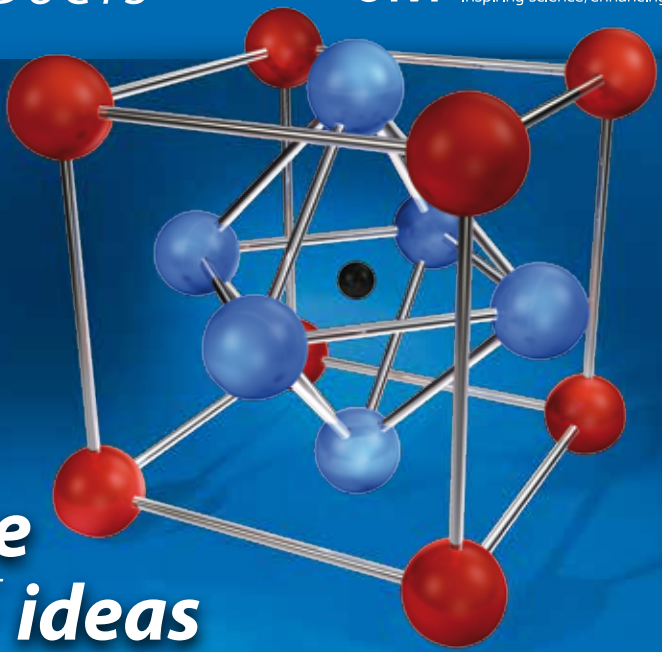
PIEZO PRODUCTS

JM Johnson Matthey
Inspiring science, enhancing life



We **move**
your **ideas**

Johnson Matthey
Inspiring science, enhancing life

PIEZOELECTRIC CERAMICS

SUITED TO MEET YOUR NEEDS

For more than 40 years we have been developing and producing Piezoceramics and other Piezo products in high volumes for a wide range of applications. Our experience and ability to produce high volumes of bending actuators and systems with Piezoceramics, mechanics and electronics, allow us to offer products of the highest quality combined with competitive prices. Our products are customized and well known for their long lifetime and reliability. We have produced and sold more than 100 million products worldwide.

We are the leading manufacturer of Piezo bending actuators for different applications in a variety of markets.

WWW.PIEZOPRODUCTS.COM

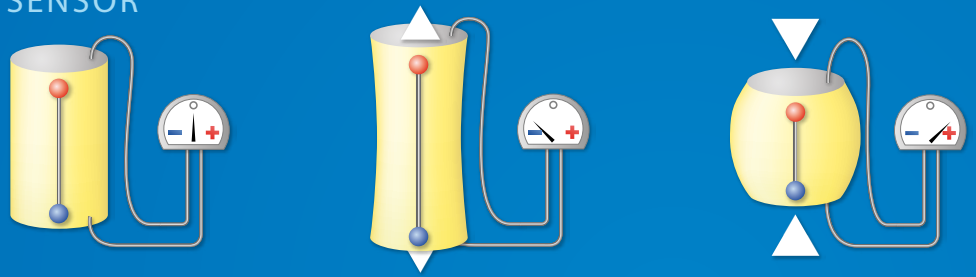
THE PIEZO-EFFECT

MOVES YOUR IDEAS

In 1880 Jacques and Pierre Curie discovered that when deformed under mechanical stress, quartz crystals became electrically charged – positively and negatively – on prism-shaped surfaces. They called this reaction the piezoelectric effect. Above a certain temperature (called the Curie temperature) these kinds of materials possess a cubic elementary cell with a centre of symmetry. The main areas of the positive and negative charges are found in the centre of the elementary cell of the crystal. The materials are paraelectric. There is no detectable piezoelectric effect.

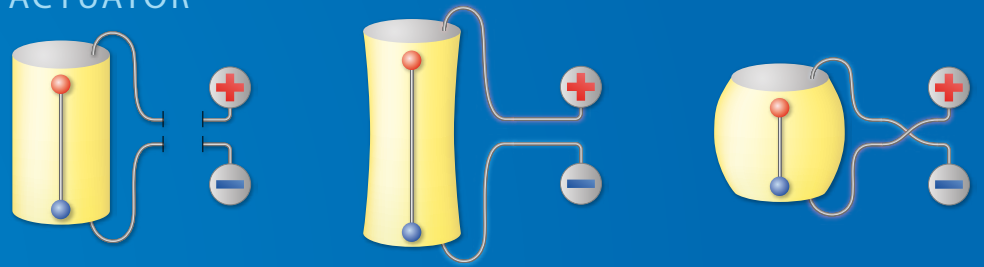
Below the Curie temperature, the materials show a spontaneous polarisation. This spontaneous polarisation is caused by the displacement of ions of the elementary cell, resulting in the loss of the centre of symmetry. The main areas of the positive and negative charges are no longer to be found in the centre of the elementary cell of the crystal. The elementary cell possesses an electric dipole. The piezoelectric properties of the ceramics, important for applications, are only produced by this polarisation process. In this case, the ceramics are exposed to a very strong electric field.

