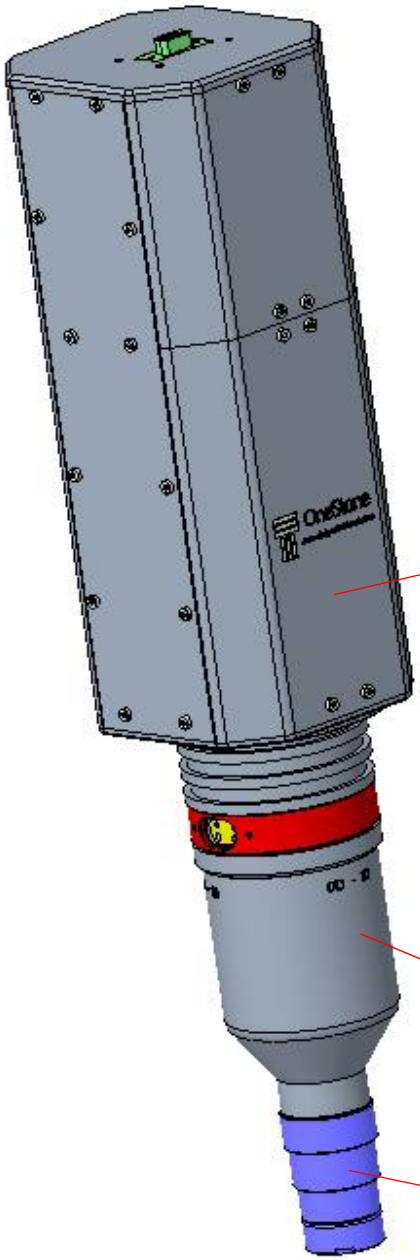
CM-10120M Collimator Module Spec.

2025-03-12
OneStone

Construction of CM-10120M

Collimator Lens Section : CL-10120 Collimating Lens (Visible, IR(850nm, 940nm))
Fixed Barrel : 1.0D FB, 2.5D FB, 3.33D FB
Diopter Variable Barrel : Motorized (0D ~ 1D, 0.78D ~ 2.5D, 1.17D ~ 3.33D)
Lighting Section : Chart Module (BLU + Chart)

CM-10120M Pictures



Barrel Module

Chart Module
(BLU + Chart)

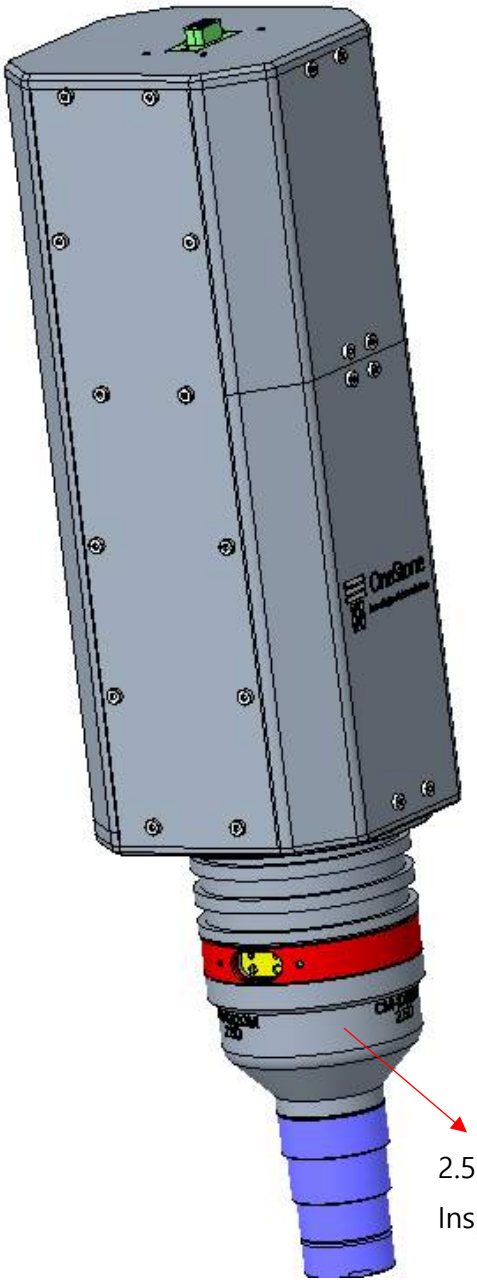
Diopter Variable Barrel
(Motorized)

1.0D Fixed Barrel
Inspection range : 1.0m ~ Inf

Collimating Lens

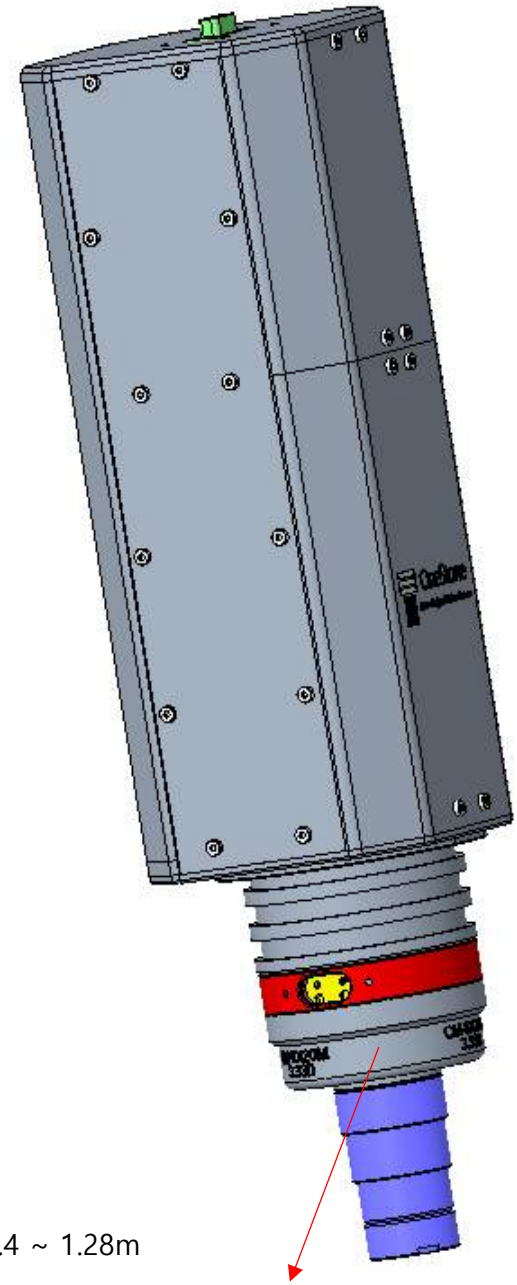
CL-10120
(Visible, IR)

CM-10120M Pictures



2.5D Fixed Barrel

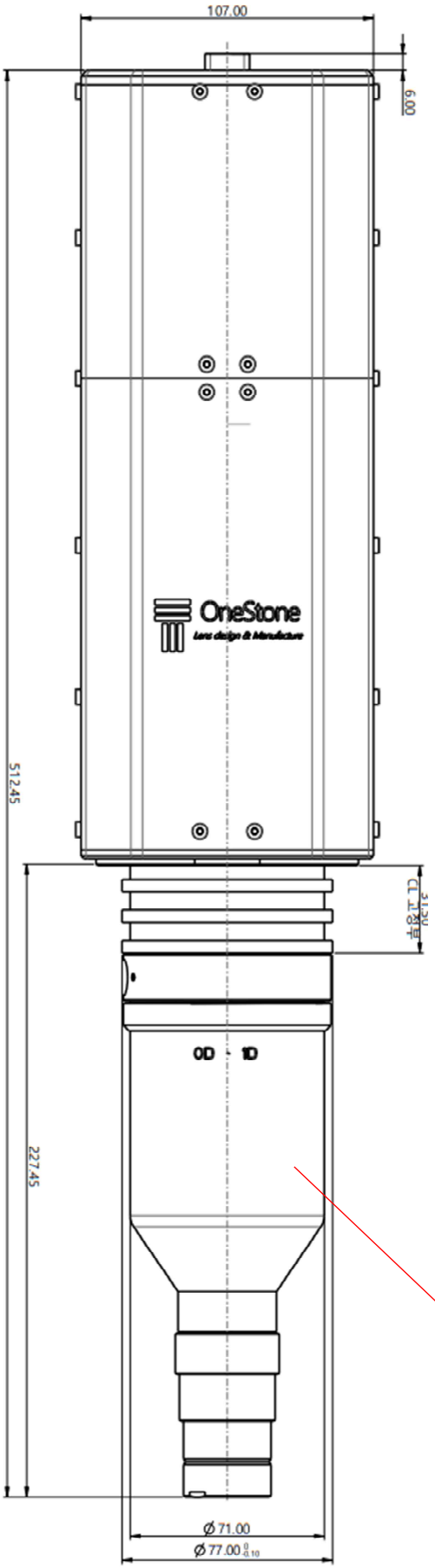
Inspection range : 0.4 ~ 1.28m

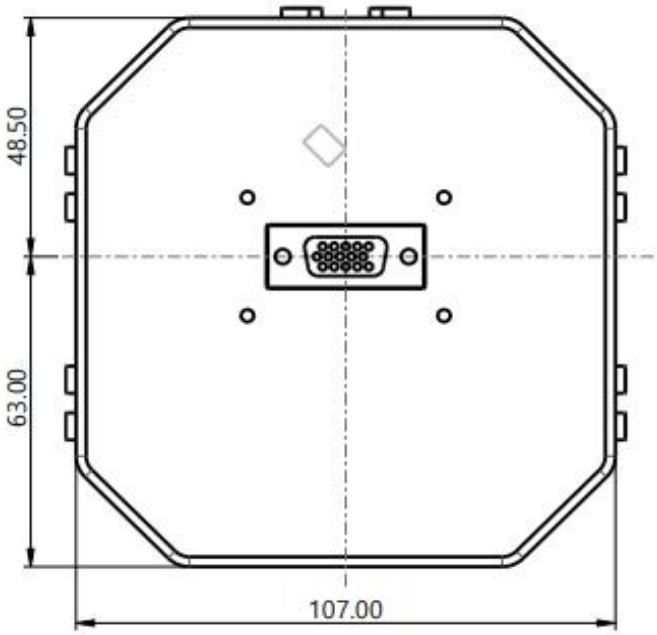


3.33D Fixed Barrel

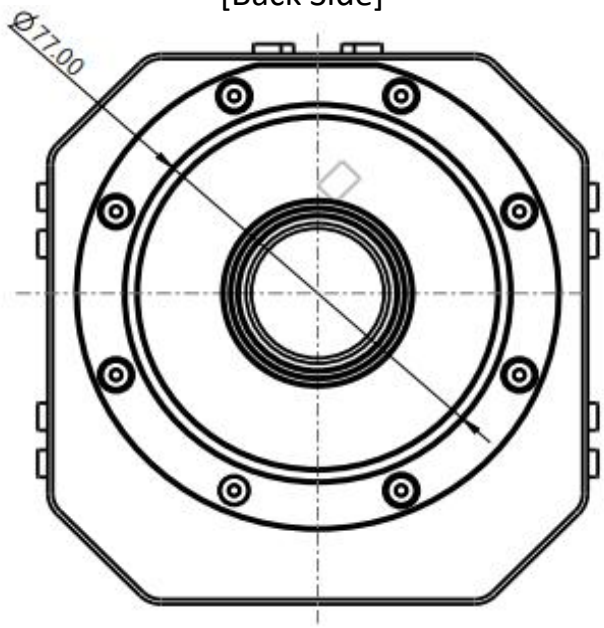
Inspection range : 0.3 ~ 0.85m

CM-10120M Drawing





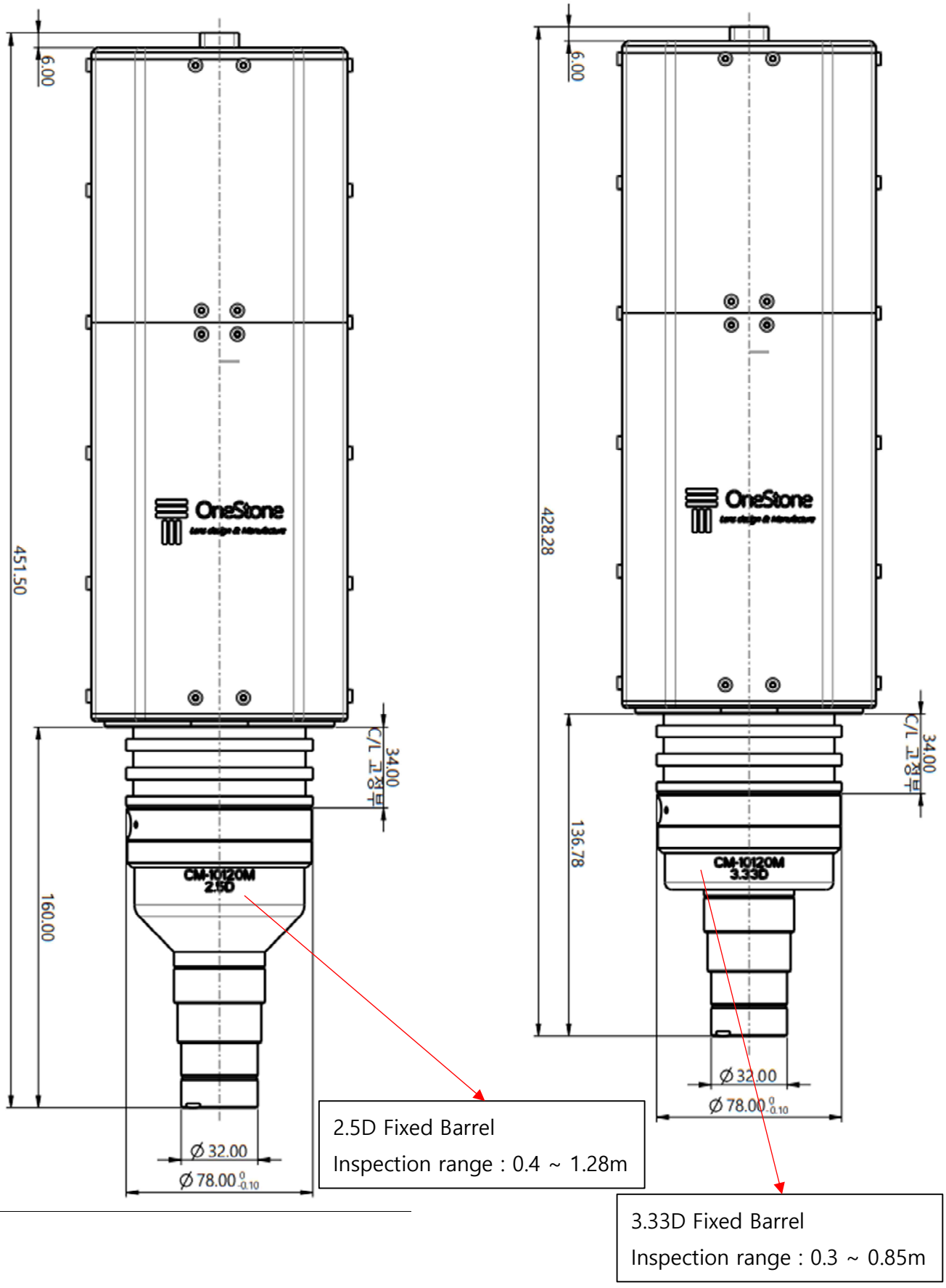
[Back Side]



[Front Side]

1.0D Fixed Barrel

Inspection range : 1.0m ~ Inf


6.00
451.50
160.00
34.00
C/L 고정부
CM-1012OM
2.5D
Ø 32.00
Ø 78.00 0 -0.10
OneStone
6.00
428.28
136.78
34.00
C/L 고정부
CM-1012OM
3.33D
Ø 32.00
Ø 78.00 0 -0.10
2.5D Fixed Barrel
Inspection range : 0.4 ~ 1.28m
3.33D Fixed Barrel
Inspection range : 0.3 ~ 0.85m

