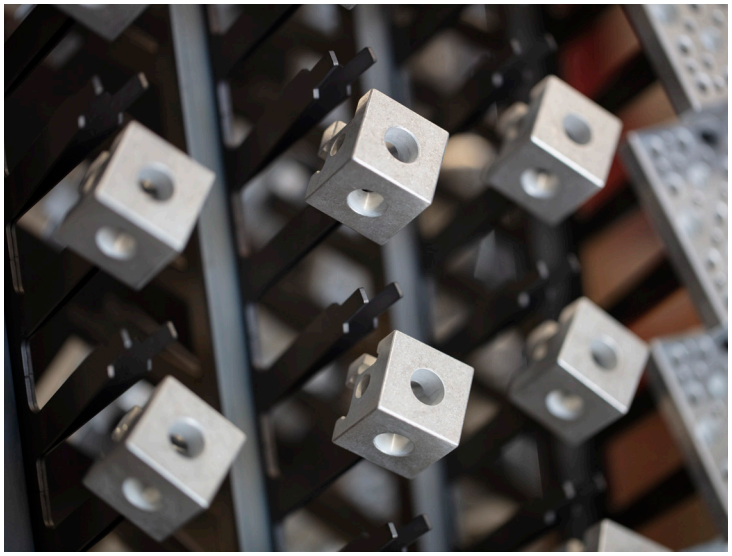
OEM Solutions



Your Concepts Realized

Through a combination of organic growth, acquisitions, and greenfield initiatives, Thorlabs has grown over its 30-year history to encompass one of the widest ranges of manufacturing capabilities in the photonics industry. For OEM customers, we are committed to leveraging our extensive manufacturing infrastructure to accelerate your production and reduce your time to market.

Thorlabs' ability to shape solutions to exact and demanding specifications extends across a comprehensive catalog of more than 22,000 products. Whether your need is volume quantities of an existing catalog item, a modified catalog item, or a tailored design, we invite you to contact us at techsales@thorlabs.com to discuss your needs.

THORLABS

Our OEM Team

Thorlabs is an experienced OEM supplier, having successfully partnered with a wide range of OEM customers with a diverse set of needs. Once you contact us regarding your OEM need via phone or email, we'll connect you with one of our OEM Sales Engineers, who will learn about your project's goal and scope. When you choose to partner with us, this Sales Engineer will serve as your Thorlabs liaison and select a Project Manager that specializes in your field.

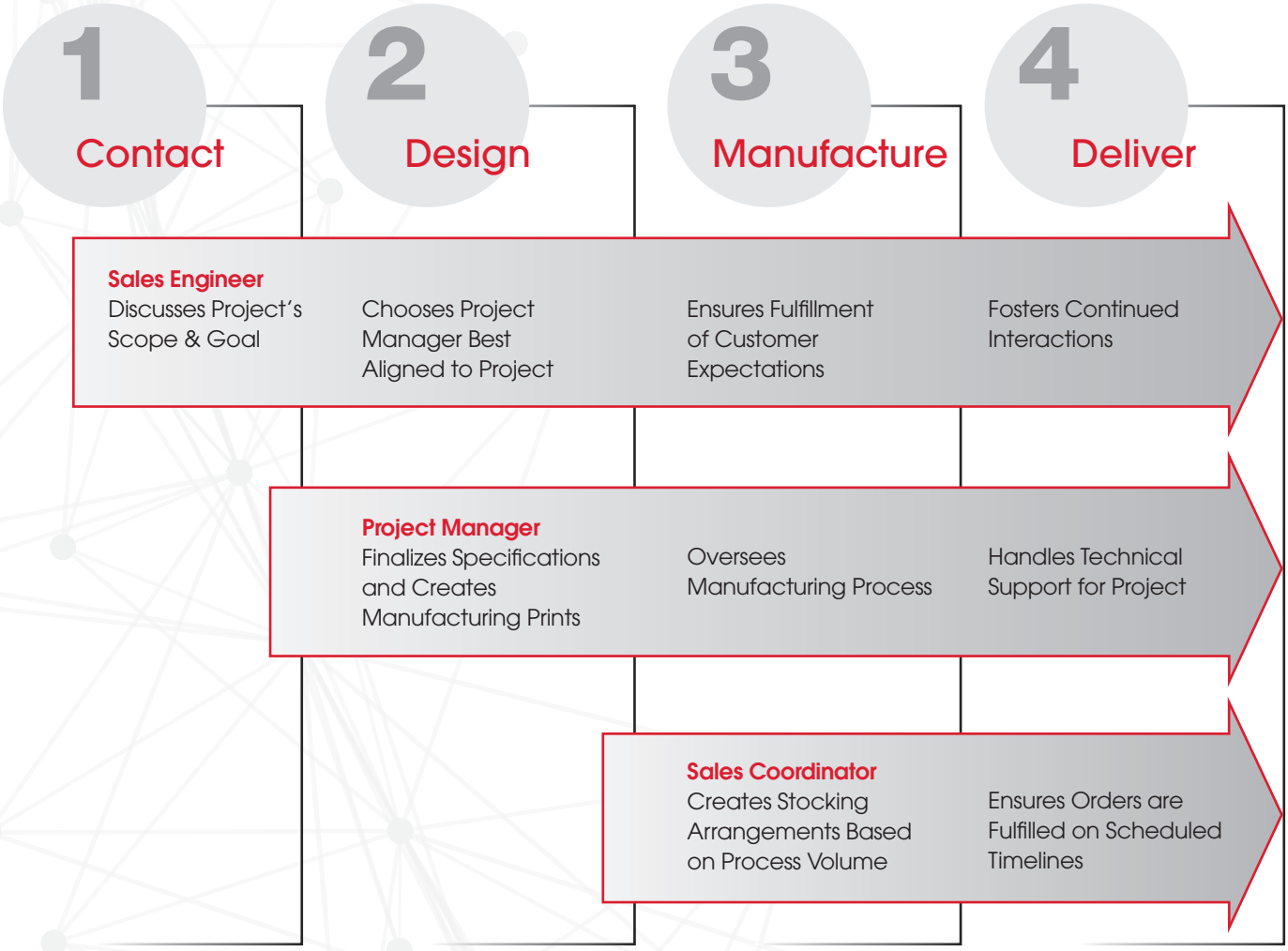
Your Project Manager serves as your single point of contact during the design and manufacturing process, helping to define the project's specifications and conformities, create documentation for production, and build prototypes. Your Project Manager will then work with our in-house manufacturing teams to design a process that will consistently deliver the volume of items necessary for your order at the times agreed upon. Next, a Sales Coordinator will work with you to finalize your sale. This includes preparing supply agreements such as Kanban and blanket orders.

Contact any member of the OEM team to discuss new projects, product modifications, or schedule changes. Designs and processes can be continuously improved to ensure your application is operating exactly as desired.

Our OEM Team at Our Newton, NJ OEM Call Center

Michael Mohammadi
VP of Sales and Business Development
mmohammadi@thorlabs.com

"We encounter unique and challenging projects across a variety of industries every day. The dynamic structure of our team allows us the flexibility to assign the appropriate resources to drive your projects to completion, enabling you to focus on your technology instead of your supply chain."



Design

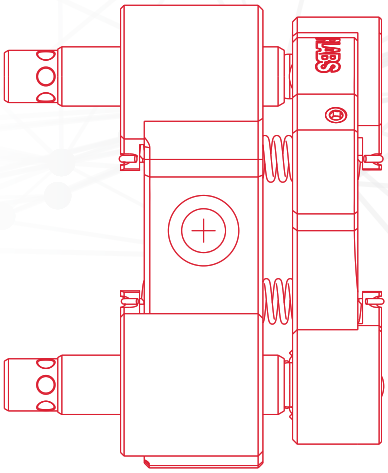
With our vast experience in designing photonics products, ranging from scientific cameras to thermally stable mirror mounts, we know that outstanding products start from well-considered designs. To ensure high quality, Thorlabs leverages its vertically integrated structure to create an environment with open, consistent communication between our engineers and technicians. This environment ensures that our designs meet your specifications and are easily manufacturable, ensuring that your OEM orders are ready on schedule.

