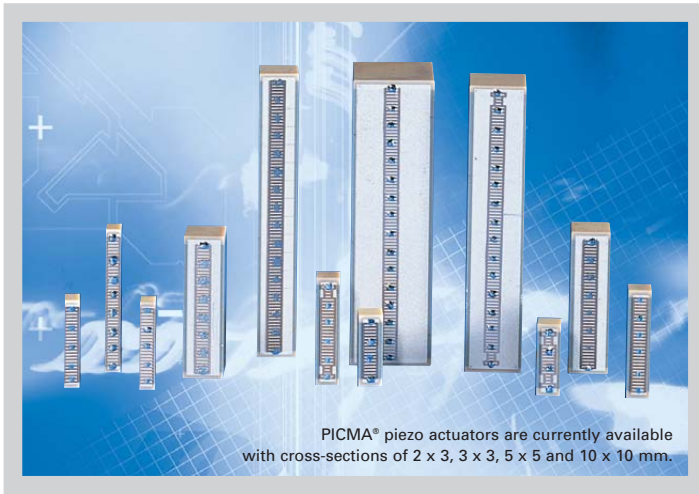


P-882 - P-888

PICMA® High-Performance Monolithic Multilayer Piezo Actuators (LVPZT)



PICMA® piezo actuators are currently available with cross-sections of 2 x 3, 3 x 3, 5 x 5 and 10 x 10 mm.

- Award-Winning Technology
- Low Operating Voltage
- Superior Lifetime Even Under Extreme Conditions
- Very Large Operating-Temperature Range
- High Humidity Resistance
- Excellent Temperature Stability
- High Stiffness
- UHV Compatible to 10⁹ hPa
- Sub-Millisecond Response & Sub-Nanometer Resolution

Increased Lifetime and Higher Performance

PICMA® (PI Ceramic Monolithic Actuator) piezo actuators are characterized by their high performance and reliability, even in extremely harsh environ-

ments. They are superior to conventional multilayer actuators in industrial applications and high-endurance situations, where they show substantially longer lifetimes both in static and dynamic operation.

Application Examples

- Precision mechanics and mechanical engineering
- Nanopositioning / high-speed switching
- Active and adaptive optics
- Vibration cancellation
- Pneumatic & hydraulic valves
- Metrology / interferometry
- Life sciences, medicine and biology

New Production Process, Optimized PZT Ceramics

PICMA® piezo actuators are made from a ceramic material in which the piezoceramic properties such as stiffness, capacitance, displacement, temperature stability and lifetime are optimally combined. The actuators' monolithic design and special electrode structure was made possible by advances in production technology. This development is just one reflection of the more than 30 years experience

PI has with thousands of industrial PZT applications.

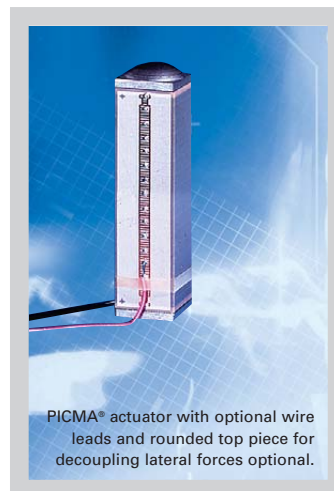
Increased Lifetime Through Humidity Resistance

The monolithic ceramic-encapsulated design provides better humidity protection than polymer-film insulation. Diffusion of water molecules into the insulation layer, is greatly reduced by the use of cofired, outer ceramic encapsulation.

High-Level Dynamic Performance—Very Wide Temperature Range

The high Curie temperature of 320 °C gives PICMA® actuators a usable temperature range extending up to 150 °C. This means that they can be operated in hotter environments, or they can be driven harder in dynamic operation. With conventional multilayer actuators, heat generation—which is proportional to operating frequency—either limits the operating frequency or duty cycle in dynamic operation, or makes ungainly cooling provisions necessary.

At the low end, operation down to a few Kelvin is possible (with reduction in performance specifications).



