Motion Control
Solutions for Laser Processing

Precision Motion – Guaranteed™

Newport

Experience | Solutions
Our Promise

At Newport, we are dedicated to continuously evolving our knowledge and experience in order to deliver innovative products and expertise that advance our customer’s technologies.

Company Overview

Established in 1969, Newport has over 40 years of industry knowledge and expertise across a broad range of technologies allowing the company to continually deliver innovative products in the areas of lasers, photonics instrumentation, vibration isolation, optical components and subsystems and precision automation to enhance the capabilities and productivity of its customer’s manufacturing, engineering and research applications.

In Addition, Newport has built a strong history of partnering with OEM customers delivering solutions from sub assemblies to full solutions including design, testing and manufacturing.

Understanding the specific needs of customers, Newport recognized the need for integrated expertise and solutions. Today, Newport manufactures a vast array of advanced technology products and includes industry leading brands such as Spectra-Physics®, New Focus™, Oriel® Instruments and Richardson Gratings™.

Motion Division

With 50 years of precision mechanical design, fabrication and application specific motion control experience and expertise, Newport has developed an extensive catalog of motorized positioning products. The underlying technology behind Newport Motion is multi-faceted drawing on a technological innovation and evolution in design, materials, manufacturing and metrology. Newport Motion can be found at the most prestigious research centers and leading high tech commercial centers. Newport is drawing on this expertise to introduce products and control algorithms specifically aimed at the challenges of precision laser machining and novel microfabrication.
Laser Machining - Markets

Laser processed materials go into numerous end markets from the automotive industry to medical device manufacturing. The applications need of the tools that make precision parts rely on technical information that encompasses lasers, optics and motion as well as process expertise.

Market Solutions

Newport is investing in innovative solutions for the laser processing market. Our aim is to provide the competitive edge to our customers and tools built on Newport Motion. Integrating ACS controllers improve performance in key criteria specific to laser processing while offering enhanced efficiency and throughput.

Newport also understands that competitiveness comes from short lead time and price competitiveness. This is why standard product lead-times are targeted at 4 weeks. We are also designing in the key performance that matters most.

The goal is simple: tools built more easily, programmed more quickly and last longer with unparalleled performance.

Configured for Preferred Control Solution

The software development that accompanies the adoption of a motion control solution often requires a significant investment in time and resources. This however also puts the customer in a precarious position with too much reliance on a single vendor. This means greater business risk and artificial limitations on capability. This can also lead to extended lead times with high pricing. Newport understands the importance of having options, even when software has already been developed.

To accommodate customers with existing software based on a specific controller, Newport can completely configure stages for out-of-the-box operation with your preferred control solution. This will require little to no adaptation of existing software or change to control or drive electronics. Stages will be optimized to the application demands. With Newport, performance is guaranteed.

For many laser processing applications, the most powerful solutions in capability and cost can be found with Newport/ACS based systems. Newport can provide a complete application optimized system with both technical advantages and competitive pricing. For customers with an interest in having a complete tool conversion, Newport offers software consulting.
Laser Processing Applications

Laser Additive Manufacturing (LAM) spans a wide range of techniques from conventional 3D Printing such as Sintering to more novel high resolution approaches as Direct Ink Writing /Robocasting or Two Photon-Polymerization. The broad scope nature of LAM draws on a wide range of motion tools with various demands.

Ablation

Laser Ablation broadly describes material removal from an irradiated area. Ablation as a precision manufacturing process performed at the micron-scale comes with challenges typical to resolving fine features with critical dosing requirements. Motion systems for ablation applications have varied performance requirements depending on the required level of precision.

Ultrafast Micromachining

A growing area of intense interest is ultrafast micromachining. The use of femtosecond lasers to ablate structures with little to no thermal distortion or damage (Heat Affected Zone, HAZ) is proving a powerful tool for laser structuring at fine scales in many types of materials. These systems tend to use fine focusing and require flatness as well as velocity stability with precise position based laser control.

