



25 mm lens with integrated EL-3-10

Test report of Optotune ELM-25-5.6-9-S

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Summary

- Versatile, affordable focusing solution for sensors up to 1/1.7"
- High resolution for 2.4 μm pixels:
 - Close to Nyquist resolution of 193-208 lp/mm in the center and edges over large working distance ranges
 - Great Polychromatic performance: no difference between blue and white light
 - Field Curvature appears only slightly at the corners, but can easily be corrected by re-focusing

- Angular Field of View [$^{\circ}$]

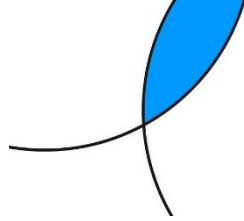
AFOV Type \ WD	800 mm	500 mm	300 mm	150 mm
Width	16.9	17.1	16.4	16.9
Height	11.3	11.5	11.0	11.3
Diagonal	20.3	20.5	19.6	20.3

WD [mm]	HFOV [mm]
800	238
500	150
300	86
150	45



- Works for S-mount cameras & C-mount cameras with adapter

Optimized performance based on your application



- Depending on the desired application, the zero-current working distance can be optimized by changing the flange focal distance (by screwing/unscrewing the C-to-S-Mount adapter)
- This way, field curvature effects can be greatly reduced so that performance is good and uniform across the whole field of view (without any need to selectively refocus)

Examples

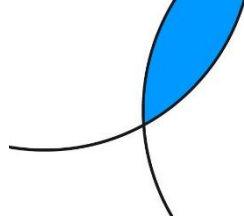
- «**Macro-like**» case: set the zero-current WD to 225 mm (middle of 150-300 mm range)

WD	Resolution (lp/mm)		
	Center	Edge	Corner
150 mm	208	185	185
300 mm	208	185	185

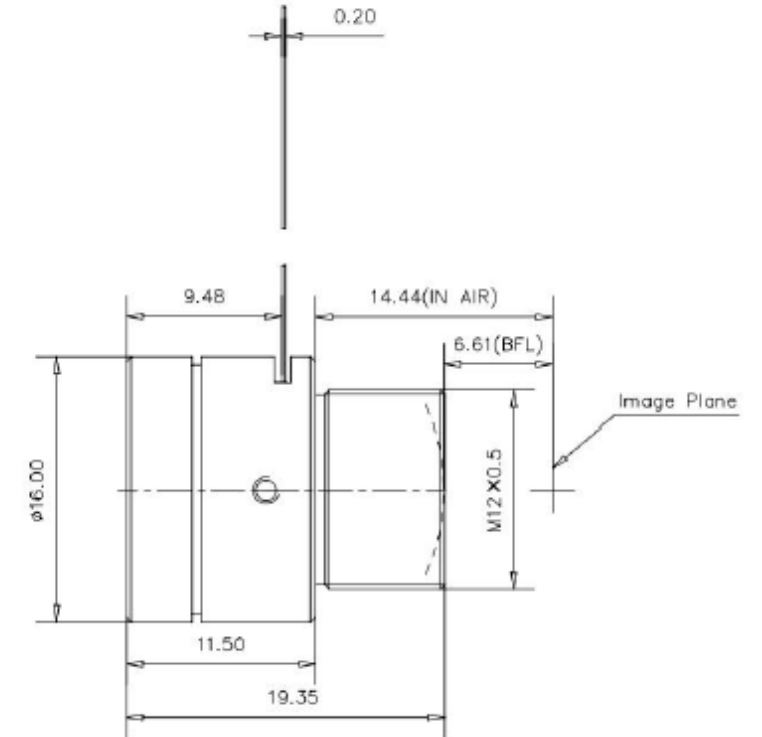
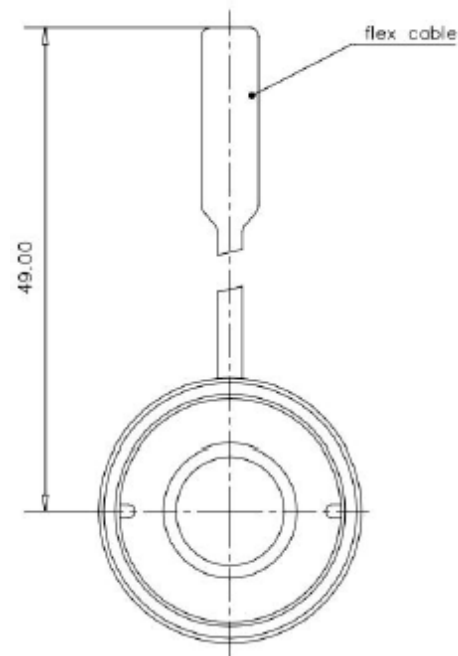
- «**Long-range**» case: set the zero-current WD to 650 mm (middle of 500-800 mm range)

