inspec.x Lenses

High-Performance Lenses
for Large Sensors

inspec.x L 5.6/105

High-Resolution Lenses for Line-Scan Applications

The inspec.x L Series was developed to meet the highest requirements in industrial image processing with very large sensors. This Lens Series shows even contrast and resolution over an image circle of up to 82 mm. The field-proven performance makes these lenses a perfect match for sensors like the popular 12k/5µm and 16k/5µm line-scan sensors. Very large area line-scan sensors also benefit from the high resolution, low distortion and excellent color correction of these lenses.
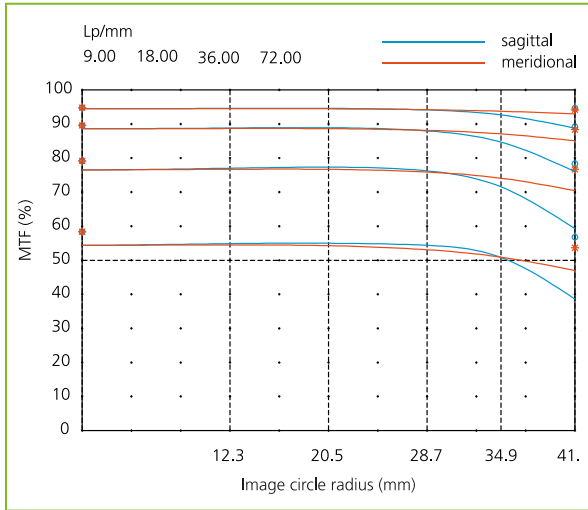
The four variants of the inspec.x L 5.6/105 are optimized for magnifications of 0.33x, 0.5x, 0.76x and 1x respectively. The V-groove interface at both ends of the lens enables adjustment to the best azimuth position and use of the lens in retro position for magnifications up to 3x. All lenses feature lockable iris and are engineered for use in harsh industrial environments.

Not exactly what you need? We are your partner for custom developments: from alterations of standard products to complete custom modules.
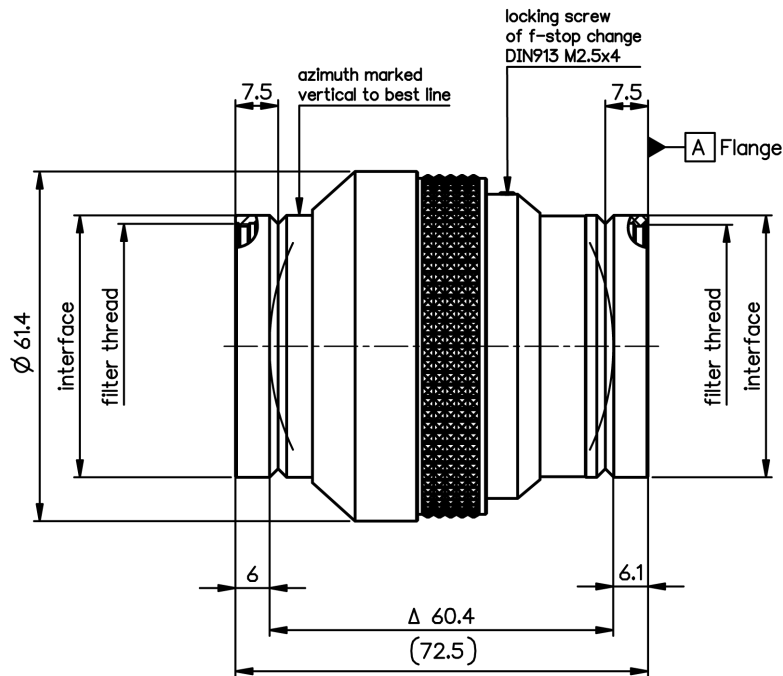
- Large image circle up to 82 mm
- Perfect match with 5 µm pixel size
- Full-metal barrel
- Lockable aperture