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Lithography

Laser Lithography and other exposure techniques with photosensitive materials and post-processing can provide sub-micron feature sizes that offer excellent CD uniformity. The material response to laser wavelength/power can be highly non-linear and typically relies on precise dose control. Taking material considerations into account along with fine feature sizes, motions systems must provide good planarity for focusing or active tracking systems. Velocity stability during scanning is of key importance.
Laser Processing Applications

Cutting
Laser cutting is a common process for numerous materials, including Steel, Aluminum, Glass, Ceramics, and Plastics. Small focal diameters enable narrow kerf widths and high precision cuts with minimal thermal material distortion. Motion systems must execute complex trajectories quickly while maintaining fixed focus over the work piece.

Scribing
Laser Scribing is taking an increasingly important role for wafer singulation as wafer die package sizes grow denser and wafers become thinner, the careful control of thermal distortion around wafer streets as well as mechanical stress is important. Scribing motion systems have excellent straightness and flatness characteristics with excellent velocity stability while delivering high-throughput.

Drilling
Laser drilled holes with tight tolerances can be accomplished at the micron scale with good aspect ratios and minimal thermal material distortion/Heat Affected Zone (HAZ). Common methods of drilling include trepanning and percussion. Laser drilling requires high dynamic responsiveness, excellent accuracy, and repeatability. Multi-axis systems are common with integrated rotation stages / galvos.

Welding
Precise control of laser power and location allow laser welding at fine scales to far exceed capability of conventional welding techniques. Important aspects of welding include thermal material distortion related to the heat affected zone and maintaining the weld path with high-throughput. Motion systems must accommodate dynamic direction changes with fast-responses, minimized settling times and clean velocity stability characteristics.

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Ultra-Performance Trajectory Based Laser Triggering

ACS has developed an optimized methodology for position synchronized laser triggering with zero latency and 4 MHz pulse output rate. This capability allows spatial pulse separation at the sub-nm scale when operating at speeds of m/s in two or more axes. The encoder count resolution is also no longer a constraint and latency between position reporting and laser triggering is effectively reduced to zero with absolute consistency. The practical result is that laser trigger positions are more accurate and machined structures true to design at very fine scales.

A Higher Level of Motion Control Performance for Laser Processing

ACS has focused intensely and solely on advanced motion control. This intense focus and expertise has been the source of unparalleled technological development in control algorithms, electronics and laser interfacing. This foundation is now being enhanced by collaboration with Newport. Newport is working with ACS to provide the best control electronics, algorithms and mechanics combined for laser processing and novel micro/nanofabrication systems. In Addition, Newport has built a strong history of partnering with OEM customers delivering solutions from sub assemblies to full solutions including design, testing and manufacturing.

Laser Synchronization with Motion
- Advanced Trajectory Based Laser Triggering
- Analog Laser Power Control
- Trajectory optimization algorithms
- G-Code Library
- Dedicated Real-Time PC Based Controllers
- Unlimited Analog and Digital I/Os
- EtherCAT interface for real-time hardware networks
- Excellent Multi-Axis Performance with Fast Servo Rate of 20KHz
- Universal Drive Modules for almost any motor type

Proprietary Technology Features
- Throughput/Performance Enhancing Algorithms
- Synchronized Autofocus module
- ServoBoost™
- NanoPWM™

Benefits of ACS Partnership

ACS Motion Control is a global company providing high performance machine control systems for advanced motion applications. With cutting edge proprietary technology ACS performance is unmatched in laser processing applications.
Newport Product Overview

For 50 years, Newport’s motion team has been developing high precision custom/OEM systems for research, industrial and aerospace customers and providing solutions from system design through manufacture to on-site installation.

IDL Series

- Industrial grade design and performance
- Non-contact, high-efficiency linear motor and high-accuracy encoder

XM Series

- Ultra-high Performance with Minimum Incremental Motion of 1 nm
- Extra-large, ironless, high-efficiency linear motor minimizes heat generation

ONE-XY Series

- Integrated design
- High flatness and straightness performance
- High stiffness

IMS - LM Series

- Stiff body design allows for rigid XY assemblies
- Single axis or gantry configuration up to 1200 mm travel
- Recirculating bearings with caged balls assure ultra-quiet motion

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IDL Series

The IDL Series is an ideal multi-purpose industrial laser processing stage. Designed and engineered for high-throughput, industrially protected, high-load capacity, micron-scale flatness and straightness and dynamic responsiveness with excellent velocity stability. The frictionless non-wear design and robust protection features are ideal for extended operation in industrial environments with heavy duty cycles.

