



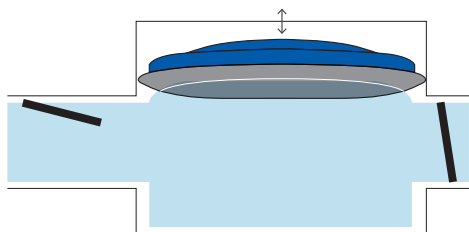
# Piezo Components for Liquid Handling

---

MICROFLUIDICS FOR IN VITRO DIAGNOSTICS

# Your Challenge

## Liquid Handling in a Small Space

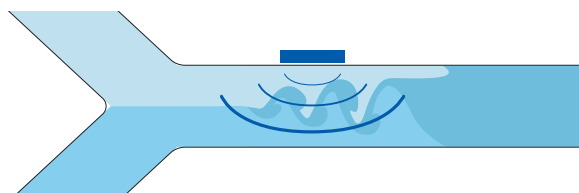


### Shock-Free Pumping of Small Liquid Volumina

Piezo components glued to substrates or membranes are suited for such applications: their bending displacement is transferred to fluid chambers, ensuring a smooth flow of the liquid. Miniaturized piezo components drive light-weight micro pumps with dimensions of less than one millimeter, which can be integrated into portable point-of-care devices.

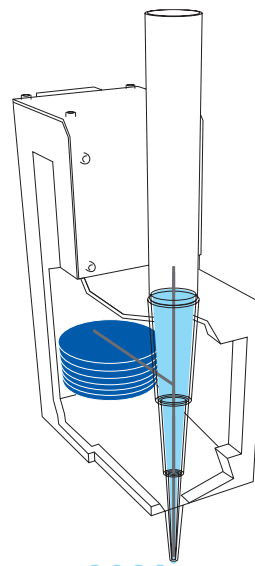
Piezoelectric microfluidic devices are used for distribution tasks whenever small volumes in the millilitre to picoliter range have to be controlled. They enable liquid handling applications in the field of in vitro diagnostics and lab automation such as

- Omics, e.g. genome sequencing or PCR
- Molecular diagnostics, e.g. ELISA testing
- Cytometry and single cell isolation
- Point-of-care and lab-on-a-chip systems
- Microarray spotting



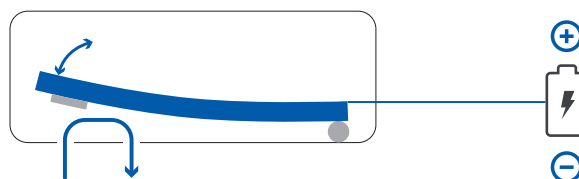
### Active Mixing Tasks

Glued on top of a pipe or capillary, piezo components such as discs or plates generate ultrasonic waves, causing local density fluctuations and micro turbulences. Active mixing can also be implemented by the use of cavitation due to power ultrasound or moving piezo actuators.



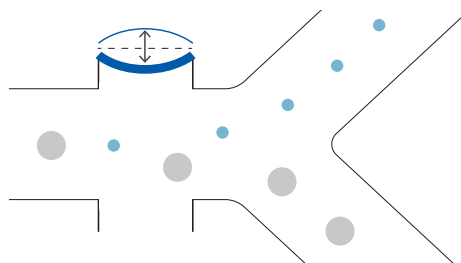
### Precise Droplet Generation

To dispense tiny droplets down to a picoliter volume, the ink-jet principle can be implemented using piezoceramic tubes. PICMA® Stack piezo actuators also offer highly dynamic motion - by placing them in a printing head, micro assays are produced generating several thousands of droplets per second with high accuracy.



### Valve Functions With Very Low Flow Rates

Piezo actuators switch valves directly or work against a closing spring or a flexible tube for volume displacement. Piezoelectric valves can be designed with PICMA® Multilayer Bending Actuators exhibiting displacement of up to a few millimeters depending on their design. Due to their extremely low energy consumption, piezo actuators are ideal for battery-operated point-of-care devices.



### Challenging Separating and Sorting Tasks

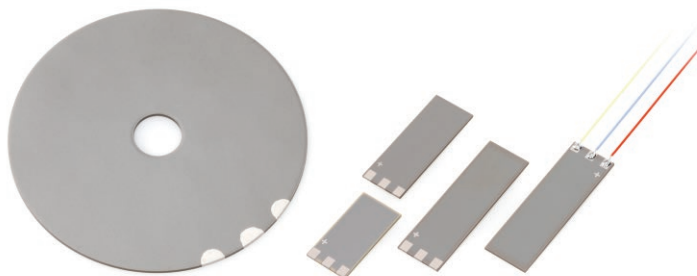
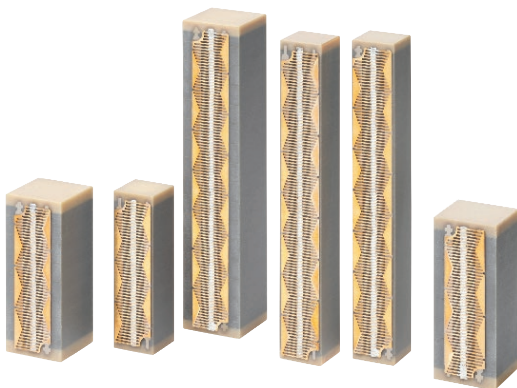
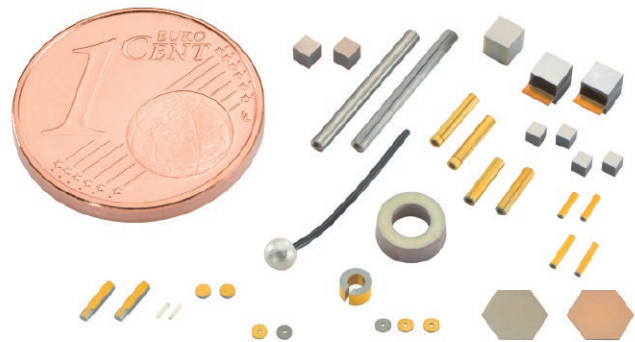
To ensure precise and fast motion, piezoelectric discs or PICMA® multilayer piezo actuators are needed. They enable instantaneous displacement of a few micrometers with a high frequency to manipulate the flow within microfluidic channels.

