

ID AX59974



| Product brochure

Fine & fast steering mirrors

Swiss engineering. Global impact

What if optics could adapt like the human eye?
This idea has guided Optotune since its beginnings
at ETH Zurich in Switzerland.

Today, Optotune has evolved into a global
company, creating tunable optical technologies
which help engineers build optical systems that
are faster, more precise, and more capable.

Our mission is to make
a positive impact through
optical innovation.

Our vision is to be the solution
of choice for optical systems
that need dynamic light control.

Global operations



Switzerland
Headquarters



Slovakia
Manufacturing



Taiwan (ROC)
Sales office

Local presence

North America
Regional sales

DACH
Regional sales

Nordics
Regional sales

China
Regional sales

Japan
Regional sales

We work with distributors around the globe:

Mexico, Brazil, Portugal, Spain, France, Germany, Italy, Israel,
Southeast Asia, China, Korea, Taiwan (ROC), Japan.

Working principle and advantages

Optotune's 2D tip-tilt mirrors cover a broad range of steering angles. Fast steering mirrors enable large tilt angles with integrated optical position feedback, ideal for applications such as field of view (FOV) expansion. Fine steering mirrors feature an ultra-thin design and large mirror surface for precise adjustments and laser wobbling.

Working principle

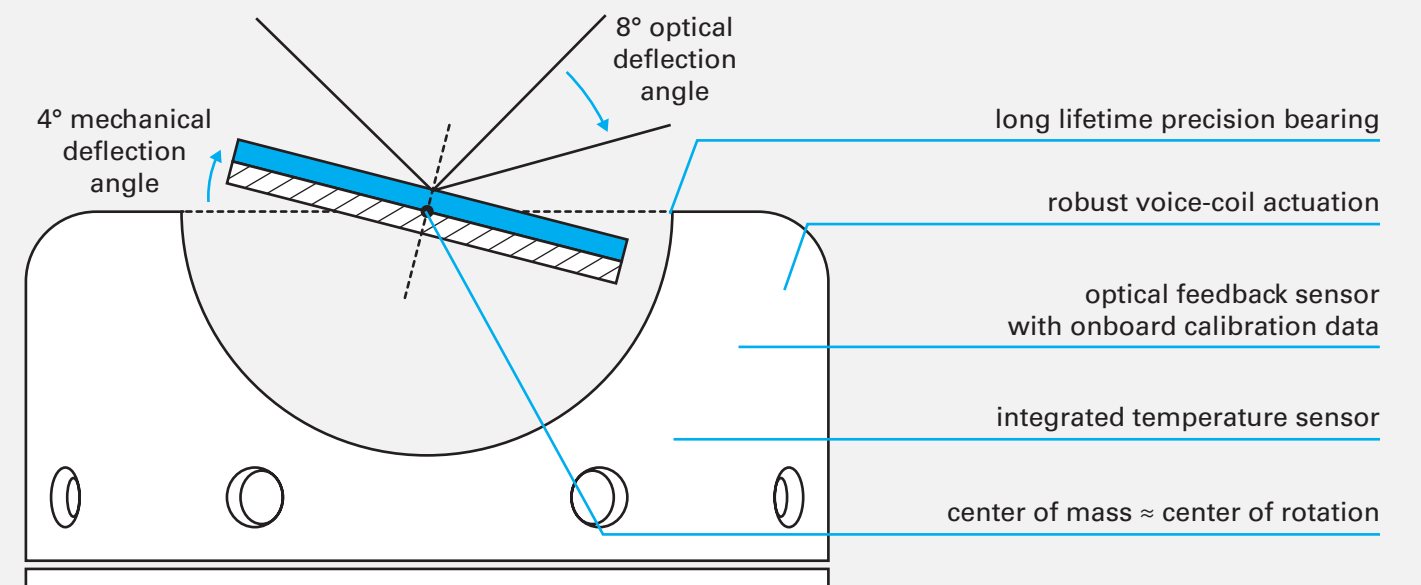
Fast & fine steering mirrors use a robust current-driven voice-coil actuator that precisely moves the mirror to its target position.

Special precision bearings allow reliable operation for more than 1 billion cycles without any change in performance. The moving magnet architecture allows for good thermal connection of the actuator

to the backside of the mirror and minimizes thermal influence on the mirror substrate flatness.

A high-resolution optical feedback sensor allows users to determine the exact mirror position in real time. An EEPROM containing the mirror's 2D calibration data allows simple plug-and-play operation with any MR-E-3 controller board (no pairing required).

