HNP Mikrosysteme

Operating manual for micro annular gear pump
mzr-7208, mzr-7208X1

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Impressum

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This manual has been prepared with care. HNP Mikrosysteme does assume no liability for any errors in this manual and resulting consequences. Likewise, no liability is assumed direct or subsequent damages arising from an incorrect use of the devices.

While using micro annular gear pumps, the relevant standards regarding the specifications of this manual have to be followed.

Subject to change without notice.

Contents

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 pumps described in this manual are suitable for continuous delivery and discrete dosage of water, watery solutions, solvents, methanol, oils, lubricating liquids, paints and varnishes as well as many other liquids.

If you intend to treat any aggressive, poisonous, or radioactive liquids, you must conform to safety measures as according to the regulations in force. Any project concerning handling of corrosive liquids should be previously discussed with the pump manufacturer.

The micro annular gear pumps *must not* be used for invasive medical applications, in which the liquid having had contact with the pump is re-introduced to the body.

Micro annular gear pumps exclusively are provided for use in the industrial area. A private use is excluded.

The micro annular gear pumps *must not* be used in aircrafts and spacecrafts or other vehicles without prior consent of the manufacturer.

Data concerning resistance of the pumps to the manipulated liquids have been elaborated according to the best of HNPM's knowledge. However, operating parameters varying from one application case to another, no warranty for this information can be given.

Information given in this manual does not release the customer from the personal obligation to check the integrity, correct choice and suitability of the pump for the intended use. The use of the micro annular gear pumps should be conform with technical norms and regulations in force.

If you wish to receive more information than comprised in this operating manual please contact directly HNP Mikrosysteme.

1.2 Pump Model Designation

This manual is valid for the micro annular gear pump mzr-7208, manufactured after 2001 by HNP Mikrosysteme GmbH, Bleicherufer 25, 19053 Schwerin, Germany.

The date of release of the present manual figures on the cover.

1.3 Technical data of the micro annular gear pump

The following table shows the technical data of the micro annular gear pump head mzr-7208.

Constructive Specifications	
Displacement volume	48 µl
Measurements (L x W x H)	205 x 60 x 80 mm
Weight	approx. 1.5 kg
Internal volume	525 µl
Material case	stainless steel 1.4435 (316L)
Material rotor	tungsten carbide Ni-based
Material bearing	tungsten carbide Ni-based
Shaft seal	graphite reinforced Teflon®, 316L
Static seals	FPM (Viton®), optional: EPDM, FFPM
Fluid connections	1/8" NPT or M10x1 internal thread, lateral
Technical data	
Flow rate	4.8 ... 288 ml/min (= 17.2 l/h)
Smallest dosage volume	5 µl
Operating pressure range	0 – 30 bar (Viskosity 1 mPas) 0 – 120 bar mzr-7208X1 (Viskosity 16 mPas) 0 – 150 bar mzr-7208 (Viskosity 16 mPas)
Max. inlet pressure	10 bar
Viscosity range	0,3 – 50.000 mPas
Precision	< 1 %
Pulsation	6 % (theoretical)
Liquid temperature	-5 … +60 °C (150 °C*)
Ambient temperature	-5 … +60 °C
Store temperature range	-5 … +40 °C

caption: * Differing specifications on request

table 1 Technical data of the micro annular gear pump head mzr-7208

Warning The material properties of a liquid (e.g. viscosity, lubricating property, particle content, corrosiveness) impacts the technical data and the lifetime of pumps. Under 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 and flow charts

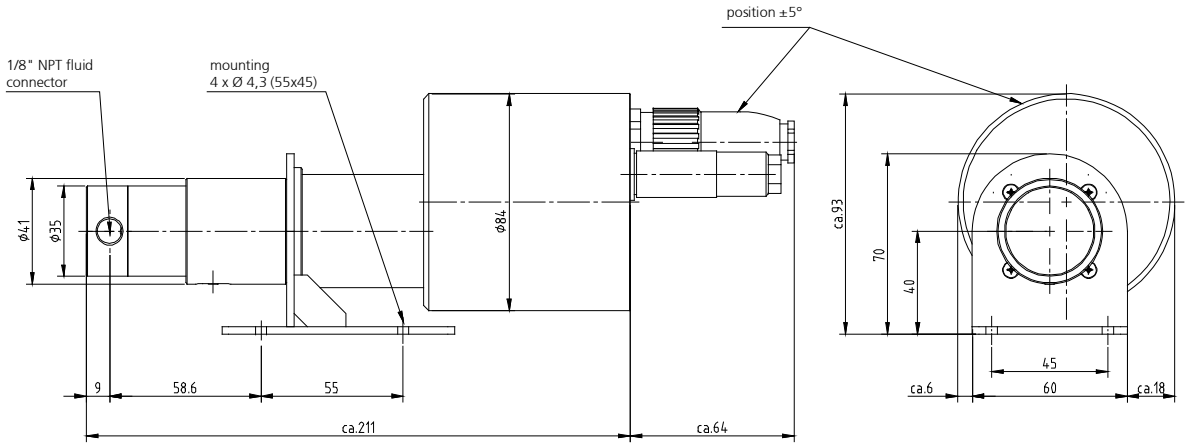


figure 1 Measures of the micro annular gear pump mzr-7208

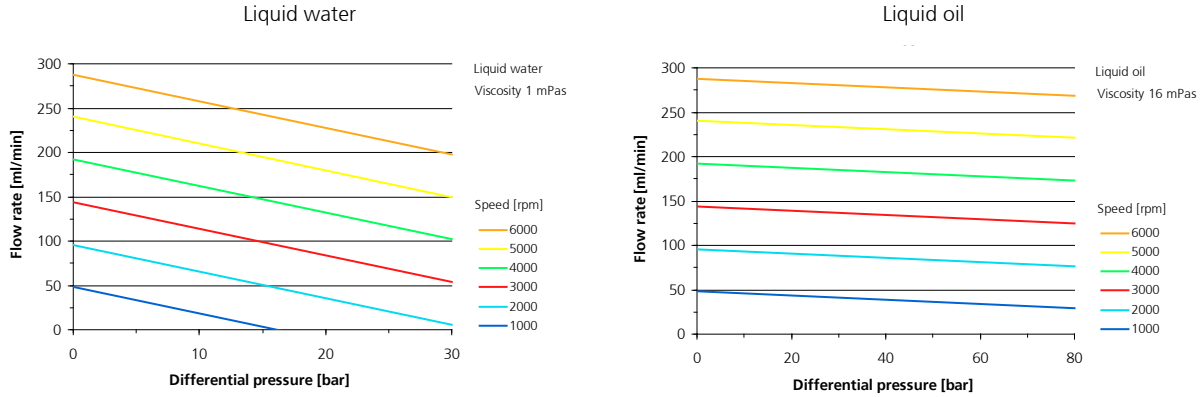


figure 2 Flow charts mzr-7208

1.5 Technical data of the standard motor

The micro annular gear pump mzr-7208 is provided with an actuator equipped with a 2 pole brushless DC-motor. The DC motor uses a high dynamic and is recommended for programmed dosage operation of the micro annular gear pump. With a control unit it is possible to manage lower RPM 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	36 V DC
Stall torque	191 mNm
Max. continuous current	6,29 A
Starting current	approx. 15 A
Assigned power rating	201 W
terminal inductance, phase-phase	143 µH
No load speed by 36 V	10450 rpm
operation range	10 ... 6.000 rpm
temperature range	-30 ... +125 °C
Protective class	IP54
Male socket for motor windings	Binder Series 623 Type: 99-4637-20-06
Female cable connector for motor windings	Binder Series 623 Type: 99-4636-00-06
Male socket for Encoder/Hall sensor cable	Lumberg Typ: SFV 120
Female cable connector for Encoder/Hall sensor	Binder Series 423 Type: 99-5130-15-12
Length connection cable	3 m lengthening up to max. 10 m

table 2 Technical data of the motor

Encoder	
Max. voltage V_{cc}	5 VDC ± 10 %
Number of channels	3 (A, B, I)
Counts per revolution and channel	500
Output current	max. 20 mA
Phase shift Φ (nominal)	90°
Operating temperature range	0 ... +40°C

table 3 Technical data encoder

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

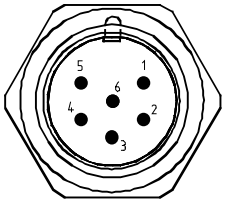


table 4 Pin configuration of the motor supply

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

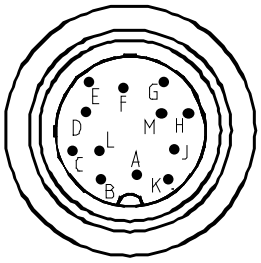


table 5 Pin configuration of the motor connector (Encoder/Hall)

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

table 6 Motor 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 7 Encoder/Hall sensors cable 8 poles with controller S-HV

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

wire colour	Description	pin Controller S-HP
red	Encoder voltage +5 V	36
blue	Encoder/Hall sensor GND	19
green	Encoder channel A	33
black	Encoder channel A neg.	16
yellow	Encoder channel B	34
violet	Encoder channel B neg.	17
grey/pink	Encoder channel I	35
red/blue	Encoder channel I neg.	18
pink	Hall sensors voltage +5 V	11
brown	Hall sensor A	9
grey	Hall sensor B	6
white	Hall sensor C	10
green/yellow	screen	earth screw

table 8 Encoder/Hall sensors cable 12 poles with controller S-HP (option)

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

The micro annular gear pump mzr-7208X1 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
Male socket for motor windings	Binder Series 623 Type: 99-4637-20-06
Female cable connector for motor windings	Binder Series 623 Type: 99-4636-00-06
Male socket for Hall sensor cable	Lumberg Type: SFV 50/6
Female cable connector for Hall sensor	Binder Serie 423 Type: 99-5114-09-05
Type of Hall effect sensor	analog
Length connection cable	2 m

table 9 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.

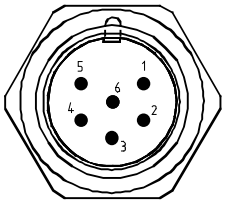


table 10 Pin configuration of the motor supply

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

table 11 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

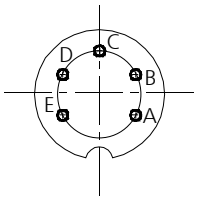


table 12 Pin configuration of the hall sensor connector

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 13 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 14 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 the safety section as well as with the special safety instructions listed under the other main sections. All legal and corporate safety instructions have to be obeyed.

2.1 Safety symbols in this operating manual

Please comply not only with the general safety instructions listed below, but also with specific safety instructions mentioned in the following chapters.

Non respect of the safety instructions marked with the following signs represents danger to *people*:

Danger symbol

Safety symbol according to DIN 4844 – W9

High voltage symbol

Safety symbol according to DIN 4844 – W8

Non compliance with the safety instructions marked with the following sign:

Warning

represents a risk of damage to the *micro annular gear pump*.

Operating instructions machined directly on the pump such as the indication of liquid input and output should be followed and kept in a clearly readable condition.

2.2 Staff qualification and training

The staff operating, servicing, inspecting and assembling the pumps must evidence the appropriate qualification for these works. Areas of responsibility and competence as well as monitoring of the staff must be precisely regulated by the decision maker. If the personnel do not have the necessary knowledge, they must be trained and instructed accordingly. If necessary, this can be implemented by the supplier or the manufacturer on behalf of the operator. Furthermore, the operator in charge must ensure that the content of the present manual has been fully understood by the personnel.

2.3 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.

2.4 Safety instructions for the operator

The surface temperature of the motor under full load may exceed 60°C. If needed, this surface should be protected on site against contact in order to avoid skin burns.

The drive should be protected against dust, water vapor condensation, humidity, splash water, aggressive gases and liquids. Please provide for adequate air ventilation and thus cooling of the motor.

The micro annular gear pumps mzr-2905, mzr-4605 and mzr-7205 must not be used in areas exposed to explosion risks or in the proximity of inflammable gases and vapors.

Possible leaks of dangerous liquids (for example from the shaft sealing) should be guided away in a way not to represent any danger for the personnel and the environment. The pump should be regularly checked for possible leakage. All legal requirements in this matter should be followed.

The existing protections against contact for the moving parts of the pump (such as for example the coupling) must not be removed during operation.

Take care that all risks resulting from the electric energy are excluded. (For details please refer to the instructions provided by the authorities in charge or your power supplier.)

Warning Please insure, that the totality of the liquid supply accessories such as tubes, hoses, filters etc. are free from dust or dirt particles. Impurities such as metal, plastic or glass particles may impair or damage the pump leading to its failure.

Warning Please, operate the pump with a filter featuring 10 µm or smaller pores. It will protect the pump.

2.5 Safety instructions for maintenance, check and assembly of the pump

As a rule all maintenance work on the device should be performed when the device is at a standstill. The shutdown procedure described in this manual must be followed. Pumps delivering liquids hazardous to health must be decontaminated. Immediately after the work had been completed all safety equipment and protection measures should be applied.

Before starting the operation, please take into notice the instructions listed in the chapter 6.

Warning Should a malfunction of the pump occur, do not dismantle the pump on your own but contact one of HNP Mikrosysteme's service staff for professional assistance.

2.6 Unauthorized pump conversions and spare part manufacture

Conversions or modification to the device are only permitted with prior consent of the manufacturer. Original spare parts and accessories authorized by the

manufacturer ensure safety. The use of other parts will annul the liability of the pump manufacturer for any resulting consequences.

2.7 Improper modes of operation

The safety of operation of the delivered device can only be insured by correct use, as described in chapter 1. The limit values given in this manual must not be exceeded in any case.

2.8 General safety instructions

Please observe the following safety instructions

The pump may operate at high pressures. For this reason please use only the delivered accessories and ensure that the employed fittings and tubing have been prescribed and approved for these pressures.

In order to decrease the pressure, provide the system with a *pressure control valve* directing the excess liquid to the storage tank or back to the suction side. In the case of blockage of the pressure side the operating pressure can multiply, this can lead to the damage of downstream components.

At a standstill, the liquid may flow through the pump in the direction of the falling pressure. In order to avoid this unwanted movement, please integrate *non-return valves* (see accessories).

Protect the micro annular gear pump and the electric drive against strokes and shocks.

Under normal working conditions the shaft sealing rings integrated in the pump prevent the liquid from leaking out of the device. The micro annular gear pumps are "technically leak-proof" however not "hermetically sealed" which means it may occur that gases or liquids enter to or escape from the pump.

The allowed operating parameters of the drive should not be exceeded. In particular an *incorrect polarity setting* of the supply voltage may lead to damage of the control unit.

