

# QGNPS-XYZ-100D-20H

## 3-axis piezo driven, flexure guided stage

The NPS-XYZ-100D-20H NanoMechanism provides 100  $\mu\text{m}$  travel in the X and Y axis, plus 20  $\mu\text{m}$  in Z.

Its flexure guiding stage guarantees pitch and yaw of < 25 micro-radians over the full 100  $\mu\text{m}$  in XY.

Integrated capacitance positioning sensors deliver sub-nanometer resolution.

The NPS-XYZ-100D-20H is made from aluminum.

When the stage is combined with the QGNPC-D-6330 multichannel digital controller, it provides market-leading dynamic performance.



### Key Features

- 100  $\mu\text{m}$  travel in XY and 20  $\mu\text{m}$  in Z axis with sub-nanometer resolution.
- Capacitive positioning sensor providing unrivalled precision and accuracy. 0.25 nm resolution in XY, 0.085 nm resolution in Z and 0.5 nm repeatability in XY and Z.
- In-situ scanning and step response optimization.
- Plug and Play: Stage connector containing the stage calibration data and reference sensor allowing easy controller interchangeability.
- Four corner mounting for best dynamic stability.
- Robust and reliable.

### Typical Applications

- AFM, SPM, NSOM
- High Precision Microscopy

## Suggested Controller

### NPC-D-6330 Multi-channel Closed Loop Controller

Designed specifically to control Queensgate's Nanopositioning stages, the fast update rate and Queensgate advanced control algorithms contribute to high speed positioning accuracy for dynamic applications that require high speed movement of the stage.

Velocity control provides high speed scanning suitable for the speed and resolution needed for high speed AFM.

The PC software allows optimisation of operating parameters, such as PID and notch filter set up.

There are eight programmable slots, three which are populated in the factory to provide fast, medium and slow PID settings, the addition five slots are available for application specific settings.

The calibration and dynamic settings are held in the stage Eprom which allows controllers to be interchanged with minimal performance changes.

## Specifications

| Axis | Parameter                           | Value                    |                |                | Units              | Comments        |
|------|-------------------------------------|--------------------------|----------------|----------------|--------------------|-----------------|
|      |                                     | Minimum                  | Typical        | Maximum        |                    |                 |
|      | <b>Static physical</b>              |                          |                |                |                    |                 |
|      | Material                            | Aluminum (nickel plated) |                |                |                    |                 |
|      | Size                                | 100 x 100 x 30           |                |                | mm                 |                 |
|      | Aperture                            | Ø15                      |                |                | mm                 |                 |
|      | Weight                              | 0.55                     |                |                | kg                 | Excluding cable |
|      | Maximum load                        | 0.5                      |                |                | kg                 | Note 1          |
|      | Cable length                        | 2                        |                |                | m                  | 3x cables       |
|      |                                     |                          |                |                |                    |                 |
| XY   | *Closed-loop range                  | ± 50                     |                |                | µm                 |                 |
|      | Static stiffness                    |                          | 1              |                | N·µm <sup>-1</sup> |                 |
|      | Resonant frequency: 0 g load        |                          | 450            |                | Hz                 |                 |
|      | 70 g load                           |                          | 290            |                | Hz                 |                 |
|      | <b>Loop settings</b>                | <b>Fast</b>              | <b>Medium</b>  | <b>Slow</b>    |                    | Note 2          |
|      | 3dB servo bandwidth                 | 100                      | -              | -              | Hz                 |                 |
|      | 2 % 2 µm step settle time           | 7                        | 12             | -              | ms                 | Note 3          |
|      | 2 % 40 µm step settle time          | 7                        | 12             |                | ms                 |                 |
|      | *Position noise (1σ)                | 0.25                     | 0.25           | -              | ms                 | Note 4          |
|      | Repeatability ± 25 µm (1σ)          |                          | 0.5            |                | nm                 | Note 4          |
|      | <b>Error terms</b>                  | <b>Minimum</b>           | <b>Typical</b> | <b>Maximum</b> |                    |                 |
|      | *Linearity error (peak)             |                          | 0.005          | 0.02           | %                  | Note 5          |
|      | *Rotational error (R <sub>z</sub> ) |                          | ± 12           | ± 16           | µrad               | Note 6          |
|      | *Rotational error(R <sub>y</sub> )  |                          | ± 1.5          | ± 6            | µrad               | Note 6          |
|      | *Rotational error (R <sub>x</sub> ) |                          | ± 1.5          | ± 6            | µrad               | Note 6          |

## Specifications

| Axis | Parameter                           | Value          |                |                | Units              | Comments |
|------|-------------------------------------|----------------|----------------|----------------|--------------------|----------|
|      |                                     | Minimum        | Typical        | Maximum        |                    |          |
| Z    | *Closed range                       | ±10            | -              | -              | µm                 |          |
|      | Static Stiffness                    |                | -              |                | N·µm <sup>-1</sup> |          |
|      | Resonant frequency: 0 g load        |                | 1500           |                | Hz                 |          |
|      | 70 g load                           |                | 1100           |                | Hz                 |          |
|      | <b>Loop settings</b>                | <b>Minimum</b> | <b>Typical</b> | <b>Maximum</b> |                    | Note 2   |
|      | 3dB bandwidth                       | 140            | -              | -              | Hz                 |          |
|      | *2 % 2 µm step settle time          | 4              | 9              | -              | ms                 | Note 3   |
|      | *Position noise (1 s)               | 0.095          | 0.085          | -              | nm                 | Note 4   |
|      | Repeatability ± 5 µm (1σ)           |                | 0.5            |                | nm                 | Note 4   |
|      | <b>Error terms</b>                  | <b>Minimum</b> | <b>Typical</b> | <b>Maximum</b> |                    |          |
|      | *Linearity error (peak)             |                | 0.015          |                | %                  | Note 5   |
|      | *Rotational error (R <sub>Z</sub> ) |                | ± 0.75         | ± 2            | µrad               | Note 6   |
|      | *Rotational error (R <sub>Y</sub> ) |                | ± 3            | ± 6            | µrad               | Note 6   |
|      | *Rotational error (R <sub>X</sub> ) |                | ± 1.5          | ± 3            | µrad               | Note 6   |

Specifications subject to change without notice.

### Notes

\*These parameters are measured and supplied with each mechanism.

1. Depends on orientation. 0.5 kg is the maximum load for gravity acting in the Z direction.
2. 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 70 grams load. Medium means the maximum 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 - equivalently low noise setting.
3. Settle time criteria applied to position at stage platform as measured from laser interferometer.
4. The actual position noise of the stage as measured from laser interferometer.
5. Percent error over the full range of motion.
6. Angular motion over the full range of the stage. These rotational errors are rotational errors around the Z, Y and X axes respectively.

## Ordering Information

| Part Number           | Description                                       |
|-----------------------|---------------------------------------------------|
| QGNPS-XYZ-100D-20H-D3 | NPS-XYZ-100D-20H Calibrated with 6330 Controller. |

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