MOTION CONTROL VOL 10


PI micos

# WELCOME

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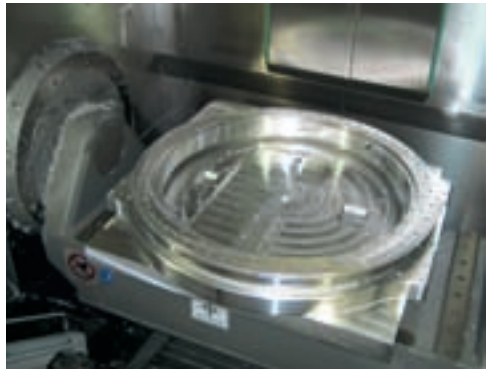
PI miCos GmbH, founded in 1990 and located in Eschbach, south west Germany operates in the high technology field with a staff of approximately 70 people.

PI miCos specialises in developing, manufacturing and marketing of innovative components and systems in the arena of ultra precise positioning, photonics and laser technology. A high quality range of positioning systems for both research and industry are offered to our customers. Distinguished companies such as Carl Zeiss, Siemens, University research institutes as well as the Fraunhofer Gesellschaft and Max-Planck-Institute are among our established customers.

Our international network of sales partners and subsidiaries support an extensive worldwide customer base. Functionality together with excellent quality down to the last detail matched with world class design and a competitive price-quality ratio can be found in all PI miCos products. Market-oriented customised solutions and a wide product range are documented in two product catalogues with around 180 pages.
Know-how, customer service and reliability are the convincing attributes of PI miCos as well as the ability to offer everything under one roof. Equally important to our company's philosophy is close customer contact. Individual requirements and challenging customised solutions require an effective and efficient support service. Therefore, expert advice always precedes the sale of components and systems alike. We are not only a high technology manufacturer but also importantly a service provider, this is what makes PI miCos stand out from the crowd.
Flexible and open-minded, PI miCos is facing the technical challenges with it's staff members working in an owner-managed company.

Lucius Amelung Managing Director

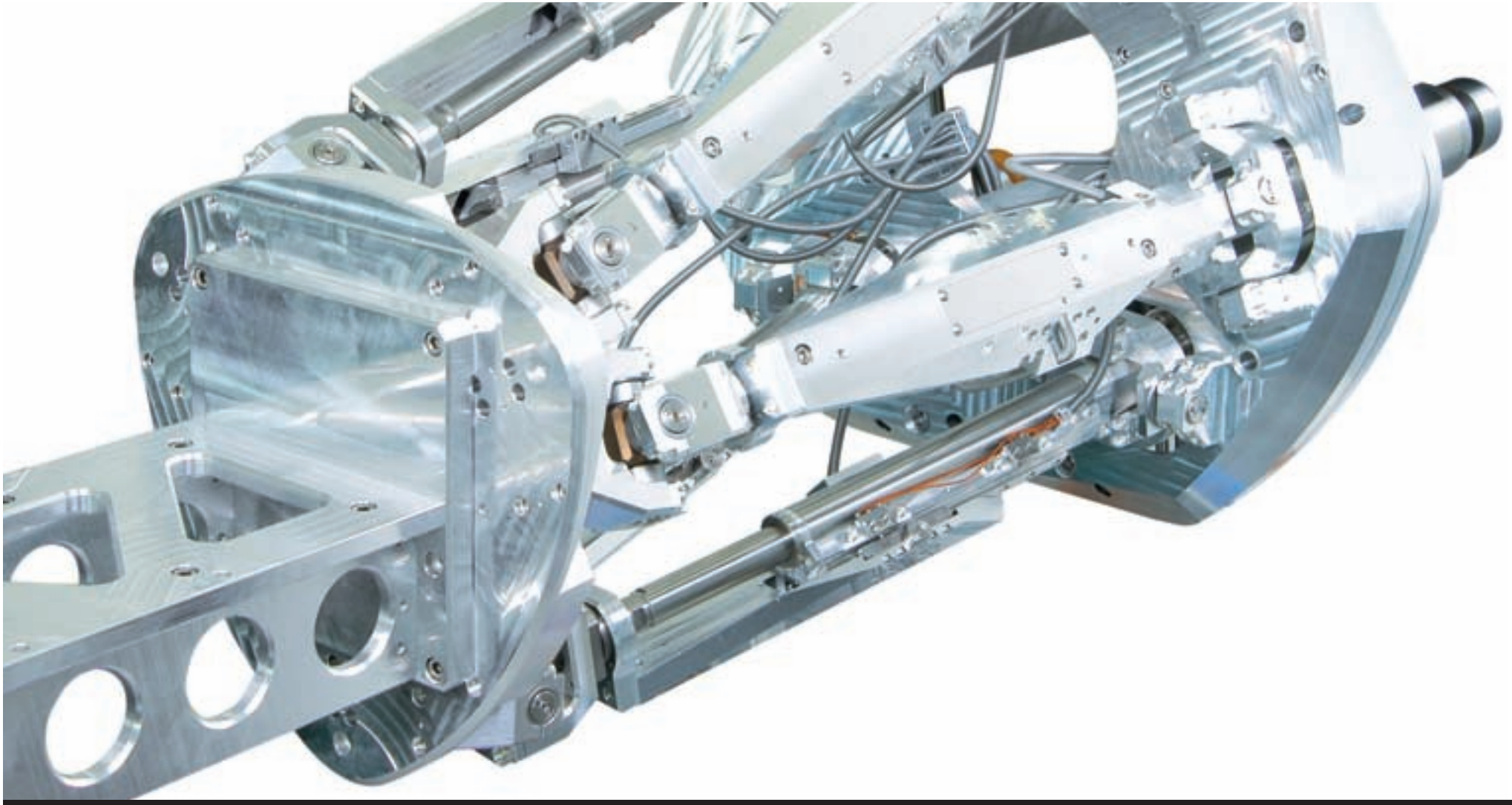
# ABOUT US

PASSION FOR MICRO AND NANO POSITIONING

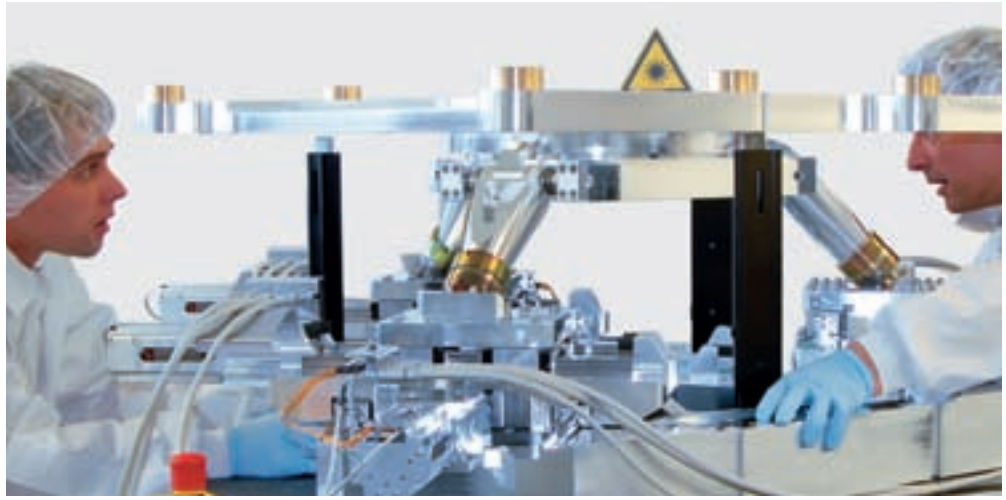
High quality standards as well as well trained PI miCos employees are prerequisites. Among them physicists, engineers and other experts form the PI miCos technical and commercial team.
The distinguishing attributes of our staff are openness, curiosity and a desire to experiment, as well as a permanent quest to improve our products and services, whilst working at the highest possible level of quality.
The support of our employees is an important cornerstone to success.

Our definition of quality is the faultless production of innovative high technology products, to meet deadlines and commitments without compromises, as well as our obligation to deal in an open and frank manner with customers and suppliers alike.
The wishes and expectations of our customers are of the highest priority. We are not just content with satisfied customers - our work is not done until they are as equally enthusiastic!



INNOVATION THROUGH CREATIVITY

Engineering is of major relevance for PI miCos to be competitive in the global market.
The essential qualifications are a constant advance through innovation and extensive know-how, customer and solution related product development, as well as optimum efficiency in production.
Technical solutions of tomorrow can be found in the engineering of today at PI miCos, where the understanding of structures, relations and functions of technical systems are among our strengths.
The design team develops new products, starting with the analysis, design scheme and simulation to the subsequent realisation of the finished product.
The fundamental basis of our innovative creativity is the synergy of different disciplines such as precision engineering, optics, electronics and software development.



Numerous customers from different markets and disciplines, such as biotechnology, life science, medical, nanotechnology, photonics, telecommunications, semi conductors, astronomy, microscopy and educational laser systems, access these abilities.
They all have a partner in PI miCos, which provides high competency in technical trouble-shooting, considers complex system solutions as a constant challenge and offers the knowledge accumulated from this experience, from the process of product development through to large project handling.

# ENGINEERING

# PIONEER OF SPECIAL CHALLENGES

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Vacuum applications are becoming more essential due to technologies that can only be applied in vacuum.

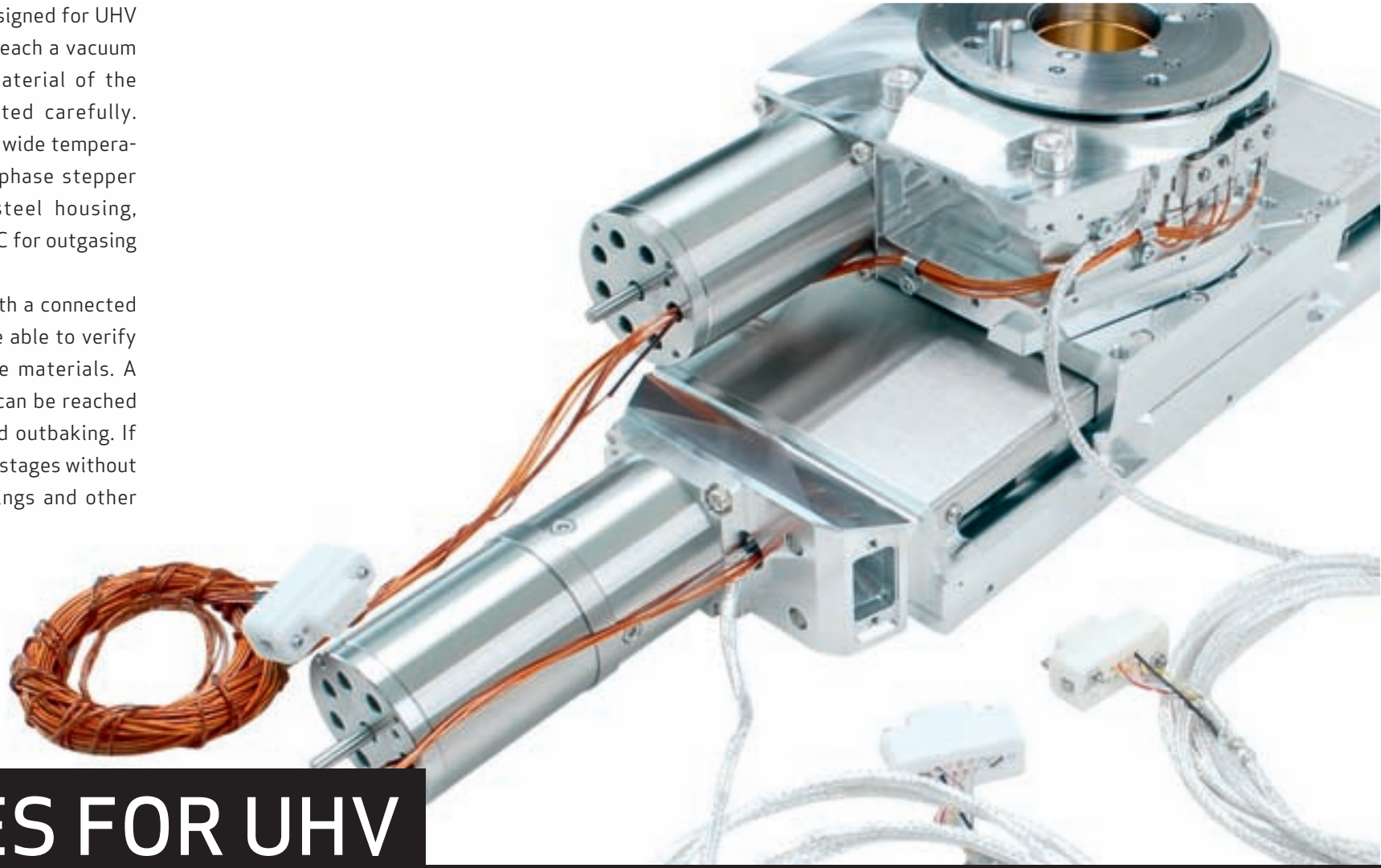
For over 12 years, PI miCos has applied its extensive vacuum experience to the motion technology field. We supply components and systems for vacuum levels from $10^{-3}$ mbar to $10^{-10}$ mbar.

Most of our standard products are designed with vacuum applications in mind allowing us to easily convert our broad range of stages to be vacuum compatible.
We also apply our vacuum expertise to complete turnkey system solutions.

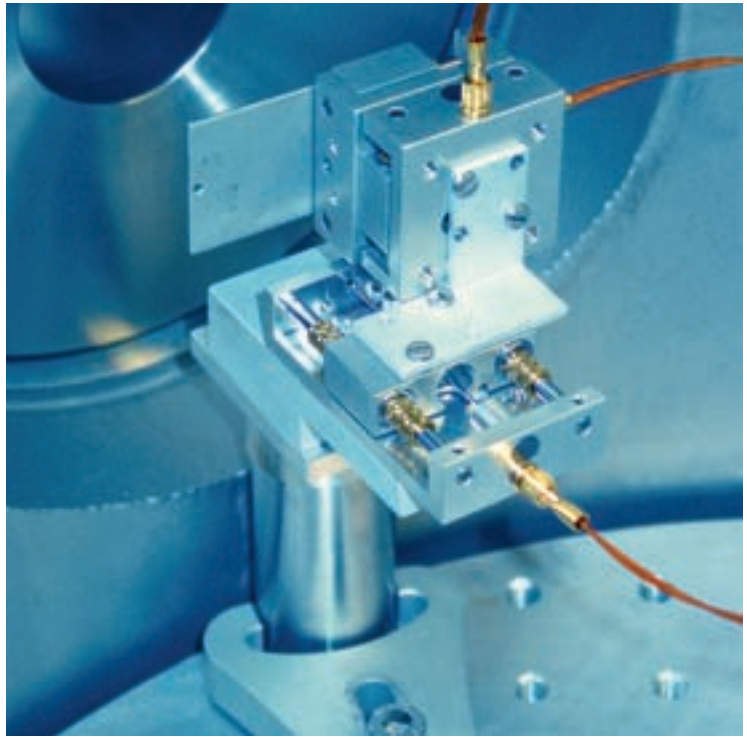
# VACUUM

PI miCos stages can be designed for UHV and cryo applications. To reach a vacuum level of $10^{-9}$ mbar the material of the stages have to be selected carefully. Special end switches for a wide temperature range and special 2 phase stepper motors with stainless steel housing, actively heated up to 120°C for outgasing can be adapted.

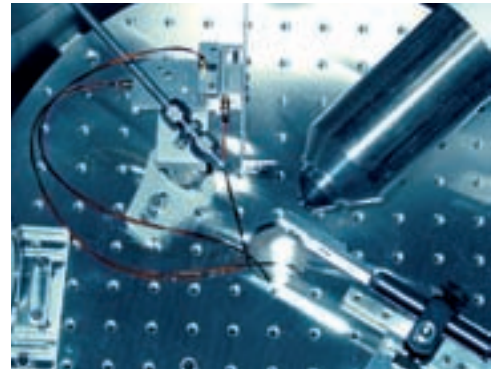
Using our own chamber with a connected mass spectrometer we are able to verify the suitability of possible materials. A level of $10^{-7}$ mbar or less can be reached by a longer pump time and outbaking. If needed we can also design stages without any grease by using coatings and other materials.

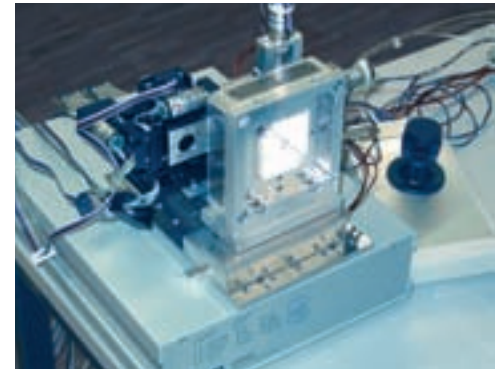


# STAGES FOR UHV



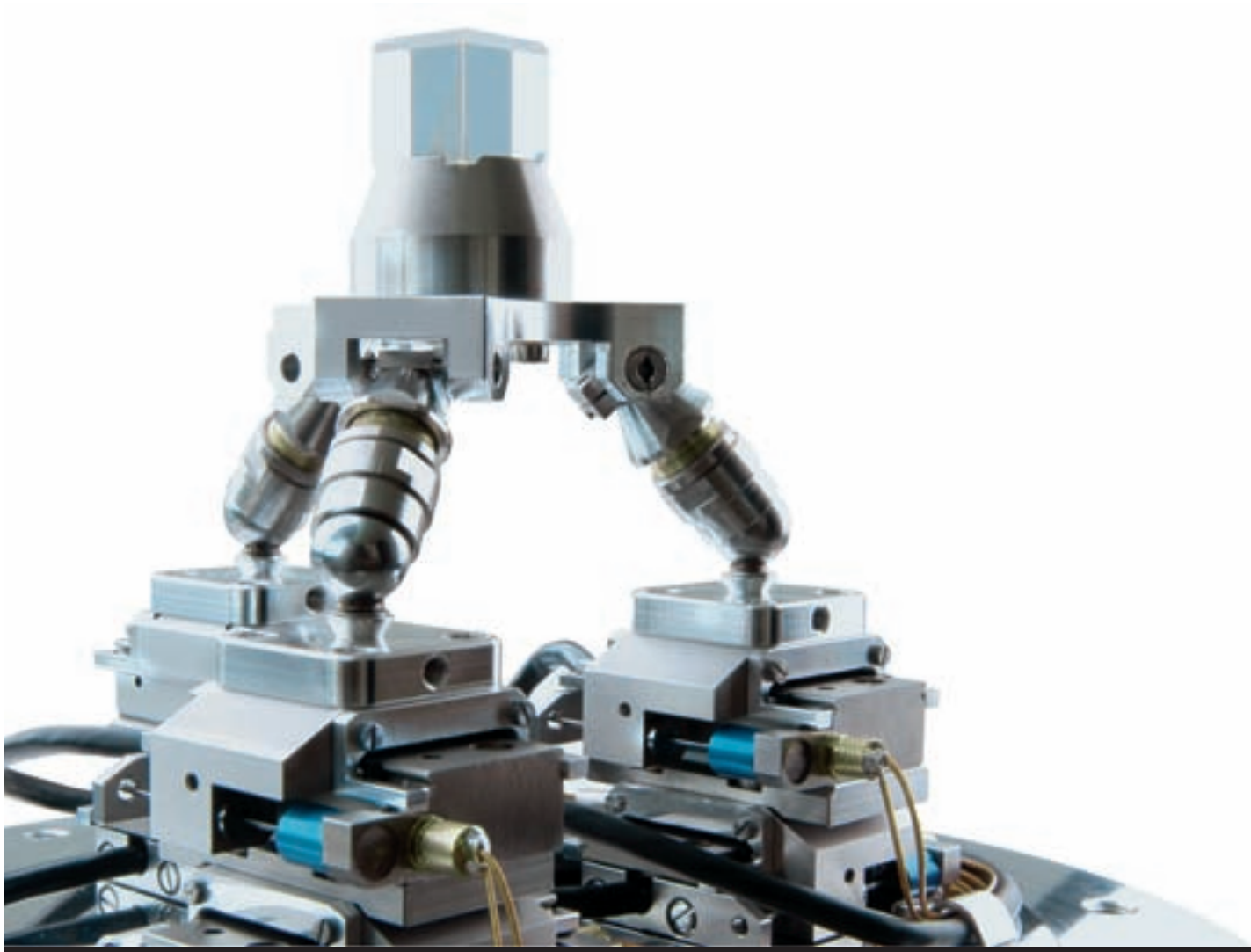
In this picture a XYZ-PP30 unit is shown which carries an adapter plate for an optical system. The application has a vacuum level of $10^{-9}$ mbar.



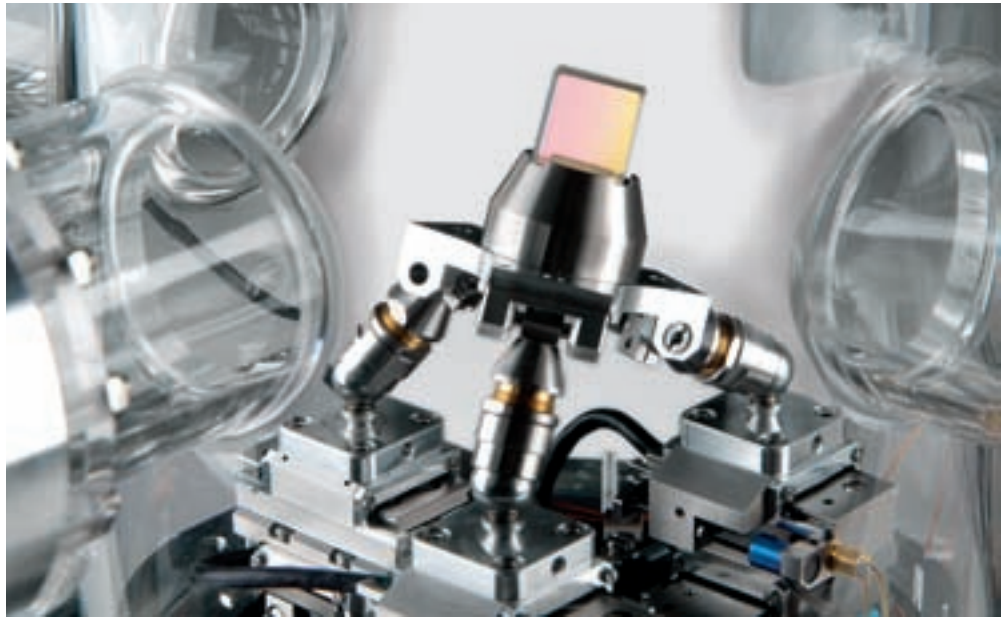


Mini-Positioner MT-55 driven by SMC corvus in a vacuum level of $10^{-3}$ mbar.

# MULTI-AXES FOR FV



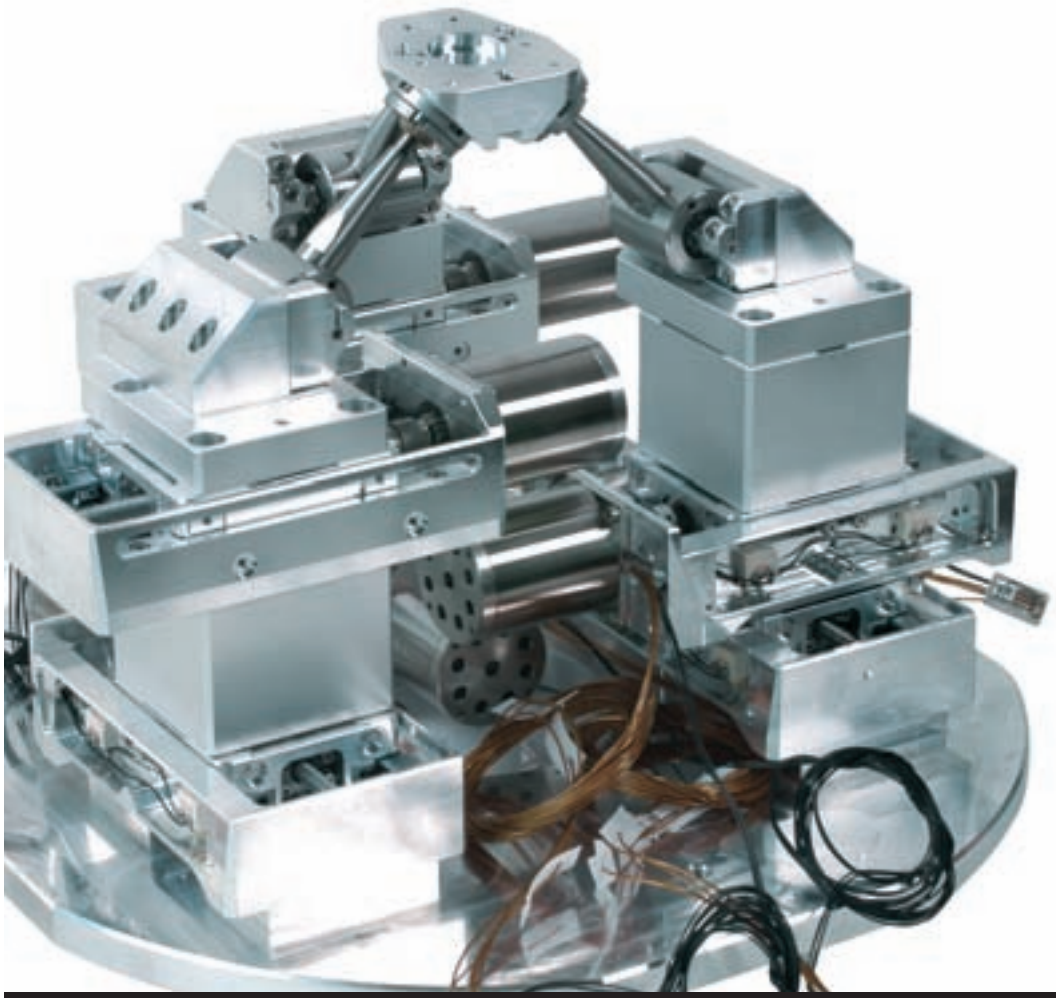
SpaceFAB SF-3000 PS is designed for applications in vacuum environments where probes have to be aligned in all six degrees of freedom. We have minimized the overall dimensions. SpaceFAB SF-3000 PS is based on LPS-30 stages which allow the highest resolution with the piezo inertia drive and a closed loop scale system.



Maximum travel ranges in XY are 12.7 mm with a vertical displacement of only 2 mm; central load of up to 0,5 kg is possible. The pivot point, i.e. the center of the probe, can be set by the customer which is very important for several applications.

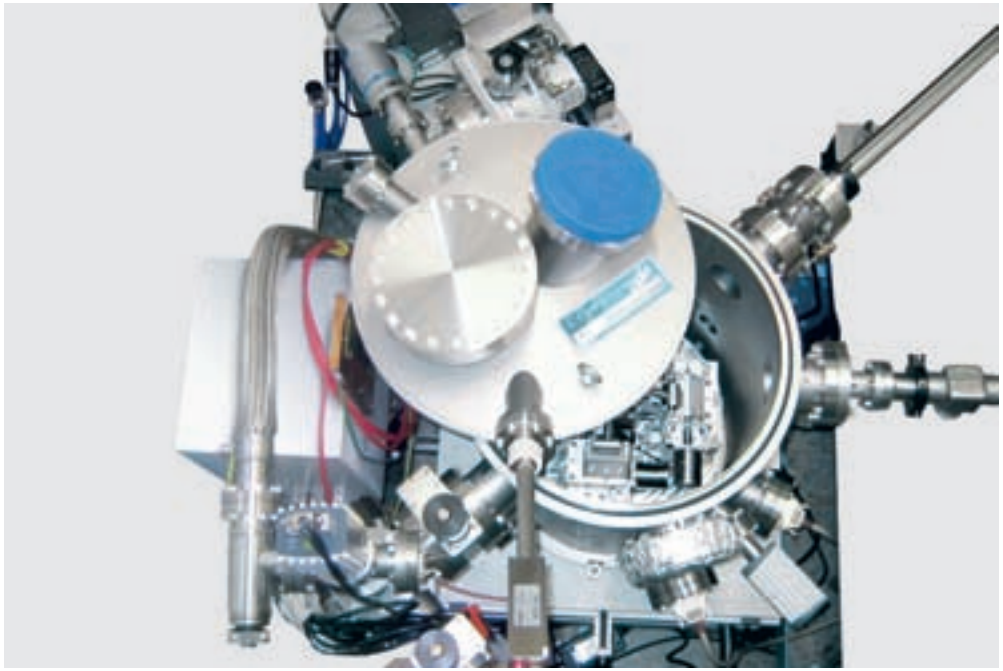
The system is based on the PI miCos Motion Server which includes all the mathematical transformations, so that the customer can start positioning directly by specifying the six coordinates X, Y, Z, Rx, Ry and Rz.

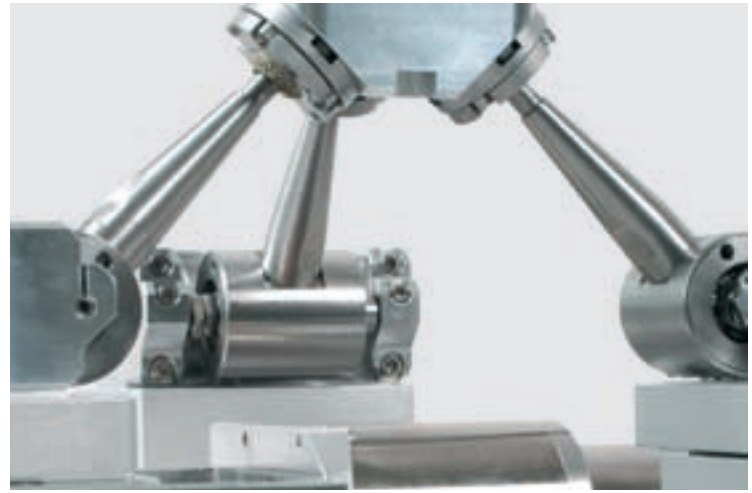
# SpaceFAB SF-3000 PS (PIEZO)



Customized SpaceFAB for vacuum $10^{-7}$ mbar and temperature range of -40°C to +80°C. 6 degrees of freedom.

With the SpaceFAB SF-3000 BS (vacuum) all six degrees of freedom can be moved without additional positioning elements. The low weight of the moving platform allows highly dynamic positioning. Using no pre-load, the design can easily carry up to 5 kg (center mounted). The pivotpoint can be set by software.



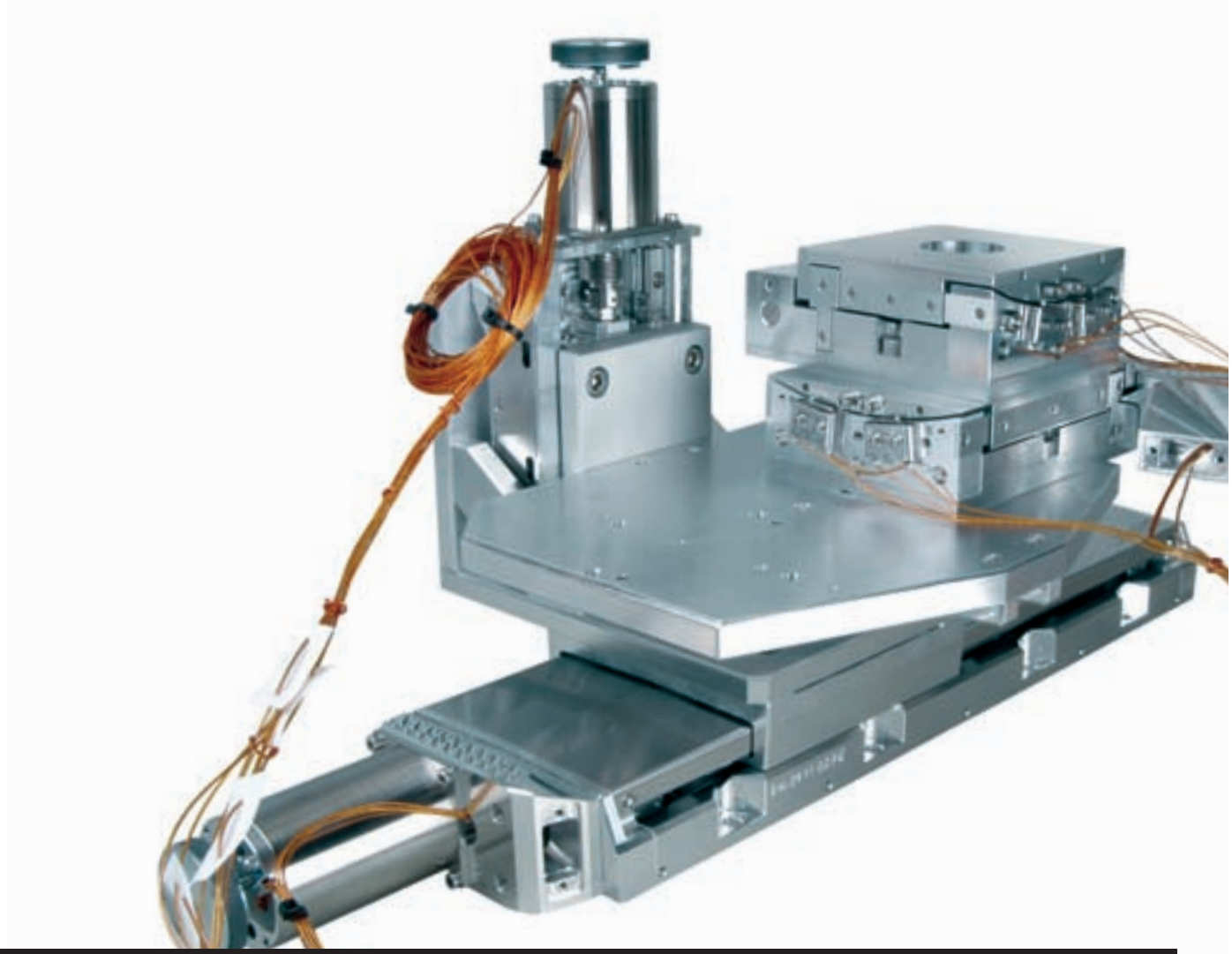


# SpaceFAB HV

1.016 Vacuum

A 5 m long spectrometer for soft x-rays used in a synchrotron radiation beamline for resonant x-ray emission spectroscopy and resonant inelastic x-ray scattering in the 400–1600 eV energy range. 5 axes advanced x-ray emission spectrometer is mounted on a rotating platform allowing the scattering angle to be varied from 25° to 130°. The spectrometer is operational at the ADRESS ADvanced REsonant SpectroScopy beam-line of the Swiss Light Source.

This positioning system was designed for a custom application. The system uses the linear stages LS-110 and the PLS-85 in addition to two goniometers (WT-100 and WT-85) at a vacuum level of $10^{-7}$ mbar.



# HIGH RESOLUTION X-RAY SPECTROMETER

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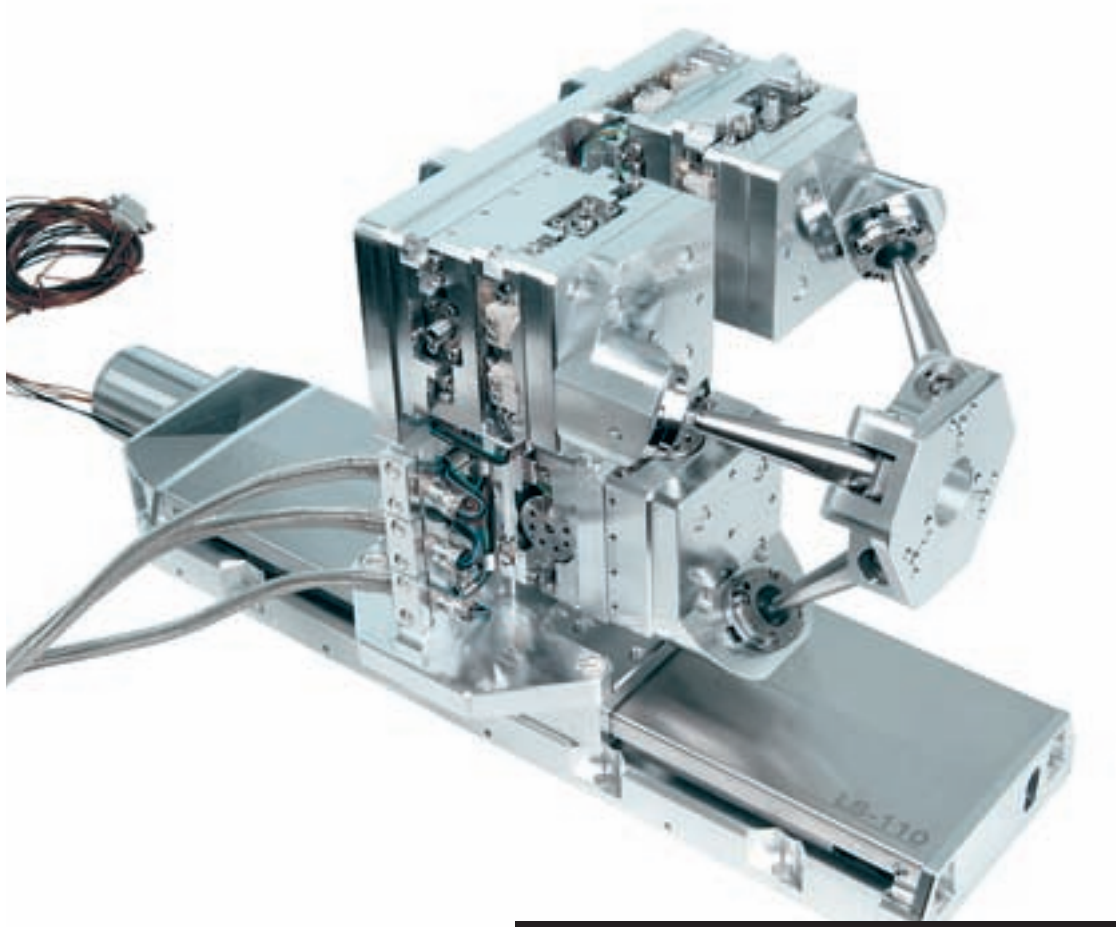
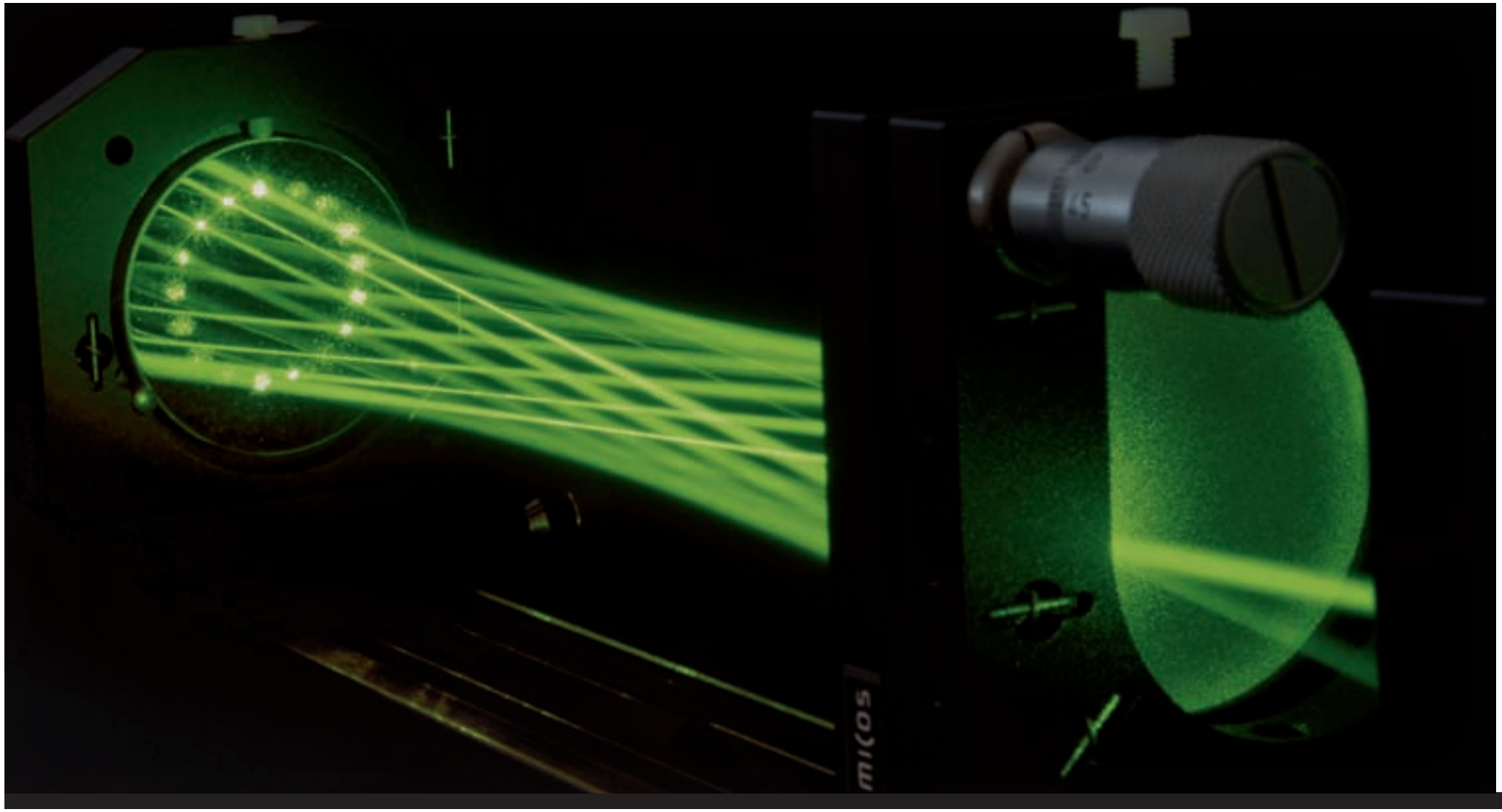


This 7 axes positioning system consists of a LS-110 and a custom designed SpaceFAB which is used for dynamic measurements. To achieve the required precision, highstiffness and repeatability was required. The pivot point can be set by software in this case important for adjusting an X-Ray single reflection lens at BESSY II in Berlin.

# SpaceFAB HV FOR SYNCHROTON




FASCINATED BY EDUCATION


Optical technologies are more regularly becoming the basis for new measuring techniques and high resolution production processes. In order to fulfil these new challenges solutions in the field of integrated optics and classical linear beam control are in more demand. Therefore future scientists, developers and engineers are having to work with lasers as part of their education.

The CAMPUS education systems offer a wide range of experiments for universities and industry. Students are taught a basic knowledge of laser and general laser measuring techniques.
Experimental setup subjects are comprised of fiber and other applications, such as laser scanner, bar code reader, materials processing and triangulation. All experiments are underpinned with theoretical foundations and feature a detailed guide for trainees.

# CAMPUS


PERFECTION AT ITS BEST

Aesthetic, ergonomic and commercial aspects, play an important role when our products are in the development stage.
Design for us is not just about shaping, but is also an intuitive understanding of function and handling, as well as the cooperation between technique and aesthetic.

Design creates the condition for many things to work in a desired manner.
For PI miCos design means – to serve the function, arouse emotions!

# DESIGN

| Icon | Definitions |
|---|---|
|  | New Product |
|  | Serial / GPIB / USB / Ethernet |
|  | Extended Warranty |
|  | Point to Point Motion |
|  | PC-card |
|  | Vacuum Option |
|  | Linear & Circular Interpolation |
|  | Linear Or Rotation Feedback |
|  | Motion Server |
|  | Torque Motor |
|  | Linear Motor |
|  | Voice Coil |
|  | Flexure |
|  | LabVIEW™ |
|  | Gearbox |
|  | Microstep |
|  | Piezomotor |
|  | Cryonic Option |
|  | Motion & Control |

| Icon | Definitions |
|---|---|
|  | Travel Range |
|  | Depth |
|  | Countersink 90° |
|  | Counterbore |
|  | Input For Power and Signals |
|  | Control |
|  | Dimension in Millimeters |
|  | Projection Method |
|  | Hole Basis Fit Ø4 Tolerance Zone H7 |
|  | Metric Thread |
|  | Square |
|  | Brake |

# 1.024 INDEX

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# CONTROLLERS

# 2.028 Controller overview

## SMC-series

| | Version | Form-Factor | Stepper Motor | DC-brushed Motor | DC-brushless Motor | Piezo-Motor | 2-Phase Linear/Torque | 3-Phase Linear/Torque | Closed-Loop | Communication | Modes of Motion | Number of Axes | Index |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | SMC corvus | desktop<br>19" rack | ■ | | | | | | yes / optional | RS-232<br>Ethernet TCP / IP<br>GPIB | linear interpolation | 2 or 3 (n x 3) | 2.032 |
|  | SMC corvus eco | desktop | ■ | | | | | | yes / optional | RS-232<br>USB | linear interpolation | 2 or 3 (n x 3) | 2.034 |
|  | SMC corvus pci | PCI-board | ■ | | | | | | yes / optional | PCI-COM RS-232 | Linear interpolation | 2 or 3 | 2.036 |
|  | SMC pollux | desktop<br>19" chassis<br>intelligent motor | ■ | | | | | | yes / optional | RS 232<br>Ethernet TCP/IP<br>USB-cable | point to point | 1, daisy chain up to 16 | 2.038 |
|  | SMC hydra | desktop CM / TT<br>19" RM | ■ | ■ | ■ | ■ | ■ | ■ | yes / optional<br>absolute encoder<br>optional: 1Vpp and RS-422 | RS-232<br>Ethernet TCP/IP | point to point<br>linear interpolation | 2 | 2.040 |
|  | SMC pegasus | SMC taurus: desktop<br>SMC pegasus: 19" rack | ■ | | | | ■ | ■ | yes / optional | RS-232 | point to point | SMC taurus: 1<br>SMC pegasus: up to 256 | 2.042 |

## SM-series

| | Version | Form-Factor | | | | | | | Closed-Loop | Communication | Modes of Motion | Number of Axes | Index |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | SM-32 | PCI-board | ■ | | | | | | no | PCI-bus | point to point | 3 | 2.044 |

## LMC-series

| | Version | Form-Factor | | | | | | | Closed-Loop | Communication | Modes of Motion | Number of Axes | Index |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | LMC-100 | pocket / desktop | | ■ | ■ | | | ■ | yes | RS-232<br>CAN-open | point to point | 1 | 2.045 |

## MoCo-series

| | Version | Form-Factor | | | | | | | Closed-Loop | Communication | Modes of Motion | Number of Axes | Index |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | MoCo DC | pocket / desktop | | ■ | | | | | yes | RS 232<br>USB-cable | point to point | 1, daisy chain up to 16 | 2.046 |

## MMC-series

| | Version | Form-Factor | Stepper Motor | DC-brushed Motor | DC-brushless Motor | Piezo-Motor | 2-Phase Linear/Torque | 3-Phase Linear/Torque | Closed-Loop | Communication | Modes of Motion | Number of Axes | Index |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | MMC-100/110 | desktop stackable | | | | ■ | | | yes<br>incremental RS-422<br>1Vpp * | USB | point to point | 1, daisy chain up to 99 | 2.048 |

## Piezo-series

| | Version | Form-Factor | | | | | | | Closed-Loop | Communication | Modes of Motion | Number of Axes | Index |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | PiCo 33 Piezo | desktop | | | | ■ | | | no<br>yes | RS-232<br>USB | point to point<br>point to point | 3<br>3 | 2.050 |
|  | PMA-100 | desktop | | | | ■ | | | no | PCI-Bus | | 1 | 2.051 |

## DMC-series

| | Version | Form-Factor | | | | | | | Closed-Loop | Communication | Modes of Motion | Number of Axes | Index |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | DMC Controller | PC based PCI-Slot<br>external 19"-chassis | ■* | ■* | ■* | ■* | ■* | ■* | yes | PCI-Bus<br>Ethernet<br>RS-232 | Linear interpolation<br>Circular interpolation<br>Contouring independant | 1..8 | 2.052 |

* in combination with MPA

## Delta-Tau-series

| | Version | Form-Factor | | | | | | | Closed-Loop | Communication | Modes of Motion | Number of Axes | Index |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | Geobrick / Clipper | 19" rackmount | ■ | ■ | ■ | ■ | ■ | ■ | yes<br>RS-422<br>1Vpp | Ethernet<br>USB<br>RS-232 | Linear interpolation<br>Circular interpolation<br>Contouring independant | 4 / 8 | 2.054 |

## FlexMotion-series

| | Version | Form-Factor | | | | | | | Closed-Loop | Communication | Modes of Motion | Number of Axes | Index |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | Flex Motion Controllers | PC based PCI /<br>PXI Slot | ■ | | ■ | | | | yes | PCI/PXI-Bus | Linear interpolation<br>Circular interpolation<br>Contouring independant | 2/4<br>2/4/6/8 | 2.056 |

## Power Amplifiers

| | Version | Form-Factor | | | | | | | Closed-Loop | Communication | Modes of Motion | Number of Axes | Index |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | MPA | 19" rack | ■ | ■ | ■ | ■ | ■ | ■ | DMC-series | | | 1..8 | 2.058 |

**Our SMC family of motion controllers is based on modern 32 bit technology which enables performances of stepper motor driven systems which haven´t been possible before. A so-called sin² acceleration offers very smooth acceleration and deceleration of the motors which allows highest performance positioning in the nanometer range. One of the big advantages of our SMC controllers is the possibility to drive the stages with extremly high resolution.**

In Figure 1 you can see the measurement results of 100 nm steps driven with a PLS-85 stage with 2 phase stepper motor in open loop (without feedback of an encoder system). The stage is moving these steps with high precision. Driving the stage with 25 nm steps (Figure 2) it is obvious that the step width shows more variations, but in average the value is about 25 ± 5 nm. Positioning in the nm range is normally done with piezo drivers. But even with a standard linear stage like PLS-85 and our SMC-controllers it is possible to push the stage in the nm range. In Figure 3 you can see the result of programmed 10 nm steps measured by an interferometer. The stage is not moving in equal 10 nm steps, but the average motion is in this range. The measurement is limited by the 5 nm resolution of the interferometer. This amazing resolution is not possible with any other typical stage.

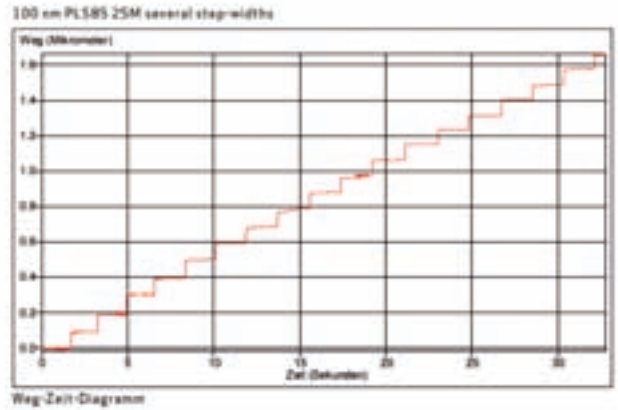


Figure 1: PLS-85, 2 SM open loop, resolution with 100 nm steps

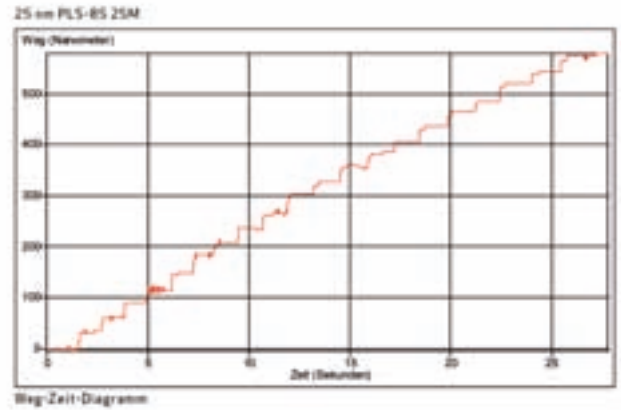


Figure 2: PLS-85, 2 SM open loop, resolution with 25 nm steps

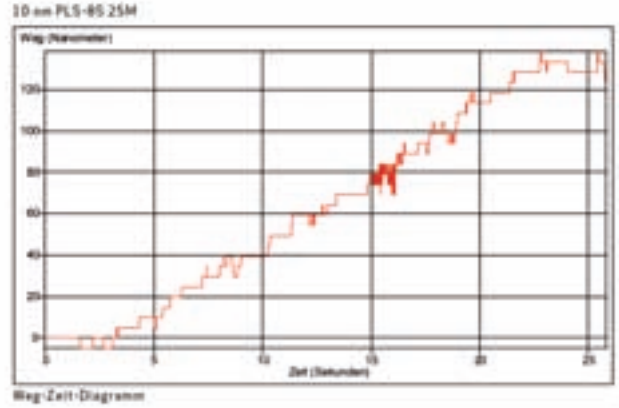


Figure 3: PLS-85, 2 SM open loop, resolution with 10 nm steps

For example, our VT-80 stage can be “positioned” with 100 nm steps (figure 4) but the result is not visible in defined levels and constant step width which is mainly due to the fine pitch leadscrew.

On the other hand the results of a PLS-85 stage shown in Figure 1-3 can be improved by driving the stage in closed loop. One of the advantages of our SMC-controllers is the intelligent control of the stage by using the 1 Vpp interface of a high resolution scale. Figure 5 shows the measurement of a LS-110 stage with a linear scale. The resolution of 50 nm is visible in well defined moving steps. Even changing the load does not disturb the stage positioning. The resolution is limited by the scale system, so using a 2 nm scale enables resolutions of 2 nm which can be influenced by environmental disturbances like temperature drift (for example, a change of 0.01 degree in the temperature is resulting in a stage expansion of about 10 nm).

For these type of applications we designed our ultra-precision stages UPM-160 and NPE-200 or customized granite based setups using Heidenhain Zerodur scales.

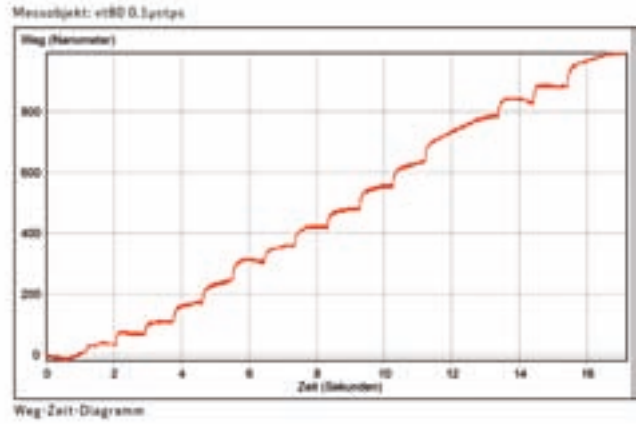



Figure 4: VT-80, 2 SM open loop, resolution with 100 nm steps

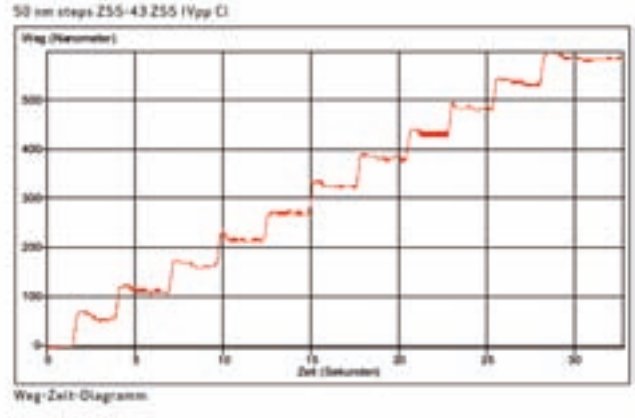



Figure 5: LS-110, 2 SM closed loop 1 Vpp, resolution with 50 nm steps

**Speed is one important parameter for setting up a system. Often the maximum speed is required but for other applications it is very important to drive very slow and smooth. Standard stepper motor controllers cannot drive smooth. Even DC servo motors are not able to drive in the low velocity range in a linear and smooth way.**

Figure 6 shows the measurement of a PLS-85 stage with linear scale (with a 10 nm encoder resolution).
The speed was set to 100 nm/s, so the stage traveled 360 µm within one hour, or about 10 mm per day. The movement is very smooth.
Figure 7 shows the first 100 nm of the travel.
Here it is important to realize that the interferometer resolution is 5 nm which results in the step-wise diagram. These steps are not coming from the stage. The movement is much smoother. It is very important to understand that the speed is linear and variations are in the 1 nm/s range which is exceptional for a loaded stage with several mm travel range. The results can be also improved by using a better encoder resolution. The result of a UPM-160 stage controlled with 45 nm/s speed is shown in Figure 8. The 450 nm move within 10 seconds is very linear. The interferometer resolution is limiting the interpretation of the picometer-per-second scale.

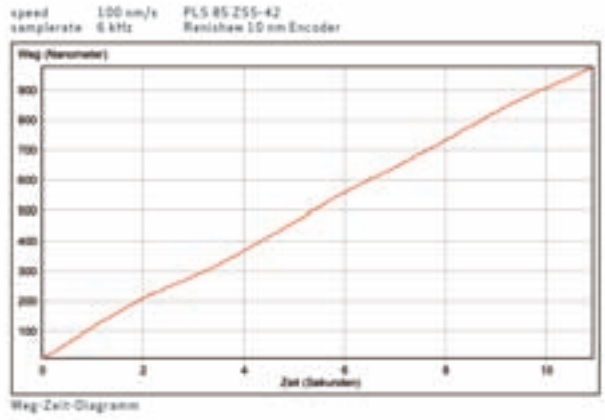


Figure 6: PLS-85, 2 SM closed loop, speed with 100 nm/s

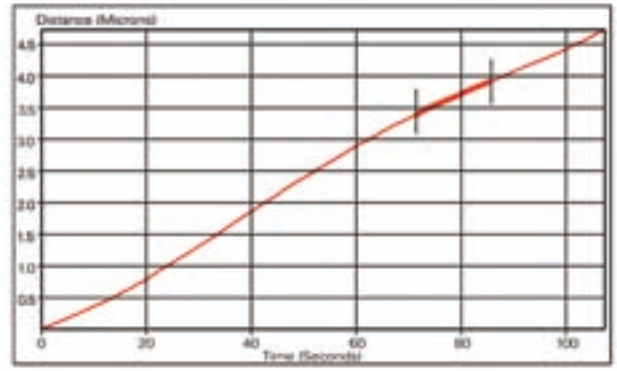


Figure 7: PLS-85, 2 SM closed loop, speed with 100 nm/s

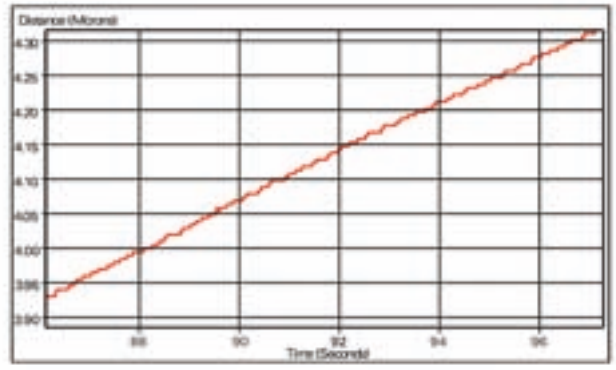


Figure 8: UPM-160, 2 SM open loop, speed with 45 nm/s

Positioning accuracy is normally limited by the quality of the bearings and drive mechanism, so for example errors in the leadscrew pitch are resulting in a positioning error. Figure 9 shows the deviation of the position between desired and measured position. Within a travel range of 100 mm the LS-180 stage has a positioning error of about 32 µm. The measurement shows both travel directions, so that the bidirectional repeatability, which depends on the backlash, can be seen with a value of 1.78 µm.

For some applications it is important to improve the absolute positioning, whereas the bidirectional repeatability is not important. The problem can be solved by using the deviation measurement for a position correction inside the SMC controller (see position correction option in SMC Corvus). The result is presented in Figure 10 which looks crowded at a deviation scale of 3 µm. The deviation is minimized by a factor of 10, eliminating the slope grading. This is a cost effective method to minimize system positioning errors.
By using a linear scale system, the repeatability and accuracy can be further improved.

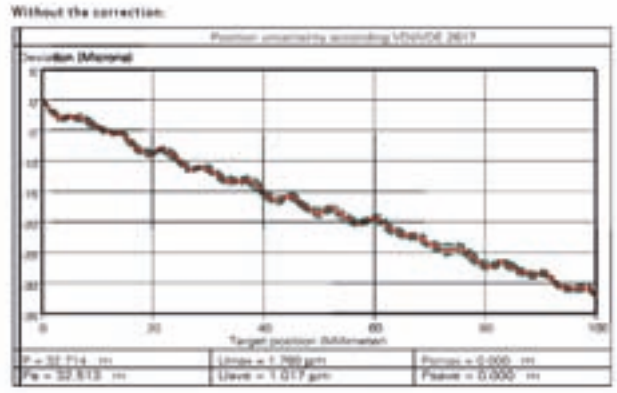



Figure 9: LS-180, 2 SM open loop, positioning error

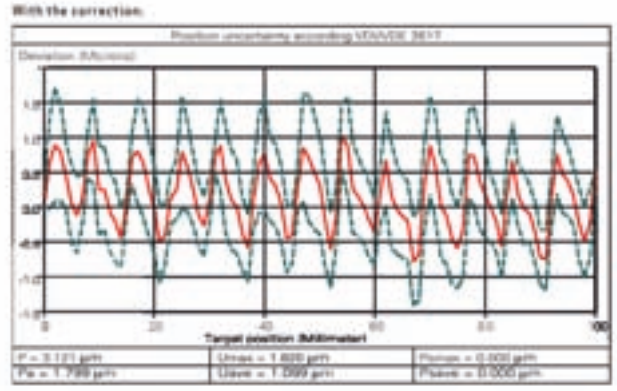



Figure 10: LS-180, 2 SM open loop, position corrected

Rack 19" 2HE

Joystick (optional)

## KEY FEATURES

- 2 or 3 axes microstep controller system
- High resolution microstep
- 48 V bus-voltage
- 133 MHz RISC processor, with flash memory
- Velocity range < 0.1 µm/s... 45 rev/s (200 step motor)
- Closed-loop for quadrature encoders (RS-422) and sin-cos encoders (1Vpp)
- Linear interpolation of all axes
- Linear & $\sin^2$ acceleration
- Position compare output <= 2 kHz
- Position capture (up to 1000 x 3 axes coordinates)
- Joystick input
- Serial interface RS-232 upto 115.6 KBaud
- Ethernet interface 10Base TCP/IP
- GPIB (IEEE-488) interface
- Venus-1 compatible string based command language

## TECHNICAL DATA

| | |
|---|---|
| **Axes** | 2 or 3 axes 2 phase stepper motors |
| **Computer interface** | RS-232 up to 115.2 kBaud, optional: Ethernet 10Mbit |
| **Commands** | Venus-1 ASCII |
| **Supply voltage** | 90-250 VAC 50-60 Hz |
| **Cooler** | Integrated |
| **Power configuration** | Desktop 50W standard, max. 100W 2/3 axes<br>19´´ 2 HE rackmount, max. 240W 2/3 axes<br>19´´ 2 HE rackmount, max. 500W 2/3 axes |
| **Limit switches** | 2 per axis software configurable |
| **Trajectory mode** | Linear interpolation |
| **Velocity range** | <0.1 µm/s.. 45 rev/s (200 step motor) |
| **Program and parameter** | Flash memory |
| **Diagnostics** | LED at the front with 2 user LEDs,<br>acoustic messages with integrated buzzer |
| **Amplifier** | 48V bipolar 2 Phase,<br>with short-circuit & temperature protection |
| **Phase-current** | max. 2.5 - 3 A |
| **Housing** | Desktop HxBxT 70x240x305 mm |
| **Software interface** | Windows demo program WINPOS-light<br>DLLs, demo applications (C/Delphi/VB)<br>LabVIEW™ VIs and Demoapplication |

## SMC corvus

| | |
|---|---|
| 2 axes SMC corvus microstep controller 48 V 50 W with RS-232 | 001 |
| 2 axes SMC corvus NET microstep controller 48 V 50 W with RS-232 and Ethernet TCP/IP | 003 |
| 3 axes SMC corvus microstep controller 48 V 50 W with RS-232 | 002 |
| 3 axes SMC corvus NET microstep controller 48 V 50 W with RS-232 and Ethernet TCP/IP | 004 |

## SMC corvus options

| | | |
|---|---|---|
| **Power amplifier** | Power amplifier 100 W (desktop/2HE/3HE) | 101 |
| | Power amplifier 150 W (2HE/3HE) | 102 |
| | Power amplifier 240 W (2HE/3HE) | 103 |
| | Power amplifier 500 W (3HE) | 104 |
| **19" 84TE Rackmount** | 19" 84TE rackmount 19" 2HE | 121 |
| | 19" 84TE rackmount 19" 3HE | 122 |
| **Closed-loop** | For quadrature encoders RS422 per axis | 115 |
| | For sin/cos encoders 1Vpp, 12-bit interpolation per axis | 116 |
| **Joystick** | 2 axes | 106 |
| | 3 axes | 107 |
| | 2 axes with 10-key touch display | 108 |
| | 3 axes with 10-key touch display | 109 |
| **Hand wheel** | Hand wheel with 3 axes selector | 110 |
| **Digital I/O** | Digital I/O<br>3 x inputs (5- 24V) 3 x outputs (5- 24V)<br>with position compare trigger output<br>and position capture functionality | 112 |
| **StPCor** | static position correction (incl. stage measurement) per axis | 118 |
| **SMC corvus GPIB** | GPIB (IEEE-488) interface | 123 |
| **Winpos** | Full version software | 124 |
| **Brake logic** | Brake logic for one axis and power output (24V 0.4A) | 125 |
| **Emergency stop** | Emergency stop button with interface and cable l=3 m | 128 |

| 7170-9- | | | |
|---|---|---|---|

Front Panel

Back Panel

Front Panel

## KEY FEATURES

- 2 or 3 axes microstep controller system
- High resolution microstep
- 24 V bus-voltage
- 133 MHz RISC processor, with flash memory
- Velocity range < 0.1 µm/s... 15 rev/s (standard) 25 rev/s (with speed upgrade) (200 step motor)
- Closed-loop for quadrature encoders (RS-422) and sin-cos encoders (1Vpp)
- Linear interpolation of all axes
- Linear & $\sin^2$ acceleration
- Position compare output = 2 kHz
- Position capture (up to 1000 x 3 axes coordinates)
- Joystick input or integrated 2/3 axes joystick
- Serial interface RS-232 115 KBaud
- USB interface
- Venus-1 compatible string based command language

## TECHNICAL DATA

| | |
|---|---|
| **Axes** | 2 or 3 axes 2 phase stepper motors |
| **Computer Interface** | RS-232 up to 115.2 kBaud<br>USB interface |
| **Commands** | |
| **Supply voltage** | 90-250 VAC 50-60 Hz |
| **Power supply** | 24 VDC 40 W |
| **Limit switches** | 2 per axis software configurable |
| **Trajectory mode** | Linear interpolation |
| **Velocity range standard** | <0.1 µm/s .. 15 rev/s (200 step motor)<br><0.1 µm/s .. 25 rev/s (200 step motor)<br>speed upgrade |
| **Program and parameter** | Flash memory |
| **Amplifier** | 24 V bipolar 2 phase,<br>with short-circuit & temperature protection |
| **Phase current** | Max. 1.5 A |
| **Housing** | Desktop 65x225x216 mm [HxWxD] |
| **Software interface** | Windows demo program WINPOS<br>DLLs, demo applications (C/Delphi/VB)<br>LabVIEW™ VIs and demo application |

Back Panel with joystick

## SMC corvus eco

| | |
|---|---|
| 2 axes SMC corvus eco microstep controller | 006 |
| 3 axes SMC corvus eco microstep controller | 007 |
| 2 axes SMC corvus eco microstep controller & joystick | 008 |
| 3 axes SMC corvus eco microstep controller & joystick | 009 |

## SMC corvus eco options

| | | |
|---|---|---|
| **Speed upgrade** | Max speed 25 rev/s (200 step motor) | 204 |
| **Closed-loop** | For quadrature encoders RS422 per axis | 201 |
| | For sin/cos encoders 1Vpp, 12-bit interpolation per axis | 202 |
| **Joystick** | External 2 axes | 106 |
| | External 3 axes | 107 |
| | 2 axes with 10-key touch display | 108 |
| | 3 axes with 10-key touch display | 109 |
| **Hand wheel** | Hand wheel with 3 axes selector | 110 |
| **Digital I/O** | 3 x inputs (5- 24 V) 3 x outputs (5- 24 V) with position compare trigger output and position capture functionality | 203 |
| **StPCor** | static position correction (incl. stage measurement) per axis | 118 |
| **Winpos** | Full version software | 124 |
| **Emergency stop** | Emergency stop button with interface and cable l=3 | 128 |

| 7170-9- | | | |
|---|---|---|---|

Joystick

## KEY FEATURES

- 2 or 3 axes microstep controller system
- High resolution microstep
- 24 V bus-voltage
- 133 MHz RISC processor, with flash memory
- Velocity range < 0.1 µm/s... 15 rev/s (standard) 25 rev/s (with speed upgrade) (200 step motor)
- Closed-loop for quadrature encoders (RS-422) and sin-cos encoders (1Vpp)
- Linear interpolation of all axes
- Linear & $\sin^2$ acceleration
- Position compare output = 2 kHz
- Position capture (up to 1000 x 3 axes coordinates)
- Joystick input or integrated 2/3 axes Joystick
- Serial interface RS-232 115 KBaud
- USB interface
- Venus-1 compatible string based command language
- 12 V PC
- PCI plug-in board with onboard microstepping power amplifiers
- Motor power 12 V (PC power supply), or optional external 24 V power supply
- Communication via PCI-Com-bridge, assures software compatibility to SMC corvus and SMC corvus eco

## TECHNICAL DATA

| | |
|---|---|
| **Axes** | 3 axes 2 phase stepper motors |
| **Computer interface** | pci-COM bridge 115.2 KBaud |
| **Commands** | Venus-1 ASCII |
| **Supply voltage** | 12 V PC or external up to 24 V DC |
| **Power configuration** | 12 V PC, max. 30 W 2/3 axes<br>24 V external, max. 30 W 2/3 axes |
| **Limit switches** | 2 per axis software configurable |
| **Trajectory mode** | Linear interpolation |
| **Velocity range** | <0.1 µm/s .. 15 rev/s (200 step motor)<br><0.1 µm/s .. 25 rev/s (200 step motor)<br>speed upgrade |
| **Program and parameter** | Flash memory |
| **Amplifier** | 12 V..24 V bipolar 2 Phase,<br>with short-circuit & temperature protection |
| **Phase current** | Max. 1.5 A |
| **Housing** | Pci slot HxB 99x184 mm |
| **Software interface** | Windows demo program WINPOS<br>DLLs, demo applications (C/Delphi/VB)<br>LabVIEW™ VIs and demo application |

## SMC corvus pci

| | |
|---|---|
| 2 axes SMC corvus pci microstep controller | 002 |
| 3 axes SMC corvus pci microstep controller | 001 |

## SMC corvus pci options

| | | |
|---|---|---|
| **Speed upgrade** | Max speed 25 rev/s (200 step motor) | 113 |
| **Closed-loop** | For quadrature encoders RS422 per axis | 115 |
| | For sin/cos encoders 1Vpp, 12-bit interpolation per axis | 116 |
| **Joystick** | 2 axes | 106 |
| | 3 axes | 107 |
| | 2 axes with 10-key touch display | 108 |
| | 3 axes with 10-key touch display | 109 |
| **Hand wheel** | Hand wheel with 3 axes selector | 110 |
| **Digital I/O** | 3 x inputs (5- 24V) 3 x outputs (5- 24V) with position compare and position capture functionality | 112 |
| **StPCor** | static position correction (incl. stage measurement) per axis | 118 |
| **Winpos** | Full version software | 124 |
| **Emergency stop** | Emergency stop button with interface and cable l = 3 m | 128 |
| **ext. power supply** | 24V DC/60 W | 126 |
| **Joystick** | Interface SMCpci | 105 |

| 7161-9- | | | |
|---|---|---|---|

Pocket Box Controller / Motor & Controller System

## KEY FEATURES

- Single axis microstep controller system
- Stand alone system, or with integrated 2-phase stepper motor
- High resolution microstep
- Up to 16 SMC pollux can be combined with only one RS-232 interface
- DSP controller type
- Velocity range <0.1 µm/s... 40 rev/s (200 step motor)
- Serial interface RS-232 19200 Baud
- Venus 2 compatible string based command language
- Windows™ user interface
- 24 VDC power supply (external)
- Synchron motion start commands
- Speed mode
- Closed-loop 1 Vpp interface, optional for NT series
- Mixed configurations (open-loop / closed-loop) possible with NT series
- LabVIEW™ VIs
- Windows DLL and open source project available
- 3 types with different torques / velocities available

## TECHNICAL DATA

| | |
|---|---|
| **Axes** | 1 axis, 2 phase stepper motors |
| **Computer interface** | RS-232 19.2 kBaud |
| **Commands** | Venus-2 ASCII |
| **Supply voltage** | 24 VDC |
| **Phase currents** | <= 1.2 A/phase |
| **Limit switches** | 2 per axis software configurable |
| **Velocity range** | For 200 step motor<br><0.1 µm/s .. 13 rev/s TYPE I<br><0.1 µm/s .. 25 rev/s TYPE II<br><0.1 µm/s .. 50 rev/s TYPE III |
| **Max. resolution** | 300 000 positions/rev. |
| **Max linear resolution** | 1 nm |
| **Program and parameter** | Flash memory |
| **Amplifier** | 24 V bipolar 2 phase,<br>with short-circuit<br>& temperature protection |
| **Version with integrated 2-Phase stepper motor** | |
| **Motor torque** | 160 mNm (Type I)<br>160 mNm (Type II)<br>320 mNm (Type III)<br>900 mNm (Type II HT) |
| **Housing** | Pocket desktop (without motor),<br>or motor/controller<br>HxWxD 48x56x97 mm (additional motor shaft 20 mm) |
| | 19" chassis SMC-pollux integration box:<br>3HE 84TE chassis with 90..230 VAC power |
| **Software Interface** | Windows demo program SMC_Pollux<br>DLLs, demo applications (C/Delphi/VB)<br>LabVIEW™ VIs and demo application |

## Pollux box controller



## Pollux motor & controller



## Pollux multiaxis desktop



## Pollux accessories



The Pollux-Chassis 19 includes power-supply (90-230VAC), RS-232 interface, interlock input, power-mains, netfilter/fuse

| 7160-9- | | | |
|---|---|---|---|

Pocket Box Controller Closed Loop

SMC pollux 16 Axes 19" 4H 84T

Motor & Controller System with VT-80, see page 4.112

SMC pollux network (2-axes), DIN rail

SMC hydra CM

SMC hydra CM

## KEY FEATURES

- 2 axes motion controller
- High resolution microstep amplifier for DC brush, 2-phase stepper, 2- and 3-phase linear / torque motors (BLDC), 4-phase piezo motor
- Motor type software configurable (except piezo motor)
- 24 V / 48 V bus-voltage up to 500 W
- Motorola power PC with 760 Mips
- Closed-loop with absolute encoder (multiturn)
- Closed-loop with incremental encoder 1Vpp or RS-422
- Encoder based trigger output
- Position capture input
- Linear interpolation
- Ethernet 10/100 MBit
- RS-232 up to 115.2 kbaud
- VENUS-3 compatible string based command language
- Handwheel (Can-Bus)
- Joystick (Can-Bus)
- Linear 4 Phase Piezo Amplifier (no PWM, for electrical noise sensitive applications)

Available soon:

- Digital IO expansion (Can-Bus)

## TECHNICAL DATA

| | |
|---|---|
| **Axes** | 2 |
| **Computer interface** | Ethernet 10/100 MBit ; RS-232 interface 115.2 kBaud |
| **Commands** | Venus-3 ASCII |
| **Motortypes** | Stepper, linear and torque motors 1, 2 and 3 phase<br>and piezo motors, up to 10 A phase current<br>Servo motors up to 200 W |
| **Input / output** | 6x inputs, optically isolated, 5-24 V<br>1x input for emergency (optically isolated)<br>4x 10 bit analog outputs<br>1x open drain output (100mA)<br>fast trigger output 400 kHz / trigger input (10 kHz) |
| **Memory** | Parameter & program 8 MByte |
| **Operating system** | Realtime |
| **Encoder Interface** | 1Vpp 12 bit sin-cos interpolator 150 kHz<br>RS-422 quadrature 16 MHz |
| **Trigger-out / capture-in** | Position compare output max. 400 kHz<br>Position capture input max 10 kHz 4M captures<br>(only available with Delta-Star interface) |
| **Operation** | Open loop and closed-loop PID standard or PID adaptive |
| **Amplifier principle** | Digital MOS-FET, galvanically isolated, 24 /48 V<br>Analog , galvanically isolated, 48 V 1A |
| **Power supply** | Hydra CM : 24 VDC 48 V 360 Watt (optional)<br>Hydra TT : 90-260 VAC 300 Watt<br>Hydra RM: 90-260 VAC 1000 Watt |

## SMC hydra



## SMC hydra options



| 7160-9- | | | |
|---|---|---|---|

CAN-Joystick

SMC hydra TT rear

Special motor with absolute encoder

CAN-handwheel

SMC pegasus 19" chassis

## KEY FEATURES

- Analog joystick port
- Manual handwheel port
- SPS in-/outputs
- Limit switch inputs
- Enable input
- Potential-free emergency contacts
- Closed-loop for quadrature encoders (RS-422) and sin-cos encoders (1Vpp)
- RS-232 interface
- ASCII command-set VENUS-2
- Windows™ user-interface
- Programming interface (32-bit DLL) with examples (sourcecode)

## TECHNICAL DATA

| | |
|---|---|
| **Axes** | 1 to 32 |
| **Computer interface** | RS-232 19.2 KBaud |
| **Commands** | Venus-2 ASCII |
| **Amplifier voltage** | 48 VDC |
| **Phase currents** | 1.5 / 2 / 5 / 10 A/phase |
| **Limit switches** | 2 per axis, software configurable |
| **Velocity range** | < 0.1 µm/s .. 37.5 rev/s (2 step motor)<br>< 0.1 µm/s .. 500 mm/s (linear motor) |
| **Program and parameter** | Flash memory |
| **Amplifier** | 48 V, bipolar 2-phase stepper,<br>2-phase linear / torque motor,<br>3-phase linear / torque motor<br>with short-circuit & temperature protection |
| **Housing** | 19" 84TE 4 HE |
| **Software interface** | Windows™ demo program SMC pegasus<br>DLLs, demo applications (C/Delphi/VB)<br>LabVIEW™ VIs and demo application |

## SMC pegasus



## SMC pegasus options



## ordering as follows:



| 7160-9- | | | |
|---|---|---|---|

## KEY FEATURES

- 3 axes microstep controller system
- Microsteps down to 1/64 (software configuration)
- PCI plug-in board with onboard microstepping power amplifiers
- Motor power 12 V (PC power supply)
- Fast PCI slot communication
- 36 W max. power, 1.8 A per axis
- 32 bit step counter
- Trajectory generation with on board processor
- DLLs for all Windows™ versions, DOS, Linux
- Trajectory mode
- Point to point, trapezoidal and 3 axes contouring (PvT mode)
- Programming examples for VC5, VB5, Delphi, visual studio, LabVIEW™

Available soon:

- PCI Express (a new PCI slot standard)
- Desktop with USB interface
- continues path control

### SM-32 pci

| | |
|---|---|
| 3 axes pci microstep controller | 001 |

### SM-32 accessories

| | |
|---|---|
| Cable splitting 3 axes PI miCos DB9f (SMC compatible) l=0.4 m | 010 |
| Cable splitting 3 axes PI miCos HD15f l=3 m | 011 |

Others interfaces on request.

| 7195-9- | | | |
|---|---|---|---|

## TECHNICAL DATA

| | |
|---|---|
| **Axes** | 3 axes 2 phase bipolar stepper motors |
| **Computer interface** | Pci port |
| **Supply voltage** | 12 V PC |
| **Power configuration** | 36 W max. power, 1.8 A per axis |
| **Limit switches** | 2 per axis, software configurable |
| **Trajectory mode** | Point to point |
| **Frequency** | Up to 16 kHz in full-step |
| **Program** | Flash memory |
| **Amplifier** | 12 V |
| **Connector** | DB25 female |
| **Form factor** | Pci slot: 110 x 18 mm |
| **Software interface** | Windows demo program SM32<br>DLLs, demo applications (DOS/C/Delphi/VB)<br>LabVIEW™ VIs and demo application |

PI miCos

LMC-100 Front

## LMC-100 Controller

| | |
|---|---|
| LMC-100 controller 2.5A | 001 |
| LMC-100 controller OEM 2.5A | 002 |
| LMC-100 controller 5A | 003 |
| LMC-100 controller OEM 5A | 004 |

## Accessories

| | | |
|---|---|---|
| Power supply | 24V DC 65W 2.7A , 90-264 VAC | 100 |
| | 24V DC 120W 5A , 90-264 VAC | 101 |
| Interfacing | Daisy chain gateway RS-232-CAN | 110 |
| | USB-CAN interface | 111 |

| 7802-9- | | | |
|---|---|---|---|

## KEY FEATURES

- Single axis servo controller for brush DC-motors, 3 phase brushless DC-motors, linear and torque motors
- RS-232 interface for 1 axis, CANopen for multi axes applications
- SimpIlQ programming language, extensive mnemonic command set
- onboard programming, event triggered with subroutines
- Single axis point to point
- Servo-mode current, velocity and position
- Advanced filtering and gain scheduling
- RS-422 encoder feedback (up to 20 MHz)
- 1 Vpp encoder feedback with internal interpolation up to x4096 max. 250 kHz
- 2 limit-switch inputs
- 1 analog input 14 bit
- 2 free digital inputs, 2 digital power outputs
- Position compare (trigger out) & position capture

## TECHNICAL DATA

| | |
|---|---|
| Axes | 1 axis RS-232 , up to 127 with CANopen |
| Computer interface | RS-232, CANBUS (CANopen DS402, DS305) |
| Commands | Simply IQ ASCII |
| Supply voltage | 12..24 V DC |
| Motor current | cont. 2.5A, peak 5A / cont. 5A, peak 10A |
| Limit switches | 2, npn / pnp type 5..24 VDC |
| Digital input | 2, npn /pnp type 5.. 24 VDC |
| Digital output | 2 x 12..24 V DC 0.5 A open collector |
| Analog output | 1 x 14 bit +/- 10V DC |
| Encoder interface | RS-422 max 20 MHz<br>1Vpp x 4096 interpolation max-250 kHz<br>emulated encoder output RS-422 |
| Program and parameter | Flash memory |
| Amplifier | PWM 22 kHz |
| Position / speed / current-loop | 4 kHz / 8 kHz / 16 kHz |
| Housing | desktop / OEM-PCB |
| Software interface | Windows setup and configuration tool<br>Automatic and manual tuning, analysis and debugging<br>WINDOWS DLL |

Desktop Single Axis

## KEY FEATURES

- Single axis DC controller system
- Cost effective, stand alone controller
- Up to 16 MoCo DC can be combined with only one RS-232 interface
- LM629 servo controller for simultaneous control of position, velocity, acceleration and torque
- Position compare output (</=1 kHz)
- With PID filtering
- PWM control of motor current for high efficiency
- Up to 3 A continuous current and up to 24 V motor supply
- Serial interface RS-232
- On-board control language with over 50 commands
- 24 VDC power supply (external)
- LabVIEW™ VIs

## TECHNICAL DATA

| | |
|---|---|
| **Axes** | 1 axis, DC motors brushed types |
| **Computer interface** | RS-232 up to 38.4k |
| **Commands** | ASCII 2 letter mnemonic |
| **Supply voltage** | 24 VDC |
| **Motor current** | < 3 A |
| **Limit switches** | Positive and negative limit switch input,<br>optically isolated, wide voltage range |
| **Position counter** | 32-bit position control 2 000 000 000 steps in each direction<br>with software adjustment endless motion possible |
| **Program and parameter** | EEPROM for permanent storage of motion parameters and programs |
| **Amplifier** | PWM control of motor current for high efficiency |
| **Closed-loop** | Single-ended or diff. encoder inputs, up to 1 MHz, index capability |
| **Status display** | Large, two-digit LED for command address and error code display |
| **Housing** | Pocket-desktop |
| **Inputs** | 4, pnp optoisolated |
| **Outputs** | 4, open-collector 0.5 A 24 VDC |
| **Analog inputs** | 4, open-collector 0.5 A 24 VDC |
| **Analog output** | 1, 0-5 V 8bit resolution |
| **Option** | -Break output<br>-Manual control<br>-Open frame version |
| **Software interface** | LabVIEW™ VIs and demo application |

Screenshots MoCo VIs for LabVIEW™

Some examples of MoCo VIs for LabView(TM)

### MoCo dc controller

| | |
|---|---|
| MoCo dc pocket desktop controller | 021 |

### MoCo dc accessories

| | |
|---|---|
| Power supply | 002 |

| 7801-9- | | | |
|---|---|---|---|

MMC100/110

## KEY FEATURES

- Integrated controller / driver for PI miCos stick-slip piezo motors
- Compact, modular design allows for bench-top or standard 2U height rack mounting
- Configurable as a standalone unit or stackable up to 99 axes
- Open-loop / closed-loop operation
- Open-loop resolution of less than 1 nm
- Closed-loop resolution dependent on the encoder (typically 5 nm)
- A quad B differenntial encoder feedback
- USB interface (one interface for up to 99 axes)
- Windows™ GUI, DLL and LabVIEW™ VI

## TECHNICAL DATA

| | | |
|---|---|---|
| **Number of axes** | 1 (stackable upto 99) | |
| **Motor type** | Stick-slip motors 1 and 2 Phase | |
| **Computer interface** | USB 2.0 compliant | |
| **Commands** | ASCII-commands | |
| **Trajectory mode** | Trapezoidal velocity profile | |
| **Resolution open-loop** | <1nm | |
| **Resolution closed-loop** | MMC-100 5 nm | MMC-110 <1 nm |
| **Velocity** | MMC-100 <=2-3 mm/s | MMC-110 > 10 mm/s |
| **Servo clock** | 10 kHz | |
| **Trajectory update** | 1 kHz | |
| **Power supply** | Regulated 5V DC (1A per module/axis) | |
| **Enclosure dimensions** | 145x85x25 mm | |
| **Software interface** | MMC-100 MCP, DLL, LabVIEW™ VI's | |

PI miCos

## MMC-100 controller

| | |
|---|---|
| MMC-100 1 axis , USB, 15 W power supply | 0110 |
| MMC-100 2 axes , USB, 15 W power supply | 0210 |
| MMC-100 3 axes , USB, 15 W power supply | 0310 |
| MMC-100 4 axes , USB, 36 W power supply | 0420 |
| MMC-100 5 axes , USB, 36 W power supply | 0520 |
| MMC-100 6 axes , USB, 36 W power supply | 0620 |

## MMC-110 controller

| | |
|---|---|
| MMC-110 1 axis , USB, 15 W power supply | 1110 |
| MMC-110 2 axes , USB, 15 W power supply | 1210 |
| MMC-110 3 axes , USB, 15 W power supply | 1310 |
| MMC-110 4 axes , USB, 36 W power supply | 1420 |
| MMC-110 5 axes , USB, 36 W power supply | 1520 |
| MMC-110 6 axes , USB, 36 W power supply | 1620 |

## MMC-100/110 accessories

| | |
|---|---|
| Closed-Loop RS422 interface per axis | 0001 |

| 7803-9- | | | |
|---|---|---|---|

## KEY FEATURES

- Special design for piezo driven step motor
- Manual control by keypads, or via RS-232
- Works with batteries or external power supply
- Operates with up to 3 axes
- Customized designs
- USB-interface optionally (see Piezo RS-232)

### PiCo piezo controller

| | |
|---|---|
| PiCo 33 piezo controller RS 232 | 001 |
| PiCo 33 Piezo controller USB | 003 |
| PiCo 33 Piezo controller USB closed-loop | 011 |

7805-9-[ ][ ][ ]

## TECHNICAL DATA

| | PiCo 33 RS-232 | PiCo 33 USB | PiCo 33 USB Closed Loop |
|---|---|---|---|
| **Power supply** | Batterie<br>AC adapter worldwide | USB interface | AC adapter worldwide |
| **Operation mode local** | Keyboard | | |
| **Computer interface** | RS-232-interface | USB 1.1 Interface | USB 2.0 interface |
| **Connections, motor output** | RS-232-interface DB9m,<br>3 axis DB9f | USB B<br>3 axis DB9f | USB B<br>3 x MMCX per axis |
| **Speed modes** | "Fast" "Slow" ("Fast"/2)<br>"Single step" | 0...1000 (0..1.0 mm/s) | 0...255 (0...1 mm/s) |
| **Data rate** | 19200 baud | | |
| **Compatibility** | for DOS, Win 95, Win 2000, Win XP and Win NT<br>executable software with action buttons<br>DLL with sourcecode Vb, C and Delphi | | |
| **Mass** | 340 gr | 150 gr | 470 gr |
| **Dimensions** | 157 x 99 x 39 mm | 118 x 86 x 26 mm | 124 x 170 x 55 mm |
| **Delivery includes** | RS-232 connecting cable | USB cable | USB cable |
| | AC adapter worldwide | | AC adapter worldwide |
| | Battery | | |

## KEY FEATURES

- Single axis piezo motor (inertial or stick-slip) driver
- Interfaces directly with a stepper motor controller
- Standard pulse and direction interface
- Typical open loop step resolution of 1.5 nm
- Typical maximum velocity of 2-3 mm/s
- No setup or adjustments required
- Universal power supply included

## PMA-100

| | |
|---|---|
| PMA-100 standard | 001 |

| 7803-9- | | | |
|---|---|---|---|

## TECHNICAL DATA

| | |
|---|---|
| **Motor type** | 1phase piezo ceramic motors inertial or stick-slip |
| **Bus voltage** | 5 VDC (36 V internally) |
| **Control signal** | Clock/direction (TTL or open-collector) |
| **Typical step size** | 1.5 nm<br>(This value varies depending on the stage type, load size and a number of other mechanical factors) |
| **Maximum velocity** | About 2-3 mm/s<br>(depends mainly on the piezo motor characteristics) |

# 2.054 DMC-series DMC Controller

DMC Ethernet / RS-232

## KEY FEATURES

- 62.5 µs (250 µs) microsecond per axes servo update rate
- Up to 8 axes of motion control
- Controls servo motors, step motors, and hydraulics
- Maximum encoder input rate up to 22 MHz (Accelera)
- Non-volatile program memory
- Multitasking of four independent programs
- Modes of motion: jogging, point to point positioning, linear and circular interpolation, electronic gearing and cam, and contouring
- Optoisolated inputs for home, abort, limits (ecxept pci low cost)
- Digital I/O and analog inputs
- High speed position capture
- High speed encoder compare output
- Programmable event triggers ( trip points )
- I/O functions and timers for executing PLC tasks
- Easy programming language plus software tools for quick start-up and tuning
- Contour mode for profiling along computer generated paths such as parabolic or spherical profiles
- Error handling including programmable software limits, automatic error shut-off, amplifier enable, user-defined error subroutines, and watchdog timer

## Possible configurations

| | DMC pci-eco | DMC pci-accelera | DMC Ethernet / RS-232 |
|---|---|---|---|
| Form factor | PCI card | PCI card | 19" card |
| Communication interface | PCI bus | PCI bus | Ethernet & RS-232 |
| Number of axes | 1..4 | 1..4 | 1..8 |
| Max encoder frequency | 12 MHz | 22 MHz | 12 MHz |
| Servo update rate | 1-2 axis 250 µs | 1-2 axis 62 µs | 1-2 axis 250 µs |
| | 3-4 axis 374 µs | 7-8 axis 187 µs | 7-8 axis 625 µs |
| Digital inputs | 8 TTL | 8..16 optically isolated | 8..16 optically isolated |
| Digital outpus | 8..16 TTL | 8..16 TTL | 8 Highside driver 8 TTL (5..8 axes) |
| Analog inputs | no | 8 | no, optional |
| Dual encoder | no | yes | yes |

## TECHNICAL DATA

| | |
|---|---|
| Axes | 1-8 axes per card, pci-eco 1-4 axes |
| Computer interface | PCI-bus / Ethernet / RS-232 |
| Commands | ASCII 2 letter mnemonic |
| Position range | ±2.147,483,647 counts/move; automatic rollover; |
| Acceleration/deceleration | 1,024 to 67,107, 840 counts/sec$^2$ mm |
| Motor command signal | +/-10 V 16-bits, Clock/Dir |
| Step motor control mode | Full, half, or microstep |
| Encoder Interface | RS-422 |
| Analog inputs | 8, ± 10 V; 12-bit resolution (16-bit optional) |
| Dedicated inputs per axes | Forward and reverse limits, high-speed position latch, home. |
| Dedicated outputs per axes | Analog motor command, pulse and direction, amplifier enable, encoder output compare. |
| Software Interface | Plug and Play: utilities for all Windows™ versions<br>.net libraries and DLL, Linux,<br>demo applications C and LabVIEW™ VIs |

| Order No. | 7110-9- | 0 | | |
|---|---|---|---|---|
| DMC pci-eco (1..4 axes) | 2 | | | |
| DMC pci-accelera (1..8 axes) | 3 | | | |
| DMC Ethernet/RS-232 (1..8 axes) | 4 | | | |
| DMC Ethernet/USB (1..8 axes) | 5 | | | |
| number axes | n | | | |

**PI miCos MPA Power Amplifier Systems, see page 2.060**

# 2.056 Delta-Tau-series Geobrick / Clipper

MC geobrick lv 8 axes control & amp

## KEY FEATURES

- 4 or 8 axes of simultaneous control (0.1 ms update time)
- 80 MHz CPU optional 240 MHz
- Ethernet TCP/IP, USB and RS-232 communication interface
- All axes independent or coordinated in any combination
- Multitasking of up to 256 motion and 64 asynchronous PLC programs
- Easy-to-use, high-level programming language
- Linear, circular, rapid, B-spline, Hermite-spline interpolation modes
- True S-curve accel/decel for jerk-limited profiles
- Dynamic multi-move lookahead for robust acceleration control
- Coordinate system translation and rotation, 2D and 3D
- Embedded forward and inverse kinematics routines for Non-Cartesian geometries (PI miCos Hexapod series and PI miCos SpaceFAB series)
- Hardware position capture and compare circuits for high precision
- Windows™ PEWin User-Interface

## TECHNICAL DATA

| | MC clipper LD DC | MC geobrick LV DC |
|---|---|---|
| **Axes** | 4 / 8 | |
| **Computer interface** | Ethernet TCP/IP 100Mbit, USB-2.0, RS-232 | |
| **Supply voltage** | 90-250 VAC 50-60 Hz | |
| **Power configuration** | 100 W | 240W (others available see options) |
| **Limit switches** | 2 x npn normally closed | 2 x npn/pnp normally closed |
| **Encoder interface** | RS-422 | RS-422 & 1Vpp x 4096 interpolator |
| **Trajectory mode** | Linear, circular, rapid, B-spline, Hermite-spline interpolation modes | |
| **Digital inputs** | | 16 optocoupler npn/pnp 12-24 VDC |
| **Digital outputs** | | 8 highside/lowside 0.5A outputs |
| **Position range** | 32 bit | |
| **Amplifier** | linear amplifier (no PWM) | direct digital PWM |
| **Program and parameter** | flash memory, 256 motion programs and 64 PLC's | |
| **Motor current** | 0.5 A continues | 5 A continues 15 A peak |
| **CPU type** | DSP 80 MHz / 240 MHz | |
| **Housing** | 19" 2HE | 19" 4HE |

MC clipper ld 8 axes control board

### Delta-Tau controller

| | |
|---|---|
| MC-Clipper LD 80MHz 8 axes DC-brush controller | 001 |
| MC-Clipper LD 80MHz 4 axes DC-brush controller | 002 |
| MC-Clipper LD 240MHz 8 axes DC-brush controller | 011 |
| MC-Geobrick LV 80MHz 8 axes DC-brush controller | 101 |
| MC-Geobrick LV 80MHz 4 axes DC-brush controller | 102 |
| MC-Geobrick LV 240MHz 8 axes DC-brush controller | 111 |

MC-Geobrick offers many custom made version with mixed motor configurations, please consult PI miCos for a detailed offer.

