QNP-Z Series

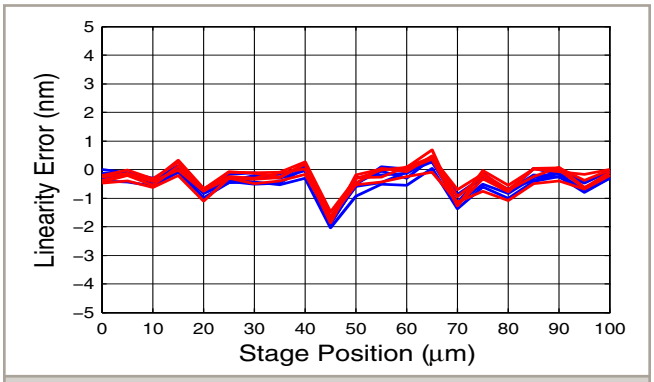
Single-Axis, Z Piezo Nanopositioning Stages

- 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, these stages have been designed to provide excellent geometric performance (straightness and angular errors) while at the same time minimizing the overall stage package size.



QNP-40-100Z linearity error plot measured with a laser interferometer over multiple bidirectional runs. The measured linearity is less than 0.002% and measured repeatability is less than 1 nm pk-pk.

Aerotech's QNP-Z series of piezo nanopositioners offer 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 -XY stages in which common travels mount together with adapter plates.

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

QNP-Z SPECIFICATIONS

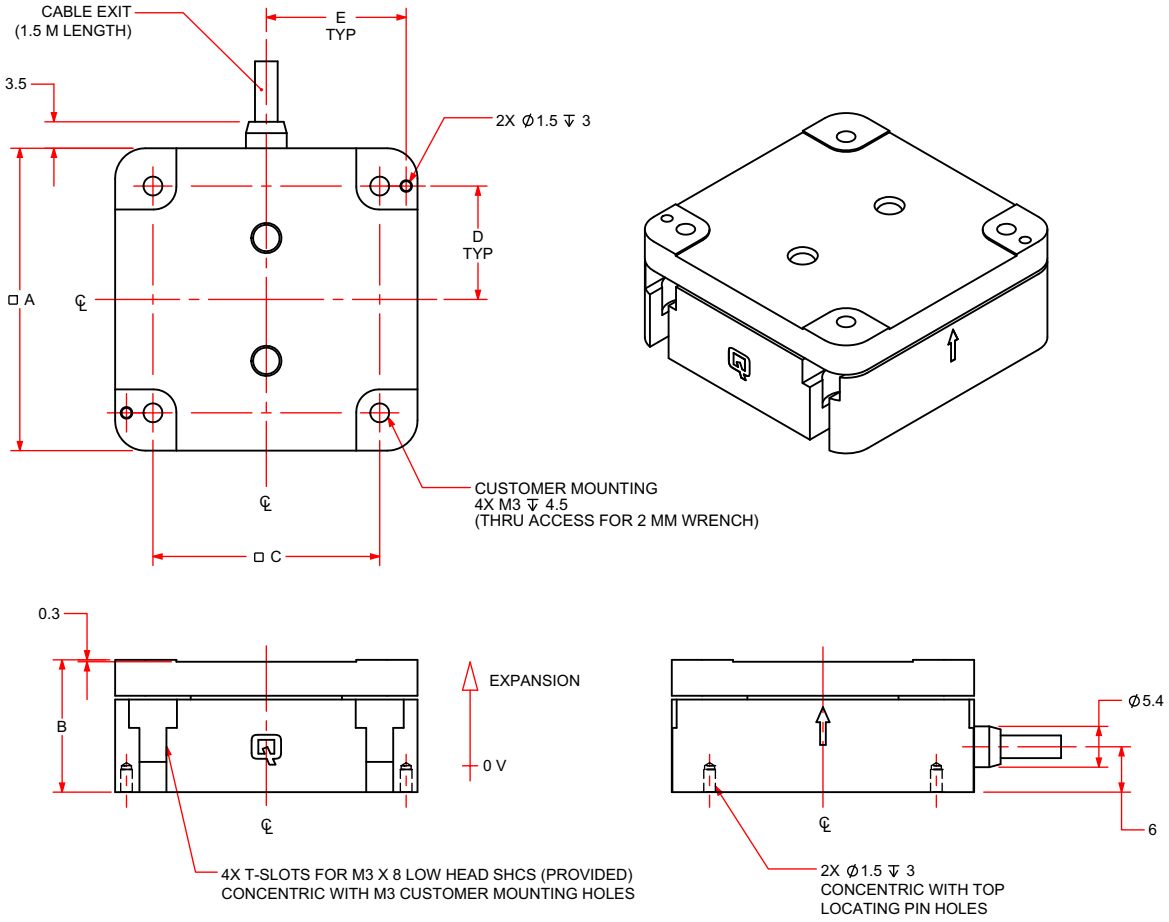
Mechanical Specifications[1]		QNP-40-100Z	QNP-50-250Z	QNP-60-500Z
Closed-Loop Travel		100 µm	250 µm	500 µm
Open-Loop Travel, -30 to +150 V[2]		140 µm	300 µm	550 µm
Resolution[3]	**Closed-Loop**	0.30 nm	0.50 nm	0.90 nm
	Open-Loop	0.15 nm	0.20 nm	0.40 nm
Linearity[4,5]		0.01%	0.01%	0.007%
Bidirectional Repeatability[6]		1 nm	1 nm	3 nm
Pitch/Roll/Yaw		15 µrad (3 arc sec)	25 µrad (5 arc sec)	39 µrad (8 arc sec)
Stiffness (in direction of motion)[7]		0.96 N/µm	0.40 N/µm	0.42 N/µm
Unloaded Resonant Frequency[7]		1050 Hz	510 Hz	310 Hz
Resonant Frequency (50 gram load)[7]		620 Hz	340 Hz	260 Hz
Push/Pull Capacity (in direction of motion)[8]		10/8 N	10/8 N	10/10 N
Max Payload[9]		1 kg	1 kg	1 kg
Stage Mass		0.08 kg	0.13 kg	0.31 kg
Material		Anodized aluminum[10]		
MTBF (Mean Time Between Failure)		30,000 Hours		

