

# Fast Tip/ Tilt Platform

SHORT SETTLING TIME AND HIGH DYNAMIC LINEARITY



## S-331

- + Tip/ tilt angle up to 5 mrad, optical deflection angle up to 10 mrad (0.57°)
- + Parallel kinematic design for identically high performance characteristics for both tip/ tilt axes
- + High resonance frequencies for dynamic motion and fast step- and- settle
- + Position sensors for high linearity
- + For mirrors up to  $\varnothing$  12.7 mm (0.5")

### Precision class tip/ tilt platform for applications with high demand on the dynamics

Two orthogonal tip/ tilt axes with common centre of rotation. Parallel kinematic design for identical performance characteristics of both axes. Flexure joints for friction- free motion and high stiffness. Direct drive.

### Strain sensors for low linear errors

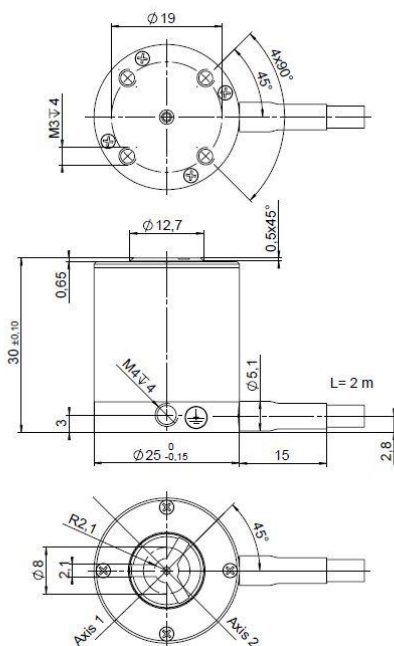
Metal foil strain gauge sensors with low temperature sensitivity. Linearity error to 0.1%.

### PICMA® High- performance drives

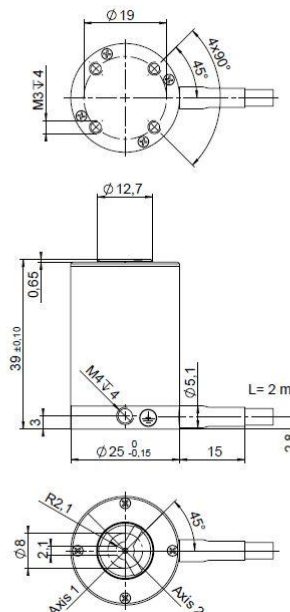
Piezoceramic actuators with all- ceramic insulation. Longer lifetime, insensitive to humidity and high operating temperatures.

### Fields of application

Image processing, image stabilization. Laser beam steering. Scanning microscopy. Materials processing, lithography. Optical filters, optical switches.



