

User Manual  
**Imaging Modules**  
linea S, M · compact M · profile M



– English –

IM · linea S · USB excl. integrated light <i>DISCONTINUED</i>	IM · linea M · USB excl. integrated light	IM · linea M · USB incl. integrated ring light	IM · linea M · GigE excl. integrated light	IM · linea M · GigE incl. integrated ring light
IL-0600002UCE	IL10-00363CU0001	IL10-00363CU2101	IL10-00363CG0001	IL10-00363CG2101
IL-0600002UBE	IL10-00363MU0001	IL10-00363MU2101	IL10-00363MG0001	IL10-00363MG2101
IL-0600003UCE	IL10-00462CU0001	IL10-00462CU2101	IL10-00462CG0001	IL10-00462CG2101
IL-0600003UBE	IL10-00462MU0001	IL10-00462MU2101	IL10-00462MG0001	IL10-00462MG2101
IL-0600001UCE	IL10-01553CU0001	IL10-01553CU2101	IL10-01553CG0001	IL10-01553CG2101
IL-0600001UBE	IL10-01553MU0001	IL10-01553MU2101	IL10-01553MG0001	IL10-01553MG2101
IL-0610003UCE	IL10-01652CU0001	IL10-01652CU2101	IL10-01652CG0001	IL10-01652CG2101
IL-0610003UBE	IL10-01652MU0001	IL10-01652MU2101	IL10-01652MG0001	IL10-01652MG2101
IL-0610001UCE	IL10-02743CU0001	IL10-02743CU2101	IL10-02743CG0001	IL10-02743CG2101
IL-0610001UBE	IL10-02743MU0001	IL10-02743MU2101	IL10-02743MG0001	IL10-02743MG2101
IL-0610002UCE	IL10-02842CU0001	IL10-02842CU2101	IL10-02842CG0001	IL10-02842CG2101
IL-0610002UBE	IL10-02842MU0001	IL10-02842MU2101	IL10-02842MG0001	IL10-02842MG2101
	IL10-03743CU0001	IL10-03743CU2101	IL10-03743CG0001	IL10-03743CG2101
	IL10-03743MU0001	IL10-03743MU2101	IL10-03743MG0001	IL10-03743MG2101
	IL10-03942CU0001	IL10-03942CU2101	IL10-03942CG0001	IL10-03942CG2101
	IL10-03942MU0001	IL10-03942MU2101	IL10-03942MG0001	IL10-03942MG2101

IM · compact M · USB excl. integrated light	IM · compact M · USB incl. integrated coaxial & ring light	IM · compact M · GigE excl. integrated light	IM · compact M · GigE incl. integrated coaxial & ring lighting
IC10-00363CU0001	IC10-04j33CU3101	IC10-00363CG0001	IC10-04j33CG3101
IC10-00363MU0001	IC10-04j33MU3101	IC10-00363MG0001	IC10-04j33MG3101
IC10-00462CU0001	IC10-04l32CU3101	IC10-00462CG0001	IC10-04l32CG3101
IC10-00462MU0001	IC10-04l32MU3101	IC10-00462MG0001	IC10-04l32MG3101
IC10-01553CU0001	IC10-05o23CU3101	IC10-01553CG0001	IC10-05o23CG3101
IC10-01553MU0001	IC10-05o23MU3101	IC10-01553MG0001	IC10-05o23MG3101
IC10-01652CU0001	IC10-05o33CU3101	IC10-01652CG0001	IC10-05o33CG3101
IC10-01652MU0001	IC10-05o33MU3101	IC10-01652MG0001	IC10-05o33MG3101
IC10-02743CU0001	IC10-05q22CU3101	IC10-02743CG0001	IC10-05q22CG3101
IC10-02743MU0001	IC10-05q22MU3101	IC10-02743MG0001	IC10-05q22MG3101
IC10-02842CU0001	IC10-05q32CU3101	IC10-02842CG0001	IC10-05q32CG3101
IC10-02842MU0001	IC10-05q32MU3101	IC10-02842MG0001	IC10-05q32MG3101
IC10-03743CU0001		IC10-03743CG0001	
IC10-03743MU0001		IC10-03743MG0001	
IC10-03942CU0001		IC10-03942CG0001	
IC10-03942MU0001		IC10-03942MG0001	

IM · profile M · USB incl. integrated transmitted light	IM · profile M · GigE incl. integrated transmitted light
IP10-06q33CU5101	IP10-06q33CG5101
IP10-06q33MU5201	IP10-06q33MG5201
IP10-07s23CU5101	IP10-07s23CG5101
IP10-07s23MU5201	IP10-07s23MG5201
IP10-08x03CU5101	IP10-08x03CG5101
IP10-08x03MU5201	IP10-08x03MG5201

# 1 Imprint

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## Technical Changes:

We reserve the right to change our products and their specifications to the extent that the technical progress at any time. This also applies to the associated information in the current operating instructions.

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## 2 Document History

Date	Modification	Initials	Release
2021-12-15	First Release	KE	MG
2022-05-05	Updates: <ul style="list-style-type: none"> <li>- Add IM-AE-00001 Power Supply Package for IM · GigE (chapter 9.6.19.6.1)</li> <li>- Add mounting brackets IM-AM-00002, IM-AM-00003 &amp; IM-AM-00004 (chapter 9.6.2)</li> <li>- Add 'Manual XYZ<math>\Phi</math> Stage' for IM · profile M (chapter 9.6.39.6.3)</li> <li>- Add link on additional documentation (data sheets for further details on IM · Platform dimensions, Application Note for Trigger Options, Assembly Instructions for IM-AM-00001)</li> <li>- Add chapter 0 IM · Illumination Specifications</li> <li>- Updating Technical Data of linea, compact and profile</li> <li>- Updating Mounting Options with revised item numbers</li> </ul>	KE	MG

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## 4 Introduction

Qualitatively sophisticated, simple and compact, stable and robust, focused on the task and flexible at the same time - in other words, maximum benefit innovation! That was the objective in the development of a small digital microscope series - our Opto Imaging Modules.

The Imaging Modules are intended to bring together the photonics and machine vision markets in terms of resolution. They close the previous gap - in other words, they bring the world of microscopy into automation. Nevertheless, they can be used to inspect both industrial and biological samples or to observe and document scientific experiments. By providing an easy way to digitise microstructures at the point of care, other application areas can be covered. Pathological scanning of slides, microfluidics, flow cytometry or blood and urine analysis could be a working case.

We are pleased that you have chosen an Imaging Module. Plug in and get started - we wish you a smooth and successful operation.

## 5 Service

Our technical staff is at your disposal by telephone in the event of faults or questions regarding compatibility, installation or maintenance.



### IMPORTANT INFORMATION

All interventions on mechanical or optical parts inside the system as well as work on the device electronics of the Imaging Modules may only be carried out by the service department of Opto GmbH or by specially authorized specialist personnel!

Info service can be found under:

Opto GmbH  
Lochhamer Schlag 14  
D- 82166 Graefelfing  
Germany

Phone: +49 89 898055 - 0  
Email: [support@opto.de](mailto:support@opto.de)



## 6 Notes on this Manual

### 6.1 Intended Use

The Imaging Modules are small, compact digital microscopes. They are intended for use in the laboratory as well as for industrial inspection tasks.

### 6.2 General information

The knowledge of this manual prior to initial start-up is required for operation of the system. Only with knowledge of the device-specific safety instructions in this operating, manual faults in the system can be avoided and a trouble-free operation is guaranteed.

The operating instructions are intended for persons who are responsible for and work with the Imaging Modules described here. The company Opto GmbH assumes no liability for damage and malfunctions that result from non-compliance with these operating instructions.

Furthermore, the manufacturer is not liable for damage resulting from the removal or replacement of parts of the device or the use of accessories from other manufacturers. If the system is passed on to third parties, the operating instructions must be provided. With the exception of the activities listed in this manual, no maintenance or repair work may be performed on the item.

### 6.3 Legend of Symbols

The following symbols are used in this manual:

#### Warning Notices



General Warning Notice

- This symbol is for information that is essential to read and observe – it's the safety alert symbol.
- Please follow the instructions very carefully and proceed with particular attention in these cases.
- Non-observance can endanger people!



Warning of hot surfaces.



Warning of possible danger through hazardous optical radiation.

#### Mandatory Instructions



General Mandatory Instruction

#### User Instructions



IMPORTANT INFORMATION

- This symbol highlights tips and information, which have to be followed for an efficient and trouble-free operation of the device.



ADMINISTRATOR

- This symbol indicates functions and applications that are especially relevant for administrators.

## 7 Safety & Mandatory Instructions

### 7.1 Duty of Training



#### CAUTION

The operator must instruct his staff of the hazards and risks of using this system prior to the commencement of work.

The pre-requisite for perfect operation is knowledge of the operating mode and maintenance in accordance with the existing maintenance, service and cleaning regulations for the system.

- This instruction must be sent to every employee who operates this system.
- The operating instructions for the individual components in chapter 11 & 12 must be observed and followed.
- Additional documentation listed in chapter 22 must also be observed.

### 7.2 Safety Instructions

The Imaging Modules including original accessories may only be used for the procedures described in these operating instructions. Any use which goes beyond these limits is considered as improper use.

The following instructions have to be observed:



#### CAUTION

LEDs emit high intensity light.

This can be harmful to your eyes.

→ Avoid direct eye exposure to light.



#### INSTALLATION SITE

- To ensure an efficient and trouble-free operation of the device follow the **set-up instructions** as described in chapters 11 & 12.
- Do **not connect** the modules to the power supply or the **PC** until you have **properly installed the software!**
- For the USB variants of the modules, make sure that a port specified as **USB3.1 Gen1** is used on PC side ( further details chapter 9.5).
- For the GigE variants of the modules, make sure that **no powered Ethernet connection** (PoE) is used.
- To ensure sufficient strain relief, use only the **screwable cables** recommended by Opto.



#### GENERAL HANDLING

- **Vibrations and shocks** should be **avoided** at all times.
- Working with the microscope must be performed in an **environment**, which is **free from oil vapours and other chemical vapor**, as well as from extreme humidity and dust.



## STORAGE & TRANSPORTATION

- **Avoid humidity inside the housing.**
- For storage and for transportation over longer distances use the **original packaging** or packaging with at least same protective function.



## OPTICS & ELECTRONICS

- **Protect** the system from **excessive temperature fluctuations**. This can lead to condensation and damage to electrical and optical components. Recommended operating temperature: +10 till +40°C
- **Avoid touching** the **lens surface**. If fingerprints still occur, remove them with a soft cloth (e.g. glasses cleaning cloth). Even small traces of finger sweat can attack the surfaces in a short time



## MECHANICS

- Do **NOT open** the **housing**! Opto GmbH must be consulted whenever the device is altered or modified.
- Unauthorized alterations to the device or noncompliant use shall void all rights to any warranty claims!

## 8 Scope of Delivery

Depending on the model variant purchased, the Imaging Modules are equipped without integrated illumination or with a ring light and/or with coaxial or transmitted illumination. They are also delivered in a pre-calibrated state. You can therefore start directly with your testing tasks.



### IMPORTANT INFORMATION

Accessories are NOT included by default.

- If you need reference targets, cables, mounting adapters or tripods for your set-up, have a look in chapter 9.6 or contact [info@opto.de](mailto:info@opto.de).

The standard scope of delivery consists of 1x Imaging Module of the linea, compact or profile series and package material (incl. IM · QuickReference & USB stick).



Figure 1: IM · Scope of delivery

An overview of the available part numbers can be found in chapter 18.3.

## 9 Product Specification

### 9.1 Scope of System

The Imaging Modules are high quality, compact digital microscopes. They are available in different magnification levels, optical concepts, resolutions, integrated illumination concepts and interfaces. Their field of application covers a broad spectrum of the Microscopy World. They can be used to inspect industrial and biological samples or to observe and document scientific experiments. These Plug & Play systems are an ideal alternative for customers using conventional microscopes.

They are intended for a use in machines, systems and products in the industrial market, but also in the life science sector. Applications in laminar flow hoods perfectly match them. In the field of developmental biology, in vitro fertilization (IVF), stem cell research, entomology, genetics, they have their fixed application. Always ready to provide fast live images in training environment (single or group sessions), this contributes significantly to a better understanding of the topic and increased practical relevance. The profile M series was developed for transmitted light applications such as blood or urine analysis.

With the OptoViewer software, images can be acquired, the illumination type(s) can be controlled and simple measuring tasks can be carried out. Basic software functions are included such as:

- Camera Acquisition (Single & Continuous)
- Light Control
- Pre-Calibrated Magnification Settings
- Pre-Processing Tools (e.g. Vignetting Correction)
- Overlays (e.g. Crosshair, Grid, Scale)
- Draw & Measurement Tools (e.g. Polygons, Angles, Images, Text)
- Multiple Device Control
- Powerful Saving Features (Images & Video)

For further information about the software please check:

<https://www.opto.de/en/software/opto-viewer/>

Alternatively, the Opto-SDK is available for integration into customer-specific software. Native use is in C/C++ for Windows operating systems. A toolkit is also available for working with LabView. Detailed information can be requested under [support@opto.de](mailto:support@opto.de).

In order to keep the Imaging Module as simple, stable and robust as possible, the standard models have no moving part and no focussing device. All components have been optimally matched to each other for a high image quality.

The modules are already pre-calibrated so that you can start directly with your measurements and documentation. The integrated coaxial and ring light illumination allows you to bring out the desired measurement details even with challenging samples and surfaces.

## 9.2 IM · Technical Data

In this chapter all specifications of the modules are listed. The basic subdivision was made according to the mechanical platform design - [IM · linea](#), [IM · compact](#), [IM · profile](#).



### IMPORTANT INFORMATION

Please note that the optical data given in this manual may deviate by up to -10% due to manufacturing tolerances.

### 9.2.1 IM · Camera Specifications

The technical details of the implemented image sensors are:

Sensor ID	Colour	Resolution [Pixel]	Pixel Size [μm]	Sensor - Ø [mm]	Shutter Type	Framerate (Free run) [fps]	Pixel Depth [Bit]
IMX264LLR-C	Mono	USB: 2456x2054 GigE: 2448x2048	3.45	USB: 11.05 GigE: 11.01	Global	USB: 36 GigE: 24	USB: 8, 10, 12 GigE: 8, 10, 12
IMX264LQR-C	Colour	USB: 2456 x 2054 GigE: 2448 x 2048	3.45	USB: 11.05 GigE: 11.01	Global	USB: 36 GigE: 24	USB: 8, 10, 12 GigE: 8, 10, 12
IMX265LLR-C	Mono	USB: 2056x1542 GigE: 2048x1536	3.45	USB: 8.87 GigE: 8.83	Global	USB: 57 GigE: 37	USB: 8, 10, 12 GigE: 8, 10, 12
IMX265LQR-C	Colour	USB: 2056x1542 GigE: 2048x1536	3.45	USB: 8.87 GigE: 8.83	Global	USB: 57 GigE: 37	USB: 8, 10, 12 GigE: 8, 10, 12
IMX273LLR-C	Mono	USB: 1448 x 1086	3.45	USB: 6.24	Global	USB: 243	USB: 8, 10, 12
IMX273LQR-C	Colour	USB: 1448 x 1086	3.45	USB: 6.24	Global	USB: 243	USB: 8, 10, 12

Table 1: IM · Image sensor details

### 9.2.2 IM · Illumination Specifications

Since the IM · Family is based on a flexible platform concept, there are modules with and without illumination, for incident or reflected light applications. An assignment of the basic lighting properties is also given with following symbols:

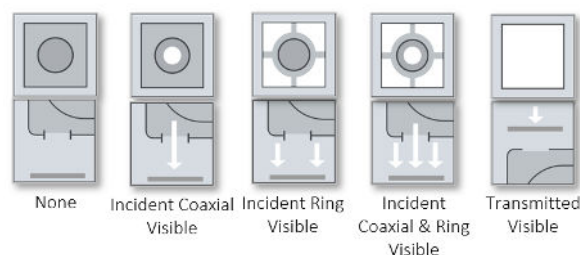


Figure 2: IM · Illumination concepts for size M

The specifications of the lightning used in linea M and compact M models are:

Model Colour	Illumination Type	LED Colour	LED Temp./ Peak W.- Length	Spectrum
Colour & Mono	Ring	White	4000 K	
	Coaxial	White	4000 K	



#### IMPORTANT INFORMATION

- The compact M modules from the MVM series are equipped with both coaxial and ring lighting. Please note that these lights can only be controlled separately - i.e. either ring light or coaxial.

The specifications of the lightning used in the profile M models are:

Model Colour	Illumination Type	LED Colour	LED Temp. / Peak W.- Length	Spectrum
Colour	Transmitted	White	4000 K	
Mono	Transmitted	Red	632 nm	

## 9.2.3 IM · linea S – Technical Data

The **linea S** modules are the entry-level modules of the IM · Family. They are suitable for a larger object field in a bright environment - i.e. for macroscopy applications with  $\beta' < 1$ . Please be aware, that this module series is discontinued and has not been replaced by successors.

### 9.2.3.1 IM · linea S - Optical Specs

Item-No. <i>DISCONTINUED</i>	System Mag. [x]	FoV [mm]	WD [mm]	NA	Resolution [LP/mm]	Object Space [μm/Px]	DoF [mm]	Image Sensor	Sensor Resolution Class [MP]	Colour ID	Interface	Illumination Type		
IL-0600002UCE	0.02	306.1 x 229.5	1000	0.01	2	211.4	16.83	IMX273LQR-C	1.5	Colour	USB3	N/A		
IL-0600002UBE					1			IMX273LLR-C		Mono		N/A		
IL-0600003UCE	0.03	194.9 x 146.2			4	134.6	19.22	IMX273LQR-C		Colour		N/A		
IL-0600003UBE					2			IMX273LLR-C		Mono		N/A		
IL-0600001UCE		150 x 112.5	500		5	103.6	4.21	IMX273LQR-C		Colour		N/A		
IL-0600001UBE					2			IMX273LLR-C		Mono		N/A		
IL-0610003UCE	0.05	95 x 71.3			8	65.6	4.81	IMX273LQR-C		Colour		N/A		
IL-0610003UBE					4			IMX273LLR-C		Mono		N/A		
IL-0610001UCE	0.06	87.5 x 65.6	300	0.02	8	60.5	1.52	IMX273LQR-C		1.5		Colour	USB3	N/A
IL-0610001UBE					4			IMX273LLR-C				Mono		N/A
IL-0610002UCE	0.09	55 x 41.3			12.5	38	1.73	IMX273LQR-C				Colour		N/A
IL-0610002UBE					6.3			IMX273LLR-C				Mono		N/A

Table 2: IM · linea S - Specification details



### 9.2.3.2 IM · linea S - Dimensions & Weight

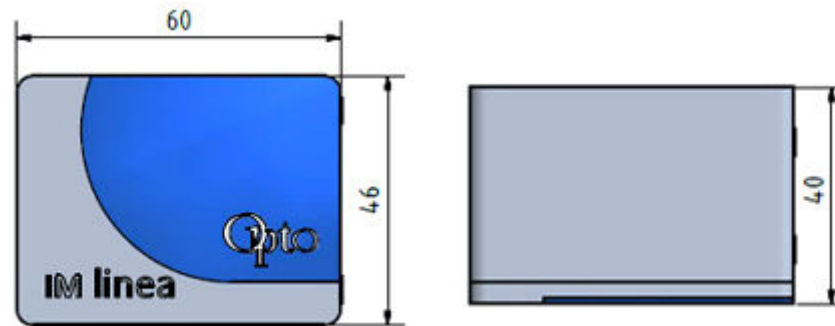


Figure 3: IM · linea S - Dimensions - **DISCONTINUED**

IM · linea S <b>DISCONTINUED</b>	
Dimensions [mm]	W46 x L60 x H40
Weight [g]	approx. 200

Table 3: IM · linea S - Dimensions & weight - **DISCONTINUED**

## 9.2.4 IM · linea M – Technical Data

The linea M series offers smaller object fields. These modules are available with and without an integrated ring light illumination (details see chapter 9.2.2).

### 9.2.4.1 IM · linea M - Optical Specs

Item-No.	System Mag. [x]	FoV [mm]	WD [mm]	NA	Resolution [LP/mm]	Object Space [μm/Px]	DoF [mm]	Image Sensor	Sensor Resolution Class [MP]	Colour ID	Interface	Illumination Type
IL10-00363CG0001	0.295	28.6 x 24	202	0.03	20	11.7	0.567	IMX264LQR-C	5	Colour	GigE	N/A
IL10-00363CG2101												Ring
IL10-00363CU0001		28.7 x 24									USB3	N/A
IL10-00363CU2101												Ring
IL10-00363MG0001		28.6 x 24			IMX264LLR-C			Mono		GigE	N/A	
IL10-00363MG2101											Ring	
IL10-00363MU0001		28.7 x 24								USB3	N/A	
IL10-00363MU2101											Ring	
IL10-00462CG0001	0.295	24 x 18	202	0.03	20	11.7	0.567	IMX265LQR-C	3	Colour	GigE	N/A
IL10-00462CG2101												Ring
IL10-00462CU0001		24 x 18									USB3	N/A
IL10-00462CU2101												Ring
IL10-00462MG0001		24 x 18			IMX265LLR-C			Mono		GigE	N/A	
IL10-00462MG2101											Ring	
IL10-00462MU0001		24 x 18								USB3	N/A	
IL10-00462MU2101											Ring	

Item-No.	System Mag. [x]	FoV [mm]	WD [mm]	NA	Resolution [LP/mm]	Object Space [μm/Px]	DoF [mm]	Image Sensor	Sensor Resolution Class [MP]	Colour ID	Interface	Illumination Type
IL10-01553CG0001	0.502	16.8 x 14.1	132	0.045	36	6.9	0.242	IMX264LQR-C	5	Colour	GigE	N/A
IL10-01553CG2101												Ring
IL10-01553CU0001		16.9 x 14.1									USB3	N/A
IL10-01553CU2101												Ring
IL10-01553MG0001		16.8 x 14.1			GigE			N/A				
IL10-01553MG2101								Ring				
IL10-01553MU0001		16.9 x 14.1			USB3			N/A				
IL10-01553MU2101								Ring				
IL10-01652CG0001	0.502	14.1 x 10.6	132	0.045	36	6.9	0.242	IMX265LQR-C	3	Colour	GigE	N/A
IL10-01652CG2101												Ring
IL10-01652CU0001		14.1 x 10.6									USB3	N/A
IL10-01652CU2101												Ring
IL10-01652MG0001		14.1 x 10.6			GigE			N/A				
IL10-01652MG2101								Ring				
IL10-01652MU0001		14.1 x 10.6			USB3			N/A				
IL10-01652MU2101								Ring				
IL10-02743CG0001	0.75	11.3 x 9.4	99	0.06	50	4.6	0.137	IMX264LQR-C	5	Colour	GigE	N/A
IL10-02743CG2101												Ring
IL10-02743CU0001		11.3 x 9.4									USB3	N/A
IL10-02743CU2101												Ring
IL10-02743MG0001		11.3 x 9.4			GigE			N/A				
IL10-02743MG2101								Ring				
IL10-02743MU0001		11.3 x 9.4			USB3			N/A				
IL10-02743MU2101								Ring				

Item-No.	System Mag. [x]	FoV [mm]	WD [mm]	NA	Resolution [LP/mm]	Object Space [μm/Px]	DoF [mm]	Image Sensor	Sensor Resolution Class [MP]	Colour ID	Interface	Illumination Type
IL10-02842CG0001	0.75	9.4 x 7.1	99	0.06	50	4.6	0.137	IMX265LQR-C	3	Colour	GigE	N/A
IL10-02842CG2101												Ring
IL10-02842CU0001		9.5 x 7.1									USB3	N/A
IL10-02842CU2101												Ring
IL10-02842MG0001		9.4 x 7.1			100			IMX265LLR-C		Mono	GigE	N/A
IL10-02842MG2101												Ring
IL10-02842MU0001		9.5 x 7.1									USB3	N/A
IL10-02842MU2101												Ring
IL10-03743CG0001	0.915	9.2 x 7.7	87	0.069	63	3.8	0.106	IMX264LQR-C	5	Colour	GigE	N/A
IL10-03743CG2101												Ring
IL10-03743CU0001		9.3 x 7.7									USB3	N/A
IL10-03743CU2101												Ring
IL10-03743MG0001		9.2 x 7.7			125			IMX264LLR-C		Mono	GigE	N/A
IL10-03743MG2101												Ring
IL10-03743MU0001		9.3 x 7.7									USB3	N/A
IL10-03743MU2101												Ring
IL10-03942CG0001	0.915	7.7 x 5.8	87	0.069	63	3.8	0.106	IMX265LQR-C	3	Colour	GigE	N/A
IL10-03942CG2101												Ring
IL10-03942CU0001		7.8 x 5.8									USB3	N/A
IL10-03942CU2101												Ring
IL10-03942MG0001		7.7 x 5.8			125			IMX265LLR-C		Mono	GigE	N/A
IL10-03942MG2101												Ring
IL10-03942MU0001		7.8 x 5.8									USB3	N/A
IL10-03942MU2101												Ring

Table 4: IM · linea M V2 - Specification details

## 9.2.4.2 IM · linea M - Dimensions & Weight

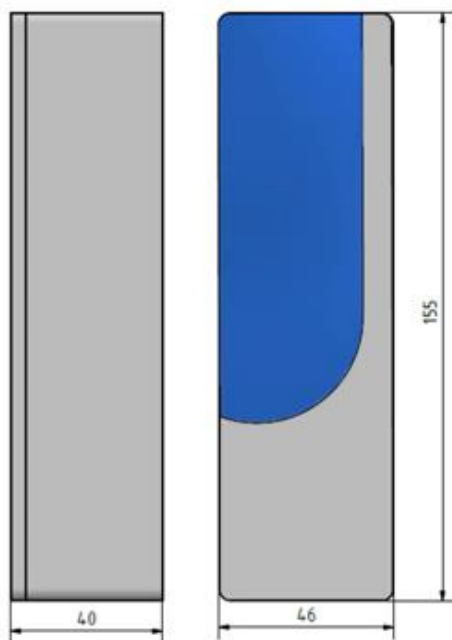


Figure 4: IM · linea M V1 - Dimensions – **DISCONTINUED**

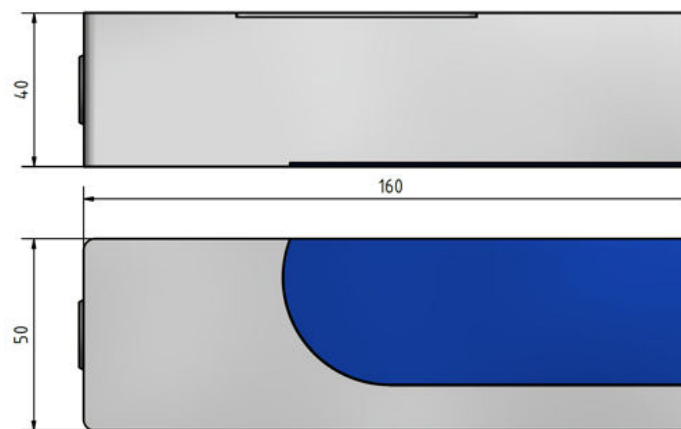


Figure 5: IM · linea M V2 - Dimensions

IM · linea M V1 <b>DISCONTINUED</b>	
Dimensions [mm]	W46 x L155 x H40
Weight [g]	approx. 500
IM · linea M V2	
Dimensions [mm]	W50 x L160 x H40
Weight [g]	approx. 550

Table 5: IM · linea M - Dimensions & weight

## 9.2.5 IM · compact M – Technical Data

The compact M platform contains models with a magnification of  $\beta' < 1$  as well as  $\beta' > 1$  (incl. integrated coaxial and ring light).