### Delta-Tau accessories

Geobrick LV 1Vpp x 4096 Interface 4 axes
Geobrick LV Absolute Encoder Interface 4 axes
(EnDat 2.2 or BISS_C) to be defined at ordering time
Geobrick LV Analog Input 8 channel, 12 Bit +/-10V
Geobrick LV IO expansion 8 outputs 16 inputs
Geobrick LV bus voltage 24 VDC 500W
Geobrick LV bus voltage 48 VDC 500W
Geobrick LV bus voltage 48 VDC 1000W
Hexpod inverse and forward kinematics (model dependend)
Spacefab inverse and forward kinematics (model dependend)

| 7151-9- | | | |
|---|---|---|---|

MC-clipper LD:

- build-in linear servo brush amplifiers (no PWM) Icont. < 0.5A per axis
- 12 VDC power-supply 30 W

MC-geobrick LV:

- build-in direct digital PWM amplifiers for DC-brush, 2Phase stepper, 3Phase BLDC, 3 phase linear and torque motors
- I cont. 5A, I peak 15 A per axis
- 24 VDC power-supply 240 W, 16 digital inputs, 8 digital outputs

Optional:

- analog inputs 8 x 12 bit ± 10 VDC
- additional 16 digital inputs / 8 outputs
- 1Vpp sin-cos encoder interpolator x 4096
- Absolute encoder interface (Endat/ BISS)
- 24/48 VDC power supply 500 W or 1000 W

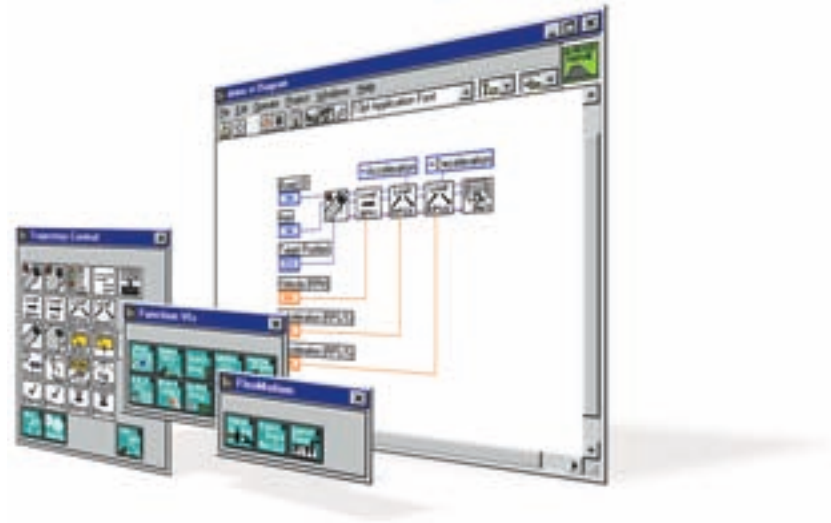
FlexMotion pci

## KEY FEATURES

- Stepper / Servo 4/8-axes controller (National Instruments)
- Real-time CPU, onboard multitasking real-time operating system, DSP
- Closed-loop control
- 62 µs PID loop update rate
- Quadrature encoder or analog feedback
- 32 digital I/O lines, 4 analog inputs / outputs
- High speed position capture inputs
- Modes of motion: point-to-point positioning, multi axes vector space control, linear, circular, spherical and helical interpolation, jogging, electronic gearing
- Blended-motion profiles
- National Instruments RTSI bus for synchronizing motion and measurement
- Software: NI-MAX, NI motion, DLLs (for Windows programming), C/C++ libraries, VIs (for LabVIEW™, LabWindows/CVI™)

## TECHNICAL DATA

| | NI-735x | NI-734x |
|---|---|---|
| **Axes** | 2 / 4 / 6 / 8 | 2 / 4 |
| **Computer interface** | PCI / PXI bus | |
| **Limit switches** | 2 x software configurable | |
| **Encoder interface** | RS-422, max. 20 MHz | |
| **Trajectory mode** | Linear, circular, spherical, helical interpolation | |
| **Digital IO** | 4 ports 8 bit TTL SW configurable | |
| **Analog inputs** | 4 x 12 bit ±10V | 4 / 8 x 12 bit ±10V |
| **Position range** | 32 bit | |
| **Motor command signal** | ±10 V 16-bits and Clock/Dir | |
| **Servo control mode** | PID, PIVff, s-curve, dual loop | |





## High Performance Controller 735x series

| | |
|---|---|
| NI pci-7352, 2-axes servo / step controller | 440-02 |
| NI pxi-7352, 2-axes servo / step controller | 540-02 |
| NI pci-7354, 4-axes servo / step controller | 440-04 |
| NI pxi-7354, 4-axes servo / step controller | 540-04 |
| NI pci-7356, 6-axes servo / step controller | 440-06 |
| NI pxi-7356, 6-axes servo / step controller | 540-06 |
| NI pci-7358, 8-axes servo / step controller | 440-08 |
| NI pxi-7358, 8-axes servo / step controller | 540-08 |

## Mid-Range Controller 734x series

| | |
|---|---|
| NI pci-7342, 2 axes servo / step controller | 916-02 |
| NI pci-7344, 4 axes servo / step controller | 916-04 |

| 778xxx- | | | |
|---|---|---|---|

**NI pxi-7344, 4 axes servo / step controller:**
**order no.: 777935-01**

**Accessories:**
**Cable SH68-C68-S 68-Pin VHDCI to 68-Pin. D-Type, 2 m:**
**order no: 186381-02**

## Possible configurations (number of axes in a 19" chassis 3HE or 4HE)

| Amplifier | Type 0 | Type 1 | Type 3 | Type 4 | Type 6 | Type 7 |
|---|---|---|---|---|---|---|
| Interface 0 | 1-4 | 1-4 | 1-6 | 1-4 | 1-6 | 1-8 |
| Interface 1 | 1-8 | 1-4 | 1-8 | 1-4 | 1-6 | 1-8 |
| Interface 2 | 1-8 | 1-6 | 1-8 | 1-4 | 1-6 | 1-8 |
| Interface 3 | 1-8 | 1-6 | 1-8 | 1-4 | 1-6 | 1-8 |
| Interface 4 | 1-8 | 1-64 | 1-8 | 1-4 | 1-6 | 1-8 |

## TECHNICAL DATA

| Amplifier | Type 0 | Type 1 | Type 3 | Type 4 | Type 6 | Type 7 (see PMA-100) |
|---|---|---|---|---|---|---|
| Motor type | DC Brush | DC Brush | 2Phase Stepper | DC Brushless | 3 Phase linear & torque motors | 1 Phase Piezo-Ceramic motors |
| Amplifier principle | 4Q-Linear current/ torque control | 4Q-PWM 50 kHz current/ torque control | PWM current control micro-stepping x250 | 4Q-PWM 50 kHz current/ torque control | 4Q-PWM 22 kHz current/ torque control | micro-stepping |
| Bus voltage | 11-30 VDC | 11-70 VDC | 11-42 VDC | 11-70 VDC | 11-48 VDC | 5 VDC (36 V internally) |
| Continuous current | 2 A | 5 A | 2 A | 5 A | 5 A | |
| Peak current | 3 A | 10 A | | 10 A | 10 A | |
| Control signal | ±10 VDC | ±10 VDC | clock/ direction | ±10 VDC | ±10 VDC | clock/ direction |

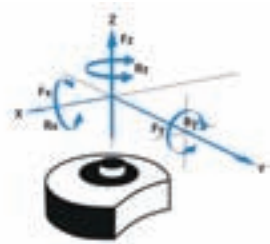
| Order No. 7145-9 | |
|---|---|
| Number axes (1..8 axes) | n |
| | |
| Amplifier DC-brush 2 A | 0 |
| Amplifier DC-brush 5 A | 1 |
| Amplifier 2SM microstep 24 V 2 A | 3 |
| Amplifier 3-Phase brushless 24 V 5 A | 4 |
| Amplifier DC brush 12 V 1 A | 5 |
| Amplifier 3-Phase linear/torque motor | 6 |
| Amplifier Piezo-Motor Driver (PMA-100) | 7 |
| | |
| Interface to NI Flexmotion Controller | 0 |
| Interface to DMC PCI controller | 1 |
| Interface to DMC Ethernet/RS-232 Controller | 2 |
| Interface to Delta-Tau PMac Controller | 3 |
| Interface to Delta-Tau UMac Controller | 4 |
| Interface to others | 9 |
| | |
| 12 VDC 100 W | 0 |
| 24 VDC 150 W | 1 |
| 24 VDC 220 W | 2 |
| 48 VDC 220 W | 3 |
| others | 9 |

# ROBOTICS

# 3.064 SpaceFAB SF-3000 BS

## FACTS

| Load characteristics | $Fx_{(N)}$ | $Fy_{(N)}$ | $Fz_{(N)}$ | $Mx_{(Nm)}$ | $My_{(Nm)}$ | $Mz_{(Nm)}$ |
|---|---|---|---|---|---|---|
| DC-B-034 | 5 | 5 | 30 | 0.2 | 0.2 | 0.2 |




## KEY FEATURES

- Six axes micro positioning system
- Compact, low profile system
- Travel ranges linear 50 x 100 x 12.7 mm
- Travel ranges rotation Rx, Ry, Rz 10°
- Load capacity 3 kg center mounted
- Automatic alignment
- Pivot point can be set by the customer
- User friendly software
- Can be used by any modern programming language
- Including software, controller and amplifiers

The SpaceFAB SF-3000 BS system can perform motions in all six degrees of freedom. The low weight of the moving platform allows high dynamic positioning processes. The non-preloaded version can easily carry up to 3 kg center mounted load. The SpaceFAB SF-3000 BS is operating in closed loop and it can generate any arbitrary trajectory. The SF-3000 BS was originally developed for fiber-optic alignment applications but can be used in many other areas like optical components alignment, micro-fabrication and much more. A vacuum version of the SpaceFab is available on request.

## TECHNICAL DATA

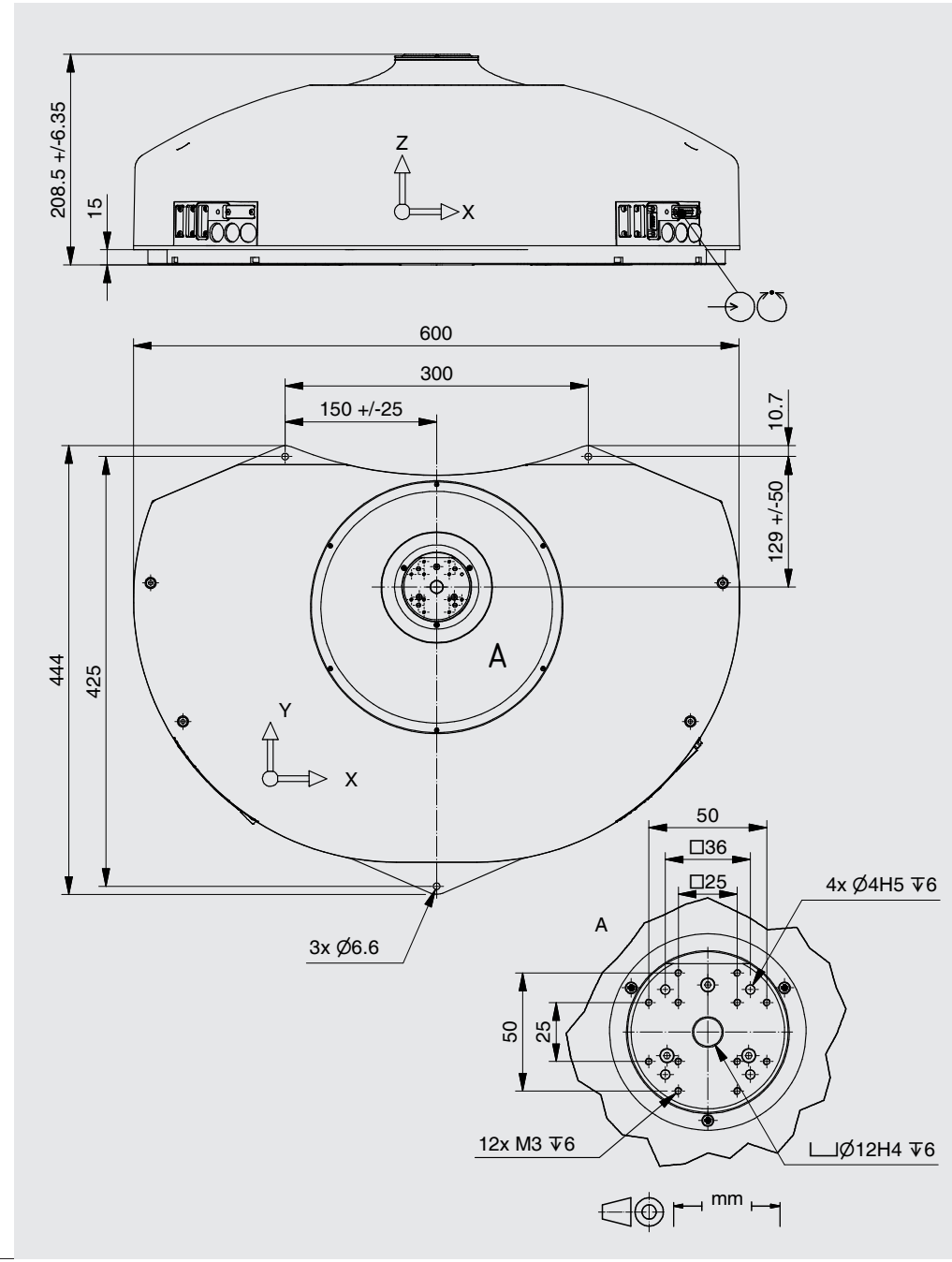
| Travel range | |
|---|---|
| X, Y, Z (mm) | 50 x 100 x 12.7 * |
| Rx, Ry, Rz (°) | 10, 10, 10 * |

| Motor (Pitch 1 mm) | DC-B-034 |
|---|---|
| Speed max. X, Y, Z (mm/sec) | 30 |
| Speed max. Rx, Ry, Rz (°/sec) | 10 |
| Velocity Range (mm/sec) | 0.01...30 |
| Velocity Range (°/sec) | 0.01...10 |
| Weight (kg) | 24 |
| Bi-directional Repeatability X, Y, Z (µm) | ± 0.5, ± 0.5, ± 0.5 |
| Bi-directional Repeatability Rx, Ry, Rz (°) | ± 0.0011 |
| Resolution, calc. without load X, Y, Z (µm) | 0.2 |
| Resolution, calc. without load (height platf.) Rx, Ry, Rz (°) | depending on the position of the pivot point |
| Resolution typical without load X, Y, Z (µm) | 0.2 |
| Resolution typical without load Rx, Ry, Rz (°) | 0.0005 |
| Current (A) | 2.3 |
| Voltage Range (V) | 24 |

| Stiffness, theoretical Kx, Ky, Kz (N/µm) | on request |
|---|---|
| Material | Stainless steel, Aluminium black anodized |

Note:
* The maximum travel ranges in different coordinate directions ( X, Y, Z, Rx, Ry, Rz ) are interdependent.
The data for each axis in this table shows its maximum travel, where all other axes are at their zero positions. If the other linear or rotational coordinates are not zero, the available travel may be less. For more information, please contact us. The travel range is depending on the position of the pivot point.

More info: Detailed info, concerning the motors and encoders, see: Appendix

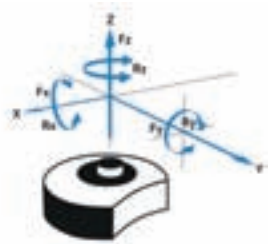



| Order No. | 6901-9- | 1 | 2 | 1 | 1 |
|---|---|---|---|---|---|

# 3.066 SpaceFAB SF-3000 LS

## FACTS

| Load characteristics | $Fx_{(N)}$ | $Fy_{(N)}$ | $Fz_{(N)}$ | $Mx_{(Nm)}$ | $My_{(Nm)}$ | $Mz_{(Nm)}$ |
|---|---|---|---|---|---|---|
| 2Phase-042 | 1.5 | 1.5 | 10 | 0.1 | 0.1 | 0.1 |




## KEY FEATURES

- Six axes micro positioning system
- Compact, low profile system
- Travel ranges linear 50 x 50 x 12.7 mm
- Travel ranges rotation Rx, Ry, Rz 10°
- Load capacity 1 kg center mounted
- Automatic alignment
- Pivot point can be set by the customer
- User friendly software
- Can be used by any modern programming language
- Including software, controller and amplifiers

The SpaceFAB SF-3000 LS is a low cost alternative to PI miCos SpaceFAB SF-3000 BS and is especially designed for precision point to point positioning. The SpaceFAB SF-3000 LS system can perform motions in all six degrees of freedom. The SpaceFAB SF-3000 LS was developed for easy alignment applications, like those required in micro-fabrication and biomedical research. The core software used for the SpaceFAB SF-3000 LS is the PI miCos Motion Server. The Motion Server includes all the mathematical transformations so that the user can start movements directly by specifying the six coordinates X, Y, Z, Rx, Ry and Rz.

## TECHNICAL DATA

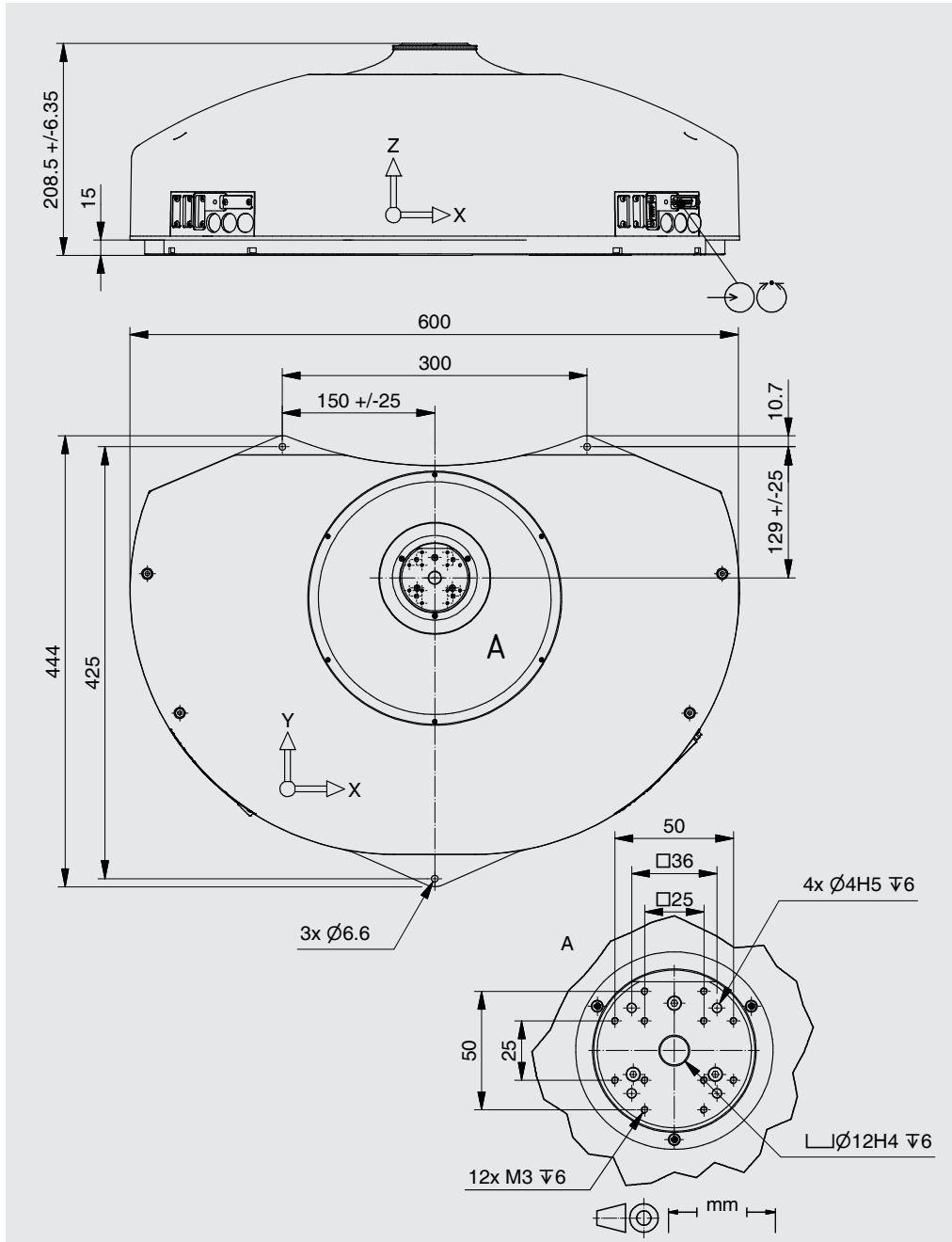
| Travel range | |
|---|---|
| X, Y, Z (mm) | 50 x 50 x 12.7 * |
| Rx, Ry, Rz (°) | 10, 10, 10 * |

| Motor (Pitch 1 mm) | 2Phase-042 |
|---|---|
| Speed max. X, Y, Z (mm/sec) | 10 |
| Speed max. Rx, Ry, Rz (°/sec) | 6 |
| Velocity Range (mm/sec) | 0.01...10 |
| Velocity Range (°/sec) | 0.01...6 |
| Weight (kg) | 24 |
| Bi-directional Repeatability X, Y, Z (µm) | ± 5, ± 5, ± 5 |
| Bi-directional Repeatability Rx, Ry, Rz (°) | ± 0.011 |
| Resolution, calc. without load X, Y, Z (µm) | 0.2 |
| Resolution, calc. without load (height platf.) Rx, Ry, Rz (°) | depending on the position of the pivot point |
| Resolution typical without load X, Y, Z (µm) | 0.5 |
| Resolution typical without load Rx, Ry, Rz (°) | 0.003 |
| Current (A) | 1.2 |
| Voltage Range (V) | 24 |

| Stiffness, theoretical Kx, Ky, Kz (N/µm) | on request |
|---|---|
| Material | Stainless steel, Aluminum black anodized |

Note:
* The maximum travel ranges in different coordinate directions ( X, Y, Z, Rx, Ry, Rz ) are interdependent. The data for each axis in this table shows its maximum travel, where all other axes are at their zero positions. If the other linear or rotational coordinates are not zero, the available travel may be less.
For more information, please contact us, for turned key solutions, please contact us. The travel range is depending on the position of the pivot point.

More info: Detailed info, concerning the motor, see: Appendix

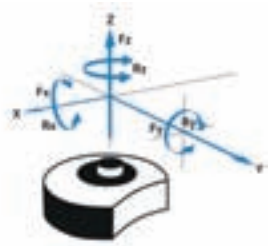



| Order No. | 6902-9- | 2 | 0 | 0 | 2 |
|---|---|---|---|---|---|

# 3.068 SpaceFAB SF-2500 LS

## FACTS

| Load characteristics | $Fx_{(N)}$ | $Fy_{(N)}$ | $Fz_{(N)}$ | $Mx_{(Nm)}$ | $My_{(Nm)}$ | $Mz_{(Nm)}$ |
|---|---|---|---|---|---|---|
| 2Phase-018 | 0.2 | 3 | 0.2 | 0.1 | 0.1 | 0.1 |



## KEY FEATURES

- Six axes micro positioning system
- Compact, low profile system
- Travel ranges linear 5 x 5 x 3.5 mm
- Travel ranges rotation Rx, Ry, Rz ± 5°
- Load capacity 0.3 kg center mounted
- Automatic alignment
- Pivot point can be set by the customer
- User friendly software
- Can be used by any modern programming language
- Including software, controller and amplifiers

The SpaceFAB SF-2500 LS is a low cost alternative to PI miCos SpaceFAB SF-Piezo and is especially designed for precision positioning with limited space conditions. The SpaceFAB SF-2500 LS can perform motions in all six degrees of freedom.

SpaceFAB SF-2500 LS was especially developed for easy alignment applications, micro-fabrication and biomedical research. The core software used for the SpaceFAB SF-2500 LS is the PI miCos Motion Server. The Motion Server includes all the mathematical transformations so that the user can start movements directly by specifying the six coordinates X, Y, Z, Rx, Ry and Rz.

## TECHNICAL DATA

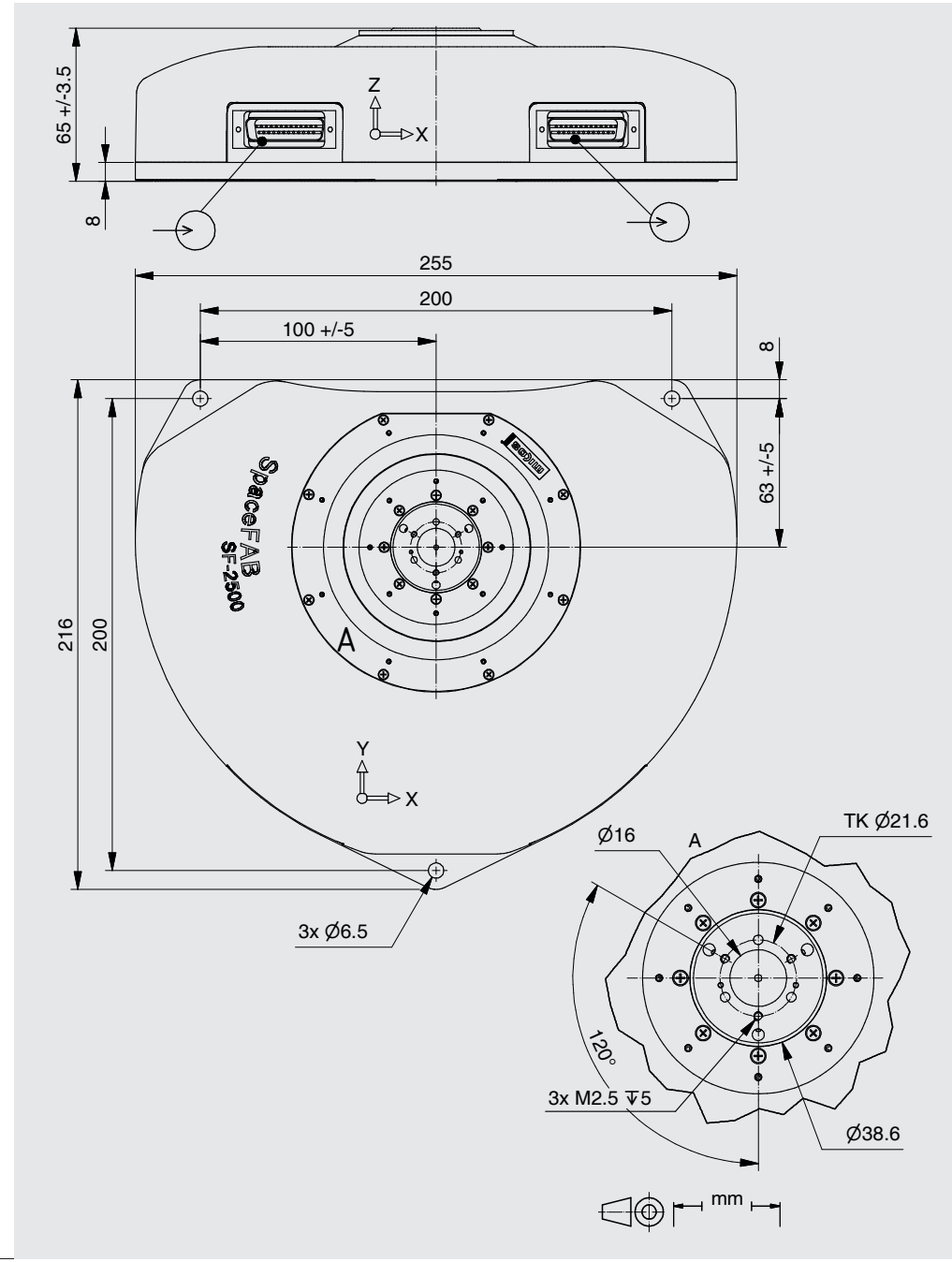
| Travel range | |
|---|---|
| X, Y, Z (mm) | 5 x 5 x 3.5 * |
| Rx, Ry, Rz (°) | 5, 5, 5 * |

| Motor (Pitch 1 mm) | 2Phase-018 |
|---|---|
| Speed max. X, Y, Z (mm/sec) | 5 |
| Speed max. Rx, Ry, Rz (°/sec) | 5 |
| Velocity Range (mm/sec) | 0.01...5 |
| Velocity Range (°/sec) | 0.01...5 |
| Weight (kg) | 2.3 |
| Bi-directional Repeatability X, Y, Z (µm) | ± 8, ± 8, ± 8 |
| Bi-directional Repeatability Rx, Ry, Rz (°) | ± 0.02 |
| Resolution, calc. without load X, Y, Z (µm) | 2.5 |
| Resolution, calc. without load (height platf.) Rx, Ry, Rz (°) | depending on the position of the pivot point |
| Resolution typical without load X, Y, Z (µm) | 2 |
| Resolution typical without load Rx, Ry, Rz (°) | 0.03 |
| Current (A) | 0.24 |
| Voltage Range (V) | 24 |

| Stiffness, theoretical Kx, Ky, Kz (N/µm) | on request |
|---|---|
| Material | Aluminum black anodized |

Note:
* The maximum travel ranges in different coordinate directions ( X, Y, Z, Rx, Ry, Rz ) are interdependent. The data for each axis in this table shows its maximum travel, where all other axes are at their zero positions. If the other linear or rotational coordinates are not zero, the available travel may be less. For more information, please contact us. The travel range is depending on the position of the pivot point.

More info: Detailed info, concerning the motors and encoders, see: Appendix




| Order No. | 6906-9- | 2 | 2 | 0 | 2 | 1 |
|---|---|---|---|---|---|---|

# 3.070 Hexapod HP-550

## FACTS

| Load characteristics | $F_{x(N)}$ | $F_{y(N)}$ | $F_{z(N)}$ |
|---|---|---|---|
| DC-B-027 | 300 | 300 | 500 |

## KEY FEATURES

- Six axes Parallel Kinematic System
- Travel ranges linear 100x100x100 mm
- Travel ranges rotation Rx, Ry 40°, Rz 60°
- Maximum speed 2 mm/sec
- Pivot Point can be set by the customer
- User friendly software
- Load capacity central ( Fx; Fy ) 30 kg / ( Fz ) 50 kg

The HP-550 Hexapod system can perform motions in all six degrees of freedom. Due to the parallel kinematic design architecture, the system can achieve a much higher stiffness than a conventional stages stack. Typical Hexapod applications include antenna positioning, medical research, laser technology, semiconductor technology and optical systems. An optimized design insures maximum system stiffness and spatial resolutions up to 0.5 µm. Vacuum versions are available on request. The system use a Delta-Tau controller includes advanced algorithms for inverse kinematic transformations within a user-friendly software package.

## TECHNICAL DATA

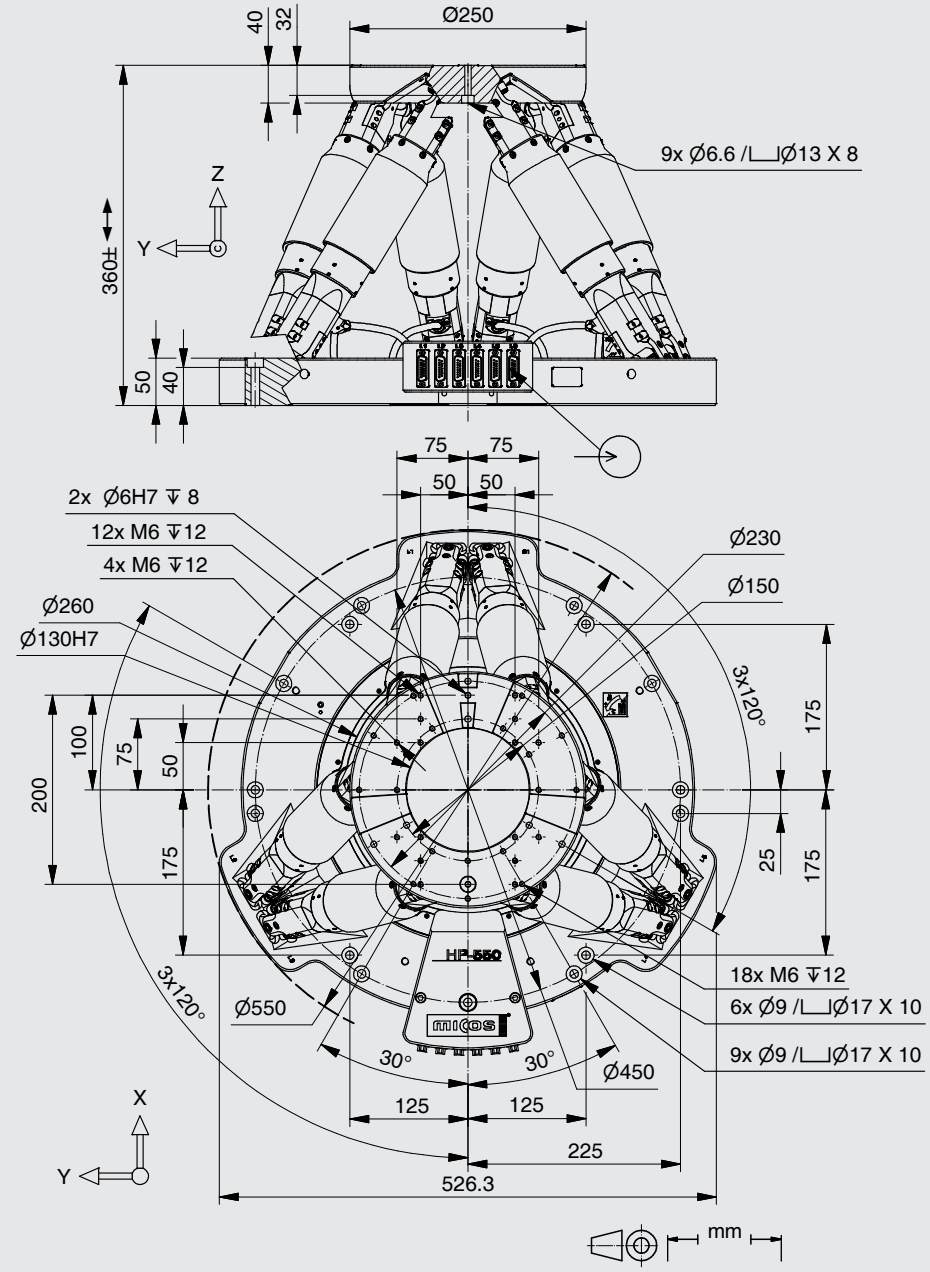
| Travel range | |
|---|---|
| X, Y, Z (mm) | 100 x 100 x 100 * |
| Rx, Ry, Rz (°) | 40, 40, 60 * |

| Motor (Pitch 1 mm) | DC-B-027 |
|---|---|
| Speed max. X, Y, Z (mm/sec) | 2 |
| Speed max. Rx, Ry, Rz (°/sec) | 1 |
| Velocity Range (mm/sec) | 0.01...2 ** |
| Velocity Range (°/sec) | 0.001...1 ** |
| Weight (kg) | 33 |
| Bi-directional Repeatability X, Y, Z (µm) | ± 4, ± 4, ± 3 |
| Bi-directional Repeatability Rx, Ry, Rz (°) | ± 0.002 |
| Resolution, calc. without load X, Y, Z (µm) | 0.016 |
| Resolution, calc. without load (height platf.) Rx, Ry, Rz (°) | depending on the position of the pivot point |
| Resolution typical without load X, Y, Z (µm) | 0.5 |
| Resolution typical without load Rx, Ry, Rz (°) | 0.00057 |
| Current (A) | 0.9 |
| Voltage Range (V) | 24 |

| Stiffness, theoretical Kx, Ky, Kz (N/µm) | on request |
|---|---|
| Material | Stainless steel, Aluminum black anodized |

Note:
* The maximum travel ranges in the different coordinate directions ( X, Y, Z, RX, RY, RZ ) are interdependent. The data for each axis in this table shows its maximum travel, where all other axes are at their zero positions. If the other linear or rotational coordinates are not zero, the available travel may be less.
** leg speed

More info: Detailed info, concerning the motors and encoders, see: Appendix




| Order No. | 6005-9- | 1 | 0 | 0 | 3 | 0 |
|---|---|---|---|---|---|---|

# 3.072 Hexapod HP-430

## FACTS

| Load characteristics | $Fx_{(N)}$ | $Fy_{(N)}$ | $Fz_{(N)}$ |
|---|---|---|---|
| DC-B-027 | 300 | 300 | 500 |

## KEY FEATURES

- Six axes Parallel Kinematic System
- Travel ranges linear 50x50x30 mm
- Travel ranges rotation Rx, Ry 20°, Rz 40°
- Maximum speed 1 mm/sec
- Pivot Point can be set by the customer
- User friendly software
- Load capacity central ( Fx; Fy ) 30 kg / ( Fz ) 50 kg

The HP-430 Hexapod system can perform motions in all six degrees of freedom. Due to the parallel kinematic design architecture, the system can achieve a much higher stiffness than a conventional stages stack. Typical Hexapod applications include antenna positioning, medical research, optical systems and synchrotron setups. An optimized design insures maximum system stiffness and spatial resolutions up to 0.5 µm. Vacuum versions are available on request. The system use a Delta-Tau controller includes advanced algorithms for inverse kinematic transformations within a user-friendly software package.

## TECHNICAL DATA

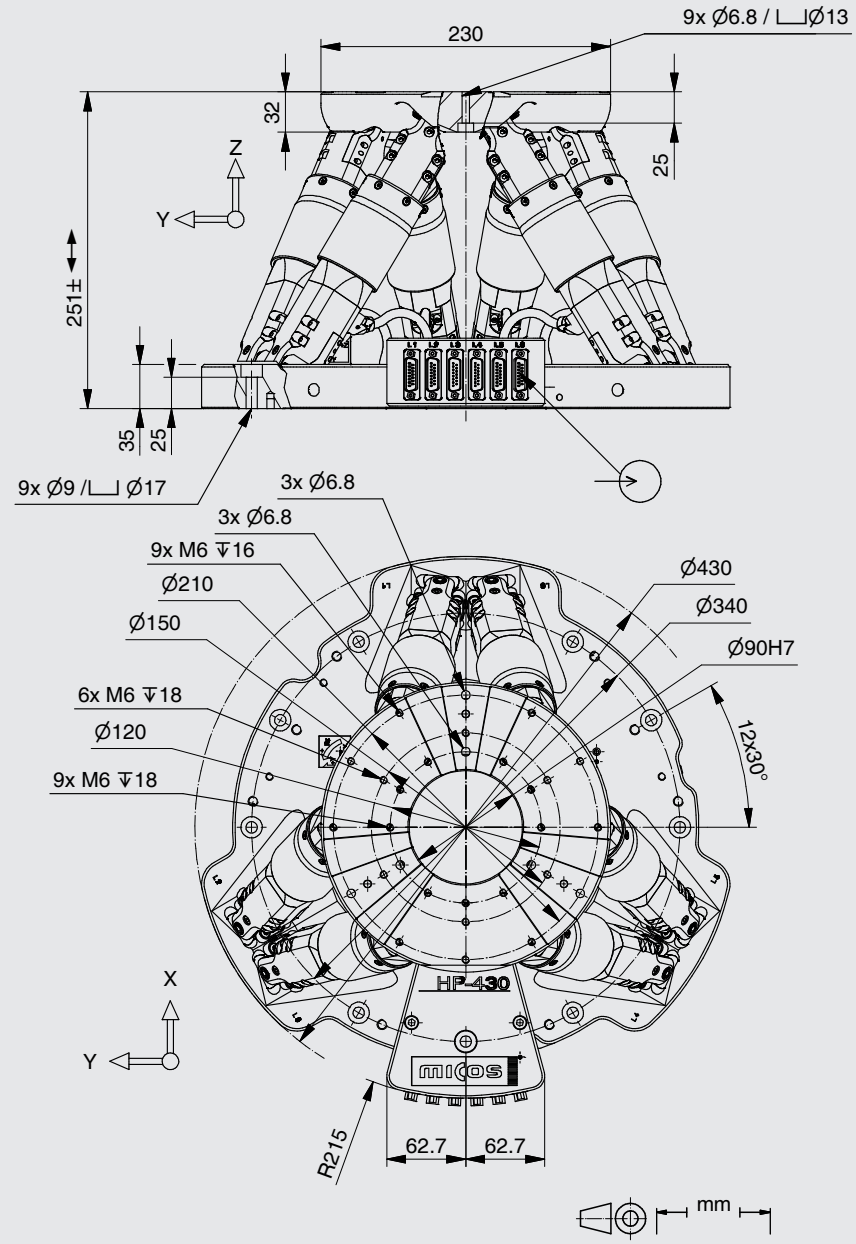
| Travel range | |
|---|---|
| X, Y, Z (mm) | 50 x 50 x 30 * |
| Rx, Ry, Rz (°) | 20, 20, 40 * |

| Motor (Pitch 1 mm) | DC-B-027 |
|---|---|
| Speed max. X, Y, Z (mm/sec) | 1 |
| Speed max. Rx, Ry, Rz (°/sec) | 0.5 |
| Velocity Range (mm/sec) | 0.01...1 ** |
| Velocity Range (°/sec) | 0.001...0.5 ** |
| Weight (kg) | 25 |
| Bi-directional Repeatability X, Y, Z (µm) | ± 3, ± 3, ± 2 |
| Bi-directional Repeatability Rx, Ry, Rz (°) | ± 0.002 |
| Resolution, calc. without load X, Y, Z (µm) | 0.01 |
| Resolution, calc. without load (height platf.) Rx, Ry, Rz (°) | depending on the position of the pivot point |
| Resolution typical without load X, Y, Z (µm) | 0.5 |
| Resolution typical without load Rx, Ry, Rz (°) | 0.00057 |
| Current (A) | 0.9 |
| Voltage Range (V) | 24 |

| Stiffness, theoretical Kx, Ky, Kz (N/µm) | on request |
|---|---|
| Material | Stainless steel, Aluminum black anodized |

Note:
* The maximum travel ranges in the different coordinate directions ( X, Y, Z, RX, RY, RZ ) are interdependent. The data for each axis in this table shows its maximum travel, where all other axes are at their zero positions. If the other linear or rotational coordinates are not zero, the available travel may be less.
** leg speed

More info: Detailed info, concerning the motors and encoders, see: Appendix




| Order No. | 6010-9- | 1 | 0 | 0 | 3 |
|---|---|---|---|---|---|

# 3.074 Hexapod HP-300

## FACTS

| Load characteristics | $Fx_{(N)}$ | $Fy_{(N)}$ | $Fz_{(N)}$ |
|---|---|---|---|
| DC-B-010 | 40 | 40 | 100 |

## KEY FEATURES

- Six axes Parallel Kinematic System
- Travel ranges linear 44x44x30 mm
- Travel ranges rotation Rx, Ry 18°, Rz 25°
- Maximum speed 2 mm/sec
- Pivot Point can be set by the customer
- User friendly software
- Load capacity central ( Fx; Fy ) 4 kg / ( Fz ) 10 kg

With a Hexapod HP-300 system motions in all six degrees of freedom can be achieved. Due to the parallel kinematic design principle of Hexapods, a much higher system stiffness is achieved than with conventional stacked stages. The low weight of the moving platform allows highly dynamic positioning processes. Hexapods are especially suited for applications of precision positioning. The HP-300 is especially designed for applications with limited space conditions. An optimized general concept allows maximum stiffness and accuracy. The system use a Delta-Tau controller includes advanced algorithms for inverse kinematic transformations within a user-friendly software package. Vacuum versions are available on request.

## TECHNICAL DATA

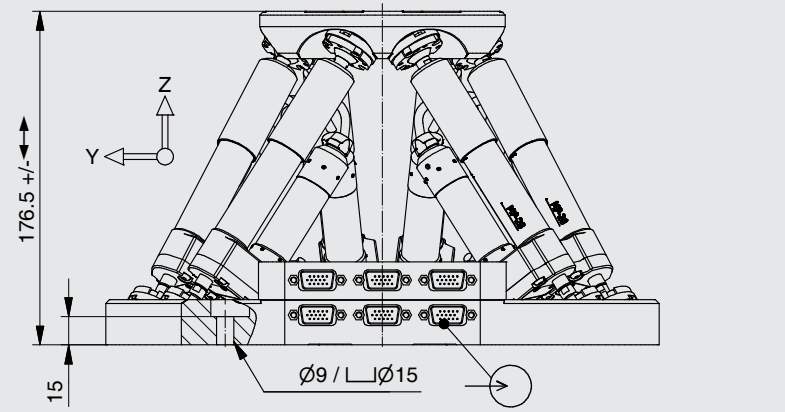
| Travel range | |
|---|---|
| X, Y, Z (mm) | 44 x 44 x 30 * |
| Rx, Ry, Rz (°) | 18, 18, 25 * |

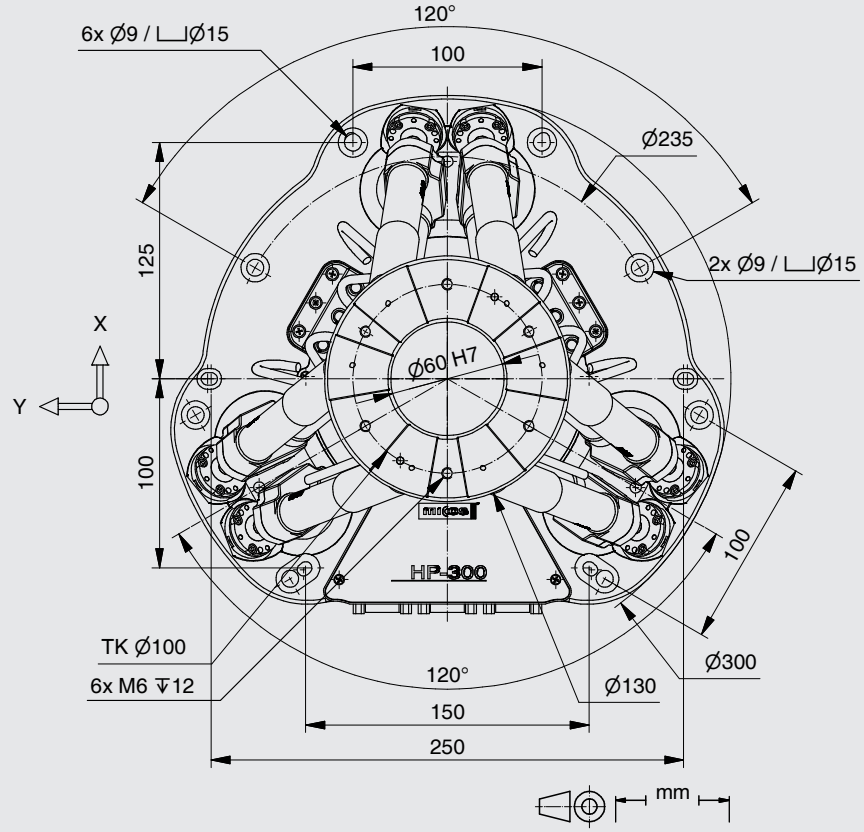
| | |
|---|---|
| Motor (Pitch 1 mm) | DC-B-010 |
| Speed max. X, Y, Z (mm/sec) | 3 |
| Speed max. Rx, Ry, Rz (°/sec) | 2 |
| Velocity Range (mm/sec) | 0.01...0.3 ** |
| Velocity Range (°/sec) | 0.001...2 ** |
| Weight (kg) | 5.8 |
| Bi-directional Repeatability X, Y, Z (µm) | ± 3, ± 3, ± 1 |
| Bi-directional Repeatability Rx, Ry, Rz (°) | ± 0.0028 |
| Resolution, calc. without load X, Y, Z (µm) | 0.022 |
| Resolution, calc. without load (height platf.) Rx, Ry, Rz (°) | depending on the position of the pivot point |
| Resolution typical without load X, Y, Z (µm) | 0.5 |
| Resolution typical without load Rx, Ry, Rz (°) | 0.001 |
| Current (A) | 0.08 |
| Voltage Range (V) | 12 |

| | |
|---|---|
| Stiffness, theoretical Kx, Ky, Kz (N/µm) | on request |
| Material | Stainless steel, Aluminum black anodized |

Note:
At present with DC-motor.
* The maximum travel ranges in the different coordinate directions (X, Y, Z, RX, RY, RZ) are interdependent. The data for each axis in this table shows its maximum travel, where all other axes are at their zero positions. If the other linear or rotational coordinates are not zero, the available travel may be less.
** leg speed

More info: Detailed info, concerning the motor, see: Appendix




| Order No. | 6020-9- | 1 | 2 | 0 | 1 | 0 |
|---|---|---|---|---|---|---|

# 3.076 Hexapod HP-140

## FACTS

| Load characteristics | $F_{x(N)}$ | $F_{y(N)}$ | $F_{z(N)}$ |
|---|---|---|---|
| DC-B-009 | 20 | 20 | 50 |

## KEY FEATURES

- Six axes Parallel Kinematic System
- Travel ranges linear 32 x 32 x 12 mm
- Travel ranges rotation Rx, Ry 12°, Rz 20 °
- Maximum speed 1 mm/sec
- Pivot Point can be set by the customer
- User friendly software
- Load capacity central ( Fx; Fy ) 2kg / ( Fz ) 5 kg

With a Hexapod HP-140 system motions in all six degrees of freedom can be achieved. Due to the parallel kinematic design principle of Hexapods, a much higher system stiffness is achieved than with conventional stacked stages. The low weight of the moving platform allows highly dynamic positioning processes. Hexapods are especially suited for applications of precision positioning. Hexapods are suitable for antenna positioning, medical technology, laser technology, semiconductor technology and for optical systems. The HP-140 is especially designed for applications with limited space conditions. An optimized general concept allows maximum stiffness and accuracy. The system use a Delta-Tau controller includes advanced algorithms for inverse kinematic transformations within a user-friendly software package. Vacuum versions are available on request.

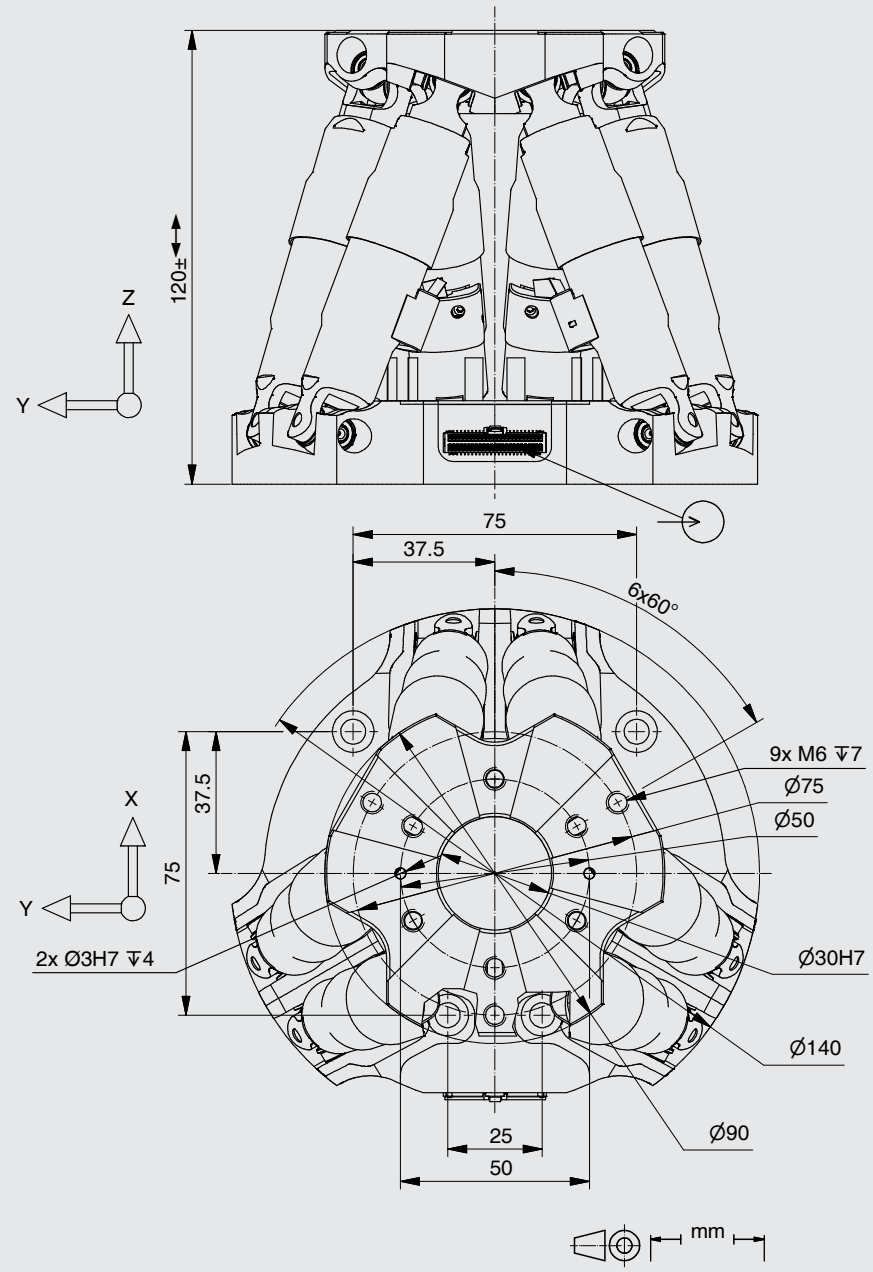
## TECHNICAL DATA

| Travel range | |
|---|---|
| X, Y, Z (mm) | 32 x 32 x 12 * |
| Rx, Ry, Rz (°) | 12, 12, 20 * |

| Motor (Pitch 1 mm) | DC-B-009 |
|---|---|
| Speed max. X, Y, Z (mm/sec) | 1 |
| Speed max. Rx, Ry, Rz (°/sec) | 0.5 |
| Velocity Range (mm/sec) | 0.01...1 ** |
| Velocity Range (°/sec) | 0.01...0.5 ** |
| Weight (kg) | 1.7 |
| Bi-directional Repeatability X, Y, Z (µm) | ± 3, ± 3, ± 1 |
| Bi-directional Repeatability Rx, Ry, Rz (°) | ± 0.003 |
| Resolution, calc. without load X, Y, Z (µm) | 0.0064 |
| Resolution, calc. without load (height platf.) Rx, Ry, Rz (°) | depending on the position of the pivot point |
| Resolution typical without load X, Y, Z (µm) | 0.5 |
| Resolution typical without load Rx, Ry, Rz (°) | 0.001 |
| Current (A) | 0.32 |
| Voltage Range (V) | 12 |

| Stiffness, theoretical Kx, Ky, Kz (N/µm) | on request |
|---|---|
| Material | Stainless steel, Aluminum black anodized |

Note:
* The maximum travel ranges in the different coordinate directions ( X, Y, Z, RX, RY, RZ ) are interdependent. The data for each axis in this table shows its maximum travel, where all other axes are at their zero positions. If the other linear or rotational coordinates are not zero, the available travel may be less.
** leg speed



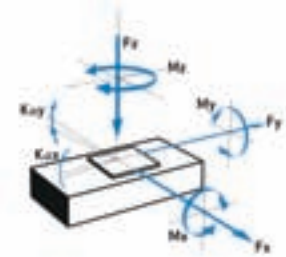

| Order No. | 6030-9- | 1 | 0 | 0 | 3 | 0 |
|---|---|---|---|---|---|---|

# LINEAR STAGES

# 4.080 Ultra Precision Stage UPS-150

## FACTS

| Load characteristics | $Fx_{(N)}$ | $Fy_{(N)}$ | $Fy\ Peak_{(N)}$ | $Fz_{(N)}$ | $Mx_{(Nm)}$ | $My_{(Nm)}$ | $Mz_{(Nm)}$ | $k\vartheta x_{(\mu rad/Nm)}$ | $k\vartheta y_{(\mu rad/Nm)}$ |
|---|---|---|---|---|---|---|---|---|---|
| LM-015 | 75 | 22 | 88 | 150 | 50 | 100 | 50 | 25 | 20 |

The UPS-150 ultra-precision linear stage was specifically designed for sub-surface wafer inspection, fiber alignment, high precision robotics and for all tasks where a maximum positioning accuracy and reliability is absolutely mandatory. All UPS-150 ultra precision stages are equipped with a linear scale which is centrally mounted between the guides. The high-quality cross-roller bearings insure a high load capacity and a smooth motion. The UPS-150 stage is driven by an iron-less linear motor and provides high acceleration and speed. A system accuracy below 1 µm / 100 mm travel and a bi-directional repeatability of less than 0.025 µm is guaranteed. The ultra precision stages are supplied with certificate of performance (flatness, straightness, pitch, yaw & position). The measurement is made with the stage mounted and unloaded on a granite table with a flatness < 1µm.

## KEY FEATURES

- Linear motor
- Travel range up to 305 mm (12")
- Uni-directional repeatability down to 0.015 µm
- Maximum speed 600 mm/sec
- Load capacity up to 15 kg
- Integrated inductive limit switches
- Integrated linear scale (center mounted)
- High long-term stability

## TECHNICAL DATA

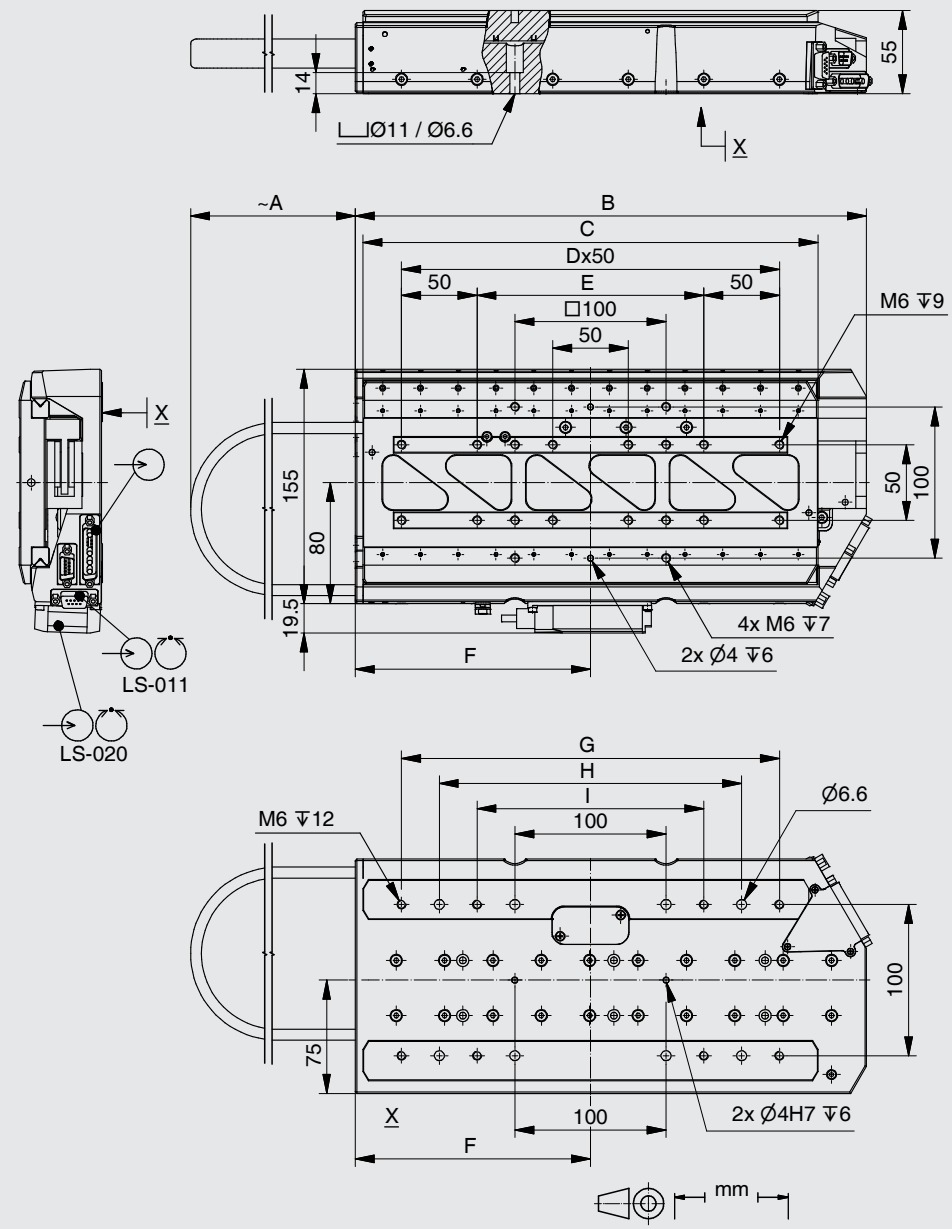
| | | | | | |
|---|---|---|---|---|---|
| Travel range (mm) | 52 | 102 | 155 | 205 | 305 |
| Straightness / Flatness (µm) | ± 0.5 | ± 0.75 | ± 1 | ± 1.25 | ± 1.75 |
| Pitch (µrad) | ± 15 | ± 20 | ± 25 | ± 30 | ± 40 |
| Yaw (µm) | ± 20 | ± 20 | ± 20 | ± 20 | ± 20 |
| Weight (kg) | 4.7 | 5.5 | 6.3 | 7.1 | 8.7 |

| | | | |
|---|---|---|---|
| Motor | LM-015 | | |
| Linear scale | | LS-011 | LS-020 |
| Speed max. (mm/sec) | 600 | | |
| Resolution calculated (µm) | | 0.015 | 0.001 |
| Resolution typical (µm) | | 0.02 | 0.015 |
| Bi-directional Repeatability (µm) | | ± 0.035 | ± 0.025 |
| Uni-directional Repeatability (µm) | | 0.025 | 0.015 |
| Nominal Current (A) | 1.4 | | |

| | |
|---|---|
| Accuracy | on request |
| Velocity range (mm/sec) | 0.0005 ... 600 |
| Material | Aluminum, black anodized |

Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.

| Travel (mm) | 52 | 102 | 155 | 205 | 305 |
|---|---|---|---|---|---|
| A | 83 | 108 | 133 | 158 | 208 |
| B | 198 | 238 | 288 | 338 | 454 |
| C | 151 | 201 | 251 | 301 | 401 |
| D | - | - | - | 5 | 7 |
| E | - | 150 | 150 | 150 | 150 |
| F | 75.5 | 105.5 | 130.5 | 155.5 | 205.5 |
| G | - | - | - | 250 | 250 |
| H | - | - | 200 | 200 | 300 |
| I | 125 | 150 | 150 | 150 | 150 |




| Order No. | 6840-9- | | | |
|---|---|---|---|---|
| LM-015 | 1 | | | |
| | | | | |
| 52 mm (2") | | 1 | | |
| 102 mm (4") | | 2 | | |
| 155 mm (6") | | 3 | | |
| 205 mm (8") | | 4 | | |
| 305 mm (12") | | 5 | | |
| | | | | |
| LS-011, Linear steel scale | | | 1 | |
| LS-020, Linear glass scale | | | 2 | |

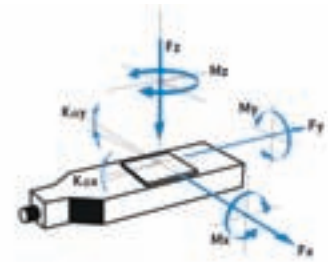
# 4.082 Ultra Precision Linear Stage UPM-160

## FACTS

| Load characteristics | $F_{x(N)}$ | $F_{y(N)}$ | $F_{z(N)}$ | $M_{x(Nm)}$ | $M_{y(Nm)}$ | $M_{z(Nm)}$ | $k_{\pm x(\mu rad/Nm)}$ | $k_{\pm y(\mu rad/Nm)}$ |
|---|---|---|---|---|---|---|---|---|
| DC-B-039 | 150 | 100 | 350 | 100 | 200 | 100 | 5 | 3 |
| 2Phase-051 | 150 | 100 | 350 | 100 | 200 | 100 | 5 | 3 |

## KEY FEATURES

- Travel range up to 205 mm (8")
- Uni-directional repeatability down to 0.035 µm
- Maximum speed 100 mm/sec
- Load capacity up to 35 kg
- Integrated mechanical limit switches
- Integrated linear scale (center mounted)



The UPM-160 ultra-precision linear stage was specifically designed for wafer inspection, fiber alignment or for any other tasks where the highest positioning accuracy and reliability are absolutely mandatory. All UPM-160 stages are equipped with an integrated linear scale that is center mounted between the guides. High-quality cross-roller bearings mounted on a stress-relieved tempered aluminum-alloy body guarantee maximum load capacity and smooth motion. The UPM-160 stage is offered with a 2-phase stepper motor or with a DC-motor and is equipped with two mechanical limit switches. All ultra precision linear stages are supplied with a certificate of performance (flatness, straightness & accuracy).

## TECHNICAL DATA

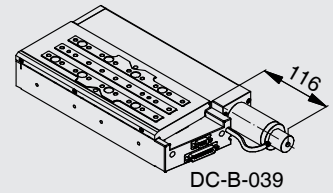
| | | | | |
|---|---|---|---|---|
| Travel range (mm) | 55 | 105 | 155 | 205 |
| Straightness / Flatness (µm) | ± 0.5 | ± 0.75 | ± 1 | ± 1.25 |
| Pitch (µrad) | ± 15 | ± 20 | ± 25 | ± 30 |
| Yaw (µm) | ± 20 | ± 20 | ± 20 | ± 20 |
| Weight (kg) | 5 | 6 | 7 | 8 |

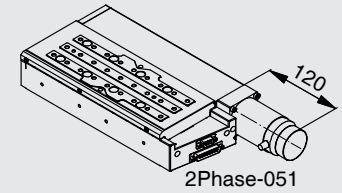
| | | | | |
|---|---|---|---|---|
| Motor (Pitch 2.5 \| 5 mm) | DC-B-039 | 2Phase-051 | | |
| Linear scale | | | LS-010 | LS-020 |
| Speed max. (mm/sec) | 50 \| 100 | 18 \| 30 | | |
| Resolution calculated (µm) | | 5 \| 10 (FS) | 0.05 | 0.001 |
| Resolution typical (µm) | | | 0.04 | 0.02 |
| Bi-directional Repeatability (µm) | | | ± 0.05 | ± 0.035 |
| Uni-directional Repeatability (µm) | | | 0.05 | 0.035 |
| Nominal Current (A) | 3.8 | 2.5 | | |
| Voltage Range (V) | 24 | | | |

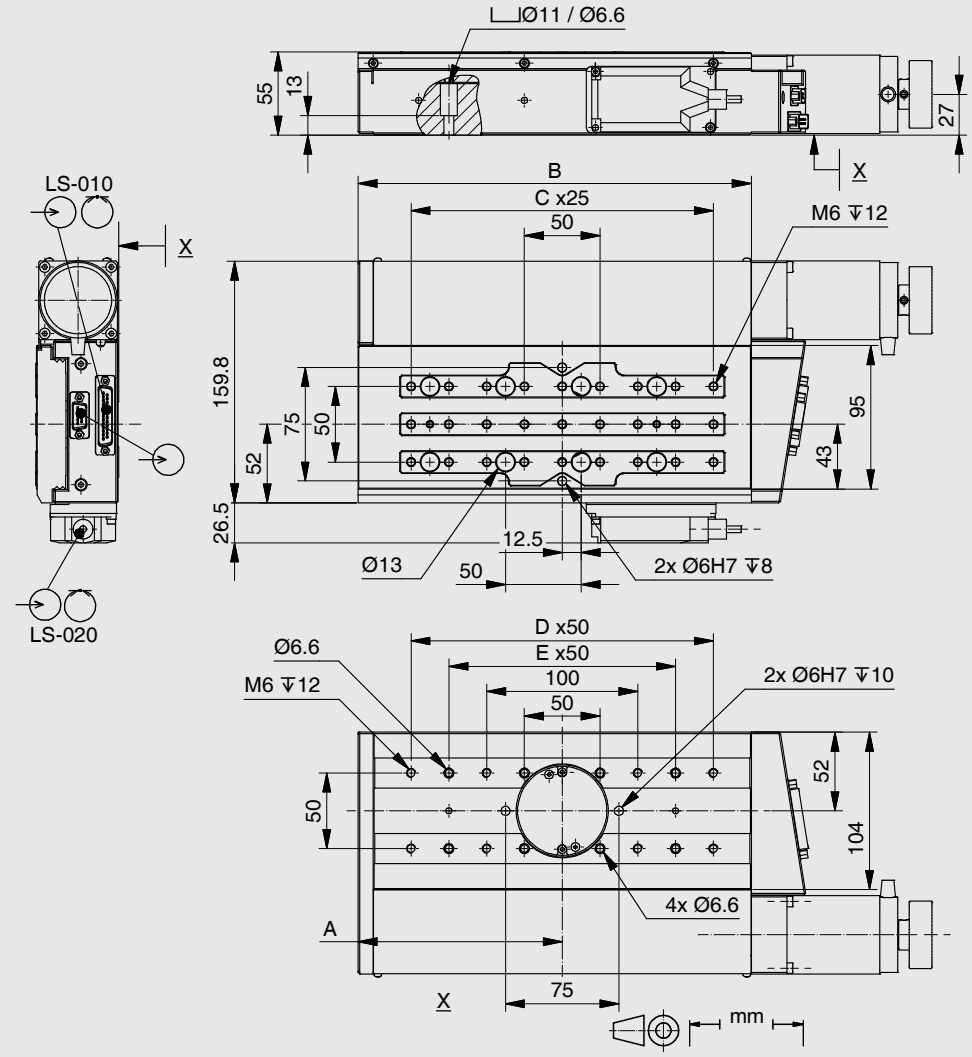
| | |
|---|---|
| Accuracy | on request |
| Velocity range (mm/sec) | 0.001 ... 100 |
| Material | Aluminum, black anodized |

Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.

| Travel (mm) | 55 | 105 | 155 | 205 |
|---|---|---|---|---|
| A | 110 | 135 | 160 | 185 |
| B | 210 | 260 | 310 | 360 |
| C | 6 | 8 | 10 | 12 |
| D | - | 4 | 4 | 6 |
| E | 3 | 3 | 5 | 5 |



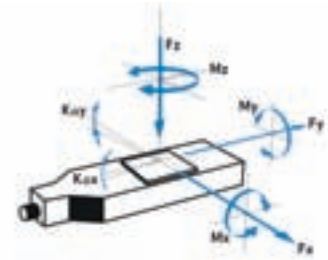




| Order No. | 6270-9- | | | | |
|---|---|---|---|---|---|
| DC-B-039 | 1 | | | | |
| 2Phase-051 | 2 | | | | |
| | | | | | |
| 55 mm (2") | | 1 | | | |
| 105 mm (4") | | 2 | | | |
| 155 mm (6") | | 3 | | | |
| 205 mm (8") | | 4 | | | |
| | | | | | |
| LS-010, Linear steel scale | | | 1 | | |
| LS-020, Linear glass scale | | | 2 | | |
| | | | | | |
| Pitch 2.5 mm | | | | 1 | |
| Pitch 5.0 mm | | | | 2 | |

# 4.084 High Precision Stage HPS-170

## FACTS

| Load characteristics | $F_{x(N)}$ | $F_{y(N)}$ | $F_{z(N)}$ | $M_{x(Nm)}$ | $M_{y(Nm)}$ | $M_{z(Nm)}$ | $k_{\pm x(\mu rad/Nm)}$ | $k_{\pm y(\mu rad/Nm)}$ |
|---|---|---|---|---|---|---|---|---|
| DC-B-040 | 150 | 100 | 350 | 300 | 400 | 300 | 12 | 8 |
| 2Phase-048 | 150 | 150 | 350 | 300 | 400 | 300 | 12 | 8 |



The HPS-170 precision stage was developed to meet the demands of high precision positioning. Due to its precise and smooth operation this linear stage is perfectly suited for measuring and inspection equipment. High-quality cross-roller bearings mounted on a stress-relieved, tempered aluminum alloy body guarantee maximum load capacity and long-time stability. The HPS-170 precision stage is available with a DC or a 2-phase stepper motor and is equipped with two mechanical limit switches. A linear scale with a resolution of less than 0.05 µm is optional. Optical and inductive limit switches as well as a certificate of performance can be supplied on request.

## KEY FEATURES

- Travel range up to 305 mm (12")
- Uni-directional repeatability down to 0.05 µm
- Maximum speed 90 mm/sec
- Load capacity up to 35 kg
- Integrated mechanical limit switches
- Option: linear scale (center mounted)

## TECHNICAL DATA

| | | | | | |
|---|---|---|---|---|---|
| Travel range (mm) | 52 | 102 | 155 | 205 | 305 |
| Straightness / Flatness (µm) | ± 0.75 | ± 1 | ± 2 | ± 3 | ± 4 |
| Pitch (µrad) | ± 20 | ± 25 | ± 30 | ± 35 | ± 40 |
| Yaw (µm) | ± 40 | ± 40 | ± 40 | ± 40 | ± 40 |
| Weight (kg) | 5 | 5.5 | 6 | 6.5 | 7 |

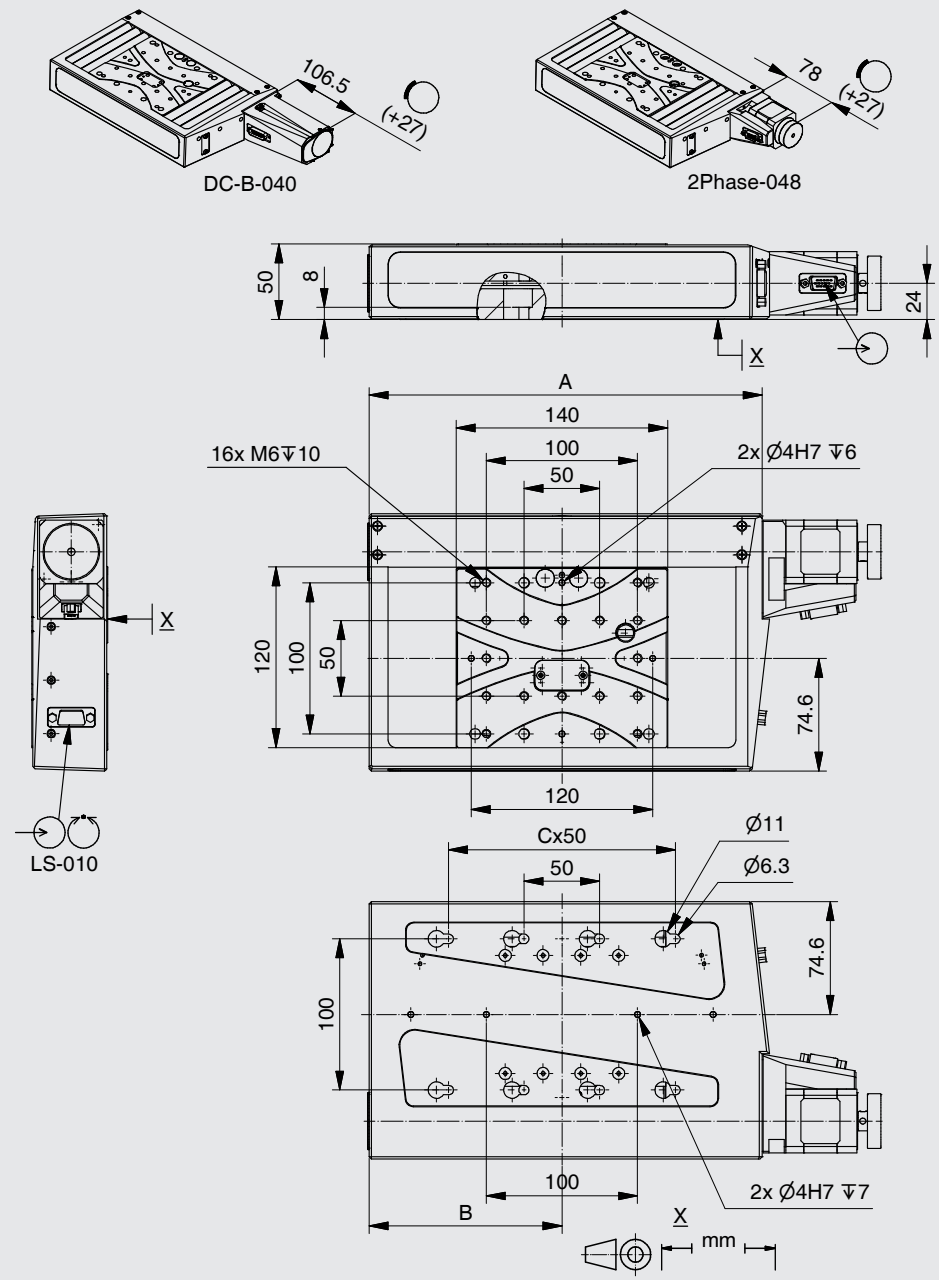
| | | | |
|---|---|---|---|
| Motor (Pitch 2 mm) | DC-B-040 | 2Phase-048 | |
| Linear scale | | | LS-010 |
| Speed max. (mm/sec) | 90 | 35 | |
| Resolution calculated (µm) | 0.1 (RE) | 10 (FS) | 0.05 |
| Resolution typical (µm) | 0.2 | 0.1 | 0.05 |
| Bi-directional Repeatability (µm) | ± 1 | ± 1 | ± 0.05 |
| Uni-directional Repeatability (µm) | 0.2 | 0.2 | 0.05 |
| Nominal Current (A) | 3.8 | 1.2 | |
| Voltage Range (V) | 24 | | |

| | |
|---|---|
| Accuracy | on request |
| Velocity range (mm/sec) | 0.001 ... 90 |
| Material | Aluminum, black anodized |

Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.

| Travel (mm) | 52 | 102 | 155 | 205 | 305 |
|---|---|---|---|---|---|
| A | 261 | 311 | 381 | 456 | 556 |
| B | 127.5 | 152.5 | 187.5 | 225 | 275 |
| C | 3 | 3 | 5 | 6 | 7 |

| Order No. | 6262-9- | | | | |
|---|---|---|---|---|---|
| DC-B-040 | 1 | | | | |
| 2Phase-048 | 2 | | | | |
| 2 mm (2") | | 1 | | | |
| 102 mm (4") | | 2 | | | |
| 155 mm (6") | | 3 | | | |
| 205 mm (8") | | 4 | | | |
| 305 mm (12") | | 5 | | | |
| without LS-010 | | | 0 | | |
| LS-010, Linear steel scale | | | 1 | | |
| without brake | | | | 0 | |
| with brake | | | | 1 | |



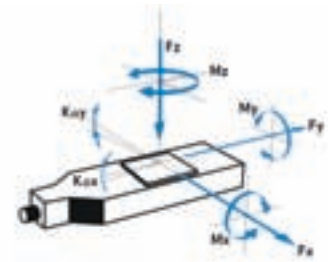
# 4.086 Linear Stage LS-270

## FACTS

| Load characteristics | $F_{x(N)}$ | $F_{y(N)}$ | $F_{z(N)}$ | $M_{x(Nm)}$ | $M_{y(Nm)}$ | $M_{z(Nm)}$ | $k_{\varphi x(\mu rad/Nm)}$ | $k_{\varphi y(\mu rad/Nm)}$ |
|---|---|---|---|---|---|---|---|---|
| DC-B-086 | 1200 | 40 | 1500 | 250 | 280 | 250 | 3.2 | 1.6 |
| 2Phase-072 | 1200 | 260 | 1500 | 250 | 280 | 250 | 3.2 | 1.6 |

## KEY FEATURES

- Travel range up to 1016 mm (40")
- Uni-directional repeatability down to 0.05 µm
- Maximum speed 150 mm/sec
- Load capacity up to 150 kg
- Integrated inductive limit switches
- Option: linear scale (center mounted)



The LS-270 linear stage was developed for positioning high loads. Cross-roller bearings mounted on a rigid tempered aluminum-alloy body guarantee very high guiding stiffness and long operating life. The ball screw with 5 mm pitch allows velocities up to 150 mm/s. For demanding positioning tasks the LS-270 linear stages can be supplied with a linear scale which is centrally installed between the guides. The LS-270 linear stages can be equipped with a DC or a 2-phase stepper motor and have two inductive limit switches.

## TECHNICAL DATA

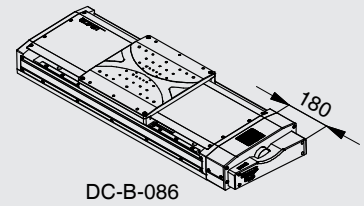
| | | | | | |
|---|---|---|---|---|---|
| Travel range (mm) | 155 | 305 | 508 | 815 | 1016 |
| Straightness / Flatness (µm) | ± 1.5 | ± 3 | ± 4 | ± 7 | ± 10 |
| Pitch (µrad) | ± 20 | ± 40 | ± 80 | ± 100 | ± 120 |
| Yaw (µm) | ± 20 | ± 20 | ± 30 | ± 40 | ± 50 |
| Weight (kg) | 25 | 29 | 35 | 43 | 50 |

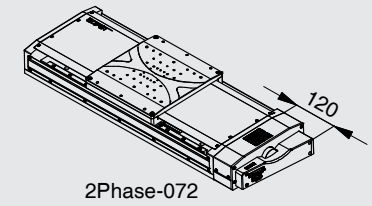
| Motor (Pitch 5 mm) | DC-B-086 | 2Phase-072 | |
|---|---|---|---|
| Linear scale | | | LS-010 |
| Speed max. (mm/sec) | 150 | 50 | |
| Resolution calculated (µm) | | 12.5 (FS) | 0.05 |
| Resolution typical (µm) | 0.5 | 0.4 | 0.05 |
| Bi-directional Repeatability (µm) | ± 2.5 | ± 2.5 | ± 0.04 |
| Uni-directional Repeatability (µm) | 0.5 | 0.4 | 0.05 |
| Nominal Current (A) | 5.57 | 2 | |
| Voltage Range (V) | 24 | | |

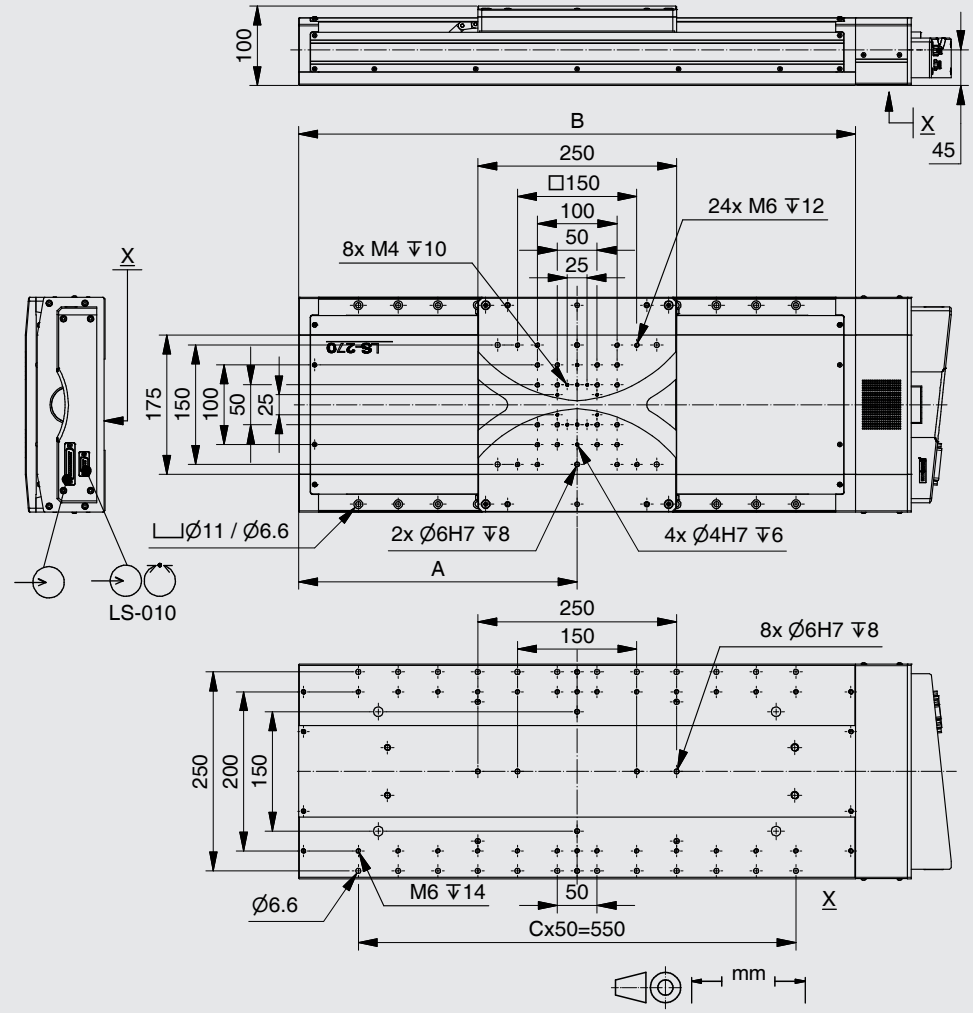
| | |
|---|---|
| Accuracy | on request |
| Velocity range (mm/sec) | 0.001 ... 150 |
| Material | Aluminum, black anodized |

Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.

| Travel (mm) | 155 | 305 | 508 | 815 | 1016 |
|---|---|---|---|---|---|
| A | 275 | 350 | 450 | 600 | 700 |
| B | 550 | 700 | 900 | 1200 | 1400 |
| C | 9 | 11 | 15 | 21 | 25 |



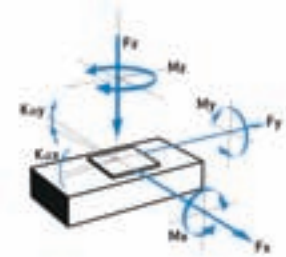




| Order No. | 6239-9- | | | | |
|---|---|---|---|---|---|
| DC-B-086 | 1 | | | | |
| 2Phase-072 | 2 | | | | |
| | | | | | |
| 155 mm (6") | | 1 | | | |
| 305 mm (12") | | 2 | | | |
| 508 mm (20") | | 3 | | | |
| 815 mm (32") | | 4 | | | |
| 1016 mm (40") | | 5 | | | |
| | | | | | |
| without LS-010 | | | 0 | | |
| LS-010, Linear steel scale | | | 1 | | |
| | | | | | |
| ILS-020, Inductive limit switches | | | | 4 | |

# 4.088 Linear Motor Stage LMS-230

## FACTS

| Load characteristics | $Fx_{(N)}$ | $Fy_{(N)}$ | $Fy\ Peak_{(N)}$ | $Fz_{(N)}$ | $Mx_{(Nm)}$ | $My_{(Nm)}$ | $Mz_{(Nm)}$ | $k\vartheta x_{(\mu rad/Nm)}$ | $k\vartheta y_{(\mu rad/Nm)}$ |
|---|---|---|---|---|---|---|---|---|---|
| LM-050 | 75 | 22 | 88 | 150 | 50 | 100 | 50 | 25 | 20 |



The Linear Motor Stage LMS-230 was specifically designed for dynamic film exposing, high precision robotics and for all tasks where a maximum of positioning accuracy and reliability is absolutely mandatory. The Linear Measuring Stage LMS-230 is equipped with a linear scale which is centrally installed between the guides. Two limit switches protect against accidental over-travel. Due to high-quality cross-roller bearings a maximum of load capacity and smooth motion is guaranteed. Special, stress-relieved, tempered aluminum-alloy guarantees a homogeneous non-warping stage structure. The Linear Measuring Stage LMS-230 is driven by a linear motor and provides high acceleration, high travel speed and guaranteed a constant motion. System accuracy below 1 µm / 100 mm travel and a bi-directional repeatability of less than 0.1 µm is guaranteed. The Linear Measuring Stage LMS-230 is supplied with certificate of performance (flatness, straightness, pitch, yaw & position).

## KEY FEATURES

- Linear Motor
- Travel range 52 mm (2")
- Uni-directional repeatability down to 0.01 µm
- Maximum speed 400 mm/sec
- Load capacity up to 15 kg
- Integrated inductive limit switches
- Integrated linear scale (center mounted)

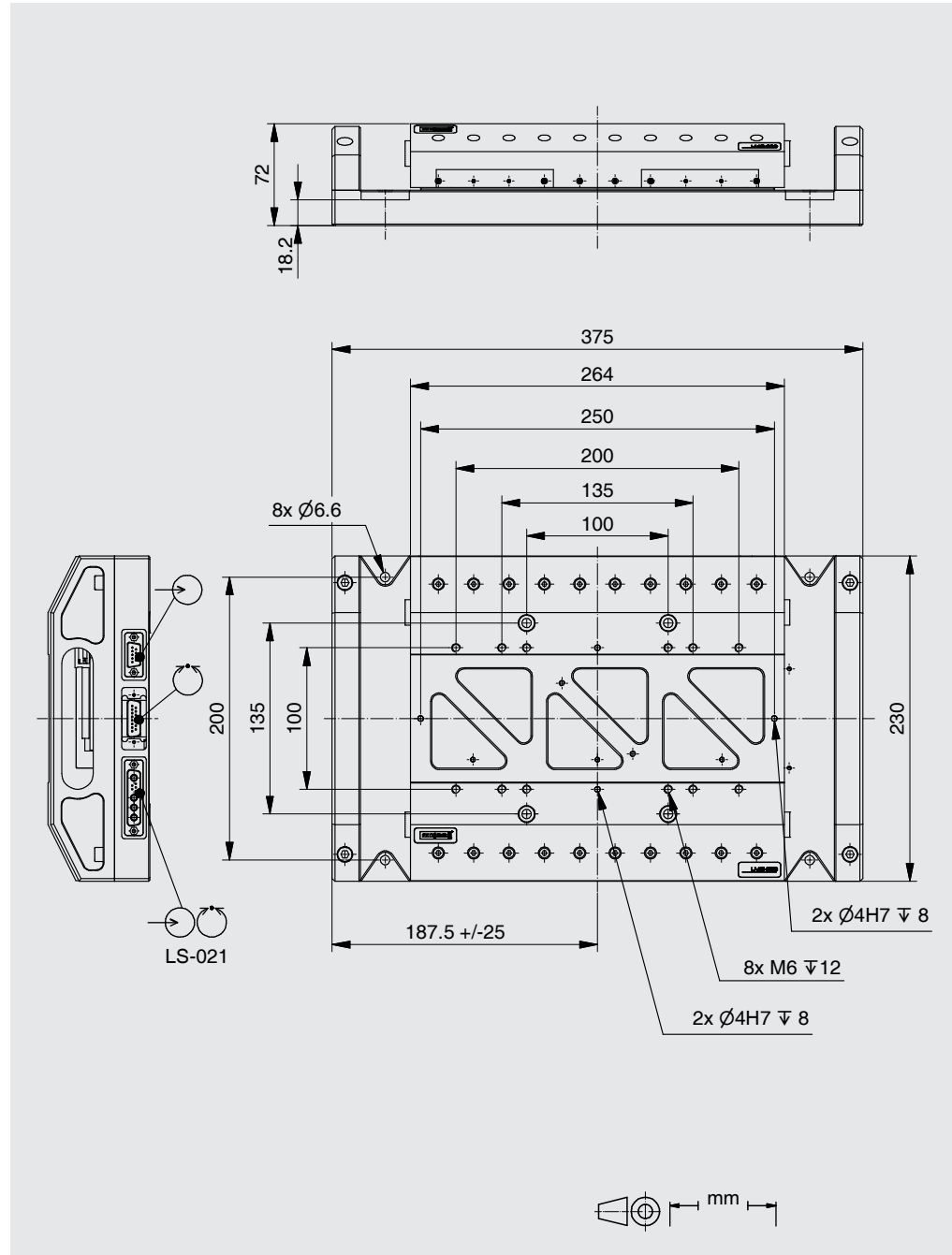
## TECHNICAL DATA

| | |
|---|---|
| Travel range (mm) | 52 |
| Straightness / Flatness (µm) | ± 0.5 |
| Pitch (µrad) | ± 10 |
| Yaw (µm) | ± 10 |
| Weight (kg) | 13.5 |

| Motor | LM-050 | |
|---|---|---|
| Linear scale | | LS-021 |
| Speed max. (mm/sec) | 400 | |
| Resolution calculated (µm) | | 0.001 |
| Resolution typical (µm) | 0.005 | 0.005 |
| Bi-directional Repeatability (µm) | | ± 0.02 |
| Uni-directional Repeatability (µm) | | 0.01 |
| Nominal Current (A) | 5.95 | |

| | |
|---|---|
| Accuracy | on request |
| Velocity range (mm/sec) | 0.0005 ... 400 |
| Material | Aluminum, black anodized |

Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.

