TCUV SERIES

UV TELECENTRIC LENSES

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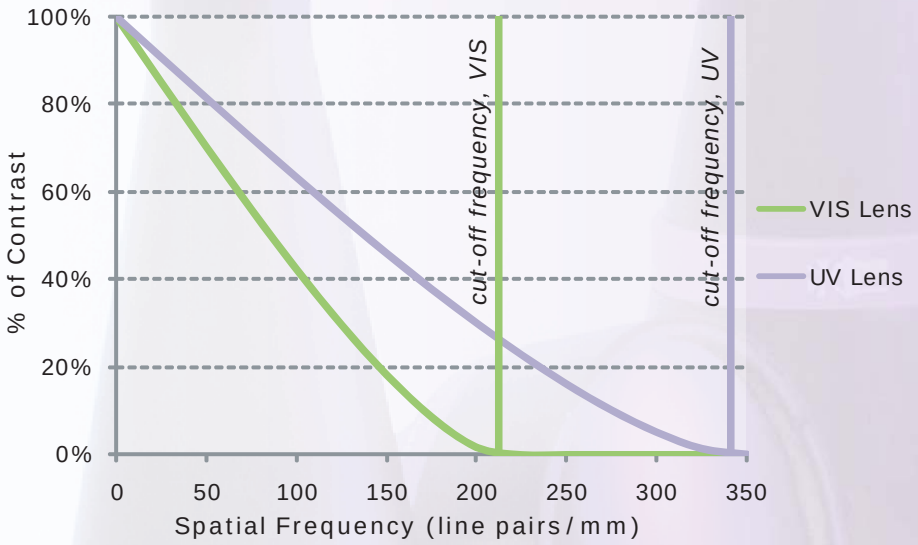
FOR MEASUREMENT APPLICATIONS REQUIRING ULTRA-HIGH IMAGE RESOLUTION, ACCURACY AND FIELD DEPTH

Our new 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 less than 2 micron pixel cameras; 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 lenses operate in the visible light range. The limiting resolution of a lens is given by the *cut-off frequency*, the spatial frequency (usually expressed in *line pairs/mm*) at which the lens is no longer able to yield image contrast information. As the cut-off frequency is inversely proportional to the light wavelength, common telecentric optics are useless with very small pixel sizes (down to 1.75 micron) which are becoming increasingly popular among industrial cameras.

TC UV telecentric Lenses, by operating in the 365/425 nm range, provide much higher image contrast at high spatial frequencies and are therefore compatible with the tiniest pixel sizes. On the other hand, used in combination with normal cameras, the resolution of these lenses is so high that they can tolerate object displacements (field depth) much larger 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 ligth) and the UV lens is operating 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: with UV lenses at 340 lp/mm contrast information is still theorethically present and pixels as small as 1.5 micron can bear significant image information.

		Detector Type										Optical Specifications						Dimensions		
		1/4"		1/3"		1/2"		1/1.8" (7)		2/3"										
Part Number	magn. (X)	w x h 3,6 x 2,7 (mm)		w x h 4,8 x 3,6 (mm)		w x h 6,4 x 4,8 (mm)		w x h 7,13 x 5,37 (mm)		w x h 8,8 x 6,6 (mm)		W.D. (1) (mm)	F/N (2)	CTF @ 140 lp/mm %	Field Depth (3) (mm)	Telecentricity (4) (deg)	Dist. (%)	Mount	Length (5) (mm)	Diam. (mm)
		Object Field of View (mm x mm) (6)																		
TCUV1236	0,175	20,5 x 15,4		27,4 x 20,5		36,5 x 27,4		40,6 x 30,6		diam. x 37,6		98,7	8	> 40	15	< 0,1	< 0,08	C	142,3	61,0
TCUV2336	0,241	14,9 x 11,2		19,9 x 14,9		26,6 x 19,9		29,6 x 22,3		36,5 x 27,4		98,7	8	> 40	10	< 0,1	< 0,08	C	160,4	61,0
TCUV1248	0,133	27,0 x 20,2		36,0 x 27,0		47,9 x 36,0		53,4 x 40,2		diam. x 49,4		130,7	8	> 40	22	< 0,08	< 0,08	C	176,1	75,0
TCUV2348	0,183	19,6 x 14,7		26,2 x 19,6		34,9 x 26,2		38,9 x 29,3		48,0 x 36,0		130,7	8	> 40	0	< 0,08	< 0,08	C	194,5	75,0
TCUV1256	0,114	31,5 x 23,6		42,0 x 31,5		56,1 x 42,0		62,4 x 47,0		diam. x 57,8		154,0	8	> 40	32	< 0,1	< 0,08	C	198,4	80,0
TCUV2356	0,157	22,9 x 17,2		30,6 x 22,9		40,8 x 30,6		45,4 x 34,2		56,1 x 42,1		154,0	8	> 40	17	< 0,1	< 0,08	C	216,8	80,0
TCUV1264	0,100	36,0 x 27,0		48,0 x 36,0		64,0 x 48,0		71,3 x 53,7		diam. x 66,0		176,0	8	> 40	40	< 0,08	< 0,08	C	219,7	100,0
TCUV2364	0,137	26,2 x 19,7		34,9 x 26,2		46,6 x 34,9		51,9 x 39,1		64,1 x 48,0		176,0	8	> 40	25	< 0,08	< 0,08	C	238,2	100,0
TCUV1280	0,080	44,8 x 33,6		59,8 x 44,8		79,7 x 59,8		88,8 x 66,9		diam. x 82,2		221,0	8	> 40	60	< 0,08	< 0,08	C	264,3	116,0
TCUV2380	0,110	32,6 x 24,4		43,5 x 32,6		58,0 x 43,5		64,5 x 48,6		79,7 x 59,8		221,0	8	> 40	40	< 0,08	< 0,08	C	283,0	116,0

