

P-620.1CD
P-621.1CD
P-622.1CD
P-625.1CD

PIHera™ Compact Long-Range Piezo Nano-Translation Stages

>> Click <http://www.pi.ws/fwd/Piezo-Stage> for the Latest Specs on these Products

Ordering Information

P-620.1CD

PIHera™ Nanopositioning System, 50 μm, Capacitive Sensors, Sub-D Connector

P-620.1CL

PIHera™ Nanopositioning System, 50 μm, Capacitive Sensors, LEMO Connectors

P-620.10L

PIHera™ Nanopositioning System, 100 μm, Open-Loop, LEMO Connector

P-621.1CD

PIHera™ NanoPositioning System, 100 μm, Capacitive Sensors, Sub-D Connector

P-621.1CL

PIHera™ NanoPositioning System, 100 μm, Capacitive Sensors, LEMO Connectors

P-621.10L

PIHera™ NanoPositioning System, 100 μm, Open-Loop, LEMO Connector

P-622.1CD

PIHera™ NanoPositioning System, 250 μm, Capacitive Sensors, Sub-D Connector

P-622.1CL

PIHera™ NanoPositioning System, 250 μm, Capacitive Sensors, LEMO Connectors

P-622.10L

PIHera™ NanoPositioning System, 250 μm, Open-Loop, LEMO Connector

P-625.1CD

PIHera™ NanoPositioning System, 500 μm, Capacitive Sensors, Sub-D Connector

P-625.1CL

PIHera™ NanoPositioning System, 500 μm, Capacitive Sensors, LEMO Connectors

P-625.10L

PIHera™ NanoPositioning System, 500 μm, Open-Loop, LEMO Connector

Vacuum versions available!

XY & Z Versions: See separate Datasheets.

Custom sizes & specifications available!



P-622.1CD, P-621.1CD, P-620.1CD and P-625.1CD PIHera™ piezo nano-translation stages, from left to right (credit card for size comparison).

- **Travel to 500 μm**
- **Compact Design**
- **Resolution < 1 nm**
- **Low Cost**
- **New Longlife Piezo Drive**
- **Capacitive Feedback (Closed-Loop)**
- **0.01 % Position Accuracy**
- **X, XY, Z, XYZ Versions**
- **Vacuum-Compatible Versions**

P-620.1CD - P-625.1CD PIHera™ systems are piezo nano-translation stages featuring travel ranges from 50 to 500 μm. Despite the increased travel ranges the units are extremely compact, while providing sub-nanometer resolution. The long travel range is achieved with a newly designed, friction-free and extremely stiff flexure system which also

offers excellent guiding accuracy (typically less than 5 μrad pitch/yaw over the full travel range) and rapid settling.

Multi-Axis Versions, X, XY, Z, XYZ

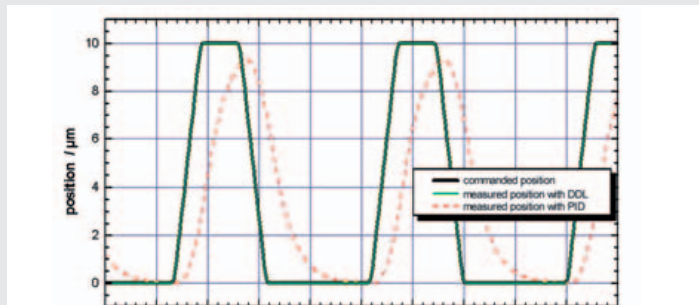
PIHera™ stages are also available in XY and Z versions. XZ and XYZ combinations can be assembled (no adapters required).