SENSOR



deformed under mechanical stress, quartz crystals become electrically charged

ACTUATOR



the same materials undergo dimensional change under the influence of an electric field

PIEZOELECTRIC PRODUCTS

FOR ACTUATOR AND SENSOR APPLICATIONS

BASIC MATERIALS

Single and multilayer ceramics, such as:
- Disks
- Plates
- Specially shaped parts

BENDING ELEMENTS

Single layer and multilayer bending actuators for:
- Braille equipment
- Textile machines
- Hard disk drives
- Valves
- Gas flow controls
- Switches
- Piezoelectric generators
- Medical equipments
- Automotive applications

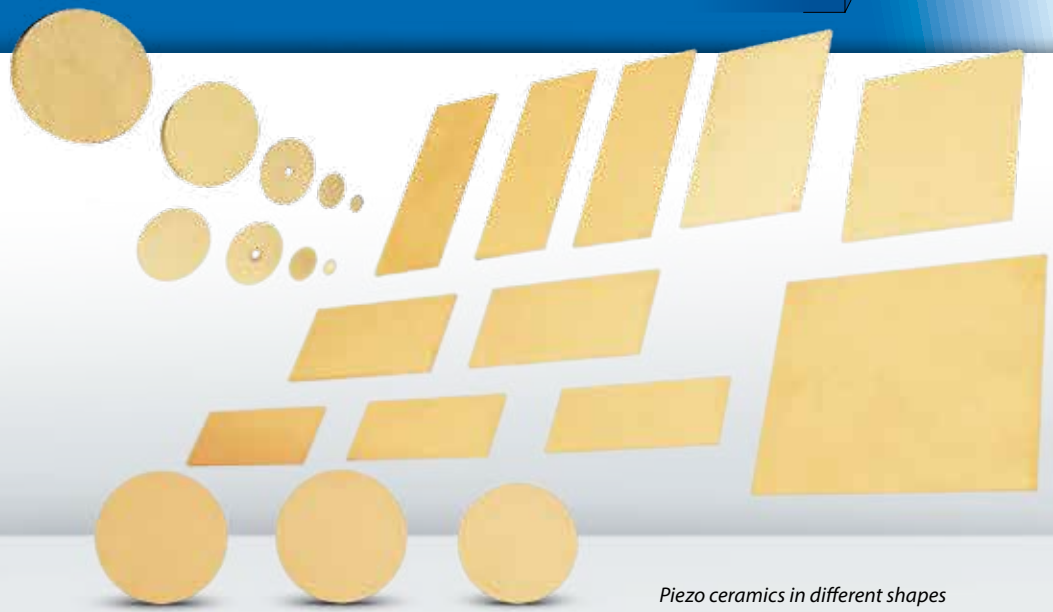
Ultrasonic transformers for:
- Flow measuring

MODULES AND DEVICES

Textile machine modules for:
- Jacquard machines
- Raschel machines
- Circular knitting machines
- Warp-knitting machines

Ultrasonic atomizers for:
- Refrigerated cabinets
- Household appliances
- Toys
- Medical Inhalers
- Greenhouses
- Medical Devices

Piezoelectric generators for:
- Energy harvesting applications
- Non-battery operated radio switches



Piezo ceramics in different shapes

BENDING ACTUATORS

customized bending actuators
for different applications

MODULES AND DEVICES

atomizing system
for medical devices

LIQUIFOG®
atomizing system,
e.g. for cooling counters

module for single needle
selection in warp knitting machines

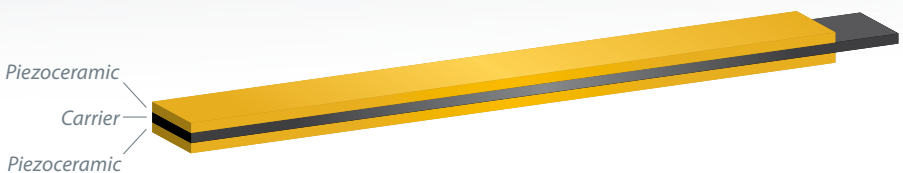
module for single needle selection
in circular knitting machines

all from one source:
customized modules and devices with Piezo ceramics
as the core technology plus mechanics and electronics

WORKING PRINCIPLE

PIEZO BENDING ACTUATOR

When two piezoelectric ceramic plates are bonded together with a supporting material and counter-actuated, this results in a pronounced deformation of the composite similar to the case of a bimetal. Its design enables deflections of several millimetres and forces up to several Newton and a short cycle time of a few milliseconds can be achieved. Therefore, the Piezo bending actuator can be employed as a high performance and fast-reacting control element. Due to the high speed of deflection, productivity is higher compared to the use of electromagnets. As a result of its compact design, the Piezo bending actuator takes up significantly less space.



