# CATALOG

S-MOUNT
C-MOUNT
MACRO
TELECENTRIC
LINE SCAN
OPTICAL DESIGN
ACCESSOIRES

LENSATION
smart lenses. smart solutions.

LENSATION

## LENSATION is a technical optics stock keeping firm that offers a wide range of optical items. We aim to be a one-stop destination for optics.

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Are you looking for a product that you haven't been able to locate? Ask us! We will source what we are unable to provide you right now. Name the product specifications and the target volume price - we can generally deliver the needed goods. And if 'your' product isn't already available, we'll design it for you!

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- OEM design and development
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- Products tailored especially according to your demands

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# S-MOUNT LENSES (M12X0.5)

## ABOUT S-MOUNT LENSES

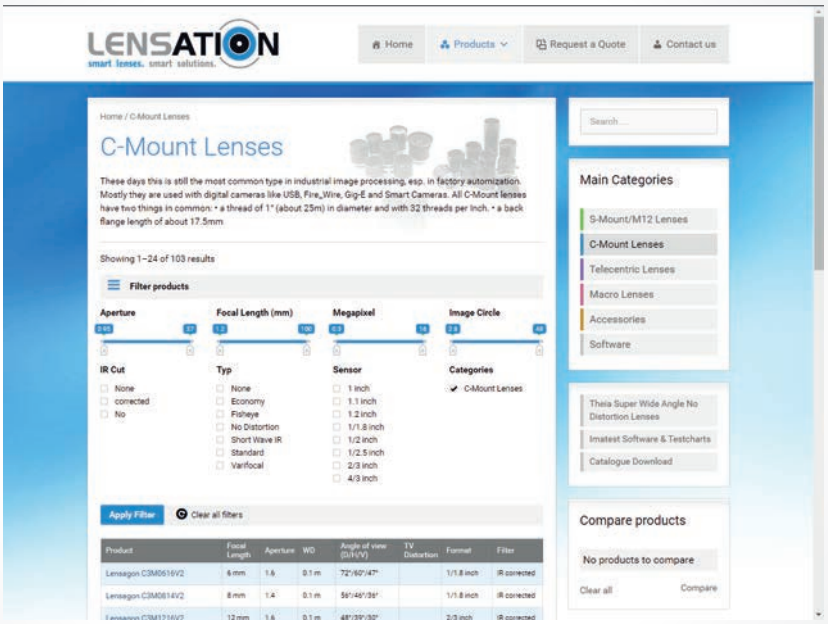
**Lenses with a M12x0.5mm thread are officially called S-Mount lenses, though "M12 lenses", "M12x0.5 lenses" or simply "board lenses" is more commonly used, as they are often used with board cameras. They are the most common "mini lenses".**

Lenses for webcams present the most basic versions. Though we offer these basic lenses as well (and label them "economical"), we opted to go with the high quality, frequently megapixel-compatible variety. Some of the most recent board lenses are even suited for 12 Megapixel cameras. Some of our 16K Telecentric lenses offer about 200 Megapixel resolution.

While most of the lenses found on the internet read to have a F-Stop of 2.0, few really have. Really light sensitive lenses in this size are hard to find, but we're proud to offer a whole range of even F1.2 lenses. Other unusual lenses you find here include board lenses with manual Iris (usually board lenses simply have fix iris) and even vario boardlenses are available. In case you need other threads, we can offer M17, M14, M13, M10, M8, M9, M7 lenses too.

## DISCOVER THE FEATURES OF OUR WEBSITE!

**www.lensation.de**




**Filter the search results.**
Set the properties and ranges of technical data according to your needs and you will only see matching lenses.

**Compare multiple products.**
A further feature to help you narrow down your selection is the product comparison. Mark the products you want to compare, and see which solution is best for you.

**Get all product details at a glance.**
If you want to take a closer look at a product, the product detail page offers you all relevant information. You'll find technical drawings and PDF datasheets for download.

# S-MOUNT LENSES (M12X0.5)



## VGA AND BELOW MEGAPIXEL HIGH RESOLUTION LENSES

- Perfect for standard image applications
- Entry level pricing
- Suited for standard resolution cameras
- Pixel size class down to 4µm

| | Focal length (mm) | Aperture (f-number) | Image format | MOD (m) | BFL (mm) | FOV (diag.) | Weight (g) | Mega Pixel | IR cut filter or option |
|---|---|---|---|---|---|---|---|---|---|
| **BK1220** | 1.2 | 2.0 | 1/4" | 0.2 | 3.4 | 192° | 5.2 | **0.3** | BK1220C |
| **BHR2125** | 2.1 | 2.5 | 1/3" | 0.2 | 4.25 | 165.7° | 6.1 | **0.7** | |
| **BHR2525** | 2.5 | 2.5 | 1/3" | 0.2 | 5.04 | 142.7° | 6.8 | **0.7** | |
| **BHR3020** | 3.0 | 2.0 | 1/3" | 0.2 | 5.67 | 126.0° | 5.9 | **0.7** | |
| **BHR4318** | 4.3 | 1.8 | 1/3" | 0.2 | 6.16 | 83.1° | 4.0 | **0.7** | |
| **BHR5620** | 5.6 | 2.0 | 1/3" | 0.2 | 8.07 | 65.3° | 4.0 | **0.7** | |
| **BT8020N** | 8.0 | 2.0 | 1/3" | 0.2 | 8.25 | 44° | 3.5 | **0.3** | BT8020NC |
| **BHR8020** | 8.0 | 2.0 | 1/3" | 0.2 | 7.6 | 43.0° | 6.0 | **0.7** | |
| **BHR12020** | 12.0 | 2.0 | 1/3" | 0.2 | 6.7 | 28.0° | 4.5 | **0.7** | |
| **BHR16012S12** | 16.0 | 1.2 | 1/2" | 0.3 | 7.2 | 21.8° | 11.0 | **0.7** | |

## BOARD LENSES UP TO 1 MEGAPIXEL

- For cameras up to 1024x768 (4:3) and 1280x720 (16:9) resolution
- Pixel size class down to 3µm

| | Focal length (mm) | Aperture (f-number) | Image format | MOD (m) | BFL (mm) | FOV (diag.) | Weight (g) | Mega Pixel | IR cut filter or option |
|---|---|---|---|---|---|---|---|---|---|
| **BK1820** | 1.8 | 2.0 | 1/4" | 0.2 | 3.65 | 160° | 5.5 | **1** | BK1820C |
| **BT1922** | 1.9 | 2.2 | 1/4" | 0.05 | 4.7 | 156° | 3.5 | **1** | BT1922C |
| **BT2120** | 2.1 | 2.0 | 1/3" | 0.2 | 4.92 | 151° | 6.5 | **1** | BT2120C |
| **BT2520** | 2.5 | 2.0 | 1/3" | 0.2 | 5.18 | 140° | 5.3 | **1** | BT2520C |
| **BT2920** | 2.9 | 2.0 | 1/3" | 0.2 | 5.02 | 138° | 4.5 | **1** | BT2920C |
| **BT3020** | 3.0 | 2.0 | 1/3" | 0.2 | 5.35 | 124° | 3.5 | **1** | BT3020C |
| **BT3620** | 3.6 | 2.0 | 1/3" | 0.2 | 5.00 | 100° | 4.1 | **1** | BT3620C |
| **BT6020V2** | 6.1 | 2.0 | 1/3" | 0.2 | 8.03 | 62° | 6.5 | **1** | BT6020V2C |
| **BT12020** | 12.0 | 2.0 | 1/3" | 0.4 | 8.97 | 29° | 3.2 | **1** | BT12020C |
| **B16020S12** | 16.0 | 2.0 | 1/2" | 0.2 | 12.3 | 27.8° | 4.2 | **1** | |
| **B25020S12** | 25.0 | 2.0 | 1/2" | 0.2 | 11.8 | 18.2° | 17.6 | **1** | |
| **B35020S12** | 35.0 | 2.0 | 1/2" | 0.2 | 18.9 | 13.0° | 15.4 | **1** | |
| **B50020S12** | 50.0 | 2.0 | 1/2" | 0.4 | 33.9 | 9.2° | 27.1 | **1** | |

# S-MOUNT LENSES (M12X0.5)

## 1-2 MEGAPIXEL BOARD LENSES

Broad portfolio for cameras in the 1.2 / 1.3 and 2.0 Megapixel class.

For common resolutions like
- 1280x 960
- 1280x1024
- 1600x1200
- 1920x1080
- 1920x1200

For Sony Starvis / Pregius image sensors. Also for Teledyne Ruby / Saphire and Snappy image sensors. Perfect for a pixel size down to 3µm.


| | Focal length (mm) | Aperture (f-number) | Image format | MOD (m) | BFL (mm) | FOV (diag.) | Distortion TV (%) | Weight (g) | Mega Pixel | IR corr. | IR cut filter / option |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **BMK2119C** | 2.1 | 1.9 | 1/3" | 0.2 | 2.2 | 160° | -73 | 2.8 | **1** | | SLAR coating 550nm |
| **BM2118V2** | 2.1 | 2.2 | 1/3" | 0.2 | 6.3 | 170° | -88.1 | 6.5 | **1** | • | BM2118V2C |
| **BMK2320C** | 2.3 | 2.0 | 1/3" | 0.16 | 2.3 | 140° | - | 2.8 | **1** | | SLAR coating 550nm |
| **BM2420** | 2.4 | 2.0 | 1/3" | 0.15 | 4.56 | 132° | -25 | 6.0 | **1** | • | BM2420C |
| **BM2820** | 2.8 | 2.0 | 1/3" | 0.2 | 5.29 | 122° | -40 | 6.0 | **1** | • | BM2820C |
| **BM3618** | 3.6 | 1.8 | 1/3" | 0.2 | 6.59 | 100° | 34.1 | 6.0 | **1** | • | BM3618C |
| **B2M3814** | 3.85 | 1.4 | 1/2.5" | 0.2 | 6.76 | 122° | - | 9.0 | **2** | | B2M3814C |
| **BM4218** | 4.2 | 1.8 | 1/3" | 0.2 | 7.21 | 89° | -29 | 7.0 | **1** | • | BM4218C |
| **BM4518S118ND-810** | 4.5 | 1.8 | 1/1.8" | 0.1 | 6.4 | 90° | <2.8 | 14.0 | **1** | • | 810nm Coating |
| **BM4525S118ND** | 4.5 | 2.5 | 1/1.8" | 0.1 | 6.4 | 90° | -2.8 | 15.0 | **1** | | |
| **BM4620DN** | 4.6 | 2.0 | 1/3" | 0.2 | 5.63 | 80° | -22 | 6.0 | **1** | • | BM4620DNC |
| **BM6018** | 6.0 | 1.8 | 1/3" | 0.2 | 9.33 | 60° | -17 | 6.0 | **1** | • | BM6018C |
| **BSM6016S12** | 6.0 | 1.8 | 1/2" | 0.2 | 8.73 | 88° | -32 | 4.5 | **2** | • | |
| **BM8021S118ND** | 7.84 | 2.1 | 1/1.8" | 0.5 | 7.8 | 60° | -2.9 (opt.) | 14.3 | **1** | • | BM8021S118NDC |
| **BM8018** | 8.0 | 1.8 | 1/3" | 0.2 | 5.4 | 45° | -8.3 | 6.0 | **1** | • | BM8018C |
| **BSM8016S12** | 8.0 | 1.9 | 1/2" | 0.2 | 5.4 | 62° | -12 | 6.0 | **2** | • | |
| **BM9040** | 9.0 | 4.0 | 1/3" | 0.1 | 8.0 | 34° | - | 3.9 | **1.3** | • | |
| **BM9050** | 9.0 | 5.0 | 1/3" | 0.1 | 8.0 | 34° | 1.0 | 3.9 | **1.3** | • | |
| **BM10028S12** | 10.0 | 2.8 | 1/2" | 0.4 | 8.0 | 44° | 1.0 | 6.0 | **1.2** | | BM10028S12C |
| **BSM12016S12** | 12.0 | 2.0 | 1/2" | 0.2 | 6.54 | 39° | - | 6.0 | **2** | • | |
| **BM16018** | 16.0 | 1.8 | 1/3" | 0.2 | 6.59 | 21° | 3.4 | 6.0 | **1** | • | BM16018C |
| **BT25020S12** | 25.0 | 2.0 | 1/2" | 0.2 | 8.29 | 18.6° | - | 7.0 | **1-2** | | BT25020S12C |

## 3 MEGAPIXEL BOARD LENSES

High resolution lenses for the popular Full HD resolution of 1920x1080 or 1920x1200 pixels

Also perfect for the classic 2048x1536 format.

Supports a pixel size down to the 2.5µm class.


| | Focal length (mm) | Aperture (f-number) | Image format | MOD (m) | BFL (mm) | FOV (diag.) | Distortion (%) | Weight (g) | Mega Pixel | IR corr. | IR cut filter / option |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **B3M21835ND** | 2.18 | 3.5 | 1/4" | 0.1 | 1.30 | 94° | <0.6 | 4.0 | **3** | | B3M21835NDC |
| **B3M2818** | 2.8 | 2.2 | 1/2.5" | 0.3 | 6.2 | 147° | < 1.9 | 5.0 | **3** | • | |
| **BM3516ND** | 3.5 | 1.6 | 1/3" | 0.2 | 5.97 | 81° | < 1.9 | 10.0 | **3** | • | BM3516NDC |
| **BM3518S125ND** | 3.5 | 1.8 | 1/2.5" | 0.2 | 5.97 | 90° | < 1.9 | 12.0 | **3** | • | BM3518S125NDC |
| **BM3524S12ND** | 3.5 | 2.4 | 1/2" | 0.1 | 6.09 | 97° | <-3.1 | 21.8 | **3** | • | BM3524S12NDC |
| **B3M4016** | 4.0 | 2.2 | 1/2.5" | 0.2 | 7.28 | 112° | -12 | 5.4 | **3** | • | |
| **BM4018S118** | 4.0 | 1.8 | 1/1.8" | 0.2 | 8.0 | 126° | -45 | 10.0 | **3** | • | BM4018S118C |
| **BM4518S125ND** | 4.5 | 1.8 | 1/2.5" | 0.2 | 6.14 | 76.4° | < 1.9 | 13.0 | **3** | • | BM4518S125NDC |
| **BM5518S12ND *** | 5.5 | 1.8 | 1/1.8" | 0.2 | 6.87 | 76° | < 1.9 | 10.0 | **2** | • | BM5518S12NDC |
| **BM5822S118ND** | 5.8 | 2.2 | 1/1.8" | 0.3 | 6.5 | 76.2° | -2.4 | 12.15 | **2** | | BM5822S118ND |
| **BM6020ND** | 6.0 | 2.0 | 1/3" | 0.2 | 6.27 | 57° | <-2.6 | 5.9 | **3** | • | BM6020NDC |
| **B3M6016** | 6.0 | 2.2 | 1/2.5" | 0.3 | 6.8 | 72° | -19 | 5.8 | **3** | • | |
| **B3M6020S12** | 6.0 | 2.0 | 1/2" | 0.5 | 8.3 | 81° | - | 9.9 | **3** | | |
| **B3M8016** | 8.0 | 2.2 | 1/2.5" | 0.4 | 8.0 | 54° | -3.8 | 5.0 | **3** | | |
| **B3M8018S12** | 8.0 | 1.8 | 1/2" | 0.5 | 7.9 | 57.7° | - | 10.7 | **3** | | |
| **B3M8556S118ND** | 8.5 | 5.6 | 1/1.8" | 0.1 | 2.9 | 54.3° | -1.15 | 6.6 | **3** | | B3M8556S118NDC |
| **B3M12016** | 12.0 | 2.3 | 1/2.5" | 0.3 | 6.44 | 35° | -6 | 5.0 | **3** | • | |
| **B3M16018V2** | 16.3 | 1.83 | 1/2" | 0.5 | 7.35 | 28.8° | -0.72 | - | **3** | • | |
| **B3M25024** | 25.0 | 2.4 | 1/2" | 0.4 | 10.26 | 18° | 3.3 | 7.1 | **3** | • | B3M25024C |
| **B3M35025V2** | 35.0 | 2.8 | 1/1.7" | 0.5 | 14.42 | 15.5° | 0.1 | 15.5 | **3** | • | B3M35025CV2 |

* Limited

# S-MOUNT LENSES (M12X0.5)

## 4 MEGAPIXEL BOARD LENSES

Our f=1.93mm offers the widest low distortion Field Of View of all M12 lenses. The unique 50mm M12 lens is perfect for 2k x 2k cameras.

B4M1920NDC B4M3516S12 B4M50028S117

| | Focal length (mm) | Aperture (f-number) | Image format | MOD (m) | BFL (mm) | FOV (diag.) | Distortion (%) | Weight (g) | Mega Pixel | IR corr. | IR cut filter / option |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **B4M1920NDC** | 1.93 | 2.0 | 1/2.9" | - | 1.137 | 117° | -5 (opt.) | 5.7 | **4** | | • |
| **B4M3516S12** | 3.5 | 1.6 | 1/2" | 0.85 | 4.8 | 160° | -13.9 (TV) | 7.7 | **4** | | B4M3516S12C |
| **B4M50028S117** | 50 | 2.8 | 1/1.7" | 1.0 | 18.7 | 18.7° | -0.1 (opt.) | 34.3 | **4** | | B4M50028S117C |

## 5 MEGAPIXEL BOARD LENSES

**Our broad portfolio of high resolution lenses.**

Perfect for the new Sony Starvis, the On Semi AR series or the Omnivision image sensors.

Supporting pixel sizes down to 2.2µm.

B5M2524 B5M2916 B5M2920S118 B5M29740ND B5M3428S123 B5M3618 BK5M3920

B5M4018 B5M4020 B5M41430ND B5M6018 B5M6020 B5M6532S123ND B5M7630

B5M8018 B5M8020 B5M12020 B5M12056 B5M16020V2 B5M25024V2

| | Focal length (mm) | Aperture (f-number) | Image format | MOD (m) | BFL (mm) | FOV (diag.) | Distortion (%) | Weight (g) | Mega Pixel | IR corr. | IR cut filter or option |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **B5M2524** | 2.5 | 2.4 | 1/2.5" | 0.1 | 4.98 | 166° | -83 | 6.1 | **5** | | B5M2524C |
| **B5M2916** | 2.9 | 2.0 | 1/2.5" | 0.1 | 4.47 | 152° | -63 | 7.2 | **5** | • | B5M2916C |
| **B5M2920S118** | 2.95 | 2.8 | 1/1.8" | 0.3 | 6.81 | 180° | -4.3 | 15.6 | **5** | • | B5M2920S118C |
| **B5M29740ND** | 2.97 | 4.0 | 1/2.5" | 0.2 | 2.97 | 102° | < 1 | 3.5 | **5** | | B5M29740NDC |
| **B5M3428S123** | 3.4 | 2.8 | 1/2.3" | 0.1 | 6.3 | 150° | -12 | 8.2 | **5** | | B5M3428S123C |
| **B5M3618** | 3.6 | 1.8 | 1/2.5" | 0.2 | 7.25 | 128° | -0.5 | 5.0 | **5** | | B5M3618C |
| **BK5M3920** (MOQ) | 3.9 | 2.0 | 1/2" | 0.8 | 6.1 | 127° | - | 11.0 | **5** | • | |
| **B5M4018** | 4.0 | 1.8 | 1/2.5" | 0.2 | 7.72 | 112° | -41.5 | 5.0 | **5** | | B5M4018C |
| **B5M4020** | 4.0 | 2.0 | 1/2.5" | 0.3 | 6.7 | 114° | -62.9 | 5.0 | **5** | | B5M4020C |

# S-MOUNT LENSES (M12X0.5)



| | Focal length (mm) | Aperture (f-number) | Image format | MOD (m) | BFL (mm) | FOV (diag.) | Distortion (%) | Weight (g) | Mega Pixel | IR corr. | IR cut filter or option |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **B5M41430ND** | 4.14 | 3.0 | 1/2.5" | 0.2 | 5.25 | 82° | < 0.2 | 8.3 | **5** | | B5M41430NDC |
| **B5M6018** | 6.0 | 1.8 | 1/2.5" | 0.2 | 9.58 | 75° | -21.4 | 6.5 | **5** | | B5M6018C |
| **B5M6020** | 6.0 | 2.0 | 1/2.5" | 0.3 | 7.3 | 67° | -19.6 | 6.0 | **5** | | B5M6020C |
| **B5M6532S123ND** | 6.0 | 3.2 | 1/2.3" | 0.3 | 7.55 | 62° | 0.8 | 3.1 | **5** | | B5M6532S123NDC |
| **B5M7630** | 7.6 | 3.0 | 1/1.8" | 0.2 | 5.38 | 58° | 1.9 | 6.0 | **5** | | B5M7630C |
| **B5M8018** | 8.0 | 1.8 | 1/2" | 0.2 | 7.8 | 56° | -14.4 | 6.5 | **5** | | B5M8018C |
| **B5M8020** | 8.0 | 2.0 | 1/2.5" | 0.3 | 8.0 | 50° | -7.7 | 5.0 | **5** | | B5M8020C |
| **B5M12020** | 12.0 | 2.0 | 1/2.5" | 0.3 | 7.6 | 35° | -4.4 | 5.0 | **5** | • | B5M12020C |
| **B5M12028** | 12.0 | 2.8 | 1/1.8" | 0.1 | 8.57 | 41° | -1.75 | 7.0 | **5** | | B5M12028C |
| **B5M12056** | 12.0 | 5.6 | 1/1.8" | 0.1 | 8.57 | 41° | -1.75 | 7.0 | **5** | | B5M12056C |
| **B5M16020V2** | 16.0 | 2.0 | 1/2.5" | 0.3 | 7.1 | 28° | 0.24 | 5.0 | **5** | • | B5M16020V2C |
| **B5M25020S23ND** | 25.0 | 2.0 | 2/3" | 0.25 | 5.2 | 25° | 0.05 | 8.4 | **5** | | |
| **B5M25024V2** | 25.0 | 2.4 | 1/2" | 0.3 | 11.98 | 18.8° | 1.13 | 5.0 | **5** | • | B5M25020V2C |
| **B5M35020S23ND** | 35.0 | 2.0 | 2/3" | 0.35 | 5.5 | 21.3° | 0.05 | 14.5 | **5** | | |

