IMAGING OPTICS

CAPABILITIES GUIDE

Your Partner for

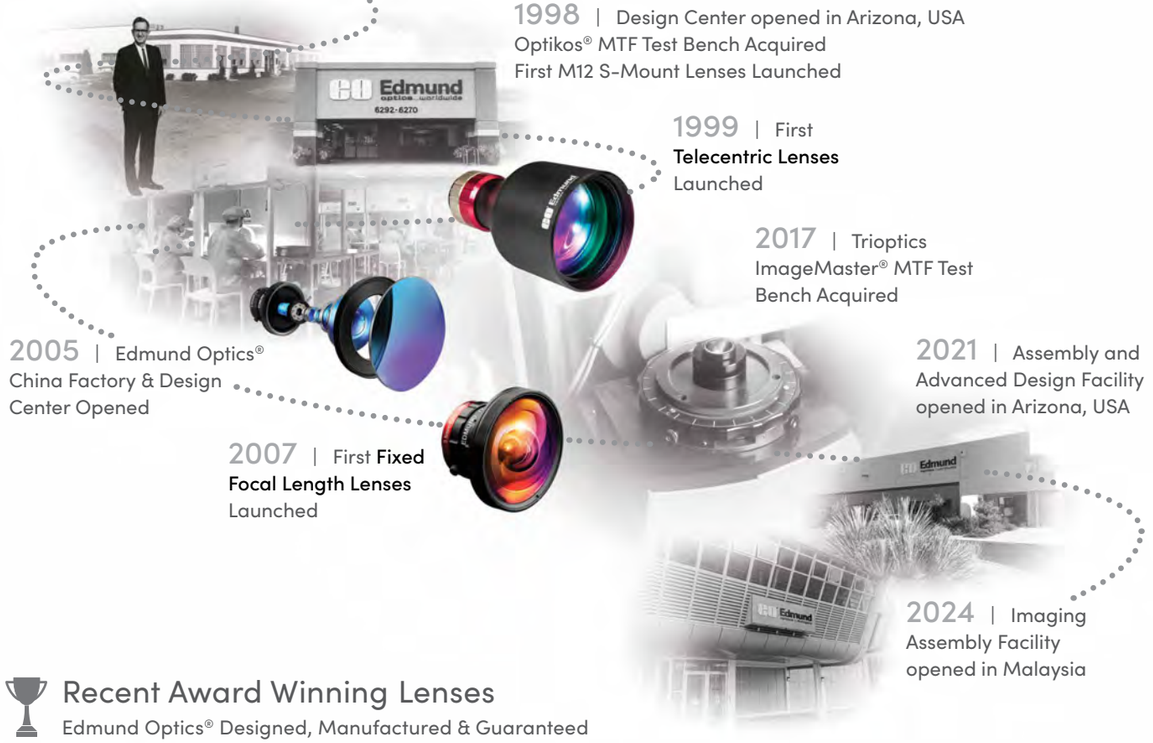
Full Imaging Solutions

The imaging lens assemblies, cameras, lighting, calibration, focusing, and technical guidance needed to make your machine vision integration easy.

800.363.1992
www.edmundoptics.com/**imaging**

Edmund optics | worldwide

Our Evolution



1998 | Design Center opened in Arizona, USA
Optikos® MTF Test Bench Acquired
First M12 S-Mount Lenses Launched

1999 | First **Telecentric Lenses** Launched

2005 | Edmund Optics® China Factory & Design Center Opened

2007 | First **Fixed Focal Length Lenses** Launched

2017 | Trioptics ImageMaster® MTF Test Bench Acquired

2021 | Assembly and Advanced Design Facility opened in Arizona, USA

2024 | Imaging Assembly Facility opened in Malaysia

Recent Award Winning Lenses

Edmund Optics® Designed, Manufactured & Guaranteed

2021 | Vision Systems Design
Innovators Award, Bronze
Cw Series Lenses

2021 | Vision Systems Design
Innovators Award, Gold and Inspect Award Winner
Vision Category, 3rd place
LT Series Lenses

2022 | Vision Systems Design
Innovators Award, Silver & Inspect Award Winner
Vision Category, 1st place
Athermal Imaging Lenses

2023 | Vision Systems Design
Innovators Award, Bronze
120i Infinity Corrected Lenses

