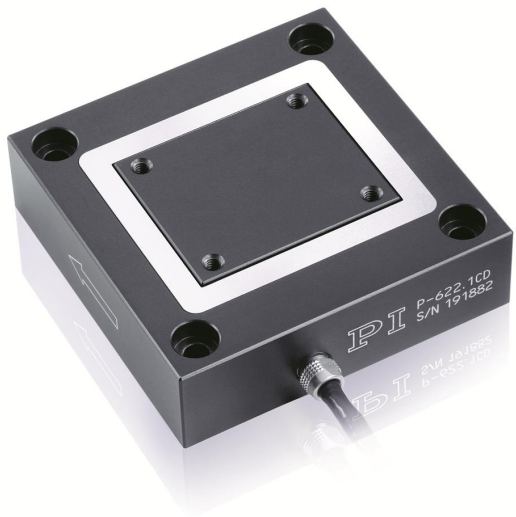
PIHera Linear Precision Positioner

Variable Travel Ranges and Axis Configuration



P-620.1 - P-629.1

- Travel ranges 50 to 1800 µm
- Resolution to 0.1 nm
- Linearity error 0.02 %
- X, XY, Z versions; XYZ combination possible

Application fields

- Interferometry
- Microscopy
- Nanopositioning
- Biotechnology
- Test applications
- Semiconductor technology
- Photonics
- Fiber positioning

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.

Maximum accuracy due to direct position measuring

Motion is measured directly at the motion platform without any influence from the drive or guide elements. This allows optimal repeatability, outstanding stability, and stiff, fast-responding control.

Motion	Unit	Tolerance	P-620.10L	P-620.1CD	P-620.1CL	P-621.10L	P-621.1CD	P-621.1CL	P-622.10L	P-622.1CD
Active axes			X	X	X	X	X	X	X	X
Travel range in X	µm			50	50		100	100		250
Travel range in X, open loop	µm	±20%	60	60	60	120	120	120	300	300
Linearity error in X	%	Typ.		0.02	0.02		0.02	0.02		0.02
Pitch (Rotational crosstalk in θY with motion in X)	µrad	Typ.	±3	±3	±3	±3	±3	±3	±3	±3
Yaw (Rotational crosstalk in θZ with motion in X)	µrad	Typ.	±3	±3	±3	±3	±3	±3	±3	±3

Positioning	Unit	Tolerance	P-620.10L	P-620.1CD	P-620.1CL	P-621.10L	P-621.1CD	P-621.1CL	P-622.10L	P-622.1CD
Bidirectional repeatability in X	nm	Typ.		1	1		1	1		1
Resolution in X, open loop	nm	Typ.	0.1	0.1	0.1	0.2	0.2	0.2	0.4	0.4
Integrated sensor				Capacitive, direct position measuring	Capacitive, direct position measuring		Capacitive, direct position measuring	Capacitive, direct position measuring		Capacitive, direct position measuring
System resolution in X	nm			0.2	0.2		0.4	0.4		0.7

Drive Properties	Unit	Tolerance	P-620.10L	P-620.1CD	P-620.1CL	P-621.10L	P-621.1CD	P-621.1CL	P-622.10L	P-622.1CD
Drive type			Piezo actuator/PICMA®	Piezo actuator/PICMA®	Piezo actuator/PICMA®	Piezo actuator/PICMA®	Piezo actuator/PICMA®	Piezo actuator/PICMA®	Piezo actuator/PICMA®	Piezo actuator/PICMA®
Maximum power consumption	W		3	3	3	9	9	9	9	9
Electrical capacitance in X	µF	±20%	0.35	0.35	0.35	1.5	1.5	1.5	3.1	3.1
Short-term maximum operating frequency	Hz		367	367	367	267	267	267	133	133

