

# HexGen HEX500-350HL

## Hexapod Six-DOF Positioning System

Six degree-of-freedom positioning with linear travels to 110 mm and angular travels to 40°

Precision design with guaranteed positioning accuracy specifications

Minimum incremental motion to 20 nm in XYZ and 0.2  $\mu$ rad in  $\theta_x\theta_y\theta_z$

Flexible configurations and customization

Vacuum preparation available upon request

Powerful controls and software with visualization of work and tool coordinate systems

Aerotech's HexGen™ hexapods represent the next-generation in six degree-of-freedom (DOF) positioning performance. The HEX500-350HL is a high-load, ultra-precision hexapod ideal for applications in x-ray diffraction, sensor testing, and high-force device manipulation.

Many trade-offs exist in the design and specification of a motion system. With its high-load capacity, large travels, high speeds, and sub-micrometer precision, the HEX500-350HL does not force you to compromise on application specifications. Providing unmatched precision, the HEX500-350HL is the only hexapod on the market today that provides guaranteed positioning accuracy specifications.

### Superior Structural Design

The HEX500-350HL is actuated with six high-accuracy struts that are built with precision preloaded bearings, ball screws, and drive components. Unlike competitive hexapods driven by DC brushed servomotors, the HEX500-350HL is driven by AC brushless, slotless servomotors that maximize device lifetime and performance. The servomotors are directly coupled to the actuator ball-screw enabling increased drive stiffness, higher positioning accuracy, and better minimum incremental motion (20 nm in XYZ and 0.2  $\mu$ rad for  $\theta_x\theta_y\theta_z$ ) when compared to competitive designs that use belts, gearheads, or compliant couplings. The strut pivot-joints are engineered to provide low friction and high stiffness enhancing the overall hexapod performance.



*The HexGen HEX500-350HL is ideal for high-load, ultra-precise positioning.*

### Design Flexibility

The HEX500-350HL is designed with flexibility and customization in mind. The platform and base can be easily modified with user-specific features or mounting patterns. For applications that require different travels or a unique performance parameter, the kinematic and/or structural layout of the design can be customized with that criteria in mind.

The HEX500-350HL is available with an absolute encoder option for applications that demand no movement on start-up or power loss. The base and platform have a 150 mm diameter clear aperture to allow for workpiece access from the bottom. The base is designed with mounting holes to adapt directly to English or metric optical tables. The hexapod can also be vacuum prepared for demanding applications in synchrotron sample or optics adjustment, semiconductor manufacturing and inspection, or satellite sensor testing.

### Powerful Controls and Software

Driving the HEX500-350HL is Aerotech's award-winning A3200 motion control software. Built on years of experience in difficult kinematics applications, the A3200 controller allows simple programming and control of the hexapod in multiple user-defined coordinate systems with an intuitive interface and real-time motion visualization. Aerotech's free HexGen™ sizing software provides the ability to easily simulate the available travel and workspace of the hexapod.

## HEX500-350HL SPECIFICATIONS

Mechanical Specifications			HEX500-350HL					
Axis			X	Y	Z	A (θx)	B (θy)	C (θz)
Travel <sup>(1)</sup>			100 mm	110 mm	54 mm	22 deg	22 deg	40 deg
Axis Positioning Accuracy <sup>(2,3)</sup>	Over Full Travel	Standard	±4 μm	±4 μm	±3 μm	±50 μrad (±10.3 arc-sec)	±50 μrad (±10.3 arc-sec)	±25 μrad (±5.2 arc-sec)
		ULTRA	±1 μm	±1 μm	±0.75 μm	±10 μrad (±2.1 arc-sec)	±10 μrad (±2.1 arc-sec)	±5 μrad (±1.0 arc-sec)
	Over any 20 mm (X, Y, Z) or 5 deg (A, B, C)	Standard	±1.25 μm	±1.25 μm	±1.25 μm	±12.5 μrad (±2.6 arc-sec)	±12.5 μrad (±2.6 arc-sec)	±7.5 μrad (±1.5 arc-sec)
		ULTRA	±0.75 μm	±0.75 μm	±0.5 μm	±5 μrad (±1.0 arc-sec)	±5 μrad (±1.0 arc-sec)	±2.5 μrad (±0.5 arc-sec)
Resolution (Minimum Incremental Motion)			20 nm	20 nm	20 nm	0.2 μrad (0.04 arc sec)	0.2 μrad (0.04 arc sec)	0.2 μrad (0.04 arc sec)
Bidirectional Repeatability, pk-pk <sup>(3)</sup>			±0.6 μm	±0.6 μm	±0.35 μm	±1 μrad (±0.2 arc sec)	±1 μrad (±0.2 arc sec)	±1 μrad (±0.2 arc sec)
Unidirectional Repeatability, pk-pk			±0.25 μm	±0.25 μm	±0.15 μm	±0.5 μrad (±0.1 arc sec)	±0.5 μrad (±0.1 arc sec)	±0.5 μrad (±0.1 arc sec)
Maximum Speed <sup>(4)</sup>			50 mm/s	50 mm/s	25 mm/s	10 deg/s	10 deg/s	20 deg/s
Load Capacity, All Positions <sup>(5)</sup>		Vertical	200 kg (Push); 120 kg (Pull)					
		Horizontal	35 kg					
Holding Capacity, De-Energized <sup>(6)</sup>			165 kg					
Stage Mass			49 kg					
Material			Anodized Aluminum Platform and Base; Steel Used in Joints and Inside Struts					

