

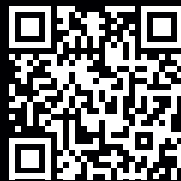
» DRIVING
INNOVATION

Thinking Beyond to Reach the Next Level of Precision

Innovation involves taking risks, challenging conventional thinking, and pushing boundaries to discover new possibilities. It drives progress. It paves the way for positive change. At PI, we enable excellence with thorough knowledge and decades of expertise, extensive skills, and that intangible element – the spark of innovation. We have created a dynamic ecosystem to encourage the generation of new ideas and solutions. Every day, we transform ideas into tangible outcomes that make a difference. Giving room to curiosity and creativity, exploring new technologies and inviting collaboration, taking risks and learning from mistakes, addressing challenges, and solving problems: This is where innovation starts.

PI. Driving Innovation.

Start your digital experience and get inspired by our innovations





High-Precision Motion and Control Solutions for Your Applications

Turning ideas into advanced motion solutions that enable our customers to improve their applications and shape future markets is what drives us at PI. Thanks to our in-depth expertise in piezo technology, nano positioning, and performance automation – combined with a wide range of technologies and a high level of vertical integration – we can meet the specific requirements of a variety of applications. Our solutions range from single components to complex multi-axis solutions, including controllers, drives, and application-specific firmware, as well as software.

Discover what PI can do for you.



PI



Consistent, clean,
and fast drilling process

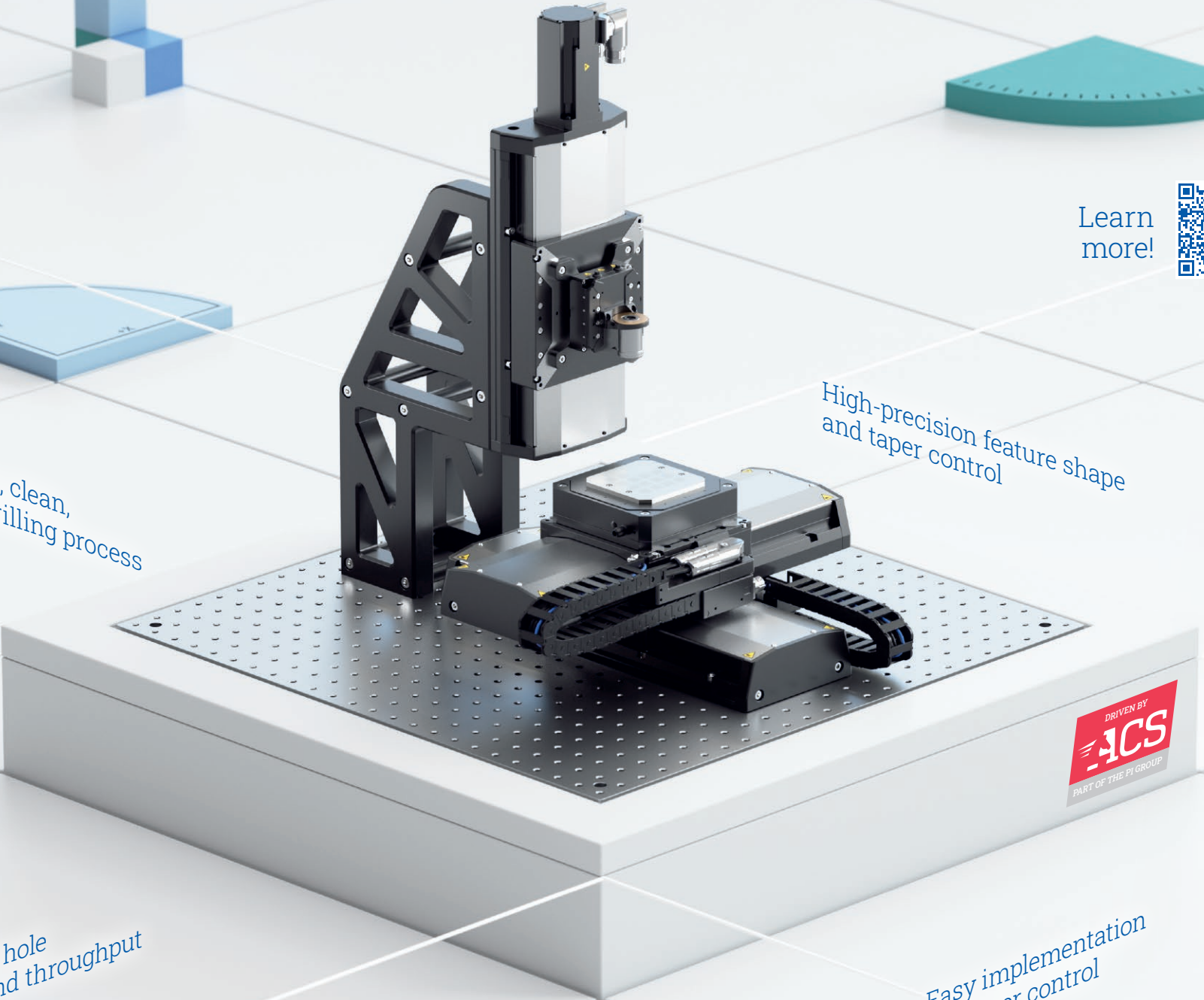
High-precision feature shape
and taper control

