

Voice Coil Focus Drive for Objectives PIFOC

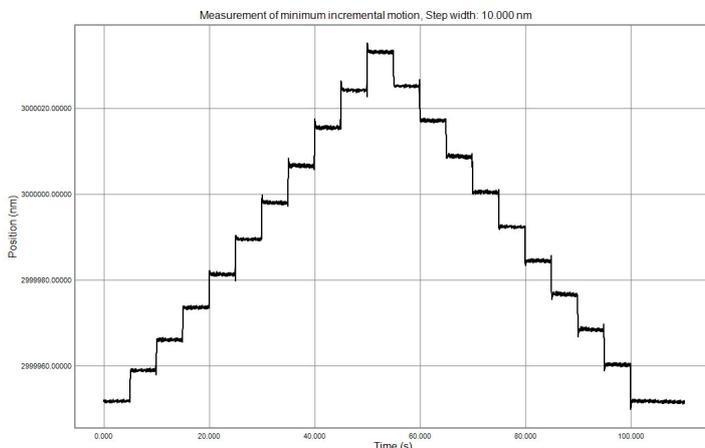
High-Dynamics Positioner for Microscope Objectives



V-308 with V-308.AP1 adapter plate, V-308.OH1 objective holder P-725.11L thread adapter, and objective

V-308

- Adjustable travel range to 7 mm
- High dynamics direct drive
- Integrated weight force compensation to 1 kg, can be adjusted by the user
- Minimum incremental motion 10 nm
- Heavy-duty crossed roller guide
- Suitable optional accessories, e.g. objective holders



V-308. minimum incremental motion of 10 nm

Z positioning of objectives with PIFOC

A positioning of the sample in the Z direction, i.e. along the optical axis of the objective, is required in many examinations or for microscopy technologies. Alternatively, it is possible to move the objective itself in the Z direction. For this purpose, PI offers solutions named PIFOC.

Integrated weight force compensation

The product is equipped with a magnetic weight force compensation. This maintains the position of a load of up to 1 kg aligned vertically to the motion axis even if no power is applied. The weight force compensation can be adjusted by the user.

PIMag® voice coil motor

Voice coil motors are direct drives. In direct drives, the force of the drive element is transmitted directly to the load to be moved without the use of mechanical transmission elements such as coupling, drive screw, or gearhead. Voice coil drives consist of a permanent magnet and a winding body that are located in the air gap of the magnetic field. When current flows through the winding body, it moves in the magnetic field of the permanent magnet. Thanks to their low weight and friction-free drive principle, voice coil drives are particularly suitable for applications that require high dynamics and high velocities at limited travel ranges. High scan frequencies and precision positioning are also possible with these drives, because they are free of the effects of hysteresis.

Direct position measuring

Position measuring is performed with the highest accuracy directly at the motion platform so that nonlinearity, mechanical play, or elastic deformation have no influence on position measuring.

Application fields

Microscopy: Multiphoton fluorescence microscopy, deep tissue inspection, digital slide scanning microscopy. Biotechnology: Genome sequencing with the Solexa-Illumina method, Immuno-Assay fluorescence. Medical devices: Scanning laser ophthalmology, automated cell counters/flow cytometers. Biomedical research: Optical & magnetic tweezers. Laser materials processing: Laser micromachining, laser ablation. Semiconductor industry: Semiconductor/wafer inspection.

