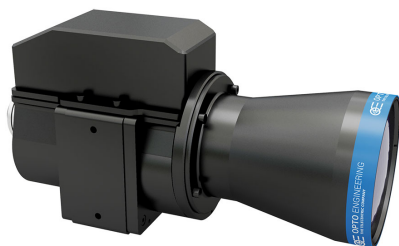


**Bi-telecentric zoom with motorized controls, mag. 0.125x to 1.000x, for sensors up to 2/3"**



## SPECIFICATIONS

### Optical specifications

|   |            |                               |
|---|------------|-------------------------------|
| Magnifications  |            | 0.125 - 0.250 - 0.500 - 1.000 |
| Image circle  | (mm)       | 11                            |
| Max sensor size   |            | 2/3"                          |
| Working distance <sup>1</sup>                           | (mm)       | 157.7                         |
| $wf/N^2$  |            | 16                            |
| Max image displacement between mag changes <sup>8</sup> | ( $\mu$ m) | 350                           |

### Motor Parameters

|                                       |      |                 |
|---------------------------------------|------|-----------------|
| Connector                             |      | DB15HD male     |
| Number of motors                      |      | 1               |
| Type                                  |      | Bipolar stepper |
| RMS winding current                   | (mA) | 600             |
| Winding voltage                       | (V)  | 24              |
| Steps per revolution                  |      | 200             |
| Min time for mag change <sup>9</sup>  | (s)  | 1.5             |
| Max time for mag change <sup>10</sup> | (s)  | 2               |

### Environment

|                             |      |                      |
|-----------------------------|------|----------------------|
| Operating temperature       | (°C) | 0-40                 |
| Storage temperature         | (°C) | 0-50                 |
| Operating relative Humidity | (%)  | 10-85 non condensing |
| IP rating                   |      | IP20                 |
| Installation                |      | Indoor use only      |

## KEY ADVANTAGES

### Perfect magnification constancy and parfocality

No need to re-calibrate or refocus after zooming thanks to an extremely precise positioning system

### Bi-telecentricity

For very accurate measurement

### Excellent image centre stability

Image centring is maintained at every magnification

### Full motorization control

Zoom magnification is set via software

### Fast and silent operations

Max 2 seconds to softly switch from one mag to another

### Detailed test report with measured optical parameters

**TCZR series** is a leading edge optical solution for imaging and measurement applications requiring both the flexibility of zoom lenses and the accuracy of fixed optics.

### Encoder parameters

|                                      |      |   |
|--------------------------------------|------|---|
| Number of encoders                   |      | 1   |
| Supply voltage                       | (V)  | 24  |
| Maximum supply current               | (mA) | 30  |
| Type                                 |      | Magnetic rotary, incremental with reference |
| Output signals                       |      | A, B, Z (index)                             |
| Interfaces                           |      | RS422                                       |
| Number of magnetic poles             |      | 120   |
| Poles pitch                          | (mm) | 2   |
| Interpolation                        |      | 500   |
| Pulses per revolution                |      | 60000                                       |
| Motor to encoder ratio <sup>11</sup> |      | 2.56  |

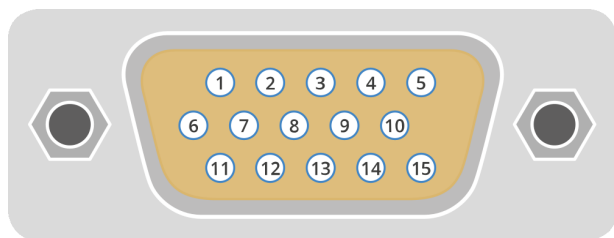
### Mechanical specifications

|                                |      |       |
|--------------------------------|------|-------|
| Mount                          |      | C     |
| Phase adjustment <sup>12</sup> |      | Yes   |
| Length                         | (mm) | 279.3 |
| Height                         | (mm) | 142.0 |
| Width                          | (mm) | 100.0 |
| Front diameter                 | (mm) | 100.0 |
| Mass                           | (g)  | 2820  |

All product specifications and data are subject to change without notice to improve reliability, functionality, design or other. Photos and pictures are for illustration purposes only. Data are reported by design, actual lens performance may vary due to manufacturing tolerances.