Learn
more!



Increased hole
density and throughput

Easy implementation
and laser control



Laser Drilling of Micro Holes

Combined Motion Technologies for High Precision, High Aspect Ratio, and Fast Drilling

When laser drilling the smallest high-density holes, many factors will impact the result: cone shape control as well as spot size and wavelength of the laser. Fast and precise positioning of the workpiece, the laser head and the laser focus height is equally important. The right combination of appropriate motion technologies and user-friendly control strategies to synchronize laser power, repetition rates and laser frequency with motion makes it possible to maintain hole accuracy and density over a wide range. This increases the throughput and quality of the laser drilling process significantly.

Z Axis - Reliable Laser Height Control

- High-precision ball screw linear stage with servo motor and holding brake for safe and reliable operation under high loads
 - Absolute encoders to avoid collisions
 - Robust industrial IP65 connectors for flexible cable exits
 - Side seal and hard cover to protect from particles
- >> **L-417 High-Load Linear Stage**

XY Axis - Fine Positioning of the Workpiece

- Piezo-based XY scanner for highly-dynamic positioning with nanometer precision
 - Parallel-kinematic design for equal dynamics in X- and Y-directions
 - High guiding accuracy thanks to zero-play flexure guides
 - Subnanometer resolution with long-term stability
 - High tracking accuracy in the nanometer range
- >> **P-527 Multi-Axis Piezo Scanner**

Z Axis - Dynamic Laser Focusing for Taper Control

- Voice coil direct drive motor for friction-free operation and high scan frequencies
 - Fast step-and-settle
 - Integrated linear encoders for accurate position feedback
 - Adjustable weight force compensation for safe operation
- >> **V-308 Voice Coil PIFOC® Focus Drive**

XY Axis - Workpiece Positioning Over Extended Travel Ranges

- Highly-dynamic ironless linear motors for fast and precise contouring
 - Reference edge for easing alignment in the machine
 - Connector for purge air, plus side seal, and hard cover, to protect against particles
 - Absolute encoders avoid referencing and ensure safety during operation
- >> **V-417 High-Load Linear Stage**

Flexible and Easy Automation Control

- Profile generation via EtherCAT® or triggering of predefined drilling profiles
 - Intuitive browser-based software for system operation
 - Laser pulse control via EtherCAT® or analog power output
 - Servo control for fast step-and-settle and for disturbance rejection
 - Option of adding fast piezo control for improved performance
- >> **E-712 Digital Piezo Controller**

3D Profiling of Small Components and Features

Fast and Reliable Sensor Placement and Scanning

Fast and reliable measurement of the surface profile of smallest components and features places high demands on the motion and control systems as well as on the sensor technology: end products must meet the requirements regarding functionality and quality. The sensor technology used should be chosen based on criteria such as sensor resolution, measuring range, and speed of data acquisition. In case of a laser-based sensor, the size of the focal spot, measurement field or view area and the ability to focus must also be considered. The motion control system has to be configured in a way that the sensor can be placed quickly and accurately at the point or in the areas of interest. This requires either fast movement to the position with a short settling time, or fast, uniform scanning of a specific area.