Specifications

Motion and positioning	V-308.753030	Unit	Tolerance
Active axes	Z		
Travel range	7	mm	
Integrated sensor	Optical encoder		
Sensor signal	Sin/cos, 1 V peak-peak, 2 μ m signal period		
Sensor resolution	1 ⁽¹⁾	nm	
Min. incremental motion	10 ⁽¹⁾	nm	
Position noise	3	nm	Max.
Settling time (100 nm step, \pm 15 nm error band)	15 ⁽²⁾	ms	Max.
Settling time (250 nm step, \pm 15 nm error band)	15 ⁽²⁾	ms	Max.
Travel accuracy, entire travel range (7 mm)	4 ⁽³⁾	μ m	Max.
Bidirectional repeatability, entire travel range (7 mm)	0.75 ⁽³⁾	μ m	Max.
Bidirectional repeatability, 100 nm step	25	nm	Max.
Pitch	125	μ rad	Max.
Yaw	125	μ rad	Max.
Roll	125	μ rad	Max.
Straightness / flatness	0.75	μ m	Max.
Velocity	200	mm/s	Max.
Acceleration	8	m/s ²	Max.
Reference switch	Optical, direction sensing (reference edge track), 5 V, TTL		
Reference switch repeatability	0.5	μ m	Max.

Mechanical properties	V-308.753030	Unit	Tolerance
Load capacity in Z	10	N	Max.
Permissible lateral force F_x	10	N	Max.
Permissible lateral force F_y	10	N	Max.
Moved mass	0.2	kg	\pm 5 %
Mass without cable	0.45	kg	\pm 5 %
Overall mass	0.6	kg	\pm 5 %
Guide type	Crossed roller guide with anti-creep system		

Drive properties	V-308.753030	Unit	Tolerance
Drive type	PIMag® voice coil drive		
Intermediate circuit voltage	48	V DC	Max.
Peak force	9.45	N	± 10 %
Nominal force	4.2	N	± 10 %
Peak current, RMS ⁽⁴⁾	3.5	A	Max.
Nominal current, RMS ⁽⁴⁾	1.15 (without cooling) / 1.55 (with cooling) ⁽⁵⁾	A	Max.
Force constant, RMS	2.7	N/A	± 10 %
Resistance	3.9	Ω	± 10 %
Inductance	0.85 (at 100 Hz)	mH	± 10 %
Back EMF	2.7	V s/m	± 10 %
Permissible temperature for positioner components	50	°C	Max.

Miscellaneous	V-308.753030	Unit	Tolerance
Operating temperature range	10 to 50	°C	
Humidity	20 – 60 % rel., not condensing		
Material	Aluminum, anodized		
Motor / sensor connector	HD D-sub 26 (m)		
Cable length	1.5	m	
Recommended controllers	C-414, G-910, ACS SPiiPlus + NPMpm (NanoPWM incl.)		

⁽¹⁾ with C-414 motion controller at an interpolation of 2¹¹

⁽²⁾ with gain scheduling (only with NanoPWM)

⁽³⁾ based on ISO 230-2

⁽⁴⁾ max. 10 s at 70 °C coil temperature

⁽⁵⁾ with horizontally aligned positioner, with perforated plate made of steel, 200 mm × 250 mm × 12 mm

The specifications apply to room temperature (22 °C ± 3 °C). The specifications can deviate outside of this range.



Objective holder V-308.OH1 for horizontal mounting



Objective holder V-308.OH2 for vertical mounting



Adapter plate V-308.AP1 for mounting V-308 positioners on honeycomb stages

Ordering Information

V-308.753030

Voice coil PIFOC high dynamics focus drive with weight force compensation, 1 to 7 mm travel range, crossed roller guide

Accessories (please order separately)

V-308.OH1

Objective holder for horizontal mounting to V-308

V-308.OH2

Objective holder for vertical mounting to V-308

V-308.AP1

Adapter plate for mounting V-308 positioners onto honeycomb stages (metric and inches)

Thread adapters

P-725.02L

Thread adapter for objective, M26 × 0.75

P-725.03L

Thread adapter for objective, M27 × 0.75

P-725.04L

Thread adapter for objective, M28 × 0.75

P-725.05L

Thread adapter for objective, M32 × 0.75

P-725.06L

Thread adapter for objective, M26 × 1/36"