PICMA® actuator with optional wire leads and rounded top piece for decoupling lateral forces optional.

Optimum UHV Compatibility—No Outgassing

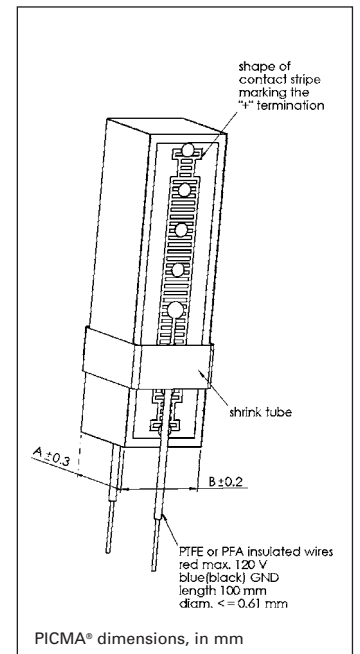
The lack of polymer insulation and the high Curie temperature make for optimal ultra-high-vacuum compatibility (no outgassing / high bakeout temperatures, up to 150 °C)

Ideal for Closed-Loop Operation

The ceramic surface of the actuators is extremely well suited for use with resistive or optical fiber strain gauge sensors. Such sensors can be easily applied to the actuator surface and exhibit significantly higher stability and linearity than with conventional polymer-insulated actuators.

Amplifiers, Drivers & Controllers

PI offers a wide range of control electronics for piezo actuators from low-power drivers to multichannel, closed-loop, digital controllers. Of course, PI also designs custom amplifiers and controllers.



PICMA® dimensions, in mm

Piezo Actuators

Nanopositioning & Scanning Systems

Active Optics / Steering Mirrors

Tutorial: Piezo-electrics in Positioning

Capacitive Position Sensors

Piezo Drivers & Nanopositioning Controllers

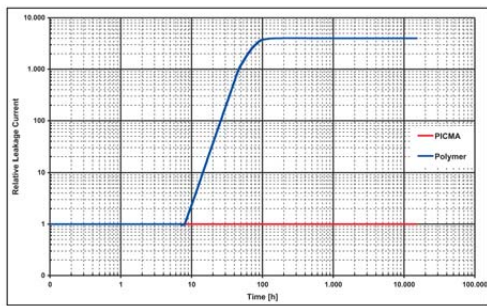
Hexapods / Micropositioning

Photonics Alignment Solutions

Motion Controllers

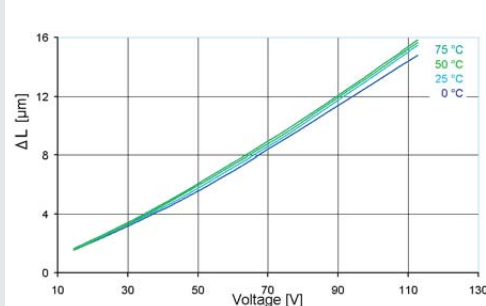
Ceramic Linear Motors & Stages

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PICMA® piezo actuators (bottom curve) compared with conventional multilayer actuators with polymer insulation (top curve). PICMA® actuators are not affected by the high-humidity test conditions. Conventional piezo actuators exhibit increased leakage current after only a few hours. Leakage current is an indication of insulation quality and expected lifetime.

Test conditions: $U = 100 V_{DC}$; $T = 25\text{ °C}$; Relative Humidity = 70%



The displacement of PICMA® actuators exhibits very low temperature dependence. This, in combination with their low heat generation, makes PICMA® actuators optimal for dynamic operation. (Operating frequency $f = 200\text{ Hz}$)

