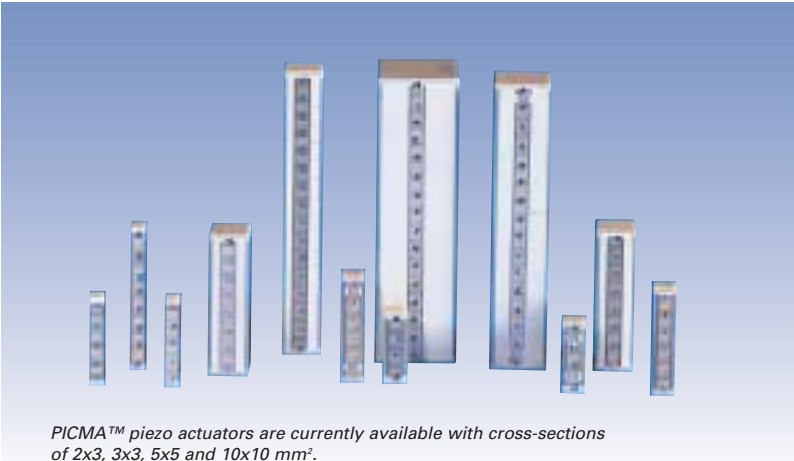
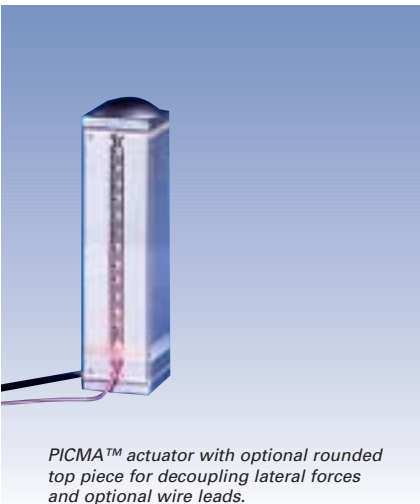


P-882-
P-888

PICMA™ High-Performance Monolithic Multilayer Piezo Actuators



PICMA™ piezo actuators are currently available with cross-sections of 2x3, 3x3, 5x5 and 10x10 mm².



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

- **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 10⁻⁹ 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 environments. 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.

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, leakage current 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 of PI Ceramic with thousands of industrial PZT applications.

Increased Lifetime through Humidity Resistance

The monolithic, ceramic-insulated design makes polymer-film insulation unnecessary. Diffusion of water molecules into the insulation layer, the major cause of dielectric breakdown, is greatly reduced by the use of cofired, outer ceramic insulation.

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 some reduction in performance specifications).

Optimum UHV Compatibility—Minimal Outgassing

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

Ideal for Closed-Loop Operation

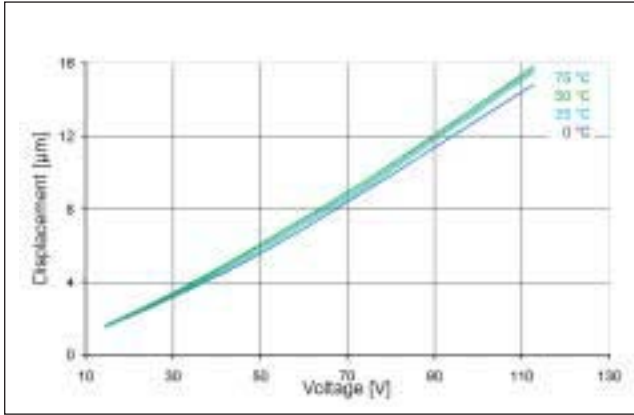
The ceramic surface of the actuators is extremely well suited for use with resistive or optical fiber strain gauge sensors. Such sensors can be easily applied to the actuator surface and exhibit significantly higher stability and linearity than with conventional polymer-insulated actuators.

Amplifiers, Drivers & Controllers

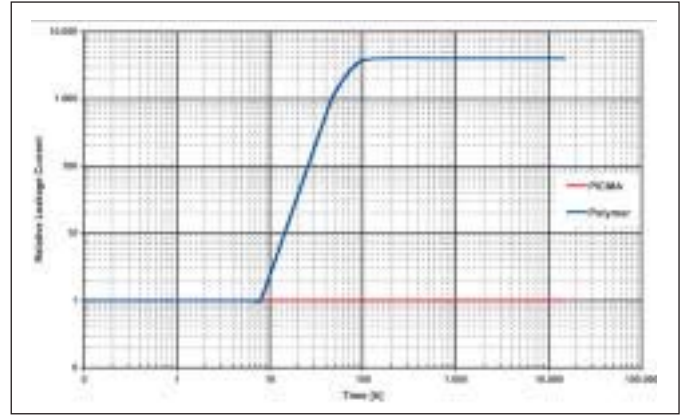
PI offers a wide range of control electronics for piezo actuators (see page 28 and www.pi.ws) from low-power drivers to multichannel, closed-loop, digital controllers. Of course, PI also designs custom amplifiers and controllers.

