

QNP-XY Series

Two-Axis, XY, Piezo Nanopositioning Stages

Travel ranges from 100 μm to 600 μm available

Long device lifetime

High-precision, frictionless flexure guidance system

Superior positioning resolution and linearity to 0.007% with direct-metrology capacitive sensor options

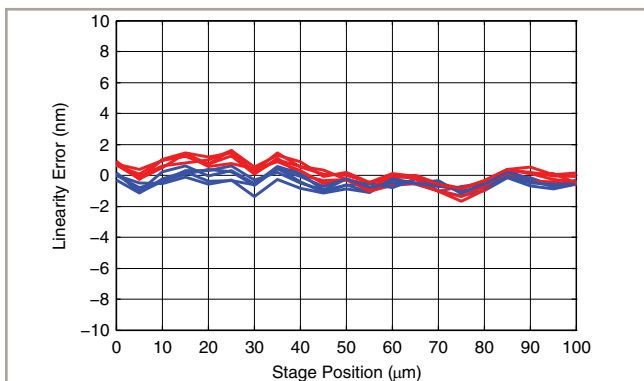
Mounting compatibility with other QNP-series piezo nanopositioners

Open-loop and vacuum versions

Aerotech's QNP™-series of piezo nanopositioning stages offers nanometer-level performance in a compact, high-stiffness package. A variety of travel (100 μm to 600 μm) and feedback options make this the ideal solution for applications ranging from microscopy to optics alignment.

High Quality in a Compact Package

The QNP piezo stages are guided by precision flexures that are optimized using finite element analysis to ensure high-stiffness and long device life. The resulting design offers outstanding stiffness and resonant frequency enabling high process throughput and fast closed-loop response. Furthermore, the integrated XY package minimizes stage stack height and moving mass, resulting in superior static and dynamic multi-axis performance.



QNP-40-100XY upper-axis linearity error plot measured with a laser interferometer over multiple bidirectional runs. The linearity measured is <math><0.002\%</math>. All sizes of the QNP stage series exhibit exceptional linearity and repeatability.



Aerotech's QNP-XY series of two-axis piezo nanopositioners offers closed-loop travel options of 100, 250, and 500 μm .

High-Resolution and Positioning Accuracy

All of the QNP piezo stages have the option of closed-loop feedback using a unique capacitive sensor design that allows for sub-nanometer resolution and high linearity. The capacitive sensors measure the output of the positioning carriage directly, enabling superior accuracy and repeatability.

Ultra-Precision Control

When coupled with Aerotech's Q-series of controllers and drives, the QNP piezo nanopositioning stages demonstrate sub-nanometer positioning resolution and in-position stability (jitter), and high-positioning bandwidth. Software options such as Aerotech's Dynamic Controls Toolbox and Motion Designer packages provide a host of advanced yet easy-to-use tools such as Learning Control, Harmonic Cancellation, and Command Shaping, providing improved tracking errors and faster step-and-settle times.

Automatic parameter and calibration identification is accomplished using Aerotech's FlashConfig feature. The stage is automatically identified and all operational parameters including axis calibration data are uploaded into the controller ensuring safe, accurate and true "plug-and-play" operation.

Design Flexibility

Aerotech's QNP piezo stages are available with capacitance sensor feedback or without feedback (open-loop). Open-loop provides a cost-effective option for applications where compact size, high-dynamics, and sub-nanometer positioning resolution are required, but absolute positioning accuracy and repeatability are not required. Open-loop designs can also be used where the piezo position is controlled via an external feedback source (interferometer, vision system, photodetector, etc.).

An optional mounting plate provides direct mounting to English or metric breadboard optical tables. The QNP-series also includes the -L and -Z stages in which common travels mount together with adapter plates.

All QNP piezo stages are available in vacuum-prepared versions upon request.

