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RESOLV4K

LENS SERIES

Superior Performance Zoom Lenses

 **NAVITAR®**

The Resolv4K Has More to Offer

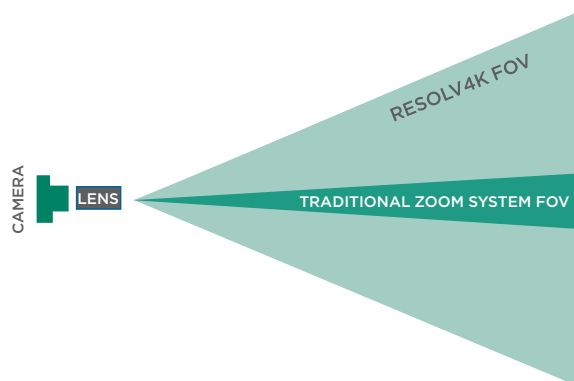
The Resolv4K Lens Series was designed from first order principles to maximize the usage of sensors with higher pixel densities. Numerous adapter options allow users to employ a range of sensors from 1/2" through APS formats and beyond. On the front end of the zoom lens attachments give users the best of both worlds; the low mag end of zoom gives wide fields of view with no sacrifice in MTF or loss of illumination, while the high mag end delivers microscope objective like resolution at extremely long working distances.

The Resolv4K lens has been designed not only for superior visible wavelength axial color correction, but dramatically increased wavelength focusing ability with Visible through Near Infrared (Vis-NIR) and SWIR options. Larger aperture lens attachments significantly increase the usable FOV for coaxial lighting options.

More Throughput

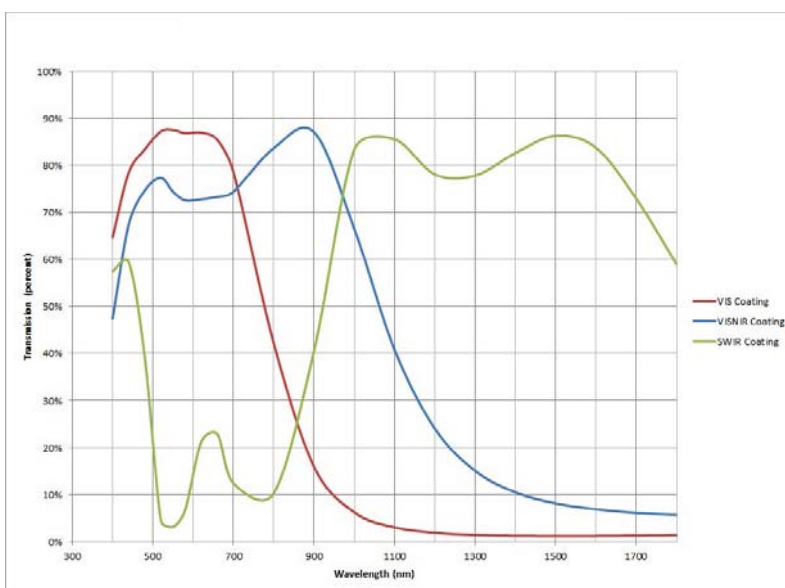
Combining Resolv4K's large field of view and exceptional lens resolution with modern high pixel density sensors results in **faster image capture** of a greater area; making it ideal for high speed inspection and precision measurement applications.

400-600% larger field of view compared to traditional zoom systems



More Wavelengths

Transmission of Resolv4K Coating Options



The Resolv4K lens series comes in visible, Vis-NIR and SWIR coating options. The visible options produce superior axial color correction to existing zoom lenses. The Vis-NIR option allows precision surface inspection in the deep blue, while performing sub-surface inspection at 1100nm without refocusing or loss of transmission. Using the SWIR goes even further beneath the surface to see damage and defects, in food and silicon wafer inspection among other applications.