(1) Working Distance: distance bewteen the front lens and the object. Set this distance within +/- 3% of the nominal value to optimize distortion and resolution
(2) Working F-number: the real F-number of a lens when used as a macro. Lenses with smaller apertures can be supplied on request
(3) At the borders of the field depth the image can be still used for measurement, but to get a very sharp image consider half the field depth
(4) Maximum slope of principal rays inside the lens: converted in millirad, it gives the maximum measurement error for any millimiter of object displacement
(5) Measured from the end of the mechanics to the camera flange
(6) For the fields with the indication "diam. =" the image of a circular object is inscribed inside the short side of the detector
(7) The 1/1.8" FOV for TC 12 XX lenses can show some vignetting at the image corners, as the lens is optimized for 1/2" detector

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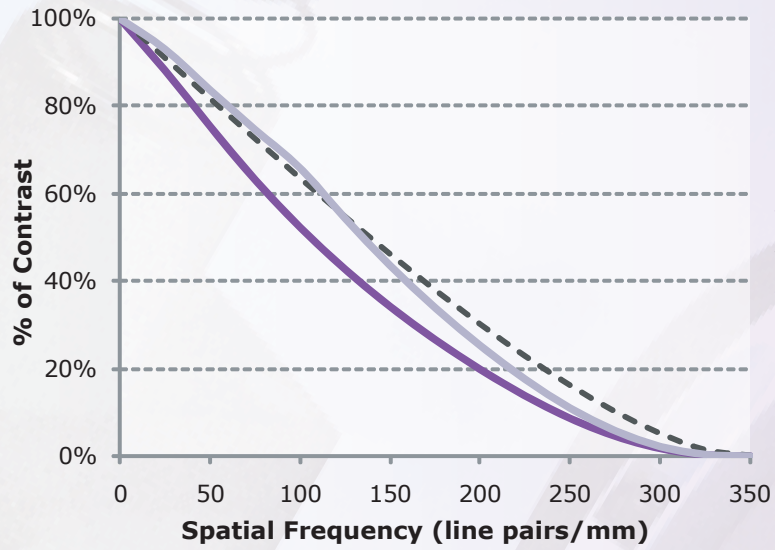
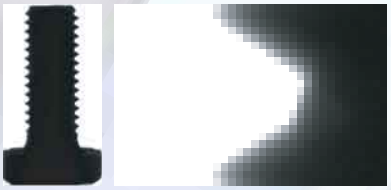


The graph shows the resolution specifications of TC UV lenses.

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*.

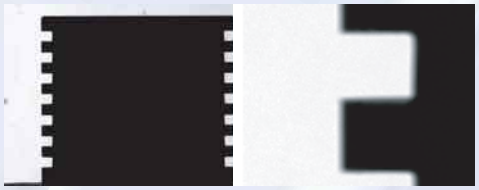
UNLIKE MOST OF OTHER PRODUCERS OF TELECENTRIC LENSES, WE LIST THE SPECS WE ARE ABLE TO GUARANTEE IN PRODUCTION, NOT THE NOMINAL PERFORMANCES, WHICH, OF COURSE, COULD BE MUCH



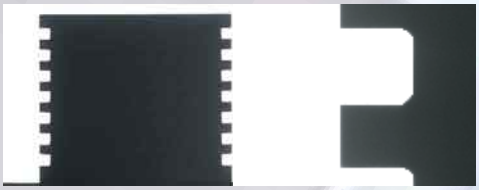
Images of back illuminated object edges are shown.

On the left the objects are observed by a lens operating in the visible range.

On the right the same images taken with a TC UV Telecentric lens.



With TC UV lenses the black/white transition takes place in less than a pixel (in this case 3.5 micron).



Part Number (*)	Beam diameter (mm)	Length (mm)	Outer diameter (mm)	Compatible Lenses TCUV12xx xx=	Compatible Lenses 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

SPECIFICATIONS:

Wavelength Range:	365... 420 nm
Optical Output:	> 50 mW
Divergence angle:	< +/- 0,5°
Input Voltage:	12 .. 24 V DC
Power Consumption:	< 2 W
Eye Safety Class:	Class IIIr LED product

TC UV SERIES Telecentric Lenses can work with UV illuminators operating in the 356 ... 420 nm range. Opto Engineering supplies UV ring, coaxial and back light illuminators operating in this range.

However the best choice for measurement applications are **LTCLUV LED Collimated Illuminators** providing image resolution and field depth enhancement.

These Telecentric Illuminators ensure an extremely efficient coupling between an UV LED source and the UV Telecentric Lens by back-lighting the object with the most appropriate geometry.

With this configuration any CCD or C-MOS camera can be integrated:

UV enhanced detectors are not needed!

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