P-720 PIFOC® Piezo Nanofocusing Systems

Compact High-Dynamics Scanner for Small Objectives

The P-720 objective nanofocusing / scanning drive (objective not included) was designed for small objectives. Similar PIFOC® systems are available for large objectives and with position sensors

- Travel Range 100 µm
- Rapid Response & Settling Behavior
- Scans and Positions Objectives with Sub-nm Resolution
- Frictionless, High-Precision Flexure Guiding System
- Outstanding Lifetime Due to PICMA® Piezo Actuators

Model	Max. objective diameter	Travel	Open-loop, resolution	Stiffness	Push/pull force capacity	Rotation around θ_X, θ_Y
P-720.00	25 mm	100 µm	0.5 nm	0.2 N/µm	100 / 20 N	13 µrad

P-721K PIFOC® Nosepiece Nanopositioner

Compact Design, Sub-Nanometer Resolution

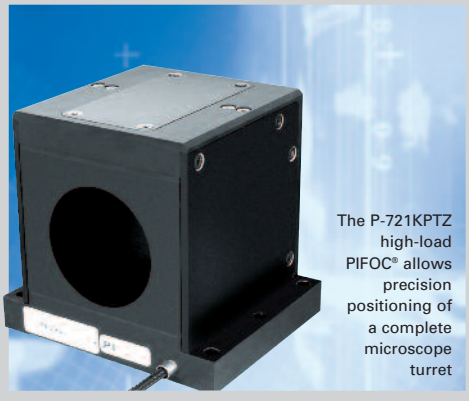
P-721KTPZ Compact Nosepiece Nanopositioner

- Positioning and Scanning of Microscope Turrets
- Direct-Metrology Capacitive Sensors for Highest Linearity, Stability and Control Dynamics
- Frictionless, High-Precision Flexure Guiding System for Better Focus Stability
- Outstanding Lifetime Due to PICMA® Piezo Actuators

Model	Travel	Closed-loop/ open-loop resolution	Resonant frequency (fully loaded)	Dimensions
P-721KTPZ Turret-PIFOC®	80 µm	10 / 0.5 nm	215 Hz	44.5 x 42 x 53 mm (W x L x H)

P-721K Power-PIFOC® Nosepiece Nanopositioner

For High-Resolution Microscopy. High-Load Capacity, Capacitive Feedback



The P-721KPTZ high-load PIFOC® allows precision positioning of a complete microscope turret

- Scans and Positions Objectives with Sub-nm Resolution
- Travel Ranges to 150 µm, Millisecond Settling Time
- Parallel Flexure Guiding for Minimized Objective Offset
- Direct Metrology with Capacitive Sensors for Highest Linearity
- Outstanding Lifetime Due to PICMA® Piezo Actuators

Model	Load capacity	Closed-loop travel	Resonant frequency	Mass
P-721KPTZ	20 N	to 150 µm	410 Hz (no load)	1.5 kg

P-720

PIFOC® High-Speed Microscope Objective Nanofocusing/Scanning Z-Drives

P-720 objective nanofocusing / scanning drive (objective not included)

- **Scans and Positions Objectives with Sub-nm Resolution**
- **Low Inertia for Fast Settling**
- **Frictionless Precision Flexure Guiding System**
- **Travel to 100 µm**
- **Straightness of Travel ≤13 µrad**
- **PICMA® High-Performance Piezo Drives**

P-720 PIFOCs® are high-speed, piezo-driven microscope objective nanofocusing/scanning devices which can be mounted on most microscopes. The frictionless, flexure guiding system combines high guiding precision for superior focus stability with fast response for rapid settling and scanning. The units are screwed between the turret and the objective, providing a positioning and scanning range of up to 100 µm with sub-nanometer resolution, while extending the optical path by only 13 mm (infinity-corrected microscope required; extension tubes are available to adjust path lengths of other objectives on the turret). The standard thread is W0.8 x 1/36", for alternate threads see the P-721.CLQ. For larger positioning ranges, to 460 µm, see the P-725, page 2-22.

Application Examples

- Scanning interferometry
- Surface structure analysis
- Disk drive testing
- Autofocus systems
- Confocal microscopy
- Biotechnology
- Semiconductor test equipment

Operation

The P-720 open-loop PIFOC® is designed for fast, high-resolution positioning and scanning tasks where the absolute position is not important or where an external sensor is used. The vertical position of the objective is roughly proportional to the drive voltage (see p. 4-15 *ff.* in the "Tutorial: Piezoelectrics in Positioning" section for behavior of open-loop piezos).
If absolute position control, high linearity, or repeatability in the nanometer range is required, refer to the P-721 and P-725 closed-loop devices (see pages 2-20 and 2-22).