SWIR and Vis-NIR options are available for the following part numbers:

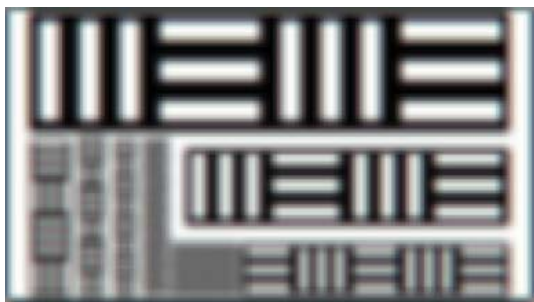
Adapters	Core Zooms and Fixed	Coax	Lens Attachments
1-81101	1-80100	1-81301	1-81201
1-81102	1-80200	1-81303	1-81202
1-81103	1-80300		1-81203
1-81104	1-80500		1-81204
	1-80800		1-81205
			1-81206
			1-81207

More Resolution

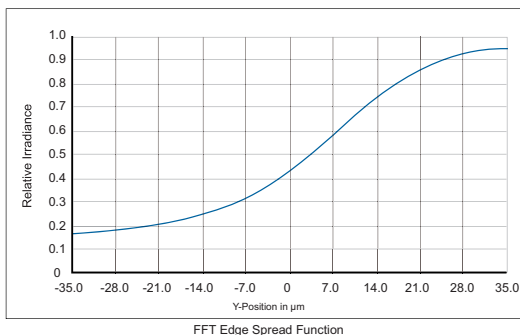
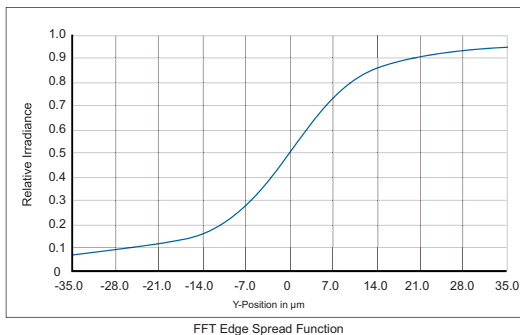
Resolv4K's higher NA, along with its superior aberration correction, gives more precise measurement capabilities than ever. Even comparing a 4.5X zoom point to a 7X mag system, the exceptional quality of the Resolv4K design delivers superior performance, as shown in the black to white transitions in the

edge spread functions below. System performance holds up all the way to the corner of the sensor, so multiple regions of interest can be set regardless of their location in your FOV. Your edge detection software will notice the difference.

12X Zoom



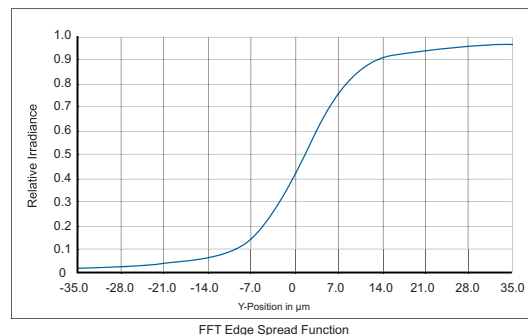
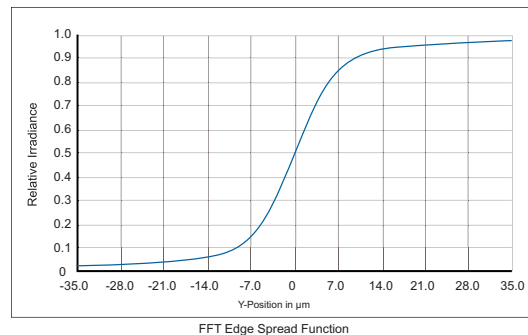
12X Zoom @ 7X High Mag
2MP Sensor – $0.79\mu\text{m}$ / pixel
1.55mm FOV – 1.28mm^2 Area



Navitar Resolv4K Zoom



Resolv4K Zoom @ 4.5X High Mag
8.9MP Sensor – $0.76\mu\text{m}$ / pixel
3.56mm FOV – 5.20mm^2 Area (3.25X more)



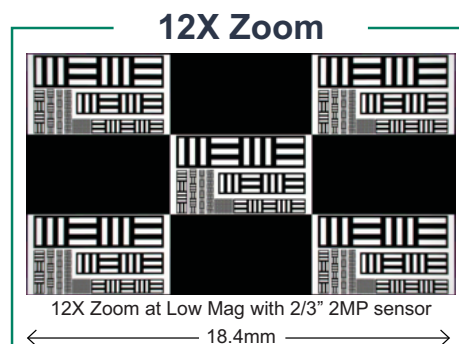
Top Pictures: Zoomed in inset of resolution lines, $0.5\mu\text{m}$, $1\mu\text{m}$, $2\mu\text{m}$, $3\mu\text{m}$, $4\mu\text{m}$, $6\mu\text{m}$, $9\mu\text{m}$ patterns

