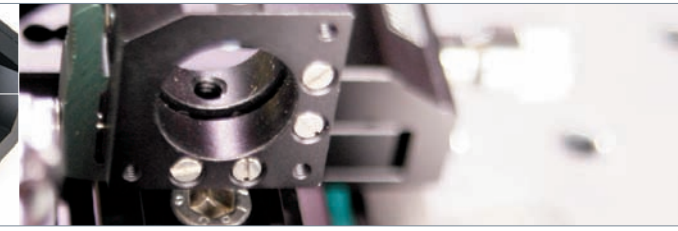
MOTION CONTROL VOL 9

precision made in germany

micos®



micos®
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Founded in 1990 in Eschbach, Germany, **micos** is a high-tech company with an extensive global presence through subsidiaries in the USA, Italy and Spain as well as representations throughout the globe.

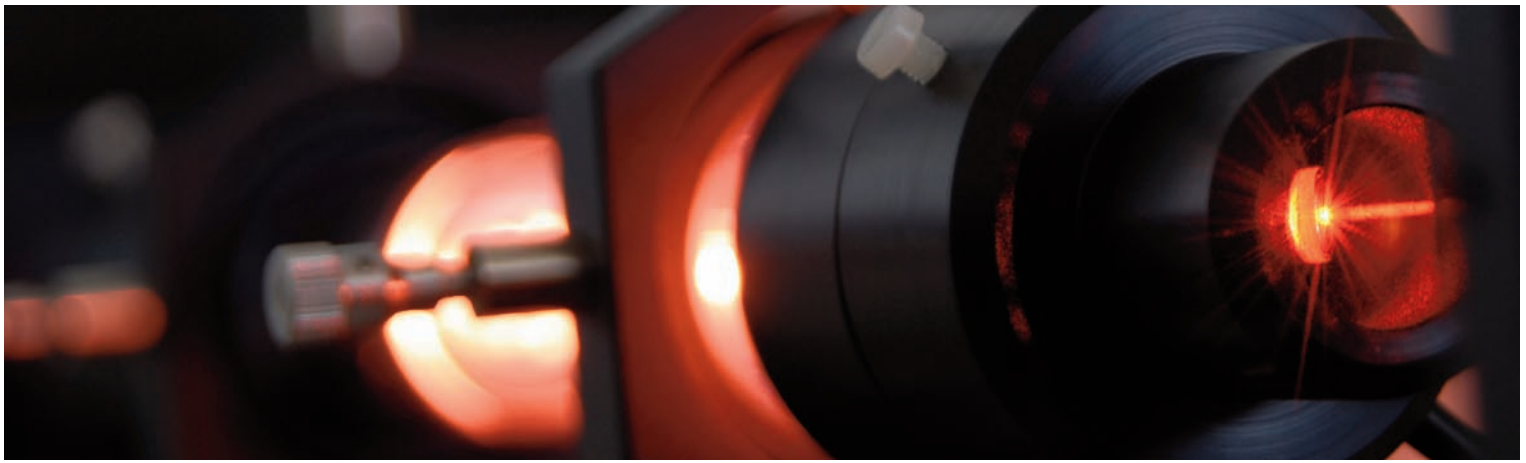
micos specializes in innovative systems and components in micro- and nano-positioning, photonics and laser technology. We offer a complete range of standard products as well as experimental kits used in education and research. Our customers include Carl Zeiss, Siemens, universities and research institutes such as Max-Planck-Institutes, Fraunhofer, MIT, CalTech, Yale and many others. Our line of standard products as well as a sampling of system examples is represented in our 180 page catalog. We take pride in offering high-quality products and services that minimize the cost of ownership to our valued customers.

Offering superior value to our industrial and research customer base, **micos** offers complete system integration and design services in the field of motion control and optics, including software, electronics and mechanics.

We specialize in especially demanding applications that require deep vacuum, extreme temperature, high precision and superior performance. Our deep knowledge base allows us to solve even the most demanding applications by consulting with our customers from the very beginning of the design stage to the ultimate product or system delivery.

micos employs over 50 PhDs, engineers and physicists as well as highly qualified technicians with specialties in motion control, robotics and optics. Equipped with state of the art machines, our in-house precision machine shop allows us to manufacture with high-precision and superior quality. After in-house assembly, every product is inspected by our quality department before it is delivered to our customers.

MAC | PhotonX®
powered by MICOS



Campus®

The use of lasers in a variety of research fields, industry, medicine and finally in many products of daily life demands a qualified education and training of students in laser technology from universities, technical high schools and vocational schools. These institutions are addressed by micos, the series of educational laser kits from micos developed to support and improve practical laser training. Within this product line 27 laser training systems of the topics optics fundamentals, laser basics, laser metrology, fiber optics and telecommunications, laser material processing, and laser applications are presented. Besides these products micos offers support for elaboration of suited curriculums for laser courses, design of the laboratories and advice in equipment selection with concepts for complete laser training facilities. Last but not least, training courses for all experimental systems are held at micos' place as well as at your site.

Moskito®

The industry is forced to shrink their products to dimensions where conventional equipment reaches its limits. Consequently micos decided to offer a miniaturized optomechanical system with all necessary components to support the scientists and engineers in their work. The optical height of 1" (25.4 mm) and useful high precision components make small system layouts in short time schedules and affordable prices possible.

Albatros®

Up to now the use of optomechanical construction systems for optics and laser technology is necessary in the labs of scientists and engineers for research and development.

The Albatros® system with an optical height of 65 mm is designed to support and simplify the layout of optical systems and laser systems in scientific labs and industry. The precise and handy components of this system are established in many labs around the world since 1991.

The easy use and the adaptability of the Albatros® components even to other systems explains the constant success in the market.

Please ask for the catalog!

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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
Ø4H7	Hole Basis Fit Ø4 Tolerance Zone H7
M6	Metric Thread
□	Square
	Brake

0.002 Index

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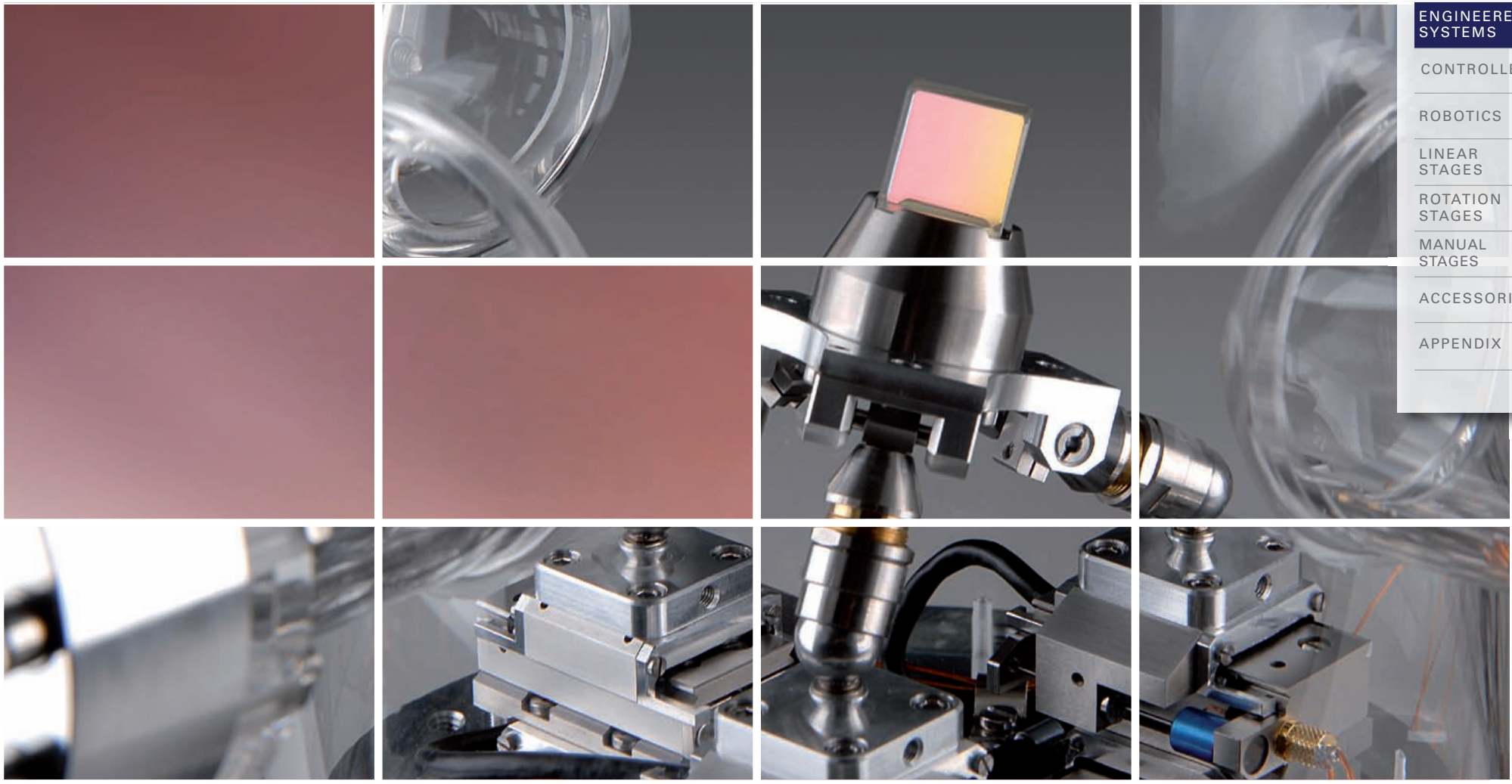
1.000 ENGINEERED SYSTEMS

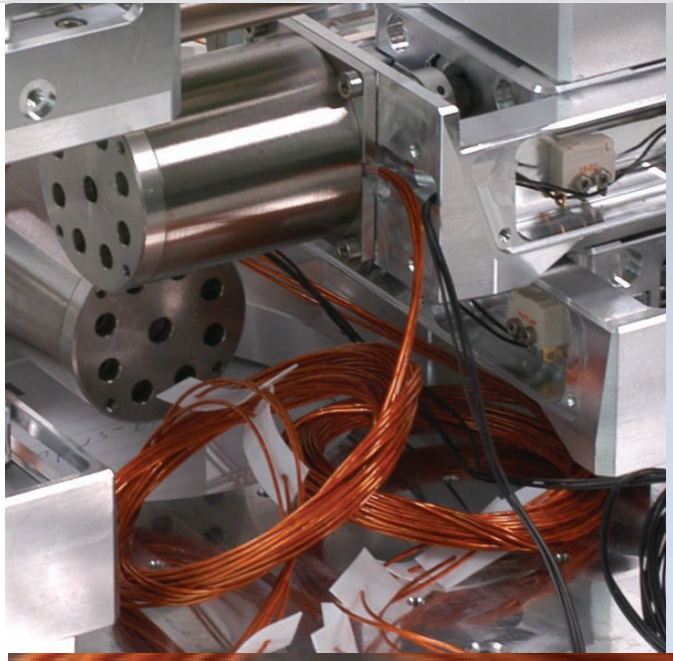


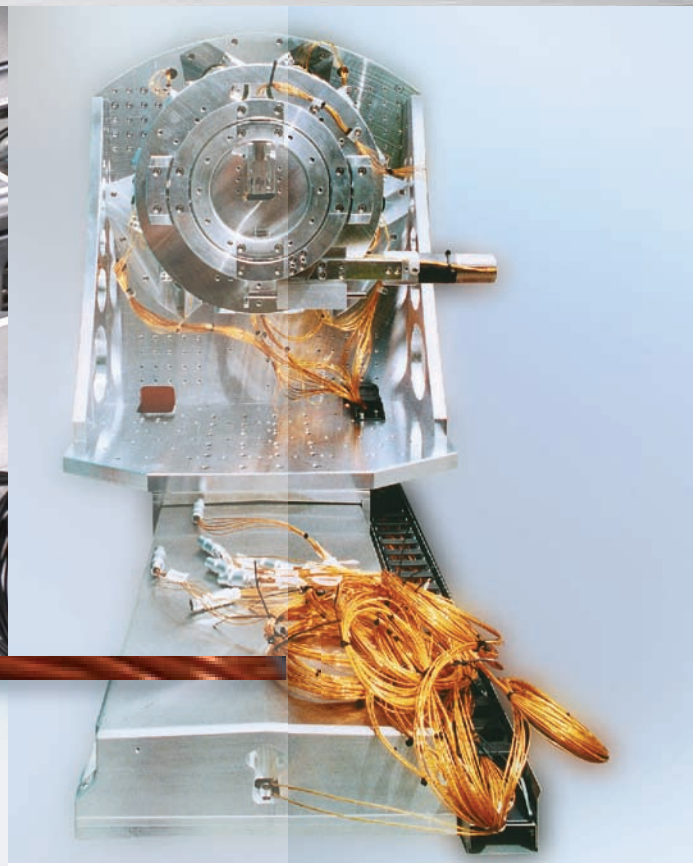



ENGINEERED SYSTEMS

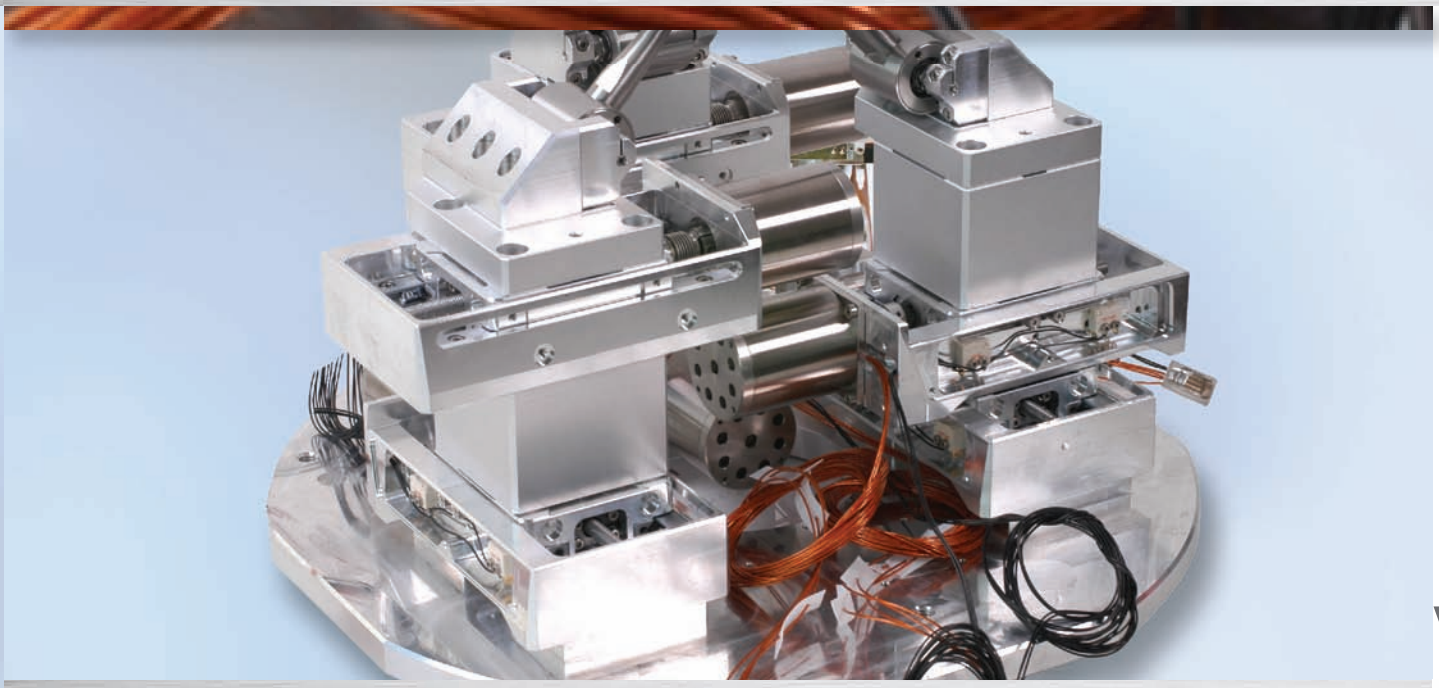
VACUUM

Vacuum applications are becoming more essential due to technologies that can only be applied in vacuum. For over 12 years, **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.





Custom made SpaceFAB version for vacuum 10^{-7} mbar and temperature range of -40°C to +80°C.
Pivot point can be set by software.

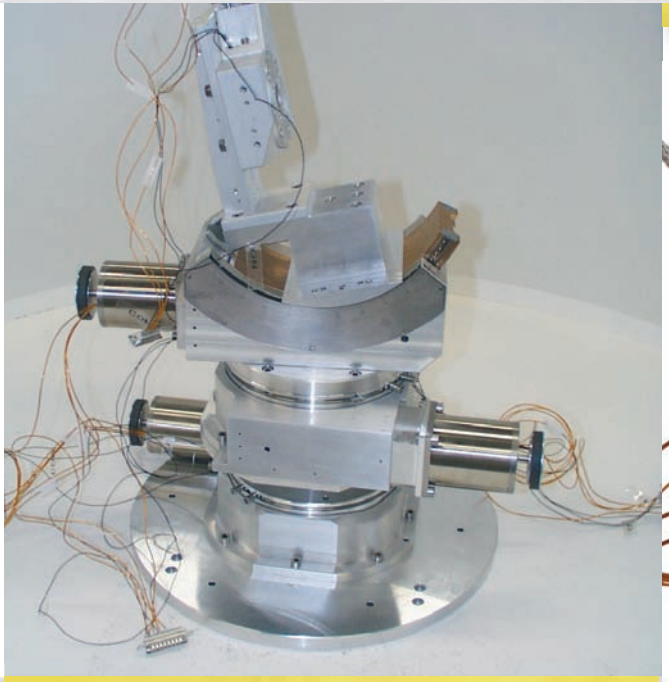


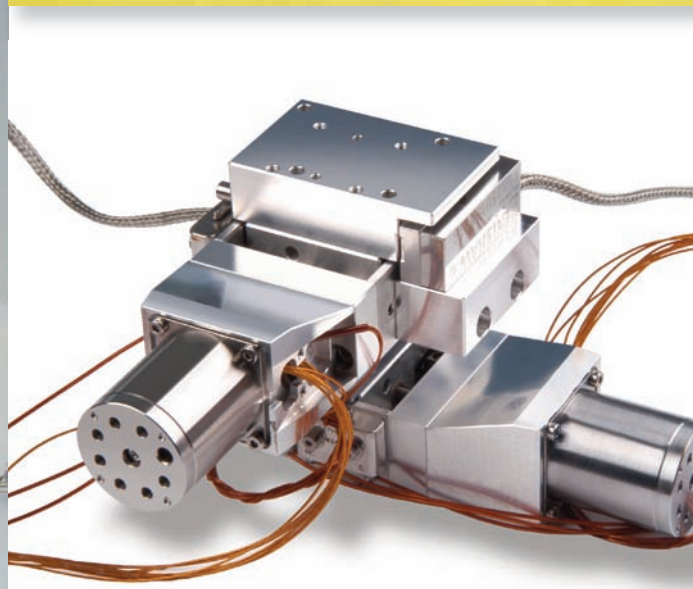
VACUUM

VACUUM

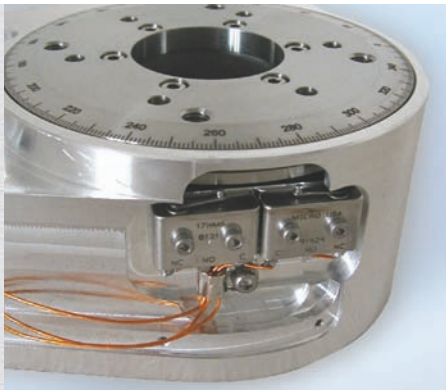
X-Ray Diffraction and Tomography

Positioning system for High-VACUUM 10^{-7} mbar. The 4 axes positioning system was specifically developed for 10^{-7} mbar. The system has a common pivot point. In all components vacuum suitable grease is used. The manipulators are driven by (PHYTRON) vacuum motors. The aluminum parts are not anodized. The system is controlled by a **SMC-pegasus** 4 axes positioning controller.

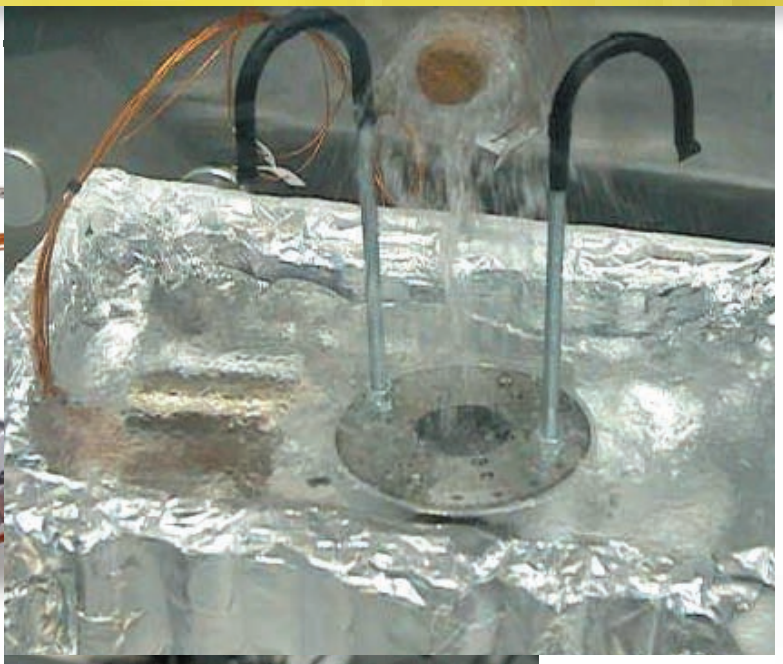


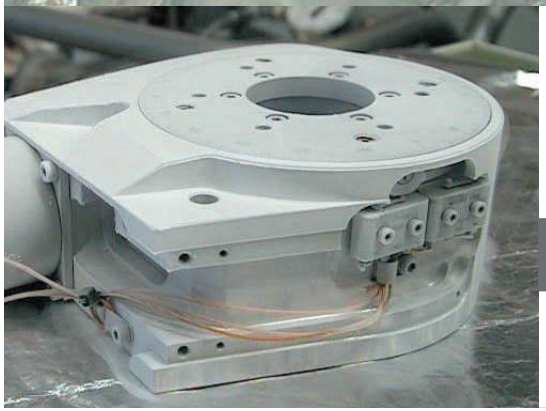


CRYO



OEM application for UHV
Precision Rotation Stage **PRS-110**



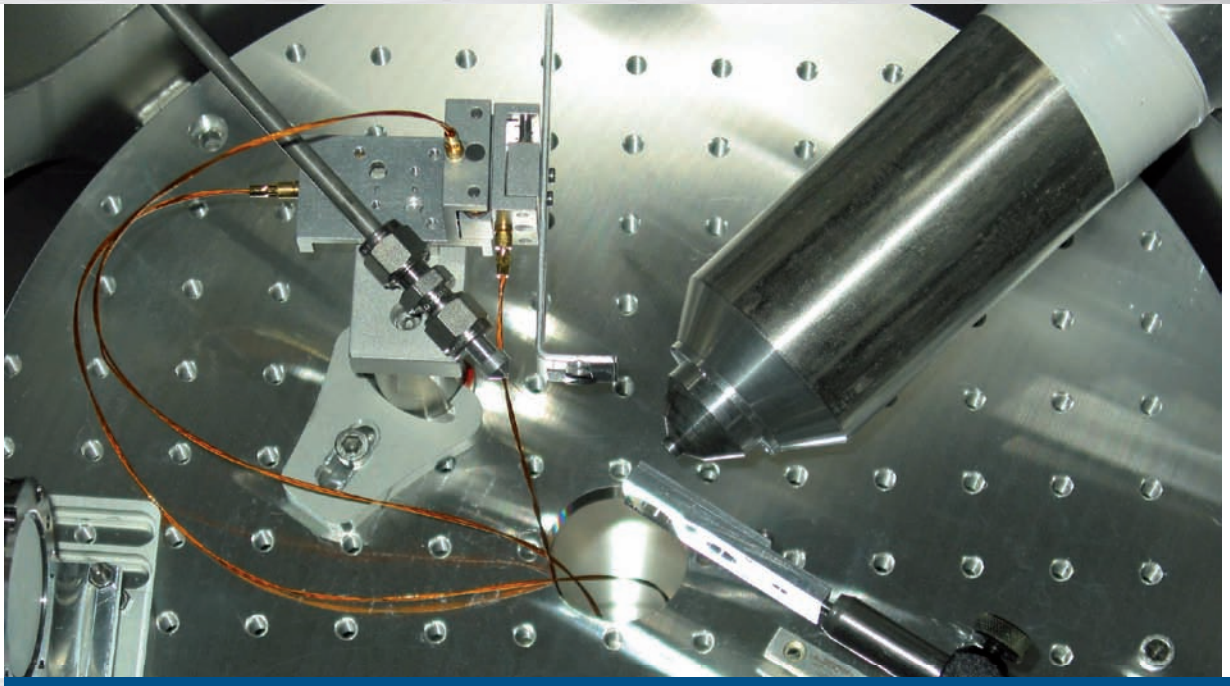


PP-30, 3 axes
Special xyz PP-30 stage for applications at 4 Kelvin.

MOVING IN ABSOLUTE 77K

(**PRS-110** UHV cryo-version)

VACUUM

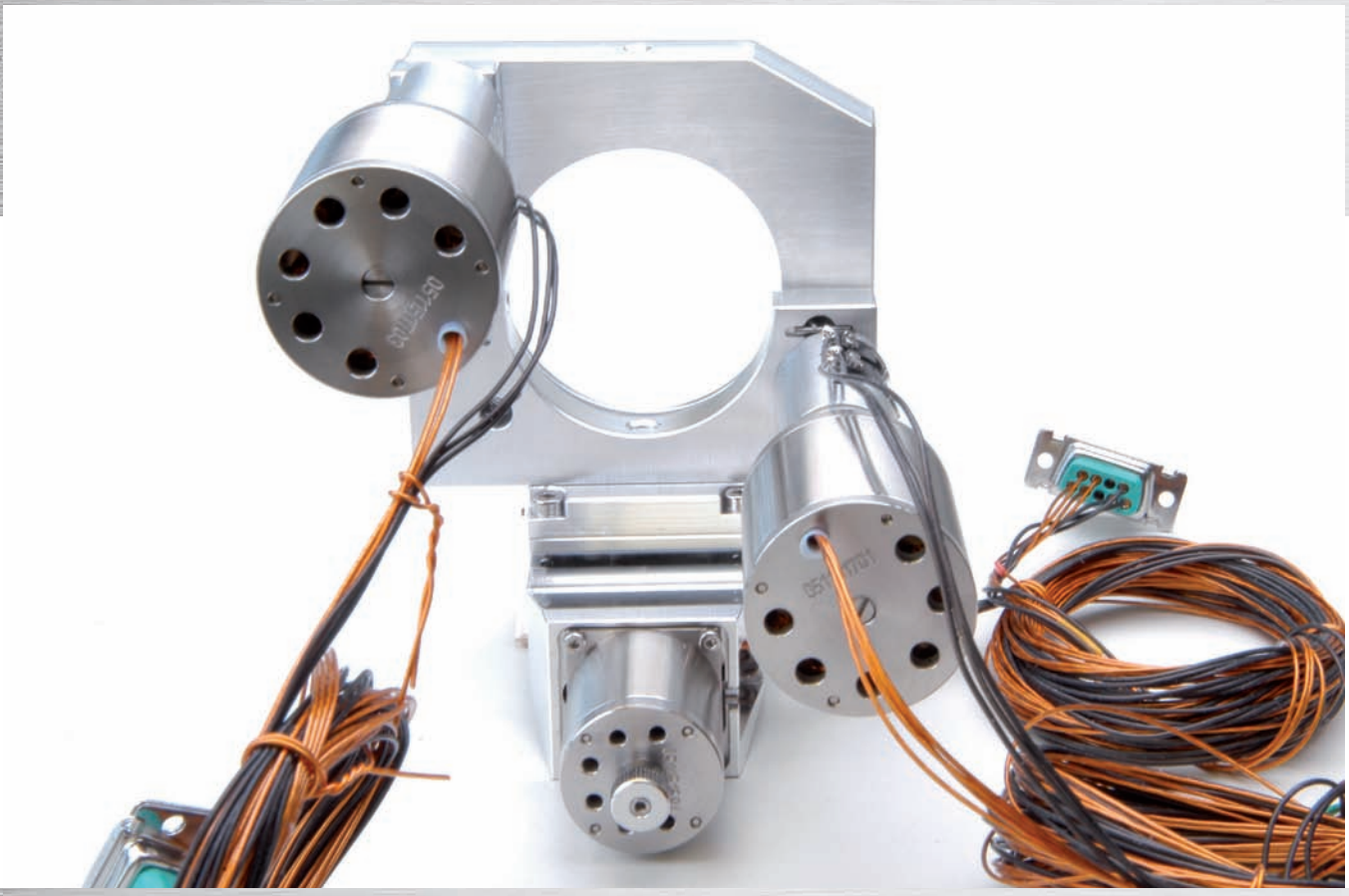


3 axes positioning system driven by a vacuum compatible piezo motor for 10^{-7} mbar.

Two linear and two rotary stages are combined to create a 4 axes manipulator for vacuum in 10^{-7} mbar. This setup is used for adjusting an x-ray lens.

VACUUM

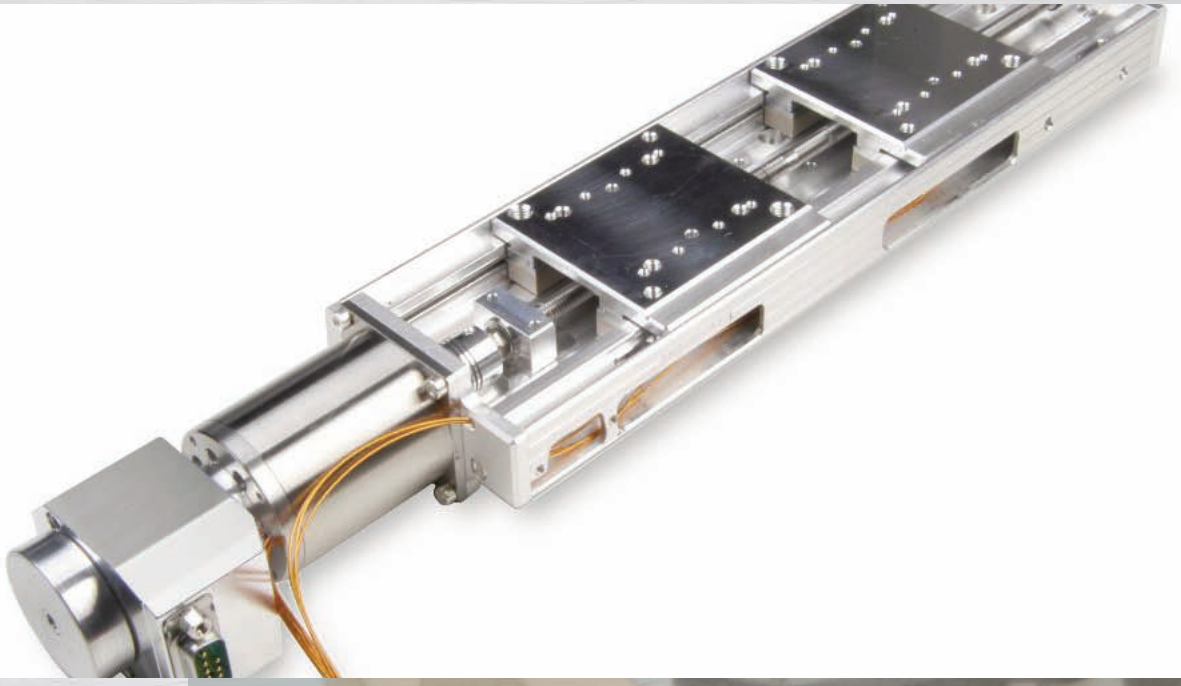
All axes are equipped with high quality vacuum motors. Drives, guides and bearings are lubricated with special lubricants for vacuum applications. All parts are manufactured from vacuum compatible materials such as stainless steel and ceramics.

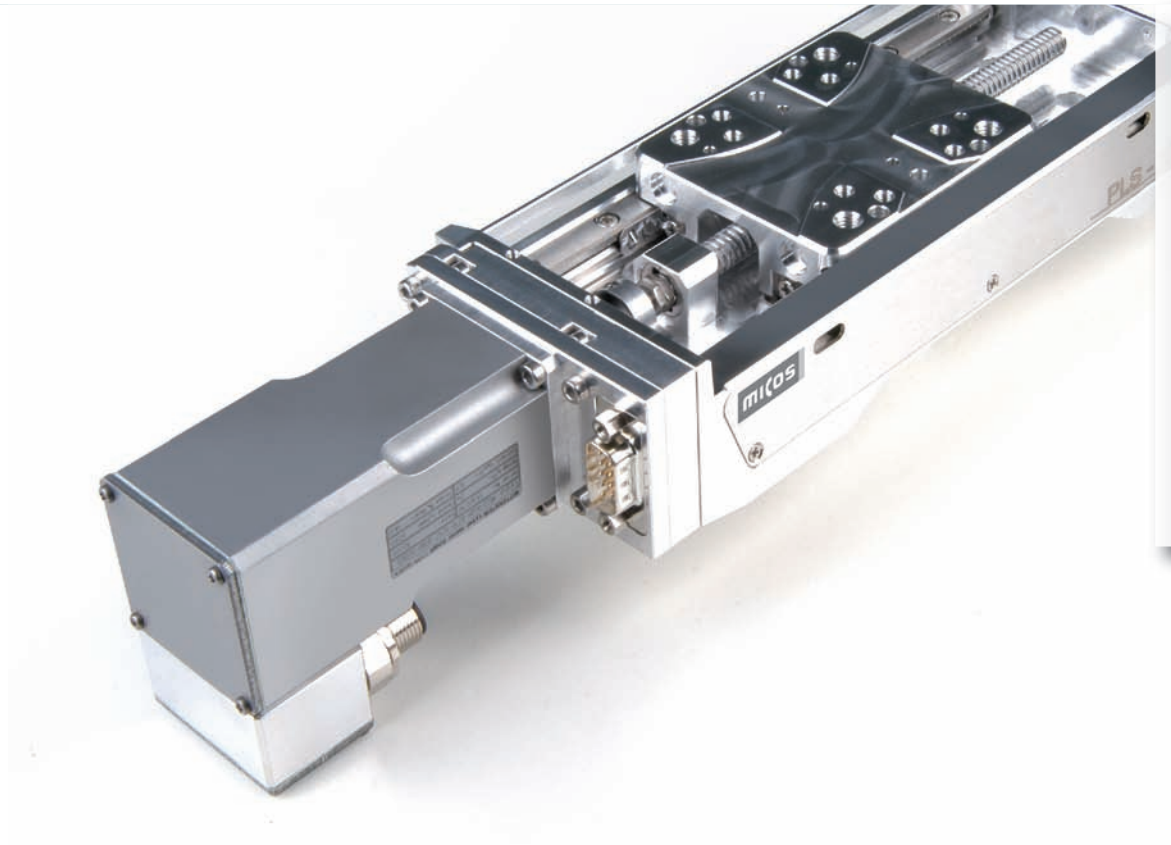


Depending on the application, parts are not anodized. For vacuum levels below 10^{-7} mbar, all cavities are vented to eliminate outgassing and components are assembled using special, clean-room compatible screws (Class 100).
All stages can be equipped with vacuum compatible encoders and limit switches.

VACUUM

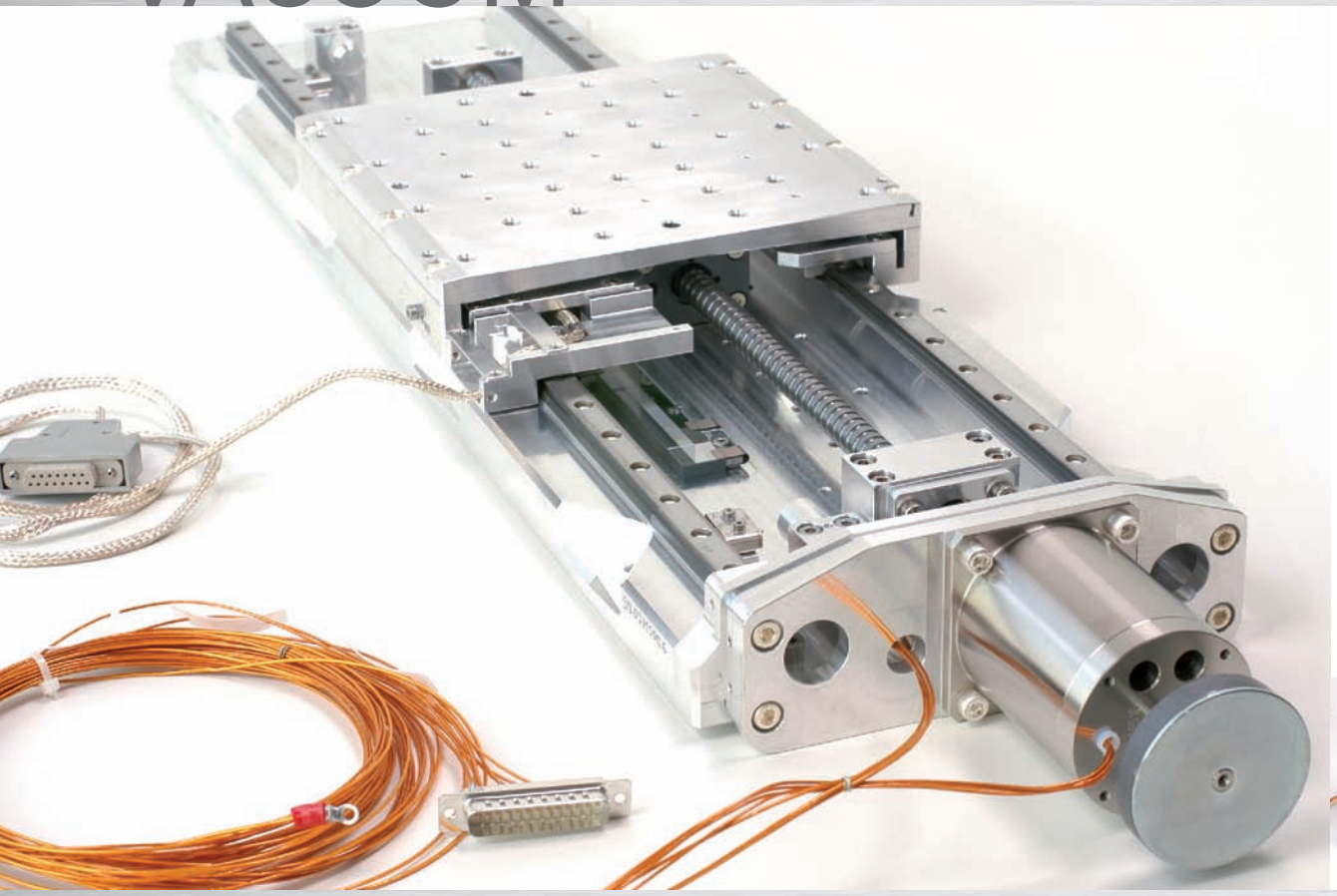
VT-80 for 10^{-7} mbar with double-slide
(in the opposite direction)



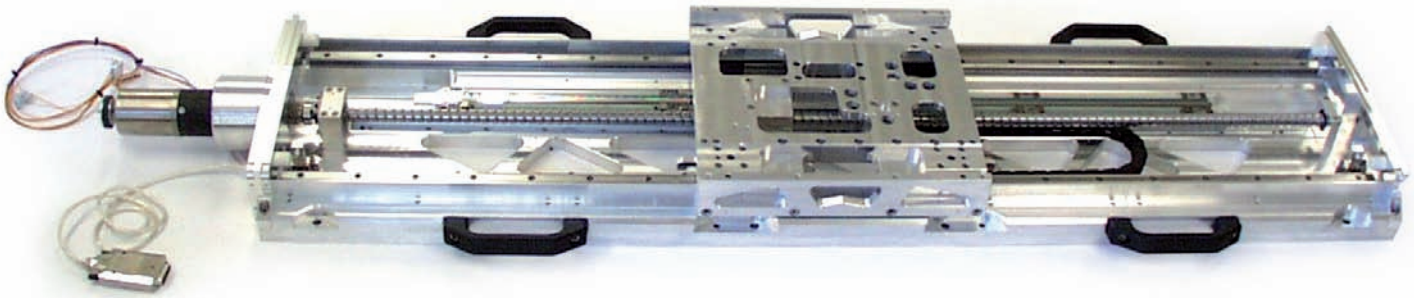


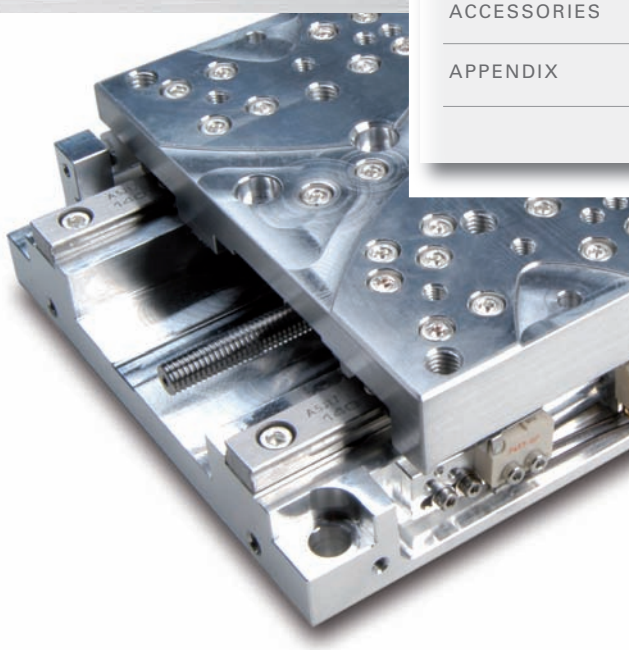
Linear stage **PLS-85** using a brushless DC motor for inertgas application.
We only use vacuum compatible connectors and cables.

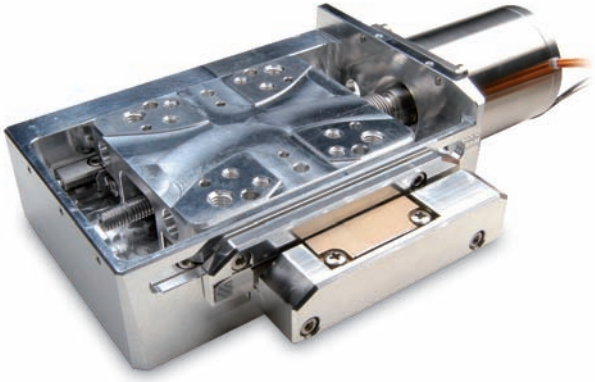
VACUUM

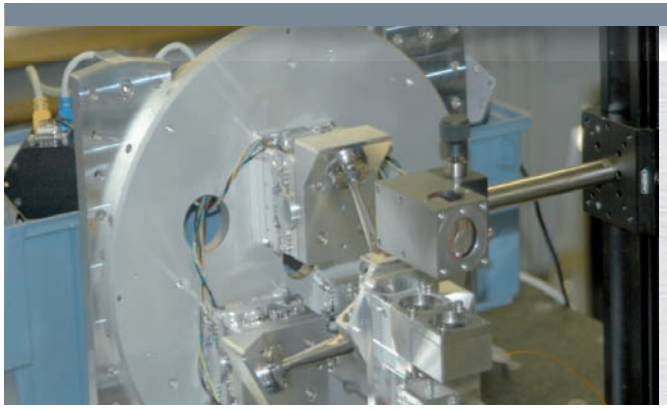


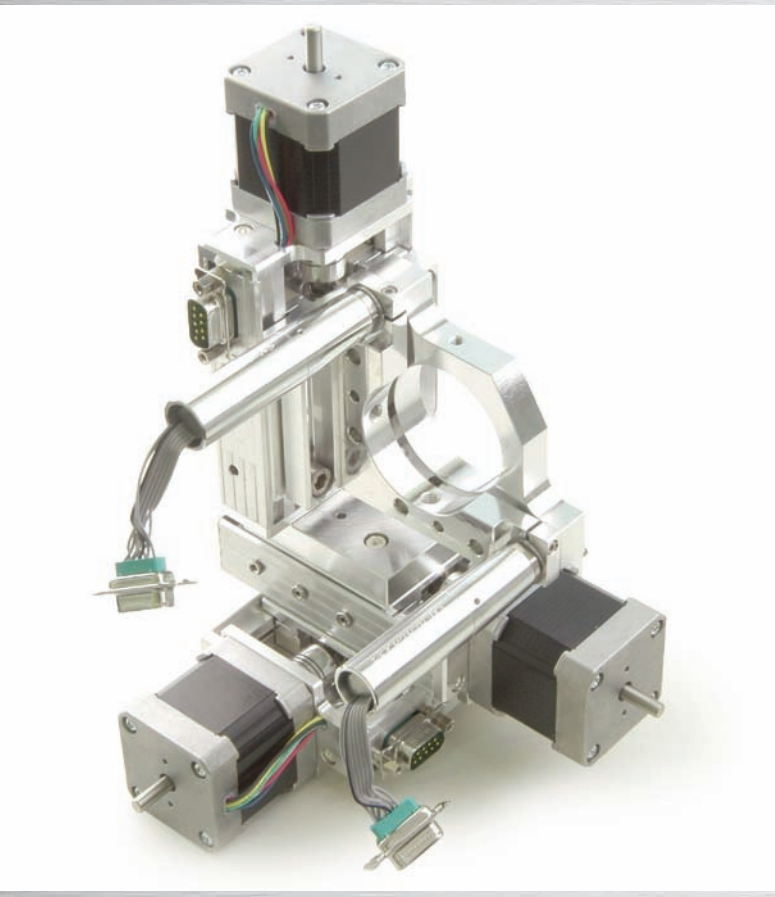
Linear stage **LS-180** equipped with a Heidenhain linear scale for vacuum in 10^{-10} mbar. The guides and ball screw are made from stainless steel, with dry lubricant applied.





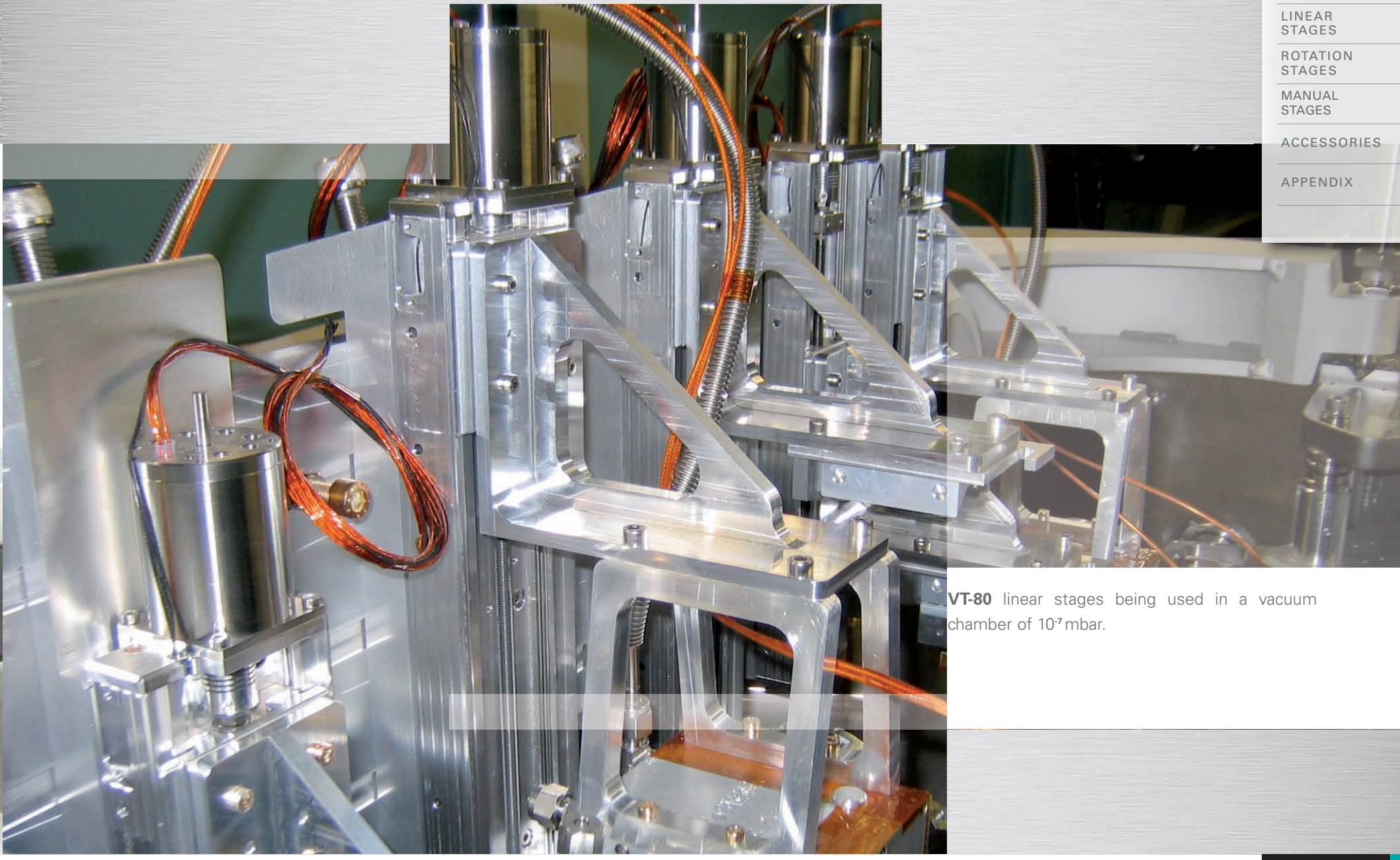






VACUUM

5-axis system using 3 **VT-80** linear stages and a motorized **AMA-45** mirror mount for use in 10^{-3} mbar vacuum.



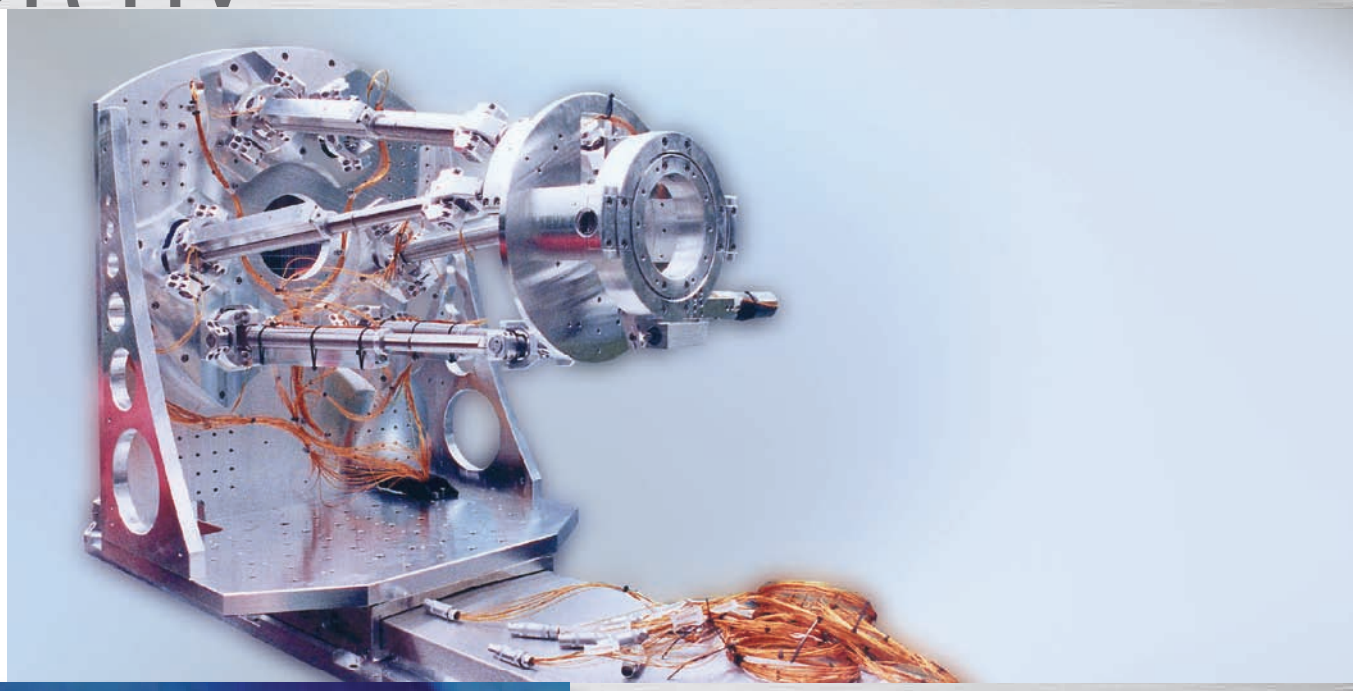
VT-80 linear stages being used in a vacuum chamber of 10^{-7} mbar.

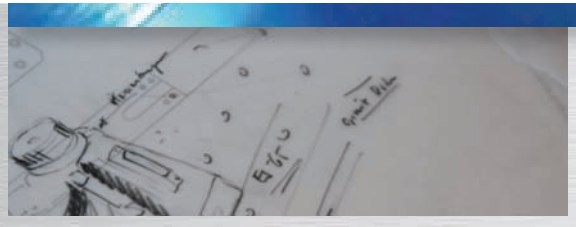
HEXAPOD FOR HV

Hexapod for Vacuum

This system consists of a **HEXAPOD**, a linear stage, and an additional tilting platform. This special arrangement was chosen to achieve a maximum of travel range within the limited space of the high vacuum chamber. The application is an angle-dependant characterization of super-conducting high frequency detectors (far infrared, FIR) for astronomy.

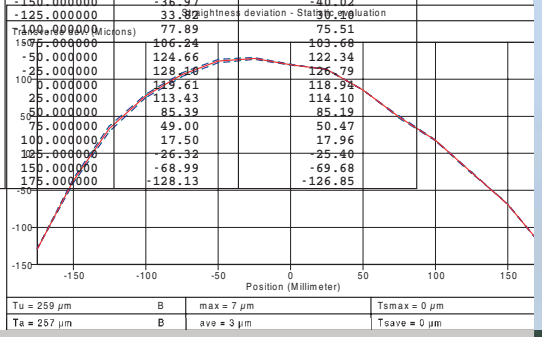
The travel range in x and y is +/- 180 mm with an angular range of +/- 20° at any position.

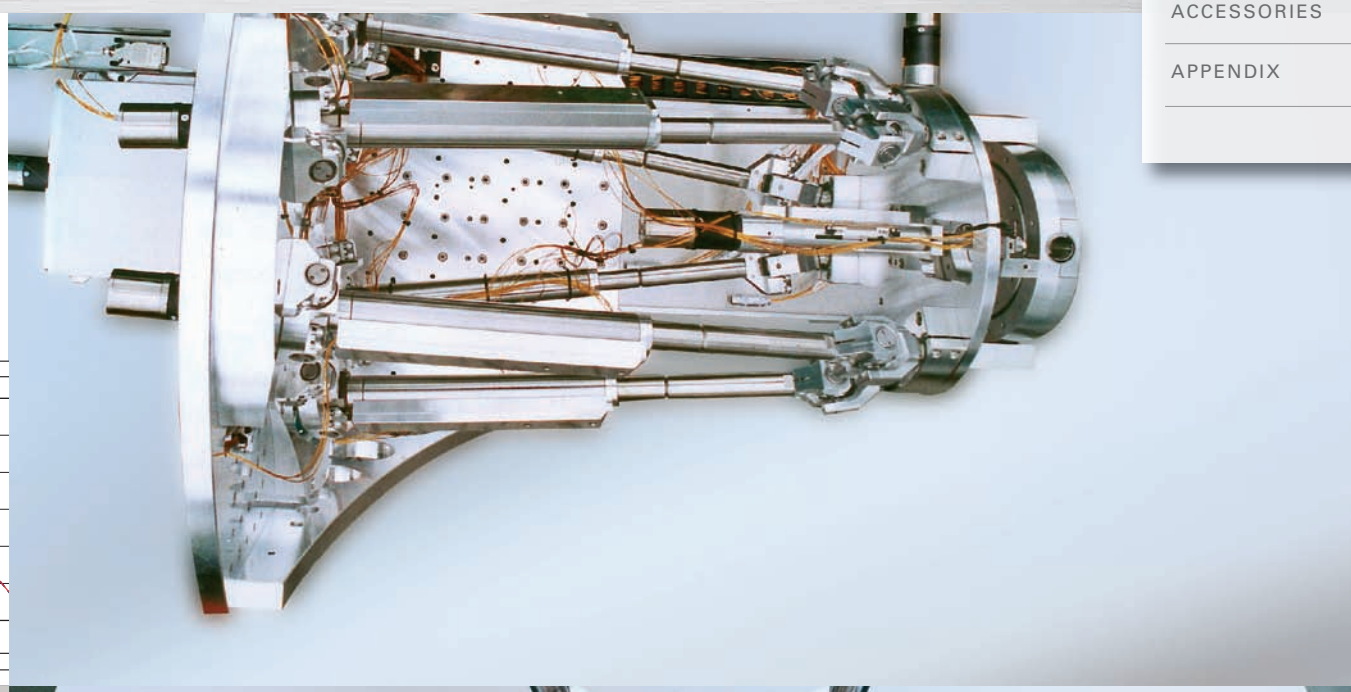


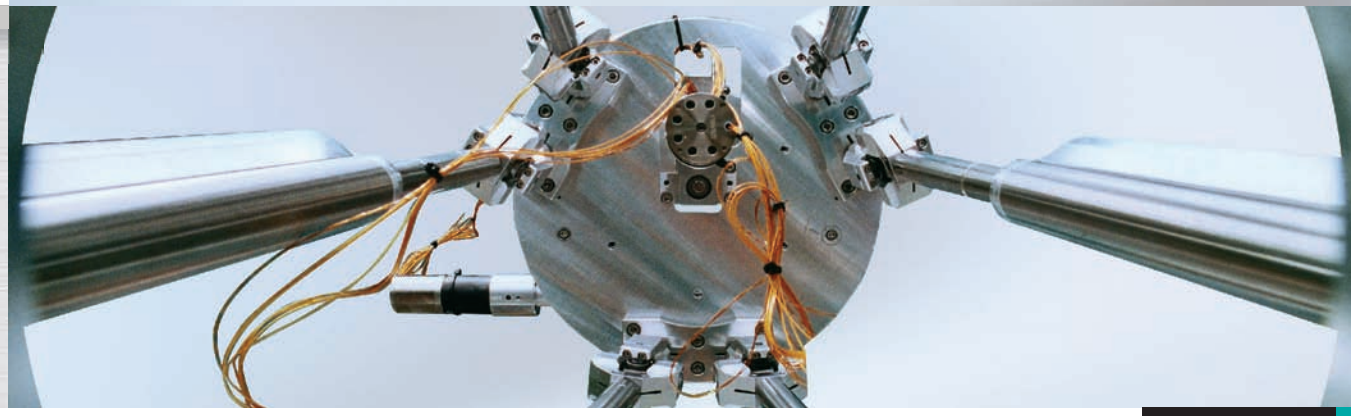


The absolute positioning errors of the **HEXAPOD** have been measured (see figure), and special compensation software is able to reduce these errors by a factor of 20.

Position Nr.	Position (Millimeter)	Mean deviation (Microns)	Mean deviation (pos.) (Microns)
1	-175.000000	-128.91	-129.40
2	-150.000000	-36.97	-40.02
3	-125.000000	33.87	30.40
4	-100.000000	77.89	75.51
5	-75.000000	106.24	103.68
6	-50.000000	124.66	122.34
7	-25.000000	128.10	126.79
8	0.000000	119.61	118.91
9	25.000000	113.43	114.10
10	50.000000	85.39	85.19
11	75.000000	49.00	50.47
12	100.000000	17.50	17.96
13	125.000000	-26.32	-25.40
14	150.000000	-68.99	-69.68
15	175.000000	-128.13	-126.85



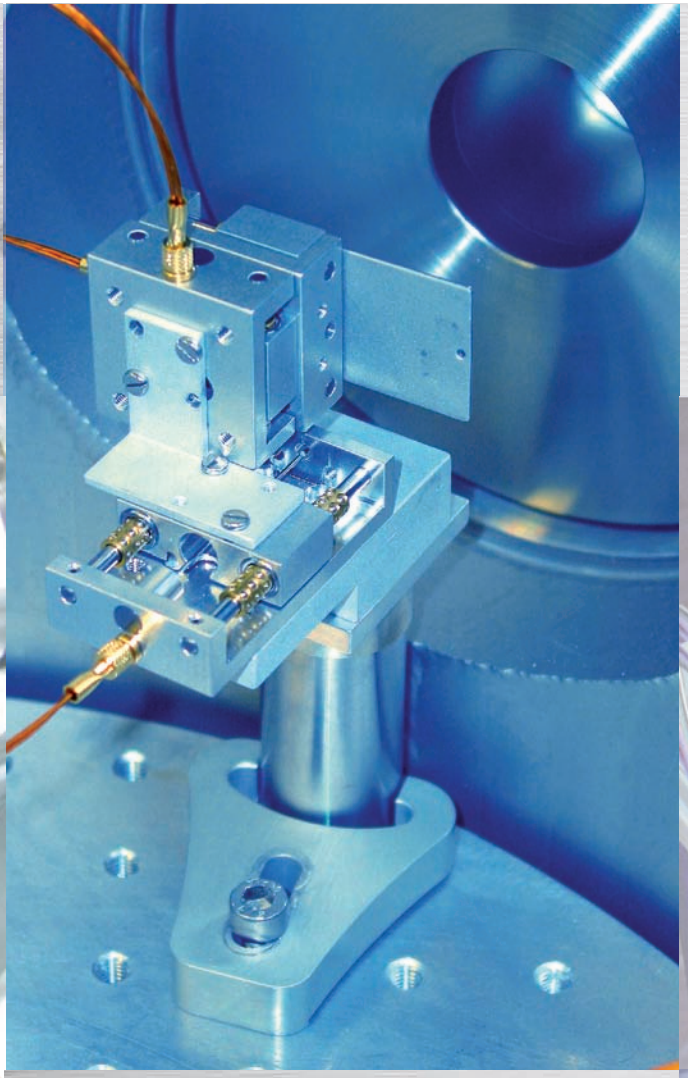




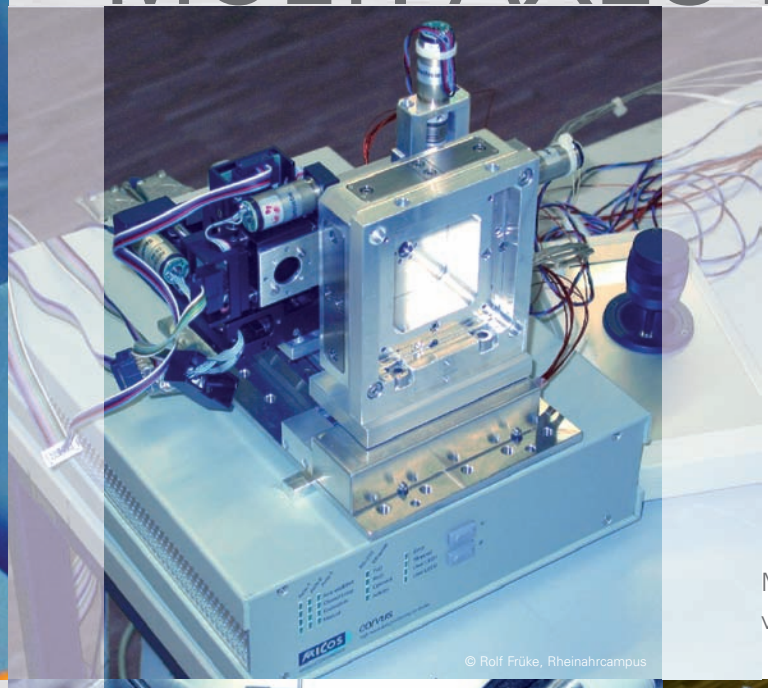
This **HEXAPOD** was developed for inspection of mirrors used in vacuum of 10^{-9} mbar. This **HEXAPOD** was equipped with linear encoders which enabled the user to achieve ultra-precise positioning.

HEXAPOD FOR UHV

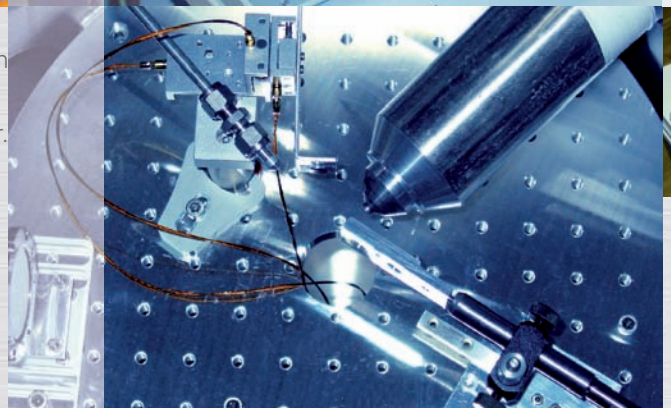
MULTI-AXES FOR FV

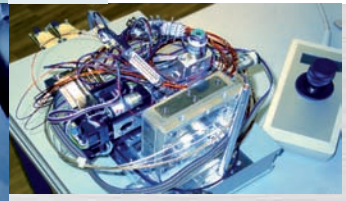


In this picture, a **XYZ-PP30** unit is shown which carries an adapter plate for an optical system. The application has a vacuum level of of 10^{-9} mbar.



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

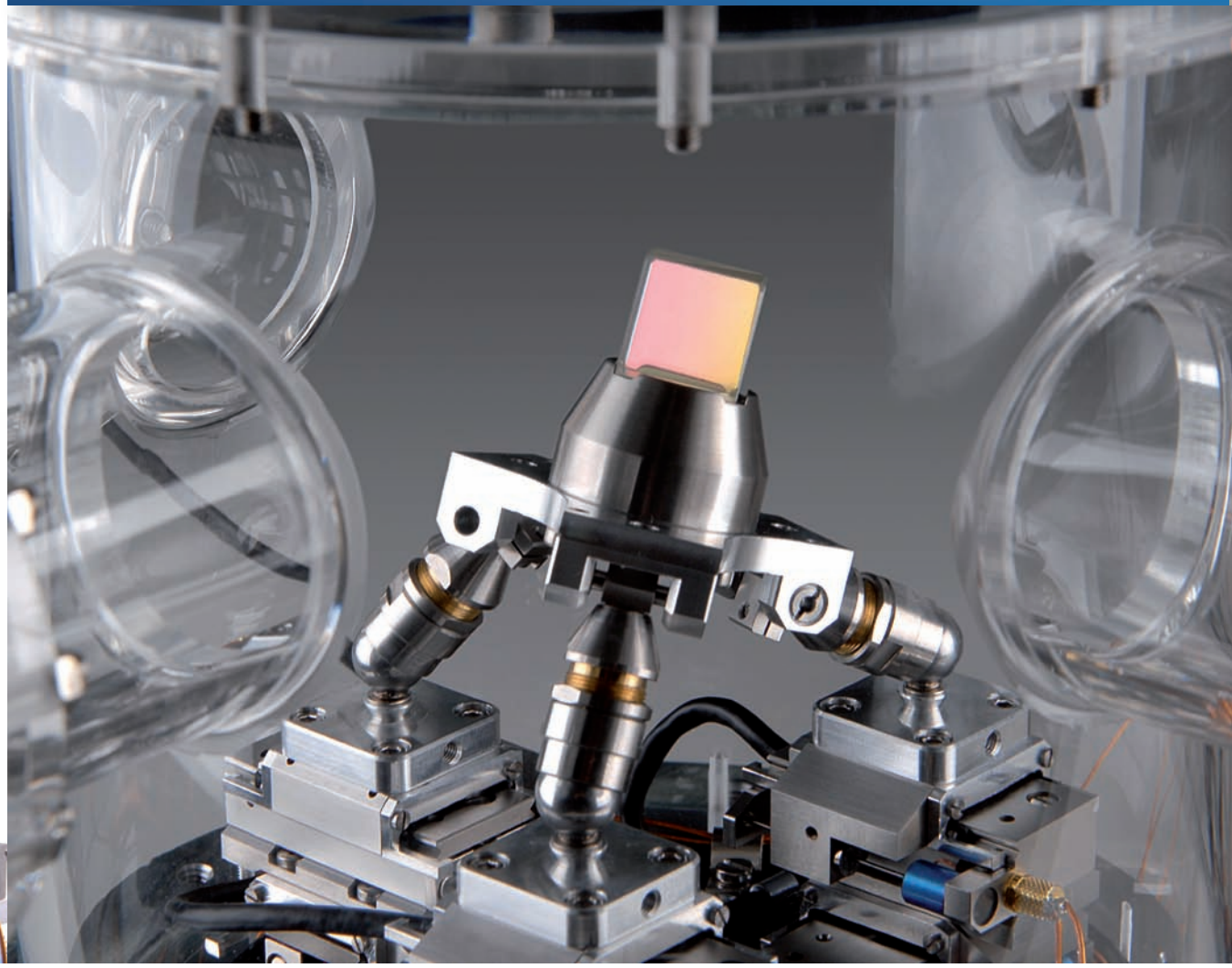


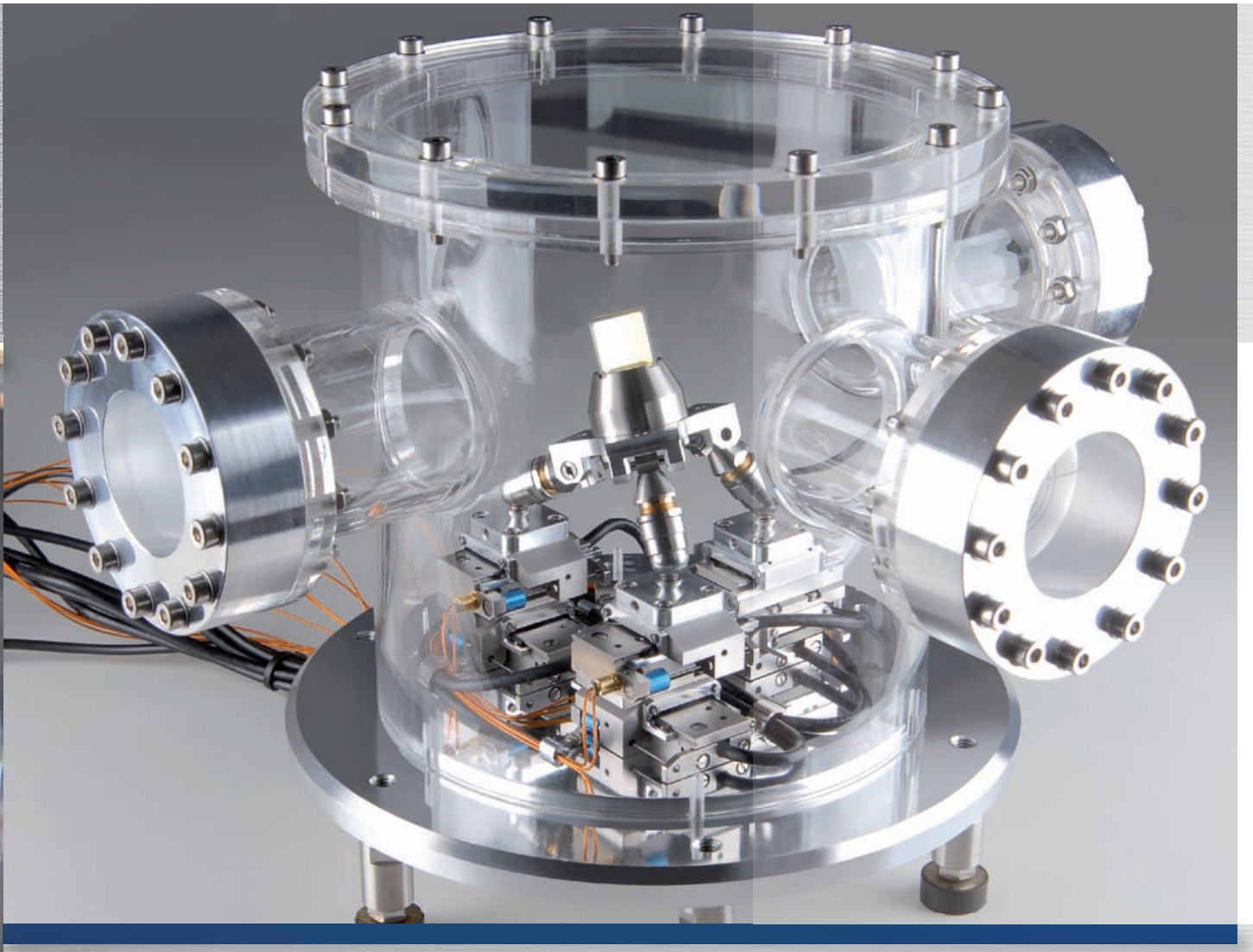


SpaceFAB SF-3000 PS (PIEZO)

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.





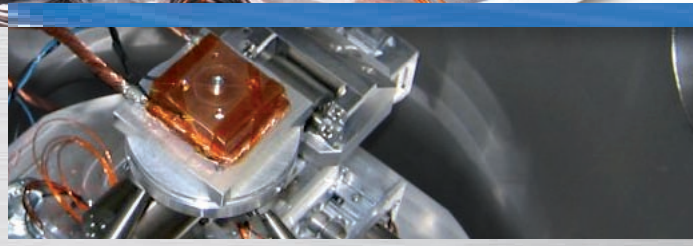
Maximum travel ranges in XY are 12.7 mm with a vertical displacement of only 2 mm; central load of up to 0,5 kg is possible. The pivot point, i.e. the center of the probe, can be set by the customer which is very important for several applications.

The system is based on the **mikos** 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.

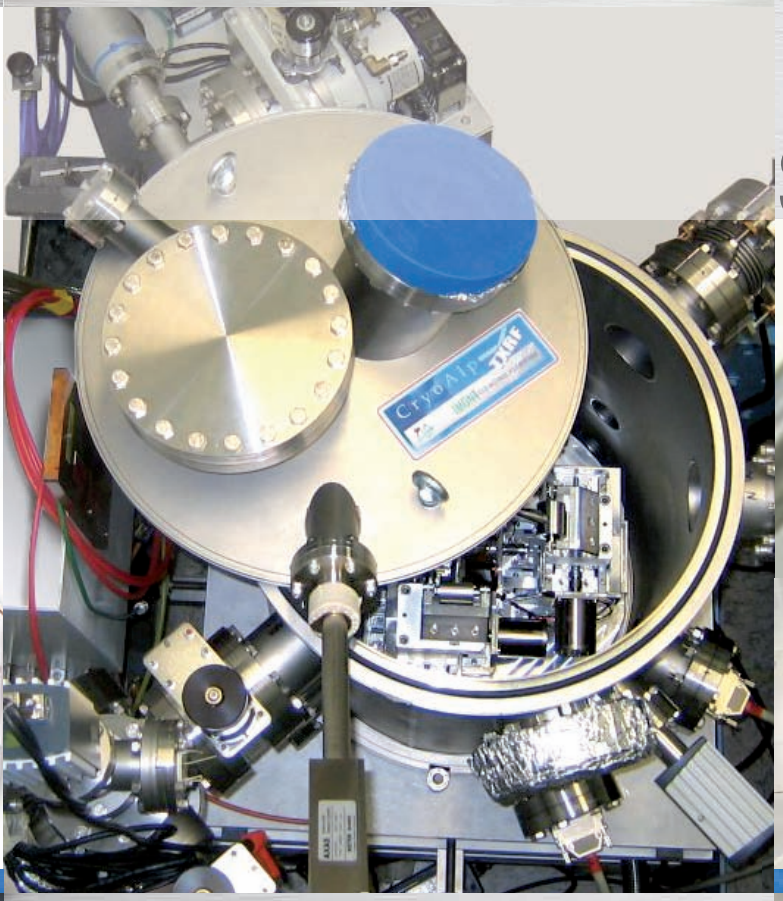
SpaceFAB HV

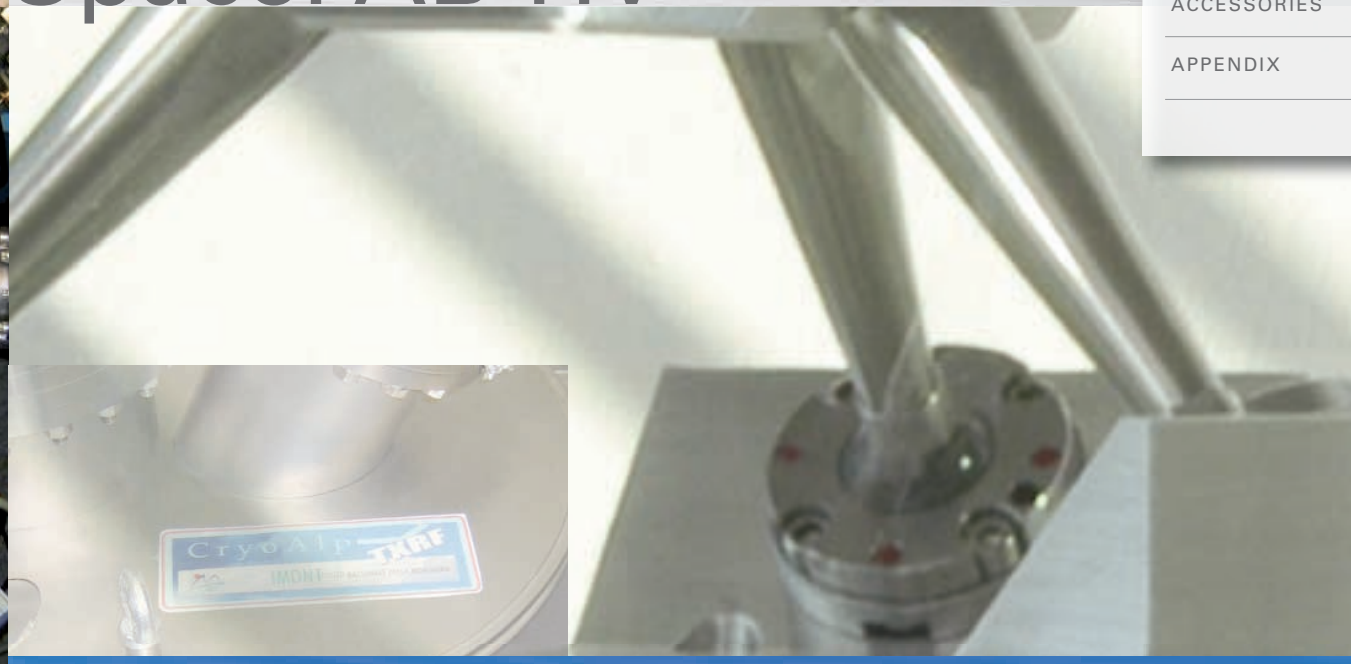
Customized **SpaceFAB** for vacuum 10-7 mbar and temperature range of -40°C to +80°C.
6 degrees of freedom.

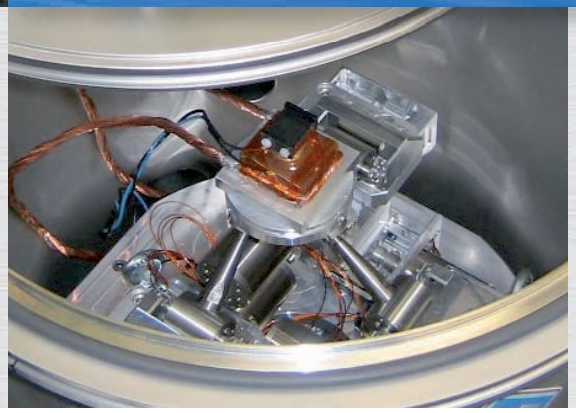
With the **SpaceFAB SF-3000 BS** (vacuum) all six degrees of freedom can be moved without additional positioning elements. The low weight of the moving platform allows highly dynamic positioning. Using no pre-load, the design can easily carry up to 5 kg (center mounted).
The pivot point can be set by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



SpaceFAB HV





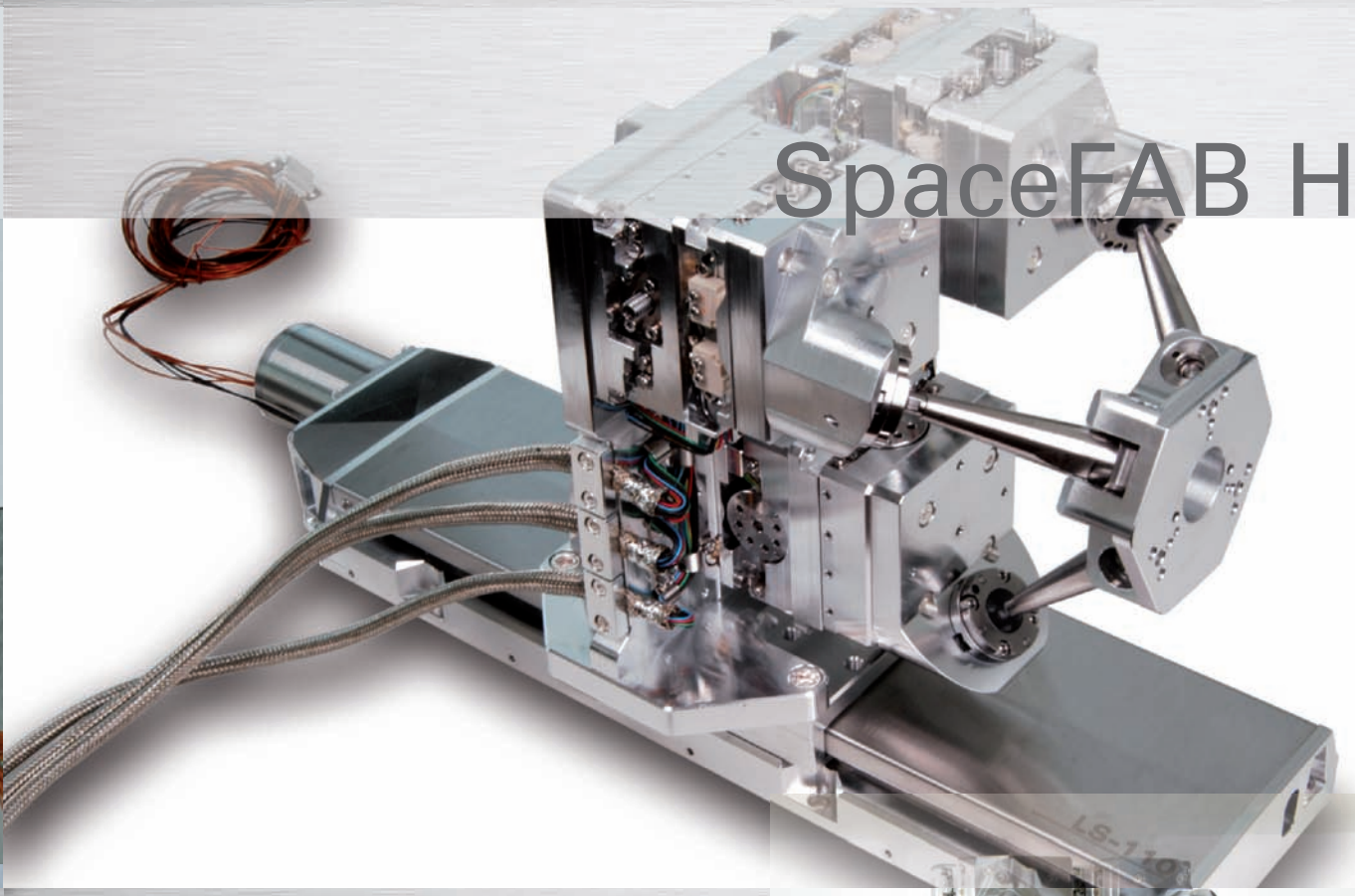


HIGH RESOLUTION X-RAY SPECTROMETER

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

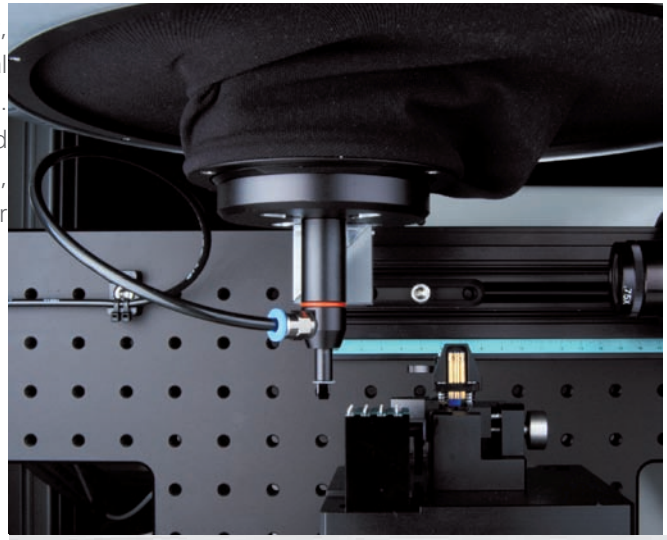
SpaceFAB HV FOR SYNCHROTRON



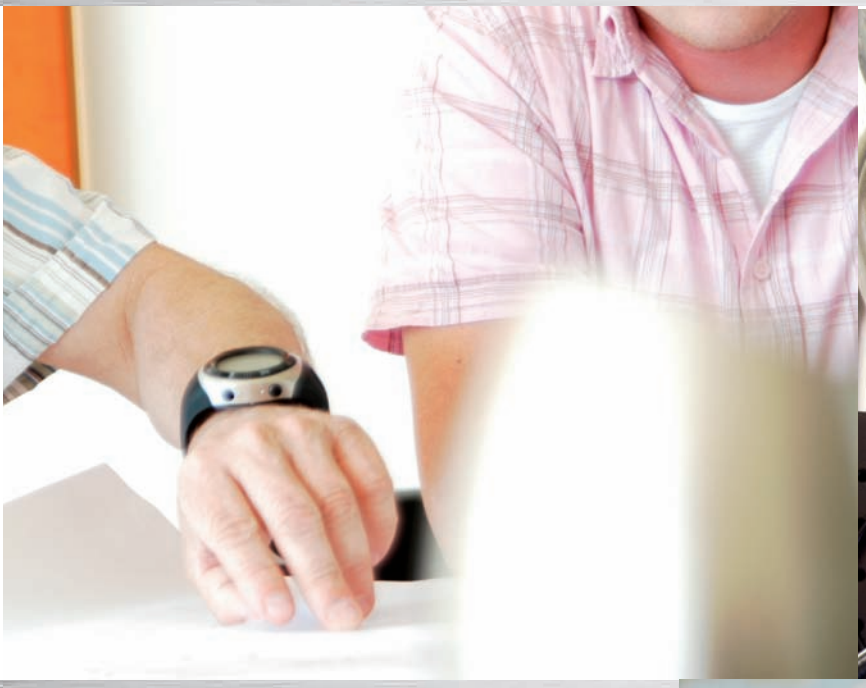
This 7 axes positioning system consists of a **LS-110** and a custom designed **SpaceFAB** which is used for dynamic measurements. To achieve the required precision, high stiffness and repeatability was required.
The pivot point can be set by software - in this case important for adjusting an X-Ray single-reflection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

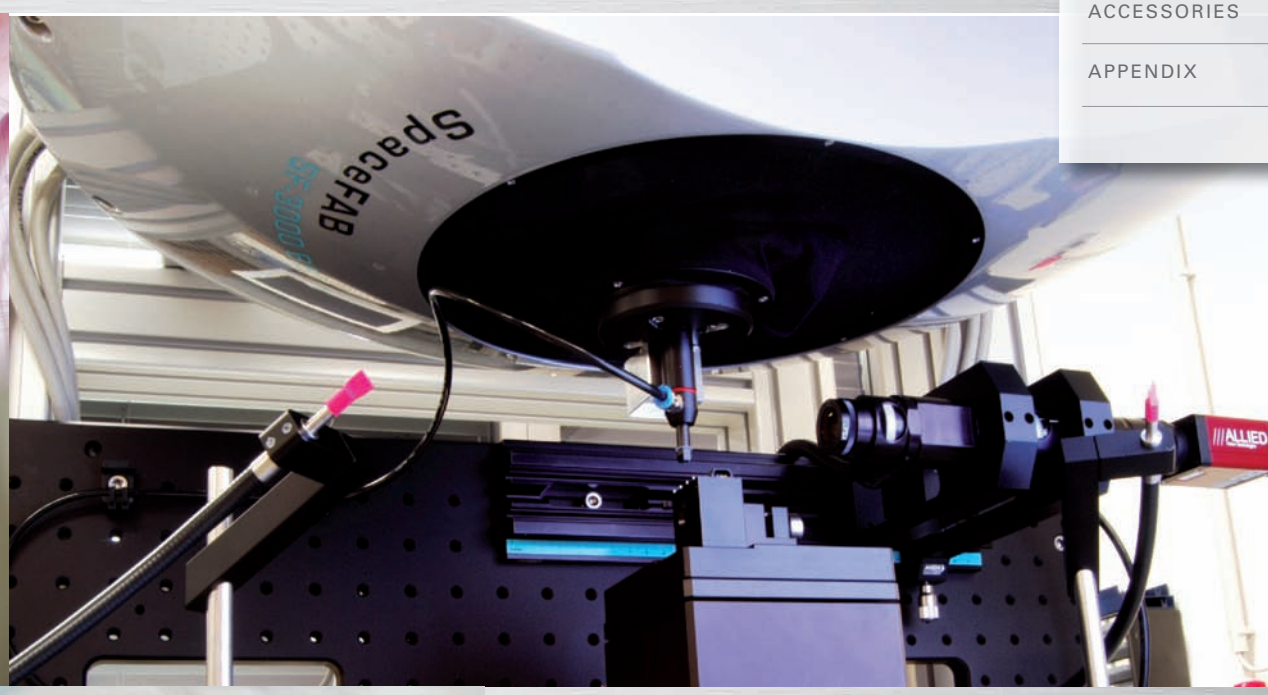
ENGINEERED SYSTEMS

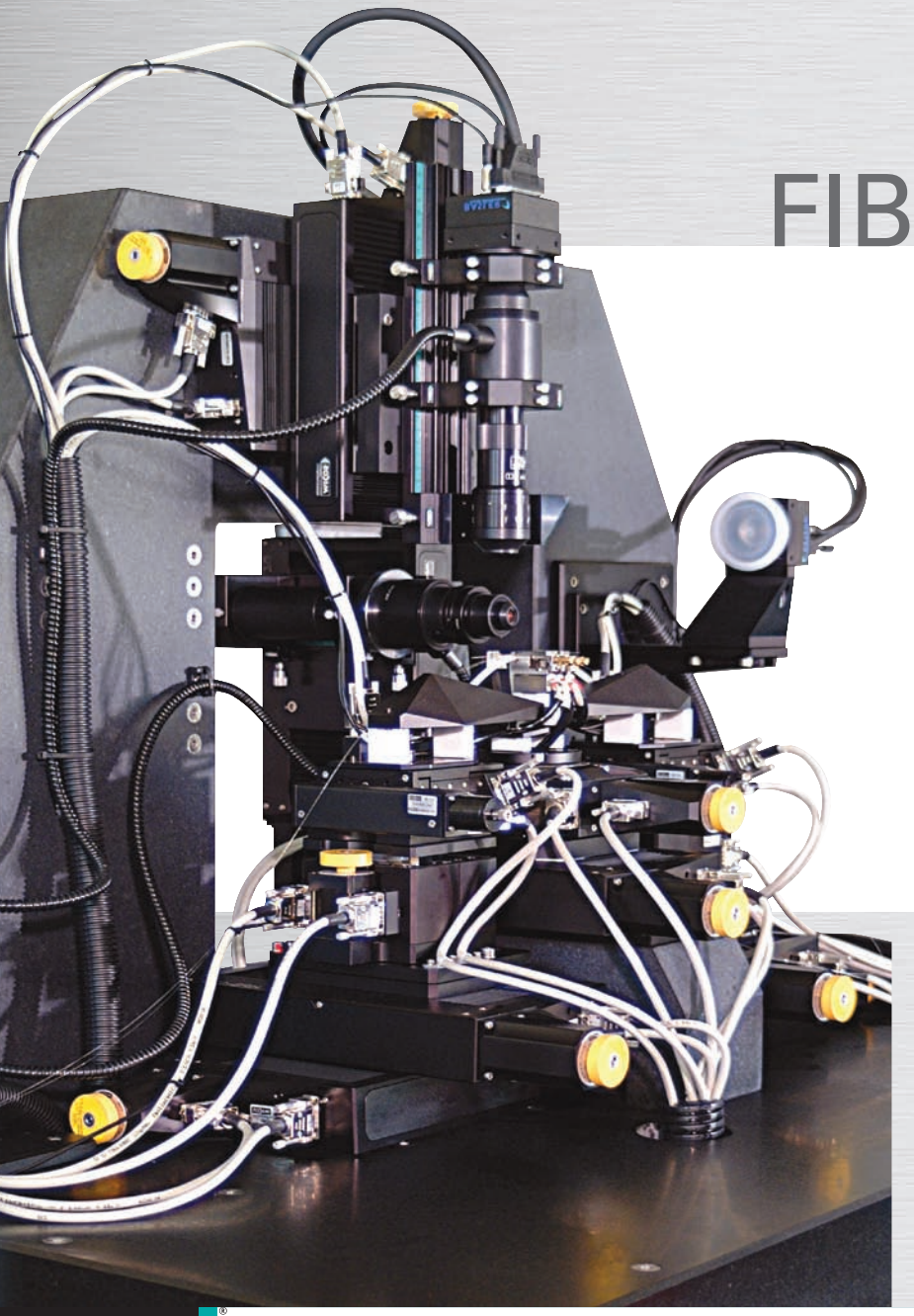
Our engineering strength is rooted in a clear understanding of the complex interactions of technical systems. micos design engineers first methodically analyze the customer requirement, then create the model and simulate the potential solutions before choosing the best product design. A multi-disciplinary approach using our broad knowledge base in precision mechanics, optics, electronics and software is the foundation of our creativity.



With the help of this multi-disciplinary expertise combined with a deep understanding of the market needs, we are able to deliver excellent customer value.





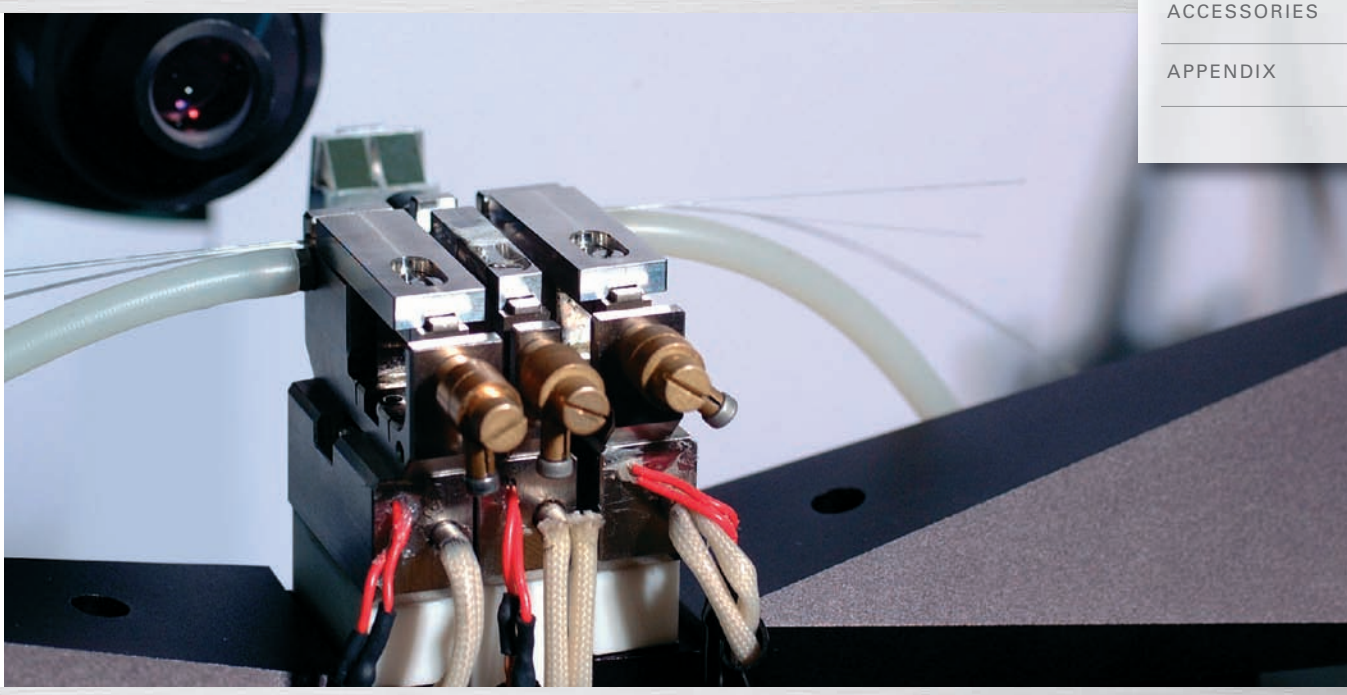


The fiber alignment system shown in the picture is an example of our customized systems. It was designed to connect two fiber arrays to a central waveguide component.