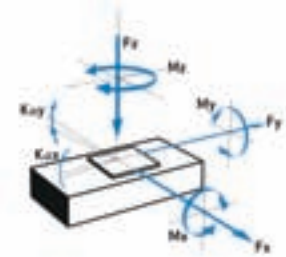



| Order No. | 6854-9- | | | | |
|---|---|---|---|---|---|
| LM-050 | 1 | | | | |
| 52 mm (2") | 1 | | | | |
| LS-021, Linear glass scale | 1 | | | | |
| ILS-020, Inductive limit switches | 1 | | | | |

# 4.090 Linear Motor Stage LMS-180

## FACTS

| Load characteristics | $Fx_{(N)}$ | $Fy_{(N)}$ | $Fy\ Peak_{(N)}$ | $Fz_{(N)}$ | $Mx_{(Nm)}$ | $My_{(Nm)}$ | $Mz_{(Nm)}$ | $k\vartheta x_{(\mu rad/Nm)}$ | $k\vartheta y_{(\mu rad/Nm)}$ |
|---|---|---|---|---|---|---|---|---|---|
| LM-010 | 480 | 50 | 176 | 450 | 65 | 120 | 65 | 80 | 60 |



The LMS-180 linear stage series is developed for advanced electronic production and laser applications. Combined with the PI miCos UPR direct-driven rotation stage series, highly-dynamic and precise positioning systems can be configured resulting in an efficient production line. The LMS-180 linear stage are driven by iron-less linear motors. The very high accuracy linear scale is installed between the guides so that higher system accuracy can be achieved. The LMS-180 series excels with very quiet, dynamic and smooth motion. All LMS-180 linear stages are equipped with inductive limit switches for protection against damage.

## KEY FEATURES

- Linear Motor
- Travel range up to 508 mm (20")
- Uni-directional repeatability down to 0.05 µm
- Maximum speed 500 mm/sec
- Integrated inductive limit switches
- Integrated linear scale (center mounted)

## TECHNICAL DATA

| | | | | | |
|---|---|---|---|---|---|
| Travel range (mm) | 155 | 205 | 305 | 408 | 508 |
| Straightness / Flatness (µm) | ± 2 | ± 3 | ± 4 | ± 5 | ± 6 |
| Pitch (µrad) | ± 40 | ± 50 | ± 60 | ± 70 | ± 80 |
| Yaw (µm) | ± 50 | ± 50 | ± 50 | ± 50 | ± 50 |
| Weight (kg) | 10.2 | 10.4 | 11.5 | 12.8 | 14.2 |

| | | |
|---|---|---|
| Motor | LM-010 | |
| Linear scale | | LS-011 |
| Speed max. (mm/sec) | 500 | |
| Resolution calculated (µm) | | 0.015 |
| Resolution typical (µm) | | 0.04 |
| Bi-directional Repeatability (µm) | | ± 0.1 |
| Uni-directional Repeatability (µm) | | 0.05 |
| Nominal Current (A) | 1.8 | |

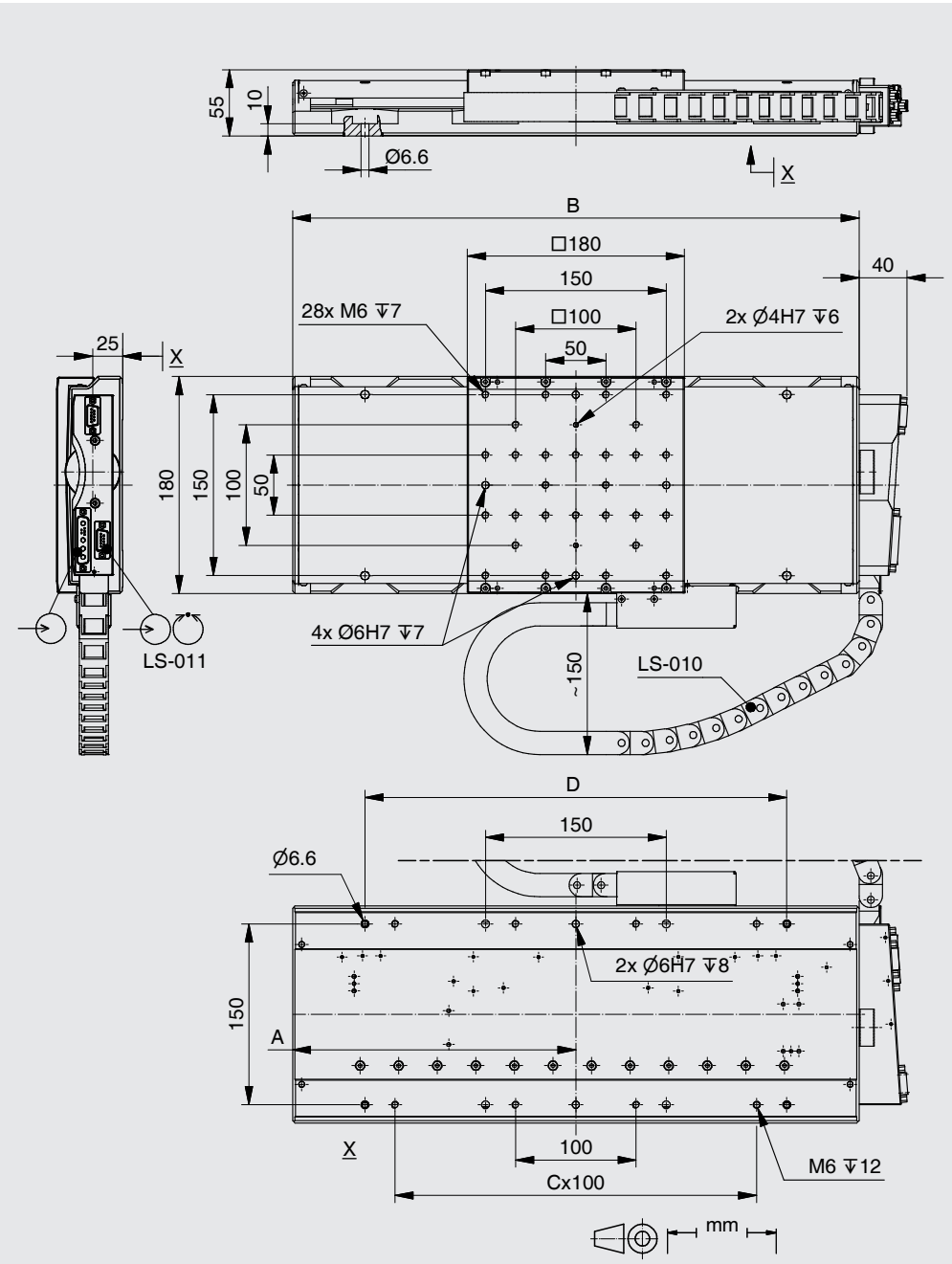
| | |
|---|---|
| Accuracy | on request |
| Velocity range (mm/sec) | 0.001 ... 500 |
| Material | Aluminum, black anodized |

Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.



PI miCos

| Travel (mm) | 155 | 205 | 305 | 408 | 508 |
|---|---|---|---|---|---|
| A | 235 | 260 | 310 | 360 | 410 |
| B | 470 | 520 | 620 | 720 | 820 |
| C | 3 | 3 | 5 | 5 | 5 |
| D | 350 | 350 | 450 | 550 | 650 |

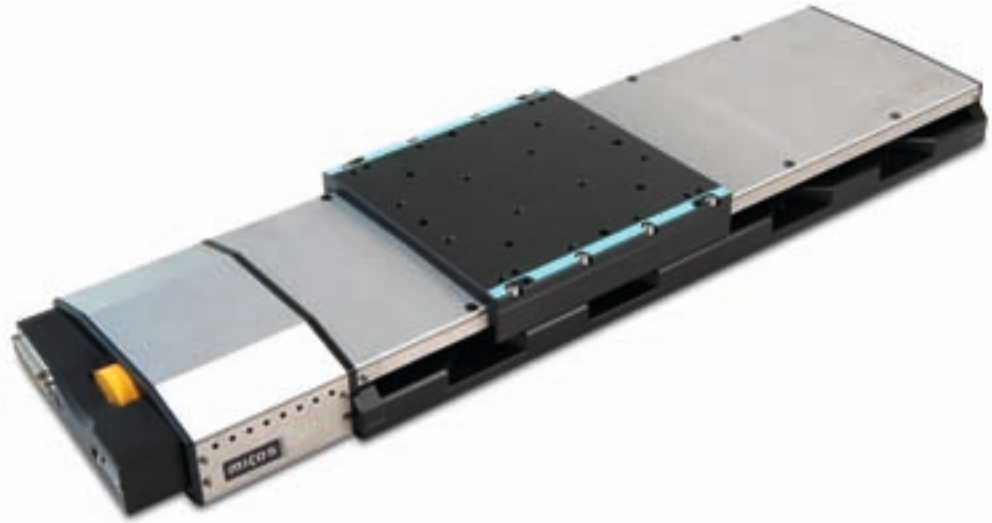


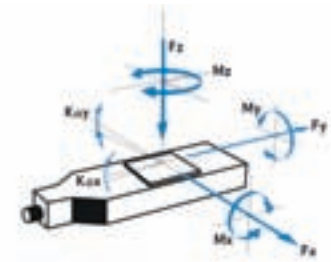

| Order No. | 6850-9- | | | |
|---|---|---|---|---|
| LM-010 | 1 | | | |
| | | | | |
| 155 mm (6") | | 1 | | |
| 205 mm (8") | | 2 | | |
| 305 mm (12") | | 3 | | |
| 408 mm (16") | | 4 | | |
| 508 mm (20") | | 5 | | |
| | | | | |
| LS-011, Linear steel scale | | | 1 | |

# 4.092 Linear Stage LS-180

## FACTS

| Load characteristics | $F_{x(N)}$ | $F_{y(N)}$ | $F_{z(N)}$ | $M_{x(Nm)}$ | $M_{y(Nm)}$ | $M_{z(Nm)}$ | $k_{\pm x(\mu rad/Nm)}$ | $k_{\pm y(\mu rad/Nm)}$ |
|---|---|---|---|---|---|---|---|---|
| DC-B-040 | 500 | 200 | 1000 | 132 | 400 | 125 | 60 | 50 |
| 2Phase-052 | 500 | 250 | 1000 | 132 | 400 | 125 | 60 | 50 |





The LS-180 linear stage was developed for industrial applications. Re-circulating ball guides mounted on a rigid tempered aluminum-alloy body guarantee a very high guiding stiffness and long operating life. The ball screw with 5 mm pitch allows velocities up to 200 mm/s. For demanding positioning tasks the linear stages LS-180 can be supplied with a linear scale which is centrally installed between the guides. The LS-180 linear stages can be equipped with a DC or a 2-phase stepper motor and are supplied with two inductive limit switches.

## KEY FEATURES

- Travel range up to 610 mm (24")
- Uni-directional repeatability down to 0.05 µm
- Maximum speed 200 mm/sec
- Load capacity up to 100 kg
- Integrated inductive limit switches
- Option: linear scale (center mounted)

## TECHNICAL DATA

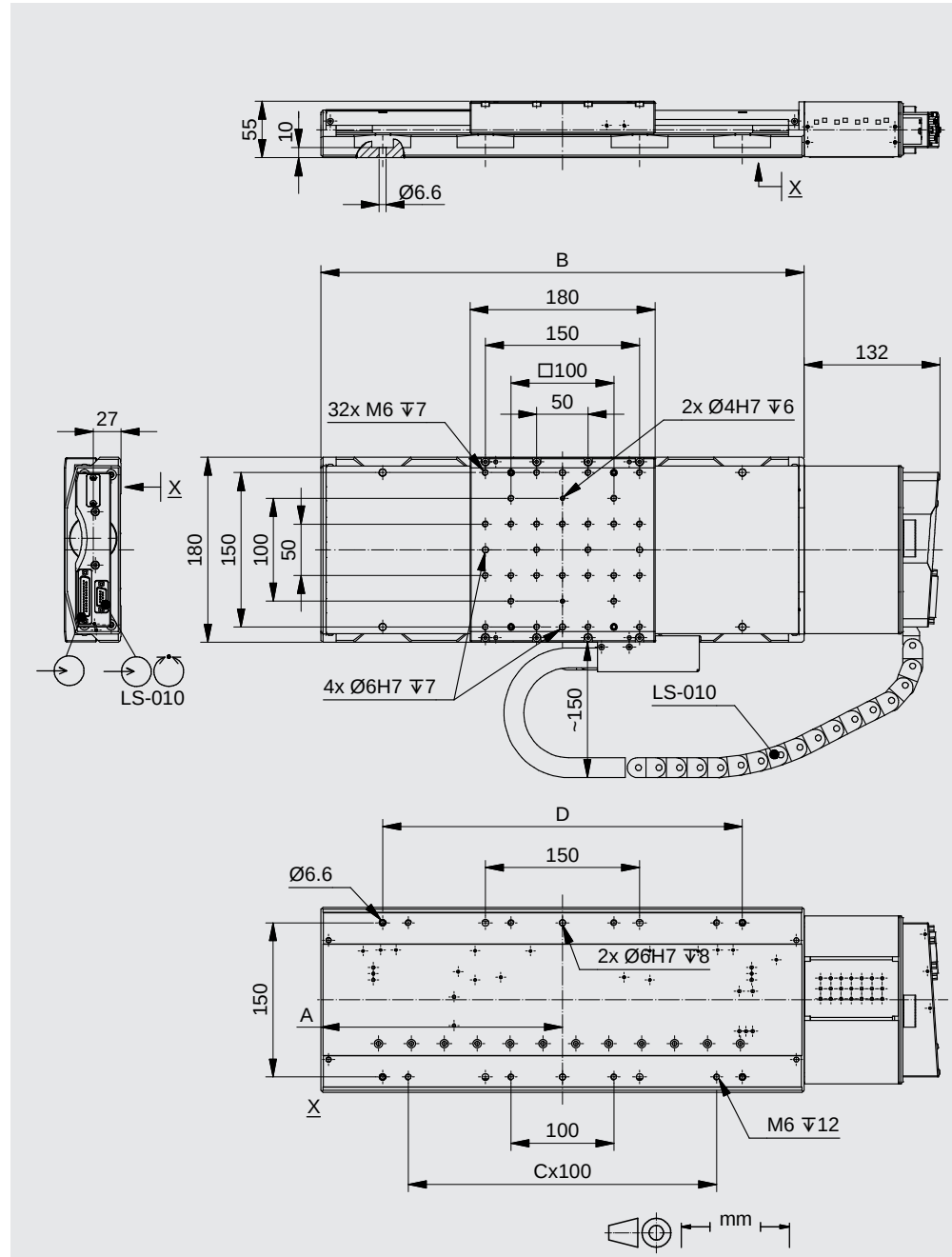
| | | | | | | |
|---|---|---|---|---|---|---|
| Travel range (mm) | 155 | 205 | 305 | 408 | 508 | 610 |
| Straightness / Flatness (µm) | ± 2 | ± 3 | ± 4 | ± 5 | ± 6 | ± 8 |
| Pitch (µrad) | ± 40 | ± 50 | ± 60 | ± 70 | ± 80 | ± 100 |
| Yaw (µm) | ± 50 | ± 50 | ± 50 | ± 50 | ± 50 | ± 50 |
| Weight (kg) | 8.4 | 8.8 | 9.6 | 10.2 | 10.8 | 12 |

| | | | |
|---|---|---|---|
| Motor (Pitch 5 mm) | DC-B-040 | 2Phase-052 | |
| Linear scale | | | LS-010 |
| Speed max. (mm/sec) | 200 | 75 | |
| Resolution calculated (µm) | 0.25 (RE) | 25 (FS) | 0.05 |
| Resolution typical (µm) | 0.5 | 0.5 | 0.05 |
| Bi-directional Repeatability (µm) | ± 2.5 | ± 2.5 | ± 0.1 |
| Uni-directional Repeatability (µm) | 0.5 | 0.5 | 0.05 |
| Nominal Current (A) | 3.8 | 2 | |
| Voltage Range (V) | 24 | | |

| | |
|---|---|
| Accuracy | on request |
| Velocity range (mm/sec) | 0.001 ... 200 |
| Material | Aluminum, black anodized |

Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.

| Travel (mm) | 155 | 205 | 305 | 408 | 508 | 610 |
|---|---|---|---|---|---|---|
| A | 235 | 260 | 310 | 360 | 410 | 460 |
| B | 470 | 520 | 620 | 720 | 820 | 920 |
| C | 3 | 3 | 5 | 5 | 5 | 7 |
| D | 350 | 350 | 450 | 550 | 650 | 750 |

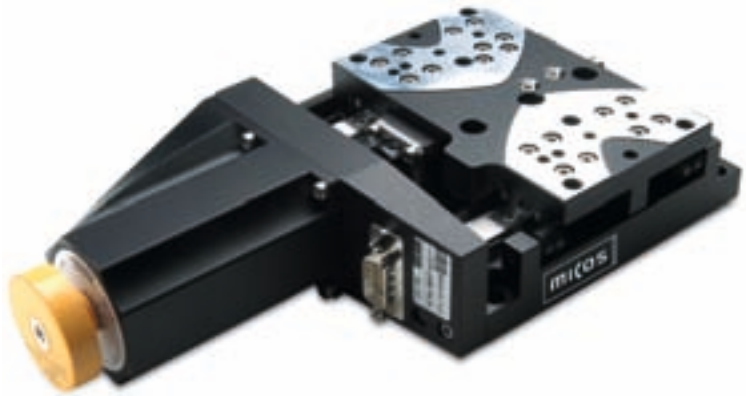



| Order No. | 6240-9- | | | |
|---|---|---|---|---|
| DC-B-040 | 1 | | | |
| 2Phase-052 | 2 | | | |
| | | | | |
| 155 mm (6") | | 1 | | |
| 205 mm (8") | | 2 | | |
| 305 mm (12") | | 3 | | |
| 408 mm (16") | | 4 | | |
| 508 mm (20") | | 5 | | |
| 610 mm (24") | | 6 | | |
| | | | | |
| without LS-010 | | | 0 | |
| LS-010, Linear steel scale | | | 1 | |

# 4.094 Linear Stage LS-120

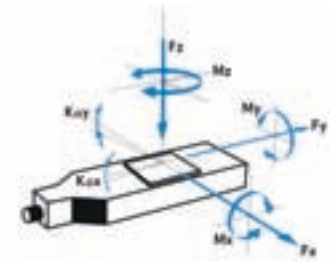
## FACTS

| Load characteristics | $Fx_{(N)}$ | $Fy_{(N)}$ | $Fz_{(N)}$ | $Mx_{(Nm)}$ | $My_{(Nm)}$ | $Mz_{(Nm)}$ | $k_{\varphi x}$ (µrad/Nm) | $k_{\varphi y}$ (µrad/Nm) |
|---|---|---|---|---|---|---|---|---|
| DC-B-033 | 50 | 80 | 100 | 30 | 60 | 33 | 40 | 30 |
| 2Phase-048 | 50 | 80 | 100 | 30 | 60 | 33 | 40 | 30 |




## KEY FEATURES

- Travel range up to 40 mm (xy setup by PI miCos)
- Maximum speed 90 mm/sec
- Load capacity up to 10 kg
- Integrated inductive limit switches
- Option: linear scale (center mounted)

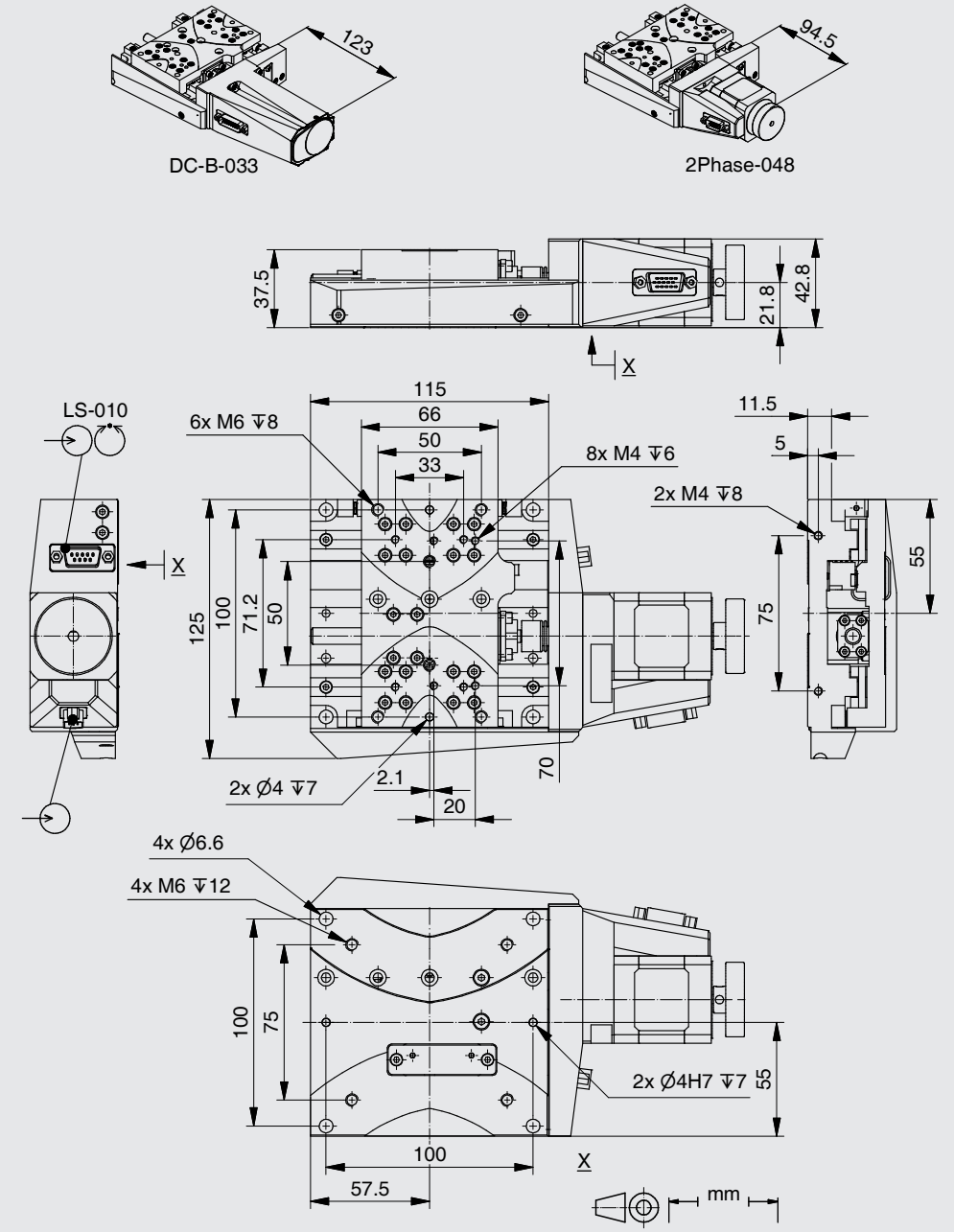


The LS-120 linear stage is suited for high precision applications with limited space conditions. High rigidity within a compact package is achieved by using re-circulating linear ball bearings mounted within a highly rigid, tempered aluminum-alloy stage body. The linear stage is driven by a re-circulating ball screw with 2 mm pitch and can be supplied with a linear scale which is centrally installed between the guides. The LS-120 linear stages can be equipped with a DC or 2-phase stepper motor. Inductive limit switches are integrated in the linear stage.

## TECHNICAL DATA

| | | | |
|---|---|---|---|
| Travel range (mm) | 40 | | |
| Straightness / Flatness (µm) | ± 1.5 | | |
| Pitch (µrad) | ± 40 | | |
| Yaw (µm) | ± 40 | | |
| Weight (kg) | 1.8 | | |
| Motor (Pitch 2 mm) | DC-B-033 | 2Phase-048 | |
| Linear scale | | | LS-010 |
| Speed max. (mm/sec) | 90 | | |
| Resolution calculated (µm) | 0.1 (RE) | | 0.05 |
| Resolution typical (µm) | 0.2 | | 0.1 |
| Bi-directional Repeatability (µm) | ± 1 | | ± 0.1 |
| Uni-directional Repeatability (µm) | 0.2 | | 0.1 |
| Nominal Current (A) | 2.3 | 1.2 | |
| Voltage Range (V) | 24 | | |
| Accuracy | on request | | |
| Velocity range (mm/sec) | 0.001 ... 90 | | |
| Material | Aluminum, black anodized | | |

Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.

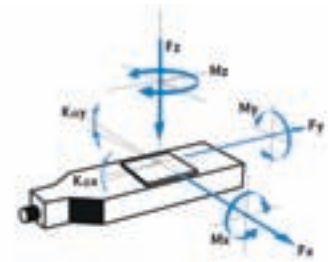



| Order No. | 6237-9- | | | | |
|---|---|---|---|---|---|
| DC-B-033 | 1 | | | | |
| 2Phase-048 | 2 | | | | |
| 40 mm (1.5") | | 1 | | | |
| 40 mm (xy setup by PI miCos) | | 2 | | | |
| without LS-010 | | | 0 | | |
| LS-010, Linear steel scale | | | 1 | | |
| ILS-010, Inductive limit switches | | | | 4 | |

# 4.096 Linear Stage LS-110

## FACTS

| Load characteristics | $F_{x(N)}$ | $F_{y(N)}$ | $F_{z(N)}$ | $M_{x(Nm)}$ | $M_{y(Nm)}$ | $M_{z(Nm)}$ | $k_{\varphi x(\mu rad/Nm)}$ | $k_{\varphi y(\mu rad/Nm)}$ |
|---|---|---|---|---|---|---|---|---|
| DC-B-032 | 50 | 80 | 100 | 30 | 60 | 33 | 50 | 40 |
| 2Phase-045 | 50 | 80 | 100 | 30 | 60 | 33 | 50 | 40 |
| DC-B-033 | 50 | 80 | 100 | 30 | 60 | 33 | 50 | 40 |



The LS-110 linear stage series is especially suited for industrial laser treatment. Linear guides with re-circulating linear ball bearings guarantee very high guiding stiffness. Driven by a re-circulating ball screw with 2 mm pitch, the LS-110 can be mounted in any orientation. For demanding positioning tasks, the LS-110 linear stages can be supplied with a linear scale which is centrally installed between the guides. The LS-110 can be equipped with a DC or a 2-phase stepper motor and is equipped with two mechanical limit switches.

## KEY FEATURES

- Travel range up to 305 mm (12")
- Uni-directional repeatability down to 0.05 µm
- Maximum speed 90 mm/sec
- Load capacity up to 10 kg
- Integrated mechanical limit switches
- Option: linear scale (center mounted)

## TECHNICAL DATA

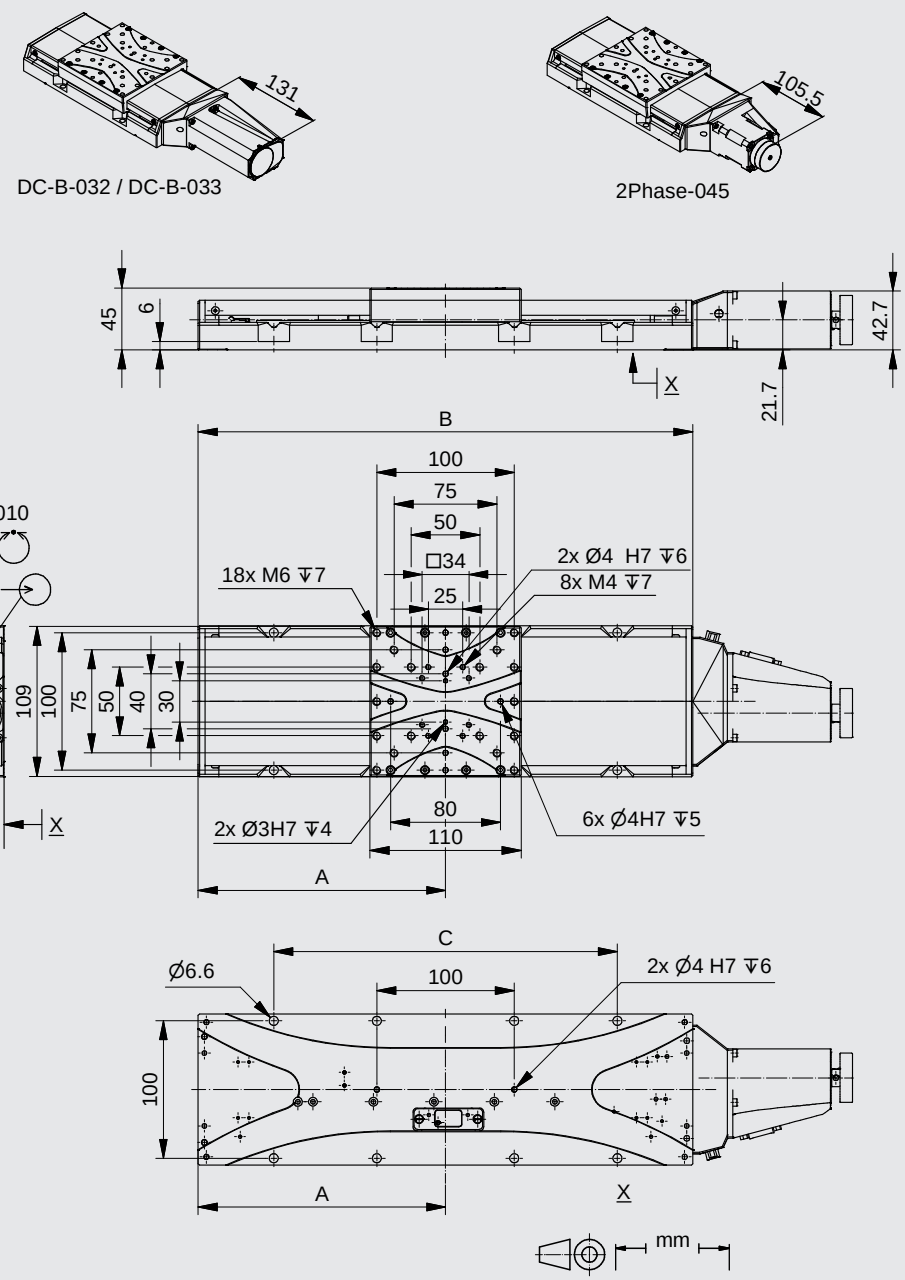
| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Travel range (mm) | 26 | 52 | 77 | 102 | 155 | 190 | 255 | 305 |
| Straightness / Flatness (µm) | ± 1 | ± 1.5 | ± 2 | ± 2.5 | ± 3 | ± 3.5 | ± 4 | ± 5 |
| Pitch (µrad) | ± 30 | ± 40 | ± 50 | ± 60 | ± 70 | ± 80 | ± 90 | ± 100 |
| Yaw (µm) | ± 40 | ± 40 | ± 40 | ± 40 | ± 40 | ± 40 | ± 40 | ± 40 |
| Weight (kg) | 2.6 | 2.7 | 2.8 | 2.9 | 3.1 | 3.1 | 3.5 | 3.7 |

| | | | | |
|---|---|---|---|---|
| Motor (Pitch 2 mm) | DC-B-032 | 2Phase-045 | DC-B-033 | |
| Linear scale | | | | LS-010 |
| Speed max. (mm/sec) | 90 | 45 | 90 | |
| Resolution calculated (µm) | 1 (RE) | 10 (FS) | 0.1 (RE) | 0.05 |
| Resolution typical (µm) | 1 | 0.2 | 0.2 | 0.05 |
| Bi-directional Repeatability (µm) | ± 1 | ± 1 | ± 1 | ± 0.1 |
| Uni-directional Repeatability (µm) | 1 | 0.2 | 0.2 | 0.05 |
| Nominal Current (A) | 2.3 | 1.2 | 2.3 | |
| Voltage Range (V) | 24 | | 24 | |

| | |
|---|---|
| Accuracy | on request |
| Velocity range (mm/sec) | 0.001 ... 90 |
| Material | Aluminum, black anodized |

Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.

| Travel (mm) | 26 | 52 | 77 | 102 | 155 | 190 | 255 | 305 |
|---|---|---|---|---|---|---|---|---|
| A | 112.5 | 125 | 137.5 | 150 | 180 | 180 | 215 | 240 |
| B | 225 | 250 | 275 | 300 | 360 | 360 | 430 | 480 |
| C | - | - | - | - | 250 | 250 | 300 | 350 |

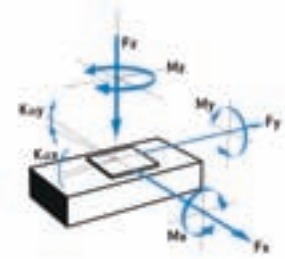



| Order No. | 6236-9- | | | | |
|---|---|---|---|---|---|
| DC-B-032 | 1 | | | | |
| 2Phase-045 | 3 | | | | |
| DC-B-033 | 4 | | | | |
| | | | | | |
| 26 mm (1") | | 1 | | | |
| 52 mm (2") | | 2 | | | |
| 77 mm (3") | | 3 | | | |
| 102 mm (4") | | 4 | | | |
| 155 mm (6") | | 5 | | | |
| 190 mm | | 6 | | | |
| 255 mm (10") | | 7 | | | |
| 305 mm (12") | | 8 | | | |
| | | | | | |
| without LS-010 | | | 0 | | |
| LS-010, Linear steel scale (max 155 mm) | | | 1 | | |
| | | | | | |
| MLS-020, Mechanical limit switches | | | | | 0 |

# 4.098 Linear Motor Stage LMS-80

## FACTS

| Load characteristics | $Fx_{(N)}$ | $Fy_{(N)}$ | $Fy\ Peak_{(N)}$ | $Fz_{(N)}$ | $Mx_{(Nm)}$ | $My_{(Nm)}$ | $Mz_{(Nm)}$ |
|---|---|---|---|---|---|---|---|
| LM-052 | 40 | 7 | 34 | 50 | 30 | 15 | 20 |



The LMS-80 linear stage was designed for industrial applications with high speed requirements in a limited space. All LMS-80 linear stages are driven by linear motors and are equipped with a linear scale. The very small height of 16 mm allows extremely compact setups. The LMS-80 linear stage is equipped with limit switches for protection against damage. Other travel ranges on request.

## KEY FEATURES

- Linear motor
- Travel range 120 mm
- Maximum speed 500 mm/sec
- Load capacity up to 5 kg
- Integrated hall limit switches
- Integrated linear scale

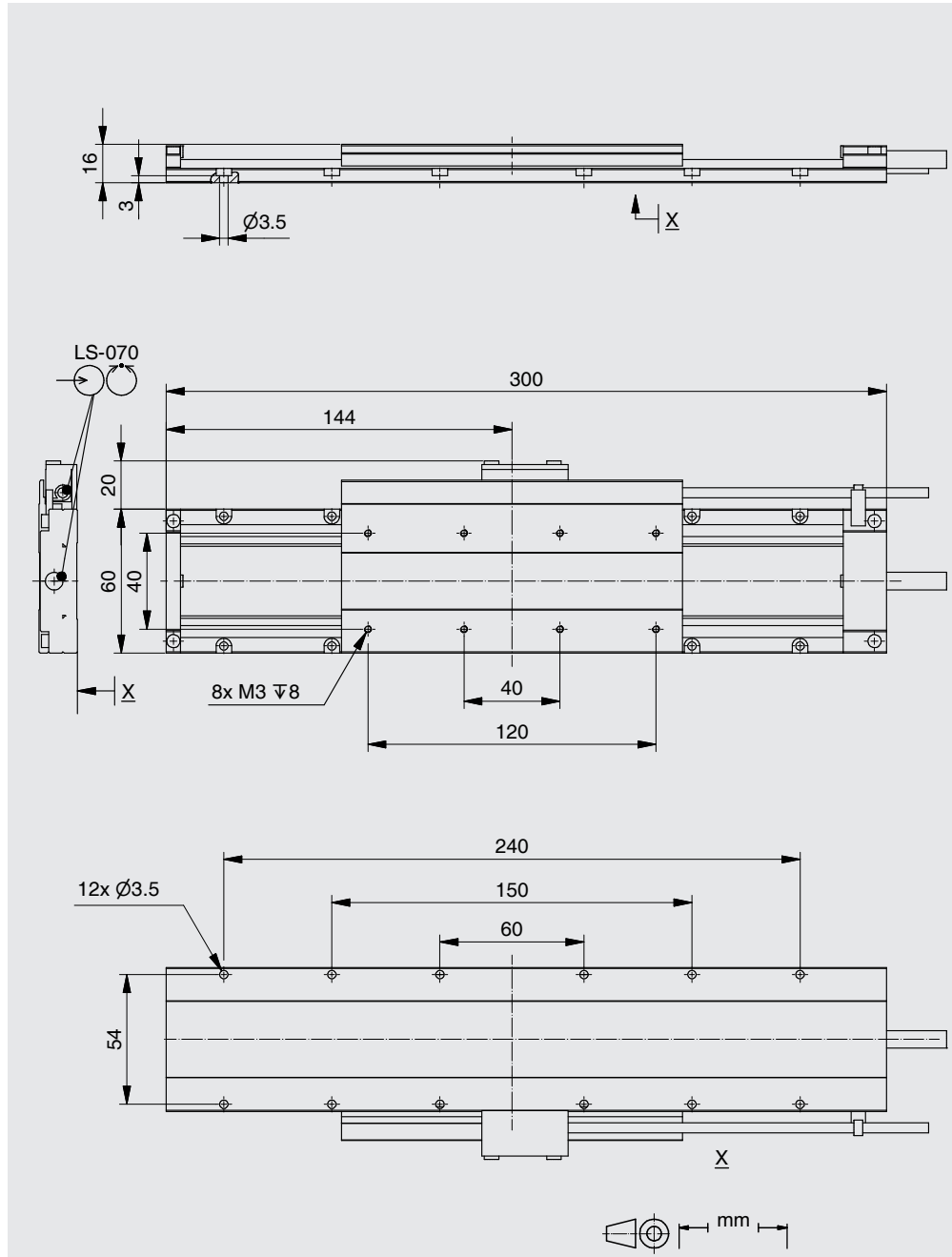
## TECHNICAL DATA

| | |
|---|---|
| Travel range (mm) | 120 |
| Straightness / Flatness (µm) | ± 4 |
| Pitch (µrad) | ± 150 |
| Yaw (µm) | ± 150 |
| Weight (kg) | 2.5 |

| | | |
|---|---|---|
| Motor | LM-052 | |
| Linear scale | | LS-070 |
| Speed max. (mm/sec) | 500 | |
| Resolution calculated (µm) | | 0.015 |
| Resolution typical (µm) | | 0.1 |
| Bi-directional Repeatability (µm) | | ± 0.1 |
| Uni-directional Repeatability (µm) | | 0.1 |
| Nominal Current (A) | 0.7 | |

| | |
|---|---|
| Accuracy | on request |
| Velocity range (mm/sec) | 0.001 ... 500 |
| Material | Steel |

Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.

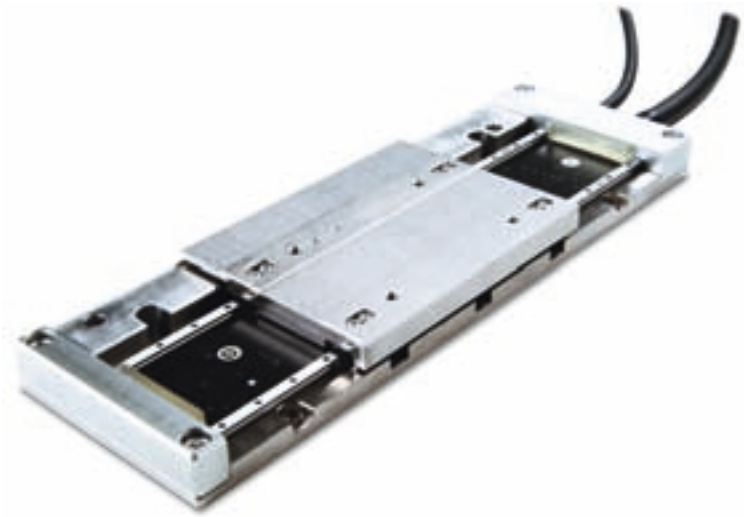


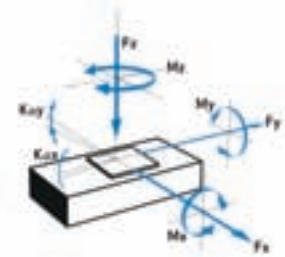

| Order No. | 6842-9- | | | | |
|---|---|---|---|---|---|
| LM-052 | 1 | | | | |
| 120 mm | 1 | | | | |
| LS-070, Linear steel scale | 1 | | | | |
| HLS-020, Hall limit switches | 1 | | | | |

# 4.100 Linear Motor Stage LMS-60

## FACTS

| Load characteristics | $Fx_{(N)}$ | $Fy_{(N)}$ | $Fy\ Peak_{(N)}$ | $Fz_{(N)}$ | $Mx_{(Nm)}$ | $My_{(Nm)}$ | $Mz_{(Nm)}$ |
|---|---|---|---|---|---|---|---|
| LM-051 | 25 | 7 | 31 | 30 | 4 | 4 | 10 |
| LM-054 | 25 | 7 | 31 | 30 | 4 | 4 | 10 |





The linear stage LMS-60 was designed for industrial applications with high speed requirements within and limited space conditions. Linear stages LMS-60 are driven by linear motors and are equipped with a linear scale. The very small height of 14 mm allows very compact setups. All Linear Stages of the LMS-60 series are equipped with limit switches for protection against damage.

## KEY FEATURES

- Linear motor
- Travel range 65 mm (LM-054)
- Maximum speed 500 mm/sec
- Load capacity up to 3 kg
- Integrated hall limit switches
- Integrated linear scale

## TECHNICAL DATA

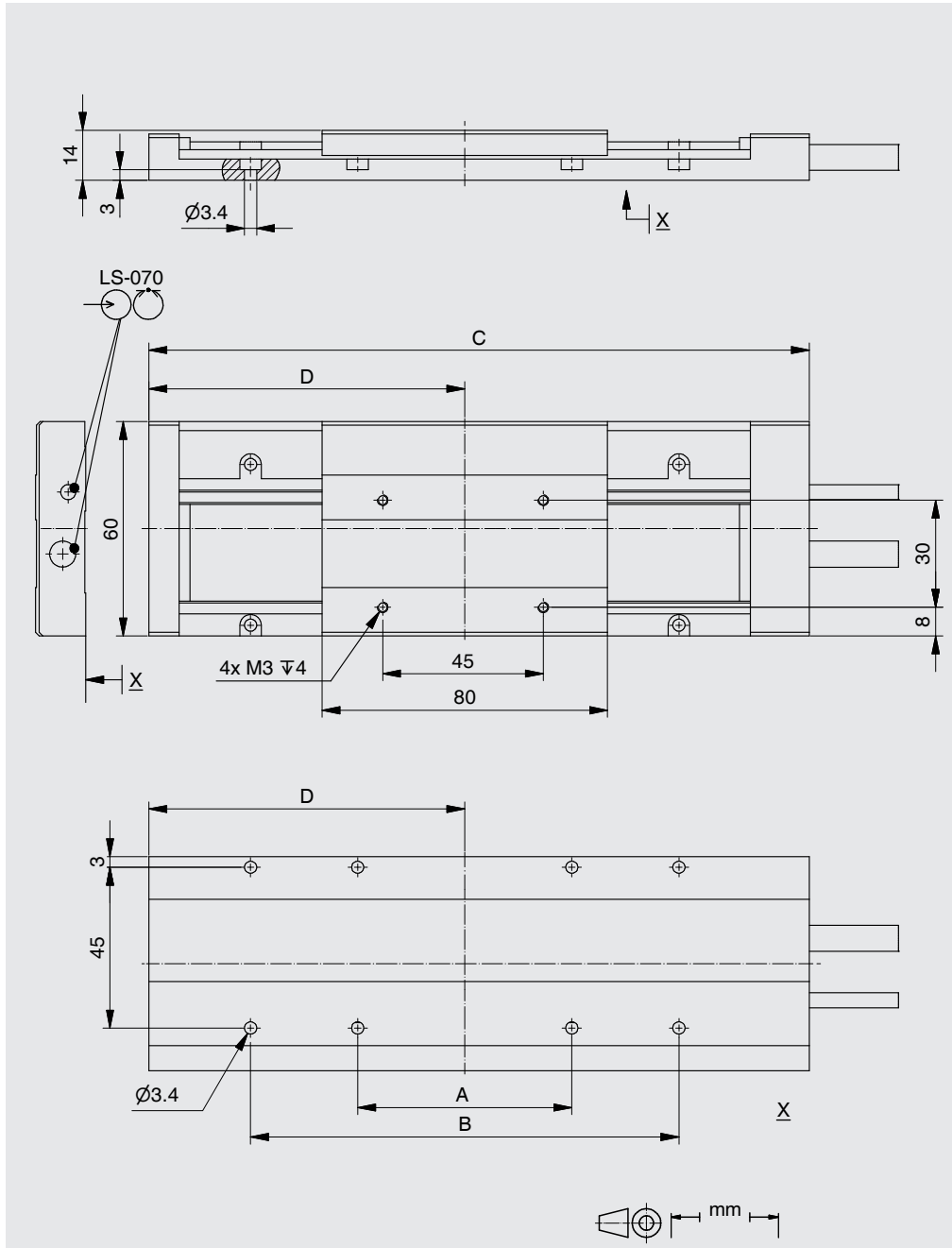
| | | |
|---|---|---|
| Travel range (mm) | 25 | 65 |
| Straightness / Flatness (µm) | ± 1 | ± 2 |
| Pitch (µrad) | ± 80 | ± 100 |
| Yaw (µm) | ± 80 | ± 100 |
| Weight (kg) | 1 | 1.8 |

| Motor | LM-051 | LM-054 | |
|---|---|---|---|
| Linear scale | | | LS-070 |
| Speed max. (mm/sec) | 500 | 500 | |
| Resolution calculated (µm) | | | 0.015 |
| Resolution typical (µm) | | | 0.1 |
| Bi-directional Repeatability (µm) | | | ± 0.1 |
| Uni-directional Repeatability (µm) | | | 0.1 |
| Nominal Current (A) | 0.32 | 0.64 | |

| | |
|---|---|
| Accuracy | on request |
| Velocity range (mm/sec) | 0.001 ... 500 |
| Material | Steel |

Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.

| Travel (mm) | 25 | 65 |
|---|---|---|
| A | 75 | 60 |
| B | - | 120 |
| C | 145 | 185 |
| D | 68.5 | 88.5 |

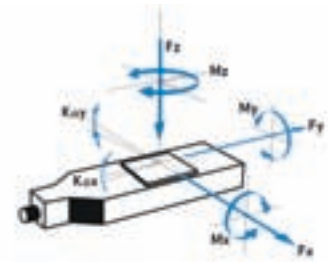



| Order No. | 6841-9- | 0 | | | |
|---|---|---|---|---|---|
| 25 mm (LM-051) | 1 | | | | |
| 65 mm (LM-054) | 2 | | | | |
| LS-070, Linear steel scale | 1 | | | | |
| HLS-020, Hall limit switches | 1 | | | | |

# 4.102 Precision Linear Stage PLS-85

## FACTS

| Load characteristics | $F_{x(N)}$ | $F_{y(N)}$ | $F_{z(N)}$ | $M_{x(Nm)}$ | $M_{y(Nm)}$ | $M_{z(Nm)}$ | $k_{\pm x(\mu rad/Nm)}$ | $k_{\pm y(\mu rad/Nm)}$ |
|---|---|---|---|---|---|---|---|---|
| DC-B-032 | 60 | 50 | 100 | 25 | 30 | 20 | 70 | 40 |
| 2Phase-045 | 60 | 50 | 100 | 25 | 30 | 20 | 70 | 40 |
| DC-B-033 | 60 | 50 | 100 | 25 | 30 | 20 | 70 | 40 |



The PLS-85 linear stages are especially suited for high precision applications with limited space conditions while allowing loads of up to 10 kg. Cross-roller bearings guarantee very high guiding stiffness. Driven by a re-circulating ball screw with 1 or 2 mm pitch options, the PLS-85 can be mounted in any orientation. For demanding positioning tasks, the PLS-85 linear stages can be supplied with a side-mounted linear scale. The PLS-85 can be equipped with a DC or a 2-phase stepper motor and has two mechanical or hall sensors limit switches.

## KEY FEATURES

- Travel range up to 155 mm (6")
- Uni-directional repeatability down to 0.05 µm
- Maximum speed 100 mm/sec
- Load capacity up to 10 kg
- Integrated mechanical / hall limit switches
- Limit switch adjustable
- Option: linear scale

## TECHNICAL DATA

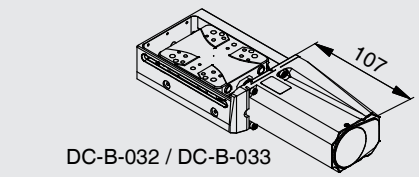
| | | | | |
|---|---|---|---|---|
| Travel range (mm) | 26 | 52 | 102 | 155 |
| Straightness / Flatness (µm) | ± 1 | ± 2 | ± 4 | ± 6 |
| Pitch (µrad) | ± 60 | ± 90 | ± 120 | ± 150 |
| Yaw (µm) | ± 60 | ± 80 | ± 100 | ± 130 |
| Weight (kg) | 0.9 | 1.2 | 1.5 | 1.8 |

| Motor (Pitch 1 \| 2 mm) | DC-B-032 | | 2Phase-045 | | DC-B-033 | | |
|---|---|---|---|---|---|---|---|
| Linear scale | | | | | | | LS-012 |
| Speed max. (mm/sec) | 50 | 90 | 20 | 45 | 50 | 90 | |
| Resolution calculated (µm) | 0.5 | 1 (RE) | 5 | 10 (FS) | 0.05 | 0.1 (RE) | 0.05 |
| Resolution typical (µm) | 0.5 | 1 | 0.05 | 0.1 | 0.1 | 0.2 | 0.05 |
| Bi-directional Repeatability (µm) | ± 1 | | ± 1 | | ± 1 | | ± 0.1 |
| Uni-directional Repeatability (µm) | 0.5 | 1 | 0.1 | 0.2 | 0.1 | 0.2 | 0.05 |
| Nominal Current (A) | 2.3 | | 1.2 | | 2.3 | | |
| Voltage Range (V) | 24 | | | | 24 | | |

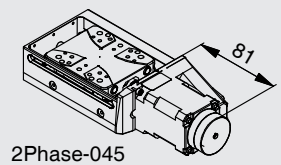
| | |
|---|---|
| Accuracy | on request |
| Velocity range (mm/sec) | 0.001 ... 100 |
| Material | Aluminum, black anodized |

Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.

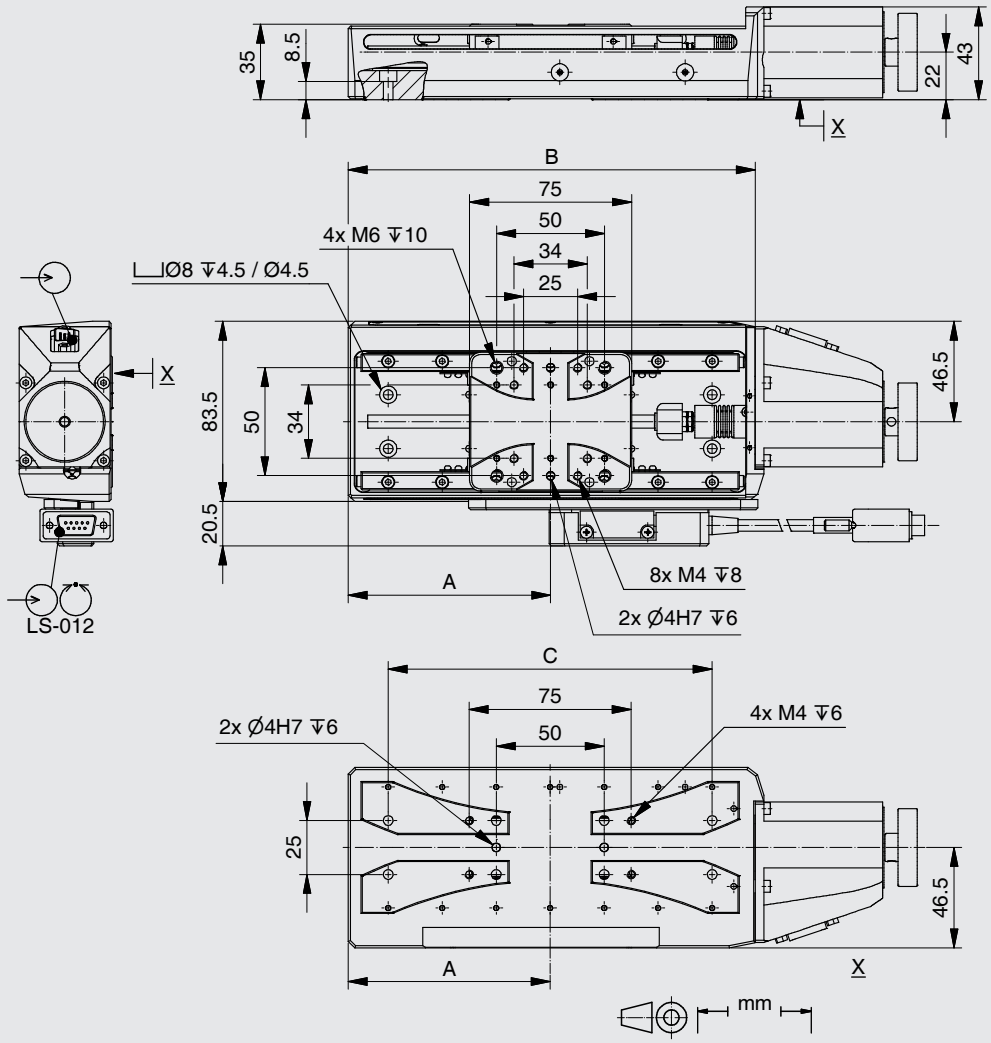
| Travel (mm) | 26 | 52 | 102 | 155 |
|---|---|---|---|---|
| A | 59 | 68.5 | 93.5 | 128 |
| B | 119.5 | 138.5 | 188.5 | 257.5 |
| C | - | 100 | 150 | 200 |



DC-B-032 / DC-B-033



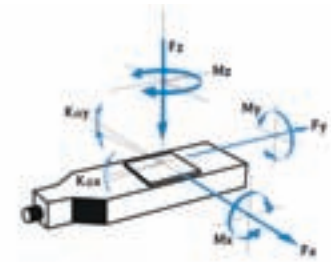
2Phase-045




| Order No. | 6234-9- | | | | |
|---|---|---|---|---|---|
| DC-B-032 | 1 | | | | |
| 2Phase-045 | 3 | | | | |
| DC-B-033 | 4 | | | | |
| 26 mm (1") | | 0 | | | |
| 52 mm (2") | | 1 | | | |
| 102 mm (4") | | 2 | | | |
| 155 mm (6") | | 3 | | | |
| without LS-012 | | | 0 | | |
| LS-012, Linear steel scale | | | 1 | | |
| Pitch 1 mm / mechanical limit switches | | | | 0 | |
| Pitch 2 mm / mechanical limit switches | | | | 1 | |
| Pitch 1 mm / hall limit switches | | | | 2 | |
| Pitch 2 mm / hall limit switches | | | | 3 | |

## FACTS

| Load characteristics | $F_{x(N)}$ | $F_{y(N)}$ | $F_{z(N)}$ | $M_{x(Nm)}$ | $M_{y(Nm)}$ | $M_{z(Nm)}$ | $k_{\theta x(\mu rad/Nm)}$ | $k_{\theta y(\mu rad/Nm)}$ |
|---|---|---|---|---|---|---|---|---|
| DC-B-026 | 50 | 15 | 60 | 7.5 | 7.5 | 7.5 | 140 | 80 |
| 2Phase-045 | 50 | 25 | 60 | 7.5 | 7.5 | 7.5 | 140 | 80 |
| 2Phase-042 | 50 | 25 | 60 | 7.5 | 7.5 | 7.5 | 140 | 80 |



The LS-65 linear stage features a compact, low profile construction for high strength in a lightweight package. Typical applications for this measuring stage are inspection stations and micro-manipulators for laser diodes and other highly sensitive components. A precision ground lead-screw with 1 mm pitch (optionally 0.4 mm pitch or ballscrew) guarantees smooth and quiet motion. The LS-65 linear stages are equipped with a re-circulating ball guiding system and are motorized with a DC or 2-phase stepper motor Additionally the LS-65 can be ordered with our SMC pollux motor-controller module ( 2Phase-042 ).

## KEY FEATURES

- Travel range up to 102 mm (4")
- Uni-directional repeatability down to 0.3 µm
- Maximum speed 10 mm/sec
- Load capacity up to 6 kg
- Integrated mechanical / optical limit switches
- Optionally higher resolution / 0.4 mm pitch
- Optionally higher repeatability with ballscrew

## TECHNICAL DATA

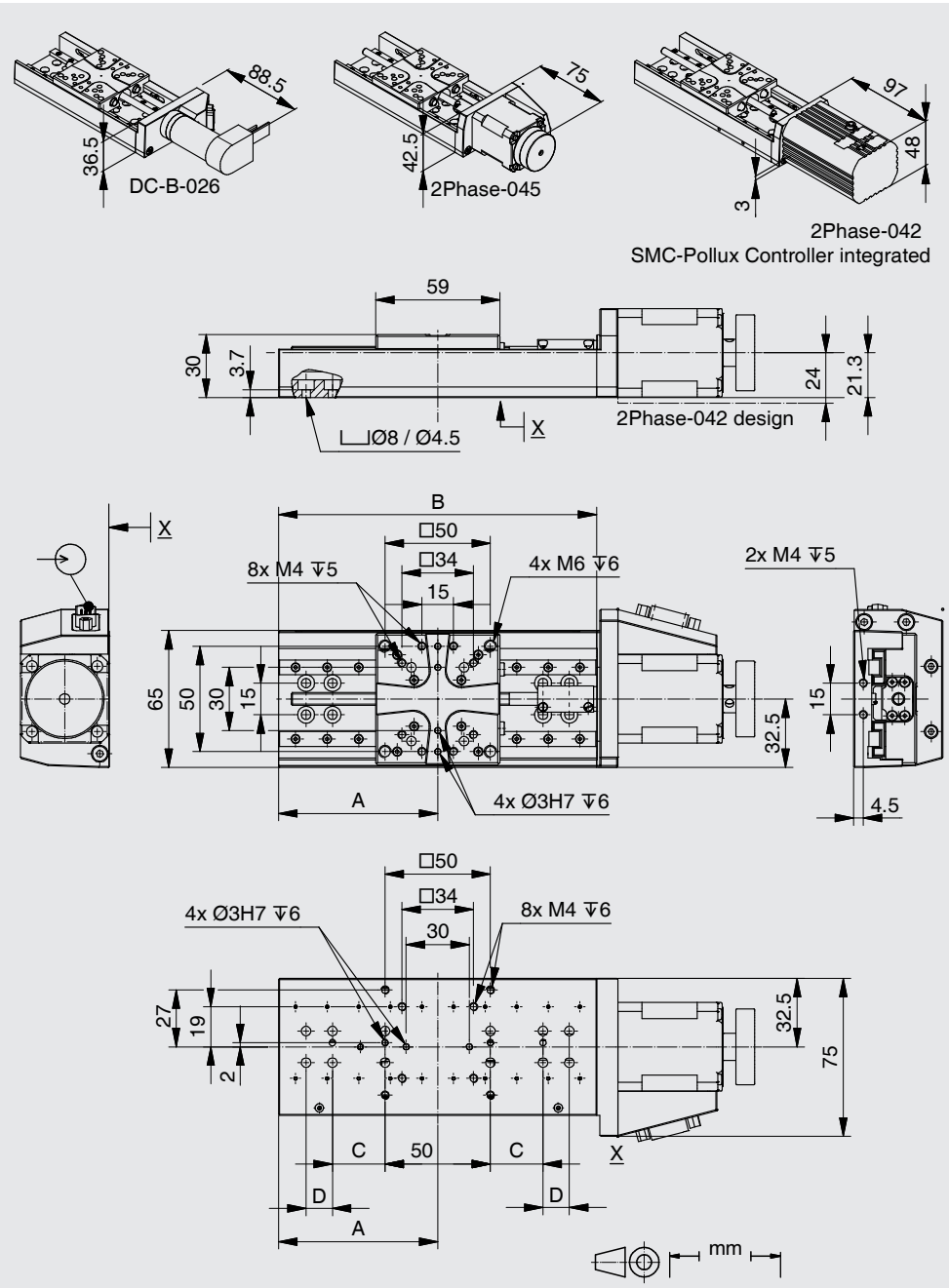
| | | | | |
|---|---|---|---|---|
| Travel range (mm) | 26 | 52 | 77 | 102 |
| Straightness / Flatness (µm) | ± 2 | ± 4 | ± 6 | ± 8 |
| Pitch (µrad) | ± 70 | ± 90 | ± 110 | ± 130 |
| Yaw (µm) | ± 70 | ± 80 | ± 90 | ± 100 |
| Weight (kg) | 0.6 | 0.7 | 0.8 | 0.9 |

| Motor (Pitch 1 mm) | DC-B-026 | 2Phase-045 | 2Phase-042 |
|---|---|---|---|
| Speed max. (mm/sec) | 20 | 20 | 13 |
| Resolution calculated (µm) | 0.5 (RE) | 5 (FS) | 5 (FS) |
| Resolution typical (µm) | 0.5 | 0.2 | 0.2 |
| Bi-directional Repeatability (µm) | ± 5 | ± 5 | ± 5 |
| Uni-directional Repeatability (µm) | 0.5 | 0.3 | 0.3 |
| Nominal Current (A) | 0.98 | 1.2 | 0.5 |
| Voltage Range (V) | 24 | | |

| | |
|---|---|
| Accuracy | on request |
| Velocity range (mm/sec) | 0.001 ... 10 |
| Material | Aluminum, black anodized |

Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.

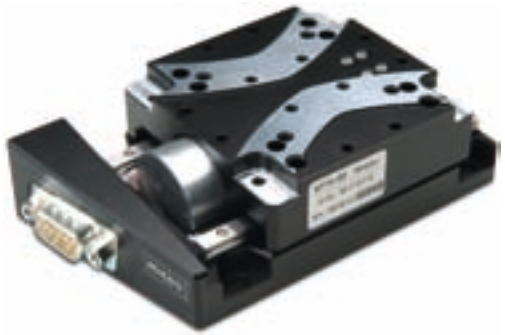
| Travel (mm) | 26 | 52 | 77 | 102 |
|---|---|---|---|---|
| A | 46.5 | 60.5 | 75.5 | 85.5 |
| B | 93 | 121 | 151 | 171 |
| C | 9 | 25 | 25 | 37.5 |
| D | - | - | 12.5 | 12.5 |




| Order No. | 6233-9- | | | 0 | |
|---|---|---|---|---|---|
| DC-B-026 | 1 | | | | |
| 2Phase-045 | 2 | | | | |
| 2Phase-042, only with OLS-010 | 3 | | | | |
| 26 mm (1") | | 1 | | | |
| 52 mm (2") | | 2 | | | |
| 77 mm (3") | | 3 | | | |
| 102 mm (4") | | 4 | | | |
| MLS-010, Mechanical limit switches | | | 2 | | |
| OLS-010, Optical limit switches | | | 3 | | |

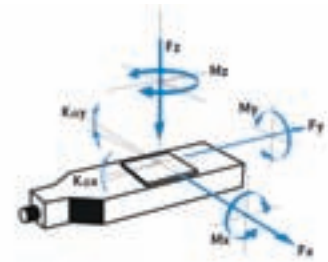
## FACTS

| Load characteristics | $F_{x(N)}$ | $F_{y(N)}$ | $F_{z(N)}$ | $M_{x(Nm)}$ | $M_{y(Nm)}$ | $M_{z(Nm)}$ | $k_{\pm x(\mu rad/Nm)}$ | $k_{\pm y(\mu rad/Nm)}$ |
|---|---|---|---|---|---|---|---|---|
| 2Phase-020 | 10 | 3 | 10 | 0.4 | 0.6 | 0.4 | 80 | 30 |



## KEY FEATURES

- Travel range up to 52 mm (2")
- Uni-directional repeatability down to 0.1 µm
- Maximum speed 10 mm/sec
- Load capacity up to 1 kg
- Integrated hall / optical limit switches
- Option: linear scale



The MTS-65 micro stage was developed for industrial application with limited space conditions and is typically used for the positioning of laser diodes and optical components. Driven by a 2-phase stepper motor using high resolution micro-stepping, the gearless stage utilizes re-circulating ball bearings and a ground re-circulating ball screw. As a result, a high stiffness, accuracy and smoothness of motion is achieved. The micro stage is equipped with two optical or hall limit switches. For higher positioning accuracy and repeatability of 0.1 µm, the MTS-65 micro stage is offered with a linear scale. Using a special mounting kit, the MTS-65 stages can be assembled as XY or XYZ-modules.

## TECHNICAL DATA

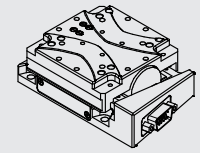
| | | | |
|---|---|---|---|
| Travel range (mm) | 13 | 26 | 52 |
| Straightness / Flatness (µm) | ± 1 | ± 2 | ± 3 |
| Pitch (µrad) | ± 40 | ± 60 | ± 80 |
| Yaw (µm) | ± 40 | ± 40 | ± 40 |
| Weight (kg) | 0.4 | 0.6 | 0.8 |

| | | |
|---|---|---|
| Motor (Pitch 1 mm) | 2Phase-020 | |
| Linear scale | | LS-050 |
| Speed max. (mm/sec) | 8 | |
| Resolution calculated (µm) | 5 (FS) | 0.05 |
| Resolution typical (µm) | 0.1 | 0.05 |
| Bi-directional Repeatability (µm) | ± 5 | ± 0.2 |
| Uni-directional Repeatability (µm) | 0.2 | 0.1 |
| Nominal Current (A) | 1.2 | |

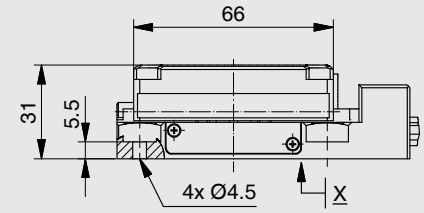
| | |
|---|---|
| Accuracy | on request |
| Velocity range (mm/sec) | 0.001 ... 10 |
| Material | Aluminum, black anodized |

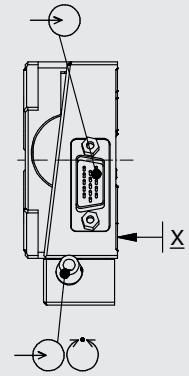
Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.

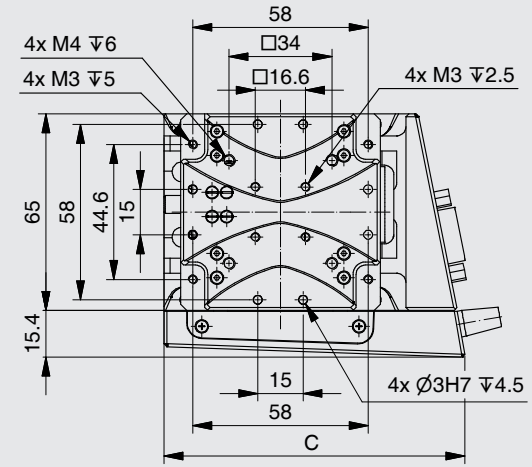
| Travel (mm) | 13 | 26 | 52 |
|---|---|---|---|
| A | 38.5 | 45 | 62 |
| B | 62 | 75 | 105 |
| C | 99.5 | 112.5 | 147.5 |

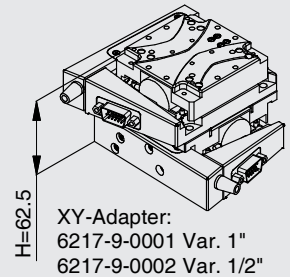


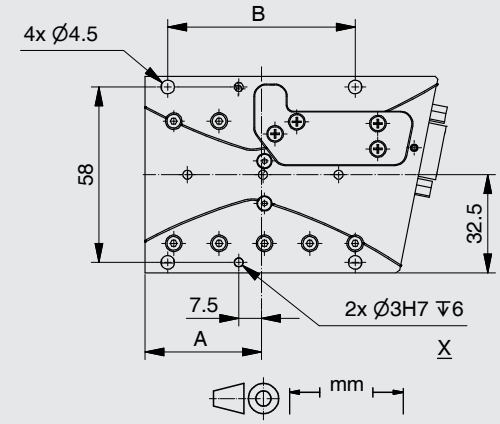
2Phase-020



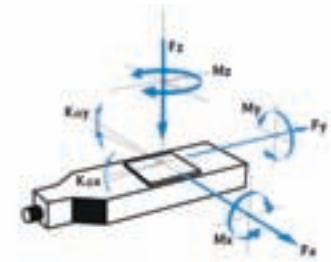




| Order No. | 6217-9- | | | | |
|---|---|---|---|---|---|
| 2Phase-020 | 2 | | | | |
| 13 mm (1/2") | | 1 | | | |
| 26 mm (1") | | 2 | | | |
| 52 mm (2") | | 3 | | | |
| without LS-050 | | | 0 | | |
| LS-050, Linear steel scale | | | 1 | | |
| HLS-010, Hall limit switches | | | | 1 | |
| OLS-010, Optical limit switches | | | | 3 | |

## FACTS

| Load characteristics | $F_{x(N)}$ | $F_{y(N)}$ | $F_{z(N)}$ | $M_{x(Nm)}$ | $M_{y(Nm)}$ | $M_{z(Nm)}$ | $k_{\vartheta x(\mu rad/Nm)}$ | $k_{\vartheta y(\mu rad/Nm)}$ |
|---|---|---|---|---|---|---|---|---|
| 2Phase-020 | 10 | 3 | 10 | 0.4 | 0.6 | 0.4 | 80 | 30 |



The MTS-70 micro stage was developed for precision industrial applications with limited space conditions. The stage is driven by a 2-phase gearless stepper motor. The MTS-70 micro stages series is provided with cross-roller bearings and a ground re-circulating ball screw guaranteeing maximum stiffness,
accuracy and smoothness of motion. The MTS-70 stages are equipped with two limit switches. For high positioning accuracy and repeatability, the MTS-70 micro stages are offered with a linear scale. The stages are offered as a single axis or as an integrated XY system.

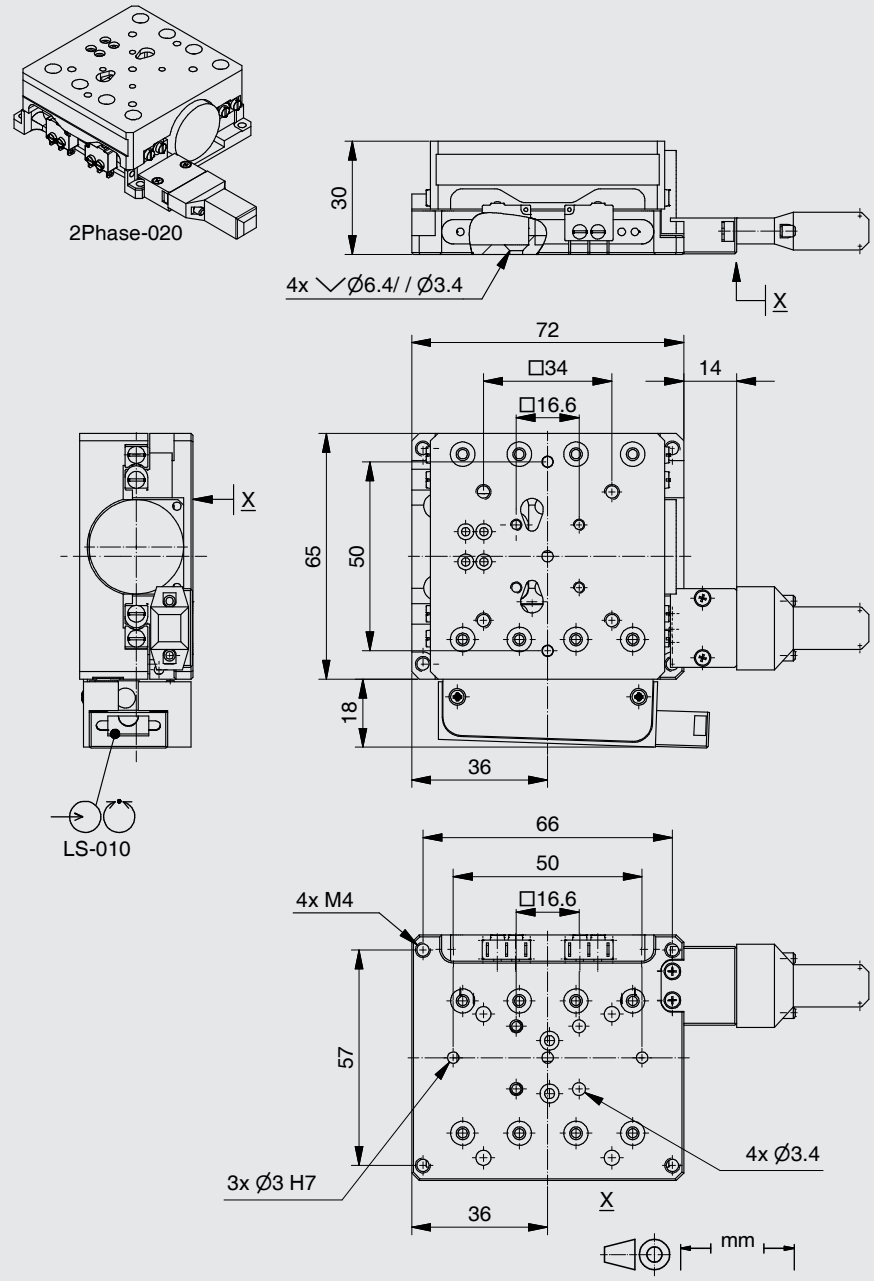
## KEY FEATURES

- Travel range 10 mm
- Uni-directional repeatability down to 0.1 µm
- Maximum speed 8 mm/sec
- Load capacity up to 1 kg
- Integrated mechanical limit switches
- Option: linear scale

## TECHNICAL DATA

| | | |
|---|---|---|
| Travel range (mm) | 10 | |
| Straightness / Flatness (µm) | ± 1 | |
| Pitch (µrad) | ± 50 | |
| Yaw (µm) | ± 50 | |
| Weight (kg) | 0.4 | |
| Motor (Pitch 1 mm) | 2Phase-020 | |
| Linear scale | | LS-010 |
| Speed max. (mm/sec) | 8 | |
| Resolution calculated (µm) | 5 (FS) | 0.05 |
| Resolution typical (µm) | 0.1 | 0.05 |
| Bi-directional Repeatability (µm) | ± 5 | ± 0.2 |
| Uni-directional Repeatability (µm) | 0.2 | 0.1 |
| Nominal Current (A) | 1.2 | |
| Accuracy | on request | |
| Velocity range (mm/sec) | 0.001 ... 8 | |
| Material | Aluminum, black anodized | |

Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.



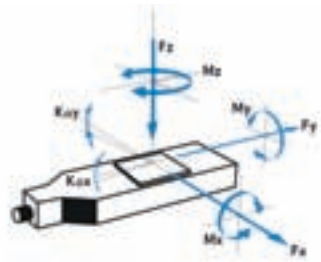

| Order No. | 6218-9- | | | | |
|---|---|---|---|---|---|
| 2Phase-020 | 2 | | | | |
| x axis | 1 | | | | |
| xy axes (setup by PI miCos) | 2 | | | | |
| 10 mm | | 0 | | | |
| without LS-010 | | | | | 0 |
| LS-010, Linear steel scale | | | | | 3 |

# 4.110 Linear Stage VT-75

NEW

## FACTS

| Load characteristics | $Fx_{(N)}$ | $Fy_{(N)}$ | $Fz_{(N)}$ | $Mx_{(Nm)}$ | $My_{(Nm)}$ | $Mz_{(Nm)}$ |
|---|---|---|---|---|---|---|
| DC-B-026 | 25 | 18 | 50 | 3 | 3 | 5 |
| 2Phase-045 | 25 | 88 | 50 | 3 | 3 | 5 |
| 2Phase-042 | 25 | 50 | 50 | 3 | 3 | 5 |



The VT-75 linear stage was designed for standard industrial applications that require less than 6 µm repeatability and up to 600 mm travel range. Typical applications for this metrology stage are inspection and assembly systems. The low profile yet rigid steel design allows setups with long travel ranges within limited space conditions. A precision ball screw with a 4 mm pitch guarantees a quiet, smooth motion. The VT-75 linear stages are equipped with a roller guide system and are motorized with a DC or 2-phase stepper motor. Additionally the VT-75 can be ordered with our SMC pollux motor-controller module.

## KEY FEATURES

- Travel range up to 600 mm
- Uni-directional repeatability down to 0.4 µm
- Maximum speed 100 mm/sec
- Load capacity up to 5 kg
- Integrated hall limit switches

## TECHNICAL DATA

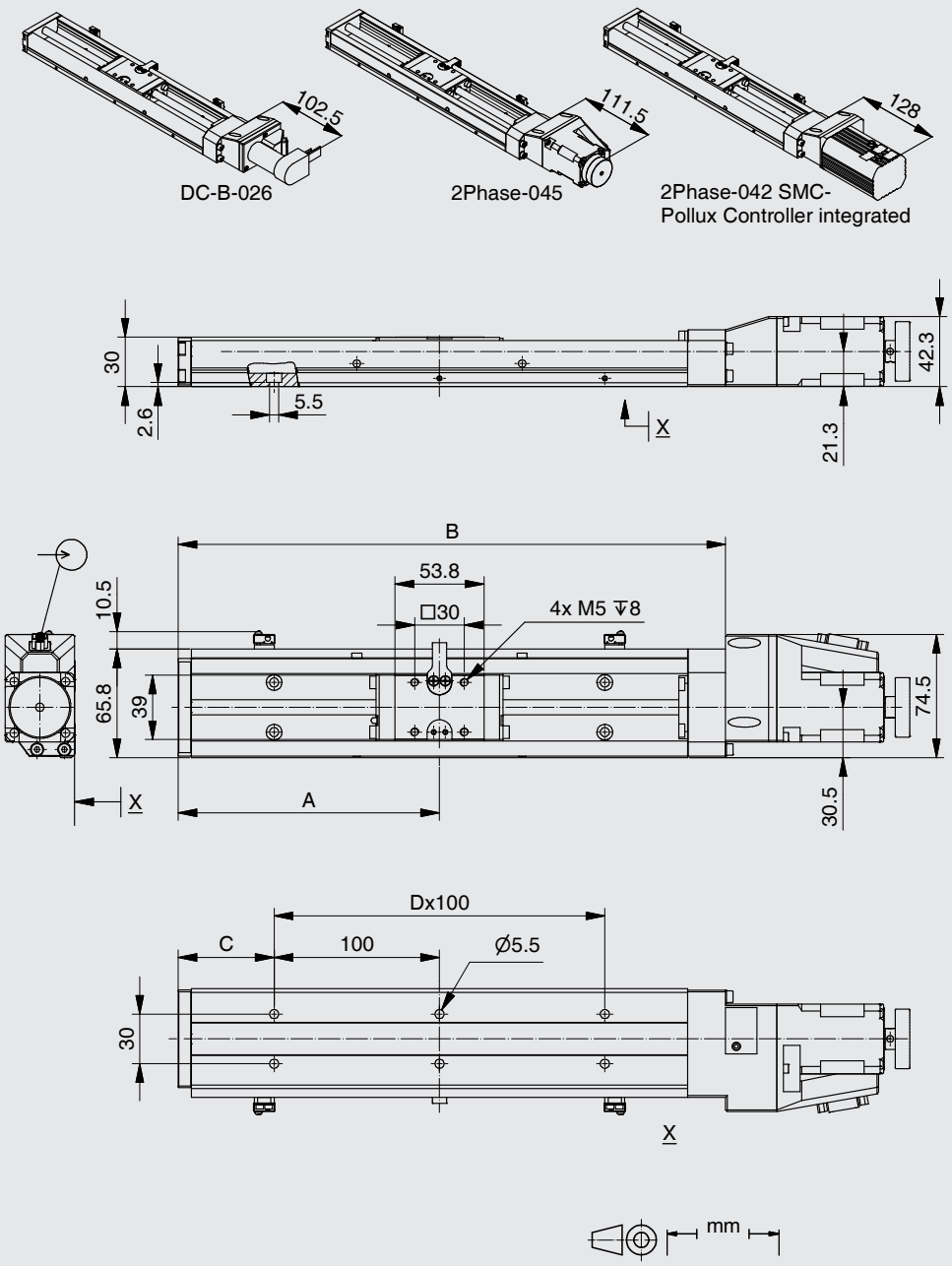
| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Travel range (mm) | 50 | 100 | 200 | 300 | 400 | 500 | 600 |
| Straightness / Flatness (µm) | ± 2 | ± 3 | ± 4 | ± 5 | ± 7 | ± 9 | ± 11 |
| Pitch (µrad) | ± 50 | ± 60 | ± 70 | ± 80 | ± 90 | ± 100 | ± 110 |
| Yaw (µm) | ± 40 | ± 40 | ± 40 | ± 60 | ± 80 | ± 90 | ± 90 |
| Weight (kg) | 1.6 | 2.1 | 2.7 | 3.4 | 4.1 | 4.7 | 5.4 |

| Motor (Pitch 4 mm) | DC-B-026 | 2Phase-045 | 2Phase-042 |
|---|---|---|---|
| Speed max. (mm/sec) | 150 | 80 | 52 |
| Resolution calculated (µm) | 2 (RE) | 20 (FS) | 20 (FS) |
| Resolution typical (µm) | 2 | 0.4 | 0.4 |
| Bi-directional Repeatability (µm) | ± 6 | ± 6 | ± 6 |
| Uni-directional Repeatability (µm) | 2 | 0.4 | 0.4 |
| Nominal Current (A) | 0.98 | 1.2 | 0.5 |
| Voltage Range (V) | 24 | | |

| | |
|---|---|
| Accuracy | on request |
| Velocity range (mm/sec) | 0.003 ... 100 |
| Material | Steel |

Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.

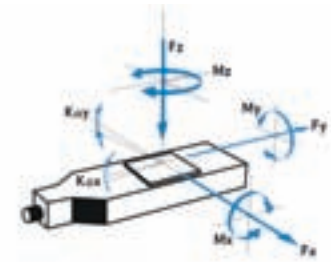
| Travel (mm) | 50 | 100 | 200 | 300 | 400 | 500 | 600 | 650 |
|---|---|---|---|---|---|---|---|---|
| A | 83 | 108 | 158 | 208 | 258 | 308 | 358 | 383 |
| B | 181 | 231 | 331 | 431 | 531 | 631 | 731 | 781 |
| C | 33 | 58 | 58 | 58 | 58 | 58 | 58 | 33 |
| D | 1 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |




| Order No. | 6229-9- | | | 0 | |
|---|---|---|---|---|---|
| DC-B-026 | 1 | | | | |
| 2Phase-045 | 2 | | | | |
| 2Phase-042 | 3 | | | | |
| 50 mm | | 1 | | | |
| 100 mm | | 2 | | | |
| 200 mm | | 3 | | | |
| 300 mm | | 4 | | | |
| 400 mm | | 5 | | | |
| 500 mm | | 6 | | | |
| 600 mm | | 7 | | | |
| HLS-010, Hall limit switches | | | 1 | | |

## FACTS

| Load characteristics | $F_{x(N)}$ | $F_{y(N)}$ | $F_{z(N)}$ | $M_{x(Nm)}$ | $M_{y(Nm)}$ | $M_{z(Nm)}$ | $k_{\vartheta x(\mu rad/Nm)}$ | $k_{\vartheta y(\mu rad/Nm)}$ |
|---|---|---|---|---|---|---|---|---|
| DC-B-026 | 40 | 30 | 50 | 2.5 | 5 | 2.5 | 220 | 150 |
| 2Phase-041 | 40 | 30 | 50 | 2.5 | 5 | 2.5 | 220 | 150 |
| 2Phase-042 | 40 | 30 | 50 | 2.5 | 5 | 2.5 | 220 | 150 |




The VT-80 translation stage is a popular laboratory stage that offers a wide range of travel lengths. A backlash-free re-circulating ball bearing along with a backlash compensated lead screw guarantee a quiet and smooth motion. The VT-80 translation stages are equipped with integrated limit switches and are motorized with a DC or 2-phase stepper motor. Additionally, the VT-80 can be ordered with our SMC Pollux motor-controller module. Due to the compact dimensions, the VT-80 stages are especially suitable for lower duty cycles applications in instrumentation. All VT-80 translation stages can be directly assembled in XY configurations. The XY systems with a travel of 25 mm must be assembled at the factory and must be specified when ordering.

## KEY FEATURES

- Travel range up to 300 mm
- Uni-directional repeatability down to 0.4 µm
- Maximum speed 20 mm/sec
- Load capacity up to 5 kg
- Integrated mechanical limit switches

## TECHNICAL DATA

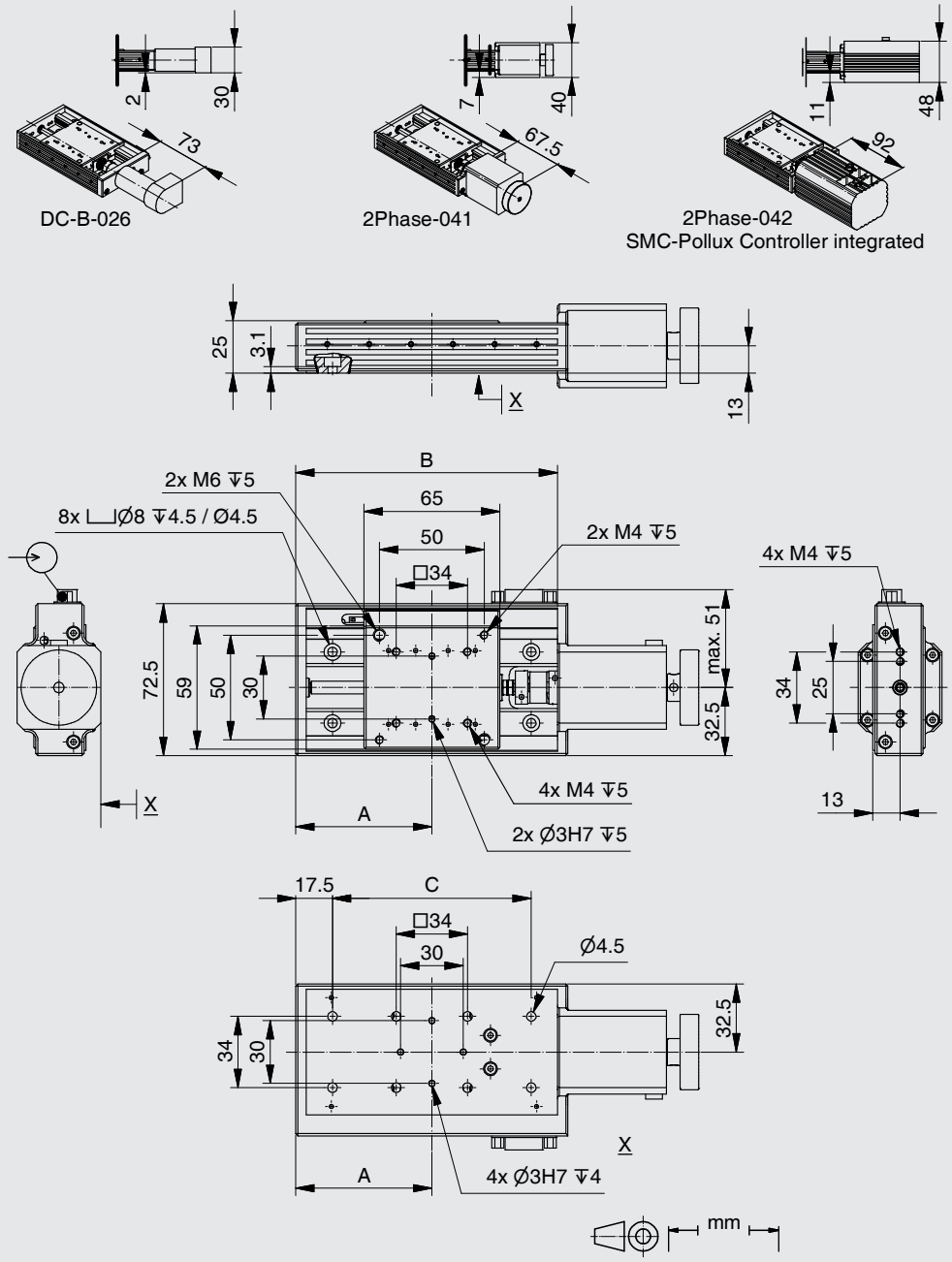
| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Travel range (mm) | 25 | 50 | 75 | 100 | 150 | 200 | 250 | 300 |
| Straightness / Flatness (µm) | ± 8 | ± 10 | ± 11 | ± 12 | ± 14 | ± 20 | ± 25 | ± 35 |
| Pitch (µrad) | ± 100 | ± 110 | ± 120 | ± 130 | ± 150 | ± 170 | ± 190 | ± 210 |
| Yaw (µm) | ± 150 | ± 150 | ± 150 | ± 150 | ± 150 | ± 150 | ± 150 | ± 150 |
| Weight (kg) | 0.55 | 0.65 | 0.7 | 0.75 | 0.85 | 0.95 | 1.1 | 1.25 |

| Motor (Pitch 1 mm) | DC-B-026 | 2Phase-041 | 2Phase-042 |
|---|---|---|---|
| Speed max. (mm/sec) | 20 | 20 | 13 |
| Resolution calculated (µm) | 0.5 (RE) | 5 (FS) | 5 (FS) |
| Resolution typical (µm) | 0.5 | 0.2 | 0.2 |
| Bi-directional Repeatability (µm) | ± 10 | ± 10 | ± 10 |
| Uni-directional Repeatability (µm) | 0.8 | 0.4 | 0.4 |
| Nominal Current (A) | 0.98 | 1.7 | 0.5 |
| Voltage Range (V) | 24 | | |

| | |
|---|---|
| Accuracy | on request |
| Velocity range (mm/sec) | 0.001 ... 20 |
| Material | Aluminum, black anodized |

Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.

| Travel (mm) | 25 | 50 | 75 | 100 | 150 | 200 | 250 | 300 |
|---|---|---|---|---|---|---|---|---|
| A | 52.5 | 65 | 77.5 | 90 | 115 | 140 | 165 | 190 |
| B | 100 | 125 | 150 | 175 | 225 | 275 | 325 | 375 |
| C | 70 | 95 | 120 | 145 | 195 | 245 | 295 | 345 |

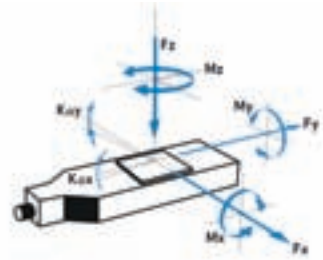



| Order No. | 6230-9- | | | |
|---|---|---|---|---|
| DC-B-026 | 1 | | | |
| 2Phase-041 | 2 | | | |
| 2Phase-042 | 4 | | | |
| | | | | |
| 25 mm (xy set up by PI miCos) | | 1 | | |
| 50 mm | | 2 | | |
| 75 mm | | 3 | | |
| 100 mm | | 4 | | |
| 150 mm | | 5 | | |
| 200 mm | | 6 | | |
| 250 mm | | 7 | | |
| 300 mm | | 8 | | |
| | | | | |
| single stage | | | 0 | |
| 25 mm xy setup | | | 1 | |

NEW V

## FACTS

| Load characteristics | $Fx_{(N)}$ | $Fy_{(N)}$ | $Fz_{(N)}$ | $Mx_{(Nm)}$ | $My_{(Nm)}$ | $Mz_{(Nm)}$ |
|---|---|---|---|---|---|---|
| DC-B-010 | 20 | 20 | 30 | 0.4 | 0.6 | 0.4 |
| 2Phase-019 | 20 | 10 | 30 | 0.4 | 0.6 | 0.4 |
| 2Phase-010 | 20 | 20 | 30 | 0.6 | 0.8 | 0.6 |



Micro stages LS-40 are suited for the precise positioning of small parts such as fibers, optical components, laser diodes and inspection equipment. The space saving modules can be assembled into XYZ-systems. The micro stage LS-40 is equipped with re-circulating ball guides and a finepitch screw with 0,5 mm pitch (optionally a ball screw with 1 mm pitch can be delivered). It is driven with a 2-phase gearless stepper motor or with a DC- or 2-phase stepper geared motor. The LS-40 series excels with very smooth, high resolution motion. For restricted space conditions, the LS-40 can also be ordered with a side-mounted motor.

