新特光电
Sintec Optronics

12 mm lens with integrated EL-3-10

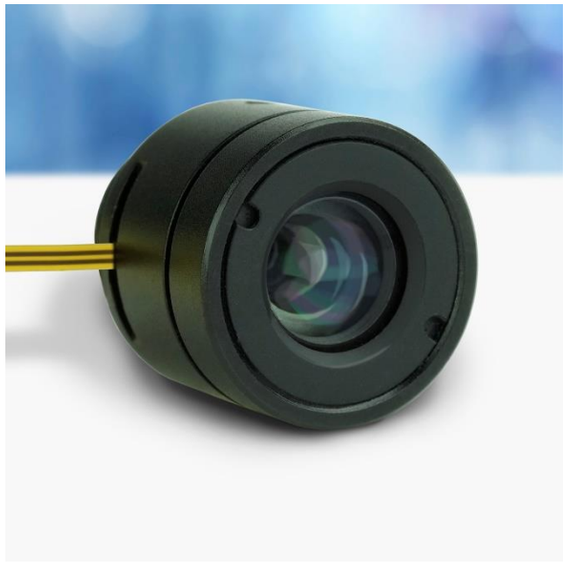
Test report of ELM-12-5.6-9-S

Summary

- Versatile, affordable focusing solution for sensors up to 1/1.7”
- High resolution for 2.4 um pixels:
  - Close to Nyquist resolution of 180-206 lp/mm across the entire field over large working distance ranges
  - Great Polychromatic performance: no difference between blue and white light
  - Field Curvature appears with extreme working distance ranges, but can easily be corrected by re-focusing
- Angular Field of View [°]

AFOV Type \ WD	800 mm	500 mm	300 mm	150 mm
Width	34.6	35.2	35.2	37.1
Height	23.5	23.9	23.8	25.2
Diagonal	41.0	41.7	41.7	43.9

WD [mm]	HFOV [mm]
800	498
500	317
300	190
150	101



- 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 from center to corner (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	192	192	192
300 mm	206	206	184

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

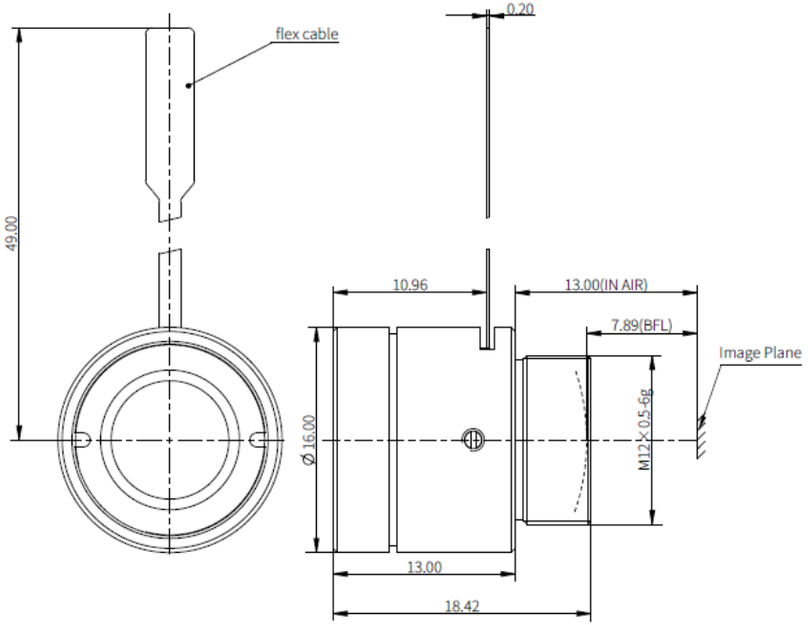
WD	Resolution (lp/mm)		
	Center	Edge	Corner
500 mm	194	194	194
800 mm	202	180	180