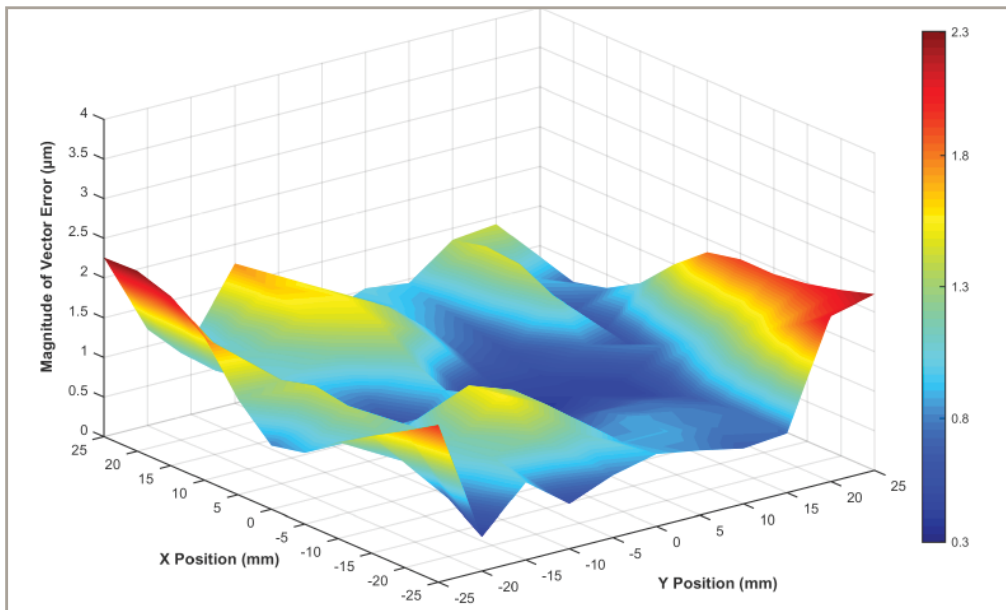
Notes:

1. Travels are mutually-exclusive. Consult our HexGen workspace simulator for detailed workspace sizing.
2. Measured with single-axis moves at a height of 50 mm above the moving platform. Results can be payload and workpoint dependent.
3. X, Y, Z performance certified as standard. X, Y, Z, A, B, C performance certified with ULTRA.
4. Requires the selection of an appropriate amplifier with sufficient voltage and current.
5. Centered loading – consult load curves.
6. Horizontal base plate, centered loading – consult load curves.

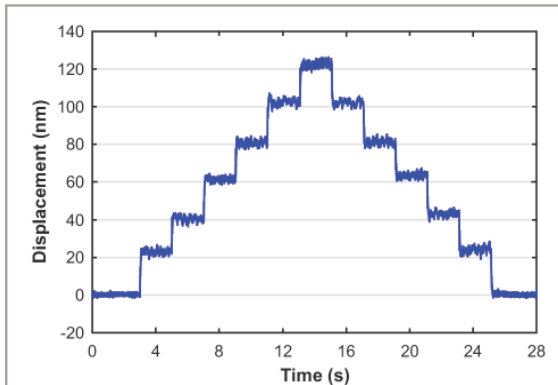
Electrical Specifications	
Drive System	Precision Ball Screw, Brushless Servomotor
Feedback	Noncontact Encoder – Incremental and Absolute Options
Maximum Bus Voltage	80 VDC
Limit Switches	5 V, Normally-Closed (Located on Each Strut)

