

P-620.1 – P-629.1 PIHera® Piezo Linear Stage Compact Nanopositioning System Family with Long Travel Ranges



PIHera® piezo nanopositioning systems feature travel ranges from 50 to 1800 µm

- Travel Ranges 50 to 1800 µm
- High-Precision, Cost-Efficient
- Resolution to 0.1 nm
- Direct Metrology with Capacitive Sensors
- 0.02 % Positioning Accuracy
- Frictionless, High-Precision Flexure Guiding System
- Outstanding Lifetime Due to PICMA® Piezo Actuators
- X-, XY-, Z-, XYZ Versions
- Vacuum-Compatible Versions Available

Single-axis PIHera® systems are piezo-nanopositioning stages featuring travel ranges from 50 to 1800 µm. Despite the increased travel ranges, the units are extremely compact and provide rapid response and high guiding precision. This and the long travel range is achieved with a friction-free and extremely stiff flexure system.

The PIHera® piezo nanopositioning series also includes Z- and XY-stages (see p. 2-40, p. 2-54).

Nanometer Precision in Milliseconds

One of the advantages of PIHera® stages over motor-driven positioning stages is the rapid response to input changes and the fast and precise settling behavior. The P-622.1CD, for example, can settle to an accuracy of 10 nm in only 30 msec (other PI stages provide even faster response)!

Superior Accuracy With Direct-Metrology Capacitive Sensors

A choice of tasks such as optical path adjustment in interferometry, sample positioning in microscopy, precision alignment or optical tracking require

the relatively long scanning ranges and nanometer precision offered by PIHera® nanopositioning stages.

PI's proprietary capacitive sensors measure position directly and without physical contact. They are free of friction and hysteresis, a fact which, in combination with the positioning resolution of well under 1 nm, makes it possible to achieve very high levels of linearity. A further advantage of direct metrology with capacitive sensors is the high phase fidelity and the high bandwidth of up to 10 kHz.

Designed for Precision

High stiffness is achieved with the FEA-optimized design of the frictionless flexure elements, which assure excellent guiding accuracy and dynamics. A straightness and flatness in the nanometer range is achieved.

Ordering Information

P-620.1CD* / P-620.1CL*
PIHera® Precision Piezo Linear Nanopositioning System, 50 µm, Direct Metrology, Capacitive Sensor

P-621.1CD* / P-621.1CL*
PIHera® Precision Piezo Linear Nanopositioning System, 100 µm, Direct Metrology, Capacitive Sensor

P-622.1CD* / P-622.1CL*
PIHera® Precision Piezo Linear Nanopositioning System, 250 µm, Direct Metrology, Capacitive Sensor

P-625.1CD* / P-625.1CL*
PIHera® Precision Piezo Linear Nanopositioning System, 500 µm, Direct Metrology, Capacitive Sensor

P-628.1CD* / P-628.1CL*
PIHera® Precision Piezo Linear Nanopositioning System, 800 µm, Direct Metrology, Capacitive Sensor

P-629.1CD* / P-629.1CL*
PIHera® Precision Piezo Linear Nanopositioning System, 1500 µm, Direct Metrology, Capacitive Sensor

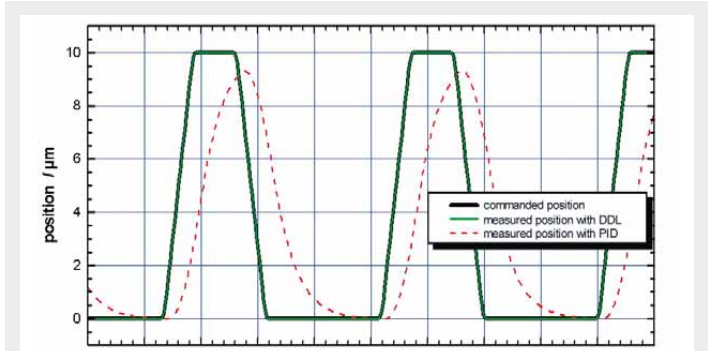
*.1CD with Sub-D Connector
*.1CL with LEMO Connector

Open-loop versions are available as P-62x.10L.

Vacuum versions to 10⁻⁹ hPa are available as P-62x.1UD.

System properties

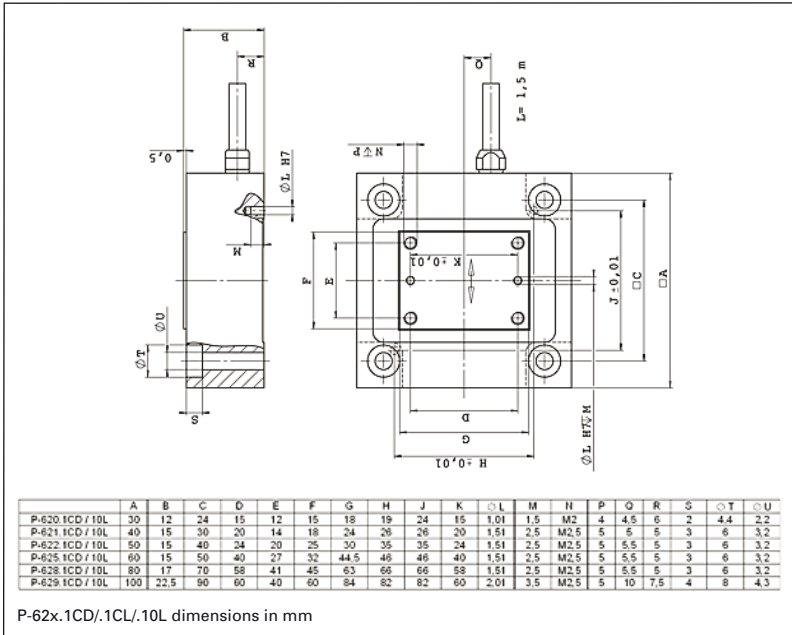
System configuration	P-625.1CD and E-500 modular piezo controller system with E-505.00F amplifier and E-509.C1A servo controller; 250 g load
Closed-loop amplifier bandwidth, large signal	30 Hz
Settling time (full travel)	31 ms