WD	Resolution (lp/mm)		
	Center	Edge	Corner
500 mm	205	205	182
800 mm	205	183	183

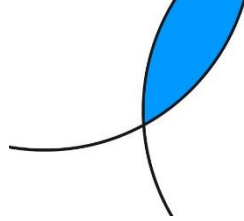
ELM-25-5.6-9-S Datasheet



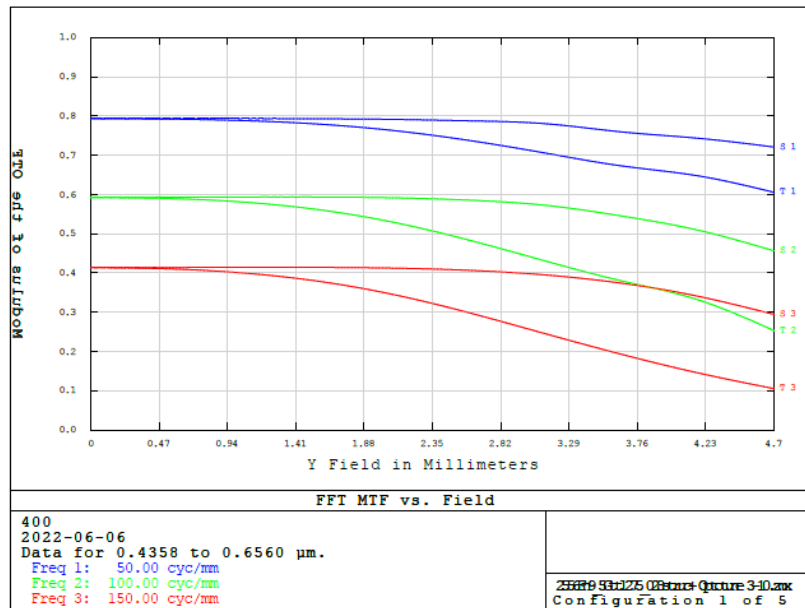
Specifications		
Effective focal length (mm)	25	
F NO.	F5.6	
Sensor ϕ (mm)	9.4(1/1.7")	
FOV Angle	Diagonal (9.25 mm)	20.35°
	Horizontal(7.4 mm)	16.30°
	Vertical (5.5 mm)	12.13°
Back Focal Length (mm)	6.61	
Flange Distance (mm)	14.44	
Optical Distortion	<0.8%	
Wavelength range (nm)	435-656	
Relative illumination	>97%	
Max chief ray angle	<6.2°	
Working distance (mm)	150-infinity	
Mount	M12x0.5	
Connector type	FPC(2 pins)	
Total Track Length (Liquid Lens included) (mm)	25.94	
Size (mm)	$\phi 16 \times 19.35$	
Focus tunable lens specifications	EL-3-10-VIS-26D-FPC	
Focal power range at 20°C (dpt)	-13 to +13	
Wavefront error at 525 nm (vertical/horizontal) (λ RMS)	<0.2 / <0.2	
Working Temperature	-20°C~+65°C	
Storage Temperature	-50°C~+85°C	
Temperature compensation	No	



