

P-603 PiezoMove Linear Actuator

Low-cost and with Large Travel Ranges



P-603 linear actuators with 500 and 100 μm travel range (from left to right). CD for size comparison

- Frictionless, High-Precision Flexure Guiding System
- Travel Ranges to 500 μm
- Cost-Effective Design
- Outstanding Lifetime Due to PICMA® Piezo Actuators
- Available with Integrated Position Sensor
- Ideal OEM Actuators for Precision Motion Control in Optics, Medical, Biotech and Microfluidics Applications
- Custom Designs with Larger Travel or Faster Response and Non-Magnetic Versions Feasible

P-603 PiezoMove flexure-guided piezo actuators integrate a frictionless high-efficiency motion amplifier to combine large

travel ranges up to 500 μm with high stiffness and very fast response. The flexure guides reduce tip at the drive head to a minimum saving the cost for additional guiding systems when integrating these actuators in micro-dispensing devices, pumps or servo valves. The overall precision of 10s of nanometers also makes these devices ideal for nanomanipulation applications.

Options and Custom Versions

For OEM applications, PiezoMove actuators can be modified in various ways to suit the customer's requirements. The stiffness and force generation can be influenced via the lever design and the dimensions of the piezo ceramics used in the actuator. If only a small force and low guiding accuracy are required, large strokes of seven-

ral 100 μm and high frequencies can be achieved with small actuators, e.g. for micropump drives. For high-accuracy applications, an integrated position feedback sensor is available. The actuators were designed to allow for considerable cost savings in large production runs.

OEM Control Electronics

PI also supplies a variety of controllers to match the actuators. These range from simple amplifier modules (see p. 2-164) and analog closed-loop OEM controllers (see p. 2-110) to high-performance digital controllers (see p. 2-100ff). The great choice of actuators and controllers allows customers to select the optimum combination of performance and cost for their application.

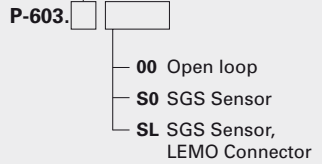
Increased Lifetime Through Humidity Resistance

The monolithic ceramic-encapsulated design provides better humidity protection than polymer-film insulation. Diffusion of water molecules into the insulation layer is greatly reduced by the use of cofired, outer ceramic encapsulation. Due to their high resonant frequency the actuators are suitable for highly dynamic applications with small loads; depending on the load an external preload for

Ordering Information

PiezoMove® OEM Linear Actuator with High Stiffness

- 1 Travel Range 100 μm
- 3 Travel Range 300 μm
- 5 Travel Range 500 μm

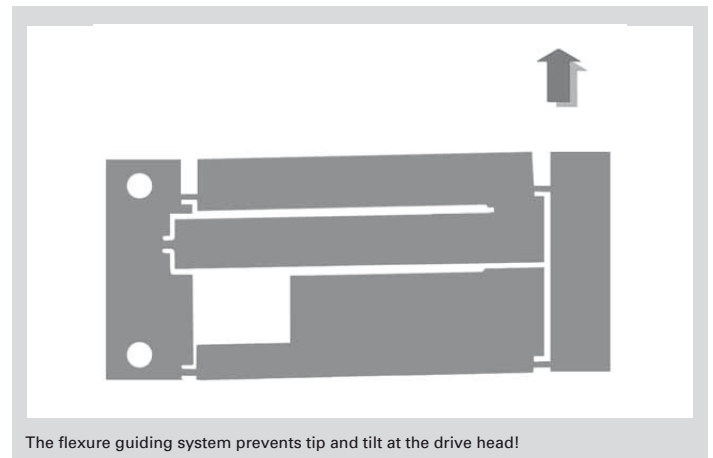


Ask about custom designs!

dynamic applications is recommended. The high Curie temperature of 320° gives PICMA® actuators a usable temperature range extending up to 150 °C, far beyond 80°C as is common for conventional multilayer actuators. With conventional multilayer actuators, heat generation – which is proportional to operating frequency – either limits the operating frequency or duty cycle in dynamic operation, or makes ungainly cooling provisions necessary. At the low end, operation down to a few Kelvin is possible (with reduced travel range).