Warning

Please insure, that the totality of the liquid supply accessories such as tubes, hoses, filters etc. are free from dust or dirt particles. Impurities such as metal, plastic or glass particles may impair or damage the pump leading to its failure.

Warning

Please operate the pump with a filter featuring 10 µm or smaller pores. It will protect the pump.

3 Transport and intermediate storage

3.1 Shipment of the pumps and protection measures

The pumps leaving the factory are secured against corrosion and shocks. The inlets and outlets of the pumps are protected with plastic plugs in order to prevent any foreign bodies from penetrating into the device.

3.2 Transport

In order to avoid any damage related to transport, the package must be protected against shocks. HNP Mikrosysteme guarantees, that all goods leave the factory in the best condition. Any noticed damage should be reported to the concerned forwarding agent, authorized dealer or to HNP Mikrosysteme, as manufacturer.

3.3 Intermediate storage

Following points concerning pump storage should be observed:

- Necessary conservation procedure (see also chapter 8.4.1)
- The protective plugs must be left screwed in
- The pump should not be stored in humid places
- For storage temperature - refer to chapter 1.3 of the present manual

4 Description

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 3). 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 4). A homogenous flow is generated between the kidney-like inlet and outlet.

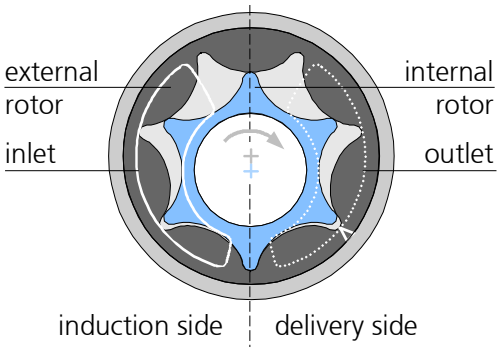


figure 3 Principle of the micro annular gear pump

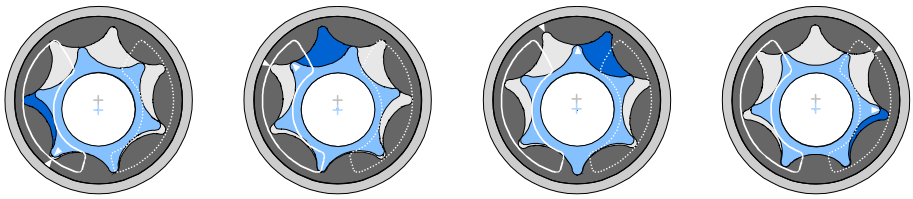


figure 4 Operating principle of the micro annular gear pump

In the case of rotary displacement pumps, the delivered amount of liquid may be easily calculated form the displacement volume V_g of the pump and the number of revolutions of the rotor n. Displacement volume stands for the volume of liquid that is moved within one revolution of the rotor. This relationship is illustrated by the following formula:

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

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: According to the formula mentioned above the mzr-7205 pump featuring a displacement volume of 48 µl delivers at 3000 rpm and with a volumetric efficiency of 100% 144 ml/min. The table 15 shows theoretical flow rate values depending on speed expressed in ml/min and ml/h.

RPM	**Q** [ml/min]	**Q** [ml/h]
100	4.8	288
500	24	1,440
1000	48	2,880
2000	96	5,760
3000	144	8,640
4000	192	11,520
5000	240	14,400
6000	288	17,280

table 15 Theoretical flow rate of the micro annular gear pump mzr-7200

Pressure generated by the pump is determined by the configuration of the fluid delivery system and results from both the hydraulic pressure and the hydraulic resistance (tubing, narrow passes etc.). The *volumetric efficiency* of a pump decreases when the differential pressure rises.

The *viscosity* of the manipulated liquid has an important impact on the volumetric efficiency. The volumetric efficiency increases for higher viscosity values because the *internal leakage* values go down.

Cavitation is an effect which, starting form a certain limit speed value, may reduce the volumetric efficiency of a pump. In the case of highly viscous liquids this limit speed value is lower. That happens because of the liquid-specific drop of vapor pressure in the suction tube which leads to gas formation inside the pump.

The particularity of the mzr-pumps is their highly precise construction, which provides for both high operating pressures and a high dosage precision. The gap between both rotors and between the rotors and the adjacent case parts lies in the range of a few micrometers. This precision is the key factor enabling to achieve volumetric efficiency close to 100%.

4.2 Construction materials

Wetted parts	mzr-7208
Pump housing	stainless steel 316 L (1.4404, 1.4435)
Rotors, shaft, bearing	tungsten carbide Ni-based
Shaft sealing	graphite-reinforced PTFE, 316L spring
Static sealing	FKM, optional: EPDM, FFKM

table 16 Construction materials of the wetted parts

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.

4.3 Liquid supply

	mzr-7208
Liquid inlet/outlet	lateral 1/8" NPT internal thread front 1/8" NPT internal thread optional: front connection M10 x 1.0
Tubing	tube/hose OD 6 mm

table 17 Liquid supply

The suction side is indicated with the letter »S« the delivery side with the letter »D«. An arrow in the front of the pump indicates the operating direction of the shaft.

In order to prevent foreign bodies from penetrating into the pump, the liquid inlet and outlet are protected with plastic plugs or screws. Please remove them before you assembly the pump.

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
- *Gas-tight sealed* version: almost hermetically sealed pump, delivered as standard with the high performance mzr-pumps

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

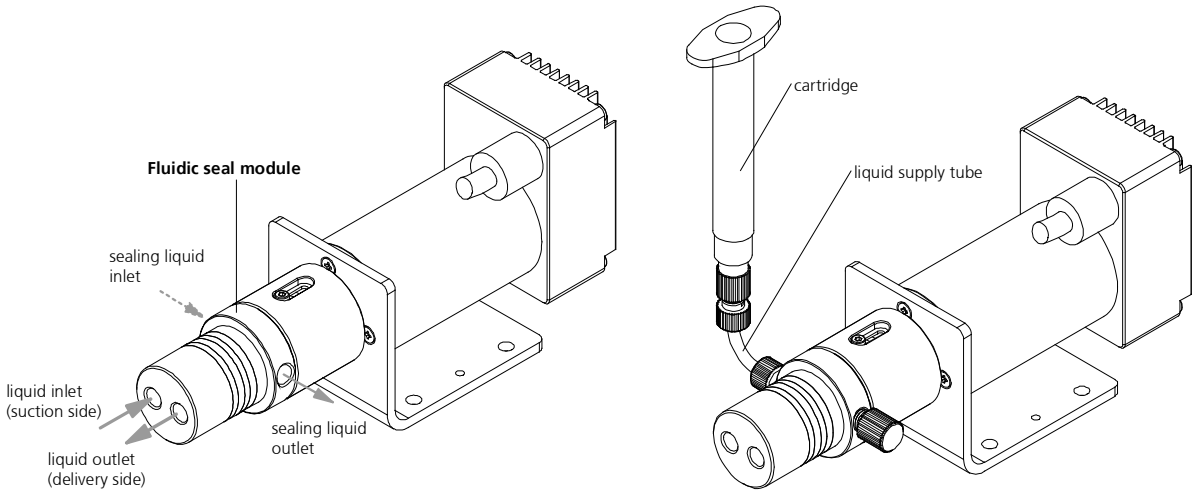


figure 5 Layout of the micro annular gear pump with the fluidic seal module, example of mzr-4605 (the layout on the right: with the optional sealing liquid delivery set)

The module can be applied for liquids which tend to react or crystallize in contact with gases such as oxygen or water. The use of a fluidic seal module has to be confirmed with the pump manufacturer.

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 6). 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.

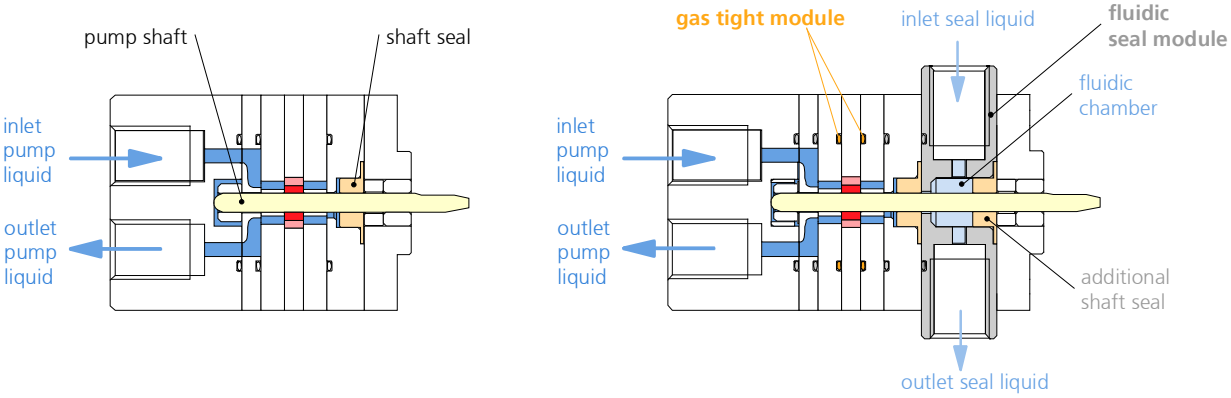


figure 6 Pump head without the fluidic seal module Pump head with the fluidic seal module

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 8). 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.

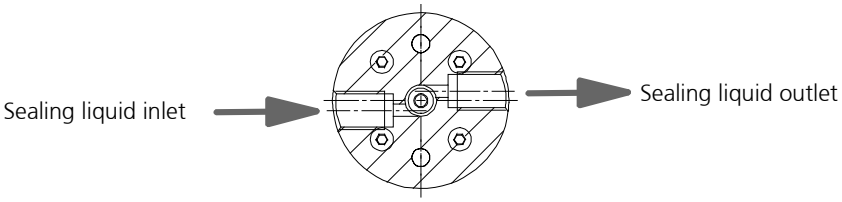


figure 7 Sectional view of the fluidic seal module

A cartridge may be used to supply the sealing liquid to the chamber (see figure 5). 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 7).

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 8 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.

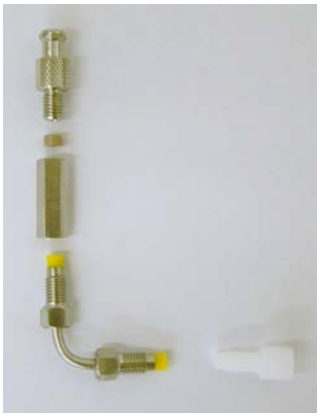


figure 9 Stainless steel set for the fluidic seal module

5.2 Heat insulation module

The heat insulation module enables to deliver hot liquids up to temperatures of 150° C (302 °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 modules

5.3.1 Electric heating module

The electric heating module enables active heating of the pump head up to 150° C (302 °C) operating temperature. The heating module consists of a heating jacket covering the pump head and a thermal element type J. 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.

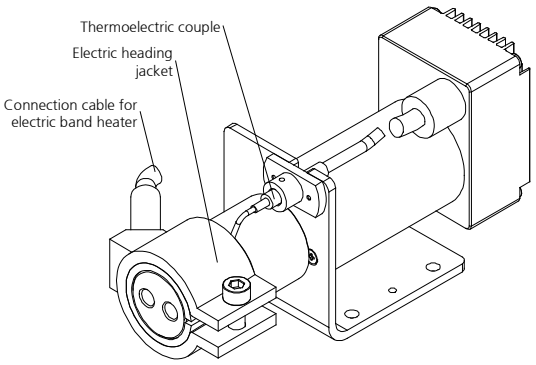


figure 10 Micro annular gear pump mzr-2905 with the electric heating module

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

Themal element	
Type	MT-1.5
Thermal element	Type J (Fe-CuNi IEC 584) alternativ: 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-2905/4605**	**mzr-7205**
Voltage	230 VAC	230 VAC
Power output	80 W	150 W
Diameter	28 mm	35 mm
Width	25 mm	25 mm

table 18 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 150 °C (302 °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 thermal liquid ports 2 x G1/8" are displaced by 45°. The inlet for the heat transfer liquid is situated at the back (beveled) and the outlet is in the front (see figure 11).

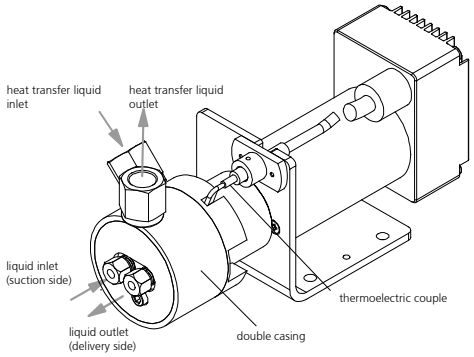


figure 11 Micro annular gear pump with integrated fluidic heating- and cooling module (example of mzr-2905)

⚠ 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 20 bar.

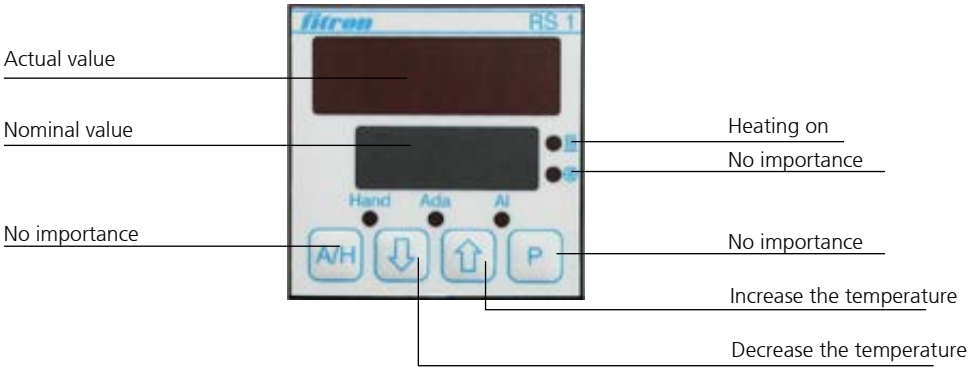
Thermal element	
Type	MT-1.5
Thermal element	Type J (Fe-CuNi IEC 584) alternativ: type L (Fe-CuNi DIN 43710)
Temperature measuring range	0 to 400 °C
Diameter of the sensing device	1.5 mm
Material	1.4541

Double jacket	**mzr-7208**
Length	45.5 mm
Diameter	48.3 mm
Double jacket material	stainless steel 316L
Inlet	2xG1/8“ (45° distance)
Operating temperature range	-20 to 150 °C
Max. pressure	max. 20 bar
Flow rate	max. 0.5 l/min

table 19 Technical data of the heating and cooling module

5.4 Heating device „*JET*micro“

The heating device „*JET*micro“ 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

cLLJ = sensor reverse polarity

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 20 Pin configuration of the heating device

5.5 Gas-tight seal module

Under normal operating conditions the sealing rings employed in the construction of the micro annular gear pump prevent the liquid from escaping out of the pump. The micro annular gear pumps are "technically tight" but not hermetically sealed, which means, it may occur that gases or liquids enter into or escape from the pump. In the case of a gas-tight version, the pump housing is sealed with supplementary rings.

