

S-340

High-Speed Piezo Tip/Tilt Platforms

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S-340.AL
Tip/Tilt
Platform

- Fixed Orthogonal Axes with a Common Pivot Point
- 4 mrad Optical Beam Deflection
- For Mirrors to 100 mm Ø
- Sub-µrad Resolution
- Closed-Loop Versions for Better Linearity
- Differential Design for Excellent Temperature Stability
- Zero Friction Flexure Guides
- Single-Moving-Platform, Parallel-Kinematics Design: Equal Dynamics for all Axes, Better Linearity & Temperature Stability

S-340 piezo tip/tilt platforms are fast and compact tilt units, providing precise angular movements of the top platform in two orthogonal axes. The tip/tilt range is 2 mrad (equivalent to 4 mrad optical beam deflection) with sub-µrad reso-

lution. Closed-loop versions are available for highest accuracy and repeatability. S-340 systems are designed for mirrors up to 100 mm diameter and have outstanding angular stability over a wide temperature range.

To match the CTEs (coefficients of thermal expansion) of various mirror materials, platforms made from different materials are available (see ordering information).

Open / Closed-Loop Operation

In open-loop operation, the platform angle roughly corresponds to the drive voltage (see page 4-17 in the "Tutorial" section for behavior of open-loop piezos). The open-loop

models are ideal for applications where the position is controlled by an external loop, based on data provided by a sensor (e.g. PSD, quad cell, CCD chip, etc.).

The closed-loop versions are equipped with two pairs (one per axis) of LVDT (linear variable differential transformer) sensors operated in a bridge circuit for ultra-high resolution and angular stability. They provide sub-µrad resolution and repeatability.

Higher Performance Through Parallel Kinematics

S-340 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

S-340 tip/tilt platforms are equipped with two pairs of long-life, ceramic-encapsulated, high-performance PICMA® piezo drives operating as a unit in push/pull mode. The aluminum case is equipped with an integrated, FEA-modeled (finite element analysis) circular flexure 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

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

See the "Piezo Drivers & Nanopositioning Controllers" section

Ordering Information

S-340.A0
Θ_x, Θ_y Piezo Tip/Tilt Platform, 2 mrad, Aluminum Top Plate

S-340.i0
Θ_x, Θ_y Piezo Tip/Tilt Platform, 2 mrad, Invar Top Plate

S-340.S0
Θ_x, Θ_y Piezo Tip/Tilt Platform, 2 mrad, Steel Top Plate

S-340.T0
Θ_x, Θ_y Piezo Tip/Tilt Platform, 2 mrad, Titanium Top Plate

S-340.AL
Θ_x, Θ_y Piezo Tip/Tilt Platform, 2 mrad, Aluminum Top Plate, Closed-Loop

S-340.iL
Θ_x, Θ_y Piezo Tip/Tilt Platform, 2 mrad, Invar Top Plate, Closed-Loop

S-340.SL
Θ_x, Θ_y Piezo Tip/Tilt Platform, 2 mrad, Steel Top Plate, Closed-Loop

S-340.TL
Θ_x, Θ_y Piezo Tip/Tilt Platform, 2 mrad, Titanium Top Plate, Closed-Loop

Ask about custom designs!

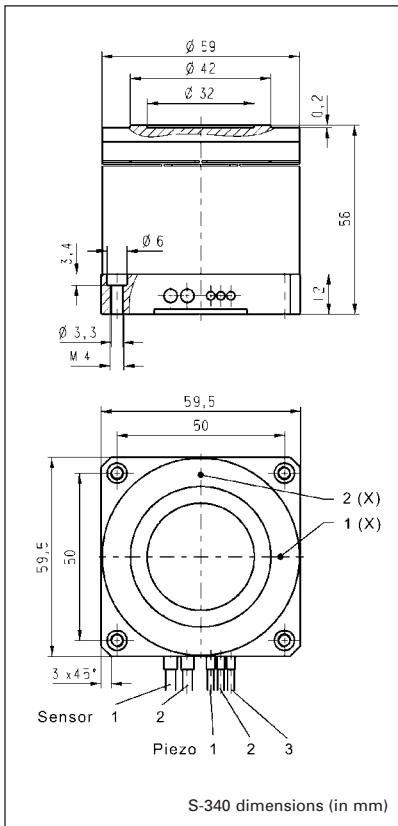
for our comprehensive line of low-noise modular and OEM control electronics for computer and manual control.