Enhanced Performance

IDL stages have been designed to excel at key performance criteria specific to industrial laser processing.

- Travel ranges from 100 mm to 1.2 m
- Payload Capacity to 150 kg
- Max Speed of 2 m/s
- Micron-scale straightness/flatness
- Micron-scale accuracy
XM Series

Newport ultra-performance XM stages excel at micro/nanofabrication applications that require tight tolerances at the nanometer scale. XM stages provide proven performance in multiple laser processing applications yielding excellent results.

The XM Series is an ideal micro / nanofabrication stage used in a wide range of applications including: lithography, mask based ablation, ultrafast micromachining, robocasting / DIW, Laser Additive Manufacturing, and many other applications with critical flatness, dosing, CD uniformity and Accuracy requirements. XM stages have demonstrated exceptional results with features as small as 90 nm. Configurable and aligned with optimal orthogonality, XM stages can be assembled in XY and XYZ stacks with integrated granite structures. With a frictionless direct drive system, XM stages are wear free and provide long-term performance.

Critical Geometries at sub-micron scale

XM stages incorporate all the design elements and manufacturing tolerances to produce high quality features at 90 nm. A thermally decoupled ironless linear motor with highly compliant T-shaped carriage and precision machined, matched crossed roller bearings guarantee smooth motion with zero cogging or velocity ripple. Constant velocity performance is often critical as slower dwell times over ablated/exposed materials will impact CD Uniformity producing non-uniform features with line width uniformity.

• Travel ranges from 50 mm to 350 mm
• Velocity Stability of <0.1%
• Accuracy to nanometers
ONE-XY Series

Newport’s ONE-XY integrated XY stages feature low profile monolithic construction. An elegant, but simple precision machined three-plate design minimizes the number of components, enhancing stiffness and providing excellent planarity, important for focusing optics. Featuring precision guides with crossed roller bearings and tightly machined tolerances. ONE-XY stages can achieve flatness of ± 1 micron over 150 mm of travel, ideal for laser micromachining applications. Micron-scale straightness with nanometer scale repeatability also means that laser machined structures are true to design in shape, placement and size.

The low profile design also reduces Abbe error from angular deviations improving the consistency and repeatability of laser machined structures. An open frame can allow the user to process or inspect the substrate from below or above at the same time. Integrated XY stages are ideal for micron-scale processing over substrate sizes ranging from 50 mm to 450 mm.

- Low Profile Monolithic Design
- Exceptional Flatness for focusing optics
- Exceptional Straightness for correct feature shape, placement and size
- High Efficiency Ironless Linear Motors provide dynamic performance
- Engineered for micron and sub-micron fabrication metrology
IMS - LM Series

IMS-LM stages are ideal for cost-effective laser processing of light substrates with critical tolerances measured in microns. Highly dynamic with efficient ironcore linear motor, IMS-LM provides high-throughput with high-speed and acceleration.

IMS - LM Series

Newport IMS-LM stages are high-precision, dynamic and cost-effective solutions to laser processing applications with light/small loads and critical tolerances at the micron-scale. IMS-LM stages feature high-power, efficient linear motors with outstanding dynamic responsiveness in a compact form factor. The non-contact direct drive system is also ideal for robust reliable operation in heavy duty cycle environments. IMS-LM stages are ideal for scanning, providing velocity stability of less than 0.5%. This guarantees laser intensity variation from motion is minimized, providing uniform dosing and excellent structure uniformity.

A high resolution linear encoder provides accurate positioning with sub-micron repeatability and micron-scale accuracy. IMS-LM stages can be stacked and precision aligned in an XY configuration or built with integrated structures in a gantry. Sealed construction is available as an option with integrated carbon fiber sidebands.

- Robust Non-Contact Direct Drive System
- Micron accuracy with sub-micron repeatability
- High Throughput, Speed and Acceleration
- Optional Sealed/Industrially protected design
- Popular configurations available with 1-2 week leadtime

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Newport has an extensive catalogue of rotation and vertical stages ideal for use in combination with the motorized XY Tables also offers low-profile vertical stages for direct integration in an XYZ stack.