- Focal length: 105 mm
- Aperture: 5.6 … 11
- Working distance: 100-420 mm
- Spectral range: 400-750 nm
- Distortion: < 0.4%
- Camera mount: V-groove
- Compatible with all inspec.x L Series accessories

inspec.x L 5.6/105

Product	Focal length (mm)	F-number	Magnification range	Image circle (mm)	Interface	Part No.
inspec.x L 5.6/105 1.0x	105	5.6	-0.85 … -1.2	82	V-groove	0703-082-000-20
inspec.x L 5.6/105 0.76x	105	5.6	-0.6 … -0.9	82	V-groove	0703-083-000-20
inspec.x L 5.6/105 0.5x	105	5.6	-0.4 … -0.65	82	V-groove	0703-084-000-20
inspec.x L 5.6/105 0.33x	105	5.6	-0.25 … -0.45	82	V-groove	0703-085-000-20

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Lp/mm
9.00   18.00   36.00   72.00

sagittal
meridional

MTF (%)

100
90
80
70
60
50
40
30
20
10
0

12.3   20.5   28.7   34.9   41.

Image circle radius (mm)

MTF of inspect.x L 5.6/105 -0.5x @ β'= -0.5 and f-stop = 5.6

Some example applications are:

- PCB inspection
- Display inspection
- Film and slide digitization
- High-end book scanning
- Glass inspection
- High-resolution web inspection
- 3D imaging

locking screw
of f-stop change
DIN913 M2.5x4

azimuth marked
vertical to best line

7.5

7.5

A   Flange

∅ 61.4

interface

filter thread

filter thread

interface

6

6.1

Δ 60.4

(72.5)

inspect.x L 5.6/105 -0.5x

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inspec.x L float 5.6/105 and 5.6/120

High-Resolution Lenses with Wide Magnification Range

The inspec.x L float lenses combine the field-proven imaging performance of the inspec.x L Series with newly developed mechanics to cover a large magnification range with only one lens.

By using floating element optics, the inspec.x float lenses achieve high performance over an extremely wide magnification range from 0.3x to 3.0x and 0.06 to 0.52 respectively.

A full-metal housing makes the lens suitable for industrial use and geared rings facilitate the use in automated environments.

- Ideal for 12 k and 16 k sensors
- Geared rings for magnification and aperture
- Large image circle up to 82 mm

- Focal length: 105 mm or 122 mm
- Extreme magnification range of -0.3x … -3x or -0.06x … 0.52x
- Floating element optics
- Perfect match with 5 µm pixel size
- Working distance: 100-420 mm or 302-2037 mm
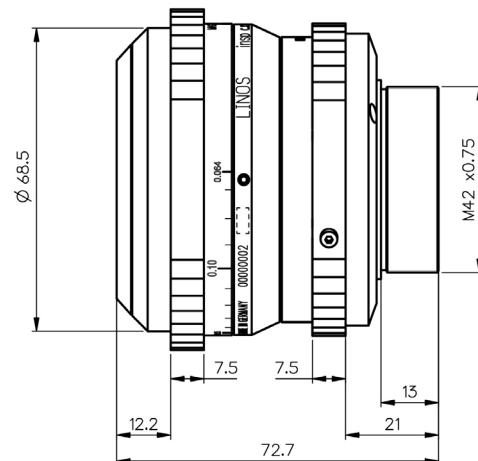- Spectral range: 400-750 nm
- Distortion: < 0.4%
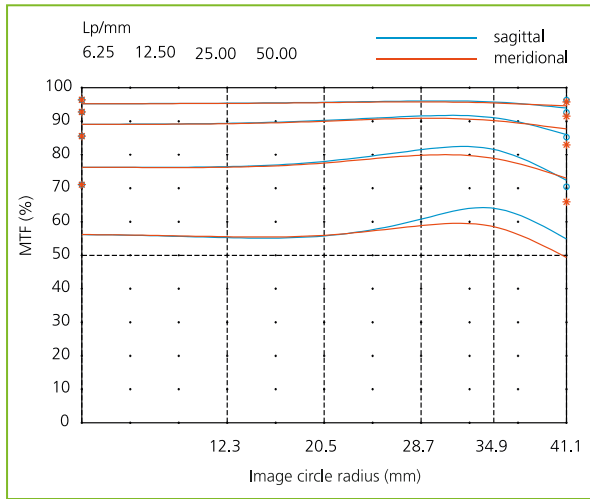

