

queensgate
a brand of **PRIOR**

High speed, high
precision applications



Experts in high speed, high precision applications

Leaders in nanopositioning

Queensgate has been a premier supplier of high precision nanopositioning products for over 40 years. The company was founded in 1979 from the groundbreaking research at Imperial College in London and quite literally "wrote the book" on nanopositioning. The Nano Positioning Book by Thomas Hicks and Paul Atherton defined the stringent use of "precision" and "accuracy." These definitions are still upheld today as the only way to precisely describe nanopositioning systems' performance.

Now part of Prior Scientific, Queensgate's research and product development activities continue to play a significant part in the R&D of a wide variety of industries. In 2018 the company was purchased by Prior Scientific Instruments Ltd.

Enhanced control technology

Digital control provides the flexibility of tuning to optimize a system for speed, resolution, and payload. Queensgate controllers have ultra-low noise electronics (at low picometres levels), can supply high power to stages, and run closed-loop control at a 20 μ s update rate.

Queensgate stages are often 4 to 5 times faster than competitive stages. They operate at high bandwidths (3 dB bandwidth) and over 40% of resonant frequency while maintaining precision and resolution.

OEM and custom solutions

Queensgate has over 40 years of experience providing custom and OEM solutions where precision, accuracy, and dynamic performance are required. The development process is closely customer-focused as the engineering teams work closely to understand the customer application and system requirements. Our in-house team provides world-leading innovation and expertise for those looking to find new, accurate, and efficient solutions for their most challenging applications. The company is ISO 9001 registered, focusing on high quality and project management to meet the performance specification on time and within budget.

Market-leading performance



Unparalleled speed

Queensgate stages are often 4 to 5 times faster than competitive stages due to advanced control algorithms.



Hardware

Low noise allows the best dynamic performance while maintaining high resolution and positioning performance.

What distinguishes Queensgate



Performance

The experts in high speed, high precision applications



Experience

Over 40 years of delivering performance-critical components



Enhanced control technology

A tool kit to deliver the best performance for the application



Design

Material selection and FEA design to meet the highest demands



Reliability

Trouble free installation over decades of use. Plug and play electronics.



Custom solutions

Over 70% of our products are custom made



The fastest settle times

Digital control provides the flexibility of tuning to optimize a system for speed, resolution and payload.



Velocity control

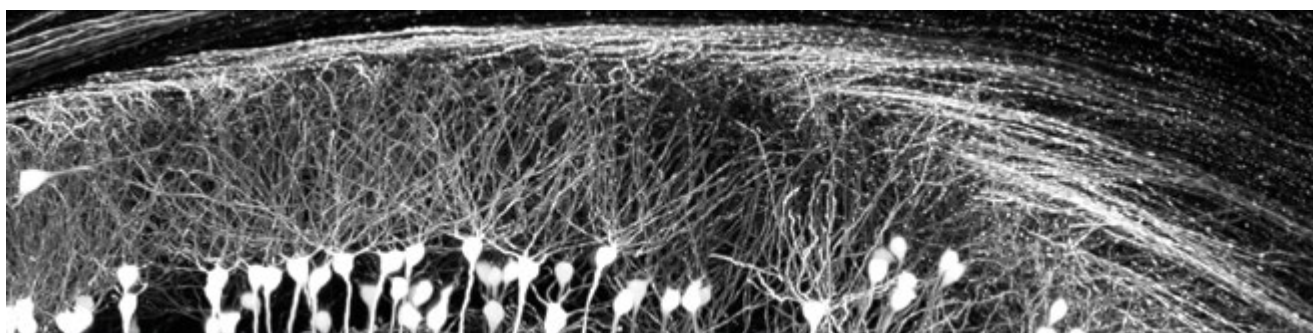
High speed imaging for AFM, or using the latest high speed, high resolution cameras.

Optical microscopy

Get the fastest step and settle time and the best positioning performance

Queensgate long-range piezo sample and objective positioners provide the best resolution, repeatability, and settle times. Queensgate controller techniques enable performance that is usually only achieved

with shorter range stages, cutting scanning times significantly. Long ranges and fast scanning times are beneficial for multiphoton microscopy techniques such as live-cell imaging (see image below).



