Lens Charts

This paper offers information useful for selecting a microvideo or C-mount lens for the iVu series vision sensor.

Working Distance and Field of View

The two main variables involved when discussing a camera's lens choice are the **Working Distance** and the **Field of View** size. The Working Distance, or WD, is the distance from the camera to the target object. In the case of this collection of lens charts, the Working Distance is measured from the front surface of the focusing window (for microvideo lens models) or the end of the black PBT sensor housing (for C-mount lens models). The distance is not measured from the end of the lens because different lenses from different manufacturers, even with the same focal length, can vary in length. Because there are two choices for length, WD is not measured from the end of the C-mount lens cover.

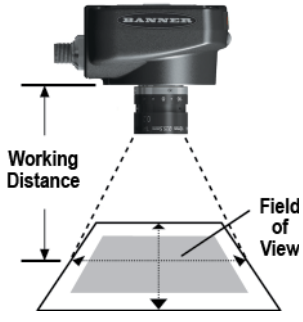


Figure 1 C-Mount Lens

The Field of View, or FOV, is the real-world size of the picture the camera takes. This can also be broken down into a horizontal FOV size and a vertical FOV size. Note that the picture taken by an iVu vision sensor is not square. The imager used in the iVu sensor is 752 × 480 pixels, making a rectangular image where the vertical FOV is about 64% the size of the horizontal FOV.

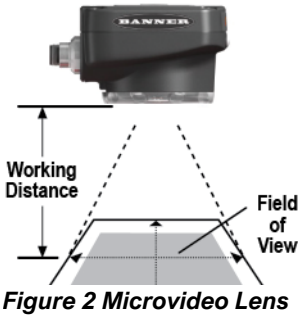


Figure 2 Microvideo Lens

The Working Distance and Field of View sizes are related by linear equations determined by the focal length of the lens. Choosing the correct lens for a given application might be a matter of selecting the desired size of the FOV, then seeing which of the options for focal length result in a good fit for camera Working Distance. The situation might also be reversed, where the desired mounting location of the camera is known (and thus the Working Distance is fixed) and the various focal length lenses give a range of FOV sizes to choose from. In all cases, only one of these two variables may be freely selected. The second variable then becomes a function of the first. This is the reason why we offer a broad range of lens focal lengths—to provide as many options as possible to suit different WD/FOV size requirements.

Multiple Manufacturers and Format Size

Banner does not manufacture any microvideo or C-mount lenses used by our vision sensors. Instead we offer a range of lenses from different suppliers.

Imager Resolution: 752 px (H) × 480 px (V)
Pixel Size: 6.0 µm × 6.0 µm
Image Size: 4.51 mm (H) × 2.88 mm (V), 5.35 mm

Off the Charts

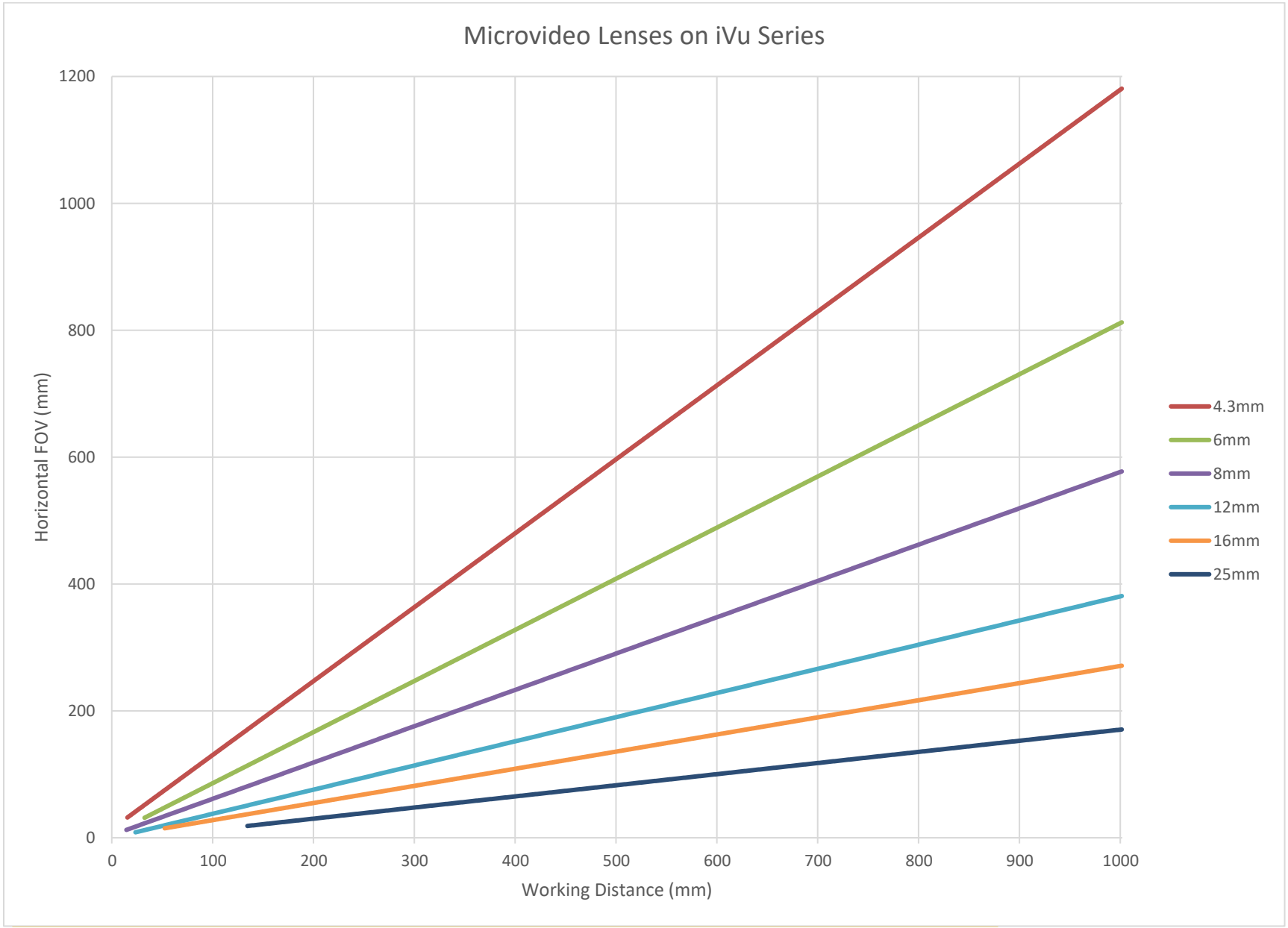
In the pages that follow, graphical views of the Working Distance versus Horizontal FOV relationships are shown, out to a maximum working distance of 1 meter. These graphs offer a quick and easy way to estimate the FOV size for a given Working Distance and lens focal length. Also provided are two tables

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with entries out to 1.5 meters. The first shows FOV size as a function of Working Distance and the second shows Working Distance as a function of FOV size. The mathematical equations that describe the relationship between these two variables are also provided, allowing for calculations beyond what the chart and tables offer.