Mechanical Properties	Unit	Tolerance	P-620.10L	P-620.1CD	P-620.1CL	P-621.10L	P-621.1CD	P-621.1CL	P-622.10L	P-622.1CD
Stiffness in X	N/µm	±20%	0.42	0.42	0.42	0.35	0.35	0.35	0.2	0.2
Resonant frequency in X, unloaded	Hz	±20%	1100	1100	1100	800	800	800	400	400
Resonant frequency in X, under load with 20 g	Hz	±20%	550	550	550	520	520	520	340	340
Resonant frequency in X, under load with 120 g	Hz	±20%	260	260	260	240	240	240	185	185
Permissible push force in X	N	Max.	10	10	10	10	10	10	10	10
Permissible push force in Y	N	Max.	10	10	10	10	10	10	10	10
Permissible push force in Z	N	Max.	10	10	10	10	10	10	10	10
Permissible pull force in X	N	Max.	10	10	10	10	10	10	10	10
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 lever amplification	Flexure guide/Flexure guide with lever amplification
Overall mass	g		110	110	110	160	160	160	200	200
Material			Aluminum	Aluminum	Aluminum	Aluminum	Aluminum	Aluminum	Aluminum	Aluminum

Miscellaneous	Unit		P-620.10L	P-620.1CD	P-620.1CL	P-621.10L	P-621.1CD	P-621.1CL	P-622.10L	P-622.1CD
Operating temperature range	°C		-20 to 150	-20 to 80	-20 to 80	-20 to 150	-20 to 80	-20 to 80	-20 to 150	-20 to 80
Connector			LEMO LV-PZT	D-sub 7W2 (m)	LEMO LV-PZT	LEMO LV-PZT	D-sub 7W2 (m)	LEMO LV-PZT	LEMO LV-PZT	D-sub 7W2 (m)
Sensor connector					LEMO for capacitive sensors			LEMO for capacitive sensors		
Cable length	m		1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Recommended controllers / drivers			E-503, E-505, E-610, E-665	E-503, E-505, E-610, E-621, E-625, E-709.1C1L, E-754	E-503, E-505, E-610, E-621, E-625, E-709.1C1L, E-754	E-503, E-505, E-610, E-665	E-503, E-505, E-610, E-621, E-625, E-709.1C1L, E-754	E-503, E-505, E-610, E-621, E-625, E-709.1C1L, E-754	E-503, E-505, E-610, E-665	E-503, E-505, E-610, E-621, E-625, E-709.1C1L, E-754

Motion	Unit	Tolerance	P-622.1CL	P-625.10L	P-625.1CD	P-625.1CL	P-628.10L	P-628.1CD	P-628.1CL	P-629.10L
Active axes			X	X	X	X	X	X	X	X
Travel range in X	µm		250		500	500		800	800	
Travel range in X, open loop	µm	±20%	300	600	600	600	950	950	950	1800
Linearity error in X	%	Typ.	0.02		0.03	0.03		0.03	0.03	
Pitch (Rotational crosstalk in θY with motion in X)	µrad	Typ.	±3	±6	±6	±6	±6	±6	±6	±30
Yaw (Rotational crosstalk in θZ with motion in X)	µrad	Typ.	±3	±6	±6	±6	±6	±6	±6	±10

Positioning	Unit	Tolerance	P-622.1CL	P-625.10L	P-625.1CD	P-625.1CL	P-628.10L	P-628.1CD	P-628.1CL	P-629.10L
Bidirectional repeatability in X	nm	Typ.	1		5	5		10	10	
Resolution in X, open loop	nm	Typ.	0.4	0.5	0.5	0.5	0.5	0.5	0.5	2
Integrated sensor			Capacitive, direct position measuring		Capacitive, direct position measuring	Capacitive, direct position measuring		Capacitive, direct position measuring	Capacitive, direct position measuring	
System resolution in X	nm		0.7		1.4	1.4		1.8	1.8	

Drive Properties	Unit	Tolerance	P-622.1CL	P-625.10L	P-625.1CD	P-625.1CL	P-628.10L	P-628.1CD	P-628.1CL	P-629.10L
Drive type			Piezo actuator/PICMA®	Piezo actuator/PICMA®	Piezo actuator/PICMA®	Piezo actuator/PICMA®	Piezo actuator/PICMA®	Piezo actuator/PICMA®	Piezo actuator/PICMA®	Piezo actuator/PICMA®
Maximum power consumption	W		9	10	10	10	18	18	18	49
Electrical capacitance in X	µF	±20%	3.1	6.2	6.2	6.2	19	19	19	52
Short-term maximum operating frequency	Hz		133	72	72	72	42	42	42	42

