be obeyed for storing the pumps:

- Do not store the pumps in wet or damp rooms
- Protective plugs must be left screwed in
- Store temperature see according section 1.3 of this manual

4 Description of the micro annular gear pump

4.1 Operating principle of the micro annular gear pump

Micro annular gear pumps are positive displacement pumps. They contain two rotors, bearing slightly eccentrically to each other; an externally toothed internal rotor and an annular, internally toothed external rotor (see figure 2). Due to their cycloid indenting, the rotors remain interlocked at any time, forming during rotation a system of several sealed pumping chambers. As the rotors revolve around their offset axis, the pumping chambers increase on the induction (suction) side and simultaneously decrease on the delivery side of the pump (see figure 3). A homogenous flow is generated between the kidney-like inlet and outlet.

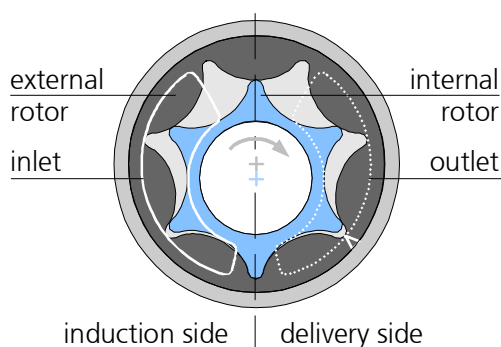


figure 2

Principle of the micro annular gear pump

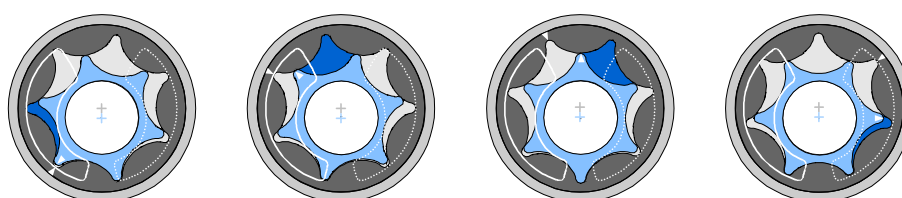


figure 3

Operating principle of the micro annular gear pump

Reciprocating and rotary pumps have a direct allocation to the fed amount of the displacement volume V_g of the pump and its actuator's number of revolutions n . The displacement volume describes the volume, which is theoretically fed with each revolution. The coherence of the flow rate referring to the formula (= volumetric flow rate) Q of the pump is:

$$Q = \eta_{Vol} \cdot V_g \cdot n$$

The volumetric efficiency η_{Vol} shows the relationship between the actual and the theoretical flow rate. The existing differences result from internal movement of the liquid during the operation.

Example: The pump head m zr-11508 has a displacement volume of 192 μl . On the assumption that the volumetric efficiency is 100%, the flow rate at a speed of 3000 RPM would be 576 ml/min, according to the above formula. The table 13 shows theoretical flow rate values depending on speed expressed in ml/min and l/h.

RPM	Q [ml/min]	Q [l/h]
100	19,2	1,15
500	96	5,76
1000	192	11,52
2000	384	23,04
3000	576	34,02
4000	768	46,08
5000	960	57,60
6000	1152	69,12

table 13

Theoretical flow rate of the micro annular gear pump m zr-11508

The pressure, which the pump has to generate, is given by the construction of the fluidic system and the results of the hydrostatic pressure and the hydraulic resistants (given by tubes, contractions etc.).

The viscosity of the pumping medium has an important influence on the volumetric efficiency. The volumetric efficiency increases with higher viscosity according to the smaller disengagement through the gaps of the pump.

Cavitation is an effect, which can result in a specific ceiling speed. The reason for this is the static pressure reaching the steam pressure of the liquid in the inlet port of the pump. In this state an increase of speed does not result in an increased flow rate. The formation of gas prevents a sufficient feeding of the pump. With increasing viscosity of the liquid (e.g. > 10.000 mPas), the ceiling speed is lower.

The specific feature of the m zr-pumps is their highly precise design, as well as the guarantee of high accumulator pressure and high accuracy in flow rate and dosage. Therefore, space width and transverse space width of the rotors as well as the interspace to the adjacent case parts are in the range of just a few micrometers. This precision is the condition to achieve a volumetric efficiency in the range of approx. 100 %.

4.2 Construction

The micro annular gear pump consist of the pump head, coupling assembly, motor and bracket (see figure 4).

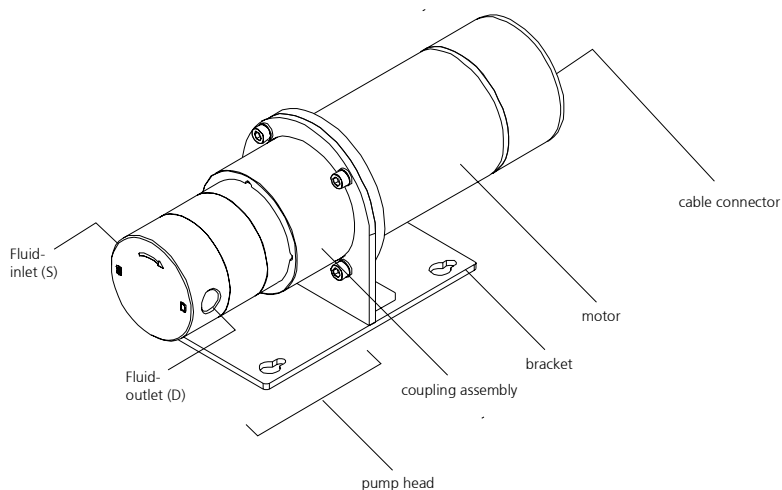


figure 4 Design of the micro annular gear pump

4.3 Construction materials

Components	
Case	stainless steel 1.4435 (316L)
Rotor, shaft, bearing	tungsten carbide Ni-based
Shaft seal	graphite-reinforced PTFE, spring Alloy C276 (2.4819)
Static seals	FPM (fluoroelastomer), optional: EPDM, FFPM

table 14 Materials of the components

The resistance of the construction materials to the delivered liquids should be verified by the operator for each individual application. Pumps handling non-lubricating liquids have shorter service lives.

4.4 Fluidic connectors

The micro annular gear pump head has an inscription on the front side (see figure 5). The liquid inlet connection is marked with the letter »S«, the liquid outlet connection with the letter »D«. An arrow indicates the inherent turning direction of the shaft.

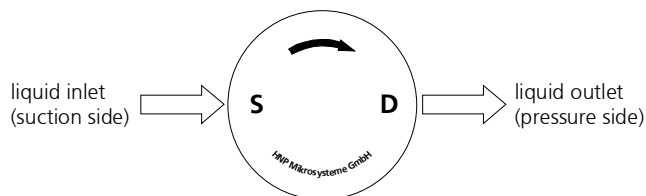


figure 5 Indication of the turning direction and fluidic connections on the front of the micro annular gear pump

The pump head has two inner threads for the connection of tube fittings. The pump head is available either in a version for lateral connections with 3/8" NPT fittings.

Sealing plugs are inserted into the holes for the fluidic connections as protection against contamination during delivery. The sealing plugs have to be removed before assembly of the fluidic connectors. If the fluidic connectors are disassembled, please re-seal the threads with the cleaned sealing plugs as protection against particles.

5 Optional modules

The spectrum of applications of the high performance micro annular gear pump series may be expanded by using different additional modules. The modules allow for special applications, which could otherwise not be accomplished with a standard pump version. The modules may be combined with each other and with almost all available pump heads and motor versions.

- *Fluidic seal module* prevents possible chemical reactions between the delivered liquid and the surrounding environment
- *Thermal insulation module* extends the operating temperature range of the pump by protecting the motor from overheating
- *Heating module* enables to regulate the temperature of the fluid-containing parts of the pump

The configuration of a given pump version should in each case be discussed with consideration to the specific requirements of the application. *Additional* customized modules may be designed on demand.

5.1 Fluidic seal module

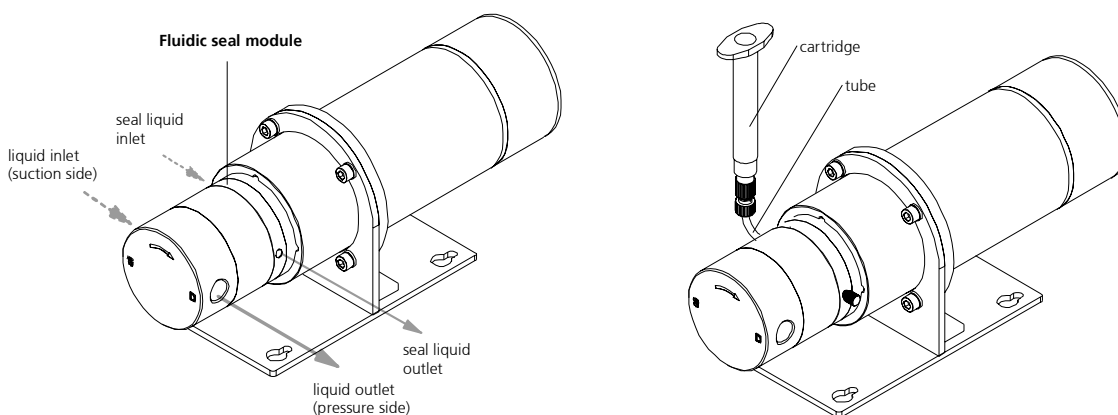


Figure 6 Design of the micro annular gear pump with fluidic seal module

The role of the fluidic seal module is to prevent moisture and oxygen in the surrounding atmosphere from penetrating into the pump. This eliminates the risk of unwanted chemical reaction between the atmospheric gases and the handled liquid (such as for example the crystallization reaction). The module limits at the same time the possibility for the manipulated liquids to escape from the pump.

The function of the fluidic seal module

The shaft sealing employed in the high performance micro annular gear pump is designed in a way that allows for the formation of a boundary layer in which the delivered liquid comes into contact with the surrounding environment. Small amounts of water vapor and oxygen may penetrate through the protective boundary liquid film into the pump. The fluidic seal module enables to control this influx - only a chosen and compatible liquid may come into contact with the delivered liquid. The fluidic seal module prevents also the inverse movement of the liquid - from the pump to the environment - which could otherwise not be excluded.

With the fluidic seal module, a second sealing is added to the existing shaft sealing. A cylindrical chamber with input and output openings displaced by 180° is located between the two seals (see figure 7). When the chamber is filled with an appropriate sealing liquid, the manipulated liquid does not enter into contact with water vapor and oxygen, but dilutes at a small ratio in the sealing liquid. The dilution ratio depends on the existing pressure relations and drops with increasing viscosity.

