

5th Edition

# Optem® FUSION

Extreme Micro-Imaging Versatility



## High-Performance... High-Magnification

- Wafer Processing
- MEMS Development
- Non-Contact Metrology
- Fiber Alignment
- Analytical Probing
- Solder Bump Inspection
- Filter & Particle Analysis
- Micro-Hole Arrays
- Nanolithography
- Laser Machining / Marking
- Micro Structures
- Materials Research
- Micro Dispensing
- Well Plate Scanning
- Crystal Development
- Gemological Analysis
- Biomedical Research
- Microfluidics



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## Your Key to Photonic Innovation

Qioptiq designs and manufactures sophisticated optical products and photonic solutions to serve a wide range of applications across the industrial manufacturing, research & development, medical, defense & aerospace and life sciences sectors. Our extensive expertise across a broad spectrum of optical and photonic technologies makes Qioptiq the perfect partner and supplier for a wide range of high-tech companies worldwide.

### Recognized Quality

We are proud to be known for our highest-quality components, products and instruments, our custom modules and assemblies, our leading-edge innovation, our precision manufacturing and our responsive global resourcing.

### An Innovative Optical Pedigree

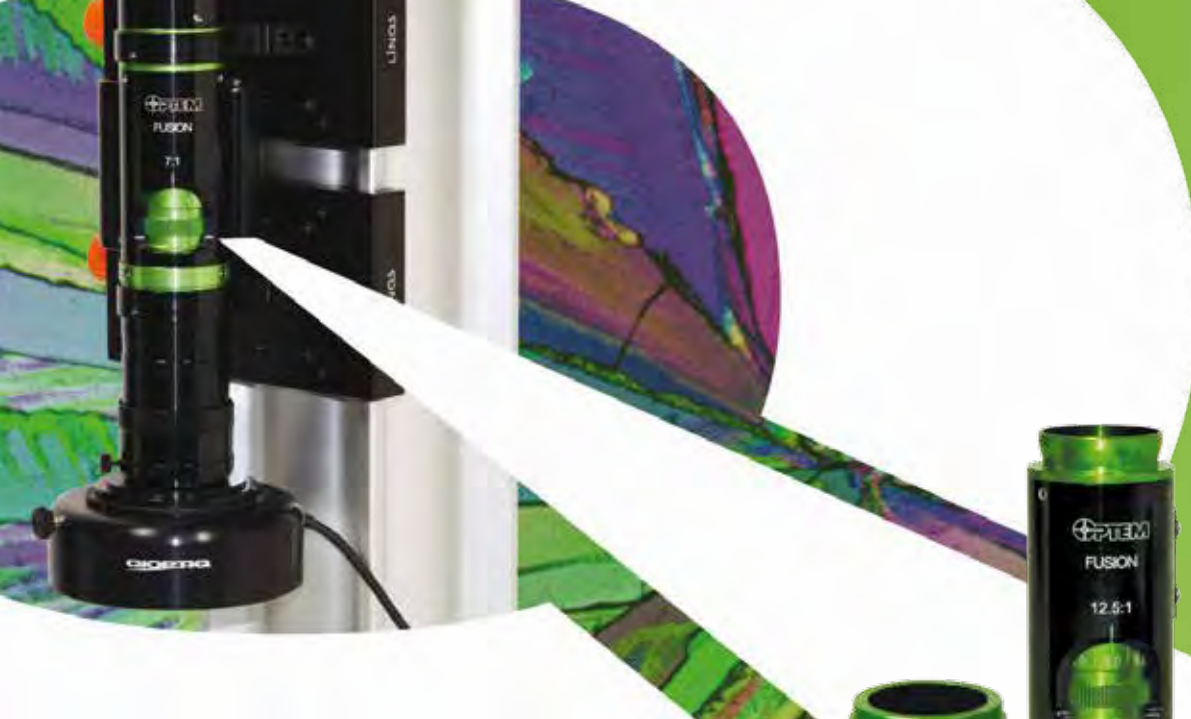
Through a series of acquisitions, Qioptiq possesses an impressive history integrating the knowledge and expertise of names like LINOS, Point Source, Spindler & Hoyer, Gsänger, Optem, Pilkington, and many others. We are proud to be the home to the world-famous LINOS Catalog and online shop.

### Expertise in Micro Imaging

With a foundation built upon more than 100 years of optical innovation and experience, today Qioptiq delivers precision optical solutions into OEM systems for applications from surgical imaging to semiconductor processing... from dimensional metrology to DNA sequencing.