## 8/10/14 MEGAPIXEL BOARD LENSES


B14M28620S123C B10M45545ND B10M5425 B10M7224V2

**For 4k cinema resolution cameras.**
Supports sensors like

- ON MT9J00x/MT9F00x/AR133x/AR1820
- Perfect for Sony IMX213/286/374/377/486/663/708
- Also suits for the Omnivision OV128xx/OV138xx series

**Crystal clear images with pixel sizes down to the 1.25µm class.**

| | Focal length (mm) | Aperture (f-number) | Image format | MOD (m) | BFL (mm) | FOV (diag.) | Distortion (%) | Weight (g) | Mega Pixel | IR corr. | IR cut filter / option |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **B8M2624S125ND** | 2.6 | 2.4 | 1/2.5" | 0.2 | 2.52 | 106° | -0.12 | - | **8** | • | B8M2624S125NDC |
| **B14M28620S123** | 2.86 | 2.0 | 1/2.3" | 0.1 | 5.71 | 170° | -25 | 15.0 | **14** | | B14M28620S123C |
| **B8M3025S125ND** | 3.0 | 2.5 | 1/2.5" | 0.2 | 3.74 | 97° | 2 | - | **8** | • | B8M3025S125NDC |
| **B8M4028S118ND** | 4.0 | 2.8 | 1/1.8" | 0.25 | 5.7 | 92.4° | -3 | 16 | **8** | | B8M4028S118NDC |
| **B8M4418S23** | 4.41 | 1.8 | 2/3" | 0.1 | 7.33 | 139.6 | -18 | 8.0 | **8** | | B8M4418S23C |
| **B10M45545ND** | 4.55 | 4.5 | 1/2.3" | 0.1 | 3.44 | 81.7° | <0.5 | 8.2 | **10** | | B10M45545NDC |
| **B10M5425** | 5.4 | 2.5 | 1/2.3" | 0.2 | 6.6 | 70° | -2 | 6.0 | **10** | • | B10M5425C |
| **B10M7224V2** | 7.2 | 2.4 | 1/2.3" | 0.3 | 7.23 | 57° | -1.8 | 12.6 | **10** | • | B10M7224V2C |
| **B8M8020S118ND** | 8.0 | 2.0 | 1/1.7" | 0.1 | 6.06 | 60.8 | -2 | - | **8** | | B8M8020S118NDC |
| **B8M12020S118ND** | 12.0 | 2.0 | 1/1.8" | 0.15 | 5.64 | 44.9 | -2 | - | **8** | | B8M12020S118NDC |

# S-MOUNT LENSES (M12X0.5)

## PINHOLE BOARD LENSES

- Suited for standard resolution cameras
- Easy to clean
- Wide field-of-view
- Perfect for LED Illumination with a ring light


BP2824S13


BPM3725C


BP3M3728S127

| | Focal length (mm) | Aperture (f-number) | Image format | MOD (m) | BFL (mm) | FOV (iag.) | Weight (g) | Mega Pixel | IR cut filter or option |
|---|---|---|---|---|---|---|---|---|---|
| **BP2824S13** | 2.8 | 2.4 | 1/3" | 0.1 | 3.1 | 125° | 1.5 | | BP2824S13C |
| **BPM3725C** | 3.7 | 2.5 | 1/3" | 0.2 | 3.64 | 106° | 1.7 | **1** | • |
| **BP3M3728S127** | 3.7 | 2.8 | 1/2.7" | 0.3 | 3.7 | 108.4° | 1.8 | **3** | BP3M3728S127C |

## TIME-OF-FLIGHT BOARD LENSES

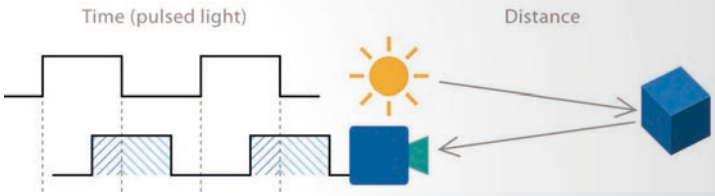
- Light sensitive lenses including a special bandpass filter for Time-of-Flight 3D Cameras
- Ideal for factory automation, robotics and logistics


BTOF2512-850


BTOF2512-940


BTOF2512-850


BTOF2512-940




| | Focal length (mm) | Aperture (f-number) | Image format | MOD (m) | BFL (mm) | FOV (diag.) | Chief ray | Optical Distortion % | bandpass filter |
|---|---|---|---|---|---|---|---|---|---|
| **BTOF2512-850** | 2.5 | 2.0 | 1/3" | 0.2 | 5.18 | 140° | 13.07° | -53 | 850nm |
| **BTOF2512-940** | 2.5 | 2.0 | 1/3" | 0.2 | 5.18 | 140° | 13.07° | -53 | 940nm |
| **BTOF1114S12-850** | 11.3 | 1.4 | 1/2" | 0.1 | 5.96 | 38.1° | 12.6° | 2.1 | 850nm |
| **BTOF1114S12-940** | 11.3 | 1.4 | 1/2" | 0.1 | 5.96 | 38.1° | 12.6° | 2.1 | 940nm |

## M16 CCTV LENSES

- Light sensitive lenses with 16mm thread
- Applications are inspection of bottles, caps and tubes
- Up to 4 times more light sensitive compared to a conventional M12 lens
- All lenses including a 2-hole mount M16 lens holder


M16B6M4010S125


M16B4M5009S118C


M16B8M54310S118

| | Focal length (mm) | Aperture (f-number) | Image format | MOD (m) | BFL (mm) | FOV (diag.) | Weight (g) | Mega Pixel | IR cut filter or option |
|---|---|---|---|---|---|---|---|---|---|
| **M16B6M4010S125** | 4.0 | 1.0 | 1/2.5" | 1.0 | 5.36 | 106° | 9 | **6** | |
| **M16B4M5009S118C** | 5.0 | 0.9 | 1/1.8" | 0.5 | 6.48 | 118° | - | **4** | • (inside holder) |
| **M16B8M54310S118** | 5.43 | 1.0 | 1/1.8" | 1.0 | 5.98 | 105° | 10 | **8** | |

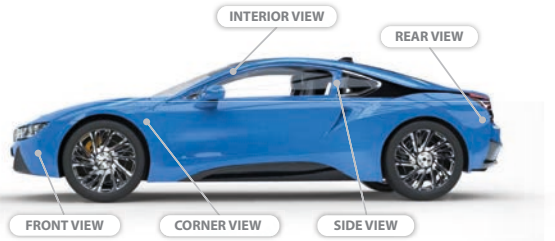
# S-MOUNT LENSES (M12X0.5)

## WATERPROOF AUTOMOTIVE BOARD LENSES

Protected against dust and humitity.
Compact size, wide FOV.

- Waterproof with IP54 classification
- Hard-coating against oil, fog and pollution

BA1520WPC BA1825WPC BA2325WPC




| | Focal length (mm) | Aperture (f-number) | Image format | MOD (m) | BFL (mm) | FOV (diag.) | Weight (g) | Megapixel | IR cut filter |
|---|---|---|---|---|---|---|---|---|---|
| **BA1520WPC** | 1.5 | 2.0 | 1/4" | 0.2 | 2.2 | 163.0° | 5.5 | <1 | • |
| **BA1825WPC** | 1.8 | 2.5 | 1/4" | 0.2 | 2.2 | 160.0° | 5.5 | <1 | • |
| **BA2325WPC** | 2.3 | 2.5 | 1/3" | 0.2 | 2.7 | 163.0° | 6.0 | <1 | • |

## FISHEYE BOARD LENSES

**Lenses for a wide field-of-view.**
For image sensors up to 16 Megapixels. Typical applications are surround view, inspection of tubes and pipes. We also offer software for unwarped images or to simulate rectified PTZ Cameras.

**Important:** The image circle diameter you need depends on your application. Choose the image circle larger than the equivalent sensor dimension (h/v/d) (see table on page 42).

BF5M12721 BF13M0922S13C BF5M11920 BF10M10526S132 BFM1220C

BF5M15828S125 BF16M220DV2 BF9M1422 BF10M14522S18 BFM1524S125

BF3M2122S13 BF5M19622 BF10M19828S118 BF5M2223S129 BF10M2628S123

| | Image Circle | Focal length (mm) | Aperture (f-number) | Image format | MOD (m) | BFL (mm) | FOV (diag.) | Weight (g) | Megapixel | IR corr. | IR cut filter or option |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **BF5M12721** | 2.8 | 1.27 | 2.1 | 1/4.0" | 0.1 | 4.18 | 185° | 4.7 | **5** | • | BF5M12721C |
| **BF13M0922S13C** | 2.9 | 0.9 | 2.2 | 1/3.2" | 0.1 | 2.01 | 200° | 5.6 | **13** | | • |
| **BF5M11920** | 3.24 | 1.19 | 2.0 | 1/3.2" | 0.2 | 6.44 | 180° | 14.7 | **5** | • | BF5M11920C |
| **BF10M10526S132** | 3.5 | 1.05 | 2.6 | 1/3.2" | 0.1 | 3.2 | 200° | 13.7 | **10** | • | BF10M10526S132C |
| **BFM1220C** | 3.84 | 1.2 | 2.0 | 1/3.0" | 0.2 | 2.91 | 190° | 7.5 | **1.3** | | • |
| **BF5M15828S125** | 4.1 | 1.58 | 2.8 | 1/2.5" | 0.1 | 5.75 | 180° | 10.9 | **5** | • | BF5M15828S125C |
| NEW **BF16M220DV2** | 4.2 | 1.2 | 2.5 | 1/2.3" | 0.1 | 2.94 | 220° | 26 | **16** | | BF16M220DV2C |
| **BF9M1422** | 4.5 | 1.41 | 2.2 | 1/2.3" | 0.1 | 3.69 | 183° | 24.0 | **9** | • | BF9M1422C |
| **BF10M14522S18** | 4.6 | 1.45 | 2.2 | 1/1.8" | 0.1 | 4.62 | 190° | 14.0 | **10** | • | BF10M14522S18C |
| **BFM1524S125** | 4.7 | 1.49 | 2.4 | 1/2.5" | 0.06 | 2.94 | 183° | 4.0 | **1.3** | | BFM1524S125C |
| **BF3M2122S13** | 4.8 | 2.1 | 2.2 | 1/3.0" | 0.1 | 3.67 | 184° | 3.9 | **3** | • | BF3M2122S13C |
| **BF5M19622** | 5.6 | 1.96 | 2.2 | 1/2.5" | 0.1 | 2.77 | 180° | 2.3 | **5** | • | BF5M19622C |
| **BF10M19828S118** | 5.6 | 1.98 | 2.8 | 1/1.8" | 0.1 | 6.32 | 180° | 15.6 | **10** | • | BF10M19828S118C |
| **BF5M2223S129** | 6.2 | 2.2 | 2.3 | 1/2.9" | 0.1 | 4.71 | 195° | 4.8 | **5** | • | BF5M2223S129C |
| NEW **BF5M2023S23** | 6.6 | 2.0 | 2.3 | 2/3 | 0.1 | 6.11 | 195° | 18.8 | **5** | • | BF5M2023S23C |
| **BF10M2628S123** | 8.0 | 2.6 | 2.8 | 1/2.3" | 0.1 | 3.67 | 150° | 6.8 | **10** | | BF10M2628S123C |

# C-MOUNT LENSES

## ABOUT C-MOUNT LENSES

**These days this is still the most common type in industrial image processing, esp. in factory automization. Mostly they are used with digital cameras like USB, Fire_Wire, Gig-E and Smart Cameras.**

All C-Mount lenses have three things in common:

- Outer diameter thread of 1" (about 2.54 cm)
- 32 threads per inch thread pitch
- A back flange length of **17.526mm**

### CS-Mount Lenses

This is the most common type of lens in the surveillance industry. CS-Mount lenses are more popular than C-Mount lenses for extreme wide angle lenses. CS-Mount lenses are still often used with analog film cameras.  All CS-Mount lenses have three characteristics in common:

- Outer diameter thread of 1" (about 2.54 cm)
- 32 threads per inch thread pitch
- A back flange length of **12.5mm**

### Not sure which is which?

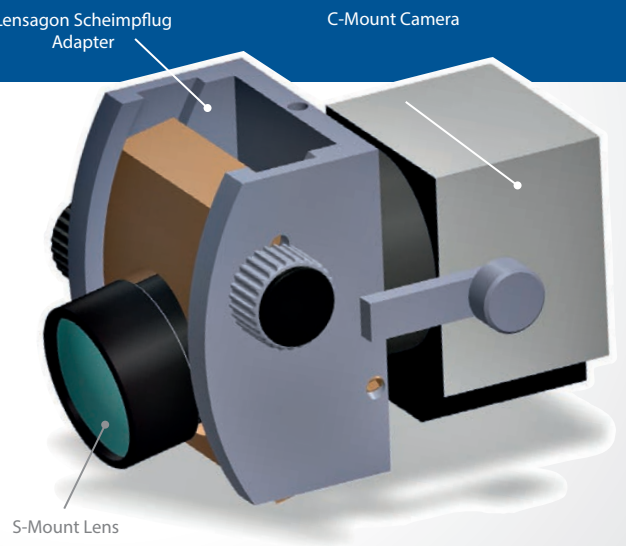
C-Mount CS-Mount lenses on first glance look very similar .. even the thread fits well. Because only the back focal length is different things can be tricky. Please visit www.optowiki.com and check the FAQ "How to distinguish C- and CS-Mount with a quick test?" if you're not sure to have the right lens.

## S-MOUNT TO C-MOUNT SCHEIMPFLUG ADAPTER

The tilt mechanism allows overall image sharpness to be controlled in a different way than conventional lenses. Used in conjunction with aperture, the tilt feature of these lenses allows objects or features within an image plane to be kept in focus. This is helpful when imaging objects at oblique angles.

If absolute sharpness in the foreground and background is required, it is necessary to first focus on the closest foreground object and then tilt the lens until the background object is focus. After selecting the correct aperture, both objects will be sharp. Using such tilt mechanisms provides an additional means of controlling depth of field and allows greater freedom over the aperture and shutter speed combinations.

http://www.optowiki.info/glossary/scheimpflug-principle/




*(CAD image)*

# HIGH QUALITY C-MOUNT LENSES


**Features**

- Cover a wide range of uses from inspection to factory automation
- Vibration-resistant focus and iris locks available
- Compatible with 1/3", 1/2", 2/3", 1" 400,000 pixel cameras

## 1/2" format

| | Focal length ( mm) | Aperture (f-number) | MOD (m) | Angle of view (Horiz. x Vert.) | Filter screw | Sensor Format |
|---|---|---|---|---|---|---|
| **CY0316** | 3.5 | 1.6 | 0.1 | 69.0° x 85.0° | M43 P=0.75 | 1/2" |
| **CY0614** | 6 | 1.4 | 0.2 | 42.0° x 54.5° | M27 P=0.5 | 1/2" |
| **CY1214** | 12 | 1,4 | 0.3 | 22.0° x 29.0° | M27 P=0.5 | 1/2" |

## 2/3" format

| | Focal length ( mm) | Aperture (f-number) | MOD (m) | Angle of view (Horiz. x Vert.) | Filter screw | Sensor Format |
|---|---|---|---|---|---|---|
| **CY0614S23** | 6 | 1.4 | 0.2 | 81.9° x 61.2° | no filter thread | 2/3" |
| **CY0813** | 8 | 1.3 | 0.2 | 45.0° x 57.8° | M25.5 P=0.5 | 2/3" |
| **CY1614** | 16 | 1.4 | 0.4 | 23.2° x 30.7° | M27 P=0.5 | 2/3" |
| **CY2514** | 25 | 1.4 | 0.5 | 21.6° x 28.5° | M27 P=0.5 | 2/3" |
| **CY3519** | 35 | 1.9 | 0.5 | 10.8° x 14.4° | M27 P=0.5 | 2/3" |
| **CY5018** | 50 | 1.8 | 1 | 7.9° x 10.5° | M30.5 P=0.5 | 2/3" |
| **CY7527** | 75 | 2.7 | 1 | 4.9° x 6.6° | M30.5 P=0.5 | 2/3" |
| **CY10035** | 100 | 3.5 | 1 | 3.8° x 5.1° | M30.5 P=0.5 | 2/3" |

# MEGAPIXEL HIGH RESOLUTION 1" C-MOUNT LENSES

| | Focal length ( mm) | Aperture (f-number) | MOD (m) | Angle of view (Horiz. x Vert.) | Filter screw | Sensor Format |
|---|---|---|---|---|---|---|
| **CM0618GS** | 6 | 1.8 | 0.1 | 96.8° x 79.4° | no filter thread | 1" |
| **CM0814GS** | 8 | 1.4 | 0.1 | 79.7° x 63.0° | M55 P=0.75 | 1" |
| **CM1214GS** | 12 | 1.4 | 0.3 | 55.6° x 42.5° | M27 P=0.5 | 1" |
| **CM1614GS** | 16 | 1.4 | 0.3 | 44.3° x 33.6° | M35.5 P=0.5 | 1" |
| **CM2514GS** | 25 | 1.4 | 0.3 | 29.3° x 22.0° | M35.5 P=0.5 | 1" |
| **CM3514GS** | 35 | 1.4 | 0.3 | 20.9° x 15.8° | M35.5 P=0.5 | 1" |
| **CM5014GS** | 50 | 1.4 | 0.5 | 14.5° x 10.8° | M40.5 P=0.5 | 1" |
| **CM7518GS** | 75 | 1.8 | 1.0 | 9.7° x 7.3° | M46.5 P=0.75 | 1" |

# C-MOUNT LENSES

## HIGH SPEED F0.95 C-MOUNT LENSES

These light-sensitive lenses are optimized for high-speed cameras. Our C-mount lenses in 1" format are designed for focal lengths of 17, 25 and 50 mm and are well suited for low-light applications.

Common applications include:
- Digital microscopy
- Motion analysis
- Transportation inspection
- Measurement systems
- Holographic imaging
- High-speed bottle inspection

| | Focal length (mm) | Aperture (f-number) | MOD (m) | Angle of view (Horiz. x Vert.) | Filter screw | Sensor Format |
|---|---|---|---|---|---|---|
| **CHS17095** | 17 | 0.95 | 0.5 | 22.0° x 29.0° | M40.5 P=0.5 | 2/3″ |
| **CHS25095** | 25 | 0.95 | 0.5 | 21.7° x 28.7° | M40.5 P=0.5 | 1″ |
| **CHS50095** | 50 | 0.95 | 0.7 | 11.0° x 14.6° | M62.0 P=0.75 | 1″ |

## MEGAPIXEL LOW DISTORTION VARIFOCAL C-MOUNT LENSES

### The CVM series maintains straight lines in wide angle images!

Utilising advanced lens technology to XD (extra low Dispersion) glass and an aspherical lens, this new multi-megapixel lens will pave the way for more possibilities in applications such as high end surveillance.

