

12X ZOOM LENS SYSTEM

12X Zoom Lens System

Navitar's Highest Combination of Zoom Range and Resolution

For high magnification applications requiring the optimal balance between optical performance, large zoom range and price, the 12X is an ideal choice. The 12X Zoom incorporates all the mechanical flexibility of the Zoom 6000 with extended zoom range, higher NA and unbeatable accuracy and repeatability for the most demanding applications. This outstanding combination of zoom range, coupled with large field coverage, means that you will now be able to view a wider range of parts with a single video inspection system and eliminate the need for bulky microscopes.

- Incredible 12X (0.58-7X) magnification for inspection of a wider range of parts
- Increased resolution with 0.005 - 0.550 NA
- Variable working distance from 13 to 341 mm
- Field of view from 0.006 mm to 85.71 mm with attachments
- Unmatched edge flatness and clarity
- Works with 1/4", 1/3", 1/2" and 2/3" format cameras
- The 12X Zoom System utilizes existing Zoom 6000 adapter tubes
- Body tubes with detents, apertures or motorized are available



12X Zoom Field of View Matrix (in mm)

Lens Attachment	W.D. (mm)	Camera Formats/Parameters	0.5X Adapter Low-High	0.67X Adapter Low-High	1X Adapter Low-High	1.33X Adapter Low-High	2X Adapter Low-High	3.3X Adapter Low-High	Resolve Limit Low-High (μm)	Depth of Field Low-High (mm)
0.25X (2)0.005-0.025 NA 1-50011	341	Mag.	0.07X - 0.87X	0.10X - 1.20X	0.15X - 1.75X	0.19X - 2.33X	0.29X - 3.50X	0.48X - 5.78X	66.66 - 13.34	20.00 - 0.80
		1/4" Sensor	57.14 - 4.59	41.16 - 3.40	27.60 - 2.28	21.05 - 1.72	13.90 - 1.14	8.36 - 0.69	66.66 - 13.34	20.00 - 0.80
		1/3" Sensor	85.71 - 6.89	61.73 - 5.10	41.38 - 3.42	31.57 - 2.57	20.69 - 1.71	12.54 - 1.04	66.66 - 13.34	20.00 - 0.80
		1/2" Sensor	—	82.32 - 6.80	55.16 - 4.56	42.10 - 3.43	27.58 - 2.28	16.72 - 1.38	66.66 - 13.34	20.00 - 0.80
		2/3" Sensor	—	(1) 72.00 - 9.35	75.88 - 6.28	57.89 - 4.72	37.94 - 3.14	22.99 - 1.90	66.66 - 13.34	20.00 - 0.80
0.5X 0.009-0.051 NA 1-50012	165	Mag.	0.14X - 1.75X	0.20X - 2.40X	0.29X - 3.50X	0.39X - 4.66X	0.58X - 7.00X	0.96X - 11.55X	37.04 - 6.66	6.17 - 0.19
		1/4" Sensor	28.57 - 2.28	20.58 - 1.70	13.79 - 1.14	10.25 - 0.86	6.90 - 0.76	4.18 - 0.35	37.04 - 6.66	6.17 - 0.19
		1/3" Sensor	42.85 - 3.42	30.87 - 2.55	20.69 - 1.71	15.38 - 1.29	10.34 - 0.86	6.27 - 0.52	37.04 - 6.66	6.17 - 0.19
		1/2" Sensor	—	41.16 - 3.40	27.58 - 2.28	20.51 - 1.72	13.79 - 1.14	8.36 - 0.69	37.04 - 6.66	6.17 - 0.19
