M-824 Compact 6-Axis-Positioning System

Precision Parallel-Kinematics Micropositioner with Controller, Vacuum Versions

M-824.3DG compact 6-axis Hexapod

- **Extremely Compact**
- **Travel Ranges to 45 mm (linear), 25° (rotation)**
- **Load Capacity to 10 kg, Self Locking Version**
- **Resolution to 7 nm**
- **Min. Incremental Motion to 300 nm**
- **Repeatability ±0.5 µm**
- **Velocity to 25 mm/sec**
- **Vacuum-Compatible Versions Available**

The M-824 is the ideal micropositioning system for all complex positioning tasks which depend on high speed and accuracy in six independent axes. In addition to positioning all axes, it allows the user to define a center of rotation (pivot point) anywhere inside or outside the system envelope by one simple software command.

Application Examples

- Biotechnology
- Semiconductor technology
- Micromachining
- Micromanipulation
- X-ray diffraction measurements
- Tool control

Extremely Compact, Two Motor Versions

The M-824 uses a very compact drive with motor and spindle mounted side-by-side and, with a height of 188 mm, has a considerably lower profile than either the M-850, page 4-6, or M-840, page 4-8 Hexapods. Two versions featuring different drives are offered: the self-locking M-824.3DG with DC motor and gearhead can position loads of up to 5 kg in any orientation (10 kg with baseplate horizontal) with sub-micron precision. The M-824.3PD with integrated ActiveDrive™ system provides a significantly higher velocity of up to 25 mm/sec with loads up to 5 kg.

Hexapod vs. Serial Kinematics Systems

The Hexapod is driven by six high-resolution actuators all connected directly to the same moving platform. This design provides a high system stiffness and a large clear aperture.

Because of the low mass of the moving platform, positioning operations can be performed with far lower settling times than with conventional, stacked multi-axis systems. In such systems, runout, guiding errors, and the friction and inertia of moving cables all accumulate to limit accuracy and repeatability—problems which do not affect parallel kinematic systems like the Hexapod.

Fixed Virtual Pivot Point

For optics and other alignment tasks, it is important to be able to define a fixed pivot point. The sophisticated Hexapod controller allows choosing any point in space as the pivot point for the rotation axes by software command. The pivot point remains fixed relative to the platform.
Target positions in 6-space are entered in user-friendly coordinates and reached by smooth vectorized motion.

Open Architecture

Control of the hexapod is facilitated by the controller's open

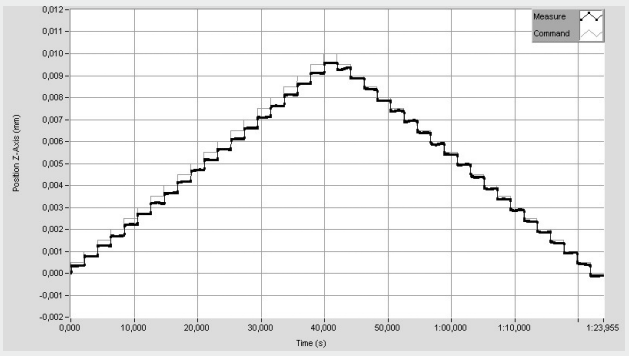
Ordering Information

M-824.3PD
Compact Hexapod Microrobot with Controller, Direct Drive

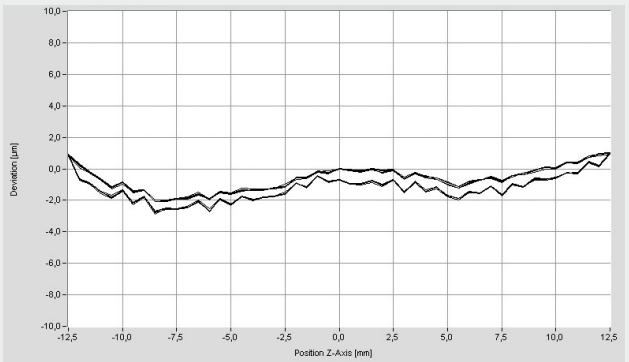
M-824.3DG
Compact Hexapod Microrobot with Controller, DC Motor Gearhead

M-824.3VP
Compact Hexapod Microrobot with Controller, Direct Drive, Vacuum Compatible to 10^{-6} hPa

M-824.3VG
Compact Hexapod Microrobot with Controller, DC Motor Gearhead, Vacuum Compatible to 10^{-6} hPa