FIBER ALIGNMENT

Alignment of the components is realized in several steps. The coarse alignment is done using image processing. Two high resolution digital cameras are used to measure the important features of the components, and based on that information, a coarse position is calculated. After this coarse positioning is complete, light passes from the laser source through the waveguide to the detectors. In a second step, the fine alignment, spiral scans are used to find the absolute maximum of the light for active alignment. Additionally, a tracking mode is included to hold the optimum position even during the connecting process with thermally curing glue.

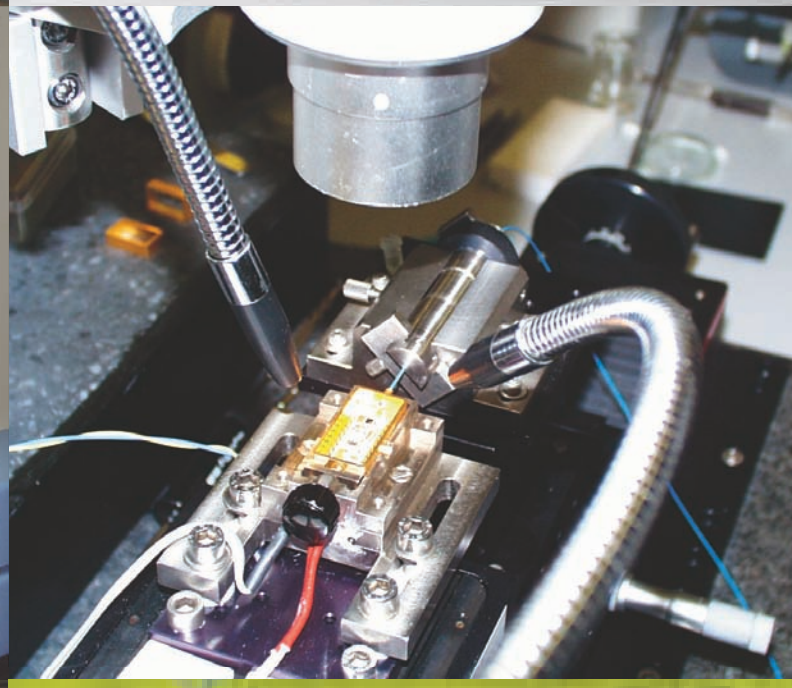
The complete system is mounted on a granite table. It consists of 14 high resolution precision stages, 9 linear stages, 2 lifting stages, 2 goniometers and 1 rotation stage.
Each fiber block uses two linear stages (x, z), one lifting stage (y) and one gonimeter (Rz). The waveguide block consists of one linear stage (x) and one rotation stage (Ry). The last four linear stages move the two high resolution digital cameras.



A third digital camera with a lower magnification (overview camera) is mounted in a fixed position. The three holders for the components are temperature controlled and thermally isolated from the positioning stages. The holders use a vacuum as well as a mechanical clamp to hold the components.

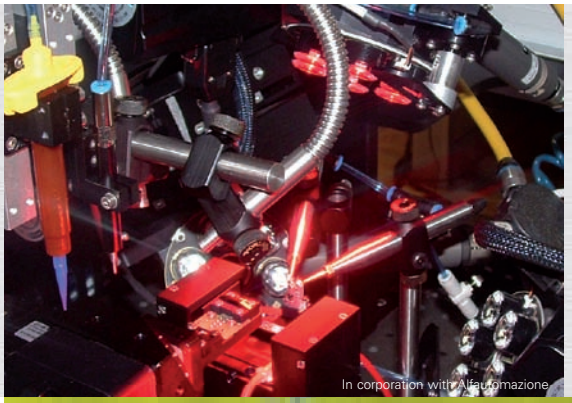
The motor drives for the stages, the temperature controllers, the laser source, the optical power meter and the PC are all integrated in a compact 19" rack. The complete system is controlled by a PXI-computer from National Instruments, the software is written in **LabVIEW™**.

FIBER ALIGNMENT



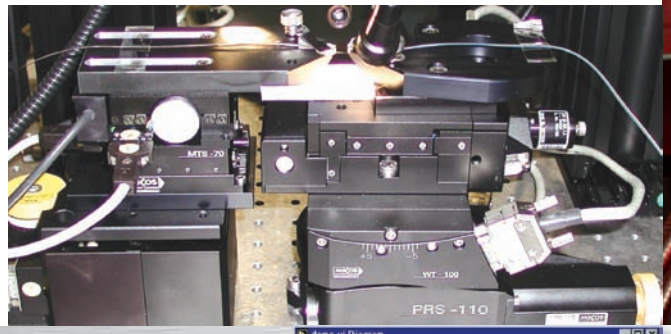
Turnkey Fiber Alignment System

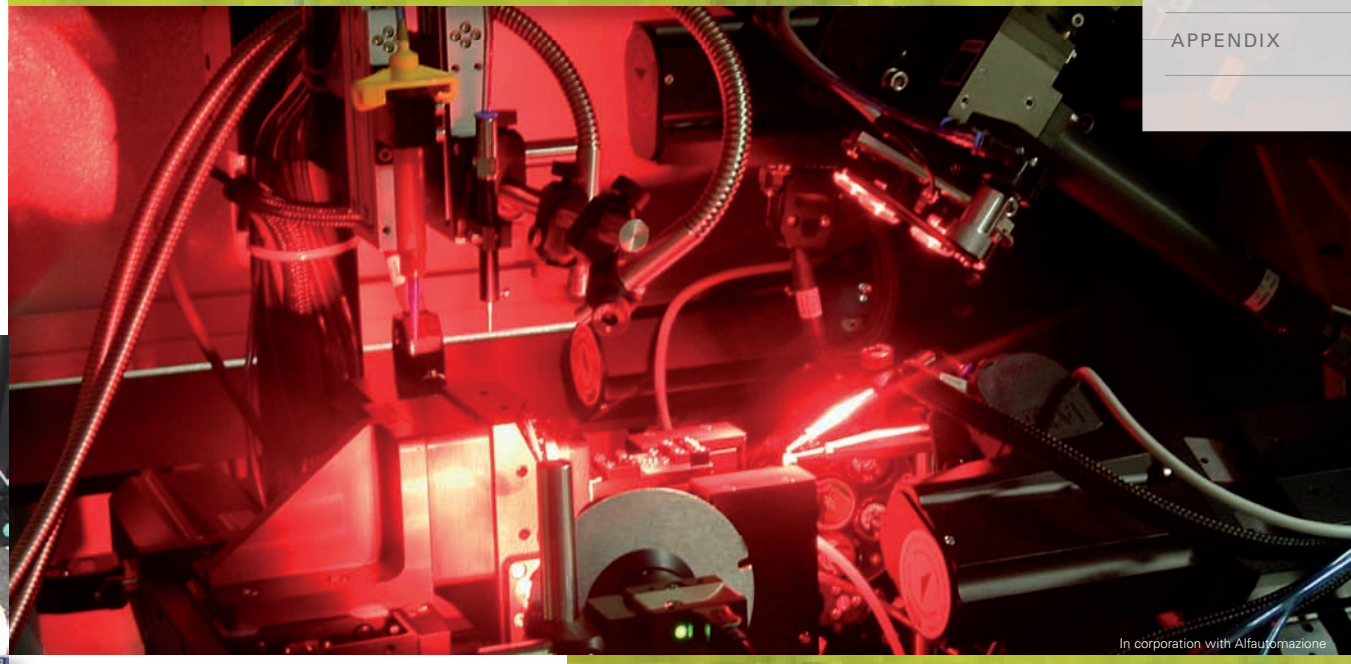
This system consists of mostly standard components. An optimized solution for unique demands was realized within a short period. The workstation operates with **LabVIEW™** and a **FlexMotion Controller** with special micos motor drivers. In this, as in many other cases, we were able to supply a turn-key system, and after a short training period, the customer was able to use the system.

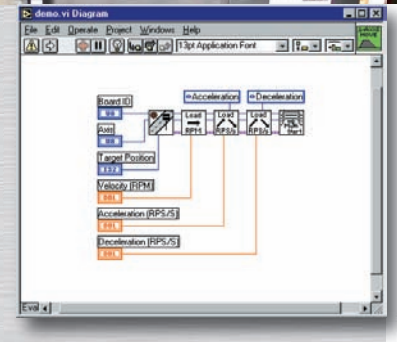

In corporation with Alfautomazione

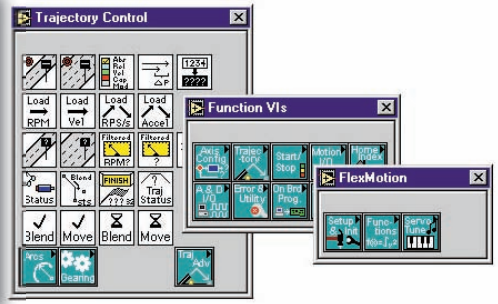
Auto Align

This fiber alignment system is a fully enclosed system used to connect glass fibers to optical parts. The positioning system consists of mostly standard components. The positioning stages are controlled by a PXI-system from National Instruments. The software bases on **LabVIEW™**.



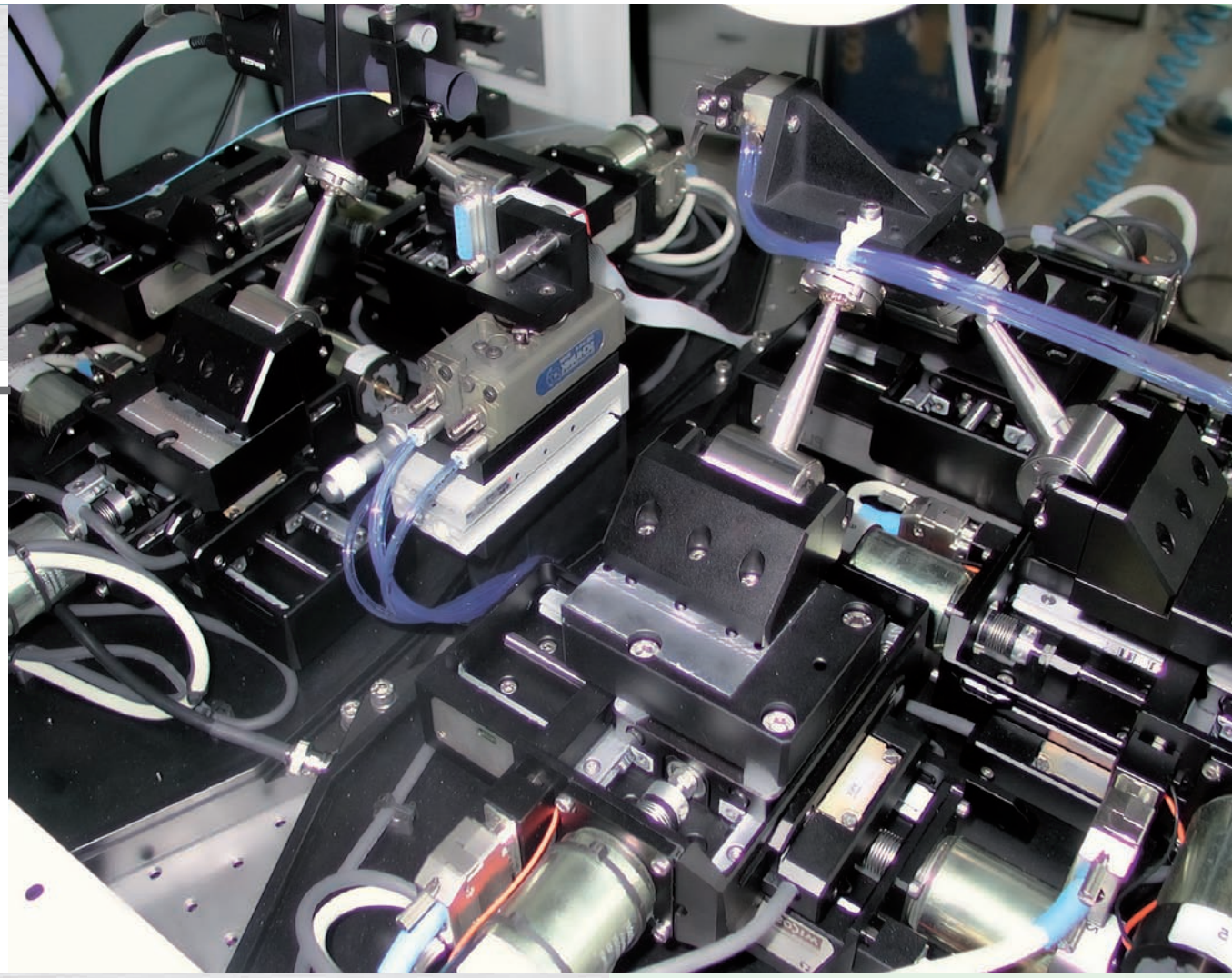

In corporation with Alfautomazione



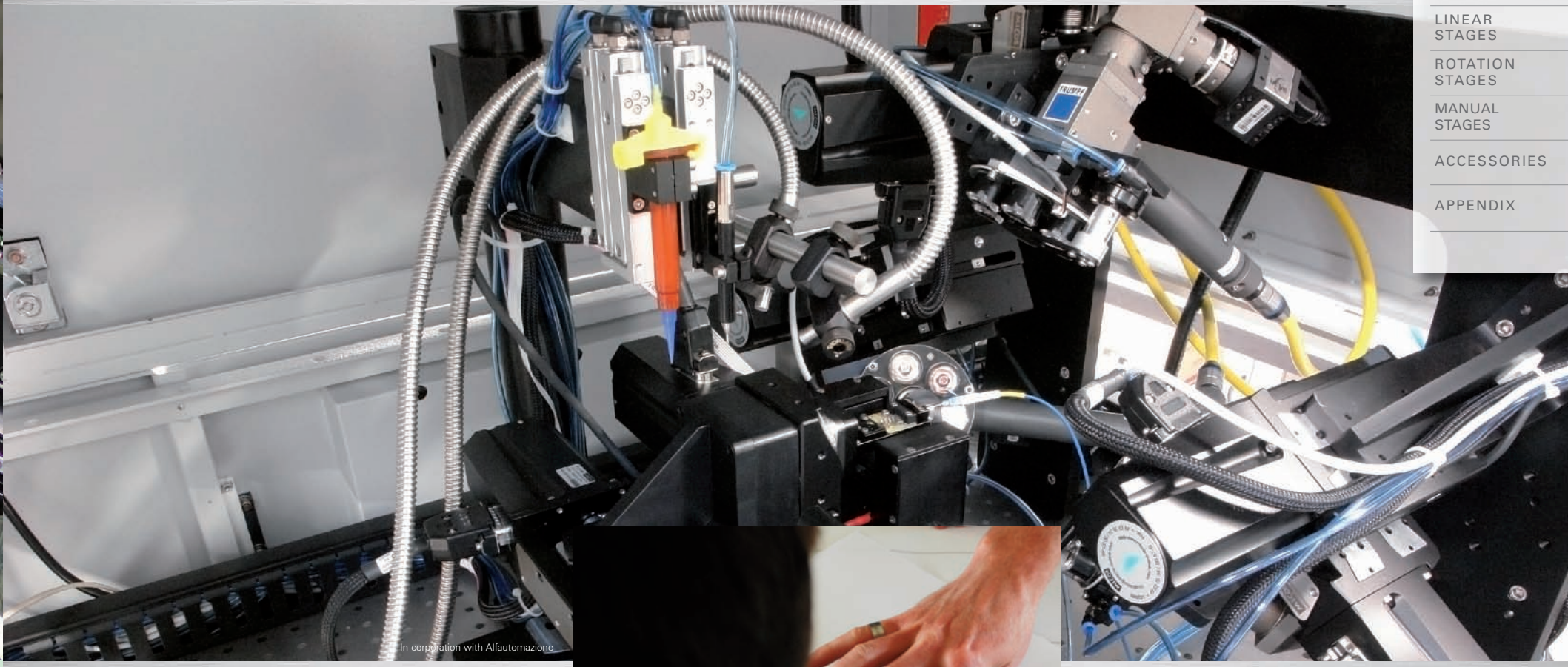


FIBER ALIGNMENT

Manufacturing system for optical amplifiers using two **SpaceFABs.**



In corporation with Alfautomazione



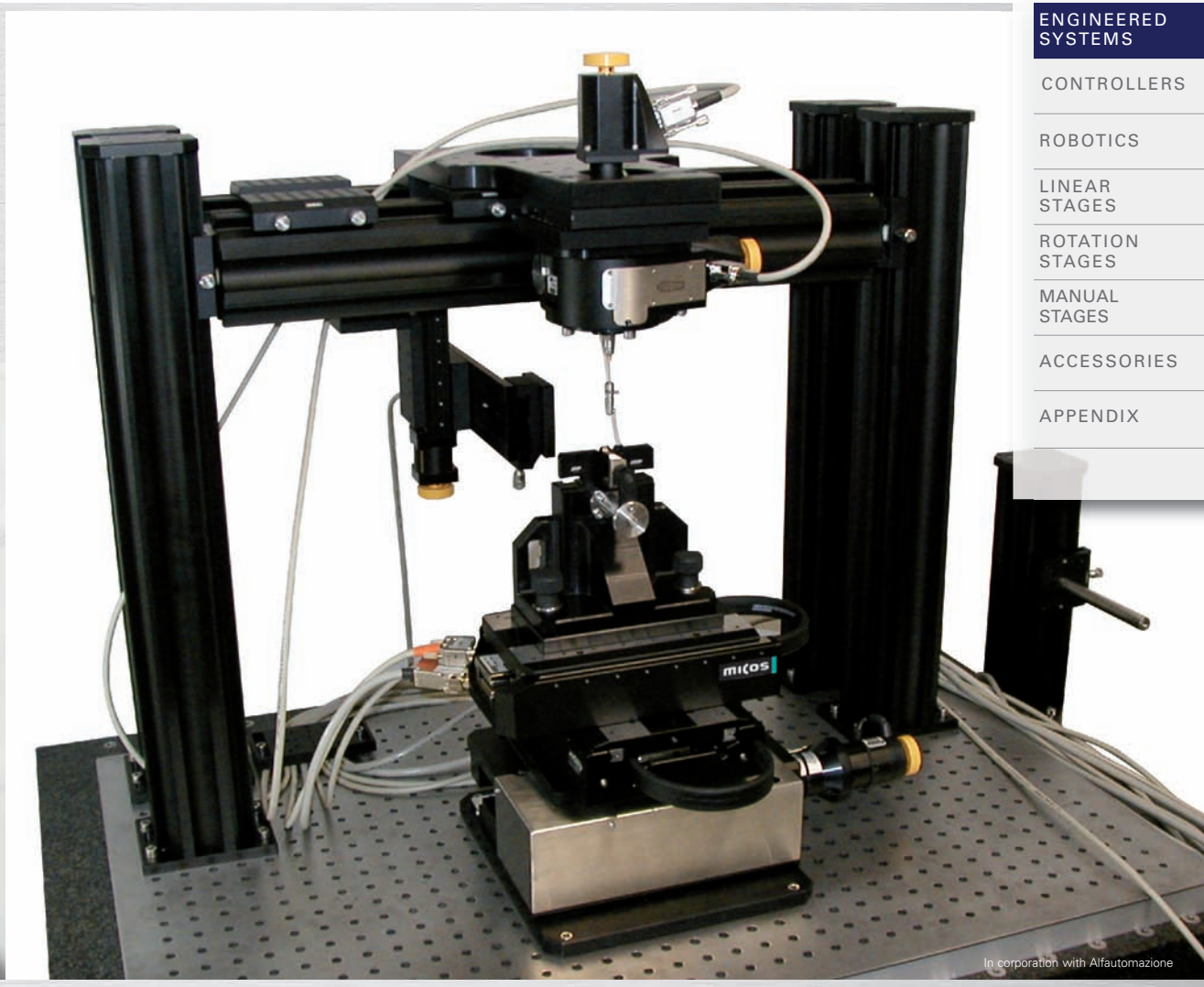
In corporation with Alfautomazione

This system uses 17 axes of motion to manufacture optical amplifiers. It includes a complete software solution using **LabVIEW™** per customer specification.

FIBER WELDING

In this system, we achieve high throughput and reliable production of various devices with a flexible approach to the motion system and measurement instruments.

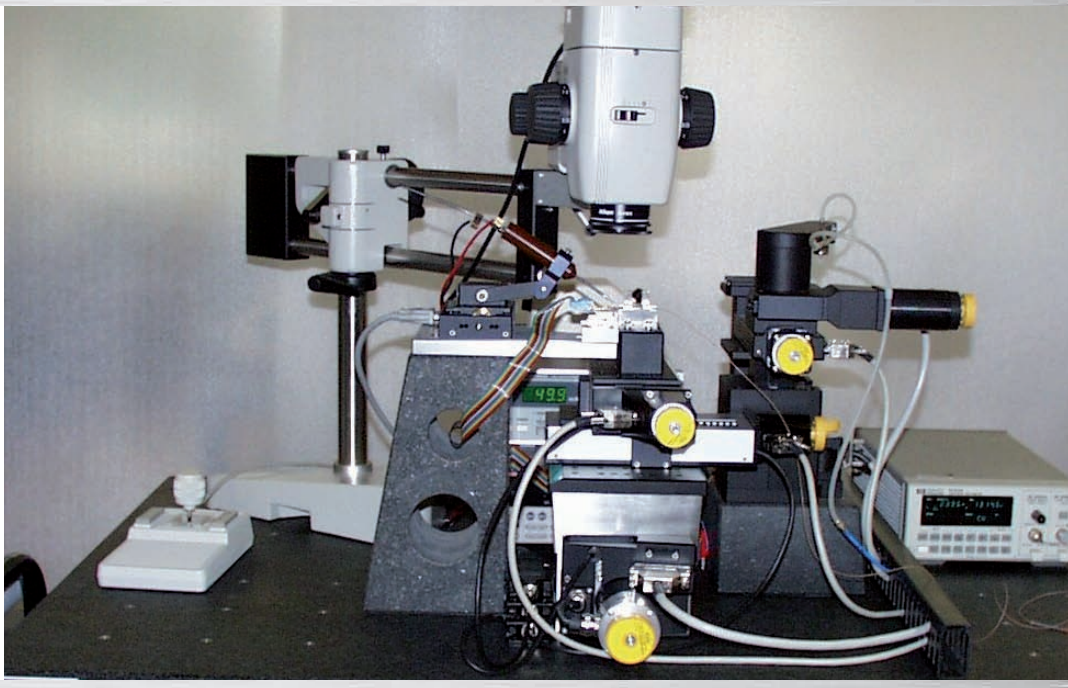
Active alignment and the subsequent welding process are made possible with the appropriate sensors which serve as feedback to optimize the position.

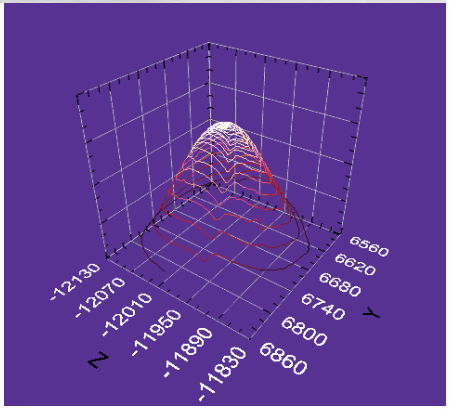


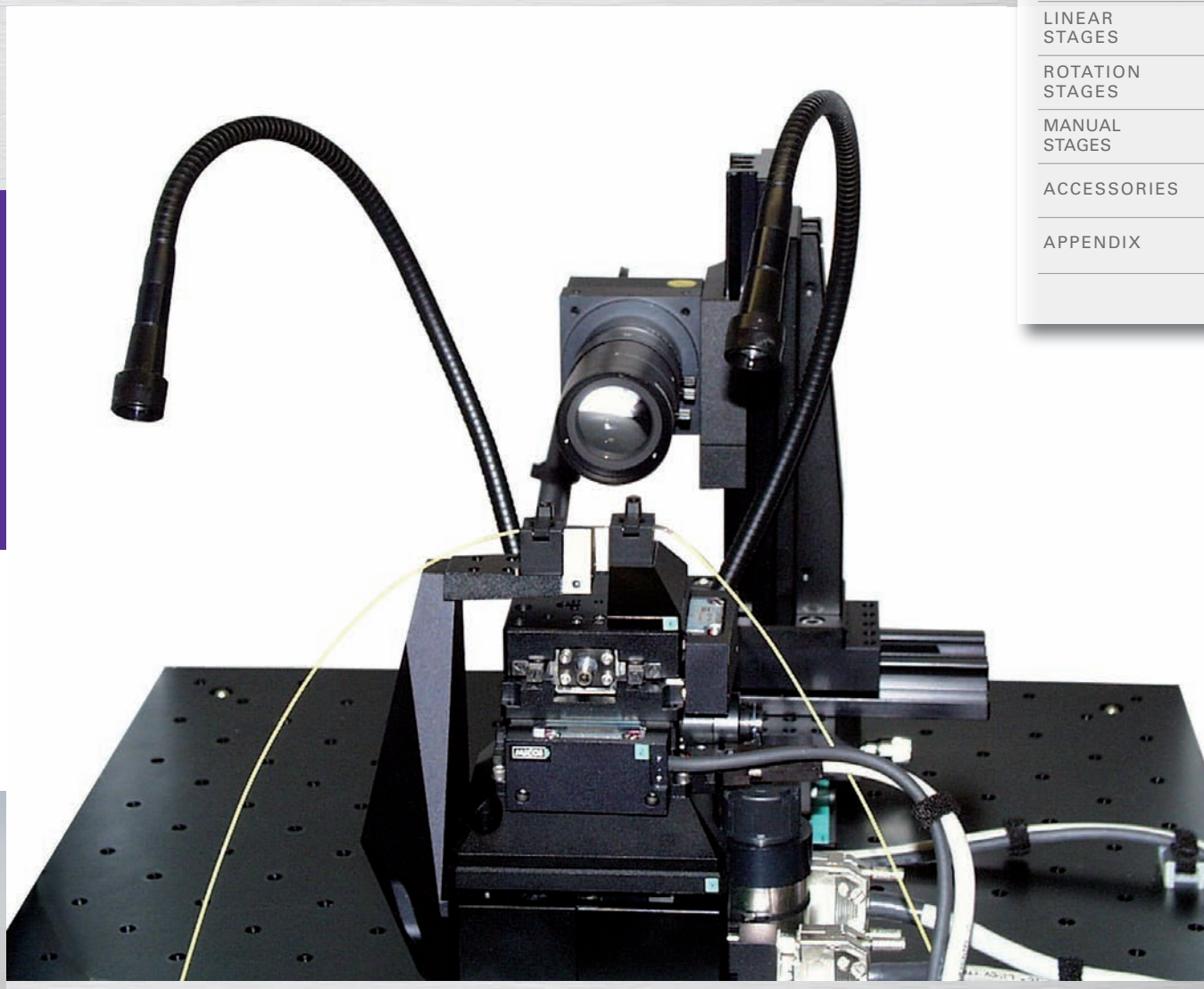
In corporation with Alfautomazione

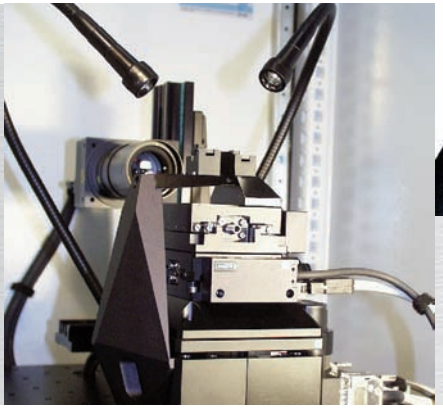
FIBER ALIGNMENT

6 axes fiber alignment system controlled with a PXI controller and **LabVIEW™**.









PICK AND PLACE

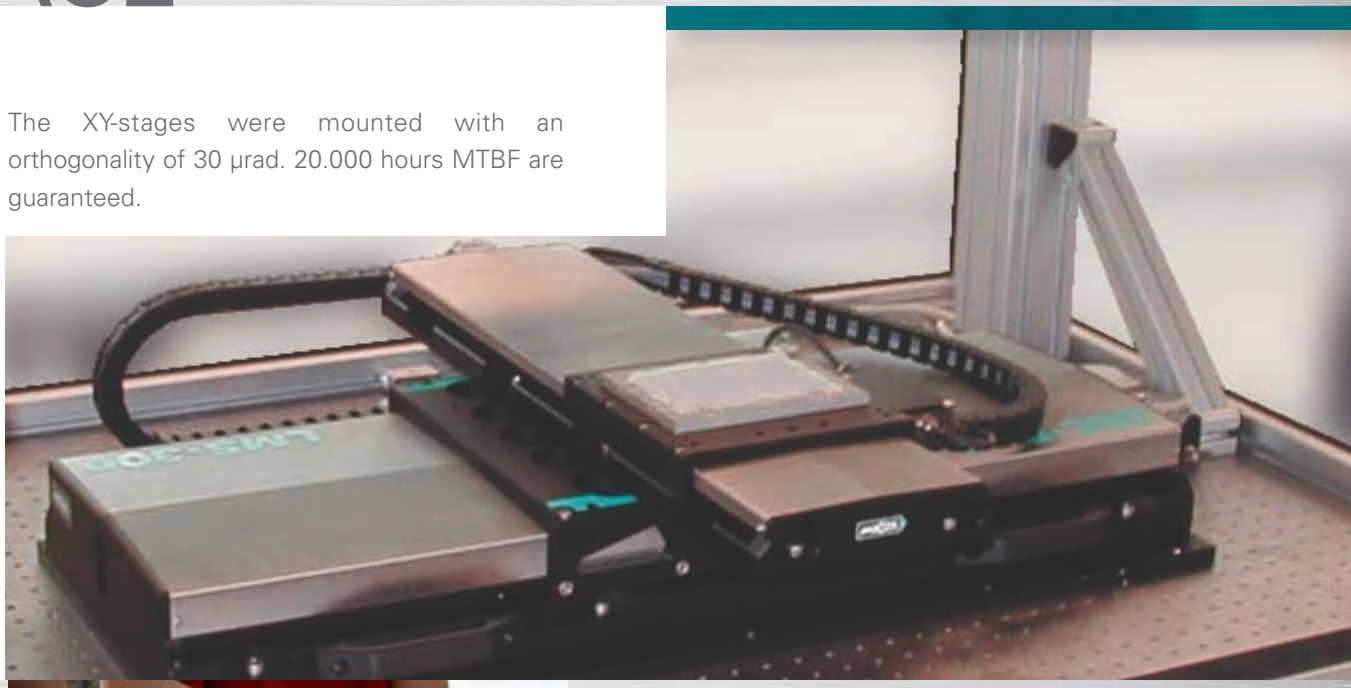
Highly Dynamic Positioning System with Linear Motors

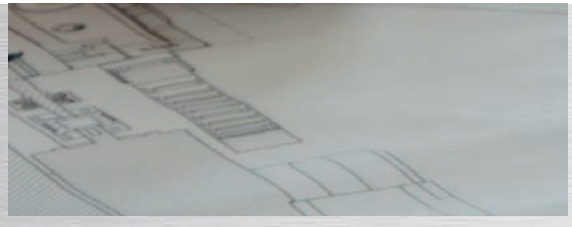
This positioning system consists of standard components **LMS-300** and **LMS-180**.

Both linear stages are equipped with linear motors achieving speeds up to 400 mm/s and an acceleration of 0.8 g with minimal response time. All linear stages are equipped with high quality Heidenhain encoders which guarantee a resolution of less than 0.1 µm.

The system has remarkably smooth movement and high repeatability. A PXI based controller and LabVIEW™ from National Instruments are used for control. The motor drivers based on the **SMC Taurus**, **Pegasus** series were specifically developed for these direct drives.

The XY-stages were mounted with an orthogonality of 30 µrad. 20.000 hours MTBF are guaranteed.





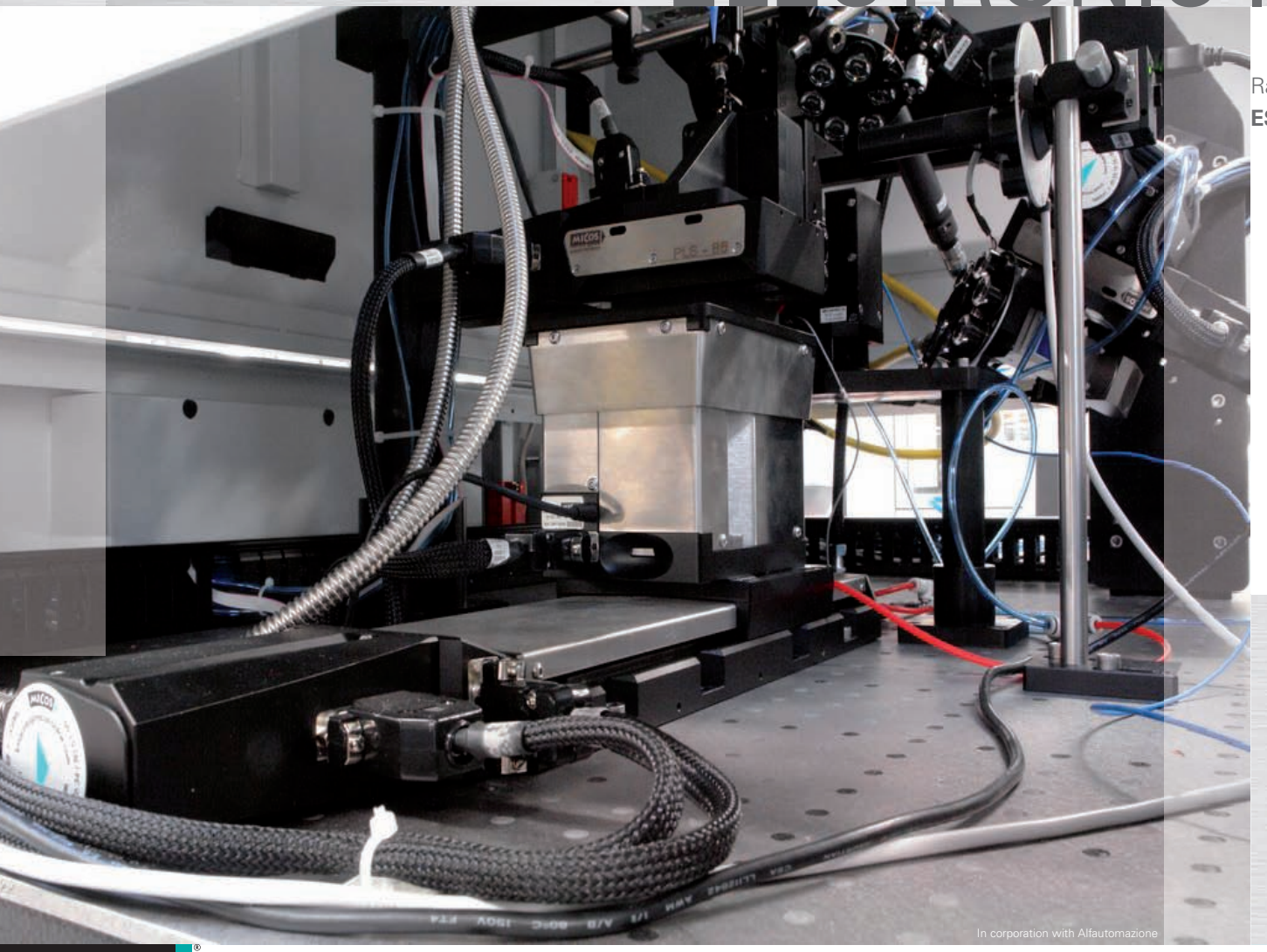
Tree Scanner

This 2 axes scanner is used for the measurement and analyzing of all characteristics of the tree population.

The scanning of the trees is made on site. Positioning system and laser work by the use of accumulator batteries.

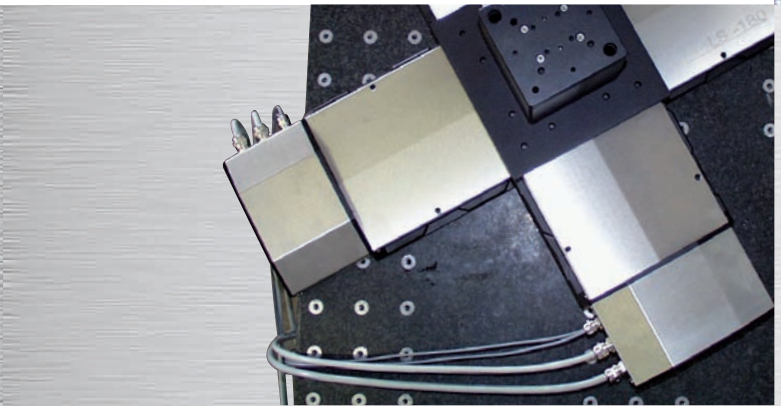
The system provides a resolution of 0.0015°. A GPS receiver is integrated. The tree scanner is well suited to use on site, as it is very immune to interference.

ELECTRONIC INSPECTION



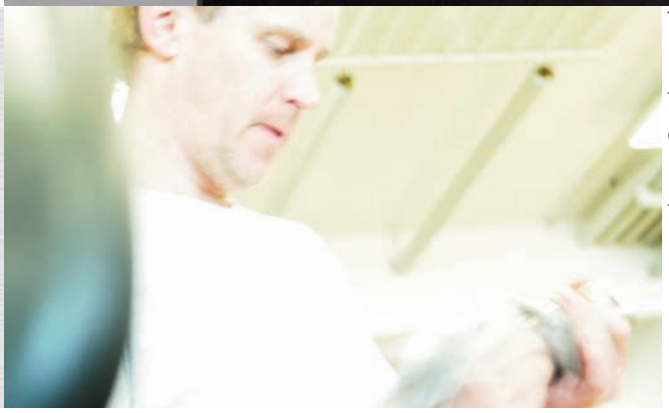
Rapid-prototyping system designed with **LS-180**, **ES-100** and **PLS-85**.

Low profile, high speed, linear motor stages **LMS-180** for X-Y high resolution and vertical stage **HT-90,** for electronic inspection.



MICROFILM SCANNER

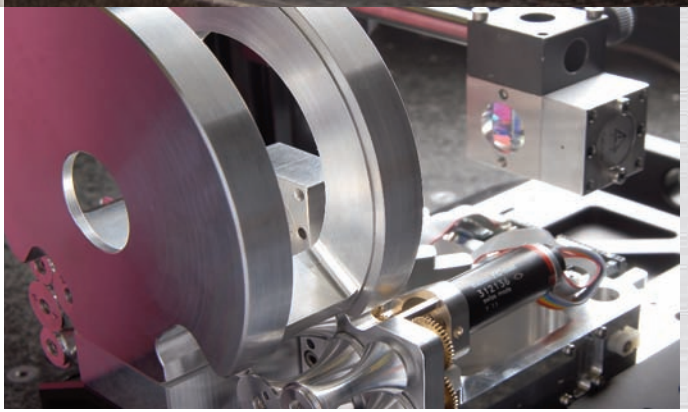
As a project partner of the Millenium project, which is organized by the Fraunhofer Institute for physical measuring technique IPM, miCos got the task of developing a very fast and constant translation stage. The target of this project is to develop a functional imagesetter for storing analog and digital data on a monochrome film.



The backup of DVD´s, hard disks or magnetic tape is durable only for some years or decades and therefore does not guarantee a longtime backup of data for more than 100 years- this way many important datas got irretrievably lost e.g. data of the NASA for Apollo missions.

The imagesetter is supposed to expose data on a monochrome film via laser technology in the form of analog pictures and / or a digital code. Therefore an extremly constant movement during the exposure process is needed. In order to achieve these targets, miCos developed the linear motor driven LMS-230, which allows a resolution of < 2nm during high dynamic and longer travel range.
On the following picture a part of the set up can be seen:
On the LMS-230 the film transport mechanism with the spindel drive holder can be seen.

LMS-230



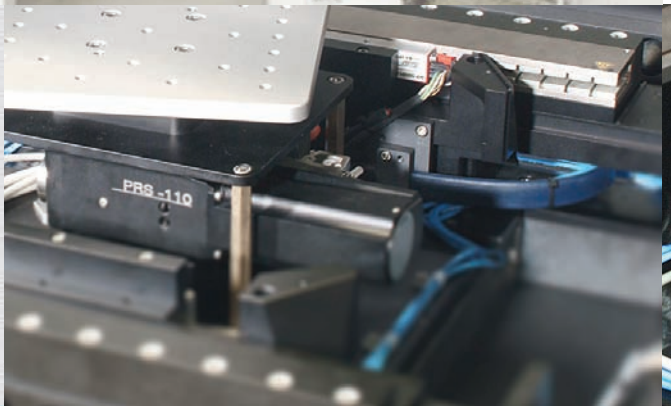
RAPID PROTOTYPING

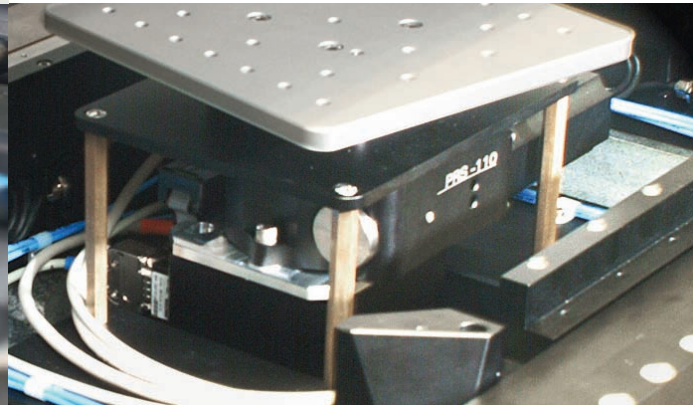
for micro-welding

Shown is a laser work station for the manufacturing of micro-structures for medical applications which was developed in cooperation with Fraunhofer ILT-Aachen.

It consists of a laser, a manufacturing cell and a wave guide. The positioning system consists of a ultra-precision, linear motor-driven XY- air bearing stage, a lifting stage and a rotary stage.

Using this approach, we were able to achieve guidance accuracies better than 100 nm over a travel range of 300 mm x 300 mm.



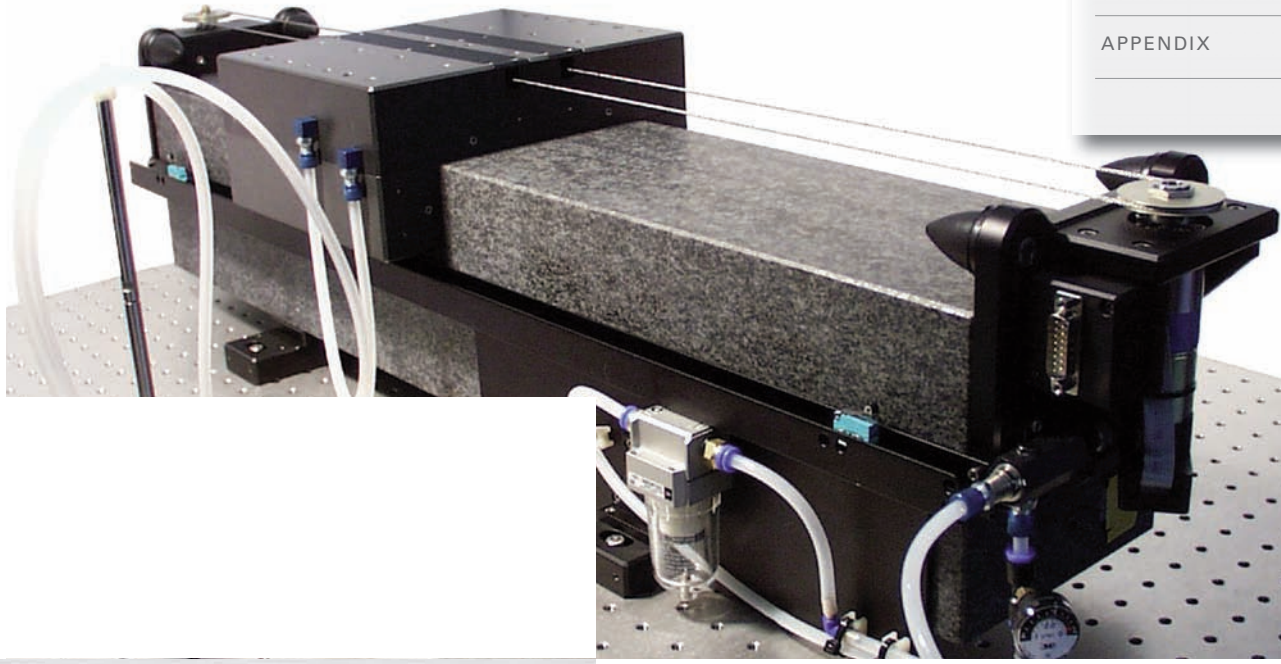


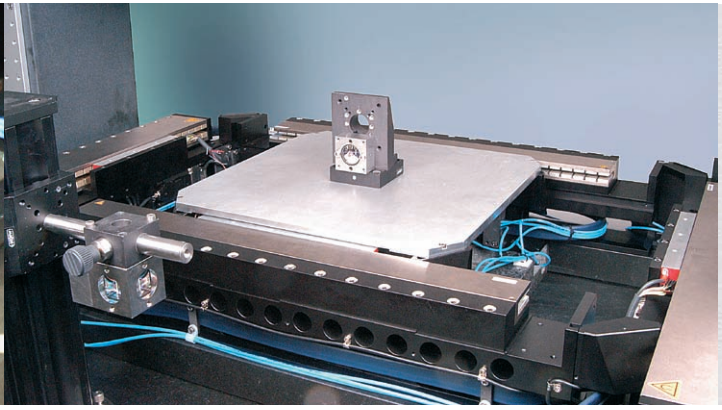
AIR BEARING

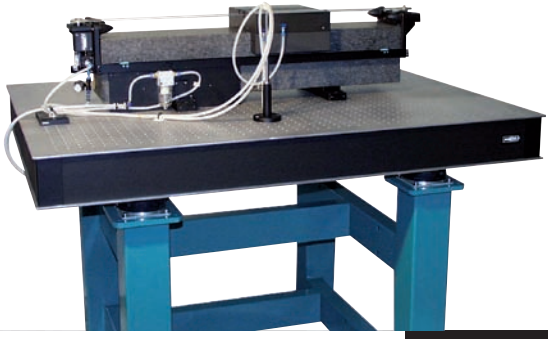
Test and Calibration Systems

Air bearing linear axis with a travel range of 600 mm. Used for the measurement of high precision linear scales, this system requires a positioning stage with optimized accuracies (minimal pitch, yaw and roll angle).

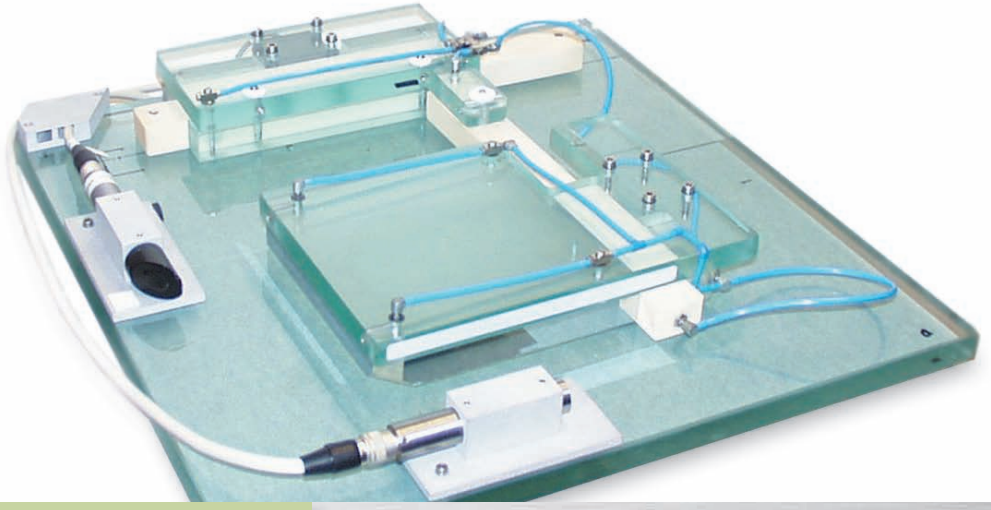
The system consists of a precision lapped granite plate and an aluminum carrier. The custom developed air bearing guiding system guarantees maximum accuracy and guiding stiffness.





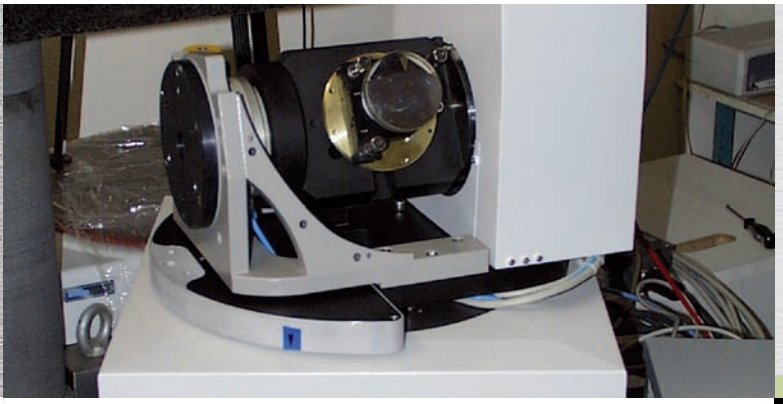


AIR BEARINGS



Air Bearing Stage made from Glass

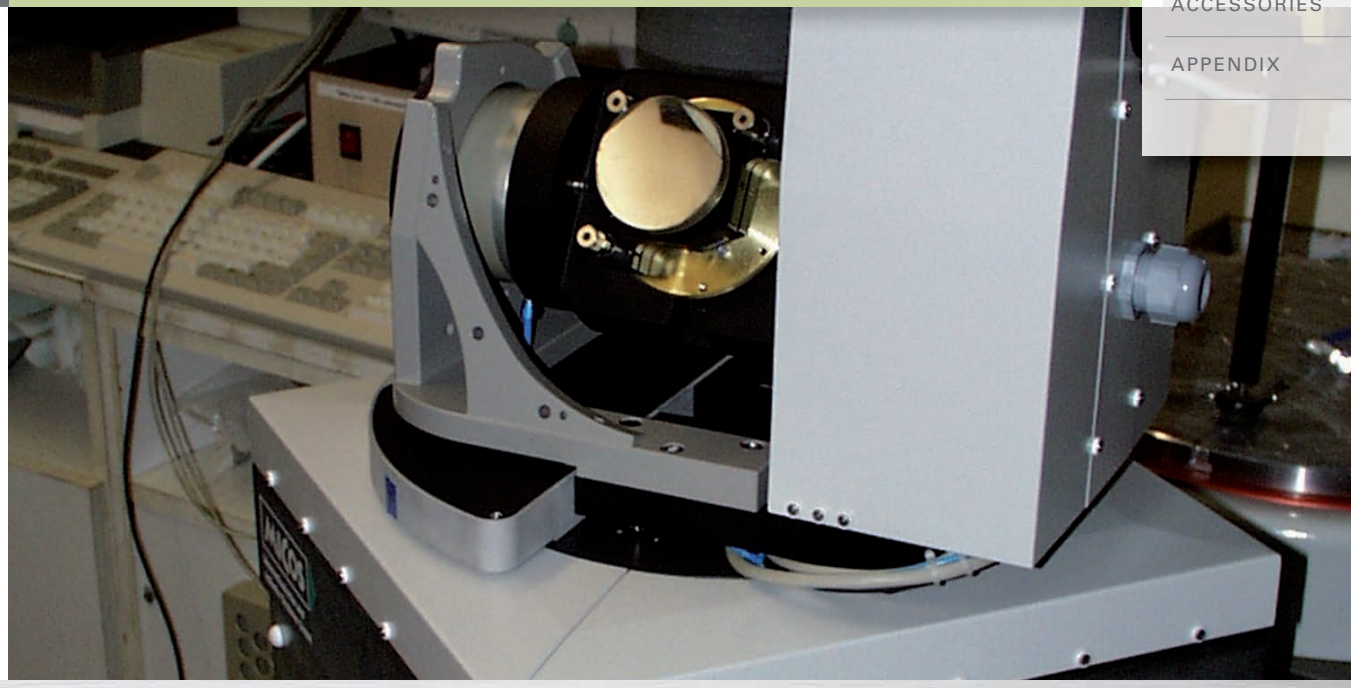
Homogeneous, highly precise XY, air bearing stage with direct drive for processing nano-structures in Semiconductor-, LCD and Flat Panel applications. The positioning system was developed to meet requirements of the highest accuracy. Base and guiding elements were custom designed in a glass ceramic sandwich structure. In order to achieve maximum accuracy, special air bearing geometries were developed. The position measurement in x and y direction is made using a laser interferometer. This frictionless positioning system allows maximum accuracy and process stability.



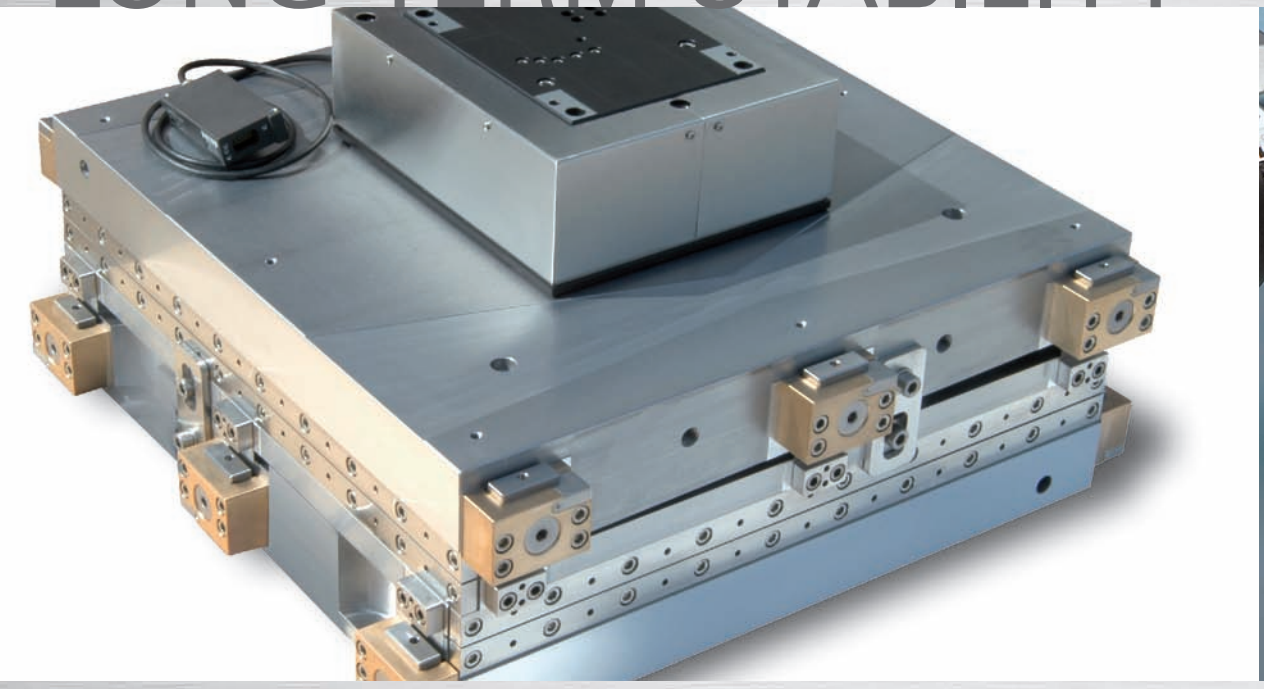
Test and Calibration Systems

2 axes ultra-precision rotary air bearing positioning system. This system excels where a maximum of positioning accuracy, repeatability and resolution is required. Both air bearing axes have a common intersecting center point.

With this positioning system, both resolution and a repeatability up to 1 arcsec can be reached. The system is equipped with high quality rotary encoders with an accuracy of 0.4 arcsec.

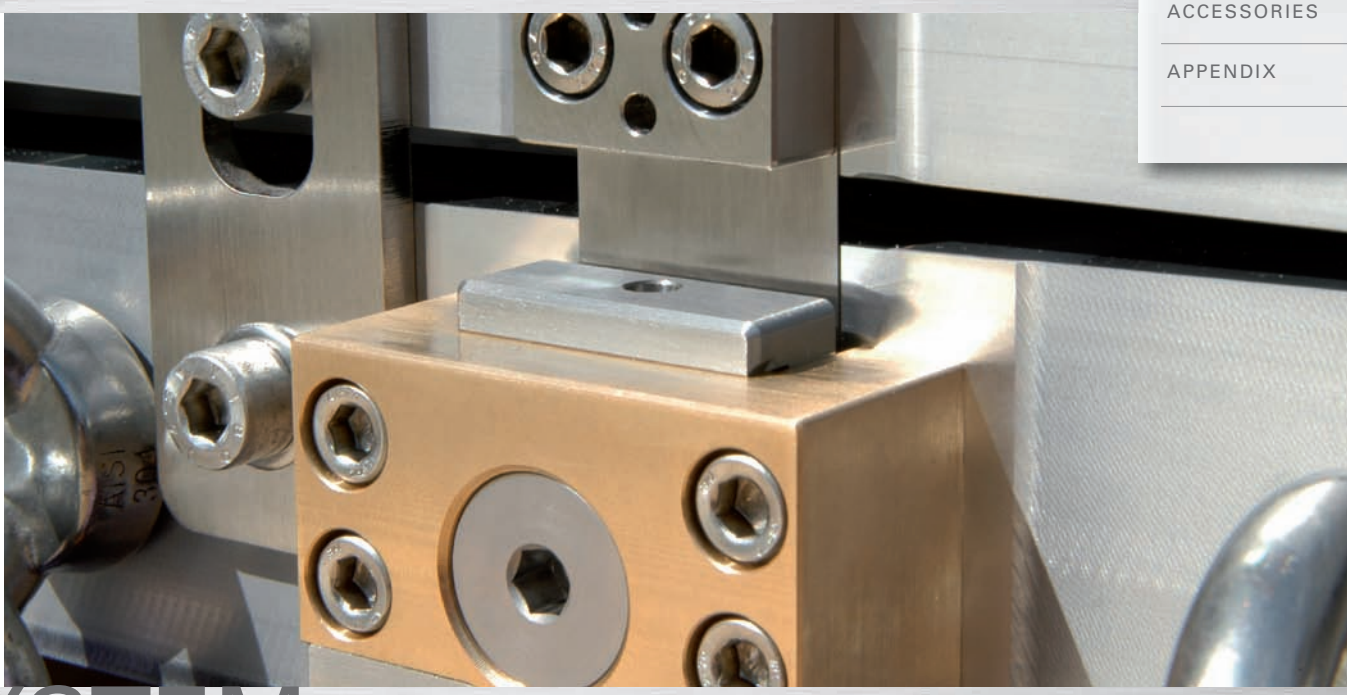


LONG-TERM STABILITY



TIP -TILT

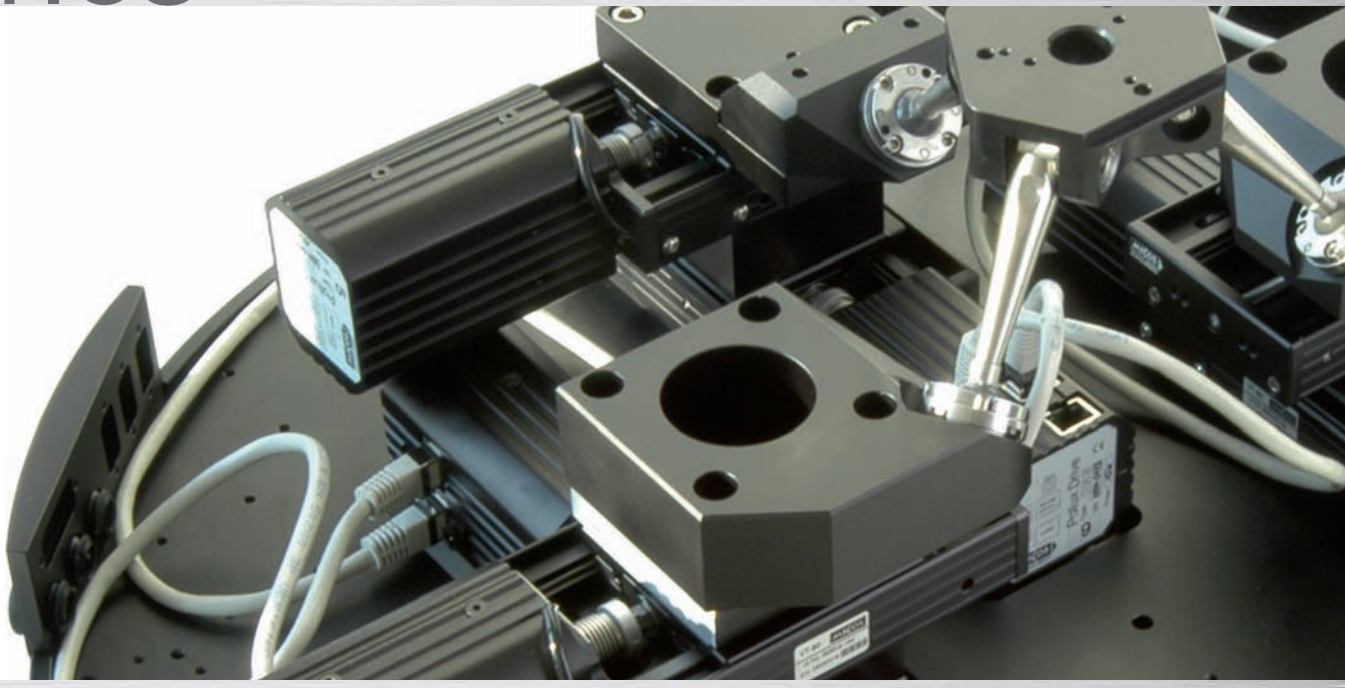
Tip-Tilt Elevation System with **NPE-200**.
This 3 axes system is used for the manufacturing of optical parts which require the highest long-term stability.



ELEVATION SYSTEM

NANO ROBOTICS

MICOS is a leading provider of positioning systems used for nano-technology applications. Our components and systems are specifically engineered for demanding uses such as laser technology, medical applications, space exploration, precision sensors and many other challenging application areas.



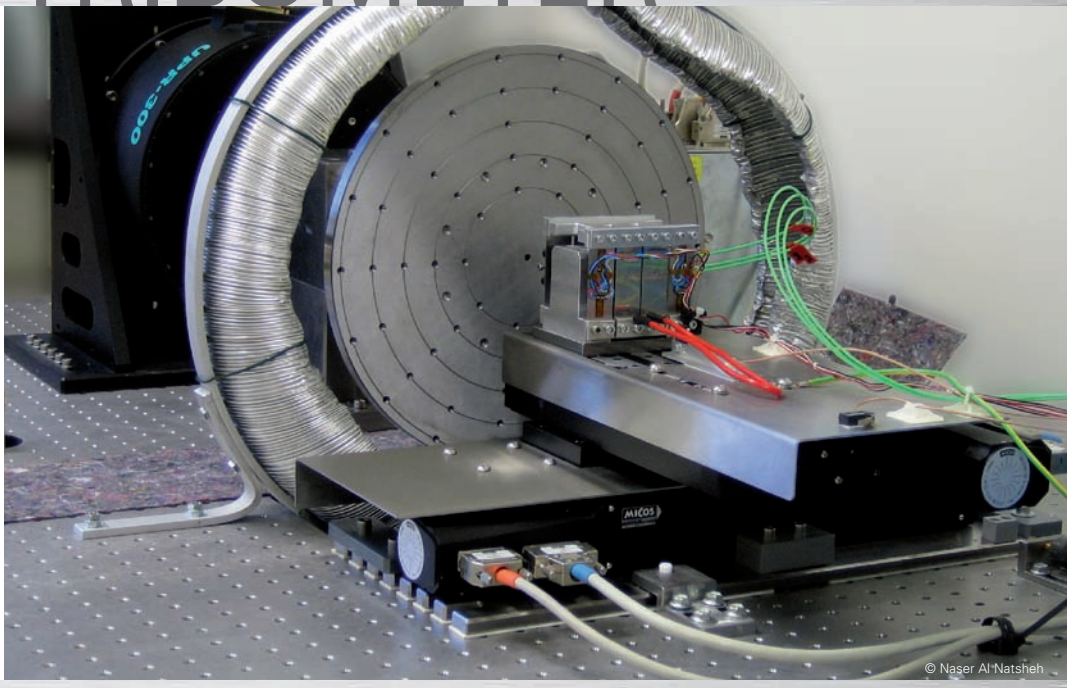
With a **HEXAPOD** system motions in all six degrees of freedom can be achieved.
Due to the parallel kinematic design principle of **HEXAPODS**, a much higher system stiffness is achieved than with conventional stacked stages.

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. An optimized general concept allows maximum stiffness and accuracy. Spatial resolutions up to 1 µm can be achieved.
The system uses a **micos DMC** or **Delta TAU** controller and includes advanced algorithms for inverse kinematic transformations within a user-friendly software package.
Custom system integration is possible.

HEXAPOD

PRECISION SPIRAL TRIBOMETER

XY-system using the **UPM-160** linear stage for precision measurements of disc brakes.
This application required extremely high stiffness and tight speed control.



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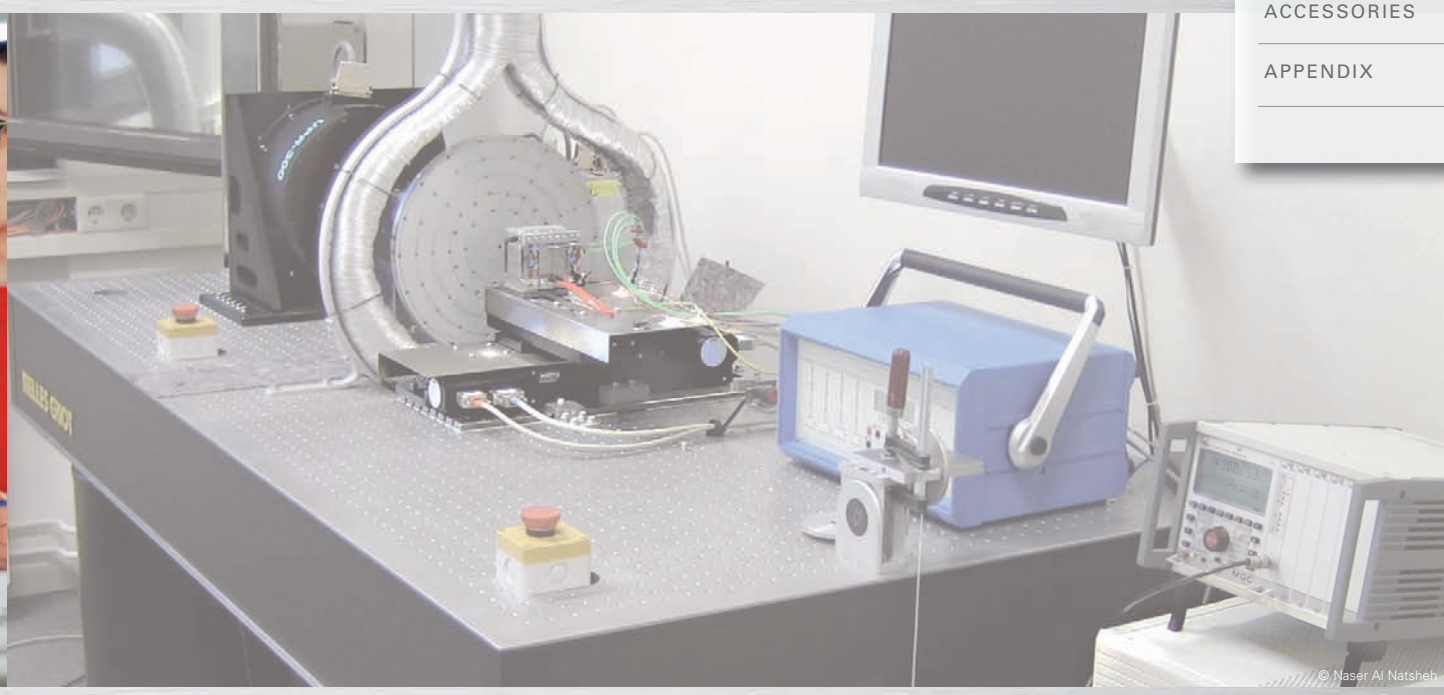
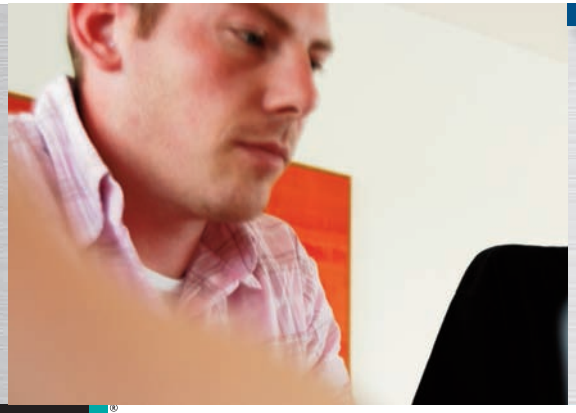
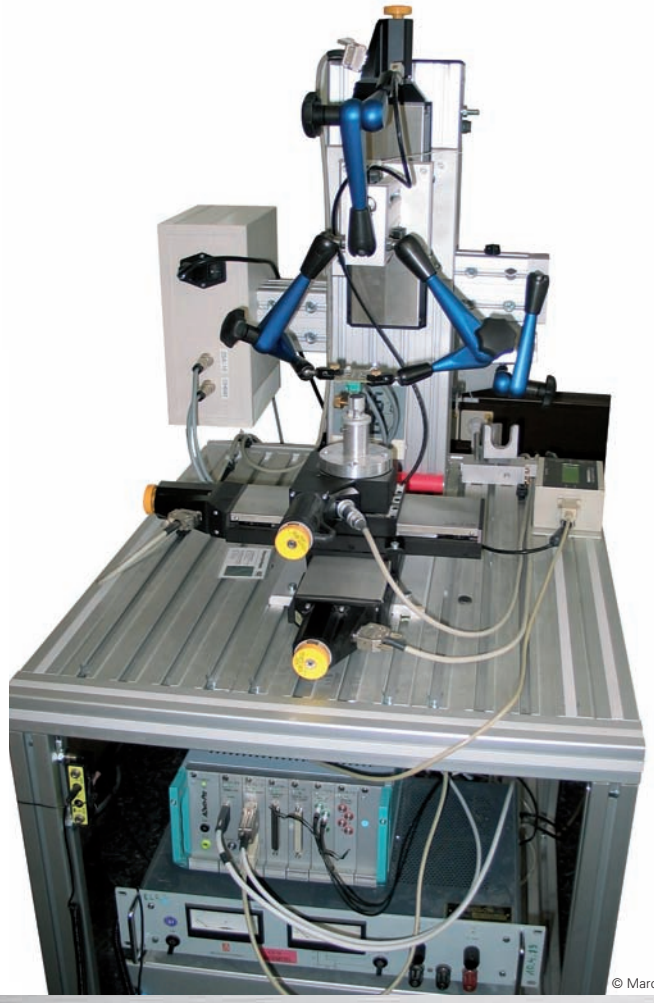


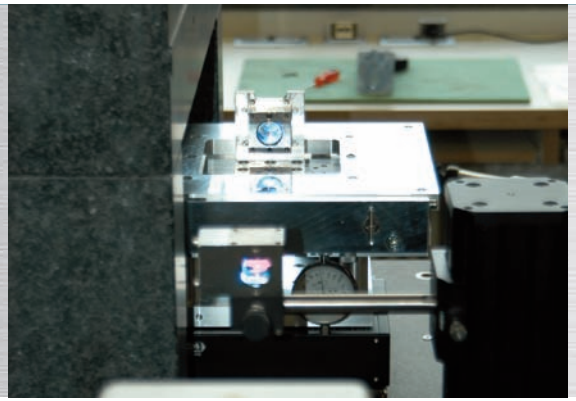
MEASUREMENT OF MAGNETIC FIELDS

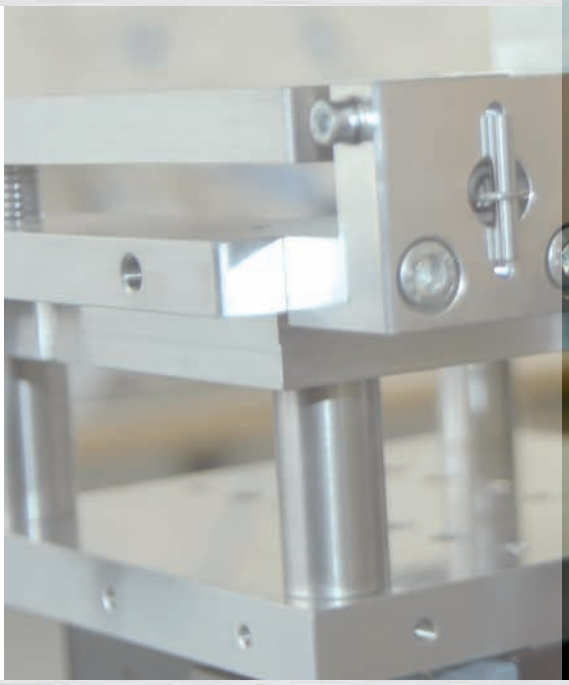


Metrology system for magnetic field sensors.
3 **LS-110** linear stages are used in an XYZ configuration to position the sensor.

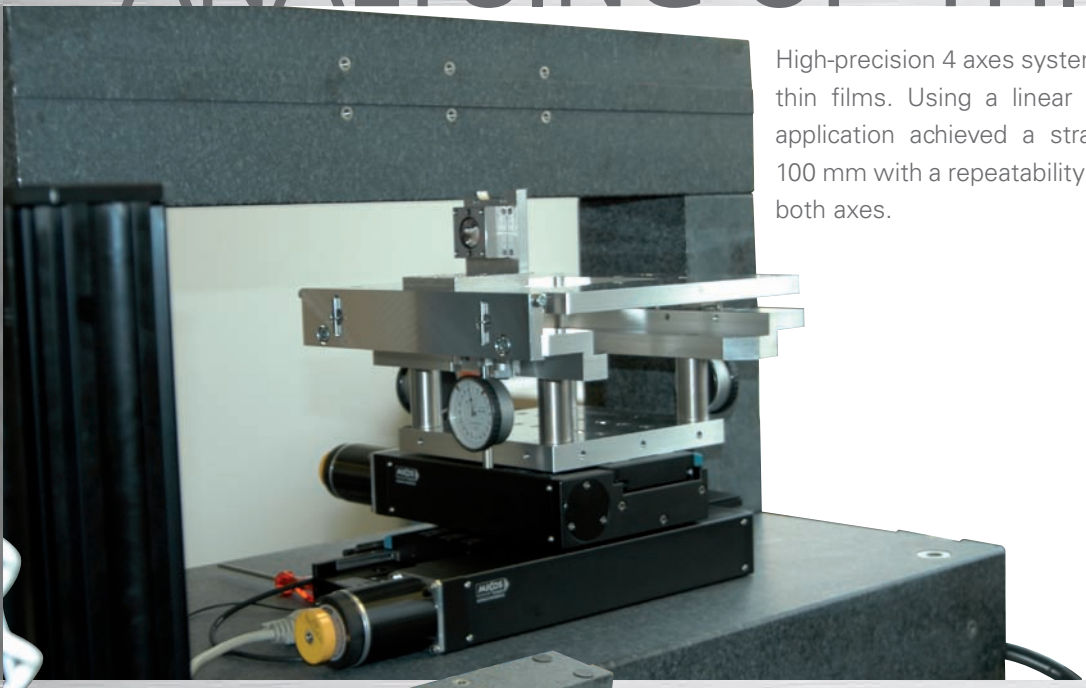


Mounted on the XY axes is a **DT-65** rotary stage which rotates a magnet, controlled by a **SMC-controller**.

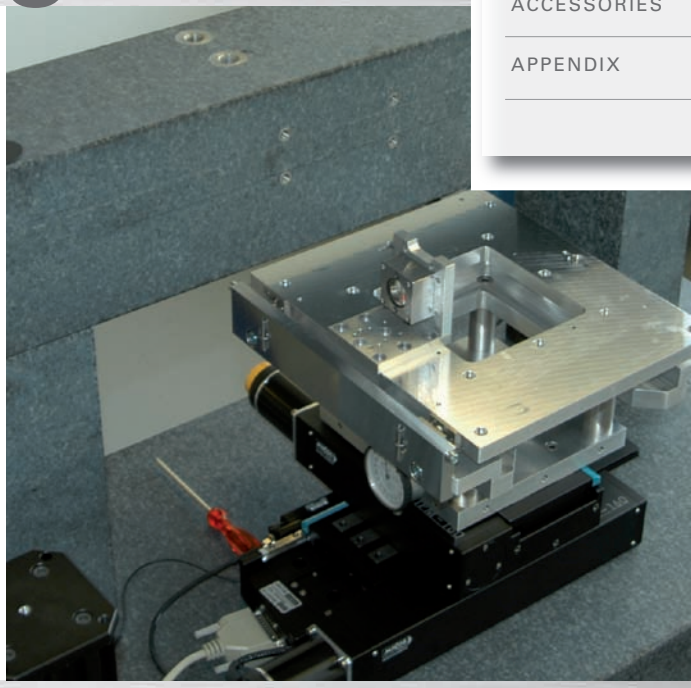


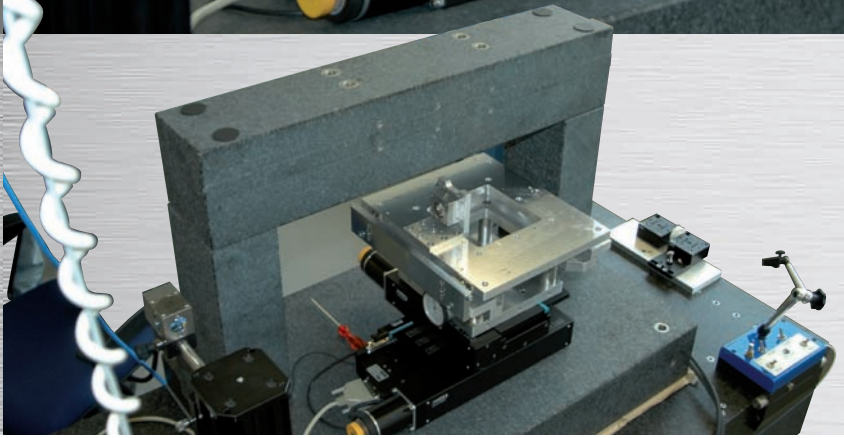


ANALYSING OF THIN FILMS

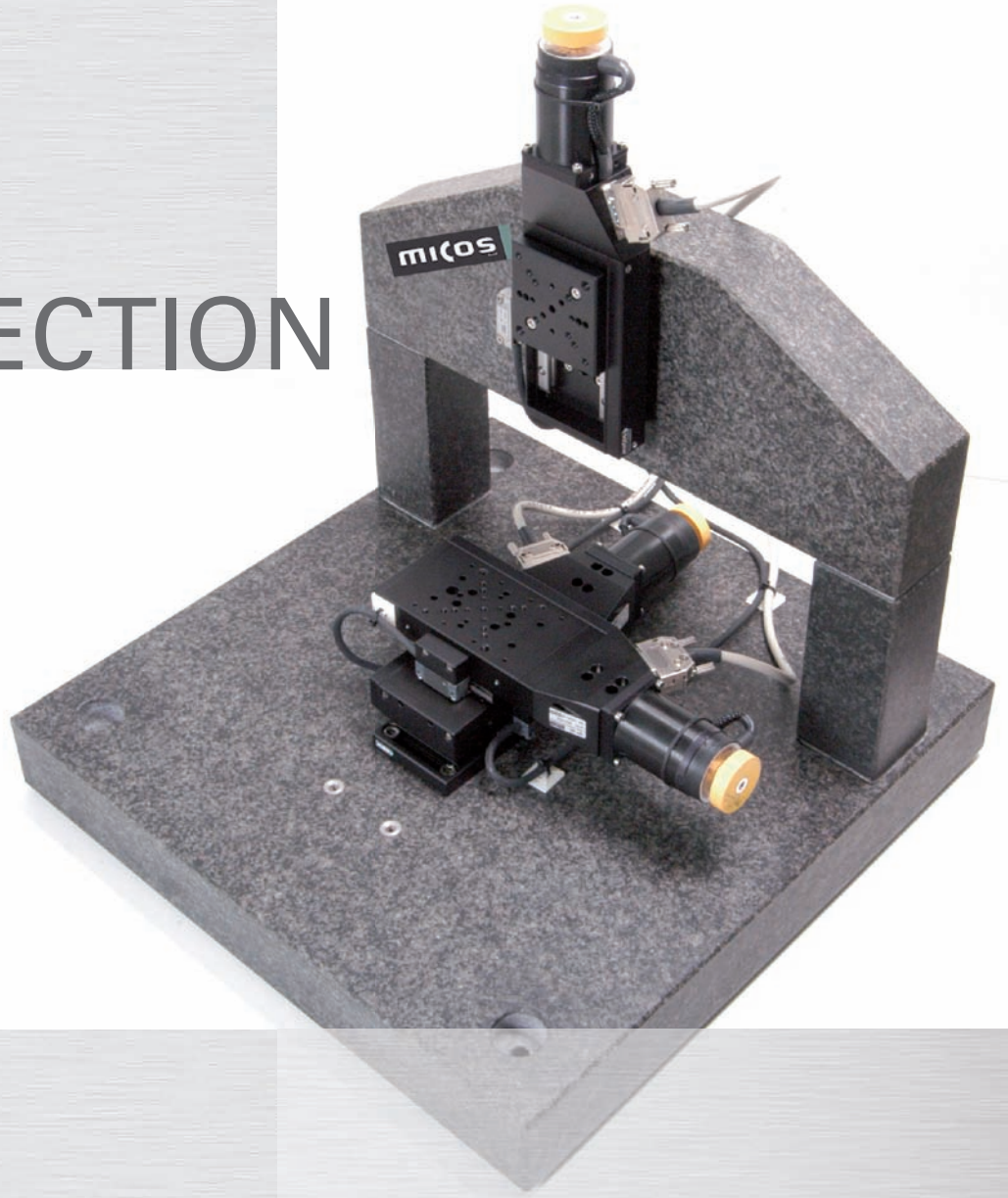


High-precision 4 axes system for quality control of thin films. Using a linear **UPM-160** stage, this application achieved a straightness of 0.5 µm/100 mm with a repeatability of less than 25 nm for both axes.





ELECTRONIC INSPECTION

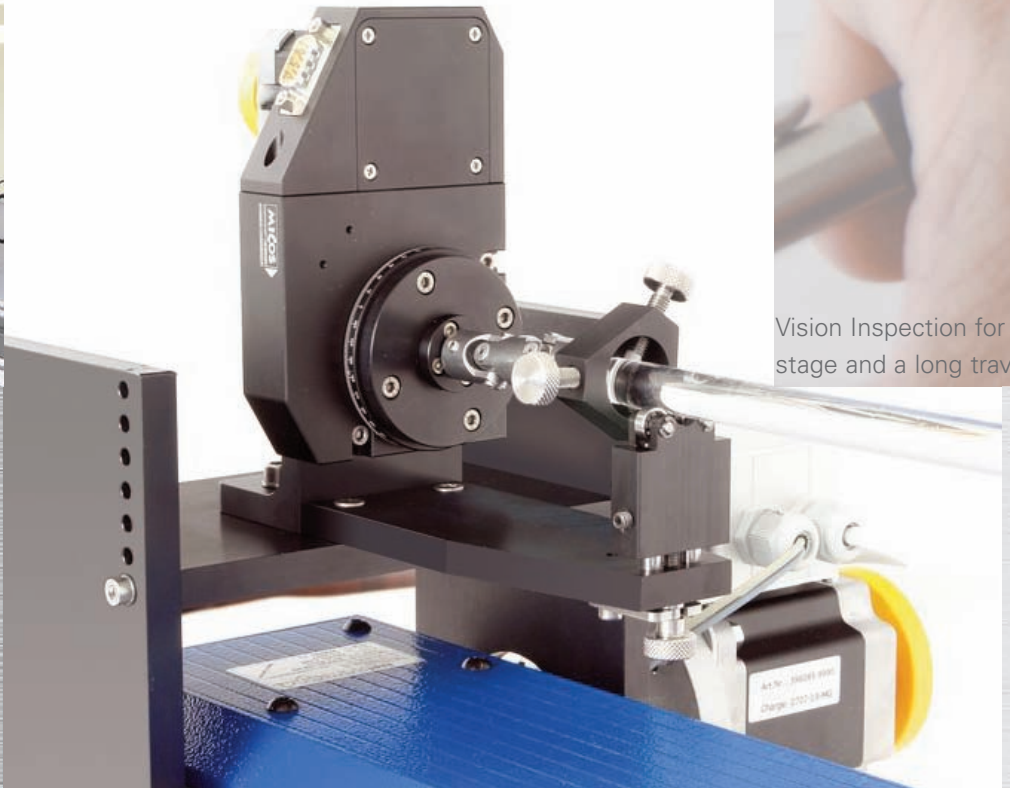


OPTICAL INSPECTION

Turnkey system using **PLS-85** linear stages and a **SMC controller** including a vision system to measure printed circuit boards.

TEST FOR SENSOR-CALIBRATION

FIBER OPTIC MANUFACTORING



Vision Inspection for glass with **DT-80 R** rotation stage and a long travel, belt driven linear stage.

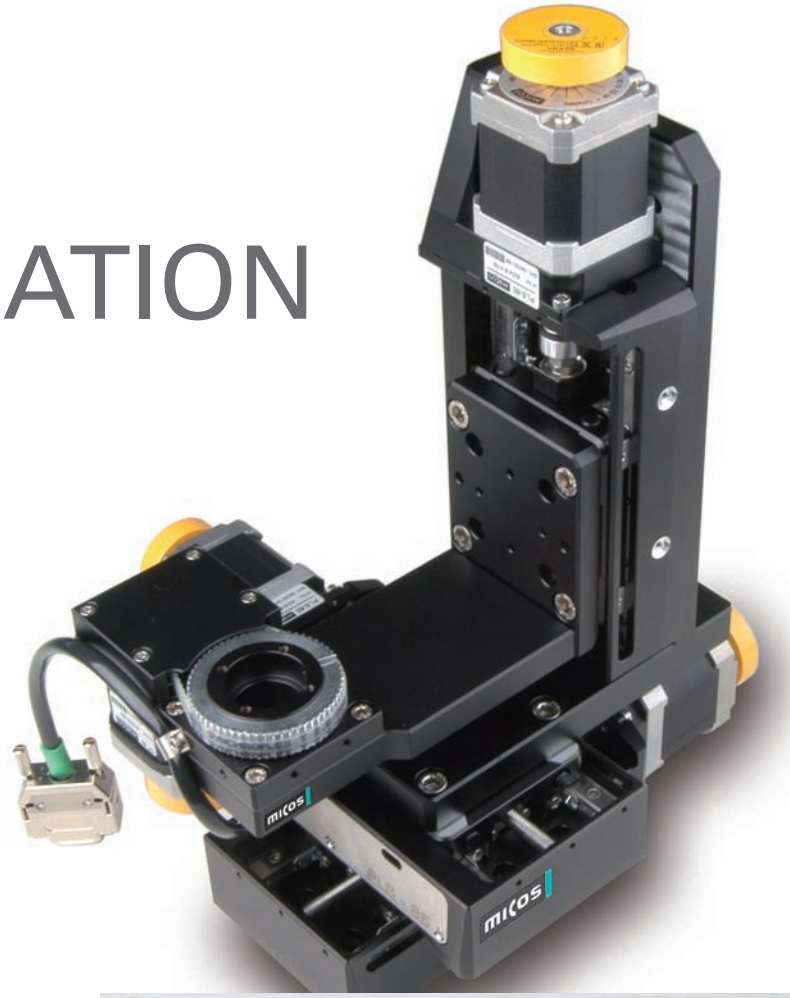
MULTIAXES STANDARD COMBINATION

DT-80 stack with a common center of rotation for realising a motorized gimbal mount.

Iris diaphragm with DT-80

SENSOR CALIBRATION

Two axes rotary system mounted on a **DT-120** rotary stage with harmonic drive.

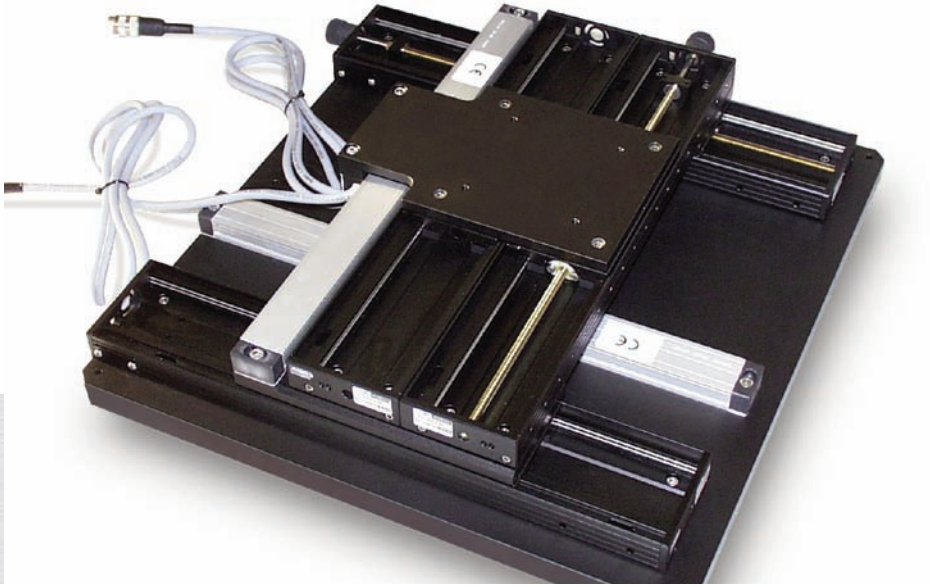


XYZ-positioning system with 4 degrees of freedom using a **PLS-85** and **DT-50**.

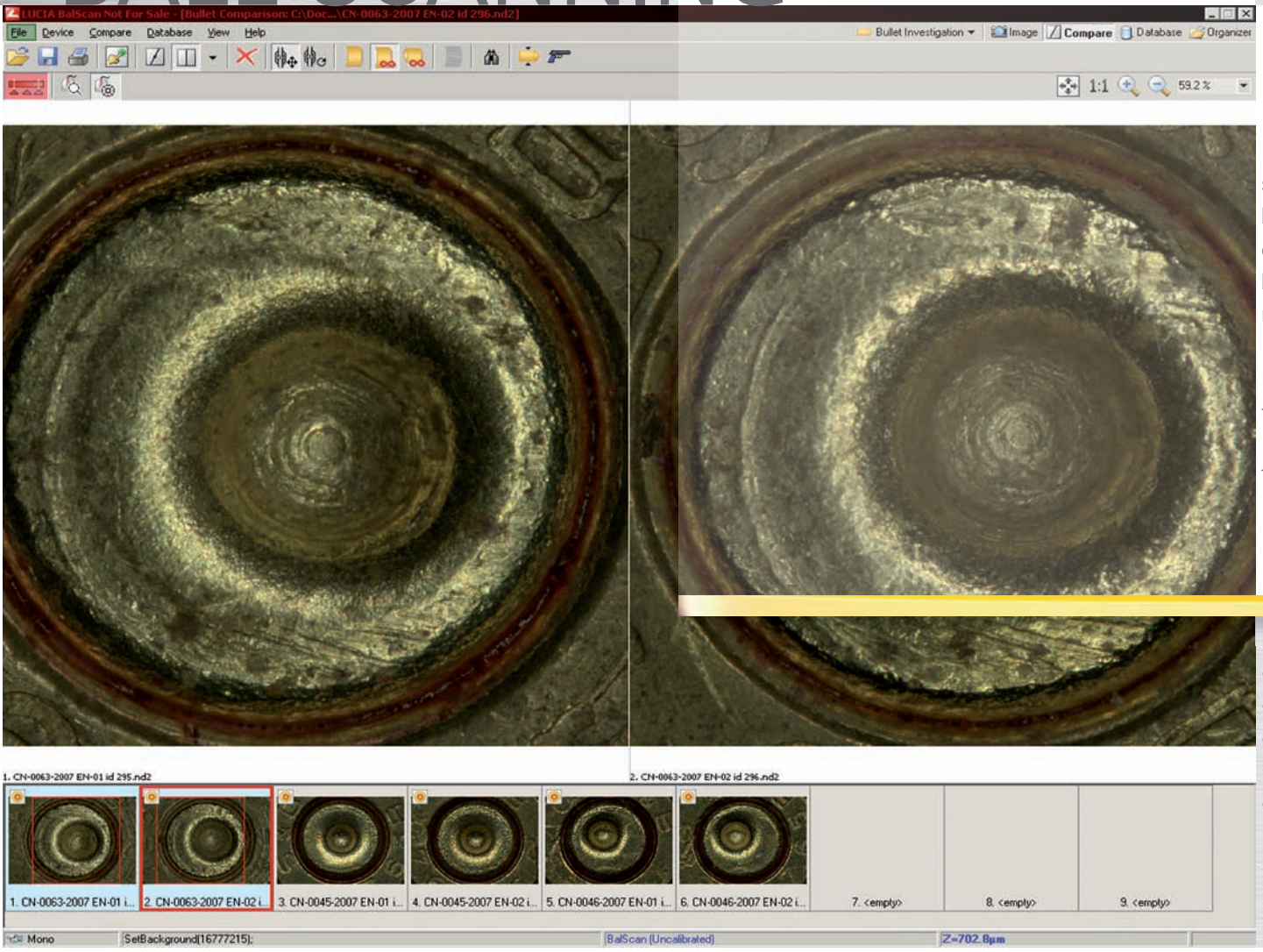
MULTIAXES STANDARD COMBINATION

Elevation stage **HT-90**, two goniometers **WT-100** and **WT-85** plus a **ARS-65** rotary stage with a common center of rotation.

Manual **VT-80** stage with linear scale.



BALL SCANNING



LUCIA BalScan is a ballistic identification system, which can be used for routine bullet and cartridge case scanning and comparison work. It can also be used for building up central databases and for networking ballistic laboratories.

Movement and scanning in 6 axes: rotation, focus, illuminator position and XY translation.

The system contains:
1 **DT-50,** 3 **PLS-85** and 2 **VT-80**.

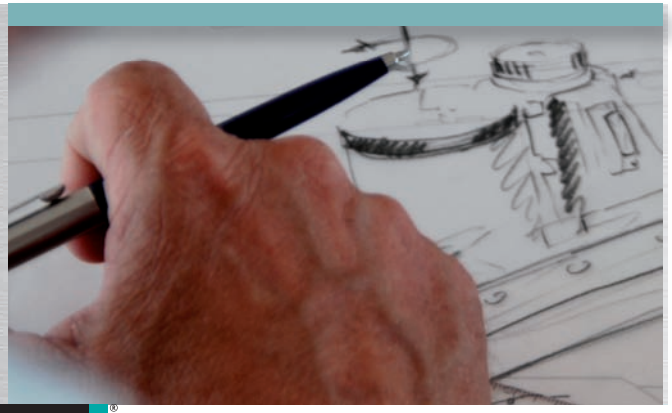
- Exact laser autofocus
- LED circular segmented ring light
- Additional LED side light
- High quality monochrome or color 2 MPix low noise camera
- High quality telecentric lens

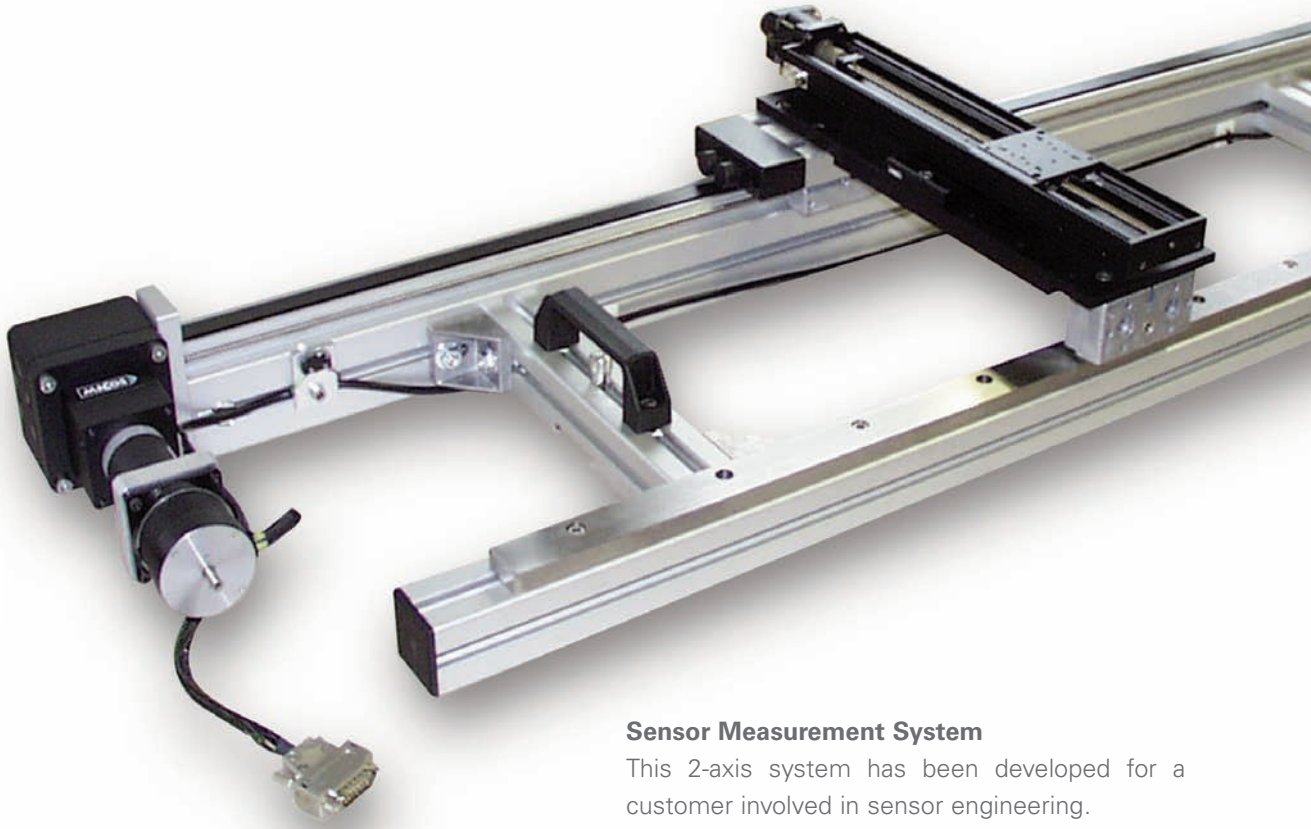
INSPECTION SENSOR MEASURMENT

3 Axes Inspection System

This 3 axes positioning system was custom developed for inspection of small optical parts and is well suited for tasks of reflected and transmitted light microscopy.