Recommended Controller		
Multi-Axis	Standard	HEX RC
	Optional	Npaq, Ndrive CP, Ndrive HLe

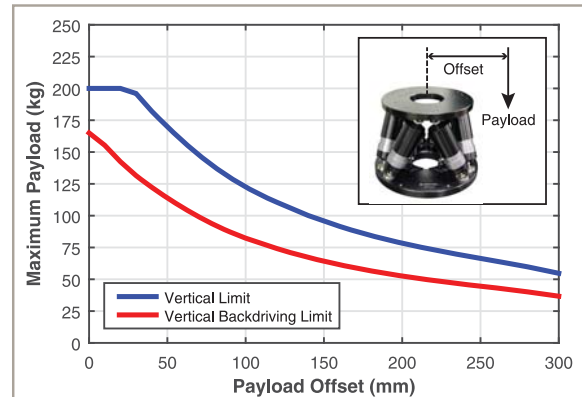
## HEX500-350HL SPECIFICATIONS



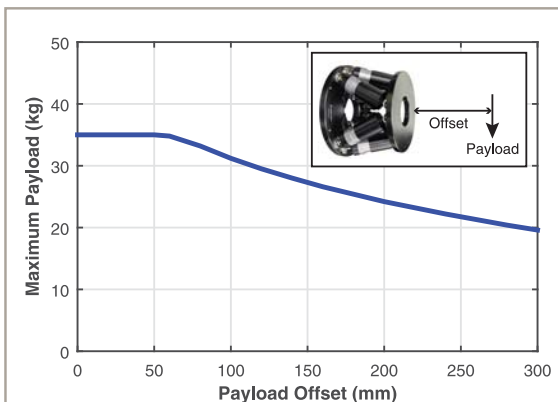
HEX500-350HL three-dimensional vector accuracy error measured when commanded to move in the XY plane at a Z position of 0 mm. The measurement was taken with three interferometers (X, Y, and Z directions) targeting a three-sided optic. The results show the outstanding three-dimensional accuracy capability of the HEX500-350HL.



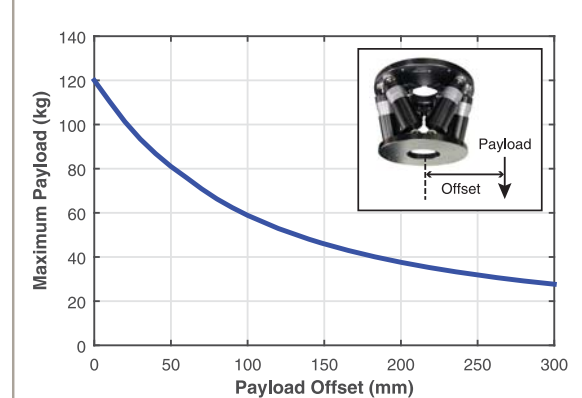
Minimum incremental step plot of the X-axis of the HEX500-350HL. All axes of the HEX500-350HL have industry-leading resolutions enabling higher-resolution processes.



HEX500-350HL vertical load capacity.

