QIOPTIQ
Photonics for Innovation
An Excelitas Technologies Company

mag.x system 125

High Resolution Wide Field Micro-Inspection System

Modular System

High resolution inspection is being used in many applications. Each application has its own requirements and constraints. In order to cater for all these diverse needs the mag.x system 125 is as modular as possible. Integration of customized elements is easy and enables a system that integrates seamlessly into the surrounding equipment.

Base units

Heart of the system is always the base unit which is available in different variations. All other components are attached to these base units. Mounting of the system to the surrounding equipment is also provided by the base unit.

Objective lenses

The optical performance of the system is mainly defined by the objective lenses. These are the components that make the mag.x system 125 really unique. All of Qioptiq's highest end technology is being used in manufacturing and testing of these lenses.

Tube lenses

System magnification and maximum sensor size are the result of the combination of tube lens and objective lens. The current selection of tube lenses allows the use of sensors with a diagonal of up to 57 mm. All tube lenses are also telecentric on image side.

Illumination

For coaxial bright field illumination Koehler illumination optics are included that can be interfaced to light sources via optical fibers or directly to LED sources. Darkfield illumination can be added easily with an optional adapter.

Autofocus solution

Focusing in an automated environment is simplified by the mag.x system 125 modular, integrated autofocus solution. Two actuators (Piezo unit respectively motorized z-axis) enable highly-precise focusing in a fraction of a second. The AF base unit couples the laser from an autofocus sensor into the beam path. The autofocus sensor and the actuator constitute a closed-loop system that ensures optimum focus in the object plane. Since no stitching is needed, high-resolution sensors can be used to create significantly shorter tact times without compromising the resolution of the inspection system.

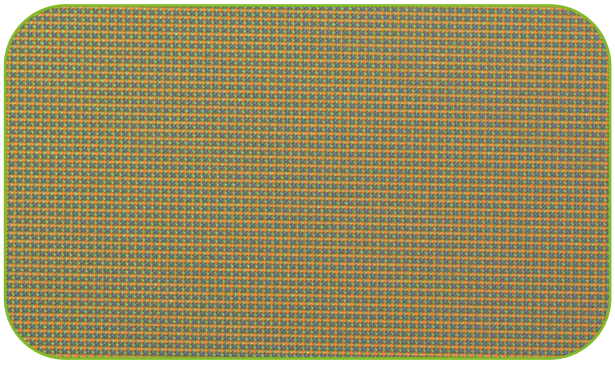
Excelitas/Qioptq cooperates with WDI Wise Device Inc. - the world's leading manufacturer of industrial autofocus sensors.

Accessories

No system is complete without an array of accessories. The wide selection ranges from camera and fiber adapters to mounting plates. Camera adapters are precisely matched to the camera and tube lens. Various camera adapters can be additionally created on request.

Applications

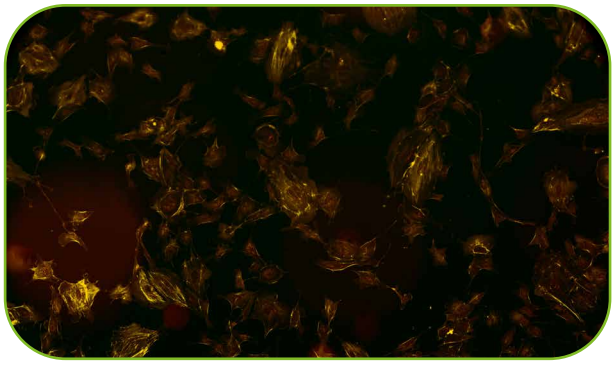
Numerous applications benefit from the versatility and the high optical performance of the mag.x system 125. The large field-of-view increases throughput of inspection installations as more object space is imaged at once and the number of images that need to be acquired to image an object in its entirety is reduced drastically – in the best case only one image is necessary by maintaining sub-µ resolution.



