



Aerotech Capabilities in Big Science

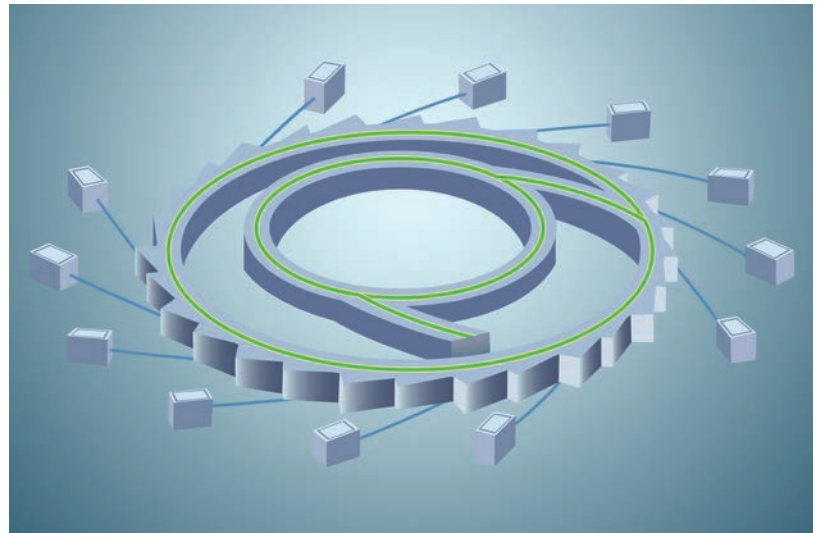
The Most Advanced Motion Controls

Pushing the boundaries of understanding in fields like biology, chemistry, materials science, engineering, and physics increasingly requires more precise control of the highest precision experimental equipment. To enable imaging of atomic-scale structures and processes in real time, scientists need the best tools available. Aerotech offers the highest precision end-station positioning solutions for:

- Diffraction
- Crystallography
- Tomography
- Laminography
- Monochromator Positioning
- X-Ray Mirror Inspection

Aerotech controls and positioning systems are designed to be the most powerful, flexible, and easy-to-use motion controllers on the market. We can help you increase the accuracy and reliability of experimental data, allow both operators and administrators faster access to diagnostic tools and advanced features, and decrease installation or changeover time.

- Fast and easy setup
- User-friendly, modern Windows® interface
- One-click performance tuning
- Flexible electronics: drive DC brush, brushless, stepper, and piezo-driven mechanical systems with one user interface
- PWM and linear amplifier options for cost-effective or high-performance applications
- **EPICS and TANGO drivers via ASCII or Ethernet**
- Local support and expertise via native speakers in the US, Canada, UK, France, Germany, Italy, India, China, Taiwan, Japan, and Thailand



Aerotech Motion Controller Solutions Deliver High Performance with Quick and Easy Setup

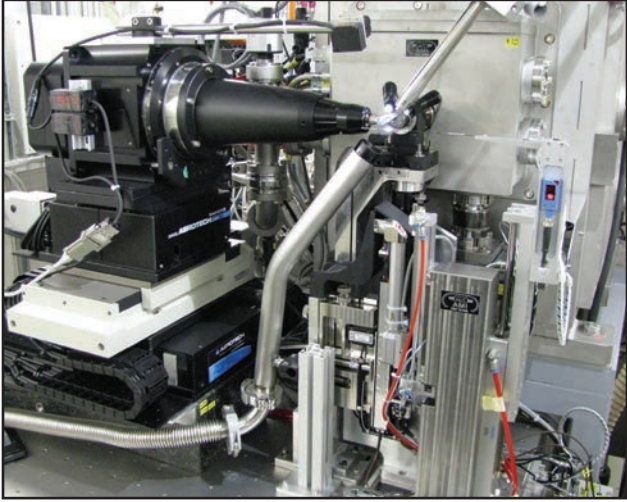
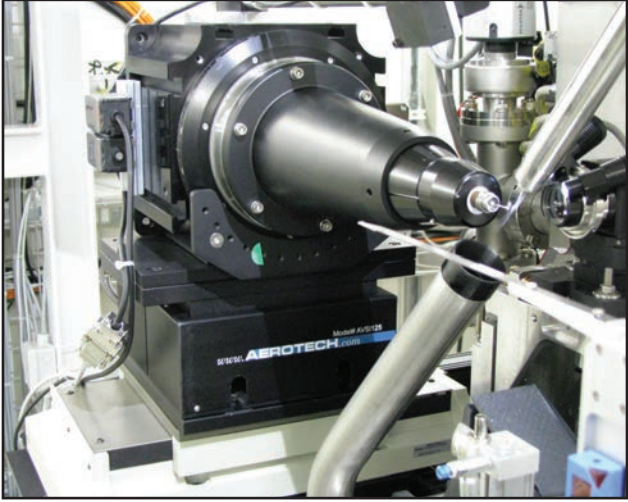
Increased Performance	Ease of Use	Reduced Setup Time
Decrease move and settle time	One software environment	Setup wizards
Increase contour speeds and accuracy	Extensive diagnostics	Configurable autotuning tools
Easily remove machine resonance	Multiple languages	Software oscilloscope