### 9.2.5.1 IM · compact M - Optical Specs

Item-No.	System Mag. [x]	FoV [mm]	WD [mm]	NA	Resolution [LP/mm]	Object Space [μm/Px]	DoF [mm]	Image Sensor	Sensor Resolution Class [MP]	Colour ID	Interface	Illumination Type			
IC10-00363CG0001	0.295	28.6 x 24	202	0.03	20	11.7	0.567	IMX264LQR-C	5	Colour	GigE	N/A			
IC10-00363CU0001		28.7 x 24			40					USB3					
IC10-00363MG0001		28.6 x 24								Mono	GigE				
IC10-00363MU0001		28.7 x 24			IMX264LLR-C			USB3							
IC10-00462CG0001	0.295	24 x 18	202	0.03	20	11.7	0.567	IMX265LQR-C	3	Colour	GigE	N/A			
IC10-00462CU0001		24 x 18			40					Mono	USB3				
IC10-00462MG0001		24 x 18									GigE				
IC10-00462MU0001		24 x 18			IMX265LLR-C			USB3							
IC10-01553CG0001	0.502	16.8 x 14.1	132	0.045	36	6.9	0.242	IMX264LQR-C	5	Colour	GigE	N/A			
IC10-01553CU0001		16.9 x 14.1			71					Mono	USB3				
IC10-01553MG0001		16.8 x 14.1									GigE				
IC10-01553MU0001		16.9 x 14.1			IMX264LLR-C			USB3							
IC10-01652CG0001	0.502	14.1 x 10.6	132	0.045	36	6.9	0.242	IMX265LQR-C	3	Colour	GigE	N/A			
IC10-01652CU0001		14.1 x 10.6			71					Mono	USB3				
IC10-01652MG0001		14.1 x 10.6									GigE				
IC10-01652MU0001		14.1 x 10.6			IMX265LLR-C			USB3							
IC10-02743CG0001	0.75	11.3 x 9.4	99	0.06	50	4.6	0.137	IMX264LQR-C	5	Colour	GigE	N/A			
IC10-02743CU0001		11.3 x 9.4			100					Mono	USB3				
IC10-02743MG0001		11.3 x 9.4									GigE				
IC10-02743MU0001		11.3 x 9.4			IMX264LLR-C			USB3							

Item-No.	System Mag. [x]	FoV [mm]	WD [mm]	NA	Resolution [LP/mm]	Object Space [μm/Px]	DoF [mm]	Image Sensor	Sensor Resolution Class [MP]	Colour ID	Interface	Illumination Type
IC10-02842CG0001	0.75	9.4 x 7.1	99	0.06	50	4.6	0.137	IMX265LQR-C	3	Colour	GigE	N/A
IC10-02842CU0001		9.5 x 7.1						USB3				
IC10-02842MG0001		9.4 x 7.1			Mono			GigE				
IC10-02842MU0001		9.5 x 7.1						USB3				
IC10-03743CG0001	0.915	9.2 x 7.7	87	0.069	63	3.8	0.106	IMX264LQR-C	5	Colour	GigE	N/A
IC10-03743CU0001		9.3 x 7.7						USB3				
IC10-03743MG0001		9.2 x 7.7			Mono			GigE				
IC10-03743MU0001		9.3 x 7.7						USB3				
IC10-03942CG0001	0.915	7.7 x 5.8	87	0.069	63	3.8	0.106	IMX265LQR-C	3	Colour	GigE	N/A
IC10-03942CU0001		7.8 x 5.8						USB3				
IC10-03942MG0001		7.7 x 5.8			Mono			GigE				
IC10-03942MU0001		7.8 x 5.8						USB3				
IC10-04j33CG3101	1.874	4.5 x 3.8	31	0.1	125	1.8	0.05	IMX264LQR-C	5	Colour	GigE	Coax & Ring
IC10-04j33CU3101								USB3				
IC10-04j33MG3101					Mono			GigE				
IC10-04j33MU3101								USB3				
IC10-04l32CG3101	1.874	3.8 x 2.8	31	0.1	125	1.8	0.05	IMX265LQR-C	3	Colour	GigE	Coax & Ring
IC10-04l32CU3101								USB3				
IC10-04l32MG3101					Mono			GigE				
IC10-04l32MU3101								USB3				
IC10-05o23CG3101	3.748	2.3 x 1.9	17.5	0.3	250	0.9	0.006	IMX264LQR-C	5	Colour	GigE	Coax & Ring
IC10-05o23CU3101								USB3				
IC10-05o23MG3101					Mono			GigE				
IC10-05o23MU3101								USB3				

Item-No.	System Mag. [x]	FoV [mm]	WD [mm]	NA	Resolution [LP/mm]	Object Space [μm/Px]	DoF [mm]	Image Sensor	Sensor Resolution Class [MP]	Colour ID	Interface	Illumination Type			
IC10-05o33CG3101	3.748	2.3 x 1.9	37	0.2	250	0.9	0.012	IMX264LQR-C	5	Colour	GigE	Coax & Ring			
IC10-05o33CU3101					500			IMX264LLR-C			USB3				
IC10-05o33MG3101								Mono		GigE					
IC10-05o33MU3101										USB3					
IC10-05q22CG3101	3.748	1.9 x 1.4	17.5	0.3	250	0.9	0.006	IMX265LQR-C	3	Colour	GigE	Coax & Ring			
IC10-05q22CU3101					500			IMX265LLR-C			USB3				
IC10-05q22MG3101								Mono		GigE					
IC10-05q22MU3101										USB3					
IC10-05q32CG3101	3.748	1.9 x 1.4	37	0.2	250	0.9	0.012	IMX265LQR-C	3	Colour	GigE	Coax & Ring			
IC10-05q32CU3101					500			IMX265LLR-C			USB3				
IC10-05q32MG3101								Mono		GigE					
IC10-05q32MU3101										USB3					

Table 6: IM · compact M V2 - Specification details



9.2.5.2 IM · compact M - Dimensions & Weight

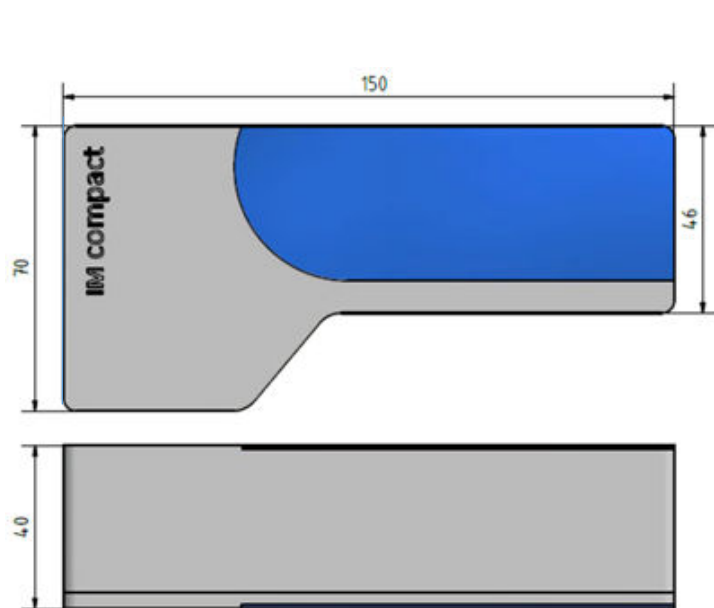


Figure 6: IM · compact M V1 - Dimensions – **DISCONTINUED**

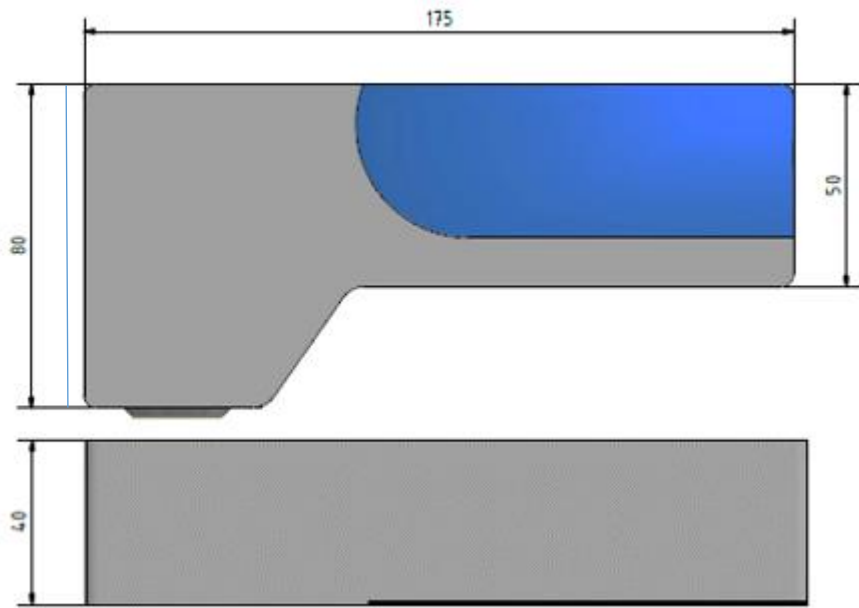


Figure 7: IM · compact M V2 – Dimensions

IM · compact M V1 <b>DISCONTINUED</b>		IM · compact M V2	
*Dimensions [mm]	W46 x L150 x H40	*Dimensions [mm]	W50 x L175 x H40
Weight [g]	approx. 600	Weight [g]	approx. 700
* For modules IC-4251101UBE/UCE there is a deviation in the dimensions due to a lens overhang - 88mm x 150mm x 40mm incl. overhang.		* For modules with $\beta' > 1$ there could be a deviation in the dimensions due to a lens overhang. Depending on the model, it can be up to 1.6 mm. Details are listed in separate IM · Product Information (see chapter 22).	

Table 7: IM · compact M - Dimensions & weight

## 9.2.6 IM · profile M – Technical Data

The IM · profile M models are intended for transmitted light applications in a very high system magnification.

### 9.2.6.1 IM · profile M - Optical Specs

Item-No.	System Mag. [x]	FoV [mm]	WD [mm]	NA	Resolution [LP/mm]	Object Space [μm/Px]	DoF [mm]	Image Sensor	Sensor Resolution Class [MP]	Colour ID	Interface	Illumination Type
IP10-06q33CG5101	5	1.7 x 1.4	31	0.1	280	0.7	0.05	IMX264LQR-C	5	Colour	GigE	Transmitted
IP10-06q33CU5101											USB3	
IP10-06q33MG5201					250			IMX264LLR-C		Mono	GigE	
IP10-06q33MU5201											USB3	
IP10-07s23CG5101	10	0.84 x 0.71	13	0.25	710	0.3	0.008	IMX264LQR-C	5	Colour	GigE	Transmitted
IP10-07s23CU5101		0.85 x 0.71									USB3	
IP10-07s23MG5201		0.84 x 0.71			630			IMX264LLR-C		Mono	GigE	
IP10-07s23MU5201		0.85 x 0.71									USB3	
IP10-08x03CG5101	20	0.42 x 0.35	3.6	0.4	900	0.2	0.003	IMX264LQR-C	5	Colour	GigE	Transmitted
IP10-08x03CU5101											USB3	
IP10-08x03MG5201					800			IMX264LLR-C		Mono	GigE	
IP10-08x03MU5201											USB3	

Table 8: IM · profile M V2 - Specification details

## 9.2.6.2 IM · profile M - Dimensions & Weight

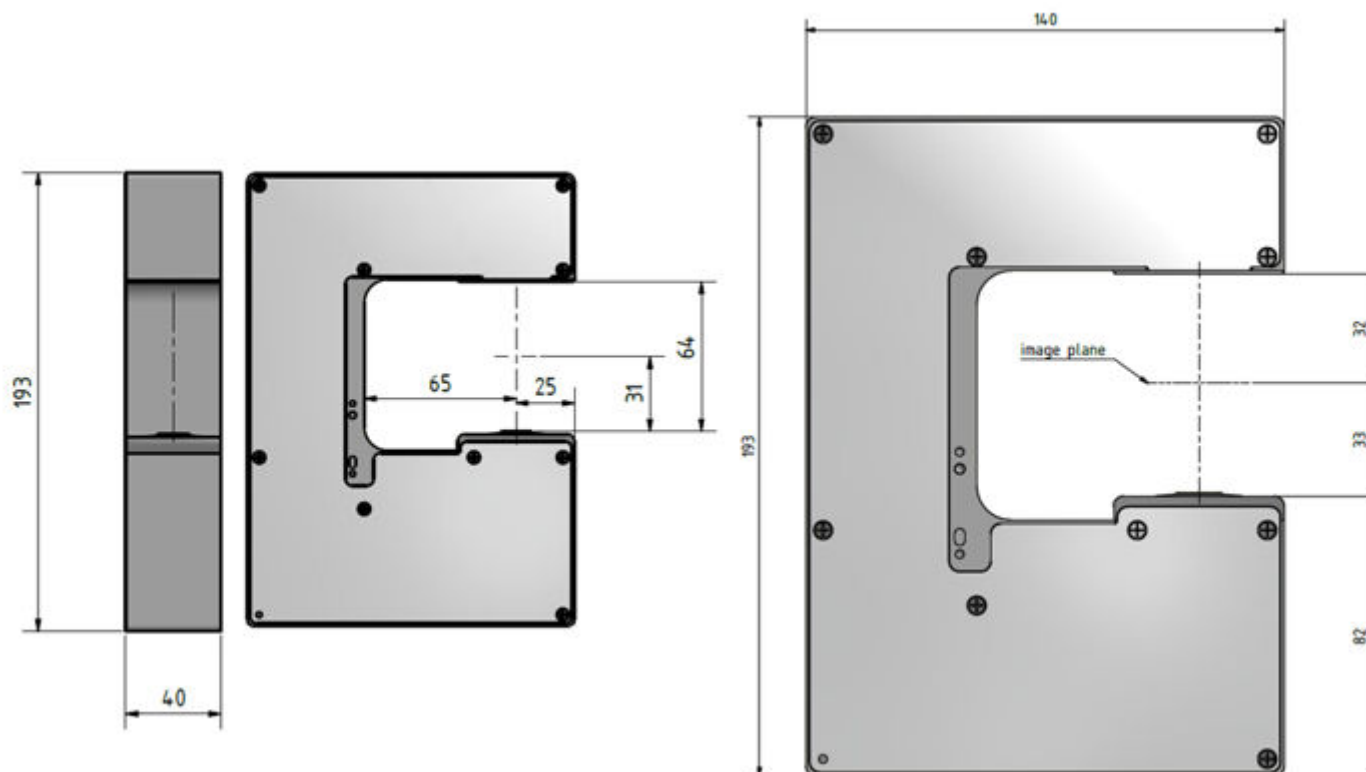


Figure 8: IM · profile M V2 - Dimensions

IM · profile M	
*Dimensions [mm]	W40 x L140 x H193
Weight [g]	approx. 1400
* There could be a deviation in the dimensions due to a lens overhang. Depending on the model, it can be up to 36.4 mm. Details are listed in separate IM · Product Information (see chapter 22).	

Table 9: IM · profile M V2 - Dimensions & weight

## 9.3 IM · Electrical Interfaces

The selection of a suitable interface usually depends on several factors. You will find a little help on this in chapter 19. Technical details of the implemented IM - interface are listed below.

### 9.3.1 IM · USB Interface



#### MANDATORY INSTRUCTION

- Do not connect the modules to the power supply or the PC until you have properly installed the software!
- Only use the **screwable cables** recommended by Opto (details see chapter 9.6).
- Further information to be considered regarding **PC requirements** are described in chapter 9.5.

#### 9.3.1.1 IM · USB Interface Specs

For this module type the image acquisition and data transfer is done via USB 3.1 Gen1 interface. The power supply for the integrated lighting is also provided via this port. The detailed requirements for USB hosts according to the USB standard are: 5V 1A.

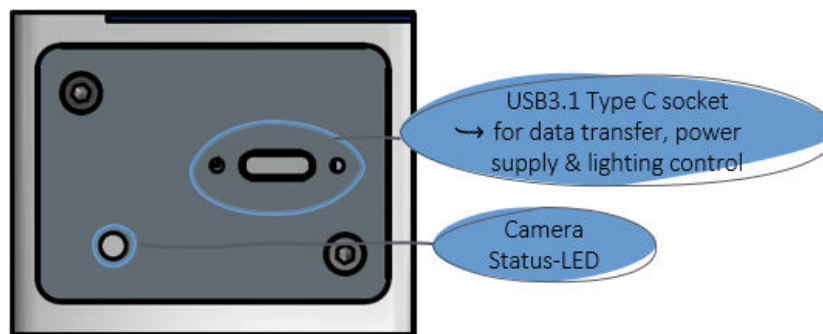


Figure 9: IM · USB interface

IM · USB – Power Consumption*	
Excluding Lighting [W]	1.7 – 3.4
Including Lighting [W]	1.9 – 4.4
* It depends on the running mode of the camera and illumination intensity.	
IM · USB – Data Transfer	
Max. Bandwidth [MB/sec.]	* 400 per USB host
* The maximum bandwidth cannot be exceeded. Therefore, the maximum possible frame rate can be reduced if the images of several USB cameras are transferred simultaneously. A reduction of the bandwidth is possible when using hubs or repeaters. The required bandwidth of a camera can be reduced by decreasing the frame rate or the image size.	
IM · USB – Cable	
Cable Length [m]	*max. 5
Connector Type	Type C, screwable
* USB3 cables are usually limited to 3-8 m in length due to their specification. If necessary, this limitation can be extended by using repeaters. Lengths of up to 20 m are thus possible and even lengths of up to 100 m are possible with signal conversion to optical signals.	

Table 10: IM · USB interface specifications

Both image acquisition and illumination control can be performed using the OptoViewer software, which is supplied free of charge with your imaging module.

### 9.3.1.2 IM · USB Status LED

IM · USB – Status LED	
LED lights up red	Camera is powered on
LED lights up green	Camera has been loaded and is operational
LED flashes	An error has occurred, please contact our support team
@ Start-up	
Status-LED flashes 2x green	USB2.0 port detected
Status-LED flashes 3x green	USB3.0 port detected
Status- LED green	Driver loaded, camera ready for operation

Table 11: IM · USB status LED

### 9.3.2 IM · GigE Interface



#### MANDATORY INSTRUCTION

- The GigE camera of the modules must be supplied with voltage from an external source. The module must NOT be connected to a PoE RJ45 socket!
- Further information or specifications regarding the PC requirements are described in chapter 9.5.

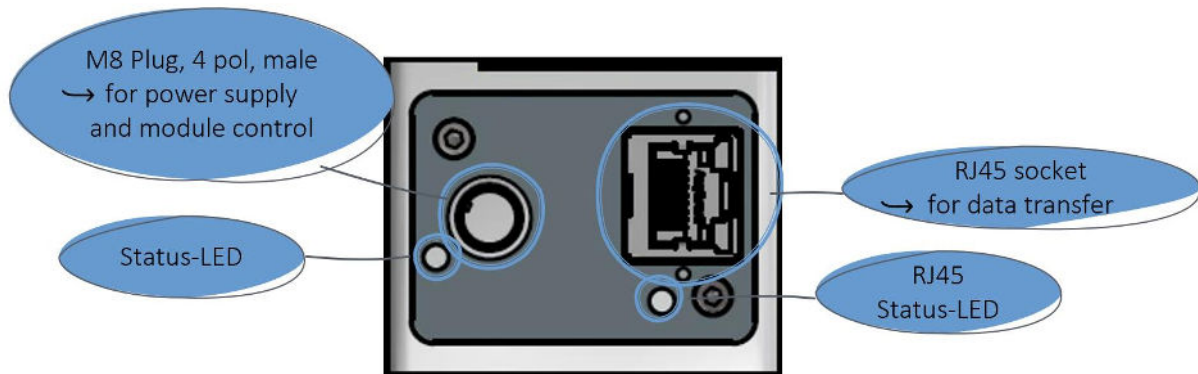
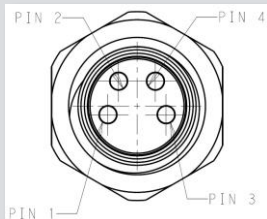
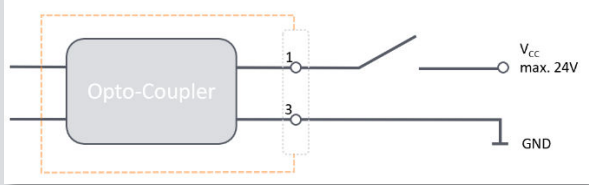


Figure 10: IM · GigE interface

#### 9.3.2.1 IM · GigE Interface Specs

IM · GigE – Power Consumption*		
Excluding Lighting [W]	1.7 – 3.4	
Including Lighting [W]	1.9 – 4.4	
* It depends on the running mode of the camera and the illumination intensity.		
IM · GigE – Data Transfer		
Max. Bandwidth [MB/sec.]	100	
IM · GigE – RJ45-Plug (Data Transfer)		
Cable Length [m]	max. 100	
Connector Type (Module Side)	RJ45, screwable	
Recommended Cable Type	CAT5e or CAD 6	
* The cable length between the individual segments must not exceed 100 m. A segment represents a continuous cable connection between two network devices. For a stable and high-quality connection we recommend cable type Cat5e or better. For appropriate strain relief, the cable should be screwable.		
IM · GigE – M8-Plug (I/O & Power Supply)		
Connector Type (Module Side)	M8 Plug, 4 pol , length 8mm	typical wire colour:
Pin Assignment	<div><div><div>PIN 1: Power Supply [V<sub>In</sub> 24V]</div><div>PIN 2: Camera Trigger<sub>In</sub></div><div>PIN 3: GND</div><div>PIN 4: Camera Trigger<sub>Out</sub></div></div></div> <td><div>brown</div><div>white</div><div>blue</div><div>black</div></td>	<div>brown</div> <div>white</div> <div>blue</div> <div>black</div>
Recommended Cable Type	Typical M8 sensor cable, 4 pol. receptacle	

* Digital Input Specifications		Symbol	Min.	Typ.	Max.
	Input <sub>High</sub> [V]	V <sub>IH</sub>	5	-	24
	Input <sub>Low</sub> [V]	V <sub>IL</sub>	0	0	1
	Input <sub>Leakage Current</sub> [μA]	I <sub>I</sub>	-	-	-
	Trigger - Pulse Width (Edge) [μs]		10	-	-
	Trigger – Slope [V/ms]		35	-	-

\*The trigger signal can be evaluated either on the rising or falling edge. The digital input is galvanically decoupled with an optocoupler to protect the camera and the PC against overvoltage. Only DC voltages may be applied to the digital input.

\*\*Please note that the specifications given here are the trigger specifications of the camera - they do NOT apply to the lighting. Should the application require it, the camera or module can be triggered via an external controller. However, this would mean a special configuration and is only available on request. For further details, please refer to the Application Note 'IM · Size M , Trigger Options' chapter 22.

Table 12: IM · GigE interface specifications

### 9.3.2.2 IM · GigE Status LED

IM · GigE – Status LED	
LED is not lit	No Power
LED flashes green quickly	Camera is booting
LED flashes green slowly	Camera is ready
LED lights up green	Camera is open
LED lights up red	No firmware loaded
IM · GigE – RJ45 LED	
LED no lit: no network connection	No network connection
LED lights up green	Network connection
LED lights up green and red alternately	Network connection with data transmission

Table 13: IM · GigE status LED

## 9.4 IM · Environmental Conditions



### MANDATORY INSTRUCTION

The system is intended for a usage in clean industrial environment.