P-725.08L

Thread adapter for objective, M19 × 0.75

P-725.11L

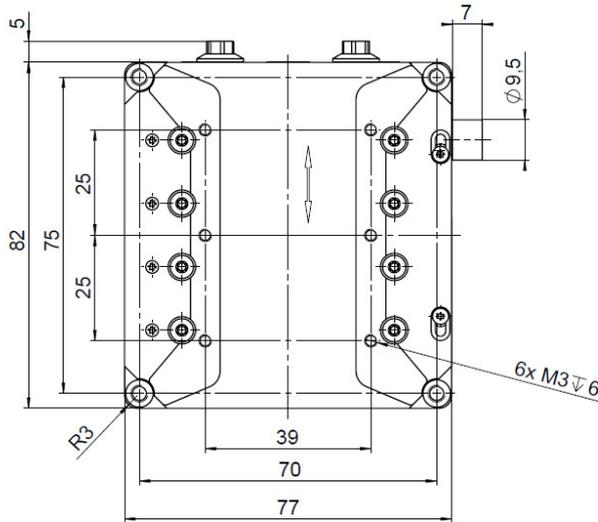
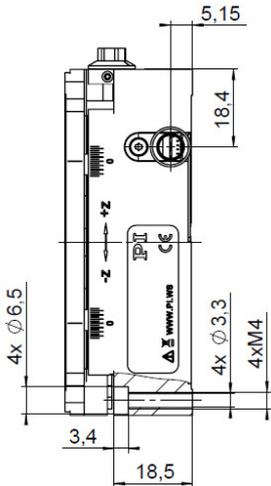
Thread adapter for objective, M25 × 0.75

P-725.12L

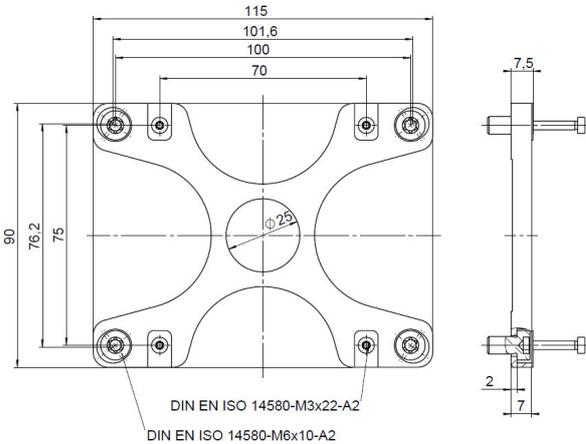
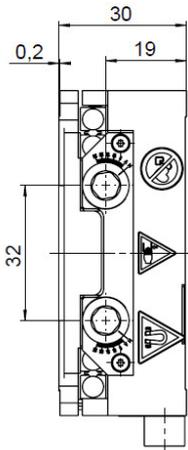
Thread adapter for objective, W0.8 × 1/36"

P-725.13L

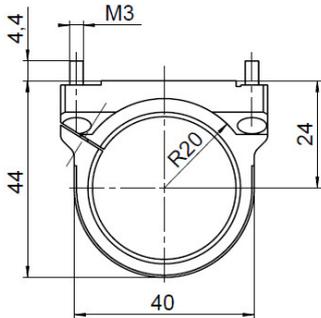
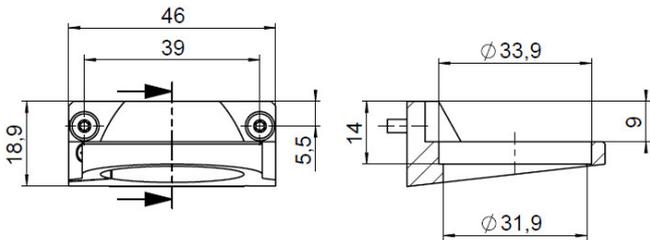
Thread adapter for objective, SM1 (1.035"-40)