Middle Graphs: Edge spread function, on axis

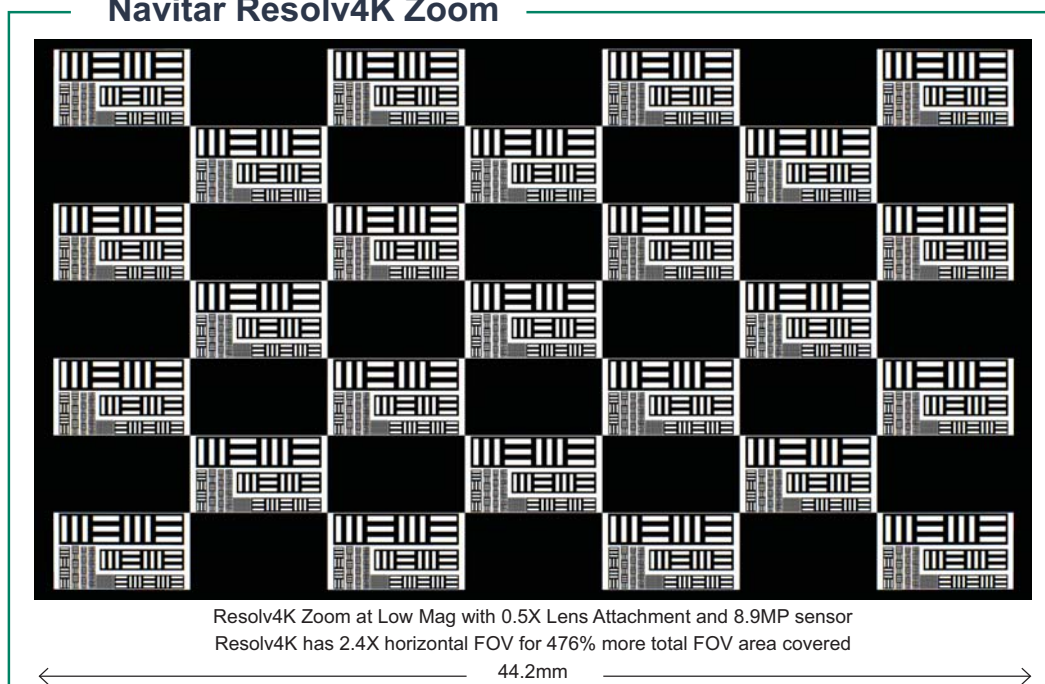
Bottom Graphs: Edge spread function, corner of the sensor

More Field of View

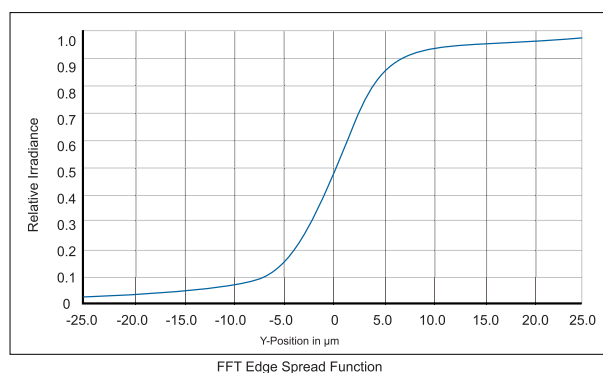
Navitar's Resolv4K Series offers so much more resolving power, that a 400-600% larger field of view is possible when compared to traditional zoom imaging, without any loss of detail. No need to stitch together multiple images from multiple captures.



Navitar Resolv4K Zoom

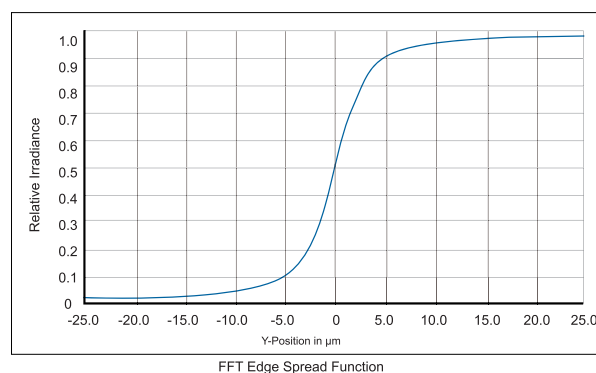


12X Zoom



13.6 μm wide transition from full off to full on.