XY Axis - Fast Step-and-Scan Motion of the Sensor

- Ironless linear motors for high-dynamic, precise, and smooth motion for fast step-and-scan
- Absolute encoders avoid referencing and ensure operational safety
- XY drag chain cable management maintains cable integrity and prolongs lifetime

>> **V-855 High-Speed Linear Stage**

Z Axis - Sensor Focusing for Distance Control

- Voice coil direct drive motor for friction-free operation, high scan frequencies, and fast step-and-settle
- High-resolution linear encoders for accurate position feedback
- Adjustable weight force compensation for safe operation
- Easy integration thanks to flexible mounting options

>> **V-308 Voice Coil PIFOC® Focus Drive**

Z Axis - Precise Vertical Motion of the Sensor

- High-precision ball screw linear stage with stepper motor and holding brake for reliable operation with simple and extremely stable positioning
- Folded drivetrain and compact design reduces installation space
- Low-weight design to maintain gantry dynamics

>> **L-836 Stackable and Highly Compact Linear Stage**

Measuring Surface Depths

- Spot size down to 2 µm enables tiny features to be measured, as well as extremely precise positioning
- Wide range of working distances
- High resolution at fast speeds for dynamic autofocus compensation and high throughput

>> **Optical Distance Sensor**

Advanced Automation Control

- EtherCAT® motion control and drive modules provide open network connectivity
- Conversion of sensor output to position data for fast output via analogue or digital interfaces
- Extensive motion controller algorithms for fast motion and settle, as well as smooth scanning
- Autofocus capabilities for dynamic focus adjustment