Superior Accuracy Through Direct-Motion-Metrology Capacitive Feedback Sensors

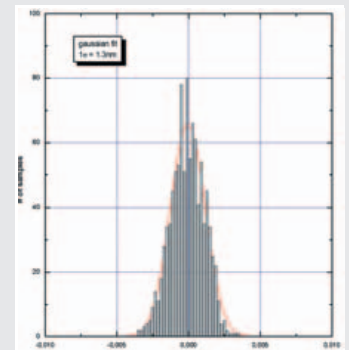
Applications such as optical path control in interferometry, or sample positioning in microscopy require long travel ranges with nanometer positioning accuracy. PIHera™

offers travel ranges to 500 μm. The closed-loop versions are equipped with non contact, zero friction, direct-measuring two-plate capacitive position sensors. Unlike conventional indirect sensors (such as strain gauge / piezo resistive sensors), they measure the position directly rather than the strain in the actuator / guiding system.

Capacitive sensors are absolute-measuring high-bandwidth devices and show none of the periodic errors found in incremental encoders. This permits motion linearity of better than 0.01 % and effective resolution in the sub-nanometer range. This technique, combined with the inherent precision of the PI two-plate capacitive sensor and the temperature-compensated design,



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.



Position repeatability data of a 100 μm PIHera™ stage show the exceptional precision of these nanopositioning devices.

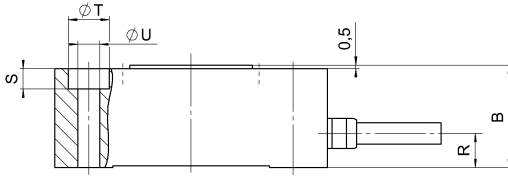
Application Examples

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

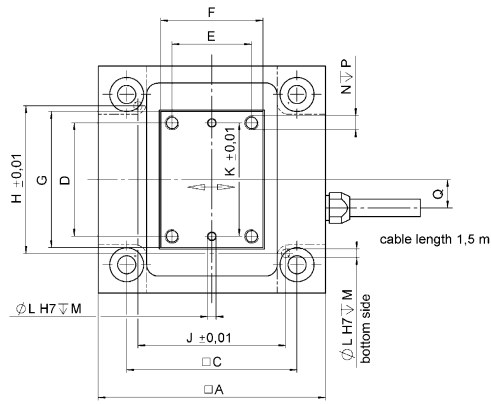


PIHera™ XYZ combination

	A	B	C	D	E	F	G	H	J	K	∅L	M	N	P	Q	R	S	∅T	∅U
P-620.1xx	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-621.1xx	40	15	30	20	14	18	24	26	26	20	1,51	2,5	M2,5	5	5	5	3	6	3,2
P-622.1xx	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-625.1xx	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



Dimensions of the P-62x.1CD/.1CL/.10L in mm, decimal places separated by commas.



Technical Data

Models	P-620.1CD	P-621.1CD	P-622.1CD	P-625.1CD	P-62x.1CL	P-62x.10L	Units
Active axes	X	X	X	X	X	X	
Closed-loop travel	50	100	250	500	same as CD version	—	µm
Min. open-loop travel -20 to 120V	60	120	300	600	same as CD version	same as CD version	mm
Integrated feedback sensor	capacitive	capacitive	capacitive	capacitive	capacitive	—	
Open-loop resolution*	0.1	0.2	0.4	0.5	same as CD version	same as CD version	nm
Closed-loop resolution*	0.2	0.4	0.7	1.4	same as CD version	—	nm
Closed-loop linearity (typ.)	0.01	0.01	0.01	0.01	0.01	—	%
Stiffness	0.42	0.35	0.15	0.1	same as CD version	same as CD version	N/µm
Push/pull force capacity (in X)	10/5	10/8	10/8	10/8	same as CD version	same as CD version	N
Max. Load	10	10	10	10	10	10	N
Lateral force limit	10	10	10	10	10	10	N
Tilt (θ _x , θ _y) (typ.)	3	3	3	6	same as CD version	same as CD version	µrad
Electrical capacitance	0.75	1.5	3.0	6.0	same as CD version	same as CD version	µF ±20%
Unloaded resonant frequency	1240	800	400	215	same as CD version	same as CD version	Hz ±20%
Resonant frequency @ 20 g load	550	520	340	180	same as CD version	same as CD version	Hz ±20%
Resonant frequency @ 120 g load	260	240	185	110	same as CD version	same as CD version	Hz ±20%
Operating temperature range	-40 to 120	-40 to 120	-40 to 120	-40 to 120	-40 to 120	-40 to 150	°C
Voltage and sensor connection	Sub-D special connector	Sub-D special connector	Sub-D special connector	Sub-D special connector	Voltage: LEMO FFA.00.250 male; sensor: 2xLEMO FFA.00.250 female	Voltage: LEMO FFA.00.250, no sensor	
Weight (with cables)	108	158	195	238			g ±5%
Body material	Al	Al	Al	Al	Al	Al	
Recommended controller	E-500 System, E-665, E-750 (digital), E-710 (digital)				E-500 System, E-610		

