

# Optical Components Machine Vision

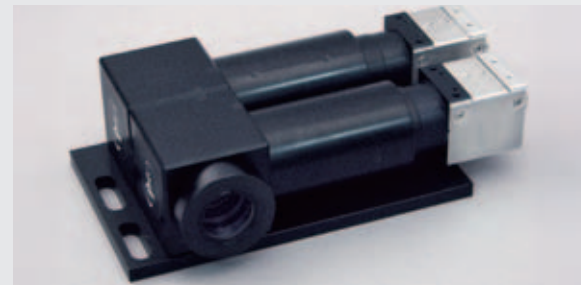
Solutions in Optics



## Welcome to Opto's Catalogue for Machine Vision Components

In this catalogue you can find a selection of our optical components for use in a variety of machine vision applications. Opto was founded in 1980 and since then has become a leading supplier of specialist objectives for Machine Vision. We take pride in having built our reputation on designing the highest quality optical equipment exactly fitting the application!

Our commitment is to offer highly efficient optomechanical solutions, 'reduced to the needs' of the application, and exactly meeting the performance and budgetary needs of your program. With quality and reliability at the heart of our business, we care for our solutions from development, through production, assembly and after delivery. With many long term customers we invent their unique selling points for many product generations.



## Opto is Your Experienced Partner for:

- a selection of optical and mechanical components for machine vision and microscopy
- complete microscopes with emphasis on display (TV)-microscopy and stereo microscopy
- development of custom optical and mechanical systems and solutions

## Contact your Nearest Partner

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## Quotation, Ordering & Terms

We are pleased to provide you with a solution tailored to your specific requirement. Simply contact your local representative for technical details or quotation.

Terms of business can be found on our webpage. Specifications in this catalogue are current at the time of publication but we reserve the right to change these specifications without prior notice. Pictures may show different or alternative specifications.

Technical information and guidance provided in this catalogue is intended to be useful in the application of Opto products but we do not accept responsibility for its use.

Terms and conditions of sale are specific to each country in which Opto operates and are supplied with all quotations and invoices. Please contact us for additional copies. Nothing in the foregoing statements modifies the Terms and Conditions in effect for each country of operation.

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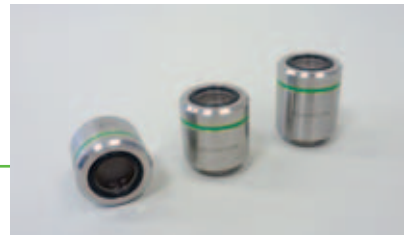
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## Basic Knowledge

### Sensor Dimensions:

Width to height proportion normally is 4 : 3. The real measurements can vary between manufacturers and models, so please refer to the datasheet of your camera. If not otherwise stated, the Field of View in this catalogue is based on a 1/2" chip size.

Sensor	Photosensitive area	Diagonal
1"	12.8 x 9.6 mm	16 mm
2/3"	8.8 x 6.6 mm	11 mm
1/1.8"	7.18 x 5.32 mm	8.9 mm
1/2"	6.4 x 4.8 mm	8 mm
1/3"	4.8 x 3.6 mm	6 mm

### Important Optical Terms:

- **Focal Length (f)** – Distance between 'middle of lens' and focus of collimated light
- **Depth of Field (DoF)** – The range which appears to be in focus
- **Distortion** – Deviation from rectilinear projection
- **Field of View (FoV)** – Area of an object displayed on chip
- **F-Number** – Defines the amount of light which can pass through an imaging system - high F-Number means less light
- **Magnification** – Ratio between object and image height
- **Resolution** – Distance of two points which can be separated
- **Working Distance (WD)** – Distance between mechanical end of lens and object

## Bi-Telecentric Mega Pixel Objectives

Opto telecentric lenses have been developed for high-precision measurement applications in machine vision. The advantage of these high-quality optics lies in their dual-side telecentric imaging function (i.e. bi-telecentric function). Due to the object-side telecentricity being spatially extended, three-dimensional objects are imaged with zero error perspective. Due to image side telecentricity, the system is far less reliant on the mechanical tolerances of the camera, and exhibits a far more uniform projection onto the camera chip with zero vignetting.

Together with its high depth of field, and extremely low distortion, telecentric lenses from Opto are the perfect choice for ultra high reliability optical measurements.

All Opto telecentrics are optimized for C-mount cameras with chip sizes up to 2/3", and represent the ideal solution for measurements of precision components with the best price/performance ratio.

### Benefits

- Large field depth
- No perspective error with three dimensional objects
- Homogeneous image acquisition with high light sensitivity
- High resolution object- and image side telecentric imaging
- Universal C-Mount lenses
- QuadraMount available for easy integration

### Applications & Markets

- Measurement of profiles
- Determination of diameters
- Adjustment of electronic components
- Measurement of objects with large height
- C-Mount cameras supported up to 2/3"



High precision measurement of profiles



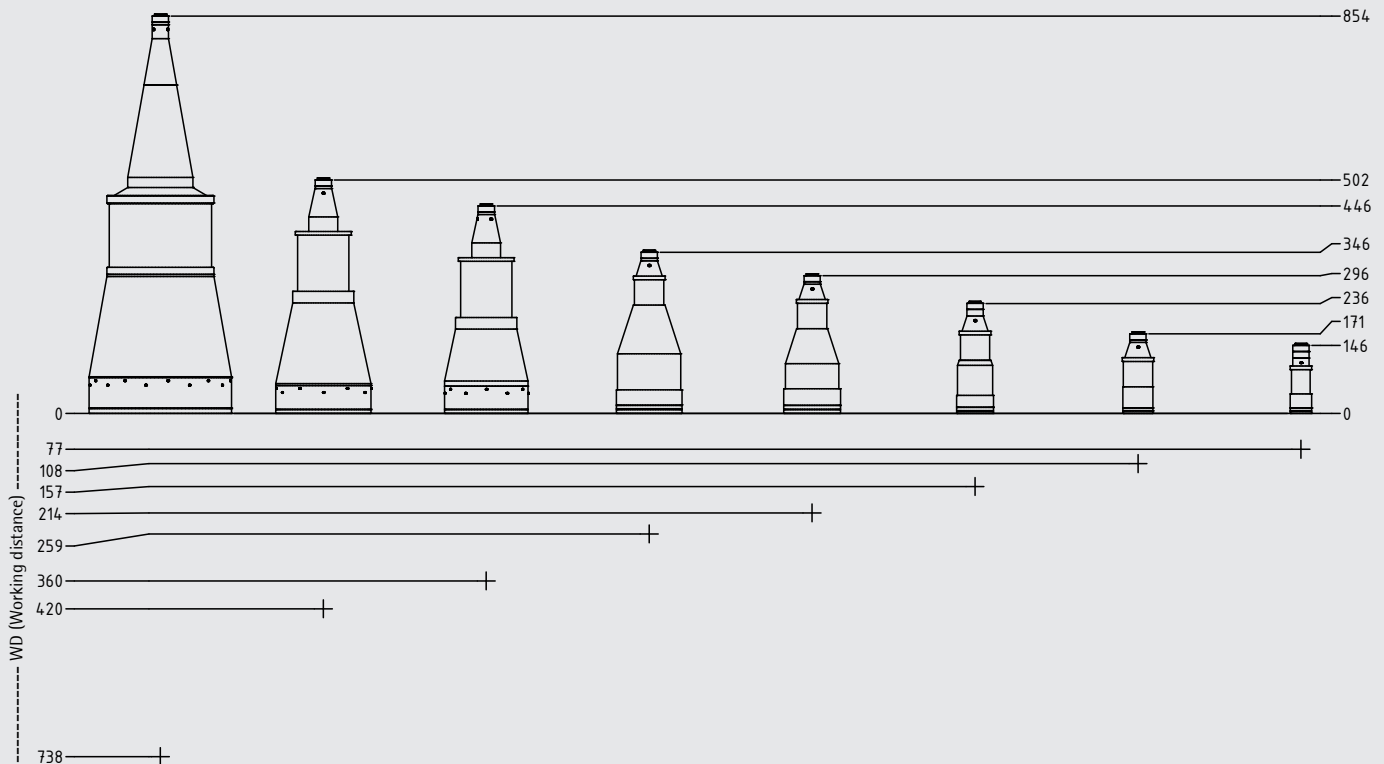
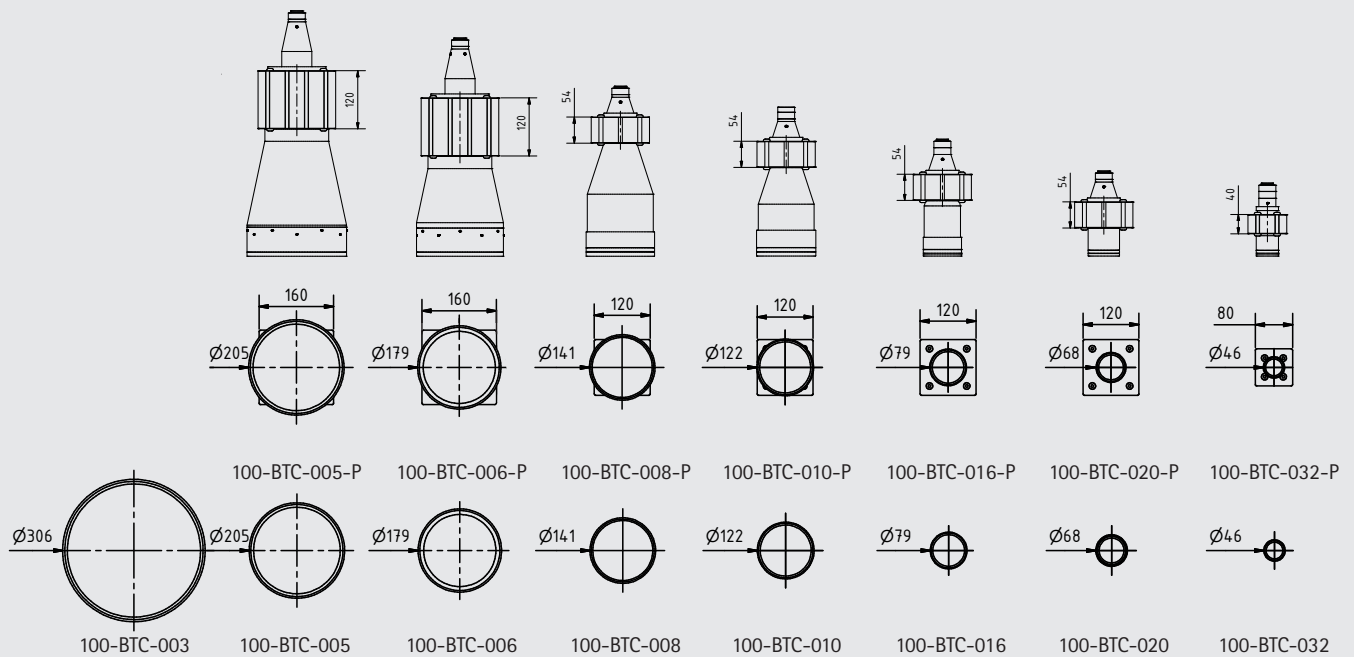
Measurement of springs



