queensgate
a brand of PRIOR

Synchrotron solutions

Queensgate Nano have decades of experience providing nanopositioning solutions for use in beamline science. Queensgate provides solutions for piezo-driven nanopositioning systems and capacitive sensors for use in vacuum from 10-2 Torr to 10-9 Torr, including radiation-hard options.

Material selection for UHV prepared products

Providing product to operate in UHV, potentially at cryogenic temperatures and needing to be rad hard, requires that we select materials carefully. The higher the vacuum, the more important it is to source materials that have low outgassing. This often means that we avoid materials such as brass, zinc or lead as they are not suitable for UHV. Polymers must also have low outgassing, so our standard air-side PVC wiring is replaced with Kapton-insulated wires, and all bonding agents are selected using the NASA outgassing database.

Vacuum preparation

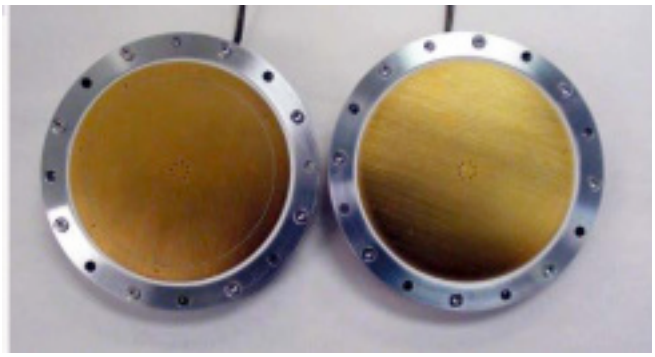
Preparation of materials and the components is also important because the manufacturing process can introducechemicals that would cause a problem under vacuum. Parts designated for use in UHV are ultrasonically cleaned to remove oils and carbon residue from any metalwork. Prior to installation we recommend a bake-out to remove any solvent residues.

- UHV option guarantees performance down to 10-9 Torr
- Ultrasonic cleaning processes
- No trapped voids or volumes
- Low out-gassing materials
- 4 individual Kapton cables with SMA or Sub-D bulkhead connection
- Plug and play interchangeability with full calibration allowing easy controller replacement once installed in a vacuum.
- Radiation prepared variants available
- Calibrated systems comprise a closed-loop piezo-driven actuator, airside extension cable, vacuum feedthrough (optional) and selected controller.

Diversity of applications

Synchrotron solutions provide a diversity of applications and often require bespoke solutions to meet a scientificchallenge. Queensgate offers an extensive choice of accessories, interfaces and UHV compatible options. Over70% of our sales are custom solutions of performance-critical components.

Positioning accuracy and vibration measurement



The NanoSensor® is a non-contact positionmeasuring system based on the principle ofcapacitance micrometry. They are non selfheatingand maintain their zero positionwhen powered down. Resolutions as smallas 7 picometres (RMS) can be achieved. Measurement ranges from 20µm up to11mm are available as standard withfrequency responses up to 5kHz andlinearity down to 0.02%.

NanoSensor are used in beamlines to provide metrological measurements but also can be used to measure the relative pitch vibrations within a monochromator.[1]

The NC NanoSensor is a new series of high resolution capacitive sensors developed specifically for UHV to 10-10Torr. Their ceramic gold construction has removed all adhesive bonding agents and their construction also meansthey can be baked out at higher temperatures and used in high radiation environments.

Single and multichannel sensor electronics are available. Single channel controllers can be synchronised to prevent noise due to electrical interference. Choice of controller is impacted by the operating bandwidth required and the length of “in vacuum” cable and the need for synchronisation.

Piezo Actuators

The DPT ranges of actuators are designed with capacitive feedback control to give precise positioning and arecapable of moving loads of up to 60 kg over the full travel range with low electronic noise, high linearity and fastsettle time provides positioning with subnanometre levels of precision. High thermal stability super invar versionsgive superior positional stability with UHV compatibility to 10^{-9} Torr.