- The optical axis should be directed downwards (except for the profile M models).
- Ensure free airflow around the system for a good heat dissipation.



### MANDATORY INSTRUCTION

Protect the system from excessive temperature fluctuations. This can lead to condensation and damage to electrical and optical components.

- Recommended operating temperature: +10°C till +40°C

Operational & Ambient Conditions	
Application Area	Indoor use only
Ambient Operating Temperature [°C]	+10 till +40
Ambient Transport Temperature [°C]	-10 till +50
Ambient Storage Temperature [°C]	-10 till +50
Operating Relative Humidity [%]	20 to 80 (non-condensing)
Transportation Relative Humidity [%]	20 to 80 (non-condensing)
Storage Relative Humidity [%]	20 to 80 (non-condensing)

Table 14: IM · Ambient & operational conditions

## 9.5 IM · System & PC Recommendations

System requirements for the PC (NOT included in the scope of delivery)	
Processor	Intel® Core™ i5 or higher
System Type	64 Bit
Operating System	Windows 10
RAM	≥ 8 GB
Memory	≥ 256 GB SSD
USB Device Interface	USB 3.1 Gen1 (min. recommended) slot
GigE Device Interface	Ethernet slot

\*For a recommendation for a suitable interface card, please contact our support team.

Table 15: IM · PC specifications



### MANDATORY INSTRUCTION

- To ensure a good strain relief of the cables, only use **screwable cables** recommended by Opto.
- Do **NOT connect the module** to the power supply / USB port **before proper software installation!**





## IMPORTANT INFORMATION

To help you get the most out of your system, here is a small checklist with optimal PC settings and general tips on using an **IM · USB model**:

- Ensure a **stable power supply at the controller hubs**. Therefore, **deactivate** all possible **energy-saving modes** in your **Windows system control**. This must also be observed for **battery operation**. In the **Windows device manager** - only visible with admin rights - there are additional energy saving options. In the 'Energy Management' tab of the corresponding host controller properties, the energy saving mode can additionally be deactivated. Further details are described in a separate application note (chapter 22).
- Make sure that the **latest USB controller driver** is installed on your PC.
- On **desktop computers**, only use the **USB back ports**, as only these ports are directly connected to the mainboard. Using front ports would mean an additional cable bridge which could affect the signal quality.
- **Observe the maximum cable length** of 5 meters specified for USB3.1 and do not exceed this.
- **Avoid additional plug connections** between camera and USB controller or hub, as this can influence the signal quality.
- If several ports are connected via the same USB controller, make sure that the **maximum possible bandwidth is not exceeded**. If you need the maximum possible data throughput, only control one camera with one controller.
- Unstable signal quality and other compatibility issues can be avoided by using a specified **USB3.1 Gen1 PCI Express card**. Further advantages are:
  - maximum available data throughput due to separate USB controller for each port
  - sufficient power supply directly via the PC board
  - identical hardware components for all systems
  - the system design is more independent of the PC hardware
  - stable driver software provided and supported directly by the manufacturer
  - longer life cycles/availability

Once a board has been specified, system security can be significantly increased.



## IMPORTANT INFORMATION

For all **IM · GigE** consider the following information:

- The GigE camera of the modules must be supplied with voltage from an external source. The module must **NOT be connected** to a **PoE RJ45 socket**.
- To ensure a stable connection, all devices that contribute to the network connection between camera and host PC should support at least 1000 MBit/s.
- If possible, the applied devices should use **jumbo frames**.
- If possible, the Imaging Module should be connected to a dedicated network adapter. **Do NOT use the same one as for your Internet connection** (or other communication network). This reduces the bandwidth for image data transfer and may result in incomplete or lost images!
- Furthermore, ensure working with the **latest driver for your ethernet adapter** for an optimal performance.
- Due to the automatically assigned IP address, it may take some time for Windows to recognize the Imaging Module. The status can be checked in the Windows 'Control Panel\Network and Internet\Network Connections' panel.
- When using USB-Ethernet adapters, please note that they have different restrictions depending on the model.
- Basically, the following is recommended for operating an IM · GigE model (adjustable in the advanced properties of your network card):
  - Maximize the size of the receive buffer or stack buffer
  - Enable jumbo frames

## 9.6 IM · Accessories & Upgrades

Opto offers a wide range of accessories to enable a quick integration of the Imaging Modules into your system. The most important ones are listed here.

### 9.6.1 IM · Electronics



#### MANDATORY INSTRUCTION

For safe commissioning and a sufficient strain relief, we strongly encourage using screwable cables recommended by Opto.

IM · USB Standard Cables		
<ul style="list-style-type: none"> <li>Cable type: double shielded in AWG26/28</li> <li>Connector: screwable USB Type-C straight to screwable USB Type-A</li> <li>Bending radius [mm]: 62</li> <li>Bending cycles: non-moving</li> </ul>		
Item number	050-8Z1AD00223	Cable length [m]: 1
Item number	050-8Z1AD00224	Cable length [m]: 3
<ul style="list-style-type: none"> <li>Cable type: USB 3.1 Gen 1 5Gbit/s. double shielded</li> <li>Connector: screwable USB Type-C straight to USB Type-C</li> <li>Bending radius [mm]: 62</li> <li>Bending cycles: non-moving</li> </ul>		
Item number	050-8Z1AD00352	Cable length [m]: 1
Item number	050-8Z1AD00353	Cable length [m]: 3

Table 16: IM · USB cables

For an extension of the specified USB cable length of 5 meters, we recommend using only tested hubs or active cables.

IM · GigE Standard Cables & I/O + Power Supply		
<b>Ethernet cable CAT.6 (RJ45 Plug)</b> <ul style="list-style-type: none"> <li>Assignment not crossed</li> <li>One side with horizontal screw connection</li> <li>Category: CAT6</li> <li>Interface: Gigabit Ethernet</li> <li>Connector: RJ45 + RJ45 with horizontal thumbscrews</li> </ul>		
Item number	050-8Z5CABLENET01	Cable length [m]: 2
<b>I/O + Power Supply Cable (M8 Plug)</b> <ul style="list-style-type: none"> <li>Sensor cable M8 female, straight, open strands</li> <li>Number of bending cycles: 4000000</li> <li>Bending radius [mm]: 44</li> <li>Cable weight [kg/km]: 25</li> </ul>		
Item number	050-8Z01681842	Cable length [m]: 1.5

#### Power Package for IM · GigE, Size M

- Incl. power supply cable (M8) & power-supply unit for Plug & Play applications (without I/O functionality)

Item number	IM-AE-00001	for quick image access of an IM · GigE module
-------------	-------------	---

Table 17: IM · GigE cables & power supply, Size M

## 9.6.2 IM · Brackets

IM · Brackets		
<ul style="list-style-type: none"> <li>• Dovetail brackets for adaptation to foldable stand 043-600505-350/500</li> </ul>		
Item number	IM-AM-00004	for mounting IM · linea M & IM · compact M models
Item number	IM-AM-00003	for mounting IM · profile M models
<ul style="list-style-type: none"> <li>• Bracket for adaption to a breadboard</li> </ul>		
Item number	IM-AM-00002	for mounting IM · profile M models on a standard breadboard (metric)

Table 18: IM · Brackets

### 9.6.3 IM · Stands

Opto's IM · Foldable Stands are particularly designed for Imaging Modules. As classic - stationary - tripods they take up little space and are best suited for single workstations. Equipped with a focus drive coarse/fine, Opto offers these stands for workstations that need to be flexible.

IM · Stands		
<b>IM · Foldable Stands</b> <ul style="list-style-type: none"> <li>• Focus drive: Coarse/Fine</li> <li>• Mechanism: foldable</li> <li>• Object level over ground [mm]: 64</li> <li>• Focus travel range [mm]: 80 rough /0.24 fine</li> <li>• Maximum load [kg]: 15</li> <li>• Plate size [mm]: 150</li> <li>• Fixation: Dovetail joint OC</li> <li>• Material: Aluminium</li> </ul>		
Item number	043-600505-350	Size [mm]: 190 x 230 x 350 Hight adjustment [mm]: 180 Hight of folded stand [mm]: 99 Weight [kg]: 2.94
Item number	043-600505-500	Size [mm]: 190 x 230 x 500 Hight adjustment [mm]: 330 Hight of folded stand [mm]: 129 Weight [kg]: 3.44
<b>IM · Manual XYZΦ Stage for profile M</b> <ul style="list-style-type: none"> <li>• Enables high-precision sample positioning in space</li> <li>• Integrated fastening threads in sample holder for flexible fixation</li> <li>• Mechanism: manual sliding stage for planar xyφ-movement (2 linear + 1 rotational degrees of freedom)</li> <li>• Travel range of the sliding table [mm]: <math>\pm 5</math>, <math>\pm 180^\circ</math></li> <li>• Focus travel range [mm]: 3</li> <li>• Maximum load [kg]: 1</li> <li>• Plate size [mm]: <math>\varnothing 102</math></li> <li>• Fixation: firmly screwed to the profile M module</li> <li>• Material: aluminium, matt anodized</li> </ul>		
Item number	IM-AM-00001	fits profile M modules only

Table 19: IM · Stands

## 9.6.4 IM · Targets

This calibration target can be used for example to measure resolution, distortion or contrast. It is also a useful tool for calibrating measuring systems. If required, a corresponding DKD certification for certain structures is possible.

IM · Calibration Target V2	
<ul style="list-style-type: none"> <li>• Structure: chrome on glass</li> <li>• Min. structure size [<math>\mu\text{m}</math>]: 0.5</li> <li>• Max. structure size [<math>\mu\text{m}</math>]: 600</li> <li>• Structure types: <ul style="list-style-type: none"> <li>○ Q1 – Lines /mm [LP/mm]: 10 - 1100</li> <li>○ Q2 – Matrix 40 x 40 dots <math>\varnothing 20\mu\text{m}</math>. 100<math>\mu\text{m}</math> grid</li> <li>○ Q3 – Positive / negative dots; Siemens star; serial number</li> <li>○ Q4 – Matrix 40 x 40 dots <math>\varnothing 10\mu\text{m}</math>. 50<math>\mu\text{m}</math> ; 10° edge in centre of 4xline pair matrix (1000lp/mm); 5x5 Siemens star matrix. 0.4mm grid; 2x2mm full chrome square</li> </ul> </li> <li>• Scale in x- and y-direction: accuracy <math>\pm 0.5\mu\text{m}</math></li> <li>• Dimension [mm]: 76 x 26 x 4.5</li> <li>• Weight [g]: 17</li> </ul>	
Item number	045-200200

Table 20: IM · Targets

Customised adaptations or solutions are also possible at any time. We will be happy to advise you on possible upgrades in order to optimally adapt the system to your needs. For any assistance in this matter, please contact your responsible sales partner.

## 10 Product Description

The IMs are based on a comprehensive platform concept. A modular selection of carefully tested components - both hardware and software - allows numerous combinations. The IMs can be grouped based on their technical characteristics, adapted to specific application requirements.

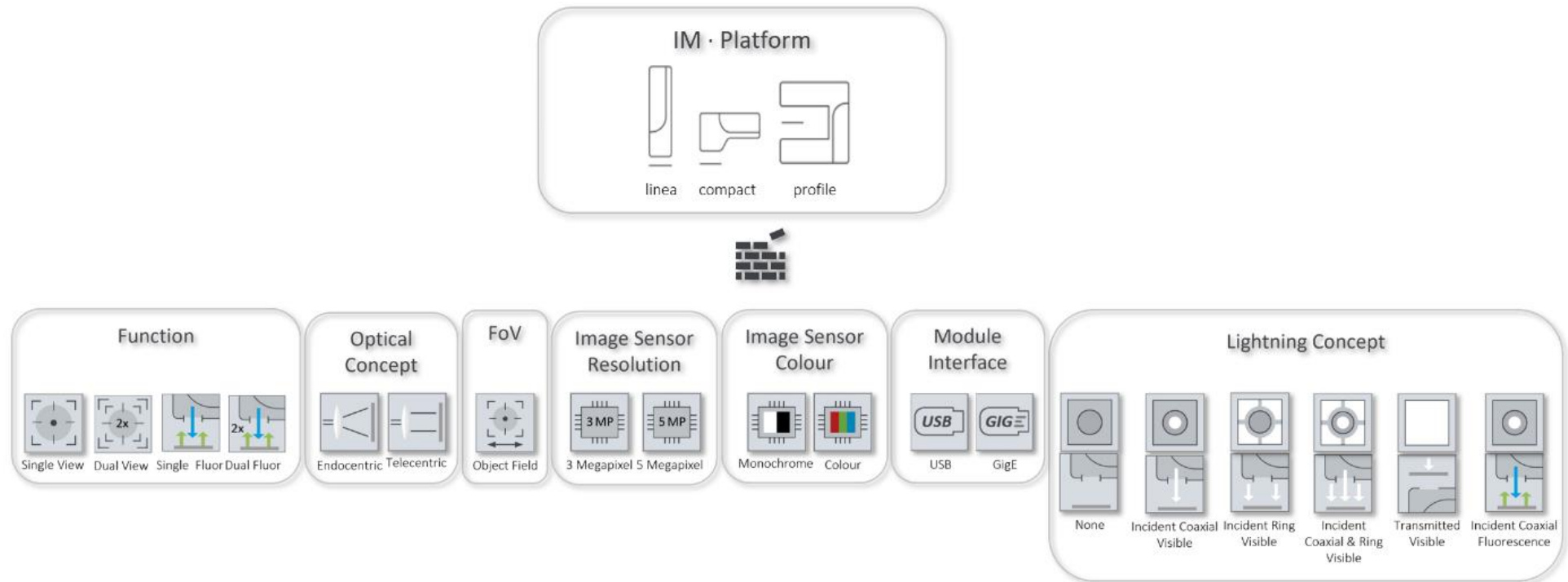


Figure 11: IM · Modular Concept

The **linea S** modules are the entry-level modules of the IM • Family. They are suitable for a larger object field in a bright environment - i.e. for macroscopy applications with  $\beta' < 1$ . They are mentioned for the sake of completeness, but have since been discontinued. The **linea M** variants add further smaller object fields to the family. These modules are available with and without integrated ring light illumination.

The compact M platform allows installations in spatially limited systems. They are available in the object fields of the linea M or in more classic microscopy FoVs ( $\beta' > 1$ ). These models are in turn equipped with ring as well as coaxial illumination. While all models described above work with reflected light, the profile M family completes the functionality for transmitted light applications in an even higher system magnification.

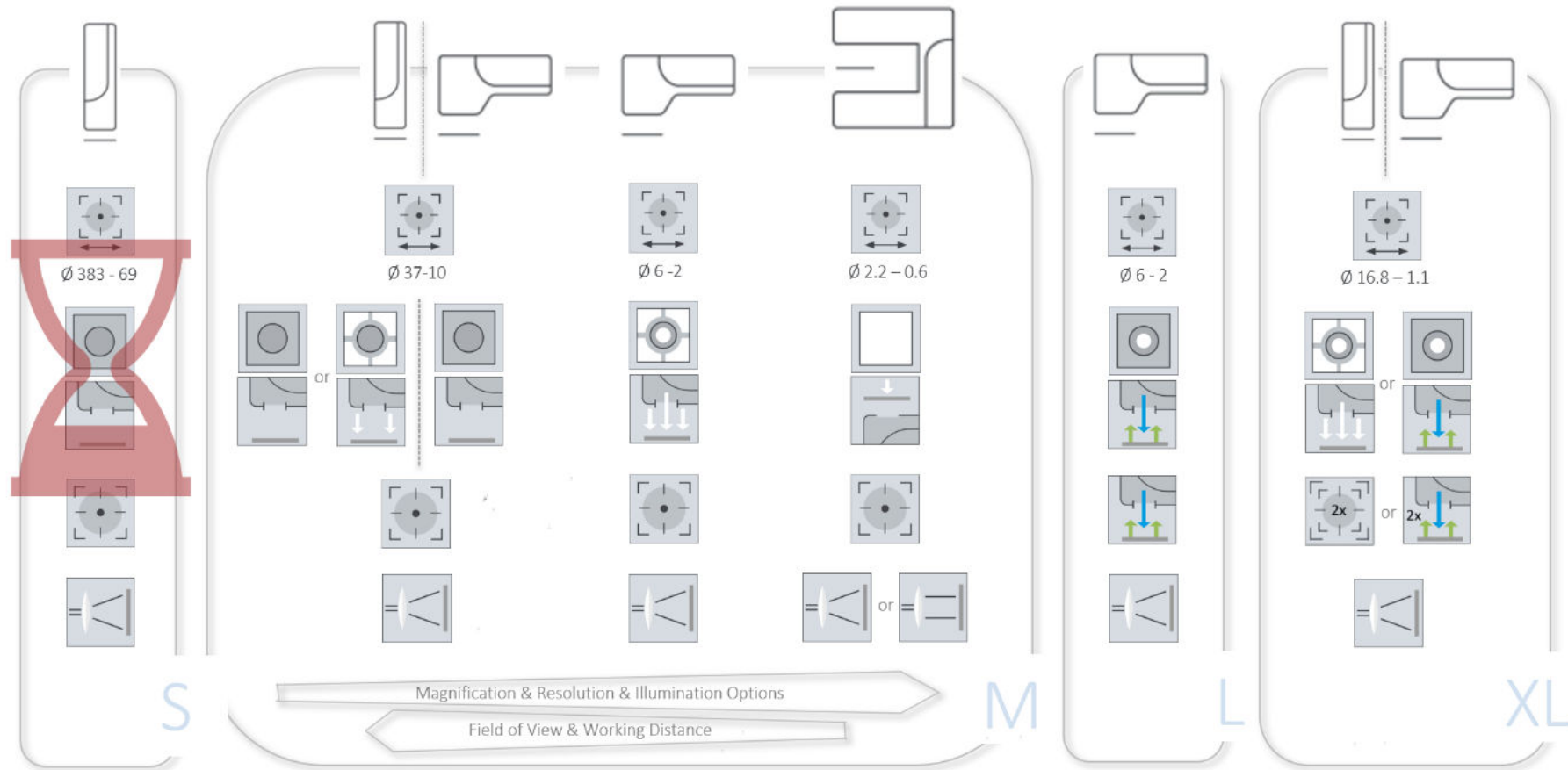


Figure 12: IM · Concept overview

The integration of telecentric optics is also envisaged for this platform. A telecentric lens is designed to have no perspective distortion, and for this reason is even more suitable for dimension measurements. Work is currently underway to integrate telecentrics into the IM · Family.

With the online [IM · ProductFinder](#) you can filter or search for a suitable Imaging Module according to your target specifications.



## 10.1 System Overview · Hardware

### 10.1.1 IM · linea S – System Overview

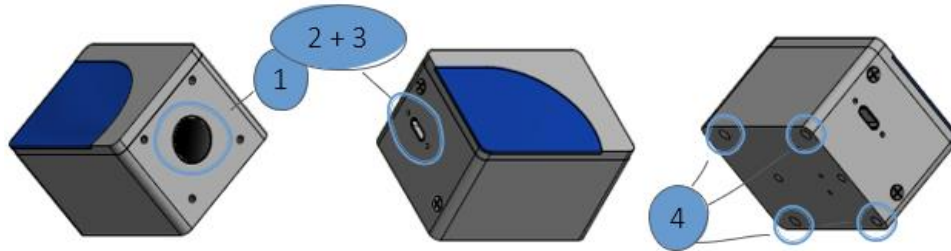


Figure 13: IM · linea S - Module overview - **DISCONTINUED**

No.	System Part	Function
1	Lens	Optics for imaging the test specimen.
2	Data / interface port	USB port for data-transfer and illumination control (chapter 9.3).
3	Holes for cable fixing screws	Holes for fixing screws of the recommended cables (chapter 9.6.1).
4	Mounting holes	Holes for adaptation to various brackets, stands or directly in machine environment (chapter 12.1.1).

Table 21: IM · linea S - Module setup & function - **DISCONTINUED**

### 10.1.2 IM · linea M – System Overview

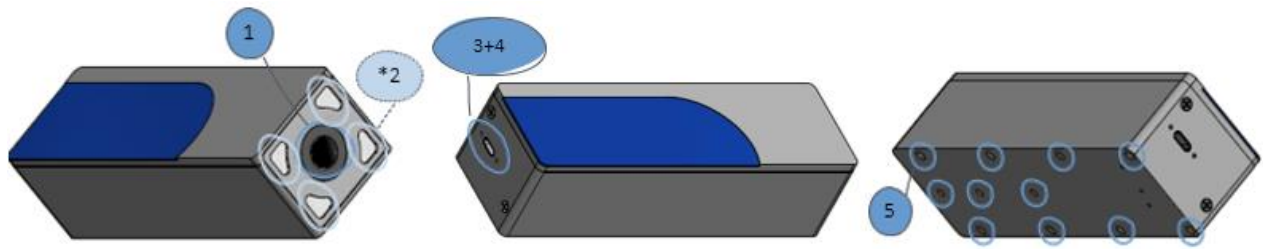


Figure 14: IM · linea M V1 - Module overview - **DISCONTINUED**

No.	System Part	Function
1	Lens	Optics for imaging the test specimen.
*2	Ring light	Valid for models with integrated ring light, controllable with OptoViewer software.
3	Data / interface port	USB port for data-transfer and illumination control (chapter 9.3).
4	Holes for cable fixing screws	Holes for fixing screws of the recommended cables (chapter 9.6.1).
5	Mounting holes	Holes for adaptation to various brackets, stands or directly in machine environment (chapter 12.1.2).

Table 22: IM · linea M V1 - Module setup & function – **DISCONTINUED**

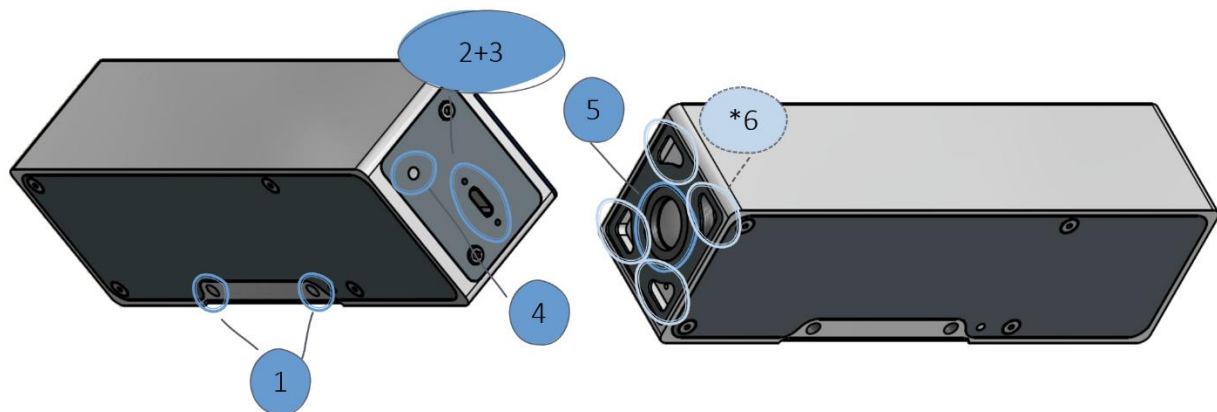


Figure 15: IM · linea M V2 - Module overview

No.	System Part	Function
1	Mounting holes	Holes for adaptation to various brackets, stands or directly in machine environment (details. see chapter 12.1.2).
2	Electronic interface port(s)	USB or GigE & M8 port for data-transfer and illumination control (chapter 9.3).
3	Holes for cable fixing screws	Holes for fixing screws of the recommended cables (chapter 9.6.1).
4	Status LED	Displays operating mode of integrated camera.
5	Lens	Optics for imaging the test specimen.
*6	Ring light	Valid for models with integrated ring light, controllable with OptoViewer software.

Table 23: IM · linea M V2 - Module setup & function

### 10.1.3 IM · compact M – System Overview

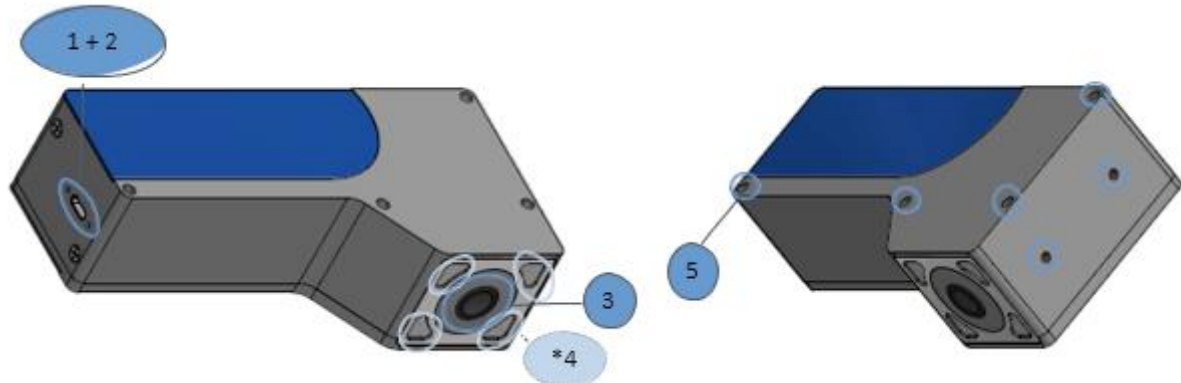


Figure 16: IM · compact M V1 - Module overview – **DISCONTINUED**

No.	System Part	Function
1	Data / interface port	USB port for data-transfer and illumination control (chapter 9.3).
2	Holes for cable fixing screws	Holes for fixing screws of the recommended USB cables (chapter 9.6.1).
3	Lens	Optics for image the test specimen.
*4	Ring light	Valid for models with integrated ring light, controllable with OptoViewer software.
5	Mounting holes	Holes for adaptation to various brackets, stands or directly in machine environment (chapter 12.1.3).