Each lens has a natural minimum Working Distance. If a camera using this lens were to move closer to the target than this minimum distance, the image would be out of focus and the lens alone would not be able to fix it. This is where extension tubes and shims are used. Extension tubes allow a lens to come into focus at a Working Distance closer than the minimum. The relationship between Working Distance and FOV size remains in effect as extension tubes are added, and so extension tubes are usually used to generate very small FOVs. A microscope is basically a high focal length lens with a large amount of extension tubes applied.

Microvideo Lenses on iVu Series



Microvideo Lenses on iVu Series, FOV as a function of WD Chart

	FOV (mm)					
WD (mm)	4.3mm	6mm	8mm	12mm	16mm	25mm
Minimum	*32 x 20 @ 14mm*	*32 x 20 @ 31mm*	*12 x 8 @ 13mm*	*8 x 5 @ 22mm*	*15 x 10 @ 51mm*	*19 x 12 @ 133mm*
20	39 x 25		16 x 10	8 x 5		
40	62 x 40	39 x 25	28 x 18	15 x 10		
60	86 x 55	55 x 35	39 x 25	23 x 15	17 x 11	
80	109 x 69	71 x 45	51 x 32	31 x 20	23 x 15	
100	132 x 84	87 x 56	62 x 40	38 x 24	28 x 18	
120	155 x 99	103 x 66	74 x 47	46 x 29	34 x 21	
140	179 x 114	119 x 76	85 x 54	54 x 34	39 x 25	20 x 13
160	202 x 129	135 x 86	97 x 62	61 x 39	44 x 28	23 x 15
180	225 x 144	152 x 97	108 x 69	69 x 44	50 x 32	27 x 17
200	249 x 159	168 x 107	119 x 76	76 x 49	55 x 35	30 x 19
220	272 x 174	184 x 117	131 x 84	84 x 54	61 x 39	34 x 22
240	295 x 188	200 x 128	142 x 91	92 x 58	66 x 42	37 x 24
260	319 x 203	216 x 138	154 x 98	99 x 63	71 x 46	41 x 26
280	342 x 218	232 x 148	165 x 105	107 x 68	77 x 49	44 x 28
300	365 x 233	248 x 158	177 x 113	114 x 73	82 x 52	48 x 31
320	388 x 248	264 x 169	188 x 120	122 x 78	88 x 56	51 x 33
340	412 x 263	281 x 179	200 x 127	130 x 83	93 x 59	55 x 35
360	435 x 278	297 x 189	211 x 135	137 x 88	98 x 63	58 x 37
380	458 x 293	313 x 200	222 x 142	145 x 93	104 x 66	62 x 40
400	482 x 307	329 x 210	234 x 149	153 x 97	109 x 70	65 x 42
420	505 x 322	345 x 220	245 x 157	160 x 102	115 x 73	69 x 44
440	528 x 337	361 x 231	257 x 164	168 x 107	120 x 77	72 x 46
460	552 x 352	377 x 241	268 x 171	175 x 112	125 x 80	76 x 48
480	575 x 367	393 x 251	280 x 179	183 x 117	131 x 83	79 x 51
500	598 x 382	409 x 261	291 x 186	191 x 122	136 x 87	83 x 53
520	622 x 397	426 x 272	303 x 193	198 x 127	142 x 90	86 x 55
540	645 x 412	442 x 282	314 x 200	206 x 131	147 x 94	90 x 57
560	668 x 426	458 x 292	326 x 208	214 x 136	152 x 97	94 x 60
580	691 x 441	474 x 303	337 x 215	221 x 141	158 x 101	97 x 62
600	715 x 456	490 x 313	348 x 222	229 x 146	163 x 104	101 x 64
620	738 x 471	506 x 323	360 x 230	236 x 151	169 x 108	104 x 66
640	761 x 486	522 x 333	371 x 237	244 x 156	174 x 111	108 x 69
660	785 x 501	538 x 344	383 x 244	252 x 161	179 x 114	111 x 71
680	808 x 516	555 x 354	394 x 252	259 x 165	185 x 118	115 x 73
700	831 x 531	571 x 364	406 x 259	267 x 170	190 x 121	118 x 75
720	855 x 545	587 x 375	417 x 266	274 x 175	196 x 125	122 x 78
740	878 x 560	603 x 385	429 x 274	282 x 180	201 x 128	125 x 80
760	901 x 575	619 x 395	440 x 281	290 x 185	206 x 132	129 x 82
780	924 x 590	635 x 405	451 x 288	297 x 190	212 x 135	132 x 84
800	948 x 605	651 x 416	463 x 295	305 x 195	217 x 139	136 x 87
820	971 x 620	667 x 426	474 x 303	313 x 199	223 x 142	139 x 89
840	994 x 635	683 x 436	486 x 310	320 x 204	228 x 146	143 x 91
860	1018 x 650	700 x 447	497 x 317	328 x 209	233 x 149	146 x 93
880	1041 x 664	716 x 457	509 x 325	335 x 214	239 x 152	150 x 96
900	1064 x 679	732 x 467	520 x 332	343 x 219	244 x 156	153 x 98
920	1088 x 694	748 x 477	532 x 339	351 x 224	250 x 159	157 x 100
940	1111 x 709	764 x 488	543 x 347	358 x 229	255 x 163	160 x 102
960	1134 x 724	780 x 498	554 x 354	366 x 234	260 x 166	164 x 104
980	1158 x 739	796 x 508	566 x 361	373 x 238	266 x 170	167 x 107
1000	1181 x 754	812 x 519	577 x 369	381 x 243	271 x 173	171 x 109
1020	1204 x 769	828 x 529	589 x 376	389 x 248	277 x 177	174 x 111
1040	1227 x 783	845 x 539	600 x 383	396 x 253	282 x 180	178 x 113
1060	1251 x 798	861 x 549	612 x 390	404 x 258	287 x 183	181 x 116
1080	1274 x 813	877 x 560	623 x 398	412 x 263	293 x 187	185 x 118
1100	1297 x 828	893 x 570	635 x 405	419 x 268	298 x 190	188 x 120
1120	1321 x 843	909 x 580	646 x 412	427 x 272	304 x 194	192 x 122
1140	1344 x 858	925 x 591	658 x 420	434 x 277	309 x 197	195 x 125
1160	1367 x 873	941 x 601	669 x 427	442 x 282	314 x 201	199 x 127
1180	1391 x 888	957 x 611	680 x 434	450 x 287	320 x 204	202 x 129
1200	1414 x 902	974 x 621	692 x 442	457 x 292	325 x 208	206 x 131
1220	1437 x 917	990 x 632	703 x 449	465 x 297	331 x 211	209 x 134
1240	1460 x 932	1006 x 642	715 x 456	472 x 302	336 x 214	213 x 136
1260	1484 x 947	1022 x 652	726 x 464	480 x 306	341 x 218	216 x 138
1280	1507 x 962	1038 x 663	738 x 471	488 x 311	347 x 221	220 x 140
1300	1530 x 977	1054 x 673	749 x 478	495 x 316	352 x 225	223 x 143
1320	1554 x 992	1070 x 683	761 x 485	503 x 321	358 x 228	227 x 145
1340	1577 x 1007	1086 x 693	772 x 493	511 x 326	363 x 232	230 x 147
1360	1600 x 1021	1102 x 704	783 x 500	518 x 331	368 x 235	234 x 149
1380	1624 x 1036	1119 x 714	795 x 507	526 x 336	374 x 239	237 x 151
1400	1647 x 1051	1135 x 724	806 x 515	533 x 340	379 x 242	241 x 154
1420	1670 x 1066	1151 x 735	818 x 522	541 x 345	385 x 245	244 x 156
1440	1693 x 1081	1167 x 745	829 x 529	549 x 350	390 x 249	248 x 158
1460	1717 x 1096	1183 x 755	841 x 537	556 x 355	395 x 252	251 x 160
1480	1740 x 1111	1199 x 765	852 x 544	564 x 360	401 x 256	255 x 163
1500	1763 x 1126	1215 x 776	864 x 551	571 x 365	406 x 259	258 x 165

