

Piezo Z Stages / Z and Tip/Tilt Stages

Low Profile, Large Aperture



P-541.Z • P-541.T

- Low profile for easy integration: 16.5 mm
- Clear aperture 80 mm × 80 mm
- Travel range to 150 μm
- Tip/tilt angle to 1.2 mrad
- Parallel kinematics for faster response times and higher multi-axis accuracy
- Sensor technology: Inexpensive strain gauge sensors or capacitive sensors for higher performance
- Outstanding lifetime due to PICMA® piezo actuators
- Combination with microscope stages possible for long travel ranges

Fields of application

- Scanning microscopy
- Super-resolution microscopy
- Biotechnology
- Mask/wafer positioning
- Sample positioning
- Interferometry
- Metrology

Outstanding lifetime thanks to PICMA® piezo actuators

The patented PICMA® piezo actuators are all-ceramic insulated. This protects them against humidity and failure resulting from an increase in leakage current. PICMA® actuators offer an up to ten times longer lifetime than conventional polymer-insulated actuators. 100 billion cycles without a single failure are proven.

Subnanometer resolution with capacitive sensors

Capacitive sensors measure with subnanometer resolution without contacting. They guarantee excellent linearity of motion, long-term stability, and a bandwidth in the kHz range.

High guiding accuracy due to zero-play flexure guides

Flexure guides are free of maintenance, friction, and wear, and do not require lubrication. Their stiffness allows high load capacity and they are insensitive to shock and vibration. They are 100 % vacuum compatible and work in a wide temperature range.

Automatic configuration and fast component exchange

Mechanics and controllers can be combined as required and exchanged quickly. All servo and linearization parameters are stored in the ID chip of the Sub-D connector of the mechanics. The autocalibration function of the digital controllers uses this data each time the controller is switched on.

High dynamics multi-axis operation due to parallel kinematics

In a parallel-kinematic multi-axis system, all actuators act on a common platform. The minimum mass inertia and the identical design of all axes allow fast, dynamic, and nevertheless precision motion.