Table 24: IM · compact M V1 - Module setup & function – **DISCONTINUED**

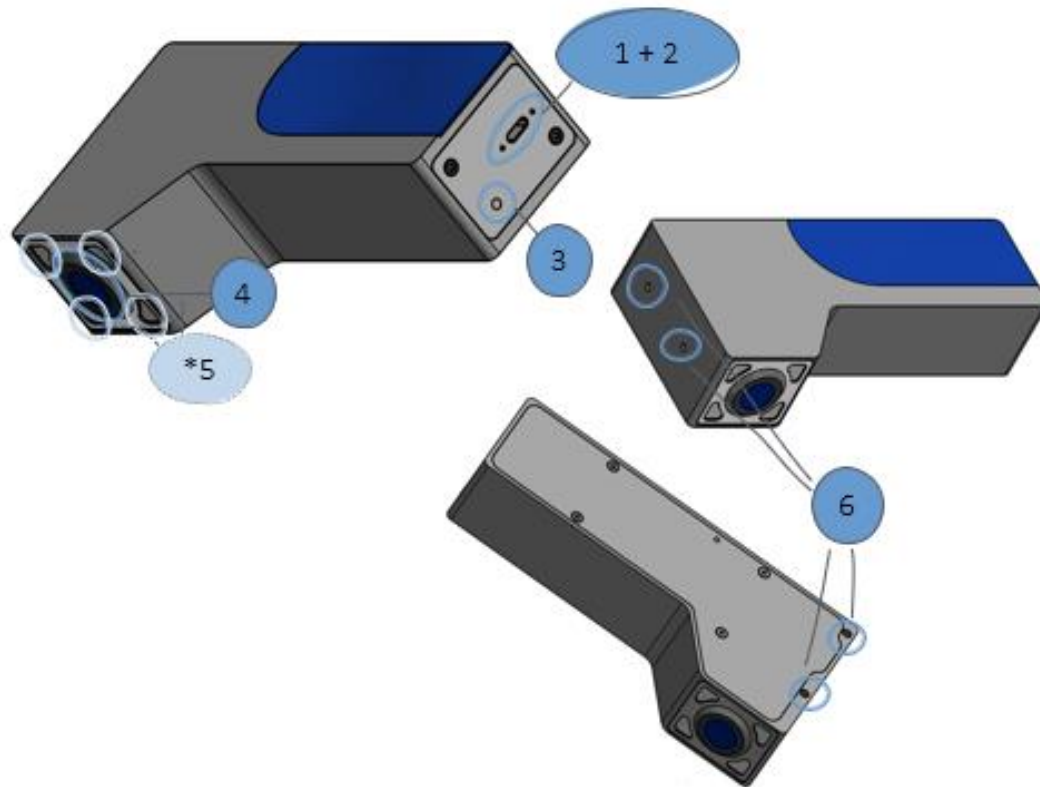


Figure 17: IM · compact M V2 – Module overview

No.	System Part	Function
1	Electronic interface port(s)	USB or GigE & M8 port for data-transfer and illumination control (chapter 9.3).
2	Holes for cable fixing screws	Holes for fixing screws of the recommended cables (chapter 9.6.1).
3	Status LED	Displays operating mode of integrated camera.
4	Lens	Optics for imaging the test specimen.
*5	Ring light	Valid for models with integrated ring light, controllable with OptoViewer software. For models with item number 'IC-xxxxxxx3101' coaxial lighting is integrated in addition.
6	Mounting holes	Holes for adaptation to various brackets, stands or directly in machine environment (chapter 12.1.3).

Table 25: IM · compact M V2 - Module setup & function

#### 10.1.4 IM · profile M – System Overview

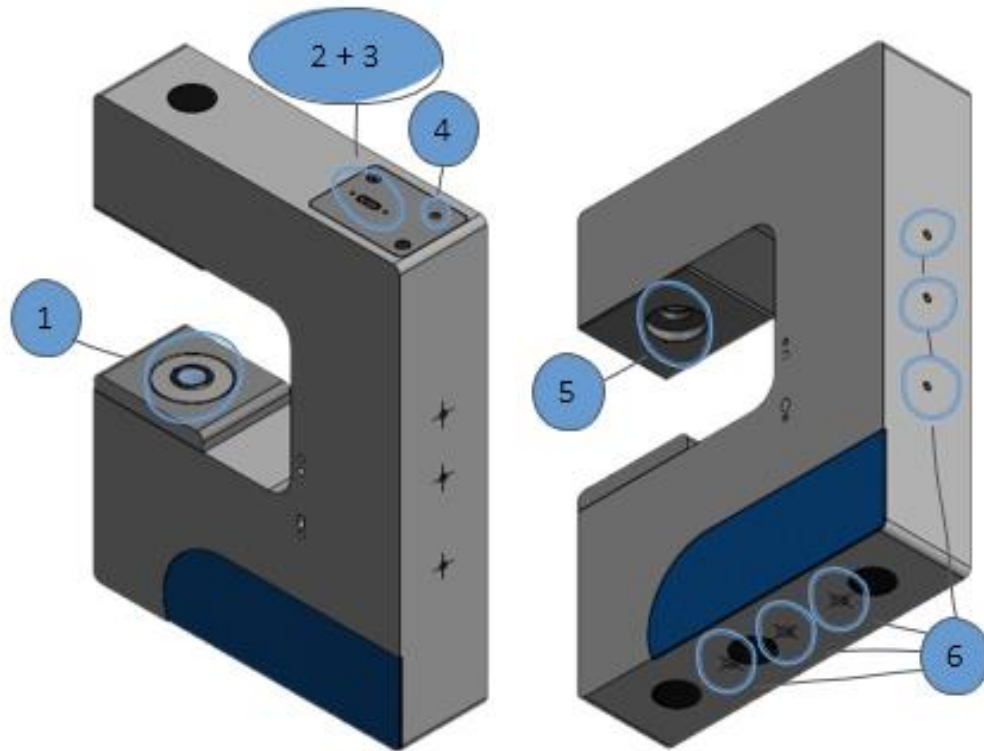


Figure 18: IM · profile M V2 - Module overview

No.	System Part	Function
1	Lens	Optics for imaging the test specimen.
2	Electronic interface port(s)	USB or GigE & M8 port for data-transfer and illumination control (chapter 9.3).
3	Holes for cable fixing screws	Holes for fixing screws of the recommended cables (chapter 9.6.1).
4	Status LED	Displays operating mode of integrated camera.
5	Transmitted light	Coaxial transmitted light illumination. Controllable with OptoViewer freeware.
6	Mounting holes	Holes for adaptation to various brackets, stands or directly in machine environment (chapter 12.1.40).

Table 26: IM · profile M V2 - Module setup & function

## 10.2 System Overview · Software

The following image shows the default GUI of OptoViewer 2.0. This software is included in the standard delivery scope of an Imaging Modules, indented for simple image acquisition, light control and measurement tasks.

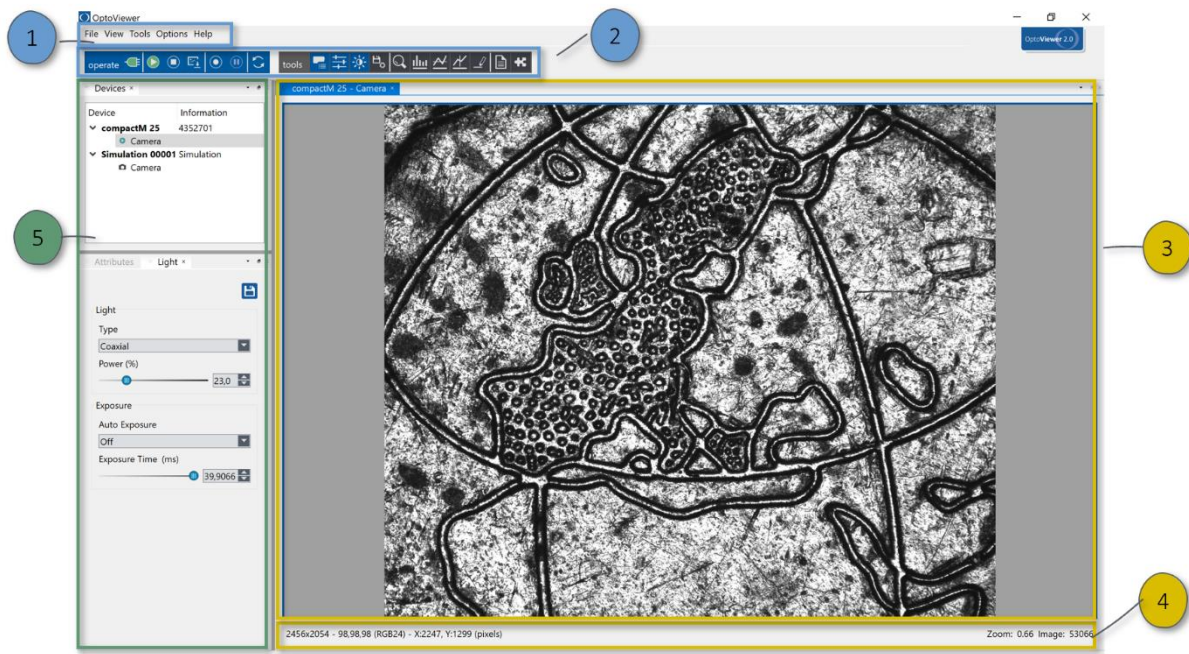


Figure 19: OptoViewer 2.0 · Default GUI

No.	System Part	Function
1	Menu bar	Contains menu bar to access all menus you need to image, edit or to change views and system settings.
2	Tool bar	Displays possible tools.
3	Image window	Main software area showing the activated camera image.
4	Status bar	Shows image size (value and position of the pixel pointed by the mouse cursor) as well as zoom and image acquisition index.
5	Control & adjustment panels	Shows default control windows for camera or lightning settings. All windows can be positioned to customer needs (and saved in layout options).

Table 27: OptoViewer 2.0 · Default GUI



### IMPORTANT INFORMATION

Detailed information about the OptoViewer can be found in the corresponding user manual and in chapters 13 & 14.



## 11 Set-Up · Software

The following chapter describes the software set-up procedure getting an Imaging Module running with the OptoViewer application. The modules consist of a compact housing in which the image sensor, optics and, depending on the module variant, lighting are integrated. The various modules differ slightly in their technical specifications, but commissioning is almost identical.

### 11.1 Installation Site

Before you start setting up and commissioning your Imaging Module, observe the following safety and handling instructions:



#### CAUTION

Choking hazard to children due to the packaging material.

- Keep packaging films away from children.
- Dispose packaging materials environmentally in friendly manner.



#### MANDATORY INSTRUCTION

- Every person who is responsible for installation or operation of the equipment shall read and follow the safety-related parts of this manual.
- The operator is responsible for the proper installation and operation of this microscope. The operator is obliged to attend every person that performs maintenance tasks to hazards that arise from the unit or the entire system.
- Use the microscope as intended and only in technically flawless state. Immediately eliminate faults that may impair safety.
- Do not connect the modules to the power supply or the PC until you have properly installed the software with the OptoViewer.exe file provided!



#### IMPORTANT INFORMATION

To help you get the most out of your system, here is a small checklist with optimal PC settings and general tips on using an **IM · USB model**:

- Ensure a **stable power supply at the controller hubs**. Therefore, **deactivate** all possible **energy-saving modes** in your **Windows system control**. This must also be observed for **battery operation**. In the **Windows device manager** - only visible with admin rights - there are additional energy saving options. In the 'Energy Management' tab of the corresponding host controller properties, the energy saving mode can additionally be deactivated. Further details are described in a separate application note (chapter 22).
- Make sure that the **latest USB controller driver** is installed on your PC.
- On **desktop computers**, only use the **USB back ports**, as only these ports are directly connected to the mainboard. Using front ports would mean an additional cable bridge which could affect the signal quality.
- **Observe the maximum cable length** of 5 meters specified for USB3.1 and do not exceed this.
- **Avoid additional plug connections** between camera and USB controller or hub, as this can influence the signal quality.
- If several ports are connected via the same USB controller, make sure that the **maximum possible bandwidth is not exceeded**. If you need the maximum possible data throughput, only control one camera with one controller.

- Unstable signal quality and other compatibility issues can be avoided by using a specified **USB3.1 Gen1 PCI Express card**. Further advantages:
  - maximum available data throughput due to separate USB controller for each port
  - sufficient power supply directly via the PC board
  - identical hardware components for all systems
  - the system design is more independent of the PC hardware
  - stable driver software provided and supported directly by the manufacturer
  - longer life cycles/availability

Once a board has been specified, system security can be significantly increased.



## IMPORTANT INFORMATION

For all **IM · GigE models** consider the following information:

- The GigE camera of the modules must be supplied with voltage from an external source. The module must **NOT be connected** to a **PoE RJ45 socket**.
- To ensure a stable connection, all devices that contribute to the network connection between camera and host PC should support at least 1000 MBit/s.
- If possible, the applied devices should use **jumbo frames**.
- If possible, the Imaging Module should be connected to a dedicated network adapter. **Do NOT use the same one as for your Internet connection** (or other communication network). This reduces the bandwidth for image data transfer and may result in incomplete or lost images!
- Furthermore, ensure working with the **latest driver for your ethernet adapter** for an optimal performance.
- Due to the automatically assigned IP address, it may take some time for Windows to recognize the Imaging Module. The status can be checked in the Windows 'Control Panel\Network and Internet\Network Connections' panel.
- When using USB-Ethernet adapters, please note that they have different restrictions depending on the model.
- Basically, the following is recommended for operating an IM · GigE model (adjustable in the advanced properties of your network card):
  - Maximize the size of the receive buffer or stack buffer
  - Enable jumbo frames



## 11.2 Installation Guide

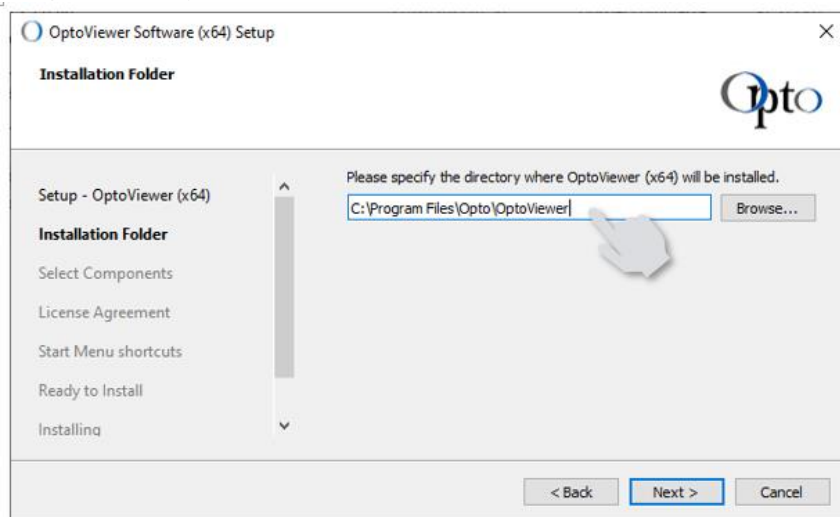
The OptoViewer software included in the scope of delivery controls both, image capture and illumination. The fixed magnification of the module enables factory calibration. You can thus start your analyses and measurements directly after unpacking. Further details on how this software works are described in chapters 13 and 14 and in corresponding user manual. Further tips and hints on choosing a suitable PC environment and on smooth image acquisition can be found in chapter 9.5.

If you want to integrate the Imaging Module into your own software environment - then the Opto-SDK is the perfect match for you. Please contact [support@opto.de](mailto:support@opto.de) for this.

Before installing the software for the first time, make sure that the above conditions are met. If this is the case, you can start with the software installation described below (installation process of OptoViewer 2.0):

### 1. Start Installer & Select Directory

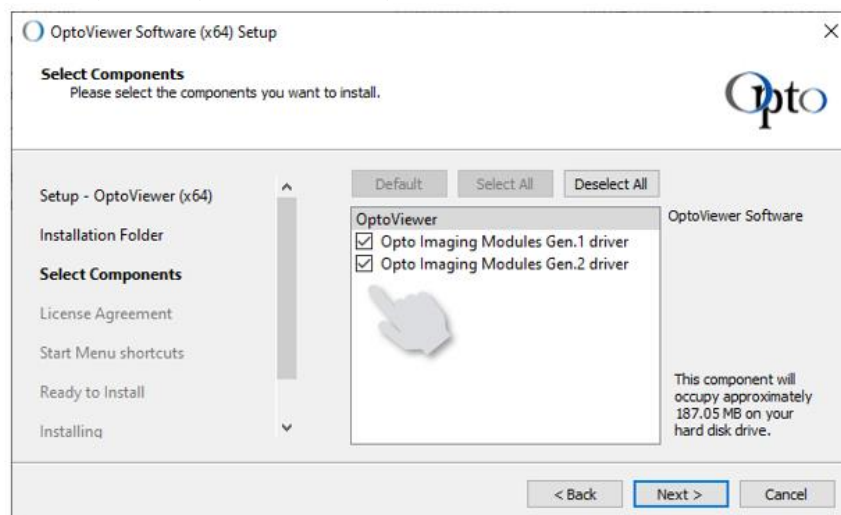
- Start OptoViewer software installer
- Select target directory



- Continue installation with the 'Next>' button

### 2. Select Components

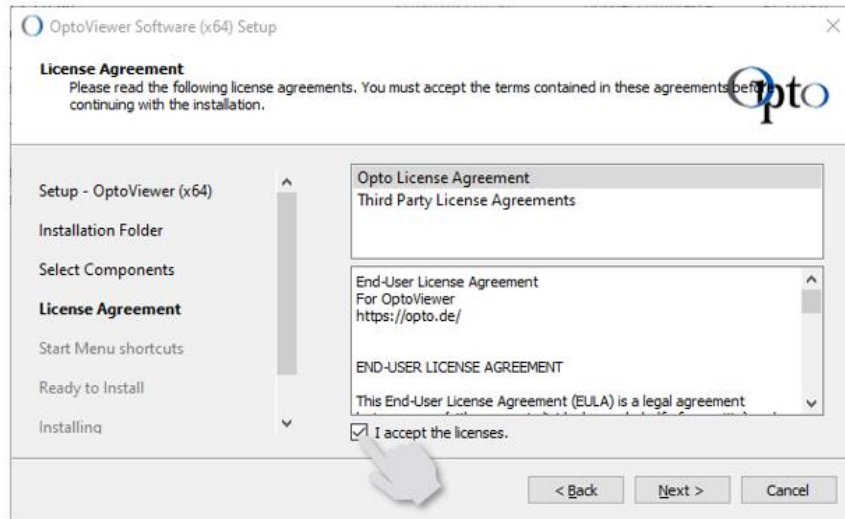
- Select the required 'OptoViewer' components.



- Continue installation with the 'Next>' button

### 3. Accept License Agreement

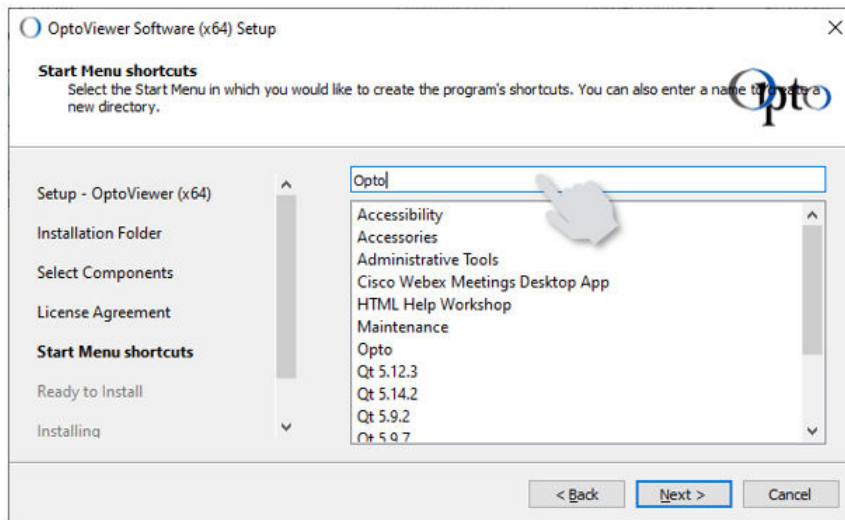
- Confirm the licence agreements with a check mark.



- Continue installation with the 'Next>' button

### 4. Assign Shortcut Name

- Assign shortcut name for Windows start menu (default: 'Opto').



- Continue installation with the 'Next>' button

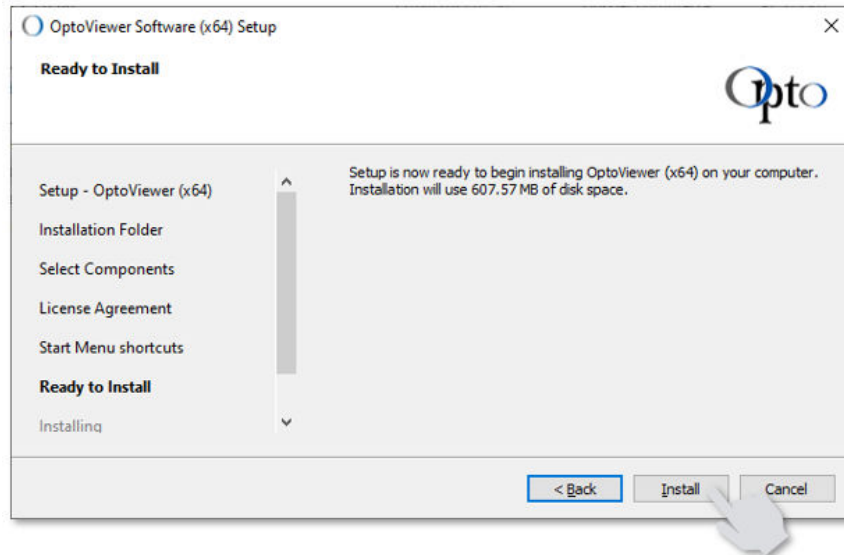
## 5. Start Installation



### IMPORTANT INFORMATION

The installation can take a few minutes, as the program automatically detects and installs all necessary drivers and software components

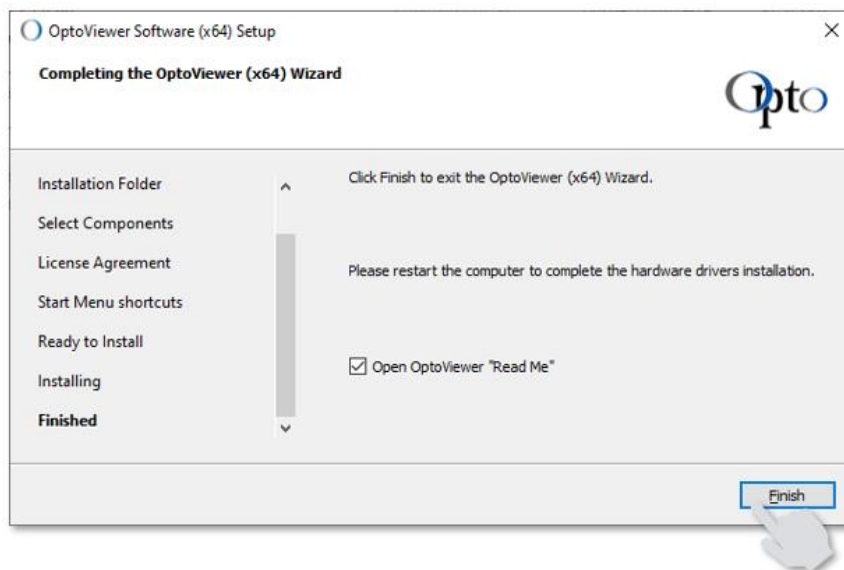
- Start installation with 'Install' button.



- Continue installation with the 'Next>' button

## 6. Complete Installation

- Complete installation with 'Finish' button.



- Software installation is completed.



### IMPORTANT INFORMATION

For technical support, please contact [support@opto.de](mailto:support@opto.de)

## 12 Set-Up · Hardware

After the software installation has been completed, the Imaging Module can be integrated in the corresponding measurement set-up.

According to the performance and optical design, the lighting is in the risk-free group of LEDs. Nevertheless, below warning notice must be taken into account under all circumstances.



### CAUTION

LEDs emit high intensity light.  
This can be harmful to your eyes.

→ Avoid direct eye exposure to light.

### 12.1 Mechanical Interfaces

The modules have standardised mechanical interfaces that allow easy integration into an industrial measuring machine, but also into a laboratory setup with stand and coarse/fine drive (chapter 9.6.3).



### MANDATORY INSTRUCTION

- In normal usage the optical axis is facing downwards. If it is mounted in any other direction take care, that a user will not be dazzled.
- The hole patterns or mounting patterns of the IM · USB and IM · GigE variants are identical.



### IMPORTANT INFORMATION

Mounting brackets and cables are not included in the scope of delivery of an Imaging Module and must be ordered separately if required (chapter 9.6).