Lighting section (Visible)

two LEDs + variable resistor : Color temperature can be adjusted

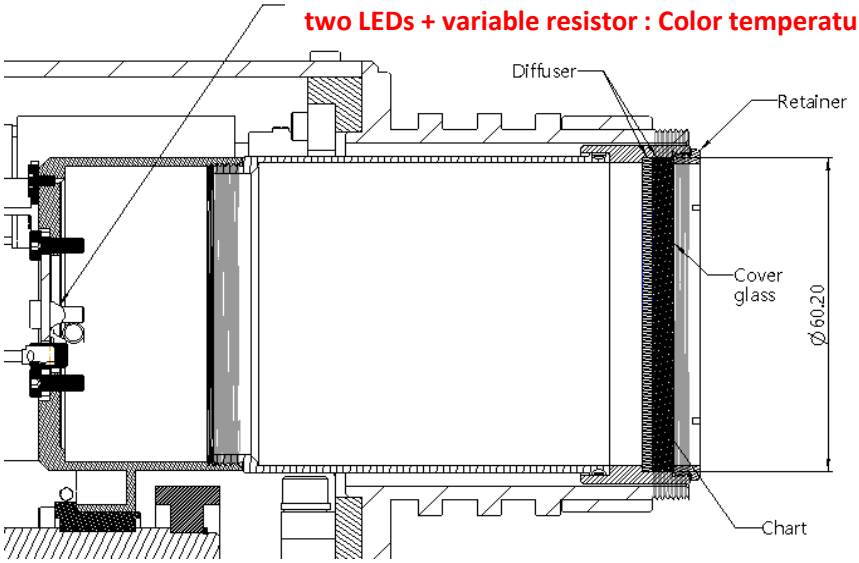


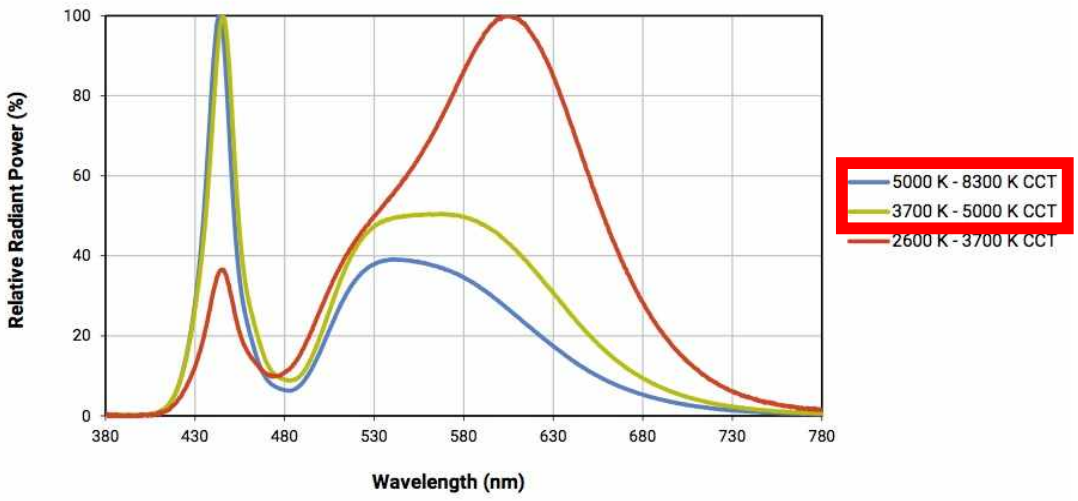
Chart Size
$\varnothing 60.20^{-0.10}_{-0.15}$

LED Specification

CHARACTERISTICS

Characteristics	Unit	Minimum	Typical	Maximum
Thermal resistance, junction to solder point	°C/W		2.5	
Viewing angle (FWHM)	degrees		125	
Temperature coefficient of voltage	mV/°C		-1.6	
ESD withstand voltage (HBM per Mil-Std-883D)	V			8000
DC forward current	mA			3000
Reverse voltage	V			-5
Forward voltage (@ 700 mA, 85 °C)	V		2.85	3.15
Forward voltage (@ 1500 mA, 85 °C)	V		3.05	
Forward voltage (@ 3000 mA, 85 °C)	V		3.3	
LED junction temperature	°C			150

RELATIVE SPECTRAL POWER DISTRIBUTION



Lighting section (IR)

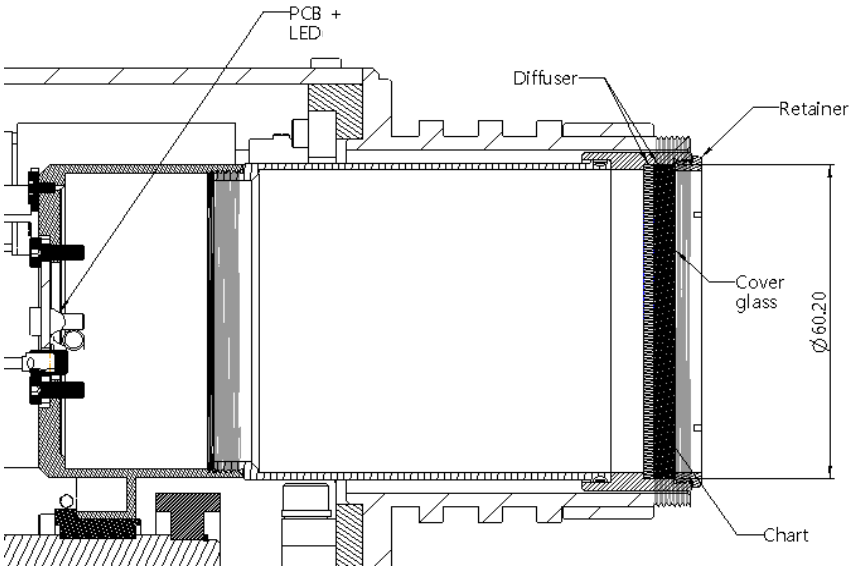


Chart Size
$\varnothing 60.20^{-0.10}_{-0.15}$

SMBB850DS

USHIO

Absolute Maximum Ratings (Tc=25°C)

Item	Symbol	Ratings	Unit
Power Dissipation	P_D	4200	mW
Forward Current	I_F	1000	mA
Pulse Forward Current	I_{FP}	(5000)	mA
Reverse Voltage	V_R	5	V
Thermal Resistance	R_{thja}	10	K/W
Junction Temperature	T_j	120	°C
Operating Temperature	T_{opr}	-40 ~ +100	°C
Storage Temperature	T_{stg}	-40 ~ +100	°C
Soldering Temperature	T_{SOL}	250	°C

‡Pulse Forward Current condition : Duty 1% and Pulse Width=10us.

‡Soldering condition : Soldering condition must be completed with 5 seconds at 250°C

Optical and Electrical Characteristics (Tc=25°C)

Parameter	Symbol	Min	Typ	Max	Unit	Test Condition
Forward Voltage	V_F		3.2	(4.2)	V	I_F=1A
	V_{FP}		4.0			I_{FP}=3A
Total Radiated Power	P_O		1400		mW	I_F=1A
			3700			I_{FP}=3A
Radiant Intensity	I_E		460		mW/sr	I_F=1A
			1200			I_{FP}=3A
Peak Wavelength	λp	840		860	nm	I_F=1A
Half Width	$\Delta\lambda$		33		nm	I_F=1A
Viewing Half Angle	$\theta 1/2$		±64		deg.	I_F=100mA
Rise Time	tr		30		ns	I_F=1A
Fall Time	tf		30		ns	I_F=1A

‡ Radiated Power is measured by S3584-08.

‡ Radiant Intensity is measured by CIE127-2007 Condition B.

USHIO

SMBB940DS

Absolute Maximum Ratings (Tc=25°C)

Item	Symbol	Ratings	Unit
Power Dissipation	P_D	3800	mW
Forward Current	I_F	1000	mA
Pulse Forward Current	I_{FP}	(5000)	mA
Reverse Voltage	V_R	5	V
Thermal Resistance	R_{thja}	10	K/W
Junction Temperature	T_j	120	°C
Operating Temperature	T_{opr}	-40 ~ +100	°C
Storage Temperature	T_{stg}	-40 ~ +100	°C
Soldering Temperature	T_{SOL}	250	°C

‡Pulse Forward Current condition : Duty 1% and Pulse Width=10us.

‡Soldering condition : Soldering condition must be completed with 5 seconds at 250°C

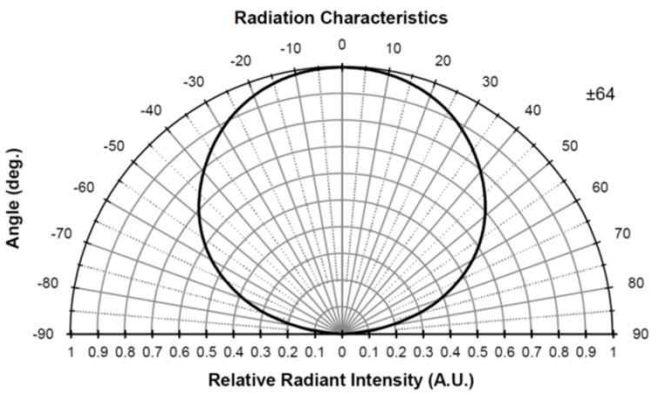
Optical and Electrical Characteristics (Tc=25°C)

Parameter	Symbol	Min	Typ	Max	Unit	Test Condition
Forward Voltage	V_F		3.0	(3.8)	V	I_F=1A
	V_{FP}		3.7			I_{FP}=3A
Total Radiated Power	P_O		1300		mW	I_F=1A
			3100			I_{FP}=3A
Radiant Intensity	I_E		430		mW/sr	I_F=1A
			1000			I_{FP}=3A
Peak Wavelength	λ_P	930		950	nm	I_F=1A
Half Width	$\Delta\lambda$		47		nm	I_F=1A
Viewing Half Angle	$\theta 1/2$		±64		deg.	I_F=100mA
Rise Time	tr		10		ns	I_F=1A
Fall Time	tf		15		ns	I_F=1A

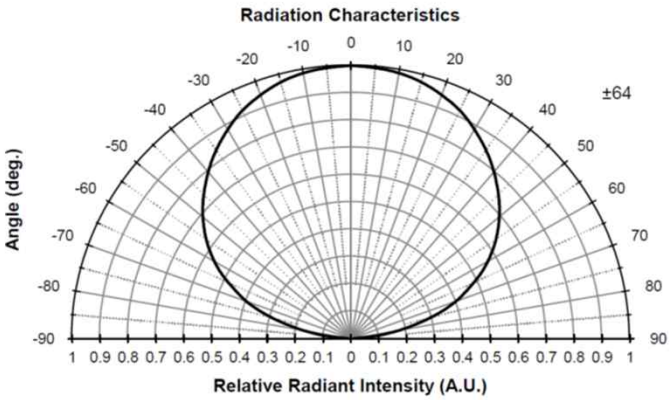
‡ Radiated Power is measured by S3584-08.

‡ Radiant Intensity is measured by CIE127-2007 Condition B.

SMBB850DS



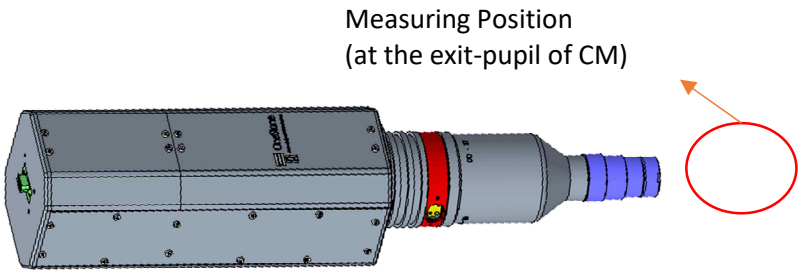
SMBB940DS



Color Temperature

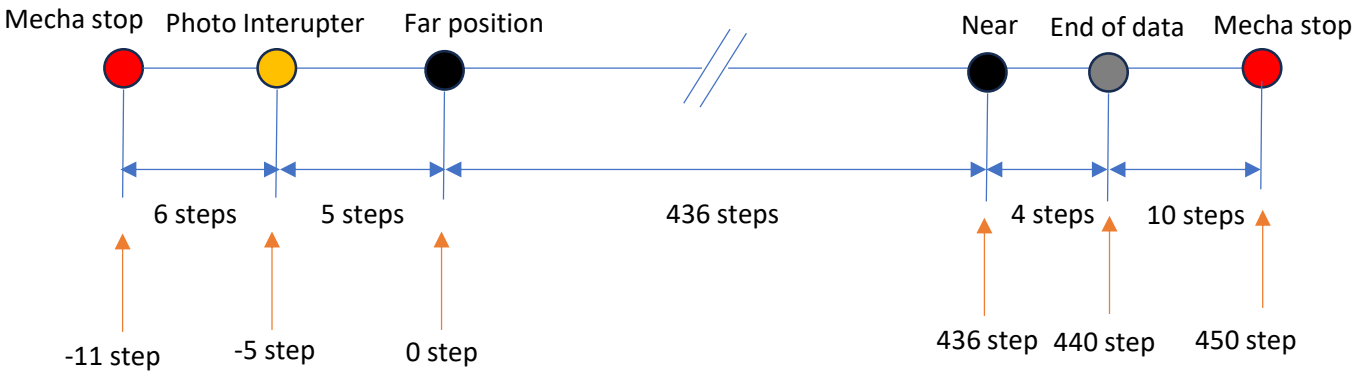
Measuring Equipment

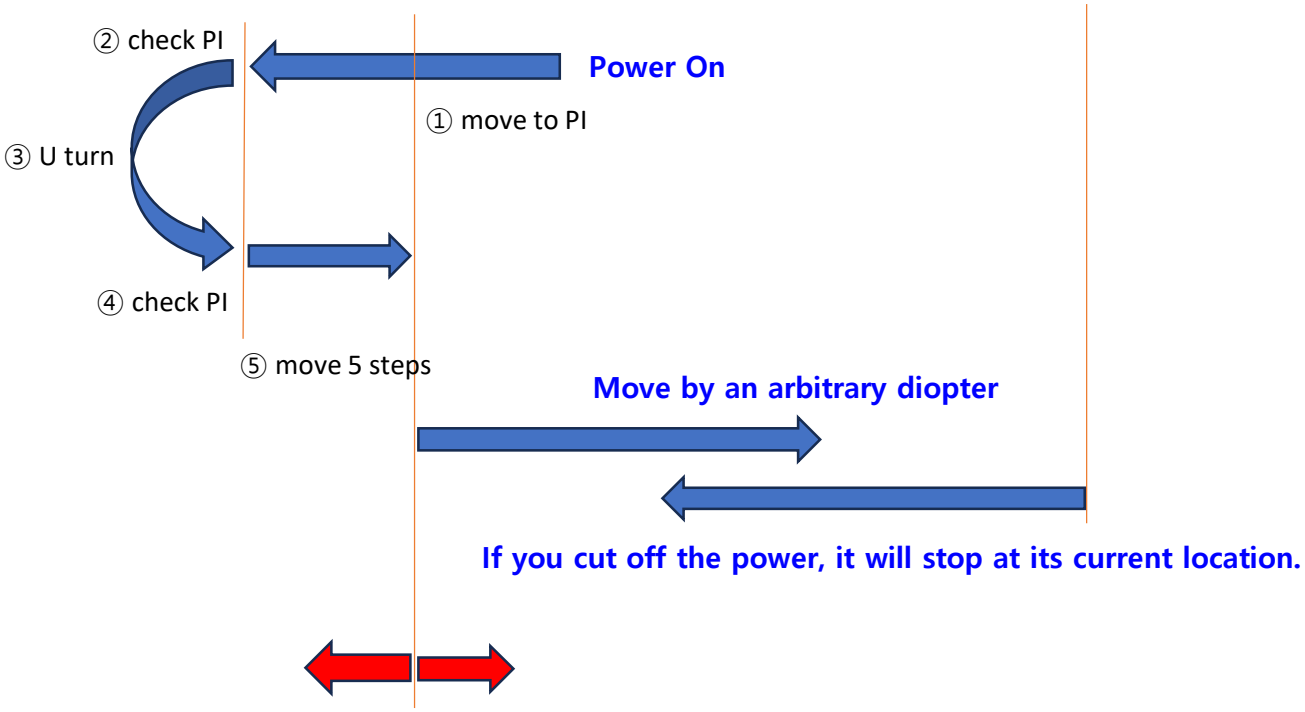
Measuring position and Setting Jig



The moving map of motorized collimating module.

