

# S-334

## Ultra-Long-Range Piezo Tip/Tilt Mirror

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- Optical Deflection to 100 mrad (~6°)
- 1.0 kHz Resonant Frequency with Mirror
- Closed-Loop Version for Higher Linearity
- For Mirrors up to 12.5 mm (0.5") Diameter
- 2 Fixed Orthogonal Axes with a Common Pivot Point
- Sensor Configuration for Excellent Temperature Stability
- Zero Friction Flexure Guides

S-334 tip/tilt platforms are fast and compact units providing precise angular movements of a mirror around two orthogonal axes. The tip/tilt range is 50 mrad with sub- $\mu$ rad resolution. Highest stability and accuracy is available in closed-loop operation.

### Huge Tip/Tilt Ranges with Excellent Motion Characteristics

The novel lever design combines the exceptionally large tip/tilt range of 3° (50 mrad, which is equivalent to 100 mrad optical beam deflection) with the high resonant frequen-

cy of 1.0 kHz (including the mirror). These parameters make the system unique in the market of high-speed, long-range scanners.

### Sub-Microradian Resolution and Stable Positioning

The S-334 provides sub-microradian resolution. When operated in closed-loop mode, it offers absolute position control and high linearity, typically under  $\pm 0.25\%$  over the entire travel range. This is achieved by high-resolution, full-bridge strain gauge sensors (SGS), calibrated specifically for each unit with the control electronics.

### Higher Performance Through Parallel Kinematics

S-334 tip/tilt platforms feature a single moving platform, parallel-kinematics design with a common pivot point. Compared to stacked, multi-axis systems, the parallel-kinematics design provides faster response and better linearity with equal dynamics for all axes in a smaller package.

### Working Principle / Lifetime

The S-334 is equipped with two pairs of long-life, ceramic-encapsulated, high-performance PICMA® piezo drives operating as a unit in push/pull mode. The linear-drive actua-

### Ordering Information

**S-334.2SL**  
Piezo Tip/Tilt Platform, 50 mrad, Closed-Loop, 100 mrad Optical Deflection, BK7-Mirror,  $\phi 10 \times 2$  mm.

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tors are driven differentially in diagonal pairs. The casing is equipped with integrated, FEA-modeled flexures featuring zero stiction, zero friction and exceptional guiding precision.

Since drives and guides are frictionless and not subject to wear and tear, these units offer an exceptionally high level of reliability.

### Notes

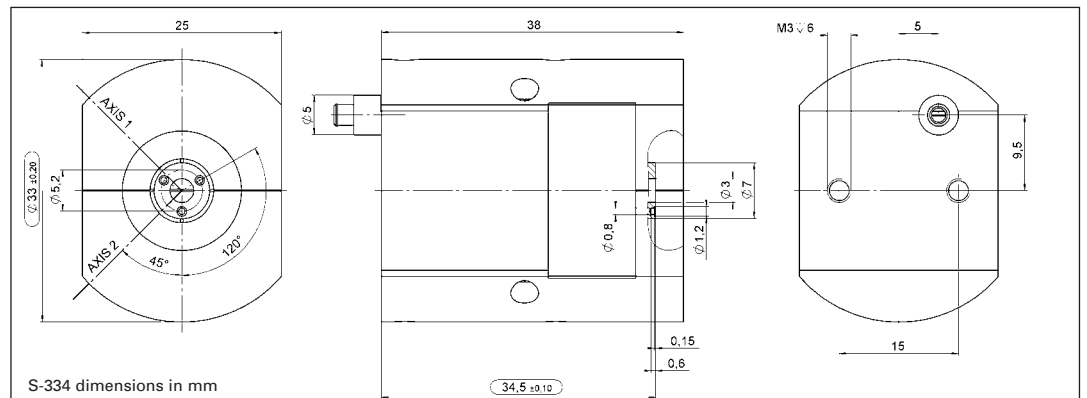
The S-334 is equipped with a factory-installed mirror 10 mm in diameter and 2 mm thick (flatness  $\lambda/5$ , reflectivity > 98% from 500 nm to 2  $\mu$ m). Custom coatings, and mirrors up to 12.5 mm diameter, are available on request. Please contact your PI sales engineer.