Wide angular range



Large FOV
(up to 100°)



Compact and simplified design



High reliability
(billions of cycles)



Robust to shock and vibration



Single-surface 2D beam steering



The mirror's center of mass is aligned with its center of rotation, minimizing torque from shock and vibration. A magnetic restoring force enhances stability, while PID control further compensates for external disturbances, ensuring robust performance.





Overview

Fine & fast steering mirrors

Optotune's compact steering mirrors use robust voice-coil actuation for precise 2D beam deflection. Fast steering mirrors provide large tilt angles with integrated position feedback for applications such as FOV expansion, while fine steering mirrors feature an ultra-thin design and large mirror surface for high-precision adjustments and laser wobbling.



Scan for more info

Fine steering mirrors

FMR series



Optotune's compact FMR series uses a voice-coil actuator around a single large mirror to provide precise 2-axis beam steering with micro-radian resolution. The bearing-free design ensures a long lifetime, while the 20 x 20 mm² mirror offers a large clear aperture and fast response.

Its compact form factor, high-power coatings, and integrated beam dump option make it ideal for demanding applications such as precision beam control and 2D laser wobbling.

Advantages

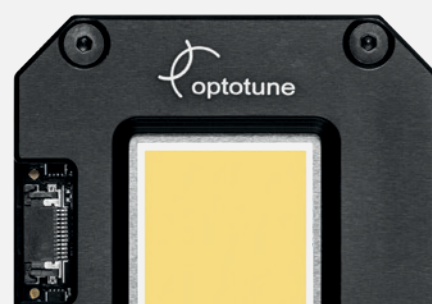
- ✦ Large clear aperture
- ✦ Precise & fast 2D beam control
- ✦ Thin and lightweight
- ✦ Suitable for high laser power

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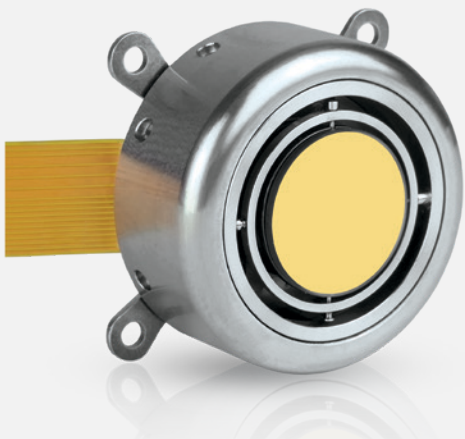
Product name	Mirror size (mm)	Tilt angle (°)	Full scale BW (Hz)	Resolution (μrad)	Repeatability RMS (μrad)	Position feedback
FMR-20	20 x 20	±0.2	250	4	-	no

All angles are mechanical.



|Fast steering mirrors

MR series



Optotune’s lightweight, compact MR series delivers large apertures with wide tilt angles for true 2D beam steering using a single optical element—reducing reflection losses, eliminating beam shift, and simplifying system design.

A robust voice-coil actuator and real-time optical feedback ensure precise, repeatable motion control. When paired with a camera, the mirrors enable FOV expansion.

Advantages

- ♦ Very large tilt angle (2D)
- ♦ Integrated and accurate optical position feedback
- ♦ Robust and compact
- ♦ Ideal for point & shoot and vector scanning