Navitar Resolv4K Zoom



9.6 μm wide transition from full off to full on, a 30% improvement even at a significantly larger FOV and a longer working distance.

Edge spread functions indicate the lens performance of a system by showing how quickly a black to white edge transition is detected by a lens. A 10% to 90% grey level value at the sensor is shown here as indicating a full off to full on.

Resolv4K Zoom Field of View Matrix (in mm)

Lens Attachment	Rear Adapter Mag		0.6875X	1X	1.375X	2X		
	Ideal Camera Format		2/3"	1"	4/3"	32mm (APS)		
	Pixel Resolution (µm)		2.24 - 5.47	3.26 - 7.95	4.48 - 10.93	6.51 - 15.90	Resolve Limit (µm)	Depth of Field (mm)
	W.D. (mm)	Format	Low-High	Low-High	Low-High	Low-High	Low-High	Low-High
0.25X 0.008 - 0.024 NA 1-81201	359.5	Mag.	0.10X - 0.77X	0.16X - 1.13X	0.22X - 1.55X	0.32X - 2.25X	40.85 - 14.13	7.41 - 0.89
		2/3" Sensor	100.00 - 14.22	68.75 - 9.78	50.00 - 7.11	34.38 - 5.17		
		1" Sensor	-	100.00 - 14.22	72.73 - 10.34	50.00 - 7.11		
		1.1" Sensor	-	110.00 - 15.64	80.00 - 11.38	55.00 - 7.82		
		4/3" Sensor	-	-	100.00 - 14.22	68.75 - 9.78		
		32mm	-	-	-	100.00 - 14.22		
0.5X 0.016 - 0.048 NA 1-81202	173	Mag.	0.22X - 1.55X	0.32X - 2.25X	0.44X - 3.09X	0.64X - 4.50X	20.43 - 7.06	1.85 - 0.22
		2/3" Sensor	50.00 - 7.11	34.38 - 4.89	25.00 - 3.56	17.19 - 2.44		
		1" Sensor	-	50.00 - 7.11	36.36 - 5.17	25.00 - 3.56		
		1.1" Sensor	-	55.00 - 7.82	40.00 - 5.69	27.50 - 3.91		
		4/3" Sensor	-	-	50.00 - 7.11	34.38 - 4.89		
		32mm	-	-	-	50.00 - 7.11		
0.75X 0.025 - 0.071 NA 1-81203	110	Mag.	0.33X - 2.32X	0.48X - 3.38X	0.66X - 4.64X	0.96X - 6.75X	13.62 - 4.71	0.82 - 0.10
		2/3" Sensor	33.33 - 4.74	22.92 - 3.26	16.67 - 2.37	11.46 - 1.63		
		1" Sensor	-	33.33 - 4.74	24.24 - 3.45	16.67 - 2.37		
		1.1" Sensor	-	36.67 - 5.21	26.67 - 3.79	18.33 - 2.61		
		4/3" Sensor	-	-	33.33 - 4.74	22.94 - 3.26		
		32mm	-	-	-	33.33 - 4.74		
1.0X 0.033 - 0.095 NA 1-81204	90	Mag.	0.44X - 3.09X	0.64X - 4.50X	0.88X - 6.19X	1.28X - 9.00X	10.21 - 3.53	0.46 - 0.055
		2/3" Sensor	25.00 - 3.56	17.19 - 2.44	12.50 - 1.78	8.59 - 1.22		
		1" Sensor	-	25.00 - 3.56	18.18 - 2.59	12.50 - 1.78		
		1.1" Sensor	-	27.50 - 3.91	20.00 - 2.84	13.75 - 1.96		
		4/3" Sensor	-	-	25.00 - 3.56	17.19 - 2.44		
		32mm	-	-	-	25.00 - 3.56		
1.25X 0.041 - 0.119 NA 1-81205	72	Mag.	0.55X - 3.87X	0.80X - 5.63X	1.10X - 7.73X	1.60X - 11.25X	8.17 - 2.83	0.30 - 0.035
		2/3" Sensor	20.00 - 2.84	13.75 - 1.96	10.00 - 1.42	6.88 - 0.98		
		1" Sensor	-	20.00 - 2.84	14.55 - 2.07	10.00 - 1.42		
		1.1" Sensor	-	22.00 - 3.13	16.00 - 2.28	11.00 - 1.56		
		4/3" Sensor	-	-	20.00 - 2.84	13.75 - 1.96		
		32mm	-	-	-	20.00 - 2.84		
1.5X 0.049 - 0.142 NA 1-81206	46.5	Mag.	0.66X - 4.64X	0.96X - 6.75X	1.32X - 9.28X	1.92X - 13.50X	6.81 - 2.35	0.206 - 0.025
		2/3" Sensor	16.67 - 2.37	11.46 - 1.63	8.33 - 1.19	5.73 - 0.81		
		1" Sensor	-	16.67 - 2.37	12.12 - 1.72	8.33 - 1.19		
		1.1" Sensor	-	18.33 - 2.61	13.33 - 1.90	9.17 - 1.30		
		4/3" Sensor	-	-	16.67 - 2.37	11.46 - 1.63		
		32mm	-	-	-	16.67 - 2.37		
2.0X 0.066 - 0.190 NA 1-81207	32.3	Mag.	0.88X - 6.19X	1.28X - 9.00X	1.76X - 12.38X	2.56X - 18.00X	5.11 - 1.77	0.116 - 0.014
		2/3" Sensor	12.50 - 1.78	8.59 - 1.22	6.25 - 0.89	4.30 - 0.61		
		1" Sensor	-	12.50 - 1.78	9.09 - 1.29	6.25 - 0.89		
		1.1" Sensor	-	13.75 - 1.96	10.00 - 1.42	6.88 - 0.98		
		4/3" Sensor	-	-	12.50 - 1.78	8.59 - 1.22		
		32mm	-	-	-	12.50 - 1.78		