inspect.x L float 5.6/105
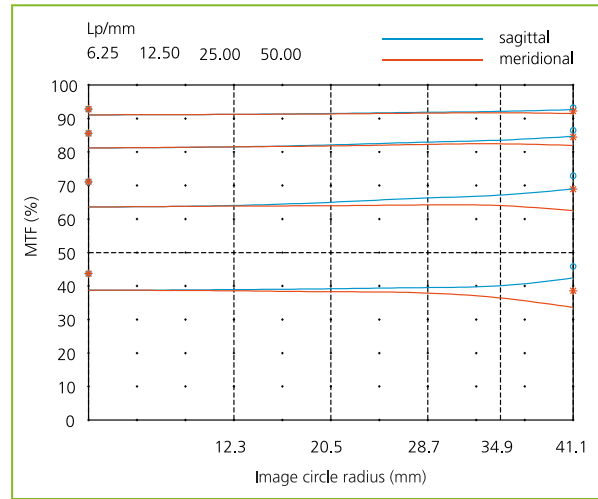
inspect.x L float 5.6/120

inspect.x L float 5.6/105

inspect.x L float 5.6/120

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4
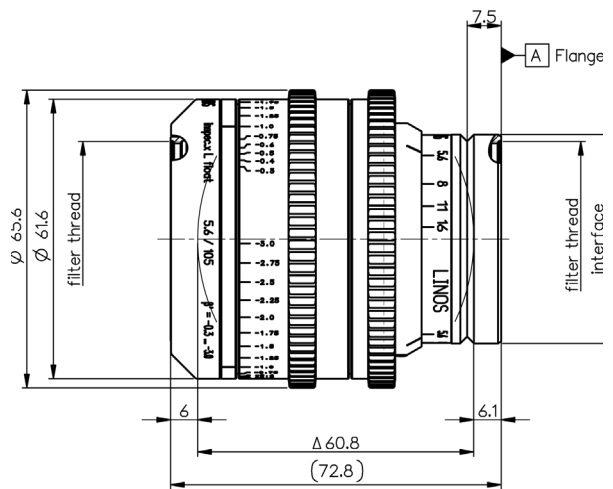
inspec.x L float 5.6/105 and 5.6/120

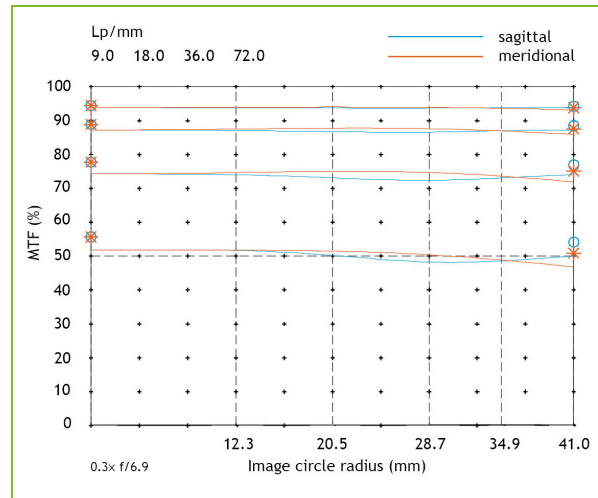| Product	Focal length (mm)	F-number	Magnification range	Image circle (mm)	Interface	Part No.
inspec.x L 5.6/105 float	105	5.6	-0.3 ... -3.0	82	V-groove	0703-114-000-20
inspec.x L 5.6/120 float	122	5.6	-0.06 ... -0.5	82	M42x0.75	0703-116-000-21