QNP-XY SPECIFICATIONS

Mechanical Specifications		QNP-40-100XY	QNP-50-250XY	QNP-60-500XY
Closed-Loop Travel		100 μm	250 μm	500 μm
Open-Loop Travel, -30 to +150 V ⁽¹⁾		120 μm	300 μm	600 μm
Resolution ⁽²⁾	Closed-Loop	0.30 nm	0.50 nm	0.90 nm
	Open-Loop	0.15 nm	0.20 nm	0.40 nm
Linearity ^(3,4)		0.01%	0.01%	0.007%
Bidirectional Repeatability ⁽⁵⁾		2 nm	2 nm	5 nm
Pitch/Yaw		6 μrad (1.2 arc sec)	6 μrad (1.2 arc sec)	12 μrad (2.5 arc sec)
Orthogonality		40 μrad (8 arc sec)	30 μrad (6 arc sec)	30 μrad (6 arc sec)
Stiffness (In Direction of Motion) ⁽⁶⁾		1.05 N/ μm	0.36 N/ μm	0.24 N/ μm
Unloaded Resonant Frequency ⁽⁶⁾	Top Axis	885 Hz	445 Hz	315 Hz
	Bottom Axis	635 Hz	295 Hz	200 Hz
Resonant Frequency (50 gram load) ⁽⁶⁾	Top Axis	495 Hz	305 Hz	240 Hz
	Bottom Axis	335 Hz	240 Hz	170 Hz
Push/Pull Capacity (In Direction of Motion) ⁽⁷⁾		10 N	10 N	10 N
Max Payload ⁽⁸⁾		1 kg	1 kg	1 kg
Stage Mass		0.11 kg	0.17 kg	0.27 kg
Material		Anodized Aluminum ⁽⁹⁾		
MTBF (Mean Time Between Failure)		30,000 Hours		

Notes:

- Value $\pm 10\%$.
- See Piezo Engineering Reference section 4.2 for description of resolution.
- Certified with each stage (closed-loop feedback models only).
- Measured approximately 15 mm above the carriage by an external metrology device. See Piezo Engineering Reference section 4.1 for description of linearity specifications.
- Specified as a 1 sigma (standard deviation) value. See Piezo Engineering Reference section 4.3 for description of bidirectional repeatability.
- Values $\pm 20\%$.
- See Piezo Engineering Reference section 4.6 for description of piezo stage load ratings.
- On-axis loading listed.
- External elements are anodized aluminum. Some stainless steel components are used in the internal construction. Other materials upon request.
- Specifications are measured centered and at a height of approximately 15 mm above the output carriage.

Electrical Specifications	QNP-40-100XY	QNP-50-250XY	QNP-60-500XY
Drive System	Piezo Multi-Layer Stack Actuator		
Feedback	Closed Loop: Integrated Capacitive Sensor (-C) Open Loop: None (-)		
Voltage Range	-30 V to +150 V		
Piezo Stack Capacitance ⁽¹⁾	1.6 μF	2.3 μF	6.4 μF

Note:

- Value $\pm 20\%$

Recommended Controller	
Ensemble	Ensemble QLAB Ensemble QDe Ensemble QLe Ensemble QL
A3200	Ndrive QLe Ndrive QL

Notes:

- Unless noted, the QLAB, QDe, or QLe drives are required to achieve the listed specifications. Contact Aerotech for specifications when used with the QL drives.

QNP-XY Series ORDERING INFORMATION

QNP-XY Series Two-Axis Piezo Nanopositioning Stage

QNP-40-100XY	QNP-XY series open-loop nanopositioner, 40 mm wide, 120 μm x 120 μm open-loop travel
QNP-40-100XY-C	QNP-XY series closed-loop nanopositioner with capacitive sensor feedback, 40 mm wide, 100 μm x 100 μm closed-loop travel (120 μm x 120 μm open-loop travel)
QNP-50-250XY	QNP-XY series open-loop nanopositioner, 50 mm wide, 300 μm x 300 μm open-loop travel
QNP-50-250XY-C	QNP-XY series closed-loop nanopositioner with capacitive sensor feedback, 50 mm wide, 250 μm x 250 μm closed-loop travel (300 μm x 300 μm open-loop travel)
QNP-60-500XY	QNP-XY series open-loop nanopositioner, 60mm wide, 600 μm x 600 μm open-loop travel
QNP-60-500XY-C	QNP-XY series closed-loop nanopositioner with capacitive sensor feedback, 60 mm wide, 500 μm x 500 μm closed-loop travel (600 μm x 600 μm open-loop travel)

Mounting Plate (Optional)

-MP	Mounting plate for English and metric optical breadboard tables
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