Actuator			
Shift length	2.000 mm	Total Pulse	330 pulses
Steps	11 steps	Reduction Ratio	1/30
length/step	0.182 mm/step		





Offset function : the far position can be adjusted from -3 ~ +5 steps.

Actuator			
Shift length	2.000 mm	Total Pulse	330 pulses
Steps	11 steps	Reduction Ratio	1/30
length/step	0.182 mm/step		

CM-10120M Fixed Barrel : **1.0D FB** **124.05mm**

Steps	Chart Distance	Object Distance	Diopter
0	203.647 mm	Infinity	0.000
1	203.466 mm	576.546 m	0.002
2	203.284 mm	288.111 m	0.003
3	203.102 mm	191.966 m	0.005
4	202.920 mm	143.894 m	0.007
5	202.738 mm	115.050 m	0.009
6	202.557 mm	95.821 m	0.010
7	202.375 mm	82.086 m	0.012
8	202.193 mm	71.785 m	0.014
9	202.011 mm	63.773 m	0.016
10	201.829 mm	57.363 m	0.017
11	201.647 mm	52.119 m	0.019
12	201.466 mm	47.749 m	0.021
13	201.284 mm	44.051 m	0.023
14	201.102 mm	40.881 m	0.024
15	200.920 mm	38.134 m	0.026
16	200.738 mm	35.730 m	0.028
17	200.557 mm	33.610 m	0.030
18	200.375 mm	31.724 m	0.032
19	200.193 mm	30.038 m	0.033
20	200.011 mm	28.520 m	0.035
21	199.829 mm	27.146 m	0.037
22	199.647 art	25.897 m	0.039
23	199.466 mm	24.757 m	0.040
24	199.284 mm	23.712 m	0.042
25	199.102 mm	22.751 m	0.044
26	198.920 mm	21.863 m	0.046
27	198.738 mm	21.042 m	0.048
28	198.557 mm	20.279 m	0.049
29	198.375 mm	19.568 m	0.051
30	198.193 mm	18.905 m	0.053
31	198.011 mm	18.285 m	0.055
32	197.829 mm	17.703 m	0.056
33	197.647 mm	17.157 m	0.058
34	197.466 mm	16.643 m	0.060
35	197.284 mm	16.158 m	0.062

36	197.102	mm	15.700	m	0.064
37	196.920	mm	15.267	m	0.065
38	196.738	mm	14.857	m	0.067
39	196.557	mm	14.468	m	0.069
40	196.375	mm	14.098	m	0.071
41	196.193	mm	13.746	m	0.073
42	196.011	mm	13.411	m	0.075
43	195.829	mm	13.092	m	0.076
44	195.647	mm	12.787	m	0.078
45	195.466	mm	12.495	m	0.080
46	195.284	mm	12.217	m	0.082
47	195.102	mm	11.950	m	0.084
48	194.920	mm	11.694	m	0.086
49	194.738	mm	11.449	m	0.087
50	194.557	mm	11.214	m	0.089
51	194.375	mm	10.987	m	0.091
52	194.193	mm	10.770	m	0.093
53	194.011	mm	10.560	m	0.095
54	193.829	mm	10.359	m	0.097
55	193.647	mm	10.165	m	0.098
56	193.466	mm	9.977	m	0.100
57	193.284	mm	9.797	m	0.102
58	193.102	mm	9.622	m	0.104
59	192.920	mm	9.454	m	0.106
60	192.738	mm	9.291	m	0.108
61	192.557	mm	9.133	m	0.109
62	192.375	mm	8.980	m	0.111
63	192.193	mm	8.833	m	0.113
64	192.011	mm	8.690	m	0.115
65	191.829	mm	8.551	m	0.117
66	191.647	mm	8.417	m	0.119
67	191.466	mm	8.286	m	0.121
68	191.284	mm	8.159	m	0.123
69	191.102	mm	8.037	m	0.124
70	190.920	mm	7.917	m	0.126
71	190.738	mm	7.801	m	0.128
72	190.557	mm	7.688	m	0.130
73	190.375	mm	7.578	m	0.132
74	190.193	mm	7.472	m	0.134
75	190.011	mm	7.368	m	0.136
76	189.829	mm	7.266	m	0.138
77	189.647	mm	7.168	m	0.140
78	189.466	mm	7.072	m	0.141
79	189.284	mm	6.978	m	0.143

80	189.102	mm	6.887	m	0.145
81	188.920	mm	6.798	m	0.147
82	188.738	mm	6.711	m	0.149
83	188.557	mm	6.626	m	0.151
84	188.375	mm	6.544	m	0.153
85	188.193	mm	6.463	m	0.155
86	188.011	mm	6.384	m	0.157
87	187.829	mm	6.307	m	0.159
88	187.647	mm	6.231	m	0.160
89	187.466	mm	6.158	m	0.162
90	187.284	mm	6.086	m	0.164
91	187.102	mm	6.015	m	0.166
92	186.920	mm	5.946	m	0.168
93	186.738	mm	5.879	m	0.170
94	186.557	mm	5.813	m	0.172
95	186.375	mm	5.748	m	0.174
96	186.193	mm	5.685	m	0.176
97	186.011	mm	5.623	m	0.178
98	185.829	mm	5.563	m	0.180
99	185.647	mm	5.503	m	0.182
100	185.466	mm	5.445	m	0.184
101	185.284	mm	5.388	m	0.186
102	185.102	mm	5.332	m	0.188
103	184.920	mm	5.277	m	0.190
104	184.738	mm	5.223	m	0.191
105	184.557	mm	5.170	m	0.193
106	184.375	mm	5.118	m	0.195
107	184.193	mm	5.067	m	0.197
108	184.011	mm	5.017	m	0.199
109	183.829	mm	4.968	m	0.201
110	183.647	mm	4.920	m	0.203
111	183.466	mm	4.873	m	0.205
112	183.284	mm	4.827	m	0.207
113	183.102	mm	4.781	m	0.209
114	182.920	mm	4.736	m	0.211
115	182.738	mm	4.692	m	0.213
116	182.557	mm	4.649	m	0.215
117	182.375	mm	4.607	m	0.217
118	182.193	mm	4.565	m	0.219
119	182.011	mm	4.524	m	0.221
120	181.829	mm	4.483	m	0.223
121	181.647	mm	4.444	m	0.225
122	181.466	mm	4.405	m	0.227
123	181.284	mm	4.366	m	0.229

124	181.102	mm	4.328	m	0.231
125	180.920	mm	4.291	m	0.233
126	180.738	mm	4.254	m	0.235
127	180.557	mm	4.218	m	0.237
128	180.375	mm	4.183	m	0.239
129	180.193	mm	4.148	m	0.241
130	180.011	mm	4.114	m	0.243
131	179.829	mm	4.080	m	0.245
132	179.647	mm	4.046	m	0.247
133	179.466	mm	4.013	m	0.249
134	179.284	mm	3.981	m	0.251
135	179.102	mm	3.949	m	0.253
136	178.920	mm	3.918	m	0.255
137	178.738	mm	3.887	m	0.257
138	178.557	mm	3.856	m	0.259
139	178.375	mm	3.826	m	0.261
140	178.193	mm	3.797	m	0.263
141	178.011	mm	3.767	m	0.265
142	177.829	mm	3.739	m	0.267
143	177.647	mm	3.710	m	0.270
144	177.466	mm	3.682	m	0.272
145	177.284	mm	3.655	m	0.274
146	177.102	mm	3.627	m	0.276
147	176.920	mm	3.600	m	0.278
148	176.738	mm	3.574	m	0.280
149	176.557	mm	3.548	m	0.282
150	176.375	mm	3.522	m	0.284
151	176.193	mm	3.496	m	0.286
152	176.011	mm	3.471	m	0.288
153	175.829	mm	3.446	m	0.290
154	175.647	mm	3.422	m	0.292
155	175.466	mm	3.398	m	0.294
156	175.284	mm	3.374	m	0.296
157	175.102	mm	3.350	m	0.298
158	174.920	mm	3.327	m	0.301
159	174.738	mm	3.304	m	0.303
160	174.557	mm	3.282	m	0.305
161	174.375	mm	3.259	m	0.307
162	174.193	mm	3.237	m	0.309
163	174.011	mm	3.215	m	0.311
164	173.829	mm	3.194	m	0.313
165	173.647	mm	3.172	m	0.315
166	173.466	mm	3.151	m	0.317
167	173.284	mm	3.130	m	0.319

168	173.102	mm	3.110	m	0.322
169	172.920	mm	3.090	m	0.324
170	172.738	mm	3.069	m	0.326
171	172.557	mm	3.050	m	0.328
172	172.375	mm	3.030	m	0.330
173	172.193	mm	3.011	m	0.332
174	172.011	mm	2.991	m	0.334
175	171.829	mm	2.973	m	0.336
176	171.647	mm	2.954	m	0.339
177	171.466	mm	2.935	m	0.341
178	171.284	mm	2.917	m	0.343
179	171.102	mm	2.899	m	0.345
180	170.920	mm	2.881	m	0.347
181	170.738	mm	2.863	m	0.349
182	170.557	mm	2.846	m	0.351
183	170.375	mm	2.828	m	0.354
184	170.193	mm	2.811	m	0.356
185	170.011	mm	2.794	m	0.358
186	169.829	mm	2.778	m	0.360
187	169.647	mm	2.761	m	0.362
188	169.466	mm	2.745	m	0.364
189	169.284	mm	2.728	m	0.367
190	169.102	mm	2.712	m	0.369
191	168.920	mm	2.696	m	0.371
192	168.738	mm	2.681	m	0.373
193	168.557	mm	2.665	m	0.375
194	168.375	mm	2.650	m	0.377
195	168.193	mm	2.634	m	0.380
196	168.011	mm	2.619	m	0.382
197	167.829	mm	2.604	m	0.384
198	167.647	mm	2.590	m	0.386
199	167.466	mm	2.575	m	0.388
200	167.284	mm	2.560	m	0.391
201	167.102	mm	2.546	m	0.393
202	166.920	mm	2.532	m	0.395
203	166.738	mm	2.518	m	0.397
204	166.557	mm	2.504	m	0.399
205	166.375	mm	2.490	m	0.402
206	166.193	mm	2.476	m	0.404
207	166.011	mm	2.463	m	0.406
208	165.829	mm	2.450	m	0.408
209	165.647	mm	2.436	m	0.410
210	165.466	mm	2.423	m	0.413
211	165.284	mm	2.410	m	0.415

212	165.102	mm	2.397	m	0.417
213	164.920	mm	2.384	m	0.419
214	164.738	mm	2.372	m	0.422
215	164.557	mm	2.359	m	0.424
216	164.375	mm	2.347	m	0.426
217	164.193	mm	2.334	m	0.428
218	164.011	mm	2.322	m	0.431
219	163.829	mm	2.310	m	0.433
220	163.647	mm	2.298	m	0.435
221	163.466	mm	2.286	m	0.437
222	163.284	mm	2.275	m	0.440
223	163.102	mm	2.263	m	0.442
224	162.920	mm	2.251	m	0.444
225	162.738	mm	2.240	m	0.446
226	162.557	mm	2.229	m	0.449
227	162.375	mm	2.217	m	0.451
228	162.193	mm	2.206	m	0.453
229	162.011	mm	2.195	m	0.456
230	161.829	mm	2.184	m	0.458
231	161.647	mm	2.173	m	0.460
232	161.466	mm	2.163	m	0.462
233	161.284	mm	2.152	m	0.465
234	161.102	mm	2.141	m	0.467
235	160.920	mm	2.131	m	0.469
236	160.738	mm	2.120	m	0.472
237	160.557	mm	2.110	m	0.474
238	160.375	mm	2.100	m	0.476
239	160.193	mm	2.090	m	0.479
240	160.011	mm	2.080	m	0.481
241	159.829	mm	2.070	m	0.483
242	159.647	mm	2.060	m	0.485
243	159.466	mm	2.050	m	0.488
244	159.284	mm	2.040	m	0.490
245	159.102	mm	2.031	m	0.492
246	158.920	mm	2.021	m	0.495
247	158.738	mm	2.012	m	0.497
248	158.557	mm	2.002	m	0.499
249	158.375	mm	1.993	m	0.502
250	158.193	mm	1.984	m	0.504
251	158.011	mm	1.974	m	0.506
252	157.829	mm	1.965	m	0.509
253	157.647	mm	1.956	m	0.511
254	157.466	mm	1.947	m	0.514
255	157.284	mm	1.938	m	0.516

256	157.102	mm	1.930	m	0.518
257	156.920	mm	1.921	m	0.521
258	156.738	mm	1.912	m	0.523
259	156.557	mm	1.903	m	0.525
260	156.375	mm	1.895	m	0.528
261	156.193	mm	1.886	m	0.530
262	156.011	mm	1.878	m	0.533
263	155.829	mm	1.870	m	0.535
264	155.647	mm	1.861	m	0.537
265	155.466	mm	1.853	m	0.540
266	155.284	mm	1.845	m	0.542
267	155.102	mm	1.837	m	0.544
268	154.920	mm	1.829	m	0.547
269	154.738	mm	1.821	m	0.549
270	154.557	mm	1.813	m	0.552
271	154.375	mm	1.805	m	0.554
272	154.193	mm	1.797	m	0.556
273	154.011	mm	1.789	m	0.559
274	153.829	mm	1.781	m	0.561
275	153.647	mm	1.774	m	0.564
276	153.466	mm	1.766	m	0.566
277	153.284	mm	1.759	m	0.569
278	153.102	mm	1.751	m	0.571
279	152.920	mm	1.744	m	0.573
280	152.738	mm	1.736	m	0.576
281	152.557	mm	1.729	m	0.578
282	152.375	mm	1.722	m	0.581
283	152.193	mm	1.715	m	0.583
284	152.011	mm	1.707	m	0.586
285	151.829	mm	1.700	m	0.588
286	151.647	mm	1.693	m	0.591
287	151.466	mm	1.686	m	0.593
288	151.284	mm	1.679	m	0.596
289	151.102	mm	1.672	m	0.598
290	150.920	mm	1.665	m	0.600
291	150.738	mm	1.658	m	0.603
292	150.557	mm	1.652	m	0.605
293	150.375	mm	1.645	m	0.608
294	150.193	mm	1.638	m	0.610
295	150.011	mm	1.632	m	0.613
296	149.829	mm	1.625	m	0.615
297	149.647	mm	1.618	m	0.618
298	149.466	mm	1.612	m	0.620
299	149.284	mm	1.605	m	0.623

