

DynamYX GT high-Throughput Stage

The DynamYX® GT stage is intended for high-throughput applications with aggressive duty-cycles. Featuring an extremely rigid structure and high load capacity air bearings, it provides up to 2G acceleration. The DynamYX GT also has high-efficiency X and Y linear motors with integrated cooling drive moving masses through respective center of gravity locations. It is also available with Newport's patented ZT3, Z-Tip-Tilt-Theta stage

DynamYX® Family of Air-bearing Stages

With the launch of the 300mm wafer initiative more than a decade ago, DynamYX was designed to provide equipment manufacturers in the semiconductor industry with a tool capable of achieving the highest levels of precision and throughput. DynamYX provides high resolution dynamic positioning of a wafer chuck or other similar substrate in two orthogonal translation axes from a single-plane carriage. A Vertical (Z) axis with Tip Tilt function and a rotary axis for wafer offset correction may be added on the carriage beneath the wafer chuck. Over the years, the form and function of DynamYX has evolved to keep pace with customer requirements. Today The DynamYX family consists of four specific designs each with their own specific features and benefits.

Position Feedback

The positioning loop on DynamYX may be closed using a single linear encoder for each axis. As shown in the adjacent illustration, the encoder measuring positions are closely located to the substrate's surface reducing the already minimal abbey offset affect. For the X-axis, the linear scale is typically mounted to the underside of the bridge structure with the read-head in-line with the system's optical path and affixed to the moving ceramic guide. System architectures that do not allow this configuration can be accommodated by mounting the X-axis scale to a supplementary SiC spar located at the rear side of the system. The Y-axis has its scale mounted to a small SiC bracket on the moving carriage. The read head is fixed to the arm of the L-shape structure.

Read-heads which have fixed positions relative to the tool's optical path are beneficial in optimizing precision. With an encoder signal period of 2mm, resolutions down to 0.1nm are possible with Newport's XPS or SPS controllers each with internal 20,000 times interpolation. Equipped with linear encoders the DynamYX is an extremely accurate and very repeatable platform allowing for very high accuracy through error mapping. The geometric stability of the ceramic elements of these stages results in systems that can be mapped once at our factory then, upon installation, only require a simple length calibration to compensate for uniform thermal expansion. For applications where the accuracy requirements exceed the capabilities of error compensation, or in certain scanning modes where the absolute position of the stage must be the basis of a very precise trigger or latch, linear encoders must yield to laser interferometers which are also part of our offering.

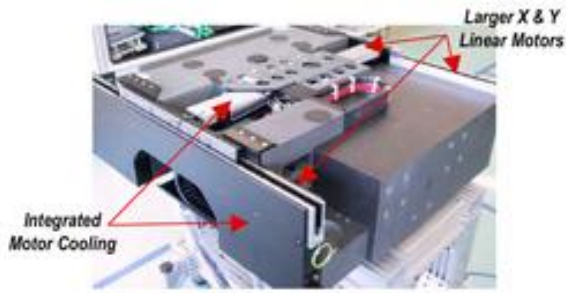
Chuck Interface

The standard mounting interface includes three precision-lapped pads for the direct mounting of a wafer chuck. In the DynamYX 300 and GT stages, these three pads are only 66mm above the granite reference plane maintaining the low-profile nature of the stage. Even with the addition of other accessory components such as a 4-axis Z-Tip-Tilt-Theta stage the height of the wafer plane in the DynamYX GT stage is only 115mm above the granite reference surface. The low profile nature of DynamYX contributes to the system's overall dynamic performance and attenuates the already minimal abbe offset effect of pitch and roll. If Newport is to supply the wafer chuck, the chuck (ideally ceramic), including vacuum lines to the chuck, and wafer lift pins may be supplied as an integrated solution.

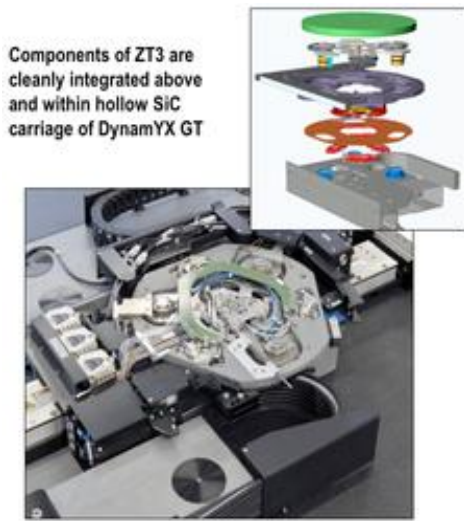
Linear Motor Drives

The original DynamYX 300 and DynamYX RS "Reticle Stage" tables are driven by only two Ironless linear motors; one in the X-axis and one for the Y-axis. The rating of each motor is carefully considered based on the intended duty cycle/throughput requirements as to minimize the power dissipation of the system. For even higher throughput requirements, the DynamYX GT and all-new DynamYX Datum incorporate a second X axis linear motor which is driven in open loop mode. Unlike H-bridge air bearing designs which rely on a synchronized servo loop for positioning and stiffness, the monolithic ceramic guide found in all four designs defines the positioning reference and overall stiffness of the positioning elements. Controlling any of the four DynamYX stages is very much like controlling a conventional XY stack with one control signal for X and one for Y. For the GT and Datum stages, a single X-axis control signal is split and fed into two amplifier channels where the output force is biased according to the linear motor ratings and total payload.

Most linear motors on the market were designed without focusing on the real needs of precision motion control applications where mass limits and efficiency are most critical. Newport air bearing stages benefit from our commitment to providing the highest possible performance by incorporating motors developed in-house that are optimized for the products and applications they address. Newport's linear motors have outstanding performance in the areas heat dissipation, time constant, force ripple, and structural integrity. From an efficiency standpoint, the performance of our motors is measured as the steepness per given motor volume where steepness is defined as the heat dissipated by a motor when delivering a given force (F^2/W) and volume is simply the motor cross-section multiplied by the coil length. In situations where the rms acceleration values are extremely high and any heat loss is a problem, our motors feature sealed-forced air or recirculating water methods of cooling.



Compared to the DynamYX 300 stage, the GT version has larger linear motors with integrated cooling in X & Y, a second (X2) linear motor, and more rigid structure with larger air bearings for increased load capacity



Components of ZT3 are cleanly integrated above and within hollow SiC carriage of DynamYX GT

Newport's Patented ZT3 with Active Plane Drive Technology provides high-bandwidth, repeatable, and stable positioning for active wafer surface tracking applications. The compact design includes an air bearing theta off-set stage which clamps for ultimate stability

- * High resolution linear encoders directly measure movement of all four axes
- * Travel range: 4mm Z, ± 0.5 mrad tip/tilt, 5° theta Z

General Specifications	
Travel Range (standard, encoder or interferometer)	380 mm X-axis 350 mm Y-axis
Travel Range (maximum, encoder)	520 mm X-axis 350 mm Y-axis
Footprint (without bridge pillars, standard travel)	1040 mm x 918 mm
Rated Payload (maintains dynamic specifications)	6 kg
Maximum Load Capacity	30 kg
Maximum Velocity (rated payload)	800 mm/sec X-axis 500 mm/sec Y-axis
Peak Acceleration (rated payload)	1.2 G X-axis 2.0 G X-axis
RMS Acceleration (rated payload)	0.8 G X-axis 1.1 G X-axis
Granite Base Thickness (standard travel)	300 mm
Total Weight	590 kg
Stiffness, First Natural Frequency (rated payload)	250 Hz
MTBF	20,000 hrs.