The above fields of view are measured diagonally in millimeters (Horizontal = Diagonal x 0.8 and Vertical = Diagonal x 0.6) on a 4:3 aspect ratio sensor.

Dark Gray box: Contact your Navitar sales representative for further guidance when selecting this option.

NOTE: Coax and fine focus options all maintain same FOV, resolution, and working distance, subject to adequate lighting

Resolv4K Field of View Matrix with Navitar Objectives (mm)

UltraZoom	Objective Lens	Rear Adapter Mag		0.6875X	1X	1.375X	2X	Resolve Limit (μm)	Depth of Field (μm)
		Ideal Camera Format		2/3"	1"	4/3"	32mm (APS)		
		Pixel Resolution (μm)		2.24 - 5.47	3.26 - 7.95	4.48 - 10.93	6.51 - 15.90		
		W.D. (mm)	Format	Low-High	Low-High	Low-High	Low-High		
			Mag.						
	Navitar 4X 0.066 - 0.190 NA 1-55075	20	Mag.	0.88X - 6.19X	1.28X - 9.00X	1.76X - 12.38X	2.56X - 18.00X	5.11 - 1.77	116 - 14
			2/3" Sensor	8.10 - 1.78	8.10 - 1.22	6.25 - 0.89	4.30 - 0.61		
			1" Sensor	-	8.10 - 1.78	8.10 - 1.29	6.25 - 0.89		
			1.1" Sensor	-	8.10 - 1.96	8.10 - 1.42	6.88 - 0.98		
			4/3" Sensor	-	-	8.10 - 1.78	8.10 - 1.22		
			32mm	-	-	-	8.10 - 1.78		
	Navitar 6X NA 0.099 - 0.285 1-55401	25	Mag.	1.32X - 9.28X	1.92X - 13.50X	2.64X - 18.56X	3.84X - 27.00X	3.40 - 1.18	51 - 6.2
			2/3" Sensor	6.25 - 1.19	6.25 - 0.81	4.17 - 0.59	2.86 - 0.41		
			1" Sensor	-	6.25 - 1.19	6.25 - 0.86	4.17 - 0.59		
			1.1" Sensor	-	6.25 - 1.30	6.25 - 0.95	4.58 - 0.65		
			4/3" Sensor	-	-	6.25 - 1.19	6.25 - 0.81		
			32mm	-	-	-	6.25 - 1.19		
	Navitar 10X 0.164 - 0.400 NA 1-55227	10	Mag.	2.20X - 15.47X	3.20X - 22.50X	4.40X - 30.94X	6.40X - 45.00X	2.04 - 0.84	19 - 3.1
			2/3" Sensor	3.20 - 0.71	3.20 - 0.49	2.50 - 0.36	1.72 - 0.24		
			1" Sensor	-	3.20 - 0.71	3.20 - 0.52	2.50 - 0.36		
			1.1" Sensor	-	3.20 - 0.78	3.20 - 0.57	2.75 - 0.39		
			4/3" Sensor	-	-	3.20 - 0.71	3.20 - 0.49		
			32mm	-	-	-	3.20 - 0.71		
	Mitotoyo 5X 0.082 - 0.140 NA 1-60226	34	Mag.	1.10X - 7.73X	1.60X - 11.25X	2.20X - 15.47X	3.20X - 22.50X	4.09 - 2.40	74.1 - 25.5
