

www.piezosystem.com

PSH
**MIRROR TIP/TILT
SYSTEMS**

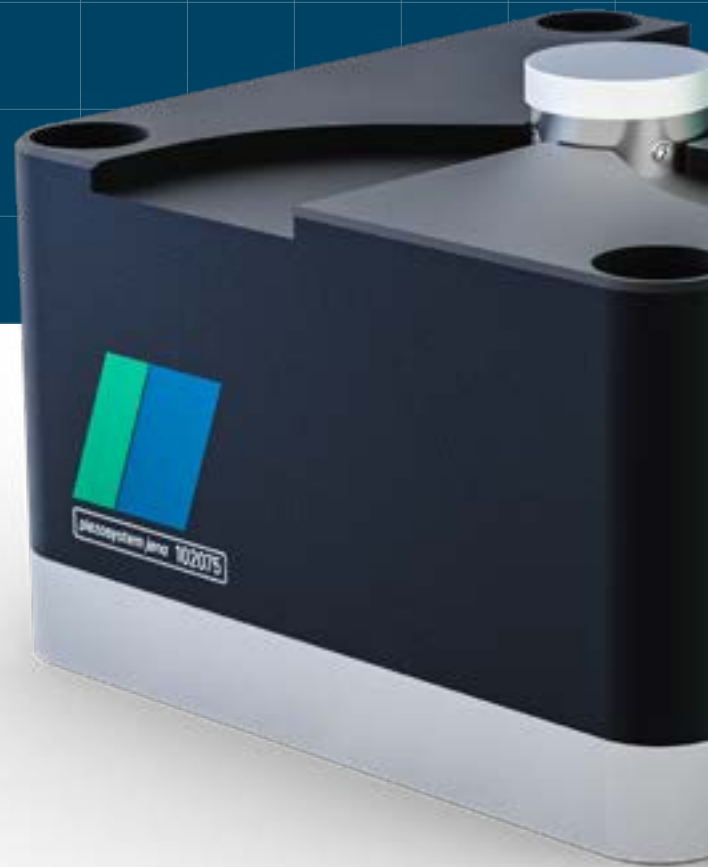


 **piezosystemjena**
incredibly precise

PSH Mirror Tip/Tilt systems are piezo-driven beam steering systems by piezosystem jena. These systems are used for precise, high speed guidance of radiation patterns such as lasers and radio signals. Beam steering systems are utilized in a wide variety of industries such as energy, aerospace, medical, and technological research. Whether it be intersatellite communication, guidance for lasers used in surgical operations, or advancing the possibilities of fusion on Earth, piezosystem jena's systems have been trusted as the top-of-the-line solution for dynamic optical alignment.

INTRODUCTION

Since our founding in 1991, piezosystem jena has been a prominent nanopositioning company based out of the optical valley of Jena, Germany. We design and manufacture over 900 different piezo mechanic nano positioning systems implemented in a broad range of manufacturing processes, research applications, guidance systems, and much more. This depth of technology stems from our customer specific development capabilities. Piezosystem jena is an industry leader in custom nano positioning solutions, continuously developing to meet our customer's needs.





