

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 $\leq 13 \mu\text{rad}$
- 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.

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"

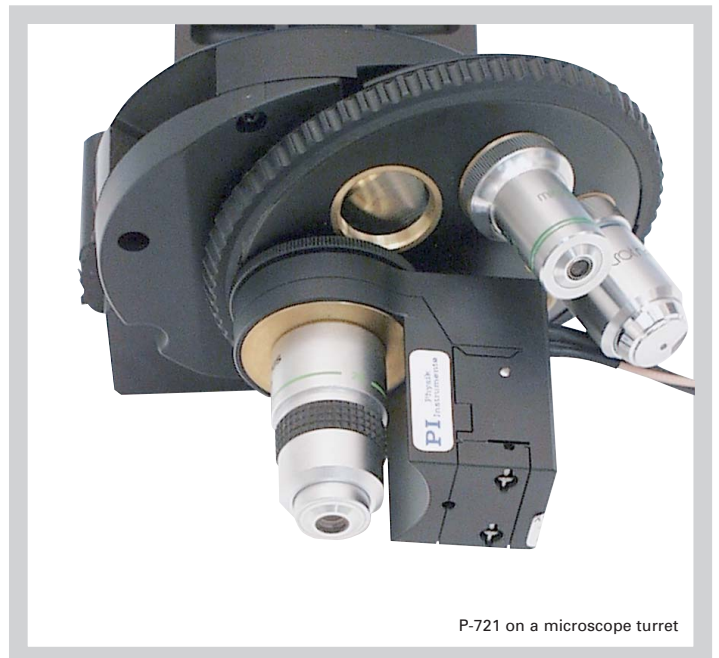
For PIFOC® Objective Positioners & Scanners with direct metrology and travel ranges to 400 μm see P-721 and P-725, p. 2-20 and p. 2-22

P-720.01
Objective extension tube, 13 mm

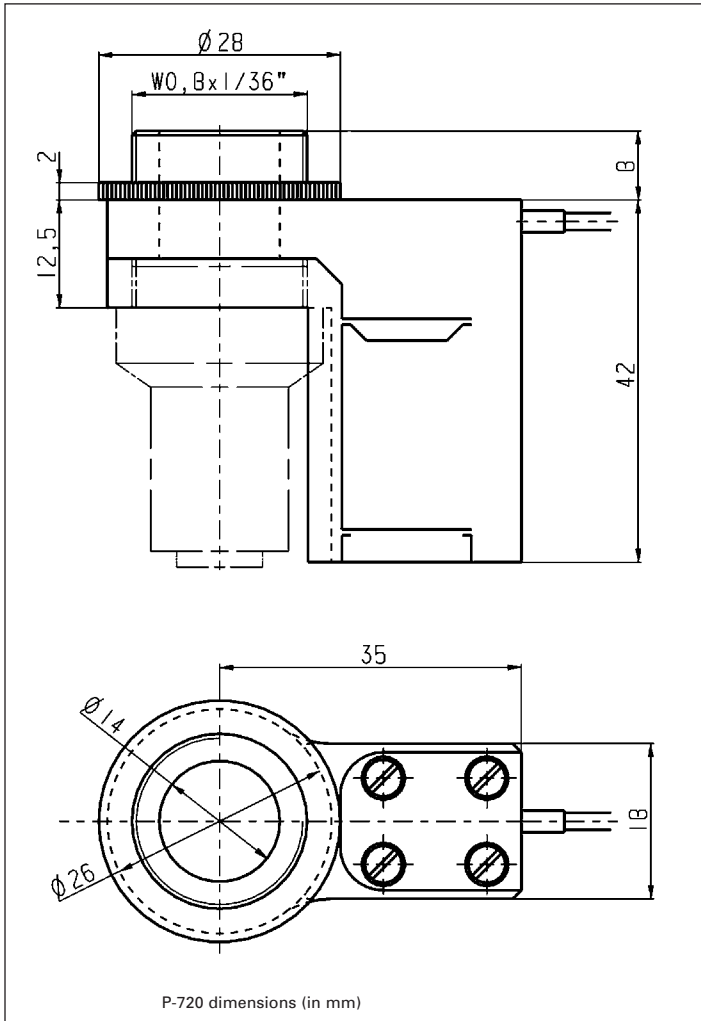
Ask about custom designs!