XY adjustment is made using a MS-8 scan stage with 8" travel range. A **MT-85** linear stage mounted on a granite bracket allows adjustment of focus of CCD-cameras or sensors. The system is usable in various fields of application.



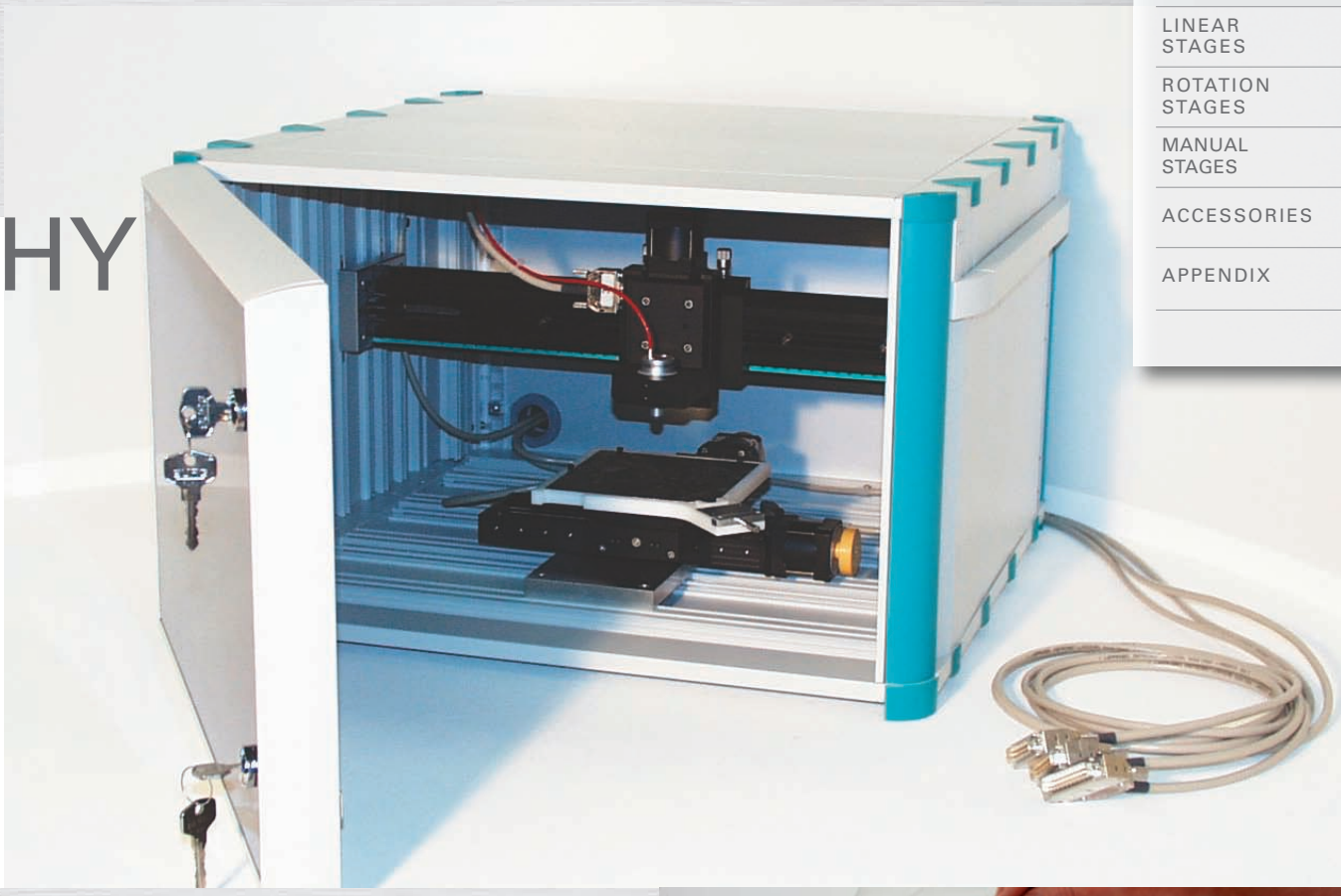


Sensor Measurement System

This 2-axis system has been developed for a customer involved in sensor engineering.

The system allows the control of optical sensors with respect to their hysteresis and angles of dispersion. It is mainly used for quality control and testing these sensors.

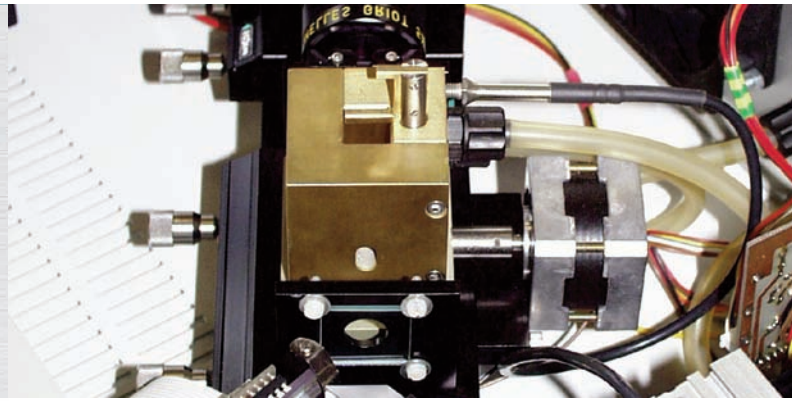
SURFACE TOPOGRAPHY

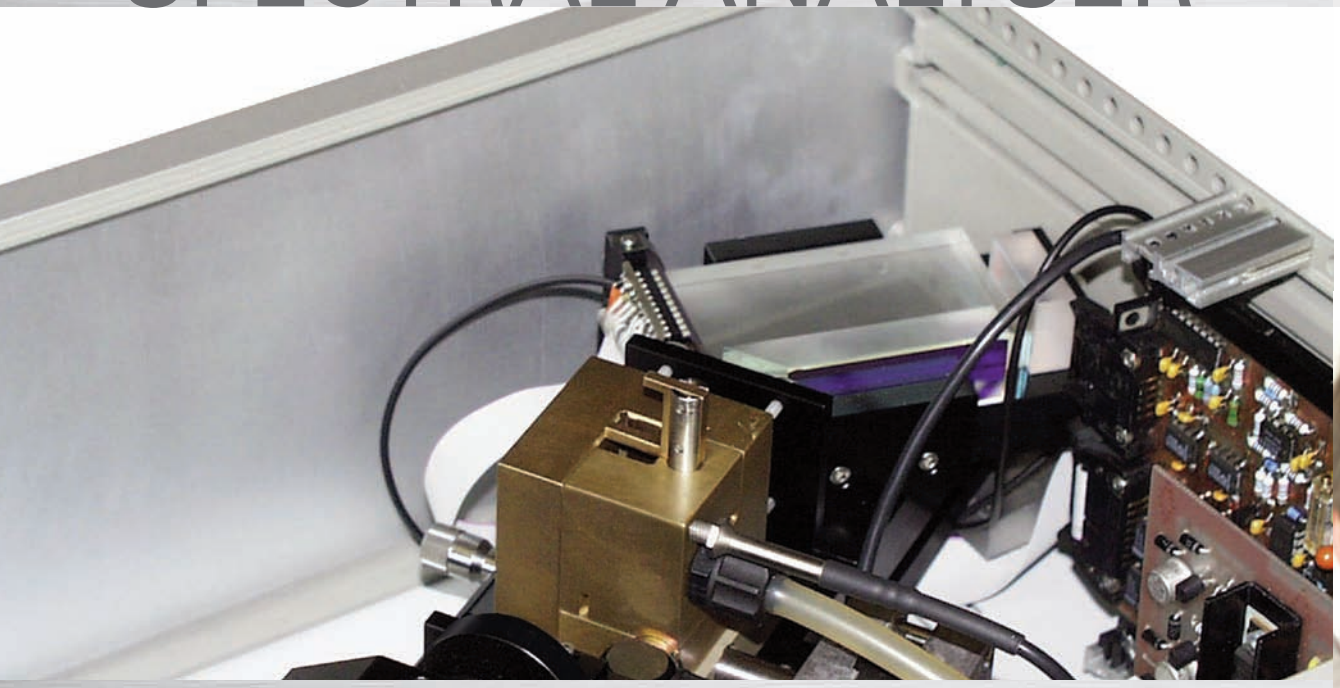


Surface Topography of Solar Cells

The 3 axes positioning system operates in an opaque chamber. The substrate can be positioned over 102 mm in X and Y. The travel range of the sensor is 25 mm. All positioning axes offer high resolution of less than 1 µm with a repeatability of 0.5 µm. The solar cells are precisely positioned and held stationary. A **SMC-Corvus** controller is used for control with customized command and interpretation software.

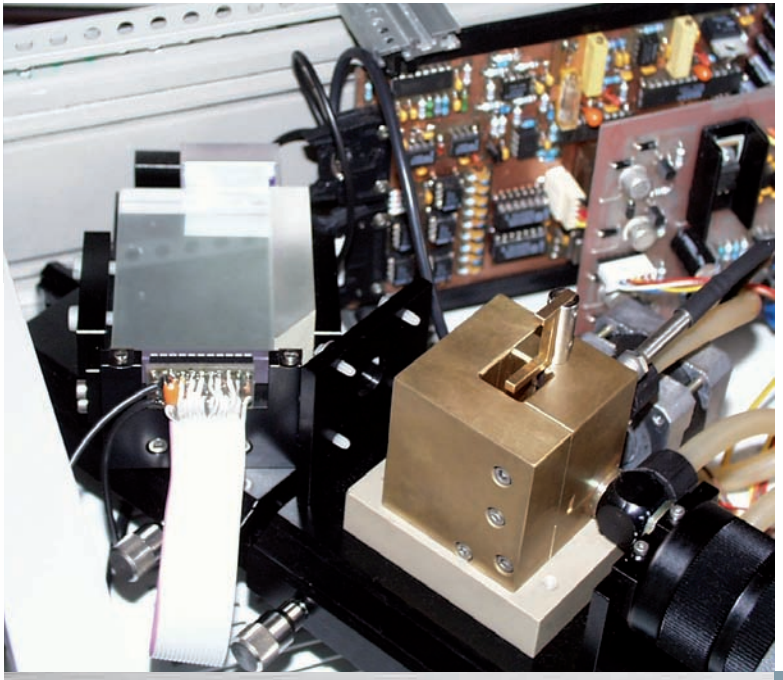
SPECTRAL ANALYSER

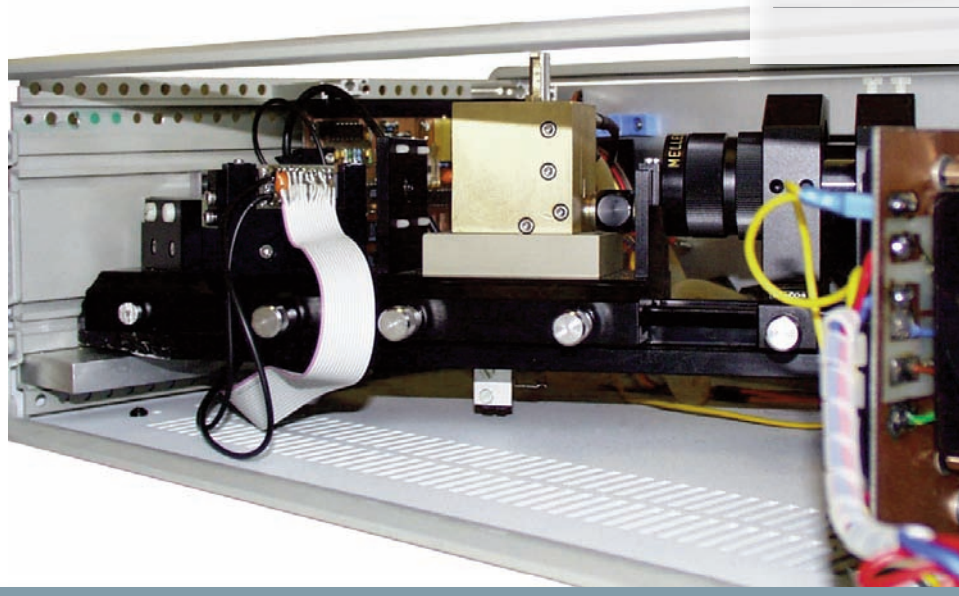




Analysis of the glucose content in wine

This system was developed using micos Albatros components according to customer specifications.



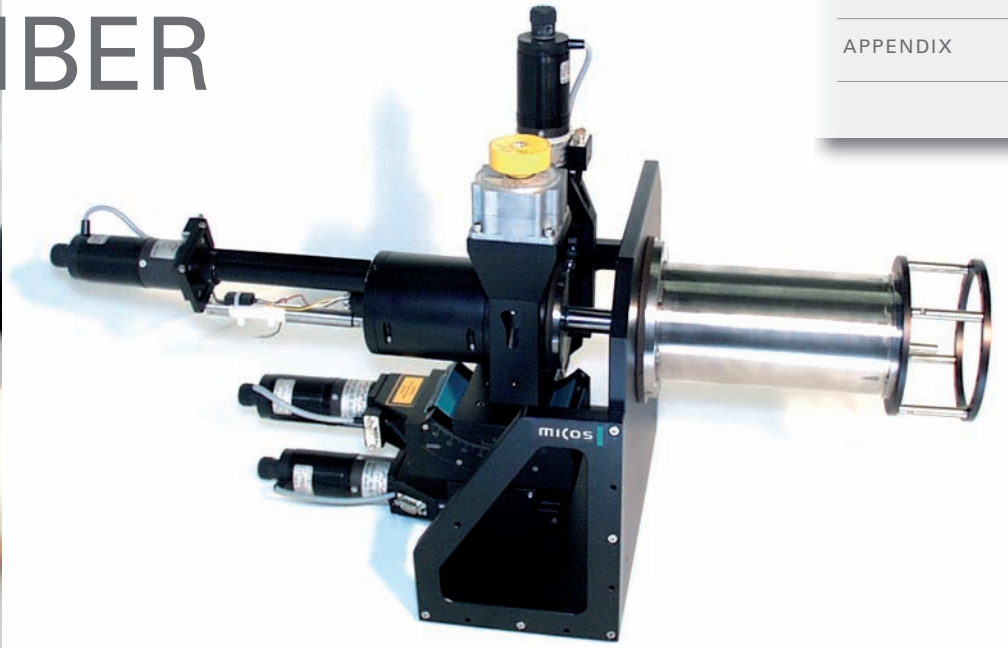


POSITIONING IN ANTARCTIC

Rotation Stage **ARS-65** is suited for vertical and horizontal use. With little effort it can be configured together with other miCos components in systems.

Application in the Antarctic

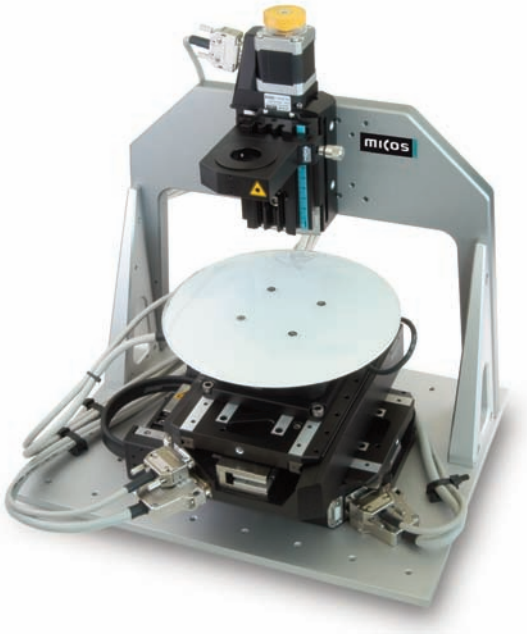
POSITIONING IN CLIMATE CHAMBER

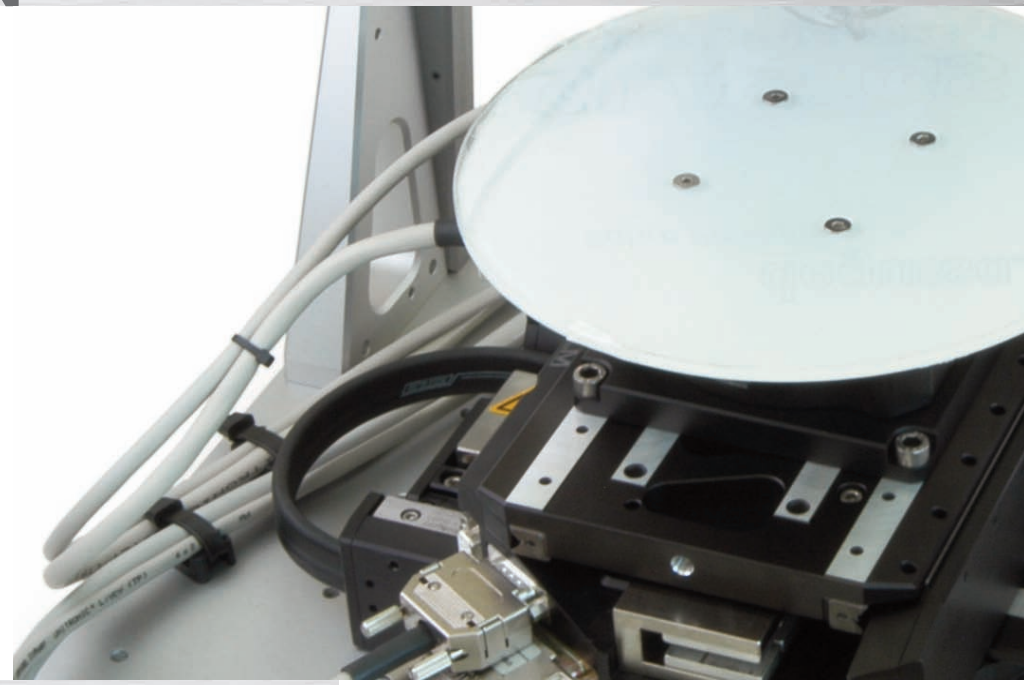


Climate chamber 6 axes system for measuring sensors from -50°C to 80°C in the automotive industry.
The test units are positioned using a 6 axes system. The travel range in XYZ is 50 mm, rotation is 360° or 10°.
The linear axes provide a resolution of less than 0.1 µm, the rotary axes less than 0.0015°.

For this task, only standard positioning components were used.
Control is implemented using a 6 axes SMC series controller in connection with a manual control using a joystick or fully automatic software control.

WAFER INSPECTION





3 axes positioning system with **UPS-150** linear motor stages for XY and **PLS-85** for sensor positioning. The system uses an **SMC-Pegasus** controller.

PRECISION OPTICS PRODUCTION

XYZ-system consisting of **LMS-180** stages using linear motors and a **DMC-series** controller.
We also design systems with up to 50 motorized axes including lasers, sensors and software.

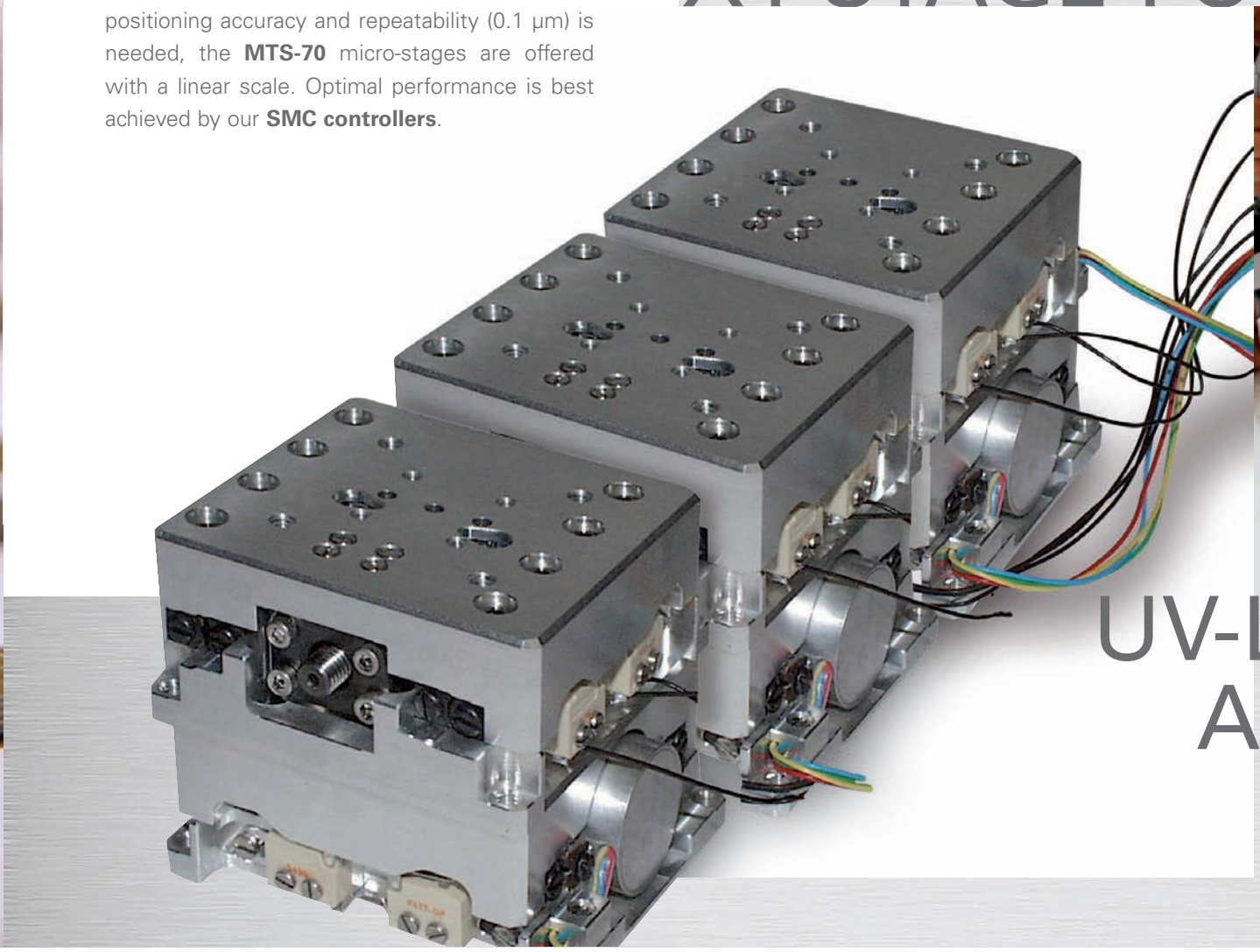
STAGE FOR AUTOFOCUSING

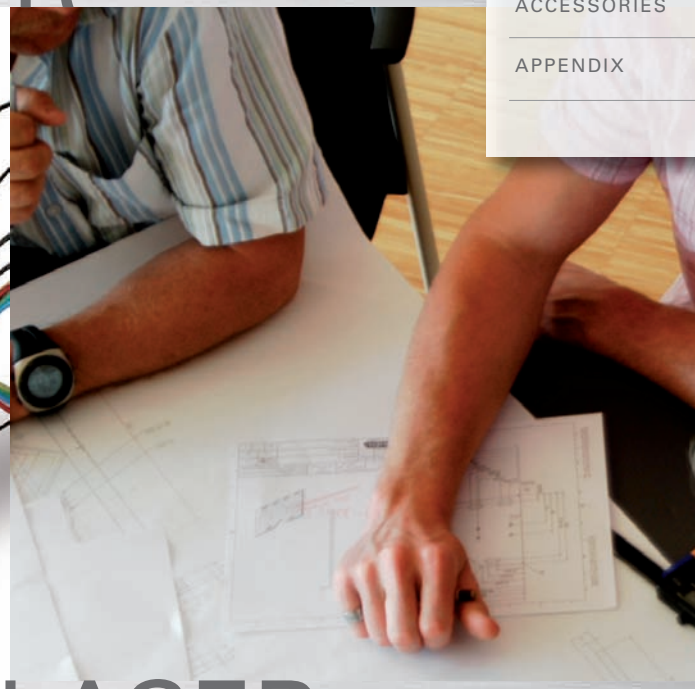
Focusing axis for medical engineering

XY-STAGE FOR UV-LASER APPLICATION

OEM Application for UV-Lasers

The miniature Micro Stage **MTS-70** was developed for vacuum applications with a limited space requirement. The drive consists of a special micro-stepped gearless stepper motor. If high positioning accuracy and repeatability (0.1 µm) is needed, the **MTS-70** micro-stages are offered with a linear scale. Optimal performance is best achieved by our **SMC controllers**.





MOTORIZED ZOOM

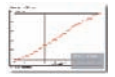
ACTUATORS

With actuators, manual drives can be replaced by motor drives. Actuators are ideal devices for motorizing mounts in optical or mechanical systems. Furthermore it is an ideal component for limited space conditions.

2.000 CONTROLLERS

CONTROLLERS

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	Page
	Technical Information SMC-series												2.020
	SMC corvus	desktop 19" rack	•						yes / optional	RS-232 Ethernet TCP/IP GPIB	linear interpolation	2 or 3 (n x 3)	2.040
	SMC corvus eco	desktop	•						yes / optional	RS-232 USB	linear interpolation	2 or 3 (n x 3)	2.050
	SMC corvus pci	PCI-board	•						yes / optional	PCI-COM RS-232	linear interpolation	2 or 3	2.051
	SMC pollux	desktop 19" chassis intelligent motor	•						yes / optional	RS-232 Ethernet TCP/IP USB-cable	point to point	1 in loop up to 16	2.060
	SMC hydra	desktop	•				•	•	yes absolute encoder optional: 1Vpp	RS-232 Ethernet TCP/IP	point to point linear interpolation	2	2.070
	SMC taurus	desktop	•				•	•	yes / optional	RS-232	point to point	1	2.080
	SMC pegasus	19" rack	•				•	•	yes / optional	RS-232	point to point	up to 256	2.080

SM-series

	Version	Form-Factor							Closed-Loop	Communication	Modes of Motion	Number of Axes	Page
	SM-32	PCI-board	•						no	PCI-bus	point to point	3	2.090

LMC-series

	Version	Form-Factor							Closed-Loop	Communication	Modes of Motion	Number of Axes	Page
	LMC-100	pocket / desktop		•	•			•	yes	RS-232 CAN-open	point to point	1/2/7	2.091

MoCo-series

	Version	Form-Factor							Closed-Loop	Communication	Modes of Motion	Number of Axes	Page
	MoCo DC	pocket / desktop		•					yes	RS-232 USB-cable	point to point	up to 16	2.100

Piezo-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	Page
	PiCo 33 Piezo Controller	desktop				●			no	RS-232	point to point	3	2.110
	PiCo 33 Piezo Controller	desktop				●			yes	USB	point to point	3	2.110
	PMA-100	desktop				●			no	Clock/Dir		1	2.111

DMC-series

	Version	Form-Factor							Closed-Loop	Communication	Modes of Motion	Number of Axes	Page
	DMC PCI-eco DMC PCI Accelera	PCI-PC-Slot	●*	●*	●*	●*	●*	●*	yes	PCI-Bus	Linear interpolation Circular interpolation Contouring Independent	1..8	2.120
	DMC Ethernet/RS-232	external 19"rack	●*	●*	●*	●*	●*	●*	yes	Ethernet & RS-232	Linear interpolation Circular interpolation Contouring Independent	1..8	2.121

* in combination with MPA

FlexMotion-series

	Version	Form-Factor							Closed-Loop	Communication	Modes of Motion	Number of Axes	Page
	FlexMotion series 734x	PCI-PXI	●		●				yes	PCI/PXI-Bus	Linear interpolation Circular interpolation Contouring Independent	2/4 2/4/6/8	2.130

MPA Power Amplifiers

	Version	Form-Factor							controller-interface	Number of Axes	Page
	MPA	19" rack	●	●	●	●	●	●	DMC-series	1..8	2.140

Software

	Version	Page
	Motion Server	2.141

Our **SMC family** is based on modern 32bit technology which enables performances of stepper motor driven systems which haven´t been possible before. A so called sin 2 acceleration offers very smooth acceleration and deceleration of the motors so that positioning in the nanometer range is possible with highest performance. One of the big advantages of our **SMC-controllers** is the possibility to drive the stages with extreme high resolution.

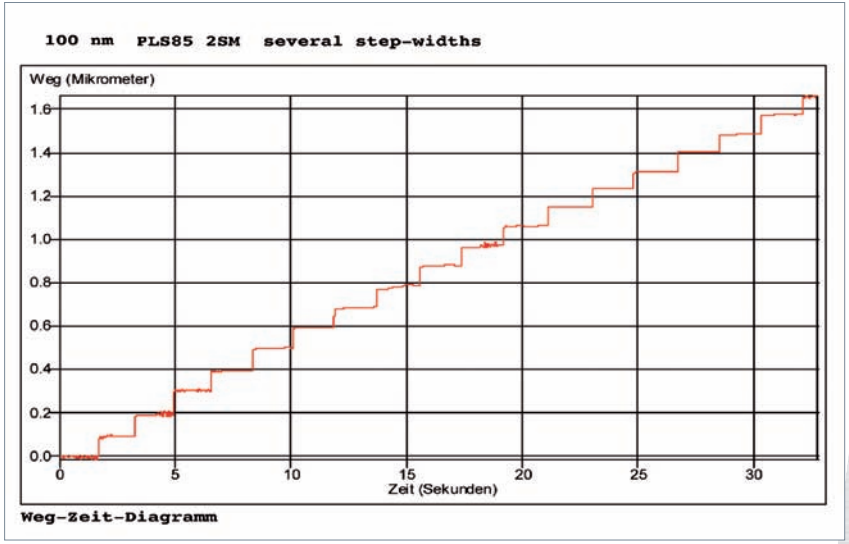


Figure 1: PLS-85, 2 SM open loop, resolution with 100 nm steps

In **figure 1** you can see the meaurement results of 100 nm steps driven with a **PLS-85** stage with 2 phase stepper motor in open loop (means, 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 the interferometer. The stage is not moving in regular 10 nm steps, but the mirror is pushed in this range. The measurement is limited by the interferometer resolution of 5 nm. This amazing resolution of the stage is not possible with any axis.

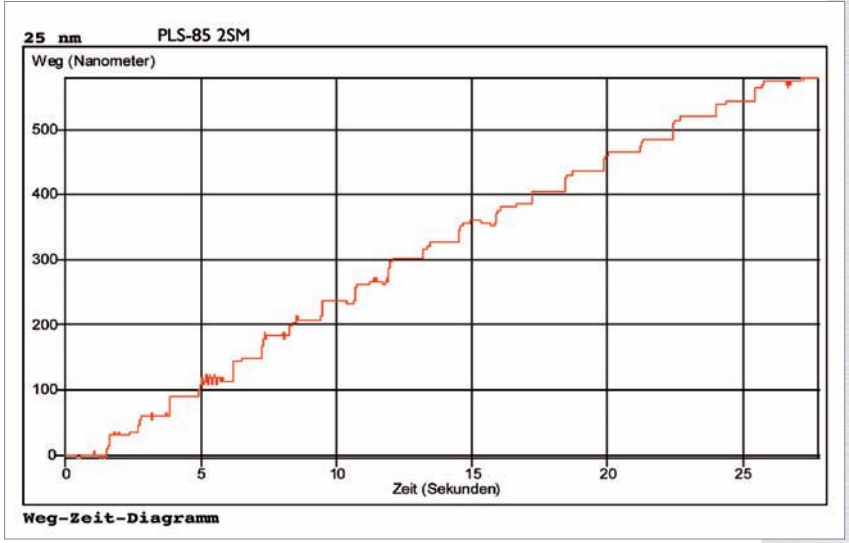


Figure 2: PLS-85, 2 SM open loop, resolution with 25 nm steps

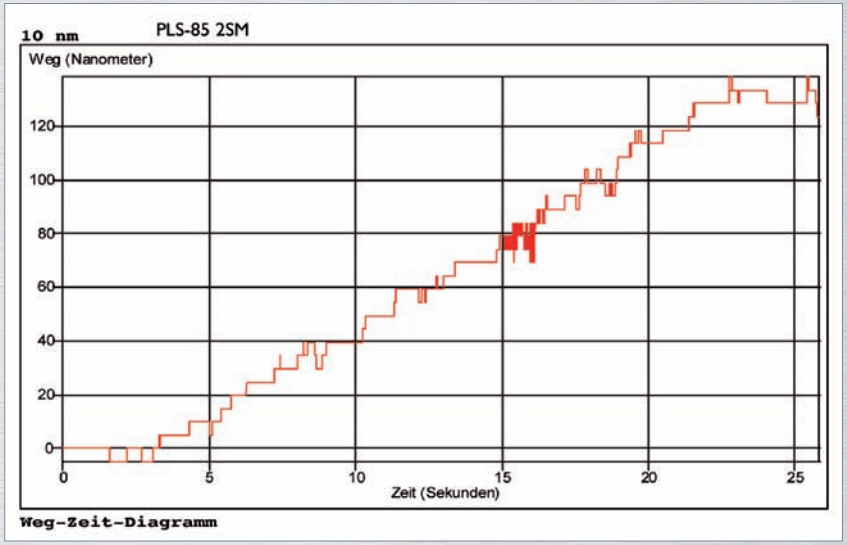


Figure 3: PLS-85, 2 SM open loop, resolution with 10 nm steps

Our eco stage **VT-80** for example 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 finepitch spindle.

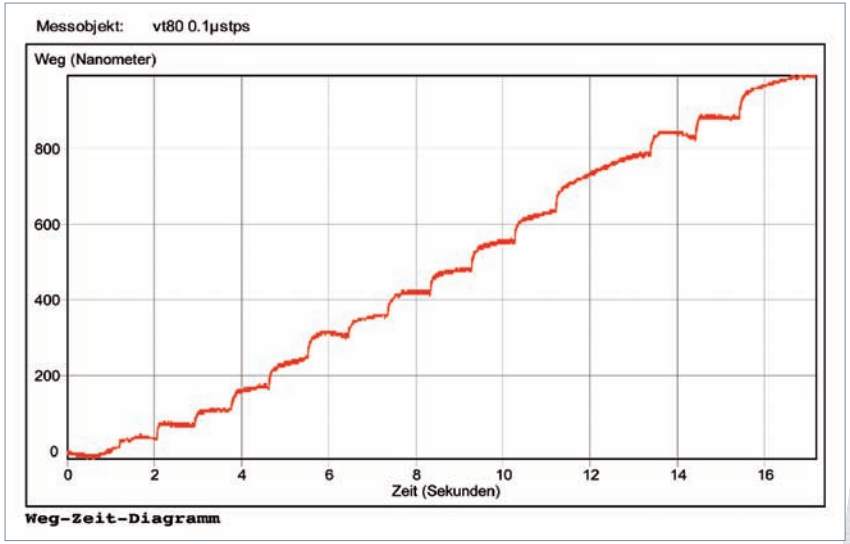


Figure 4: VT-80, 2 SM open loop, resolution with 100 nm steps

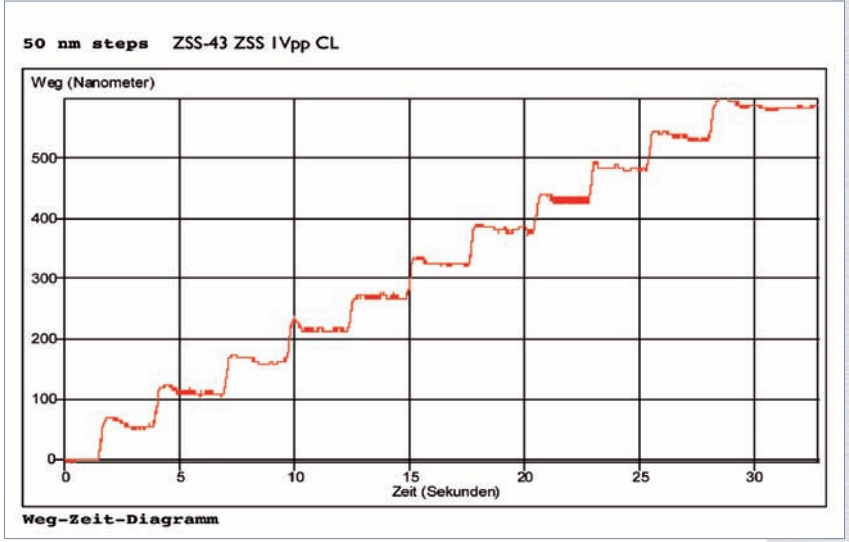


Figure 5: LS-110, 2 SM closed loop 1 Vpp, resolution with 50 nm steps

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 V pp interface of a high resoluting scale. In **figure 5** the measurement of a **LS-110** stage with a linear scale is shown – the resolution of 50 nm is visible in well defined levels.

Even changing the load of the stage doesn´t disturb the positioning.

The resolution is limited by the scale system, so using a 2 nm scale enables resolutions of 2 nm influenced by enviromental disturbances like temperature drifts (example: a change of the temperature by 0.01 degree is resulting in expansion of about 10 nm).

For these applications we designed our ultraprecision stages **UPM-160** and **NPE-200** or customized granite based setups using Heidenhain Zerodur scales.

Speed is one important parameter for setting up a system. Often the maximum speed is requested but for several applications it´s very important to drive very slow and smooth. With standard stepper motor controllers you cannot drive smooth. Even with **DC servo motors** you are not able to drive in the low velocity range in such a linear and smooth way.

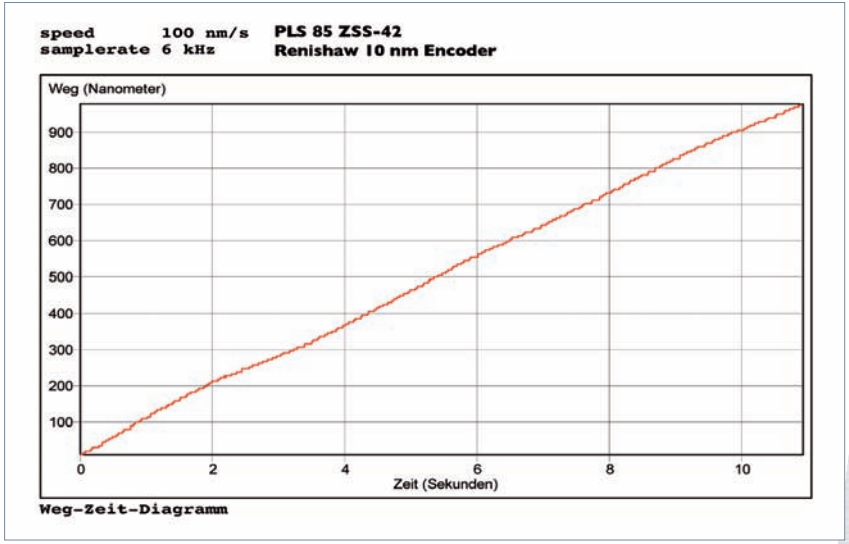


Figure 6: PLS-85, 2 SM closed loop, speed with 100 nm/s

Figure 6 shows the measurement of a **PLS-85** stage with linear scale (with encoder resolution of 10 nm).
The speed of 100 nm/s was choosen, so 360 µm within one hour or about 10 mm per day. The movement is very smooth.
Zooming the first 100 nm travel is shown **figure 7**.
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 more smooth. But its very important to understand that the speed is linear and variations are in the 1 nm/s range which is amazing for a loaded stage with several mm travel range. Also here the results can be improved by using a better encoder resolution. The result of a **UPM-160** stage controlled with 45 nm/s speed is visible in **figure 8**. The movement of 450 nm within 10 seconds is very linear. The interferometer resolution is limiting the interpretation in the picometer per second scale.

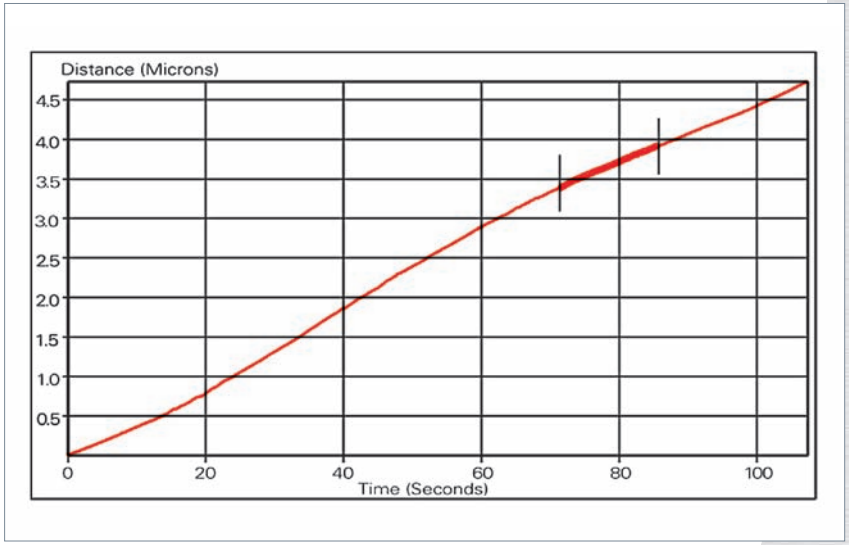


Figure 7: PLS-85, 2 SM closed loop, speed with 100 nm/s

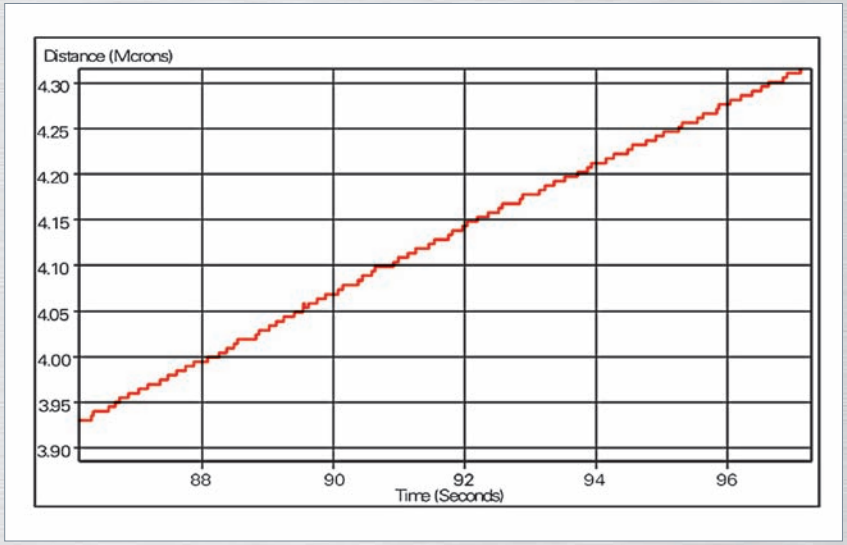


Figure 8: UPM-160, 2 SM open loop, speed with 45 nm/s

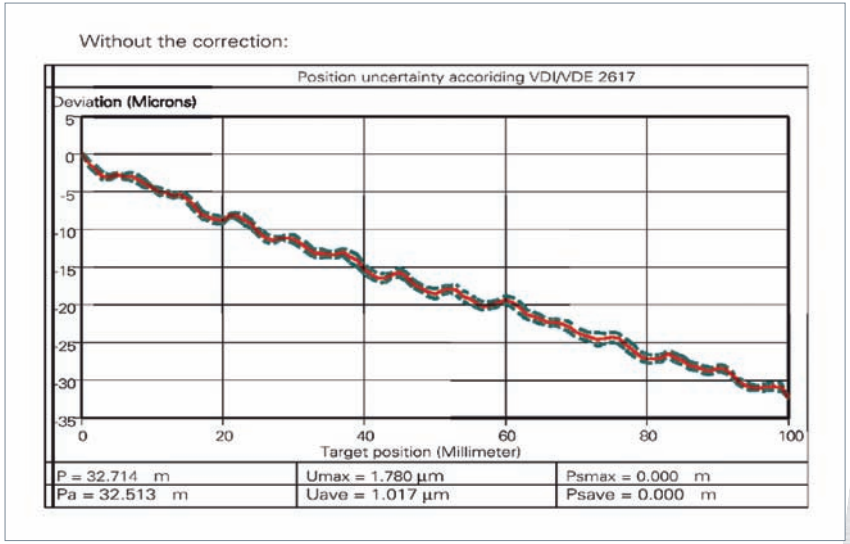


Figure 9: LS-180, 2 SM open loop, positioning error

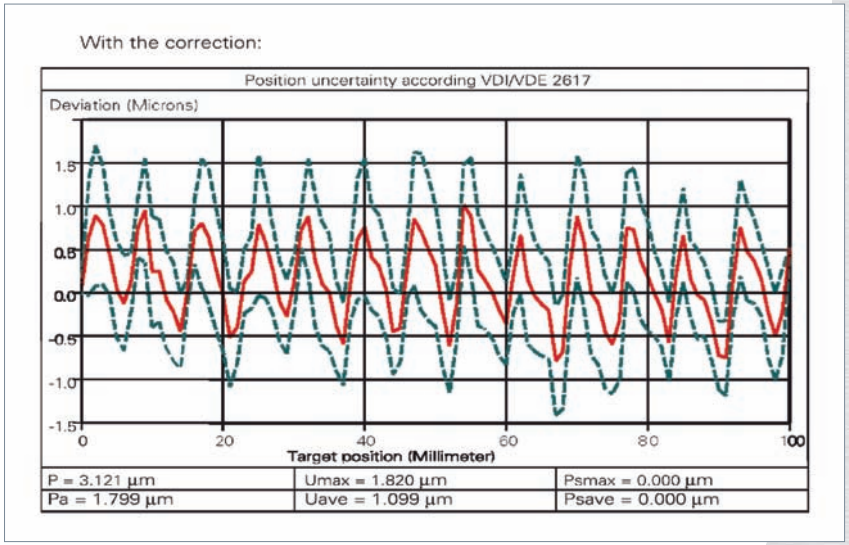


Figure 10: LS-180, 2 SM open loop, position corrected

Positioning to an exact position is normally limited by the quality of the guidances and spindles, so e.g. errors in the spindle pitch are resulting in another position than wanted. **Figure 9** shows the deviation of the position between wanted and measured position. Within a travel range of 100 mm the **LS-180** stage is positioning with a positioning error of 32 µm. The measurement shows both travel directions, so that the bidirectional repeatability, which is depending of 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 option position correction at e.g. **SMC corvus**). The result is presented in figure 10 which looks crowdy at first. But please realize that the deviation scale is 3 µm. The deviation is minimized by a factor of 10 and without gradiating slope. A cost effective method to get rid of system positioning errors.
By using a linear scale system the repeatability and accuracy can be improved further on.

2.040 SMC-series SMC corvus

Keyfeatures

- 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 & sin2 acceleration
- Position-Compare output ≤2 kHz
- Position-Capture (up to 1000 3 axis coordinates)
- Joystick input
- Serial Interface RS-232 115 KBaud
- Ethernet Interface 10Base TCP/IP
- GPIB (IEEE-488) interface
- Venus-1 compatible string-based command language
- Manual, free download: www.micos.ws/support.html

Rack 19" 2HE

Desktop-Chassis

Joystick (optional)

TECHNICAL DATA

Axes	2 or 3 Axes 2 phase stepper-motors
Computer Interface	RS-232 up to 115200 Baud
Supply Voltage	90-250 VAC 50-60 Hz
Cooler	integrated
Power Configuration	Desktop 50 W standard, max. 100 W 2/3 axes 19´´ 2 HE rackmount, max. 240 W 2/3 axes 19´´ 2 HE rackmount, max. 500 W 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 LED`s acoustic messages with integrated buzzer
Amplifier	*48V bipolar 2 Phase,* *with short-circuit & temperature protection*
Phase-current	max. 2.5 - 3 A
Housing	Desktop HxBxT 70x240x305 mm
Software Interface	Windows Demoprogram WINPOS-light DLLs, demo applications (C/Delphi/VB) LabVIEW™ VIs and Demoapplication

Front-Panel

Back-Panel

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**

7170-9-			

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 1 Vpp signals for interpolation 12-bit per axis	**116**
Joystick	Joystick with 2 axes	**106**
	Joystick with 3 axes	**107**
	Joystick with 10 Key-Touch-Display 2 axes	**108**
	Joystick with 10 Key-Touch-Display 3 axes	**109**
Hand-Wheel	Hand-Wheel with 3 axes selector	**110**
Digital I/O	Digital I/O 3 x Inputs (5- 24V) 3 x Outputs (5- 24V) with position-compare trigger-output 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-			

2.050 SMC-series SMC corvus eco

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 & sin2 acceleration
- Position-Compare Output ≤ 2 kHz
- Position-Capture (up to 1000 3 axis coordinates)
- Joystick input or integrated 2/3 axis Joystick
- Serial Interface RS-232 115 KBaud
- USB interface
- Venus-1 compatible string-based command language
- Manual, free download: www.micos.ws/support.html

Back-Panel, with joystick

Front-Panel

SMC corvus eco

SMC corvus-eco 2 Achs Microstep-Controller	**006**
SMC corvus-eco 3 Achs Microstep-Controller	**007**
SMC corvus-eco 2 Achs Microstep-Controller & Joystick	**008**
SMC corvus-eco 3 Achs Microstep-Controller & Joystick	**009**

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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 1 Vpp signals with interpolation 12-bit per axis	**202**
Joystick	external 2 axes	**106**
	external 3 axes	**107**
	Joystick/ 10 Key-Touch-Display 2 axes	**108**
	Joystick/ 10 Key-Touch-Display 3 axes	**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**

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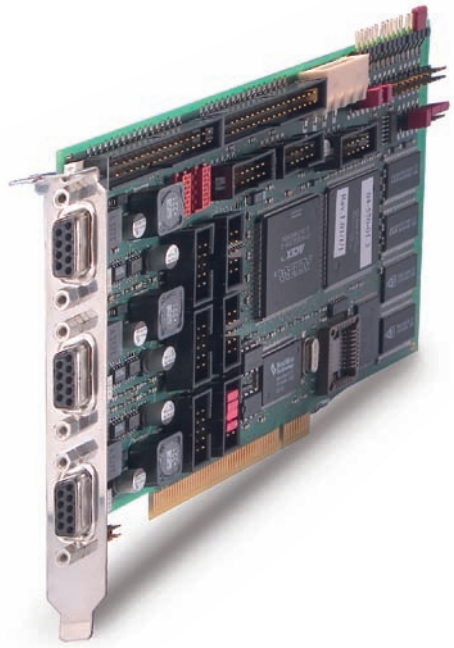
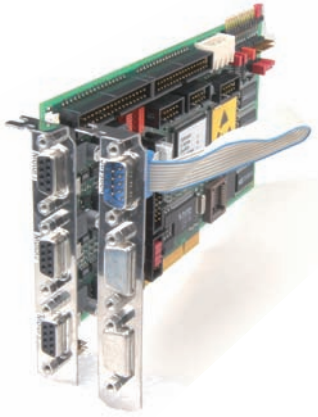
TECHNICAL DATA

Axes	2 or 3 Axes 2 phase stepper-motors
Computer Interface	-RS-232 up to 115.2 kBaud -USB interface
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) <0.1 µm/s .. 25 rev/s (200 step motor) speed-upgrade
Program and Parameter	Flash-Memory
Amplifier	24 V bipolar 2 Phase, with short-circuit & temperature protection
Phase-current	max. 1.5 A
Housing	Desktop 65x225x216 mm [HxWxD]
Software Interface	Windows Demoprogram WINPOS DLLs, demo applications (C/Delphi/VB) LabVIEW™ VIs and Demoapplication

Key features (see SMC corvus eco)

- 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
- Manual, free download: www.micos.ws/support.html





Joystick

SMC corvus pci

2 axis SMC corvus pci Microstep-Controller	**002**
3 axis SMC corvus pci Microstep-Controller	**001**

7161-9- | | | |

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 1 Vpp signals with interpolation 12-bit per axis	**116**
Joystick	external 2 axes	**106**
	external 3 axes	**107**
	Joystick/ 10 Key-Touch-Display 2 axes	**108**
	Joystick/ 10 Key-Touch-Display 3 axes	**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	
ext. Power supply	24V DC/60 W	**126**
Joystick	interface SMCpci	**105**

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TECHNICAL DATA

Axes	3 Axes 2 phase stepper-motors
Computer Interface	pci-COM bridge 115200 Baud
Supply Voltage	12 V PC or external up to 24 V DC
Power Configuration	12 V PC, max. 30 W 2/3 axes 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) <0.1 µm/s .. 25 rev/s (200 step motor) speed-upgrade
Program and Parameter	Flash-Memory
Amplifier	12 V..24 V bipolar 2 Phase, with short-circuit & temperature protection
Phase-current	max. 1.5 A
Housing	pci slot HxB 99x184 mm
Software Interface	Windows Demoprogram WINPOS DLLs, demo applications (C/Delphi/VB) LabVIEW™ VIs and Demoapplication

2.060 SMC-series SMC pollux

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
- Manual, free download: www.micos.ws/support.html

Pocket Box Controller

Motor & Controller System

Pollux Box Controller

Type I	511
Type II	512
Type III	513

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Pollux Motor & Controller

Type I	501
Type II	502
Type III	503
Type II HT (100 Ncm)	504
Type CL - I	514
Type CL - II	515

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Pollux Accessories

SMC pollux RS-232 cable RJ45-RJ45, 0.5 m length to combine 2 pollux controller	524
SMC pollux RS-232 cable DSub9-RJ45, 2 m length For PC-connection	520
SMC pollux power supply, 60 W, 90-264 VAC	522
SMC pollux DIN Rail mounting-kit	530
SMC pollux Ethernet TCP/IP Interface for Pollux Chassis	544
SMC pollux Ethernet TCP/IP Interface DIN-Rail	545
SMC pollux 4 Axis Chassis 19" 3HE 84TE	550
SMC pollux 8 Axis Chassis 19" 3HE 84TE	551
SMC pollux 12 Axis Chassis 19" 3HE 84TE	552
SMC pollux 16 Axis Chassis 19" 4HE 84TE	553
SMC pollux CL 4 Axis Chassis 19" 3HE 84TE	554
SMC pollux CL 6 Axis Chassis 19" 3HE 84TE	555
SMC pollux CL 8 Axis Chassis 19" 4HE 84TE	556

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

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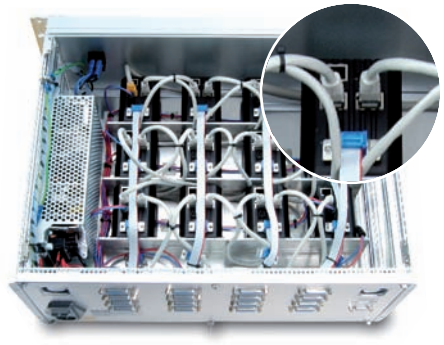
SMC pollux network (2-axes), DIN rail



SMC pollux 16 Axes Chassis 19" 4H 84T

Pocket Box Controller Closed Loop

Motor & Controller System with DT-80,
see page 5.130

Motor & Controller System with VT-80,
see page 4.210

Motor & Controller gear combination

TECHNICAL DATA

Axes	1 axis, 2 phase stepper-motors
Computer Interface	RS-232 19200Baud
Supply Voltage	24 VDC
Phase Currents	≤ 1.2 A/phase
Limit Switches	2 per axis software configurable
Velocity range	for 200 step motor <0.1 µm/s .. 13 rev/s TYPE I <0.1 µm/s .. 25 rev/s TYPE II <0.1 µm/s .. 40 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, with short-circuit & temperature protection
Version with integrated 2-Phase stepper motor	
Motor torque	16 Ncm (Type I) 16 Ncm (Type II) 32 Ncm (Type III) 100 Ncm (Type II HT)
Housing	Pocket-Desktop (without motor), or Motor/Controller HxWxD 48x56x97 mm (additional motor shaft 20 mm)
	19" Chassis SMC-pollux integration box: 3HE 84TE Chassis with 90..230 VAC power
Software Interface	Windows Demoprogram SMC_Pollux DLLs, demo applications (C/Delphi/VB) LabVIEW™ VIs and Demoapplication

2.070 SMC-series SMC hydra

Key features

- 2 axis Motion-Controller
- High Resolution Microstep Amplifier for
  DC brush, 2-Phase Stepper, 2- and 3-Phase Linear / Torque Motors
- Motor Type Software configurable
- 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
- Linear interpolation
- Ethernet 10/100 MBit
- RS-232 up to 460kbaud
- VENUS-3 compatible string-based command language
- Manual, free download: www.micos.ws/support.html

Available soon:

- Handwheel (Can-Bus)
- Joystick (Can-Bus)
- Digital IO expansion (Can-Bus)
- Linear Amplifier (no PWM, for electrical noise sensitive applications)
- Piezo Motor Amplifier

SMC hydra CM

SMC hydra

SMC hydra CM	2 Axis Motion Controller 24 V	**600**
SMC hydra TT	2 Axis Motion Controller 24 V	**601**
SMC hydra TT	2 Axis Motion Controller 48 V	**602**
SMC hydra CM	2 Axis Motion Controller 48 V	**603**

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SMC hydra options:

Motor with absolute encoder & gearbox 5 Nm	**610**
Motor with absolute encoder & gearbox 12 Nm	**611**
Motorcable for motor with absolute encoder	**620**
Power-Supply 24 V / 360 W	**621**
Power-Supply 24 V / 90 W	**622**
1 Vpp interface 2 axes	**630**

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TECHNICAL DATA

Communication	RS-232 interface, 460 kBaud, Ethernet 10/100 MBit
Motortypes	Stepper, Linear and torque motors 1, 2 and 3 Phase up to 10 A phase-current Servo-motors up to 200 W
Input/Output	6x Inputs, optically isolated, 5-24 V 1x Input for Emergency (optically isolated) 4x 10 Bit analog Outputs 1x open Drain Output (100mA) fast trigger-output / trigger-input
Memory	Parameter & Program 8 MByte
Operating System	Realtime
Operation	Open Loop and Servo
Amplifier principle	Digital MOS-FET, galvanicaly isolated, 24 V
Power-Supply	hydra CM : 24 VDC 48 V 360 Watt (optional) hydra TT : 90-260 VAC 300 Watt

SMC hydra CM

SMC hydra CM front

SMC hydra TT front

SMC hydra TT rear

Special motors with absolute encoders

with absolute encoder, IP65

with absolute encoder

with absolute encoder + gearbox

The newest member of the **SMC-series** offers now a Closed-Loop with a specially designed new absolute encoder system.

Just power-on the system, no homing necessary, you know where you are. By the way, the new **SMC-hydra** supports classical rotary and linear encoders 1Vpp, 2 Phase stepper motors, 2 Phase and 3-Phase direct drives, and standard DC-brush motors.

In preparations is a piezo-motor implementation for our PiCo stages. The very powerfull processor architecture (PowerPC) gives us a high flexibility offering new features. Modern communication-interface via Ethernet 10/100 Mbit and High-Speed RS-232 simplifies the software integration.

The VENUS-3 command-interpreter is based on our well known Venus-1 and Venus-2 interpreters.

2.080 SMC-series SMC taurus / SMC pegasus

Key features

- Analog joystick-port
- Manual hand-wheel 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 (source-code)
- Manual, free download: www.micos.ws/support.html

The **SMC taurus** is a compact, high-resolution single axis position-controller for 2 and 3 phase linear- and rotational motors, with integrated amplifier.

The **SMC pegasus** is a multi-axis high-resolution motor controller, especially designed for linear and rotational 2 and 3 phase motors. With this new technology based on our well known SMC-series, we are able to offer a controller which covers many requirements, from low-cost open-loop, up to high-end air-bearing linear motor systems with resolutions in the **10 nm** range.

The commands are sent via the serial interface RS-232, the command language is Venus-2 (modified Venus-1).

We are able to drive more than 30 axis with one serial interface RS-232.

pegasus Desktop 19" Chassis

taurus Desktop Chassis

TECHNICAL DATA

Computer Interface	*RS-232 19200 Baud*
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)* *< 0.1 µm/s .. 500 mm/s (linear motor)*
Program and Parameter	*Flash-Memory*
Amplifier	*48 V, bipolar 2Phase Stepper ,* *2 Phase Linear/Torque Motor,* *3 Phase Linear/Torque Motor* *with short-circuit & temperature protection*
Housing	*SMC-pegasus 19" 4HE*
	SMC-taurus desktop
Software Interface	Windows Demoprogram SMC-Pegasus DLLs, demo applications (C/Delphi/VB) LabVIEWTM VIs and Demoapplication

7160-9-			

How to order
If you are looking for:
- 3 axes controller mixed configuration inclusive:
- one Rotation Stage PRS-110 stage open-loop
- one Ultra Precision Stage UPM-160 stage closed-loop (with LS-020, Linear scale)
- one Linear Motor Stage UPS-150 stage closed-loop (with LS-020, Linear scale)
- RS-232 interface

ordering as follows:
1x SMC pegasus 19" 3HE rackmount, 300 W 304
1x SMC Com-module RS-232/CAN 311
1x SMC pegasus axis module 1.5 A 312
1x SMC pegasus axis module 2.5 A 313
1x SMC pegasus axis module 10 A 315
2x SMC taurus/pegasus closed-loop 1Vpp 121
with integrated interpolator

If you are looking for:
- 1 axis controller:
- one Rotation Stage UPR-160 AIR

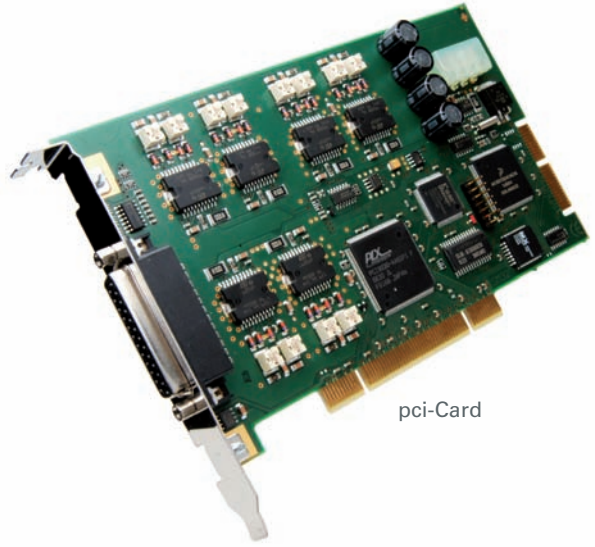
ordering as follows:
1x SMC taurus, 100 W 331
1x Closed Loop 1 Vss with integrated interpolator 12-bit 121

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 axis contouring (PvT mode)
- Programming examples for VC5, VB5, Delphi, Visual Studio, LabVIEW™
- Manual, free download: www.micos.ws/support.html

Available soon:

- PCI Express (a new PCI Slot standard)
- Desktop with USB Interface
- Continues Path Control



pci-Card

SM-32 pci

3 axes pci Microstep Controller **001**

SM-32 Accessories

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

Others interfaces on request

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TECHNICAL DATA

Axes	3 Axes 2 phase bipolar stepper motors
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 Demoprogram SM32 DLLs, demo applications (DOS/C/Delphi/VB) LabVIEW™ VIs and Demoapplication

micos® www.micos.ws | info@micos.ws | phone: +49-(0)7634-50 57 230 | fax: +49-(0)7634-50 57 393

Key features

- Single axis servo controller for 2 Phase brush motors, 3 Phase brushless motors, linear and torque motors
- RS-232 interface for 1 axis, CANopen for multi axes applications
- SimpliQ 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

Manual, free download: www.micos.ws/support.html

The **LMC-100** is based on an intelligent miniature digital servo drive for DC brush and brushless motors, linear motors and voice coils. The system supports up to 5 amps continuous current. Its high density allows the drive to deliver 480 W peak power and 200 W continuous power. Based on SimpliQ technology, the **LMC-100** is capable of operating in position, velocity and current modes and contains a wide range of feedback and I/O options. By using the Composer software, users can easily perform drive setup, configuration, tuning, analysis and programming. The drive operates on DC power.

LMC-100 Controller

7802-9-	0	0	1

Accessories

LMC-100 power-supply 50 W, 90-264 VAC	**100**
LMC-100 power-supply 100 W, 90-264 VAC	**101**
LMC-100 power-supply 200 W, 90-264 VAC	**102**
LMC-100 Daisy-Chain Gateway RS-232-CAN	**110**
LMC-100 USB-CAN Interface	**111**

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TECHNICAL DATA

Axes	1 axis RS-232 , up to 127 with CANopen
Computer interface	RS-232, CANBUS (CANopen DS402, DS305)
Supply voltage	12..48 V DC
Motor-current	up to 5 A, 10 A peak
Limit Switches	2, npn / pnp type 5..24 VDC
Digital Input	2, npn /pnp type 5.. 24 VDC
Digital Output	2, 24 V DC 0.5 A open collector for resitive/inductive load
Program and Parameter	Flash-Memory
Amplifier	PWM 22 kHz
Position/ Speed Current/ Loop	4 kHz / 8 kHz / 16 kHz
Housing	Pocket Desktop
Software interface	Windows Setup and configuration tool Automatic and manual tuning, analysis and debugging WINDOWS DLL

2.100 MoCo-series MoCo dc

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
- Manual, free download: www.micos.ws/support.html

Back-Panel

Desktop Single Axis

MoCo dc Controller

MoCo dc pocket-desktop-controller **021**

MoCo dc Accessories

Power Supply **002**

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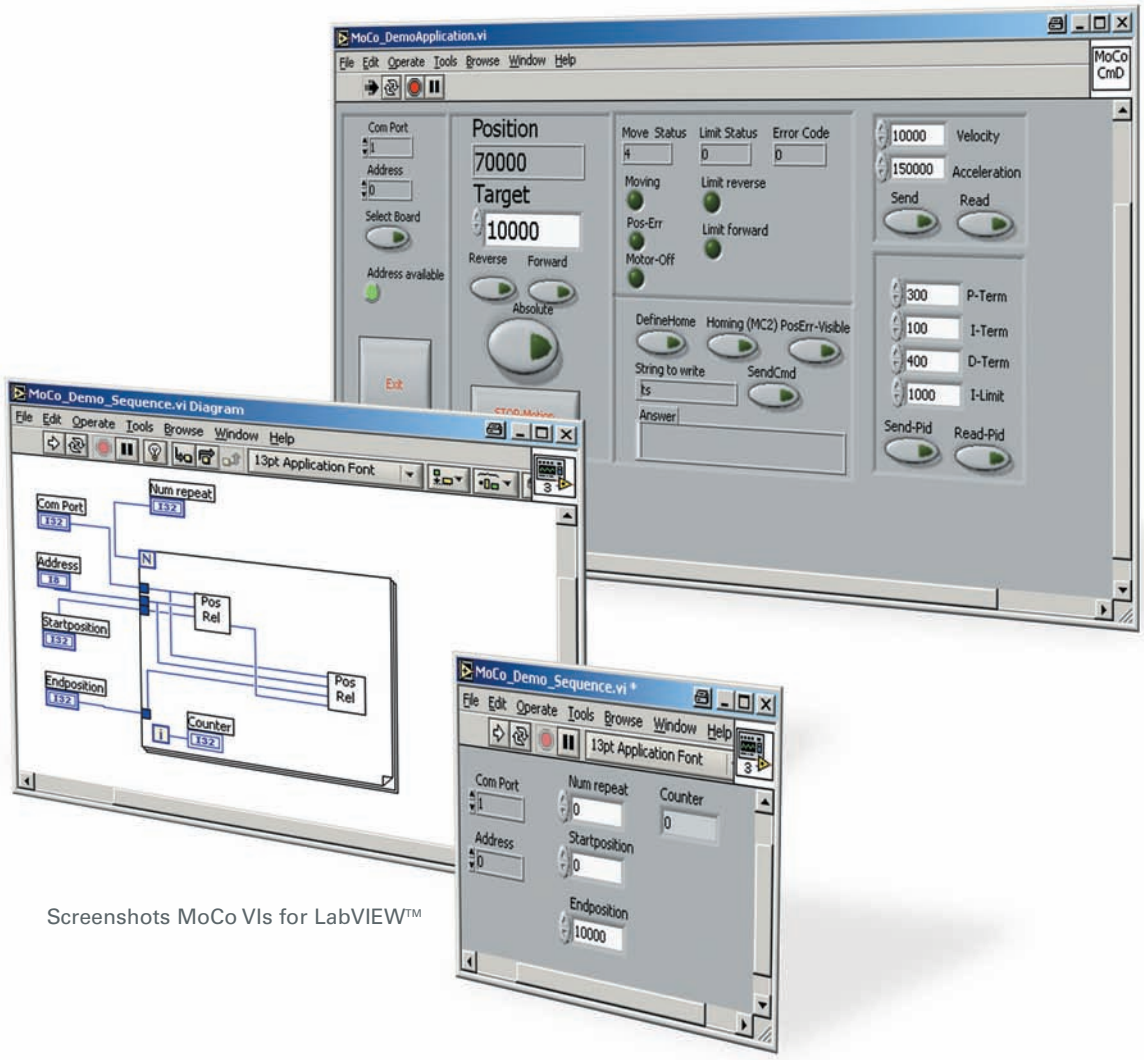
TECHNICAL DATA

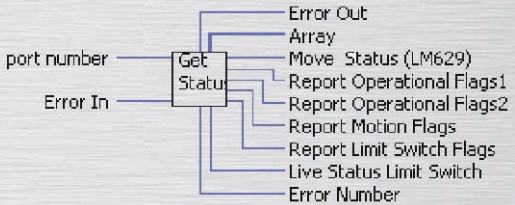
Axes	1 axis, DC- motors brushed types
Computer Interface	*RS-232 up to 38.4k*
Supply Voltage	24 VDC
Phase Currents	≤ 3 A
Limit Switches	Positive and negative limit switch input, Optically isolated, wide voltage range
Position Counter	32-bit position control 2 000 000 000 steps in each direction with 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 *Analog Inputs* *Analog Output*	*4, open-collector 0.5 A 24 VDC* *2, 0-5 V 8bit resolution* *1, 0-5 V 8bit resolution*
Option	-Break-Output -Manual Control -open frame version
Software Interface	LabVIEW™ VIs and demo application



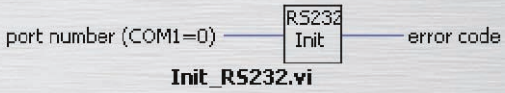
Screenshots MoCo VIs for LabVIEW™

Some examples of MoCo VIs for LabVIEW™:

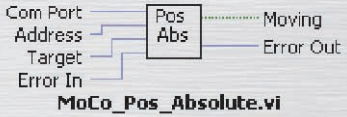
MoCo_Getposition.vi



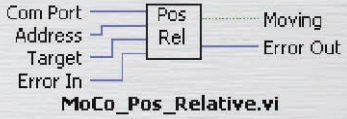
MoCo_GetStatus.vi



Init_RS232.vi



MoCo_Pos_Absolute.vi



MoCo_Pos_Relative.vi

2.110 PiCo-series PiCo 33 Piezo

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 up to 3 axes
- Customized designs
- USB-interface optionally (without keypads)
- USB closed-loop controller (optionally)
- Manual, free download: www.micos.ws/support.html

PiCo 33 Piezo USB

Application PP-30 HV

Desktop

PiCo 33 Piezo Controller

PiCo 33 Piezo Controller RS 232 . . . . . **001**
PiCo 33 Piezo Controller USB **003**
PiCo 33 Piezo Controller USB closed loop **011**

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TECHNICAL DATA

	Pico 33 RS-232	Pico 33 USB	Pico 33 USB Closed-Loop
Power supply:	Batterie AC adapter worldwide	USB-interface	AC adapter worldwide
Operation modes: *Local* *Remote*	 Keyboard RS-232-Interface	 USB 1.1 interface	 USB 2.0 interface
Connections: *Motor Output*	RS-232-interface DB9m 3 axis DB9f	USB B 3 axis DB9f	USB B 3 x MMCX per axis
Speed modes:	"Fast" "Slow" ("Fast"/2) "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 executable software with action buttons DLL with source code 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
	Batterie		

More info: Detailed information, concerning motor and connectors, see: Appendix

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 3 mm/s
- No setup or adjustments required
- Universal power supply included

Manual, free download: www.micos.ws/support.html

The **PMA-100** is a piezo motor amplifier that allows to drive piezo stages like the PP-30 or LPS-35 to be directly driven by a stepper motor controller. By implementing a proprietary algorithm, any standard stepper motor controller that outputs pulse and direction signals can drive a piezo motor the same as it would drive a stepper motor. This allows the user to mix stepper and piezo motor stages on the same controller platform. The typical open loop step width is 1.5 nm, but depends on the stage type, load and other factors. Besides the standard pulse and direction signals, the connector also has a "motion disable" line; closed loop option is available. All signals are TTL or open collector compatible.

PMA-100

7803-9-	0	0	1

— TECHNICAL DATA —

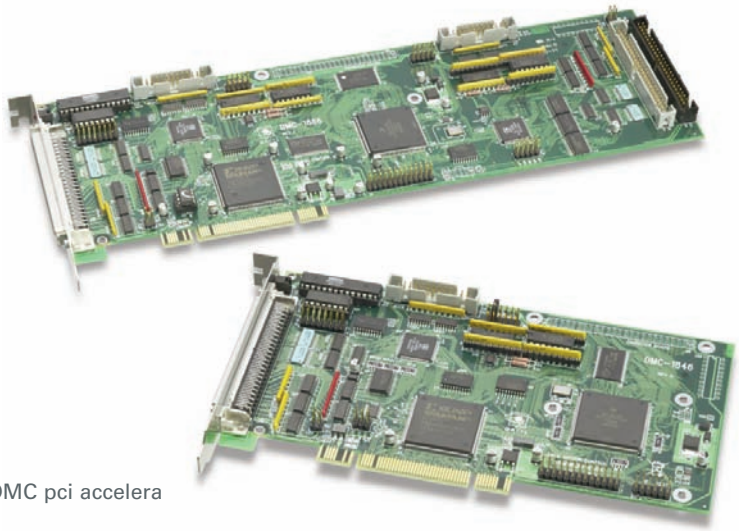
motortype	1Phase Piezo-Ceramic motors inertial or stick-slip
Bus Voltage	5 VDC (36 V internally)
Control Signal	Clock/direction (TTL or open-collector)
Typical step size	1.5 nm (This value varies depending on the stage type, load size and a number of other mechanical factors)
Maximum Velocity	about 3 mm/s (depends mainly on the piezo motor characteristics)
Material	Special-Alu, black anodized

2.120 DMC-series DMC Controller

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

Manual, free download: www.micos.ws/support.html



DMC pci accelera

DMC motion controllers use a 32-bit microcomputer and are packed with powerful features to handle any application no matter how simple or complex.

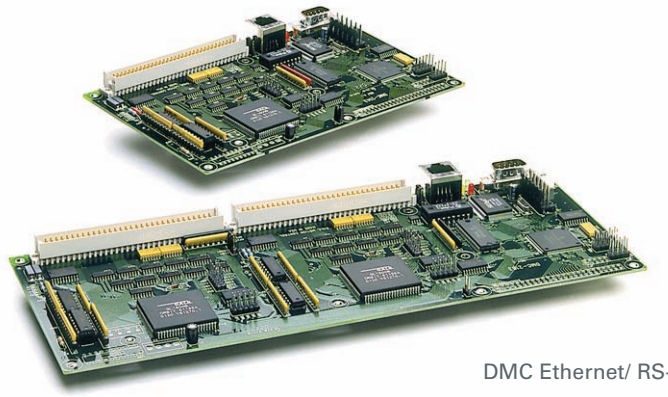
That means you get advanced PID tuning with notch filter, velocity and acceleration feedforward, non-volatile memory with multitasking to execute application programs, and plenty of analog and digital I/O for interfacing to external sensors. They also handle various modes of motion including point-to-point positioning, velocity control, linear and circular interpolation, contouring, electronic gearing and ECAM.

micos also provides numerous accessories such as 19" amplifier chassis (MPA's), standard software tools, a communication library for Windows (Linux, DOS and QNX versions are also available) includes sample programs, utilities, a complete terminal program, and full documentation. With this library, all **DMC motion controllers** can be programmed using C/C++, VB dotNet, LabVIEW™, etc.

As option we can deliver a very powerful ActiveX Tool Kit.

TECHNICAL DATA

	DMC controllers
Block execution time	In contour mode, up to 500 blocks (moves)/sec with full trajectory calculation
Position accuracy	1 quadrature count
Velocity accuracy	Long-term: phase-locked, better than .003% Short-term: system dependent
Synchronization	All axes in the same card are perfectly synchronized and share the same servo cycle. All cards sharing synchronization signal are perfectly synchronized in the same servo cycle.
Position capture accuracy	25 microsec with optoisolation; 0.1 µs
Position range	±2,147,483,647 counts/move; automatic rollover;
Acceleration/Deceleration	1,024 to 67,107, 840 counts/sec² mm
Motor command resolution	16-bits or 0.0003 V
Step motor control mode	Full, half, or microstep
Feedback	Two channels of A/B quadrature per axes with third channel for index. In servo mode, includes auxiliary encoder inputs for each axes. Single-ended or differential. Can be configured for quadrature or pulse and direction. Option for analog feedback or absolute encoders.
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.
Axes	1-8 axes per card, pci Eco 1-4 axes
Software Interface	Plug and Play: Utilities for DOS and all Windows versions Windows Terminal Smartterm DLLs, demo applications C and LabVIEW™ VIs



DMC Ethernet/ RS-232

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..8	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 isolateted	8..16 optically isolated
Digital Outpus	8..16 TTL	8..16 TTL	8 HighSide Driver 8 TTL (5.8 axis)
Analog Inputs	no	8	no, optional
Dual Encoder	no	yes	yes

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) **5**

number axes..... **n**

miCos MPA Power Amplifier Systems, see page 2.140

Independent Axes Positioning: In this mode, each axis follows its own prescribed profile.

Jogging: The jog mode allows the user to command each motor to run at a prescribed jog speed.

Linear Interpolation: The **DMC controllers** provide a linear interpolation mode for any combination of 1 to 8 axes.

Linear and Circular Interpolation: The **DMC controllers** coordinated motion mode (VM) makes it easy to follow a two-dimensional path consisting of multiple straight-line and arc segments.

Motion Smoothing: To eliminate the jerk of mechanical systems, the **DMC controllers** provides profile smoothing.

Contouring: The contouring mode allows the user to bypass the **DMC controllers** motion profiler. It prescribes any arbitrary position trajectory defined by position increments.

Electronic Gearing: This mode allows up to 8 axes to be electronically geared to up to 4 masters.

Electronic Cam: This mode allows synchronizing up to seven axes with a master axes according to any function.

Dual Loop: The dual-loop encoder feature enables the **DMC controllers** to compensate for backlash.

High Speed Encoder Compare: The controller produces a pulse every time the encoder passes a second specified distance. This feature is useful for triggering external events to exact positions within 0.5 microseconds.

High Speed Latch: For precisely synchronizing the position to an external input, the high speed latch captures exact main or auxiliary encoder position on the occurrence of an input.

2.130 FlexMotion series Controllers

Key features

- Stepper / servo 4-axis 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, ServoTune PID utility, DLLs (for Windows programming), C/C++ libraries, VIs (for LabVIEW™, LabWindows/CVI)
- Manual, free download: www.micos.ws/support.html

FlexMotion pci

High Performance Controller 735x series:

NI pci-7352, 2-axis servo / step Controller	**440-02**
NI pxi-7352, 2-axis servo / step Controller	**540-02**
NI pci-7354, 4-axis servo / step Controller	**440-04**
NI pxi-7354, 4-axis servo / step Controller	**540-04**
NI pci-7356, 6-axis servo / step Controller	**440-06**
NI pxi-7356, 6-axis servo / step Controller	**540-06**
NI pci-7358, 8-axis servo / step Controller	**440-08**
NI pxi-7358, 8-axis servo / step Controller	**540-08**

Mi d-Range Controller 734x series:

NI pci-7342, 2 axis servo / step Controller	**916-02**
NI pci-7344, 4 axis servo / step Controller	**916-04**

778				-		

NI pxi-7344, 4 axis servo / step Controller

777	9	3	5	-	0	1

Accessories:

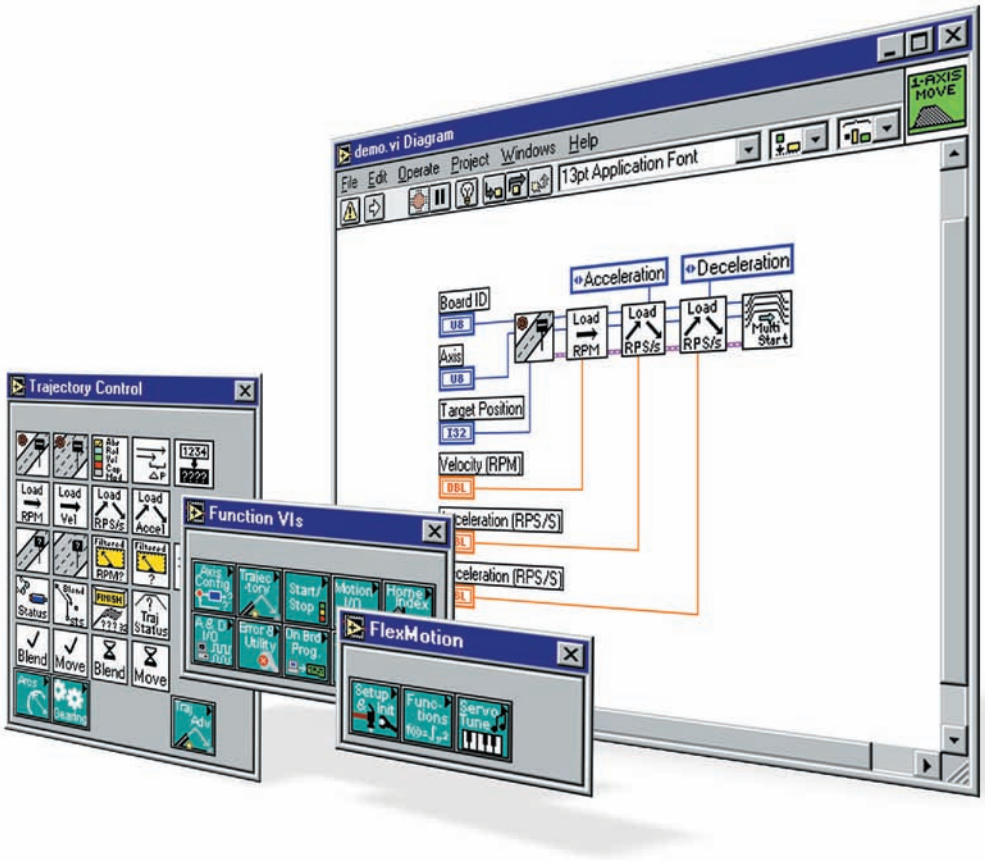
Cable SH68-C68-S 68-Pin VHDCI to 68-Pin. D-Type, 2m

186	3	8	1	-	0	2

miCos FlexMotion Amplifier Systems, see page 2.140

With the **FlexMotion-series**, miCos offers a family of high-performance servo and stepper motion controllers for use in pci, PXI/CompactPCI, and IEEE-1394 (FireWire) computers. The **FlexMotion** high-performance capabilities are the direct result of an advanced controller architecture using a Motorola real-time 32-bit CPU, combined with an Analog Devices DSP and custom FPGAs (field programmable gate array). This multitasking, dual-processor controller design easily accomplishes all advanced motion profiles. The FIFO bus interface and powerful command set provide high-speed communications and offload complex motion functions from the host PC for optimum system performance.

FlexMotion is a family of advanced technology controllers for all motion applications, bringing full-feature capability for the most sophisticated requirements. **FlexMotion** gives you blended motion trajectory control and fully coordinated circular, linear, point-to-point, gearing, and vector space control in either embedded real-time motion operation or host-centric programming environments.



FlexMotion VIs for LabVIEW™

The **FlexMotion** VI library contains hundreds of high-level VIs for controlling National Instruments **FlexMotion** controllers with LabVIEW™. **FlexMotion** VIs bring fully integrated, graphical, object-oriented programming to motion control. **FlexMotion** VIs are designed to simplify and maximize the power of National Instruments motion controllers. Hundreds of powerful functions, including Configure Axis Resources, Load Circular Arc, Blend Motion, Enable Gearing, and Run Program are fully functional VIs. **FlexMotion** VIs, combined with LabVIEW™ analysis and programming functions, provide high-level multi axes control in an easy-to-use graphical development environment.

Additional Software

Additional to the **FlexMotion** VIs, Windows DLLs and **FlexMotion** Servo Tune are included. With the DLLs, you can write your own applications using C++, Delphi or Visual Basic. Also included are C/C++ libraries and some examples in C, Visual Basic and LabWindows/CVI. Servo Tune provides a graphical interface to PID parameters for setting and tuning.

2.140 MPA Power Amplifiers

Order No.	7145-9				

Number axes (1..8 axes) ..... n

Type of amplifier

DC-brush 2 A	0
DC-brush 5 A	1
2SM microstep 24 V 2 A	3
3-Phase brushless 24 V 5 A	4
DC brush 12 V 1 A	5
3-Phase linear/torque motor	6
Piezo-Motor Driver (PMA-100)	7

Interface to controller

NI Flexmotion Controller	0
DMC PCI controller	1
DMC Ethernet/RS-232 Controller	2
Delta-Tau PMac Controller	3
Delta-Tau UMac Controller	4
others	9

Bus voltage & power

12 VDC 100 W	0
24 VDC 150 W	1
24 VDC 220 W	2
48 VDC 220 W	3
others	9

MPA amplifiers

For the several PC-Slot controllers like FlexMotion, DMC and Delta-Tau-series, **micos** offers power-amplifiers, which fit very well to **micos** stages. The design of the system bases on standardized 19" rackmount housings, with all necessary devices integrated. All available signals of the controllers are broken out to per axis specific DSub-connectors which fits to our motorcables. The controller-specific motion-independent signals like digital and analog I/Os are wired to additional connectors.

We integrate several different amplifier-modules to meet the desired demands, mixed versions (different power/bus-voltage/drive-type/drive-principle) are also available on request.

The most sold types are the two servo-brush modules documented in this paper.

Possible configurations (number of axis 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

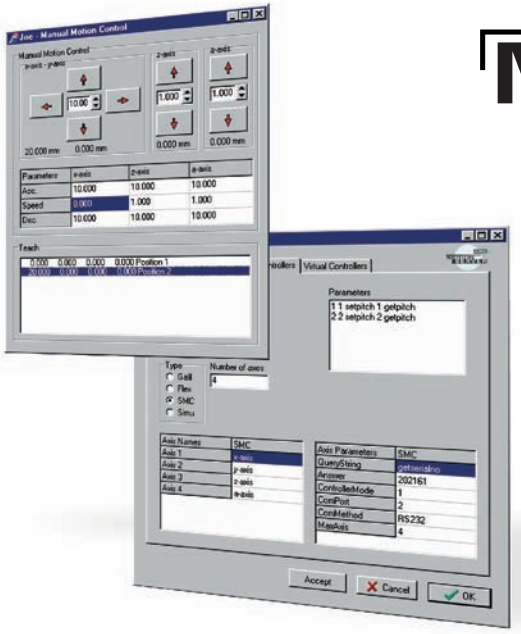
TECHNICAL DATA

Amplifier	**Type 0**	**Type 1**	**Type 3**	**Type 4**	**Type 6**	**Type 7** (see PMA-100)
Motortype	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	microstepping
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

Key features

- Complete separation of the application from the motion hardware
- Mixed operation of several controllers from different manufacturers
- Axes of several controllers can be grouped to virtual controllers
- Virtual controllers for any number of axes
- Manual Control window for operating the axes even without an application software
- TCP/IP connection between application and Motion Server
- Easy command language for the communication
- Command Prompt window to use the commands even without an application software
- Manual, free download: www.micos.ws/support.html

MICOS® MOTION SERVER



Command set - examples

Joe Power On	starts communication with the controller, initialization
Joe Calibrate 1 2 3 4	starts a homing sequence for axes 1-4
Joe MoveAbs 10 20 30 40	moves axes 1-4 to the coordinates 10, 20, 30, 40 mm
Joe AxisRel 1 20	moves axis number 1 relatively by 20 mm

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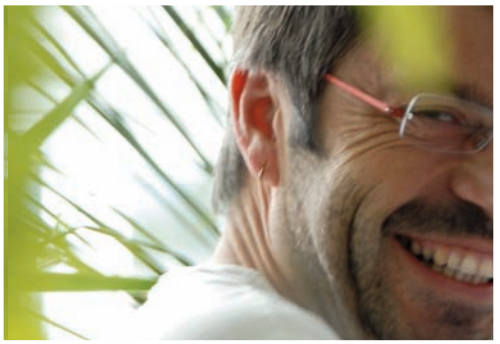
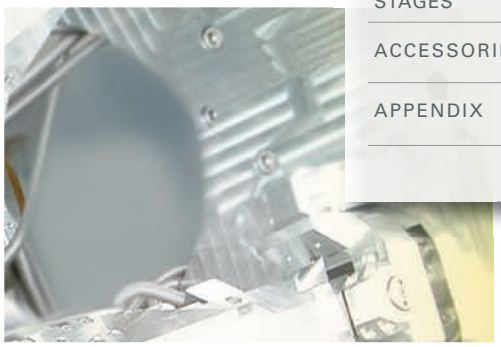
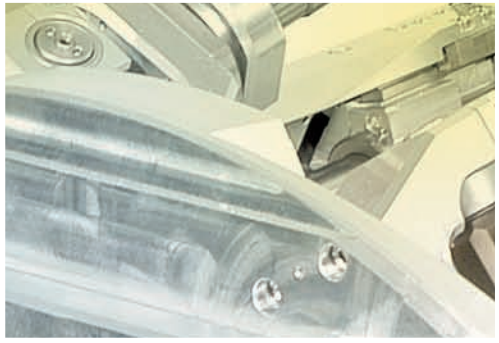
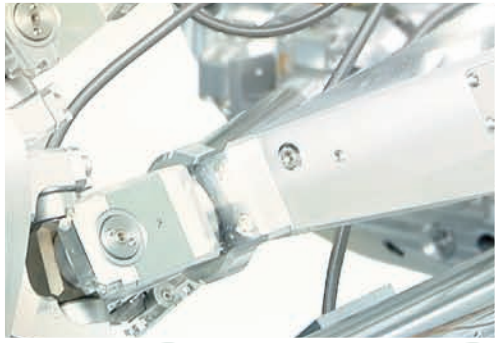






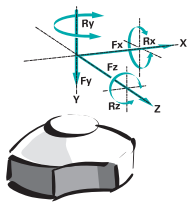


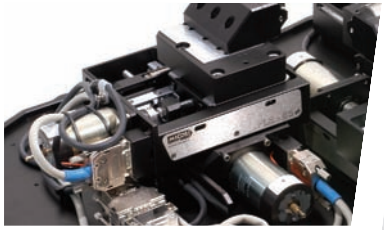

ROBOTICS

3.010 SpaceFAB SF-3000 BS

FACTS

Load Characteristics	Fx(N)	Fy(N)	Fz(N)	Mx(Nm)	My(Nm)	Mz(Nm)
DC-B-034	5	30	5	0.2	0.2	0.2





With one **SpaceFAB SF-3000 BS** all six degrees of freedom can be moved without additional positioning elements. The low weight of the moving platform allows high-dynamic positioning processes. The non pre-loaded design can easily carry up to 2 kg center mounted. **SpaceFAB SF-3000 BS** is operating in closed loop mode.

SpaceFAB SF-3000 BS was especially developed for applications in fiber-optic alignment. Furthermore **SpaceFAB SF-3000 BS** is perfectly designed for auto alignment of optical components, micro-fabrication and bio-genetic. The core software used for the **SpaceFAB**

Software

- Pivot point can be set by the customer
- Digital display of position and orientation
- Control by Macro-language stored in own editor
- Jog mode

Keyfeatures

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

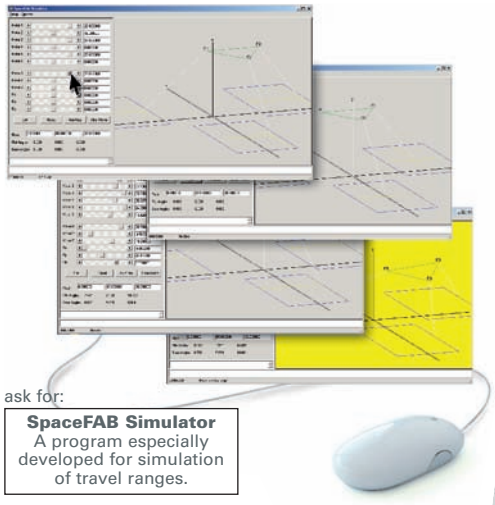
TECHNICAL DATA

Travel Range		
X,Y	*(mm)*	50 x 12.7 *
Z	*(mm)*	100 *
Rx, Ry	*(°)*	10 *
Rz	*(°)*	10 *
Velocity Range	*(mm/sec)*	0.01 ... 10 **
Velocity Range	*(°/sec)*	0.01 ... 10 **
Ballscrew Pitch	*(mm)*	1
Bi-directional Repeatability (µm)		X, Y, Z +/- 0.5
Bi-directional Repeatability (µrad)		Rx, Ry, Rz +/- 20
***Motor** (Pitch 1 mm)*		**DC-B-034**
Speed max. X,Y, Z	*(mm/sec)*	30
Speed max. Rx, Ry, Rz	(°/sec)	10
Resolution X,Y, Z	*without load (µm)*	0.2
Resolution Rx, Ry, Rz	*without load (°)*	0.0005
Weight (kg)		24
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 more information, please contact us, For turned key solutions, please contact us*
The travel range is depending on the position of the pivot point

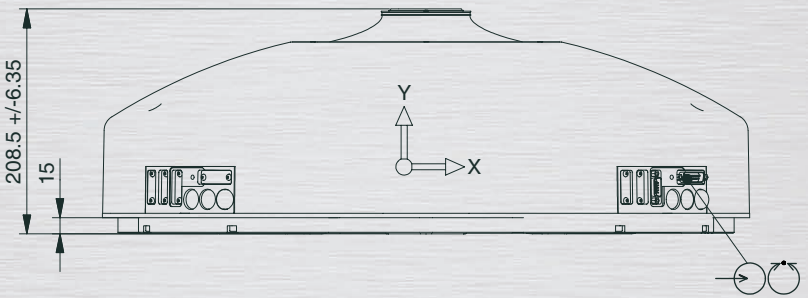
More info: Detailed information, concerning the motor, see: Appendix

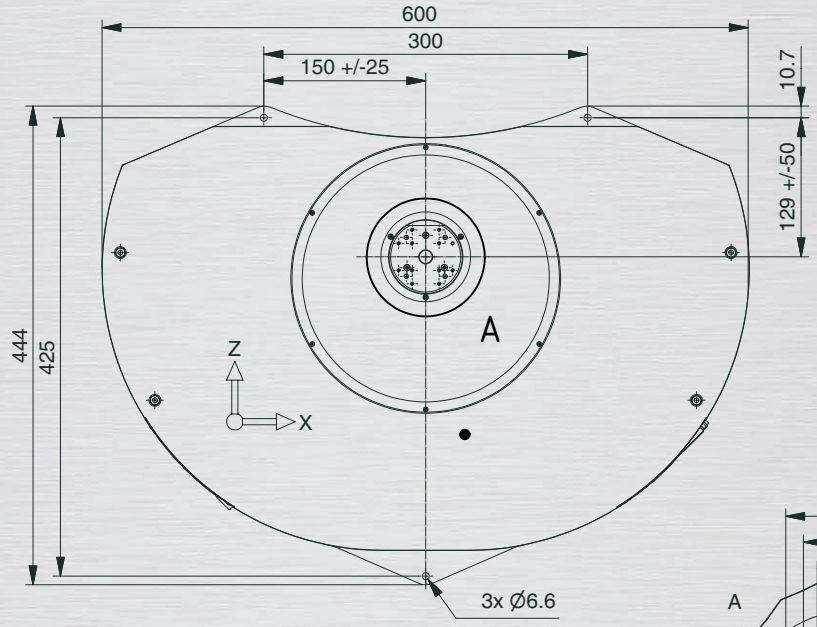
SF-3000 BS is the micos Motion Server. The Motion Server includes all the mathematical transformations so that the user can start movements directly by specifying the six coordinates x, y, z, Rx, Ry and Rz.
It is also possible to move arbitrary trajectories in a contouring mode.
The Motion Server can be used as a stand alone software or in combination with micos or selfmade applications. These applications can be written in any modern programming language, the communication is done with TCP/IP.
A vacuum-version of the SpaceFAB is available on request.