QuadraMount versions allow quick, flexible and reliable fixation in machine vision applications

Art. No.	Mag.	W.D. [mm]	FoV 1/2" [mm]	FoV 1/1.8" [mm]	FoV 2/3" [mm]	F-No. F/#	Resolution MTF@70LP/MM	Field Depths	Telecentricity	Distortion	Camera Mount
100-BTC-003	0.03x	738	218 x 163	242 x 180	290 x 218	8	50	780	0.05	0.05	C-Mount
100-BTC-005 / -P	0.05x	420	125 x 94	139 x 104	167 x 125	8	50	253	0.08	0.07	C-Mount
100-BTC-006 / -P	0.06x	360	106 x 80	118 x 89	142 x 106	8	50	186	0.08	0.07	C-Mount
100-BTC-008 / -P	0.08x	259	79 x 59	88 x 65	105 x 79	8	50	101	0.08	0.07	C-Mount
100-BTC-010 / -P	0.1x	214	65 x 49	72 x 54	86 x 65	8	50	68	0.08	0.07	C-Mount
100-BTC-016 / -P	0.16x	157	40 x 30	45 x 33	54 x 40	8	50	27	0.08	0.08	C-Mount
100-BTC-020 / -P	0.2x	108	32 x 24	35 x 27	42 x 32	8	45	17	0.08	0.08	C-Mount
100-BTC-032 / -P	0.32x	77	20 x 15	22 x 16	26 x 20	8	45	7	0.08	0.08	C-Mount

Article numbers ending with '-P' include QuadraMount



## Compact Telecentric Lenses

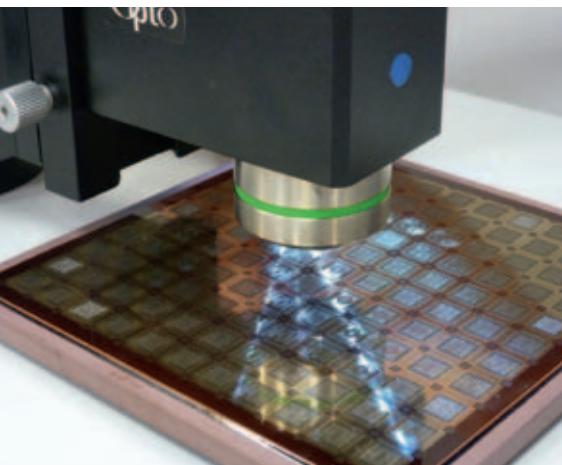
Telecentric lenses are used for performing exact measurements of objects due to their ability to image the exact size of an object regardless of its position within the field of view or its distance from the lens. With their compact size, ultra low optical distortion and economical price, these lenses are the ideal choice for a wide variety of measurement applications where space is a premium.

### Benefits

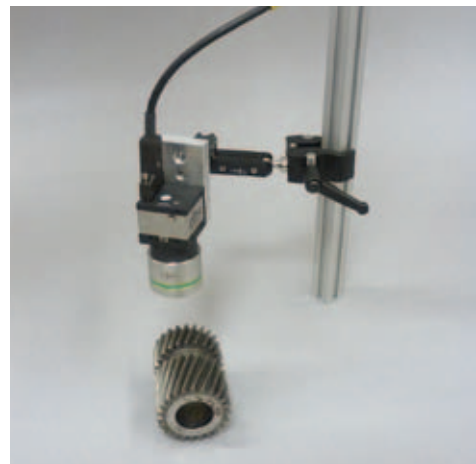
- Small and compact for OEM integration
- Object side telecentric for precise measurements
- Virtually distortion free
- Standard C-Mount

### Applications & Markets

- Dimensional measurement of medical devices
- Biomedical analysis of growth in well plates
- High resolution gauging of mechanical precision parts



*Precise dimensional measurement of wafers and BGA prints*

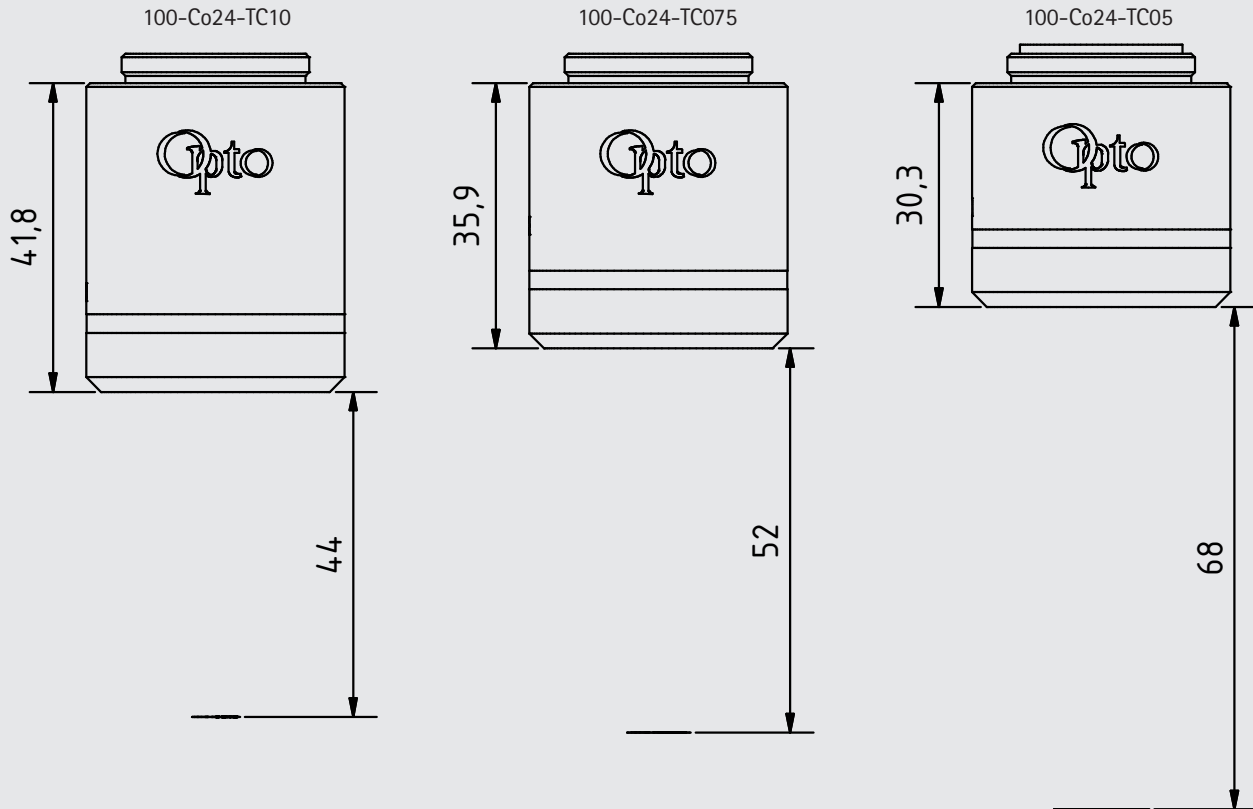


*Large working distance allows easy sample handling for inspection of surface defects*



*Measurement of well plates*

Art. No.	Mag.	W.D.	F-No.	Field Depths	Telecentricity	Distortion	FoV 1/3" [mm]	FoV 1/2" [mm]
100-CO24-TC05	0.5x	68 mm	6	0.3 mm	0.75°	< 1%	9.6 x 7.2	12.8 x 9.6
100-CO24-TC075	0.75x	52 mm	9	0.3 mm	0.05°	< 1 %	6.4 x 4.8	8.5 x 6.4
100-CO24-TC10	1.0x	44 mm	12	0.3 mm	0.02°	< 0.5%	4.8 x 3.6	6.4 x 4.8



All objectives have Ø 35mm.