ELM-12-5.6-9-S Datasheet

Specifications

Effective focal length (mm)		12
Sensor ø(mm)		9.4(1/1.7")
F NO.		F5.6
FOV Angle	Diagonal (9.25 mm)	42.39°
	Horizontal (7.4 mm)	34.38°
	Vertical (5.5 mm)	26.00°
Wavelength range (nm)		435 ~ 656
Relative illumination		>70%
Working distance (mm)		150 ~ ∞
Working distance without current (mm)		275
Distortion (at WD 275)		<1.41%
Max chief ray angle		<5.5°
Flange focal distance (mm)		13.00
Back focal length (mm)		7.89
Mount		M12×0.5-6g
Connector type		FPC(2 pins)
Size (mm)		ø16×13
Total track length (Liquid Lens included) (mm)		26.00
Focus tunable lens specifications		EL-3-10-VIS-26D-FPC
Focal power range at 20°C (dpt)		-13 ~ +13
Wavefront error at 525 nm (vertical/horizontal) (λRMS)		<0.2 / <0.2
Working temperature		-20℃ ~ +65℃
Storage temperature		-50℃ ~ +85℃
Temperature compensation		No

Mechanical drawings



Good nominal MTF values at different working distances

180mm

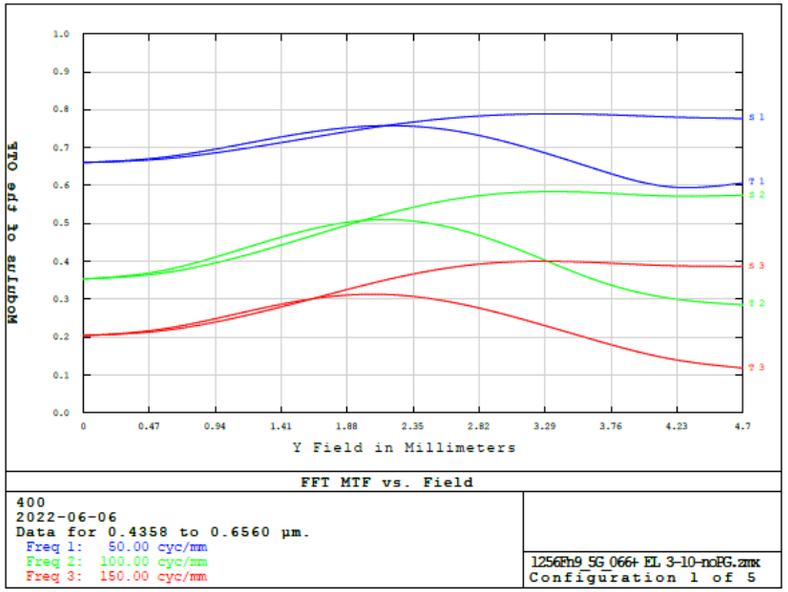


Fig. 2 MTF vs. Field of the OPT-S1256-LQL at WD=180 mm

275mm
(WD with best nominal performance)