2024 | Vision Systems Design
Innovators Award, Silver
UAV Series Lenses

From product design to full-scale volume production, Edmund Optics® Imaging supports customers at each step of your project journey

1250+ Employees

290+ Engineers

30+ A3 Certified Vision Professionals

4 Imaging Design Centers
Arizona, New Jersey, China & Germany

6 Warehouses
US (New Jersey), China, Korea, UK, Singapore, & Japan

NEW 24/7 Application Support

>1.7 Million Imaging Lenses Sold

170,000+ Imaging Lenses produced per year

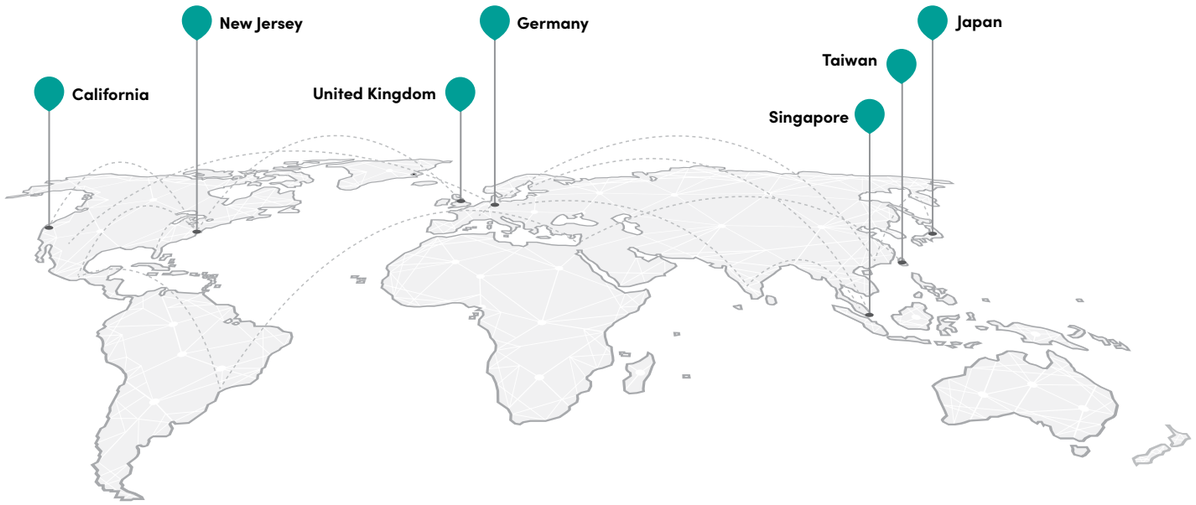
8 Factories
US: New Jersey, Arizona & Florida, Germany, Japan, China, Singapore & Malaysia

> "Edmund Optics' robust offering of imaging lenses and broad application knowledge uniquely positions us to **solve any application that needs imaging** and to service our customers with around the clock support. Our vast availability of in-stock optics means our customers can get what they need when they need it, and our ability to design custom optics ensures that no goal is unreachable."

Nicholas Sischka
Director of Imaging

Where We Are

7 Imaging Optics Labs



Meet our Experts

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Crafting Excellence in Every Product

Edmund Optics® designs and manufactures a wide range of off-the-shelf, modified standard, and fully custom imaging lens assemblies

Off-the-Shelf Lenses

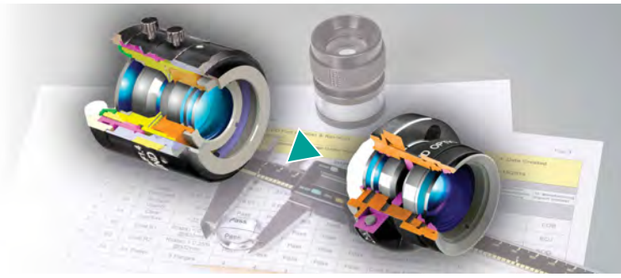
Telecentric Lenses
Eliminate or parallax error, ideal for precise gauging and metrology

Microscope Objectives
High magnification objectives for short working distance imaging in either machine vision or medical systems

Fixed Focal Length Lenses
The standard types of lenses used in many inspection and robotics applications

M12 Lenses
These compact, board-level lenses are used in applications sensitive to size, weight, and cost