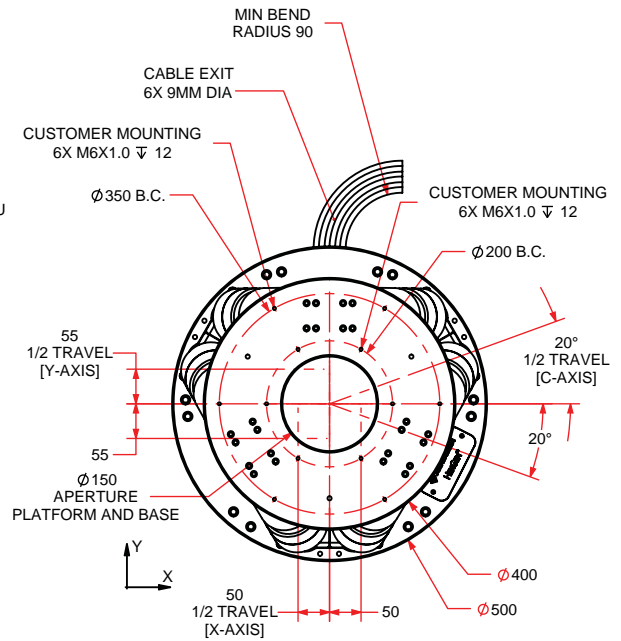
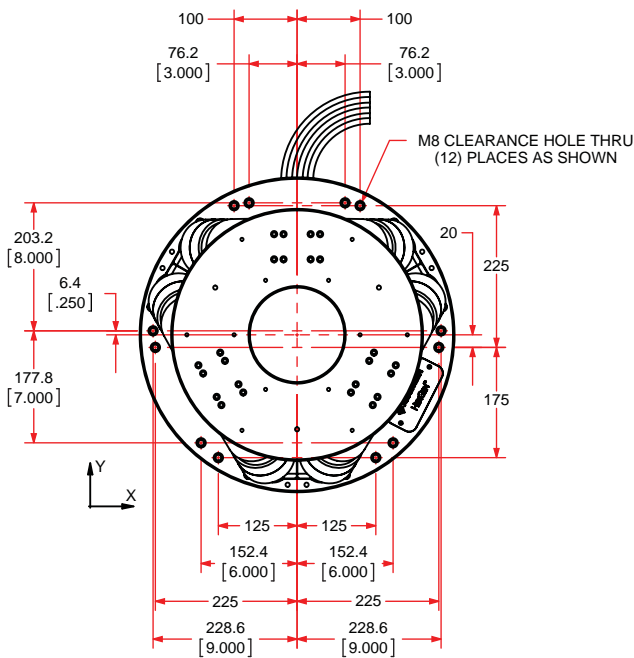
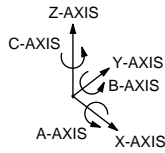
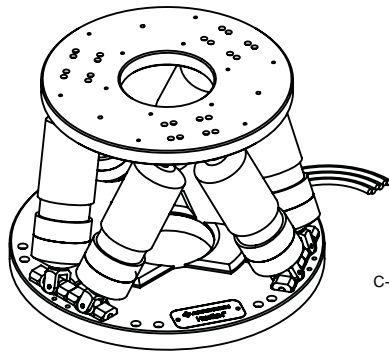


HEX500-350HL horizontal load capacity.

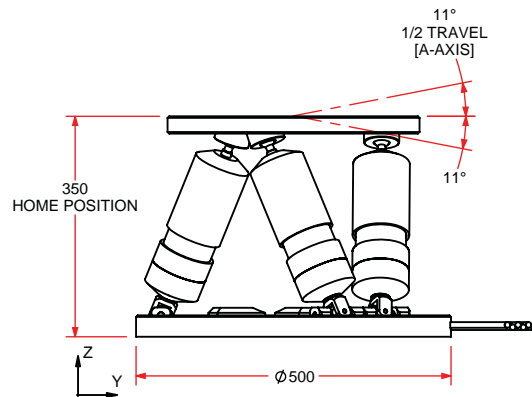
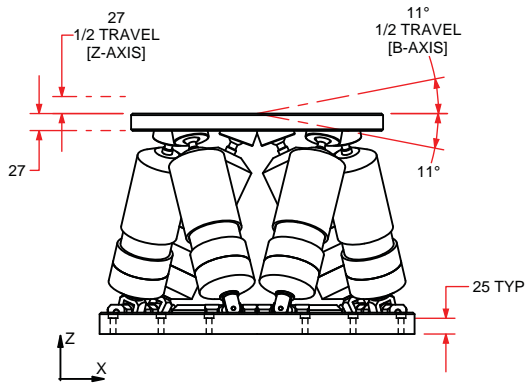


HEX500-350HL inverted load capacity.

# HEX500-350HL DIMENSIONS



NOTE: ALL TRAVELS SPECIFIED AS SINGLE-AXIS MOVES FROM HOME POSITION



DIMENSIONS: MILLIMETERS [INCHES]

## HEX500-350HL ORDERING INFORMATION

### HexGen™ HEX500-350HL Hexapod 6-DOF Positioning System

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HEX500-350HL Six degree-of-freedom hexapod positioning system; 500 mm diameter base; 350 mm height at mid-travel; high-load capacity version

#### Encoder (Required)

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-E1 Incremental encoder installed in each strut  
-E2 Absolute encoder installed in each strut

#### Performance (Optional)

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-PL4 ULTRA performance accuracy option