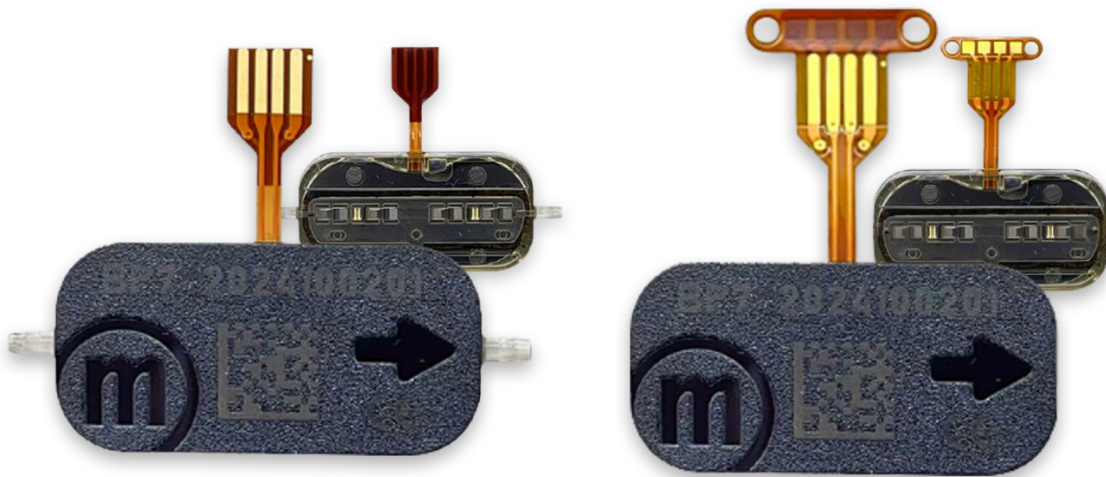


The Bartels Pump | BP7 Series Manual



1 Contents

| | | |
|------|--|----|
| 1 | Revision History..... | 3 |
| 2 | Technical Specifications The Bartels Pump BP7 series..... | 3 |
| 3 | Fluidic Specifications The Bartels Pump BP7 series..... | 4 |
| 3.1 | Dependency of pressure and flowrate | 4 |
| 3.2 | Priming..... | 4 |
| 3.3 | Cleaning..... | 5 |
| 3.4 | Performance with the three driver options..... | 5 |
| 3.5 | Typical performance of The Bartels Pump BP7 series depending on viscosity..... | 7 |
| 3.6 | Parallel and series connection | 8 |
| 3.7 | Bi-directional pumping..... | 8 |
| 3.8 | Pump Compatibility..... | 10 |
| 3.9 | Material Compatibility..... | 10 |
| 3.10 | Sound Emission..... | 11 |
| 3.11 | Low Flow Rates for Liquids (water) | 12 |
| 4 | Electronic Specifications The Bartels Pump BP7 series..... | 15 |
| 4.1 | Electronic signal | 15 |
| 4.2 | Pin-Layout..... | 15 |
| 5 | Mechanical specifications | 16 |
| 5.1 | Geometry and Handling | 16 |
| 5.2 | Internal Volumes | 17 |
| 5.3 | Mounting..... | 18 |
| 6 | Ordering Information and Packaging The Bartels Pump BP7 series | 19 |
| 7 | Important Notices..... | 19 |
| 7.1 | Warranty..... | 19 |
| 7.2 | Warning, Personal Injury..... | 20 |
| 8 | Company information..... | 21 |

1 Revision History

Changes from v1.0 to v1.1

- New sub chapter: 5.2 Internal Volumes added
- Diagrams in 3.4 updated in higher resolution

Changes from v1.1 to v1.2

- Correction in table 6: Input voltage for mp-Labtronix 7.5 and mp-Specdriver to mp-Driver
- Chapter Warning, Personal Injury: Paragraph 4 extended

Changes from v1.2 to v1.3

- Renaming from "Data Sheet" to "Guide"
- Single page data sheet extracted and separated

2 Technical Specifications The Bartels Pump | BP7 series

| The Bartels Pump series | |
|--------------------------------------|--|
| Pump type | piezoelectric diaphragm pump |
| Dimensions without connectors | 30 x 15 x 3.8 mm 1.1811 x 0.5906 x 0.1498 in. |
| Typ. Dynamic Range Flow Rate (Water) | 0 - 14000 µl/min ^{1,2} |
| Typ. Dynamic Range Pressure (Water) | 0 - 500 mbar ^{1,2} |
| Typ. Dynamic Range Flow Rate (Air) | 0 - 35000 µl/min ^{1,3} |
| Typ. Dynamic Range Pressure (Air) | 0 - 140 mbar ^{1,3} |
| Operating temperature | 0 - 70°C |
| Internal Volume | ~ 30 µl |
| Weight | 2 g |
| Burst pressure | 1.5 bar |
| Life time | 5000 h ² |
| Power consumption | ~ 50 mW ² |
| IP code | IP33 ⁴ |
| Material in contact with media | Polyphenylsulfone (PPSU) ⁵ |

Table 1 General information The Bartels Pump | BP7 series¹

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

2 Conditions: settings mp-labtronix: 100 Hz, 250 V, SRS

3 Conditions: air, room temperature 23°C, settings mp-labtronix: 300 Hz, 250 V, SRS, the max. volume flow will be reached after a few minutes of operation time.

4 Can be changed to IP44.

5 Other materials available on request

General configuration of the Outgoing Quality Control (OQC): This setup is used to define and apply the values specified in Table 1.

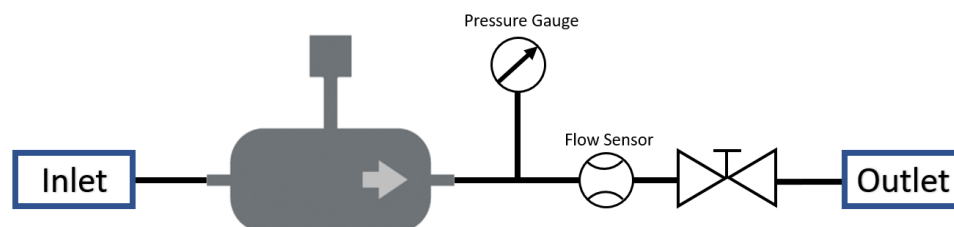


Figure 1 Schematic of OQC in production line at Bartels Mikrotechnik

3 Fluidic Specifications The Bartels Pump | BP7 series

3.1 Dependency of pressure and flowrate

Of course, the flowrate of the The Bartels Pump | BP7 micropumps can be adjusted electronically and depends on the backpressure as the following diagram shows in principle.

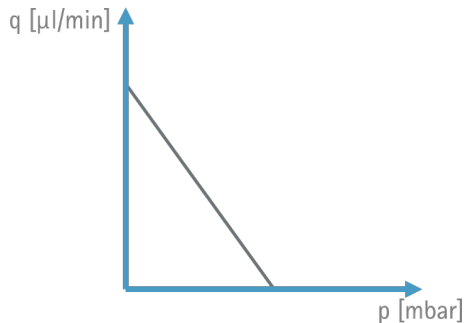


Figure 2 General dependency flow rate/ backpressure

At maximum backpressure, which can be a system pressure or a hydrostatic pressure, the The Bartels Pump | BP7 micropump needs to face, there is no flow anymore. But the The Bartels Pump | BP7 can withstand or rather keep a certain pressure.

See the diagram below for an example: The The Bartels Pump | BP7 micropump is able to reach a pressure value of up to 150 mbar for gases which equals a hydrostatic pressure of 150 cm. Now, if the height distance of a source reservoir to a target reservoir is 150 cm, the The Bartels Pump | BP7 will not be able to generate any flow. If a source is only 100 cm lower than a target reservoir, the The Bartels Pump | BP7 can suck from that reservoir and will be able to fill up the system.