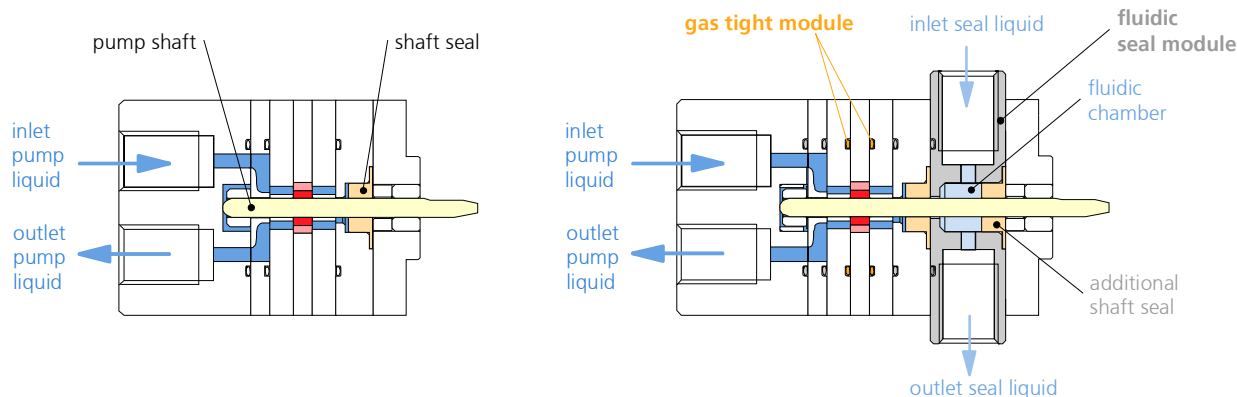


figure 7 Pump head without the fluidic seal module

Pump head with the fluidic seal module

Pump operation with the fluidic seal module

Only liquids compatible with the delivered liquid may be used as sealing liquids. That means no liquids that could possibly react with the delivered liquid should be employed. The composition of the sealing liquid should be determined by the operator.

While filling up the fluidic seal chamber a particular attention should be paid to proper venting of the chamber through the two openings featuring a 1/4 - 28 UNF thread. These openings are slightly shifted downwards and upwards to facilitate the degassing of the sealing chamber (see figure 9). The chamber is filled through the bottom opening. The sealing liquid should be filled in so long, till it flows free of air bubbles out of the top opening. Now the inlet should be screwed down.

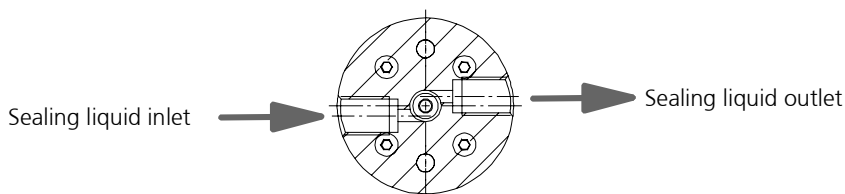


figure 8

Sectional view of the fluidic seal module

A cartridge may be used to supply the sealing liquid to the chamber (see figure 7). In special cases compressed air may be applied to the sealing liquid in order to enhance the sealing function. The sealing chamber may be flushed.



Make sure that enough sealing liquid is supplied to the fluidic seal chamber in order to prevent any penetration of air and water vapor to the module.



If the fluidic seal chamber is empty, the pump should immediately be stopped. Dry operation may lead to shaft seal damage.

In case the pump is not installed in the standard way (pump name read horizontally), it is possible to shift the outlet and inlet openings of the pump. However an appropriate supply of the sealing liquid should still be ensured and all presence of air bubbles within the fluidic seal chamber should be avoided.

Use of the fluidic seal accessories



The fluidic seal set is mounted at the bottom inlet (see figure 8).

During assembly it is important to check if the ferrule is tightly attached to the tube and that the tube is tightly screwed to the inlet of the fluidic chamber.



figure 9

Assembly of the fluidic seal accessories (standard version)

Liquid supply set in stainless steel version (as separate accessory)

Stainless steel liquid supply set is available on request. The use is the same as with the standard version. The liquid supply is done by a glass syringe.

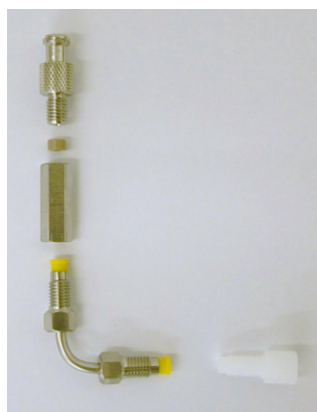


figure 10

Stainless steel set for the fluidic seal module

5.2 Heat insulation module

The heat insulation module enables to deliver hot liquids up to temperatures of 120° C (248 °C). It comprises thermally insulating coupling components made of plastic (PEEK) located between the pump and the drive. The drive should not be exposed to overheating. For this reason the heat transfer from the pump to the drive should be limited. An additional thermal barrier is provided by the plastic motor housing. If the surrounding temperature rises, the pump is working over a longer period or the manipulated liquid features a high temperature, convection cooling of the motor is recommended.

5.3 Heating module

5.3.1 Electric heating module

The electric heating module enables active heating of the pump head up to 120° C (248 °C) operating temperature. The heating module consists of a heating jacket covering the pump head and a thermal element type L. Depending on the pump size, the thermal element will be integrated on the pump head in different ways. In order to adjust the temperature of the pump head, an additional heat regulating device may be delivered.

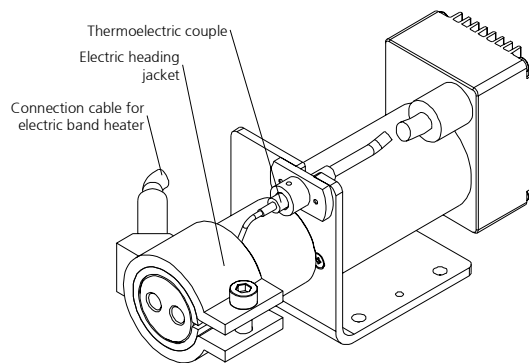


figure 11 Micro annular gear pump mZR-2905 with the electric heating module



Before connecting the heating jacket and the thermal element to the power supply, please observe the following technical data.

Thermal element	
Type	MT-1.5
Thermal element	Type L (Fe-CuNi DIN 43710)
Temperature measuring range	0 to 400 °C
Diameter of the sensing device	1.5 mm
Material	V4A (1.4541)
Heating jacket	
	mZR-11508
Voltage	230 VAC
Power output	400 W
Diameter	70 mm
Width	approx. 60 mm

table 15 Technical data of the electric heating module

5.3.2 Fluidic heating- and cooling module

The fluidic heating and cooling module permits active heating or cooling of the pump head in the operating temperature range from -20 °C (-4 °F) to a maximum of 120 °C (248 °F). The module consists of a double casing covering the pump head and a thermoelectric couple type L, whose mode of integration varies depending on the pump size. Oil, water, superheated steam or adapted cooling liquids may be used as thermal liquids. If you are not sure, which heat transfer liquid is the best adapted in your case, HNP Mikrosysteme will help you find the suitable one. The inlet for the heat transfer liquid is situated at the back (beveled) and the outlet is in the front (see figure 12).

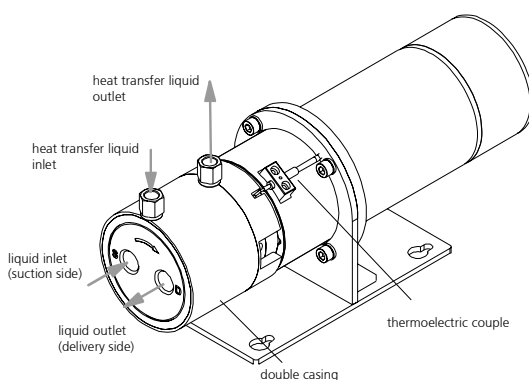


figure 12

Micro annular gear pump with integrated fluidic heating- and cooling module



This heating module is not certified for use in areas exposed to explosion hazards!



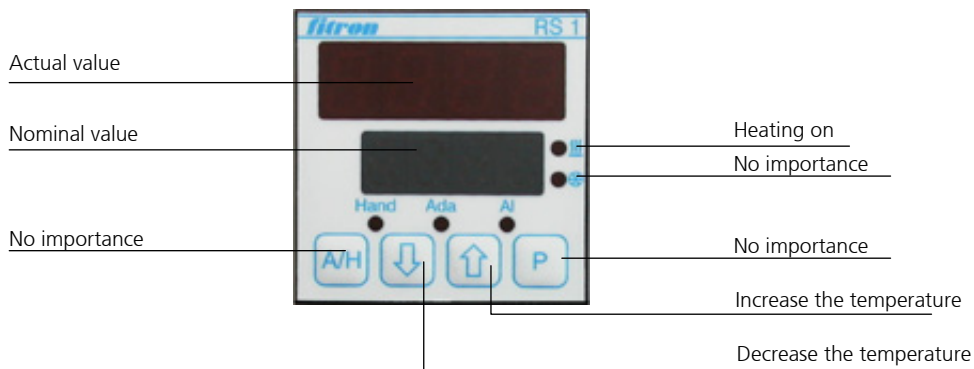
Before connecting the liquid supply, please observe the following technical data! The maximal pressure of the heat transfer liquid should not exceed 10 bar.

Thermal element	
Type	MT-1.5
Thermal element	Type L (Fe-CuNi DIN 43710)
Temperature measuring range	0 to 400 °C
Diameter of the sensing device	1.5 mm
Material	1.4541
Double jacket	
	mzr-11507
Length	82 mm
Diameter	85 mm
Double jacket material	stainless steel 316L
Inlet	2xG1/8"
Operating temperature range	-20 to 120 °C
Max. pressure	max. 10 bar
Flow rate	max. 0.5 l/min

table 16 Technical data of the heating and cooling module

5.4 Heating device „JETmicro“

The heating device „JETmicro“ has been designed for use with the electric heating module (see chapter 5.3.1).



- Hand:** Blinks during temperature set in the manual input mode
- Ada:** Ada display blinks during the automatic control adjustment
- AL:** Alarm display – not configured, no importance

Actual value display:

- OPEN** = sensor failure
- cLL** = sensor reverse polarity
- cHH** = actual temperature value transgressed

With or the nominal temperature may be set.

Power supply

Shock-proof plug, 3 m long, 90-230 VAC

Electrical connection

10-pole bush insert, 16 A/250 V

	Heating		Sensor	
	L	N	+	-
Zone 1	1	6	2	7
Zone 2 (Option)	4	9	5	10

table 17

Pin configuration of the heating device

6 System integration

6.1 Check before installation

Inspect the pumps for potential damage during the shipment (see chapter 3.2).

Please check, if the right pump type has been delivered, as according to the following points:

- Compatibility with the delivered liquid
- Viscosity range
- Pump performance (displacement volume, dosage volumes, operating pressures)
- Operating temperature range



If you notice any difference between the required and the delivered pump type, please contact HNP Mikrosysteme. Do not put the pump into operation without prior approval.

6.2 Mounting of the micro annular gear pump

The micro annular gear pump is mounted on an angle support with M5 screws. The favored mounting position of the micro annular gear pump is horizontal. However, if the pump has to be operated vertically, the motor must be located above the pump head in order to prevent the liquid from entering into the motor.

Warning

Install the pump in such a way that in case of failure no liquid can enter the motor or controller.



Take precautions that in case of leakage no surrounding objects or environment will be damaged.



Install the micro annular gear pump only in places that fulfill the required conditions for safe pump operation.



The motor must be protected against humidity, dust or sweat.