*Resolution of PI Piezo NanoPositioners is not limited by friction or stiction. Noise equivalent motion with E-710 controller.

<http://www.pi.ws>
info@pi.ws

results in higher linearity scans, and provides superior responsiveness, resolution, repeatability and stability.

Rapid Positioning over Long Ranges

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

Dynamic Digital Control for Best Scanning Linearity

Use our new digital control electronics with the dynamic digital control option for the highest linearity in scanning applications. These systems virtually eliminate tracking errors and permit use of the entire travel range with high dynamic accuracy in the nanometer range.

Increased Lifetime with New Piezoceramic Technology

The PIHera™ stage drive units are based on our P-885 PICMA™ low-voltage multilayer piezo ceramics. These newly designed and highly optimized drives are more robust than conventional piezo actuators, and feature superior lifetime in dynamic and static applications. Because guidance and sensors are all frictionless and maintenance-free, PIHera™ systems achieve exceptional levels of reliability.

P-620.2CD
P-621.2CD
P-622.2CD
P-625.2CD

PIHera™ Compact XY Long-Range Piezo Nano-Translation Stages

Ordering Information

P-620.2CD

PIHera™ XY Nanopositioning System, 50 µm, Capacitive Sensors, Sub-D Connector

P-620.2CL

PIHera™ XY Nanopositioning System, 50 µm, Capacitive Sensors, LEMO Connectors

P-620.20L

PIHera™ XY Nanopositioning System, 50 µm, Open-Loop, LEMO Connector

P-621.2CD

PIHera™ XY Nanopositioning System, 100 µm, Capacitive Sensors, Sub-D Connector

P-621.2CL

PIHera™ XY Nanopositioning System, 100 µm, Capacitive Sensors, LEMO Connectors

P-621.20L

PIHera™ XY Nanopositioning System, 100 µm, Open-Loop, LEMO Connector

P-622.2CD

PIHera™ XY Nanopositioning System, 250 µm, Capacitive Sensors, Sub-D Connector

P-622.2CL

PIHera™ XY Nanopositioning System, 250 µm, Capacitive Sensors, LEMO Connectors

P-622.20L

PIHera™ XY Nanopositioning System, 250 µm, Open-Loop, LEMO Connector

P-625.2CD

PIHera™ XY Nanopositioning System, 500 µm, Capacitive Sensors, Sub-D Connector

P-625.2CL

PIHera™ XY Nanopositioning System, 500 µm, Capacitive Sensors, LEMO Connectors

P-625.20L

PIHera™ XY Nanopositioning System, 500 µm, Open-Loop, LEMO Connector

Vacuum versions available!

X & Z Versions: See separate Datasheets.

Custom sizes & specifications available!



P-621.2CD, P-622.2CD and P-625.2CD PIHera™ XY piezo nano-translation stages, from left to right (CD for size comparison).

- XY-Travel to 500 µm
- Compact Design
- Resolution < 1 nm
- Low Cost
- New Longlife Piezo Drive
- Capacitive Feedback (Closed-Loop)
- 0.01 % Position Accuracy
- X, XY, Z, XYZ Versions
- Vacuum-Compatible Versions

P-620.2CD - P-625.2CD PIHera™ systems are XY piezo nano-translation stages featuring travel ranges from 50 to 500 µm. Despite the increased travel ranges the units are extremely compact, while providing sub-nanometer resolution. The long travel range is achieved with a newly designed, friction-free and extremely stiff flexure system which also offers excellent guiding accuracy (typically less than 5 µrad pitch/yaw over the full travel range) and rapid settling.