Microvideo Lenses on iVu Series, WD as a function of FOV Chart

FOV (mm)			WD (mm)											
			4.3mm		6mm		8mm		12mm		16mm		25mm	
		Minimum	32	20	32	20	12	8	8	5	15	10	19	12
			@ 14mm		@ 31mm		@ 13mm		@ 22mm		@ 51mm		@ 133mm	
20	x	15					26		52		70		141	
40	x	30	21		48		61		104		144		255	
60	x	45	38		72		96		157		218		369	
80	x	60	55		95		131		209		292		483	
100	x	75	72		119		166		262		366		597	
120	x	90	90		143		201		314		440		711	
140	x	105	107		166		236		367		514		825	
160	x	120	124		190		271		419		588		939	
180	x	135	141		214		306		472		662		1053	
200	x	150	158		237		341		525		736		1167	
220	x	165	175		261		376		577		810		1281	
240	x	180	193		285		411		630		885		1395	
260	x	195	210		308		446		682		959		1509	
280	x	210	227		332		480		735		1033		1623	
300	x	225	244		356		515		787		1107		1737	
320	x	240	261		380		550		840		1181		1851	
340	x	255	278		403		585		892		1255		1965	
360	x	270	296		427		620		945		1329		2079	
380	x	285	313		451		655		997		1403		2193	
400	x	300	330		474		690		1050		1477		2307	
420	x	315	347		498		725		1102		1551		2421	
440	x	330	364		522		760		1155		1625		2535	
460	x	345	381		545		795		1207		1699		2649	
480	x	360	399		569		830		1260		1773		2763	
500	x	375	416		593		865		1312		1847		2877	
520	x	390	433		616		900		1365		1922		2991	
540	x	405	450		640		935		1417		1996		3106	
560	x	420	467		664		970		1470		2070		3220	
580	x	435	484		687		1005		1522		2144		3334	
600	x	450	502		711		1040		1575		2218		3448	
620	x	465	519		735		1074		1627		2292		3562	
640	x	480	536		759		1109		1680		2366		3676	
660	x	495	553		782		1144		1733		2440		3790	
680	x	510	570		806		1179		1785		2514		3904	
700	x	525	587		830		1214		1838		2588		4018	
720	x	540	605		853		1249		1890		2662		4132	
740	x	555	622		877		1284		1943		2736		4246	
760	x	570	639		901		1319		1995		2810		4360	
780	x	585	656		924		1354		2048		2885		4474	
800	x	600	673		948		1389		2100		2959		4588	
820	x	615	690		972		1424		2153		3033		4702	
840	x	630	708		995		1459		2205		3107		4816	
860	x	645	725		1019		1494		2258		3181		4930	
880	x	660	742		1043		1529		2310		3255		5044	
900	x	675	759		1066		1564		2363		3329		5158	
920	x	690	776		1090		1599		2415		3403		5272	
940	x	705	793		1114		1634		2468		3477		5386	
960	x	720	810		1137		1668		2520		3551		5500	
980	x	735	828		1161		1703		2573		3625		5614	
1000	x	750	845		1185		1738		2625		3699		5728	
1020	x	765	862		1209		1773		2678		3773		5842	
1040	x	780	879		1232		1808		2730		3847		5956	
1060	x	795	896		1256		1843		2783		3922		6070	
1080	x	810	913		1280		1878		2835		3996		6184	
1100	x	825	931		1303		1913		2888		4070		6298	
1120	x	840	948		1327		1948		2941		4144		6412	
1140	x	855	965		1351		1983		2993		4218		6526	
1160	x	870	982		1374		2018		3046		4292		6640	
1180	x	885	999		1398		2053		3098		4366		6754	
1200	x	900	1016		1422		2088		3151		4440		6868	
1220	x	915	1034		1445		2123		3203		4514		6982	
1240	x	930	1051		1469		2158		3256		4588		7096	
1260	x	945	1068		1493		2193		3308		4662		7210	
1280	x	960	1085		1516		2228		3361		4736		7324	
1300	x	975	1102		1540		2262		3413		4810		7438	
1320	x	990	1119		1564		2297		3466		4885		7553	
1340	x	1005	1137		1587		2332		3518		4959		7667	
1360	x	1020	1154		1611		2367		3571		5033		7781	
1380	x	1035	1171		1635		2402		3623		5107		7895	
1400	x	1050	1188		1659		2437		3676		5181		8009	
1420	x	1065	1205		1682		2472		3728		5255		8123	
1440	x	1080	1222		1706		2507		3781		5329		8237	
1460	x	1095	1240		1730		2542		3833		5403		8351	
1480	x	1110	1257		1753		2577		3886		5477		8465	
1500	x	1125	1274		1777		2612		3938		5551		8579	

Microvideo Lens equations for iVu Series

H = horizontal FOV size, W = working distance



4.3mm lens

Banner model: LMF04 (p/n 10853)
ML Optics model: ML-4.3E
1/3-inch format, fixed iris f/2.6
H(W), mm
H = 1.165 × W + 15.61 (minimum W ~ 14mm)
W(H), mm
W = (H – 15.61)/1.165 (minimum H ~ 32mm)



6 mm lens

Banner model: LMF06 (p/n 10854)
ML Optics model: ML-6020
1/3-inch format, fixed iris f/1.8
H(W), mm
H = 0.806 × W + 6.57 (minimum W ~ 13mm)
W(H), mm
W = (H - 6.57)/0.806 (minimum H ~ 7mm)



8 mm lens

Banner model: LMF08 (p/n 80943)
ML Optics model: ML-8020
1/3-inch format, fixed iris f/2.0
H(W), mm
H = 0.572 × W + 4.98 (minimum W ~ 13mm)
W(H), mm
W = (H - 4.98)/0.572 (minimum H ~ 12mm)



12 mm lens

Banner model: LMF12 (p/n 80944)
ML Optics model: ML-12020
1/3-inch format, fixed iris f/2.0
H(W), mm
H = 0.381 × W + 0.258 (minimum W ~ 22mm)
W(H), mm
W = (H – 0.258)/0.381 (minimum H ~ 8mm)



