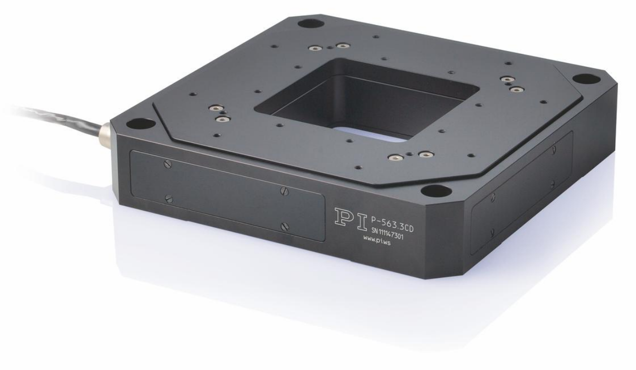
PIMars Nanopositioning Stage

High-Precision Nanopositioner for up to 3 Axes



P-561 • P-562 • P-563

- Parallel kinematics in the X and Y axes for faster response times and greater multi-axis accuracy
- Travel ranges to 300 × 300 × 300 µm
- Highest linearity due to capacitive sensors
- Zero-play and highly accurate flexure guides
- Excellent scanning flatness
- High dynamics XYZ version
- Clear aperture 66 mm × 66 mm
- Outstanding lifetime thanks to PICMA® piezo actuators
- UHV versions to 10^{-9} hPa

Application fields
- Scanning microscopy
- Mask / wafer positioning
- Interferometry
- Measuring technology
- Biotechnology
- Scanning and screening

Outstanding lifetime due to PICMA® piezo actuators
The 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 work in a wide temperature range.

Automatic configuration and fast component exchange
Mechanics and controllers can be can be combined as required and exchanged quickly. All servo and linearization parameters are stored in the ID chip of the mechanics' D-sub connector. The auto calibration function on the digital controller automatically uses this data every time the controller is switched on.

High tracking accuracy in the nanometer range due to parallel position measuring
All degrees of freedom are measured against a single fixed reference. Undesired crosstalk between axes can be actively compensated (active guiding) in real time (depending on the bandwidth). High tracking accuracy is achieved in the nanometer range even in dynamic operation.

Suitable for sophisticated vacuum applications
All components used in the piezo systems are excellently suited for use in vacuum. No lubricant or grease is necessary for operating. Polymer-free piezo systems allow particularly low outgas rates.

Motion	Unit	Toleran-ce	P-561.3CD	P-561.3CL	P-562.3CD	P-562.3CL	P-563.3CD	P-563.3CL	P-561.3DD
Active axes			X, Y, Z	X, Y, Z	X, Y, Z	X, Y, Z	X, Y, Z	X, Y, Z	X, Y, Z
Travel range in X	µm		100	100	200	200	300	300	45
Travel range in Y	µm		100	100	200	200	300	300	45
Travel range in Z	µm		100	100	200	200	300	300	15
Travel range in X, open loop, at -20 to 120 V	µm	+20 / -0 %	150	150	300	300	340	340	58
Travel range in Y, open loop, at -20 to +120 V	µm	+20 / -0 %	150	150	300	300	340	340	58
Travel range in Z, open loop, at -20 to 120 V	µm	+20 / -0 %	150	150	300	300	340	340	18
Linearity error in X	%	Max.	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Linearity error in Y	%	Max.	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Linearity error in Z	%	Max.	0.03	0.03	0.03	0.03	0.03	0.03	0.08
Flatness (Linear crosstalk in X with motion in Z)	nm	Typ.	±30	±30	±50	±50	±50	±50	±20
Straightness (Linear cros-stalk in Y with motion in Z)	nm	Typ.	±30	±30	±50	±50	±50	±50	±20
Flatness (Linear crosstalk in Z with motion in X)	nm	Typ.	±15	±15	±20	±20	±25	±25	±10
Flatness (Linear crosstalk in Z with motion in Y)	nm	Typ.	±15	±15	±20	±20	±25	±25	±10
Pitch (Rotational crosstalk in θX with motion in Y)	µrad	Typ.	±1	±1	±2	±2	±2	±2	±3
Yaw (Rotational crosstalk in θX with motion in Z)	µrad	Typ.	±15	±15	±20	±20	±25	±25	±3
Pitch (Rotational crosstalk in θY with motion in X)	µrad	Typ.	±1	±1	±2	±2	±2	±2	±3
Pitch (Rotational crosstalk in θY with motion in Z)	µrad	Typ.	±15	±15	±20	±20	±25	±25	±3
Yaw (Rotational crosstalk in θZ with motion in X)	µrad	Typ.	±6	±6	±10	±10	±10	±10	±3
Yaw (Rotational crosstalk in θZ with motion in Y)	µrad	Typ.	±6	±6	±10	±10	±10	±10	±3