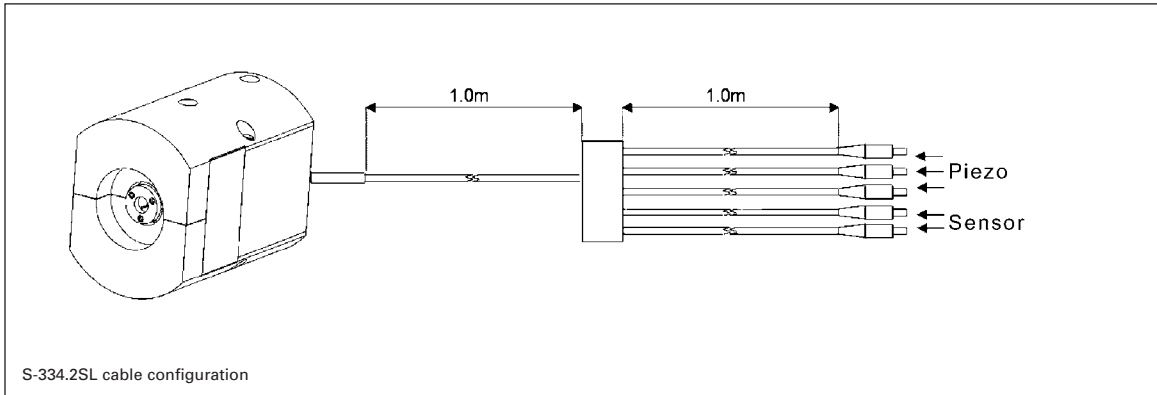
See the "Selection Guide" on p. 3-8 for comparison with other steering mirrors.

See "Piezo Drivers & Nanopositioning Controllers" section for our comprehensive line of low-noise modular and OEM control electronics for computer and manual control.

### Application Examples

- Beam steering, scanning, stabilization
- Image stabilization
- Interlacing, dithering
- Beam switching
- Adaptive optics systems
- Imaging systems
- Scanning microscopy





### Technical Data

Models	S-334.2SL	Units	Notes see page 3-26
Active Axes	$\Theta_x, \Theta_y$		
* Open-loop tilt angle @ 0 to 100 V	50	mrad $\pm 20\%$	A2
* Closed-loop tilt angle	50	mrad	A3
Integrated feedback sensor	4 x full-bridge strain gauge sensors		B
** Closed-loop / open-loop angular resolution	<5 / 0.5	$\mu\text{rad}$	C1
Closed-loop linearity (typ.)	$\pm 0.25$	%	
Electrical capacitance	3.0 / axis	$\mu\text{F} \pm 20\%$	F1
Resonant frequency with 10 mm diam. x 2 mm glass mirror	1.0	$\text{kHz} \pm 20\%$	G2
Resonant frequency with 12.5 mm diam. x 2.5 mm glass mirror	0.8	$\text{kHz} \pm 20\%$	G3
Distance of pivot point to platform surface (lower mirror surface)	2 $\pm$ 0.5	mm	
Operating temperature range	-20 to 80	$^{\circ}\text{C}$	H2
Voltage connection	3 x LEMO FFA.00.250, 2 m		
Sensor connection	2 x LEMO FFA.0S.304, 2 m		
Weight (without cables)	65	g $\pm 5\%$	
Standard mirror	diameter: 10 mm, thickness: 2 mm, BK7, $\lambda / 5$ , R >98% ( $\lambda = 500 \text{ nm to } 2 \mu\text{m}$ )		
Material casing	Titanium		L
Recommended amplifier/controller (codes explain page 3-9)	H <sup>†</sup> , D		

\* Mechanical tilt, optical beam deflection is 100 mrad.

\*\* For calibration information see p. 3-7. Resolution of PI piezo tip/tilt platforms is not limited by friction or stiction. Noise equivalent motion with E-503 amplifier.

<sup>†</sup> With (1 x E-505.00S + 2 x E-505.00) or 1 x E-503.00S

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