Used together with the gas-tight seal module and the fluidic seal module the pumps are almost perfectly hermetic.

Up from March 2006 all micro annular gear pump mzr-7208 are delivered in a gas-tight version as a standard.

6 System integration

6.1 Check before the first assembly

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

Mounting of the micro annular gear pump head to an actuator

Mounting of the micro annular gear pump head is done by stainless steel M4 screws on the front side flange of the actuator. If you should assemble your own actuator, please pay attention to the fact that axial forces may not occur by this actuator. The misalignment of the bore holes of the counterbalanced shaft coupling may not exceed 1/100 mm.

Mounting of the micro annular gear pump

The mounting angle of the micro annular gear pump can be fixed with four M4 screws. The preferential position of the pump is horizontal. If the pump has to be operated vertically, the position of the motor must be above the pump head in order to prevent liquid from entering into the motor.

Warning

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

Take precautions for the case of a leakage in order to prevent damage of nearby objects and the environment.

The motor have to be protected from damp and dust.

6.3 Assembly of the fluid connection fittings for mzr-7208

The micro annular gear pump mzr-7208 is available in two versions. The liquid supply openings may be lateral or front with a 1/8" NPT thread screw. Pump heads equipped with the heating module are available with front liquid ports only.

Alternative we can deliver the front fluid supply connection M10x1 or M12x1.

Lateral screw connection 1/8" NPT

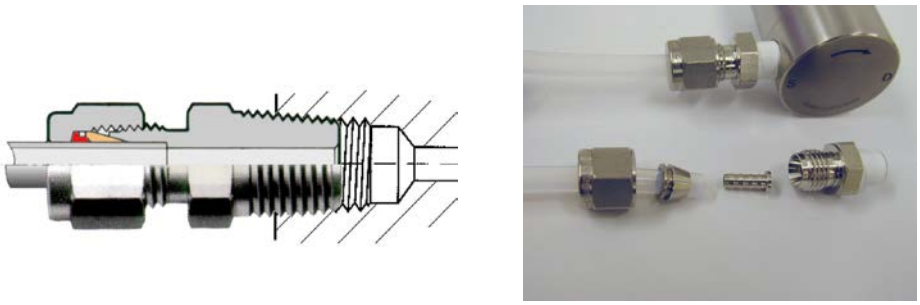


figure 12 Fluid connection fitting 1/8" NPT, stainless steel

1. The thread of the fitting should be wrapped with 2-3 layers of PTFE tape and screwed in the NPT thread (see table 21). First manually, then tightened with ½ to ¾ wrench turns.

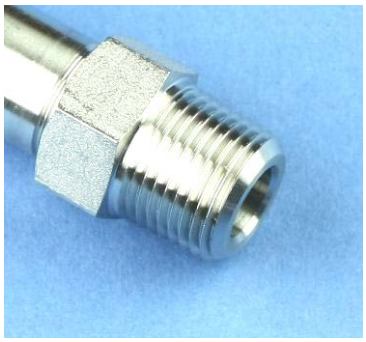
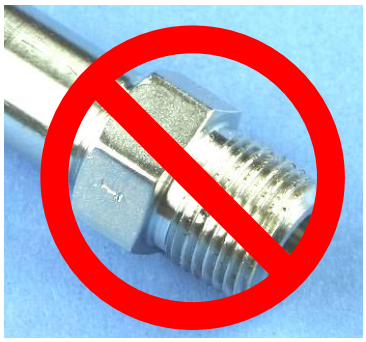
		
Clean the internal and external screw threads leaving no residues.	Make sure the internal and external screw threads are not dented or deformed.	Wrap the PTFE tape around the screw thread clockwise beginning with the second pitch of screw thread..
		
The PTFE tape should be wrapped tightly around the screw thread approx. 3 - 4 times.	Cut the PTFE tape off and wind the end of the tape tightly around the screw thread.	The PTFE tape should not stick out over screw thread because pieces can be cut off and get into the system.

table 21 Use of PTFE Tape

2. Cut the tube or hose to the right angle with an adapted hose cutter. Metal tubing, that produces swarf during cutting must be throughoutly cleansed and flushed. The smallest piece of swarf in the liquid delivery system may cause failure of the micro annular gear pump.

3. Screw the tube or hose (the latter always with a support tube) in the fluid inlet/outlet port of the pump first manually then tighten it with 1¼ wrench turns. During this operation use a second wrench to hold the hose against the bottom of the inlet/outlet port.

4. In order to avoid dry operation, provide for a sufficient liquid supply before each use.

Front fluid supply connection M10x1

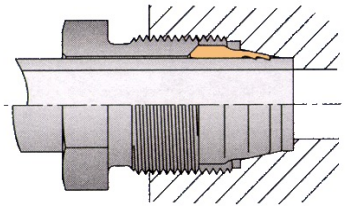


figure 13 Fluid connection fitting M10x1, stainless steel

1. Cut the tube or hose to the right angle with an adapted hose cutter. Metal tubing, that produces swarf during cutting must be throughoutly cleansed and flushed. The smallest piece of swarf in the delivery system may cause failure of the micro annular gear pump.

2. Slide the pressure screw on the tube (the latter always with a metal support tube).

3. Slide on the clamping ring, bevel towards the end of the tube or hose.

4. Screw the tube or hose (the latter always with a metal support tube) in the liquid supply port first manually then tighten it with 1¼ wrench turns

5. In order to avoid dry operation, check before each use that enough liquid is supplied to the pump.

Warning Dry operation of the micro annular gear pump may damage in particular the bearing and the sealing. However, a short dry working phase at the beginning of the operation is harmless.

6.4 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 a longer 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-7208!

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	24 (11 – 70)	V
Max. continuous Current	I_{cont}	6,28*)	A
Max. peak Current	I_{max}	20*)	A
Velocity Range		50...6000*)	rpm
Inputs			
Set value	Input resistor	20	kΩ
	Voltage signal	± 10	V
Encoder signals	Channel	A, B	
	Logic level	TTL	
	Frequency range	max. 100	kHz
Enable	Logic level	low 0...0,5/high 8...30	
	Enable	high active	
Display	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	kΩ
Speed monitor „monitor n“	Output voltage range	± 10	V
	proportional factor	0,5	V/A
	Output resistor	10	kΩ
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 22 Technical Data of the controller S-HV

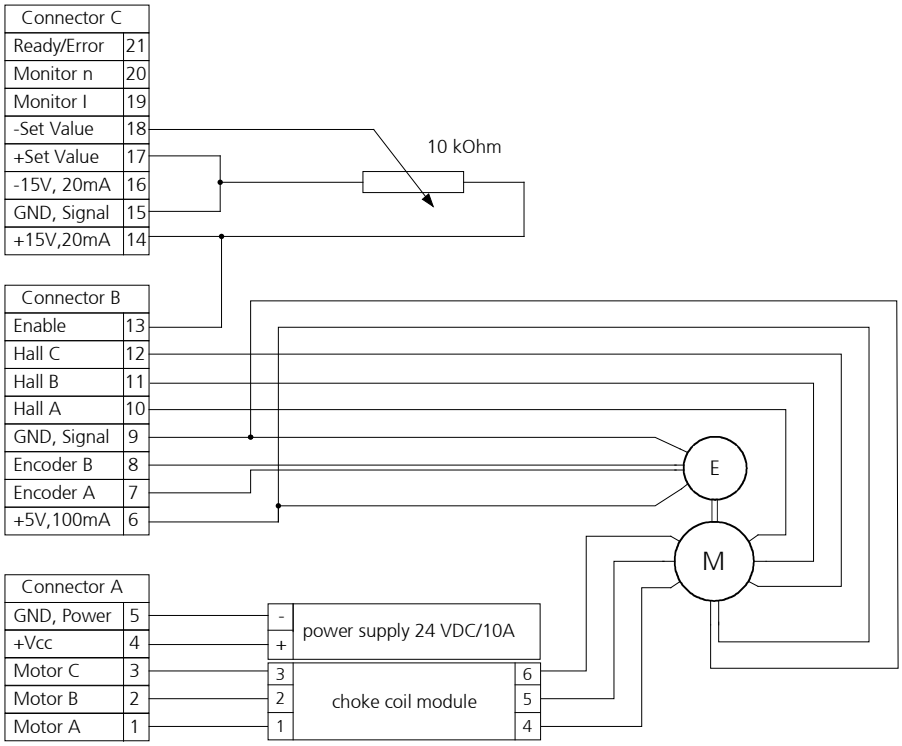


Figure 14 Connection plan with controller S-HV and micro annular gear pump mzr-7208

Initial operation procedure

1. Connect the motor cables with a motor control unit (see Figure 14).

2. Connect the supplied choke coil module in the lines of the motor winding.

At low speeds or frequent stops the drive of the micro annular gear pump mzr-7208 can become hot! By placing the choke coil module to the additional inductors in each phase of the motor winding, the heating of the actuator can be reduced.

3. Insert the jumper J2, J5, J6 and J7 for the encoder mode.

4. Connect the DC- power supply with 24 V to the control unit. Check for correct polarity. False connecting may cause severe malfunction or even destroy the electronic of the motor.

5. 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	60 %
P5	Offset	50 %

table 23 Internal potentiometer position

6. To avoid in any case dry running of the micro annular gear pump we recommend ensuring steady media supply.

7. Programming the control unit or turn the potentiometer in 0 position that the pump not rotate (0 rpm)

8. 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 mzr-7208 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	5000 rpm
J10	10000 rpm
J11	20000 rpm (not recommended)
-	40000 rpm (not recommended)

table 24 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. A short phase of dry running when setting the pump into operation is negligible.

7.2 Operation with Controller S-HP-E

We deliver the micro annular gear pump mzr-7208 with the controller S-HP-E. This programmable control unit enables to adjust speed for constant flow rates or the position of the motor for the dosage of constant amounts of liquid.

Electrical parameter of the controller S-HP-E			
Power supply	U_B	48 (20 – 55)	V
Max. continuous Current	I_{dauer}	6*)	mA
Max. peak Current	I_{max}	10 (< 1s)*)	mA
Speed range		30...6,000*)	rpm
Max. motor power		800*)	W
Interface RS-232	after RS-232 standard	9600 Baud, 8 Bit, 1 Stop-Bit, RxD, TxD, GND (keine Handshake Signale)	
Interface CAN	after DSP 301, DSP 402		
Software	Composer, Elmo Studio		
Input			
Digitale Eingänge	programmable	10	
	Voltage signal	12 – 24 (High)	V
Analoge Eingänge	Input resistor	2	
	programmable	± 10, 14 bit Auflösung	V
Encodersignale	Voltage signal	A, /A, B, /B, I, /I	
	Channel	max. 5	MHz
Hallsignale	Frequency range	A, B, C	
	Channel	0 – 1 (Low) 2,5 – 5 (high)	V
Output			
Digital output	programmable	5	
Voltage +5 V Encoder	Voltage	5	V
	Max. Current	200	mA
Voltage +5 V Hall sensors	Voltage	5	V
	Max. Current	30	mA
Voltage +5 V Auxiliary	Voltage	5	V
	Max. Current	200	mA
Technical Data			
Temperature range	operation	0 … +40 °C	
	storage	-20 … +85 °C	
Humidity range	non condensing	20 … 90 % rel. hum.	
Dimensions	L x B x H	150 x 105 x 25.4 mm	
Weight		IP20	
Temperature range		640 g	

*) Values limited in the control unit with corresponding software

table 25 Technical Data of the controller S-HP-E

The control unit S-HP-E permits an easy startup of the pump with following interfaces:

- Power supply over connector
- Interface RS-232 over connector alternative CAN Bus over separate connector
- Prepared separate cable for the motor and the encoder/hall sensor with electrical connectors (useful for initial setup and an example for installation in control cabinet)
- Status display over LED.

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

Warning Follow the enclosed instructions!

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

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

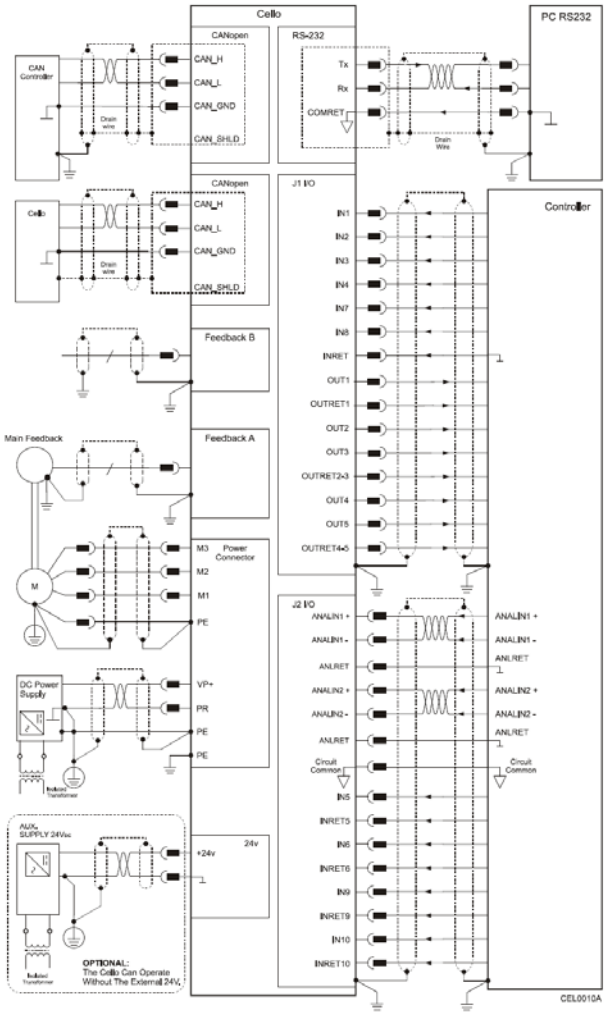


figure 15 Connection plan with controller S-HP-E

Initial operation

1. Connect the power cables with a motor control unit.

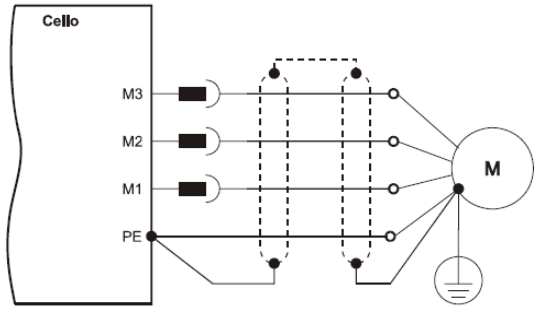


figure 16 Connection plan power cable

Connector Power & Motor S-HP-E	Cable LIY(C)Y 3 x 1,5 mm²	Description	Connector 6 poles motor
M1	brown	Phase A	1
M2	green	Phase B	3
M3	white	Phase C	5
	yellow/green	screen	