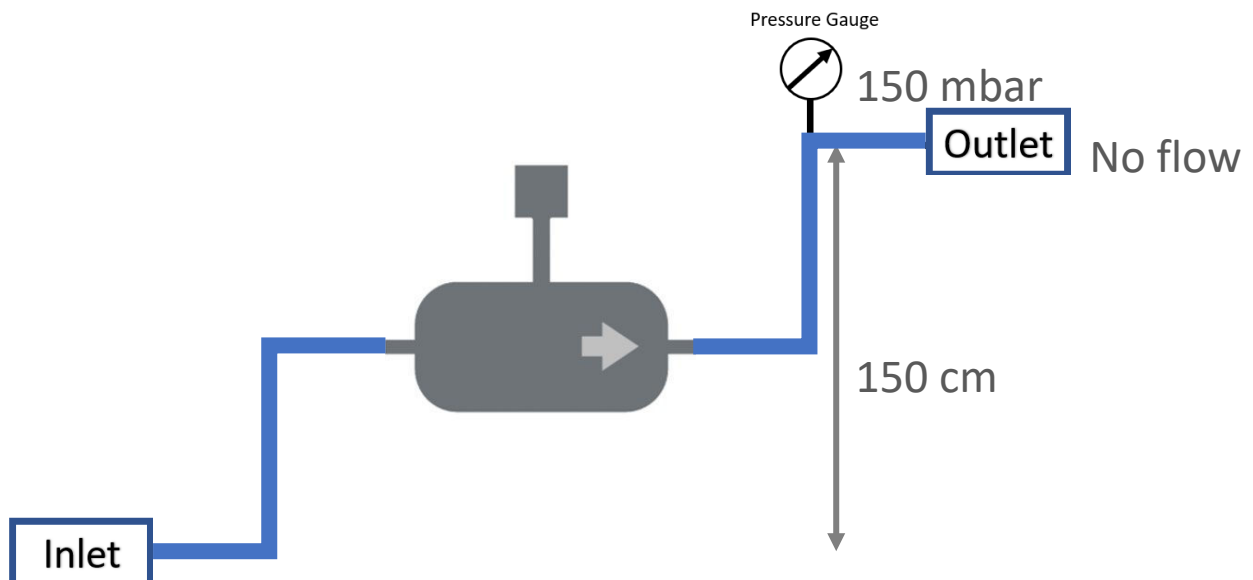


Figure 3 Example increased pressure due to height difference in the system

3.2 Priming

The The Bartels Pump | BP7 micropumps are able to transport liquids and gases. This fact allows the The Bartels Pump | BP7 to suck from a source reservoir, transporting the liquid to a target reservoir, while pumping out the air on itself. It is recommended to start with the highest voltage that is possible and a frequency of at least 300 Hz to remove the air. As soon as the liquid reaches the micropump one needs to switch to a lower frequency for best performance, e.g. 100 Hz for water.

Another option is to apply a negative pressure at the outlet. Recommended is a syringe for manual priming. It is also possible to connect an external pump, e.g. a second The Bartels Pump | BP7, only for priming the first The Bartels Pump | BP7. **Flushing is only possible in pump direction! Negative pressure at outlet is rather recommended than positive pressure at inlet!**

3.3 Cleaning

For a thorough cleaning of the The Bartels Pump | BP7 micropumps we recommend using Isopropyl alcohol (IPA). One can either rinse the system by sucking in the IPA with a syringe from the outlet or by driving the The Bartels Pump | BP7 micropump conveying IPA or Ethanol for a few minutes. Afterwards, we suggest to rinse the micropump with distilled water to get rid of any leftover alcohol from the pump channels and chambers. The pump can be washed by pumping or by flushing with the help of a syringe. **Flushing is only possible in pump direction! Negative pressure at outlet is rather recommended than positive pressure at inlet!**

3.4 Performance with the three driver options

As said before, the flowrate of the The Bartels Pump | BP7 micropumps can be adjusted electronically. Accompanying to our The Bartels Pump | BP7 micropumps we offer integrated driver solutions. The charts listed below showcase the trend of flowrates and pressures vs. the peak-to-peak voltage for different signal frequencies (for distilled water or air).

mp-Highdriver

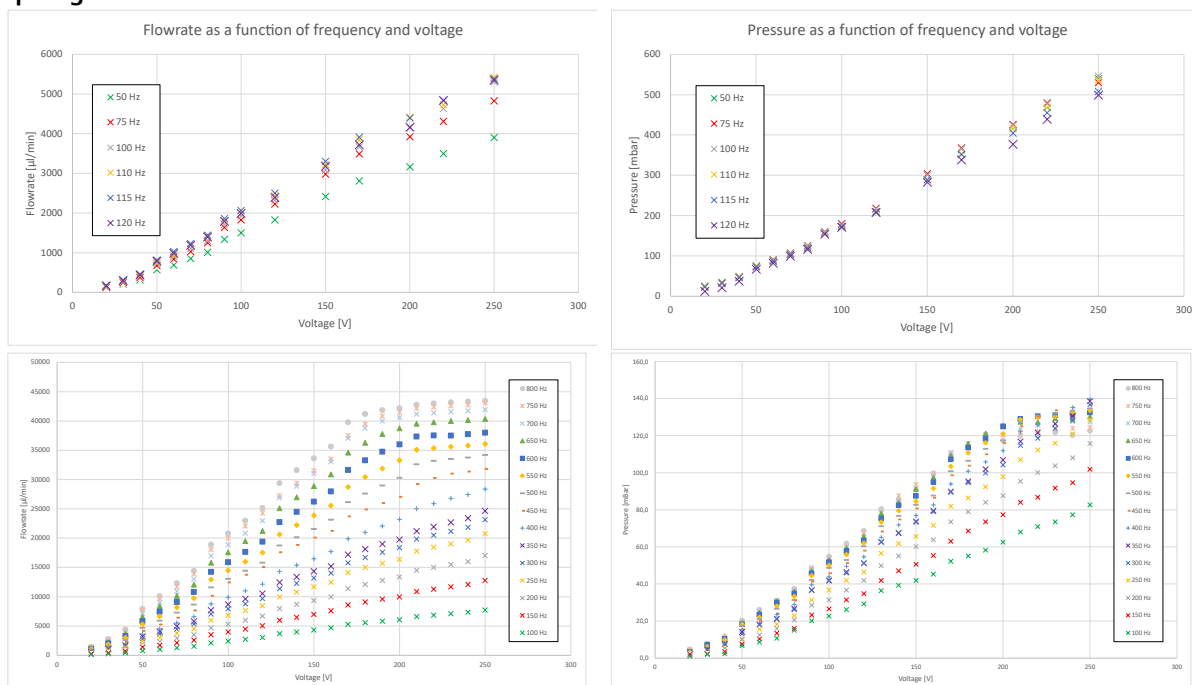


Figure 4 Typical mp-Highdriver flow rates for water (top left), water pressure (top right), flow rates for air (bottom left), air pressure (bottom right)

mp-Lowdriver

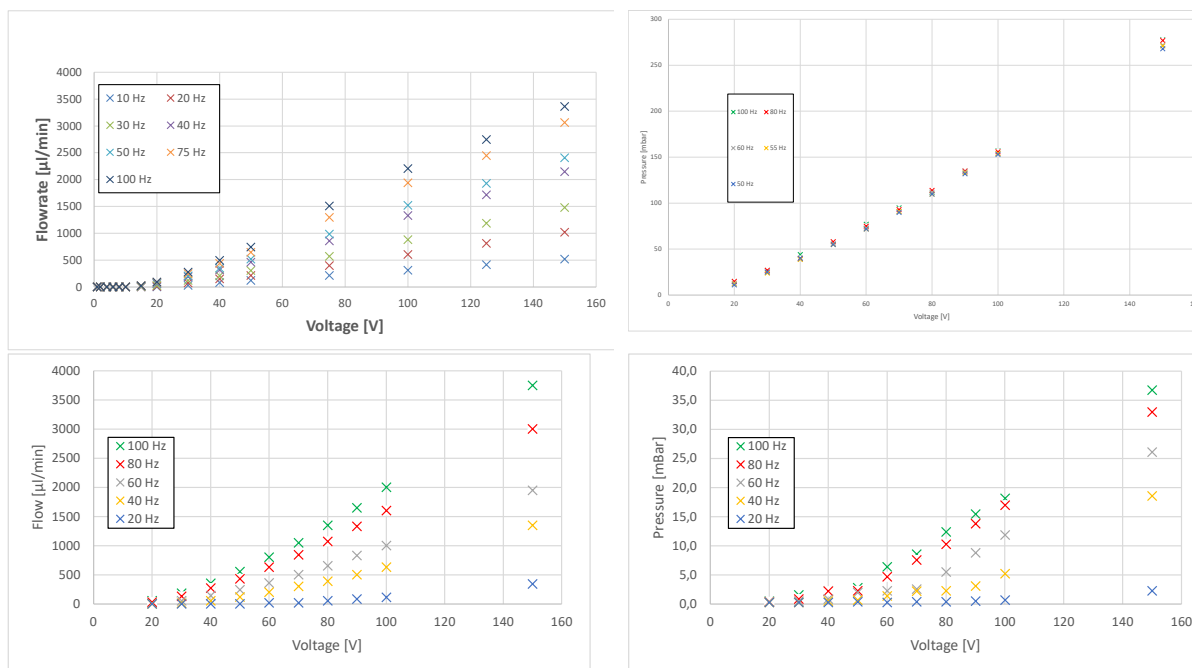


Figure 5 Typical mp-Lowdriver flow rates for water (top left), water pressure (top right), flow rates for air (bottom left), air pressure (bottom right)

