

XYZ Piezo Nanopositioner

High-Precision XYZ Scanner with Aperture



P-733.3

- Travel ranges to 100 μm \times 100 μm in X, Y and to 10 μm in Z
- Resolution to 0.1 nm due to capacitive sensors
- High velocity versions with direct drive
- Ultrahigh vacuum-compatible and nonmagnetic versions
- Parallel kinematics for higher accuracy and dynamics
- Parallel metrology for active compensation of guiding errors
- Zero-play, high-precision flexure guide system
- Clear aperture 50 mm \times 50 mm for transmitted-light applications

Fields of application

- Scanning microscopy
- Confocal microscopy
- Mask/wafer positioning
- Surface measuring technology
- Nanoimprinting
- Micromanipulation
- Image processing / stabilization
- Nanopositioning with high flatness and straightness of motion

Outstanding lifetime thanks to PICMA® piezo actuators

The patented PICMA® piezo actuators are all-ceramic insulated. This protects them against humidity and failure resulting from an increase in leakage current. PICMA® actuators offer an up to ten times longer lifetime than conventional polymer-insulated actuators. 100 billion cycles without a single failure are proven.

Subnanometer resolution with capacitive sensors

Capacitive sensors measure with subnanometer resolution without contacting. They guarantee excellent linearity of motion, long-term stability, and a bandwidth in the kHz range.

High guiding accuracy due to zero-play flexure guides

Flexure guides are free of maintenance, friction, and wear, and do not require lubrication. Their stiffness allows high load capacity and they are insensitive to shock and vibration. They are 100 % vacuum compatible and work in a wide temperature range.

Automatic configuration and fast component exchange

Mechanics and controllers can be combined as required and exchanged quickly. All servo and linearization parameters are stored in the ID chip of the D-sub connector of the mechanics. The autocalibration function of the digital controllers uses this data each time the controller is switched on.

High tracking accuracy in the nanometer range due to parallel position measuring

All degrees of freedom are measured against a single fixed reference. Undesired crosstalk of motion to another axis can be actively compensated in real time (depending on the bandwidth) (active guiding). High tracking accuracy is achieved in the nanometer range even in dynamic operation.

Suitable for sophisticated vacuum applications

All components used in the piezo systems are excellently suited for use in vacuum. No lubricant or grease is necessary for operating. Polymer-free piezo systems allow particularly low outgas rates.

Specifications

	P-733.3CD P-733.3CL	P-733.3DD	Unit	Tolerance
Active axes	X, Y, Z	X, Y, Z		
Motion and positioning				
Integrated sensor	Capacitive	Capacitive		
Travel range at -20 to 120 V, open loop	115 μm \times 115 μm \times 12 μm	33 μm \times 33 μm \times 14 μm		+20 % / -0 %
Travel range, closed loop	100 μm \times 100 μm \times 10 μm	30 μm \times 30 μm \times 10 μm		
Resolution, open loop	0.2 (X), 0.2 (Y), 0.1 (Z)	0.1	nm	typ.
Resolution, closed loop	0.3 (X), 0.3 (Y), 0.2 (Z)	0.1	nm	typ.
Linearity error (X, Y)	0.03	0.03*	%	typ.
Linearity error (Z)	0.03	0.03*	%	typ.
Repeatability (X, Y)	<2	<2	nm	typ.
Repeatability (Z)	<1	<1	nm	typ.
Pitch (X,Y)	± 3	± 5	μrad	typ.
Yaw (X, Y)	± 10	± 10	μrad	typ.
Tilt with motion in Z	± 5	± 5	μrad	typ.
Mechanical properties				
Stiffness	1.4 (X), 1.4 (Y), 9 (Z)	4 (X), 4 (Y), 10 (Z)	N/ μm	± 20 %
Resonant frequency, no load	460 (X), 460 (Y), 1400 (Z)	1200 (X), 1200 (Y), 1100 (Z)	Hz	± 20 %
Resonant frequency, under load, 120 g	340 (X), 340 (Y), 1060 (Z)	–	Hz	± 20 %
Resonant frequency, under load, 200 g	295 (X), 295 (Y), 650 (Z)	530 (X), 530 (Y), 635 (Z)	Hz	± 20 %
Push/pull force capacity in motion direction	50 / 20	50 / 20	N	max.
Drive properties				
Piezo ceramic	PICMA® P-885	PICMA® P-885		
Electrical capacitance	6 (X), 6 (Y), 2.4 (Z)	6.2 (X), 6.2 (Y), 3.3 (Z)	μF	± 20 %
Miscellaneous				
Operating temperature range	-20 to 80	-20 to 80	$^{\circ}\text{C}$	
Material	Aluminum	Aluminum		
Mass	0.675	0.675	kg	± 5 %
Cable length	1.5	1.5	m	± 10 mm
Sensor/voltage connection	CD version: D-sub 25W3 (m) CL version: LEMO	D-sub 25W3 (m)		
Recommended electronics	E-503, E-505, E-610, E-621, E-625, E-712	E-503, E-505, E-610, E-621, E-625, E-712		

* With digital controller. Nonlinearity of direct drive stages measured with analog controllers is typically up to 0.1 %.

The resolution of the system is limited only by the noise of the amplifier and the measuring technology because PI piezo nanopositioning systems are free of friction.

All specifications based on room temperature (22 $^{\circ}\text{C}$ ± 3 $^{\circ}\text{C}$).

Ask about customized versions.

Ordering Information

Versions with direct drive

P-733.3DD

High dynamics, precision XYZ nanopositioning system, 30 μm \times 30 μm \times 10 μm , direct drive, capacitive sensors, parallel metrology, D-sub connector

Versions with D-sub connector (m)

P-733.3CD

Precision XYZ nanopositioning system, 100 μm \times 100 μm \times 10 μm , capacitive sensors, parallel metrology, D-sub connector

Versions with LEMO connector

P-733.3CL

Precision XYZ nanopositioning system, 100 μm \times 100 μm \times 10 μm , capacitive sensors, parallel metrology, LEMO connectors

Vacuum-compatible versions to 10^{-6} hPa

P-733.3VD

Precision XYZ nanopositioning system, 100 μm \times 100 μm \times 10 μm , capacitive sensors, parallel metrology, D-sub connector, vacuum compatible to 10^{-6} hPa