MTF of inspect.x L float 5.6/105 @ β'= -0.5 and f-stop = 5.6

MTF of inspect.x L float 5.6/105 @ β'= -2.0 and f-stop = 5.6
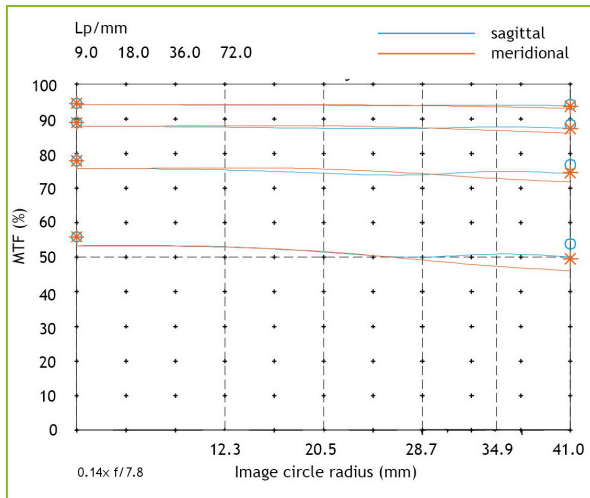
MTF of inspect.x L float 5.6/120 @ β'= -0.14 and f-stop = 7.8

MTF of inspect.x L float 5.6/120 @ β'= -0.3 and f-stop = 6.9

inspec.x L 4/105

High-Resolution Lenses for High Magnification Imaging

This inspec.x L 4/105 Series lens was developed to achieve an object resolution down to 2 µm. These lenses are designed for sensors with up to 82 mm length and achieve an enormous resolution of up to 200 lp/mm in the object plane. This high imaging quality is achieved across the complete image circle. Another advantage is the extremely small distortion, which is well under 1µm over the complete field of view.

The inspec.x L 4.0/105 Series is the perfect match for modern, high-resolution 12k/5µm and 16k/5µm cameras for applications that require extremely high resolution. Two magnifications of 3.5x and 5x are available. Both lenses can be ordered in a version that is optimized for a prism beamsplitter on the object side for coaxial illumination (see opposite page for details).

- Outstanding MTF performance over the entire image circle
- Diffraction-limited optical design
- High numerical aperture

- Focal length: 105 mm
- Magnifications: 3.5x, 5x
- Image circle up to 82 mm
- Spectral range: 400-750 nm
- Iris diaphragm: manual, lockable
- Mount: V-groove
- Wide range of mechanical accessories
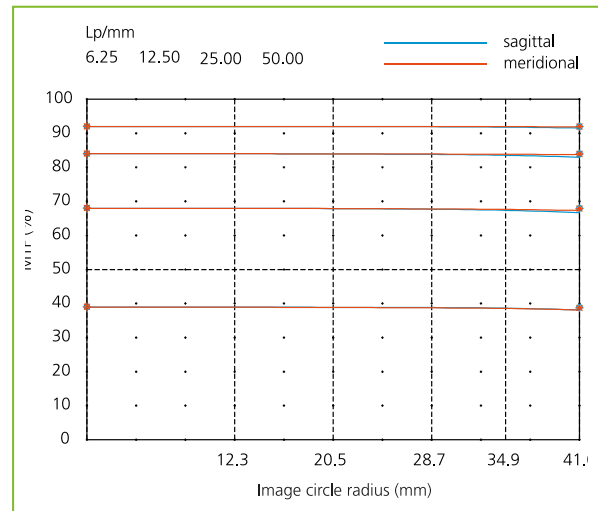
MTF of inspec.x L 4.0/105 -3.5x @ β'= -3.5 and f-stop = 4

inspect.x L 4.0/105 -3.5x

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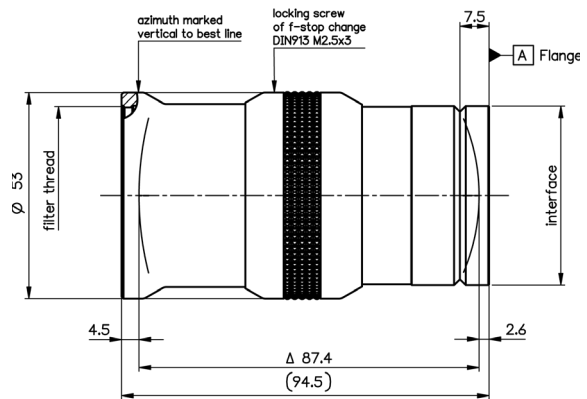
inspec.x L 4/105