16 mm lens

Banner model: LMF16 (p/n 80945)
Evetar model: E3057Q
1/3-inch format, fixed iris f/1.8
H(W), mm
H = 0.27 × W + 1.18 (minimum W ~ 51mm)
W(H), mm
W = (H – 1.18)/0.27 (minimum H~15mm)



25 mm lens

Banner model: LMF25 (p/n 80951)
Fuzhou Senview Photoelectric model: TN2502B
1/3-inch format, fixed iris f/2.0
H(W), mm
H = 0.175 × W – 4.71 (minimum W ~ 133mm)
W(H), mm
W = (H + 4.71)/0.175 (minimum H ~ 19mm)

Standard Resolution C-mount Lenses on iVu Series



Standard C-mount Lenses on iVu Series, FOV as a function of WD Chart

	FOV (mm)					
WD (mm)	4mm	8mm	12mm	25mm	50mm	75mm
Minimum	*63 x 40 @ 49mm*	*15 x 10 @ 31mm*	*64 x 41 @ 171mm*	*88 x 56 @ 610mm*	*50 x 32 @ 732mm*	*34 x 22 @ 781mm*
20						
40		21 x 13				
60	77 x 49	32 x 21				
80	102 x 65	44 x 28				
100	127 x 81	56 x 36				
120	153 x 98	68 x 43				
140	178 x 114	79 x 51				
160	203 x 130	91 x 58				
180	229 x 146	103 x 66	67 x 43			
200	254 x 162	114 x 73	75 x 48			
220	279 x 178	126 x 80	83 x 53			
240	305 x 195	138 x 88	90 x 58			
260	330 x 211	149 x 95	98 x 62			
280	355 x 227	161 x 103	105 x 67			
300	381 x 243	173 x 110	113 x 72			
320	406 x 259	185 x 118	120 x 77			
340	431 x 275	196 x 125	128 x 82			
360	457 x 292	208 x 133	136 x 87			
380	482 x 308	220 x 140	143 x 91			
400	507 x 324	231 x 148	151 x 96			
420	533 x 340	243 x 155	158 x 101			
440	558 x 356	255 x 163	166 x 106			
460	583 x 372	267 x 170	174 x 111			
480	609 x 389	278 x 178	181 x 116			
500	634 x 405	290 x 185	189 x 120			
520	659 x 421	302 x 193	196 x 125			
540	685 x 437	313 x 200	204 x 130			
560	710 x 453	325 x 208	211 x 135			
580	735 x 469	337 x 215	219 x 140			
600	761 x 486	349 x 223	227 x 145			
620	786 x 502	360 x 230	234 x 149	89 x 57		
640	811 x 518	372 x 237	242 x 154	92 x 59		
660	837 x 534	384 x 245	249 x 159	95 x 61		
680	862 x 550	395 x 252	257 x 164	98 x 63		
700	887 x 566	407 x 260	265 x 169	101 x 65		
720	913 x 583	419 x 267	272 x 174	104 x 67		
740	938 x 599	431 x 275	280 x 179	107 x 68	51 x 32	
760	963 x 615	442 x 282	287 x 183	110 x 70	52 x 33	
780	989 x 631	454 x 290	295 x 188	113 x 72	54 x 34	
800	1014 x 647	466 x 297	302 x 193	116 x 74	55 x 35	35 x 22
820	1039 x 663	477 x 305	310 x 198	119 x 76	57 x 36	36 x 23
840	1065 x 680	489 x 312	318 x 203	122 x 78	59 x 37	37 x 24
860	1090 x 696	501 x 320	325 x 208	125 x 80	60 x 38	38 x 25
880	1115 x 712	513 x 327	333 x 212	128 x 82	62 x 39	40 x 25
900	1141 x 728	524 x 335	340 x 217	131 x 84	63 x 40	41 x 26
920	1166 x 744	536 x 342	348 x 222	134 x 86	65 x 41	42 x 27
940	1191 x 760	548 x 350	355 x 227	137 x 88	66 x 42	43 x 27
960	1217 x 777	559 x 357	363 x 232	140 x 89	68 x 43	44 x 28
980	1242 x 793	571 x 365	371 x 237	143 x 91	69 x 44	45 x 29
1000	1267 x 809	583 x 372	378 x 241	146 x 93	71 x 45	46 x 30
1020	1293 x 825	595 x 379	386 x 246	149 x 95	72 x 46	47 x 30
1040	1318 x 841	606 x 387	393 x 251	152 x 97	74 x 47	49 x 31
1060	1343 x 857	618 x 394	401 x 256	155 x 99	75 x 48	50 x 32
1080	1369 x 874	630 x 402	409 x 261	158 x 101	77 x 49	51 x 32
1100	1394 x 890	641 x 409	416 x 266	161 x 103	78 x 50	52 x 33
1120	1419 x 906	653 x 417	424 x 270	164 x 105	80 x 51	53 x 34
1140	1445 x 922	665 x 424	431 x 275	167 x 107	81 x 52	54 x 35
1160	1470 x 938	677 x 432	439 x 280	170 x 108	83 x 53	55 x 35
1180	1495 x 954	688 x 439	446 x 285	173 x 110	84 x 54	56 x 36
1200	1521 x 971	700 x 447	454 x 290	176 x 112	86 x 55	57 x 37
1220	1546 x 987	712 x 454	462 x 295	179 x 114	87 x 56	59 x 37
1240	1571 x 1003	723 x 462	469 x 300	182 x 116	89 x 57	60 x 38
1260	1597 x 1019	735 x 469	477 x 304	185 x 118	91 x 58	61 x 39
1280	1622 x 1035	747 x 477	484 x 309	188 x 120	92 x 59	62 x 40
1300	1647 x 1051	759 x 484	492 x 314	191 x 122	94 x 60	63 x 40
1320	1673 x 1068	770 x 492	500 x 319	194 x 124	95 x 61	64 x 41
1340	1698 x 1084	782 x 499	507 x 324	197 x 126	97 x 62	65 x 42
1360	1723 x 1100	794 x 507	515 x 329	200 x 128	98 x 63	66 x 42
1380	1749 x 1116	805 x 514	522 x 333	203 x 129	100 x 64	68 x 43
1400	1774 x 1132	817 x 522	530 x 338	206 x 131	101 x 65	69 x 44
1420	1799 x 1148	829 x 529	537 x 343	209 x 133	103 x 66	70 x 45
1440	1825 x 1165	840 x 536	545 x 348	212 x 135	104 x 67	71 x 45
1460	1850 x 1181	852 x 544	553 x 353	215 x 137	106 x 68	72 x 46
1480	1875 x 1197	864 x 551	560 x 358	218 x 139	107 x 68	73 x 47
1500	1901 x 1213	876 x 559	568 x 362	221 x 141	109 x 69	74 x 47