Application Examples

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



P-721 on a 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	$\mu\text{m} \pm 20\%$	A2
* Open-loop resolution	1	nm	C1
Stiffness	0.2	$\text{N}/\mu\text{m} \pm 20\%$	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	$\mu\text{F} \pm 20\%$	F1
** Dynamic operating current coefficient (DOCC)	3.8	$\mu\text{A}/(\text{Hz } 3 \mu\text{m})$	F2
Unloaded resonant frequency	400	$\text{Hz} \pm 20\%$	G2
Resonant frequency @ 120 g load	180	$\text{Hz} \pm 20\%$	G3
Resonant frequency @ 200 g load	150	$\text{Hz} \pm 20\%$	G3
Operating temperature range	-20 to 80	$^{\circ}\text{C}$	H2
Voltage connection	VL		J1
Weight (with cables)	100	$\text{g} \pm 5\%$	
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 nano-positioners 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 $30 \mu\text{m}$ at 10 Hz requires approximately 1.2 mA drive current.

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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E-660

LVPZT Piezo Drivers



E-660.00

- Single-Channel Piezo Driver
- 12 V Battery or P/S Operation
- Output Voltage Range 5 to 100 V

The E-660.00 piezo driver is a low-cost amplifier for low-voltage PZTs. It can output and sink a peak current of 20 mA and an average current of 10 mA. The E-660 is designed for static and low-level dynamic PZT applications. Because an operating current of only 150 mA @ 12 V

is required, battery operation is possible.

E-660.OE is the OEM version of the E-660.00 amplifier. The OEM module does not provide manual controls. All inputs and outputs are via 8 header pins located on the bottom of the

Technical Data

Models	E-660.00	E-660.OE
Function	Power amplifier	Power amplifier
Channels	1	1
Output power	2 W (s. page 6-52)	2 W (see page 6-52)
Output current	20 mA	20 mA
Current limitation	Short-circuit proof	Short-circuit proof
Voltage gain	10 ±0.1	10 ±0.1
Polarity	Positive	Positive
Control input voltage	0 to +11 V	0 to +10 V
Output voltage	5 to 110 V	5 to 100 V
DC offset setting	5 to 110 V with 1-turn pot.	-
Input impedance	100 kΩ	100 kΩ
Control input socket	BNC	header pins
PZT voltage output socket	LEMO ERA.00.250.CTL	header pins
Dimensions	150 x 195 x 75 mm	93 x 45 x 28 mm
Weight	0.5 kg	0.25 kg
Operating voltage	12 to 15 VDC, stabilized	12 to 15 VDC, stabilized
Max. Operating current	150 mA	150 mA
Operating temperature range	0 to +50 °C	0 to +50 °C
Power supply	Optional (3.5 mm jack socket)	-

Ordering Information

E-660.00
LVPZT Piezo Driver

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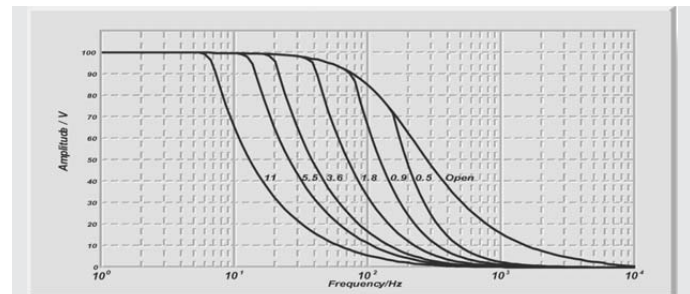
E-660.OE. The module is designed to be mounted on circuit boards. The electronics are fully enclosed in a metal case. The E-660.00 and E-660.OE can be operated in two ways:

I. Manual Control:

Output voltage can be set by a DC-offset potentiometer (not supplied with E-660.OE) in the range of 5 to 100 V.

II. External Control:

Output voltage is controlled by an analog signal in the range of 0 to 10 V, applied to the BNC input (E-660.00). Multiplying by the gain factor of 10, an output voltage range of +5 to +100 V results. The DC-offset potentiometer adds a DC bias to the input, allowing continuous shifting of the input voltage range between 0 V to +10 V and -10 V to 0 V (see page 6-52).



E-660, frequency response with various PZT loads. Values shown are capacitance values are in μF , measured in actual PZT.