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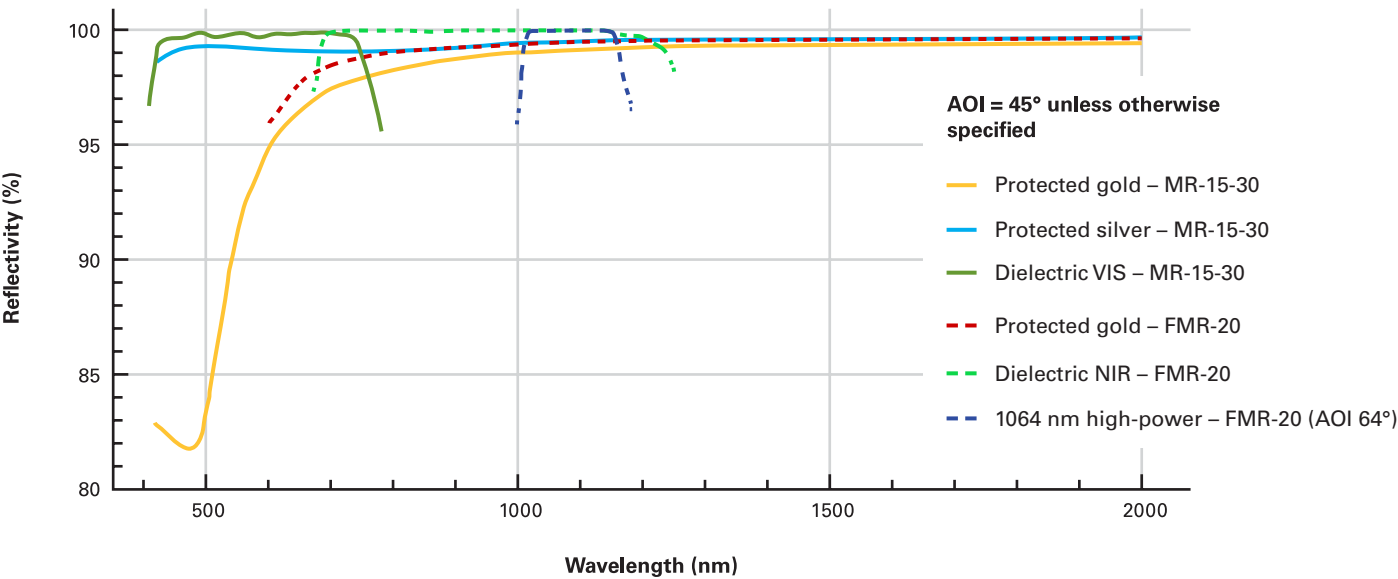
Product name	Mirror size (mm)	Tilt angle (°)	Full scale BW (Hz)	Resolution (μrad)	Repeatability RMS (μrad)	Position feedback
MR-15-30	15	±25	20	22	44	yes
MR-15-30-BK	15	±25	20	22	44	yes

All angles are mechanical.

Detailed series comparison

Name of the series	FMR series	MR series
Scan direction	2D	2D
Control	Open loop	Closed loop on both axes
Mech. tilt angle	±0.2° both axes	±25° both axes
Mirror size	20 x 20 mm ²	Ø15 mm
Resolution	4 μrad	22 μrad
Repeatability RMS (typical)	-	40 μrad
Full scale bandwidth	250 Hz both axes	20 Hz both axes
Settling time	4 ms (0.2° mech. step)	2-2.5 ms (0.1° mech. step) 8 ms (20° mech. step)
Mirror coatings	Protected gold Dielectric NIR 1064 high-power Other coatings upon request	Protected gold Protected silver Dielectric VIS Other coatings upon request
Mirror flatness P-V @549 nm	4λ	λ/2
Connectivity	2 coils, I2C (temperature sensor, EEPROM)	2 coils, 4 analog sensor channels, I2C (temperature sensor, EEPROM)
Compatible controller	ICC-4C-2000 with extension kit	MR-E-3

Combined reflectivity spectra of MR-15-30 and FMR-20



|Fast steering mirrors

FOV expansion



The FOV expansion kit featuring a MR-15-30 dual-axis fast steering mirror enables field of view expansion and area of interest (AOI) selection. The standalone camera on the left is equipped with a wide-angle objective to capture the overall scene. The camera on the right, equipped with a narrow-angle tele lens, looks at the mirror, and allows you to “zoom in” and select a small AOI out of a 100° optical FOV.

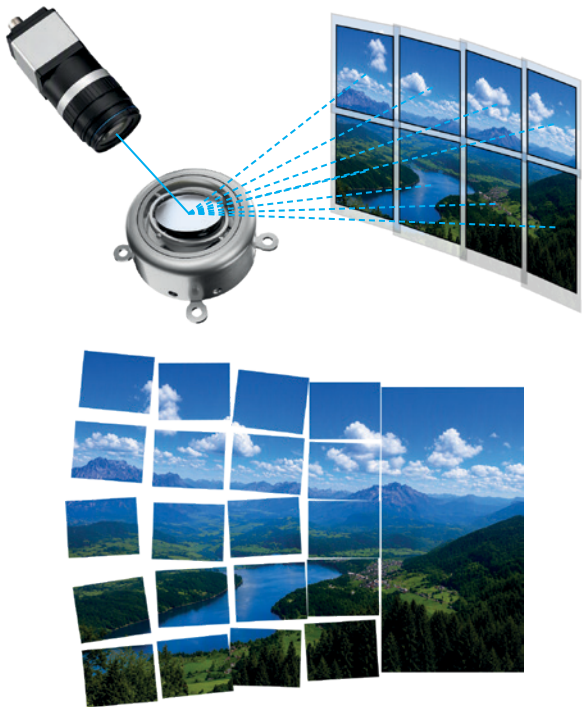
Applications

- ✦ Drone detection
- ✦ Surveillance and face-tracking in airports and other public spaces
- ✦ Inspection
- ✦ Gigapixel imaging