**Features**
- High resolution, compatible with sensors of over 1 megapixel
- Compact design and low distortion: Where "normal" 4.5mm lenses for 1/2" have a distortion of between 20% and 30%, this brand new aspherical lenses have a distortion of below 0.5% (T) on a 1/2" sensor.

| | Focal length (mm) | Aperture (max.) | MOD (m) | TV Distortion | Angle of View (H x V) Wide | Angle of View (H x V) Tele | Sensor Format |
|---|---|---|---|---|---|---|---|
| **CVM0411ND** | 4.4 - 11 | 1.6 | 0.3 | W: -0.2% T: 0.35% | 76.6 ° x 61.2° | 36.7° x 28.0° | 1/1.8″ |
| **CVM1040ND** | 10 - 40 | 1.6 | 0.5 | W: -0.17% T: 0.1% | 39.5° x 48.3° | 10.5° x 13.1° | 1/1.8″ |
| **CVM1664NDGS** | 16 - 64 | 1.8 | 1.0 | W: -3.4% T: 0.2% | 45.9° x 34.2° | 11.7° x 8.8° | 1″ |

## MEGAPIXEL LOW DISTORTION CCTV LENSES (ND SERIES)

**Features**

- High resolution, compatible with sensors of over 1 megapixel
- High performance at less than WD500 mm
- Low color aberration and low TV distortion
- Micro-photography without extension ring

| | Focal length ( mm) | Aperture (f-number) | MOD (m) | TV Distortion | Angle of view (Horiz. x Vert.) | Filter screw | Sensor Format |
|---|---|---|---|---|---|---|---|
| CMFA0420ND | 4 mm | 2.0 | 0.1 | 0.91% | 60° x 75.1° | M27 P=0.5 | 1/2″ |
| CMFA0622ND | 6 mm | 2.2 | 0.1 | -0.01% | 40.5° x 52.3° | M30.5 P=0.5 | 1/2″ |
| CMFA1022ND | 10 mm | 2.2 | 0.1 | -0.08% | 26.3° x 34.6° | M27 P=0.5 | 1/2″ |
| CMFA1520ND | 15 mm | 2.0 | 0.1m~∞ | -0.09% | 24.1° x 31.8° | M27 P=0.5 | 2/3″ |
| CMFA2020ND | 20 mm | 2.0 | 0.1m~1m | -0.10% | 18.2° x 24.1° | M27 P=0.5 | 2/3″ |
| CMFA2520ND | 25 mm | 2.0 | 0.15m~1m | -0.01% | 14.8° x 19.6° | M27 P=0.5 | 2/3″ |
| CMFA3020ND | 30 mm | 2.0 | 0.2m~1m | -0.02% | 12.6° x 16.7° | M27 P=0.5 | 2/3″ |
| CMFA3519ND | 35 mm | 1.9 | 0.3m~1m | -0.03% | 10.8° x 14.3° | M27 P=0.5 | 2/3″ |
| CMFA5025ND | 50 mm | 2.5 | 0.4m~1m | -0.03% | 7.8° x 10.4° | M27 P=0.5 | 2/3″ |
| CMFA7538ND | 75 mm | 3.8 | 0.4m~1m | -0.01% | 5.1° x 6.8° | M27 P=0.5 | 2/3″ |

## 3 MEGAPIXEL C-MOUNT LENSES (C3M SERIES)

**Features:**

- Compatible with over 3 megapixel sensors
- Low optical distortion
- High performance and excellent value for money
- Focal length 4 mm coming soon!
- Lock screws for manual iris and manual focus.

| | Focal length ( mm) | Aperture (f-number) | MOD (m) | Angle of view (Horiz. x Vert.) | Weight (g) | Sensor Format |
|---|---|---|---|---|---|---|
| C3M0616V2 | 6 mm | 1.6 | 0.15 | 45.1°x 71.1° | 91.1 | 1/1.8" |
| C3M0814V2 | 8 mm | 1.4 | 0.20 | 48.3"x 36.4° | 64.8 | 1/1.8" |
| C3M1216V2 | 12 mm | 1.6 | 0.15 | 40.2° x 30.5° | 68.2 | 2/3″ |
| C3M1616V2 | 16 mm | 1.6 | 0.30 | 29.5° x 22.6° | 89 | 2/3″ |
| C3M2518V2 | 25 mm | 1.8 | 0.30 | 19.6° x 15.2° | 55 | 2/3″ |
| C3M3520V2 | 35 mm | 2.0 | 0.40 | 14.2° x 10.5° | 56 | 2/3″ |
| C3M5025V2 | 50 mm | 2.5 | 0.50 | 10.3° x 7.3° | 79 | 2/3″ |
| C3M7528V2 | 75 mm | 2.8 | 1.20 | 9.2° x 6.9° | 167.5 | 1" |

# C-MOUNT LENSES

## 5 MEGAPIXEL HIGH RESOLUTION MACHINE VISION LENSES

### Suitable for inspection and alignment, high accuracy

- Suitable for 5 mega upto 10 megapixel sensors
- Focal length longer than f=16mm is compatible with 1.1 sensor
- High resolution at whole range of WD and excellent brightness
- Robust design, suitable for machine vision applications
- Two different mount types available : slip mount for all lenses, fix mount for 25 mm, 50 mm, 75 mm

| | Focal length ( mm) | Aperture (f-number) | MOD (m) | TV Distortion | max. Magnification | Filter size | Sensor Format |
|---|---|---|---|---|---|---|---|
| **C5M0528V2** | 5 | 2.8 | 0.05 | 0.29% | 0.044x | M55 P=0.75 | 2/3" |
| **C5M0818V2** | 8 | 1.8 | 0.1 | 0.31% | 0.078x | M40.5 P=0.75 | 2/3" |
| **C5M1214V2** | 12 | 1.4 | 0.1 | -0.31% | 0.1x | M37.5 P=0.5 | 2/3" |
| **C5M1618GSV2** | 16 | 1.8 | 0.033 | -0.28% | 0.3x | M49 P=0.75 | 1.1" |
| **C5M2514GSV2** | 25 | 1.4 | 0.08 | -0.09% | 0.3x | M52 P=0.75 | 1.1" |
| **C5M3514GSV2** | 35 | 1.4 | 0.11 | 0.07% | 0.3x | M46 P=0.75 | 1.1" |
| **C5M5018GSV2** | 50 | 1.8 | 0.192 | -0.01% | 0.3x | M49 P=0.75 | 1.1" |
| **C5M7518GSV2** | 75 | 1.8 | 0.29 | 0.001% | 0.3x | M55 P=0.75 | 1.1" |

* TV distortion indicates a value for the closest working distance with 2/3 sensor

## 6/8 MEGAPIXEL COMPACT MACHINE VISION LENSES

### Compact designed models

- from f6~f75 mm for 2/3" or 1/1.8" sensors
- High resolution for high megapixel cameras
- Lock screws for iris and focus for all models

| | Focal length ( mm) | Aperture (f-number) | MOD (m) | Optical Distortion | Angle of view (Horiz. x Vert.) | Weight (g) | Sensor Format |
|---|---|---|---|---|---|---|---|
| **CK8M0828S23** | 8 | 2.8 | 0.1 | -1.51% | 47.06°x 54.97 ° | 80.7 | 2/3" |
| **CK8M1628S23** | 16 | 2.8 | 0.1 | -0.2% | 24.38° x 28.94° | 57.1 | 2/3" |

| | Focal length ( mm) | Aperture (f-number) | MOD (m) | Distortion | Angle of view (Horiz. x Vert.) | Filter size | Sensor Format |
|---|---|---|---|---|---|---|---|
| **CK6M0628S118** | 6 | 2.0 | 0.035 | -1.5% opt. | 44.8° x 63.5° | - | 1/1.8" |
| **CK6M0828S118** | 8 | 2.0 | 0.1 | -0.03% TV | 34° x 49.3° | M27 P=0.5 | 1/1.8" |
| **CK6M1228S118** | 12 | 2.0 | 0.1 | -0.12% TV | 23.4° x 34.4° | M27 P=0.5 | 1/1.8" |
| **CK6M1628S118** | 16 | 2.0 | 0.1 | -0.08% TV | 17.5° x 25.7° | M27 P=0.5 | 1/1.8" |
| **CK6M2528S118** | 25 | 2.0 | 0.1 | -0.02% TV | 11° x 16.3° | M25 P=0.5 | 1/1.8" |
| **CK6M3528S118** | 35 | 2.0 | 0.15 | -0.02% TV | 7.6° x 11.3° | M27 P=0.5 | 1/1.8" |
| **CK6M5028S118** | 50 | 2.0 | 0.3 | 0.11% opt. | 5.4° x 8° | M25.5 P=0.5 | 1/1.8" |

# 10 MEGAPIXEL C-MOUNT LENSES

## Designed for 4/3" sensors (Ø 23 mm format)

**Features**

- Large image format of Ø 23 mm
- High defined picure throughout the entire image format
- Filters are available for all models

| | Focal length ( mm) | Aperture (f-number) | MOD (m) | Optical Distortion | Angle of view (Horiz. x Vert.) | Filter size | Image Format |
|---|---|---|---|---|---|---|---|
| **CK10M1220S43** | 12 | 2.0 | 0.15 | -2.4% | 61.1° x 75.5° | M77 P=0.75 | 4/3" |
| **CK10M1620S43** | 16 | 2.0 | 0.1 | -2.81% | 47.3° x 60.9° | M58 P=0.75 | 4/3" |
| **CK10M2520S43** | 25 | 2.0 | 0.15 | -0.66% | 31° x 40.6° | M46 P=0.75 | 4/3" |
| **CK10M3520S43** | 35 | 2.0 | 0.2 | -0.56% | 22.4° x 29.6° | M40.5 P=0.5 | 4/3" |
| **CK10M5020S43** | 50 | 2.0 | 0.3 | -0.14% | 15.7° x 20.9° | M40.5 P=0.5 | 4/3" |
| **CK10M8520S43** | 85 | 2.0 | 1.2 | -0.04% | 9.3° x 12.1° | M77 P=0.75 | 4/3" |

# 12 MEGAPIXEL C-MOUNT LENSES

## Designed for 12 Megapixel sensors

**Features**

- High performance from macro distance range to infinity
- Suited fine for factory automation and also high end surveillance

| | Focal length ( mm) | Aperture (f-number) | MOD (m) | Optical Distortion | Angle of view (Horiz. x Vert.) | Filter size | Image Format |
|---|---|---|---|---|---|---|---|
| **CK12M1628S11** | 16 | 2.8 | 0.08 | -1.3% | 44.9° x 33.9° | M35.5 P=0.5 | 1.1" |
| **CK12M2528S11** | 25 | 2.8 | 0.12 | 0.4% | 29.6° x 22.1° | M35.5 P=0.5 | 1.1" |
| **CK12M3528S11** | 35 | 2.8 | 0.18 | -0.21% | 21.4° x 15.9° | M35.5 P=0.5 | 1.1" |
| **CK12M5028S11** | 50 | 2.8 | 0.275 | -0.05% | 11.2° x 15.1° | M35.5 P=0.5 | 1.1" |

# KNOWLEDGE BASE

## Do you already know optowiki.info?

You will find many interesting questions about optics

...and surprising answers!


Q: CAN S-MOUNT LENSES BE AS GOOD AS C-MOUNT LENSES?

A: EVEN BETTER!
ALTHOUGH THERE IS A NATURAL LIMIT ON THE QUALITY OF S-MOUNT LENSES, SOME OF THEM PROVIDE A QUALITY NOT FOUND IN THE C-MOUNT AREA, OR ONLY FOR DRAMATICALLY HIGHER PRICES.

Q: WHY IS THE CAMERA IMAGE TOTALLY BLURRED!?

A: ...NOT JUST 'A LITTLE' OUT OF FOCUS!?
IT COULD BE THAT YOU ARE USING A CS-MOUNT LENS ON A C-MOUNT CAMERA.
AT CS-MOUNT CAMERAS IT IS ABOUT 5MM LESS FROM THE LEADING EDGE OF THE MECHANICS TO THE SENSOR.

- **Interactive graphics**
- **Online calculators**
- **Optics glossary**
- **Trouble shooting**

# ACCESSORIES

## S-MOUNT (M12X0.5)

ST05

### M12 Extension ring 5mm

Material: Aluminium, Height: 5 mm

ST10

### M12 Extension ring 10mm

Material: Aluminium, Height: 10 mm

M12TM14

### M12 to M14 Adapter

Material: Aluminium. For using M12x0.5 lenses in M14x0.5 mounts

NEW

SH04F85

### S-mount lens holder 8.5mm

Material: Plastic, mounting hole distance 22mm, Height: 8.9 mm, Base width: 19.8 mm

SH02M13V3

### S-mount lens holder 13mm

Material: Plastic, mounting hole distance 22mm, Height: 13 mm, Width: 20.3 mm

SH03H16V4

### S-mount lens holder 16mm

Material: Plastic, mounting hole distance 22mm, side hole for lock screw. Inner height 5mm

LRM12V2

### M12 x 0.5 Lock Ring

Material: Aluminium, Black anodized, Height: 2 mm, Diameter: 15.8 mm

FAM12D14H08

### Iris/Filter adapter for M12x0.5

allows to add a filter to standard S-Mount (M12x0.5) Lenses or to modify the F-Number.

NEW

SHM16

### M16 to S-Mount Lens Holder

Material: Plastic

NEW

DC-D27H11 / DC-D46H27

### Scratch Resistant Dome Cover

Hard coating 1.2 or 2 inch dome with plating, 3.5/7.6cm, PE film

## C-MOUNT

ADCTS

### C-Mount to CS-Mount Adapter

with male and female thread, 5mm effective height, for use of c-mount lenses with cs-mount cameras

CT40

### Extension Tube 40mm

Material: Aluminium, Height: 40 mm
40mm extension tube for C-Mount lenses.

AD02F

### S-Mount to C-Mount Adapter Flat

Male c-mount thread and female M12x0.5 thread, for use of s-mount lenses in c-mount cameras.

AD03H

### S-Mount to C-Mount Adapter High

Male c-mount thread and female M12x0.5 thread, for use of s-mount lenses in c-mount cameras.

AD01S

### S-Mount to C-Mount Adapter Standard

Male c-mount thread and female M12x0.5 thread, for use of s-mount lenses in c-mount cameras.

AD04M

### S-Mount to C-Mount Adapter Medium

Male c-mount thread and female M12x0.5 thread, H: 6mm, for s-mount lenses in c-mount cameras.

LRICM / LROCM

### C-Mount Lock Rings

Outside thread: Dia.: 20mm, H: 2.5mm
Inside thread: Dia.: 31mm, Height 2mm

ADM16TCF / ADM16TCM

### M16 to C-Mount Adapters

Outside thread: C-Mount (1-32 UN 2A)
Inside thread: M16x0.5mm

# TELECENTRIC LENSES

## DOUBLE SIDE TELECENTRIC LENSES

### These lenses are the best choice for accurate dimensional measurent of large part samples.

**Despite the fact that we display a wide range of catalog lenses here, we offer significantly more customized lens designs.**
For example, lenses having folded optical paths, non-circular geometry, ultra-short working distances, and, to our knowledge, the world's smallest telezentrical lens. No perspective error over the whole FOV

- IRIS diaphragm for adjusting DOF
- Well suited for High Megapixel sensors like 5M, 4M, 16M, 29M (Diagonal length from 11mm to 43mm)
- Good for engine parts, metal parts, molding and casting semiconductor parts application
- Optional mounts : M58, C, F, customized

## T29M SERIES

| | Magnification | WD (mm) | Res. Obj. (µm) | NA (obj.) | Aperture (wF#) | DOF (µm) | Telecentricity (<degree) | Optical Distort. (%) | Sensor size (max.) | Standard mount |
|---|---|---|---|---|---|---|---|---|---|---|
| **T29M-015-545** | 0.15X | 545 | 34.41 | 0.0097 | 7.7 | 15050 | 0.05 | 0.03 | 36 x 24 mm | M58 |
| **T29M-024-400I** | 0.24X | 400 | 28 | 0.012 | 10 | 7640 | 0.05 | 0.03 | 43mm | M58 |
| **T29M-038-265I** | 0.38X | 265 | 17.6 | 0.019 | 10 | 3050 | 0.04 | 0.03 | 43mm | M58 |
| **T29M-0563-160I** | 0.563X | 160 | 12 | 0.028 | 10 | 1270 | 0.05 | 0.04 | 43mm | M58 |
| **T29M-0664-181I** | 0.664X | 181 | 8.4 | 0.04 | 8.3 | 1110 | 0.05 | 0.05 | 43mm | M58 |

## T4M SERIES

| | Magnification | WD (mm) | Res. Obj. (µm) | NA (obj.) | Aperture (wF#) | DOF (mm) | Telecentricity (<degree) | Optical Distort. (%) | Sensor size (max.) | Standard mount |
|---|---|---|---|---|---|---|---|---|---|---|
| **T4M-01-470I** | 0.1X | 470 | 51.6 | 0.0065 | 7.7 | 61.6 | 0.05 | 0.026 | 1.2" | F |

## TDC SERIES

| | Magnification | WD (mm) | Res. Obj. (µm) | NA (obj.) | Aperture (wF#) | DOF (mm) | Telecentricity (<degree) | Optical Distort. (%) | Sensor size (max.) | Standard mount |
|---|---|---|---|---|---|---|---|---|---|---|
| **TDC-0044-398** | 0.044X | 398 | 116 | 0.0029 | 7.5 | 310 | 0.05 | 0.03 | 1/2" (8mm) | C |
| **TDC-0061-398** | 0.061X | 398 | 78 | 0.0043 | 7 | 150 | 0.05 | 0.03 | 2/3" (11mm) | C |
| **TDC-012-230** | 0.12X | 230 | 40.91 | 0.0082 | 7.3 | 40.5 | 0.04 | 0.03 | 2/3" (11mm) | C |
| **TDC-0138-184** | 0.138X | 184 | 38.563 | 0.0095 | 7.5 | 30.7 | 0.05 | 0.03 | 2/3" (11mm) | C |
| **TDC-0157-160** | 0.157X | 160 | 32.259 | 0.0104 | 7.5 | 24.3 | 0.05 | 0.03 | 2/3" (11mm) | C |
| **TDC-0184-135** | 0.184X | 135 | 27.5 | 0.0122 | 7.5 | 17.7 | 0.04 | 0.05 | 2/3" (11mm) | C |
| **TDC-024-108** | 0.24X | 108 | 20.96 | 0.016 | 7.5 | 10.4 | 0.04 | 0.04 | 2/3" (11mm) | C |
| **TDC-0255-70** | 0.255X | 70 | 20.97 | 0.016 | 8 | 9.8 | 0.04 | 0.04 | 2/3" (11mm) | C |
| **TDC-035-72** | 0.35X | 72 | 14.399 | 0.0233 | 7.5 | 4.9 | 0.05 | 0.04 | 2/3" (11mm) | C |

I = Manual Iris, C = Coaxial, IC = Both

# OBJECT SIDE TELECENTRIC LENSES

## T47M SERIES

- This lens can be applied for 47MP sensor cameras which have 56.7mm diagonal length
- Good for various inspections like Flat Panel Display applications & automobile components
- High resolution and good telecentricity regarding of all series
- Iris diaphragm adapted for adjusting DOF

| | Magni-fication | WD (mm) | Res. Obj. (µm) | NA (obj.) | Aperture (wF#) | DOF (mm) | Telecentricity (<degree) | Optical Distort. (%) | Sensor size (max.) | Standard mount |
|---|---|---|---|---|---|---|---|---|---|---|
| **TD47M-02-542** | 0.2X | 542 | 26 | 0.013 | 7.7 | 8.4 | 0.03 | 0.04 | 47M (56.7mm) | M72 |
| **T47M-04-208I** | 0.4X | 208.3 | 14 | 0.024 | 8.3 | 2.3 | 0.04 | 0.04 | 47M (56.7mm) | M72 |
| **T47M-07-117I** | 0.7X | 117 | 7.7 | 0.0437 | 8 | 718µm | 0.04 | 0.07 | 47M (56.7mm) | M72 |
| **T47M-064-170I** | 0.64X | 170 | 8.4 | 0.04 | 8 | 860µm | 0.04 | 0.06 | 47M (56.7mm) | M72 |
| **T47M-087-137I** | 0.87X | 137 | 6.4 | 0.052 | 8.3 | 482µm | 0.04 | 0.07 | 47M (56.7mm) | M72 |
| **T47M-10-122C** | 1.0X | 122 | 6.7 | 0.05 | 10 | 440µm | 0.04 | 0.02 | 47M (56.7mm) | M72 |
| **T47M-13-105C** | 1.3X | 105 | 5.6 | 0.06 | 10.8 | 281µm | 0.03 | 0.03 | 47M (56.7mm) | M72 |
| **T47M-10-122** | 1.0X | 122 | 6.7 | 0.05 | 10 | 440µm | 0.04 | 0.02 | 47M (56.7mm) | M72 |
| **T47M-13-105** | 1.3X | 105 | 5.6 | 0.06 | 10.8 | 281µm | 0.03 | 0.03 | 47M (56.7mm) | M72 |

I = Manual Iris, C = Coaxial, IC = Both / DOF Calculation: Permissible of circle of confusion : 22µm

## T25M SERIES

- This telecentric lens supports up to 25 megapixel sensor cameras with 32mm diagonal length.
- It is compatible with 12M sensor camera according to the customer requirement
- High resolution lens & No perspective error over the whole FOV
- Iris diaphragm adapted for adjusting DOF
- Possible to change M48-Mount / F-Mount.