### Telecentric Lenses

With a normal lens, magnification differs when changing the distance from the lens. Additionally features which are located at the edge of an image are viewed at a different angle than objects in the centre of the field of view (FoV). Telecentric lenses are used for performing exact

measurements of objects because they offer images which represent the exact size of an object regardless of its position within the FoV or its distance from the lens. Like all our products, we offer custom made lenses tailored to your specific needs on request.



Telecentric Image



Endocentric Image

## Zero Distortion Mega Pixel Macro Lenses

This family of macro lenses is designed to image small objects at very high image resolution and virtually zero distortion. These lenses are typically used for measurements of mechanical parts, electronic components and board inspection. They are used in printing, microbiology, forensic, and video microscopy applications. The 35 mm diameter mechanic fits directly to many of our standard mounting and illumination equipment, which you can find in our inspection equipment catalogue or online at [www.opto.de](http://www.opto.de).

### Benefits

- High resolution color corrected lenses with no distortion
- Long working distance for small objects
- Robust, simple and reduced to your needs

### Applications & Markets

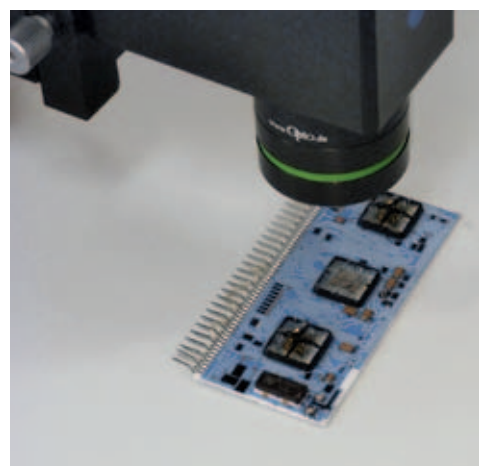
- Survey of production processes in factory automation
- Alignment control in AOI Machines
- Online color control in printing machines
- Observation and analysis of biological structures



Suits C-Mount cameras up to 2/3" chip size



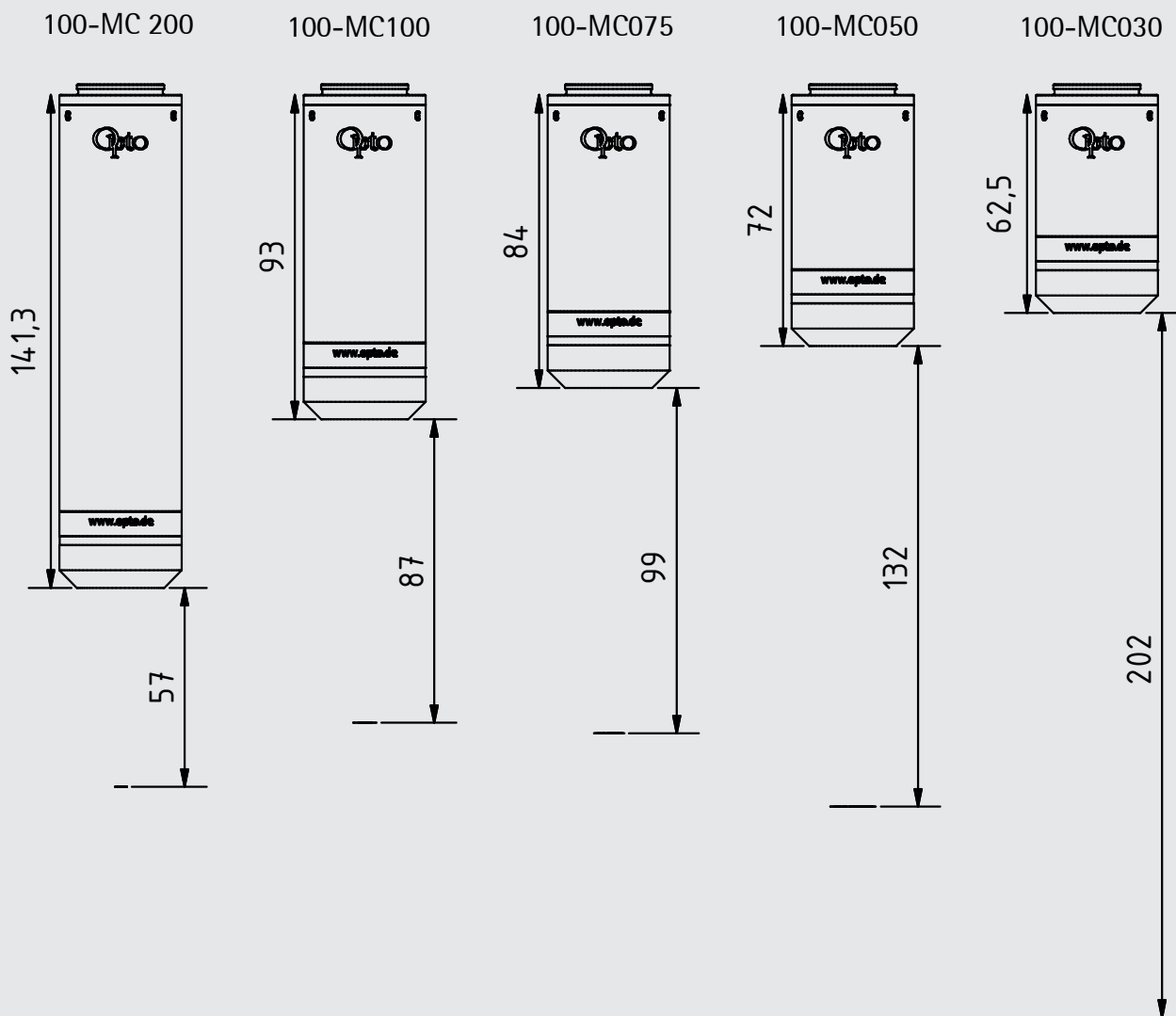
Color corrected lens - ideal for print inspection and color control



Perfect for alignment and measurement tasks with adjustable C-Mount



Art. No.	Mag.	W.D.	F-No.	Resolution	Field Depths	Distortion	FoV 1/3" [mm]	FoV 1/2" [mm]	FoV 1/1.8" [mm]	FoV 2/3" [mm]
100-MC030	0.3x	202 mm	8.4	22 LP/mm	1.5 mm	< 0.01%	16.0 x 12.0	21.3 x 16.0	23.9 x 17.7	29.3 x 22.0
100-MC050	0.5x	132 mm	10	35 LP/mm	0.8 mm	< 0.01%	9.6 x 7.2	12.8 x 9.6	14.3 x 10.6	17.6 x 13.2
100-MC075	0.75x	99 mm	12	50 LP/mm	0.5 mm	< 0.01%	6.4 x 4.8	8.5 x 6.4	9.6 x 7.1	11.7 x 8.8
100-MC100	1.0x	87 mm	14	60 LP/mm	0.4 mm	< 0.01%	4.8 x 3.6	6.4 x 4.8	7.2 x 5.3	8.8 x 6.6
100-MC200	2.0x	57 mm	20	90 LP/mm	0.2 mm	< 0.01%	2.4 x 1.8	3.2 x 2.4	3.6 x 2.7	4.4 x 3.3



All objectives have Ø 35mm.

### Accessories



043-610914  
Clamp for diameter 35 mm

## Modular C-Mount Objectives

Our modular C-Mount objective system offers versatile, economical performance with almost every camera.

This economical, modular fixed magnification imaging system is a simple and reliable solution for most imaging applications. All tubes have diameter 35 mm and a C-Mount.

Configuration is very simple:

From the chart diagram, you can quickly identify the possible combinations of your components. Just pick a tube and objective combination and add coax illumination or just the basic adapter.

