

# micro annular gear pumps

precise pumps – smart solutions



# Products

## Company

HNP Mikrosysteme was founded in 1998. Since then, the company has grown to 80 employees, including scientists, engineers and designers. At our location in Northern Germany, our products propagate from ideas, to designs, to testing, and finally to sale. Micro annular gear pumps (mzr®-pumps) accomplish conventional micro fluidic tasks effectively and efficiently and open up new technological fields. We have received numerous awards for our innovative ideas in the field of micro technology. HNP Mikrosysteme is aware of its responsibilities to society and the environment. We provide further education and training for the next generation of engineering minds and actively support the interest in science and technology of children and young people.

## Products

The micro annular gear pump product range consists of five different series of mzr®-pumps for dosing and metering small amounts of low to high viscosity liquids. With different equipment, dosing volumes starting at 0.25 µl, flow rates ranging from 1 µl/h to 1.1 l/min as well as pressures from 0 to a maximum of 150 bar are possible. The range of the liquid viscosity extends from 0.3 to 1,000,000 mPas. Operation in an explosion-proof area is also possible.

HNP Mikrosysteme offers the development of OEM pumps, dosing systems, **application-specific consulting**, technical support and training.

## Advantages

- precise dosing
- long service life due to tungsten carbide and ceramic components
- corrosion-resistant materials
- self-priming
- dosing, metering and rinsing
- low dead volume
- compact structure
- low weight
- low pulsation
- low shear stress
- wide dynamic range
- forward and reverse operation

## Application Fields

### Life Science

- laboratory and analysis technology
- diagnostics
- cell analysis
- chromatography
- biochip technology
- mass spectrometry
- biotechnology

- agrochemistry
- petrochemistry
- food
- cosmetics

### Chemistry

- fine chemistry
- pharmaceuticals
- polymer chemistry
- basic chemistry

### Mechanical Engineering

- packaging and filling
- automotive industry
- tobacco industry
- mechanical engineering for medical devices
- cooling technology
- color dosing in plastic injection moulding



## Technology

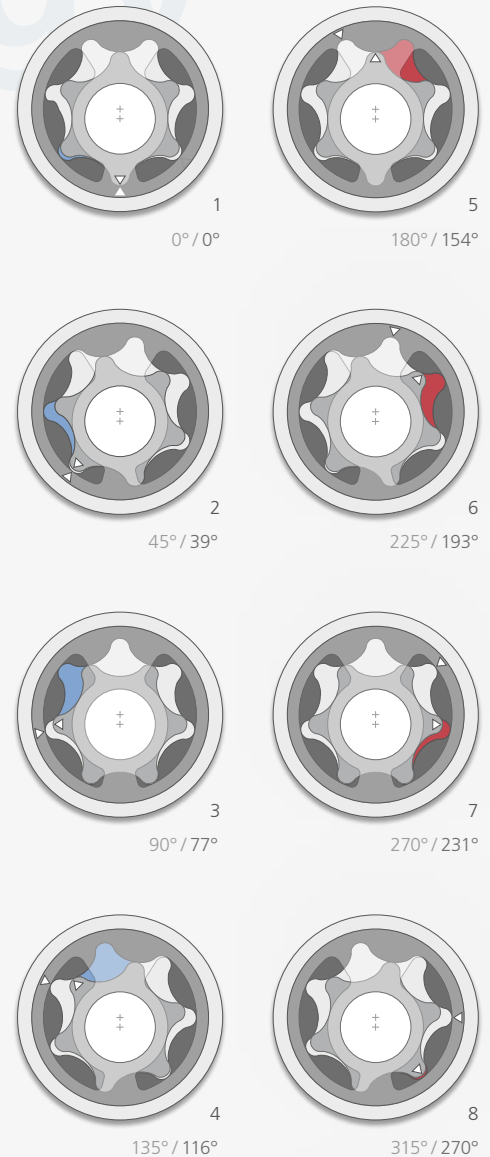
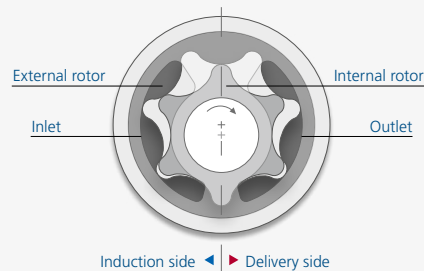
**Micro annular gear pumps** are miniaturized rotary positive displacement pumps. They are based on a so-called micro annular gear principle with an externally toothed internal rotor and an internally toothed external rotor. The internal rotor has one tooth less than the external rotor with the tooth ratios of 6/7 and 10/11 used. The manufacturing tolerances of the rotors are in the range of few micrometers.