Single-Source Provider

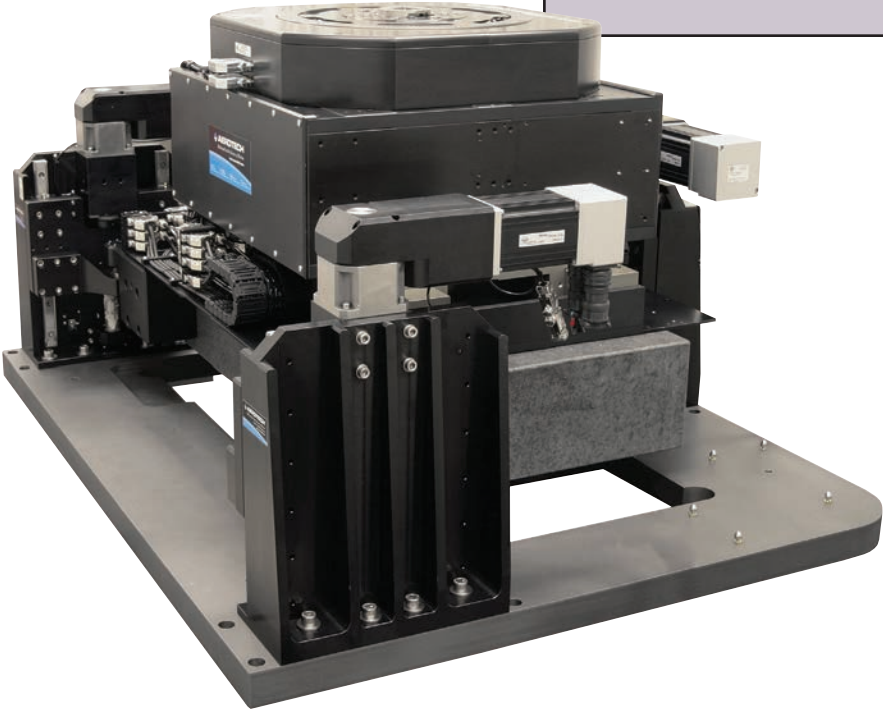
- Motion Controls
- Software
- Amplifiers/Drives
- Motors
- Positioning Stages
- Systems

The Most Advanced Motion Systems

Minimizing spatial errors including accuracy, repeatability, and sphere of confusion to the nanometer-level allows for more accurate imaging and higher quality data. Stepper, servo, and piezo actuator technology can be mixed and matched to optimize each piece of the instrument. This provides a high degree of flexibility for future experiments and upgrades with minimal difficulties.



