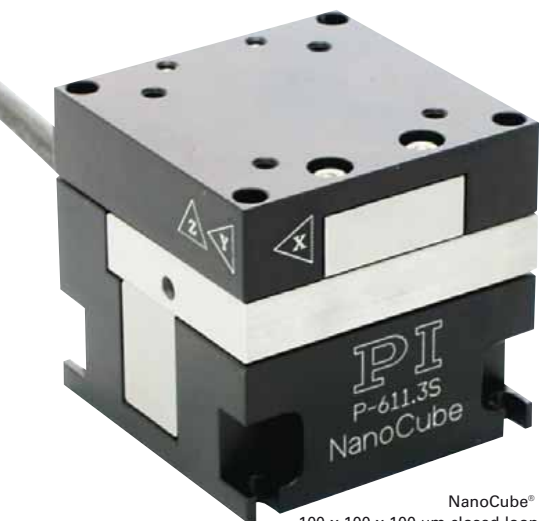


NanoCube® XYZ Stage with Piezo Flexure Drive

Compact Multi-Axis Piezo System for Nanopositioning and Fiber Alignment



NanoCube® XYZ-nanopositioning system, 100 x 100 x 100 µm closed-loop travel range, resolution 1 nm

- Up to 120 x 120 x 120 µm Travel Range
- Very Compact: 44 x 44 x 44 mm
- Resolution to 0.2 nm, Rapid Response
- Frictionless, High-Precision Flexure Guiding System
- Outstanding Lifetime Due to PICMA® Piezo Actuators
- Fast Multi-Axis Scanning
- Version with Integrated Fiber Adapter Interface
- Cost-Effective Mechanics/Electronics System Configurations

The P-611 NanoCube® piezo stage is a versatile, multi-axis piezo-nanopositioning system. Its 100 x 100 x 100 µm positioning and scanning range comes in an extremely compact package of only 44 x 44 x 44 mm. Equipped with a stiff, zero-stiction, zero-friction guiding system, this NanoCube® provides motion with ultra-high resolution and settling times of only a few milliseconds. The minimal moved masses and the stiff

piezo drive make it ideal for high-throughput applications such as fiber alignment where it enables significantly faster device characterization than achievable with conventional motorized drives.

Closed-Loop and Open-Loop Versions

High-resolution, fast-responding, strain gauge sensors (SGS) are applied to appropriate locations on the drive train and provide a high-bandwidth, nanometer-precision position feedback signal to the controller. The sensors are connected in a full-bridge configuration to eliminate thermal drift, and assure optimal position stability in the nanometer range.

The open-loop models are ideal for applications where fast response and very high resolution are essential, but absolute

positioning is not important, e.g. in tracking or fiber positioning. They can also be used when the position is controlled by an external linear position sensor such as an interferometer, a PSD (position sensitive diode), CCD chip / image processing system, or the eyes and hands of an operator.

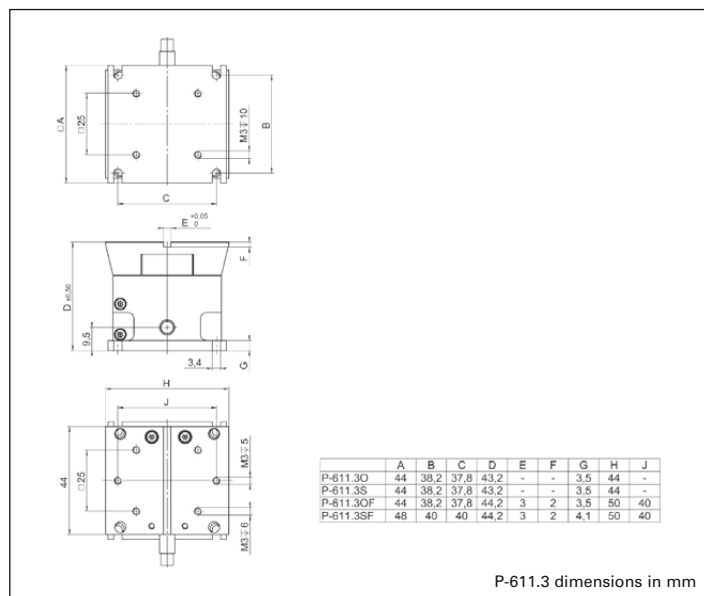
Versatility & Combination with Motorized Stages

The P-611 family of piezo stages comprises a variety of single- and multi-axis versions (X, XY, Z, XZ and XYZ) that can be easily combined with a number of very compact manual or motorized micropositioning systems to form coarse/fine positioners with longer travel ranges (see p. 2-20, p. 2-36 and p. 2-50). For fiber positioning tasks, several fiber, waveguide and optics adapters are available for mounting on the NanoCube® P-611.3SF (e.g. for combination with the F-206.S nanoalignment system see p. 4-12).