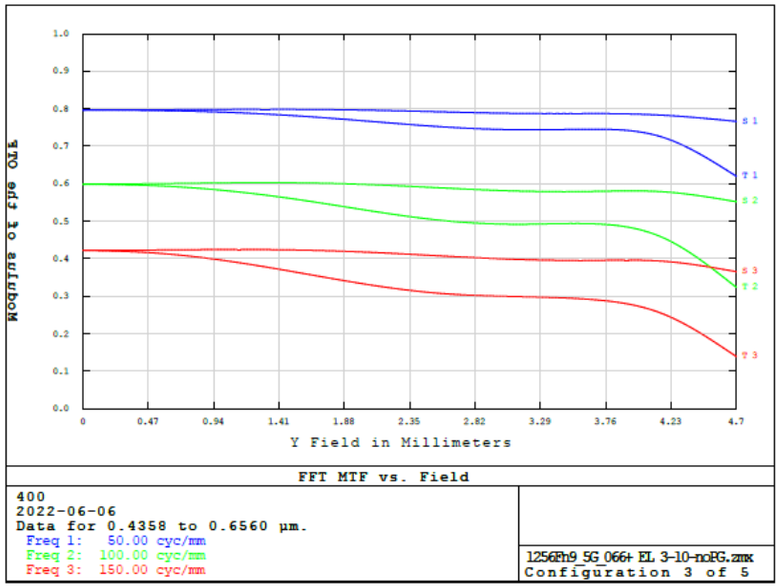


Fig. 3 MTF vs. Field of the OPT-S1256-LQL at WD=275 mm

400mm

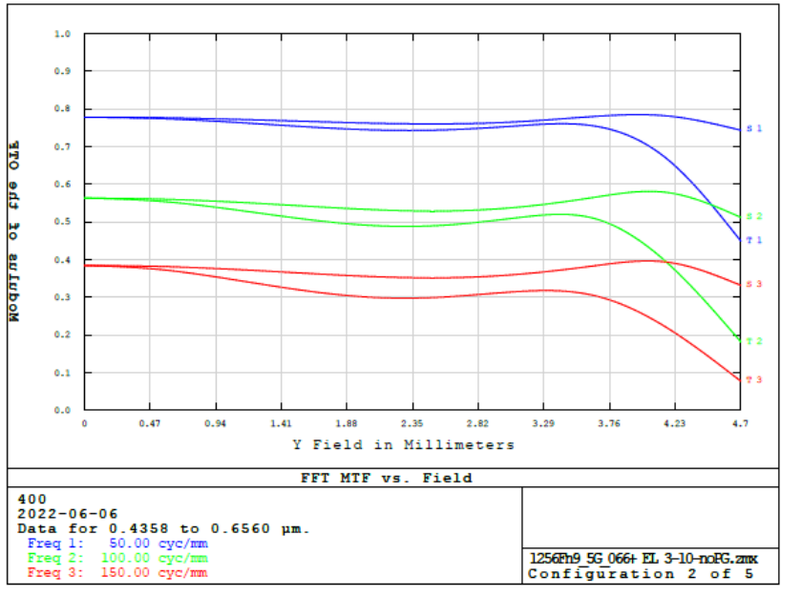