Linear air-bearing flatness	<1 μm
Linear air-bearing pitch/roll/yaw	± 1 arc-sec
Fine positioning piezo stages	Sophisticated slip-ring arrangement allows 360 degree continuous travel in theta
Lift/tip/tilt	3-point mount Z axes with kinematic mount offer precision lift, tip, and tilt motion for entire assembly



Crystallography Sample Positioning



Design Features

- Minimizing spatial errors including accuracy, repeatability, and sphere of confusion to the nanometer-level allows for more accurate imaging and higher quality data
- Optional cable management simplifies experimental setup and reduces operating complexity

Grazing Incidence Mirror Inspection

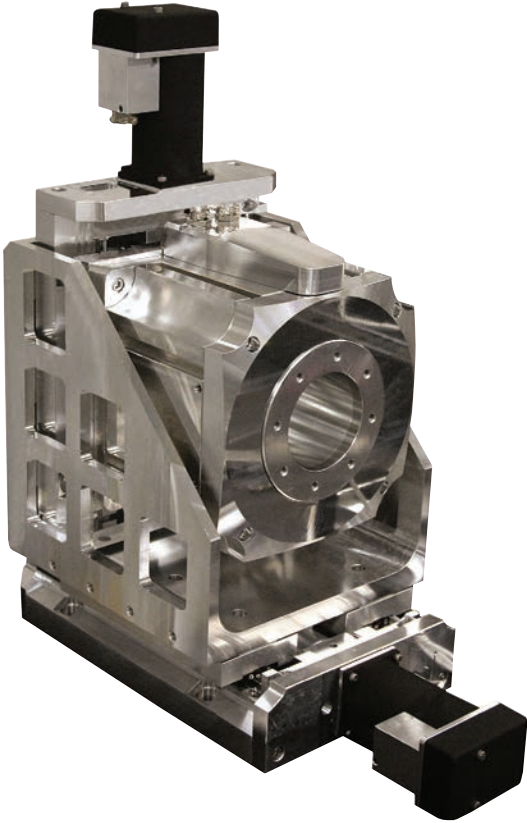
Light sources use long (~1 m) mirrors known as grazing incidence mirrors coated with various substances to direct and focus X-rays. X-rays are difficult to focus with lenses, so mirrors are the solution for many of these applications.

The system shown here was designed to inspect the flatness and surface quality of these mirrors. The key performance requirement was outstanding angular motion performance. Pitch, roll, and yaw were less than 7 arc-sec over 1 m of travel.

The performance of grazing incidence X-ray mirrors depends heavily on the slope of the mirror surface. It is critical to measure that slope error to the highest degree possible. Aerotech's air-bearing stages offer the ultimate angular stability for optical measurement equipment used to characterize these mirrors.

