QNP-L Series

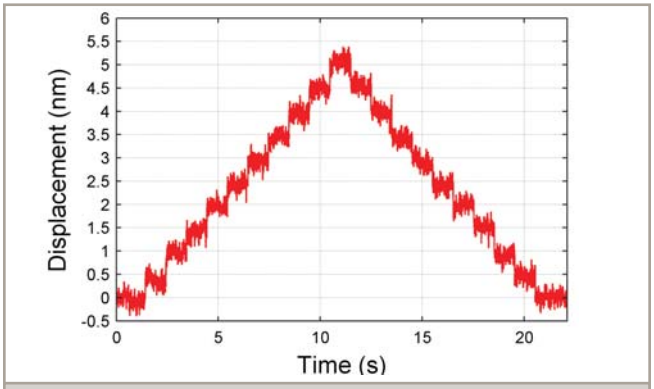
Single-Axis Linear Piezo Nanopositioning Stages

- 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 offer sub-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-40-100L 0.5 nm bidirectional step plot measured with an external ultra-precision capacitance sensor. All sizes of the QNP-L stage series offer exceptional sub-nm mechanical step capability.

Aerotech's QNP-L series of single-axis 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 XY 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-L SPECIFICATIONS

Mechanical Specifications		QNP-40-100L	QNP-50-250L	QNP-60-500L
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 (Integrated Feedback)**	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]		1 nm	1 nm	3 nm
Pitch/Yaw		6 µrad (1.2 arc sec)	6 µrad (1.2 arc sec)	12 µrad (2.5 arc sec)
Stiffness (In Direction of Motion)[6]		1.25 N/µm	0.40 N/µm	0.27 N/µm
Unloaded Resonant Frequency[6]		1300 Hz	475 Hz	350 Hz
Resonant Frequency (50 Gram Load)[6]		650 Hz	325 Hz	260 Hz
Push/Pull Capacity (In Direction of Motion)[7]		10 N		
Max Payload[8]		1 kg		
Stage Mass		0.06 kg	0.09 kg	0.14 kg
Material		Anodized Aluminum[9]		
MTBF (Mean Time Between Failure)		30,000 Hours		

Notes:
1. Value ±10%.
2. See Piezo Engineering Reference section 4.2 for description of resolution.
3. Certified with each stage (closed-loop feedback models only).
4. See Piezo Engineering Reference section 4.1 for description of linearity specifications.
5. Specified as a 1 sigma (standard deviation) value. See Piezo Engineering Reference section 4.3 for description of bidirectional repeatability.
6. Values ±20%.
7. See Piezo Engineering Reference section 4.6 for description of piezo stage load ratings.
8. On-axis loading listed.
9. External elements are anodized aluminum. Some internal components are stainless steel. Other materials upon request.
10. Specifications are measured centered and at a height of approximately 15 mm above the output carriage.