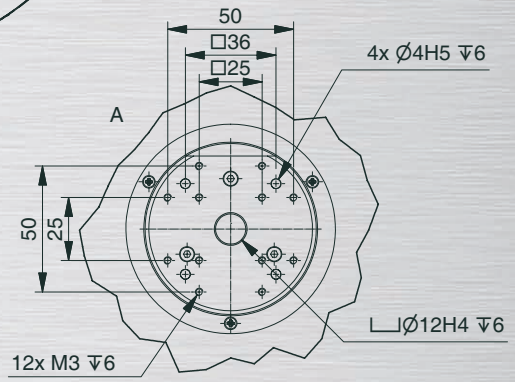


ask for:

SpaceFAB Simulator
A program especially developed for simulation of travel ranges.







mm

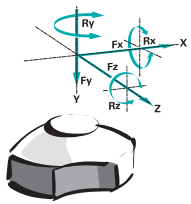
Order No.	6901-9-		0	0	0

DC-B-034 1

3.020 SpaceFAB SF-3000 LS

FACTS

Load Characteristics	Fx(N)	Fy(N)	Fz(N)	Mx(Nm)	My(Nm)	Mz(Nm)
2Phase-042	1.5	10	1.5	0.1	0.1	0.1



The **SpaceFAB SF-3000 LS** is a low cost alternative to **micos SpaceFAB SF-3000 BS** and is especially designed for precision positioning. With one **SpaceFAB SF-3000 LS** all six degrees of freedom can be moved without additional positioning elements. **SpaceFAB SF-3000 LS** was especially developed for easy alignment applications. Furthermore **SpaceFAB SF-3000 LS** is perfectly designed for micro-fabrication and biomedical. The core software used for the **SpaceFAB SF-3000 LS** is the **micos** Motion Server.

Software

- Pivot point can be set by the customer
- Digital display of position and orientation

Keyfeatures

- Six axes micro robot system
- Low profile system
- Travel ranges linear 50 x 12.7 x 50 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

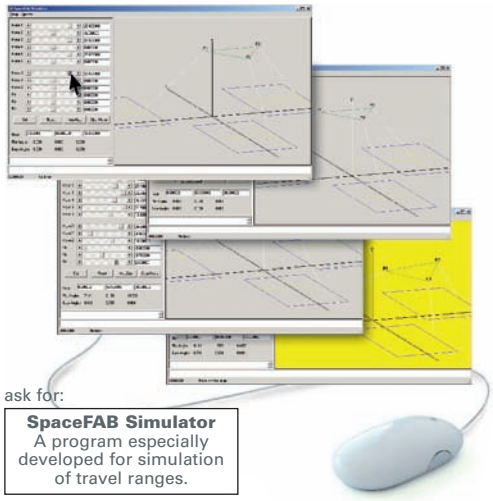
TECHNICAL DATA

Travel Range		
X,Y	*(mm)*	50 x 12.7 *
Z	*(mm)*	50 *
Rx, Ry	*(°)*	10 *
Rz	*(°)*	10 *
Bi-directional Repeatability (µm)		X, Y, Z +/- 5
Bi-directional Repeatability (µrad)		Rx, Ry, Rz +/- 200
***Motor** (Pitch 1 mm)*		**2Phase-042**
Speed max. X,Y, Z	*(mm/sec)*	10
Speed max. Rx, Ry, Rz	*(°/sec)*	6
Resolution X,Y, Z	*without load (µm)*	0.5
Resolution Rx, Ry, Rz	*without load* (°)	0.003
Weight (kg)		24
Material		hardended steel, 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.(*) for more information, please contact us.*
The travel range is depending on the position of the pivot point

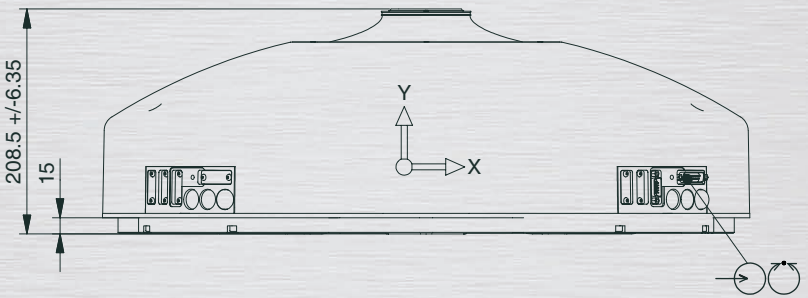
More info: Detailed information, concerning the motor, see: Appendix

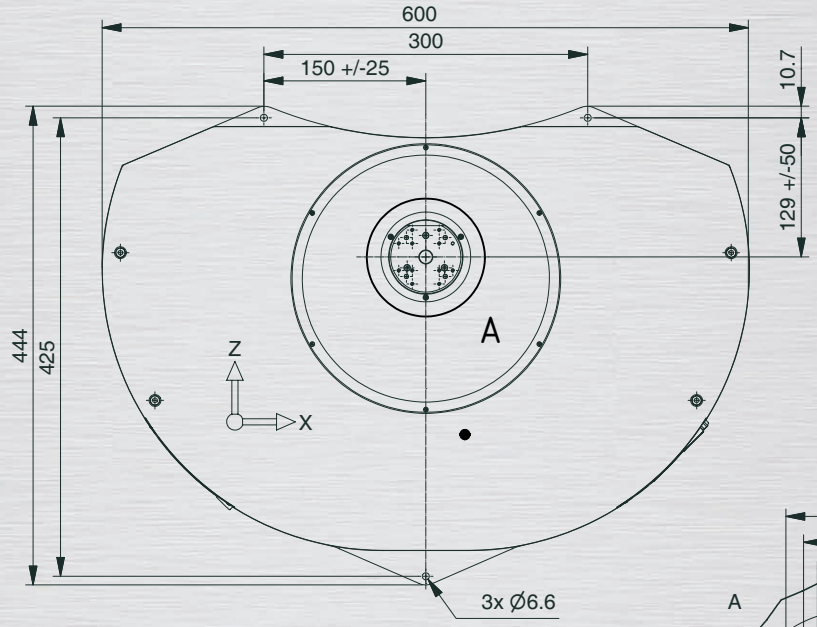
The Motion Server includes all the mathematical transformations so that the user can start movements directly by specifying the six coordinates x, y, z, Rx, Ry and Rz.
The Motion Server can be used as a stand alone software or in combination with **mikos** or selfmade applications. These applications can be written in any modern programming language, the communication is done via TCP/IP.

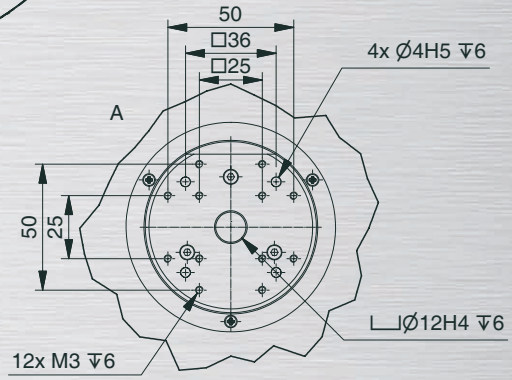


ask for:

SpaceFAB Simulator
A program especially developed for simulation of travel ranges.







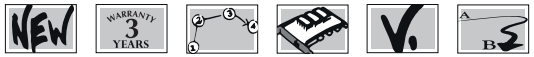
mm

Order No.	6902-9-		0	0	

2Phase-042 (Pollux) **2**

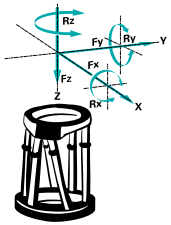
MLS-010,
Mechnical limit switches **2**

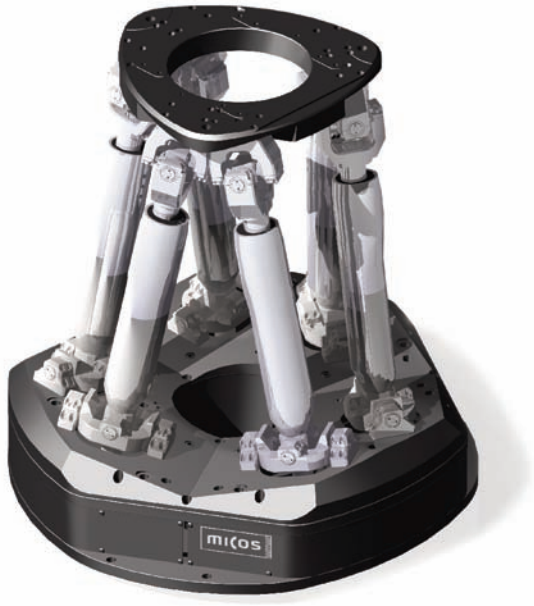
3.030 Hexapod PAROS



FACTS

Load Characteristics	Fx(N)	Fy(N)	Fz(N)
DC-B-013	400	400	1500
DC-B-041	50	50	200





Keyfeatures

- Six axes **PA**rallel **R**obot **O**perating **S**ystem
- Travel ranges linear 200 x 200 x 80 mm
- Travel ranges rotation Rx, Ry 30°, Rz 60°
- Maximum speed 30 mm/sec (leg speed)
- Repeatability in space +/- 5 µm
- High stiffness
- High dynamic
- Pivot point can be set by the customer
- User friendly software
- Load capacity central 150 kg
- Including software, controller and amplifiers

With a **HEXAPOD** 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. An optimized general concept allows maximum stiffness and accuracy. Spatial resolutions up to 1 µm can be achieved.

Software

- Calculation of motion path with collision detection
- Pivot point can be set by the customer
- Graphic display of the robot from any view
- Digital display of position and orientation
- Control by Macro-language stored in own editor

TECHNICAL DATA

Travel Range		on request	
X,Y	*(mm)*	200 x 200 *	
Z	*(mm)*	80 *	
Rx, Ry	*(°)*	30 *	
Rz	*(°)*	60 *	
Velocity Range	*(mm/sec)*	0.01 ... 30 **	
Velocity Range	*(°/sec)*	0.001 ... 10 **	
Ballscrew Pitch	*(mm)*	1	
Bi-directional Repeatability (µm)		X, Y, Z +/- 5	
Bi-directional Repeatability (µrad)		Rx, Ry +/- 75, Rz +/- 450	
***Motor** (Pitch 1 mm)*		DC-B-013, gearhead	DC-B-041, direct drive
Speed max. X,Y, Z	*(mm/sec)*	2.5*	30*
Speed max. Rx, Ry	(°/sec)	1.5	15
Speed max. Rz	(°/sec)	8	30
Current (A) / Voltage Range (V)		0.3 | 24	3 | 24
Weight (kg)		21	
Material		Stainless steel, Aluminum black anodized	

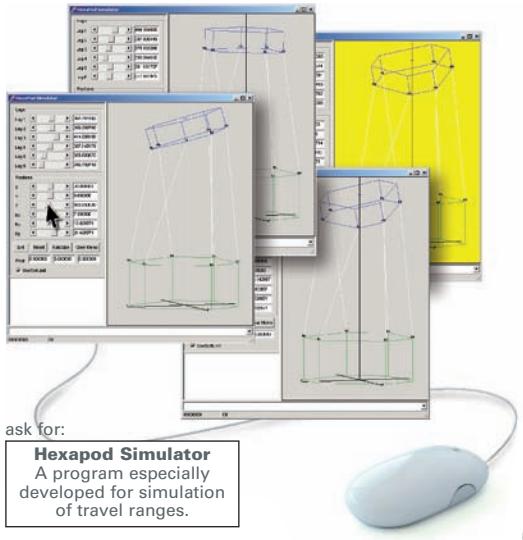
Note: At present with DC-motor

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

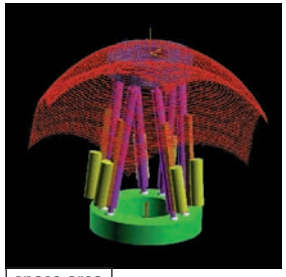
** The maximum travel ranges in the different coordinate directions (X, Y, Z, RX, RY, RZ) are interdependent. The data for each axis in this table shows its maximum travel, where all other axes are at their zero positions. If the other linear or rotational coordinates are not zero, the available travel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

*** leg speed*

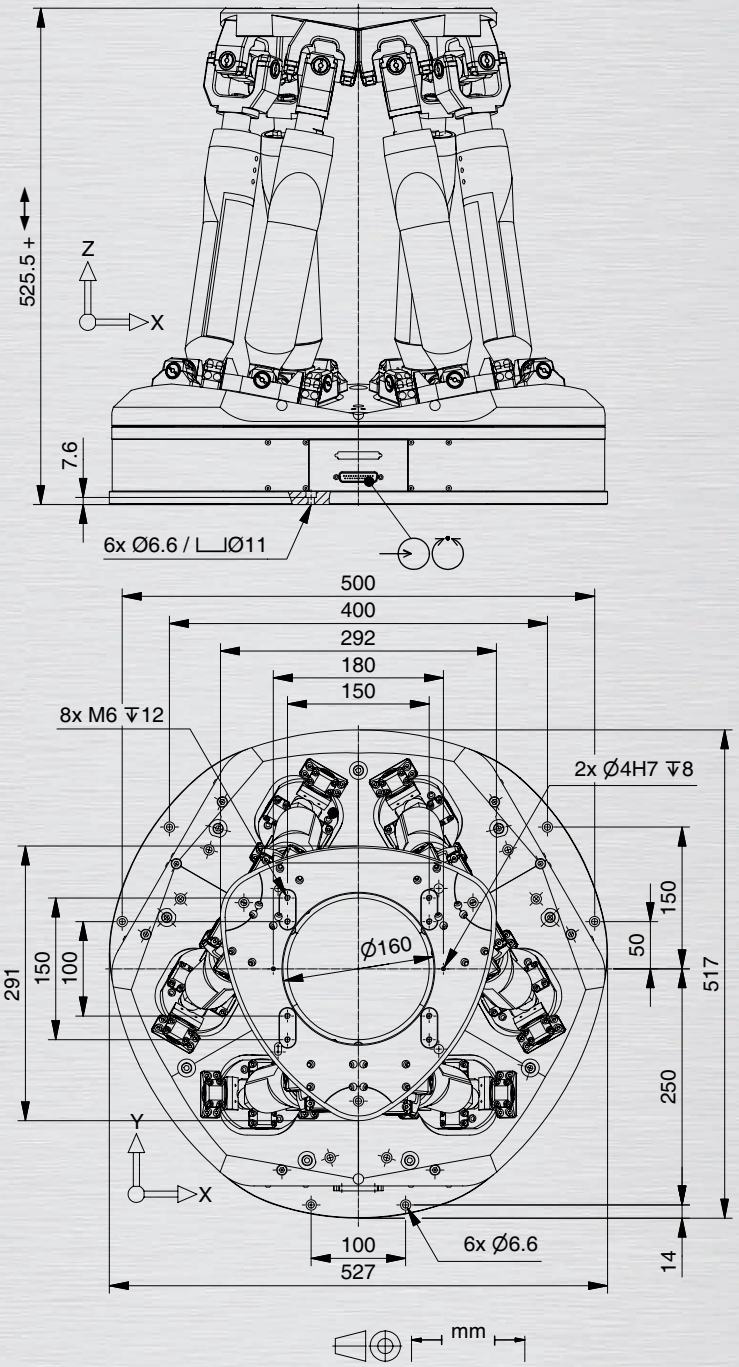
The system uses a **micos** DMC or **Delta TAU** controller and includes advanced algorithms for inverse kinematic transformations within a user-friendly software package.
Especially for high resolution and high forces the robot can be equipped with a 1 mm pitch and a gear motor combination. An individual system integration is possible. A one-day training at **micos** is included in the price.



ask for:
Hexapod Simulator
A program especially developed for simulation of travel ranges.



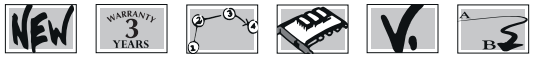
space-area

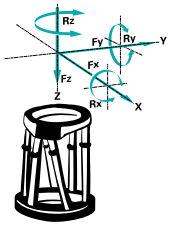


Order No.	6000-9-		0	0

DC-B-013, gear-head **1**
DC-B-041, direct drive **2**

3.040 Hexapod HP-430





F A C T S

Load Characteristics	Fx(N)	Fy(N)	Fz(N)
DC-B-027	300	300	500

Self-locking up to: 30 kg

With a **HEXAPOD** 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, optical systems and positioning at synchrotron lines. An optimized general concept allows maximum stiffness

- Calculation of one motion path with collision detection
- Pivot Point can be set by the customer
- Graphic display of the robot from any view
- Digital display of position and orientation
- Control by Macro-language stored in own editor

Keyfeatures

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

TECHNICAL DATA

Travel Range		
X,Y	*(mm)*	50 x 50 *
Z	*(mm)*	30 *
Rx, Ry	*(°)*	20 *
Rz	*(°)*	40 *
Velocity Range	*(mm/sec)*	0.01 ... 1 **
Velocity Range	*(°/sec)*	0.001 ... 0.5 **
Roller Thread Pitch	*(mm)*	1
Resolution, calculated without load		
Linear Travel (µm)	X, Y, Z	1
Rotation (µrad)	Rx, Ry, Rz	10
Repeatability for vertical orientation		
Bi-directional Repeatability (µm)		*X, Y +/- 3; Z +/- 2*
Bi-directional Repeatability (µrad)		Rx, Ry, Rz +/- 40
***Stiffness, theoretical** (N/µm)*		Kx, Ky 3; Kz 10
***Motor** (Pitch 1 mm)*		DC-B-027, HD gear
Speed max. X,Y, Z	*(mm/sec)*	1
Speed max. Rx, Ry, Rz	*(°/sec)*	0.5
Current (A) / Voltage Range (V)		0.9 | 24
Weight (kg)		ca. 25
Material		Stainless steel, Aluminum black anodized

Note: At present with DC-motor

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

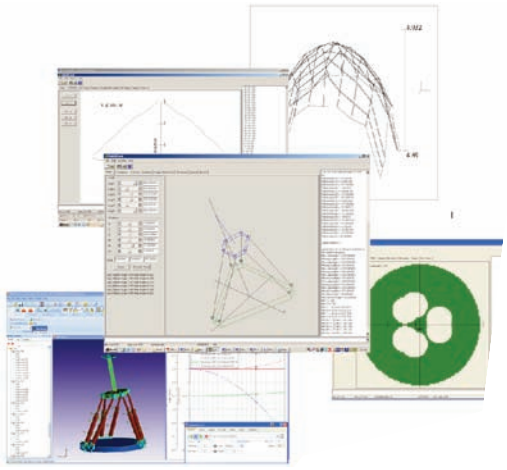
** The maximum travel ranges in the different coordinate directions (X, Y, Z, RX, RY, RZ) are interdependent. The data for each axis in this table shows its maximum travel, where all other axes are at their zero positions. If the other linear or rotational coordinates are not zero, the available travel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

*** leg speed*

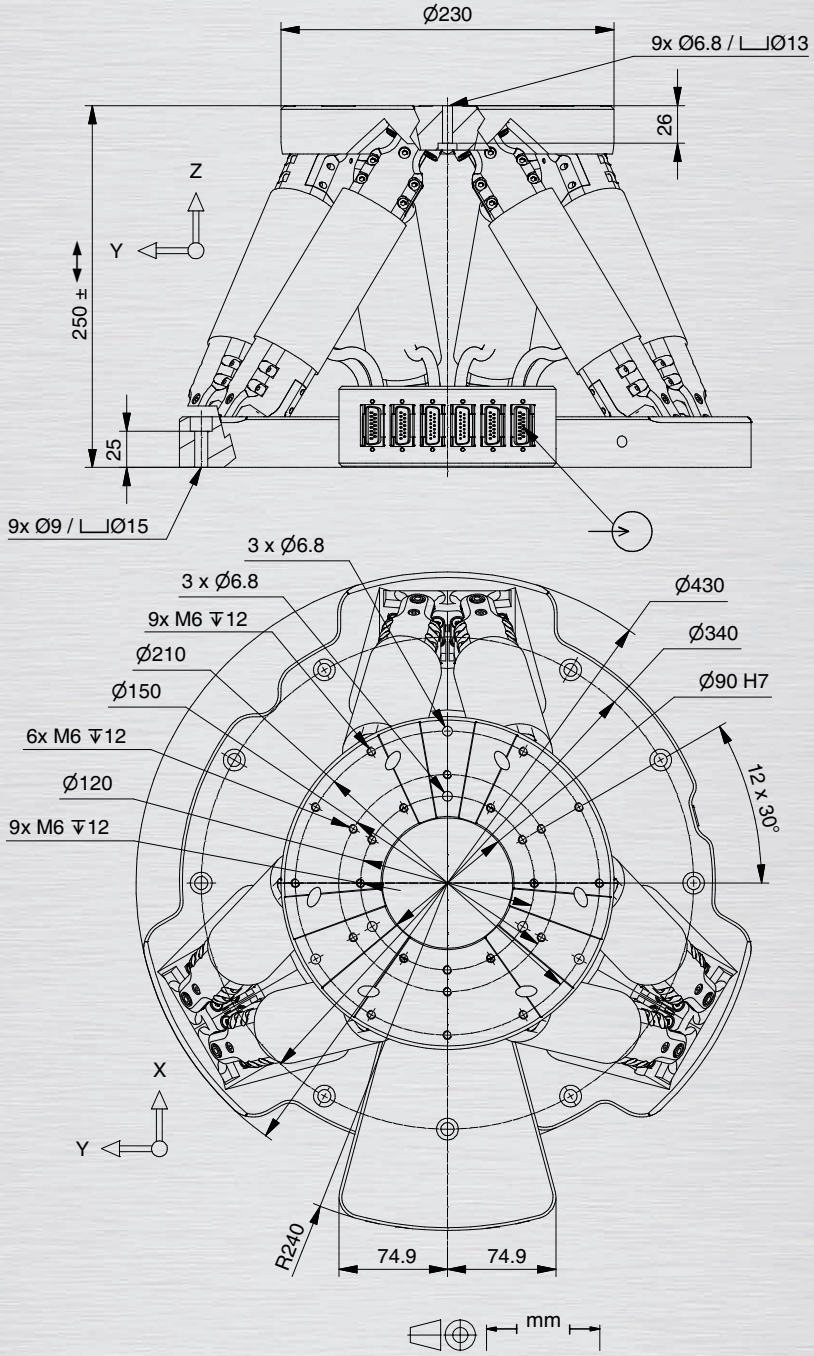
and accuracy. Spatial resolutions up to 1 µm can be achieved.

The system uses a **micos** DMC or **Delta TAU** controller and includes advanced algorithms for inverse kinematic transformations within a user-friendly software package.

Especially for high resolution and high forces the robot can be equipped with a 1 mm pitch and a gear motor combination. An individual system integration is possible. A one-day training at **micos** is included in the price.



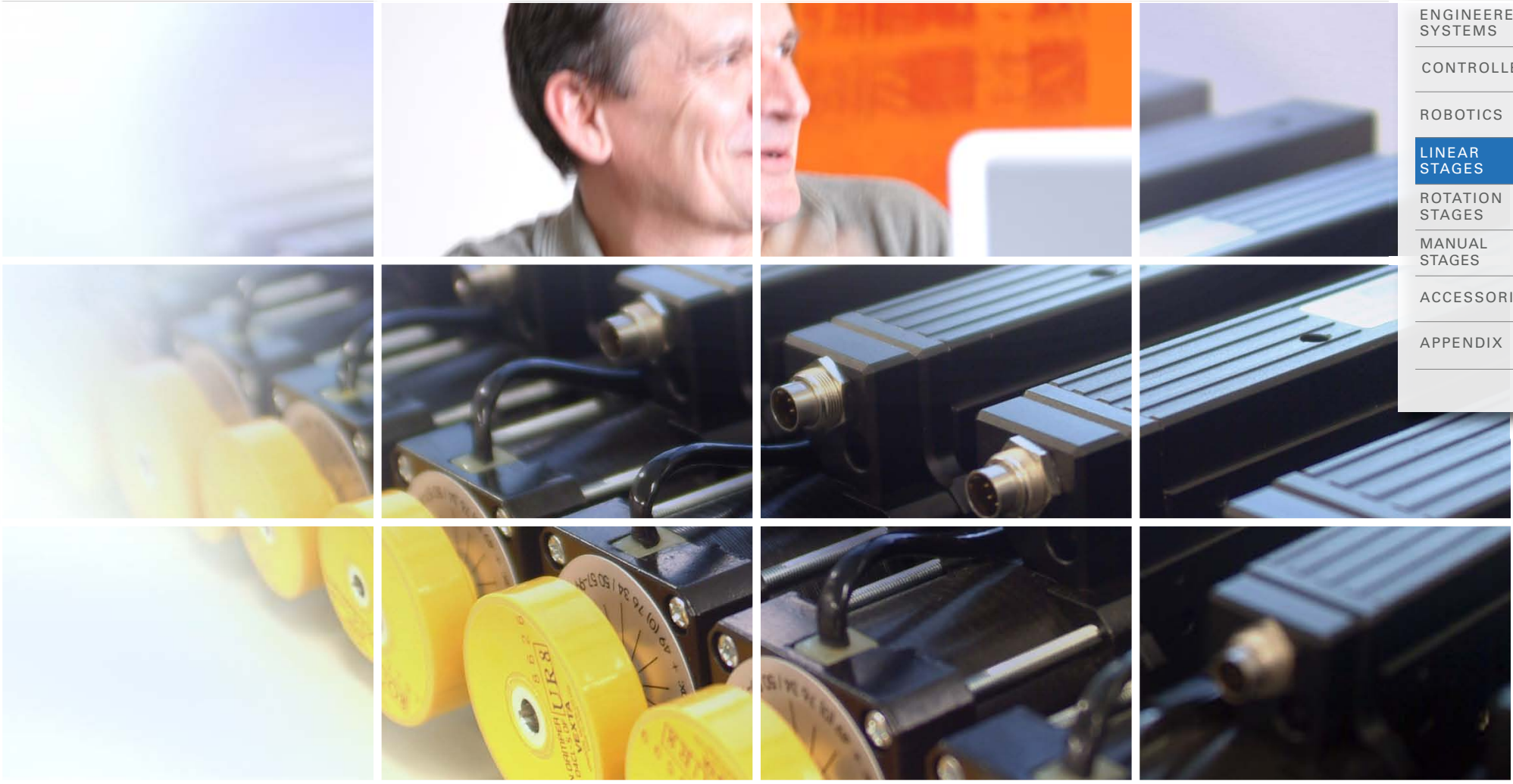
Modeling and simulations performed with proprietary specific (PAROS) and/or standard software (ADAMS/SimXpert, MathCAD, etc)



Order No.	6010-9-		0	0	

DC-B-027, gear-head **1**

OLS-010, Optical limit switches . . **3**

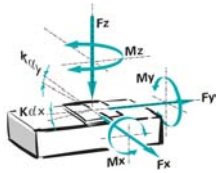


LINEAR STAGES

4.010 Ultra Precision Stage UPS-150

FACTS

Load characteristics	Fx(N)	Fy(N)	Fy Peak(N)	Fz(N)	Mx(Nm)	My(Nm)	Mz(Nm)	kαx(µrad/Nm)	kαy(µrad/Nm)
LM-015	75	22	88	150	50	100	50	25	20



The Ultra Precision Stage **UPS-150** was specifically designed for sub-surface wafer inspection, fiber alignment, high precision robotics and for all tasks where a maximum of positioning accuracy and reliability is absolutely mandatory. All ultra precision stages **UPS-150** are 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 structural series 150 is driven by iron-less linear motors and provides high acceleration and high travel speed. System accuracy below 1µm/100mm 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 granite 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 limit switches
- Integrated linear scale (center mounted)
- High long-term stability

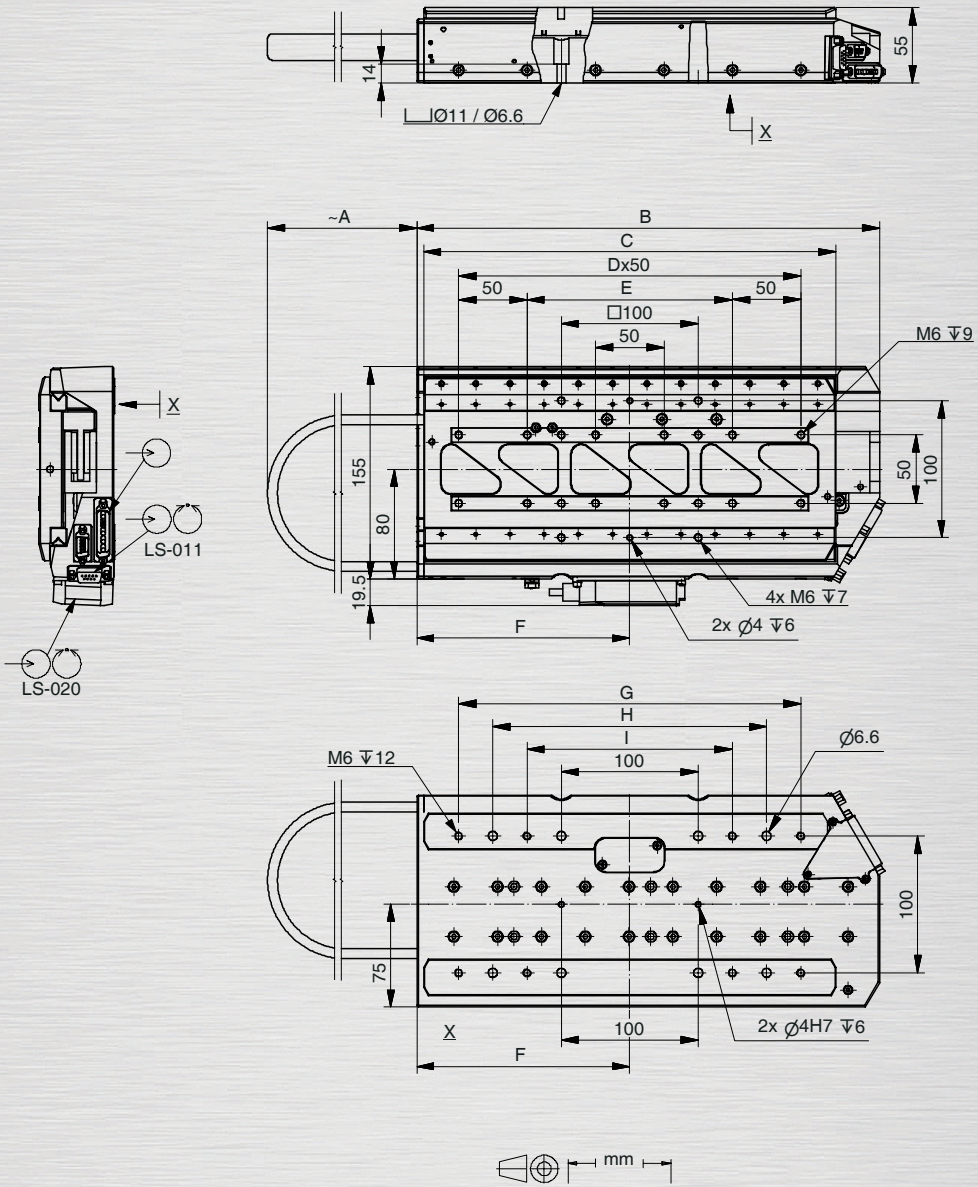
TECHNICAL DATA

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 (µrad)	+/- 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

Setup with UPR-100



Order No.	6840-9-			

LM-015 1

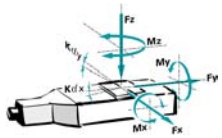
52 mm (2") 1
102 mm (4") 2
155 mm (6") 3
205 mm (8") 4
305 mm (12") 5

LS-011, Linear steel scale 1
LS-020, Linear glass scale 2

4.020 Ultra Precision Linear Stage UPM-160

FACTS

Load characteristics	Fx(N)	Fy(N)	Fz(N)	Mx(Nm)	My(Nm)	Mz(Nm)	kαx(µrad/Nm)	kαy(µrad/Nm)
DC-B-039	150	100	350	100	200	100	5	3
2Phase-051	150	100	350	100	200	100	5	3



The Ultra Precision Linear Stage **UPM-160** was specifically designed for wafer inspection, fiber alignment or for any other tasks where a maximum of positioning accuracy and reliability is 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. **UPM-160** stages are offered with a 2-phase stepper motor or with a DC-motor and are equipped with two mechanical limit switches. All ultra precision linear stages are supplied with a certificate of performance (flatness, straightness & accuracy).

Key features

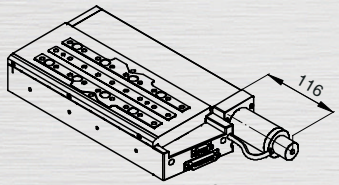
- Travel range up to 205 mm (8")
- Uni-directional repeatability down to 0.035 µm
- Maximum speed 100 mm/sec
- Load capacity up to 35 kg
- Integrated limit switches
- Integrated linear scale (center mounted)

TECHNICAL DATA

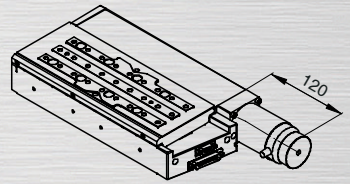
Travel range *(mm)*	**55**	**105**	**155**	**205**
Straightness / Flatness (µm)	+/- 0.5	+/- 0.75	+/- 1	+/- 1.25
Pitch (µrad)	+/- 15	+/- 20	+/- 25	+/- 30
Yaw (µrad)	+/- 20	+/- 20	+/- 20	+/- 20
Weight (kg)	5	6	7	8
Motor *(Pitch 2.5 | 5 mm)*	**DC-B-039**	**2Phase-051**		
Linear scale			**LS-010**	**LS-020**
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

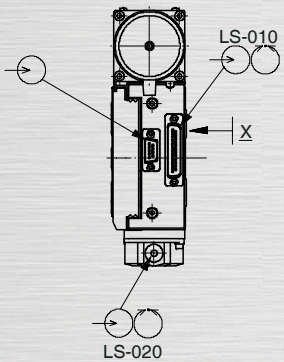


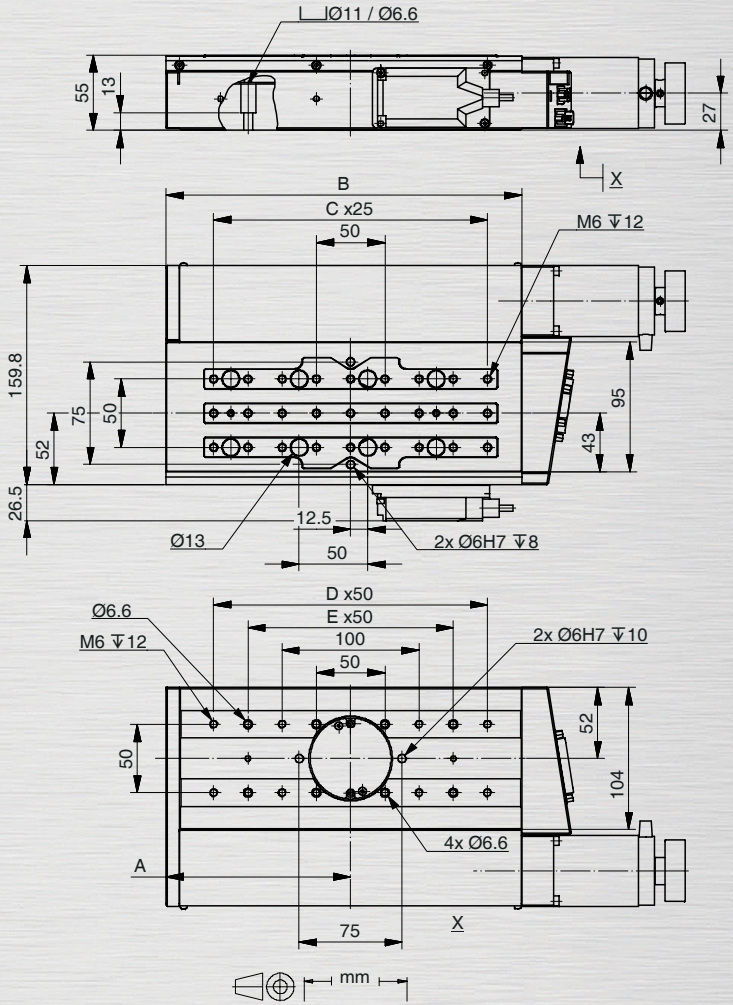
DC-B-039



2Phase-051

UPM-160 with Harmonic Drive gear





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

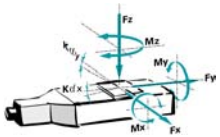
LS-010, Linear steel scale 1
LS-020, Linear glass scale 2

Pitch 2.5 mm 1
Pitch 5.0 mm 2

4.030 High Precision Stage HPS-170

FACTS

Load characteristics	Fx(N)	Fy(N)	Fz(N)	Mx(Nm)	My(Nm)	Mz(Nm)	kαx(µrad/Nm)	kαy(µrad/Nm)
DC-B-040	150	100	350	300	400	300	12	8
2Phase-033	150	100	350	300	400	300	12	8



The Precision Stage **HPS-170** was developed to meet high precision positioning demands. 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 precision stage **HPS-170** 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 limit switches
- Optionally: linear scale (center mounted)

TECHNICAL DATA

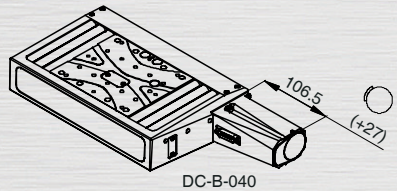
Travel range *(mm)*	**52**	**102**	**155**	**205**	**305**
Straightness / Flatness (µm)	+/- 0.75	+/- 1	+/- 2	+/- 3	+/- 4
Pitch (µrad)	+/- 20	+/- 25	+/- 30	+/- 35	+/- 40
Yaw (µrad)	+/- 40	+/- 40	+/- 40	+/- 40	+/- 40
Weight (kg)	5	5.5	6	6.5	7

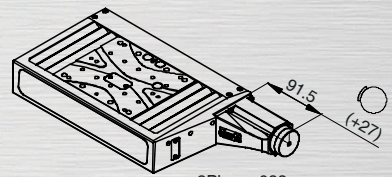
Motor *(Pitch 2 mm)*	**DC-B-040**	**2Phase-033**	
Linear scale			**LS-010**
Speed max. (mm/sec)	90	35	
Resolution calculated (µm)	0.1 (RE)	10 (FS)	0.05
Resolution typical (µm)	0.2	0.1	0.05
Bi-directional Repeatability (µm)	+/- 1	+/- 1	+/- 0.05
Uni-directional Repeatability (µm)	0.2	0.2	0.05
Nominal Current (A)	3.8	1.2	
Voltage Range (V)	24		

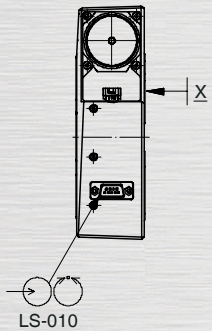
Accuracy	on request
Velocity Range (mm/sec)	0.001 ... 90
Material	Aluminum, black anodized

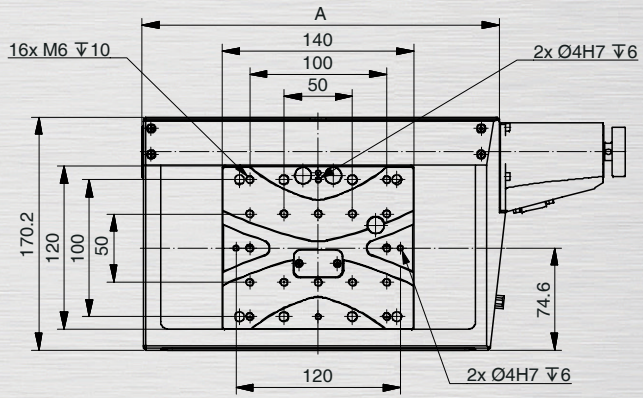
Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.

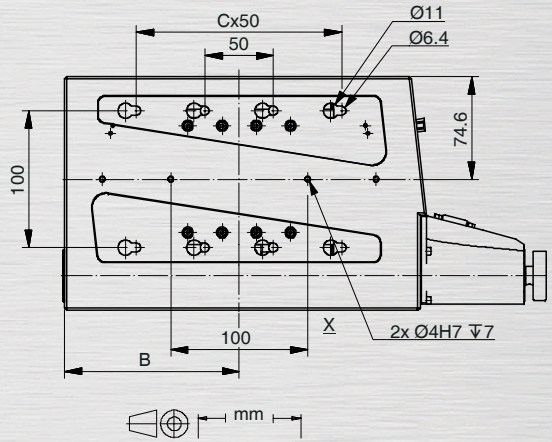
Travel (mm)	52	102	155	205	305
A	261	311	381	456	556
B	127.5	152.5	187.5	225	275
C	3	3	5	6	7











Order No. 6262-9- ☐ ☐ ☐ ☐

DC-B-040 1
2Phase-033 2

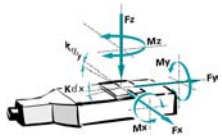
52 mm (2") 1
102 mm (4") 2
155 mm (6") 3
205 mm (8") 4
305 mm (12") 5

without LS-010 0
LS-010, Linear steel scale 1

without brake 0
with brake 1

FACTS

Load characteristics	Fx(N)	Fy(N)	Fz(N)	Mx(Nm)	My(Nm)	Mz(Nm)
DC-B-086	1200	40	1500	250	280	250
2Phase-072	1200	260	1500	250	280	250



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

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 limit switches
- Optionally: linear scale (center mounted)

TECHNICAL DATA

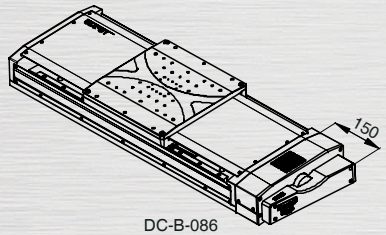
Travel range *(mm)*	**155**	**305**	**508**	**815**	**1016**
Straightness / Flatness (µm)	+/- 1	+/- 2	+/- 4	+/- 7	+/- 10
Pitch (µrad)	+/- 15	+/- 30	+/- 60	+/- 80	+/- 120
Yaw (µrad)	+/- 20	+/- 20	+/- 30	+/- 40	+/- 50
Weight (kg)	25	29	35	43	50

Motor *(Pitch 5 mm)*	**DC-B-086**	**2Phase-072**	
Linear scale			**LS-010**
Speed max. (mm/sec)	150	50	
Resolution calculated (µm)	0.25 (RE)	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)	23		

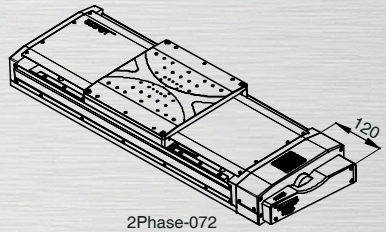
Accuracy	on request
Velocity Range (mm/sec)	0.001 ... 150
Material	Aluminum, black anodized

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

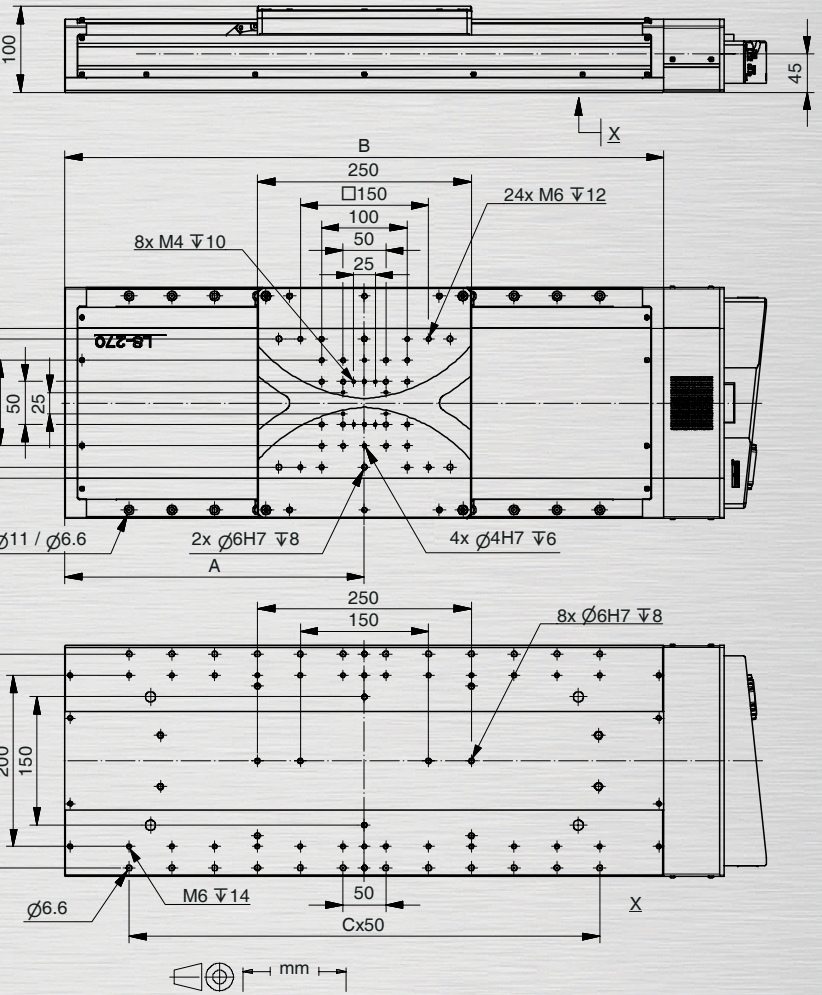


DC-B-086



2Phase-072


xy setup on an optical table



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

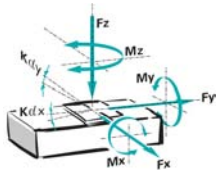
without LS-010 0
LS-010, Linear steel scale 1

ILS-020, Inductive limit switches 4

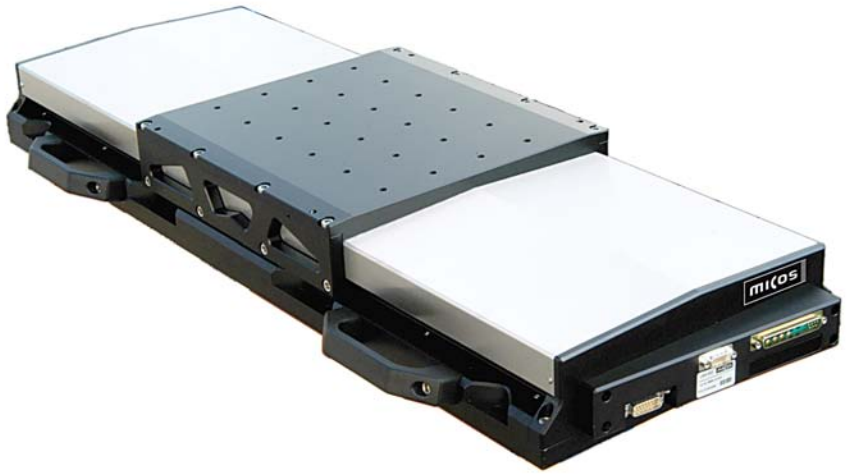
4.050 Linear Motor Stage LMS-300

FACTS

Load characteristics	Fx(N)	Fy(N)	Fy Peak(N)	Fz(N)	Mx(Nm)	My(Nm)	Mz(Nm)	kαx(µrad/Nm)	kαy(µrad/Nm)
LM-020	900	150	420	1000	110	200	110	50	40



Linear Stages of the structural series **LMS-300** and LMS-180 were developed for modern electronic production and laser applications. When driven with direct-driven MICOS rotation stages UPR, highly-dynamic, precise positioning systems can be created resulting in an efficient production line. Linear stages **LMS-300** and LMS-180 are driven by iron-less linear motors. The high accuracy linear scale is installed between the guides assuring high system accuracy. All linear stages of the series **LMS-300** are equipped with inductive limit switches. Optionally, the linear stage **LMS-300** can be equipped with a second linear motor resulting in higher speeds, higher dynamic range and more power.



Key features

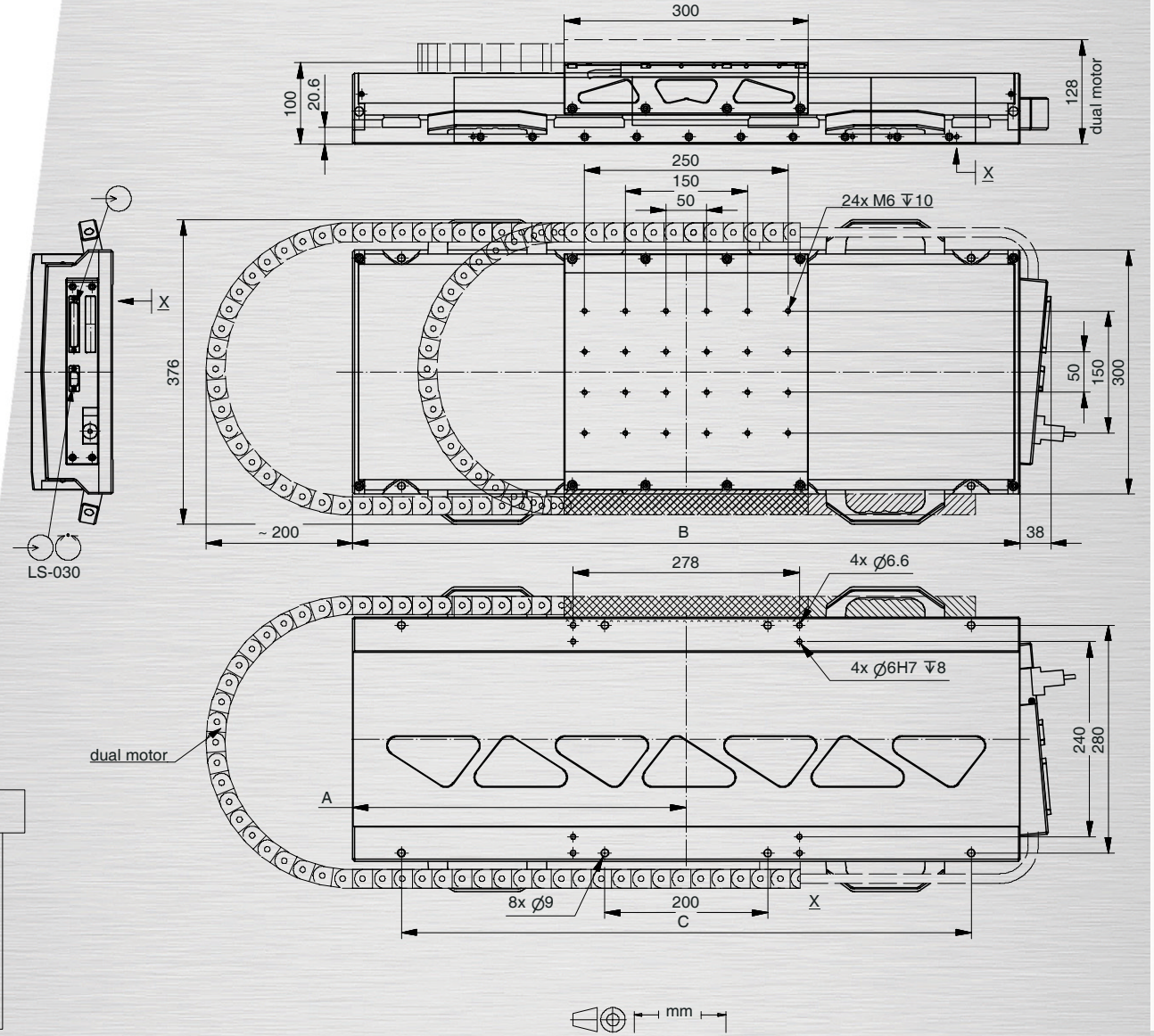
- Linear Motor
- Travel range up to 815 mm (32")
- Uni-directional repeatability down to 0.05 µm
- Maximum speed 800 mm/sec
- Load capacity up to 100 kg
- Integrated limit switches
- Integrated linear scale (center mounted)

TECHNICAL DATA

Travel range *(mm)*	**415**	**615**	**815**
Straightness / Flatness (µm)	+/- 4	+/- 6	+/- 8
Pitch (µrad)	+/- 50	+/- 70	+/- 90
Yaw (µrad)	+/- 50	+/- 60	+/- 70
Weight (kg)	39	58	75
Motor	**LM-020**		
Linear scale			**LS-030**
Speed max. (mm/sec)	800		
Resolution calculated (µm)			0.005
Resolution typical (µm)			0.04
Bi-directional Repeatability (µm)			+/- 0.05
Uni-directional Repeatability (µm)			0.05
Nominal Current (A)	4.4		
Accuracy	on request		
Velocity Range (mm/sec)	0.001 ... 800		
Material	Aluminum, black anodized		

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

Travel (mm)	415	615	815
A	410	510	610
B	820	1020	1220
C	700	900	1100



Order No.	6860-9-				

LM-020 1

415 mm (16") 2
615 mm (24") 3
815 mm (32") 4

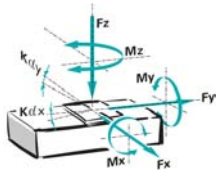
LS-030, Linear glass scale 1

single motor 0
dual motor 1

4.060 Linear Stage LMS-230

FACTS

Load characteristics	Fx(N)	Fy(N)	Fy Peak(N)	Fz(N)	Mx(Nm)	My(Nm)	Mz(Nm)	kαx(µrad/Nm)	kαy(µrad/Nm)
LM-050	75	22	88	150	50	100	50	25	20



The Linear Measuring 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 1µm/100mm 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).

The measurement is made with the stage mounted and unloaded on granite with a flatness < 1µm.

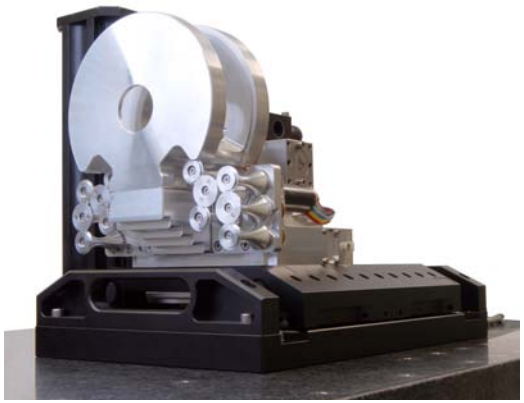
Key features

- 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 limit switches
- Integrated linear scale (center mounted)
- High long-term stability

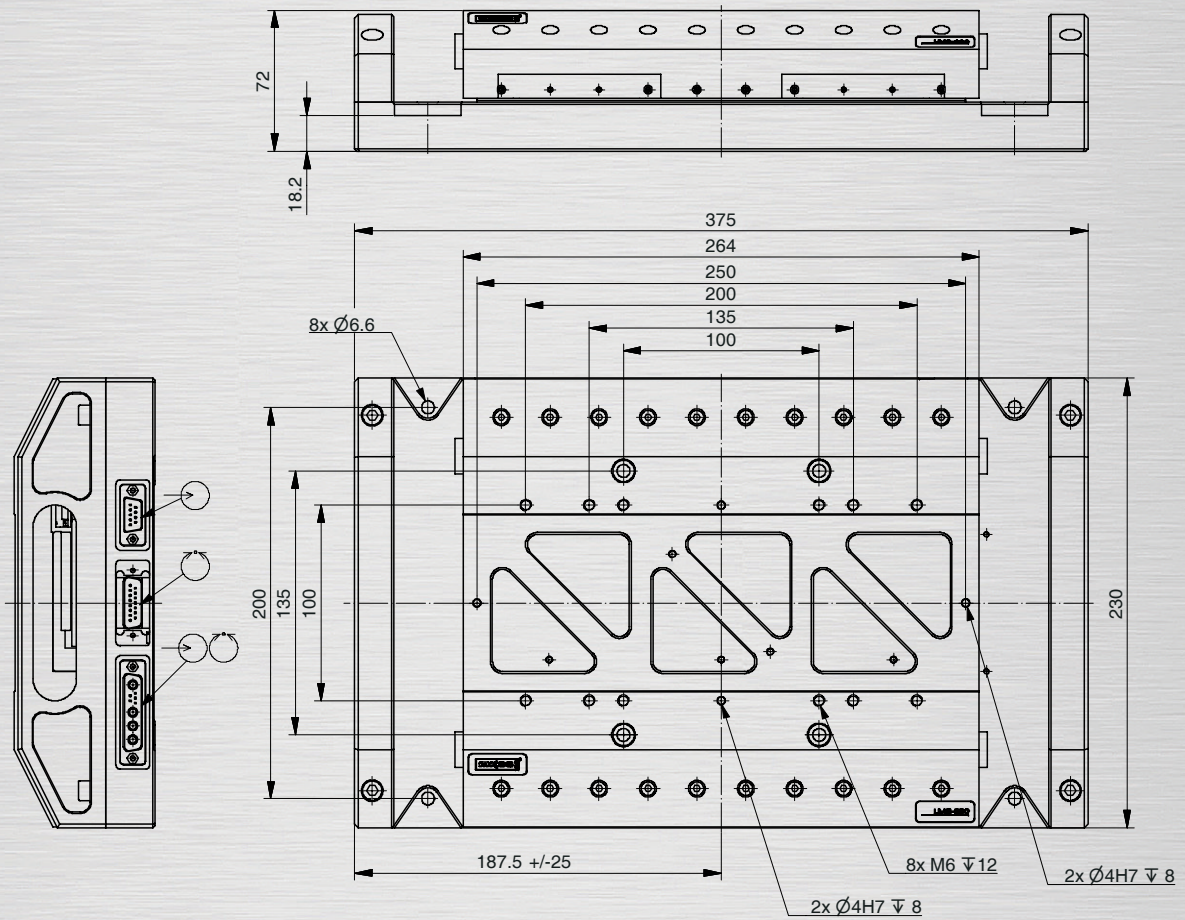
TECHNICAL DATA

Travel range *(mm)*	**52**	
Straightness / Flatness (µm)	+/- 0.5	
Pitch (µrad)	+/- 10	
Yaw (µrad)	+/- 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.



Microfilm scanner, see page 1.044



Order No.	6854-9-				

LM-050 1

52 mm (2") 1

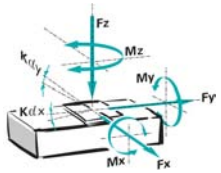
LS-021, Linear glass scale 1

ILS-020, Inductive limit switches 1

4.070 Linear Motor Stage LMS-180

FACTS

Load characteristics	Fx(N)	Fy(N)	Fy Peak(N)	Fz(N)	Mx(Nm)	My(Nm)	Mz(Nm)	kαx(µrad/Nm)	kαy(µrad/Nm)
LM-010	450	50	176	450	65	120	65	80	60



Linear Stages of the series **LMS-180** and LMS-300 were developed for advanced electronic production and laser applications. Combined with direct-driven rotation stages of the MICOS UPR series, highly-dynamic and precise positioning systems can be configured resulting in an efficient production line. Linear stages **LMS-180** and LMS-300 are driven by iron-less linear motors. The linear scale with very high accuracy 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 linear stages of the series **LMS-180** are equipped with inductive limit switches for protection against damage.

Key features

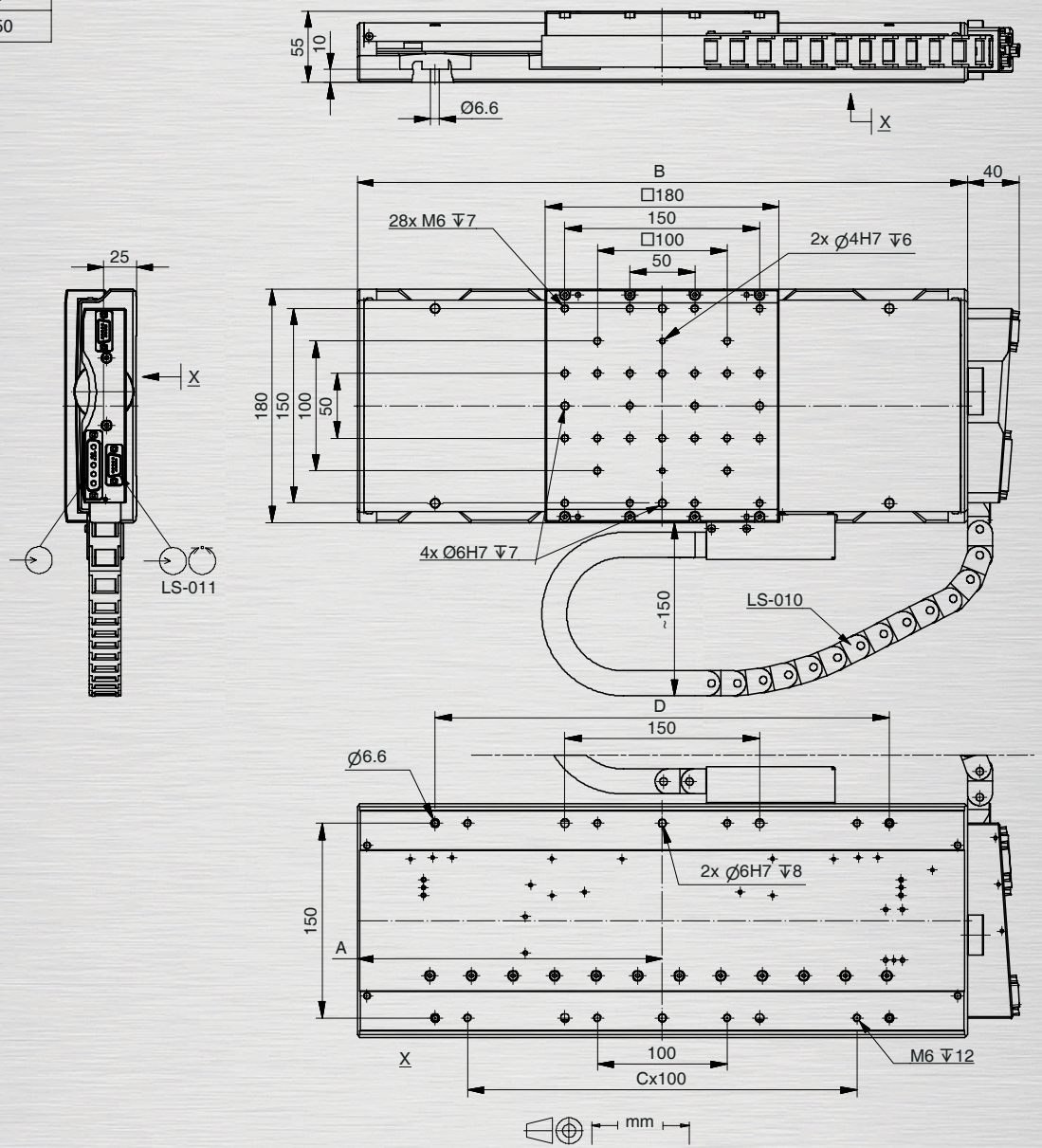
- Linear Motor
- Travel range up to 508 mm (20")
- Uni-directional repeatability down to 0.05 µm
- Maximum speed 500 mm/sec
- Load capacity up to 45 kg
- Integrated limit switches
- Integrated linear scale (center mounted)

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 (µrad)	+/- 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.

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

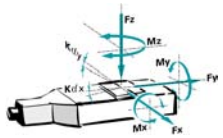
155 mm (6") 1
205 mm (8") 2
305 mm (12") 3
408 mm (16") 4
508 mm (20") 5

LS-011, Linear steel scale 1

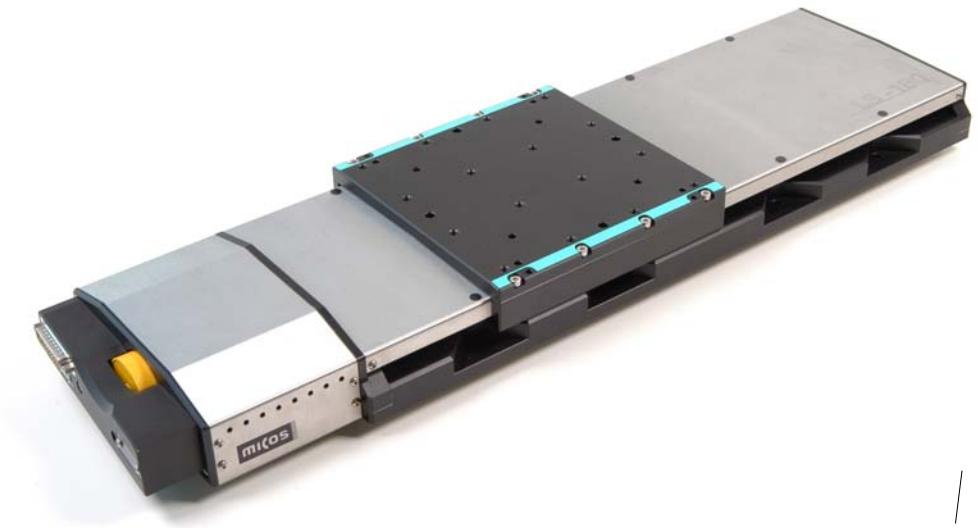
4.080 Linear Stage LS-180

FACTS

Load characteristics	Fx(N)	Fy(N)	Fz(N)	Mx(Nm)	My(Nm)	Mz(Nm)	kαx(µrad/Nm)	kαy(µrad/Nm)
DC-B-040	500	200	1000	132	400	125	60	50
2Phase-052	500	200	1000	132	400	125	60	50



The linear stage **LS-180** was developed for industrial applications. Re-circulating ball guides mounted on rigid tempered aluminum-alloy guarantee a very high guiding stiffness and long 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. Linear stages **LS-180** can be equipped with a DC or a 2-phase stepper motor and are equipped with two mechanical limit switches.



Key features

- Travel range up to 508 mm (20")
- Uni-directional repeatability down to 0.05 µm
- Maximum speed 200 mm/sec
- Load capacity up to 100 kg
- Integrated limit switches
- Optionally: linear scale (center mounted)

TECHNICAL DATA

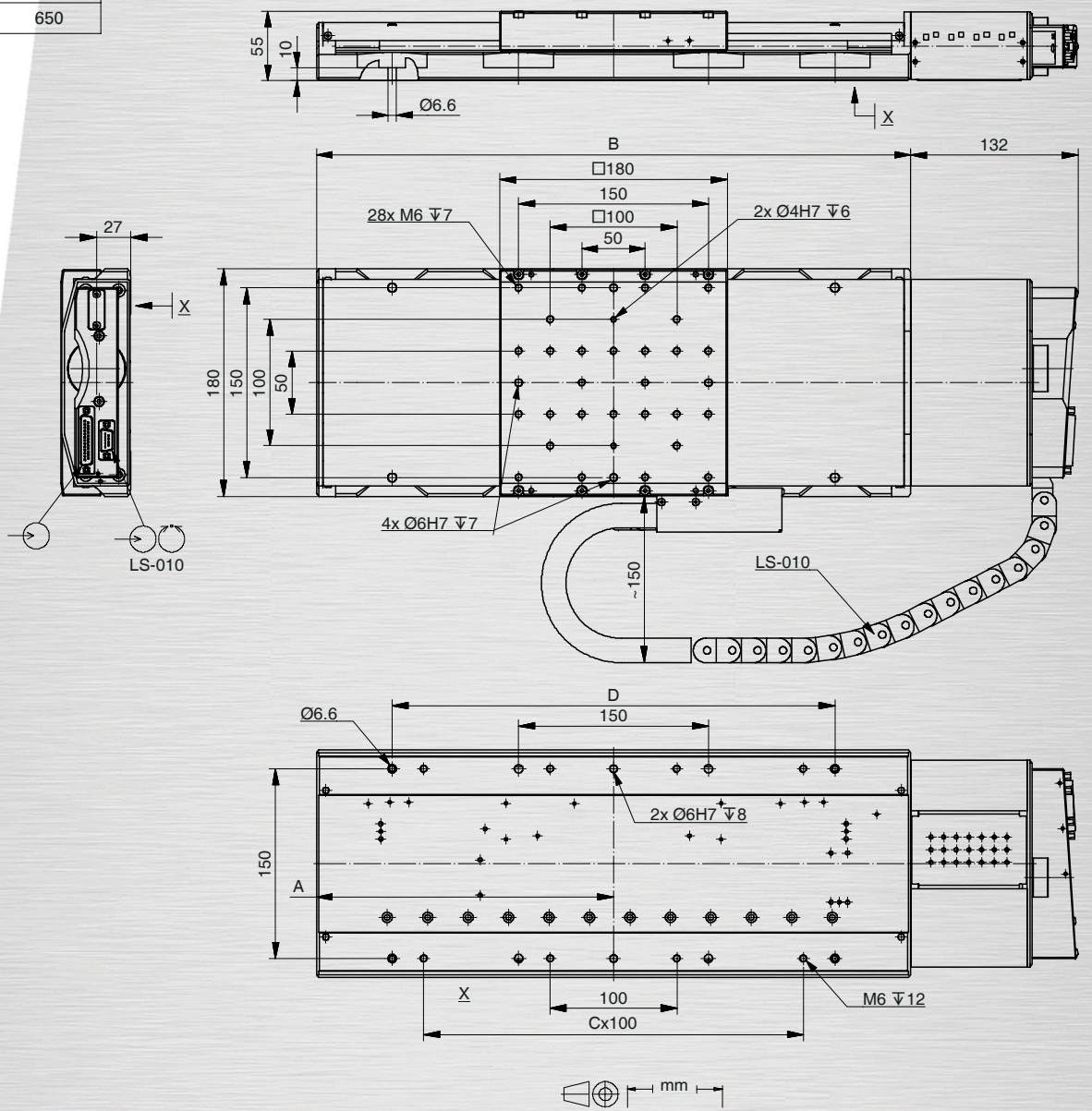
Travel range *(mm)*	**155**	**205**	**305**	**408**	**508**
Straightness / Flatness (µm)	+/- 2	+/- 3	+/- 4	+/- 5	+/- 6
Pitch (µrad)	+/- 40	+/- 50	+/- 60	+/- 70	+/- 80
Yaw (µrad)	+/- 50	+/- 50	+/- 50	+/- 50	+/- 50
Weight (kg)	8.4	8.8	9.6	10.2	10.8

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
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.	6240-9-			

DC-B-040 1
2Phase-052 2

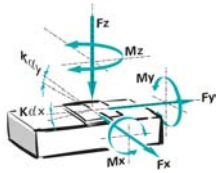
155 mm (6") 1
205 mm (8") 2
305 mm (12") 3
408 mm (16") 4
508 mm (20") 5

without LS-010 0
LS-010, Linear steel scale 1

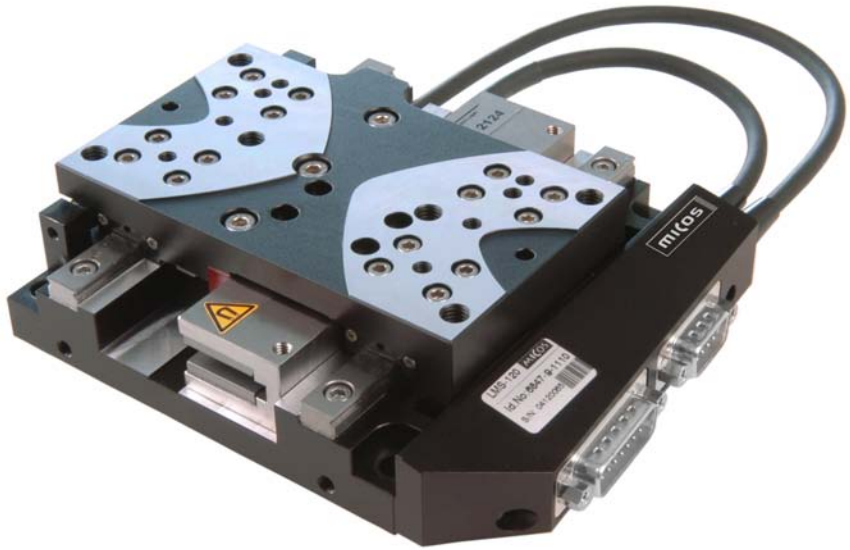
4.090 Linear Motor Stage LMS-120

FACTS

Load characteristics	Fx(N)	Fy(N)	Fy Peak(N)	Fz(N)	Mx(Nm)	My(Nm)	Mz(Nm)	kαx(µrad/Nm)	kαy(µrad/Nm)
LM-005	20	6	20	40	30	60	30	100	70



The Linear Stage **LMS-120** was developed for electronic production and other applications where highest accuracy and dynamic capability are needed under limited space conditions. Linear stages **LMS-120** are driven by iron-less linear motors and are delivered with inductive limit switches. A linear scale with very high accuracy is centrally installed between the guides. The **LMS-120** series excels with very quiet, dynamic and smooth motion.



Key features

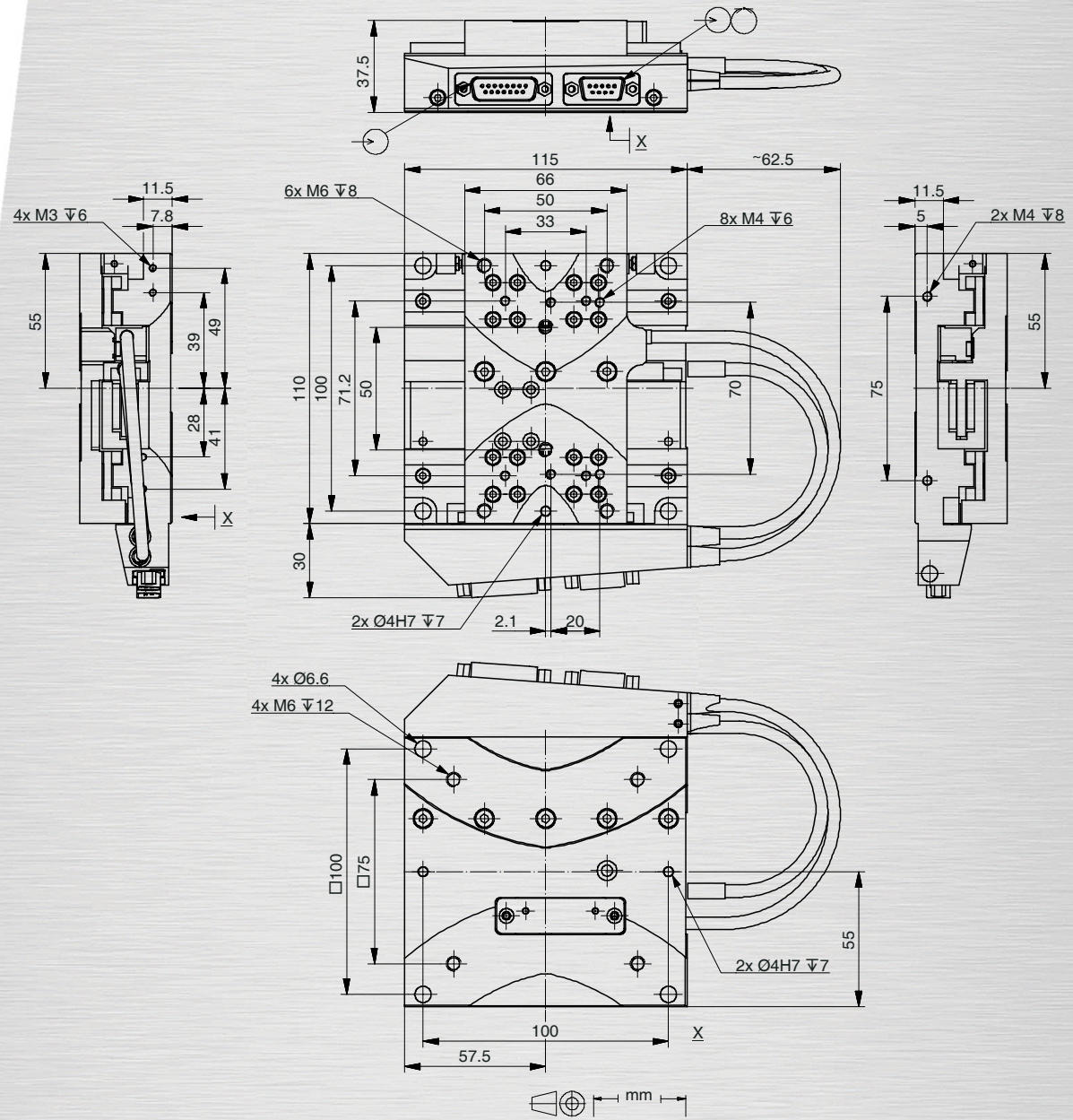
- Linear Motor
- Travel range up to 40 mm (xy setup by MICOS)
- Uni-directional repeatability down to 0.03 µm
- Maximum speed 200 mm/sec
- Load capacity up to 4 kg
- Integrated limit switches
- Integrated linear scale (center mounted)

TECHNICAL DATA

Travel range *(mm)*	**40**	
Straightness / Flatness (µm)	+/- 1.5	
Pitch (µrad)	+/- 40	
Yaw (µrad)	+/- 40	
Weight (kg)	1.3	
Motor	**LM-005**	
Linear scale		**LS-011**
Speed max. (mm/sec)	200	
Resolution calculated (µm)		0.015
Resolution typical (µm)		0.05
Bi-directional Repeatability (µm)		+/- 0.05
Uni-directional Repeatability (µm)		0.03
Nominal Current (A)	0.9	
Accuracy	on request	
Velocity Range (mm/sec)	0.01 ... 200	
Material	Aluminum, black anodized	

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

LMS-120 xy with vertical LS-120 stage

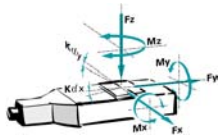


Order No.	6848-9-				
LM-005 1					
40 mm (1.5") ..... 1 40 mm (xy setup by MICOS) 2					
LS-011, Linear steel scale 1					
ILS-010, Inductive limit switches 4					

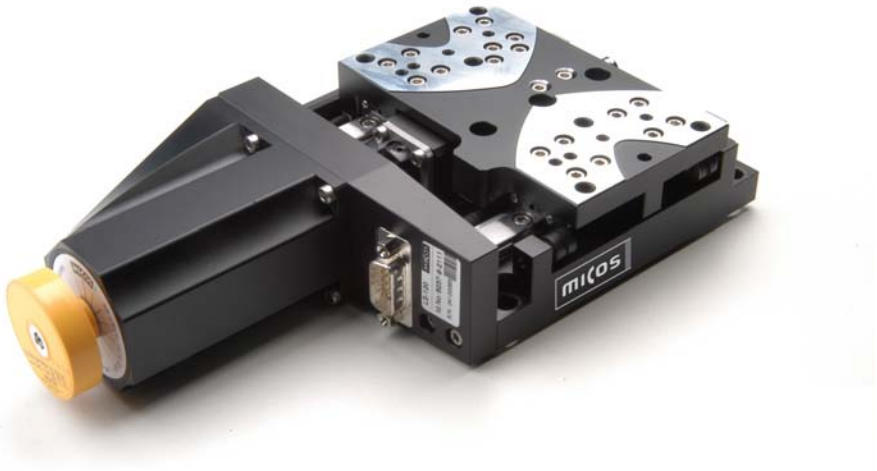
4.100 Linear Stage LS-120

FACTS

Load characteristics	Fx(N)	Fy(N)	Fz(N)	Mx(Nm)	My(Nm)	Mz(Nm)	kαx(µrad/Nm)	kαy(µrad/Nm)
DC-B-033	50	80	100	30	60	33	40	30
2Phase-032	50	80	100	30	60	33	40	30



The **LS-120** stage was specifically designed as a vertical stage for the linear motor driven stage LMS-120. 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 linear stages **LS-120** can be equipped with a 2-phase stepper motor. Inductive limit switches are integrated in the linear stage.



Key features

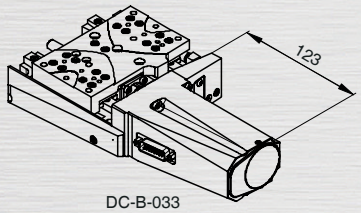
- Travel range up to 40 mm (xy setup by MICOS)
- Uni-directional repeatability down to 0.1 µm
- Maximum speed 90 mm/sec
- Load capacity up to 10 kg
- Integrated limit switches
- Optionally: linear scale (center mounted)

TECHNICAL DATA

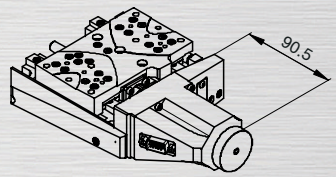
Travel range *(mm)*		**40**	
Straightness / Flatness (µm)		+/- 1.5	
Pitch (µrad)		+/- 40	
Yaw (µrad)		+/- 40	
Weight (kg)		1.8	
Motor *(Pitch 2 mm)*	**DC-B-033**	**2Phase-032**	
Linear scale			**LS-010**
Speed max. (mm/sec)	90	35	
Resolution calculated (µm)	0.1 (RE)	10 (FS)	0.05
Resolution typical (µm)	0.2	0.2	0.1
Bi-directional Repeatability (µm)	+/- 1	+/- 1	+/- 0.1
Uni-directional Repeatability (µm)	0.2	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.

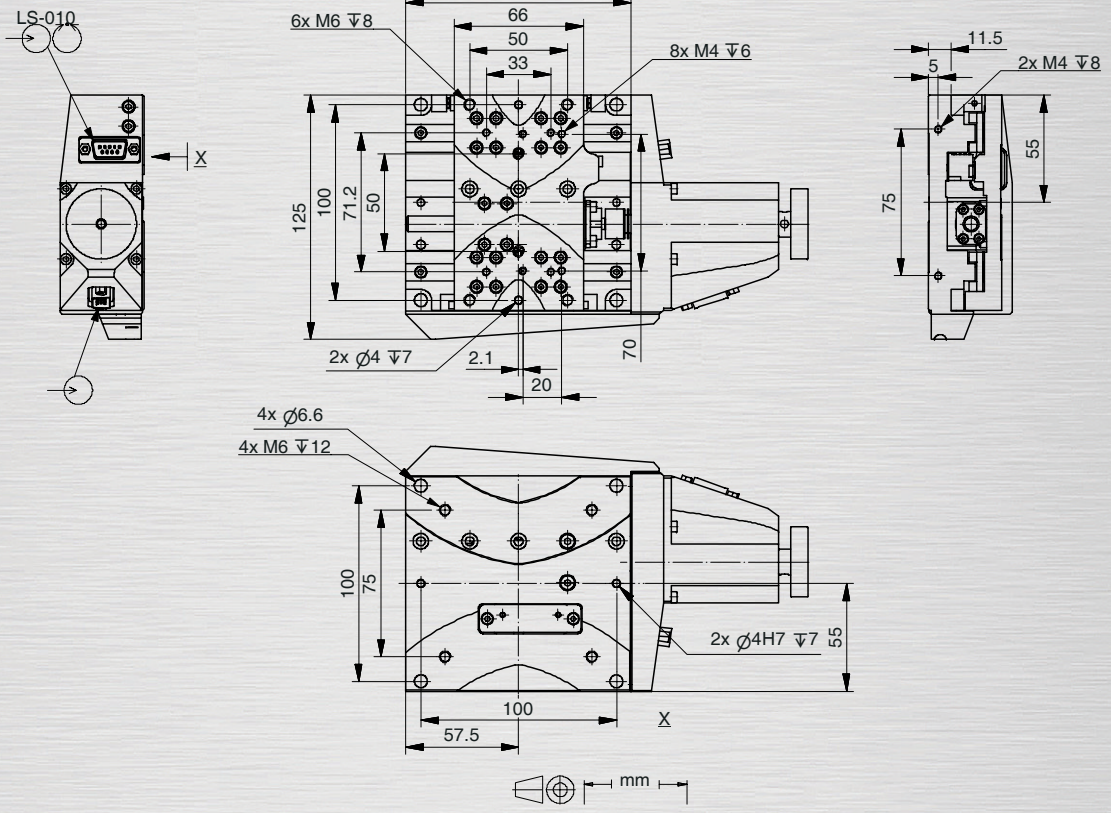
xyz setup with LMS-120 stage



DC-B-033



2Phase-032



Order No.	6237-9-				

DC-B-033 1
2Phase-032 2

40 mm (1.5") 1
40 mm (xy setup by MICOS) 2

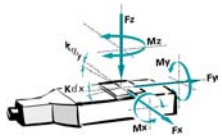
without LS-010 0
LS-010, Linear steel scale 1

ILS-010, Inductive limit switches 4

4.110 Linear Stage LS-110

FACTS

Load characteristics	Fx(N)	Fy(N)	Fz(N)	Mx(Nm)	My(Nm)	Mz(Nm)	kαx(µrad/Nm)	kαy(µrad/Nm)
DC-B-032	50	80	100	30	60	33	50	40
2Phase-033	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



Linear stages of the series **LS-110** are 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 linear stages **LS-110** 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 0.1 µm
- Maximum speed 90 mm/sec
- Load capacity up to 10 kg
- Integrated limit switches
- Optionally: linear scale (center mounted)

TECHNICAL DATA

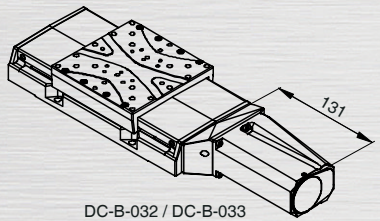
Travel range *(mm)*	**26**	**52**	**77**	**102**	**155**	**190**	**255**	**305**
Straightness / Flatness (µm)	+/- 1	+/- 1.5	+/- 2	+/- 2.5	+/- 3	+/- 3.5	+/- 4	+/- 5
Pitch (µrad)	+/- 30	+/- 40	+/- 50	+/- 60	+/- 70	+/- 80	+/- 90	+/- 100
Yaw (µrad)	+/- 40	+/- 40	+/- 40	+/- 40	+/- 40	+/- 40	+/- 40	+/- 40
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-033**	**2Phase-045**	**DC-B-033**	
Linear scale					**LS-010**
Speed max. (mm/sec)	90	35	45	90	
Resolution calculated (µm)	1 (RE)	10 (FS)	10 (FS)	0.1 (RE)	0.05
Resolution typical (µm)	1	0.2	0.2	0.2	0.1
Bi-directional Repeatability (µm)	+/- 1	+/- 1	+/- 1	+/- 1	+/- 0.1
Uni-directional Repeatability (µm)	1	0.2	0.2	0.2	0.1
Nominal Current (A)	2.3	1.2	1.2	2.3	
Voltage Range (V)	24			24	

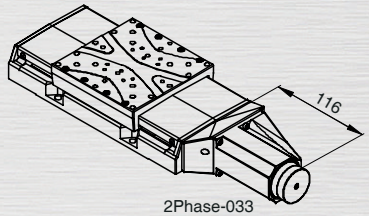
Accuracy	on request
Velocity Range (mm/sec)	0.001 ... 90
Material	Aluminum, black anodized

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

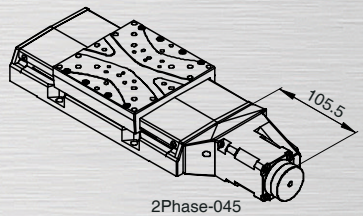
Travel (mm)	26	52	77	102	155	190	255	305
A	112.5	125	137.5	150	180	180	215	240
B	225	250	275	300	360	360	430	480
C	-	-	-	-	250	250	300	350



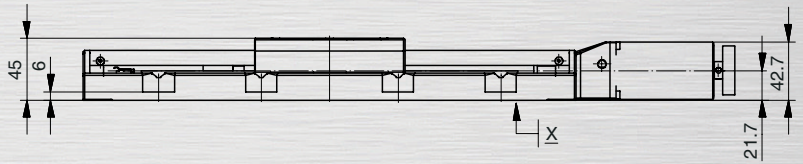
DC-B-032 / DC-B-033



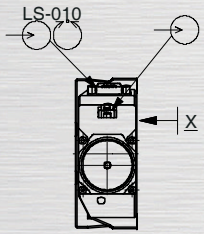
2Phase-033

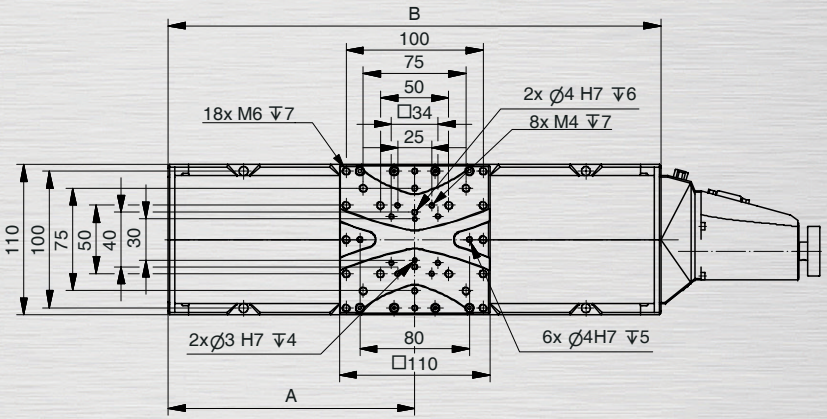


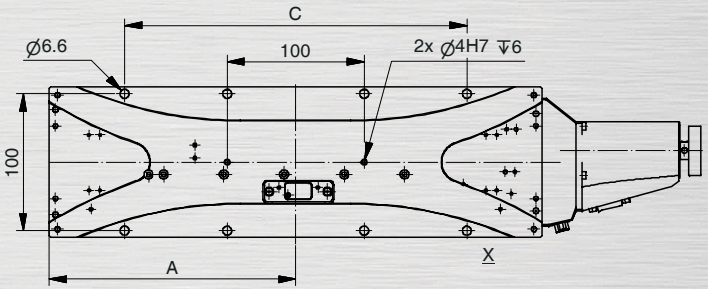
2Phase-045

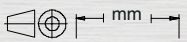



LS-110 with horizontal SpaceFab setup









Order No. 6236-9-

DC-B-032 1
2Phase-033 2
2Phase-045 3
DC-B-033 4

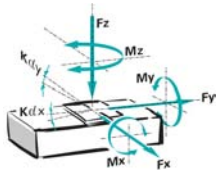
26 mm (1") 1
52 mm (2") 2
77 mm (3") 3
102 mm (4") 4
155 mm (6") 5
190 mm 6
255 mm (10") 7
305 mm (12") 8

without LS-010 0
LS-010, Linear steel scale (max 155 mm) 1

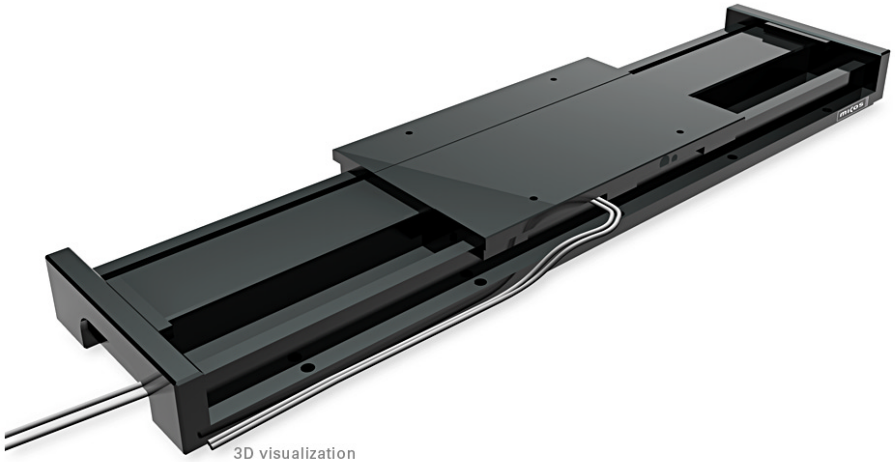
MLS-020, Mechanical limit switches 0

FACTS

Load characteristics	Fx(N)	Fy(N)	Fy Peak(N)	Fz(N)	Mx(Nm)	My(Nm)	Mz(Nm)
LM-053	150	15	158	200	85	70	70



The NEW linear stage **LMS-100** is designed for industrial applications with high speed and limited space conditions such as semiconductor and flat panel display manufacturing. Linear stages **LMS-100** are driven by linear motors and are equipped with a linear scale. The very small height of 30 mm and the width of 100 mm allows very compact setups even for long travel ranges. All linear stages of the **LMS-100** series are equipped with limit switches for protection against damage.



3D visualization

Key features

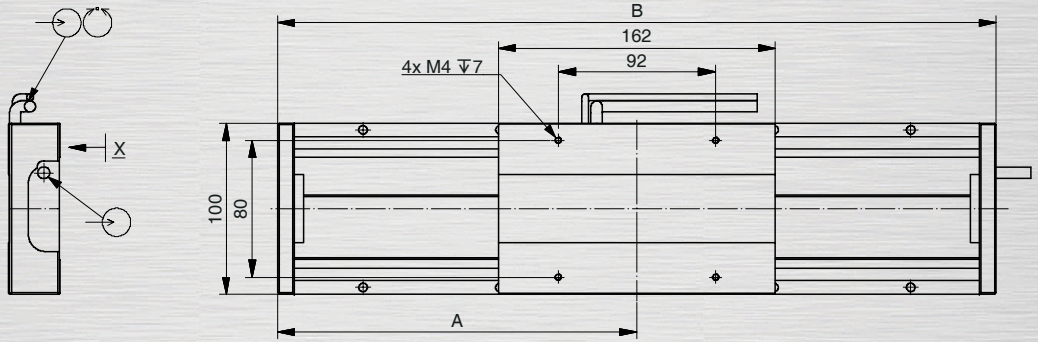
- Linear Motor
- Travel range up to 1000 mm
- Uni-directional repeatability down to 0.1 µm
- Maximum speed 500 mm/sec
- Load capacity up to 20 kg
- Integrated limit switches
- Integrated linear scale (center mounted)

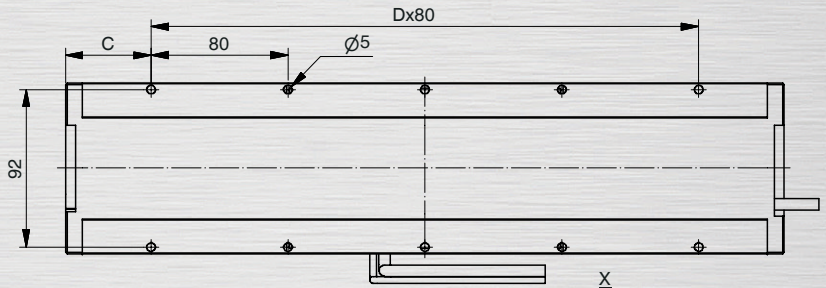
TECHNICAL DATA

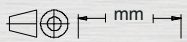
Travel range *(mm)*	**200**	**400**	**600**	**800**	**1000**
Straightness / Flatness (µm)	+/- 3	+/- 5	+/- 7	+/- 9	+/- 11
Pitch (µrad)	+/- 50	+/- 70	+/- 90	+/- 110	+/- 130
Yaw (µrad)	+/- 50	+/- 50	+/- 50	+/- 60	+/- 70
Weight (kg)	5	7	9	11.5	13.5
Motor	**LM-053**				
Linear scale				**LS-070**	
Speed max. (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)	0.33				
Accuracy	on request				
Material	Aluminum, black anodized				

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

Travel (mm)	200	400	600	800	1000
A	210	310	410	510	610
B	420	620	820	1020	1220
C	50	30	50	30	50
D	4	7	9	12	14







Order No.	6843-9-				

LM-053 1

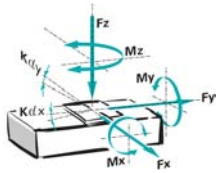
200 mm 1
400 mm 2
600 mm 3
800 mm 4
1000 mm 5

LS-070, Linear steel scale 1

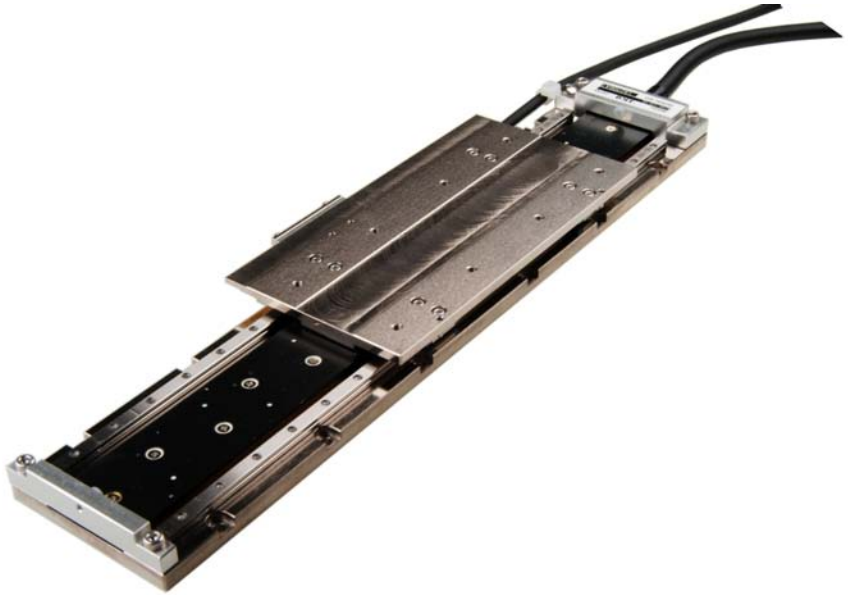
HLS-020, Hall limit switches 1

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 NEW linear stage **LMS-80** was designed for industrial applications with high speed requirements within a limited space. Linear stages **LMS-80** are driven by linear motors and are equipped with a linear scale. The very small height of 16 mm allows extremely compact setups. The Linear stage **LMS-80** is equipped with limit switches for protection against damage.



