

## P-601 PiezoMove™ Z-Actuator

### Flexure-Guided OEM Piezo Actuator with Long Stroke to 400 µm



PiezoMove™ Lever-amplified piezo actuators of the P-601 series

- Flexure Guidance for Frictionless, Ultra-Straight Motion
- Travel Ranges to 400 µm
- Resolution to 0.2 nm
- High Dynamics and Stiffness
- Custom Designs with Longer Travel or Faster Response and Non-Magnetic Versions Feasible
- Outstanding Lifetime Due to PICMA® Piezo Actuators
- Choice of Closed-Loop and Open-Loop Models
- Ideal OEM Actuator for Precision Motion Control in Optics, Medical, Biotech and Microfluidics Applications

The flexure-guided, lever-amplified PiezoMove™ P-601 actuators provide large vertical travel ranges up to 400 µm, fast response and high positioning accuracy in a very small package. With settling times of only

a few milliseconds and a resolution in the sub-nanometer range they are well suited for both static and dynamic applications.

P-601 PiezoMove™ lever-amplified actuators cover the range between direct-driven preloaded piezo translators, such as the P-840 series (see p. 1-74) and single-axis nanopositioning stages, like the P-611 series (see p. 2-20). Compared to direct-driven piezo translators, lever-amplified actuators offer larger travel ranges and much higher lateral stiffness and guiding precision. Compared to single-axis nanopositioning stages, they offer significantly smaller sizes. PiezoMove™ lever-amplified actuators feature a resolution to 0.2 nm and a repeatability to 8 nm.

#### OEM Actuator with Integrated Guidance

With their highly precise, frictionless flexure guidance, a very high stiffness and excellent straightness of motion are achieved. Together with their small dimensions and the cost-effective design, the P-601 lever amplified actuators are especially suited for OEM applications. Versions with strain-gauge sensors (SGS) are equipped with a full bridge circuit that is insensitive to thermal drift. Versions without sensors are also available for open-loop applications such as in high-speed switches and pumps. In addition to the standard steel models, special invar and non-magnetic versions are available on request.

#### Ceramic Insulated Piezo Actuators Provide Long Lifetime

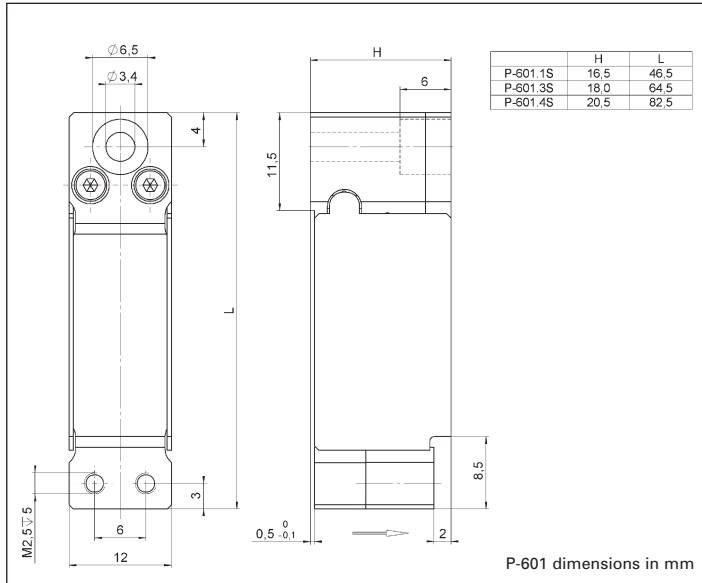
Highest possible reliability is assured by the use of award-winning PICMA® multilayer piezo actuators. PICMA® actuators are the only actuators on the market with ceramic-only insulation, which makes them resistant to ambient humidity and leakage-current failures. They are thus far superior to conventional actuators in reliability and lifetime.