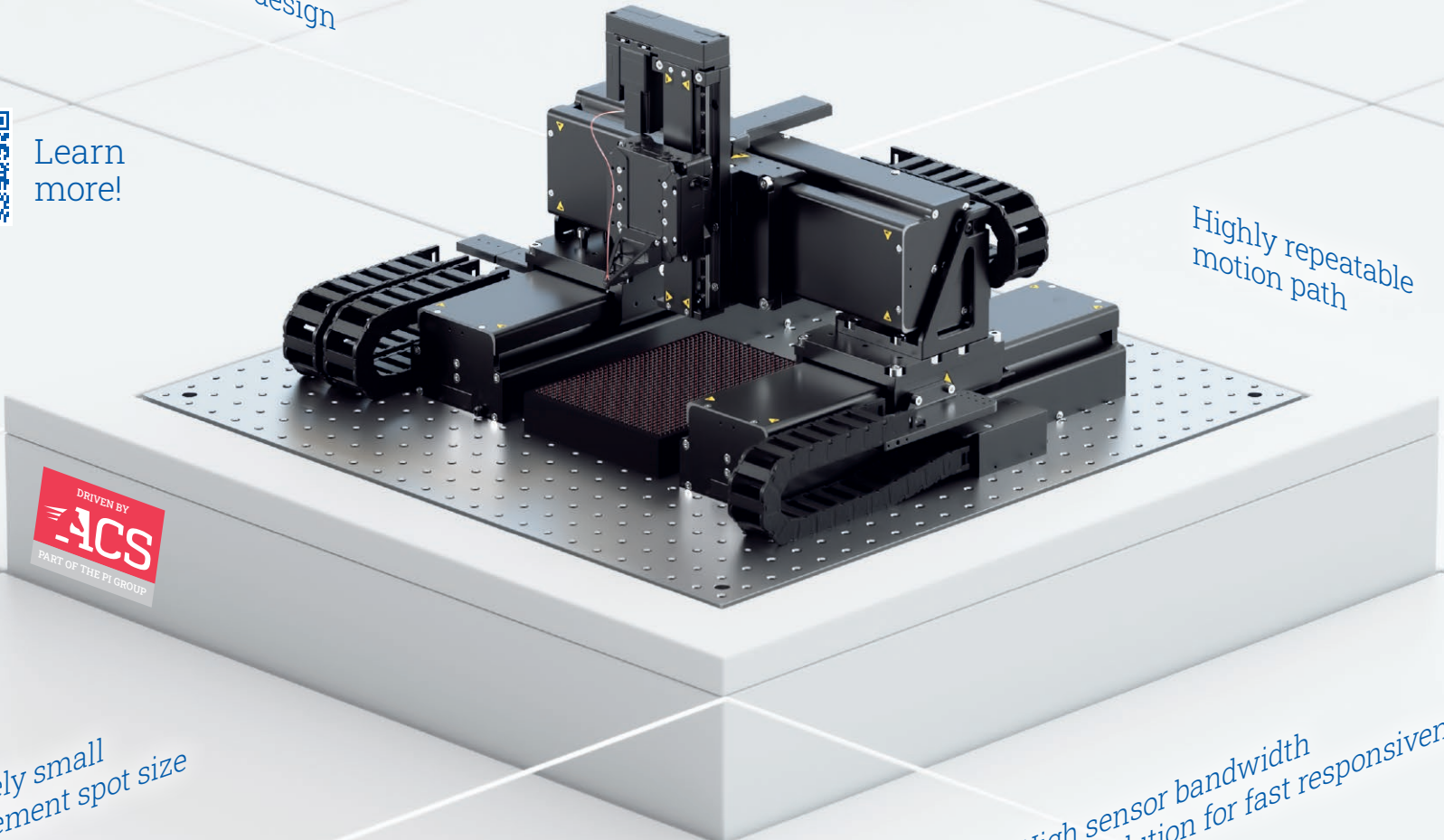
>> **Motion Controller**

Compact and economic design



Learn more!

