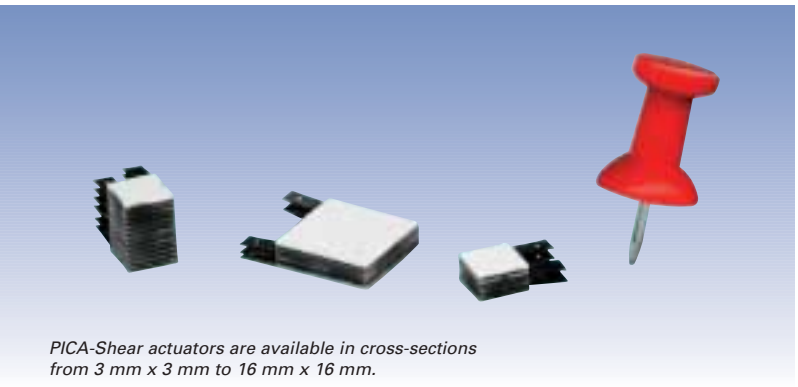
P-111-P-151 PICA-Shear Piezo Actuators–Compact Multiaxis Motion



PICA-Shear actuators are available in cross-sections from 3 mm x 3 mm to 16 mm x 16 mm.

- **Compact Multiaxis Actuators**
- **X, XY, XZ and XYZ Versions**
- **High Resonant Frequencies**
- **Extreme Reliability >10^9 Cycles**
- **Picometer-Resolution / Sub-Millisecond Settling Time**
- **Ultra-High-Vacuum-Compatible Versions to 10^{-9} hPa**
- **Non-Magnetic and Clear Aperture Versions**

PICA-Shear series multi-axis piezo actuators are only available from PI Ceramic. These devices are extremely compact and feature sub-namometer resolution and ultra-fast response. They are available in a variety of geometries providing displacements to 10 µm.

High Stiffness under High Duty Cycles

PICA-Shear actuators exhibit high stiffness, both parallel and perpendicular to the motion direction. Based on the piezoelectric shear effect, PICA-Shear X and XY actuators show almost twice the displacement amplitudes of conventional piezo actuators at the same electric field. Consequently they can be made smaller and have higher resonant frequencies. This results in reduced power requirements for a given induced displacement in dynamic X- and Y-axis operation.

Ultra-High Reliability, High Displacement, Low Power Requirements

PICA actuators are specifically designed for high-duty-cycle applications. All materials used are specifically matched for robustness and lifetime. Endurance tests proved consistent performance even after billions (1,000,000,000) of cycles. The combination of high displacement and low electrical capacitance provides for excellent dynamic behavior with reduced driving power requirements.

Flexibility: PI Ceramic's Strength

All manufacturing processes at PI Ceramic are set up for maximum flexibility. Should our standard actuators not fit your application, let us provide you with a custom design. Our engineers will work with you to find the optimum solution for your application, at a very attractive price, even for small quantities. Some of our custom capabilities are listed below:

- Vacuum Versions to 10^{-9} hPa
- Non-Magnetic Designs
- Clear Aperture
- Custom Endplates (Alumina, Glass, ...)
- Extra-Tight Length Tolerances, to 0.02 mm
- Optical Surface Quality
- Custom Geometries
- Custom Displacement
- Custom Load / Force Ranges
- Low-Temperature Designs, Down to L-He
- Combination with Piezoelectric Shear Sensors (no Pyroelectric Effect)

Short Leadtime for Standard & Custom Designs

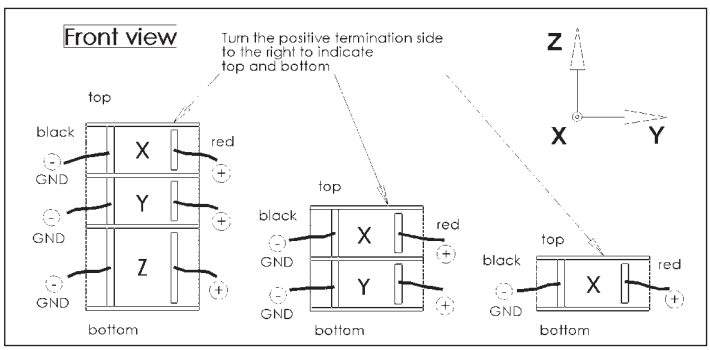
Because all piezoelectric materials used in PICA actuators are manufactured at PI Ceramic, leadtimes are short and quality is outstanding. All standard and custom PICA actuators are delivered with performance test sheets.

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 multi-channel, closed-loop, digital controllers. Of course, PI also designs custom amplifiers and controllers.

