Piezo · Nano · Positioning

PI

PI nano™ Z, High-Speed Piezo-Z Slide Scanner

Low-Profile, Low-Cost, Nanopositioning System for Super Resolution Microscopy

PI nano™ Z nanopositioning stages (shown with optional slide and Petri dish holder) feature a very low profile of 20 mm (0.8"), a large aperture and deliver highly accurate motion with sub-nanometer resolution.

- ■ **Extremely Fast Step & Settle, From 5 msec**
- ■ **Low Profile for Easy Integration: 20 mm (0.8")**
- ■ **100 and 200 µm Travel Ranges**
- ■ **Longest Lifetime with Proprietary PICMA® Piezo Technology**
- ■ **Cost Effective due to Low-Cost Piezoresistive Sensors**
- ■ **Compatible w/ Leading Image Acquisition Software Packages**
- ■ **Closed-Loop Control for High Repeatability and Accuracy**
- ■ **24 Bit USB Controller & Software Included**

High-Speed, Low Profile, Optimized for Microscopy

The new PI nano™ Z low-profile piezo Z stages are optimized for very fast step and settle and easy integration into high-resolution microscope applications. They feature a very low profile of 0.8" (20 mm), a large aperture, and travel ranges of up to 200 µm with sub-nanometer closed-loop resolution–ideal for leading-edge microscopy and imaging applications.

Longest lifetime is guaranteed by the integrated ceramic-encapsulated PICMA® piezo actuators. Due to the significantly higher humidity resistance, the patented PICMA® design provides up to 10 times longer life than conventional piezo actuators (see latest test results at www.pi.ws/picma).

Cost Effective Design, High Performance

PI nano® series piezo positioning stages are designed to provide high performance at minimum cost. For highly-stable, closed loop operation, piezoresistive sensors are applied directly to the moving structure and precisely measure the displacement of the stage platform. The very high sensitivity of these sensors provides optimum position stability and responsiveness as well as sub-nanometer resolution. A proprietary servo controller significantly improves the motion linearity compared to conventional piezoresistive sensor controllers.

Working Principle / Reliability

Flexures optimized with Finite Element Analysis (FEA) are employed to guide the PI nano® series stages. FEA techniques give the design the highest possible stiffness in, and perpendicular to, the direction of motion, and to minimize linear and angular runout. Flexures allow extremely high-precision motion, no matter how minute, as they are completely free of play and friction. The award-winning PICMA®

piezo drives are more robust than conventional piezo actuators, featuring superior lifetime and performance in both dynamic and static applications. Because guidance, actuators and sensors are all maintenance-free, these nanopositioning systems achieve outstanding levels of reliability.

Controller & Software Included

The PI nano™ Z stage comes complete with a powerful closed-loop controller. The integration of 24-bit converters represents more than 2 orders of magnitude improvement over the still widely used 16-bit converters. The controller features USB & RS-232 digital interfaces as well as a wide-band analog interface and is compatible with leading image acquisition software packages such as MetaMorph etc.

The piezo controller comes with Windows installation software, DLLs and LabVIEW drivers. The extensive command set is based on the hardware-independent General Command Set (GCS), common to all PI micro & nanopositioning systems. The GCS philosophy greatly reduces the programming effort when upgrading a system with a different PI controller as well as when working on complex multi-axis positioning tasks, such as coarse/fine control with motorized long-travel stages.

Application Examples

- ■ Scanning microscopy
- ■ 3D Imaging
- ■ Laser technology
- ■ Interferometry
- ■ Metrology
- ■ Biotechnology
- ■ Micromanipulation

