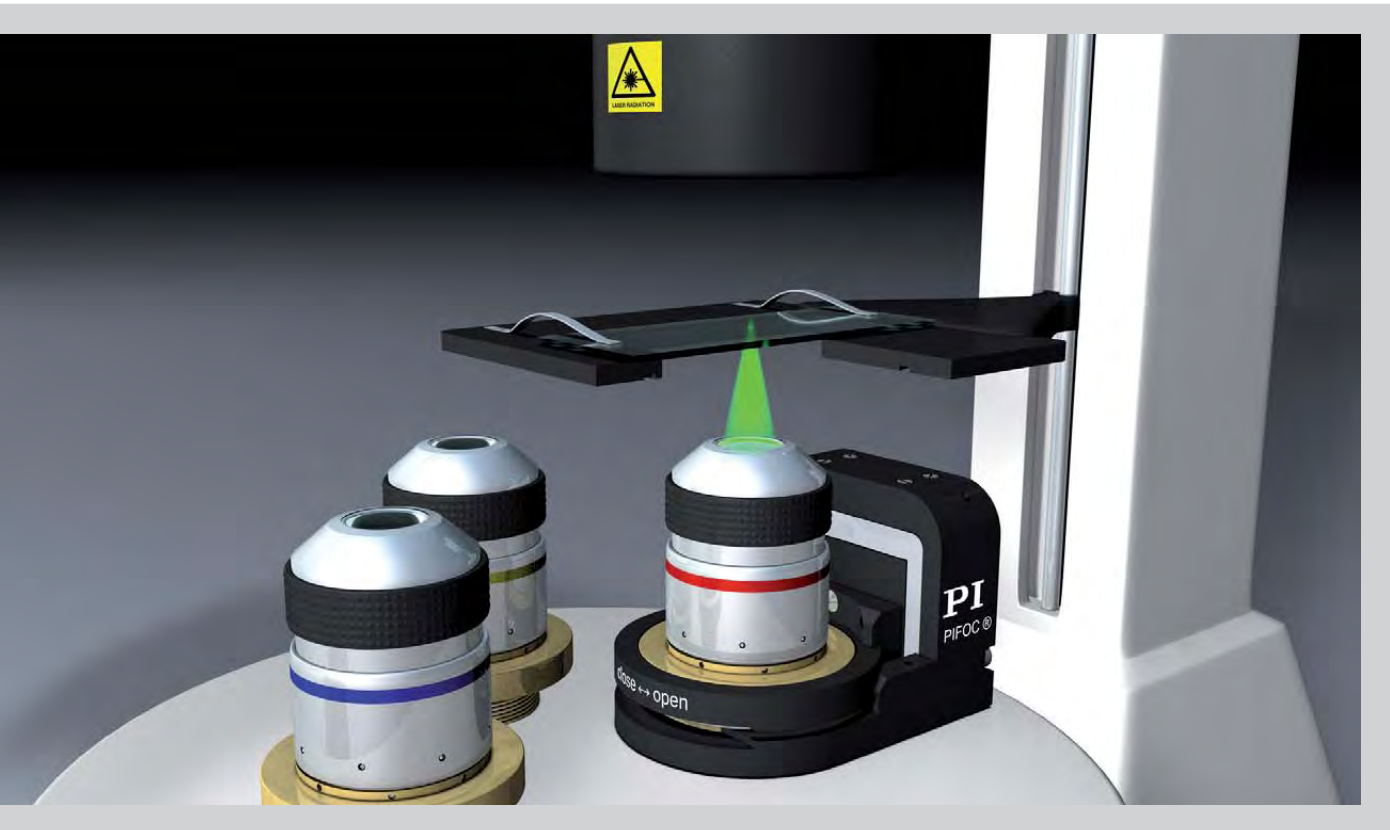


PIFOC Objective Scanner Systems Image Faster



- Ultra-Fast Z-Steps with Patented Piezo Ceramic Drives
- 7 msec Step Time for Typical high-NA Immersion Objective
- System Includes Everything You Need:
Piezo-Mechanics, Controller, Adapters
- Compatible with all Major Image Acquisition Packages
- Legendary PI Performance, Reliability & Robustness
- Capacitive Position Feedback as used in
NIST Reference Class Nanometrology Systems
- Moving Objective does not Disturb Sample
- From the Inventor of Piezo-Z Scanners

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.