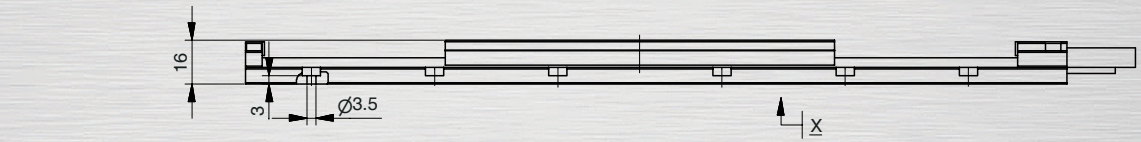
Key features

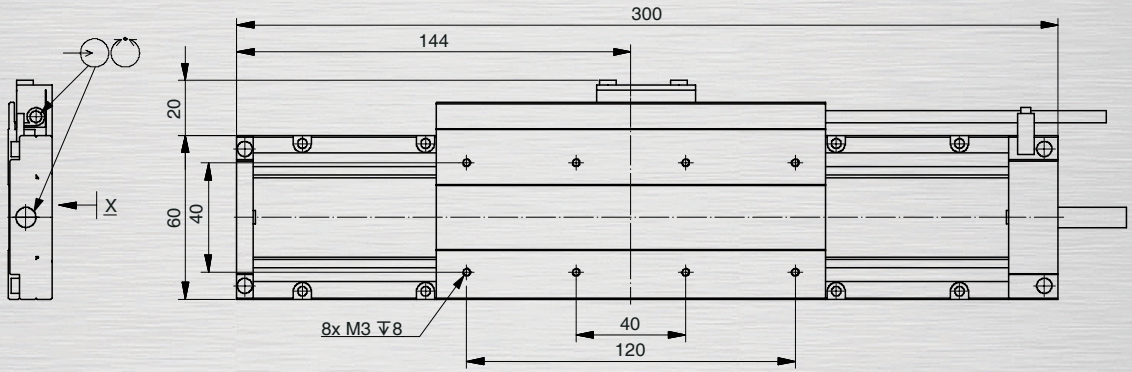
- Linear Motor
- Travel range 120 mm
- Uni-directional repeatability down to 0.1 µm
- Maximum speed 500 mm/sec
- Load capacity up to 5 kg
- Integrated limit switches
- Integrated linear scale

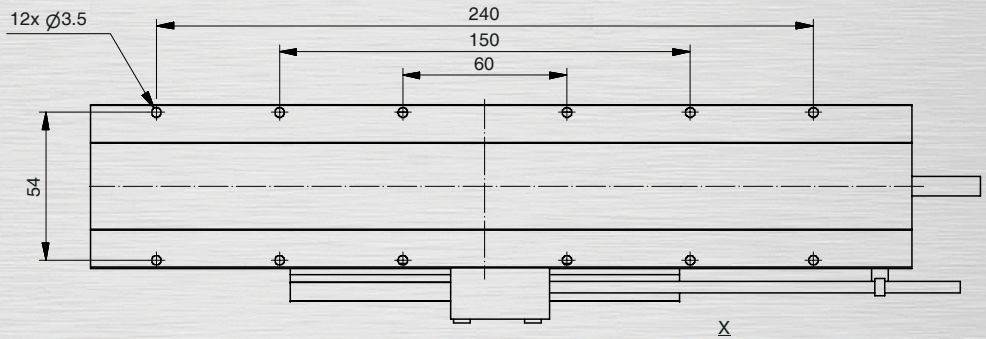
TECHNICAL DATA

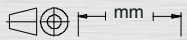
Travel range *(mm)*	**120**	
Straightness / Flatness (µm)	+/- 4	
Pitch (µrad)	+/- 150	
Yaw (µrad)	+/- 150	
Weight (kg)	2.5	
Motor	**LM-052**	
Linear scale		**LS-070**
Speed max. (mm/sec)	500	
Resolution calculated (µm)		0.015
Resolution typical (µm)		0.1
Bi-directional Repeatability (µm)		+/- 0.1
Uni-directional 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.





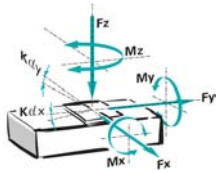




Order No.	6842-9-				
LM-052	1				
120 mm	1				
LS-070, Linear steel scale	1				
HLS-020, Hall limit switches	1				

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 NEW 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 up to 65 mm (LM-054)
- Uni-directional repeatability down to 0.1 µm
- Maximum speed 500 mm/sec
- Load capacity up to 3 kg
- Integrated limit switches
- Integrated linear scale

TECHNICAL DATA

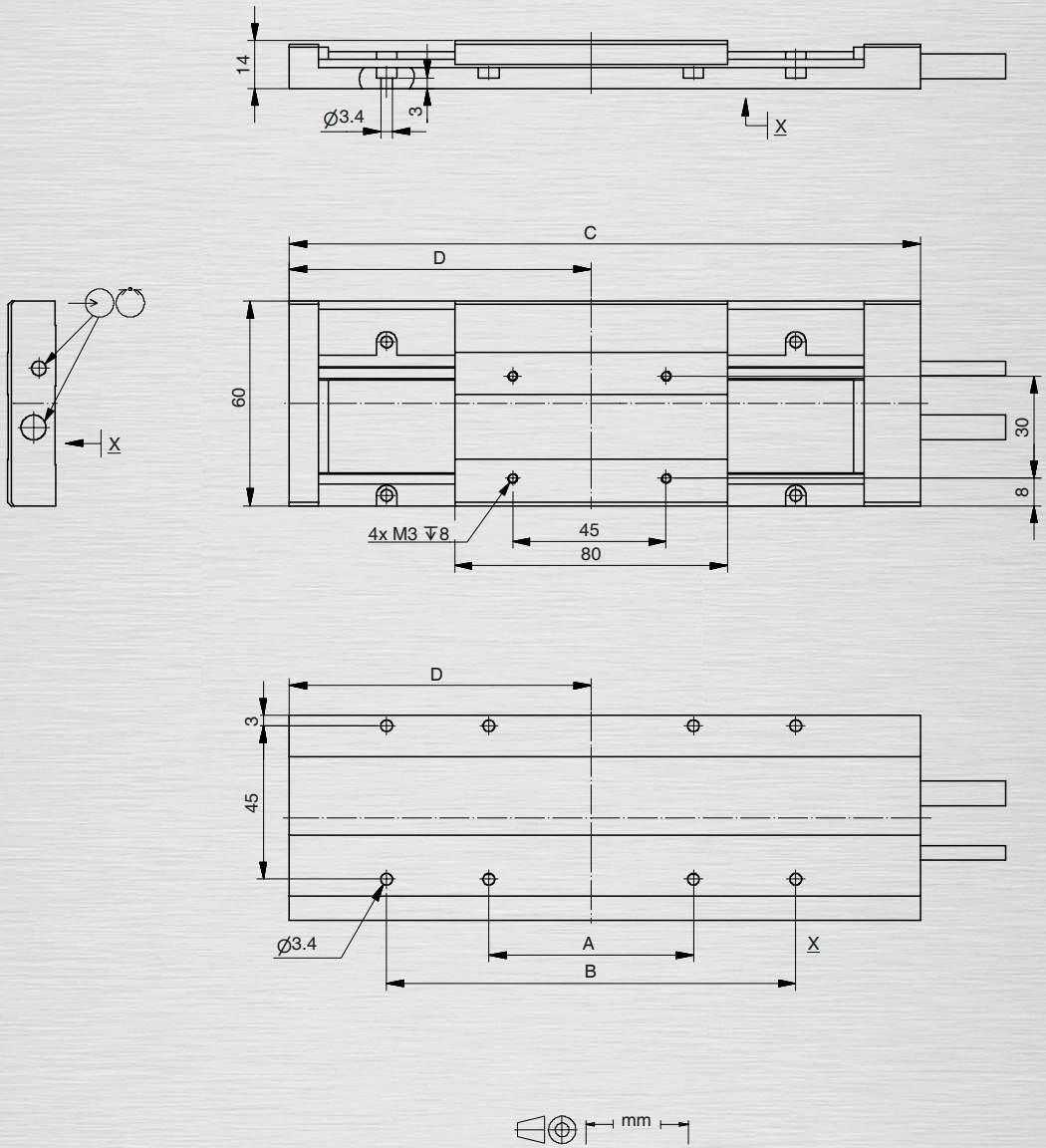
Travel range *(mm)*	**25**	**65**
Straightness / Flatness (µm)	+/- 1	+/- 2
Pitch (µrad)	+/- 80	+/- 100
Yaw (µrad)	+/- 80	+/- 100
Weight (kg)	1	1.8

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			

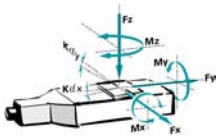
25 mm (LM-051) 1
65 mm (LM-054) 2

LS-070, Linear steel scale 1

HLS-020, Hall limit switches 1

FACTS

Load characteristics	Fx(N)	Fy(N)	Fz(N)	Mx(Nm)	My(Nm)	Mz(Nm)	kαx(µrad/Nm)	kαy(µrad/Nm)
DC-B-032	40	30	80	25	30	20	70	40
2Phase-032	40	30	100	25	30	20	70	40
2Phase-045	40	30	100	25	30	20	70	40
DC-B-033	40	30	80	25	30	20	70	40



Linear stages of the **PLS-85** series are especially suited for high precision applications with limited space conditions while allowing loads of 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 linear stages **PLS-85** 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 limit switches or hall sensors.

Key features

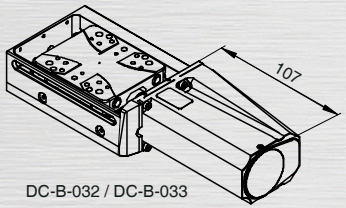
- Travel range up to 102 mm (4")
- Uni-directional repeatability down to 0.05 µm
- Maximum speed 100 mm/sec
- Load capacity up to 10 kg
- Integrated limit switches
- Optionally: linear scale

TECHNICAL DATA

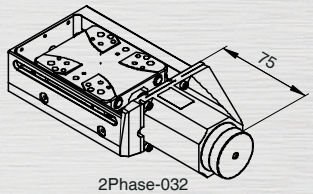
Travel range *(mm)*	**26**		**52**		**102**
Straightness / Flatness (µm)	+/- 1		+/- 2		+/- 4
Pitch (µrad)	+/- 60		+/- 90		+/- 120
Yaw (µrad)	+/- 60		+/- 80		+/- 100
Weight (kg)	0.9		1.2		1.5
Motor *(Pitch 1 | 2 mm)*	**DC-B-032**	**2Phase-032**	**2Phase-045**	**DC-B-033**	
Linear scale					**LS-012**
Speed max. (mm/sec)	50 | 90	20 | 35	20 | 45	50 | 90	
Resolution calculated (µm)	0.5 | 1 (RE)	5 | 10 (FS)	5 | 10 (FS)	0.05 | 0.1 (RE)	0.05
Resolution typical (µm)	0.5 | 1	0.05 | 0.1	0.05 | 0.1	0.1 | 0.2	0.05
Bi-directional Repeatability (µm)	+/- 1 | +/- 1	+/- 1 | +/- 1	+/- 1 | +/- 1	+/- 1 | +/- 1	+/- 0.1
Uni-directional Repeatability (µm)	0.5 | 1	0.1 | 0.2	0.1 | 0.2	0.1 | 0.2	0.05
Nominal Current (A)	2.3	1.2	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.

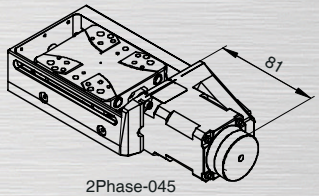
Travel (mm)	26	52	102
A	59	68.5	93.5
B	119.5	138.5	188.5
C	-	100	150



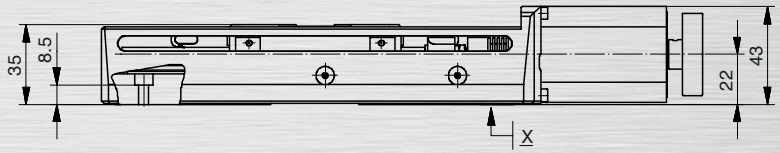
DC-B-032 / DC-B-033

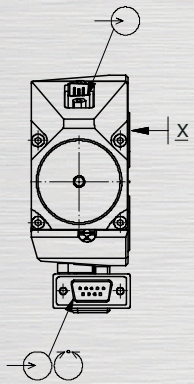


2Phase-032

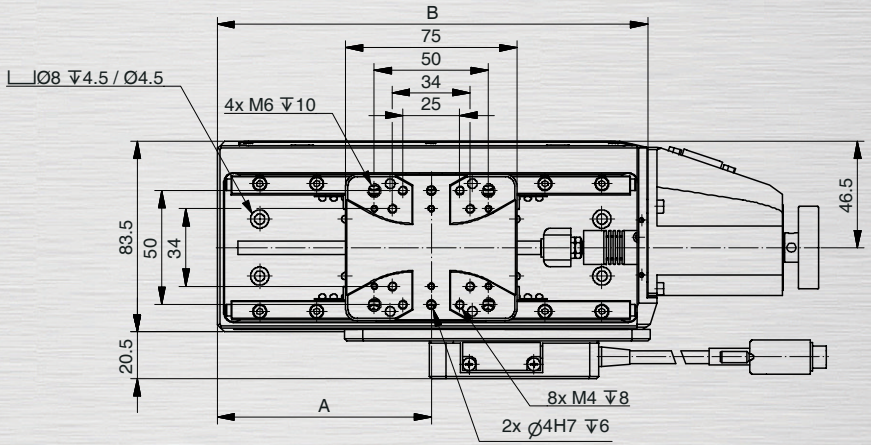


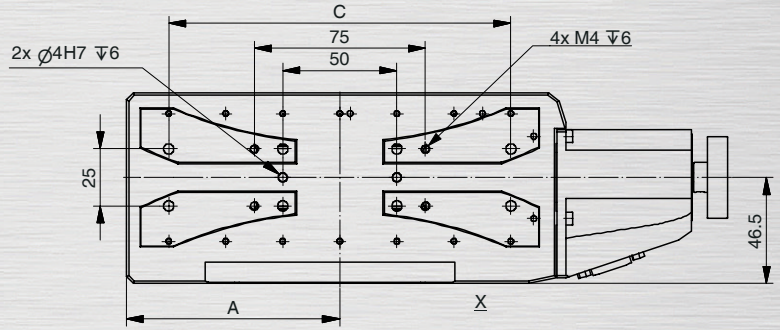
2Phase-045

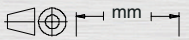




LS-012







Order No.	6234-9-				

DC-B-032 1
2Phase-032 2
2Phase-045 3
DC-B-033 4

26 mm (1") 0
52 mm (2") 1
102 mm (4") 2

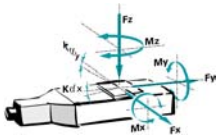
without LS-012 0
LS-012, Linear steel scale 1

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

NEW

FACTS

Load characteristics	Fx(N)	Fy(N)	Fz(N)	Mx(Nm)	My(Nm)	Mz(Nm)	kαx(µrad/Nm)	kαy(µrad/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 NEW linear stage **LS-65** 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) 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 and have two optical or mechanical limit switches. Additionally the **LS-65** can be ordered with our smc pollux motor-controller module.

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 limit switches
- Optionally 0.4 mm pitch

TECHNICAL DATA

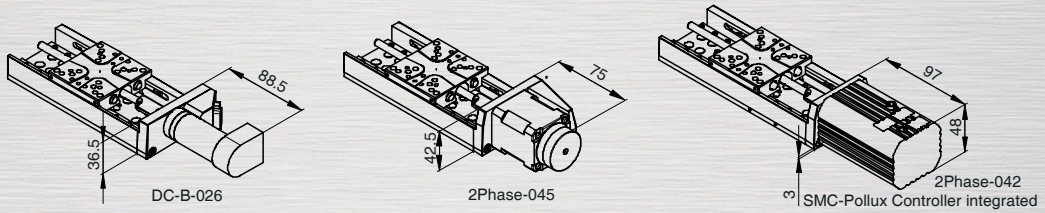
Travel range *(mm)*	**26**	**52**	**77**	**102**
Straightness / Flatness (µm)	+/- 2	+/- 4	+/- 6	+/- 8
Pitch (µrad)	+/- 70	+/- 90	+/- 110	+/- 130
Yaw (µrad)	+/- 70	+/- 80	+/- 90	+/- 100
Weight (kg)	0.6	0.7	0.8	0.9

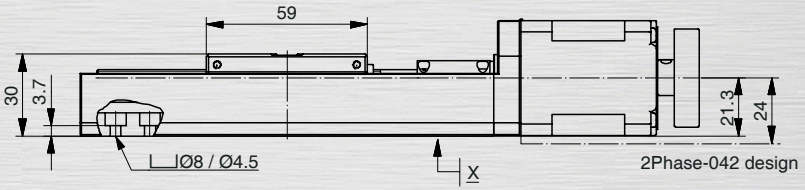
Motor *(Pitch 1 mm)*	**DC-B-026**	**2Phase-045**	**2Phase-042**
Speed max. (mm/sec)	20	20	13
Resolution calculated (µm)	0.5 (RE)	5 (FS)	5 (FS)
Resolution typical (µm)	0.5	0.2	0.2
Bi-directional Repeatability (µm)	+/- 5	+/- 5	+/- 5
Uni-directional Repeatability (µm)	0.5	0.3	0.3
Nominal Current (A)	0.98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

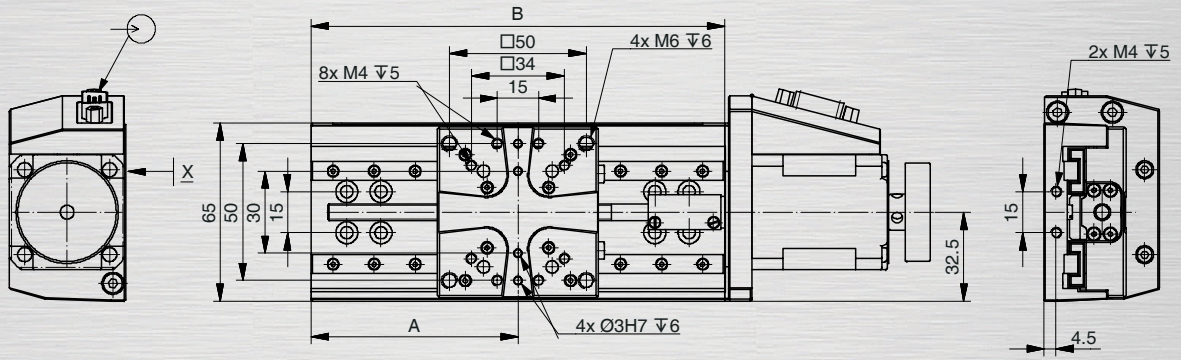
Accuracy	on request
Velocity Range (mm/sec)	0.001 ... 10
Material	Aluminum, black anodized

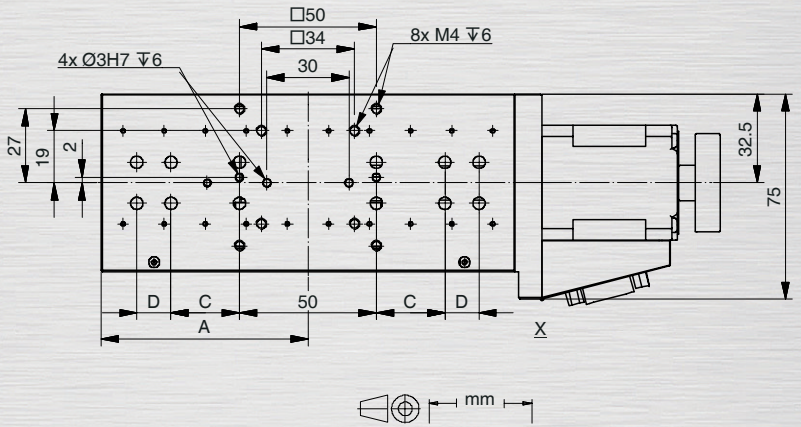
Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.

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	

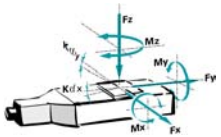
DC-B-026 1
2Phase-045 2
2Phase-042, only with OLS-010 3

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	Fx(N)	Fy(N)	Fz(N)	Mx(Nm)	My(Nm)	Mz(Nm)	kαx(µrad/Nm)	kαy(µrad/Nm)
2Phase-020	10	3	20	0.4	0.6	0.4	80	30



The micro stage **MTS-65** was developed for industrial application with limited space conditions and is typically used for the positioning of laser diodes and optical parts. Driven by a 2-phase stepper motor using high-resolution micro-stepping, the gear-less stages utilize re-circulating ball bearings and a ground re-circulating ball screw. As a result, maximum of stiffness, accuracy and smoothness of motion is guaranteed.

The micro stage is equipped with two optical or hall limit switches. For higher positioning accuracy and repeatability 0.1 µm, the micro stages **MTS-65** are offered with a linear scale. Using a special mounting kit, **MTS-65** stages can be assembled to XY or XYZ- modules.

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 2 kg
- Integrated limit switches
- Optionally: linear scale

TECHNICAL DATA

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

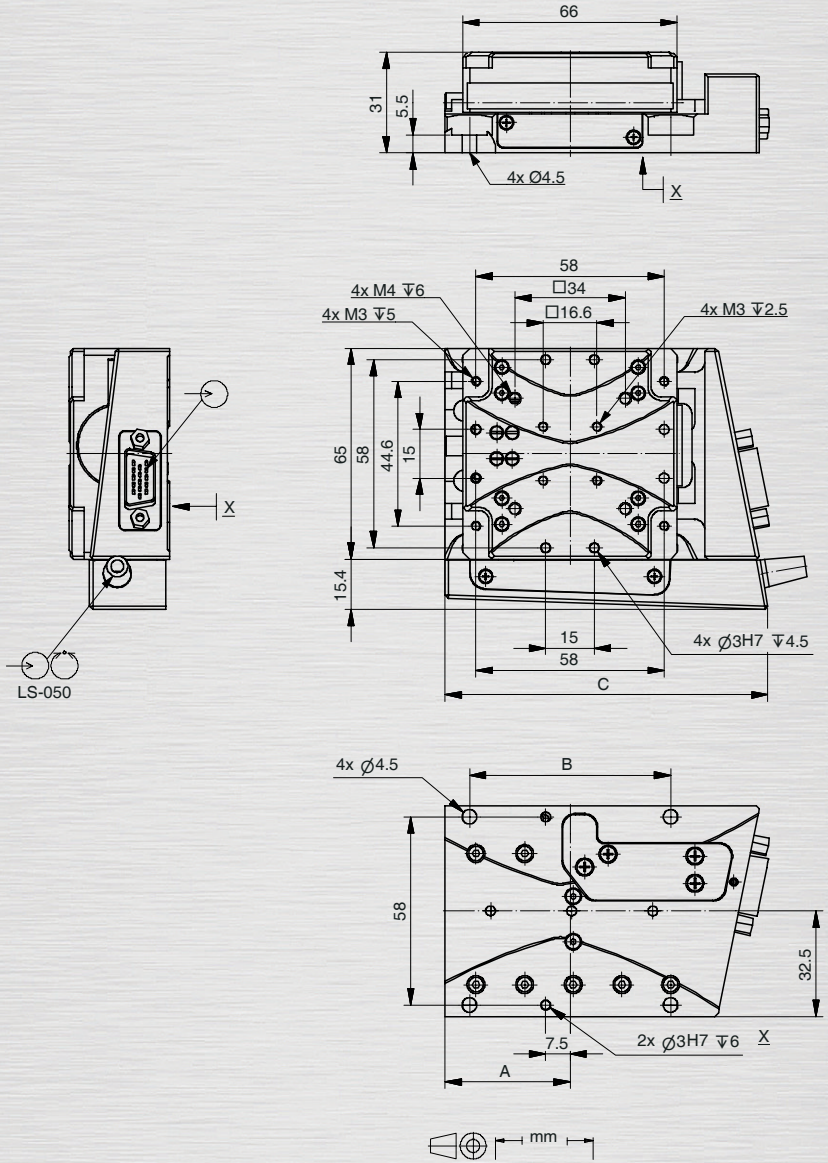
Motor *(Pitch 1 mm)*	**2Phase-020**	
Linear scale		**LS-050**
Speed max. (mm/sec)	8	
Resolution calculated (µm)	5 (FS)	0.05
Resolution typical (µm)	0.1	0.05
Bi-directional Repeatability (µm)	+/- 5	+/- 0.2
Uni-directional Repeatability (µm)	0.2	0.1
Nominal Current (A)	1.2	

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

xyz setup



Order No.	6217-9-				

2Phase-020 2

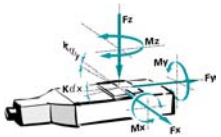
13 mm (1/2") 1
26 mm (1") 2
52 mm (2") 3

without LS-050 0
LS-050, Linear steel scale 1

HLS-010, Hall limit switches 1
OLS-010, Optical limit switches 2

FACTS

Load characteristics	Fx(N)	Fy(N)	Fz(N)	Mx(Nm)	My(Nm)	Mz(Nm)	kαx(µrad/Nm)	kαy(µrad/Nm)
2Phase-020	10	3	20	0.4	0.6	0.4	80	30



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

Key features

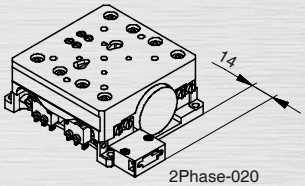
- Travel range 10 mm
- Uni-directional repeatability down to 0.1 µm
- Maximum speed 8 mm/sec
- Load capacity up to 2 kg
- Integrated limit switches
- Optionally: linear scale

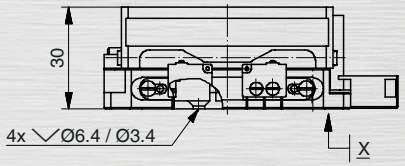
TECHNICAL DATA

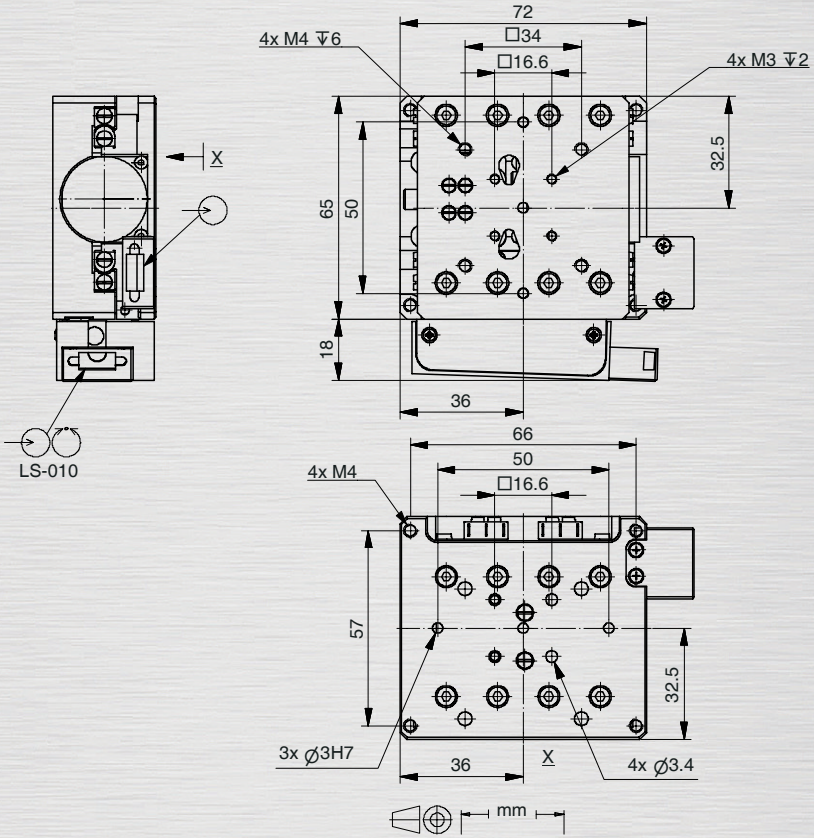
Travel range *(mm)*	**10**	
Straightness / Flatness (µm)	+/- 1	
Pitch (µrad)	+/- 50	
Yaw (µrad)	+/- 50	
Weight (kg)	0.4	
Motor *(Pitch 1 mm)*	**2Phase-020**	
Linear scale		**LS-010**
Speed max. (mm/sec)	8	
Resolution calculated (µm)	5 (FS)	0.05
Resolution typical (µm)	0.1	0.05
Bi-directional Repeatability (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.

MTS-70 xy combination for vacuum





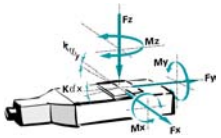


Order No.	6218-9-				
2Phase-020	2				
x axis	1				
xy axes (setup by MICOS)	2				
10 mm		0			
without LS-010			0		
LS-010, Linear steel scale			3		

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 NEW linear stage **VT-75** was designed for standard industrial applications that require 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 4 mm pitch guarantees quiet, smooth motion. The **VT-75** linear stages are equipped with a roller guide system and motorized with a DC- or 2-phase stepper motor. Additionally the **VT-75** can be ordered with our smc pollux motor- controller module. The stages are equipped with two hall limit switches.

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 limit switches

TECHNICAL DATA

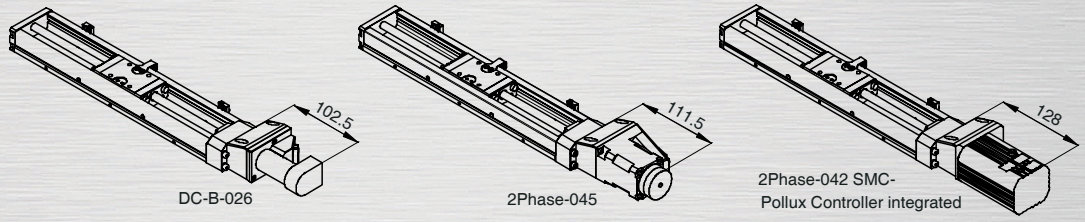
Travel range *(mm)*	**50**	**100**	**200**	**300**	**400**	**500**	**600**
Straightness / Flatness (µm)	+/- 2	+/- 3	+/- 4	+/- 5	+/- 7	+/- 9	+/- 11
Pitch (µrad)	+/- 50	+/- 60	+/- 70	+/- 80	+/- 90	+/- 100	+/- 110
Yaw (µrad)	+/- 40	+/- 40	+/- 40	+/- 60	+/- 80	+/- 90	+/- 90
Weight (kg)	1.6	2.1	2.7	3.4	4.1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

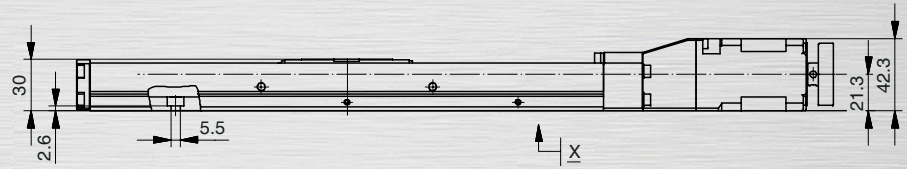
Motor *(Pitch 4 mm)*	**DC-B-026**	**2Phase-045**	**2Phase-042**
Speed max. (mm/sec)	150	80	52
Resolution calculated (µm)	2 (RE)	20 (FS)	20 (FS)
Resolution typical (µm)	2	0.4	0.4
Bi-directional Repeatability (µm)	+/- 6	+/- 6	+/- 6
Uni-directional Repeatability (µm)	2	0.4	0.4
Nominal Current (A)	0.98	1.2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

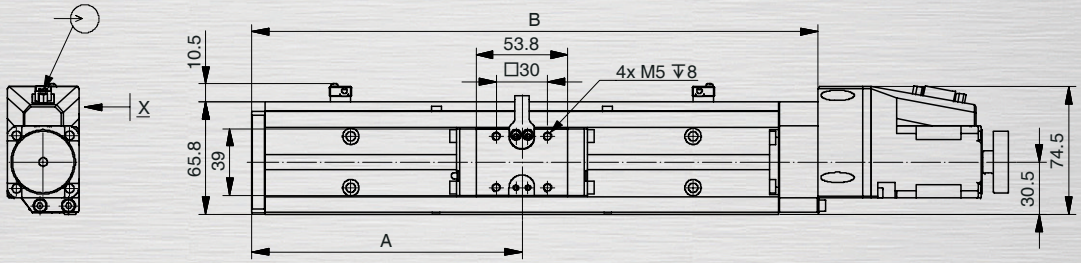
Accuracy	on request
Velocity Range (mm/sec)	0.003 ... 100
Material	Steel

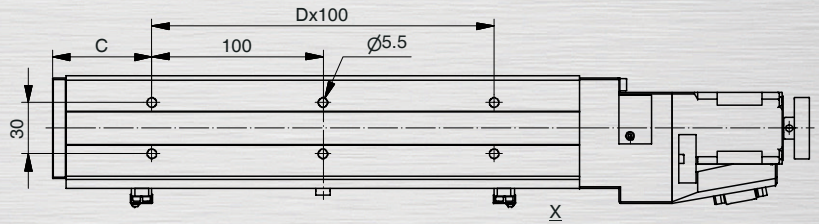
Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.

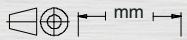
Travel (mm)	50	100	200	300	400	500	600
A	83	108	158	208	258	510	510
B	181	231	331	431	531	631	731
C	33	58	58	58	58	58	58
D	1	1	2	3	4	5	6











Order No.	6229-9-			0	

DC-B-026 1
2Phase-045 2
2Phase-042 3

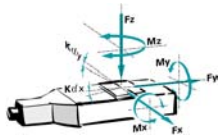
50 mm 1
100 mm 2
200 mm 3
300 mm 4
400 mm 5
500 mm 6
600 mm 7

HLS-010, Hall limit switches 1

NEW

FACTS

Load characteristics	Fx(N)	Fy(N)	Fz(N)	Mx(Nm)	My(Nm)	Mz(Nm)
DC-B-026	5	7	10	1	2.5	1
2Phase-023	5	25	10	1	2.5	1



The NEW linear stage **VT-40** is designed for standard industrial applications with about 6 µm repeatability and miniature size requirements. Typical applications for this metrology stage are inspection systems. The low profile, short but rigid steel design allows setups under limited space conditions. A precision ball screw with 4 mm pitch guarantees quiet, smooth motion. The **VT-40** linear stages are equipped with a roller guide system and are motorized with a DC- or 2-phase stepper motor. The stages are equipped with two hall limit switches.

Key features

- Travel range up to 100 mm
- Uni-directional repeatability down to 0.4 µm
- Maximum speed 150 mm/sec
- Load capacity up to 1 kg
- Integrated limit switches

TECHNICAL DATA

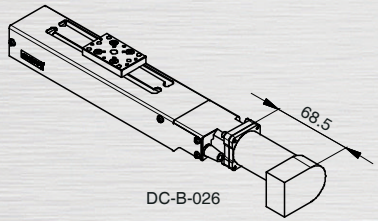
Travel range *(mm)*	**30**	**65**	**100**
Straightness / Flatness (µm)	+/- 3	+/- 4	+/- 6
Pitch (µrad)	+/- 210	+/- 230	+/- 250
Yaw (µrad)	+/- 90	+/- 90	+/- 90
Weight (kg)	0.3	0.4	0.5

Motor *(Pitch 4 mm)*	**DC-B-026**	**2Phase-023**
Speed max. (mm/sec)	150	60
Resolution calculated (µm)	2 (RE)	20 (FS)
Resolution typical (µm)	2	0.4
Bi-directional Repeatability (µm)	+/- 4	+/- 4
Uni-directional Repeatability (µm)	2	0.4
Nominal Current (A)	0.98	1.3
Voltage Range (V)	24	

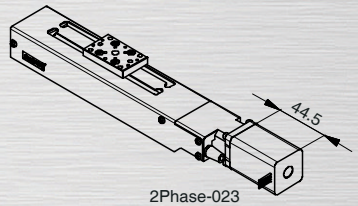
Accuracy	on request
Velocity Range (mm/sec)	0.003 ... 150
Material	Steel

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

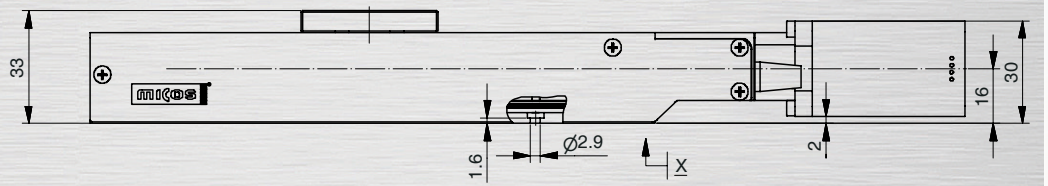
Travel (mm)	30	65	100
A	64	81.5	99
B	176	211	246
C	2	3	4

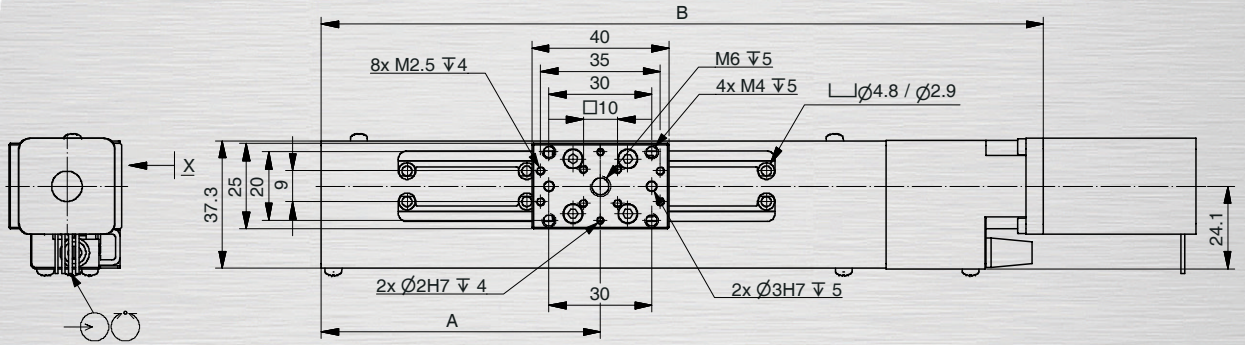


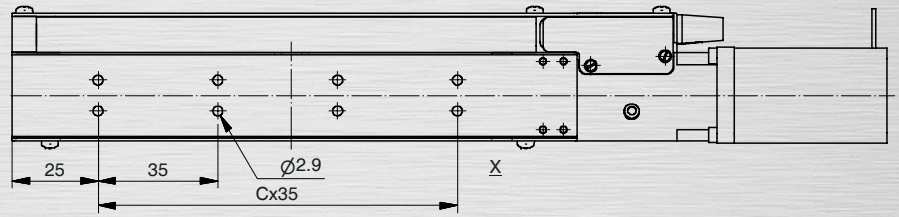
DC-B-026



2Phase-023







mm

Order No.	6228-9-			0	

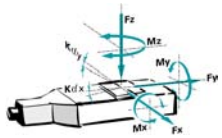
DC-B-026 1
2Phase-023 2

30 mm 1
65 mm 2
100 mm 3

HLS-010, Hall limit switches 1

FACTS

Load characteristics	Fx(N)	Fy(N)	Fz(N)	Mx(Nm)	My(Nm)	Mz(Nm)	kαx(µrad/Nm)	kαy(µrad/Nm)
DC-B-026	40	50	50	2.5	5	2.5	220	150
2Phase-041	40	50	50	2.5	5	2.5	220	150
2Phase-042	40	50	50	2.5	5	2.5	220	150



The translation stage **VT-80** is a popular laboratory stage with a wide range of travel lengths. A backlash-free re-circulating ball bearing along with a back-lash compensated lead screw guarantees quiet and smooth motion. The translation stages **VT-80** are equipped with integrated limit switches and motorized with DC or 2-phase stepper motors. 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 applications in instrumentation, but suitable only for lower duty cycles. All translation stages of the series **VT-80** can be directly assembled as XY. XY-assembly with travel of 25 mm must be set-up at our plant. Please indicate set-up configurations 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 limit switches

TECHNICAL DATA

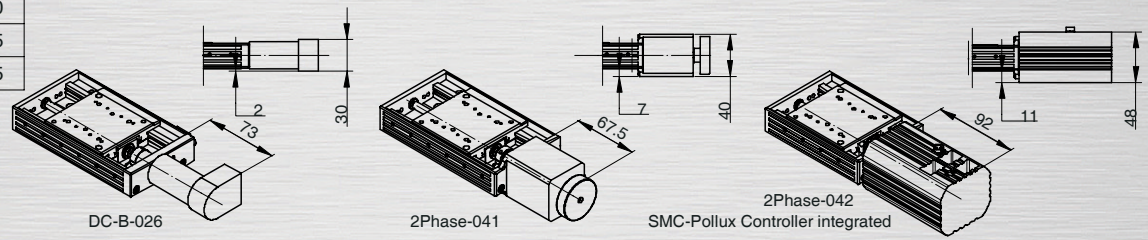
Travel range *(mm)*	**25**	**50**	**75**	**100**	**150**	**200**	**250**	**300**
Straightness / Flatness (µm)	+/- 8	+/- 10	+/- 11	+/- 12	+/- 14	+/- 20	+/- 25	+/- 35
Pitch (µrad)	+/- 100	+/- 110	+/- 120	+/- 130	+/- 150	+/- 170	+/- 190	+/- 210
Yaw (µrad)	+/- 150	+/- 150	+/- 150	+/- 150	+/- 150	+/- 150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

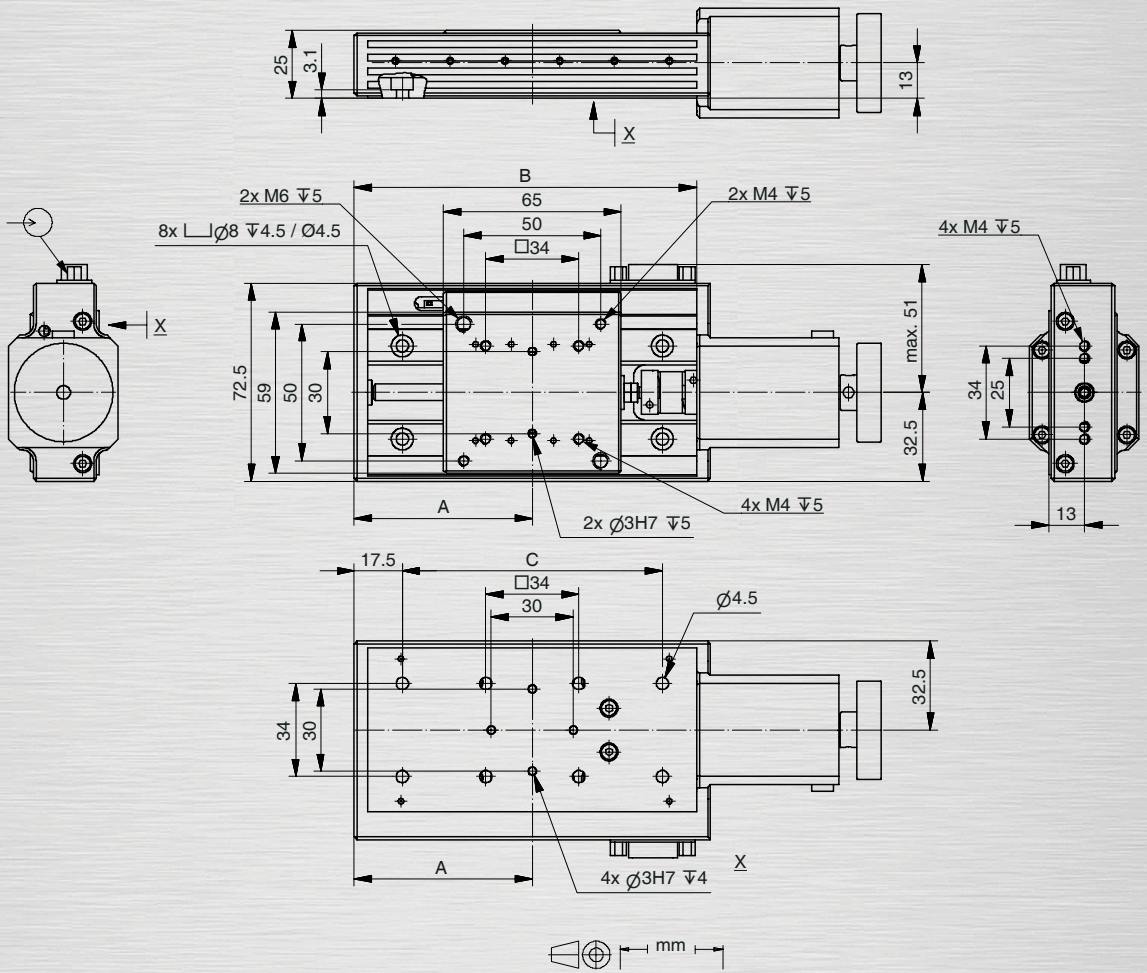
Motor *(Pitch 1 mm)*	**DC-B-026**	**2Phase-041**	**2Phase-042**
Speed max. (mm/sec)	20	20	13
Resolution calculated (µm)	0.5 (RE)	5 (FS)	5 (FS)
Resolution typical (µm)	0.5	0.2	0.2
Bi-directional Repeatability (µm)	+/- 10	+/- 10	+/- 10
Uni-directional Repeatability (µm)	0.8	0.4	0.4
Nominal Current (A)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

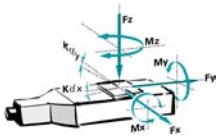
25 mm (xy set up by MICOS) 1
50 mm 2
75 mm 3
100 mm 4
150 mm 5
200 mm 6
250 mm 7
300 mm 8

single stage 0
25 mm xy setup 1

NEW

FACTS

Load characteristics	Fx(N)	Fy(N)	Fz(N)	Mx(Nm)	My(Nm)	Mz(Nm)
DC-B-010	5	3	5	0.4	0.6	0.4
2Phase-019	20	30	20	0.6	0.8	0.6
2Phase-010	7	7	7	0.4	0.6	0.4



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.
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.

3D visualization

Key features

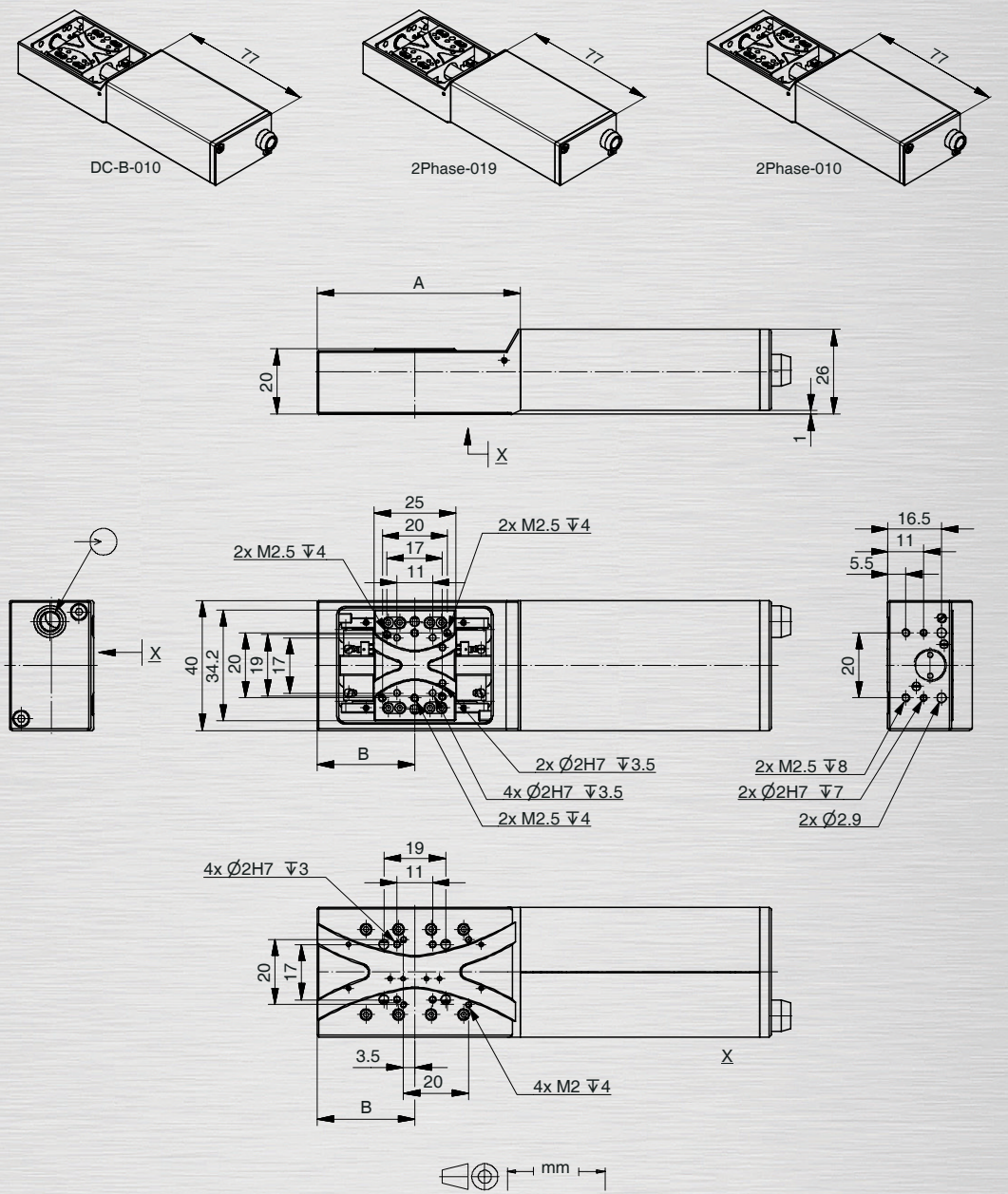
- Travel range up to 52 mm
- Uni-directional repeatability down to 0.1 µm
- Maximum speed 5 mm/sec
- Load capacity up to 2 kg
- Integrated limit switches
- High resolution

TECHNICAL DATA

Travel range *(mm)*	**13**	**26**	**52**
Straightness / Flatness (µm)	+/- 1.5	+/- 3	+/- 5
Pitch (µrad)	+/- 150	+/- 170	+/- 190
Yaw (µrad)	+/- 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)	0.2745122 (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

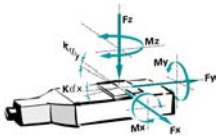
13 mm 1
26 mm 2
52 mm 3

HLS-010, Hall limit switches 1

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 NEW Linear Stage **VT-21 L** is designed for applications with very limited space conditions and about 8 µm repeatability. Typical applications for this measuring stage are inspection and systems. The **VT-21 L** linear stages are motorized with a 2-phase-stepper motor, and with two limit switches. As an option a linear scale can be ordered. xy and xz setups can be mounted with a special bracket.

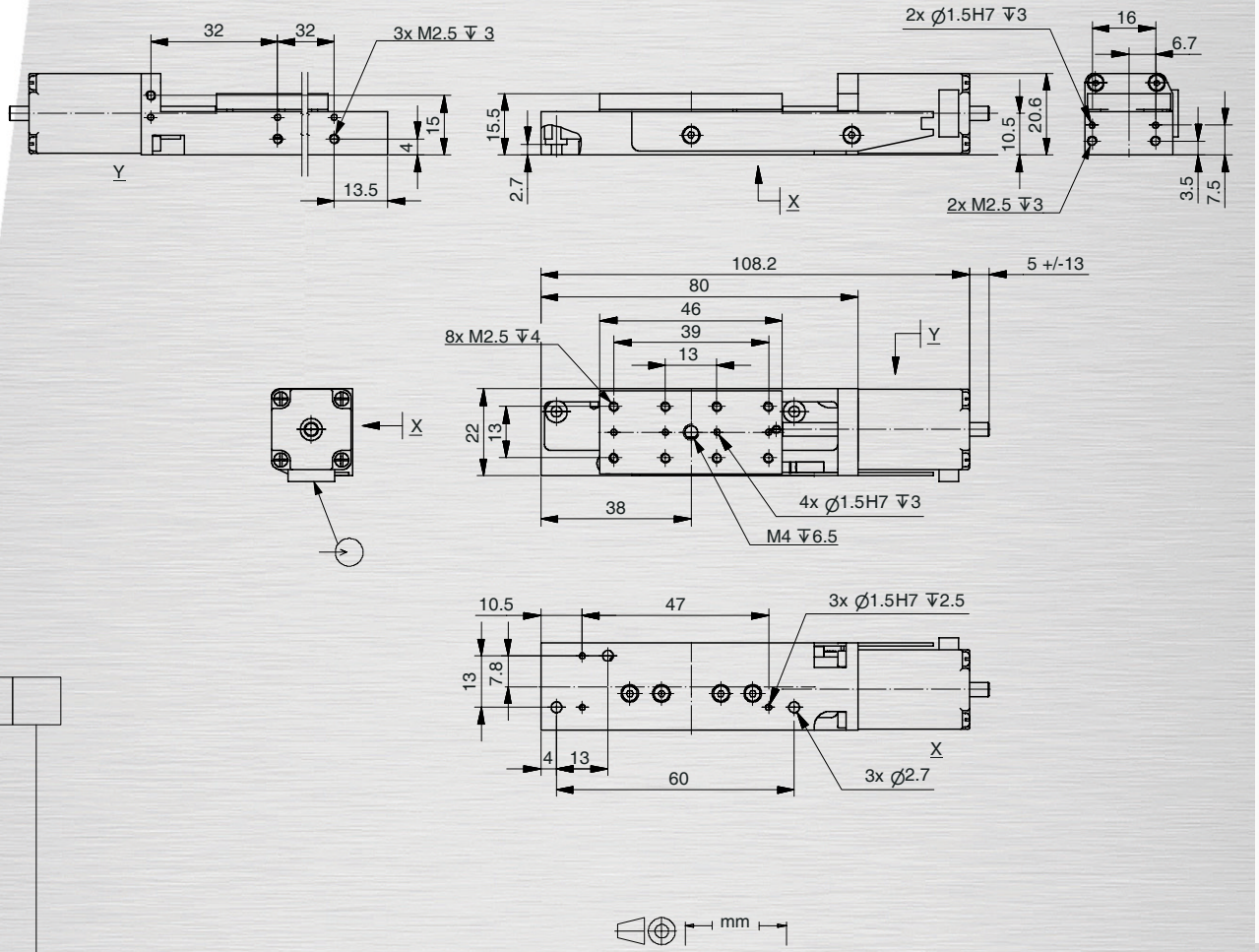
Key features

- Travel range 26 mm
- Uni-directional repeatability down to 0.5 µm
- Maximum speed 5 mm/sec
- Load capacity up to 1 kg
- Integrated limit switches
- Optionally: linear scale
- Other resolutions and accuracies available upon request

TECHNICAL DATA

Travel range *(mm)*	**26**	
Straightness / Flatness (µm)	+/- 2	
Pitch (µrad)	+/- 100	
Yaw (µrad)	+/- 100	
Weight (kg)	0.12	
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	
Bi-directional Repeatability (µm)	+/- 4	
Uni-directional Repeatability (µm)	0.5	
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.	6216-9-					

2Phase-018 2
26 mm 3

without LS-012 0
LS-012, Linear steel scale 1

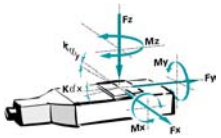
MLS-060 2

Pitch 0.5 mm 1

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 NEW Linear Stage **VT-21 S** is designed for applications with very limited space conditions and about 8 µm repeatability. Typical applications for this measuring stage are inspection and systems. The **VT-21 S** linear stages are motorized with a 2-phase-stepper motor, and with two limit switches. As an option a linear scale can be ordered. xy and xz setups can be mounted with a special bracket.

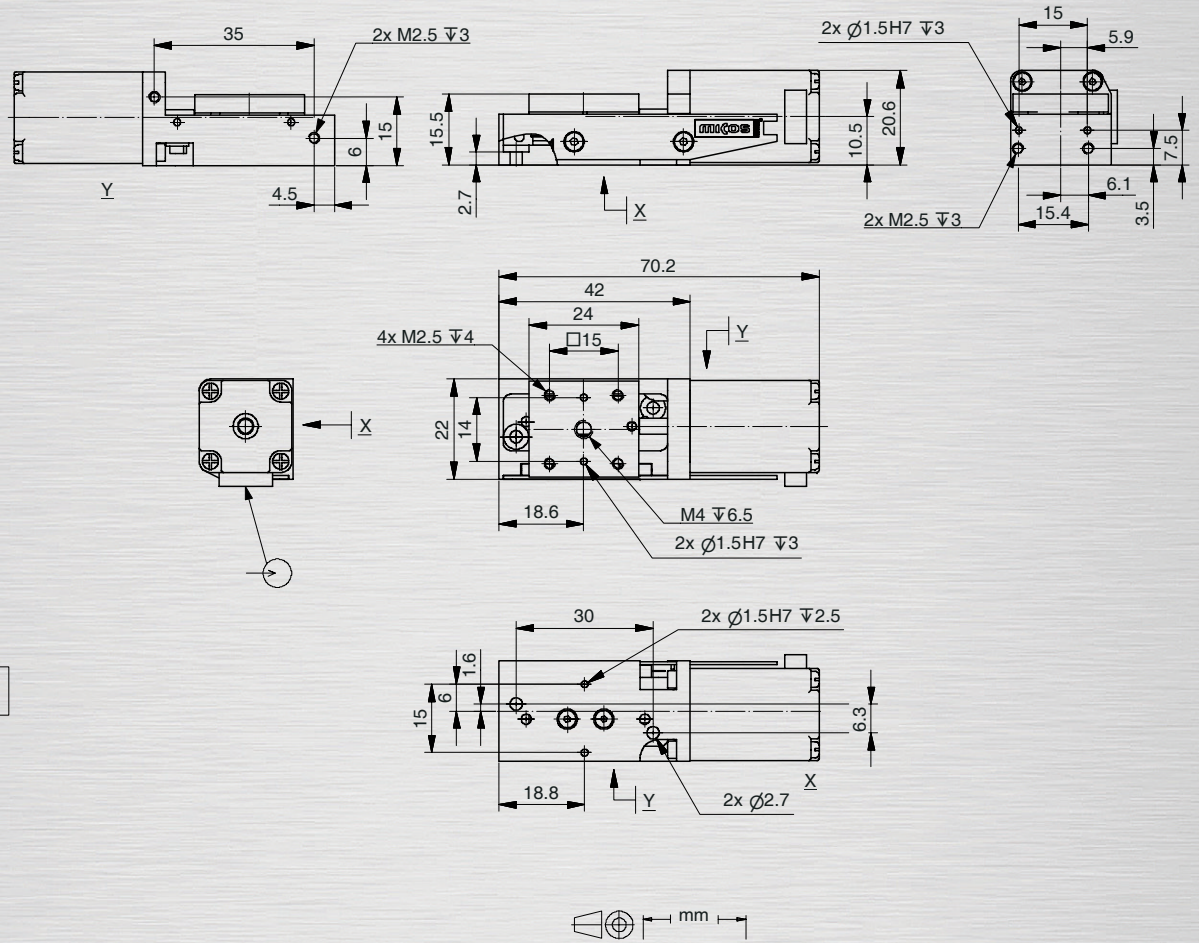
Key features

- Travel range 10 mm
- Uni-directional repeatability down to 0.5 µm
- Maximum speed 5 mm/sec
- Load capacity up to 1 kg
- Integrated limit switches
- Optionally: linear scale
- Other resolutions and accuracies available upon request

TECHNICAL DATA

Travel range *(mm)*	**10**	
Straightness / Flatness (µm)	+/- 1	
Pitch (µrad)	+/- 70	
Yaw (µrad)	+/- 70	
Weight (kg)	0.1	
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	
Bi-directional Repeatability (µm)	+/- 4	
Uni-directional Repeatability (µm)	0.5	
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.

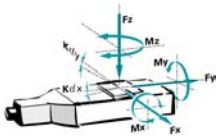


Order No.	6214-9-					

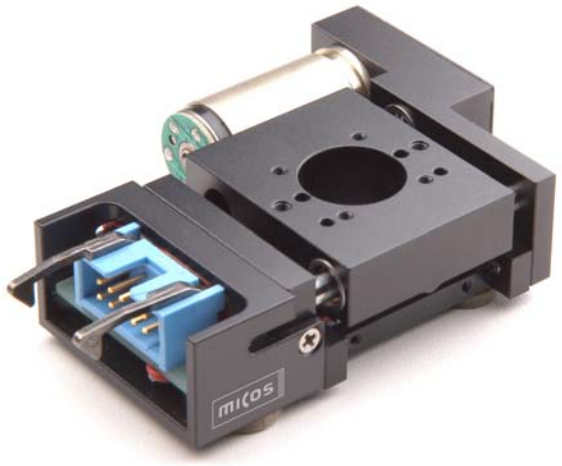
2Phase-018 2
10 mm 2
without LS-012 0
LS-012, Linear steel scale 1
MLS-060 2
Pitch 0.5 mm 1

FACTS

Load characteristics	Fx(N)	Fy(N)	Fz(N)	Mx(Nm)	My(Nm)	Mz(Nm)	kαx(µrad/Nm)	kαy(µrad/Nm)
DC-B-010	5	5	8	0.3	0.5	0.3	300	160
2Phase-010	5	5	8	0.3	0.5	0.3	300	160



Micro stages **MT-55** are especially suited for integration in limited space environments. The **MT-55** can be used for precision high-resolution positioning of small components such as fibers, optical components and laser diodes. The **MT-55** is equipped with zero-backlash ball bearings and a precision lead screw with 0.25 mm pitch. The **MT-55** micro stage is driven by a low-backlash belt drive using a DC or 2-phase stepper motor with zero-backlash gear. The travel range is 5 mm. The **MT-55** is provided with a clear aperture of 15 mm diameter, so it is well suited for all tasks in microscopy. Two limit switches prevent damage from accidental over-travel. XY-assembly is possible at the factory and must be indicated when ordering.



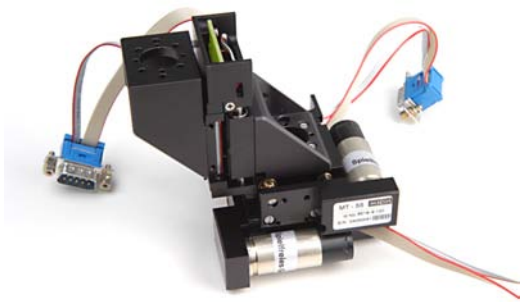
Key features

- Travel range 5 mm
- Uni-directional repeatability down to 0.2 µm
- Maximum speed 1 mm/sec
- Load capacity up to 0.8 kg
- Integrated limit switches
- Center hole 15 mm
- High Resolution

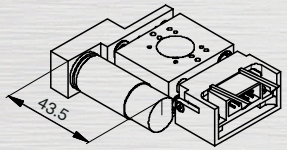
TECHNICAL DATA

Travel range *(mm)*	**5**	
Straightness / Flatness (µm)	+/- 1	
Pitch (µrad)	+/- 30	
Yaw (µrad)	+/- 15	
Weight (kg)	0.18	
Motor *(Pitch 0.25 mm)*	**DC-B-010**	**2Phase-010**
Speed max. (mm/sec)	1	0.25
Resolution calculated (µm)	0.0055402 (RE)	0.1372561 (FS)
Resolution typical (µm)	0.2	0.2
Bi-directional Repeatability (µm)	+/- 4	+/- 4
Uni-directional Repeatability (µm)	0.2	0.2
Nominal Current (A)	0.32	0.25
Voltage Range (V)	12	
Accuracy	on request	
Velocity Range (mm/sec)	0.001 ... 1	
Material	Aluminum, black anodized	

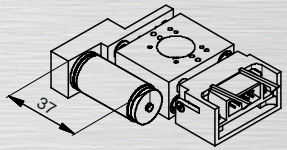
Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.



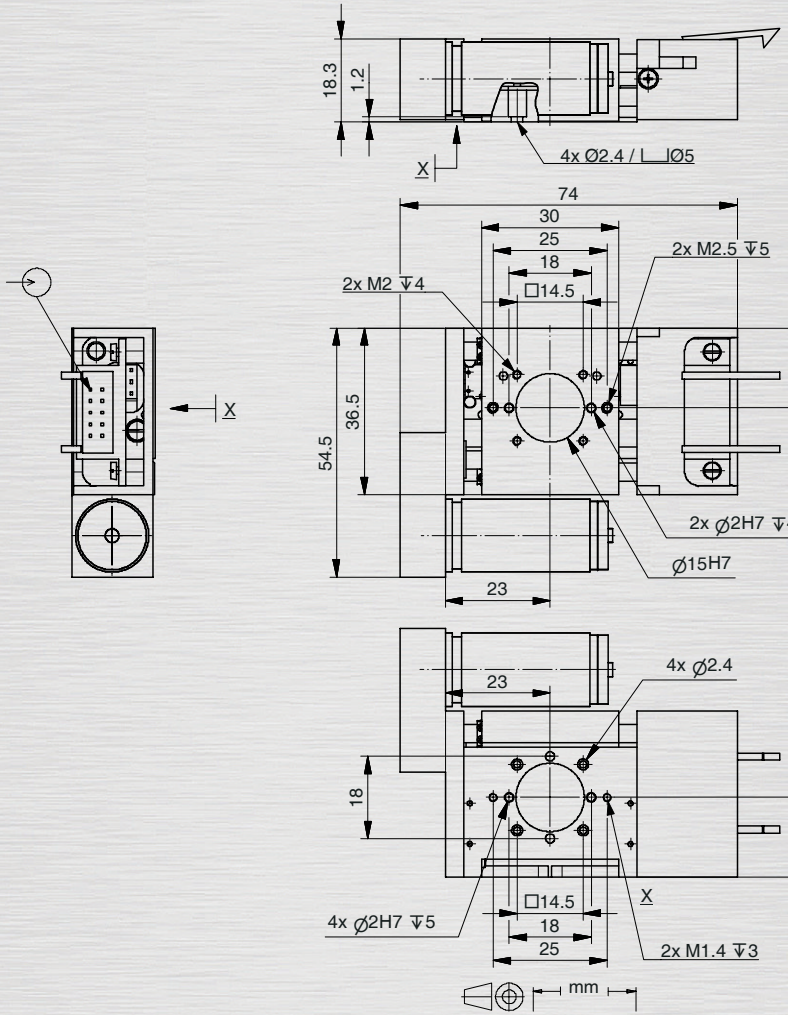
xyz setup



DC-B-010



2Phase-010



Order No.	6219-9-			

DC-B-010 1
2Phase-010 2

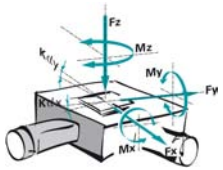
x axis 1
xy axes (setup by MICOS) 2

5 mm 0

4.410 Cross Stage CS-430

FACTS

Load characteristics	Fx(N)	Fy(N)	Fz(N)	Mx(Nm)	My(Nm)	Mz(Nm)	kαx(µrad/Nm)	kαy(µrad/Nm)
2Phase-071	110	110	300	80	80	80	120	120



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

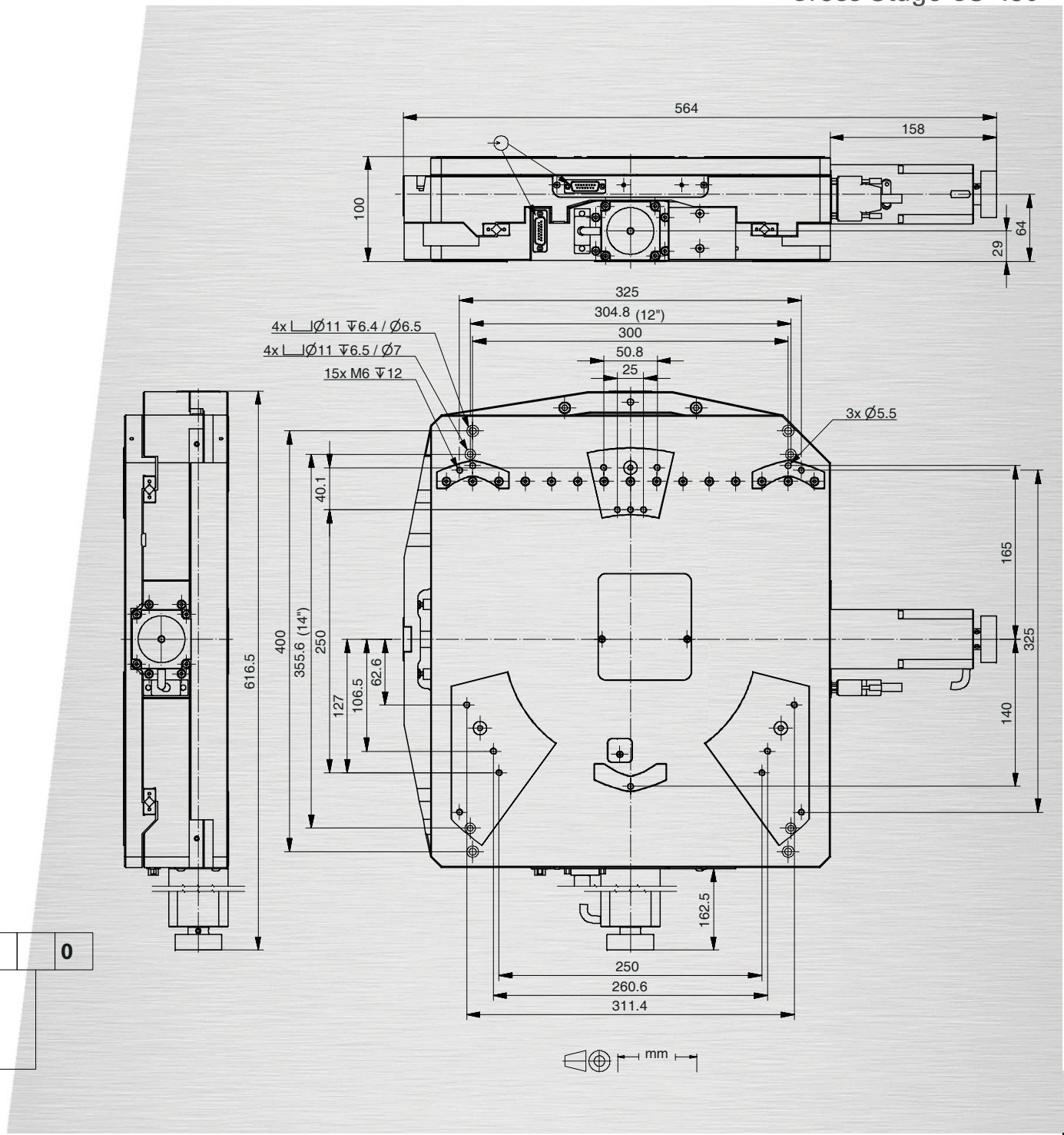
Key features

- 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 limit switches
- Optionally: linear scale (center mounted)

TECHNICAL DATA

Travel range *(mm)*	**350 x 300**	
Orthogonality (µrad)	90	
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.



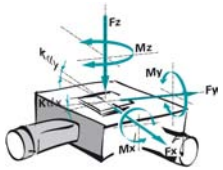
Order No.	6330-9-				0

2Phase-071 2
350 mm x 300 mm 1
without LS-010 0
LS-010, Linear steel scale 1

4.420 Scan Table MS-8

FACTS

Load characteristics	Fx(N)	Fy(N)	Fz(N)	Mx(Nm)	My(Nm)	Mz(Nm)	kαx(µrad/Nm)	kαy(µrad/Nm)
DC-B-032	20	20	40	0.5	0.5	0.5	400	400
2Phase-033	20	20	40	0.5	0.5	0.5	400	400



The scan stage **MS-8** 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 scan stage **MS-8** is suited for tasks using reflected and/or transmitted light microscopy. With the scan stage **MS-8** 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. Motor-drive options are DC- or 2-phase stepper motors. For higher positioning accuracy and repeatability, the scan stage **MS-8** can be optionally equipped with a linear scale.

Key features

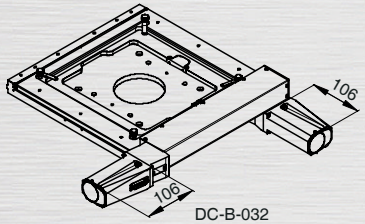
- Travel range 205 mm (8") x 205 mm (8")
- Uni-directional repeatability down to 0.25 µm
- Maximum speed 90 mm/sec
- Load capacity up to 4 kg
- Integrated limit switches
- Optionally: linear scale
- Clear aperture 205 x 205 mm

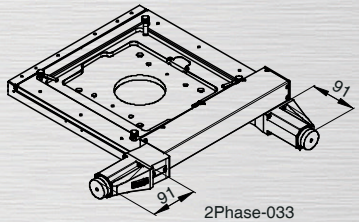
TECHNICAL DATA

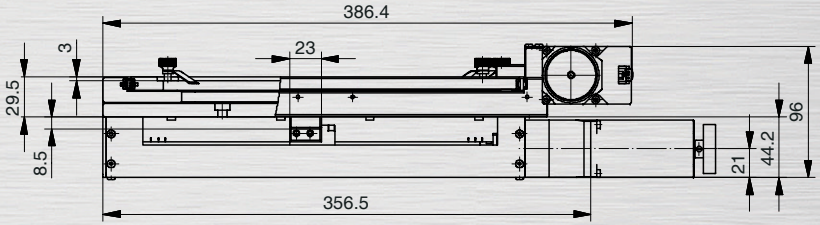
Travel range *(mm)*		**205 x 205**	
Straightness / Flatness (µm)		+/- 10	
Pitch (µrad)		+/- 500	
Yaw (µrad)		+/- 500	
Orthogonality (µrad)		150	
Weight (kg)		9.5	
Motor *(Pitch 2 mm)*	**DC-B-032**	**2Phase-033**	
Linear scale			**LS-010**
Speed max. (mm/sec)	90	35	
Resolution calculated (µm)	1 (RE)	10 (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 ... 90		
Material	Aluminum, black anodized		

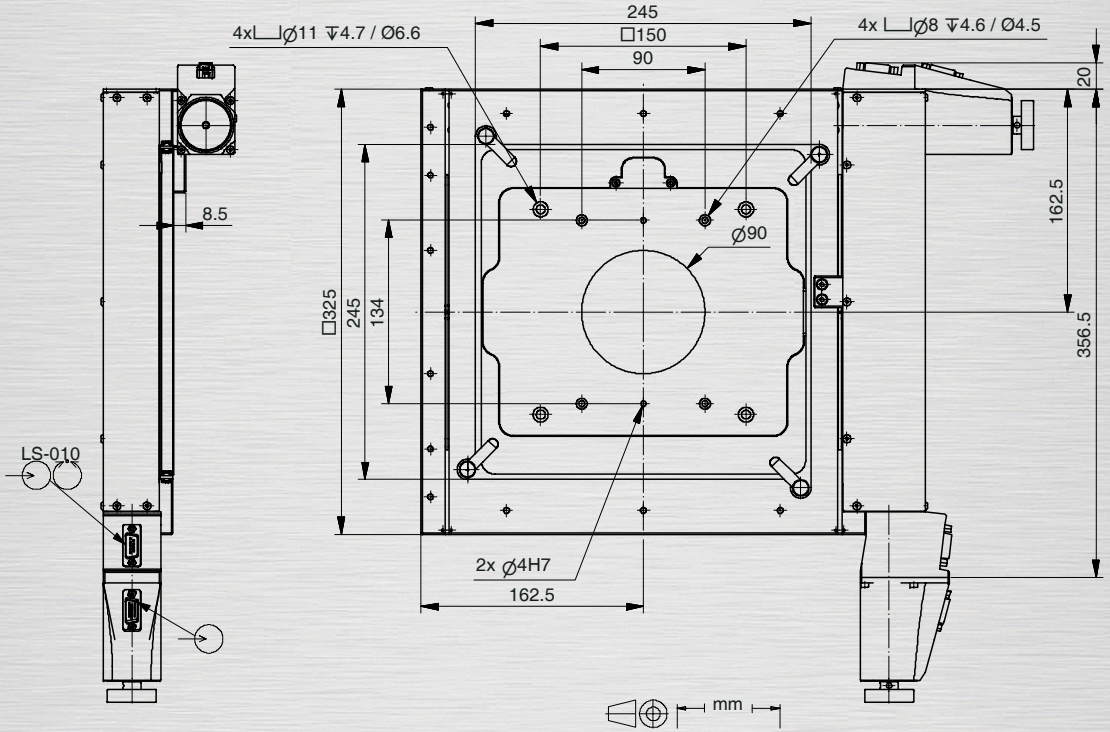
Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.

MS-8 used for imaging









Order No.	6316-9-			

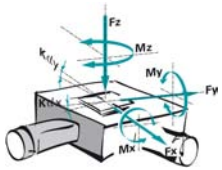
DC-B-032 1
2Phase-033 2

205 mm (8") x 205 mm (8") 1

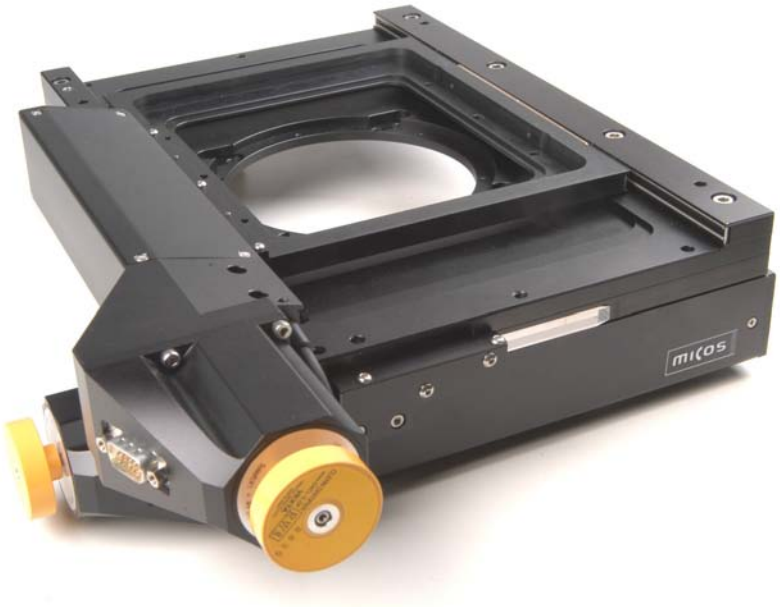
without LS-010 0
LS-010, Linear steel scale 1

FACTS

Load characteristics	Fx(N)	Fy(N)	Fz(N)	Mx(Nm)	My(Nm)	Mz(Nm)	kαx(µrad/Nm)	kαy(µrad/Nm)
DC-B-032	15	15	30	0.5	0.5	0.5	350	350
2Phase-032	15	15	30	0.5	0.5	0.5	350	350



The scan stages **MS-4** with 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 scan stage **MS-4** is equipped with re-circulating ball screw and two limit switches. Optionally, the scan stages **MS-4** can be equipped with a linear scale for higher accuracy.



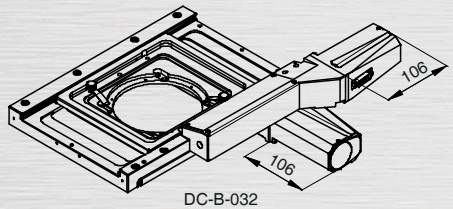
Key features

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

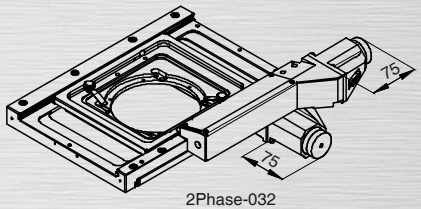
TECHNICAL DATA

Travel range *(mm)*		**102 x 102**	
Straightness / Flatness (µm)		+/- 5	
Pitch (µrad)		+/- 200	
Yaw (µrad)		+/- 200	
Orthogonality (µrad)		150	
Weight (kg)		3.8	
Motor *(Pitch 2 mm)*	**DC-B-032**	**2Phase-032**	
Linear scale			**LS-050**
Speed max. (mm/sec)	90	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 ... 90		
Material	Aluminum, black anodized		

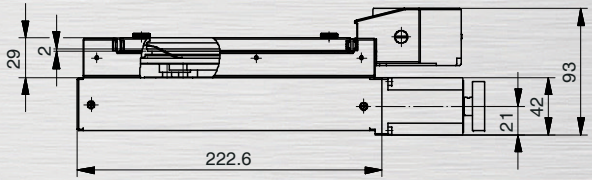
Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.

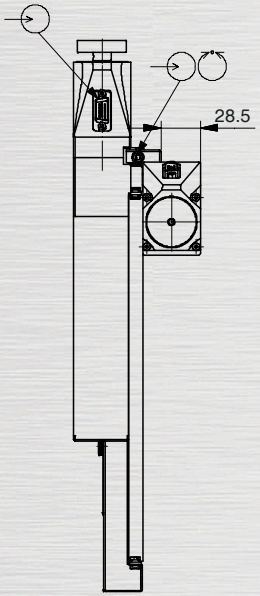


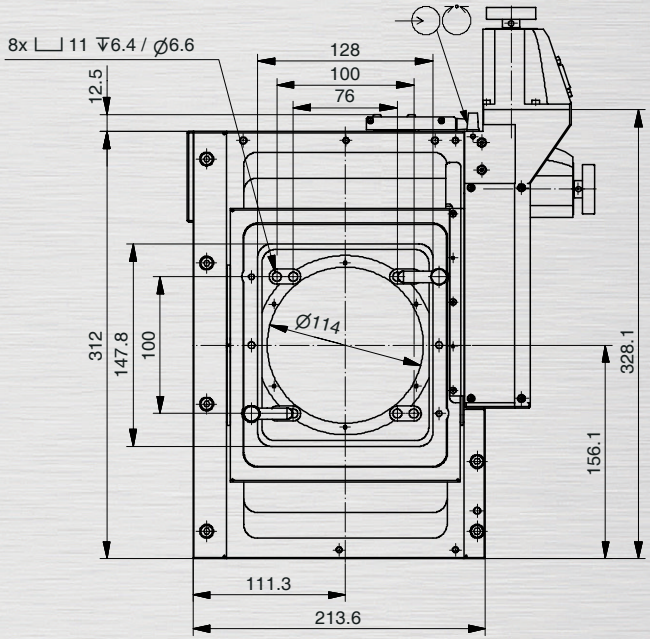
DC-B-032



2Phase-032







mm

Order No.	6315-9-				

DC-B-032 1
2Phase-032 2

102 mm (4") x 102 mm (4") 0

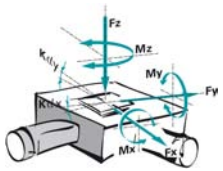
without LS-050 0
LS-050, Linear steel scale 1

MLS-020, Mechanical limit switches 1
HLS-010, Hall limit switches 2

NEW

FACTS

Load characteristics	Fx(N)	Fy(N)	Fz(N)	Mx(Nm)	My(Nm)	Mz(Nm)	kαx(µrad/Nm)	kαy(µrad/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 cross stage **KT-120** with 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 scan stages **KT-120** are driven by MP-20 L actuators with re-circulating ball screws and equipped with limit switches. Geared DC- and 2-phase stepper motors are available.

Key features

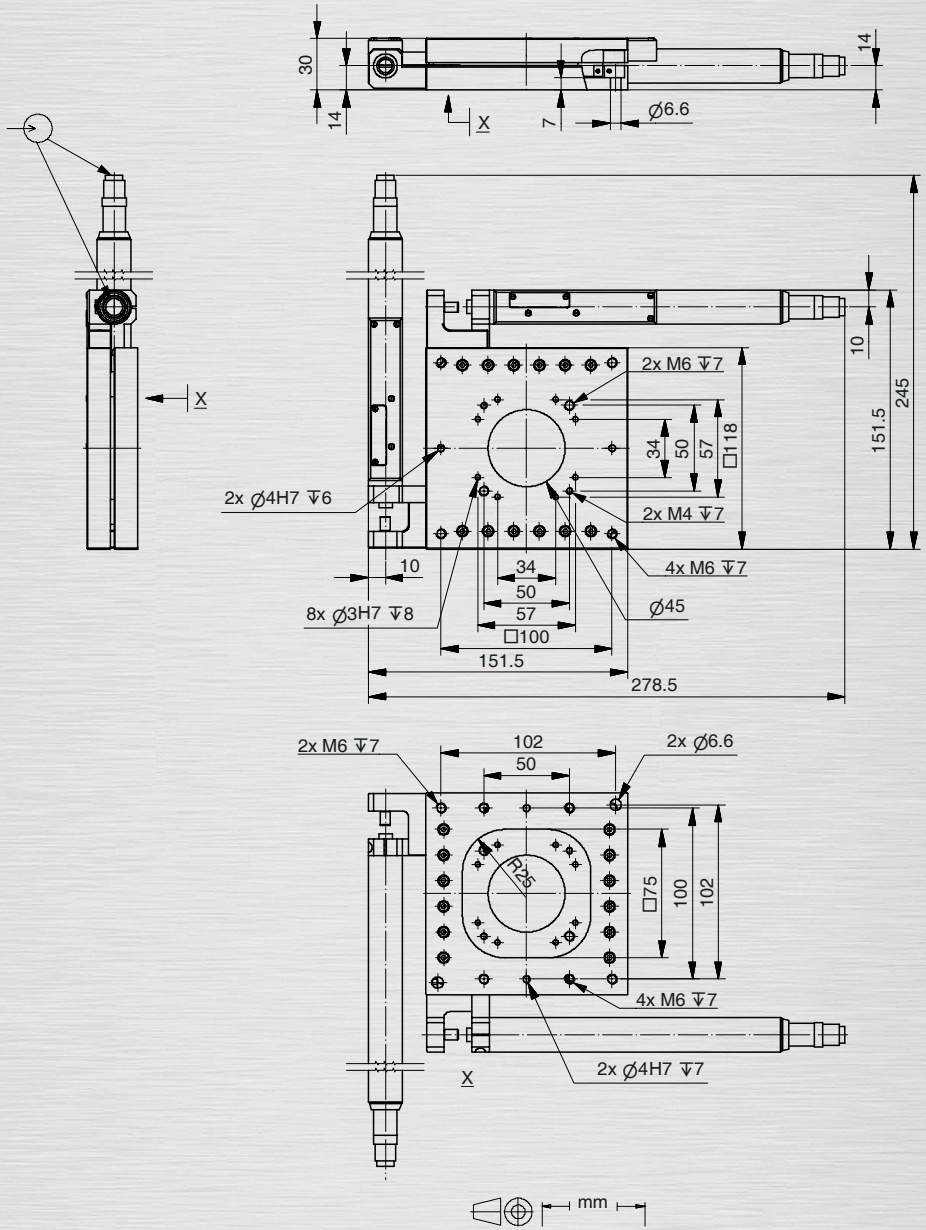
- Travel range 26 mm (1") x 26 mm (1")
- Uni-directional repeatability down to 2 µm
- Maximum speed 3.5 mm/sec
- Load capacity up to 5 kg
- Integrated limit switches
- Clear aperture 45 mm

TECHNICAL DATA

Travel range *(mm)*	**26 x 26**	
Straightness / Flatness (µm)	+/- 4	
Pitch (µrad)	+/- 110	
Yaw (µrad)	+/- 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)	0.0221609 (RE)	0.5490245 (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.

KT-120 for manual use



Order No.	6312-9-			2

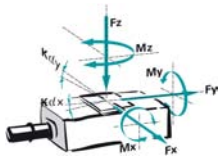
DC-B-010 1
2Phase-010 2

26 mm (1") x 26 mm (1") 1

4.610 Nano Precision Elevation Stage NPE-200

FACTS

Load characteristics	Fx(N)	Fy(N)	Fz(N)	Mx(Nm)	My(Nm)	Mz(Nm)	kαx(µrad/Nm)	kαy(µrad/Nm)
2Phase-034	100	80	300	100	50	100	3	1



The nano-precision elevation stage **NPE-200** 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 stable 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).

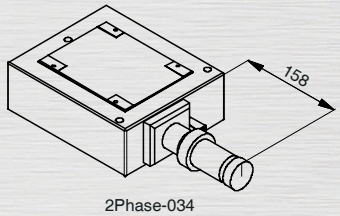
Key features

- 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 limit switches
- Integrated linear scale (center mounted)

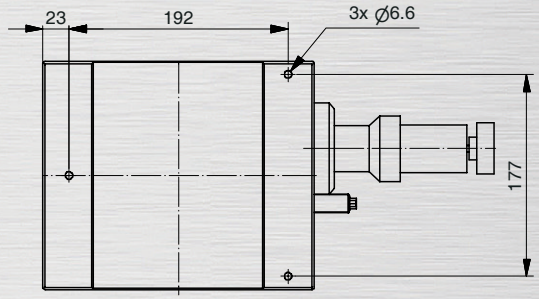
TECHNICAL DATA

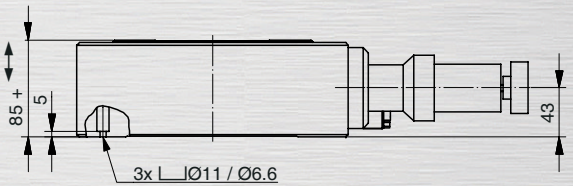
Travel range *(mm)*	**13**	
Straightness (µm)	+/- 0.7	
Pitch (µrad)	+/- 20	
Yaw (µrad)	+/- 20	
Weight (kg)	9.2	
Motor *(Pitch 2 mm)*	**2Phase-034**	
Linear scale		**LS-040**
Speed max. (mm/sec)	0.2	
Resolution calculated (µm)	0.2 (FS)	0.001
Resolution typical (µm)		0.005
Bi-directional Repeatability (µm)		+/- 0.04
Uni-directional Repeatability (µm)		0.04
Nominal Current (A)	1.2	
Accuracy	on request	
Velocity Range (mm/sec)	1E-5 ... 0.2	
Material	Aluminum, black anodized	

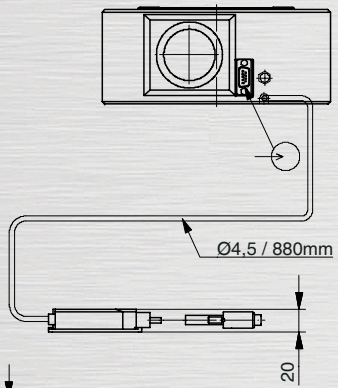
Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.

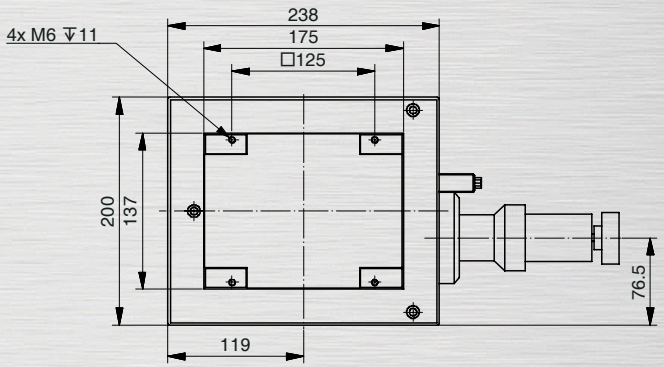


2Phase-034









Order No.	6283-9-			

2Phase-034 2

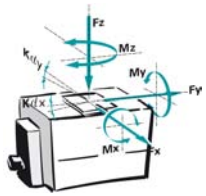
13 mm (1/2") 0

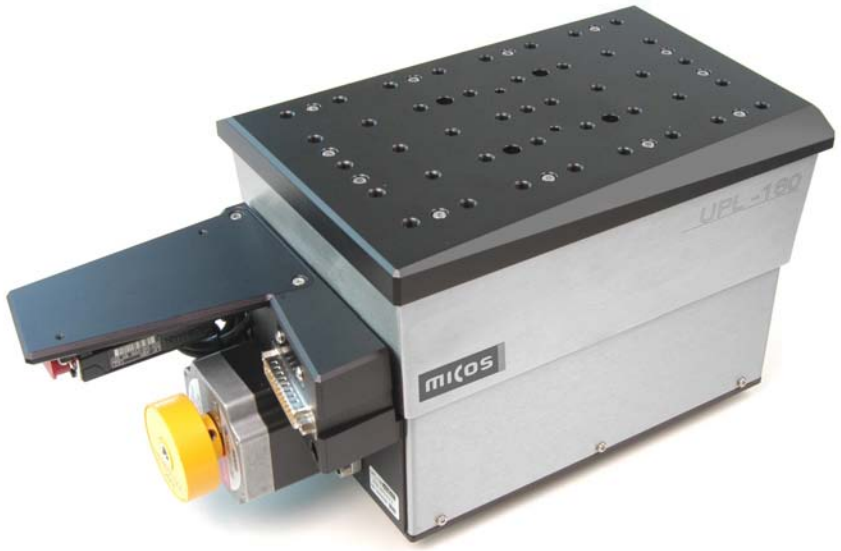
LS-040, Linear Zerodur scale 0

4.620 Ultra Precision Elevation Stage UPL-160

FACTS

Load characteristics	Fx(N)	Fy(N)	Fz(N)	Mx(Nm)	My(Nm)	Mz(Nm)	kαx(µrad/Nm)	kαy(µrad/Nm)
DC-B-039	200	100	300	175	49	175	3	1
2Phase-070	200	100	300	175	49	175	3	1





The ultra-precision elevation stage **UPL-160** supplements the UPM-160 stage. It was specifically designed for wafer inspection, fiber alignment and any other task where maximum positioning accuracy and reliability are absolutely mandatory. All **UPL-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 smoothness of motion. **UPL-160** stages are offered with a 2-phase stepper motor or with a DC-motor with an optional brake and are equipped with two mechanical limit switches. All ultra-precision linear stages are supplied with a certificate of performance (flatness, straightness & accuracy).

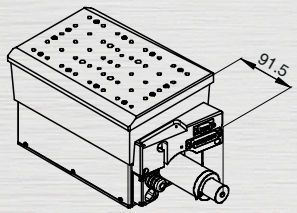
Key features

- Travel range 26 mm (1")
- Uni-directional repeatability down to 0.03 µm
- Maximum speed 30 mm/sec
- Load capacity up to 30 kg
- Integrated limit switches
- Integrated linear scale (center mounted)

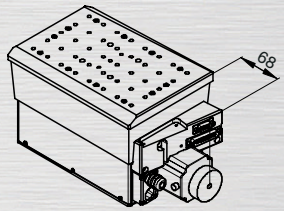
TECHNICAL DATA

Travel range *(mm)*		**26**		
Straightness (µm)		+/- 1.5		
Pitch (µrad)		+/- 40		
Yaw (µrad)		+/- 25		
Weight (kg)		7.9		
Motor *(Pitch 2 mm)*	**DC-B-039**	**2Phase-070**		
Linear scale			**LS-010**	**LS-020**
Speed max. (mm/sec)	20	15		
Resolution calculated (µm)		10 (FS)	0.05	0.001
Resolution typical (µm)			0.05	0.03
Bi-directional Repeatability (µm)			+/- 0.05	+/- 0.035
Uni-directional Repeatability (µm)			0.05	0.03
Nominal Current (A)	3.8	2		
Voltage Range (V)	24			
Accuracy	on request			
Velocity Range (mm/sec)	0.001 ... 30			
Material	Aluminum, black anodized			

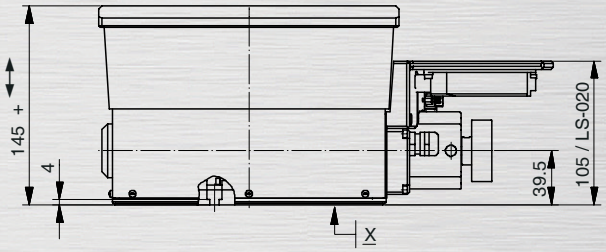
Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.