- <sup>1</sup> Working distance: distance between the front end of the mechanics and the object. Set this distance within  $\pm 3\%$  of the nominal value for maximum resolution and minimum distortion.
- <sup>2</sup> Working  $f/N$ : the real  $f/N$  of a lens in operating conditions.
- <sup>3</sup> Maximum angle between chief rays and optical axis on the object side. Typical (average production) values and maximum (guaranteed) values are listed.
- <sup>4</sup> Percent deviation of the real image compared to an ideal, undistorted image. Typical (average production) values and maximum (guaranteed) values are listed.
- <sup>5</sup> At the borders of the field depth the image can be still used for measurement but, to get a very sharp image, only half of the nominal field depth should be considered. Pixel size used for calculation is  $3.45 \mu\text{m}$ .
- <sup>6</sup> Object side, calculated with the Rayleigh criterion with  $\lambda = 520 \text{ nm}$
- <sup>7</sup> Image side, at  $1 \sigma$  standard deviation
- <sup>8</sup> Image side
- <sup>9</sup> One magnification step
- <sup>10</sup> Two magnification steps
- <sup>11</sup> 1 encoder pulse = 2.56 motor  $\mu\text{steps}$  (with a 256 microstepping control)
- <sup>12</sup> Indicates the availability of an integrated camera phase adjustment feature.

## CONNECTION



## COMPATIBLE CONTROLLER

The TCZRS lens must be controlled by a suitable motion controller for bipolar stepper motors. Cable and controller are sold separately. The following part numbers are fully compatible with the TCZRS series:

**CBMT002**, 15 wires cable, DB15HD Male to DB15HD Female connector, 2 m.

**MTDV1CH-22A2**, Motion controller for bipolar stepper motors with additional encoder input. Multi-channel versions are compatible as well.

## COMPATIBLE PRODUCTS

Full list of compatible products available [here](#).



A wide selection of innovative machine vision components.

| Pin | Name   | Description                     |
|-----|--------|---------------------------------|
| 1   | 5V     | 5V encoder power supply         |
| 2   | GND    | 0V encoder reference ground     |
| 3   | ENC_A+ | Encoder quadrature signal – A + |
| 4   | ENC_B+ | Encoder quadrature signal – B + |
| 5   | ENC_Z+ | Encoder quadrature signal – Z + |
| 6   | MOT_A+ | Motor – Phase A +               |
| 7   | MOT_B+ | Motor – Phase B +               |
| 8   | ENC_A- | Encoder quadrature signal – A - |
| 9   | ENC_B- | Encoder quadrature signal – B - |
| 10  | ENC_Z- | Encoder quadrature signal – Z - |
| 11  | MOT_A- | Motor – Phase A -               |
| 12  | MOT_B- | Motor – Phase B -               |
| 13  | N.C.   | -                               |
| 14  | N.C.   | -                               |
| 15  | N.C.   | -                               |