Standard C-mount Lenses on iVu Series, WD as a function of FOV Chart

FOV (mm)			WD (mm)					
			4mm	8mm	12mm	25mm	50mm	75mm
		Minimum	63 x 40 @ 49mm	15 x 10 @ 31mm	64 x 41 @ 171mm	88 x 56 @ 610mm	50 x 32 @ 732mm	34 x 22 @ 781mm
20	x	15		39				
40	x	30		73				888
60	x	45		107			859	1245
80	x	60	63	141	213		1122	1602
100	x	75	78	175	266	691	1384	1959
120	x	90	94	210	319	825	1647	2316
140	x	105	110	244	372	959	1909	2673
160	x	120	126	278	424	1093	2172	3031
180	x	135	142	312	477	1227	2434	3388
200	x	150	157	346	530	1362	2697	3745
220	x	165	173	380	583	1496	2959	4102
240	x	180	189	415	635	1630	3222	4459
260	x	195	205	449	688	1764	3484	4816
280	x	210	220	483	741	1898	3747	5173
300	x	225	236	517	794	2032	4009	5531
320	x	240	252	551	846	2166	4272	5888
340	x	255	268	585	899	2300	4534	6245
360	x	270	284	619	952	2434	4796	6602
380	x	285	299	654	1005	2568	5059	6959
400	x	300	315	688	1057	2702	5321	7316
420	x	315	331	722	1110	2836	5584	7673
440	x	330	347	756	1163	2970	5846	8031
460	x	345	363	790	1216	3104	6109	8388
480	x	360	378	824	1268	3238	6371	8745
500	x	375	394	859	1321	3372	6634	9102
520	x	390	410	893	1374	3506	6896	9459
540	x	405	426	927	1427	3640	7159	9816
560	x	420	442	961	1479	3774	7421	10173
580	x	435	457	995	1532	3908	7684	10531
600	x	450	473	1029	1585	4043	7946	10888
620	x	465	489	1063	1638	4177	8209	11245
640	x	480	505	1098	1690	4311	8471	11602
660	x	495	521	1132	1743	4445	8733	11959
680	x	510	536	1166	1796	4579	8996	12316
700	x	525	552	1200	1849	4713	9258	12673
720	x	540	568	1234	1901	4847	9521	13031
740	x	555	584	1268	1954	4981	9783	13388
760	x	570	599	1303	2007	5115	10046	13745
780	x	585	615	1337	2060	5249	10308	14102
800	x	600	631	1371	2113	5383	10571	14459
820	x	615	647	1405	2165	5517	10833	14816
840	x	630	663	1439	2218	5651	11096	15173
860	x	645	678	1473	2271	5785	11358	15531
880	x	660	694	1507	2324	5919	11621	15888
900	x	675	710	1542	2376	6053	11883	16245
920	x	690	726	1576	2429	6187	12146	16602
940	x	705	742	1610	2482	6321	12408	16959
960	x	720	757	1644	2535	6455	12670	17316
980	x	735	773	1678	2587	6589	12933	17673
1000	x	750	789	1712	2640	6723	13195	18031
1020	x	765	805	1747	2693	6858	13458	18388
1040	x	780	821	1781	2746	6992	13720	18745
1060	x	795	836	1815	2798	7126	13983	19102
1080	x	810	852	1849	2851	7260	14245	19459
1100	x	825	868	1883	2904	7394	14508	19816
1120	x	840	884	1917	2957	7528	14770	20173
1140	x	855	900	1951	3009	7662	15033	20531
1160	x	870	915	1986	3062	7796	15295	20888
1180	x	885	931	2020	3115	7930	15558	21245
1200	x	900	947	2054	3168	8064	15820	21602
1220	x	915	963	2088	3220	8198	16083	21959
1240	x	930	978	2122	3273	8332	16345	22316
1260	x	945	994	2156	3326	8466	16607	22673
1280	x	960	1010	2191	3379	8600	16870	23031
1300	x	975	1026	2225	3431	8734	17132	23388
1320	x	990	1042	2259	3484	8868	17395	23745
1340	x	1005	1057	2293	3537	9002	17657	24102
1360	x	1020	1073	2327	3590	9136	17920	24459
1380	x	1035	1089	2361	3642	9270	18182	24816
1400	x	1050	1105	2395	3695	9404	18445	25173
1420	x	1065	1121	2430	3748	9538	18707	25531
1440	x	1080	1136	2464	3801	9673	18970	25888
1460	x	1095	1152	2498	3853	9807	19232	26245
1480	x	1110	1168	2532	3906	9941	19495	26602
1500	x	1125	1184	2566	3959	10075	19757	26959

Standard C-mount Lens equations for iVu Series

H = horizontal FOV size, W = working distance



4 mm lens

Banner model: LCF04 (p/n 68884

Marshall Electronics model: V-4504ML

1/3-inch format, no filter, fixed iris f/2.5, fits with either IVUSLC50 or IVUSLC75 lens covers

H(W), mm

H = 1.267 × W + 0.775 (minimum W ~ 49mm)

W(H), mm

W = (H – 0.775)/1.267 (minimum H ~ 63mm)

NOTE: Banner recommends using a 0.25 mm spacer (LEKS)



8 mm lens

Banner model: LCF08 (p/n 57298)

Azure Photonics model: AZURE-0813F

½-inch format, no filter, fixed iris f/1.3, fits with either IVUSLC50 or IVUSLC75 lens covers

H(W), mm

H = 0.586 × W – 2.77 (minimum W ~ 31mm)

W(H), mm

W = (H + 2.77)/0.586 (minimum H ~ 15mm)



12 mm lens

Banner model: LCF12 (p/n 57299)

Marshall Electronics model: V-4512

1/3-inch format, no filter, fixed iris f/2.0, fits with either IVUSLC50 or IVUSLC75 lens covers

H(W), mm

H = 0.379 × W – 0.855 (minimum W ~ 171mm)

W(H), mm

W = (H + 0.855)/0.379 (minimum H ~ 64mm)



25mm lens

Banner model: LCF25R (p/n 68885)

Goyo Optical model: GMG42514C

1-inch format, 37.5 mm filter, min f/1.4, fits with IVUSLC75 lens cover

H(W), mm

H = 0.149 × W – 3.14 (minimum W ~ 610mm)

W(H), mm

W = (H + 3.14)/0.149 (minimum H ~ 88mm)



50mm lens

Banner model: LCF50L2R (p/n 68888)

Goyo Optical model: GMG45018MCN

1-inch format, 40.5 mm filter, min f/1.8, fits with IVUSLC75 lens cover, requires LHWK-1 set screws

H(W), mm

H = 0.0762 × W – 5.49 (minimum W ~ 732mm)

W(H), mm

W = (H + 5.49)/0.0762 (minimum H ~ 50mm)



75mm lens

Banner model: LCF75LR (p/n 70545)