mp-Labtronix

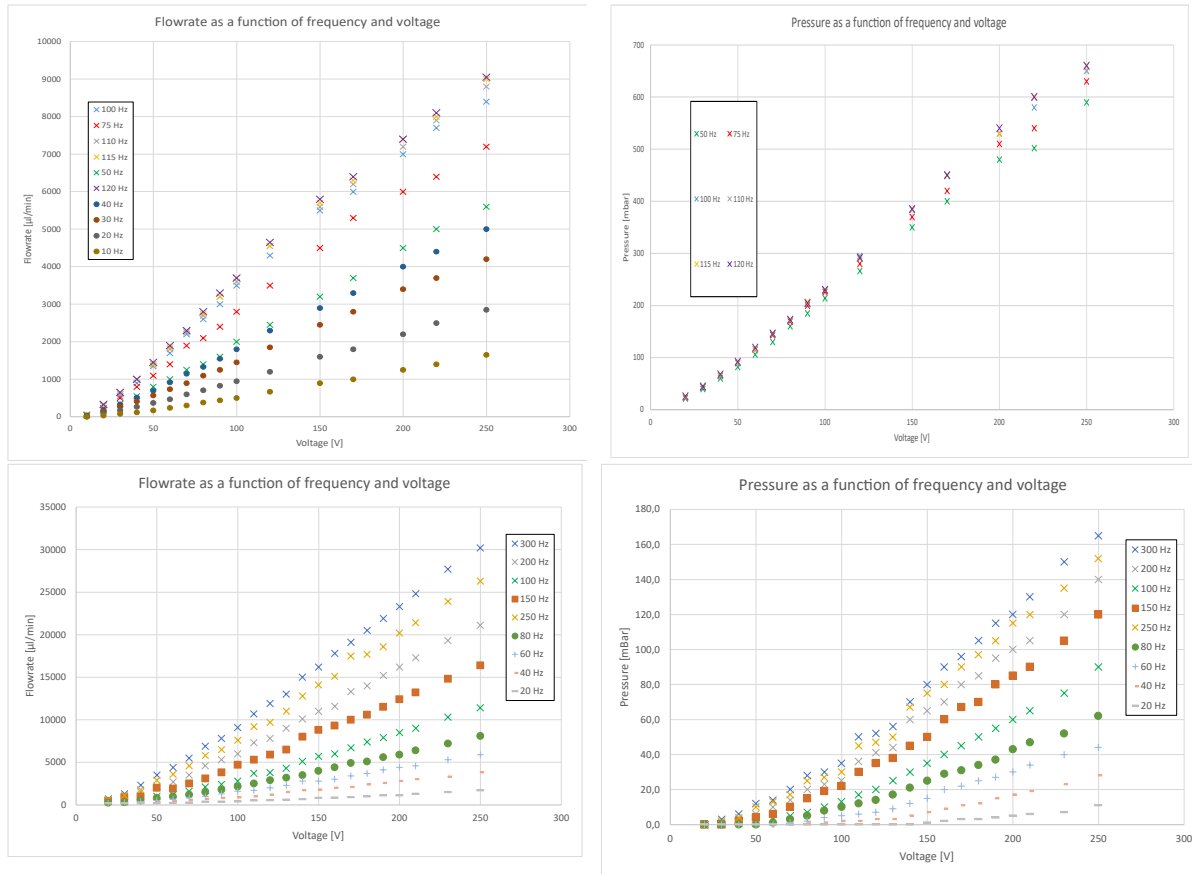


Figure 6 Typical mp-Labtronix flow rates for water (top left), water pressure (top right), flow rates for air (bottom left), air pressure (bottom right)

3.5 Typical performance of The Bartels Pump | BP7 series depending on viscosity

The micropumps performance is dependent on the viscosity of the conveyed liquid. The following figure demonstrates the difference between distilled water (1mPas) and various glycerine-water mixtures.

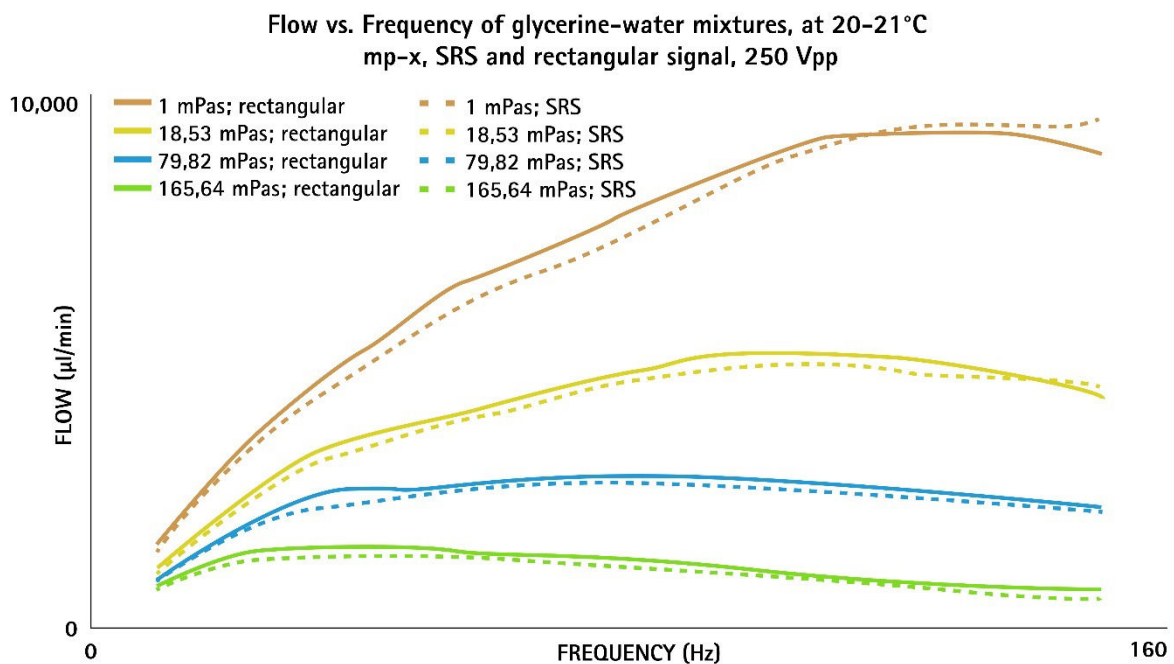
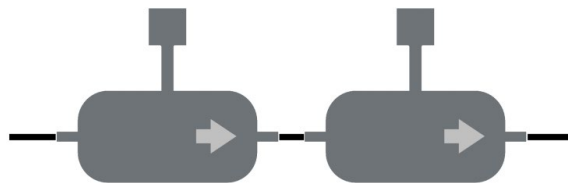


Figure 7 Difference in flow vs. frequency between distilled water (1mPas) and various glycerine-water mixtures

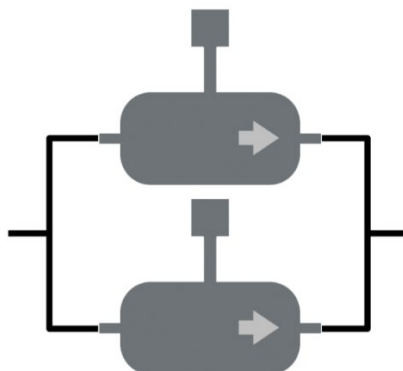
3.6 Parallel and series connection

The micropumps can be combined to achieve higher flow rates or pressure than the single unit can generate.

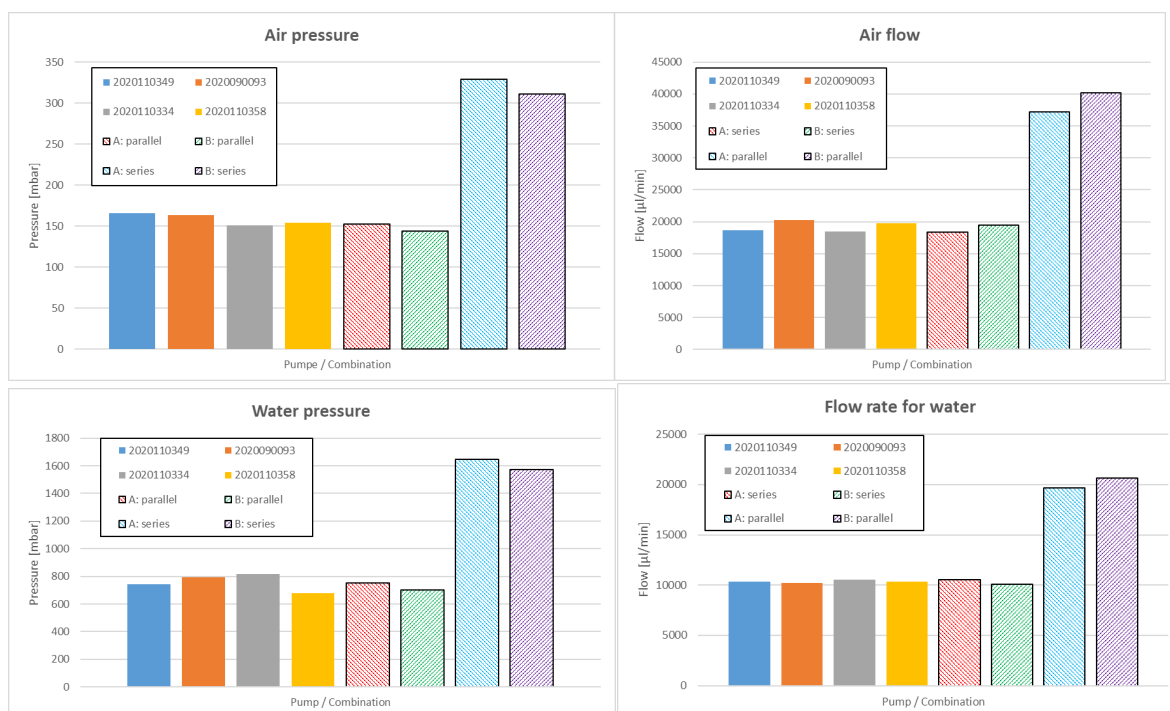
With series connection, the pressures add up.



