P-541.2SL · P-542.2SL

Low-Profile, Parallel-Kinematics XY Piezo Scanning Stages for Microscopy

P-540-series nanopositioning stages feature a very low profile of 16.5 mm, a large 80 x 80 mm aperture and deliver highly accurate motion with sub-nanometer resolution. Dimensions and patterns are the same for all P-541/P-542 stages.

- **Low Profile for Easy Integration: 16.5 mm**
- **Parallel Kinematics for Fast Response**
- **To 200 x 200 µm Travel Range**
- **80 x 80 mm Clear Aperture**
- **PICMA® High-Performance Piezo Actuators for Superior Lifetime**

Low Profile, Optimized for Microscopy Applications

P-541/P-542 nanopositioning and scanning stages are designed for easy integration into high-resolution microscopes. They feature a very low profile of 16.5 mm, a large 80 x 80 mm aperture, and offer highly accurate motion with sub-nanometer resolution.

Choice of Travel Ranges

Two versions are offered, the 100 µm version featuring a higher resonant frequency for faster positioning and a 200 µm version for applications requiring a longer travel range. Models with a shorter positioning range for faster scanning and Z, tip/tilt stages for tasks like nanofocusing are also available (see p. 2-48).

Application Examples

- Optical trapping
- Scanning microscopy
- Mask & wafer alignment
- Scanning interferometry
- Surface metrology
- Biotechnology
- Micromanipulation

Parallel Kinematics for Faster Response

All P-540-series XY piezo positioning stages feature a single-module, parallel-kinematics design with all actuators operating on one central platform and no moving cables to cause microfriction. Advantages over serial kinematics setups are a lower profile, reduced inertia and better, axis-independent dynamics.

Open- and Closed-Loop Models

Open- and closed-loop versions are offered to suit your application. The open-loop models are ideal for applications where fast response and very high resolution are essential, but absolute positioning is not important. They can also be used when the position is controlled by an external linear position sensor such as an intereferometer; a PSD quad cell; a CCD chip / image processing system; or the eyes and hands of an operator.

The closed-loop versions are equipped with high-resolution strain gauge sensors mounted on the flexure guiding system for optimum position stability and responsiveness. The sensors are operated in a full bridge circuit and provide position information with nanometer resolution to the servo controller.

Models with capacitive position sensors for critical applications, requiring the highest positioning linearity are also available.

Working Principle / Reliability

P-540-series stages are equipped with the award-winning PICMA® piezo drives, integrated into a sophisticated, single-module, parallel-kinematics, 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 nanopositioning systems achieve outstanding levels of reliability.

Ordering Information

P-541.2SL
Microscopy XY Nanopositioning & Scanning Stage, 100 x 100 µm, Strain Gauge Sensors

P-542.2SL
Microscopy XY Nanopositioning & Scanning Stage, 200 x 200 µm, Strain Gauge Sensors

P-541.20L
Microscopy XY Nanopositioning & Scanning Stage, 100 x 100 µm, Open-Loop

P-542.20L
Microscopy XY Nanopositioning & Scanning Stage, 200 x 200 µm, Open-Loop

Version with Capacitive Sensors (direct metrology) see p. 2-62

P-541.2DD
Microscopy XY Nanopositioning & Scanning Stage, High-Speed Direct Drive, 45 x 45 µm, Parallel Metrology, Capacitive Sensors

P-541.2CD
Microscopy XY Nanopositioning & Scanning Stage, 100 x 100 µm, Parallel Metrology, Capacitive Sensors