300	149.102	mm	1.599	m	0.625
301	148.920	mm	1.593	m	0.628
302	148.738	mm	1.586	m	0.630
303	148.557	mm	1.580	m	0.633
304	148.375	mm	1.574	m	0.635
305	148.193	mm	1.567	m	0.638
306	148.011	mm	1.561	m	0.640
307	147.829	mm	1.555	m	0.643
308	147.647	mm	1.549	m	0.646
309	147.466	mm	1.543	m	0.648
310	147.284	mm	1.537	m	0.651
311	147.102	mm	1.531	m	0.653
312	146.920	mm	1.525	m	0.656
313	146.738	mm	1.519	m	0.658
314	146.557	mm	1.513	m	0.661
315	146.375	mm	1.507	m	0.663
316	146.193	mm	1.502	m	0.666
317	146.011	mm	1.496	m	0.668
318	145.829	mm	1.490	m	0.671
319	145.647	mm	1.484	m	0.674
320	145.466	mm	1.479	m	0.676
321	145.284	mm	1.473	m	0.679
322	145.102	mm	1.468	m	0.681
323	144.920	mm	1.462	m	0.684
324	144.738	mm	1.457	m	0.687
325	144.557	mm	1.451	m	0.689
326	144.375	mm	1.446	m	0.692
327	144.193	mm	1.440	m	0.694
328	144.011	mm	1.435	m	0.697
329	143.829	mm	1.430	m	0.700
330	143.647	mm	1.424	m	0.702
331	143.466	mm	1.419	m	0.705
332	143.284	mm	1.414	m	0.707
333	143.102	mm	1.408	m	0.710
334	142.920	mm	1.403	m	0.713
335	142.738	mm	1.398	m	0.715
336	142.557	mm	1.393	m	0.718
337	142.375	mm	1.388	m	0.721
338	142.193	mm	1.383	m	0.723
339	142.011	mm	1.378	m	0.726
340	141.829	mm	1.373	m	0.728
341	141.647	mm	1.368	m	0.731
342	141.466	mm	1.363	m	0.734
343	141.284	mm	1.358	m	0.736

344	141.102	mm	1.353	m	0.739
345	140.920	mm	1.348	m	0.742
346	140.738	mm	1.343	m	0.744
347	140.557	mm	1.339	m	0.747
348	140.375	mm	1.334	m	0.750
349	140.193	mm	1.329	m	0.752
350	140.011	mm	1.324	m	0.755
351	139.829	mm	1.320	m	0.758
352	139.647	mm	1.315	m	0.760
353	139.466	mm	1.310	m	0.763
354	139.284	mm	1.306	m	0.766
355	139.102	mm	1.301	m	0.769
356	138.920	mm	1.297	m	0.771
357	138.738	mm	1.292	m	0.774
358	138.557	mm	1.287	m	0.777
359	138.375	mm	1.283	m	0.779
360	138.193	mm	1.279	m	0.782
361	138.011	mm	1.274	m	0.785
362	137.829	mm	1.270	m	0.788
363	137.647	mm	1.265	m	0.790
364	137.466	mm	1.261	m	0.793
365	137.284	mm	1.257	m	0.796
366	137.102	mm	1.252	m	0.799
367	136.920	mm	1.248	m	0.801
368	136.738	mm	1.244	m	0.804
369	136.557	mm	1.239	m	0.807
370	136.375	mm	1.235	m	0.810
371	136.193	mm	1.231	m	0.812
372	136.011	mm	1.227	m	0.815
373	135.829	mm	1.223	m	0.818
374	135.647	mm	1.219	m	0.821
375	135.466	mm	1.214	m	0.823
376	135.284	mm	1.210	m	0.826
377	135.102	mm	1.206	m	0.829
378	134.920	mm	1.202	m	0.832
379	134.738	mm	1.198	m	0.835
380	134.557	mm	1.194	m	0.837
381	134.375	mm	1.190	m	0.840
382	134.193	mm	1.186	m	0.843
383	134.011	mm	1.182	m	0.846
384	133.829	mm	1.178	m	0.849
385	133.647	mm	1.174	m	0.851
386	133.466	mm	1.171	m	0.854
387	133.284	mm	1.167	m	0.857

388	133.102	mm	1.163	m	0.860
389	132.920	mm	1.159	m	0.863
390	132.738	mm	1.155	m	0.866
391	132.557	mm	1.151	m	0.868
392	132.375	mm	1.148	m	0.871
393	132.193	mm	1.144	m	0.874
394	132.011	mm	1.140	m	0.877
395	131.829	mm	1.137	m	0.880
396	131.647	mm	1.133	m	0.883
397	131.466	mm	1.129	m	0.886
398	131.284	mm	1.126	m	0.888
399	131.102	mm	1.122	m	0.891
400	130.920	mm	1.118	m	0.894
401	130.738	mm	1.115	m	0.897
402	130.557	mm	1.111	m	0.900
403	130.375	mm	1.108	m	0.903
404	130.193	mm	1.104	m	0.906
405	130.011	mm	1.100	m	0.909
406	129.829	mm	1.097	m	0.912
407	129.647	mm	1.093	m	0.915
408	129.466	mm	1.090	m	0.917
409	129.284	mm	1.087	m	0.920
410	129.102	mm	1.083	m	0.923
411	128.920	mm	1.080	m	0.926
412	128.738	mm	1.076	m	0.929
413	128.557	mm	1.073	m	0.932
414	128.375	mm	1.070	m	0.935
415	128.193	mm	1.066	m	0.938
416	128.011	mm	1.063	m	0.941
417	127.829	mm	1.059	m	0.944
418	127.647	mm	1.056	m	0.947
419	127.466	mm	1.053	m	0.950
420	127.284	mm	1.050	m	0.953
421	127.102	mm	1.046	m	0.956
422	126.920	mm	1.043	m	0.959
423	126.738	mm	1.040	m	0.962
424	126.557	mm	1.037	m	0.965
425	126.375	mm	1.033	m	0.968
426	126.193	mm	1.030	m	0.971
427	126.011	mm	1.027	m	0.974
428	125.829	mm	1.024	m	0.977
429	125.647	mm	1.021	m	0.980
430	125.466	mm	1.018	m	0.983
431	125.284	mm	1.015	m	0.986

432	125.102	mm	1.011	m	0.989
433	124.920	mm	1.008	m	0.992
434	124.738	mm	1.005	m	0.995
435	124.557	mm	1.002	m	0.998
436	124.375	mm	0.999	m	1.001
437	124.193	mm	0.996	m	1.004
438	124.011	mm	0.993	m	1.007
439	123.829	mm	0.990	m	1.010
440	123.647	mm	0.987	m	1.013

2.5D FB	**58.432 mm**
Reference Distance	124.375 mm
Shift length	65.618 mm

CM-10120M-2.5D Fixed Barrel : **2.5D FB**

Steps	Chart Distance	Object Distance	Diopter
0	138.029 mm	1.275 m	0.785
1	137.847 mm	1.270 m	0.787
2	137.666 mm	1.266 m	0.790
3	137.484 mm	1.261 m	0.793
4	137.302 mm	1.257 m	0.796
5	137.120 mm	1.253 m	0.798
6	136.938 mm	1.248 m	0.801
7	136.756 mm	1.244 m	0.804
8	136.575 mm	1.240 m	0.807
9	136.393 mm	1.236 m	0.809
10	136.211 mm	1.231 m	0.812
11	136.029 mm	1.227 m	0.815
12	135.847 mm	1.223 m	0.818
13	135.666 mm	1.219 m	0.820
14	135.484 mm	1.215 m	0.823
15	135.302 mm	1.211 m	0.826
16	135.120 mm	1.207 m	0.829
17	134.938 mm	1.203 m	0.832
18	134.756 mm	1.199 m	0.834
19	134.575 mm	1.195 m	0.837
20	134.393 mm	1.191 m	0.840
21	134.211 mm	1.187 m	0.843
22	134.029 art	1.183 m	0.846
23	133.847 mm	1.179 m	0.848
24	133.666 mm	1.175 m	0.851
25	133.484 mm	1.171 m	0.854
26	133.302 mm	1.167 m	0.857
27	133.120 mm	1.163 m	0.860
28	132.938 mm	1.159 m	0.862
29	132.756 mm	1.156 m	0.865
30	132.575 mm	1.152 m	0.868
31	132.393 mm	1.148 m	0.871
32	132.211 mm	1.144 m	0.874
33	132.029 mm	1.141 m	0.877
34	131.847 mm	1.137 m	0.880
35	131.666 mm	1.133 m	0.882

36	131.484	mm	1.130	m	0.885
37	131.302	mm	1.126	m	0.888
38	131.120	mm	1.122	m	0.891
39	130.938	mm	1.119	m	0.894
40	130.756	mm	1.115	m	0.897
41	130.575	mm	1.111	m	0.900
42	130.393	mm	1.108	m	0.903
43	130.211	mm	1.104	m	0.906
44	130.029	mm	1.101	m	0.908
45	129.847	mm	1.097	m	0.911
46	129.666	mm	1.094	m	0.914
47	129.484	mm	1.090	m	0.917
48	129.302	mm	1.087	m	0.920
49	129.120	mm	1.083	m	0.923
50	128.938	mm	1.080	m	0.926
51	128.756	mm	1.077	m	0.929
52	128.575	mm	1.073	m	0.932
53	128.393	mm	1.070	m	0.935
54	128.211	mm	1.066	m	0.938
55	128.029	mm	1.063	m	0.941
56	127.847	mm	1.060	m	0.944
57	127.666	mm	1.057	m	0.947
58	127.484	mm	1.053	m	0.949
59	127.302	mm	1.050	m	0.952
60	127.120	mm	1.047	m	0.955
61	126.938	mm	1.043	m	0.958
62	126.756	mm	1.040	m	0.961
63	126.575	mm	1.037	m	0.964
64	126.393	mm	1.034	m	0.967
65	126.211	mm	1.031	m	0.970
66	126.029	mm	1.027	m	0.973
67	125.847	mm	1.024	m	0.976
68	125.666	mm	1.021	m	0.979
69	125.484	mm	1.018	m	0.982
70	125.302	mm	1.015	m	0.985
71	125.120	mm	1.012	m	0.988
72	124.938	mm	1.009	m	0.991
73	124.756	mm	1.006	m	0.994
74	124.575	mm	1.003	m	0.997
75	124.393	mm	1.000	m	1.000
76	124.211	mm	0.996	m	1.004
77	124.029	mm	0.993	m	1.007
78	123.847	mm	0.990	m	1.010
79	123.666	mm	0.987	m	1.013

80	123.484	mm	0.984	m	1.016
81	123.302	mm	0.982	m	1.019
82	123.120	mm	0.979	m	1.022
83	122.938	mm	0.976	m	1.025
84	122.756	mm	0.973	m	1.028
85	122.575	mm	0.970	m	1.031
86	122.393	mm	0.967	m	1.034
87	122.211	mm	0.964	m	1.037
88	122.029	mm	0.961	m	1.040
89	121.847	mm	0.958	m	1.043
90	121.666	mm	0.955	m	1.047
91	121.484	mm	0.953	m	1.050
92	121.302	mm	0.950	m	1.053
93	121.120	mm	0.947	m	1.056
94	120.938	mm	0.944	m	1.059
95	120.756	mm	0.941	m	1.062
96	120.575	mm	0.939	m	1.065
97	120.393	mm	0.936	m	1.068
98	120.211	mm	0.933	m	1.072
99	120.029	mm	0.930	m	1.075
100	119.847	mm	0.928	m	1.078
101	119.666	mm	0.925	m	1.081
102	119.484	mm	0.922	m	1.084
103	119.302	mm	0.920	m	1.087
104	119.120	mm	0.917	m	1.091
105	118.938	mm	0.914	m	1.094
106	118.756	mm	0.912	m	1.097
107	118.575	mm	0.909	m	1.100
108	118.393	mm	0.906	m	1.103
109	118.211	mm	0.904	m	1.107
110	118.029	mm	0.901	m	1.110
111	117.847	mm	0.899	m	1.113
112	117.666	mm	0.896	m	1.116
113	117.484	mm	0.893	m	1.119
114	117.302	mm	0.891	m	1.123
115	117.120	mm	0.888	m	1.126
116	116.938	mm	0.886	m	1.129
117	116.756	mm	0.883	m	1.132
118	116.575	mm	0.881	m	1.135
119	116.393	mm	0.878	m	1.139
120	116.211	mm	0.876	m	1.142
121	116.029	mm	0.873	m	1.145
122	115.847	mm	0.871	m	1.148
123	115.666	mm	0.868	m	1.152

124	115.484	mm	0.866	m	1.155
125	115.302	mm	0.863	m	1.158
126	115.120	mm	0.861	m	1.162
127	114.938	mm	0.858	m	1.165
128	114.756	mm	0.856	m	1.168
129	114.575	mm	0.854	m	1.171
130	114.393	mm	0.851	m	1.175
131	114.211	mm	0.849	m	1.178
132	114.029	mm	0.846	m	1.181
133	113.847	mm	0.844	m	1.185
134	113.666	mm	0.842	m	1.188
135	113.484	mm	0.839	m	1.191
136	113.302	mm	0.837	m	1.195
137	113.120	mm	0.835	m	1.198
138	112.938	mm	0.832	m	1.201
139	112.756	mm	0.830	m	1.205
140	112.575	mm	0.828	m	1.208
141	112.393	mm	0.825	m	1.211
142	112.211	mm	0.823	m	1.215
143	112.029	mm	0.821	m	1.218
144	111.847	mm	0.819	m	1.222
145	111.666	mm	0.816	m	1.225
146	111.484	mm	0.814	m	1.228
147	111.302	mm	0.812	m	1.232
148	111.120	mm	0.810	m	1.235
149	110.938	mm	0.807	m	1.238
150	110.756	mm	0.805	m	1.242
151	110.575	mm	0.803	m	1.245
152	110.393	mm	0.801	m	1.249
153	110.211	mm	0.799	m	1.252
154	110.029	mm	0.796	m	1.256
155	109.847	mm	0.794	m	1.259
156	109.666	mm	0.792	m	1.262
157	109.484	mm	0.790	m	1.266
158	109.302	mm	0.788	m	1.269
159	109.120	mm	0.786	m	1.273
160	108.938	mm	0.784	m	1.276
161	108.756	mm	0.781	m	1.280
162	108.575	mm	0.779	m	1.283
163	108.393	mm	0.777	m	1.287
164	108.211	mm	0.775	m	1.290
165	108.029	mm	0.773	m	1.294
166	107.847	mm	0.771	m	1.297
167	107.666	mm	0.769	m	1.301

168	107.484	mm	0.767	m	1.304
169	107.302	mm	0.765	m	1.308
170	107.120	mm	0.763	m	1.311
171	106.938	mm	0.761	m	1.315
172	106.756	mm	0.759	m	1.318
173	106.575	mm	0.757	m	1.322
174	106.393	mm	0.755	m	1.325
175	106.211	mm	0.753	m	1.329
176	106.029	mm	0.751	m	1.332
177	105.847	mm	0.749	m	1.336
178	105.666	mm	0.747	m	1.339
179	105.484	mm	0.745	m	1.343
180	105.302	mm	0.743	m	1.347
181	105.120	mm	0.741	m	1.350
182	104.938	mm	0.739	m	1.354
183	104.756	mm	0.737	m	1.357
184	104.575	mm	0.735	m	1.361
185	104.393	mm	0.733	m	1.365
186	104.211	mm	0.731	m	1.368
187	104.029	mm	0.729	m	1.372
188	103.847	mm	0.727	m	1.375
189	103.666	mm	0.725	m	1.379
190	103.484	mm	0.723	m	1.383
191	103.302	mm	0.721	m	1.386
192	103.120	mm	0.719	m	1.390
193	102.938	mm	0.718	m	1.394
194	102.756	mm	0.716	m	1.397
195	102.575	mm	0.714	m	1.401
196	102.393	mm	0.712	m	1.405
197	102.211	mm	0.710	m	1.408
198	102.029	mm	0.708	m	1.412
199	101.847	mm	0.706	m	1.416
200	101.666	mm	0.705	m	1.419
201	101.484	mm	0.703	m	1.423
202	101.302	mm	0.701	m	1.427
203	101.120	mm	0.699	m	1.430
204	100.938	mm	0.697	m	1.434
205	100.756	mm	0.695	m	1.438
206	100.575	mm	0.694	m	1.442
207	100.393	mm	0.692	m	1.445
208	100.211	mm	0.690	m	1.449
209	100.029	mm	0.688	m	1.453
210	99.847	mm	0.687	m	1.457
211	99.666	mm	0.685	m	1.460