Product	Focal length (mm)	F-number	Magnification range	Image circle (mm)	Interface	Part No.
inspec.x L 4.0/105 -3.5x	105	4.0	-3.3 ... -3.7	82	V-groove	0703-095-000-21
inspec.x L 3.5/105 -5.0x	105	3.5	-4.8 ... -5.2	82	V-groove	0703-102-000-20
inspec.x L 4.0/105 -3.5x prism	105	4.0	-3.3 ... -4.0	82	V-groove	0703-107-000-20
inspec.x L 3.5/105 -5.0x prism	105	3.5	-4.8 ... -5.2	82	V-groove	0703-108-000-20

inspec.x L Prism Module

Beam Splitter Prism for High-Resolution Lenses

Coaxial illumination is very common for high-resolution applications. Excelitas offers an easy-to-use prism module that is optimized for use with our prism type inspec.x L. This prism module is designed with a universal mount for fiber guides that are widely used for line-scan illumination. With a simple setup, our prism module provides a complete optical system which combines the lens and illumination unit that achieves diffraction-limited performance.

Inspect.x L prism lens with prism module

The prism module is designed for the following lenses:

• inspec.x L 4/105 -3.5x prism
• inspec.x L 3.5/105 -5x prism

Beam splitter prism

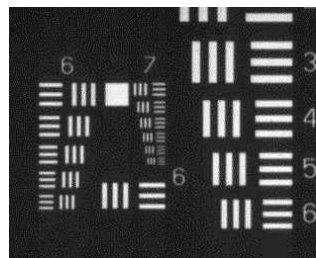| Product	Part No.
Prism module	0703-107-824-00

USAF-Testchart exposure with a Dalsa Piranha HS 12k in area-mode and 430 nm illumination. Element 6 of group 7 could be resolved, which means up to 228 lp/mm at a field of view of 17.8 mm.
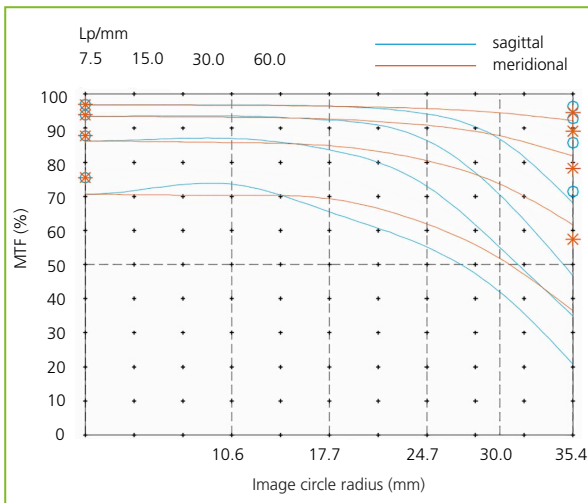
inspec.x L 4/60

High-Resolution Lense for Small Magnifications

The inspec.x L 4/60 is optimized for use from infinity down through magnifications of around 0.2. In this range, the lense shows exceptional contrast over a large sensor size of up to 70mm. High contrast goes along with very good color correction and low distortion. The 60mm lens provides unusually high performance for such a short focal length and enables imaging of large objects in space constrained environments with large sensors.

The inspec.x L4/60 features a threaded interface for use with the popular Modular Focus helical mount that provides access to virtually all existing cameras via different camera adapters.

- High contrast for small magnifications
- Excellent color correction

- Focal length: 60 mm
- Magnifications: 0 … 0.2
- Image circle up to 70 mm
- Spectral range: 400-750 nm
- Iris diaphragm: manual, continuous with set screw
- Mount: compatible to Modular Focus
- Wide range of mechanical accessories