		2/3" Sensor	—	(1) 36.00 - 4.68	37.94 - 3.14	28.20 - 2.36	18.97 - 1.57	11.50 - 0.95	37.04 - 6.66	6.17 - 0.19
0.75X 0.014-0.076 NA 1-50013	108	Mag.	0.22X - 2.62X	0.29X - 3.50X	0.44X - 5.30X	0.58X - 6.98X	0.87X - 10.50X	1.44X - 17.33X	23.80 - 4.44	2.55 - 0.09
		1/4" Sensor	18.18 - 1.52	13.72 - 1.14	9.19 - 0.76	6.89 - 0.57	4.60 - 0.38	2.78 - 0.23	23.80 - 4.44	2.55 - 0.09
		1/3" Sensor	27.27 - 2.29	20.58 - 1.70	13.79 - 1.14	10.34 - 0.85	6.89 - 0.57	4.18 - 0.35	23.80 - 4.44	2.55 - 0.09
		1/2" Sensor	—	27.44 - 2.27	18.34 - 1.52	13.79 - 1.14	9.19 - 0.76	5.56 - 0.46	23.80 - 4.44	2.55 - 0.09
		2/3" Sensor	—	(1) 24.30 - 3.12	25.30 - 2.09	18.96 - 1.57	12.64 - 1.05	7.67 - 0.63	23.80 - 4.44	2.55 - 0.09
None 0.019-0.101 NA	86	Mag.	0.29X - 3.49X	0.39X - 4.70X	0.58X - 7.00X	0.77X - 9.31X	1.16X - 14.00X	1.91X - 23.10X	18.52 - 3.34	1.39 - 0.05
		1/4" Sensor	13.79 - 1.14	10.29 - 0.85	6.90 - 0.57	5.19 - 0.43	3.45 - 0.29	2.09 - 0.17	18.52 - 3.34	1.39 - 0.05
		1/3" Sensor	20.69 - 1.72	15.44 - 1.28	10.34 - 0.86	7.79 - 0.64	5.18 - 0.43	3.13 - 0.26	18.52 - 3.34	1.39 - 0.05
		1/2" Sensor	—	20.58 - 1.70	13.79 - 1.14	10.39 - 0.86	6.90 - 0.57	4.18 - 0.35	18.52 - 3.34	1.39 - 0.05
		2/3" Sensor	—	(1) 18.20 - 2.34	18.97 - 1.57	14.28 - 1.18	9.49 - 0.78	5.75 - 0.48	18.52 - 3.34	1.39 - 0.05
1.5X 0.028-0.151 NA 1-50014	50	Mag.	0.43X - 5.23X	0.58X - 7.00X	0.87X - 10.50X	1.16X - 14.0X	1.74X - 21.00X	2.87X - 34.65X	12.34 - 2.24	0.64 - 0.02
		1/4" Sensor	9.30 - 0.76	6.86 - 0.57	4.60 - 0.38	3.44 - 0.28	2.30 - 0.19	1.39 - 0.12	12.34 - 2.24	0.64 - 0.02
		1/3" Sensor	13.95 - 1.14	10.29 - 0.85	6.89 - 0.57	5.17 - 0.44	3.45 - 0.29	2.09 - 0.17	12.34 - 2.24	0.64 - 0.02
		1/2" Sensor	—	13.72 - 1.13	9.19 - 0.76	6.89 - 0.57	4.60 - 0.38	2.78 - 0.23	12.34 - 2.24	0.64 - 0.02
		2/3" Sensor	—	(1) 12.20 - 1.55	12.64 - 1.05	9.48 - 0.78	6.33 - 0.52	3.83 - 0.323	12.34 - 2.24	0.64 - 0.02
2.0X 0.038-0.202 NA 1-50015	37	Mag.	0.58X - 6.98X	0.78X - 9.40X	1.16X - 14.00X	1.54X - 18.6X	2.32X - 28.00X	3.83X - 46.20X	9.00 - 1.66	0.35 - 0.01
		1/4" Sensor	6.89 - 0.57	5.14 - 0.43	3.45 - 0.29	2.59 - 0.21	1.73 - 0.15	1.05 - 0.09	9.00 - 1.66	0.35 - 0.01
		1/3" Sensor	10.34 - 0.85	7.72 - 0.64	5.18 - 0.43	3.89 - 0.32	2.59 - 0.22	1.57 - 0.13	9.00 - 1.66	0.35 - 0.01
		1/2" Sensor	—	10.29 - 0.85	6.90 - 0.57	5.19 - 0.43	3.45 - 0.29	2.09 - 0.17	9.00 - 1.66	0.35 - 0.01
		2/3" Sensor	—	(1) 9.10 - 1.17	9.49 - 0.78	7.14 - 0.59	4.75 - 0.40	2.88 - 0.24	9.00 - 1.66	0.35 - 0.01

(1) Vignetting occurs at zoom settings less than 0.9X.