Superior Accuracy Through Direct-Motion-Metrology Capacitive Feedback Sensors

Applications such as optical path control in interferometry, or sample positioning in

Multi-Axis Versions, X, XY, Z, XYZ

PIHera™ stages are also available in X, and Z versions. XZ and XYZ combinations can be assembled (no adapters required).

microscopy require long travel ranges with nanometer positioning accuracy. PIHera™ offers travel ranges to 500 µm. The closed-loop versions are equipped with non contact, zero friction, direct-measuring two-plate capacitive position sensors. Unlike conventional indirect sensors (such as strain gauge / piezo resistive sensors), they measure the position directly rather than the strain in the actuator / guiding system. Capacitive sensors are absolute-measuring high-bandwidth devices and show none of the periodic errors found in incremental encoders. This permits motion linearity of better than 0.01 % and effective resolution in the sub-nanometer range. This technique, combined with the inherent precision of the PI two-plate capacitive sensor and the tempera-

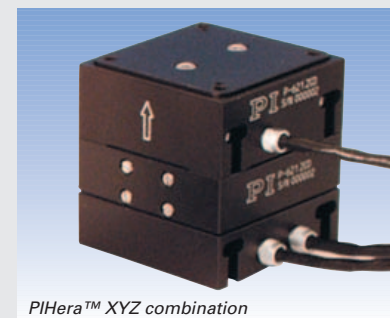
ture-compensated design, results in higher linearity scans, and provides superior responsiveness, resolution, repeatability and stability.

Rapid Positioning over Long Ranges

One of the advantages of PIHera™ stages over (linear) motor driven positioning stages is the rapid response to motion inputs and fast and precise settling behavior. The P-622, for example, can settle to an accuracy of 10 nm in only 30 msec after a 10 mm step (other PI stages provide even faster response)!

Dynamic Digital Control for Best Scanning Linearity

Use our new E-710 digital control electronics with adaptive dynamic digital linearization (DDL) algorithms for the highest linearity in scanning applications. These systems virtually eliminate tracking errors and

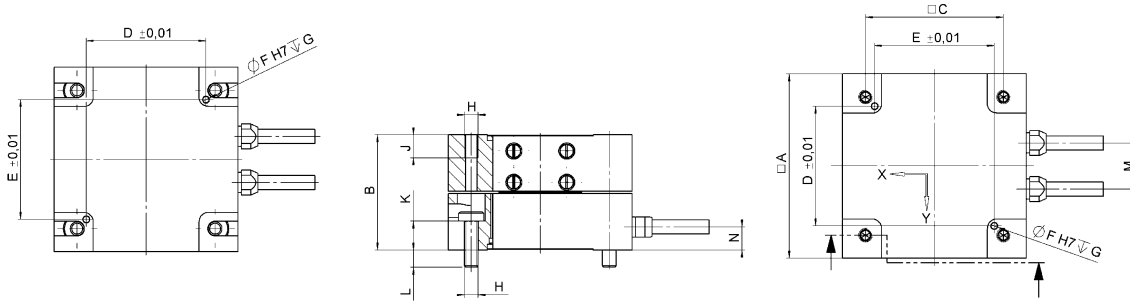


PIHera™ XYZ combination

Application Examples

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

	A	B	C	D	E	∅F	G	H	J	K	L	M	N
P-620.2CD	30	21,5	24	24	19	1,01	1,5	M2	3,5	5,1	3	9	6
P-621.2CD	40	25	30	26	26	1,51	2,5	M3	5	6,25	3,75	10	5
P-622.2CD	50	25	40	35	35	1,51	2,5	M3	5	6,25	3,75	11	5
P-625.2CD	60	25	50	45	45	1,51	2,5	M3	6	6,25	3,75	11	5



Dimensions of the P-62x.2CD/.2CL/.20L in mm, decimal places separated by commas.

permit use of the entire travel range with high dynamic accuracy in the nanometer range.