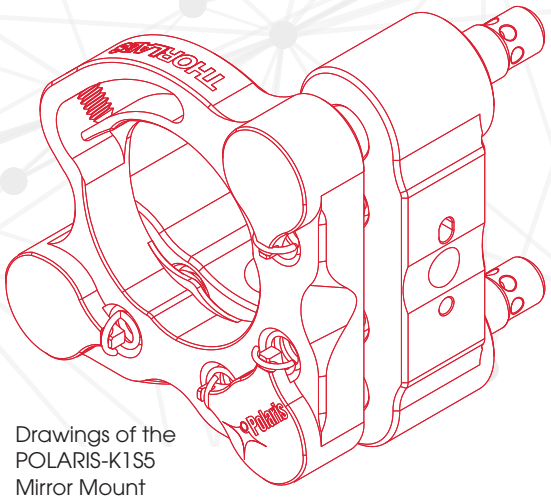
3D Printed Prototype of a Polaris® Mount

Product Highlight: Polaris® Mirror Mount

Our Polaris Mount is an exceptional example of how our existing designs can be used to create a unique product for you. Our catalog options include four different optic retention methods, six types of adjusters, and support for mirror sizes from ½" to 6". Using our existing designs as a starting point, we can easily customize any Polaris mirror mount, or any other product in our catalog, to meet your OEM needs.