Travel ranges of 13, 26 or 52 mm are available and two standard limit switches prevent damage from accidental over-travel. XY-assembly is possible at the factory and must be indicated when ordering.

## KEY FEATURES

- Travel range up to 52 mm
- Uni-directional repeatability down to 0.1 µm
- Maximum speed 5 mm/sec
- Load capacity up to 2 kg
- Integrated hall / mechanical / optical limit switches
- Optionally higher quality with ballscrew

## TECHNICAL DATA

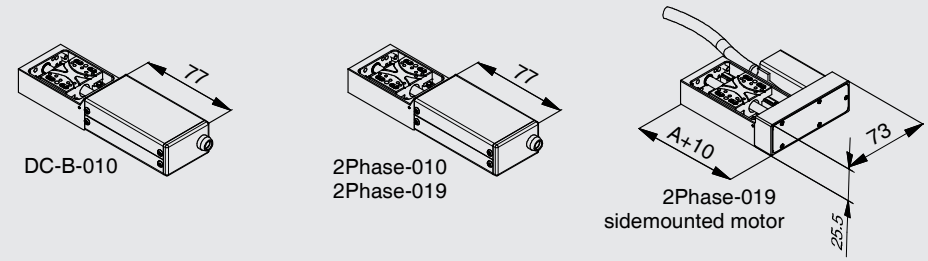
| | | | |
|---|---|---|---|
| Travel range (mm) | 13 | 26 | 52 |
| Straightness / Flatness (µm) | ± 1.5 | ± 3 | ± 5 |
| Pitch (µrad) | ± 150 | ± 170 | ± 190 |
| Yaw (µm) | ± 150 | ± 150 | ± 150 |
| Weight (kg) | 0.18 | 0.2 | 0.25 |

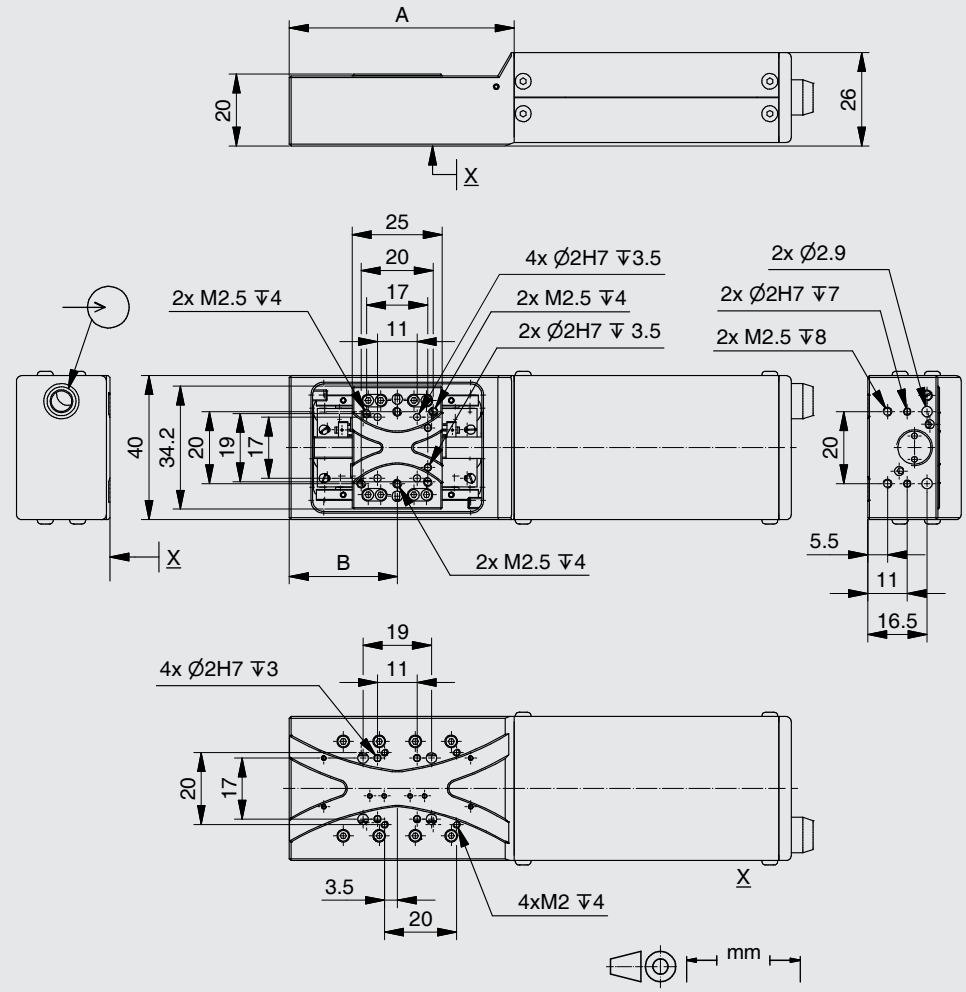
| Motor (Pitch 0.5 mm) | DC-B-010 | 2Phase-019 | 2Phase-010 |
|---|---|---|---|
| Speed max. (mm/sec) | 1.5 | 5 | 0.4 |
| Resolution calculated (µm) | 0.0110804 (RE) | 2.5 (FS) | 0.2745086 (FS) |
| Resolution typical (µm) | 0.1 | 0.1 | 0.1 |
| Bi-directional Repeatability (µm) | ± 3 | ± 3 | ± 3 |
| Uni-directional Repeatability (µm) | 0.1 | 0.1 | 0.1 |
| Nominal Current (A) | 0.32 | 0.8 | 0.25 |
| Voltage Range (V) | 12 | | |

| | |
|---|---|
| Accuracy | on request |
| Velocity range (mm/sec) | 0.001 ... 5 |
| Material | Aluminum, black anodized |

Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.

| Travel (mm) | 13 | 26 | 52 |
|---|---|---|---|
| A | 62.5 | 75.5 | 101.5 |
| B | 30 | 36.5 | 49.5 |



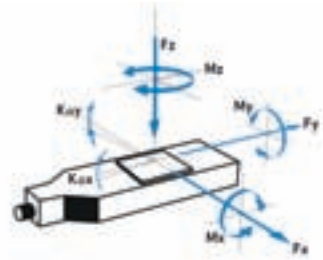

| Order No. | 6213-9- | | | 0 | |
|---|---|---|---|---|---|
| DC-B-010 | 1 | | | | |
| 2Phase-019 | 2 | | | | |
| 2Phase-010 | 3 | | | | |
| 2Phase-019 sidemounted | 4 | | | | |
| | | | | | |
| 13 mm | | 1 | | | |
| 26 mm | | 2 | | | |
| 52 mm | | 3 | | | |
| | | | | | |
| HLS-010, Hall limit switches | | | 1 | | |
| MLS-010, Mechanical limit switches | | | 2 | | |
| OLS-010, Optical limit switches | | | 3 | | |

# 4.116 Translation Stage VT-21 S

NEW

## FACTS

| Load characteristics | $Fx_{(N)}$ | $Fy_{(N)}$ | $Fz_{(N)}$ | $Mx_{(Nm)}$ | $My_{(Nm)}$ | $Mz_{(Nm)}$ |
|---|---|---|---|---|---|---|
| **2Phase-018** | 10 | 10 | 10 | 0.4 | 0.6 | 0.5 |



The VT-21 S linear stage is designed for applications with very limited space conditions and about 8 µm repeatability. Typical applications for this stage are inspection and OEM systems. The VT-21 S linear stages are motorized with a 2 phase stepper motor, and with two limit switches. An optional linear scale is also available. XY and XZ configurations can be assembled with a special bracket.

## KEY FEATURES

- Travel range 10 mm
- Maximum speed 5 mm/sec
- Load capacity up to 1 kg
- Integrated mechanical limit switches
- Option: linear scale

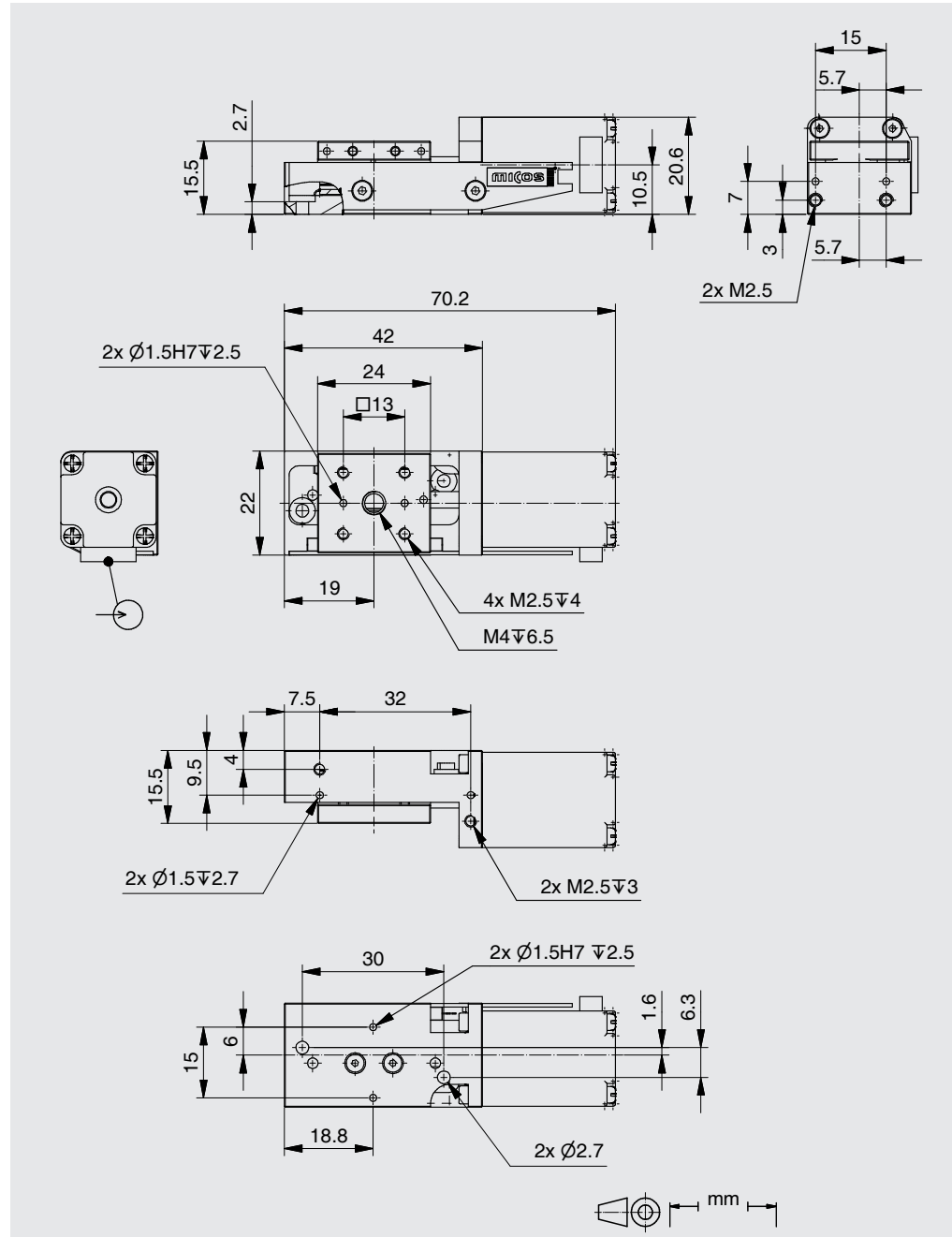
## TECHNICAL DATA

| | |
|---|---|
| **Travel range (mm)** | 10 |
| **Straightness / Flatness (µm)** | ± 2.5 |
| **Pitch (µrad)** | ± 150 |
| **Yaw (µm)** | ± 150 |
| **Weight (kg)** | 0.1 |

| | | |
|---|---|---|
| **Motor (Pitch 0.5 mm)** | 2Phase-018 | |
| **Linear scale** | | LS-059 |
| **Speed max. (mm/sec)** | 5 | |
| **Resolution calculated (µm)** | 2.5 (FS) | 0.05 |
| **Resolution typical (µm)** | 0.5 | 0.05 |
| **Bi-directional Repeatability (µm)** | ± 4 | ± 0.3 |
| **Uni-directional Repeatability (µm)** | 0.5 | 0.2 |
| **Nominal Current (A)** | 0.24 | |

| | |
|---|---|
| **Accuracy** | on request |
| **Velocity range (mm/sec)** | 0.001 ... 5 |
| **Material** | Aluminum, black anodized |

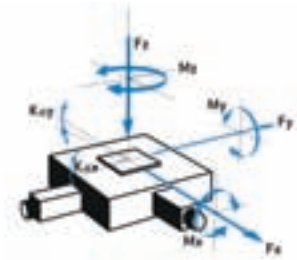
Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.




| Order No. | 6214-9- | | | | | |
|---|---|---|---|---|---|---|
| 2Phase-018 | 2 | | | | | |
| 10 mm | 2 | | | | | |
| without LS-059 | 0 | | | | | |
| LS-059, Linear scale | 1 | | | | | |
| MLS-060 | 2 | | | | | |
| Pitch 0.5 mm | 1 | | | | | |

## FACTS

| Load characteristics | $F_{x(N)}$ | $F_{y(N)}$ | $F_{z(N)}$ | $M_{x(Nm)}$ | $M_{y(Nm)}$ | $M_{z(Nm)}$ | $k_{\vartheta x(\mu rad/Nm)}$ | $k_{\vartheta y(\mu rad/Nm)}$ |
|---|---|---|---|---|---|---|---|---|
| 2Phase-071 | 110 | 110 | 300 | 80 | 80 | 80 | 120 | 120 |



The CS-430 XY stage was developed for industrial test- and inspection systems. The travel ranges in XY are 350 x 300 mm. The CS-430 XY stage is equipped with re-circulating ball screws and precision cross-roller bearings. All CS-430 stages are motorized with 2-phase stepper motors and are equipped with two mechanical limit switches per axis. For higher positioning accuracy the CS-430 XY stage can be optionally equipped with linear scales. Optical or inductive limit switches as well as a certificate of performance can be supplied on request.

## KEY FEATURES

- Travel range 350 mm x 300 mm
- Uni-directional repeatability down to 0.1 µm
- Maximum speed 100 mm/sec
- Load capacity up to 30 kg
- Integrated optical limit switches
- Option: Linear scale

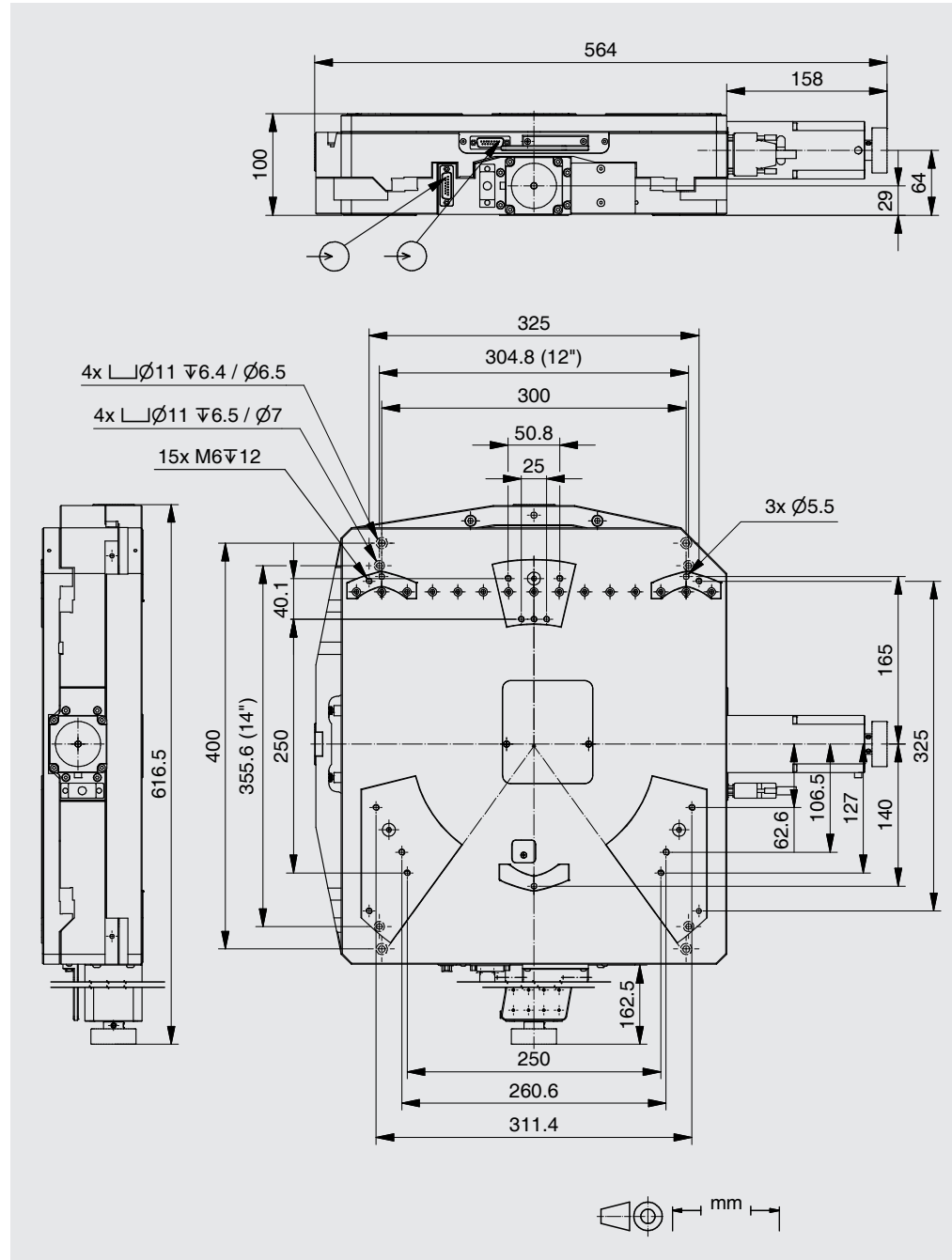
## TECHNICAL DATA

| | |
|---|---|
| Travel range (mm) | 350 x 300 |
| Straightness / Flatness (µm) | ± 6 |
| Pitch (µrad) | ± 80 |
| Yaw (µm) | ± 80 |
| Orthogonality (µrad) | 90 |
| Weight (kg) | 23 |

| | | |
|---|---|---|
| Motor (Pitch 10 mm) | 2Phase-071 | |
| Linear scale | | LS-010 |
| Speed max. (mm/sec) | 100 | |
| Resolution calculated (µm) | 25 (FS) | 0.05 |
| Resolution typical (µm) | 0.5 | 0.1 |
| Bi-directional Repeatability (µm) | ± 4 | ± 0.1 |
| Uni-directional Repeatability (µm) | 0.5 | 0.1 |
| Nominal Current (A) | 2 | |

| | |
|---|---|
| Accuracy | on request |
| Velocity range (mm/sec) | 0.001 ... 100 |
| Material | Aluminum, black anodized |

Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.

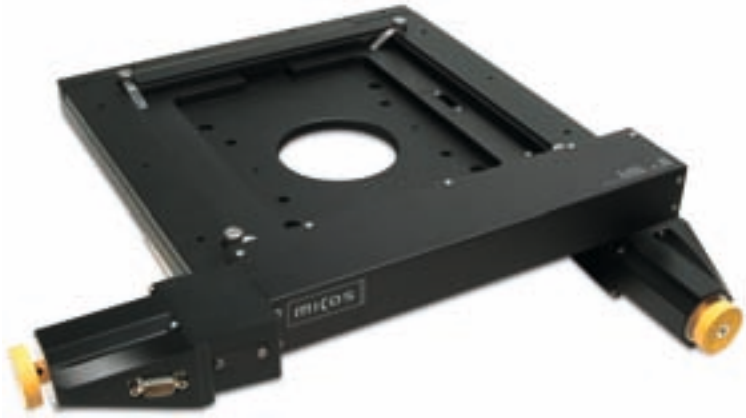



| Order No. | 6330-9- | | | | 0 |
|---|---|---|---|---|---|
| 2Phase-071 | 2 | | | | |
| 350 mm x 300 mm | 1 | | | | |
| without LS-010 | 0 | | | | |
| LS-010, Linear steel scale | 1 | | | | |

# 4.120 Scan Table MS-8

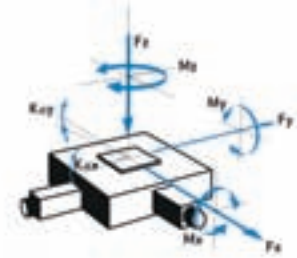
## FACTS

| Load characteristics | $F_{x(N)}$ | $F_{y(N)}$ | $F_{z(N)}$ | $M_{x(Nm)}$ | $M_{y(Nm)}$ | $M_{z(Nm)}$ | $k_{\pm x(\mu rad/Nm)}$ | $k_{\pm y(\mu rad/Nm)}$ |
|---|---|---|---|---|---|---|---|---|
| DC-B-032 | 20 | 20 | 40 | 0.5 | 0.5 | 0.5 | 400 | 400 |
| 2Phase-044 | 20 | 20 | 40 | 0.5 | 0.5 | 0.5 | 400 | 400 |



## KEY FEATURES

- Travel range 205 mm (8") x 205 mm (8")
- Clear aperture 205 x 205 mm
- Uni-directional repeatability down to 0.25 µm
- Maximum speed 60 mm/sec
- Load capacity up to 4 kg
- Integrated mechanical limit switches
- Option: linear scale

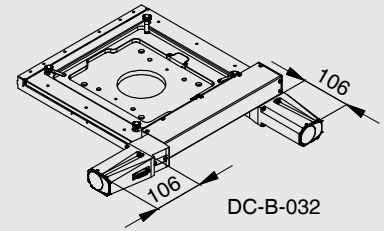


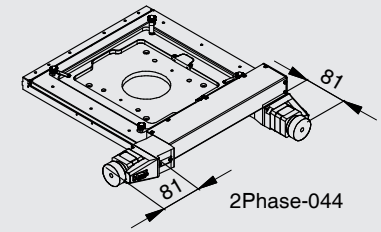
The MS-8 scan stage with a clear aperture of 205 x 205 mm was developed for inspection systems and microscopy. Travel ranges in XY are 205 x 205 mm (8" x 8"). Due to its low profile, the MS-8 scan stage is suited for tasks using reflected and/or transmitted light microscopy. With the MS-8 scan stage samples with a dimension of 205 x 205 mm can be tested and measured. The MS-8 is equipped with re-circulating ball screw and two limit switches on each axis. Motor drive options are DC or 2-phase stepper motors. For higher positioning accuracy and repeatability, the MS-8 scan stage can be optionally equipped with linear scales.

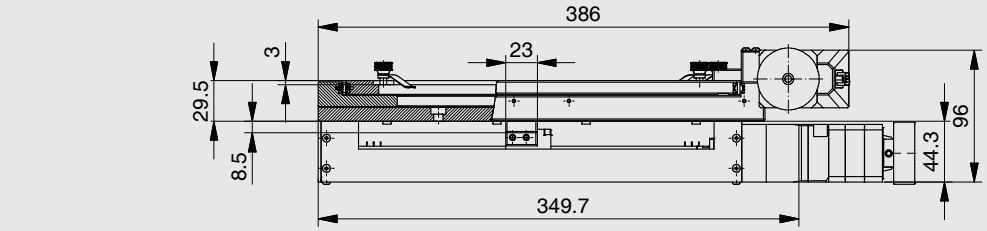
## TECHNICAL DATA

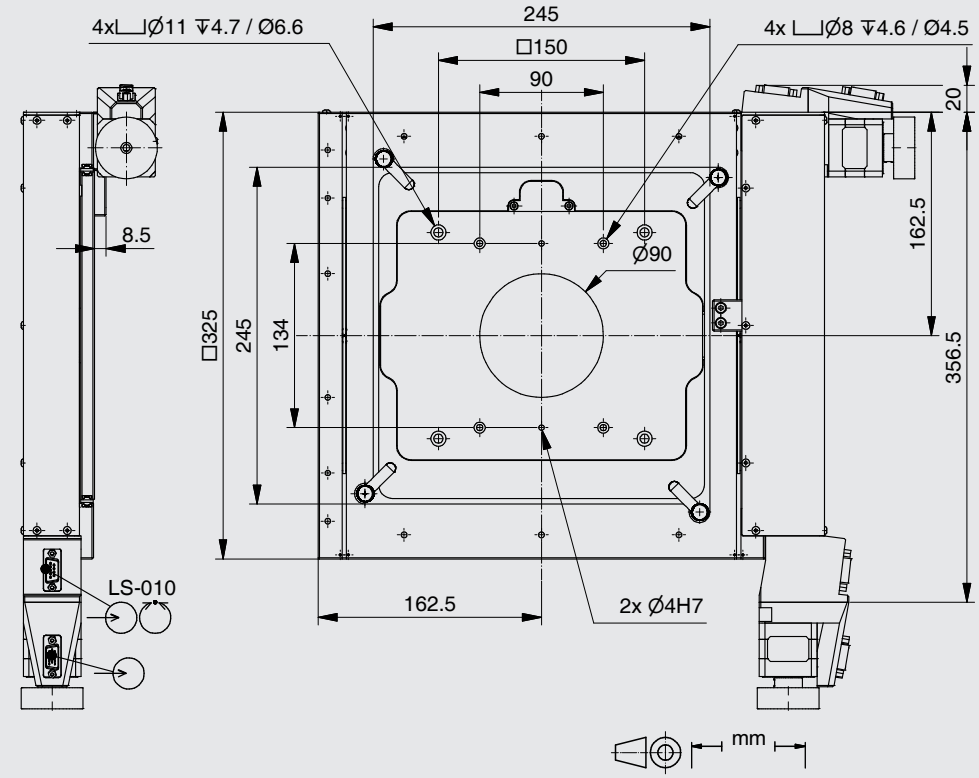
| | | | |
|---|---|---|---|
| Travel range (mm) | 205 x 205 | | |
| Straightness / Flatness (µm) | ± 10 | | |
| Pitch (µrad) | ± 500 | | |
| Yaw (µm) | ± 500 | | |
| Orthogonality (µrad) | 150 | | |
| Weight (kg) | 9.5 | | |
| Motor (Pitch 2 mm) | DC-B-032 | 2Phase-044 | |
| Linear scale | | | LS-010 |
| Speed max. (mm/sec) | 60 | 35 | |
| Resolution calculated (µm) | 1 (RE) | 10 (FS) | 0.05 |
| Resolution typical (µm) | 1 | 0.5 | 0.2 |
| Bi-directional Repeatability (µm) | ± 5 | ± 5 | ± 0.5 |
| Uni-directional Repeatability (µm) | 2 | 2 | 0.25 |
| Nominal Current (A) | 2.3 | 1.2 | |
| Voltage Range (V) | 24 | | |
| Accuracy | on request | | |
| Velocity range (mm/sec) | 0.001 ... 60 | | |
| Material | Aluminum, black anodized | | |

Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.



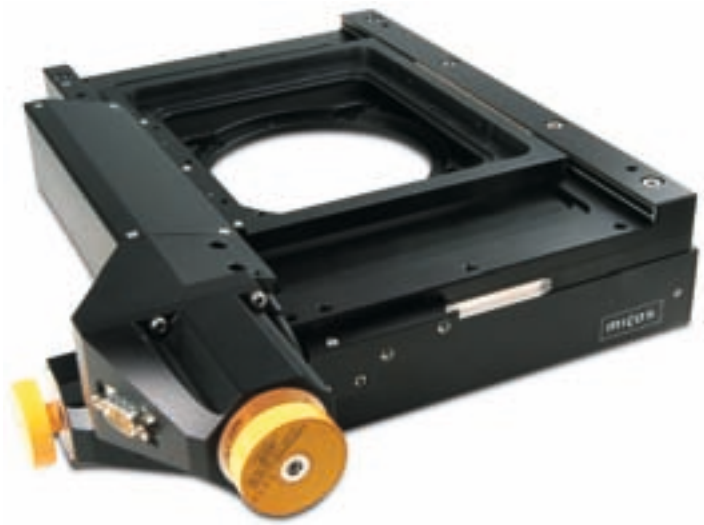



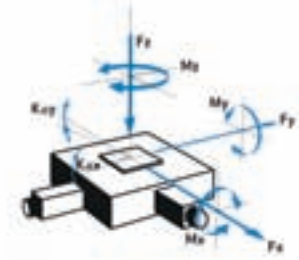




| Order No. | 6316-9- | | | |
|---|---|---|---|---|
| DC-B-032 | 1 | | | |
| 2Phase-044 | 2 | | | |
| 205 mm (8") x 205 mm (8") | | 1 | | |
| without LS-010 | | | 0 | |
| LS-010, Linear steel scale | | | 1 | |

## FACTS

| Load characteristics | $F_{x(N)}$ | $F_{y(N)}$ | $F_{z(N)}$ | $M_{x(Nm)}$ | $M_{y(Nm)}$ | $M_{z(Nm)}$ | $k_{\varphi x(\mu rad/Nm)}$ | $k_{\varphi y(\mu rad/Nm)}$ |
|---|---|---|---|---|---|---|---|---|
| DC-B-032 | 15 | 15 | 30 | 0.5 | 0.5 | 0.5 | 350 | 350 |
| 2Phase-044 | 15 | 15 | 30 | 0.5 | 0.5 | 0.5 | 350 | 350 |





The MS-4 scanning stages with a clear aperture of 100 mm were developed for inspection and microscopy applications. Travel ranges in XY are 102 x 102 mm (4" x 4"). Due to their low profile, they are suited for tasks using reflected and/or transmitted light microscopy. The MS-4 scan stages are equipped with re-circulating ball screw and two limit switches on each axis. Optionally, the MS-4 scan stages can be equipped with linear scales for higher accuracy.

## KEY FEATURES

- Travel range 102 mm (4") x 102 mm (4")
- Clear aperture 102 x 102 mm
- Uni-directional repeatability down to 0.25 µm
- Maximum speed 90 mm/sec
- Load capacity up to 3 kg
- Integrated mechanical / hall limit switches
- Option: linear scale

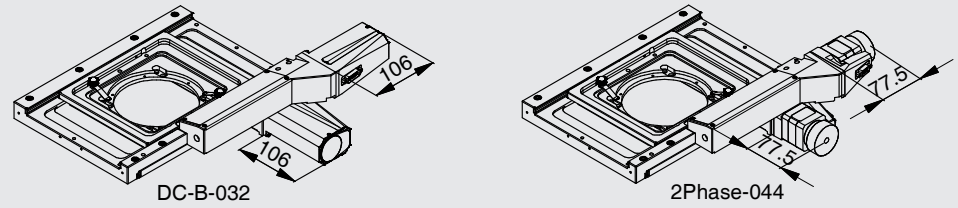
## TECHNICAL DATA

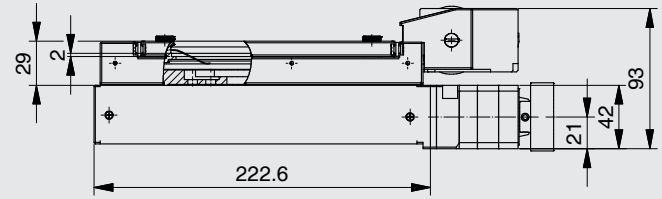
| | |
|---|---|
| Travel range (mm) | 102 x 102 |
| Straightness / Flatness (µm) | ± 5 |
| Pitch (µrad) | ± 200 |
| Yaw (µm) | ± 200 |
| Orthogonality (µrad) | 150 |
| Weight (kg) | 3.8 |

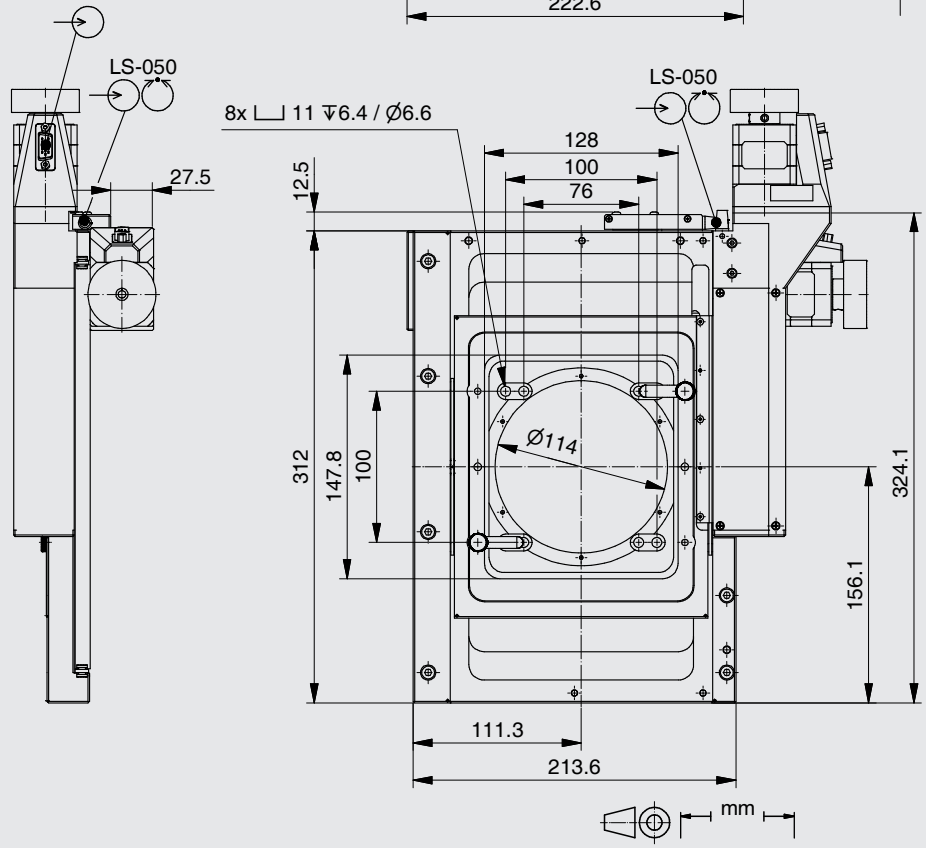
| | | | |
|---|---|---|---|
| Motor (Pitch 2 mm) | DC-B-032 | 2Phase-044 | |
| Linear scale | | | LS-050 |
| Speed max. (mm/sec) | 90 | 35 | |
| Resolution calculated (µm) | 1 (RE) | | 0.05 |
| Resolution typical (µm) | 1 | 0.5 | 0.2 |
| Bi-directional Repeatability (µm) | ± 5 | ± 5 | ± 0.5 |
| Uni-directional Repeatability (µm) | 2 | 2 | 0.25 |
| Nominal Current (A) | 2.3 | 1.2 | |
| Voltage Range (V) | 24 | | |

| | |
|---|---|
| Accuracy | on request |
| Velocity range (mm/sec) | 0.001 ... 90 |
| Material | Aluminum, black anodized |

Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.



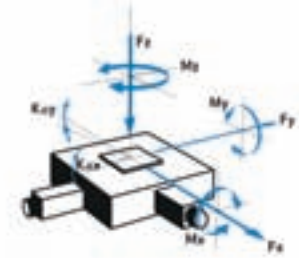




| Order No. | 6315-9- | | | | |
|---|---|---|---|---|---|
| DC-B-032 | 1 | | | | |
| 2Phase-044 | 2 | | | | |
| 102 mm (4") x 102 mm (4") | | 0 | | | |
| without LS-050 | | | 0 | | |
| LS-050, Linear steel scale | | | 1 | | |
| MLS-020, Mechanical limit switches | | | | 1 | |
| HLS-010, Hall limit switches | | | | 2 | |

## FACTS

| Load characteristics | $F_{x(N)}$ | $F_{y(N)}$ | $F_{z(N)}$ | $M_{x(Nm)}$ | $M_{y(Nm)}$ | $M_{z(Nm)}$ | $k_{\varphi x(\mu rad/Nm)}$ | $k_{\varphi y(\mu rad/Nm)}$ |
|---|---|---|---|---|---|---|---|---|
| DC-B-010 | 20 | 30 | 50 | 0.5 | 0.4 | 0.4 | 200 | 200 |
| 2Phase-010 | 20 | 30 | 50 | 0.5 | 0.4 | 0.4 | 200 | 200 |



The KT-120 XY stage with a clear aperture of 45 mm was developed for test and inspection systems. Travel ranges in XY are 25 x 25 mm (1" x 1"). Due to its low profile, it is suited for tasks using reflected and/or transmitted light microscopy. The KT-120 scan stages are driven by MP-20 actuators with re-circulating ball screws and equipped with limit switches. Geared DC- and 2-phase stepper motors are available.

## KEY FEATURES

- Travel range 26 mm (1") x 26 mm (1")
- Clear aperture 45 mm
- Uni-directional repeatability down to 2 µm
- Maximum speed 3.5 mm/sec
- Load capacity up to 5 kg
- Integrated hall limit switches

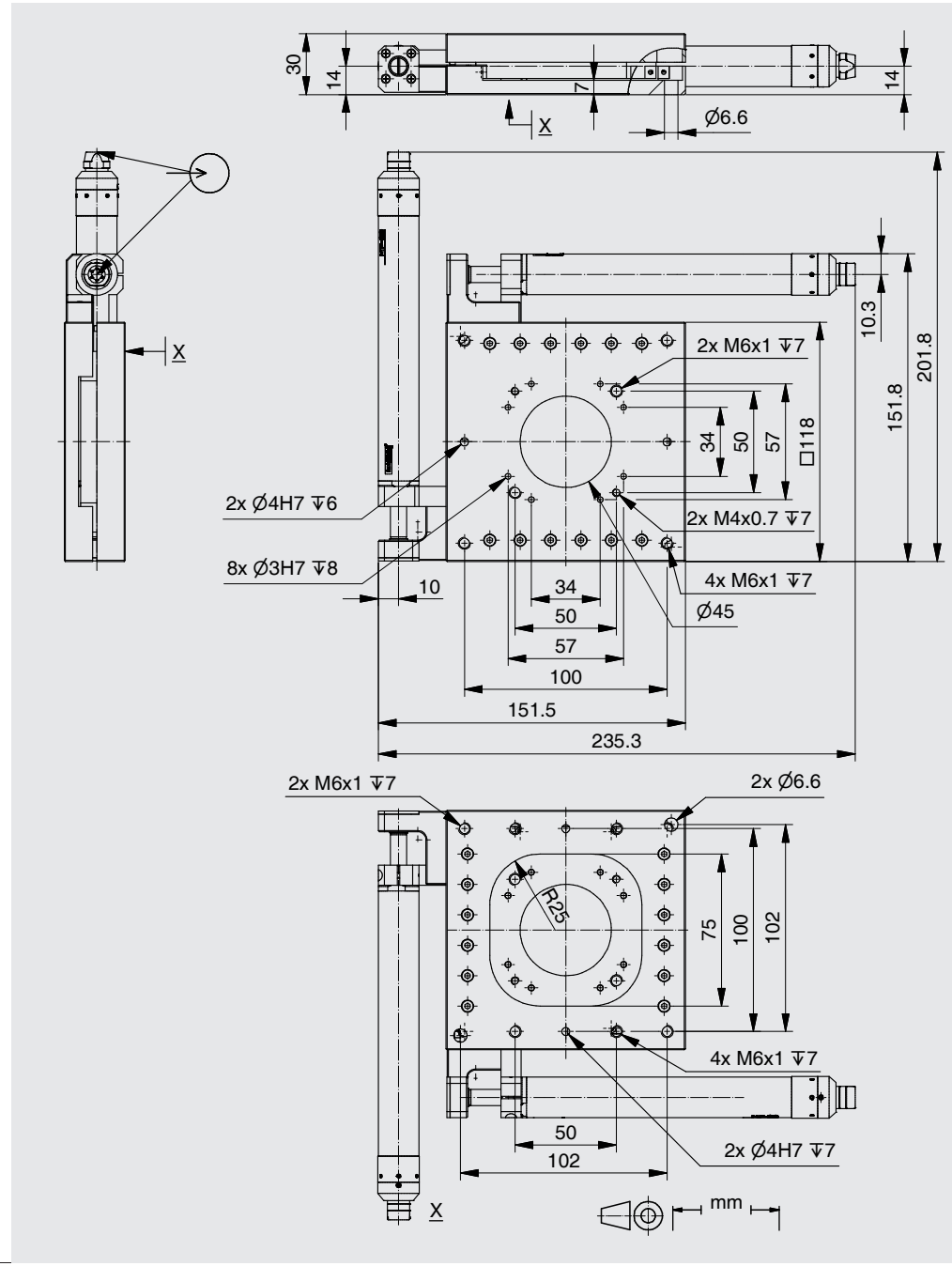
## TECHNICAL DATA

| | |
|---|---|
| Travel range (mm) | 26 x 26 |
| Straightness / Flatness (µm) | ± 4 |
| Pitch (µrad) | ± 110 |
| Yaw (µm) | ± 90 |
| Orthogonality (µrad) | 130 |
| Weight (kg) | 1.2 |

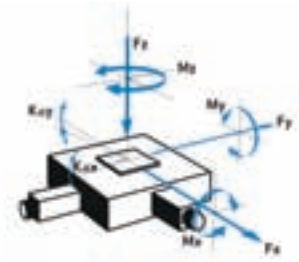
| Motor (Pitch 1 mm) | DC-B-010 | 2Phase-010 |
|---|---|---|
| Speed max. (mm/sec) | 3.5 | 0.8 |
| Resolution calculated (µm) | 0.0221608 (RE) | 0.5490171 (FS) |
| Resolution typical (µm) | 0.2 | 0.2 |
| Bi-directional Repeatability (µm) | ± 5 | ± 5 |
| Uni-directional Repeatability (µm) | 2 | 2 |
| Nominal Current (A) | 0.32 | 0.25 |
| Voltage Range (V) | 12 | |

| | |
|---|---|
| Accuracy | on request |
| Velocity range (mm/sec) | 0.001 ... 3.5 |
| Material | Aluminum, black anodized |

Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.




| Order No. | 6312-9- | | | 2 |
|---|---|---|---|---|
| DC-B-010 | 1 | | | |
| 2Phase-010 | 2 | | | |
| 26 mm (1") x 26 mm (1") | 1 | | | |



New microscope stage MS-bio with integrated controller and linear motor drive. Advantages fast and precise positioning of compounds under the microscope. At any time immediately ready for operation without referencing. Integrated high-performance controller with minimal power consumption. Can run under a 65W table power supply unit. 100Mbit/s ethernet interface for fast communication with the application software. CAN bus to connect joystick or hand wheel.

High stiffness by the use of prestressed industrial guidings. Serially with object holder for compounds of 3x1" und 3x2" with automatic loading.

For reflected and transmitted light applications.

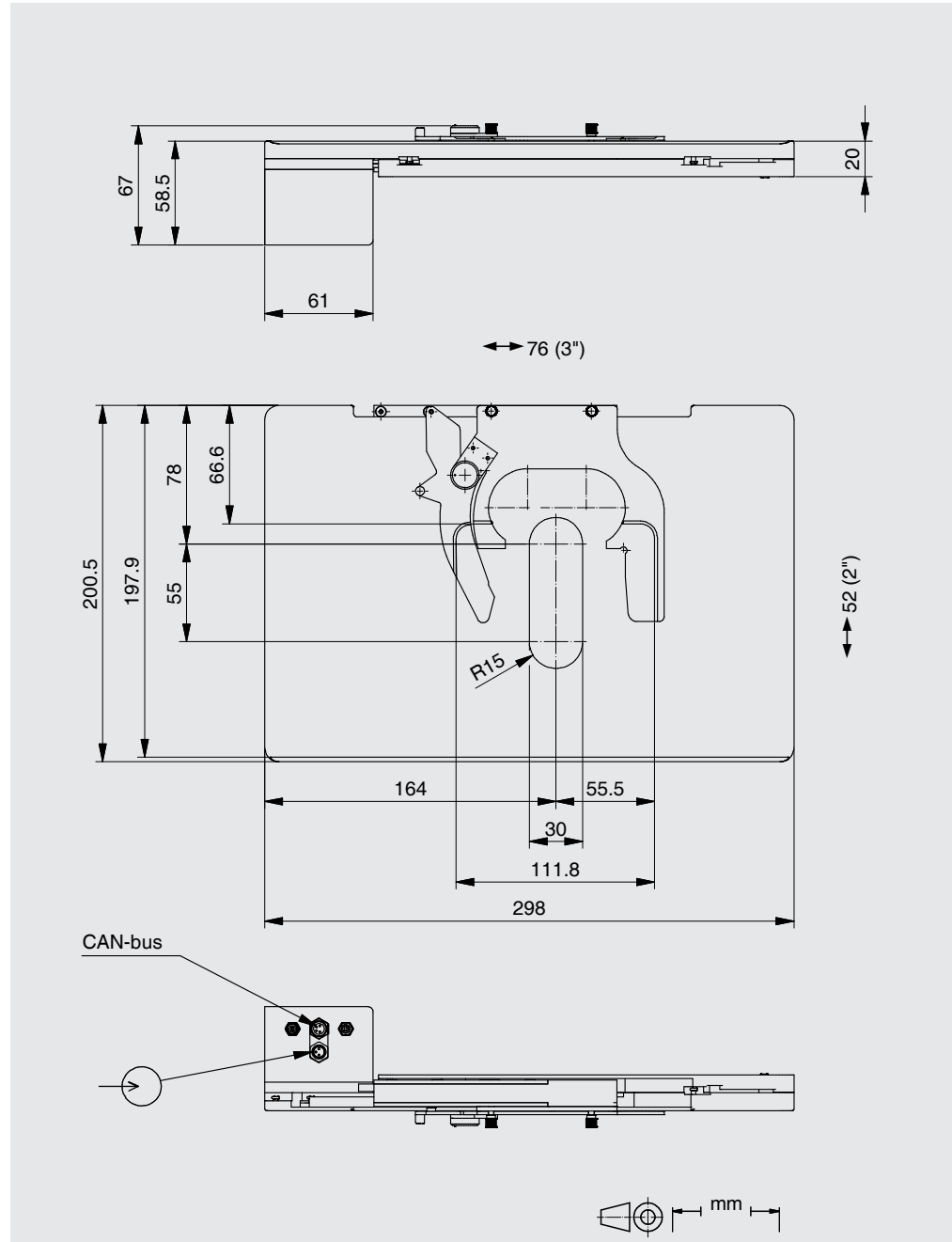
## KEY FEATURES

- Travel range 76 mm x 52 mm
- Max. speed 1000 mm/s
- Uni-directional repeatability

## TECHNICAL DATA

| | | |
|---|---|---|
| Travel range (mm) | 76 x 52 | |
| Weight (kg) | 2.8 | |
| Motor | LM-030 | |
| Linear scale | | LS-028 |
| Speed max. (mm/sec) | 1000 | |
| Resolution calculated (µm) | | |
| Resolution typical (µm) | 0.05 | 0.05 |
| Bi-directional Repeatability (µm) | ± 1 | ± 1 |
| Uni-directional Repeatability (µm) | | |
| Nominal Current (A) | 3 | |
| Accuracy | on request | |
| Velocity range (mm/sec) | 0.001 ... 1000 | |
| Material | Aluminium, Plasmaceramic, black, min. 900 HV | |

Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.




| Order No. | 6319-9- | | | | 0 | 0 |
|---|---|---|---|---|---|---|
| LM-030 | 2 | | | | | |
| 76mm (3") x 52mm (2") | | 1 | | | | |
| LS-028 Linear absolut encoder | | | 1 | | | |

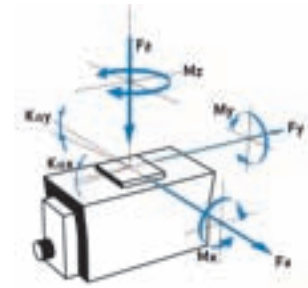
# 4.128 Nano Precision Elevation Stage NPE-200

## FACTS

| Load characteristics | $F_{x(N)}$ | $F_{y(N)}$ | $F_{z(N)}$ | $M_{x(Nm)}$ | $M_{y(Nm)}$ | $M_{z(Nm)}$ | $k_{\vartheta x(\mu rad/Nm)}$ | $k_{\vartheta y(\mu rad/Nm)}$ |
|---|---|---|---|---|---|---|---|---|
| **2Phase-034** | 100 | 80 | 300 | 100 | 50 | 100 | 3 | 1 |


## KEY FEATURES

- Travel range 13 mm (1/2")
- Uni-directional repeatability down to 0.04 µm
- Maximum speed 0.2 mm/sec
- Load capacity up to 30 kg
- Integrated mechanical limit switches
- Integrated linear scale (center mounted)



The NPE-200 nano-precision elevation stage offers the highest precision in our elevation stage series. Maximum positioning accuracy and high stiffness makes this stage especially suitable for lithography, fiber alignment and wafer inspection. High-quality, double cross-roller bearings mounted on a stress-relieved, tempered aluminum-alloy body guarantee a non-warping stage structure, high stiffness and smooth motion. Position stability of less than 5 nm over a period of 1 minute can be achieved. The NPE-200 is equipped with a 2-phase stepper motor using a backlash-free gear-head (ratio=50:1), two mechanical limit switches and a linear scale which is center mounted for highest accuracy. All nano-precision elevation stages are supplied with a certificate of performance (flatness, pitch, yaw, straightness & accuracy).

## TECHNICAL DATA

| | |
|---|---|
| **Travel range (mm)** | 13 |
| **Straightness / Flatness (µm)** | ± 0.7 |
| **Pitch (µrad)** | ± 20 |
| **Yaw (µm)** | ± 20 |
| **Weight (kg)** | 9.2 |

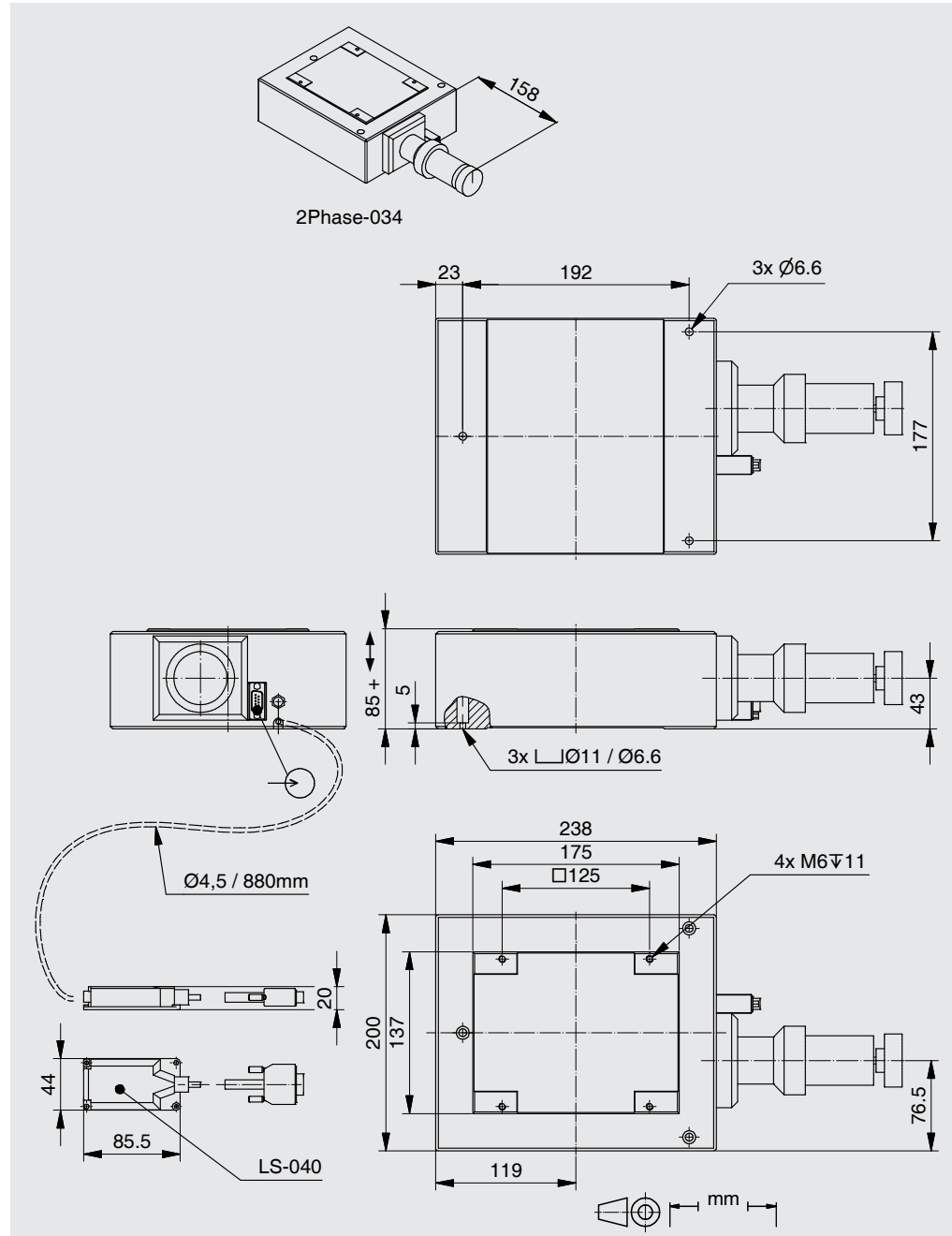
| | | |
|---|---|---|
| **Motor (Pitch 2 mm)** | 2Phase-034 | |
| **Linear scale** | | LS-040 |
| **Speed max. (mm/sec)** | 0.2 | |
| **Resolution calculated (µm)** | 0.2 (FS) | 0.001 |
| **Resolution typical (µm)** | | 0.005 |
| **Bi-directional Repeatability (µm)** | | ± 0.04 |
| **Uni-directional Repeatability (µm)** | | 0.04 |
| **Nominal Current (A)** | 1.2 | |

| | |
|---|---|
| **Accuracy** | on request |
| **Velocity range (mm/sec)** | 0.00001 ... 0.2 |
| **Material** | Aluminum, black anodized |

Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.



PI micos




| Order No. | 6283-9- | | | |
|---|---|---|---|---|
| 2Phase-034 | 2 | | | |
| 13 mm (1/2") | | 0 | | |
| LS-040, Linear Zerodur scale | | | 0 | |

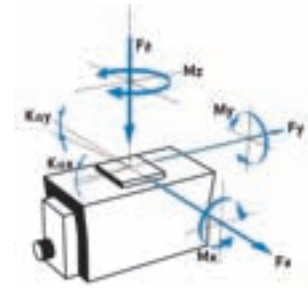
# 4.130 Ultra Precision Elevation Stage UPL-120

## FACTS

| Load characteristics | $F_{x(N)}$ | $F_{y(N)}$ | $F_{z(N)}$ | $M_{x(Nm)}$ | $M_{y(Nm)}$ | $M_{z(Nm)}$ | $k_{\pm x(\mu rad/Nm)}$ | $k_{\pm y(\mu rad/Nm)}$ |
|---|---|---|---|---|---|---|---|---|
| DC-B-028 | 200 | 150 | 200 | 130 | 38 | 150 | 35 | 65 |
| 2Phase-025 | 200 | 150 | 150 | 130 | 38 | 130 | 35 | 65 |

## KEY FEATURES

- Travel range 13 mm (1/2")
- Uni-directional repeatability down to 0.05 µm
- Maximum speed 6 mm/sec
- Load capacity up to 15 kg
- Integrated optical limit switches
- Option: linear scale (center mounted)



The UPL-120 ultra-precision elevation stage replaces our older UPL-160 stage. It was specifically designed for wafer inspection, fiber alignment and any other task where maximum positioning accuracy and reliability are absolutely mandatory. The UPL-120 stage can be equipped with an integrated linear scale.

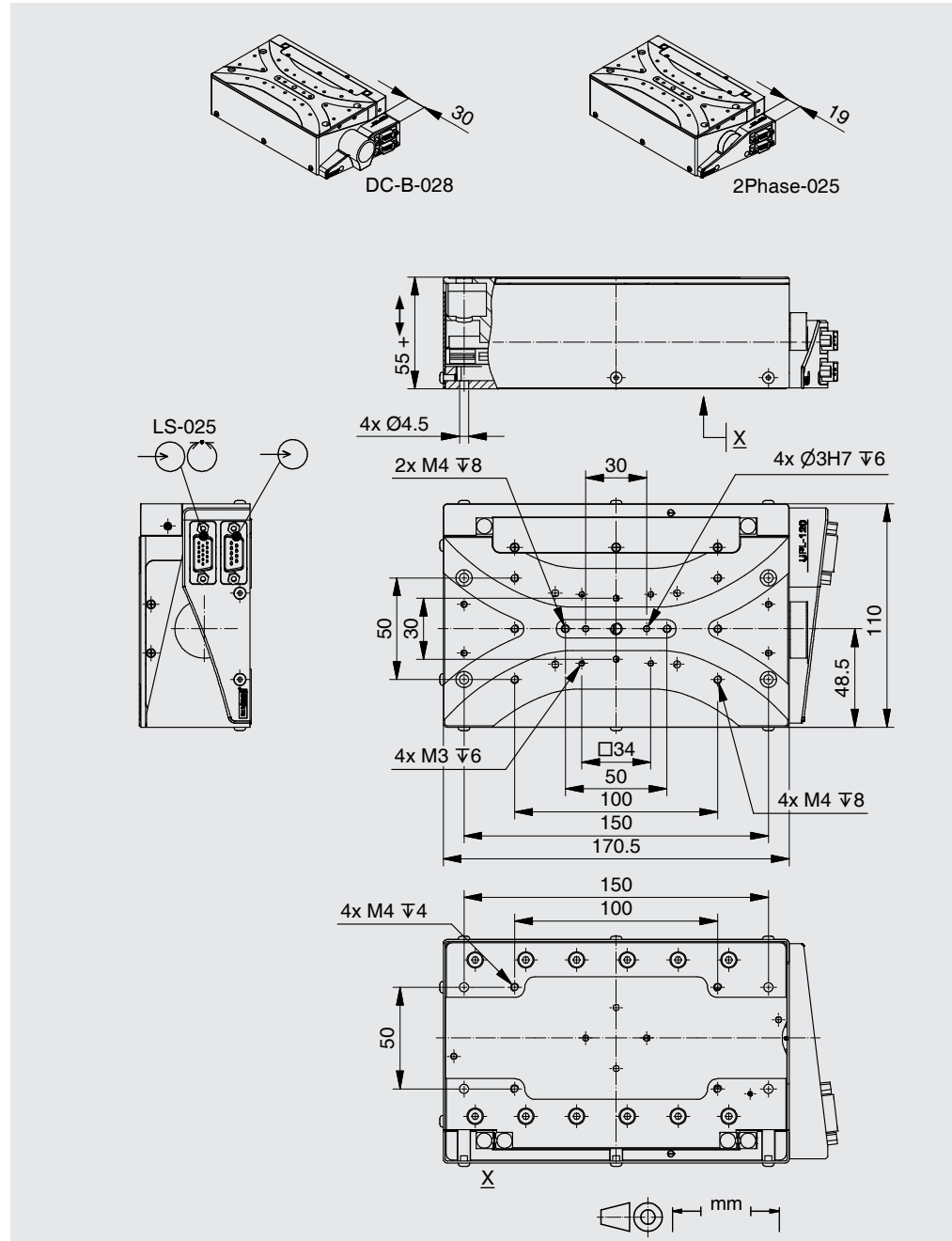
High-quality cross roller bearings mounted on a stress-relieved tempered aluminum alloy body guarantee a maximum load capacity and smooth motion.

The UPL-120 stage is offered with a 2-phase SM motor or with a DC-motor and is equipped with two optical limit switches.

## TECHNICAL DATA

| | | | |
|---|---|---|---|
| Travel range (mm) | 13 | | |
| Straightness / Flatness (µm) | ± 2 | | |
| Pitch (µrad) | ± 35 | | |
| Yaw (µm) | ± 35 | | |
| Weight (kg) | 2.1 | | |
| Motor (Pitch 0.268 mm) | DC-B-028 | 2Phase-025 | |
| Linear scale | | | LS-025 |
| Speed max. (mm/sec) | 6 | 6 | |
| Resolution calculated (µm) | 0.0134 | 1.34 | |
| Resolution typical (µm) | 0.5 | 0.5 | 0.1 |
| Bi-directional Repeatability (µm) | ± 1.5 | ± 1.5 | ± 0.05 |
| Uni-directional Repeatability (µm) | 0.5 | 0.5 | 0.05 |
| Nominal Current (A) | 0.98 | | |
| Voltage Range (V) | 24 | | |
| Accuracy | on request | | |
| Velocity range (mm/sec) | 0.0001 ... 6 | | |
| Material | Aluminum, black anodized | | |

Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.




| Order No. | 6635-9- | | | | |
|---|---|---|---|---|---|
| DC-B-028 | 1 | | | | |
| 2Phase-025 | 2 | | | | |
| 13 mm (1/2") | | 1 | | | |
| open loop | | 0 | | | |
| LS-025, Linear steel scale | | 1 | | | |
| OLS-010 | | 3 | | | |

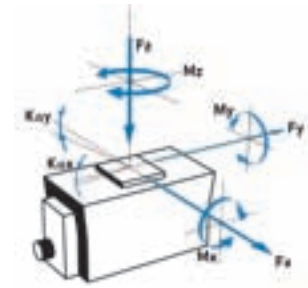
# 4.132 Elevation Stage ES-100

## FACTS

| Load characteristics | $F_{x(N)}$ | $F_{y(N)}$ | $F_{z(N)}$ | $M_{x(Nm)}$ | $M_{y(Nm)}$ | $M_{z(Nm)}$ | $k_{\pm x(\mu rad/Nm)}$ | $k_{\pm y(\mu rad/Nm)}$ |
|---|---|---|---|---|---|---|---|---|
| DC-B-032 | 100 | 50 | 30 | 40 | 80 | 80 | 60 | 60 |
| 2Phase-044 | 100 | 50 | 55 | 40 | 80 | 80 | 60 | 60 |


## KEY FEATURES

- Travel range up to 26 mm (1")
- Uni-directional repeatability down to 0.05 µm
- Maximum speed 20 mm/sec
- Load capacity up to 5.5 kg
- Integrated mechanical / hall limit switches
- Option: linear scale (center mounted)



The ES-100 elevation stage matches the LS-110 and PRS-110 stage families. The elevation stage is driven by a precision ground re-circulating ball screw with a 1 mm pitch.

Newly developed cross-roller bearings guarantee a maximum rigidity and guiding quality. The ES-100 can be motorized with a DC or a 2-phase stepper motor and is equipped with two mechanical or hall limit switches. The travel ranges are 13 mm or 26 mm.

For demanding positioning tasks, the ES-100 elevation stages can be supplied with a cost-effective linear scale.

## TECHNICAL DATA

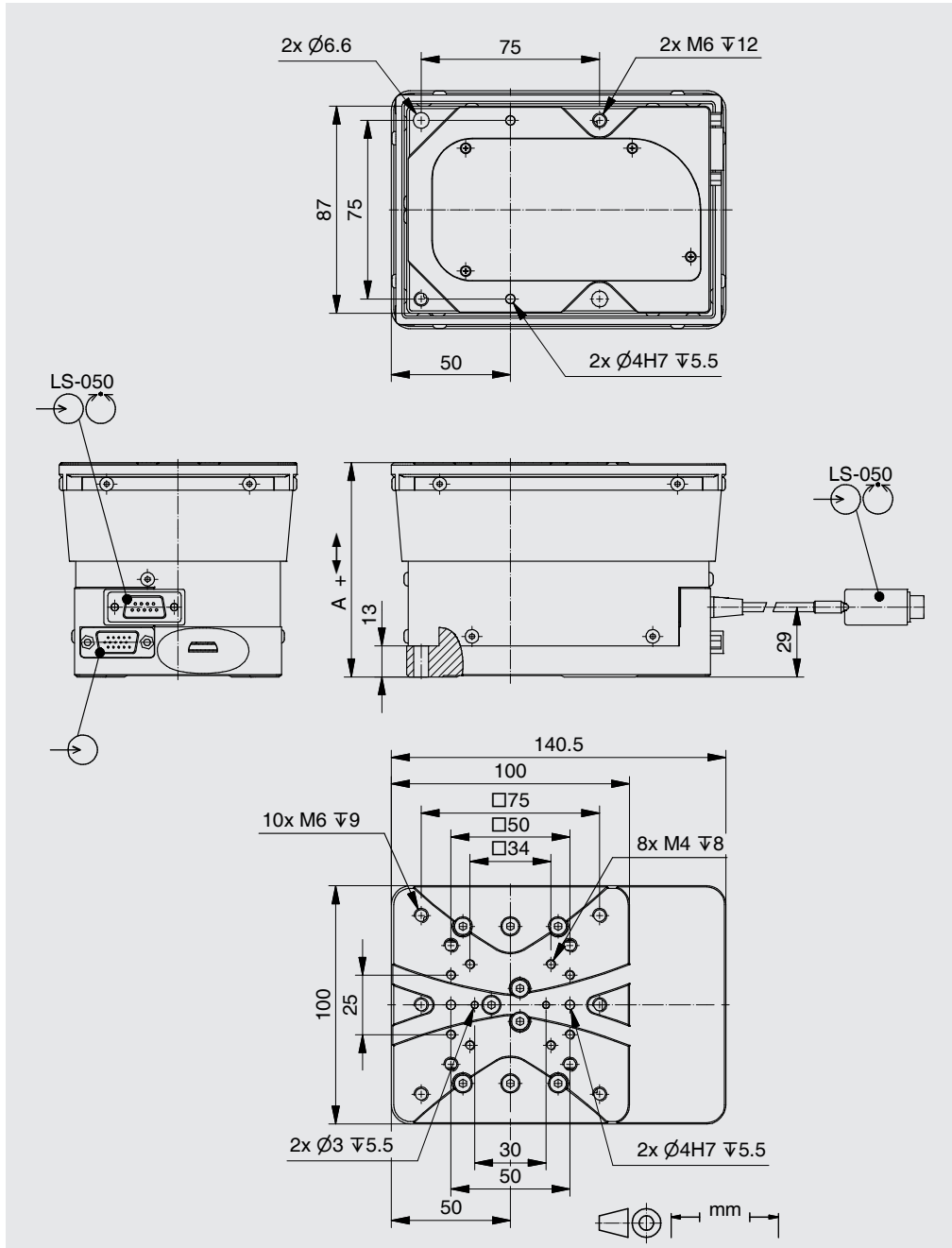
| | | |
|---|---|---|
| Travel range (mm) | 13 | 26 |
| Straightness / Flatness (µm) | ± 2 | ± 3 |
| Pitch (µrad) | ± 100 | ± 150 |
| Yaw (µm) | ± 100 | ± 150 |
| Weight (kg) | 2.4 | 2.5 |

| Motor (Pitch 1 mm) | DC-B-032 | 2Phase-044 | |
|---|---|---|---|
| Linear scale | | | LS-050 |
| Speed max. (mm/sec) | 20 | 15 | |
| Resolution calculated (µm) | 0.5 (RE) | 5 (FS) | 0.05 |
| Resolution typical (µm) | 0.5 | 0.2 | 0.05 |
| Bi-directional Repeatability (µm) | ± 1.5 | ± 1.5 | ± 0.1 |
| Uni-directional Repeatability (µm) | 0.5 | 0.2 | 0.05 |
| Nominal Current (A) | 2.3 | 1.2 | |
| Voltage Range (V) | 24 | | |

| | |
|---|---|
| Accuracy | on request |
| Velocity range (mm/sec) | 0.001 ... 20 |
| Material | Aluminum, black anodized |

Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.

| Travel (mm) | 13 | 26 |
|---|---|---|
| A | 90 | 105 |

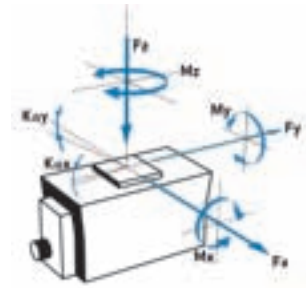



| Order No. | 6611-9- | | | | |
|---|---|---|---|---|---|
| DC-B-032 | 1 | | | | |
| 2Phase-044 | 2 | | | | |
| | | | | | |
| | | 13 mm (1/2") | 1 | | |
| | | 26 mm (1") | 2 | | |
| | | | | | |
| | | | without LS-050 | 0 | |
| | | | LS-050, Linear steel scale | 1 | |
| | | | | | |
| | | | | HLS-010, Hall limit switches | 1 |
| | | | | MLS-020, Mechanical limit switches | 2 |

# 4.134 Elevation Stage ES-82

## FACTS

| Load characteristics | $Fx_{(N)}$ | $Fy_{(N)}$ | $Fy\ Peak_{(N)}$ | $Fz_{(N)}$ | $Mx_{(Nm)}$ | $My_{(Nm)}$ | $Mz_{(Nm)}$ |
|---|---|---|---|---|---|---|---|
| DC-B-009 | 5 | 5 | | 20 | 0.25 | 0.25 | 0.25 |
| 2Phase-010 | 5 | 5 | 99 | 20 | 0.25 | 0.25 | 0.25 |



The ES-82 elevation stage excels due to its minimum height and can be combined with the PLS-85, LS-65 or MTS-65 stages. The ES-82 can be equipped with a DC or a 2-phase geared stepper motor and is equipped with two hall limit switches. The travel range is 13 mm.

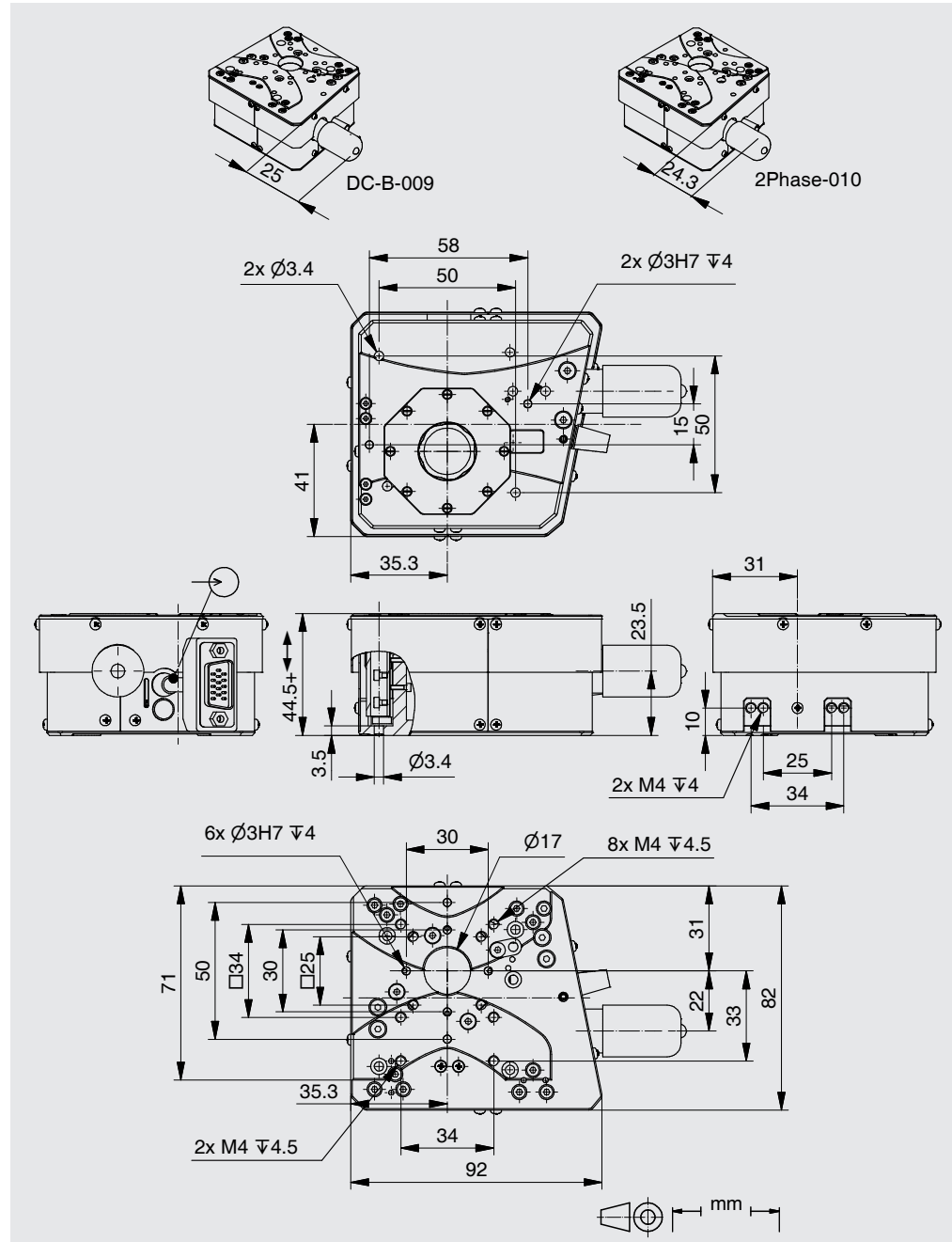
## KEY FEATURES

- Travel range 13 mm (1/2")
- Uni-directional repeatability down to 0.1 µm
- Maximum speed 0.1 mm/sec
- Load capacity up to 2 kg
- Integrated hall limit switches
- Option: linear scale

## TECHNICAL DATA

| | | | |
|---|---|---|---|
| Travel range (mm) | 13 | | |
| Straightness / Flatness (µm) | ± 3 | | |
| Pitch (µrad) | ± 75 | | |
| Yaw (µm) | ± 75 | | |
| Weight (kg) | 0.8 | | |
| Motor (Pitch 7 mm) | DC-B-009 | 2Phase-010 | |
| Linear scale | | | LS-025 |
| Speed max. (mm/sec) | 0.1 | 0.08 | |
| Resolution calculated (µm) | 0.0005004 (RE) | 0.0427009 (FS) | 0.05 |
| Resolution typical (µm) | 0.3 | 0.3 | 0.1 |
| Bi-directional Repeatability (µm) | ± 2 | ± 2 | ± 0.2 |
| Uni-directional Repeatability (µm) | 0.3 | 0.3 | 0.1 |
| Nominal Current (A) | 0.16 | 0.25 | |
| Voltage Range (V) | 12 | | |
| Accuracy | on request | | |
| Velocity range (mm/sec) | 0.001 ... 0.1 | | |
| Material | Aluminum, black anodized | | |

Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.



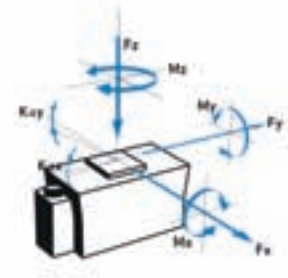

| Order No. | 6613-9- | | | | |
|---|---|---|---|---|---|
| DC-B-009 | 1 | | | | |
| 2Phase-010 | 2 | | | | |
| 13 mm (1/2") | | 1 | | | |
| without LS-025 | | | 0 | | |
| LS-025, Linear glass scale | | | 1 | | |
| HLS-010, Hall limit switches | | | | | 1 |

# 4.136 Elevation Stage ES-70

NEW V

## FACTS

| Load characteristics | $Fx_{(N)}$ | $Fy_{(N)}$ | $Fz_{(N)}$ | $Mx_{(Nm)}$ | $My_{(Nm)}$ | $Mz_{(Nm)}$ |
|---|---|---|---|---|---|---|
| DC-B-009 | 5 | 5 | 20 | 0.25 | 0.25 | 0.25 |
| 2Phase-010 | 5 | 5 | 20 | 0.25 | 0.25 | 0.25 |



The ES-70 elevation stage excels due to its minimum height. The ES-70 can be combined with the PLS-85, LS-65 or MTS-65 stages. The ES-70 can be equipped with a DC or a 2-phase geared stepper motor and is equipped with two hall limit switches. The travel range is 6.25 mm.


## KEY FEATURES

- Travel range 6.25 mm (1/4")
- Uni-directional repeatability down to 0.3 µm
- Maximum speed 0.1 mm/sec
- Load capacity up to 2 kg
- Integrated hall limit switches

## TECHNICAL DATA

| | |
|---|---|
| Travel range (mm) | 6.25 |
| Straightness / Flatness (µm) | ± 2 |
| Pitch (µrad) | ± 50 |
| Yaw (µm) | ± 50 |
| Weight (kg) | 0.6 |

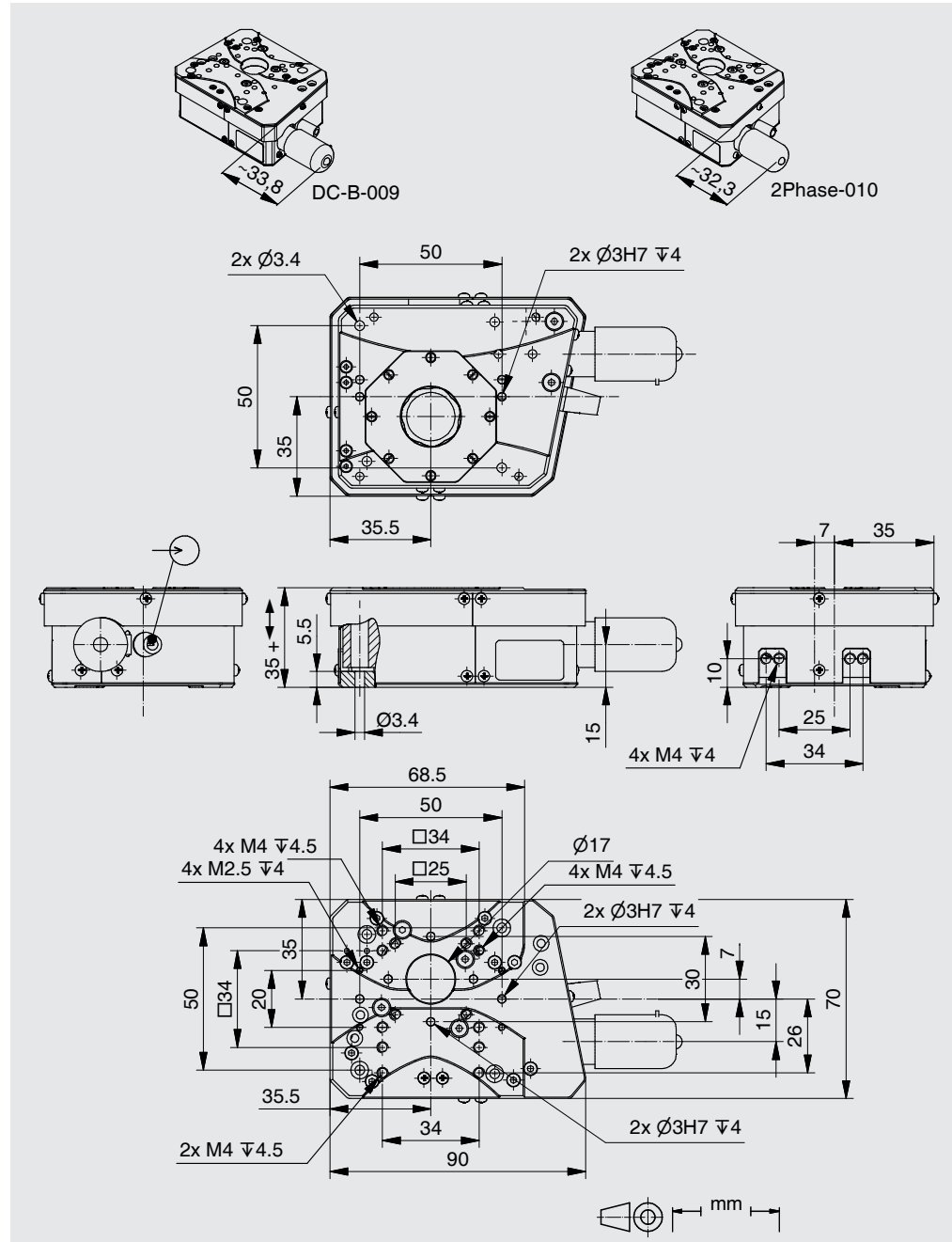
| Motor (Pitch 7 mm) | DC-B-009 | 2Phase-010 |
|---|---|---|
| Speed max. (mm/sec) | 0.1 | 0.08 |
| Resolution calculated (µm) | 0.0005004 (RE) | 0.0427009 (FS) |
| Resolution typical (µm) | 0.3 | 0.3 |
| Bi-directional Repeatability (µm) | ± 2 | ± 2 |
| Uni-directional Repeatability (µm) | 0.3 | 0.3 |
| Nominal Current (A) | 0.16 | 0.25 |
| Voltage Range (V) | 12 | |

| | |
|---|---|
| Accuracy | on request |
| Velocity range (mm/sec) | 0.001 ... 0.1 |
| Material | Aluminum, black anodized |

Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.



PI micos



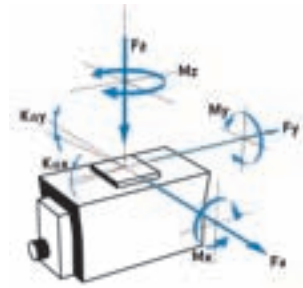

| Order No. | 6609-9- | | | 0 | |
|---|---|---|---|---|---|
| DC-B-009 | 1 | | | | |
| 2Phase-010 | 2 | | | | |
| 6.25 mm (1/4") | | 1 | | | |
| HLS-010, Hall limit switches | | | 1 | | |

# 4.138 Elevation Stage ES-50

NEW V

## FACTS

| Load characteristics | $Fx_{(N)}$ | $Fy_{(N)}$ | $Fz_{(N)}$ | $Mx_{(Nm)}$ | $My_{(Nm)}$ | $Mz_{(Nm)}$ |
|---|---|---|---|---|---|---|
| 2Phase-018 | 5 | 5 | 10 | 1 | 1 | 1 |

The ES-50 elevation stage is designed for applications with limited space conditions. ES-50 linear stage is driven by a 2-phase stepper motor and are equipped with two mechanical limit switches.

Two pre-loaded ball bearings assure smooth motion and high stiffness. The ES-50 is optionally available with a linear encoder with 50 nm resolution.

## KEY FEATURES

- Travel range 10 mm
- Uni-directional repeatability down to 0.1 µm
- Maximum speed 5 mm/sec
- Load capacity up to 1 kg
- Integrated mechanical limit switches
- Option: linear scale

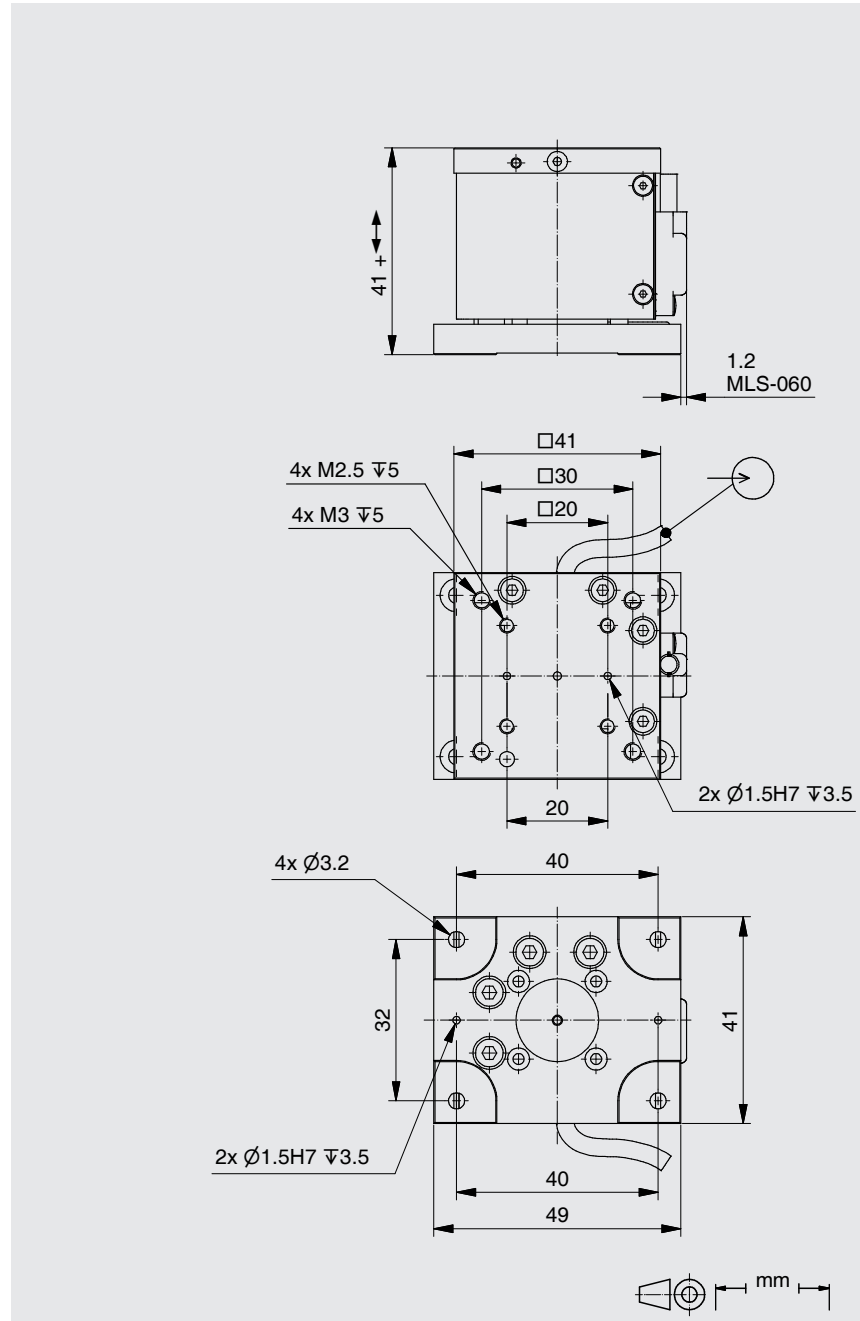
## TECHNICAL DATA

| | | |
|---|---|---|
| Travel range (mm) | 10 | |
| Straightness / Flatness (µm) | ± 4 | |
| Pitch (µrad) | ± 300 | |
| Yaw (µm) | ± 300 | |
| Weight (kg) | 1.1 | |
| Motor (Pitch 0.5 mm) | 2Phase-018 | |
| Linear scale | | LS-012 |
| Speed max. (mm/sec) | 5 | |
| Resolution calculated (µm) | 2.5 (FS) | 0.05 |
| Resolution typical (µm) | 0.5 | 0.1 |
| Bi-directional Repeatability (µm) | ± 4 | ± 0.3 |
| Uni-directional Repeatability (µm) | 1 | 0.2 |
| Nominal Current (A) | 0.24 | |
| Accuracy | on request | |
| Velocity range (mm/sec) | 0.001 ... 5 | |
| Material | | |

Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.



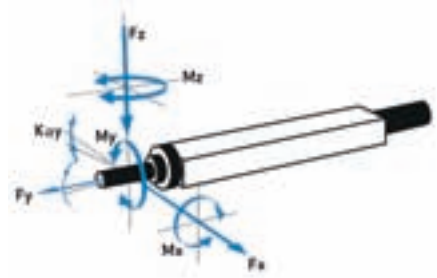
PI micos




| Order No. | 6606-9- | | | | | |
|---|---|---|---|---|---|---|
| 2Phase-018 | 2 | | | | | |
| 10 mm | 2 | 2 | | | | |
| without LS-012 | 0 | | 0 | | | |
| LS-012, Linear steel scale | 1 | | | | | |
| MLS-060 | 2 | | | 2 | | |
| Pitch 0.5 mm | 1 | | | | 1 | |

## FACTS

| Load characteristics | $F_{x(N)}$ | $F_{y(N)}$ | $F_{z(N)}$ |
|---|---|---|---|
| DC-B-013 | 10 | 500 | 10 |
| DC-B-031 | 10 | 200 | 10 |
| 2Phase-045 | 10 | 300 | 10 |




The MA-35 micro actuator was designed for applications with limited space conditions or where high precision actuators must be positioned decoupled from the drive. Compared to other pushers, the standard force is very high (200 N) and can be increased. The MA-35 actuators are motorized with DC gear-motor with encoder or 2-phase gear-motor combination or as direct drive DC with encoder or 2-phase stepper motor. The motorized drives can be combined with a ground preloaded re-circulating ball screw with 1 mm or 2 mm pitch. Depending on the requirement, the actuator can be configured for high pushing forces, high resolution or high speed. The travel range is 52 mm (2"). Two integrated mechanical or optional hall limit switches prevent damage from accidental over-travel. All critical elements are made of stainless steel.

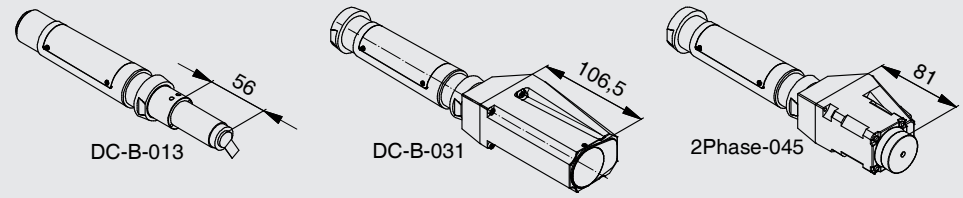
## KEY FEATURES

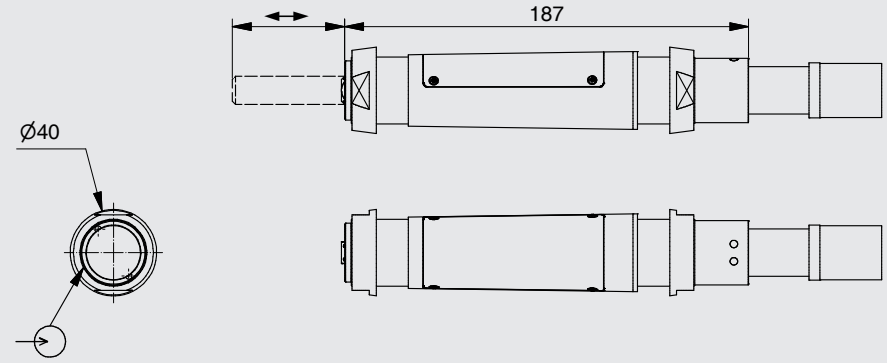
- Travel range 52 mm (2")
- Uni-directional repeatability down to 0.2 µm
- Maximum speed 100 mm/sec
- Force max. 500 N
- Integrated hall / mechanical limit switches
- High resolution

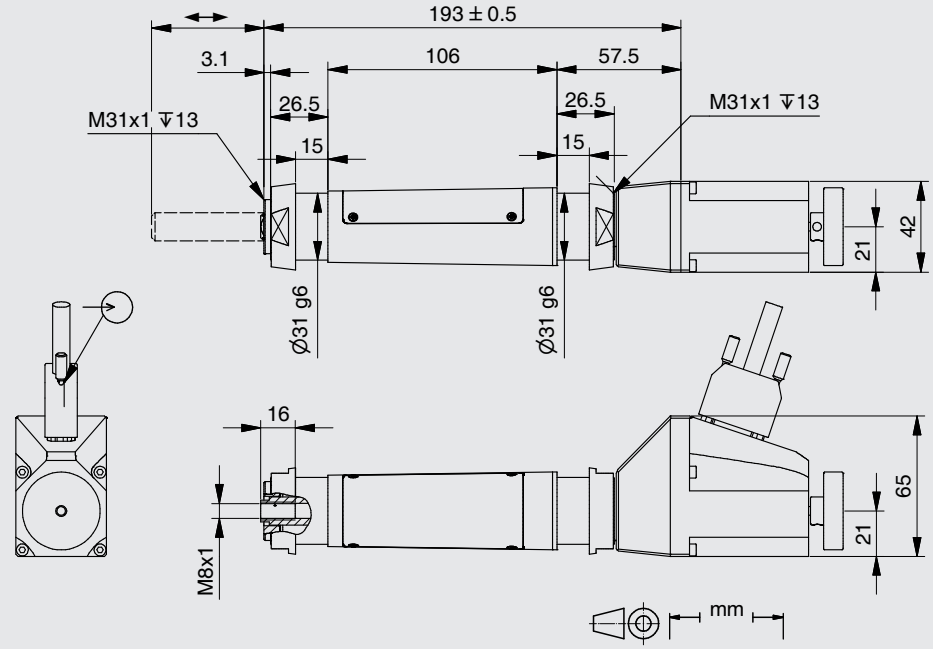
## TECHNICAL DATA

| | | | | | | |
|---|---|---|---|---|---|---|
| Travel range (mm) | 52 | | | | | |
| Weight (kg) | 2 | | | | | |
| Motor (Pitch 1 \| 2 mm) | DC-B-013 | | DC-B-031 | | 2Phase-045 | |
| Speed max. (mm/sec) | 2.5 | 5 | 50 | 90 | 25 | 45 |
| Resolution calculated (µm) | 0.0164726 | 0.0329 (RE) | 0.5 | 1 (RE) | 5 | 10 (FS) |
| Resolution typical (µm) | 0.1 | 0.2 | 0.5 | 1 | 0.1 | 0.2 |
| Bi-directional Repeatability (µm) | ± 1 | | ± 1 | | ± 1 | |
| Uni-directional Repeatability (µm) | 0.2 | | 0.5 | 1 | 0.2 | |
| Nominal Current (A) | 0.28 | | 1.96 | | 1.2 | |
| Voltage Range (V) | 24 | | 24 | | | |
| Accuracy | on request | | | | | |
| Velocity range (mm/sec) | 0.001 ... 100 | | | | | |
| Material | Stainless steel | | | | | |

Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.