PICMA® high-performance piezo actuators which are integrated into a sophisticated, FEA-modeled, flexure guiding system. The PICMA® actuators feature cofired ceramic encapsulation and thus offer better performance and reliability than conventional piezo actuators. Actuators, guidance and sensors are maintenance-free and not subject to wear, and thus offer an extraordinary reliability.

High Reliability and Long Lifetime

The compact P-611 systems are equipped with preloaded



Application Examples

- Photonics / integrated optics
- Micromanipulation
- Biotechnology
- Semiconductor testing
- Fiber positioning



Combination of P-611.3SF
NanoCube® XYZ Nanopositioning
System, 100 x 100 x 100 µm and
M-111 XYZ MicroPositioner
15 x 15 x 15 mm

Technical Data

| Model | P-611.3S P-611.3SF | P-611.3O P-611.3OF | Units | Tolerance |
|--|---|--|--------------|----------------|
| Active axes | X, Y, Z | X, Y, Z | | |
| Motion and positioning | | | | |
| Integrated sensor | SGS | | | |
| Open-loop travel, -20 to +120 V | 120 / axis | 120 / axis | µm | min. (+20%/0%) |
| Closed-loop travel | 100 / axis | – | µm | |
| Open-loop resolution | 0.2 | 0.2 | nm | typ. |
| Closed-loop resolution | 1 | – | nm | typ. |
| Linearity | 0.1 | – | % | typ. |
| Repeatability | <10 | – | nm | typ. |
| Pitch in X,Y | ±5 | ±5 | µrad | typ. |
| Runout θ_x (Z motion) | ±10 | ±10 | µrad | typ. |
| Yaw in X | ±20 | ±20 | µrad | typ. |
| Yaw in Y | ±10 | ±10 | µrad | typ. |
| Runout θ_y (Z motion) | ±10 | ±10 | µrad | typ. |
| Mechanical properties | | | | |
| Stiffness | 0.3 | 0.3 | N/µm | ±20% |
| Unloaded resonant frequency X / Y / Z | 350 / 220 / 250 | 350 / 220 / 250 | Hz | ±20% |
| Resonant frequency @ 30 g X / Y / Z | 270 / 185 / 230 | 270 / 185 / 230 | Hz | ±20% |
| Resonant frequency @ 100 g X / Y / Z | 180 / 135 / 200 | 180 / 135 / 200 | Hz | ±20% |
| Push/pull force capacity in motion direction | +15 / -10 | +15 / -10 | N | Max. |
| Load capacity | 15 | 15 | N | Max. |
| Drive properties | | | | |
| ceramic type | PICMA® P-885 | PICMA® P-885 | | |
| Electrical capacitance | 1.5 | 1.5 | µF | ±20% |
| Dynamic operating current coefficient | 1.9 | 1.9 | µA/(Hz • µm) | ±20% |
| Miscellaneous | | | | |
| Operating temperature range | -20 to 80 | -20 to 80 | °C | |
| Material | Aluminum, steel | Aluminum, steel | | |
| Dimensions | 44 x 44 x 43.2 SF-version: 44 x 50 x 44.2 | 44 x 44 x 43.2 OF-version: 44 x 50 x 44.2 | mm | |
| Mass | 0.32 | 0.32 | kg | ±5% |
| Cable length | 1.5 | 1.5 | m | ±10 mm |
| Sensor connector | Sub-D | – | | |
| Voltage connection | Sub-D | Sub-D | | |
| Recommended controller / amplifier | E-664 Nanocube® Controller (p. 2-137) | 3 x E-610.00F OEM amplifier modules (p. 2-110); E-663 3-channel amplifier, bench-top (p. 2-136) | | |

Resolution of PI Piezo Nanopositioners is not limited by friction or stiction. Value given is noise equivalent motion with E-503 amplifier (p. 2-146)
Dynamic Operating Current Coefficient in µA per Hz and µm. Example: Sinusoidal scan of 50 µm at 10 Hz requires approximately 0.8 mA drive current.
Adapter cable with LEMO connectors for sensor and operating voltage available.