MTF of inspect.x L 4/60 @ β'= -0.03 and f-stop = 5.6
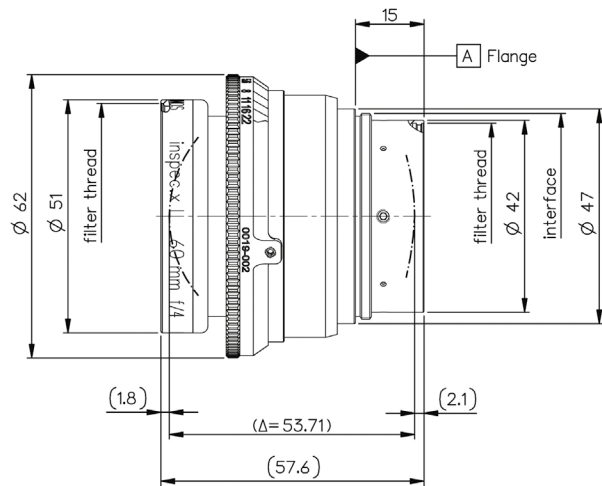
inspect.x L 4/100

inspec.x L 4/60

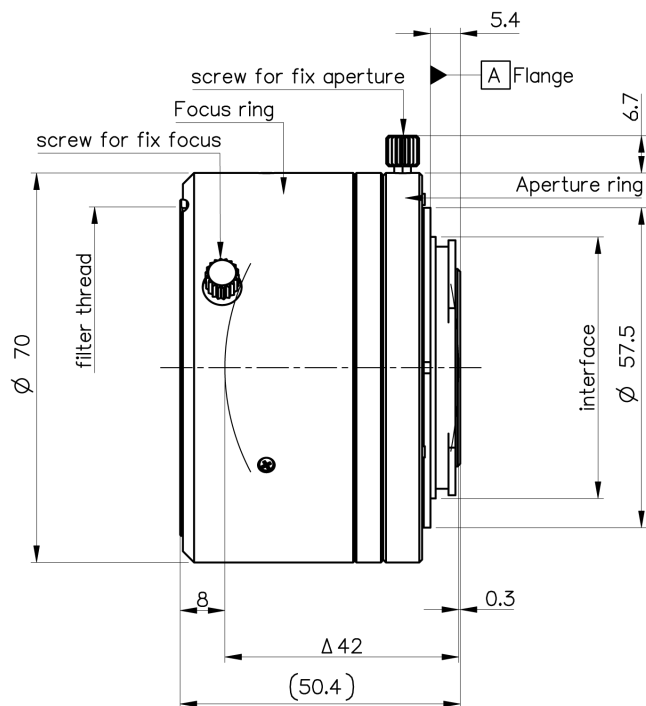| Product	Focal length (mm)	F-number	Magnification range	Image circle (mm)	Interface	Part No.
inspec.x L 4.0/60	60	4.0	0 … -0.2	70.8	M45x0.75	0019-002-000-50

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inspec.x M

Lenses with Large Aperture for Low-Light Line-Scan and Area-Scan Applications

The inspec.x M Series closes the gap between the outstanding C-Mount MeVis-C lenses and the large format inspec.x L lenses.

Equipped with lockable manual focus and manual iris, these F-Mount lenses are the ideal choice for sensors up to 35 mm format when a fast f/# is required. The 1.4/50 mm lens is available for visible spectral range or near-infrared. The NIR version lens features a coating for wavelengths ranging from 900 to 1350 nm, making it an ideal choice for applications like electro- and photoluminescence

- Large magnification range
- Very high numerical aperture
- Low distortion

- Optical magnification: -0.07
- Image circle: 43.3 mm
- Max. sensor size: 35 mm format
- Camera mount: F-Mount
- Focusing: manual, lockable
- Iris diaphragm: manual, lockable

inspec.x M

Product	Focal length mm)	F-number	Magnification range	Image circle (mm)	Interface	Part No.
inspec.x M 1.4/50	50	1.4	0 ... -0.15	43.3	F-Mount	0009-243-000-40
inspec.x M NIR 1.4/50	50	1.4	0 ... -0.15	43.3	F-Mount	0009-243-000-42

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MachVis Software

Lens Selection and Configurator Software

Excelitas has developed a software tool that simplifies your tasks for imaging and machine vision needs

MachVis is specifically designed to help you identify and select the most suitable lenses and accessories. Your benefit is a high-resolution and stable image on your sensor. With MachVis, Excelitas offers you a software with a user-friendly interface for quick and comprehensive solutions.