Modified Standard Lenses



- Quickly modify standard lenses, reducing lead times to weeks rather than months, instead of designing custom lenses from scratch
- Customize the aperture, optomechanics, or coatings of off-the-shelf lenses
- Ideal for rapid prototyping if no standard lens directly fits your needs

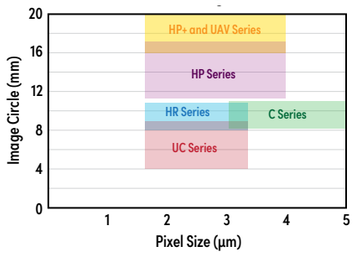
Fully Custom Design and Manufacturing

- Advanced design, simulation, and analysis for optical and optomechanical manufacturability, sensitivity, and tolerancing
- Multiphysics modeling, finite element analysis, and other software tools expedite the design process
- Production manufacturing from first articles to high volumes and every stage of development in between
- Cost-conscious geometric dimensioning and tolerancing

Wide-Ranging Product Selection

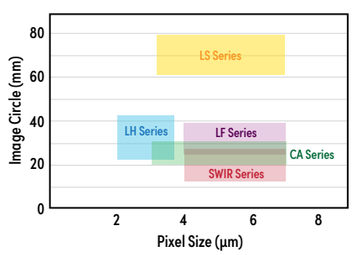
These charts provide a starting point for understanding which off-the-shelf Edmund Optics® lenses are the best fit for your camera's sensor and pixel size.

Fixed Focal Length Lenses



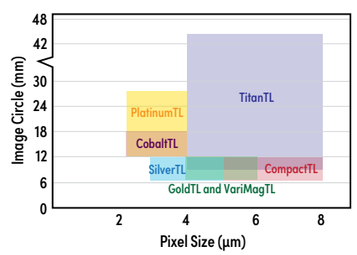
- Used in factory automation, robotics, and inspection applications (more details on page 12)
- Wide variety of focal length, sensor format, aperture, and working distance options
- SWIR and ruggedized options available for shock and vibration, water exposure, and temperature swings

Large Format Fixed Focal Length Lenses



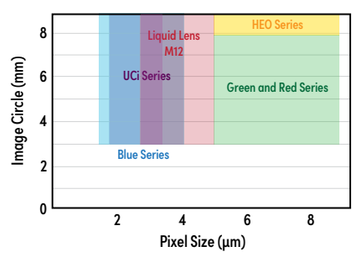
- Ideal for metrology, gauging, CCD-based measurement, or microlithography (more details on pages 12 and 14)
- Wide variety of magnifications and sensor format options
- SWIR and in-line illumination options available

Telecentric Lenses



- Used in small camera format applications including automotive, forensics, pharmaceutical, and food inspection
- Ruggedized options available for shock and vibration and water exposure
- Versions with integrated liquid lenses for quick, electronic autofocus

M12 Lenses



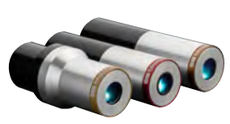
- Ideal for life science and machine vision applications such as microscopy, flow cytometry, pharmaceutical inspection, and assembly line or fault inspection (more details on page 15)
- Infinite and finite conjugate objectives
- Compact designs and versions with integrated liquid lenses for quick, electronic autofocus

Microscope Objectives

Edmund Optics® 120i Plan APO Infinity Corrected Objectives
Compact, infinite conjugate, and plan-apochromatic

UCf Objectives
Ultra-compact form factor and finite conjugate

Cf Objectives
Optimized for long working distances and configurable magnification

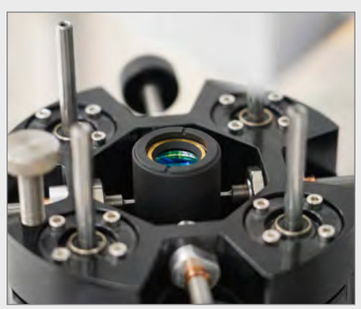


Production Design and Metrology

Why Use Lenses Made by Edmund Optics®?

High Volume Production

Active Alignment



Advanced Optical Metrology

What's Next?