With parallel connection, the volume flows add up.



The following diagrams prove the fact that pumps in series or respective in parallel increase the pressure or flow rate:



3.7 Bi-directional pumping

The The Bartels Pump | BP7 micropumps are unidirectional due to the pressure driven valves inside. Here two simple setups for bidirectional pumping are demonstrated. The figure below shows an assembly of four active Valves, fluid source and target, the The Bartels Pump | BP7 micropump as well as a reference flow sensor. We divided the four valves in two corresponding pairs, red and blue. Pairwise open or closed, they imply a change of direction for the liquid flow.

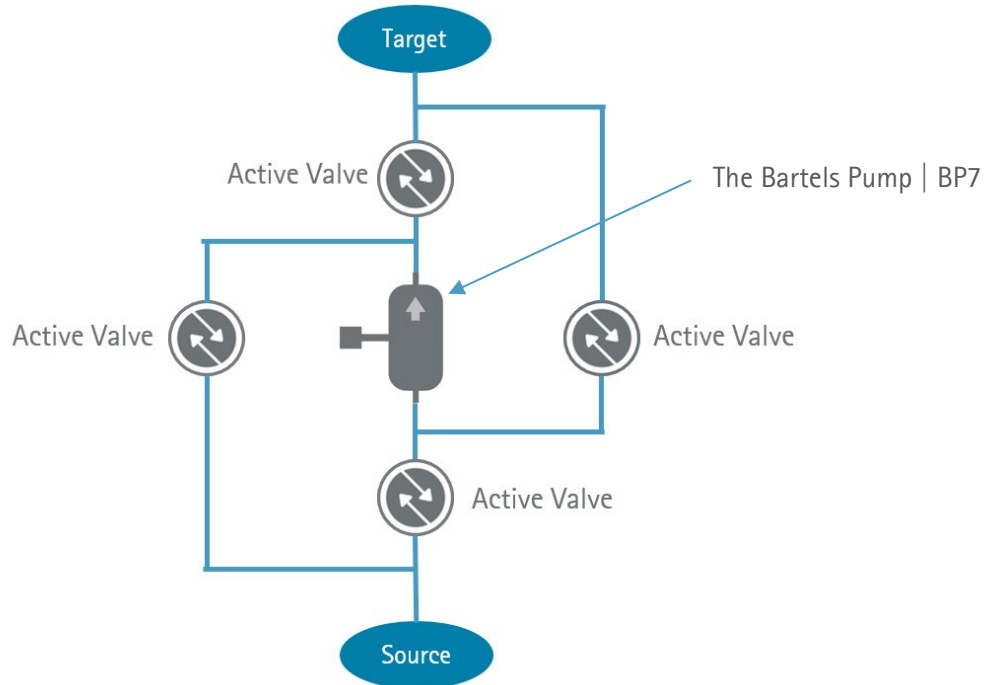


Figure 8 Block diagram for a bidirectional driven The Bartels Pump | BP7 micropump, assisted by a smart combination of four Takasago valves.

Another option is using two micropumps in opposite direction and two 2/2-way valves as shown below.

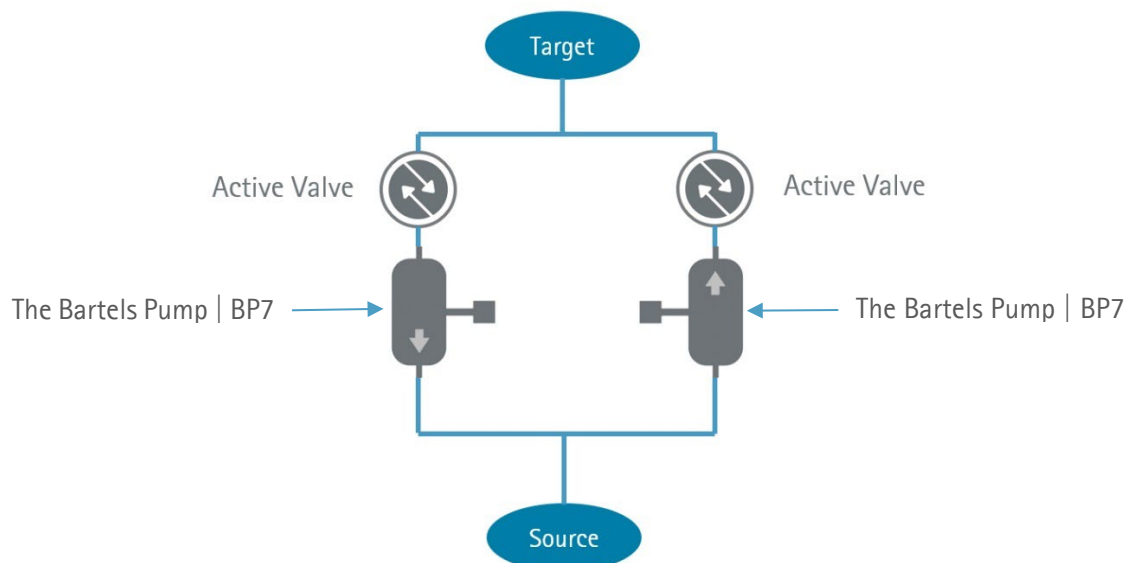


Figure 9 Block diagram for using two micropumps in opposite direction and two 2/2-way valves

3.8 Pump Compatibility

Impact of liquids on pump performance*

The following table shows the compatibility of the pump performance degradation due to the absorption of liquid molecules that change the mechanical behaviour of the internal parts of the pump. This effect has got an impact during the pumping process, but it is reversible. The pump is not permanently damaged.

Table 2 Pump Compatibility

| Reagent | Concentration (%) | PPSU |
|-------------------|-------------------|------|
| Acetone | 100 | - |
| Acetic acid | 100 | o |
| Ethanol | 100 | - |
| Ethyl acetate | 100 | - |
| Glycerin | 60 | ++ |
| Isopropanol | 100 | o |
| Methanol | 100 | - |
| Cleaning gasoline | 100 | o |
| Vacuum pump oil | 100 | + |
| Sodium hydroxide | 0,2 | ++ |

* Longterm measurements with The Bartels Pump | BP7 micropumps at 250Vpp/100Hz for two weeks

** Classification

- ++ Excellent: Little to no effect
- + Good: No serious loss of properties
- o Fair: Some negative effects, some useful properties retained
- Poor: Sever attack or rupture

3.9 Material Compatibility

Chemical resistance of polyphenylsulfone by immersion*

The following table shows the chemical impact of liquids on the wetted parts of the pumps. In this case the parts react with the liquids and are permanently damaged.

Organic Chemicals

Table 3 Chemical Compatibility

| Reagent | Concentration (%) | Weight change (%) | Classification** PPSU |
|-----------------------|-------------------|-------------------|-----------------------|
| 1,1,1-Trichloroethane | 100 | 0,0 | + |
| Acetic acid - glacial | 100 | 0,0 | + |
| Acetic anhydride | 100 | +1,0 | - |
| Acetone | | 100 | - |
| Benzene | | 100 | o |
| Butanol | 100 | 0,0 | ++ |
| Butyl acetate | | 100 | ++ |
| Carbitol solvent | 100 | 0,0 | ++ |
| Carbon tetrachloride | 100 | | ++ |
| Citric acid | 100 | +0,5 | + |
| Cyclohexane | 100 | 0,0 | ++ |
| Ethanol | | 100 | o |
| Ethyl acetate | | 100 | - |
| Ethylene glycol | 100 | -0,4 | + |

| | | | |
|--------------|-----|------|----|
| Formaldehyde | 40 | +0,4 | + |
| Formic acid | 10 | +0,6 | + |
| Glycerol | 100 | 0,0 | ++ |
| Methanol | 100 | +0,9 | o |
| Toluene | | 100 | o |

Inorganic Chemicals

| Reagent | Concentration (%) | Weight change (%) | Classification** PPSU |
|---------------------|-------------------|-------------------|-----------------------|
| Hydrochloric acid | 20 | +0,2 | ++ |
| Hydrochloric acid | 37 | +0,2 | o |
| Nitric acid | 20 | +0,5 | + |
| Nitric acid | 71 | +26,9 | - |
| Oleic acid | 100 | 0,0 | ++ |
| Potassium hydroxide | 10 | +0,5 | + |
| Sodium hydroxide | 10 | +0,5 | + |
| Sulfuric acid | 50 | +0,1 | + |
| Sulfuric acid | 97 | -11,3 | - |

Functional Fluids

| Reagent | Concentration (%) | Weight change (%) | Classification** PPSU |
|--------------------|-------------------|-------------------|-----------------------|
| Brake fluid | 100 | -0,2 | o |
| Gasoline | 100 | +0,1 | o |
| Hydraulic oil LO-1 | 100 | 0,0 | ++ |
| Jet fuel JP-4 | 100 | 0,0 | o |
| Kerosene | 100 | 0,0 | ++ |
| Motor oil 10W-40 | 100 | 0,0 | + |
| Skydrol® 500B | 100 | -0,3 | - |

* Test specimens of polyphenylsulfone were immersed in a variety of common reagents for seven days at room temperature. The effects were monitored by measuring the change in weight and noting any change in appearance.

