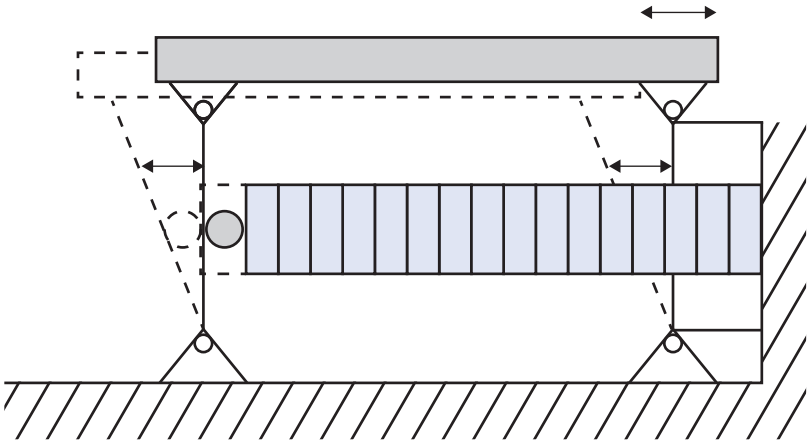
Technology:
Piezo Actuators with Guiding and Preload



Simple lever amplification. The point contact decouples shear forces and thus tensile stress on the piezo ceramic

Preloaded and Cased Actuators

Piezoceramic actuators are insensitive to push forces, but must be protected from pulling and shearing stress. A case mechanically decouples lateral forces and insulates contacting. Between the case and the piezo ceramic, a preload can be applied, e.g. by means of a spring, which allows dynamic operation of higher loads.

Flexure Guides Direct Motion and Maintain Stiffness

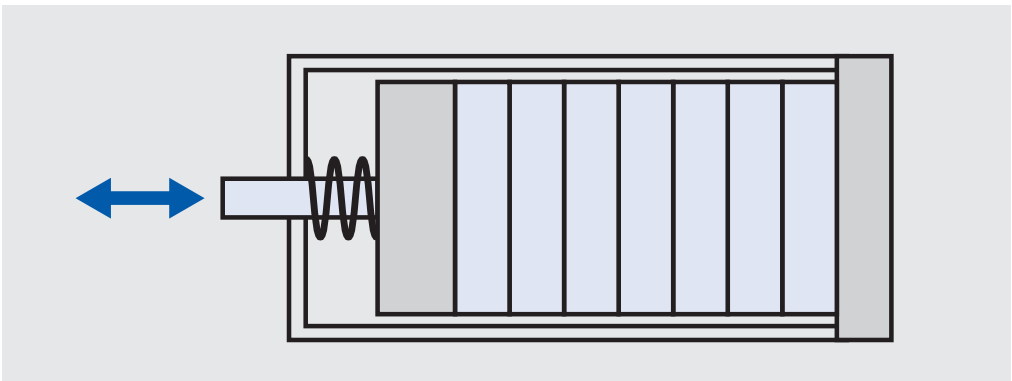
Precise straight motions require the piezo actuator to be embedded in a guide. This is usually a flexure guide, which is frictionless and allows hysteresis-free motion at the possible travel ranges of up to a few millimeters. Ideally this mechanical guiding concept also integrates force decoupling and preloading without an adverse effect on the system stiffness.

Lever Amplification Allows Travel Ranges of up to 1 mm

The displacements of piezo stack actuators are typically up to a few ten millimeters and a few 100 micrometers maximum. The flexure guide can be designed such that it will act like a mechanical lever. This mechanically amplifies the displacement of the piezo actuator and guides it into a different direction, if necessary.

Lever-amplified systems have an extremely demanding design: On the one hand, they are supposed to prevent lateral migration and, on the other, to always guide it in a straight line, even though the lever always leads through a pivot point. Moreover, increasing the travel range is at the cost of stiffness.

The flexure guide can be designed such that further integration does not require any additional guide.



The piezo ceramic stack is mechanically preloaded against the housing by means of a spring. This prevents pull forces, such as the ones caused by the inert mass of the load in dynamic operation

From Stack Actuator to 6-Axis Stage

Integration levels of piezo actuators

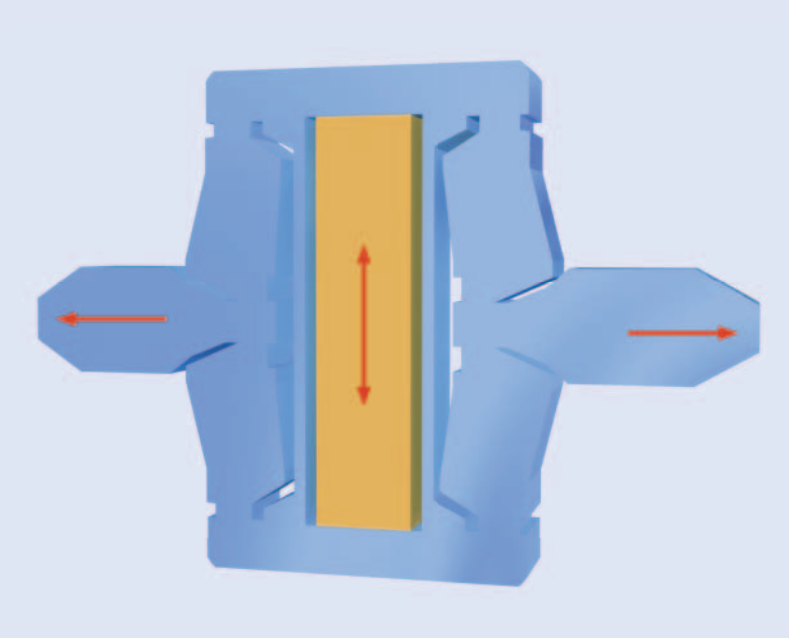
	Stack Actuators	Lever-Amplified Actuators	Positioning Systems
Travel ranges	up to approx. 300 µm	to 1 mm	to 1 mm
Moving axes	one	one	up to 3 linear axes and 3 tip/tilt axes
Sensor technology	optional SGS	optional SGS	SGS or direct measuring capacitive sensors
Linearity	up to 99.8 %	up to 99.8 %	more than 99.9 %
Guiding	none	flexure joints for tilts <10°	flexure joints for tilts <2°
Space requirement	low	low	depending on configuration
Price	low	low	depending on configuration
Integration effort	average	low	low

PiezoMove® OEM Flexure Actuators with Built-In Guiding

PiezoMove® actuators combine guided motion with long travel ranges of up to 1 mm and provide precision in the 10 nanometer range if ordered with the position sensor option. Their high-precision, frictionless flexure guides achieve very high stiffness and excellent straightness of motion. This makes them easier to handle than a simple piezo actuator, but still keeps them extremely compact. The number and size of the piezo actuators used determine stiffness and force generation.

These features, their small dimensions and cost-efficient design make PiezoMove® flexure actuators suitable in particular for OEM applications. For open-loop applications, versions without sensors are available.

In addition to the standard steel models, special invar and nonmagnetic versions are available on request.



This lever mechanism with flexure guides transforms the actuator travel range (vertical) to an even, straight motion (horizontal)

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