Soft X-ray Monochromator 2 DPT-D-20-UHV Actuators

- 30 µm travel range
- 30kg per actuator
- Stable operation at fast setting
- 400Hz bandwidth

Used for fine tilting of grating to compensate for background vibration

Piezo Stages

Vacuum compatible versions of Queensgate flexureguidedpiezo-actuated stages are available andassembled using kapton wiring. The stages can be usedto position optics with sub nanometre precision.

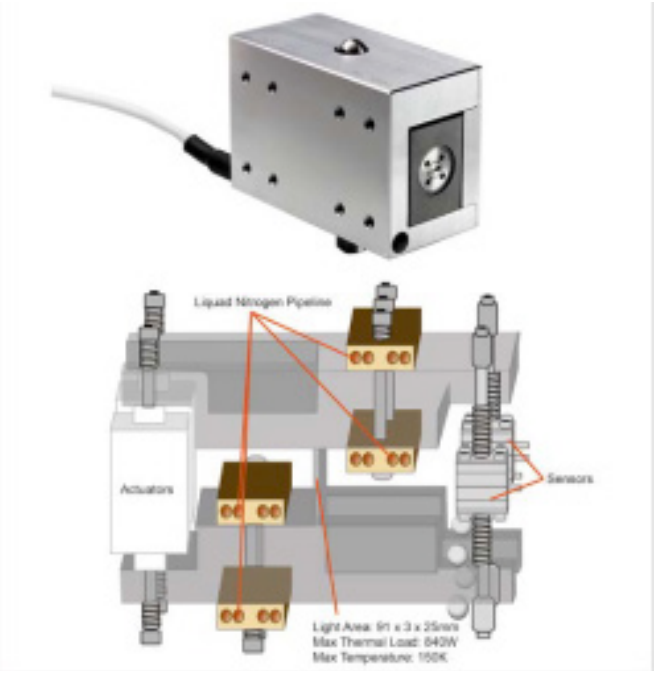
Bending of Silicon Crystal at 80ºK UHVSolution:NPS-Z-500B-UHV

Solution:

NPS-Z-500B-UHV

Range > 80µm at 80ºKNC - Sensors to measure crystal bending.

Many Queensgate stages can be produced as vacuum compatible systems, from our high-speed,high–precision, single-axis systems to our multi-axis XYZ and tip-tilt stages. As part of a vacuum nanopositioning/nanosensing solution, feedthroughs and airside cables are required. Suitable feedthroughs can be provided by Queensgate or sent to be calibrated as part of complete system calibration.



Advanced control techniques developed by Queensgate provide a command resolution of 24 bits.

Single and multichannel variants are available.

Special features include:

- Standalone single, dual or triple - axis digital controller for NanoMechanisms and DPTs.
- 4th order linearization algorithm for high positional accuracy.
- Digital PID control loop for ease of setting up.
- Fast 20µs control loop update.
- Supports NanoMechanism EEPROM calibration data storage for automatic setup.
- Low noise floor offers precise imaging and focussing.
- Easy to interface with OEM software using supplied DLL (Dynamic Link Library).
- Examples of software in C/C++, Python and LabVIEW® provided.
- Front panel LEDs to provide instant operational status.
- Analogue input/output for external analogue control of NanoMechanism position.
- USB and Ethernet interfaces.

‘Works well, we are happy with it’.

‘It is stable, doesn’t vibrate or shake andis happy working in a high radiationenvironment.’

Quotes from Principal Beamline Scientist

- Analogue command and analogue position monitors.
- Function playback, where pre-programmed waveforms can be downloaded into the controller and played back, triggered on command from the USB, Ethernet or TTL inputs. This would be useful for raster scanning or other repeatable scan patterns. Playback may be independent for each channel, or may be synchronised for multi-axis control.
- Programmable TTL trigger output based on the function playback. The trigger points can be programmed at any point(s) within the function playback waveform, allowing other equipment to be triggered accurately at locations in a scan pattern.
- In-position TTL output, per channel, to indicate that the stage/actuator position is within a pre-programmed tolerance from the commanded position. This signal is also available via the USB and Ethernet interfaces.
- Tuneable low-pass and notch filters per channel for improved stability and reduced noise.
- Synchronisation allowing multiple controllers to be used together.

[1] Vibration Measurements of High Heatload Monochromators for DESY PETRA III

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