Scan for more info



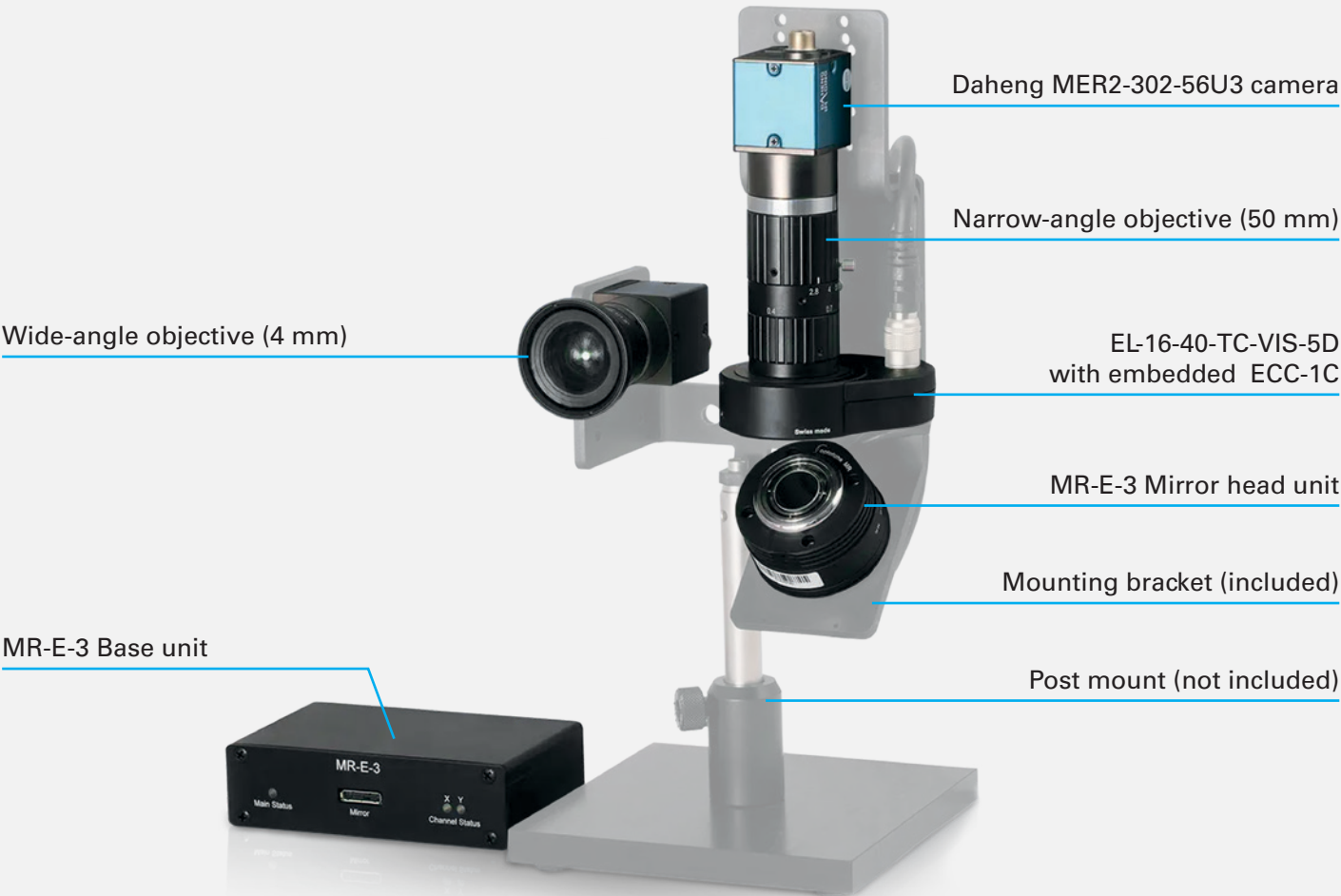
Gigapixel imaging



Area of interest (AOI) selection



FOV expansion development kit



Compatible mirror controller	MR-E-3 Base unit
Mirror version	MR-E-3 Mirror head dielectric
Tunable lens	EL-16-40-TC-VIS-5D (-2 dpt to +3 dpt)
Tunable lens controller	ECC-1C
Camera	Daheng 1/1.8" 3MP
Wide angle lens	4 mm (80° HFOV)
Narrow angle lens Image system angular resolution	50 mm (8° HFOV) or 75 mm (5° HFOV)
Image system angular resolution	6 mdeg/pixel (50 mm lens) or 4 mdeg/pixel (75 mm lens)
Use cases	Gigapixel imaging, AOI selection, face recognition
Advantages	All-in-one
Thermal management	Assured by kit
Connectivity	USB



Overview

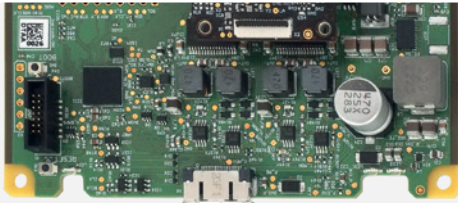
Mirror Controllers

Optotune controllers provide precise drive and control of MR fast steering mirrors and FMR mirrors. Multiple interfaces and Optockpit® software enable straightforward evaluation, prototyping, and system integration.