Mechanical Properties	Unit	Toleran-ce	P-622.1CL	P-625.10L	P-625.1CD	P-625.1CL	P-628.10L	P-628.1CD	P-628.1CL	P-629.10L
Stiffness in X	N/µm	±20%	0.2	0.1	0.1	0.1	0.12	0.12	0.12	0.13
Resonant frequency in X, unloaded	Hz	±20%	400	215	215	215	125	125	125	125
Resonant frequency in X, under load with 20 g	Hz	±20%	340	180	180	180	115	115	115	120
Resonant frequency in X, under load with 120 g	Hz	±20%	185	110	110	110	90	90	90	110
Permissible push force in X	N	Max.	10	10	10	10	10	10	10	10
Permissible push force in Y	N	Max.	10	10	10	10	10	10	10	8
Permissible push force in Z	N	Max.	10	10	10	10	10	10	10	10
Permissible pull force in X	N	Max.	10	10	10	10	10	10	10	10
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 lever amplification	Flexure guide/Flexure guide with lever amplification
Overall mass	g		200	240	240	240	380	380	380	720
Material			Aluminum	Aluminum	Aluminum	Aluminum	Aluminum	Aluminum	Aluminum	Aluminum

Miscellaneous	Unit		P-622.1CL	P-625.10L	P-625.1CD	P-625.1CL	P-628.10L	P-628.1CD	P-628.1CL	P-629.10L
Operating temperature range	°C		-20 to 80	-20 to 150	-20 to 80	-20 to 80	-20 to 150	-20 to 80	-20 to 80	-20 to 150
Connector			LEMO LV-PZT	LEMO LV-PZT	D-sub 7W2 (m)	LEMO LV-PZT	LEMO LV-PZT	D-sub 7W2 (m)	LEMO LV-PZT	LEMO LV-PZT
Sensor connector			LEMO for capacitive sensors			LEMO for capacitive sensors			LEMO for capacitive sensors	
Cable length	m		1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Recommended controllers / drivers			E-503, E-505, E-610, E-621, E-625, E-709.1C1L, E-754	E-503, E-505, E-610, E-665	E-503, E-505, E-610, E-621, E-625, E-709.1C1L, E-754	E-503, E-505, E-610, E-621, E-625, E-709.1C1L, E-754	E-503, E-505, E-610, E-665	E-503, E-505, E-610, E-621, E-625, E-709.1C1L, E-754	E-503, E-505, E-610, E-621, E-625, E-709.1C1L, E-754	E-503, E-505, E-610, E-665

Motion	Unit	Toleran-ce	P-629.1CD	P-629.1CL
Active axes			X	X
Travel range in X	µm		1500	1500
Travel range in X, open loop	µm	±20%	1800	1800
Linearity error in X	%	Typ.	0.03	0.03
Pitch (Rotational crosstalk in θY with motion in X)	µrad	Typ.	±30	±30
Yaw (Rotational crosstalk in θZ with motion in X)	µrad	Typ.	±10	±10

Positioning	Unit	Toleran-ce	P-629.1CD	P-629.1CL
Bidirectional repeatability in X	nm	Typ.	14	14
Resolution in X, open loop	nm	Typ.	2	2
Integrated sensor			Capacitive, direct position measuring	Capacitive, direct position measuring
System resolution in X	nm		3	3

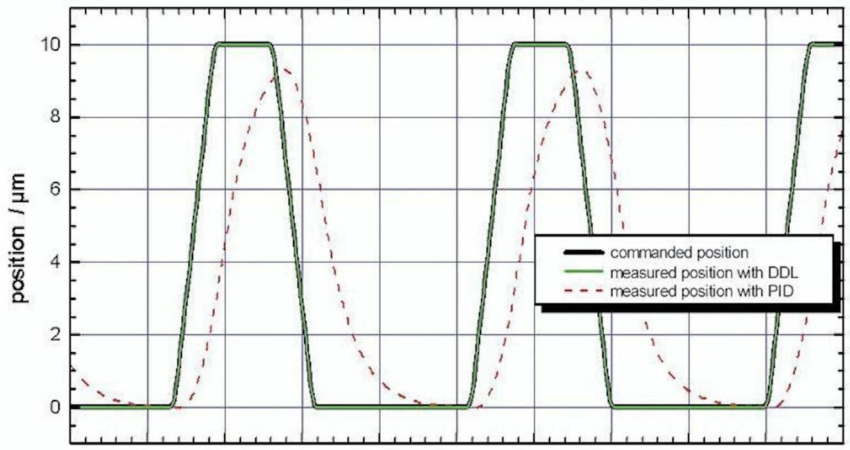
Drive Properties	Unit	Toleran-ce	P-629.1CD	P-629.1CL
Drive type			Piezo actuator/PICMA®	Piezo actuator/PICMA®
Maximum power con-sumption	W		49	49
Electrical capacitance in X	µF	±20%	52	52
Short-term maximum operating frequency	Hz		42	42