Based upon four key parameters of your application,
- Working distance
- Object size (or magnification)
- Sensor size
- Camera mount

MachVis will provide the lens solutions that are most suitable to your specification:

All necessary optical components as well as mechanical accessories, are directly downloadable of the 3D data for a smooth integration into the project are available with a single click. Configurators are available for the more complex microscope systems, where e.g. the motorization, the installation of zoom systems, beam splitters, filters and, last but not least, the coupling of the illumination open up a virtually unlimited range of possibilities and flexibility. With this features, MachVis reaches a new level from selection to an optical configuration software.

In addition to the LINOS® Machine Vision Lenses, the OPTEM® Fusion Micro-imaging System and the Qioptiq mag.x® Microscope system, the PCO® Scientific Cameras are also available from Excelitas now.

MachVis: Example of the user face

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Apart from the geometric optical calculation based on the parameters provided by the user, the software also acts as a product database, providing quick and easy access to all product data and presenting an instant schematic representation of the entire optical system.

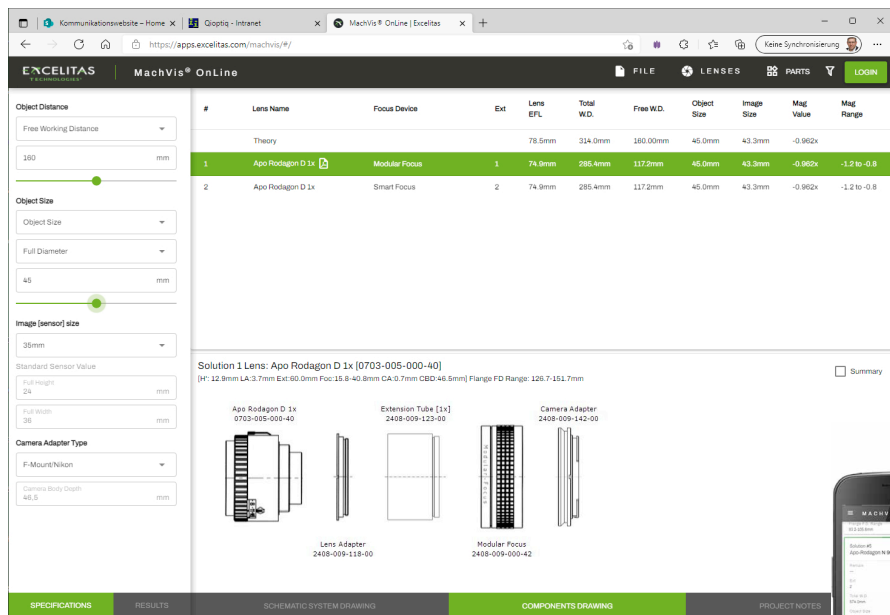With **MachVis Online** it is possible to access MachVis directly without the need to download and install any software. Let MachVis online convince you and receive more flexibility and independence. MachVis not only helps to identify the perfect lens solution, it saves your time in the lens selection and configuration process.

Try our new online application today and create your own user profile so you can access your individual configurations on any mobile device!

MachVis or
MachVis Online:
Access for FREE!

For access or download and further information, please go to www.excelitas. com/product/machvis-lens-configurator.

MachVis Online: Example of the user face

Mechanical Accessories

Mechanical Adapters

LINOS Machine Vision Lenses have different threads and most have no focusing device. Therefore, we offer a complete range of mechanical accessories to adapt the lenses to all types of camera systems.

The focus tubes were specially developed for the inspec.x L series at high magnifications with large sensors. The flange focal distances are relatively long and vignetting and stray light must be prevented in order to ensure excellent imaging.
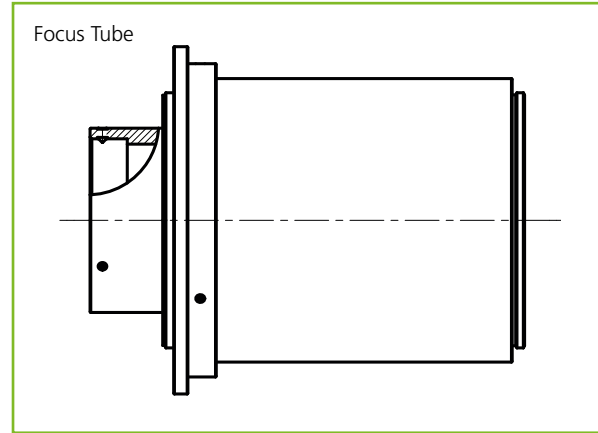
Focus Tube