(2) NA varies depending on zoom setting. The above fields of view are measured diagonally in millimeters (Horizontal = Diagonal x 0.8 and Vertical = Diagonal x 0.6).

12X ZOOM LENS SYSTEM

12X Zoom Performance Specifications

12X Zoom Combinations Lens Attachment, Prime Lens & Adapter	Working Distance (mm)	System Mag. Low-High	NA Objective Low-High	Resolve Limit Low-High (μm)	Matching Pixel Size Low-High (μm)	Depth of Field Low-High (mm)
0.25x + 12X Zoom + 0.5x	341	0.07 - 0.87	0.005 - 0.025	66.66 - 13.34	2.33 - 5.8	20.00 - 0.80
0.25x + 12X Zoom + 0.67x	341	0.10 - 1.17	0.005 - 0.025	66.66 - 13.34	3.33 - 7.80	20.00 - 0.80
0.25x + 12X Zoom + 1.0x	341	0.15 - 1.75	0.005 - 0.025	66.66 - 13.34	5.00 - 11.67	20.00 - 0.80
0.25x + 12X Zoom + 1.33x	341	0.19 - 2.33	0.005 - 0.025	66.66 - 13.34	6.33 - 15.54	20.00 - 0.80
0.25x + 12X Zoom + 2.0x	341	0.29 - 3.50	0.005 - 0.025	66.66 - 13.34	9.67 - 23.34	20.00 - 0.80
0.25x + 12X Zoom + 3.3x	341	0.48 - 5.78	0.005 - 0.025	66.66 - 13.34	16.59 - 40.53	20.00 - 0.80
0.5x + 12X Zoom + 0.5x	165	0.14 - 1.75	0.009 - 0.051	37.04 - 6.66	2.59 - 5.82	6.17 - 0.19
0.5x + 12X Zoom + 0.67x	165	0.19 - 2.35	0.009 - 0.051	37.04 - 6.66	3.60 - 7.68	6.17 - 0.19
0.5x + 12X Zoom + 1.0x	165	0.29 - 3.50	0.009 - 0.051	37.04 - 6.66	5.38 - 11.45	6.17 - 0.19
0.5x + 12X Zoom + 1.33x	165	0.39 - 4.66	0.009 - 0.051	37.04 - 6.66	7.22 - 15.51	6.17 - 0.19
0.5x + 12X Zoom + 2.0x	165	0.58 - 7.00	0.009 - 0.051	37.04 - 6.66	10.74 - 22.89	6.17 - 0.19
0.5x + 12X Zoom + 3.3x	165	0.96 - 11.55	0.009 - 0.051	37.04 - 6.66	16.64 - 50.60	6.17 - 0.19
0.75x + 12X Zoom + 0.5x	108	0.22 - 2.62	0.014 - 0.076	23.80 - 4.44	2.61 - 5.81	2.55 - 0.09
0.75x + 12X Zoom + 0.67x	108	0.29 - 3.52	0.014 - 0.076	23.80 - 4.44	3.45 - 7.73	2.55 - 0.09
0.75x + 12X Zoom + 1.0x	108	0.44 - 5.25	0.014 - 0.076	23.80 - 4.44	5.24 - 11.52	2.55 - 0.09
0.75x + 12X Zoom + 1.33x	108	0.58 - 6.98	0.014 - 0.076	23.80 - 4.44	6.90 - 15.49	2.55 - 0.09
0.75x + 12X Zoom + 2.0x	108	0.87 - 10.50	0.014 - 0.076	23.80 - 4.44	10.35 - 23.05	2.55 - 0.09
0.75x + 12X Zoom + 3.3x	108	1.44 - 17.33	0.014 - 0.076	23.80 - 4.44	16.62 - 46.34	2.55 - 0.09