212	99.484	mm	0.683	m	1.464
213	99.302	mm	0.681	m	1.468
214	99.120	mm	0.680	m	1.472
215	98.938	mm	0.678	m	1.475
216	98.756	mm	0.676	m	1.479
217	98.575	mm	0.674	m	1.483
218	98.393	mm	0.673	m	1.487
219	98.211	mm	0.671	m	1.491
220	98.029	mm	0.669	m	1.494
221	97.847	mm	0.667	m	1.498
222	97.666	mm	0.666	m	1.502
223	97.484	mm	0.664	m	1.506
224	97.302	mm	0.662	m	1.510
225	97.120	mm	0.661	m	1.514
226	96.938	mm	0.659	m	1.517
227	96.756	mm	0.657	m	1.521
228	96.575	mm	0.656	m	1.525
229	96.393	mm	0.654	m	1.529
230	96.211	mm	0.652	m	1.533
231	96.029	mm	0.651	m	1.537
232	95.847	mm	0.649	m	1.541
233	95.666	mm	0.647	m	1.545
234	95.484	mm	0.646	m	1.548
235	95.302	mm	0.644	m	1.552
236	95.120	mm	0.643	m	1.556
237	94.938	mm	0.641	m	1.560
238	94.756	mm	0.639	m	1.564
239	94.575	mm	0.638	m	1.568
240	94.393	mm	0.636	m	1.572
241	94.211	mm	0.635	m	1.576
242	94.029	mm	0.633	m	1.580
243	93.847	mm	0.631	m	1.584
244	93.666	mm	0.630	m	1.588
245	93.484	mm	0.628	m	1.592
246	93.302	mm	0.627	m	1.596
247	93.120	mm	0.625	m	1.600
248	92.938	mm	0.624	m	1.604
249	92.756	mm	0.622	m	1.608
250	92.575	mm	0.620	m	1.612
251	92.393	mm	0.619	m	1.616
252	92.211	mm	0.617	m	1.620
253	92.029	mm	0.616	m	1.624
254	91.847	mm	0.614	m	1.628
255	91.666	mm	0.613	m	1.632

256	91.484	mm	0.611	m	1.636
257	91.302	mm	0.610	m	1.640
258	91.120	mm	0.608	m	1.644
259	90.938	mm	0.607	m	1.648
260	90.756	mm	0.605	m	1.652
261	90.575	mm	0.604	m	1.656
262	90.393	mm	0.602	m	1.661
263	90.211	mm	0.601	m	1.665
264	90.029	mm	0.599	m	1.669
265	89.847	mm	0.598	m	1.673
266	89.666	mm	0.596	m	1.677
267	89.484	mm	0.595	m	1.681
268	89.302	mm	0.593	m	1.685
269	89.120	mm	0.592	m	1.689
270	88.938	mm	0.590	m	1.694
271	88.756	mm	0.589	m	1.698
272	88.575	mm	0.588	m	1.702
273	88.393	mm	0.586	m	1.706
274	88.211	mm	0.585	m	1.710
275	88.029	mm	0.583	m	1.714
276	87.847	mm	0.582	m	1.719
277	87.666	mm	0.580	m	1.723
278	87.484	mm	0.579	m	1.727
279	87.302	mm	0.578	m	1.731
280	87.120	mm	0.576	m	1.736
281	86.938	mm	0.575	m	1.740
282	86.756	mm	0.573	m	1.744
283	86.575	mm	0.572	m	1.748
284	86.393	mm	0.571	m	1.752
285	86.211	mm	0.569	m	1.757
286	86.029	mm	0.568	m	1.761
287	85.847	mm	0.566	m	1.765
288	85.666	mm	0.565	m	1.770
289	85.484	mm	0.564	m	1.774
290	85.302	mm	0.562	m	1.778
291	85.120	mm	0.561	m	1.782
292	84.938	mm	0.560	m	1.787
293	84.756	mm	0.558	m	1.791
294	84.575	mm	0.557	m	1.795
295	84.393	mm	0.556	m	1.800
296	84.211	mm	0.554	m	1.804
297	84.029	mm	0.553	m	1.809
298	83.847	mm	0.552	m	1.813
299	83.666	mm	0.550	m	1.817

300	83.484	mm	0.549	m	1.822
301	83.302	mm	0.548	m	1.826
302	83.120	mm	0.546	m	1.830
303	82.938	mm	0.545	m	1.835
304	82.756	mm	0.544	m	1.839
305	82.575	mm	0.542	m	1.844
306	82.393	mm	0.541	m	1.848
307	82.211	mm	0.540	m	1.852
308	82.029	mm	0.539	m	1.857
309	81.847	mm	0.537	m	1.861
310	81.666	mm	0.536	m	1.866
311	81.484	mm	0.535	m	1.870
312	81.302	mm	0.533	m	1.875
313	81.120	mm	0.532	m	1.879
314	80.938	mm	0.531	m	1.884
315	80.756	mm	0.530	m	1.888
316	80.575	mm	0.528	m	1.893
317	80.393	mm	0.527	m	1.897
318	80.211	mm	0.526	m	1.902
319	80.029	mm	0.525	m	1.906
320	79.847	mm	0.523	m	1.911
321	79.666	mm	0.522	m	1.915
322	79.484	mm	0.521	m	1.920
323	79.302	mm	0.520	m	1.925
324	79.120	mm	0.518	m	1.929
325	78.938	mm	0.517	m	1.934
326	78.756	mm	0.516	m	1.938
327	78.575	mm	0.515	m	1.943
328	78.393	mm	0.513	m	1.947
329	78.211	mm	0.512	m	1.952
330	78.029	mm	0.511	m	1.957
331	77.847	mm	0.510	m	1.961
332	77.666	mm	0.509	m	1.966
333	77.484	mm	0.507	m	1.971
334	77.302	mm	0.506	m	1.975
335	77.120	mm	0.505	m	1.980
336	76.938	mm	0.504	m	1.985
337	76.756	mm	0.503	m	1.989
338	76.575	mm	0.502	m	1.994
339	76.393	mm	0.500	m	1.999
340	76.211	mm	0.499	m	2.003
341	76.029	mm	0.498	m	2.008
342	75.847	mm	0.497	m	2.013
343	75.666	mm	0.496	m	2.018

344	75.484	mm	0.494	m	2.022
345	75.302	mm	0.493	m	2.027
346	75.120	mm	0.492	m	2.032
347	74.938	mm	0.491	m	2.037
348	74.756	mm	0.490	m	2.041
349	74.575	mm	0.489	m	2.046
350	74.393	mm	0.488	m	2.051
351	74.211	mm	0.486	m	2.056
352	74.029	mm	0.485	m	2.061
353	73.847	mm	0.484	m	2.065
354	73.666	mm	0.483	m	2.070
355	73.484	mm	0.482	m	2.075
356	73.302	mm	0.481	m	2.080
357	73.120	mm	0.480	m	2.085
358	72.938	mm	0.479	m	2.090
359	72.756	mm	0.477	m	2.095
360	72.575	mm	0.476	m	2.099
361	72.393	mm	0.475	m	2.104
362	72.211	mm	0.474	m	2.109
363	72.029	mm	0.473	m	2.114
364	71.847	mm	0.472	m	2.119
365	71.666	mm	0.471	m	2.124
366	71.484	mm	0.470	m	2.129
367	71.302	mm	0.469	m	2.134
368	71.120	mm	0.468	m	2.139
369	70.938	mm	0.466	m	2.144
370	70.756	mm	0.465	m	2.149
371	70.575	mm	0.464	m	2.154
372	70.393	mm	0.463	m	2.159
373	70.211	mm	0.462	m	2.164
374	70.029	mm	0.461	m	2.169
375	69.847	mm	0.460	m	2.174
376	69.666	mm	0.459	m	2.179
377	69.484	mm	0.458	m	2.184
378	69.302	mm	0.457	m	2.189
379	69.120	mm	0.456	m	2.194
380	68.938	mm	0.455	m	2.199
381	68.756	mm	0.454	m	2.204
382	68.575	mm	0.453	m	2.209
383	68.393	mm	0.452	m	2.214
384	68.211	mm	0.451	m	2.220
385	68.029	mm	0.449	m	2.225
386	67.847	mm	0.448	m	2.230
387	67.666	mm	0.447	m	2.235

388	67.484	mm	0.446	m	2.240
389	67.302	mm	0.445	m	2.245
390	67.120	mm	0.444	m	2.251
391	66.938	mm	0.443	m	2.256
392	66.756	mm	0.442	m	2.261
393	66.575	mm	0.441	m	2.266
394	66.393	mm	0.440	m	2.271
395	66.211	mm	0.439	m	2.277
396	66.029	mm	0.438	m	2.282
397	65.847	mm	0.437	m	2.287
398	65.666	mm	0.436	m	2.292
399	65.484	mm	0.435	m	2.298
400	65.302	mm	0.434	m	2.303
401	65.120	mm	0.433	m	2.308
402	64.938	mm	0.432	m	2.313
403	64.756	mm	0.431	m	2.319
404	64.575	mm	0.430	m	2.324
405	64.393	mm	0.429	m	2.329
406	64.211	mm	0.428	m	2.335
407	64.029	mm	0.427	m	2.340
408	63.847	mm	0.426	m	2.345
409	63.666	mm	0.425	m	2.351
410	63.484	mm	0.424	m	2.356
411	63.302	mm	0.423	m	2.362
412	63.120	mm	0.422	m	2.367
413	62.938	mm	0.422	m	2.372
414	62.756	mm	0.421	m	2.378
415	62.575	mm	0.420	m	2.383
416	62.393	mm	0.419	m	2.389
417	62.211	mm	0.418	m	2.394
418	62.029	mm	0.417	m	2.400
419	61.847	mm	0.416	m	2.405
420	61.666	mm	0.415	m	2.411
421	61.484	mm	0.414	m	2.416
422	61.302	mm	0.413	m	2.422
423	61.120	mm	0.412	m	2.427
424	60.938	mm	0.411	m	2.433
425	60.756	mm	0.410	m	2.438
426	60.575	mm	0.409	m	2.444
427	60.393	mm	0.408	m	2.449
428	60.211	mm	0.407	m	2.455
429	60.029	mm	0.406	m	2.461
430	59.847	mm	0.405	m	2.466
431	59.666	mm	0.405	m	2.472

432	59.484	mm	0.404	m	2.477
433	59.302	mm	0.403	m	2.483
434	59.120	mm	0.402	m	2.489
435	58.938	mm	0.401	m	2.494
436	58.756	mm	0.400	m	2.500
437	58.575	mm	0.399	m	2.506
438	58.393	mm	0.398	m	2.511
439	58.211	mm	0.397	m	2.517
440	58.029	mm	0.396	m	2.523

3.33D FB	**35.208 mm**
Reference Distance	124.375 mm
Shift length	88.842 mm

CM-10120M-3.33D Fixed Barrel : **3.33D FB**

Steps	Chart Distance	Object Distance	Diopter
0	114.805 mm	0.857 m	1.167
1	114.624 mm	0.854 m	1.171
2	114.442 mm	0.852 m	1.174
3	114.260 mm	0.849 m	1.177
4	114.078 mm	0.847 m	1.180
5	113.896 mm	0.845 m	1.184
6	113.714 mm	0.842 m	1.187
7	113.533 mm	0.840 m	1.190
8	113.351 mm	0.838 m	1.194
9	113.169 mm	0.835 m	1.197
10	112.987 mm	0.833 m	1.200
11	112.805 mm	0.831 m	1.204
12	112.624 mm	0.828 m	1.207
13	112.442 mm	0.826 m	1.211
14	112.260 mm	0.824 m	1.214
15	112.078 mm	0.822 m	1.217
16	111.896 mm	0.819 m	1.221
17	111.714 mm	0.817 m	1.224
18	111.533 mm	0.815 m	1.227
19	111.351 mm	0.813 m	1.231
20	111.169 mm	0.810 m	1.234
21	110.987 mm	0.808 m	1.238
22	110.805 art	0.806 m	1.241
23	110.624 mm	0.804 m	1.244
24	110.442 mm	0.801 m	1.248
25	110.260 mm	0.799 m	1.251
26	110.078 mm	0.797 m	1.255
27	109.896 mm	0.795 m	1.258
28	109.714 mm	0.793 m	1.262
29	109.533 mm	0.791 m	1.265
30	109.351 mm	0.788 m	1.268
31	109.169 mm	0.786 m	1.272
32	108.987 mm	0.784 m	1.275
33	108.805 mm	0.782 m	1.279
34	108.624 mm	0.780 m	1.282
35	108.442 mm	0.778 m	1.286

36	108.260	mm	0.776	m	1.289
37	108.078	mm	0.774	m	1.293
38	107.896	mm	0.772	m	1.296
39	107.714	mm	0.769	m	1.300
40	107.533	mm	0.767	m	1.303
41	107.351	mm	0.765	m	1.307
42	107.169	mm	0.763	m	1.310
43	106.987	mm	0.761	m	1.314
44	106.805	mm	0.759	m	1.317
45	106.624	mm	0.757	m	1.321
46	106.442	mm	0.755	m	1.324
47	106.260	mm	0.753	m	1.328
48	106.078	mm	0.751	m	1.331
49	105.896	mm	0.749	m	1.335
50	105.714	mm	0.747	m	1.339
51	105.533	mm	0.745	m	1.342
52	105.351	mm	0.743	m	1.346
53	105.169	mm	0.741	m	1.349
54	104.987	mm	0.739	m	1.353
55	104.805	mm	0.737	m	1.356
56	104.624	mm	0.735	m	1.360
57	104.442	mm	0.733	m	1.364
58	104.260	mm	0.731	m	1.367
59	104.078	mm	0.729	m	1.371
60	103.896	mm	0.728	m	1.374
61	103.714	mm	0.726	m	1.378
62	103.533	mm	0.724	m	1.382
63	103.351	mm	0.722	m	1.385
64	103.169	mm	0.720	m	1.389
65	102.987	mm	0.718	m	1.393
66	102.805	mm	0.716	m	1.396
67	102.624	mm	0.714	m	1.400
68	102.442	mm	0.712	m	1.404
69	102.260	mm	0.711	m	1.407
70	102.078	mm	0.709	m	1.411
71	101.896	mm	0.707	m	1.415
72	101.714	mm	0.705	m	1.418
73	101.533	mm	0.703	m	1.422
74	101.351	mm	0.701	m	1.426
75	101.169	mm	0.700	m	1.429
76	100.987	mm	0.698	m	1.433
77	100.805	mm	0.696	m	1.437
78	100.624	mm	0.694	m	1.441
79	100.442	mm	0.692	m	1.444

