



## Motion and Positioning

THE BROADEST AND DEEPEST PORTFOLIO

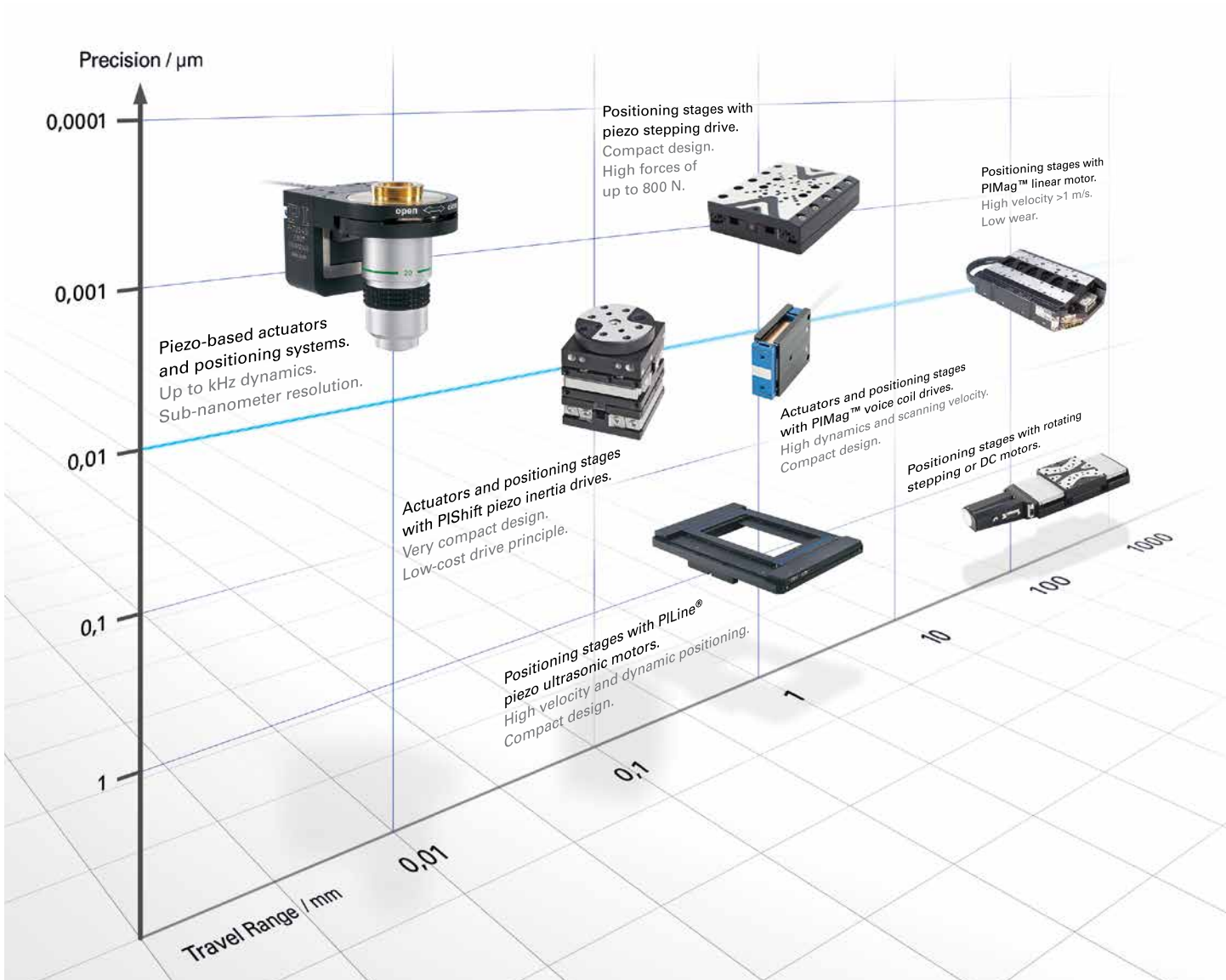
# Technology

## The Broadest and Deepest Portfolio

### Core Technologies

- Piezo components, actuators and motors
- Magnetic drives
- Guiding systems
- Nanometrology sensors
- Electronic amplifiers
- Digital controllers
- Software

The technological scope of the PI Group is unique worldwide. PI develops, manufactures and qualifies all its core technologies itself. Thus PI is independent of components available on the market and offers individual solutions that go beyond the state of the art. Through its high measure of flexibility, PI plays a pioneering role in precision positioning and enables PI customers to benefit from distinct competitive advantages.