| | Magni-fication | WD (mm) | Res. Obj. (µm) | NA (obj.) | Aperture (wF#) | DOF (µm) | Telecentricity (<degree) | Optical Distort. (%) | Sensor size (max.) | Standard mount |
|---|---|---|---|---|---|---|---|---|---|---|
| **T25M-033-347I** | 0.33X | 347 | 16.8 | 0.0124 | 8 | 2940 | 0.03 | 0.02 | 25M (32mm) | M48 |
| **T25M-035-213I** | 0.35X | 213 | 14.39 | 0.0233 | 7.5 | 2200 | 0.03 | 0.08 | 25M (32mm) | M48 |
| **T25M-045-270I** | 0.45X | 270 | 9.31 | 0.036 | 6.25 | 1110 | 0.03 | 0.08 | 25M (32mm) | F |
| **T25M-046-150I** | 0.46X | 150 | 10.2 | 0.033 | 7 | 1200 | 0.03 | 0.04 | 25M (32mm) | M48 |
| **T25M-05-237I** | 0.5X | 237 | 8.4 | 0.04 | 6.25 | 900 | 0.03 | 0.08 | 25M (32mm) | M48 |
| **T25M-06-132I** | 0.6X | 132 | 7 | 0.048 | 6.3 | 630 | 0.03 | 0.04 | 25M (32mm) | M48 |
| **T25M-08-240I** | 0.8X | 240 | 6.3 | 0.0533 | 7.5 | 421 | 0.03 | 0.04 | 25M (32mm) | F |
| **T25M-082-270I** | 0.82X | 270 | 6.1 | 0.0546 | 7.5 | 401 | 0.03 | 0.04 | 25M (32mm) | F |
| **T25M-092-170I** | 0.92X | 170 | 5.2 | 0.064 | 7.14 | 303 | 0.04 | 0.03 | 25M (32mm) | M48 |
| **T25M-12-155I** | 1.2X | 155 | 4.2 | 0.08 | 7.5 | 187 | 0.03 | 0.03 | 25M (32mm) | F |
| **T25M-135-110I** | 1.35X | 110 | 4.5 | 0.075 | 9 | 178 | 0.03 | 0.01 | 25M (32mm) | F |
| **T25M-15-100I** | 1.5X | 100 | 4.47 | 0.075 | 10 | 160 | 0.03 | 0.03 | 25M (32mm) | F |
| **T25M-30-78/C** | 3.0X | 78 | 3.4 | 0.1 | 15 | 60 | 0.04 | 0.09 | 25M (32mm) | F |

I = Manual Iris, C = Coaxial, IC = Both / DOF Calculation: Permissible of circle of confusion : 18µm

# TELECENTRIC LENSES

## T12M SERIES

- High resolution lens, no perspective error
- Compatible with 12M sensors Ø28mm
- Manual iris to adjust DOF vs. resolution

| | Magni-fication | WD (mm) | Res. Obj. (µm) | NA (obj.) | Aperture (wF#) | DOF (µm) | Telecentricity (<degree) | Optical Distort. (%) | Sensor size (max.) | Standard mount |
|---|---|---|---|---|---|---|---|---|---|---|
| **T12M-055-271/C** | 0.55X | 271 | 9.1 | 0.037 | 7.4 | 1000 | 0.03 | 0.01 | 12M (28mm) | M48 |
| **T12M-0785-275/C** | 0.785X | 275 | 6.3 | 0.053 | 7.4 | 528 | 0.03 | 0.01 | 12M (28mm) | M48 |

I = Manual Iris, C = Coaxial, IC = Both / DOF Calculation: Permissible of circle of confusion : 22µm

## TF8M SERIES

- High telecentricity: no perspective error.
- Telecentric lenses for large detectors 4M (15.2mm x 15.2mm) and 1.2"
- Manual iris to adjust DOF vs. resolution
- Wide magnification range from 0.315X to 2.0X
- Great for semiconductor & SMT & PCB components measurement

| | Magni-fication | WD (mm) | Res. Obj. (µm) | NA (obj.) | Aperture (wF#) | DOF (µm) | Telecentricity (<degree) | Optical Distort. (%) | Sensor size (max.) | Standard mount |
|---|---|---|---|---|---|---|---|---|---|---|
| **TF8MHR-0315-130I** | 0.315X | 130 | 13.3 | 0.0252 | 6.25 | 2780 | 0.03 | 0.03 | 8M (23mm) | F |
| **TF8MHR-0318-265I** | 0.318X | 265 | 10.6 | 0.0318 | 5 | 2180 | 0.03 | 0.08 | 8M (23mm) | F |
| **TF8MHR-0348-130I** | 0.348X | 130 | 12.1 | 0.0278 | 6.25 | 2300 | 0.03 | 0.04 | 8M (23mm) | F |
| **TF8MHR-0348-200I** | 0.348X | 200 | 12 | 0.0289 | 6 | 2180 | 0.03 | 0.02 | 8M (23mm) | F |
| **TF8MHR-0385-130I** | 0.385X | 130 | 12.4 | 0.027 | 7.1 | 2100 | 0.015 | 0.03 | 8M (23mm) | F |
| **TF8MHR-042-132I** | 0.42X | 132 | 5.4 | 0.0627 | 3.35 | 835.6 | 0.03 | 0.03 | 8M (23mm) | F |
| **TF8M-042-130I** | 0.42X | 130 | 16 | 0.021 | 10 | 2500 | 0.023 | 0.1 | 8M (23mm) | F |
| **TF8MHR-049-132I** | 0.49X | 132 | 7.5 | 0.0446 | 5.5 | 1010 | 0.03 | 0.05 | 8M (23mm) | F |
| **TF8MHR-05-130I** | 0.5X | 130 | 9.4 | 0.0357 | 7 | 1230 | 0.03 | 0.05 | 8M (23mm) | F |
| **TF8M-056-130I** | 0.56X | 130 | 12.7 | 0.028 | 10 | 1400 | 0.03 | 0.06 | 8M (23mm) | F |
| **TF8MHR-058-254I** | 0.58X | 254 | 5.8 | 0.058 | 5 | 653.9 | 0.03 | 0.08 | 8M (23mm) | F |
| **TF8MHR-06-130I** | 0.6X | 130 | 6.2 | 0.054 | 5.6 | 684.4 | 0.03 | 0.06 | 8M (23mm) | F |
| **TF8M-06-130I** | 0.6X | 130 | 11.6 | 0.029 | 10.4 | 1300 | 0.23 | 0.1 | 8M (23mm) | F |
| **TF8MHR-06-258I** | 0.6X | 258 | 5.6 | 0.06 | 5 | 611.1 | 0.03 | 0.03 | 8M (23mm) | F |
| **TF8MHR-064-130I** | 0.64X | 130 | 5.8 | 0.0576 | 5.56 | 597.3 | 0.02 | 0.06 | 8M (23mm) | F |
| **TF8MHR-06-310I** | 0.6X | 310 | 7 | 0.048 | 6.25 | 671.4 | 0.03 | 0.08 | 8M (23mm) | F |
| **TF8MHR-07-130I** | 0.7X | 130 | 5.1 | 0.066 | 5.3 | 476 | 0.03 | 0.05 | 8M (23mm) | F |
| **TF8MHR-10-157I** | 1.0X | 157 | 4.7 | 0.071 | 7 | 308 | 0.03 | 0.06 | 8M (23mm) | F |
| **TF8MHR-20-50/C** | 2.0X | 50 | 3 | 0.112 | 8.93 | 98.2 | 0.03 | 0.04 | 8M (23mm) | F |

Possible to change mount. For Robot guidance applications we recommend metrical threads (and not bajonett F-mount) due to the higher mechanical stability.

## TC4M SERIES

- High telecentricity: no perspective error.
- Telecentric lenses for large detectors 4M (Ø16mm) and 1.2"
- Manual iris to adjust DOF vs. resolution
- Wide magnification range from 0.15X to 3X
- Great for semiconductor & SMT & PCB components measurement

| | Magni-fication | WD (mm) | Res. Obj. (µm) | NA (obj.) | Aperture (wF#) | DOF (µm) | Telecentricity (<degree) | Optical Distort. (%) | Sensor size (max.) | Standard mount |
|---|---|---|---|---|---|---|---|---|---|---|
| **TC4MHR-015-255I** | 0.15X | 255 | 31.4 | 0.0107 | 7 | 13.68mm | 0.023 | 0.01 | 1" (16mm) | C |
| **TC4MHR-016-240I** | 0.16X | 240 | 30.5 | 0.011 | 7 | 12.03mm | 0.03 | 0.01 | 1" (16mm) | C |
| **TC4MHR-0215-163I** | 0.215X | 163 | 17.65 | 0.019 | 5.6 | 5300 | 0.03 | 0.03 | 1" (16mm) | C |
| **TC4MHR-0234-130I** | 0.234X | 130 | 15.97 | 0.021 | 5.6 | 4500 | 0.03 | 0.031 | 1" (16mm) | C |
| **TC4MHR-0234-200I** | 0.234X | 200 | 16 | 0.021 | 5.6 | 4500 | 0.03 | 0.03 | 1" (16mm) | C |
| **TC4MHR-026-130I** | 0.26X | 130 | 14.3 | 0.0234 | 5.6 | 3644 | 0.03 | 0.031 | 1" (16mm) | C |
| **TC4MHR-026-200I** | 0.26X | 200 | 14.3 | 0.0234 | 5.6 | 3644 | 0.03 | 0.031 | 1" (16mm) | C |
| **TC4MHR-0275-240I** | 0.275X | 240 | 16.8 | 0.02 | 6.87 | 4000 | 0.025 | 0.04 | 1" (16mm) | C |
| **TC4MHR-0312-130I** | 0.312X | 130 | 7.21 | 0.0465 | 3.35 | 1514 | 0.03 | 0.031 | 1" (16mm) | C |
| **TC4MHR-0312-200I** | 0.312X | 200 | 9.7 | 0.0346 | 4.5 | 2000 | 0.03 | 0.03 | 1" (16mm) | C |
| **TC4MHR-037-240I** | 0.37X | 240 | 12.1 | 0.0277 | 6.66 | 2100 | 0.03 | 0.01 | 1" (16mm) | C |
| **TC4MHR-0445-130I** | 0.445X | 130 | 10.583 | 0.037 | 7 | 1560 | 0.023 | 0.065 | 1" (16mm) | C |
| **TC4MHR-07-65/C** | 0.7X | 65 | 6.57 | 0.051 | 6.8 | 610 | 0.03 | 0,03 | 1" (16mm) | C |
| **TC4MHR-08-130C** | 0.8X | 130 | 8.38 | 0.04 | 10 | 687 | 0.03 | 0.03 | 1" (16mm) | C |
| **TC4MHR-10-65/C** | 1.0X | 65 | 5.41 | 0.062 | 8 | 352 | 0.03 | 0.03 | 1" (16mm) | C |
| **TC4M-10-110/C** | 1.0X | 110 | 5.41 | 0.062 | 8 | 352 | 0.03 | 0.03 | 1" (16mm) | C |
| **TC4MHR-22-40/C** | 2.2X | 40 | 2.72 | 0.123 | 8.9 | 80.9 | 0.03 | 0.02 | 1" (16mm) | C |
| **TC4MHR-30-40/C** | 3.0X | 40 | 2.4 | 0.14 | 10.7 | 52.3 | 0.03 | 0.03 | 1" (16mm) | C |

I = Manual Iris, C = Coaxial, IC = Both / DOF Calculation: Permissible of circle of confusion : 22µm

# TELECENTRIC LENSES

## TC5M SERIES
## ULTRA HIGH RESOLUTION

**In combination with Megapixel cameras (up to 2/3" sensor), you can get high-quality images.**

- Designed for 5M sensor cameras (3.45m/pixel)
- Ultra High resolution and contrast with high NA.
- Very low distortion in whole field.
- Compact design with optional coaxial illumination.
- High telecentricity , No perspective error

## TC5M SERIES (WD: 65MM)

| | Magni-fication | WD (mm) | Res. Obj. (µm) | NA (obj.) | Aperture (wF#) | DOF (µm) | Telecentricity (<degree) | Optical Distort. (%) | Sensor size (max.) | Standard mount |
|---|---|---|---|---|---|---|---|---|---|---|
| **TC5M-05-65/C** | 0.5X | 65 | 8.4 | 0.04 | 6.25 | 1000 | 0.02 | 0.17 | 2/3" | C |
| **TC5M-08-65/C** | 0.8X | 65 | 5.25 | 0.064 | 6.25 | 390.6 | 0.02 | 0.13 | 2/3" | C |
| **TC5M-10-65/C** | 1.0X | 65 | 4.8 | 0.07 | 7.14 | 285.6 | 0.022 | 0.16 | 2/3" | C |
| **TC5M-10-65I/IC** | 1.0X | 65 | 4.8 | 0.07 | 7.14 | 285.6 | 0.022 | 0.16 | 2/3" | C |
| **TC5M-20-65/C** | 2.0X | 65 | 2.8 | 0.12 | 8.3 | 83 | 0.03 | 0.02 | 2/3" | C |
| **TC5M-20-65I/IC** | 2.0X | 65 | 2.8 | 0.12 | 8.3 | 83 | 0.03 | 0.02 | 2/3" | C |
| **TC5M-30-65/C** | 3.0X | 65 | 2.15 | 0.156 | 9.6 | 42.7 | 0.02 | 0.05 | 2/3" | C |
| **TC5M-30-65I/IC** | 3.0X | 65 | 2.15 | 0.156 | 9.6 | 42.7 | 0.02 | 0.05 | 2/3" | C |
| **TC5M-40-65/C** | 4.0X | 65 | 2.09 | 0.16 | 12.5 | 31.3 | 0.02 | 0.03 | 2/3" | C |
| **TC5M-40-65I/IC** | 4.0X | 65 | 2.09 | 0.16 | 12.5 | 31.3 | 0.02 | 0.03 | 2/3" | C |

I = Manual Iris, C = Coaxial, IC = Both / DOF Calculation: Permissible of circle of confusion : 20µm

## TC5M SERIES (WD: 110MM)

| | Magni-fication | WD (mm) | Res. Obj. (µm) | NA (obj.) | Aperture (wF#) | DOF (µm) | Telecentricity (<degree) | Optical Distort. (%) | Sensor size (max.) | Standard mount |
|---|---|---|---|---|---|---|---|---|---|---|
| **TC5M-03-110/C** | 0.3X | 110 | 15.3 | 0.0219 | 6.9 | 3040 | 0.04 | 0.02 | 2/3" | C |
| **TC5M-05-110/C** | 0.5X | 110 | 7.2 | 0.0465 | 5.38 | 861 | 0.02 | 0.02 | 2/3" | C |
| **TC5M-05-110I/IC** | 0.5X | 110 | 7.2 | 0.0465 | 5.38 | 861 | 0.02 | 0.02 | 2/3" | C |
| **TC5M-07-110/C** | 0.7X | 110 | 5.15 | 0.0651 | 5.38 | 439 | 0.02 | 0.02 | 2/3" | C |
| **TC5M-07-110I/IC** | 0.7X | 110 | 5.15 | 0.0651 | 5.38 | 439 | 0.02 | 0.012 | 2/3" | C |
| **TC5M-09-110/C** | 0.9X | 110 | 4.473 | 0.075 | 6 | 296 | 0.025 | 0.01 | 2/3" | C |
| **TC5M-10-110/C** | 1.0X | 110 | 4.36 | 0.077 | 6.5 | 260 | 0.03 | 0.03 | 2/3" | C |
| **TC5M-10-110I/IC** | 1.0X | 110 | 4.36 | 0.077 | 6.5 | 260 | 0.03 | 0.03 | 2/3" | C |
| **TC5M-18-110/C** | 1.8X | 110 | 4.14 | 0.081 | 11 | 95 | 0.03 | 0.03 | 2/3" | C |
| **TC5M-20-110/C** | 2.0X | 110 | 3.7 | 0.09 | 11 | 110 | 0.05 | 0.03 | 2/3" | C |
| **TC5M-20-110I/IC** | 2.0X | 110 | 3.7 | 0.09 | 11 | 110 | 0.05 | 0.03 | 2/3" | C |

I = Manual Iris, C = Coaxial, IC = Both / DOF Calculation: Permissible of circle of confusion : 20µm

## TC5M SERIES (WD: 130-170MM)

| | Magni-fication | WD (mm) | Res. Obj. (µm) | NA (obj.) | Aperture (wF#) | DOF (µm) | Telecentricity (<degree) | Optical Distort. (%) | Sensor size (max.) | Standard mount |
|---|---|---|---|---|---|---|---|---|---|---|
| **TC5M-0315-130I** | 0.315X | 130 | 13.3 | 0.0252 | 6.25 | 2052 | 0.03 | 0.03 | 2/3" | C |
| **TC5M-0348-130I** | 0.348X | 130 | 12.1 | 0.0278 | 6.25 | 2060 | 0.03 | 0.04 | 2/3" | C |
| **TC5M-042-130I** | 0.42X | 130 | 5.4 | 0.0627 | 3.35 | 759 | 0.03 | 0.03 | 2/3" | C |
| **TC5M-07-130I** | 0.7X | 130 | 5.33 | 0.063 | 5.5 | 449 | 0.03 | 0.05 | 2/3" | C |
| **TC5M-026-150I** | 0.26X | 150 | 13.7 | 0.0245 | 5.3 | 3100 | 0.03 | 0.08 | 2/3" | C |
| **TC5M-017-170I** | 0.17X | 170 | 9.73 | 0.058 | 5 | 4775 | 0.03 | 0.06 | 2/3" | C |
| **TC5M-03-170I** | 0.3X | 170 | 17.94 | 0.0187 | 8 | 3550 | 0.03 | 0.01 | 2/3" | C |
| **TC5M-065-170/C** | 0.65X | 170 | 5.78 | 0.058 | 5.6 | 530 | 0.02 | 0.06 | 2/3" | C |

I = Manual Iris, C = Coaxial, IC = Both / DOF Calculation: Permissible of circle of confusion : 20µm

# TELECENTRIC LENSES

## TCHR SERIES OF TELECENTRIC LENSES

- Designed for mega-pixel sensor cameras (4.65µm/pixel)
- High Resolution and contrast design in FOV
- WD Lineup of 65, 110, 130mm
- Support up to 2/3" cameras
- Various magnification with low-distortion design
- Uniform coaxial illumination over the whole FOV
- Coaxial versions are partly non-rotatable

## TCHR SERIES (WD: 65MM)

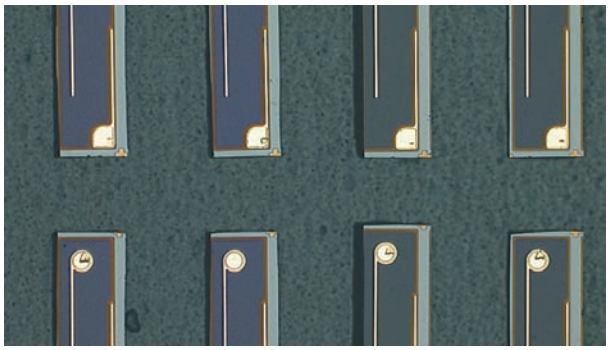
| | Magni-fication | WD (mm) | Res. Obj. (µm) | NA (obj.) | Aperture (wF#) | DOF (µm) | Telecentricity (<degree) | Optical Distort. (%) | Sensor size (max.) | Standard mount |
|---|---|---|---|---|---|---|---|---|---|---|
| **TCHR-013-60I** | 0.13X | 60 | 34.6 | 0.0097 | 6.7 | 31.7mm | 0.03 | 0.08 | 1/2" (8mm) | C |
| **TCHR-05-65/C** | 0.5X | 65 | 11.2 | 0.03 | 8.3 | 2600 | 0.02 | 0.17 | 2/3" (11mm) | C |
| **TCHR-05-65I** | 0.5X | 65 | 11.2 | 0.03 | 8.3 | 2600 | 0.02 | 0.17 | 2/3" (11mm) | C |
| **TCHR-08-65/C** | 0.8X | 65 | 6.7 | 0.05 | 8 | 1000 | 0.02 | 0.134 | 2/3" (11mm) | C |
| **TCHR-10-65/C** | 1.0X | 65 | 6.7 | 0.05 | 10 | 800 | 0.022 | 0.16 | 2/3" (11mm) | C |
| **TCHR-15-65/C** | 1.5X | 65 | 4.8 | 0.07 | 10.7 | 380 | 0.022 | 0.07 | 1/2" (8mm) | C |
| **TCHR-20-65/C** | 2.0X | 65 | 4.5 | 0.074 | 13.4 | 268 | 0.05 | 0.03 | 2/3" (11mm) | C |
| **TCHR-24-65/C** | 2.4X | 63.6 | 4.8 | 0.07 | 17.2 | 239 | 0.015 | 0.1 | 2/3" (11mm) | C |
| **TCHR-30-65/C** | 3.0X | 65 | 4.04 | 0.083 | 18 | 120 | 0.02 | 0.14 | 1/2" (8mm) | C |
| **TCHR-40-65/C** | 4.0X | 65 | 3 | 0.11 | 18.18 | 90 | 0.05 | 0.03 | 2/3" (11mm) | C |
| **TCHR-60-65/C** | 6.0X | 65 | 3 | 0.11 | 27.2 | 61 | 0.05 | 0.03 | 2/3" (11mm) | C |
| **TCHR-100-65/C** | 10.0X | 65 | 2.2 | 0.15 | 33.3 | 27 | 0.01 | 0.14 | 1/2" (8mm) | C |
| **TCHR-120-65/C** | 12.0X | 65 | 2.1 | 0.161 | 37.3 | 21 | 0.004 | 0.1 | 1/2" (8mm) | C |