Ready-to-use kits combine a controller with a mounted mirror for rapid setup and testing. OEM electronics, standalone mirror options, and application-specific optical coatings support seamless integration into custom systems.



Scan for more info



Controllers' specifications

			
Product name	MR-E-3 / MR-E-3 OEM		ICC-4C-2000
Current range	-1000 to +1000 mA		-2000 to +2000 mA
Interfaces	USB, UART, SPI Analog input (0 - 10 V)		USB, UART, I2C, Ethernet with PoE+, Analog input (0 - 10 V)
SDKs	C#, Python		C#, Python
Supply voltage	24-48 V		24-48 V
Channels	2		4

Available kits' overview

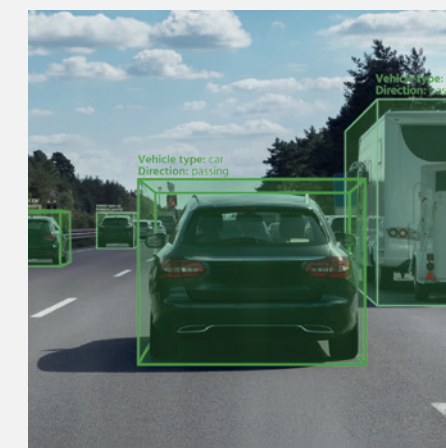
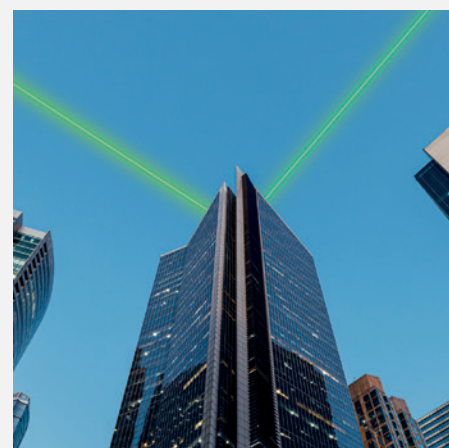
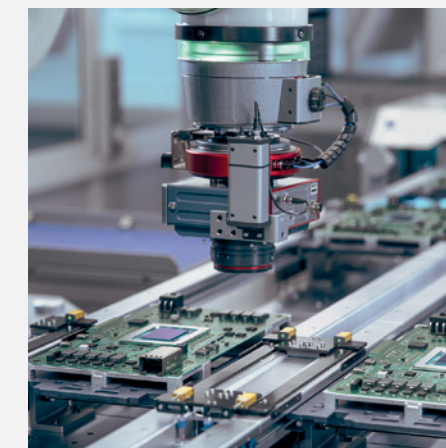
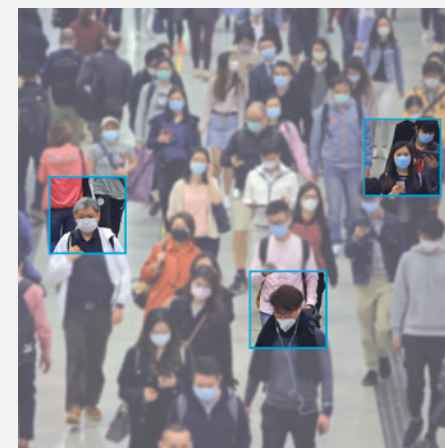
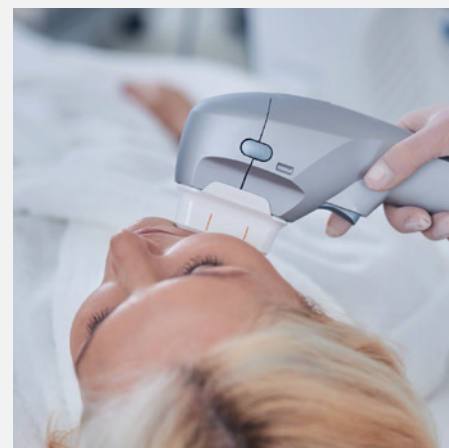
			