80	100.260	mm	0.691	m	1.448
81	100.078	mm	0.689	m	1.452
82	99.896	mm	0.687	m	1.456
83	99.714	mm	0.685	m	1.459
84	99.533	mm	0.684	m	1.463
85	99.351	mm	0.682	m	1.467
86	99.169	mm	0.680	m	1.471
87	98.987	mm	0.678	m	1.474
88	98.805	mm	0.677	m	1.478
89	98.624	mm	0.675	m	1.482
90	98.442	mm	0.673	m	1.486
91	98.260	mm	0.671	m	1.490
92	98.078	mm	0.670	m	1.493
93	97.896	mm	0.668	m	1.497
94	97.714	mm	0.666	m	1.501
95	97.533	mm	0.665	m	1.505
96	97.351	mm	0.663	m	1.509
97	97.169	mm	0.661	m	1.513
98	96.987	mm	0.659	m	1.516
99	96.805	mm	0.658	m	1.520
100	96.624	mm	0.656	m	1.524
101	96.442	mm	0.654	m	1.528
102	96.260	mm	0.653	m	1.532
103	96.078	mm	0.651	m	1.536
104	95.896	mm	0.650	m	1.540
105	95.714	mm	0.648	m	1.544
106	95.533	mm	0.646	m	1.547
107	95.351	mm	0.645	m	1.551
108	95.169	mm	0.643	m	1.555
109	94.987	mm	0.641	m	1.559
110	94.805	mm	0.640	m	1.563
111	94.624	mm	0.638	m	1.567
112	94.442	mm	0.637	m	1.571
113	94.260	mm	0.635	m	1.575
114	94.078	mm	0.633	m	1.579
115	93.896	mm	0.632	m	1.583
116	93.714	mm	0.630	m	1.587
117	93.533	mm	0.629	m	1.591
118	93.351	mm	0.627	m	1.595
119	93.169	mm	0.625	m	1.599
120	92.987	mm	0.624	m	1.603
121	92.805	mm	0.622	m	1.607
122	92.624	mm	0.621	m	1.611
123	92.442	mm	0.619	m	1.615

124	92.260	mm	0.618	m	1.619
125	92.078	mm	0.616	m	1.623
126	91.896	mm	0.615	m	1.627
127	91.714	mm	0.613	m	1.631
128	91.533	mm	0.612	m	1.635
129	91.351	mm	0.610	m	1.639
130	91.169	mm	0.609	m	1.643
131	90.987	mm	0.607	m	1.647
132	90.805	mm	0.606	m	1.651
133	90.624	mm	0.604	m	1.655
134	90.442	mm	0.603	m	1.659
135	90.260	mm	0.601	m	1.664
136	90.078	mm	0.600	m	1.668
137	89.896	mm	0.598	m	1.672
138	89.714	mm	0.597	m	1.676
139	89.533	mm	0.595	m	1.680
140	89.351	mm	0.594	m	1.684
141	89.169	mm	0.592	m	1.688
142	88.987	mm	0.591	m	1.692
143	88.805	mm	0.589	m	1.697
144	88.624	mm	0.588	m	1.701
145	88.442	mm	0.587	m	1.705
146	88.260	mm	0.585	m	1.709
147	88.078	mm	0.584	m	1.713
148	87.896	mm	0.582	m	1.718
149	87.714	mm	0.581	m	1.722
150	87.533	mm	0.579	m	1.726
151	87.351	mm	0.578	m	1.730
152	87.169	mm	0.577	m	1.734
153	86.987	mm	0.575	m	1.739
154	86.805	mm	0.574	m	1.743
155	86.624	mm	0.572	m	1.747
156	86.442	mm	0.571	m	1.751
157	86.260	mm	0.570	m	1.756
158	86.078	mm	0.568	m	1.760
159	85.896	mm	0.567	m	1.764
160	85.714	mm	0.565	m	1.768
161	85.533	mm	0.564	m	1.773
162	85.351	mm	0.563	m	1.777
163	85.169	mm	0.561	m	1.781
164	84.987	mm	0.560	m	1.786
165	84.805	mm	0.559	m	1.790
166	84.624	mm	0.557	m	1.794
167	84.442	mm	0.556	m	1.799

168	84.260	mm	0.555	m	1.803
169	84.078	mm	0.553	m	1.807
170	83.896	mm	0.552	m	1.812
171	83.714	mm	0.551	m	1.816
172	83.533	mm	0.549	m	1.820
173	83.351	mm	0.548	m	1.825
174	83.169	mm	0.547	m	1.829
175	82.987	mm	0.545	m	1.834
176	82.805	mm	0.544	m	1.838
177	82.624	mm	0.543	m	1.842
178	82.442	mm	0.541	m	1.847
179	82.260	mm	0.540	m	1.851
180	82.078	mm	0.539	m	1.856
181	81.896	mm	0.538	m	1.860
182	81.714	mm	0.536	m	1.865
183	81.533	mm	0.535	m	1.869
184	81.351	mm	0.534	m	1.874
185	81.169	mm	0.532	m	1.878
186	80.987	mm	0.531	m	1.883
187	80.805	mm	0.530	m	1.887
188	80.624	mm	0.529	m	1.892
189	80.442	mm	0.527	m	1.896
190	80.260	mm	0.526	m	1.901
191	80.078	mm	0.525	m	1.905
192	79.896	mm	0.524	m	1.910
193	79.714	mm	0.522	m	1.914
194	79.533	mm	0.521	m	1.919
195	79.351	mm	0.520	m	1.923
196	79.169	mm	0.519	m	1.928
197	78.987	mm	0.517	m	1.932
198	78.805	mm	0.516	m	1.937
199	78.624	mm	0.515	m	1.942
200	78.442	mm	0.514	m	1.946
201	78.260	mm	0.513	m	1.951
202	78.078	mm	0.511	m	1.955
203	77.896	mm	0.510	m	1.960
204	77.714	mm	0.509	m	1.965
205	77.533	mm	0.508	m	1.969
206	77.351	mm	0.507	m	1.974
207	77.169	mm	0.505	m	1.979
208	76.987	mm	0.504	m	1.983
209	76.805	mm	0.503	m	1.988
210	76.624	mm	0.502	m	1.993
211	76.442	mm	0.501	m	1.997

212	76.260	mm	0.499	m	2.002
213	76.078	mm	0.498	m	2.007
214	75.896	mm	0.497	m	2.012
215	75.714	mm	0.496	m	2.016
216	75.533	mm	0.495	m	2.021
217	75.351	mm	0.494	m	2.026
218	75.169	mm	0.492	m	2.031
219	74.987	mm	0.491	m	2.035
220	74.805	mm	0.490	m	2.040
221	74.624	mm	0.489	m	2.045
222	74.442	mm	0.488	m	2.050
223	74.260	mm	0.487	m	2.054
224	74.078	mm	0.486	m	2.059
225	73.896	mm	0.484	m	2.064
226	73.714	mm	0.483	m	2.069
227	73.533	mm	0.482	m	2.074
228	73.351	mm	0.481	m	2.079
229	73.169	mm	0.480	m	2.084
230	72.987	mm	0.479	m	2.088
231	72.805	mm	0.478	m	2.093
232	72.624	mm	0.477	m	2.098
233	72.442	mm	0.476	m	2.103
234	72.260	mm	0.474	m	2.108
235	72.078	mm	0.473	m	2.113
236	71.896	mm	0.472	m	2.118
237	71.714	mm	0.471	m	2.123
238	71.533	mm	0.470	m	2.128
239	71.351	mm	0.469	m	2.133
240	71.169	mm	0.468	m	2.138
241	70.987	mm	0.467	m	2.143
242	70.805	mm	0.466	m	2.147
243	70.624	mm	0.465	m	2.152
244	70.442	mm	0.464	m	2.157
245	70.260	mm	0.462	m	2.162
246	70.078	mm	0.461	m	2.168
247	69.896	mm	0.460	m	2.173
248	69.714	mm	0.459	m	2.178
249	69.533	mm	0.458	m	2.183
250	69.351	mm	0.457	m	2.188
251	69.169	mm	0.456	m	2.193
252	68.987	mm	0.455	m	2.198
253	68.805	mm	0.454	m	2.203
254	68.624	mm	0.453	m	2.208
255	68.442	mm	0.452	m	2.213

256	68.260	mm	0.451	m	2.218
257	68.078	mm	0.450	m	2.223
258	67.896	mm	0.449	m	2.228
259	67.714	mm	0.448	m	2.234
260	67.533	mm	0.447	m	2.239
261	67.351	mm	0.446	m	2.244
262	67.169	mm	0.445	m	2.249
263	66.987	mm	0.444	m	2.254
264	66.805	mm	0.443	m	2.259
265	66.624	mm	0.442	m	2.265
266	66.442	mm	0.441	m	2.270
267	66.260	mm	0.440	m	2.275
268	66.078	mm	0.439	m	2.280
269	65.896	mm	0.438	m	2.286
270	65.714	mm	0.437	m	2.291
271	65.533	mm	0.436	m	2.296
272	65.351	mm	0.435	m	2.301
273	65.169	mm	0.434	m	2.307
274	64.987	mm	0.433	m	2.312
275	64.805	mm	0.432	m	2.317
276	64.624	mm	0.431	m	2.323
277	64.442	mm	0.430	m	2.328
278	64.260	mm	0.429	m	2.333
279	64.078	mm	0.428	m	2.339
280	63.896	mm	0.427	m	2.344
281	63.714	mm	0.426	m	2.349
282	63.533	mm	0.425	m	2.355
283	63.351	mm	0.424	m	2.360
284	63.169	mm	0.423	m	2.366
285	62.987	mm	0.422	m	2.371
286	62.805	mm	0.421	m	2.376
287	62.624	mm	0.420	m	2.382
288	62.442	mm	0.419	m	2.387
289	62.260	mm	0.418	m	2.393
290	62.078	mm	0.417	m	2.398
291	61.896	mm	0.416	m	2.404
292	61.714	mm	0.415	m	2.409
293	61.533	mm	0.414	m	2.415
294	61.351	mm	0.413	m	2.420
295	61.169	mm	0.412	m	2.426
296	60.987	mm	0.411	m	2.431
297	60.805	mm	0.410	m	2.437
298	60.624	mm	0.409	m	2.442
299	60.442	mm	0.409	m	2.448

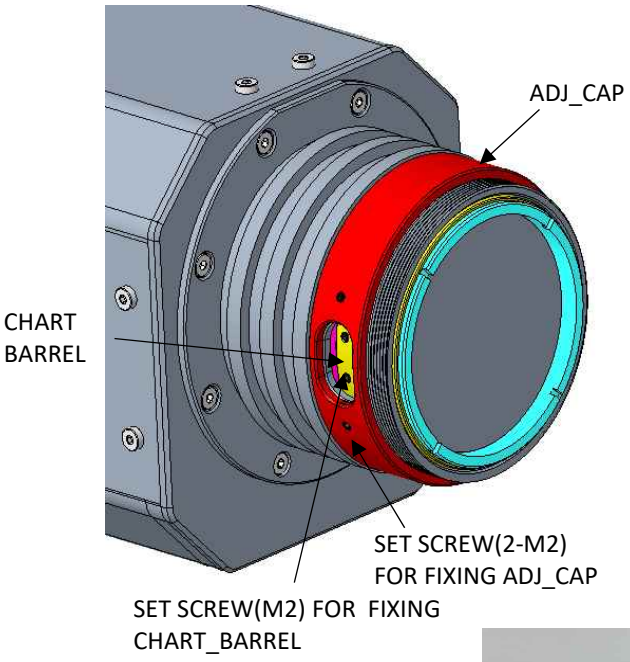
300	60.260	mm	0.408	m	2.453
301	60.078	mm	0.407	m	2.459
302	59.896	mm	0.406	m	2.465
303	59.714	mm	0.405	m	2.470
304	59.533	mm	0.404	m	2.476
305	59.351	mm	0.403	m	2.481
306	59.169	mm	0.402	m	2.487
307	58.987	mm	0.401	m	2.493
308	58.805	mm	0.400	m	2.498
309	58.624	mm	0.399	m	2.504
310	58.442	mm	0.398	m	2.510
311	58.260	mm	0.398	m	2.516
312	58.078	mm	0.397	m	2.521
313	57.896	mm	0.396	m	2.527
314	57.714	mm	0.395	m	2.533
315	57.533	mm	0.394	m	2.538
316	57.351	mm	0.393	m	2.544
317	57.169	mm	0.392	m	2.550
318	56.987	mm	0.391	m	2.556
319	56.805	mm	0.390	m	2.562
320	56.624	mm	0.389	m	2.567
321	56.442	mm	0.389	m	2.573
322	56.260	mm	0.388	m	2.579
323	56.078	mm	0.387	m	2.585
324	55.896	mm	0.386	m	2.591
325	55.714	mm	0.385	m	2.597
326	55.533	mm	0.384	m	2.603
327	55.351	mm	0.383	m	2.608
328	55.169	mm	0.383	m	2.614
329	54.987	mm	0.382	m	2.620
330	54.805	mm	0.381	m	2.626
331	54.624	mm	0.380	m	2.632
332	54.442	mm	0.379	m	2.638
333	54.260	mm	0.378	m	2.644
334	54.078	mm	0.377	m	2.650
335	53.896	mm	0.377	m	2.656
336	53.714	mm	0.376	m	2.662
337	53.533	mm	0.375	m	2.668
338	53.351	mm	0.374	m	2.674
339	53.169	mm	0.373	m	2.680
340	52.987	mm	0.372	m	2.686
341	52.805	mm	0.371	m	2.692
342	52.624	mm	0.371	m	2.698
343	52.442	mm	0.370	m	2.704

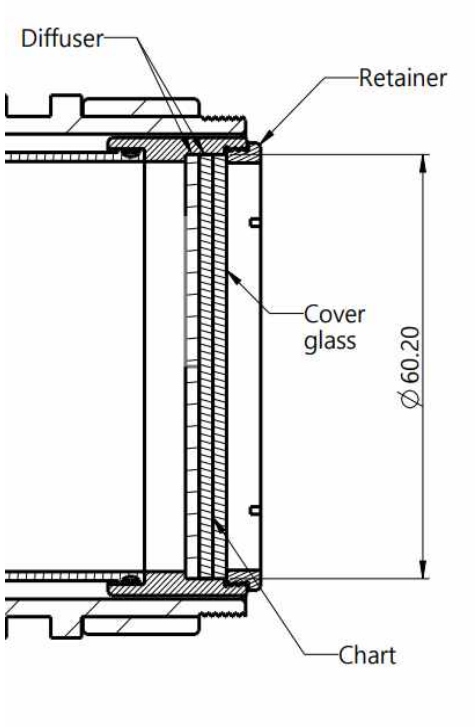
344	52.260	mm	0.369	m	2.710
345	52.078	mm	0.368	m	2.717
346	51.896	mm	0.367	m	2.723
347	51.714	mm	0.366	m	2.729
348	51.533	mm	0.366	m	2.735
349	51.351	mm	0.365	m	2.741
350	51.169	mm	0.364	m	2.747
351	50.987	mm	0.363	m	2.754
352	50.805	mm	0.362	m	2.760
353	50.624	mm	0.362	m	2.766
354	50.442	mm	0.361	m	2.772
355	50.260	mm	0.360	m	2.779
356	50.078	mm	0.359	m	2.785
357	49.896	mm	0.358	m	2.791
358	49.714	mm	0.357	m	2.797
359	49.533	mm	0.357	m	2.804
360	49.351	mm	0.356	m	2.810
361	49.169	mm	0.355	m	2.816
362	48.987	mm	0.354	m	2.823
363	48.805	mm	0.353	m	2.829
364	48.624	mm	0.353	m	2.835
365	48.442	mm	0.352	m	2.842
366	48.260	mm	0.351	m	2.848
367	48.078	mm	0.350	m	2.855
368	47.896	mm	0.350	m	2.861
369	47.714	mm	0.349	m	2.867
370	47.533	mm	0.348	m	2.874
371	47.351	mm	0.347	m	2.880
372	47.169	mm	0.346	m	2.887
373	46.987	mm	0.346	m	2.893
374	46.805	mm	0.345	m	2.900
375	46.624	mm	0.344	m	2.906
376	46.442	mm	0.343	m	2.913
377	46.260	mm	0.343	m	2.920
378	46.078	mm	0.342	m	2.926
379	45.896	mm	0.341	m	2.933
380	45.714	mm	0.340	m	2.939
381	45.533	mm	0.339	m	2.946
382	45.351	mm	0.339	m	2.952
383	45.169	mm	0.338	m	2.959
384	44.987	mm	0.337	m	2.966
385	44.805	mm	0.336	m	2.972
386	44.624	mm	0.336	m	2.979
387	44.442	mm	0.335	m	2.986