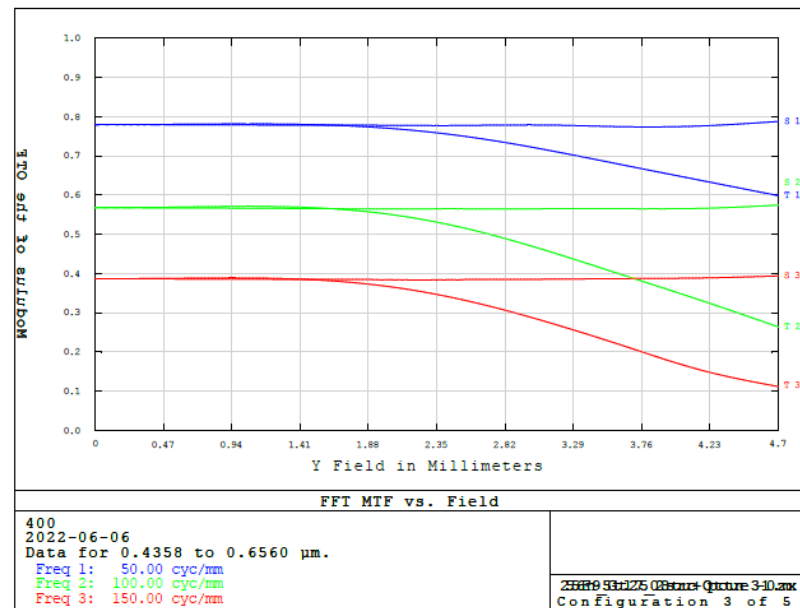
Good nominal MTF values at different working distances



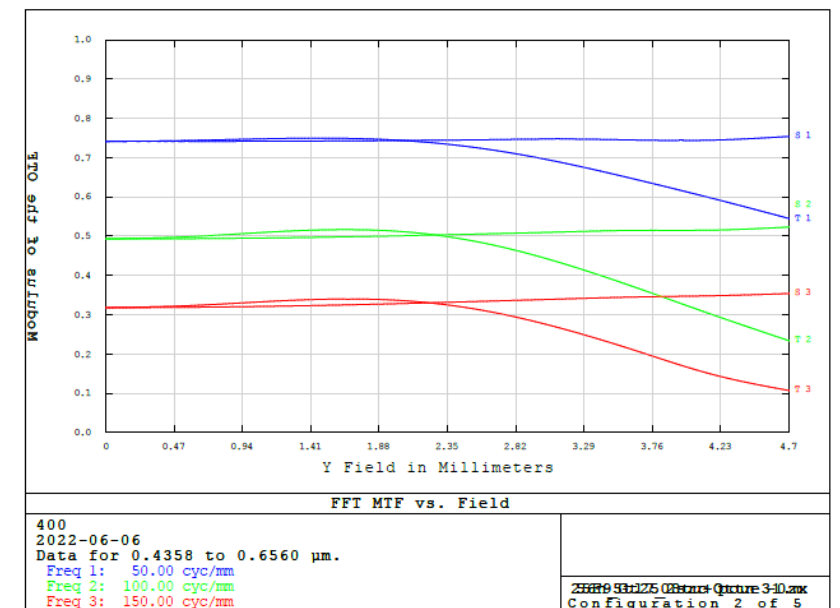
180mm



300mm (WD with best nominal performance)