Focus Tube inspec.x L 105

Product	Part No.
Focus tube M72 for inspec.x L 105 mm -0.33x and -0.5x	2408-012-000-31
Focus tube M72 for inspec.x L 105 mm -0.76x and -1.0x	2408-012-000-30
Focus tube M72 for inspec.x L 105 mm -3.0x and -3.5x	2408-012-000-47
Focus tube M72 for inspec.x L 105 mm -5.0x	2408-012-000-33
Focus tube M95 for inspec.x L 105 mm -0.33x and -0.5x	2408-012-000-41
Focus tube M95 for inspec.x L 105 mm -0.76x and -1.0x	2408-012-000-43
Focus tube M95 for inspec.x L 105 mm -3.0x and -3.5x	2408-012-000-46
Focus tube M95 for inspec.x L 105 mm -5.0x	2408-012-000-45

Focus tube inspec.x L 105

## A Closer Look

Detailed technical information as well as CAD files of all mechanical components can be found at www. qioptiq-shop.com under "Docs and Drawings" on the respective product sheets.

Example: inspec.x L float

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Modular Focus

A helical mount with locking screw and travel range of 25 mm. Lenses are mounted via an M45 thread using the various lens adapters and extension tubes that Qioptiq offers. A large variety of camera adapters is mounted directly with three set screws. The complete setup can be rotated freely for best azimuth or convenient access to aperture and locking screw. Smart mechanical design of the Modular Focus prevents the lens from rotating during focusing.
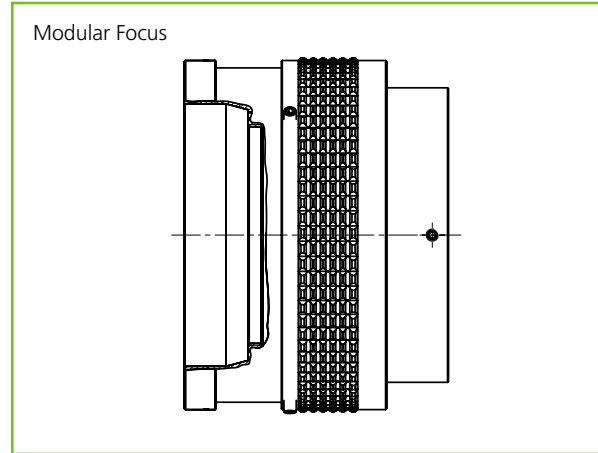
Modular Focus

Modular Focus

Product	Part No.
Modular focus helical mount	2408-009-000-42
Extension tube 24.5 mm M45x0.75	2408-009-113-00
Extension tube 60 mm M45x0.75	2408-009-123-00
Extension tube 87.5 mm M45x0.75	2408-009-122-00

Modular focus

Camera Adapter

Product	Part No.
Camera adapter C-Mount	2408-009-106-00
Camera adapter F-Mount	2408-009-142-00
Camera adapter TFL-I Mount	2408-009-174-00
Camera adapter M42x1	2408-009-119-00
Camera adapter M48x0.75 (TFL-II Mount)	2408-009-148-00
Camera adapter M58x0.75	2408-009-132-00
Camera adapter M72x0.75	2408-009-134-00
Camera adapter M90x1	2408-009-166-00
Camera adapter M95x1.0	2408-009-155-00

Camera adapter M42

Camera Extension Tubes

Product	Part No.
Extension tube M72x0.75-24mm	2408-009-135-00
Extension tube M95x1.0-24mm	2408-009-156-00

Extension tube M72

Lens Adapter

Product	Part No.
Lens adapter M45 V-groove	2408-009-147-00
Lens adapter M45-M42	2408-009-173-00

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Discover the capabilities, knowledge, equipment
and technology of Qioptiq

The Vision Technology product area covers the
whole range of industrial magnification tasks from
Macro to Micro and Line-Scan to Area-Scan.

Enabling the future through light.

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