

## Flow controlled micropumps

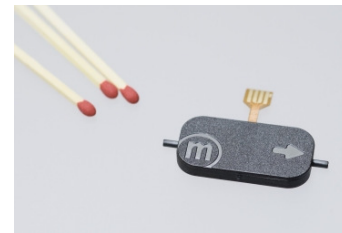
*Two new approaches of flow controlled micropumps open up innovation potential for medical applications. Their small size, low power consumption and price level provides attractive characteristics for medical devices. With either the new patented low costs intrinsic sensing solution or a hybrid system including silicon flow sensors, different accuracies and flow ranges can be achieved.*

The micropump mp6 is a micro membrane pump actuated by a double configuration of piezo elements, in combination with passive valves. The two actuator stages have been combined in a single pump for the first time. Besides providing a pressure of up to 500 mbar, the double actuator principle assures self filling of the pump at startup and reliable function. Having only a single polymeric material certified in accordance to ISO 10993 and USP class VI in contact with the medium and the fact that the pump is produced by automated assembly, allowing tracking of components and process parameters paves the way towards medical use.

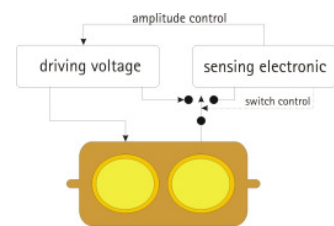
However, looking at the behavior of membrane pumps, the performance is dependent on the pressure levels at the in- and outlet. On the other hand, viscosity changes for example due to temperature changes will result in varying flow rates. In membrane pumps this effect is observed stronger than in syringe pumps as membrane pumps do not exhibit high pressure stability, and are stronger affected by changes of the liquid itself. The demand in medical applications for constant flow rates with low deviation at different environmental conditions like temperatures and pressures leads to the necessity of closed loop control of these pumps to be able to address medical applications.

The flow control in micropumps can be realized by two different approaches:

The mp6 micropump with the double actuator provides an intrinsic sensor function. The reversible piezo effect can be used for actuation (pumping) and sensing mode. By continuous operation between pumping and feedback mode, no significant drop of pump performance is observed. Lower accuracy, in the order of 10%, as requested for passive solutions like drop infusion systems can be achieved based on the intrinsic sensor function for the feedback signal. Especially at higher flow ranges under varying system conditions (e.g. pressure conditions at the in- and outlet) the piezo sensor principle provides constant performance.



Micropump mp6



Flow-sensing schematics of intrinsic sensor function



For applications in the lower flow range with higher accuracy demands as for example dosing systems for drug delivery the closed-loop can be achieved by micropumps equipped with thermal flow sensors as sensing element. Accuracies in the range of 2-5% can be achieved by such hybrid systems.

In both cases smart system electronics will give the user access to the system status and also allowing the manual administration of additional bolus rates. Both approaches offer interesting new potential for various medical applications, especially where small, portable and battery powered systems are required. Depending on the detailed requirements a custom fit system can be evaluated and realized.

Both flow controlled micropump systems are presented at the ComPaMED. The performance of the flow controlled pump is demonstrated by a pressure loaded system comparing a flow controlled micropump with the standard pump. Application specific requirements and suitability can be discussed with product manager Severin Dahms directly at the fair.

#### About Bartels Mikrotechnik

Ever since its foundation in 1996 Bartels Mikrotechnik GmbH has been a synonym for great innovative power and microtechnological know-how.

Bartels specializes in innovative applications of micro systems technology (MST) in the branches of classical consumer goods, mechanical engineering and medical technology. Microfluidics, microactuation and micromechanics constitute the company's technological focus. The international activities of Bartels Mikrotechnik subdivide into two business segments: Bartels microEngineering and Bartels microComponents.

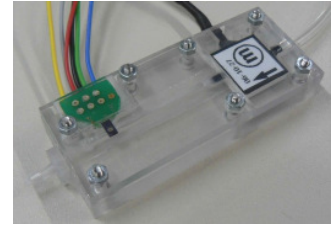
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Hybrid setup of micropump with thermal sensor

