

## 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 resonant frequencies for dynamic motion and fast step-and-settle
- Position sensors for high linearity
- For mirrors up to Ø 12.7 mm (0.5")

#### Fields of application

- Image processing / stabilization
- Optical trapping
- Laser scanning / beam steering
- Laser tuning
- Optical filters / switches
- Optics
- Beam stabilization

#### 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.

#### 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 Sub-D connector of the mechanics. The autocalibration function of the digital controllers uses this data each time the controller is switched on.

## High dynamics multi-axis operation due to parallel kinematics

In a parallel-kinematic multi-axis system, all actuators act on a common platform. The minimum mass inertia and the identical design of all axes allow fast, dynamic, and nevertheless precision motion.

## Specifications

	S-331.2SL / S-331.2SH	S-331.5SL / S-331.5SH	Unit	Tolerance
Active axes	$\theta_x, \theta_y$	$\theta_x, \theta_y$		
<b>Motion and positioning</b>				
Integrated sensor	SGS	SGS		
Tip/tilt angle in $\theta_x, \theta_y$ at -20 to 120 V, open loop	4.2	7	mrad	min.
Tip/tilt angle in $\theta_x, \theta_y$ , closed loop	3	5	mrad	
Resolution in $\theta_x, \theta_y$ , open loop	0.05	0.1	$\mu$ rad	typ.
Resolution in $\theta_x, \theta_y$ , closed loop	0.1	0.25	$\mu$ rad	typ.
Linearity error in $\theta_x, \theta_y$	0.3 <sup>(1)</sup> 0.1 <sup>(2)</sup>	0.3 <sup>(1)</sup> 0.1 <sup>(2)</sup>	%	typ.
Repeatability in $\theta_x, \theta_y$ , 10 % tip/tilt angle	0.3	0.5	$\mu$ rad	typ.
Repeatability in $\theta_x, \theta_y$ , 100 % tip/tilt angle	3	5	$\mu$ rad	typ.
<b>Mechanical properties</b>				
Resonant frequency, no load, in $\theta_x, \theta_y$	12	16	kHz	$\pm 20$ %
Resonant frequency, under load in $\theta_x, \theta_y$ (with glass mirror, $\varnothing$ 12.7 mm, thickness 3 mm)	9	10	kHz	$\pm 20$ %
Distance of pivot point to platform surface	4	4	mm	$\pm 1$ mm
Platform moment of inertia	30	30	$g \times mm^2$	$\pm 20$ %
<b>Drive properties</b>				
Ceramic type	PICMA®	PICMA®		
Electrical capacitance	0.96 / axis	6.2 / axis	$\mu$ F	$\pm 20$ %
<b>Miscellaneous</b>				
ID chip functionality	S-331.2SH	S-331.5SH		
Operating temperature range	-20 to 80	-20 to 80	$^{\circ}$ C	
Material housing	Steel	Steel		
Platform material	Titanium	Titanium		
Mass	0.13	0.28	kg	$\pm 5$ %
Cable length	2	2	m	+100 mm / -0 mm
Sensor/voltage connection	SH version: Sub-D 37 (m) SL version: LEMO	SH version: Sub-D 37 (m) SL version: LEMO		
Recommended electronics	E-503, E-727	E-503, E-727		

<sup>(1)</sup> S-331.xSL in conjunction with E-5xx analog controller modules.