Contact Us
Let us help you over the phone, through email, or with 24/7 live chat with our engineers

Imaging Lens Selector
This interactive calculator identifies compatible lenses based on your camera

Basic Lens Selector
Learn the basics of choosing the right lens based on a certain camera's specifications

Advanced Engineering and Design Solutions

Ruggedization for Harsh Environments

- Streamlined instrumentation designs for OEM
- Stability to combat damage from shock and vibration
- Ingress protection for immersion and washdown
- Athermalization for shifting temperatures

State-of-the-Art Metrology and Testing

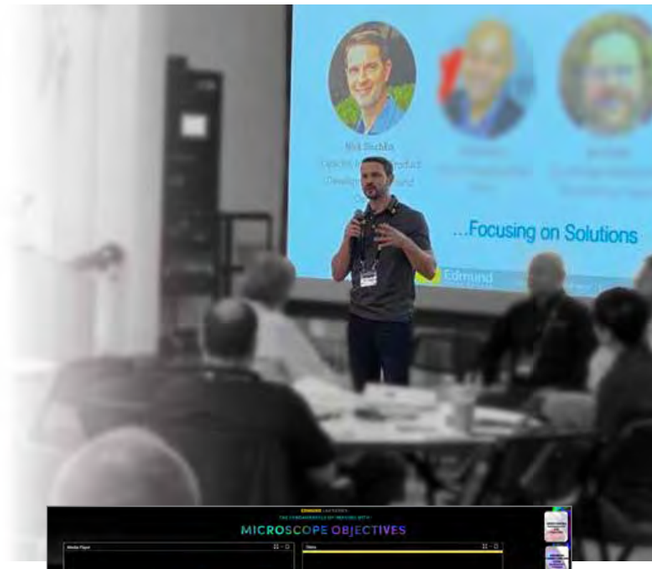
- MTF (reverse projection, slanted edge, camera-type), CTF, camera, stray light, telecentricity, wavefront distortion, and more
- Environmental testing capabilities
- Application specific testbed development
- Test reports, documentation, and serialization
- Correlation studies and error analysis

Customer Imaging Solutions Labs

Woodcrest, New Jersey | **Cupertino, California** | **Mainz, Germany** | **Tokyo, Japan** | **Taichung City, Taiwan** | **Singapore, Singapore** | **York, United Kingdom**

Troubleshoot, Collaborate, and Learn

Machine vision design can be challenging, but Edmund Optics® has you covered. Visit one of our 7 imaging labs around the world to learn from and collaborate with our team of expert engineers and vision professionals. Develop vision systems solutions and explore our products, hands-on.



Unable to Visit One of Our Labs?

Join discussions about machine vision applications and technologies through our in-person **Innovation Summits**, online **Imaging Lab webinar series**, or other virtual events.

Scan to view our Imaging Optics Resource Center
Verified library of trusted technical resources created by our 240+ global engineers.

FLEXIBLE VISION

> By partnering with Edmund Optics® for all of our machine vision lenses we are able to **consistently deliver high quality images** that meet the wide variety of applications our customers bring to us. The quality of their products and expert support takes the guess work out of specifying components. By standardizing on high quality lenses we are free to focus on other things knowing that we have the best possible optics for our projects.
>
> **Adam Mull**, *Flexible Vision*

> Edmund has made it possible for us to **push the limits of optical microscopy**, and without them it's difficult to imagine getting to where we are today. Their support from workshopping early design concepts to high volume production of productized lenses has been invaluable to our development process. As we continue to expand our product line and explore new imaging strategies, we have great deal of confidence that our optics will be reliable and of the highest quality.
>
> **Paul Reamey**, *Ramona Optics*

ramona

Our Factories

NEW Edmund Optics® Tucson Advanced Assembly and Design Facility

- Advanced Design and High-Volume Manufacturing Services
- Commercial and ITAR-Compliant Facility
- ISO 6 Cleanroom Assembly and Advanced Testing for MTF, Stray Light, Thermal Cycling, Shock and Vibration, and More
- Advanced Assemblies Requiring Active Alignment, Electronics Integration, and/or Environmental Ruggedization
- Officially AS 9100 and ISO 9001 Certified

Edmund Optics® now operates a brand new facility in Tucson, Arizona. This location offers assembly and advanced design services. Our skilled team of optical assembly technicians has extensive experience with high-performance systems in cleanroom facilities and customers now have access to more sophisticated commercial and ITAR compliant offerings at a new location on the US West Coast.