#### 12.1.1 IM · linea S – Mounting Options

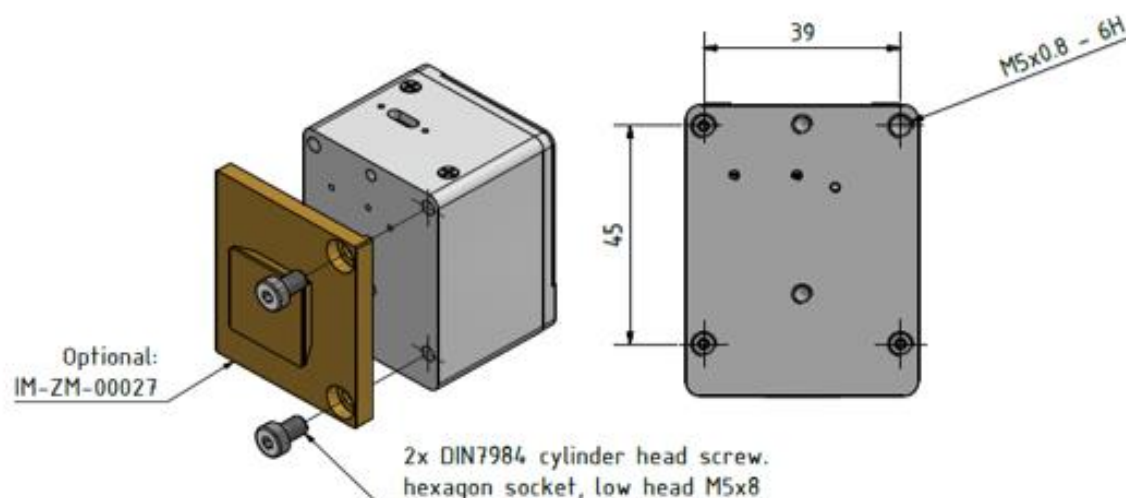


Figure 20: IM · linea S - Mounting options - **DISCONTINUED**

## 12.1.2 IM · linea M – Mounting Options

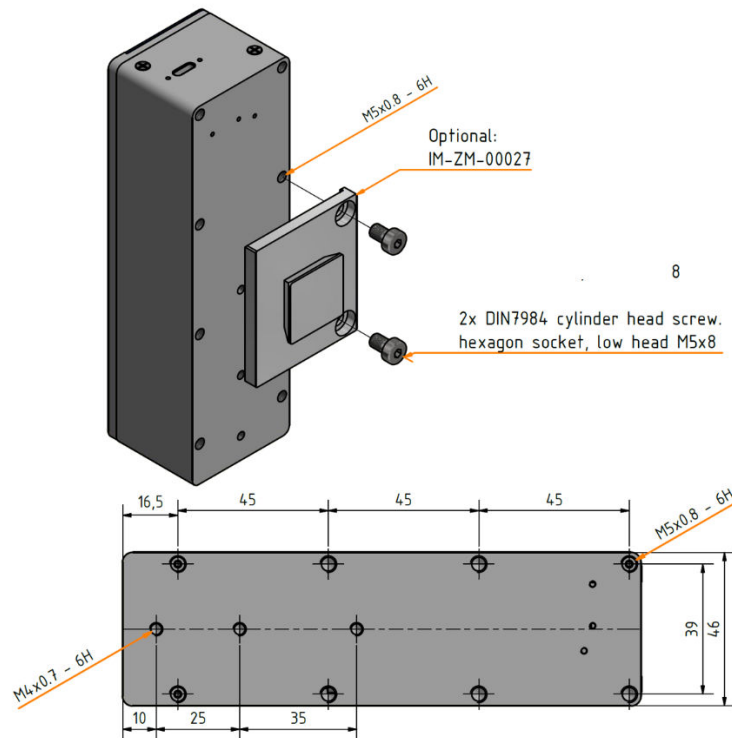


Figure 21: IM · linea M V1 - Mounting options – **DISCONTINUED**

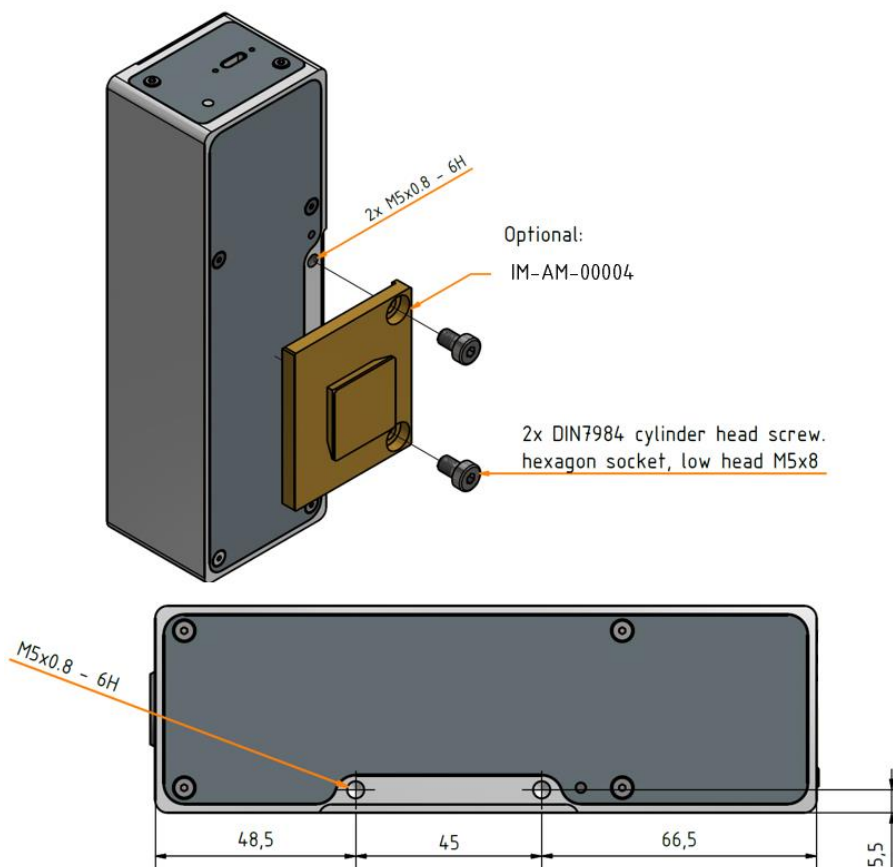


Figure 22: IM · linea M V2 - Mounting options

### 12.1.3 IM · compact M – Mounting Options

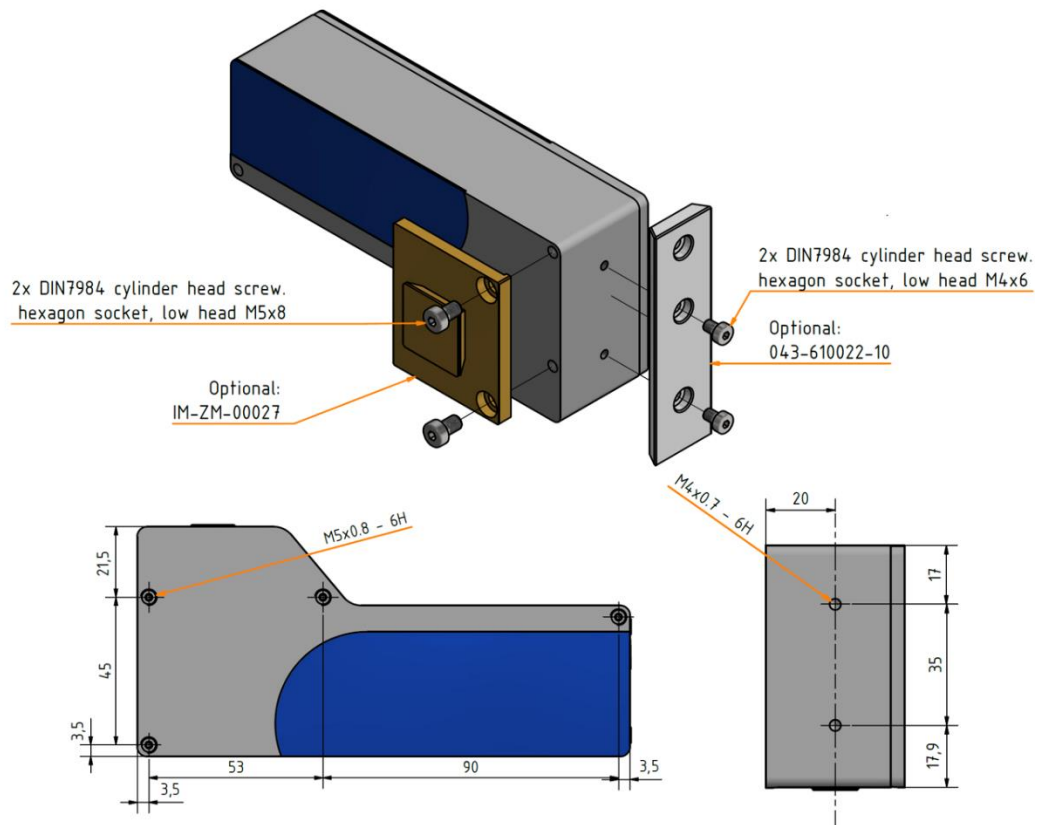


Figure 23: IM · compact M V1 - Mounting options - **DISCONTINUED**

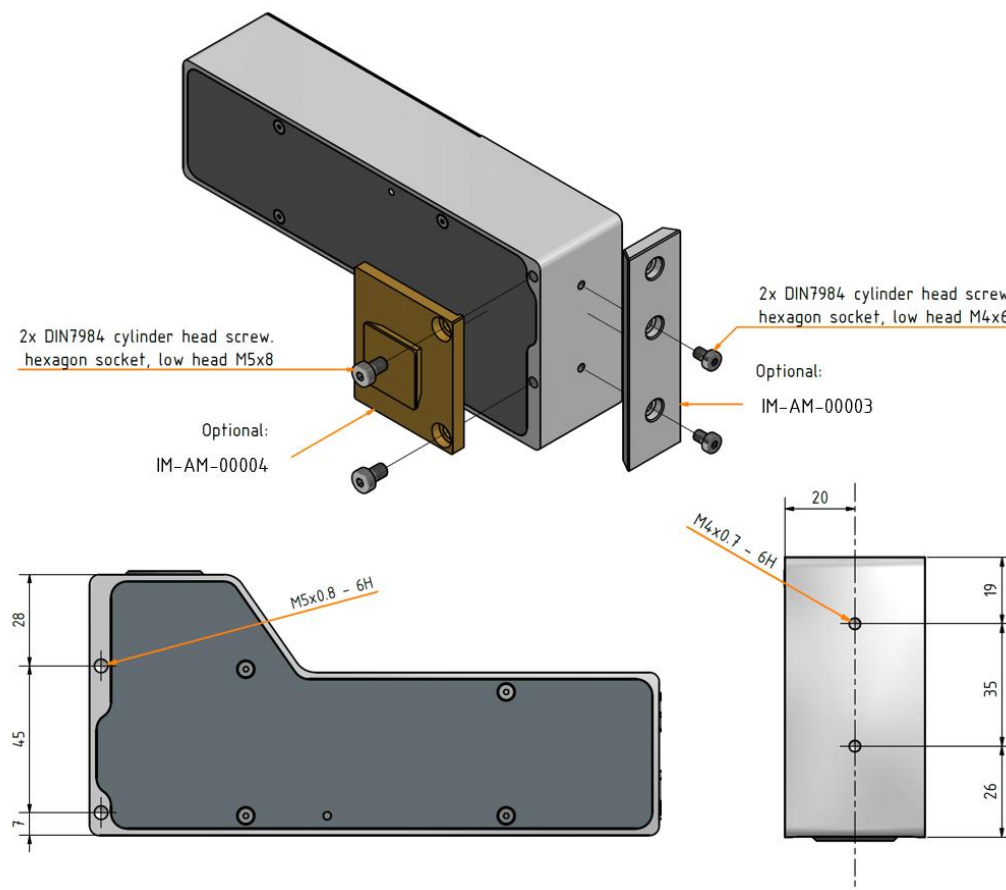


Figure 24: IM · compact M V2 - Mounting options

## 12.1.4 IM · profile M – Mounting Options

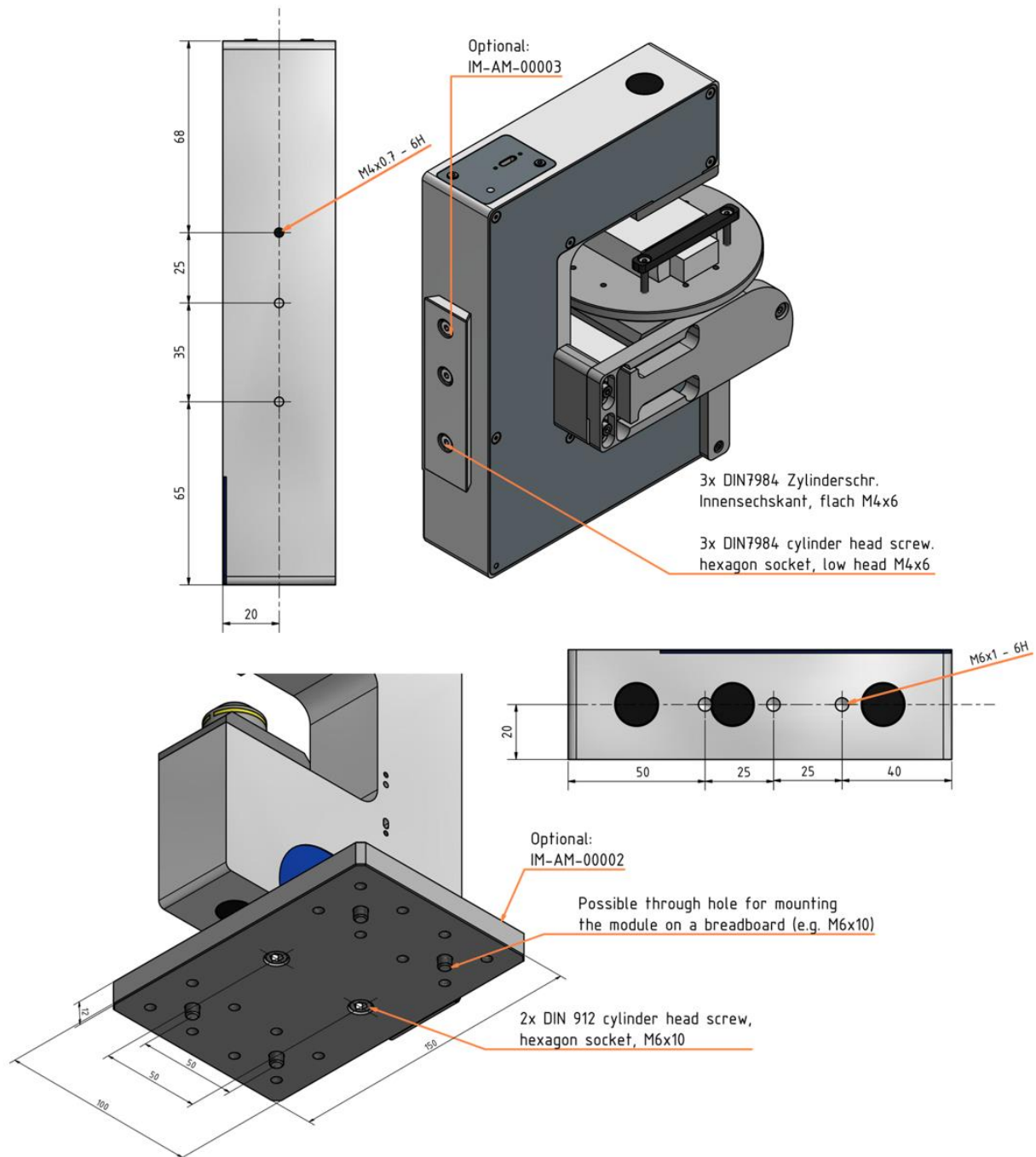


Figure 25: IM · profile M V2 - Mounting options



## 12.2 Microscope Axis



### MANDATORY INSTRUCTION

In normal usage the optical axis is facing downwards. If it is mounted in any other direction take care, that a user will not be dazzled.

### 12.2.1 IM · linea S – Microscope Axis

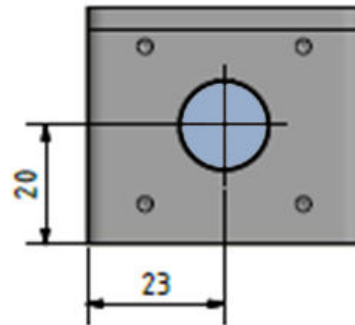


Figure 26: IM · linea S - Microscope axis – **DISCONTINUED**

### 12.2.2 IM · linea M – Microscope Axis

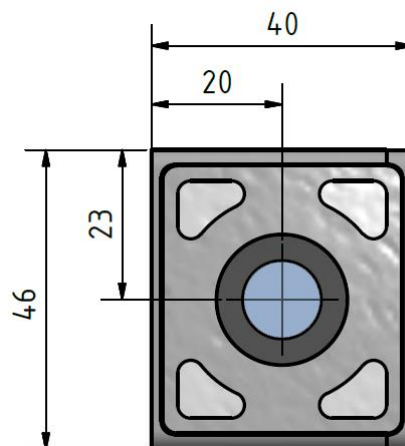


Figure 27: IM · linea M V1 – Microscope axis - **DISCONTINUED**

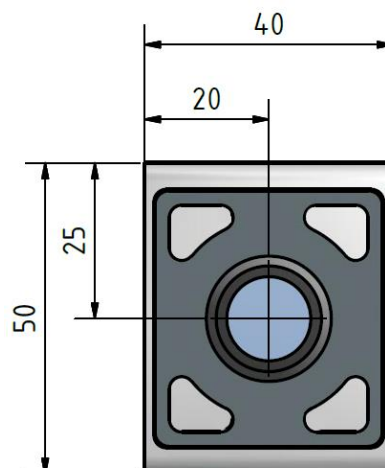


Figure 28: IM · linea M V2 - Microscope axis



### 12.2.3 IM · compact M – Microscope Axis

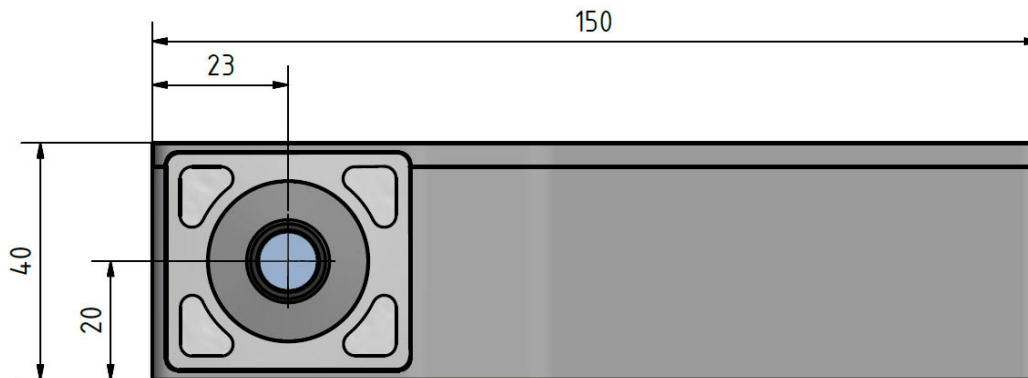


Figure 29: IM · compact M V1 – Microscope axis- **DISCONTINUED**



Figure 30: IM · compact M V2 – Microscope axis

### 12.2.4 IM · profile M – Microscope Axis

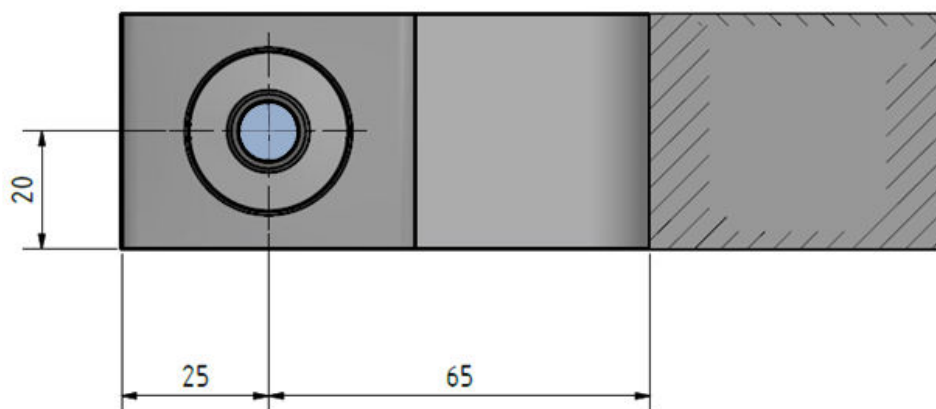


Figure 31: IM · profile M V2 – Microscope axis

## 12.3 Function Control

For a flawless and stable process, the following steps can be re-checked again in conclusion.

1. **Current software package & device drivers** are fully installed.
2. **Cable** is correctly **connected and tightly screwed**.
3. After plugging the module, the **status LED** on the back should react as follows:

IM · USB3	
Status LED flashes 2x green	USB2.0 port detected
Status LED flashes 3x green	USB3.0 port detected
LED lights up green	Driver loaded & camera is ready for operation

IM · GigE	
Status LED flashes green slowly	Camera is ready
RJ45 LED lights up green	Network connection is set
RJ45 LED lights up green & red alternately	Data transmission with network

Further details on possible LED settings are described in chapter 9.3.

4. The connected module is recognised without error in the Windows Device Manager.  
(This item represents an additional and optional control possibility.)
5. Blue **optical protection film** is **removed**.

Now you can start the OptoViewer application and adjust the exposure and illumination settings to perform an optimised inspection. Since the calibration details are already stored in the camera, measurements can also be carried out off the cuff.

An application example as well as a short overview of the available functions are described in the next chapters. Further details on the functionality of the software can be found in the associated user manual.

## 13 Application Description

After complete assembly and successful functional check, the Imaging Module is ready for operation. The following section presents a possible use case that can be run working with OptoViewer 2.0.



### MANDATORY INSTRUCTION

The first Imaging Modules (V1) are EXCLUSIVELY for use with OptoViewer 1.3 or higher. For newer modules, use OptoViewer 2.0 or higher.



### Distance Measurement

#### 1. Select Imaging Module

- Select and activate needed Imaging Module in 'Devices' panel

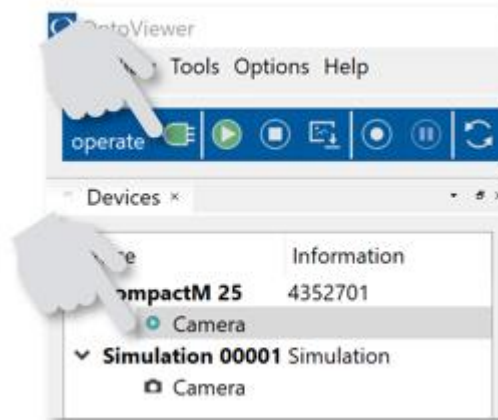


Figure 32: OptoViewer 2.0 · Selecting module

Image can be focused now.

## 2. Select Illumination & Focus Image

- Select illumination type (coaxial, ring or transmitted light).
- Focus the image (corresponding WD see chapter 9.2).

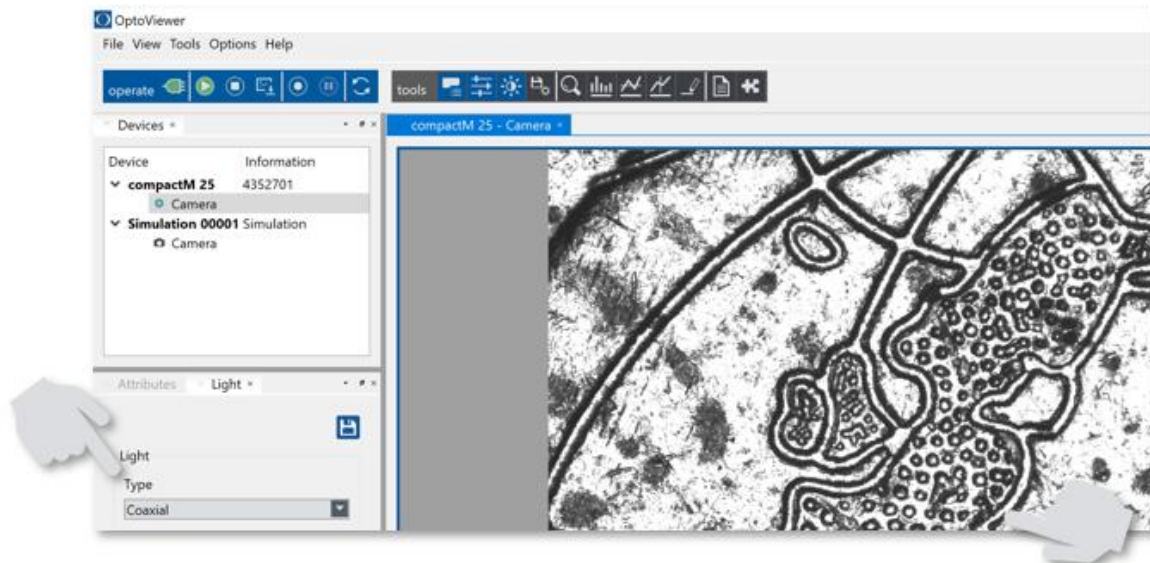


Figure 33: OptoViewer 2.0 · Selecting illumination

Image brightness can be adjusted now.

## 3. Set image brightness

- Set correct image brightness.

