

PIMag[®] Magnetic Direct Drives

PRECISION ENGINEERING AND MOTION CONTROL EXPERTISE

PIMag® Core Technologies

Magnetic Direct Drive Technology

Drive technology and regulation know-how as well as an expertise in bearings and encoders allow for a broad range of motors for system integration. Proprietary developments also include high-resolution force sensors for manufacturing and test equipment.

Voice Coil Drives

- High dynamics for fast scanning and positioning
- OEM actuators, linear scanners, Hexapods
- Optional force sensors

Ironless Linear Motors

- High acceleration and velocity
- Linear stages, planar scanners, PIMag® 6D positioning system
- Torque motors for rotation stages

Drive Technology Beyond Standard

- Highest accelerations up to 60g with resonance motor
- Highest force density for single phase linear motors with reluctance motor and cylindrical Halbach arrays
- High force density and low weight with linear Halbach arrays

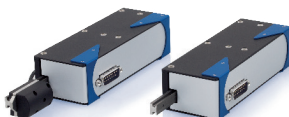
Guiding Systems

- Flexure guidings provide frictionless motion over short strokes
- Ball and roller bearings from the leading suppliers
- Active magnetic guidings align flatness during motion
- PIGlide air bearings for frictionless motion and optimum straightness and flatness

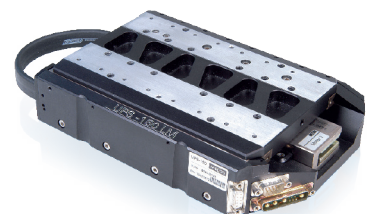
**FORCE
REGULATION**



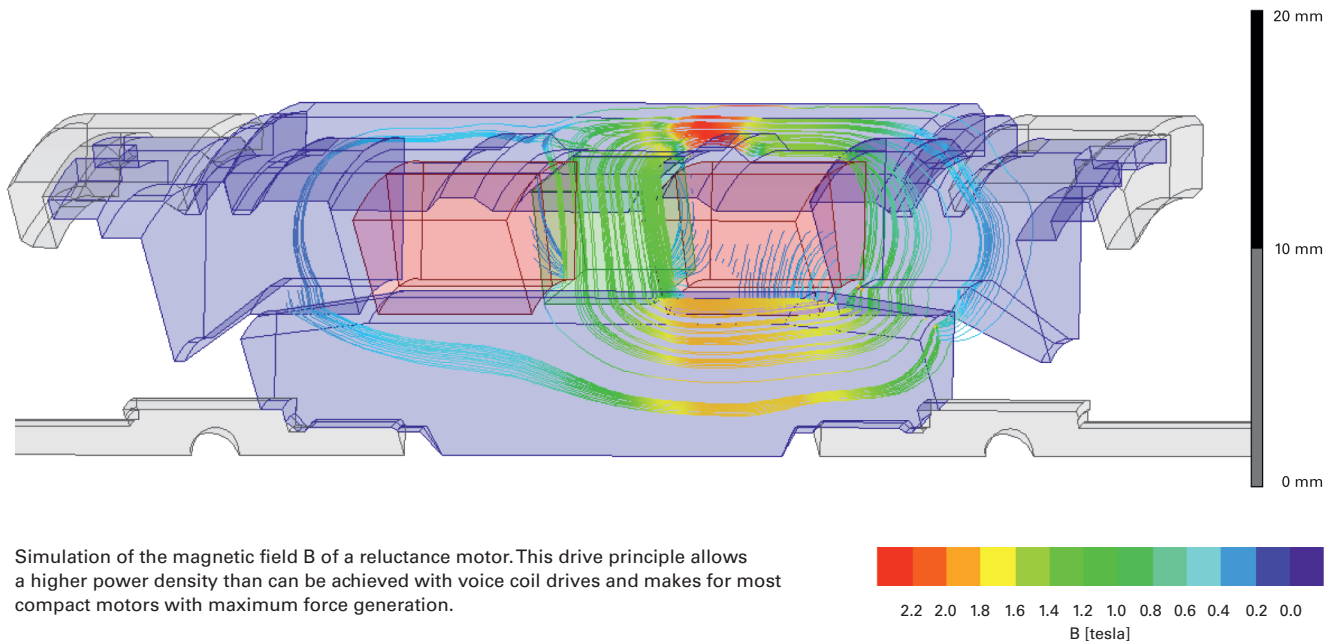
**NANOMETER
PRECISION**



**UP TO 60G
ACCELERATION**



Unique in Technology for Precision Positioning



PIMag[®] Magnetic Direct Drives supplement PI's broad portfolio of innovative solutions for dynamic motion and positioning tasks. PIMag[®] technology is developed fully in-house as a basis for application and customer specific needs. This includes drives, force and position sensors as well as guidings for single-, multi-axis and customized solutions. The proprietary development of motion controllers, regulation concepts and their software complete the package and enable PI to provide a new approach to precision automation. PI produces all key components in-house, to guarantee highest quality and optimal customer orientation.