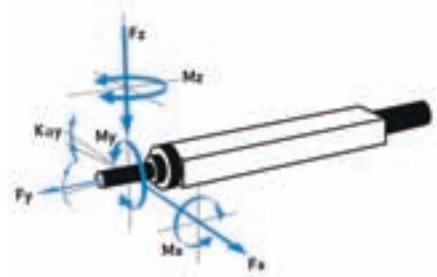

| Order No. | 5702-9- | | | 0 | |
|---|---|---|---|---|---|
| DC-B-013 | 1 | | | | |
| DC-B-031 | 2 | | | | |
| 2Phase-045 | 5 | | | | |
| 52 mm (2") | | 1 | | | |
| Pitch 1 mm / mechanical limit switches | | | | 0 | |
| Pitch 2 mm / mechanical limit switches | | | | 1 | |
| Pitch 1 mm / hall limit switches | | | | 2 | |
| Pitch 2 mm / hall limit switches | | | | 3 | |

# 4.142 Micro Pusher MP-20

NEW V

## FACTS

| Load characteristics | $F_{x(N)}$ | $F_{y(N)}$ | $F_{z(N)}$ |
|---|---|---|---|
| DC-B-010 | 1 | 125 | 1 |
| 2Phase-010 | 1 | 125 | 1 |
| 2Phase-017 | 1 | 30 | 1 |




The new MP-20 micro pusher is designed to motorize manual drives or mirror mounts and it is an ideal component for limited space conditions. Small light components such as mirrors and diodes can be directly mounted to the tip. The MP-20 micro pusher is equipped with a re-circulating ball screw for a quiet, precise and homogeneous smooth motion and has a non-rotating tip. The MP-20 micro pushers are offered with DC or 2-phase geared stepper motor combination or with a gearless 2-phase stepper motor. Round or flat ground inserts can be attached to the tip. The side-mounted design of model MP-20 B results in much shorter length.

## KEY FEATURES

- Travel range up to 72 mm (3")
- Uni-directional repeatability down to 0.3 µm
- Maximum speed 12 mm/sec
- Force max. 125 N
- Integrated hall limit switches

## TECHNICAL DATA

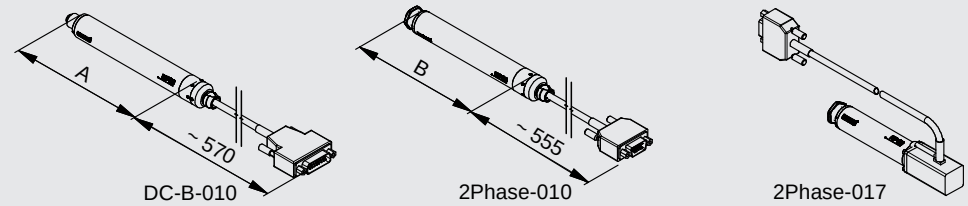
| Travel range (mm) | 13 | 26 | 52 | 76 |
|---|---|---|---|---|
| Motor (Pitch 1 mm) | DC-B-010 | 2Phase-010 | 2Phase-017 | |
| Speed max. (mm/sec) | 3.5 | 0.8 | 12 | |
| Resolution calculated (µm) | 0.0221608 (RE) | 0.5490171 (FS) | 5 (FS) | |
| Resolution typical (µm) | 0.1 | 0.1 | 0.1 | |
| Bi-directional Repeatability (µm) | ± 1 | ± 1 | ± 1 | |
| Uni-directional Repeatability (µm) | 0.3 | 0.3 | 0.3 | |
| Nominal Current (A) | 0.32 | 0.25 | 0.6 | |
| Voltage Range (V) | 12 | | | |
| Accuracy | on request | | | |
| Velocity range (mm/sec) | 0.001 ... 12 | | | |
| Material | Stainless steel | | | |

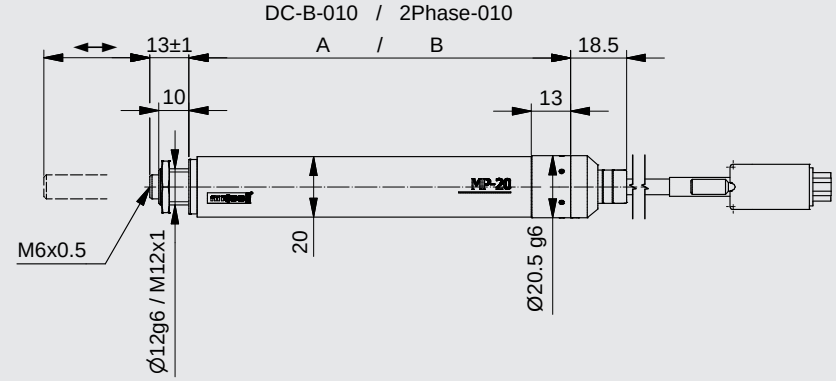
Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.

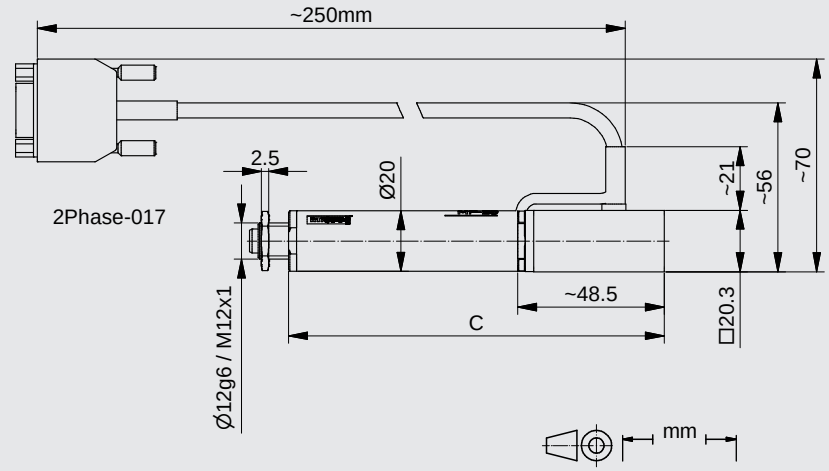


PI micos

| Travel (mm) | 13 | 26 | 52 | 76 |
|---|---|---|---|---|
| A | 133 | 146.5 | 171.5 | 196.5 |
| B | 126 | 139.5 | 164.5 | 189.5 |
| C | 124.5 | 137.7 | 162.7 | 187.7 |



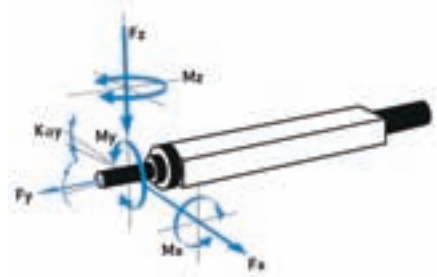

| Order No. | 5701-9- | | | 0 | 1 | |
|---|---|---|---|---|---|---|
| DC-B-010 | 1 | | | | | |
| 2Phase-010 | 2 | | | | | |
| 2Phase-017 | 3 | | | | | |
| | | | | | | |
| 13 mm (1/2") | | 1 | | | | |
| 26 mm (1") | | 2 | | | | |
| 52 mm (2") | | 3 | | | | |
| 72 mm (3") | | 4 | | | | |
| | | | | | | |
| 12g6 | | | 1 | | | |
| M12x1 | | | 2 | | | |

# 4.144 Micro Pusher MP-20 B

NEW

## FACTS

| Load characteristics | $Fx_{(N)}$ | $Fy_{(N)}$ | $Fz_{(N)}$ |
|---|---|---|---|
| DC-B-010 | 1 | 110 | 1 |
| 2Phase-010 | 1 | 110 | 1 |
| 2Phase-017 | 1 | 25 | 1 |





The new MP-20 B micro pusher is designed to motorize manual drives or mirror mounts and it is an ideal component for limited space conditions. Small light components such as mirrors and diodes can be directly mounted to the tip. The MP-20 B micro pusher is equipped with a re-circulating ball screw for a quiet, precise and homogeneous smooth motion and has a non-rotating tip. The MP-20 B micro pushers are offered with DC or 2-phase geared stepper motor combination or with a gearless 2-phase stepper motor. Round or flat ground inserts can be attached to the tip. The side-mounted design of model MP-20B results in much shorter length.

## KEY FEATURES

- Travel range up to 76 mm ( 3" )
- Uni directional repeatability down to 0.3 µm
- Max. speed 10 mm/sec
- Force 110 N
- Integrated limit switches (hall)

## TECHNICAL DATA

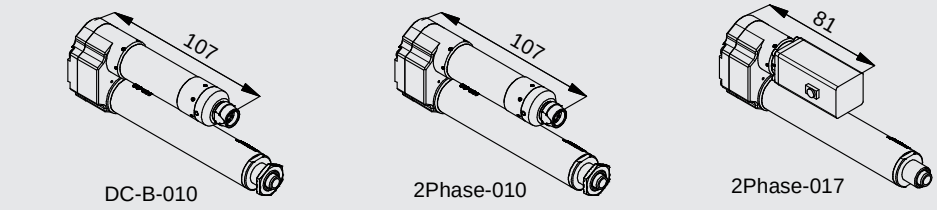
| Travel range (mm) | 13 | 26 | 52 | 76 |
|---|---|---|---|---|
| Motor (Pitch 1 mm) | DC-B-010 | 2Phase-010 | 2Phase-017 | |
| Speed max. (mm/sec) | 2.5 | 0.6 | 10 | |
| Resolution calculated (µm) | 0.0221608 | 0.5490171 (FS) | 5 (FS) | |
| Resolution typical (µm) | 0.2 | 0.2 | 0.2 | |
| Bi-directional Repeatability (µm) | ± 1.5 | ± 1.5 | ± 1.5 | |
| Uni-directional Repeatability (µm) | 0.5 | 0.5 | 0.5 | |
| Nominal Current (A) | 0.32 | 0.25 | 0.6 | |
| Voltage Range (V) | 12 | | | |
| | | | | |
| Accuracy | on request | | | |
| Velocity range (mm/sec) | 0.002 ... 10 | | | |
| Material | Stainless steel | | | |

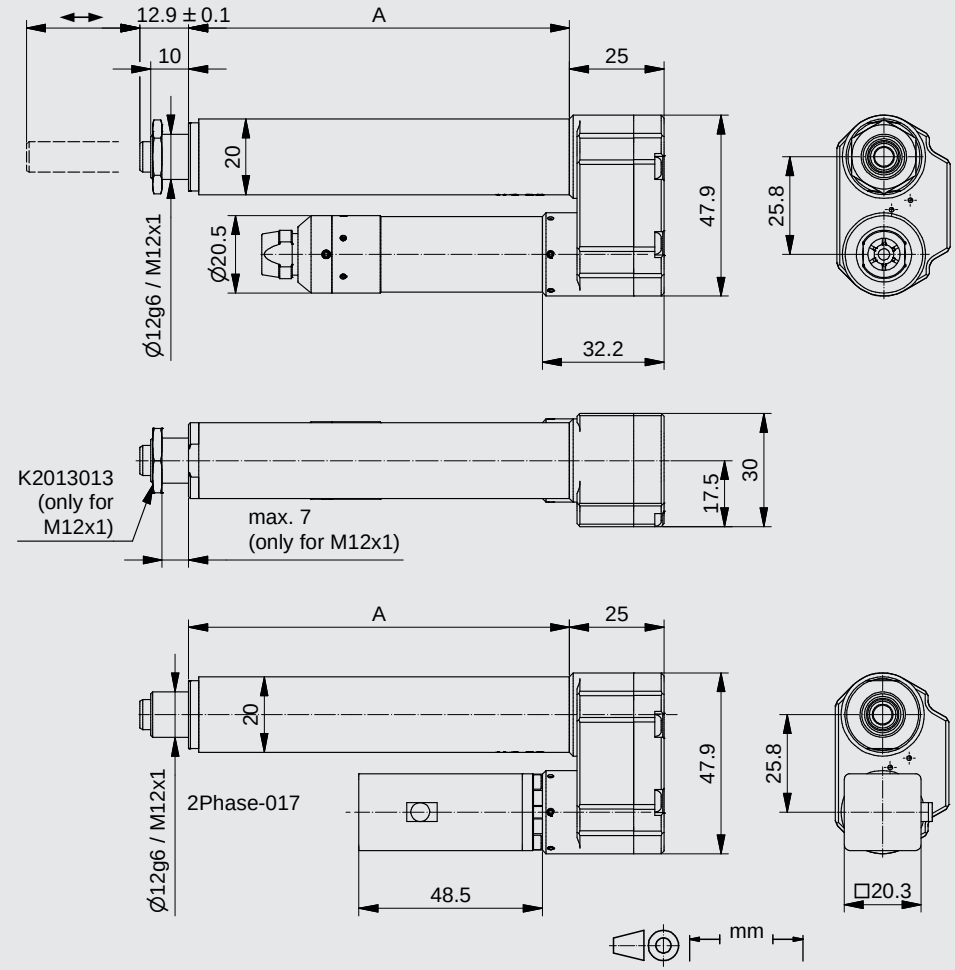
Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.



PI micos

| Travel (mm) | 13 | 26 | 52 | 76 |
|---|---|---|---|---|
| A | 63 | 76 | 101 | 126 |

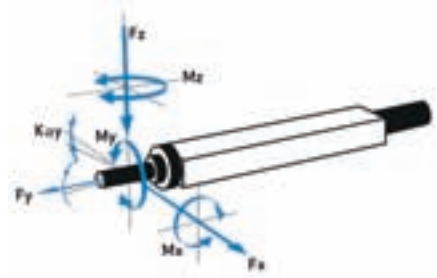



| Order No. | 5696-9- | | | 0 | 1 | |
|---|---|---|---|---|---|---|
| DC-B-010 | | 1 | | | | |
| 2Phase-010 | | 2 | | | | |
| 2Phase-017 | | 3 | | | | |
| 13 mm (1/2") | | | 1 | | | |
| 26 mm (1") | | | 2 | | | |
| 52 mm (2") | | | 3 | | | |
| 72 mm (3") | | | 4 | | | |
| 12g6 | | | | | | 1 |
| M12x1 | | | | | | 2 |

## FACTS

| Load characteristics | $Fx_{(N)}$ | $Fy_{(N)}$ | $Fz_{(N)}$ |
|---|---|---|---|
| DC-B-008 | 0 | 10 | 0 |
| 2Phase-005 | 0 | 10 | 0 |




The MP-15 micro pusher was specifically designed to motorize manual drives or mirror mounts. It is an ideal component for limited space conditions. The MP-15 micro pusher is equipped with a 0.5 mm fine-pitch screw thread resulting in a quiet and homogeneous smooth motion. The MP-15 is offered with DC or 2-phase geared stepper motor and is delivered with two integrated limit switches.

## KEY FEATURES

- Travel range up to 12.7 mm
- Uni-directional repeatability down to 0.5 µm
- Maximum speed 0.3 mm/sec
- Force max. 10 N
- Integrated hall limit switches

## TECHNICAL DATA

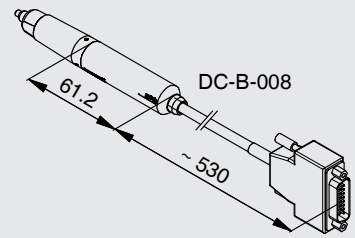
| | | |
|---|---|---|
| Travel range (mm) | 6 | 12.7 |
| Weight (kg) | 0.1 | 0.15 |

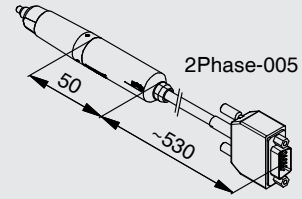
| Motor (Pitch 0.5 mm) | DC-B-008 | 2Phase-005 |
|---|---|---|
| Speed max. (mm/sec) | 0.3 | 0.1 |
| Resolution calculated (µm) | 0.0488281 (RE) | 0.0976563 (FS) |
| Resolution typical (µm) | 0.2 | 0.2 |
| Bi-directional Repeatability (µm) | ± 10 | ± 10 |
| Uni-directional Repeatability (µm) | 0.5 | 0.5 |
| Nominal Current (A) | 0.08 | 0.25 |
| Voltage Range (V) | 12 | |

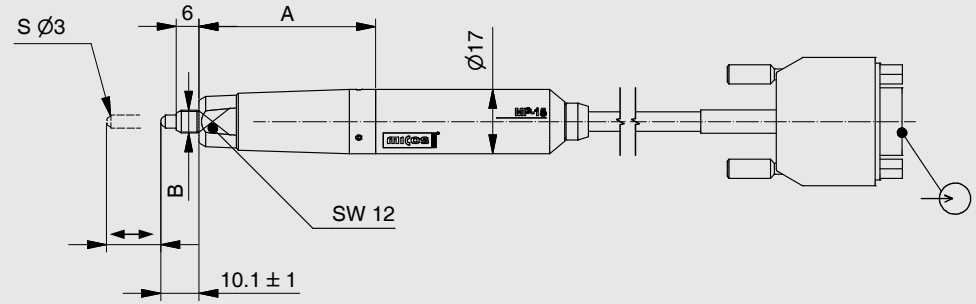
| | |
|---|---|
| Accuracy | on request |
| Velocity range (mm/sec) | 0.001 ... 0.3 |
| Material | Aluminum, black anodized |

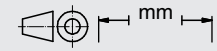
Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.

| Travel (mm) | 6 | 12.7 |
|---|---|---|
| A | 33.5 | 47 |




| Order No. | 5663-9- | | | 0 | | |
|---|---|---|---|---|---|---|
| DC-B-008 | 1 | | | | | |
| 2Phase-005 | 2 | | | | | |
| 6 mm | | 1 | | | | |
| 12.7 mm | | 2 | | | | |
| HLS-010, Hall limit switches | | | 1 | | | |
| Mounting surface B=Ø6 mm | | | | | 1 | |
| Mounting surface B=Ø9.5 mm | | | | | 2 | |
| Mounting surface B=M8x0.35 mm | | | | | 3 | |
| Mounting surface B=M6x0.5 mm | | | | | 4 | |


## KEY FEATURES

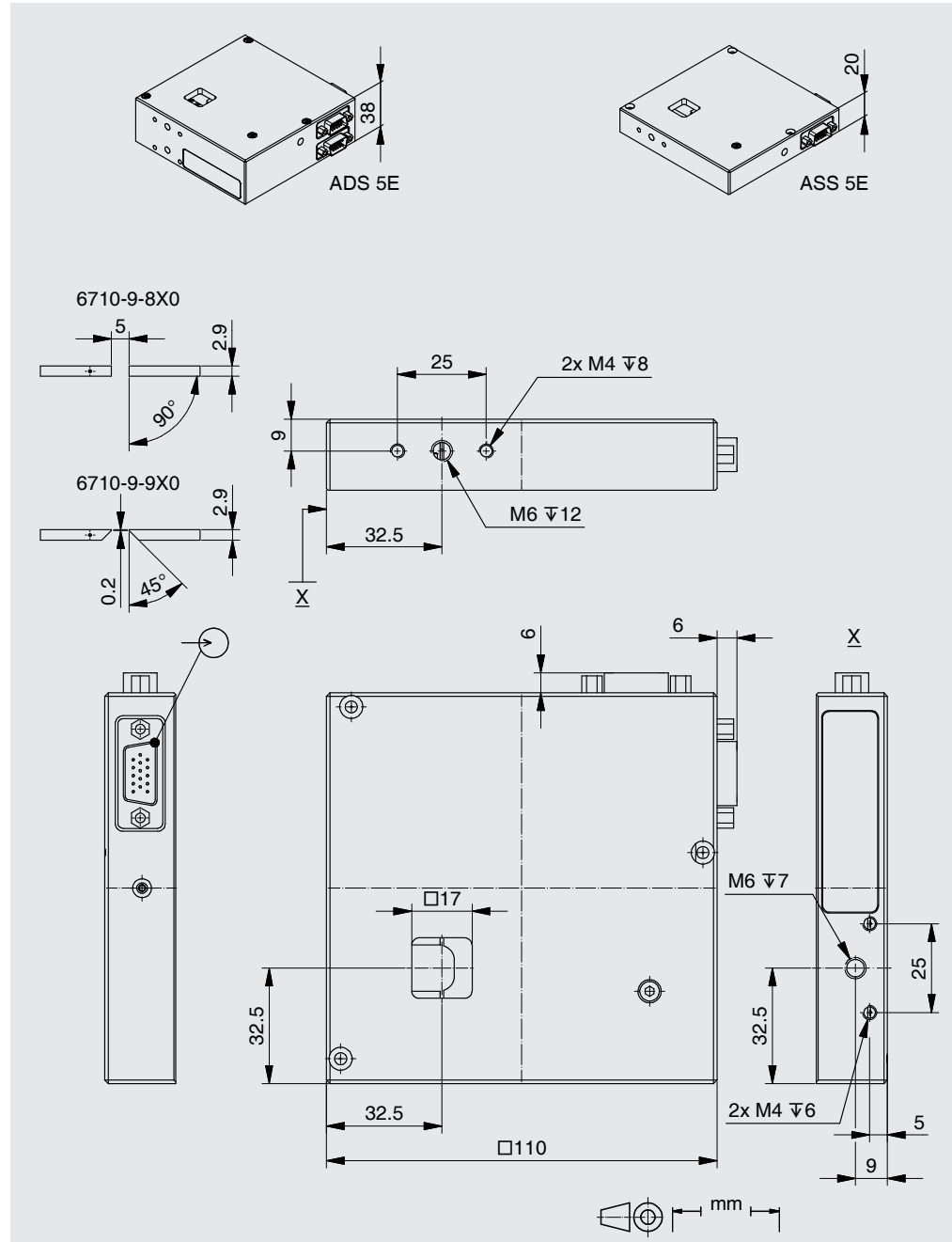
- Uni-directional repeatability down to 0.1 µm
- Maximum speed 0.8 mm/sec
- Integrated mechanical limit switches
- Maximum aperture 5 mm
- High resolution

The ASS 5E slit and ADS 5E cross slits are high quality instruments for industrial and research applications, specifically in the areas of laser and radiology applications. The slits are provided with a DC or stepper motor driven apertures with a maximum opening of 5 mm. With an aperture of 1 mm, the slit can be positioned asymmetrically by ±2.5 mm from the optical axis. The slits are standard made from aluminum alloy or stainless steel. For high energy radiation, slits up to 3 mm thickness made from tungsten, titanium or stainless steel are optionally available. All slits are calibrated in pairs and lobed. High-precision, selected preloaded recirculating ball screws guarantee a parallel opening and closing of the slits. To avoid collision or damage, the slits are protected by a safety clutch and a limit switch. By combining two single slits, one cross slit can be easily configured. Slit jaws are not included in the standard product and must be ordered separately. The slit yaws are listed on page 8.239.

## TECHNICAL DATA

| | | | | |
|---|---|---|---|---|
| Travel range (mm) | 5 | | | |
| Weight (kg) | 0.4 | | | |
| Motor (Pitch 0.25 mm) | DC-B-010 | | 2Phase-010 | |
| Speed max. (mm/sec) | 0.4 | 0.8 | 0.1 | 0.2 |
| Resolution calculated (µm) | 0.0027701 | 0.0055402 (RE) | 0.0686271409 | 0.1372543 (FS) |
| Resolution typical (µm) | 0.2 | | 0.2 | |
| Bi-directional Repeatability (µm) | ± 4 | | ± 4 | |
| Uni-directional Repeatability (µm) | 0.2 | | 0.2 | 0.1 |
| Nominal Current (A) | 0.32 | | 0.25 | |
| Voltage Range (V) | 12 | | | |
| Reduction belt | 1:2 (open/close) \| 1:1 (parallel) | | | |
| Accuracy | on request | | | |
| Velocity range (mm/sec) | 0.001 ... 0.8 | | | |
| Material | Aluminum, black anodized | | | |

Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.



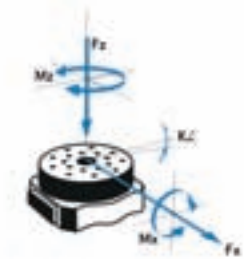

| Order No. | 6710-9- | | | 0 |
|---|---|---|---|---|
| DC-B-010 | 1 | | | |
| 2Phase-010 | 2 | | | |
| Single Slide (ASS 5E) | 1 | | | |
| Double Slide (ADS 5E) | 2 | | | |

# ROTATION STAGES

# 5.152 Ultra Precision Rotation Stage UPR-270 AIR

## FACTS

| Load characteristics | $Fx_{(N)}$ | $Fz_{(N)}$ | $Mz_{(Nm)}$ | $Mz\ Peak_{(Nm)}$ | $k+x_{(\mu rad/Nm)}$ |
|---|---|---|---|---|---|
| TM-050 | 100 | 400 | 4.8 | 10 | 30 |


The UPR-270 AIR ultra-precision rotation stage was developed for dynamic positioning with a maximum of precision. The high precision air-bearing insure excellent flatness, wobble and accuracy values. All UPR-270 AIR rotation stages are directly driven by a torque motor. The UPR-270 AIR is equipped with an angular scale system and a reference switch. Standard resolutions of up to 0.00002° can be achieved.

## KEY FEATURES

- High-precision air bearings
- Torque motor
- Uni-directional repeatability down to 0.00003 °
- Flatness and eccentricity ± 0.07 µm
- Wobble ± 1.25 µrad
- Maximum speed 360 °/sec
- Load capacity up to 40 kg (center mounted on top of the platform)
- Integrated inductive reference switch
- Integrated angular scale
- Free center hole 35 mm diameter
- Optionally double head system for higher accuracy

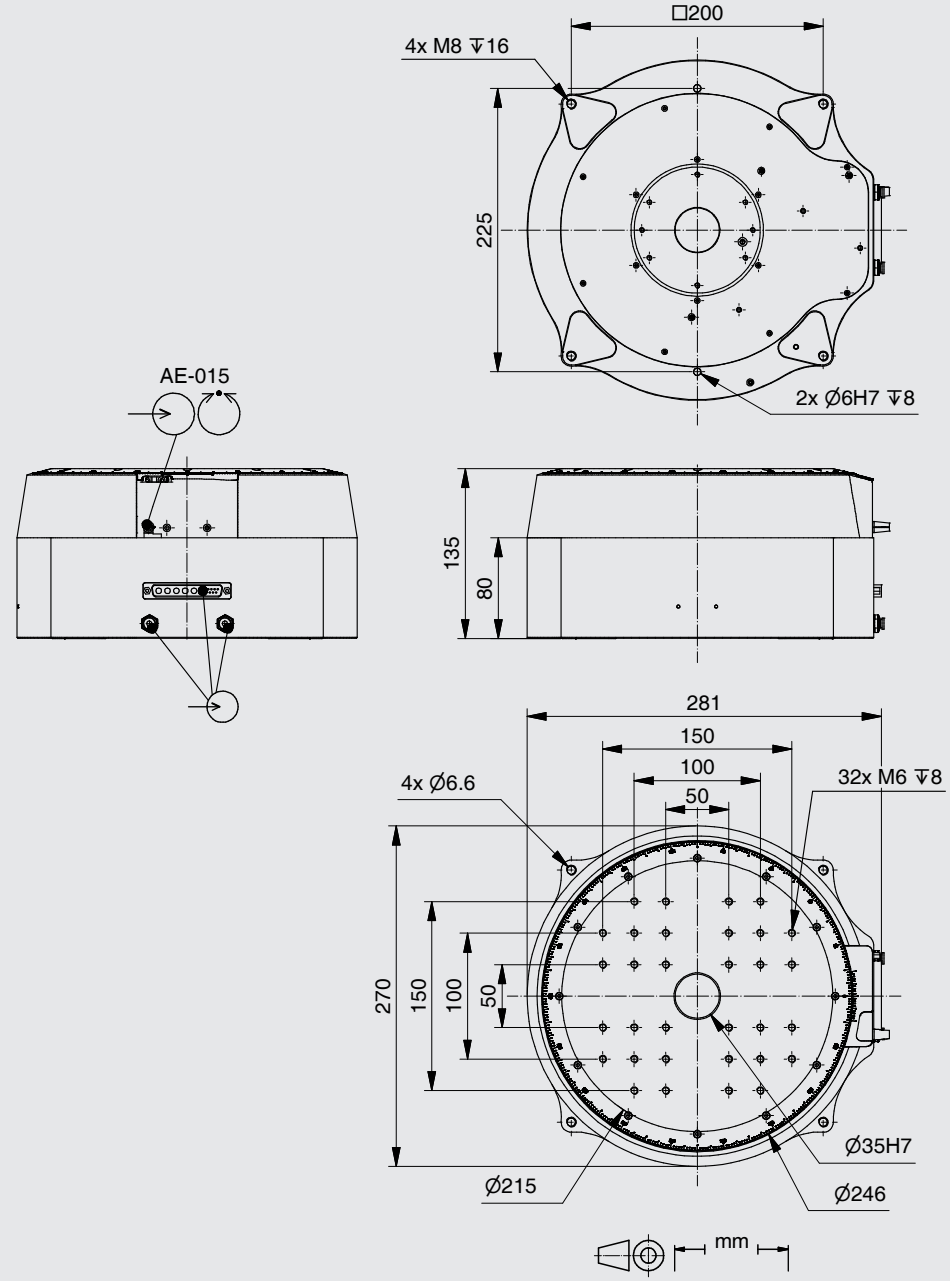
## TECHNICAL DATA

| | | |
|---|---|---|
| Travel range (°) | 360, endless | |
| Flatness (Bearings) (µm) | ± 0.05 | |
| Eccentricity (Bearings) (µm) | ± 0.07 | |
| Wobble (Bearings) (µrad) | ± 1.25 | |
| Weight (kg) | 33 | |
| Motor | TM-050 | |
| Linear scale | | AE-015 |
| Speed max. (°/sec) | 360 | |
| Resolution calculated (°) | | 0.00001 |
| Resolution typical (°) | | 0.00002 |
| Bi-directional Repeatability (°) | | ± 0.00005 |
| Uni-directional Repeatability (°) | | 0.00003 |
| Nominal Current (A) | 2 | |
| Accuracy | on request | |
| Velocity range (°/sec) | 0.0005 ... 360 | |
| Material | Aluminum, black anodized / stainless steel (rotary platform) | |

Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.



PI micos




| Order No. | 6829-9- | | 0 | |
|---|---|---|---|---|
| TM-050 | 1 | | | |
| AE-015, Angular scale | 0 | | | |

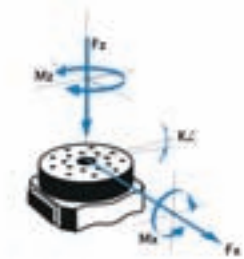
# 5.154 Ultra Precision Rotation Stage UPR-270

## FACTS

| Load characteristics | $Fx_{(N)}$ | $Fz_{(N)}$ | $Mz_{(Nm)}$ | $Mz\ Peak_{(Nm)}$ | $k+x_{(\mu rad/Nm)}$ |
|---|---|---|---|---|---|
| TM-050 | 200 | 400 | 4.5 | 10 | 8 |


## KEY FEATURES

- High-precision bearings
- Torque motor
- Uni-directional repeatability down to 0.00007 °
- Flatness and eccentricity ± 1 µm
- Wobble ± 15 µrad
- Maximum speed 360 °/sec
- Load capacity up to 40 kg (center mounted on top of the platform)
- Integrated inductive reference switch
- Free center hole 60 mm diameter
- Integrated angular scale
- Optionally double head system for higher accuracy



The UPR-270 ultra-precision rotation stages are mainly utilized in the field of semiconductor technology, for positioning systems of laser treatment, robotics and synchrotron applications and high load applications. All UPR rotation stages are directly driven by a torque motor, eliminating the need for mechanical transmissions. This results in better positioning accuracies, higher acceleration and speed. Calibrated paired angular ball bearings guarantee a high central load capacity without breakdown torque. The UPR rotation stages are equipped with a high resolution angular scale and with an inductive reference switch.

## TECHNICAL DATA

| | |
|---|---|
| Travel range (°) | 360, endless |
| Flatness (Bearings) (µm) | ± 1 |
| Eccentricity (Bearings) (µm) | ± 2.5 |
| Wobble (Bearings) (µrad) | ± 15 |
| Weight (kg) | 29 |

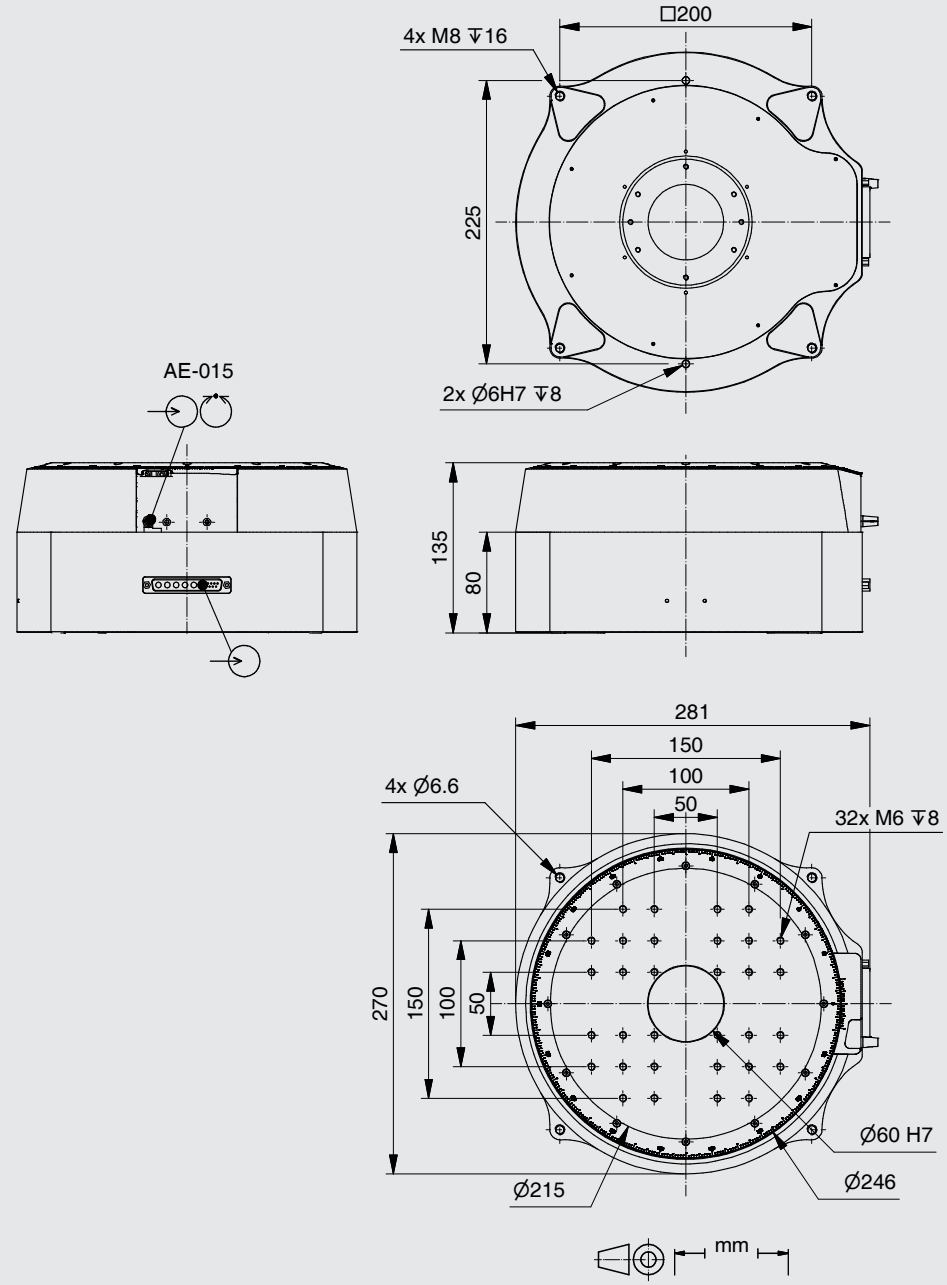
| | | |
|---|---|---|
| Motor | TM-050 | |
| Linear scale | | AE-015 |
| Speed max. (°/sec) | 360 | |
| Resolution calculated (°) | | 0.00001 |
| Resolution typical (°) | | 0.00005 |
| Bi-directional Repeatability (°) | | ± 0.0001 |
| Uni-directional Repeatability (°) | | 0.00007 |
| Nominal Current (A) | 2 | |

| | |
|---|---|
| Accuracy | on request |
| Velocity range (°/sec) | 0.001 ... 360 |
| Material | Aluminum, black anodized / stainless steel (rotary platform) |

Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.



PI micos

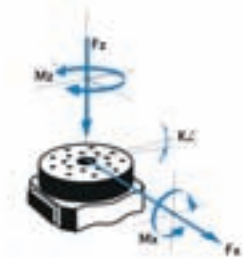



| Order No. | 6814-9- | | 0 | |
|---|---|---|---|---|
| TM-050 | 1 | | | |
| AE-015, Angular Scale | 0 | | | |

# 5.156 Ultra Precision Rotation Stage UPR-160 AIR

## FACTS

| Load characteristics | $Fx_{(N)}$ | $Fz_{(N)}$ | $Mz_{(Nm)}$ | $Mz\ Peak_{(Nm)}$ | $k+x_{(\mu rad/Nm)}$ |
|---|---|---|---|---|---|
| TM-010 | 40 | 200 | 0.7 | 2 | 40 |



The UPR-160 AIR ultra-precision rotation stage was developed for maximum precision dynamic positioning applications. The high precision air-bearing insure excellent flatness, wobble and accuracy values. All UPR-160 AIR rotation stages are directly driven by a torque motor. The UPR-160 AIR is equipped with an angular scale system and reference switches. Standard resolutions of up to 0.00004° can be achieved.

## KEY FEATURES

- High precision air bearings
- Torque motor
- Uni-directional repeatability down to 0.00005 °
- Flatness and eccentricity ± 0.1 µm
- Wobble ± 1.25 µrad
- Maximum speed 360 °/sec
- Load capacity up to 20 kg (center mounted, on top of the platform )
- Integrated inductive reference switch
- Free center hole 35 mm diameter
- Integrated angular scale

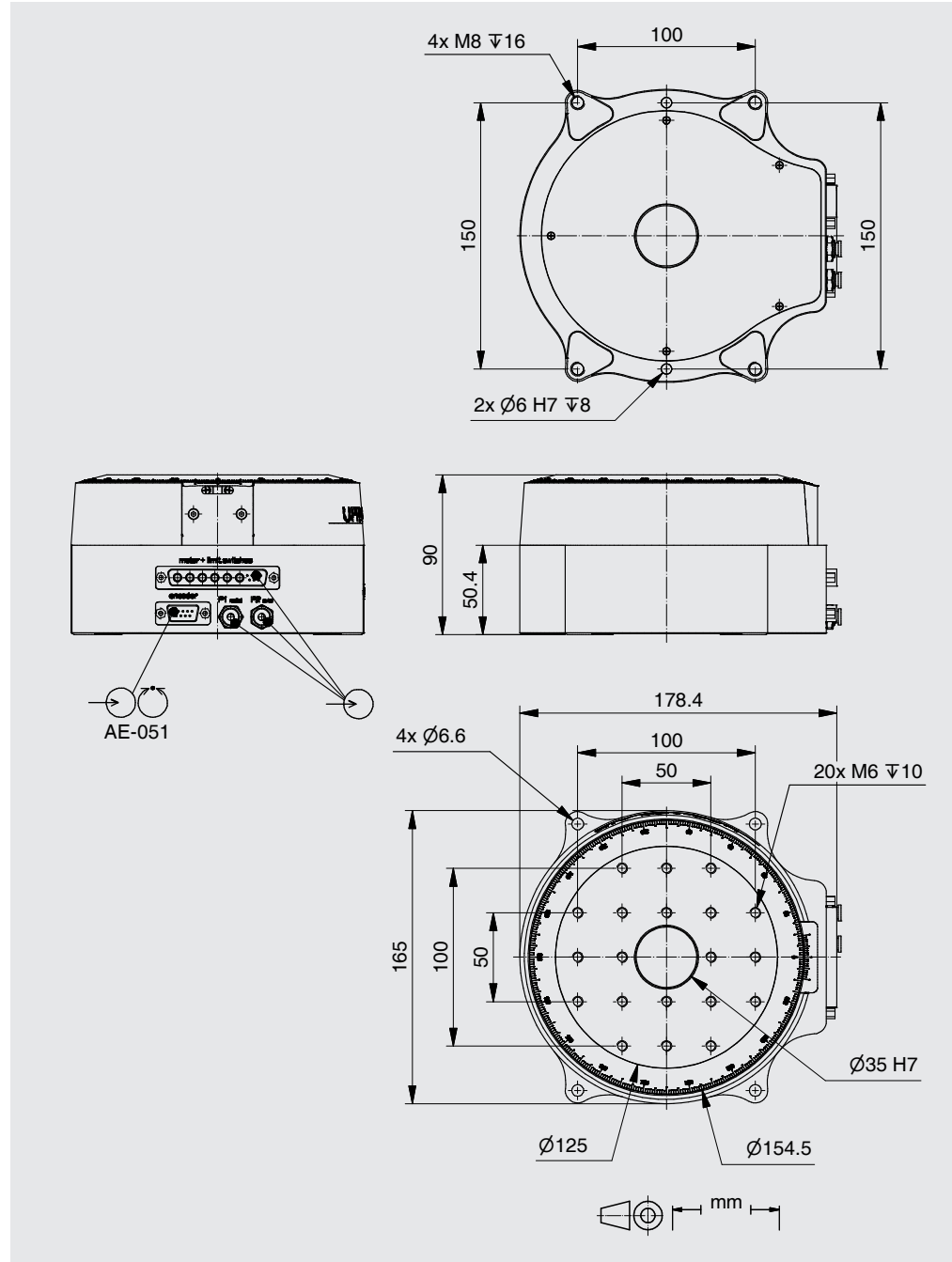
## TECHNICAL DATA

| | |
|---|---|
| Travel range (°) | 360, endless |
| Flatness (Bearings) (µm) | ± 0.05 |
| Eccentricity (Bearings) (µm) | ± 0.1 |
| Wobble (Bearings) (µrad) | ± 1.25 |
| Weight (kg) | 7.5 |

| Motor | TM-010 | |
|---|---|---|
| Linear scale | | AE-051 |
| Speed max. (°/sec) | 360 | |
| Resolution calculated (°) | | 0.00002 |
| Resolution typical (°) | | 0.00004 |
| Bi-directional Repeatability (°) | | ± 0.00008 |
| Uni-directional Repeatability (°) | | 0.00005 |
| Nominal Current (A) | 2.4 | |

| | |
|---|---|
| Accuracy | on request |
| Velocity range (°/sec) | 0.0005 ... 360 |
| Material | Aluminum, black anodized / stainless steel (rotary platform) |

Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.

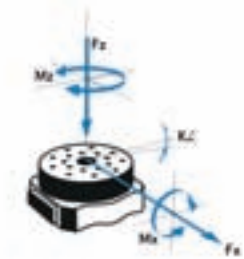



| Order No. | 6826-9- | | 0 | |
|---|---|---|---|---|
| TM-010 | 1 | | | |
| AE-051, Angular Scale | 0 | | | |

# 5.158 Ultra Precision Rotation Stage UPR-160

## FACTS

| Load characteristics | $Fx_{(N)}$ | $Fz_{(N)}$ | $Mz_{(Nm)}$ | $Mz\ Peak_{(Nm)}$ | $k+x_{(\mu rad/Nm)}$ |
|---|---|---|---|---|---|
| TM-010 | 100 | 200 | 0.5 | 2 | 16 |



The UPR-160 ultra-precision rotation stages are mainly utilized in the field of semiconductor technology, for positioning of laser treatment systems, robotics and synchrotron applications for rather fast applications. All UPR rotation stages are directly driven by a torque motor, eliminating the need for mechanical transmissions. This results in better positioning accuracies, higher acceleration and speed. Calibrated, paired angular ball bearings guarantee a high central load capacity without breakdown torque. The UPR-160 rotation stages are equipped with a high resolution angular scale and with inductive limit switches.

## KEY FEATURES

- High-precision bearings
- Torque motor
- Uni-directional repeatability down to 0.00008 °
- Flatness and eccentricity ± 3 µm
- Wobble ± 25 µrad
- Maximum speed 360 °/sec
- Load capacity up to 20 kg (center mounted, on top of the platform)
- Integrated inductive reference switch
- Free center hole 35 mm diameter
- Integrated angular scale

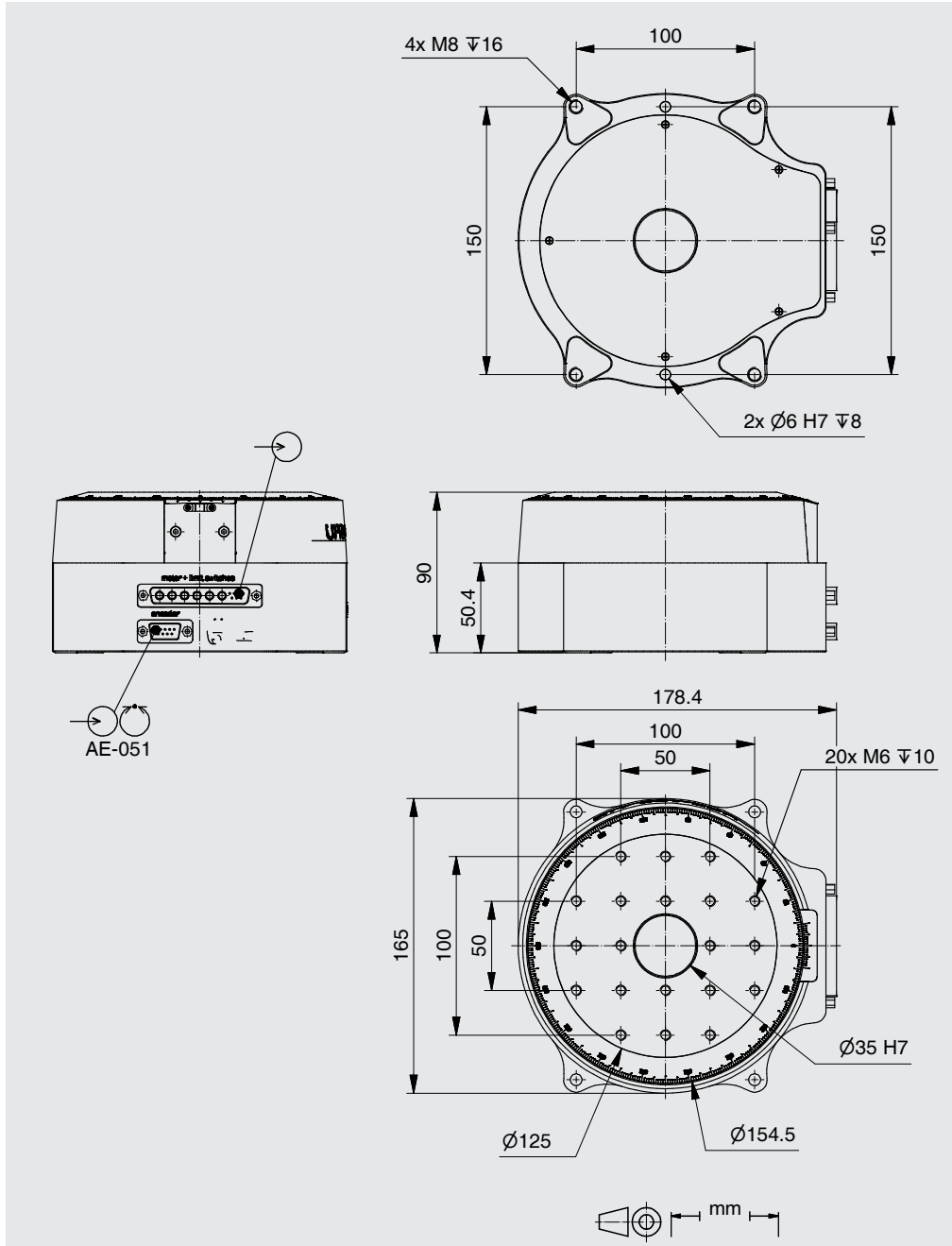
## TECHNICAL DATA

| | |
|---|---|
| Travel range (°) | 360, endless |
| Flatness (Bearings) (µm) | ± 1 |
| Eccentricity (Bearings) (µm) | ± 3 |
| Wobble (Bearings) (µrad) | ± 25 |
| Weight (kg) | 6 |

| Motor | TM-010 | |
|---|---|---|
| Linear scale | | AE-051 |
| Speed max. (°/sec) | 360 | |
| Resolution calculated (°) | | 0.00002 |
| Resolution typical (°) | | 0.00008 |
| Bi-directional Repeatability (°) | | ± 0.0001 |
| Uni-directional Repeatability (°) | | 0.00008 |
| Nominal Current (A) | 2.4 | |

| | |
|---|---|
| Accuracy | on request |
| Velocity range (°/sec) | 0.001 ... 360 |
| Material | Aluminum, black anodized / stainless steel (rotary platform) |

Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.

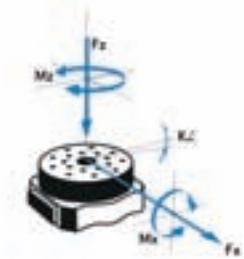



| Order No. | 6811-9- | | 0 | |
|---|---|---|---|---|
| TM-010 | 1 | | | |
| AE-051, Angular Scale | 0 | | | |

# 5.160 Ultra Precision Rotation Stage UPR-120 AIR

## FACTS

| Load characteristics | $Fx_{(N)}$ | $Fz_{(N)}$ | $Mz_{(Nm)}$ | $Mz\ Peak_{(Nm)}$ | $k+x_{(\mu rad/Nm)}$ |
|---|---|---|---|---|---|
| TM-012 | 40 | 200 | 0.7 | 2 | 40 |




The UPR-120 AIR ultra-precision rotation stage was developed for dynamic positioning with a maximum precision. Due to the use of a high precision air-bearing, the stage achieves excellent values for flatness, wobble and accuracy. All UPR-120 AIR rotation stages are directly driven by a torque motor. The UPR-120 AIR is equipped with an angular scale system and an optical reference switch. For higher positioning accuracies or resolutions, the UPR-120 AIR can be offered with different angular scales or even a double head scale system.

## KEY FEATURES

- High-precision air bearings
- Torque motor
- Uni-directional repeatability down to 0.00005 °
- Flatness and eccentricity ± 0.1µm
- Wobble ± 1.25 µrad
- Maximum speed 360 °/sec
- Load capacity up to 20 kg (center mounted, on top of the platform)
- Integrated optical reference switch
- Free center hole 35 mm diameter
- Integrated angular scale
- Optionally double head system for higher accuracy

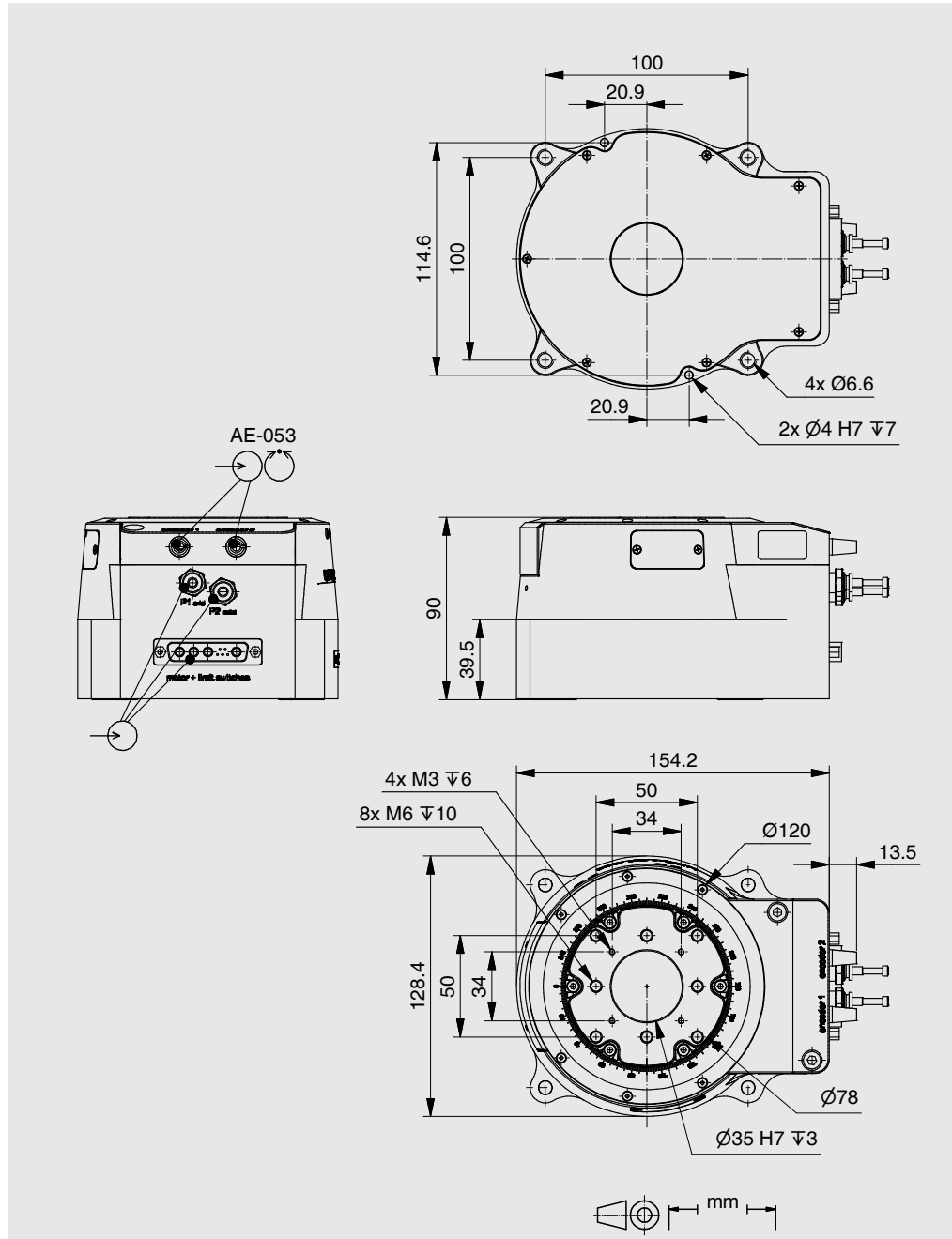
## TECHNICAL DATA

| | |
|---|---|
| Travel range (°) | 360, endless |
| Flatness (Bearings) (µm) | ± 0.05 |
| Eccentricity (Bearings) (µm) | ± 0.1 |
| Wobble (Bearings) (µrad) | ± 1.25 |

| | | |
|---|---|---|
| Motor | TM-012 | |
| Linear scale | | AE-053 |
| Speed max. (°/sec) | 360 | |
| Resolution calculated (°) | | 0.00002 |
| Resolution typical (°) | | 0.00004 |
| Bi-directional Repeatability (°) | | ± 0.00008 |
| Uni-directional Repeatability (°) | | 0.00005 |
| Nominal Current (A) | 2.4 | |

| | |
|---|---|
| Accuracy | on request |
| Velocity range (°/sec) | 0.0005 ... 360 |
| Material | Aluminum, black anodized / stainless steel (rotary platform) |

Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.




| Order No. | 6824-9- | | 1 | | | 0 |
|---|---|---|---|---|---|---|
| TM-012 | | 1 | | | | |
| AE-053, Angular scale | | 1 | | | | |
| OLS-012, Optical switches | | 3 | | | | |

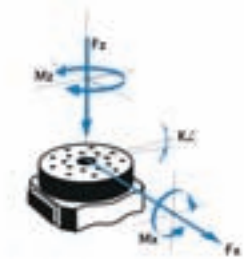
# 5.162 Ultra Precision Rotation Stage UPR-120

## FACTS

| Load characteristics | $Fx_{(N)}$ | $Fz_{(N)}$ | $Mz_{(Nm)}$ | $Mz\ Peak_{(Nm)}$ | $k+x_{(\mu rad/Nm)}$ |
|---|---|---|---|---|---|
| TM-012 | 100 | 200 | 0.5 | 2 | 16 |

## KEY FEATURES

- High-precision bearings
- Torque motor
- Uni-directional repeatability down to 0.00008 °
- Flatness and eccentricity ± 3 µm
- Wobble ± 25 µrad
- Maximum speed 360 °/sec
- Load capacity up to 20 kg (center mounted, on top of the platform)
- Integrated optical reference switch
- Free center hole 35 mm diameter
- Integrated angular scale
- Optionally double head system for higher accuracy



The UPR-120 ultra-precision rotation stage was developed for fast and accurate positioning applications. This stage is mainly used in the field of semiconductor technology, for positioning of laser treatment systems, robotics and synchrotron applications. All rotation stages from the UPR series are directly driven by a torque motor, eliminating the need for mechanical transmissions. This results in better positioning accuracy, higher acceleration and speed. Calibrated cross roller bearings guarantee a high central load capacity without breakdown torque. The UPR-120 rotation stages are equipped with a high resolution angular scale and with a contactless limit switch.

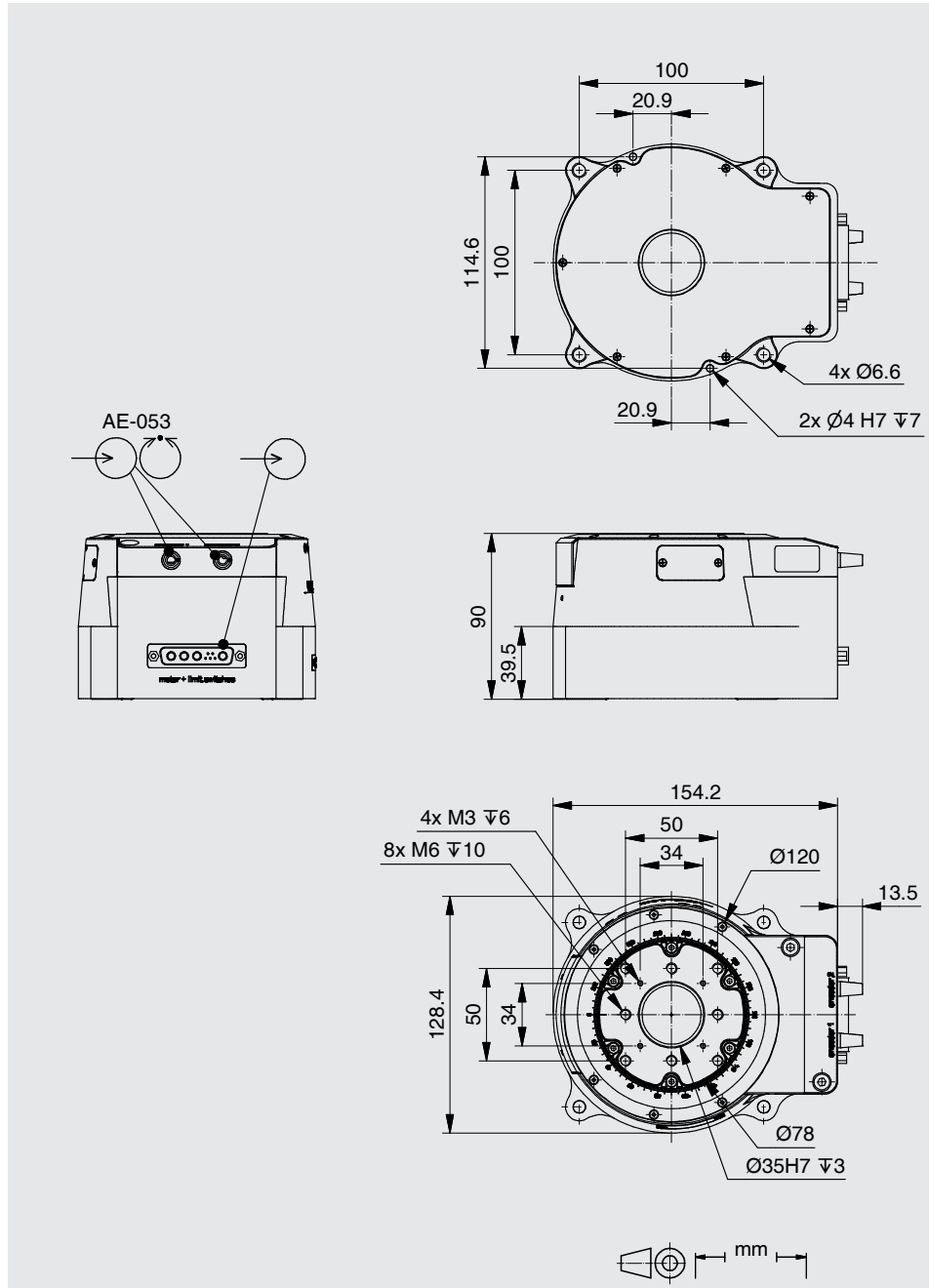
## TECHNICAL DATA

| | |
|---|---|
| Travel range (°) | 360, endless |
| Flatness (Bearings) (µm) | ± 1 |
| Eccentricity (Bearings) (µm) | ± 3 |
| Wobble (Bearings) (µrad) | ± 25 |
| Weight (kg) | 6 |

| | | |
|---|---|---|
| Motor | TM-012 | |
| Linear scale | | AE-053 |
| Speed max. (°/sec) | 360 | |
| Resolution calculated (°) | 0.00002 | 0.00002 |
| Resolution typical (°) | 0.00008 | 0.00008 |
| Bi-directional Repeatability (°) | ± 0.0001 | ± 0.0001 |
| Uni-directional Repeatability (°) | 0.00008 | 0.00008 |
| Nominal Current (A) | 2.4 | |

| | |
|---|---|
| Accuracy | on request |
| Velocity range (°/sec) | 0.001 ... 360 |
| Material | Aluminum, black anodized / stainless steel (rotary platform) |

Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.

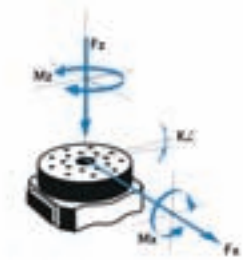



| Order No. | 6808-9- | | 1 | | | 0 |
|---|---|---|---|---|---|---|
| TM-012 | 1 | | | | | |
| AE-053, Angular scale | 1 | | | | | |
| OLS-012, Optical switches | 3 | | | | | |

# 5.164 Ultra Precision Rotation Stage UPR-100 AIR

## FACTS

| Load characteristics | $Fx_{(N)}$ | $Fz_{(N)}$ | $Mx_{(Nm)}$ | $Mz_{(Nm)}$ | $Mz\ Peak_{(Nm)}$ |
|---|---|---|---|---|---|
| TM-030 | 7.5 | 15 | 0.05 | 0.25 | 0.5 |



The UPR-100 AIR ultra-precision rotation stages are developed for maximum precision dynamic positioning applications. Due to the high precision air-bearing the stage can achieve excellent values for flatness, wobble and accuracy. All UPR-100 AIR rotation stages are directly driven by a torque motor. The UPR-100 AIR is equipped with an angular scale system and reference switches. The standard resolution is 0.00004°.

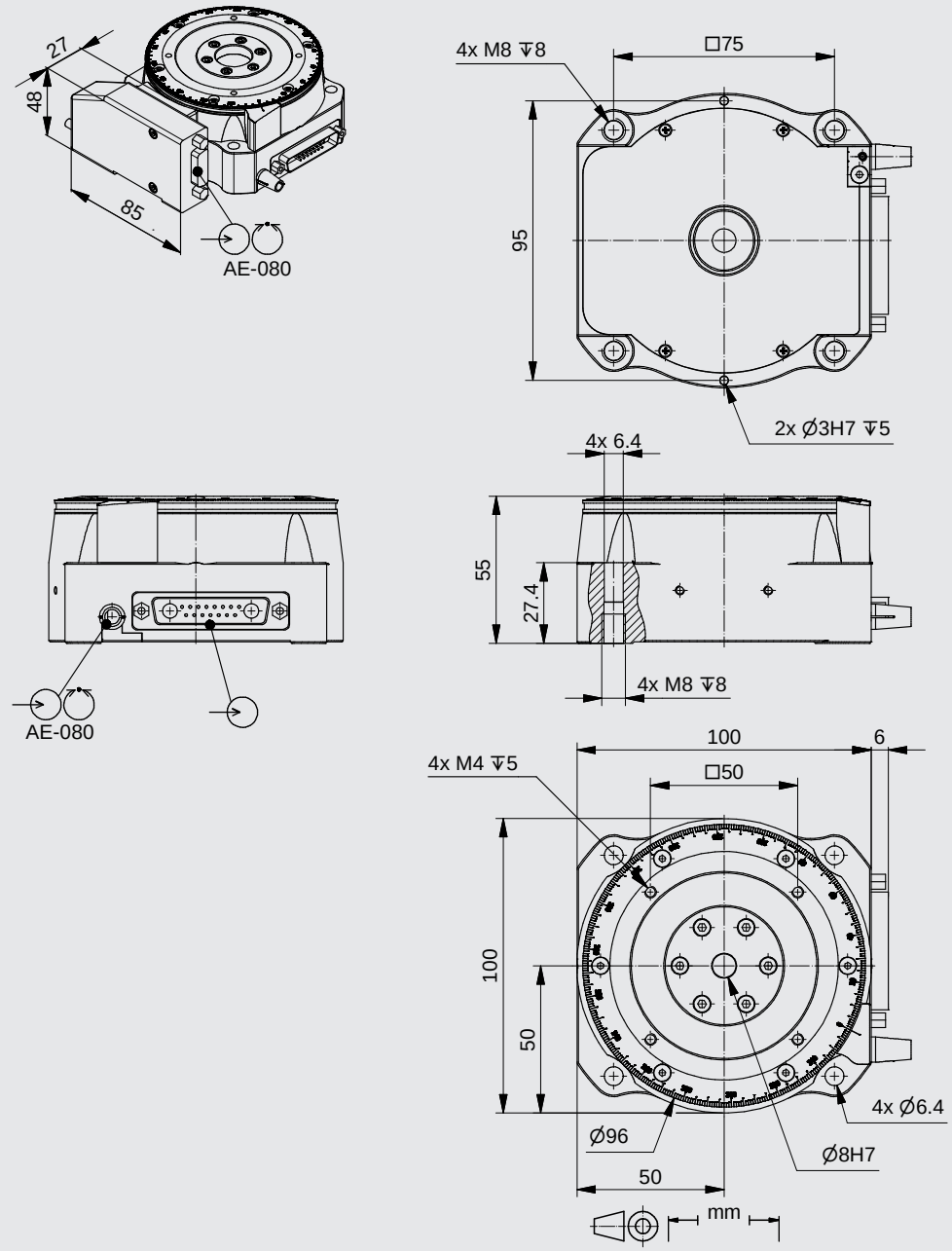
## KEY FEATURES

- High-precision air bearings
- Torque motor
- Uni-directional repeatability down to 0.00005 °
- Flatness and eccentricity ± 0.2 µm
- Wobble ± 5 µrad
- Maximum speed 360 °/sec
- Load capacity up to 1.5 kg (center mounted, on top of the platform)
- Integrated reference mark (encoder index)
- Free center hole 8 mm diameter
- Integrated angular scale

## TECHNICAL DATA

| | | |
|---|---|---|
| Travel range (°) | 360, endless | |
| Flatness (Bearings) (µm) | ± 0.1 | |
| Eccentricity (Bearings) (µm) | ± 0.2 | |
| Wobble (Bearings) (µrad) | ± 5 | |
| Weight (kg) | 1.2 | |
| Motor | TM-030 | |
| Linear scale | | AE-080 |
| Speed max. (°/sec) | 360 | |
| Resolution calculated (°) | | 0.00002 |
| Resolution typical (°) | | 0.00004 |
| Bi-directional Repeatability (°) | | ± 0.00008 |
| Uni-directional Repeatability (°) | | 0.00005 |
| Nominal Current (A) | 1.2 | |
| Accuracy | on request | |
| Velocity range (°/sec) | 0.0005 ... 360 | |
| Material | Aluminum, black anodized | |

Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.

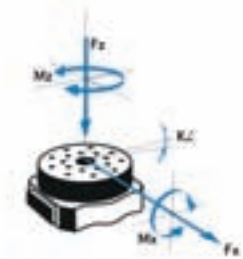



| Order No. | 6823-9- | | 1 | | |
|---|---|---|---|---|---|
| TM-030 | 1 | | | | |
| AE-080, Angular scale | 1 | | | | |
| HLS-010, Hall switches | 1 | | | | |

# 5.166 Ultra Precision Rotation Stage UPR-100

## FACTS

| Load characteristics | $Fx_{(N)}$ | $Fz_{(N)}$ | $Mx_{(Nm)}$ | $Mz_{(Nm)}$ | $Mz\ Peak_{(Nm)}$ | $k_{\vartheta x}{}_{(\mu rad/Nm)}$ |
|---|---|---|---|---|---|---|
| TM-030 | 15 | 20 | 5 | 0.25 | 0.5 | 80 |



The UPR-100 ultra-precision rotation stages are mainly utilized in the field of semiconductor technology, for positioning of laser treatment systems, robotics and synchrotron applications. All rotation stages from the UPR series are directly driven by a torque motor, eliminating the need for mechanical transmissions. This results in better positioning accuracies, higher acceleration and speed. Calibrated paired angular ball bearings guarantee a high central load capacity. The UPR-100 rotation stages are equipped with a high resolution angular scale and with hall limit switches.

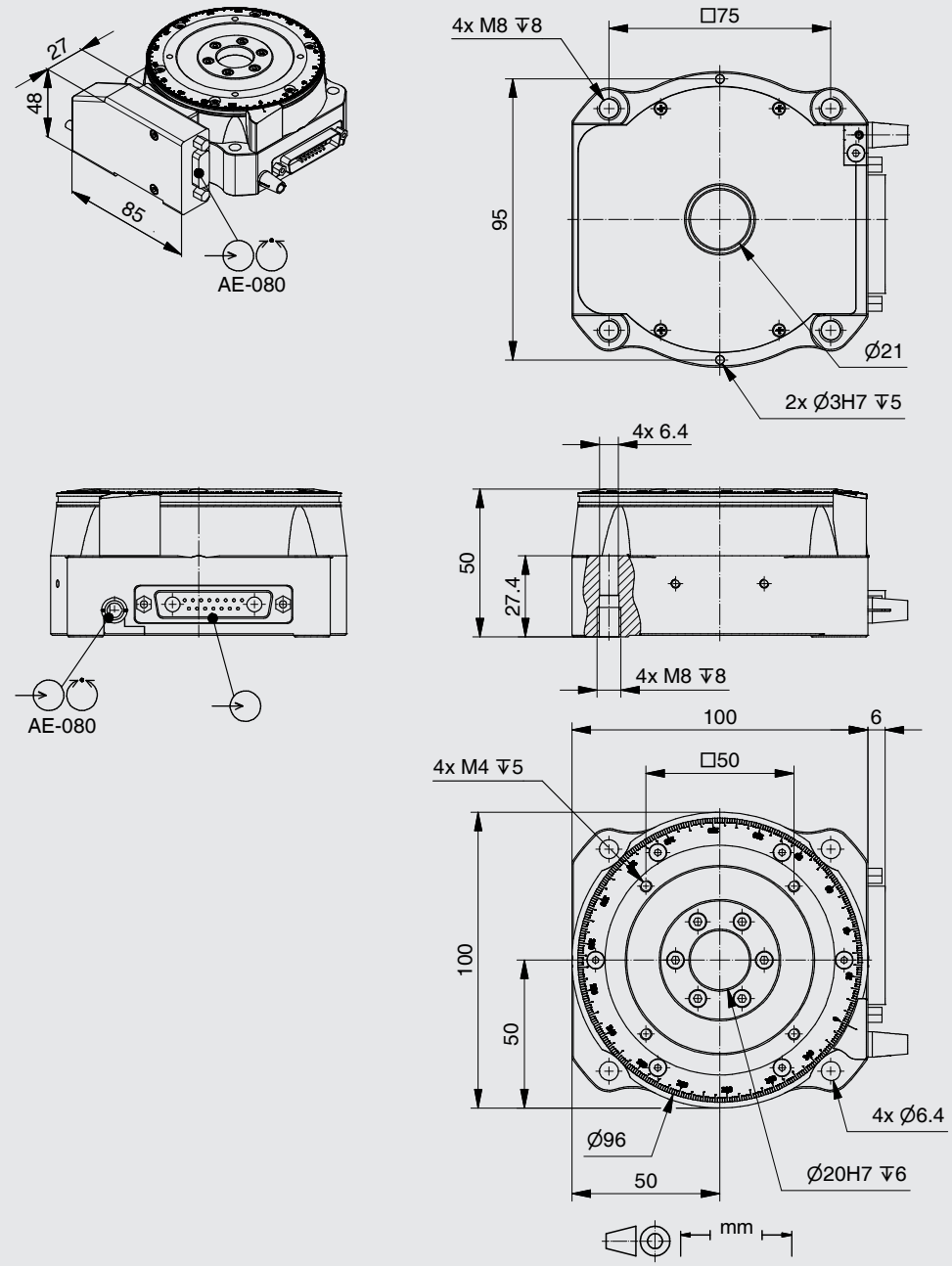
## KEY FEATURES

- High-precision bearings
- Torque motor
- Uni-directional repeatability down to 0.00008 °
- Flatness and eccentricity ± 2.5 µm
- Wobble ± 25 µrad
- Maximum speed 360 °/sec
- Load capacity up to 2 kg (center mounted, on top of the platform)
- Integrated reference mark (encoder index)
- Free center hole 20 mm diameter
- Integrated angular scale

## TECHNICAL DATA

| | | |
|---|---|---|
| Travel range (°) | 360, endless | |
| Flatness (Bearings) (µm) | ± 1 | |
| Eccentricity (Bearings) (µm) | ± 3.5 | |
| Wobble (Bearings) (µrad) | ± 25 | |
| Weight (kg) | 1.2 | |
| Motor | TM-030 | |
| Linear scale | | AE-080 |
| Speed max. (°/sec) | 360 | |
| Resolution calculated (°) | | 0.00002 |
| Resolution typical (°) | | 0.00008 |
| Bi-directional Repeatability (°) | | ± 0.0001 |
| Uni-directional Repeatability (°) | | 0.00008 |
| Nominal Current (A) | 1.2 | |
| Accuracy | on request | |
| Velocity range (°/sec) | 0.002 ... 360 | |
| Material | Aluminum, black anodized | |

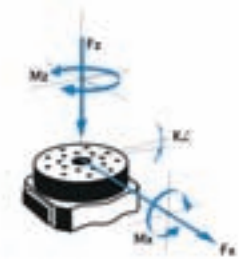
Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.




| Order No. | 6805-9- | | 1 | | |
|---|---|---|---|---|---|
| TM-030 | 1 | | | | |
| AE-080, Angular scale | 1 | | | | |
| HLS-010, Hall switches | 1 | | | | |

## FACTS

| Load characteristics | $Fx_{(N)}$ | $Fz_{(N)}$ | $Mx_{(Nm)}$ | $Mz_{(Nm)}$ |
|---|---|---|---|---|
| TM-040 | 3 | 5 | 5 | 0.05 |



The TRS-65 precision rotation stage was developed for fast and accurate positioning applications in a smaller 45° travel range, typically on top of an XY stage stack. It is a perfect fit for the LMS-60 and LMS-80 linear motor driven stages. It is mainly utilized in the field of semiconductor technology, for positioning of laser treatment systems and robotics. The TRS-65 is directly driven by a torque motor eliminating the need for mechanical transmissions. This results in better positioning accuracies, higher acceleration and speed and a longer operating life.

## KEY FEATURES

- Torque motor
- Travel range 45°
- Maximum speed 360 °/sec
- Load capacity up to 0.5 kg
- Integrated hall limit switches
- Integrated angular scale

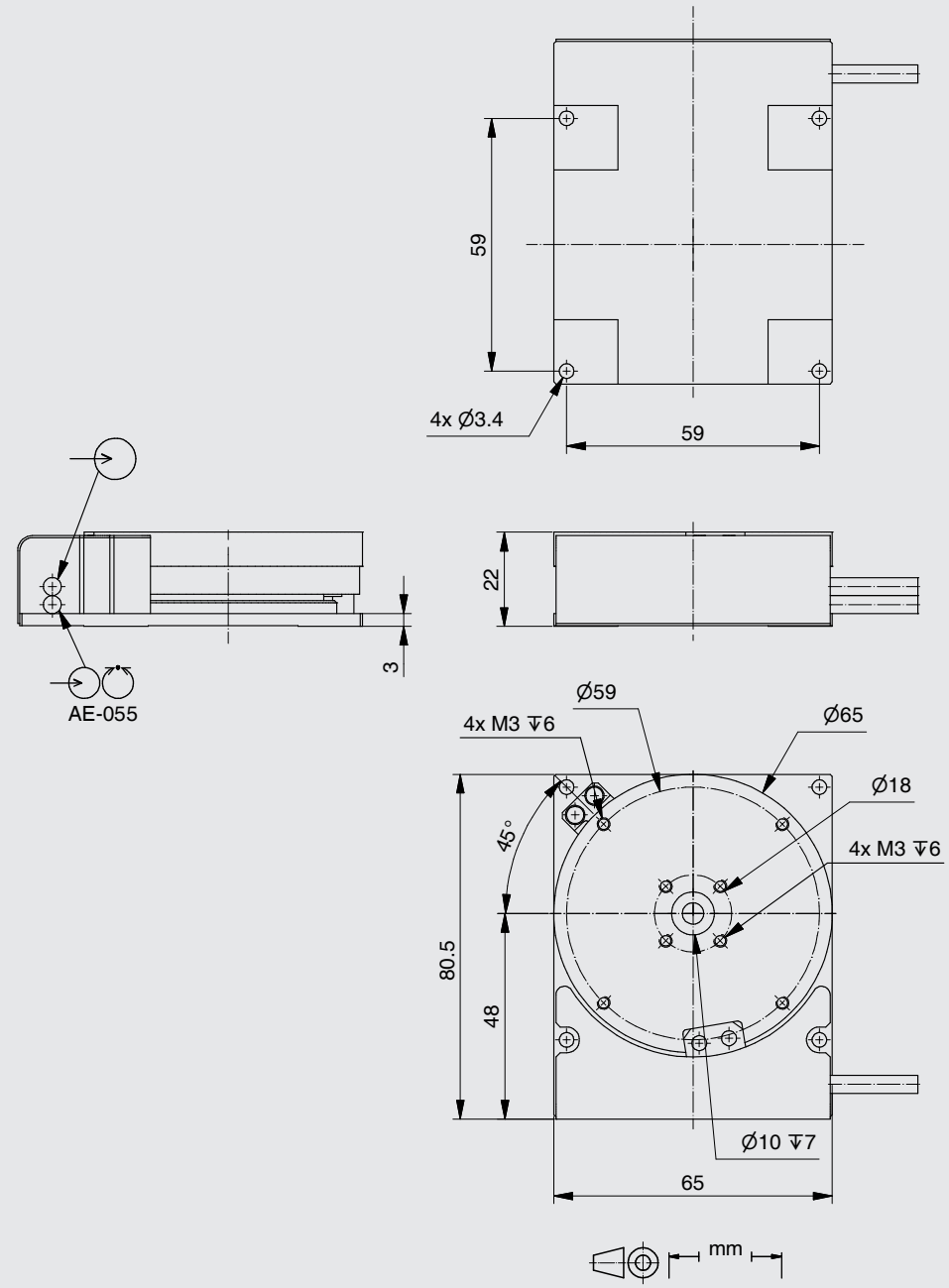
## TECHNICAL DATA

| | |
|---|---|
| Travel range (°) | 45 |
| Flatness (Bearings) (µm) | ± 2 |
| Eccentricity (Bearings) (µm) | ± 3 |
| Wobble (Bearings) (µrad) | ± 30 |
| Weight (kg) | 0.75 |

| Motor | TM-040 | |
|---|---|---|
| Linear scale | | AE-055 |
| Speed max. (°/sec) | 360 | |
| Resolution calculated (°) | | |
| Resolution typical (°) | | 0.0005 |
| Bi-directional Repeatability (°) | | ± 0.0005 |
| Uni-directional Repeatability (°) | | 0.00025 |
| Nominal Current (A) | | |

| | |
|---|---|
| Accuracy | on request |
| Velocity range (°/sec) | 0.001 ... 360 |
| Material | Stainless steel |

Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.

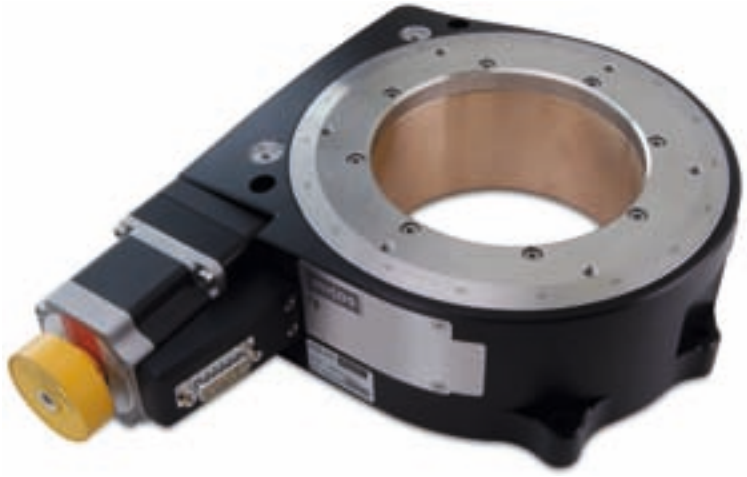


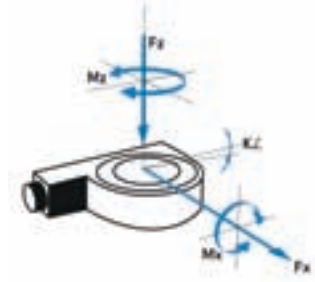

| Order No. | 6803-9- | | | | |
|---|---|---|---|---|---|
| TM-040 | 1 | | | | |
| 45° | 1 | | | | |
| AE-055 | 1 | | | | |
| HLS-020, Hall switches | 1 | | | | |

# 5.170 Precision Rotation Stage PRS-200

## FACTS

| Load characteristics | $Fx_{(N)}$ | $Fz_{(N)}$ | $Mx_{(Nm)}$ | $Mz_{(Nm)}$ | $k\pm x_{(\mu rad/Nm)}$ |
|---|---|---|---|---|---|
| DC-B-088 | 200 | 500 | 60 | 4 | 10 |
| 2Phase-070 | 200 | 500 | 60 | 4 | 10 |






The large 120 mm diameter clear aperture is particularly significant for the PRS-200 rotation stages. The body is fabricated from a special, high-rigidity, tempered aluminum alloy. Two calibrated preloaded zero backlash precision roller bearings guarantee an excellent flatness and smooth motion. A hardened and ground screw worm combined with a calibrated worm gear guarantee a quiet and smooth motion. As an option, the PRS-200 stages can be delivered with an integrated optical angular scale. The PRS-200 rotation stages are equipped with two reference switches which can be easily adjusted by the user. Drive variations including a DC or 2-phase stepper motor are available.

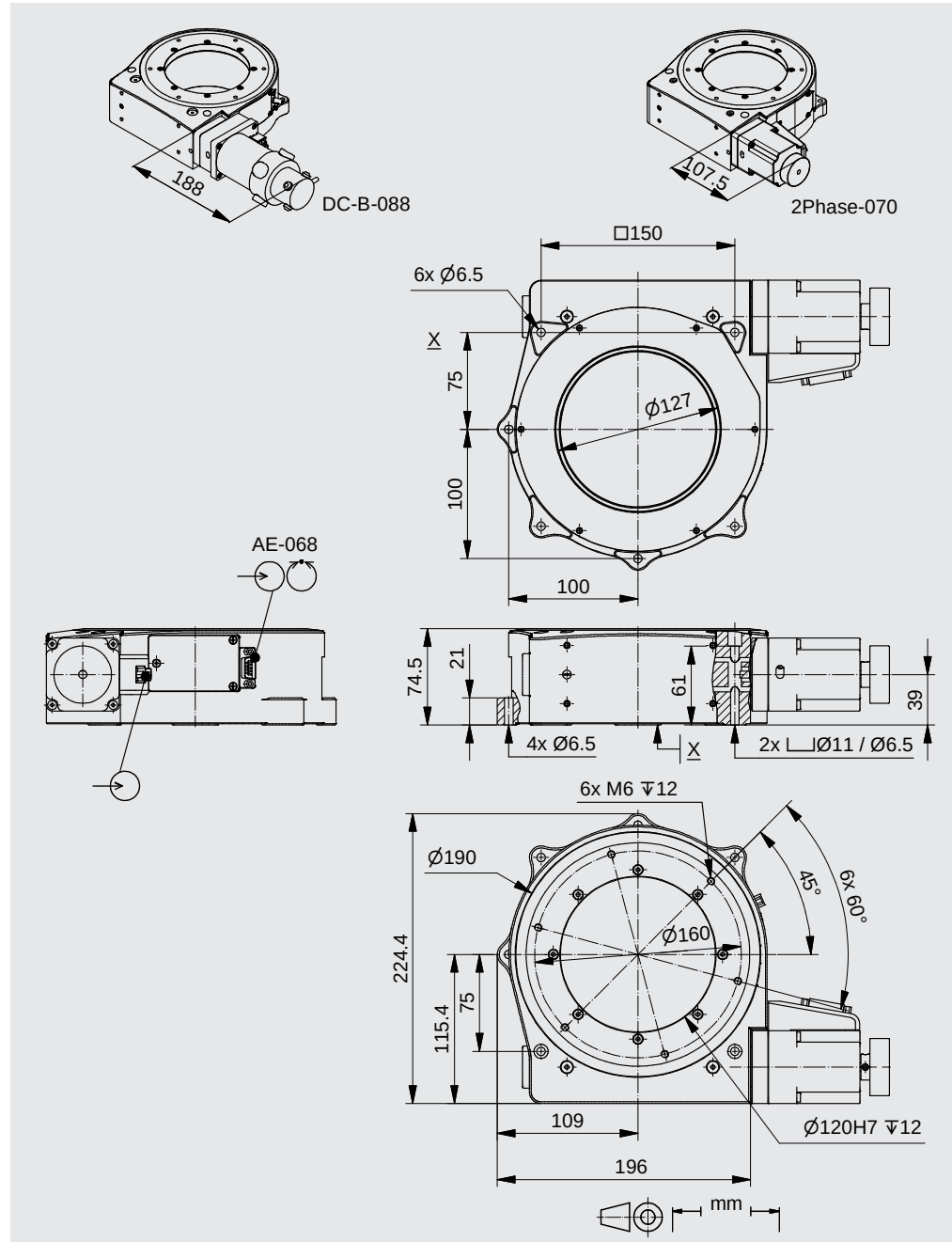
## KEY FEATURES

- Uni-directional repeatability down to 0.0003 °
- Maximum speed 150 °/sec
- Load capacity up to 50 kg
- Integrated reference hall limit switches
- Limit switch adjustable
- Option: angular scale
- Clear aperture 120 mm

## TECHNICAL DATA

| | | | | | |
|---|---|---|---|---|---|
| Travel range (°) | 360, endless | | | | |
| Flatness (Bearings) (µm) | ± 1 | | | | |
| Eccentricity (Bearings) (µm) | ± 2.5 | | | | |
| Wobble (Bearings) (µrad) | ± 17.5 | | | | |
| Weight (kg) | 8 | | | | |
| Motor | DC-B-088 | | 2Phase-070 | | |
| Linear scale | | | | | AE-068 |
| Speed max. (°/sec) | 75 | 150 | 35 | 60 | |
| Resolution calculated (°) | 0.0001 | 0.0002 (RE) | 0.01 | 0.02 (FS) | 0.00008 |
| Resolution typical (°) | 0.001 | | 0.001 | 0.002 | 0.0003 |
| Bi-directional Repeatability (°) | ± 0.01 | | ± 0.01 | | ± 0.0005 |
| Uni-directional Repeatability (°) | 0.002 | | 0.002 | | 0.0003 |
| Nominal Current (A) | 4.35 | | 2 | | |
| Voltage Range (V) | 48 | | | | |
| Worm gear reduction | 180:1 \| 90:1 | | | | |
| Accuracy | on request | | | | |
| Velocity range (°/sec) | 0.001 ... 150 | | | | |
| Material | Aluminum, black anodized, stainless steel, red brass | | | | |

Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.

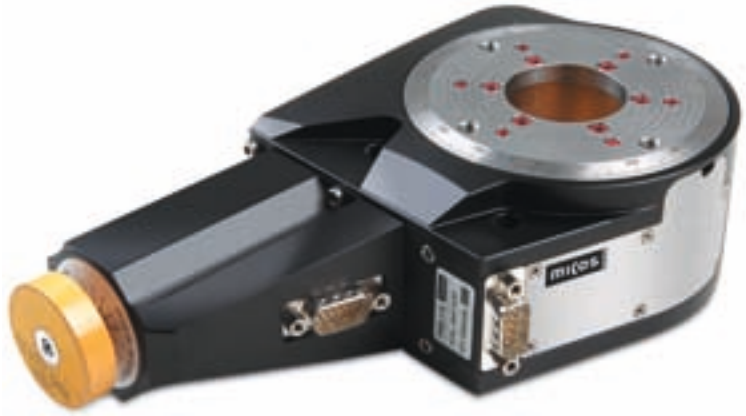


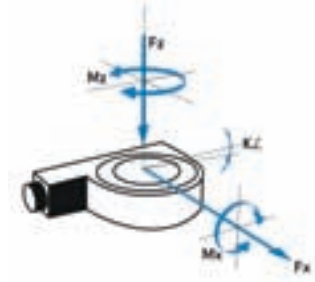

| Order No. | 6449-9- | | 1 | | | |
|---|---|---|---|---|---|---|
| DC-B-088 | 1 | | | | | |
| 2Phase-070 | 2 | | | | | |
| without AE-068 | | 0 | | | | |
| AE-068, Angular scale | | 1 | | | | |
| HLS-010, Hall switches | | | | 1 | | |
| Worm gear reduction 180:1 | | | | | 1 | |
| Worm gear reduction 90:1 | | | | | 2 | |

# 5.172 Precision Rotation Stage PRS-110

## FACTS

| Load characteristics | $Fx_{(N)}$ | $Fz_{(N)}$ | $Mx_{(Nm)}$ | $Mz_{(Nm)}$ | $k\vartheta x_{(\mu rad/Nm)}$ |
|---|---|---|---|---|---|
| DC-B-040 | 50 | 100 | 40 | 3 | 30 |
| 2Phase-033 | 50 | 100 | 40 | 3 | 30 |






The PRS-110 precision rotation stages can be used in a wide range of industrial and scientific applications. They are a good fit with the LS-110 linear stages and ES-100 elevation stages. The body is fabricated from a special, high-rigidity tempered aluminum alloy. Two calibrated and preloaded four-point contact bearings guarantee excellent wobble, flatness and eccentricity specifications. A hardened and ground worm screw combined with a calibrated worm gear insure a smooth and accurate motion. The PRS-110 precision rotation stages can be equipped with optical angular scales. Resolutions up to 0.0002° are standard. The PRS-110 precision rotation stages are equipped with reference switches and are motorized with DC or 2-phase stepper motors.