Technical Data / Product Order Numbers

| Order number* | Dimensions A x B x L [mm] | Nominal displacement [μm @ 100 V] | Max. displacement [μm @ 120 V] | Blocking force [N @ 120 V] | Stiffness [N/ μm] | Electrical capacitance [μF] $\pm 20\%$ | Resonant frequency [kHz] $\pm 20\%$ |
|---------------|---------------------------|---|--|----------------------------|-------------------------------|---|-------------------------------------|
| P-882.10 | 2 x 3 x 9 | 6.5 $\pm 20\%$ | 8 $\pm 20\%$ | 190 | 24 | 0.13 | 135 |
| P-882.20 | 2 x 3 x 11 | 8.5 $\pm 20\%$ | 10.5 $\pm 20\%$ | 210 | 20 | 0.18 | 110 |
| P-882.30 | 2 x 3 x 13.5 | 11 $\pm 20\%$ | 13 $\pm 20\%$ | 210 | 16 | 0.22 | 90 |
| P-882.50 | 2 x 3 x 18 | 15 $\pm 10\%$ | 18 $\pm 10\%$ | 210 | 12 | 0.31 | 70 |
| P-883.10 | 3 x 3 x 9 | 6.5 $\pm 20\%$ | 8 $\pm 20\%$ | 290 | 36 | 0.21 | 135 |
| P-883.20 | 3 x 3 x 11 | 8.5 $\pm 20\%$ | 10.5 $\pm 20\%$ | 310 | 29 | 0.27 | 110 |
| P-883.30 | 3 x 3 x 13.5 | 11 $\pm 20\%$ | 13 $\pm 20\%$ | 310 | 24 | 0.35 | 90 |
| P-883.50 | 3 x 3 x 18 | 15 $\pm 10\%$ | 18 $\pm 10\%$ | 310 | 18 | 0.48 | 70 |
| P-885.10 | 5 x 5 x 9 | 6.5 $\pm 20\%$ | 8 $\pm 20\%$ | 800 | 100 | 0.6 | 135 |
| P-885.20 | 5 x 5 x 11 | 8.5 $\pm 20\%$ | 10.5 $\pm 20\%$ | 850 | 82 | 0.8 | 110 |
| P-885.30 | 5 x 5 x 13.5 | 11 $\pm 20\%$ | 13 $\pm 20\%$ | 870 | 67 | 1.1 | 90 |
| P-885.50 | 5 x 5 x 18 | 15 $\pm 10\%$ | 18 $\pm 10\%$ | 900 | 50 | 1.5 | 70 |
| P-885.90 | 5 x 5 x 36 | 32 $\pm 10\%$ | 38 $\pm 10\%$ | 950 | 25 | 3.1 | 40 |
| P-887.30 | 7 x 7 x 13.5 | 11 $\pm 20\%$ | 13 $\pm 20\%$ | 1700 | 130 | 2.2 | 90 |
| P-887.50 | 7 x 7 x 18 | 15 $\pm 10\%$ | 18 $\pm 10\%$ | 1750 | 100 | 3.1 | 70 |
| P-887.90 | 7 x 7 x 36 | 32 $\pm 10\%$ | 38 $\pm 10\%$ | 1850 | 50 | 6.4 | 40 |
| P-888.30 | 10 x 10 x 13.5 | 11 $\pm 20\%$ | 13 $\pm 20\%$ | 3500 | 267 | 4.3 | 90 |
| P-888.50 | 10 x 10 x 18 | 15 $\pm 10\%$ | 18 $\pm 10\%$ | 3600 | 200 | 6.0 | 70 |
| P-888.90 | 10 x 10 x 36 | 32 $\pm 10\%$ | 38 $\pm 10\%$ | 3800 | 100 | 13.0 | 40 |

Recommended preload for dynamic operation
15 to 30 MPa

* For optional PTFE insulated wires, pigtail length 100 mm, change order number extension to .x1 (e.g. P-882.11).

Unloaded (longitudinal) resonant frequency measured at $1 V_{pp}$; capacitance at $1 V_{pp}$, 1 kHz.

Standard PZT ceramic type: PIC 52

Max. operating voltage: -20 to +120 V
Max. operating temperature: -40 to +150 °C

Standard Mechanical Interface: ceramic (top & bottom)
Standard Electrical Interface: solderable pads

Available Options: strain gauge sensors, special mechanical interfaces, etc.
Other specifications on request. Specifications subject to change without notice.