Customers benefit from PI in many ways:

- Six R&D and manufacturing sites around the world in touch with the local markets
- Present in all key technology regions worldwide: 14 facilities around the globe for sales, service, repair and system qualification
- Sales engineers and application experts ensure close contact for customized developments from the initial consultation to the delivery
- Over 40 years of experience in precision motion and positioning technology
- Company in private ownership with continuous and constant growth

Precision Motion Control

The flexible PIMag[®] controller design allows to pursue different goals while the focus is always on high-precision positioning systems. Sinusoidal commutated control with low-noise power amplifiers provides for smoothest operation. Controller configurations include single or dual axis controllers and modular multi-axis devices with housing. Digital controller solutions for 1- and 3-phase motors up to 48 VDC are available. Communication interfaces meet industrial standards.

Sensor Technology

- Nanometrology position sensors
 - Absolute measuring, capacitive single and dual plate sensors
 - PIONe optical incremental encoder with picometer resolution
 - Incremental sensors (1V_{pp}) with adjustable interpolation (up to 65536fold)
 - Absolute encoders (BISS)
- High resolution proprietary force sensor measures and records applied forces at highest resolution (1 mN, open-loop)

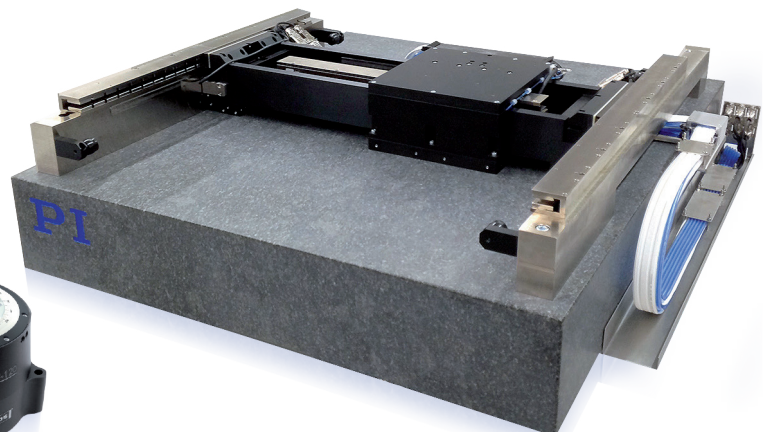
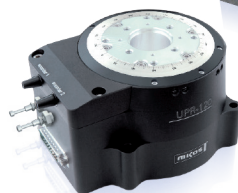
Regulation of Position, Velocity and Force

- Dynamic: Peak current up to 15 A_{rms}, continuous current up to 5 A_{rms}, up to 150 kHz current regulation loop
- Fast step and settle
- Constant scanning velocity
- Allows on-the-fly switch from position control mode to force control mode

Software Interfaces

- Graphic easy-to-use user interface for rapid start-up and optimization of parameters
- One command set for all PI motor technologies
- Drivers for fast integration into third party software, various supported languages like C, C++, VB, Python, LabVIEW[™], Matlab[®], etc.