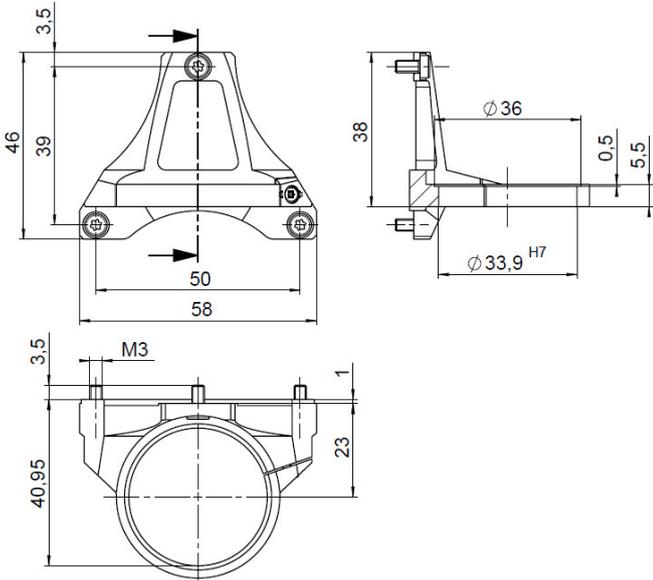
V-308.753030, dimensions in mm.



V-308.AP1, dimensions in mm.



V-308.OH1, dimensions in mm.



V-308.OH2, dimensions in mm.

Fast Piezo Focus Systems: 100 μm - 400 μm PIFOC[®]

Affordable High Performance: With Digital Controller & Software



Several PIFOC[®] piezo objective scanners (fast focus mechanisms) with QuickLock thread adapter and digital controller (objective not included)

- Complete System with Controller: Fast Digital Controller, Software-Configurable Servo Parameters
- Travel Ranges to 400 μm
- Scans and Positions Objectives with Sub-nm Resolution
- Frictionless, High-Precision Flexure Guiding System for Better Focus Stability
- Choice of SGS Sensor (Lower Cost) and Capacitive Feedback with Direct Metrology for highest Stability and Linearity
- Clear Aperture up to 29 mm \varnothing , QuickLock Adapter for Easy Attachment
- Interfaces: USB, RS-232 and analog
- Comprehensive Software Package, Compatible with MetaMorph Imaging Software

The PIFOC[®] piezo objective scanner systems include a high precision piezo mechanism and a custom-tuned compact digital controller. This combination provides higher performance at reduced costs. The integrated, frictionless and stiff piezo flex-

ure drive ensures high stiffness and fast settling times, as well as an exceptional guiding accuracy and response. The settling time of less than 10 ms increases the throughput and allows rapid Z-stack acquisition.

level resolution can be used which are applied to appropriate places on the drive train and thus measure the displacement of the moving part of the stage. The linearity is improved considerably with the digital controller provided.

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. For applications which require a particularly large optical aperture a version with a 29 mm diameter threaded inserts is available.

Digital Controller for Automated Scans

Included in the delivery is a digital controller which opens up the possibilities of digital control for piezo-driven nanopositioning systems for the same price as analog controllers. The advantage: higher linearity, simple operation and access to advanced features.

Ordering Information

PD72Z1CAA
Fast PIFOC[®] Piezo Nanofocusing Z-Drive, 100 μm , Capacitive Sensor, M32 Large Aperture QuickLock Thread Adapters, Digital Controller with USB, RS-232

PD72Z1CAQ
Fast PIFOC[®] Piezo Nanofocusing Z-Drive, 100 μm , Capacitive Sensor, M25 QuickLock Thread Adapters, Digital Controller with USB, RS-232

PD72Z1SAA
Fast PIFOC[®] Piezo Nanofocusing Z-Drive, 100 μm , SGS Sensor, M32 Large Aperture QuickLock Thread Adapters, Digital Controller with USB, RS-232