### Benefits

- Modular compact C-Mount objectives
- Economical, high performance solution
- High magnification with large working distances

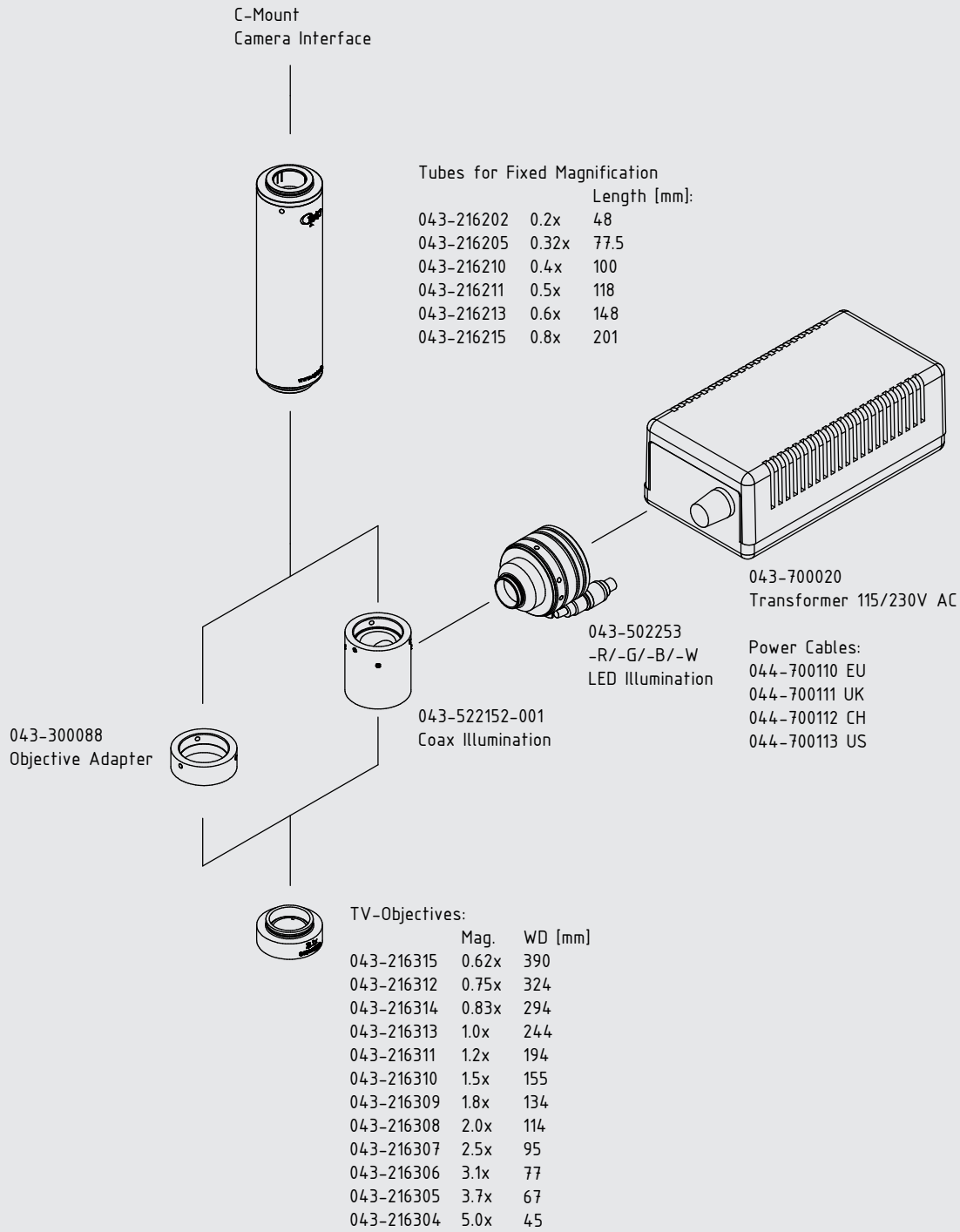
### Applications & Markets

- Integration in AOI machines for control of product positioning
- Bond inspection for dies and wires inside semiconductor machines
- Online manufacturing control for high speed applications
- Structures on wafers, dies and boards in semiconductor applications
- With coaxial illumination perfect for metallurgical examinations such as hardness testing
- Biological applications including tracking of cell growth in well plates



*Coaxial LED illumination is perfect for metallurgical applications*

	Standard Tubes	
	Minimum Config.	Maximum Config.
Combination:	Tube 0.2x Objective 0.62x	Tube 0.8x Objective 5.0x
Magnification:	0.124x	4.0x
Working Distance:	390 mm	45 mm
NA:	0.0225	0.18
Field Depths:	0.98 mm	0.015 mm
Field of View 1/3":	38.7 x 29.0 mm	1.2 x 0.9 mm
Field of View 1/2":	51.6 x 38.7 mm	1.6 x 1.2 mm
Field of View 1/1.8":	58.1 x 42.7 mm	1.8 x 1.3 mm
Field of View 2/3":	70.9 x 53.2 mm	2.2 x 1.7 mm



## Accessories



043-610914  
Clamp for diameter 35 mm



043-801101  
C-Mount extender 2.0x

## Digital Mega Pixel Microscopes

All the optical power of a high-end microscope in a sleek and compact format. These high performance optics are ideal for cameras up to 64 mega pixels and fluorescence applications.

This modular fixed magnification imaging system offers the highest resolution possible from a fixed magnification system, and is able to handle sensor sizes up to 25 mm diagonal.

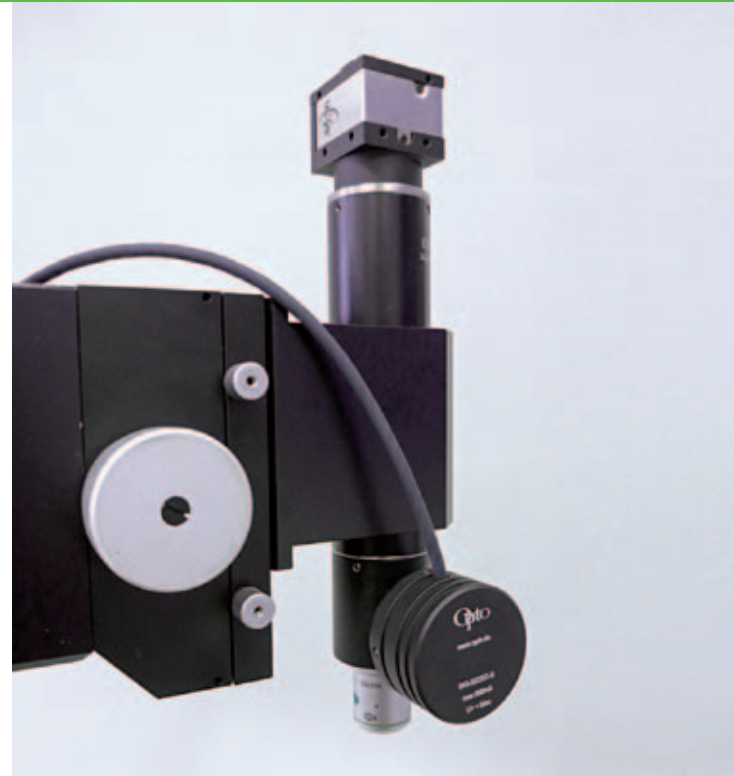
Just choose between C-Mount and F-Mount and select a micro objective. Additionally there is coaxial illumination with and without Köhler.

### Benefits

- Modular compact objectives
- Perfect for small pixel sizes
- High magnification for large sensors
- High resolution microscope