## Philosophy

### Growth and Advances in Technology

The aim of the PI Group is to expand its pioneering role on the world market through advanced positioning solutions. The broad spectrum of technology and the high vertical range of manufacturing available at PI are the basis for further growth and expansion. Novel drive concepts, products and system solutions have led to a continuous growth in market shares and a healthy company development in the past years.

### PI Compact

- Four production sites in Germany, six in total worldwide
- More than 850 employees worldwide
- 13 subsidiaries in key markets
- Privately run company
- 40 years of experience in piezo technology

## Production Management

### Manufacturing Precision Efficiently



# Product Overview



PICMA® multilayer piezo actuators



Piezoelectric components

## PIEZO ACTUATORS AND COMPONENTS, PRELOADED PIEZO ACTUATORS

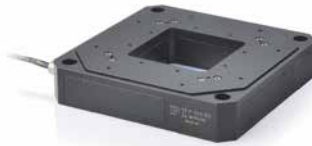
Variable Designs, Optionally with Position Measurement, UHV Versions, High Dynamics, Sub-Millisecond Response Time, Picometer Resolution

## PIEZO SCANNERS AND POSITIONING STAGES

Nanometer Precision and Millisecond Settling Time



Fast tip/tilt mirrors



Technology for up to six axes: flexure joints, capacitive sensors, PICMA® piezo actuators



Piezo scanners and lens focusers: microscope lens and specimen fast and precise positioning

## PRECISION LINEAR ACTUATORS AND DIRECT DRIVES



4 PiezoMike for drift-free long-term positioning



OEM piezomotor linear drive



High load actuators with axial forces up to 400 N for industrial automation

## PRECISION LINEAR POSITIONING STAGES

From Miniature Positioning Stages to Travel Ranges of 1 m



Miniature stages with piezomotors



High-precision positioning stages

## ROTATION STAGES

From Miniature Sizes to Ultra-Precision Stages



Ultraprecise with air bearings



Piezomotor miniature rotation stages

## HEXAPOD AND SPACEFAB

Parallel Kinematics for Precise Positioning in Six Axes



Precision Hexapods



Vacuum versions up to  $10^{-9}$  hPa



High-load Hexapods for 1000 kg loads

# Markets

## MECHANICAL ENGINEERING



Image: ICT-IMM

Vibrations of a piezo actuator reduce the processing times for high-precision micro-sized holes

- Processing, e.g. out-of-round turning with piezo actuators
- Precise positioning, even of high loads in six degrees of freedom
- Setup of testing systems

## BASIC RESEARCH

Creativity for research and development special designs for extreme ambient conditions such as UHV to  $10^{-10}$  hPa, radiation or pronounced variations in temperature up the cryogenic range.



Image: Surface



Image: WITec GmbH

## MICROSCOPY

Position Lens or Specimen

Optical methods have been relying on PI positioning systems for years, e.g. for aligning optical systems or samples. Piezo actuators and motors are increasingly replacing conventional drive systems because they are more compact, more precise and faster. Other non-optical microscopic processes, such as SEM (scanning electron microscope) and AFM (atomic force microscope), use PI systems due to their high accuracy and dynamics.