Color CCD sensor with 5.5µm pixel size

Typical applications include the inspection of large objects like

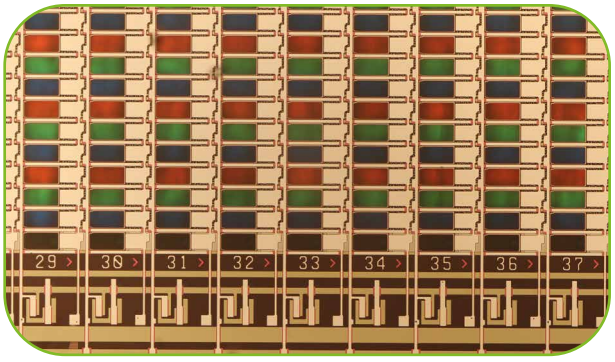
- Display panels
- Printed circuit boards
- Glass panels



Bovine Pulmonary Artery fluorescence sample

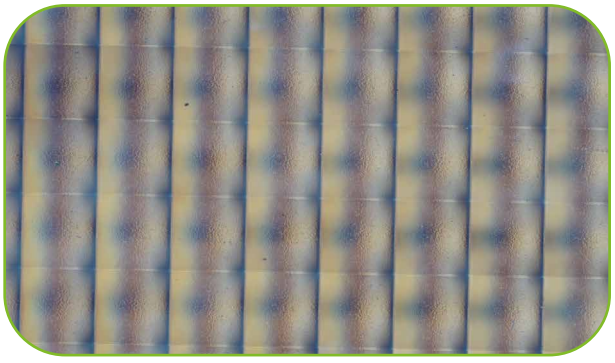
These objects are usually inspected with line scan cameras to achieve maximum resolution and throughput. Smaller objects can often be imaged at once or with only few images with an area scan camera. The 1.73x tube lens is specifically designed for the popular 35mm format cameras that achieve up to 50MPixel resolution. Typical applications here are

- Semiconductor inspection
- Biochip reading
- Fluorescence microscopy
- Digital pathology/histology
- High precision non-contact measurement machines
- Cleanliness of optical components



Color TFT display

The optional DIC module expands the applications even more to transparent objects and enables visualization of changes in refractive index or thickness in materials that would not be possible to inspect otherwise.