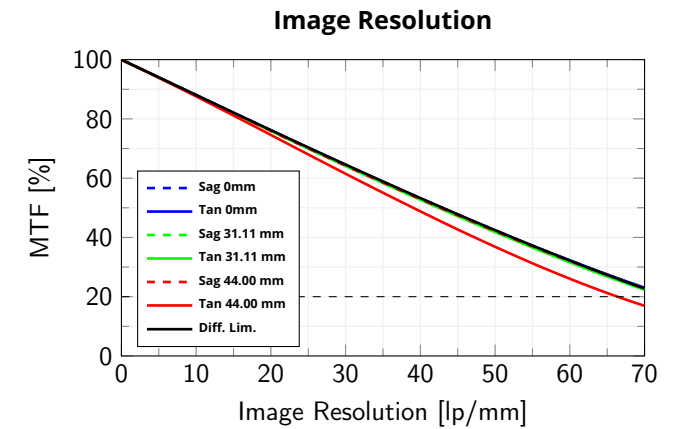
MAGNIFICATION: 0.125X

SPECIFICATION

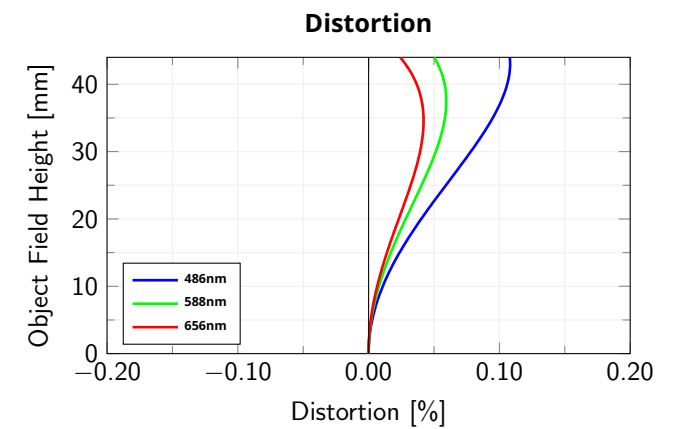
| Optical specifications                     |      |               |
|--|------|---------------|
| Telecentricity typical (max) <sup>3</sup>  | (°)  | < 0.05 (0.10) |
| Distortion typical (max) <sup>4</sup>      | (%)  | < 0.10 (0.10) |
| Field depth <sup>5</sup>                   | (mm) | 52.99         |
| Resolution (max) <sup>6</sup>              | (μm) | 81            |
| Reference point repeatability <sup>7</sup> | (μm) | < 6           |

FIELD OF VIEW

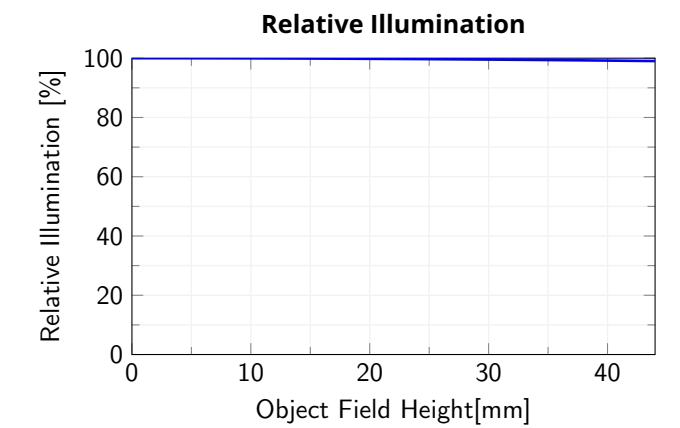
| Sensors                      | (mm x mm)     |
|------------------------------|---------------|
| 1/3" (4.8 x 3.6 mm x mm)     | 38.40 x 28.80 |
| 1/2.5" (5.70 x 4.28 mm x mm) | 45.60 x 34.24 |
| 1/2" (6.4 x 4.8 mm x mm)     | 51.20 x 38.40 |
| 1/1.8" (7.13 x 5.33 mm x mm) | 57.04 x 42.64 |
| 2/3" (8.50 x 7.09 mm x mm)   | 68.00 x 56.72 |



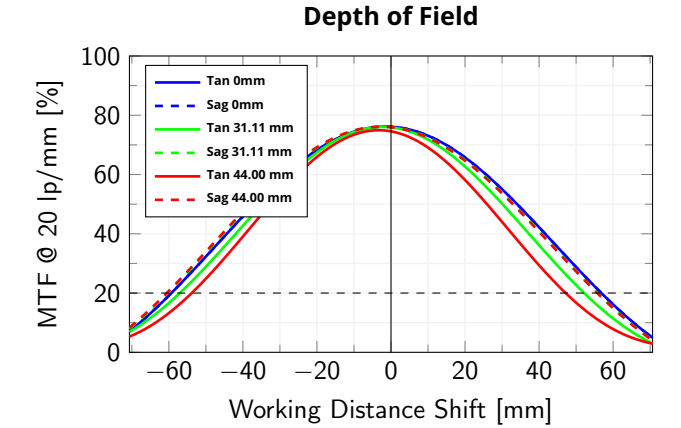
Modulation Transfer Function (MTF) vs. Image Resolution, wavelength range 486 nm - 656 nm



