

P-753

LISA Piezo NanoAutomation® Stages / Actuators with Direct Metrology

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P-753.11C LISA linear stage actuators, used as stage (left) and actuator (right)

- **Unique Design: Both Stage and Actuator**
- **Frictionless Precision Flexure Guiding System**
- **0.05 nm Resolution**
- **Direct Metrology with Capacitive Sensors for Highest Precision**
- **Ultra-Fast Response, Very Compact**
- **PICMA® High-Performance Piezo Drives**
- **ID-Chip for AutoCalibrate Function**
- **Vacuum Versions Available**

The P-753 LISA (Linear Stage Actuators) high-speed nanopositioners can be used both as linear actuators or as translation stages. They are equipped with capacitive feedback sensors, frictionless, flexure guiding systems and high-performance piezo drives providing a positioning and scanning

range of up to 38 µm with very fast settling time and extremely low tip/tilt error.

Nanometer Precision in Milliseconds

The direct-drive design, together 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 with settling times in the millisecond range.

Furthermore our new digital control electronics with DDL (Dynamic Digital Linearization) can be used to increase linearity and effective bandwidth in scanning applications by up to 1000-fold (see p. 6-16).

AutoCalibration

For optimized operation and interchangeability of nano-

mechanisms and controllers, models P-753.xCD are equipped with an ID-chip which holds all calibration data and sends it to the digital controller (e.g. E-750.CP). Models P-753.xxC can be used with either analog or digital controllers.

Superior Accuracy Through Direct-Motion Metrology with Capacitive Sensors

P-753 stages are equipped with absolute-measuring, direct-metrology capacitive sensors. These sensors make possible motion linearity to 0.03% with effective resolution in the sub-nanometer range. They boast high bandwidth and exhibit no periodic errors.

Unlike conventional sensors, capacitive sensors measure the actual distance between the fixed frame and the moving part of the stage. They detect errors contributed by all components in the drive train—from the actuator through the flexures to the platform. This results in higher motion linearity, long-term stability, phase fidelity, and—because external disturbances are seen by the sensor immediately—a stiffer, faster-responding servo-loop. See p. 2-4 *ff.* and p. 5-2 *ff.* for more information.

Working Principle / Reliability

P-753 stages are equipped with the award winning PICMA® piezo drives, integrated into a sophisticated flexure guiding system. The wire-EDM-cut flexures are FEA modeled for zero stiction, zero friction and exceptional guiding precision. The ceramic-encapsulated PICMA® drives are more robust than conventional piezo actuators, featuring superior lifetime and performance in both dynamic and static applications. Because guidance, actuators

Ordering Information

P-753.11C
LISA Piezo NanoAutomation® Stage Actuator, 12 µm, Capacitive Sensor, Lemo Connector

P-753.21C
LISA Piezo NanoAutomation® Stage Actuator, 25 µm, Capacitive Sensor, Lemo Connector

P-753.31C
LISA Piezo NanoAutomation® Stage Actuator, 38 µm, Capacitive Sensor, Lemo Connector

P-753.1CD
LISA Piezo NanoAutomation® Stage Actuator, 12 µm, Capacitive Sensor, sub-D Connector

P-753.2CD
LISA Piezo NanoAutomation® Stage Actuator, 25 µm, Capacitive Sensor, sub-D Connector

P-753.3CD
LISA Piezo NanoAutomation® Stage Actuator, 38 µm, Capacitive Sensor, sub-D Connector

*** Vacuum Versions / non magnetic versions**

P-753.xUD
Vacuum Version up to 10⁻⁹ hPa.

P-753.xND
Non-magnetic Vacuum Version up to 10⁻⁹ hPa.

Ask about custom designs!

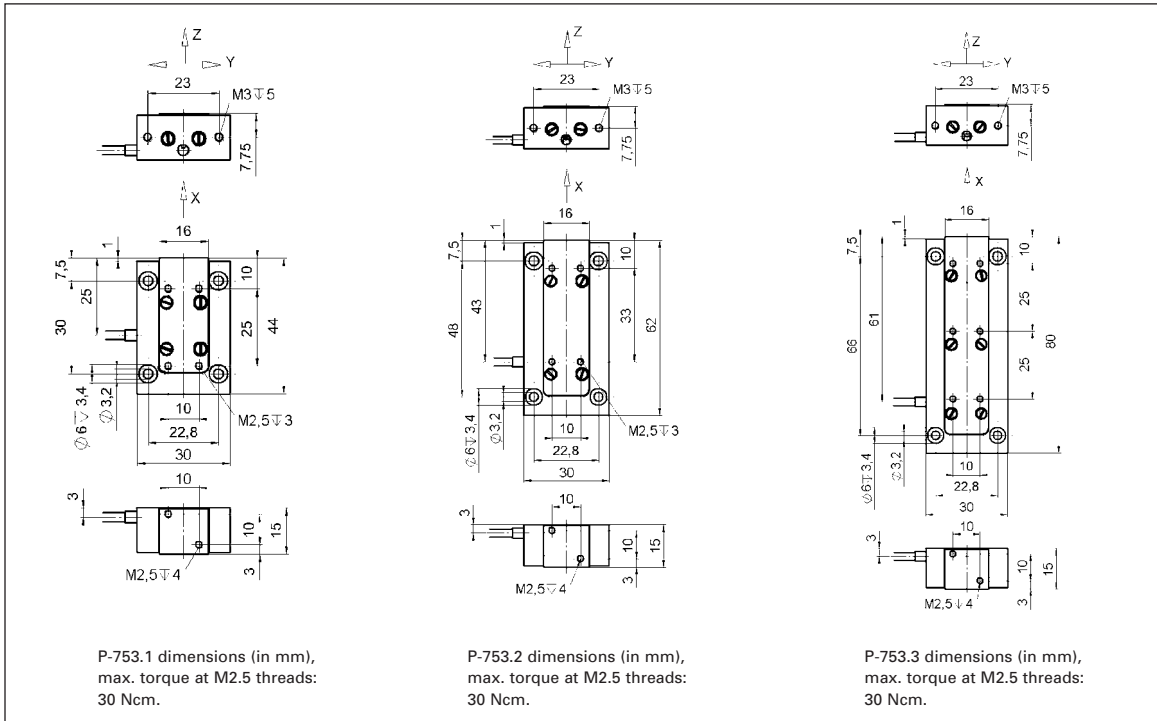
and sensors are all frictionless and maintenance-free, these nanopositioning systems achieve outstanding levels of reliability.