None + 12X Zoom + 0.5x	86	0.29 - 3.49	0.019 - 0.101	18.52 - 3.34	2.68 - 5.82	1.39 - 0.05
None + 12X Zoom + 0.67x	86	0.39 - 4.69	0.019 - 0.101	18.52 - 3.34	3.42 - 7.74	1.39 - 0.05
None + 12X Zoom + 1.0x	86	0.58 - 7.00	0.019 - 0.101	18.52 - 3.34	5.09 - 11.55	1.39 - 0.05
None + 12X Zoom + 1.33x	86	0.77 - 9.31	0.019 - 0.101	18.52 - 3.34	7.13 - 15.54	1.39 - 0.05
None + 12X Zoom + 2.0x	86	1.16 - 14.00	0.019 - 0.101	18.52 - 3.34	10.17 - 23.10	1.39 - 0.05
None + 12X Zoom + 3.3x	86	1.91 - 23.10	0.019 - 0.101	18.52 - 3.34	16.60 - 40.54	1.39 - 0.05
1.5x + 12X Zoom + 0.5x	50	0.43 - 5.23	0.028 - 0.151	12.34 - 2.24	2.65 - 5.85	0.64 - 0.02
1.5x + 12X Zoom + 0.67x	50	0.58 - 7.04	0.028 - 0.151	12.34 - 2.24	3.45 - 7.78	0.64 - 0.02
1.5x + 12X Zoom + 1.0x	50	0.87 - 10.50	0.028 - 0.151	12.34 - 2.24	5.18 - 11.60	0.64 - 0.02
1.5x + 12X Zoom + 1.33x	50	1.16 - 14.00	0.028 - 0.151	12.34 - 2.24	7.15 - 15.68	0.64 - 0.02
1.5x + 12X Zoom + 2.0x	50	1.74 - 21.00	0.028 - 0.151	12.34 - 2.24	10.74 - 23.34	0.64 - 0.02
1.5x + 12X Zoom + 3.3x	50	2.87 - 34.65	0.028 - 0.151	12.34 - 2.24	16.62 - 40.77	0.64 - 0.02
2.0x + 12X Zoom + 0.5x	37	0.58 - 6.98	0.038 - 0.202	9.00 - 1.66	2.61 - 5.79	0.35 - 0.01
2.0x + 12X Zoom + 0.67x	37	0.78 - 9.38	0.038 - 0.202	9.00 - 1.66	3.42 - 7.79	0.35 - 0.01
2.0x + 12X Zoom + 1.0x	37	1.16 - 14.00	0.038 - 0.202	9.00 - 1.66	5.09 - 11.62	0.35 - 0.01
2.0x + 12X Zoom + 1.33x	37	1.54 - 18.60	0.038 - 0.202	9.00 - 1.66	6.93 - 15.43	0.35 - 0.01
2.0x + 12X Zoom + 2.0x	37	2.32 - 28.00	0.038 - 0.202	9.00 - 1.66	10.17 - 23.24	0.35 - 0.01
2.0x + 12X Zoom + 3.3x	37	3.83 - 46.20	0.038 - 0.202	9.00 - 1.66	16.56 - 36.04	0.35 - 0.01

Assumptions:

1. Minimum resolvable feature size is half of the threshold line pair limit. Calculation = $1/(3000 \times \text{Lens NA})$
2. Matching pixel size is that which will permit the minimum feature size to overlap two pixels. Calculation = $1/2(\text{Feature Size} \times \text{System Magnification})$
3. If the matching pixel size is greater than the camera pixel size, the system is "lens limited.", if less than the camera pixel size, the system is "camera limited."