Notes:
1. All specifications, unless noted, are measured centered over the output carriage.
2. Value ±10%.
3. See Piezo Engineering reference section 4.2 for description of resolution.
4. Certified with each stage (closed-loop feedback models only).
5. See Piezo Engineering reference section 4.1 for description of linearity and accuracy specifications.
6. Specified as a 1 sigma (standard deviation) value. See Piezo Engineering reference section 4.3 for description of bidirectional repeatability.
7. Values ±20%
8. See Piezo Engineering reference section 4.6 for description of piezo stage load ratings
9. On-axis loading listed
10. External elements are anodized aluminum. Some stainless steel components are used in the internal construction. Other materials upon request.

Electrical Specifications	QNP-40-100Z	QNP-50-250Z	QNP-60-500Z
Drive System	Piezo Multi-Layer Stack Actuator		
Feedback	Closed Loop: Capacitive Sensor (-C) Open Loop: None (-)		
Maximum Voltage	-30 V to +150 V		
Piezo Stack Capacitance[1]	1.6 µF	2.3 µF	13.2 µF

Note:
1. Value ±20%

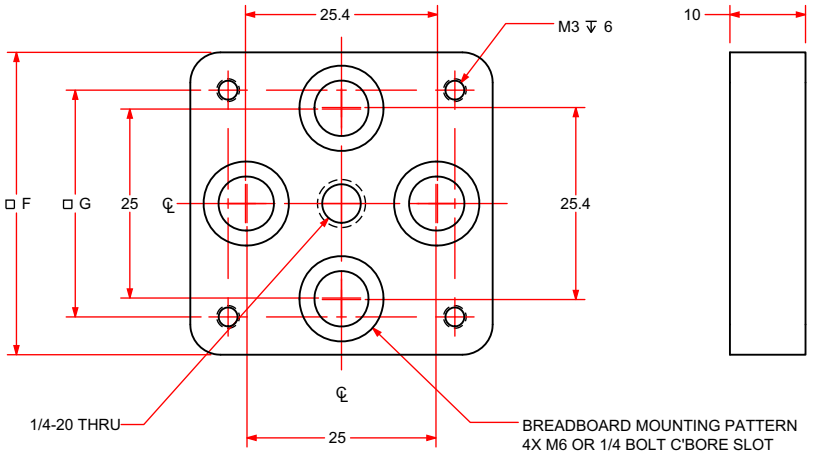
QNP-Z Series DIMENSIONS



(STAGE SHOWN AT 0 V POSITION)

STAGE	A	B	C	D	E
QNP-40-100Z	40	17.5	30	15	18.5
QNP-50-250Z	50	17.5	40	20	23.5
QNP-60-500Z	60	25	50	25	28.5

-MP (MOUNTING PLATE, BREADBOARD)



STAGE	F	G
QNP-40-100Z	40	30
QNP-50-250Z	50	40
QNP-60-500Z	60	50

DIMENSIONS: MILLIMETERS

QNP-Z Series ORDERING INFORMATION

QNP-Z Series Two-Axis Piezo Nanopositioning Stage

QNP-40-100Z	QNP-Z series open-loop nanopositioner, 40 mm wide, 120 µm x 120 µm open-loop travel
QNP-40-100Z-C	QNP-Z 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-50-250Z	QNP-Z series open-loop nanopositioner, 50 mm wide and 300 µm x 300 µm open-loop travel
QNP-50-250Z-C	QNP-Z 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-60-500Z	QNP-Z series open-loop nanopositioner, 60mm wide, 600 µm x 600 µm open-loop travel
QNP-60-500Z-C	QNP-Z 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