table 26 Power cable

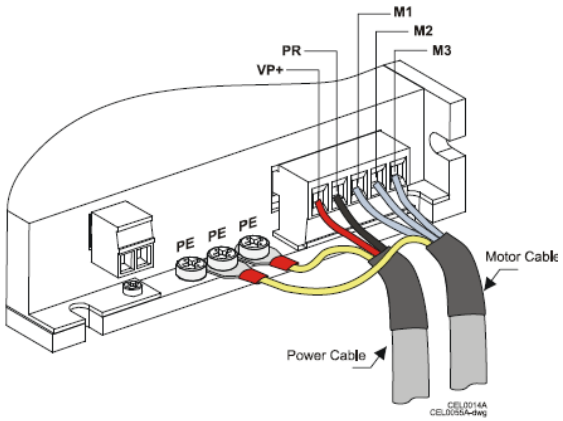


figure 17 Connecting the power cable

Connector Feedback S-HP-E PIN	Feedback Cable CBL-DFDBK	Cable LIY(C)Y 12 x 0,14 mm²	Description	Connector 12 poles motor
1	green	white	Hall sensor C	M
10	yellow	grey	Hall sensor B	L
2	pink	brown	Hall sensor A	K
3	white	blue	GND	B
4	brown	red/pink	+5 V (Hall/Encoder)	A / J
5	orange	black	Encoder Channel A neg.	D
6	light-blue	green	Encoder Channel A	C
7	blue	red/blue	Encoder Channel I neg.	H
8	red	grey/pink	Encoder Channel I	G
14	black	purple	Encoder Channel B neg.	F
15	purple	yellow	Encoder Channel B	E
	grey	n.c.	no function	n.c.

table 27 Feedback Cable

Connector J1 S-HP-E PIN	Elmo I/O cable CBL-CELIO1	Signal	Function
1	orange	IN1	Programmable Input 1
2	light-blue	IN2	Programmable Input 2
3	purple	IN3	Programmable Input 3
8	black	IN8	Programmable Input 8
4	grey	OUT2	Programmable Output 2
5	pink	OUT3	Programmable Output 3
6	blue	IN4	Programmable Input 4
7	red	IN7	Programmable Input 7
9	white / yellow	INRET	General Input Return
10	white / red	OUTRET2-3	Programmable Output Return 2 + 3
11	yellow	OUT4	Programmable Output 4
13	green	OUT5	Programmable Output 5
12	white /black	OUTRET4-5	Programmable Output Return 4 + 5
14	brown	OUT1	Programmable Output 1
15	white	OUTRET1	Programmable Output Return 1

Tabelle 1 I/O cable J1

2. Connect the RS-232 port of the controller with a free serial interface of a PC. For this purpose use the delivered adapter cable.

3. To avoid in any case dry running of the micro annular gear pump we recommend ensuring steady media supply.

4. Connect the power supply of 48 VDC on the connector Power & Motor. 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-E the green LED "power" light on.

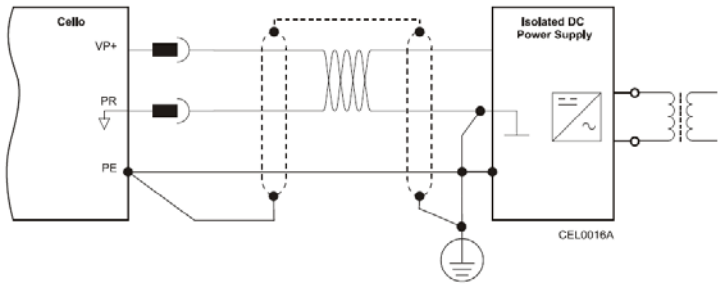


figure 18 Main power supply connection diagram

The power supply of the controller S-HP-E should be 48 VDC. With this power supply can be operated the micro annular gear pump with the entire speed range (see chapters 1.3 and 7.2).

5. You may now install the delivered software » Composer « as described in the chapter 9.

Remarks:

For problems with the initial operation read the included manual for detailed motion controller! Further documentations are also located on the enclosed CD.

7.3 Operation with Controller S-BL (Option)

The micro annular gear pump mzr-7208 with brushless DC motor and analog hall sensors as drive be delivered with the S-BL control unit. This programmable control unit enables to adjust speed for constant flow rates or the position of the motor for the dosage of constant amounts of liquid. On the delivered diskettes or CDs you will find a PC-program operating under Windows that enables to program such parameters as speed, acceleration and current consumption. The delivery package comprises also a null-modem cable for connection to a serial interface of a PC.

S-BL control unit			
Type of control unit		4-Q servo amplifier	
Nominal voltage	U	24	V
Power supply	U_B	12 - 30	V
Residual ripple		≤ 2 %	
Max. continuous output current	$I_{continuous}$	4500*)	mA
Max. peak output current	I_{max}	6000*)	mA
Speed range		10...5900*)	rpm
Input No. 1	input resistance	5	kΩ
Nominal analog speed	voltage range	± 10	V
Nominal digital speed	PWM signal	low 0...0.5 / high 4...30	V
	frequency range	100...2000	Hz
Output/Input No. 2	Error state	max. U_B / 30 mA	
	no error	switched to GND	
	programmed as input	low 0...0.5 / high 3,5... U_B	V
Input No. 3	TTL - logic level	low 0...0.5 / high 3,5...30	V
	PLC - logic level	low 0...7 / high 12,5...30	V
Program memory		6,6	kBytes

*) Values limited in the control unit with corresponding software

table 28 Technical data of the S-ND control unit

The control unit permits an easy startup of the pump with:

- the possibility to connect the voltage supply to the delivered DIN socket
- the possibility to connect the voltage supply with screw clamps
- a 8-pole screw clamps connector assembly for the motor cable
- speed set with potentiometer
- analog voltage signal 0-10 V for speed control at the screw clamps
- 9-pole connection plug for the RS-232 interface
- error output with status LED, programmable also as trigger input with screw connections
- tumbler switch S1 for the connection of digital input No. 3 of the motor control unit

Startup of the micro annular gear pump with the S-BL control unit

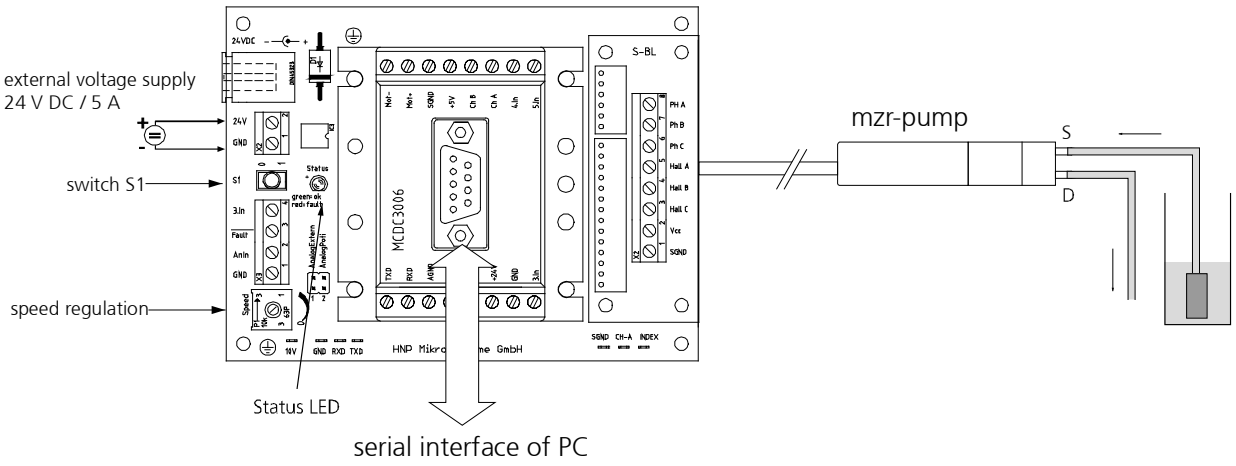


figure 19 Connection of the micro annular gear pump mzr-7208X1 and the S-BL control unit

1. Connect the motor cables to the connector of the S-BL control unit. The pin configuration is indicated in table 14.

2. Connect the RS-232 port of the MCBL3006 with a free serial interface of a PC. For this purpose use the delivered 9-pole null-modem cable.

3. Put the potentiometer of the S-BL control unit to zero position by turning it clockwise to the limit stop.

4. Connect the voltage supply 24 VDC. This can be done with the integrated DIN connector or, alternatively the 2-pole screw clamp (24 V = »+«; GND = »-«). Pay attention to the correct polarity.

5. You may now install the delivered software »Motion Manager« as described in the chapter 9.

While connecting the DC voltage pay attention to the correct polarity, otherwise electronics may be damaged.

Remarks:

- It is possible to adjust speed of the micro annular gear pump with the potentiometer without the need to connect the serial interface.
- With the analog nominal value input (connection clamps »AnIN« and »GND«) it is possible to adjust speed of the pump with a standard signal 0-10°V. For this purpose it is necessary to plug the jumper on the S-BL control unit from the »AnalogPoti« to the »AnalogExtern«. The serial interface does not need to be connected.
- In case of an overcurrent error the green status LED on the S-BL control unit turns red
- The standard programs memorized in the motor control unit may be started with the tumbler switch S1. Basic sample programs are shown in the chapter 9. For more advanced programs please refer to the user manual for Motion Controller MCBL3006.

7.4 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	24 (11 – 70)	V
Max. continuous Current	I_{dauer}	6,28*)	A
Max. peak Current	I_{max}	20*)	A
Velocity Range		1...6000*)	rpm
Motor inductance (minimum) by (50 kHz)		100	µH
Communication interfaces	RS-232	9600	Baud
	CAN (CAN-Open)	ISO/DIN 11898	
Digital Inputs	programmable	4	
	Voltage signal	13 - 30	V
	Input resistor	5	kΩ
Digital Inputs	for lim. sw., 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 29 Technical Data of the controller S-HP

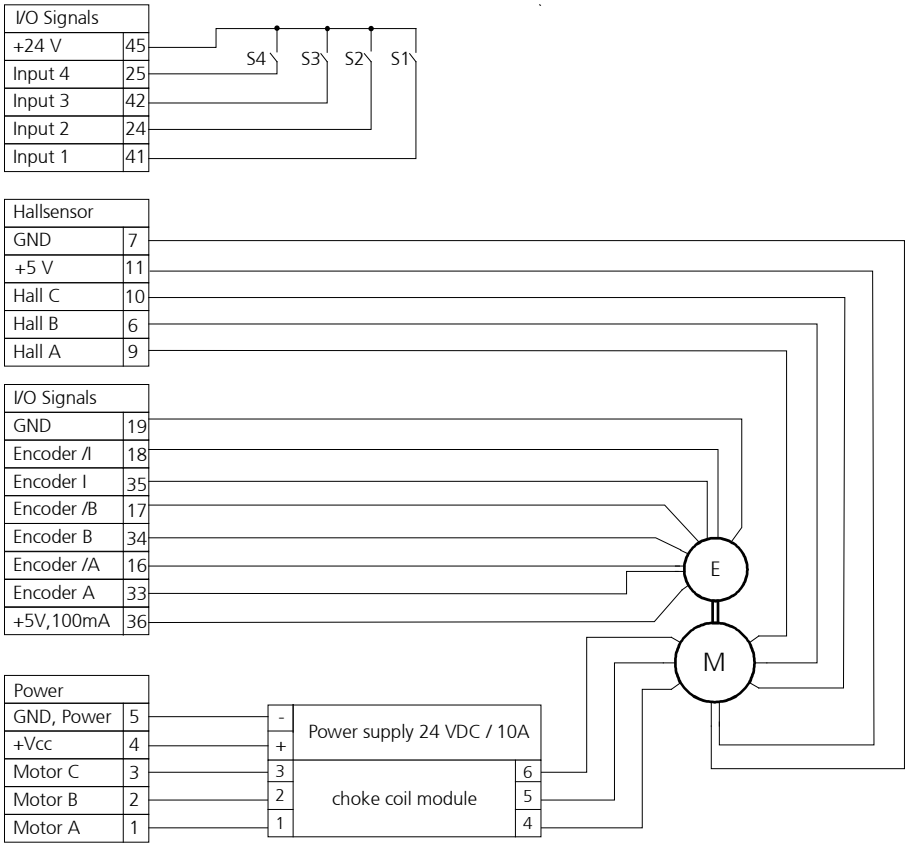


Figure 20 Connection plan with controller S-HP and micro annular gear pump mzr-7208

Initial operation procedure

1. Connect the motorcables with a motor control unit (see Figure 20).

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 24 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_7208.m«! If you switch S1 the pump runs with approx. 3000 rpm and a flow rate of approx. 140 ml/min. If this parameter are 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.

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 longer 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 over a longer time. 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 30 and table 31). 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.