** Classification

- ++ Excellent: Little to no effect
- + Good: No serious loss of properties
- o Fair: Some negative effects, some useful properties retained
- Poor: Severe attack or rupture

Next to aqueous solution this plastic exhibits a good chemical resistance against diluted acids and many organic solvents. Furthermore it is resistant against diluted alkali solutions. Most organic chemicals, with exception of ketones, have no influence to polyphenylsulfone in the tested time slot. From the tested inorganic reagents concentrated acids have a damaging effect to polyphenylsulfone.

As this data was determined under restricted test conditions, we recommend verifying the compatibility of the pump directly with the pumped media in the customer application. If your media is not compatible with polyphenylsulfone or if you need a different material for the The Bartels Pump | BP7-hyb, it is possible to change the material on a customer basis to suit your requirements.

Please note that Bartels Mikrotechnik can't assume any warranty and liability if a pump gets damaged through the pumping media.

3.10 Sound Emission

Driving parameters: 250 V, 100 Hz, mp-x controller

Measurement of 5 pumps, no major deviations between the pumps were observed.

| Gas performance | Sound level [dB[A]] sine signal | Sound level [dB[A]] SRS signal | Sound level [dB[A]] rectangular signal |
|-------------------|------------------------------------|-----------------------------------|---|
| Next to pump body | 33.5 - 35 | 50 - 51 | 66.6 |
| 0.3 m distance | 33.5 - 35 | 40.5 | 53.4 |
| 1 m distance | 33.5 - 35 | 40 | 52 |

Driving parameters: 250 V, 300 Hz, mp-x controller

Measurement of 5 pumps, no major deviations between the pumps were observed.

| Gas performance | Sound level [dB[A]] sine signal | Sound level [dB[A]] SRS signal | Sound level [dB[A]] rectangular signal |
|-------------------|------------------------------------|-----------------------------------|---|
| Next to pump body | 33.5 - 35 | 65 - 67 | 69.8 |
| 0.3 m distance | 33.5 - 35 | 50.5 - 52 | 54.6 |
| 1 m distance | 33.5 - 35 | 47.5 | 53 |

Driving parameters: 250 V, 100 Hz, mp-x controller, pump is filled with water

Measurement of 5 pumps, no major deviations between the pumps were observed.

| Water performance | Sound level [dB[A]] sine signal | Sound level [dB[A]] SRS signal | Sound level [dB[A]] rectangular signal |
|-------------------|------------------------------------|-----------------------------------|---|
| Next to pump body | 33.5 - 35 | 38.5 | 39.2 |
| 0.3 m distance | 33.5 - 35 | 33.5 - 35 | 36.6 |
| 1 m distance | 33.5 - 35 | 33.5 - 35 | 35.6 |

Driving parameters: 250 V, 300 Hz, mp-x controller, pump is filled with water

Measurement of 5 pumps, no major deviations between the pumps were observed.

| Water performance | Sound level [dB[A]] sine signal | Sound level [dB[A]] SRS signal | Sound level [dB[A]] rectangular signal |
|-------------------|------------------------------------|-----------------------------------|---|
| Next to pump body | 38.8 | 43.8 | 43.8 |
| 0.3 m distance | 35.4 | 37 | 37.8 |
| 1 m distance | 33.5 - 35 | 35 | 35.4 |
| | | | |

3.11 Low Flow Rates for Liquids (water)

Option A: Low power values for low liquid performance

Both mp-Labtronix and mp-Lowdriver can be adjusted down to 1 Vpp amplitude and less than 10 Hz frequency. These characteristics lead to the fact that the The Bartels Pump | BP7 can reach low fluid performances.

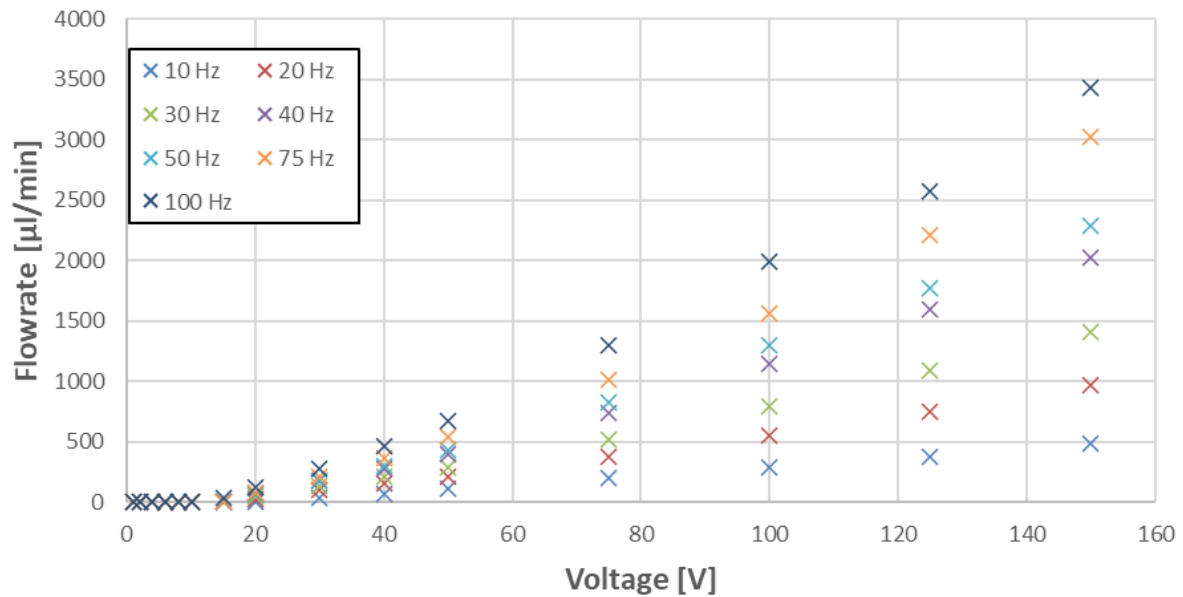


Figure 10 Example for The Bartels Pump | BP7 run by mp-Lowdriver pumping water

Option B: High frequencies for low liquid performance

Due to mass inertia and shear forces due to viscosity one can decrease flow rates by increasing the frequency. Increasing the frequency means to increase the acceleration by keeping forces constant. This behaviour can be realised by all the available drivers.

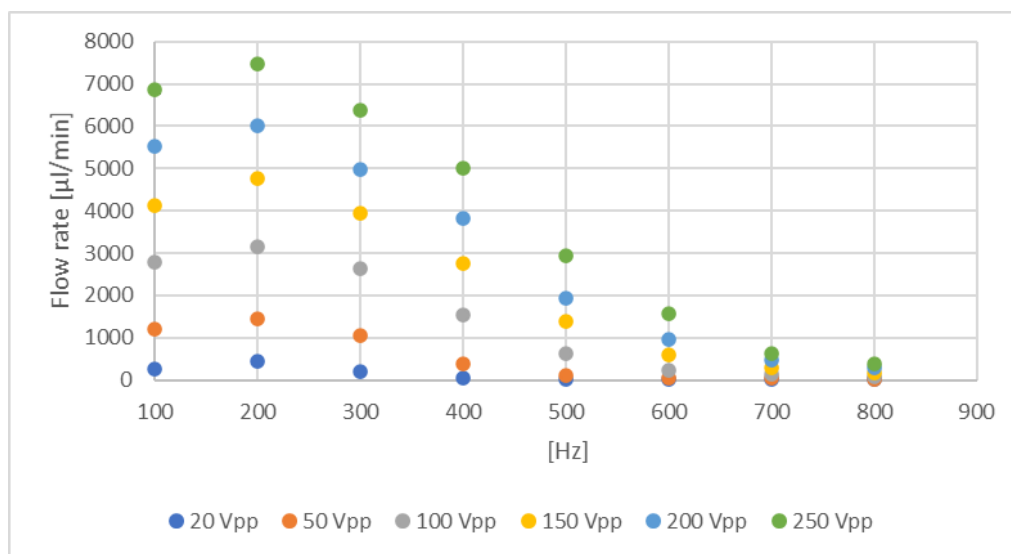


Figure 11 Example The Bartels Pump | BP7 run by mp-Highdriver pumping water (high frequencies)

Option C: Flow restriction

The following figure shows the flow rate behaviour for water of the The Bartels Pump | BP7 run by the mp-Highdriver.