400mm



Field of view with 1/1.8" sensor

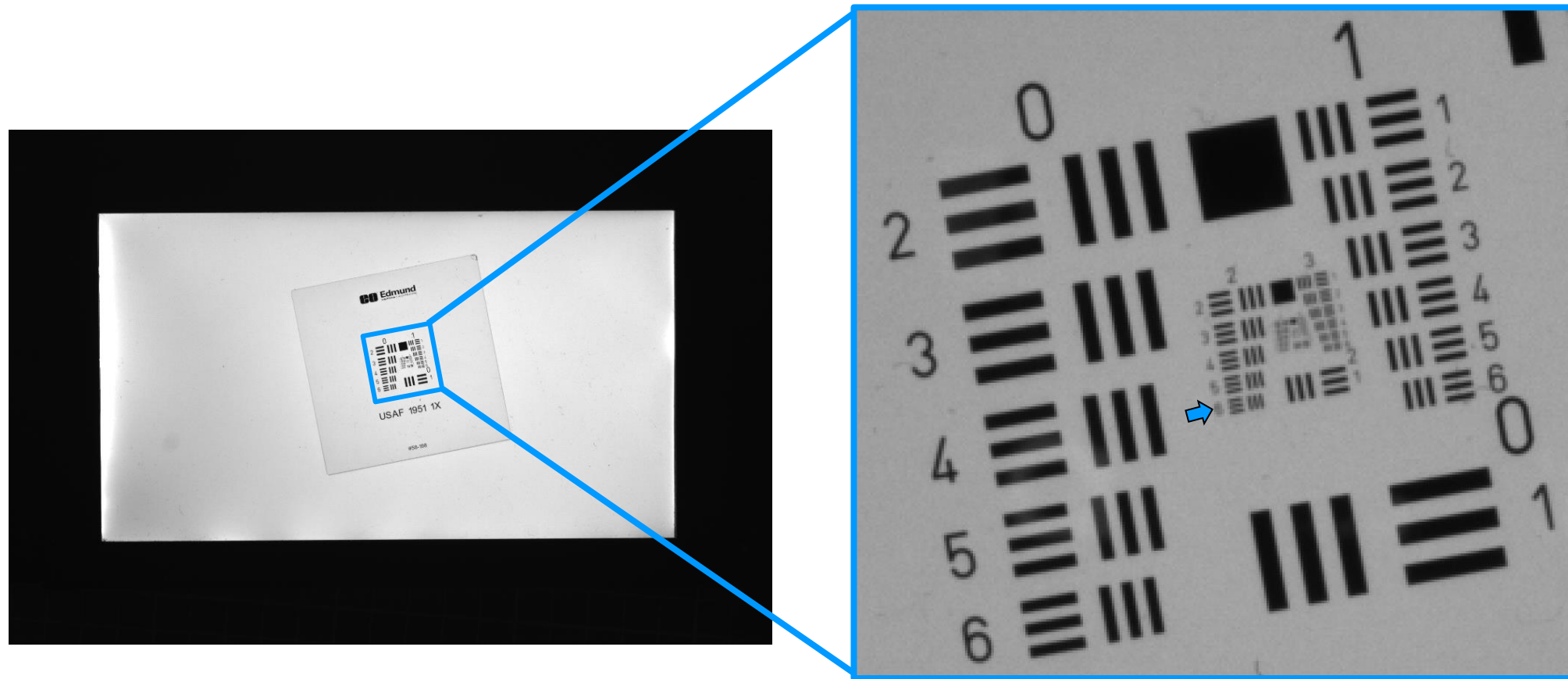


Image size (2.4 um px):

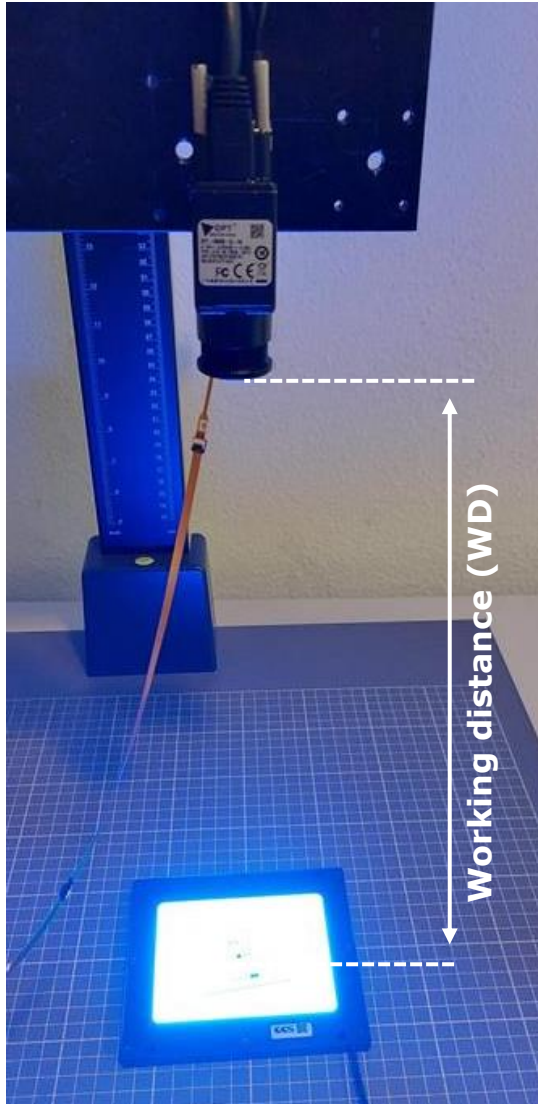
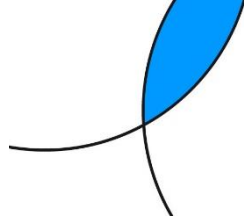
- Width = 7.37 mm
- Height = 4.9 mm
- Diagonal = 8.86 mm