**FAST STEP
AND SETTLE**



PIMag® Stages

The Step Ahead with the Full Range of PI Technologies

All core technologies available in-house allows PI to design and manufacture excellent products. Optimum performance is achieved by extensive simulations of relevant components, from the magnetic field for the motor layout, the FEM simulations of stages, to the regulation loop. Keeping the number of parts low secures high reliability of the system.

Flexible Axis Configurations

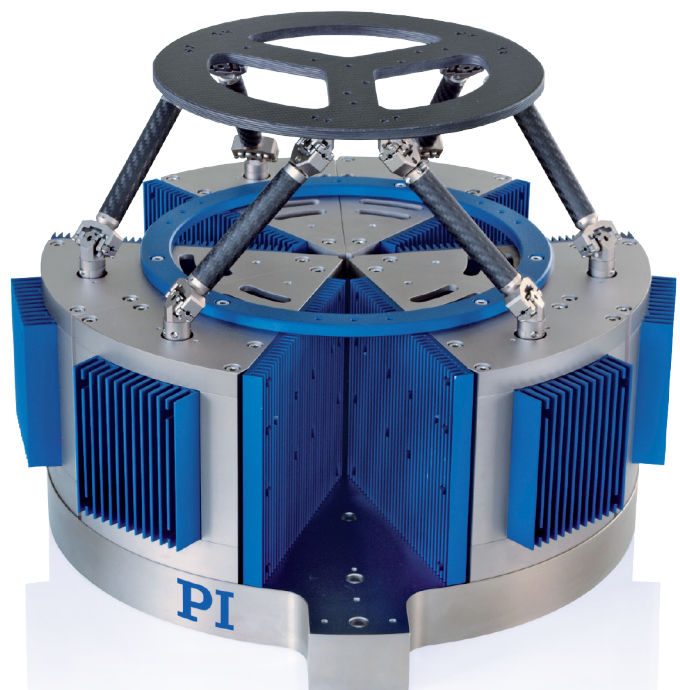
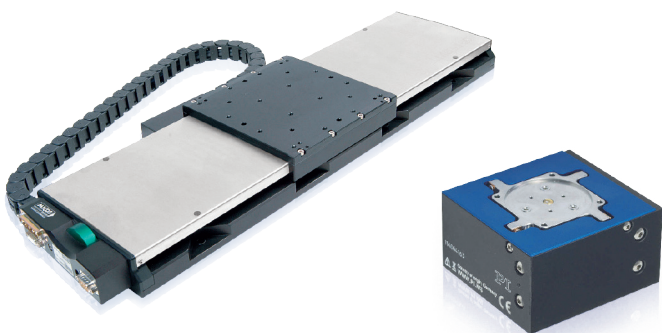
- Single-axis linear and rotary stages
- Multi-axis solutions in different accuracy classes, like planar scanners, tip-tilt mirrors and XY-stages
- Parallel kinematics for up to six axes, as for Hexapods and PIMag® 6D magnetic levitation technology