12X ZOOM LENS SYSTEM

12X Zoom with Co-axial Illumination

Navitar's 12X Zoom with Internal Co-axial Illumination (1-50487) is ideal for applications involving highly reflective surfaces, such as wafers, polished samples, and fluids. Designed to provide even illumination for higher magnification applications, it provides extremely detailed resolution under incident lighting, particularly when a high resolution camera is used. Various illumination sources can be used.

Field of View Matrix for 12X Zoom with Co-axial Illumination - 1-50487 (mm)

Lens Attachment	W. D. (mm)	Camera Formats/ Parameters	.67X Adapter Low - High	1X Adapter Low - High	1.33X Adapter Low - High	2X Adapter Low - High	3.3X Adapter Low - High
None 0.019 - 0.101 NA (2)	86	Mag.	0.39X - 4.70X	0.58X - 7.00X	0.77X - 9.31X	1.16X - 14.00X	1.91X - 23.10X
		1/4" Sensor	10.29 - 0.85	6.90 - 0.57	5.19 - 0.43	3.45 - 0.29	2.09 - 0.17
		1/3" Sensor	15.44 - 1.28	10.34 - 0.86	7.80 - 0.64	5.18 - 0.43	3.13 - 0.26
		1/2" Sensor	20.58 - 1.70	13.79 - 1.14	10.39 - 0.86	6.90 - 0.57	4.18 - 0.35
		2/3" Sensor	(1) 18.20 - 2.34	18.97 - 1.57	14.28 - 1.18	9.49 - 0.78	5.75 - 0.48
1.5X 0.028 - 0.151 NA (2) 1-50014	50	Mag.	0.58X - 7.00X	0.87 - 10.50X	1.16X - 14.00X	1.74X - 21.00X	2.87X - 34.65X
		1/4" Sensor	6.86 - 0.57	4.60 - 0.38	3.45 - 0.29	2.30 - 0.19	1.39 - 0.12
		1/3" Sensor	10.29 - 0.85	6.89 - 0.57	5.17 - 0.43	3.45 - 0.29	2.09 - 0.17
		1/2" Sensor	13.72 - 1.13	9.19 - 0.76	6.89 - 0.57	4.60 - 0.38	2.78 - 0.23
		2/3" Sensor	(1) 12.20 - 1.55	12.64 - 1.05	9.48 - 0.79	6.33 - 0.52	3.83 - 0.32
2.0X 0.038 - 0.202 NA (2) 1-50015	37	Mag.	0.78X - 9.40X	1.16X - 14.00X	1.54X - 18.6X	2.32X - 28.00X	3.83X - 46.20X
		1/4" Sensor	5.14 - 0.43	3.45 - 0.29	2.59 - 0.22	1.73 - 0.15	1.05 - 0.09
		1/3" Sensor	7.72 - 0.64	5.18 - 0.43	3.89 - 0.32	2.59 - 0.22	1.57 - 0.13
		1/2" Sensor	10.29 - 0.85	6.90 - 0.57	5.19 - 0.43	3.45 - 0.29	2.09 - 0.17
		2/3" Sensor	(1) 9.10 - 1.17	9.49 - 0.78	7.14 - 0.59	4.75 - 0.40	2.88 - 0.24

NOTE:

The internal coax will illuminate a circular area of about 14 mm in diameter. Any field of view larger than 14 mm will have darkened corners.

Low power lens attachments can be used but produce increasing vignetting.

(1) Zoom Setting at 1.0X.

(2) NA varies depending on zoom setting

12X ULTRAZOOM LENS SYSTEM

12X UltraZoom Lens System

Unmatched Optical Quality for High Magnification Applications

Navitar's 12X UltraZoom incorporates infinity corrected objectives in an advanced design that offers long working distances and outstanding edge flatness and clarity. The UltraZoom is also available with fine focus or with fine focus and coaxial illumination.