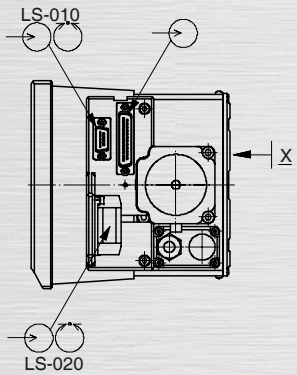


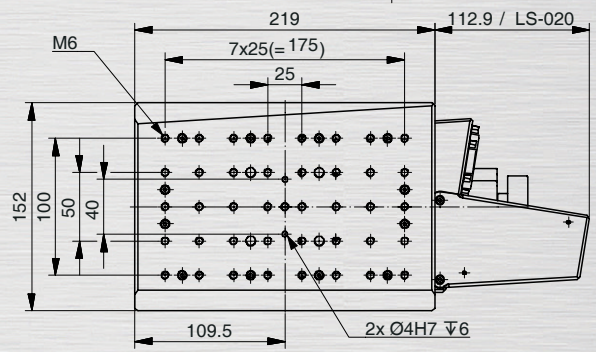
DC-B-039

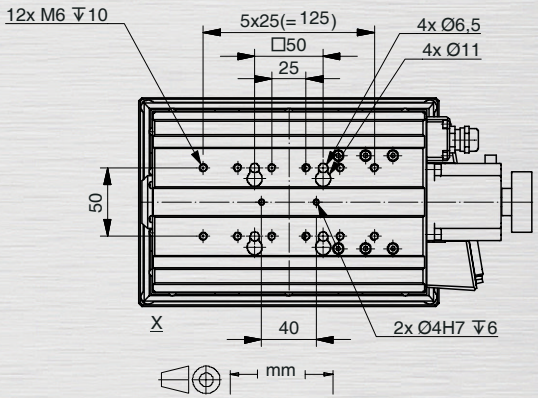


2Phase-070









Order No.	6272-9-			

DC-B-039 1
2Phase-070 2

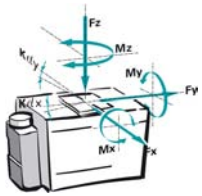
26 mm (1") 1

LS-010, Linear steel scale 1
LS-020, Linear glass scale 2

4.630 Elevation Stage ES-100

FACTS

Load characteristics	Fx(N)	Fy(N)	Fz(N)	Mx(Nm)	My(Nm)	Mz(Nm)	kαx(µrad/Nm)	kαy(µrad/Nm)
DC-B-032	100	50	30	40	80	80	60	60
2Phase-044	100	50	55	40	80	80	60	60



The elevation stage **ES-100** matches the family of LS-110 and PRS-110 stages. The elevation stage is driven by a precision ground re-circulating ball screw with 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 elevation stages **ES-100** can be supplied with a cost-effective linear scale.

Key features

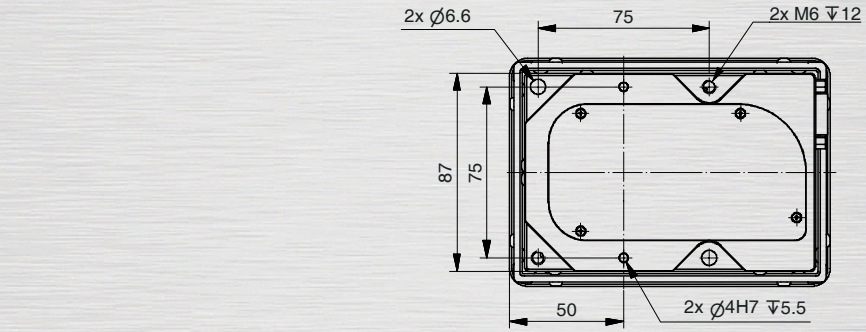
- Travel range up to 26 mm (1")
- Uni-directional repeatability down to 0.05 µm
- Maximum speed 20 mm/sec
- Load capacity up to 5.5 kg
- Integrated limit switches
- Optionally: linear scale (center mounted)
- Higher load on request

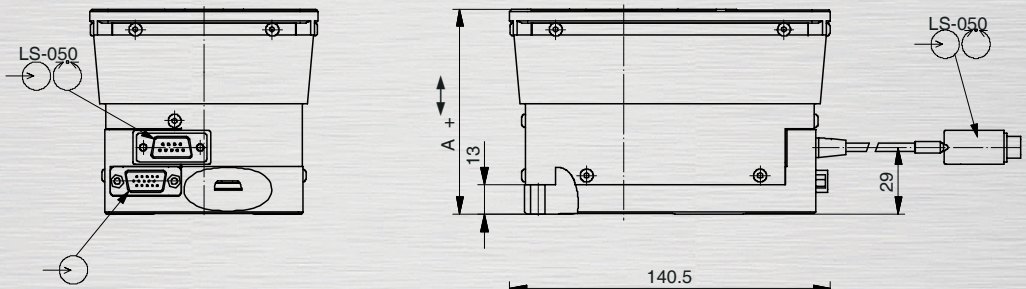
TECHNICAL DATA

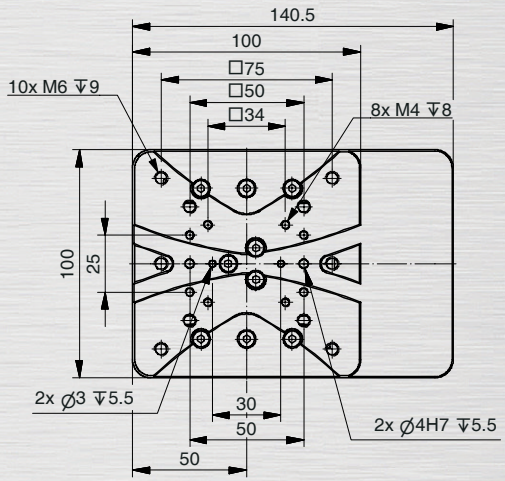
Travel range *(mm)*	**13**		**26**
Straightness (µm)	+/- 2		+/- 3
Pitch (µrad)	+/- 100		+/- 150
Yaw (µrad)	+/- 100		+/- 150
Weight (kg)	2.4		2.5
Motor *(Pitch 1 mm)*	**DC-B-032**	**2Phase-044**	
Linear scale			**LS-050**
Speed max. (mm/sec)	20	15	
Resolution calculated (µm)	0.5 (RE)	5 (FS)	0.05
Resolution 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		

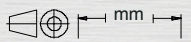
Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.

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

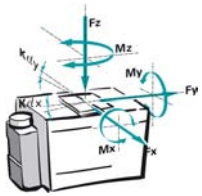
without LS-050 0
LS-050, Linear steel scale 1

HLS-010, Hall limit switches 1
MLS-020, Mechanical limit switches 2

4.640 Elevation Stage ES-82

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 elevation stage **ES-82** excels due to its minimum height and can be combined with the PLS-85, LS-65 and 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.

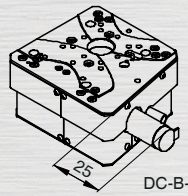
Key features

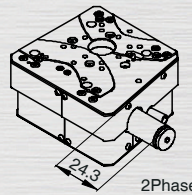
- Travel range 13 mm (1/2")
- Uni-directional repeatability down to 0.1 µm
- Maximum speed 0.1 mm/sec
- Load capacity up to 2 kg
- Integrated limit switches
- Optionally: linear scale

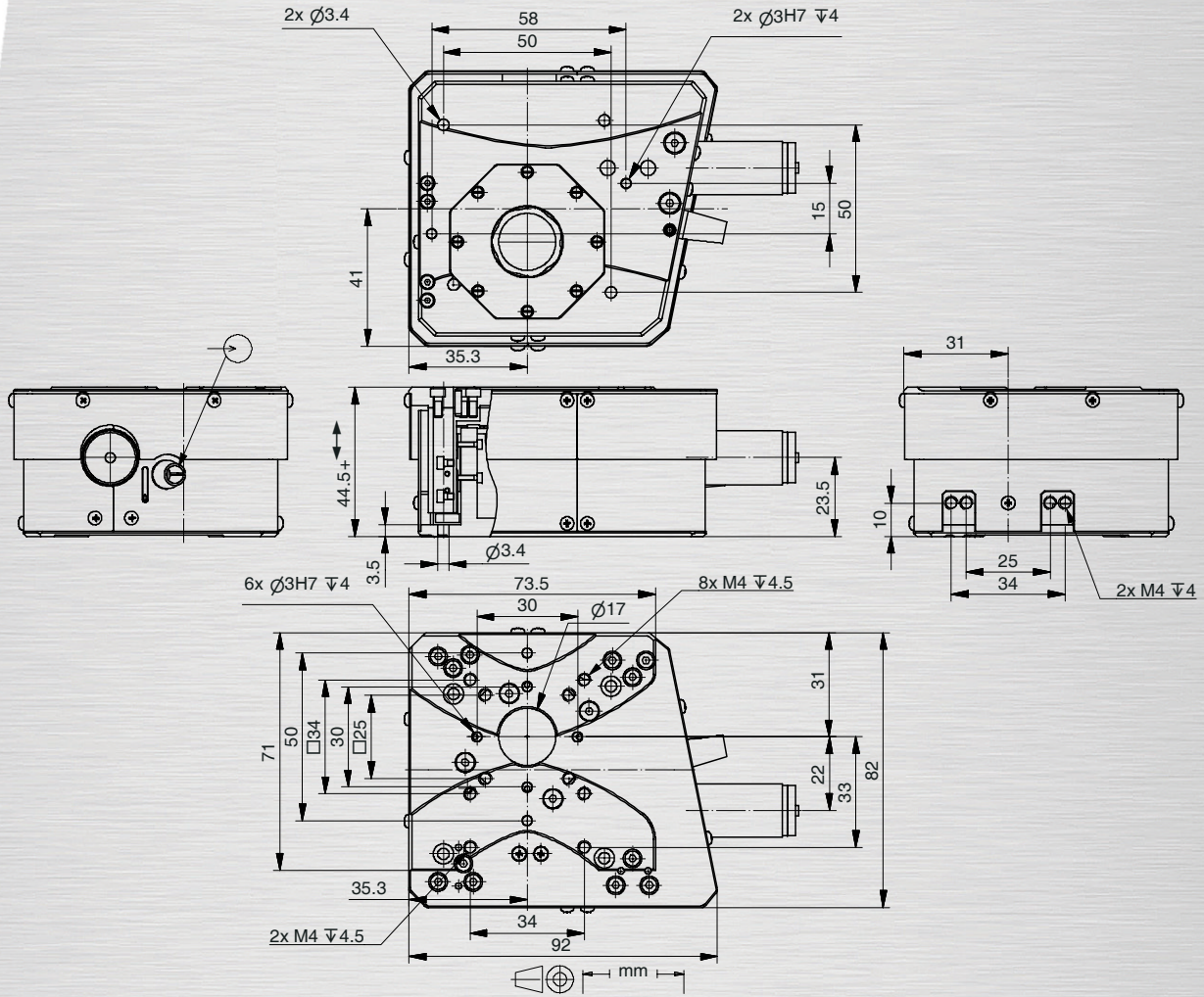
TECHNICAL DATA

Travel range *(mm)*		**13**	
Straightness (µm)		+/- 3	
Pitch (µrad)		+/- 75	
Yaw (µrad)		+/- 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)	0.0427015 (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

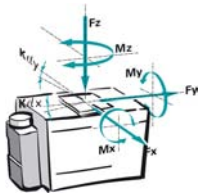
without LS-025 0
LS-025, Linear glass scale 1

HLS-010, Hall limit switches 1

NEW

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 elevation stage **ES-70** excels due to its minimum height. The **ES-70** can be combined with the PLS-85, LS-65 and 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.

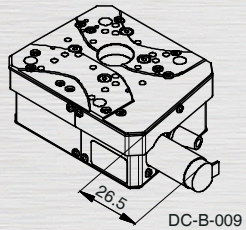
Key features

- 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 limit switches

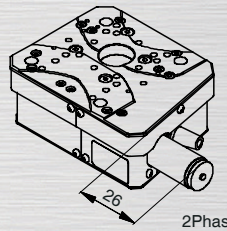
TECHNICAL DATA

Travel range *(mm)*	**6.25**	
Straightness (µm)	+/- 2	
Pitch (µrad)	+/- 50	
Yaw (µrad)	+/- 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)	0.0427015 (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	

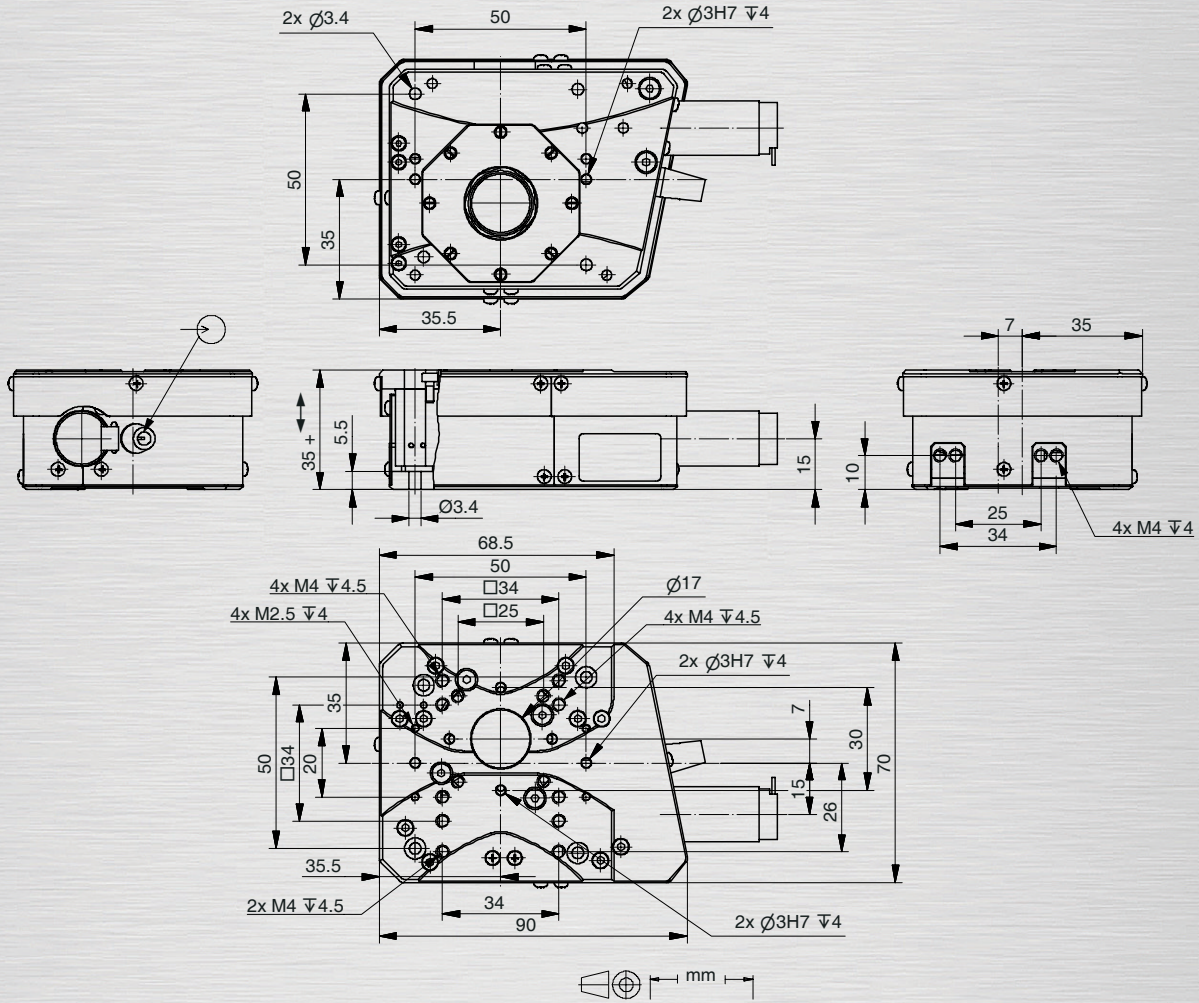
Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.



DC-B-009



2Phase-010



Order No.	6609-9-			0	

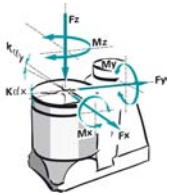
DC-B-009 1
2Phase-010 2

6.25 mm (1/4") 1

HLS-010, Hall limit switches 1

FACTS

Load characteristics	Fx(N)	Fy(N)	Fz(N)	Mx(Nm)	My(Nm)	Mz(Nm)	kαx(µrad/Nm)	kαy(µrad/Nm)
DC-B-041	0.5	5	15	2	2	5	300	300
2Phase-045	0.5	5	20	2	2	5	300	300



The special characteristic of the elevation stage **ES-65** is its very compact shape. The unit is well suited for the precision positioning of light loads. A DC- or a 2-phase stepper motor is available as the drive. The belt driven stage is equipped with two mechanical limit switches.

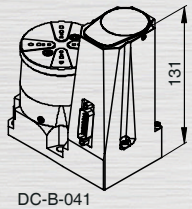
Key features

- Travel range 26 mm (1")
- Uni-directional repeatability down to 2 µm
- Maximum speed 20 mm/sec
- Load capacity up to 2 kg
- Integrated limit switches
- Ball bearings

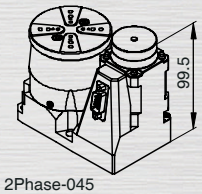
TECHNICAL DATA

Travel range *(mm)*	**26**	
Straightness (µm)	+/- 10	
Pitch (µrad)	+/- 300	
Yaw (µrad)	+/- 300	
Weight (kg)	1.1	
Motor *(Pitch 1 mm)*	**DC-B-041**	**2Phase-045**
Speed max. (mm/sec)	15	10
Resolution calculated (µm)	0.25 (RE)	2.5 (FS)
Resolution typical (µm)	1	1
Bi-directional Repeatability (µm)	+/- 5	+/- 5
Uni-directional Repeatability (µm)	2	2
Nominal Current (A)	3.8	1.2
Voltage Range (V)	24	
Reduction belt	2:1	
Accuracy	on request	
Velocity Range (mm/sec)	0.001 ... 20	
Material	Aluminum, black anodized	

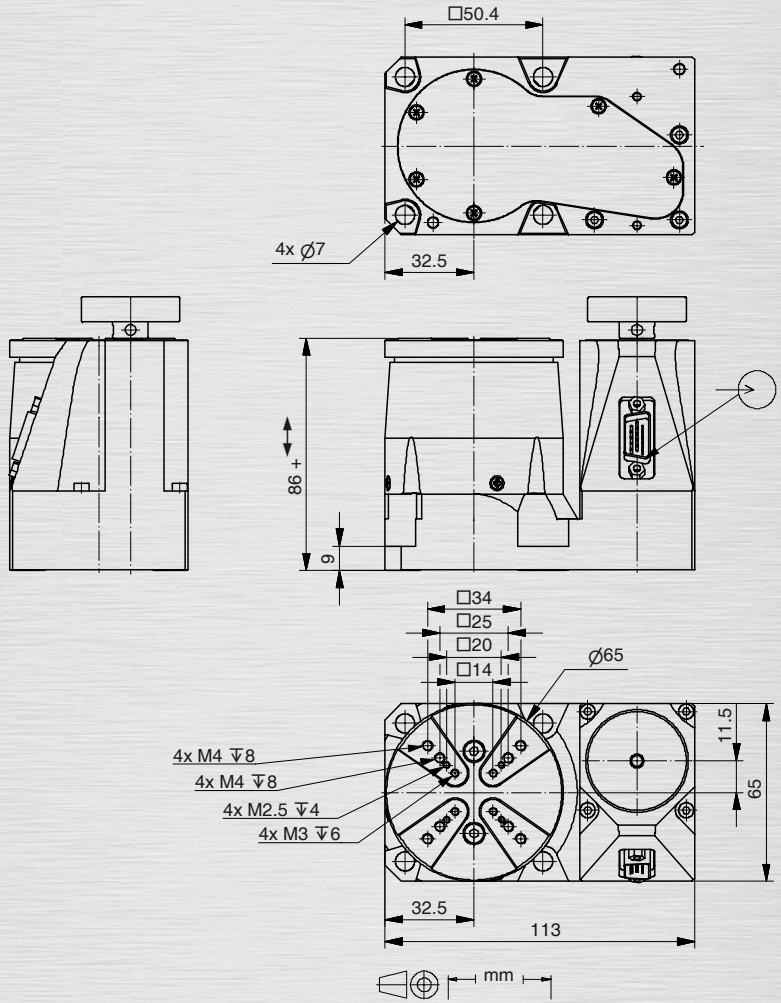
Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.



DC-B-041



2Phase-045



Order No.	6608-9-			0	0

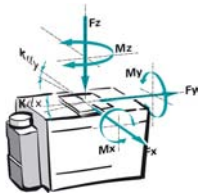
DC-B-041 1
2Phase-045 3

26 mm (1") 2

NEW

FACTS

Load characteristics	Fx(N)	Fy(N)	Fz(N)	Mx(Nm)	My(Nm)	Mz(Nm)
2Phase-018	5	5	10	1	1	1



The NEW elevation stage **ES-50** is designed for applications with limited space conditions. All **ES-50** linear stages are 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.

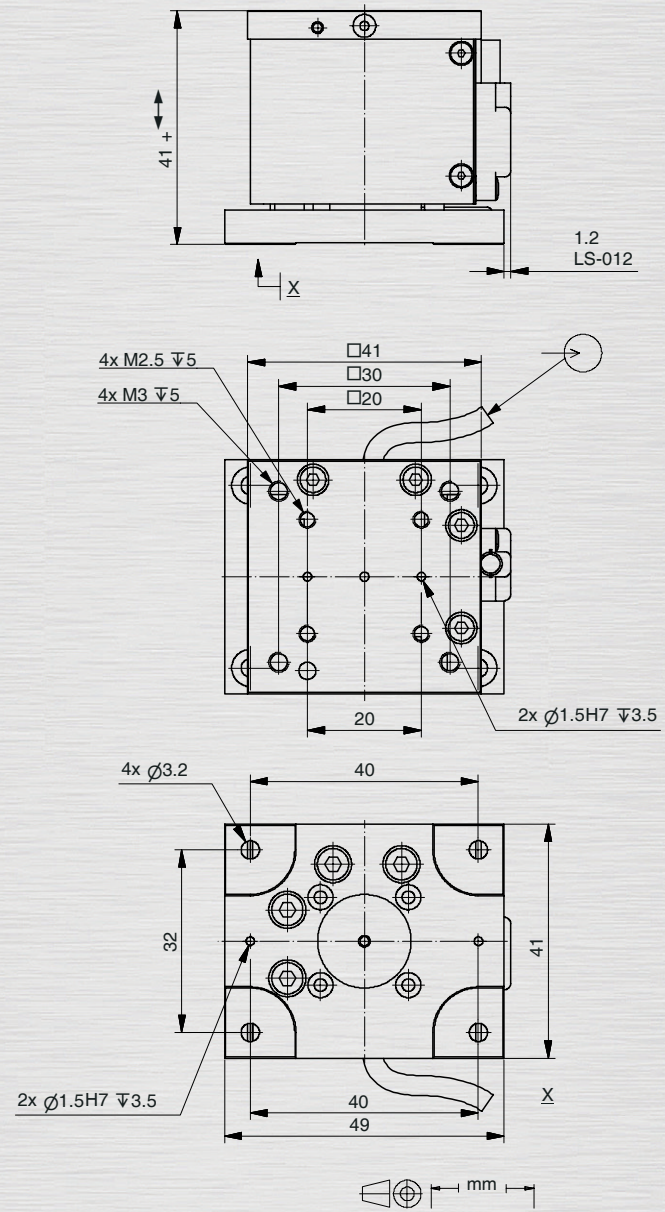
Key features

- Travel range 10 mm
- Uni-directional repeatability down to 0.1 µm
- Maximum speed 5 mm/sec
- Load capacity up to 1 kg
- Integrated limit switches
- Optionally: linear scale
- Other resolutions and accuracies available upon request

TECHNICAL DATA

Travel range *(mm)*	**10**	
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)	0.1	
Bi-directional Repeatability (µm)	+/- 2	+/- 0.1
Uni-directional Repeatability (µm)	1	0.1
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.

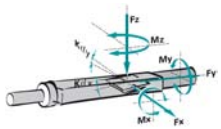


Order No.	6606-9-					

2Phase-018 2
10 mm 2
without LS-012 0
LS-012, Linear steel scale 1
MLS-060 2
Pitch 0.5 mm 1

FACTS

Load characteristics	Fx(N)	Fy(N)	Fz(N)
DC-B-013	10	500	10
DC-B-031	10	200	10
2Phase-021	10	500	10
2Phase-032	10	200	10
2Phase-045	10	300	10



The micro actuator **MA-35** was designed for applications with limited space conditions or where high-precision actuators must be positioned decoupled of the drive. Compared to other pushers the standard force is very high (200 N) and can be increased. The actuators **MA-35** are motorized with DC gear-motor with encoder and 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 requirement high pushing forces, high resolution or high speed can be achieved. The travel range is 52 mm (2"). Two integrated mechanical or optional hall limit switches prevent damage from accidental overtravel. All critical elements are made of stainless steel.

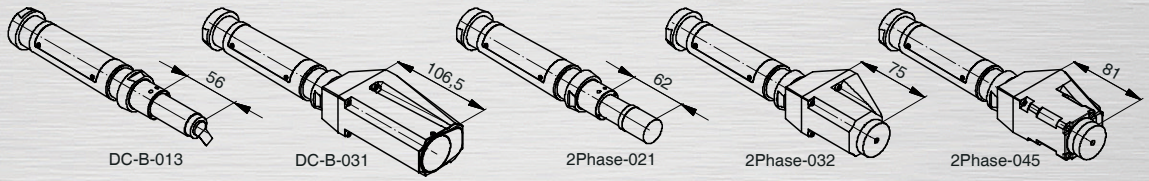
Key features

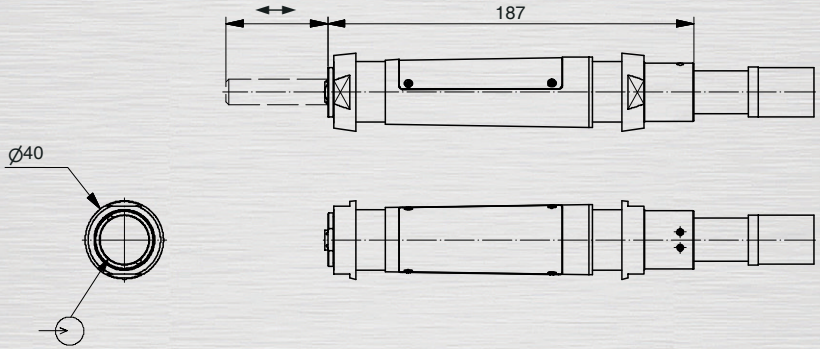
- Travel range 52 mm (2")
- Uni-directional repeatability down to 0.2 µm
- Maximum speed 100 mm/sec
- Force max. 500 N
- Integrated limit switches
- High resolution

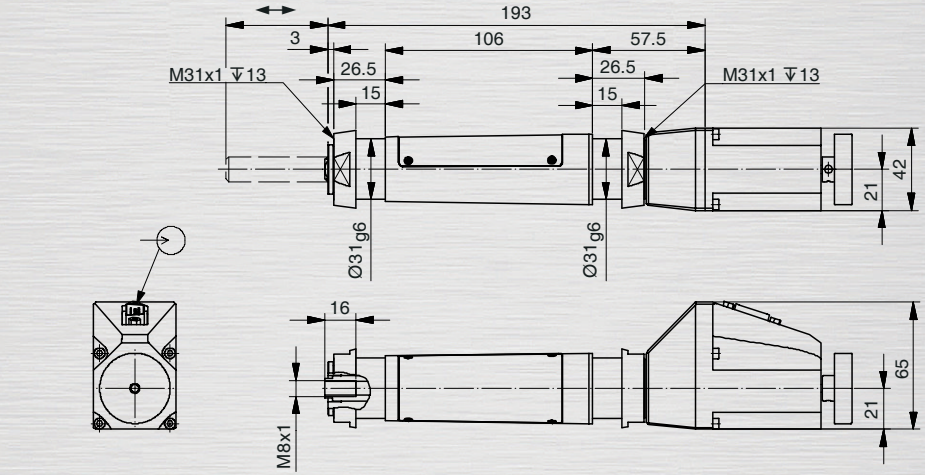
TECHNICAL DATA

Travel range *(mm)*	**52**				
Weight (kg)	2				
Motor *(Pitch 1 | 2 mm)*	**DC-B-013**	**DC-B-031**	**2Phase-021**	**2Phase-032**	**2Phase-045**
Speed max. (mm/sec)	2.5 | 5	50 | 90	1.5 | 2.5	20 | 35	25 | 45
Resolution calculated (µm)	0.016 | 0.033 (RE)	0.5 | 1 (RE)	0.313 | 0.625 (FS)	5 | 10 (FS)	5 | 10 (FS)
Resolution typical (µm)	0.1 | 0.2	0.5 | 1	0.2 | 0.2	0.1 | 0.2	0.1 | 0.2
Bi-directional Repeatability (µm)	+/- 1 | +/- 1	+/- 1 | +/- 1	+/- 1 | +/- 1	+/- 1 | +/- 1	+/- 1 | +/- 1
Uni-directional Repeatability (µm)	0.2 | 0.2	0.5 | 1	0.2 | 0.2	0.2 | 0.2	0.2 | 0.2
Nominal Current (A)	0.28	1.96	1.2	1.2	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-021 3
2Phase-032 4
2Phase-045 5

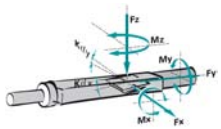
52 mm (2") 1

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

4.720 Micro Pusher MP-20 L

FACTS

Load characteristics	Fx(N)	Fy(N)	Fz(N)
DC-B-010	1	125	1
2Phase-010	1	125	1



The micro pusher **MP-20 L** 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 micro pusher **MP-20 L** is equipped with a re-circulating ball screw for a quiet, precise and homogeneous smooth motion and has a non- rotating tip. Micro pushers **MP-20 L** are offered with DC- or 2-phase gear motor combination and are equipped with two limit switches. Alternatively crowned or flat ground inserts can be screwed in at the tip.

Key features

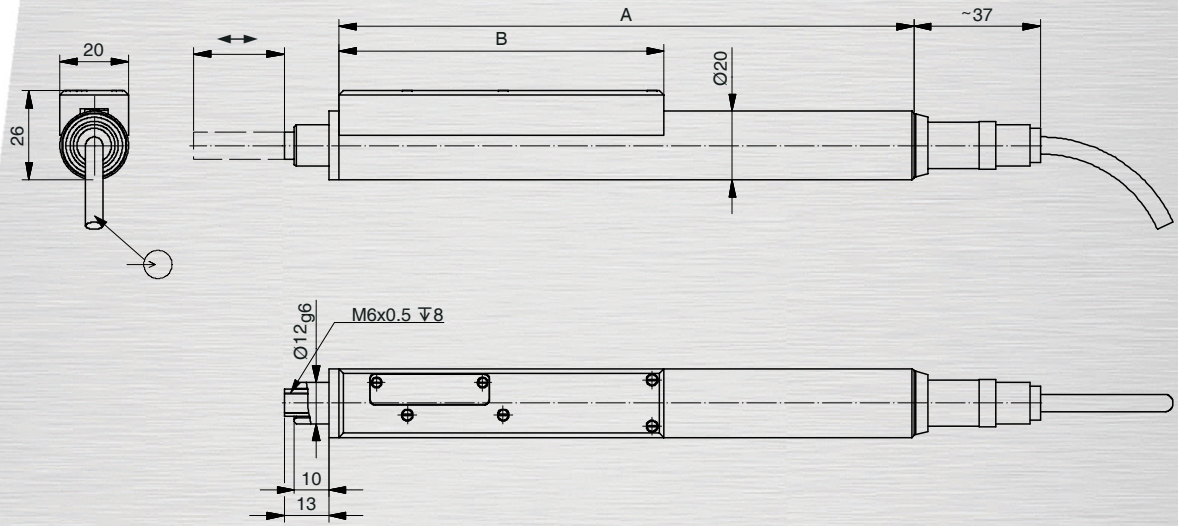
- Travel range up to 75 mm
- Uni-directional repeatability down to 0.3 µm
- Maximum speed 3.5 mm/sec
- Force max. 125 N
- Integrated limit switches
- High resolution
- Including both inserts MP-B & MP-F

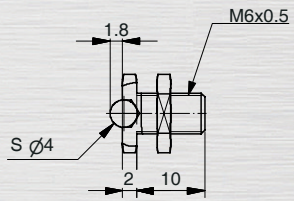
TECHNICAL DATA

Travel range *(mm)*	**25**	**50**	**75**
Weight (kg)	0.2	0.23	0.25
Motor *(Pitch 1 mm)*	**DC-B-010**		**2Phase-010**
Speed max. (mm/sec)	3.5		0.8
Resolution calculated (µm)	0.0221609 (RE)		0.5490245 (FS)
Resolution typical (µm)	0.1		0.1
Bi-directional Repeatability (µm)	+/- 1		+/- 1
Uni-directional Repeatability (µm)	0.3		0.3
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		

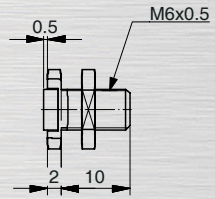
Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.

Travel (mm)	25	50	75
A	168	193	218
B	95	120	145





Order No . 5700-9-902



Order No. 5700-9-901

Order No.	5700-9-			0

DC-B-010 1
2Phase-010 4

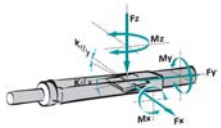
25 mm 1
50 mm 2
75 mm 3

mm

4.730 Micro Pusher MP-20 S

FACTS

Load characteristics	Fx(N)	Fy(N)	Fz(N)
DC-B-010	1	20	1
2Phase-010	1	20	1
2Phase-025	1	6	1



With the micro pusher **MP-20 S** manual drives can be replaced by motor drives. It is an ideal component for limited space conditions. For positioning tasks light components such as mirrors and diodes can be directly mounted to the tip. The micro pusher **MP-20 S** is equipped with a precision screw thread with a fine pitch of 0.25 mm resulting in a quiet and homogeneous smooth motion. The **MP-20 S** is equipped with two mechanical limit switches to prevent damage from accidental over-travel and a non-rotating tip. The **MP-20 S** is offered with DC-, 2-phase geared- or 2-phase direct driven motor. The front part can be supplied alternatively with crowned or flat ground inserts. Please indicate when ordering.

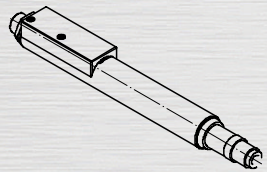
Key features

- Travel range 12.5 mm
- Uni-directional repeatability down to 2 µm
- Maximum speed 3 mm/sec
- Force max. 20 N
- Integrated limit switches
- High resolution

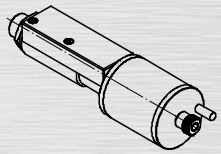
TECHNICAL DATA

Travel range *(mm)*		**12.5**	
Weight (kg)		0.15	
Motor *(Pitch 0.25 mm)*	**DC-B-010**	**2Phase-010**	**2Phase-025**
Speed max. (mm/sec)	1	0.25	2
Resolution calculated (µm)	0.0055402 (RE)	0.1372561 (FS)	1.25 (FS)
Resolution typical (µm)	0.5	0.5	0.5
Bi-directional Repeatability (µm)	+/- 5	+/- 5	+/- 5
Uni-directional Repeatability (µm)	2	2	2
Nominal Current (A)	0.32	0.25	1.2
Voltage Range (V)	12		
Accuracy	on request		
Velocity Range (mm/sec)	0.001 ... 3		
Material	Aluminum, black anodized		

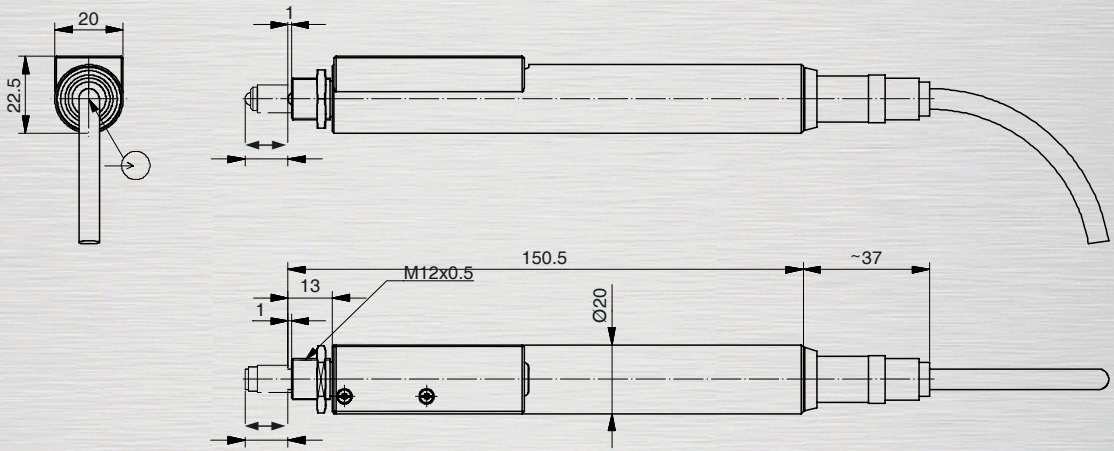
Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.

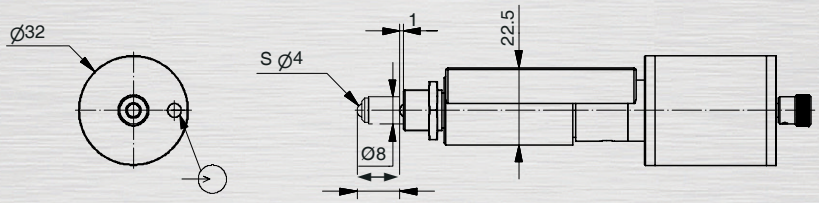


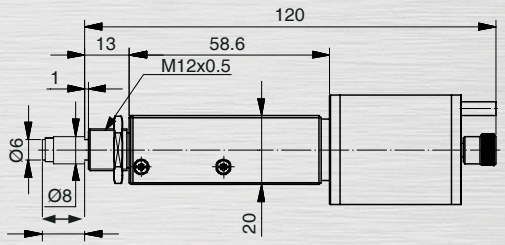
DC-B-010 / 2Phase-010

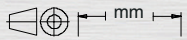


2Phase-025









Order No.	5690-9-			

DC-B-010 1
2Phase-010 2
2Phase-025 4

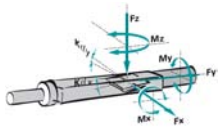
Surface flat 1
Surface crowned 2

12.5 mm 0

NEW

FACTS

Load characteristics	Fx(N)	Fy(N)	Fz(N)
2Phase-018	0	40	0



The NEW Linear Stage **MP-21** is designed for applications with very limited space conditions and about 0.5 µm repeatability. Typical applications for these pushers are inspection and systems. The **MP-21** pushers are motorized with a 2-phase-stepper motor and with one limit switch.

Key features

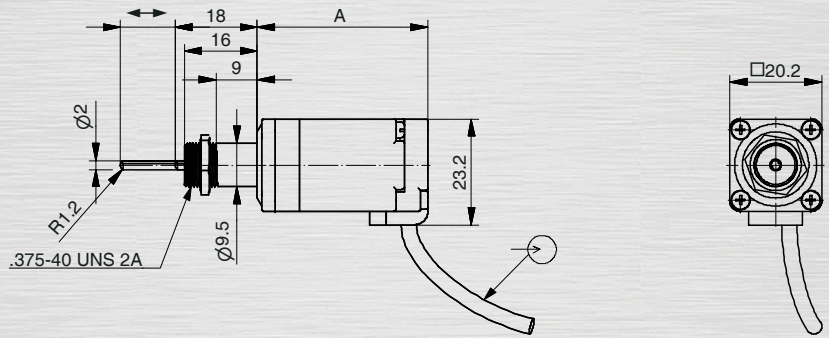
- Travel range up to 25 mm
- Uni-directional repeatability down to 0.4 µm
- Maximum speed 5 mm/sec
- Force max. 40 N
- Integrated limit switch
- Other resolutions and travel lengths available upon request

TECHNICAL DATA

Travel range *(mm)*	**12**	**25**
Weight (kg)	0.14	0.17
Motor *(Pitch 0.5 mm)*	**2Phase-018**	
Speed max. (mm/sec)	5	
Resolution calculated (µm)	2.5 (FS)	
Resolution typical (µm)	0.05	
Bi-directional Repeatability (µm)	+/- 0.5	
Uni-directional Repeatability (µm)	0.4	
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.

Travel (mm)	12	25
A	37.4	58.7



Order No.	5680-9-			0		

2Phase-018 2

12 mm 2
25 mm 4

MLS-062 2

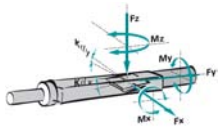
Pitch 0.5 mm 1

mm

4.750 Micro Pusher MP-15

FACTS

Load characteristics	Fx(N)	Fy(N)	Fz(N)
DC-B-008	0	10	0
2Phase-005	0	10	0



With the micro pusher **MP-15** manual drives or mirror mounts can be motorized later on. It is an ideal component for limited space conditions. The micro pusher **MP-15** is equipped with a fine-pitch screw thread of 0.5 mm pitch resulting in a quiet and homogeneous smooth motion. The **MP-15** is offered with DC or 2-phase gear motor and is delivered with two integrated limit switches.

Key features

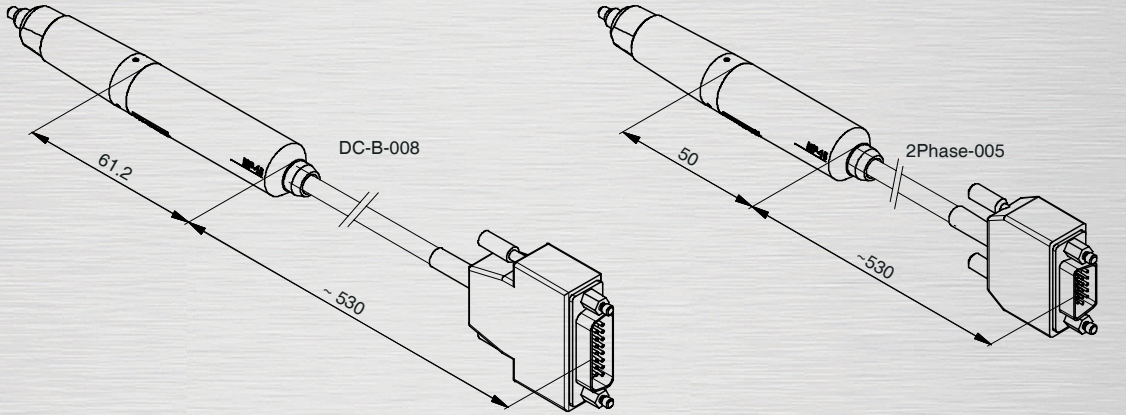
- Travel range up to 12.7 mm
- Uni-directional repeatability down to 0.5 µm
- Maximum speed 0.3 mm/sec
- Force max. 10 N
- Integrated limit switches
- a choice of different interfaces like M6

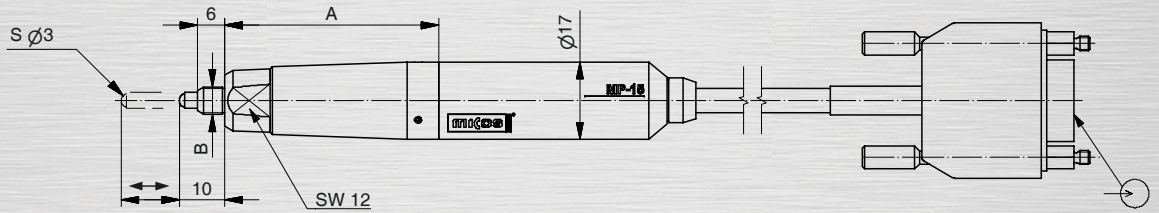
TECHNICAL DATA

Travel range *(mm)*	**6**	**12.7**
Weight (kg)	0.1	
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

Slit and cross slits **ASS 5E** and ADS 5E are high quality instruments for industry and research specifically in the areas of laser applications and radiology. The slits are provided with a DC or stepper motor driven aperture with 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 7.030.

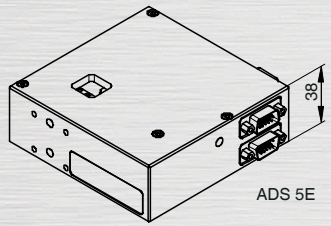
Key features

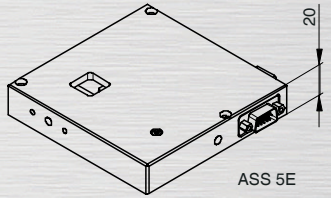
- Uni-directional repeatability down to 0.2 µm
- Maximum speed 0.8 mm/sec
- Integrated limit switches
- Maximum aperture 5 mm
- High resolution

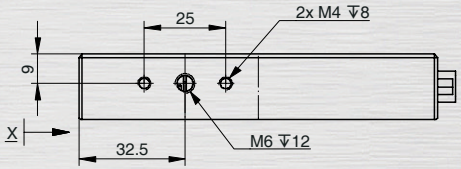
TECHNICAL DATA

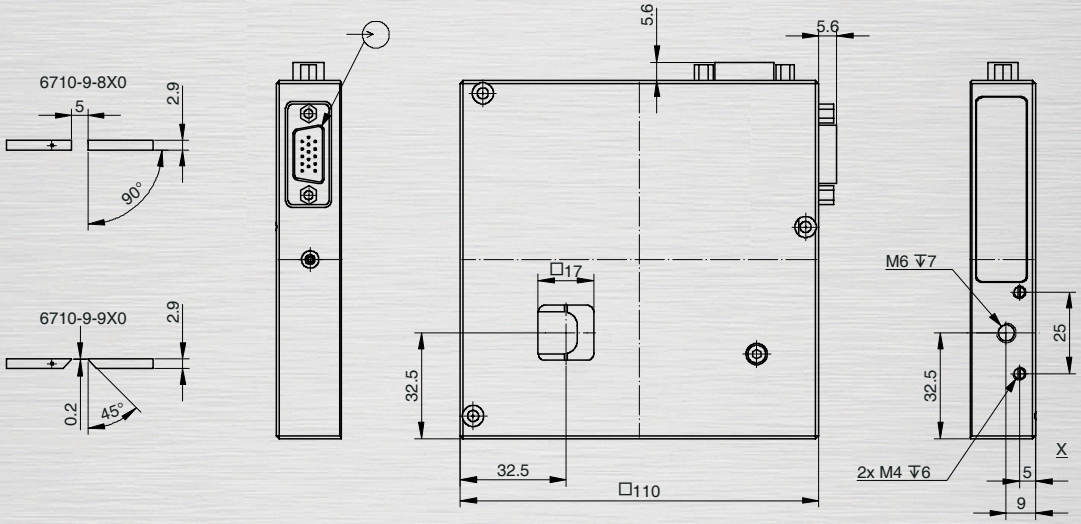
Travel range *(mm)*	**5**	
Weight (kg)	0.4	
Motor *(Pitch 0.25 mm)*	**DC-B-010**	**2Phase-010**
Speed max. (mm/sec)	0.4 | 0.8	0.1 | 0.2
Resolution calculated (µm)	0.0027701 | 0.0055402 (RE)	0.0686281 | 0.1372561 (FS)
Resolution typical (µm)	0.2	0.2
Bi-directional Repeatability (µm)	+/- 4	+/- 4
Uni-directional Repeatability (µm)	0.2	0.2
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.









mm

Order No.	6710-9-			0

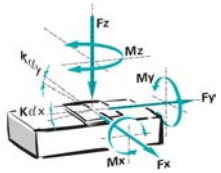
DC-B-010 1
2Phase-010 2

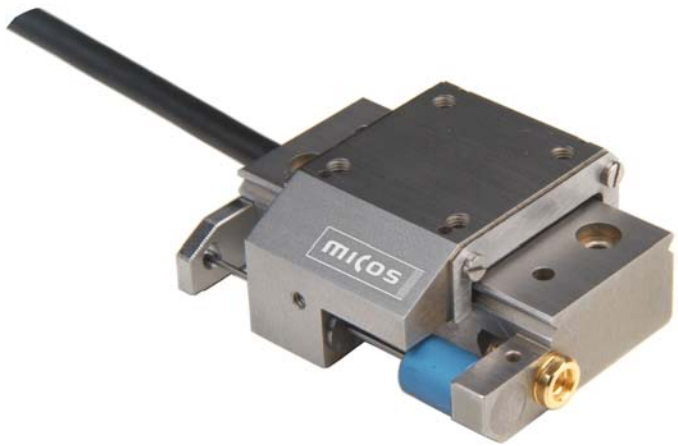
Single Slide (ASS 5E) 1
Double Slide (ADS 5E) 2

4.810 Linear Piezo Stage LPS-30

FACTS

Load characteristics	Fx(N)	Fy(N)	Fz(N)	Mx(Nm)	My(Nm)	Mz(Nm)	kαx(µrad/Nm)	kαy(µrad/Nm)
PM-005	4	2	8	0.2	0.3	0.2	250	150





The linear piezo stage **LPS-30** 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. Due to the steel structure it is also a good choice for UHV applications. **LPS-30** stages are working in open or closed loop mode, where a resolution of up to 50 nm is available. It is directly driven with an inertial piezo motor without any backlash. The **LPS-30** modules can be assembled to XY systems and space saving XYZ systems. The travel range is 6.5 mm or 13 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

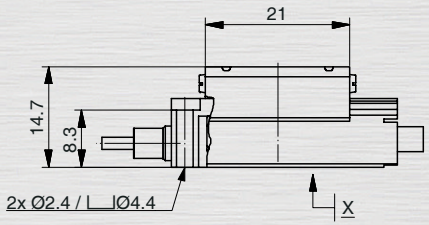
- Travel range up to 13 mm (1/2")
- Uni-directional repeatability down to 0.05 µm
- Maximum speed 0.5 mm/sec
- Load capacity up to 0.8 kg
- Integrated linear scale
- Piezo driven inertia motor
- Encoder resolution 5 nm
- Holding force 4 N

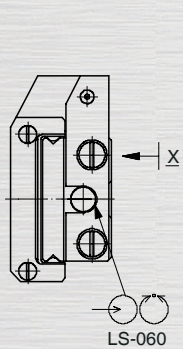
TECHNICAL DATA

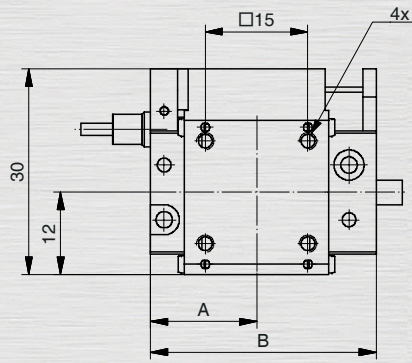
Travel range *(mm)*	**6.5**	**13**
Straightness / Flatness (µm)	+/- 2	+/- 4
Pitch (µrad)	+/- 40	+/- 60
Yaw (µrad)	+/- 40	+/- 60
Weight (kg)	0.22	0.24
Motor	**PM-005**	
Linear scale		**LS-060**
Speed max. (mm/sec)	0.5	
Resolution calculated (µm)		0.005
Bi-directional Repeatability (µm)		+/- 0.1
Uni-directional Repeatability (µm)		0.05
Accuracy	on request	
Material	Stainless Steel	

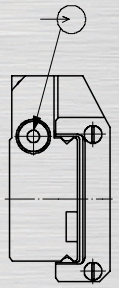
Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.

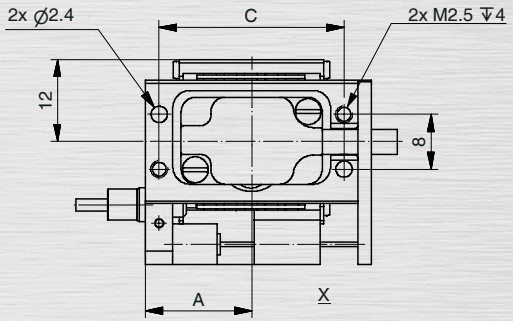
Travel (mm)	6.5	13
A	15.5	19.75
B	33	39.5
C	27	29.5

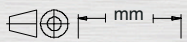












Order No.	5800-9-				0

PM-005 1

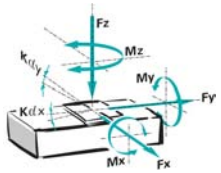
6.5 mm (1/4") 1
13 mm (1/2") 2

LS-060, Linear steel scale 1

4.820 Linear Piezo Stage LPS-35

FACTS

Load characteristics	Fx(N)	Fy(N)	Fz(N)	Mx(Nm)	My(Nm)	Mz(Nm)	kαx(µrad/Nm)	kαy(µrad/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

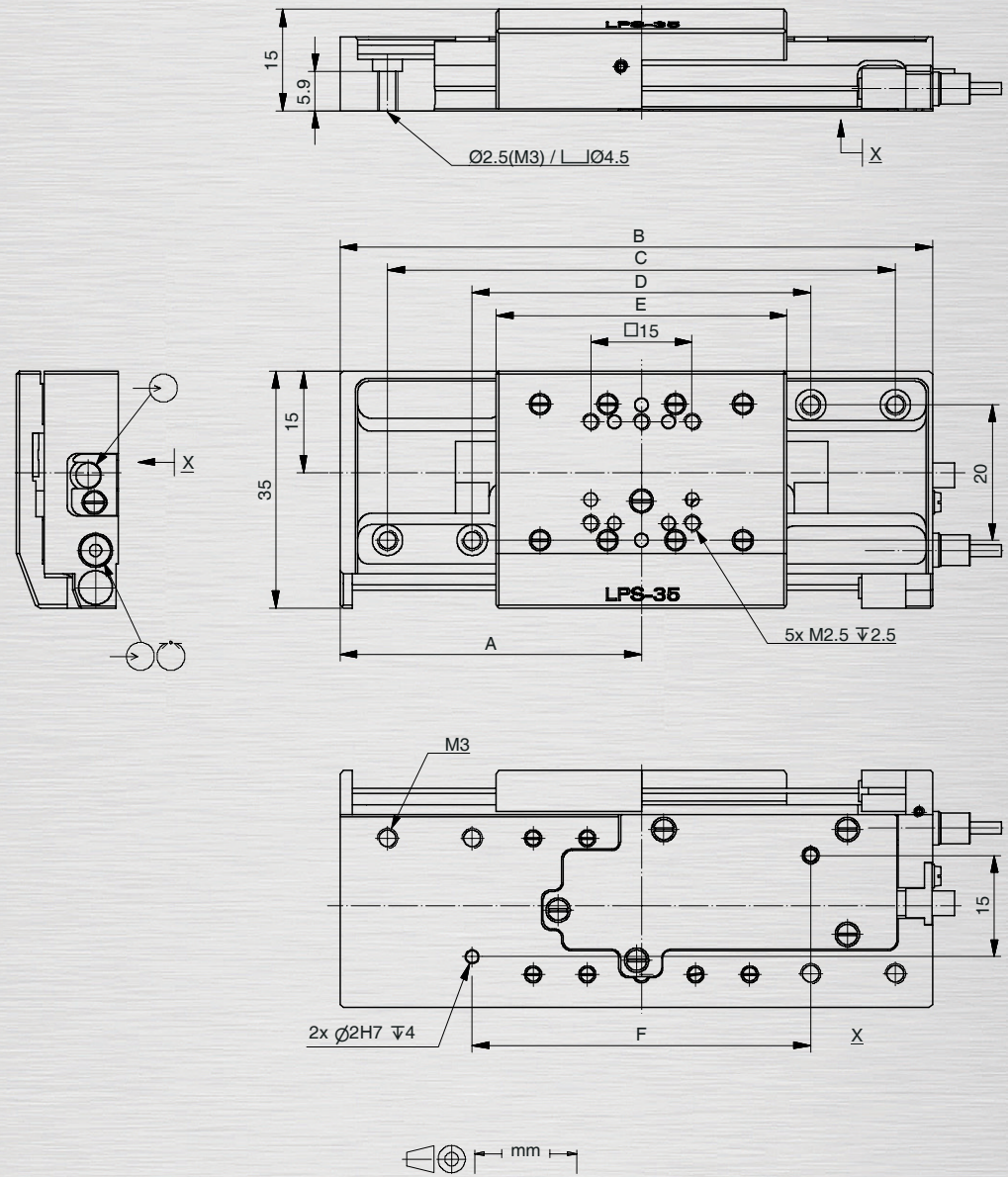
- Travel range up to 38 mm (1 1/2")
- Uni-directional repeatability down to 0.03 µm
- Maximum speed 0.5 mm/sec
- Load capacity up to 0.8 kg
- Optionally: linear scale
- Piezo driven inertia motor
- Encoder resolution 5 nm
- Holding force 4 N

TECHNICAL DATA

Travel range *(mm)*	**6.5**	**13**	**26**	**38**
Straightness / Flatness (µm)	+/- 3	+/- 5	+/- 8	+/- 10
Pitch (µrad)	+/- 50	+/- 60	+/- 80	+/- 100
Yaw (µrad)	+/- 60	+/- 70	+/- 90	+/- 110
Weight (kg)	0.17	0.2	0.23	0.26
Motor	**PM-005**			
Linear scale		**LS-060**		**LS-035**
Speed max. (mm/sec)	0.5			
Resolution calculated (µm)		0.005		0.05
Bi-directional Repeatability (µm)		+/- 0.1		+/- 0.05
Uni-directional Repeatability (µm)		0.05		0.03
Accuracy	on request			
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

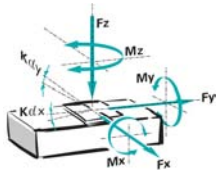
6.5 mm (1/4") 1
13 mm (1/2") 2
26 mm (1") 3
38 mm (1 1/2") 4

without linear glass scale 0
LS-060, Linear glass scale 1
LS-035, Linear glass scale 2

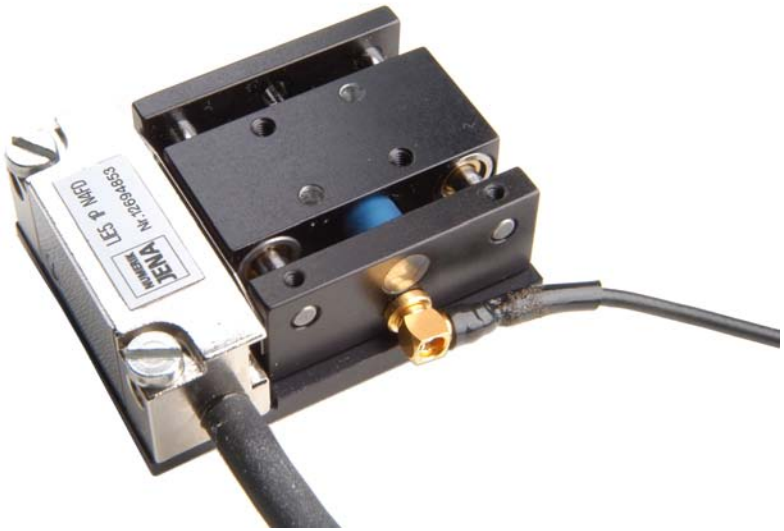
4.830 Piezo Positioner PP-30

FACTS

Load characteristics	Fx(N)	Fy(N)	Fz(N)	Mx(Nm)	My(Nm)	Mz(Nm)
PM-005	10	2	8	0.2	0.3	0.2



Piezo positioner stages **PP-30** are designed for precise adjusting of small components. They are ideal for a variety of applications, such as Micro-, Bio Technology, Microscopy, Quality control and R&D. **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. Due to the inertial piezo motor principle the repeatability in open loop is poor. The stages can be assembled as compact XY or XYZ positioning systems. The travel range is 8 mm, 18 mm or 30 mm. Applications in vacuum or cryogenic environments are possible as an option. **PP-30** is 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
- Optionally: linear scale
- Piezo driven step motor, no hysteresis
- Holding force 4 N

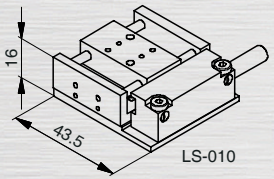
TECHNICAL DATA

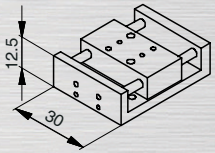
Travel range *(mm)*	**8**	**18**	**30**
Straightness / Flatness (µm)	+/- 0.7	+/- 1.5	+/- 3
Pitch (µrad)	+/- 60	+/- 80	+/- 100
Yaw (µrad)	+/- 120	+/- 120	+/- 120
Weight (kg)	0.15	0.2	0.25
Motor	**PM-005**		
Linear scale			**LS-010**
Speed max. (mm/sec)	0.5		
Resolution calculated (µm)			0.05
Bi-directional Repeatability (µm)			+/- 0.1
Uni-directional Repeatability (µm)			0.05
Accuracy	on request		
Velocity Range (mm/sec)	0.001 ... 2		
Material	Aluminum, black anodized		

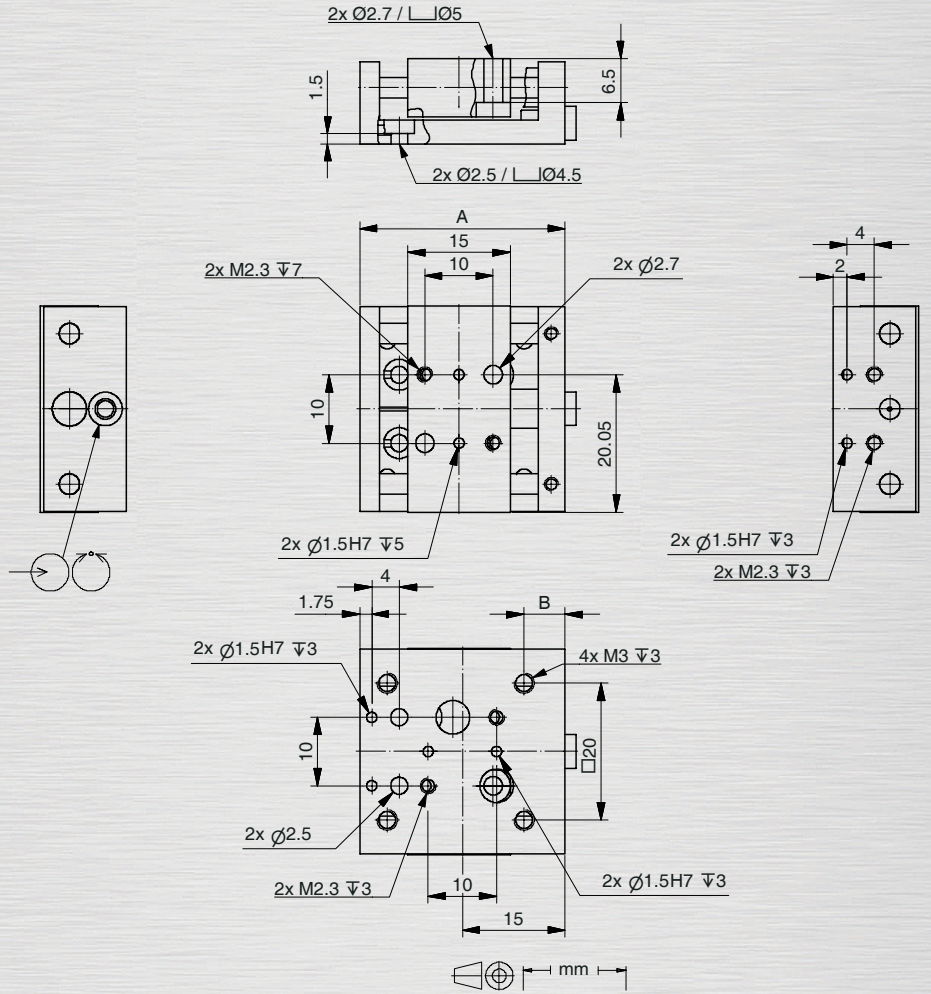
Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.

Travel (mm)	8	18	30
A	30	40	52
B	6	10	16

Special PP-30 xyz for 4 Kelvin







Order No.	5805-9-				0

PM-005 1

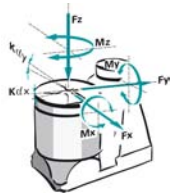
8 mm 1
18 mm 2
30 mm 3

without LS-010 0
LS-010, Linear steel scale 1

4.840 Elevation Piezo Stage EPS-30

FACTS

Load characteristics	Fx(N)	Fy(N)	Fz(N)	Mx(Nm)	My(Nm)	Mz(Nm)	kαx(µrad/Nm)	kαy(µrad/Nm)
PM-005	2	1	1.5	0.1	0.15	0.1	250	150



The elevation piezo stage **EPS-30** is specifically designed for precise positioning of small components. It is ideal for a variety of applications, such as Micro-, Nano- technology, Bio Technology, Microscopy and R&D. Due to the steel construction it is a good choice for UHV applications. Elevation piezo stages **EPS-30** stages are working in open or closed loop mode, which enables a resolution up to 50 nm. The stage can be assembled in compact XZ or XYZ-systems with the linear piezo stage LPS-30. **EPS-30** is directly driven with an inertial piezo motor without any backlash and offers a travel range of 6.5 mm or 13 mm. XZ-assembly can only be made with a special mounting adapter and must be specified when ordering. Customized designs for OEM are possible.

Key features

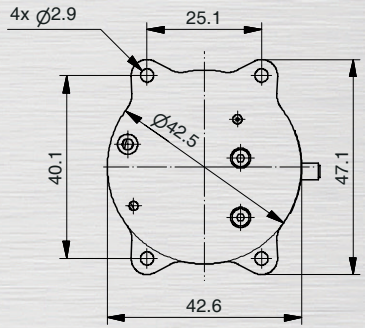
- Travel range up to 13 mm (1/2")
- Uni-directional repeatability down to 0.05 µm
- Maximum speed 0.3 mm/sec
- Load capacity up to 0.15 kg
- Integrated linear scale (center mounted)
- Piezo inertia drive
- Encoder resolution up to 5 nm
- Holding force 1.5 N

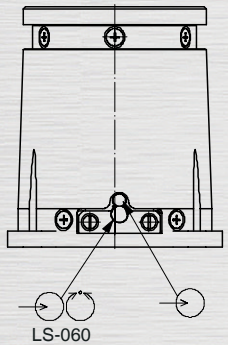
TECHNICAL DATA

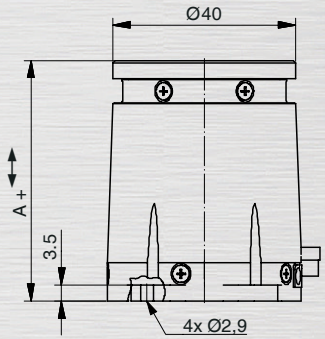
Travel range *(mm)*	**6.5**	**13**
Straightness / Flatness (µm)	+/- 2	+/- 4
Pitch (µrad)	+/- 30	+/- 60
Yaw (µrad)	+/- 30	+/- 30
Weight (kg)	0.32	0.35
Motor	**PM-005**	
Linear scale		**LS-060**
Speed max. (mm/sec)	0.3	
Resolution calculated (µm)		0.005
Bi-directional Repeatability (µm)		+/- 0.1
Uni-directional Repeatability (µm)		0.05
Accuracy	on request	
Velocity Range (mm/sec)	0.001 ... 0.3	
Material	Stainless Steel	

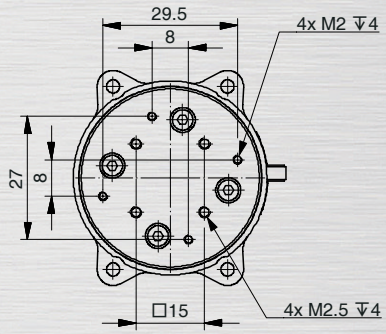
Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.

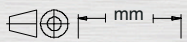
Travel (mm)	6.5	13
A	49.5	55.5











Order No.	5810-9-				0

PM-005 1

6.5 mm (1/4") 1
13 mm (1/2") 2

LS-060, Linear steel scale 1

5.000 ROTATION STAGES







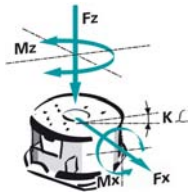


ROTATION STAGES

5.010 Ultra Precision Rotation Stage UPR-270 AIR

FACTS

Load characteristics	Fx(N)	Fz(N)	kαx(µrad/Nm)
TM-050	150	400	30



Ultra precision rotation stages of the structural series **UPR-270 AIR** are developed for dynamic positioning with a maximum of precision. With best values for flatness and wobble you can reach highest accuracies due to the high precision air-bearing. All rotation stages **UPR-270 AIR** are directly driven by a torque motor. The **UPR-270 AIR** is equipped with an angular scale system and reference switches. Standard resolutions up to 0.00002° can be achieved.

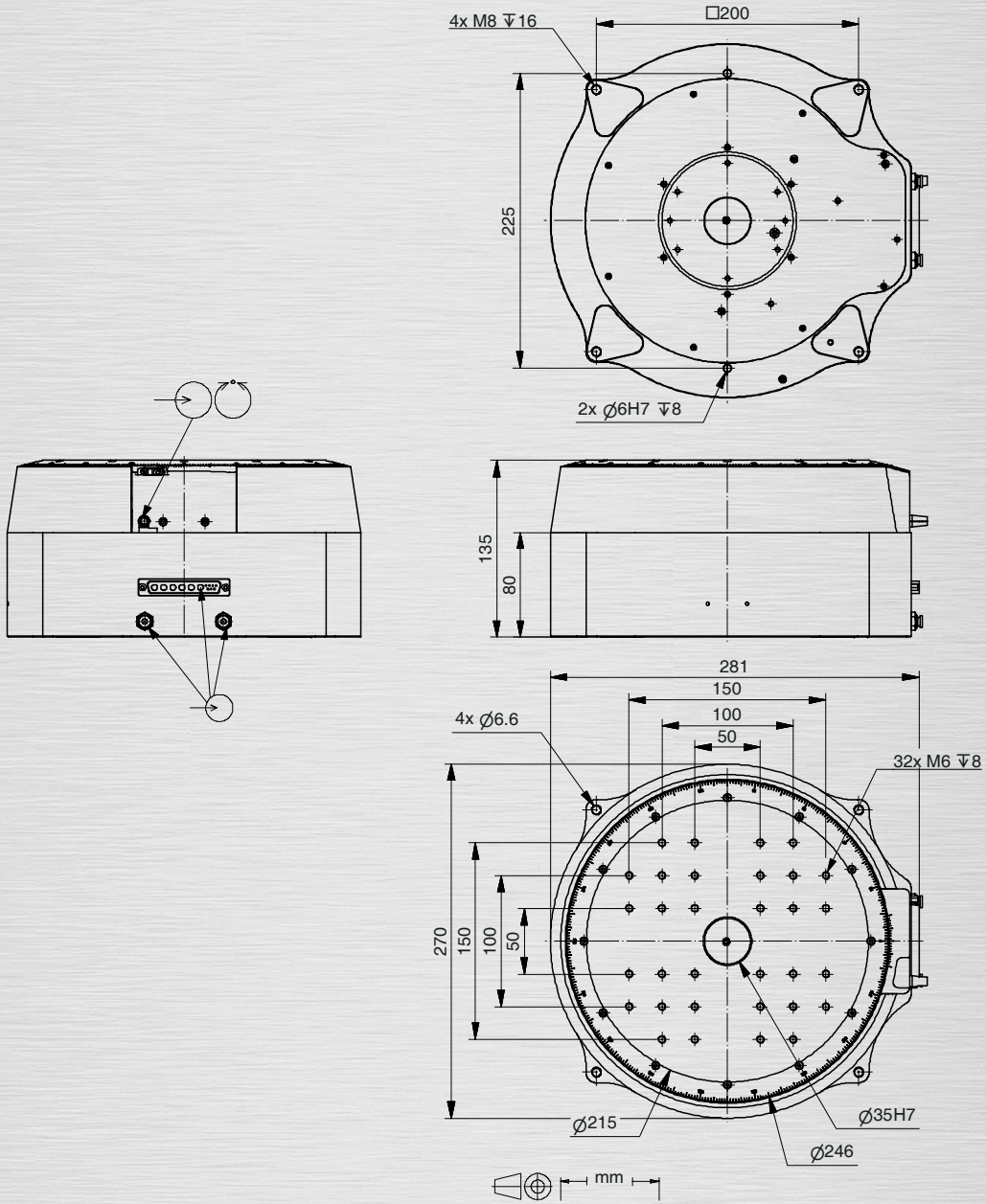
Key features

- Torque Motor
- Uni-directional repeatability down to 0.00003 °
- Maximum speed 360 °/sec
- Load capacity up to 40 kg
- Integrated reference switches
- Integrated angular scale
- High precision air bearings
- Free center hole 35 mm diameter
- Eccentricity +/- 0.07 µm
- Wobble +/- 1.25 µrad
- Option: Clean room
- Recommended option: Air box, see accessories

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**	
Angular Measurement System		**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)	2.5	
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.	6829-9-		0	

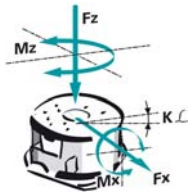
TM-020 1

AE-015, Angular Scale 0

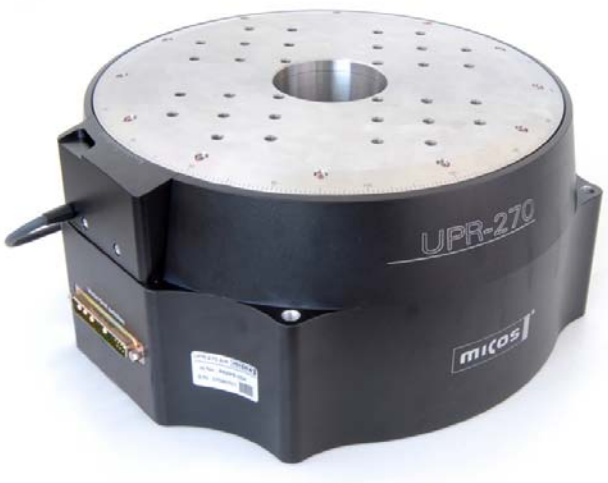
5.020 Ultra Precision Rotation Stage UPR-270

FACTS

Load characteristics	Fx(N)	Fz(N)	kαx(µrad/Nm)
TM-050	400	400	8



Ultra precision rotation stages of the structural series **UPR-270** are developed for dynamic positioning of high load applications. They are mainly utilized in the field of semiconductor technology, for positioning systems of laser treatment, robotics and synchrotron applications. All rotation stages of the structural series UPR are directly driven by a torque motor so that mechanical transmissions are not necessary. This results in better positioning accuracies, higher acceleration and speed. Calibrated, paired angular ball bearings guarantee a high central load capacity without breakdown torque. UPR rotation stages are equipped with a high resoluting angular scale and with inductive reference switches.



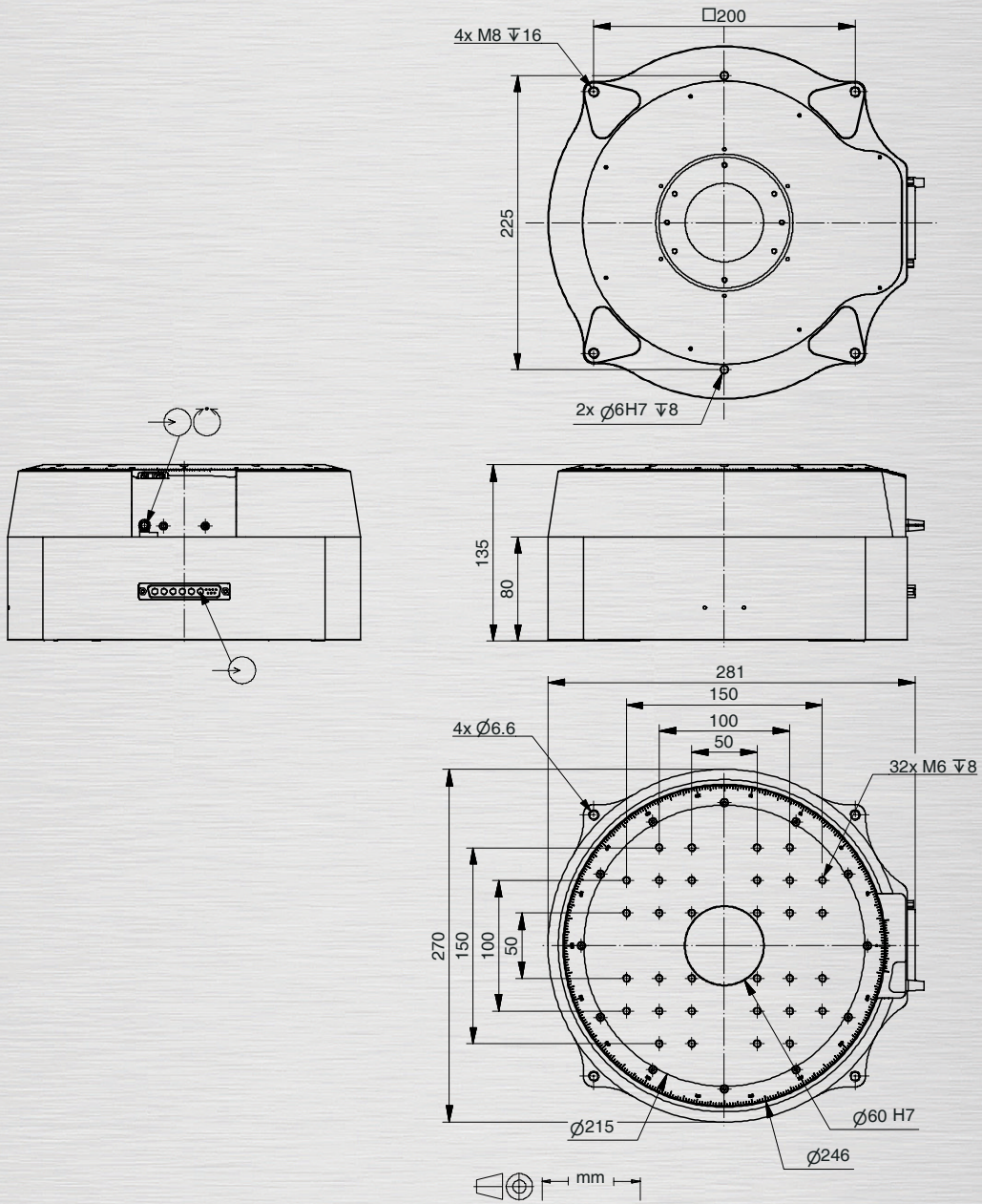
Key features

- Torque Motor
- Uni-directional repeatability down to 0.00007 °
- Maximum speed 360 °/sec
- Load capacity up to 40 kg
- Integrated reference switches
- Integrated angular scale
- High-precision ball bearings
- Free center hole 60 mm diameter

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**	
Angular Measurement System		**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)	2.5	
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.	6814-9-		0	

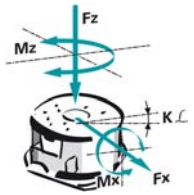
TM-020 1

AE-015, Angular Scale 0

5.030 Ultra Precision Rotation Stage UPR-160 AIR

FACTS

Load characteristics	Fx(N)	Fz(N)	Mz(Nm)	Mz Peak(Nm)	kαx(µrad/Nm)
TM-010	40	200	0.97	2	40



Ultra precision rotation stages of the structural series **UPR-160 AIR** are developed for dynamic positioning with a maximum of precision. With best values for flatness and wobble you can reach highest accuracies due to the high precision air-bearing. All rotation stages **UPR-160 AIR** are directly driven by a torque motor. The **UPR-160 AIR** is equipped with an angular scale system and reference switches. Standard resolutions up to 0.00004° can be achieved.

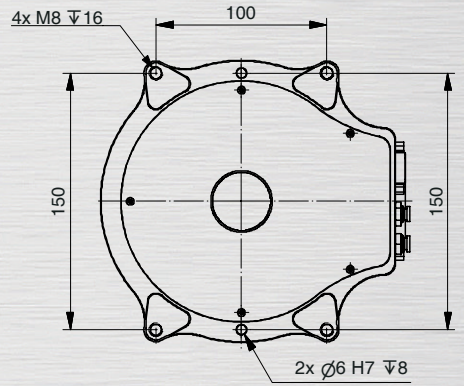
Key features

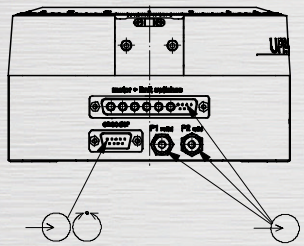
- Torque Motor
- Uni-directional repeatability down to 0.00005 °
- Maximum speed 360 °/sec
- Load capacity up to 20 kg
- Integrated reference switches
- Integrated angular scale
- High precision air bearings
- Free center hole 35 mm diameter
- Flatness and eccentricity +/- 0.1 µm
- Wobble +/- 1.25 µrad
- Option: Clean room
- Recommended option: Air box, see accessories

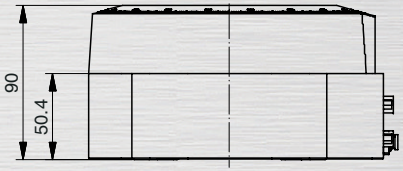
TECHNICAL DATA

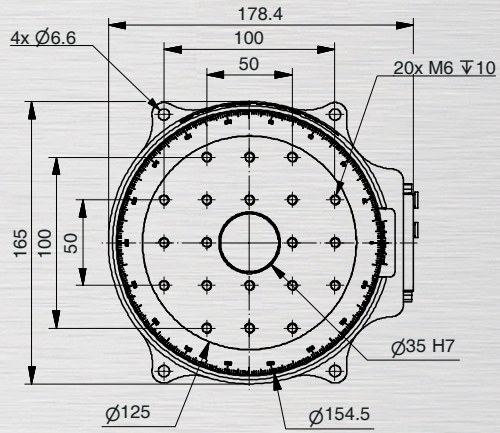
Travel range *(°)*	**360°, endless**	
Flatness (Bearings) (µm)	+/- 0.05	
Eccentricity (Bearings) (µm)	+/- 0.1	
Wobble (Bearings) (µrad)	+/- 1.25	
Weight (kg)	7.5	
Motor	**TM-010**	
Angular Measurement System		**AE-051**
Speed max. (°/sec)	360	
Resolution calculated (°)		0.00002
Resolution typical (°)		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)	

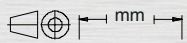
Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.











Order No.	6826-9-		0	

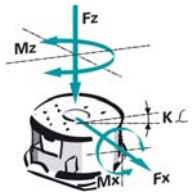
TM-010 1

AE-051, Angular Scale 0

5.040 Ultra Precision Rotation Stage UPR-160

FACTS

Load characteristics	$F_{x(N)}$	$F_{z(N)}$	$M_{z(Nm)}$	$k\alpha_{x(\mu rad/Nm)}$
TM-010	200	200	0.95	16



Ultra precision rotation stages of the series **UPR-160** are developed for fast and accurate positioning applications. They are mainly utilized in the field of semiconductor technology, for positioning of laser treatment systems, robotics and synchrotron applications. All rotation stages of the series UPR are directly driven by a torque motor so that mechanical transmissions are not necessary. This results in better positioning accuracies, higher acceleration and speed. Calibrated, paired angular ball bearings guarantee a high central load capacity without breakdown torque. **UPR-160** rotation stages are equipped with a high resolution angular scale and with inductive limit switches.

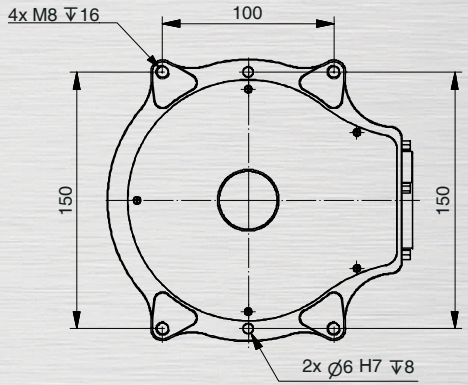
Key features

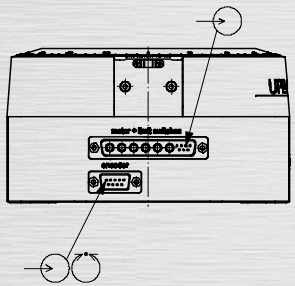
- Torque Motor
- Uni-directional repeatability down to 0.00008 °
- Maximum speed 360 °/sec
- Load capacity up to 20 kg
- Integrated reference switches
- Integrated angular scale
- Free center hole 35 mm
- High-precision ball bearings

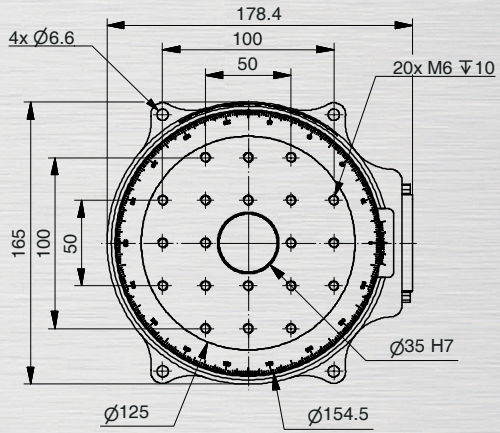
TECHNICAL DATA

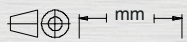
Travel range *(°)*	**360°, endless**	
Flatness (Bearings) (µm)	+/- 1	
Eccentricity (Bearings) (µm)	+/- 3	
Wobble (Bearings) (µrad)	+/- 25	
Weight (kg)	6	
Motor	**TM-010**	
Angular Measurement System		**AE-051**
Speed max. (°/sec)	360	
Resolution calculated (°)		0.00002
Resolution typical (°)		0.00008
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	

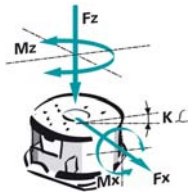
TM-010 1

AE-051, Angular Scale 0

5.050 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	0.16	0.25	0.5



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

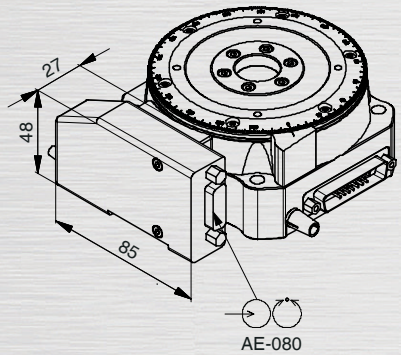
Key features

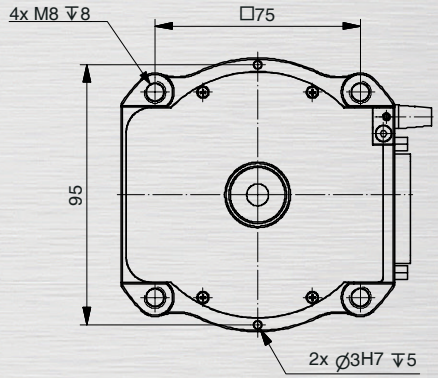
- Torque Motor
- Uni-directional repeatability down to 0.00005 °
- Maximum speed 360 °/sec
- Load capacity up to 1.5 kg
- Integrated reference switches
- Integrated angular scale
- High precision air bearings
- Free center hole 8 mm diameter
- Flatness and eccentricity +/- 0.2 µm
- Wobble +/- 5 µrad
- Option: Clean room
- Recommended option: Air box, see accessories

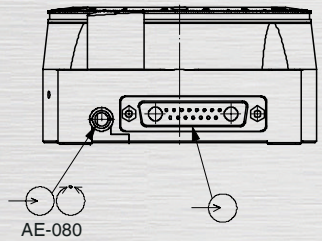
TECHNICAL DATA

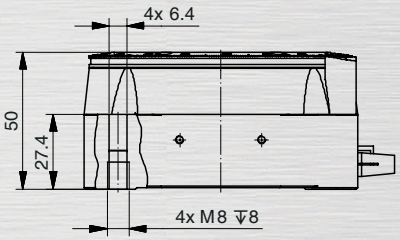
Travel range *(°)*	**360°, endless**	
Flatness (Bearings) (µm)	+/- 0.1	
Eccentricity (Bearings) (µm)	+/- 0.2	
Wobble (Bearings) (µrad)	+/- 5	
Weight (kg)	1.2	
Motor	**TM-030**	
Angular Measurement System		**AE-080**
Speed max. (°/sec)	360	
Resolution calculated (°)		0.00002
Resolution typical (°)		0.00004
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	

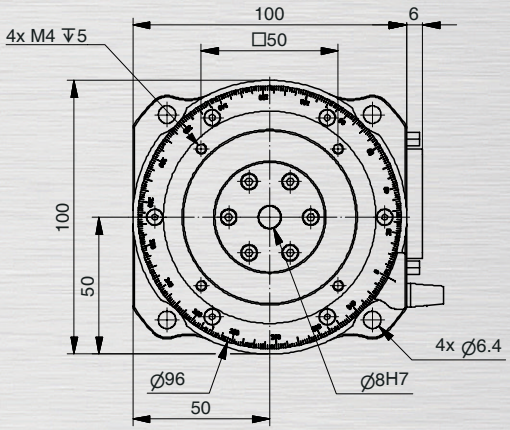
Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.











mm

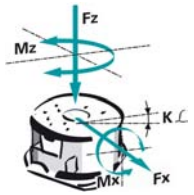
Order No.	6823-9-		1		

TM-030 1
AE-080, Angular scale 1
HLS-010, Hall switches 1

5.060 Ultra Precision Rotation Stage UPR-100

FACTS

Load characteristics	Fx(N)	Fz(N)	Mx(Nm)	Mz(Nm)	Mz Peak(Nm)	kαx(µrad/Nm)
TM-030	15	20	5	0.25	0.5	80



Ultra precision rotation stages of the series **UPR-100** are developed for fast and accurate positioning applications. They are mainly utilized in the field of semiconductor technology, for positioning of laser treatment systems, robotics and synchrotron applications. All rotation stages of the series UPR are directly driven by a torque motor so that mechanical transmissions are not necessary. This results in better positioning accuracies, higher acceleration and speed. Calibrated, paired angular ball bearings guarantee a high central load capacity. **UPR-100** rotation stages are equipped with a high resolution angular scale and with hall limit switches.

Key features

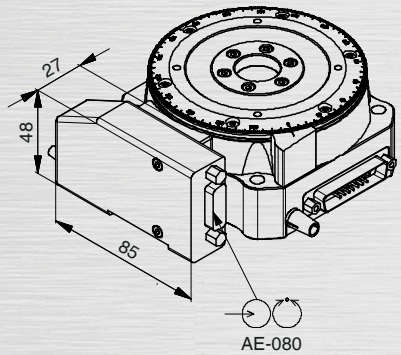
- Torque Motor
- Uni-directional repeatability down to 0.00008 °
- Maximum speed 360 °/sec
- Load capacity up to 2 kg
- Integrated reference switches
- Integrated angular scale
- Free center hole 20 mm diameter
- Option: Vacuum & Clean room

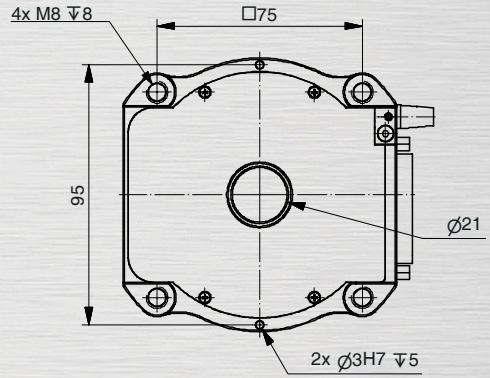
TECHNICAL DATA

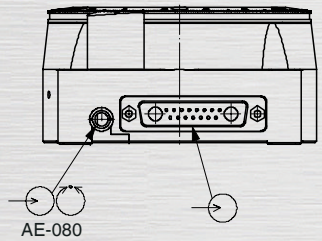
Travel range *(°)*		**360°, endless**
Flatness (Bearings) (µm)		+/- 2.5
Eccentricity (Bearings) (µm)		+/- 2.5
Wobble (Bearings) (µrad)		+/- 15
Weight (kg)		1.2
Motor	**TM-030**	
Angular Measurement System		**AE-080**
Speed max. (°/sec)	360	
Resolution calculated (°)		0.00002
Resolution typical (°)		0.00008
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	

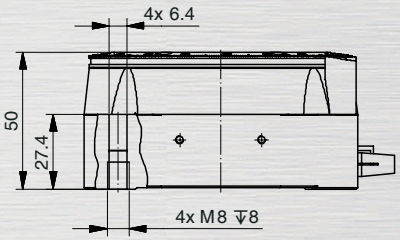
Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.

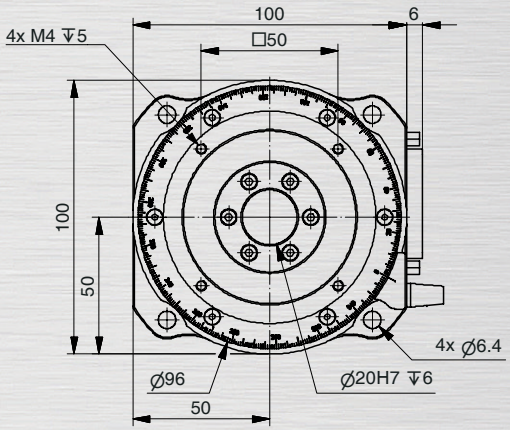
Setup with UPS-150

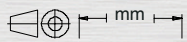












Order No.	6805-9-		1		

TM-030 1

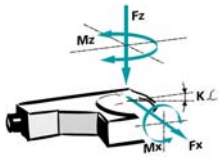
AE-080, Angular scale 1

HLS-010, Hall switches 1

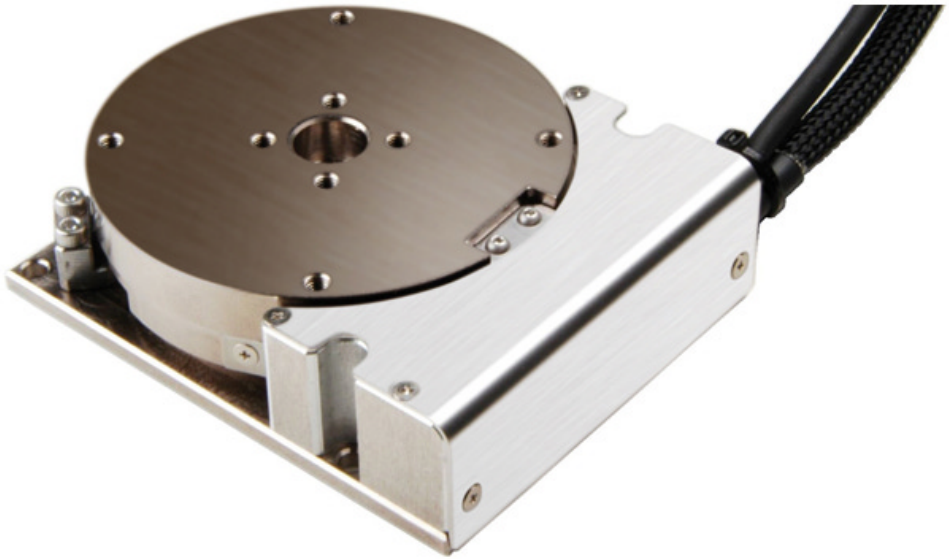
5.070 Torque Rotation Stage TRS-65

FACTS

Load characteristics	Fx(N)	Fz(N)	Mz(Nm)
TM-040	3	5	0.05



The Precision Rotation Stage **TRS-65** was developed for fast and accurate positioning applications in a smaller travel range up to 45°, typically on top of an xy setup. It fits ideal to the linear motor driven stages LMS-60 and LMS-80. They are 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 so that mechanical transmissions are not necessary. This results in better positioning accuracies, higher acceleration and speed and as well longer lifetime.



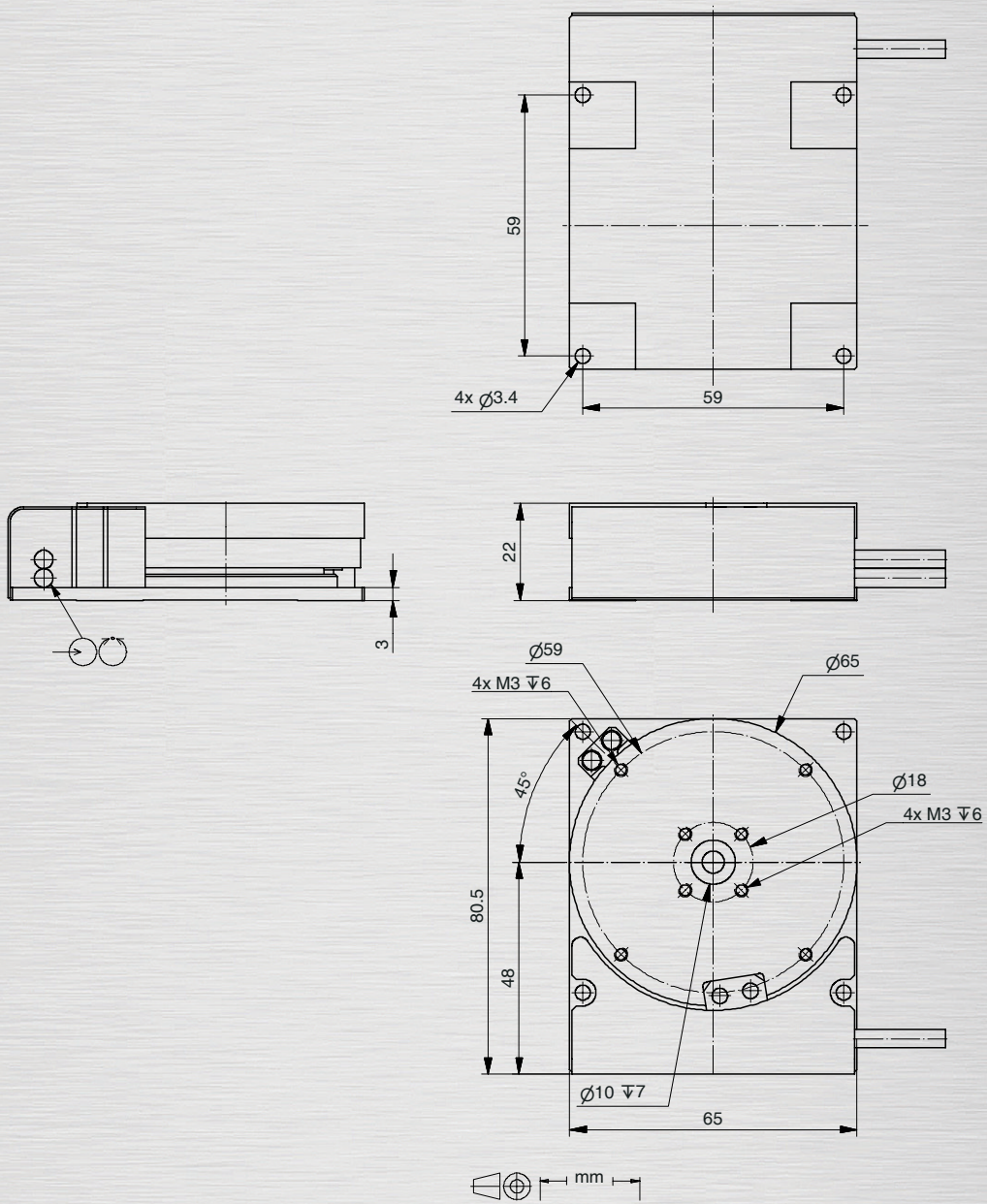
Key features

- Torque Motor
- Travel range 45°
- Uni-directional repeatability down to 0.00025 °
- Maximum speed 360 °/sec
- Load capacity up to 0.5 kg
- Integrated 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**	
Angular Measurement System		**AE-055**
Speed max. (°/sec)	360	
Resolution calculated (°)		
Resolution typical (°)		0.0005
Bi-directional Repeatability (°)		+/- 0.0005
Uni-directional Repeatability (°)		0.00025
Accuracy	on request	
Velocity Range (°/sec)	0.001 ... 360	
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.



