

P-620.1 – P-629.1

PIHera® Miniature Long-Range Piezo Nanopositioning Stages with Direct Metrology



- Travel to 1800 µm
- Compact Design
- Resolution <1 nm
- Frictionless Precision Flexure Guiding System
- PICMA® High-Performance Piezo Drives
- Direct Metrology with Capacitive Sensors for Highest Precision
- Up to 0.02 % Position Accuracy
- X, XY, Z, XYZ Versions
- Vacuum-Compatible Versions

P-620.1CD – P-629.1CD 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 sub-nanometer resolution. The long travel range is achieved with a newly designed, friction-free and extremely stiff flexure system, which also offers rapid response and excellent guiding accuracy (typically less than 5 µrad pitch/yaw over the full travel range).

Application Examples

- (Dynamic) interferometry
- Microscopy
- Nanopositioning
- Biotechnology
- Quality assurance
- Semiconductor technology

Superior Accuracy Through Direct-Motion Metrology with Capacitive Sensors

The capacitive-sensor-equipped versions provide motion linearity to 0.02 % with effective resolution in the sub-nanometer range. PI capacitive sensors are absolute-measuring, direct-metrology devices that boast

very high bandwidth and exhibit no periodic errors.

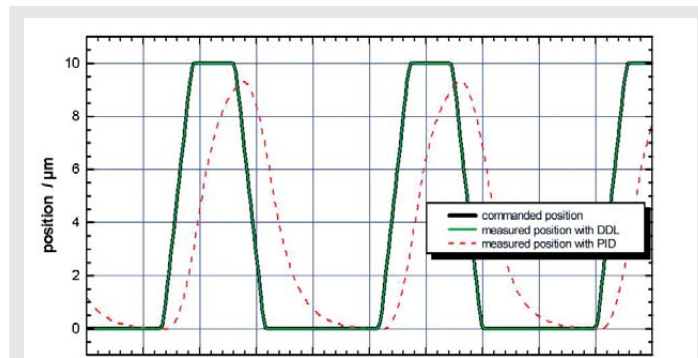
Unlike conventional sensors, capacitive sensors measure the actual distance between the fixed frame and the moving part of the stage. They detect errors contributed by all components in the drive train—from the actuator through the flexures to the platform. This results in higher motion linearity, long-term stability, phase fidelity, and—because external disturbances are seen by the sensor immediately—a stiffer, faster-responding servo-loop. See p. 2-4 ff. and p. 5-2 ff. for more information.

Nanometer Precision in Milliseconds

One of the advantages of PIHera® stages over motor-driven positioning stages is the rapid response to input changes and 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)!

Single & Multi-Axis Versions

See page 2-42 and page 2-54 for Z and XY versions. XZ and XYZ combinations can be assembled without adapters.



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

Ordering Information

P-620.1CD * / P-620.1CL *
PIHera® Nanopositioning System, 50 µm, Capacitive Sensors

P-620.10L
PIHera® Nanopositioning System, 60 µm, Open-Loop, LEMO Conn.

P-621.1CD * / P-621.1CL *
PIHera® Nanopositioning System, 100 µm, Capacitive Sensors

P-621.10L
PIHera® Nanopositioning System, 120 µm, Open-Loop, LEMO Conn.

P-622.1CD * / P-622.1CL *
PIHera® Nanopositioning System, 250 µm, Capacitive Sensors

P-622.10L
PIHera® Nanopositioning System, 300 µm, Open-Loop, LEMO Conn.

P-625.1CD * / P-625.1CL *
PIHera® Nanopositioning System, 500 µm, Capacitive Sensors

P-625.10L
PIHera® Nanopositioning System, 600 µm, Open-Loop, LEMO Conn.

P-628.1CD * / P-628.1CL
PIHera® Nanopositioning System, 800 µm, Capacitive Sensors

P-628.10L
PIHera® Nanopositioning System, 950 µm, Open-Loop, LEMO Conn.