6.3 General instructions for the assembly of the liquid supply network



Please always cut the tubing at a right angle with an adapted hose cutter. If metal tubes are used, an intensive cleansing procedure will be necessary. After machining the tubing has to be cleansed and flushed throughoutly. The smallest piece of swarf within the liquid delivery system may cause failure of the micro annular gear pump.



Please note that correct integration of the tubing with the pump head is a necessary condition to ensure the right direction of flow. If you wish to operate the pump in a reverse direction, please contact HNP Mikrosysteme, since it is not possible in every case.



In order to protect the interior of the pump from pollution, the pump heads are delivered with protective plugs. They should be put on when the pump is at a standstill.



For the best performance the suction tube should be as short as possible and have a large internal diameter.

Warning

In most cases the pump should be operated with a filter featuring pores that do not exceed 10 µm. The filter protects the pump from particles and dirt.

6.4 Assembly instruction for tubing and accessories

Particles or soiling can block or impair the function of the micro annular gear pump.

Warning

Please check that all wetted parts of the fluidic system are clean. Clean these parts in case before mounting the pump.

Please check whether there are swarfs in the screw connections, pollution remaining in reservoirs or soiling in valves, pipe work or filters.

Assembly of the tubing and piping system

1. Please cut the tubing rectangular with a hose cutter. If metal pipes are used an intensive cleaning procedure is necessary. After machining the pipes have to be cleaned and flushed very carefully. Smallest swarfs within the fluidic system can cause failure of the micro annular gear pump.
2. Connect the fittings with the tubing respectively the pipe work according to the attached installation instruction.



Please note that the correct assembly of tubes respectively pipes with the pump head is a necessary condition to secure the right direction of flow. When you want to operate the pump in reverse direction please contact HNP Mikrosysteme since this is not possible in any application.

3. The suction line should be installed ascending to the pump for better degassing. The suction line should be designed as short as possible. The inner diameter of the suction line should be large to guarantee good priming of the liquid. At the planning of the pipe system take care of possibilities for degassing.
4. Operate the micro annular gear pump always with a filter with a pore size of 10 µm or smaller. The filter prevents that particles or solids penetrate into the pump what can cause major damage.
5. Avoid dry running of the pump. Make sure that the liquid flow is not interrupted.

6.5 Filter selection and use

In majority of cases it is recommended to integrate a filter on the suction side of the micro annular gear pump to ensure its secure operation. The

recommended filter pores or mesh size should not exceed 10 µm. The penetration of particles or swarf that could cause a blockage or damage to the pump can only be avoided by using an adapted filter.

HNP Mikrosysteme offers a choice of standard filters covering a broad spectrum of applications. You may count on our assistance for the selection of the most suitable one.

In order to select the best adapted filter, such operating parameters as flow rate, viscosity and degree of pollution of the liquid will be needed. An increase in at least one of the mentioned terms will require the use of a bigger filtering element or the pressurization of the delivered liquid. In case no suitable filter for high viscosity liquid can be found, it is possible to use a filter with slightly larger pore size. Prior discussion with HNP Mikrosysteme is here recommended. A filter with larger pores is still better than no filter at all. Alternatively an already filtered liquid may be used.

Warning

Because filters have a large internal volume, it is recommended to fill in the filter and the suction tube with already filtered liquid in order to avoid dry operation of the pump during the startup.

Warning

Please control regularly the filtering elements for pollution. Cleanse regularly the filter or replace it with a new one. A polluted filter may considerably decrease the volumetric efficiency of a pump. Furthermore, because of the cavitation effects dosage imprecision and even pump damage may occur.

Warning

A too small filter (too little filtering surface) may considerably decrease the volumetric efficiency of the micro annular gear pump. What is more, because of the cavitation effects dosage imprecision and even pump damage may occur.

7 Motion Controller

Without a control unit you cannot start the micro annular gear pump mzr-11508!

7.1 Operation with Controller S-HV

We deliver the micro annular gear pump with the controller S-HV. Over this controller can be control the speed of the motor and the flow rate of the pump.

Electrical parameter of the controller S-HV			
Power supply	U_B	48 (11 – 70)	V
Max. continuous Current	I_{cont}	10 ^{*)}	A
Max. peak Current	I_{max}	20 ^{*)}	A
Velocity Range		50...6000 ^{*)}	rpm
Inputs			
Set value	Input resistor	20	k Ω
	Voltage signal	± 10	V
Encoder signals	Channel	A, B	
	Logic level	TTL	
Enable	Frequency range	max. 100	kHz
	Logic level	low 0...0,5/high 8...30	
Display	Enable	high active	
	2-colour LED	green: Ready, red: Error	
Outputs			
Current monitor „Monitor I“	Output voltage range	± 10	V
	proportional factor	0,5	V/A
	Output resistor	10	k Ω
Speed monitor „monitor n“	Output voltage range	± 10	V
	proportional factor	0,5	V/A
	Output resistor	10	k Ω
Supervision output Ready	Input voltage range	max. 30	V
	current	< 20	mA
Technical Data			
Temperature range	operation	-10 ... +45 °C	
	storage	-10 ... +80 °C	
Humidity range	non condensing	20 ... 80 % rel. hum.	
Dimensions	L x B x H	180 x 100 x 40 mm	

*) Values are different for each pump type

table 18

Technical Data of the controller S-HV

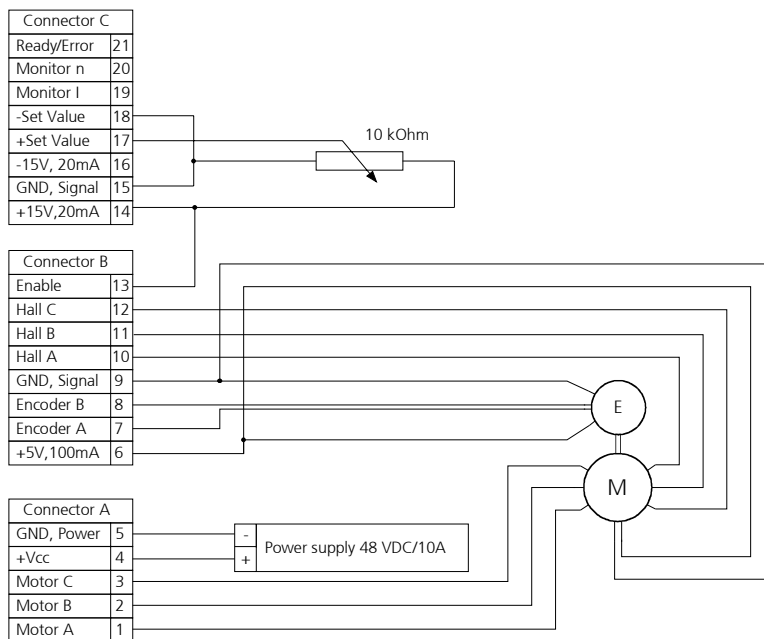


Figure 13 Connection plan with controller S-HV and micro annular gear pump mzs-11508

Initial operation procedure

1. Connect the motor cables with an motor control unit (see Figure 13).
2. Connect the DC- power supply with 48 V to the control unit. Check for correct polarity. False connecting may cause severe malfunction or even destroy the electronic of the motor.
3. Check the adjustment of the internal potentiometer.

potentiometer	function	potentiometer position
P1	Gain course	5 %
P2	Gain fine	0 %
P3	maximum speed at set value of 10 V	100 %
P4	Current limitation	100 %
P5	Offset	50 %

table 19 Internal potentiometer position

4. To avoid in any case dry running of the micro annular gear pump we recommend ensuring steady media supply.
5. Programming the control unit or turn the potentiometer in 0 position that the pump not rotate (0 rpm)
6. Switch on in the DC-power supply and start the micro annular gear pump.

Notice:

By an installation with the control unit SCA-B4-70-10 please read the operating instruction of the control unit! The speed range can change with the jumper on the control unit. The motor of the micro annular gear pump mzs-11508 have 2 pole! You can configure the control unit to control the speed with external potentiometer! You can configure the control unit to control the speed with external potentiometer! The speed range is to be set by jumper J10 and J11. One of four speed ranges is to be set.

Jumper(s)	max. speed
J10 and J11	2500 rpm
J10	5000 rpm
J11	10000 rpm

table 20

Speed range



Skilled personnel may only do *mounting* and *initial operating* of micro annular gear pumps.



Check for correct polarity. False connecting may cause severe malfunction or even destroy the electronic of the motor.



Avoid in any case *dry running* of your *micro annular gear pump* as this may especially damage the seals.

Filling the pump with liquid before you start the pump!

For filling use a syringe!

7.2 Operation with Controller S-HP-M (Option)

We deliver the micro annular gear pump mZR-11508 with the controller S-HP-M. Over this controller can be control the speed and the position of the motor for controlling of the flow rate and the dosage volume of the pump.

Electrical parameter of the controller S-HP-M			
Power supply	U_B	48 (11 – 70)	V
Max. continuous Current	I_{dauer}	10 ^{*)}	mA
Max. peak Current	I_{max}	20 ^{*)}	mA
Velocity Range		1...6000 ^{*)}	rpm
Max. motor power		700	W
Interface RS-232	after RS-232 standard	9600 Baud, 8 Bit, 1 Stop-Bit, RxD, TxD, GND (no handshake signals)	
Interface CAN	after ISO/DIN 11898		
Software	EPOS UserInterface		
Input			
Digital Inputs	programmable	8	
	Voltage signal	9 – 24 (High)	V
	Input resistor	1,8	k Ω
Analog Inputs	programmable	2	
	Voltage signal	0 – 5, 10 bit resolution	V
Encoder signals	Channel	A, /A, B, /B, I, /I	
	Frequency range	max 1	MHz
Hall signals	Channel	A, B, C	
	Signal level	0 – 0,8 (Low) 2,9 – 6 (high)	
Output			
Digital output	programmable	4	
Voltage +5 V Encoder	Voltage	5	V
	Max. Current	100	mA
Voltage +5 V Hall sensors	Voltage	5	V
	Max. Current	30	mA
Voltage +5 V Auxiliary	Voltage	5	V
	Max. Current	$R_i = 1 \text{ k}\Omega$	
Technical Data			
Temperature range	operation	-10 ... +45 °C	
	storage	-40 ... +85 °C	
Humidity range	non condensing	20 ... 80 % rel. hum.	
Dimensions	L x B x H	150 x 93 x 27 mm	
Weight		330 g	

*) Values are different for each pump type

table 21

Technical Data of the controller S-HP-M

The controller enables the easy set-up of micro annular gear pump with the help of the following interfaces:

- Power supply over connector
- Interface RS-232 over connector alternative CAN Bus over separate connector
- Motor connections over separate connector
- Status display over LED.

Warning

When commissioning with the controller S-HP-M note the attached technical descriptions!

Warning

Without a motion controller is the micro annular ring pump not set in operation!



Make sure that the polarity of the supplied direct current is correct, otherwise electronics will be damaged.

