

# P-611.1 Piezo Nanopositioner

## Cost-Effective, Compact Linear Positioning System



P-611.1 linear nanopositioning system, 100  $\mu$ m travel, resolution of 0.2 nm

- Compact Design: Footprint 44 x 44 mm
- Travel Range to 120  $\mu$ m
- Resolution to 0.2 nm
- Cost-Effective Mechanics/Electronics System Configurations
- Outstanding Lifetime Due to PICMA® Piezo Actuators
- Z Stage, XY, XZ and XYZ Versions Available

P-611.1 piezo stages are flexure-guided nanopositioning systems featuring a compact footprint of only 44 x 44 mm. The linear stages described here are part of the P-611 family of positioners available in 1 to 3 axis configurations. Despite their small dimensions, the systems provide up to 120  $\mu$ m travel with sub-nanometer resolution. They are ideally suited for positioning tasks such as optical-path length correction in interferometry, sample positioning in microscopy or scanning applications. Equipped with ceramic-encapsulated piezo drives and a stiff zero-stiction, zero-friction flexure guiding

### Application Examples

- Micromachining
- Microscopy
- Micromanipulation
- Semiconductor testing

system, all P-611 piezo stages combine millisecond responsiveness with nanometric precision and extreme reliability.

### Closed-Loop and Open-Loop Versions

High-resolution, fast-responding, strain gauge sensors (SGS) are applied to appropriate locations on the drive train and provide a high-bandwidth, nanometer-precision position feedback signal to the controller. The sensors are connected in a full-bridge configuration to eliminate thermal drift, and assure optimal position stability in the nanometer range.

The open-loop models are ideal for applications where fast response and very high resolution are essential, but absolute positioning is not important. They can also be used when the position is controlled by an external feedback system such as an interferome-

ter, a PSD (position sensitive diode), CCD chip / image processing system, or the eyes and hands of an operator.

### Versatility & Combination with Motorized Stages

The P-611 family of piezo stages comprises a variety of single- and multi-axis versions (X, XY, Z, XZ and XYZ) that can be easily combined with a number of very compact manual or motorized micropositioning systems to form coarse/fine positioners with longer travel ranges (see p. 2-36, 2-50 ff).

### High Reliability and Long Lifetime

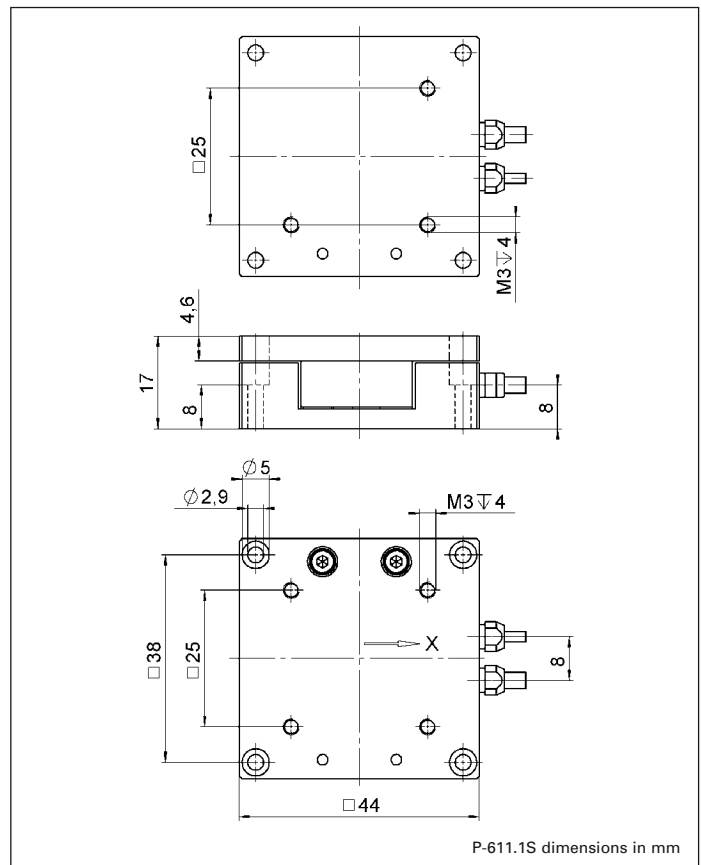
The compact P-611 systems are equipped with preloaded PICMA® high-performance piezo actuators which are inte-