Our innovations and expertise in high-magnification image quality, field-flatness, zoom precision and repeatability, camera optimization, optomechanical automation, and integrated illumination define the leading edge of micro-imaging technology... Take a closer look through Qioptiq.





*Qioptiq coalesces 40 years of Optem® Lens manufacturing expertise into the perfect fusion of performance, simplicity and flexibility.*

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## Optem FUSION

### Extreme Micro-Imaging Versatility

The all new Optem FUSION Lens System incorporates expanded functionality, bi-directional infinity optics, and a uniform modular matrix to provide OEMs with the ideal lens solution for streamlined integration of high-magnification imaging.

Simply change-out modules to modify the form, function and performance of your Optem FUSION Lens System to meet the exact spatial, functional, mounting and imaging requirements of your system.

### OEM-Optimized to Streamline Time-to-market

A FUSION imaging solution can be designed and configured in minutes... not hours. And FUSION's modular offering of universally interchangeable components means your prototype is in place in days... not months.

### Configured to Your Application

Using standard FUSION Lens matrix components, Qioptiq has the optical design prowess and manufacturing expertise to incorporate virtually any optical microscopy feature into your Optem FUSION Lens System. Specialized components and custom-tailored configurations are simple, expedient and cost effective.



### Unmatched Modular Imaging Flexibility

- Configure for versatile 7:1 or 12.5:1 zoom optics or for a wide range of economical fixed magnifications
- NOW, All FUSION Lens System accessories are compatible with the **NEW Fetura+** High-Performance Automated Zoom Lens
- Swap out lower lenses or LWD objectives to configure a wide range of imaging envelopes
- Interchange Camera Mounts and Camera Tubes to optimize sensor coverage for virtually any camera format or mount
- Integrate coaxial or ringlight LED illumination and automate focus and/or zoom with stepper motors
- Plug-n-play programmable control for multi-axis illumination focus and zoom
- Incorporate accessories at virtually any point of the lens assembly
- Space-efficient inline multi-point mount Blocks ensure added imaging stability





## FUSION Flexibility...

At the heart of FUSION's extreme versatility, is the simplicity of stacking a variety of modules to affect magnification, function and form of the lens system.

Following are the basic required components of a functional FUSION lens assembly. From here, features and accessories are easily swapped in to meet your requirements...

### Camera Mount

Mates FUSION with C, CS, F, EOS, 4/3-mount cameras and more

### Camera Tube

Modifies magnification to your camera optimizing chip coverage & performance

### Core Optical Module

Determines optical function... Fixed, 7:1 or 12.5:1 zoom magnification... motorized or manual

### Lower Function Module

Integrates internal focus (motorized or manual) and coaxial LED illumination options

### Lower Lens

Modifies taking magnification to affect field of view, NA and working distance

## Modular design allows FUSION to evolve quickly and easily

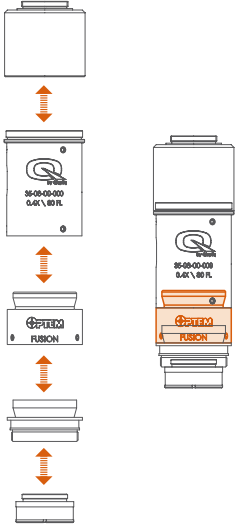
With a simple change-out of a few modules, you can modify FUSION performance, form and function to meet the evolving requirements of your system. This streamlines prototyping stages and aids the evolution of your system. Refer to the page opposite for an example of the modular changeout flexibility Optem FUSION presents.



Optem FUSION  
Extreme Micro-Imaging Versatility

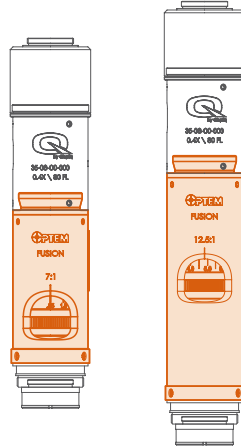
## Assemble a basic Fixed-Magnification lens configuration

Vary Camera Tube and Lower Lens magnifications with the Fixed Aperture Block to yield a wide range of fixed-imaging lens configurations.



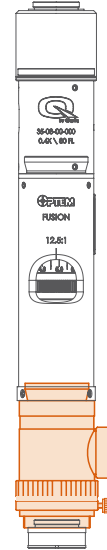
## Change out core optical modules to integrate Zoom Imaging

Replace the Fixed Aperture Block with a 7:1 or 12.5:1 Zoom Module to introduce variable magnification imaging.



