

Parallel Kinematic Positioner



- Vacuum-Compatible 6 Axis Parallel Positoner
- Parallel Controller & Software Included
- Travel XYZ: 34x32x13mm, Rot: to 42 Deg
- Load Capacity to 5 kg
- Actuator Resolution 40 nm
- Min. Incremental Motion to 200 nm
- Repeatability up to $\pm 0.2 \mu\text{m}$
- Velocity to 10 mm/s

Technical Data

Model	M-811.STV
Active axes	X, Y, Z, θX , θY , θZ
Motion and positioning	
*Travel range X, Y, Z	± 17 , ± 16 , ± 6.5 mm
*Travel range θX , θY , θZ	$\pm 10^\circ$, $\pm 10^\circ$, $\pm 21^\circ$
Actuator drive	Brushless DC motor, ActiveDrive
Single-actuator design resolution	0.04 μm
Integrated sensor	Rotary encoder
Sensor resolution	12800 cts./rev.
**Min. incremental motion X, Y	0.5 μm
**Min. incremental motion Z	0.2 μm
**Min. incremental motion θX , θY , θZ	10 μrad
Repeatability X, Y	$\pm 0.5 \mu\text{m}$
Repeatability Z	$\pm 0.2 \mu\text{m}$
Repeatability θX , θY , θZ	$\pm 2 \mu\text{rad}$
Backlash X, Y	1 μm
Backlash Z	0.2 μm
Max. velocity X, Y, Z	10 mm/s
Max. velocity θX , θY , θZ	250 mrad/s
Typ. velocity X, Y, Z	5 mm/s
Typ. velocity θX , θY , θZ	120 mrad/s
Mechanical properties	
Stiffness X, Y	0.2 N/ μm
Stiffness Z	3.6 N/ μm
Load (baseplate horizontal / any orientation)	5 / 2.5 kg
Miscellaneous	
Operating temperature range	0 to +50 °C
Material	Stainless steel, aluminum
Mass	2.2 kg
Controller	
Operating voltage	100-240 VAC, 50/60 Hz

* The travel ranges of the individual coordinates (X, Y, Z, θX , θY , θZ) 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.

** Six-axis move. No moving cables (unlike serial-kinematic stacked systems). Eliminates bending, inertia and friction, improving accuracy.

Technical data are specified at 20 ± 3 °C. Data for vacuum versions may differ.

Ordering Information

M-811.STV
 Miniature Hexapod Microrobot with
 Controller, Direct Drive, 5 kg Load,
 Vacuum Compatible to 10^{-6} hPa

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Parallel vs Serial Positioners

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

The M-811.STV is PI's smallest standard vacuum-compatible Hexapod. Despite its size it can handle loads up to 5 kg (2.5 kg in any orientation) and achieves velocities up to 10 mm/sec. With a diameter of only 130 mm and a height of 115 mm it provides travel ranges up to 35 mm in the XY-plane and up to 13 mm in the Z-direction. In combination with the large tilting angles of 20° around the X and Y axis and up to 40° around the vertical axis it allows for complex motion profiles with particularly flexible placement of the load – a great advantage in restricted areas (such as beam lines) and small vacuum chambers.

Each individual strut has a positioning resolution of 40 nm; multi-axis motion can be accomplished with sub-micron repeatability. In addition to controlling all axes in Cartesian coordinates, a software command allows the user to select the center of rotation (pivot point) freely anywhere inside or outside the system envelope.