Live-cell image of brain tissue taken using QGSP600, acquired in 30 seconds..



NanoScan OP400 Nanopositioning Piezo Objective Positioner



NanoScan SP400/SP600 Nanopositioning Piezo Sample Scanner



Microscopy product range

Part number	Material	Range (closed loop)	Resolution (typical)	Linearity (typical)	Repeatability (typical)	Step settle times (typical) 5% settle 0.5µm step
QGOP400 objective positioner	Stainless steel	400 µm	0.7 nm	0.005%	1.6 nm	7 ms (150 g)/ 10 ms (250 g)/ 18 ms (500 g objective)
QGSP400 Sample scanner Z	Aluminum	400 x 400 µm	0.7 nm	0.2%	4 nm	7 ms
QGSP600 Sample scanner Z	Aluminium	600 x 600 µm	0.7 nm	0.2%	4 nm	7 ms
QGSPXY600Z600	Aluminium	600 x 600 XY 600 µm Z	1 nm	0.02%	5 nm	

Atomic-force microscopy (AFM)

Ultrafast high-resolution imaging with velocity control

Queensgate closed-loop velocity control enables faster AFM scanning, capturing high-quality (high resolution) imagery at raster speeds of up to 4 mm/s over larger scan areas. Scan areas of 100x100 μm to 600 x600 μm can accommodate larger samples and payloads. In addition the linearity of the position data allows high quality images to be captured without requiring complex post processing techniques to remove piezo distortion or stitching effects.

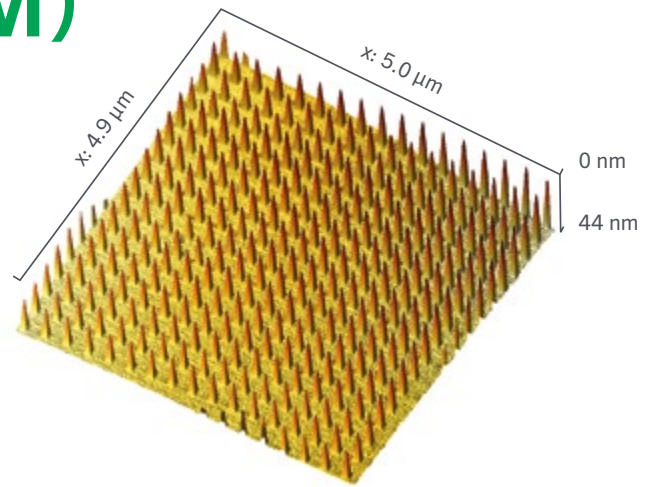


Image captured at 0.5 $\mu\text{m/s}$, 1000 scan lines acquisition time 4 minutes. Pitch spacings measured are consistent to within 0.2 nm (0.06%) demonstrating any error in velocity is highly reproducible.

AFM scanners

Queensgate high performance piezoelectric stages are used in the specimen scanner of an AFM to provide sub-nanometre spacial resolution. Dynamic performance is also important as the faster the Z dimension can adjust to the sample's topography, the quicker the surface can be scanned in the X and Y axis. Speed is essential as it reduces measurement times and possible temperature drift.



QGNPS-XY-100 stage

AFM product range

Part number	Material	Range (closed loop)	Resolution (typical)	Linearity (typical)	Repeatability (typical)
QGNPS-XY-100A	Super Invar	110 x 110 μm	0.25 nm	0.01%	0.75 nm
QGNPS-XY-100D	Aluminium	110 x 110 μm	0.14 nm	0.005%	0.5 nm
QGNPS-XYZ-100D-20H	Aluminium	110 x 110 μm 20 μm	XY – 0.14 nm Z – 0.05 nm	0.005% 0.02%	0.5 nm 0.25 nm
QGSPXY600	Aluminium	600 x 600 μm	1 nm	0.02%	5 nm

Separate Z axis stages

Part number	Material	Range (closed loop)	Resolution (typical)	Linearity (typical)	Repeatability (typical)
QGNPS-X-15B	Aluminium	20 μm	0.05 nm	0.005%	0.25 nm
QGNPS-X-28C	Titanium	28 μm	0.05 nm	0.005%	0.25 nm

Scanning electron microscopy (SEM)

Designed for demanding environments

Electron microscopes have a higher resolving power than light microscopes and can reveal the structure of smaller objects to picometre levels of resolution. Queensgate provides very low noise piezo systems which are non-magnetic and UHV compatible.

