

## P-631 Compact Piezo Nanopositioning System

### Cost-Effective, Scalable Design for High-Volume Applications

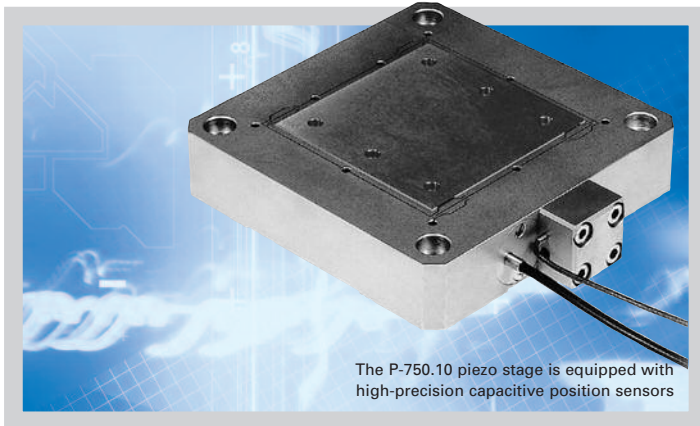


- Cost-Effective, Compact Design for High-Volume Applications
- Travel Range 100  $\mu\text{m}$ , Longer Ranges on Request
- Direct Metrology with Capacitive Sensors
- Resolution to 0,2 nm
- Outstanding Lifetime Due to PICMA® Piezo Actuators
- Mechanically Compatible to P-621 PIHera® Nanopositioning Stages

Model	Closed-loop / open-loop travel @ -20 to +120 V	Closed-loop / open-loop resolution	Linearity	Pitch / yaw	Load capacity
P-631.1CD	120 / 100 $\mu\text{m}$	0.2 / 0.4 nm	0.02%	25 $\mu\text{rad}$	10 N

## P-750 Piezo Nanopositioning System

### Dynamic High-Load Nanopositioning Stages with Direct Metrology



- 1 nm Lateral Guiding Accuracy
- Frictionless, High-Precision Flexure Guiding System
- Load Capacity 10 kg
- Resolution <1 nm
- Superior Accuracy With Direct-Metrology Capacitive Sensors
- Direct Drive for Faster Response
- 75  $\mu\text{m}$  Travel Range
- Outstanding Lifetime Due to PICMA® Piezo Actuators

Model	Closed-loop / open-loop travel	Closed-loop / open-loop resolution	Load capacity	Rotation around $\theta_x, \theta_y$	Unloaded resonant frequency
P-750.00	- / 75 $\mu\text{m}$	- / 0.4 nm	100 N	$\pm 10 \mu\text{rad}$	600 Hz
P-750.20 with capacitive sensor	75 / 75 $\mu\text{m}$	1 / 0.4 nm	100 N	$\pm 10 \mu\text{rad}$	600 Hz

## P-772 Miniature Piezo Nanopositioning System

### High Dynamics and Direct Position Measurement



- Smallest Stage with Direct Metrology
- Frictionless, High-Precision Flexure Guiding System
- Resolution <0.1 nm
- Travel Range to 12  $\mu\text{m}$
- Closed-Loop and Open-Loop Versions
- Rapid Response and Settling
- Outstanding Lifetime Due to PICMA® Piezo Actuators

Modell	Closed-loop / open-loop travel @ 0 to +100 V	Closed-loop / open-loop resolution	Linearity	Unloaded resonant frequency	Load capacity
P-772.1CD / P-772.1CL	10 / 12 $\mu\text{m}$	0.05 / 0.05 nm	0.03%	1.7 kHz	5 N
P-772.0L	- / >10 $\mu\text{m}$	- / 0.05 nm	-	1.7 kHz	5 N

# P-772

## Ultra-Compact Piezo NanoAutomation® Stage with Direct Metrology



P-772.1CD piezo nanostage / scanning stage (DIP switch for size comparison)

- Smallest Flexure-Guided Stage with Capacitive Feedback
- Ideal for Head/Media Test & Fiber Optics
- Resolution <0.1 nm
- Ultra-Fast Response (1.7 kHz Resonant Frequency)
- ID-Chip for Auto Calibrate Function
- Frictionless Precision Flexure Guiding System
- PICMA® High-Performance Piezo Drives

P-772 nanostaging stages are the smallest flexure-guided, piezo-driven positioning systems with integrated capacitive sensors currently available. They provide a positioning and scanning range of up

to 10 µm, sub-nanometer resolution and ultra-fast response.

### Nanometer Precision in Milliseconds

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 nanomechanisms and controllers,

model P-772.1CD is equipped with an ID-chip which holds all calibration data and sends it to the digital controller (e.g. E-750.CP). Model P-772.1CL can be used with either analog or digital controllers.

### Superior Accuracy Through Direct-Motion Metrology with Capacitive Sensors

P-772 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. 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-772 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 and sensors are all frictionless and maintenance-free, these nanostaging systems achieve outstanding levels of reliability.