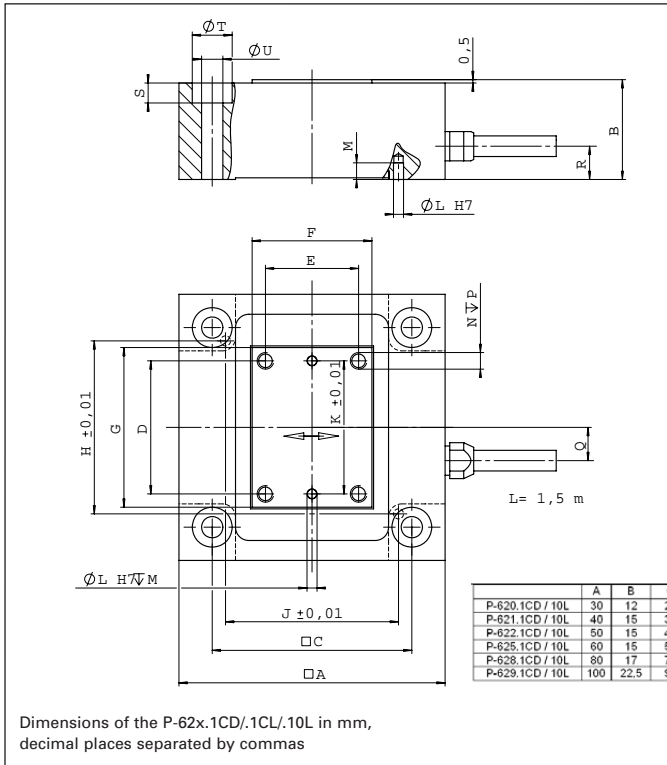
P-629.1CD * / P-629.1CL *
PIHera® Nanopositioning System, 1500 µm, Capacitive Sensors

P-629.10L
PIHera® Nanopositioning System, 1800 µm, Open-Loop, LEMO Conn.

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

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

Custom sizes & specifications available!



	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

Piezo Actuators

Nanopositioning & Scanning Systems

Active Optics / Steering Mirrors

Tutorial: Piezo-electrics in Positioning

Capacitive Position Sensors

Piezo Drivers & Nanopositioning Controllers

Hexapods / Micropositioning

Photonics Alignment Solutions

Motion Controllers

Ceramic Linear Motors & Stages

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Technical Data

Models	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	Units
Active axes	X	X	X	X	X	X	X	
Open-loop travel -20 to 120 V	60	120	300	600	950	1800	see P-62x.1CD	µm
Closed-loop travel	50	100	250	500	800	1500	-	µm
Integrated feedback sensor	capacitive	capacitive	capacitive	capacitive	capacitive	capacitive	-	
* 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	2.5 / 2.0	- / see P-62x.1CD	nm
Closed-loop linearity (typ.)	0.02	0.02	0.02	0.03	0.03	0.03	-	%
Stiffness	0.42	0.35	0.15	0.10	-	0.13	see P-62x.1CD	N/µm
Push / pull force capacity (in X)	10/5	10/8	10/8	10/8	10/8	10/8	see P-62x.1CD	N
Max. Load	10	10	10	10	10	10	see P-62x.1CD	N
Lateral force limit	10	10	10	10	10	10	see P-62x.1CD	N
Tilt (θ _y , θ _z) (typ.)	3	3	3	6	6	30/10	see P-62x.1CD	µrad
Electrical capacitance	0.75	1.5	3.0	6.0	18.6	-	see P-62x.1CD	µF ±20%
Dynamic operating current coefficient (DOCC)	1.9	1.9	1.5	1.5	-	-	see P-62x.1CD	µA/(Hz x µm)
Unloaded resonant frequency	1240	800	400	215	125	125	see P-62x.1CD	Hz ±20%
Resonant frequency @ 20 g load	550	520	340	180	115	-	see P-62x.1CD	Hz ±20%
Resonant frequency @ 120 g load	260	240	185	110	90	110	see P-62x.1CD	Hz ±20%
Operating temperature range	-40 - 120	-40 - 120	-40 - 120	-40 - 120	-40 - 120	-40 - 120	-40 - 150	°C
Voltage Connection	D **	D **	D **	D **	D **	D **	VL	
Sensor Connection	D **	D **	D **	D **	D **	D **	-	
Weight (with cables)	108	158	195	238	375	720		g ±5%
Body material	Al	Al	Al	Al	Al	Al	Al	
Recommended amplifier/controller (codes explained p. 2-17)	F, M, L, H	F, M, L, H	F, M, L, H	F, M, L, H	F, M, L, H	F, M, L, H	C, G	

* For calibration information see p. 2-8. Resolution of PI piezo nanopositioners is not limited by friction or stiction. The value given is noise equivalent motion with E-710 controller
 ** Version .1CL with Lemo connectors.