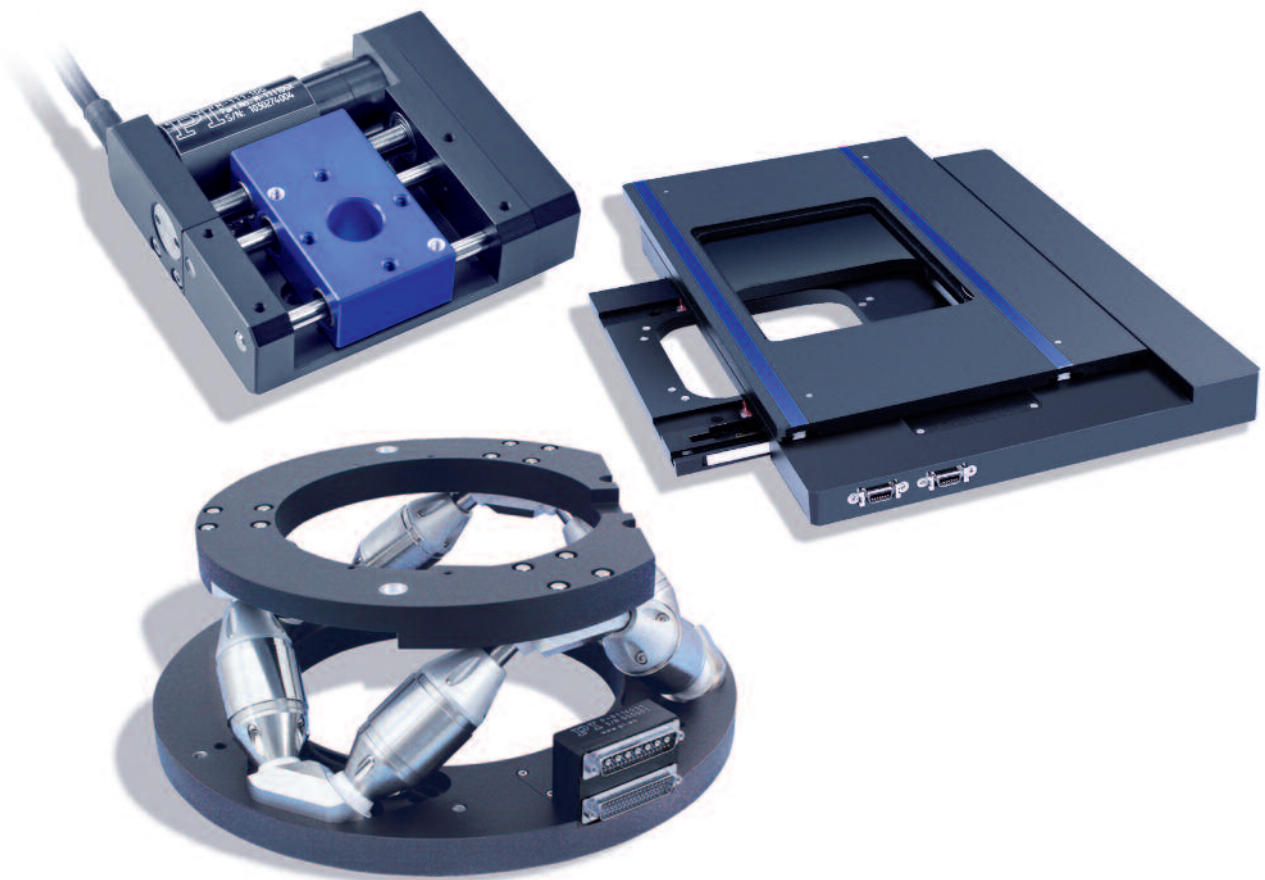


Micropositioning

Product Overview



Micropositioning

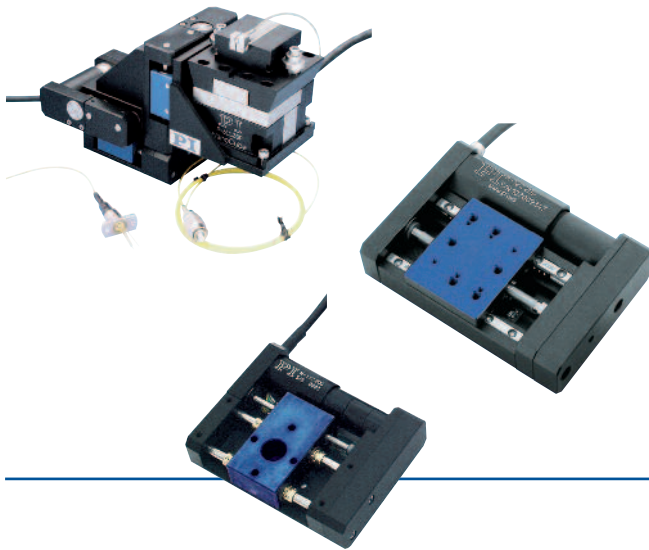
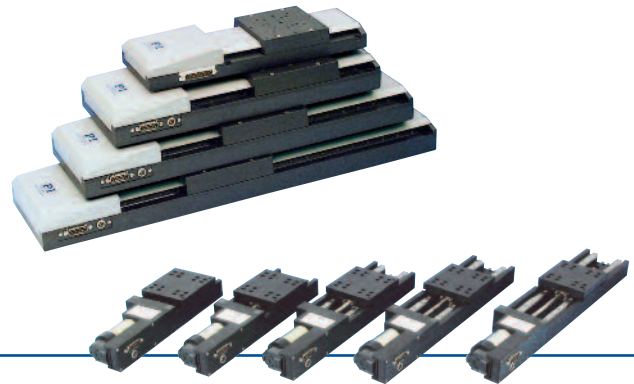
Precision Positioning over Long Travel

Micropositioning systems provide motion resolution and positioning accuracies in the range between a few tens of micrometers and 0.1 μm . Conventional DC or stepper motors as well as piezo linear motors are available as drives. The precision of the system depends both on the drive and also on components such as the position sensor, the guides and, for conventional motors, also on the quality of the spindle or the worm drive and possibly also the gear. An improvement of the system properties can be achieved with digital controls via advanced control procedures.

Linear Positioners

Solutions for All Fields of Application

- Travel ranges between 25 and 300 mm
- Bidirectional repeatability up to 0.1 μm
