

## P-111 · P-151 PICA™ Shear Actuators

### Compact Multi-Axis Actuators Based on the Piezo Shear Effect



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

- Compact Single- and Multi-Axis Actuators
- X-, XY-, XZ- and XYZ-Versions
- High Resonant Frequencies
- Extreme Reliability >10<sup>9</sup> Cycles
- Picometer-Resolution / Sub-Millisecond Response
- UHV Versions to 10<sup>9</sup> hPa
- Non-Magnetic and Clear Aperture Versions

The unique PICA™ Shear piezo actuator series are exclusively available from PI. These devices are extremely compact and feature sub-nanometer resolution and ultra-fast response. They come in a variety of geometries providing displacements to 10 μm. Possible applications for these devices are e.g. scanning microscopy, or in motor drives.

#### Application Examples

- Nanopositioning
- Precision mechanics / -machining
- Active vibration damping
- Semiconductor technology / test systems
- Laser tuning
- Atomic force microscopy
- Switches
- Scanning applications
- Linear motors
- Nanotechnology

#### High Stiffness and High Displacement

PICA™ Shear actuators exhibit high stiffness, both parallel and perpendicular to the motion direction. Based on the piezoelectric shear effect, the 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.

#### High Reliability under High Duty Cycles, Low Power Requirements

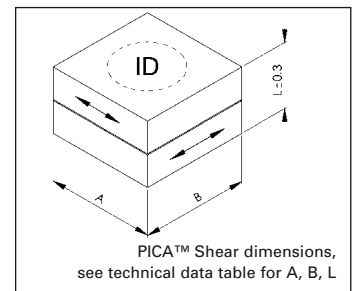
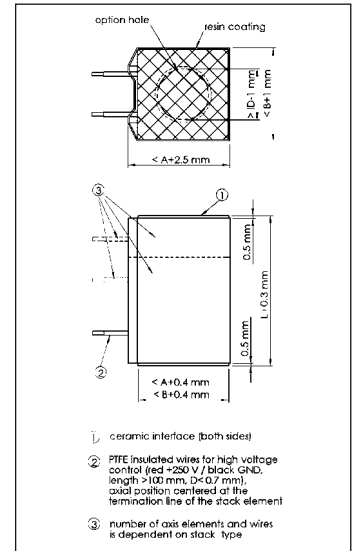
PICA™ Shear actuators are specifically designed for high-duty-cycle applications. All materials used are specifically matched for robustness and lifetime. Endurance tests proved consistent performance, even after billions (1,000,000,000) of cycles. The combination of high displace-

ment and low electrical capacitance provides for excellent dynamic behavior with reduced driving power requirements.

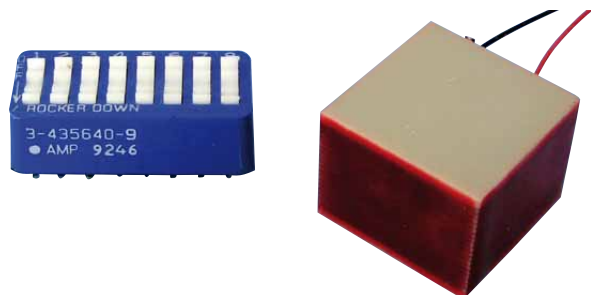
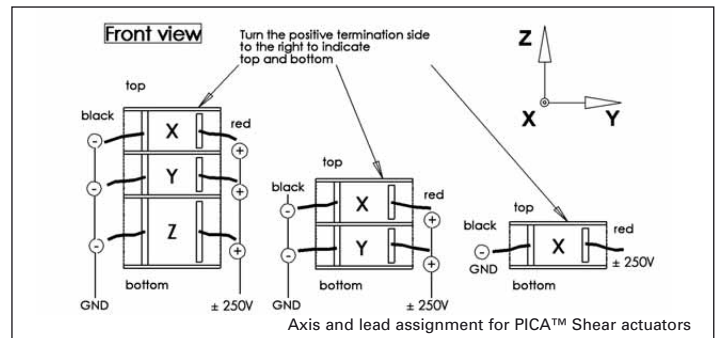
#### Short Leadtime for Standard & Custom Designs

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 at a very attractive price, even for small quantities. Some of our custom capabilities are listed below:

- Custom Materials
- Custom Voltage Range / Custom Displacement
- Clear Aperture
- Custom Load / Force Ranges
- Custom Flat or Spherical Endplates (Metal, Ceramics, Glass, Sapphire, ...) / Optical Surface Quality



PICA™ Shear dimensions, see technical data table for A, B, L



The standard actuator P-151.10 is delivered with a 10 cm lead

- Extra-Tight Length Tolerances
  - Combination with Piezoelectric Shear Sensors (no Pyroelectric Effect)
  - Low-Temperature Designs, Down to Liquid-He
  - Vacuum Compatible and Non-Magnetic Versions
- Because all piezoelectric materials used in these actuators

are manufactured at PI Ceramic, leadtimes are short and quality is outstanding. All standard and custom actuators are delivered with performance test sheets.

#### Amplifiers and Controllers

The E-413.OE bipolar piezo driver is recommended for operating these actuators.

Other high-resolution amplifiers and servo-control electronics, both digital and analog, are described in the “Piezo Drivers / Servo Controllers” section.

#### Technical Data / Product Order Numbers

Order number	Active axes	Displacement [µm] -10/+20% for -250 to 250 V	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 x 3	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 / 0.5	230
P-112.03	XY	3 x 3*	3 x 3	9.5	10	25	1.5 / 1.5	120
P-122.01	XY	1 x 1*	5 x 5	5	50	140	1.4 / 1.4	230
P-122.03	XY	3 x 3*	5 x 5	9.5	40	70	4.2 / 4.2	120
P-122.05	XY	5 x 5	5 x 5	14	30	50	7 / 7	85
P-142.03	XY	3 x 3*	10 x 10	9.5	200	280	17 / 17	120
P-142.05	XY	5 x 5	10 x 10	14	100	190	28 / 28	85
P-142.10	XY	10 x 10	10 x 10	23	50	120	50 / 50	50
P-152.03	XY	3 x 3*	16 x 16	9.5	300	730	43 / 43	120
P-152.05	XY	5 x 5	16 x 16	14	300	490	71 / 71	85
P-152.10	XY	10 x 10	16 x 16	23	100	300	130 / 130	50
P-123.01	XYZ	1 x 1 x 1*	5 x 5	7.5	40	90	1.4 / 1.4 / 2.9	155
P-123.03	XYZ	3 x 3 x 3*	5 x 5	15.5	10	45	4.2 / 4.2 / 7.3	75
P-143.01	XYZ	1 x 1 x 1*	10 x 10	7.5	200	360	5.6 / 5.6 / 11	155
P-143.03	XYZ	3 x 3 x 3*	10 x 10	15.5	100	170	17 / 17 / 29	75
P-143.05	XYZ	5 x 5 x 5	10 x 10	23	50	120	28 / 28 / 47	50
P-153.03	XYZ	3 x 3 x 3*	16 x 16	15.5	300	450	43 / 43 / 73	75
P-153.05	XYZ	5 x 5 x 5	16 x 16	23	100	300	71 / 71 / 120	50
P-153.10	XYZ	10 x 10 x 10	16 x 16	40	60	170	130 / 130 / 230	30
P-153.10H	XYZ	10 x 10 x 10	16 x 16 / 10	40	20	120	89 / 89 / 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

Standard piezo ceramic type: 255

\* Tolerances ±30 %

Unloaded (longitudinal) resonant frequency measured at 1 V<sub>pp</sub>, capacitance at 1 V<sub>pp</sub>, 1 kHz, unloaded, free at both sides

Capacitance at 1 V<sub>pp</sub>, 1 kHz

Operating voltage: -250 V to +250 V

Operating temperature range: -20 to +85 °C

Standard mechanical interfaces: Ceramics

PTFE-insulated wires, pigtail length 100 mm

Available options: integrated piezo force sensors, non magnetic, vacuum compatible, free aperture etc.

Other specifications on request.

#### Linear Actuators & Motors

PiezoWalk® Motors / Actuators

PILine® Ultrasonic Motors

DC-Servo & Stepper Actuators

#### Piezo Actuators & Components

Guided / Preloaded Actuators

Unpackaged stack Actuators

Patches/Benders/Tubes/Shear..

Nanopositioning / Piezoelectrics

Nanometrology

Micropositioning

Index