			2/3" Sensor	4.80 - 1.42	4.80 - 0.98	4.80 - 0.71	3.44 - 0.49		
			1" Sensor	-	4.80 - 1.42	4.80 - 1.03	4.80 - 0.71		
			1.1" Sensor	-	4.80 - 1.56	4.80 - 1.14	4.80 - 0.78		
			4/3" Sensor	-	-	4.80 - 1.42	4.80 - 0.98		
			32mm	-	-	-	4.80 - 1.42		
	Mitotoyo 10X 0.164 - 0.280 NA 1-60227	33	Mag.	2.20X - 15.47X	3.20X - 22.50X	4.40X - 30.94X	6.40X - 45.00X	2.04 - 1.20	18.5 - 6.4
			2/3" Sensor	2.40 - 0.71	2.40 - 0.49	2.40 - 0.36	1.72 - 0.24		
			1" Sensor	-	2.40 - 0.71	2.40 - 0.52	2.40 - 0.36		
			1.1" Sensor	-	2.40 - 0.78	2.40 - 0.57	2.40 - 0.39		
			4/3" Sensor	-	-	2.40 - 0.71	2.40 - 0.49		
			32mm	-	-	-	2.40 - 0.71		
	Mitotoyo 20X 0.329 - 0.420 NA 1-60228	20	Mag.	4.40X - 30.94X	6.40X - 45.00X	8.80X - 61.88X	12.80X - 90.00X	1.02 - 0.80	4.6 - 2.8
			2/3" Sensor	1.20 - 0.36	1.20 - 0.24	1.20 - 0.18	0.86 - 0.12		
			1" Sensor	-	1.20 - 0.36	1.20 - 0.26	1.20 - 0.18		
			1.1" Sensor	-	1.20 - 0.39	1.20 - 0.28	1.20 - 0.20		
			4/3" Sensor	-	-	1.20 - 0.36	1.20 - 0.24		
			32mm	-	-	-	1.20 - 0.36		

Fixed	Navitar Objective Lens	Rear Adapter Mag		0.6875X	1X	1.375X	2X	Resolve Limit (μm)	Depth of Field (μm)
		Pixel Resolution (μm)		1.85	2.68	3.69	5.37		
		W.D. (mm)	Format						
			Mag.						
	4X 0.200 NA 1-55075	20	Mag.	2.20X	3.20X	4.40X	6.40X	1.77	13.75
			2/3" Sensor	5.00	3.44	2.50	1.72		
			1" Sensor	-	5.00	3.64	2.50		
			1.1" Sensor	-	5.50	4.00	2.75		
			4/3" Sensor	-	-	5.00	3.44		
			APS	-	-	-	5.00		
	6X 0.300 NA 1-55401	25	Mag.	3.30X	4.80X	6.60X	9.60X	1.12	6.11
			2/3" Sensor	3.33	2.29	1.67	1.15		
			1" Sensor	-	3.33	2.42	1.67		
			1.1" Sensor	-	3.67	2.67	1.83		
			4/3" Sensor	-	-	3.33	2.29		
			APS	-	-	-	3.33		
	10X 0.400 NA 1-55227	10	Mag.	5.50X	8.00X	11.00X	16.00X	0.70	3.44
			2/3" Sensor	2.00	1.38	1.00	0.69		
			1" Sensor	-	2.00	1.45	1.00		
			1.1" Sensor	-	2.20	1.60	1.10		
			4/3" Sensor	-	-	2.00	1.38		
			APS	-	-	-	2.00		

Dark Gray box: Contact your Navitar sales representative for further guidance when selecting this option.