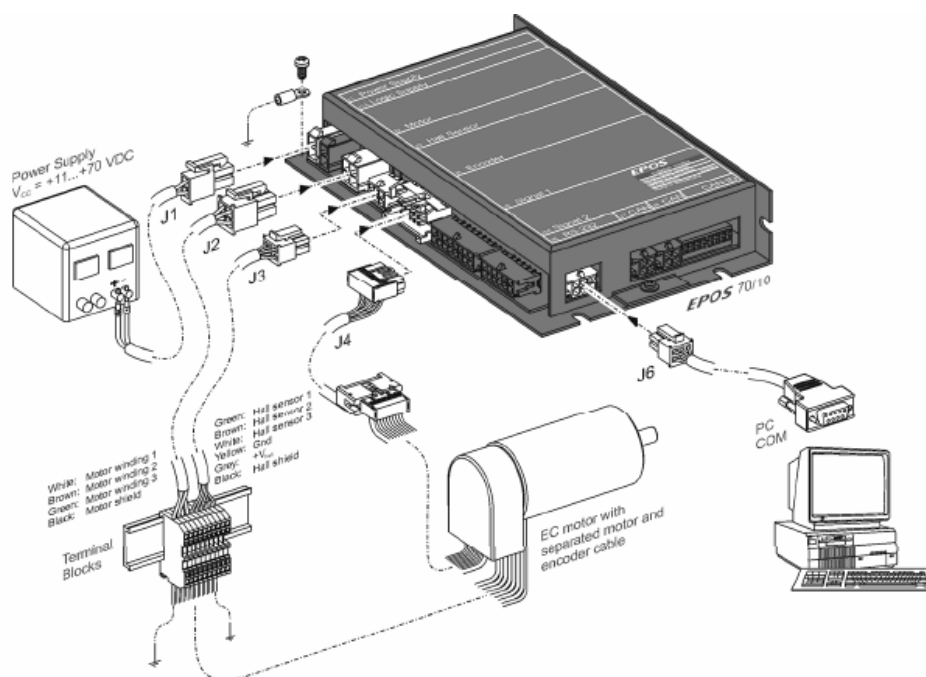


Figure 14

Minimum wiring for controller S-HP-M for micro annular gear mzs-11508

Initial operation

1. Connect the drive with the separate wires to the controller.

Connector J3 S-HP-M	Maxon Hall Sensor Kabel 275878	Cable LIY(C)Y 12x0,14 mm ²	Description	12 poles Connector
5	grey	pink	+5 V	J
4	yellow	blue	GND	B
1	green	brown	Hall sensor A	K
2	brown	grey	Hall sensor B	L
3	white	white	Hall sensor C	M
6	black	n.c.		

table 22

Hall sensor cable

Connector J4 S-HP-M	Maxon Encoder Cable 275934	Twisted wire	Cable LIY(C)Y 12x0,14 mm ² 2	Description	12 poles Connector
1	brown	Pair 1	n.c.		
2	white	Pair 1	red	+5 V	A
3	red	Pair 2	blue	GND	B
4	white	Pair 2	n.c.		
5	orange	Pair 3	purple	Channel B neg.	F
6	white	Pair 3	yellow	Channel B	E
7	yellow	Pair 4	black	Encoder Channel A neg.	D
8	white	Pair 4	green	Encoder Channel A	C
9	green	Pair 5	red/blue	Encoder Channel I neg.	H
10	white	Pair 5	grey/pink	Encoder Channel I	G
			yellow/green	screen	ground

table 23

Encoder cable



The encoder channels A and B are swapped against each other in the controller S-HP-M!

Connector J2 S-HP-M	Maxon Motorcable 275851	Cable LIY(C)Y 3 x 1,5 mm ²	Description	6 poles Connector
1	white	brown	motor phase A	1
2	brown	green	motor phase B	3
3	green	white	motor phase C	5
4	black		Screen	

table 24

Motor supply cable

2. Verbinden Sie den RS-232-Anschluss der Steuerung (Adapterkabel an der Steuerung) mit einer freien seriellen Schnittstelle eines PC. Verwenden Sie hierfür das mitgelieferte Kabel.

Connector	Twisted Wire	Description	Wires
1	Pair 1	EPOS RxD	yellow
2	Pair 2	EPOS TXD	white
3	n.c.		
4	Pair 1	GND	green
5	Pair 2	GND	brown
6		Screen	black

table 25

Connector of the Interface RS-232

3. Provide for a steady liquid supply to the pump in order to avoid dry operation of the device.
4. Connect the power supply of 48 VDC on the connector J1. False connecting may cause severe malfunction or even destroy the electronic of the controller! After switch on of the power supply during the initial phase of the S-HP-M the red LED "power" light on.



The power supply of the controller S-HP-M should amount to 48 VDC, since this supply voltage of the entire speed control range (see chapter 1.3) of the micro annular gear pump.

5. The pump may now be put into operation by using the software »EPOS UserInterface«.

Remarks:

- If there are problems with the initial operation read the attached detailed operating instructions for the controller.

7.3 Operation with Controller S-HP (Option)

We deliver the micro annular gear pump with the controller S-HP. Over this controller can be control the speed and the position of the motor for controlling of the flow rate and the dosage volume of the pump.

Electrical parameter of the controller S-HP			
Power supply	U_B	48 (11 – 70)	V
Max. continuous Current	I_{dauer}	10 ^{*)}	A
Max. peak Current	I_{max}	20 ^{*)}	A
Velocity Range		1...6000 ^{*)}	rpm
Motor inductance (minimum) by (50 kHz)		100	μ H
Communication interfaces	RS-232	9600	Baud
	CAN (CAN-Open)	ISO/DIN 11898	
Digital Inputs	programmable	4	
	Voltage signal	13 - 30	V
	Input resistor	5	k Ω
Digital Inputs	for lim. sv., home position	3	
Digital Outputs	programmable	4	
	current	< 500	mA
Digital Output "ready"		1	
	current	< 500	mA
Auxiliary voltage output I/O		24	V
Auxiliary voltage output for encoders	Voltage signal	5	V
	current	100	mA
Display	Input + Output + Status	4 + 4 + 4	
Operating system	EPOS		
Microprocessor	CPU MC 68332.25 MHz		
RAM	SRAM 2 * 32 kB		
ROM	EPROM 2 * 128 kB		
Technical Data			
Temperature range	operation	0 ... +40	°C
	storage	- 20 ... +85	°C
Humidity range	non condensing	20 ... 80 % rel. hum.	
Dimensions	L x B x H	190 x 100 x 40	mm
Weight		900	g

*) Values are different for each pump type

table 26

Technical Data of the controller S-HP

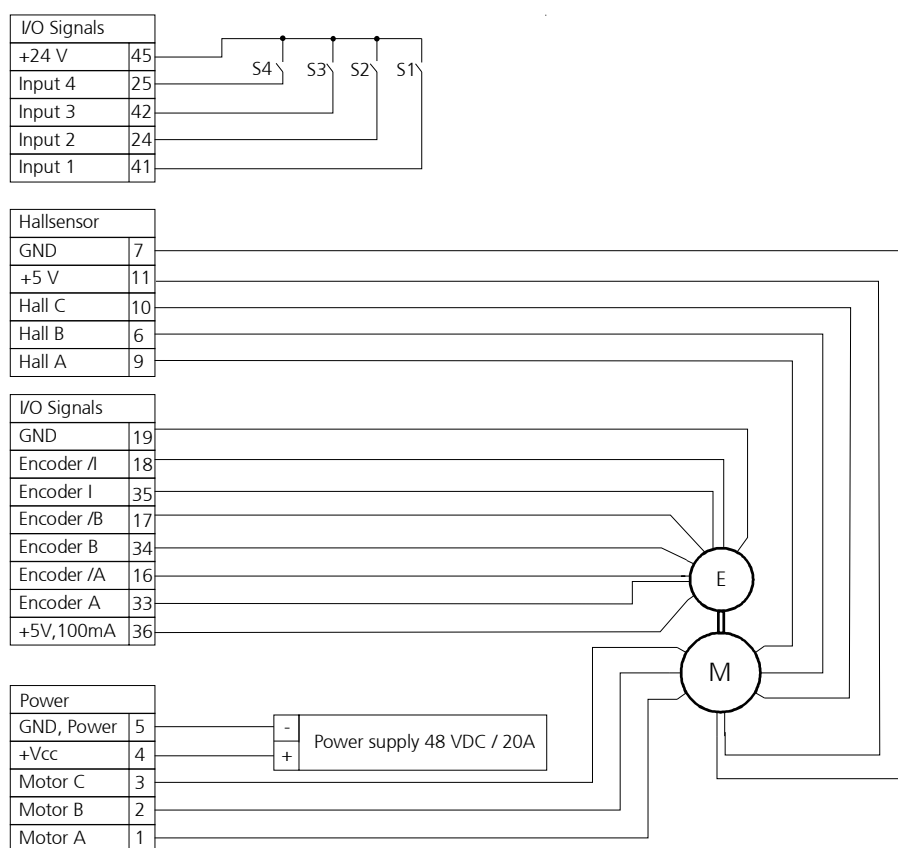


Figure 15

Connection plan with controller S-HP and micro annular gear pump mzs-11508

Initial operation procedure

1. Connect the motor cables with a motor control unit (see Figure 15).
2. Connect the RS232-Connector of the controller with a free serial interface of a PC. Here for use the 9-pin zero-modem cable, included in the delivery volume.
3. Connect the DC- power supply with 48 V to the control unit. Check for correct polarity. False connecting may cause severe malfunction or even destroy the electronic of the motor.
4. To avoid in any case dry running of the micro annular gear pump we recommend ensuring steady media supply.
5. Switch on in the DC-power supply and start the micro annular gear pump.
6. The micro annular gear pump can now be taken into service either by switching the switch S1 or by using the software »EPOS« delivered with (Installation see further down).



The Controller S-HP is programming with the program »continuous_flowrate_11508.m«! If you switch S1 the pump runs with approx. 3000 rpm and a flow rate of approx. 576 ml/min. If this parameter is not the best for the process, please change the parameter in the program!

Notice:



Skilled personnel may only do *mounting* and *initial operating* of micro annular gear pumps.



Check for correct polarity. False connecting may cause severe malfunction or even destroy the electronic of the motor.



Avoid in any case *dry running* of your *micro annular gear pump* as this may especially damage the seals. A short phase of dry running when setting the pump into operation is negligible.

Filling the pump with liquid before you start the pump!

For filling use a syringe!

8 Start Up / Shut Down

8.1 Preparing for operation

After the liquid supply system had been completed, please check once again the operating conditions of the micro annular gear pump as according to the following points:

- Are the inlet and outlet tubes correctly connected?
- Is the entire liquid supply system clean - that means free of particles, foreign bodies, pollution or swarf?
- Has a filter been installed on the suction side?
- Has a sufficient amount of the right liquid been supplied?
- The pump does not run the risk of a dry operation?
- The entire liquid supply system has been checked for leakage?
- Is it possible to stop the pump by an emergency switch if an unexpected malfunction occurs at the startup?

8.2 Startup of the micro annular gear pump

Switch on the voltage supply. The micro annular gear pump can now be put into operation by turning on the potentiometer knob or by sending a nominal external voltage signal.

Start the filling in of the pump at low or middle speed (1000 - 3000 rpm).

Warning

Avoid dry operation of the pump. The pump should be filled in before it is put to operation.