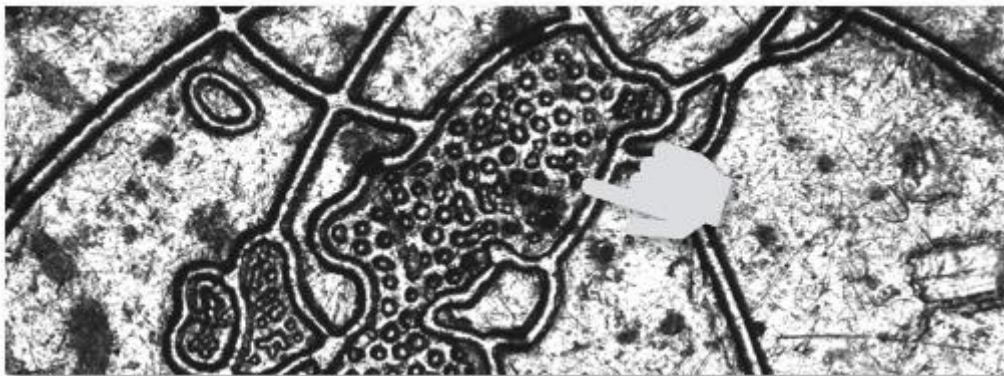


Figure 34: OptoViewer 2.0 · Setting sensible image brightness



### IMPORTANT INFORMATION

Avoid under- or over-lighting. With the help of the 'Histogram' tool, you can cross-check the intensity distribution as well as other useful statistics.

Especially when using the 'Auto Exposure' function, you should pay attention to the image brightness. No automatic gain is applied, only exposure time is controlled. When a low frame rate is set, this allows long exposure times to be applied in case of low light conditions. Long exposure time can cause motion blur in case of moving object. It is always recommended to increase the light power when possible.

For colour modules 'White Balance' can be adjusted.

#### 4. Adjust 'White Balance' (OPTIONAL)



##### IMPORTANT INFORMATION

Depending on the type of lighting, the white balance may vary slightly. Settings can be adapted in the 'Attributes' panel.

- Select needed 'White Balance' function in section 'Analog Control'.

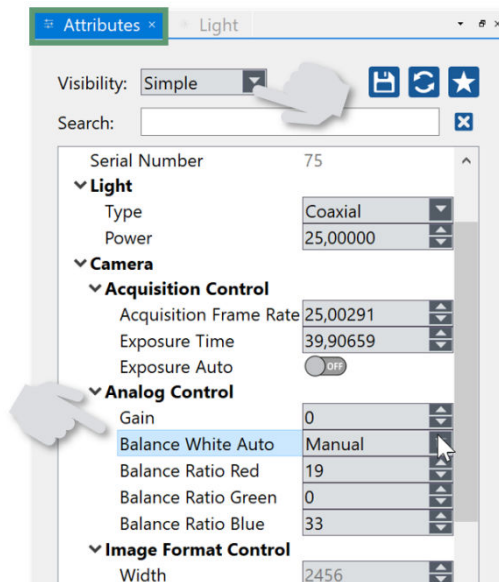


Figure 35: OptoViewer 2.0 · Activating 'White Balance'

Measurement can be started.

#### 5. Insert measurement tool

- Insert tool 'Length' and mark desired distance.

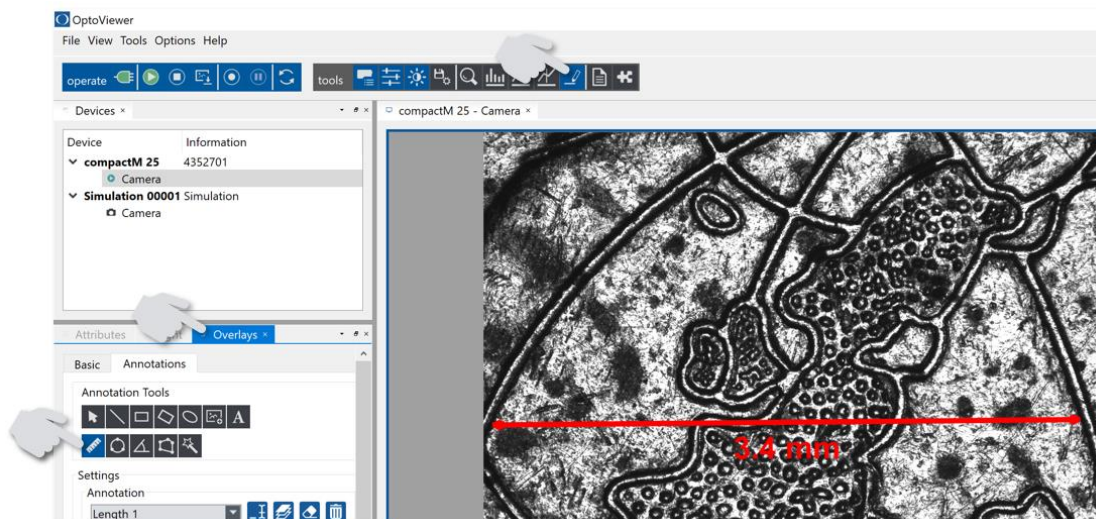


Figure 36: OptoViewer 2.0 · Determining length

Image with marked measurement can be merged and saved.

## 6. Save image

- Select function 'Save Image As' in register 'File'.

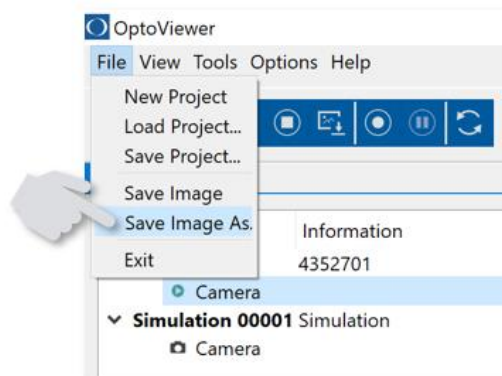


Figure 37: OptoViewer 2.0 · Saving image

Measurement is finished and report saved.



### IMPORTANT INFORMATION

The functionality implemented in the software is suitable for a variety of other applications. A comprehensive description is contained in the corresponding operating manual.



## 14 Function Description

The topics listed in this chapter are only intended to provide a short overview of the OptoViewer 2.0 basics and enable a quick start. For a detailed description of the full range of functions, please refer to the corresponding user manual.

### 14.1 Device Connection & Basic Image Acquisition

Establishing the connection to the module and activating image capture can be controlled with only a few buttons. These are contained in the 'Device' panel and 'operate' toolbar.

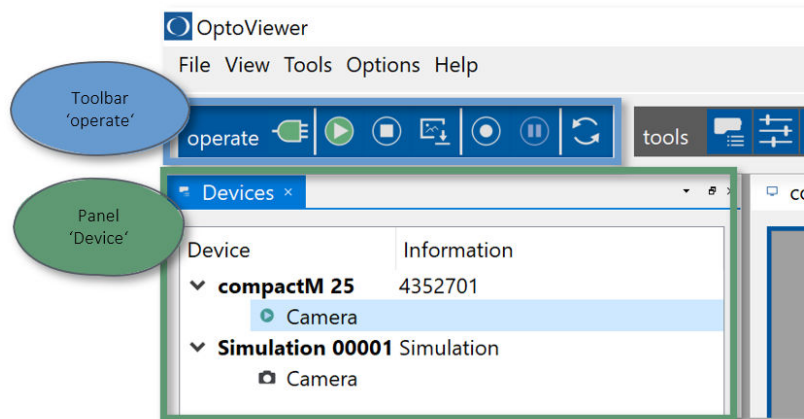
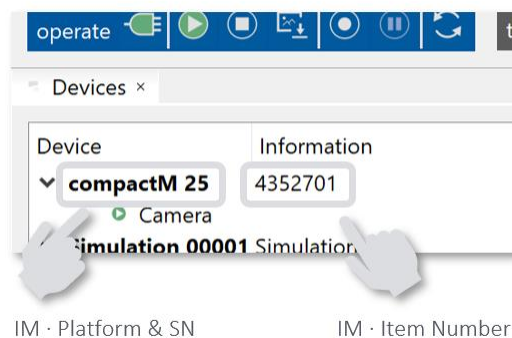


Figure 38: OptoViewer 2.0 · Basic image acquisition tools

Basic Image Acquisition		
	Open / close module	Sets up device connectivity of selected camera in panel 'Device'.
	Start image acquisition	Starts continuous image acquisition and display. The streaming data can be checked in the 'Status bar'. For more details on the operating sequence, see the Log tool. Image acquisition will automatically start if only 1 module is connected.
	Stop image acquisition	Stops current image acquisition.
	Continuous image recording	Starts continuous image recording and display. Parameters can be set in the 'Saving' panel.
	Save image	Saves current image in pre-defined directory (assigned in window 'Saving').

Table 28: OptoViewer 2.0 · Toolbar for basic image acquisition



IM · Platform & SN

IM · Item Number

Figure 39: OptoViewer 2.0 · Module identification

Already saved image files and videos can also be viewed afterwards. They can be imported via a 'Simulation Module', activated in the 'Devices' panel. The image or video selection is done in the 'Attributes' panel. In the 'Acquisition Control' area, the desired file selection can be defined in the 'Path' field. The 'Play' button starts the image acquisition.

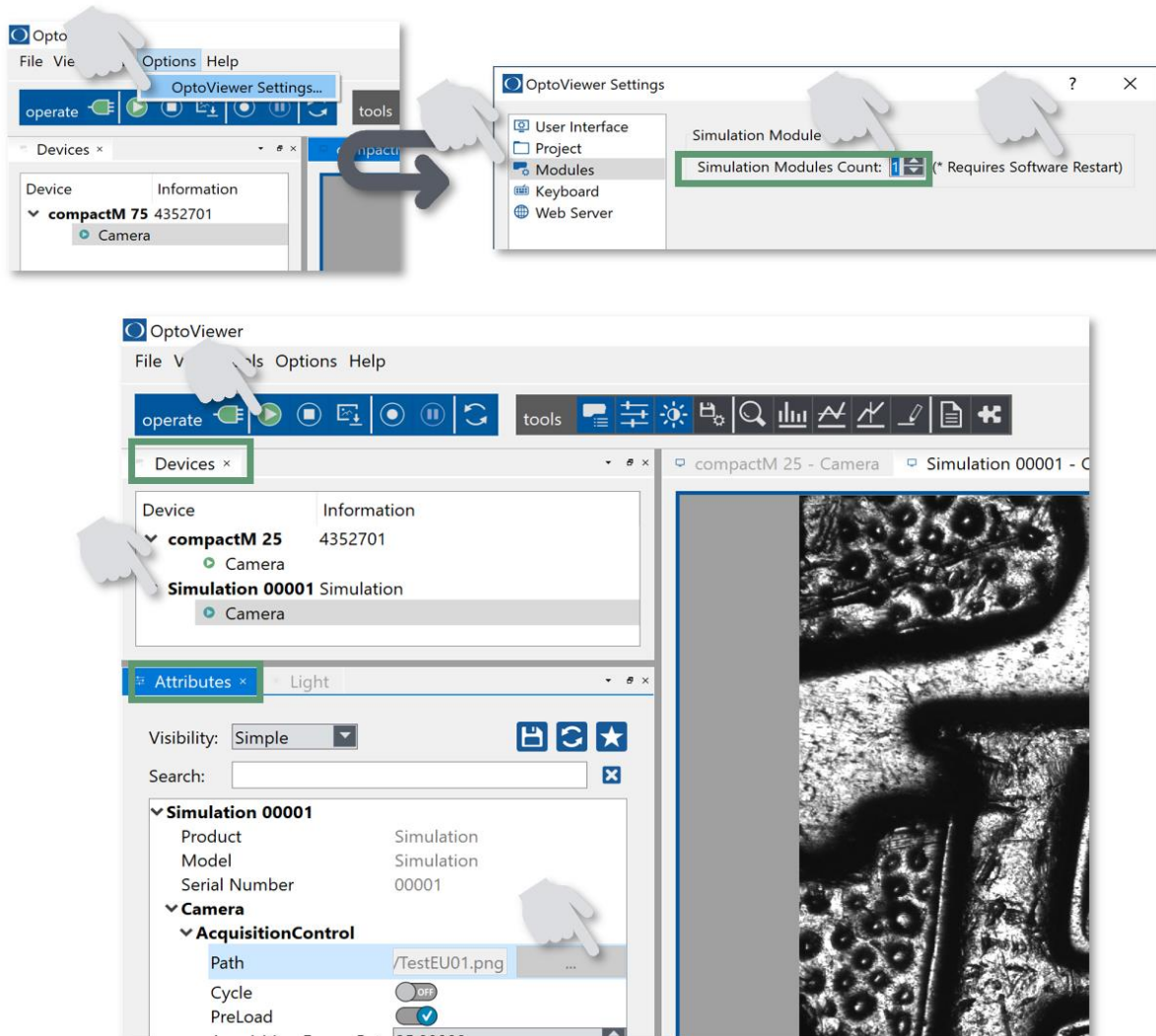


Figure 40: OptoViewer 2.0 · Simulation Module



## 14.2 Basic Module Settings

For a perfect image adjustment, there are two main adjustment panels available in the OptoViewer 2.0 – ‘Light’ & ‘Attributes’.

### 14.2.1 Light

The ‘Light’ settings can be displayed/hidden under register ‘Tools’. This panel has a predefined position in the GUI by default. Nevertheless, it can be adapted to your needs at any time (chapter 14.4).

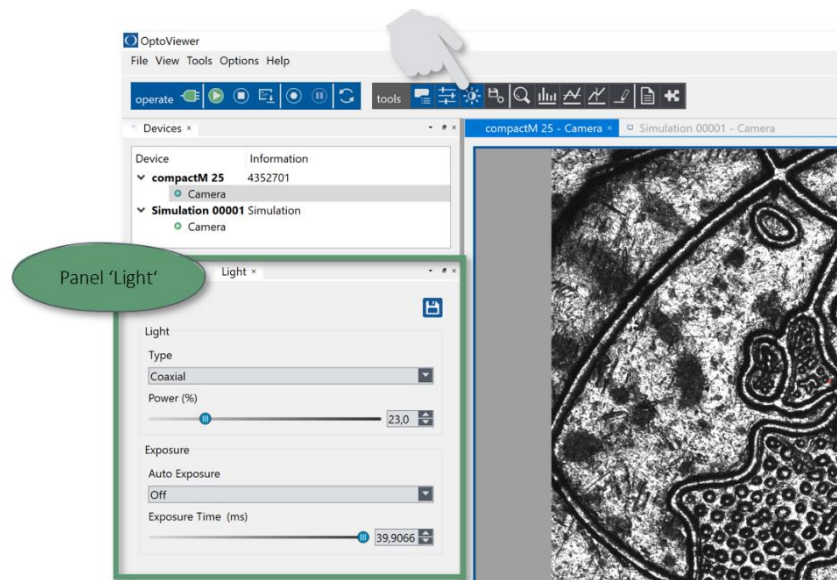


Figure 41: OptoViewer 2.0 · Default GUI with displayed 'Light' panel

Here you can select the desired type of illumination (if integrated), the illuminance as well as the exposure settings (in a simple way).

Light	
Light	The type of lighting can be selected in the drop-down menu. If no light is integrated, the field is greyed out. Use the slider to set the illumination level. If you prefer to work with concrete numbers, use the number field.
Exposure	Especially when using the ‘Auto Exposure’ function, you should pay attention to the image brightness. No automatic gain is applied, only exposure time is controlled. When a low frame rate is set, this allows long exposure times to be applied in case of low light conditions. Long exposure time can cause motion blur in case of moving object. It is always recommended to increase the light power when possible.

Table 29: OptoViewer 2.0 · 'Light' panel settings

## 14.2.2 Attributes

The 'Attributes' panel allows more detailed settings to be made on the module, and at the same time the metadata of the module can be viewed (serial number, calibration factor, etc.). A manual white balance as well as the individual values of the image acquisition are fully controllable here.

This section introduces you only to the most important ones. For a detailed description please refer to the OptoViewer user manual.

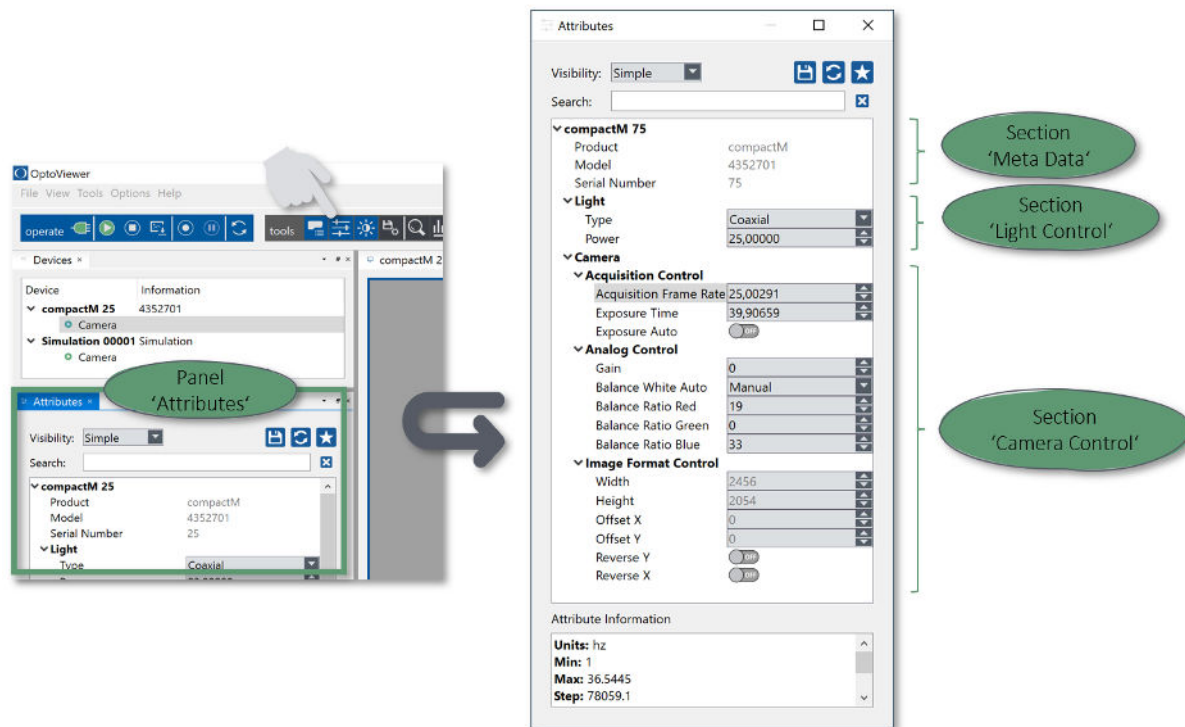


Figure 42: OptoViewer 2.0 · Default GUI with displayed 'Attributes' panel and its settings

Attributes		
Meta Data	Module Information	Displays complete identity information incl. calibration factor of the selected module.
Light Control	Type	Shows drop-down menu with possible illumination types - if it's a module equipped with integrated lighting.
	Power	Defines illuminance of selected lighting type above.
Camera Control	Acquisition Control	All parameters required for image acquisition can be set manually. Also trigger functionality can be activated here.
	Analog Control	These settings should only be adjusted if there is a deeper understanding of these variables. You can adjust the 'Gain' or the 'Gamma Factor' (in case your preparation needs an adjusted contrast). The 'Black Level' value as well as the 'White Balance' can also be corrected at this point.
	Image Format Control	Allows you to define a certain ROI, mirror the image, etc.

Table 30: OptoViewer 2.0 · 'Attributes' panel settings

If not all parameters are required for your application or corrections, the content of the window parameters displayed can be adjusted. The 'Visibility' field already contains predefined parameters.

The 'Favourites' option can be used to customise your preferred displayed content once again. Click on the star button to select your favourite attributes.

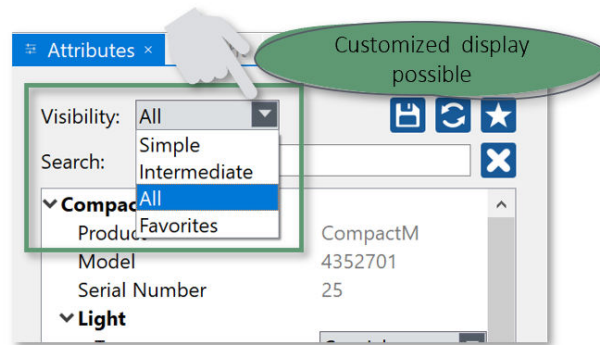


Figure 43: OptoViewer 2.0 · Display options for 'Attributes' panel

## 14.3 Overlay Tools

OptoViewer 2.0 offers a wide range of overlay tools to optimise your documentation results and include coarse length or angle measurements. This includes basics like grids, scales as well as drawing tools or other annotations (e.g. text).

### 14.3.1 Overlay · Basics

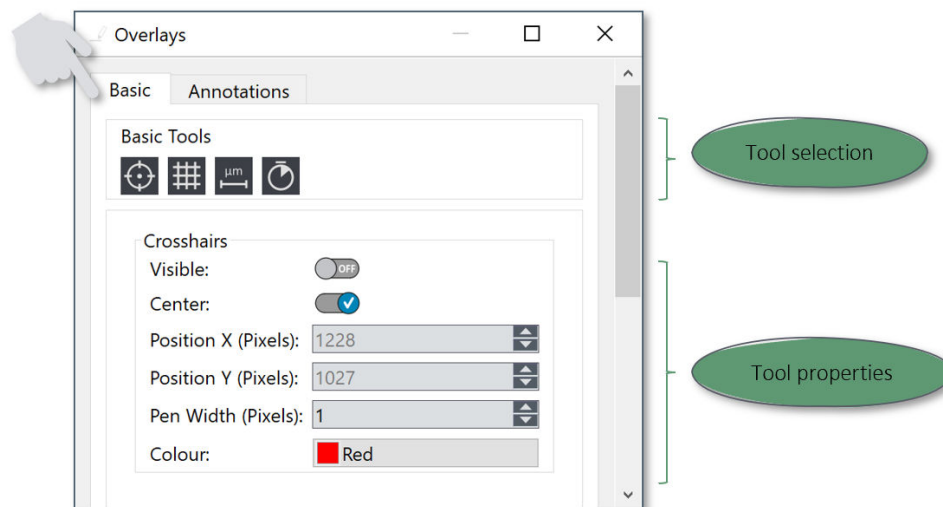


Figure 44: OptoViewer 2.0 · 'Overlay' panel - 'Basic Tools'

Overlay · Basic Tools		
	Crosshair	Activates the display of a crosshair whose properties can be changed (e.g. colour, pen width, size, position of the intersection point).
	Grid	Activates the display of a grid whose properties can be changed (e.g. colour, pen width, size, position). It's a helpful tool for alignment operations.
	Scale	Activates the display of a scale whose properties can be changed (e.g. colour, pen width, size, position, unit).
	Timestamp	Activates the display of a timestamp whose properties can be changed (e.g. colour, pen width, size, position).

Table 31: OptoViewer 2.0 · 'Overlay' - Basic tools

### 14.3.2 Overlay · Annotations

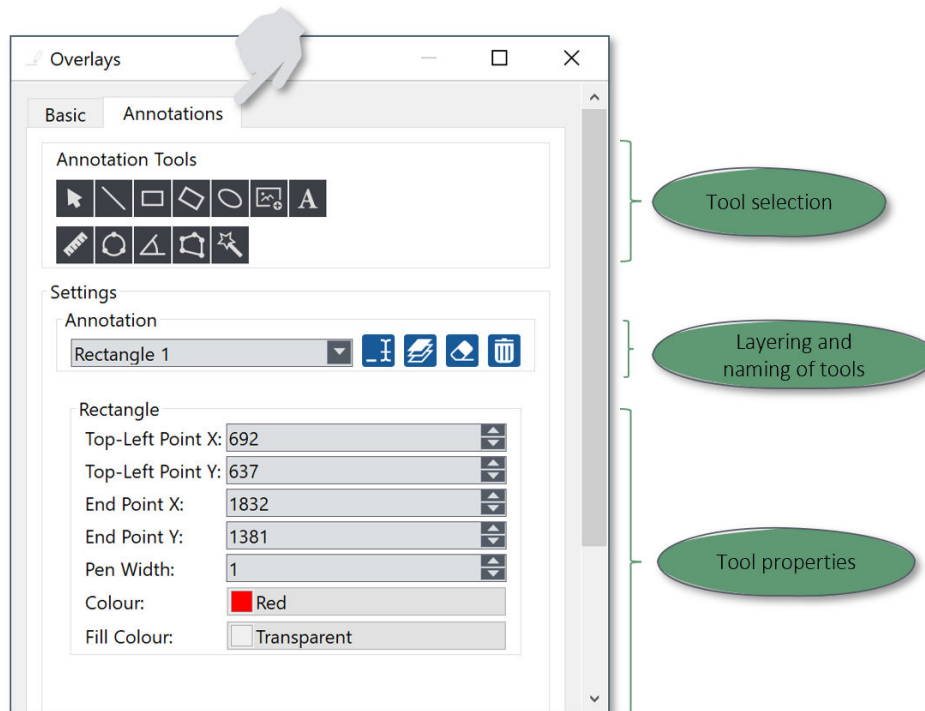


Figure 45: OptoViewer 2.0 · 'Overlay' panel - 'Annotations'

Overlay · Annotation Tools		
	Select	Activates the correspondingly selected tool, which can be changed in its property (e.g. colour, pen width, size, position).
	Line	Inserts a line tool that can subsequently be adapted as desired with 'Select' tool.
	Rectangle	Inserts a rectangle tool that can subsequently be adapted in terms of size and colour with 'Select' tool.
	Rotated Rectangle	Inserts a rectangle tool, which can then be adjusted as desired with the tool 'Select'. The rotate function is applicable when the appearance of the mouse pointer changes accordingly.
	Circle of 3 Points	Inserts a circle defined by three points. This can then be adjusted as desired with the 'Select' tool.
	Ellipse	Inserts a ellipse tool that can subsequently be adapted as desired with 'Select' tool. The rotate function is applicable when the appearance of the mouse pointer changes accordingly.
	Image	Inserts an image file (*.png. *.bmp. *.tif. *.jpg. *.jp2). The images cannot be scaled inside the OptoViewer. The size has to be defined before importing the file. What can be adapted is the position of the image.
	Text	Inserts text that can subsequently be adapted as desired with 'Select' tool.
	Length	Shows length of defined image distance.
	Angle	Shows angle of contained structures.
	Polygon Area & Perimeter	Sets a freely definable polygon and shows perimeter and area according to assigned calibration factor of the module.
	Contour Area & Perimeter	Inserts a tool for automatic contour detection. Displays the determined area and perimeter.