## Operation Principle

Both rotors, which are eccentrically mounted, are intermeshed with their cycloid gearing. As a result a system of several sealed pumping chambers exists at all times. With a tooth ratio of 6/7, a chamber number of six results.

The shaft of the micro annular gear pump is connected to the internal rotor and is powered by a precisely controlled electric motor. The external rotor is mounted rotatable and is driven by the internal rotor.

As the rotors turn around their offset axes, the volume of the pumping chambers increases on the induction side and simultaneously decreases on the delivery side of the pump. A homogeneous and low-pulsation flow rate is generated between the kidney-shaped inlet and outlet which also combines several pumping chambers at the same time. The pump's conveying direction is reversible, however, a recommended direction of rotation exists.



## Patents and Trademarks

Micro annular gear pumps (and housings) are protected by issued patents: US 6,520,757 B1, US 10,012,220 B2, EP 1354135, US 7,698,818 B2, US 9,404,492 B2, DE 10 2011 001 041.6 B4, EP 2 640 977 (not yet granted), CN 103 348 141 B, HK 13 11 2934.9, EP 2 726 740, CN 103 732 921 B. In the US, Europe and China additional patents are pending. HNPM®, mzt®, MoDoS®, µDispense®, LiquiDoS®, smartDoS®, colorDoS®, are registered German trademarks of HNP Mikrosysteme GmbH.

Internal rotor / External rotor

# Pump Series

## High performance pump series



The high performance pump series is well suited for **challenging dosing tasks** requiring high precision, a middle pressure range, high temperatures and viscosities ranging from 0.3 to 1,000,000 mPas. The pump has a double-sided bearing system and is driven by a powerful DC-servo motor with integrated controller. With a large choice of additional modules such as the fluidic seal module, heating module, heat insulation module or gear modules, the high performance pumps are especially recommended for mechanical and plant engineering. Depending on the pump size, standardized connectors 1/4"-28 UNF, 1/8" NPT or 3/8" NPT are offered.

## Hermetic inert pump series



The hermetic and chemically inert series is almost **universally suitable for aggressive liquids** and therefore an innovation in pumping technology. Rotors and functional elements made from nickel-based tungsten carbide or ceramics like zirconia and alumina lend the pumps high chemical resistance and outstanding wear-resistance. With shaft and bearing material of hot isostatic pressed silicon carbide (SiC) and the housing components of alloy C 22 (2.4602), the pumps can be used with demanding oxidizing and reducing liquids, acids, bases and solvents. The pumps are designed hermetically and driven by a torsion-proof NdFeB magnetic coupling.

## Ex-versions



The high performance series pumps as well as the hermetic inert series pumps can be equipped with drives which have Ex-approval for **use in areas with potential explosion risk** or UL/CSA certification. The approval of the pumps is in compliance with ATEX according to the EU Directive 2014/34/EU.

## Low pressure pump series



The pumps of the low pressure pump series are used in analytical instrumentation for precise dosage tasks **at low pressures and for low viscosities**. They are particularly suited for lowest volumes of non-lubricating liquids. Using DC mini motors, the pumps have small dimensions and low power consumption so that they can be easily integrated into OEM applications. The pumps are suitable for metering and dosing de-ionized water, watery solutions, solvents as well as low-viscosity oils and lubricants.