Notes

See the "Piezo Drivers & Nanopositioning Controllers" section, p. 6-8 *ff.* for our comprehensive line of low-noise control electronics. See the "Selection Guide" on p. 2-14 *ff.* for comparison with other nanopositioning systems.

Application Examples

- Disk drive testing
- FBG writing (fiber bragg gratings)
- Metrology
- Nanopositioning
- Scanning microscopy
- Photonics
- Scanning interferometry
- Biotechnology
- Micromanipulation



Piezo Actuators

**Nanopositioning &
Scanning Systems**
Active Optics /
Steering MirrorsTutorial: Piezo-
electrics in PositioningCapacitive Position
SensorsPiezo Drivers & Nano-
positioning ControllersHexapods /
MicropositioningPhotonics Alignment
Solutions

Motion Controllers

Ceramic Linear
Motors & Stages

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Technical Data

Models	P-753.11C	P-753.21C	P-753.31C	P-753.1CD	P-753.2CD	P-753.3CD	Units	Notes see p. 2-84
Active axes	X	X	X	X	X	X		
Open-loop travel @ 0 to 100 V	12	25	38	12	25	38	$\mu\text{m} \pm 20\%$	A2
Closed-loop travel	12	25	38	12	25	38	μm	A5
Integrated feedback sensor	capacitive	capacitive	capacitive	capacitive	capacitive	capacitive		B
* Closed-loop / open-loop resolution	0.05 / 0.05	0.1 / 0.1	0.2 / 0.2	0.05 / 0.05	0.1 / 0.1	0.2 / 0.2	nm	C1
Closed-loop linearity (typ.)	0.03	0.03	0.03	0.03	0.03	0.03	%	
Full-range repeatability (typ.)	± 1	± 2	± 3	± 1	± 2	± 3	nm	C3
Stiffness	45	24	16	45	24	16	$\text{N}/\mu\text{m} \pm 20\%$	D1
Push/pull force capacity (in operating direction)	100 / 20	100 / 20	100 / 20	100 / 20	100 / 20	100 / 20	N	D3
Max. normal load (vertical/horizontal operation)	100 / 20	100 / 20	100 / 20	100 / 20	100 / 20	100 / 20	N	D4
Lateral force limit	30	30	30	30	30	30	N	D5
Electrical capacitance	1.5	3.0	4.5	1.5	3.0	4.5	$\mu\text{F} \pm 20\%$	F1
** Dynamic operating current coefficient (DOCC)	15	15	15	15	15	15	$\mu\text{A}/(\text{Hz} \times \mu\text{m})$	F2
Unloaded resonant frequency	5.6	3.7	2.9	5.6	3.7	2.9	$\text{kHz} \pm 20\%$	G2
Resonant frequency @ 200 g load	2.5	1.7	1.4	2.5	1.7	1.4	$\text{kHz} \pm 20\%$	G3
Operating temperature range	-20 to 80	-20 to 80	-20 to 80	-20 to 80	-20 to 80	-20 to 80	$^{\circ}\text{C}$	H2
Voltage connection	VL	VL	VL	ID	ID	ID		J1
Sensor connection	2 x C	2 x C	2 x C	ID	ID	ID		J2
Weight (with cables)	150	205	250	160	215	260	$\text{g} \pm 5\%$	
Body material	S	S	S	S	S	S		L
Recommended amplifier/controller (codes explained p. 2-17)	H, F, L	H, F, L	H, F, L	M	M	M		

* For calibration information see p. 2-8. Resolution of PI piezo nanopositioners is not limited by friction or stiction. The value given is noise equivalent motion with E-503 amplifier.

** Dynamic Operating Current Coefficient in μA per Hz and μm .

Example: Sinusoidal scan of $10 \mu\text{m}$ at 10 Hz requires approximately 1.5 mA drive current.