Performance parameters

RANGE, RESOLUTION AND FREQUENCY

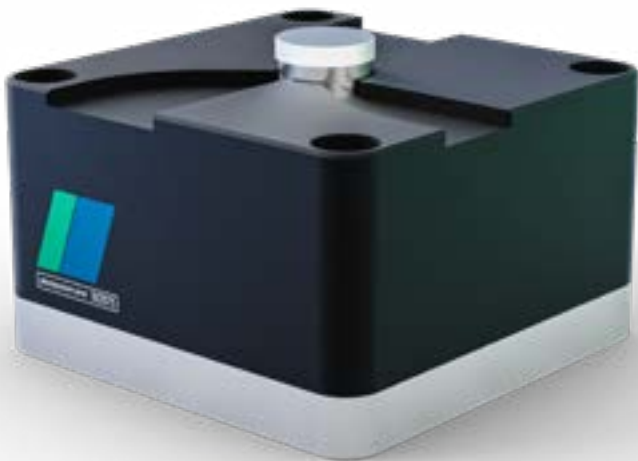
BEAM STEERING TECHNOLOGIES

For fast beam steering, there are three core specifications that define performance parameters: range, resolution, and frequency. For some technologies, users are limited to choosing which specifications they most need and sacrificing the others. For example, with voice coils, users can attain travel up few degrees, even tenth of degrees, but lose out on frequency and resolution. The best of these systems achieves 1000 Hz, and resolutions can be expected around 1 μ rad or larger. MEMS mirrors are another alternative, and can in fact achieve an even greater travel of up to 75mrad, however these systems have proportionately lower speed capabilities around 300 Hz and a similar resolution. These MEMS mirrors have a secondary issue as well: they have to act as the reflective surface themselves. The device itself can only be so reflective by nature, which creates a poor signal quality after the MEMS receives the radiation source. Another drawback of both of these systems is they can be influenced by magnetic fields, and generate their own electromagnetic fields by nature. This can cause issues when they are implemented nearby sensitive electronics or are used in areas sensitive to magnetism.

High quality made in Jena

OUR BEAM STEERING ACTUATORS

Piezosystem jena's PSH piezoelectric beam steering actuators offer a solution that allows for a strong intersection of the core specifications. Our actuators achieve up to ± 20 mrad in x and y axes with up to 30 μm motion in the z axis, and 35 mrad in a single axis. Even at these long ranges of motion, our systems maintain resolutions as low as 0.2 μrad , with more precise systems going as low as 0.02 μrad . As far as speeds go, psj's systems have resonance frequencies up to 6,800 Hz for low travel systems, and several kHz for higher travel, depending on the mass of the optic you choose.



PSH 25/2

- **Range:** ± 20 mrad (2 Axis)
- **Resolution:** 0.2 μrad
- **Resonance Frequency:** 1,400 Hz w/ 13g mirror
- **Mass:** 350g
- **Dimensions:** 60 x 60 x 40.5



PSH 1z

- **Range:** up to 4mrad (3 Axis incl Z)
- **Resolution:** 0.02 μ rad (closed loop version)
- **Resonance Frequency:** up 5,800 Hz
- **Mass:** starting at 48g
- **Dimensions:** 25 x 25 x 32



PSH 35/1

- **Range:** 35 mrad (1 Axis)
- **Resolution:** 0.07 μ rad
- **Resonance Frequency:** 1,200 Hz
- **Mass:** 50g
- **Dimensions:** 60x 25x 14mm



PSH 10/2

- **Range:** +/- 4 mrad (2Axis, with z motion)
- **Resolution:** 0.02 μ rad
- **Resonance Frequency:** 3,500 Hz w/ 5g mirror
- **Mass:** 52g
- **Dimensions:** 22x22x47.5mm



PSH 4/1

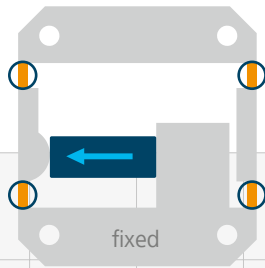
- **Range:** +/- 2 mrad (1 Axis)
- **Resolution:** 0.008 μ rad
- **Resonance Frequency:** 6,500 Hz
- **Mass:** 20g
- **Dimensions:** \varnothing 12x20mm

High level piezo precision

THE nanoX PRINCIPLE

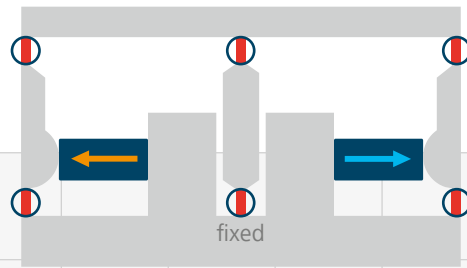
These high specifications can be achieved by leveraging our advanced flexure designs and nanoX principle. This principle allows us to utilize two piezo's per axis of motion, one discharging as the other charges, allowing for both stiffness and speed to be increased simultaneously. By increasing these aspects, our systems can carry a wide range of optics up to 50 mm in diameter with uncompromised precision in the kHz range.

piezo ← → reset



Conventional Piezo

piezo ← → reset
reset ← → piezo



nanoX principle

The NV200/D Net & PiSoWorks

Especially for use with piezo Systems, piezosystem jena has developed the next generation of smart controllers with a new software interface: The NV200/D Net - a digital piezo controller with a max output current of 400mA (peak current). With 16-bit resolution and a noise level of 0.3mV, the NV200/D guarantees fast response times and high positioning accuracy. The customer can easily integrate and control the actuator with different interfaces such as SPI and Ethernet for local and remote control.