Object Field Height vs. Distortion, from the optical axis to the corner of the field of view



Relative illumination vs. Object Field Height, from the optical axis to the corner of the field of view



Modulation Transfer Function (MTF) @ 20 lp/mm vs. Working Distance Shift from the best focus Working Distance, wavelength range 486 nm - 656 nm

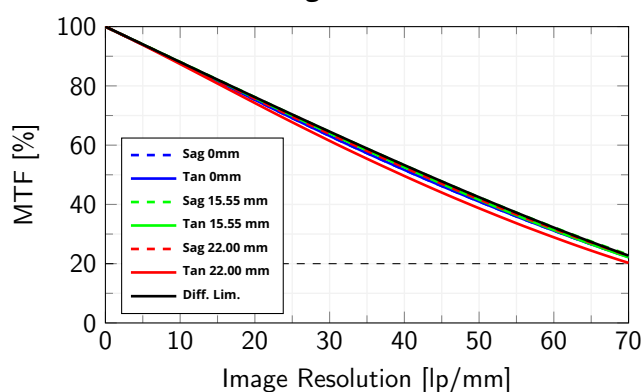
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**MAGNIFICATION: 0.250X****SPECIFICATION****Optical specifications**

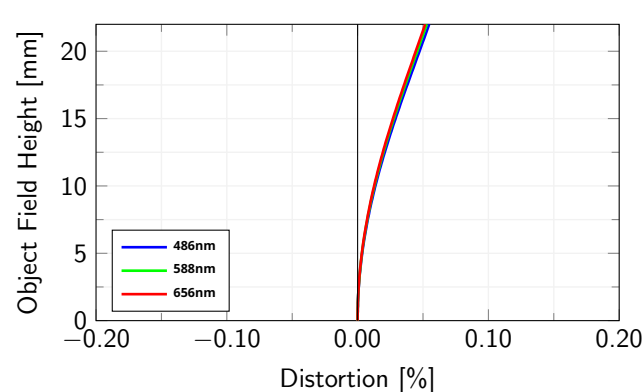
|  |                   |               |
|--|-------------------|---------------|
| Telecentricity typical (max) <sup>3</sup>  | (°)               | < 0.05 (0.10) |
| Distortion typical (max) <sup>4</sup>      | (%)               | < 0.08 (0.10) |
| Field depth <sup>5</sup>                   | (mm)              | 13.25         |
| Resolution (max) <sup>6</sup>              | ( $\mu\text{m}$ ) | 41            |
| Reference point repeatability <sup>7</sup> | ( $\mu\text{m}$ ) | < 5           |

**FIELD OF VIEW****Sensors**

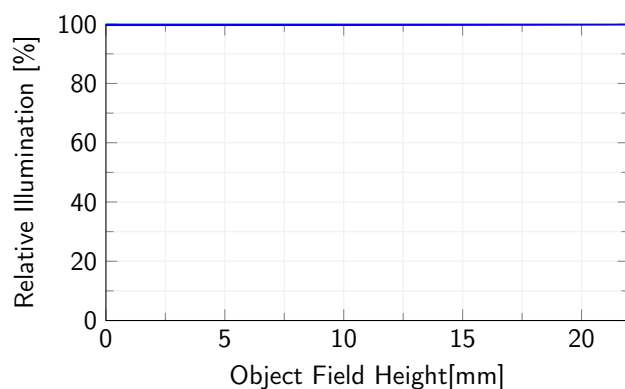
|                              | (mm x mm)     |
|------------------------------|---------------|
| 1/3" (4.8 x 3.6 mm x mm)     | 19.20 x 14.40 |
| 1/2.5" (5.70 x 4.28 mm x mm) | 22.80 x 17.12 |
| 1/2" (6.4 x 4.8 mm x mm)     | 25.60 x 19.20 |
| 1/1.8" (7.13 x 5.33 mm x mm) | 28.52 x 21.32 |
| 2/3" (8.50 x 7.09 mm x mm)   | 34.00 x 28.36 |