## Modular pump series



The modular micro annular gear pumps are suitable for use with **light corrosive liquids**. When equipped with oxide ceramic bearing components, the pump bodies as well as the rotors can be combined from different materials dependent on the liquid to be conveyed. The rotors are available in a zirconia based ceramic and, alternately in nickel-based tungsten carbide. Alloy C 22, stainless steel 316 L, aluminium and PEEK™ form the different options for the wetted pump housing. The pump covers applications from analytical instrumentation to chemistry.

## Magnetic hermetic pump series



The pumps of the magnetic hermetic series are qualified to **handle crystallizing, air or moisture-sensitive liquids** because the pump has no shaft seal. This feature is made possible thanks to a liquid-separating cup surrounding the magnetic drive. The compact dimension of the pump is realized using a completely new product design and optimal coordination with an integrated motion controller. The pump can be used in all areas where leak-free operation and long service life as well as low energy consumption are important requirements.

## Technical Data

	V <sub>g</sub> [μl]	Flow rate range [ml/min]	Min. dosage amount [μl]**	Differential pressure [bar]**	Viscosity [mPas]
	0.001 0.01 0.1 1 10 100 1000		0 5 10 100 0.01 1 100 10 <sup>4</sup> 10 <sup>6</sup>		
mzr-2505	1.5	0.0015 9	0.25	30	0.3 25,000
mzr-2905	3	0.003 18	0.5	30	0.3 50,000
mzr-4005	6	0.006 36	1	50	0.3 25,000
mzr-4605	12	0.012 72	2	50	0.3 50,000
mzr-6305	24	0.024 144	15	40	0.3 25,000
mzr-7205	48	0.048 288	30	40 150*	0.3 1,000,000*
mzr-11508	192	0.19 1152	100	100 140*	0.3 150,000
mzr-6355	24	0.024 144	15	40	0.3 1000
mzr-7255	48	0.048 288	30	40	0.3 1000
mzr-11558	192	0.19 1152	100	60	0.3 1000
mzr-2509X2 Ex	1.5	0.0015 6	0.25	5	0.3 5000
mzr-2909X2 Ex	3	0.003 12	0.5	5	0.3 5000
mzr-4609X2 Ex	12	0.012 48	2	10	0.3 5000
mzr-6309X2 Ex	24	0.024 96	15	15	0.3 5000
mzr-7209X2 Ex	48	0.048 192	30	30	0.3 5000
mzr-11507 Ex	192	29* 58 1152	–	80	0.3 5000
mzr-6359X2 Ex	24	0.024 96	15	40	0.3 100
mzr-7259X2 Ex	48	0.048 192	30	40	0.3 100
mzr-11557 Ex	192	29* 58 1152	–	60	0.3 1000
mzr-2521	1.5	0.0015* 0.15 9	0.25	3	0.3 100 1000*
mzr-2921	3	0.003* 0.3 18	0.5	3	0.3 100 1000*
mzr-4622	12	0.012* 1.2 72	2	5	0.3 100 1000*
mzr-2542	1.5	0.0015* 0.15 9	0.25	3	0.3 100 1000*
mzr-2942	3	0.003* 0.3 18	0.5	3	0.3 100 1000*
mzr-7245	48	0.048 288	30	5 40*	0.3 10,000
mzr-11548X1	192	1.92 1152	100	15	0.3 10,000
mzr-2965	3	0.03 18	10	3	0.3 100
mzr-4665	12	0.12 72	20	5	0.3 50
mzr-7265	48	0.048 288	30	10	0.3 10

V<sub>g</sub> = Displacement volume

\* with additional equipment such as high-resolution encoder, gear box, special drive

\*\* depending on liquid and viscosity

Even if single parameters are within the indicated performance range of technical data, certain parameter combinations may not be achievable. Single parameters may exceed their indicated performance range under adequate circumstances. For detailed evaluation please contact HNP Mikrosysteme. Actual performance may vary. Specifications are subject to change without notice.



