

HyBrYX XY Hybrid Air Bearing Stage



Newport's HyBrYX stages offer unique advantages and a robust feature set that includes:

- Excellent price-to-performance value for demanding industrial OEM applications
- Ideal choice for scanning applications requiring ultra-low velocity ripple and dynamic following error
- True single plane XY architecture with optional theta and Z-Tip-Tilt solutions
- Reliable, long-life operation well suited for high duty cycle environments
- Large (>1 meter) XY Travel range
- Scanning velocities up to 600mm/sec and 0.6G acceleration

The HyBrYX stages are ideal for a wide range of applications including:

- Wafer Inspection
- PCB Patterning
- Wafer Bump Inspection
- Automated Optical Inspection
- Array Checking
- Array Repair
- Color Filter Generation
- Edge Isolation
- Scribing
- Fiducial and Barcode Generation
- Wave Guide Direct Writing
- Optical Calibration

The all-new HyBrYX™ single plane XY hybrid stages are the latest addition to Newport's air bearing products offering the advantages of a single plane air bearing stage at a much lower cost than previously possible. HyBrYX is well suited for semiconductor wafer inspection systems as well as being an excellent choice for use in large substrate (flat panel display and photovoltaic panel) inspection and processing tools.

The unique hybrid architecture of HyBrYX® offers the following outstanding performance characteristics for demanding scanning applications:

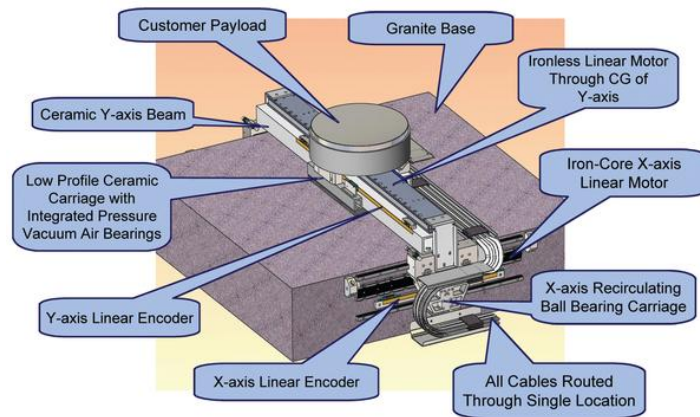
- Z-Jitter & dynamic straightness of less than $\pm 25\text{nm}$ during high speed motion
- Better than 0.1% velocity ripple
- Compact 1200mm by 765mm footprint with 650mm by 350mm travel range
- Long-life & high MTBF as air bearing is not limited by bearing travel/life- expectancy

Innovative Architecture

HyBrYX® stages blend the cost-effectiveness of mechanical bearings with the precision of a single plane air bearing carriage to deliver a powerful combination of throughput, precision and value. During motion, a ceramic carriage freely slides in X and Y on a precision lapped granite reference plane using a proprietary pressure-vacuum air bearing design. This XY carriage is pressure-vacuum preloaded to, and guided along the Y-axis by a rigid and lightweight ceramic beam. The beam is supported (and guided) at each end by recirculating ball bearing carriages resulting in a low-profile design that is extremely rigid, well-damped, and capable of quick & precise point-to-point moves and exceptional high-speed scanning performance. For large payloads, such as Generation-5 LCD display or Photovoltaic panels, the HyBrYX-G5 offers an oversized carriage with higher air bearing load capacity on both the horizontal and vertical reference surfaces.

Performance without Compromise

HybrYX was developed to overcome the disadvantages found in conventional "stacked" XY stage systems. Truck-and-rail based stages have limited performance capabilities, long-travel crossed roller bearing designs are hindered by large footprints and may not have adequate life-time or MTBF characteristics, and a (pure) dual axis air bearing is often cost prohibitive.



Design Details	HybrYX
Stage Architecture	Single Plane XY Air Bearing / Mechanical Bearing Hybrid
Material	Ceramic (SiC), Granite
Drive Mechanism	Brushless linear servo motor (Y-axis Ironless, X-axis Iron-core)
Position Feedback	Non-contact optical linear encoders - Standard: Heidenhain LIDA, steel scale with 20 μm signal period - Optional: Heidenhain LIF, glass scale with 4 μm signal period - Optional: Renishaw Signum, Invar scale with 20 μm signal period
Bearings	Pressure-Vacuum Air Bearing (XY Carriage and Y-travel), Recirculating ball-bearing (X-travel)
Cable Management	Fully integrated, clean-room compatible, single point exit/entry, minimal external force
General Specifications	
Travel Range (standard)	350 mm X-axis 650 mm Y-axis
Footprint (without bridge pillars)	1200 mm x 765 mm x 375 mm
Rated Payload (maintains dynamic specifications)	14 kg
Maximum Load Capacity	20 kg
Maximum Velocity (rated payload)	300 mm/sec X-axis (stepping) 600 mm/sec Y-axis (scanning)
Peak Acceleration (rated payload)	0.3 G X-axis 0.6 G Y-axis
RMS Acceleration (rated payload)	0.15 G X-axis 0.2 G Y-axis
Granite Base Thickness	250 mm
Total Weight	750 kg
Stiffness, First Natural Frequency	150 Hz
MTBF	20,000 hrs.
Performance Specifications	
Pitch, Yaw, Roll (300 mm by 600 mm travel)	<15 μrad
Y-axis Straightness (300 mm line)	0.6 μm TIR
Y-axis Straightness (25 mm line)	0.1 μm TIR
Noise on Y-axis Straightness (sampled at >5 Hz.)	± 25 nm
XY Flatness (300mm circle)	0.6 μm TIR
Y-axis Position Accuracy over 25 mm	± 250 nm with 20 μm LIDA scale ± 50 nm with 4 μm LIF scale
Accuracy in XY (with linear and perpendicularity error compensation)	$\pm 1,5$ μm over 300 x 600 mm with 20 μm LIDA scale ± 1.0 μm over 300 x 600 mm with 4 μm LIF scale
Noise on XY Flatness (sampled at > 5Hz)	± 20 nm
XY Orthogonality	< 10 μrad
Y-axis Speed Stability (velocity ripple sampled at 2kHz and 400mm/sec)	0.1%
Step-and-Settle Times (using ND40 Passive Isolators)	Settling into ± 100 nm window Note: Addition of Reaction Force Compensation System allows same step-and-settle times into ± 40 nm window
300 mm step	< 1300 msec X-axis < 750 msec Y-axis
100 mm step	< 650 msec X-axis < 360 msec Y-axis
25 mm step	< 350 msec X-axis < 350 msec X-axis
Ideal Interpolated Encoder Resolution	2 nm