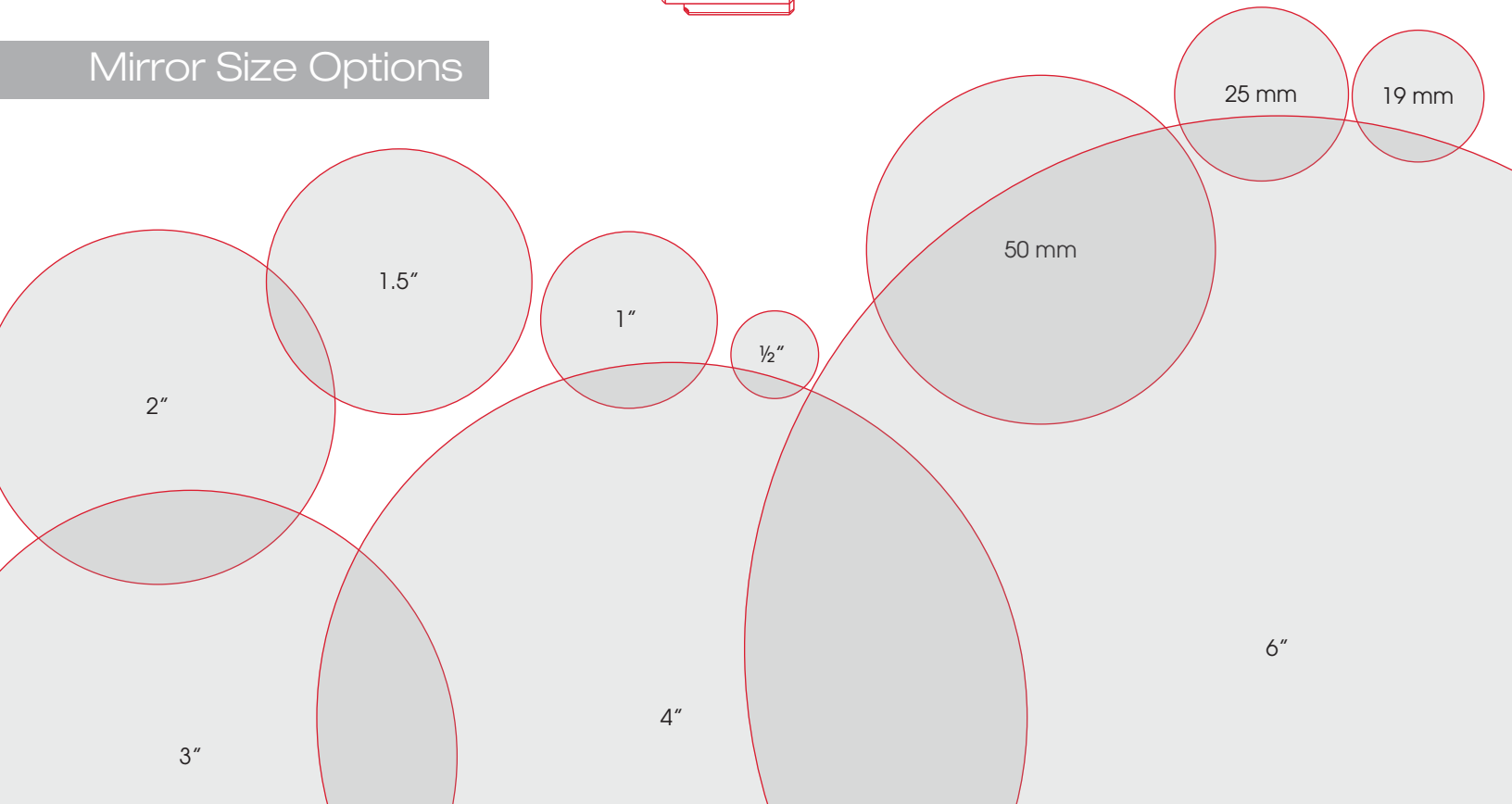
Adjuster Options





Drawings of the POLARIS-K1S5 Mirror Mount

Mirror Size Options



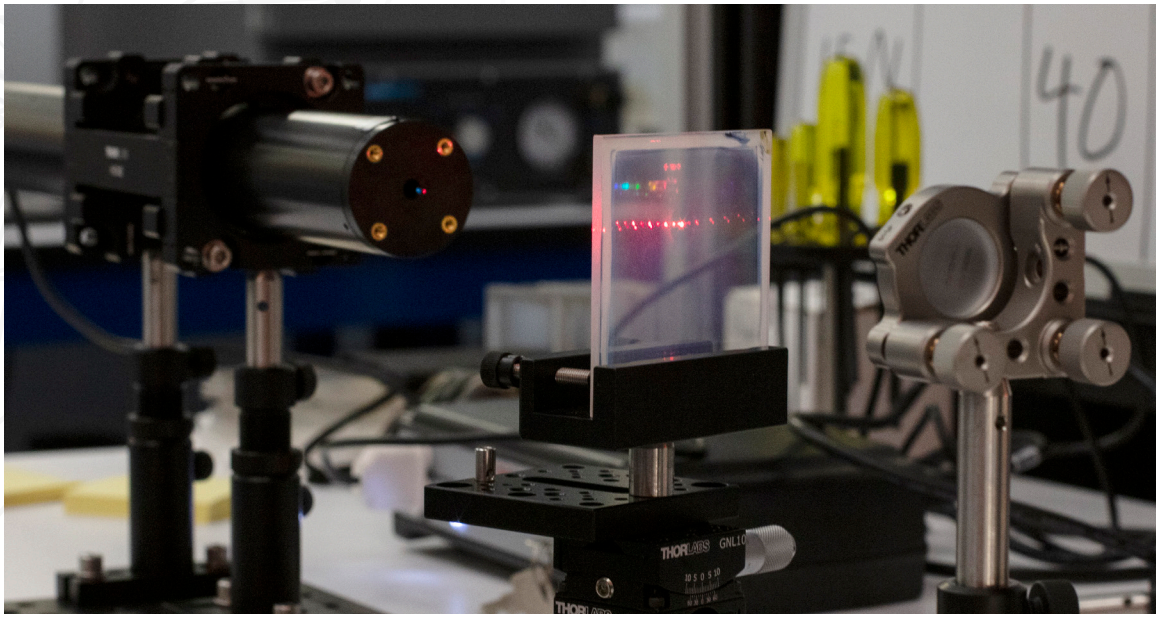
Testing

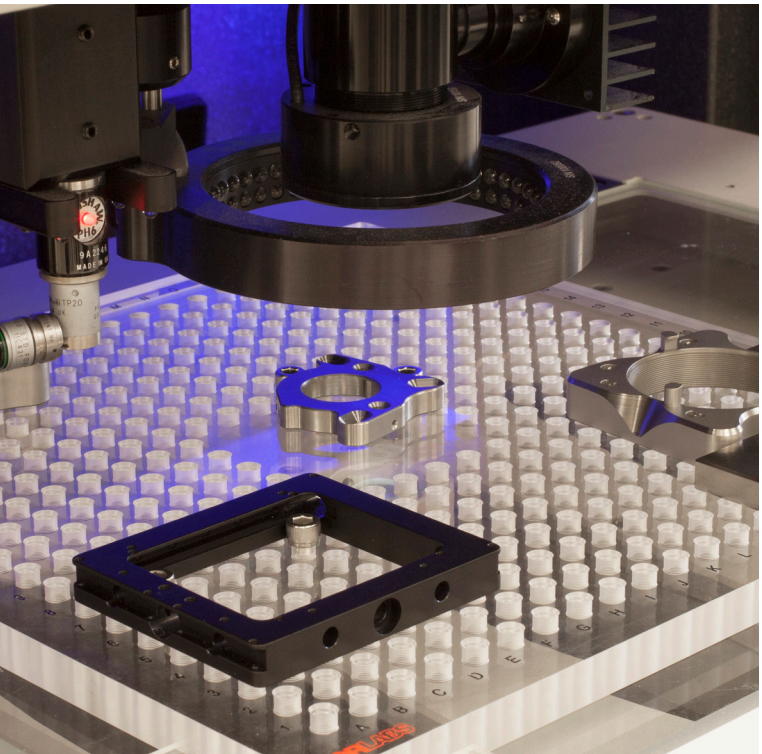
Testing is an important step between design and manufacturing. Thorlabs creates industry-leading products by continuously using test data to improve performance and quality standards.

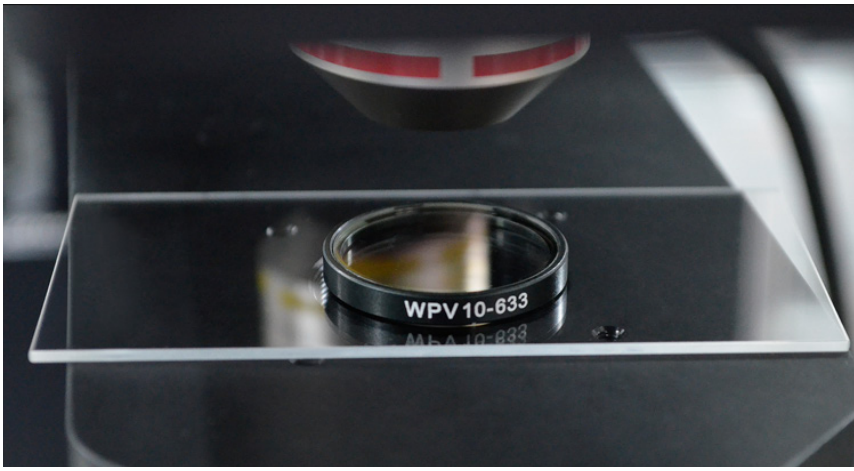
For example, our volume phase holographic (VPH) gratings are created using wet processes, which as a family are notorious for being easily affected by environmental factors. To consistently fabricate reliable gratings, our technicians need to test at the key steps throughout the process. This test data is fed back into our production, ensuring our gratings only improve over time.

We regularly draw upon lessons learned from our past experiences and from developing our own instruments. Test rigs are developed to check dimensions to high accuracy as well as to verify optical properties.

These testing and inspection processes extend to all our catalog and OEM products and help ensure high quality and performance in every Thorlabs component.





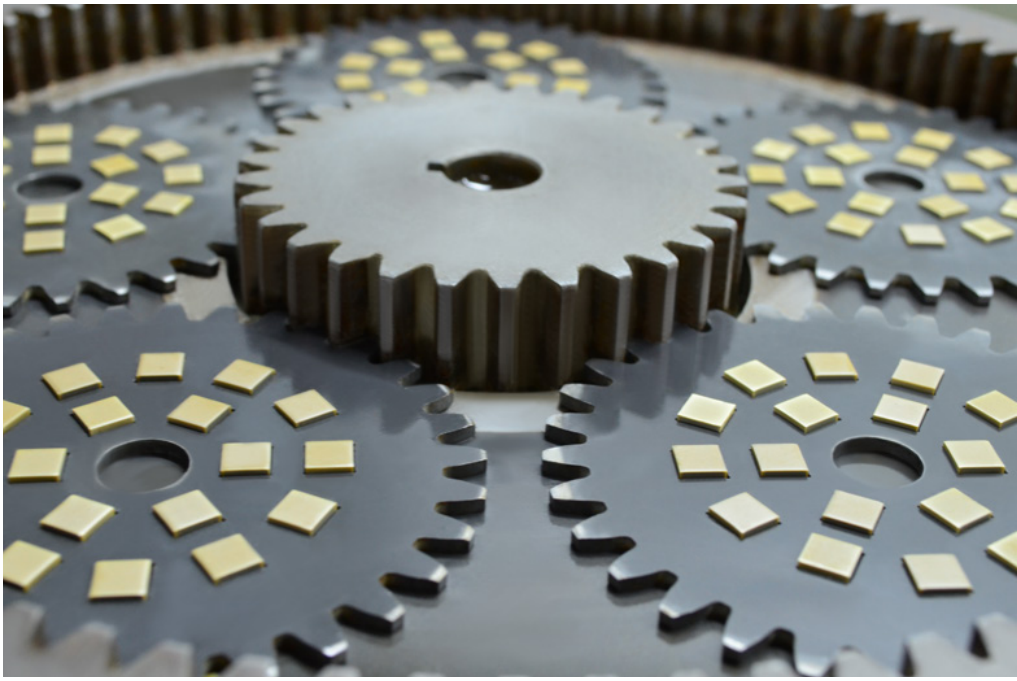


Top Right: A Grating Being Inspected for Line Density, Using a HeNe Laser

Bottom Right: A Close-Up of a Vortex Retarder in a Test Setup

Left: A Coordinate Measuring Machine (CMM) Used for Verifying Our Items Dimensions

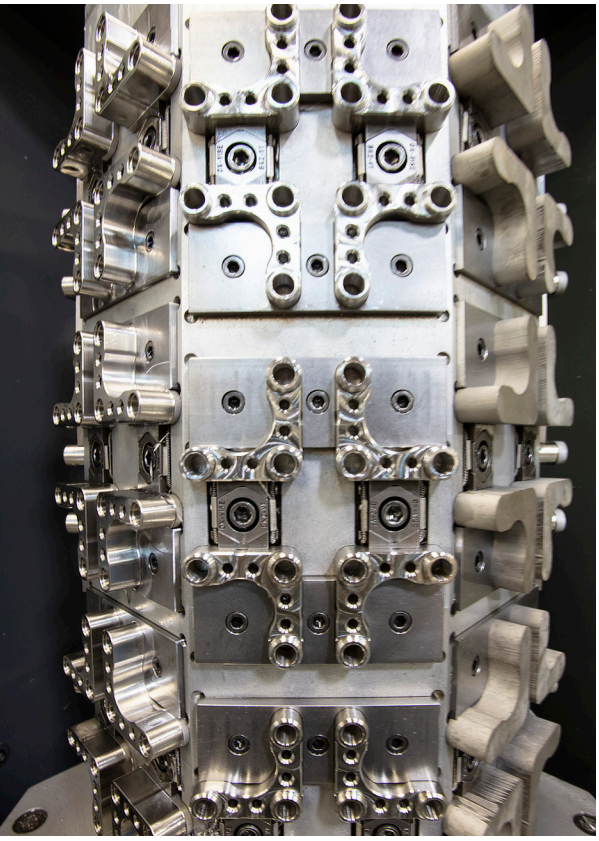
Manufacturing



Right: PR Hoffman Double-Sided Grinding Machine for Lapping

Below: Milling Mirror Mounts Using a Vertical CNC Mill

Below Right: Technician Using Gantry Mill for Machining Long Mechanical Components



Thorlabs is focused on being able to bring as much of our catalog production in-house as possible, as this improves our quality, quantity, and customizability. Over our history, we have built vacuum deposition laboratories, metal and glass fabrication shops, fiber draw towers, electronic assembly clean rooms, and more. We leverage these cultivated capabilities to bring our OEM customers a breadth of in-house manufacturing possibilities unmatched in the photonics industry.