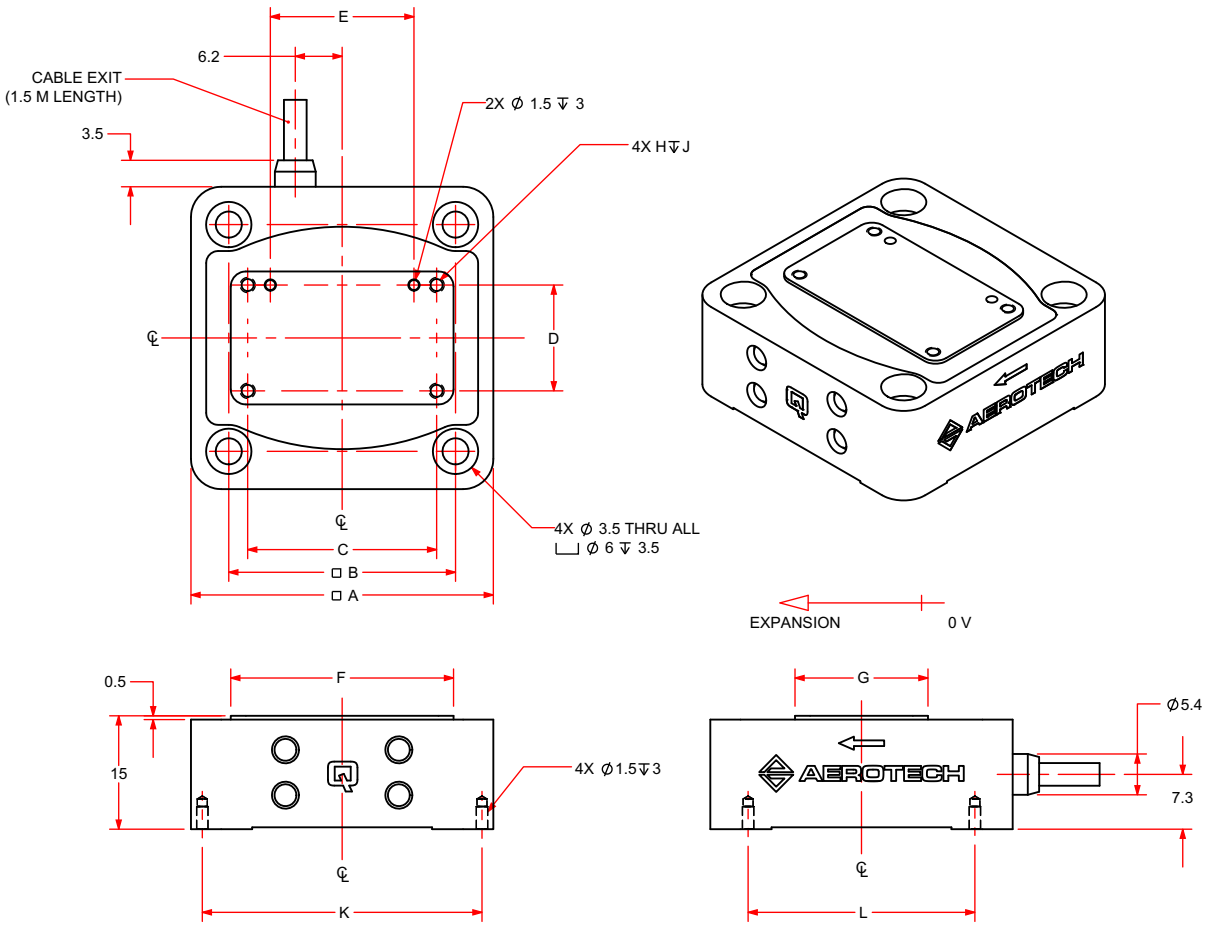
Electrical Specifications	QNP-40-100L	QNP-50-250L	QNP-60-500L
Drive System	Piezo Multi-Layer Stack Actuator		
Feedback	Closed Loop: Integrated Capacitive Sensor (-C) Open Loop: None (-)		
Voltage Range	-30 V to +150 V		
Piezo Stack Capacitance[1]	1.6 µF	2.3 µF	6.4 µF

Notes:
1. Value ±20%.

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

Notes:
1. 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.

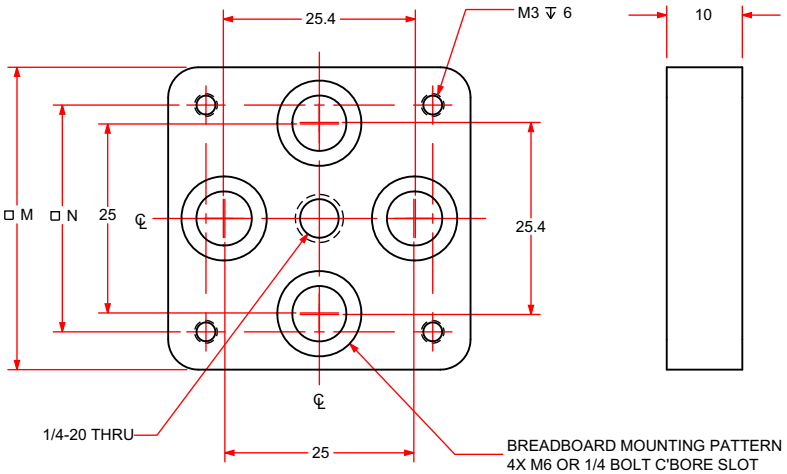
QNP-L Series DIMENSIONS



(STAGE SHOWN AT MID-TRAVEL)

STAGE	A	B	C	D	E	F	G	H	J	K	L
QNP-40-100L	40	30	25	14	19	29.5	17.6	M2	4	37	30
QNP-50-250L	50	40	30	18	23	41.8	24.3	M2.5	5	47	40
QNP-60-500L	60	50	40	30	33	51	35	M2.5	5	57	50

-MP (MOUNTING PLATE, BREADBOARD)

