

Application Note

Micropumps – Active Transport on Point-of-Care Platforms

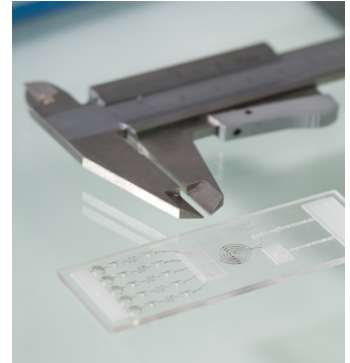
Micro system technology is a cross sectional technology, focusing on the miniaturization of technical components and devices. Nowadays it is increasingly applied in devices or technology platforms which are developed for medical diagnostics or drug development. Objective target are mobile point-of-care-(POC) systems with the aim of a near patient, decentralized and individualized diagnosis and therapy.

In such POC- systems for analysis, diagnostics or screening methods the typically required steps of sample preparation, assay technology and corresponding detection are brought together in a miniaturized format on microfluidic platforms. For all processes the handling of fluids is required.

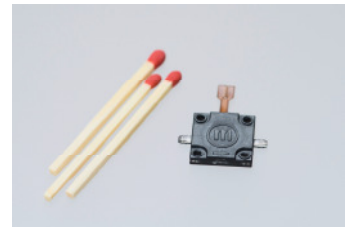
Numerous approaches employ passive fluid control techniques like capillary forces. In some applications external actuation means are additionally used for a directed transport of the media. Examples are rotary drives applying centrifugal forces for the fluid transport on the passive chips. For more targeted processes on chip active transport systems come into play. Substantial components are integrated micropumps for the fluidic transport and micro valves to direct the flow. Here the piezo membrane micropumps from Bartels Mikrotechnik open up new fields of application. Due to their simple setup, they can be produced at a low cost level, are therefore applicable as disposable, and with their particle tolerance they prove performance under real conditions.

The micropumps mp5 and mp6 can provide a maximum flow rate of 6 ml/min with liquids and about 21 ml/min with gases. By using the available evaluation kits, the pump performance can be tested in the target application and driving parameters can be defined.

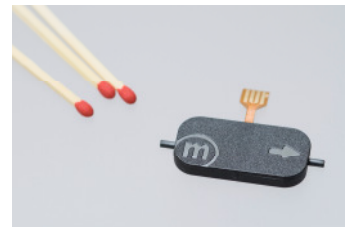
With its small dimensions, the pump can be used as a subassembly integrated on chip, being a part of the disposable. Optimal space-saving can be achieved by placing parts of the pump directly into the injection molded parts of the fluidic chip. Depending on the disposable concept of the POC platform it is alternatively possible



Physio Check - passive Lab-on-a-chip-system for diagnostics



Micropump mp5



Micropump mp6

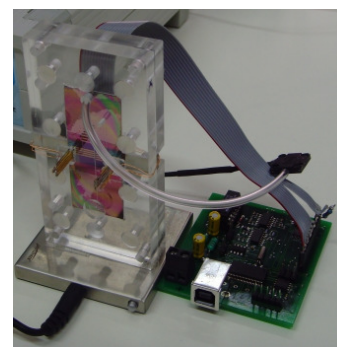


to integrate the micropump as an OEM component into the read-out unit.

Especially for portable instruments, where miniaturization plays an important role, the low energy consumption of the micropumps becomes a relevant issue. Battery operation can be easily realized. Dependent on the customers need the driving electronics can be either integrated into the main PCB of the unit or even inside an enlarged pump housing.

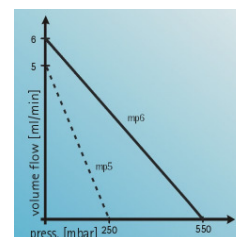
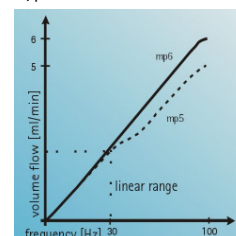
A customer application, the POC analyzer platform 'Mr. Bead' (www.microwebfab.com/Info_MrBead_D.pdf) utilizes the Bartels micropump for its liquid handling. In this case the micropump is not directly integrated on chip but will be combined together with the electronic into the chip read-out-device. Since an indirect pumping method is applied, the pump is not in direct contact with the media and can be re-used. Momentarily an immunologic assay for human diagnostics is developed. Subsequently the platform 'Mr. Bead' will be transferred to other areas of application as veterinary, food or drug of abuse screening.

Other POC developments which follow a direct integration of the micropump into the disposable are momentarily under evaluation. In case the standard micropumps are not able to fully cover the applications need, Bartels microComponents offers to develop tailor-made micropumps, system integration and the development of application specific controller.



POC analyzer platform 'Mr. Bead'

Typical Characteristics:



General Specifications	mp5*	mp6*
type	piezoelectric diaphragm pump	
pump medium	liquids or gases	liquids, gases and mixtures
outer dimensions (without fluidic connectors)	14 x 14 x 3.5 mm ³	30 x 15 x 3.8 mm ³
fluidic connectors	tube clips, 2 mm outer diameter	tube clips, 1.6 mm outer diameter
operating temperature	0 - 70 °C	
life time	> 5000 h ²	
materials in contact with media	PPSU/PI/NBR	PPSU
max. flow, water ¹	5 ml/min (100 Hz)	6 ml/min (100 Hz)
max. pressure, water ¹	250 mbar (100Hz)	550 mbar (100 Hz)
max. flow, air ¹	15 ml/min (300 Hz)	On request.
max. pressure, air ¹	30 mbar (300 Hz)	On request.

* Typical values. Values can vary under application conditions. Content is subject to changes without notice.

¹ Values taken with electronic controller mp-x set to 250 V amplitude, SRS signal

² Conditions: DI water, room temperature, settings mp-x: 100 Hz, 250 V, SRS.