More Options

The new Resolv4K Fixed system is a combination of the superb optical performance of the Resolv4K Zoom and design principles of our Precise Eye Fixed that is ideal for fixed field of view applications with closer working distances. The Resolv4K Fixed lens offers higher magnification and resolving power than standard enlarging or SLR lenses in macro mode.

- High apertures improve resolving power by 30% at familiar working distances
- Available interface modules allow users to build their system specifically for their needs
- Standard large camera format options
- Compatible with 10MP cameras and beyond
- Built-in rear adapter fine manipulation focus
- Larger focus options with motorization available
- Compatible with Infinity Corrected Objectives
- Object side telecentricity of select combinations

Resolv4K Fixed Field of View Matrix (in mm at nominal W.D.)

Lens Attachment	Camera Adapter				0.6875X	1X	1.375X	2X
	Pixel Resolution (µm)				1.85	2.68	3.69	5.37
	W.D. (mm)	DOF (mm)	Res. Limit (µm)	Format	Diagonal			
0.25X 0.025 NA 1-81201	359.5	0.88	13.42	Mag.	0.275X	0.40X	0.55X	0.80X
				2/3" Sensor	40.00	27.50	20.00	13.75
				1" Sensor	-	40.00	29.09	20.00
				1.1" Sensor	-	44.00	32.00	22.00
				4/3" Sensor	-	-	40.00	27.50
				APS	-	-	-	40.00
0.5X 0.05 NA 1-81202	173	0.22	6.71	Mag.	0.55X	0.80X	1.10X	1.60X
				2/3" Sensor	20.00	13.75	10.00	6.88
				1" Sensor	-	20.00	14.55	10.00
				1.1" Sensor	-	22.00	16.00	11.00
				4/3" Sensor	-	-	20.00	13.75
				APS	-	-	-	20.00
0.75X 0.075 NA 1-81203	110	0.0978	4.47	Mag.	0.825X	1.20X	1.65X	2.40X
				2/3" Sensor	13.33	9.17	6.67	4.58
				1" Sensor	-	13.33	9.70	6.67
				1.1" Sensor	-	14.67	10.67	7.33
				4/3" Sensor	-	-	13.33	9.17
				APS	-	-	-	13.33
1.0X 0.1 NA 1-81204	90	0.055	3.36	Mag.	1.10X	1.60X	2.20X	3.20X
				2/3" Sensor	10.00	6.88	5.00	3.44
				1" Sensor	-	10.00	7.27	5.00
				1.1" Sensor	-	11.00	8.00	5.50
				4/3" Sensor	-	-	10.00	6.88
				APS	-	-	-	10.00
1.25X 0.125 NA 1-81205	72	0.0352	2.68	Mag.	1.375X	2.00X	2.750X	4.00X
				2/3" Sensor	8.00	5.50	4.00	2.75
				1" Sensor	-	8.00	5.82	4.00
				1.1" Sensor	-	8.80	6.40	4.40
				4/3" Sensor	-	-	8.00	5.50
				APS	-	-	-	8.00
1.5X 0.15 NA 1-81206	46.5	0.0244	2.24	Mag.	1.650X	2.40X	3.30X	4.80X
				2/3" Sensor	6.67	4.58	3.33	2.29
				1" Sensor	-	6.67	4.85	3.33
				1.1" Sensor	-	7.33	5.33	3.67
				4/3" Sensor	-	-	6.67	4.58
				APS	-	-	-	6.67
2X 0.20 NA 1-81207	32.3	0.0138	1.68	Mag.	2.20X	3.20X	4.40X	6.40X
				2/3" Sensor	5.00	3.44	2.50	1.72
				1" Sensor	-	5.00	3.64	2.50
				1.1" Sensor	-	5.50	4.00	2.75
				4/3" Sensor	-	-	5.00	3.44
				APS	-	-	-	5.00

Dark Gray box: Contact your Navitar sales representative for further guidance when selecting this option.