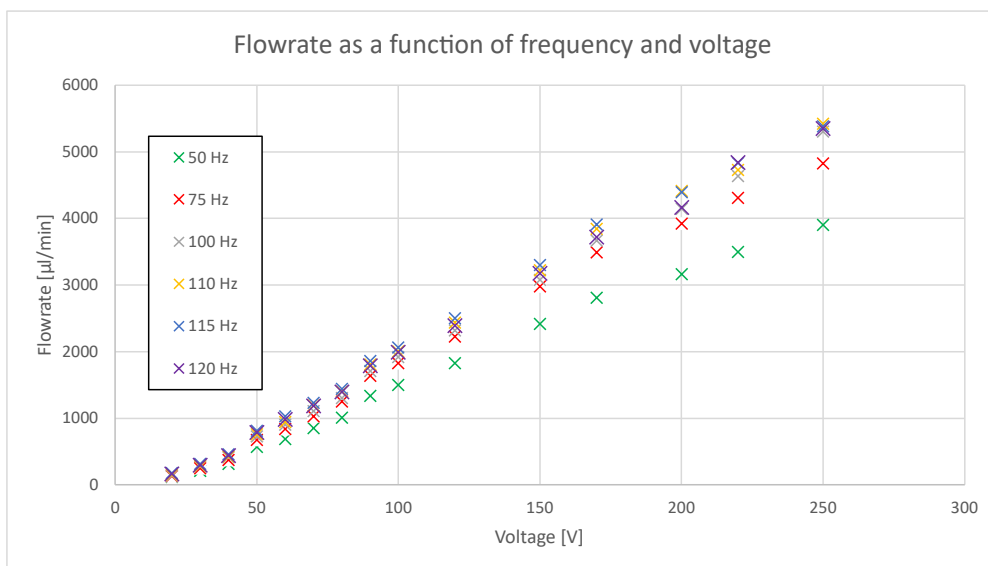


Figure 12 Example The Bartels Pump | BP7 run by mp-Highdriver pumping water (low frequencies)

The mp-Highdriver has got a bottom limit of frequency at 50 Hz. That leads to a bottom flow rate of about **100 µl/min**. For decreasing the flow rate even further it is possible to restrict the flow by a capillary for instance. The following figure shows the possible shift of the flow rate utilizing a capillary with a length of 70 mm and an inner diameter of 65 µm.

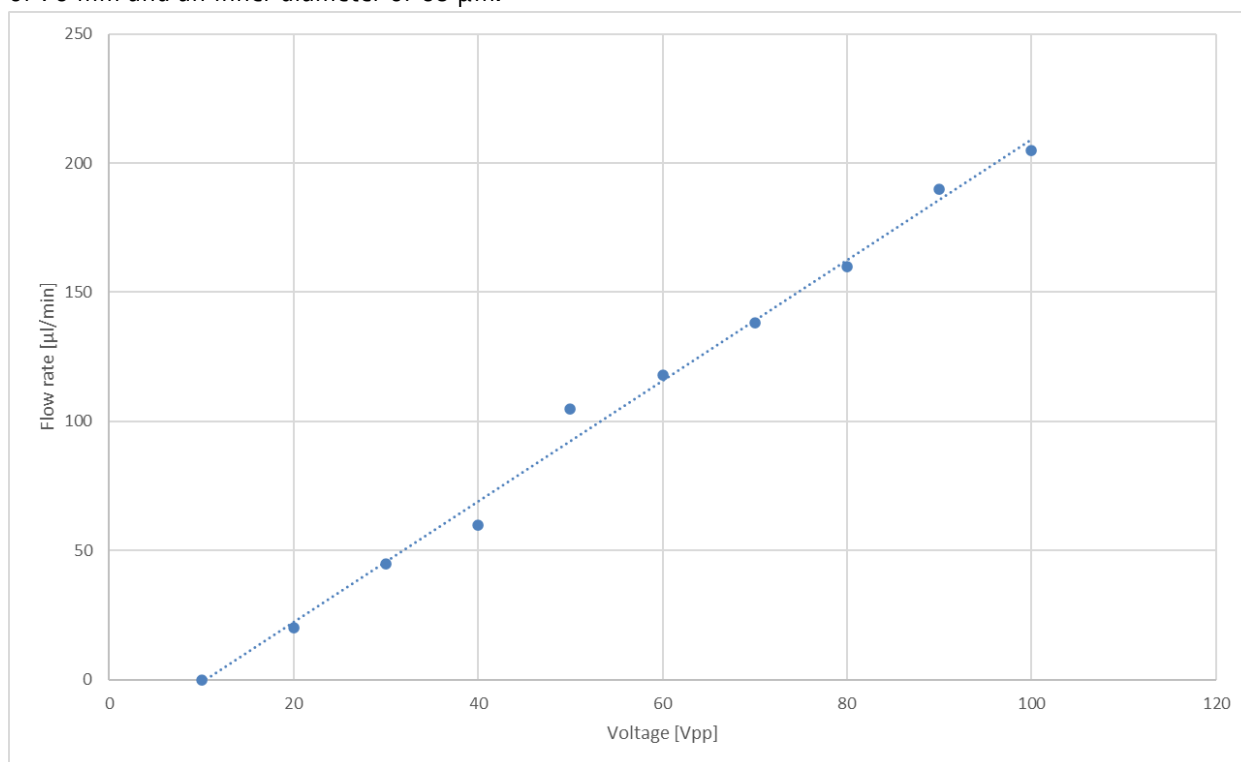


Figure 13 Flow restriction utilizing capillary l = 70 mm and ID = 65 µm with mp-Highdriver at 50 Hz pump frequency

4 Electronic Specifications The Bartels Pump | BP7 series

4.1 Electronic signal

The active components of The Bartels Pump | BP7 micropumps are two build-in piezo actuators. By driving them with an oscillating signal (e.g. sine) the actuators work as pistons to convey fluids. Additionally, they have to be driven with a 180° phase shift to each other. That way, the pulled in fluid inside the first pump chamber can be passed to the second chamber and ejected out of the pump with the next pump cycle. The figure below shows examples of possible driving signal for The Bartels Pump | BP7 micropumps.

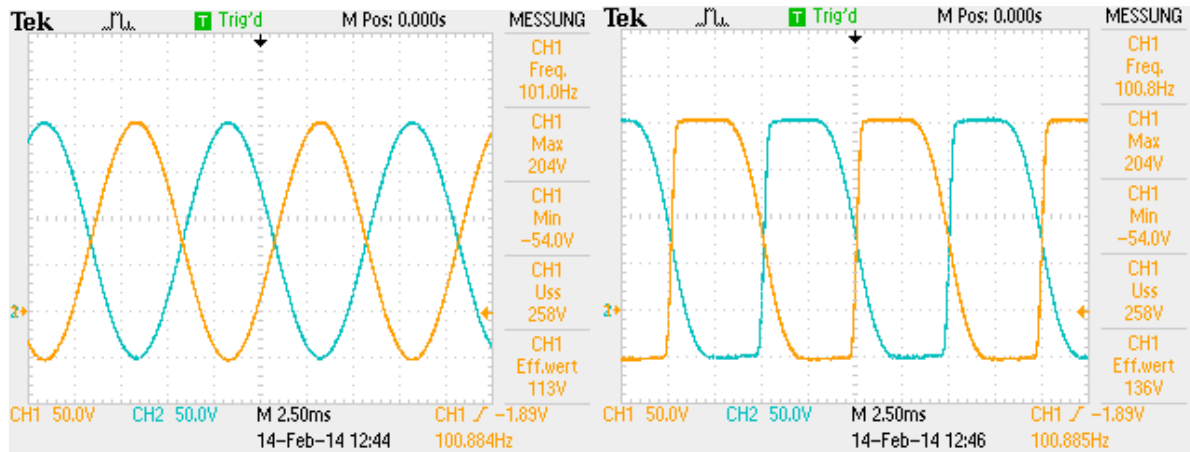


Figure 14 Scopeshots of a The Bartels Pump | BP7 micropump at 250Vpp; 100 Hz; sine signal (left); SRS signal (right) / Voltage at piezo actuator 1 \triangle CH1 & piezo actuator 2 \triangle CH2