- Active Alignment
- Thermal Cycling
- Shock and Vibration
- Modulation Transfer Function (MTF)
- Wavefront and Distortion
- Electronics Integration
- Environmental Factors
- High-Precision Mechanical Tolerances
- Stray Light
- Application-Specific Development

With this new facility, Edmund Optics® strengthens a globally diversified supply chain that lowers risk for customers and enables advanced optical, opto-mechanical, and opto-electronic assembly design and manufacturing.

Edmund Optics® Asia Volume Production Facilities

- High-Volume Imaging and Opto-mechanical Assembly
- On-Site Interferometry, Alignment and Centering, Spectrophotometry, Focometry and More
- MTF, Rear Projection, Ingress Protection, Thermal Cycling, Shock and Vibration Testing, Custom Metrology and More
- Class 1,000 Cleanrooms
- Class 100 Laminar Flow Booths
- ESD Assembly Room
- ISO 9001 and AS 9100 Certified

The Edmund Optics® Asia design and manufacturing facilities focuses on cost-effective and mid-to-high volume production from ideation to metrology of the final product. These ISO 9001 and AS 9100 facilities are equipped for shock and vibration, ingress protection (IP), stray light, MTF testing, and much more.

Arizona, USA
Design & Manufacturing Center

21,225 sq. ft (1,972 m²) facility for advanced, high-volume opto-electronic assembly, imaging optics design, and optical assembly metrology.

Florida, USA
Laser Optics Center

34,000 sq. ft (3,159 m²) dedicated to manufacturing high laser damage coatings, laser crystals, and other high-precision optics.

New Jersey, USA
Corporate Headquarters

120,000 sq. ft (11,150 m²); 20,000 sq. ft (1,860 m²) of dedicated manufacturing space. High-precision fabrication, coating, assembly, and testing cells.

Germany
Design & Manufacturing Center

7,060 sq. ft. (600 m²) European manufacturing base for polarizers and colored filter glass and home for European Optical Design services.

China

16,140 sq. ft (1,500 m²) of manufacturing space. On-site design, assembly, and testing of high volume optomechanical and imaging assemblies.

Malaysia

19,000 sq. ft (1,765 m²) of manufacturing space. Supports Singapore facility in volume production of spherical lenses and prisms.

Japan

80,000 sq. ft (7,430 m²) of manufacturing space. High-precision spherical lenses, prisms, and other coated optics with over 50 years of experience.

Singapore

77,000 sq. ft (7,150 m²) of manufacturing space. Highly vertically-integrated facility for volume production of components and mounted optics.

Key Markets

Factory automation is the continuously increasing manufacturing trend of using computerized control systems, programming, and sensors to perform repetitive tasks with reduced human oversight. Machine vision systems collect and feedback information about objects of interest and the environment the objects are situated within, much like how humans use eyes.

Automotive Manufacturing

Automated articulating arms assemble products by using fixed focal length lenses to detect components within a manufacturing environment.

HP Series Fixed Focal Length Lenses

- High resolutions up to 20 megapixels with a 2.8µm pixel size
- Sensor formats up to ⅓" supported

Warehouse Automation and Logistics

Vision guided autonomous mobile robots (AMRs) use M12 lenses to detect, replenish, and sort product inventory.

Ci Series Fixed Focal Length Lenses

- Up to 7.5 megapixels, 2.8µm pixel size sensors
- Their streamlined mechanics make them robust and cost-effective

Pharmaceutical Manufacturing

Fixed focal length lenses are used in pharmaceutical manufacturing settings to read data from 2-dimensional barcodes to identify contents.

Electronics and Semiconductor Inspection

Automated optical inspection (AOI) systems use microscope objectives and telecentric lenses to inspect for wafer alignment, dicing, and placement defects.

Telecentric Lenses

- Their elimination of parallax error results in the high level of accuracy required for pharmaceutical and electronics inspection
- Sensor sizes supported from ½" to full frame

Ruggedized lenses are designed to withstand the harsh environments of the many demanding applications and are available in four types: Industrial, Ingress Protected, Stability, and Athermal Ruggedization.

