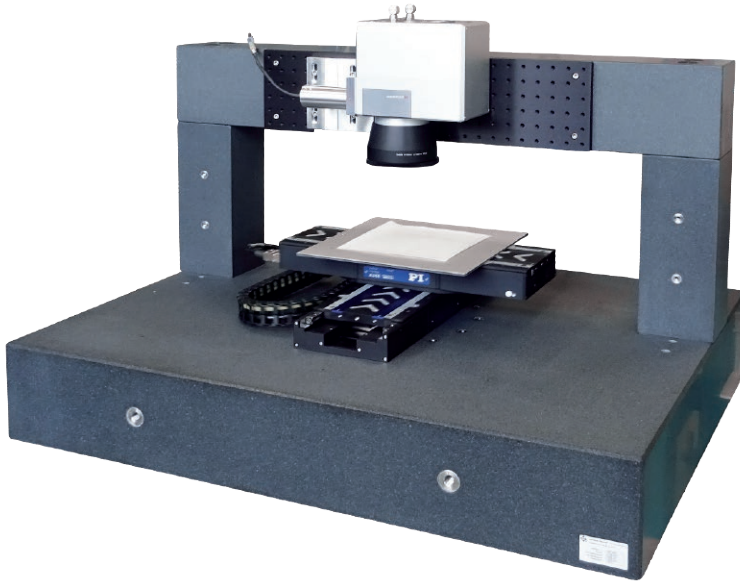


# Engineered Systems

LEADING AUTOMATION SOLUTIONS FOR MOTION & POSITIONING

# From the Initial Design to Delivery

Working Closely Together for the Best Solution



PI designs and manufactures to a wide variety of precision motion technologies, including air bearings, linear motors, piezoelectric drives, flexure guides and mag-lev systems, to name a few.

PI's **Engineered Systems Division** integrates these components into custom motion systems. Complete solutions, fitting seamlessly into existing processes that advance automation in major industrial and research installations for applications such as

- Semiconductor inspection and production
- Photonics alignment, test and packaging
- Laser micromachining
- Additive nano-manufacturing
- Surface metrology
- Biotechnology

Post-delivery service is an essential part of PI's philosophy and includes commissioning and on-site installation as well as training and maintenance support.

## How PI Engineered Systems Works:

1. Definition phase: Together, we identify current issues and the goal of your new motion system
2. Concept phase: Brainstorming about the best solution in close cooperation with your and our engineering teams
3. The resulting solution is converted into a Technical and Business Proposal
4. The design and detail phase begins after your approval
5. The system is then assembled and tested, and - after your approval - delivered
6. You end up with a fully functioning system, and avoid losing time trying to integrate components from different suppliers



"The most important thing is to understand the customer's task. Our engineers have extensive experience in implementing and qualifying the systems. In order to achieve the maximum benefit, we also consider the local constraints right from the very beginning."

**Dr. Marthe Kauffholz,**  
**Head of Product Division**  
**Engineered Systems**

# Perfect Motion and Positioning

Engineered Systems Benefit from the Broadest Technology Portfolio for the Most Demanding Tasks

## From High-Precision Drive Components to the Turnkey Solution

Precision components, stable control and a great deal of experience in engineering are essential for high-precision complex motion and positioning solutions. PI supplies all components the positioning stages, sensors, motion control and software on all levels of integration.

### Core Competences

- Application support and consulting for motion and positioning applications
- Reliable and prompt series production even for large quantities
- Economic design
- Commissioning of turnkey solutions
- Complex multi-axis designs and parallel kinematic robotics
- Broad spectrum of technologies: Piezo and motor based drives; flexures, mechanical guide or air bearings; high-resolution sensors
- In-house motion control electronics and software platform
- Customized software integration such as Epics, LabVIEW, Tango, ...



This 20-ton, 56-axis motion system is used for x-ray microscopy and quality assurance of x-ray optics. It is equipped with 56 motors, 16 controllers, 7 air bearing granite sliders and has an overall mass of more than 20,000 kilograms. An extraordinary precision of some hundreds of nanometers over the full range could be achieved.