12X UltraZoom Field of View Matrix for 1-50502, 1-50503 and 1-50504 (mm)

Objective Lens Long W.D.	W.D. (mm)	Camera Formats/ Parameters	1X Adapter Low - High	1.33X Adapter Low - High	2X Adapter Low - High	3.3X Adapter Low - High
4X 0.20 NA* 1-55341	20	Mag.	(1) 2.90X - 13.35X	(2) 2.61X - 17.75X	2.19X - 26.69X	3.61X - 44.04X
		1/4" Sensor	1.38 - 0.30	1.53 - 0.23	1.83 - 0.15	1.11 - 0.09
		1/3" Sensor	2.07 - 0.45	2.30 - 0.34	2.74 - 0.22	1.66 - 0.14
		1/2" Sensor	2.76 - 0.60	3.06 - 0.45	3.65 - 0.30	2.21 - 0.18
		2/3" Sensor	3.79 - 0.82	4.21 - 0.62	5.02 - 0.41	3.04 - 0.25
5X 0.14 NA* 1-60226	34	Mag.	(1) 3.57X - 16.66X	(2) 3.26X - 22.16X	2.77X - 33.31X	4.52X - 55.05X
		1/4" Sensor	1.12 - 0.24	1.22 - 0.18	1.44 - 0.12	0.89 - 0.07
		1/3" Sensor	1.68 - 0.36	1.84 - 0.27	2.17 - 0.18	1.33 - 0.11
		1/2" Sensor	2.24 - 0.48	2.45 - 0.36	2.89 - 0.24	1.77 - 0.15
		2/3" Sensor	—	2.45 - 0.49	3.97 - 0.33	2.44 - 0.20
10X 0.28 NA* 1-60227	33	Mag.	(1) 7.14X - 33.31X	(2) 6.50X - 44.30X	5.54X - 66.63X	9.03X - 110.10X
		1/4" Sensor	0.56 - 0.12	0.61 - 0.09	0.72 - 0.06	0.44 - 0.04
		1/3" Sensor	0.84 - 0.18	0.92 - 0.13	1.08 - 0.09	0.66 - 0.05
		1/2" Sensor	1.12 - 0.24	1.23 - 0.18	1.44 - 0.12	0.89 - 0.07
		2/3" Sensor	—	1.23 - 0.25	1.99 - 0.17	1.22 - 0.10
20X 0.42 NA* 1-60228	20	Mag.	(1) 14.28X - 64.63X	(2) 13.10X - 85.96X	11.08X - 133.25X	18.07X - 220.21X
		1/4" Sensor	0.28 - 0.06	0.30 - 0.04	0.36 - 0.03	0.22 - 0.02
		1/3" Sensor	0.42 - 0.09	0.46 - 0.07	0.54 - 0.04	0.33 - 0.03
		1/2" Sensor	0.56 - 0.12	0.61 - 0.09	0.72 - 0.06	0.44 - 0.04
		2/3" Sensor	—	0.61 - 0.13	0.99 - 0.08	0.61 - 0.05
50X 0.55 NA* 1-60229	13	Mag.	(1) 35.69X - 166.57X	(2) 40.00X - 221.54X	27.50X - 333.13X	45.17X - 550.52X
		1/4" Sensor	0.11 - 0.02	0.10 - 0.02	0.14 - 0.01	0.09 - 0.007
		1/3" Sensor	0.17 - 0.04	0.15 - 0.05	0.22 - 0.02	0.13 - 0.010
		1/2" Sensor	0.22 - 0.05	0.20 - 0.04	(2) 0.17 - 0.03	0.18 - 0.010
		2/3" Sensor	—	0.20 - 0.05	0.40 - 0.03	0.24 - 0.020

NOTE: This system is not recommended for use with a 2/3" Sensor.

(1) Zoom setting at 1.5X.