Fig. 4 MTF vs. Field of the OPT-S1256-LQL at WD=400 mm

Field of view with 1/1.8” sensor

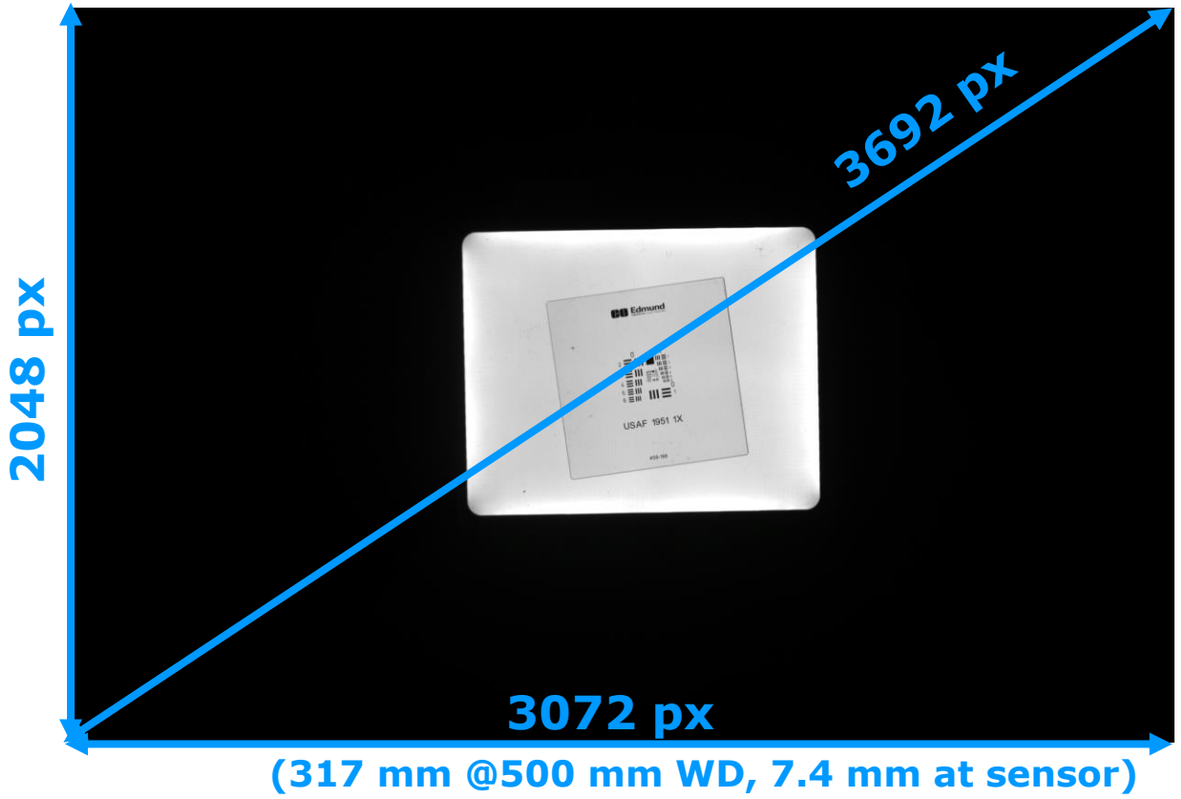
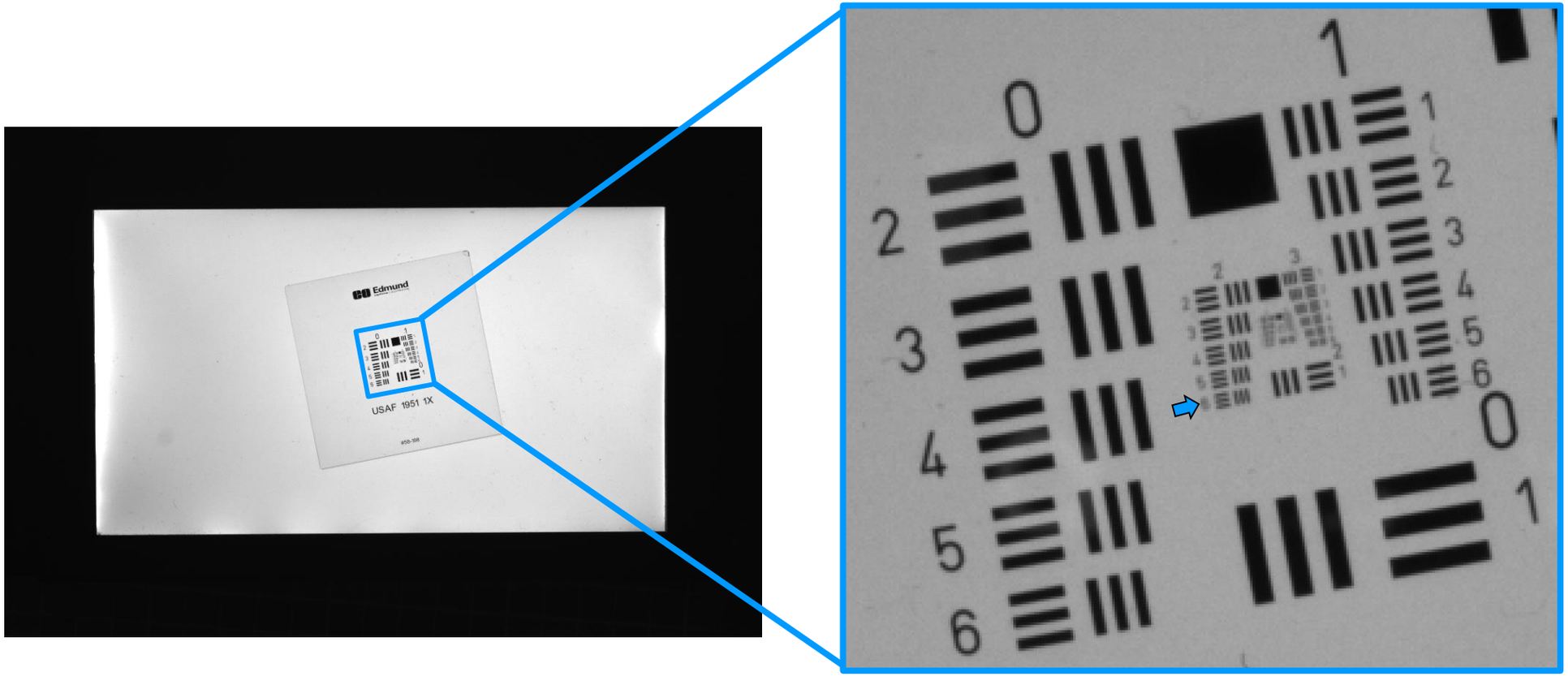