## INDUSTRIAL MANUFACTURING AND QUALITY ASSURANCE, OPTICAL METROLOGY

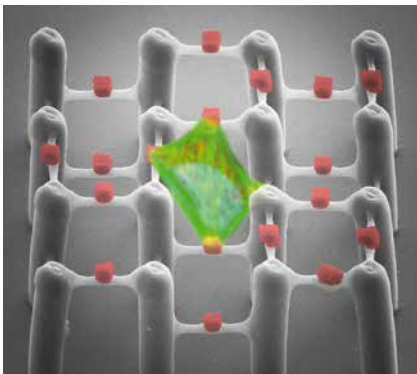
Inspection systems in the semiconductor industry utilize the performance features of PI systems, for example, for surface structures on semiconductors or flat-screen monitors with white light interferometry. PI piezomotor and actuator systems also help in the precise adjustment of wafers, imaging optics and the masks in semiconductor production.



Image: Polytec GmbH

## BIOTECHNOLOGY/LIFE SCIENCES

Micro- and Nanopositioning Solutions



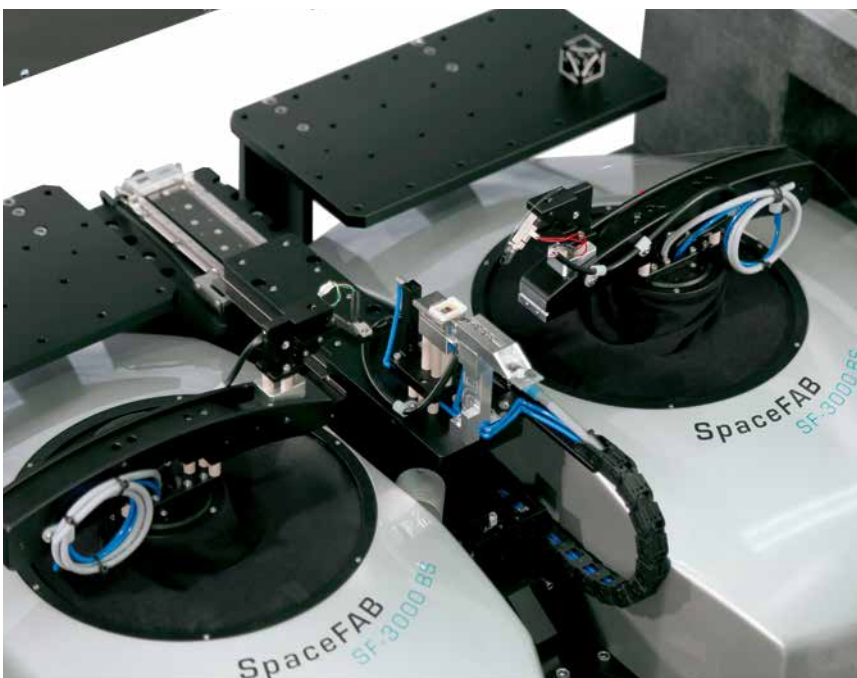
Biotechnological applications using precise positioning system from PI are not only limited to typical optical procedures, such as focusing, or to moving and manipulation of samples in microscopy or in genome sequencers. In nanodosing and microfluidics, drive system from PI allow the dosing of smallest volumes in procedures, such as PipeJet, or the design of finest structures by means of nanoimprint or 3D lithography.

Image: B. Richter and M. Bastmeyer, Zoological Institute, Karlsruhe Institute of Technology (KIT)

## PHOTONICS PACKAGING, SILICON PHOTONICS

Configuring and Testing Microchips

For manufacturing and testing components and systems, that are based on silicon photonics, precise positioning is crucial.



## MEDICAL TECHNOLOGY

Drives for Mobile End Devices, Imaging, Miniature Drives

Piezo ceramics to generate ultrasonic waves, actuators for microdosing and the production of nanoliter drops as well as miniature piezomotors for mobile medication devices – all these are tasks for which the PI Group has been offering solutions for many years. For imaging processes, such as OCT, focusing or miniature zoom lenses, small and reliable drive systems are increasingly required.