Goyo Optical model: GMG47518MCN

1-inch format, 46 mm filter, min f/1.8, does not fit with a sealed lens cover

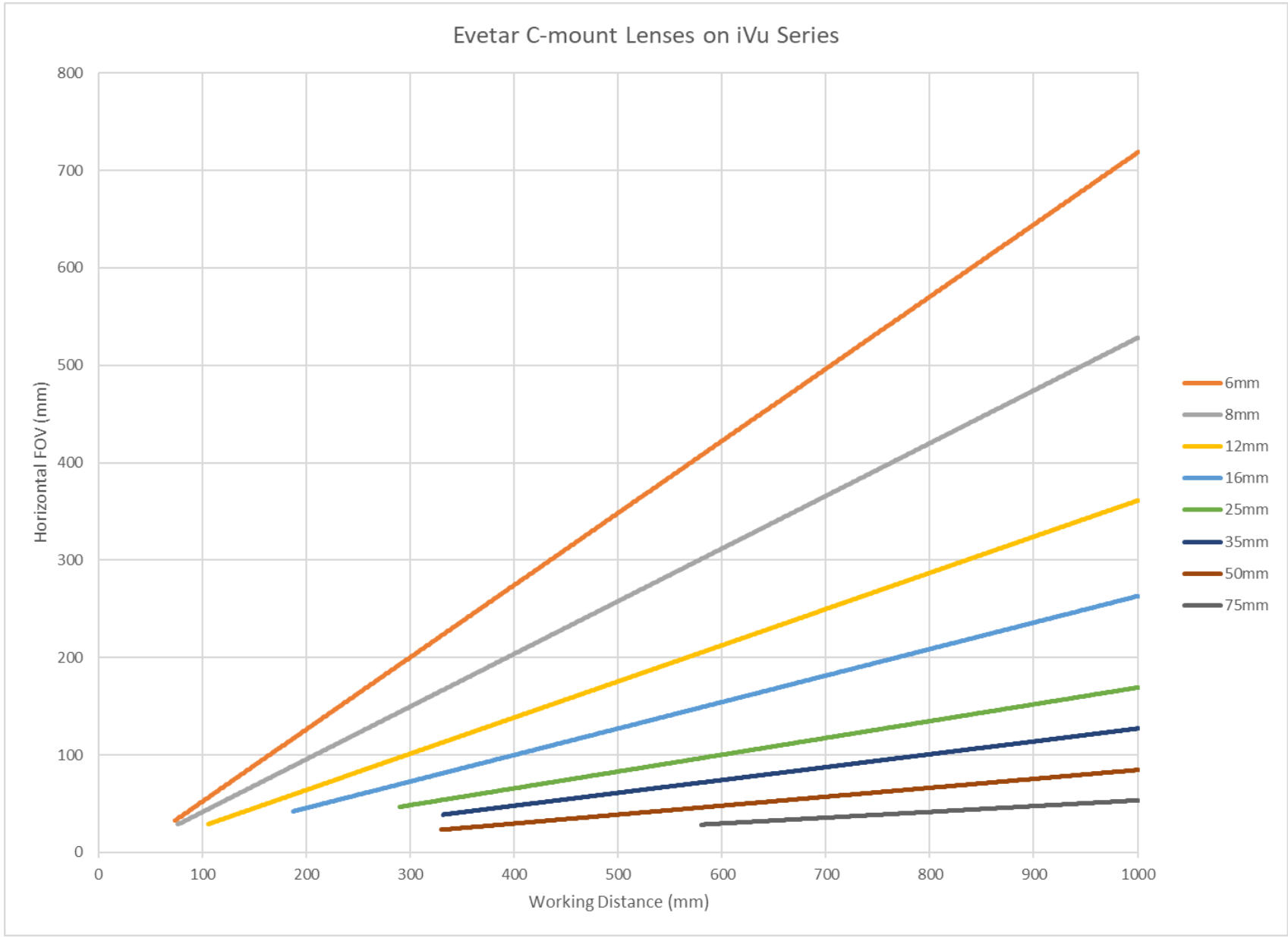
H(W), mm

H = 0.056 × W – 9.71 (minimum W ~ 781mm)

W(H), mm

W = (H + 9.71)/0.056 (minimum H ~ 34mm)