Image size (2.4 um px):

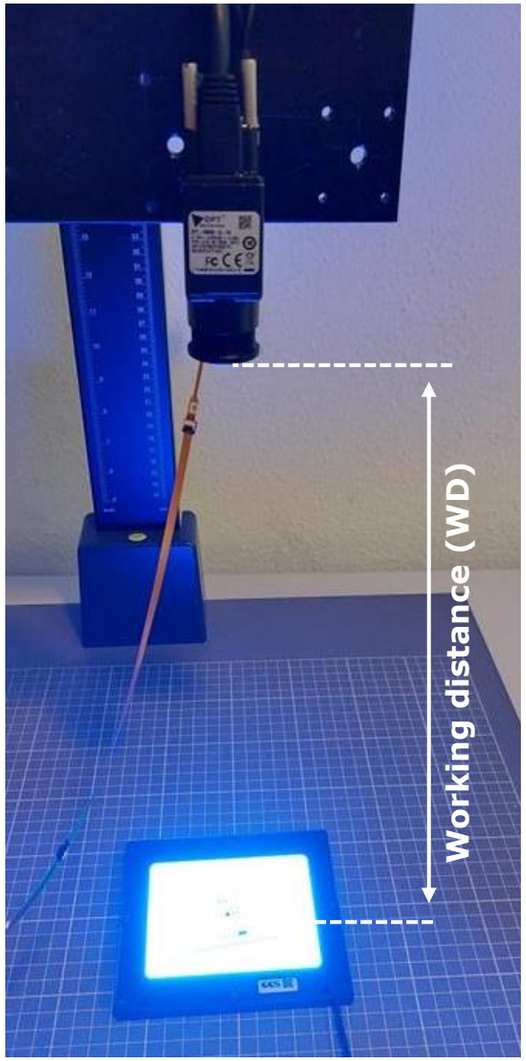
- Width = 7.37 mm
- Height = 4.9 mm
- Diagonal = 8.86 mm

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 um S to C-mount adapter
Lens:	ELM-12-56-9-S 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 full FOV