8.3 Flushing procedure after use

After each service the micro annular gear pump should be carefully flushed with a non-corrosive, filtered and particle-free flushing liquid (see table 27 and table 28). During flushing procedure the pump should operate at a speed of about 3000 rpm and if possible against a low pressure (that can be obtained by using a restrictor, a capillary or similar). The flushing liquid must be compatible with the delivered liquid and suitable for solving the remaining liquid rests. Depending on the application for example water, or isopropanol may be used. If you have doubts whether a particular liquid is suitable for this function or not, please ask the manufacturer of the liquid or HNP Mikrosysteme.

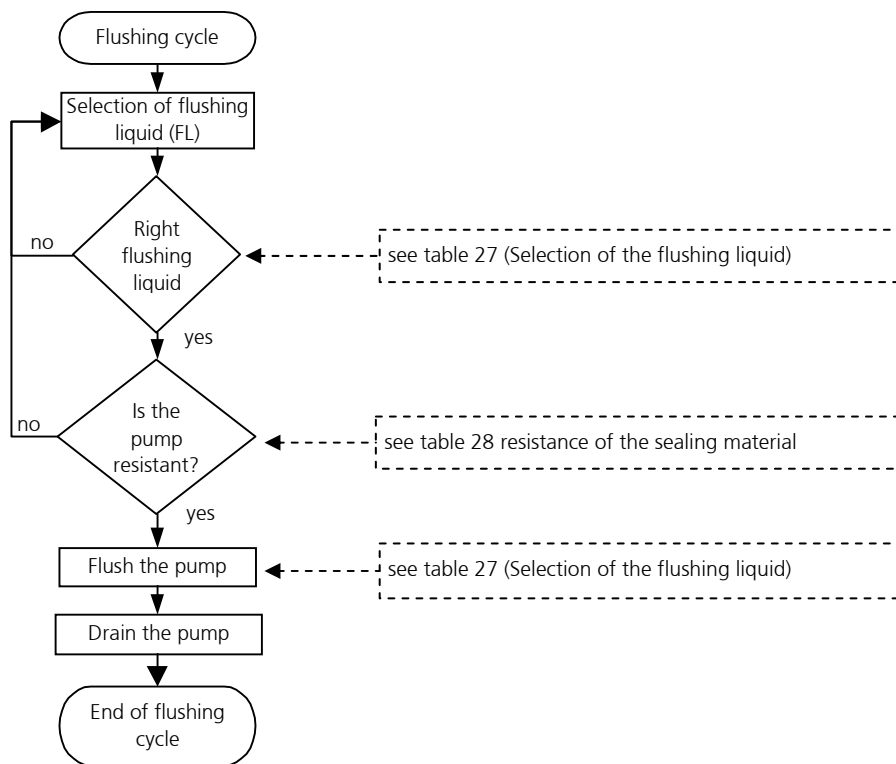


figure 16

Diagram of the flushing procedure

Warning

Liquids that remain in the pump may crystallize, coagulate or lead to corrosion and as a consequence impair the work of the micro annular gear pump.

Warning

Please make sure that the pump components and particularly O-rings and sealing are resistant to the employed flushing liquid. (see table 28).

Warning

The flushing liquid (solvent) and the recommended duration of the flushing procedure depend on the delivered liquid (see table 28). The indicated flushing liquids are simple recommendations and should therefore be checked by the user as to their compatibility and suitability.



Regulations concerning use of substances dangerous to health should be followed!

	Nature of the delivered liquid	Flushing time [min]	Suitable flushing liquid
1	Oils, fats, plastifiers	15-20	isopropanol, ethanol, acetone, benzine/petroleum ether
2	Solvents (polar + nonpolar)	5-10	isopropanol, ethanol
3	Other organic liquids	10-15	isopropanol, ethanol
4	Refrigerating and cooling agents	15-20	isopropanol, ethanol
5	Neutral water/y solutions	20-25	isopropanol, ethanol
6	Basic solutions	25-30	DI-water (deionized water)
7	Organic acids	30-40	isopropanol, ethanol
8	Weak mineral acids	25-30	DI- water
9	Strong mineral acids	35-45	DI- water
10	Strong oxidizing liquids	35-45	DI- water
11	Paints, varnishes, adhesives	50-60	not specified - for further information please contact HNP Mikrosysteme.

table 27 Selection of the flushing liquid (solvent) and the duration of the flushing procedure depending on the delivered liquid.

Warning

Please make sure that the pump components and particularly O-rings and sealing are resistant to the employed flushing liquid (see table 28).

Flushing liquid	Shaft sealing		O-ring material		
	PTFE (Teflon®), graphite- reinforced	UHMWPE	FKM (Viton®)	EPDM	FFKM
acetone	0	0	3	0	0
benzene	0	3	1	3	0
benzyl alcohol	0	-	0	2	0
butanol	0	-	1	0	0
dimethyl sulfoxide (DMSO)	0	0	3	0	0
ethanol	0	0	0	0	0
isopropanol	0	0	0	0	0
methanol	0	0	2	0	0
methylethylketone (MEK)	0	0	3	1	0
styrene	0	-	1	3	1
toluene	0	1	2	3	0
water	0	0	0	0	0
xylene	0	1	2	3	0
benzine/petroleum ether	0	0	0	3	0
oil / fine mechanics oil	0	0	0	3	0

Legend: 0 ... good suitability 1 ... suitability 2 ... conditional suitability 3 ... labile - ... not specified

table 28 Resistance of the sealing materials depending on the flushing liquid (solvent)

8.4 Shutdown of the micro annular gear pump

In order to shut down a mZR-pump the following steps should be followed:

- Flush the pump with a filtered and particle-free flushing liquid (solvent) as described in the chapter 8.3.
- After the flushing procedure decrease speed of the pump to 0 rpm
- Fill the pump with a suitable conservation liquid (see chapter 8.4.1)
- Remove the pump from the system (see chapter 8.4.2)

By proceeding as shown in the diagram (see figure 18) you may prepare the pump for a longer standstill.

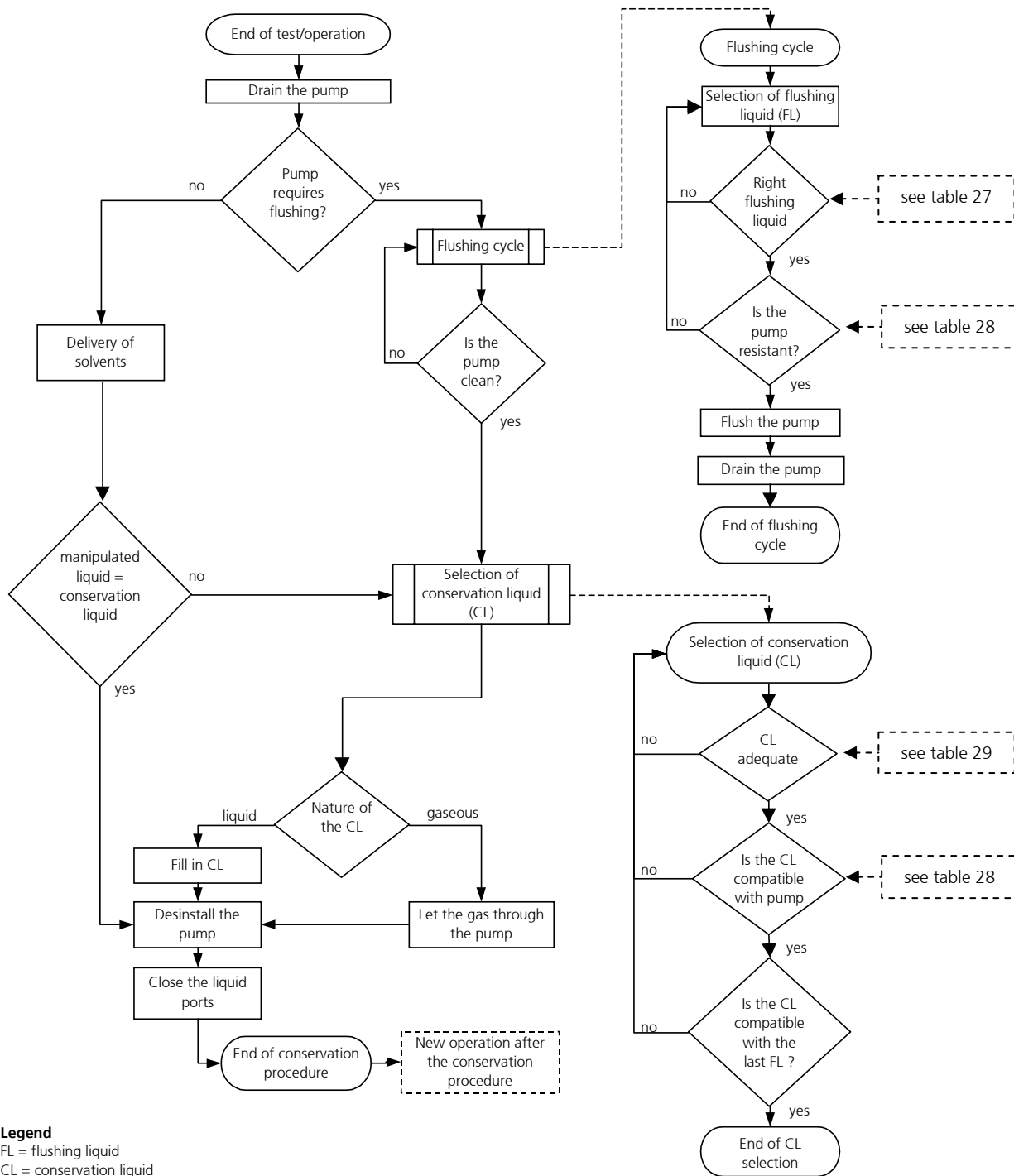


figure 17 Diagram of the shutdown procedure

8.4.1 Conservation

If the micro annular gear pump operates at irregular intervals or for other reasons should be put out of operation for a longer period, it should, after service and flushing procedure (see chapter 8.3), be filled in with a suitable conservation liquid.

The conservation liquid may be selected from the table 29 depending on the duration of the standstill and the resistance of the pump to the manipulated liquid. The indicated conservation liquids are simple recommendations and should therefore be checked by the user as to their compatibility and suitability. The figure 18 presents a diagram of conservation agent selection.

Remark: This diagram is repeated as a part of the figure 17 (shutdown procedure of the micro annular gear pump).

After the cleansing procedure the pump should be filled with a suitable conservation agent. You will find a choice of possible conservation agents in the table 29.