Application Example

- Nanopositioning
- CCD / CMOS camera technology / Micro scanning
- Cell manipulation, biohandling
- Medical technology
- Micropumps
- Micro-dispensing
- Slit width adjustment
- Cavity Tuning
- Beam stabilization
- Photonics / integrated optics
- Switches



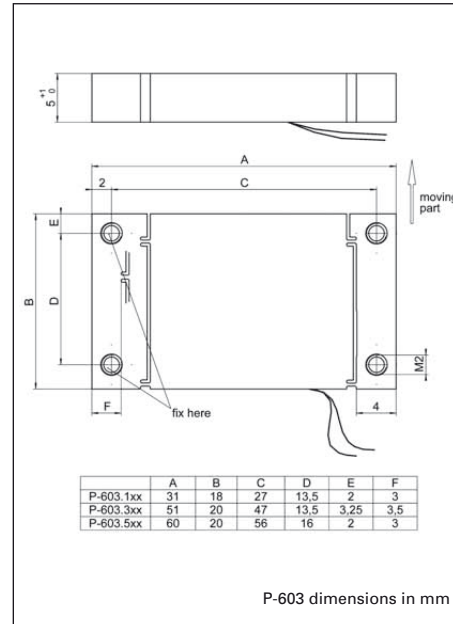
The flexure guiding system prevents tip and tilt at the drive head!



Levels of Integration: From Stack Actuator to 6-Axis Stage

	Stack actuators	Lever-amplified actuators	Positioning systems
Travel ranges	up to approx. 150 μm	up to 1 mm	up to 2 mm
Axes moved	one	one	up to three linear axes and three tip/tilt axes
Sensors	SGS optional	SGS optional	SGS or direct measuring capacitive sensors
Linearity	up to 99.8 %	up to 99.8 %	over 99.9 %
Guidance	none	flexures for rotations <10°	flexures for rotations <2°
Space required	low	low	depends on features
Price	low	low	depends on features
Integration effort	high	low	low

Flexure guided, lever-amplified actuators form a reasonably priced and easily integrated class of products between conventional piezo stack actuators and the complex piezo nanopositioning systems



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

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Technical Data (preliminary)

Model	P-603.1S0 P-603.1SL	P-603.3S0 P-603.3SL	P-603.5S0 P-603.5SL	P-603.x00 open-loop versions	Units	Tolerance
Active axes	X	X	X	X		
Motion and positioning						
Integrated sensor	SGS	SGS	SGS	–		
Open-loop travel, -20 to +120 V	100	300	550	as P-603.xS0	μm	min. (+20%/-0)
Closed-loop travel	100	300	500	–	μm	calibrated
Open-loop resolution	0.2	0.3	0.4	as P-603.xS0	nm	typ.
Closed-loop resolution	2	4	7.5	–	nm	typ.
Linearity, closed-loop	0.3	0.3	0.3	–	%	typ.
Repeatability	8	10	30	–	nm	typ.
Mechanical properties						
Stiffness in motion direction	0.25	0.14	0.06	as P-603.xS0	N/ μm	$\pm 20\%$
Unloaded resonant frequency	900	450	300	as P-603.xS0	Hz	$\pm 20\%$
Push/pull force capacity in motion direction	20 / 2.5	15 / 2	10 / 1.5	as P-603.xS0	N	max.
Blocking force	20	35	25	as P-603.xS0	N	max.
Drive properties						
Ceramic type	PICMA® P-885	PICMA® P-885	PICMA® P-885	PICMA® P-885		
Electrical Capacitance	1.5	3.1	3.7	as P-603.xS0	μF	$\pm 20\%$
Dynamic operating current coefficient	1.9	1.3	1.6	as P-603.xS0	$\mu\text{A}/(\text{Hz}\cdot\mu\text{m})$	$\pm 20\%$
Miscellaneous						
Operating temperature range	-20 to 80	-20 to 80	-20 to 80	-20 to 80	$^{\circ}\text{C}$	
Material	Stainless steel	Stainless steel	Stainless steel	Stainless steel		
Mass	0.02 / 0.031	0.032 / 0.043	0.038 / 0.049	as P-603.xS0	kg	$\pm 5\%$
Cable length	0.5	0.5	0.5	0.5	m	$\pm 10\text{ mm}$
Sensor / voltage connection	S-version: open leads SL-version: LEMO connector (SGS Sensor)	S-version: open leads SL-version: LEMO connector (SGS Sensor)	S-version: open leads SL-version: LEMO connector (SGS Sensor)	Open leads		

Recommended controller / amplifier

E-610 controller / amplifier see p. 2-110, E-625 bench-top controller see p. 2-114