Camera

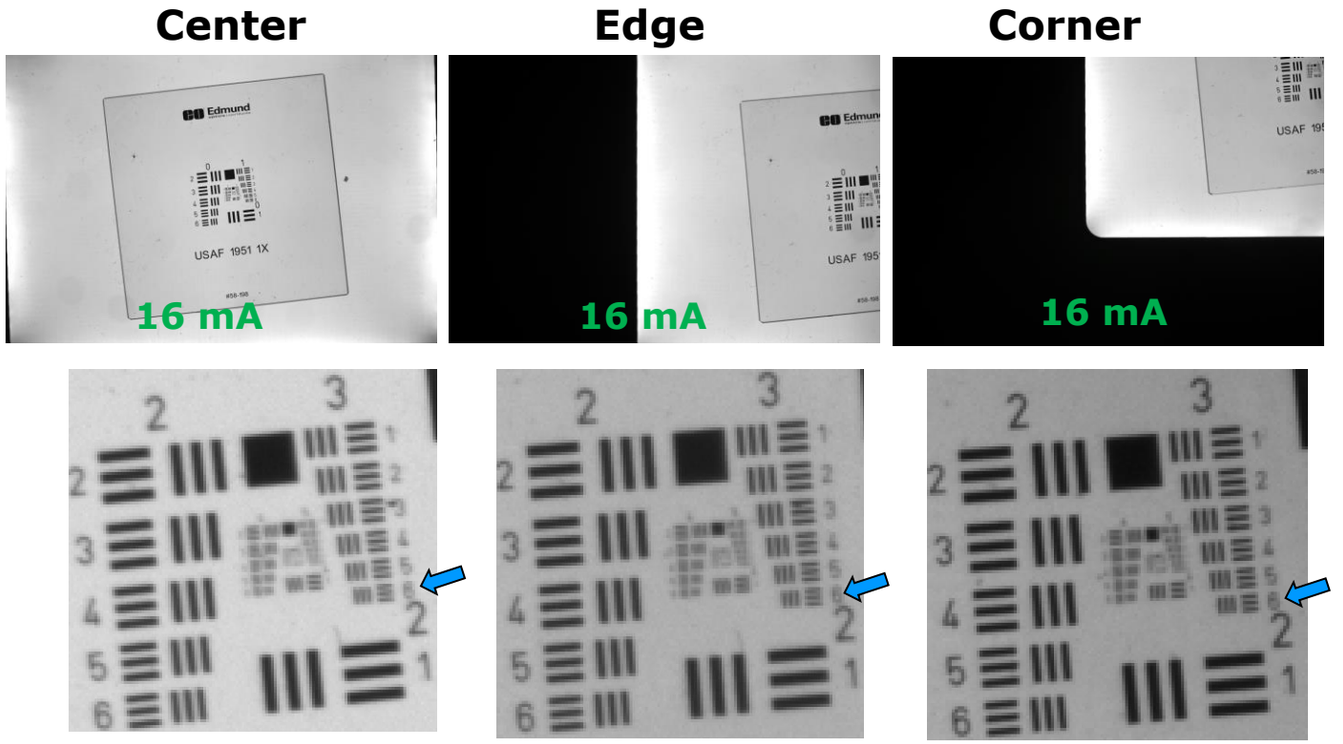
Sensor size = 3072 x 2048 px

Nyquist limit = 208 lp/mm

Pixel size = 2.4 um

Light

Blue background illumination



	Center	Edge	Corner
USAF element:	3/6	3/6	3/6
Line width (um):	35.08	35.08	35.08
Lp/mm (object):	14	14	14
Magnification:	0.074	0.074	0.074
Lp/mm (image):	**192**	**192**	**192**