Highly repeatable motion path



Extremely small measurement spot size

High sensor bandwidth and resolution for fast responsiveness

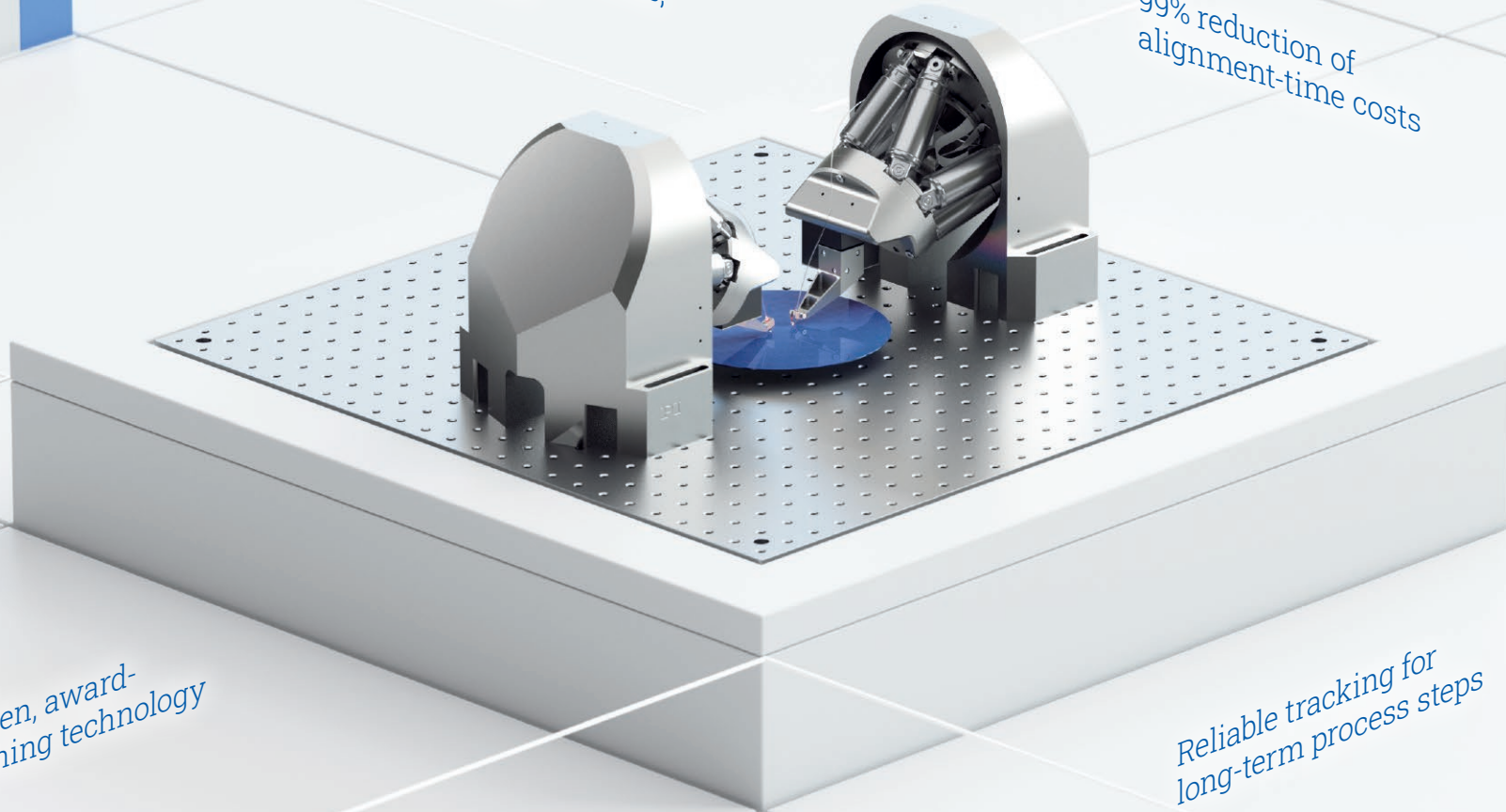


Simultaneous alignment across
multiple channels, I/Os, elements,
and degrees of freedom

Learn
more!



99% reduction of
alignment-time costs



Proven, award-
winning technology

Reliable tracking for
long-term process steps

Test and Assembly of Photonic Devices

Fast Multi-Channel Active Alignment

Integrating photonic structures or elements such as waveguides, photodiodes, lasers, and multiplexers presents a variety of demanding challenges to test and assembly processes, starting at wafer level through to final packaging. The common theme: multiple channels, multiple elements, and multiple interacting inputs, as well as outputs, across multiple degrees of freedom, all requiring multiple alignment optimization. Traditionally, this is a time-consuming and expensive task. PI's Multi-Channel Photonics Alignment (FMPA) systems and unique proprietary alignment algorithms, which are built into the controller, automatically enable simultaneous alignment across channels, devices, and degrees of freedom, optimizing overall alignment in one quick step. Subsequently, compared to serial operation, reduction of 99% in time and costs is possible.

XYZ Axis - Nanometer Alignment of Optical Components

- Parallel-kinematic piezo system for high stiffness in all spatial orientations
- Mechanical design provides scanning frequencies of up to 100 Hz, as well as fast tracking
- Zero-play flexure guides for high guiding accuracy without any wear or particle generation
- Integrated sensors offer excellent linearity of motion and long-term stability
- Piezo actuators with all-ceramic insulation for an outstanding lifetime