**Image Resolution**

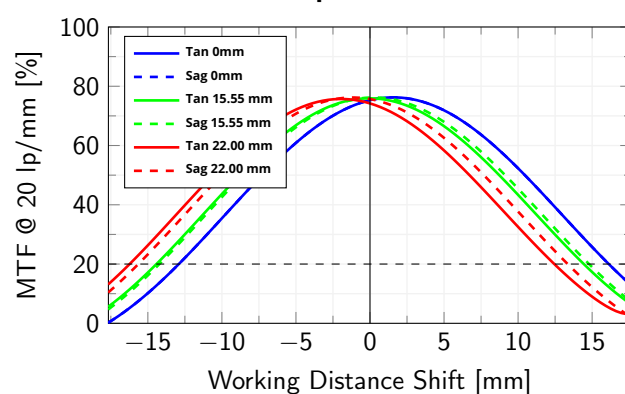
Modulation Transfer Function (MTF) vs. Image Resolution, wavelength range 486 nm - 656 nm

**Distortion**

Object Field Height vs. Distortion, from the optical axis to the corner of the field of view

**Relative Illumination**

Relative illumination vs. Object Field Height, from the optical axis to the corner of the field of view

**Depth of Field**

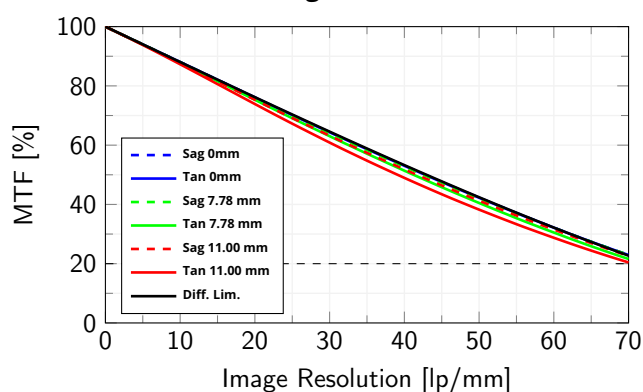
Modulation Transfer Function (MTF) @ 20 lp/mm vs. Working Distance Shift from the best focus Working Distance, wavelength range 486 nm - 656 nm

**MAGNIFICATION: 0.500X****SPECIFICATION****Optical specifications**

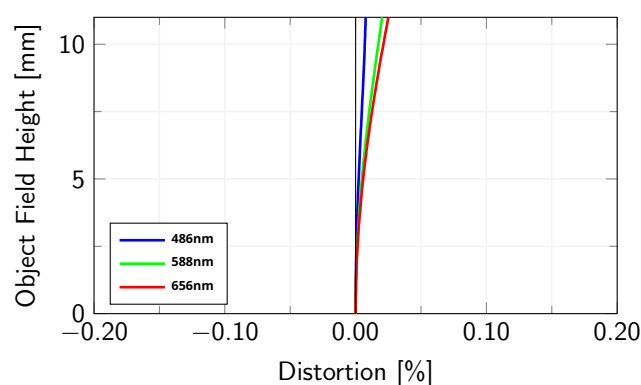
|  |      |               |
|--|------|---------------|
| Telecentricity typical (max) <sup>3</sup>  | (°)  | < 0.05 (0.10) |
| Distortion typical (max) <sup>4</sup>      | (%)  | < 0.05 (0.10) |
| Field depth <sup>5</sup>                   | (mm) | 3.31          |
| Resolution (max) <sup>6</sup>              | (μm) | 20            |
| Reference point repeatability <sup>7</sup> | (μm) | < 2           |