Rapid scanning motion of a P-621.1CD (commanded rise time 5 ms) with the E-710 controller ##600300 and Digital Dynamic Linearization (DDL) option. DDL virtually eliminates the tracking error (<20 nm) during the scan. The improvement over a classical PI controller is up to 3 orders of magnitude, and increases with the scanning frequency

Application Examples

- Interferometry
- Microscopy
- Nanopositioning
- Biotechnology
- Quality assurance testing
- Semiconductor technology



Technical Data

Model	P-620.1CD/ P-620.1CL	P-621.1CD/ P-621.1CL	P-622.1CD/ P-622.1CL	P-625.1CD/ P-625.1CL	P-628.1CD/ P-628.1CL	P-629.1CD/ P-629.1CL	P-62x.10L open-loop version	Units	Tolerance	
Active axes	X	X	X	X	X	X	X			
Motion and positioning										
Integrated sensor	Capacitive	Capacitive	Capacitive	Capacitive	Capacitive	Capacitive	–			
Open-loop travel, -20 to +120 V	60	120	300	600	950	1800	as P-62x.1CD	µm	min. (+20%/0%)	
Closed-loop travel	50	100	250	500	800	1500	–	µm	calibrated	
Closed-loop / open-loop resolution	0.2 / 0.1	0.4 / 0.2	0.7 / 0.4	1.4 / 0.5	1.8 / 0.5	3 / 2	as P-62x.1CD	nm	typ.	
Linearity, closed-loop	0.02	0.02	0.02	0.02	0.03*	0.03**	–	%	typ.	
Repeatability	±1	±1	±1	±5	±10	±14	–	nm	typ.	
Pitch / yaw	±3	±3	±3	±6	±6	±10	as P-62x.1CD	µrad	typ.	
Mechanical properties										
Stiffness in motion direction	0.42	0.35	0.2	0.1	0.12	0.13	as P-62x.1CD	N/µm	±20%	
Unloaded resonant frequency	1100	800	400	215	125	125	as P-62x.1CD	Hz	±20%	
Resonant frequency @ 20 g	550	520	340	180	115	120	as P-62x.1CD	Hz	±20%	
Resonant frequency @ 120 g	260	240	185	110	90	110	as P-62x.1CD	Hz	±20%	
Push/pull force capacity in motion direction	10	10	10	10	10	10	as P-62x.1CD	N	Max.	
Load capacity	10	10	10	10	10	10	as P-62x.1CD	N	Max.	
Lateral Force	10	10	10	10	10	8	as P-62x.1CD	N	Max.	
Drive properties										
Ceramic type	PICMA® P-883	PICMA® P-885	PICMA® P-885	PICMA® P-885	PICMA® P-887	PICMA® P-888	as P-62x.1CD			
Electrical capacitance	0.35	1.5	3.1	6.2	19	52	as P-62x.1CD	µF	±20%	
Dynamic operating current coefficient	0.9	1.9	1.9	1.6	3	4.3	as P-62x.1CD	µA/(Hz • µm)	±20%	
Miscellaneous										
Operating temperature range	-20 to 80	-20 to 80	-20 to 80	-20 to 80	-20 to 80	-20 to 80	-20 to 150	°C		
Material	Aluminum	Aluminum	Aluminum	Aluminum	Aluminum	Aluminum	Aluminum			
Dimensions	30 x 30 x 12	40 x 40 x 15	50 x 50 x 15	60 x 60 x 15	80 x 80 x 17	100 x 100 x 22.5	as P-62x.1CD	mm		
Mass	0.11	0.16	0.2	0.24	0.38	0.72	as P-62x.1CD	kg	±5%	
Cable length	1.5	1.5	1.5	1.5	1.5	1.5	1.5 m		±10 mm	
Sensor / voltage connection	CD version: Sub-D special CL version: LEMO	CD version: Sub-D special CL version: LEMO	CD version: Sub-D special CL version: LEMO	CD version: Sub-D special CL version: LEMO	CD version: Sub-D special CL version: LEMO	CD version: Sub-D special CL version: LEMO	LEMO (no sensor)			

Resolution of PI Piezo Nanopositioners is not limited by friction or stiction. The value given is noise equivalent motion with E-710 controller (p. 2-128).
 *With digital controller. For analog controller 0.05%.
 **With digital controller. For analog controller 0.07%.
 Recommended controller / amplifier
 CD version: E-610 servo controller / amplifier (p. 2-110), E-625 servo controller, bench-top (p. 2-114), E-665 powerful servo controller, bench-top (p. 2-116)
 Single-channel digital controller: E-753 (bench-top) (p. 2-108)
 CL version: E-500 modular piezo controller system (p. 2-142) with E-505 amplifier module (high power) p. 2-147 and E-509 controller (p. 2-152)
 Open-loop version: E-500 modular piezo controller system (p. 2-142) with E-505 amplifier module (high power) (p. 2-147)