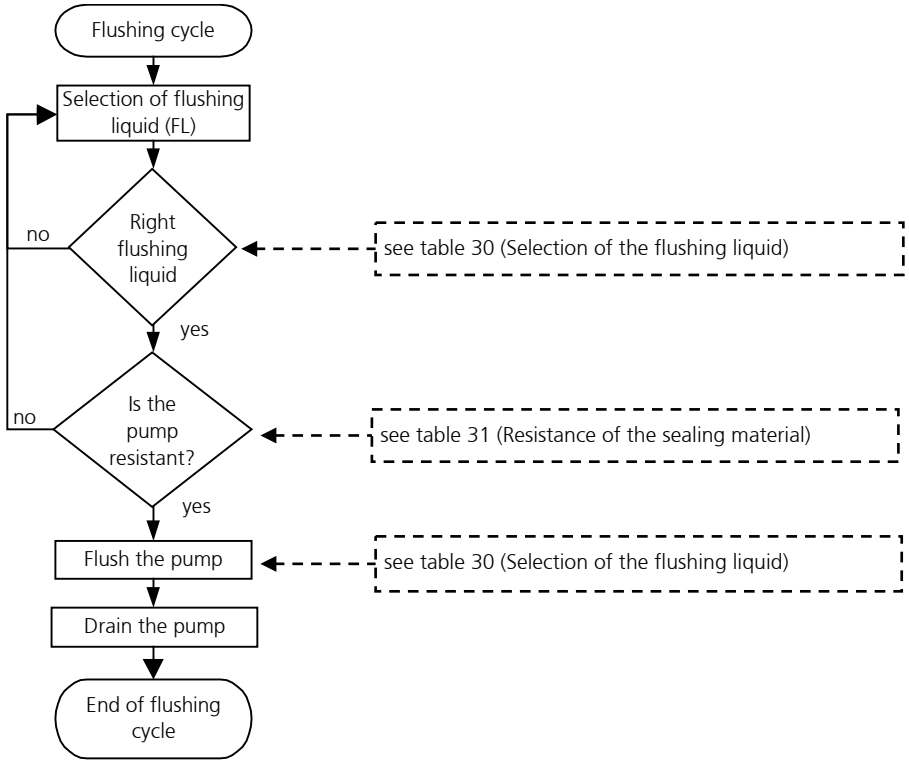


figure 21 Diagram of the flushing procedure

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 31).

Warning The flushing liquid (solvent) and the recommended duration of the flushing procedure depend on the delivered liquid (see table 31). 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, plastifierss	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 30 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 31).

	Shaft sealing		O-ring material		
Flushing liquid	PTFE (Teflon®), graphite-reinforced	UHMWPE	FPM (Viton®)	EPDM	FFPM
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 31 Resistance of the sealing materials depending on the flushing liquid (solvent)

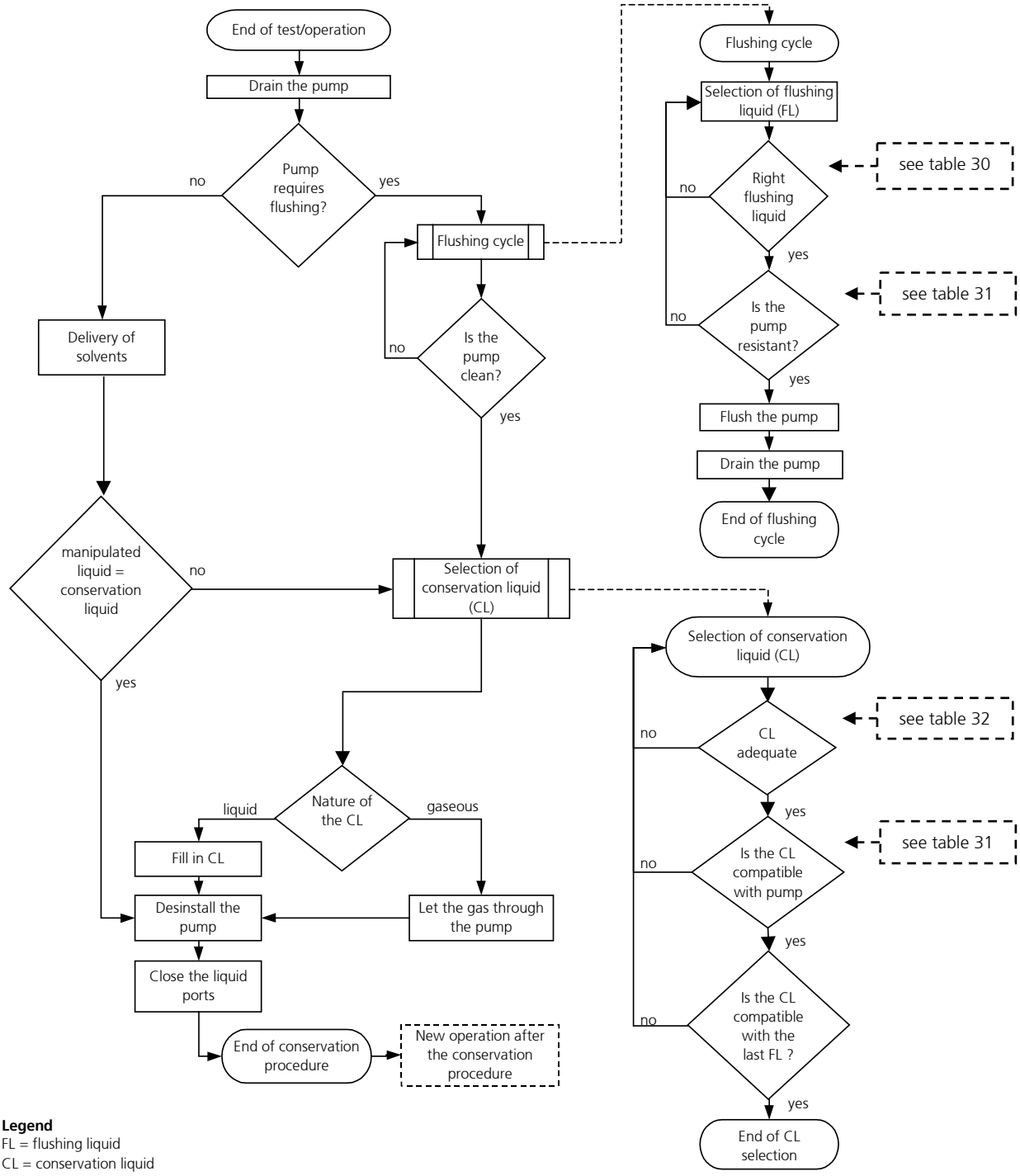
8.4 Shutdown of the micro annular gear pump

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 23) you may prepare the pump for a longer standstill.



Legend
FL = flushing liquid
CL = conservation liquid

figure 22 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 32 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 23 presents a diagram of conservation agent selection.

Remark: This diagram is repeated as a part of the figure 22 (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 32.

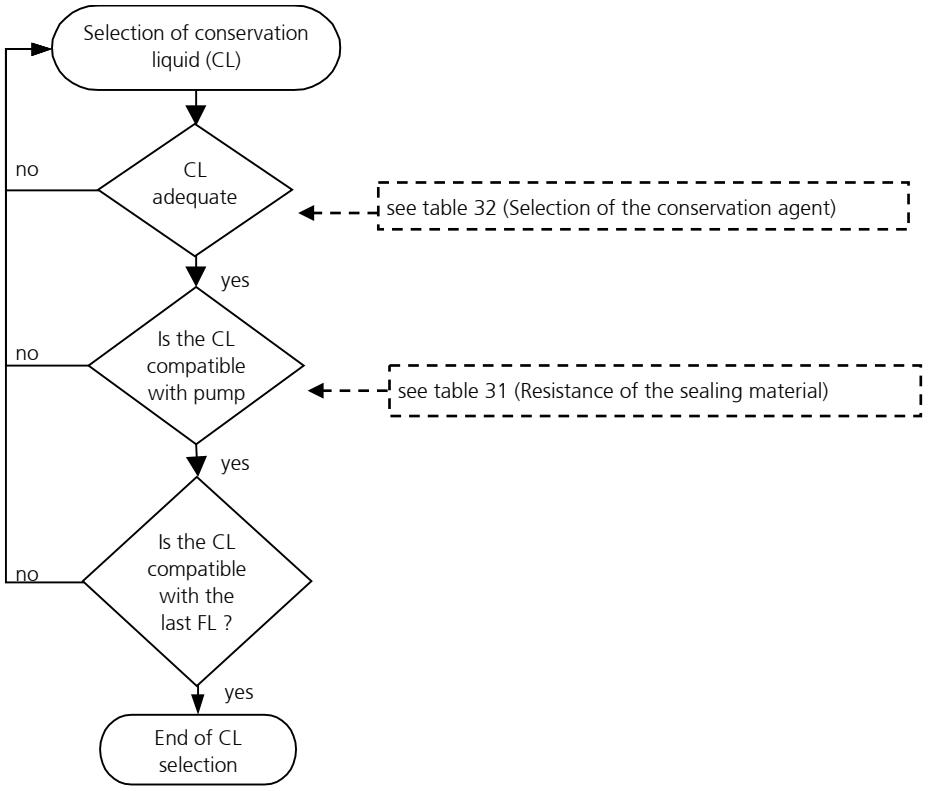


figure 23 Diagram - selection of conservation liquid (CL)

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 (*Warning*: 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 32 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 Trouble 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 30 and table 31) 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) 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 21). This form may also be downloaded from the web site *https://www.hnp-mikrosysteme.de/service/download-center.html*.

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 »Composer« and »Elmo Studio« (Option for S-HP-E)

The » Composer « software enables operation and configuration of the drive and offers a possibility of an online graphic analysis of the operating data. The software is delivered on CD. The program may be installed on a PC running under Windows 2000®, Windows XP® and Vista® operating systems.

Install the software » Composer « by starting the program »Setup« on the CD.

After the installation the » Composer « program may be started from the folder 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 described below are explained very detailed in the documentations of the controller manufacturer.

9.1 Use application of CD

Load the application contained on the CD with the default parameters of the micro annular gear pump.

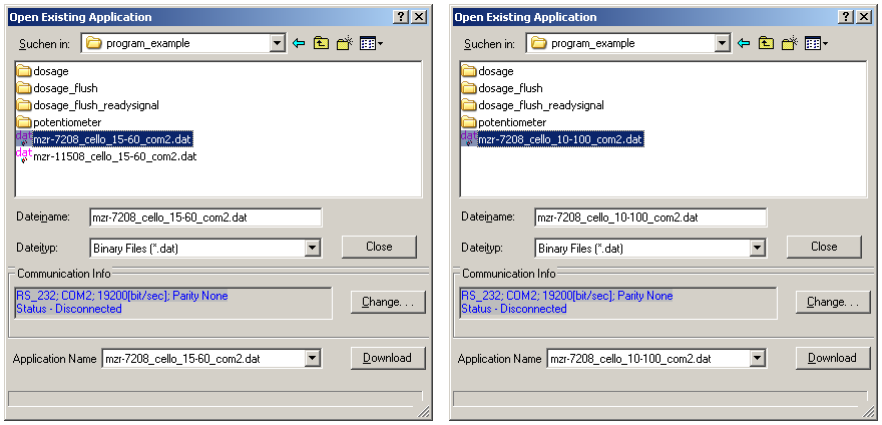


Figure 24 Open Existing Application (Cello 15/60) or (Cello 10/100)

The serial port RS-232 can change with button »Charge«.

The communication opens via button "Download". The program in the EEPROM of the controller is deleted after a prior notice.

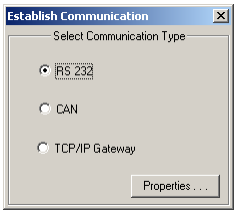


Figure 25 Select Communication Type

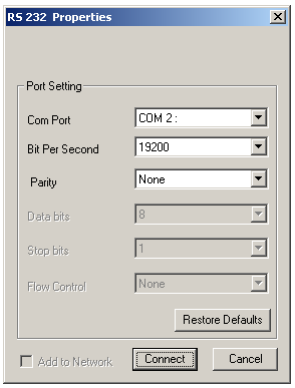


Figure 26 RS-232 interface properties

9.2 Creating a new application

Following windows are to go through to create a new application.

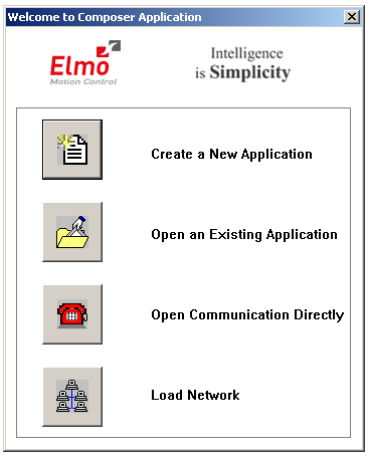


Figure 27 Welcome windows to Composer applications

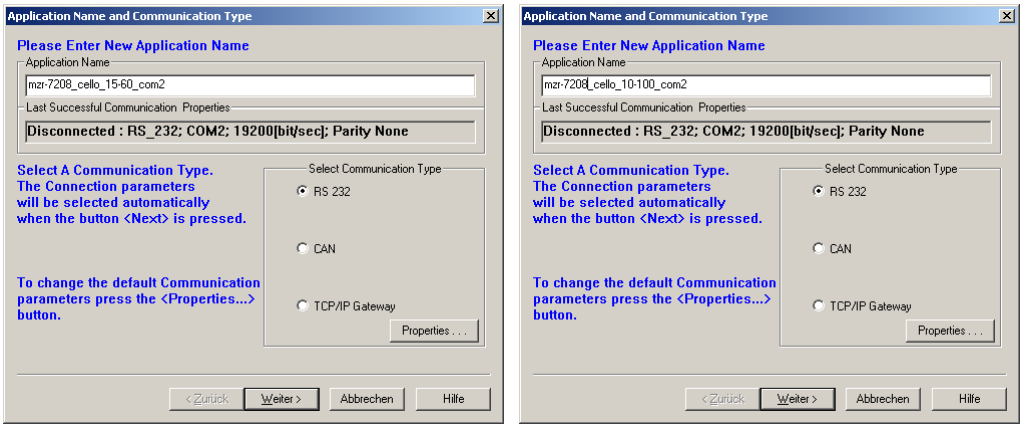


Figure 28 New Application name (Cello 15/60) or (Cello 10/100)

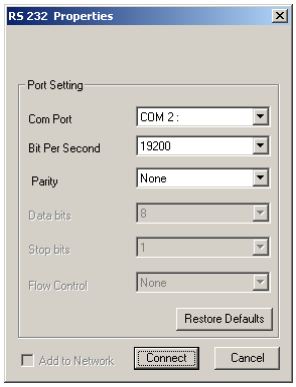


Figure 29 Selection of the relevant interface

Subsequently run the automatic scan of the serial port.