PIEZO BENDING SENSOR

Piezo ceramic benders can also be used as sensors. Bending generates a charge/a voltage on both ceramic layers. Parallel connecting both ceramics layers will add their charge. Thus they are suitable for measuring big and small movements/vibrations/accelerations and energy harvesting.

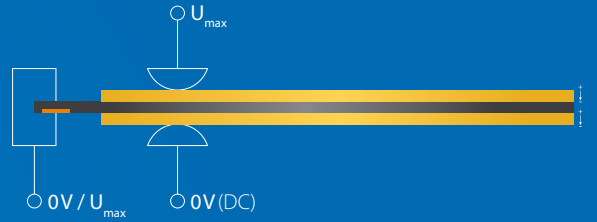
Our Piezo benders usually have a working life of more than a billion cycles.

The contraction of the ceramic when the operating voltage is applied results in deflection and force on the tip of the bending actuator. Or, if a force is applied to the tip, this generates an electrical charge.

OVERVIEW BENDING ACTUATORS

A SMALL SELECTION OF OUR ACTUATORS AND THEIR TYP ICAL CHARACTERISTIC VALUES

	TYPE 1	TYPE 2	TYPE 3	TYPE 4	TYPE 5	TYPE 6	TYPE 7	TYPE 8	TYPE 9	TYPE 10
Material [1]	M1100	M1100	M1876	M1100	M1876	M1100	M1876	M1334	M1100	M1334
Total length [mm]	49.95	49.0	47.4	47.4	47.0	36.0	32.5	25.0	12.5	9.0
Free length [mm]	38.0	38.0	38.0	38.0	38.0	30.0	27.5	18.0	9.5	6.5
Width [mm]	7.2	2.1	1.9	1.5	5.9	2.1	1.9	7.2	11.0	1.0
Thickness [mm]	0.80	0.90	0.80	0.80	0.80	0.67	0.70	0.48	0.80	0.50
Total displacement [mm] [2]	2	2	2.2	1.8	2.8	1.4	1.4	0.05	0.10	0.07
Blocking force on each side F_b [mN] [2], [3]	450	150	180	100	500	150	180	50	2100	130
Capacity per ceramic side C [nF] [4]	45	14	18	10	60	11	10	40	16/21 [6]	1.9/2.3 [7]
Operating voltage U_{max} [V] [5]	230	230	230	230	230	230	230	24	230	130



[1] *cf. Specification sheet piezoelectric Ceramics*

[2] *Unlimited displacement and blocking force will be determined at U_{max} at the specified free length and at 23°C ambient temperature*

[3] *The deflected bending actuator will be pressed back to zero position to determine F_b.*

[4] *Capacity is measured at 1V/1kHz and 23° C ambient temperature.*

[5] *Recommended operating voltage is 0.8 x U_{max}*

[6] *With a ceramic length of 10.5 mm and 12.5 mm*

[7] *With a ceramic length of 7.7 mm and 9 mm*

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

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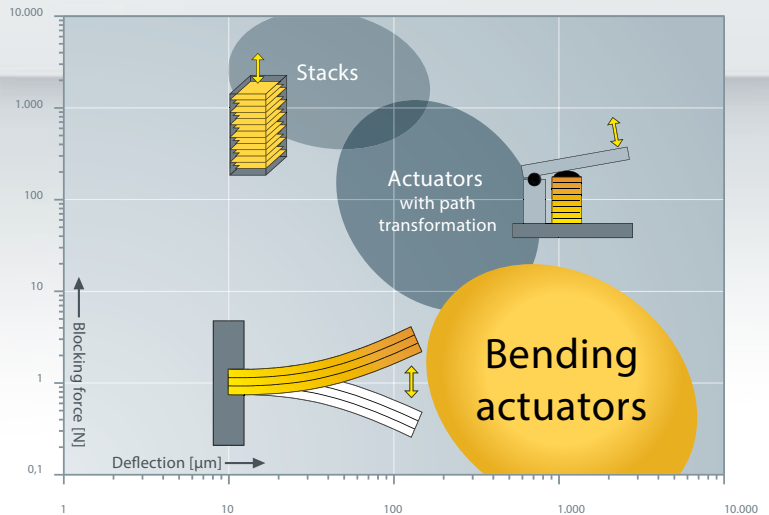


Performance features of three different kinds of Piezo actuators:
Comparison of values of force and deflection of stacks, actuators with path transformations and bending actuators.