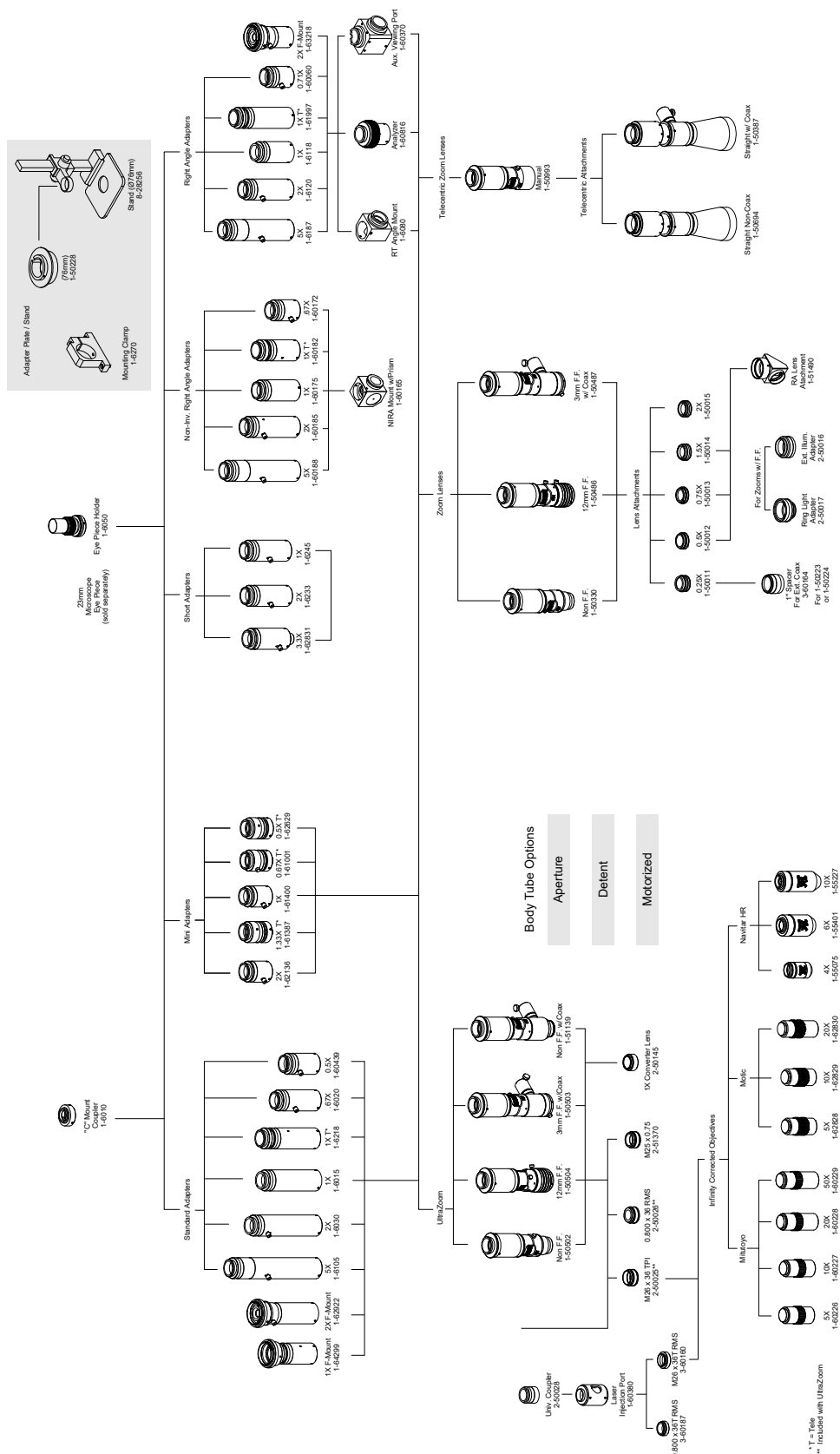
(2) Zoom setting at 1.0X.

*NA at high mag. NA varies with zoom setting.



12X ZOOM SYSTEM DIAGRAM

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*T = Tube
** Includes with UltraZoom