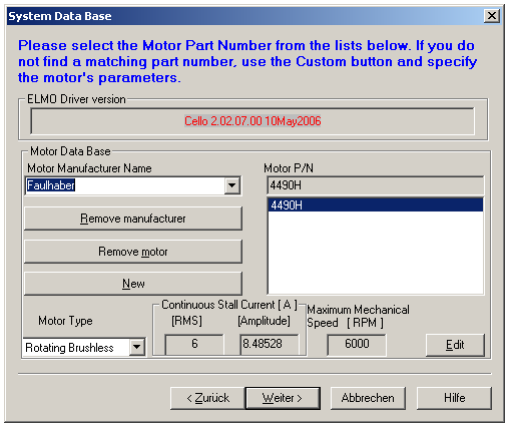


Figure 30 Adjustment of the motor data

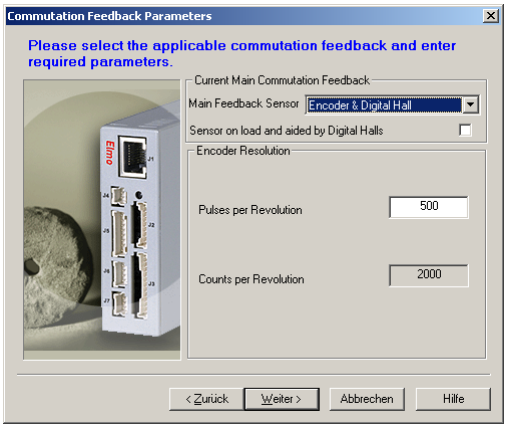


Figure 31 Adjustment of the encoder data

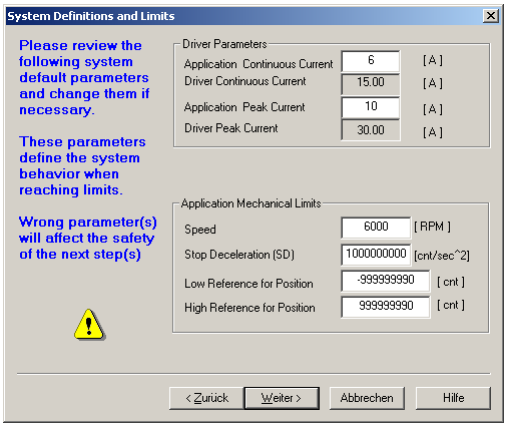


Figure 32 Adjustment of the driver parameter

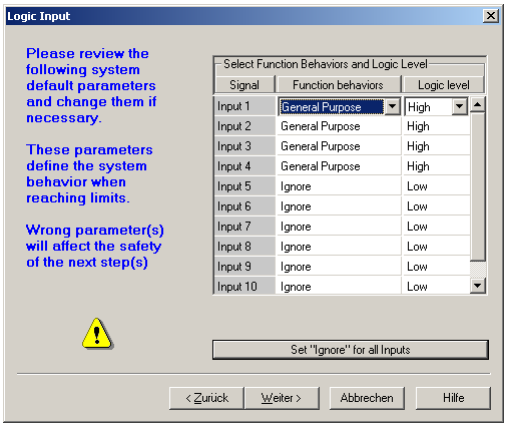


Figure 33 Adjustment of the digital inputs

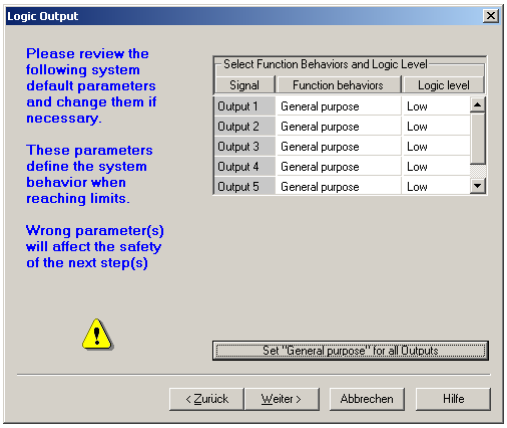


Figure 34 Adjustment of the digital outputs

9.3 Adjustment of controller parameter

The controller parameters of the controller must be set for the operation of micro annular gear pump. If the controller settings are noted with an uneven running of the motor tuning of the controller, a further optimization will be carried out.

The controller settings can be easily implemented on the following window.

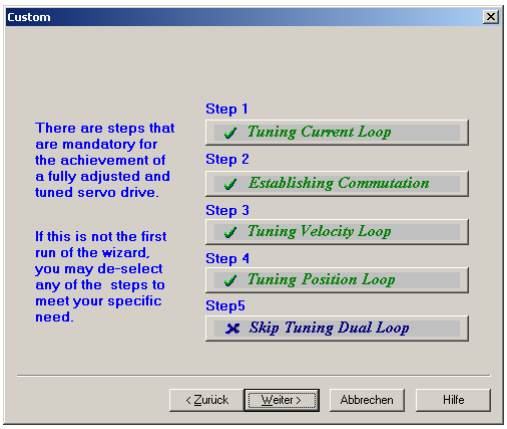


Figure 35 Adjustment of controller parameter

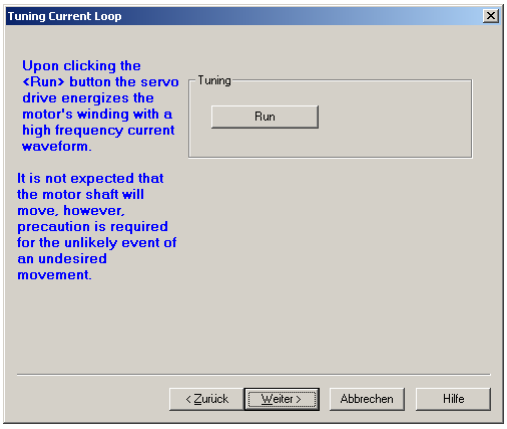


Figure 36 Start Autotuning

Figure 37 Start commutation test

Figure 38 Advice turning the motor shaft

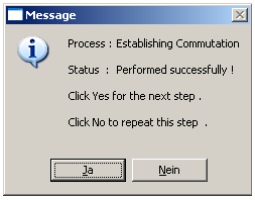


Figure 39 Message with status

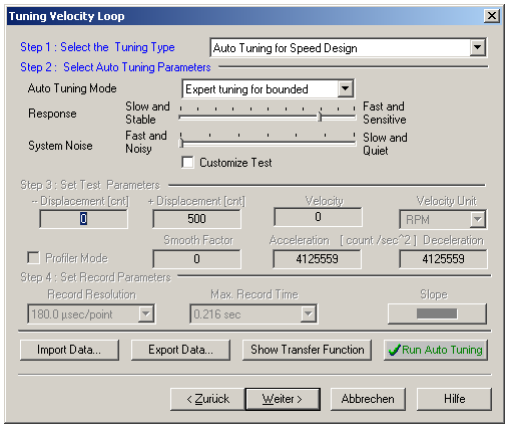


Figure 40 Tuning parameter of velocity loop

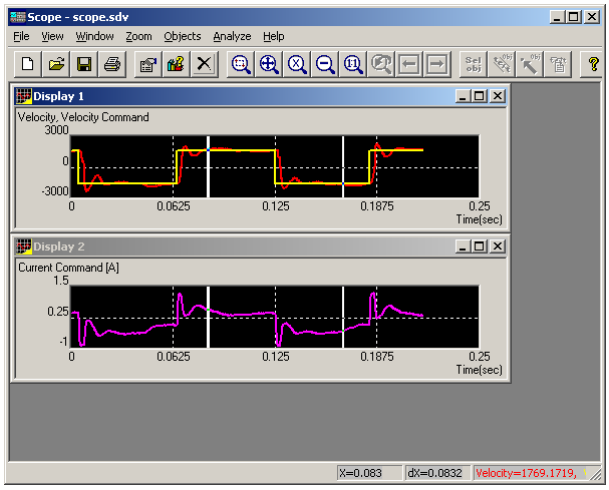


Figure 41 Windows scope motor velocity

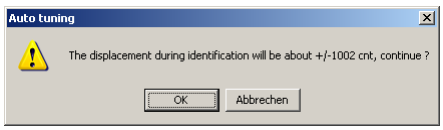


Figure 42 Advice window of motor rotation

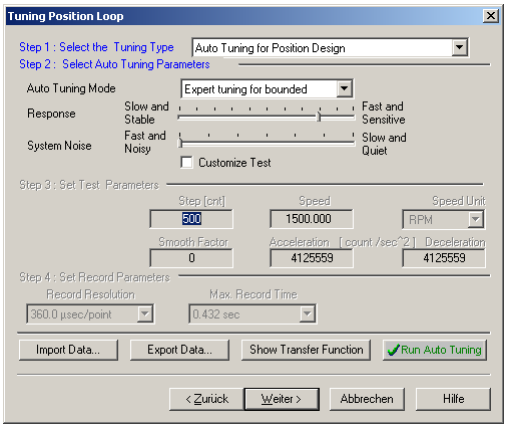


Figure 43 Tuning parameter of position loop

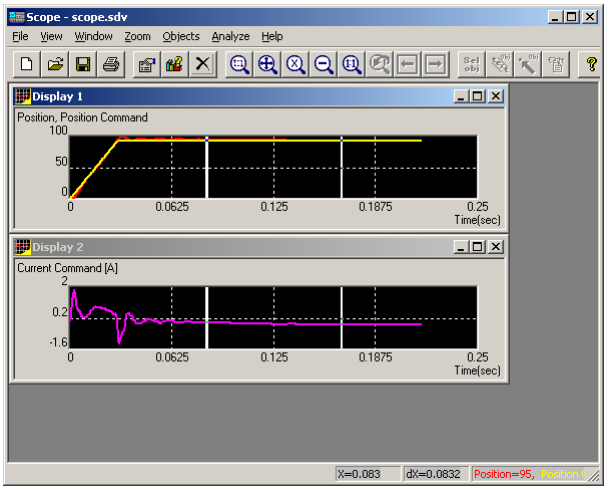


Figure 44 Windows scope motor positioning

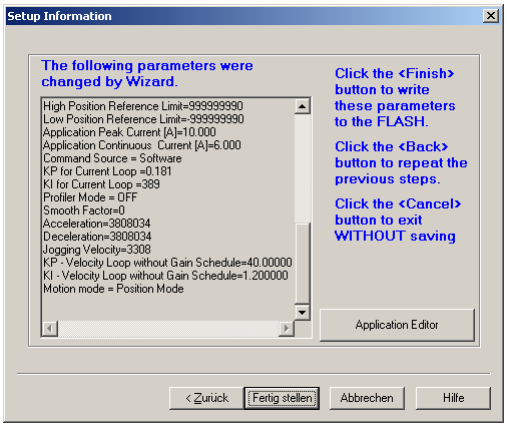


Figure 45 Setup Information

After adjustment of controller parameters, all parameters are saving with *parameter/Save all parameters*.

9.4 Operation of micro annular gear pump with RS-232 interface

In the *velosity mode*, the velocity of the pump motor speed is adjustable.

An example for continuous delivery

Command	Description
1000	Rotation speed of 1000 rpm
3000	Rotation speed of 3000 rpm
0	Standstill of the pump (speed 0 rpm)

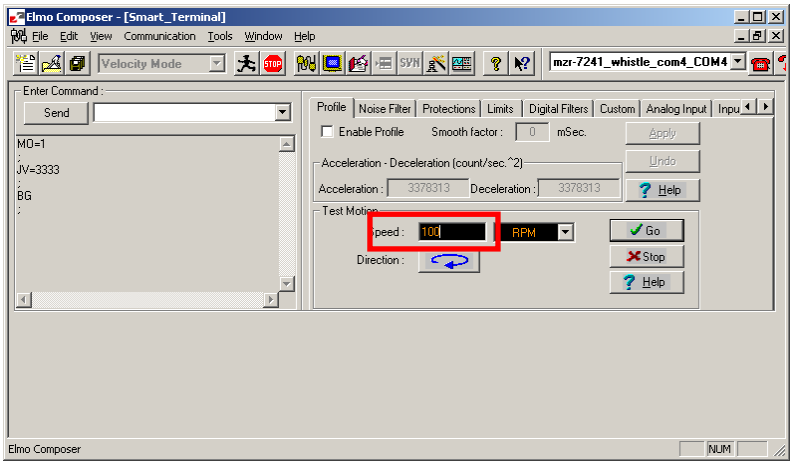


Figure 46 Speed adjustment

9.5 Operation of micro annular gear pump as stand alone application

With the software "Elmo Studio" sequence programs are permanently save in the controller. The programs start automatically when the supply voltage.

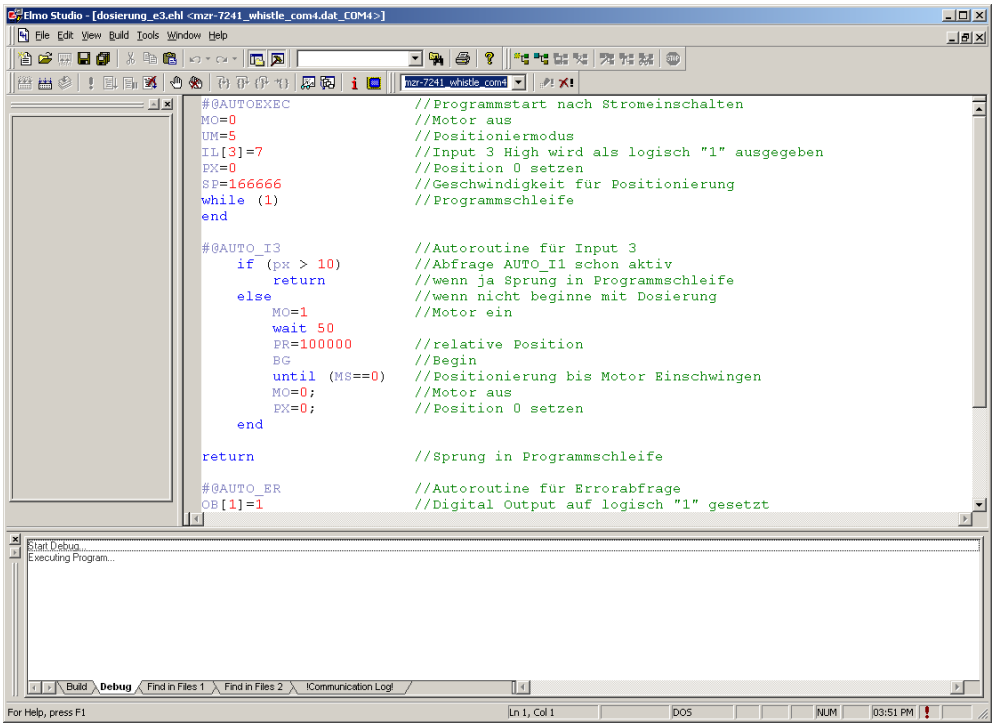


Figure 47 Software Elmo Studio

Programming is described in detail in the documentation of the motion control manufacturer explained. Some example programs for dispensing with the micro annular gear pump are included on the CD

9.6 Problems and their removal with controller S-HP-E

Error	Possible cause of error	Action
LED does not light up	No power supply	Check all power switches
LED lights	Motor does not rotate	Using the software for error check of the controller
Control is not responding	Wrong interface	Überprüfen, ob am PC die richtige Schnittsteller verwendet wird, ggf. umstecken oder EPOS die richtige Schnittstelle mitteilen
	wrong cable assignment	Check the wiring, correct if necessary
Motor hums whistles, or swinging	Controller parameters are not optimal	Controller parameters to check (see "Regulation tuning") in the separate manual control

table 33 Excerpt error control S-HP-E

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.