## KEY FEATURES

- Uni-directional repeatability down to 0.0002 °
- Maximum speed 200 °/sec
- Load capacity up to 10 kg
- Integrated mechanical limit switches
- Limit switch adjustable
- Option: angular scale
- Clear aperture 35 mm

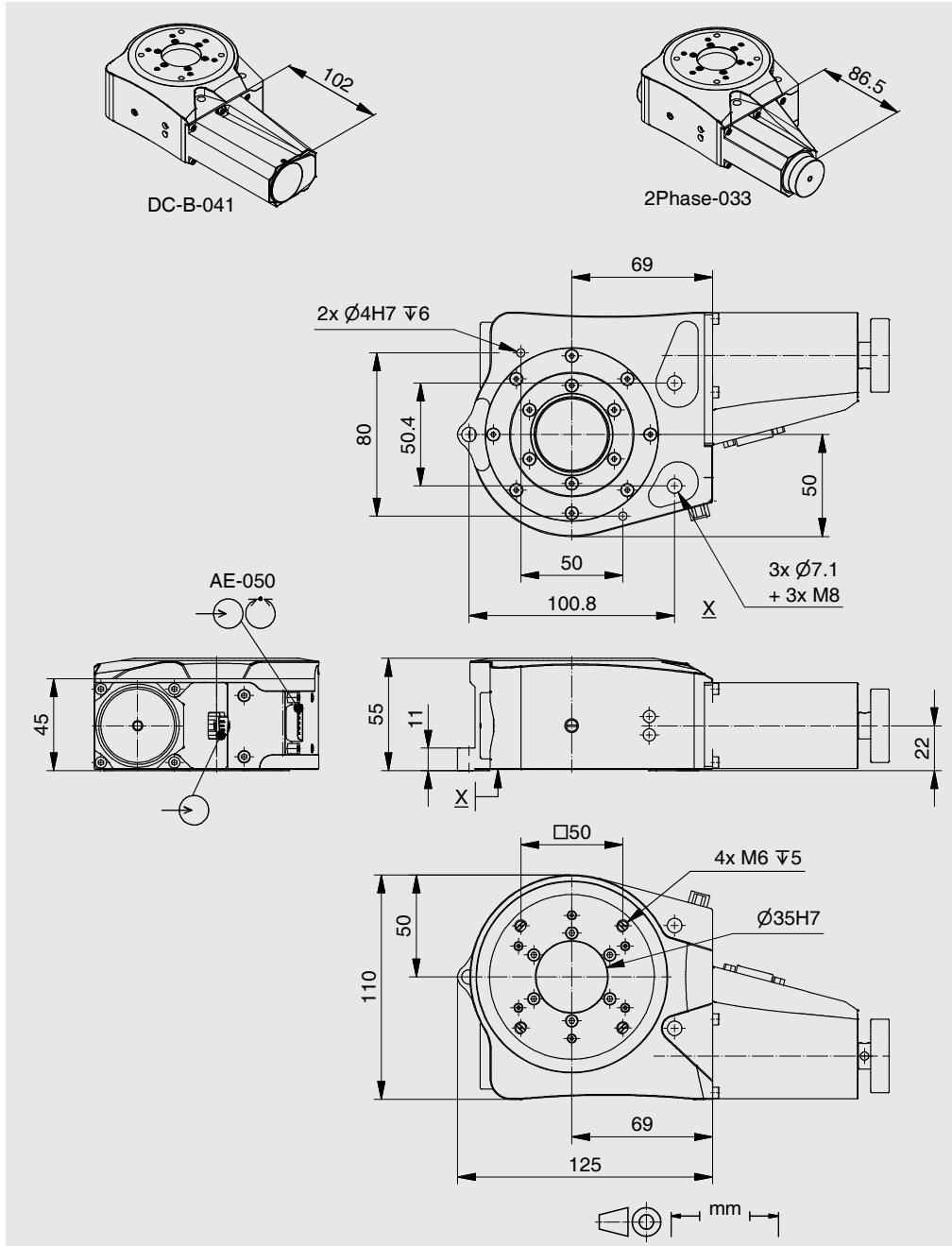
## TECHNICAL DATA

| | | | |
|---|---|---|---|
| Travel range (°) | 360, endless | | |
| Flatness (Bearings) (µm) | ± 1 | | |
| Eccentricity (Bearings) (µm) | ± 2.5 | | |
| Wobble (Bearings) (µrad) | ± 15 | | |
| Weight (kg) | 2.6 | | |
| **Motor** | **DC-B-040** | **2Phase-033** | |
| Linear scale | | | AE-050 |
| Speed max. (°/sec) | 200 | 50 | |
| Resolution calculated (°) | 0.0002 (RE) | 0.02 (FS) | 0.0001 |
| Resolution typical (°) | 0.002 | 0.002 | 0.0002 |
| Bi-directional Repeatability (°) | ± 0.01 | ± 0.01 | ± 0.0002 |
| Uni-directional Repeatability (°) | 0.002 | 0.002 | 0.0002 |
| Nominal Current (A) | 3.8 | 1.2 | |
| Voltage Range (V) | 24 | | |
| Worm gear reduction | 90:1 | | |
| Accuracy | on request | | |
| Velocity range (°/sec) | 0.002 ... 200 | | |
| Material | Aluminum, black anodized, stainless steel, red brass | | |

Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.



PI micos

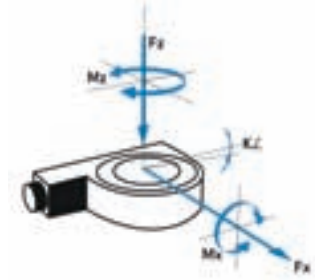



| Order No. | 6447-9- | | 0 | |
|---|---|---|---|---|
| DC-B-040 | 1 | | | |
| 2Phase-033 | 2 | | | |
| without AE-050 | 0 | | | |
| AE-050, Angular scale | 1 | | | |

# 5.174 Rotation Stage DT-65 N

## FACTS

| Load characteristics | $Fx_{(N)}$ | $Fz_{(N)}$ | $Mx_{(Nm)}$ | $Mz_{(Nm)}$ | $k+x_{(\mu rad/Nm)}$ |
|---|---|---|---|---|---|
| DC-B-031 | 15 | 30 | 10 | 0.8 | 180 |
| 2Phase-045 | 15 | 30 | 10 | 0.8 | 180 |




The rotation stages DT-65 N are fabricated from a special high-rigidity tempered aluminum alloy. A pre-loaded four-point double row ball bearing guarantees good wobble and flatness specifications. A hardened and ground worm screw combined with a calibrated worm gear guarantees minimum backlash. All motorized rotation DT-65 N stages are equipped with a reference switch. Drive variations such as DC or 2-phase stepper motors are available.

## KEY FEATURES

- Uni-directional repeatability down to 0.002 °
- Maximum speed 60 °/sec
- Load capacity up to 3 kg
- Integrated mechanical reference switch
- Clear aperture 25 mm
- Optionally rotary encoder on the rotation axis

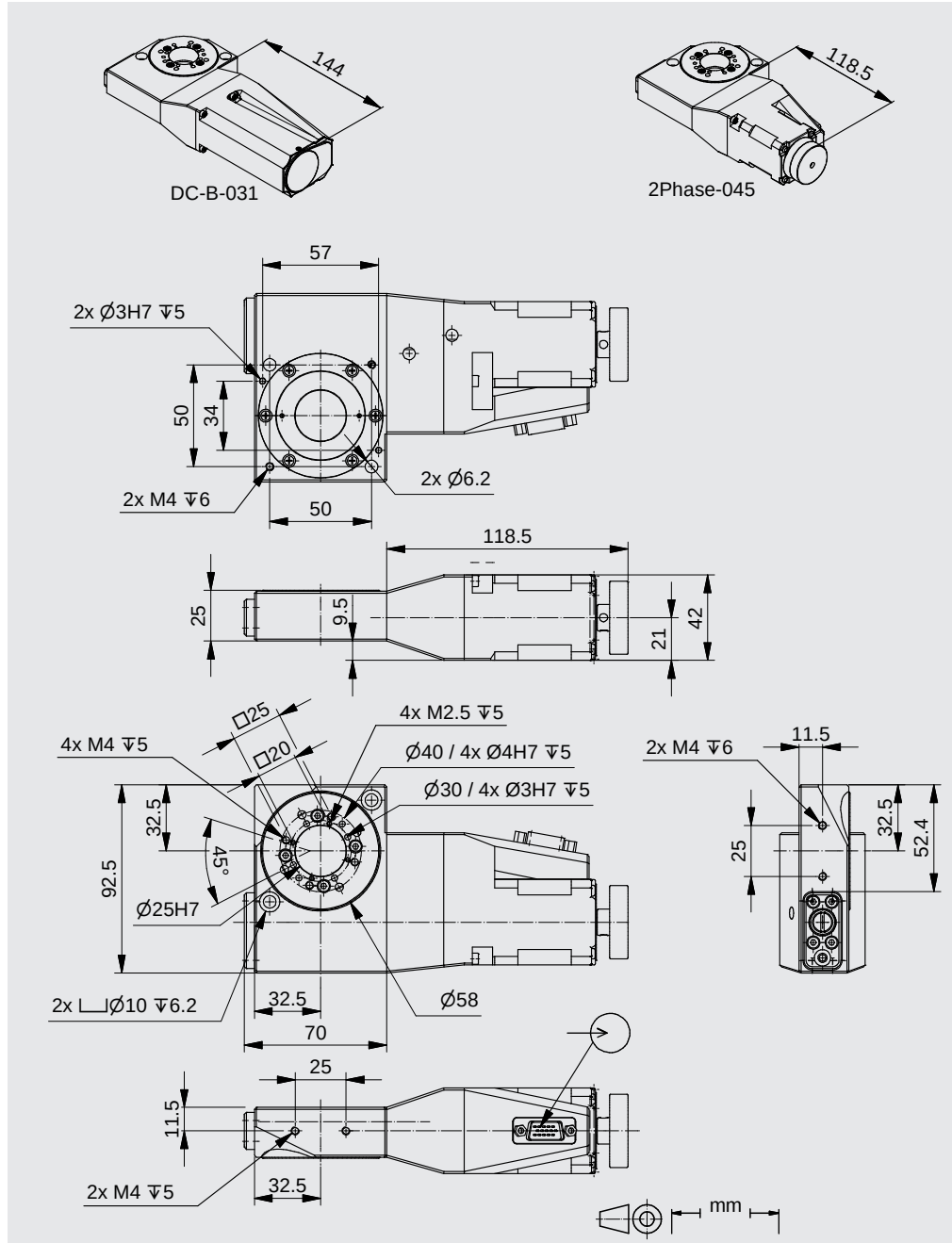
## TECHNICAL DATA

| | |
|---|---|
| Travel range (°) | 360, endless |
| Flatness (Bearings) (µm) | ± 6 |
| Eccentricity (Bearings) (µm) | ± 6 |
| Wobble (Bearings) (µrad) | ± 30 |
| Weight (kg) | 1.3 |

| Motor | DC-B-031 | 2Phase-045 |
|---|---|---|
| Speed max. (°/sec) | 60 | 45 |
| Resolution calculated (°) | 0.001 (RE) | 0.01 (FS) |
| Resolution typical (°) | 0.002 | 0.002 |
| Bi-directional Repeatability (°) | ± 0.01 | ± 0.01 |
| Uni-directional Repeatability (°) | 0.002 | 0.002 |
| Nominal Current (A) | 1.96 | 1.2 |
| Voltage Range (V) | 24 | |

| | |
|---|---|
| Worm gear reduction | 180:1 |
| Accuracy | on request |
| Velocity range (°/sec) | 0.001 ... 60 |
| Material | Aluminum, black anodized, red brass |

Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.



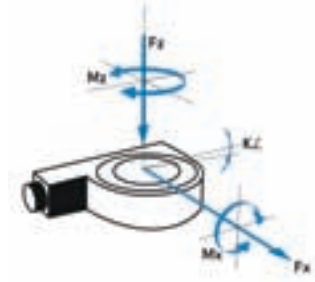

| Order No. | 6440-9- | | 0 | 0 |
|---|---|---|---|---|
| DC-B-031 | | 1 | | |
| 2Phase-045 | | 3 | | |

# 5.176 Rotation Stage RS-40

NEW V

## FACTS

| Load characteristics | $Fx_{(N)}$ | $Fz_{(N)}$ | $Mx_{(Nm)}$ | $Mz_{(Nm)}$ | $k\vartheta x_{(\mu rad/Nm)}$ |
|---|---|---|---|---|---|
| DC-B-009 | 10 | 20 | 2 | 0.2 | 270 |
| 2Phase-010 | 5 | 10 | 1 | 0.2 | 270 |




The RS-40 rotation stage is very compact but offers a big 20 mm (25 mm holding diameter) aperture. A precision bearing guarantees a perfectly smooth move. The RS-40 rotation stages have nearly zero backlash worm gear reduction. All RS-40 motorized rotation stages are equipped with a hall reference switch and are offered with a DC or geared stepper motor.

## KEY FEATURES

- Clear aperture 20 mm
- Uni-directional repeatability down to 0.005 °
- Maximum speed 7 °/sec
- Load capacity up to 1 kg
- Integrated hall reference switch
- Optionally rotary encoder on the rotation axis

## TECHNICAL DATA

| | |
|---|---|
| Travel range (°) | 360, endless |
| Flatness (Bearings) (µm) | ± 5 |
| Eccentricity (Bearings) (µm) | ± 5 |
| Wobble (Bearings) (µrad) | ± 35 |
| Weight (kg) | 0.4 |

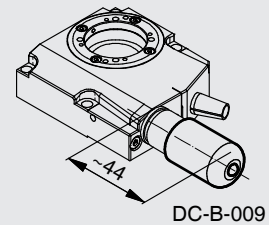
| Motor | DC-B-009 | 2Phase-010 |
|---|---|---|
| Speed max. (°/sec) | 7 | 5 |
| Resolution calculated (°) | 0.00003 (RE) | 0.0021961 (FS) |
| Resolution typical (°) | 0.005 | 0.005 |
| Bi-directional Repeatability (°) | ± 0.04 | ± 0.04 |
| Uni-directional Repeatability (°) | 0.005 | 0.005 |
| Nominal Current (A) | 0.16 | 0.25 |
| Voltage Range (V) | 12 | |

| | |
|---|---|
| Worm gear reduction | 90:1 |
| Accuracy | on request |
| Velocity range (°/sec) | 0.002 ... 7 |
| Material | Aluminum, black anodized, stainless steel, red brass |

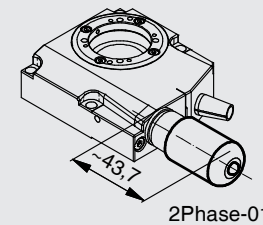
Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.



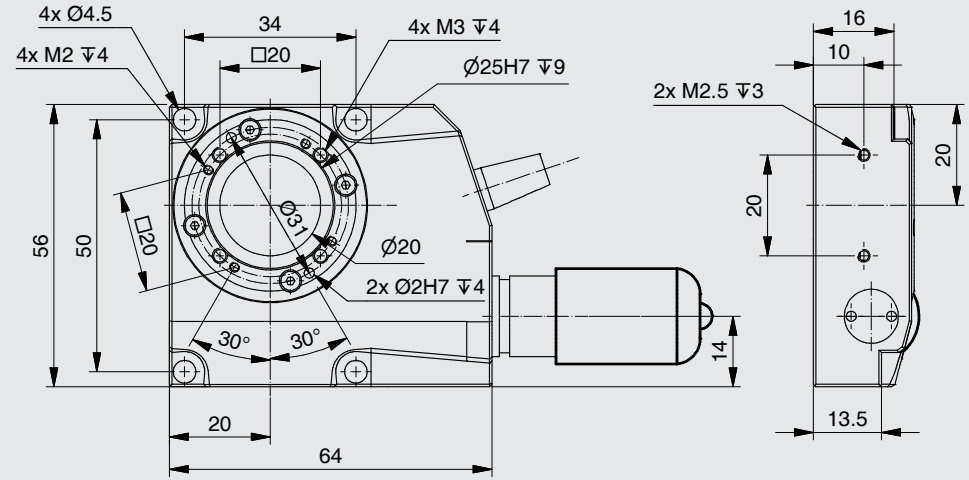
PI micos

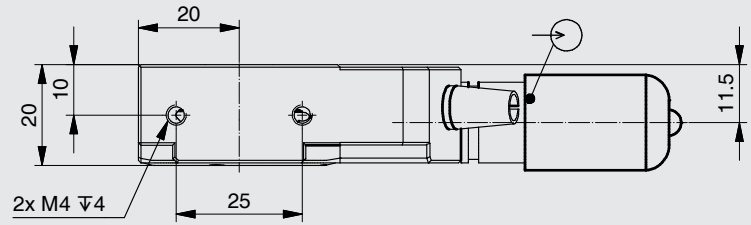


DC-B-009



2Phase-010



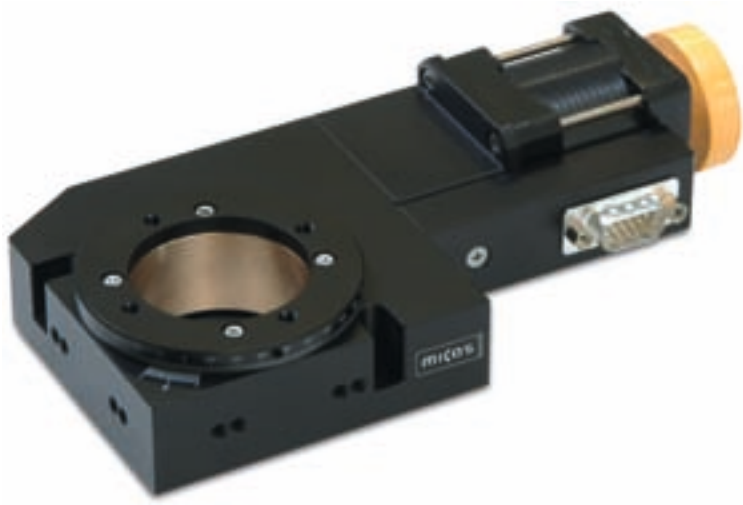



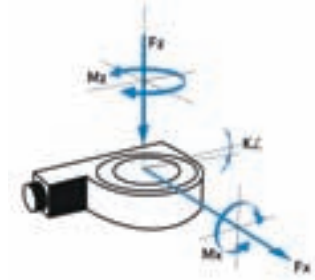

mm

| Order No. | 3216-9- | | 0 | 0 | |
|---|---|---|---|---|---|
| DC-B-009 | | 1 | | | |
| 2Phase-010 | | 2 | | | |
| HLS-010, Hall switch | | 1 | | | |

## FACTS

| Load characteristics | $Fx_{(N)}$ | $Fz_{(N)}$ | $Mx_{(Nm)}$ | $Mz_{(Nm)}$ | $k\vartheta x_{(\mu rad/Nm)}$ |
|---|---|---|---|---|---|
| DC-B-029 | 10 | 20 | 5 | 0.1 | 150 |
| 2Phase-041 | 10 | 20 | 5 | 0.1 | 150 |
| 2Phase-042 | 10 | 20 | 5 | 0.1 | 150 |






PRS-110 high precision rotation stages. They are mainly developed for simple positioning in the laboratory. The large aperture of 40 mm diameter is suitable for many applications in the microscopy area. The worm screw and worm gear combination is preloaded to produce a near "zero-backlash" and smooth motion. Rotation stages of the DT-80 series can be driven by a DC or 2-phase stepper motor and are equipped with a mechanical reference switch.
Additionally the DT-80 can be ordered with our SMC pollux motor-controller module ( 2Phase-042 ).

The DT-80 rotation stages are a low cost alternative to the PI miCos DT-65 N and

## KEY FEATURES

- Uni-directional repeatability down to 0.01 °
- Maximum speed 40 °/sec
- Load capacity up to 2 kg
- Integrated mechanical reference switch
- Clear aperture 40 mm

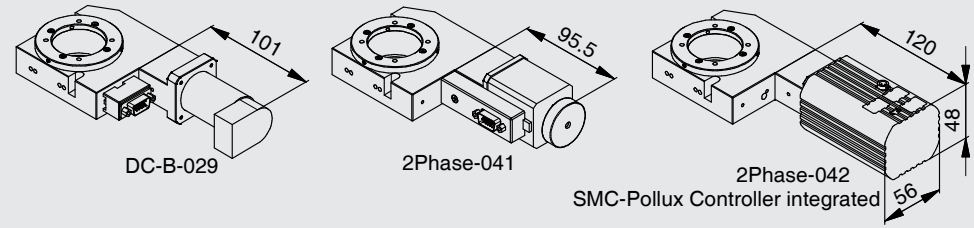
## TECHNICAL DATA

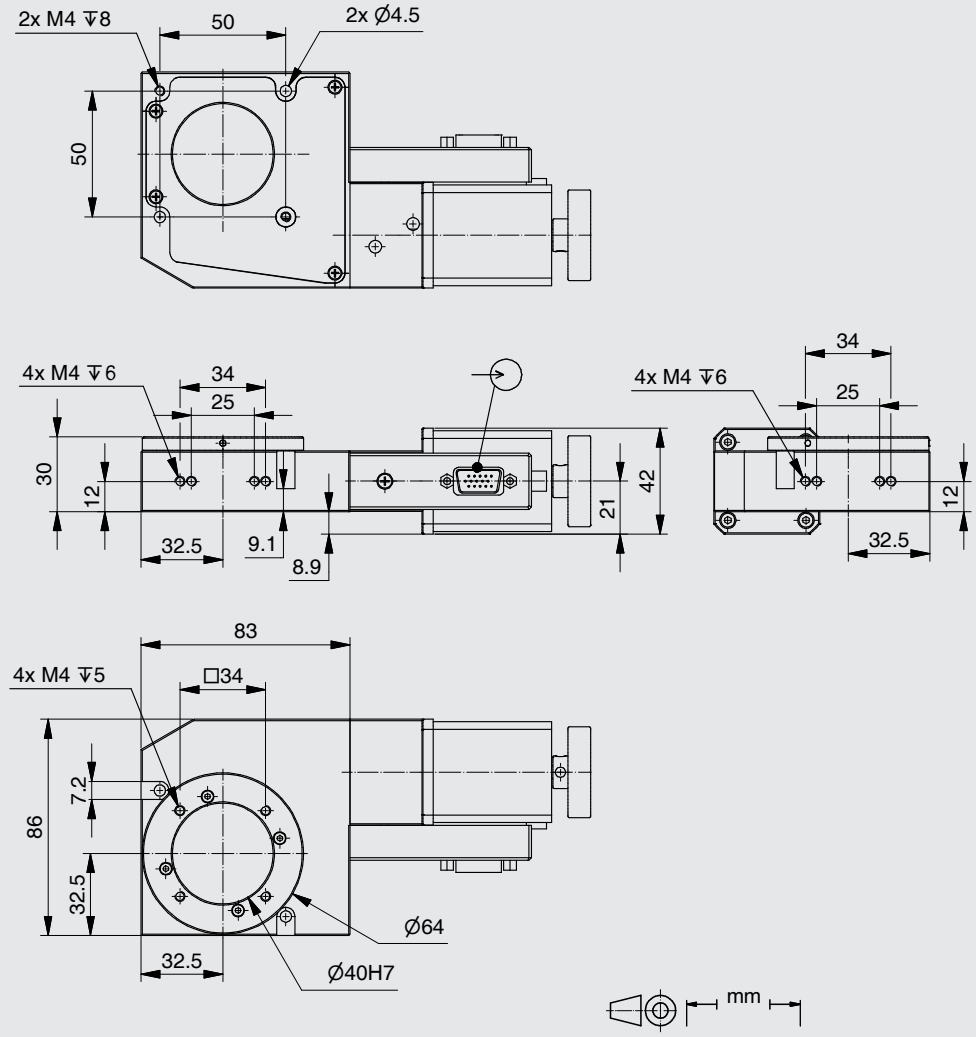
| | |
|---|---|
| Travel range (°) | 360, endless |
| Flatness (Bearings) (µm) | ± 30 |
| Eccentricity (Bearings) (µm) | ± 30 |
| Wobble (Bearings) (µrad) | ± 100 |
| Weight (kg) | 0.8 |

| Motor | DC-B-029 | 2Phase-041 | 2Phase-042 |
|---|---|---|---|
| Speed max. (°/sec) | 40 | 30 | 30 |
| Resolution calculated (°) | 0.001 (RE) | 0.01 (FS) | 0.01 (FS) |
| Resolution typical (°) | 0.004 | 0.004 | 0.004 |
| Bi-directional Repeatability (°) | ± 0.5 | ± 0.5 | ± 0.5 |
| Uni-directional Repeatability (°) | 0.01 | 0.01 | 0.01 |
| Nominal Current (A) | 1.17 | 1.7 | 0.5 |
| Voltage Range (V) | 24 | | |

| | |
|---|---|
| Worm gear reduction | 180:1 |
| Accuracy | on request |
| Velocity range (°/sec) | 0.001 ... 40 |
| Material | Aluminum, black anodized, red brass |

Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.



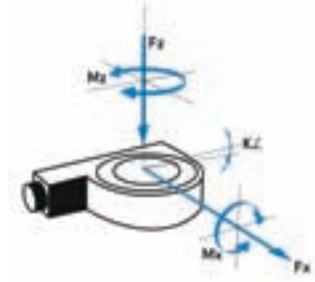




| Order No. | 6443-9- | | 0 | 0 |
|---|---|---|---|---|
| DC-B-029 | 1 | | | |
| 2Phase-041 | 2 | | | |
| 2Phase-042 | 4 | | | |

# 5.180 Rotation Stage DT-80 R

## FACTS

| Load characteristics | $Fx_{(N)}$ | $Fz_{(N)}$ | $Mx_{(Nm)}$ | $Mz_{(Nm)}$ | $k+x_{(\mu rad/Nm)}$ |
|---|---|---|---|---|---|
| DC-B-013 | 10 | 20 | 5 | 0.1 | 150 |
| 2Phase-047 | 10 | 20 | 5 | 0.1 | 150 |
| 2Phase-042 | 10 | 20 | 5 | 0.1 | 150 |




The DT-80 R rotation stage is a low cost alternative to the PI miCos DT-65 N and PRS-110 high precision rotation stages. The preloaded belt driven DT-80 R produces a nearly zero backlash and smooth motion and allows a much higher speed of rotation in comparison to other stages. The large aperture of 40 mm diameter is suitable for many applications in the microscopy area. The DT-80 R is equipped with hall reference switches and is driven by a DC or 2-phase stepper motor. Additionally the DT-80 R can be ordered with our SMC pollux motor-controller module.

## KEY FEATURES

- Uni-directional repeatability down to 0.01 °
- Maximum speed 1170 °/sec
- Load capacity up to 2 kg
- Integrated hall reference switches
- Limit switches adjustable
- Clear aperture 40 mm
- Optionally totally closable iris diaphragm

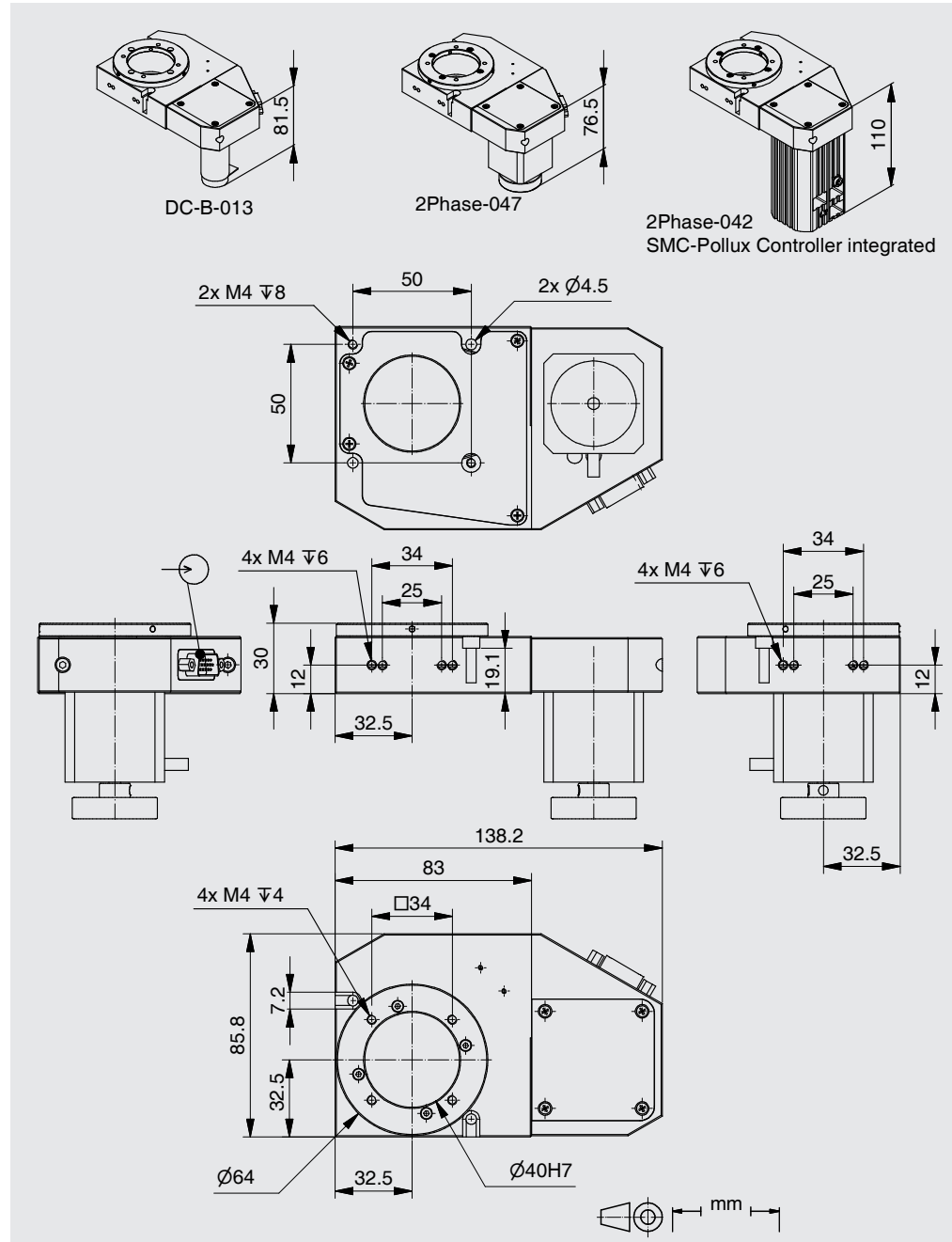
## TECHNICAL DATA

| | |
|---|---|
| Travel range (°) | 360, endless |
| Flatness (Bearings) (µm) | ± 30 |
| Eccentricity (Bearings) (µm) | ± 30 |
| Wobble (Bearings) (µrad) | ± 100 |
| Weight (kg) | 0.8 |

| Motor | DC-B-013 | 2Phase-047 | 2Phase-042 |
|---|---|---|---|
| Speed max. (°/sec) | 270 | 900 | 1170 |
| Resolution calculated (°) | 0.0014825 (RE) | 0.225 (FS) | 0.45 (FS) |
| Resolution typical (°) | 0.004 | 0.004 | 0.004 |
| Bi-directional Repeatability (°) | ± 0.02 | ± 0.03 | ± 0.03 |
| Uni-directional Repeatability (°) | 0.01 | 0.015 | 0.015 |
| Nominal Current (A) | 0.28 | 1.2 | 0.5 |
| Voltage Range (V) | 24 | | |

| | |
|---|---|
| Belt Drive Reduction | 4:1 |
| Accuracy | on request |
| Velocity range (°/sec) | 0.001 ... 1170 |
| Material | Aluminum, black anodized, red brass |

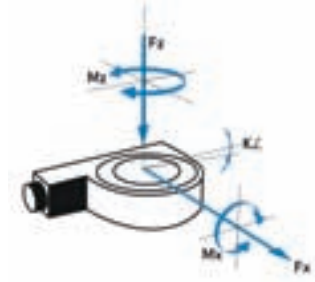
Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.




| Order No. | 6450-9- | | 0 | 0 | 1 |
|---|---|---|---|---|---|
| DC-B-013 | | 1 | | | |
| 2Phase-047 | | 2 | | | |
| 2Phase-042 | | 3 | | | |

## FACTS

| Load characteristics | $Fx_{(N)}$ | $Fz_{(N)}$ | $Mx_{(Nm)}$ | $Mz_{(Nm)}$ | $k\vartheta x_{(\mu rad/Nm)}$ |
|---|---|---|---|---|---|
| DC-B-029 | 5 | 10 | 5 | 0.15 | 150 |
| 2Phase-047 | 5 | 10 | 5 | 0.15 | 150 |
| 2Phase-042 | 5 | 10 | 5 | 0.15 | 150 |




The DT-50 rotation stages are a low cost and lower accuracy alternative to the PI miCos RS-40 stage. The belt driven DT-50 rotation stage allows a much higher speed of rotation in comparison to other stages. The clear aperture of 20 mm diameter is suitable for many applications in the microscopy area. The belt driven combination is preloaded to produce near zero backlash and a smooth motion. The DT-50 rotation stages are equipped with hall reference switches and are driven by a DC or 2-phase stepper motor. Additionally the DT-50 can be ordered with our SMC pollux motor-controller module.

## KEY FEATURES

- Uni-directional repeatability down to 0.015 °
- Maximum speed 4000 °/sec
- Load capacity up to 1 kg
- Integrated hall reference switch
- Clear aperture 20 mm

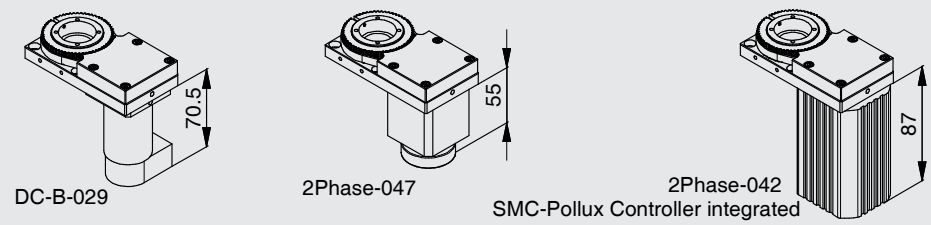
## TECHNICAL DATA

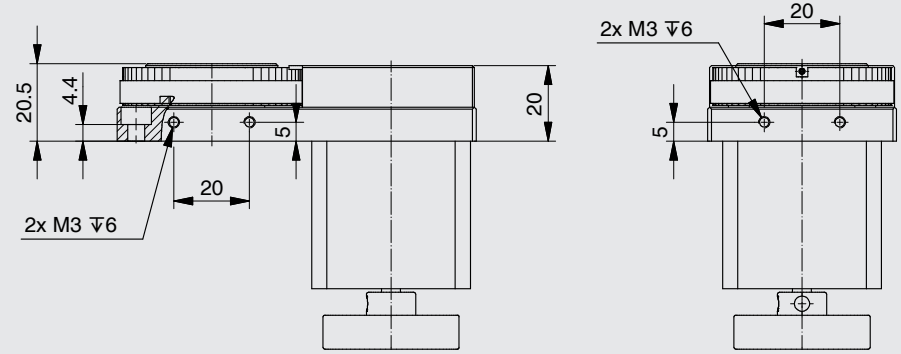
| | |
|---|---|
| Travel range (°) | 360, endless |
| Weight (kg) | 0.14 |

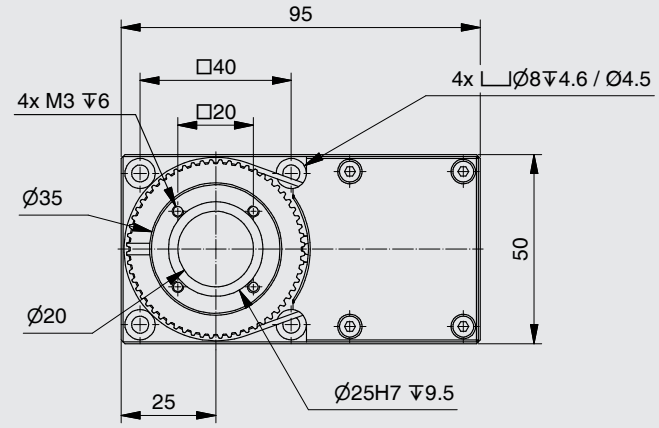
| Motor | DC-B-029 | 2Phase-047 | 2Phase-042 |
|---|---|---|---|
| Speed max. (°/sec) | 4000 | 1100 | 1560 |
| Resolution calculated (°) | 0.06 (RE) | 0.3 (FS) | 0.6 (FS) |
| Resolution typical (°) | 0.005 | 0.005 | 0.005 |
| Bi-directional Repeatability (°) | ± 0.03 | ± 0.03 | ± 0.03 |
| Uni-directional Repeatability (°) | 0.015 | 0.015 | 0.015 |
| Nominal Current (A) | 1.17 | 1.2 | 0.5 |
| Voltage Range (V) | 24 | | |

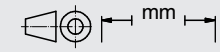
| | |
|---|---|
| Belt Drive Reduction | 3:1 |
| Accuracy | on request |
| Velocity range (°/sec) | 0.05 ... 4000 |
| Material | Aluminum, black anodized |

Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.



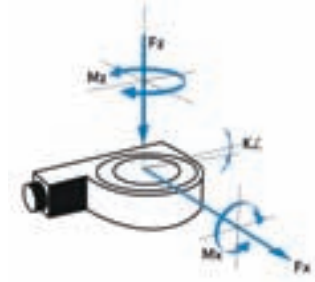

| Order No. | 6435-9- | | 0 | 0 | |
|---|---|---|---|---|---|
| DC-B-029 | 1 | | | | |
| 2Phase-047 | 2 | | | | |
| 2Phase-042 | 3 | | | | |
| HLS-010, Hall switch | 1 | | | | |

# 5.184 Rotation Stage DT-34

NEW V

## FACTS

| Load characteristics | $Fx_{(N)}$ | $Fz_{(N)}$ | $Mx_{(Nm)}$ | $Mz_{(Nm)}$ | $k\vartheta x_{(\mu rad/Nm)}$ |
|---|---|---|---|---|---|
| DC-B-010 | 2.5 | 15 | 2.5 | 0.9 | 200 |
| 2Phase-010 | 2.5 | 5 | 2.5 | 0.3 | 200 |




The DT-34 rotation stages are a very compact low cost alternative to the PI miCos RS-40 stage but the belt driven design allows a much higher speed of rotation in comparison to other stages. The clear aperture of 10 mm diameter is suitable for many applications in the microscopy area. The belt driven combination is preloaded to produce near zero backlash and a smooth motion. The DT-34 rotation stages are equipped with optical reference switches and are driven by a DC or 2 phase stepper motor.

## KEY FEATURES

- Uni-directional repeatability down to 0.01 °
- Load capacity up to 0.5 kg
- Integrated optical reference switch
- Clear aperture 10 mm

## TECHNICAL DATA

| | |
|---|---|
| Travel range (°) | 360, endless |

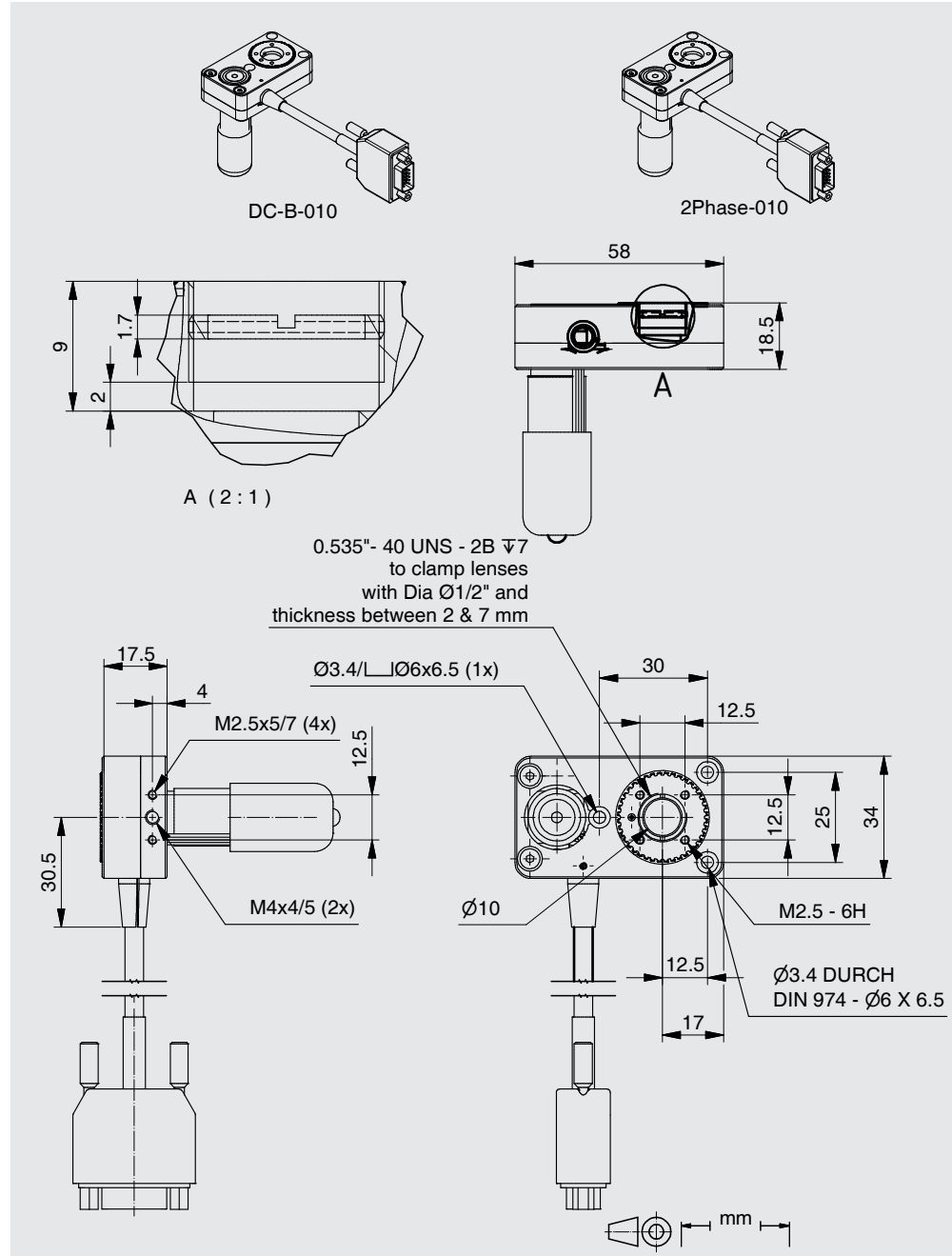
| Motor | DC-B-010 | 2Phase-010 |
|---|---|---|
| Speed max. (°/sec) | 675 | 195 |
| Resolution calculated (°) | 0.00004 (RE) | 0.001098 (FS) |
| Resolution typical (°) | 0.00044 | 0.005 |
| Bi-directional Repeatability (°) | ± 0.04 | ± 0.04 |
| Uni-directional Repeatability (°) | 0.01 | 0.015 |
| Nominal Current (A) | 0.32 | 0.25 |
| Voltage Range (V) | 12 | |

| | |
|---|---|
| Accuracy | on request |
| Velocity range (°/sec) | 0.05 ... 675 |
| Material | |

Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.



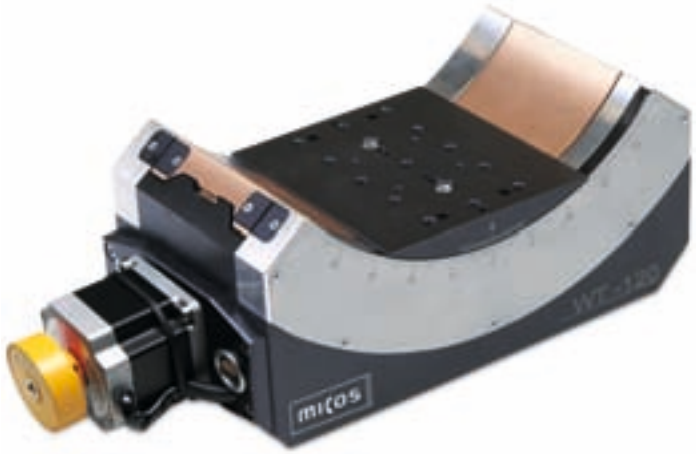
PI miCos




| Order No. | 3215-9- | | 0 | 0 | | 0 |
|---|---|---|---|---|---|---|
| DC-B-010 | | 1 | | | | |
| 2Phase-010 | | 2 | | | | |
| OLS-030, Optical limit switch | | 3 | | | | |

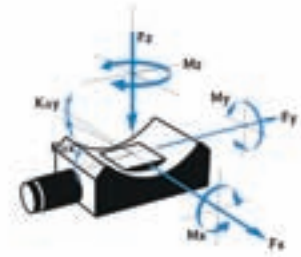
## FACTS

| Load characteristics | $F_{x(N)}$ | $F_{y(N)}$ | $F_{z(N)}$ | $M_{x(Nm)}$ | $M_{y(Nm)}$ | $M_{z(Nm)}$ | $k_{\pm x(\mu rad/Nm)}$ | $k_{\pm y(\mu rad/Nm)}$ |
|---|---|---|---|---|---|---|---|---|
| DC-B-082 | 90 | 90 | 200 | 8 | 25 | 25 | 15 | 15 |
| 2Phase-070 | 90 | 90 | 200 | 8 | 25 | 25 | 15 | 15 |




## KEY FEATURES

- Uni-directional repeatability down to 0.001 °
- Max. speed 30 °/sec
- Load capacity up to 20 kg
- integrated Mechanical Limit Switches
- Limit switch adjustable
- Option: angular scale
- Uni-directional repeatability down to 0.001 °
- Maximum speed 30 °/sec
- Load capacity up to 20 kg
- Integrated mechanical limit switches
- Limit switch adjustable
- Option: angular scale
- Together with WT-90 one centre of rotation

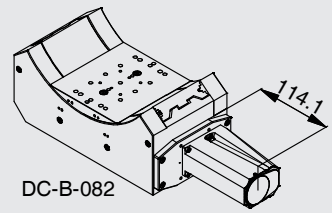


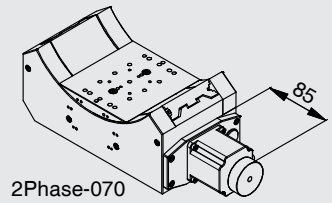
The WT-120 goniometer stage is designed for all tasks where conventional rotation stages cannot be used due to limited space conditions. Typical uses are applications in the area of laser positioning and radiology. The WT-120 and WT-90 goniometer stages are matched to work together. When mounted orthogonally to each other they have a common center of rotation. The WT-120 stage is equipped with a ground bearing guide. The ground and hardened worm screw and worm gear combination produces a very quiet and smooth motion. The stages are directly driven by a DC or 2-phase stepper motor and can achieve a relatively high speed. The WT-120 stages can be equipped with an optical angular scale system and have two limit switches.

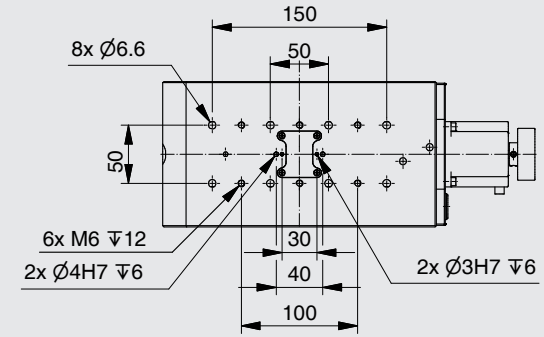
## TECHNICAL DATA

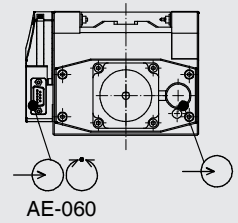
| | | | |
|---|---|---|---|
| Travel range (°) | 90 | | |
| Wobble (Bearings) (µrad) | ± 125 | | |
| Weight (kg) | 11.5 | | |
| Motor | DC-B-082 | 2Phase-070 | |
| Linear scale | | | AE-060 |
| Speed max. (°/sec) | 30 | 25 | |
| Resolution calculated (°) | 0.0001 (RE) | 0.01 (FS) | 0.00009 |
| Resolution typical (°) | 0.004 | 0.004 | 0.001 |
| Bi-directional Repeatability (°) | ± 0.02 | ± 0.02 | ± 0.001 |
| Uni-directional Repeatability (°) | 0.005 | 0.005 | 0.001 |
| Nominal Current (A) | 3.33 | 2 | |
| Voltage Range (V) | 48 | | |
| Worm gear reduction | 180:1 | | |
| Accuracy | on request | | |
| Velocity range (°/sec) | 0.001 ... 30 | | |
| Material | Aluminum, black anodized, stainless steel, red brass | | |

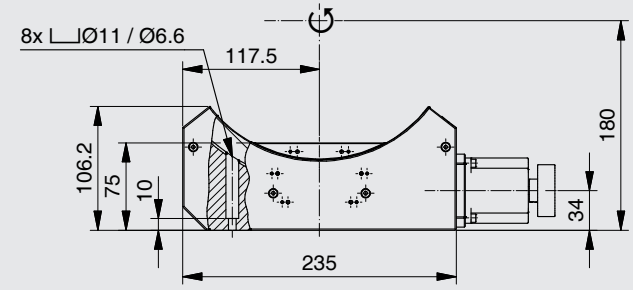
Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.

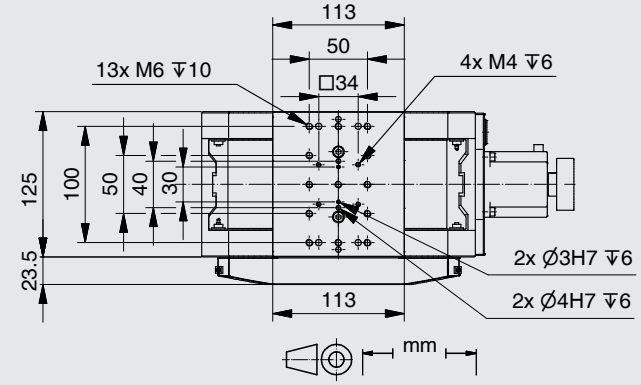


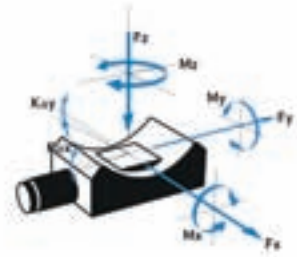

| Order No. | 6560-9- | | 1 | |
|---|---|---|---|---|
| DC-B-082 | 1 | | | |
| 2Phase-070 | 2 | | | |
| | | | | |
| without AE-060 | 0 | | | |
| AE-060, Angular scale | 1 | | | |

## FACTS

| Load characteristics | $F_{x(N)}$ | $F_{y(N)}$ | $F_{z(N)}$ | $M_{x(Nm)}$ | $M_{y(Nm)}$ | $M_{z(Nm)}$ | $k_{\pm x(\mu rad/Nm)}$ | $k_{\pm y(\mu rad/Nm)}$ |
|---|---|---|---|---|---|---|---|---|
| DC-B-040 | 50 | 50 | 80 | 2.5 | 12 | 12 | 25 | 25 |
| 2Phase-048 | 50 | 50 | 80 | 2.5 | 12 | 12 | 25 | 25 |

## KEY FEATURES

- Uni-directional repeatability down to 0.001 °
- Maximum speed 15 °/sec
- Load capacity up to 8 kg
- Integrated mechanical limit switches
- Together with WT-120 one centre of rotation
- Option: Integrated angular scale

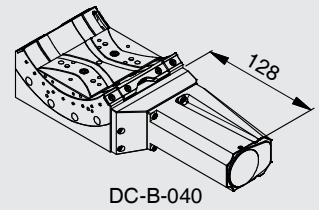


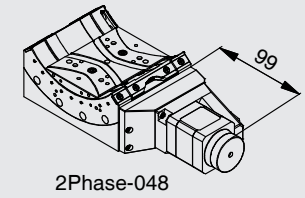
The WT-90 goniometer stage is designed for all tasks where conventional rotation stages cannot be used due to limited space conditions. Typical uses are applications in the area of laser positioning and radiology. The WT-120 and WT-90 goniometer stages are matched to work together. When mounted orthogonally to each other they have a common center of rotation. The WT-90 is equipped with a ground bearing guide. The ground and hardened worm screw and worm gear combination produces a very quiet and smooth motion. The stages are directly driven by a DC or 2-phase stepper motor and can achieve a relatively high speed. The WT-90 stages can be equipped with an optical angular scale system and have two limit switches.

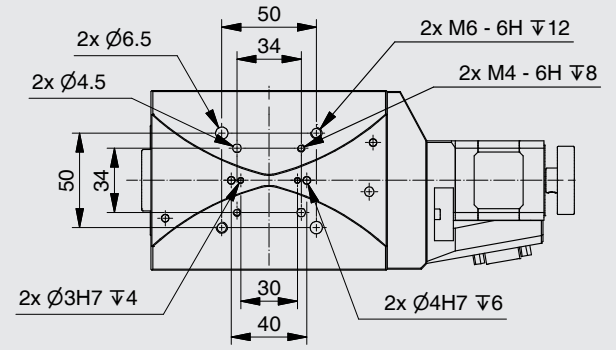
## TECHNICAL DATA

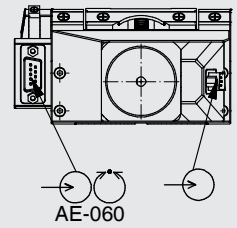
| | | | |
|---|---|---|---|
| Travel range (°) | 90 | | |
| Wobble (Bearings) (µrad) | ± 125 | | |
| Weight (kg) | 2.8 | | |
| Motor | DC-B-040 | 2Phase-048 | |
| Linear scale | | | AE-060 |
| Speed max. (°/sec) | 15 | | |
| Resolution calculated (°) | 0.00005 (RE) | 0.001 (FS) | 0.0001542 |
| Resolution typical (°) | 0.003 | | 0.001 |
| Bi-directional Repeatability (°) | ± 0.02 | | ± 0.001 |
| Uni-directional Repeatability (°) | 0.005 | | 0.001 |
| Nominal Current (A) | 3.8 | 1.2 | |
| Voltage Range (V) | 24 | | |
| Worm gear reduction | 360:1 | | |
| Accuracy | on request | | |
| Velocity range (°/sec) | 0.001 ... 15 | | |
| Material | Aluminum, black anodized, stainless steel, red brass | | |

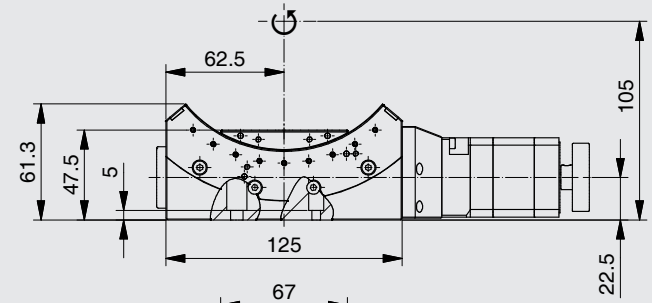
Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.

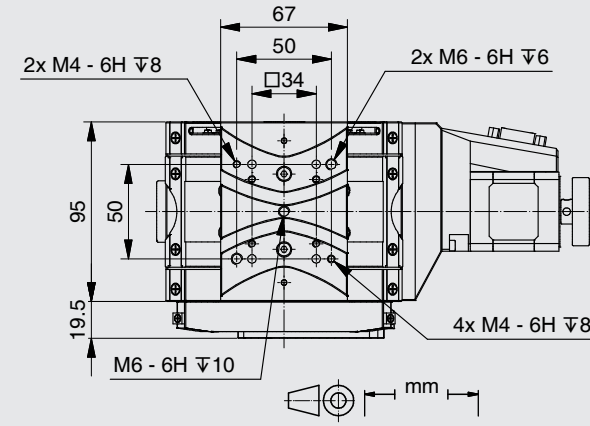


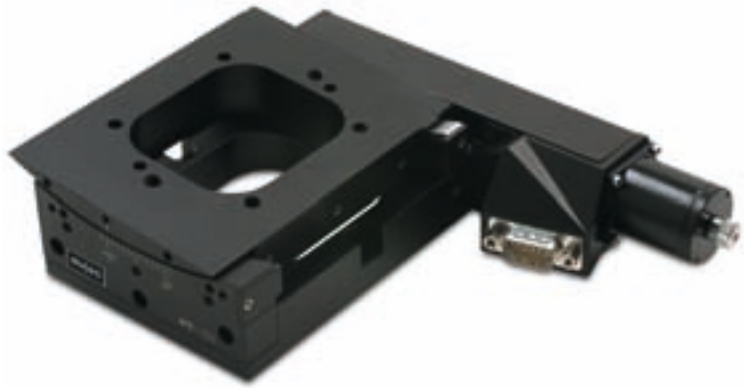




| Order No. | 6550-9- | | 0 | |
|---|---|---|---|---|
| DC-B-040 | 1 | | | |
| 2Phase-048 | 2 | | | |
| without AE-060 | 0 | | | |
| AE-060, Angular scale | 1 | | | |

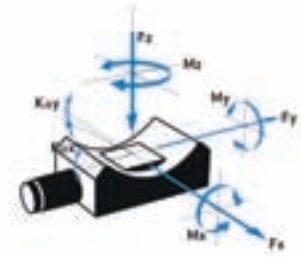
## FACTS

| Load characteristics | $Fx_{(N)}$ | $Fy_{(N)}$ | $Fz_{(N)}$ | $Mx_{(Nm)}$ | $My_{(Nm)}$ | $Mz_{(Nm)}$ | $k_{\vartheta x(\mu rad/Nm)}$ | $k_{\vartheta y(\mu rad/Nm)}$ |
|---|---|---|---|---|---|---|---|---|
| DC-B-070 | 15 | 15 | 20 | 0.75 | 4 | 4 | 80 | 80 |
| 2Phase-020 | 15 | 15 | 20 | 0.75 | 4 | 4 | 80 | 80 |



## KEY FEATURES

- Uni-directional repeatability down to 0.0005 °
- Maximum speed 15 °/sec
- Load capacity up to 2 kg
- Integrated mechanical limit switches
- Clear aperture 60 x 25 mm
- Precise, smooth continuous 10° motion
- Together with WT-85 one centre of rotation
- Option: Integrated angular scale

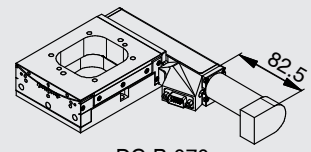


The WT-100 goniometer stage is designed for all tasks where conventional rotation stages cannot be used due to limited space conditions or where a clear aperture is needed. Typical applications are metrology tasks in the area of laser technology and radiology. The WT-100 and WT-85 goniometer stages are designed to work together. When mounted orthogonally to each other they have a common center of rotation. The WT-100 has a 60 x 25 mm clear aperture. A unique driving mechanism insures a very quiet and smooth motion. The stages are driven directly by a DC or 2-phase stepper motor and can achieve a relatively high speed. The WT-100 stage is available with optional optical angular scales and is equipped with two limit switches.

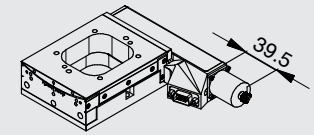
## TECHNICAL DATA

| | | | |
|---|---|---|---|
| Travel range (°) | 10 | | |
| Wobble (Bearings) (µrad) | ± 125 | | |
| Weight (kg) | 0.9 | | |
| Motor | DC-B-070 | 2Phase-020 | |
| Linear scale | | | AE-060 |
| Speed max. (°/sec) | 15 | 7 | |
| Resolution calculated (°) | 0.0002 (RE) | 0.002 (FS) | 0.00009 |
| Resolution typical (°) | 0.001 | 0.001 | 0.0005 |
| Bi-directional Repeatability (°) | ± 0.004 | ± 0.004 | ± 0.0005 |
| Uni-directional Repeatability (°) | 0.004 | 0.004 | 0.0005 |
| Nominal Current (A) | 0.931 | 1.2 | |
| Voltage Range (V) | 36 | | |
| Reduction | 900:1 | | |
| Accuracy | on request | | |
| Velocity range (°/sec) | 0.001 ... 15 | | |
| Material | Aluminum, black anodized | | |

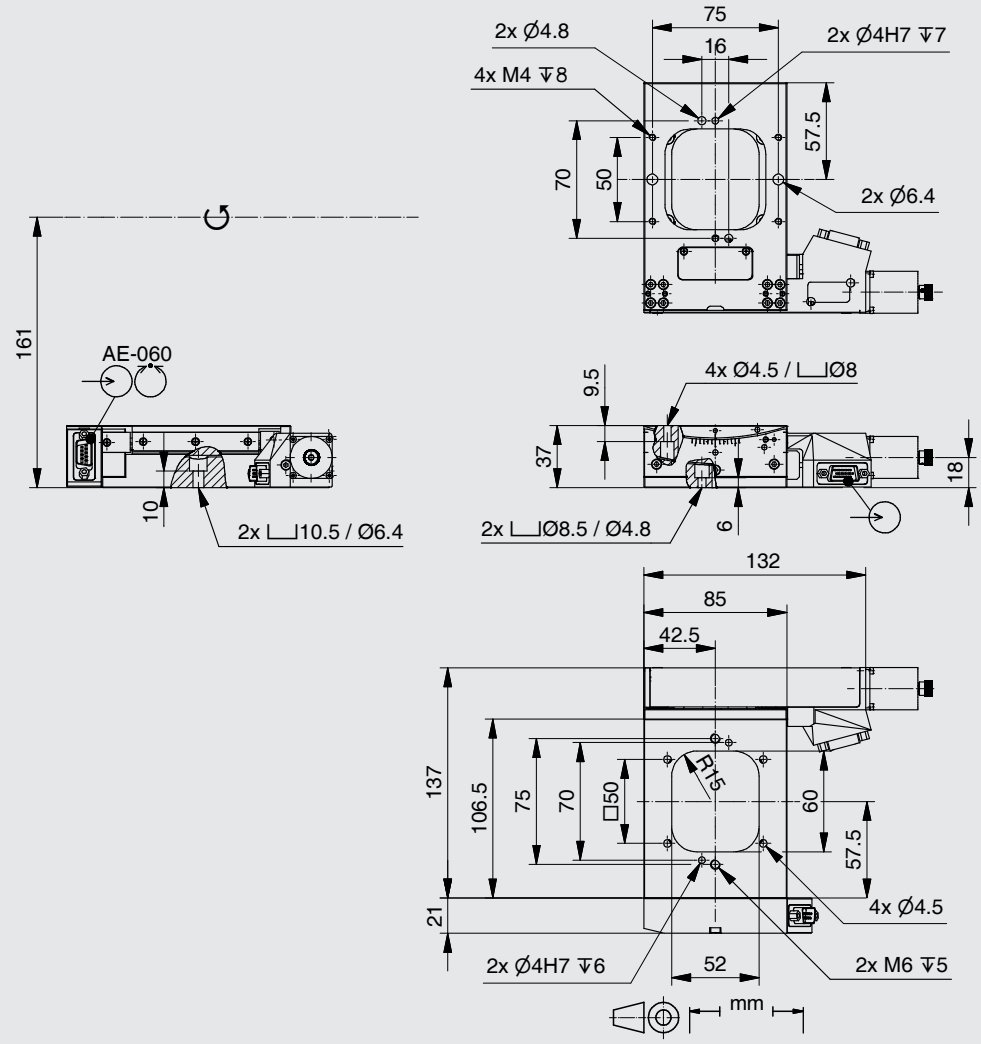
Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.




DC-B-070



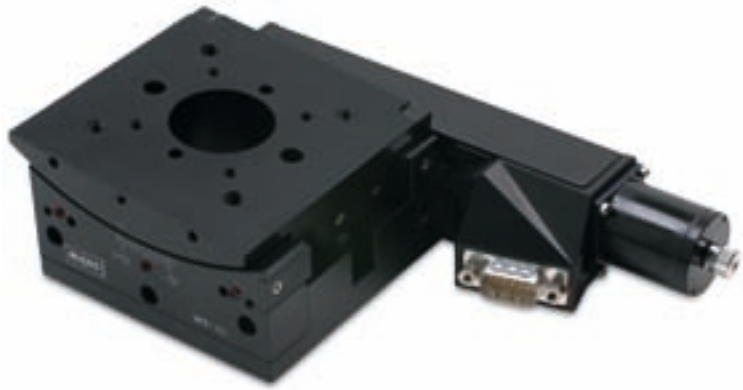

2Phase-020




| Order No. | 6541-9- | | 0 | |
|---|---|---|---|---|
| DC-B-070 | 1 | | | |
| 2Phase-020 | 2 | | | |
| without AE-060 | 0 | | | |
| AE-060, Angular scale | 1 | | | |

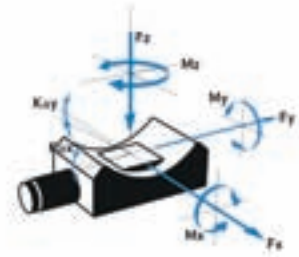
## FACTS

| Load characteristics | $F_{x(N)}$ | $F_{y(N)}$ | $F_{z(N)}$ | $M_{x(Nm)}$ | $M_{y(Nm)}$ | $M_{z(Nm)}$ | $k_{\pm x(\mu rad/Nm)}$ | $k_{\pm y(\mu rad/Nm)}$ |
|---|---|---|---|---|---|---|---|---|
| DC-B-070 | 15 | 15 | 20 | 0.75 | 4 | 4 | 80 | 80 |
| 2Phase-020 | 15 | 15 | 20 | 0.75 | 4 | 4 | 80 | 80 |



## KEY FEATURES

- Uni-directional repeatability down to 0.0005 °
- Maximum speed 15 °/sec
- Load capacity up to 2 kg
- Integrated mechanical limit switches
- Clear aperture 30 mm
- Precise, smooth continuous 10° motion
- Option: Integrated angular scale
- Together with WT-100 one centre of rotation

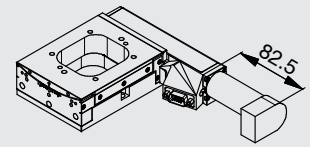


The WT-85 goniometer stage is designed for all tasks where conventional rotation stages cannot be used due to limited space conditions or where a clear aperture is needed. Typical applications are metrology tasks in the area of laser technology and radiology. The WT-85 and WT-100 goniometer stages are designed to work together. When mounted orthogonally to each other they have a common center of rotation. The WT-85 has a 30 mm clear aperture. A unique driving mechanism insures a very quiet and smooth motion. The stage is driven directly by a DC or 2-phase stepper motor and can achieve a relatively high speed. The WT-85 stages are available with an optional optical angular scale and are equipped with two limit switches.

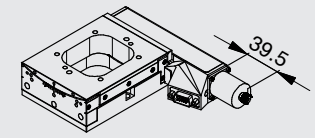
## TECHNICAL DATA

| | | | |
|---|---|---|---|
| Travel range (°) | 10 | | |
| Wobble (Bearings) (µrad) | ± 125 | | |
| Weight (kg) | 0.9 | | |
| Motor | DC-B-070 | 2Phase-020 | |
| Linear scale | | | AE-060 |
| Speed max. (°/sec) | 15 | 7 | |
| Resolution calculated (°) | 0.0002667 (RE) | 0.0026665 (FS) | 0.0001208 |
| Resolution typical (°) | 0.001 | 0.001 | 0.0005 |
| Bi-directional Repeatability (°) | ± 0.004 | ± 0.004 | ± 0.0005 |
| Uni-directional Repeatability (°) | 0.004 | 0.004 | 0.0005 |
| Nominal Current (A) | 0.931 | 1.2 | |
| Voltage Range (V) | 36 | | |
| Reduction | 675:1 | | |
| Accuracy | on request | | |
| Velocity range (°/sec) | 0.001 ... 15 | | |
| Material | Aluminum, black anodized | | |

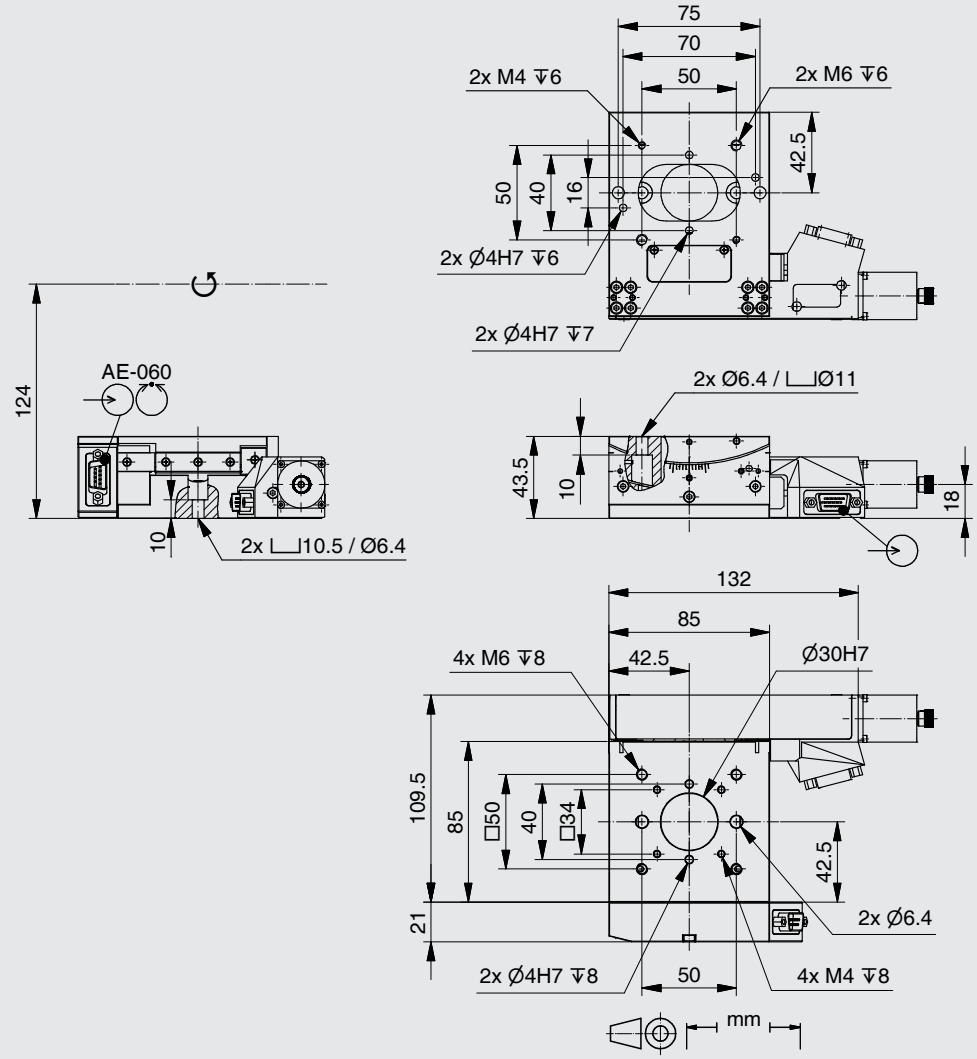
Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.




DC-B-070




2Phase-020

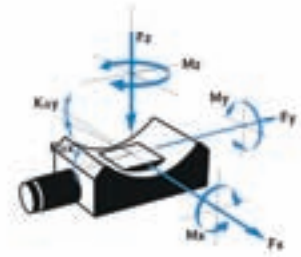



| Order No. | 6540-9- | | 0 | |
|---|---|---|---|---|
| DC-B-070 | 1 | | | |
| 2Phase-020 | 2 | | | |
| without AE-060 | 0 | | | |
| AE-060, Angular scale | 1 | | | |

NEW V

## FACTS

| Load characteristics | $Fx_{(N)}$ | $Fy_{(N)}$ | $Fz_{(N)}$ | $Mx_{(Nm)}$ | $My_{(Nm)}$ | $Mz_{(Nm)}$ |
|---|---|---|---|---|---|---|
| DC-B-005 | 1 | 1 | 5 | 0.05 | 0.05 | 0.3 |




The TT-65 tip-tilt stage was designed for applications where optical elements have to be remotely tilted in an optical beam path. The tilt range in both axes is 5°. The stage can be mounted horizontally on linear stages like LS-65 or vertically, for example in our CAMPUS systems. The tip-tilt stage is equipped with a reference switch and is offered with a DC or stepper motor.

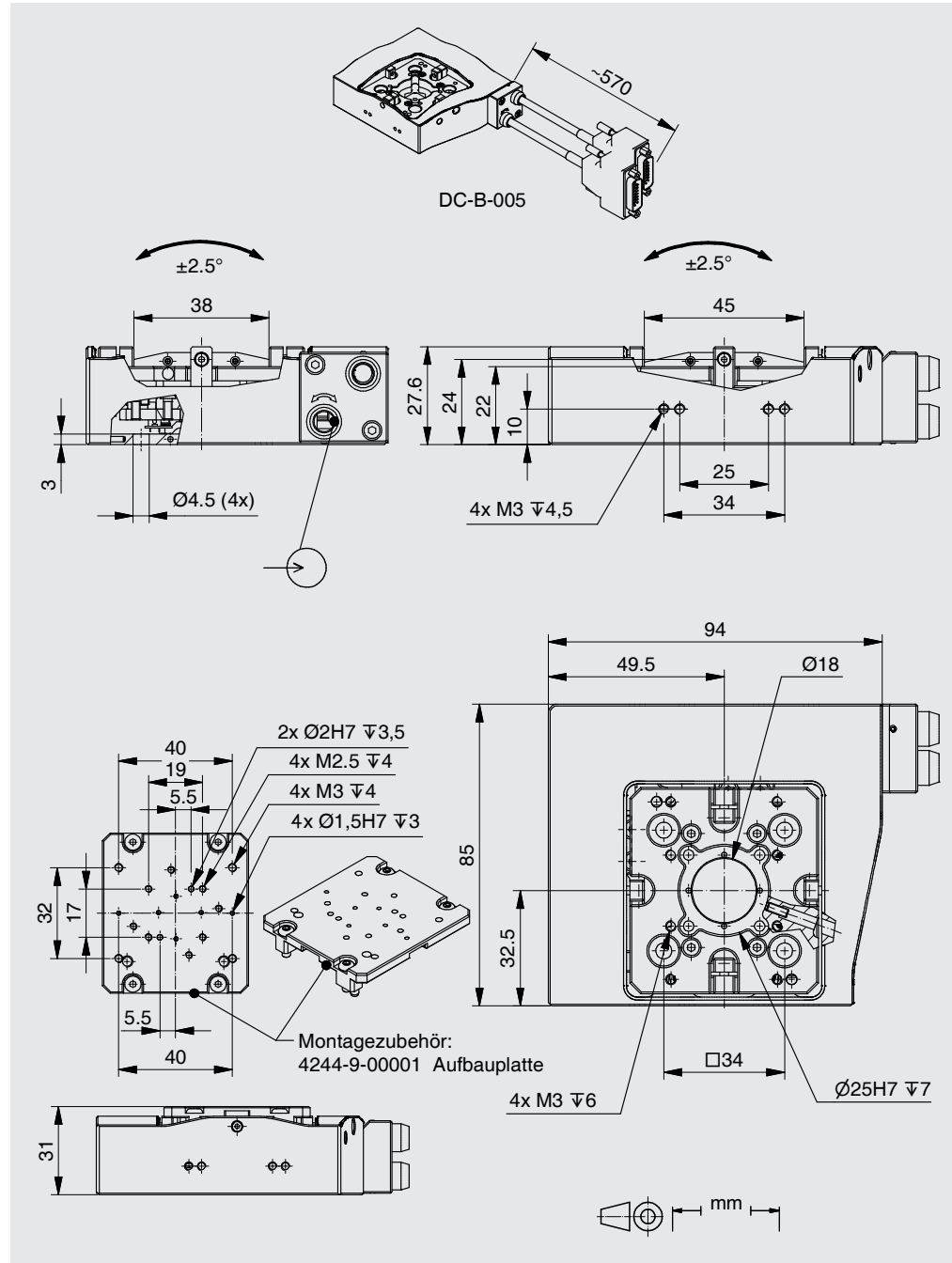
## KEY FEATURES

- Uni-directional repeatability down to 0.004 °
- Travel range in tip, tilt 5 °
- Maximum speed 0.25 °/sec
- Load capacity up to 0.5 kg
- Integrated mechanical limit switches
- Clear aperture 25 mm diameter

## TECHNICAL DATA

| | |
|---|---|
| Travel range (°) | 5 |
| Weight (kg) | 0.45 |
| Motor | DC-B-005 |
| Speed max. (°/sec) | 0.25 |
| Resolution calculated (°) | 0.0018675 (RE) |
| Resolution typical (°) | 0.001 |
| Bi-directional Repeatability (°) | ± 0.004 |
| Uni-directional Repeatability (°) | 0.004 |
| Nominal Current (A) | 0.08 |
| Voltage Range (V) | 12 |
| Accuracy | on request |
| Velocity range (°/sec) | 0.00025 ... 0.25 |
| Material | Aluminum, black anodized |

Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.




| Order No. | 4244-9- | | 1 | 0 | | 0 |
|---|---|---|---|---|---|---|
| DC-B-005 | | 1 | | | | |
| OLS-010, Optical limit switches | | 3 | | | | |

NEW V

The AFW-65 filter wheel was designed for rotating 6 filters with diameter of 25.4 mm. It can be mounted in a linear setup and fits in our Albatros optical bench as well as in the optical height of the LINOS microbench rail with carrier. The filter wheels are equipped with a reference switch and are offered with DC or stepper motors. The filters can be fixed with a screw or with filter mounts.

## KEY FEATURES

- Uni-directional repeatability down to 0.1 °
- Maximum speed 360 °/sec
- Integrated hall reference switch
- Up to 6 filters
- Clear aperture 25 mm

## TECHNICAL DATA

| | |
|---|---|
| Travel range (°) | 360, endless |
| Weight (kg) | 0.7 |

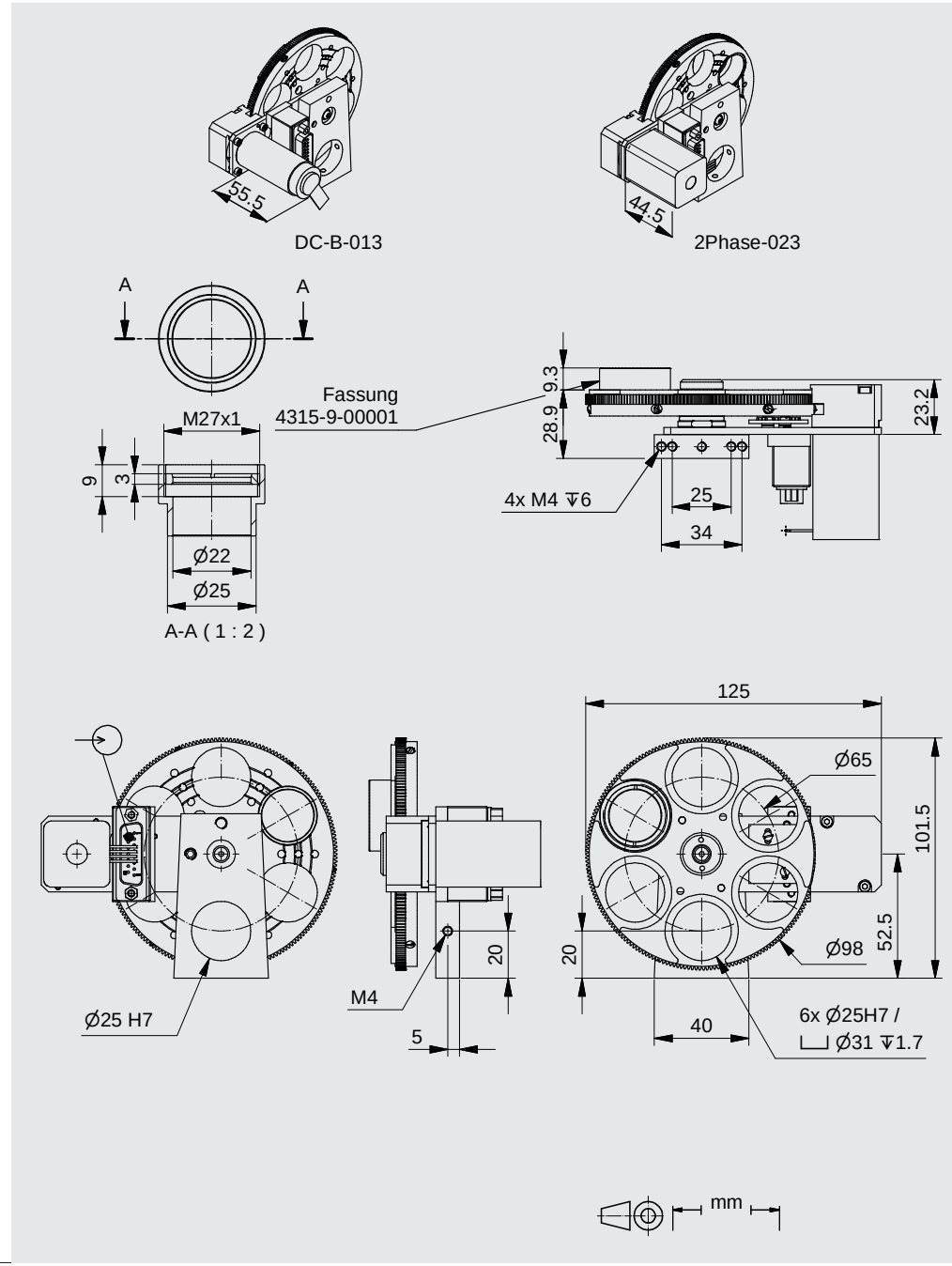
| Motor | DC-B-013 | 2Phase-023 |
|---|---|---|
| Speed max. (°/sec) | 90 | 360 |
| Resolution calculated (°) | 0.0014881 (RE) | 0.4517 (FS) |
| Resolution typical (°) | 0.001 | 0.05 |
| Bi-directional Repeatability (°) | ± 0.5 | ± 0.5 |
| Uni-directional Repeatability (°) | 0.1 | 0.1 |
| Nominal Current (A) | 0.28 | 1.3 |
| Voltage Range (V) | 24 | |

| | |
|---|---|
| Accuracy | on request |
| Velocity range (°/sec) | ... 360 |
| Material | Aluminum, black anodized |

Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.



PI micos



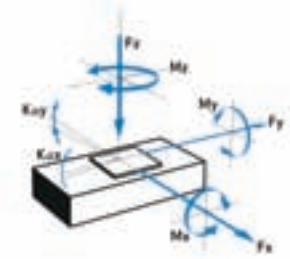

| Order No. | 4315-9- | | 0 | 0 | |
|---|---|---|---|---|---|
| DC-B-013 | | 1 | | | |
| 2Phase-023 | | 2 | | | |
| HLS-010, Hall switches | | 1 | | | |

# PIEZO STAGES

# 6.200 Linear Piezo Stage LPS-35

## FACTS

| Load characteristics | $F_{x(N)}$ | $F_{y(N)}$ | $F_{z(N)}$ | $M_{x(Nm)}$ | $M_{y(Nm)}$ | $M_{z(Nm)}$ | $k_{\pm x(\mu rad/Nm)}$ | $k_{\pm y(\mu rad/Nm)}$ |
|---|---|---|---|---|---|---|---|---|
| PM-005 | 4 | 2 | 8 | 0.2 | 0.3 | 0.2 | 250 | 150 |



The linear piezo stage LPS-35 is specifically designed for precise positioning of small components. They are ideal for a variety of applications, such as Micro-, Nano- technology, Bio Technology, Microscopy and R&D. LPS-35 stages are working in open or closed-loop mode, where a resolution of up to 50 nm is available. Due to the principle in open loop there is no repeatability. It is directly driven with an inertial piezo motor without any backlash. The travel range is 6.5, 13, 26 or 38 mm. Mounting the stage to an XY assembly can be made only with a special mounting adapter and must be specified when ordering.

## KEY FEATURES

- Piezo driven inertia motor
- Travel range up to 38 mm (1 1/2")
- Uni-directional repeatability down to 0.03 µm
- Maximum speed 0.5 mm/sec
- Load capacity up to 0.8 kg
- Encoder resolution 5 nm
- Holding force 4 N
- Option: linear scale

## TECHNICAL DATA

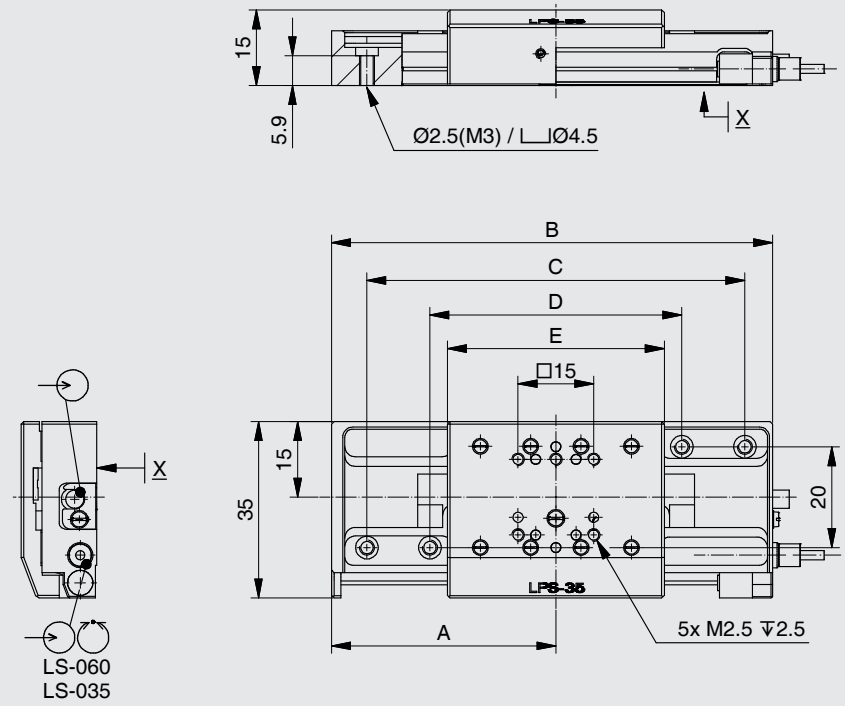
| | | | | |
|---|---|---|---|---|
| Travel range (mm) | 6.5 | 13 | 26 | 38 |
| Straightness / Flatness (µm) | ± 3 | ± 5 | ± 8 | ± 10 |
| Pitch (µrad) | ± 50 | ± 60 | ± 80 | ± 100 |
| Yaw (µm) | ± 60 | ± 70 | ± 90 | ± 110 |
| Weight (kg) | 0.17 | 0.2 | 0.23 | 0.26 |

| | | | |
|---|---|---|---|
| Motor | PM-005 | | |
| Linear scale | | LS-035 | LS-060 |
| Speed max. (mm/sec) | 0.5 | | |
| Resolution calculated (µm) | | 0.05 | 0.005 |
| Resolution typical (µm) | | 0.05 | |
| Bi-directional Repeatability (µm) | | ± 0.1 | ± 0.1 |
| Uni-directional Repeatability (µm) | | 0.05 | 0.05 |
| Nominal Current (A) | | | |

| | |
|---|---|
| Accuracy | on request |
| Velocity range (mm/sec) | ... 0.5 |
| Material | Aluminum, black anodized |

Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.

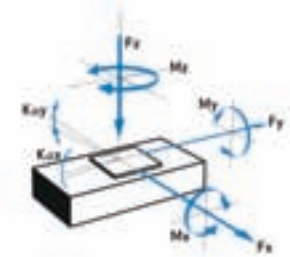
| Travel (mm) | 6.5 | 13 | 26 | 38 |
|---|---|---|---|---|
| A | 17.3 | 20.55 | 38.55 | 44.6 |
| B | 33 | 39.5 | 75.5 | 87.5 |
| C | - | - | - | 75 |
| D | 25 | 25 | 50 | 50 |
| E | 20 | 20 | 44 | 44 |
| F | 27 | 27 | 50 | 50 |




| Order No. | 5801-9- | | | | 0 |
|---|---|---|---|---|---|
| PM-005 | 1 | | | | |
| 6.5 mm (1/4") | | 1 | | | |
| 13 mm (1/2") | | 2 | | | |
| 26 mm (1") | | 3 | | | |
| 38 mm (1 1/2") | | 4 | | | |
| without linear glass scale | | | | | 0 |
| LS-060, Linear glass scale | | | | | 1 |
| LS-035, Linear glass scale | | | | | 2 |

## FACTS

| Load characteristics | $F_{x(N)}$ | $F_{y(N)}$ | $F_{z(N)}$ | $M_{x(Nm)}$ | $M_{y(Nm)}$ | $M_{z(Nm)}$ | $k_{\pm x(\mu rad/Nm)}$ | $k_{\pm y(\mu rad/Nm)}$ |
|---|---|---|---|---|---|---|---|---|
| PM-005 | 5 | 2 | 8 | 0.2 | 0.3 | 0.2 | 250 | 250 |



The PP-30 piezo stages are designed for the precise positioning of small components. They are ideal for a variety of applications, such as micro technology, bio technology, microscopy, quality control and R&D. The PP-30 stages are working in open or closed-loop mode. The closed loop resolution is 0.1 µm and open loop average resolution is about 300 nm. For higher repeatability PI miCos recommends an optional linear encoder. The stages can be assembled as compact XY or XYZ positioning systems. The travel range is 8 mm, 18 mm or 30 mm. Optionally the stages can be configured for vacuum or cryogenic environments. The PP-30 stages can be controlled by our PiCo-33 controllers. Customized designs for OEM are possible.

## KEY FEATURES

- Travel range up to 30 mm
- Uni-directional repeatability down to 0.05 µm
- Maximum speed 2 mm/sec
- Load capacity up to 0.8 kg
- Integrated linear scale
- Piezo driven step motor, no hysteresis
- Holding force 4 N
- Option: Linear scale

## TECHNICAL DATA

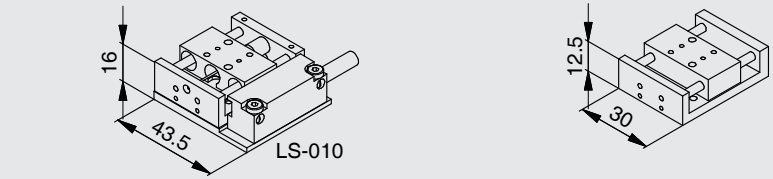
| | | | |
|---|---|---|---|
| Travel range (mm) | 8 | 18 | 30 |
| Straightness / Flatness (µm) | ± 0.7 | ± 1.5 | ± 3 |
| Pitch (µrad) | ± 100 | ± 150 | ± 250 |
| Yaw (µm) | ± 120 | ± 120 | ± 120 |
| Weight (kg) | 0.15 | 0.2 | 0.25 |

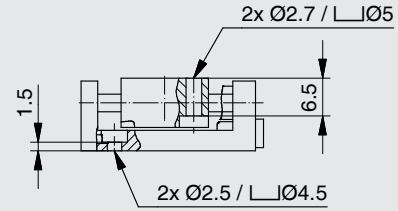
| | | |
|---|---|---|
| Motor | PM-005 | |
| Linear scale | | LS-010 |
| Speed max. (mm/sec) | 0.5 | |
| Resolution calculated (µm) | | 0.05 |
| Resolution typical (µm) | | 0.2 |
| Bi-directional Repeatability (µm) | | ± 0.1 |
| Uni-directional Repeatability (µm) | | 0.05 |
| Nominal Current (A) | | |

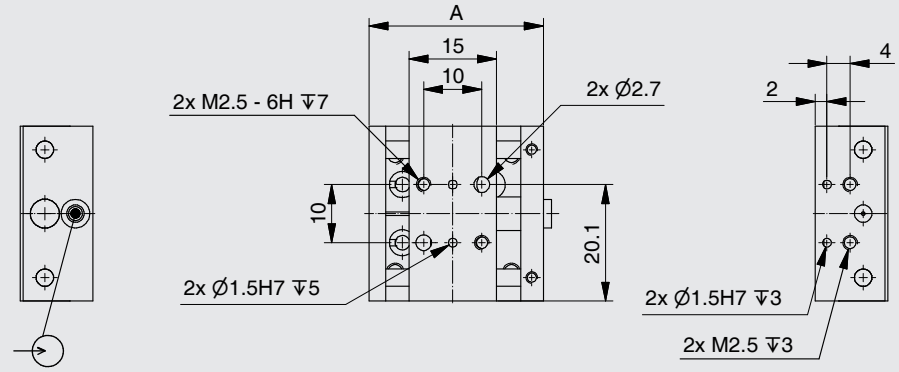
| | |
|---|---|
| Accuracy | on request |
| Velocity range (mm/sec) | 0.001 ... 2 |
| Material | Aluminum, black anodized |

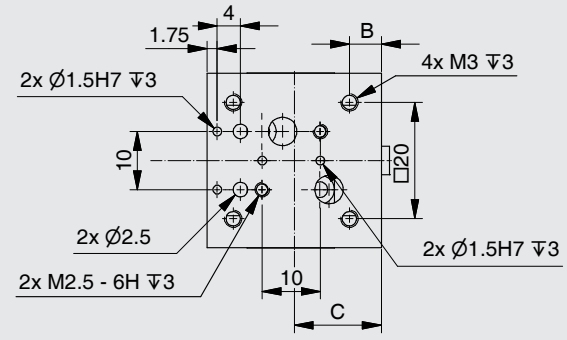
Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.

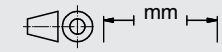
| Travel (mm) | 8 | 18 | 30 |
|---|---|---|---|
| A | 30 | 40 | 52 |
| B | 5.5 | 10.5 | 16.5 |
| C | 15.5 | 20.5 | 26.5 |



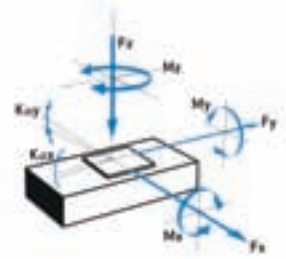




| Order No. | 5805-9- | | | | 0 |
|---|---|---|---|---|---|
| PM-005 | 1 | | | | |
| 8 mm | | 1 | | | |
| 18 mm | | 2 | | | |
| 30 mm | | 3 | | | |
| without LS-010 | | | | | 0 |
| LS-010, Linear steel scale | | | | | 1 |

# 6.204 Piezo Positioner PP-20

## FACTS

| Load characteristics | $F_{x(N)}$ | $F_{y(N)}$ | $F_{z(N)}$ | $M_{x(Nm)}$ | $M_{y(Nm)}$ | $M_{z(Nm)}$ |
|---|---|---|---|---|---|---|
| PM-002 | 10 | 2 | 10 | 0.4 | 0.6 | 0.5 |



The PP-20 is a compact linear stage designed for open loop applications where nanopositioning for higher loads is required. Low profile and high load capacity are achieved by using a dual piezo motor combined with a steel ball bearing, which allows smooth travel up to 11 mm. Vacuum and Ultra High Vacuum $10^{-9}$ mbar compatible versions are available.