Increased Lifetime with New Piezoceramic Technology

The PIHera™ stage drive units are based on our P-885 PICMA™ low-voltage multilayer piezo ceramics. These newly designed and highly optimized drives are more robust than conventional piezo actuators, and feature superior lifetime in dynamic and static applications. Because guidance and sensors are all frictionless and maintenance-free, PIHera™ systems achieve exceptional levels of reliability.

Technical Data

Models	P-620.2CD	P-621.2CD	P-622.2CD	P-625.2CD	P-62x.2CL	P-62x.20L	Units
Active axes	X, Y	X, Y	X, Y	X, Y	X, Y	X, Y	
Closed-loop travel per axis	50	100	250	500	same as CD version	—	µm
Min. open-loop travel -20 to 120 V per axis	60	120	300	600	same as CD version	same as CD version	µm
Integrated feedback sensor	capacitive	capacitive	capacitive	capacitive	capacitive	—	
Open-loop resolution*	0.1	0.2	0.4	0.5	same as CD version	same as CD version	nm
Closed-loop resolution*	0.2	0.4	0.7	1.4	same as CD version	—	nm
Closed-loop linearity (typ.)	0.03	0.03	0.03	0.03	0.03	—	%
Stiffness	0.40	0.25	0.20	0.10	same as CD version	same as CD version	N/µm
Push/pull force capacity (in X and Y)	10/5	10/8	10/8	10/8	same as CD version	same as CD version	N
Max. Load	10	10	10	10	10	10	N
Lateral force limit	10	10	10	10	10	10	N
Tilt (θ _x , θ _y) (typ.)	3	3	3		same as CD version	same as CD version	µrad
Electrical capacitance per axis	0.75	1.5	3	6	same as CD version	same as CD version	µF ±20% w
Unloaded resonant frequency (upper/lower axis)	1200/	635/535	435/270	350/150	same as CD version	same as CD version	Hz ±20% ²
Resonant frequency @ 50 g load (upper/lower axis)	395/270	380/365	300/220	280/125	same as CD version	same as CD version	Hz ±20%
Resonant frequency @ 100 g load (upper/lower axis)	300/285	290/285	235/190	210/115	same as CD version	same as CD version	Hz ±20%
Operating temperature range	-40 to 120	-40 to 120	-40 to 120	-40 to 120	-40 to 120	-40 to 150	°C
Voltage and sensor connection	Sub-D special connector	Sub-D special connector	Sub-D special connector	Sub-D special connector	Voltage: 2x LEMO FFA.00. 250 male; sensor: 4x LEMO FFA.00. 250 female	Voltage: 2x LEMO FFA.00. 250, no sensor	
Weight (with cables)	195	295	348	430			g ±5%
Body material	Al	Al	Al	Al	Al	Al	
Recommended controller	E-500 System, E-665, E-750 (digital), E-710 (digital)				E-500 System, E-610		

*Resolution of PI PZT NanoPositioners is not limited by friction or stiction. Noise equivalent motion with E-710 controller.

**P-620.ZCD
P-621.ZCD
P-622.ZCD**

PIHera™ Compact Vertical Piezo Nano-Elevation Stages

Application Examples

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

Ordering Information

P-620.ZCD

PIHera™ Vertical Nanopositioning System, 50 µm, Capacitive Sensors, Sub-D Connector

P-620.ZCL

PIHera™ Vertical Nanopositioning System, 50 µm, Capacitive Sensors, LEMO Connectors

P-620.ZOL

PIHera™ Vertical Nanopositioning System, 50 µm, Open-Loop, LEMO Connector

P-621.ZCD

PIHera™ Vertical Nanopositioning System, 100 µm, Capacitive Sensors, Sub-D Connector

P-621.ZCL

PIHera™ Vertical Nanopositioning System, 100 µm, Capacitive Sensors, LEMO Connectors

P-621.ZOL

PIHera™ Vertical Nanopositioning System, 100 µm, Open-Loop, LEMO Connector

P-622.ZCD

PIHera™ Vertical Nanopositioning System, 250 µm, Capacitive Sensors, Sub-D Connector

P-622.ZCL

PIHera™ Vertical Nanopositioning System, 250 µm, Capacitive Sensors, LEMO Connectors

P-622.ZOL

PIHera™ Vertical Nanopositioning System, 250 µm, Open-Loop, LEMO Connector

Vacuum versions available!
X & XY Versions: See separate Datasheets.
Custom sizes & specifications available!