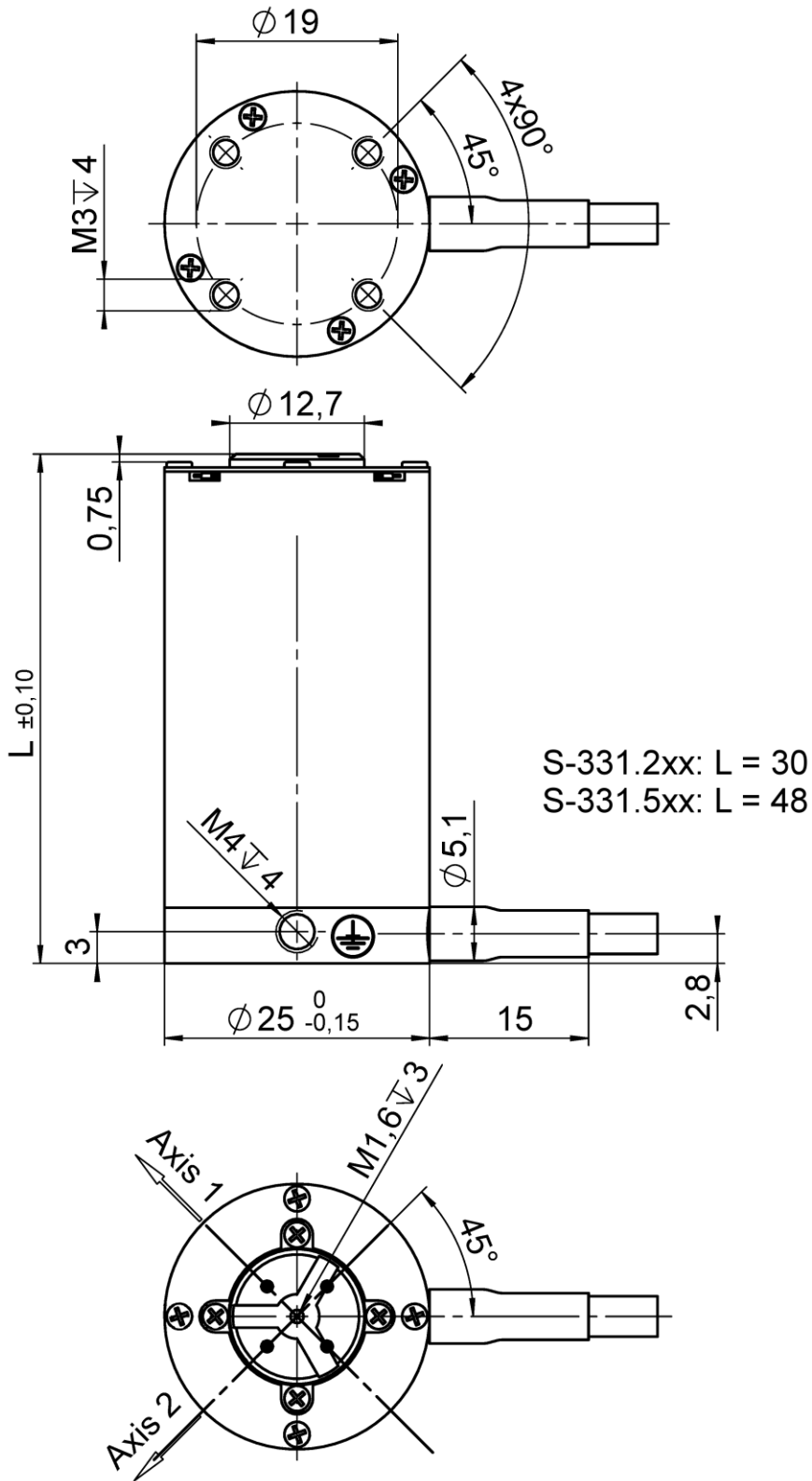
<sup>(2)</sup> S-331.xSH in conjunction with digital controllers, unidirectional.

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.

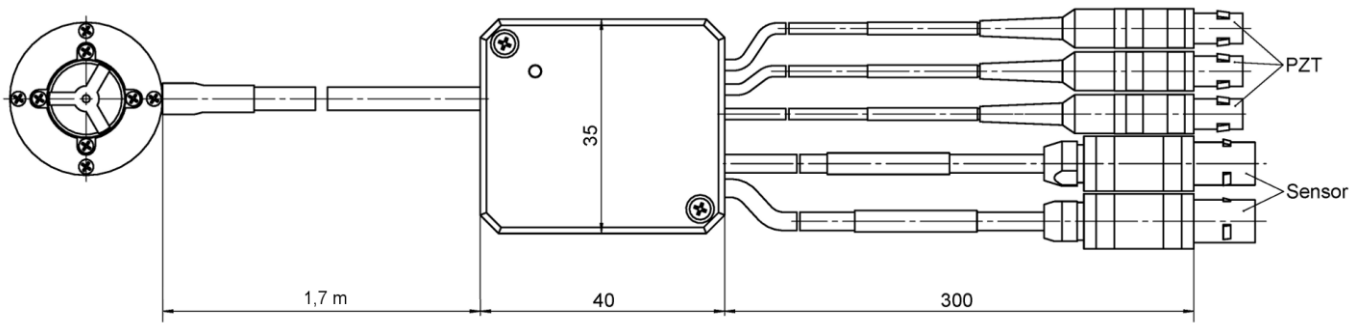
All specifications based on room temperature ( $22 \text{ }^{\circ}\text{C} \pm 3 \text{ }^{\circ}\text{C}$ ).