Method for image evaluation

- After acquisition, images are zoomed in to show resolution limited element



Test setup

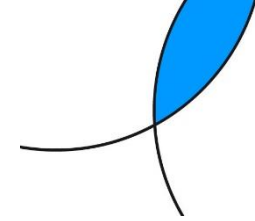


- Camera: OPT-CM600-GL-0402
1/1.8", 3072 x 2048 px
Pixel size = 2.4 μ m
S to C-mount adapter
- Lens: ELM-25-5.6-9 with EL-3-10-VIS-26D-FPC embedded
- Orientation: Vertical Optical Axis
- Driver: Optotune ICC-4C
- Target: USAF chrome target, transparent
- Light: Blue backlight (LFL-100BL2, 470 nm)



WD 150 mm "Macro"

Performance is close to Nyquist in the center



Camera

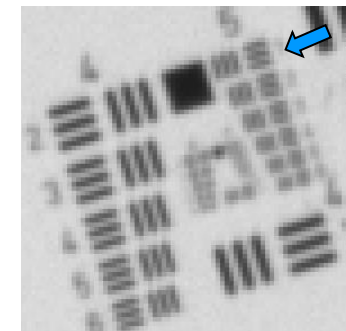
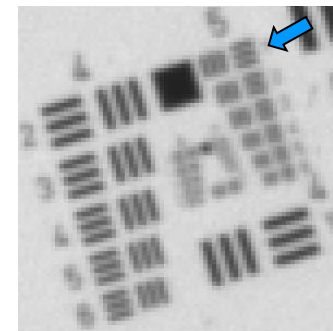
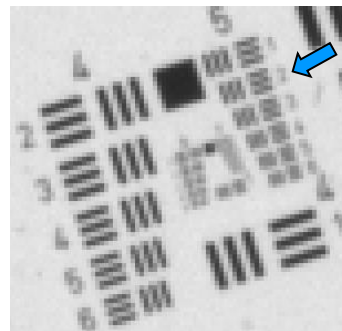
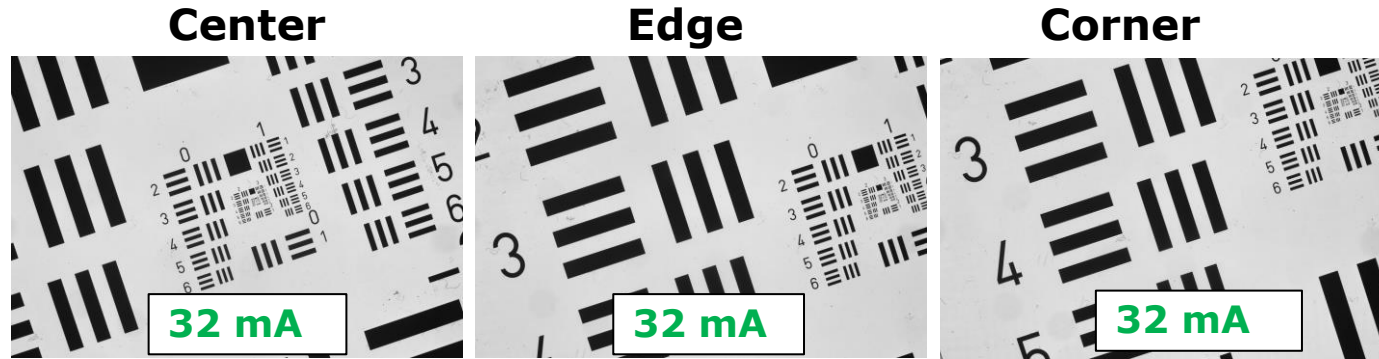
Sensor size = 3072 x 2048 px

Nyquist limit = 208 lp/mm

Pixel size = 2.4 μm

Light

Blue background illumination



USAF element:	5/2	5/1	5/1
Line width (μm):	13.92	15.63	15.63
Lp/mm (object):	36	32	32
Magnification:	0.173	0.173	0.173
Lp/mm (image):	208	185	185

Note: Module was initially focused manually at 225mm WD @0mA

WD 300 mm "Macro"

