P-725 PIFOC® Long-Travel Objective Scanner

High-Precision Positioner / Scanner for Microscope Objectives

P-725.2CL with QuickLock option P-721.12Q for W0.8 x 1/36" threads and objective (QuickLock adapter and objective not included)

- **Travel Ranges to 460 µm**
- **Significantly Faster Response and Higher Lifetime than Motorized Z-Stages**
- **Scans and Positions Objectives with Sub-nm Resolution**
- **Direct Metrology with Capacitive Sensors for Highest Linearity**
- **Parallel Precision Flexure Guiding for Better Focus Stability**
- **Compatible with Metamorph™ Imaging Software**
- **Outstanding Lifetime Due to PICMA® Piezo Actuators**
- **QuickLock Adapter for Easy Attachment**
- **Clear Aperture up to 29 mm Ø**

Ordering Information

P-725 PIFOC® Piezo Nanofocusing Z-Drive for Long Scanning Ranges

P-725. ☐ ☐

- **1** Travel Range 100 µm (closed-loop)
- **2** Travel Range 250 µm (closed-loop)
- **4** Travel Range 400 µm (closed-loop)

- **CA** Capacitive Sensor, Sub-D Connectors, for Large Aperture QuickLock Thread Adapters
- **CD** Capacitive Sensor, Sub-D Connectors, for QuickLock Thread Adapters
- **CL** Capacitive Sensor, LEMO Connector, for QuickLock Thread Adapters
- **0L** No Sensor, Sub-D Connectors, for QuickLock Thread Adapters, Travel Range see Data Table

Accessories
QuickLock Thread Adapters s. fig.,
Extension Tubes for Objectives s. www.pi.ws

P-725 PIFOC® nanofocus systems are long-travel (up to 460 µm), high-speed, piezo-driven microscope objective nanofocusing/scanning devices. The innovative, frictionless, flexure guiding system provides enhanced precision for superior focus stability with fast response for rapid settling and scanning. Despite the larger travel range, they are 20 % shorter than P-721 units (p. 2-25) while providing sub-nanometer resolution. For applications which require a particularly high resolution, such as the two photon spectroscopy, there are versions which allow a free aperture of up to 29 mm in diameter.

Application Examples

- 3D-Imaging
- Screening
- Interferometry
- Metrology
- Disc-drive-testing
- Autofocus systems
- Confocal microscopy
- Biotechnology
- Semiconductor testing

Superior Accuracy With Direct-Metrology Capacitive Sensors

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. Further advantages of direct metrology with capacitive sensors is the high phase fidelity and the high bandwidth of up to 10 kHz.
Open-loop models are available for applications where fast response and very high resolution are essential. Here, specifying or reporting absolute position values is either not required or is handled by external sensors, such as interferometers, a vision system or photodiode PSD (position sensitive detector). These models retain the inherent piezo advantages such as high resolution and speed.

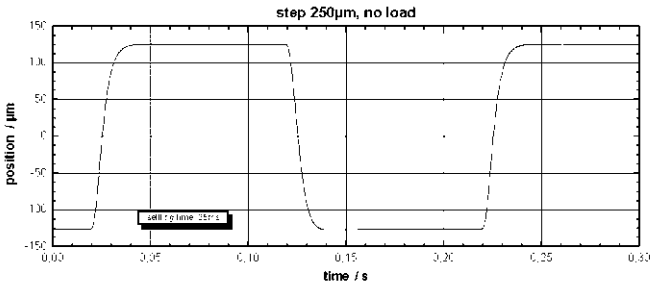
Open-loop models are available for applications where fast response and very high resolution are essential. Here, specifying or reporting absolute position values is either not required or is handled by external sensors, such as interferometers, vision system or photodiode PSD (position sensitive detector). These models retain the inherent piezo advantages as high resolution and speed.

Simple Installation with QuickLock Thread Options

The PIFOC® is mounted between the turret and the objective with the QuickLock thread adapter. After threading the adapter into the turret, the QuickLock is affixed in the desired position. Because the PIFOC® body need not to be rotated, cable wind-up is not an issue.

High Reliability and Long Lifetime

The compact PIFOC® systems are equipped with preloaded PICMA® high-performance piezo actuators which are integrated into a sophisticated, FEA-modeled, flexure guiding system. The PICMA® actuators feature



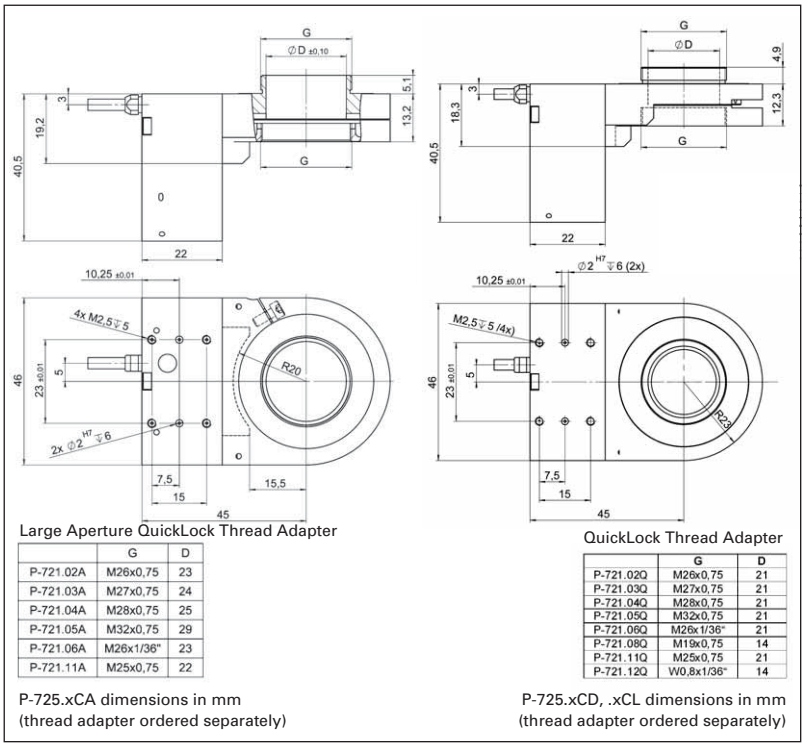
Fastest step and settle: The P-725.2CL can perform a 250 µm step to 1 % accuracy in only 25 ms (no load; 50 ms with a load of 150 g. With E-665.CR controller)