10 »Motion Manager« software

The »Motion Manager« software enables operation and configuration of the drive and offers a possibility of an online graphic analysis of the operating data. The software is delivered on CD. The program may be installed on a PC running under Windows 7®, Windows 8 or Windows 8.1® operating systems.

Install the software »Motion Manager« by starting the program »Setup« from the CD.

If the CD are not available you may still download this program from the web site http://www.hnp-mikrosysteme.de/download-center.html or the web site www.faulhaber.com (menu support - download). Here, the latest version is always available in English and German.

After the installation the »Motion Manager« program may be loaded from the »Faulhaber Motors« folder from the Windows start menu.

In order to program the drive, the micro annular gear pump should be put into operation. The drive should be connected to the PC with the delivered null-modem cable.

10.1 Direct drive control

In the »Motion Manager« software the input commands may be sent directly to the drive. This enables to execute the movement commands and to modify the drive parameters.

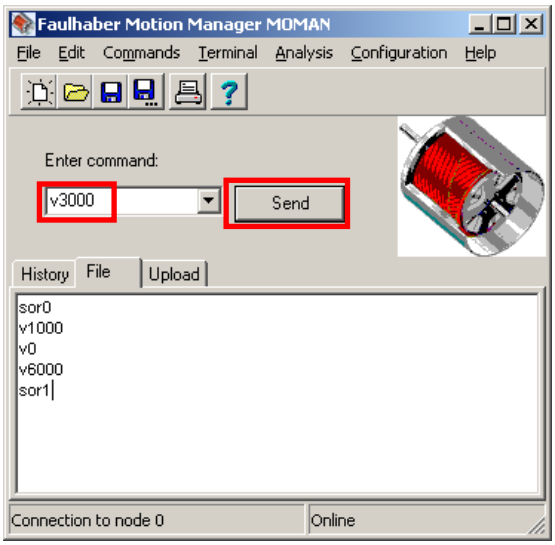


figure 48 Motion Manager software for direct control of the drive

The commands are entered in the field »Enter command:«. The button »Send« will send the command to the drive for execution (see figure 48). The commands may be given alternatively in capital letters or low case. The drive will ignore excess space characters.

An example for continuous delivery

Commands	Description
SOR0	Operating mode RS-232: Set the nominal speed via the RS-232 interface
V1000	Rotation speed of 1000 rpm
V0	Standstill of the pump (speed 0 rpm)
V6000	Speed value 6000 rpm
SOR1	Analog input of the operating mode: setup of the nominal speed with the potentiometer knob or by connecting an external voltage signal to the analog input

An example for discrete dosage

Command	Description
SOR0	Operating mode RS-232: set the position via RS-232 interface
LR10000	Load a relative position of 10000 to the control unit 10,000 = 10 rotations (*Remark: 1000 steps = 1 rotation)*
M	Execute the task / start positioning
LR20000	Load a relative position of 20000 to the control unit 20,000 = 20 rotations
M	Execute the task / start positioning
SOR1	Analog input operating mode: Set nominal speed with potentiometer or by connecting a voltage signal to the analog input

In case of the mzr-7208 micro annular gear pumps 1 revolution of the rotor corresponds to 1000 steps. The gear reduction is to be considered while using a gear reduction module.

For more details concerning the operation of the Motion Manager, please read the online program help.

10.2 Programming of the control

The control of the micro annular gear pump may be adapted by the user to a specific task by means of an easy programming language. The program files are available in the ASCII code and have by default the »mcl« extension which stands for "*m*otion *c*ontroller *l*anguage". Various parameters of the drive such as the maximal speed, the acceleration, the number of rotations, the allowable current load and the parameters of the PI-controller may be programmed with this language. Furthermore, it is possible to program short movement sequences which will be saved in the internal memory of the drive and then autonomously executed.

10.2.1 Transfer of a mcl file to the drive

The existing mcl files may be loaded to the file editor window using the menu command *File - Open…* (in the program window).

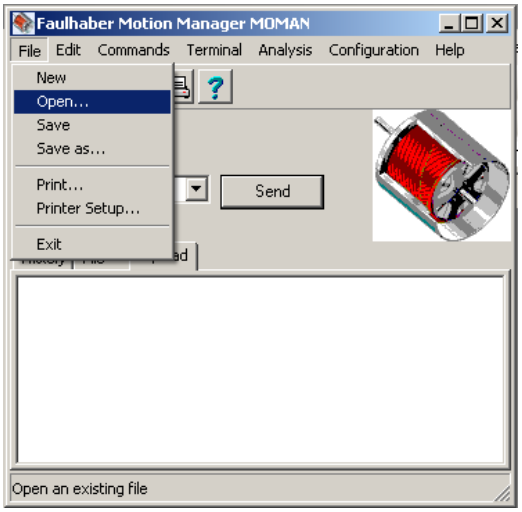


figure 49 Menu file- open

The required mcl file may be selected and loaded via the file selection window (see figure 49). By using the menu command *Terminal - Transfer configuration file* the mcl file will be transferred to the drive (see figure 50).

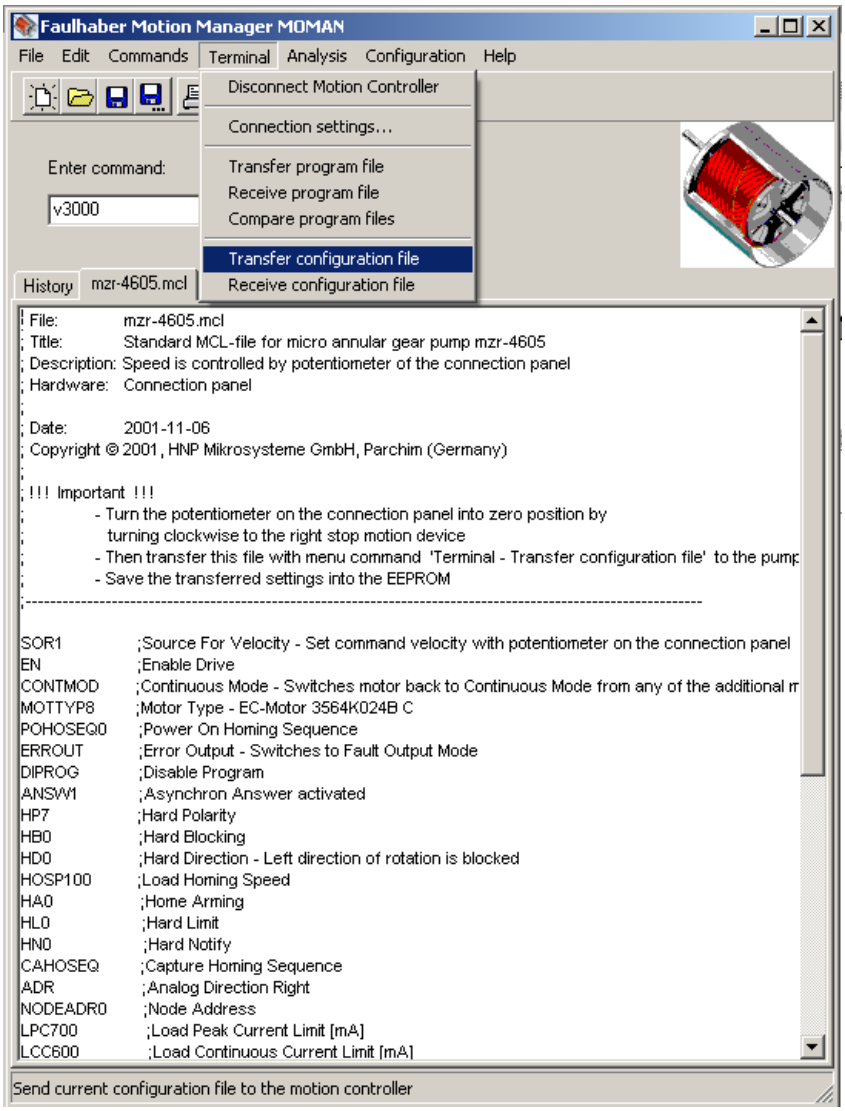


figure 50 Transfer of the mcl files as parameter data

When a window appears with the enquiry if the mcl files should be transferred to the »Motion-Controller«, answer by clicking on the »Yes« button.

In order to save the configuration and the programmed operation files in the EEPROM, confirm the dialogue window with »OK« (see figure 51). By this confirmation the program will be saved in the memory with a resident status and will be available for future operation.

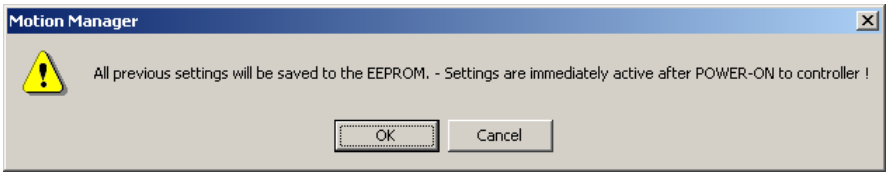


figure 51 Storage confirmation

A diskette with sample mcl programms is delivered along with the Motion Manager. At the delivery the pump has a standard program configuration. Moreover, a sample program that may be started with an external switch is available for discrete dosage tasks.

Pump type	Standard program	Sample program for dosage tasks
mzr-7208	mzr-7208_S.mcl	switchdosage_7208_e3_S.mcl

table 34 Overview of mcl sample programs

11 Software »EPOS« (Option)

For Windows® user we provide the E-Motion software EPOS 6.51 (see figure 52), 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.

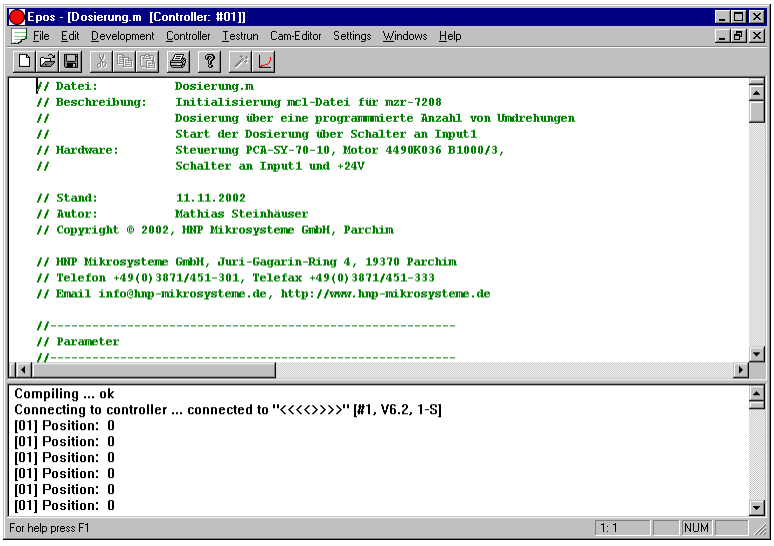


figure 52 Software EPOS for motor control

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.

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 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	Flush the fluid system and check the fluid system for opening connections
	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

table 35 Trouble shooting guide

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.

15 EU Directive

A Directive or EU Directive is a legal instrument of the European Community addressing at the member states and forcing them to implement specific regulations or targets. Leastwise, micro annular gear pumps are covered, by the scope of application of the following Directives: The following directives are of importance for the user of the described micro annular gear pumps:

Low-Voltage Directive (2014/35/EU)

The Low-Voltage Directive is not relevant for micro annular gear pumps described in this manual, because the supply voltage is limited to a maximum of 30 VDC.

Machinery Directive (2006/42/EU)

A micro annular gear pump is a machine and is consequently covered by this Directive. However, it may be a part of a machine or installation.

EMC Directive (2014/30/EU)

The Directive on Electromagnetic Compatibility (EMC) applies to all electronic and electrical devices, installations and systems. Consequently, the Motion Controller of the micro annular gear pump is covered by the EMC Directive.

RoHS Directive (2011/65/EU)

To our knowledge our products delivered to you do not contain substances or applications in concentrations that are forbidden by this directive. No substances contain our products delivered to you after our current knowledge in concentrations or application, the placing on the market in products according to the valid requirements forbade to the Directive.

WEEE Directive (2002/96/EU)

Disposal of micro annular gear pumps has to be environmentally sound.

All materials and liquids haveto be recycled in accordance with the relevant regulations. Electrical parts can not be disposed of as household waste. They have to be delivered to designated collection points.

REACH regulation (EU) No. 1907/2006

HNP Mikrosysteme is not a manufacturer or importer of chemical substances subjected to registration, but in terms of regulation, a downstream user. As downstream user, we conduct the necessary communication with our suppliers to ensure future deliveries of all components necessary to us. We will notify you of all relevant, changes in our products, their availability and the quality of parts/products delivered by us within our business and coordinate the appropriate action in individual cases with you. Previous inspection did not show any limitation in the supply of material from our upstream suppliers.

15.1 Electromagnetic Compatibility (EMC)

Electromagnetic compatibility is defined as the ability of a electric or electronic device to function satisfactorily as intended in its electromagnetic environment without introducing intolerable electromagnetic disturbances in that environment.

15.1.1 EMC Directive and Standards

Comformity was proven by proof of compliance with the following harmonized standards by the company Dr. Fritz Faulhaber:

– EN 61000-6-4 (10/01): Generic standards – Emission standard for industrial environments
– EN 61000-6-2 (10/01): Generic standards – Immunity for industrial environments

These standards prescribe certain standardised tests for the emitted-interference and interference-immunity tests. The following tests are required due to the connections on the controller:

Generic Standard on Emitted Interference:	**Description**
EN 55011 (05/98)+A1(08/99)+A2(09/02):	Radio disturbance characteristics
Generic Standard on Interference Immunity	
EN 61000-4-2 (05/95)+A1(4/98)+A2(02/01):	Electrostatic discharge immunity test
EN 61000-4-3 (04/02)+A1(10/02):	Radiated, radio-frequency, electromagnetic field immunity test
EN 61000-4-4 (09/04):	Electrical fast transient/burst immunity test
EN 61000-4-5 (03/95)+A1(02/01	Surge immunity test
EN 61000-4-6 (07/96)+A1(02/01):	Immunity to conducted disturbances, induced by radio-frequency fields
EN 61000-4-8 (09/93)+A1(02/01):	Power frequency magnetic field immunity test

Table 2 Standards Summary

All tests were conducted successfully.