- Velocity up to 150 mm/s
- Conventional drive versions with DC and stepper motors
- Incremental encoders for direct position measurement as an option
- Low-cost designs, variants as modular system



Compact Linear Positioners

High Precision in a Small Package

- Travel ranges between 5 and 25 mm
- Compact stages to high load positioners
- Velocity up to 20 mm/s
- Conventional drive versions with DC and stepper motors
- Incremental encoders for direct position measurement as an option
- Systems with piezo linear motors for high speed and compact size

DC and Stepper Micrometer Drives

Low-Cost Precision

- Flexible designs with non-rotating drive tip
- High-load versions to 400 N
- Travel ranges up to 50 mm and speed up to 30 mm/s
- Resolution up to <math><100\text{ nm}</math>





Rotation Stages

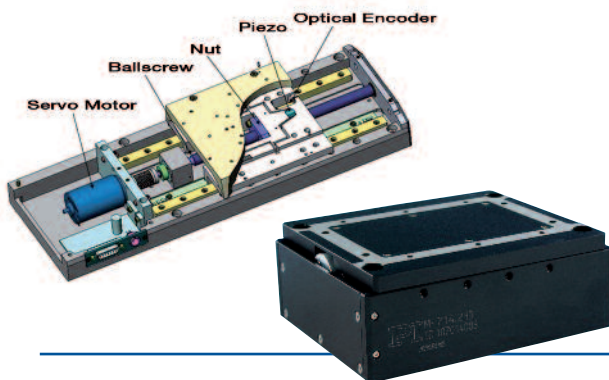
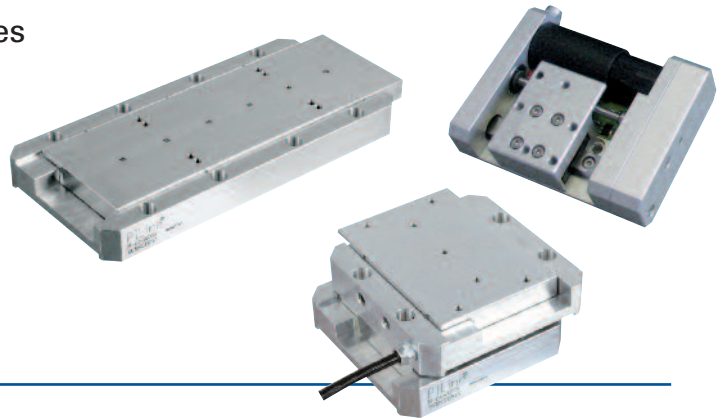
A Large Selection for a Broad Spectrum of Applications