Working Principle / Reliability

PIFOCs® are equipped with the award winning PICMA® piezo drives, integrated into a sophisticated flexure guiding system. The wire-EDM-cut flexures are FEA modeled for zero stiction, zero friction and exceptional guiding precision. The ceramic-encapsulated PICMA® drives are more robust than conventional piezo actuators, featuring superior lifetime and performance in both dynamic and static applications.

Notes

See the "Selection Guide" on p. 2-14 *ff.* for comparison with other nanopositioning systems.

Ordering Information

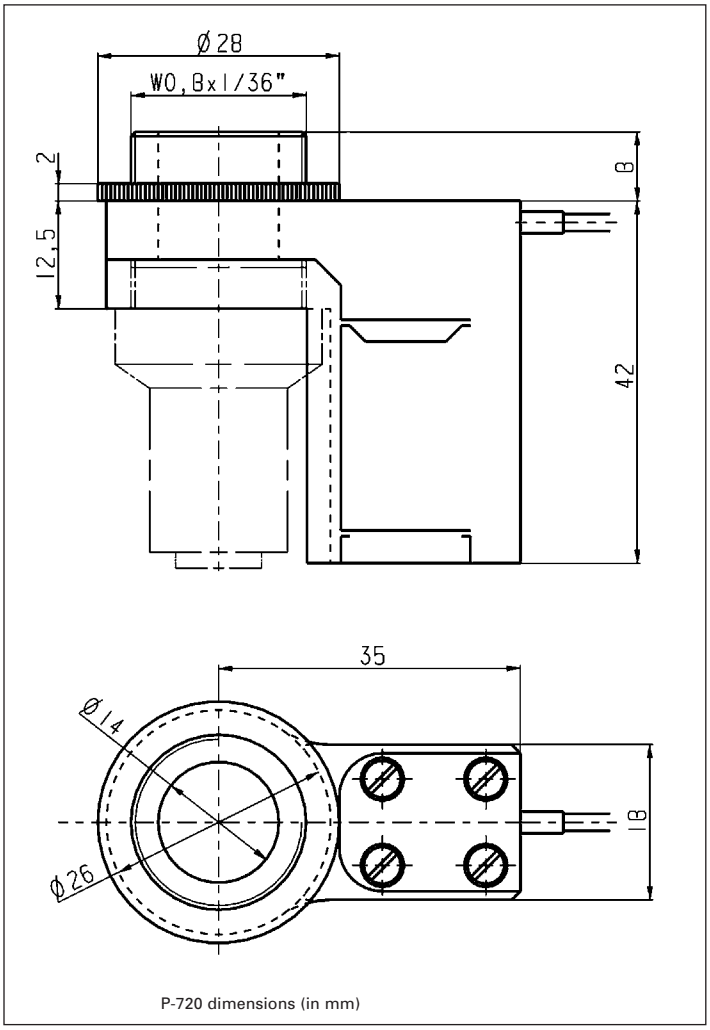
P-720.00
PIFOC® Objective Positioner & Scanner, 100 µm, W0.8 x 1/36"

For PIFOC® Objective Positioners & Scanners with direct metrology and travel ranges to 400 µm see P-721 and P-725, p. 2-20 and p. 2-22

P-720.01
Objective extension tube, 13 mm

Ask about custom designs!

P-721 on a microscope turret



P-720 dimensions (in mm)

Custom PIFOC® nosepiece nanopositioner for microscope turret.

Technical Data

Models	P-720.00	Units	Notes see p. 2-84
Max. objective diameter	25	mm	
Open-loop travel @ 0 to 100 V	100	µm ±20%	A2
* Open-loop resolution	1	nm	C1
Stiffness	0.2	N/µm ±20%	D1
Push/pull force capacity (in operating direction)	100 / 20	N	D3
Tilt (θ_X, θ_Y) (typ.)	13	µrad	E1
Lateral runout (Y) (typ.)	100	nm	E2
Electrical capacitance	3.0	µF ±20%	F1
** Dynamic operating current coefficient (DOCC)	3.8	µA/(Hz 3 µm)	F2
Unloaded resonant frequency	400	Hz ±20%	G2
Resonant frequency @ 120 g load	180	Hz ±20%	G3
Resonant frequency @ 200 g load	150	Hz ±20%	G3
Operating temperature range	-20 to 80	°C	H2
Voltage connection	VL		J1
Weight (with cables)	100	g ±5%	
Body material	Al		L
Recommended driver/controller (codes explained p. 2-17)	G, C, (A)		

* 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-503 amplifier.

** Dynamic Operating Current Coefficient in µA per Hz and µm. Example: Sinusoidal scan of 30 µm at 10 Hz requires approximately 1.2 mA drive current.