Evetar C-mount Lenses on iVu Series



Evetar C-mount Lenses on iVu Series, FOV as a function of WD Chart

	FOV (mm)							
WD (mm)	6mm	8mm	12mm	16mm	25mm	35mm	50mm	75mm
Minimum	*34 x 22*	*29 x 19*	*29 x 19*	*42 x 27*	*46 x 29*	*39 x 25*	*23 x 15*	*28 x 18*
	@ 73mm	*@ 76mm*	*@ 105mm*	*@ 187mm*	*@ 290mm*	*@ 331mm*	*@ 330mm*	*@ 580mm*
20								
40								
60								
80	38 x 24	31 x 20						
100	52 x 33	42 x 27						
120	67 x 43	52 x 33	34 x 22					
140	82 x 52	63 x 40	42 x 27					
160	97 x 62	74 x 47	49 x 31					
180	112 x 71	85 x 54	57 x 36					
200	126 x 81	96 x 61	64 x 41	46 x 29				
220	141 x 90	107 x 68	72 x 46	51 x 33				
240	156 x 100	117 x 75	79 x 50	56 x 36				
260	171 x 109	128 x 82	86 x 55	62 x 40				
280	186 x 119	139 x 89	94 x 60	67 x 43				
300	201 x 128	150 x 96	101 x 65	73 x 46	48 x 31			
320	215 x 137	161 x 103	109 x 69	78 x 50	52 x 33			
340	230 x 147	171 x 109	116 x 74	84 x 53	55 x 35	40 x 26	24 x 15	
360	245 x 156	182 x 116	124 x 79	89 x 57	59 x 38	43 x 27	26 x 17	
380	260 x 166	193 x 123	131 x 84	95 x 60	62 x 40	45 x 29	28 x 18	
400	275 x 175	204 x 130	138 x 88	100 x 64	66 x 42	48 x 31	30 x 19	
420	289 x 185	215 x 137	146 x 93	105 x 67	69 x 44	51 x 32	31 x 20	
440	304 x 194	226 x 144	153 x 98	111 x 71	73 x 46	53 x 34	33 x 21	
460	319 x 204	236 x 151	161 x 103	116 x 74	76 x 49	56 x 36	35 x 22	
480	334 x 213	247 x 158	168 x 107	122 x 78	80 x 51	58 x 37	37 x 24	
500	349 x 223	258 x 165	176 x 112	127 x 81	83 x 53	61 x 39	39 x 25	
520	363 x 232	269 x 172	183 x 117	133 x 85	86 x 55	64 x 41	41 x 26	
540	378 x 241	280 x 178	190 x 122	138 x 88	90 x 57	66 x 42	42 x 27	
560	393 x 251	290 x 185	198 x 126	143 x 92	93 x 60	69 x 44	44 x 28	
580	408 x 260	301 x 192	205 x 131	149 x 95	97 x 62	72 x 46	46 x 29	28 x 18
600	423 x 270	312 x 199	213 x 136	154 x 99	100 x 64	74 x 47	48 x 31	30 x 19
620	437 x 279	323 x 206	220 x 141	160 x 102	104 x 66	77 x 49	50 x 32	31 x 20
640	452 x 289	334 x 213	228 x 145	165 x 105	107 x 68	80 x 51	52 x 33	32 x 20
660	467 x 298	345 x 220	235 x 150	171 x 109	111 x 71	82 x 52	53 x 34	33 x 21
680	482 x 308	355 x 227	242 x 155	176 x 112	114 x 73	85 x 54	55 x 35	34 x 22
700	497 x 317	366 x 234	250 x 159	182 x 116	117 x 75	87 x 56	57 x 36	36 x 23
720	511 x 326	377 x 241	257 x 164	187 x 119	121 x 77	90 x 58	59 x 38	37 x 23
740	526 x 336	388 x 248	265 x 169	192 x 123	124 x 79	93 x 59	61 x 39	38 x 24
760	541 x 345	399 x 254	272 x 174	198 x 126	128 x 82	95 x 61	63 x 40	39 x 25
780	556 x 355	409 x 261	280 x 178	203 x 130	131 x 84	98 x 63	64 x 41	40 x 26
800	571 x 364	420 x 268	287 x 183	209 x 133	135 x 86	101 x 64	66 x 42	42 x 26
820	586 x 374	431 x 275	294 x 188	214 x 137	138 x 88	103 x 66	68 x 43	43 x 27
840	600 x 383	442 x 282	302 x 193	220 x 140	142 x 90	106 x 68	70 x 45	44 x 28
860	615 x 393	453 x 289	309 x 197	225 x 144	145 x 93	109 x 69	72 x 46	45 x 29
880	630 x 402	464 x 296	317 x 202	230 x 147	149 x 95	111 x 71	74 x 47	46 x 30
900	645 x 412	474 x 303	324 x 207	236 x 151	152 x 97	114 x 73	75 x 48	47 x 30
920	660 x 421	485 x 310	332 x 212	241 x 154	155 x 99	117 x 74	77 x 49	49 x 31
940	674 x 430	496 x 317	339 x 216	247 x 158	159 x 101	119 x 76	79 x 50	50 x 32
960	689 x 440	507 x 323	346 x 221	252 x 161	162 x 104	122 x 78	81 x 52	51 x 33
980	704 x 449	518 x 330	354 x 226	258 x 164	166 x 106	124 x 79	83 x 53	52 x 33
1000	719 x 459	528 x 337	361 x 231	263 x 168	169 x 108	127 x 81	85 x 54	53 x 34
1020	734 x 468	539 x 344	369 x 235	269 x 171	173 x 110	130 x 83	86 x 55	55 x 35
1040	748 x 478	550 x 351	376 x 240	274 x 175	176 x 112	132 x 84	88 x 56	56 x 36
1060	763 x 487	561 x 358	384 x 245	279 x 178	180 x 115	135 x 86	90 x 57	57 x 36
1080	778 x 497	572 x 365	391 x 250	285 x 182	183 x 117	138 x 88	92 x 59	58 x 37
1100	793 x 506	583 x 372	398 x 254	290 x 185	186 x 119	140 x 90	94 x 60	59 x 38
1120	808 x 516	593 x 379	406 x 259	296 x 189	190 x 121	143 x 91	96 x 61	60 x 39
1140	822 x 525	604 x 386	413 x 264	301 x 192	193 x 123	146 x 93	97 x 62	62 x 39
1160	837 x 534	615 x 393	421 x 269	307 x 196	197 x 126	148 x 95	99 x 63	63 x 40
1180	852 x 544	626 x 399	428 x 273	312 x 199	200 x 128	151 x 96	101 x 65	64 x 41
1200	867 x 553	637 x 406	436 x 278	318 x 203	204 x 130	153 x 98	103 x 66	65 x 42
1220	882 x 563	647 x 413	443 x 283	323 x 206	207 x 132	156 x 100	105 x 67	66 x 42
1240	896 x 572	658 x 420	450 x 288	328 x 210	211 x 134	159 x 101	107 x 68	68 x 43
1260	911 x 582	669 x 427	458 x 292	334 x 213	214 x 137	161 x 103	108 x 69	69 x 44
1280	926 x 591	680 x 434	465 x 297	339 x 217	218 x 139	164 x 105	110 x 70	70 x 45
1300	941 x 601	691 x 441	473 x 302	345 x 220	221 x 141	167 x 106	112 x 72	71 x 45
1320	956 x 610	702 x 448	480 x 306	350 x 223	224 x 143	169 x 108	114 x 73	72 x 46
1340	971 x 619	712 x 455	488 x 311	356 x 227	228 x 145	172 x 110	116 x 74	74 x 47
1360	985 x 629	723 x 462	495 x 316	361 x 230	231 x 148	175 x 111	118 x 75	75 x 48
1380	1000 x 638	734 x 469	502 x 321	366 x 234	235 x 150	177 x 113	119 x 76	76 x 48
1400	1015 x 648	745 x 475	510 x 325	372 x 237	238 x 152	180 x 115	121 x 77	77 x 49
1420	1030 x 657	756 x 482	517 x 330	377 x 241	242 x 154	183 x 117	123 x 79	78 x 50
1440	1045 x 667	766 x 489	525 x 335	383 x 244	245 x 156	185 x 118	125 x 80	79 x 51
1460	1059 x 676	777 x 496	532 x 340	388 x 248	249 x 159	188 x 120	127 x 81	81 x 51
1480	1074 x 686	788 x 503	540 x 344	394 x 251	252 x 161	190 x 122	129 x 82	82 x 52
1500	1089 x 695	799 x 510	547 x 349	399 x 255	255 x 163	193 x 123	130 x 83	83 x 53