PD72Z1SAQ
Fast PIFOC[®] Piezo Nanofocusing Z-Drive, 100 μm , SGS Sensor, M25 QuickLock Thread Adapters, Digital Controller with USB, RS-232

PD72Z2CAA
Fast PIFOC[®] Piezo Nanofocusing Z-Drive, 250 μm , Capacitive Sensor, M32 Large Aperture QuickLock Thread Adapters, Digital Controller with USB, RS-232

PD72Z2CAQ
Fast PIFOC[®] Piezo Nanofocusing Z-Drive, 250 μm , Capacitive Sensor, M25 QuickLock Thread Adapters, Digital Controller with USB, RS-232

PD72Z4CAA
Fast PIFOC[®] Piezo Nanofocusing Z-Drive, 400 μm , Capacitive Sensor, M32 Large Aperture QuickLock Thread Adapters, Digital Controller with USB, RS-232

PD72Z4CAQ
Fast PIFOC[®] Piezo Nanofocusing Z-Drive, 400 μm , Capacitive Sensor, M25 QuickLock Thread Adapters, Digital Controller with USB, RS-232

Application Examples

- Microscopy
- Confocal microscopy
- 3D Imaging
- Screening
- Autofocus systems
- Surface analysis
- Wafer inspection

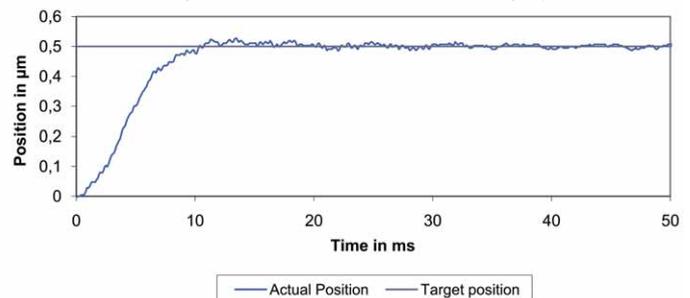
Position Measurement with Highly Accurate Capacitive Sensors or Lower-Priced Strain Gauge Sensors

Capacitive sensors measure the position directly and without contact, they offer therefore a position resolution of far below one nanometer and excellent values in linearity.

As an alternative, compact and lower-priced strain gauge sensors (SGS) with nanometer-

Step and Settle

Settling time of the system PD72Z1CAQ with 150 g objective



Information on Laser Autofocus System: [Click Here](#)

Flexibility: Software Configurable Servo Parameters

All servo controllers require tuning and adjustment of servo parameters for optimum performance (e.g. as a result of changes to the load or the motion profile). With a digital controller, all adjustments are carried out by simple software commands and the resulting motion or transient characteristics can be viewed, analyzed and further optimized immedi-

ately with the provided software. It is also possible to switch between previously found sets of parameters when the controller is in operation. Since jumpers and potentiometers no longer have to be set manually, system integration becomes much more straightforward.

System setup with the included user-interface software is fast and easy, interfacing to the customers' software is facilitated with the included LabVIEW drivers and DLLs.

Drivers for MetaMorph and μ Manager are available.