Specifications

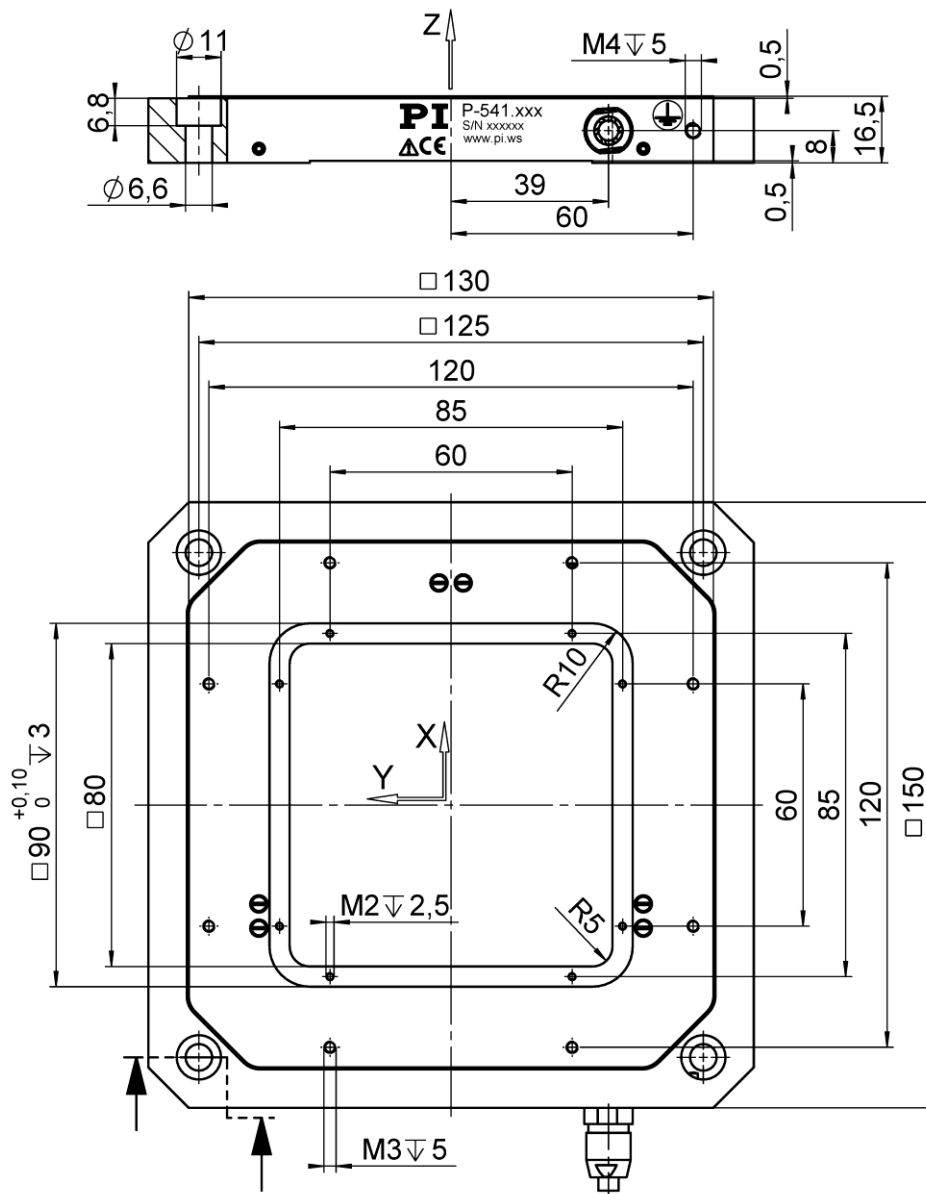
	P-541.ZCD	P-541.TCD*	P-541.ZSL	P-541.TSL*	P-541.ZOL	P-541.TOL*	Unit	Tolerance
Active axes	Z	Z, θ_x , θ_y	Z	Z, θ_x , θ_y	Z	Z, θ_x , θ_y		
Motion and positioning								
Integrated sensor	Capacitive	Capacitive	SGS	SGS	–	–		
Travel range in Z at -20 to 120 V, open loop	150	150	150	150	150	150	μm	+20 % / -0 %
Tip/tilt angle in θ_x , θ_y at -20 to 120 V, open loop	–	± 0.6	–	± 0.6	–	± 0.6	mrad	+20 % / -0 %
Travel range in Z, closed loop	100	100	100	100	–	–	μm	
Tip/tilt angle in θ_x , θ_y , closed loop	–	± 0.4	–	± 0.4	–	–	mrad	
Resolution Z, open loop	0.2	0.2	0.2	0.2	0.2	0.2	nm	typ.
Resolution in θ_x , θ_y , open loop	–	0.02	–	0.02	–	0.02	μrad	typ.
Resolution in Z, closed loop	0.5	0.5	2.5	2.5	–	–	nm	typ.
Closed-loop resolution in θ_x , θ_y	–	0.08	–	0.25	–	–	μrad	typ.
Linearity error Z, θ_x , θ_y	0.03	0.03	0.2	0.2	–	–	%	typ.
Repeatability Z	<2	<2	<10	<10	–	–	nm	typ.
Repeatability θ_x , θ_y	–	0.01	–	0.05	–	–	μrad	typ.
Tilt θ_x , θ_y (motion in Z)	± 15	± 15	± 15	± 15	± 15	± 15	μrad	typ.
Mechanical properties								
Stiffness Z	0.8	0.8	0.8	0.8	0.8	0.8	N/ μm	± 20 %
Resonant frequency Z, no load	410	410	410	410	410	410	Hz	± 20 %
Resonant frequency θ_x , θ_y , no load	–	330	–	330	–	330	Hz	± 20 %
Resonant frequency Z, 200 g	250	250	250	250	250	250	Hz	± 20 %
Resonant frequency @ 200 g, θ_x , θ_y	–	270	–	270	–	270	Hz	± 20 %
Push/pull force capacity	50 / 20	50 / 20	50 / 20	50 / 20	50 / 20	50 / 20	N	max.
Drive properties								
Ceramic type	PICMA® P-885	PICMA® P-885	PICMA® P-885	PICMA® P-885	PICMA® P-885	PICMA® P-885		
Electrical capacitance	6.3	6.3	6.3	6.3	6.3	6.3	μF	± 20 %
Miscellaneous								
Operating temperature range	20 to 80	20 to 80	20 to 80	20 to 80	20 to 80	20 to 80	°C	
Material	Aluminum	Aluminum	Aluminum	Aluminum	Aluminum	Aluminum		
Mass	750	750	730	730	700	700	g	± 5 %
Cable length	1.5	1.5	1.5	1.5	1.5	1.5	m	± 10 mm
Sensor connection	Sub-D 7W2 (m)	Sub-D 25W3 (m)	LEMO	3 × LEMO	–	–		
Voltage connection	Sub-D 7W2 (m)	Sub-D 25W3 (m)	LEMO	3 × LEMO	LEMO	3 × LEMO		
Recommended electronics	E-503, E-505, E-610, E-621, E-625, E-712, E-727, E-754	E-503, E-505, E-610, E-621, E-625, E-712, E-727, E-754	E-503, E-505, E-610, E-621, E-625, E-712, E-727, E-754	E-503, E-505, E-610, E-621, E-625, E-712, E-727, E-754	E-503, E-505, E-610, E-621, E-625, E-712, E-727, E-754	E-503, E-505, E-610, E-621, E-625, E-712, E-727, E-754		

* Parallel kinematics design; the maximum displacement for translation motion and tip/tilt motion cannot be achieved simultaneously.

The resolution of the system is limited only by the noise of the amplifier and the measuring technology because PI piezo nanopositioning systems are free of friction.

All specifications based on room temperature (22 °C \pm 3 °C).

Drawings / Images



P-541.Z / P-541.T, dimensions in mm

Ordering Information

P-541.ZCD

Vertical nanopositioning stage with large aperture, 100 μm , direct position measuring, capacitive sensors

P-541.TCD

Nanopositioner Z and tip/tilt stage with large aperture, 100 μm / 0.8 mrad, parallel metrology, capacitive sensors

P-541.ZSL

Vertical nanopositioning stage with large aperture, 100 μm , strain gauge sensors

P-541.TSL

Nanopositioner Z and tip/tilt stage with large aperture, 100 μm / 0.8 mrad, strain gauge sensors

P-541.ZOL

Vertical nanopositioning stage with large aperture, 150 μm , without sensor

P-541.TOL

Nanopositioner Z and tip/tilt stage with large aperture, 150 μm / 1.2 mrad, without sensor