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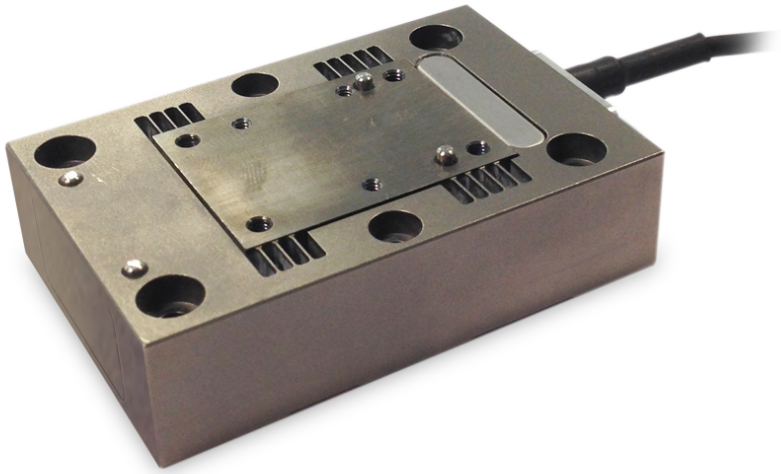
QG: 36

Nano mechanisms

NPS-X-30B



Applications

- MR head and disk drive testing
- Interferometry
- Metrology
- AFM Z axis

Suggested controllers

NPC-D-5200 or NPC-D-6330 series controllers are designed specifically to control Queensgate's Nanometer Precision Mechanisms. They use modern DSP techniques and combine piezo drive amplifiers, capacitance position sensing circuitry and servo control capability.

Use of PID (proportional integral differential) feedback terms greatly improves settle times and minimizes the effect of mechanical resonances. The virtual front panel software facilitates user control of all operating parameters, including PID loop set up.

NPS-X-30B

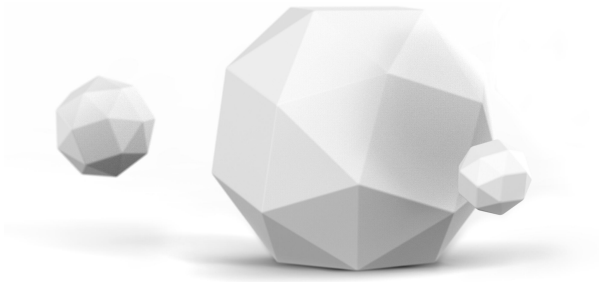
The NPS-X-30B was originally developed for high speed, ultra precision MR head and disk drive testing.

It's small size and millisecond response time is ideal for applications where high reliability and throughput are essential. A low moving mass and high stiffness combine to offer extremely high bandwidth.

The capacitive sensor design provides the sub-nanometer displacement measurement and closed-loop feedback over a range in excess of 30 microns. Flexure guidance offers high purity of motion, with parasitic motion. Combined with Queensgate's digital closed-loop controllers, the NPS-X-30B can achieve millisecond response and settle times.

Key features

- **>30μm travel with sub-nanometer resolution**
- **First resonant frequency >4.5KHz**
- **Bandwidths up to 1KHz**
- **In-situ scanning and stepping response optimization**
- **Robust and reliable for production test**
- **Plug and play facilities for low down-time**



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Queensgate Instruments
info@queensgate.com
www.nanopositioning.com

Nano mechanisms: NPS-X-30B

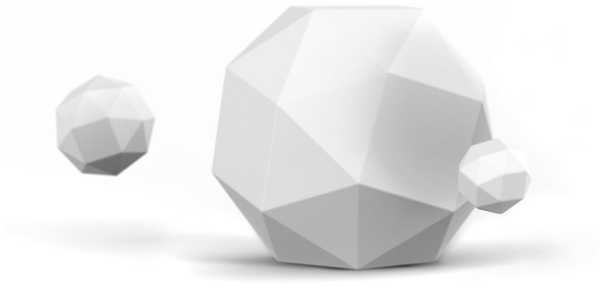
Specification

Parameter	Symbol	Value			Units	Comments
Static Physical						
		Minimum	Typical	Maximum		
Material		Titanium				
Size		60 long x 40 wide x 15.5 high			mm	
*Range	d_{xp}·max	± 15			µm	
Scale factor	*bx1*		1		µm	Note 1
Scale factor error (1σ)	δ*bx*1		0.1		%	
Resonant frequency:	$f_{0\cdot0}$	4.5	5		KHz	
Maximum load				10	Kg	Note 2
Dynamic Physical (typical values)						
		Fast	Medium	Slow		Note 3
3dB Bandwidth	$B_{x\cdot p}$	600	400	50	Hz	
*Small signal settle times	$t_{xs\cdot s}$	1			ms	Note 4
*Position noise (1σ)	$\delta x_{p\cdot n}$	0.12	0.09	0.04	nm_{rms}	Note 5
Error terms						
		Minimum	Typical	Maximum		
*Hysteresis (peak to peak)	$\delta_{xp\text{-}hyst}$		0.005	0.01	%	Note 7
*Linearity error (peak)	$\delta_{xp\text{-}lin}$		0.01	0.02	%	Note 8
*Rotational error	$\delta\varphi_x$		1	5	µradians	Note 9
* Rotational error	$\delta\theta_x$		1	5	µradians	Note 9
* Rotational error	$\delta\gamma_x$		1	5	µradians	Note 9

Notes

*These parameters are measured and supplied with each mechanism.

1. All position commands are given in micrometers with seven digit resolution.
2. This is the maximum load for gravity acting in the Z-direction to avoid damage to the stage 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 loads up to 500 grams – equivalent to low noise setting.
4. This is the 2% settle time. It is a function of the servo loop parameters which are user controllable. The test step size is 500 nm.
5. The actual position noise of the stage.
6. The highest rate of change of true position with time that can be achieved. It is limited by the closed loop parameters; the absolute maximum value (in open loop operation) is ~3.5 μm•ms-1.
7. Percent of the displacement. The hysteresis specification for a displacement of less than 1μm amplitude is 0.1 nm.
8. Percent error over the full range of motion.
9. Angular motion over the full range of the stage. These rotational errors are rotational errors around the Z, Y and X axes respectively.



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