Due to our vertically integrated structure, our engineers and technicians can work closely. This open communication allows them to effectively utilize our vast resources ensuring continuous improvement and high quality for our OEM customers.

QuickTurn™ Optics

Using our rapid optical prototyping capabilities, we can deliver custom optics and engineered multi-element assemblies in a fraction of typical lead times. By leveraging our vertically-integrated structure, we eliminate typical wait times between manufacturing steps and enable our customers to have shorter product development cycles and faster times to market.

Company Overview

Thorlabs is an international manufacturer of quality photonics equipment. Founded in 1989, we seek to develop close relationships with our customers. The insights we've gained allow us to identify, enable, and accelerate key photonics technologies utilizing our wide variety of capabilities and services.

Corporate Highlights

- Founded in 1989
- 22 Facilities in 9 Countries
- Over 1,000,000 Square Feet of Manufacturing Space
- Over 3,000 Employees Worldwide
- Over 22,000 Products
- Over 1,000 OEM Accounts
- Certified ISO 9001:2015 Compliant
- ITAR-Capable Upon Request

Bergkirchen, Germany

Thorlabs' Headquarters in Newton, NJ

Shanghai, China

Letter from Our CEO

Over the past three decades, Thorlabs has been privileged to play a role in the advancement of the photonic sciences. Throughout our existence, we've evolved from a small startup, machining a handful of basic optomechanical components in the early years, to a vibrant member of the photonics community releasing over 1,400 new items to our website annually. The growth of our portfolio can be attributed to a mix of organic product line extensions, greenfield initiatives into new technologies such as Optical Coherence Tomography (OCT), and a series of acquisitions that have added new manufacturing competencies at various locations around the globe. Today, Thorlabs is comprised of 22 manufacturing and design facilities in 9 countries.

Thorlabs' continual double-digit growth has allowed us to invest heavily in the infrastructure and capital equipment needed to manufacture the majority of the 22,000 photonics products that comprise our catalog. In addition, these in-house manufacturing capabilities give us the freedom to respond to the needs of our customers, whether they be for large quantities of an existing product or a low volume request for a modification to an existing stocked design.

Consequently, we are able to partner with you, not only during the concept phase when one traditionally buys a basket of items in small quantities, but also when you reach full production and need a partner capable of manufacturing quantities of select items that can be called off as needed. While Thorlabs has always been a price leader, we can realize additional economies of scale when provided with the ability to plan future production/deliveries. These cost savings, which we share with our OEM customers, are often significant. They arise from being able to integrate your OEM needs with our own internal production in a manner that ensures on-time deliveries at highly competitive prices.

Our product portfolio, as you probably know, contains one of the most extensive photonic tools selections in the world. What you might not know is that Thorlabs has added many components that are specifically designed to serve the OEM side of our customer base. Offering these component parts to a multitude of OEM customers further ensures economies of scale that reinforce our strength as a competitive OEM supplier.

Additionally, there is a customer focus that permeates our entire OEM Business Group, leading us to put into place processes that show a deep respect for the responsibility that comes with supplying a production facility. As an OEM supplier, we have built a number of additional elements that provide all important services, timed take-outs that are flexible, safety stock, and strict revision controls, all of which are designed to ensure there are no surprises.

We are committed to being a strong partner for your OEM needs, with a desire to be connected to our industry in a way that far exceeds what would be expected of a vendor. As our OEM business continues to grow, I personally invite you to contact me at any time to provide feedback on any of our products or services. It is a privilege to have my company's products serve as the building blocks within the systems and subsystems you produce.

Sincerely,

Alex Cable

Founder & CEO
acable@thorlabs.com

Optics

Whether you are building assemblies from scratch with individual elements or looking for a preconfigured optical system, our facilities are capable of producing optics and assemblies to fit your needs. The majority of our optics are shaped, finished, and assembled in-house, allowing our fabrication facilities to modify stock and create your ideal product. Optical surfaces can be enhanced with a variety of standard and custom thin film optical coatings in order to optimize transmission, reflection, polarization, or beam quality. All of our optics can be accompanied by Zemax design files to help further ease integration.

Key Capabilities

- Ability to Meet Many Quality Standards Including:
  - *Compliances:* ITAR, RoHS, and REACH
  - *Military Specifications:* MIL-PRF-13830B and MIL-C-48497A
  - *Other Standards:* ISO 10110, ISO 19012, ISO 8039, ISO 9345, ISO 9001:2015, and ANSI/ASQZ 1.4-2003
- Plano Optic Fabrication Facility
- CNC and MRF Lens Fabrication
- Thin Film Coating Lab in ISO Class 10,000 and 1,000 Cleanrooms

Technician Inspecting an Optic

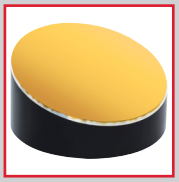
A Selection of Our Products

All of these items are built in-house and can be customized by our engineers for your application.

PBS252
Beamsplitter Cube

AHWP05M-340
Mounted Half-Wave Plate

AL50100
Aspheric Lens



MPD2103-M01
Off-Axis Parabolic Mirror

I4500W4
Free-Space Isolator

TC25FC-1064
Triplet Collimator

LMH-50X-532
Focusing Objective

Mechanics

Our Mechanics Business Unit is comprised of experienced engineers, draftsmen, and machinists. Utilizing our in-house mills, lathes, screw machines, and laser engravers, we can be sure that all our production processes are carefully controlled. Our machinists' innovative techniques use shop equipment in unique ways to increase the efficiency of each machine, including designing custom fixtures that greatly reduce or eliminate setup time. We take the necessary steps to ensure quality, including regularly scheduled service, creating jigs to enable reproducibility, and utilizing the latest available technology.

Key Capabilities

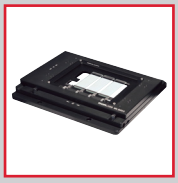
- Solidworks for 3D Modeling
- Finite Element Analysis (FEA) for Evaluating Materials Stresses
- In-House Anodization Facilities with Total Line Automation
- Accelerated Lead Times for Prototypes and Initial Production Runs