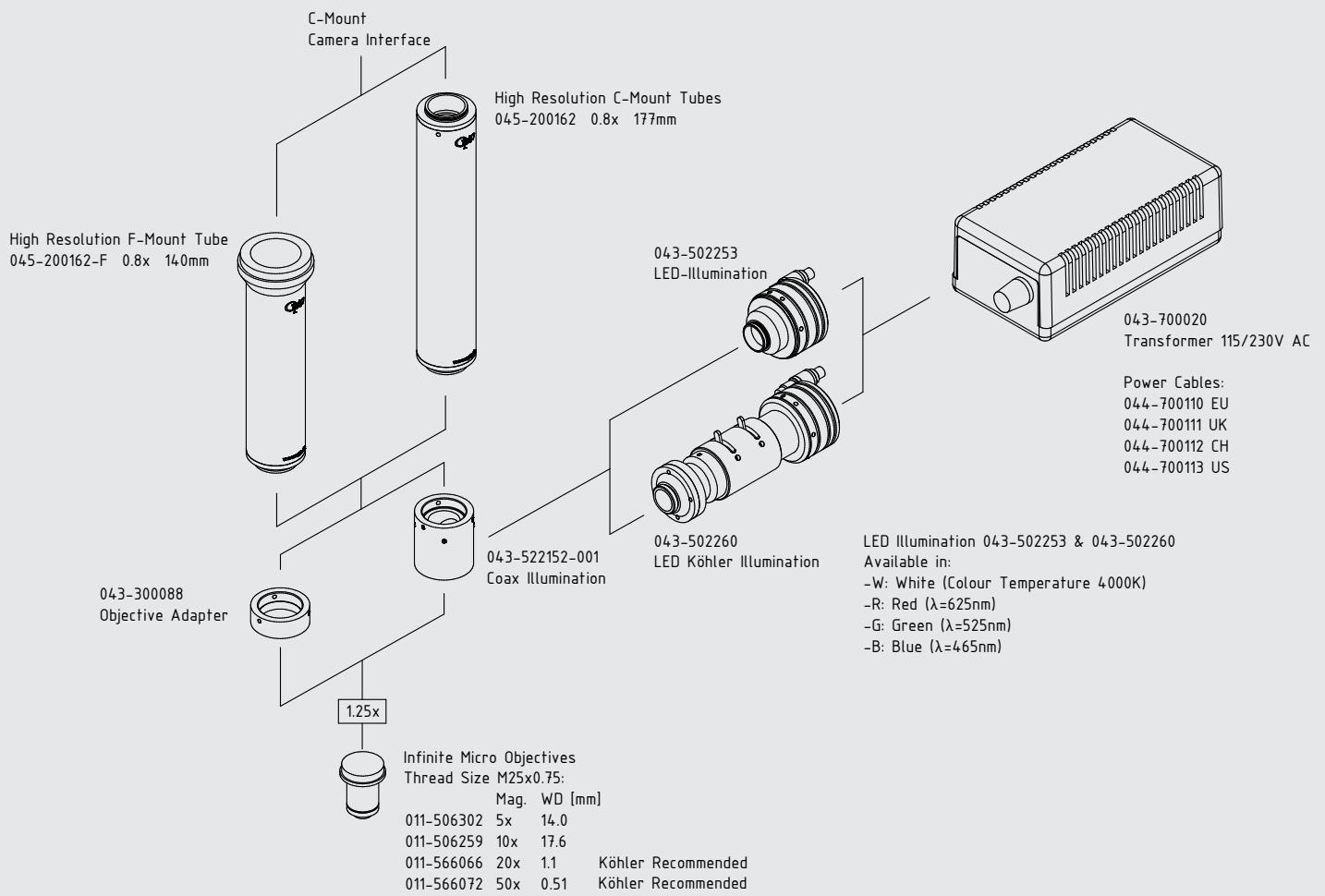
### Applications & Markets

- Coaxial illumination perfect for metallurgical microscopy
- Industrial and scientific applications
- Structures on wafers and dies in semiconductor applications
- Biological applications including visualisation of cell growth in well plates



*Our high resolution lenses offer identical performance as research type microscopes with magnifications up to 50x on chip*

	Digital Microscopes	
	Minimum Config.	Maximum Config.
Combination:	Tube 0.8x Objective 5.0x	Tube 0.8x Objective 0x
Magnification:	5.0x	50x
Working Distance:	14 mm	0.51 mm
NA:	0.12	0.75
Field Depths:	0.015 mm	0.001 mm
Field of View 1/3":	0.96 x 0.72 mm	0.10 x 0.07 mm
Field of View 1/2":	1.28 x 0.96 mm	0.13 x 0.10 mm
Field of View 1/1.8":	1.44 x 1.06 mm	0.14 x 0.11 mm
Field of View 2/3":	1.76 x 1.32 mm	0.18 x 0.13 mm



## Accessories



- 043-610018**  
Focus Drive O, Coarse/Medium
- travel: 70mm; travel of fine focus: 0.3 mm
  - resolution in fine focus:  $< 2\mu\text{m}$
  - for objectives up to 50x
  - Load: max. 7kg



- 043-610911**  
Clamp for TV Microscope  
Ø35 mm
- stable mount for Digital Microscopes and Zoom Systems
  - for focus drives O and R

## 6:1 Macro Video Zoom Lens

The 6:1 Macro Zoom Lens is designed to be attached directly to C-Mount cameras. With optional 'click stop' detents, this objective is now usable for measuring task applications which require variable fields of view over large areas. This unique objective includes a special „close up“ lens that allows to cover a field of view from 4.3 to 400 mm.

Applications include automation with robots and image processing, inspections on production lines and in the packaging. The high magnification and long working distance is ideal for visualization of defects in the repair of SMD components. A machine integration is also possible.

### Benefits

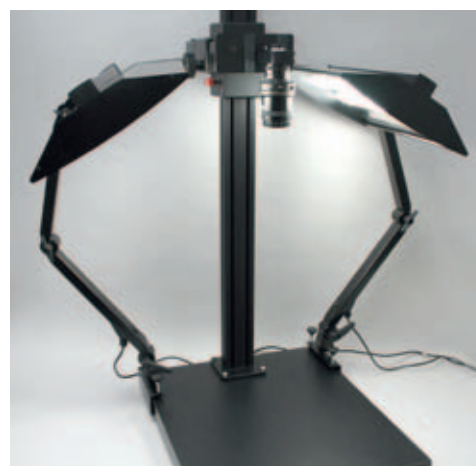
- Macro and micro imaging with one lens
- Click stops allow repeatable measurements
- Parfocal 6:1 zoom range

### Applications & Markets

- Measurements of mechanical parts in quality labs and machining
- In-line Macro Imaging with reliable magnification settings for quick adjustments to changing objects
- Flexible documentation of changing samples in forensics and museums
- AOI applications for quality control in electronics manufacturing



*Compact setup for biomedical samples with transmitted light base*



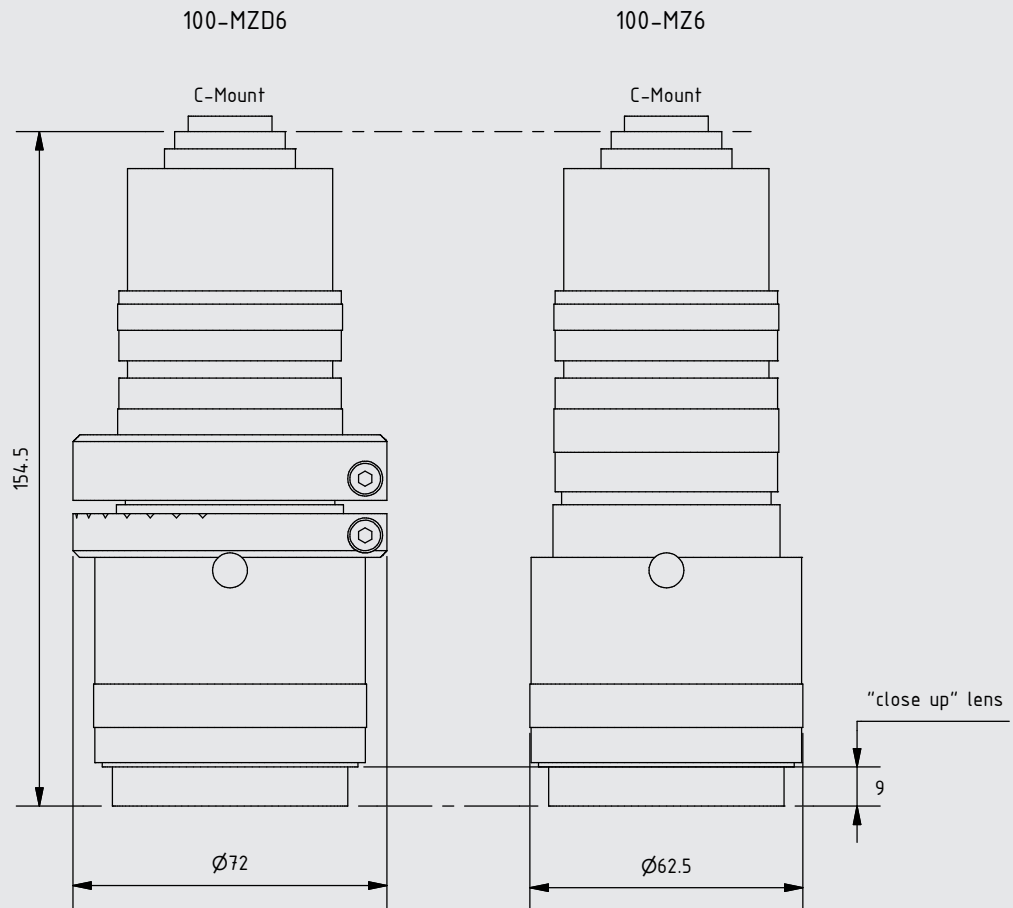
*Variable lens perfect for documentation of big samples with incident illumination*



*Macro and Micro imaging combined in one lens - detents for repeatable measurements*

Art. No.	Type	Zoom	Focus	Iris	Mount	Focal length	F-No.	Max. chip
100-MZ6	6:1 Macro Video Zoom Lens	Manual	Manual, lockable	Manual	C-Mount	18-108 mm	2.5 - closed	2/3"
100-MZD6	Detended 6:1 Macro Video Zoom Lens	Manual, 10 click stop positions	Manual, lockable	Manual	C-Mount	18-108 mm	2.5 - closed	2/3"

	Mag.	W.D.	FoV 1/3" [mm]	FoV 1/2" [mm]	FoV 1/1.8" [mm]	FoV 2/3" [mm]
With closeup lens	0.17 x - 1.0 x	140 - 280 mm	4.3 x 3.2 - 72 x 54	5.7 x 4.3 - 96 x 72	6.4 x 4.8 - 106 x 80	8 x 6 - 133 x 100
Without close up lens	0.066 x - 0.4 x	280 - ∞ mm	10.2 x 7.5 - 298 x 224	14 x 10 - 398 x 299	15.2 x 11.2 - 442 x 332	19 x 14 - 553 x 415



Filter Thread:  
 $\varnothing 52$  mm, P = 0.75

## Accessories



**043-640052**  
 Clamp for Macro Video Zoom Lens on Column 25 mm, distance of column axis and optical axis 110 mm



**043-640053**  
 Clamp for Macro Video Zoom Lens with 1/4" internal thread, distance between back of clamp and optical axis is 65 mm



**045-300179**  
 Lever Set for Macro Video Zoom Lens  
 For easy change of zoom and focus  
 Not applicable with 100-MZD6

## 7:1 OEM C-Mount Zoom

Our unique square design enables easy and versatile mounting options with customisable, built-in threads incorporated into the design, as well as a robust locking mechanism to fix the desired magnification. This high-end optical design and the compact mechanics of these zooms make them the first choice for highly specified applications requiring reliable zooming at a reasonable price. There is a standard version and a version with integrated focus available. The internal focus covers a distance of 15 mm, compared to the standard version the order number shows an additional IF.