Industrial Ruggedization

- Streamlined and simplified mechanics prevent focus or f/# change
- Made to "set and forget"
- More cost-effective than traditional fixed focal length lenses

Ci Series Fixed Focal Length Lenses

- Industrial ruggedized version of our C Series Lenses
- Designed for volume integration into applications such as factory inspection and automation

Ingress Protected Ruggedization

- Sealed in a weatherproof assembly
- Waterproof to IPX7 and IPX9K ratings
- Hermetically sealable to a camera

Cw Series Fixed Focal Length Lenses

- Waterproof version of our C Series Lenses
- Eliminate the need for a protective lens cover when exposed to contamination

Stability Ruggedization

- Minimize pixel shift from shock and vibration
- Robust mechanics with simplified focus mechanics
- Elements glued in place to maintain optical pointing stability

Cr Series Fixed Focal Length Lenses

- Stability ruggedized to withstand 50g of shock
- Ideal for calibrated imaging systems, 3D stereo vision, and autonomous vehicles

Athermal Ruggedization

- Passive compensation for thermal expansion
- Eliminate the need for refocusing due to temperature change
- Ideal for aerial & aerospace applications

Athermal Imaging Lenses

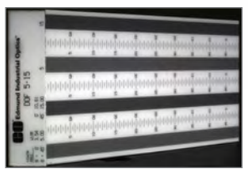
- Operating temperature range from -10 to +50 °C
- Large sensor coverage up to 1.1"

Key Markets

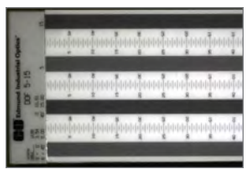
Many **machine vision systems** are simply used to detect the presence of defects or successful installation of components, but others require high-precision, high-accuracy measurements systems for critical dimensional information.

Imaging a depth of field target using a telecentric lens

Fixed focal length lens and conventional backlight



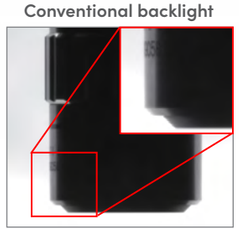
Telecentric lens and backlight



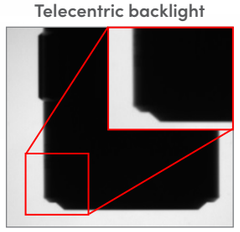
Telecentric lenses produce images free of parallax or perspective error (*right*) as opposed to fixed focal length lenses (*left*).

Imaging a mounting post being backlit with telecentric illumination and using a telecentric lens

Conventional backlight



Telecentric backlight



Telecentric lenses used with telecentric illumination produce images with sharp contrast at edges (*right*) as opposed to fixed focal length lenses (*left*).

Telecentric Lenses

- Magnifications ranging from 0.05X to 8X
- Sensor sizes supported from ½" to full frame
- SWIR and in-line illumination versions available
- Options with integrated liquid lenses for quick, electronic autofocus

Scan to learn the Advantages of Telecentricity

In this video, Nicholas Sischka, our Director of Imaging, explains and demonstrates the benefits of telecentric lenses.

From advanced in vitro, in vivo, and in situ **diagnostic platforms** to machine vision inspection for pharmaceutical packaging, imaging systems are used in a wide range of **life science applications**. Some imaging applications include microscopy (fluorescence, brightfield, darkfield, etc.), polymerase chain reaction (PCR), flow cytometry, microfluidics, surgical robots, and so many more.

Microscopy

Image of fibroblast cells labeled with multiple fluorophores to analyze their cellular structures.

PCR

Loading a 96-well plate with DNA samples for amplification.

High-Throughput Microscopy

Multi-camera microscopes allow for high-throughput screening of well-plates.

Vision-Guided Surgical Robots

Surgical robots used to provide enhanced visualization in situ during surgery to help avoid complications.

Microscope Objectives

Microscope Objectives 120i Plan APO Infinity Corrected Objectives

- Up to 43% smaller than industry standard infinite conjugate systems
- Optimized performance for up to 1.1" sensors
- Exceptional image flatness and chromatic correction over 400-700nm

UCf Objectives

- Compact finite conjugate objectives
- Near diffraction-limited performance
- Mount directly to a C-Mount camera without additional extension tubes

Edmund optics | worldwide

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♦ REFERENCE NUMBER

♦ CUSTOMER NUMBER

The **Future** Depends on Optics®

Custom Product Development

- **Fully custom lens designs** utilizing the newest tech trends such as liquid lens and electronics integration, and environmental ruggedization
- **Extensive expertise** in Fixed Focal Length, Telecentric, M12, Microscope objective design, and more to develop the best lens to solve your unique application
- **Designs optimized** for cost-effective volume production to ensure your long-term success

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