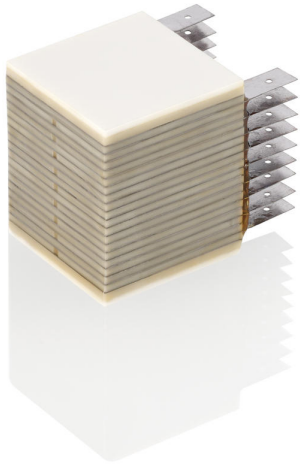
Shear Actuators for Cryogenic Applications

Compact Actuators for Cryogenic and UHV Environments



PICA Shear

- UHV-compatible to 10^{-9} hPa
- For cryogenic environments
- Extreme reliability: >10^{9} cycles
- Picometer resolution
- µs response time

Piezo shear actuators
Operating voltage -250 to 250 V. Suitable for use in cryogenic and UHV environments to 10^{-9} hPa. Lateral displacement is based on the piezoelectric shear effect. Excellent dynamics with minimum electric power requirement. Variants for multi-axis motion, also with inner hole.

Possible modifications
- Piezo ceramic material
- Nonmagnetic versions
- Operating voltage range, displacement, layer thickness, cross-sectional dimension
- Load capacity, force generation
- Mechanical interfaces: flat, spherical, metal, ceramic, glass, sapphire, etc.
- Extra-tight length tolerances

Application fields
- Industry and research
- Low temperature / vacuum environment to 10^{-9} hPa
- Scanning applications
- Microscopy
- Precision mechanics
- Switching applications

Motion	Unit	Tolerance	P-111.01T	P-111.03T	P-121.01T	P-121.03T
Active axes			X	X	X	X
Travel range in X, open loop	µm	±30 %	1	3	1	3

Drive properties	Unit	Tolerance	P-111.01T	P-111.03T	P-121.01T	P-121.03T
Actuator type			Shear actuator	Shear actuator	Shear actuator	Shear actuator
Drive type			PICA Shear	PICA Shear	PICA Shear	PICA Shear
Operating voltage	V		-250 to 250	-250 to 250	-250 to 250	-250 to 250
Electrical capacitance	nF	±20 %	2 × 0.25	6 × 0.25	2 × 0.70	6 × 0.70

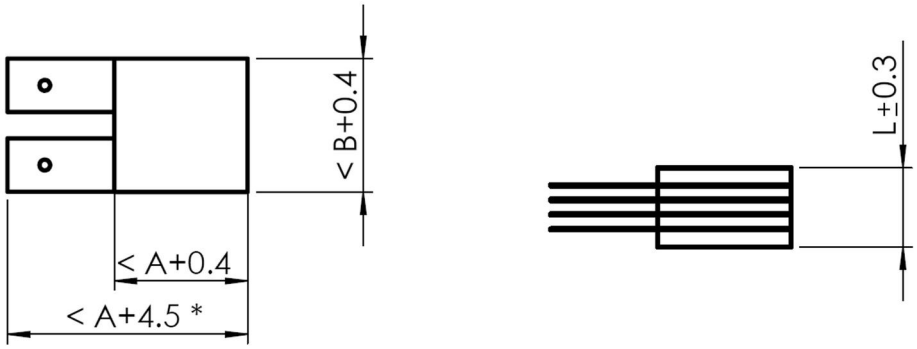
Mechanical properties	Unit	Tolerance	P-111.01T	P-111.03T	P-121.01T	P-121.03T
Axial stiffness	N/µm		110	55	310	150
Axial resonant frequency, unloaded	kHz		530	260	530	260
Maximum shear load	N		20	20	50	50
Cross section			rectangular	rectangular	rectangular	rectangular
Material			Standard mechanical interfaces: Ceramic (Al_2O_3, 96 % pure). Outer surface: Epoxy resin.	Standard mechanical interfaces: Ceramic (Al_2O_3, 96 % pure). Outer surface: Epoxy resin.	Standard mechanical interfaces: Ceramic (Al_2O_3, 96 % pure). Outer surface: Epoxy resin.	Standard mechanical interfaces: Ceramic (Al_2O_3, 96 % pure). Outer surface: Epoxy resin.
Piezo material			PIC255	PIC255	PIC255	PIC255
Surface A × B	mm		3 × 3	3 × 3	5 × 5	5 × 5
Length L	mm	±0.3 mm	2.2	4.4	2.2	4.4

Miscellaneous	Unit		P-111.01T	P-111.03T	P-121.01T	P-121.03T
Operating temperature range	°C		-269 to 85	-269 to 85	-269 to 85	-269 to 85
Vacuum class	hPa		10^{-9}	10^{-9}	10^{-9}	10^{-9}
Connector			Solderable contacts	Solderable contacts	Solderable contacts	Solderable contacts
Recommended controllers/ drivers			E-413.2 - E-413.6, E-413, E-508	E-413.2 - E-413.6, E-413, E-508	E-413.2 - E-413.6, E-413, E-508	E-413.2 - E-413.6, E-413, E-508

Travel range in X, open loop: Measured at room temperature. Value is reduced at lower temperatures.
Electrical capacitance: Measured at 1 V_{pp}, 1 kHz, RT.
Axial resonant frequency, unloaded: Measured at 1 V_{pp}, unclamped. The value is halved for unilateral clamping.
Operating temperature range: Temporary short-term bakeout to 150 °C only when short-circuited.
Standard connections: Ta. contacting with conductive adhesive possible.
Other specifications on request.