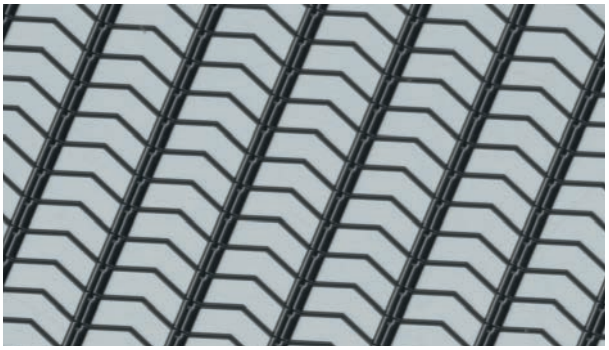
I = Manual Iris, C = Coaxial, IC = Both / DOF Calculation: Permissible of circle of confusion : 40µm

## TCHR SERIES (WD: 110MM)

| | Magni-fication | WD (mm) | Res. Obj. (µm) | NA (obj.) | Aperture (wF#) | DOF (µm) | Telecentricity (<degree) | Optical Distort. (%) | Sensor size (max.) | Standard mount |
|---|---|---|---|---|---|---|---|---|---|---|
| **TCHR-035-110-S12/C** | 0.35X | 110 | 21.1 | 0.016 | 11 | 4500 | 0.03 | 0.05 | 1/2" (8mm) | C |
| **TCHR-05-110-S13/C** | 0.5X | 110 | 11.2 | 0.03 | 8.3 | 2600 | 0.03 | 0.02 | 1/3" (6mm) | C |
| **TCHR-05-110/C** | 0.5X | 110 | 14.9 | 0.0225 | 11.1 | 3500 | 0.02 | 0.15 | 2/3" (11mm) | C |
| **TCHR-08-110/C** | 0.8X | 110 | 11.2 | 0.03 | 13.2 | 1650 | 0.017 | 0.15 | 2/3" (11mm) | C |
| **TCHR-10-110/C** | 1.0X | 110 | 6.7 | 0.05 | 10 | 800 | 0.03 | 0.15 | 2/3" (11mm) | C |
| **TCHR-15-110/C** | 1.5X | 110 | 7.0 | 0.048 | 15.6 | 555 | 0.01 | 0.15 | 2/3" (11mm) | C |
| **TCHR-15-110-S12/C** | 1.5X | 110 | 5.6 | 0.06 | 12.5 | 444 | 0.02 | 0.06 | 1/2" (8mm) | C |
| **TCHR-20-110/C** | 2.0X | 110 | 4.4 | 0.077 | 13 | 260 | 0.02 | 0.03 | 2/3" (11mm) | C |
| **TCHR-30-110/C** | 3.0X | 110 | 3.7 | 0.09 | 10.6 | 148 | 0.02 | 0.11 | 2/3" (11mm) | C |
| **TCHR-40-110/C** | 4.0X | 110 | 3.72 | 0.09 | 22.2 | 111 | 0.05 | 0.03 | 2/3" (11mm) | C |
| **TCHR-40-110I** | 4.0X | 110 | 3.72 | 0.09 | 22.2 | 111 | 0.05 | 0.03 | 2/3" (11mm) | C |
| **TCHR-60-110/C** | 6.0X | 110 | 3.72 | 0.09 | 33.4 | 74 | 0.05 | 0.03 | 2/3" (11mm) | C |
| **TCHR-80-110/C** | 8.0X | 110 | 3.72 | 0.09 | 44.4 | 56 | 0.05 | 0.19 | 2/3" (11mm) | C |

I = Manual Iris, C = Coaxial, IC = Both / DOF Calculation: Permissible of circle of confusion : 40µm





## TCHR SERIES (WD: 130MM-190MM)

| | Magni-fication | WD (mm) | Res. Obj. (µm) | NA (obj.) | Aperture (wF#) | DOF (µm) | Telecentricity (<degree) | Optical Distort. (%) | Sensor size (max.) | Standard mount |
|---|---|---|---|---|---|---|---|---|---|---|
| **TCHR-01-150I** | 0.1X | 150 | 40.4 | 0.0083 | 6.0 | 48.0mm | 0.04 | 0.05 | 1/2" (8mm) | C |
| **TCHR-0165-130I** | 0.165X | 130 | 28.2 | 0.012 | 7.1 | 20.8mm | 0.017 | 0.13 | 1/2" (8mm) | C |
| **TCHR-023-130I** | 0.23X | 130 | 20 | 0.016 | 7.1 | 10.7mm | 0.01 | 0.13 | 2/3" (11mm) | C |
| **TCHR-03-130I** | 0.3X | 130 | 17.6 | 0.019 | 7.9 | 7000 | 0.04 | 0.08 | 2/3" (11mm) | C |
| **TCHR-035-130I** | 0.35X | 130 | 14.1 | 0.0238 | 7.3 | 4800 | 0.035 | 0.08 | 1/2" (8mm) | C |
| **TCHR-10-190I** | 1.0X | 190 | 6.7 | 0.05 | 10 | 360 | 0.035 | 0.08 | 1/2" (8mm) | C |

I = Manual Iris, C = Coaxial, IC = Both / DOF Calculation: Permissible of circle of confusion : 40µm

# TELECENTRIC LENSES

## TCST SERIES

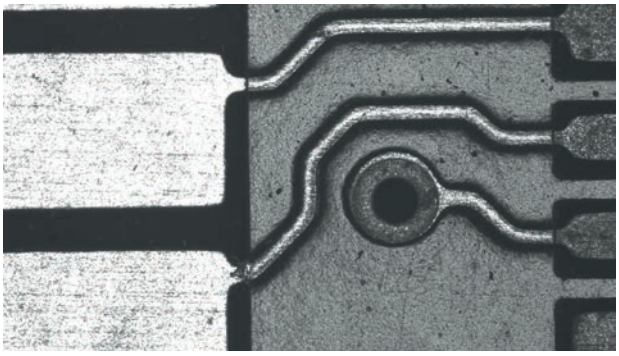
Telecentric lenses are useful for measuring without changing magnification across the DOF and coaxial illumination for even illumination (telecentric lighting). As shown below, we have a range of telecentric lenses with varying working distances, magnification, sensor sizes, and high or standard resolution.

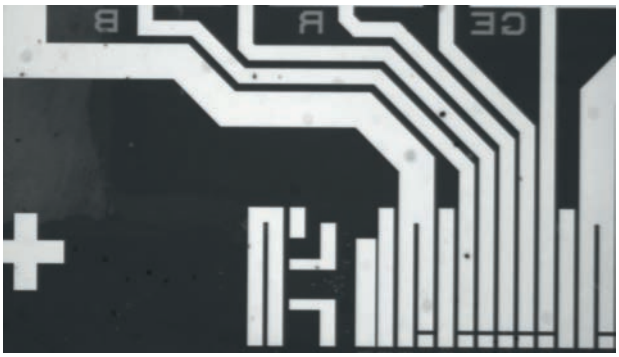
- Fixed magnification lens
- Low optical distortion & excellent telecentricity
- High resolution and high contrast design
- Various WD & magnifications
- Even coaxial illumination types
- **Remark:** To keep the prices low, some Coaxial versions are not fully rotatable

## TCST SERIES (WD: 40MM)

| | Magnification | WD (mm) | Res. Obj. (µm) | NA (obj.) | Aperture (wF#) | DOF (µm) | Telecentricity (<degree) | Optical Distort. (%) | Sensor size (max.) | Standard mount |
|---|---|---|---|---|---|---|---|---|---|---|
| **TCST-05-40/C** | 0.5X | 43 | 11.2 | 0.03 | 8.3 | 2600 | 0.03 | 0.08 | 1/2" (8mm) | C |
| **TCST-10-40/C** | 1.0X | 40 | 6.21 | 0.054 | 9.26 | 740 | 0.03 | 0.08 | 1/2" (8mm) | C |
| **TCST-15-40/C** | 1.5X | 40 | 5.32 | 0.063 | 11.9 | 423 | 0.03 | 0.25 | 1/2" (8mm) | C |
| **TCST-20-40/C** | 2.0X | 40 | 4.8 | 0.07 | 14.28 | 286 | 0.03 | 0.03 | 1/2" (8mm) | C |
| **TCST-30-40/C** | 3.0X | 40 | 4.8 | 0.07 | 21.5 | 191 | 0.02 | 0.26 | 1/2" (8mm) | C |
| **TCST-40-40/C** | 4.0X | 40 | 4.8 | 0.07 | 28.6 | 143 | 0.02 | 0.2 | 1/2" (8mm) | C |
| **TCST-50-40/C** | 5.0X | 40 | 4.2 | 0.08 | 31.25 | 100 | 0.02 | 0.05 | 1/2" (8mm) | C |
| **TCST-60-40/C** | 6.0X | 40 | 4.2 | 0.08 | 37.4 | 83 | 0.02 | 0.02 | 1/2" (8mm) | C |
| **TCST-80-40/C** | 8.0X | 40 | 4.2 | 0.08 | 50 | 63 | 0.01 | 0.03 | 1/2" (8mm) | C |

I = Manual Iris, C = Coaxial, IC = Both / DOF Calculation: Permissible of circle of confusion : 40µm





## TCST SERIES (WD: 65MM)

| | Magni-fication | WD (mm) | Res. Obj. (µm) | NA (obj.) | Aperture (wF#) | DOF (µm) | Telecentricity (<degree) | Optical Distort. (%) | Sensor size (max.) | Standard mount |
|---|---|---|---|---|---|---|---|---|---|---|
| **TCST-05-65/C** | 0.5X | 65 | 20.2 | 0.017 | 15.0 | 4800 | 0.03 | 0.04 | 1/2" (8mm) | C |
| **TCST-08-65/C** | 0.8X | 65 | 12.4 | 0.027 | 14.8 | 1850 | 0.03 | 0.03 | 1/2" (8mm) | C |
| **TCST-10-65/C** | 1.0X | 65 | 12.4 | 0.027 | 18.5 | 1450 | 0.03 | 0.03 | 1/2" (8mm) | C |
| **TCST-15-65/C** | 1.5X | 65 | 7 | 0.048 | 15.6 | 554 | 0.05 | 0.06 | 1/2" (8mm) | C |
| **TCST-20-65/C** | 2.0X | 65 | 5.2 | 0.065 | 15.4 | 308 | 0.02 | 0.03 | 1/2" (8mm) | C |
| **TCST-30-65/C** | 3.0X | 65 | 4.8 | 0.07 | 21.5 | 191 | 0.02 | 0.16 | 1/2" (8mm) | C |
| **TCST-40-65/C** | 4.0X | 66 | 4.4 | 0.076 | 26.3 | 132 | 0.04 | 0.03 | 1/2" (8mm) | C |
| **TCST-50-65/C** | 5.0X | 65.5 | 4.4 | 0.076 | 32.9 | 105 | 0.04 | 0.05 | 1/2" (8mm) | C |
| **TCST-60-65/C** | 6.0X | 65.3 | 4.4 | 0.076 | 39.5 | 88 | 0.04 | 0.06 | 1/2" (8mm) | C |
| **TCST-80-65/C** | 8.0X | 64.9 | 4.4 | 0.076 | 52.6 | 66 | 0.05 | 0.05 | 1/2" (8mm) | C |

I = Manual Iris, C = Coaxial, IC = Both / DOF Calculation: Permissible of circle of confusion : 40µm

## TCST SERIES (WD: 110MM)

| | Magni-fication | WD (mm) | Res. Obj. (µm) | NA (obj.) | Aperture (wF#) | DOF (µm) | Telecentricity (<degree) | Optical Distort. (%) | Sensor size (max.) | Standard mount |
|---|---|---|---|---|---|---|---|---|---|---|
| **TCST-05-110/C** | 0.5X | 110 | 20.21 | 0.0166 | 15 | 4800 | 0.05 | 0.05 | 1/2" (8mm) | C |
| **TCST-08-110/C** | 0.8X | 110 | 12.4 | 0.027 | 14.8 | 1850 | 0.05 | 0.05 | 1/2" (8mm) | C |
| **TCST-08-110I** | 0.8X | 110 | 12.4 | 0.027 | 14.8 | 1850 | 0.05 | 0.05 | 1/2" (8mm) | C |
| **TCST-10-113/C** | 1.0X | 113 | 14 | 0.024 | 20.8 | 1660 | 0.02 | 0.023 | 1/2" (8mm) | C |
| **TCST-12-110-S13/C** | 1.0X | 110 | 10.16 | 0.033 | 18 | 1000 | 0.03 | 0.03 | 1/3" (6mm) | C |
| **TCST-20-110/C** | 2.0X | 110 | 7.4 | 0.045 | 22.2 | 444 | 0.02 | 0.02 | 1/2" (8mm) | C |
| **TCST-24-110/C** | 2.4X | 107 | 7.4 | 0.045 | 26.7 | 370 | 0.02 | 0.07 | 1/2" (8mm) | C |
| **TCST-30-110/C** | 3.0X | 110 | 6.1 | 0.055 | 27.3 | 243 | 0.01 | 0.14 | 1/2" (8mm) | C |
| **TCST-40-110/C** | 4.0X | 110 | 5.6 | 0.06 | 33.45 | 167 | 0.01 | 0.16 | 1/2" (8mm) | C |
| **TCST-50-110/C** | 5.0X | 110 | 5.6 | 0.06 | 41.77 | 134 | 0.01 | 0.14 | 1/2" (8mm) | C |
| **TCST-60-110/C** | 6.0X | 110 | 5.6 | 0.06 | 50 | 111 | 0.01 | 0.1 | 1/2" (8mm) | C |
| **TCST-80-110/C** | 8.0X | 110 | 5.6 | 0.06 | 66.7 | 85 | 0.015 | 0.25 | 1/2" (8mm) | C |

I = Manual Iris, C = Coaxial, IC = Both / DOF Calculation: Permissible of circle of confusion : 40µm

## TCST LONG WD SERIES

- Long working distance telecentric lenses. (up to 400mm)
- Good for the alignment application where long WD is requested
- 4 types of WD (150, 200, 300, 400mm)
- Homogeneous illumination on the whole area
- High Resolution & low distortion

## TCST SERIES (WD: 150-170MM)

| | Magni-fication | WD (mm) | Res. Obj. (µm) | NA (obj.) | Aperture (wF#) | DOF (µm) | Telecentricity (<degree) | Optical Distort. (%) | Sensor size (max.) | Standard mount |
|---|---|---|---|---|---|---|---|---|---|---|
| **TCST-08-173/C** | 0.8X | 173 | 11.2 | 0.03 | 13.3 | 1660 | 0.04 | 0.07 | 1/2" (8mm) | C |
| **TCST-10-156/C** | 1.0X | 156 | 8.8 | 0.038 | 13.1 | 1000 | 0.04 | 0.07 | 1/2" (8mm) | C |
| **TCST-12-173/C** | 1.2X | 173 | 11.2 | 0.03 | 20 | 1110 | 0.04 | 0.13 | 1/2" (8mm) | C |
| **TCST-15-156/C** | 1.5X | 156 | 8.83 | 0.038 | 19.7 | 700 | 0.04 | 0.16 | 1/2" (8mm) | C |
| **TCST-16-173/C** | 1.6X | 173 | 11.2 | 0.03 | 26.7 | 834 | 0.04 | 0.18 | 1/2" (8mm) | C |
| **TCST-20-156/C** | 2.0X | 156 | 8.83 | 0.038 | 26.3 | 526 | 0.04 | 0.19 | 1/2" (8mm) | C |

I = Manual Iris, C = Coaxial, IC = Both / DOF Calculation: Permissible of circle of confusion : 40µm

## TCST SERIES (WD: 200-250MM)

| | Magni-fication | WD (mm) | Res. Obj. (µm) | NA (obj.) | Aperture (wF#) | DOF (µm) | Telecentricity (<degree) | Optical Distort. (%) | Sensor size (max.) | Standard mount |
|---|---|---|---|---|---|---|---|---|---|---|
| **TCST-075-220/C** | 0.75X | 220 | 8.9 | 0.0375 | 10 | 1400 | 0.03 | 0.08 | 1/2" (8mm) | C |
| **TCST-075-220-S23/C** | 0.75X | 220 | 9.1 | 0.037 | 10 | 1400 | 0.03 | 0.02 | 2/3" (11mm) | C |
| **TCST-10-220/C** | 1.0X | 220 | 7.4 | 0.045 | 11 | 880 | 0.03 | 0.01 | 2/3" (11mm) | C |
| **TCST-10-250-S118/C** | 1.0X | 250 | 7.45 | 0.045 | 11 | 484 | 0.03 | 0.081 | 1/1.8" (9mm) | C |
| **TCST-15-220-S12/C** | 1.5X | 220 | 7.45 | 0.045 | 16.6 | 590 | 0.03 | 0.13 | 1/2" (8mm) | C |
| **TCST-15-200/C** | 1.5X | 200 | 5 | 0.067 | 11.2 | 398 | 0.03 | 0.08 | 2/3" (11mm) | C |
| **TCST-20-200/C** | 2.0X | 200 | 4.2 | 0.08 | 12.5 | 250 | 0.03 | 0.02 | 1/2" (8mm) | C |
| **TCST-30-200/C** | 3.0X | 200 | 4.2 | 0.08 | 18.7 | 166 | 0.02 | 0.1 | 1/2" (8mm) | C |
| **TCST-40-200/C** | 4.0X | 200 | 4.19 | 0.08 | 25 | 125 | 0.015 | 0.13 | 1/2" (8mm) | C |

I = Manual Iris, C = Coaxial, IC = Both / DOF Calculation: Permissible of circle of confusion : 40µm

## TCST SERIES (WD: 300MM)

| | Magni-fication | WD (mm) | Res. Obj. (µm) | NA (obj.) | Aperture (wF#) | DOF (µm) | Telecentricity (<degree) | Optical Distort. (%) | Sensor size (max.) | Standard mount |
|---|---|---|---|---|---|---|---|---|---|---|
| **TCST-08-320/C** | 0.8X | 320 | 11.98 | 0.028 | 14.0 | 1750 | 0.03 | 0.03 | 1/2" (8mm) | C |
| **TCST-10-300/C** | 1.0X | 300 | 9.6 | 0.035 | 14.2 | 1100 | 0.02 | 0.03 | 1/2" (8mm) | C |
| **TCST-10-340/C** | 1.0X | 340 | 38.56 | 0.04 | 12.5 | 1000 | 0.03 | 0.04 | 1/2" (8mm) | C |
| **TCST-15-300/C** | 1.5X | 300 | 9.6 | 0.035 | 21.4 | 762 | 0.02 | 0.13 | 1/2" (8mm) | C |
| **TCST-20-300/C** | 2.0X | 300 | 9.6 | 0.035 | 28.5 | 571 | 0.01 | 0.17 | 1/2" (8mm) | C |

I = Manual Iris, C = Coaxial, IC = Both / DOF Calculation: Permissible of circle of confusion : 40µm

## TCST SERIES (WD: 400MM)

| | Magni-fication | WD (mm) | Res. Obj. (µm) | NA (obj.) | Aperture (wF#) | DOF (µm) | Telecentricity (<degree) | Optical Distort. (%) | Sensor size (max.) | Standard mount |
|---|---|---|---|---|---|---|---|---|---|---|
| **TCST-05-400/C** | 0.5X | 402 | 12.9 | 0.026 | 9.6 | 3.07mm | 0.03 | 0.05 | 1/2" (8mm) | C |

I = Manual Iris, C = Coaxial, IC = Both / DOF Calculation: Permissible of circle of confusion : 40µm

# TELECENTRIC LENSES

## TELECENTRIC ZOOM LENSES

**Features**

- Telecentricity at any magnification
- Suitable for high resolution megapixel cameras
- Magnification can be converted from 0.25x to 2.6x by using front converters
- Less shading, uniformity of intensity
- TV distortion less than 0.01%

Magnification changes with WD.
Telecentricity around this WD.

| | Magnification | WD ( mm) | Depth of Field | Resolution Obj. (µm) | NA (obj.) | Sensor size (max.) | Standard mount |
|---|---|---|---|---|---|---|---|
| **TZ0510** | 0.5× - 1.0× | 174 - 114 | 1.20 - 0.47 | 12.5 - 9.8 | 0.066 - 0.085 | 2/3" (8mm) | C |
| **TZ0513** | 0.5× - 1.3× | 173 - 97 | 1.84 - 0.52 | 8 - 6.4 | 0.044 - 0.059 | 2/3" (8mm) | C |

Values when the converter is attached to TZ0513:

| | Magnification | WD ( mm) | Application |
|---|---|---|---|
| **FC02510** | 0.25× - 1.0× | 323.2 - 115.6 | Front converter for TZ0513 |
| **FC1426** | 1.4× - 2.6× | 56.2 - 42.6 | Front converter for TZ0513 |

Depth of field is calculated assuming a horizontal 320 TV resolution using 1/2" (8mm) sensor cameras (permissible circle of confusion 40µ)

# TL4K SERIES
# 4K LINE SENSORS TELECENTRIC LENSES

**We offer several telecentric lenses for 4K line sensor cameras (7µm/Pixel)**

- High accuracy lens for 4K line sensor camera
- Very good telecentricity and high contrast image
- Low distortion over the whole field of view
- Manual iris for adjusting DOF vs. resolution
- Object-side telecentric lens

| | Magni-fication | WD (mm) | Res. Obj. (µm) | NA (obj.) | Aperture (wF#) | DOF (µm) | Telecentricity (<degree) | Optical Distort. (%) | Sensor size (max.) | Standard mount |
|---|---|---|---|---|---|---|---|---|---|---|
| **TL4K-05-237I** | 0.5X | 237 | 8.4 | 0.04 | 6.25 | 700 | 0.02 | 0.08 | 4K(7µm) 28mm | F |
| **TL4K-07-130I** | 0.7X | 130 | 5.1 | 0.066 | 5.3 | 303 | 0.04 | 0.05 | 4K(7µm) 28mm | F |
| **TL4K-077-140I** | 0.77X | 140 | 7 | 0.0477 | 8 | 544 | 0.03 | 0.06 | 4K(10µm) 40mm | M72 |
| **TL4K-092-170I** | 0.92X | 170 | 5.2 | 0.064 | 7.14 | 250 | 0.01 | 0.03 | 4K(7µm) 28mm | F |
| **TL4K-10-138I** | 1.0X | 138 | 6.1 | 0.055 | 9.1 | 364 | 0.04 | 0.02 | 4K(10µm) 40mm | F |
| **TL4K-20-102** | 2.0X | 102 | 3.7 | 0.09 | 11.1 | 111 | 0.03 | 0.07 | 4K(10µm) 40mm | F |

I = Manual Iris, C = Coaxial, IC = Both / Possible to change mount
For Robot guidance applications we recommend metrical threads (and not bajonett F-mount) due to the higher mechanical stability.