Performance is close to Nyquist in center and edge without refocusing

Camera

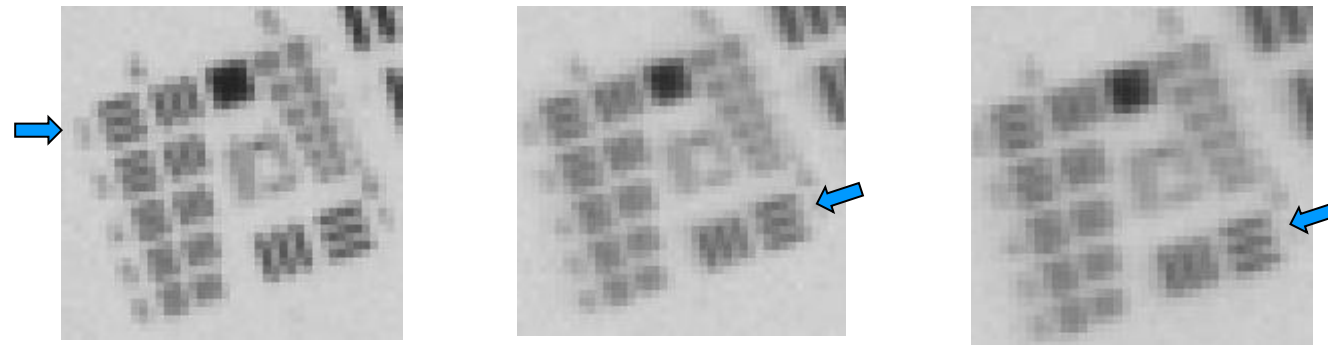
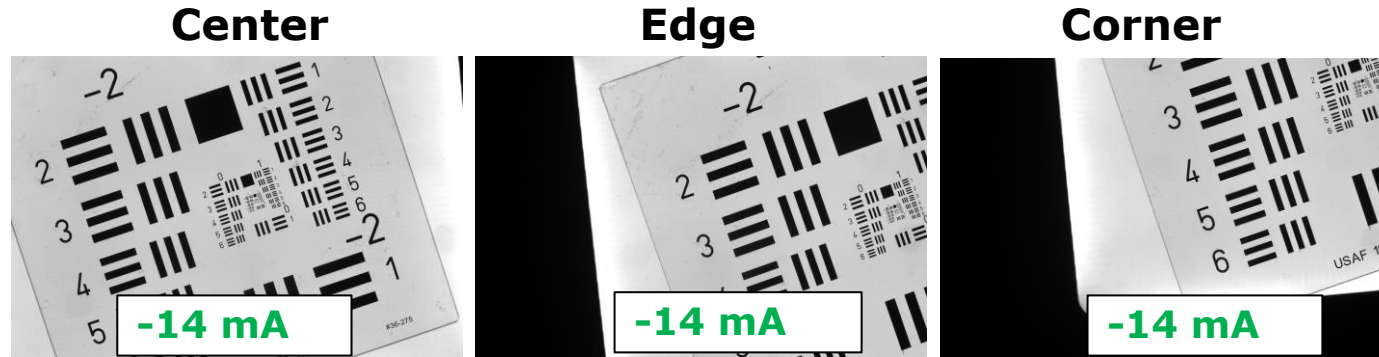
Sensor size = 3072 x 2048 px

Nyquist limit = 208 lp/mm

Pixel size = 2.4 μm

Light

Blue background illumination



USAF element:	4/2	4/1	4/1
Line width (μm):	27.84	31.25	31.25
Lp/mm (object):	18	16	16
Magnification:	0.087	0.087	0.087
Lp/mm (image):	208	185	185

Note: Module was initially focused manually at 225mm WD @0mA

WD 500 mm "long-range"