We recommend a max peak-to-peak voltage of 250Vpp reaching from -50V to +200V. If you apply voltages higher than 270Vpp you risk a surge voltage through the piezo actuator and possibly damage your driving circuit. Furthermore, voltages under -70V can cause a reverse polarisation of the actuators leaving the The Bartels Pump | BP7 micropump unusable. Bartels Mikrotechnik provides four driving options with the following specifications:

Table 4 Overview output/input of all driver types

| Driver | Output | | Input |
|----------------|---------------------|----------------|----------------|
| | Voltage Range (Vpp) | Frequency (Hz) | Voltage (V DC) |
| mp-Labtronix | 0-250 | 1-300 | 7.5 |
| mp-Driver | 80-250 | 1-225 | 5 |
| mp-Lowdriver | 0-150 | 8-2000 | 5 |
| mp-Highdriver | 0-250 | 50-800 | 5 |
| mp-Highdriver4 | 0-250 | 50-800 | 5 |

4.2 Pin-Layout

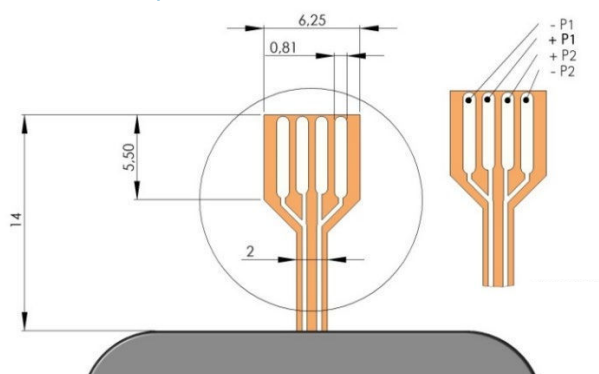


Figure 15 Schematic of the FCC connector of the The Bartels Pump | BP7 micropump; all dimensions in [mm]

The micropumps can be connected via FCC connector. The layout of the connector and pin assignment of the pumps is as shown above. Each piezo (P1 / P2) has a single lead for the negative (P1/-P2) and the positive (+P1/+P2) supply voltage.

The recommended connector is a 4-pin 1.25 mm pitch FCC connector manufactured by Molex. The straight version part number 39 53 2045. An alternative is the angulated version with the part number 39 53 2044.

The recommended maximum wire length between controller and the pump is 1 m. The customer has to assure that the assembly of pump, controller and electrical connection complies with the EMC regulations and electrical safety in the specific field of application.

5 Mechanical specifications

5.1 Geometry and Handling

The following figures name the most important parts of the pump and the geometric dimensions.

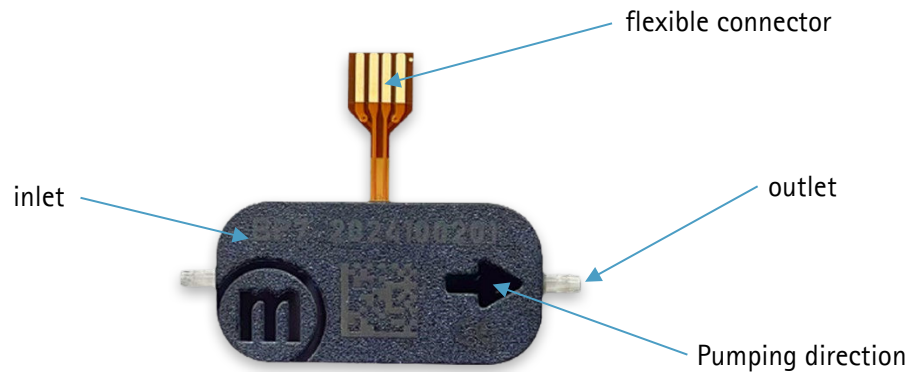


Figure 16 Overview of the The Bartels Pump | BP7 micropump

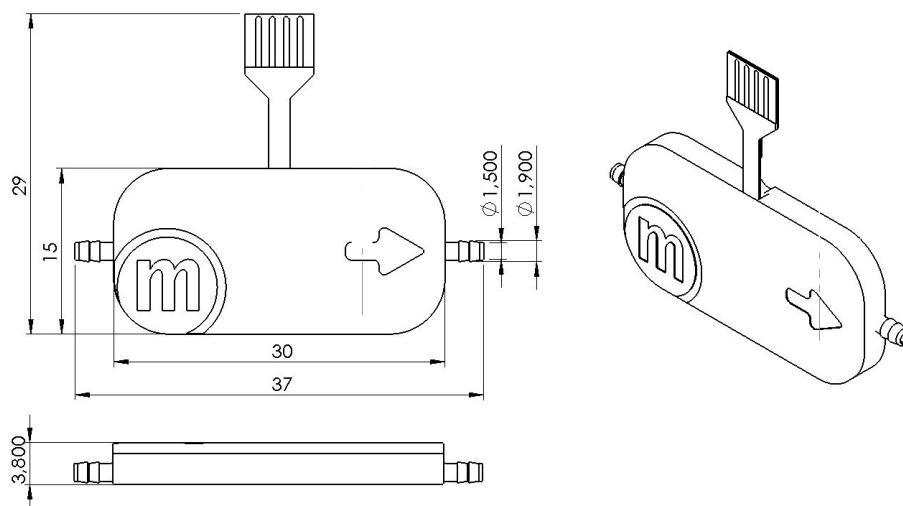


Figure 17 Dimensions in [mm] of the The Bartels Pump | BP7 micropump

You can find the CAD file in the download section on our website (<https://bartels-mikrotechnik.de/downloads/>)

Please connect suitable tubes to the inlet and outlet. The tubing should have an inner diameter of ~ 1.3 mm for all The Bartels Pump | BP7 micropumps. The micropump has to be connected to a suitable controller as described in the sections above. Bartels Mikrotechnik recommends the Tygon LMT-55 (for water-based solutions) or F4040 (for solvents) with ID = 1.3 mm and OD = 3 mm.

To connect the pumps and Molex, refer to the following three figures. Orientate both components as indicated on the first picture, the pumps facing downwards with its serial number marking (!) and the Molex connector with the four small openings visible from above. Then insert the The Bartels Pump | BP7 flex into the Molex connector (Step1). Close the Molex connector to complete the interconnection between both components (Step 2).

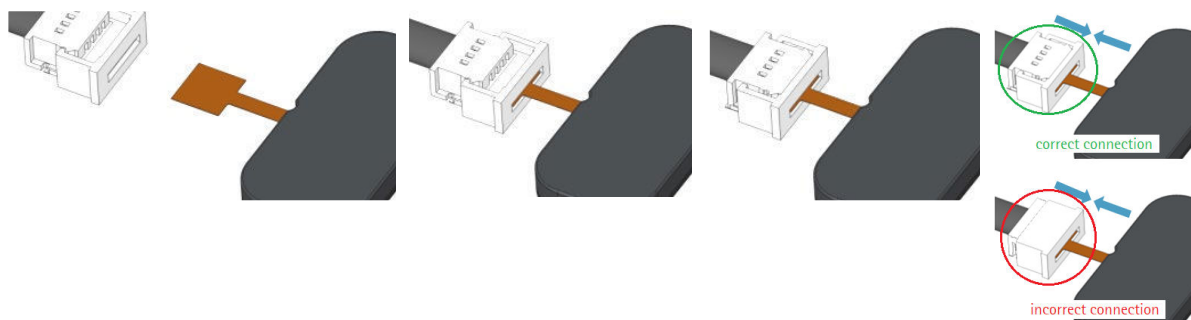


Figure 18 How to connect the The Bartels Pump | BP7 micropump to the Molex connector

When removing the micropump, the Molex connector needs to be opened first!

The Molex flex cable has contacts only on one side, so it can be connected to the Molex connector only in one way. If connected in the other way, the pump will not function.

In order to prevent damage to the flexible cable, the following points should be considered for the final pump assembly:



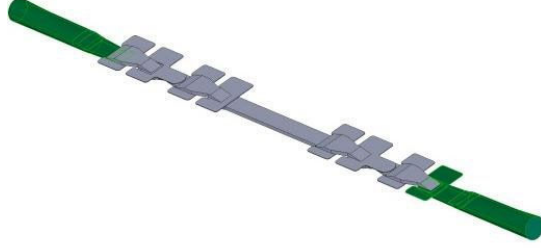
- the flexible connector must not be bent around sharp edges or kinked
- the flexible connector must not be bend on top or bottom of the pump
- the Molex connector is not watertight, additional sealing with e.g. silicone will be necessary
- fixation of the Molex connector in the final assembly is recommended



Figure 19 Important notes about the proper use of the flexible connector

5.2 Internal Volumes

| What part | Image | Volume |
|-----------|-------|--------------|
| total | | 30.2 μ l |

| | | |
|--|--|---|
| Both pump chambers |  | 13.7 μ l |
| both entrances of pump chambers |  | 1.38 μ l |
| channel area - inlet and outlet areas of tubing clips up to internal valve (areas highlighted in green) - rest |  | - inlet and outlet: 10.32 μ l - rest: 4.76 μ l |

5.3 Mounting

For mechanical mounting of the The Bartels Pump | BP7 micropumps, Bartels Mikrotechnik provides the mp-mf mounting frame. The mp-mf is made from PLA (Polylactide).