# TELECENTRIC LINE SCAN LENSES

## TL8K SERIES
## 8K LINE SENSORS TELECENTRIC LENS

- High accuracy lens for 8K line sensor camera
- Very good telecentricity and high contrast image
- Low distortion over the whole field of view
- Uniform coaxial illumination with LED coaxial guide
  - Provides easy alignment with sensor camera and illumination
  - **Inner** coaxial illumination, not external coaxial illumination
- Good for 8K TDI & general line scan cameras

| | Magni-fication | WD (mm) | Res. Obj. (µm) | NA (obj.) | Aperture (wF#) | DOF (µm) | Telecentricity (<degree) | Optical Distort. (%) | Sensor size (max.) | Standard mount |
|---|---|---|---|---|---|---|---|---|---|---|
| **TL8K-0467-278/C** | 0.467X | 278 | 12 | 0.028 | 8 | 1000 | 0.04 | 0.03 | 8K(7µm) 56mm | M72 |

## TL12K SERIES
## 12K LINE SENSORS TELECENTRIC LENSES

- High resolution & High contrast optical design
- Can be used for 8K to 12K line sensor
- Almost perfect telecentric design. (telecentricity: < 0.04 degree)
- Low distortion over the whole field of view
- Support upto 5um/pixel (12K Line sensor)
- Uniform coaxial illumination with LED coaxial guide
  - Provides easy alignment with sensor camera and illumination
  - **Inner** coaxial illumination, not an external coaxial illumination

| | Magni-fication | WD (mm) | Res. Obj. (µm) | NA (obj.) | Aperture (wF#) | DOF (µm) | Telecentricity (<degree) | Optical Distort. (%) | Sensor size (max.) | Standard mount |
|---|---|---|---|---|---|---|---|---|---|---|
| **TL12K-064-170I** | 0.64X | 170 | 8.4 | 0.04 | 8 | 390 | 0.04 | 0.06 | 12K(5µm) 60mm | M72 |
| **TL12K-07-117I** | 0.7X | 117 | 7.7 | 0.044 | 8 | 326 | 0.04 | 0.07 | 12K(5µm) 60mm | M72 |
| **TL12K-07-145/C** | 0.7X | 145 | 10.16 | 0.033 | 10.6 | 450 | 0.04 | 0.03 | 12K(5µm) 60mm | M72 |
| **TL12K-087-137I** | 0.87X | 137 | 6.5 | 0.052 | 8.3 | 219 | 0.04 | 0.07 | 12K(5µm) 60mm | M72 |
| **TL12K-10-122/C** | 1.0X | 122 | 6.7 | 0.05 | 10 | 200 | 0.04 | 0.02 | 12K(5µm) 60mm | M72 |
| **TL12K-20-107I** | 2.0X | 107 | 3.9 | 0.085 | 11.8 | 59 | 0.04 | 0.03 | 12K(5µm) 60mm | M72 |
| **TL12K-35-78/C** | 3.5X | 78 | 3.05 | 0.11 | 15.9 | 25.9 | 0.04 | 0.05 | 12K(5µm) 60mm | M72 |
| **TL12K-50-78/C** | 5.0X | 78 | 2.58 | 0.13 | 19.2 | 15.2 | 0.04 | 0.08 | 12K(5µm) 60mm | M72 |
| **TL12K-70-15/C** | 7.0X | 15 | 1.5 | 0.23 | 15.2 | 62 | 0.03 | 0.32 | 12K(5µm) 60mm | M72 |
| **TL12K-100-13/C** | 10.0X | 13.5 | 1.68 | 0.2 | 25 | 5 | 0.04 | 0.02 | 12K(5µm) 60mm | M72 |

# ENTOCENTRIC LINE SCAN LENSES FOR WIDE FIELD OF VIEW

Our large format lens series has been specifically designed for the line-scan and large area sensor market. Covering sensors up to 62mm diag., these low distortion lenses are ready for challenging applications.

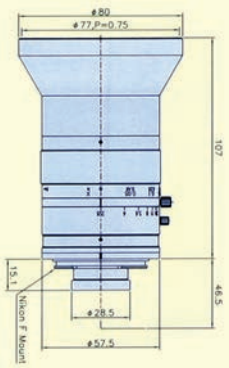
**Features:**

- Working distance and magnification are adjustable
- Suitable for long working distance
- Designed for machine vision applications
- FLS8528 is compatible with M72 mount (option)
- Suitable for various applications such as printing, PC, glass, textile etc..

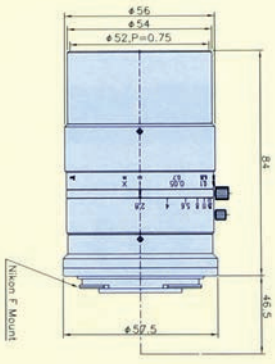
| | F No. | Focal length | Range of WD | Magnification | Distortion | Max. comp. sensor | Mount |
|---|---|---|---|---|---|---|---|
| **FLS2528** | 2.8 | 25 mm | 140 mm | 0.15x | 0.66% | Ø 44 mm | F |
| **FLS3528** | 2.8 | 35 mm | 230 mm | 0.15x | -0.31% | Ø 44 mm | F |
| **FLS5026** | 2.6 | 50 mm | 0.32m | 0.18x | 0.23% | Ø 45 mm | F |
| **FLS5014HS** | 1.4 | 50 mm | 0.27m | 0.2x | 0.17% | Ø 45 mm | F |
| **FLS5028CW** | 2.8 | 50 mm | 190 mm | 0.3x | -0.40% | Ø 44 mm | F |
| **FLS8528** | 2.8 | 85 mm | 0.46m | 0.2x | 0.04% | Ø 62 mm | F or M72 |

Indicated specifications are design values.
For Robot guidance applications we recommend metrical threads (and not bajonett F-mount) due to the higher mechanical stability.

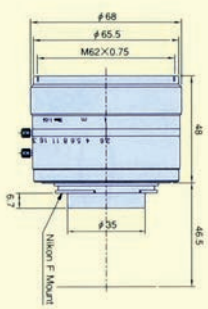
FLS2528



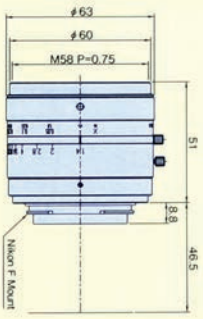

FLS3528



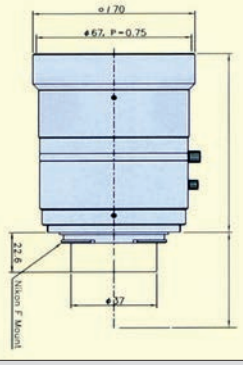

FLS5026



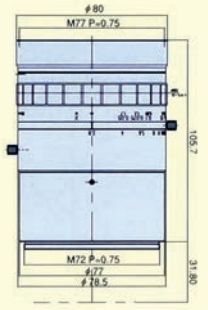

FLS5014HS




FLS5028CW




FLS8528



# LINE SCAN LENSES

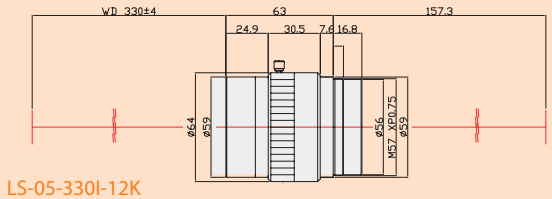
## ENTOCENTRIC LS-12K SERIES: LINE SCAN LENSES FOR 8K TO 12K SENSORS

### WD 50 - 320

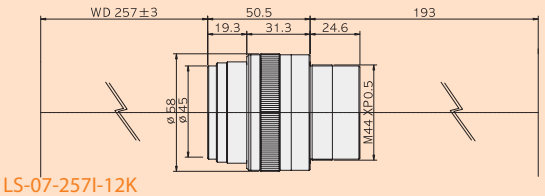
| | Magnification | WD (mm) | DOF (µm) | Res. (Obj.) | NA (obj.) | Sensor size | Aperture (wF#) | Optical Distortion (%) | Mount |
|---|---|---|---|---|---|---|---|---|---|
| **LS-05-330I-12K** | 0.5X | 330 | 512 | 8.6 µm | 0.039 | 12k (5u) 60mm | 6.4 | 0.08 | M57 |
| **LS-07-257I-12K** | 0.7X | 257 | 408 | 9.6 µm | 0.035 | 12k (5u) 60mm | 10 | 0.01 | M47 |
| **LS-10-202I-12K** | 1.0X | 202 | 100 | 6.7 µm | 0.05 | 12k (5u) 60mm | 10 | 0.04 | M47 |
| **LS-14-168I-12K** | 1.4X | 168 | 113 | 5.4 µm | 0.063 | 12k (5u) 60mm | 11.1 | 0.02 | M47 |
| **LS-20-50I-12K** | 2.0X | 50 | 45 | 3.1 µm | 0.11 | 12k (5u) 60mm | 9.1 | 0.03 | M47 |
| **LS-20-140I-12K** | 2.0X | 140 | 64 | 4.3 µm | 0.078 | 12k (5u) 60mm | 12.8 | 0.03 | M57 |
| **LS-35-88I-12K** | 3.5X | 88 | 41 | 2.4 µm | 0.14 | 12k (5u) 60mm | 12.5 | 0.05 | M47 |

Possible to change mount

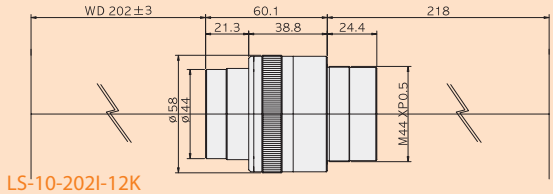
- High resolution & high contrast optical design
- Can be applied from 8K to 12K line scan cameras
- Low distortion for excellent image quality
- Large image circle up to 61.4 (12K @ 5um)
- Magnifications from 0.5X to 3.5X



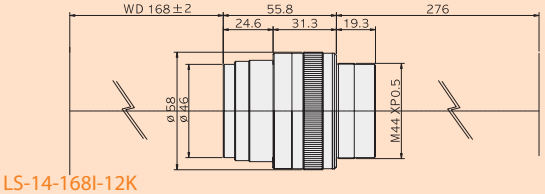
LS-05-330I-12K



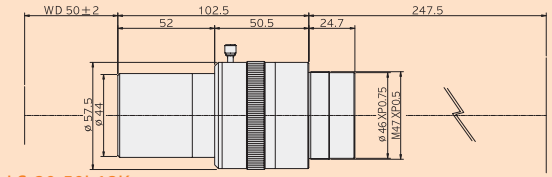
LS-07-257I-12K



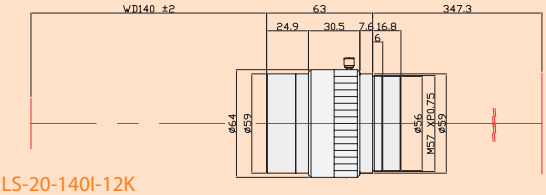
LS-10-202I-12K



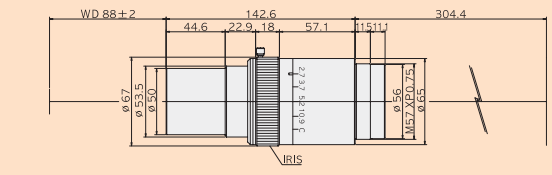
LS-14-168I-12K



LS-20-50I-12K



LS-20-140I-12K



LS-35-88I-12K

# HIGH RESOLUTION
# LINE SCAN LENSES FOR 8K/16K SENSORS

EFL 41 - 116

Discover our range of line scan lenses with up to 16K resolution, for a variety of industrial applications.

| | Central Magnification | EFL/mm | Magnification Range | Image format | Pixel Size | Aperture | Mount |
|---|---|---|---|---|---|---|---|
| **16K APO Series** | 4.38 | 116.4mm | 3.80 - 4.80 | φ88mm | 3.5um | F1.6 - F16 | M90, M95 |
| apochromatic lens | 6.20 | 117mm | 5.60 - 6.90 | φ88mm | 3.5um | F1.6 - F16 | M90, M95 |
| | 0.30 | 115mm | 0.29 - 0.34 | φ62mm | 3.5um | F3.78 - F16 | M58, M72, M90 |
| | 0.50 | 113mm | 0.46 - 0.54 | φ70mm | 3.5um | F3.65 - F16 | M58, M72, M90 |
| | 0.70 | 112mm | 0.65 - 0.76 | φ80mm | 3.5um | F3.6 - F16 | M58, M72, M90 |

| | Central Magnification | EFL/mm | Magnification Range | Image format | Pixel Size | Aperture | Mount |
|---|---|---|---|---|---|---|---|
| **8K APO Series** | 0.14 | 78mm | 0.04 - 0.33 | φ60mm | 5um | F5.6 - F22 | M58, M72, M90 |
| apochromatic lens | 0.21 | 78mm | 0.04 - 0.33 | φ64mm | 5um | F4.0 - F22 | M42, M58, M72 |

| | Central Magnification | EFL/mm | Magnification Range | Image format | Pixel Size | Aperture | Mount |
|---|---|---|---|---|---|---|---|
| **8K Series** | 0.1 | 41 | 0.04 - 0.33 | φ44mm | 5um | F2.8 - 11 | M42, M58, M72 |
| | 0.17 | 41 | 0.04 - 0.33 | φ60mm | 5um | F5.6 - 22 | M58, M72, M90 |
| | 0.167 | 60 | 0.04 - 0.33 | φ64mm | 5.5um | F4 - 22 | M42, M58, M72 |
| | 0.17 | 61 | 0.04 - 0.33 | φ82mm | 5.5um | F5.6 - 22 | M58, M72, M90 |
| | 0.3 | 80 | 0.2 - 0.4 | φ64mm | 5um | F5.6 - 22 | M58, M72, M90 |
| | 0.2 | 90 | 0.15 - 0.3 | φ86mm | 5um | F5.6 - 22 | M58, M72, M90 |
| | 0.17 | 100mm | 0.08 - 0.33 | φ108mm | 5um | F5.6 - F16 | M72, M90, M95 |
| | 0.50 | 120mm | 0.37 - 0.65 | φ86mm | 5um | F5.6 - F16 | M72, M90, M95 |

- High resolution & high contrast optical design
- Can be applied from 8K to 16K line scan cameras
- Low distortion for excellent image quality

apochromatic lens = better correction of chromatic and spherical aberration

# MACRO LENSES

## MACRO LENSES

These series are entocentric lenses for machine vision applications like factory automation.
For many types of sensor cameras like 1/2", 2/3", 2M, 4M, 5M, 8M, 12M & 15M, with high resolution and low distortion quality.

**Features:**

- Various working distance and magnification
- Fixed magnification (can be modified to anothermagnification)
- Mount: C-mount, F-mount & M48-P0.75
- Some models provide a manual iris adjustment

### Standard

| | Magni-fication | WD (mm) | Res. Obj. (µm) | NA (obj.) | Aperture (wF#) | DOF (µm) | Optical Distort. (%) | Sensor size (max.) | Standard mount |
|---|---|---|---|---|---|---|---|---|---|
| **MCST-034-120** | 0.34X | 120 | 15.80 | 0.0212 | 8.00 | 5500 | 0.07 | 1/2" (8mm) | C |
| **MCST-053-110** | 0.53X | 110 | 11.18 | 0.0300 | 9.00 | 2560 | 0.06 | 1/2" (8mm) | C |
| **MCST-06-117** | 0.6X | 117 | 9.30 | 0.0360 | 8.30 | 1800 | 0.02 | 1/2" (8mm) | C |
| **MCST-06-120** | 0.6X | 120 | 9.30 | 0.0360 | 8.30 | 1800 | 0.04 | 1/2" (8mm) | C |
| **MCST-08-100** | 0.8X | 100 | 8.20 | 0.0410 | 9.70 | 1200 | 0.03 | 1/2" (8mm) | C |
| **MCST-12-100** | 1.2X | 100 | 7.80 | 0.0430 | 13.90 | 772 | 0.03 | 1/2" (8mm) | C |
| **MCST-20-100** | 2.0X | 100 | 7.10 | 0.0470 | 21.20 | 424 | 0.04 | 1/2" (8mm) | C |
| **MCST-40-92** | 4.0X | 92 | 6.10 | 0.0550 | 36.40 | 180 | 0.01 | 1/2" (8mm) | C |
| **MCHR-019-240** | 0.19X | 240 | 28.00 | 0.0120 | 7.77 | 17 mm | 0.13 | 2/3" (11mm) | C |
| **MCHR-03-240** | 0.3X | 240 | 17.66 | 0.0190 | 7.80 | 6900 | 0.135 | 2/3" (11mm) | C |
| **MCHR-057-200** | 0.57X | 200 | 11.57 | 0.0290 | 10.00 | 2460 | 0.04 | 2/3" (11mm) | C |

### 2 Megapixel

| | Magni-fication | WD (mm) | Res. Obj. (µm) | NA (obj.) | Aperture (wF#) | DOF (µm) | Optical Distort. (%) | Sensor size (max.) | Standard mount |
|---|---|---|---|---|---|---|---|---|---|
| **MCHR-0198-185** | 0.198X | 185 | 21.20 | 0.0158 | 6.25 | 9570 | 0.06 | 1/1.8" | C |
| **MC2M-025-194I** | 0.25X | 194 | 8.50 | 0.0395 | 3.16 | 3030 | 0.01 | 2M | C |
| **MC2M-047-176** | 0.47X | 176 | 10.17 | 0.0330 | 7.14 | 1900 | 0.28 | 2M | C |
| **MC2M-055-164** | 0.55X | 164 | 9.80 | 0.0342 | 8.10 | 2100 | 0.06 | 2M | C |
| **MC2M-05-253** | 0.5X | 253 | 11.18 | 0.0300 | 8.33 | 2000 | 0.06 | 2M | C |
| **MC2M-075-164** | 0.75X | 164 | 8.90 | 0.0376 | 10.00 | 1070 | 0.06 | 2M | C |

DOF Calculation: Permissible of circle of confusion : 30µm

# MACRO LENSES

## 4 Megapixel

| | Magni-fication | WD (mm) | Res. Obj. (µm) | NA (obj.) | Aperture (wF#) | DOF (µm) | Optical Distort. (%) | Sensor size (max.) | Standard mount |
|---|---|---|---|---|---|---|---|---|---|
| **MC4M-0185-225I** | 0.185X | 225 | 18.10 | 0.0185 | 5.00 | 8770 | 0.01 | 4M | C |
| **MC4M-0215-226I** | 0.215X | 226 | 20.00 | 0.0170 | 6.25 | 8120 | 0.01 | 4M | C |
| **MF4M-0247-267** | 0.247X | 267 | 13.60 | 0.0247 | 5.00 | 4900 | 0.01 | 4M | F |
| **MC4M-025-194I** | 0.25X | 194 | 14.80 | 0.0230 | 5.50 | 5280 | 0.01 | 4M | C |
| **MF4M-037-261** | 0.37X | 261 | 9.10 | 0.0370 | 5.00 | 2190 | 0.01 | 4M | F |
| **MF4M-055-210** | 0.55X | 210 | 10.20 | 0.0330 | 8.30 | 1650 | 0.04 | 4M | F |
| **MF4M-075-193** | 0.75X | 193 | 8.90 | 0.0376 | 10.00 | 1060 | 0.06 | 4M | F |
| **MC4M-015-255I** | 0.15X | 255 | 29.8 | 0.01125 | 6.7 | 17.87mm | 0.08 | 4M | C |
| **MF4M-0296-267** | 0.296X | 267 | 12 | 0.028 | 5.3 | 3600 | 0.01 | 4M | F |
| **MC4M-03-170I** | 0.3X | 170 | 17.2 | 0.02 | 7.7 | 5130 | 0.06 | 4M | C |
| **MF4M-043-261** | 0.43X | 261 | 7.8 | 0.043 | 5 | 1620 | 0.01 | 4M | F |
| **MF4M-063-310I** | 0.63X | 310 | 6.9 | 0.0485 | 6.5 | 983 | 0.08 | 4M | F |
| **MF4M-074-247** | 0.74X | 247 | 6.5 | 0.0518 | 7.1 | 778 | 0.06 | 4M | F |