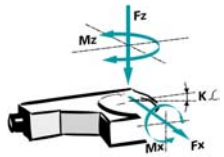
Order No.	6803-9-				

TM-040 1
45° 1
AE-055 1
HLS-020, Hall switches 1

5.080 Precision Rotation Stage PRS-200

FACTS

Load characteristics	Fx(N)	Fz(N)	Mx(Nm)	Mz(Nm)	kαx(µrad/Nm)
DC-B-088	200	500	60	4	10
2Phase-070	200	500	60	4	10



The large clear aperture with a diameter of 120 mm is particularly significant for the rotation stages **PRS-200**. 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 rotation stages **PRS-200** are equipped with two reference switches which can be easily adjusted by the customer. Drive variations including DC or 2-phase stepper motors are available.

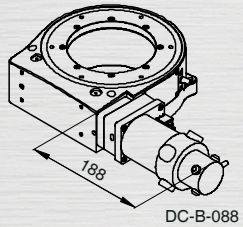
Key features

- Uni-directional repeatability down to 0.0003 °
- Maximum speed 150 °/sec
- Load capacity up to 50 kg
- Integrated reference switches
- Optionally: angular scale
- Clear aperture 120 mm
- Preloaded worm drive for zero backlash

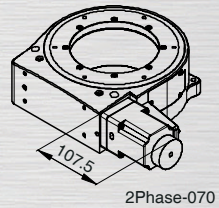
TECHNICAL DATA

Travel range *(°)*		**360°, endless**	
Flatness (Bearings) (µm)		+/- 1	
Eccentricity (Bearings) (µm)		+/- 2.5	
Wobble (Bearings) (µrad)		+/- 17.5	
Weight (kg)		8	
Motor *(180:1 | 90:1)*	**DC-B-088**	**2Phase-070**	
Angular Measurement System			**AE-068**
Speed max. (°/sec)	75 | 150	35 | 60	
Resolution calculated (°)	0.0001 | 0.0002 (RE)	0.01 | 0.02 (FS)	0.000076271
Resolution typical (°)	0.001	0.001	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)	48.6		
Worm gear reduction	180:1 | 90:1		
Accuracy	on request		
Velocity Range (°/sec)	0.001 ... 150		
Material	Aluminum, black anodized, stainless steel, red brass		

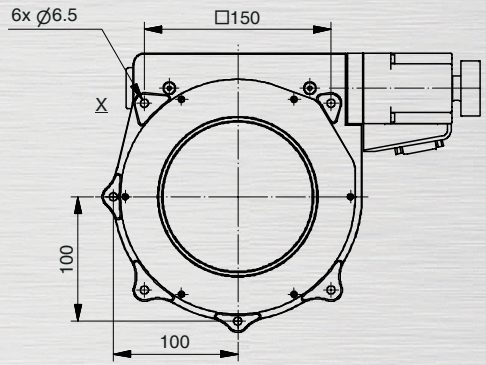
Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.

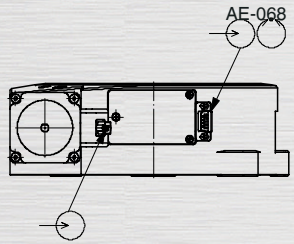


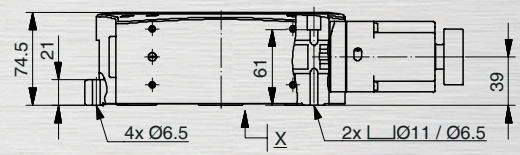
DC-B-088

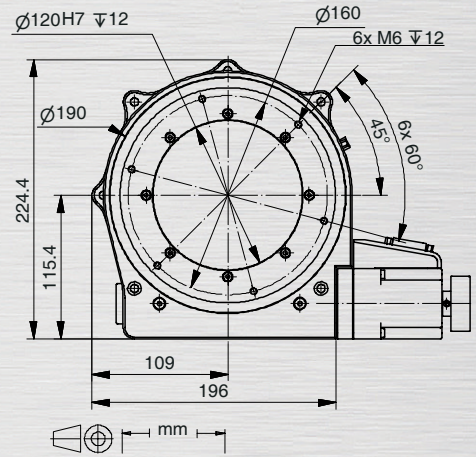


2Phase-070









Order No.	6449-9-		1			

DC-B-088 1
2Phase-070 2

without AE-068 0
AE-068, Angular scale 1

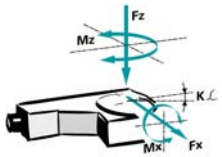
HLS-010, Hall switches 1

Worm gear reduction 180:1 1
Worm gear reduction 90:1 2

5.090 Precision Rotation Stage PRS-110

FACTS

Load characteristics	Fx(N)	Fz(N)	Mx(Nm)	Mz(Nm)	kαx(µrad/Nm)
DC-B-040	50	100	40	3	30
2Phase-033	50	100	40	3	30



The precision rotation stages **PRS-110** 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. **PRS-110** precision rotation stages can be equipped with optical angular scales. Resolutions up to 0.0002° are standard. The precision rotation stages **PRS-110** are equipped with reference switches and are motorized with DC or 2-phase stepper motors.

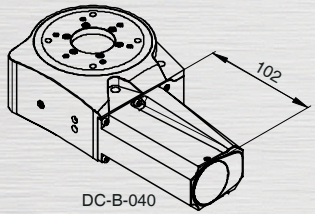
Key features

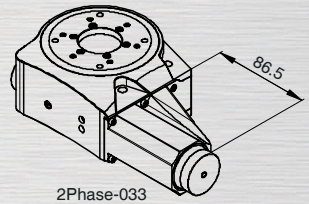
- Uni-directional repeatability down to 0.0002 °
- Maximum speed 200 °/sec
- Load capacity up to 10 kg
- Integrated reference switches
- Optionally: angular scale
- Clear aperture 35 mm
- Preloaded worm drive for zero backlash
- Precise, smooth continuous 360° motion

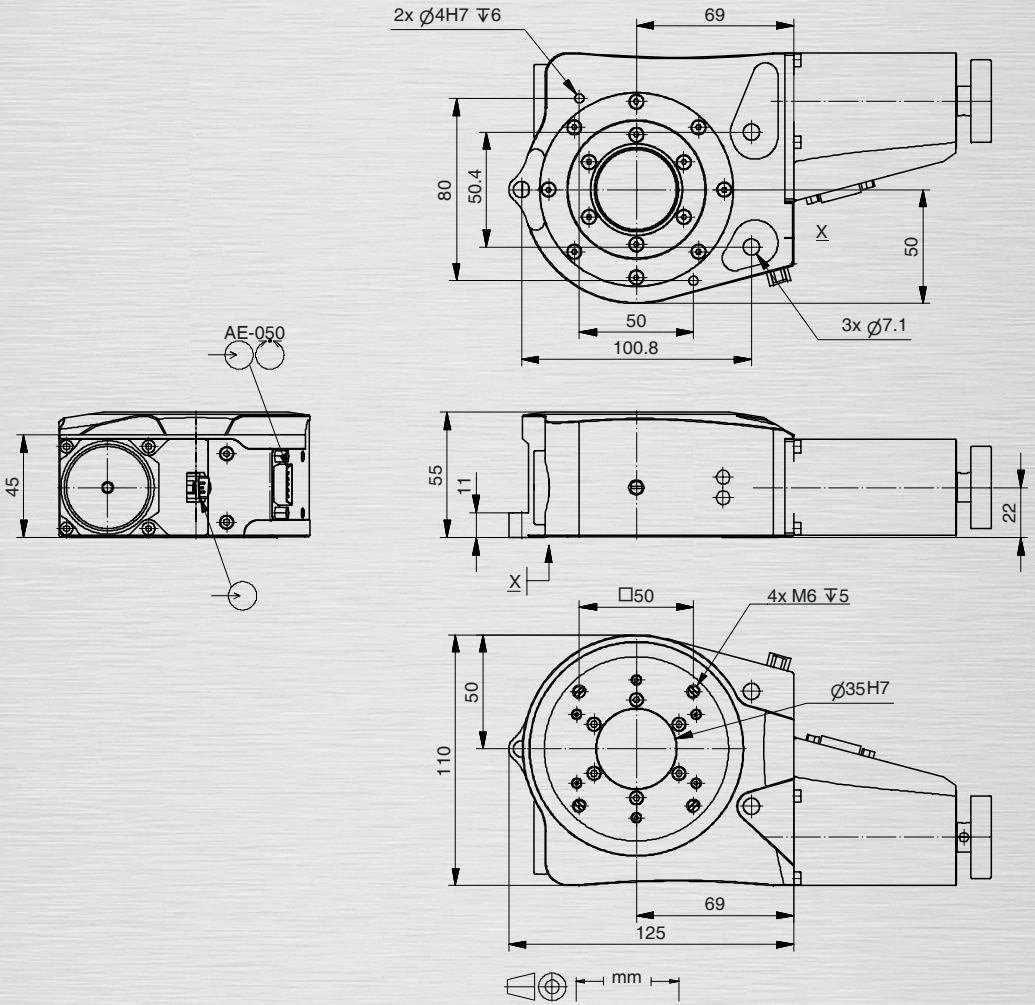
TECHNICAL DATA

Travel range *(°)*		**360°, endless**	
Flatness (Bearings) (µm)		+/- 1	
Eccentricity (Bearings) (µm)		+/- 2.5	
Wobble (Bearings) (µrad)		+/- 15	
Weight (kg)		2.6	
Motor *(90:1)*	**DC-B-040**	**2Phase-033**	
Angular Measurement System			**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.







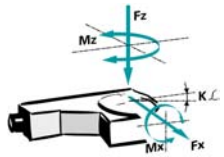
Order No.	6447-9-		0	

DC-B-040 1
2Phase-033 2

without AE-050 0
AE-050, Angular scale 1

FACTS

Load characteristics	Fx(N)	Fz(N)	Mx(Nm)	Mz(Nm)	kαx(µrad/Nm)
DC-B-031	15	30	10	0.8	180
2Phase-033	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 stages **DT-65 N** are equipped with a reference switch. Drive variations such as DC or 2-phase stepper motors are available.

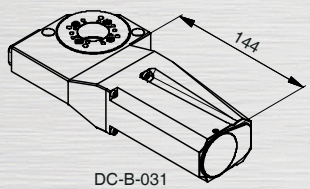
Key features

- Uni-directional repeatability down to 0.002 °
- Maximum speed 60 °/sec
- Load capacity up to 3 kg
- Integrated reference switch
- Clear aperture 25 mm
- Preloaded worm drive for zero backlash

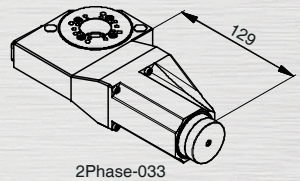
TECHNICAL DATA

Travel range *(°)*	**360°, endless**		
Flatness (Bearings) (µm)	+/- 6		
Eccentricity (Bearings) (µm)	+/- 6		
Wobble (Bearings) (µrad)	+/- 30		
Weight (kg)	1.3		
Motor *(180:1)*	**DC-B-031**	**2Phase-033**	**2Phase-045**
Speed max. (°/sec)	60	30	45
Resolution calculated (°)	0.001 (RE)	0.01 (FS)	0.01 (FS)
Resolution typical (°)	0.002	0.002	0.002
Bi-directional Repeatability (°)	+/- 0.01	+/- 0.01	+/- 0.01
Uni-directional Repeatability (°)	0.002	0.002	0.002
Nominal Current (A)	1.96	1.2	1.2
Voltage Range (V)	24		
Worm gear reduction	180:1		
Accuracy	on request		
Velocity Range (°/sec)	0.001 ... 60		
Material	Aluminum, black anodized		

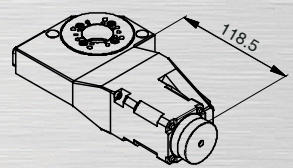
Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.



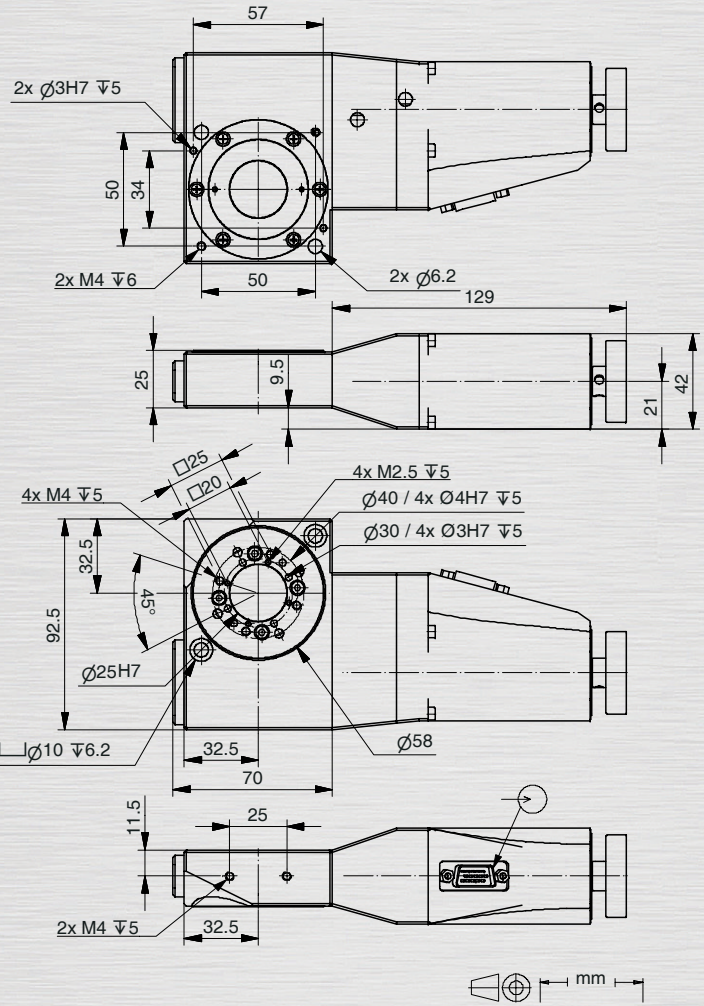
DC-B-031

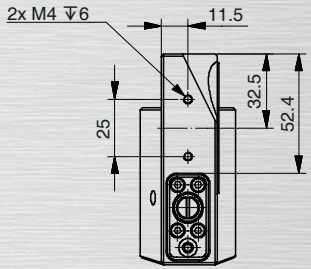


2Phase-033



2Phase-045





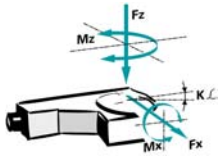
Order No.	6440-9-		0	0

DC-B-031 1
2Phase-033 2
2Phase-045 3

5.110 Rotation Stage RS-40

FACTS

Load characteristics	Fx(N)	Fz(N)	Mx(Nm)	Mz(Nm)	kαx(µrad/Nm)
DC-B-009	10	20	2	0.2	270
2Phase-010	10	20	2	0.2	270



The NEW rotation stage **RS-40** is very compact but offers a big aperture of 20 mm (25 mm holding diameter). 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 DC or stepper motors with gear.

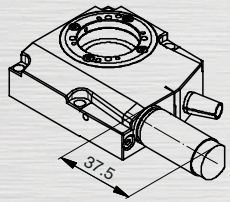
Key features

- Uni-directional repeatability down to 0.005 °
- Maximum speed 7 °/sec
- Load capacity up to 2 kg
- Integrated reference switch
- Clear aperture 20 mm
- Worm gear drive
- Precise, smooth continuous 360° motion

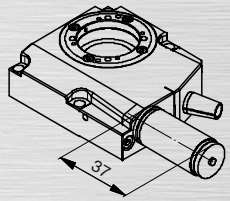
TECHNICAL DATA

Travel range *(°)*	**360°, endless**	
Flatness (Bearings) (µm)	+/- 5	
Eccentricity (Bearings) (µm)	+/- 5	
Wobble (Bearings) (µrad)	+/- 35	
Weight (kg)	0.4	
Motor *(90:1)*	**DC-B-009**	**2Phase-010**
Speed max. (°/sec)	7	5
Resolution calculated (°)	0.0000257 (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.

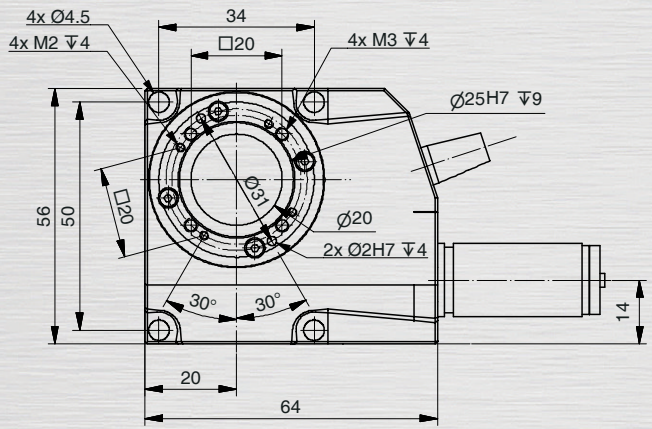


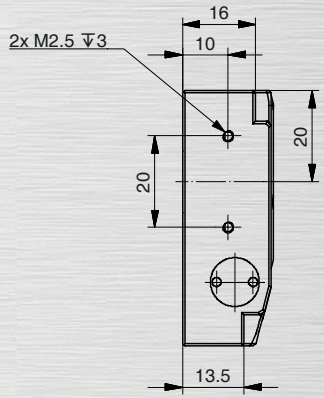
DC-B-009

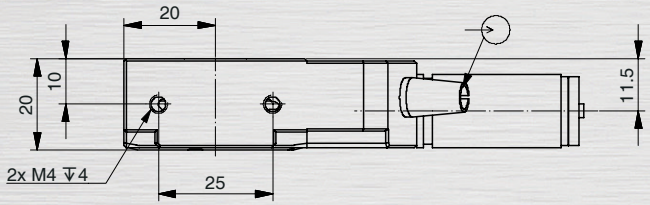


2Phase-010

Setup with WT-100 and WT-85







mm

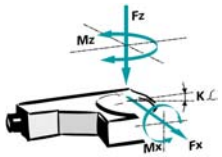
Order No.	3216-9-		0	0	

DC-B-009 1
2Phase-010 2

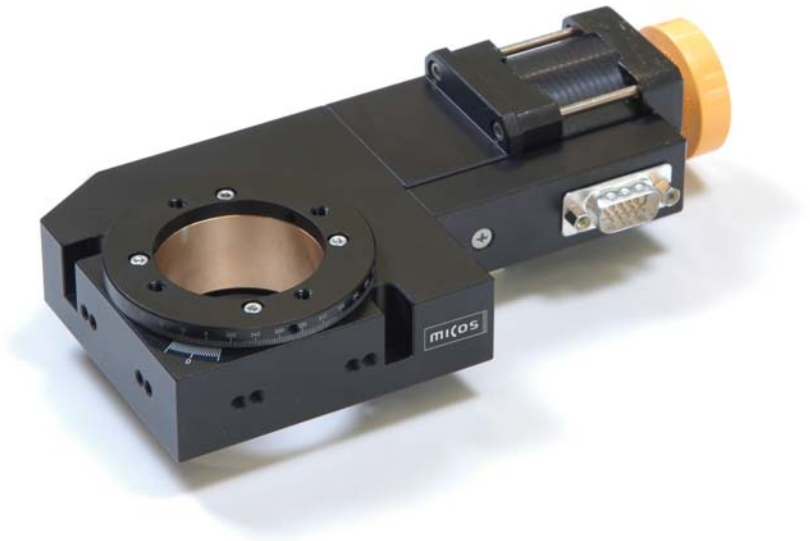
HLS-010, Hall switch 1

FACTS

Load characteristics	$F_{x(N)}$	$F_{z(N)}$	$M_{x(Nm)}$	$M_{z(Nm)}$	$k\alpha_{x(\mu rad/Nm)}$
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



The rotation stages **DT-80** are a low cost alternative to the MICOS high precision rotation stages DT-65 N and PRS-110. 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 field. The worm screw and worm gear combination is preloaded to produce a near "zero-backlash" and smooth motion. Rotation stages of the series **DT-80** 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.



Key features

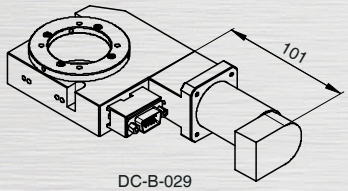
- Uni-directional repeatability down to 0.01 °
- Maximum speed 40 °/sec
- Load capacity up to 2 kg
- Integrated reference switch
- Clear aperture 40 mm
- Rotation range 360°, endless

TECHNICAL DATA

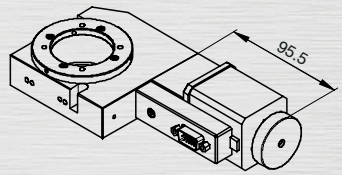
Travel range *(°)*	**360°, endless**		
Flatness (Bearings) (µm)	+/- 30		
Eccentricity (Bearings) (µm)	+/- 30		
Wobble (Bearings) (µrad)	+/- 100		
Weight (kg)	0.8		
Motor *(180:1)*	**DC-B-029**	**2Phase-041**	**2Phase-042**
Speed max. (°/sec)	40	30	30
Resolution calculated (°)	0.001 (RE)	0.01 (FS)	0.01 (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		

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

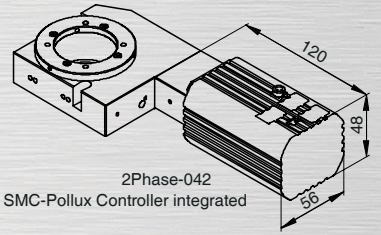
Motorized ThetaPhi like gimbal



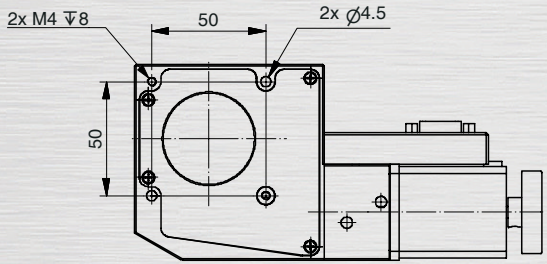
DC-B-029

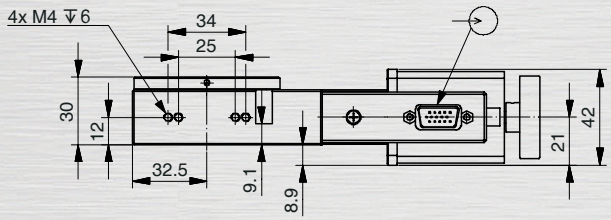


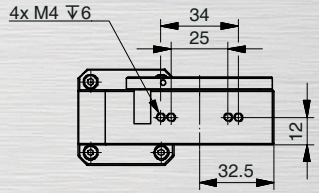
2Phase-041

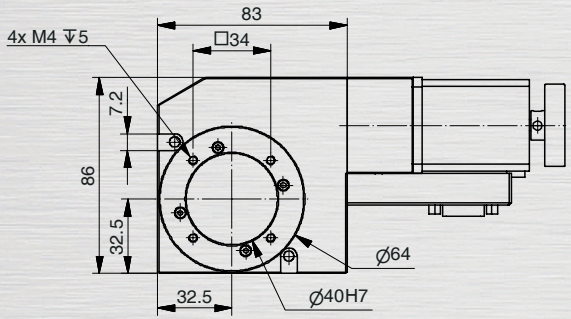


2Phase-042
SMC-Pollux Controller integrated









mm

Order No.	6443-9-		0	0

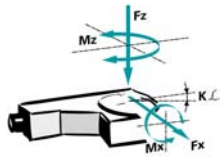
DC-B-029 1
2Phase-041 2
2Phase-042 4

5.130 Rotation Stage DT-80 R

NEW

FACTS

Load characteristics	Fx(N)	Fz(N)	Mx(Nm)	Mz(Nm)	kαx(µrad/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 NEW rotation stage **DT-80 R** is a low cost alternative to the MICOS DT-65 N and PRS-110 high precision rotation stages. The belt driven **DT-80 R** rotation stage 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 belt driven combination is preloaded to produce a nearly zero backlash and smooth motion. **DT-80 R** rotation stages are equipped with hall reference switches and are driven by a DC or 2-phase stepper motor. Additionally the **DT-80 R** can be ordered with our smc pollux motor-controller module.

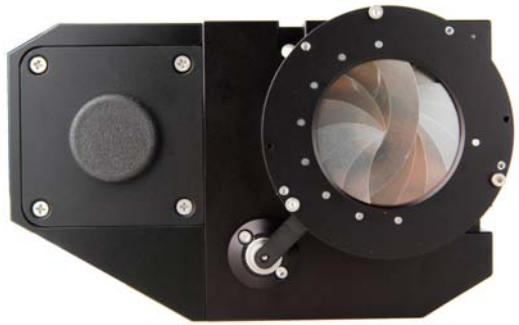
Key features

- Uni-directional repeatability down to 0.01 °
- Maximum speed 1170 °/sec
- Load capacity up to 2 kg
- Integrated reference switches
- Clear aperture 40 mm
- Rotation range 360°, endless

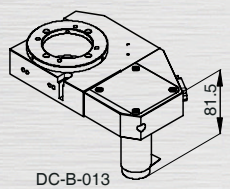
TECHNICAL DATA

Travel range *(°)*	**360°, endless**		
Flatness (Bearings) (µm)	+/- 30		
Eccentricity (Bearings) (µm)	+/- 30		
Wobble (Bearings) (µrad)	+/- 100		
Weight (kg)	0.8		
Motor *(4:1)*	**DC-B-013**	**2Phase-047**	**2Phase-042**
Speed max. (°/sec)	270	900	1170
Resolution calculated (°)	0.0014846 (RE)	0.225 (FS)	0.45 (FS)
Resolution typical (°)	0.004	0.004	0.004
Bi-directional Repeatability (°)	+/- 0.02	+/- 0.02	+/- 0.02
Uni-directional Repeatability (°)	0.01	0.01	0.01
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		

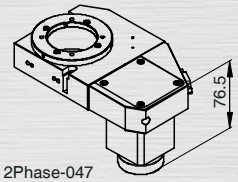
Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.



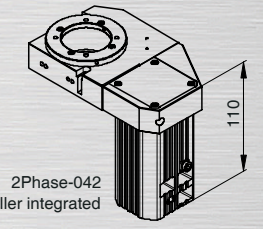
Motorized Iris diaphragm based on DT-80R



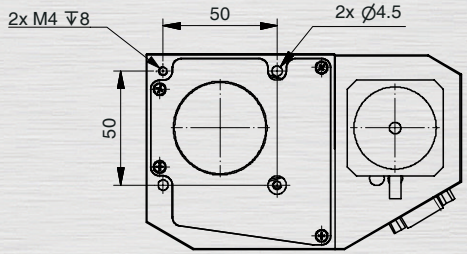
DC-B-013

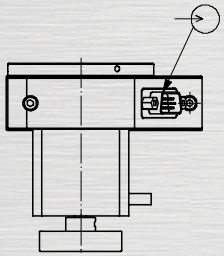


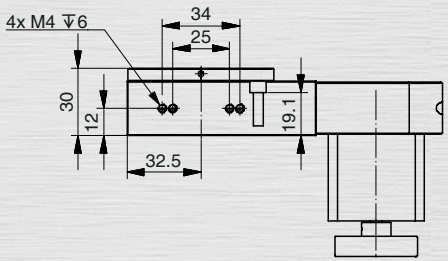
2Phase-047

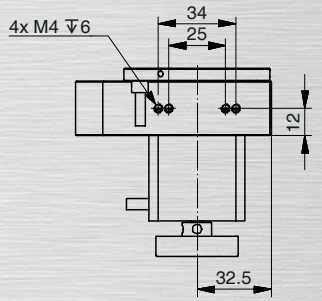


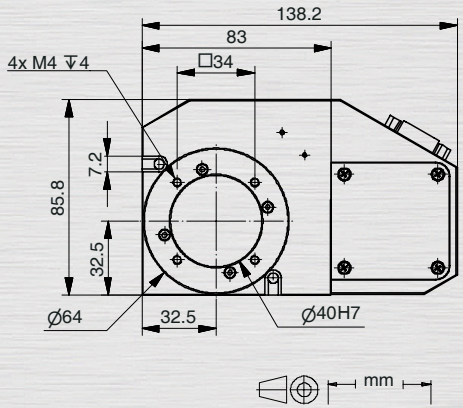
2Phase-042
SMC-Pollux Controller integrated











mm

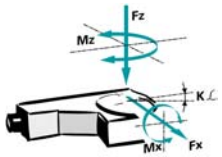
Order No.	6450-9-		0	0	1

DC-B-013 1
2Phase-047 2
2Phase-042 3

NEW

FACTS

Load characteristics	Fx(N)	Fz(N)	Mx(Nm)	Mz(Nm)	kαx(µrad/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 NEW **DT-50** rotation stages are a low cost and lower accuracy alternative to the 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. **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.

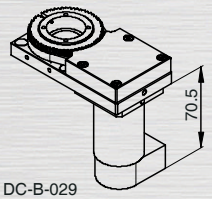
Key features

- Uni-directional repeatability down to 0.015 °
- Maximum speed 4000 °/sec
- Load capacity up to 1 kg
- Integrated reference switch
- Clear aperture 20 mm
- Rotation Range 360°, endless

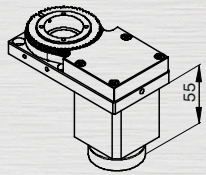
TECHNICAL DATA

Travel range *(°)*	**360°, endless**		
Weight (kg)	0.14		
Motor *(3:1)*	**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		

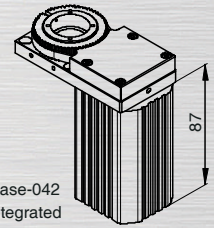
Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.



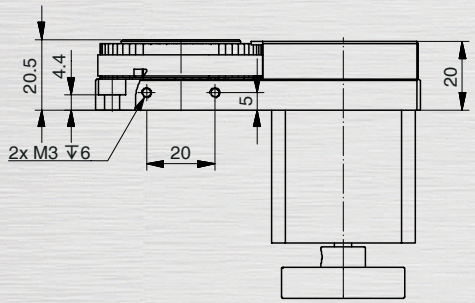
DC-B-029

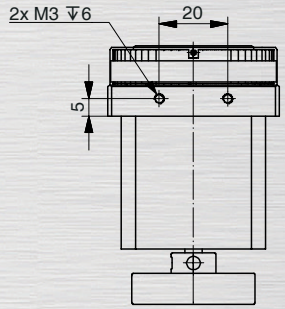


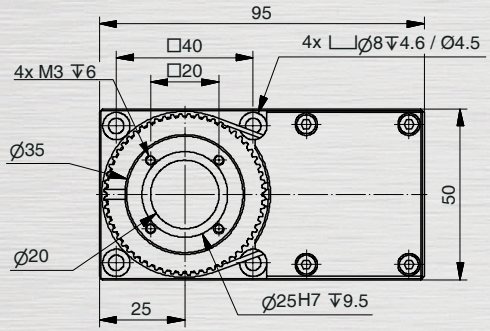
2Phase-047



2Phase-042
SMC-Pollux Controller integrated







mm

Order No.	6435-9-		0	0	

DC-B-029 1
2Phase-047 2
2Phase-042 3

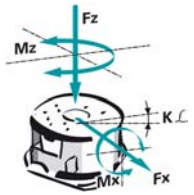
HLS-010, Hall switch 1

5.150 Rotation Stage Pollux RSP-200

MC

FACTS

Load characteristics	Fx(N)	Fz(N)	Mx(Nm)	Mz(Nm)	kαx(µrad/Nm)
2Phase-072	2	20	2.5	0.1	200



The rotation stages Pollux **RSP-200** are designed for simple industrial metrology applications, vision control and inspection systems. The **RSP-200** is a plug & play system with an integrated SMC-Pollux controller. The communication is done with a RS-232 serial interface (19200 baud). The integrated SMC-Pollux controller uses the VENUS2 command language. LabVIEW VIs are also included. A characteristic feature of the SMC-Pollux is the extremely smooth and high resolution microstepping operation while having a wide dynamic velocity range. The motor controller module comes always with an universal power supply, RS-232 cable and software. It is a perfect integrated system for a wide range of rotary applications in the standard precision range.

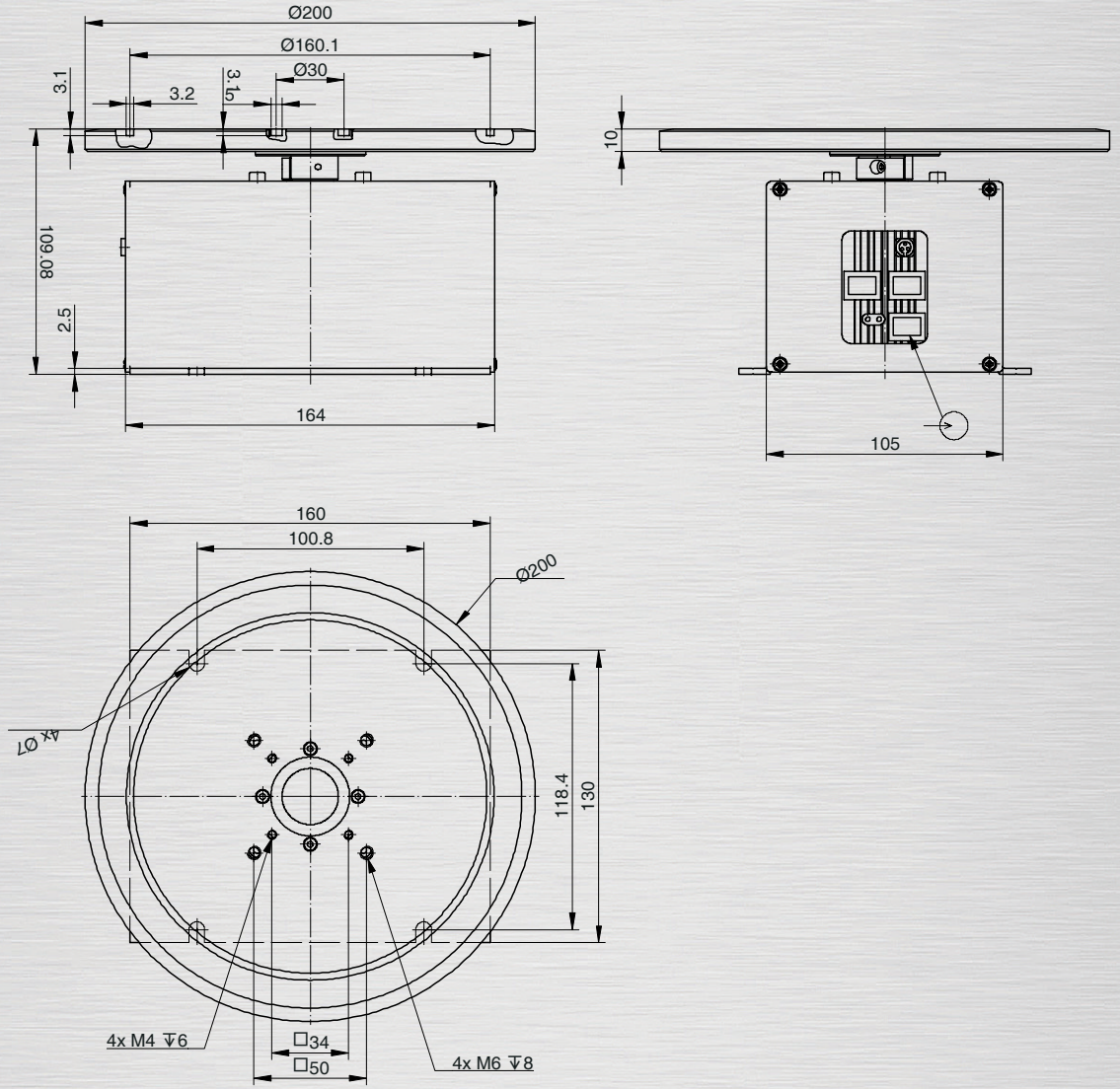
Key features

- Uni-directional repeatability down to 0.05 °
- Maximum speed 200 °/sec
- Load capacity up to 2 kg
- Integrated reference switches
- Single-axis microstepping motor & controller combination
- Stand-alone system with integrated 2-phase stepper motor
- Serial Interface RS-232 19200 Baud
- 24 VDC power supply and RS-232 cable included

TECHNICAL DATA

Travel range *(°)*	**360°, endless**
Flatness (Bearings) (µm)	+/- 50
Eccentricity (Bearings) (µm)	+/- 10
Weight (kg)	2.1
Motor *(1:1)*	**2Phase-072**
Speed max. (°/sec)	200
Resolution calculated (°)	0.9 (FS)
Resolution typical (°)	0.1
Bi-directional Repeatability (°)	+/- 0.1
Uni-directional Repeatability (°)	0.05
Nominal Current (A)	2
Direct driven	1:1
Accuracy	on request
Velocity Range (°/sec)	0.01 ... 200
Material	Aluminum, black anodized

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

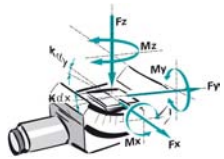


Order No.	6448-9-		1	0	0

2Phase-072 2

FACTS

Load characteristics	Fx(N)	Fy(N)	Fz(N)	Mx(Nm)	My(Nm)	Mz(Nm)	kαx(µrad/Nm)	kαy(µrad/Nm)
DC-B-082	90	90	200	8	25	25	15	15
2Phase-070	90	90	200	8	25	25	15	15



The goniometer stages **WT-120** and WT-90 are 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 goniometer stages **WT-120** and WT-90 are matched to work together. When mounted orthogonally to each other they have a common center of rotation. **WT-120** 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. **WT-120** stages can be equipped with an optical angular scale system and have two limit switches.

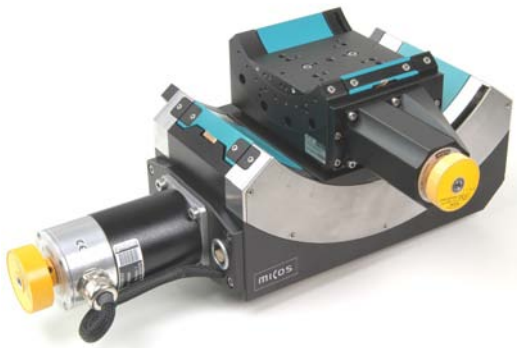
Key features

- Uni-directional repeatability down to 0.001 °
- Maximum speed 30 °/sec
- Load capacity up to 20 kg
- Integrated limit switches
- Optionally: angular scale
- Hardened worm gear drive
- Precise, smooth continuous 90° motion
- Together with WT-90 one centre of rotation

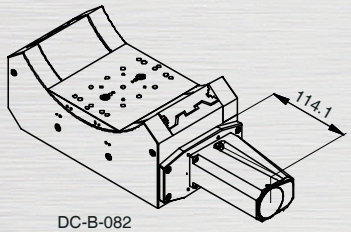
TECHNICAL DATA

Travel range *(°)*		**90**	
Wobble (Bearings) (µrad)		+/- 125	
Weight (kg)		11.5	
Motor *(180:1)*	**DC-B-082**	**2Phase-070**	
Linear scale			**AE-060**
Speed max. (°/sec)	30	25	
Resolution calculated (°)	0.0001 (RE)	0.01 (FS)	0.00008696
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, hardened steel		

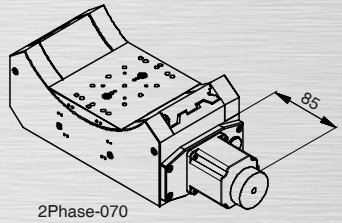
Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.



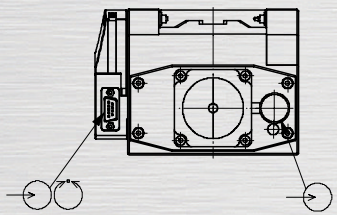
WT-120/WT-90 combination

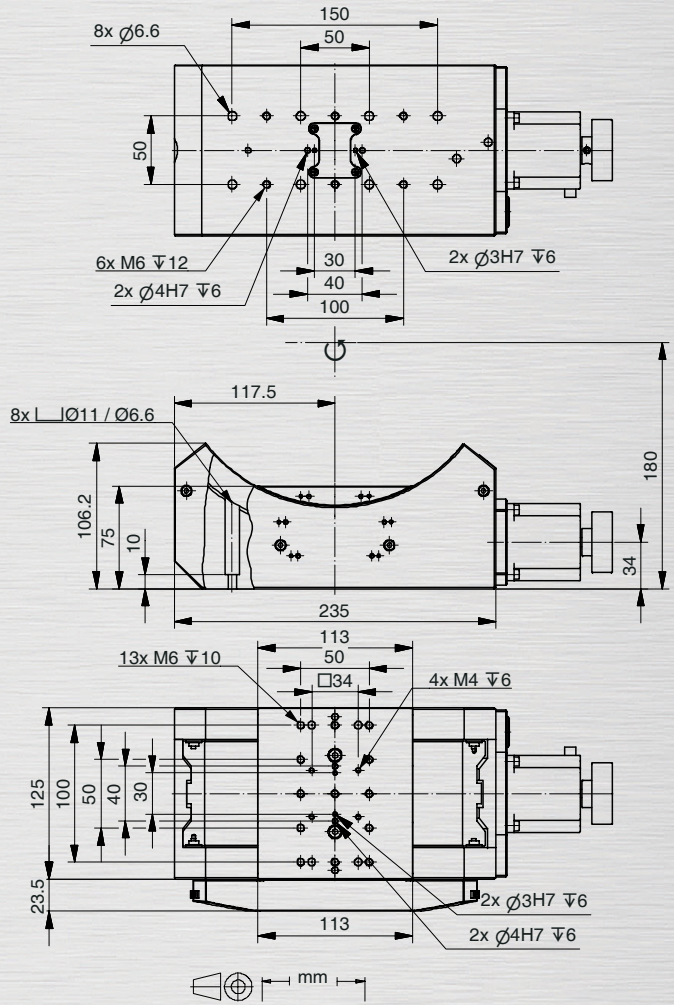


DC-B-082



2Phase-070





Order No.	6560-9-		1	

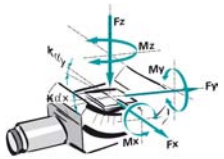
DC-B-082 1
2Phase-070 2

without AE-060 0
AE-060, Angular scale 1

5.320 Goniometer WT-90

FACTS

Load characteristics	Fx(N)	Fy(N)	Fz(N)	Mx(Nm)	My(Nm)	Mz(Nm)	kαx(µrad/Nm)	kαy(µrad/Nm)
DC-B-031	50	50	80	2.5	12	12	25	25
2Phase-033	50	50	80	2.5	12	12	25	25



The goniometer stages **WT-90** and WT-120 are 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 goniometer stages WT-120 and **WT-90** are matched to work together. When mounted orthogonally to each other they have a common center of rotation. **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. **WT-90** stages can be equipped with optical angular scale system and have two limit switches.

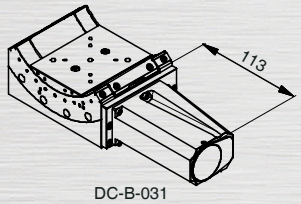
Key features

- Uni-directional repeatability down to 0.001 °
- Maximum speed 15 °/sec
- Load capacity up to 8 kg
- Integrated limit switches
- Optionally: angular scale
- Precise, smooth continuous 90° motion
- Together with WT-120 one centre of rotation

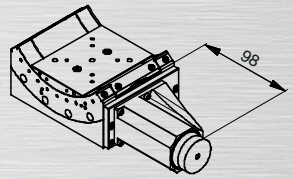
TECHNICAL DATA

Travel range *(°)*		**90**	
Wobble (Bearings) (µrad)		+/- 125	
Weight (kg)		2.8	
Motor *(360:1)*	**DC-B-031**	**2Phase-033**	
Linear scale			**AE-060**
Speed max. (°/sec)	15	15	
Resolution calculated (°)	0.0005 (RE)	0.005 (FS)	0.0001542
Resolution typical (°)	0.003	0.003	0.001
Bi-directional Repeatability (°)	+/- 0.02	+/- 0.02	+/- 0.001
Uni-directional Repeatability (°)	0.005	0.005	0.001
Nominal Current (A)	1.96	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, hardened steel		

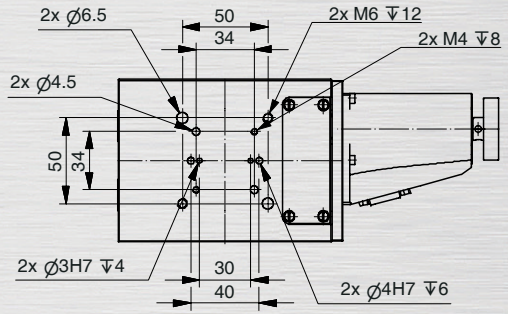
Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.

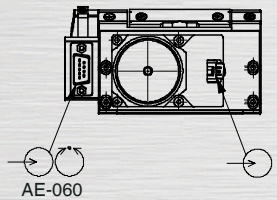


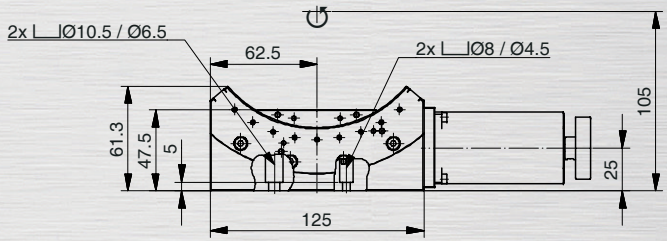
DC-B-031

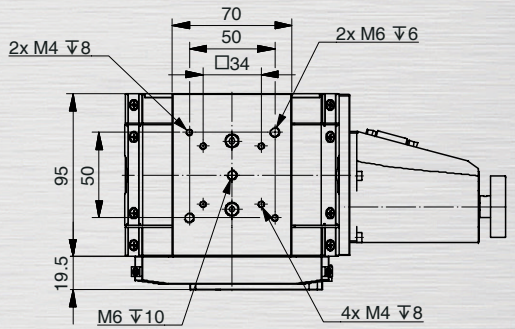


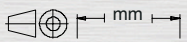
2Phase-033




AE-060







Order No.	6550-9-		0	

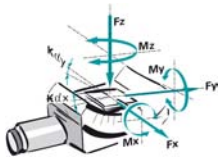
DC-B-031 1
2Phase-033 2

without AE-060 0
AE-060, Angular scale 1

5.330 Goniometer WT-100

FACTS

Load characteristics	Fx(N)	Fy(N)	Fz(N)	Mx(Nm)	My(Nm)	Mz(Nm)	kαx(µrad/Nm)	kαy(µrad/Nm)
DC-B-070	15	15	20	0.75	4	4	80	80
2Phase-020	15	15	20	0.75	4	4	80	80



The goniometer stages **WT-100** and WT-85 are 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 goniometer stages **WT-100** and WT-85 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. It is driven directly by a DC or 2-phase stepper motor and can achieve a relatively high speed. The **WT-100** stages are available with optional optical angular scales and are equipped with two limit switches.

Key features

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

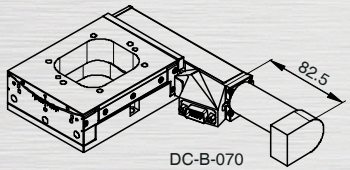
TECHNICAL DATA

Travel range *(°)*		**10**	
Wobble (Bearings) (µrad)		+/- 125	
Weight (kg)		0.9	
Motor *(900:1)*	**DC-B-070**	**2Phase-020**	
Linear scale			**AE-060**
Speed max. (°/sec)	15	7	
Resolution calculated (°)	0.0002 (RE)	0.002 (FS)	0.0000872
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		

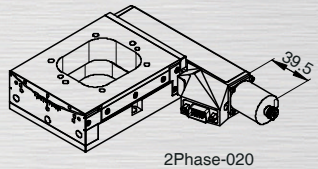
Reduction	900:1
Accuracy	on request
Velocity Range (°/sec)	0.001 ... 15
Material	Aluminum, black anodized, stainless steel

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

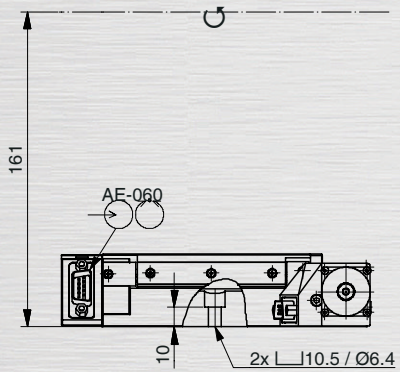
WT-100/WT-85 combination

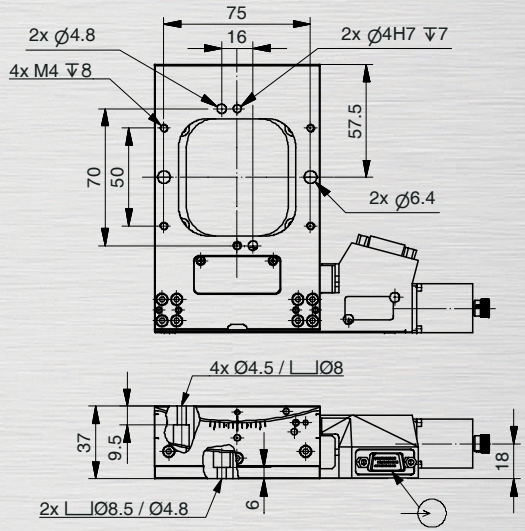


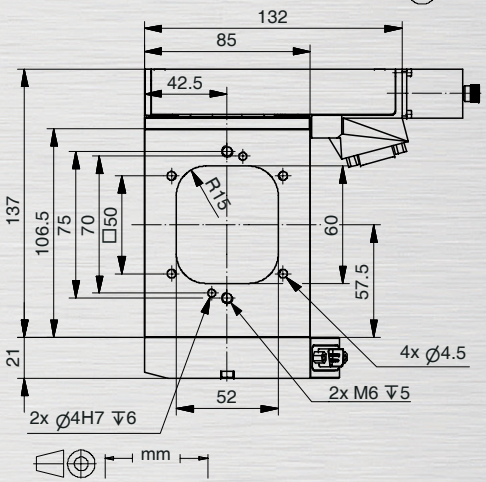
DC-B-070



2Phase-020







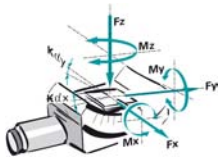
Order No.	6541-9-		0	

DC-B-070 1
2Phase-020 2

without AE-060 0
AE-060, Angular scale 1

FACTS

Load characteristics	Fx(N)	Fy(N)	Fz(N)	Mx(Nm)	My(Nm)	Mz(Nm)	kαx(µrad/Nm)	kαy(µrad/Nm)
DC-B-070	15	15	20	0.75	4	4	80	80
2Phase-020	15	15	20	0.75	4	4	80	80



The goniometer stages **WT-85** and WT-100 are 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 goniometer stages **WT-85** and WT-100 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. It 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 optional optical angular scales and are equipped with two limit switches.

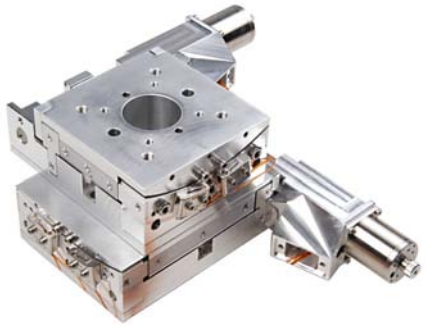
Key features

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

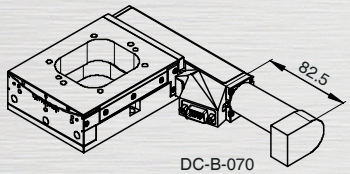
TECHNICAL DATA

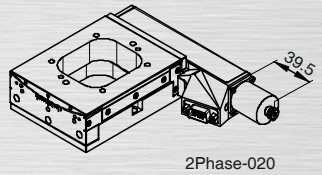
Travel range *(°)*		**10**	
Wobble (Bearings) (µrad)		+/- 125	
Weight (kg)		0.9	
Motor *(675:1)*	**DC-B-070**	**2Phase-020**	
Linear scale			**AE-060**
Speed max. (°/sec)	15	7	
Resolution calculated (°)	0.0002667 (RE)	0.0026665 (FS)	0.0001208
Resolution typical (°)	0.001	0.001	0.0005
Bi-directional Repeatability (°)	+/- 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, stainless steel		

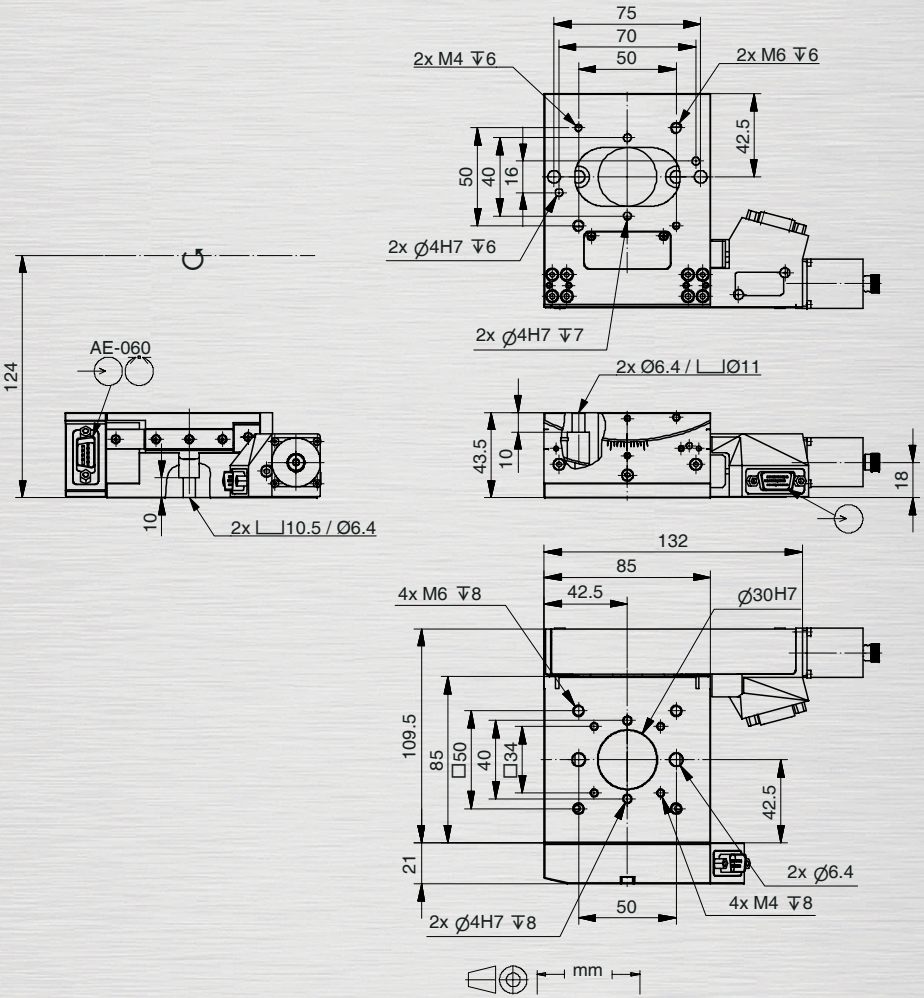
Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.



Vacuum setup







Order No.	6540-9-		0	

DC-B-070 1
2Phase-020 2

without AE-060 0
AE-060, Angular scale 1

5.350 Filter Wheel AFW-65

NEW

Our NEW filter wheel **AFW-65** was designed for rotating 6 filters with dia 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.

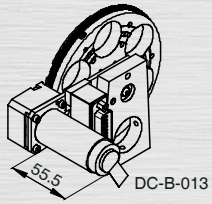
Key features

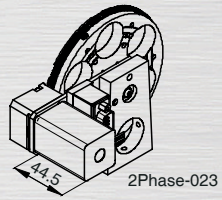
- Uni-directional repeatability down to 0.1 °
- Maximum speed 360 °/sec
- Integrated reference switches
- up to 6 filters
- Clear aperture 25 mm

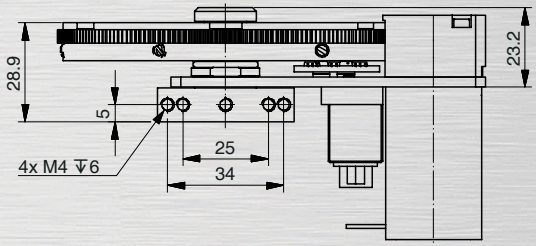
TECHNICAL DATA

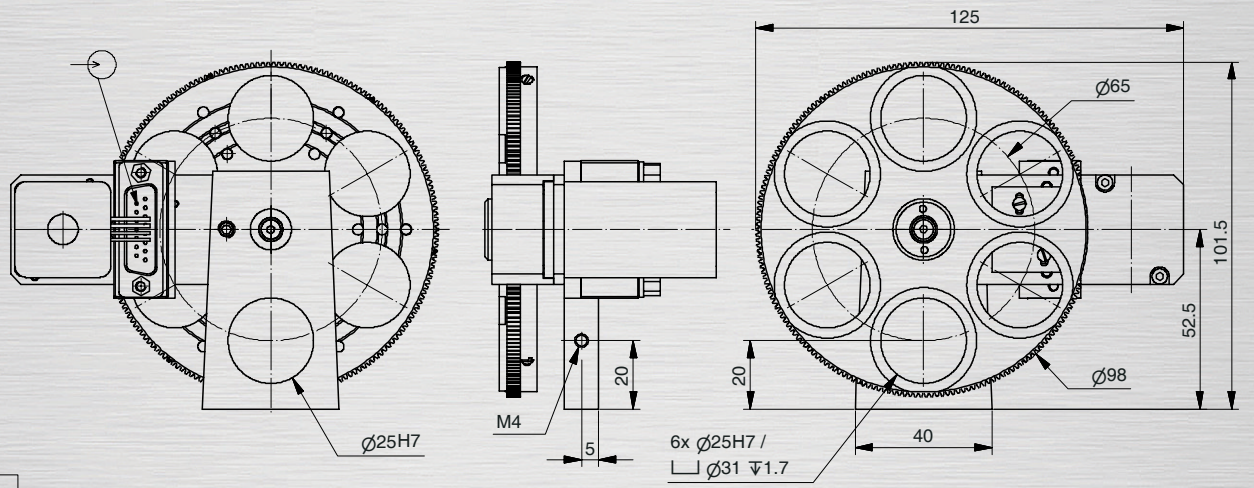
Travel range *(°)*	**360°, endless**	
Weight (kg)	0.7	
Motor	**DC-B-013**	**2Phase-023**
Speed max. (°/sec)	90	360
Resolution calculated (°)	0.0014902 (RE)	0.4517 (FS)
Resolution typical (°)	0.001	0.05
Bi-directional Repeatability (°)	+/- 0.5	+/- 0.5
Uni-directional Repeatability (°)	0.1	0.1
Nominal Current (A)	0.28	1.3
Voltage Range (V)	24	
Accuracy	on request	
Material	Aluminum, black anodized	

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









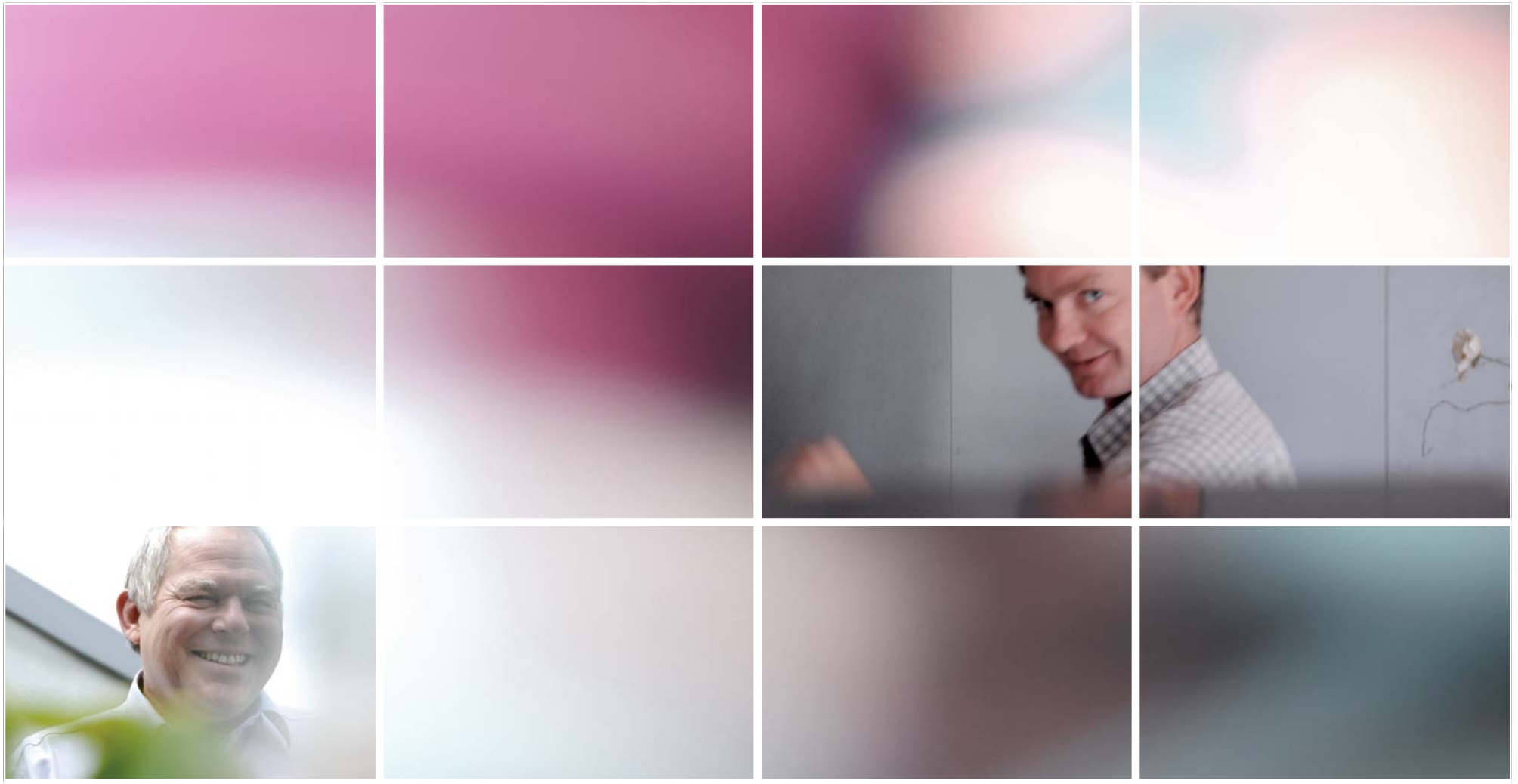
mm

Order No.	4315-9-		0	0	

DC-B-013 1
2Phase-023 2

HLS-010, Hall switches 1

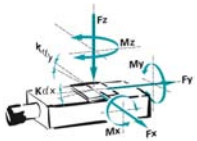
6.000 MANUAL STAGES

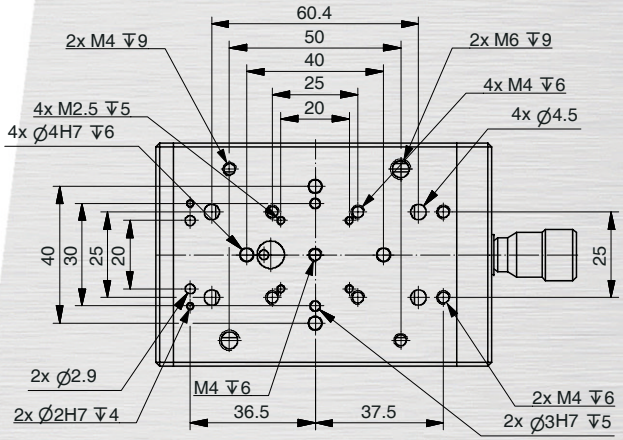


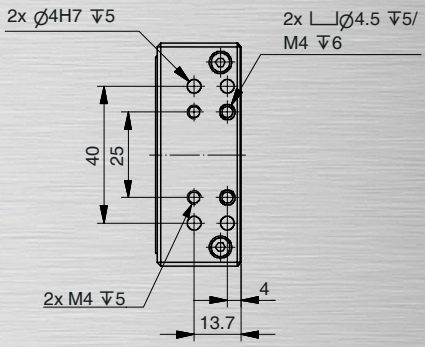
MANUAL STAGES

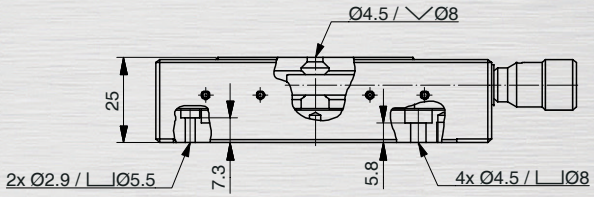
6.010 Linear Stage APT-65

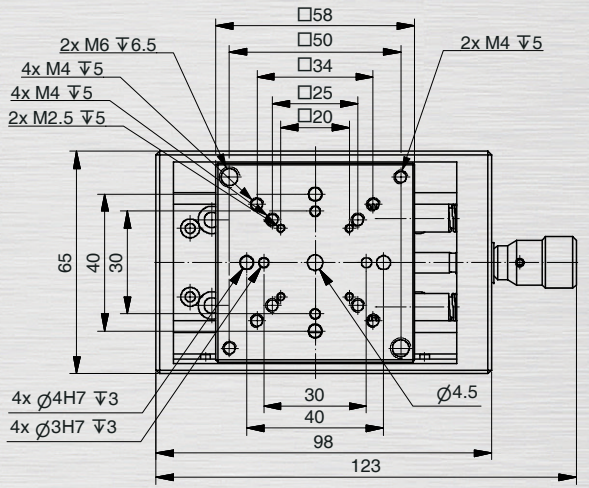
Travel:	25 mm
Slides:	dove tail
Screw:	fine pitch
Pitch:	0.35 mm
Sensitivity:	5 µm
Load:	Fx: 140 N, Fy: 150 N, Fz: 300 N
Weight	0.4 kg
XYZ assembly possible:	yes

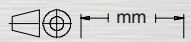












Order No.	6223-9-	1	0	0

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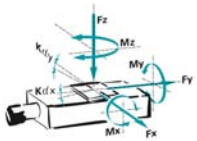
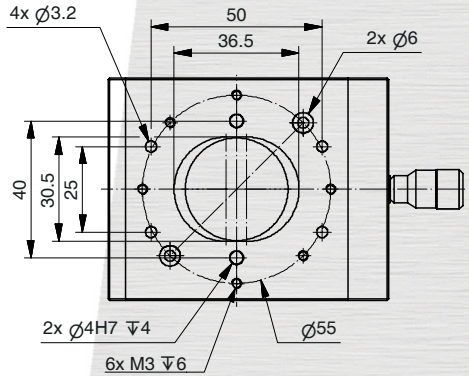
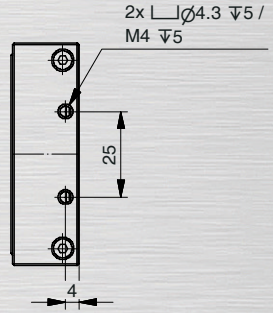
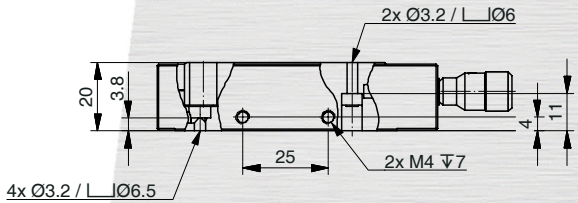
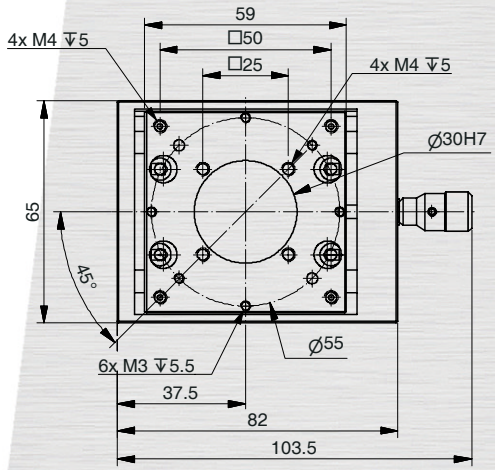
Travel:	5 mm
Slides:	dove tail
Screw:	fine pitch
Pitch:	0.25 mm
Aperture:	30 mm
Sensitivity:	5 µm
Load:	Fx: 30 N, Fy: 10 N, Fz: 40 N
Weight:	0.4 kg
XYZ assembly possible:	yes, in combination with AKT-65

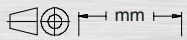








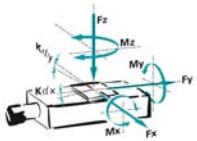


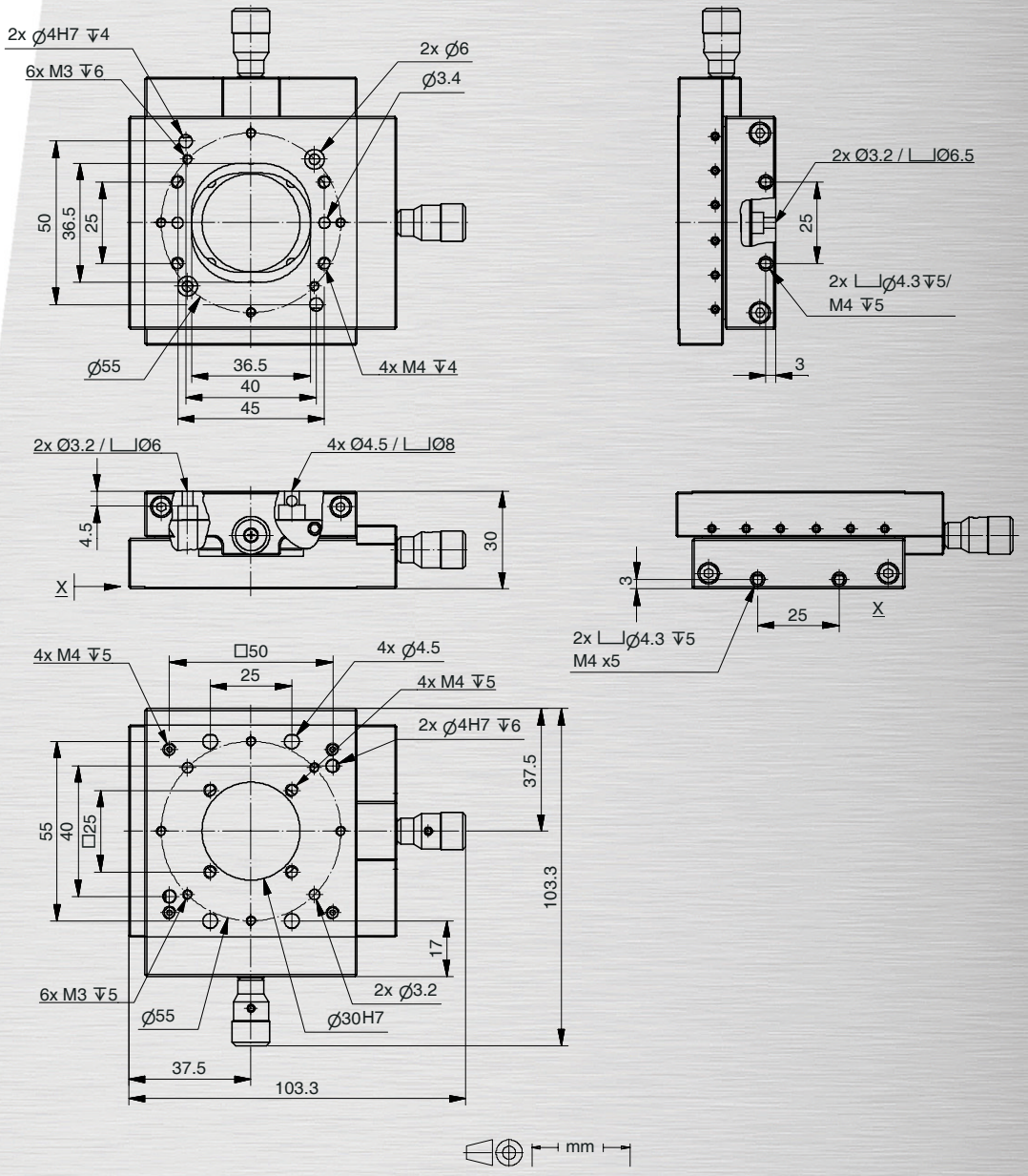


Order No.	4211-9-	2	0	0

6.020 Cross Stage AKT-65

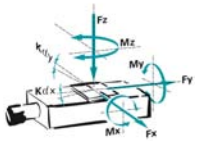
Travel:	5 mm x 5 mm
Slides:	dove tail
Screw:	fine pitch
Pitch:	0.25 mm
Aperture:	30 mm
Sensitivity:	5 µm
Load:	Fx: 30 N, Fy: 10 N, Fz: 40 N
Weight:	0.55 kg
XYZ assembly possible:	yes, in combination with AVT-65

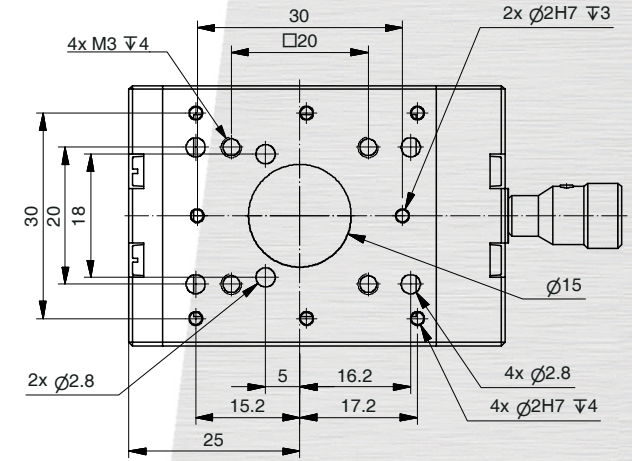


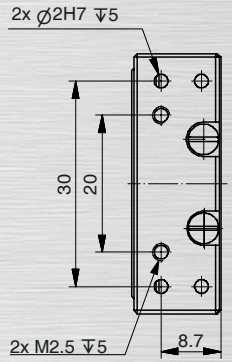


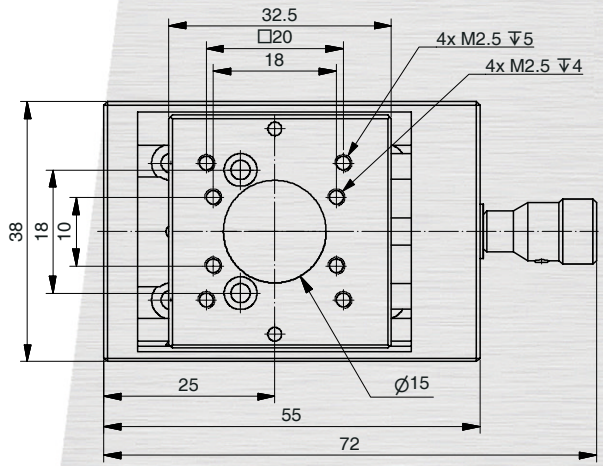
Order No.	4212-9-	2	0	0

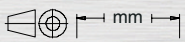
Travel:	5 mm
Slides:	dove tail
Screw:	fine pitch
Pitch:	0.25 mm
Aperture:	15 mm
Sensitivity:	5 µm
Load:	Fx: 30 N, Fy: 10 N, Fz: 40 N
Weight:	0.1 kg
XYZ assembly possible:	yes





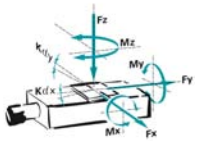


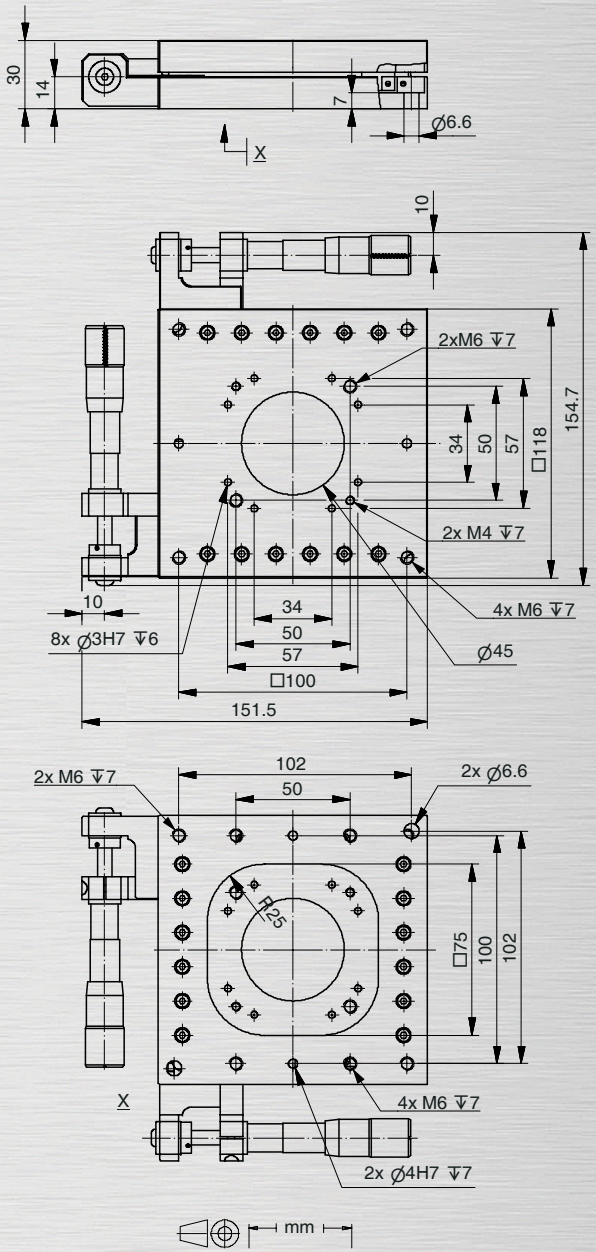




Order No.	3211-9-	1	0	0

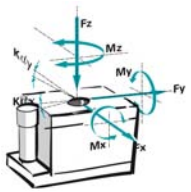
Travel:	25 mm x 25 mm
Slides:	cross-roller bearings
Screw:	micrometer
Resolution:	10 µm
Aperture:	45 mm
Sensitivity:	2 µm
Load:	Fx: 20 N, Fy: 20 N, Fz: 40 N
Weight:	1.1 kg
XYZ assembly possible:	no

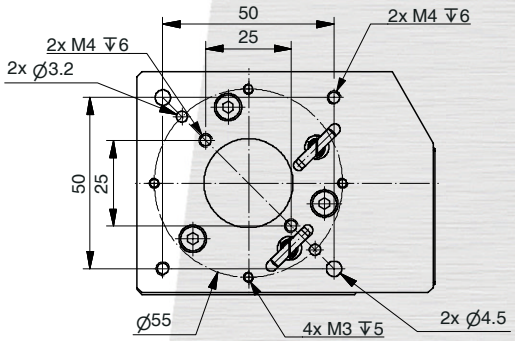


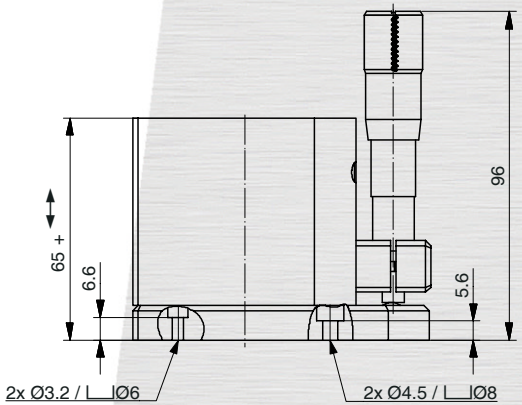


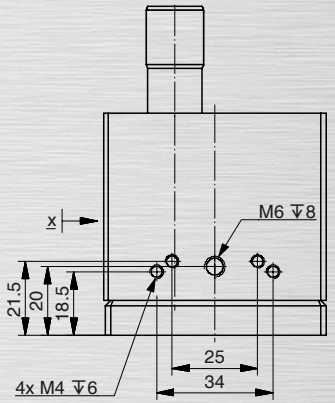
Order No.	6312-9-	5	1	0

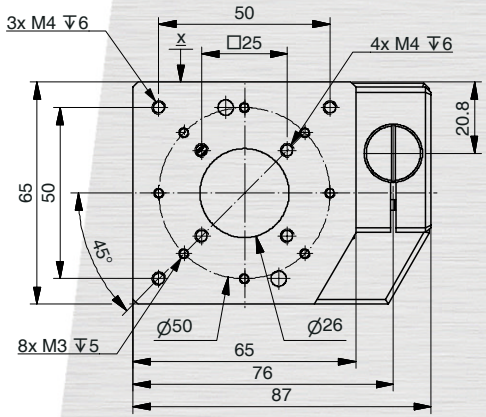
Travel:	25 mm
Slides:	linear ball bearings
Screw:	micrometer
Resolution:	10 µm
Aperture:	25 mm
Sensitivity:	2 µm
Load:	Fx: 30 N, Fy: 30 N, Fz: 30
Weight:	0.9 kg

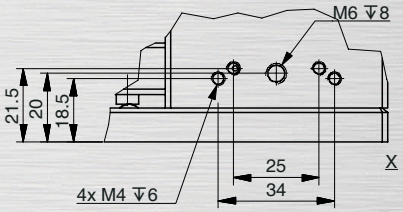








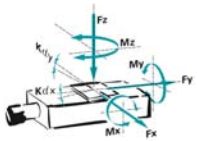


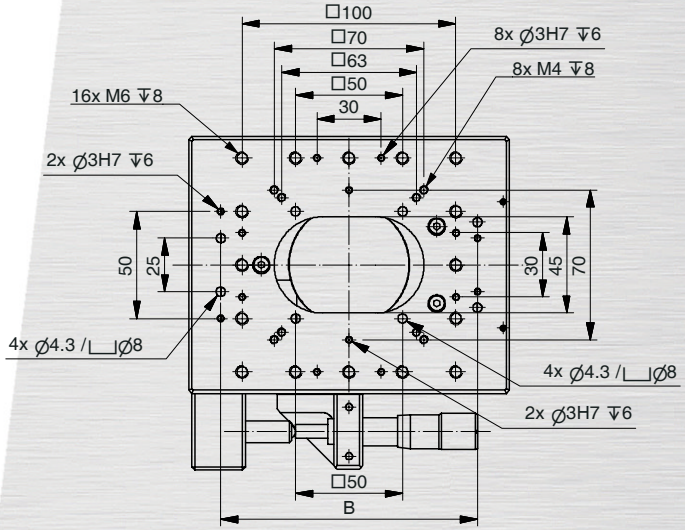


mm

Order No.	4246-9-	2	1	0

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



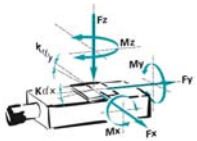


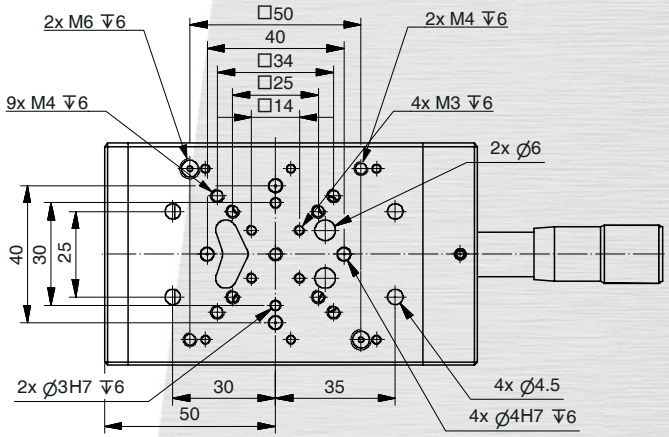
Travel (mm)	25	50
A	150	175
B	120	145

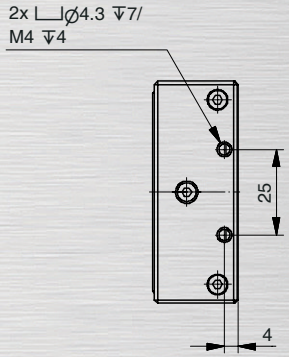
Order No.	6227-9-		0	0

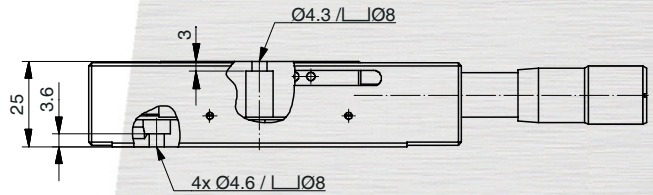
25 mm 1
50 mm 2

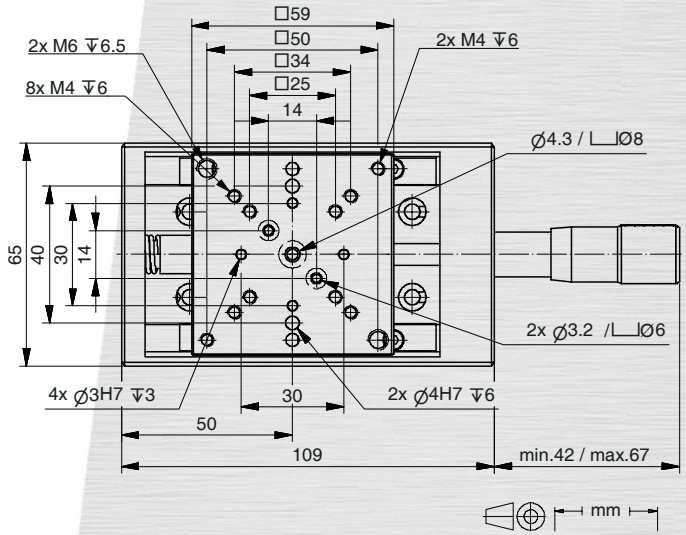
Travel:	25 mm
Slides:	cross-roller bearings
Screw:	micrometer
Pitch:	0.5 mm
Resolution:	10 µm
Sensitivity:	1 µm
Load:	Fx: 70 N, Fy: 80 / -Fy: 10 N, Fz: 160 N
Weight:	0.5 kg
XYZ assembly possible:	yes





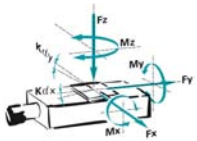


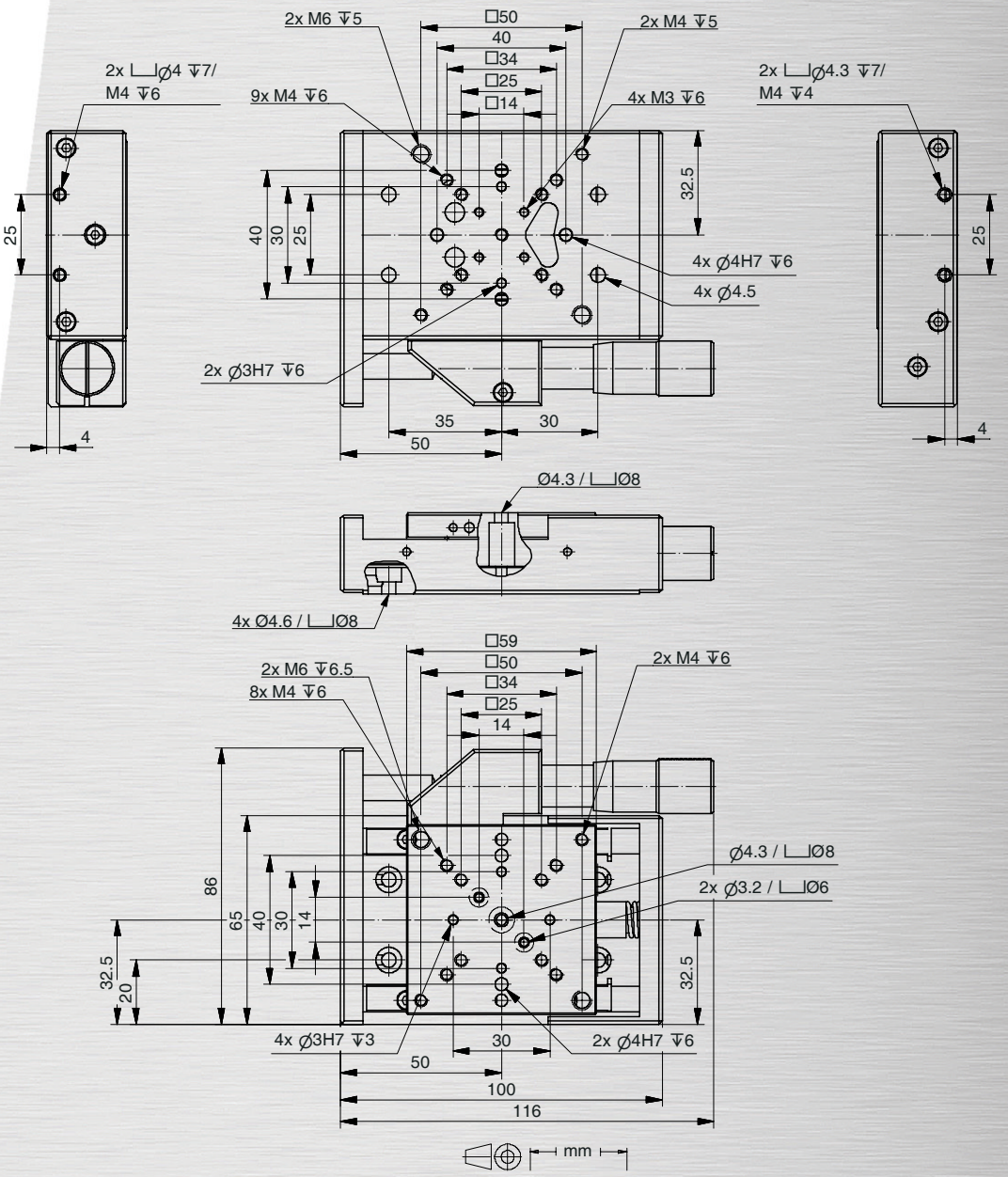




Order No.	6225-9-	6	1	0

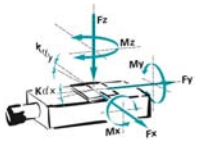
Travel:	25 mm
Slides:	cross-roller bearings
Screw:	micrometer
Pitch:	0.5 mm
Resolution:	10 µm
Sensitivity:	1 µm
Load:	Fx: 70 N, Fy: +80 / -Fy: 10 N, Fz: 160 N
Weight:	0.5 kg
XYZ assembly possible:	yes

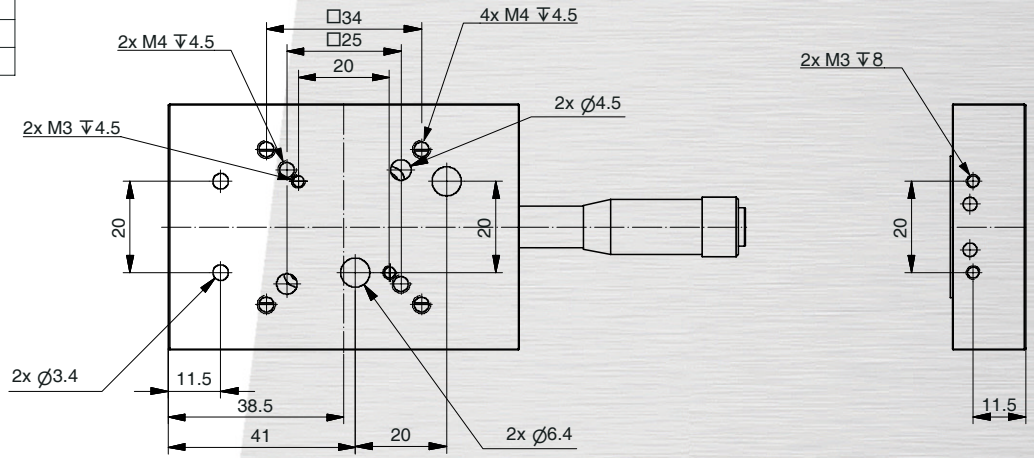


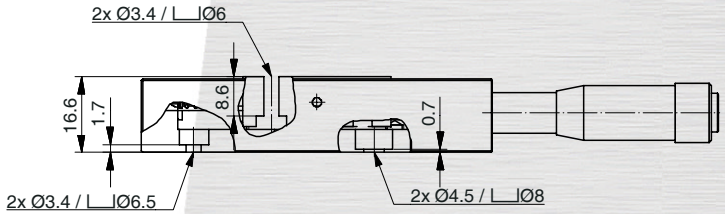


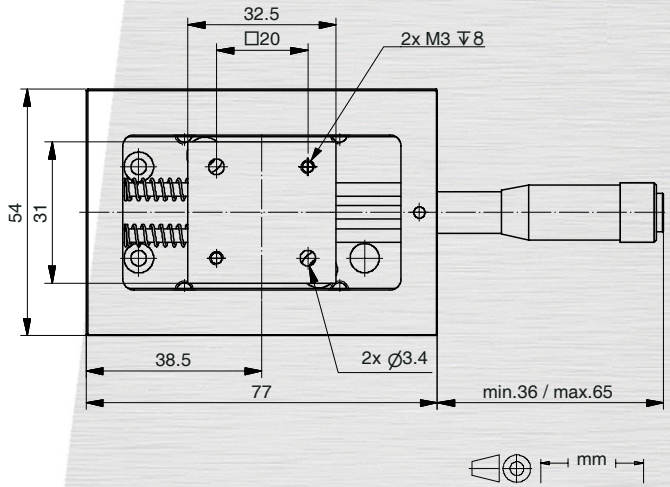
Order No.	6225-9-	5	1	0

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





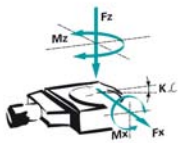


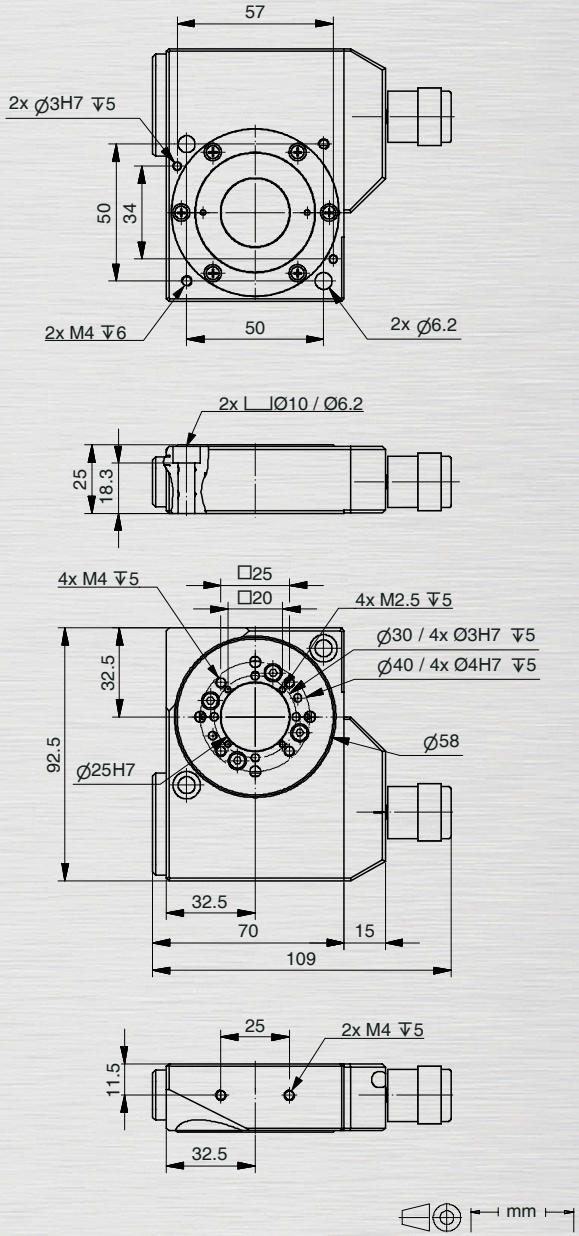


Order No.	6212-9-	2	0	0

6.060 Rotation Stage ADT-65

Drive:	preloaded driveworm, backlash free four point bearings
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