- Unlimited rotation range
- Reference and optional limit switches
- Up to 720°/s
- Resolution up to 1 μ rad
- Conventional drive versions with DC and stepper motors
- Systems with piezo motors for high speed and compact size
- Incremental encoders for direct position measurement as an option

Linear Positioners and Micrometer Drives

For Vacuum and Strong Magnetic Fields

- For high vacuum and optionally ultra-high vacuum
- Travel ranges up to 300 mm
- Compact stages to high load positioners
- Velocity up to 150 mm/s
- DC and stepper motors or piezo linear motors
- Incremental encoders for direct position measurement as an option
- Non-magnetic stages with piezo linear motors



Hybrid Drive Systems

Advantages of Piezos also over Long Travel

- Long travel ranges and speeds up to 50 mm/s
- Resolution up to 2 nm closed loop
- Shortest incremental motion below 10 nm
- Digital controller with sophisticated regulation

The hybrid PI systems feature conventional motorized drive solutions coupled to piezoceramic actuators. Both drives are controlled by the same servo-loop with a high-resolution sensor and therefore achieve high trajectory fidelity, immediate startup and fast, precise settling.

Motor Controllers

For Conventional Drives and Piezo Motors

- 1 to 20 axes
- Analog, USB and RS-232 interfaces (some optional)
- Sophisticated algorithms for linearization and regulation
- Comprehensive software support, software drivers for D/A boards
- Low-cost OEM versions and PC boards



Hexapods, Tripods – Parallel Kinematics

Efficient Implementation of Multi-Axis Motion

PI uses parallel kinematic designs wherever multi-axis and highprecision motion is required. Thereby all drives act directly on the same moving platform. This creates advantages in the precision and dynamics compared to stacked axes, where the errors of the individual axes are cumulative and dynamic losses are caused because the upper axes are also dragged along. The parallel kinematic principle is independent of the used drive. It is thus possible to produce positioning systems with motion with up to six degrees of freedom.

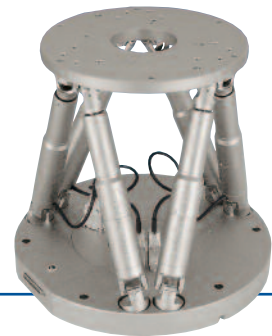
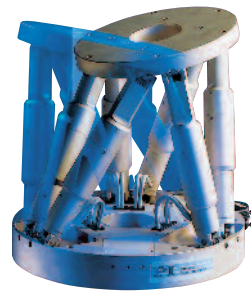


Compact Hexapods

- Linear travel ranges up to 20 mm
- Rotation ranges up to 60°
- Actuator resolution up to 33 nm
- Load capacity up to 50 N
- DC motors and brushless DC motors

Hexapods for High Precision and Medium Loads

- Linear travel ranges up to 100 mm
- Rotation ranges up to 60°
- Actuator resolution up to 5 nm
- Velocities up to 50 mm/s
- DC motors, brushless DC motors and piezo linear motors
- Load capacity up to 2000 N