Application Examples

- NanoPositioning
- Precision mechanics
- Active vibration cancellation
- Semiconductor manufacturing and testing
- Laser tuning
- Atomic force microscopy
- Switching
- Scanning applications
- Micro-stepper motors

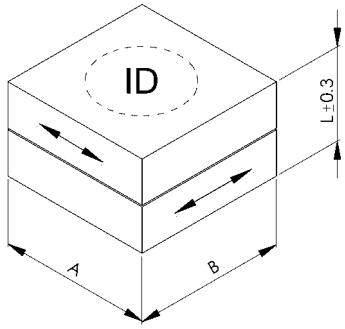


Technical Data / Ordering Numbers

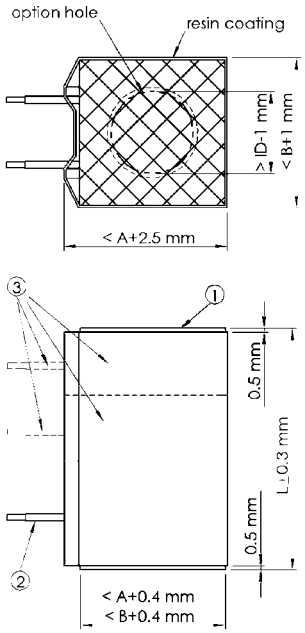
Ordering Number	Active Axes	Displacement [µm -10/+20%]	Cross section A x B / ID [mm]	Length L [mm ±0.3]	Max. Shear Load [N]	Axial Stiffness [N/µm]	Capacitance [nF ±20%]	Resonant Frequency [kHz]
P-111.01	X	1*	3 x 3	3.5	20	70	0.5	330
P-111.03	X	3*	3 x3	5.5	20	45	1.5	210
P-111.05	X	5	3 x 3	7.5	20	30	2.5	155
P-121.01	X	1*	5 x 5	3.5	50	190	1.4	330
P-121.03	X	3*	5 x 5	5.5	50	120	4.2	210
P-121.05	X	5	5 x 5	7.5	40	90	7	155
P-141.03	X	3*	10 x 10	5.5	200	490	17	210
P-141.05	X	5	10 x 10	7.5	200	360	28	155
P-141.10	X	10	10 x 10	12	200	230	50	100
P-151.03	X	3*	16 x 16	5.5	300	1300	43	210
P-151.05	X	5	16 x 16	7.5	300	920	71	155
P-151.10	X	10	16 x 16	12	300	580	130	100
P-112.01	XY	1 x 1*	3 x 3	5	20	50	0.5 x 0.5	230
P-112.03	XY	3 x 3*	3 x 3	9.5	10	25	1.5 x 1.5	120
P-122.01	XY	1 x 1*	5 x 5	5	50	140	1.4 x 1.4	230
P-122.03	XY	3 x 3*	5 x 5	9.5	40	70	4.2 x 4.2	120
P-122.05	XY	5 x 5	5 x 5	14	30	50	7 x 7	85
P-142.03	XY	3 x 3*	10 x 10	9,5	200	280	17 x 17	120
P-142.05	XY	5 x 5	10 x 10	14	100	190	28 x 28	85
P-142.10	XY	10 x 10	10 x 10	23	50	120	50 x 50	50
P-152.03	XY	3 x 3*	16 x 16	9.5	300	730	43 x 43	120
P-152.05	XY	5 x 5	16 x 16	14	300	490	71 x 71	85
P-152.10	XY	10 x 10	16 x 16	23	100	300	130 x 130	50
P-123.01	XYZ	1 x 1 x 1*	5 x 5	7.5	40	90	1.4 x 1.4 x 2.9	155
P-123.03	XYZ	3 x 3 x 3*	5 x 5	15.5	10	45	4.2 x 4.2 x 7.3	75
P-143.01	XYZ	1 x 1 x 1*	10 x 10	7.5	200	360	5.6 x 5.6 x 11	155
P-143.03	XYZ	3 x 3 x 3*	10 x 10	15.5	100	170	17 x 17 x 29	75
P-143.05	XYZ	5 x 5 x 5	10 x10	23	50	120	28 x 28 x 47	50
P-153.03	XYZ	3 x 3 x 3*	16 x 16	15.5	300	450	43 x 43 x 73	75
P-153.05	XYZ	5 x 5 x 5	16 x 16	23	100	300	71 x 71 x 120	50
P-153.10	XYZ	10 x 10 x 10	16 x 16	40	60	170	130 x 130 x 230	30
P-153.10H	XYZ	10 x 10 x 10	16 x 16 / 10	40	20	120	89 x 89 x 160	30
P-151.03H	X	3*	16 x 16 / 10	5.5	200	870	30	210
P-151.05H	X	5	16 x 16 / 10	7.5	200	640	49	155
P-151.10H	X	10	16 x 16 / 10	12	200	460	89	100

** Tolerances ± 30%*
Unloaded (longitudinal) resonant frequency measured at 1 V_{pp}, capacitance at 1 V_{pp}, 1 kHz.

Standard PZT ceramic type: PIC 255 (see page 40). For more information on the shear effect see p. 42.
Operating voltage range: -250 V to +250 V
Operating temperature range: -20 to +85 °C
Standard mechanical interface (top & bottom): ceramic plates
Available options: integrated piezo sensor, non-magnetic, UHV, low temperature, clear aperture etc.
Other specifications on request.
Specifications subject to change without notice.



PICA-Shear actuator dimensions, in mm. See technical data table for explanation of A, B, L.



1. ceramic interface (both sides)
2. PTFE insulated wires for high voltage control (red +250 V / black GND, length >100 mm, D< 0.7 mm), axial position centered at the termination line of the stack element
3. number of axis elements and wires is dependent on stack type