# Partnering Research & Industry

## From 1-off to Series: Maximum Flexibility for Customized Products

A modern production management and an integrated management system allow PI to guarantee the high quality of its products, processes, and services.

The continual improvement of organization and processes is an integral part of the corporate culture. KAIZEN workshops and an active innovation management are important elements for achieving this.

The production processes for the standard range are made flexible by the fractal production structure and it is therefore possible to manufacture even large series with full process control.

Active, system-based requirements management makes it possible to dispense with comprehensive storage facilities.

### Vertical Production Range and Production Capacity

The product spectrum ranging from the two-ton hexapod to the 10-gram nanopositioner requires PI to have the equipment and technologies at its disposal that allow the systems to be manufactured, assembled, and qualified.

- 13,000 m<sup>2</sup> of overall production space
- 5,000 m<sup>2</sup> for cleanrooms
- Air-conditioned and vibration-proof measuring conditions
- Vacuum chambers for startup and residual gas analysis
- Measuring technology with traceable, calibrated measuring equipment
- Monitoring of piezo actuator technology from material composition to final inspection
- In-house manufacturing of positioning sensors
- Production hall with measuring technology for heavy loads
- Fractal production organization



# PI's Global Services



## Start-Up, User Training and Life Long Support

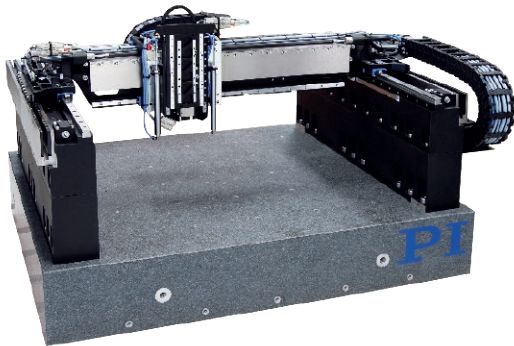
PI is dedicated to supporting its customers' right from the initial consultation through to when a customer has purchased a PI system. But we don't stop there, PI's services division is committed to ensuring that every aspect of owning a PI system is catered for. Every customer is unique with their application, environment, challenges and the way they like to be supported. As such, PI have a series of packaged service offerings to cover most customer demands, but in addition to that, PI can design **bespoke flexible service packages** that are tailored exactly to match each customer needs.

### PI's Standard on-Site Services

- Set up and Commissioning – On-site support to un-box, set-up and commission the PI system.
- Training Program – User training on software and programming, through to optimization of system performance.
- Support – On-going remote and on-site support to maximize system uptime and provide maintenance for the whole life of any system.

# Throughput, Precision and Reliability

## Solutions for Motion-Centric Industrial Automation



### Gantry Systems – High-Dynamic Precision Positioning in 3 Axes

- Linear motor or brushless drives, optionally with air bearings
- Individual travel ranges in XY up to 2 m
- Z-axis with pneumatic counterweight, DC or Stepper motor
- Piezomotor for fine adjustment
- Incremental or absolute encoders
- Controlled by ACS Motion Control

The specifications below are an example of what is feasible. Contact PI to discuss your requirements!

	X	Y	Z	Unit	Tolerance
Active axes	X	Y	Z		
<b>Motion and positioning</b>					
Travel range	508	508	155	mm	
Integrated sensor	Optical linear encoder, incremental	Optical linear encoder, incremental	Optical linear encoder, incremental		
Sensor resolution	0.002	0.002	0.002	µm	
Unidirectional repeatability	0.5	0.5	0.5	µm	typ.
Max. velocity*	3000	3000	2000	mm/s	typ.
Max. acceleration**	30	30	20	m/s <sup>2</sup>	typ.
<b>Mechanical properties</b>					
Bearings	Ball bearing	Ball bearing	Cross roller bearings		
Load capacity	5			kg	max.
Motor type	Ironless linear motor	Ironless linear motor	Ironless linear motor with pneumatic counterbalance		

\* Maximum speed based on stage capability. Maximum application velocity may be limited by system data rate and system resolution. Maximum speed of the z-axis is specified without pneumatic counterbalance.