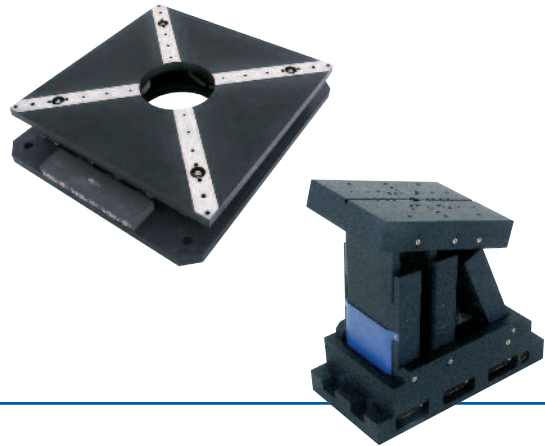


Hexapods for High Loads

- Linear travel ranges up to 400 mm
- Rotation ranges up to 40°
- Actuator resolution up to 80 nm
- Velocities up to 10 mm/s
- DC motors, brushless DC motors and piezo linear motors
- Load capacity up to 10.00 N

Parallel Kinematics with Different Motion Axes; Tripods

- Tripods with X, Z and θY : Travel ranges up to 50 mm and 60°
- Tripods with X, Y and θZ : Travel ranges up to 20 mm and 8°
- Load capacity up to 1500 N
- Actuator resolution up to 50 nm
- DC motors

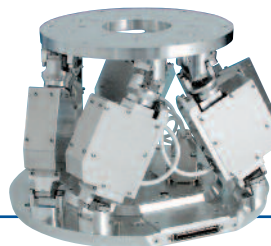


High-Precision Parallel Kinematics with Piezo Linear Motors

- Tripods and hexapods with up to six axes of motion
- Travel ranges up to 10 mm, rotation ranges up to 6°
- Load capacity up to 2000 N
- Actuator resolution up to 5 nm
- Piezo stepper drives

Non-Magnetic and Vacuum-Compatible Hexapods

- Linear travel ranges up to 100 mm
- Rotation ranges to 60°
- Actuator resolution up to 5 nm
- Load Capacity to 2000 N
- DC motors, stepper motors or piezo linear motors



Digital Hexapod Controller

Convenient Control of Parallel Kinematics

- Independent of the drive
- Places commands in Cartesian coordinates
- Real-time operating system
- Analog, USB, TCP/IP and RS-232 interface
- Comprehensive software support and simulation programs

PILine® Ultrasonic Motors

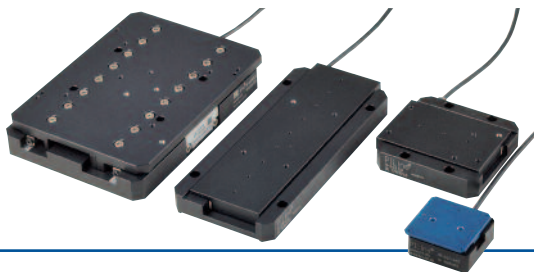
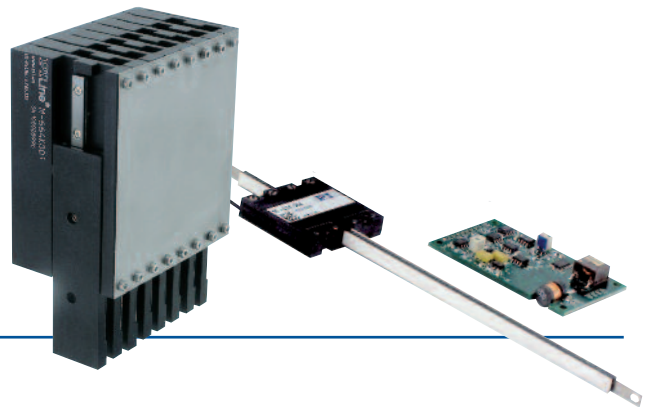
Small and Fast over Long Distances

Piezo ultrasonic motors can replace conventional motor/spindle combinations or magnetic linear drives. PILine® drives have a very small form factor, generate high forces and are selflocking when switched off. PI uses ultrasonic motors in micropositioning for minute stages and systems where the limited space is a challenge. PILine® ultrasonic motors can achieve speeds up to 0.5 m/s and forces up to several tens of newtons.