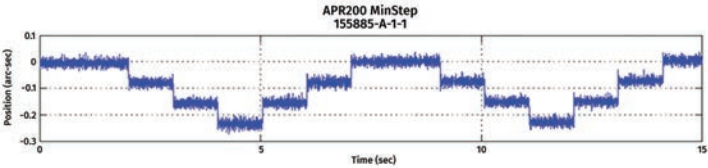


Monochromator Crystal Positioning

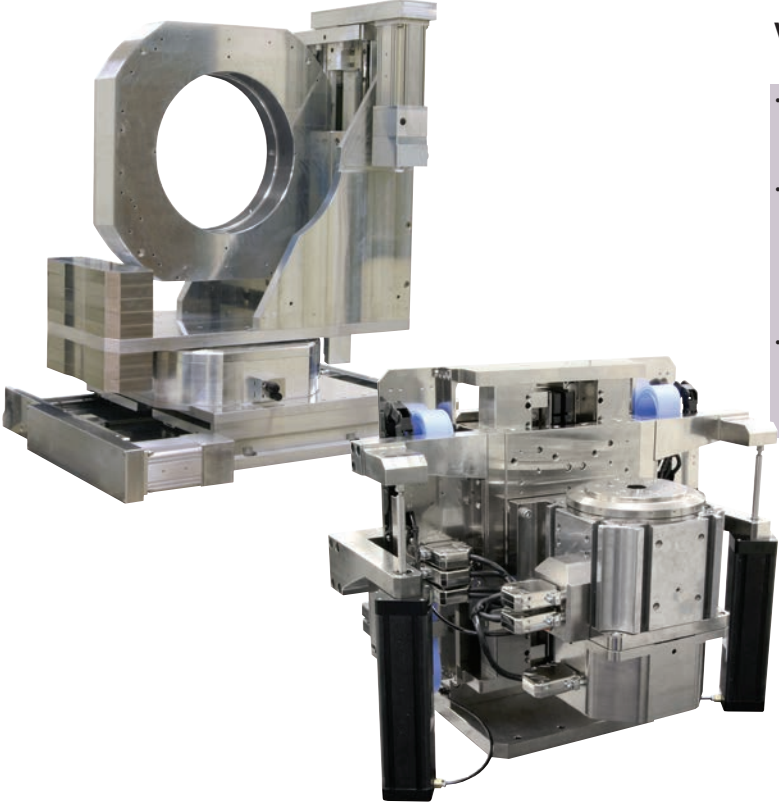


This system is used for positioning of diffraction crystals for X-ray beam conditioning in a high-vacuum environment. Very fine step-size and repeatability on the rotary axis were the key requirements in order to position crystals used in the beamline. Aerotech's APR200 rotary stage achieved the specifications easily, and there are no competitive solutions for a mechanical-bearing rotary stage with the required accuracy/repeatability and step size.

Motion	X, Z, Theta: ATS2000 and APR200
Critical Specification	Rotary step size: 0.1 arc sec or better
Environment	High Vacuum



Custom Systems



Vacuum Systems

- Our wide range of standard products are easily configured for vacuum applications
- Three vacuum level options:
 - Low Vacuum Option (10^{-3} torr)
 - Standard Vacuum Option (10^{-6} torr)
 - High Vacuum Option (10^{-8} torr)
- This machine is an example of how we combine standard and custom products into very specialized vacuum-rated automation solutions

HexGen[®] Hexapods

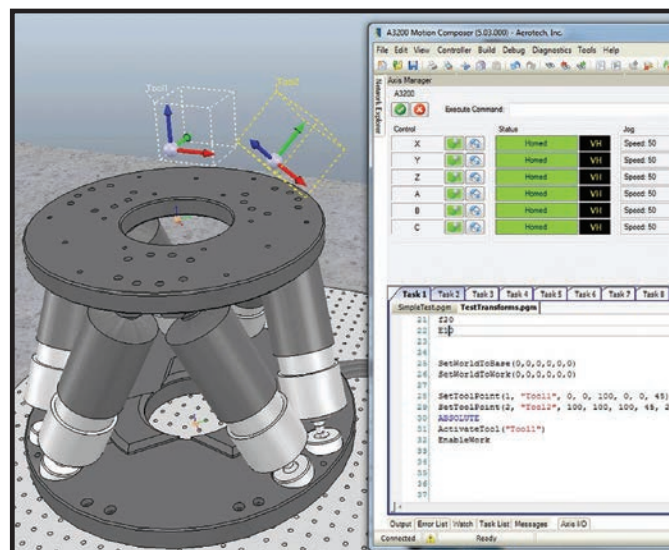
The next-generation in 6 degree-of-freedom positioning



HEX500-350HL

HexGen[®] hexapods coupled with our control and visualization software make accurate six degree-of-freedom positioning incredibly easy.

- Six degree-of-freedom positioning with linear travels to 110 mm and angular travels to 40°
- Precision design with guaranteed positioning accuracy specifications
- Minimum incremental motion to 20 nm in XYZ and 0.2 μ rad in $\theta_x\theta_y\theta_z$
- Flexible configurations and customization
- Vacuum preparation available upon request
- Powerful controls and software with visualization of work and tool coordinate systems
- Absolute encoders optional