Interferometer tests show the high repeatability, here with 500 nm steps



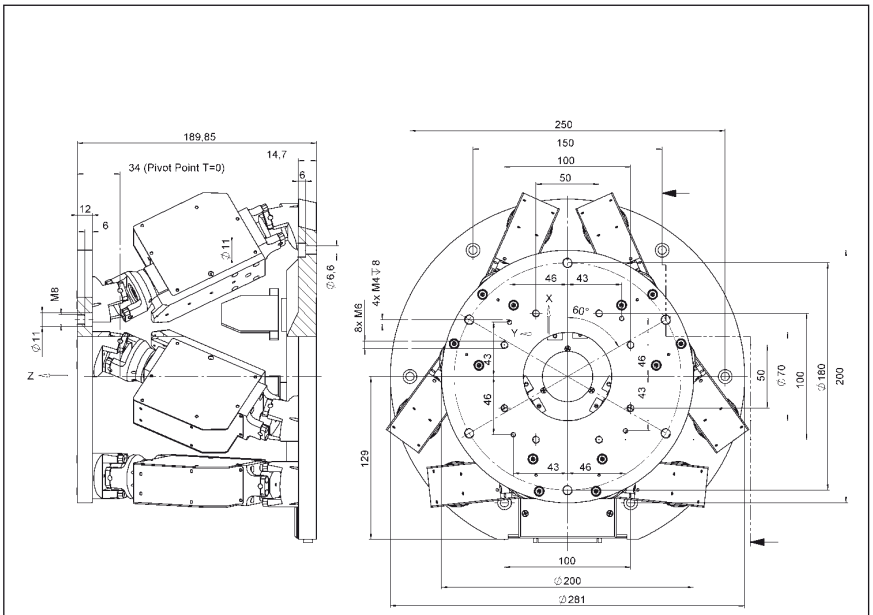
The interferometer test shows the Z axis accuracy over the entire travel range of 25 mm and the extremely high repeatability of ±0.046 µm

interface architecture, which provides a variety of high-level commands and includes a macro language for programming and storing command sequences.

Vacuum Versions

Both models are available as vacuum versions that enable use in applications such as X-ray diffraction microscopy with ambient pressures down to 10^{-6} hPa.

The M-824 comes with a powerful 6D controller and sophisticated, user-friendly positioning and alignment sofware. Keypad and display are optional



M-824 dimensions in mm, 3 m cable included

Technical Data

Model	M-824.3DG	M-824.3PD	Units
Active axes	X, Y, Z, θ_X, θ_Y, θ_Z	X, Y, Z, θ_X, θ_Y, θ_Z	
Motion and positioning			
*Travel range X, Y	±22.5	±22.5	mm
*Travel range Z	±12.5	±12.5	mm
*Travel range θ_X, θ_Y	±7.5	±7.5	°
*Travel range θ_Z	±12.5	±12.5	°
Single-actuator drive	DC-motor, gearhead	ActiveDrive™ DC Motor	
Actuator stroke	±12.5	±12.5	mm
Single-actuator design resolution	0.007	0.5	µm
Integrated sensor	Rotary encoder	Rotary encoder	
Sensor resolution	2048	2048	cts./rev.
**Min. incremental motion X, Y, Z	0.3	1	µm
**Min. incremental motion θ_X, θ_Y, θ_Z	3.5	12	µrad
Repeatability X, Y, Z	±0.5	±0.5	µm
Repeatability θ_X, θ_Y, θ_Z	±6	±6	µrad
Max. velocity X, Y, Z	1	25	mm/s
Max. velocity θ_X, θ_Y, θ_Z	11	270	mrad/s
Typ. velocity X, Y, Z	0.5	10	mm/s
Typ. velocity θ_X, θ_Y, θ_Z	5.5	55	mrad/s
Mechanical properties			
*Stiffness X, Y	1.7	1.7	N/µm
Stiffness Z	7	7	N/µm
Load capacity (baseplate horizontal/any orientation)	10/5***	5/2.5	kg
Miscellaneous			
Operating temperature range	-10 to +50	-10 to +50	°C
Material	Aluminum	Aluminum	
Mass	8	8	kg
Controller			
Controller included	M-850.502	M-850.502	
Operating voltage	100–240 VAC, 50/60 Hz	100–240 VAC, 50/60 Hz	

*The travel ranges of the individual coordinates (X, Y, Z, θ_X, θ_Y, θ_Z) 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
**Simultaneous motion of all 6 actuators! No moving cables (as in serial-kinematics stacked systems) to introduce bending sources, torque and friction, which degrade positioning accuracy
***Self Locking
Technical data are specified at 20 ±3 °C.
Data for vacuum versions may differ.