Positioning	Unit	Toleran-ce	P-561.3CD	P-561.3CL	P-562.3CD	P-562.3CL	P-563.3CD	P-563.3CL	P-561.3DD
Unidirectional repeatabili-ty in X	nm	Typ.	±2	±2	±2	±2	±2	±2	±2
Unidirectional repeatabili-ty in Y	nm	Typ.	±2	±2	±2	±2	±2	±2	±2
Unidirectional repeatabili-ty in Z	nm	Typ.	±2	±2	±4	±4	±4	±4	±2
Resolution in X, open loop	nm	Typ.	0.2	0.2	0.4	0.4	0.5	0.5	0.1
Resolution in Y, open loop	nm	Typ.	0.2	0.2	0.4	0.4	0.5	0.5	0.1
Resolution in Z, open loop	nm	Typ.	0.2	0.2	0.4	0.4	0.5	0.5	0.1
Integrated sensor			Capacitive, in-direct positi-on measuring	Capacitive, in-direct positi-on measuring	Capacitive, in-direct positi-on measuring	Capacitive, in-direct positi-on measuring	Capacitive, in-direct positi-on measuring	Capacitive, in-direct positi-on measuring	Capacitive, in-direct positi-on measuring
System resolution in X	nm		0.8	0.8	1	1	2	2	0.2
System resolution in Y	nm		0.8	0.8	1	1	2	2	0.2
System resolution in Z	nm		0.8	0.8	1	1	2	2	0.2

Drive Properties	Unit	Toleran-ce	P-561.3CD	P-561.3CL	P-562.3CD	P-562.3CL	P-563.3CD	P-563.3CL	P-561.3DD
Drive type			Piezo actua-tor/PICMA®	Piezo actua-tor/PICMA®	Piezo actua-tor/PICMA®	Piezo actua-tor/PICMA®	Piezo actua-tor/PICMA®	Piezo actua-tor/PICMA®	Piezo actua-tor/PICMA®
Electrical capacitance in X	µF	±20%	5.2	5.2	7.4	7.4	7.4	7.4	38
Electrical capacitance in Y	µF	±20%	5.2	5.2	7.4	7.4	7.4	7.4	38
Electrical capacitance in Z	µF	±20%	10.4	10.4	14.8	14.8	14.8	14.8	6

Mechanical Properties	Unit	Toleran-ce	P-561.3CD	P-561.3CL	P-562.3CD	P-562.3CL	P-563.3CD	P-563.3CL	P-561.3DD
Resonant frequency in X, unloaded	Hz	±20%	190	190	160	160	140	140	920
Resonant frequency in X, under load with 100 g	Hz	±20%			145	145	120	120	860
Resonant frequency in X, under load with 350 g	Hz	±20%	150	150	125	125	93	93	640
Resonant frequency in Y, unloaded	Hz	±20%	190	190	160	160	140	140	920
Resonant frequency in Y, under load with 100 g	Hz	±20%			145	145	120	120	860
Resonant frequency in Y, under load with 350 g	Hz	±20%	150	150	125	125	93	93	640
Resonant frequency in Z, unloaded	Hz	±20%	380	380	315	315	250	250	1050
Resonant frequency in Z, under load with 100 g	Hz	±20%			275	275	215	215	950
Resonant frequency in Z, under load with 350 g	Hz	±20%	260	260	211	211	148	148	695
Permissible push force in X	N	Max.	60	60	50	50	40	40	200
Permissible push force in Y	N	Max.	60	60	50	50	40	40	200
Permissible push force in Z	N	Max.	100	100	60	60	30	30	250
Permissible pull force in X	N	Max.	40	40	40	40	30	30	70
Permissible pull force in Y	N	Max.	40	40	40	40	30	30	70
Permissible pull force in Z	N	Max.	100	100	60	60	30	30	60
Guide			Flexure guide/Flexure guide with lever amplification	Flexure guide/Flexure guide with lever amplification	Flexure guide/Flexure guide with lever amplification	Flexure guide/Flexure guide with lever amplification	Flexure guide/Flexure guide with lever amplification	Flexure guide/Flexure guide with lever amplification	Flexure guide/Flexure guide with direct drive
Overall mass	g	±5%	1450	1450	1450	1450	1450	1450	1550
Material			Aluminum	Aluminum	Aluminum	Aluminum	Aluminum	Aluminum	Aluminum