P-620.ZCL, P-621.ZCL and P-622.ZCL (from left to right) PIHera™ piezo nano-elevation stages (CD for size comparison).

- Z-Travel to 250 µm
- Ultra-Compact Design
- Resolution < 1 nm
- Low Cost
- New Longlife Piezo Drive
- Capacitive Feedback (Closed-Loop)
- 0.01 % Position Accuracy
- X, XY, Z, XYZ Versions
- Vacuum-Compatible Versions

P-620.ZCD - P-622.ZCD PIHera™ systems are novel piezo nano-elevation stages featuring travel ranges from 50 to 250 µm. Despite the increased travel ranges the units are extremely compact, while providing sub-nanometer resolution. The long travel range is achieved with a newly designed, friction-free and extremely stiff flexure system which also offers excellent guiding accuracy and rapid settling.

Superior Accuracy Through Direct-Motion-Metrology Capacitive Feedback Sensors

Applications such as optical path control in interferometry, or sample positioning in microscopy require long travel

ranges with nanometer positioning accuracy. PIHera™ offers Z-travel ranges to 250 µm (500 µm X and XY versions are also available). The closed-loop versions are equipped with

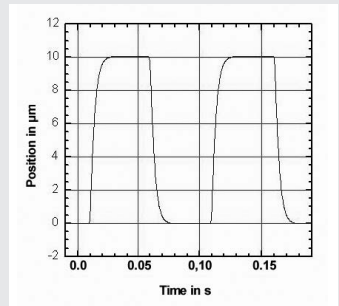
Multi-Axis Versions, X, XY, Z, XYZ

PIHera™ stages are also available in X and XY versions. XZ and XYZ combinations can be assembled (no adapters required).

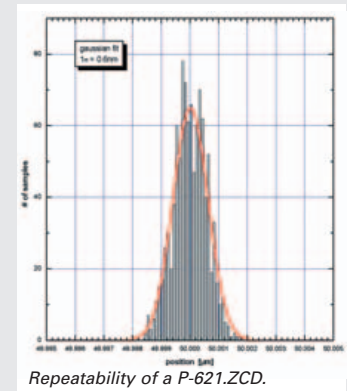
non contact, zero friction, direct-measuring two-plate capacitive position sensors. Unlike conventional indirect sensors (such as strain gauge / piezo resistive sensors), they measure the position directly rather than the strain in the actuator / guiding system.

Capacitive sensors are absolute-measuring high-bandwidth devices and show none of the periodic errors found in incremental encoders. This permits motion linearity of better than 0.01 % and effective resolution in the sub-nanometer range.

This technique, combined with the inherent precision of the PI two-plate capacitive sensor and the temperature-compensated design, results in higher linearity scans, and provides superior responsiveness, resolution, repeatability and stability.



The settling time of a P-621.ZCD (10 µm steps) is 15 milliseconds.

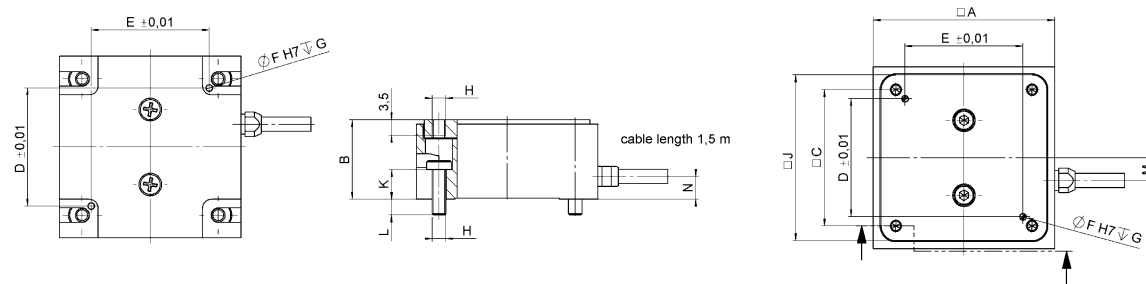


Repeatability of a P-621.ZCD.