For 4:3 aspect ratio sensor, Horizontal = Diagonal x 0.8, Vertical = Diagonal x 0.6
APS - 32mm image circle

Resolv4K System Diagram

Distribution in the UK & Ireland



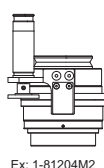
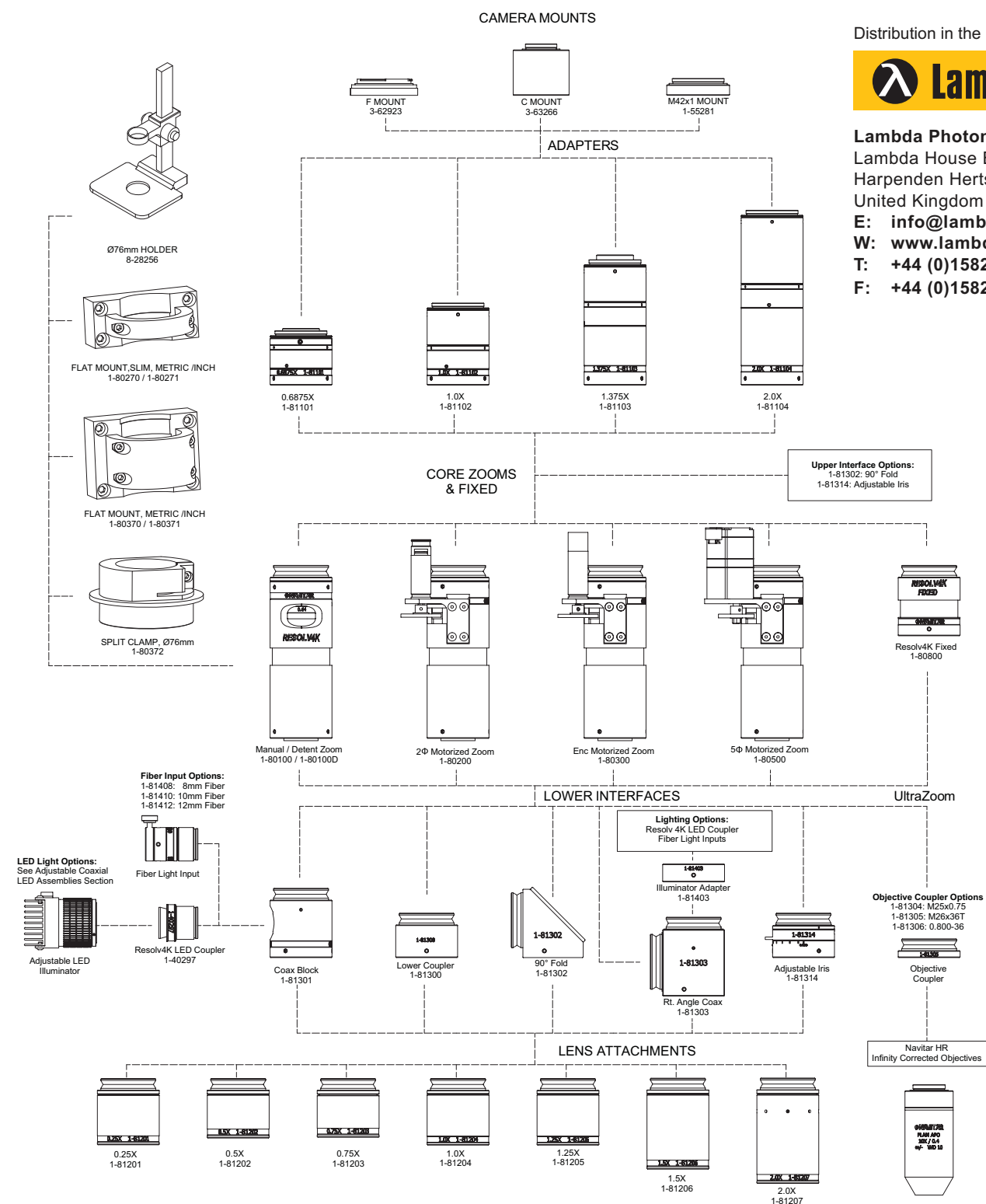
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Fine Focus Options on Lens Attachments

M1 Manual FF
 M2 2Φ Motorized FF
 M3 Encoded Motor FF
 M5 5Φ Motorized FF
 e.g. 1-81204M2:
 2Φ Motorized 1X LA

Cable Length	1-80200 (2 phase motor)	1-80300 (encoded motor)	1-80500 (5 phase motor)
24"	1-40283	1-40286	1-40290
48"	1-40282	1-40285	1-40289
72"	1-40281	1-40284	1-40170

Available Adapters

Part #	Description
1-81304	UltraZoom M25x0.75 Adapter
1-81305	UltraZoom M26x36T Adapter Used for all Navitar HR objectives
1-81306	UltraZoom 0.8x36T RMS Adapter