Miscellaneous	Unit	Toleran-ce	P-561.3CD	P-561.3CL	P-562.3CD	P-562.3CL	P-563.3CD	P-563.3CL	P-561.3DD
Operating temperature range	°C		-20 to 80	-20 to 80	-20 to 80	-20 to 80	-20 to 80	-20 to 80	-20 to 80
Connector			D-sub 25W3 (m)	LEMO LVPZT	D-sub 25W3 (m)	LEMO LVPZT	D-sub 25W3 (m)	LEMO LVPZT	D-sub 25W3 (m)
Cable length	m	+50 / -0 mm	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Recommended controllers / drivers			E-503, E-505, E-621, E-712, E-727	E-503, E-505, E-621, E-712, E-727	E-503, E-505, E-621, E-712, E-727	E-503, E-505, E-621, E-712, E-727	E-503, E-505, E-621, E-712, E-727	E-503, E-505, E-621, E-712, E-727	E-503, E-505, E-621, E-712, E-727

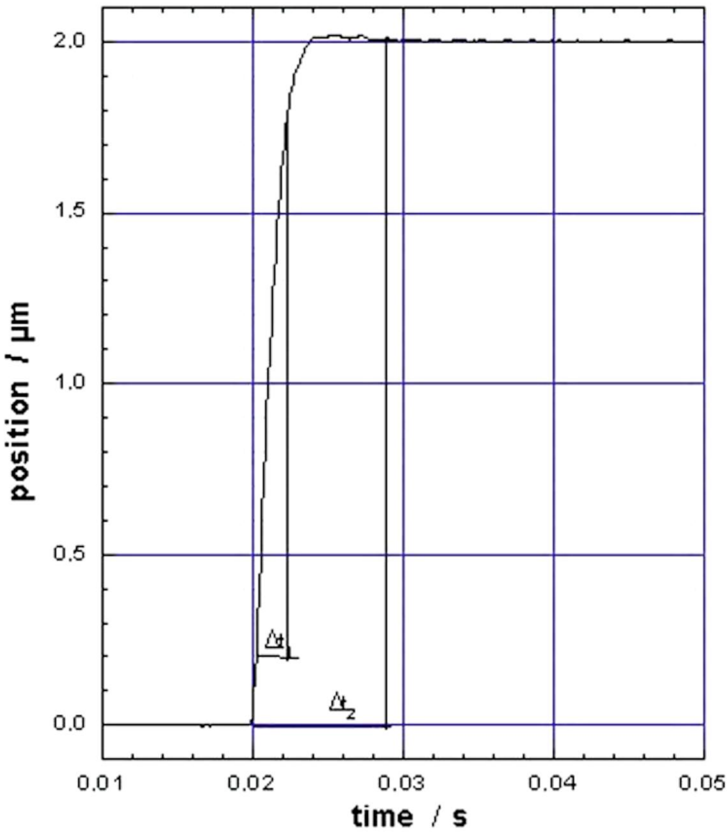
Linearity error of P-561.3DD: With digital controller. Nonlinearity of direct drive positioners measured with analog controllers is typically up to 0.1 %.

Parallel kinematics only available for the X and Y axes (not in Z).

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.

