

# P-752 High Precision Nanopositioning Stage

## High-Dynamics, Very Stable Piezo Scanner with Extreme Guiding Accuracy



P-752.11C piezo nanopositioning system

- 0.1 nm Resolution, Fast Response
- Travel to 35  $\mu\text{m}$
- Capacitive Sensors for Highest Linearity
- Flexure Guidance for Frictionless, Ultra-Straight Motion
- Outstanding Lifetime Due to PICMA® Piezo Actuators

P-752 series high-speed nanopositioning stages are extremely precise devices, providing a positioning and scanning range up to 30  $\mu\text{m}$  with very rapid settling and extremely low tip/tilt errors. These stages were specially designed for high-speed dithering and disk drive testing applications.

### Direct-Drive Design for Fastest Response

The direct-drive design, together

#### Application Examples

- Disc-drive-testing
- Metrology
- Nanopositioning
- Scanning microscopy
- Photonics / integrated optics
- Interferometry
- Biotechnology
- Micromanipulation

her with careful attention to mass minimization, results in significant reduction in inertial recoil forces applied to the supporting structures, enhancing overall system response, throughput and stability. In combination with the E-500 controller system the P-752.11C stage with 300 g load settles to better than 1% with less 10 msec.

P-752 stages are equipped with capacitive sensors providing sub-nanometer resolution and stability. PI's proprietary capacitive sensors measure position directly and without physical contact. They are free of friction and hysteresis, a fact which, in combination with the positioning resolution of well under 1 nm, makes it possible to achieve very high levels of linearity. Further advantages of direct metrology with capacitive sensors are the high phase fidelity and the high bandwidth of up to 10 kHz.

### Automatic Configuration

The ".CD" versions are equipped with an ID-chip that stores all individual stage data and servo-control parameters. This data is read out automatically by the AutoCalibration function of PI's digital piezo controllers. Thus, digital controllers and nanopositioning stages with ID-chip can be operated in any combination.

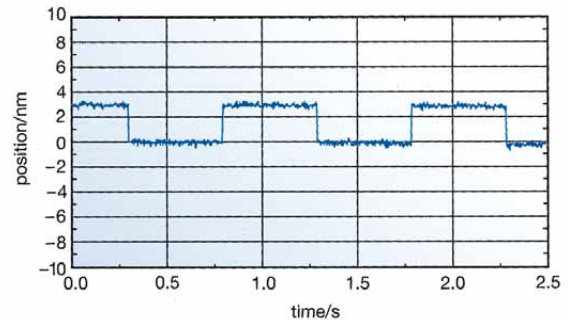
### Higher Precision in Periodic Motion

The highest dynamic accuracy in scanning applications is made possible by the DDL algorithm, which is available in most of PI's modern digital controllers. DDL eliminates tracking errors, improving dynamic linearity and usable

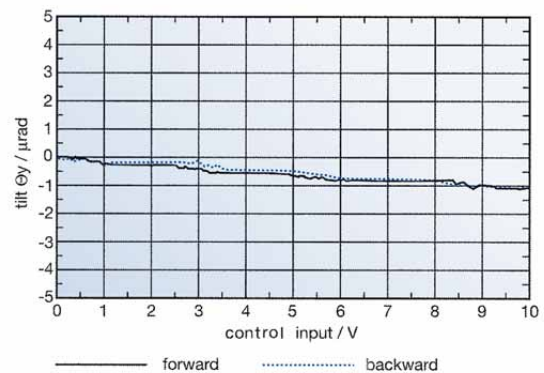
### Ordering Information

- P-752.11C**  
High-Dynamics Piezo Nanopositioning System, 15  $\mu\text{m}$ , Direct Metrology, Capacitive Sensor, LEMO Connector
- P-752.21C**  
High-Dynamics Piezo Nanopositioning System, 30  $\mu\text{m}$ , Direct Metrology, Capacitive Sensor, LEMO Connector
- P-752.1CD**  
High-Dynamics Piezo Nanopositioning System, 15  $\mu\text{m}$ , Direct Metrology, Capacitive Sensor, Sub-D Connector
- P-752.2CD**  
High-Dynamics Piezo Nanopositioning System, 30  $\mu\text{m}$ , Direct Metrology, Capacitive Sensor, Sub-D Connector

bandwidth by up to three orders of magnitude!