## 5 Megapixel

| | Mag. | WD (mm) | Res. Obj. (µm) | NA (obj.) | wF# | DOF (µm) | Opt.Distort. (%) | Sensor (max.) | Mount |
|---|---|---|---|---|---|---|---|---|---|
| **MC5M-019-240** | 0.19X | 240 | 17.70 | 0.0190 | 5.00 | 5500 | 0.03 | 2/3" | C |
| **MC5M-0257-185** | 0.257X | 185 | 16.80 | 0.0200 | 6.25 | 3800 | 0.01 | 2/3" | C |

## 8 Megapixel

| | Mag. | WD (mm) | Res. Obj. (µm) | NA (obj.) | wF# | DOF (µm) | Opt.Distort. (%) | Sensor (max.) | Mount |
|---|---|---|---|---|---|---|---|---|---|
| **MF8M-0247-267** | 0.247X | 267 | 13.6 | 0.0247 | 5.0 | 3600 | 0.01 | 8M (23mm) | F |
| **MF8M-0296-267** | 0.296X | 267 | 12 | 0.028 | 5.3 | 2700 | 0.01 | 8M (23mm) | F |
| **MF8M-035-300** | 0.35X | 300 | 9.6 | 0.035 | 5.0 | 1800 | 0.08 | 8M (23mm) | F |
| **MF8M-037-261** | 0.37X | 261 | 9.1 | 0.037 | 5.0 | 1600 | 0.01 | 8M (23mm) | F |
| **MF8M-043-261** | 0.43X | 261 | 7.8 | 0.043 | 5.0 | 1200 | 0.01 | 8M (23mm) | F |
| **MF8M-05-300** | 0.5X | 300 | 6.7 | 0.05 | 5.0 | 880 | 0.08 | 8M (23mm) | F |
| **MF8M-055-210** | 0.55X | 210 | 10.2 | 0.033 | 8.3 | 1200 | 0.04 | 8M (23mm) | F |
| **MF8M-063-310I** | 0.63X | 310 | 6.9 | 0.0485 | 6.5 | 720 | 0.08 | 8M (23mm) | F |
| **MF8M-074-247** | 0.74X | 247 | 6.5 | 0.0518 | 7.1 | 574 | 0.06 | 8M (23mm) | F |
| **MF8M-075-193** | 0.75X | 193 | 8.9 | 0.0376 | 10 | 780 | 0.005 | 8M (23mm) | F |
| **MF8M-08-260** | 0.8X | 260 | 5.9 | 0.0568 | 7.0 | 484 | 0.05 | 8M (23mm) | F |

## 12 Megapixel

| | Mag. | WD (mm) | Res. Obj. (µm) | NA (obj.) | wF# | DOF (µm) | Opt.Distort. (%) | Sensor (max.) | Mount |
|---|---|---|---|---|---|---|---|---|---|
| **MD12M-054-235I** | 0.54X | 235 | 7.80 | 0.0430 | 6.25 | 1280 | 0.05 | 12M | M48 |

## 15 Megapixel

| | Mag. | WD (mm) | Res. Obj. (µm) | NA (obj.) | wF# | DOF (µm) | Opt.Distort. (%) | Sensor (max.) | Mount |
|---|---|---|---|---|---|---|---|---|---|
| **MF15M-042-300** | 0.42X | 300 | 8.6 | 0.039 | 5.37 | 1200 | 0.08 | 15M | F |
| **MF15M-0789-260** | 0.789X | 260 | 5.95 | 0.056 | 7 | 674 | 0.06 | 15M | F |

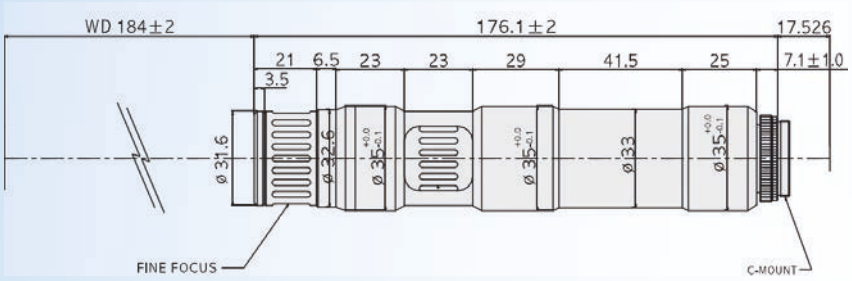
DOF Calculation: Permissible of circle of confusion : 20µm
For Robot guidance applications we recommend metrical threads (and not bajonett F-mount) due to the higher mechanical stability.

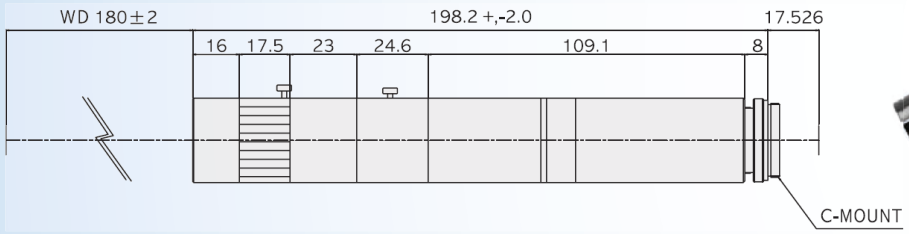
# MACRO LENSES

## MACRO ZOOM LENSES

| | Magnification | WD (mm) | Res. (Obj.) | NA (obj.) | Aperture (wF#) | DOF (μm) | Optical Distortion (%) | Sensor size | Standard mount |
|---|---|---|---|---|---|---|---|---|---|
| **MZC0515** | 0.5X | 184 | 11.25 | 0.0298 | 8.3 | 2600 | 0.2 | 1/2" (8mm) | C |
| | 1.5X | 184 | 6.7 | 0.05 | 15 | 533 | 0.15 | 1/2" (8mm) | |
| **MZC0530S12** | 0.5X | 180 | 21 | 0.016 | 15.6 | 4990 | 0.6 | 1/2" (8mm) | C |
| | 3.0X | 180 | 7.8 | 0.043 | 34.9 | 310 | 0.2 | 1/2" (8mm) | |
| **MZC0530S13** | 0.5X | 180 | 18.6 | 0.018 | 13.9 | 4450 | 0.25 | 1/3" (6mm) | C |
| | 3.0X | 180 | 7 | 0.048 | 31.3 | 278 | 0.14 | 1/3" (6mm) | |

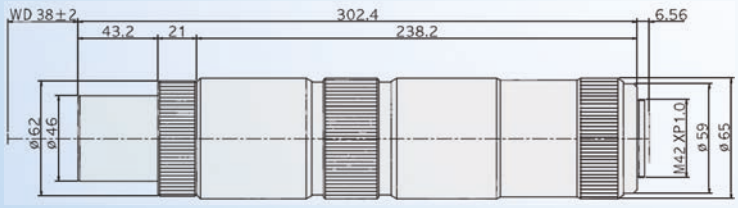
- This zoom lens has high resolution to get high contrast image compared to the general zoom lens.
- Magnification ranges: 0.5 ~ 1.5X, 0.5X ~ 3.0X
- WD: 184mm, 180mm. Support up to 1/2" or 1/3" sensor camera
- Fine focus adjustment



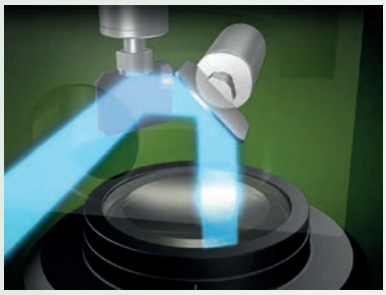

| | Magnification | WD (mm) | Res. (Obj.) | NA (obj.) | Aperture (wF#) | DOF (μm) | Optical Distortion (%) | Sensor size | Standard mount |
|---|---|---|---|---|---|---|---|---|---|
| **MZ3050** | 3.0X | 38 | 3.6 | 0.093 | 16.1 | 93.6 | 0.046 | 2K(13u) 26mm | M42 |
| | 4.0X | 38 | 2.92 | 0.115 | 17.4 | 56.5 | 0.032 | 2K(13u) 26mm | |
| | 5.1X | 38 | 2.6 | 0.13 | 19.6 | 39.1 | 0.044 | 2K(13u) 26mm | |

- This zoom lens is designed specially for large sensor cameras like 2K Line sensor, 4M sensor cameras, etc
- This lens has high resolution and low distortion over the full range of the image
- Manual iris adapted 26mm diagonal




# F-THETA SCAN LENSES

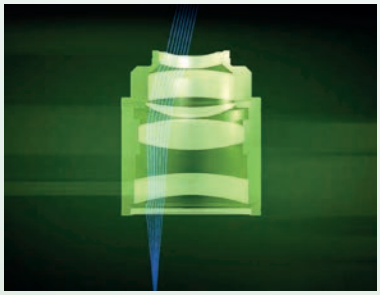
**Together with high speed Galvo-Mirrors, F-theta lenses enable laser cutting and writing, soldering and even welding.**



While laser pointers with with a mere 0.3mW power, industrial lasers can have for example 30W, but some High Power Lasers work with for example 6000W.

For the laser not to immediately destroy the lens, high end surface coatings are mandatory and the laser beam must be expanded before it enters the lens.

Here you get optical components: Mirrors, mirror holders, beam expanders and F-Thetas for the various wavelengths and laser powers. We offer a set of standard types designed and patented by our workshop.



However we can show our real strength by customised designs.
For further information please contact our sales department

https://www.lensation.de/
product-category/f-theta-lenses

# LENSATION SENSOR DATABASE

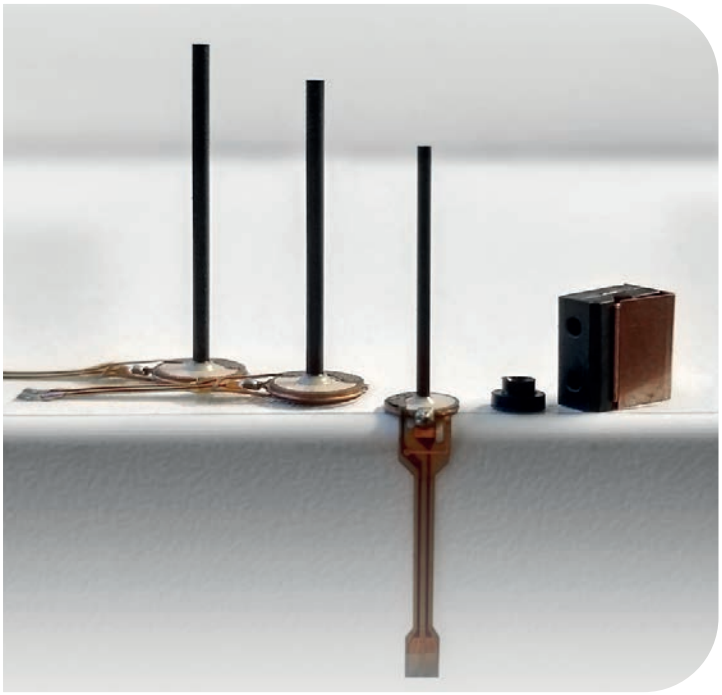
**Not sure what size your sensor is?**
Here you can find all relevant information
like resolution, optical diagonal and sensor area.

**Your sensor is not listed?**
**www.lensation.de/sensor-db/**

| Manufacturer | Sensor | Megapixel | Pixelsize | Resolution Horiz. (X) | Resolution Vert. (Y) | Width (mm) | Height (mm) | Diag (mm) | Exact opt. Diag |
|---|---|---|---|---|---|---|---|---|---|
| AMS (CMOSIS) | CMV2000 | 2.228 | 5.50 | 2048 | 1088 | 11.26 | 5.98 | 12.75 | 1/1.25" |
| AMS (CMOSIS) | CMV4000 | 4.194 | 5.50 | 2048 | 2048 | 11.26 | 11.26 | 15.93 | 1/1.0" |
| AMS (CMOSIS) | CMV8000 | 8.387 | 5.50 | 3360 | 2496 | 18.48 | 13.73 | 23.02 | 1.44" |
| AMS (CMOSIS) | CMV12000 | 12.583 | 5.50 | 4096 | 3072 | 22.53 | 16.90 | 28.16 | 1.76" |
| AMS (CMOSIS) | CMV20000 | 19.661 | 6.40 | 5120 | 3840 | 32.77 | 24.58 | 40.96 | 2.56" |
| AMS (CMOSIS) | CMV50000 | 47.552 | 4.60 | 7920 | 6004 | 36.43 | 27.62 | 45.72 | 2.86" |
| Gpixel | GCINE4349 | 49.152 | 4.30 | 8192 | 6000 | 35.23 | 25.80 | 43.66 | 2.73" |
| Gpixel | GL0204-0467 | | 4.67 | 6300 | 4 | 29.42 | 0.02 | 29.42 | 1.84" |
| Gpixel | GL0402 | | 7.00 | 4096 | 2 | 28.67 | 0.01 | 28.67 | 1.79" |
| Gpixel | GL0816 | | 5.00 | 8322 | 16 | 41.61 | 0.08 | 41.61 | 2.6" |
| Gpixel | GL1608 | | 5.00 | 16384 | 8 | 81.92 | 0.04 | 81.92 | 5.12" |
| Gpixel | GLT5009BSI | | 5.00 | 9072 | 288 | 45.36 | 1.44 | 45.38 | 2.84" |
| Gpixel | GMAX0505 | 26.214 | 2.50 | 5120 | 5120 | 12.80 | 12.80 | 18.10 | 1.13" |
| Gpixel | GMAX2505 | 5.530 | 2.50 | 2560 | 2160 | 6.40 | 5.40 | 8.37 | 1/1.91" |
| Gpixel | GMAX2509 | 9.072 | 2.50 | 4200 | 2160 | 10.50 | 5.40 | 11.81 | 1/1.36" |
| Gpixel | GMAX2518 | 18.474 | 2.50 | 4508 | 4098 | 11.27 | 10.25 | 15.23 | 1/1.05" |
| Gpixel | GMAX32103 | 103.739 | 3.20 | 11276 | 9200 | 36.08 | 29.44 | 46.57 | 2.91" |
| Gpixel | GMAX32152 | 152.315 | 3.20 | 16556 | 9200 | 52.98 | 29.44 | 60.61 | 3.79" |
| Gpixel | GMAX3265 | 65.408 | 3.20 | 9344 | 7000 | 29.90 | 22.40 | 37.36 | 2.34" |
| Gpixel | GMAX4651 | 50.814 | 4.60 | 8424 | 6032 | 38.75 | 27.75 | 47.66 | 2.98" |
| Gpixel | GSENSE2020BSI | 4.194 | 6.50 | 2048 | 2048 | 13.31 | 13.31 | 18.83 | 1.18" |
| Gpixel | GSENSE400 | 4.194 | 11.00 | 2048 | 2048 | 22.53 | 22.53 | 31.86 | 1.99" |
| Gpixel | GSENSE4040BSI | 16.777 | 9.00 | 4096 | 4096 | 36.86 | 36.86 | 52.13 | 3.26" |
| Gpixel | GSENSE6060 | 37.749 | 10.00 | 6144 | 6144 | 61.44 | 61.44 | 86.89 | 5.43" |
| Gpixel | GSPRINT4521 | 20.972 | 4.50 | 5120 | 4096 | 23.04 | 18.43 | 29.51 | 1.84" |
| On Semi (Aptina) | AR0521 | 5.039 | 2.20 | 2592 | 1944 | 5.70 | 4.28 | 7.13 | 1/2.53" |
| On Semi (Aptina) | AR0820 | 8.294 | 2.10 | 3840 | 2160 | 8.06 | 4.54 | 9.25 | 1/1.73" |
| On Semi (Aptina) | AR1820 | 18.096 | 1.25 | 4912 | 3684 | 6.14 | 4.61 | 7.68 | 1/2.35" |
| On Semi (Cypress) | PYTHON 1300 | 1.311 | 4.80 | 1280 | 1024 | 6.14 | 4.92 | 7.87 | 1/2.29" |
| On Semi (Cypress) | PYTHON 2000 | 2.304 | 4.80 | 1920 | 1200 | 9.22 | 5.76 | 10.87 | 1/1.47" |
| On Semi (Cypress) | PYTHON 5000 | 5.308 | 4.80 | 2592 | 2048 | 12.44 | 9.83 | 15.86 | 1/1.01" |
| On Semi (Cypress) | PYTHON 12K | 12.583 | 4.50 | 4096 | 3072 | 18.43 | 13.82 | 23.04 | 1.44" |
| On Semi (Cypress) | PYTHON 16K | 16.777 | 4.50 | 4096 | 4096 | 18.43 | 18.43 | 26.07 | 1.63" |
| On Semi (Cypress) | PYTHON 25K | 26.214 | 4.50 | 5120 | 5120 | 23.04 | 23.04 | 32.58 | 2.04" |
| On Semi (Micron) | MT9V032 \| 034 | 0.361 | 6.00 | 752 | 480 | 4.51 | 2.88 | 5.35 | 1/3.36" |
| On Semi (Micron) | MT9P006 \| 031 | 5.039 | 2.20 | 2592 | 1944 | 5.70 | 4.28 | 7.13 | 1/2.53" |
| On Semi (Micron) | MT9J003 | 10.658 | 1.67 | 3856 | 2764 | 6.44 | 4.62 | 7.92 | 1/2.27" |
| On Semi (Micron) | MT9F002 | 15.151 | 1.40 | 4608 | 3288 | 6.45 | 4.60 | 7.93 | 1/2.27" |
| On Semi | XGS 2000 (1. Gen) | 2.304 | 3.20 | 1920 | 1200 | 6.14 | 3.84 | 7.25 | 1/2.48" |