Optomechanical Prototyping at Our Facility in Newton, NJ

POLARIS-K15F4
Ø1.5" Mirror Mount

RSP1D/M
Rotation Mount

ELL12
Six-Position Slider



MLS203-1
XY Scanning Stage

LMR1V
Vacuum-Compatible Ø1" Lens Mount

XE25L30
Construction Rail

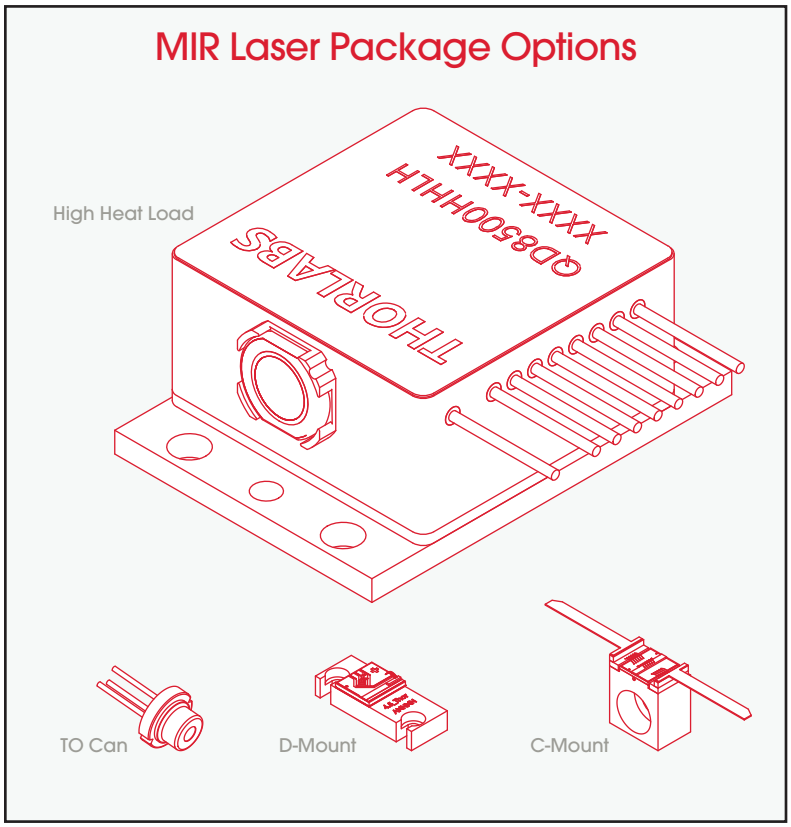
MB12D
Breadboard

Semiconductor Fabrication

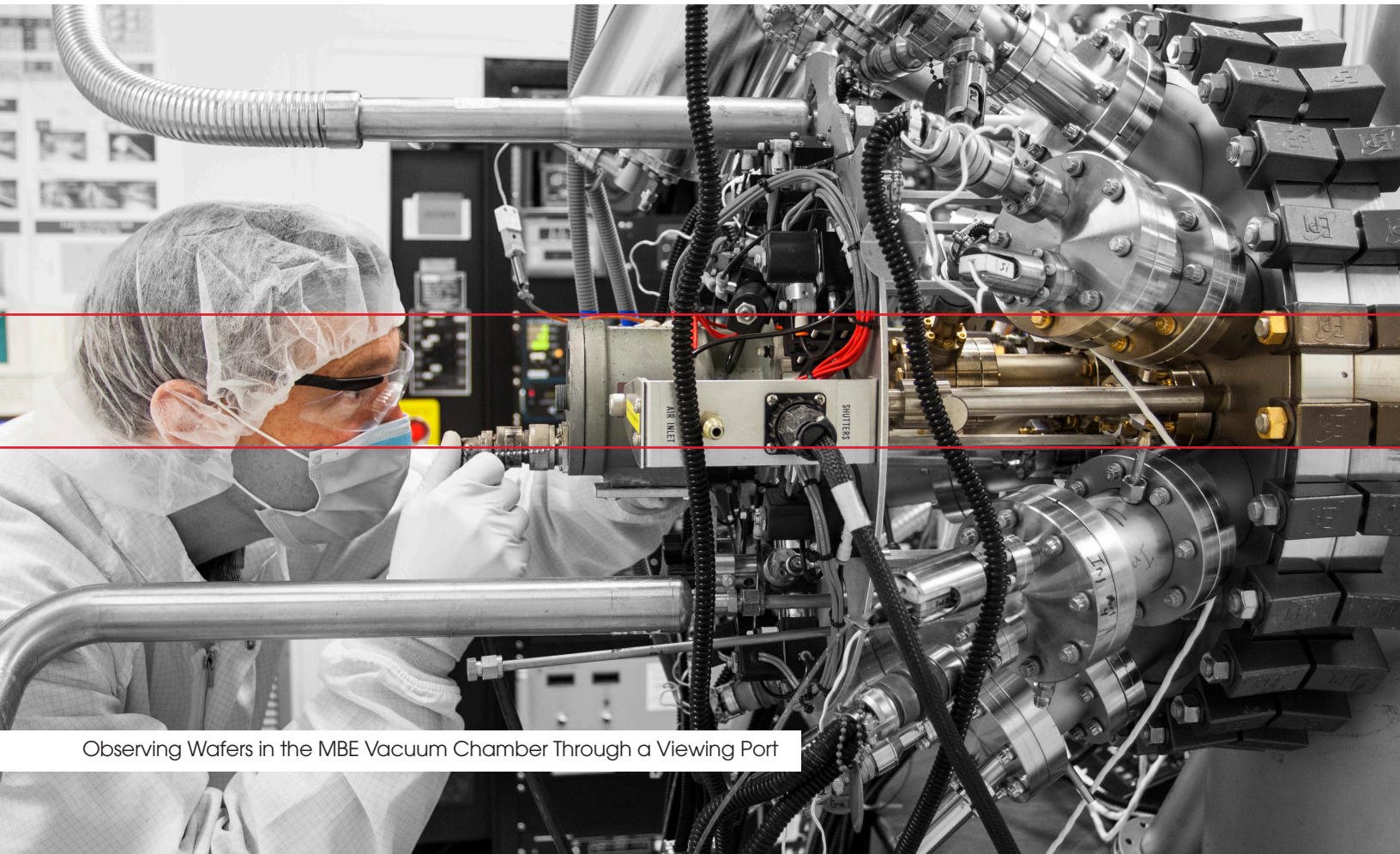
Key Capabilities

- Wavelength Options from the UV to the MIR
- In-House Manufacturing for Ultimate Customization
- ISO 9001:2015 Certified
- Hermetic Packaging and Testing Available

Thorlabs is a global leader in the manufacture of semiconductors for laser diodes. Our 84,000 sq. ft., US-based facility houses a vertically-integrated fabrication suite. Our engineers and scientists command multiple techniques for epitaxial wafer growth and fabrication with in-house assembly and packaging areas. This infrastructure allows us to support proprietary production processes for custom laser diodes with emission wavelengths ranging from 375 nm to 11.0 µm. We offer laser diodes in a variety of package sizes, from chip-on-submount (CoS) all the way up to turnkey laser systems, with integrated heat management and current control.



Our MIR capabilities exemplify Thorlabs' design and manufacturing abilities in semiconductor fabrication.



Observing Wafers in the MBE Vacuum Chamber Through a Viewing Port

Fiber

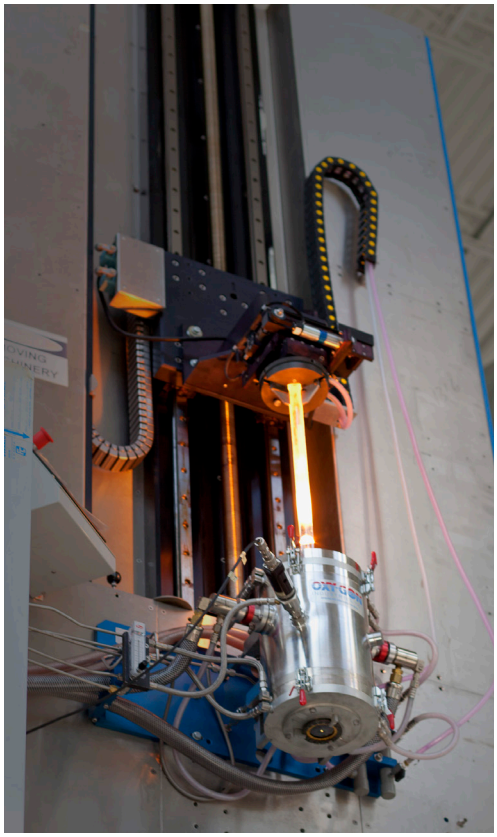
Our ITAR-certified fiber draw towers and assembly facility are built to accommodate volume production with fast turnaround times. In addition to manufacturing our catalog offerings, the facility supports flexible tower configurations and draw schedules required for fabricating custom fibers. Our engineering team has experience with designing and fabricating specialty optical fibers for academic, industrial, and government applications.