See the figures below for the possible mounting option, how to correctly insert the The Bartels Pump | BP7 micropump into the frame. M1.6 mm screws are suitable with this frame.



Figure 20 Pictures of the mounting frame mp-mf

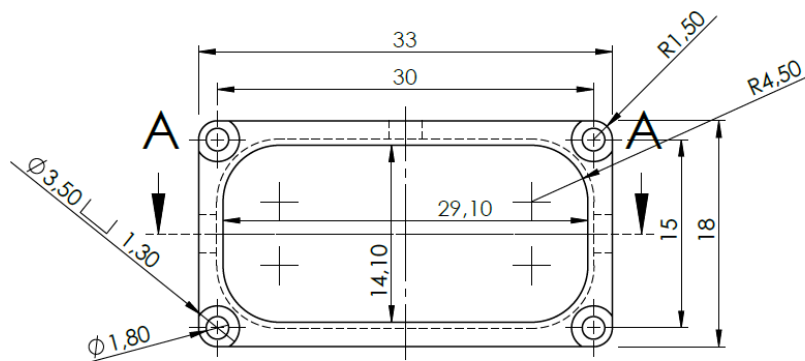


Figure 21 Dimensions of the mounting frame mp-mf

You can find the CAD file in the download section on our website (<https://bartels-mikrotechnik.de/downloads/>)

6 Ordering Information and Packaging The Bartels Pump | BP7 series

The MOQ of pumps is ten and the pumps are shipped bags. One packaging unit contains ten pumps.

| Product | Description | Order code |
|-----------------------------------|---------------------------------------|------------|
| The Bartels Pump BP7 – Tubing | Tubing pump | BM-P-0016 |
| The Bartels Pump BP7 – Mounting | Mountable pump | BM-P-0017 |
| mp-basic set | Basic evaluation kit (see below) | BM-S-0006 |
| mp-advance set | Extensive evaluation kit (see below) | BM-S-0005 |
| mp-Lab! set | Laboratory evaluation kit (see below) | BM-S-0007 |

Our evaluation kits come with everything necessary to start testing, including pump, electronics and PC application for configuration and control. The evaluation kits are suitable for laboratory testing, proof of concept and product prototyping. Contact us to request a quotation or visit our online shop to see the current portfolio of our evaluation kits (<https://bartels-mikrotechnik.shop/>).

7 Important Notices

This operating manual contains necessary instructions for the installation, commissioning, operation and maintenance of the The Bartels Pump | BP7-series. The manual is intended to help you achieving optimal results in a short time and shall also assist avoiding possible sources of errors. The operating manual of the controllers and the accessories are available separately.

The products have been designed with state-of-the-art technology and in accordance with all relevant safety regulations. However, a risk of damage to the units, other property, the operator and/or other persons cannot be fully excluded.

Always ensure that specialized and trained personnel will comply with the following general instructions. Therefore, please keep this manual and hand out copies as required.

All values are approximate and no guarantee of specific technical properties.
Changes in the course of technical progress are possible without notice.

7.1 Warranty

The The Bartels Pump | BP7 micropumps have been developed for the transport of gases or liquids. The controllers have been developed for operating the The Bartels Pump | BP7 micropumps. Bartels Mikrotechnik can assume no liability for damages resulting from the pump media. This applies especially for hazardous fluids.

The The Bartels Pump | BP7 micropumps must be operated with Bartels Mikrotechnik electronics. Bartels Mikrotechnik GmbH cannot guarantee the proper work of the units with customer specific electronics. If other controllers than the ones from Bartels Mikrotechnik are used, Bartels Mikrotechnik disclaims any warranty.

Bartels Mikrotechnik assumes no liability for abnormal handling, improper or negligent use of the The Bartels Pump | BP7 micropumps and the controller that is not conform to the specified purpose of the system. This applies especially for micropump controllers, components and systems of other manufacturers, which have not been certified by Bartels Mikrotechnik.

We guarantee that the The Bartels Pump | BP7 micropumps comply with the actual state of scientific and technical knowledge and due to this, the operational risks are limited to a minimum.

Bartels Mikrotechnik GmbH warrants solely to the original purchaser of this product for a period of 12 months (one year) from the date of delivery that this product shall be of the quality, material and workmanship defined in Bartels Mikrotechnik GmbH published specifications of the product. Within such period, if proven to be defective, Bartels Mikrotechnik GmbH shall repair and/or replace this product, in Bartels Mikrotechnik GmbH's discretion, free of charge to the Buyer, provided that:

- notice in writing describing the defects shall be given to Bartels Mikrotechnik GmbH within fourteen (14) days after their appearance
- such defects shall be found, to Bartels Mikrotechnik GmbH's reasonable satisfaction, to have arisen from Bartels Mikrotechnik GmbH's faulty design, material or workmanship
- the defective product shall be returned to Bartels Mikrotechnik's factory at the Buyer's expense
- the warranty period for any repaired or replaced product shall be limited to the unexpired portion of the original period.

This warranty does not apply to any equipment which has not been installed and used within the specifications recommended by Bartels Mikrotechnik GmbH for the intended and proper use of the equipment.

EXCEPT FOR THE WARRANTIES EXPRESSLY SET FORTH HEREIN, Bartels Mikrotechnik GmbH MAKES NO WARRANTIES, EITHER EXPRESS OR IMPLIED, WITH RESPECT TO THE PRODUCT. ANY AND ALL WARRANTIES, INCLUDING WITHOUT LIMITATION, WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, ARE EXPRESSLY EXCLUDED AND DECLINED. Bartels Mikrotechnik GmbH is only liable for defects of this product arising under the conditions of operation provided for in the data sheet and proper use of the goods. Bartels Mikrotechnik GmbH explicitly disclaims all warranties, express or implied, for any period during which the goods are operated or stored not in accordance with the technical specifications. Bartels Mikrotechnik GmbH does not assume any liability arising out of any application or use of any product or circuit and specifically disclaims any and all liability, including without limitation consequential or incidental damages. All operating parameters, including without limitation recommended parameters, must be validated for each customer's applications by customer's technical experts. Recommended parameters can and do vary in different applications. Bartels Mikrotechnik GmbH reserves the right, without further notice, (i) to change the product specifications and/or the information in this document and (ii) to improve reliability, functions and design of this product.

7.2 Warning, Personal Injury

Bartels Mikrotechnik GmbH rejects any responsibility for damages to persons or property resulting from non-compliance with the instructions in this manual. In this case all warranties shall be void.

Do not use this product as safety or emergency stop devices or in any other application where failure of the product could result in personal injury. Do not use this product for applications other than its intended and authorized use. Before installing, handling, using or servicing this product, please consult the data sheet and application notes. Failure to comply with these instructions could result in death or serious injury. If the Buyer shall purchase or use Bartels Mikrotechnik GmbH products for any unintended or unauthorized application, Buyer shall defend, indemnify and hold harmless Bartels Mikrotechnik GmbH and its officers, employees, subsidiaries, affiliates and distributors against all claims, costs, damages and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if Bartels Mikrotechnik GmbH shall be allegedly negligent with respect to the design or the manufacture of the product.

Moreover, please note that components of the controller and pump are operating with high voltage. Therefore, persons wearing pacemakers are recommended to avoid the operating system. Do not open the housing of the micropump and the controllers.

The use of liquids, which may alone or in combination create explosive or otherwise health-endangering conditions (including vapors) is not permitted.

All work in connection with the installation, assembly, commissioning/decommissioning, disassembly, operation, servicing, cleaning and repairing of the pump and the controller must be carried out by qualified, suitably trained and instructed personnel. Work on electrical components and assemblies must be carried out by supervised personnel with the necessary qualifications and skills, after verifying that the components do not lead residual voltage or charge and in a dry environment.

We guarantee that the micropumps comply with the actual state of scientific and technical knowledge and due to this, the operational risks are limited to a minimum.

ESD Precautions: The inherent design of the active electronic components, i.e. mp-Lowdriver, -Highdriver, -Highdriver4, Valvedriver and -Labtronix causes it to be sensitive to electrostatic discharge (ESD). To prevent ESD-induced damage and/or degradation, take customary and statutory ESD precautions when handling this product.

8 Company information



Bartels Mikrotechnik is a globally active manufacturer and development service provider in the field of microfluidics. In the microEngineering division, the company supports industrial customers in the modification, adaptation and new development of high-performance and market-oriented product solutions through the innovative means of microsystems technology. The second division, microComponents, produces and distributes microfluidic products and systems, especially for miniaturized and portable applications. Our key products are micropumps that convey smallest quantities of gases or liquids and are used in a variety of ways in biotechnology, pharmaceuticals, medical technology and numerous other applications.

Bartels Mikrotechnik with passion for microfluidics!

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