Application Examples

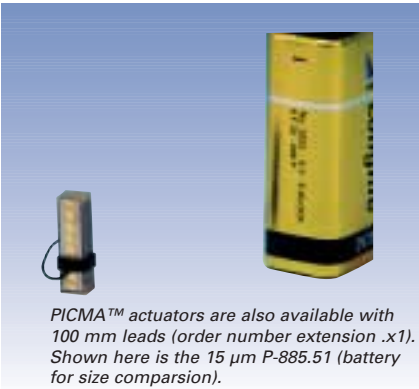
- Precision Mechanics and Mechanical Engineering
- NanoPositioning / High-Speed Switching
- Active and Adaptive Optics
- Vibration cancellation
- Pneumatic & Hydraulic Valves
- Metrology / Interferometry
- Life Sciences, Medicine and Biology



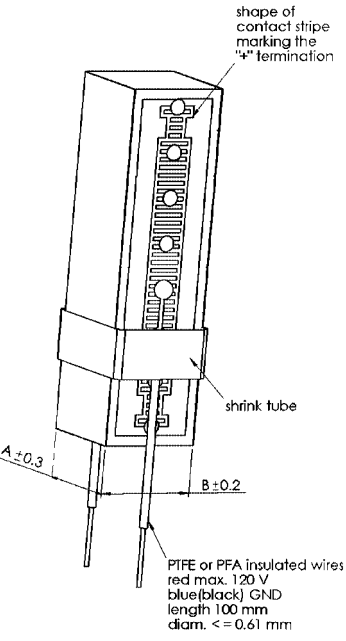
The displacement of PICMA™ actuators exhibits very low temperature dependence. This, in combination with their low heat generation, makes PICMA™ actuators optimal for dynamic operation. (Operating frequency $f = 200$ Hz)



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



PICMA™ actuators are also available with 100 mm leads (order number extension .x1). Shown here is the 15 µm P-885.51 (battery for size comparison).



PICMA™ dimensions, in mm

Technical Data / Ordering Numbers

Ordering 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] (±20%)	Resonant Frequency [kHz]
P-882.10	2 x 3 x 9	6.5 ± 20%	8 ± 20%	190	24	0.13	135
P-882.30	2 x 3 x 13.5	11 ± 20%	13 ± 20%	210	16	0.22	90
P-882.50	2 x 3 x 18	15 ± 10%	18 ± 10%	210	12	0.31	70
P-883.10	3 x 3 x 9	6.5 ± 20%	8 ± 20%	290	36	0.21	135
P-883.30	3 x 3 x 13.5	11 ± 20%	13 ± 20%	310	24	0.35	90
P-883.50	3 x 3 x 18	15 ± 10%	18 ± 10%	310	18	0.48	70
P-885.10	5 x 5 x 9	6.5 ± 20%	8 ± 20%	800	100	0.6	135
P-885.30	5 x 5 x 13.5	11 ± 20%	13 ± 20%	870	67	1.1	90
P-885.50	5 x 5 x 18	15 ± 10%	18 ± 10%	900	50	1.5	70
P-885.90	5 x 5 x 36	32 ± 10%	38 ± 10%	950	25	3.1	40
P-887.30	7 x 7 x 13.5	11 ± 20%	13 ± 20%	1700	130	2.2	90
P-887.50	7 x 7 x 18	15 ± 10%	18 ± 10%	1750	100	3.1	11
P-887.90	7 x 7 x 36	32 ± 10%	38 ± 10%	1850	50	6.4	40
P-888.30	10 x 10 x 13.5	11 ± 20%	13 ± 20%	3500	267	4.3	90
P-888.50	10 x 10 x 18	15 ± 10%	18 ± 10%	3600	200	6.0	70
P-888.90	10 x 10 x 36	32 ± 10%	38 ± 10%	3800	100	13.0	40

* 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 252 (see page 40)

Max. operating voltage: -20 to +120 V
 Max. operating temperature: -40 to +150 °C
 Recommended preload 15 to 30 MPa

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

Available Options: Strain Gauge Sensors, special mechanical interfaces, etc.
 Other specifications on request.
 Specifications subject to change without notice.