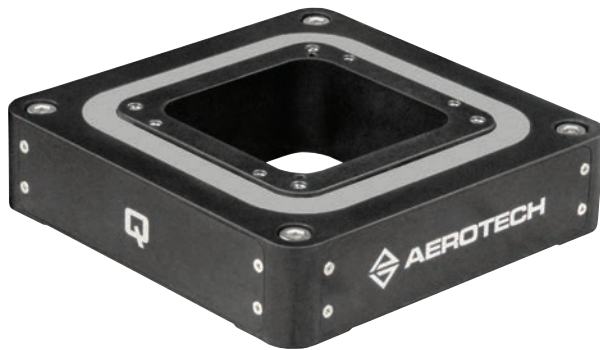


HexGen Visualization Software

HEX RC Multi-Axis Robotic Controller



QNP2 Series Piezo Nanopositioners

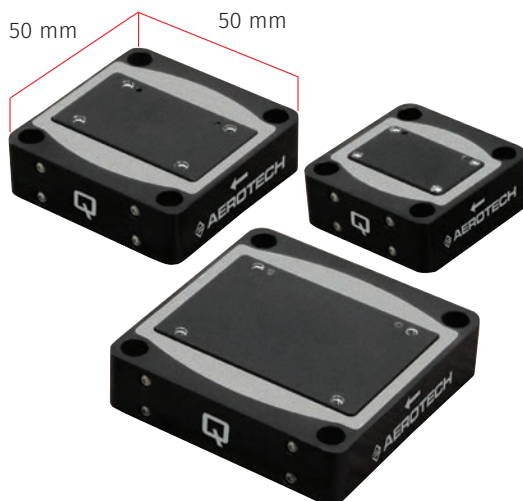


QNP2 Series

- Travels to 120 μm x 120 μm
- 50 x 50 mm square clear aperture
- Superior multi-axis accuracy via parallel-kinematic design
- High-stiffness and dynamics resulting in high process throughput
- High-precision, frictionless flexure guidance
- Patent-pending design provides unmatched geometric performance
- Long device lifetime
- Superior positioning resolution and linearity with direct-metrology capacitive sensor option
- Open-loop and vacuum versions

QNP2 Series	
Features	QNP2-100-100XYA
Closed-Loop Travel (X x Y)	100 μm x 100 μm
Open-Loop Travel, -30 to +150 V	120 μm x 120 μm
Linearity	0.01%

QNP-L Series Piezo Nanopositioners



QNP-L Series

- High-precision, frictionless flexure guidance system
- Proprietary piezo multi-layer stack actuator
- Closed-loop travel options of 100, 250, and 500 μm
- High-positioning resolution and linearity with direct-metrology capacitive sensor options
- Mounting compatibility with other QNP-series piezo nanopositioners (XY and Z)
- Open-loop and vacuum versions

QNP-L Series			
Features	QNP-40-100L	QNP-50-250L	QNP-60-500L
Closed-Loop Travel	100 μm	250 μm	500 μm
Open-Loop Travel	120 μm	300 μm	600 μm
Linearity	0.01%	0.01%	0.007%

QNP-XY Series Piezo Nanopositioners



QNP-XY Series

- High-precision, frictionless flexure guidance system
- Proprietary piezo multi-layer stack actuator
- Closed-loop travel options of 100, 250, and 500 μm
- High-positioning resolution and accuracy with direct-metrology capacitive sensor options
- Mounting compatibility with other QNP-series piezo nanopositioners (L and Z)
- Open-loop and vacuum versions

QNP-XY Series			
Features	QNP-40-100XY	QNP-50-250XY	QNP-60-500XY
Closed-Loop Travel	100 μm x 100 μm	250 μm x 250 μm	500 μm x 500 μm
Open-Loop Travel	120 μm x 120 μm	300 μm x 300 μm	600 μm x 600 μm
Linearity	0.01%	0.01%	0.007%

QNP-Z Series Piezo Nanopositioners



QNP-Z Series

- High-precision, frictionless flexure guidance system
- Proprietary piezo multi-layer stack actuator
- Closed-loop travel options of 100, 250, and 500 μm
- High-positioning resolution and accuracy with direct-metrology capacitive sensor options
- Mounting compatibility with other QNP-series piezo nanopositioners (L and XY)
- Open-loop and vacuum versions

QNP-Z Series			
Features	QNP-40-100Z	QNP-50-250Z	QNP-60-500Z
Closed-Loop Travel	100 μm	250 μm	500 μm
Open-Loop Travel	140 μm	300 μm	600 μm
Linearity	0.01%	0.01%	0.007%

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