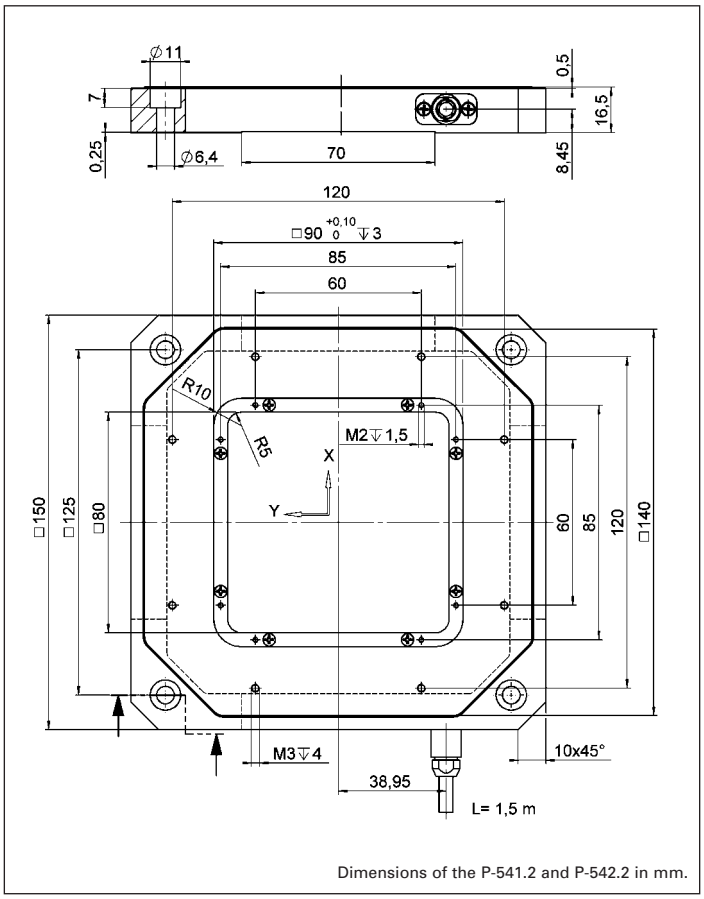
P-542.2CD
Microscopy XY Nanopositioning & Scanning Stage, 200 x 200 µm, Parallel Metrology, Capacitive Sensors

Vacuum Versions Available.

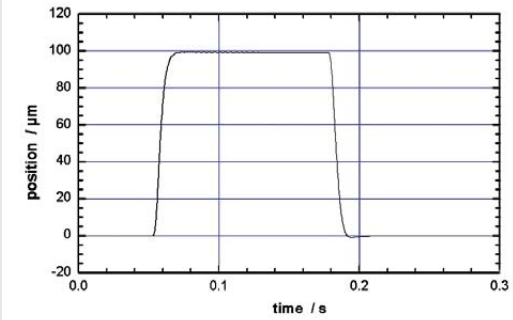
P-540-Series Z-Tip/Tilt Stages see p. 2-48

Notes

See the "Selection Guide" on p. 2-14 *ff.* for comparison with other nanopositioning systems.



Dimensions of the P-541.2 and P-542.2 in mm.



Settling behavior of the P-541.ZSL stage.

For fully independent XYZ motion, the P-541/P-542 XY stages can be combined with the P-725 PIFOC® nanofocusing Z-drives.

Technical Data

Models	P-541.2SL	P-541.20L	P-542.2SL	P-542.20L	Units	Notes see p. 2-84
Active axes	XY	XY	XY	XY		
Min. open-loop travel -20 to 120 V	150 x 150	150 x 150	250 x 250	250 x 250	µm	A2
Closed-loop travel	100 x 100	100 x 100	200 x 200	200 x 200	µm	A5
Integrated feedback sensor	SGS	-	SGS	-		B
* Closed-loop / open-loop resolution	2.5 / 0.2	- / 0.2	4 / 0.4	- / 0.4	nm	C1
Closed-loop linearity (typ.)	0.5	-	0.5	-	%	
Repeatability	<10				nm	
Push force capacity	100, 100	100, 100	100, 100	100, 100	N	D3
Pull force capacity	30, 30	30, 30	30, 30	30, 30	N	D3
Max. load	20	20	20	20	N	D4
Electrical capacitance (per axis)	6.75	6.75	7.5	7.5	µF ±20%	F1
** Dynamic Operating	8.5	8.5	4.8	4.8	µA/(Hz x µm)	F2
Current Coefficient (per axis)						
Resonant frequency unloaded	500, 500	500, 500	370, 370	370, 370	Hz ±20%	G2
Resonant frequency @ 185 g load			250	250	Hz ±20%	G3
Operating temperature	-20 to 80	-20 to 80	-20 to 80	-20 to 80	°C	H2
Voltage & sensor connection	VL, L	VL	VL, L	VL		J1/J2
Body material	Al	Al	Al	Al		L
Recommended amplifier/controller (codes explained p. 2-17)	D, H	A, G	D, H	A, G		

* For calibration information see p. 2-8. Resolution of PI Piezo Nanopositioning systems is not limited by friction or stiction. Noise equivalent motion with E-503 amplifier.
** Dynamic Operating Current Coefficient in µA per Hz and µm. Example: Sinusoidal scan of 10 µm at 10 Hz with the P-542.2 requires approximately 0.48 mA drive current.