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-

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

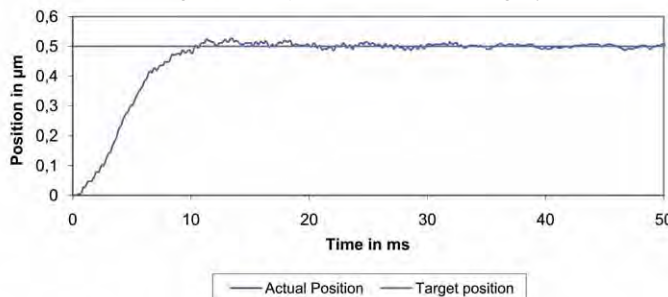
PD72Z4CAQ
Fast PIFOC[®] Piezo Nanofocusing Z-Drive, 400 μm , Capacitive Sensor, M25 QuickLock Thread Adapters, Digital Controller with USB, RS-232

Application Examples

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

Step and Settle

Settling time of the system PD72Z1CAQ with 150 g objective



PIFOC Objective Scanner Systems

Image Faster



- From the Inventor of Piezo-Z Scanners for Fast Z-Stack / Focus Control
- Choice of Travel Ranges / Controllers
 - 100 μm or 400 μm
 - Display Controller or Compact Controller
- Custom Tuning for Fastest Possible Speed (to 7 msec per Step)
- System Includes Everything You Need:
 - Mechanics, Controller, Adapters, Distance Cases
- Legendary PI Performance, Reliability & Robustness
- Compatible w/ all Major Image Acquisition Packages
- Capacitive Feedback as used in NIST Reference Class Nanometrology Systems
- ISO 9001 Quality from the Global Leader in Nanopositioning
- UL and CSA Certified

Z-Stack Imaging & Focusing: Faster with Piezo Z-Scanners

PIFOC[®] piezo-actuated Z-scanners achieve typically 10 times higher focusing speed & precision than motorized drives and

thus provide higher-quality images faster.

Scanning the Objective

The compact, light and stiff objective scanner design pro-

vides very fast response and does not disturb the sample.

Compatible with Imaging Software

PIFOC[®] controllers come with a high-bandwidth analog inter-

face for extremely fast response and compatibility with all major image acquisition packages.

About PI

PI, the global leader in nanopositioning, has been ISO 9001 certified since 1994 and employs more than 400 people world wide. PI's patented piezo technology provides longer lifetime and higher performance than any other piezo device on the market. PIFOC[®] was invented by PI 15 years ago and has since become the global standard in objective scanners, with thousands of units installed in the field.

PIFOC[®] Objective Scanner System Configurations:

Display Controller

Full featured E-665 PIFOC[®] controller with display and additional manual control. 36W piezo power.

100 μm Scanning Range

P-721 PIFOC[®] scanner for ultra-fast Z-Stack imaging / focusing



PIFOC[®] 100D System

400 μm Scanning Range

P-725 PIFOC[®] scanner for fast focusing / Z-stack imaging



PIFOC[®] 400D System

Compact Controller

E-625 PIFOC[®] economical controller. 14W piezo power.



PIFOC[®] 100 System



PIFOC[®] 400 System

All PIFOC[®] systems include the piezo objective scanner, a controller and two distance cases. To order, specify part number and objective thread (e.g. PIFOC[®] 100D, M25 x 0.75)

PI (Physik Instrumente) L.P.

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 Auburn, MA 01501
 Tel. +1 (508) 832 3456
 Fax +1 (508) 832 0506
 Email: info@pi-usa.us
 http://www.pi-usa.us

West:

5420 Trabuco Road
 Suite 100
 Irvine, CA 92620-5743
 Tel. +1 (949) 679-9191
 Fax +1 (949) 679-9292
 Email: info@pi-usa.us
 http://www.pi-usa.us

PIFOC Voice Coil Fast Focus Motor Drive for Microscopy

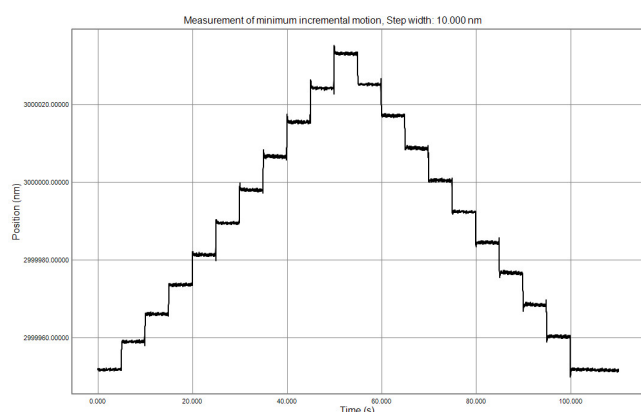
High-Dynamics Positioner for Microscope Objectives



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



C-414, PIMag® motion controller, 1 axis, 48 V, 5 A, benchtop device, TCP/IP and USB interface