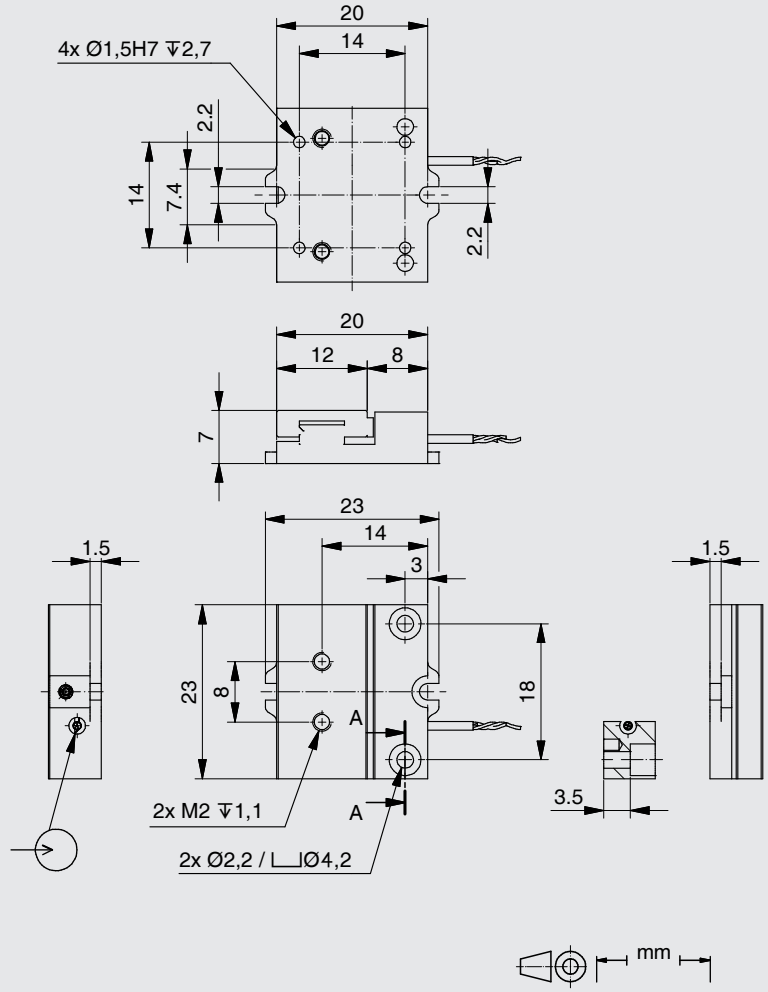
## KEY FEATURES

- Travel range of up to 11 mm
- Load capacity up to 1 kg
- nm resolution
- Steel ball bearing
- Low profile, 7 mm stage height
- Vacuum versions available

## TECHNICAL DATA

| | |
|---|---|
| Travel range (mm) | 11 |
| Weight (kg) | 0.013 |
| Motor | PM-002 |
| Speed max. (mm/sec) | 2 |
| Resolution calculated (µm) | 0.001 |
| Resolution typical (µm) | |
| Bi-directional Repeatability (µm) | |
| Uni-directional Repeatability (µm) | |
| Nominal Current (A) | |
| | |
| Accuracy | on request |
| Velocity range (mm/sec) | 0 ... 2 |
| Material | Stainless steel bearings, aluminum body |

Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.

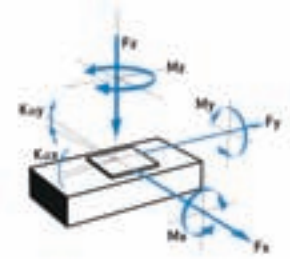



| Order No. | 5830-9- | | | | | |
|---|---|---|---|---|---|---|
| PM-002 | 1 | | | | | |
| 11 mm | 1 | | | | | |
| open loop | 0 | | | | | |
| without limit switch | 0 | | | | | |
| non vacuum | 0 | | | | | |
| $10^{-6}$ mbar | 6 | | | | | |
| $10^{-9}$ mbar | 9 | | | | | |

# 6.206 Piezo Positioner PP-22

## FACTS

| Load characteristics | $Fx_{(N)}$ | $Fy_{(N)}$ | $Fz_{(N)}$ | $Mx_{(Nm)}$ | $My_{(Nm)}$ | $Mz_{(Nm)}$ |
|---|---|---|---|---|---|---|
| PM-002 | 10 | 2 | 10 | 0.4 | 0.6 | 0.5 |



The PP-22 is a low profile linear stage utilizing a dual piezo motor for increased precision and load carrying capacity. The use of two steel ball bearings guarantees smooth and stable motion over a travel length of 12 mm and an optional linear encoder provides nanometer repeatability. The PP-22 can be stacked c_qgjw in XY and XYZ arrangements. Vacuum and Ultra High Vacuum ($10^{-9}$ mbar) compatible versions are available.
Encoder is rated at $10^{-8}$ mbar.

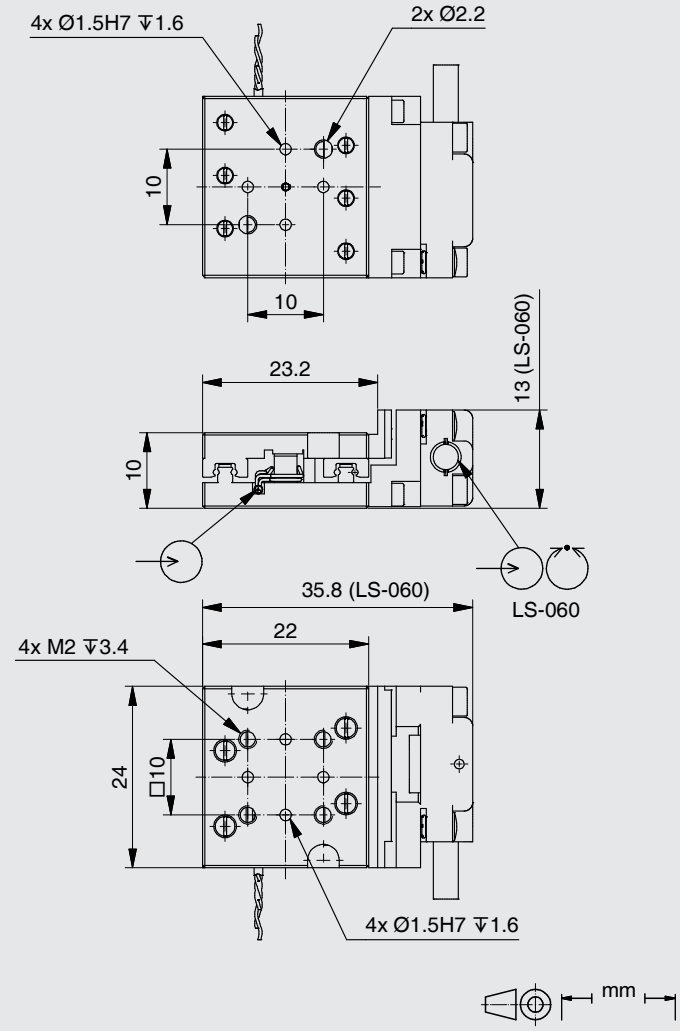
## KEY FEATURES

- Travel range of up to 12 mm
- Load capacity up to 1 kg
- Low profile, 10 mm stage height
- Two steel ball bearings
- Available with a linear encoder down to 5 nm resolution (1.2 nm upon request)
- Vacuum versions available

## TECHNICAL DATA

| | | |
|---|---|---|
| Travel range (mm) | 12 | |
| Weight (kg) | 0.015 | |
| Motor | PM-002 | |
| Linear scale | | LS-060 |
| Speed max. (mm/sec) | 2 | |
| Resolution calculated (µm) | 0.001 | 0.005 |
| Resolution typical (µm) | | |
| Bi-directional Repeatability (µm) | | |
| Uni-directional Repeatability (µm) | | |
| Nominal Current (A) | | |
| Accuracy | on request | |
| Velocity range (mm/sec) | 0 ... 2 | |
| Material | Stainless steel bearings, aluminum body | |

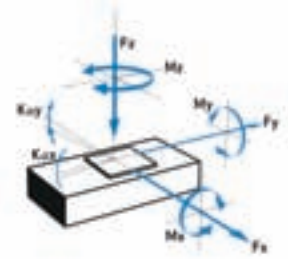
Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.




| Order No. | 5831-9- | | | | | |
|---|---|---|---|---|---|---|
| PM-002 | 1 | | | | | |
| 12 mm | | 1 | | | | |
| open loop | | | 0 | | | |
| LS-060, Linear glass scale | | | 1 | | | |
| without limit switch | | | | 0 | | |
| non vacuum | | | | | 0 | |
| $10^{-6}$ mbar | | | | | 6 | |
| $10^{-9}$ mbar | | | | | 9 | |

## FACTS

| Load characteristics | $Fx_{(N)}$ | $Fy_{(N)}$ | $Fz_{(N)}$ | $Mx_{(Nm)}$ | $My_{(Nm)}$ | $Mz_{(Nm)}$ |
|---|---|---|---|---|---|---|
| PM-002 | 2 | 2 | 10 | 0.4 | 0.6 | 0.5 |



The PPX-32 is a low profile XY-stage designed for space saving applications where fgefcp load carrying capacity and nanopositioning are required. An optional linear encoder provides nanometer repeatability, while two dual piezo motors and steel ball bearings ensure smooth and steady motion. The PPX-32 can also be combined with the PR-32 and a z-stage can be added (e.g. PP-30, PP-22) with a mounting bracket.
Encoder is rated at $10^{-8}$ mbar.

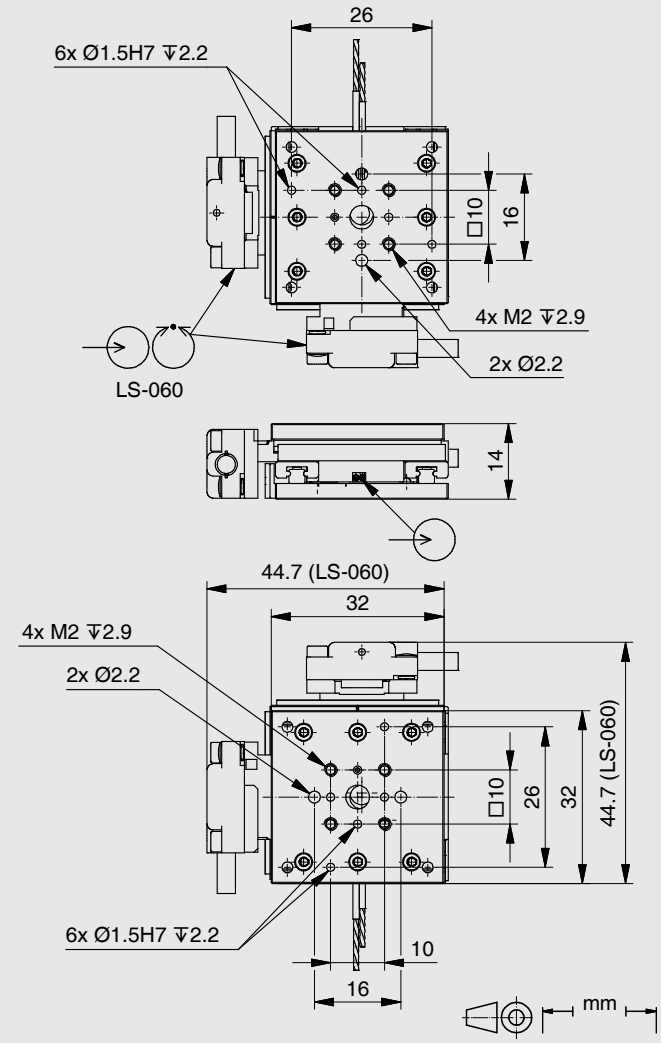
## KEY FEATURES

- Travel range of 18 mm x 18 mm
- Load capacity up to 1 kg
- Low profile, 14 mm stage height
- Steel ball bearings
- Available with linear encoders down to 5 nm resolution
- Vacuum versions available

## TECHNICAL DATA

| | | |
|---|---|---|
| Travel range (mm) | 18 x 18 | |
| Weight (kg) | 0.04 | |
| Motor | PM-002 | |
| Linear scale | | LS-060 |
| Speed max. (mm/sec) | 2 | |
| Resolution calculated (µm) | 0.001 | 0.005 |
| Resolution typical (µm) | | |
| Bi-directional Repeatability (µm) | | |
| Uni-directional Repeatability (µm) | | |
| Nominal Current (A) | | |
| Accuracy | on request | |
| Velocity range (mm/sec) | 0 ... 2 | |
| Material | Stainless steel bearings, aluminum body | |

Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.

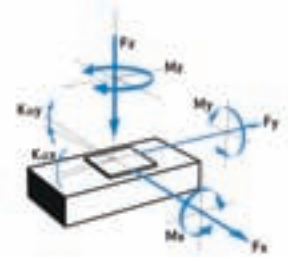



| Order No. | 5832-9- | | | | | |
|---|---|---|---|---|---|---|
| PM-002 | 1 | | | | | |
| 18 mm | 2 | | | | | |
| open loop | | 0 | | | | |
| LS-060, Linear glass scale | | 1 | | | | |
| without limit switch | | | 0 | | | |
| non vacuum | | | | 0 | | |
| $10^{-6}$ mbar | | | | | 6 | |
| $10^{-9}$ mbar | | | | | 9 | |

# 6.210 Precision Piezo Stage PPS-20

## FACTS

| Load characteristics | $Fx_{(N)}$ | $Fy_{(N)}$ | $Fz_{(N)}$ | $Mx_{(Nm)}$ | $My_{(Nm)}$ | $Mz_{(Nm)}$ |
|---|---|---|---|---|---|---|
| PM-002 | 20 | 2 | 20 | 1 | 1 | 1 |



The PPS-20 is a high-precision, long travel linear piezo stage. Miniature cross-roller bearings assure high stiffness and guiding accuracy for loads up to 20 N (horizontal orientation). It utilizes our patent-pending multi-phase piezo motor resulting in high speed (> 2 mm/s) and high blocking force (> 2 N). The PPS-20 is available in open loop or with a linear glass scale encoder. Resolutions of 1.2 nm are achievable. Versions capable of operation in vacuum ($10^{-9}$ mbar) and/or cryo (< 4 Kelvin) are available. Encoder is rated at $10^{-8}$ mbar.

## KEY FEATURES

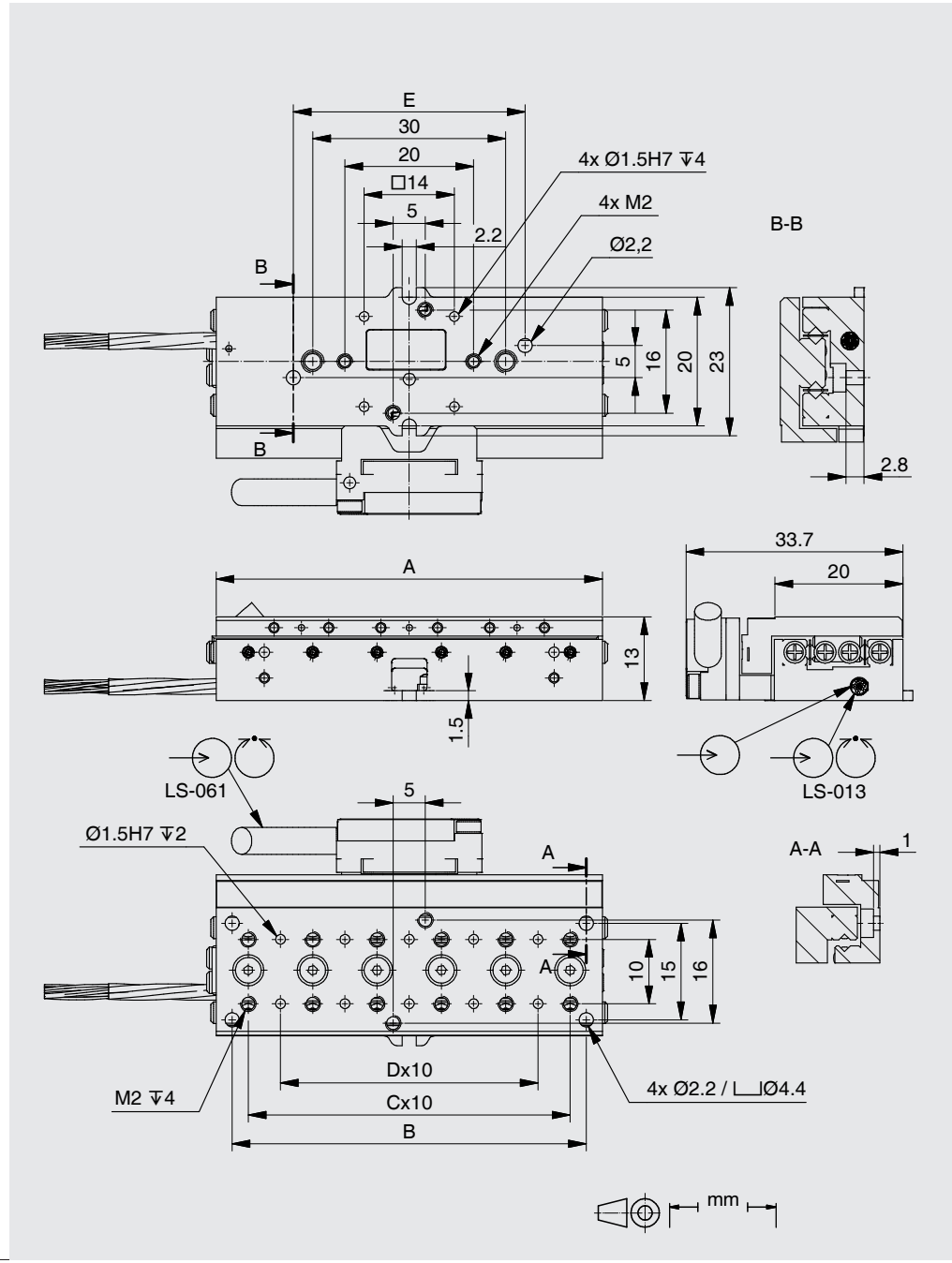
- Travel range of up to 51 mm
- nm resolution
- Load capacity up to 2 kg
- Steel cross-roller bearing
- Low profile, 13 mm stage height (10 mm without carriage)
- Vacuum, cryo and non-magnetic versions available

## TECHNICAL DATA

| | | | | | |
|---|---|---|---|---|---|
| Travel range (mm) | 11 | 18 | 26 | 38 | 51 |
| Weight (kg) | 0.017 | 0.017 | 0.027 | 0.039 | 0.051 |
| Motor | PM-002 | | | | |
| Linear scale | | | LS-013 | LS-061 | |
| Speed max. (mm/sec) | 2 | | | | |
| Resolution calculated (µm) | 0.001 | | 0.01 | 0.0012 | |
| Resolution typical (µm) | | | | | |
| Bi-directional Repeatability (µm) | | | | | |
| Uni-directional Repeatability (µm) | | | | | |
| Nominal Current (A) | | | | | |
| Accuracy | on request | | | | |
| Velocity range (mm/sec) | 0 ... 2 | | | | |
| Material | Stainless steel bearings, aluminum body | | | | |

Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.

| Travel (mm) | 11 | 18 | 26 | 38 | 51 |
|---|---|---|---|---|---|
| A | 20 | 30 | 40 | 60 | 80 |
| B | 15 | 25 | 35 | 55 | 75 |
| C | 1 | 1 | 3 | 5 | 7 |
| D | - | - | 2 | 4 | 6 |
| E | 16 | 16 | 36 | 36 | 36 |

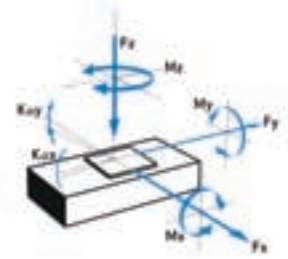



| Order No. | 5835-9- | | | | | |
|---|---|---|---|---|---|---|
| PM-002 | 1 | | | | | |
| 11 mm | | 1 | | | | |
| 18 mm | | 2 | | | | |
| 26 mm | | 3 | | | | |
| 38 mm | | 4 | | | | |
| 51 mm | | 5 | | | | |
| LS-013, Linear glass scale | | | 1 | | | |
| LS-061, Linear glass scale | | | 3 | | | |
| without limit switch | | | | 0 | | |
| non vacuum | | | | | 0 | |
| $10^{-6}$ mbar | | | | | 6 | |
| $10^{-9}$ mbar | | | | | 9 | |

# 6.212 Precision Piezo Stage PPS-28

## FACTS

| Load characteristics | $Fx_{(N)}$ | $Fy_{(N)}$ | $Fz_{(N)}$ | $Mx_{(Nm)}$ | $My_{(Nm)}$ | $Mz_{(Nm)}$ |
|---|---|---|---|---|---|---|
| PM-002 | 50 | 2 | 50 | 1 | 1 | 1 |



The PPS-28 is a high-precision, long travel linear piezo stage. Miniature cross-roller bearings assure high stiffness and guiding accuracy for loads up to 50 N (horizontal orientation). It utilizes our patent-pending multi-phase piezo motor resulting in high speed (> 2 mm/s) and high blocking force (> 2 N). The PPS-28 is available in open loop or with a linear glass scale encoder. Resolutions of 1.2 nm are achievable. Versions capable of operation in vacuum ($10^{-9}$ mbar) and/or cryo (< 4 Kelvin) are available. Encoder is rated at $10^{-8}$ mbar.

## KEY FEATURES

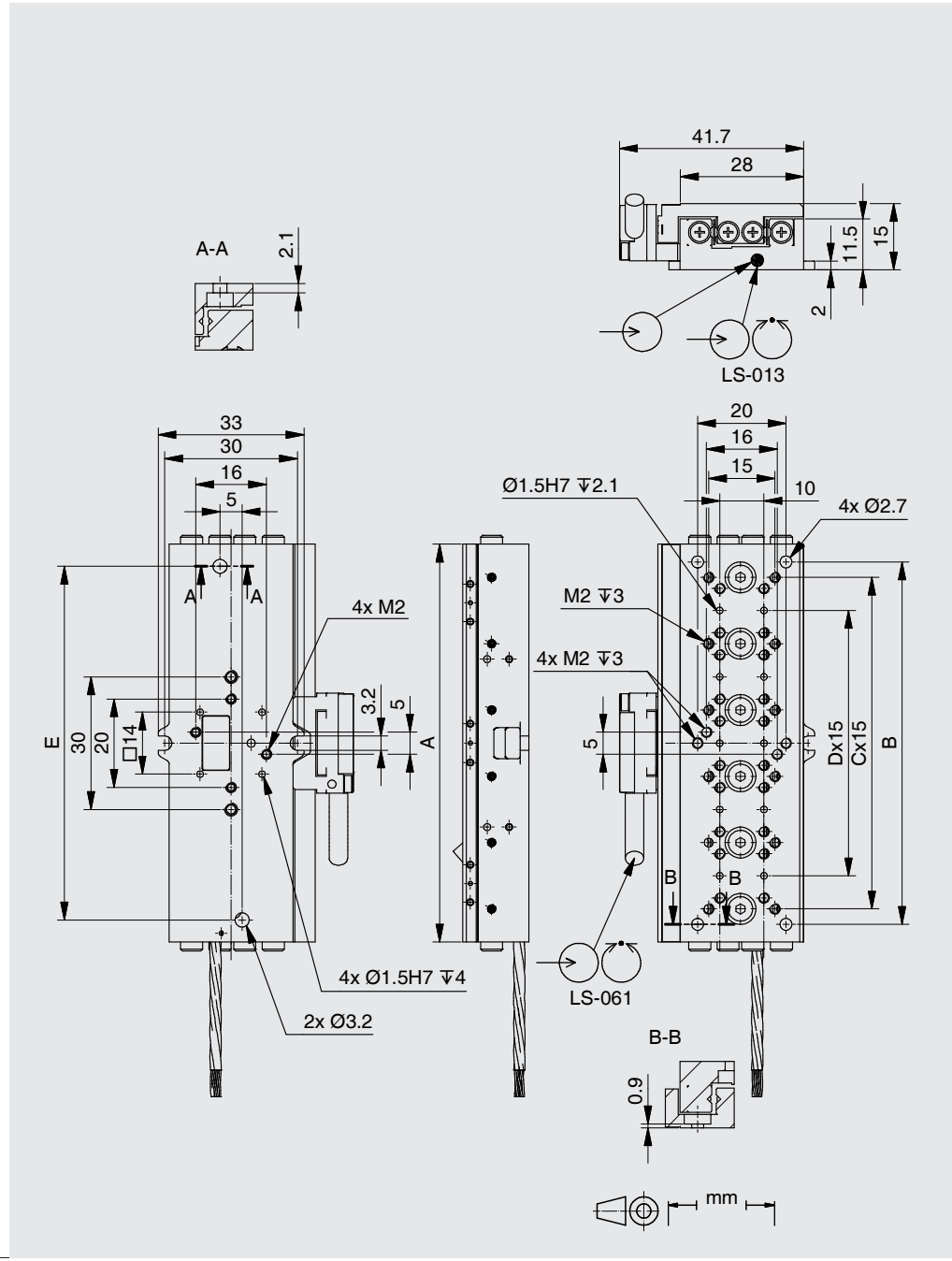
- Travel range of up to 102 mm
- nm resolution
- Load capacity up to 5 kg
- Steel cross-roller bearing
- Low profile, 15 mm stage height (11.5 mm without carriage)
- Vacuum, cryo and non-magnetic versions available

## TECHNICAL DATA

| | | | | | |
|---|---|---|---|---|---|
| Travel range (mm) | 26 | 35 | 51 | 76 | 102 |
| Weight (kg) | 0.063 | 0.083 | 0.125 | 0.165 | 0.206 |
| Motor | PM-002 | | | | |
| Linear scale | | | LS-013 | LS-061 | |
| Speed max. (mm/sec) | 2 | | | | |
| Resolution calculated (µm) | 0.001 | | 0.01 | 0.0012 | |
| Resolution typical (µm) | | | | | |
| Bi-directional Repeatability (µm) | | | | | |
| Uni-directional Repeatability (µm) | | | | | |
| Nominal Current (A) | | | | | |
| Accuracy | on request | | | | |
| Velocity range (mm/sec) | 0 ... 2 | | | | |
| Material | Stainless steel bearings, aluminum body | | | | |

Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.

| Travel (mm) | 26 | 35 | 51 | 76 | 102 |
|---|---|---|---|---|---|
| A | 45 | 60 | 90 | 120 | 150 |
| B | 37 | 52 | 82 | 112 | 142 |
| C | 1 | 3 | 5 | 7 | 9 |
| D | 1 | 2 | 4 | 6 | 8 |
| E | 40 | 40 | 80 | 80 | 80 |

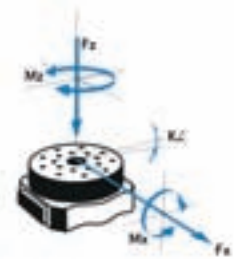



| Order No. | 5837-9- | | | | |
|---|---|---|---|---|---|
| PM-002 | 1 | | | | |
| 26 mm | | 1 | | | |
| 35 mm | | 2 | | | |
| 51 mm | | 3 | | | |
| 76 mm | | 4 | | | |
| 102 mm | | 5 | | | |
| open loop | | | 0 | | |
| LS-013, Linear glass scale | | | 1 | | |
| LS-061, Linear glass scale | | | 3 | | |
| without limit switch | | | | 0 | |
| non vacuum | | | | | 0 |
| $10^{-6}$ mbar | | | | | 6 |
| $10^{-9}$ mbar | | | | | 9 |

# 6.214 Piezo Rotation Stage PR-32

## FACTS

| Load characteristics | $Fx_{(N)}$ | $Fy_{(N)}$ | $Fz_{(N)}$ | $Mx_{(Nm)}$ | $Mz_{(Nm)}$ |
|---|---|---|---|---|---|
| PM-009 | 10 | 10 | 10 | 0.5 | 0.06 |



The PR-32 is a compact, open aperture, rotation stage utilizing a dual piezo motor for higher precision and load carrying capacity. Two steel ball bearings allow for high load carrying capacity, smooth motion and an unlimited degree of travel. An optional encoder provides up to 22 x $10^{-6}$ degree resolution. The PR-32 can be combined with the linear series of piezo stages. Vacuum and Ultra High Vacuum ($10^{-9}$ mbar) compatible versions are available.
Encoder is rated at $10^{-8}$ mbar.

## KEY FEATURES

- Continuous 360° motion
- Load capacity up to 1kg
- Steel ball bearings
- Vacuum versions available

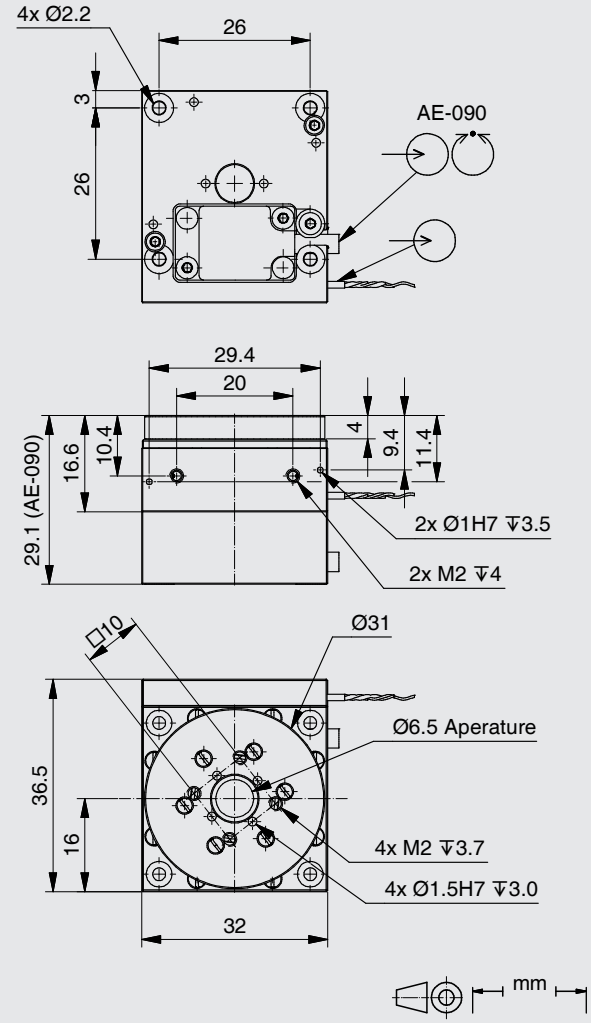
## TECHNICAL DATA

| | |
|---|---|
| Travel range (°) | 360 |
| Weight (kg) | 0.05 |

| | | |
|---|---|---|
| Motor | PM-009 | |
| Linear scale | | AE-090 |
| Speed max. (°/sec) | 5 | |
| Resolution calculated (°) | 0.000002 | 0.000002 |
| Resolution typical (°) | | |
| Bi-directional Repeatability (°) | | |
| Uni-directional Repeatability (°) | | |
| Nominal Current (A) | | |

| | |
|---|---|
| Accuracy | on request |
| Velocity range (°/sec) | 0.000001 ... 5 |
| Material | Stainless steel bearings, aluminum body |

Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.

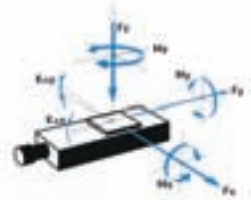


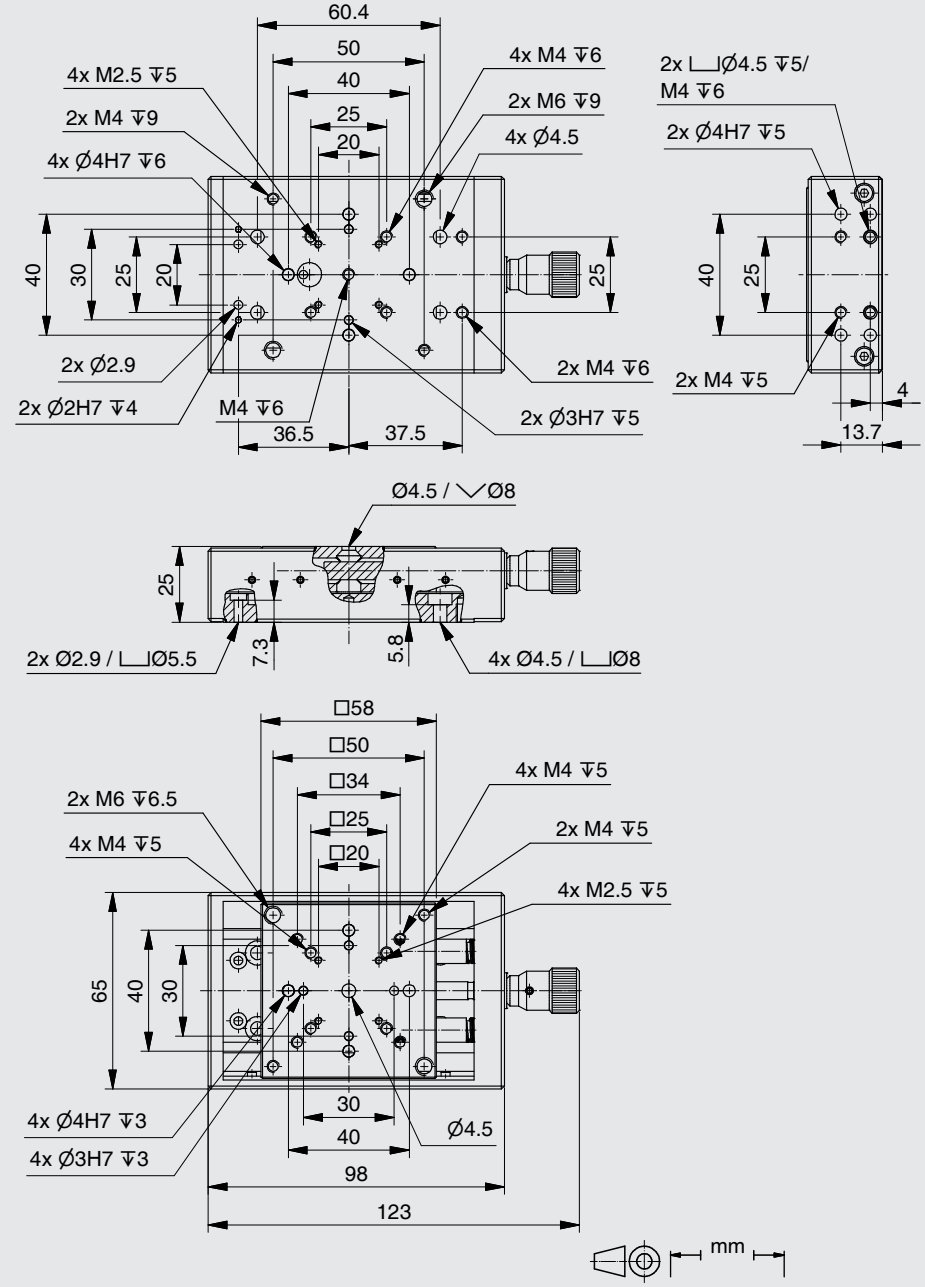

| Order No. | 5897-9- | | | | | |
|---|---|---|---|---|---|---|
| PM-009 | 1 | | | | | |
| 360° | | 1 | | | | |
| open loop | | | 0 | | | |
| AE-090, Angular glass scale | | | 1 | | | |
| No limit switch | | | | 0 | | |
| Non vacuum | | | | | 0 | |
| vacuum prepared $10^{-6}$ mbar | | | | | 6 | |
| vacuum prepared $10^{-9}$ mbar | | | | | 9 | |

# MANUAL STAGES

# 7.218 Linear Stage APT-65

| | |
|---|---|
| Travel: | 25 mm |
| Slides: | dove tail |
| Screw: | fine pitch |
| Pitch: | 0.35 mm |
| Sensitivity: | 5 µm |
| Load: | Fx: 140 N, Fy: 150 N, Fz: 300 N |
| Weight | 0.4 kg |
| XYZ assembly possible: | yes |

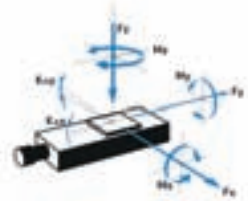


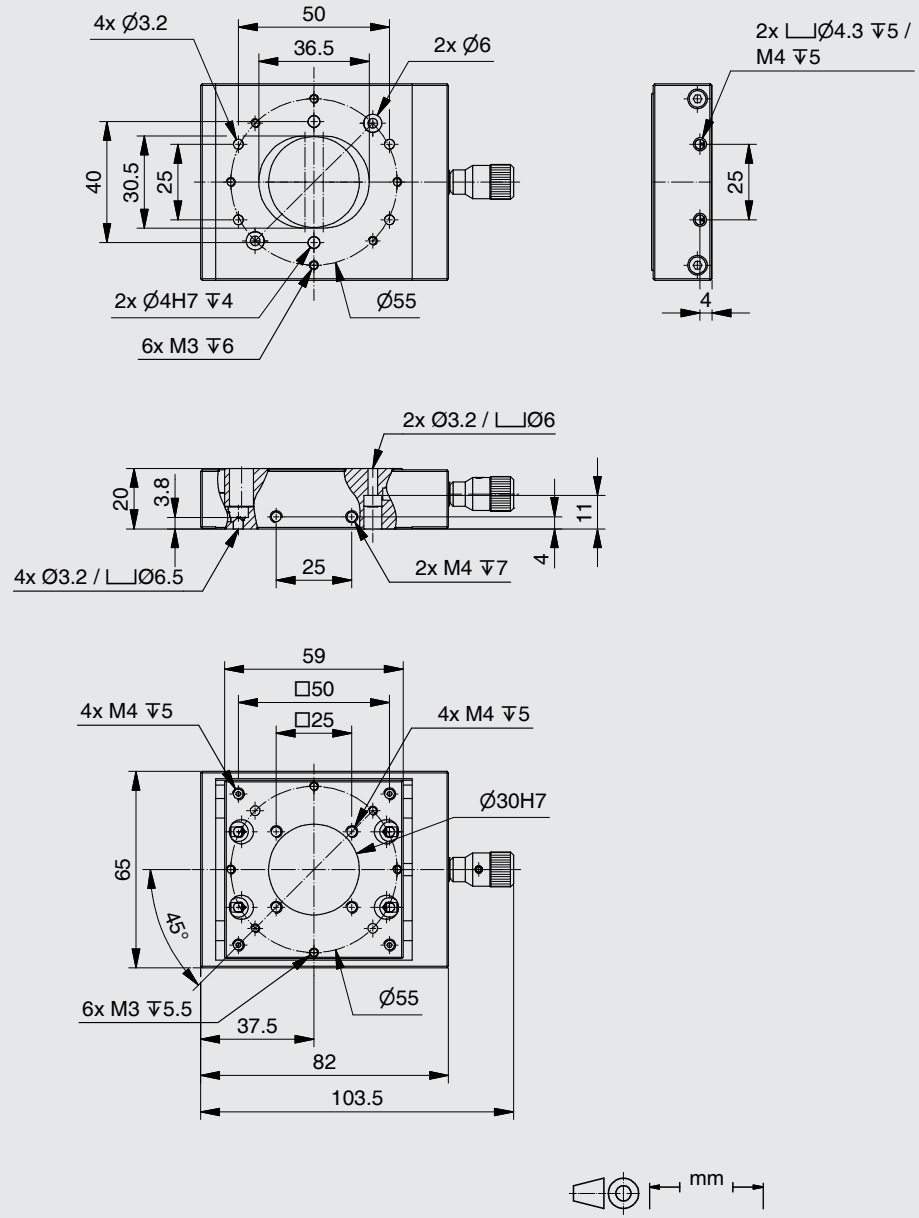

| Order No. | 6223-9- | 1 | 0 | 0 |
|---|---|---|---|---|

PI micos

| | |
|---|---|
| Travel: | 5 mm |
| Slides: | dove tail |
| Screw: | fine pitch |
| Pitch: | 0.25 mm |
| Aperture: | 30 mm |
| Sensitivity: | 5 µm |
| Load: | Fx: 30 N, Fy: 10 N, Fz: 40 N |
| Weight: | 0.4 kg |
| XYZ assembly possible: | yes, in combination with AKT-65 |

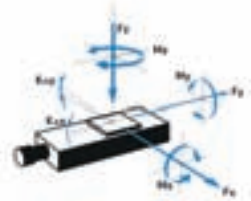


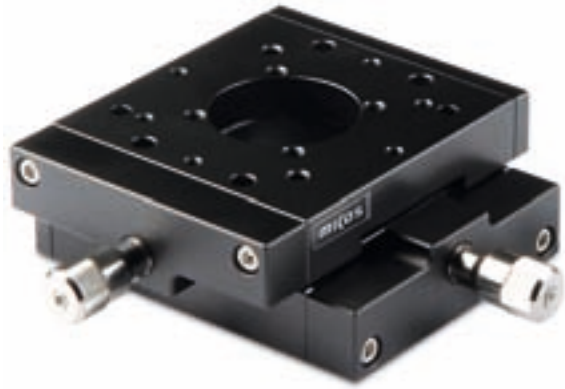
| Order No. | 4211-9- | 2 | 0 | 0 |
|---|---|---|---|---|



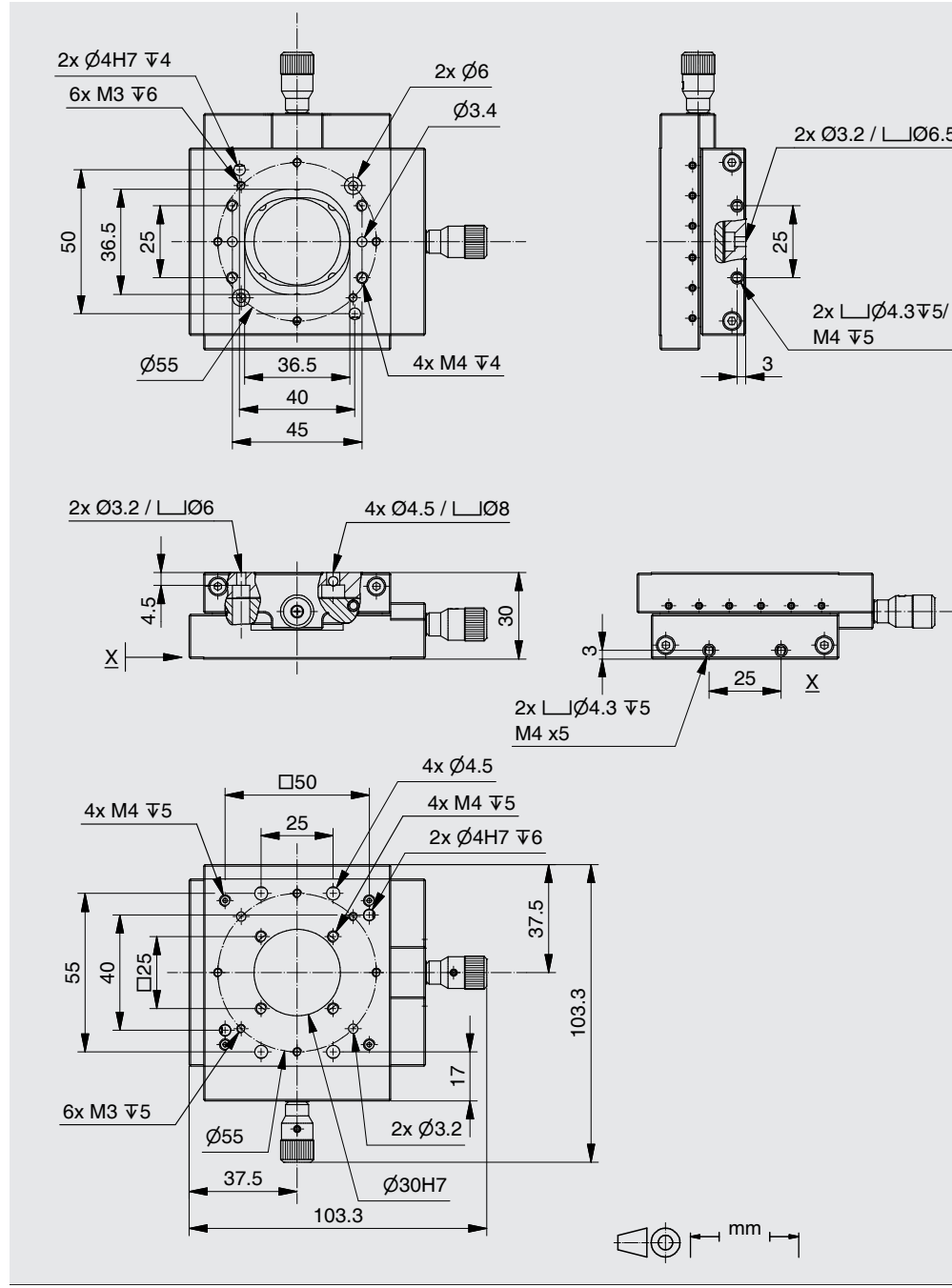
# 7.220 Cross Stage AKT-65

| | |
|---|---|
| Travel: | 5 mm x 5 mm |
| Slides: | dove tail |
| Screw: | fine pitch |
| Pitch: | 0.25 mm |
| Aperture: | 30 mm |
| Sensitivity: | 5 µm |
| Load: | Fx: 30 N, Fy: 10 N, Fz: 40 N |
| Weight: | 0.55 kg |
| XYZ assembly possible: | yes, in combination with AVT-65 |



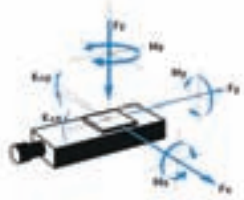


| Order No. | 4212-9- | 2 | 0 | 0 |
|---|---|---|---|---|

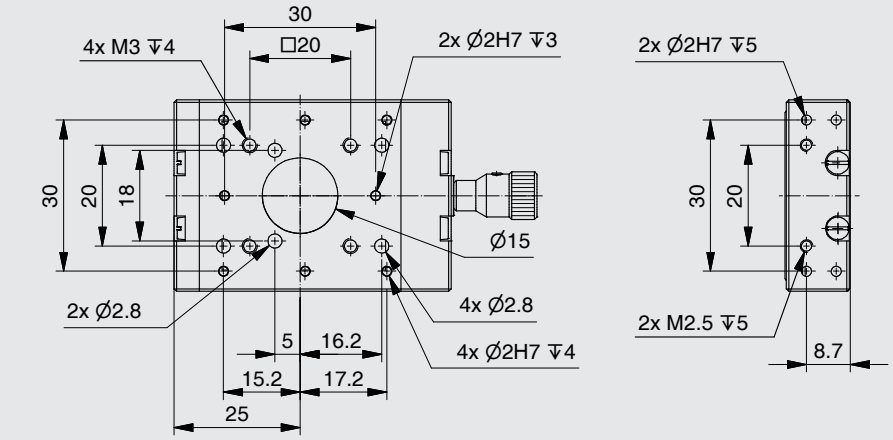


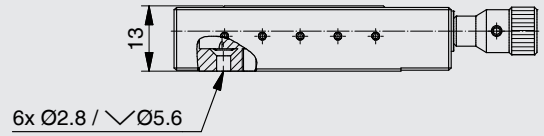

Error and technical modifications are subject to change

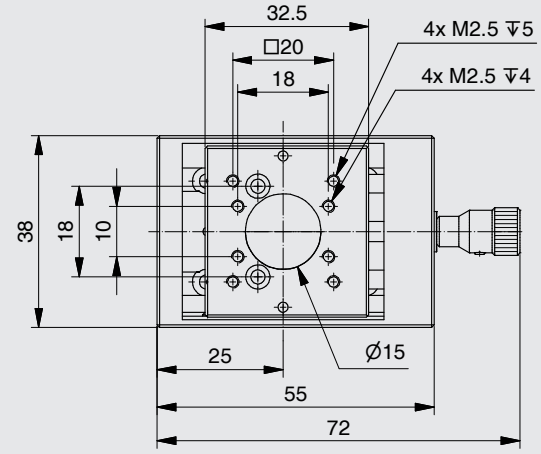
| | |
|---|---|
| Travel: | 5 mm |
| Slides: | dove tail |
| Screw: | fine pitch |
| Pitch: | 0.25 mm |
| Aperture: | 15 mm |
| Sensitivity: | 5 µm |
| Load: | Fx: 30 N, Fy: 10 N, Fz: 40 N |
| Weight: | 0.1 kg |
| XYZ assembly possible: | yes |

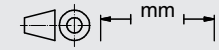


| Order No. | 3211-9- | 1 | 0 | 0 |
|---|---|---|---|---|



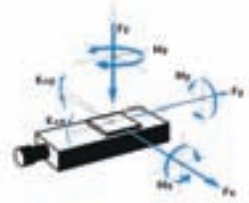



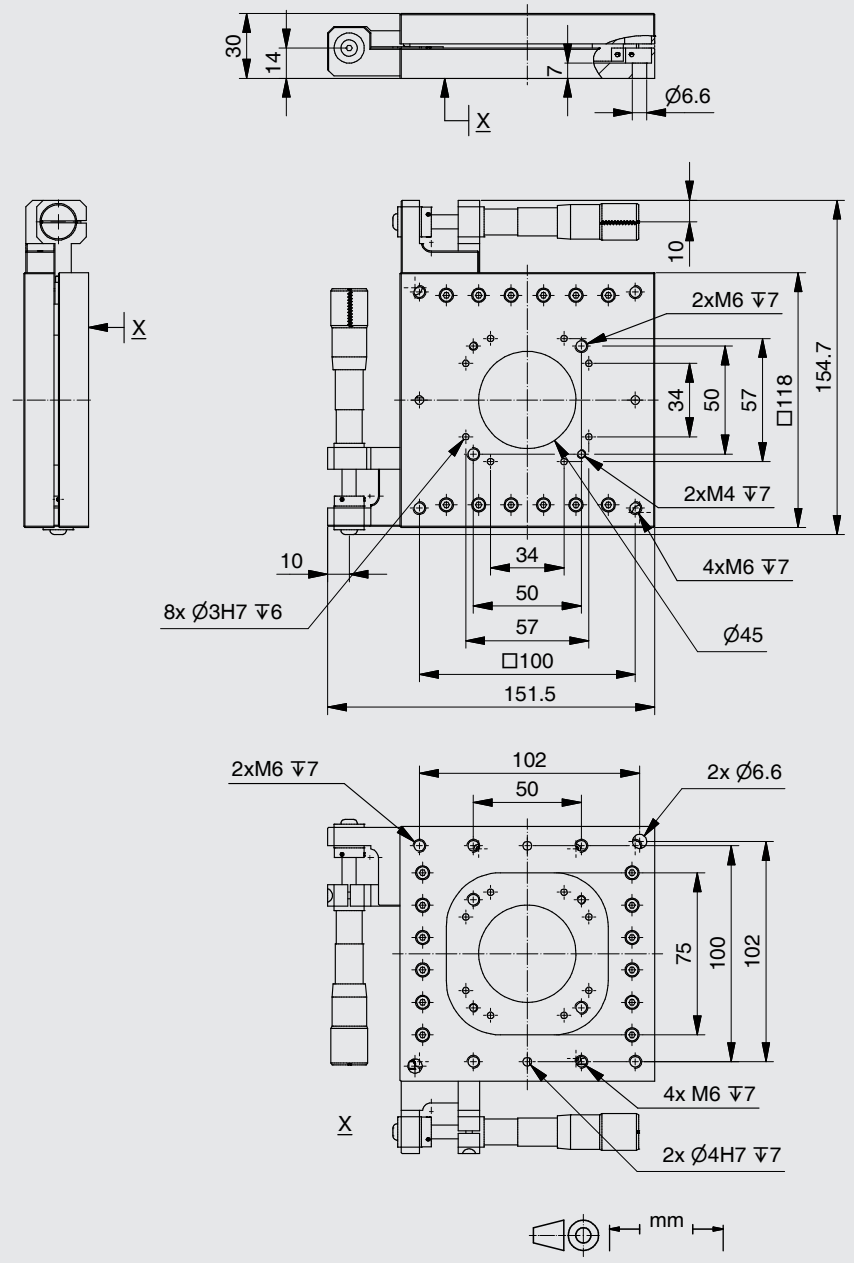



# 7.222 Cross Stage AKT-120

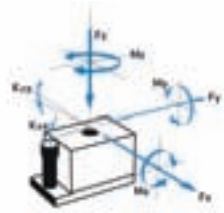
| | |
|---|---|
| Travel: | 25 mm x 25 mm |
| Slides: | cross-roller bearings |
| Screw: | micrometer |
| Resolution: | 10 µm |
| Aperture: | 45 mm |
| Sensitivity: | 2 µm |
| Load: | Fx: 20 N, Fy: 20 N, Fz: 40 N |
| Weight: | 1.1 kg |
| XYZ assembly possible: | no |



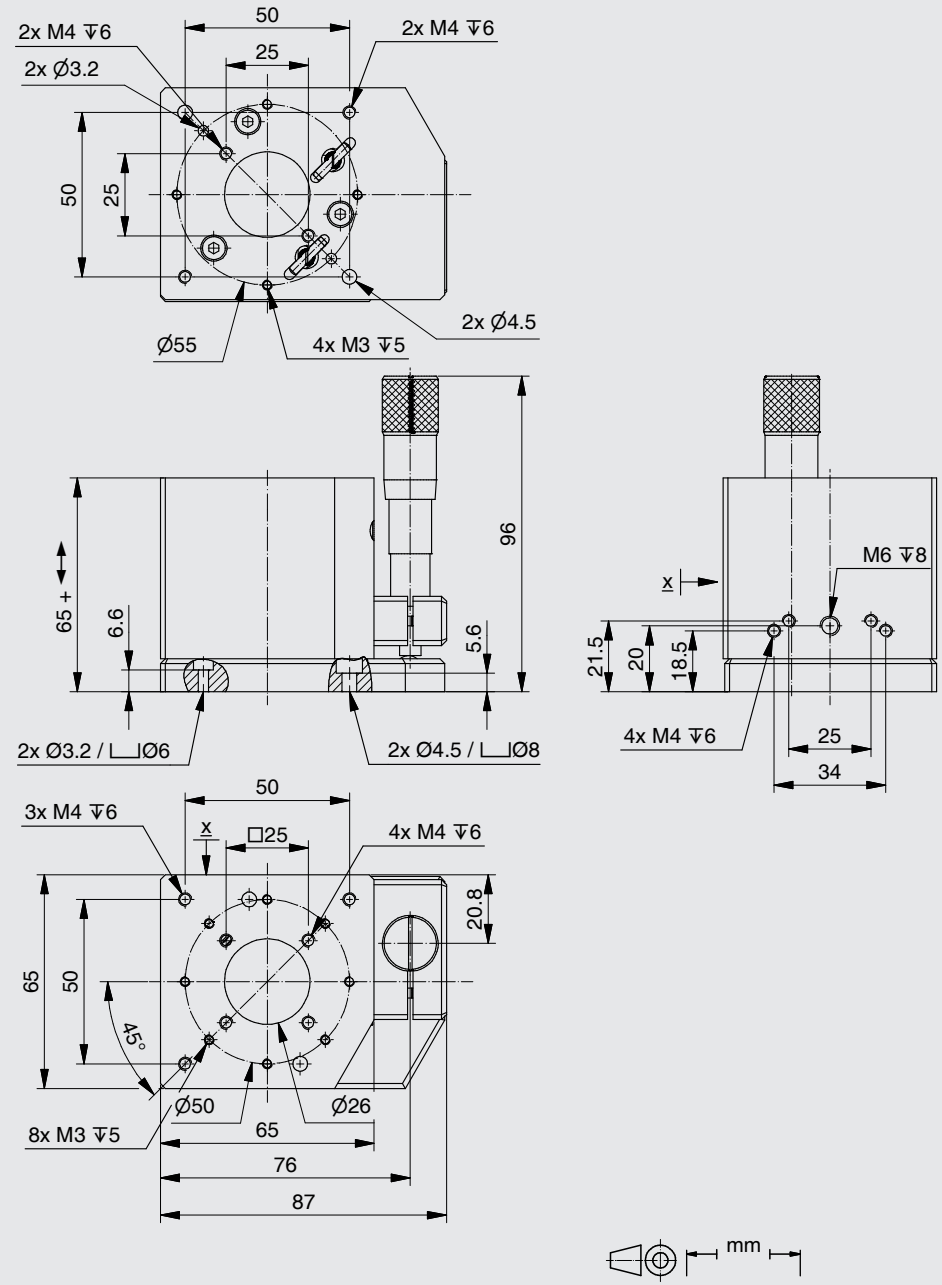
| Order No. | 6312-9- | 5 | 1 | 0 |
|---|---|---|---|---|



| | |
|---|---|
| Travel: | 25 mm |
| Slides: | linear ball bearings |
| Screw: | micrometer |
| Resolution: | 10 µm |
| Aperture: | 25 mm |
| Sensitivity: | 2 µm |
| Load: | Fx: 30 N, Fy: 30 N, Fz: 30 |
| Weight: | 0.9 kg |

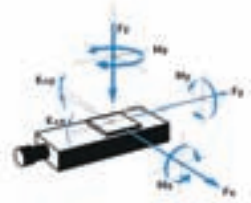


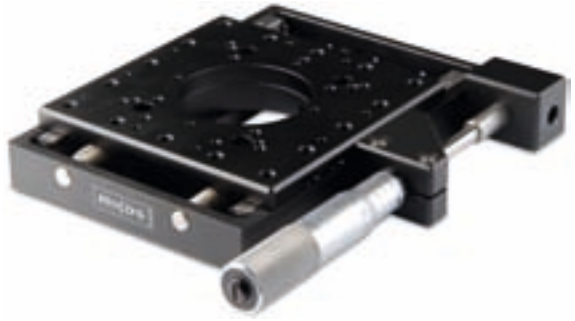
| Order No. | 4246-9- | 2 | 1 | 0 |
|---|---|---|---|---|



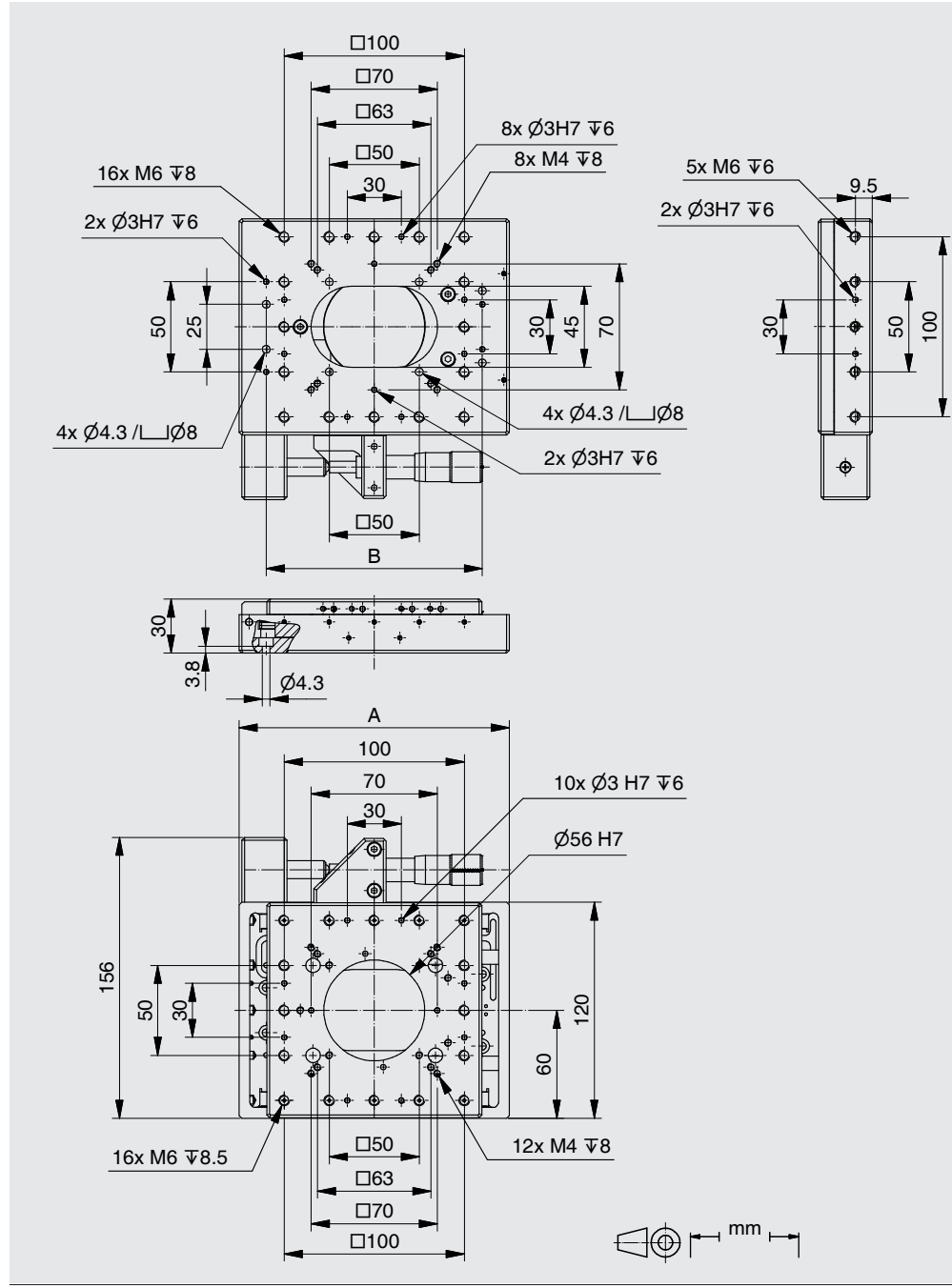
# 7.224 Linear Stage AMT-120

| | |
|---|---|
| Travel: | 25 / 50 mm |
| Slides: | cross-roller bearings |
| Screw: | micrometer |
| Pitch: | 0.5 mm |
| Resolution: | 10 µm |
| Sensitivity: | 2 µm |
| Load: | Fx: 100 N, Fy: 80 / -Fy: 10 N, Fz: 200 N |
| Weight: | 1.3 kg / 1.5 kg |
| XYZ assembly possible: | yes |



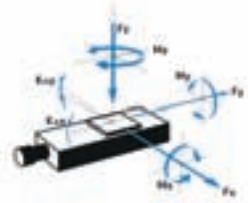


| Order No. | 6227-9- | | 0 | 0 |
|---|---|---|---|---|
| 25 mm | | 1 | | |
| 50 mm | | 2 | | |

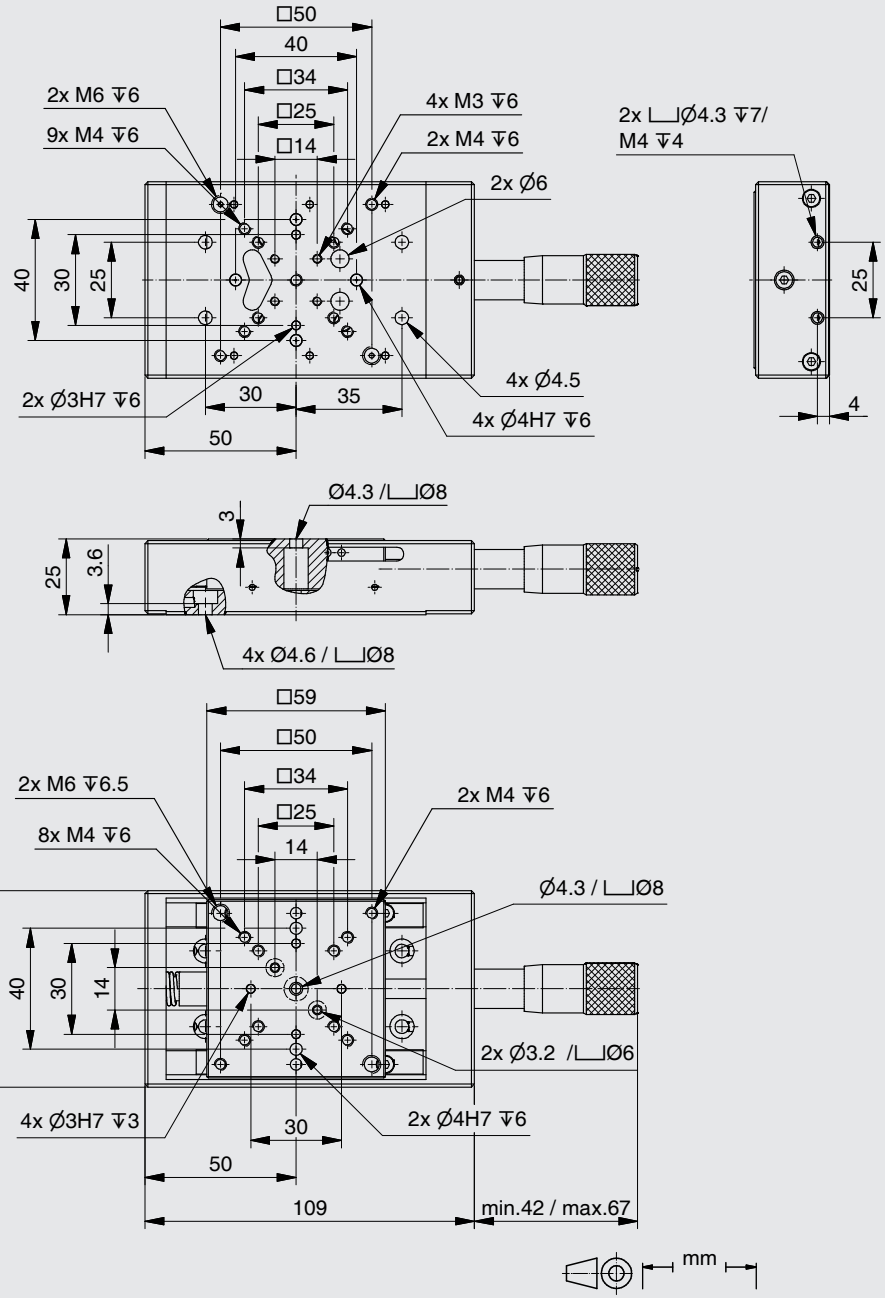



Error and technical modifications are subject to change

| | |
|---|---|
| Travel: | 25 mm |
| Slides: | cross-roller bearings |
| Screw: | micrometer |
| Pitch: | 0.5 mm |
| Resolution: | 10 µm |
| Sensitivity: | 1 µm |
| Load: | Fx: 70 N, Fy: 80 / -Fy: 10 N, Fz: 160 N |
| Weight: | 0.5 kg |
| XYZ assembly possible: | yes |

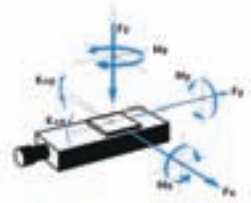


| Order No. | 6225-9- | 6 | 1 | 0 |
|---|---|---|---|---|

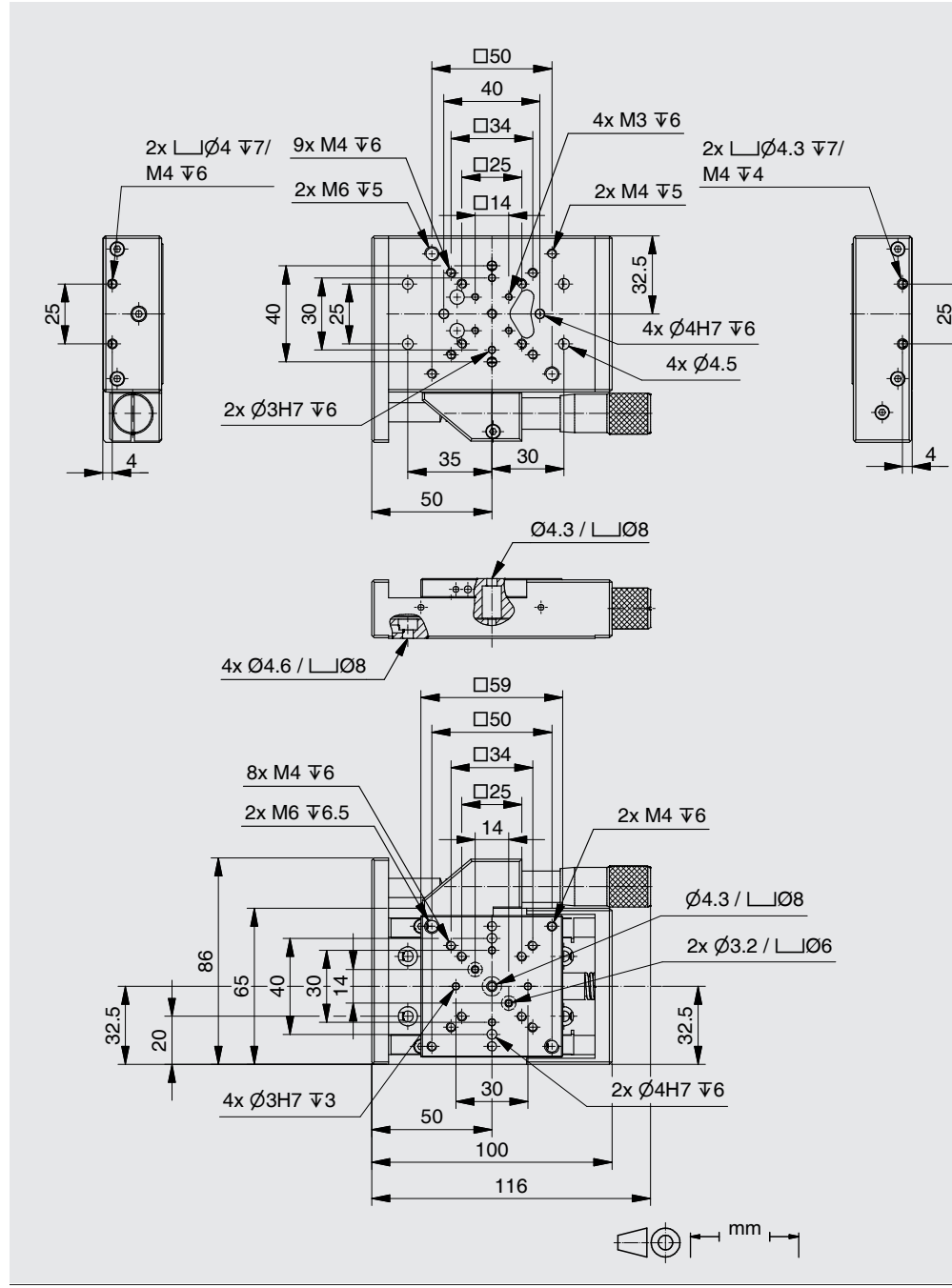


# 7.226 Linear Stage AMT-65 S

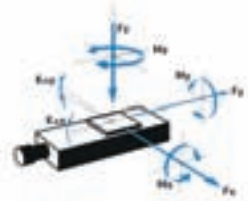
| | |
|---|---|
| Travel: | 25 mm |
| Slides: | cross-roller bearings |
| Screw: | micrometer |
| Pitch: | 0.5 mm |
| Resolution: | 10 µm |
| Sensitivity: | 1 µm |
| Load: | Fx: 70 N, Fy: +80 / -Fy: 10 N, Fz: 160 N |
| Weight: | 0.5 kg |
| XYZ assembly possible: | yes |



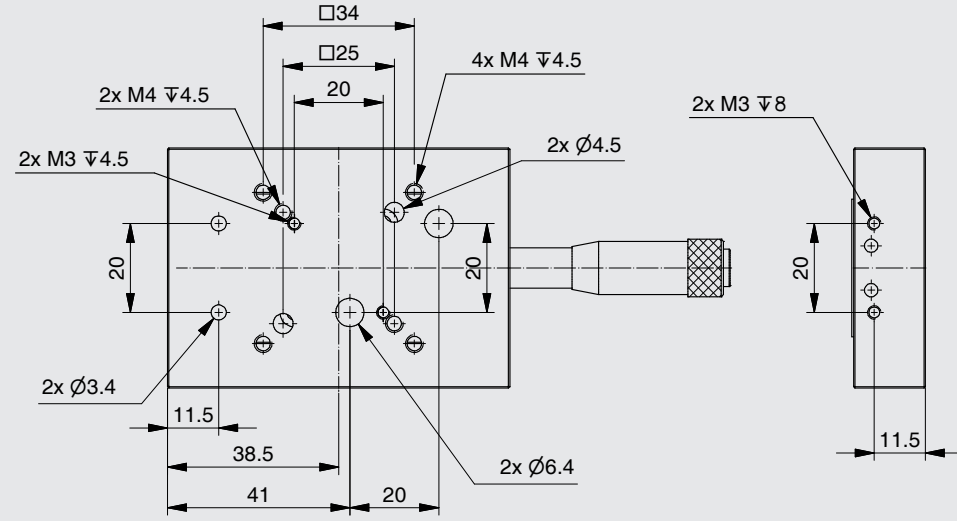
| Order No. | 6225-9- | 5 | 1 | 0 |
|---|---|---|---|---|

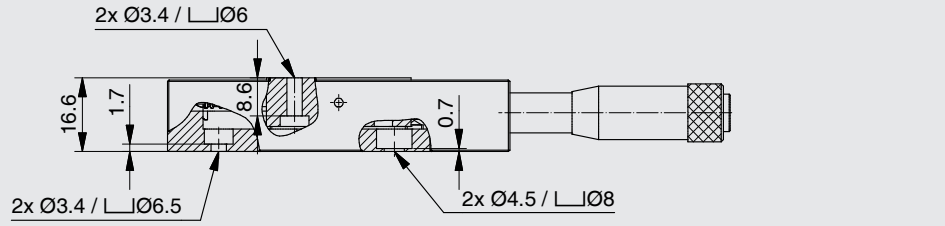


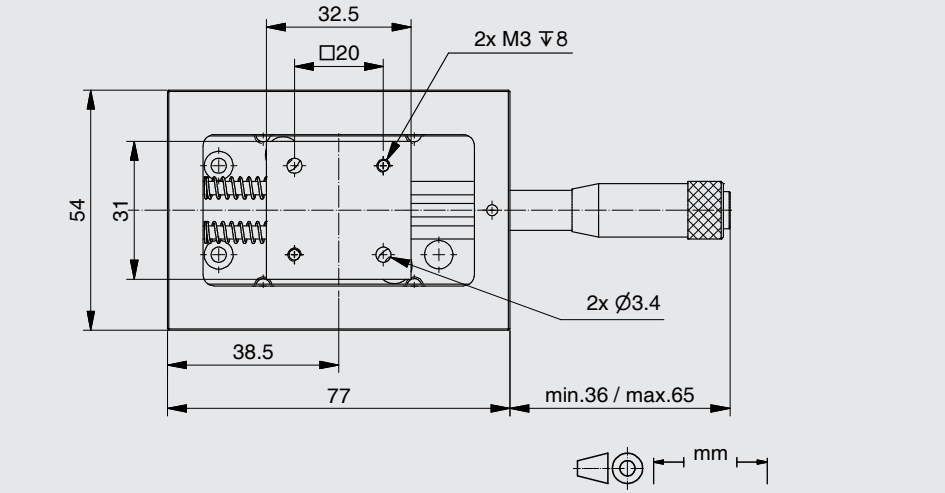
| | |
|---|---|
| Travel: | 25 mm |
| Screw: | micrometer, 0.5 mm |
| Resolution: | 10 µm |
| Sensitivity: | 5 µm |
| Load: | Fx: 10 N / 4 N, Fy: 4 N, Fz: 10 N |
| Weight: | 0.2 kg |
| XYZ assembly possible: | yes |



| Order No. | 6212-9- | 2 | 0 | 0 |
|---|---|---|---|---|

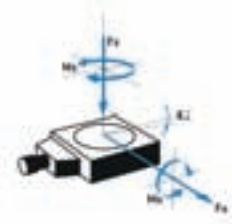


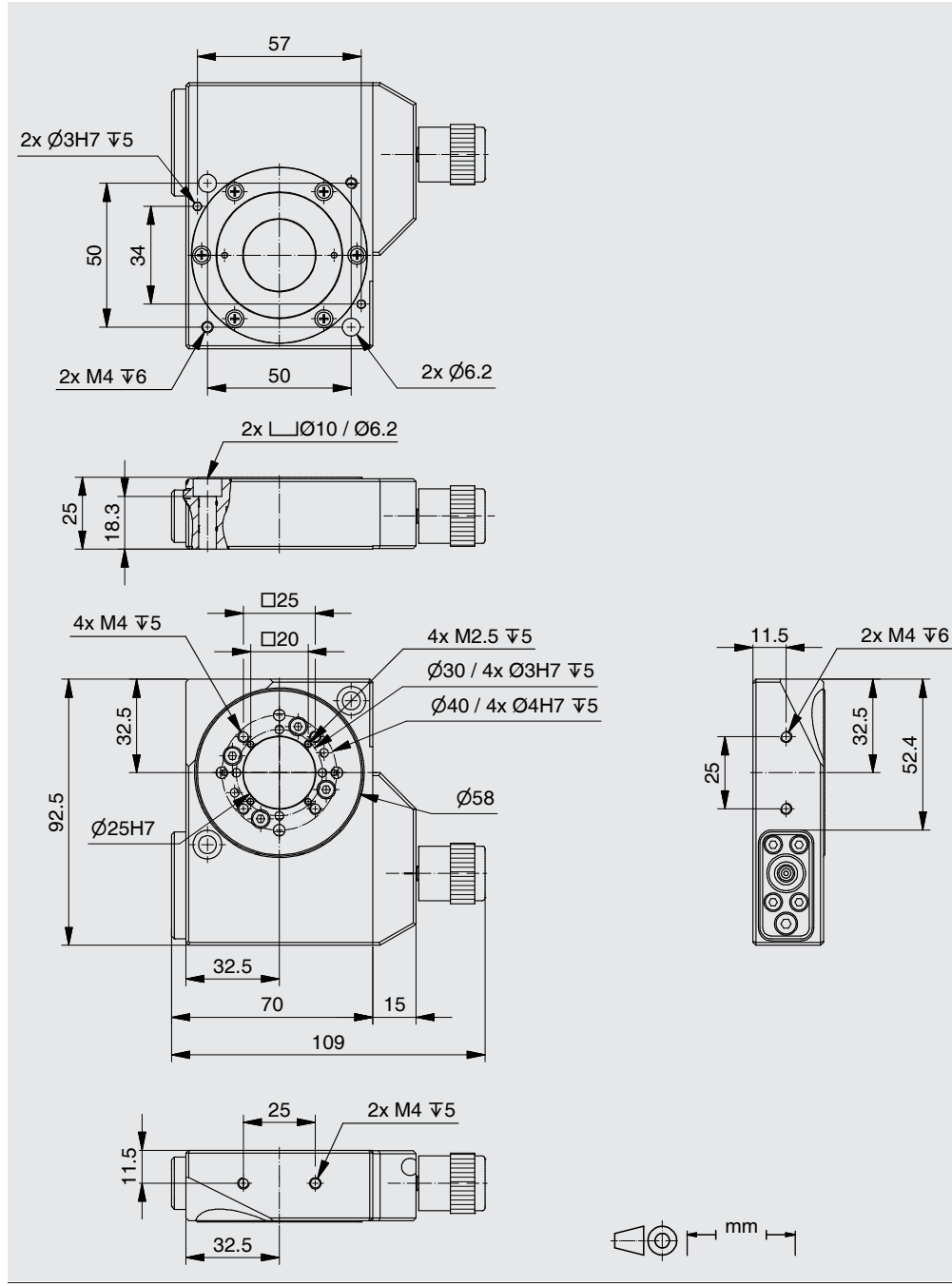



# 7.228 Rotation Stage ADT-65

| | |
|---|---|
| Drive: | preloaded driveworm, backlash free four point |
| Range: | 360° endless |
| Aperture: | 25 mm |
| Gear: | 180:1 |
| Sensitivity | 0.02° |
| Load: | Fx: 15 N, Fz: 30 N, Mz: 0.3 Nm |
| Weight: | 0.5 kg |

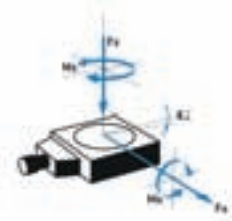


| Order No. | 6441-9- | 6 | 0 | 0 |
|---|---|---|---|---|

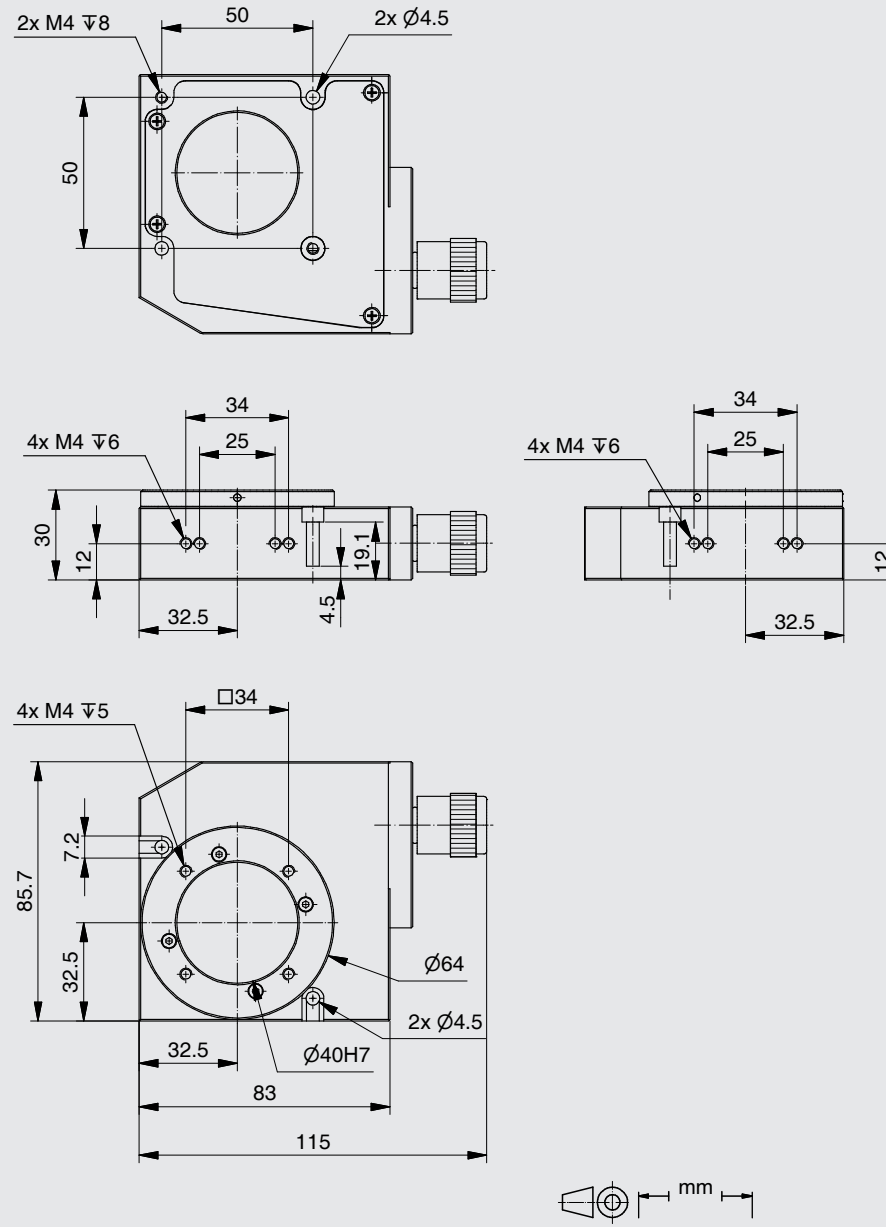



Error and technical modifications are subject to change

| | |
|---|---|
| Drive: | spring prestressed screw worm-gear, double |
| Range: | 360° endless |
| Aperture: | 40 mm |
| Gear: | 180:1 |
| Sensitivity | 0.02 ° |
| Load: | Fx: 10 N, Fz: 10 N, Mz: 0.1 Nm |
| Weight: | 0.45 kg |

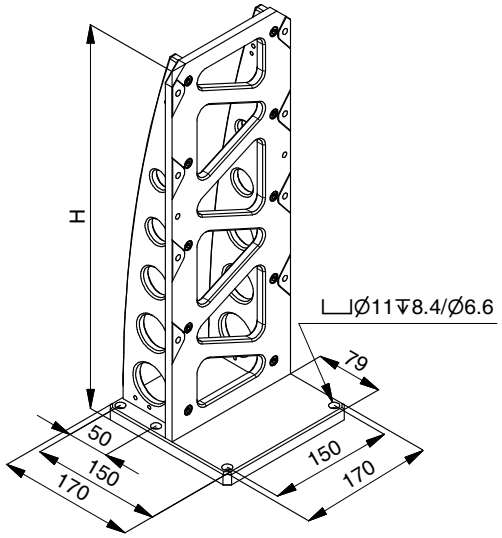


| Order No. | 6443-9- | 6 | 0 | 0 |
|---|---|---|---|---|



# ACCESSORIES

AB-180 L (6" & 8") H=465
AB-180 XL (12"&16") H=665

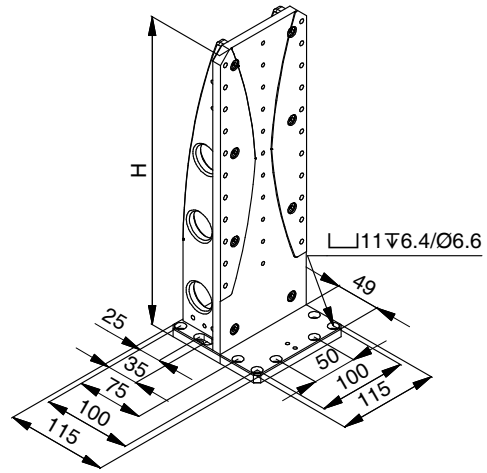



MOUNTING

| | |
|---|---|
| LMS-180 | LMS-180 |
| LS-180 | LS-180 |
| UPL-160 | |
| UPR-270 AIR | |

| | | | | |
|---|---|---|---|---|
| 6100-9- | 0 | 6 | 1 | AB-180 L (6" & 8") |
| 6100-9- | 0 | 6 | 2 | AB-180 XL (12"&16") |

AB-150 L H=350
AB-150 XL H=550

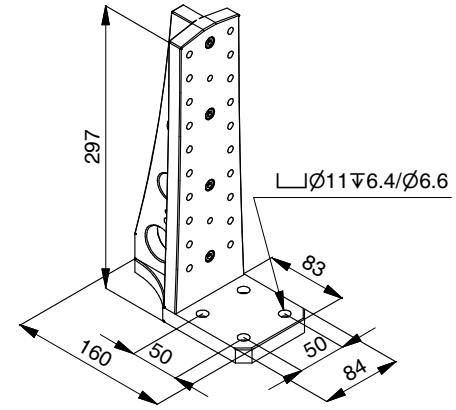



MOUNTING

| | |
|---|---|
| UPS-150 | HPS-170 |
| HPS-170 | LS-120 |
| LS-180 | LS-110 |
| LS-110 | UPR-160 AIR |
| UPL-160 | |
| UPR-270 AIR | |

| | | | | |
|---|---|---|---|---|
| 6100-9- | 0 | 7 | 1 | AB-150 L |
| 6100-9- | 0 | 7 | 2 | AB-150 XL |

AB-160

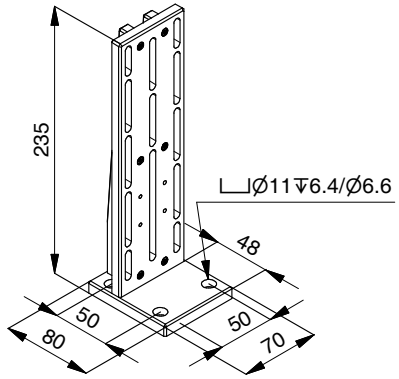



MOUNTING

| | | | |
|---|---|---|---|
| UPS-150 | LS-180 | ES-100 | UPM-160 |
| UPM-160 | LMS-120 | UPR-270 AIR | WT-120 |
| HPS-170 | LS-120 | UPR-160 AIR | WT-90 |
| LMS-300 | LS-110 | WT-120 | |
| LMS-180 | UPL-160 | | |

| | | | | |
|---|---|---|---|---|
| 6270-9- | 5 | 1 | 0 | AB-160 |

## AB-XL

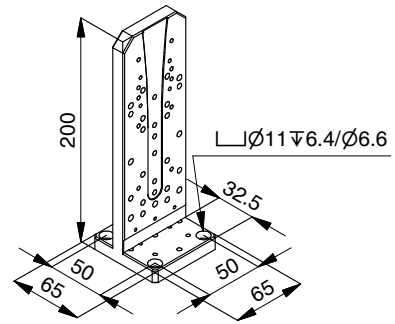



MOUNTING

| | | | |
|---|---|---|---|
| UPS-150 | LS-110 | UPR-160 AIR | WT-90 |
| UPM-160 | PLS-85 | PRS-110 | WT-100 |
| HPS-170 | LS-65 | WT-120 | WT-85 |
| LMS-300 | UPL-160 | WT-90 | |
| LMS-180 | ES-100 | | |
| LS-180 | UPR-270 AIR | | |

| | | | | |
|---|---|---|---|---|
| 6244-9- | 5 | 1 | 5 | AB-XL |

## AB-65 XL
## AB-65 LS65

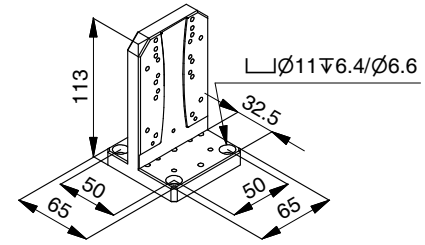



MOUNTING

| | | | |
|---|---|---|---|
| UPS-150 | PLS-85 | RSP-200 | PLS-85 |
| UPM-160 | VT-80 | WT-120 | VT-80 |
| HPS-170 | UPL-160 | WT-90 | DT-65 N |
| LMS-300 | ES-100 | WT-85 | WT-90 |
| LMS-180 | UPR-270 AIR | APT-65 | WT-100 |
| LS-180 | UPR-160 AIR | AMT-65 C | WT-85 |
| LS-110 | PRS-110 | AMT-65 S | |

| | | | | |
|---|---|---|---|---|
| 6100-9- | 0 | 7 | 6 | AB-65 XL |
| 6100-9- | 0 | 7 | 9 | AB-65 LS65 |

## AB-65 L

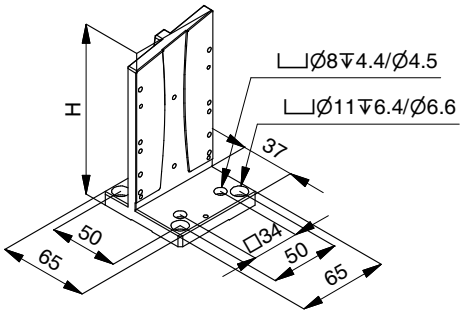



MOUNTING

| | | | |
|---|---|---|---|
| UPS-150 | PLS-85 | RSP-200 | VT-80 |
| UPM-160 | VT-80 | WT-120 | RS-40 |
| HPS-170 | UPL-160 | WT-90 | DT-80 |
| LMS-300 | ES-100 | WT-85 | DT-80 R |
| LMS-180 | UPR-270 AIR | APT-65 | WT-90 |
| LS-180 | UPR-160 AIR | AMT-65 C | ADT-80 |
| LS-110 | PRS-110 | AMT-65 S | |

| | | | | |
|---|---|---|---|---|
| 6100-9- | 0 | 7 | 5 | AB-65 L |

AB-65 M H=123
AB-65 ML H=155

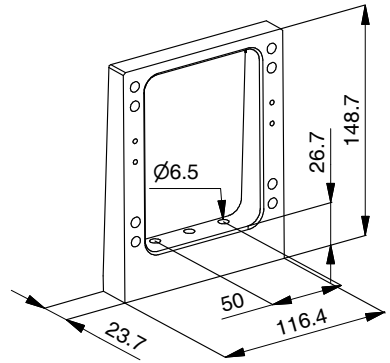



MOUNTING

| | | | |
|---|---|---|---|
| UPS-150 | MTS-70 | DT-80 R | MTS-65 |
| UPM-160 | VT-80 | RSP-200 | |
| HPS-170 | UPL-160 | WT-120 | |
| LMS-300 | ES-100 | WT-90 | |
| LMS-180 | LPS-65 | WT-85 | |
| LS-180 | UPR-270 AIR | APT-65 | |
| LS-110 | UPR-160 AIR | AMT-65 C | |
| PLS-85 | PRS-110 | AMT-65 S | |
| MTS-65 | DT-80 | ADT-80 | |

| | | | | |
|---|---|---|---|---|
| 6100-9- | 0 | 7 | 4 | AB-65 M |
| 6100-9- | 0 | 7 | 8 | AB-65 ML |

BF-1202

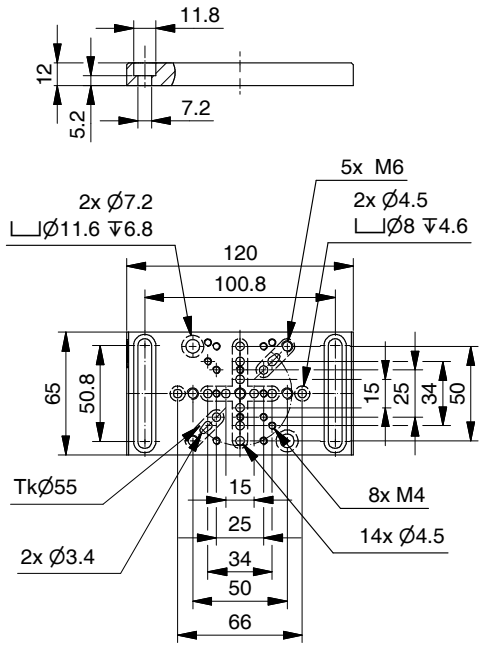



MOUNTING

| | |
|---|---|
| AMT-120 | AMT-120 |

| | | | | |
|---|---|---|---|---|
| 6227-9- | 1 | 4 | 0 | BF-1202 |

## FP-120N Fußplatte

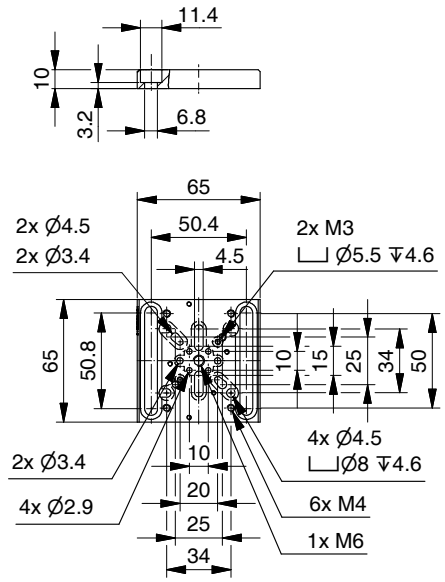



MOUNTING

| | |
|---|---|
| LS-65 | LS-65 |
| VT-80 | DT-80 |
| DT-80 | DT-80 R |
| APT-65 | APT-65 |
| AKT-65 | |

| 2541-9- | 0 | 2 | 0 | FP-120N Fußplatte |
|---|---|---|---|---|

## FP-65N Fußplatte

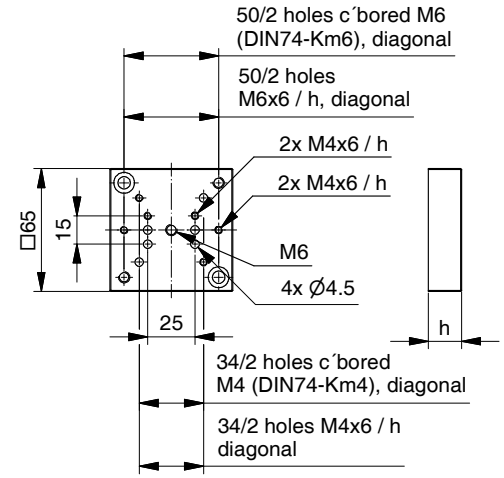



MOUNTING

| | |
|---|---|
| LS-40 | LS-65 |
| PP-30 | ASS 5E |
| RS-40 | RS-40 |
| APT-38 | DT-80 |
| AVT-54 | DT-80 R |
| MT-40 | DT-50 |
| | AFW-65 |
| | APT-65 |
| | APT-38 |
| | AVT-54 |
| | MT-40 |

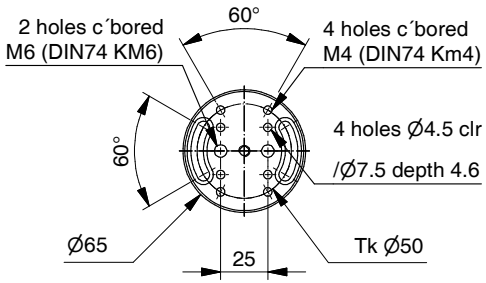
| 2541-9- | 0 | 2 | 1 | FP-65N Fußplatte |
|---|---|---|---|---|

BFP-65 L=17.5 H=17.5
BFP-65 L=25.0 H=25
BFP-65 L=32.5 H=32.5



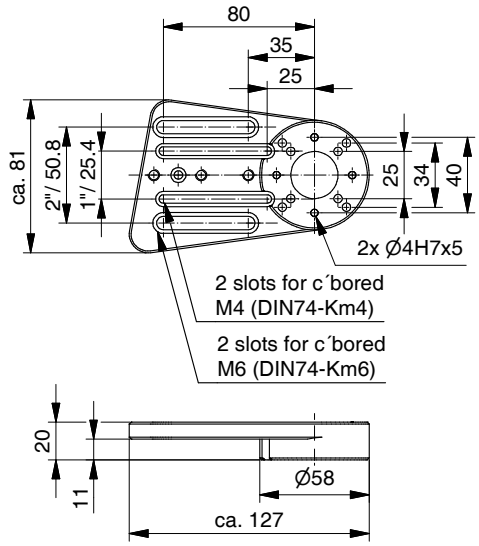

| 2710-9- | 1 | 0 | 5 | BFP-65 L=17.5 |
|---|---|---|---|---|
| 2710-9- | 1 | 1 | 5 | BFP-65 L=25.0 |
| 2710-9- | 1 | 2 | 0 | BFP-65 L=32.5 |

## FP-65R




| | | | | |
|---|---|---|---|---|
| 2541-9- | 0 | 1 | 2 | FP-65R |

## MP-rot



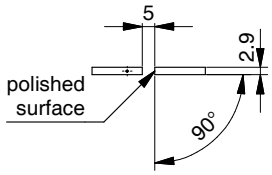

MOUNTING

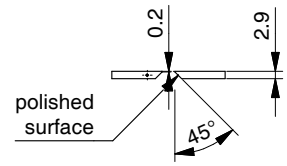
| | |
|---|---|
| DT-65 N | DT-65 N |
| DT-80 | RS-40 |
| | DT-80 |

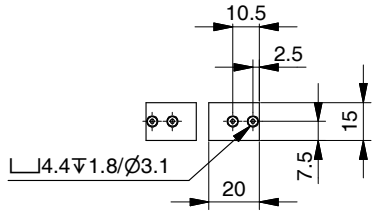
| | | | | |
|---|---|---|---|---|
| 6100-9- | 0 | 5 | 0 | MP-rot |

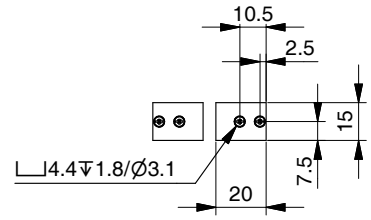
S-90 aluminium
S-90 stainless steel
S-90 wolfram

S-45 aluminium
S-45 stainless steel
S-45 wolfram




| | | | | |
|---|---|---|---|---|
| 6710-9- | 8 | 1 | 0 | S-90 aluminium |
| 6710-9- | 8 | 2 | 0 | S-90 stainless steel |
| 6710-9- | 8 | 3 | 0 | S-90 wolfram |

| | | | | |
|---|---|---|---|---|
| 6710-9- | 9 | 1 | 0 | S-45 aluminium |
| 6710-9- | 9 | 2 | 0 | S-45 stainless steel |
| 6710-9- | 9 | 3 | 0 | S-45 wolfram |

AIRBOX one

AIRBOX two

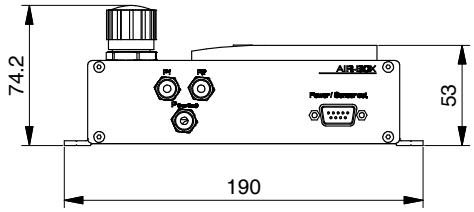
The Airbox 1 and 2 are specially designed for our airbearing stages.
This device gives the possibility:

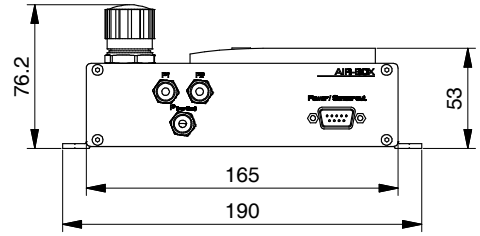
- to adjust and display the air-pressure for 1 channel (Airbox one) or 2 channels (Airbox two)
- to define individual pressure switch points which activates a open-collector output (pressure 'good' signal).