Evetar C-mount Lenses on iVu Series, WD as a function of FOV Chart

FOV (mm)			WD (mm)													
			6mm		8mm		12mm		16mm		25mm		35mm		50mm		75mm	
		Minimum	34 x 22		29 x 19		29 x 19		42 x 27		46 x 29		39 x 25		23 x 15		28 x 18	
			@ 73mm		@ 76mm		@ 105mm		@ 187mm		@ 290mm		@ 331mm		@ 330mm		@ 580mm	
20	x	15																
40	x	30	83		97		135						340		514		775	
60	x	45	110		134		189		253		367		492		732		1112	
80	x	60	137		171		243		327		483		643		950		1449	
100	x	75	164		208		296		400		599		795		1168		1786	
120	x	90	191		245		350		474		715		946		1386		2124	
140	x	105	218		282		404		547		831		1098		1604		2461	
160	x	120	245		319		458		621		947		1249		1822		2798	
180	x	135	272		356		512		694		1062		1401		2041		3136	
200	x	150	299		393		566		768		1178		1552		2259		3473	
220	x	165	326		430		620		841		1294		1704		2477		3810	
240	x	180	353		467		673		915		1410		1855		2695		4147	
260	x	195	380		504		727		989		1526		2007		2913		4485	
280	x	210	407		541		781		1062		1642		2158		3131		4822	
300	x	225	434		578		835		1136		1758		2310		3349		5159	
320	x	240	461		615		889		1209		1874		2462		3567		5496	
340	x	255	488		652		943		1283		1990		2613		3785		5834	
360	x	270	515		689		997		1356		2106		2765		4003		6171	
380	x	285	542		726		1050		1430		2222		2916		4222		6508	
400	x	300	569		763		1104		1503		2338		3068		4440		6845	
420	x	315	596		800		1158		1577		2454		3219		4658		7183	
440	x	330	623		836		1212		1651		2570		3371		4876		7520	
460	x	345	650		873		1266		1724		2686		3522		5094		7857	
480	x	360	677		910		1320		1798		2802		3674		5312		8195	
500	x	375	704		947		1373		1871		2918		3825		5530		8532	
520	x	390	731		984		1427		1945		3033		3977		5748		8869	
540	x	405	759		1021		1481		2018		3149		4128		5966		9206	
560	x	420	786		1058		1535		2092		3265		4280		6185		9544	
580	x	435	813		1095		1589		2165		3381		4431		6403		9881	
600	x	450	840		1132		1643		2239		3497		4583		6621		10218	
620	x	465	867		1169		1697		2313		3613		4734		6839		10555	
640	x	480	894		1206		1750		2386		3729		4886		7057		10893	
660	x	495	921		1243		1804		2460		3845		5037		7275		11230	
680	x	510	948		1280		1858		2533		3961		5189		7493		11567	
700	x	525	975		1317		1912		2607		4077		5340		7711		11905	
720	x	540	1002		1354		1966		2680		4193		5492		7929		12242	
740	x	555	1029		1391		2020		2754		4309		5643		8147		12579	
760	x	570	1056		1428		2074		2827		4425		5795		8366		12916	
780	x	585	1083		1465		2127		2901		4541		5946		8584		13254	
800	x	600	1110		1502		2181		2975		4657		6098		8802		13591	
820	x	615	1137		1539		2235		3048		4773		6249		9020		13928	
840	x	630	1164		1576		2289		3122		4889		6401		9238		14265	
860	x	645	1191		1613		2343		3195		5004		6552		9456		14603	
880	x	660	1218		1650		2397		3269		5120		6704		9674		14940	
900	x	675	1245		1687		2450		3342		5236		6855		9892		15277	
920	x	690	1272		1724		2504		3416		5352		7007		10110		15614	
940	x	705	1299		1761		2558		3489		5468		7158		10328		15952	
960	x	720	1326		1798		2612		3563		5584		7310		10547		16289	
980	x	735	1353		1835		2666		3637		5700		7462		10765		16626	
1000	x	750	1380		1872		2720		3710		5816		7613		10983		16964	
1020	x	765	1407		1909		2774		3784		5932		7765		11201		17301	
1040	x	780	1434		1946		2827		3857		6048		7916		11419		17638	
1060	x	795	1461		1983		2881		3931		6164		8068		11637		17975	
1080	x	810	1488		2020		2935		4004		6280		8219		11855		18313	
1100	x	825	1515		2057		2989		4078		6396		8371		12073		18650	
1120	x	840	1542		2094		3043		4151		6512		8522		12291		18987	
1140	x	855	1569		2131		3097		4225		6628		8674		12509		19324	
1160	x	870	1596		2168		3151		4299		6744		8825		12728		19662	
1180	x	885	1623		2205		3204		4372		6860		8977		12946		19999	
1200	x	900	1650		2242		3258		4446		6976		9128		13164		20336	
1220	x	915	1677		2279		3312		4519		7091		9280		13382		20673	
1240	x	930	1704		2316		3366		4593		7207		9431		13600		21011	
1260	x	945	1731		2352		3420		4666		7323		9583		13818		21348	
1280	x	960	1758		2389		3474		4740		7439		9734		14036		21685	
1300	x	975	1785		2426		3527		4813		7555		9886		14254		22023	
1320	x	990	1812		2463		3581		4887		7671		10037		14472		22360	
1340	x	1005	1839		2500		3635		4961		7787		10189		14691		22697	
1360	x	1020	1866		2537		3689		5034		7903		10340		14909		23034	
1380	x	1035	1893		2574		3743		5108		8019		10492		15127		23372	
1400	x	1050	1920		2611		3797		5181		8135		10643		15345		23709	
1420	x	1065	1947		2648		3851		5255		8251		10795		15563		24046	
1440	x	1080	1974		2685		3904		5328		8367		10946		15781		24383	
1460	x	1095	2001		2722		3958		5402		8483		11098		15999		24721	
1480	x	1110	2028		2759		4012		5475		8599		11249		16217		25058	
1500	x	1125	2055		2796		4066		5549		8715		11401		16435		25395	

Evetar C-mount Lens equations for iVu Series

H = horizontal FOV size, W = working distance



6mm Megapixel lens

Banner model: LCF06LEVMP (p/n 97345)
Evetar model: MV118FM06C
1/1.8-inch format, 34 mm filter, min f/1.6, fits with IVUSLC75 lens cover
H(W), mm
H = 0.74 × W – 21.6 (minimum W ~730mm)
W(H), mm
W = (H + 21.6)/0.74 (minimum H ~ 34mm)



8mm Megapixel lens

Banner model: LCF08LEVMP (p/n 97346)
Evetar model: MV118FM08C
1/1.8-inch format, 27 mm filter, min f/1.4, fits with IVUSLC75 lens cover
H(W), mm
H = 0.541 × W – 12.46 (minimum W ~ 76mm)
W(H), mm
W = (H + 12.46)/0.541 (minimum H ~ 29mm)



12mm Megapixel lens

Banner model: LCF12LEVMP (p/n 97347)
Evetar model: MV23FM12C
2/3-inch format, 27 mm filter, min f/1.6, fits with IVUSLC75 lens cover
H(W), mm
H = 0.371 × W – 10.1 (minimum W ~ 105mm)
W(H), mm
W = (H + 10.1)/0.371 (minimum H ~ 29mm)



16mm Megapixel lens

Banner model: LCF16LEVMP (p/n 97348)
Evetar model: MV23FM16CR1
2/3-inch format, 27 mm filter, min f/1.6, fits with IVUSLC75 lens cover
H(W), mm
H = 0.272 × W – 8.78 (minimum W ~ 187mm)
W(H), mm
W = (H + 8.78)/0.272 (minimum H ~ 42mm)



25mm Megapixel lens

Banner model: LCF25LEVMP (p/n 97349)
Evetar model: MV23FM25C
2/3-inch format, 27 mm filter, min f/1.8, fits with IVUSLC75 lens cover
H(W), mm
H = 0.173 × W – 3.27 (minimum W ~ 290mm)
W(H), mm
W = (H + 3.27)/0.173 (minimum H ~ 46mm)



35mm Megapixel lens

Banner model: LCF35LEVMP (p/n 97350)
Evetar model: MV23FM35C
2/3-inch format, 27 mm filter, min f/2.0, fits with IVUSLC75 lens cover
H(W), mm
H = 0.132 × W – 4.921 (minimum W ~ 331mm)
W(H), mm
W = (H + 4.921)/0.132 (minimum H ~ 39mm)



50mm Megapixel lens

Banner model: LCF50LEVMP (p/n 97351)
Evetar model: MV23FM50C
2/3-inch format, 30.5 mm filter, min f/2.6, fits with IVUSLC75 lens cover
H(W), mm
H = 0.092 × W – 7.12 (minimum W ~ 330mm)
W(H), mm
W = (H + 7.12)/0.092 (minimum H ~ 23mm)



75mm Megapixel lens

Banner model: LCF75LEVMP (p/n 97352)
Evetar model: MV11FM75C
1-inch format, 34 mm filter, min f/2.8, does not fit with a sealed lens cover
H(W), mm
H = 0.059 × W – 5.94 (minimum W ~ 580mm)
W(H), mm
W = (H + 5.94)/0.059 (minimum H ~ 28mm)