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

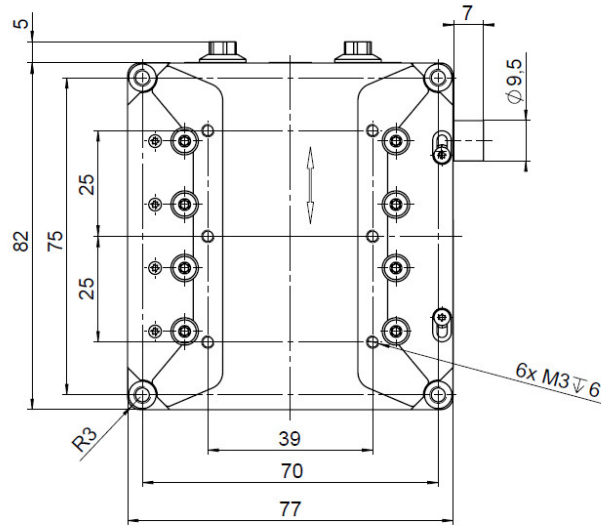
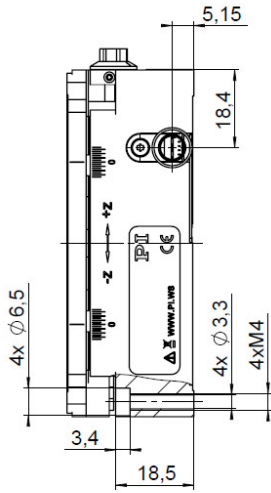
Thread adapter for objective, M25 × 0.75

P-725.12L

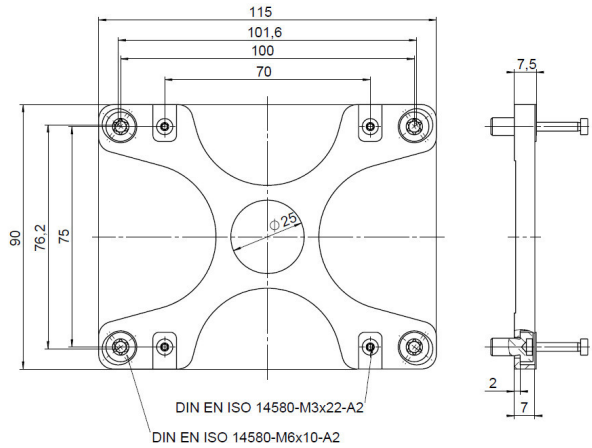
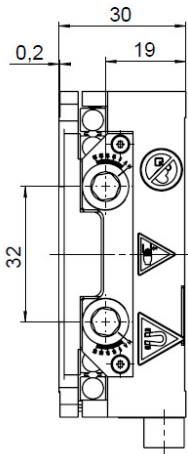
Thread adapter for objective, W0.8 × 1/36"

P-725.13L

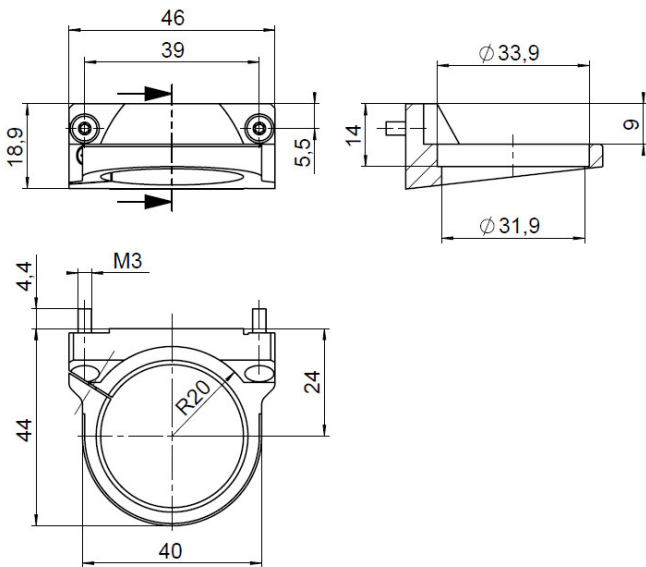
Thread adapter for objective, SM1 (1.035"-40)



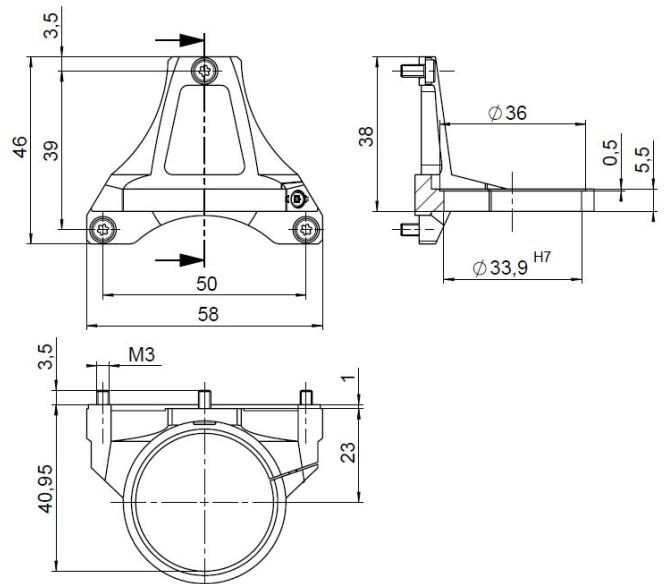
V-308.753030, dimensions in mm.



V-308.AP1, dimensions in mm.



V-308.OH1, dimensions in mm.



V-308.OH2, dimensions in mm.