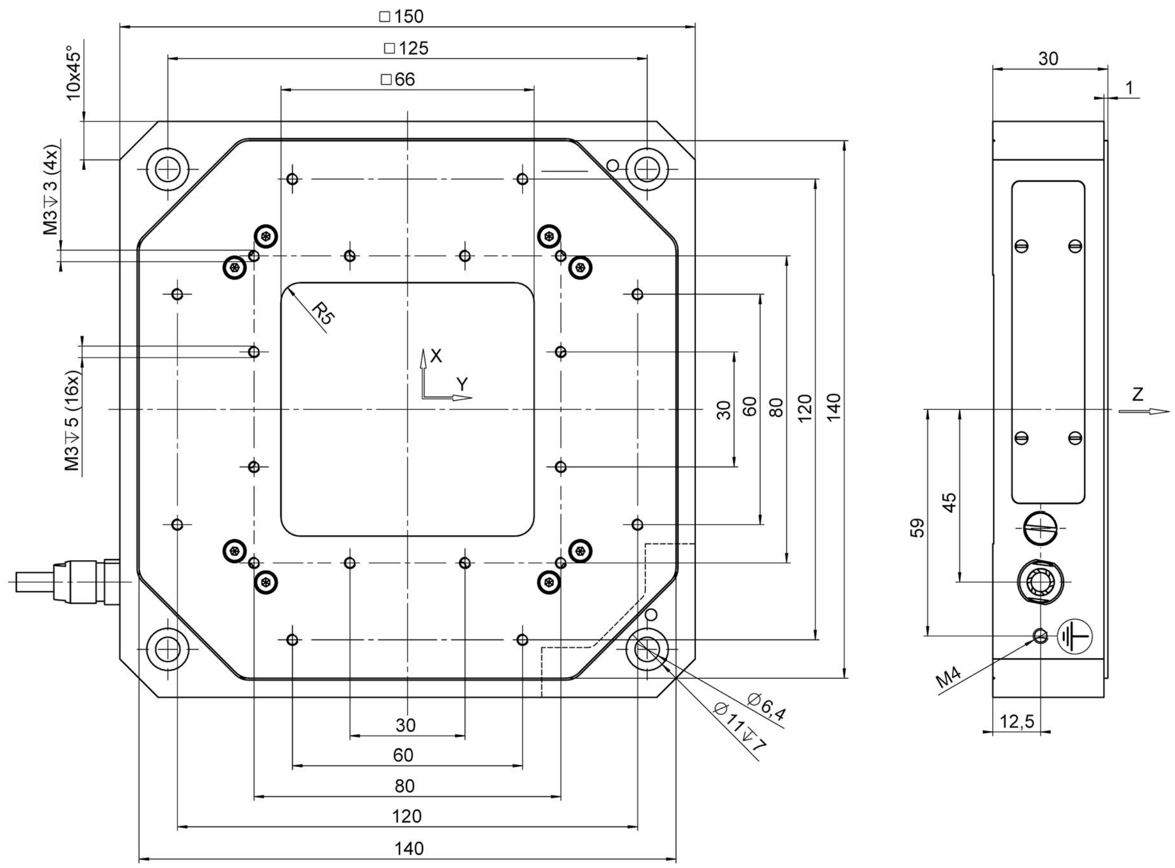
Super Invar and titanium versions available.
Ask about customized versions.