Table 32: OptoViewer 2.0 · 'Overlay' - Annotation tools

## 14.4 Customisation

The OptoViewer has various standard settings that can be adapted to the customer or application-specific needs at any time. The following sections provide a brief overview of possible adaptations. For a detailed explanation, please refer to the corresponding user manual of the software.

### 14.4.1 Custom Layout · Panel & Toolbar Arrangement

For some inspection tasks, customising the GUI may improve the user experience significantly. In these cases, it is possible to adapt the layout of the OptoViewer accordingly.

Depending on the application, individual panels can be shown or hidden. The same applies to the toolbars.

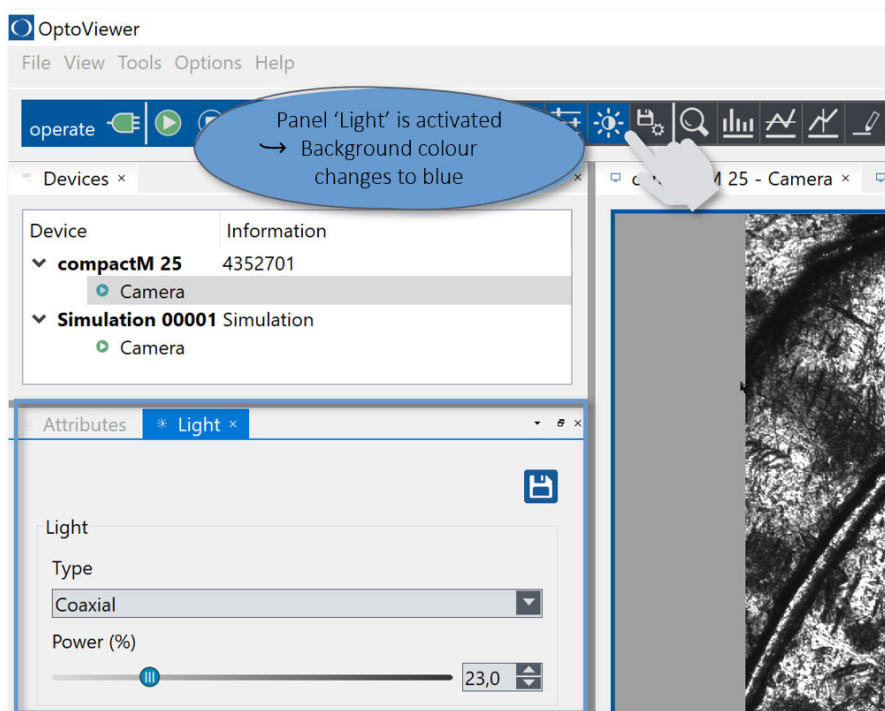


Figure 46: OptoViewer 2.0 · Showing & hiding panels

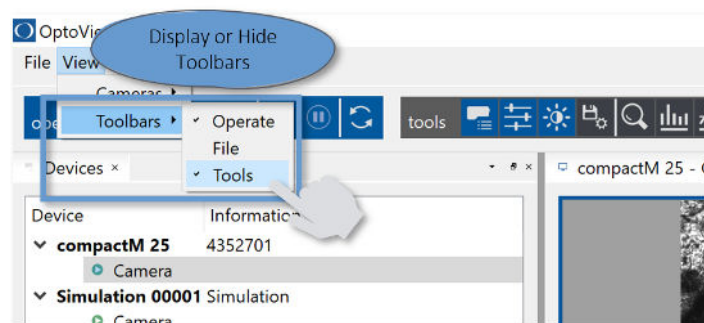


Figure 47: OptoViewer 2.0 · Showing & hiding toolbars

If a (control) panel or a toolbar is visible or displayed in the GUI, the corresponding icon is highlighted – either by means of a blue background colour or a check mark. Clicking on the icon displays or hides the function.



The standard GUI includes a fixed number of displayed panels. These are arranged in a fixed order to each other. However, this predefined position can be adjusted according to the user's own requirements as well. With a left click in the panel header, it can be picked up and positioned at the desired location – this could be fixed frame position or in a flying one.

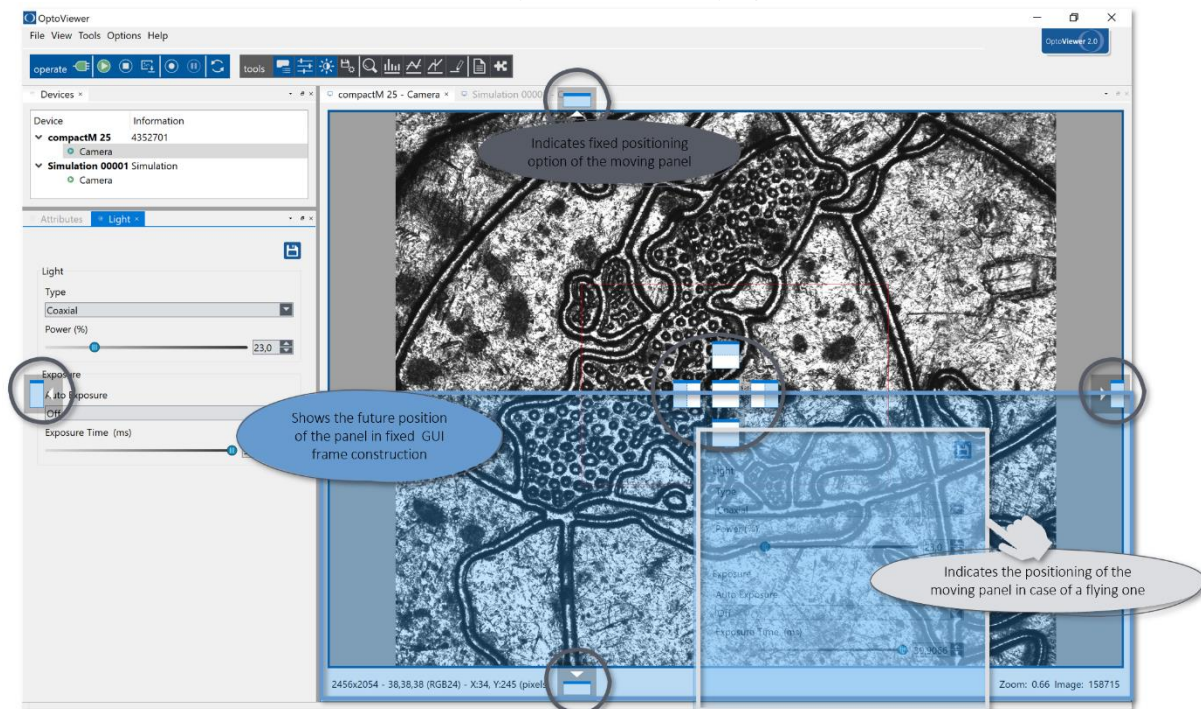


Figure 48: OptoViewer 2.0 · Panel arrangement

Once the layout has been adapted to the application requirements, it can be saved in the OptoViewer settings (further details see next chapter).

## 14.4.2 OptoViewer Settings

In order to further usability improvements and customisation, additional functions are available in the 'OptoViewer Settings'.

### 14.4.2.1 Customized User Interface

The GUI customisation options described in previous chapter can be saved as own custom layouts in the 'OptoViewer Settings'.

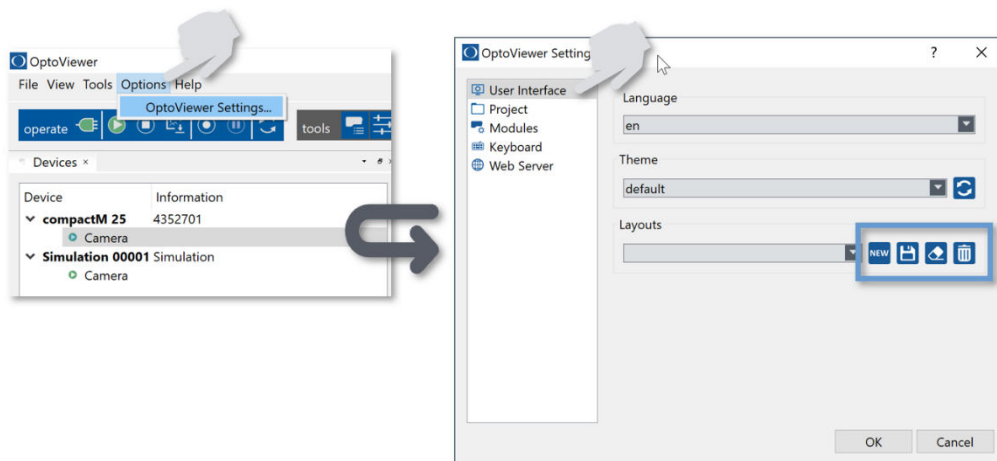


Figure 49: OptoViewer 2.0 · Layout options

The 'NEW' button can be used to save the current GUI settings as a new layout.

### 14.4.2.2 Project Data

To obtain comparable test results and ensure that the same settings are used when running an evaluation on several specimens, the project data can be saved.

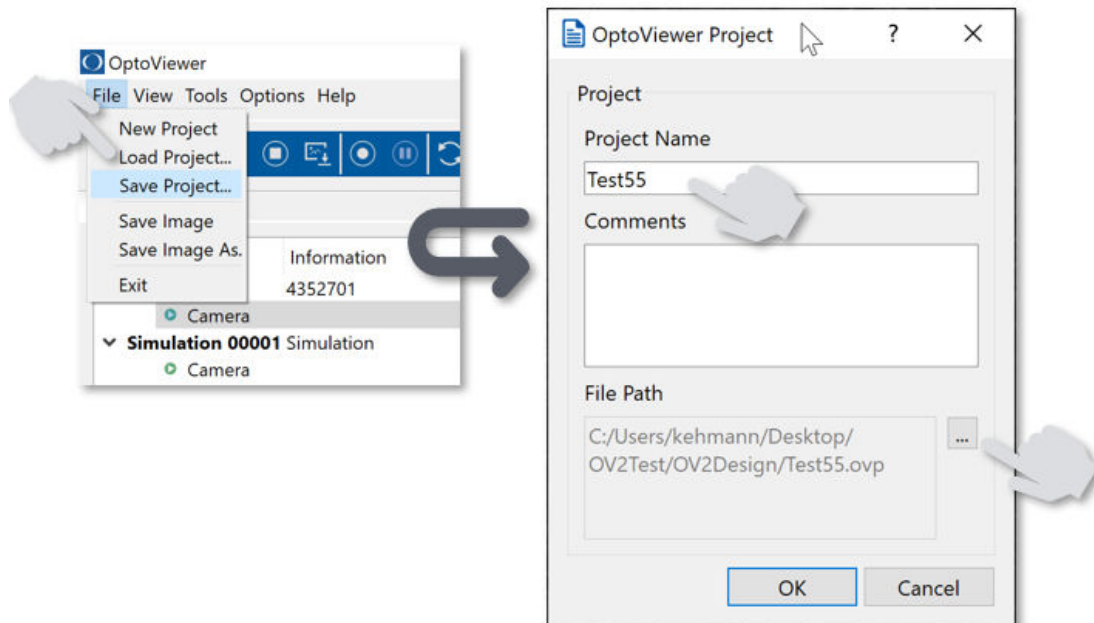


Figure 50: OptoViewer 2.0 · Saving 'Project' data

This specific project file contains information on following subjects:

- Module settings (e.g. light type & power, exposure time, white balance settings)
- Overlay settings (e.g. inserted scale or rectangle)
- Plugin sequences
- Layout settings

It's also possible to activate the project data automatically when starting the program (details see chapter 14.4.2.3).



#### IMPORTANT INFORMATION

Note that the project data is linked to the module (specific serial number) that you used to start or save this file once. This means that the saved settings are NOT transferable to other modules.

### 14.4.2.3 Auto-Start Functions

OptoViewer 2.0 offers several possibilities to simplify the start of a module. The device connection is established automatically, if there is only one module connected and you can see the live image immediately.

In case additional project data (e.g. exposure time or illuminance) is needed, you can also load them automatically and start the corresponding live image.

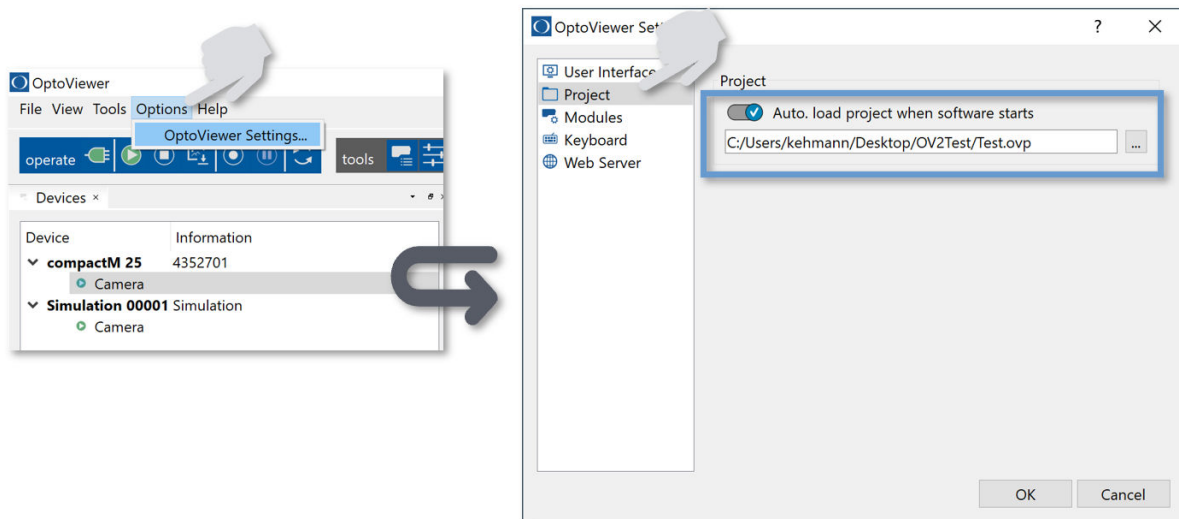


Figure 51: OptoViewer 2.0 · Auto-start function 'Project'

### 14.4.3 Saving Options

The memory or saving options of the OV2 can be divided into two basic categories - sequence recording or single recording. Thus, conventional snapshots but also videos or time-lapse recordings can be realized. An auto-stop function as well as recording with overlays is possible.

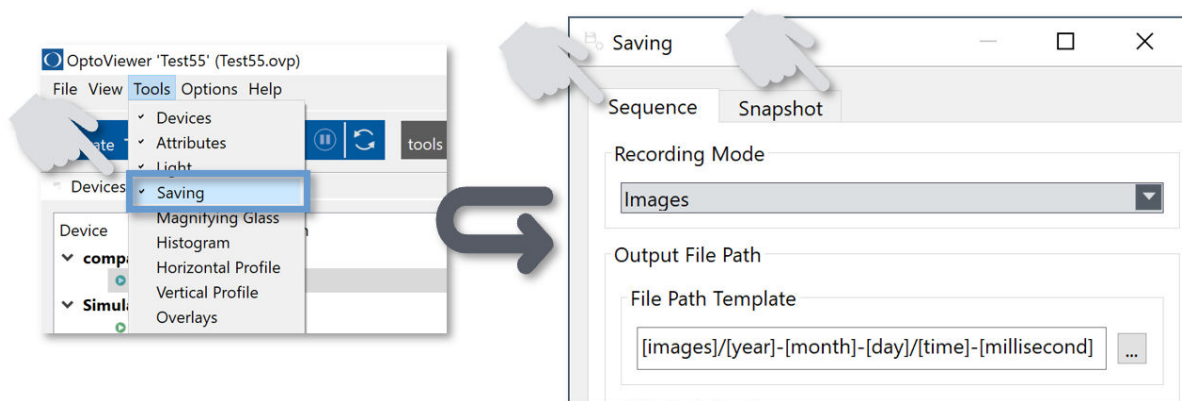


Figure 52: OptoViewer 2.0 · 'Saving' panel



## 15 Care Instructions



### IMPORTANT INFORMATION

Microscope lenses can easily be scratched and should be treated with great care.

- Never use sharp instruments or abrasive materials to clean the microscope lens.
- For cleaning moisten lens paper, 'bellows' or brush and clean the lens with a circular motion.
- Dry the lens with a clean, dry piece of lens paper and after finishing use an aspirator to remove any lingering dirt or particles.  
Opto Cleaning Set 043-9900044 recommended.
- Clean housing surface with a soft, damp cloth.

Further notes are documented in the respective sections of this manual as well as in the corresponding operating manuals of the components. In the case of larger contamination, please contact [support@opto.de](mailto:support@opto.de). Only trained and qualified personnel are allowed to clean the system.

## 16 Maintenance

All parts of the microscope are maintenance-free.



### IMPORTANT INFORMATION

It's strongly recommended that users make regular checks on the condition of the unit, as well as controls after transportation or shocks.

- Maintenance may only be performed by authorized personnel.
- Please contact Opto if any damage occurs.

For cleaning purposes use the Opto Cleaning Set 043-990004.

## 17 Troubleshooting

The safety notes and handling instructions contained in this manual must be observed before and while using an IM · linea S, M · compact M · profile M. If disruptions occur while working with the module, in below table you can find a brief summary on possible causes. For any kind of issue (mechanical, optical or software) please contact your dealer or [support@opto.de](mailto:support@opto.de).

Issue	Possible Causes	Solution
Illumination is not working (for variants with integrated light)	<ul style="list-style-type: none"> <li>• Incorrect software settings</li> <li>• Defect cable or socket or USB port / power pack</li> <li>• Defect LED</li> </ul>	<ul style="list-style-type: none"> <li>• Check driver status</li> <li>• Check USB port functionality</li> <li>• Try other cable</li> <li>• Contact support@opto.de</li> </ul>
Status LED is flashing red	<ul style="list-style-type: none"> <li>• host PC is NOT reaching needed specifications (valid for IM · USB models)</li> <li>• Camera driver issues</li> </ul>	<ul style="list-style-type: none"> <li>• Check driver status</li> <li>• Contact support@opto.de</li> </ul>
Limited camera operation (missing images, failure hints, e.g.)	<ul style="list-style-type: none"> <li>• USB port only support USB2.0 bandwidth. Visible by ONLY double flashing of status LED when initiating the camera.</li> </ul>	<ul style="list-style-type: none"> <li>• Use full compatible USB3.1 Gen1 port or ensure needed specifications are met</li> </ul>
No live image	<ul style="list-style-type: none"> <li>• Camera not connected properly</li> </ul>	<ul style="list-style-type: none"> <li>• Check connection status in Windows Device Manager</li> <li>• Check camera status LED</li> <li>• Check interface, cables and sockets (@ device &amp; @ PC)</li> <li>• Possibly use other slots</li> <li>• Contact support@opto.de</li> </ul>
	<ul style="list-style-type: none"> <li>• Defect camera cable</li> </ul>	<ul style="list-style-type: none"> <li>• Try checking with other cable(s). Use screwable for this purpose recommended in chapter 9.6.</li> </ul>
	<ul style="list-style-type: none"> <li>• Defect camera or incorrect camera settings in software</li> </ul>	<ul style="list-style-type: none"> <li>• Check visibility and connectivity status in Windows Device Manager</li> <li>• Take a detailed look on exposure settings and frame rate</li> <li>• Contact support@opto.de</li> </ul>
	<ul style="list-style-type: none"> <li>• Driver issues</li> </ul>	<ul style="list-style-type: none"> <li>• Check Windows Device Manager</li> <li>• Contact support@opto.de</li> </ul>
	<ul style="list-style-type: none"> <li>• Illumination too weak or defect</li> </ul>	<ul style="list-style-type: none"> <li>• Check illumination intensity in appropriate software panel</li> <li>• For modules with integrated ring light: Check the integrated LEDs for functionality. Do not look directly into the light!</li> </ul>
	<ul style="list-style-type: none"> <li>• Graphic card defect</li> </ul>	<ul style="list-style-type: none"> <li>• Replace your defective hardware with compatible components.</li> </ul>

Table 33: IM · Troubleshooting

## 18 IM · Nomenclature & Versions

### 18.1 IM · Nomenclature

The nomenclature of the IM · Family is presented below. It shows the possible assignment of the individual digits, and thus allows the user a rough assignment of the module specifications.

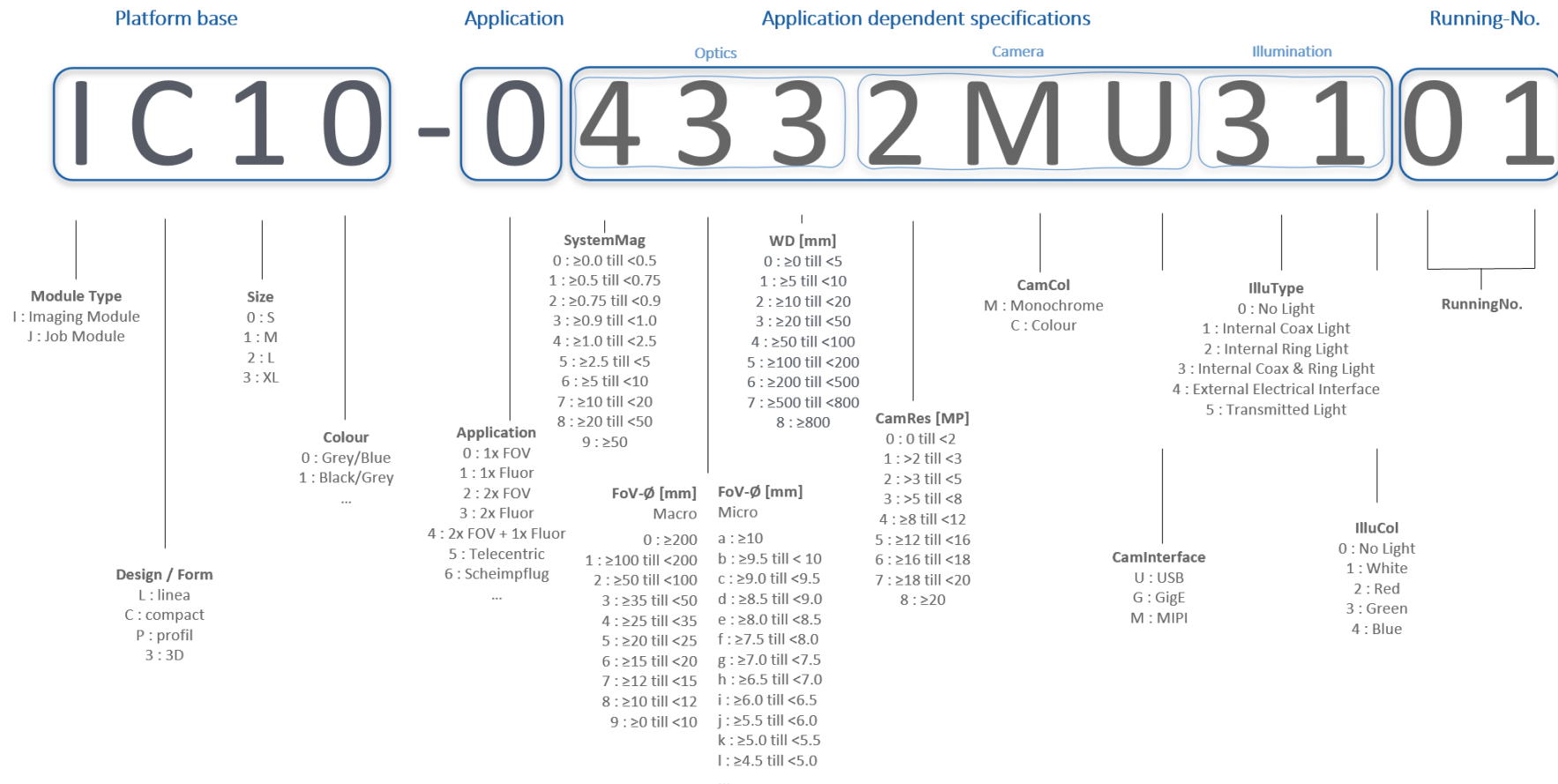


Figure 53: IM · Nomenclature

## 18.2 IM · Mechanical Platform Versions

### 18.2.1 IM · linea M – Platform Versions

The following table shows an overview of old (V1) and new (V2) item numbers of the IM · linea M family with USB interface. The technical specifications have remained almost the same. Only the mechanical platform, i.e. the size of the housing, mounting options and the weight of the modules have changed slightly (chapter 9.2.4). For improved usability, a camera status LED has also been integrated. V2 is based on a new nomenclature described in chapter 18.1.