Kit name	MR-E-3 development kit	MR-E-3 OEM kit	FMR development kit
Compatible mirror controller	MR-E-3 base unit	MR-E-3 OEM version	ICC-4C-2000
Mirror version	MR-E-3 mirror head (gold, silver, dielectric, custom)	MR-15-30, MR-C-15-30 (custom)	FMR-20-X-0.2x0.2D-M (gold, dielectric NIR, 1064 high-power)
Use cases	Evaluation, R&D, plug-and-play	Prototyping, integration into OEM equipment	Evaluation, R&D, plug-and-play
Advantages	Electronics fully protected in housing	Compactness	Electronics fully protected in housing
Thermal management	Assured by kit	By customer	Assured by kit
Interfaces	USB, UART, SPI Analog input (0 - 10 V)	USB, UART, SPI Analog input (0 - 10 V)	USB, UART, I2C, Ethernet with PoE+, Analog input (0 - 10 V)

Fine & fast steering mirrors

Markets & applications

The lightweight and compact MR Series Fast Steering Mirrors enable true 2D beam steering with a single optical element, combining large apertures with wide tilt angles. This approach reduces reflection losses, eliminates beam shift, and simplifies optical system design.

Driven by robust voice-coil actuators and proven through more than 1 billion cycles, the MR series delivers the speed, precision, and reliability required for demanding applications such as OCT, cosmetic laser systems, barcode scanners, free-space optical communication, and many more.



Medical

- ✦ Cosmetic lasers
- ✦ In-vitro fertilization incubators
- ✦ OCT
- ✦ Ophthalmology
- ✦ Skin scanners

Manufacturing & logistics

- ✦ Barcode scanners
- ✦ Laser processing
- ✦ LiDAR scanners
- ✦ Quality control

Defense

- ✦ Dazzling
- ✦ Drone detection
- ✦ Free-space optical communication (FSOC)
- ✦ Targeting & illumination

Consumer

- ✦ Gigapixel imaging
- ✦ Surveillance/face detection

| From idea to implementation

Pre- and post-sales customer support



Engineering & feasibility studies

- Integration
- Optical feasibility studies
- Simulation & modeling
- Use-case, cost analyses



Rapid prototyping & evaluation

- Application demos
- Fast customization
- Plug-and-play kits
- Prototype in weeks



Custom development (OEM/ODM)

- Application-specific tuning
- Industrial packaging
- IP and licensing collaboration
- System integration