PILine® Manipulator and Linear Actuator

For Bio-Handling and Automation

- Low profile height of 9 mm
- Low-cost design
- Travel ranges up to 150 mm
- Self-locking at rest



Linear Positioner with PILine®

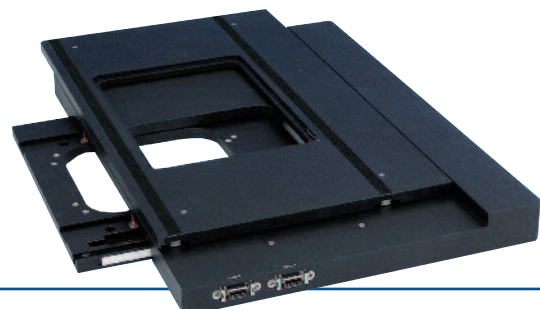
Fast and Compact

- Velocity up to 400 mm/s
- Direct position measurement with linear encoder
- Dimensions from 35 x 35 x 15 mm
- Self-locking at rest

XY-Stage with PILine® Ultrasonic Drive

Compact Size and Stable Positioning

- Velocity up to 100 mm/s
- Low profile height of 27 mm
- Direct position measurement with linear encoder
- Travel ranges up to 225 x 85 mm
- Self-locking at rest



Nanopositioning Systems

Precision for up to 6 Axes

- From linear axes to motion with 6 degrees of freedom
- Parallel kinematic principle for multi-axis systems
- Versions with direct position measurement and capacitive sensors
- Travel ranges between 5 and 1800 μm
- Available in a variety of designs, travel ranges and precision classes



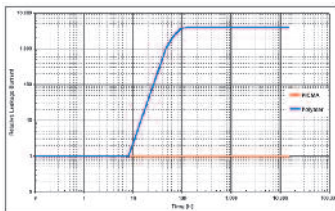
PI headquarters in Karlsruhe

PI is the market and technology leader for precision positioning systems with accuracies far below one nanometer. Nanometer-range motion control is the key to worlds where millions of transistors fit on one square millimeter, where molecules are manipulated, where living cells are observed in thousands of "virtual slices", or where optical fiber bundles no larger than a human hair are aligned in six degrees of freedom.

Future Technology Solutions

Today PI delivers micro- and nanopositioning solutions for all important high-tech markets:

- Semiconductor Technology
- Optical Metrology, Microscopy
- Biotechnology and Medical Devices
- Precision Automation and Handling
- Precision Machining
- Data Storage
- Photonics, Fiber Optics, Telecom
- Nano Technology
- Microsystems Technology
- Aerospace Engineering
- Astronomy

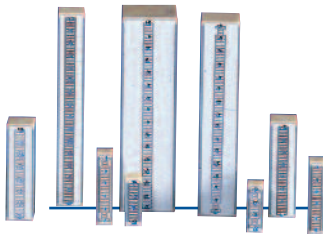


Nanopositioning Engines: PICMA®

Piezoceramic Multilayer Actuators

- Higher reliability and performance
- Long life time, unaffected by humidity
- Flexible cross sections and displacements
- Resolution below one nanometer
- Response time below one millisecond

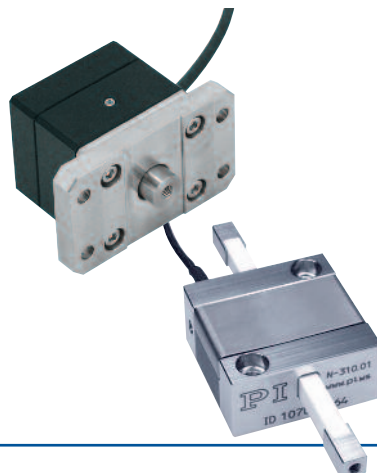
PI uses its own PICMA® piezoceramic actuators in its classical positioning systems for nanopositioning. This in-house development incorporates a special insulation which increases the life time especially at static displacements. PI piezo actuators can be flexibly matched to customer specifications because they are produced in-house.