### Benefits

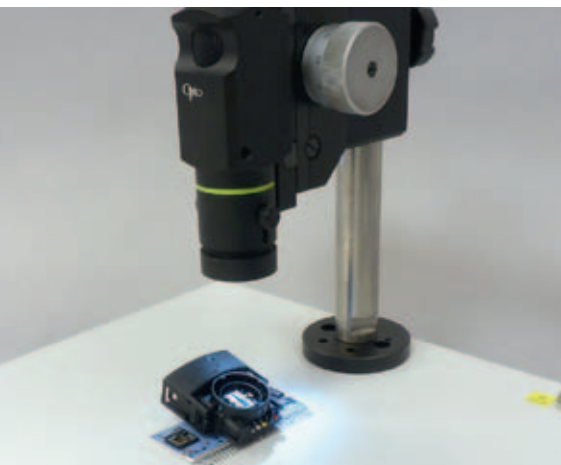
- Optimum price / performance ratio
- All in one 7:1 zoom optic and clamp – no need for additional mounting brackets
- Fully parfocal and parcentric – zooming without the need to re-focus
- Adjustable C-Mount for easy camera adjustment

### Applications & Markets

- One step overview and detailed control of electronic SMD devices
- Single optical system for standalone QC and documentation of micromechanical parts
- Easy to use TV-Zoom microscope for research labs



Square design allows easy mounting, M6 threads adapt accessories like Kniegelenke (→ Page 22)



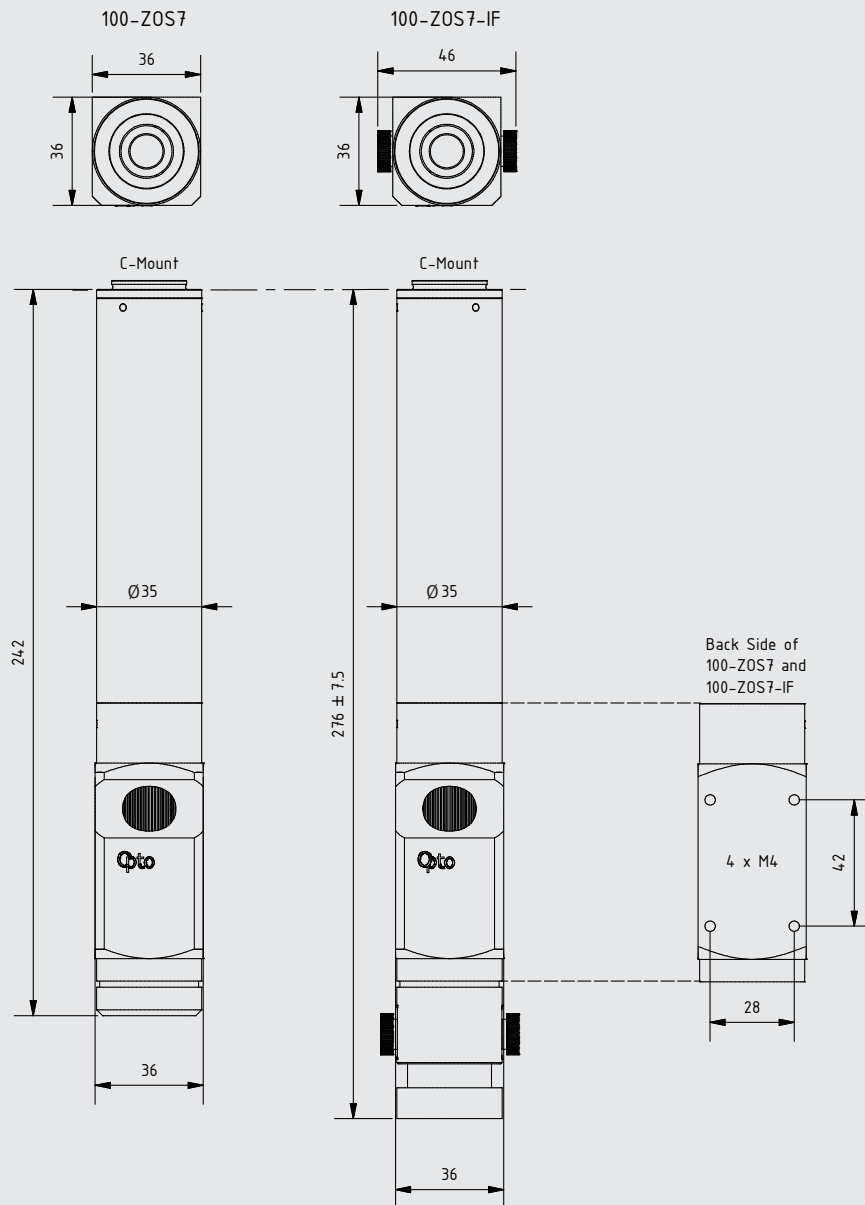
High magnification QC with quick adjustment to changing sample sizes



Long working distances, perfect for documentation and tilted viewing tasks



Art. No.	Mag.	W.D.	FoV 1/3" [mm]	FoV 1/2" [mm]	FoV 1/1.8" [mm]	FoV 2/3" [mm]
100-ZOS7-06 / IF06	0.18 x - 1.3 x	390 mm	26.7 x 20.0 - 3.8 x 2.8	35.6 x 26.7 - 5.0 x 3.8	40.0 x 29.4 - 5.7 x 4.2	48.9 x 36.7 - 6.9 x 5.2
100-ZOS7-10 / IF10	0.3 x - 2.2 x	240 mm	16.7 x 12.5 - 2.4 x 1.8	22.2 x 16.7 - 3.2 x 2.4	25.0 x 18.4 - 3.6 x 2.6	30.6 x 22.9 - 4.3 x 3.3
100-ZOS7-12 / IF12	0.36 x - 2.6 x	194 mm	13.3 x 10.0 - 1.9 x 1.4	17.8 x 13.3 - 2.5 x 1.9	20.0 x 14.7 - 2.8 x 2.1	24.4 x 18.3 - 3.5 x 2.6
100-ZOS7-15 / IF15	0.45 x - 3.3 x	155 mm	10.7 x 8.0 - 1.5 x 1.1	14.2 x 10.7 - 2.0 x 1.5	16.0 x 11.8 - 2.3 x 1.7	19.6 x 14.7 - 2.8 x 2.1
100-ZOS7-20 / IF20	0.6 x - 4.4 x	114 mm	8.0 x 6.0 - 1.1 x 0.9	10.7 x 8.0 - 1.5 x 1.1	12.0 x 8.8 - 1.7 x 1.3	14.7 x 11.0 - 2.1 x 1.6
100-ZOS7-25 / IF25	0.75 x - 5.5 x	95 mm	6.7 x 5.0 - 0.9 x 0.7	8.9 x 6.7 - 1.3 x 0.9	10.0 x 7.4 - 1.4 x 1.0	12.2 x 9.2 - 1.7 x 1.3
100-ZOS7-31 / IF31	0.93 x - 6.8 x	77 mm	5.3 x 4.0 - 0.8 x 0.6	7.1 x 5.3 - 1.0 x 0.8	8.0 x 5.9 - 1.1 x 0.8	9.8 x 7.3 - 1.4 x 1.0



0.6 x Magnification

1.21 x

1.81 x

2.42 x

3.02 x

3.63 x

4.23 x

## 7:1 Modular C-Mount Zoom

Our exceptionally reliable zoom guarantees a solution for most imaging applications where flexible magnification is needed. Configuration is simple: Choose your tube / objective combination (For best performance, try to use a higher magnification objective rather than a higher tube magnification). Then simply add any number of the additional features, ranging from click stops (for repeatable zoom positions) all the way to optional coaxial illumination or any one of our high power objective lenses. Check our website for full configuration chart and magnification table.

