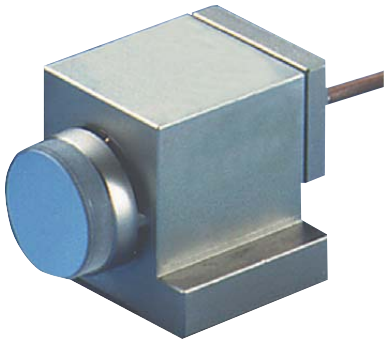
S-224 · S-226

High-Speed Miniature Piezo Tilt Mirror



S-224 Tilt Mirror

- **Sub-µrad Resolution**
- **Sub-Millisecond Response**
- **Up to 4.4 mrad Optical Beam Deflection**
- **Closed-Loop Versions for Better Linearity**
- **Includes BK7 Mirror**
- **Zero Friction Flexure Guiding System**

S-224/S-226 miniature tilt platforms are extremely fast and compact tilt units, providing a tilt range of 2.2 mrad and sub-millisecond response. The S-224 and S-226 are delivered with a Ø 15 x 4 mm BK7 glass mirror.

Open- and Closed-Loop Operation

The S-224 is specifically designed for open-loop operation. The S-226 closed-loop version is available for highest accuracy and repeatability. In open-loop operation, the platform's angular position is roughly proportional to the drive voltage (see page 4-17 in the "Tutorial" section for behavior of open-loop piezos). Open-loop operation is ideal for applications where the position is controlled by data provided by an external optical sensor, a CCD camera, etc.

The closed-loop version (S-226) allows absolute position control, high linearity, and repeatability based on the internal ultra-high-resolution feedback sensor.

Working Principle / Lifetime

S-224/S-226 miniature tilt platforms are equipped with long-life, ceramic-encapsulated, high-performance PICMA® piezo drives pushing a frictionless, flexure-mounted platform. The flexure is FEA (finite element analysis) modeled for zero stiction, zero friction and exceptional guiding precision; it also serves as the pivot point and preload for the piezo actuator.

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

Ordering Information

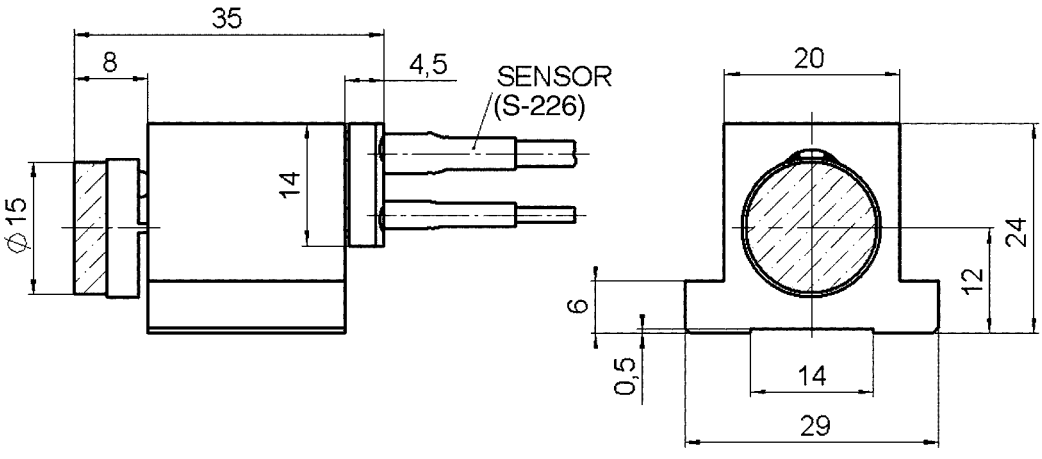
S-224.00
Piezo Tilt Platform 2.2 mrad (4.4 mrad optical) with Mirror, Open-Loop

S-226.00
Piezo Tilt Platform 2.0 mrad (4.4 mrad optical) with Mirror, Closed-Loop

Ask about custom designs!