Technical Data

Model	PD72Z1SAA PD72Z1SAQ	PD72Z1CAA PD72Z1CAQ	Units	Tolerance
Active axes	Z	Z		
Motion and positioning				
Integrated sensor	SGS	Capacitive		
Closed-loop travel	100	100	μ m	
Closed-loop resolution	5	1	nm	typ.
Closed-loop linearity	0.2	0.06	%	typ.
Repeatability	\pm 10	\pm 5	nm	typ.
Runout θ X, θ Y	13	13	μ rad	typ.
CrossTalk in X, Y	100	100	nm	typ.
Settling time (0.5 μ m step with 5 % accuracy, 150 g)	10	10	ms	typ.
Mechanical properties				
Stiffness in motion direction	0.3	0.3	N/ μ m	\pm 20%
Unloaded resonant frequency	580	580	Hz	\pm 20%
Resonant frequency @ 120 g	235	235	Hz	\pm 20%
Resonant frequency @ 200 g	180	180	Hz	\pm 20%
Push/pull force capacity in motion direction	100 / 20	100 / 20	N	Max.
Drive properties				
Ceramic type	PICMA® P-885	PICMA® P-885		
Controller				
Function	Digital controller for single-axis piezo nanopositioning systems			
Processor	DSP 32-bit floating point, 150 MHz			
Communication interfaces	USB, RS-232, SPI			
Linearization	5th order polynomials			
Amplifier power	10 W (<5 ms); 5 W (>5 ms)			
I/O Connector	HD-Sub-D 26-pin, 1 Analog input 0 to 10 V, 1 Sensor monitor 0 to 10 V, 1 digital input (LVTTTL, programmable), 5 digital outputs (LVTTTL, 3 predefined, 2 programmable)			
User software	PIMikroMove, NanoCapture			
Software drivers	LabVIEW drivers, DLLs			
Supported functionality	Digital setting of the control parameters, wave generator, data recorder, auto zero, trigger I/O; compatible to MetaMorph, μ Manager			
Display	Status LED, overflow LED			
Miscellaneous				
Operating temperature range	10 to 50	10 to 50	$^{\circ}$ C	
Material scanner	Aluminum	Aluminum		
Weight	0.22 (scanner), 0.5 (controller)	0.24 (scanner), 0.5 (controller)	kg	\pm 5%
Cable length to controller	1	1	m	
Dimensions controller	160 x 96 x 33	160 x 96 x 33	mm	

Technical Data

Model	PD72Z2CAA PD72Z2CAQ	PD72Z4CAA PD72Z4CAQ	Units	Tolerance
Active axes	Z	Z		
Motion and positioning				
Integrated sensor	Capacitive	Capacitive		
Closed-loop travel	250	400	μm	
Closed-loop resolution	1.5	2.5	nm	typ.
Linearity, closed-loop	0.06	0.06	%	typ.
Repeatability	±5	±5	nm	typ.
Runout θX	6	10	μrad	typ.
Runout θY	45	45	μrad	typ.
Crosstalk in X	20	60	nm	typ.
Crosstalk in Y	40	60	nm	typ.
Settling time	15	20	ms	typ.
(0.5 μm step to 5 % accuracy, 150 g)				
Mechanical properties				
Stiffness in motion direction	0.17	0.12	N/μm	±20%
Unloaded resonant frequency	330	230	Hz	±20%
Resonant frequency @ 150 g	140	120	Hz	±20%
Push/pull force capacity in motion direction	100 / 20	100 / 20	N	Max.
Drive properties				
Ceramic type	PICMA® P-885	PICMA® P-885		
Controller				
	Digital controller for single-axis piezo nanopositioning systems			
Processor	DSP 32-bit floating point, 150 MHz			
Communication interfaces	USB, RS-232, SPI			
Linearization	5th order polynomials			
Amplifier power	10 W (<5 ms); 5 W (>5 ms)			
I/O Connector	HD-Sub-D 26-pin, 1 Analog input 0 to 10 V, 1 Sensor monitor 0 to 10 V, 1 digital input (LVTTTL, programmable), 5 digital outputs (LVTTTL, 3 predefined, 2 programmable)			
User software	PIMikroMove, NanoCapture			
Software drivers	LabVIEW drivers, DLLs			
Supported functionality	Digital setting of the control parameters, wave generator, data recorder, auto zero, trigger I/O; Compatible to MetaMorph, μManager			
Display	Status LED, overflow LED			
Miscellaneous				
Operating temperature range	10 to 50 °C			
Material scanner	Aluminum			
Weight	0.23 kg (scanner), 0.5 kg (controller)			±5%
Cable length to controller	1.5 m			
Dimensions controller	160 x 96 x 33 mm			