Fibers are sold bare or sent to our dedicated assembly area, allowing us to ship many custom patch cables the same day they are ordered, letting you design, build, or repair your fiber optic systems quickly.

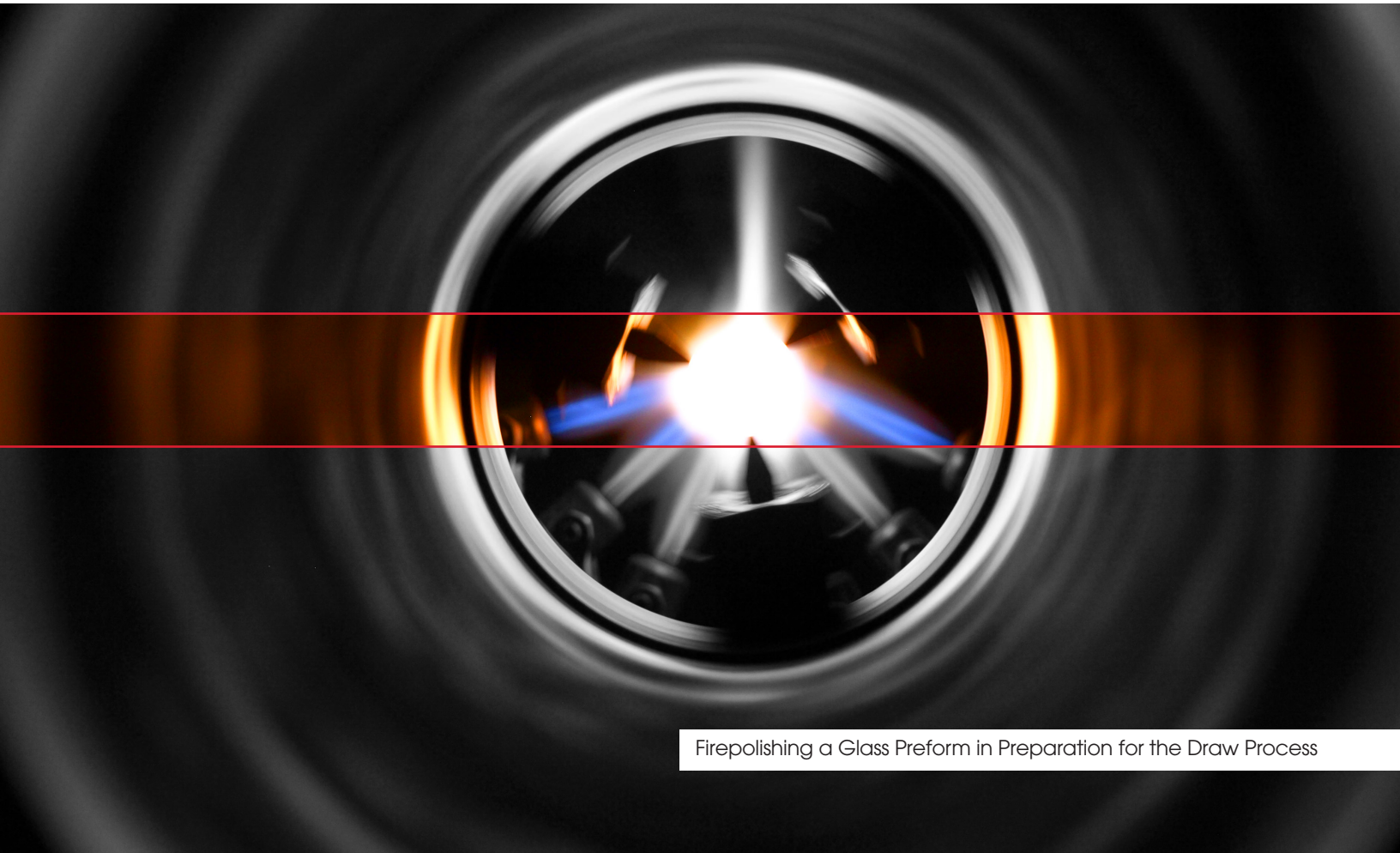
Our stock fiber can also be incorporated into fiber couplers and wavelength division multiplexers (WDMs). In-house fiber fusion facilities produce a large variety of these products in 1x2, 2x2, and 1x4 configurations with operating ranges between 400 nm and 2.3 µm. Both couplers and WDMs can be customized within this range to meet your needs. Every coupler and WDM is serialized and includes an individualized product data sheet.

Fiber Connectors

- FC/PC or FC/APC
- Stainless Steel or Ceramic Ferrule
- Subscriber Connector (SC)
- Lucent Connector (LC)
- Straight Tip (ST)
- Sub-Miniature A (SMA)