Performance is Nyquist-resolved in center and edge without refocusing

Camera

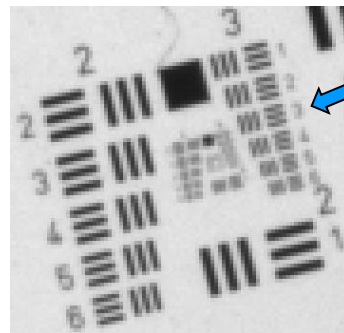
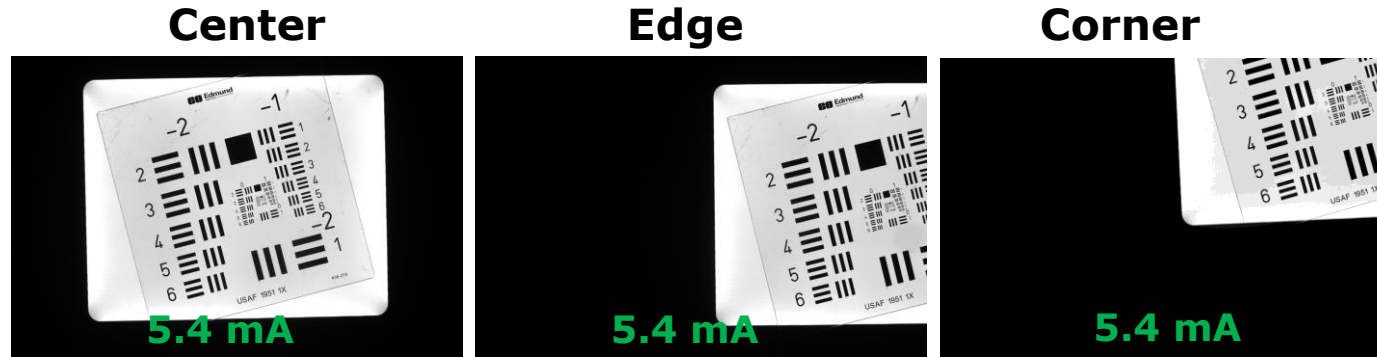
Sensor size = 3072 x 2048 px

Nyquist limit = 208 lp/mm

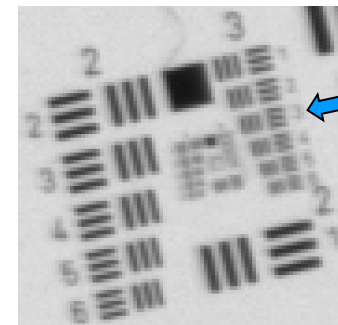
Pixel size = 2.4 μm

Light

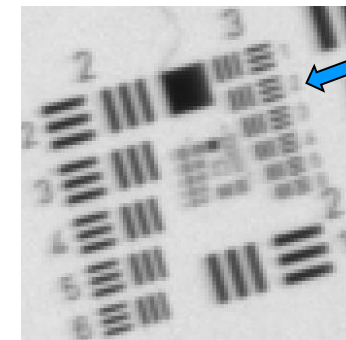
Blue background illumination



USAF element: 3/3
Line width (μm): 49.61
Lp/mm (object): 10
Magnification: 0.049
Lp/mm (image): 205



USAF element: 3/3
Line width (μm): 49.61
Lp/mm (object): 10
Magnification: 0.049
Lp/mm (image): 205



USAF element: 3/2
Line width (μm): 55.68
Lp/mm (object): 9
Magnification: 0.049
Lp/mm (image): 182

Note: Module was initially focused manually at 650mm WD @0mA

WD 800 mm "long-range"

Performance is Nyquist-resolved in center and edge without refocusing

Camera

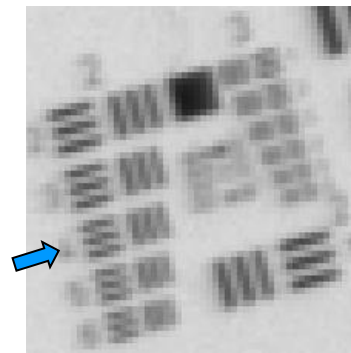
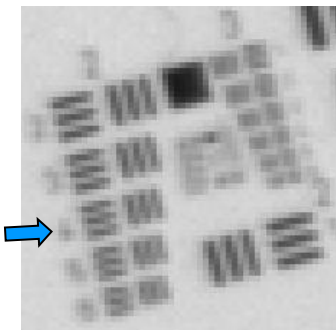
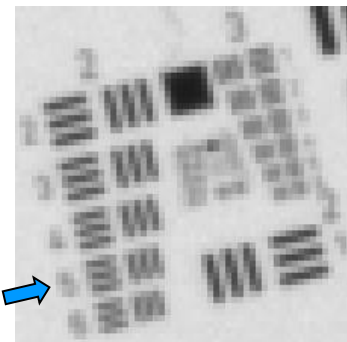
Sensor size = 3072 x 2048 px

Nyquist limit = 208 lp/mm

Pixel size = 2.4 μm

Light

Blue background illumination



USAF element: 2/5
Line width (μm): 78.75
Lp/mm (object): 6
Magnification: 0.031
Lp/mm (image): 205

2/4
88.39
6
0.031
183

2/4
88.39
6
0.031
183

Note: Module was initially focused manually at 650mm WD @0mA