Scaling to mass production

- Application troubleshooting
- Root cause analysis
- System-level optimization



Firmware & control optimization

- API and software integration support
- Controller tuning
- Firmware updates



Integration & commissioning

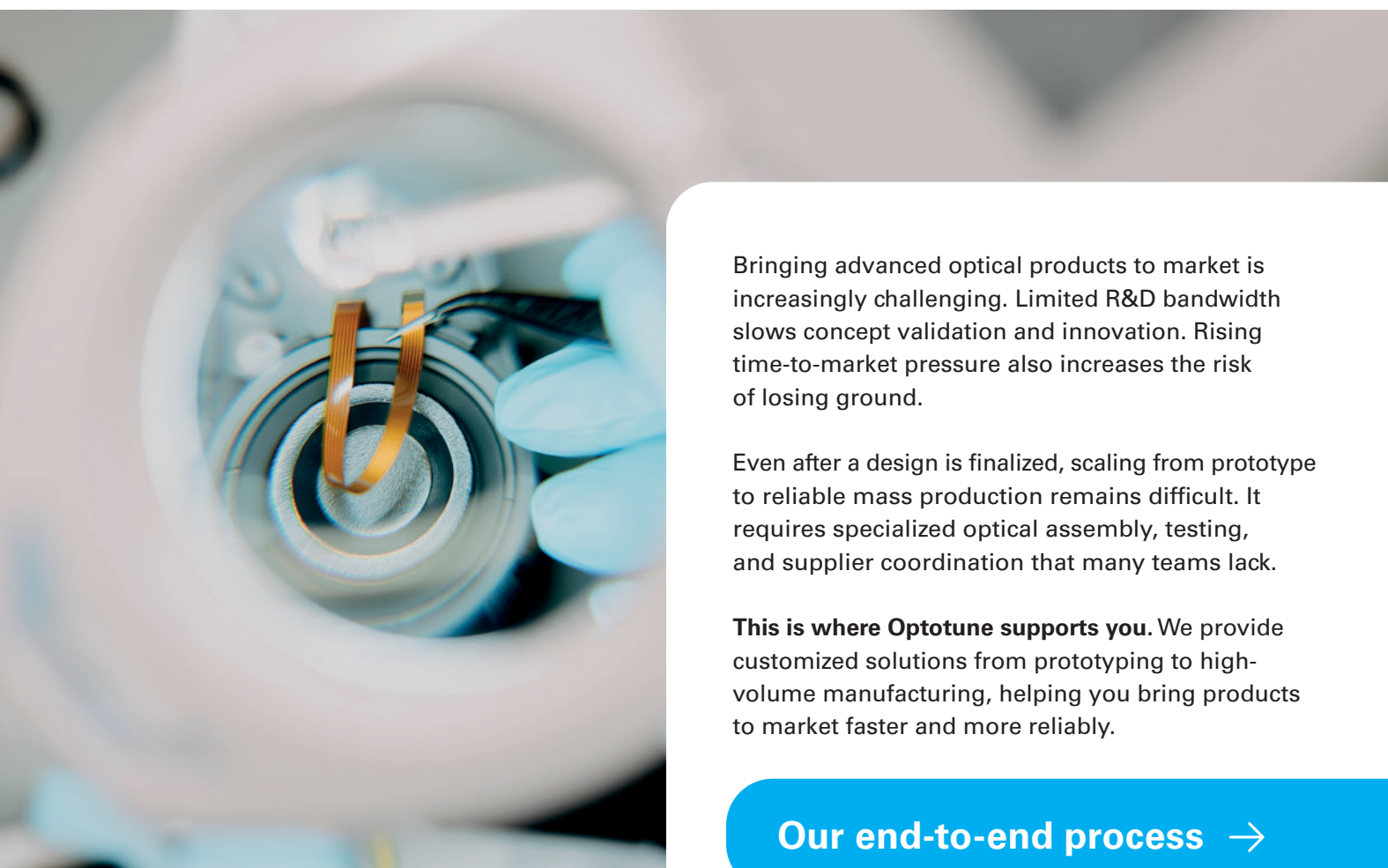
- On-site/remote support
- Optical calibration
- Performance validation
- System tuning

Sale

Support at every step of your journey. We do not stop at delivering a product. Every project has its own technical challenges, and we are here to solve them together with you.



Customized optical solutions



Bringing advanced optical products to market is increasingly challenging. Limited R&D bandwidth slows concept validation and innovation. Rising time-to-market pressure also increases the risk of losing ground.

Even after a design is finalized, scaling from prototype to reliable mass production remains difficult. It requires specialized optical assembly, testing, and supplier coordination that many teams lack.

This is where Optotune supports you. We provide customized solutions from prototyping to high-volume manufacturing, helping you bring products to market faster and more reliably.

Our end-to-end process →

Why work with Optotune?

World-class engineering team

Over 45 specialists with expertise in electromechanical design, optical simulations, material characterization, software, and firmware.

Scalable in-house manufacturing

Automated production lines, digitalized processes powered by SAP, and fully integrated testing and validation systems.

Reduced time to market

Accelerated design and validation cycles help you launch innovative solutions faster than your competition.

State-of-the-art facilities

ISO-certified clean rooms, humidity- and temperature-controlled assembly areas, and automated testing systems.

01

Conceptualization & feasibility

We go beyond executing specifications – we help shape them. As your partner, we bring new ideas and alternative approaches based on our engineering expertise. Early on, we assess feasibility and explore architecture options to ensure concepts are practical and scalable before detailed design.

02

Design

We translate your requirements into detailed 3D CAD models and engineering drawings. Our team optimizes designs for functionality, manufacturability, and performance while running feasibility studies, simulations, and opto-mechanical integration checks.