### Ordering Information

**P-611.10**  
Linear Nanopositioning System, 120  $\mu$ m, No Sensor

**P-611.1S**  
Linear Nanopositioning System, 100  $\mu$ m, SGS-Sensor

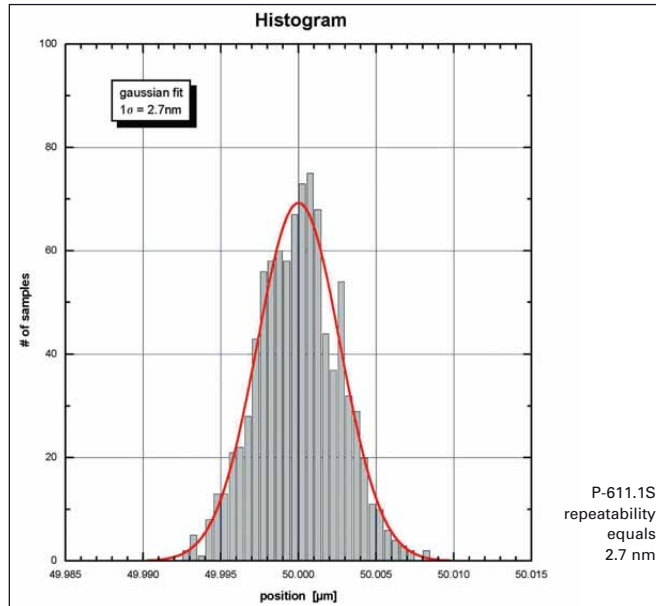
grated into a sophisticated, FEA-modeled, flexure guiding system. The PICMA® actuators feature cofired ceramic encapsulation and thus offer better performance and reliability than conventional piezo actuators. Actuators, guidance and sensors are maintenance-free and not subject to wear, and thus offer an extraordinary reliability.



P-611.1S dimensions in mm

**System properties**

System configuration	P-611.1S and E-665.SR controller, 30 g load
Closed-loop amplifier bandwidth, small signal	45 Hz
Settling time (10% step width)	18 ms

**Technical Data**

Model	P-611.1S	P-611.10	Unit	Tolerance
Active axes	X	X		
<b>Motion and positioning</b>				
Integrated sensor	SGS	–		
Open-loop travel, -20 to 120 V	120	120	µm	min. (+20%/0%)
Closed-loop travel	100	–	µm	calibrated
Open-loop resolution	0.2	0.2	nm	typ.
Closed-loop resolution	2	–	nm	typ.
Linearity, closed-loop	0.1	–	%	typ.
Repeatability	<10	–	nm	typ.
Pitch	±5	±5	µrad	typ.
Yaw	±20	±20	µrad	typ.
Flatness	10	10	nm	typ.
<b>Mechanical properties</b>				
Stiffness in motion direction	0.2	0.2	N/µm	±20%
Unloaded resonant frequency	400	400	Hz	±20%
Resonant frequency @ 30 g	300	300	Hz	±20%
Resonant frequency @ 100 g	195	195	Hz	±20%
Push/pull force capacity in motion direction	15 / 10	15 / 10	N	Max.
Load capacity	15	15	N	Max.
<b>Drive properties</b>				
Ceramic type	PICMA® P-885	PICMA® P-885		
Electrical capacitance	1.5	1.5	µF	±20%
Dynamic operating current coefficient	1.9	1.9	µA/(Hz • µm)	±20%
<b>Miscellaneous</b>				
Operating temperature range	-20 to 80	-20 to 80	°C	
Material	Aluminum, steel	Aluminum, steel		
Dimensions	44 x 44 x 17	44 x 44 x 17	mm	
Mass	0.135	0.135	kg	±5%
Cable length	1.5	1.5	m	±10 mm
Voltage connection	LEMO	LEMO		
Sensor connector	LEMO	–		

Resolution of PI Piezo Nano-positioners is not limited by friction or stiction. Noise equivalent motion with E-503 amplifier (p. 2-146). Dynamic Operating Current Coefficient in µA per Hz and µm. Example: Sinusoidal scan of 50 µm at 10 Hz requires approximately 0.9 mA drive current.

Recommended controller / amplifier  
E-610 servo controller / amplifier (p. 2-110), E-625 servo controller, bench-top (p. 2-114), E-665 powerful servo controller, bench-top (p. 2-116), for open-loop systems:  
E-660 bench-top (p. 2-119) for multiple independent axes:  
E-621 controller module (p. 2-160)

## Linear Actuators &amp; Motors

## Nanopositioning / Piezoelectrics

## Piezo Flexure Stages / High-Speed Scanning Systems

## Linear

Vertical &amp; Tip/Tilt

2- and 3-Axis

6-Axis

Fast Steering Mirrors / Active Optics

Piezo Drivers / Servo Controllers

Single-Channel

Multi-Channel

Modular

Accessories

Piezoelectrics in Positioning

## Nanometrology

## Micropositioning

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