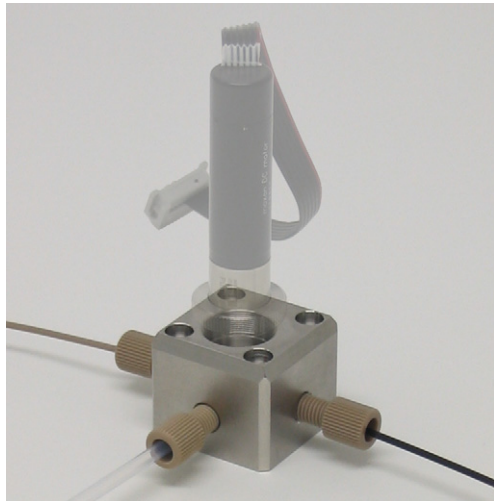


Low pressure series

**By-pass module for the Nanoliter flow range**

Flow rate starting at 1 µl/h



- **Flow rate in Nanoliter range**  
lowest flow rate from 1 µl/h to 10 ml/h
- **Pulsation free delivery**  
damped flow
- **Wide flow rate range**  
small-volume dispensing with a dynamic factor of up to 1000
- **Pressure resistance**  
generation of pressure up to 3 bar
- **Customized system**  
for use with micro annular gear pumps m zr-2521, m zr-2921 or m zr-4622

With the by-pass module constant small flow rates reaching the nanoliter range can be obtained. The technology bases on the partitioning of flow according to the relationship of the fluidic resistance of two capillaries. The flow is generated by a micro annular

gear pump and shows a very good constancy and little pressure dependence. This technology creates a pulsation-free master circulation, from which a side current is derived. Smallest flow rates starting at 1 µl/h can be achieved. Depending on the differential

pressure and flow rate range a dynamic factor of up to 1000 may be obtained. The lower limit of flow rate is defined by tuning of the two capillary tubes and can be adjusted according to customer's needs from 1 to 10,000 µl/h.

**Applications**

- Analytical instrumentation
- Microreaction technology
- Lubrication
- Biotechnology

**Technical data**

Operating flow rate range	1 – 10,000 µl/h
Differential pressure range	0 – 3 bar
Maximum inlet pressure	1 bar
Pulsation	<1 %
Temperature range	-20 ... +60 °C
Viscosity range	0.3 – 100 mPas
Fluid connection	capillary connections 1/4"-28 UNF master capillary: tube, OD 1/8" secondary capillary: tube, OD 1/16"
Materials	stainless steel 316L, PEEK
Measurements	□ 32 x 25 mm (by-pass socket without pump)
Weight	140 g (by-pass socket without pump)

Subject to technical changes.

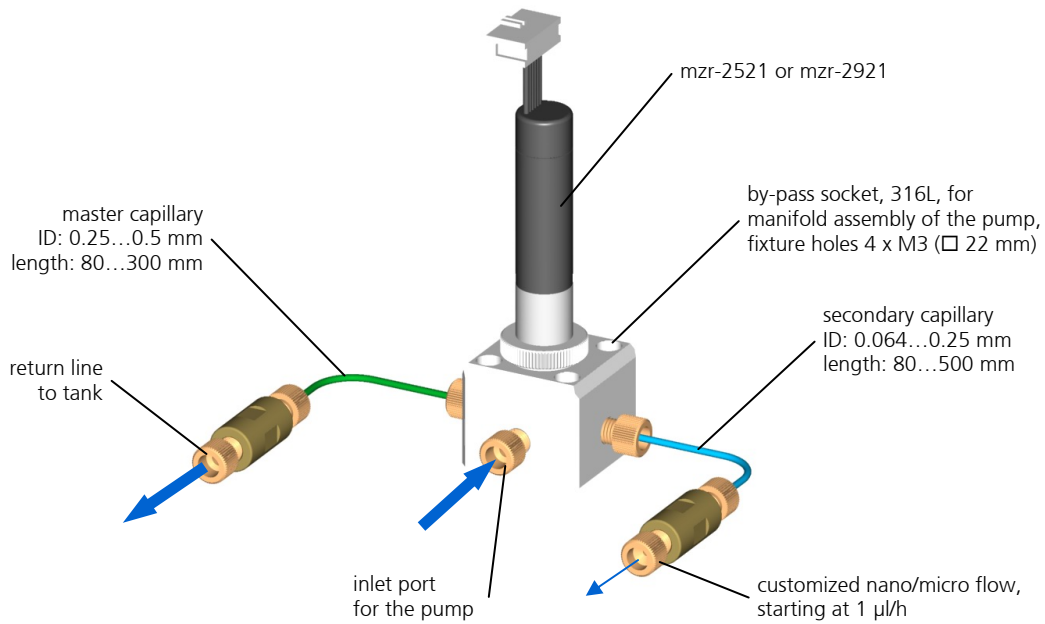
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## Setup of By-pass module and pump



Subject to technical changes.

## Working principle

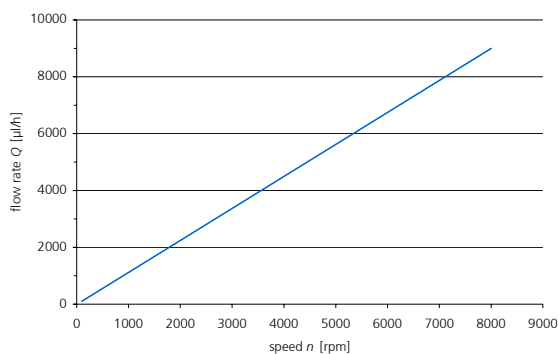
The by-pass module shown in the picture consists of a main circulation with a micro annular gear pump and a master capillary tube. A secondary capillary diverts the dosing flow from the main circulation according to the differential pressure ratio in both capillary tubes.

The customized dimensioning of the system is carried out by analogy with the bleeder chain rules in electrical engineering. The main and the secondary capillary correspond to hydraulic resistors, which split the flows reciprocally proportional. Pump size and capillaries

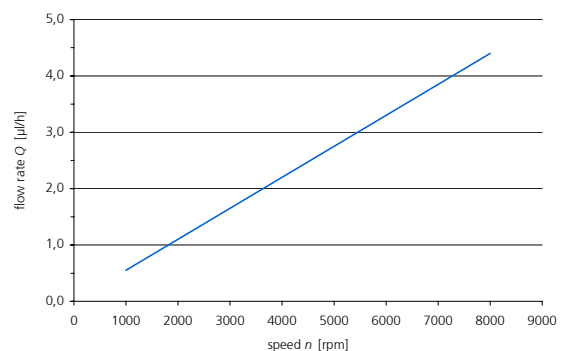
are adapted to each other in such a way that the pump is in the right working range and the desired outlet pressure is achieved. The by-pass module serves as a fixture for integration of a micro annular gear pump. The by-pass module is tested and adjusted.

## Sample characteristics

flow rate 100 – 9,000 µl/h



flow rate 0.6 – 4.4 µl/h



## Item number

11 06 03 17

By-pass system, manifold assembly for mzr-2521 and mzr-2921, for pulsation free, pressure damped nano/micro dispensing, capillaries and fittings, customized and tested flow

11 06 03 18

By-pass system, manifold assembly for mzr-4622, for pulsation free, pressure damped nano/micro dispensing, capillaries and fittings, customized and tested flow

By-pass systems for higher number of dispensing lines on request.