### Benefits

- Modular configuration of working distance, magnification and illumination
- Compact and reliable zoom that stays in focus throughout the zoom range
- Unique metallurgical zoom configurable using coaxial illumination

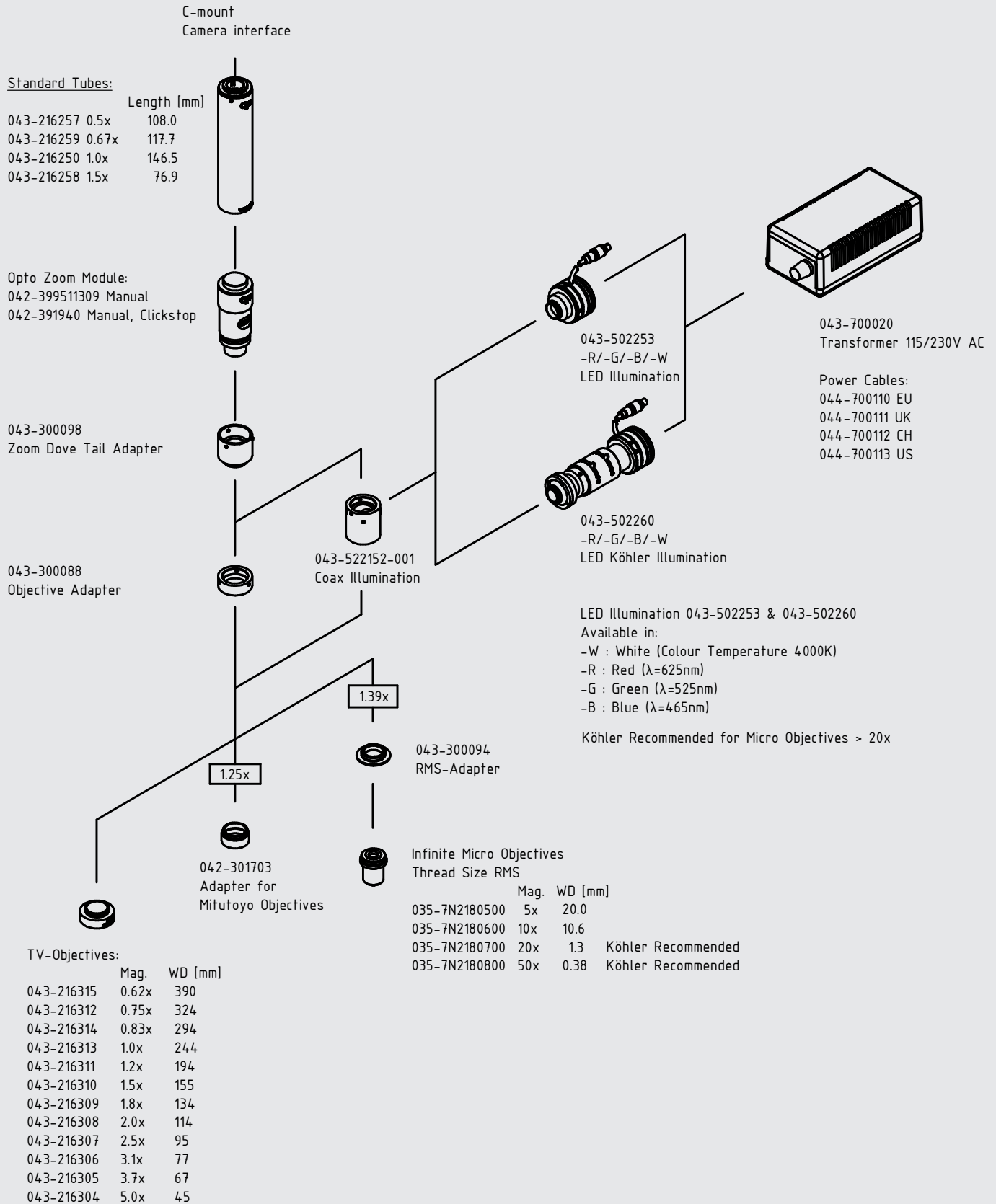
### Applications & Markets

- Post bond inspection of assembled semiconductors
- Automatic analysis of metallurgical surface defects
- Optical system inside universal measurements machines



*Köhler Illumination is recommended for objectives with magnifications higher than 20x*

	Minimum Config.		Maximum Config.	
Combination:	Tube 0.5x Objective 0.62x		Tube 1.5x Objective 50x	
	Low Zoom	High Zoom	Low Zoom	High Zoom
Magnification:	0.09x	0.68x	31.3x	229.4x
Working Distance:	390 mm		0.51 mm	
Field of View 1/3":	51.6 x 38.7 mm	7.0 x 5.3 mm	0.15 x 0.11 mm	0.02 x 0.01 mm
Field of View 1/2":	68.8 x 51.6 mm	9.4 x 7.0 mm	0.21 x 0.15 mm	0.03 x 0.02 mm
Field of View 1/1.8":	77.4 x 57.0 mm	10.6 x 7.8 mm	0.23 x 0.17 mm	0.03 x 0.02 mm
Field of View 2/3":	94.6 x 71.0 mm	12.9 x 9.7 mm	0.28 x 0.21 mm	0.04 x 0.03 mm



## 7:1 Motorized C-Mount Zoom

Featuring the same long-life reliability of our standard zooms, but with the benefits of either stepper or DC encoded motorisation options, our Opto motorised zooms are the optimum solution for high precision, machine integrated measurement tasks. Designed with machine integration in mind, the Opto zoom has much to offer, including a unique square design enabling easy machine integration and setup. A dedicated zoom controller ensures that electronic integration is simple and straightforward. And with our trademark modularity, your configuration remains fully customisable and upgradable at all times.

For volume integration we offer customized versions that fit your mechanical specification and which integrate illumination as a complete OEM package.

### Benefits

- Modular configuration of working distance, magnification and illumination
- Compact and reliable stepper or DC-motorisation
- Coaxial illumination for unique metallurgical configuration

### Applications & Markets

- Post bond inspection of assembled semiconductors
- Automatic analysis of metallurgical surface defects
- Universal measurement machines

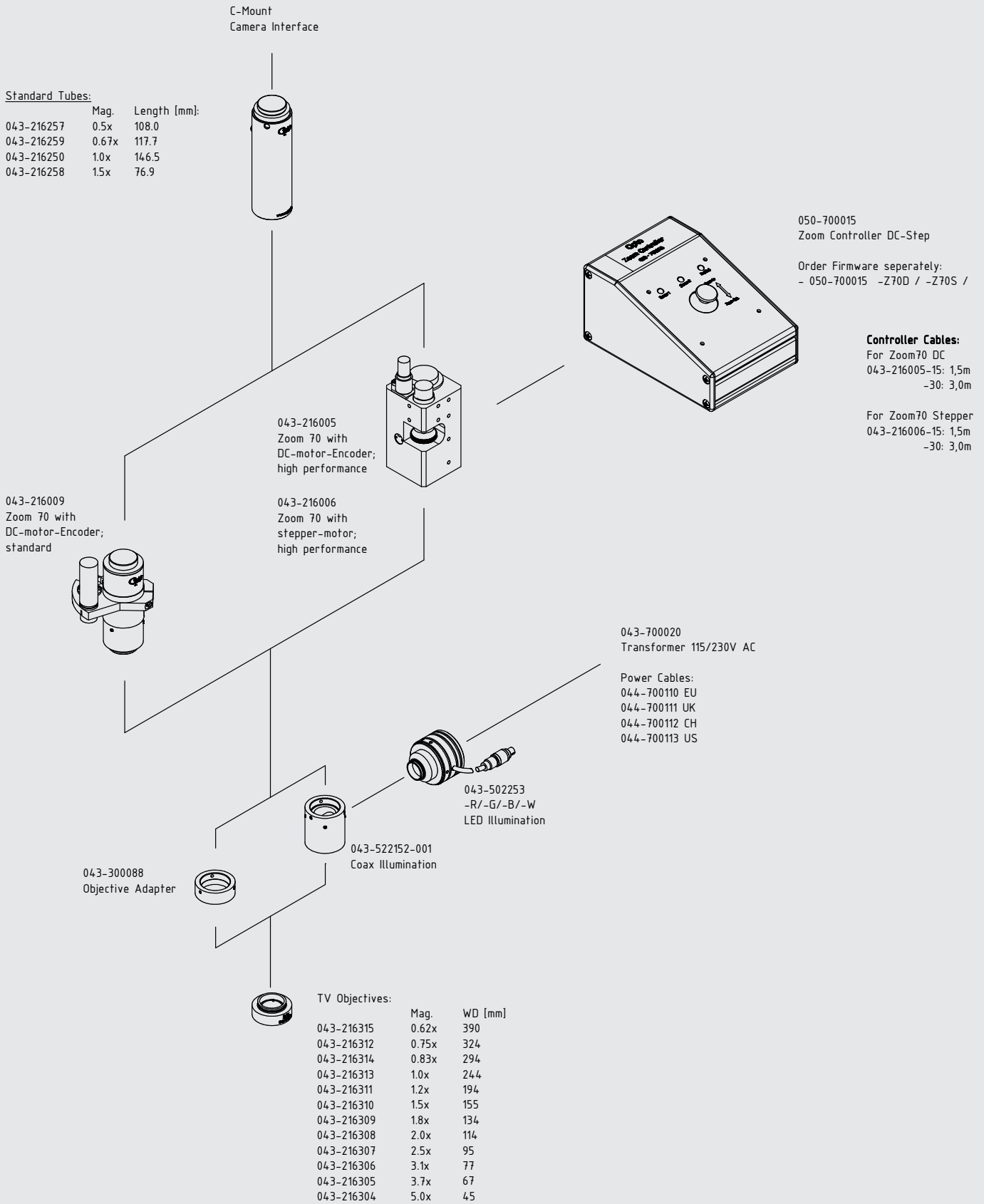


Optional Zoom Controller



Customized OEM-Version

	Minimum Config.		Maximum Config.	
Combination:	Tube 0.5x Objective 0.62x		Tube 1.5x Objective 50x	
	Low Zoom	High Zoom	Low Zoom	High Zoom
Magnification:	0.09x	0.68x	31.3x	229.4x
Working Distance:	390 mm		0.51 mm	
Field of View 1/3":	51.6 x 38.7 mm	7.0 x 5.3 mm	0.15 x 0.11 mm	0.02 x 0.01 mm
Field of View 1/2":	68.8 x 51.6 mm	9.4 x 7.0 mm	0.21 x 0.15 mm	0.03 x 0.02 mm
Field of View 1/1.8":	77.4 x 57.0 mm	10.6 x 7.8 mm	0.23 x 0.17 mm	0.03 x 0.02 mm
Field of View 2/3":	94.6 x 71.0 mm	12.9 x 9.7 mm	0.28 x 0.21 mm	0.04 x 0.03 mm