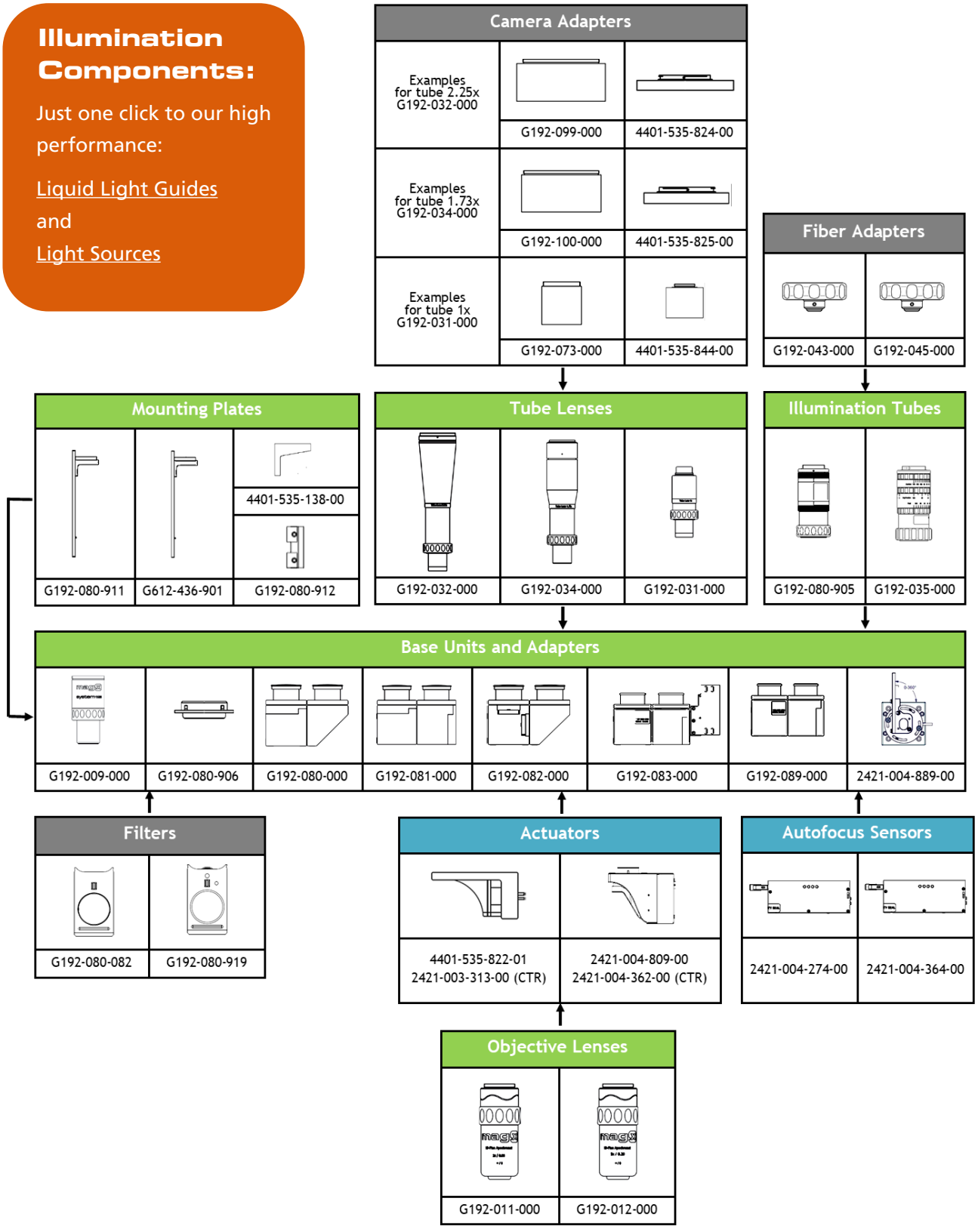
Micro lens array in DIC mode

Overview of the mag.x Micro-Inspection System

Illumination Components:

Just one click to our high performance:

Liquid Light Guides
and
Light Sources



mag.x Modules and Components

Tube Lenses

Order No.	
G192-031-000	Tube lens 1x
G192-034-000	Tube lens 1.73x
G192-032-000	Tube lens 2.25x

Illumination Tube

Order No.	
G192-080-905	Illumination tube 5x lens
G192-035-000	Illumination tube Vario

Mounting Plates

Order No.	
G192-080-912	X95 carrier
4401-535-138-00	Mount for direct adapter
G192-080-911	Mounting plate for tube lens 2.25x
G612-436-901	Mounting plate for tube lens 1.73x

Objective Lenses

Order No.	
G192-011-000	LD-Plan Apo 2x/0.08
G192-012-000	LD-Plan Apo 5x/0.20

Base Units and Adapters

Order No.	
G192-009-000	Direct adapter
G192-080-906	Adapter objective lens
G192-080-000	Base unit, standard [1]
G192-081-000	Base unit, for adaptation of external components [1]
G192-082-000	Base unit, standard w/ filter dummy [1]
G192-083-000	Base unit, for WDI ATF6 (785nm) w/ filter dummy
G192-089-000	Base unit, for rotatable WDI ATF6 (785nm) w/ filter dummy
2421-004-889-00	Adapter kit for rotatable autofocus sensor

Autofocus Components

Order No.	
Actuators	
4401-535-822-01	Piezo unit incl. Piezo controller 2421-003-313-00
2421-004-809-00	Z-Axis Actuator (stepper motor)
2421-004-362-00	Controller MCX (for 2421-004-809-00 as stand alone)
Autofocus Sensors	
2421-004-274-00	Sensor kit for Piezo unit: WDI ATF6 SA PZ 785nm incl. controller MCX-PZ
2421-004-364-00	Sensor kit for stepper ZZA: WDI ATF6 SYS 785nm incl. controller MCZ

Camera Adapters [2]

Order No.	Thread, Opt. dist. [mm]
Camera Adapters for Tube lens 1x	
G192-073-000	M42 x 1 - 11.5
G192-091-000	M42 x 1 - 12.0
G192-094-000	M58 x 0.75 - 12.0
G192-103-000	M72 x 0.75 - 22.2
G192-087-000	M90 x 1 - 12.0
4401-535-844-00	C-mount
2408-009-175-00	F-mount
Camera Adapters for Tube lens 1.73x	
G192-098-000	M42 x 1 - 12.0
G192-078-000	M72 x 0.75 - 6.4
G192-097-000	M72 x 0.75 - 10.1
G192-086-000	M72 x 0.75 - 12.0
G192-100-000	M72 x 0.75 - 19.5
G192-079-000	M72 x 0.75 - 19.6
G192-096-000	M72 x 0.75 - 22.2
G192-093-000	M90 x 1 - 12.0
4401-535-825-00	F-mount