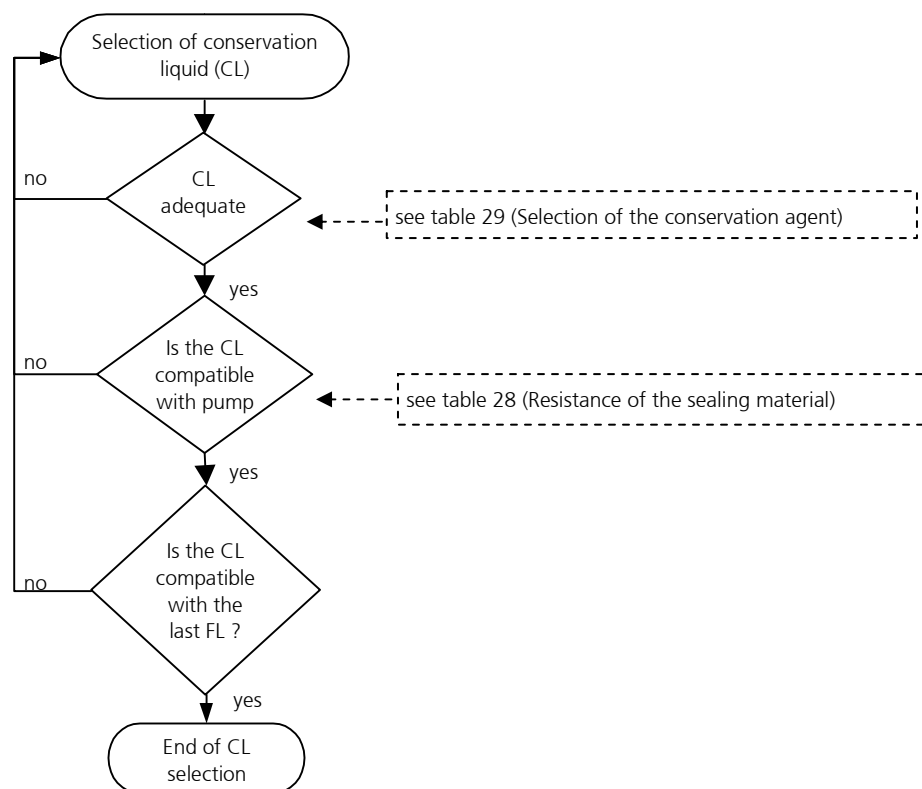


figure 18

Diagram - selection of conservation liquid (CL)

Liquids	Solubility in water	Compatibility with the delivered liquid	Duration of storage	Breakaway torque	Toxicology	Viscosity	Description
isopropanol	+	+	o	o	o	+	solvent for organic compounds, cosmetics, essential oils waxes, and esters, antifreezers, antiseptic agents
acetone	+	+	o	o	o	+	solvent for a number of organic compounds, unlimited solubility in water, dissolves natural and synthetic resins, fats, oils and commonly used plastifiers
ethanol	+	+	o	o	o	+	solvent for organic compounds, fats, oils and resins
DI-water	+	+	-	-	+	+	solvent for many organic and mineral liquids
fine mechanics oil	-	-	+	+	+	+	cleansing and protective action (dissolves fats, tar, rubber or adhesive substances, protects against corrosion).
hydraulic oil	-	-	+	+	+	-	lubricating and preserving properties (<i>Warning</i> : may resinate or deteriorate with time)
nitrogen	-	+	+	+	o	+	is not a solvent, may leave deposits after drying out
air / compressed air		+	+	+	+	+	is not a solvent, may leave deposits after drying out

Legend: + ... good/suitable o ... satisfactory; - ... bad/inadequate

table 29

Selection of the conservation agent

In order to prevent dust particles and foreign bodies from penetrating into the pump or the conservation agent from leaking out, please secure the liquid input and output openings with the delivered protective plugs or screws.

Warning

Water or DI-water should not be used as conservative liquids. They germinate already after a few days and build a biofilm which can later block the pump.

8.4.2 Dismantling of the system

- Put the drive out of operation by turning down speed to 0 rpm and by switching off the voltage supply. Make sure that the procedure described in the chapter 8.3 has been completed.
- Now that the pump has been stopped you may remove it from the system.
- Protect the inlet and outlet openings of the pump with adapted protective plugs or screws.

8.5 Problem shooting

If the pump stops operating abruptly or has difficulties with starting operation, please undertake the following steps:

Try to liberate the micro annular gear pump:

- by turning the potentiometer knob back and forth or by connecting an analog voltage
- via the control software
- by pressing with a syringe a suitable flushing liquid (see table 27 and table 28) through the micro annular gear pump
- by changing the operating direction of the pump.

If these measures turn out to be ineffective, please contact the service staff of HNP Mikrosysteme (see chapter 16) and send the pump back to the manufacturer for inspection.

Warning

You should under no condition try to disassemble the pump by yourself. This may cause damage to the pump components and consequently annul your warranty claims.

8.6 Return of the micro annular gear pump to the manufacturer

For the return of a micro annular gear pump and components that have already been employed, please follow the instructions:

- drain any remaining rests of the delivered liquid from the pump
- flush the pump with an adapted solvent
- remove the filter elements from integrated or loosely delivered filters
- protect all openings against dust with the delivered protective plugs or screws
- return the pump in its original packing

The service personnel which carries out the repair should be informed about the condition of the already used micro annular gear pump. This is done by means of the "Declaration of media in contact with the micro annular gear pump and its components" (see chapter 15). This form may also be downloaded from the web site www.hnp-mikrosysteme.de/download.



The "Declaration of liquids in contact with the micro annular gear pump and its components" must imperatively be filled in. The nature of liquid which entered into contact with the micro annular gear pump and its components must be specified.

In case of non-compliance, the sender will be liable for any resulting injure to persons or any object damage.

9 Software » EPOS UserInterface«

The » EPOS UserInterface « software enables operation and configuration of the drive and offers a possibility of an online graphic analysis of the operating data. The program may be installed on a PC running under Windows 95®, Windows 98®, Windows NT®, Windows 2000® or Windows XP® operating systems.

Install the software » EPOS UserInterface « by starting the program »EPOS_CD-ROM« on the CD.

After the installation the » EPOS UserInterface « program may be loaded from the Windows start menu.

In order to program the drive the micro annular gear pump should be put into operation. The drive and the PC should be connected with the delivered "RS232-COM cable".

All chapters are described in the documentation of the control manufacturer in great detail.

9.1 Startup Wizard for mZR-11508

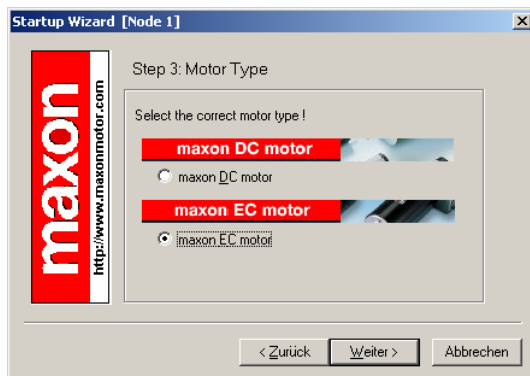


figure 19

Startup wizard dialog for setting RS232 communication

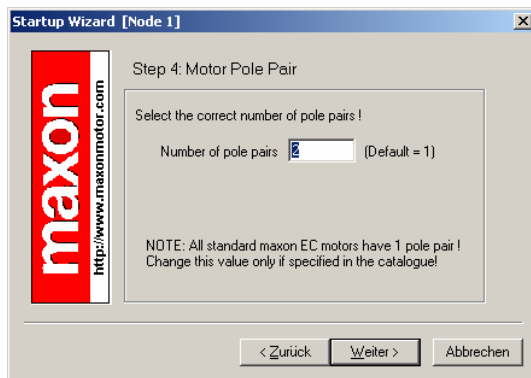


figure 20 Startup wizard dialog for choosing motor type

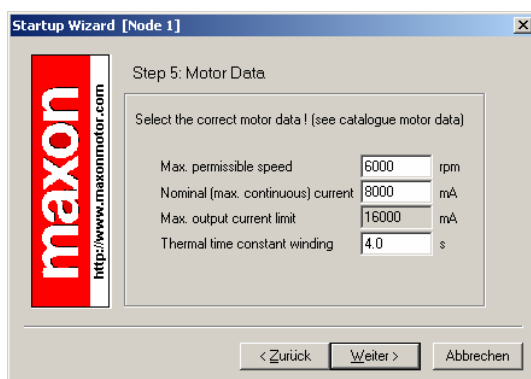


figure 21 Startup wizard dialog for choosing motor data

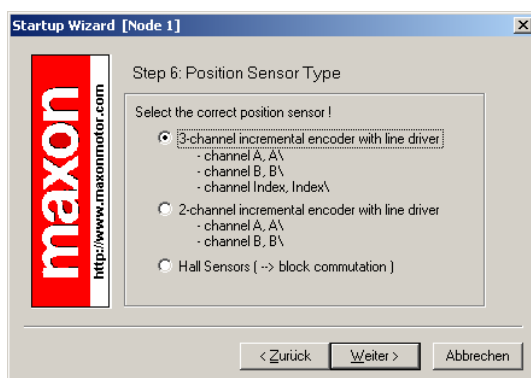


figure 22 Startup wizard dialog for choosing encoder type

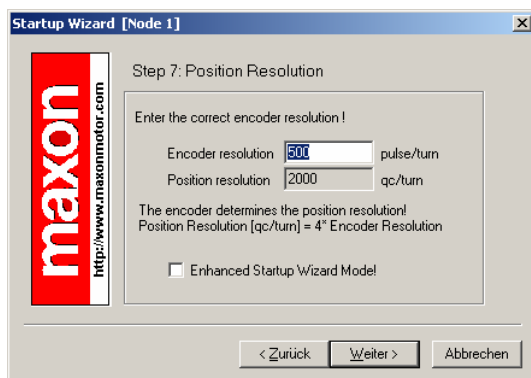


figure 23 Startup wizard dialog for choosing the encoder resolution

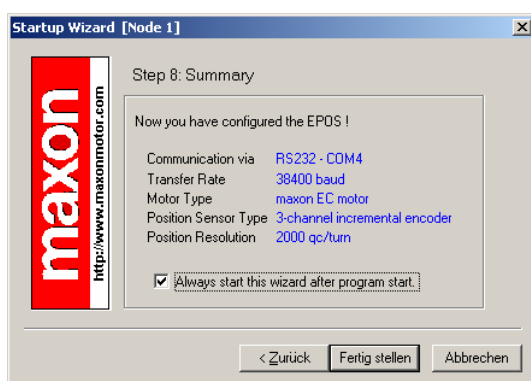


figure 24 Summary of the configuration

9.2 Adjustment the control parameters

The control parameters of the controller must be set for operating the micro annular gear pump. If this control settings restless running of the motor should be established on a further *Regulation Tuning* optimization controls are implemented.

The regulator setting can easily realize the following windows.

