



## ALIO Trademark Details

### True Nano Positioning® and True Nano®

Background: Nano has become the new focus and buzz in the motion and manufacturing segments for maybe 5 years or less. Most stage companies in the past 3 to 5 years are claiming “nano” as a form of marketing on stage products. ALIO has focused in building nano precision stages for 12 years and we felt it necessary to protect our long term IP and commitment with trademarks. Companies offer nanometer resolution or large nano errors with uni-directional planar numbers which are actually microns on true stage performance. Resolution means absolutely nothing in the True Nano® world.

Definition: Real positioning performance at the nanometer level based on fully documented NIST traceable proof of performance to registered standards.

### 6-D Nano Precision®

Background: ALIO designs, builds and tests stages in all 6 degrees of freedom. We believe a nano precision stage must have most importantly straightness and flatness precise that is sub-micron as well. Many applications have failed and ALIO has lost business due to other motion companies touting nano repeatability and accuracy (which are a planar numbers) knowing the customer application needs ALIO’s straightness and flatness to succeed. Customers’ assumptions of nano precision are mostly based on 2 D planar precision without focus on 6-D. ALIO wanted to define a term that represented the higher levels of our products and set us apart thus leveling the sales field of data sheet hype and true precision NIST traceable results

Definition: 6-D refers to the 6 dimensions of motion; linear, straightness, flatness, pitch, yaw and roll. Nano Precision refers to documented proof of performance at or below the +/- 450 nm level. 6-D Nano Precision® means the documented proof of performance over all 6 degrees of freedom of a body in motion at the nanometer level of precision.

### 6-D Point Precision® or Point Precision®

Background: This trademark is an extension of True and 6-D and references performance specifications to a point in space, not the planar methodology current standards use. Point precision or path precision of the stage motion is the strength of ALIO’s metrology and laser processing markets. We continue to replace legacy stages in these applications and integrate into novel new products utilizing improved and novel metrology sensors and fiber laser which outperform the legacy motion systems of others. ALIO’s focus on nano



precision position of stages at a point in space is the basis of the new NIST standard for measuring motion system. Nathan Brown from ALIO is championing the development of this new NIST/ISO standard per the ALIO methodology. This new standard and ALIO's long term focus on nano precision motion systems plus our trademark's strongly position ALIO for all future ultra-precision or nano precision motion systems.

Definition: Point Precision<sup>®</sup> and 6-D Point Precision<sup>®</sup> both define bi-directional repeatability of all 6 degrees of freedom (linear, straightness, flatness, pitch, yaw and roll) to a single point of precision in space for a single motion stage or in ALIO's case we push this singular stage approach even further with our monolithic XY stages which have combined 6-D point precision at the nanometer precision level of the both axes combined.

### Nano Metrology<sup>®</sup>

Background: The evolution and new novel designs of metrology sensors have created a need for better stages to move the sample or sensor. Many years ago ALIO successfully delivered a standard XY monolithic stage to Phillips after they determined that the 5 stages from Europe they test all could not move the razor heads precisely for measurement with a standard Precitec white light laser interferometer. ALIO was quick to market this new knowledge to metrology OEM's but this novel idea of nanometer precision of straightness of travel confused all and still does for some OEM's. After a couple years of not getting any metrology companies to understand our approach to reducing their uncertainty of measurement we had planned on beginning our own metrology division just when we finally got traction and now we have several metrology OEM's using our XY monolithic and more to come!

Definition: The ability to measure at the nanometer level of uncertainty which include motion and sensor combined error quotient.

### Nano Z<sup>®</sup>

Background: Years ago ALIO focused time on Tier One semiconductor companies thus we developed the patent pending planar XY air bearing and the patented air bearing Z stage for wafer manufacturing and metrology. This patented Z lift stage is ideal for a wafer chuck on top with vacuum and electrical up the center opening. This design was so novel that we trademarked its name and with patent protection we are positioned for future Tier One semiconductor companies at 300 mm or 600 mm and beyond plus ultra precision Z motion in other applications

Definition: The ability to move in Z, vertical or lift a part with nanometer precision.



## Hybrid Hexapod ®

Background: Hexapods are legacy motion products originally designed for amusement park rides and then flight simulators. During the years of the Micron Age of manufacturing precision Hexapods frequently were used where 5 or 6 axes were needed reducing stacked stage footprint and most times stacked stage error quotients.

ALIO holds 2 US patents for piezo driven Hexapods and Tripods that have forward and inverse kinematics equations thus making them an order of magnitude more precise than all other legacy designs made in the world. ALIO has spent years improving our precision but our best flatness and straightness of travel is still in the tens of microns per axis due to the laws of physics. As we transition into the Nano Age, Hexapods will become rare and may become obsolete.

Since our beginning in 2001, ALIO has marketed our Tripod product with varied success. Recently, the precision of the XY monolithic stages have allowed us to integrate the linear motor Tripod with these stages for what we term a Hybrid Hexapod. The Hybrid is easily winning sales with our patent pending linear motor design that is available from coffee cup size to meters tall carrying hundreds of kilograms of payload in atmosphere or HV vacuum all with 6-D nanometer precision especially with flatness and straightness which are the Nano Age's critical precision needs.

Definition: Hybrid refers to a new and sometimes novel approach of combining two platforms that improve the performance of each design as a whole. Hexapods have been known for years as a 6 axis parallel kinematic structure. The ALIO Hybrid planar and point precision is 2 orders of magnitude more precise than all Hexapods built today or tomorrow simple deducted from basic physics of motion and the error quotient.