| Manufacturer | Sensor | Megapixel | Pixelsize | Resolution Horiz. (X) | Resolution Vert. (Y) | Width (mm) | Height (mm) | Diag (mm) | Exact opt. Diag |
|---|---|---|---|---|---|---|---|---|---|
| On Semi | XGS 5000 (2. Gen) | 5.308 | 3.20 | 2592 | 2048 | 8.29 | 6.55 | 10.57 | 1/1.51" |
| On Semi | XGS 8000 (2. Gen) | 8.847 | 3.20 | 4096 | 2160 | 13.11 | 6.91 | 14.82 | 1/1.08" |
| On Semi | XGS 12000 (2. Gen) | 12.583 | 3.20 | 4096 | 3072 | 13.11 | 9.83 | 16.38 | 1.02" |
| On Semi | XGS 20000 (1. Gen) | 20.250 | 3.20 | 4500 | 4500 | 14.40 | 14.40 | 20.36 | 1.27" |
| On Semi | XGS 32000 (1. Gen) | 32.472 | 3.20 | 6580 | 4935 | 21.06 | 15.79 | 26.32 | 1.65" |
| On Semi | XGS 45000 (1. Gen) | 44.728 | 3.20 | 8192 | 5460 | 26.21 | 17.47 | 31.50 | 1.97" |
| Teledyne e2v | Emerald 2M \| Snappy 2M | 2.074 | 2.80 | 1920 | 1080 | 5.38 | 3.02 | 6.17 | 1/2.92" |
| Teledyne e2v | Emerald 5M \| Snappy 5M | 4.956 | 2.80 | 2560 | 1936 | 7.17 | 5.42 | 8.99 | 1/1.78" |
| Teledyne e2v | Emerald 16M | 17.040 | 2.80 | 4128 | 4128 | 11.56 | 11.56 | 16.35 | 1.02" |
| Teledyne e2v | Emerald 36M | 37.749 | 2.50 | 6144 | 6144 | 15.36 | 15.36 | 21.72 | 1.36" |
| Teledyne e2v | Emerald 67M | 67.897 | 2.50 | 8256 | 8224 | 20.64 | 20.56 | 29.13 | 1.82" |
| Teledyne e2v | ev76C560 \| 660 \| 661 | 1.311 | 5.30 | 1280 | 1024 | 6.78 | 5.43 | 8.69 | 1/1.84" |
| Teledyne e2v | ev76C570 \| 571 | 1.920 | 4.50 | 1600 | 1200 | 7.20 | 5.40 | 9.00 | 1/1.78" |
| Sony | IMX178 (Starvis 1. Gen) | 6.440 | 2.40 | 3096 | 2080 | 7.43 | 4.99 | 8.95 | 1/1.79" |
| Sony | IMX183 (Starvis 1. Gen) | 20.480 | 2.40 | 5544 | 3694 | 13.31 | 8.87 | 15.99 | 1/1.0" |
| Sony | IMX226 (Starvis 1. Gen) | 12.403 | 1.85 | 4072 | 3046 | 7.53 | 5.64 | 9.41 | 1/1.7" |
| Sony | IMX250 \| 264 (Pregius 2. Gen) | 5.066 | 3.45 | 2464 | 2056 | 8.50 | 7.09 | 11.07 | 1/1.45" |
| Sony | IMX252 \| 265 (Pregius 2. Gen) | 3.187 | 3.45 | 2064 | 1544 | 7.12 | 5.33 | 8.89 | 1/1.8" |
| Sony | IMX253 \| 304 (Pregius 2. Gen) | 12.369 | 3.45 | 4112 | 3008 | 14.19 | 10.38 | 17.58 | 1.1" |
| Sony | IMX255 \| 267 \| 305 (Pregius 2. Gen) | 8.948 | 3.45 | 4112 | 2176 | 14.19 | 7.51 | 16.05 | 1.0" |
| Sony | IMX273 \| 296 (Pregius 2. Gen) | 1.584 | 3.45 | 1456 | 1088 | 5.02 | 3.75 | 6.27 | 1/2.87" |
| Sony | IMX287 \| 297 (Pregius 2. Gen) | 0.396 | 6.90 | 728 | 544 | 5.02 | 3.75 | 6.27 | 1/2.87" |
| Sony | IMX290 \| 291 (Starvis 1. Gen) | 2.134 | 2.90 | 1945 | 1097 | 5.64 | 3.18 | 6.48 | 1/2.78" |
| Sony | IMX334 (Starvis 2. Gen) | 8.424 | 2.00 | 3864 | 2180 | 7.73 | 4.36 | 8.87 | 1/1.8" |
| Sony | IMX335 (Starvis 2. Gen) | 5.138 | 2.00 | 2616 | 1964 | 5.23 | 3.93 | 6.54 | 1/2.75" |
| Sony | IMX342 (Pregius 2. Gen) | 31.493 | 3.45 | 6480 | 4860 | 22.36 | 16.77 | 27.95 | 1.75" |
| Sony | IMX367 (Pregius 2. Gen) | 19.660 | 3.45 | 4432 | 4436 | 15.29 | 15.30 | 21.63 | 1.35" |
| Sony | IMX387 (Pregius 2. Gen) | 16.876 | 3.45 | 5472 | 3084 | 18.88 | 10.64 | 21.67 | 1.35" |
| Sony | IMX390 (Automotive) | 2.455 | 3.00 | 2017 | 1217 | 6.05 | 3.65 | 7.07 | 1/2.55" |
| Sony | IMX392 (Pregius 2. Gen) | 2.354 | 3.45 | 1936 | 1216 | 6.68 | 4.20 | 7.89 | 1/2.28" |
| Sony | IMX397 (Pregius 2. Gen) | 0.326 | 3.45 | 658 | 496 | 2.27 | 1.71 | 2.84 | 1/6.33" |
| Sony | IMX411 | 151.003 | 3.76 | 14192 | 10640 | 53.36 | 40.01 | 66.69 | 4.17" |
| Sony | IMX412 (Starvis 1. Gen) | 12.330 | 1.55 | 4056 | 3040 | 6.29 | 4.71 | 7.86 | 1/2.29" |
| Sony | IMX420 \| 428 (Pregius 3. Gen) | 7.101 | 4.50 | 3216 | 2208 | 14.47 | 9.94 | 17.55 | 1.1" |
| Sony | IMX421 \| 429 \| 437 (Pregius 3. Gen) | 2.862 | 4.50 | 1944 | 1472 | 8.75 | 6.62 | 10.97 | 1/1.46" |
| Sony | IMX422 \| 430 (Pregius 3. Gen) | 2.037 | 4.50 | 1632 | 1248 | 7.34 | 5.62 | 9.25 | 1/1.73" |
| Sony | IMX425 \| 432 (Pregius 3. Gen) | 1.775 | 9.00 | 1608 | 1104 | 14.47 | 9.94 | 17.55 | 1.1" |
| Sony | IMX426 \| 433 (Pregius 3. Gen) | 0.509 | 9.00 | 816 | 624 | 7.34 | 5.62 | 9.25 | 1/1.73" |
| Sony | IMX455 (Starvis 1. Gen) | 61.171 | 3.76 | 9576 | 6388 | 36.01 | 24.02 | 43.28 | 2.71" |
| Sony | IMX461 | 101.897 | 3.76 | 11656 | 8742 | 43.83 | 32.87 | 54.78 | 3.42" |
| Sony | IMX485 (Starvis 1.Gen) \| IMX585 (2. Gen) | 8.391 | 2.90 | 3856 | 2176 | 11.18 | 6.31 | 12.84 | 1/1.25" |
| Sony | IMX490 (Automotive) | 5.433 | 3.00 | 2896 | 1876 | 8.69 | 5.63 | 10.35 | 1/1.55" |
| Sony | IMX492 (Starvis 1. Gen) | 47.082 | 2.32 | 8336 | 5648 | 19.30 | 13.08 | 23.31 | 1.46" |
| Sony | IMX500 (Vision Sensor) | 12.330 | 1.55 | 4056 | 3040 | 6.29 | 4.71 | 7.86 | 1/2.29" |
| Sony | IMX530 \| 540 (Pregius S 4. Gen) | 24.551 | 2.74 | 5328 | 4608 | 14.60 | 12.63 | 19.30 | 1.21" |
| Sony | IMX531 \| 541 (Pregius S 4. Gen) | 20.358 | 2.74 | 4512 | 4512 | 12.36 | 12.36 | 17.48 | 1.09" |
| Sony | IMX532 \| 542 (Pregius S 4. Gen) | 16.197 | 2.74 | 5328 | 3040 | 14.60 | 8.33 | 16.81 | 1.05" |
| Sony | IMX533 (Starvis 1. Gen) | 9.066 | 3.76 | 3011 | 3011 | 11.32 | 11.32 | 16.01 | 1.0" |
| Sony | IMX535 \| 545 \| 565 (Pregius S 4. Gen) | 12.417 | 2.74 | 4128 | 3008 | 11.31 | 8.24 | 14.00 | 1/1.14" |
| Sony | IMX536 \| 546 \| 566 (Pregius S 4. Gen) | 8.134 | 2.74 | 2856 | 2848 | 7.83 | 7.80 | 11.05 | 1/1.45" |
| Sony | IMX537 \| 547 \| 548 \| 567 \| 568 (Pregius S 4. Gen) | 5.102 | 2.74 | 2472 | 2064 | 6.77 | 5.66 | 8.82 | 1/1.81" |
| Sony | IMX556 (ToF) | 0.311 | 10.00 | 642 | 484 | 6.42 | 4.84 | 8.04 | 1/1.99" |
| Sony | IMX570 (ToF) | 0.316 | 5.00 | 648 | 488 | 3.24 | 2.44 | 4.06 | 1/4.44" |
| Sony | IMX571 (Starvis 1. Gen) | 26.108 | 3.76 | 6252 | 4176 | 23.51 | 15.70 | 28.27 | 1.77" |
| Sony | IMX577 | 12.477 | 1.55 | 4072 | 3064 | 6.31 | 4.75 | 7.90 | 1/2.28" |
| Sony | IMX661 (Pregius 4. Gen) | 127.675 | 3.45 | 13400 | 9528 | 46.23 | 32.87 | 56.73 | 3.55" |
| Sony | IMX662 (Starvis 2. Gen) | 2.125 | 2.90 | 1937 | 1097 | 5.62 | 3.18 | 6.46 | 1/2.79" |
| Sony | IMX677 | 23.915 | 1.12 | 5663 | 4223 | 6.34 | 4.73 | 7.91 | 1/2.28" |
| Sony | IMX678 (Starvis 2. Gen) | 8.391 | 2.00 | 3856 | 2176 | 7.71 | 4.35 | 8.86 | 1/1.81" |
| Sony | IMX990 (SenSWIR) | 1.337 | 5.00 | 1296 | 1032 | 6.48 | 5.16 | 8.28 | 1/1.93" |
| Sony | IMX991 (SenSWIR) | 0.341 | 5.00 | 656 | 520 | 3.28 | 2.60 | 4.19 | 1/4.3" |

# We like to move it!



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# OPTICAL GLOSSARY

## Resolution(μm)

Resolution is a measure of how closely spaced two points may be before they cannot be distinguished.For example, 1μm resolution means that two points that are 1μm away from each other can be distinguished. Resolution values in this catalog are lenses' theoretical resolutions. The following is a formula to calculate theoretical resolution based on an aplanatic lens's ray diffraction. (Rayleigh formula) Wavelength 0.61× NA

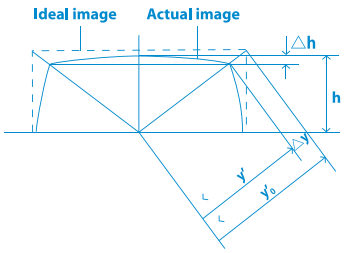
## Resolving power(line/mm)

Resolving power indicates the number of black and white lines distinguished within 1mm in an image through a black and white grid-like chart lens. It is expressed by line/mm.
For example, 100 line/mm means that black and white pitch 1/100mm(10μ) can be distinguished. The width of both the black and white lines is 1/200mm(5μ).

## Horizontal TV resolution

The total number of black and white horizontal stripes on a TV monitor screen. It is expressed in TV lines.
For example, 200TV lines of horizontal TV resolution means that 100 white horizontal lines is counted as one line. However, for TV lines, one pair is counted as 2 TV lines. For example, if a 1/2-inch CCD camera is used with a lens of 50 lines/mm resolving power, horizontal TV resolution on a TV monitor screen is calculated as follows; 50×6.4(CCD width)×2=640TV

## Distortion




| | |
|---|---|
| D | Optical distortion |
| $D_{TV}$ | TV distortion |
| m | Vertical screen/Diagonal |

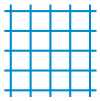
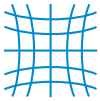
**Optical distortion**
Lens's aberration where a straight object outside of the optical axis appears curved.

$$\frac{y'-y'_0}{y'_0}\times 100\%$$

**Positive distortion of a straight line is called pincushion distortion. Negative distortion is called barrel distortion.**

**TV distortion**
Image distortion on a TV monitor. The closer to zero, the better the performance.

$$D_{TV}=\frac{\triangle h}{2h}\times 100\% \quad D_{TV}=\frac{1}{2}(1-m^2)D \quad m=0.6 \quad D_{TV}=0.32D$$

| Object | Pincushion distortion | Barrel distortion |
|---|---|---|
|  |  |  |

**Aperture efficiency / Marginal light quantity (%)**

Aperture efficiency indicates the brightness difference between the optical axis of the image formation plane and its surrounding area when an evenly bright object is captured with a lens. It is expressed by percent(%) assuming that the center brightness is 100. It is one of a lens's optical characteristics.

## Shading

Shading is the brightness difference between TV monitor's center and its edges when an evenly bright object is captured with a lens and CCD-TV camera. Shading indicates comprehensive performance of a lens and TV camera.

## Chromatic aberration

In lenses' optional systems, positions where images are formed and image magnification differ according to light's wavelength. Rays with different wavelengths have different colors. This is called chromatic aberration. Aberration on the optical axis is called chromatic aberration on the axis and magnification difference is called magnification chromatic aberration.

## F Number (F No)

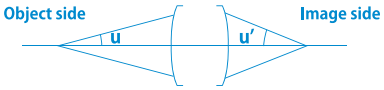
The value indicates a lens's brightness. It is calculated by dividing the lens's focal length by the lens's effective diameter(entrance pupil D mm) looking from object side. It can be also calculated by NA and lens's optical magnification( ). The smaller the number, the brighter the lens is. F No = f/D

## Effective F No

The value indicates a lens's brightness. It is calculated by dividing the lens's focal length by the lens's effective diameter(entrance pupil D mm) looking from object side. It can be also calculated by NA and Lens's optical magnification(). The smaller the number, the brighter the lens is. Effective F No = (1+M) x F No

## Numerical aperture

The higher the NA, the greater the resolution and brightness are.
When the half angle that an image makes on exit pupil is u' and refractive index is n', n' x sin u' is called image side numberical aperture, NA'.
NAs in this catalog indicate object side numerical apertures.




**NA=M/2xF, NA'=1/2xF.**
**Relation of NA and NA' is NA=NA' x Optical magnfification or NA'=NA/optical magnficiattion.**

## MTF

It provides a graph analyzing a lens' ability to resolve sharp details in very fine sets of parallel lines, and a lens' contrast or ability to provide a sharp transfer between light and dark areas in sets of thicker parallel lines.

## Depth of field

Images through lenses theoretically form as points. Acceptable blur on an acceptably clear image is called the permissible circle of confusion.
Depth is the distance between the nearest and farthest points that appear in acceptably sharp focus when an object is shifted back and force from the best focal point. Depth range of the object side is called depth of field.
Depth of field = 2(Permissible circle of confusion x Effective F No/Magnificaition$^2$)

## Depth of focus

Depth is the distance between the nearest and farthest points that appear in acceptably sharp forcus when a CCD is shifted back and force from the best focal point. Depth range of the image side is called depth of focus.

## Angle of view

The angle formed by imaginary lines connecting the lens second principal point with both ends of the image diagonal. Angle of view is directly associated with lens focal length. As the focal length is longer, the angle of view is narrower.

Angle of view 2x tan$^{1}$D Image size 2f Focal length

## WD

Distance from the front end of a lens system to the object under inspection.

## OI

Distance from the object to the image sensor.

## Focal length

Focal length is the distance from the optical system's principle point to the focal point. Distance from the vertex of the last lens to the back focal point is called back length. Distance from the vertex of the first lens to the front focal point is called front focal length.

## Image size

The diameter of the sharp image circle formed by a lens. Area sensor is expressed by inch and diameter of image circle is equal to diagonal of sensor. Image circle of diameter for line sensor is equal to the maximum sensor size. It is expressed by pixel size x resolution.

## How to calculate optical magnification

**Most of Lensagon lens series are designed at finite distance. Optical magnification is the image size (CCD) ratio against the object size (FOV) and the most important for selection of a lens.**

### Sensor size

Area Sensor

Examples of area sensor used for machine vision.
It is expected that various sensors will be available for next generation.

| Image Size inch | 1/4 | 1/3 | 1/2 | 1/1.8 | 2/3 | 1 | 1.1 |
|---|---|---|---|---|---|---|---|
| Vertical mm | 2.7 | 3.6 | 4.8 | 5.35 | 6.6 | 9.6 | 12 |
| Horizontal mm | 3.6 | 4.8 | 6.4 | 7.14 | 8.8 | 12.8 | 12 |
| Diagonal mm | 4.5 | 6 | 8 | 8.93 | 11 | 16 | 17 |

Line Sensor

Length of line sensor is formed, depended on pixel size and resolution. As the line sensor is larger, the dimension of a lens becomes larger. Design and manufacture of lenses for the large line sensors are required for high specification.

| Image Size mm | 10.24 | 14.34 | 20.48 | 28.67 | 28.67 | 35 | 36 | 57.34 | 61.44 |
|---|---|---|---|---|---|---|---|---|---|
| Pixel size µm | 10 | 14 | 10 | 14 | 7 | 4.7 | 7 | 7 | 5 |
| Resolution pixel | 1024 | 1024 | 2048 | 2048 | 4096 | 7450 | 5150 | 8192 | 12288 |

### Formula of optical magnification

FOV

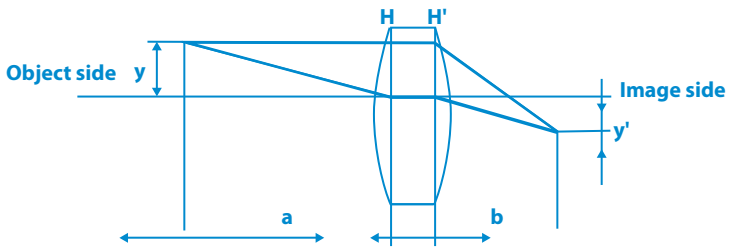
**Field of view (FOV) The actual size of a viewed object that can be taken when the lens is attached to the camera.**
**Ex. Optical magnification: 0.5x Sensor: 1/2"**

**Vertical FOV 4.8 ÷ 0.5 9.6mm Horizontal FOV 6.4 ÷ 0.5 12.8mm**

Magnification

**Optical magnification (M) = Sensor size/FOV**

$$M = y'/y = b/a$$




### Electronic magnification and monitor magnification

Electronic magnification — **Magnification of an image on a sensor when it is displayed on a monitor screen.**

Monitor magnification — **Magnification of an object displayed on a monitor screen through a lens.**

**Ex. Optical magnification: 0.5x Sensor: 1/2 Monitor size: 15 inch (1 inch = 25.4mm)**

**Electronic magnification 15 x 25.4 ÷ 8 47.6x**

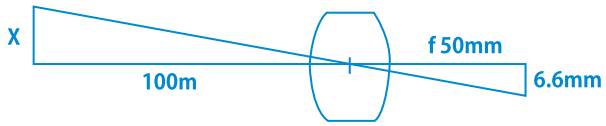
**Monitor magnification 0.5 x 47.65 23.8x**

## How to calculate focal length and photographic range

### Formula of photographic range

$$X = \frac{\text{Distance from lens to object} \times \text{Image size}}{\text{Focal length}}$$

**Ex. Object distance: 100mm Focal length: 50mm CCD: 2/3**

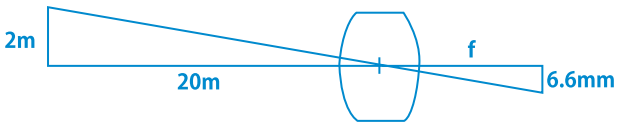



$$X = \frac{100{,}000 \times 6.6}{50} = 13{,}200\,(\text{mm})$$ **Height: 13.2m**

### Formula of Focal length

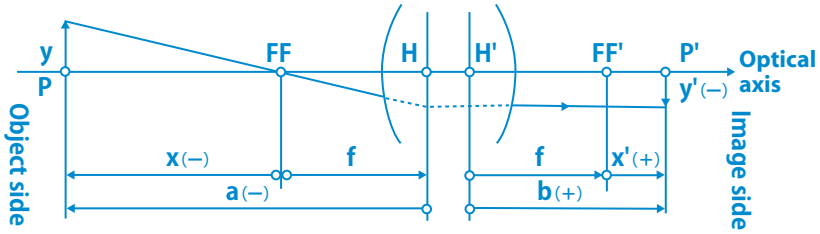
$$f = \frac{\text{Distance from lens to object} \times \text{Image size}}{\text{Height}}$$

**Ex. Object distance: 20m Height: 6.6m CCD: 2/3**




$$f = \frac{20{,}000 \times 6.6}{2{,}000} = 66\,(\text{mm})$$ **Focal length: 66mm**

## Formula of conjugation relationship




- **Basics formula** $-\frac{1}{a} + \frac{1}{b} = \frac{1}{f}$
- **Horizontal magnification** $M = \frac{y'}{y} = \frac{b}{a}$
- **Object point distance** $-a = (1 - \frac{1}{M}) \times f$
- **Image point distance** $b = (1 - M) \times f$

f : Focal length
FF : Front side focal point
FF' : Rear side focal point
H : Front side principal point
H' : Rear side principal point
P : Object point
P' : Image point
a : Distance from front side point to object point
b : Distance from rear side principal point to image point
x : Distance from front side focal point to object point
x' : Distance from rear side focal point to image side point
M : Magnification

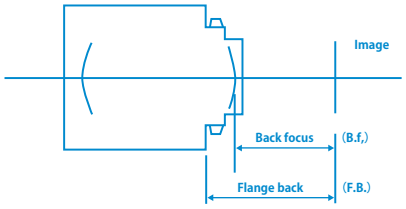
### F No./NA Formula

- **Relationship of object side NA and image side NA (NA ´)** $NA' = \frac{NA}{M}$
- **Relationship of F No. and Effective F no.(Ef)** $Fe = (1-M)F$
- **Relationship of NA and Effective F No.** $NA' = \frac{1}{2Fe}$ $NA' = \frac{1}{2(1-M)F}$ $NA = \frac{M}{2Fe}$ $NA = \frac{M}{2(1-M)F}$

## Camera mount and flange back

**Back focus** — Distance from the vertex of the last lens to the back focal point.

**Flange back** — Distance from the camera's lens mount reference surface to the focal plane.




| Name | Flange back | Screw size |
|---|---|---|
| C Mount | 17.526mm | 25.4mm 32tpi thread |
| CS Mount | 12.5mm | 25.4mm 32tpi thread |
| F Mount | 46.5mm | Bayonet |
| K Mount | 45.5mm | Bayonet |

# Catalog 2023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