**Vertical Stages**
- Multiple Designs ideal for a wide range of laser processing applications
- Designs ideal for fine focus adjustments important to micron/sub-micron fabrication

**Rotation Stages**
- Extensive catalogue of rotation stages ideal for laser machining of curved substrates
- Differentiated engineering with optimized wobble/radial runout characteristics

**Air Bearing Stages**
- Unmatched world-leading dynamic performance
- Tightly integrated 6-DOF compensated systems with proprietary technology features
- Ceramics Engineering Expertise with optimized stiff/light structures

**Custom/OEM Motion Systems**
- Applications specific turnkey motion systems with integrated VC structures/platforms
- Advanced Laser Processing Features (high performance trajectory laser triggering with analog power control, etc...)
Newport’s Laser μFAB™

This tool combines the flexibility and accessibility of a typical research grade experimental setup with the stability, reliability, and ease of operation of a fully developed industrial fabrication system.

The Laser μFAB can be integrated with various types of lasers giving the user the capability to machine virtually any dielectric, conductive, and ceramic materials. With the aid of software written specifically to meet the requirements of laser micromachining, two- and three-dimensional microstructures can easily be patterned. Newport’s Laser μFAB is the ideal solution for the most advanced research in materials science and device physics.

Applications

- Ablation of industrially relevant materials including metals, polymers, semiconductors, glasses, ceramics, and biological targets (laser milling, dicing, scribing and selective material removing)
- Surface micro- and nano-structuring (sensors and bio-inspired materials)
- Three-dimensional microfabrication by two-photon polymerization of photonics, microelectronics, and MEMS devices
- Volume writing of waveguides and microfluidics in dielectrics
- Nanosurgery for in vivo sub-cellular investigations in model organisms
Custom/OEM Systems

For over 50 years, Newport’s motion team has been developing high precision application specific custom/OEM motion systems for leading research facilities and industrial manufacturing centers. Newport custom motion systems leverage this expertise along with an extensive motion product catalogue to design and build applications optimized systems collaboratively with the customer.

Newport custom motion systems are available in three broad classes:

Technology Platforms

These systems take advantage of Newport differentiated technology and offer very specific performance enhancements. These systems are typically implemented when a standard product or control feature is not available in standard catalogue products.

Assemblies

Standard catalogue products are often assembled and precision aligned with external fixtures. These system level builds are possible with almost any motorized positioning product from Newport when designed within necessary tolerances.

Advanced Solutions

Advanced systems constitute complete multi-axis turn-key systems with software tools and application specific process steps developed in collaboration with the customer.

Newport Custom/OEM systems offer a unique single vendor structure for sourcing multiple components ideal for integrators or manufacturers. Working with the customer, Newport can design in the necessary vibration control, platforms, bridge structures, granite bases and laser mounts. Newport, as a laser supplier also offers a diverse selection of lasers from High Q, Spectra Physics, or V-Gen. Newport precision motion systems are however not constrained to these lasers suppliers and systems can be prepared to receive preferred laser source.
TAC Capabilities

The Newport Technology and Applications Center (TAC) located in Irvine, California offers a specialization in laser micro/nanofabrication and ultrafast technology. The TAC team works directly with external customers to verify specific processes as well as providing standard research level fabrication tools. TAC expertise is multifaceted with both materials and process knowledge ranging from ultrafast micromachining to two-photon polymerization.

The Precision Motion team works closely with TAC to optimize application-specific motion performance in research tools, while also verifying stage performance through dedicated process studies. This combined expertise guarantees that applications specific motion impact is well-understood and verified for precision laser processing to deliver unparalleled performance.

This collaboration extends to Newport customers who build and develop laser processing tools and other novel micro/nanofabrication systems. Newport will collaborate to provide precision motion systems optimally tuned to the customer’s application.

Service and Support

Newport offers a vast array of services to match our extensive product offering. Our product service and support is focused on minimal downtime for manufacturing, engineering and research applications. Standard services include factory authorized repairs and calibrations throughout the US, Asia, and Europe. We also offer Service contracts and Field Service worldwide to support customer demand on critical projects.

Our continued success in satisfying customer needs is through a multi-site knowledge base, rapid response and standardized processes that emphasize best performance at all-times. Newport continuously improves the skill levels of our service and repair staff, with technical support and field service engineers that ensure unsurpassed service and delivery.