BENEFITS

OF PIEZOCERAMIC BENDING ACTUATORS

The bending actuator produces no heat ▸ NO COOLING is required

Lower energy consumption compared to the solenoid ▸ REDUCED OPERATING COSTS

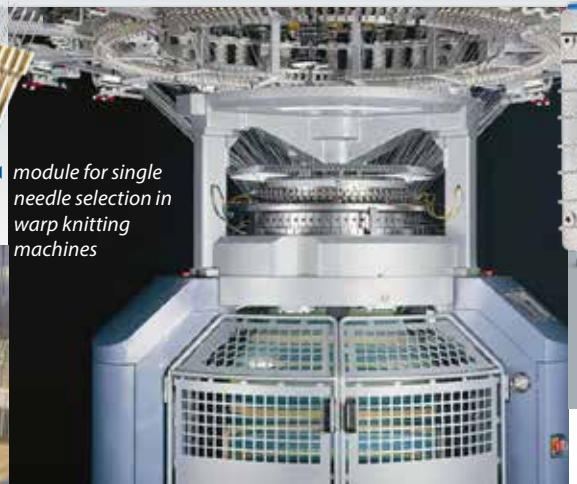
Rapid positioning speed ▸ significantly INCREASED PRODUCTIVITY

Higher reliability ▸ REDUCED DOWNTIME

Compact construction of the bending actuators ▸ significantly LESS SPACE

Silent operation ▸ MOST CONVENIENT AND COMFORTABLE workplace

PIEZOCERAMIC BENDING ACTUATORS AND SYSTEMS WITH ELECTRONICS AND MECHANICS



module for single needle selection in warp knitting machines

module for single needle selection in circular knitting machines

circular knitting machine

PIEZOCERAMIC BENDING ACTUATORS AND ATOMIZERS

Piezo inhaler

Braille keyboard

battery free radio switch

humidifier „Liquifog“ for cooling counters

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IN A PERFECT COMBINATION

PIEZOELECTRIC CERAMICS AND ELECTRONICS

FROM PIEZOELECTRIC CERAMIC ELEMENTS TO PIEZOELECTRIC MODULES

Johnson Matthey Piezo Products is well known for its competence in development and production in all areas of electrical engineering, electronics and mechanics. This enables us to find Piezo solutions for all types of industry.

We are able to correctly match ceramic and electronic parts together and to supply them as a module according to individual customer requirements. We can supply a complete system for control, actuator and sensor modules.

bending element protected by a cage

PIEZOELECTRIC CERAMICS COVER A WIDE RANGE OF APPLICATIONS

circular knitting module with electronics

The two key features used are deflection and a controlling force which are applied variably in different actuator systems. We are specialized in piezoelectric modules. A complete Piezo system – for example, a control module for textile machines – consists of the "Piezoelectric ceramic bending actuator" component, mechanical parts and driving electronics. We can add a control computer to the system as an option. We work closely with our customers to achieve the best possible solution for their requirements.

TYPICAL PIEZO APPLICATIONS

WE MOVE YOUR IDEAS

Textile Machine Industry

As a control element in the manufacture of patterned fabrics for curtain and lace.

Braille Instruments

Piezoelectric bending actuators control the pins in Braille keyboards. This enables the blind and the partially sighted to „read" the contents of a line.

Industrial Automation

Pneumatic valves such as for electro-pneumatic position regulators for opening and closing pipelines.

Automobiles

Piezo ceramic products have been used in the automotive industry in different fields of application for many years. Our Piezo elements were first used in cars 25 years ago. We continue to work with innovations and pioneering process technologies to create new applications.

Airplanes

Our Piezo products are distinguished by their high reliability, and are present even in aircrafts, where the demands on the materials used are very high.

Medical Applications

Our Piezoelectric bending actuators and atomizers are perfectly suitable to work precisely and reliably in medical devices and in aerosol therapy. There is a wide range of medical applications where Piezoceramic systems offer the right solutions.

HIGHEST QUALITY

MODULES AND DEVICES

Piezo systems developed and produced at one site ▸ HIGHEST QUALITY

All from one source – Piezoceramics, electronics and mechanics ▸ ONE PARTNER

Fast handling and easy maintenance ▸ HIGHEST PRODUCTIVITY

Special coating ▸ LONGER LIFETIME

Customized solutions ▸ OPTIMIZED FOR YOUR APPLICATION

WWW.PIEZOPRODUCTS.COM

SUMMARY

JOHNSON MATTHEY PIEZO PRODUCTS

More than **40 years of experience** in Piezo technology

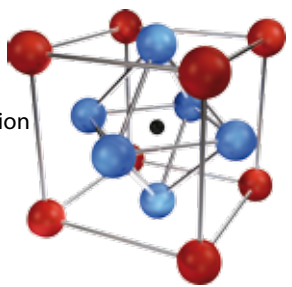
Main products are **bending elements, atomizers, modules and devices**

Customized products available for actuator and sensor applications as well as for energy harvesting

Market leader for bending actuators

Over **100 million Piezo products** produced

Long term partnerships from the initial idea through to series production



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