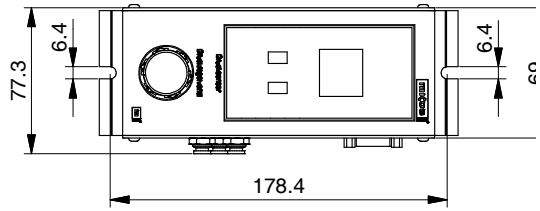
The device is based on a piezoresistive pressure sensor, with one or two digital displays and an individual manual pressure control valve with interlock.

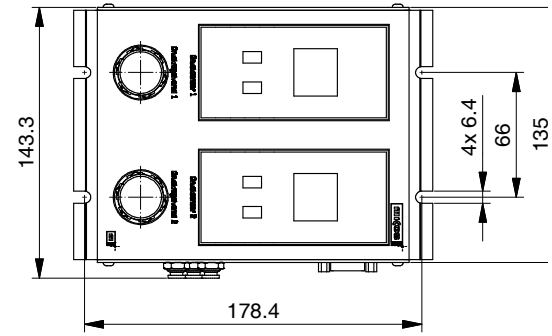
## TECHNICAL DATA

| | |
|---|---|
| **pressure range** | 0.12-5.99 bar |
| **max input pressure** | 6 bar |
| **electrical interface** | DB9 female, open-collector output I = 5 mA 24 VDC |
| **supply voltage** | 15-30 VDC |
| **power consumption** | 50 mA @24 VDC |
| **pneumatical interface input** | 1 x 4 mm connection |
| **pneumatical interface output** | 1 x 4 mm connection (Airbox one)<br>2 x 4 mm connection (Airbox two) |






## AIRBOX one

| Order No. | 6801-9- | 0 | 0 | 0 | 1 |
|---|---|---|---|---|---|

## AIRBOX two

| Order No. | 6801-9- | 0 | 0 | 0 | 2 |
|---|---|---|---|---|---|

# APPENDIX

## TECHNICAL DATA

### DC-brush motors

| Alias | Model | Design voltage | Continuous current | Continuous torque | Continuous power | Resistance | Inductance | Voltage constant kn | Torque constant km | Max. speed | Gearbox | Encoder |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | V | A | mNm | W | Ohm | mH | rpm/V | mNm/A | rpm | (backlash-free) | |
| **DC-B-005** | 1016.012G 1024:1 | 12 | 0.08 | 0.48 | 0.36 | 95 | 0.31 | 1419 | 6.73 | 5000 | 1024 | RE-002 |
| **DC-B-008** | 1016-012G 256:1 | 12 | 0.08 | 0.48 | 0.36 | 95 | 0.31 | 1419 | 6.73 | 5000 | 256 | RE-002 |
| **DC-B-009** | 1516E-012 SR | 12 | 0.16 | 0.8 | 0.52 | 60 | 0.4 | 1160 | 8.26 | 5000 | 75.8932 | RE-005 |
| **DC-B-010** | 1524T 012SR | 12 | 0.32 | 2.5 | 1.82 | 19.8 | 0.25 | 843 | 11.33 | 5000 | 22.033509 | |
| **DC-B-013** | 2224-024 SR | 24 | 0.28 | 5 | 3.88 | 36.3 | 0.8 | 328 | 29.1 | 5000 | 29.641975 | RE-005 |
| **DC-B-026** | 2642-024 CR | 24 | 0.98 | 28 | 23 | 5.78 | 0.55 | 276 | 34.6 | 5000 | 1 | RE-010 |
| **DC-B-028** | 2642-024 CR | 24 | 0.98 | 28 | 23 | 5.78 | 0.55 | 276 | 34.6 | 6400 | 1 | RE-015 |
| **DC-B-029** | 3242-024 CR | 24 | 1.17 | 35 | 25 | 5.2 | 0.56 | 231 | 41.3 | 5000 | 1 | RE-010 |
| **DC-B-031** | 3557-024 CR | 24 | 1.96 | 60 | 72 | 2 | 0.27 | 223 | 42.88 | 5000 | 1 | RE-010 |
| **DC-B-032** | 3257-024 CR | 24 | 2.3 | 70 | 83.2 | 1.63 | 0.27 | 253 | 37.7 | 5000 | 1 | RE-010 |
| **DC-B-033** | 3257-024 CR | 24 | 2.3 | 70 | 83.2 | 1.63 | 0.27 | 253 | 37.7 | 5000 | 1 | RE-015 |
| **DC-B-039** | 3863-024 C | 24 | 3.8 | 110 | 224 | 0.62 | 0.13 | 285 | 33.48 | 8000 | 1 | |
| **DC-B-040** | 3863-024 C | 24 | 3.8 | 110 | 224 | 0.62 | 0.13 | 285 | 33.48 | 8000 | 1 | RE-015 |
| **DC-B-070** | RE-026 | 36 | 0.931 | 33.8 | 18 | 5.68 | 0.43 | 263 | 36.3 | 6000 | 1 | RE-010 |
| **DC-B-082** | RE-040 | 48 | 3.33 | 201 | 150 | 1.16 | 0.33 | 158 | 60.3 | 5000 | 1 | RE-015 |
| **DC-B-086** | RS-230C ohne Encoder | 24 | 5.57 | 300 | 94 | 0.65 | 0.42 | 166 | 57 | 3000 | 1 | RE-015 |
| **DC-B-088** | RS320H | 48.6 | 4.35 | 500 | 157 | 1.5 | 2.2 | 75.2 | 127 | 3000 | 1 | RE-016 |

TECHNICAL DATA



## 2-Phase stepper

| Alias | Model | Wiring scheme | Design voltage | Phase current | Holding torque | Detend torque | Phase resistance | Inductance | Gearbox | Steps / rev. |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | V | A | mNm | mNm | Ohm | mH | (backlash-free) | |
| **2Phase-005** | AM-1020-025 | bipolar parallel | <38 | 0.25 | 1.6 | 0.4 | 7.4 | 2.1 | 256 | 20 |
| **2Phase-010** | AM-1524-025 | bipolar parallel | <38 | 0.25 | 6 | 0.9 | 12.5 | 5.5 | 75.8932 | 24 |
| **2Phase-017** | LIN208-13-01 | bipolar parallel | 50 | 0.6 | 20 | 2 | 6.5 | 1.7 | 1 | 200 |
| **2Phase-018** | HSY-21 series | bipolar parallel | <50 | 0.24 | 20 | 2 | 20.4 | 5 | 1 | 200 |
| **2Phase-019** | LIN208-17-01 | bipolar parallel | <50 | 0.8 | 30 | 2 | 5.4 | 1.5 | 1 | 200 |
| **2Phase-020** | ZSS-25-200-1.2 | bipolar parallel | <100 | 1.2 | 13 | 2 | 0.95 | 0.4 | 1 | 200 |
| **2Phase-023** | LIN211-18-02 | bipolar parallel | <50 | 1.3 | 100 | 2 | 1.3 | 0.8 | 1 | 200 |
| **2Phase-025** | ZSS-32-200-1.2 | bipolar parallel | <100 | 1.2 | 50 | 3 | 1.3 | 1.2 | 1 | 200 |
| **2Phase-026** | ZSS-33-200-1.2 | bipolar parallel | <100 | 1.2 | 75 | 3 | 1.3 | 1.2 | 1 | 200 |
| **2Phase-033** | ZSS-43-200-1.2 | bipolar parallel | <100 | 1.2 | 260 | 7 | 2.6 | 5.2 | 1 | 200 |
| **2Phase-034** | ZSS-42-200-1.2 | bipolar parallel | <100 | 1.2 | 140 | 5 | 1.6 | 3 | 50 | 200 |
| **2Phase-041** | 4H4018 | bipolar parallel | <100 | 1.7 | 260 | 5 | 1.7 | 2.7 | 1 | 200 |
| **2Phase-042** | Pollux1 | bipolar parallel | 24 | 0.5 | 160 | 8 | | | 1 | 200 |
| **2Phase-044** | PK244-01B | | <100 | 1.2 | 260 | 13 | 3.3 | 3.2 | 1 | 200 |
| **2Phase-045** | ST4018L1206 | bipolar parallel | <100 | 1.2 | 350 | 10 | 3.3 | 4.3 | 1 | 200 |
| **2Phase-047** | PK244M-01B | bipolar parallel | <100 | 1.2 | 260 | 10 | 3.3 | 4.3 | 1 | 400 |
| **2Phase-048** | PK264JB-A1 | bipolar half winding | <100 | 1.2 | 320 | 16 | 3.3 | 2.8 | 1 | 200 |
| **2Phase-049** | PK245-01-B | bipolar parallel | <100 | 1.4 | 320 | 10 | 3.3 | 2.8 | 1 | 200 |
| **2Phase-051** | ZSS-52-500-2.5E | bipolar parallel | <200 | 2.5 | 420 | 12 | 0.6 | 1.6 | 1 | 500 |
| **2Phase-052** | PK256-02B | bipolar parallel | <200 | 2 | 1200 | 14 | 2.4 | 2.87 | 1 | 200 |
| **2Phase-070** | PK266-E2.0 | bipolar parallel | <100 | 2 | 900 | 20 | 1.8 | 2.5 | 1 | 200 |
| **2Phase-071** | PK268-E2.0B | bipolar parallel | <100 | 2 | 1350 | 25 | 2.25 | 4.8 | 1 | 400 |
| **2Phase-072** | PK266M-E2.0 | bipolar parallel | <100 | 2 | 900 | 20 | 1.8 | 3.2 | 1 | 400 |

## TECHNICAL DATA

### Torque motors

| Alias | Model | Max. bus voltage | Cont. current | Cont. torque | Peak torque | Phase resistance | Inductance | Motor constant | Torque constant | Max. speed | Electr. time const. | Number of poles | Back EMF |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | V | A (@ 80°C) | Nm (@ 80°C) | Nm | Ohm (@ 80°C) | mH | Nm/sqrt(W) | Nm/Arms | rpm | ms | | V/(rad/s) |
| TM-010 | RM-2P-77/2 | 80 | 2.4 | 0.76 | 2.08 | 2.2 | 1.17 | 0.13 | 0.26 | 400 | 0.53 | 7 | 0.18 |
| TM-012 | RM-2P-77/2 | 80 | 2.4 | 0.76 | 2.08 | 2.2 | 1.17 | 0.13 | 0.26 | 400 | 0.53 | 7 | 0.18 |
| TM-030 | RM-3P-84 | 150 | 1.2 | 0.16 | 0.5 | 6.6 | 0.7 | 0.04 | 0.13 | 600 | 0.11 | 14 | 0.67 |
| TM-050 | URM-3P-142/15 | 160 | 2 | 3.4 | 10 | 9.7 | 4.5 | 0.49 | 1.9 | 528 | 0.46 | 10 | 1.5 |

## TECHNICAL DATA

### Linear motors

| Alias | Model | Max. bus voltage | Cont. current | Cont. force | Peak force | Phase resistance | Inductance | Motor constant | Force constant | Electr. time const. | Back EMF | Pole period |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | V | A (@ 80°C) | N (@ 80°C) | N | Ohm (@ 80°C) | mH | N/sqrt(W) | N/Arms | ms | V/(m/s) | mm |
| LM-010 | ULIM4-2p_192/170 | 60 | 1.8 | 43 | 177 | 3.3 | 1.22 | 9.3 | 15.3 | 0.304 | 17 | 32 |
| LM-015 | ULIM4-2p_96/80 | 60 | 1.4 | 22 | 88 | 2.72 | 1 | 6.6 | 15.3 | 0.37 | 10.9 | 32 |
| LM-030 | LM30 2Phase | 48 | 3 | 7 | 0 | 0.4 | 0.1 | 0 | 0 | 0.1 | 0 | 12 |
| LM-050 | LM50-4-7 2Phase | 48 | 5.95 | 64 | 320 | 0.8 | 0.09 | 12 | 10.8 | 0.11 | 10.7 | 24 |
| LM-051 | LMS 60 25 3Phase | 180 | 0.32 | 7 | 31 | 72 | 24 | | 22 | | 7.2 | 30 |
| LM-052 | LMS 80 3Phase | 180 | 0.7 | 7 | 34 | 18 | 6 | | 11 | | 3.6 | 30 |
| LM-054 | LMS 60 65 3Phase | 180 | 0.64 | 7 | 31 | 36 | 12 | | 22 | | 7.2 | 30 |

## TECHNICAL DATA

### Piezo motors

| Alias | Model | Max. bus voltage | Cont. force | Phases |
|---|---|---|---|---|
| | | V | N (@ 80°C) | |
| PM-002 | Piezomotor 2 Phase 2N | 48 | 2 | 2 |
| PM-005 | Mecho-6.5mm | 48 | 2 | 1 |
| PM-009 | Piezomotor 2 Phase 2N | 48 | 2 | 2 |
| PM-411 | LEGS-Spring-SV 10N | 48 | 10 | 4 |

TECHNICAL DATA



## Linear encoders LE

| Alias | Model | Accuracy | Resolution | Recommended meas. step | Index position | Signals | Signal output, (quadrature) channels |
|---|---|---|---|---|---|---|---|
| | | µm | µm | µm | | | |
| **AE-060** | RGS-S+RGH24Z | ± 1 | 0.2 | 0.2 | in the middle of travel | RS 422 differential | 2 + 1 index and complementary outputs |
| **LS-010** | LIA-20 RS422 | ± 1 | 0.05 | 0.05 | all 50 mm starting in the middle of travel | RS-422 differential | 2 + 1 index and complementary outputs |
| **LS-011** | LIA-20 1Vpp | ± 1 | 20 (1Vss) | 0.015 | all 50 mm starting in the middle of travel | 1 Vpp | 2 + 1 index and complementary outputs |
| **LS-012** | LIA-20 RS422 | ± 1 | 0.05 | 0.05 | all 50 mm starting in the middle of travel | RS-422 differential | 2 + 1 index and complementary outputs |
| **LS-013** | Epiflex Meßmodul EM D0.1-2 Sensor 5x10 | | 20 (1Vpp) | 0.05 | | 1Vpp | 2 |
| **LS-020** | LIP-481-R 1Vpp | ± 0.5 | 2 (1Vss) | 0.001 | app. middle of travel | 1 Vpp | 2 + 1 index and complementary outputs |
| **LS-021** | LIP-481-R 1Vpp | ± 0.2 | 2 (1Vss) | 0.001 | app. middle of travel | 1 Vpp | 2 + 1 index and complementary outputs |
| **LS-025** | Kit-L2 | ± 1 | 0.05 | 0.05 | app. middle of travel | RS-422 differential | 2 + 1 index and complementary outputs |
| **LS-028** | NanoStar | 5 | 0.05 | 0.05 | | absolute | |
| **LS-030** | LIP-581-R | ± 1 | 4 (1Vss) | 0.005 | yes | 1 Vpp | 2 + 1 index and complementary outputs |
| **LS-035** | LIK-41 | ± 1 | 0.05 | 0.05 | app. middle of travel | RS-422 differential | 2 + 1 index and complementary outputs |
| **LS-036** | LIK-41 | ±1 | 20 (1Vpp) | 0.01 | app. middle of travel | 1Vpp | 2+1 index and complementary outputs |
| **LS-040** | LIP-372 | ± 0.5 | 0.001 | 0.001 | no | RS-422 differential | 2 |
| **LS-050** | LIK-21 | ± 1 | 0.05 | 0.05 | all 50 mm starting in the middle of travel | RS-422 differential | 2 + 1 index and complementary outputs |
| **LS-059** | Mercury 3000 | ±3 | 0.02 | 0.02 | in the middle of travel | RS-422 differential | 2 + 1 index and complementary outputs |
| **LS-060** | M3500L | ±3 | 0.005 | 0.005 | in the middle of travel | RS-422 differential | 2 + 1 index and complementary outputs |
| **LS-061** | M6000L | ± 1.5 | 0.005 | 0.005 | middle of travel | RS-422 differential | 2 + 1 index and complementary outputs |
| **LS-070** | RGH25+RGB25B | ± 3 | 20 (1Vss) | 0.015 | yes | 1 Vpp | 2 + 1 index and complementary outputs |

## TECHNICAL DATA

### Rotary encoders RE

| Alias | Model | Resolution | Increments/revolution | Index position | Signals | Signal output, (quadrature) channels |
|---|---|---|---|---|---|---|
| | | ° | | | | |
| **RE-002** | 30B19 | 9 | 10 | no | TTL | 2 |
| **RE-005** | IE2-512 | 0.17578125 | 512 | no | TTL | 2 |
| **RE-010** | HEDL-5540 | 0.18 | 500 | yes | RS-422 differential | 2 + 1 index and complementary outputs |
| **RE-015** | 2RMHF | 0.018 | 5000 | yes | RS-422 differential | 2 + 1 index and complementary outputs |
| **RE-016** | F14 | 0.018 | 5000 | yes | RS-422 differential | 2 + 1 index and complementary outputs |
| **RE-025** | MR256 | 0.3515 | 256 | yes | RS-422 differential | 2 + 1 index and complementary outputs |

## TECHNICAL DATA

### Rotary encoders AE

| Alias | Model | Accuracy | Resolution | Recommended meas. step | Index position | Signals | Signal output, (quadrature) channels | Increments/revolution |
|---|---|---|---|---|---|---|---|---|
| | | ArcSec | ° | ° | | | | |
| **AE-015** | Signnum d=229 mm | 0,97 | 0.01 (1Vpp) | 0.00001 | yes | 1 Vpp + RS422 | 2 + 1 index and complementary outputs | 36000 |
| **AE-050** | RIK RS-422 P4 | ±20 (5.5m°) | 0.0001 | 0.0001 | one, near cal-switch | RS 422 differential | 2 + 1 index and complementary outputs | 9000 |
| **AE-051** | RIK 1Vpp | ±20 (5.5m°) | 0.04 (1Vpp) | 0.00002 | one, near cal-switch | 1 Vpp | 2 + 1 index and complementary outputs | 9000 |
| **AE-053** | Reni T2011-30 A | ±2.3 | 0.022866 (1Vpp) | 0.00001 | one | | 2 + 1 index and complementary outputs | 15744 |
| **AE-068** | Signum d=150 mm | 1.5 | 0.000076271 | 1.5E-5 | yes | RS 422 differential + 1 Vpp | 2 + 1 index and complementary outputs | 23600 |
| **AE-070** | RGR+RGH24B | | 0.0000573 | 0.0000573 | yes | RS 422 differential | 2 + 1 index and complementary outputs | 31453 |
| **AE-080** | Signum d=57mm | ±4 | 0.04 (1Vpp) | 0.00002 | yes | 1 Vpp | 2 + 1 index and complementary outputs | 9000 |

SERVICE

At PI miCos, customer service starts with the first customer contact. With the customer being part of our team, we collaborate one-on-one to help analyze requirements and needs in detail.

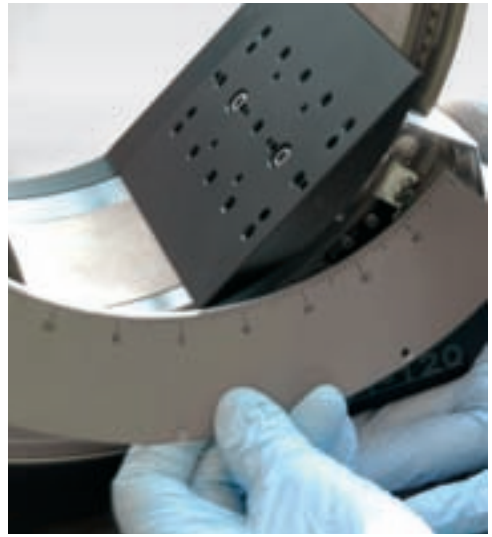
DESIGN

MANUFACTURING

# QUALITY STARTS HERE ...

PRECISION

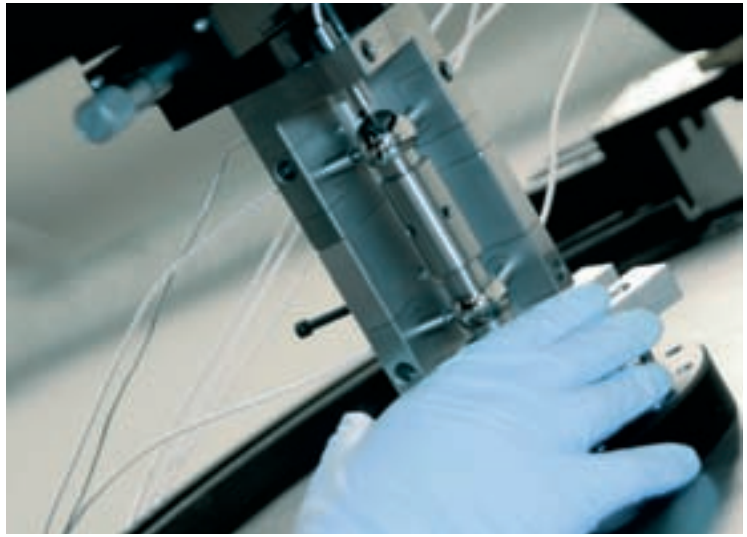
Our experienced design engineers will then transform the specifications into 3-D models once the team agrees on an optimal solution. All parts are then machined and manufactured in-house by highly qualified machinists with many years of precision machining background. State of the art precision CNC machines are operated 16 h a day in 2 shifts.

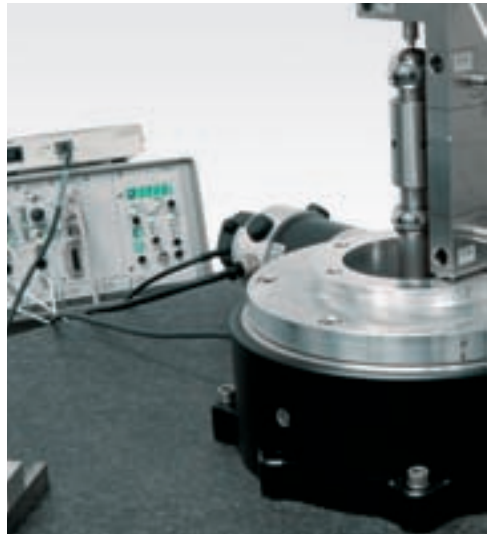


ASSEMBLY

The precision machined parts are then assembled by our in-house technicians into the final product while paying utmost attention to meeting the customers specifications. Finally, our metrology department uses state of the art metrology equipment to assure optimal performance of the overall system before it is shipped to the customer.

# ... AND DOESN'T END





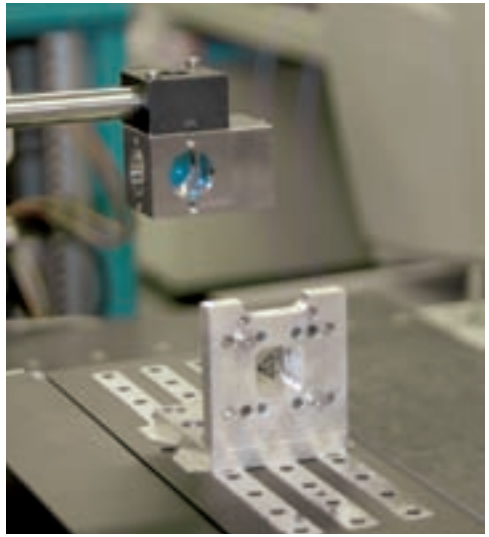
Rotation measurement with capacitive measurement system

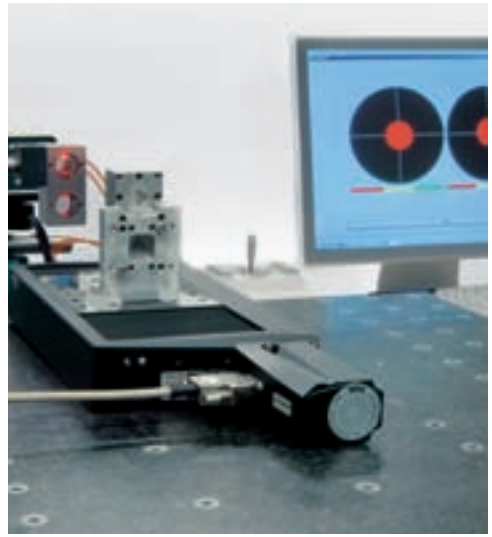
Angle measurement of eveness and eccentricity of rotation stages

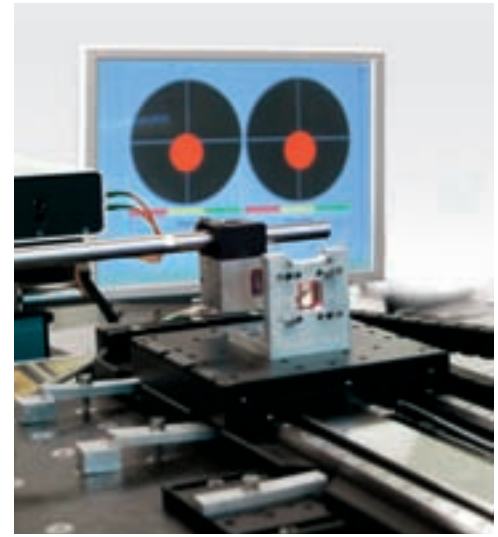
All positioners are placed on a flat granite platform (0.5µm flatness) and are measured with defined torque. The measuringsensor height is about 50 mm above the stage platform for linear stages and 40 mm above the rotating platform for rotary stages.

For high precision applications it is critically important that the stage meets the desired specification. For a small surcharge, PI miCos can supply an extensive metrology report with actual performance data for the product delivered.

# MEASUREMENT ROTATION







Measurement with interferrometer of linear stages

# MEASUREMENT LINEAR

## ABSOLUTE ACCURACY

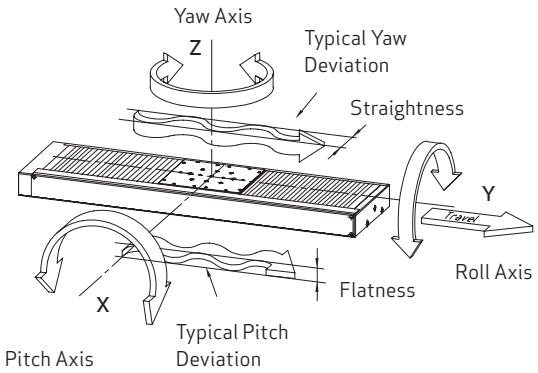
**Absolute accuracy is defined as the difference between the required position and the achieved position for each possible position within the full travel range. Absolute accuracy should not be confused with resolution. Resolution is defined as the smallest measurable increment of motion in a system. For most systems, the positioning resolution is considerably higher than its absolute accuracy.**

There are several sources of error in a positioning system. Linear errors can be caused by an imperfect screw pitch, thermal expansion or angular deviations at the point of measurement.

For absolute accuracies below 1 µm for longer travel ranges, a closed loop linearmeasuring systemis required. Some examples of linear measuring systems are laser interferometer, optical linear encoders using glass scales or magnetic encoders. Most sources of mechanical positioning inaccuracies, such as pitch error and thermal expansion, can be corrected using such measurement devices. Stepper motors in open loop or DC-motors with rotary, shaft mounted encoders are usually not capable of achieving sub-micron accuracies.

## DEFINITION OF LINEAR STAGES

X: Linear movement orthogonal to the moving direction
Y: Linear movement to the moving direction
Z: Vertical movement

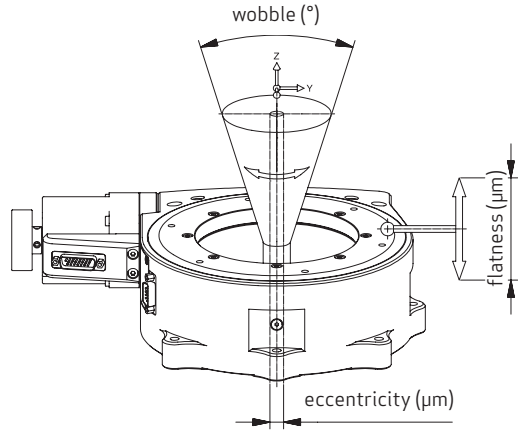



## RUN-OUT

Run-out is defined as the discrepancy from a perfectly straight line and describes any undesired movement in the remaining 5 degrees of freedom of motion other than the desired axis. For example, for a desired translation in y axis, there will also be small but undesired motion in x and z direction as well as rotation around y (Θy = roll), x (Θx = pitch) and z (Θz = yaw). Errors in guidance (run-out) appear because of bearing imperfection in addition to mounting base imperfections.

## DEFINITION OF ROTATION STAGES

Θx: Rotation around Y (roll)
Θy: Rotation around X (pitch)
Θz: Rotation around Z (yaw)

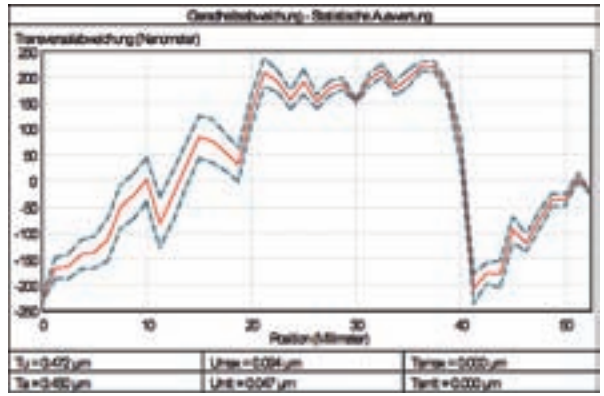


## EXAMPLE FOR LINEAR MEASUREMENT

| | | |
|---|---|---|
| Stage | | HPS-170 52 mm 2SM-LIE5 encoder 15 nm resolution |
| Serial Number | | 07090035 |
| Customer | | |
| Date | | 18.09.07 |
| Measurement Device | | Laser-interferometer ZLM 500 Zeiss |
| Measurement Base | | Granit-base 800x600 mm, Quality LAB, Max error= 0.0014 mm |
| Environment | Temperature | 20.6 °C |
| | Humidity | 58% |
| | Pressure | 992 hPa |
| Hint | | HPS-170 mounted with 8 x M6 (5Nm) |

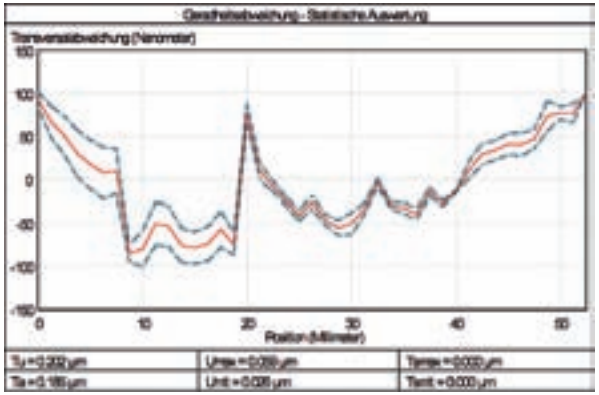
## STRAIGHTNESS

measured in a height 40 mm above the slider. The straightness referring to the travel range of 52 mm will be measured. The straightness is Tu = 0.472 µm absolute. The repeatability of the guidance accuracy referring to the straightness is Umax = 0.094 µm.



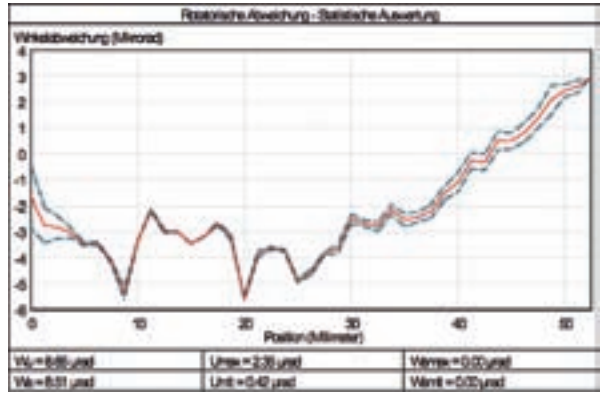
## FLATNESS

The flatness referring to the travel range of 52 mm will be measured. The flatness is Tu = 0.0202 µm absolute. The repeatability of the guidance accuracy referring to the flatness is Umax = 0.059 µm.



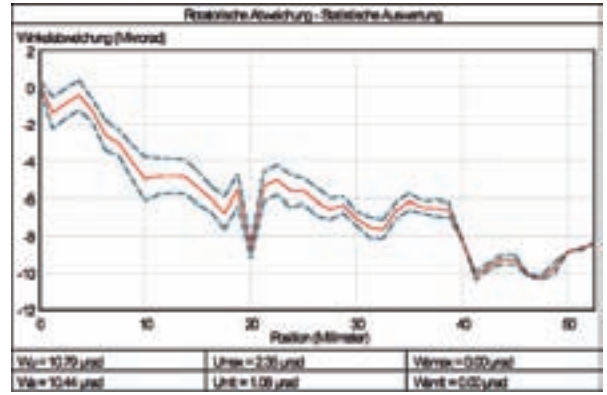
## PITCH

measured in a height 40 mm above the slider. The pitch angle referring to the travel range of 52 mm, will be measured. The pitch angle is Wu = 8.65 µrad absolute. The repeatablility of the guidance accuracy referring to the pitch angle is Umax = 2.35 µrad.



## YAW

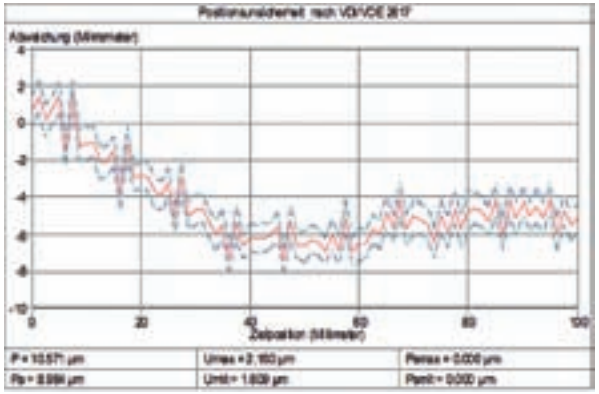
measured in a height 40 mm above the slider. The yaw angle referring to the travel range of 52 mm, will be measured. The yaw angle is Wu = 10.79 µrad absolute. The repeatablility of the guidance accuracy referring to the yaw angle is Umax = 2.35 µrad.



Next 3 measuring protocols are illustrating the positioning accuracy of stages with a travel range of 100 mm, respectively 52 mm.
The first stage will operate in open loop. The second stage will be controlled using a linear encoder (closed loop). The third stage is equipped with a linear encoder in closed loop. The stage was calibrated with additional positioning correction in software. In this case, interferometrically measured stage data is mapped in the controller and used to electronically compensate mechanical errors.

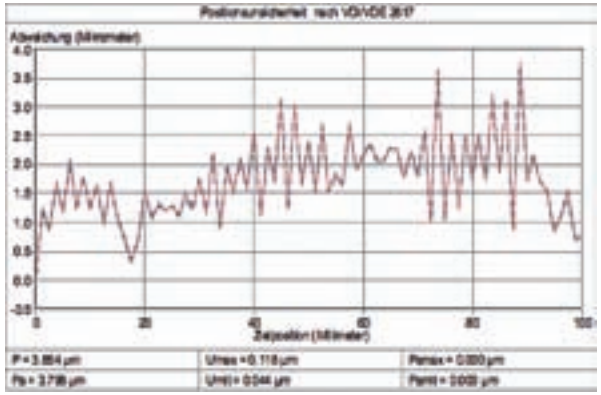
## POSITION, OPEN LOOP

measured in a height 40 mm above the slider.
The stage is operated in open loop.
With a total travel range of 100 mm the absolute position accuracy is P = 10.571 µm.
The stage has a backlash of Umax = 2.16 µm.



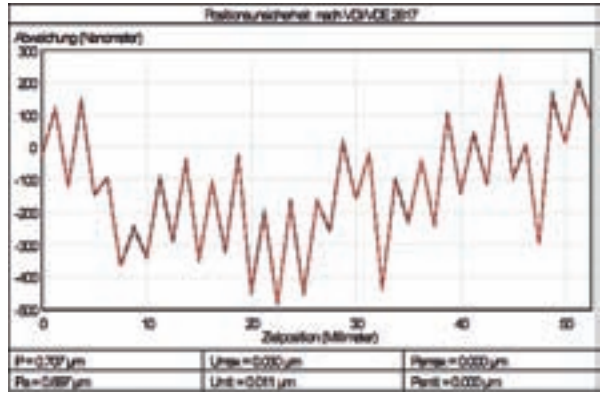
## POSITION, CLOSED LOOP

measured in a height 40 mm above the slider.
The linear stage, equipped with a linear scale with a resolution of 50 nm and a total accuracy of +/- 3 µm, operates in closed loop.
Absolute positioning accuracy improved from Pmax = 10.571µm to P = 3.854 µm. The backlash (hysteresis) of the stage was reduced from Umax = 2.16 µm to Umax = 0.118 µm. (Please compare with the measuring protocol).



## POSITION CLOSED - LOOP WITH POSITION CORRECTION

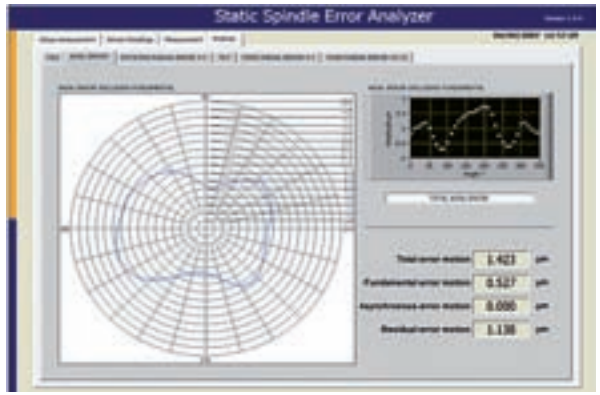
measured in a height 40 mm above the slider.
The absolute position accuracy with a travel range of 52 mm is P = 0.707 µm. The backlash of the absolute position accuracy (bidirectional) Umax = 0.030 µm.



## EXAMPLE FOR ROTATION MEASUREMENT

### AXIAL ERROR

This measurements shows the flatness of a rotation stage. The flatness measured at a 360° rotation is 1.423 µm.




### ROTATING RADIAL ERROR X2-Y2

The eccentricity error in the Y coordinate at a rotation of 360° is 1.015 µm.


### TILT-Y

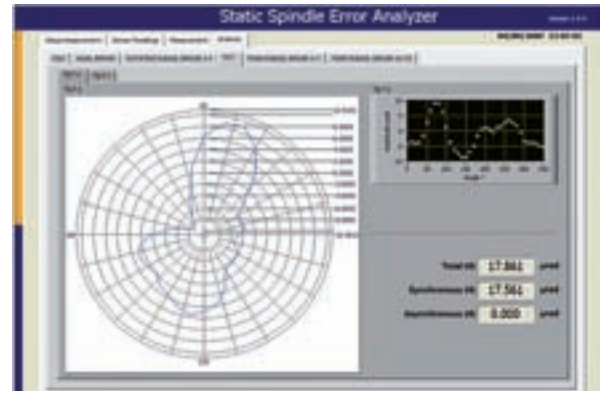
The angle error (wobble) in the Y coordinate at a rotation of 360° is 22,531µrad.


### ROTATING RADIAL ERROR X1-Y1 (WOBBLE IN X-COORDINATE)

The eccentricity error in the X coordinate at a 360° rotation is 2.324 µm.


### TILT-X

The angle error (wobble) in the X coordinate at a rotation of 360° is 12.861 µrad.

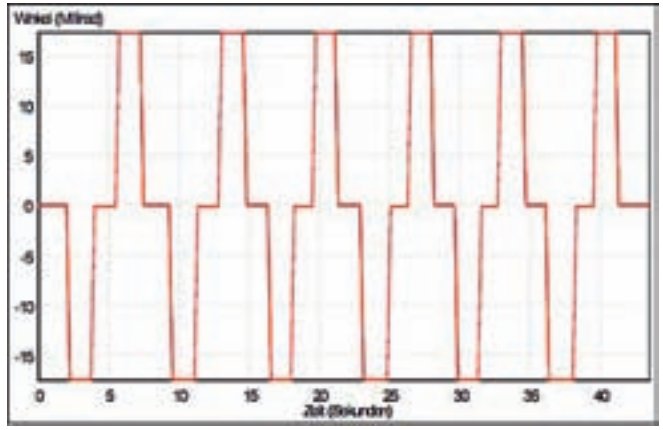


## EXAMPLE REPEATABILITY OF PRS-200 STAGE OPEN LOOP

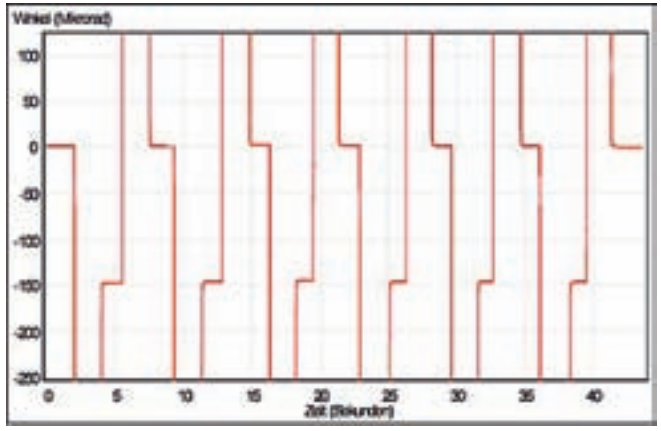
| | | |
|---|---|---|
| Stage | | PRS-200 2SM |
| Serial Number | | 07090203 |
| Customer | | TSA |
| Date | | 04.10.07 |
| Measurement Device | | Laser-interferometer ZLM 500 Zeiss |
| Measurement Base | | Granit-base 800x600 mm<br>Quality LAB Max error= 0.0014 mm |
| Environment | Temperature | 21.8 °C |
| | Humidity | 54% |
| | Pressure | 994 hPa |
| Hint | | PRS-200 mounted with 4 x M6 (5Nm) |

Shown is the repeatability of a rotation stage PRS-200 in open loop.

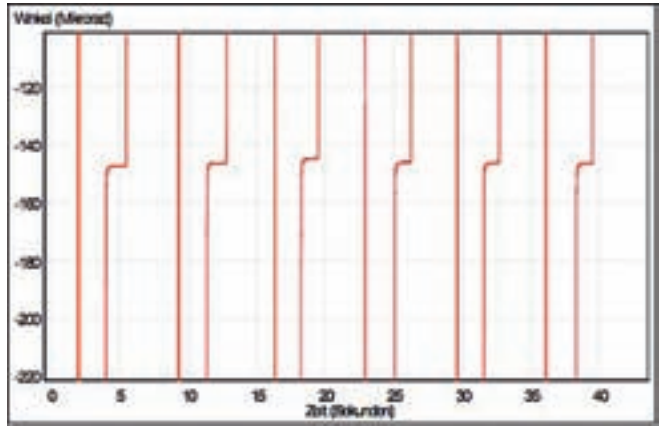
## MILLIRAD SCALE



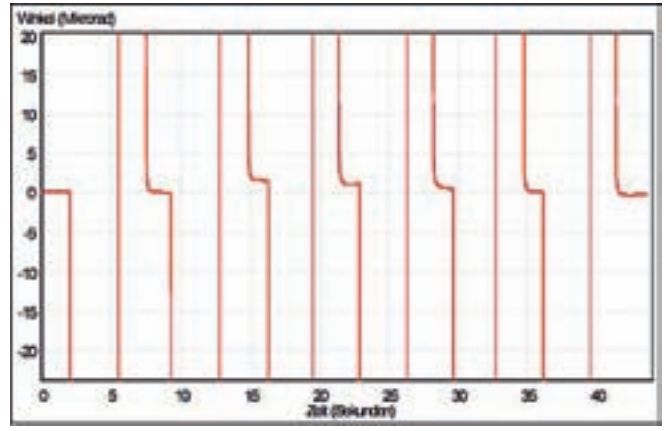
## MICRORAD SCALE



## REPEATABILITY BI-DIRECTIONAL ZOOM



## REPEATABILITY UNI-DIRECTIONAL ZOOM



## RESOLUTION, RESPECTIVELY SMALLEST STEP SIZE

This is the smallest movement, which can be performed repeatably.

PI miCos distinguishes between calculated and actual resolution. Actual resolution is often worse than the calculated value due to stiction, friction, elastic deformations in the drive train and elasticities in the guides.

## CALCULATED RESOLUTION

Is defined as the theoretically smallest movement, which can be achieved by the positioning system based on the ideal values for drive components (pitch, gear ratio, angular resolution of the motor or encoder, etc). The theoretical resolution almost always is many times better than the actual resolution (smallest step size). In real systems, the minimally achievable motion increment is almost always bigger than the calculated resolution.

## STICK-SLIP EFFECT (STICTION)

This effect appears at the junction of static friction to sliding friction and leads to a sudden motion jump. This effect limits the smallest repeatable step size. Only frictionless actuators such as flexure-based piezo stages, are able to overcome such effects and are therefore ideal in the nanometer and sub-nanometer range.

## BACKLASH

Reverse backlash is defined as a systems dead zone that occurs if an adjustment component is moved from one direction to the opposite direction. Preload as well as closed loop control by using a linear scale can avoid this effect.

## UNI-DIRECTIONAL REPEATABILITY

This specification means the ability to repeat a motion in one direction only. Backlash and hysteresis are compensated.

## BI-DIRECTIONAL REPEATABILITY

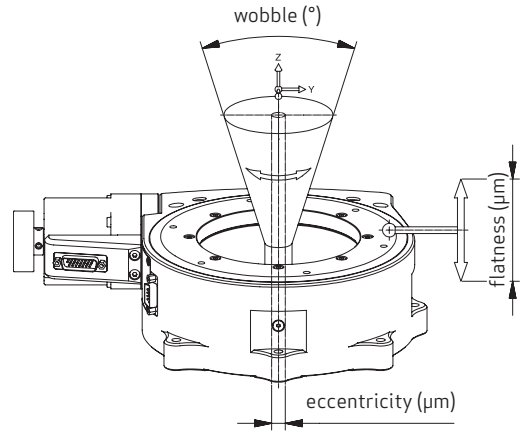
The ability to achieve a commanded position over many attempts independent of the direction where positioning occurs.

## ECCENTRICITY

Also called concentricity, occurs in a rotation stage and defines the deviation of the center of rotation from its mean position.

## WOBBLE

Is defined as the angular deviation of the axis of rotation over one revolution.




## OVERALL CONTROL

The overall control is a static and frictionless slide element, which is based on the deformation (curving) of a solid object (e.g. steel) and operates completely without rolling or gliding parts.

Further advantages are the high stiffness, capacity and little wastage.

## ORTHOGONALITY

For example, in the case of XY stages, orthogonality is the deviation of the ideal 90° angle of two axes.

## LOAD CAPACITY

The permissible force due to load vertically applied at the center of the stage.

## NORMAL LOAD CAPACITY

The maximum centered load that can be placed directly on the stage.

## TRANSVERSE LOAD CAPACITY

The maximum load that can be applied vertically to the stage and along the surface of the stage. This so-called 'side load' capacity is limited by the load capacity of the bearings.

## STIFFNESS

Refers to the amount of force that is necessary to produce a given amount of deflection.

## AIR BEARINGS

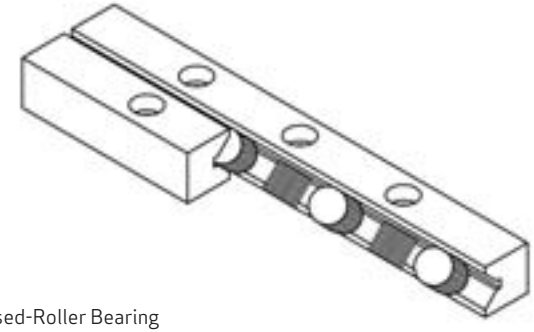
Air bearings are elements that separate two moving surfaces with a thin air film in the µm range. Air-bearings are nearly frictionless and allow guiding accuracy up to factor 10 better than mechanical bearings. PI miCos air bearings are equipped with air pressure connectors as well as vacuum connectors to pre-load the bearings, which optimizes guiding accuracy. Air bearings are used for ultra precision machines (measuring systems and machines) and high-speed machines (high-speed spindles).

Air-Bearing

## CROSSED-ROLLER BEARINGS

As with ball bearing slides rolls roll between two precisely ground and hardened sides.

The individual balls are lead through a ball cage in order to prevent obstruction. The rollers are arranged reciprocally in the cage. Roller bearings are as the ball bearing slides terminate guiding mechanism where the rollers cover 0.5-times of the way of the translating object. Due to good rolling features (they lack static and sliding friction) crossed roller bearings are perfectly suited for precision adjustment units. In contrast to ball bearing slides they provide a significant higher stiffness and load capacity.

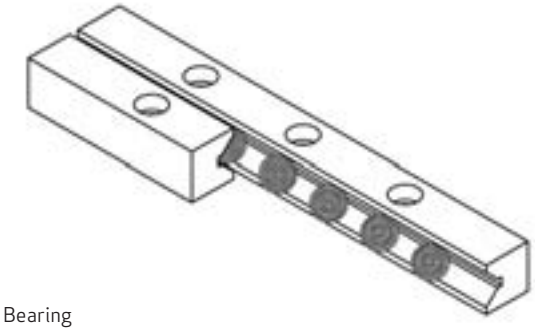


Crossed-Roller Bearing

## BALL BEARINGS

Balls roll between two precisely ground and hardened sides. This corresponds to the principle of a ball bearing. The individual balls are led through a ball cage in order to prevent obstruction. Ball bearing slides are finite guiding mechanisms where the balls cover 0.5-times the way of the translating object.

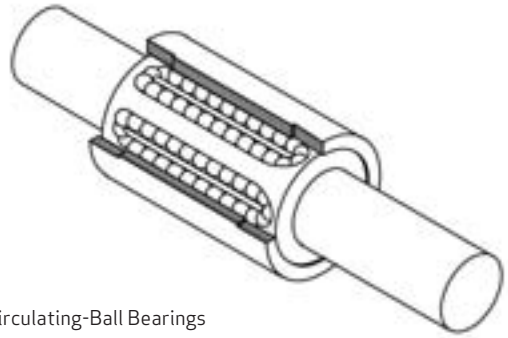
Owing to good rolling features (they are lacking static and sliding friction) they are preferable to conventional guidings such as dovetail slides. Backlash free linear translation is achieved by precise adjustment. However, the load capacity is not as high as with classical gliding guides.



Ball Bearing

## RECIRCULATING-BALL BEARINGS

On a hardened and ground surface balls roll in guiding grooves. Arriving at the end of the guide body the balls are carried back by an integrated recirculation to the beginning of the guide body. Therefore the guidance system achieves travel ranges that are a multiple of the guidance bodys dimensions. The travel range is only limited by the terminate length of the guide surface. Adjustment and zero backlash respectively are achieved by adjusting screws. No static or sliding friction occurs with correct adjustment.

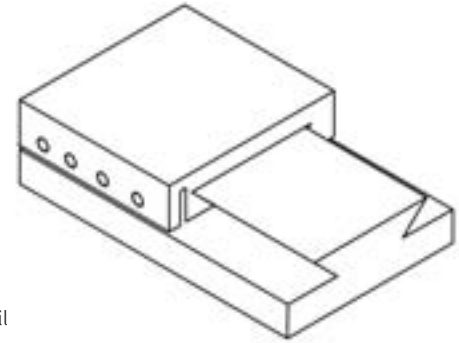


Recirculating-Ball Bearings

## DOVETAIL

Dovetail slide prevents the carriage from elevation off by slanting the side faces. Adjustment is made possible by a screw adjusted gib strip. Advantages of dovetail slides are high load capacity and precise guiding (if well adjusted).

Sliding and static friction that do not appear with bearings such as ball bearing slides or crossed roller bearing slides are disadvantageous.

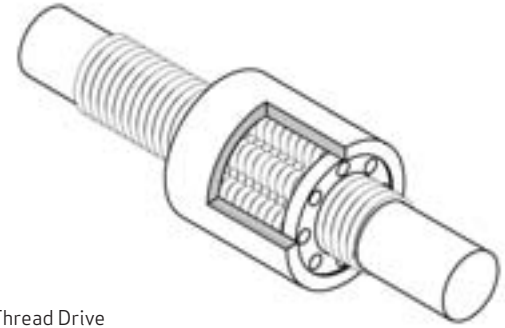


Dovetail

DRIVE SYSTEMS

## ROLLER THREAD DRIVE

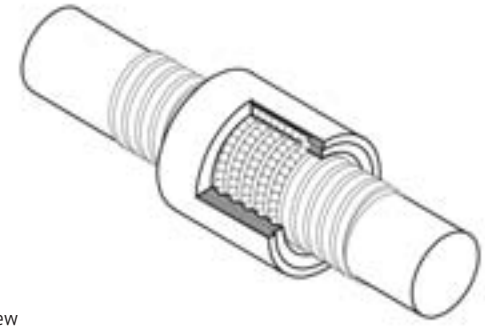
Roller thread drives consist mainly of a threaded screw and a threaded nut. Between threaded screw and threaded nut several thread rolls are arranged parallel to the axis. Roller thread drives stand out for their high load capacity and stiffness. Likewise very small pitches can be realized. As with ballscrews, rotational speed depends on length and diameter of the threaded screw. With appropriate greasing and assembly an approximately three-fold rotational speed and lifetime of ball screw is achieved.



Roller Thread Drive

## BALL SCREW

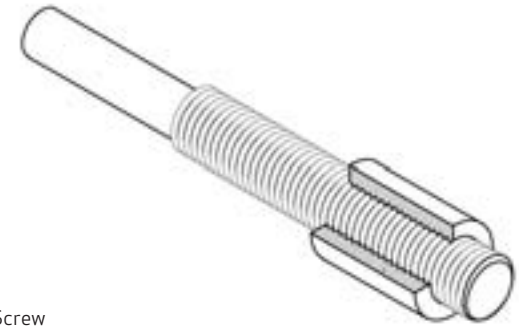
Balls roll on a ground or rolled shaft, having a helical groove. The balls support themselves in a helical groove with same pitch which is incorporated in the nut. Due to the revolving shaft the balls roll in the groove andmove the nut (if not revolving) one screw pitch per rotation (further).
The nut incorporates a recirculation system returning the balls that arrived at the end to the beginning of the nut. This model allows execution of linear motions by rotary movements. This ball screw shows high efficiency. Stick-slip effect does not occur. Due to selected balls a thread-nut combination with zero backlash can be achieved.



Ball Screw

## LEAD SCREW

The lead screw corresponds to the principle of screw-nut combination. However the screw and the nut respectively are highly precise manufactured. In combination with particular thread pitch and corresponding choice of material static and sliding friction can be reduced to minimum. In spite of high quality of manufacture the lead screw shows some axial backlash. This can be eliminated with help of preload. A limited lifetime is due to friction of the sides of threaded nut and threaded screw. The lead screw is not suited for highly static and dynamic loads.



Lead Screw

DRIVE OPTIONS

## MOTORS

With the conception of a positioning system the basic question of a necessary drive system occurs. Different parameters are relevant to the choice. They differ depending on type of problem.

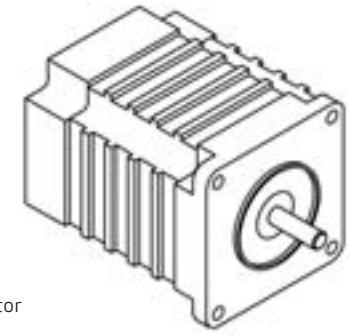
Deciding factors are:

- Speed of translation
- Smoothness of running
- Resolution
- Occurring load moments
- Range of capacity
- Heat of the motor

## STEPPER MOTORS

A stepper motor is an electromagnetic driving system that moves around a particular reproduceable step angle due to defined wiring and triggering of windings (phases).

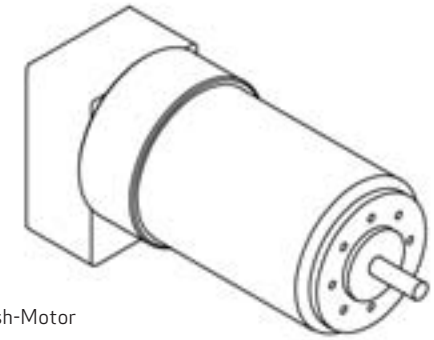
A quasi-continuous rotation is achieved owing to the stepper motor control that triggers the phases. Rotation speed depends directly on frequency of triggering/drive. The smallest possible resolution of positioning depends on the motor as well as on the type of drive. Commercial stepper motors allow resolutions from 200 up to 1000 steps per revolution. However resolution can be considerably increased by electronic micro-stepping. The advantage of a stepper motor compared with other electric drives is that expensive encoders or glass scales are not required. For reproduceable positioning, however, a loss of steps must be excluded because a feedback of the stepper motors' position does not follow. The reason for loss of steps is often an incorrectly designed drive unit where frequencies of triggering/drive, accelerations or irregular ranges of capacities occur that are too high.



Stepper Motor

## BRUSH-MOTORS

In contrast to a stepper motor a DC-motor (direct current motor/servo motor) requires no external commutation. By feeding with an appropriate direct current, the DC-motor starts to move. The rotational speed of the unloaded DC-motor is direct proportional to the applied voltage, the torque of a motor is directly proportion the motorcurrent. Since a direct current motor does not have defined grid steps, an additional hodometry is required to determine the actual position. Usually incremental encoders, glass scales or interferometers are utilized.



Brush-Motor

LINEAR / TORQUE MOTORS

## DIRECT-DRIVES

Unlimited Travel motors do not have limitations on travel displacements. Since the stationary magnet assemblies can be easily joined together to form any length of motor, travel can be made as long as necessary. Since the same moving coil assembly could be used for any travel, there is no trade-off in performance as a function of travel.

Screw-driven systems, on the other hand, have critical speed limitations and higher inertia with added length. Speed limitations, high inertia, and low stiffness are major performance trade-offs with larger travels with other drive techniques.

## SMOOTHNESS OF MOTION

Brushless linear servo motors can provide extremely smooth motion, since they have no contacting surfaces to cause jitter.

Ultimate smooth motion is achieved with sinusoidal-commutated non-ferrous motors. By contrast, ball screws are not as smooth due to the vibrating nature of the balls entering and exiting the ball nut raceways, which is easily observed in sub-micron systems. Belt and rack-and-pinion drives also have contacting mechanisms which are susceptible to friction and backlash caused vibrations.

With linear motors, the only limit to total system accuracy and repeatability is the sensing device and the bearings of the positioning system.

In rotary driven systems there are additional factors which effect these performance variables, including backlash, hysteresis, lost motion and jitter.

## PIEZO MOTOR

Piezo drives achieve resolutions of 1 nm or better. They are offered as an alternative option to our numerous linear, elevation or rotation stages.

Piezo stages are able to operate with high velocities, low friction and low backlash.

## OPEN LOOP

Driving signals are not controlled using postion feedback and error correction.

## CLOSED LOOP

The actual position of the stage is measured and compared to the ideal (commanded) postion.

In order to achieve the ideal position, a control algorithm is used. As a result, the positioning accuracy will be increased.

## ROTARY ENCODER

For indirect position measurements of linear and rotation stages, as well as actuators we use rotary encoders mounted on the motor.

However, this method is not able to correct for spindle errors, hysteresis and backlash.

## LINEAR ENCODER

Linear encoders are used for direct position feedback. Linear encoders have a positive effect on overall positioning accuracy, resolution and repeatability. They also improve speed regulation of the stage. Mechanical inaccuracies of stages, such as backlash, hysteresis, and spindle errors can be improved.

## ABSOLUTE ENCODER

Absolute encoders always give an absolute positioning data, unlike incremental encoders, even after a potential loss of power to the stage.

Absolute encoders most often use several readtracks to generate binary codes such as gray codes which contain the absolute position.

## TACHOMETERS

Utilized for applications requiring velocity regulation. Speed can be measured directly or from the encoder supplied position information.

## GEAR HEAD

Gears are most often used to increase the torque and/or resolution of the motor.

## ACCELERATION

Is defined as the change in velocity per unit time.

## VELOCITY

Is defined as change in distance per unit time.

Specifications for maximum speed are stated at the normal load capacity of the stage.

Linear servo motors can be used in both very low and very high velocity applications, all with very high precision. They can precisely operate at velocities ranging from less than

0.1 µm/s to more than 5 m/s. Ball screws and lead screws have critical speed limitations. Belt drives exhibit lower stiffness. Rack-and-pinion drives typically have backlash and poor low velocity performance.

## SPEED STABILITY

Refers to the ability to keep a constant speed over time.

## POSITION STABILITY

Refers to the ability to keep a constant position over time.

## INERTIA

Describes the measure of a loads resistance to change in velocity. The larger the inertia, the greater the torque that is necessary to accelerate or decelerate the load. Therefore loads such as sliding or static friction and fitting positions (horizontally or vertically) must be taken into account.

## COSINE ERROR

Misalignment between the measurement axis and the axis of motion produces cosine error. This error is a function of the angle between the measurement axis and the axis of motion. It is eliminated when the axis of motion and the measurement axis are parallel.

## HYSTERESIS

Hysteresis is a component of the reversal error and is dependent on the recent history of the system. It is observed when the forces acting on a system reverse direction and is the result of elastic forces in the various components. It affects both bi-directional repeatability and accuracy.

## RUNOUT

Runout error is the divergence of an imaginary point, on the moving part of the positioning element, to a stationary coordination system. Due to work tolerance in guiding systems the translators carriage does not move in an ideal straight line. The divergence of this straight line is referred to as runout error.

Two types of runout errors are to be defined:

- In translation direction (plane motion)
- In crosswise translation direction (out of plane motion)

Additionally these divergences can be defined as relative or absolute runout error.

## MTBF

Stands for Mean Time Between Failure and means reliability and lifetime of the stage.

PI miCos SPECIFICATIONS

## CALCULATED RESOLUTION

Calculated resolution is the theoretical resolution of the stage. The main factors depend on the lead screw, the motor, gear and the measuring system such as the encoder or interpolation unit.

## TYPICAL RESOLUTION

The typical resolution specifies the statistical resolution based on real-world measurement data.

## VACUUM

For specifying the necessary vacuum level it is important to analyze the application. Coating of optics, epitaxy or crystallography are different in the necessary vacuum level as well as mass spectroscopy or others. Not the general vacuum level of $10^{-6}$ or $10^{-9}$ mbar is often important but e.g. the partial pressure of hydrocarbons. As a result of using a wrong grease with higher vapor pressure or use of plastics these hydrocarbons can be a source of contamination of surfaces. Especially laser applications e.g. in the UV range are critical because the hydrocarbons can be split into fragments and these fragments can be deposed on optics. The choice of materials and handling processes are at the end the most important points to get the right vacuum stage.

## DEFINITION VACUUM

Vacuum is defined as pressure lower than normal air pressure. A system is in vacuum if the pressure is lower than the atmospherical pressure. The PI miCos catalog uses mbar as a unit of air pressure. Other physical units commonly used are Pascal (Pa) and Torr (Torr).

## DEFINITION ACCORDING TO DIN 28400

Vacuum is defined as pressure lower than the air pressure of the atmosphere.

## CLASSIFICATION OF THE VACUUM CLASSES

| Vacuum class | Abbrev. | Temperature range * | Pressure ** |
|---|---|---|---|
| Low vacuum | FV | -20°C ... +150°C | < 1-1x $10^{-3}$ mbar |
| High vacuum | HV | -20°C ... +210°C | < 1x $10^{-3}$-1x $10^{-7}$ mbar |
| Ultra-high vacuum | UHV | -20°C ... +210°C | < 1x $10^{-7}$-1x $10^{-9}$ mbar |
| Ultra-high vacuum Grease | UHV-G | -20°C ... +210°C | < $10^{-9}$ mbar |
| Ultra-high vacuum Cryo | UHV-C | -269°C ... +40°C | up to $10^{-11}$ mbar |
| Extreme-ultra-high vacuum | EUHV | -20°C ... +300°C | 1x $10^{-9}$ -1x $10^{-11}$ mbar |

* The values refer to the vacuum motors ready to use for autbaking
** Classification of the vacuum classes general terms

Almost all PI miCos stages can be prepared for FV, HV and UHV.

For UHV vacuum class all components are made for $10^{-9}$ mbar. Special UHV motors, cables, controllers, greases and coatings are used.

## PI MICOS STANDARD VACUUM PREPARATION CATEGORIES:

### FV UP TO $10^{-3}$ MBAR

- Standard motor
- Standard measuring system, if measuring system required
- Standard wiring
- Standard connector for plug connection
- Standard limit switch
- All Al parts are anodized
- Stainless steel screws
- All guidance and driving elements are equipped with vacuum grease
- Outbaking temperature max. 50°C

### FV UP TO $10^{-3}$ MBAR TO $10^{-7}$ MBAR

- Special vacuum motor
- Measuring system modified for the use in vacuum
- Motor and limit switches equipped with teflon braids 1 m length wired to a test plug
- Standard limit switches, with plastic parts
- All Al parts left un-anodized
- Stainless steel screws
- All guides and driving elements are equipped with vacuum grease
- No use of CuZn alloys
- All holes are vented

### WHEN STAGES ARE USED IN VACUUM PLEASE CONSIDER THE FOLLOWING:

- Use low speed operation, max. motor speed 10 rev/s
- Shorter life time expectation
- Stages can only be run in vacuum
- Stages are delivered with test plugs, not designed for vacuum
- Outbaking temperature max. 80°C

### UHV $10^{-7}$ UP TO $10^{-9}$ MBAR

- Special vacuum motor
- Measuring system modified for the use in vacuum
- Motor and limit switches equipped with kapton braids 1 m length wired to a test plug
- No limit switches, but can be offered with special UHV limit switches
- All Al parts are left un-anodized
- Stainless steel screws are Ag coated, with degass drilling (apart from M3 thread)
- Bearing and driving elements made of hardened stainless steel and equipped with vacuum grease
- No use of CuZn alloys
- No use of plastics, unless so desired after consultation with the customer
- All holes are vented (if possible)

Electronic devices such as controller, amplifier and other electronic devices supplied by PI miCos are not made for vacuum use. Therefore, they must be placed outside the vacuum chamber. PI miCos supplies vacuum-prepared stages with test plugs, which cannot be used in vacuum. The plug has to be disconnected and replaced by a vacuum plug by the customer. Vacuum feed-through and plugs can optionally be obtained from PI miCos.

For use in HV and UHV all guides and spindles are lubricated with vacuum lubricant. The specific lubricant for your application will be defined during the ordering process.

### HANDLING / CLEAN ROOM

Our vacuum stages are assembled in clean room conditions. All components are cleaned in an ultrasonic bath. Afterwards they are packed in a particle free and antistatic bag. Our components and systems can be used in clean room, cryogenic applications and various other climatic environments.

### PI miCos PREFERRED MATERIALS FOR STAGES ARE:

- Stainless steel
- Aluminum
- Titanium
- Brass
- Viton
- Ceramic
- Sapphire
- Teflon
- Peek
- Kapton
- Macor

## PRICE LIST

All prices are valid for sales in Germany. For international prices contact PI miCos or our representatives. Offers and invoices are quoted in EURO. Our offers are valid for 60 days. Inside Germany transport is included, outside Germany ex works. Transport insurance is included.

## INTERNATIONAL PRICE LIST

Prices outside of Europe include insurance plus packing and customs duty. Offers and invoices are quoted in EURO.

Our offers are valid for 60 days. Customers from countries where PI miCos is not represented are directly supplied by PI miCos Germany.

## TERMS OF PAYMENT

Inside Germany 10 days with 2% cash discount, 30 days net after receipt of delivery.
Outside Germany 30 days net after receipt of the goods.

In case of larger orders or custom-made systems delivery is only made after receipt of a bank surety, prepayment or 30% deposit when placing your order.

We will reserve the right to deliver part of the goods and to make out partial invoices.
The supplied goods are our own until complete payment has been made.

VAT: DE 142213462
INAN: DE 14 6805 0101 0012 5837 97
SWIFT/BIC: FRSPDE66

## CANCELLATION

Orders can only be written cancelled by mutual agreement with PI miCos GmbH Germany.

## PRODUCT MODIFICATIONS

Because we endeavour to offer our customers modernst technical developments we will always improve our products. For this reason our products are subject to change.

## WARRANTIES

All PI miCos products are guaranteed for a period of two years. In case of repaired products, all replaced structural parts are guaranteed for a period of 36 months.
If you do need to return a product for check up without exchange of any parts we grant a 12 months warranty. Please take into account that all PI miCos products can only be returned with the original packing. Furthermore, the customers pay insurance for the goods.

## RETURN OF PRODUCTS

Standard products can only be returned/exchanged within 30 days. They are subject to a restocking fee of up to 15% net.
In case of damage we reserve the right to repair the defective products.

## GENERAL

Measuring certificates are not included in delivery, only on request and for an extra charge!

## SHIPMENT

All PI miCos products are carefully dispatched with the original packing.
Please verify product specifications immediately after receipt of the goods.
In case of damage please inform at once the shipping carrier or PI miCos Germany.
PI miCos products can only be returned via the shipping carrier that delivered the goods.

If these instructions are not observed you are not entitled to damages.

## REPRESENTATIVES

We have learned that our customers appreciate the direct contact with a local distributor. Therefore PI miCos has selected qualified representatives in different countries. We continuously provide training and updated product information to them so that they are able to offer an excellent customer service concerning technical questions, customs paperwork, insurance and delivery. If you find no representative in your region, please contact us directly.

When ordering a product or a service you accept the PI miCos AGB's.

# Allgemeine Lieferungs- und Zahlungsbedingungen für den Verkauf von PI miCos-Produkten und PI miCos-Systemen

## 1. Allgemeines

Diese allgemeinen Verkaufsbedingungen gelten ausschließlich, soweit sie nicht durch ausdrückliche schriftliche Vereinbarung zwischen den Parteien abgeändert werden. Jeglichen Bedingungen oder vertragsändernden Bestimmungen des Käufers wird widersprochen. Etwaige irrtumsbedingte Fehler in Verkaufsprospekten, Preislisten, Angebotsunterlagen oder sonstigen Dokumentationen des Lieferers dürfen vom Lieferer berichtigt werden, ohne dass er für Schäden aus diesen Fehlern zur Verantwortung gezogen werden darf.

## 2. Angebot

2.1. Unsere Angebote sind freibleibend. Bestellungen sind für uns nur verbindlich, soweit wir sie bestätigen oder ihnen durch Übersendung der Ware nachkommen.

2.2. Die zu dem Angebot gehörenden Unterlagen wie Abbildungen, Zeichnungen, Gewichts- und Maßangaben sind nur annähernd maßgebend, soweit sie nicht ausdrücklich als verbindlich bezeichnet sind.

2.3. An Kostenvoranschlägen, Zeichnungen und anderen Unterlagen behält sich der Verkäufer das Eigentums- und Urheberrecht vor; sie dürfen Dritten nicht zugänglich gemacht werden. Der Verkäufer ist verpflichtet, vom Käufer als vertraulich bezeichnete Plänen nur mit dessen Zustimmung Dritten zugänglich zu machen.

## 3. Lieferumfang

3.1. Für den Umfang der Lieferung ist die schriftliche Auftragsbestätigung des Lieferers maßgebend. Einer Auftragsbestätigung bedarf es im Falle eines Angebots des Lieferers mit zeitlicher Bindung nicht, sofern seitens des Käufers die fristgemäße Annahme erfolgte und keine rechtzeitige Auftragsbestätigung vorliegt.

3.2. Nebenabreden und Änderungen bedürfen der schriftlichen Bestätigung des Lieferers.

## 4. Preis, Zahlungsbedingungen

4.1. Die Preise gelten mangels besonderer Vereinbarung ab Werk einschließlich Verladung im Werk, jedoch ausschließlich Verpackung. Zu den Preisen kommt die Mehrwertsteuer in der jeweiligen gesetzlichen Höhe hinzu.

4.2. Mangels besonderer Vereinbarung ist die Zahlung bar ohne jeden Abzug frei Zahlstelle des Lieferers zu leisten, und zwar: 1/3 Anzahlung nach Eingang der Auftragsbestätigung; 1/3, sobald dem Käufer mitgeteilt ist, dass die Lieferung bzw. Teillieferung versandbereit ist; der Restbetrag innerhalb eines weiteren Monats.

4.3. Die Zurückhaltung von Zahlungen oder die Aufrechnung wegen etwaiger vom Verkäufer bestrittenen Gegenansprüche des Käufers sind nicht statthaft.

4.4. Bei Bestellungen unter einem Auftragswert von 100,00 Euro wird auf den Bestellwert eine Bearbeitungspauschale von 20,00 Euro aufgeschlagen.

4.5. Der Verkäufer ist zu Preisanhebungen berechtigt, die vor Auslieferung der Ware aufgrund unvorhergesehener Preisentwicklung erforderlich werden (deutlicher Anstieg von Material- oder Herstellungskosten) oder aufgrund geänderter Zuliefererbedingungen nötig sind. Wechsel oder Schecks werden nur aufgrund besonderer Vereinbarung und nur zahlungshalber akzeptiert; die Kosten der Einziehung und der Diskontierung trägt der Käufer.

4.6. Bei Überschreitung der Zahlungsfrist werden unter Vorbehalt der Geltendmachung eines weiteren Schadens Verzugszinsen, mindestens 5 % über dem jeweiligen Diskontsatz der Deutschen Bundesbank, berechnet. Bei Zahlungsverzug und begründeten Zweifeln an der Zahlungsfähigkeit oder Kreditwürdigkeit des Käufers ist der Verkäufer unbeschadet seiner sonstigen Rechte befugt, Sicherheiten oder Vorauszahlungen für ausstehende Lieferungen zu verlangen und sämtliche Ansprüche aus der Geschäftsverbindung sofort fällig zu stellen.

4.7. Nur unbestrittene oder rechtskräftig festgestellte Forderungen berechtigen den Käufer zur Aufrechnung oder Zurückbehaltung.

## 5. Lieferung, Lieferzeit

5.1. Die Lieferung erfolgt ab Werk .... des Verkäufers. Teillieferungen sind zulässig.

5.2. Die Lieferfrist beginnt mit der Absendung der Auftragsbestätigung, jedoch nicht vor Beibringung der vom Käufer zu beschaffenden Unterlagen, Genehmigungen, Freigaben sowie vor Eingang einer vereinbarten Anzahlung.

5.3. Die Lieferfrist ist eingehalten, wenn bis zu ihrem Ablauf der Liefergegenstand das Werk verlassen hat oder die Versandbereitschaft mitgeteilt ist.

5.4. Die Lieferfrist verlängert sich angemessen beim Eintritt unvorhergesehener Ereignisse, sowie solchen Hindernisse, die die Fertigstellung oder Ablieferung des Liefergegenstandes erheblich beeinflussen. Dies gilt auch, wenn die Umstände bei Unterlieferern eintreten. Die vorbezeichneten Umstände sind auch dann vom Verkäufer nicht zu vertreten, wenn sie während eines bereits vorliegenden Verzuges entstehen. Beginn und Ende derartiger Hindernisse wird in wichtigen Fällen dem Käufer baldmöglichst mitgeteilt.

5.5. Die Einhaltung der Lieferfrist setzt die Erfüllung der Vertragspflichten seitens des Bestellers voraus.

## 6. Gefahrübergang

6.1. Verladung und Versand erfolgen unversichert auf Gefahr des Käufers. Auf Wunsch des Käufers wird auf seine Kosten die Ware durch den Verkäufer versichert.

6.2. Verzögert sich der Versand infolge von Umständen, die der Käufer zu vertreten hat, so geht die Gefahr des zufälligen Untergangs und der zufälligen Verschlechterung vom Tage der Versandbereitschaft ab auf den Käufer über.

6.3. Angelieferte Gegenstände sind, auch wenn sie unwesentliche Mängel aufweisen, vom Käufer unbeschadet der Rechte aus Abschnitt 8 entgegenzunehmen.

6.4. Teillieferungen sind zulässig.

## 7. Eigentumsvorbehalt

7.1. Die verkaufte Ware bleibt bis zum Eingang aller Zahlungen aus dem Liefervertrag im Eigentum des Lieferers. Der Käufer ist befugt, über die gekaufte Ware im ordentlichen Geschäftsgang zu verfügen.

7.2. Der Eigentumsvorbehalt erstreckt sich auch auf die durch Verarbeitung, Vermischung oder Verbindung der gelieferten Ware entstehenden Erzeugnisse zu deren vollem Wert, wobei der Lieferer als Hersteller gilt, gegebenenfalls wird Miteigentum im Verhältnis der Rechnungswerte der verarbeiteten Waren erworben.

7.3. Die aus dem Weiterverkauf entstehenden Forderungen gegen Dritte tritt der Käufer schon jetzt insgesamt bzw. in Höhe eines etwaigen Miteigentumsanteils zur Sicherung an den Verkäufer ab. Der Käufer ist ermächtigt, die Forderungen bis zum Widerruf oder zur Einstellung seiner Zahlungen für Rechnung des Lieferers einzuziehen.

7.4. Der Käufer darf den Liefergegenstand weder verpfänden noch zur Sicherung übereignen. Bei Pfändungen sowie Beschlagnahme oder sonstigen Verfügungen durch dritte Hand hat er den Lieferer unverzüglich davon zu benachrichtigen.

7.5. Bei vertragswidrigem Verhalten des Käufers, insbesondere bei Zahlungsverzug, ist der Lieferer zur Zurücknahme nach Mahnung berechtigt und der Käufer zur Herausgabe verpflichtet. Die Geltendmachung des Eigentumsvorbehaltes sowie die Pfändung des Liefergegenstandes durch den Verkäufer gelten nicht als Rücktritt vom Vertrag.

7.6. Übersteigt der Wert der Sicherheiten die Forderungen des Lieferers um mehr als 20 %, so werden auf Verlangen des Käufers insoweit Sicherheiten nach Wahl des Lieferers freigegeben.

## 8. Gewährleistung/Vertragsmäßigkeit der Ware, Haftungsausschluss

8.1. Der Käufer hat dieWare unverzüglich nach Erhalt zu untersuchen und, sollte ein Sachmangel feststellbar sein, dem Verkäufer schriftlich Anzeige zu machen.

8.2. Vertragliche Angaben über Eignung, Verarbeitung und Anwendung der gelieferten Ware sowie technische Bedienungsanweisungen und sonstige Angaben erfolgen nach bestem Wissen, begründen jedoch keine Garantie oder Zusicherung von Eigenschaften. Gleiches gilt für Haltbarkeitsangaben bei Waren, die zum alsbaldigen Verbrauch bestimmt sind.

8.3. Ist die Ware nicht vertragsgemäß, haftet der Verkäufer wie folgt:

- Der Verkäufer darf die Vertragswidrigkeit zunächst nach seiner Wahl durch Nachbesserung oder Ersatzlieferung innerhalb angemessener Frist nach Aufforderung durch den Käufer beheben;
- Soweit der Verkäufer zur Ausbesserung oder Ersatzlieferung nicht bereit oder in der Lage ist, ist der Käufer nach seiner Wahl berechtigt, die Wandlung (Rückgängigmachung des Vertrages) oder eine Minderung (Herabsetzung des Kaufpreises) zu verlangen.

8.4. Der Verkäufer übernimmt keine Verantwortung für:

- Defekte der Ware, die auf eine Warenbeschreibung oder Spezifikation des Käufers zurückgehen;
- für Teile, Material oder sonstige Ausrüstungsgegenstände, die vom Käufer oder in dessen Auftrag hergestellt wurden, es sei denn, der Hersteller dieser

Teile übernimmt dem Lieferer gegenüber die Verantwortung;
- für die Fehlerhaftigkeit der Ware, wenn der fällige Kaufpreis bis zum Fälligkeitstag nicht bezahlt worden ist.

8.5. Von der Gewährleistung nicht erfasst sind Produktfehler, die aufgrund fehlerhafter Installation oder Nutzung, Fehlgebrauch, Fahrlässigkeit oder anderen Gründen entstehen.

8.6. Der Verkäufer ist von der Mängelhaftung befreit, wenn der Käufer ihm die erforderliche Zeit und Gelegenheit zu einer notwendigen Ausbesserung und Ersatzlieferung nicht gibt. Nur in dringenden Fällen der Gefährdung der Betriebssicherheit und zur Abwehr unverhältnismäßig großer Schäden ist der Käufer befugt, den Mangel selbst oder durch Dritte beseitigen zu lassen oder vom Verkäufer Ersatz der notwendigen Kosten zu verlangen.

8.7. Von den durch die Ausbesserung bzw. Ersatzlieferung entstehenden unmittelbaren Kosten trägt der Verkäufer – insoweit als sich die Beanstandung als berechtigt herausstellt – die Kosten des Ersatzstückes einschließlich des Versandes sowie die angemessenen Kosten des Aus- und Einbaues.

8.8. Durch etwa seitens des Käufers oder Dritter unsachgemäß ohne vorherige Genehmigung des Lieferers vorgenommene Änderungen oder Instandsetzungsarbeiten wird die Haftung für die daraus entstehenden Folgen aufgehoben.

8.9. Weitere Ansprüche des Käufers, insbesondere ein Anspruch auf Ersatz von Schäden, die nicht an dem Liefergegenstand selbst entstanden sind, sind ausgeschlossen. Dieser Haftungsausschluss gilt nicht bei Vorsatz, bei grober Fahrlässigkeit des Inhabers oder leitender Angestellter sowie bei schuldhafter Verletzung wesentlicher Vertragspflichten. Bei schuldhafter Verletzung wesentlicher Vertragspflichten haftet der Verkäufer – außer in den Fällen des Vorsatzes und der groben Fahrlässigkeit des Inhabers und leitender Angestellter – nur für den vertragstypischen, vernünftiger Weise vorhersehbaren Schaden, jedoch nur bis zur Höhe von max. 15 % des Verkaufspreises. Der Haftungsausschluss gilt ferner nicht in den Fällen, in denen nach Produkthaftungsgesetz bei Fehlern des Liefergegenstandes für Personen- oder Sachschäden an privat genutzten Gegenständen gehaftet wird. Er gilt auch nicht bei Fehlen von Eigenschaften, die ausdrücklich zugesichert sind, wenn die Zusicherung gerade bezweckt hat, den Käufer gegen Schäden, die nicht am Liefergegenstand selbst entstanden sind, abzusichern.

**9. Nichtbelieferung**

Soweit dem Verkäufer die Lieferung ganz oder teilweise unmöglich wird, darf der Käufer bezüglich des nicht gelieferten Teils vom Vertrag zurücktreten, es sei denn, die Annahme der nur teilweisen Erfüllung ist unzumutbar. Der Abschnitt 8.9 findet entsprechende Anwendung.

**10. Gesetzliche Produkthaftung**

10.1. Der Käufer ist verpflichtet, den Verkäufer auf ihm bekannt werdende besondere Gefahren, die sich aus dem Gebrauch der gelieferten Waren ergeben, hinzuweisen.

10.2. Soweit gelieferte Ware unter § 1 der 9. Verordnung zum Gerätesicherheitsgesetz vom 12.05.1993 fällt, entspricht sie den grundlegenden Sicherheits- und Gesundheitsanforderungen des Anhangs der EU-Richtlinie 98/392.

**11. Höhere Gewalt**

Fälle höherer Gewalt – als solche gelten die Umstände und Vorkommnisse, die mit der Sorgfalt einer ordentlichen Betriebsführung nicht verhindert werden können – suspendieren die Vertragsverpflichtungen der Parteien für die Dauer der Störung und im Umfang ihrer Wirkung. Überschreiten da aus sich ergebende Verzögerungen den Zeitraum von sechs Wochen, so sind beide Vertragspartner berechtigt, hinsichtlich des betroffenen Leistungsumfanges vom Vertrag zurückzutreten. Sonstige Ansprüche bestehen nicht.

**12. Rücktrittsrecht des Verkäufers**

Erhält der Verkäufer nach Abschluss des Kaufvertrages Hinweise darauf, dass der Käufer sich in Zahlungsschwierigkeiten befindet, ist der Verkäufer zum Rücktritt vom Vertrag berechtigt; die bis dahin erbrachten Aufwendungen werden dem Käufer in Rechnung gestellt. Alternativ: Der Verkäufer kann vom Käufer Sicherheit in Höhe des Rechnungsbetrages verlangen.

**13. Verjährung**

Jegliche Ansprüche des Käufers wegen Vertragswidrigkeiten verjähren binnen sechs Monaten ab Gefahrübergang (Abschnitt 6). Die Verantwortlichkeit des Verkäufers beschränkt sich auf Vertragswidrigkeiten, die innerhalb dieses Zeitraums auftreten. Mit Ablauf dieses Zeitraums verliert der Käufer das Recht, sich auf Vertragswidrigkeiten zu berufen. Für ersatzweise gelieferte oder ausgebesserte Ware beträgt die Verjährungsfrist drei Monate, sie läuft mindestens aber bis zum Ablauf der ursprünglichen Verjährungsfrist für den Liefergegenstand. Die Frist für die Mängelhaftung an dem Liefergegenstand wird um die Dauer der durch die Nachbesserungsarbeiten verursachten Betriebsunterbrechung verlängert.

**14. Schutzrechte**

Der Käufer steht dafür ein, dass zwecks Spezifikation/Nachbau vorgelegten Zeichnungen, Pläne und Muster nicht Rechte Dritter verletzt werden und dass er über die der Spezifikation beiliegendem Rechte noch nicht anderweitig verfügt hat.

**15. Verschiedenes**

15.1. Der Verkäufer ist berechtigt, die Ware zu verändern und zu verbessern, ohne den Käufer hiervon vorher informieren zu müssen, soweit Veränderung oder Verbesserung weder Form noch Funktion der Ware nachhaltig belasten oder verschlechtern.

15.2. Die vorstehenden Bedingungen ersetzen alle anderen Vereinbarungen, die die Vertragspartner vorher schriftlich oder mündlich getroffen haben und die mit Unterzeichnung dieser Bedingungen unwirksam werden.

15.3. Im Falle der Unwirksamkeit einer oder mehrerer Bestimmungen dieses Vertrages werden die Vertragsparteien eine der unwirksamen Regelung wirtschaftlich möglichst nahe kommende rechtswirksame Ersatzregelung schaffen.

**16. Gerichtsstand**

Bei allen sich aus dem Vertragsverhältnis ergebenden Streitigkeiten ist, wenn der Käufer Vollkaufmann, eine juristische Person des öffentlichen Rechts oder ein öffentlich rechtliches Sondervermögen ist, die Klage bei dem für den Hauptsitz zuständigen Gericht zu erheben. Der Verkäufer ist auch berechtigt, am Hauptsitz des Käufers zu klagen.

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CATALOG MOTION CONTROL®



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