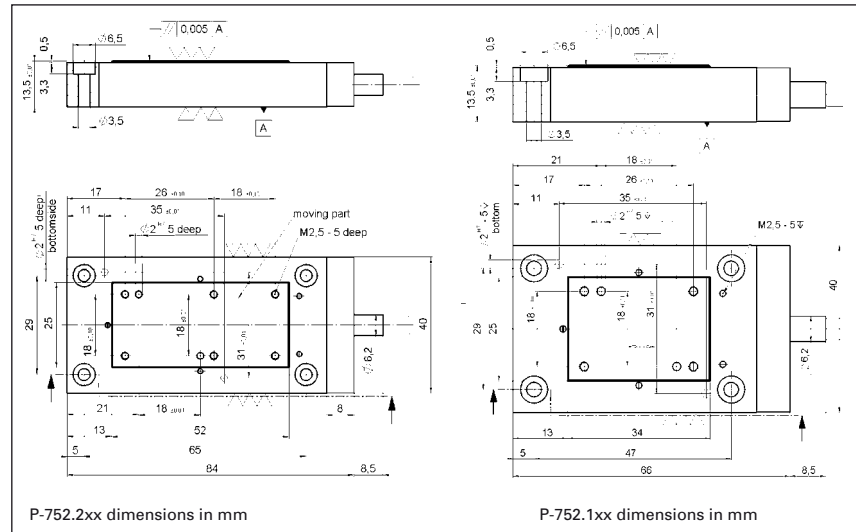
Response of a P-752.11C to a square wave control signal with 3 nm amplitude shows true sub-nm positional stability, incremental motion and bidirectional repeatability (measured with E-501 & E-503.00 & E-509.C1 controller, bandwidth set to 240 Hz)



Typical 0.5  $\mu\text{rad}$  bidirectional trajectory repeatability (P-752.11C stage) means processes may be performed bidirectionally for twice the productivity

### High Reliability and Long Lifetime

The compact P-752 systems are equipped with preloaded 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.



### Linear Actuators & Motors

### Nanopositioning/Piezoelectrics

### Piezo Flexure Stages / High-Speed Scanning Systems

#### Linear

Vertical & Tip/Tilt

2- and 3-Axis

6-Axis

Fast Steering Mirrors / Active Optics

Piezo Drivers / Servo Controllers

Single-Channel

Multi-Channel

Modular

Accessories

Piezoelectrics in Positioning

### Nanometrology

### Micropositioning

### Index

### Technical Data

Model	P-752.11C	P-752.1CD	P-752.21C	P-752.2CD	Units	Tolerance
Active axes	X	X	X	X		
<b>Motion and positioning</b>						
Integrated sensor	Capacitive	Capacitive	Capacitive	Capacitive		
Open-loop travel, -20 to +120 V	20	20	35	35	µm	min. (+20%/-0%)
Closed-loop travel	15	15	30	30	µm	calibrated
Closed-loop / open-loop resolution	0.1	0.1	0.2	0.2	nm	typ.
Linearity, closed-loop	0.03	0.03	0.03	0.03	%	typ.
Repeatability	±1	±1	±2	±2	nm	typ., full travel
Pitch / yaw	±1	±1	±1	±1	µrad	typ.
<b>Mechanical properties</b>						
Stiffness in motion direction	30	30	20	20	N/µm	±20%
Unloaded resonant frequency	3200	3200	2100	2100	Hz	±20%
Resonant frequency @ 300 g	980	980	600	600	Hz	±20%
Push/pull force capacity in motion direction	100 / 10	100 / 10	100 / 10	100 / 10	N	Max.
Load capacity	30	30	30	30	N	Max.
<b>Drive properties</b>						
Ceramic type	PICMA® P-885	PICMA® P-885	PICMA® P-885	PICMA® P-885		
Electrical capacitance	2.1	2.1	3.7	3.7	µF	±20%
Dynamic operating current coefficient	17	17	15	15	µA/(Hz • µm)	±20%
<b>Miscellaneous</b>						
Operating temperature range	-20 to 80	-20 to 80	-20 to 80	-20 to 80	°C	
Material	Stainless steel	Stainless steel	Stainless steel	Stainless steel		
Dimensions	66 x 40 x 13.5	66 x 40 x 13.5	84 x 40 x 13.5	84 x 40 x 13.5	mm	
Mass	0.25	0.25	0.35	0.35	kg	±5%
Cable length	1.5	1.5	1.5	1.5	m	±10 mm
Sensor / voltage connection	LEMO	Sub-D Special	LEMO	Sub-D Special		

Resolution of PI Piezo Nanopositioners is not limited by friction or stiction. Value given is noise equivalent motion with E-503 (p. 2-146) amplifier.

Recommended controller / amplifier

LEMO connector: E-500 piezo controller system (p. 2-142) with E-505 high-power amplifier (p. 2-147) and E-509 servo module (p. 2-152)

Sub-D special connector: E-610 servo controller / amplifier (p. 2-110), E-625 servo controller, bench-top (p. 2-114), E-665 high-power display controller, bench-top (p. 2-116), E-753 digital controller (p. 2-108)