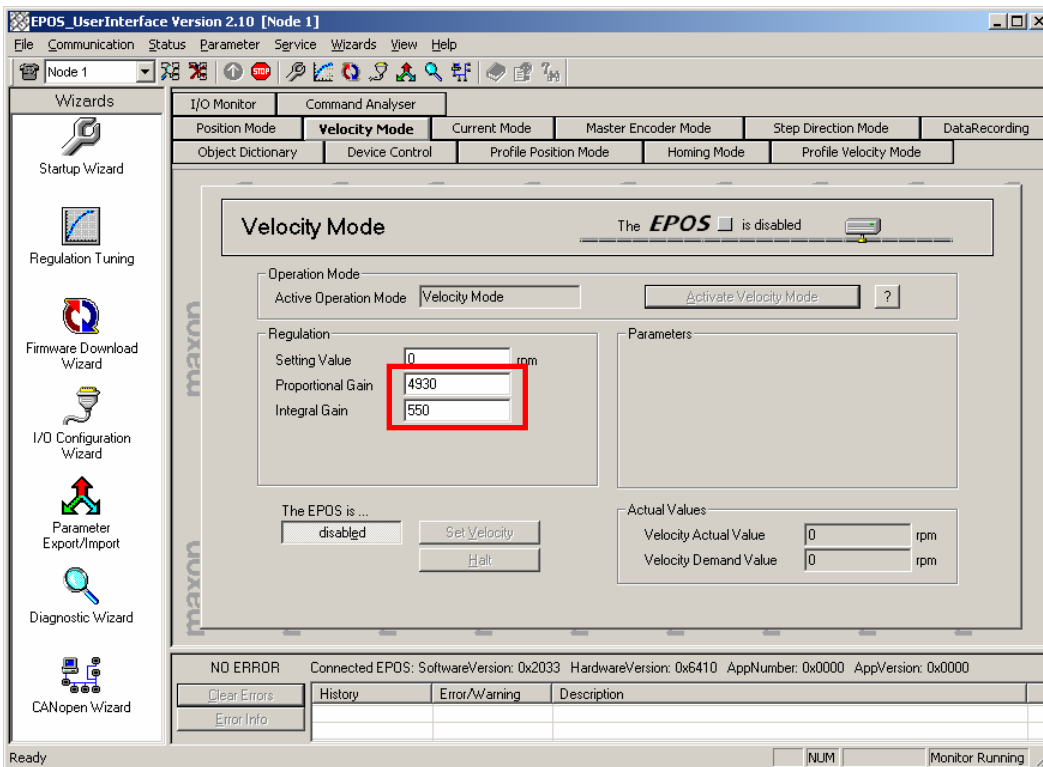


figure 25 Adjustment of regulations for velocity mode

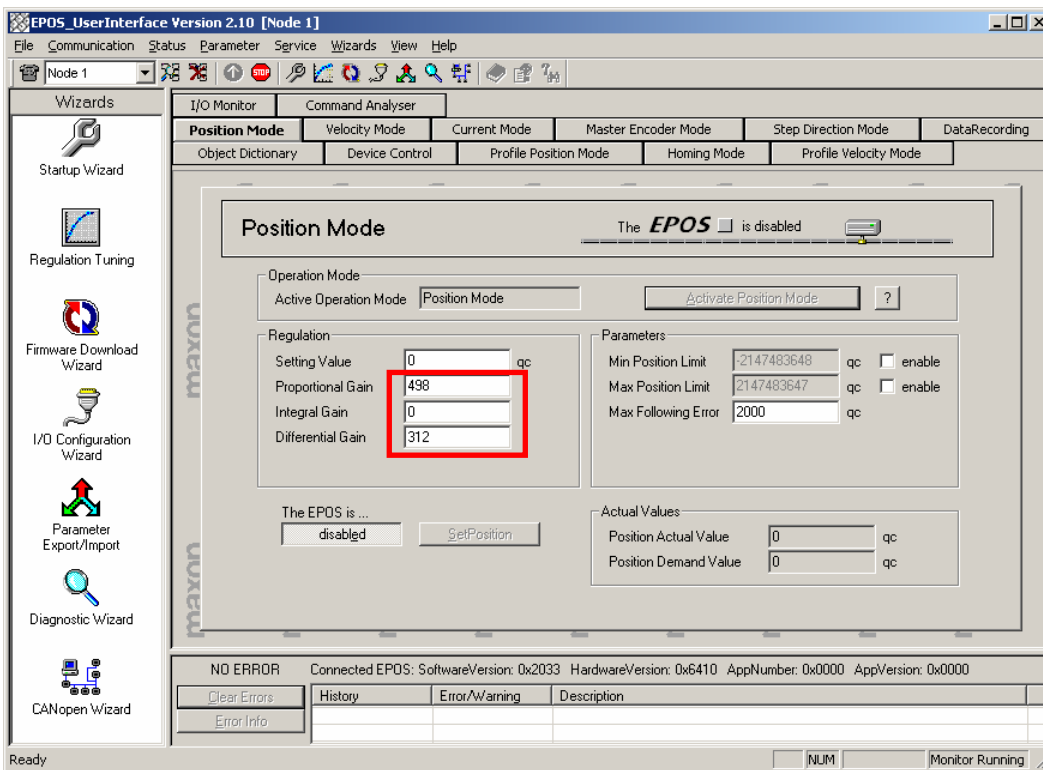


figure 26 Adjustment of regulations for position mode

After setting the parameters should control all the parameters of *Parameter/Save all Parameter* are save.

9.3 Direct drive control

In *Velocity Mode* is the motor speed of the pump set.

An example for continuous delivery

Setting Value	Description
1000	Operate the pump at 1000 rpm (Flow rate: mzs-11508 = 192°ml/min)
3000	Operate the pump at 3000 rpm (Flow rate: mzs-11508 = 576°ml/min)
0	Pump at rest (speed 0 rpm)

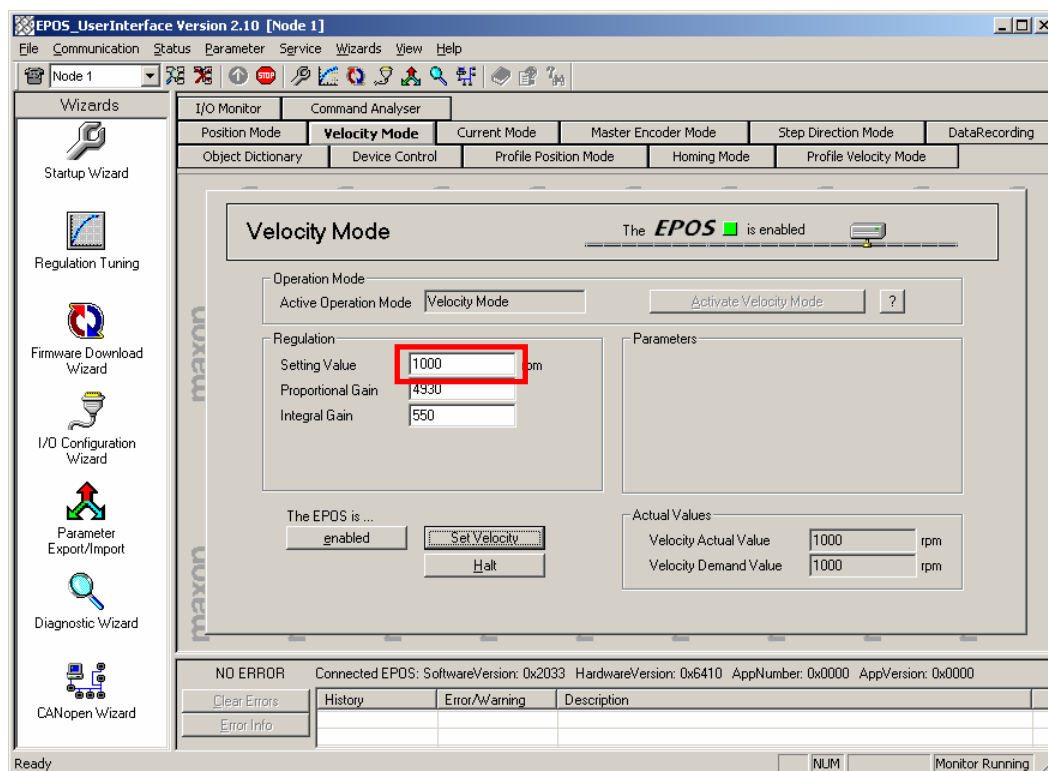


figure 27 Surface for velocity mode

9.4 LED Status

The green LED shows the operating status and the red LED indicates an error of the positioning controller S-HP-M. Detailed information may be found in the Firmware Specification document.

Disturbance	Cause	Solution
LED not shine	power supply does not works	Check the wires on fixed seat, review of the power supply voltage measuring device on basic function
LED lights rot	controller error	Review error of the controller with the help of software
Controller not answer	wrong interface	Check that the right on the PC interface is used or controller notify the right interface
	wrong cable position	Check cable position
Motor whistling, buzzing or oscillates	Control parameters are not optimally set	Check the control parameters (see „regulation tuning“ in the separate manual of the controller)

table 30 Excerpt of errors controller S-HP-M



If a disturbance that has not been mentioned in the above list, or that makes the use of the micro annular gear pump unsafe appears, please stop the operation of the pump without delay and contact the manufacturer.

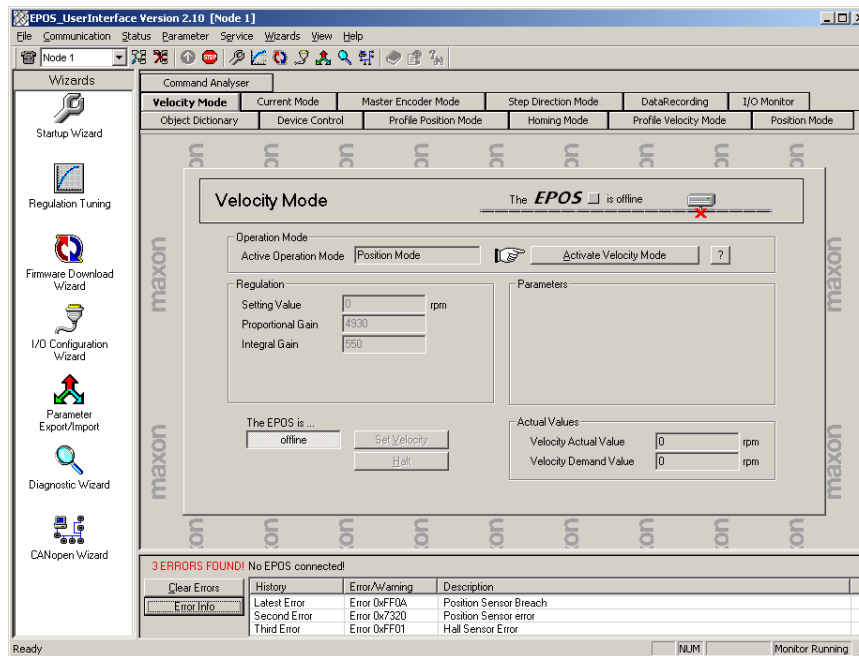


figure 28 Error messages of not connected micro annular gear pump

10 Software »EPOS« (Option)

For Windows® user we provide the E-Motion software EPOS 6.51 (see figure 29), a fully functional configurations and operations manager with online graphic performance analysis.

Install the software » EPOS « of CD, included in the delivery volume.