cofired ceramic encapsulation and thus offer better performance and reliability than conventional piezo actuators. Actuators, guidance and sensors are maintenance-free and not subject to wear, and thus offer an extraordinary reliability.

Scanner for Higher Dynamics and Higher Loads

PI offers a series of related PIFOC® objective scanners with different specifications. For higher loads and dynamic scanning applications the models P-726 (s. p. 2-32) and P-725.DD (s. p. 2-30) featuring a stroke of up to 100 µm are available.

Alternatively, the sample can be moved into focus: The P-737 piezo Z-nanopositioner features a large aperture to hold a variety of sample holders.



Large Aperture QuickLock Thread Adapter

	G	D
P-721.02A	M26x0,75	23
P-721.03A	M27x0,75	24
P-721.04A	M28x0,75	25
P-721.05A	M32x0,75	29
P-721.06A	M26x1/36"	23
P-721.11A	M25x0,75	22

P-725.xCA dimensions in mm
(thread adapter ordered separately)

QuickLock Thread Adapter

	G	D
P-721.02Q	M26x0,75	21
P-721.03Q	M27x0,75	21
P-721.04Q	M28x0,75	21
P-721.05Q	M32x0,75	21
P-721.06Q	M26x1/36"	21
P-721.08Q	M19x0,75	14
P-721.11Q	M25x0,75	21
P-721.12Q	W0,8x1/36"	14

P-725.xCD, .xCL dimensions in mm
(thread adapter ordered separately)

Technical Data

Model	P-725.1CL P-725.1CD P-725.1CA	P-725.2CL P-725.2CD P-725.2CA	P-725.4CL P-725.4CD P-725.4CA	P-725.x0L closed-loop version	Units	Tolerance
Active axes	Z	Z	Z	Z		
Motion and positioning						
Integrated sensor	Capacitive	Capacitive	Capacitive	-		
Open-loop travel, -20 to +120 V	150	330	460	as P-725.xCL	µm	min. (+20 %/-0 %)
Closed-loop travel	100	250	400	-	µm	calibrated
Open-loop resolution	0.3	0.4	0.5	as P-725.xCL	nm	typ.
Closed-loop resolution	0.65	0.75	1.25	-	nm	typ.
Linearity, closed-loop	0.03	0.03	0.03	-	%	typ.
Repeatability	±5	±5	±5	-	nm	typ.
Runout Θ_X	1	6	10	as P-725.xCL	µrad	typ.
Runout Θ_Y	20	45	45	as P-725.xCL	µrad	typ.
Crosstalk in X	20	20	60	as P-725.xCL	nm	typ.
Crosstalk in Y	20	40	60	as P-725.xCL	nm	typ.
Mechanical properties						
Stiffness in motion direction	0.23	0.17	0.12	as P-725.xCL	N/µm	±20 %
Unloaded resonant frequency	470	330	230	as P-725.xCL	Hz	±20 %
Resonant frequency @ 150 g	185	140	120	as P-725.xCL	Hz	±20 %
Push/pull force capacity in motion direction	100 / 20	100 / 20	100 / 20	as P-725.xCL	N	Max.
Drive properties						
Ceramic type	PICMA® P-885	PICMA® P-885	PICMA® P-885	as P-725.xCL		
Electrical capacitance	4.2	6.2	6.2	as P-725.xCL	µF	±20 %
Dynamic operating current coefficient	5.2	3.1	1.9	as P-725.xCL	µA/(Hz • µm)	±20 %
Miscellaneous						
Operating temperature range	-20 to 80	-20 to 80	-20 to 80	-20 to 80	°C	
Material	Aluminum	Aluminum	Aluminum	Aluminium		
Max. objective diameter	39	39	39	39	mm	
Mass	0.215	0.23	0.23	as P-725.xCL	kg	±5 %
Sensor / voltage connection	CL-version: LEMO others: Sub-D special	CL-version: LEMO others: Sub-D special	CL-version: LEMO others: Sub-D special	LEMO (no sensor)		

Recommended controller / amplifier
CL-versions:
E-610 servo controller / amplifier (p. 2-110); E-500 modular piezo controller system (p. 2-142) with E-505 high-performance amplifier module (p. 2-147) and E-509 controller (p. 2-152)
CD/CA-versions:
E-621 controller module (p. 2-160), E-625 servo controller, bench-top (p. 2-114), E-665 display servo controller, with digital interface, bench-top (p. 2-116)
Single-channel digital controller:
E-753 (bench-top) (p. 2-108), E-709