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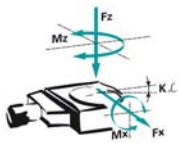
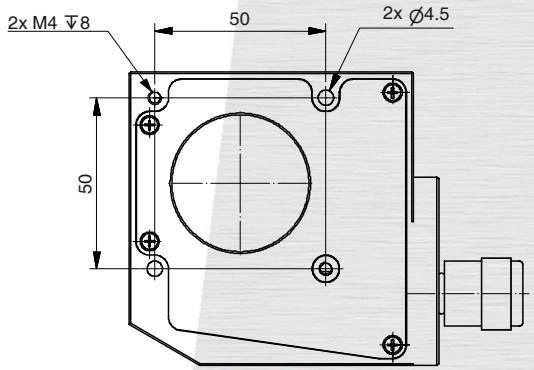
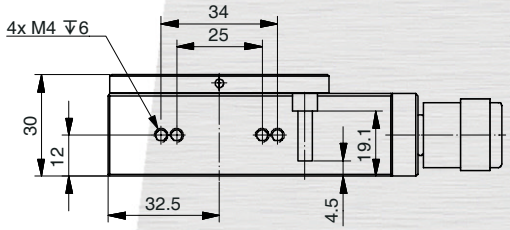
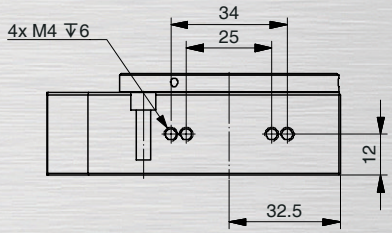
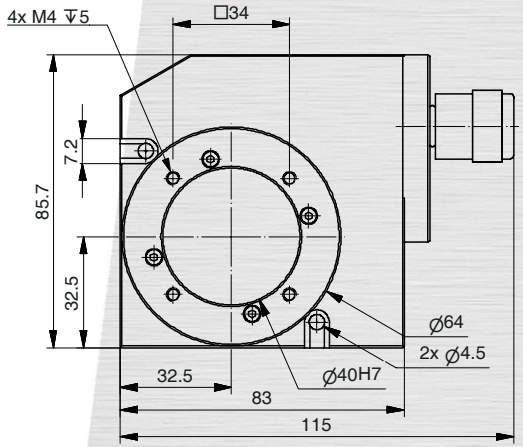
Drive:	spring prestressed screw worm-gear, double row ball bearings
Range:	360° endless
Aperture:	40 mm
Gear:	180:1
Sensitivity	0.02 °
Load:	Fx: 10 N, Fz: 10 N, Mz: 0.1 Nm
Weight:	0.45 kg







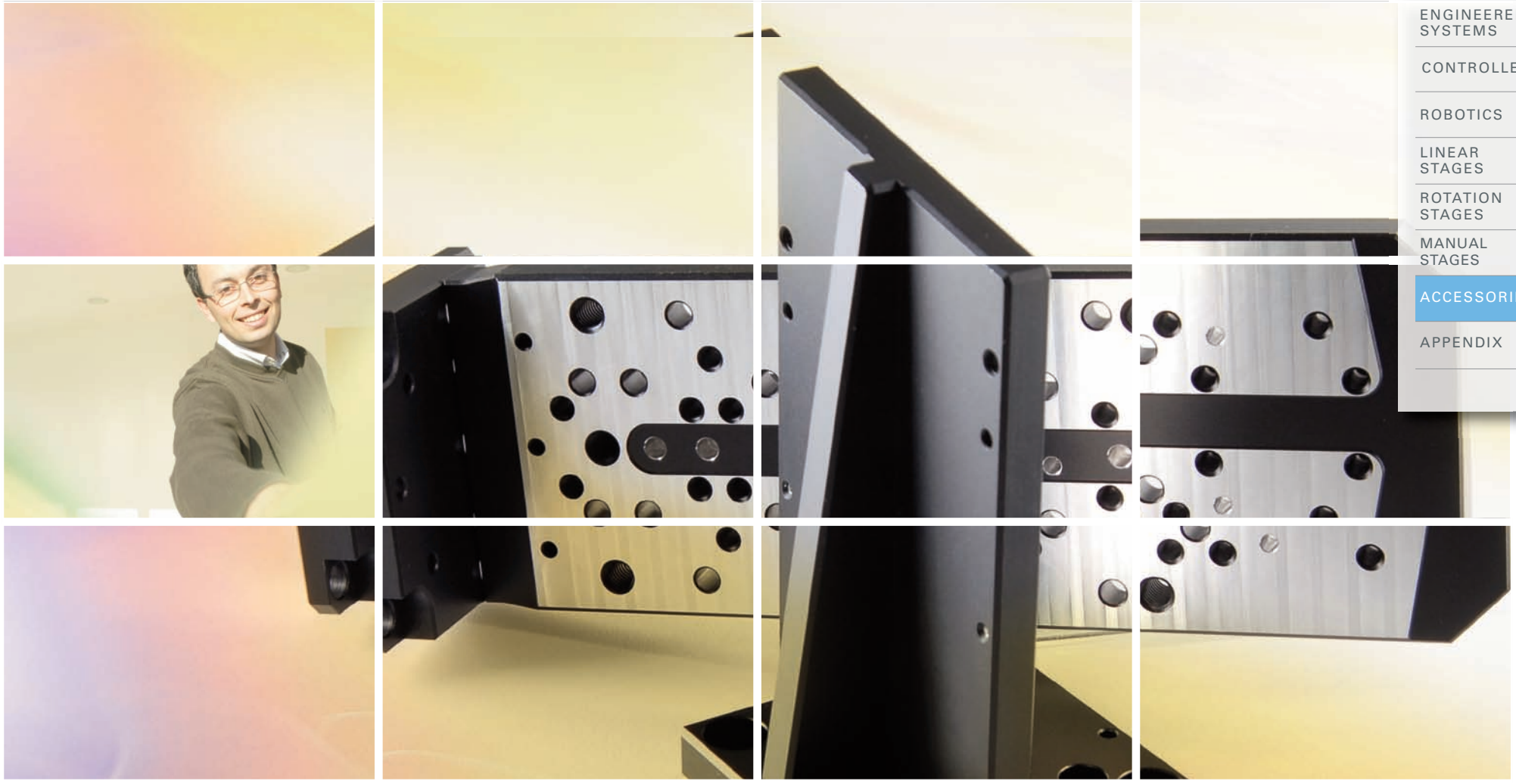




mm

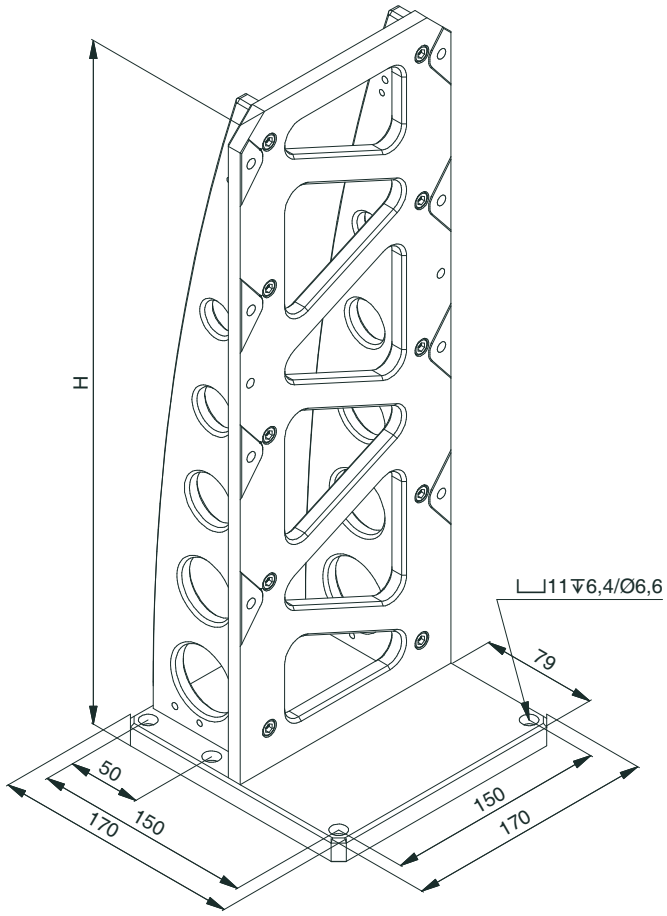
Order No.	6443-9-	6	0	0

7.000 ACCESSORIES



ACCESSORIES

AB-180 L H= 465
AB-180 XL H= 665

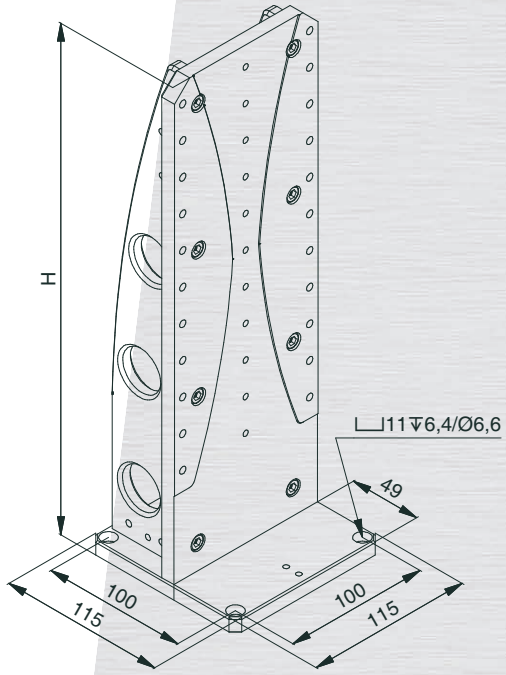


Mounting

PAROS UPL -160 LS-180 LMS-180	LMS-300 UPR-270/ AIR	*LS-180* *LMS-180*

6100-9-	**0**	**6**	**1**	AB-180 L
6100-9-	**0**	**6**	**2**	AB-180 XL

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



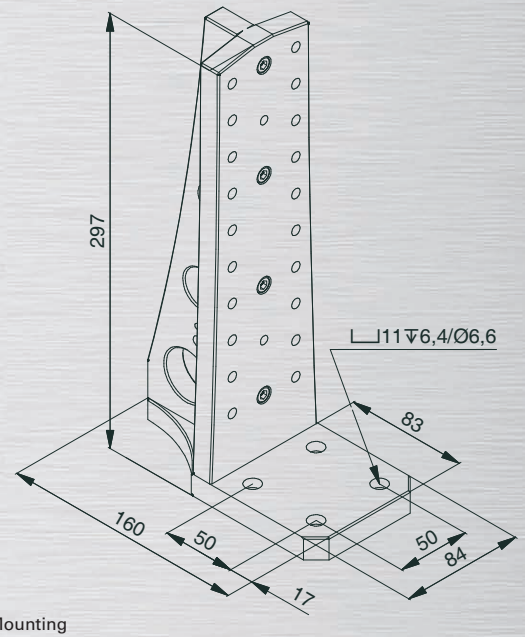
Mounting

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

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

AB-160

Dimension in millimeters

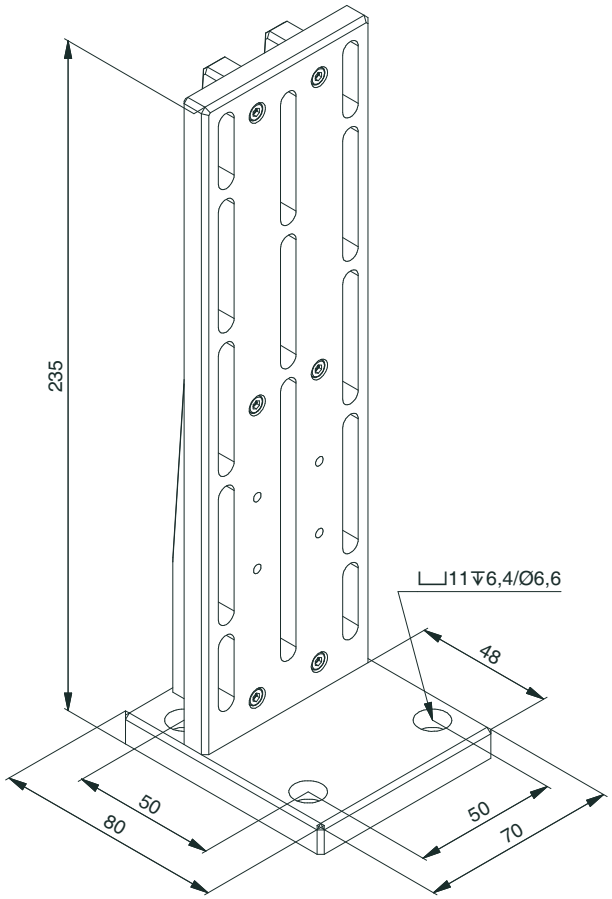


Mounting

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

6270-9-	**5**	**1**	**0**	

AB-XL

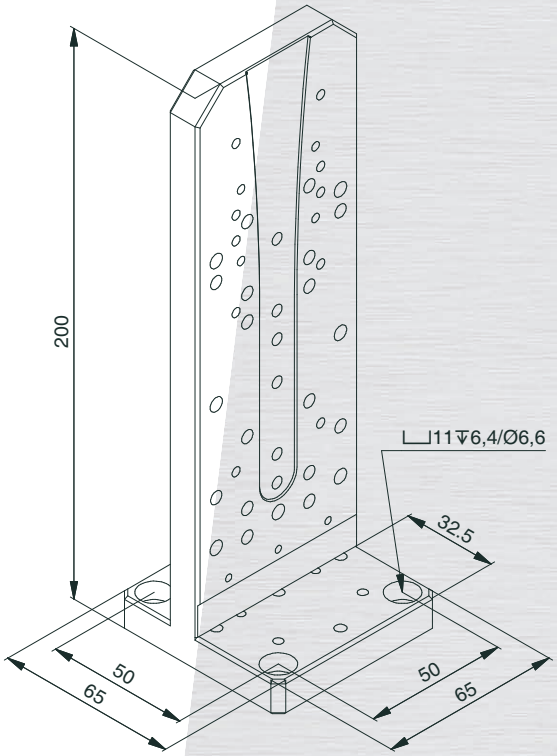


Mounting

UPM-160	PLS-85		
UPL-160	VT-80	WT-90	
HPS-170	LS-65	UPS-150	*VT-80*
LS-180	ES-100	LMS-300	*WT-90*
LMS-180	PRS-110	UPR-160 / AIR	*WT-85*
LS-110	WT-120	UPR-270 / AIR	*WT-100*

6244-9-	5	1	5

AB-65XL



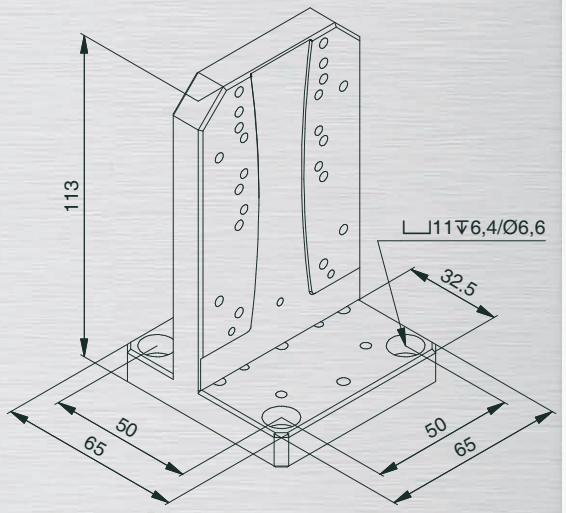
Mounting

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

6100-9-	0	7	6

AB-65L

Dimension in millimeters

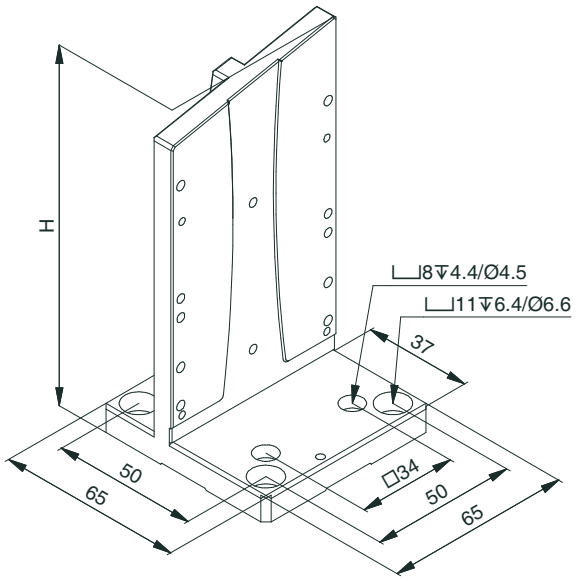


Mounting

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

6100-9-	0	7	5

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

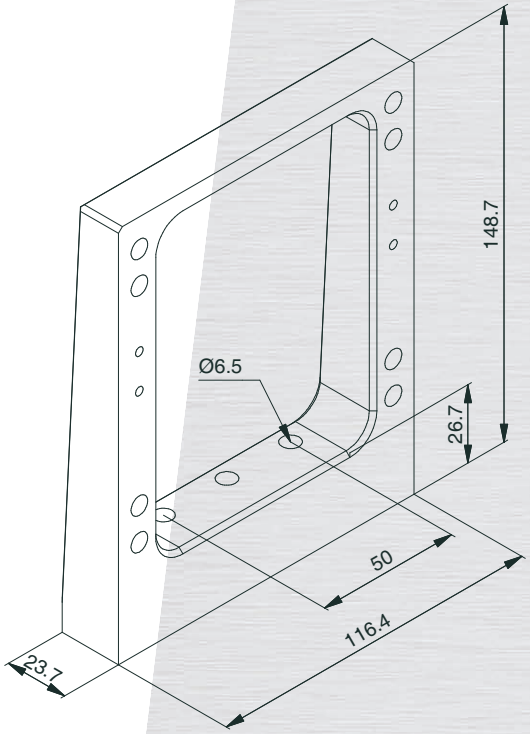


Mounting

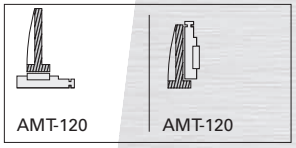
	PLS-85			
	VT-80			
	LS-65			
	ES-100	WT-85		
UPM-160	RSP-200	MTS-65		
UPL-160	PRS-110	MTS-70		
HPS-170	DT-80	UPS-150	APT-65	
LS-180	DT-80 R	LMS-300	AMT-65C	
LMS-180	WT-120	UPR-160 / AIR	AMT-65S	
LS-110	WT-90	UPR-270 / AIR	ADT-80	*MTS-65*

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

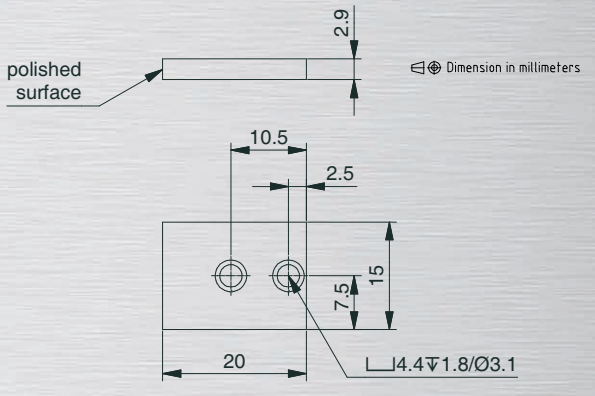
BF-1202



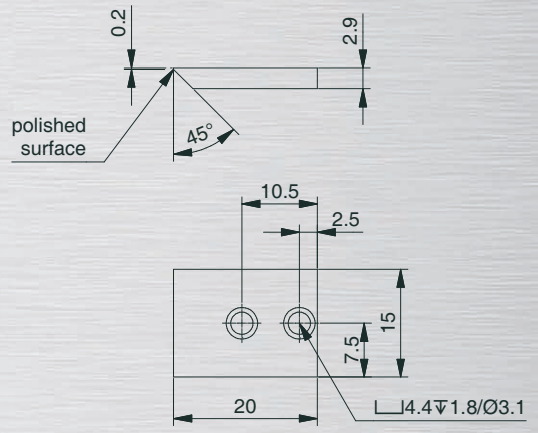
Mounting



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

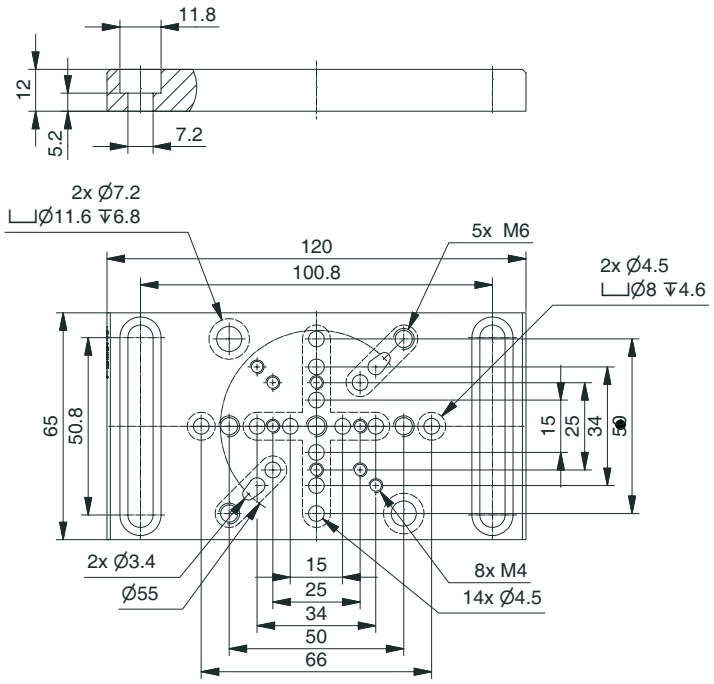


6710-9-	**8**	**1**	**0**	S-90 aluminum
6710-9-	**8**	**2**	**0**	S-90 stainless steel
6710-9-	**8**	**3**	**0**	S-90 wolfram



6710-9-	**9**	**1**	**0**	S-45 aluminum
6710-9-	**9**	**2**	**0**	S-45 stainless steel
6710-9-	**9**	**3**	**0**	S-45 wolfram

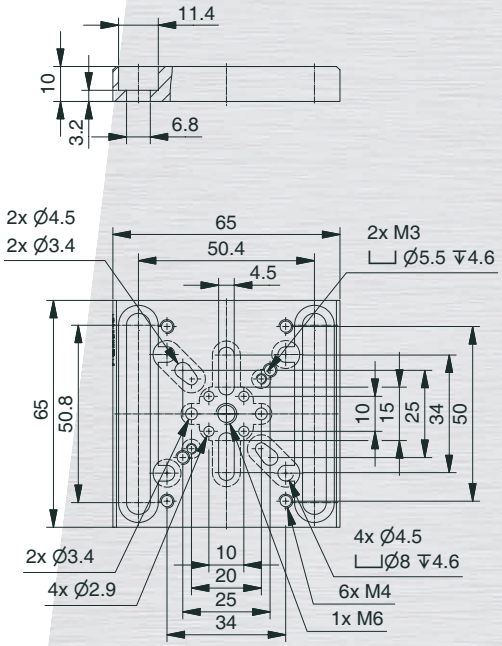
FP-120N



Mounting	
LS-65	AMT-65
VT-80	DT-65
DT-80	DT-80
DT-65	DT-80R
AMT-65	AMT-120
APT-65	APT-65
AKT-65	LS-65

2541-9-	0	1	6

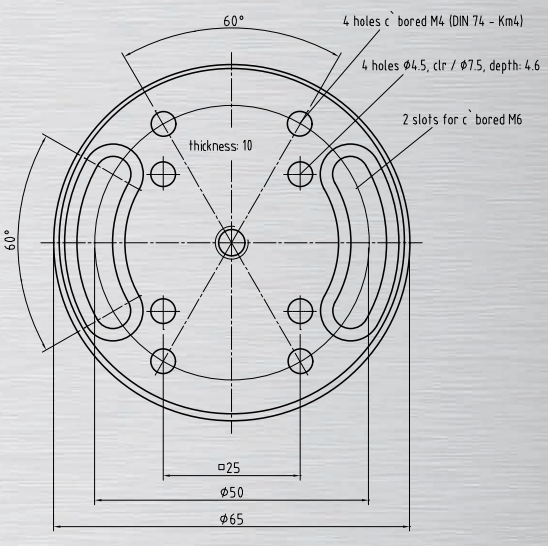
FP-65N



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

2541-9-	0	0	4

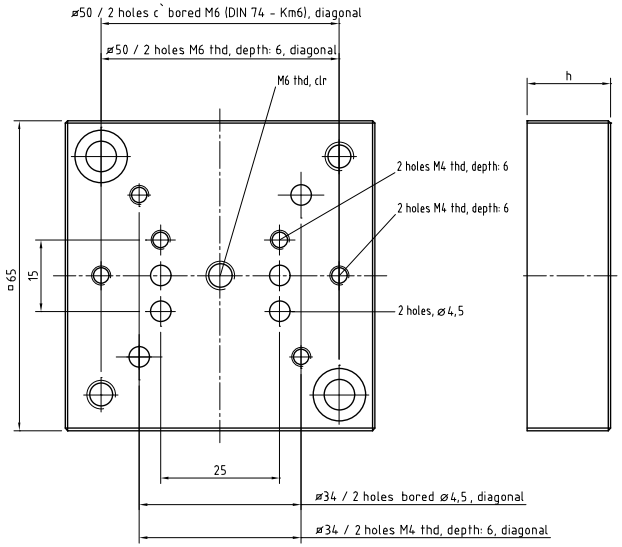
FP-65R



Dimension in millimeters

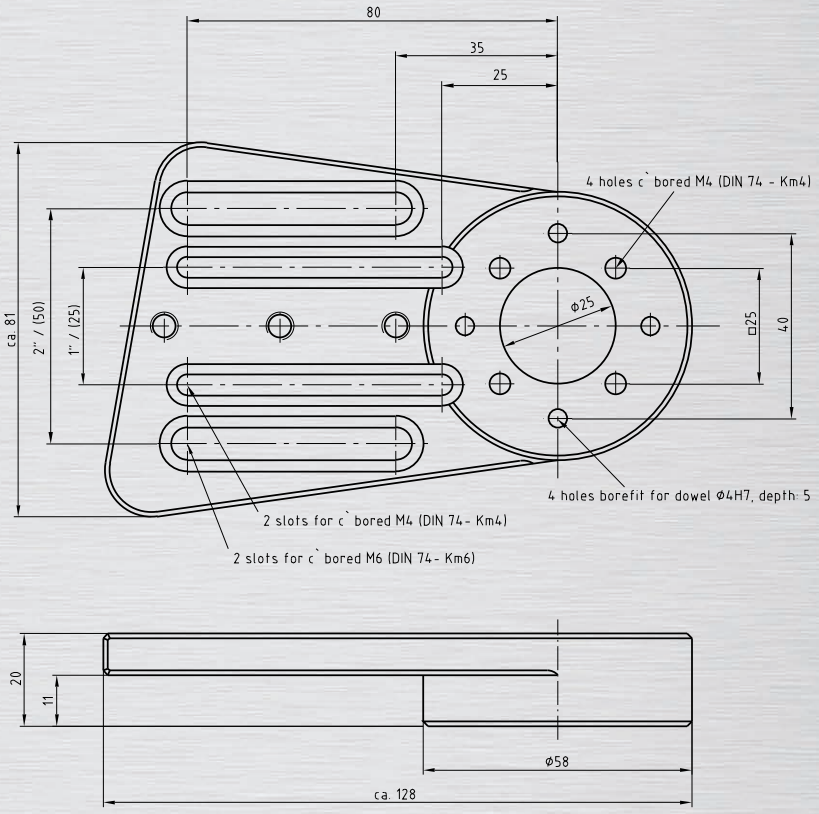
2541-9-	0	1	2

BFP-65



2710-9-	1	0	5	(h=17.5)
2710-9-	1	1	0	(h=20.0)
2710-9-	1	1	5	(h=25.0)
2710-9-	1	2	0	(h=32.5)

MP-rot



Mounting
DT-65
DT-80

6100-9-	0	5	0

Dimension in millimeters

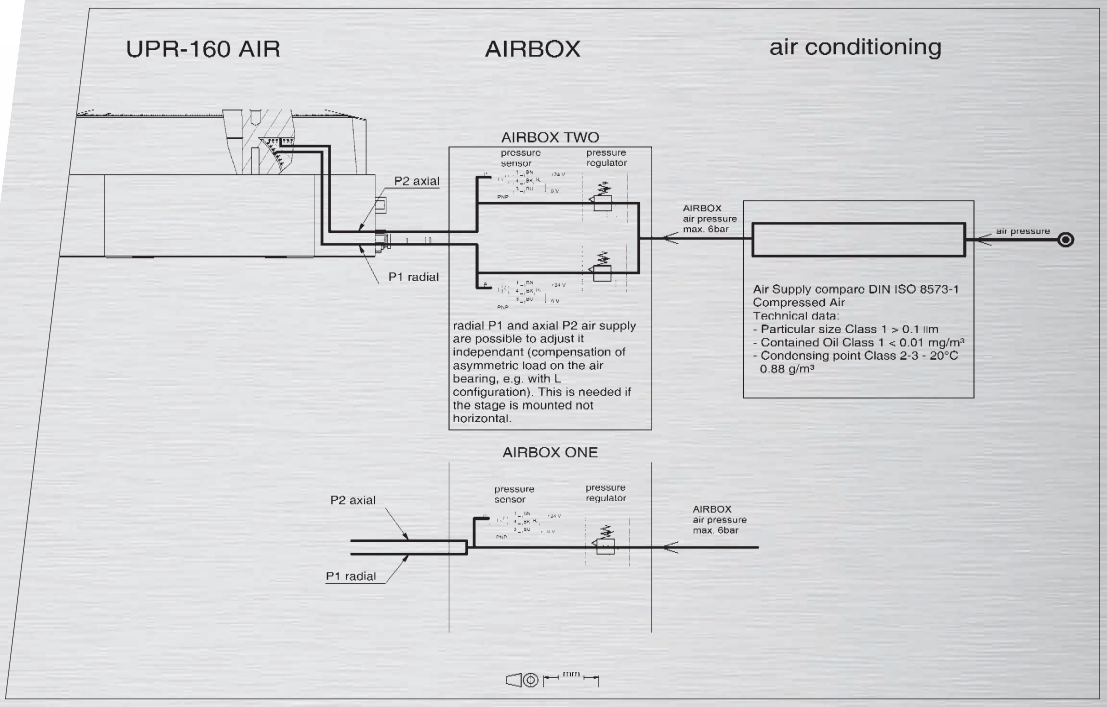
AIRBOX one

AIRBOX two

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

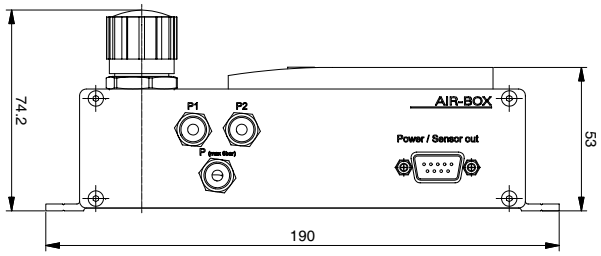
- to adjust and display the air-pressure for 1 channel **(Airbox one)** or 2 channels **(Airbox two)**
- to define individual pressure switch points which activates a open-collector output (pressure 'good' signal).

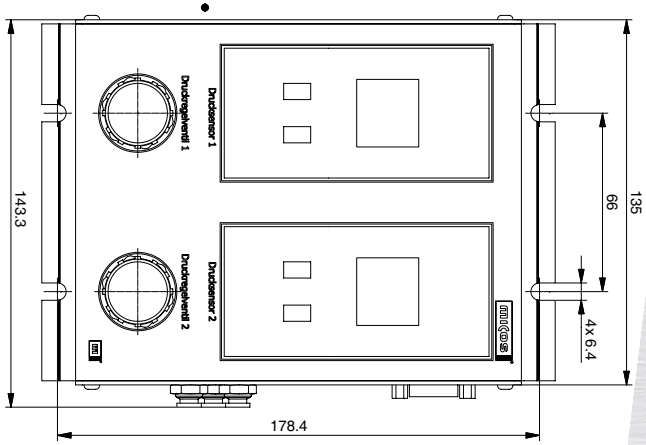
The device is based on a piezoresistive pressure sensor, with one or two digital displays and an individual manual pressure control valve with interlock.

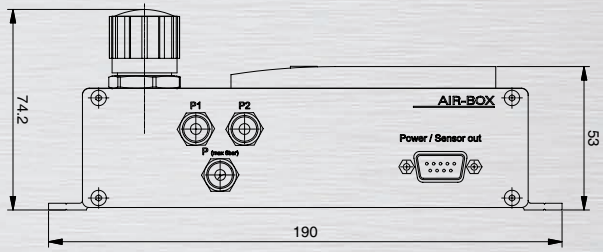


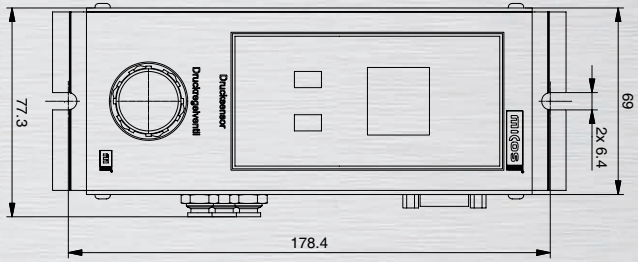
TECHNICAL DATA

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) 2 x 4 mm connection (Airbox two)









AIRBOX one

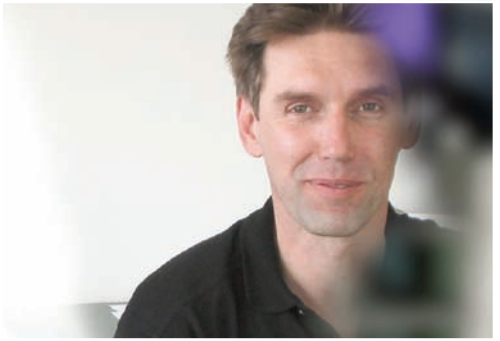
6801-9-	0	0	0	1

AIRBOX two

6801-9-	0	0	0	2

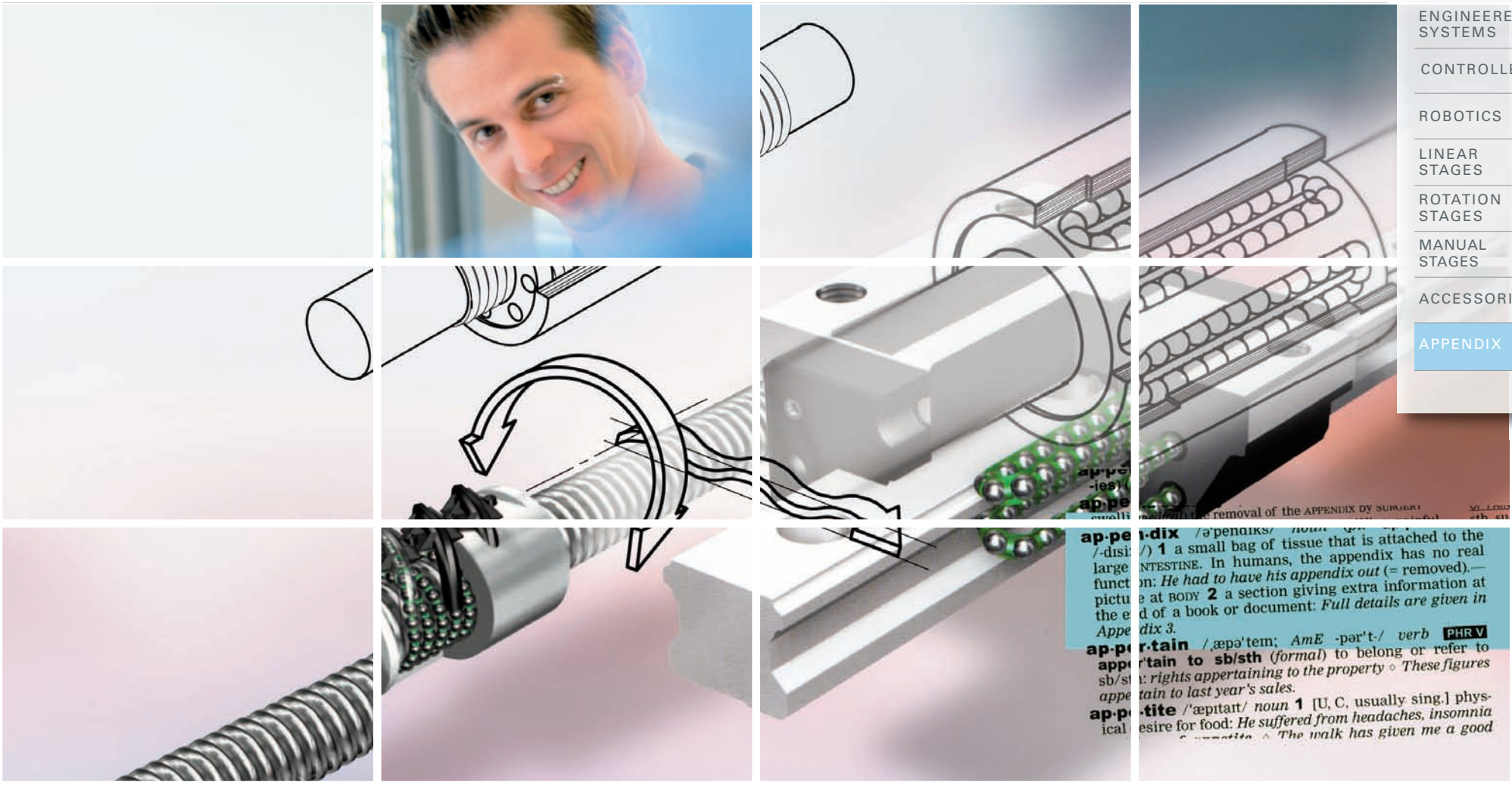
8.000 APPENDIX











APPENDIX

TECHNICAL DATA

DC-brush Motors DC

Alias	Model	Design Voltage	Continuous Current	Continuous Torque	Continuous Power	Resistance	Inductance	Voltage Constant kn	Torque Constant km	Maximum Speed	Gearbox	Encoder
		V	A	mNm	W	Ohm	mH	rpm/V	mNm/A	rpm	(backlash-free)	
DC-B-006	RE-010	12	0.08	0.775	0.75	114	0.92	1000	9.55	14300	40	RE-025
DC-B-007	1016-012G	12	0.08	0.48	0.36	95	0.31	1419	6.73	13000	64	RE-002
DC-B-008	1016-012G	12	0.08	0.48	0.36	95	0.31	1419	6.73	13000	256	RE-002
DC-B-009	1516E-012 SR	12	0.16	0.8	0.52	60	0.4	1160	8.26	12000	75.892187	RE-005
DC-B-010	1524-012 SR	12	0.32	2.5	1.82	19.8	0.25	843	11.33	5000	22.0335	RE-005
DC-B-013	2224-024 SR	24	0.28	5	3.88	36.3	0.8	328	29.1	8000	29.6	RE-005
DC-B-014	2232-024 SR	24	0.46	10	8.68	16.4	0.71	298	32.1	8000	50	RE-005
DC-B-025	2642-024 CR	24	0.98	28	23	5.78	0.55	276	34.6	5000	1	
DC-B-026	2642-024 CR	24	0.98	28	23	5.78	0.55	276	34.6	5000	1	RE-010
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-034	3557-024 CR	24	1.96	60	72	2	0.27	223	42.88	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-041	3863-024 C	24	3.8	110	224	0.62	0.13	285	33.48	8000	1	RE-010
DC-B-042	3863-024 C	24	3.8	110	224	0.62	0.13	285	33.48	8000	3.71	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	RS230	23	5.57	300	94	0.65	0.42	167	57	3000	1	RE-016
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 Motors 2Phase

Alias	Model	Wiring scheme	Design Voltage	Phase Current	Holding Torque	Detend Torque	Phase Resistance	Inductance	Gearbox	Steps/Revolution	Encoder
			V	A	mNm	mNm	Ohm	mH	(backlash-free)		
2Phase-003	AM-1020-025	bipolar parallel	<38	0.25	1.6	0.4	7.4	2.1	1000	20	
2Phase-004	AM-1020-025	bipolar parallel	<38	0.25	1.6	0.4	7.4	2.1	40	20	
2Phase-005	AM-1020-025	bipolar parallel	<38	0.25	1.6	0.4	7.4	2.1	256	20	
2Phase-006	AM-1020-025	bipolar	<38	0.25	1.6	0.4	7.4	2.1	64	20	
2Phase-010	AM-1524-025	bipolar	<38	0.25	6	0.9	12.5	5.5	75.892187	24	
2Phase-018	HSY-21 series	bipolar	<50	0.24	20	2	20.4	5	1	200	
2Phase-019	LIN208-17-01	bipolar	<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-021	ZSS-25 1.2.200 GPL-22	bipolar parallel	<100	1.2	13	2	0.95	0.4	16	200	
2Phase-023	LIN211-18-02	bipolar	<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-032	ZSS-42-200-1.2	bipolar parallel	<100	1.2	140	5	1.6	3	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	<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	bipolar	<100	1.2	260	8	3.3	3.2	1	200	
2Phase-045	ST4018L1206	bipolar	<100	1.2	350	10	3.3	4.3	1	200	
2Phase-047	PK244M-01B	bipolar	<100	1.2	260	10	3.3	4.3	1	400	
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	<200	2	600	14	1.5	1.4	1	200	
2Phase-070	PK266-E2.0	bipolar parallel	<100	2	900	20	1.8	2.5	1	200	
2Phase-071	PK268M-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	
2Phase-133	VSS-43-200-1.2E UHVC 77K	bipolar parallel	<100	1.2	235	7	2.6	5.2	1	200	
2Phase-165	VSS-65-200-2.5E UHVC 77K	bipolar parallel	<200	2.5	450	50	0.8	2.4	1	200	
2Phase-232	ZSS-42-200-1.2	bipolar parallel	<100	1.2	140	5	1.6	3	1	200	RE-010

TECHNICAL DATA

Torque Motors TM

Alias	Model	Max. bus voltage	Cont. Current	Cont. Torque	Peak Torque	Phase Resistance	Inductance	Motor Constant	Torque Constant	Max. Speed	Electrical Time Constant	Number Of Poles	Back EMF
		V	A (@ 80°C)	Nm (@ 80°C)	Nm	Ohm (@ 80°C)	mH	Nm/√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-020	TM-0210-030-3TB	160	6.32	20.4	93.2	1.42	3.23		3.3	270	2.88	44	2.7
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-040	Iko												
TM-050	URM-3P-142x15	160	2.5	4.8	10.7	9.7	4.5	0.49	1.9	240	0.46	10	1.5

Linear Motors LM

Alias	Model	Max. bus voltage	Cont. Current	Cont. Force	Peak Force	Phase Resistance	Inductance	Motor Constant	Force Constant	Electrical Time Constant	Pole Period	Back EMF
		V	A (@ 80°C)	N (@ 80°C)	N	Ohm (@ 80°C)	mH	N/√W	N/Arms	ms	mm	V/(m/s)
LM-005	ULIM3-2P 66/20	60	0.9	6	23	1.76	0.38	3.3	6.2	0.34		4.4
LM-010	ULIM4-2p_192/170	60	1.8	43	177	3.3	1.22	9.3	15.3	0.304		17
LM-015	ULIM4-2p_96/80	60	1.4	22	88	2.72	1	6.6	15.3	0.37		10.9
LM-020	ILF-12-050 3ND	160	4.4	110	447	2.55	1.4	14.9	26.1	0.68		21.4
LM-050	LM50-4-7 2Phase	48	5.95	64	320	0.8	0.09	12	10.8	0.11	24	10.7
LM-051	LMS 60 25 3Phase	200	0.32	7	31	72	24		22		30	7.2
LM-052	LMS 80 3Phase	200	0.7	7	34	18	6		11		30	3.6
LM-053	LMS 100 3Phase	200	0.33	15	158	64			48		40	16
LM-054	LMS 60 65 3Phase	200	0.64	7	31	36	12		22		30	7.2

TECHNICAL DATA

Linear scales LS

Alias	Model	Accuracy	Resolution	Recommended meas.step	Index position	Signals	Signal output, (quadrature) channels
		µm	µm	µm			
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-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-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-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-060	M3500L	+/-3	0.005	0.005	in the 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
AE-060	RGS-S+RGH24Z	+/- 1	0.2	0.2	in the middle of travel	RS 422 differential	2 + 1 index and complementary outputs

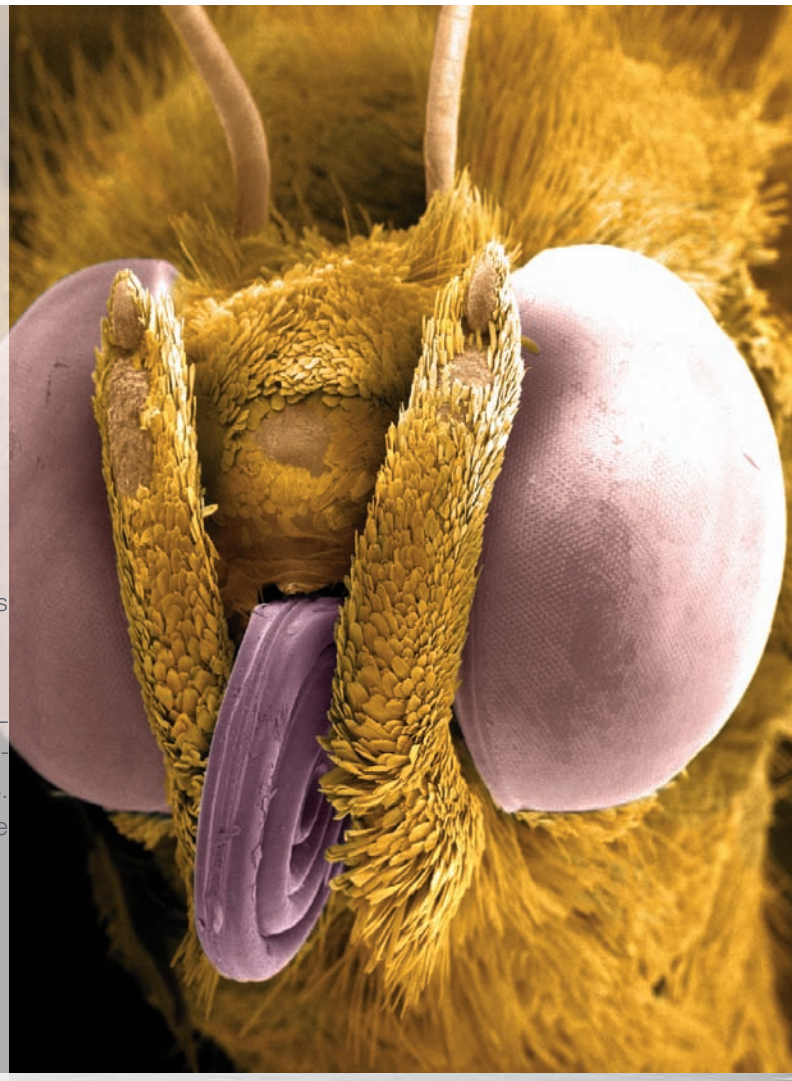
Rotary encoders RE

Alias	Model	Resolution	Inkrements/rev	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		RS-422 differential	

Angular Measurement Systems AE

Alias	Model	Accuracy	Resolution	Recommended meas.step	Inkrements/rev	Index position	Signals	Signal output, (quadrature) channels
		ArcSec	°	°				
AE-010	RON-285-C	+/- 5	0.02 (1Vpp)	0.000015	18000	yes	1 Vpp	2 + 1 index and complementary outputs
AE-015	Signum d=229 mm	+/- 0.97	0.01 (1Vpp)	0.00001	36000	yes	1 Vpp + RS422	2 + 1 index and complementary outputs
AE-050	RIK RS-422 P4	+/-20 (5.5m°)	0.0001	0.0001	9000	one, near cal-switch	RS 422 differential	2 + 1 index and complementary outputs
AE-051	RIK 1Vpp	+/-20 (5.5m°)	0.04 (1Vpp)	0.00002	9000	one, near cal-switch	1 Vpp	2 + 1 index and complementary outputs
AE-055	RGB TRS							
AE-068	Signum d=150 mm	+/- 1.5	0.000076271	1.5E-5	23600	yes	RS 422 differential + 1 Vpp	2 + 1 index and complementary outputs
AE-070	RGR+RGH24B		0.0000573	0.0000573	31453	yes	RS 422 differential	2 + 1 index and complementary outputs
AE-080	Signum d=57mm	+/-4	0.04 (1Vpp)	0.00002	9000	yes	1 Vpp	2 + 1 index and complementary outputs

MICROPOSITIONING



miCos offers a wide range of precision stages and high-end controllers for micro- and nano positioning applications.

From miniature stages with a travel range of several mm, up to linear stages with 1 m travel, miCos offers over 50 different linear and rotation stages.

Our precision stages are equipped with 2 phase stepper motors, DC-servo motors or linear motors with repeatabilities down to 25 nm for linear motion and 0.0003° for rotary motion. For higher resolutions and positioning accuracy in the nm range, piezo motors are used.

Our mechanical product offering is completed by a wide range of advanced motion controllers and in-depth application expertise that enables miCos to solve the most demanding requirements in micro- and nano positioning. For example, our state-of-the-art motion controllers excel at velocities of less than 100 nm/sec or resolutions of less than 25 nm.

One of the many highlights in MOTION CONTROL are our multi-axis, six axes of freedom system solutions, such as our Paros hexapod and SpaceFAB. Nearly all components can be configured for a use in vacuum down to ultra-high vacuum and below.

Micropositioning

To achieve mechanical movements with resolutions in the micrometer and sub-micrometer as well as arcsec range, it is critically important to utilize a combination of optimal mechanical design, materials, controller technology and software.

To counteract adverse bearing and driving force effects, we utilize advanced tuning methods to achieve the desired high precision positioning results that are essential for our customer's applications.

Nanopositioning

Nano-positioning achieves movements in the nanometer and sub-nanometer range. For this level of precision, we use piezo electrical drives and high precision guides. micos is investing increasingly in piezo technology and materials to offer ever more products with nm precision.

Certificated by DIN EN ISO 9001:2000-12

As a leading global manufacturer of innovative motion components and systems for the medical device, photonic, microscopy and semiconductor markets, micos utilizes state-of-the-art metrology equipment to assure the highest quality of all our components and systems. Each product leaves our factory only after thorough inspection and test.

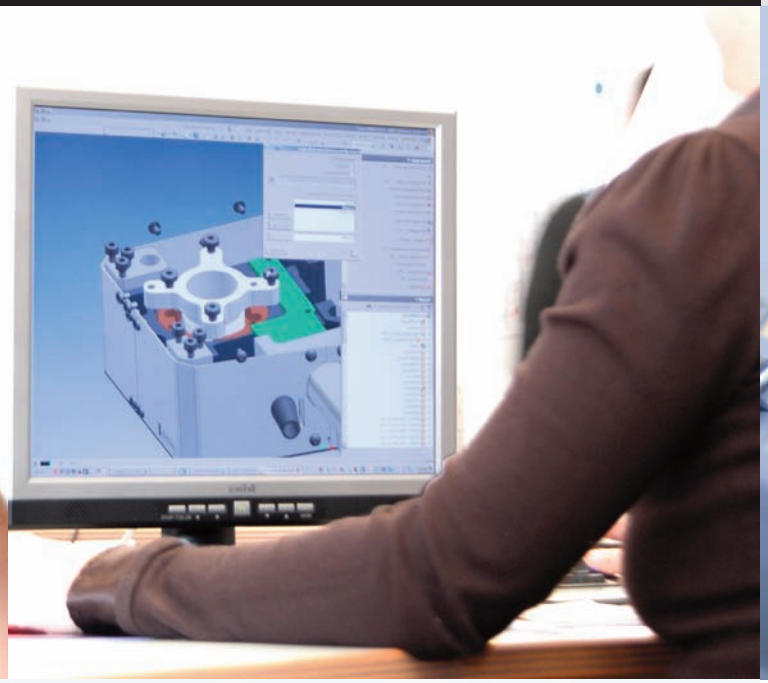
Our metrology laboratory is equipped with an advanced air-conditioning system to assure temperature stability. Additionally, all measurements are conducted on a granite platform that is vibration isolated from any environmental vibrations.
The granite table exhibits a flatness of better than 1 µm and all measurements are taken at a temperature of 22° +/- 1° Celsius.

NANOPOSITIONING

micos uses both high precision interferometric as well as capacitive methods to assure that our products meet the highest positioning accuracies. Each product is handmade and therefore unique.

QUALITY STARTS HERE...

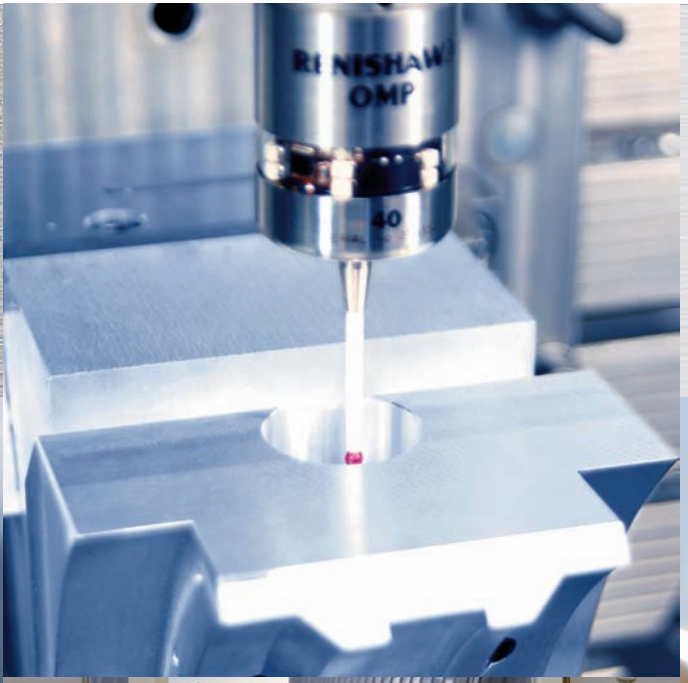
Service



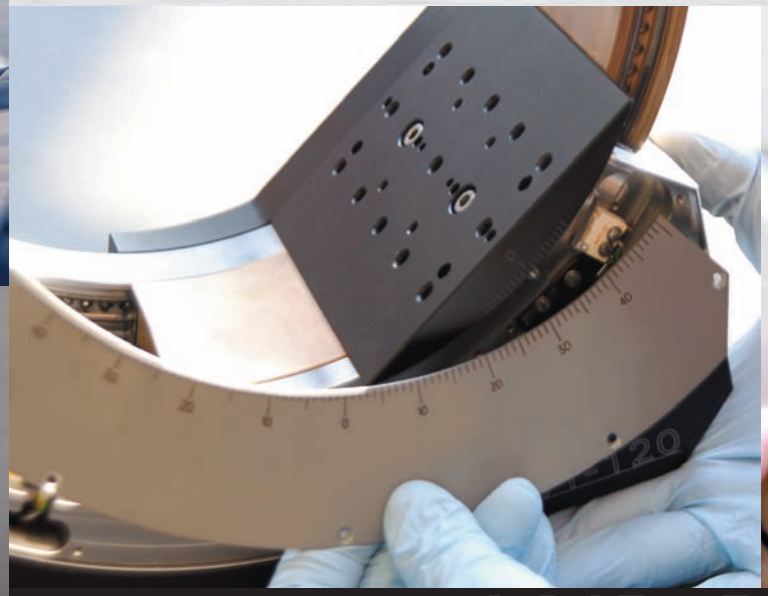
Design

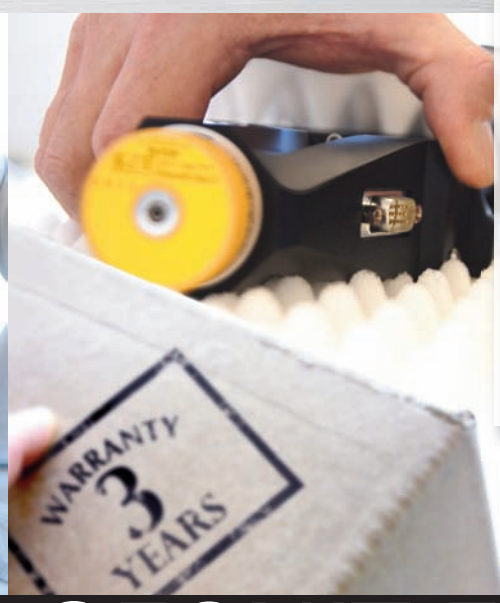
Manufacturing

At 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.



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.



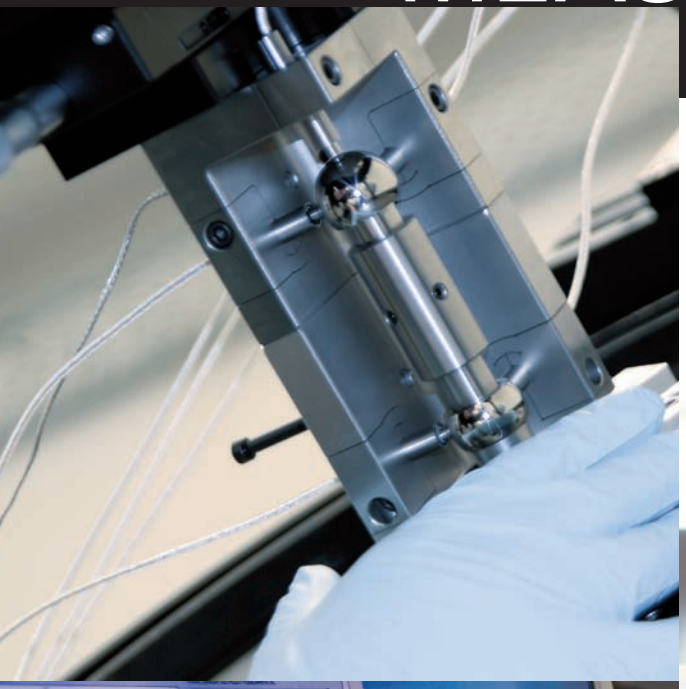


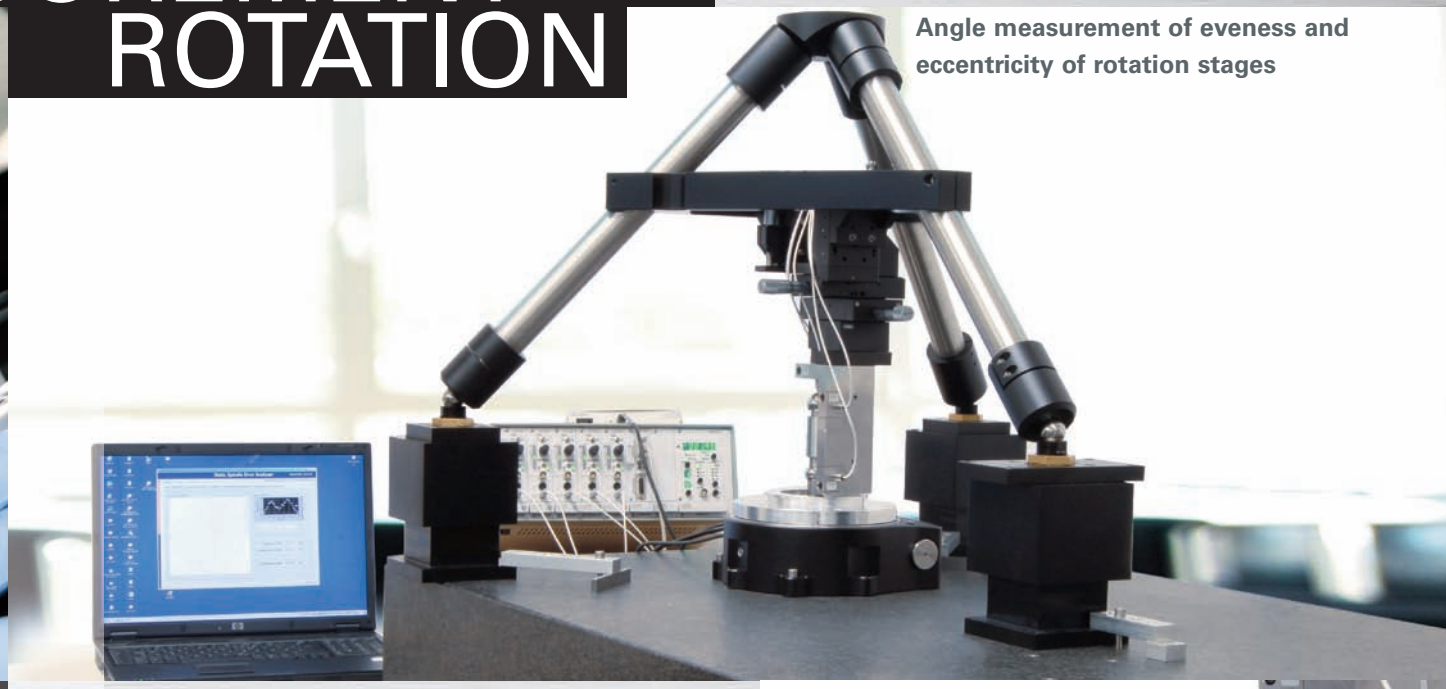
... AND DOESN'T END

Precision **Assembly** **Shipping**

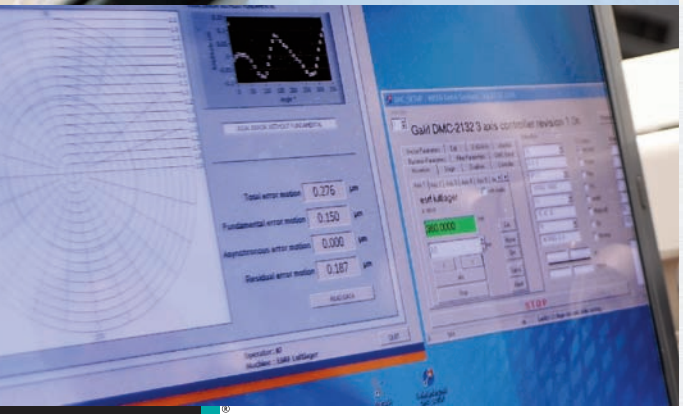
The precision machined parts are then assembled by our in-house technicians into the final product while paying utmost attention to meeting the customer specifications. Finally, our metrology department uses state of the art metrology equipment to assure optimal performance of the overall system before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

MEASUREMENT ROTATION

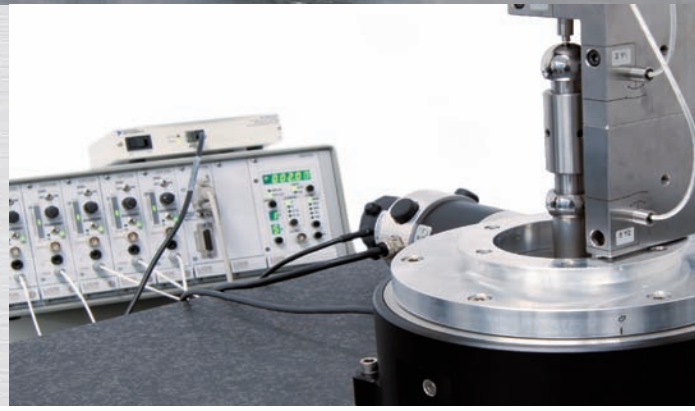


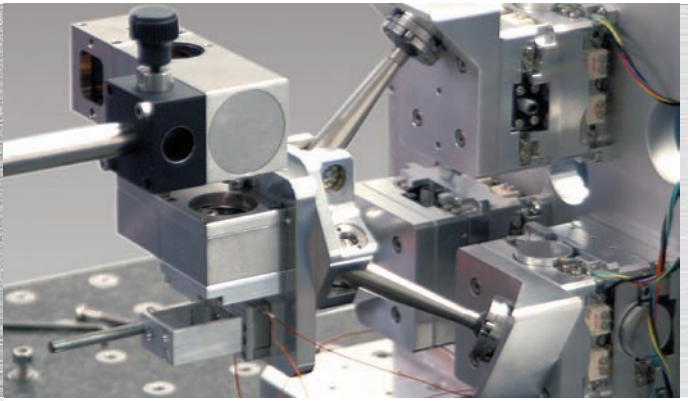


Angle measurement of eveness and eccentricity of rotation stages



Rotation measurement with capacitive measurement system

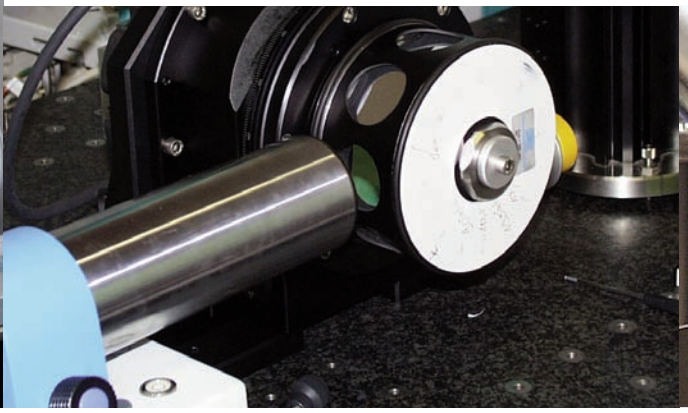


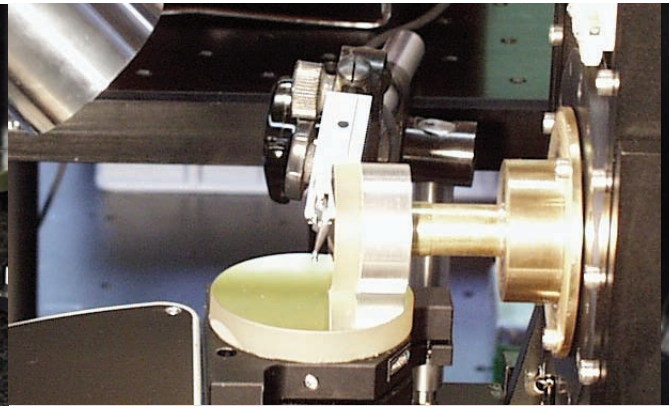


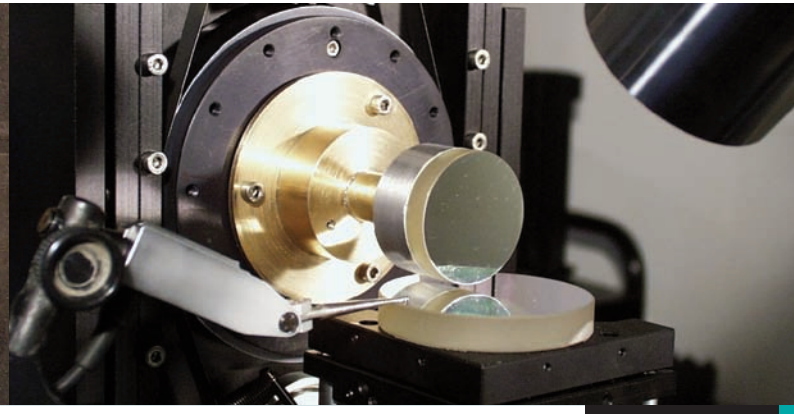
Angle measurement with an interferrometer

All positioners are placed on a flat granite platform (0.5 µm flatness) and are measured with defined torque. The measuring sensor 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, **micos** can supply an extensive metrology report with actual performance data for the product delivered.

Angle measurement with an autocollimator

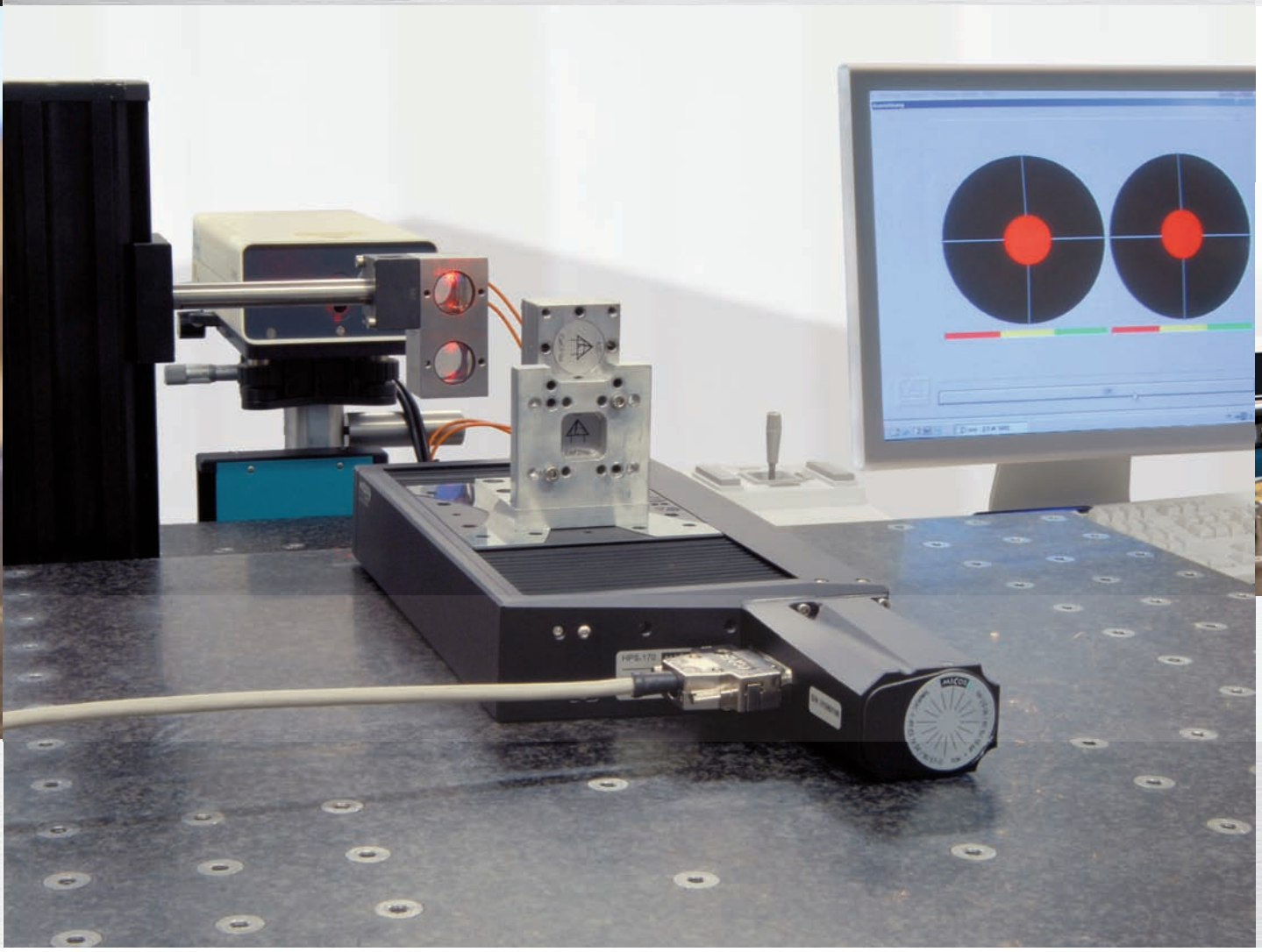


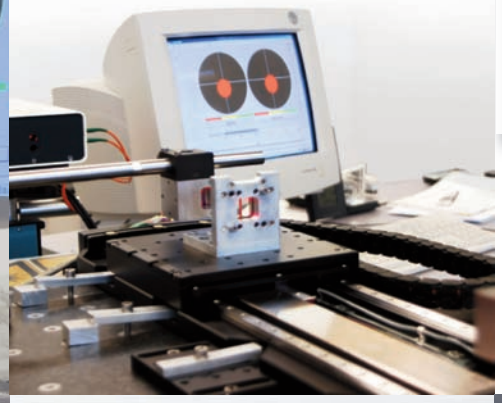




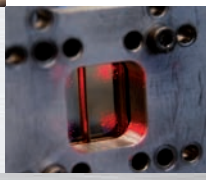
MEASUREMENT LINEAR

Measurement with interferrometer of linear stages





Measurement with interferrometer of linear stages



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.

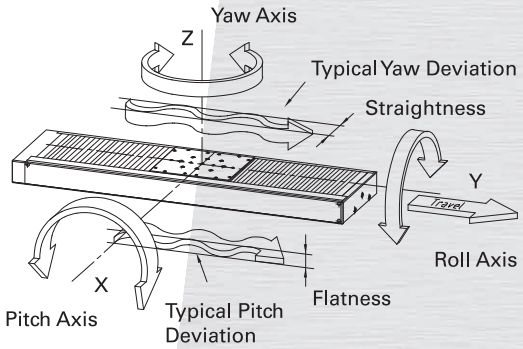
For absolute accuracies below 1 µm for longer travel ranges, a closed loop linear measuring system is required. Some examples of linear measuring systems are laser interferometer, optical linear encoders using glass scales or magnetic encoders. Most sources of mechanical positioning inaccuracies, such 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

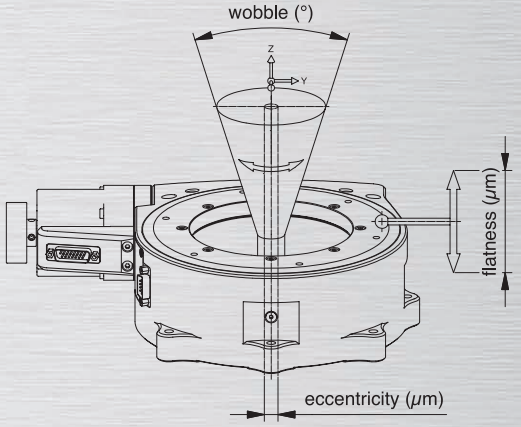
Run-out is defined as the discrepancy from a perfectly straight line and describes any undesired movement in the remaining 5 degrees of freedom of motion other than the desired axis. For example, for a desired translation in y axis, there will also be small but undesired motion in x and z direction as 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)

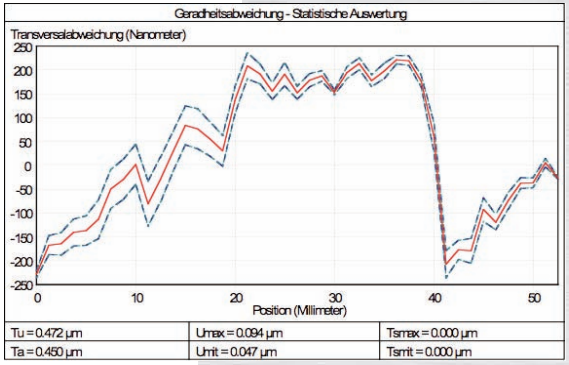


Example for Linear Measurement

Stage		HPS-170 52mm 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 800x600mm Quality LAB Max error= 0.0014mm
Environment	Temperature	20.6 °C
	Humidity	58%
	Pressure	992 hPa
Hint		HPS-170 mounted with 8 x M6 (5Nm)

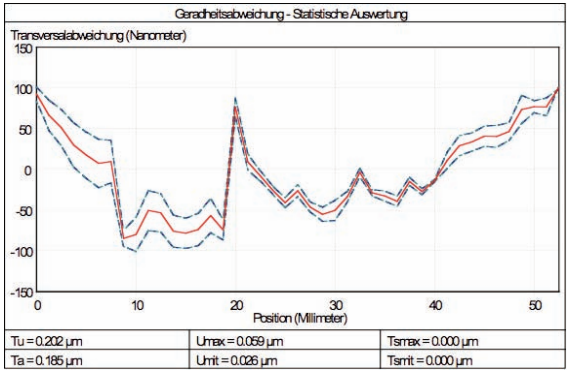
Straightness

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.



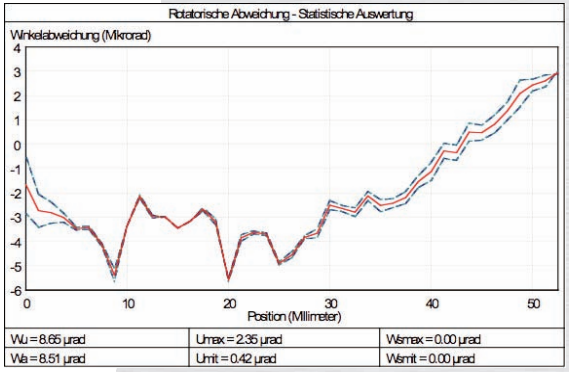
Flatness:

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.



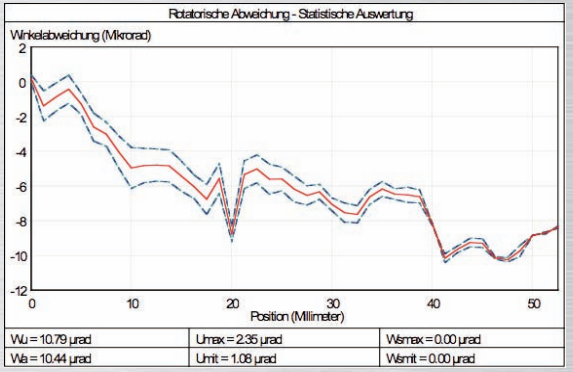
Pitch

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

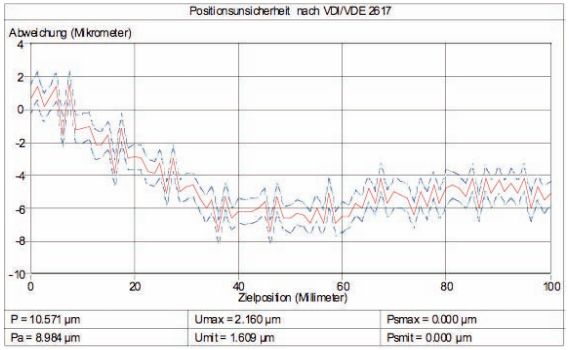
measured in a height 40 mm above the slider. The yaw angle referring to the travel range of 52 mm, will be measured.
The yaw angle is Wu = 10.79 µrad absolute. The repeatablility of the guidance accuracy referring to the yaw angle is Umax = 2.35 µrad.



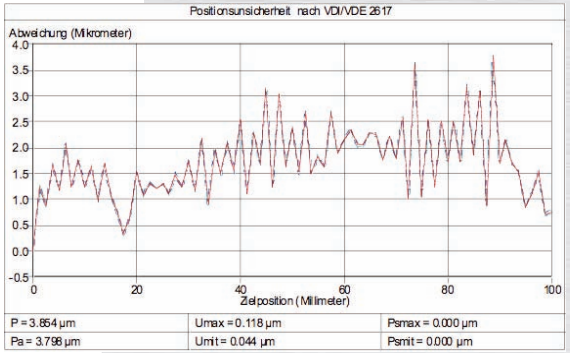
Next 3 measuring protocols are illustrating the positioning accuracy of stages with a travel range of 100 mm, respectively 52 mm.

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.

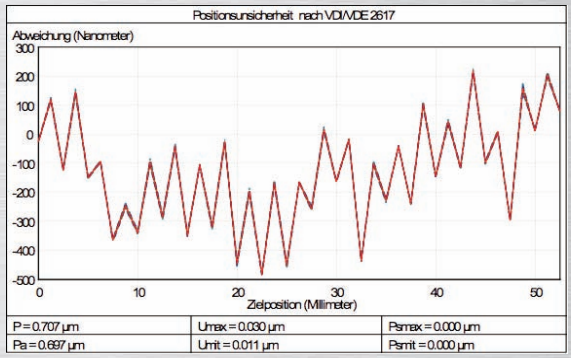
Position, Open Loop,
measured in a height 40 mm above the slider.
The stage is operated in open loop.
With a total travel range of 100 mm the absolute position accuracy is P = 10.571 µm
The stage has a backlash of Umax = 2.16 µm.



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).



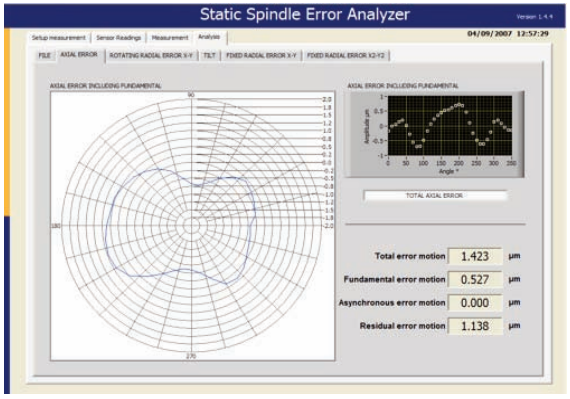
Position Closed - Loop with Position Correction
measured in a height 40 mm above the slider.
The absolute position accuracy with a travel range of 52mm is P = 0.707 µm. The backlash of the absolute position accuracy (bidirectional) Umax = 0.030 µm.



Example for Rotation Measurement

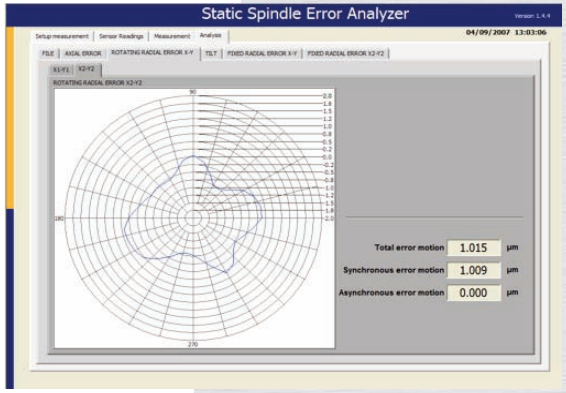
Axial Error

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



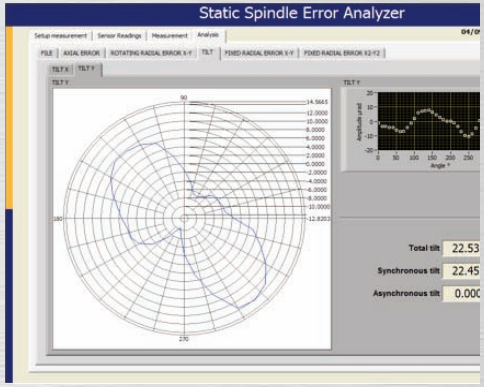
Rotating radial error X2 – Y2

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



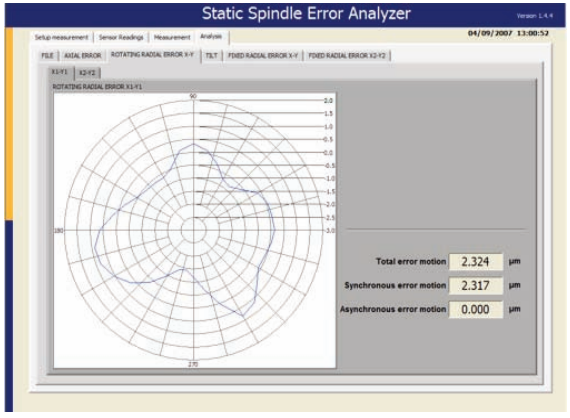
Tilt – Y

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



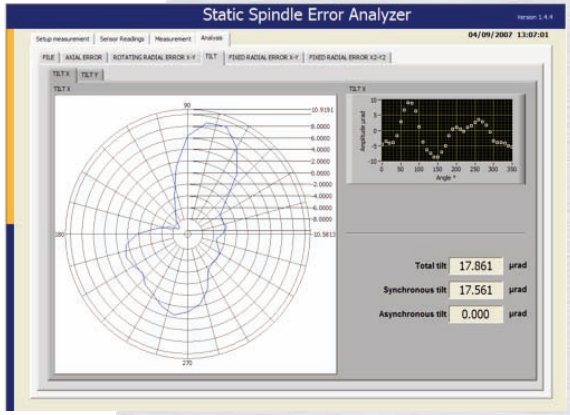
Rotating radial error X1 – Y1 (Wobble in X-coordinate)

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.

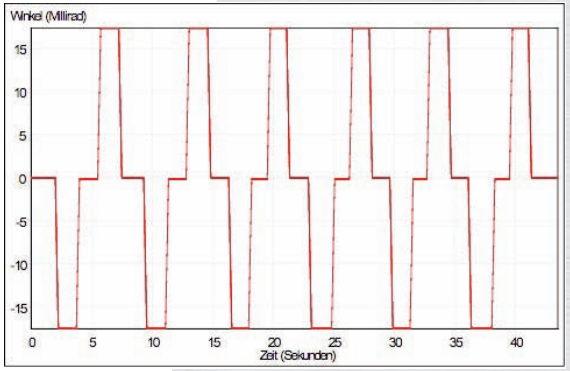


Example Repeatability of PRS-200 stage Open Loop

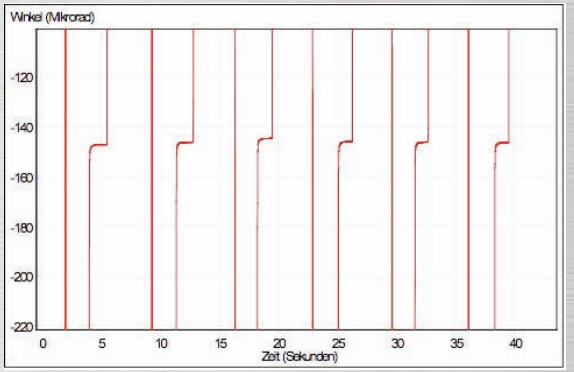
Stage		PRS-200 2SM
Serial Number		07090203
Customer		TSA
Date		04.10.07
Measurement Device		Laser-interferometer ZLM 500 Zeiss
Measurement Base		Granit-base 800x600mm Quality LAB Max error= 0.0014mm
Environment	Temperature	21.8 °C
	Humidity	54%
	Pressure	994 hPa
Hint		PRS-200 mounted with 4 x M6 (5Nm)

Shown is the repeatability of a rotation stage PRS-200 in open loop.

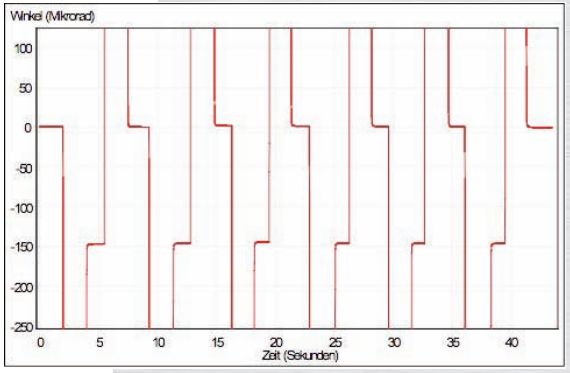
Millirad scale



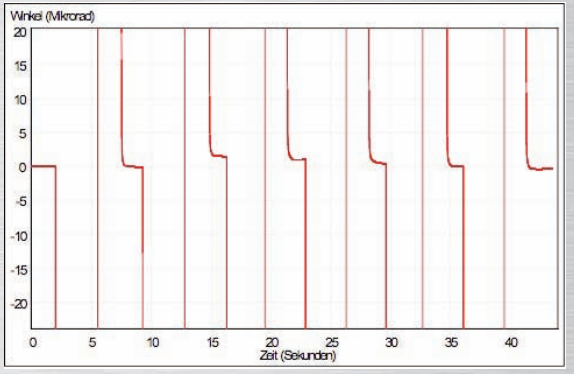
Repeatability bi-directional Zoom



Microrad scale



Repeatability uni-directional Zoom



Resolution, respectively smallest step size.
This is the smallest movement, which can be performed repeatably.
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.

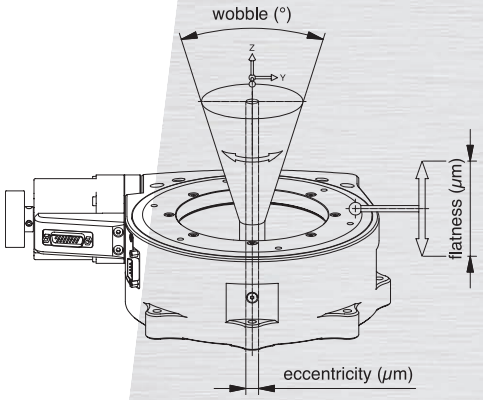
Backlash
Reverse backlash is defined as a system`s dead zone that occurs if an adjustment component is moved from one direction to the opposite direction. Preload as well as closed loop control by using a linear scale can avoid this effect.

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.

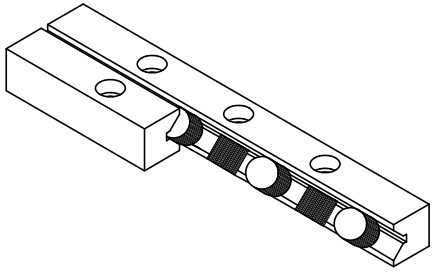
Stiffness
Refers to the amount of force that is necessary to produce a given amount of deflection.

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.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).

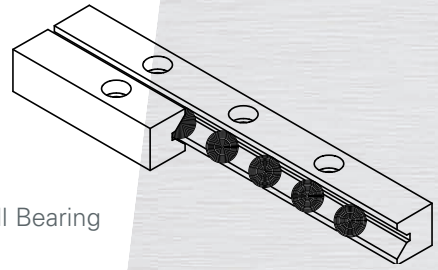
Crossed-Roller Bearings

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.



Ball Bearings

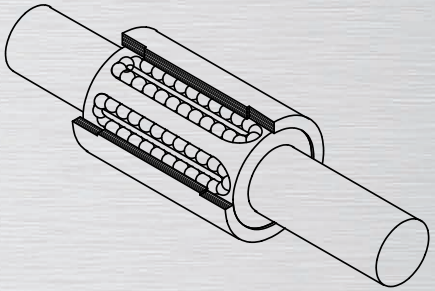
Balls roll between two precisely ground and hardened sides. This corresponds to the principle of a ball bearing. The individual balls are led through a ball cage in order to prevent obstruction. Ball bearing slides are finite guiding mechanisms where the balls cover 0.5-times the way of the translating 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

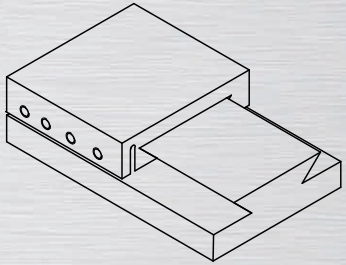
On a hardened and ground surface balls roll in guiding grooves.Arriving at the end of the guide body the balls are carried back by an integrated recirculation to the beginning of the guide body. Therefore the guidance system achieves travel ranges that are a multiple of the guidance body`s dimensions. 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.

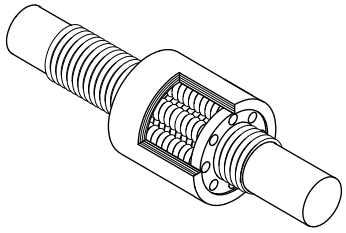


Dovetail

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.

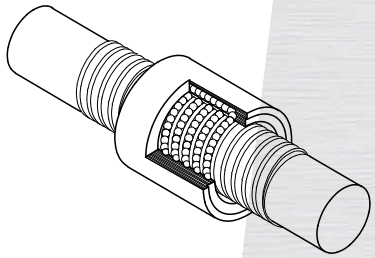


Roller Thread Drive

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 and move the nut (if not revolving) one screw pitch per rotation (further).

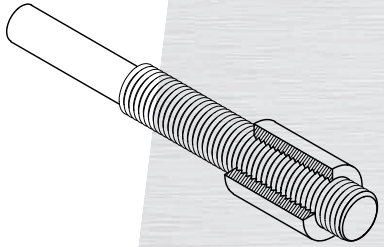
The nut incorporates a recirculation system returning the balls that arrived at the end to the beginning of the nut. This model allows execution of linear motions by rotary movements. This ball screw shows high efficiency. Stick-slip effect does not occur. Due to selected balls a thread-nut combination 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

Worm gear drive

The thread of a driving screw (worm gear) paired with a wheel produces rotation. The advantages of a worm gear drive compared to direct drive are higher axial capacities and self-locking.

Drive Options

Motors

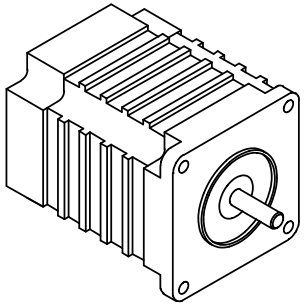
With the conception of a positioning system the basic question of a necessary drive system occurs. Different parameters are relevant to the choice. They differ depending on type of problem.
Deciding factors are:

- 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

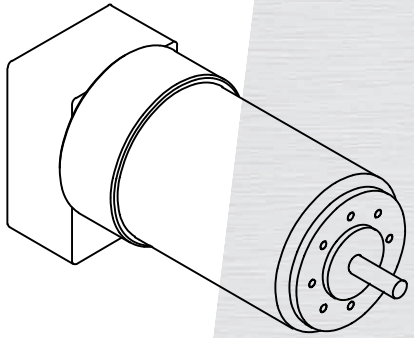
excluded because a feedback of the stepper motor`s position does not follow. The reason for loss of steps is often an incorrectly designed drive unit where frequencies of triggering / drive, accelerations or irregular ranges of capacities occur that are too high.



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 load's 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 translator`s 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.

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 cristallography 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 f.e. 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 f.e. 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 micos catalog uses mbar as a unit of air pressure. Other physical units commonly used are Pascal (Pa) and Torr (Torr).

Definition according to DIN28400

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 - 10^{-3} mbar
High vacuum	HV	-20°C... +200°C	10^{-3} - 10^{-7} mbar
Ultra-high vacuum	UHV	-20°C... +300°C	10^{-7} - 10^{-11} mbar
Extreme-ultra-high vacuum	EUHV		10^{-12} mbar
Ultra-high vacuum Cryo	UHVC	-270°C... +40°C	10^{-11} mbar

Almost all 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.

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
- Outgassing temperature max. 50°C

HV up to 10^{-3} to 10^{-7} mbar

- special vacuum motor
- measuring system modified for the use in vacuum
- motor and limit switches equipped with teflon braids 1m 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
- Outgassing 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 teflon braids 1m 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 micos are not made for vacuum use. Therefore, they must be placed outside the vacuum chamber. 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 micos.

Lubrication

For use in HV and UHV all guides and spindles are lubricated with vacuum lubricant BRAYCOATE 601. Other lubricants are also available.

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.

micos preferred materials for stages are:

- Stainless steel
- Aluminum
- Titanium
- Bronze
- Viton
- Ceramic
- Sapphire
- Teflon
- Peak
- Kapton
- Macor

Price List

All prices are valid for sales in Germany. For international prices contact 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 micos is not represented are directly supplied by 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 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 micos products are guaranteed for a period of two year. 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 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 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 micos Germany.
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 learnt that our customers appreciate the direct contact with a local distributor. Therefore 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 micos AGB's.

Allgemeine Lieferungs- und Zahlungsbedingungen für den Verkauf von MICOS-Produkten und MICOS-Systemen

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Diese allgemeinen Verkaufsbedingungen gelten ausschließlich, soweit sie nicht durch ausdrückliche schriftliche Vereinbarung zwischen den Parteien abgeändert werden. Jeglichen Beding-ungen oder vertragsändernden Bestimmungen des Käufers wird widersprochen.
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2.1. Unsere Angebote sind freibleibend. Bestellungen sind für uns nur verbindlich, soweit wir sie bestätigen oder ihnen durch Übersendung der Ware nach- kommen.

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 bestrittene 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 Preis-entwicklung erforderlich werden (deutlicher Anstieg von Material- oder Herstellungskosten) oder aufgrund geänderter Zulieferer-bedingungen 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 Auftrags-bestätigung, 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 Versand-bereitschaft 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 die Ware 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 Bedienungs-anweisungen 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 wesent-licher 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 Betriebs-führung nicht verhindert werden können - suspendieren die Vertragsverpflichtungen der Parteien für die Dauer der Störung und im Umfang ihrer Wirkung. Überschreiten daraus sich ergebende Verzögerungen den Zeitraum von sechs Wochen, so sind beide Vertragspartner berechtigt, hinsichtlich des betroffenen Leistungs-umfanges 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 Vertragswidrig-keiten 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 Verjähr-ungsfrist 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 Bestim-mungen 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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