Installation of EPOS

1. Insert EPOS Installations CD
2. Select Windows » START -> run «
3. Enter " D:\Einstall " (D: drive unit stands for the CD-ROM) and activate the installation with OK. Alternatively search the drive unit or directory that contains the installation file "Einstall.exe".
4. Follow the installation statements on the screen until the installation end is indicated.
5. This CD contains in addition a full illustrated installation statement in the PDF- format / Win200_Install_eng.PDF. At the finished installation of EPOS still a few simple operating system adaptations are necessary.

```

Epos - [Dosierung.m [Controller: #01]]
File Edit Development Controller Iestrun Cam-Editor Settings Windows Help
// Datei: Dosierung.m
// Beschreibung: Initialisierung mcl-Datei für mzz-7208
// Dosierung über eine programmierte Anzahl von Umdrehungen
// Start der Dosierung über Schalter an Input1
// Hardware: Steuerung PCA-SY-70-10, Motor 4490K036 B1000/3,
// Schalter an Input1 und +24V
// Stand: 11.11.2002
// Autor: Mathias Steinhäuser
// Copyright © 2002, HNP Mikrosysteme GmbH, Parchin
// HNP Mikrosysteme GmbH, Juri-Gagarin-Ring 4, 19370 Parchin
// Telefon +49 (0) 3871/451-301, Telefax +49 (0) 3871/451-333
// Email info@hnp-mikrosysteme.de, http://www.hnp-mikrosysteme.de
// Parameter
//-----
//-----
Compiling ... ok
Connecting to controller ... connected to "<<<<<<>>>>" [#1, V6.2, 1-S]
[01] Position: 0
[01] Position: 0
[01] Position: 0
[01] Position: 0
[01] Position: 0
[01] Position: 0
For help press F1
NUM

```

figure 29

Software EPOS for motor control

To use the EPOS-Software please read the Online-Help and the manual on CD. For stand-alone use without a PC the delivery volume contains a disk with

m-files, which could be downloaded to the control unit and saved permanently to the EEPROM.

11 Problems and their removal

Error	Possible cause of error	Action
1 No function	No power supply	Check all power switches
2 Pump does not dose	No dosage liquid in the tank	Fill the liquid tank
	Motor error	Check motor Status of the pump with the software Motion Manager
	Dosage needle blocked	Check and clean the dosage needle
	Back-pressure valve does not work	Check the back-pressure valve
	No signal for start dosage	Check the start signal of the central control unit (PLC)
	Pump error	Replace pump and send the pump to the manufacturer
3 Pump does not prime during bringing the dosage system into service	Pump does not suck	Check of the installation
	-"-	Check air pressure on tank
	-"-	Back-pressure valve does not open, Check the back-pressure valve!
	-"-	Air bubbles in fluid system (tubings, valves)
	Tubings leak	Change the tubings
4 Motor works but pump does not pump	No liquid in pump	Prime the pump
	Air bubbles in fluid system (tubings, valves)	Prime the pump and the fluid system
	Valve not open	Flush the valve
	Dosage needle blocked	Clean, flush or change the dosage needle
	Coupling of the connection motor –pump is loose	Replace pump and send the pump to the manufacturer
	Pump shaft is broken	Replace pump and send the pump to the manufacturer
5 Pump does not pump but is filled with liquid	Particle in dosage liquid or pump blocked	Check Status of the pump with the software Motion Manager Try to get free the pump with negative prime speed (-500 rpm) for only 1 s
	-"-	Don't change the parameter of the motor with command »FCONFIG«, »LPC«, »LCC«!
	-"-	Flush the pump with the syringe
	Back-pressure valve not open	Flush the valve
	Dosage needle blockade	Clean or flush the needle
	Air bubbles in fluid system (tubings, valves)	Fill/Prime the pump and the fluid system
	6 Dosage volume does not correspond with the datasheet or calculation	Air bubbles in fluid system and pump
Filter dirty		Change the filter
Back-pressure valve not open		Flush the back-pressure valve
7 Liquid leaks out of the dosage needle (dosage needle drops)	Back-pressure valve not closed	Flush the back-pressure valve
	Pressure at process liquid tank	Disconnect the pressure connection of the process liquid tank
8 Liquid leaks out of the sealing liquid needle	Pressure at sealing liquid tank	Disconnect the pressure connection of the sealing liquid tank
9 Dosage volume reduces over the time	Filter dirty	Change the filter
	Dirt or deposition in the pump	Flush the pump or send the pump to the manufacturer for cleaning
10 Leak at the pump body	Seal out of order	Send the pump to inspection to the

Error	Possible cause of error	Action
		manufacturer
11 Leak of the fluid connections	Flangeless ferrules leak	Change the flangeless ferrules
12 Status of the pump cannot be checked or calibrated	No contact/connection to the pump	Check the power supply of the pump
	-"-	Check the connection of the zero modem cable between PC and dosage system or try to use a new cable
	Motor control out of order	Switch the power supply for a short time OFF and then ON to start the motor control again
13 Over temperature	Pump surface dirty	Clean the pump surface
	Pump works heavy	Flush the pump
14 Over current	Pump works heavy	Dosage needle damage, replace the needle
	-"-	Dosage needle blockade, clean or flush the needle
	Back-pressure valve not open	Flush the back-pressure valve
	Particle in dosage liquid	Flush the pump
15 Under voltage	Supply voltage < 12 VDC	Check the power supply voltage
16 Over voltage	Supply voltage > 28 VDC	Check the power supply voltage

table 31

Trouble shooting guide

If unknown faults appear or an uncertainty arises from appearing faults in the working with the pump, immediately shut down the micro annular gear pump at first!

12 Accessories for microfluidic systems

The accessory range for the liquid delivery systems of HNP Mikrosysteme comprises complementary equipment such as hoses, tubes, fluid fittings, filters and non-return valves that are best adapted to your micro annular gear pump. We will eagerly share our long date experience as far as component selection is concerned.

13 Non-liability clause

HNP Mikrosysteme GmbH shall not be liable any damage resulting form the non-respect of instructions comprised in this operating manual.

It belongs to the user to check the integrity, the correct choice and the suitability of the product for the intended use.

It remains at the responsibility of the user to conform to all laws, rules and regulations in force. This applies above all to the treatment of aggressive, poisonous, corrosive and other dangerous liquids.

14 Service and maintenance

For service and maintenance, you have the possibility to send your micro annular gear pump to HNP Mikrosysteme (the address is found on the cover of this manual). In measures of the service package, seals and other parts subject to wear are exchanged.

15 Service, maintenance and warranty.

The maintenance of the micro annular gear pump should be carried out depending on the delivered liquid

- *for lubricating liquids* after 12,000 h working hours, but not later than 24 months after the initial operation
- *for non-lubricating liquids, crystallizing liquids or liquids containing particles,* after 5000 h working hours but not later than 12 months after the initial operation. If during the first inspection no substantial wearout of the pump is observed, the following inspection under the same working conditions should be performed after 8000 h working hours, yet not later than 15 months following to the last inspection.

If during the first inspection the pump shows a particularly strong wearout, the maintenance intervals should be readapted to the operating parameters.

In order to prevent a strong wearout of the pump, the pump should be shut down properly after every application as described in the chapter 8.4. A supplementary flushing procedure with a neutral flushing liquid (see chapter 8.3) also slows down the wearout process of the pump.



It is not allowed to open the micro annular gear pumps. The warranty extincts with the expiry of the legal warranty period or with the opening of the pump. Furthermore HNP Mikrosysteme cannot give any warranty of exchange for parts whose damage result from incorrect use.



For service and maintenance please return your micro annular gear pump to HNP Mikrosysteme (You will find the address on the cover of the present operating manual).



The declaration of liquids having had contact with the micro annular gear pump and components must imperatively be completed. The nature of the liquids must be specified. In case of non-compliance the sender will be liable for any resulting injure to persons or any object damage.



Sealings, rotors and shaft are parts that undergo wear and will be replaced by HNP Mikrosysteme GmbH during maintenance depending on their degree of wear.

16 Contact persons

Development and application assistance , service and accessories

Mr. Sven Reimann
Phone +49| (0) 3871|451-349

Service and maintenance

Mr. Steffen Edler
Phone +49| (0) 3871|451-307

Drive and control technology

Mr. Lutz Nowotka
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17 Legal information

Marks

Teflon® is a registered trademark of DuPont.

Viton® is a registered trademark of DuPont Dow Elastomers.

Microsoft®, Windows® are registered trademarks of Microsoft Corporation in the USA and in the other countries.

mzr® is a registered trademark of HNP Mikrosysteme GmbH.

Other product names or descriptions not mentioned above are possibly registered trademarks of related companies.

Patents

Micro annular gear pumps (and housings) are protected by assigned patents: DE 198 43 161 C2, EP 1115979 B1, US 6,520,757 B1, EP 852674 B1, US 6,179,596 B1, EP 1354135. Patents pending: DE 101 46 793, US 10,466,792, DE 10 2004 052 866. In the US, Europe and Japan additional patents are pending.

18 Safety information for the return of already employed micro annular gear pumps and components

18.1 General information

The operator carries the responsibility for health and safety of his/her employees. The responsibility extends also to employees not belonging to the company that have a direct contact with the micro annular gear pump and its components during repair or maintenance works. The nature of media (liquids) coming into contact with the micro annular gear pump and its components must be specified in the corresponding declaration form.

18.2 Declaration of liquids in contact with the micro annular gear pump

The staff performing the repair or maintenance works must be informed about the condition of the micro annular gear pump before starting any work on the device. The »Declaration of media in contact with the micro annular gear pump« should be filled in for this purpose.

The declaration should be sent directly to the supplier or to the company designated by the supplier. A second copy of the declaration must be attached to the shipment documents.

18.3 Shipment

The following instructions should be observed for the shipment of the micro annular gear pump.

- drain any remaining liquid from the pump
- flush the pump with an adapted flushing liquid
- remove the filter elements from the integrated or loosely delivered filters
- all the openings should be air-tight plugged
- return the pump in the original packing

19 Declaration of media in contact with the micro annular gear pump and its components

Type of the device

Pump type/serial number/article:

Operating hours/running time:

Bill of delivery-number and delivery date:

Reason of the return:

.....
.....

Contact with media (liquids)

The micro annular gear pump has entered into contact with:

.....
and has been cleansed with:

.....
The safety specification of the liquid has been attached (Yes / No):

or is available on the following web site: www.....

If a pump which had contact with dangerous substances could not be properly cleansed prior to the shipment, we reserve the right to entrust a specialized company with the cleansing of the device. The return of the pump in the original packing is purposive. This measure is necessary in order to protect the employees and the delivery staff.

Nature of the delivered liquid:

- | | | |
|---|--|--|
| <input type="checkbox"/> explosive | <input type="checkbox"/> oxidizing | <input type="checkbox"/> susceptible to moisture |
| <input type="checkbox"/> toxic (toxic byproducts) | <input type="checkbox"/> radioactive | <input type="checkbox"/> pH-value:
..... |
| <input type="checkbox"/> carcinogenic | <input type="checkbox"/> microbiological | <input type="checkbox"/> other:
..... |
| <input type="checkbox"/> caustic | <input type="checkbox"/> corrosive | |

Declaration

I/we certify herewith that the stated information is exhaustive and correct. The micro annular gear pump and corresponding liquid supply components are shipped in conformity with the applicable regulations.

Company/Institute:

Street: Zip code, location:

Telephone: Fax:

Contact person (in printed characters):

Date: Company stamp:

Obligatory signature:

20 Supplement

- Drawings
- Manual of the motion controller S-HV
- Manual of the motion controller S-HP-M (optional)
- Manual of the motion controller S-HP (optional)