LabVIEW

MATLAB Enabled

MetaMorph™

C++ C# VB.NET VB Delphi

A compact 24 bit piezo controller with USB, RS-232 and a high–bandwidth analog interface is included
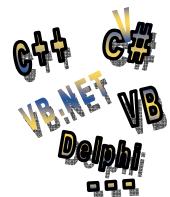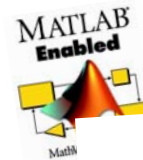
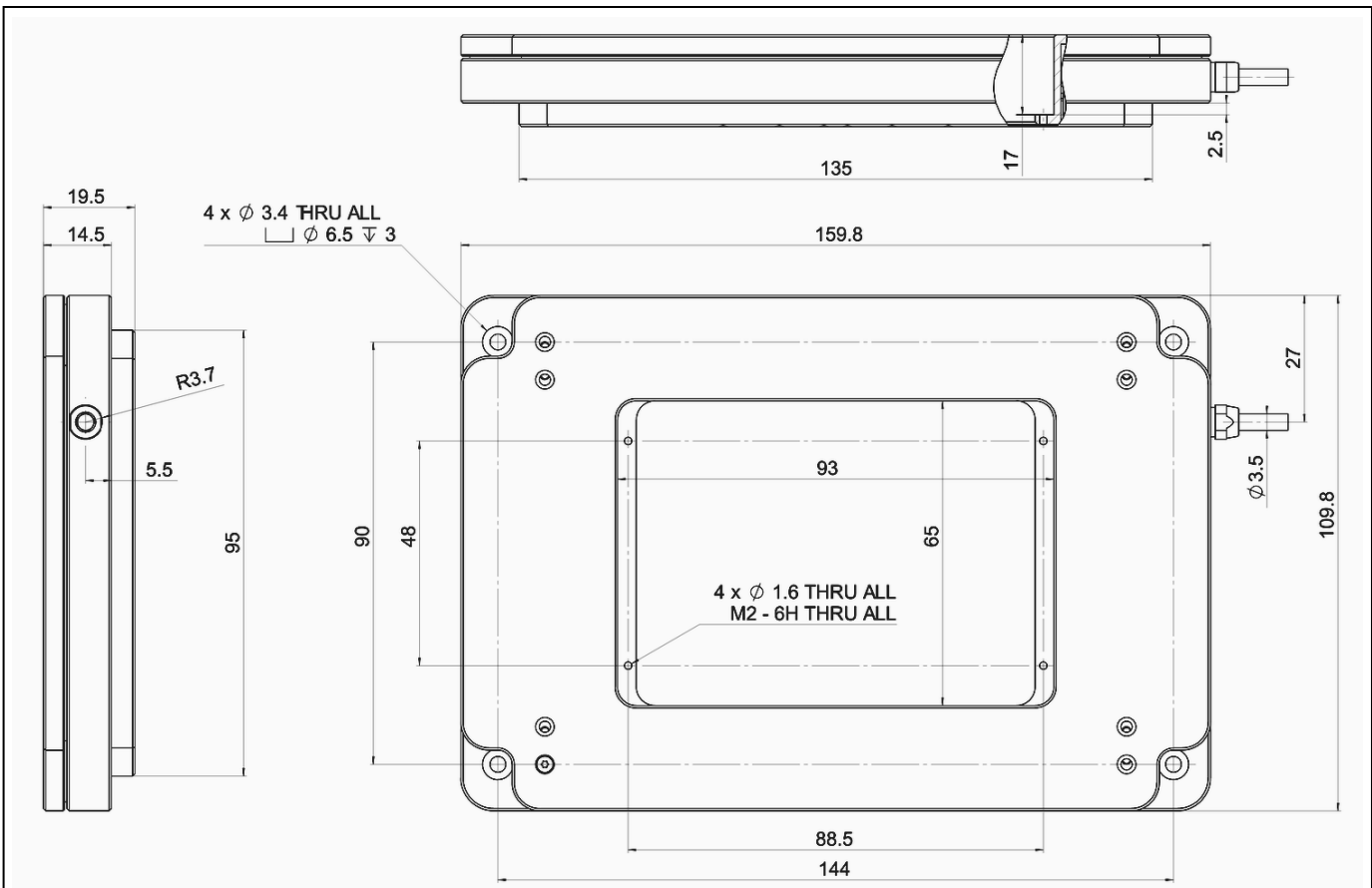| Models	PI nano Z 100	PI nano Z 200	Units	Tolerance
Active axes	Z	Z		
Motion and positioning				
Integrated sensor	Piezoresistive	Piezoresistive		
Closed-loop travel	100	200	µm	
*Closed-loop / open-loop resolution	0.2 / 0.4	0.4 / 0.7	nm	typ.
Linearity	+/-0.1	+/-0.1	%	typ.
Repeatability	<4	<5	nm	typ.
Mechanical properties				
Unloaded resonant frequency	1000	700	Hz	+/- 20%
Step Response, small signal	5	7	msec	+/- 20%
Max. payload	500	500	g	Max.
Drive properties				
Ceramic type	PICMA® P-885	PICMA® P-885		
Miscellaneous				
Operating temperature range	15 to 40	15 to 40	°C	
Material	Aluminum	Aluminum		
Weight	550	550	g	
Cable Length	1.5	1.5	m	

*Resolution of PI Piezo Nanopositioners is not limited by friction or stiction. Value given is noise equivalent motion measured with interferometer.

PI nano ™ Z stage, dimensions in mm