Drawings / Images



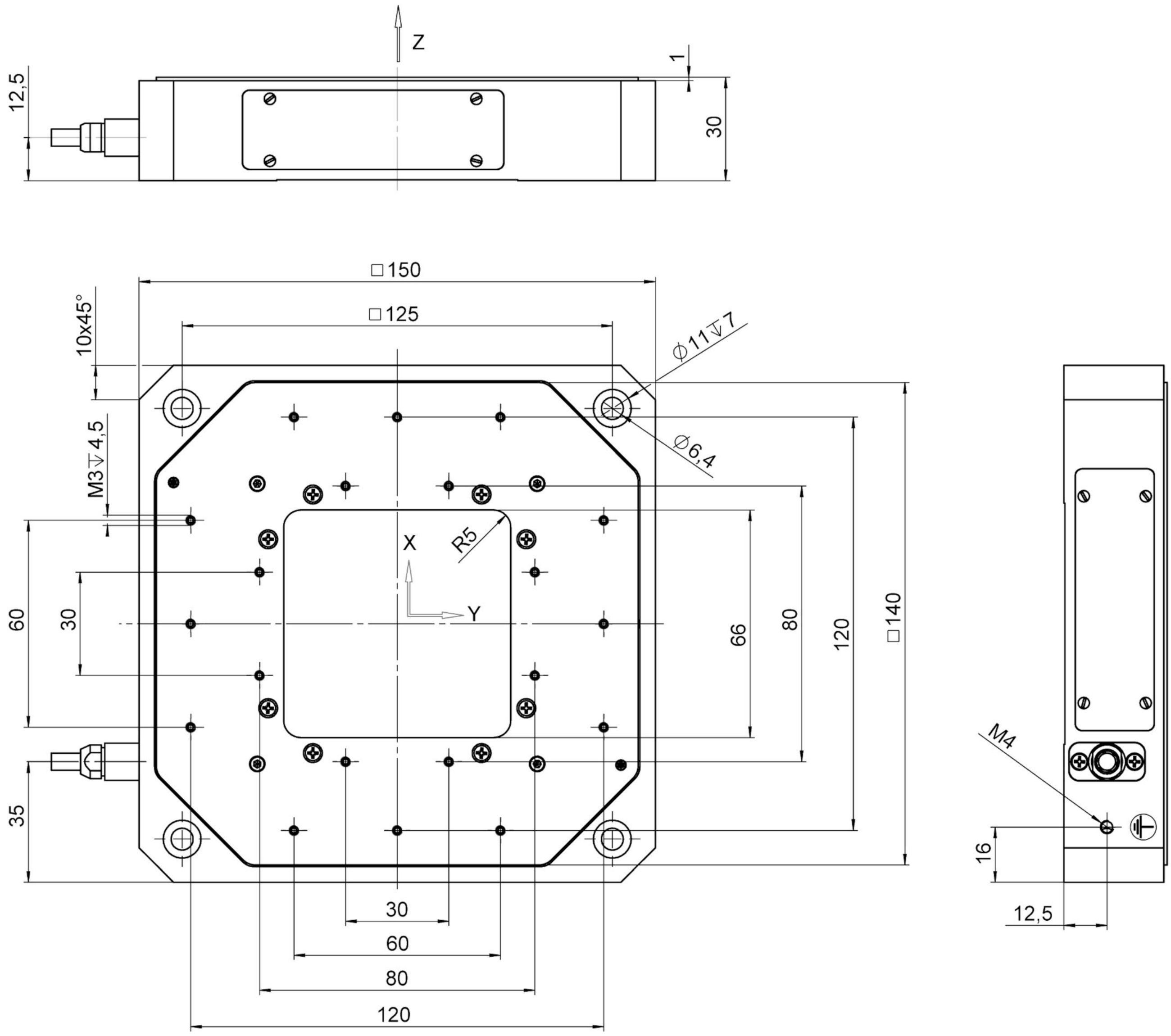
Response behavior of the P-562.3CD: Step-and-settle in less than 10 ms in X, Y, and Z.

Drawings / Images



P-56x.3CD and P-56x.3CL, dimensions in mm. Note that a comma is used in the drawings instead of a decimal point.

Drawings / Images



P-561.3DD, dimensions in mm. Note that a comma is used in the drawings instead of a decimal point.

Order Information

P-561.3CD
PIMars nanopositioning stage; 100 µm × 100 µm × 100 µm travel range (X × Y × Z), capacitive, indirect position measuring; D-sub 25W3 (m)

P-561.3CL
PIMars nanopositioning stage; 100 µm × 100 µm × 100 µm travel range (X × Y × Z), capacitive, indirect position measuring; LE-MO LVPZT

P-562.3CD
PIMars nanopositioning stage; 200 µm × 200 µm × 200 µm travel range (X × Y × Z), capacitive, indirect position measuring; D-sub 25W3 (m)

P-562.3CL
PIMars nanopositioning stage; 200 µm × 200 µm × 200 µm travel range (X × Y × Z), capacitive, indirect position measuring; LE-MO LVPZT

P-563.3CD
PIMars nanopositioning stage; 300 µm × 300 µm × 300 µm travel range (X × Y × Z), capacitive, indirect position measuring; D-sub 25W3 (m)

P-563.3CL
PIMars nanopositioning stage; 300 µm × 300 µm × 300 µm travel range (X × Y × Z), capacitive, indirect position measuring; LE-MO LVPZT

P-561.3DD
PIMars nanopositioning stage; 45 µm × 45 µm × 15 µm travel range (X × Y × Z); capacitive, indirect position measuring; D-sub 25W3 (m); direct drive