15.1.2 Information on use as intended

For micro annular gear pumps, note the following:
Requirement for the intended operation is the operation according to the technical data and the manual.

Restrictions

If the micro annular gear pumps are used at home, in business or in commerce or in small businesses, appropriate measures must be taken to ensure that emitted interferences are below the permitted limit a values!

16 Declarations of conformity

The delivered micro annular gear pump falls within scope of the following EU-directives:

– Machinery Directive (2006/42/EU)
– EMC Directive (2014/30/EU)

You may request the declarations of conformity for the micro annular gear pumps from us separately.

HNP Mikrosysteme

EU-manufacturer's certificate (following Machinery Directive 2006/42/EU)

We hereby declare that the following micro annular gear pumps of the high performance series:

mzr-7208, mzr-7208X1

are intended for installation into another machinery/plant and that start of operation is forbidden until it is identified that the machinery/plant into which these micro annular gear pumps shall be installed corresponds to the regulations of the EU guidelines regarding safety and health requirements.

We confirm the conformity of the product described above to the following standards in terms of applied directives

– Machinery Directive (2006/42/EU)

Applied standards are particularly

DIN EN 809	DIN EN 60204-1	DIN EN 294
DIN EN ISO 12100 part 1		DIN EN 953
DIN EN ISO 12100 part 2		UVV

This statement does not warrant any characteristics in terms of product liability. Please note the safety instructions in the manual.

Mr. Lutz Nowotka, HNP Mikrosysteme GmbH, Bleicherufer 25, D-19053 Schwerin is authorised to compile the technical file according to Annex VII A.

Date: December 30, 2016

Signature manufacturer:

Dr. Thomas Weisener
CEO

HNP Mikrosysteme

EU-manufacturer's certificate (following EMC Directive 2014/30/EU)

We hereby declare that the following micro annular gear pump of the high performance series:

mzr-7208X1

is intended for installation into another machinery/plant and that start of operation is forbidden till it is identified that the machinery/plant into which these micro annular gear pumps shall be installed corresponds to the regulations of the EU guidelines regarding safety and health requirements.

We confirm the conformity of the product described above to the following standards in terms of applied directives

– EMC Directive (2014/30/EU)

Applied standards are particularly

EN 61000-6-4 (10/01):	Generic standards – Emission standard for industrial environments
EN 61000-6-2 (10/01):	Generic standards – Immunity for industrial environments

This statement does not warrant any characteristics in terms of product liability. Please note the safety instructions in the manual.

Date: December 30, 2016

Signature manufacturer:

Dr. Thomas Weisener
CEO

17 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.

18 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
Phone +49| (0) 3871|451-346

19 Legal information

Marks

mzr® is a registered German trademark of HNP Mikrosysteme GmbH.

MoDoS® is a registered German trademark of HNP Mikrosysteme GmbH.

µ-Clamp® is a registered German trademark of HNP Mikrosysteme GmbH.

HNPM® is a registered German trademark of HNP Mikrosysteme GmbH.

Teflon® is a registered trademark of DuPont.

Viton® is a registered trademark of DuPont Dow Elastomers.

Kalrez® Spectrum™ is a registered trademark of DuPont.

PEEK™ is a registered trademark of Victrex plc.

HASTELLOY® is a registered trademark of Haynes International, Inc.

Aflas® is a registered trademark of ASAHI Glass Ltd.

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

Cavro® is a registered trademark of Tecan Systems, Inc.

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: EP 1115979 B1, US 6,520,757 B1, EP 852674 B1, US 6,179,596 B1, EP 1354135, US 7,698,818 B2. Patents pending DE 10 2011 001 041.6, PCT/IB2011/055108, EP 11 81 3388.3, US 13/884,088, CN 2011 8006 5051.7, HK 13 11 2934.9, DE 10 2011 051 486.4, PCT/EP2012/061514, EP 12 728264.8, US 9,404,492 B2, CN 2012 8003 8326.2. In the US, Europe and China additional patents are pending.

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

20.1 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.

20.2 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.

20.3 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

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

Type of the device

Pump type/article no.: _____

Serial number: _____

Operating hours/running time: _____

Reason of return: _____

_____

_____

Contact with media (liquids)

The micro annular gear pump was in contact with:

_____

and has been rinsed with:

_____

Product info sheet / Material Safety Data Sheet: ☐ yes* ☐ no

* Please attach file

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 shipment, we reserve the right to entrust a specialized company with cleansing of the device. The return of the pump in original packing is advisable. It is necessary in order to protect the employees and delivery staff.

Nature of media contact:

☐ explosive	☐ oxidizing	☐ sensitive to moisture
☐ toxic (toxic byproducts)	☐ radioactive	pH-value: approx. ____ to ____
☐ carcinogenic	☐ microbiological	other: _____
☐ irritant	☐ corrosive	_____

Hazard (H-statements): _____ Precautionary (P-statements): _____

Declaration

Hereby I/we affirm that the stated information is complete and correct. Micro annular gear pump and accessories are shipped in conformity with the applicable regulations.

company: _____ ☐ Mrs ☐ Mr title: _____

division: _____ name: _____

street, no.: _____ phone: _____

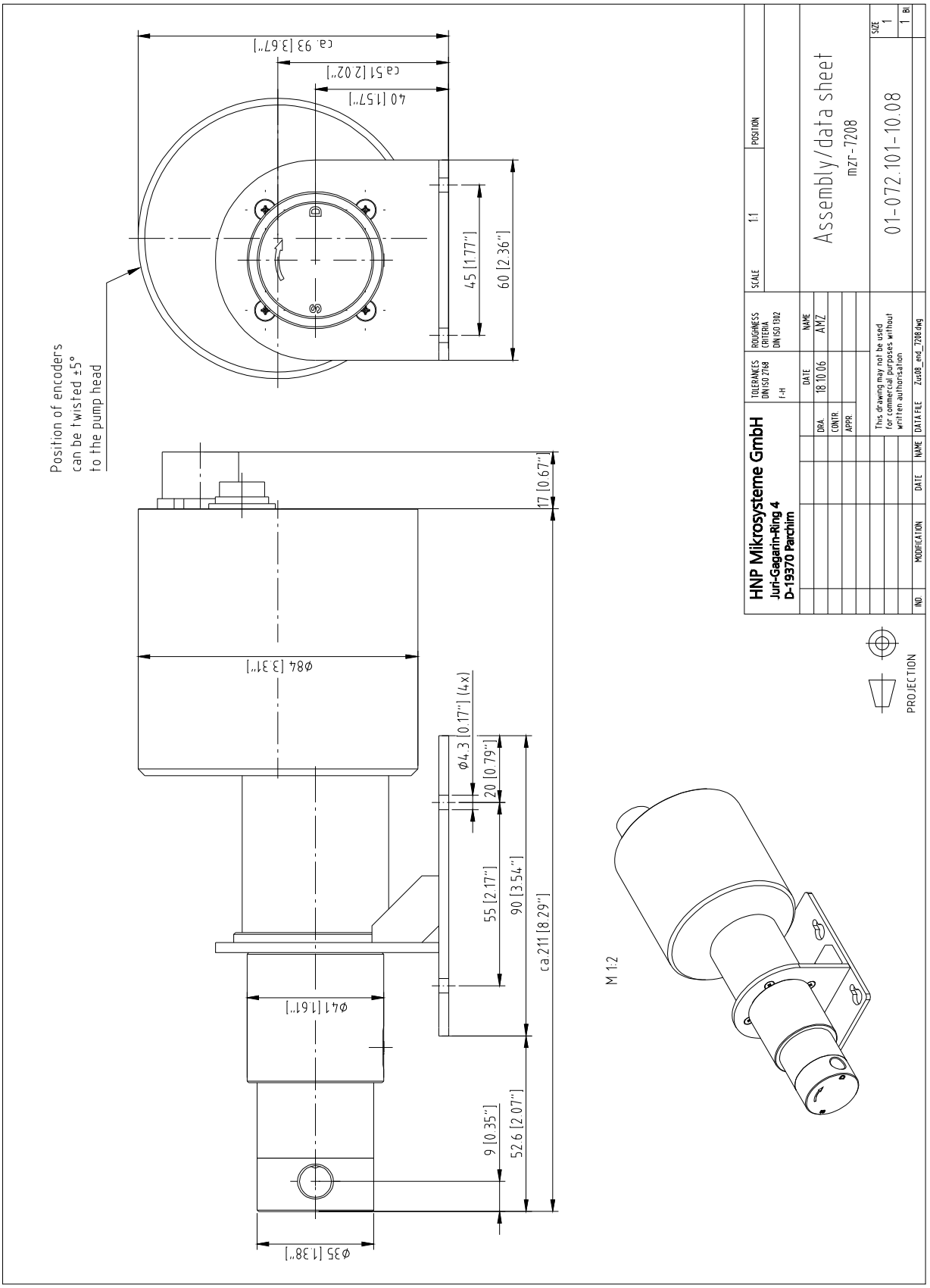
ZIP/city: _____ e-mail: _____

country: _____

city, date: _____ authorized signature / company stamp:

22 Supplement

- Drawings
- Manual of the motion controller S-HV (optional)
- Manual of the motion controller S-BL (optional)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60 [2.36"]
Position of encoders
can be twisted ±5°
to the pump head
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ø84 [3.31"]
ø4.3 [0.17"] (4x)
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ø35 [1.38"]
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HNP Mikrosysteme GmbH
Juri-Gagarin-Ring 4
D-19370 Parchim
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ROUGHNESS CRITERIA DIN ISO 1302
SCALE 1:1
POSITION
Assembly/data sheet
mzr-7208
01-072.101-10.08
SIZE 1
1 Bl
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APPR.
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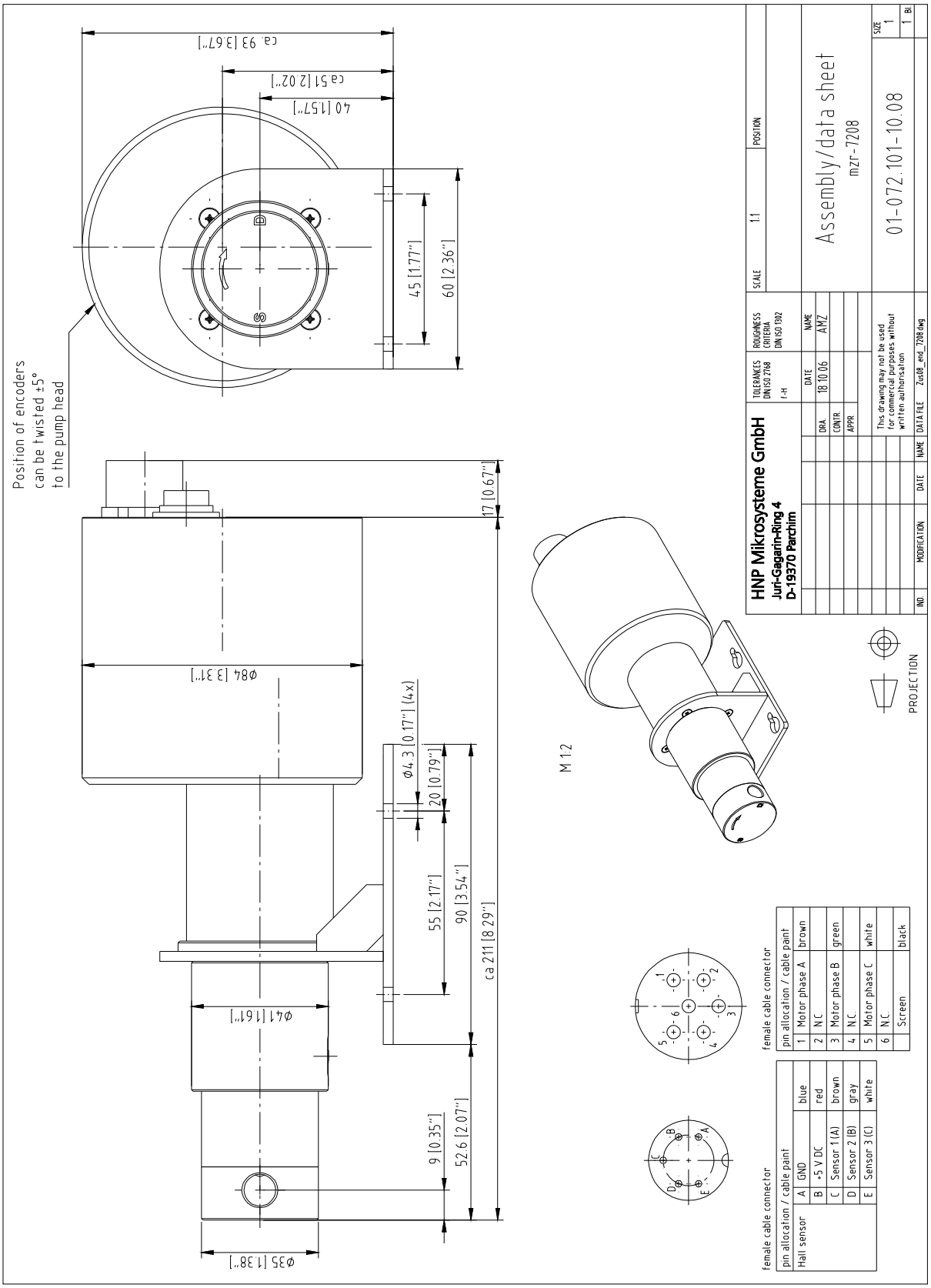
Position of encoders
can be twisted ±5°
to the pump head
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9 [0.35"]
52.6 [2.07"]
ø35 [1.38"]
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HNP Mikrosysteme GmbH
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ROUGHNESS CRITERIA DIN ISO 1302
SCALE 1:1
POSITION
DRA. 18.10.06 AMZ
CONTR.
APPR.
This drawing may not be used for commercial purposes without written authorisation
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Assembly/data sheet
mzr-7208
01-072.101-10.08
SIZE 1
IND. MODIFICATION DATE NAME
female cable connector
pin allocation / cable paint
Hall sensor
A GND blue
B +5 V DC red
C Sensor 1 (A) brown
D Sensor 2 (B) gray
E Sensor 3 (C) white
female cable connector
pin allocation / cable paint
1 Motor phase A brown
2 N.C.
3 Motor phase B green
4 N.C.
5 Motor phase C white
6 N.C.
Screen black