## Accessories

### Kniegelenke

Our Kniegelenke (German for knee joint or jointed coupler) are used for precise and reliable fixation of cameras, illuminations, sensors or optical accessories. They come with M6, M8 or 1/4" threads usually in length from one link (72 mm), two links (132 mm) or three links (191 mm) or even longer.

You can find all available standard versions on our website.

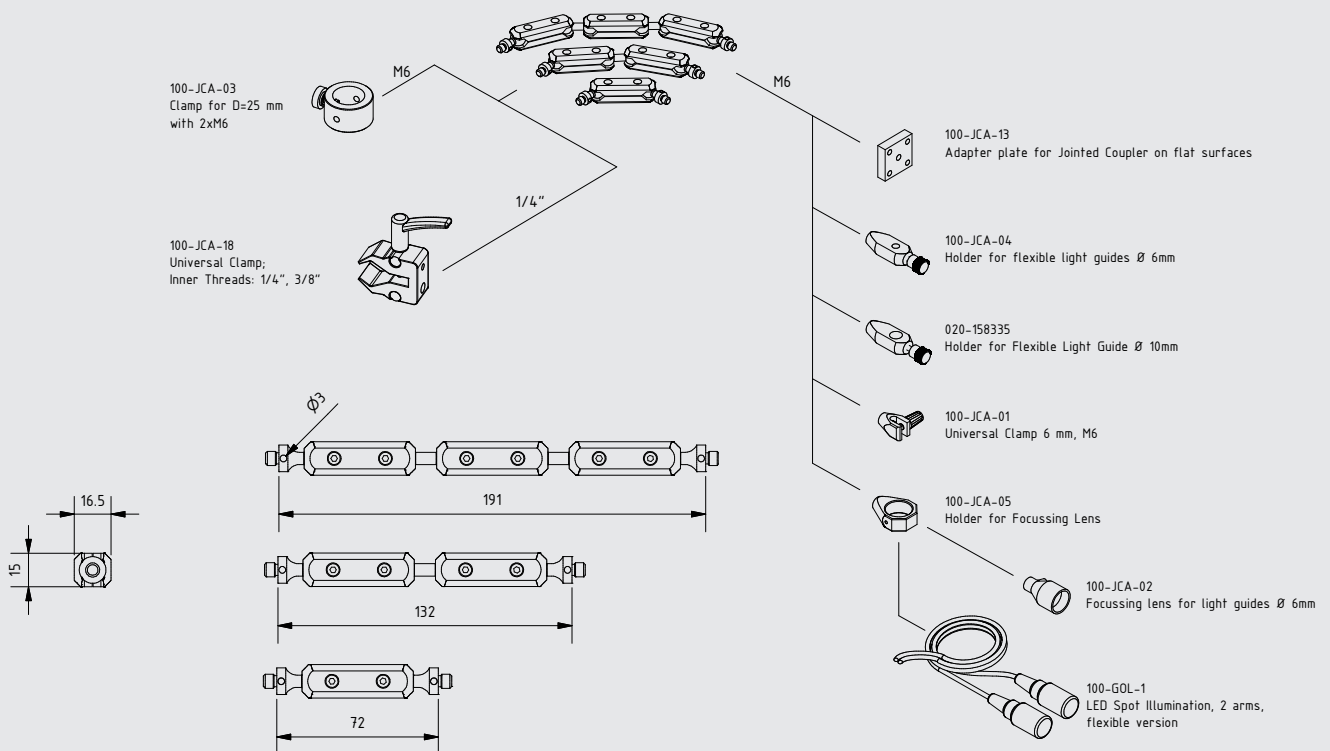


### Benefits

- Easy to mount
- Easy to position
- Ultimate locking strength

### Applications & Markets

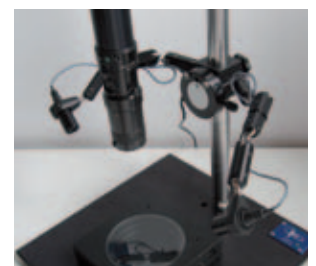
- Mounting of cameras with 1/4" thread for e.g. surveillance, code readers or in automations
- Mounting of illumination components such as LED's or fibre optics in Machine Vision and Microscopy
- Fine positioning of sensors in rough environments such as soldering or outdoor applications

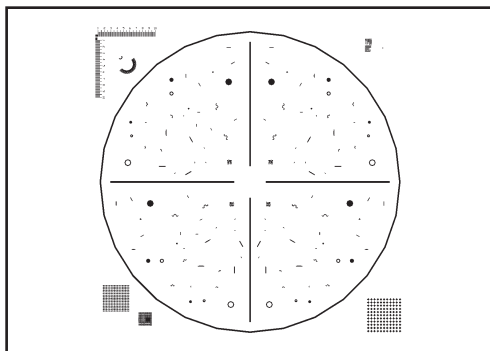


### LED focussable double spot

- 2 branches, length 380 mm
- focusable spot size Ø at 50 mm distance adjustable between 30-70 mm
- 16 step adjustable light intensity
- Universal power supply included
- Fixation with 100-JCA-15 and Kniegelenke

Art. No.	Type
100-GOL-1	Focusable LED Spot Illumination, 2 arms
100-JCA-15	Clamp on 25 mm, adaption for 2xM6 and 100-GOL-1 Base

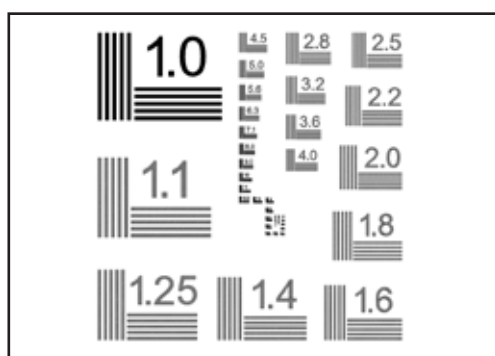




## Particle Standard Target

The Target allows the calibration of measurement functions in microscopes. A field of objects in different forms and sizes allow the user to check: rectangles, ellipsis, circles, rings and even fibre-shaped objects. To determine optical distortions there are three different sized arrays of cross-targets. The smallest Object is as small as 5µm.

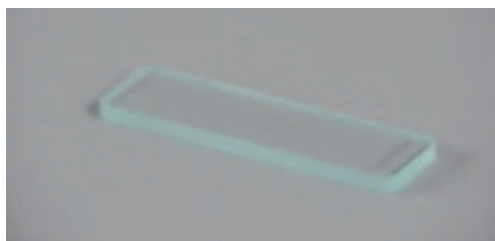
Art. No.	Description	Dimensions
043-102302-72	Particle Standard Target	70x70x2mm



## Resolution Test Target Lp/mm

These resolution test targets are a easy way to determine the optical resolution of your system.

Art. No.	Description	Scale
044-290011	Resolution Test Target	1-250 LP/mm
045-200176	Resolution Test Target	10-500 LP/mm



## Stage Micrometer

The stage micrometer is a helpfull tool for calibration purposes. It comes with a 50 mm scale with 0.1 and 0.01 mm graduation.

Art. No.	Description
010-310345	Stage Micrometer



## Optic cleaning set

Small dust "specks" are annoying, waste time and can interfere with detailed laboratory work. These tiny particles are difficult to remove from microscope and camera lenses, viewfinders and optical instruments.

The cleaning kit includes an anti-static lens and optics brush, an anti-static microfibre cleaning cloth, precision cleaning solution for effective oil and residue removal, and a special tool for picking up dust specks.

Art. No.	Description
100-CS-1	Optic cleaning set



## C-Mount Extender

This Extender is a simple way to double the magnification of an optical system, by adding a negative focal length to the camera end. This allows to keep the original working distance and decreases the field of view by two.

Art. No.	Description
043-801101	C-Mount Extender 2.0x

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