**FIELD OF VIEW****Sensors**

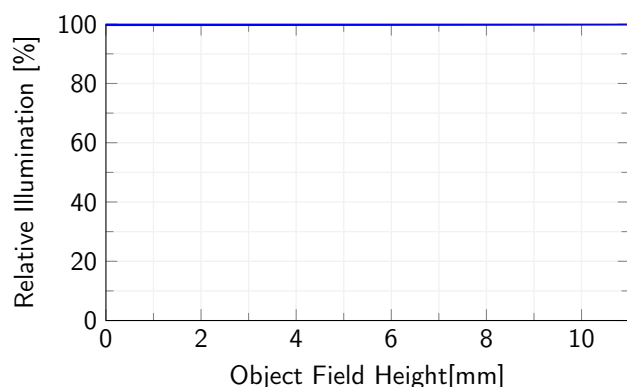
|                              | (mm x mm)     |
|------------------------------|---------------|
| 1/3" (4.8 x 3.6 mm x mm)     | 9.60 x 7.20   |
| 1/2.5" (5.70 x 4.28 mm x mm) | 11.40 x 8.56  |
| 1/2" (6.4 x 4.8 mm x mm)     | 12.80 x 9.60  |
| 1/1.8" (7.13 x 5.33 mm x mm) | 14.26 x 10.66 |
| 2/3" (8.50 x 7.09 mm x mm)   | 17.00 x 14.18 |

**Image Resolution**

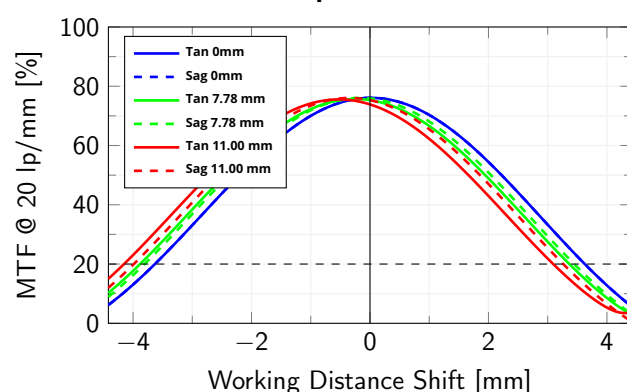
Modulation Transfer Function (MTF) vs. Image Resolution, wavelength range 486 nm - 656 nm

**Distortion**

Object Field Height vs. Distortion, from the optical axis to the corner of the field of view

**Relative Illumination**

Relative illumination vs. Object Field Height, from the optical axis to the corner of the field of view

**Depth of Field**

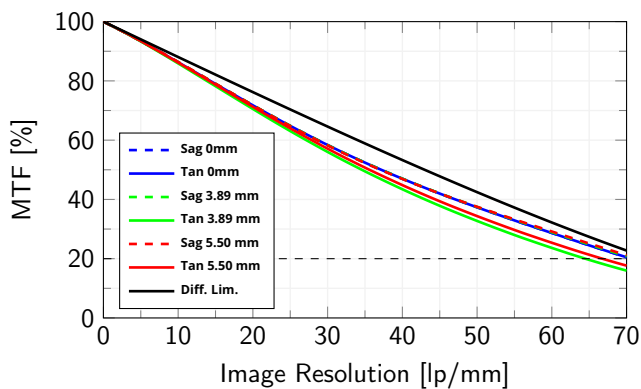
Modulation Transfer Function (MTF) @ 20 lp/mm vs. Working Distance Shift from the best focus Working Distance, wavelength range 486 nm - 656 nm