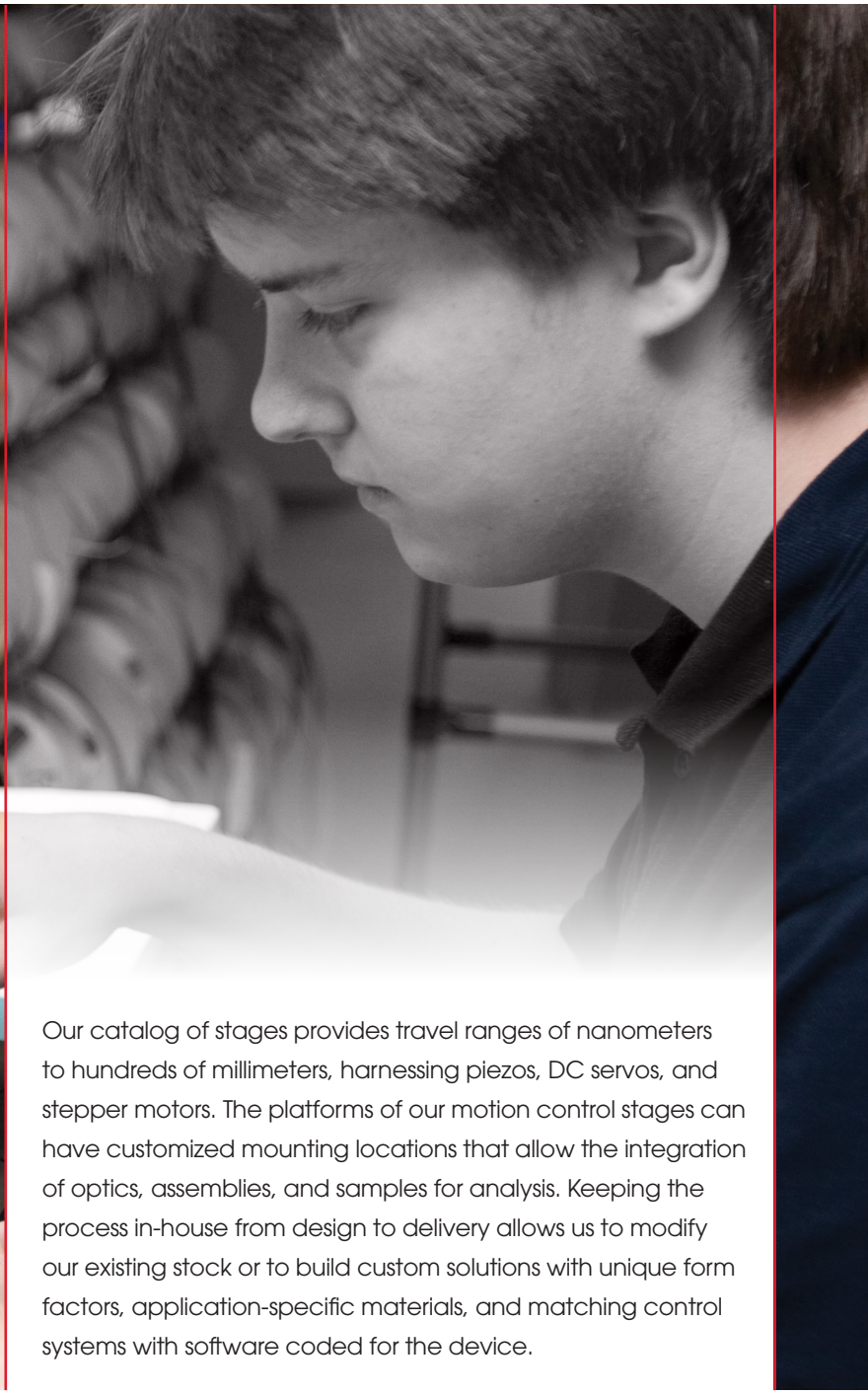


Preform and Furnace of Our ITAR-Certified Fiber Draw Facility



Firepolishing a Glass Preform in Preparation for the Draw Process

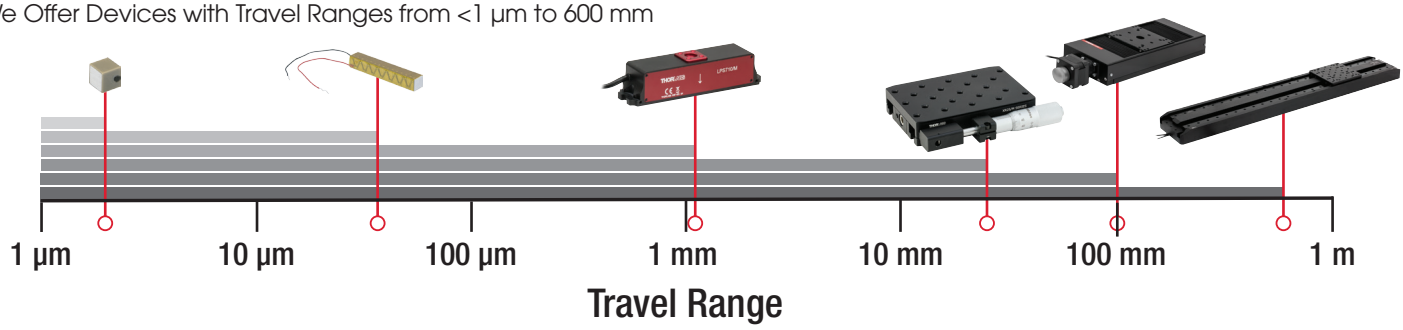
Motion Control

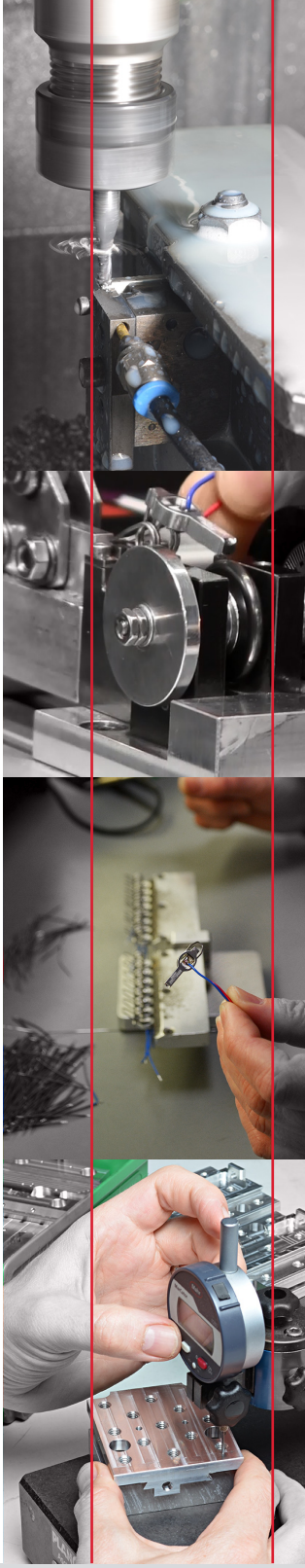


Our catalog of stages provides travel ranges of nanometers to hundreds of millimeters, harnessing piezos, DC servos, and stepper motors. The platforms of our motion control stages can have customized mounting locations that allow the integration of optics, assemblies, and samples for analysis. Keeping the process in-house from design to delivery allows us to modify our existing stock or to build custom solutions with unique form factors, application-specific materials, and matching control systems with software coded for the device.

Selection of Motion Control Devices

We Offer Devices with Travel Ranges from <1 µm to 600 mm

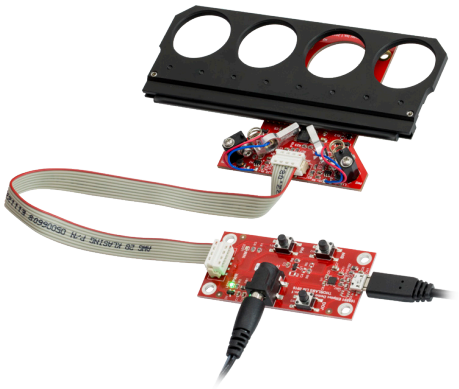




From Top to Bottom: Milling, Assembling, Soldering, and Evaluating an Elliptec Piezoelectic Motor

Elliptec® Piezoelectric Motor Highlight

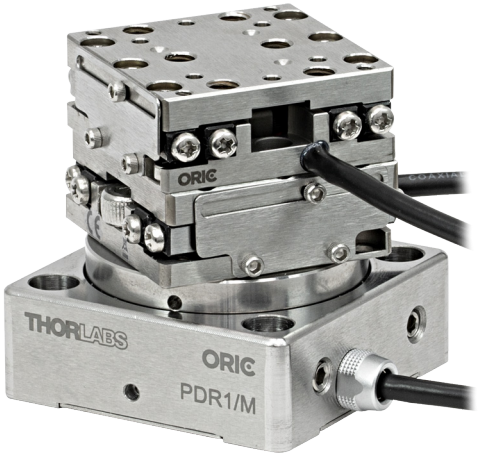
Our Elliptec motors provide fast, high-precision actuation in a compact and lightweight package. The motor is comprised of a piezoelectric element press fit into the aluminum resonator. The piezoelectric element causes the resonator arm to vibrate in an elliptical motion with the motor's head moving at 350 mm/s (typical). This effect is the result of meticulous design, manufacturing, and quality control practices, and virtually eliminates inertial delay and backlash found in other motors.



The ELL9K Elliptec SM1-Threaded Four-Position Slider Bundle for Switching Among SM1-Mounted Optics

Circuit boards controlling the piezoelectric elements are modeled in-house together with all of the unit's mechanical components, producing an integrated system able to take on application-specific form factors. The Elliptec motor is simple to run either with included control boards or through USB connection, requiring very little power. Programmers can create routines with the open-source communication protocols for the device.

ORIC® Piezoelectric Inertia Stage Highlight



XY + Rotation Stage Created by Mounting Two PD1(/M) Linear Stages on a PDR1(/M) Rotation Stage

Thorlabs' ORIC® Piezoelectric Inertia Drive Stages provide fast and stable piezo-controlled linear motion in compact packages with no backlash. We offer open-loop operation in single- and dual- axis packages, closed-loop operation in a single-axis package, and open- and closed-loop rotary motion stages.