Application Examples

- Laser beam steering & scanning
- Beam switching
- Correction of polygon scanner errors
- Laser beam stabilization



S-224, S-226 dimensions (in mm)

Technical Data

Models	S-224.00	S-226.00	Units	Notes see page 3-26
Active axes	Θ_X	Θ_X		
* Open-loop tilt angle @ 0 to 100 V	2.2	2.2	mrad ±20%	A2
* Closed-loop tilt angle	-	2.0	mrad	A3
Integrated feedback sensor	-	strain gauge		B
** Closed-loop / open-loop resolution	- / 0.05	0.1 / 0.05	µrad	C1
Closed-loop linearity (typ.)	-	0.2	%	
Full-range repeatability (typ.)	-	±3	µrad	C3
Electrical capacitance	1.5	1.5	µF ±20%	F1
*** Dynamic operating current coefficient (DOCC)	0.1	0.1	µA/(Hz x µrad)	F2
Unloaded resonant frequency (f_0)	9.0	9.0	kHz ±20%	G2
Resonant frequency w/ ø 15 x 4 mm glass mirror (included)	7.5	7.5	kHz ±20%	G3
Resonant frequency w/ ø 15 x 4 mm copper mirror	5.7	5.7	kHz ±20%	G3
Distance, pivot point to platform surface (T)	4	4	mm	
Platform moment of inertia	215	215	g · mm²	
Operating temperature range	- 20 to 80	- 20 to 80	°C	H2
Voltage connection	VL	VL		J1
Sensor connection	-	L		J2
Weight (w/o cables)	98	98	g ±5%	
Material (case / platform)	N-S / N-S	N-S / N-S		L
Recommended amplifier/controller (codes explained page 3-9)	G, C	H, D		

* 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 µrad at 10 Hz requires approximately 0.1 mA drive current.

S-323 Piezo Z/Tip/Tilt Platform

High Dynamics & Stability Nanopositioning System with Direct Metrology

The S-323 Z/tip/tilt platform integrates capacitive sensors for highest resolution and stability

- Optical Beam Deflection to 6 mrad
- Sub-µrad Resolution for High Positioning Stability
- Position Servo-Control with Capacitive Sensors
- Frictionless, High-Precision Flexure Guiding System
- System Combination with Digital Controllers for Highest Linearity

Model	Active axes	Travel range	Resolution	Unloaded resonant frequency
S-323.3CD	Z, θ_X, θ_Y	30 µm, ±1.5 mrad	0.1 nm, ±0.05 µrad	1.7 kHz

S-303 Piezo Phase Shifter

Highest Dynamics and Stability with Capacitive Feedback Sensor

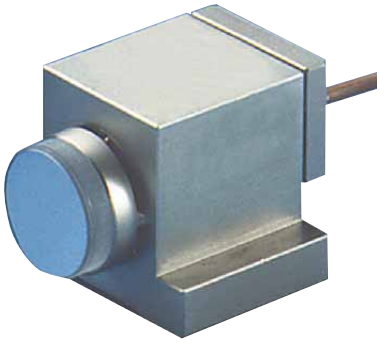
S-303 closed-loop model (left) and open-loop model (right). DIP switch for size comparison

- 25 kHz Resonant Frequency for Sub-Millisecond Dynamics
- Capacitive Sensor Option for Highest Linearity and Stability
- 3 µm Travel Range
- Compact Size: 30 mm Diameter x 10 mm
- Aperture with Open-Loop Versions
- Invar Option for Highest Thermal Stability

Model	Active axes	Closed-loop/ open-loop travel @ -20 to +120V	Closed-loop/ open-loop resolution	Unloaded resonant frequency
S-303.CD (closed-loop)/ S-302.0L (open-loop)	Z	2 / 3 µm	0.03 nm	25 kHz

S-224 – S-226 Piezo Tilt-Mirror

Fast Steering Mirror Combines Highest Dynamics and Compact Design



S-224 Piezo tip/tilt mirror for high-speed beam steering tasks and image stabilization applications

- Optical Beam Deflection to 4.4 mrad
- Sub-µrad Resolution, Sub-Millisecond Response
- Frictionless, High-Precision Flexure Guiding System
- Includes BK7 Mirror
- Optional Position Feedback Sensor
- Outstanding Lifetime Due to PICMA® Piezo Actuators

Model	Active axes	Open-loop tilt angle @ 0 to +100V	Closed-loop/ open-loop resolution	Unloaded resonant frequency
S-224.00 (open-loop)/ S-226.00 (closed-loop)	θ_X	2.0 / 2.2 mrad	0.1 / 0.05 µrad	9 kHz