Mechanical Properties	Unit	Toleran-ce	P-629.1CD	P-629.1CL
Stiffness in X	N/µm	±20%	0.13	0.13
Resonant frequency in X, unloaded	Hz	±20%	125	125
Resonant frequency in X, under load with 20 g	Hz	±20%	120	120
Resonant frequency in X, under load with 120 g	Hz	±20%	110	110
Permissible push force in X	N	Max.	10	10
Permissible push force in Y	N	Max.	8	8
Permissible push force in Z	N	Max.	10	10
Permissible pull force in X	N	Max.	10	10
Guide			Flexure guide/Flexure guide with lever amplification	Flexure guide/Flexure guide with lever amplification
Overall mass	g		720	720
Material			Aluminum	Aluminum

Miscellaneous	Unit		P-629.1CD	P-629.1CL
Operating temperature range	°C		-20 to 80	-20 to 80
Connector			D-sub 7W2 (m)	LEMO LVPZT
Sensor connector				LEMO for capacitive sensors
Cable length	m		1.5	1.5
Recommended controllers / drivers			E-503, E-505, E-610, E-621, E-625, E-709.1C1L, E-754	E-503, E-505, E-610, E-621, E-625, E-709.1C1L, E-754

P-628.1CD / P-628.1CL: Linearity error in X (typ.) 0.03 % with digital controller. With analog controllers 0.05 %.
P-629.1CD / P-629.1CL: Linearity error in X (typ.) 0.03 % with digital controller. With analog controllers 0.08 %.
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.
Vacuum versions to 10^{-9} hPa are available under the P-62x.1U order numbers.
All specifications based on room temperature (22 °C ±3 °C).