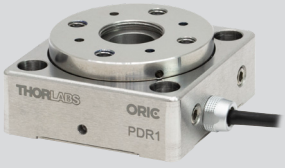
- Linear Step Size: 1 µm (Typical) to <3 µm (Max)
- Rotation Step Size: 250 µrad (Typical) to <350 µrad (Max)
- Ideal for Set-and-Hold Applications that Require Relative Positioning with High Resolution
- Vacuum-Compatible Versions Available

Selection of ORIC® Stages

Open- and Closed-Loop Linear and Rotation Stages with a Variety of Adapters to Suit Any Need

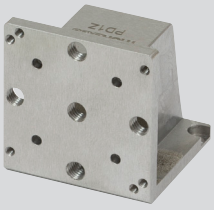
PD1
Linear Stage

PD1D
XY Stage



PDR1
Rotation Stage

PD1B2/M
Mounting Adapter



PD1Z
Right-Angle Bracket Adapter

Product Highlights

Galvanometers

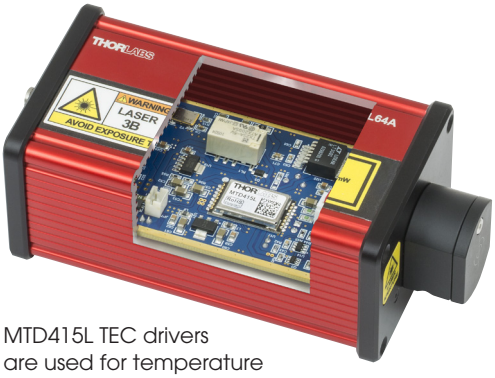
- For Laser Marking, Machining, Imaging, and Beam Steering
- 60+ Configurations Available for Same-Day Shipment
- Many Custom Configurations Available in 2-3 Weeks, Including Custom Mechanics and Optics

Our packaged galvo scan heads support a broad range of beam sizes, power levels, and wavelengths. Pre- and post-objective scanning options enable the field and spot sizes to be configured based on the needs of the application.

3-axis scanning systems use dynamic focusing to maintain a focused laser spot over a large, flat field or an arbitrary 3D surface.

LD and TEC Controllers

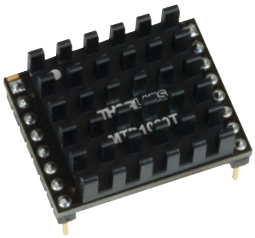
For those seeking to manufacture laser systems, Thorlabs offers both stocked and custom Laser Diodes (LD) and Thermoelectric Cooler (TEC) controllers. All of these compact devices are 100% batch tested during production to guarantee performance. Devices can be delivered in IC tubes for production lines incorporating pick-and-place machines.



MTD415L TEC drivers are used for temperature regulation in Thorlabs' Nanosecond Pulsed Laser Systems, as shown in this cutaway view of the NPL64A.

MLD203CLN
Low Noise Constant Current LD Driver, SMT Package

MTD415L
TEC Driver, SMT Package



MTD1020T
TEC Driver, THT Package with Heatsink

Power Meters

- All Power Meters are USB Compatible and Support Analog, RS-232 Operation, and UART Operation
- Includes Thorlabs' OPM Software, which Enables Simultaneous Control of Up to Eight Power Meters
- Selectable Bandwidth of 20 Hz or 100 kHz for Better Accuracy or Pulse Detection, Respectively
- Compatibility for Photodiode Power, Thermal Power, Thermal Position and Power, and Pyroelectric Energy Sensors

PM103
Photodiode Power and Pyroelectric Energy Sensor Interface

Datacom and Telecom

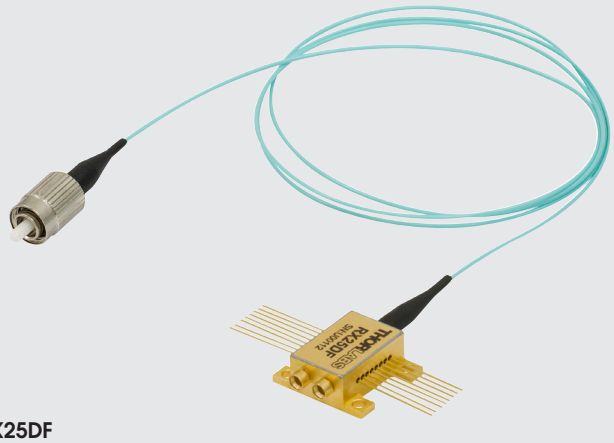
Key Capabilities

- Facilities for Creating High-End Datacom and Telecom Instruments
- Offerings Include Transmitters, Receivers, Amplifiers, Modulators, Fiber Couplers and More

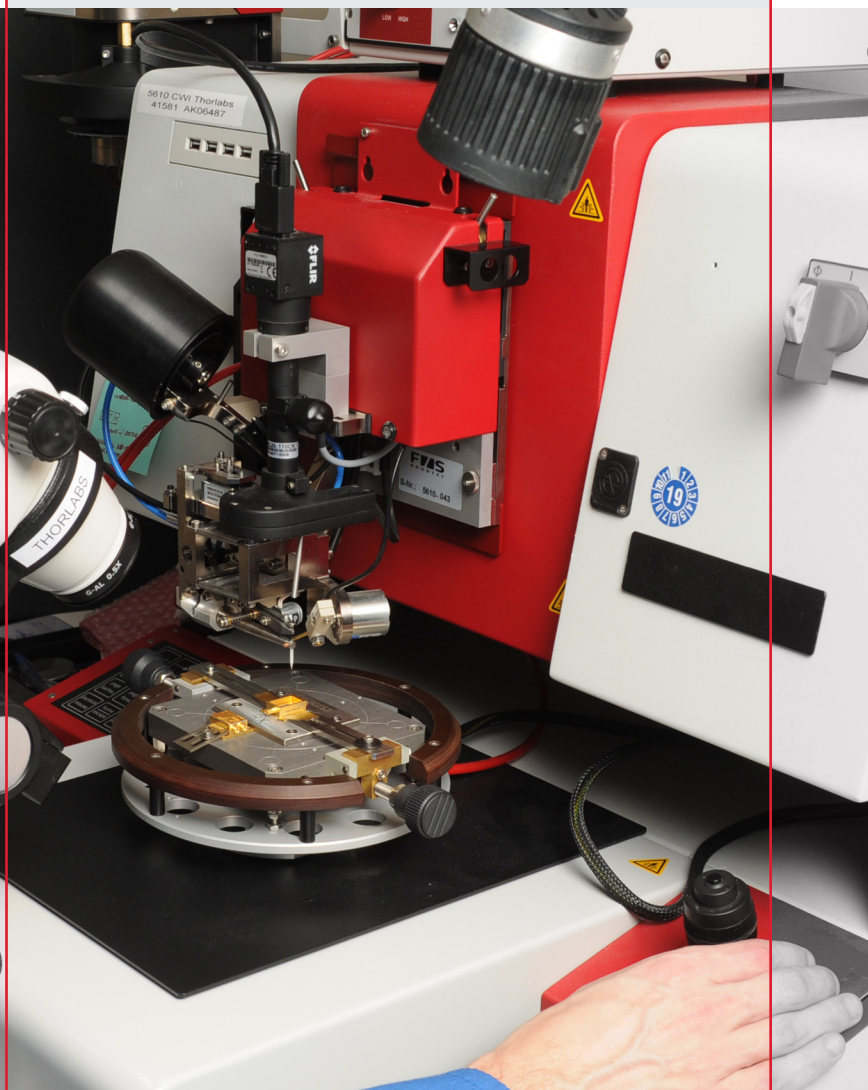
We offer expertise in creating high-speed instrumentation products operating up to 110 GHz. Our current offerings support all common telecom wavelengths and offer a series of excellent starting points for further OEM customization. We can supply fully operational instruments or compact, hermetically sealed packages. Our engineers are happy to guide you through this process to ensure we create something that will meet your needs.

High-Speed Photoreceiver Modules

- Hermetically Sealed GaAs or InGaAs Detector Module
- Multimode and Single Mode Options Available
- Maximum Bandwidth of 10, 25, 38, 40, or 42 GHz
- Ideal for OEM Customization



RX25DF
700 – 870 nm Multimode Photoreceiver Module



Worldwide Support

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