Prototyping & validation

We produce functional prototypes to validate fit and performance. Iterative testing and adjustments ensure the design meets your expectations and early risks are addressed before scale-up.

03

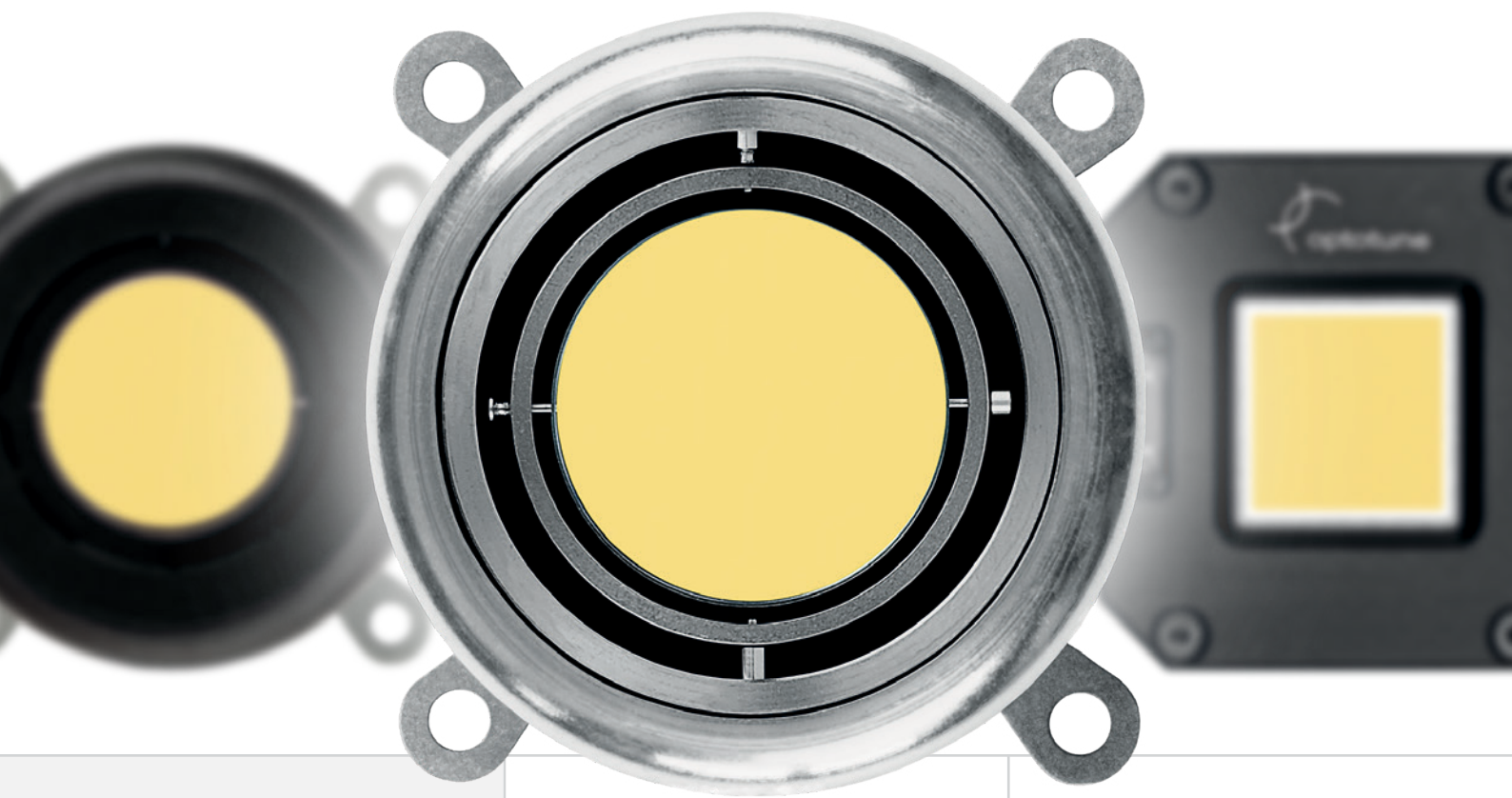
Manufacturing & delivery

Production scales in our ISO-certified facilities with full assembly, calibration, and final testing performed in-house. Packaging, logistics, and traceability are included, ensuring smooth global delivery.

04



Making **optical innovation**
happen since 2008



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