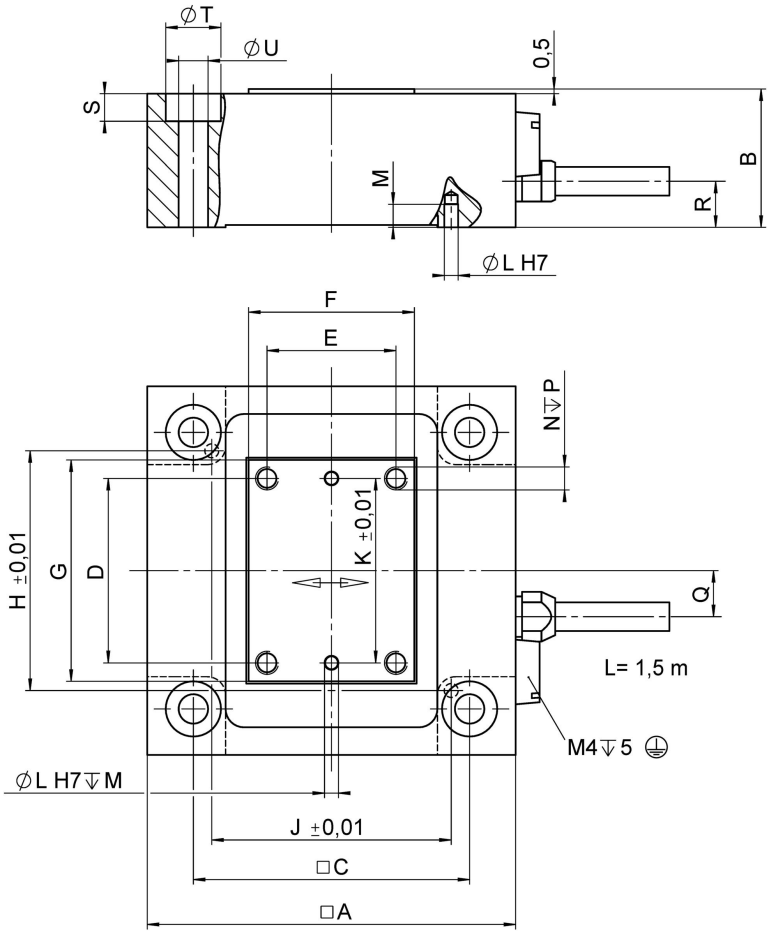
Drawings / Images



Rapid scanning motion of a P-621.1CD (specified rise time: 5 ms) with a digital controller with 16-bit sensor resolution and DDL option. The digital dynamic linearization reduces the tracking error during scanning to <20 nm. The improvement over a standard PID controller is up to 3 orders of magnitude and increases with the frequency.

Drawings / Images

	A	B	C	D	E	F	G	H	J	K	∅L	M	N	P	Q	R	S	∅T	∅U
P-620.1CD / 10L	30	12	24	15	12	15	18	19	24	15	1,01	1,5	M2	4	4,5	6	2	4,4	2,2
P-621.1CD / 10L	40	15	30	20	14	18	24	26	26	20	1,51	2,5	M2,5	5	5	5	3	6	3,2
P-622.1CD / 10L	50	15	40	24	20	25	30	35	35	24	1,51	2,5	M2,5	5	5,5	5	3	6	3,2
P-625.1CD / 10L	60	15	50	40	27	32	44,5	46	46	40	1,51	2,5	M2,5	5	5,5	5	3	6	3,2
P-628.1CD / 10L	80	17	70	58	41	45	63	66	66	58	1,51	2,5	M2,5	5	5,5	5	3	6	3,2
P-629.1CD / 10L	100	22,5	90	60	40	60	84	82	82	60	2,01	3,5	M2,5	5	10	7,5	4	8	4,3



P-62x.1CD/.1CL/.10L, dimensions in mm.

Order Information

P-620.10L
PIHera precision linear nanopositioner, 60 µm, without sensor, LEMO connector

P-620.1CD
PIHera precision linear nanopositioner, 50 µm, direct position measuring, capacitive sensor, D-sub connector

Order Information

P-620.1CL
PIHera precision linear nanopositioner, 50 µm, direct position measuring, capacitive sensor, LEMO connectors

P-621.10L
PIHera precision linear nanopositioner, 120 µm, without sensor, LEMO connector

P-621.1CD
PIHera precision linear nanopositioner, 100 µm, direct position measuring, capacitive sensor, D-sub connector

P-621.1CL
PIHera precision linear nanopositioner, 100 µm, direct position measuring, capacitive sensor, LEMO connectors

P-622.10L
PIHera precision linear nanopositioner, 300 µm, without sensor, LEMO connector

P-622.1CD
PIHera precision linear nanopositioner, 250 µm, direct position measuring, capacitive sensor, D-sub connector

P-622.1CL
PIHera precision linear nanopositioner, 250 µm, direct position measuring, capacitive sensor, LEMO connectors

P-625.10L
PIHera precision linear nanopositioner, 600 µm, without sensor, LEMO connector

P-625.1CD
PIHera precision linear nanopositioner, 500 µm, direct position measuring, capacitive sensor, D-sub connector

P-625.1CL
PIHera precision linear nanopositioner, 500 µm, direct position measuring, capacitive sensor, LEMO connectors

P-628.10L
PIHera precision linear nanopositioner, 950 µm, without sensor, LEMO connector

P-628.1CD
PIHera precision linear nanopositioner, 800 µm, direct position measuring, capacitive sensor, D-sub connector

P-628.1CL
PIHera precision linear nanopositioner, 800 µm, direct position measuring, capacitive sensor, LEMO connectors

P-629.10L
PIHera precision linear nanopositioner, 1800 µm, without sensor, LEMO connector

P-629.1CD
PIHera precision linear nanopositioner, 1500 µm, direct position measuring, capacitive sensor, D-sub connector

P-629.1CL
PIHera precision linear nanopositioner, 1500 µm, direct position measuring, capacitive sensor, LEMO connectors