

Nano mechanisms

NPS-Z-15L

The NPS-Z-15L is a piezo-scanned stage optimized for high load applications.

The NPS-Z-15L offers over $15\mu\text{m}$ of closed loop travel, with sub-nanometre resolution and stability. This stage has been specifically designed for high stiffness, which allows demanding loads up to 15Kg to be carried.

Optimised mechanical design has yielded a device with an unloaded resonant frequency of greater than 8000Hz. Super Invar construction means the stage has very high thermal and environmental stability. Dynamic optimisation via closed loop PID electronics maximise *in-situ* stepping response and position stability of the system. Electronic configurations can offer independent control of up to 3 or up to 6 stages, ideal for alignment/levelling of large optic or wafer/mask devices.



NPS-Z-15L

Key features

- > 15 micrometer travel with sub-nanometer resolution
- Typically < 0.02% hysteresis and < 0.01% linearity error
- First resonant frequency >8KHz
- 15Kg maximum load
- Robust and reliable
- Super Invar construction

Applications

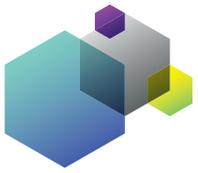
- Semiconductor wafer/mask positioning systems
- Large optical position systems

Suggested controller

NPC-A-1110DS or NPC-D-5110DS series closed loop controller. The NPC-D-511DS controller is 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. Advanced control techniques developed by Queensgate allow-24 bit resolution, providing 0.006nm steps in a $100\mu\text{m}$ range. The virtual front panel software facilitates user control of all operating parameters, including PID loop set up.





Nano mechanisms NPS-Z-15L

Specification

| Parameter | Symbol | Value | | | Units | Comments |
|--|--------------------|------------------------------------|---------|---------|--------------------------|----------|
| Static physical | | | | | | |
| | | Minimum | Typical | Maximum | | |
| Material | | Super Invar (Bright nickel plated) | | | | |
| Size | | 53.5 height x 60 diameter | | | mm | |
| Cable length | | | 2000 | | mm | |
| *Range | $d_{zp,max}$ | | ± 8 | | μm | |
| Scale factor | B_{z1} | | 1 | | μm | Note 1 |
| *Scale factor error (1σ) | δb_{z1} | | 0.05 | 0.1 | % | Note 2 |
| Resonant frequency: 0g load | $f_{0.0}$ | | 8000 | | Hz | |
| Maximum load | | | | 15 | Kg | |
| Dynamic physical (Typical values) | | | | | | |
| | | Fast | Medium | Slow | | |
| *Position noise (1σ) | δz_{p-n} | | 0.3 | 0.2 | nm_{rms} | Note 3 |
| Slew rate | u_{zp-max} | | 0.1 | | $\mu\text{m}/\text{ms}$ | Note 4 |
| Error terms | | | | | | |
| | | Minimum | Typical | Maximum | | |
| *Hysteresis (peak to peak) | $\delta_{zp-hyst}$ | | 0.02 | 0.03 | % | Note 5 |
| *Linearity error (peak) | δ_{zp-lin} | | 0.01 | 0.02 | % | Note 6 |

Notes

*These parameters are measured and supplied with each mechanism

- All position commands are given in micrometers with seven digit resolution.
- This is the difference between the measured scale factor and the desired scale factor of $1\mu\text{m}$ motion per $1\mu\text{m}$ command). For example a scale factor error of 0.003% means the actuator will move $1.00003\mu\text{m}$ when a command of $1\mu\text{m}$ is sent to the NPS3330 digital controller.

3. The actual position noise of the stage.

4. The highest rate of change of true position with time that can be achieved. It is limited by the closed loop parameters.

5. Percent of the displacement. The hysteresis specification for a displacement of less than $1\mu\text{m}$ amplitude is 0.1 nm.

6. Percent error over the full range of motion.