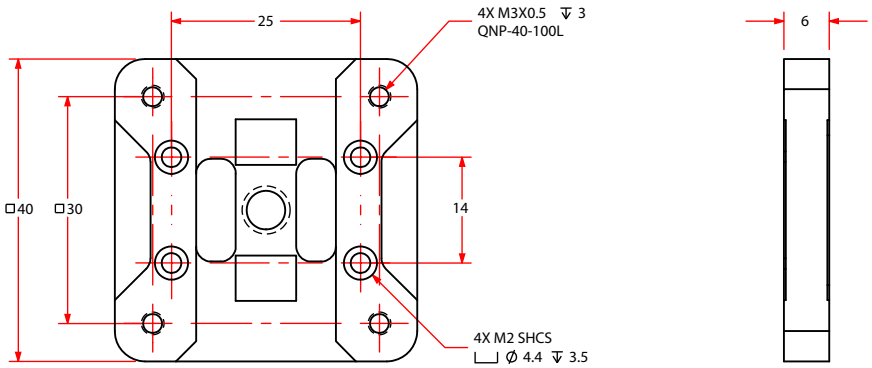


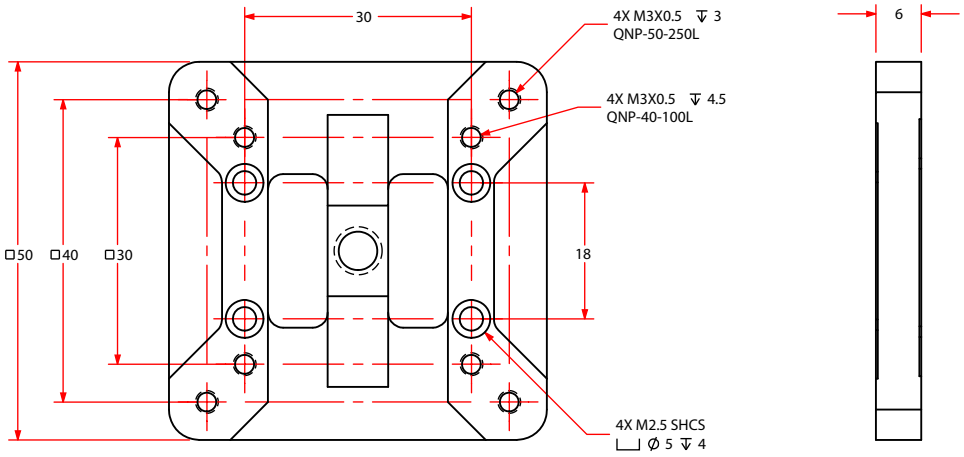
STAGE	M	N
QNP-40-100L	40	30
QNP-50-250L	50	40
QNP-60-500L	60	50

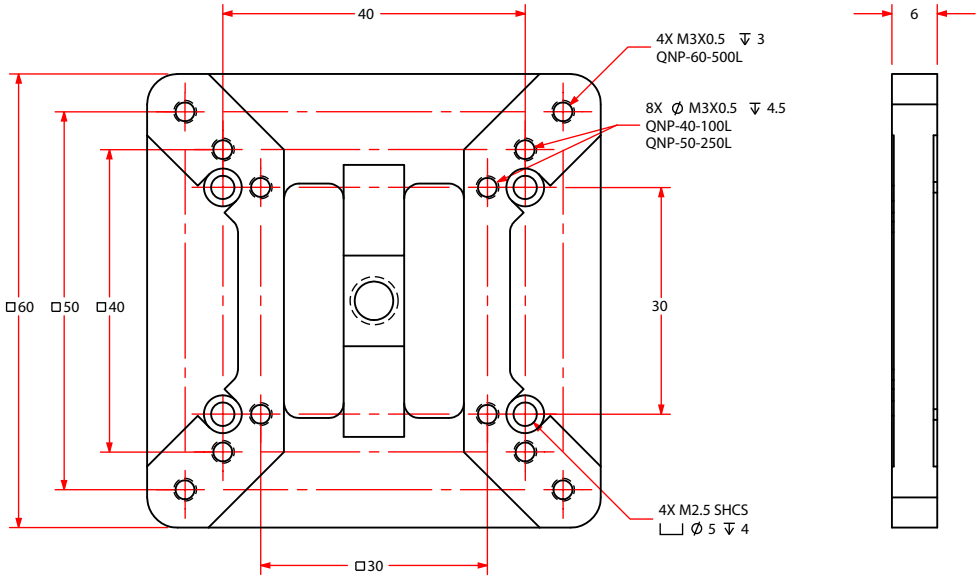
DIMENSIONS: MILLIMETERS

QNP-L Series Adapter Plate DIMENSIONS

-AP (ADAPTER PLATE)







DIMENSIONS: MILLIMETERS

QNP-L Series ORDERING INFORMATION

QNP-L Series Single-Axis Piezo Nanopositioning Stage

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

Options

-MP	Mounting plate for English and metric optical breadboard tables
-AP	Adapter plate kit for customer mounting of multi-axis QNP stages; AP-QNP-40-100 mounts 100L upper-axis to 100L lower-axis; AP-QNP-50-250 mounts 100L/250L upper-axis to 250L lower-axis; AP-QNP-60-500 mounts 100L/250L/500L upper-axis to 500L lower-axis

Two QNP-40-100L stages in an XY arrangement using the AP-QNP-40-100 adapter plate.

A QNP-50-250L and QNP-40-100L in an XY arrangement using the AP-QNP-50-250 adapter plate.