PIHera™ XYZ combination

	A	B	C	D	E	∅F	G	H	J	K	L	M	N
P-620.ZCD	30	15	24	19	24	1.01	2	M2	28	5	3	4,5	6
P-621.ZCD	40	17,5	30	26	26	1.51	2,5	M3	36,5	6,5	3,5	5	5
P-622.ZCD	50	17,5	40	35	35	1.51	2,5	M3	46,5	6,5	3,5	5	5



Dimensions of the P-62x.ZCD/ZCL/ZOL in mm, decimal places separated by commas.

Technical Data

Models	P-620.ZCD preliminary data	P-621.ZCD	P-622.ZCD preliminary data	P-62x.ZCL	P-62x.ZOL	Units
Active axes	Z	Z	Z	Z	Z	
Closed-loop travel	50	100	250	same as CD version	—	µm
Min. open-loop travel -20 to 120 V		120	275	same as CD version	same as CD version	µm
Integrated feedback sensor	capacitive	capacitive	capacitive	capacitive	—	
Open-loop resolution*		0.2		same as CD version	same as CD version	nm
Closed-loop resolution*		0.3		same as CD version	—	nm
Closed-loop linearity (typ.)	0.01	0.01	0.01	0.01	—	%
Stiffness	0.8	0.8	0.3	same as CD version	same as CD version	N/mm
Push/pull force capacity (in X)	10/5	10/8	10/8	same as CD version	same as CD version	N
Max. Load	10	10	10	10	10	N
Lateral force limit	10	10	10	10	10	N
Tilt (θ _x , θ _y) (typ.)		30		same as CD version	same as CD version	µrad
Electrical capacitance	1.5	3.0	6.0	same as CD version	same as CD version	µF ±20%
Unloaded resonant frequency		880		same as CD version	same as CD version	Hz ±20%
Resonant frequency @ 20 g load		600		same as CD version	same as CD version	Hz ±20%
Resonant frequency @ 100 g load		400		same as CD version	same as CD version	Hz ±20%
Resonant frequency @ 200 g load		300		same as CD version	same as CD version	Hz ±20%
Operating temperature range	-40 to 120	-40 to 120	-40 to 120	-40 to 120	-40 to 150	°C
Voltage and sensor connection	Sub-D special connector	Sub-D special connector	Sub-D special connector	Sub-D special FFA.00.250 male; sensor: 2xLEMOFFA.00.250 female	Voltage: LEMO FFA.00.250, no sensor	Voltage: LEMO
Weight (with cables)		170				g ±5%
Body material	Al	Al	Al	Al	Al	
Recommended controller	E-500 System, E-665, E-750 (digital), E-710 (digital)			E-500 System, E-610		

*Resolution of PI Piezo NanoPositioners is not limited by friction or stiction. Noise equivalent motion with E-710 controller.

Rapid Positioning over Long Ranges

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

Dynamic Digital Control for Best Scanning Linearity

Use our new digital control electronics with the dynamic digital control option for the highest linearity in scanning applications. These systems virtually eliminate tracking errors and permit use of the entire travel range with high dynamic accuracy in the nano-meter range.

Increased Lifetime with New Piezoceramic Technology

The PIHera™ stage drive units are based on our P-885 PICMA™ low-voltage multilayer piezo ceramics. These newly designed and highly optimized drives are more robust than conventional piezo actuators, and feature superior lifetime in dynamic and static applications. Because guidance and sensors are all frictionless and maintenance-free, PIHera™ systems achieve exceptional levels of reliability.