

ULTRA-HIGH IMAGE RESOLUTION, ACCURACY AND FIELD DEPTH

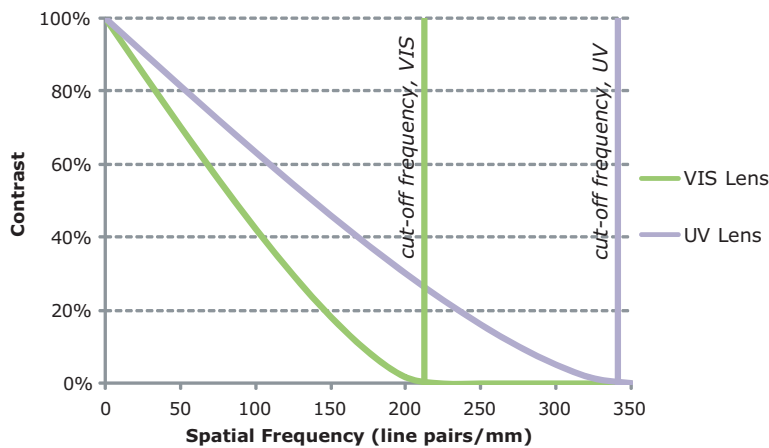


Opto Engineeringd **TC UV Series** Telecentric Lenses are specifically designed to ensure **the highest image resolution today available** in the machine vision world.

No other lenses in the market can efficiently operate with **pixels as small as 2 micron**; for this reason TC UV Telecentric Lenses are a **MUST** for all those using high resolution cameras and seeking for the highest possible system accuracy.

Common lenses and traditional telecentric lenses operate in the visible light range. The limiting resolution of a lens is given by the cut-off frequency, the spatial frequency at which the lens is no longer able to yield sufficient image contrast information. As the *cut-off* frequency is inversely proportional to the light wave-

length, common telecentric optics are useless with very small pixel sizes (such as 1.75 micron) which are becoming increasingly popular among industrial cameras. **TC UV** telecentric Lenses operate in the 365/425 nm range and deliver much higher image contrast at high spatial frequencies, being therefore compatible with the tiniest pixel sizes. On the other hand, when used in combination with normal cameras, the resolution of these lenses is so high that they can cope with much larger object displacements (higher field depths) than VIS lenses before any image defocusing becomes evident.



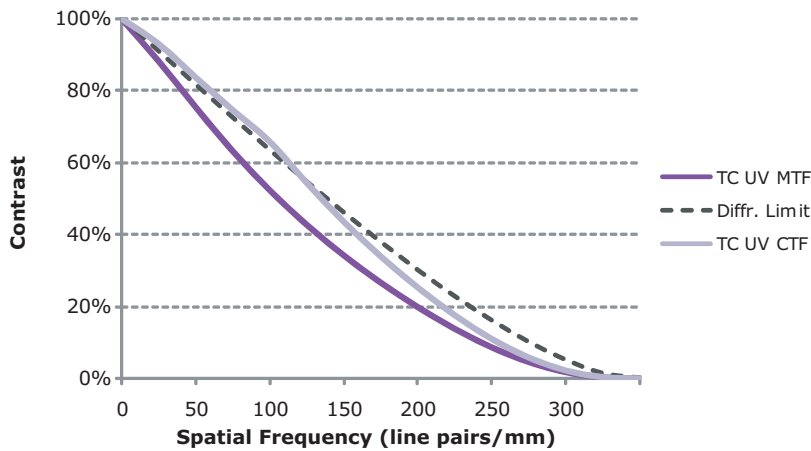
The graph on the left shows the limiting performances (diffraction limit) of two lenses operating at working F-number 8.

The **VIS** lens operates at 587 nm (green lighth) while the **UV** lens operates at 365 nm.

The **MTF** function, which expresses the contrast ratio, is much larger at high spatial frequencies in the **UV** than in the **VIS** range.

The vertical bars show the cut-off frequencies of both lenses: at 340 lp/mm, contrast yield by **TCUV** Lenses is still significant and pixels as small as 1.5 micron can bear useful image information.

Part Number	magn. (x)	Detector Type					Optical Specifications					Dimensions					
		1/4"		1/3"		1/2"	1/1.8"		2/3"		W.D. (1)	F/N (2)	Telecentricity (4)	Dist. (%)	Field Depth (3)	CTF @ 140 lp/mm (%)	Mount
		w x h (mm)	w x h (mm)	w x h (mm)	w x h (mm)	w x h (mm)	w x h (mm)	w x h (mm)	W.D. (mm)	F/N	Telecentricity (deg)	Dist. (%)	Field Depth (mm)	CTF @ 140 lp/mm (%)	Mount	Length (mm)	Diam. (mm)
		3,6 x 2,7	4,8 x 3,6	6,4 x 4,8	7,13 x 5,37	8,8 x 6,6	(1)	(2)	(4)	(%)	(3)	(%)					
		(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)
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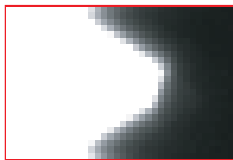


The graph shows the resolution specifications of TC UV lenses.

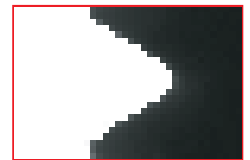
In addition to the MTF diffraction limit, both the MTF curve of TC UV lenses and the CTF (Contrast Transfer Function) curve are displayed.

MTF curve refers to the response of the lens to a sinusoidal pattern, while the CTF function expresses the contrast the lens is yielding when a "square wave" pattern made of black and white stripes is imaged.

If w is the spatial frequency and p is the pixel size, then a pixel whose size is $p = 1/2w$ will yield a contrast given by the CTF at the spatial frequency w .



Images of a back illuminated object: on the left the image is captured with a lens operating in the visible range, on the right the same image is taken with a TC UV Telecentric lens.



Opto Engineering offers a wide range of TCUV-compatible illuminators, such as UV collimated, ring, coaxial and back lights.

For high accuracy measurement applications **LT CL UV Collimated Illuminators** are the products of choice due to superior image resolution and field depth enhancement.

These Telecentric Illuminators ensure an extremely efficient optical coupling with UV Telecentric Lenses, making **UV enhanced detectors not necessary**; this allows for any CCD or C-MOS camera to be integrated.

Part Number	Beam diameter (mm)	Mechanical Specs		Compatible lenses	
		Length (mm)	Outer diameter (mm)	TCUV12xx xx=	TCUV23xx xx=
LTCLUV36	45	138,9	61	36	36
LTCLUV48	60	174,0	75	48	48
LTCLUV56	70	197,3	80	56	56
LTCLUV64	80	219,5	100	64	64
LTCLUV80	100	264,2	116	80	80

Optical Specifications:

Wavelength Range:	405 +/-20 nm FWHM
Divergence angle:	< +/- 0,5°
Optical Output:	> 40 mW
Eye Safety Class:	Class IIIb LED product

Device Power Ratings:

Input Voltage:	12 .. 24 V DC
Minimum DC Voltage:	12 volt
Maximum DC Voltage:	24 volt
Power Consumption:	< 2 watt

Led Power Ratings

Forward Voltage:	3,7 volt
Forward Current:	350 mA