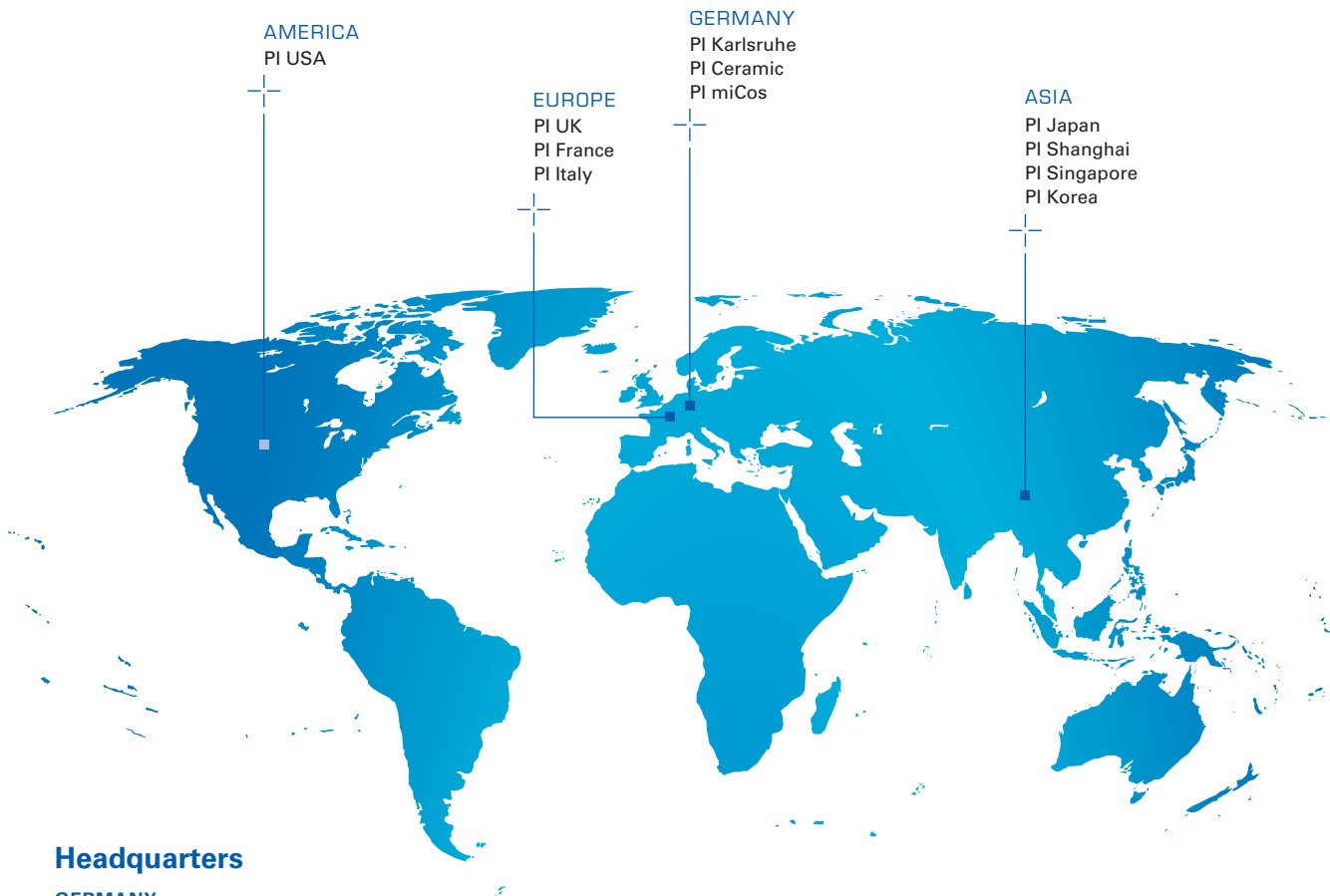
Standard Products & Customized Solutions

- Standard range of high-resolution single-axis scanning stages: linear motor stages for various strokes and torque motor rotation stages
- Application-specific solutions: vertical axes for assembly and automation with force control, 2-axis testing systems in XZ, or air-bearing gantry systems
- High-end solutions adapted to detailed customer specifications in automation, semiconductor, medical or other markets. Examples are multi-axis combinations of linear and rotary axes, most compact devices providing maximum force, low-energy-consumption solutions, and actuators that optionally include force sensors for high-volume production observing low cost targets

SYSTEM SOLUTIONS

CONSTANT VELOCITY





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