Order No.	Thread, Opt. dist. [mm]
Camera Adapters for Tube lens 2.25x	
4401-535-182-00	M42 x 1 - 12.0
4401-535-843-00	M58 x 0.75 - 11.5
G192-101-000	M58 x 0.75 - 12.0
4401-535-845-00	M58 x 0.75 - 19.9
G192-071-000	M72 x 0.75 - 6.6
G192-092-000	M72 x 0.75 - 9.4
G192-088-000	M72 x 0.75 - 10.1
G192-077-000	M72 x 0.75 - 12.0
G192-099-000	M72 x 0.75 - 19.5
G192-095-000	M72 x 0.75 - 22.2
G192-102-000	M90 x 1 - 12.0
G192-074-000	M95 x 0.75 - 9.4
G192-090-000	M95 x 1 - 12.0
4401-535-824-00	F-mount

Fiber Adapters

Order No.	
G192-043-000	Fiber adapter for 9mm fiber dia.
G192-045-000	Fiber adapter for 7mm fiber dia.

Filters and Illumination Adapter

Order No.	
Filters for Base Unit G192-082 / -083- / -089-000	
G192-080-919	Polarizer
G192-080-082	Dummy filter holder
Darkfield Illumination Adapter	
G192-044-901	Darkfield adapter 66mm dia.

[1] NOT for use in combination with autofocus sensor ATF6

[2] Further camera adapters on request

Please find additional information and download detailed datasheets from our Q-Shop: mag.x System 125

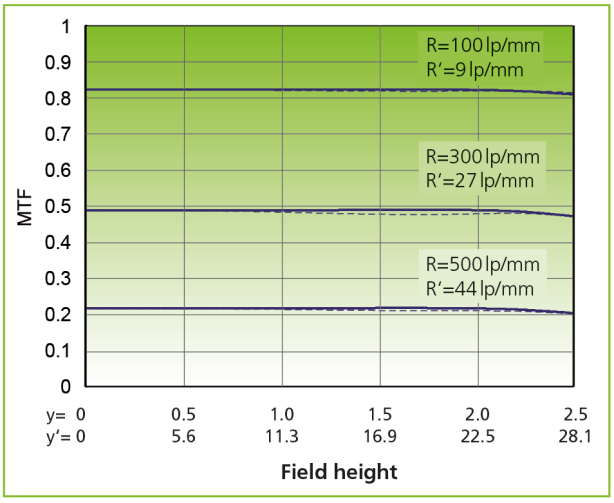
Designed for Large Sensors

The mag.x system 125 is the first microscope system that is specifically designed for the use with large sensors to achieve true wide field imaging with high resolution. With a supported sensor diameter of 57mm popular line scan sensors like 8k TDI sensors as well as modern super high-resolution array sensors can be used. These sensors fully utilize the high optical bandwidth of the mag.x system 125 that supports up to 50MPixel sensor resolution.

mag.x system 125

Optical Performance

Mag.x system 125 stands out from conventional microscope systems by numerical aperture (NA) values considerably higher than those of other systems. High optical quality is not only ensured on the optical axis, but also is maintained over the entire sensor format. The MTF chart below shows the polychromatic MTF versus field height. Values for object y and image heights y' are given under the horizontal axis. Note that the high contrast values close to the diffraction limit are maintained over the entire field!



Polychromatic MTF vs. field height
LD Plan Apo 5x/0.2 + TL2.25x; 2y=5 mm, 2y'=56.3 mm

The complete system is chromatically corrected in the spectral range of 430–700 nm. High contrast is maintained over the entire spectrum and no refocusing is required if the illumination wavelength is changed. Multispectral imaging becomes possible without any additional focus needs.