### Ordering Information

**P-772.1CD**  
Ultra-Compact NanoAutomation® Stage, Capacitive Sensor, AutoCalibrate, Sub-D Connector

**P-772.1CL**  
Ultra-Compact NanoAutomation® Stage, Capacitive Sensor, Lemo Connector

Ask about custom designs!

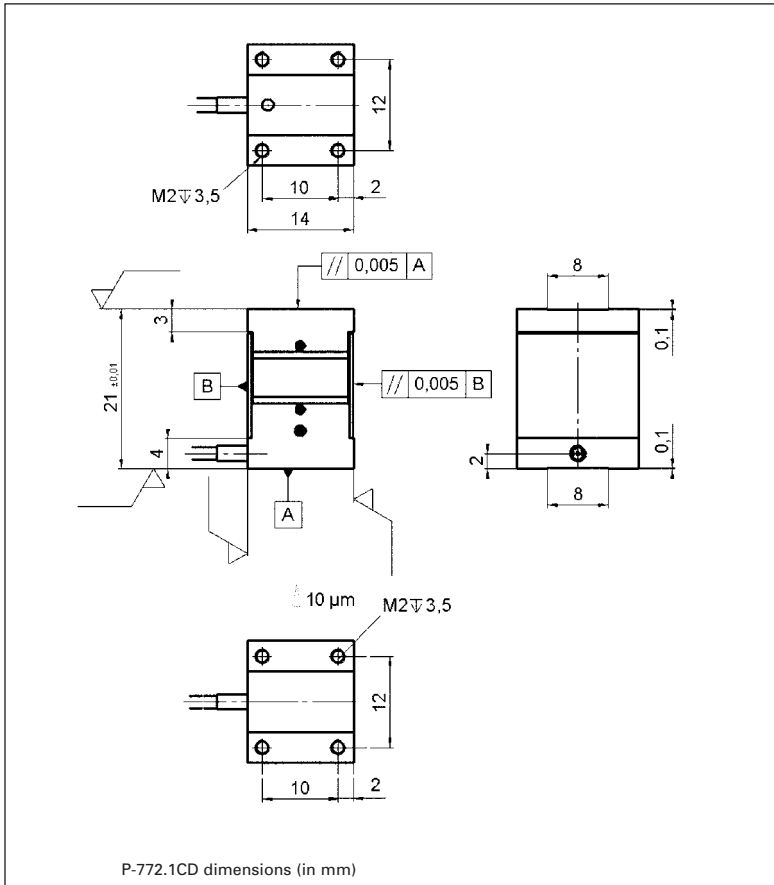
### Notes

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

- Head/media test
- Disk drive test
- Laser tuning
- Fiber optics
- Metrology
- Nanopositioning
- Scanning microscopy
- Scanning interferometry
- Biotechnology
- Micromanipulation, etc.



### Technical Data

Models	P-772.1CD	P-772.1CL	Units	Notes see page 2-84
Active axes	X	X		
Open-loop travel @ 0 to 100 V	12	12	$\mu\text{m} \pm 20\%$	A2
Closed-loop travel	10	10	$\mu\text{m}$	A5
Integrated feedback sensor	capacitive	capacitive		B
* Closed-loop / open-loop resolution	0.05 / 0.05	0.05 / 0.05	nm	C1
** Closed-loop linearity (typ.)	0.03	0.03	%	
Full-range repeatability (typ.)	$\pm 1$	$\pm 1$	nm	C3
Stiffness	7	7	$\text{N}/\mu\text{m} \pm 20\%$	D1
Push/pull force capacity (in operating direction)	50 / 5	50 / 5	N	D3
Max. ( $\pm$ ) normal load	5	5	N	D4
Lateral force limit	10	10	N	D5
Electrical capacitance	0.8	0.8	$\mu\text{F} \pm 20\%$	F1
*** Dynamic operating current coefficient (DOCC)	7.5	7.5	$\mu\text{A}/(\text{Hz} \times \mu\text{m})$	F2
Unloaded resonant frequency	1700	1700	$\text{Hz} \pm 20\%$	G2
Operating temperature range	-20 to 80	-20 to 80	$^{\circ}\text{C}$	H2
Voltage connection	ID	VL		J1
Sensor connection	ID	2 x C		J2
Weight (w/o cables)	170	170	$\text{g} \pm 5\%$	
Body material	N-S	N-S		L
Recommended amplifier/controller (codes explained p. 2-17)	M	H, F, L		

\* 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, E-710

\*\* with digital controller  
\*\*\* Dynamic Operating Current Coefficient in  $\mu\text{A}$  per Hz and  $\mu\text{m}$ .  
Example: Sinusoidal scan of 10  $\mu\text{m}$  at 10 Hz requires approximately 0.8 mA drive current.

Piezo Actuators

**Nanopositioning & Scanning Systems**

Active Optics / Steering Mirrors

Tutorial: Piezo-electrics in Positioning

Capacitive Position Sensors

Piezo Drivers &amp; Nanopositioning Controllers

Hexapods / Micropositioning

Photonics Alignment Solutions

Motion Controllers

Ceramic Linear Motors &amp; Stages

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