Materials Match

Platform	Recommended Mirror	Recommended Models
Aluminum	Aluminum	S-340.Ax
Invar	Zerodur glass	S-340.ix
Titanium	BK7 glass	S-340.Tx
Steel		S-340.Sx

Application Examples

- Image stabilization
- Laser beam stabilization
- Beam switching
- Adaptive optics systems
- Laser beam steering & scanning
- Correction of polygon scanner errors
- Interlacing, dithering



Technical Data

Models	S-340.x0	S-340.xL	Units	Notes see page 3-26
Active axes	Θ_x, Θ_y	Θ_x, Θ_y		
* Open-loop tilt angle 0 to 100 V	2 (4 optical)	2 (4 optical)	mrad $\pm 20\%$	A2
* Closed-loop tilt angle	-	2 (4 optical)	mrad	A3
Integrated feedback sensor	-	4 x LVDT		B
** Closed-loop / open-loop resolution	- / 0.1	0.5 / 0.1	μrad	C1
Closed-loop linearity (typ.)	-	± 0.1	%	
Full-range repeatability (typ.)	-	± 1	μrad	C3
Electrical capacitance	6.0 / axis	6.0 / axis	$\mu\text{F} \pm 20\%$	F1
*** Dynamic operating current coefficient (DOCC)	0.38 / axis	0.38 / axis	$\mu\text{A}/(\text{Hz} \times \mu\text{rad})$	F2
**** Unloaded resonant frequency (f_0)	1.4	1.4	$\text{kHz} \pm 20\%$	G2
**** Resonant frequency w/ $\phi 50 \times 15$ mm glass mirror	0.9	0.9	$\text{kHz} \pm 20\%$	G3
**** Resonant frequency w/ $\phi 75 \times 22$ mm glass mirror	0.4	0.4	$\text{kHz} \pm 20\%$	G3
Distance, pivot point to platform surface (T)	7.5	7.5	mm	
**** Platform moment of inertia	18000	18000	$\text{g} \cdot \text{mm}^2$	
Operating temperature range	- 20 to 80	- 20 to 80	$^{\circ}\text{C}$	H2
Voltage connection	3 x VL	3 x VL		J1
Sensor connection	-	2 x L		J2
Weight (w/o cables)	335	335	$\text{g} \pm 5\%$	
Material (case / platform)	Al / depends on version	Al / depends on version		L
Recommended amplifier/controller (codes explained page 3-9)	G ^a , C	H ^a , E		

* Mechanical tilt, optical beam deflection is twice as large.

** For calibration information see p. 3-7.

Resolution of PZT tip/tilt platforms is not limited by friction or stiction. Noise equivalent motion with E-503 amplifier.

*** Dynamic Operating Current Coefficient in μA per Hz and μrad . Example: Sinusoidal scan of $100 \mu\text{rad}$ at 10 Hz requires approximately 0.38 mA drive current.

**** Value for aluminum top plate. Lower resonant frequency for other platforms due to higher moment of inertia: titanium: +60%; invar: +200%; steel: +190%.

^a With (1 x E-505.00S + 2 x E-505.00) or 1 x E-503.00S

Piezo Actuators

Nanopositioning & Scanning Systems

Active Optics / Steering Mirrors

Tutorial: Piezo-electrics in Positioning

Capacitive Position Sensors

Piezo Drivers & Nanopositioning Controllers

Hexapods / Micropositioning

Photonics Alignment Solutions

Motion Controllers

Ceramic Linear Motors & Stages

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