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

WD 300 mm “Macro”
Performance is close to Nyquist in full FOV

Camera

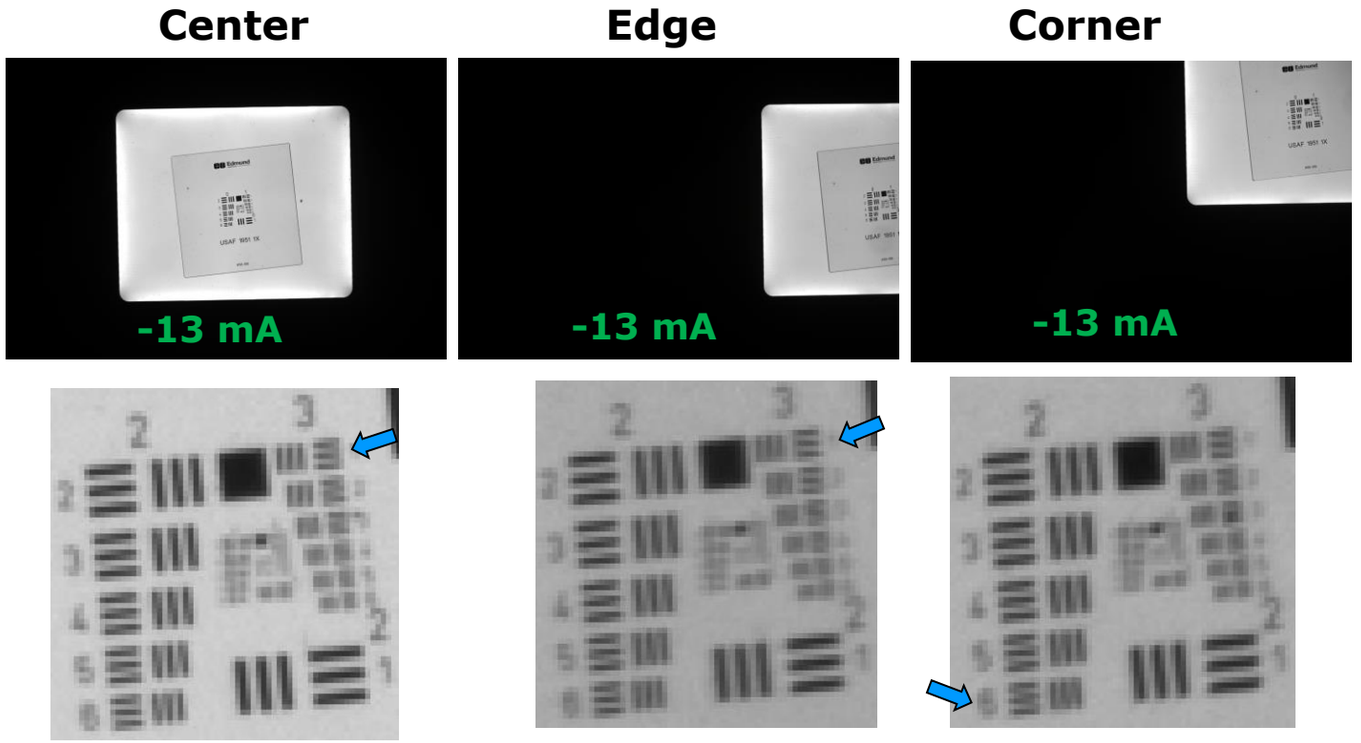
Sensor size = 3072 x 2048 px

Nyquist limit = 208 lp/mm

Pixel size = 2.4 um

Light

Blue background illumination



USAF element:	3/1	3/1	2/6
Line width (um):	62.5	62.5	70.15
Lp/mm (object):	8	8	7
Magnification:	0.039	0.039	0.039
Lp/mm (image):	**206**	**206**	**184**