## System Design

Knowledge of the right design, the correct choice of components, their behaviour and their interactions with each other plays a decisive role in the successful development and implementation of production and testing plants. Our sales team, made up of chemists, physicists, biochemists, electrical and mechanical engineers can provide you with comprehensive advice. Discuss your application with our application engineers and take advantage of our long years of experience.

We are happy to talk about new possibilities and questions you might have. Application-specific modifications to our pumps and the control related integration are possible, as well as metering and dosing testing. We also provide support in commissioning on site and certain system solutions.

The **Modular Dosing System MoDoS®** is a tailor-made pump system for pilot plants and industrial research in the field of fine chemical and pharmaceutical production. Some components of the system are, among others, m zr®-pumps, filters, sensors, valves, control modules and bus systems. The components are selected based on our long-term experience and are integrated into the system according to your requirements. As a user, you can focus more intensively on the actual process.

The Micro **Dispense Module µDispense®** is a compact and smart dosing system for analytical instrumentation. It realizes precise dosing and metering in the microliter to milliliter range. In addition to pipetting the smallest liquid amounts during the dosing process, continuous operation as well as rinsing at high flow rates are possible as well as reversing operation. The size corresponds to half the size of the syringe pump and allows compatible integration in analytical devices.

In addition to the pump, other components such as filter, valve, flow sensor and several fluidic inputs and outputs can be integrated. Further systems are **LiquiDoS®** and **smartDoS®**.



## Service

m zr®-pumps are high-quality and durable products. The functional components are, however, subject to natural wear depending on demand and liquid. We offer professional and fast service for the replacement of components. We are, of course, available for any question during the integration, commissioning and the running process.

## Training

At demand, we provide training in our application lab which is tailored to your needs. For larger groups, we offer training and lectures at companies, universities and institutes.

# Accessories

## Drive Technology

DC drive technology is the basis for a compact design of micro annular gear pumps and their excellent calibration properties. Due to the high design and function-related requirements, only regulated **precision motors** are used. Depending on requirements with regard to discrete or continuous dosing as well as the required performance, other drive options such as stepper motors or three phase AC motors are available.

## Supplementary Modules

Depending on pump series, there are supplementary modules which increase the application range of the pumps. For metering air and moisture-sensitive liquids as well as for vacuum applications, a fluidic seal module is available. With the use of a heat insulation module, cold and hot liquids of -20 up to 200° Celsius may be delivered. Active heating of the pump head to maintain the liquid temperature is made possible using the heating module.

## Controller

The product range includes additional controller modules, such as cabinet control units and customer-specific OEM solutions with various interfaces to complement the drive technology.

The pump control **mzr-Touch Control®** with graphical user interface provides easy handling by direct input of dosing quantity, speed and duration and offers further useful features.

Two programs provide support to operate the pumps. Our own control program mzr®-pump controller is available for laboratory and test operations. Alternatively, using the software »Motion Manager« which runs under Microsoft Windows®, all drive parameters can be set and saved.

## Flow Control

Depending on the application, we offer combined systems, consisting of pump, sensor and control as well as several **flow sensors** based on different thermal principles or on the Coriolis principle.

## Filter

HNP Mikrosysteme always recommends the use of a filter with a pore size or mesh width of 10 µm to protect the micro annular gear pump. Straight inline filters and inline T-filters as well as inlet filters made of various materials with different filter surfaces are offered. Our filters can be ordered separately as single product.

## Accessories

A fluidic system consists of several individual components. We supply some products such as flow meters and controllers, valves, fittings, adapters, tubes and pipes as accessories which are tailored to the recommended micro annular gear pump.

Pump with double shell heating module



Controller



Filter



Valves



Fittings



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