IM · linea M · V1 excl. integrated light <b>DISCONTINUED</b>	IM · linea M · V2 excl. integrated ring light	IM · linea M · V1 incl. integrated ring light <b>DISCONTINUED</b>	IM · linea M · V2 incl. integrated ring light
IL-1622001UCE	IL10-00363CU0001	IL-4622301UCE	IL10-00363CU2101
IL-1622001UBE	IL10-00363MU0001	IL-4622301UBE	IL10-00363MU2101
IL-1621001UCE	IL10-00462CU0001	IL-4621301UCE	IL10-00462CU2101
IL-1621001UBE	IL10-00462MU0001	IL-4621301UBE	IL10-00462MU2101
IL-1532001UCE	IL10-01553CU0001	IL-4532301UCE	IL10-01553CU2101
IL-1532001UBE	IL10-01553MU0001	IL-4532301UBE	IL10-01553MU2101
IL-1531001UCE	IL10-01652CU0001	IL-4531301UCE	IL10-01652CU2101
IL-1531001UBE	IL10-01652MU0001	IL-4531301UBE	IL10-01652MU2101
IL-1432001UCE	IL10-02743CU0001	IL-4432301UCE	IL10-02743CU2101
IL-1432001UBE	IL10-02743MU0001	IL-4432301UBE	IL10-02743MU2101
IL-1431001UCE	IL10-02842CU0001	IL-4431301UCE	IL10-02842CU2101
IL-1431001UBE	IL10-02842MU0001	IL-4431301UBE	IL10-02842MU2101
IL-1452001UCE	IL10-03743CU0001	IL-4452301UCE	IL10-03743CU2101
IL-1452001UBE	IL10-03743MU0001	IL-4452301UBE	IL10-03743MU2101
IL-1451001UCE	IL10-03942CU0001	IL-4451301UCE	IL10-03942CU2101
IL-1451001UBE	IL10-03942MU0001	IL-4451301UBE	IL10-03942MU2101

Table 34: IM · linea M - Mechanical platform versions

### 18.2.2 IM · compact M – Platform Versions

The following table shows an overview of old (V1) and new (V2) item numbers of the IM · compact M family with USB interface. The technical specifications have remained almost the same. Only the mechanical platform, i.e. the size of the housing, mounting options and the weight of the modules have changed slightly (details see chapter 9.29.2.5). For improved usability, a camera status LED has also been integrated. V2 is based on a new nomenclature, which is described in chapter 18.1.

IM · compact M · V1 excl. integrated light <b>DISCONTINUED</b>	IM · compact M · V2 excl. integrated light	IM · compact M · V1 incl. integrated coaxial & ring light <b>DISCONTINUED</b>	IM · compact M · V2 incl. integrated coaxial & ring light
IC-1622001UCE	IC10-00363CU0001	IC-4352701UCE	IC10-04j33CU3101
IC-1622001UBE	IC10-00363MU0001	IC-4352701UBE	IC10-04j33MU3101
IC-1621001UCE	IC10-00462MU0001	IC-4351701UCE	IC10-04l32CU3101
IC-1621001UBE	IC10-00462MU0001	IC-4351701UBE	IC10-04l32MU3101
IC-1532001UCE	IC10-01553CU0001	IC-4352702UCE	IC10-05o33CU3101
IC-1532001UBE	IC10-01553MU0001	IC-4352702UBE	IC10-05o33MU3101
IC-1531001UCE	IC10-01652CU0001	IC-4351702UCE	IC10-05q32CU3101
IC-1531001UBE	IC10-01652MU0001	IC-4351702UBE	IC10-05q32MU3101
IC-1432001UCE	IC10-02743CU0001	IC-4251101UCE	alternative model
IC-1432001UBE	IC10-02743MU0001	IC-4251101UBE	alternative model
IC-1431001UCE	IC10-02842CU0001		
IC-1431001UBE	IC10-02842MU0001		
IC-1452001UCE	IC10-03743CU0001		
IC-1452001UBE	IC10-03743MU0001		
IC-1451001UCE	IC10-03942CU0001		
IC-1451001UBE	IC10-03942MU0001		

Table 35: IM · compact M - Mechanical platform versions

## 18.3 IM · Interface Versions

For the IMs, you can choose between two electrical interfaces - USB and GigE. The item number of the corresponding module variants is almost the same, only one digit defines the implemented interface (highlighted below).

### 18.3.1 IM · linea M – Interface Versions

IM · linea M · USB excl. integrated light	IM · linea M · GigE excl. integrated light	IM · linea M · USB incl. integrated ring light	IM · linea M · GigE incl. integrated ring light
IL10-00363CU0001	IL10-00363CG0001	IL10-00363CU2101	IL10-00363CG2101
IL10-00363MU0001	IL10-00363MG0001	IL10-00363MU2101	IL10-00363MG2101
IL10-00462CU0001	IL10-00462CG0001	IL10-00462CU2101	IL10-00462CG2101
IL10-00462MU0001	IL10-00462MG0001	IL10-00462MU2101	IL10-00462MG2101
IL10-01553CU0001	IL10-01553CG0001	IL10-01553CU2101	IL10-01553CG2101
IL10-01553MU0001	IL10-01553MG0001	IL10-01553MU2101	IL10-01553MG2101
IL10-01652CU0001	IL10-01652CG0001	IL10-01652CU2101	IL10-01652CG2101
IL10-01652MU0001	IL10-01652MG0001	IL10-01652MU2101	IL10-01652MG2101
IL10-02743CU0001	IL10-02743CG0001	IL10-02743CU2101	IL10-02743CG2101
IL10-02743MU0001	IL10-02743MG0001	IL10-02743MU2101	IL10-02743MG2101
IL10-02842CU0001	IL10-02842CG0001	IL10-02842CU2101	IL10-02842CG2101
IL10-02842MU0001	IL10-02842MG0001	IL10-02842MU2101	IL10-02842MG2101
IL10-03743CU0001	IL10-03743CG0001	IL10-03743CU2101	IL10-03743CG2101
IL10-03743MU0001	IL10-03743MG0001	IL10-03743MU2101	IL10-03743MG2101
IL10-03942CU0001	IL10-03942CG0001	IL10-03942CU2101	IL10-03942CG2101
IL10-03942MU0001	IL10-03942MG0001	IL10-03942M <b>U</b> 2101	IL10-03942M <b>G</b> 2101

Table 36: IM · linea M V2 - Interface versions

### 18.3.2 IM · compact M – Interface Versions

IM · compact M · USB excl. integrated light	IM · compact M · GigE excl. integrated light	IM · compact M · USB incl. integrated coaxial & ring light	IM · compact M · GigE incl. integrated coaxial & ring light
IC10-00363CU0001	IC10-00363CG0001	IC10-04j33CU3101	IC10-04j33CG3101
IC10-00363MU0001	IC10-00363MG0001	IC10-04j33MU3101	IC10-04j33MG3101
IC10-00462MU0001	IC10-00462MG0001	IC10-04l32CU3101	IC10-04l32CG3101
IC10-00462MU0001	IC10-00462MG0001	IC10-04l32MU3101	IC10-04l32MG3101
IC10-01553CU0001	IC10-01553CG0001	IC10-05o23CU3101	IC10-05o23CG3101
IC10-01553MU0001	IC10-01553MG0001	IC10-05o23MU3101	IC10-05o23MG3101
IC10-01652CU0001	IC10-01652CG0001	IC10-05o33CU3101	IC10-05o33CG3101
IC10-01652MU0001	IC10-01652MG0001	IC10-05o33MU3101	IC10-05o33MG3101
IC10-02743CU0001	IC10-02743CG0001	IC10-05q22CU3101	IC10-05q22CG3101
IC10-02743MU0001	IC10-02743MG0001	IC10-05q22MU3101	IC10-05q22MG3101
IC10-02842CU0001	IC10-02842CG0001	IC10-05q32CU3101	IC10-05q32CG3101
IC10-02842MU0001	IC10-02842MG0001	IC10-05q32MU3101	IC10-05q32MG3101
IC10-03743CU0001	IC10-03743CG0001		
IC10-03743MU0001	IC10-03743MG0001		
IC10-03942CU0001	IC10-03942CG0001		
IC10-03942MU0001	IC10-03942MG0001		

Table 37: IM · compact M V2 - Interface versions

### 18.3.3 IM · profile M – Interface Versions

IM · profile M · USB incl. integrated transmitted light	IM · profile M · GigE incl. integrated transmitted light
IP10-06q33CU5101	IP10-06q33CG5101
IP10-06q33MU5201	IP10-06q33MG5201
IP10-07s23CU5101	IP10-07s23CG5101
IP10-07s23MU5201	IP10-07s23MG5201
IP10-08x03CU5101	IP10-08x03CG5101
IP10-08x03MU5201	IP10-08x03MG5201

Table 38: IM · profile M V2 - Interface versions

## 19 IM · Knowledge Base



The resolution of an optical system is the ability to show object details separately. That is the distance that 2 points can have in order to still be recognizable as 2 separate structures.

According to the underlying **Nyquist-Shannon sampling theorem** all components in a signal must have smaller frequencies than the Nyquist frequency, so that the sampled signal can be reconstructed with arbitrary accuracy. This is the case for an optical system with sensor. The sampling rate is the number of pixels per mm [LP/mm]. The signal to be sampled is for example, the line pairs per mm of the resolution plate.

$$f_{Nyquist \text{ 'Sensor' }} = 0.5 f_{Scan}$$

In an optical system with magnification, the Nyquist frequency must still be transferred to the FOV plane using the system magnification M:

$$f_{Nyquist \text{ 'FoV' }} = f_{Nyquist \text{ 'Sensor' }} * M$$

Example: For a sensor with a pixel width of  $w = 3.45 \mu m$ , the following results:

$$f_{Nyquist \text{ 'Sensor' }} = 0.5 \frac{1}{w} = 0.5 \frac{1}{3.45 \mu m} \frac{1000 \mu m}{1 mm} = 145 LP/mm$$

With a magnification of  $M=1.87$ :

$$f_{Nyquist \text{ 'FoV' }} = f_{Nyquist \text{ 'Sensor' }} * M = 271 LP/mm$$

The **Rayleigh criterion** states that two diffraction discs (Airy discs) of the same brightness and colour can still be separated if the minimum of the first coincides with the maximum of the second, i.e. the two maxima of 0th order just do not overlap any more. Therefore, the resolution of a lens can be evaluated by measuring the size of the Airy disc. The smallest resolvable distance d results from:

$$d[mm] = \frac{1.22 \lambda}{2NA}$$

Thus the number of possible line pairs is:

$$R_{Rayleigh}[LP/mm] = \frac{1}{d}$$

Example: For the module we have an NA of 0.1. This gives:

$$d = \frac{0.61 * 0.55 \mu m}{0.1} = 3.36 \mu m \Rightarrow R_{Rayleigh} = \frac{1}{3.36 \mu m} = 298 LP/mm$$

\* When using white light, the wavelength is calculated as 550nm, when using monochromatic illumination, the corresponding peak wavelength is used.



Depending on how the signal and sampling frequency are oriented to each other, correction factors still have to be taken into account. When using colour sensors with Bayer patterns, the resolution of the system is additionally reduced. (A correction factor of 0.5 is taken into account here.)

$$R_{IM.Spec} = \min(f_{Nyquist} \cdot R_{Sensor} \cdot R_{Rayleigh})$$

Furthermore, please note that the optical data given in this manual may deviate by up to -10% due to manufacturing tolerances.



### Object Space Resolution

The 'Pixel Size' or 'Object Space Resolution' describes which distance in the object field is mapped on one pixel. This specification is comparable to that of a scale and is often called 'Digital Magnification'. It also describes the number of pixels with which an object of a certain size is 'resolved'. E.g. an object is 50µm in size, Pixel size 5µm/Px → then the object is imaged with 10 pixels.

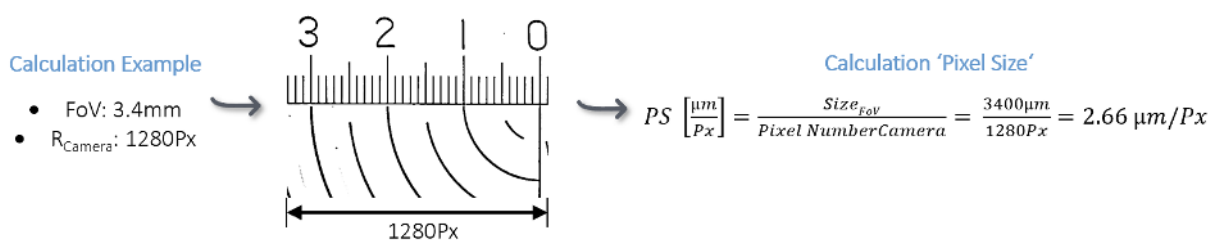


Figure 54: Definition of 'Pixel Size'



### Depth of Field

Depth of field is a measure of an area in which the image of the object is considered to be sharp. This is influenced by many factors, but mainly by the aperture selected. The smaller the aperture, the greater the depth of field. The possible depth of field can be calculated with the following approximation formula:

$$DoF [mm] = \frac{0.0005}{NA^2}$$

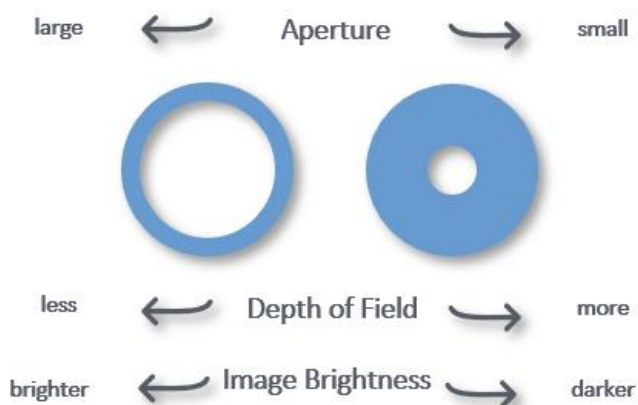


Figure 55: Aperture and its Influence



## Basic Microscope Set-Up

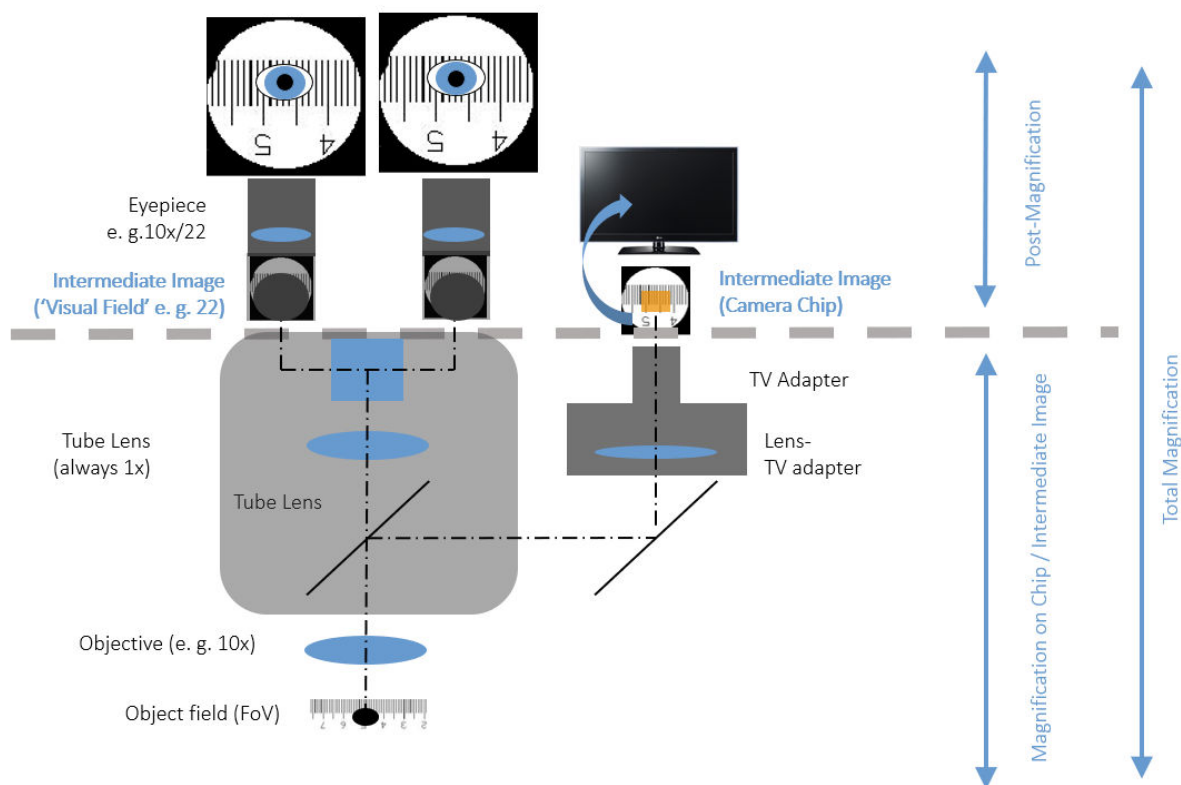


Figure 56: Basic microscope setup



## Magnification · Eyepiece vs. Camera

When comparing different microscopy systems and their magnifications, it must always be taken into account that a camera magnification and eyepiece magnification are NOT identical!

To avoid confusion, focus exclusively on the Field of View (or/and integrate a scale) when choosing your needed system.

**Calculation Example:** Objective: 10x, Eyepiece: 10x/22, TV Adapter: 0.63x, Camera Chip: ½", Screen: 19"

### Analogue - Eyepiece



$$M_{\text{VisualField}} = M_{\text{Objective}} \times M_{\text{TubeLens}}$$

$$M_{\text{VisualField}} = 10 \times 1 = 10x$$

$$M_{\text{Total}} = M_{\text{Objective}} \times M_{\text{TubeLens}} \times M_{\text{Eyepiece}}$$

$$M_{\text{Total}} = 10 \times 1 \times 10 = 100x$$

### Digital - Camera



$$M_{\text{Chip}} = M_{\text{Objective}} \times M_{\text{TV-Adapter}}$$

$$M_{\text{Chip}} = 10 \times 0.63 = 6.3x$$

$$M_{\text{Total}} = M_{\text{Objective}} \times M_{\text{TV-Adapter}} \times (\phi_{\text{Screen}} / \phi_{\text{Camera}})$$

$$M_{\text{Total}} = 10 \times 0.63 \times (430\text{mm} / 8\text{mm}) = 339x$$

Figure 57: Magnification · Eyepiece vs. camera



## Telecentricity

Telecentric optics is designed according to a specific optical concept that eliminates perspective distortion, as is the case with endocentric - common used - lenses. Within a certain 'Telecentric Range', the magnification is the same regardless of the working distance to the object. That makes measurements much more easier and precise, especially when dealing with highly three-dimensional specimens difficult to position.

Factors that limit the accuracy and repeatability of measurement applications with conventional optics can be greatly reduced or completely eliminated with the telecentric concept. This concerns:

- o changed image scale, depending on object distance to the sensor
- o perspective errors
- o image distortion
- o blurred edges of the specimen, caused by light geometry

Especially blurred object edges can be reduced by using a telecentric illumination in addition.

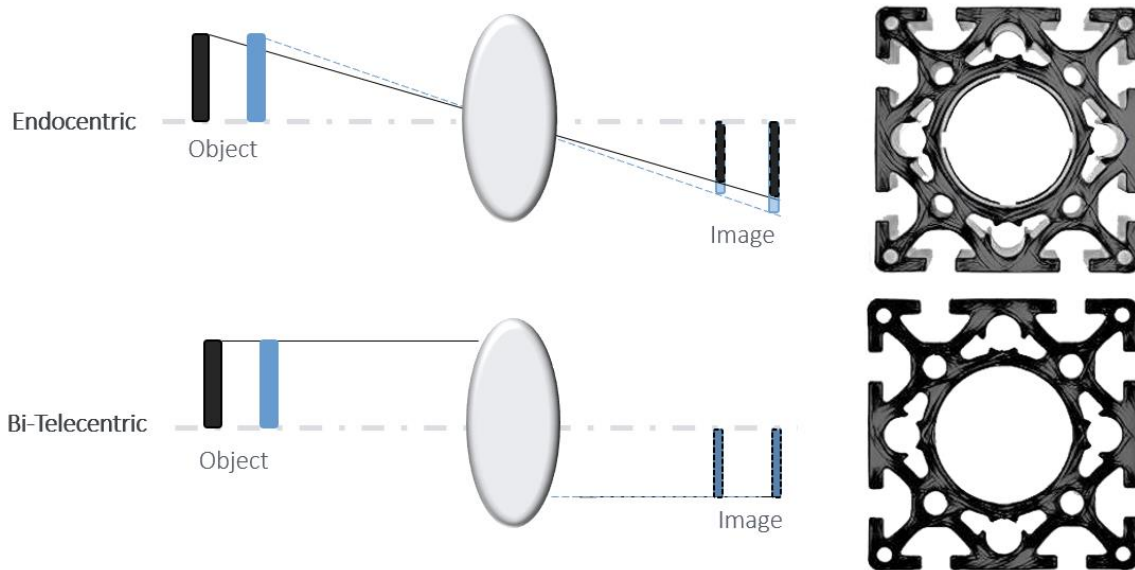


Figure 58: Endocentric lens vs. telecentric lens

Please note that the currently available models work exclusively with endocentric optics. The implementation of telecentric optics is being worked on.



## Interface Definition

The selection of a suitable interface usually depends on several factors. In addition to application-specific requirements and programming option, the required bandwidth and the required cable length are decisive.

The following section(s) gives you a brief overview of the available IM · Interfaces and their most important features.

	Bandwidth [MB/sec.]	Cable Length [m]	Cable Costs	Plug & Play Usability	Trigger
IM · USB	*400	5	↑	✓	SW
IM · GigE	*100	100	↓	✓	SW

\* By reducing the frame rate and / or the image size the data rate and thus the average bandwidth of a module can be reduced.

The following approximation formula shows the calculation of the required amount of data for your application. Once this parameter has been determined, the possible interfaces are also defined.

$$\text{Data Rate} = \text{Image Sensor Resolution} * \text{Frame Rate} * \text{Bit}$$

## 20 Warranty

The device manufacturer warrants that the device is free of material and manufacturing defects upon delivery. Any defects are to be reported immediately and everything must be done to minimize the damage. If such a defect is reported, the device manufacturer is obliged to remedy the defect at his discretion by repair or delivery of a defect-free device. For defects resulting from natural wear and tear (wearing parts in particular) as well as improper handling no guarantee is given.

Any of the following that are done without the explicit and written approval of the manufacturer:

- modifications or additions,
- use of non-original spare parts,
- performance of repairs or modifications by third parties not authorised by the manufacturer

can lead to the loss of warranty.

For these Imaging Modules, the legal regulations apply with regard to the warranty period. Detailed foundations for this guarantee can be found at: <http://www.opto.de>.

## 21 Disposal

In terms of linea S, M · compact M · profile M:



This equipment is marked with the crossed out wheeled bin symbol to indicate that this equipment must not be disposed of with unsorted waste.

Instead, it's your responsibility to correctly dispose of your equipment at lifecycle -end by handing it over to an authorized facility for separate collection and recycling.

We take back the system as part of the implementation of the ElektroG. (Law on the circulation, return and the environmentally friendly disposal of electrical and electronic equipment).

Please send this directly to us (sufficiently stamped), so that we can dispose of it properly and environment-friendly (WEEE-Reg.-Nr. DE 68564667).

### In terms of batteries:

Every consumer is, according to the Battery Directive, obliged by law to return all spent batteries and/or accumulators. Disposal of normal household waste is prohibited. Old batteries can be returned free of charge to public collection points in the community and wherever batteries and accumulators of the type in question are sold.

The batteries that have been received from Opto can be sent back after use for disposal. Please send them with an additional remark 'Return of used Batteries for disposal' to:

Opto GmbH  
Lochhamer Schlag 14  
D-82166 Graefelfing

### In terms of packing material:

If possible, please save the packaging during the warranty period in order to properly package the system in the case of a warranty claim. The packaging protects the system from transport damage. The packaging materials are selected according to environmental and disposal aspects and therefore they are recyclable.

The return of the packaging to the material cycle reduces waste and saves raw materials. Please dispose of packaging materials that are no longer needed at the collection points for the recycling system 'Grüner Punkt'.

## 22 Additional Documentation

For further technical tips on hardware and software, we recommend that you consult the latest version of the associated documentation.

IM · Hardware & Software Documentation			
IM · Standard Series		Quick Start Guide(s)	<a href="https://www.opto.de/en/company/downloads/">https://www.opto.de/en/company/downloads/</a>
IM · Platform Dimensions		Product Information	<a href="https://www.opto.de/en/company/downloads/">https://www.opto.de/en/company/downloads/</a>
IM · USB Interface		Application Note	<a href="https://www.opto.de/en/company/downloads/">https://www.opto.de/en/company/downloads/</a>
IM · Trigger Options (Size M)		Application Note	<a href="https://www.opto.de/en/company/downloads/">https://www.opto.de/en/company/downloads/</a>
Opto · OptoViewer 2.0		User Manual	<a href="mailto:support@opto.de">support@opto.de</a>
Opto · OptoViewer 2.0		Quick Start Guide	<a href="mailto:support@opto.de">support@opto.de</a>
Opto · SDK		User Manual	<a href="mailto:support@opto.de">support@opto.de</a>
IM · Accessory Documentation			
045-600505-350 045-600505-500	IM · Foldable Stand	Factsheet	<a href="https://www.opto.de/en/company/downloads/">https://www.opto.de/en/company/downloads/</a>
045-200200	Calibration Target Micro	Factsheet	<a href="https://www.opto.de/en/company/downloads/">https://www.opto.de/en/company/downloads/</a>
IM-AM-00001	linea S, M · compact M · profile M	Assembly Instructions	<a href="https://www.opto.de/en/company/downloads/">https://www.opto.de/en/company/downloads/</a>

Table 39: IM · Additional documentation

## 23 Declaration of Conformity

The corresponding declaration of conformity will be provided at any time if required. Please contact your sales representative or send an e-mail to [info@opto.de](mailto:info@opto.de).