#### Application Example

- Nanopositioning
- Imaging
- High-speed switching
- Patch clamp
- Micro-dispensing
- Semiconductor testing
- Adaptronics / Automation
- Photonics / integrated optics
- Biotechnology

#### Ordering Information

- P-601.1S**  
PiezoMove™ OEM Flexure-Guided, Lever-Amplified Actuator, 100 µm, SGS-Sensor
- P-601.3S**  
PiezoMove™ OEM Flexure-Guided, Lever-Amplified Actuator, 250 µm, SGS-Sensor
- P-601.4S**  
PiezoMove™ OEM Flexure-Guided, Lever-Amplified Actuator, 400 µm, SGS-Sensor
- P-601.1SL**  
PiezoMove™ OEM Flexure-Guided, Lever-Amplified Actuator, 100 µm, SGS-Sensor, LEMO Connector
- P-601.3SL**  
PiezoMove™ OEM Flexure-Guided, Lever-Amplified Actuator, 250 µm, SGS-Sensor, LEMO Connector
- P-601.4SL**  
PiezoMove™ OEM Flexure-Guided, Lever-Amplified Actuator, 400 µm, SGS-Sensor, LEMO Connector
- P-601.10**  
PiezoMove™ OEM Flexure-Guided, Lever-Amplified Actuator, 100 µm, Open-Loop
- P-601.30**  
PiezoMove™ OEM Flexure-Guided, Lever-Amplified Actuator, 250 µm, Open-Loop
- P-601.40**  
PiezoMove™ OEM Flexure-Guided, Lever-Amplified Actuator, 400 µm, Open-Loop



### Technical Data

Model	P-601.1S P-601.1SL	P-601.3S P-601.3SL	P-601.4S P-601.4SL	P-601.x0 Open-loop versions	Units	Tolerance
Active axes	Z	Z	Z	Z		
<b>Motion and positioning</b>						
Integrated sensor	SGS	SGS	SGS	–		
Open-loop travel, -20 to +120 V	100	250	400	as P-601.xS	µm	min. (+20%/0%)
Closed-loop travel	100	250	400	–	µm	calibrated
Open-loop resolution	0.2	0.3	0.4	as P-601.xS	nm	typ.
Closed-loop resolution	2	6	12	–	nm	typ.
Linearity, closed-loop	0.1	0.3	0.3	–	%	typ.
Repeatability	8	10	30	–	nm	typ.
Runout $\theta_x, \theta_y$	20 / 10	20 / 10	20 / 10	as P-601.xS	µrad	typ.
<b>Mechanical properties</b>						
Stiffness in motion direction	0.8	0.38	0.28	as P-601.xS	N/µm	±20 %
Unloaded resonant frequency	750	440	350	as P-601.xS	Hz	±20 %
Resonant frequency @ 30 g	620	350	290	as P-601.xS	Hz	±20 %
Push/pull force capacity in motion direction	30/10	20/10	15/10	as P-601.xS	N	Max.
Lateral force	30	30	30	as P-601.xS	N	Max.
<b>Drive properties</b>						
Ceramic type	PICMA® P-885	PICMA® P-885	PICMA® P-885	as P-601.xS		
Electrical capacitance	1.5	3.1	4.6	as P-601.xS	µF	±20 %
Dynamic operating current coefficient	1.9	1.6	1.4	as P-601.xS	µA/(Hz•µm)	±20 %
<b>Miscellaneous</b>						
Operating temperature range	-20 to 80	-20 to 80	-20 to 80	-20 to 80	°C	
Material	Stainless steel	Stainless steel	Stainless steel	Stainless steel		
Mass without cables	0.05	0.08	0.11	as P-601.xS	kg	±5 %
Cable length	S-version: 0.3 SL-version: 1.5	S-version: 0.3 SL-version: 1.5	S-version: 0.3 SL-version: 1.5	0.3	m	±10 mm
Sensor / voltage connection	S-version: open leads SL-version: LEMO	S-version: open leads SL-version: LEMO	S-version: open leads SL-version: LEMO	Open leads (no sensor)		

Recommended controller / amplifier  
E-610 controller / amplifier (p. 2-110), E-625 bench-top controller (p. 2-114)

### Linear Actuators & Motors

PiezoWalk® Motors / Actuators

PLine® 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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