>> **P-616 NanoCube® Nanopositioner**

XYZ / θ X θ Y θ Z - Submicron Alignment of Optical Components

- Parallel-kinematic hexapod for alignment in six degrees of freedom
- High stiffness of the mechanical design provides high dynamics and short settling times
- Freely-definable center of rotation allows flexible alignment
- Position sensors ensure high accuracy and operational reliability
- Compact design for space saving integration

>> **H-811 6-Axis Miniature Hexapod**

User-Friendly and Flexible Automation Control

- EtherCAT® interfaces for fast integration into high-throughput industrial systems
- High-performance industrial controllers automate built-in scans and optimizations in parallel with millisecond responsiveness
- Proprietary firmware enables fast alignment based on fast area-scanning algorithms for first light detection and gradient search for peak coupling
- Software support for common operating systems, as well as for many programming languages including MATLAB, Python, C# and NI LabVIEW
- Quick start-up and ease-of-use thanks to PIMicroMove software

>> **C-887 Hexapod Motion Controller with EtherCAT®**

>> **E-712 Digital Piezo Controller**

Production-Level Wafer Probing and Silicon Photonics Testing

Active Alignment at High Duty Cycles

Silicon photonics plays a crucial role in the advancement of cutting-edge technologies such as quantum computing, nanosatellites, light detection and ranging (LIDAR), or optical logic, as well as in improving data processing, storage, and transmission. These technologies place many challenges on test and packaging processes, especially when it comes to the alignment of fiber optic devices in high volume production environments with high cleanliness requirements. PI offers advanced motion solutions for fast, 24/7, automated operation based on different motor, guiding and sensor technologies. Complemented by unique proprietary alignment algorithms for the parallel optimization of any figure-of-merit, the solutions can increase throughput by a factor of more than 100.

θZ Axis - Precise Rotational Positioning of Photonic Devices

- Highly accurate and repeatable 360° rotation without backlash
 - Direct drive motor technology enables smooth and precise operation without cogging
 - Brushless torque motor for high dynamics
 - High-precision absolute or incremental encoder options
 - Low-profile design for space-saving integration
- >> **V-623 High-Precision Rotation Stage with Direct Drive**

XYZ Axis - Fiber-to-Fiber or Fiber-to-Waveguide Alignments

- Friction- and maintenance-free air-bearing design for 24/7 high duty cycle applications
 - Voice coil direct drive motor for smooth operation, high dynamics and fast step-and-settle
 - Integrated linear encoders for accurate positioning
 - Innovative and compact XYZ design for space-saving integration
 - Integrated Z-axis counterbalance enables vertical operation with minimal impact on stage's form factor
- >> **A-142 PIglide Voice Coil Linear Stage with Air Bearings**

User-Friendly and Flexible Automation Control

- High-performance industrial controller with onboard ACS-based alignment algorithms
 - Proprietary firmware provides fast area-scanning algorithms for first light detection, as well as gradient and centroid algorithms for peak coupling.
 - Software support for common operating systems, as well as for many programming languages including MATLAB, Python, C# and NI LabVIEW
- >> **A-81x PIglide Motion Controller**



Learn more!

Production class automated
photonics alignment

Reliable performance
during 24/7 operation



Increase in throughput
by a factor of 100

Suitable for extremely clean
application areas

The PI Group

The PI Group with headquarters in Karlsruhe, Germany, is market leader for high-precision positioning solutions and piezo technology applications in the semiconductor industry, life sciences, photonics, and industrial automation. In close cooperation with international customers, PI has been pushing technological boundaries and developing solutions to drive future market trends for more than fifty years. More than 500 patents prove the company's claim to innovation. PI develops, manufactures, and qualifies its entire core technologies: from piezo elements and motors, magnetic direct drives and air bearings, and magnetic and flexure guides to sensors, as well as controllers and software. With nine production sites and sixteen sales and service offices in Europe, North America and Asia, the PI Group is ideally positioned in all key technology regions. PI is privately owned, with healthy growth, and more than 1,500 employees worldwide.

PI USA ●

● PI USA

● PI USA

Innovation drives the world. **We drive innovation.**





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