Ask about customized versions.

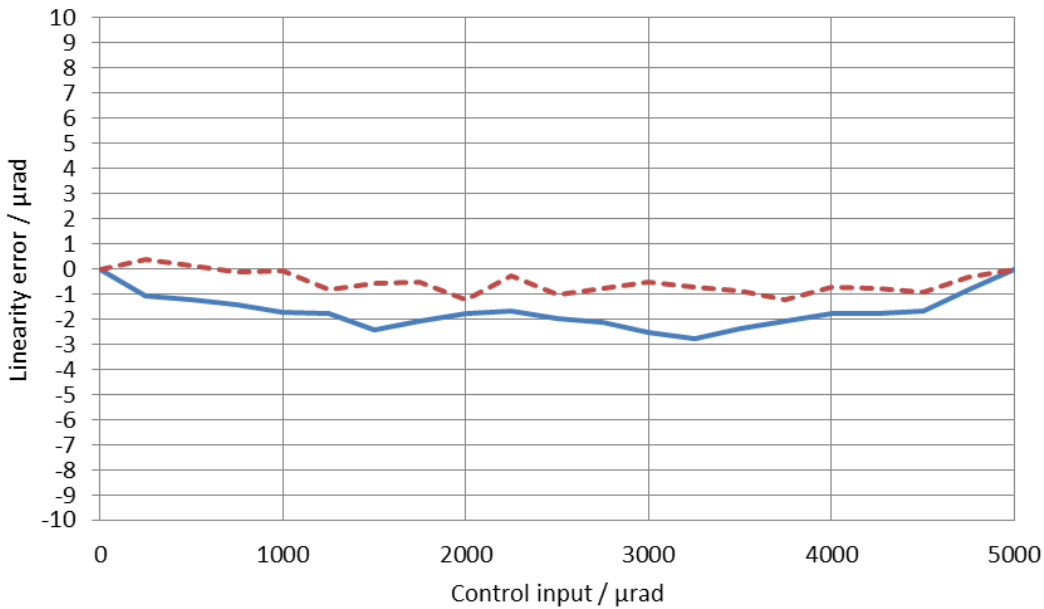
## Drawings / Images



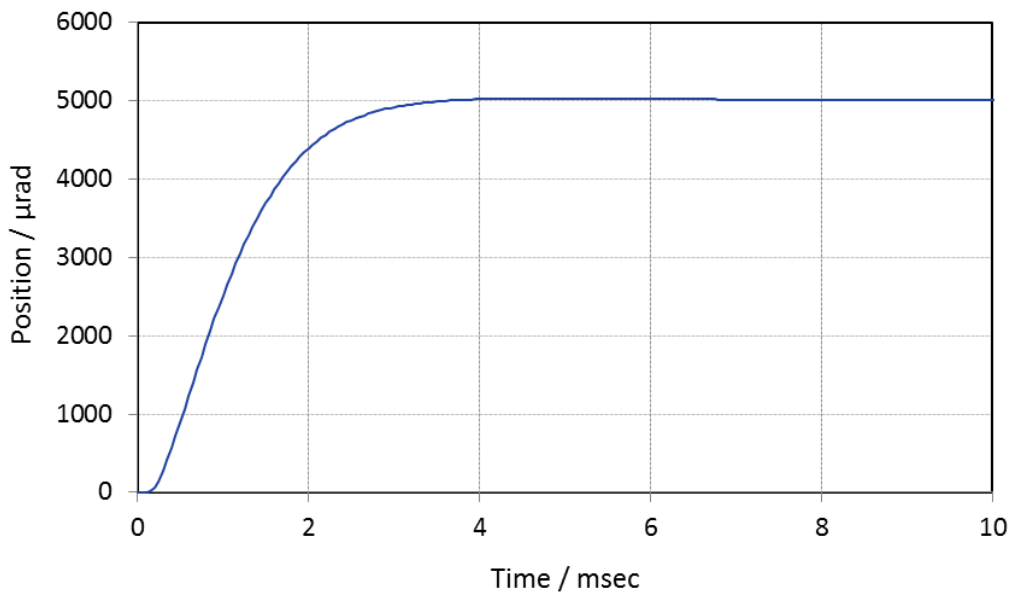
S-331, dimensions in mm



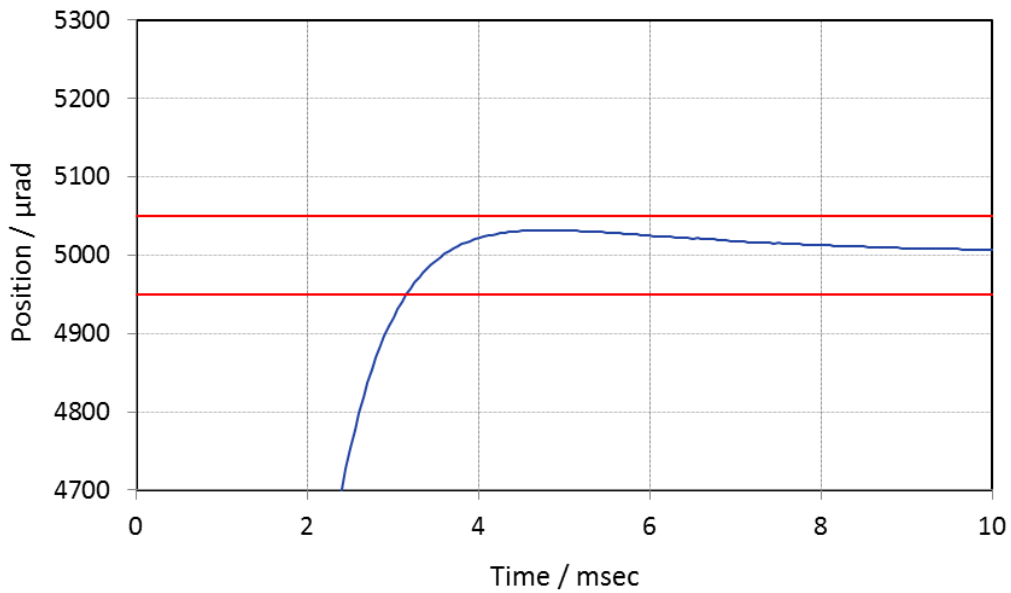
S-331.xSL with cable splitter box; dimensions in mm



Unidirectional linearity error for both axes: The solid blue line represents axis 1, the dotted brown line represents axis 2. The linearity error at full displacement of the S-331.5SH with the E-727.3SD digital piezo controller is less than 0.05 %.



Full displacement of an unloaded S-331.5SL with E-505 piezo amplifier module and E-509 servo controller module



Settling time of an unloaded S-331.5SL at full displacement with E-505 piezo amplifier module and E-509 servo controller module: The settling time is 3 ms with an accuracy of  $\pm 1\%$  for a step of 5 mrad (full displacement).

## Ordering Information

### **S-331.2SH**

High-dynamics tip/tilt platform with high stiffness, 3 mrad tip/tilt angle, strain gauge sensor, Sub-D 37 connector (m)

### **S-331.2SL**

High-dynamics tip/tilt platform with high stiffness, 3 mrad tip/tilt angle, strain gauge sensor, LEMO connector(s)

### **S-331.5SH**

High-dynamics tip/tilt platform with high stiffness, 5 mrad tip/tilt angle, strain gauge sensor, Sub-D 37 connector (m)

### **S-331.5SL**

High-dynamics tip/tilt platform with high stiffness, 5 mrad tip/tilt angle, strain gauge sensor, LEMO connector(s)