## Integrate Lower Function Modules to add Focus and/or Coaxial Illumination

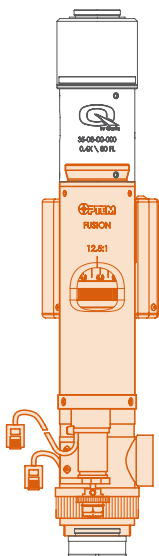
Swap out Basic Lower Function Module to integrate 15mm Fine Focus, integrated Coaxial Illumination or 5mm Focus with Coaxial Illumination.



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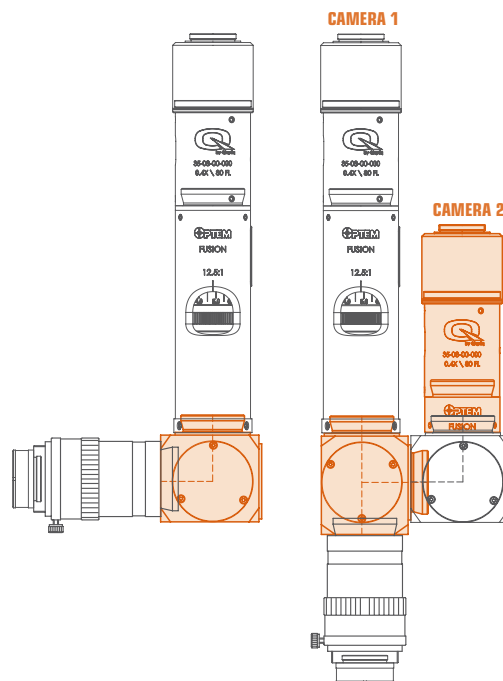
## Motorized Zoom and Focus Modules for streamlined integration of automation

Swap out Manual Zoom Modules and Fine Focus Lower Function Modules with stepper motorized modules. Digital, Multi-function Controller affords programmable control of all zoom, focus and illumination.



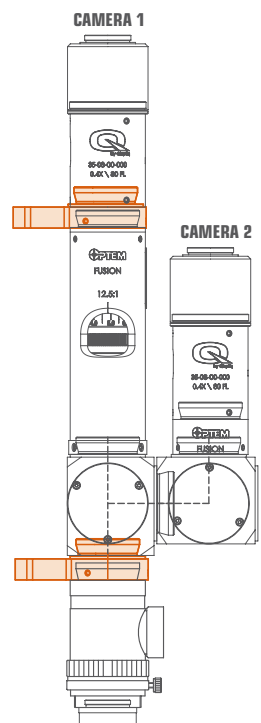
## Introduce 90° Mirror Cubes and 50/50 Cubes to modify form and function

If you have spacial constraints, integrate Mirror Cube Modules at any point of the lens assembly to introduce rotatable 90° and 180° turns in the optical path. Combine with 50/50 Cubes to incorporate multiple imaging functions and/or cameras.



## Streamline lens mounting and ensure imaging stability and centration

Infinity Optics afford placement of inline mounting blocks at most any point of the lens system. Ensures maximum imaging stability and solid centration repeatability even in gimbal systems.



# FUSION Features...

Optem FUSION is engineered to deliver unprecedented configuration and performance flexibility. A wide array of interchangeable components affords OEMs with forward flexibility to evolve imaging capability with the life cycle of their system, and affords researchers with quick swap-out flexibility for benchtop video microscopy applications.



## Extreme Imaging Versatility

FUSION delivers three distinct optomechanical capabilities within a single Lens System.

Specify economical Fixed Magnification imaging modules or 7:1 and 12.5:1 Zoom Optical Modules to meet your exact micro-imaging needs. Infinity Optics and uniform fitting components streamline swap-out and maximize flexibility in the development and forward evolution of your system.

## Optomechanical Flexibility

Integrate 90° Mirror Cubes and 50/50 Cubes at most any point along the optical path to modify the shape and fit of FUSION to your specific integration requirements. Combinations of multiple Cube Modules permit multiple cameras and lens functions to be integrated over a single optical subject.



## Enclosed Motors

Fully enclosed stepper motors on automated modules streamline integration and cable management and reduce potential operational contamination.