388	44.260	mm	0.334	m	2.993
389	44.078	mm	0.333	m	2.999
390	43.896	mm	0.333	m	3.006
391	43.714	mm	0.332	m	3.013
392	43.533	mm	0.331	m	3.020
393	43.351	mm	0.330	m	3.026
394	43.169	mm	0.330	m	3.033
395	42.987	mm	0.329	m	3.040
396	42.805	mm	0.328	m	3.047
397	42.624	mm	0.327	m	3.054
398	42.442	mm	0.327	m	3.061
399	42.260	mm	0.326	m	3.067
400	42.078	mm	0.325	m	3.074
401	41.896	mm	0.325	m	3.081
402	41.714	mm	0.324	m	3.088
403	41.533	mm	0.323	m	3.095
404	41.351	mm	0.322	m	3.102
405	41.169	mm	0.322	m	3.109
406	40.987	mm	0.321	m	3.116
407	40.805	mm	0.320	m	3.123
408	40.624	mm	0.319	m	3.130
409	40.442	mm	0.319	m	3.137
410	40.260	mm	0.318	m	3.144
411	40.078	mm	0.317	m	3.151
412	39.896	mm	0.317	m	3.158
413	39.714	mm	0.316	m	3.165
414	39.533	mm	0.315	m	3.173
415	39.351	mm	0.314	m	3.180
416	39.169	mm	0.314	m	3.187
417	38.987	mm	0.313	m	3.194
418	38.805	mm	0.312	m	3.201
419	38.624	mm	0.312	m	3.208
420	38.442	mm	0.311	m	3.216
421	38.260	mm	0.310	m	3.223
422	38.078	mm	0.310	m	3.230
423	37.896	mm	0.309	m	3.237
424	37.714	mm	0.308	m	3.245
425	37.533	mm	0.308	m	3.252
426	37.351	mm	0.307	m	3.259
427	37.169	mm	0.306	m	3.267
428	36.987	mm	0.305	m	3.274
429	36.805	mm	0.305	m	3.281
430	36.624	mm	0.304	m	3.289
431	36.442	mm	0.303	m	3.296

432	36.260	mm	0.303	m	3.303
433	36.078	mm	0.302	m	3.311
434	35.896	mm	0.301	m	3.318
435	35.714	mm	0.301	m	3.326
436	35.533	mm	0.300	m	3.333
437	35.351	mm	0.299	m	3.341
438	35.169	mm	0.299	m	3.348
439	34.987	mm	0.298	m	3.356
440	34.805	mm	0.297	m	3.363

How to replace the Chart





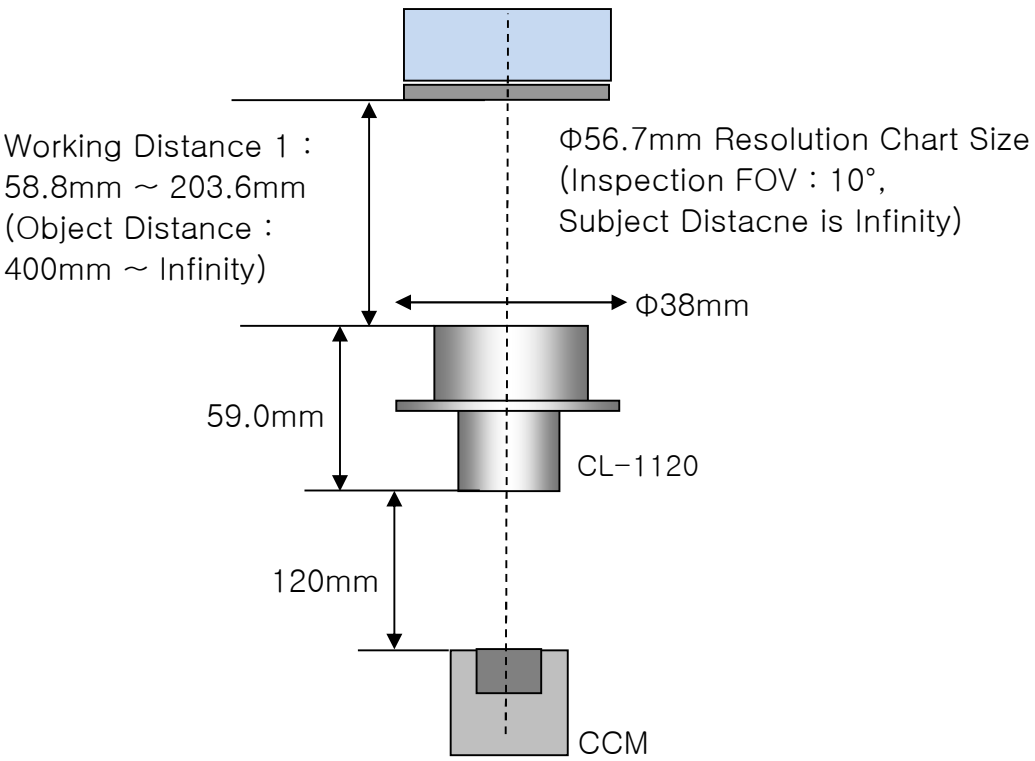
[Special tool for chart rotation]

1) Drive the motor to move the chart assembly to the 450 step position.
   The chart can only be replaced at this position.
2) If you separate the adapter barrel, you can see the chart as shown in the picture above.
3) Slightly loosen the two SET SCREWs that secure the ADJ_CAP.
   Then, the ADJ_CAP will be able to rotate and rotate until the CHART_BARREL is visible.
4) Release the retainer and remove the cover glass.
   At this time, check the direction of the front and back of the cover glass.
   Of the two sides of the cover glass, the side facing the chart is painted black.
   Then, you can replace the chart.
5) After replacing the chart, put the cover glass back in its original orientation.
   Then, attach the retainer.
6) This is a method to rotate the chart in the desired direction while it is assembled.
   In this case, loosen the SET_SCREW(M2) that fixes the CHART_BARREL.
   Then, rotate the chart using a special tool.
   When the chart is finished rotating, tighten the SET_SCREW(M2).
7) Rotate the ADJ_CAP until the CHART_BARREL is no longer visible.
   Then, tighten the SET SCREW(2-M2) fot fixing the ADJ_CAP.
8) Attach the adapter barrel.
9) There are cases where you just rotate the chart without replacing it.
   You only need to do steps 1-3-6-7 in the above order.

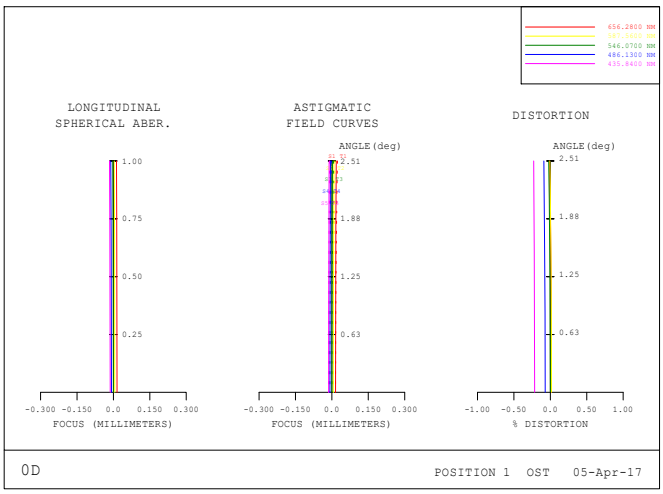
CL-10120 Collimator Lens Specification

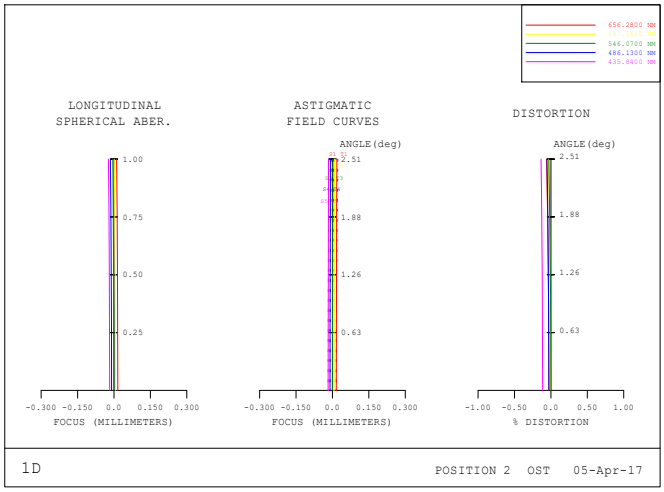
Model name	CL-10120 (Designed by OneStone) Collimator lens of CM-10120
Characteristc of CL-10120	Inspection of only a specific 10 degree section of the full angle of the full angle of view of the camera lens.
Construction of CL-10120	4 Glass lenses
EFL	323.9mm
Inspectable FOV of CCM	10°
Ass'y Size	Φ38mm X L59mm, weight 108g
Exit Pupil Size	Φ4.5mm
Exit Pupil Position	120.0mm (Distance from camera lens to CL)
Working Distance (from CL 1st Lens R1 surface to chart)	203.6mm at Object Distance Infinity Chart Size : Φ56.7mm

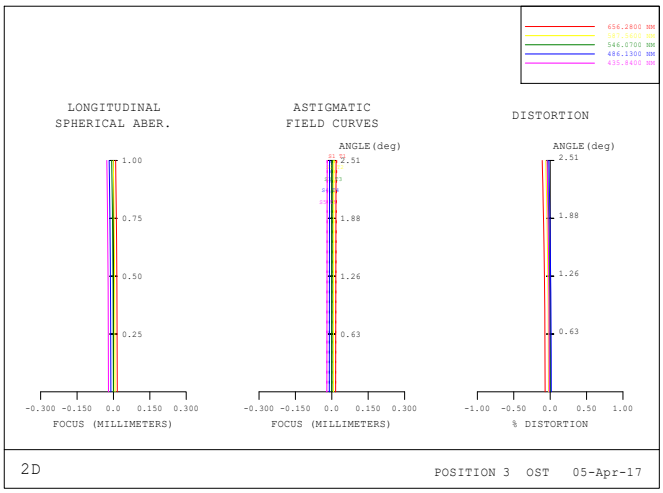
Schematic of CL-10120

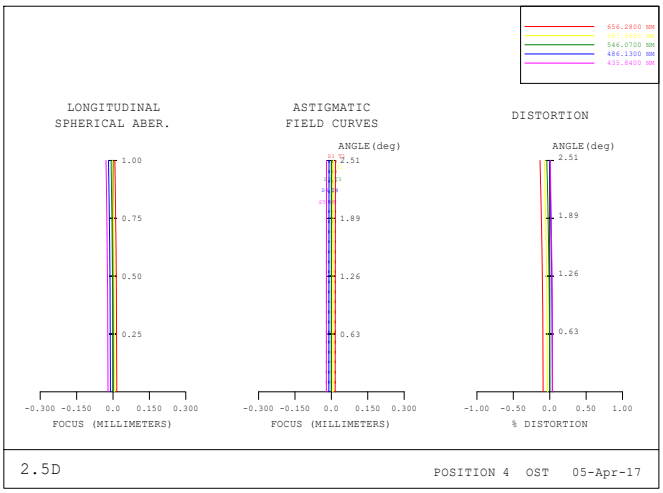


Optical Performance of CL-10120 (Scale 0.3 0.3 1.0)

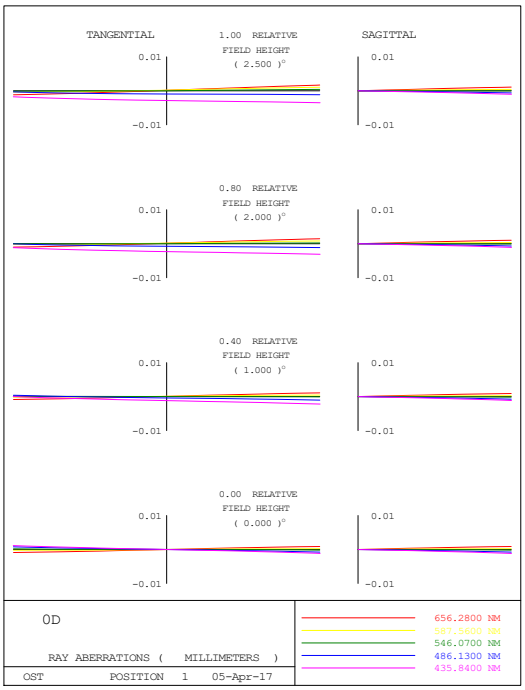


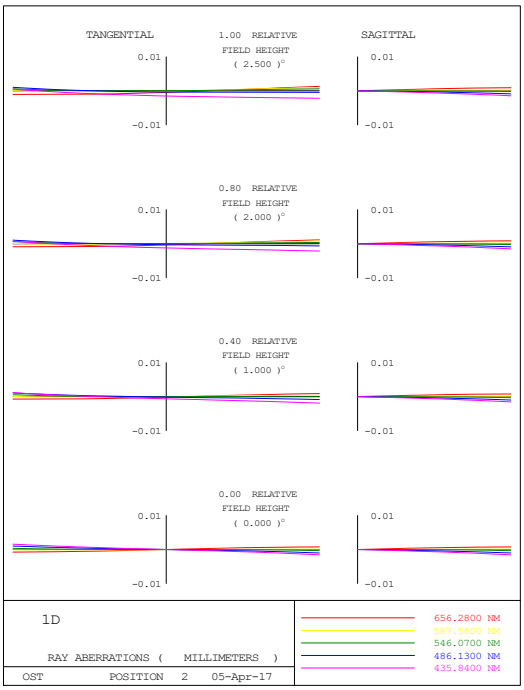


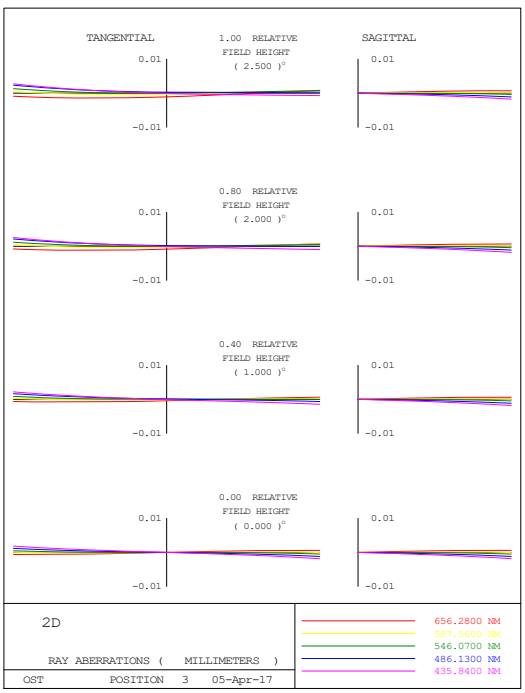


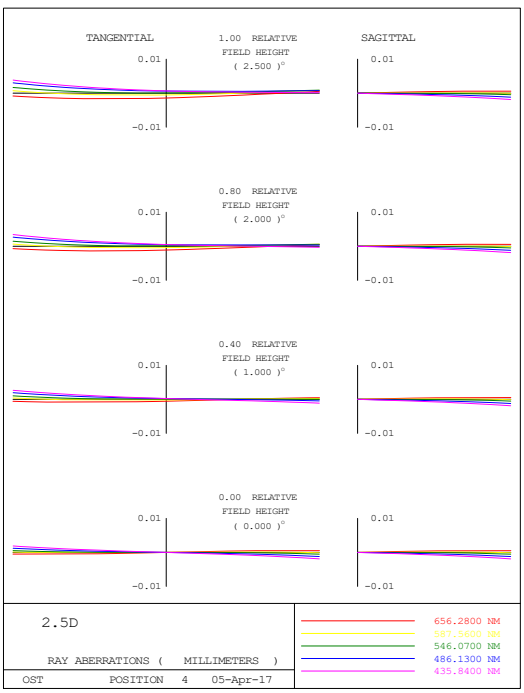


Optical Performance of CL-10120 (Scale ±0.01)