The NV200/D comes with an integrated close-loop control, as well as ILC (iterative learning control) for closed-loop precision at open-loop speeds.

Actuator and stages from piezosystem jena are based on the piezoelectric effect from using PZT ceramics as motion technologies. As a smart material piezos are extremely fast, precise and generate high forces. Their natural characteristics also include hysteresis and drift, which can lead to non-linear motion profile. By using closed-loop control and smart algorithms these effects can be reduced to a minimum.



piezosystem jena has developed and integrated the new software PiSoWorks with the NV200/D Net giving the user complete control over both the actuator and its motion profile. The user only needs one cable.

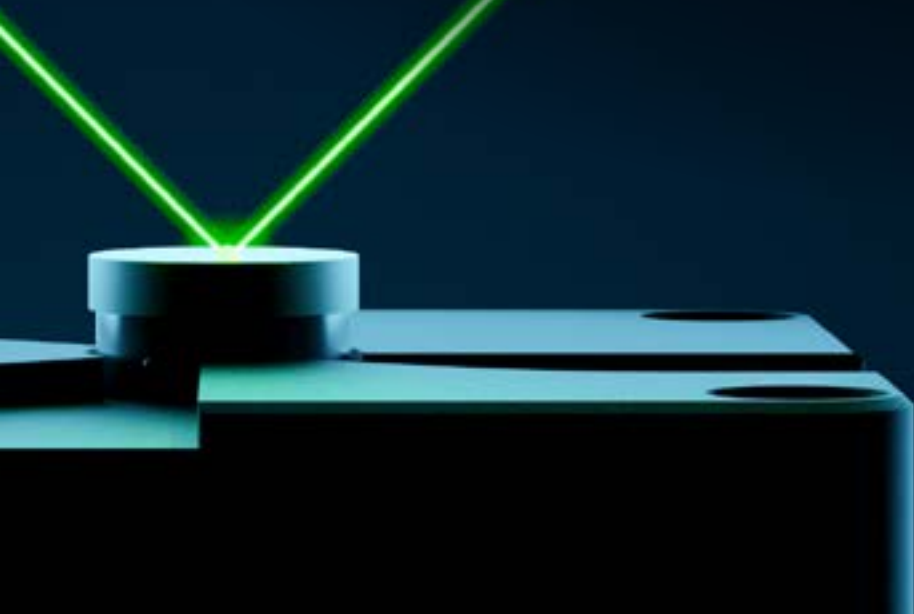
PiSoWorks allows for control of the actuator's exact position, speed and open and closed-loop control. The software includes a function generator for open and closed-loop control, and positions are stored in a data recorder.

The software has two different modes - easy and advanced. Easy mode allows for quick function tests. In the advanced mode there are several additional controlling options such as PID controls, set-smooth and iterative learning control (ILC).

Over the years, piezosystem jena's systems have been implemented in many industries. Not only is this due to our systems specifications, it is also because of their usability in diverse environments. Our actuators are solid state systems with no mechanical friction in their drive technology, which means they do not wear out. Their non-magnetic nature and aluminum and stainless-steel construction allows them to be used in electronically sensitive or magnetized environments. With configurations that can be modified upon consultation, our systems

can easily integrate into your systems. PSH tip/tilt mirrors also work in both pressurized and vacuum conditions and have been space application tested and utilized.

Piezosystem jena's PSH systems offer a depth of beam steering systems that will suit any dynamic optical alignment application. If we don't have the right system for your application, contact us. We specialize in custom nano solutions, and together we can build the right actuator for the job.



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