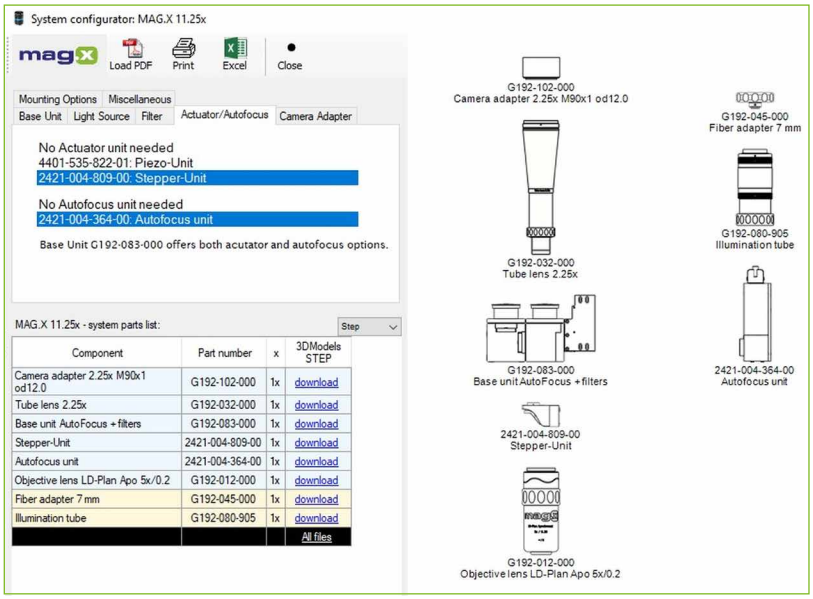
To enable even the most demanding measurement tasks the mag.x system 125 features precise object space telecentricity to prevent flawed measurements of objects with varying height.

Configuration Made Easy: MachVis Software

Our MachVis software makes it easy to find the right lens for a given task and facilitates configuration of a mag.x system setup considerably. Furthermore, all technical data are available right away.

MachVis download

Download for free today:
MachVis Lens Configurator



Specifications

Objective Plan Apochromat					Tube Lens System											
					1x				1.73x				2.25x			
					f'_{tub} = 250 mm				f'_{tub} = 432.5 mm				f'_{tub} = 563 mm			
					2y' = 25 mm				2y' = 43.3 mm				2y' = 57 mm			
Magn./NA	WD	f'_{obj}	δ_{obj}	R_0	M	2y	NA'	R'_0	M	2y	NA'	R'_0	M	2y	NA'	R'_0
	mm	mm	µm	lp/mm		mm		lp/mm		mm		lp/mm		mm		lp/mm
2x/0.08	24.8	125.0	±42.7	293	2	12.5	0.04	147	3.5	12.5	0.023	85	4.5	12.5	0.018	65
5x/0.20	13.0	50.0	±6.8	733	5	5.0	0.04	147	8.7	5.0	0.023	85	11.25	5.0	0.018	65

NA Numerical aperture in the object space = n · sin (σ)
WD Working distance
f'_{obj} Focal length of the objective
f'_{tub} Focal length of the tube lens
δ_{obj} Depth of field at 546 nm $\delta_{obj} = \pm n \cdot \lambda/(2 \cdot NA^2)$

R'_0 Cut off frequency in image space at 546 nm
R_0 Cut off frequency in object space at 546 nm $R_0 = (2 \cdot NA) / \lambda$
2y' Image field size (maximum detector diagonal)
2y Object field size
M Magnification of the overall system; $M = M_{obj} \cdot M_{tub}$

	AF solution	Configuration	Configuration
Actuator	Type	Qioptiq Piezo unit	WDI ZAxisActuator
	Travel range	±0.2 mm	±4 mm
	Speed	1.9 mm/s	10 mm/s
Sensor	Type	WiseDeviceInc. ATF6	
	Function principle	„Through-the-Lens-Lasertriangulation“	
	Laser type	semiconductor	
	Wavelength	785 nm	

Discover the Q!

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Contact us today:

Europe
+49 (0) 89 255 458 0

North America
+1 (800) 429 0257

Asia/Pacific
+65 64 99 7777

Inspection@excelitas.com
www.excelitas.com
www.qioptiq-shop.com

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