Product range

Part number	Material	Range (closed loop)	Resolution (typical)	Linearity (typical)	Repeatability (typical)
QGWP120A-VAC ⁽¹⁾ (300 mm wafer scanner)	Aluminium Non magnetic nickel	120 µm	1.5 nm	0.1%	5.5 nm
QGNPS-X-28C	Titanium	26 µm	0.05 nm	0.005%	

(1) High load custom version for use up to 14 kg, tip tilt Z custom version for platform levelling and scanning, custom 160 µm extended range version, custom version for 200 mm wafer.

Surface inspection

Positioning accuracy is essential in optical metrology, microscopy, and other imaging applications. Queensgate nanopositioning systems offer the best possible accuracy, and our systems operate with repeatability in the nanometer range and have response times below one millisecond. Queensgate's world-leading velocity control allows image collection at speeds greater than 1000 µm/s.



Piezo wafer scanner combined with Prior PureFocus850 laser autofocus and OpenStand LS microscope

Product range

Part number	Material	Range (closed loop)	Resolution (typical)	Linearity (typical)	Repeatability (typical)
QGWP120A wafer scanner ⁽²⁾	Aluminium Non magnetic nickel	120 µm	1.5 nm	0.1%	5.5 nm
QGOP400 objective positioner	Stainless steel	400 µm	0.7 nm	0.005%	1.6 nm
Nose piece positioner 2.5 – 10 kg loading	Selected for performance	200 – 300 µm	1 nm	0.01%	4 nm

(2) UHV version, high load custom version for use up to 14 kg, tip tilt Z custom version for platform levelling and scanning, custom 160 µm extended range version, custom version for 200 mm wafer.

Industrial solutions

Hard disk drive testing

Queensgate designed a custom stage and controller for a hard disk drive (HDD) read/write head testing system to meet the manufacturer's high quality and precision needs. The factory tests about one million heads per day before building them into the final hard disk drives. The demands of the test equipment are aligned with the final HDD's performance. Consumer expectations for product performance are high and ever-advancing. When the product specifications change, the requirements for the test equipment also changes. The total position error budget for testing is currently less than 0.5 nm, requiring measurement at the angstrom level. When operating with small margins, everything from conversations in the same room to fractional degrees of temperature change affects positioning.

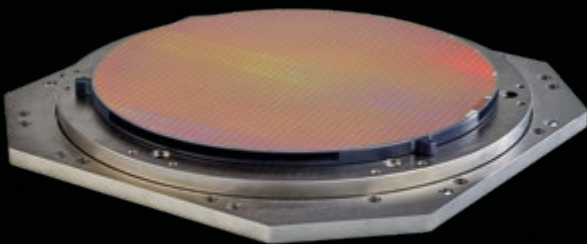


Custom electronics with low picometres of noise and high speed interface

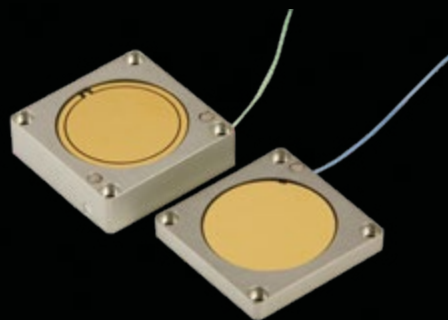
“ We have received what I believe is the best nanopositioner on the market. ”

Ron Anderson
Managing Principal Engineer, Seagate

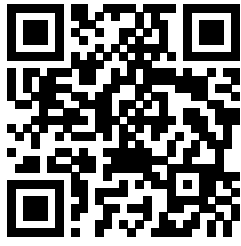
Semiconductor



Custom UHV wafer scanner



Custom ceramic sensors provide non-magnetic, UHV, and rad-hard options with extremely low thermal expansion coefficient.



For more information, visit:
nanopositioning.com

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