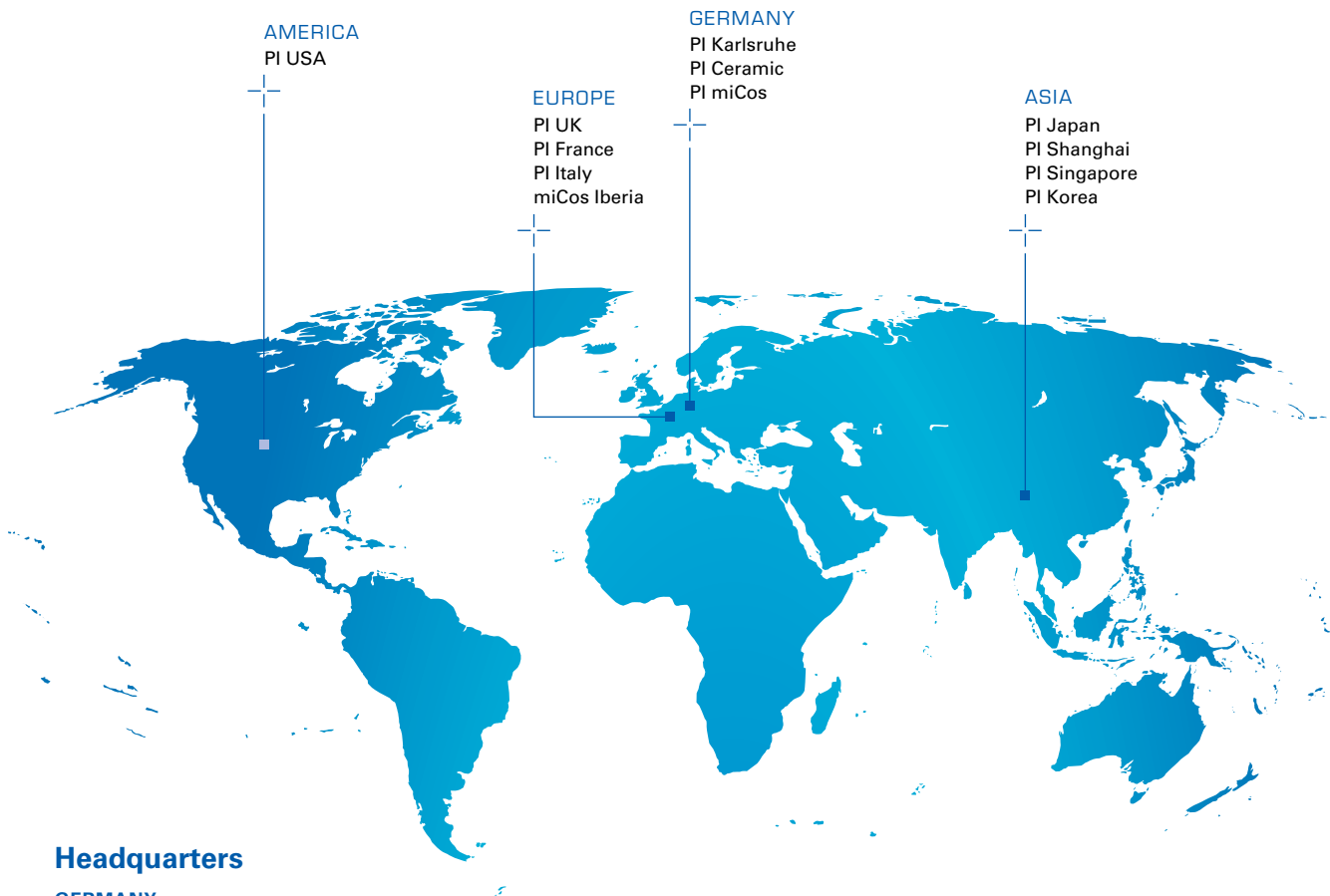
## ASTRONOMY/ AEROSPACE RESEARCH

Highest Reliability, Maintenance-Free Operation



Image: ALMA (ESO/NAOJ/NRAO)

Precision is also in demand in astronomy and aerospace research. Hexapods from PI align secondary mirrors of telescopes with a precision of 1  $\mu\text{m}$  or better; piezo-driven active mirrors align the elements of large segmented mirrors.



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