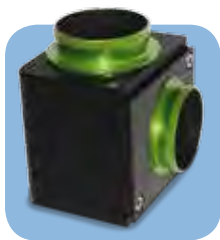


## Tunable lens module

Space saving liquid lens module provides fast autofocus capabilities without cumbersome motorized focus drives. Simply inserts directly above the chosen Lower Function Module.



**Optem FUSION**  
Extreme Imaging Versatility



## Fluorescence Imaging

Two modules utilizing user supplied Zeiss type 91029 cubes. Lower module provides system fluorescence illumination and imaging. The upper module will allow two different wavelengths to be directed to separate cameras.



## Fetura+ High Speed Zoom

Replace the standard 12.5:1 FUSION core zoom module with NEW Fetura+ for increased speed and durability. Fetura+ travels through the entire zoom range in less than 1sec and offers service life in excess of 1-million cycles. Motorization and control is already built in.



## Optical Accessories

Bi-directional infinity optics allow a range of Accessory Modules including iris, filter wheels, polarizers and apertures to be integrated at most any point along the optical path.



## Achieve Higher Magnification

FUSION is optimized to image through Optem Long-Working Distance Objectives. Select from 2X to 50X in High-Resolution and M-Plan APO and Objectives.



## LED Illuminator

The LED illuminator provides variable illumination levels to Optem fiber optic cables that exceed a Halogen 150W light source. The illuminator is small and compact in size weighing only 2.7KG/5.9 lbs. It has a lifetime of more than 25,000 hours. RoHS compliant; UL and CE approved.

## Image Stable Design

Enlarged barrel diameters and wall thickness combine with a 3-point dovetail coupling interface to promote robust lens assembly. Additionally, low profile, Inline Mount Blocks allow multiple mounting points along the assembly length to ensure maximum integration stability.



# FUSION Performance

## Fixed Magnification

### MINIMUM CONFIGURATION

Magnification .....	0.16X
NA .....	0.005
Resolution .....	15.0 lp/mm
Depth-of-Field .....	23 mm
Field-of-View* .....	41 x 55 mm
Working Distance .....	490 mm

### MAXIMUM CONFIGURATION

Magnification .....	12X
NA .....	0.18
Resolution .....	540 lp/mm
Depth-of-Field .....	0.018 mm
Field-of-View* .....	0.55 x 0.73 mm
Working Distance .....	32 mm

## 7:1 Zoom Magnification

### MINIMUM CONFIGURATION

	Low Zoom	High Zoom
Magnification	0.067X	0.46X
NA	0.0047	0.016
Resolution (lp/mm)	14 lp/mm	47 lp/mm
Depth-of-Field (mm)	25 mm	2.4 mm
Field-of-View* (mm)	131 x 98 mm	19 x 14 mm
Working Dist. (mm)	490 mm	490 mm

### MAXIMUM CONFIGURATION

	Low Zoom	High Zoom
Magnification	5X	35X
NA	0.047	0.16
Resolution (lp/mm)	142 lp/mm	465 lp/mm
Depth-of-Field (mm)	0.25 mm	0.024 mm
Field-of-View* (mm)	1.7 x 1.3 mm	0.25 x 0.19 mm
Working Dist. (mm)	32 mm	32 mm

## 12.5:1 Zoom Magnification

### MINIMUM CONFIGURATION

	Low Zoom	High Zoom
Magnification	0.045X	0.55X
NA	0.0036	0.019
Resolution (lp/mm)	11 lp/mm	58 lp/mm
Depth-of-Field (mm)	44 mm	1.5 mm
Field-of-View* (mm)	196 x 147 mm	16 x 12 mm
Working Dist. (mm)	490 mm	490 mm

### MAXIMUM CONFIGURATION

	Low Zoom	High Zoom
Magnification	3.4X	41X
NA	0.036	0.19
Resolution (lp/mm)	108 lp/mm	576 lp/mm
Depth-of-Field (mm)	0.44 mm	0.015 mm
Field-of-View* (mm)	2.6 x 1.9 mm	0.21 x 0.16 mm
Working Dist. (mm)	32 mm	32 mm

\* - All field-of-view data calculated for 2/3" camera



## The FUSION of Simplicity and Flexibility

Designed to meet the evolving needs of today's micro imaging applications in OEM systems, the Optem® FUSION Lens System combines a uniform mechanical interface with bi-directional infinity optics to deliver unmatched interchangeability, performance versatility and functional flexibility. Improve your image and streamline your development time... specify Optem FUSION to integrate *Extreme Imaging Versatility*.

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