**MAGNIFICATION: 1.000X****SPECIFICATION****Optical specifications**

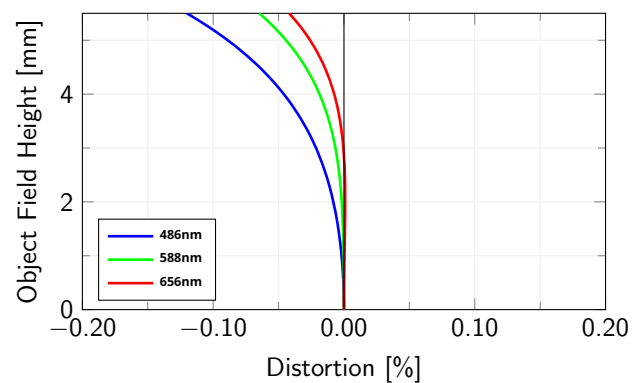
|  |                   |               |
|--|-------------------|---------------|
| Telecentricity typical (max) <sup>3</sup>  | (°)               | < 0.05 (0.10) |
| Distortion typical (max) <sup>4</sup>      | (%)               | < 0.07 (0.10) |
| Field depth <sup>5</sup>                   | (mm)              | 0.83          |
| Resolution (max) <sup>6</sup>              | ( $\mu\text{m}$ ) | 10            |
| Reference point repeatability <sup>7</sup> | ( $\mu\text{m}$ ) | < 4           |

**FIELD OF VIEW****Sensors**

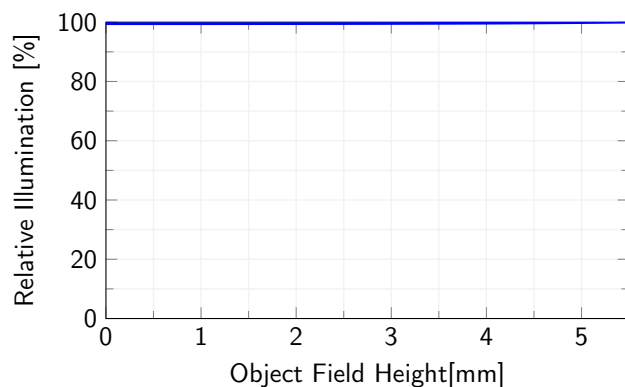
|                              | (mm x mm)   |
|------------------------------|-------------|
| 1/3" (4.8 x 3.6 mm x mm)     | 4.80 x 3.60 |
| 1/2.5" (5.70 x 4.28 mm x mm) | 5.70 x 4.28 |
| 1/2" (6.4 x 4.8 mm x mm)     | 6.40 x 4.80 |
| 1/1.8" (7.13 x 5.33 mm x mm) | 7.13 x 5.33 |
| 2/3" (8.50 x 7.09 mm x mm)   | 8.50 x 7.09 |

**Image Resolution**

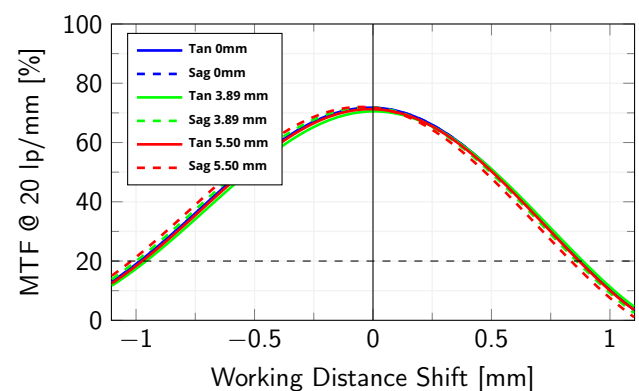
Modulation Transfer Function (MTF) vs. Image Resolution, wavelength range 486 nm - 656 nm

**Distortion**

Object Field Height vs. Distortion, from the optical axis to the corner of the field of view

**Relative Illumination**

Relative illumination vs. Object Field Height, from the optical axis to the corner of the field of view

**Depth of Field**

Modulation Transfer Function (MTF) @ 20 lp/mm vs. Working Distance Shift from the best focus Working Distance, wavelength range 486 nm - 656 nm