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

WD 500 mm “long-range”
Performance is close to Nyquist in full FOV

Camera

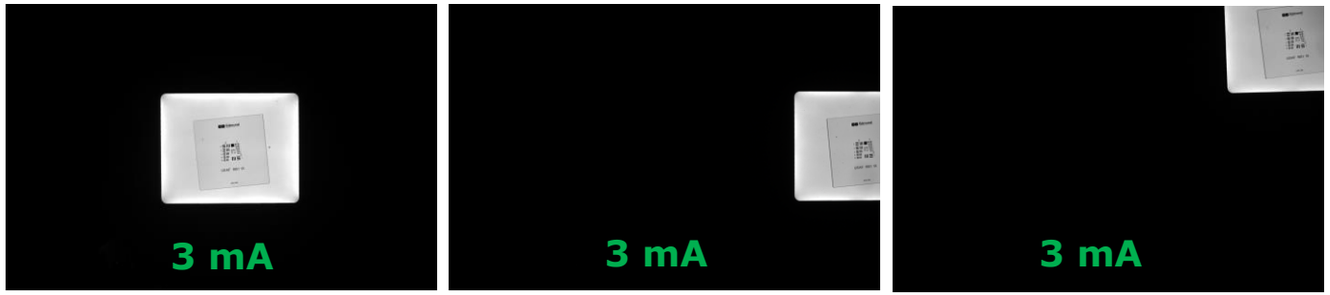
Sensor size = 3072 x 2048 px

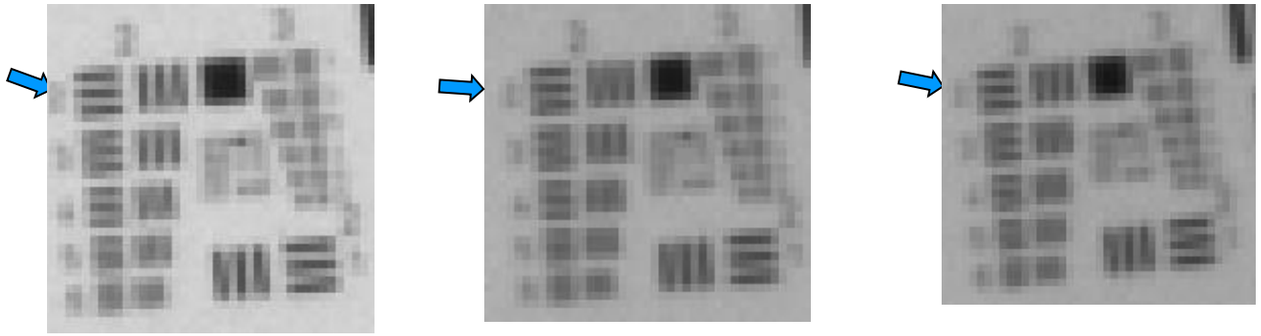
Nyquist limit = 208 lp/mm

Pixel size = 2.4 um

Light

Blue background illumination





USAF element:	2/2	2/2	2/2
Line width (um):	111.36	111.36	111.36
Lp/mm (object):	4	4	4
Magnification:	0.023	0.023	0.023
Lp/mm (image):	**194**	**194**	**194**

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

WD 800 mm “long-range”
Performance is close to Nyquist in full FOV

Camera

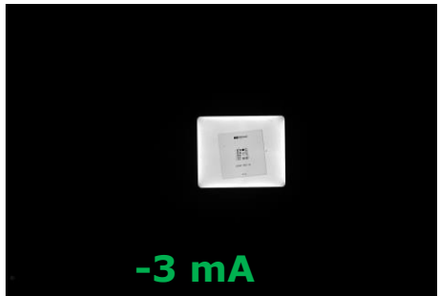
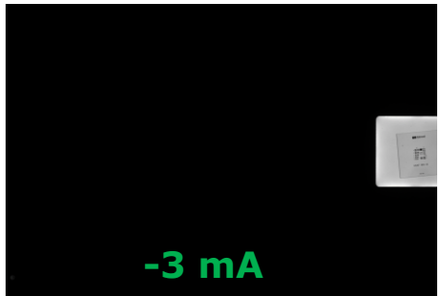
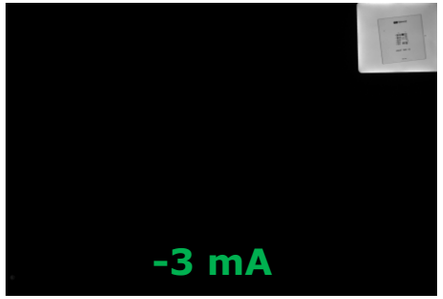
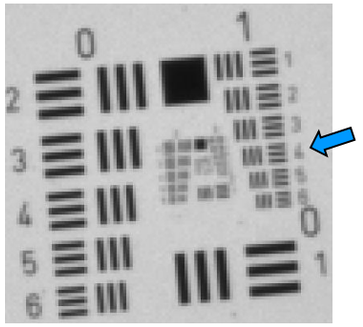
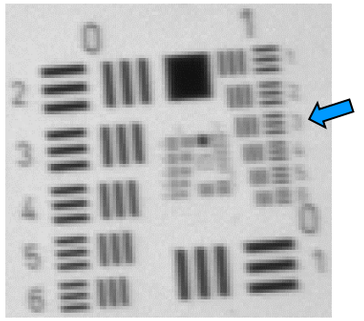
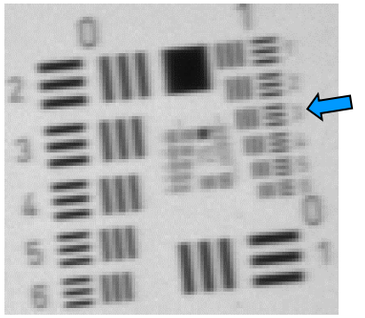
Sensor size = 3072 x 2048 px

Nyquist limit = 208 lp/mm

Pixel size = 2.4 um

Light

Blue background illumination

	Center	Edge	Corner
			
			
USAF element:	1/4	1/3	1/3
Line width (um):	176.78	198.43	198.43
Lp/mm (object):	3	3	3
Magnification:	0.014	0.014	0.014
Lp/mm (image):	**202**	**180**	**180**

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

Great polychromatic performance
No difference between blue and white light @ 500 mm WD