

## NPS-XY-100A & NPS-XY-100A-UHV 100µm x 100µm Super Invar Stage Nanopositioning Stage



The NPS-XY-100A and the NPS-XY-100A-UHV NanoMechanisms are piezo scanned flexure guided stage with integrated capacitance position sensors capable of sub- nanometer resolution and reproducibility. The NPS-XY-100A-UHV has been designed to operate down to 10<sup>-9</sup> Torr.

Finite element analysis of the flexure guidance mechanisms has reduced parasitic angular motions to less than 25 micro-radians over the full 100µm range.

The Super Invar construction (CTE 0.3ppm K<sup>-1</sup>, compared to Aluminium at 23ppm K<sup>-1</sup>) minimizes thermal drift, which on a nanometer scale can be very important.

The unique iso-static mounting system ensures that stresses from the mounting system are properly relieved and establishes the center of the stage as the co-ordinate reference point.

### Key features

- >100µm travel in each axis with sub-nanometer resolution
- Typically <0.005% hysteresis and <0.01% linearity error
- First resonant frequency >350Hz
- In-situ scanning and stepping response optimization
- Robust and reliable
- Super Invar construction

### Typical applications

- AFM, SPM, NSOM
- High Precision Microscopy

### Suggested controllers

NanoScan NPC-D-6330 Series Controllers  
Delivering Low noise, Low drift, High power, High Resolution and High position update rates.

Designed specifically to control Queensgate's Nanometer Precision Mechanisms incorporating capacitive sensors. They give precise positional feedback delivering high resolution and linearity of movement. The fast update rate and Queensgate control algorithms contribute to high speed

positioning accuracy for dynamic applications that require high speed movement of the stage.

The PC software facilitates user optimisation of all operating parameters, including PID and notch filter set up. There are eight programmable slots, three which are populated to provide fast, medium and slow PID settings, the addition five slots are available for application specific settings.

Function playback provides user defined pre-programmed waveforms for applications such as raster scanning or constant velocity scanning. The calibration and dynamic settings are held in the stage eeprom which allows controllers to be interchanged with minimal performance changes.

## NPS-XY-100A & NPS-XY-100A-UHV Nanopositioning Stage

### Technical specification NPS-XY-100A

Parameter	Symbol	Value			Units	Comments
<b>Static physical</b>						
Material		Super Invar (Bright nickel plated)				
Size		100 x 100 x 23			mm	Note 1
		Minimum	Typical	Maximum		
*Range closed loop	$\delta x \cdot \max$	$\pm 50$	$\pm 55$		$\mu\text{m}$	
*Scale factor error ( $1\sigma$ )	$\delta b \cdot x1$			0.1	%	
Static stiffness			1		$\text{N} \cdot \mu\text{m}^{-1}$	
Resonant frequency:	0g load F0-0		350		Hz	
	50g load F0-50		260		Hz	
	1000g load F0-100		120		Hz	
	Maximum load			1	Kg	Note 2
<b>Dynamic physical (Typical values)</b>						
		Fast	Medium	Slow		Note 3
*3dB Bandwidth	$B \cdot x \cdot p$	53	20	4		Typical
*Small signal settle time	$t \cdot x \cdot s \cdot s$	15	30	130	ms	Note 4
*Position noise ( $1\sigma$ )	$\delta x \cdot p \cdot n$	0.5	0.4	0.25	nmRms	Note 5
<b>Error terms</b>						
		Minimum	Typical	Maximum		
*Hysteresis (peak to peak)	$\delta x \cdot p \cdot \text{hyst}$		0.005	0.015	%	Note 6
*Linearity error (peak)	$\delta x \cdot p \cdot \text{lin}$		0.005	0.01	%	Note 6
*Rotational error	$\delta \phi \cdot x$		10	25	$\mu\text{radians}$	Note 7
*Rotational error	$\delta \theta \cdot x$		5	10	$\mu\text{radians}$	Note 7
*Rotational error	$\delta \gamma \cdot x$		5	10	$\mu\text{radians}$	Note 7
Orthogonality	$\delta \theta \cdot \text{orth}$		8	10	mradians	

#### Notes

\*These parameters are measured and supplied with each mechanism

1. With 40mm diameter central aperture.
2. Depends on orientation. 1 kg is the maximum load for gravity acting in the Z direction. 0.5 kg is the maximum load for gravity acting in the X or Y axes. Loads greater than 5 kg can cause damage to the flexure mechanism.
3. For dynamic operation the servo-loop parameters are preset for different performances; the parameters are user settable via software control. Fast means the fastest the stage can stably move with less than 50 grams load. Medium means the maximum stable speed for loads up to 200 grams. Slow means the speed at which the servo loop is stable for all masses up to the maximum allowed mass – equivalent to low noise setting.
4. Step and Settle time is the time taken to settle to within 2% of the step measured using an interferometer. The step settle time is a function of the servo loop parameters which are user controllable. The test step size is 2000 nm.
5. The actual position noise of the stage. Measured with a laser interferometer sampling 1 Hz to 25 kHz.
6. Percent of the displacement.
7. Percent error over the full range of motion

General Note: Specifications assume standard 2m cable length, for custom cable lengths and UHV position noise, linearity and hysteresis may vary.