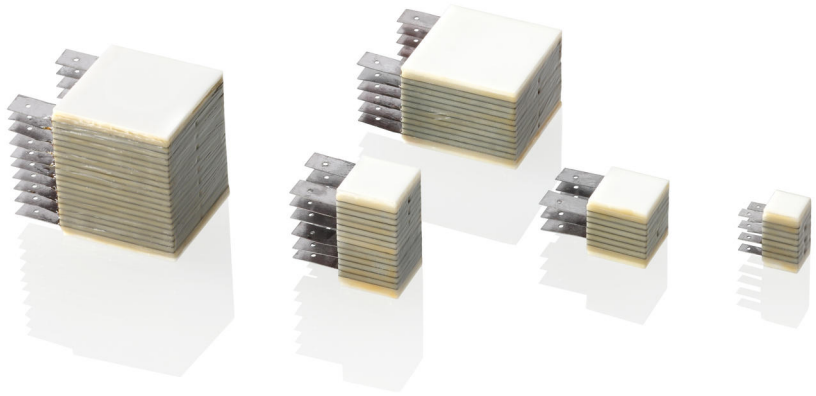
At PI, technical data is specified at 22 ±3 °C. Unless otherwise stated, the values are for unloaded conditions. Some properties are interdependent. The designation "typ." indicates a statistical average for a property; it does not indicate a guaranteed value for every product supplied. During the final inspection of a product, only selected properties are analyzed, not all. Please note that some product characteristics may deteriorate with increasing operating time.

Drawings / Images

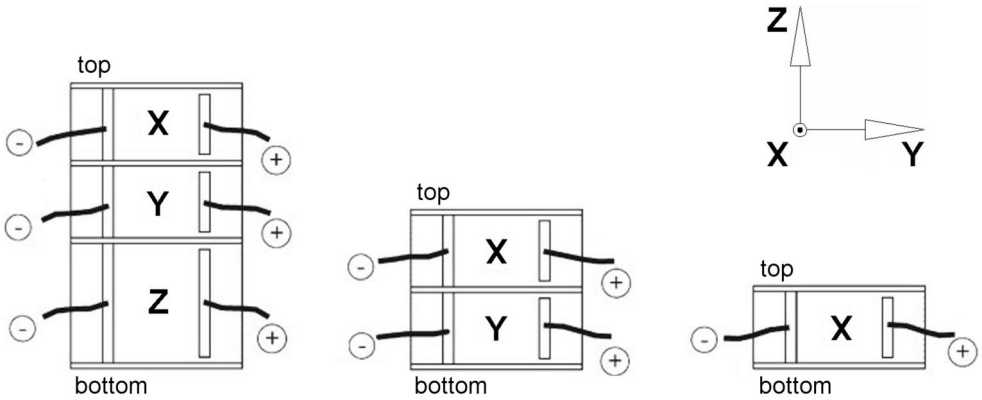


PICA Shear P-1xx.xxT actuators. Surface A × B and length L, see data table. Dimensions in mm. (* <A+2.5 with cross section 3 × 3)

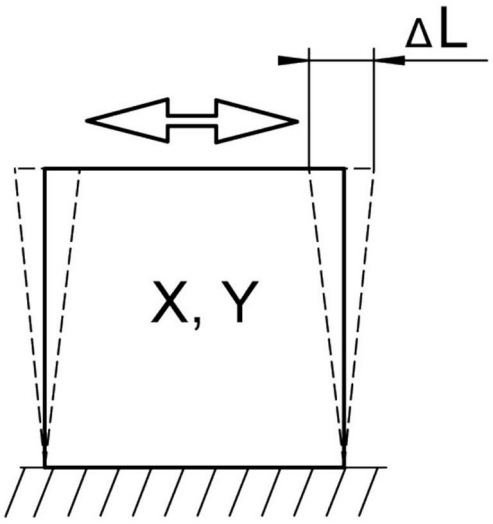
Drawings / Images



PICA Shear P-1x1.0xT actuators for cryogenic and UHV environments



Axis and cable assignment for PICA shear actuators. GND: 0 V. +: ±250 V.



Principle of shear motion. ΔL refers to the travel range.

Order Information

P-111.01T
PICA Shear piezo actuator; PICA Shear piezo actuator drive; 1 µm travel range (open loop); 3 mm × 3 mm surface; 2.2 mm length; vacuum-compatible to 10 hPa; operating temperature up to -269 °C; solderable contacts

P-111.03T
PICA Shear piezo actuator; PICA Shear piezo actuator drive; 3 µm travel range (open loop); 3 mm × 3 mm surface; 4.4 mm length; vacuum-compatible to 10 hPa; operating temperature up to -269 °C; solderable contacts

P-121.01T
PICA Shear piezo actuator; PICA Shear piezo actuator drive; 1 µm travel range (open loop); 5 mm × 5 mm surface; 2.2 mm length; vacuum-compatible to 10 hPa; operating temperature up to -269 °C; solderable contacts

P-121.03T
PICA Shear piezo actuator; PICA Shear piezo actuator drive; 3 µm travel range (open loop); 5 mm × 5 mm surface; 4.4 mm length; vacuum-compatible to 10 hPa; operating temperature up to -269 °C; solderable contacts