\*\* No load. Maximum acceleration of the z-axis is specified without pneumatic counterbalance.

### XY and Gantry Systems from PI

Positioning and motion tasks in industrial automation such as those in assembly, semiconductor manufacturing, mechanical engineering, laser material processing, inspection systems or in additive manufacturing demand solutions that need to be robust and reliable.

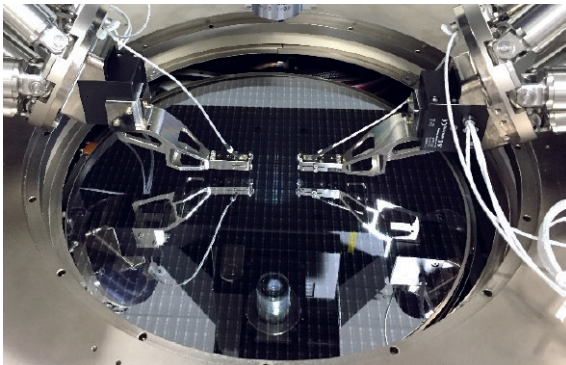
PI offers a broad range of in-house drive and motion control technologies such as EtherCAT-based industrial controllers by ACS, where PI holds the major shares, or air bearing technology for optimized guiding accuracy. System engineering for customization and a global service and training network are added-value offers. PI is therefore the ideal partner for motion-centric industrial solutions.



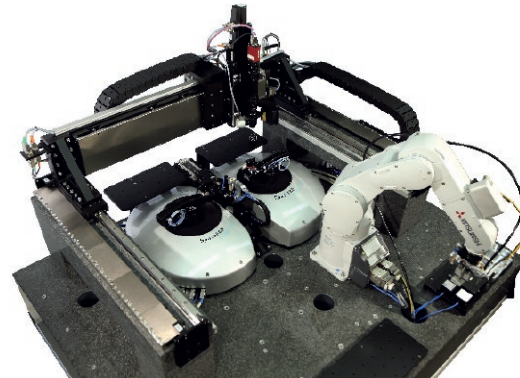


# Experience in Custom Solutions

## Examples from Research and Industrial Projects



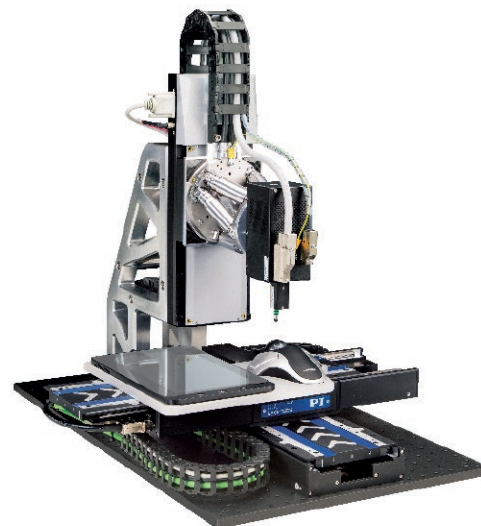
18-Axis double alignment system provides fast NxM alignment of SiP devices in wafer probers. Cascade Microtech's pioneering CM300xi photonics-enabled engineering wafer probe station integrates PI's Fast Multichannel Photonics Alignment systems for high throughput, wafer-safe, nano-precision optical probing of on-wafer Silicon Photonics devices. (Image: Cascade Microtech, a FormFactor company)



This system for the automated assembly and alignment of the optical fibers on a silicon photonic chip integrates several hardware components and software, such as pick-and-place robot technology, image processing, or devices for precision positioning



Wafer inspection system with integrated linear motor axes for fast precision XY scanning. Stepper motor axis for fine vertical position of the inspection equipment. Front page: Double-sided wafer inspection system in a flexible 15-axis configuration



The touchscreen is scanned with a precise and controlled force. A 6-axis hexapod adjusts the contact angle with microradian accuracy. This integrated system consists mainly of standard stages and is used for automation of inspection processes



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