S-331.2SL,  
dimensions in mm



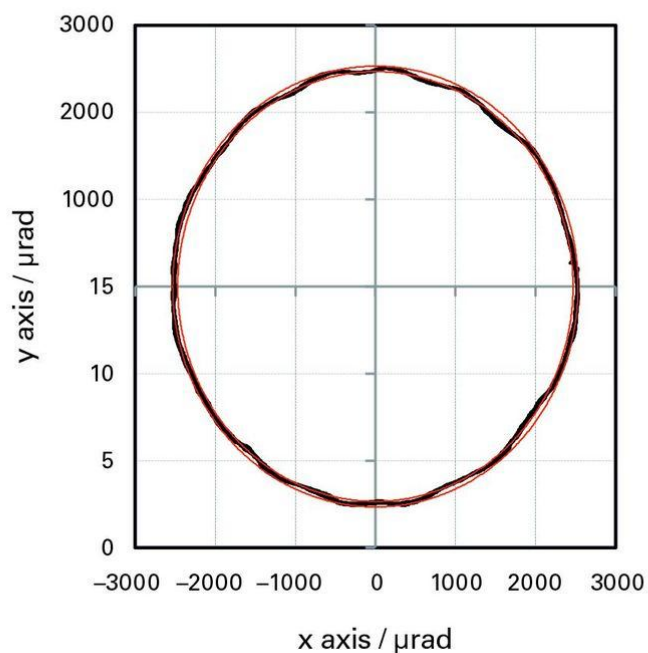
S-331.5SL,  
dimensions in mm

## Specifications

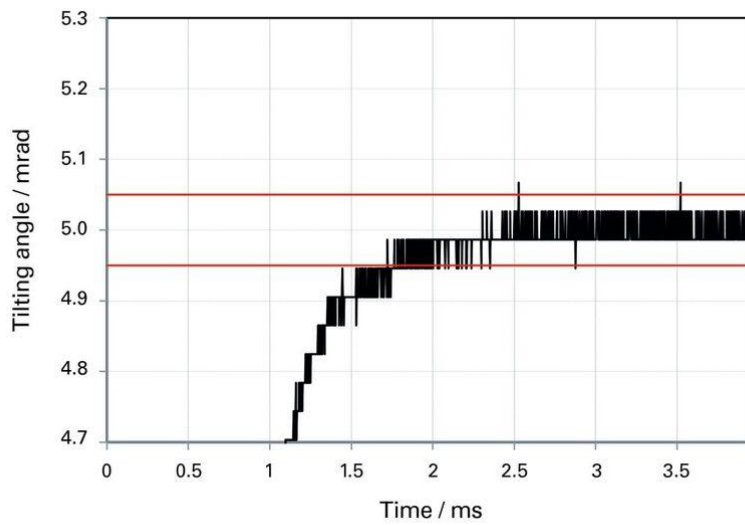
Preliminary Data	S-331.2SL / S-331.2SD	S-331.5SL / S-331.5SD	Unit	Tolerance
Active axes	$\theta_x, \theta_y$	$\theta_x, \theta_y$		
<b>Motion and Positioning</b>				
Integrated sensor	SGS	SGS		
Open- loop tip/ tilt angle in $\theta_x, \theta_y$ at -20 to 120 V	4.2	7	mrad	min.
Closed- loop tilt angle in $\theta_x, \theta_y$	3	5	mrad	
Open- loop resolution in $\theta_x, \theta_y$	0.05	0.1	$\mu$ rad	typ.
Closed- loop resolution in $\theta_x, \theta_y$	0.1	0.25	$\mu$ rad	typ.
Linearity error in $\theta_x, \theta_y$	0.4	0.4	%	typ.
Repeatability in $\theta_x, \theta_y$ , 10% tip/ tilt angle	0.3	0.3	$\mu$ rad	typ.
Repeatability in $\theta_x, \theta_y$ , 100% tip/ tilt angle	3	5	$\mu$ rad	typ.
<b>Mechanical Properties</b>				
Resonance frequency, unloaded in $\theta_x, \theta_y$	10	6	kHz	$\pm 20$ %
Resonant frequency, unloaded in $\theta_x, \theta_y$ (with glass mirror, $\varnothing$ 12.7 mm, thickness 3 mm)	6	4	kHz	$\pm 20$ %
Distance of pivot point to platform surface	4	4	mm	$\pm 1$ mm
Platform moment of inertia	30	30	$\text{g} \times \text{mm}^2$	$\pm 20$ %
<b>Drive Properties</b>				
Ceramic type	PICMA®	PICMA®		
Electrical capacitance	0.96/ axis	1.44/ axis	$\mu$ F	$\pm 20$ %
<b>Miscellaneous</b>				
Operating temperature range	-20 to 80	-20 to 80	$^{\circ}$ C	
Material case	Steel	Steel		
Material platform	Titanium	Titanium		
Mass	0.13	0.14	kg	$\pm 5$ %
Cable length	1.5	1.5	m	$\pm 10$ mm
Sensor / voltage connection	LEMO (S-331.2SL), Sub- D 25-pin (m) (S-331.2SD)	LEMO (S-331.5SL), D- Sub 25-pin (m) (S-331.5SD)		

### Recommended controllers / amplifiers

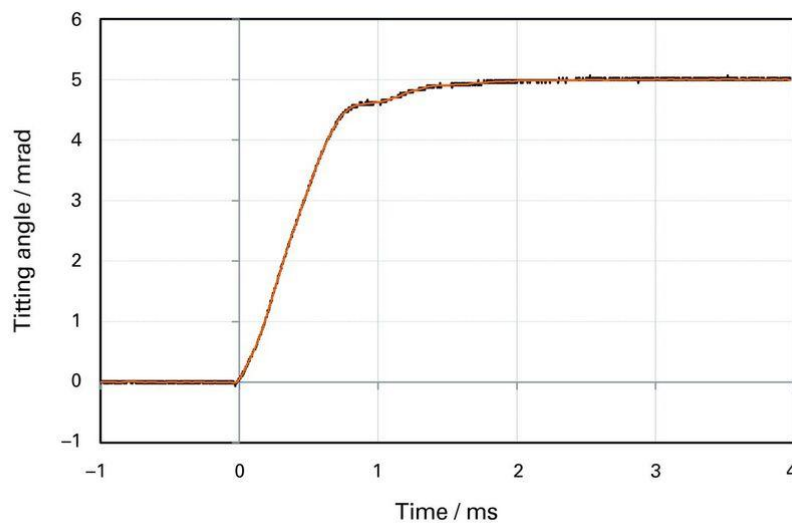
Versions with LEMO connectors: E-500 modular piezo controller system with E-503.00S amplifier module (three channel) or 1 x E-505.00S and 2 x E-505 (highly dynamic applications) and E-509 power amplifier (optional). Versions with Sub- D connector: E-616 controller for tip/ tilt mirror systems.



High dynamic linearity of a circular motion with 5 mrad displacement per axis (full displacement of the S-311.5SL with E-505 power amplifier and E-509 controller). The linear error on the ideal circular path at a frequency of 25 Hz is approx. 0.5%, which corresponds to 2.5  $\mu$ rad.



The settling time of the unloaded S-331.5SL for one 5 mrad step (full displacement) is 1.8 ms with an accuracy of  $\pm 1\%$ .



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High dynamics even in continuous operation.

	Control Voltage	Frequency
S-331.2SL	20 V	2.5 kHz
	50 V	2.5 kHz
	100 V	1.75 kHz
S-331.5SL	20 V	2 kHz
	50 V	2 kHz
	100 V	1.5 kHz