# Our Solution

## Piezos for Lab Automation and Point-of-Care Devices

### PIEZOCERAMIC COMPONENTS

- Various geometries (plates, discs, tubes) as well as freeforms
- Electrodes with thick film silver or thin film Au, CuNi etc.
- Fully customized geometry, dimensions and electrode design possible
- Miniaturisation down to dimensions of less than one millimeter
- Plug-and-play with contacted components using wires, braids or flexible PCBs
- Assembling of components by means of bonding with substrates or membranes
- Connection technology including matching layers, seismic masses and housings, insulation, potting and encapsulation



### PICMA® STACK & PICMA® BENDER PIEZO ACTUATORS

- Low operating voltage
- Microsecond response
- High force suitable for highly viscous fluids
- Extreme durability
- Subnanometer resolution
- Benders show high displacement of up to 2 millimeters
- Customized designs including end pieces, electrical connection and assembling



## Headquarters

### GERMANY

**PI Ceramic GmbH**  
Lindenstrasse  
07589 Lederhose  
Phone +49 36604 882-0  
Fax +49 36604 882-4109  
info@piceramic.com  
www.piceramic.com

### Physik Instrumente (PI) GmbH & Co. KG

Auf der Roemerstrasse 1  
76228 Karlsruhe  
Phone +49 721 4846-0  
Fax +49 721 4846-1019  
info@pi.ws  
www.pi.ws

### PI miCos GmbH

Freiburger Strasse 30  
79427 Eschbach  
Phone +49 7634 5057-0  
Fax +49 7634 5057-99  
info@pimicos.com  
www.pi.ws

## ACS Motion Control

### ISRAEL

**ACS Motion Control Ltd.**  
Ramat Gabriel Industrial Park  
1 Hataasia St.  
Migdal HaEmek, 2307037  
POB 984  
Phone +972-4-6546440  
Fax +972-4-6546443  
info@acsmotioncontrol.com  
www.acsmotioncontrol.com



## PI Subsidiaries

### USA (East) & CANADA

**PI (Physik Instrumente) L.P.**  
Auburn, MA 01501  
www.pi-usa.us

### USA (San Francisco Bay Area)

**PI (Physik Instrumente) L.P.**  
Sausalito, CA 94965  
www.pi-usa.us

### ITALY

**Physik Instrumente (PI) S. r. l.**  
Bresso  
www.pionline.it

### FRANCE

**PI France SAS**  
Aix-en-Provence  
www.pi.ws

### JAPAN

**PI Japan Co., Ltd.**  
Tokyo  
www.pi-japan.jp

### CHINA

**Physik Instrumente (PI Shanghai) Co., Ltd.**  
Shanghai  
www.pi-china.cn

### SOUTHEAST ASIA

**PI (Physik Instrumente) Singapore LLP**  
Singapore  
www.pi-singapore.sg  
For ID / MY / PH / SG / TH / VNM

### KOREA

**PI Korea Ltd.**  
Seoul  
www.pikorea.co.kr

### USA (West) & MEXICO

**PI (Physik Instrumente) L.P.**  
Irvine, CA 92620  
www.pi-usa.us

### UK & IRELAND

**PI (Physik Instrumente) Ltd.**  
Cranfield, Bedford  
www.physikinstrumente.co.uk

### NETHERLANDS

**PI Benelux B.V.**  
Sint-Oedenrode  
www.pi.ws/benelux

### SPAIN

**Micos Iberia S.L.**  
Vilanova i la Geltrú  
www.pimicos.es

**PI Japan Co., Ltd.**  
Osaka  
www.pi-japan.jp

**Physik Instrumente (PI Shanghai) Co., Ltd.**  
Beijing  
www.pi-china.cn

### TAIWAN

**Physik Instrumente (PI) Taiwan Ltd.**  
Taipei  
www.pi-taiwan.com.tw

© Physik Instrumente (PI) GmbH & Co. KG  
All contents, including texts, graphics, data etc., as well as their layout, are subject to copyright and other protective laws. Any copying, modification or redistribution in whole or in parts is subject to a written permission of PI.

Although the information in this document has been compiled with the greatest care, errors cannot be ruled out completely. Therefore, we cannot guarantee for the information being complete, correct and up to date. Illustrations may differ from the original and are not binding. PI reserves the right to supplement or change the information provided without prior notice.

Follow us on:   