PiezoWalk® Linear Drive

High Resolution over Long Travel

- NEXLINE®: Up to 600 N drive force
- NEXACT®: 10 N force and 10 mm/s speed
- Versions with linear encoder to 5 nm resolution
- Self-locking when switched off
- Travel ranges between 10 and 125 mm



Our employees look forward to your visit



The hardbound "Piezo Nano Positioning Inspirations 2009" catalog from PI is available. The 530 page publication is the most comprehensive reference book on the fundamentals of nanopositioning, piezo systems and micropositioning technology yet. The catalog contains 200 products with more than 1000 drawings, graphs, images and technical diagrams.

The 530 page publication presents PI's state-of-the-art products and technologies – such as:

- Nanopositioning / Scanning Stages
- Scanning Microscopy Stages
- Steering Mirrors, Mirror Shifters
- Piezo Actuators
- Piezo Motors
- Piezo Controllers
- Motorized Stages & Actuators
- Motor Controllers
- Hexapod 6-Axis Alignment Systems

The catalog also contains a tutorial on piezo technology and application examples of nanopositioning products in the following industries:

- Biotechnology / Life Sciences
- Semiconductor Technology
- Data Storage
- Nanotechnology
- Aeronautics
- Astronomy
- Adaptive Optics
- Metrology / Laser-Systems
- Precision Machining

Headquarters

GERMANY

Physik Instrumente (PI) GmbH & Co. KG

Auf der Römerstr. 1
76228 Karlsruhe/Palmbach
Tel: +49 (721) 4846-0
Fax: +49 (721) 4846-100
info@pi.ws · www.pi.ws

PI Ceramic GmbH

Lindenstr.
07589 Lederhose
Tel: +49 (36604) 882-0
Fax: +49 (36604) 882-25
info@piceramic.de
www.piceramic.de

Subsidiaries

USA (East) & CANADA

PI (Physik Instrumente) L.P.

16 Albert St.
Auburn, MA 01501
Tel: +1 (508) 832 3456
Fax: +1 (508) 832 0506
info@pi-usa.us
www.pi-usa.us

USA (West) & MEXICO

PI (Physik Instrumente) L.P.

5420 Trabuco Rd., Suite 100
Irvine, CA 92620
Tel: +1 (949) 679 9191
Fax: +1 (949) 679 9292
info@pi-usa.us
www.pi-usa.us

JAPAN

PI Japan Co., Ltd.

Akebono-cho 2-38-5
Tachikawa-shi
Tokyo 190
Tel: +81 (42) 526 7300
Fax: +81 (42) 526 7301
info@pi-japan.jp
www.pi-japan.jp

PI Japan Co., Ltd.

Hanahara Dai-ni-Building, #703
4-11-27 Nishinakajima,
Yodogawa-ku, Osaka-shi
Osaka 532
Tel: +81 (6) 6304 5605
Fax: +81 (6) 6304 5606
info@pi-japan.jp
www.pi-japan.jp

CHINA

Physik Instrumente (PI Shanghai) Co., Ltd.

Building No. 7-301
Longdong Avenue 3000
201203 Shanghai, China
Tel: +86 (21) 687 900 08
Fax: +86 (21) 687 900 98
info@pi-china.cn
www.pi-china.cn

UK & IRELAND

PI (Physik Instrumente) Ltd.

Trent House
University Way,
Cranfield Technology Park,
Cranfield,
Bedford MK43 0AN
Tel: +44 (1234) 756 360
Fax: +44 (1234) 756 369
uk@pi.ws
www.physikinstrumente.co.uk

FRANCE

PI France S.A.S.

32 rue Delizy
93694 Pantin Cedex
Tel: +33 (1) 57 14 07 10
Fax: +33 (1) 41 71 18 98
info@pifrance.fr
www.pifrance.fr

ITALY

Physik Instrumente (PI) S.r.l.

Via G. Marconi, 28
20091 Bresso (MI)
Tel: +39 (02) 665 011 01
Fax: +39 (02) 610 396 56
info@pionline.it
www.pionline.it