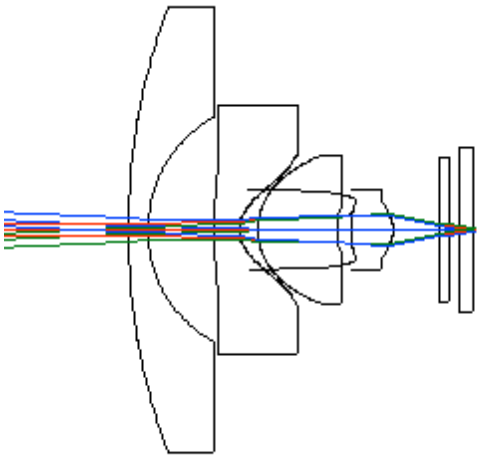




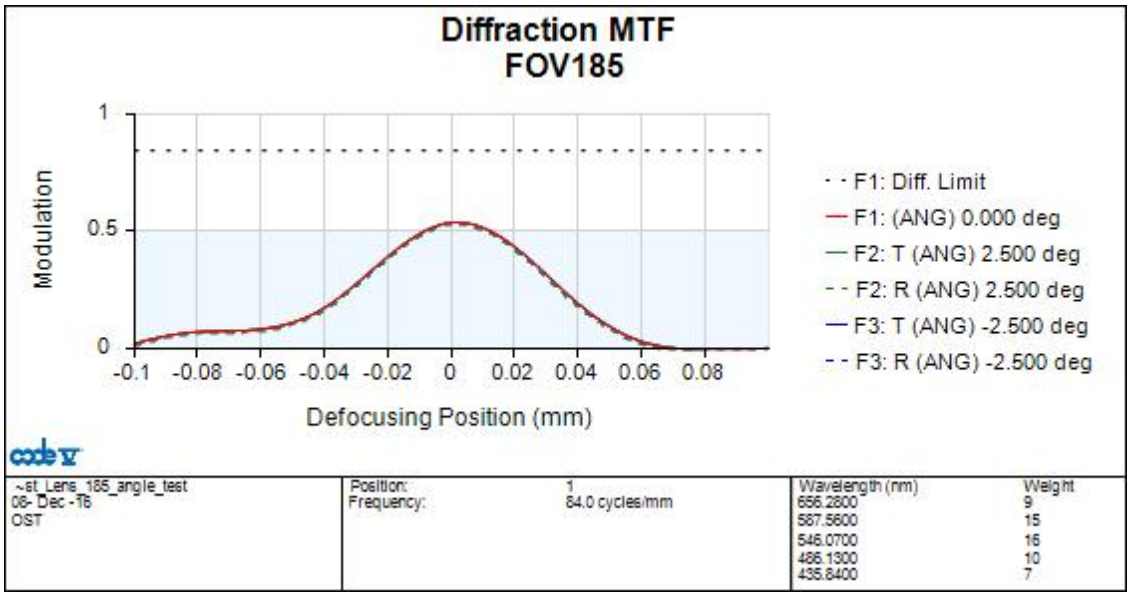


MTF Analysis for FOV 185° Lens of A-Company

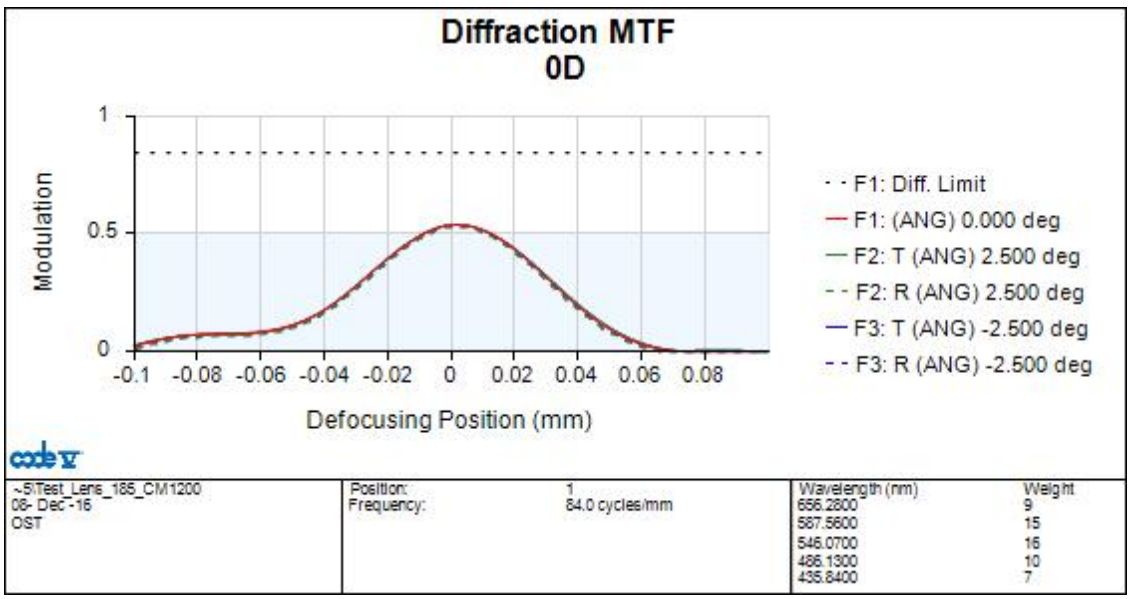
0 degree



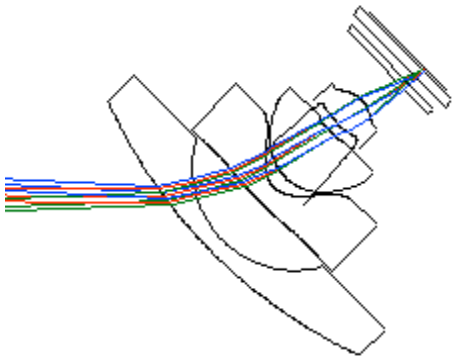
Only Camera Lens



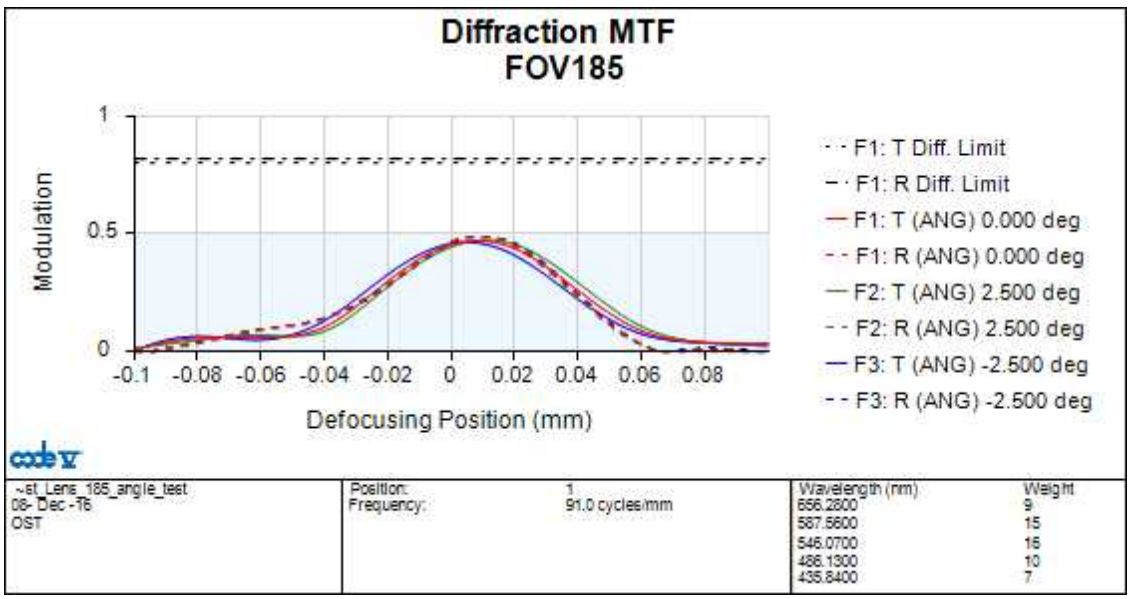
CL-1120B + Camera Lens



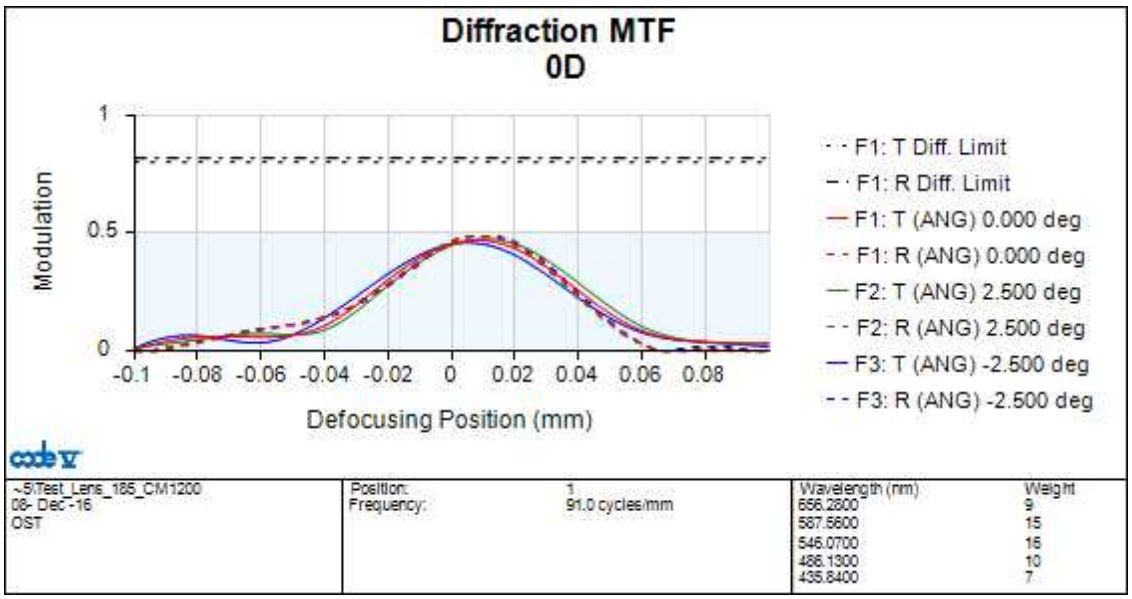
90 degree



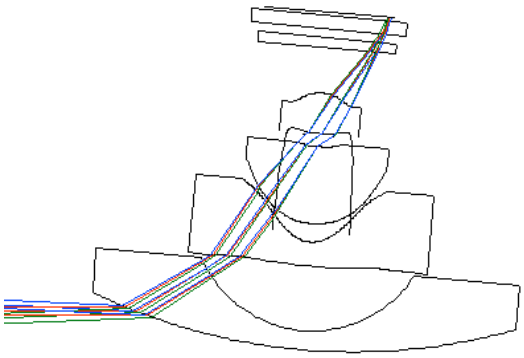
Only Camera Lens



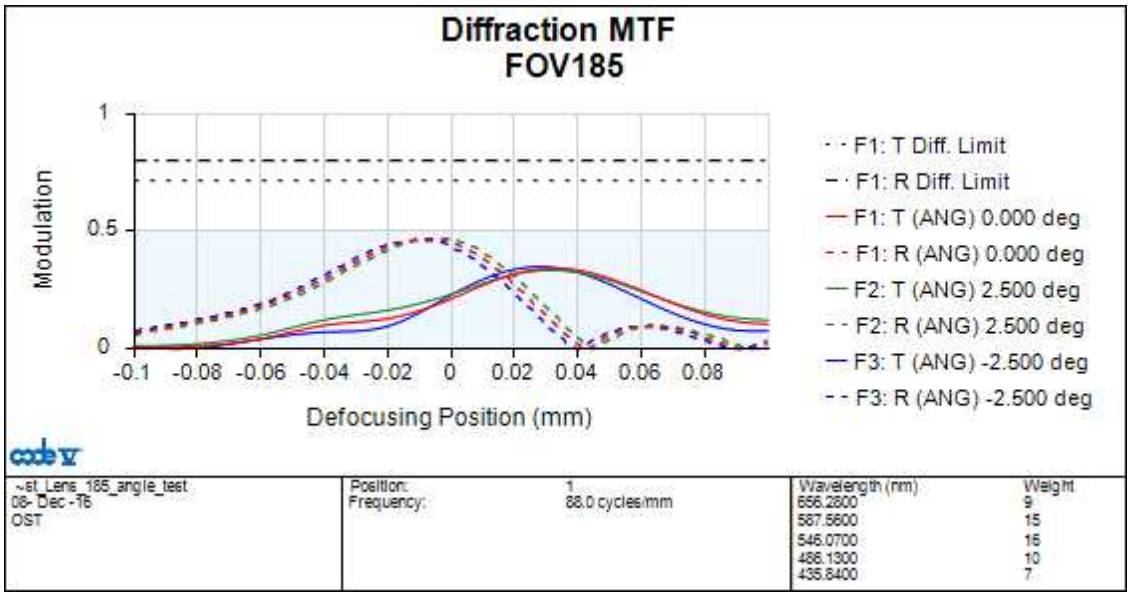
CL-1120B + Camera Lens



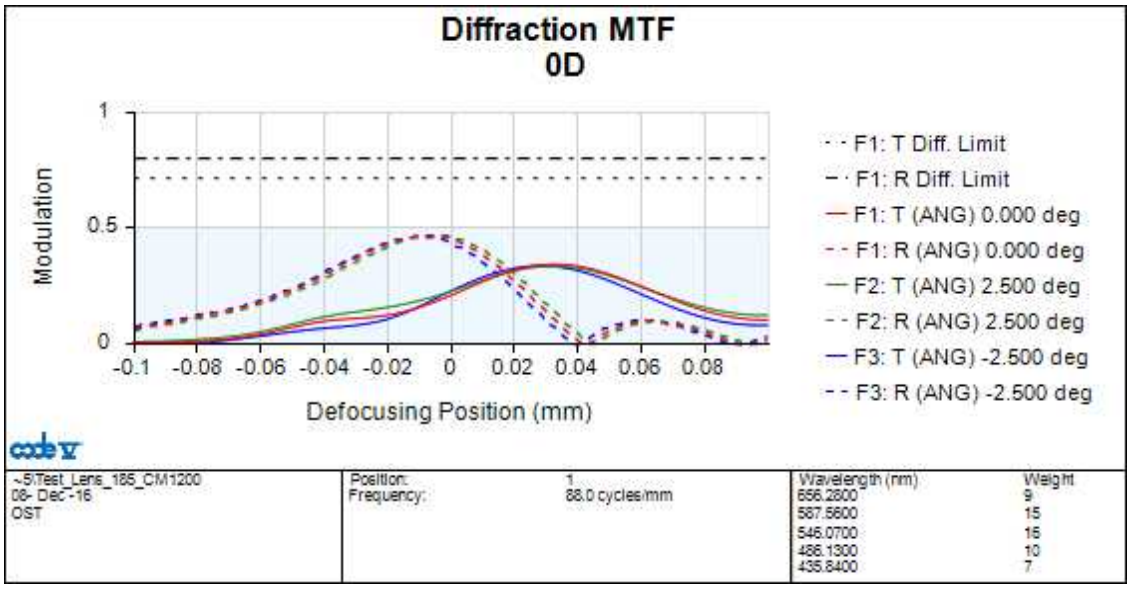
170 degree



Only Camera Lens



CL-1120B + Camera Lens



The Chart Size of CM-10120 (with 1.0D FB)

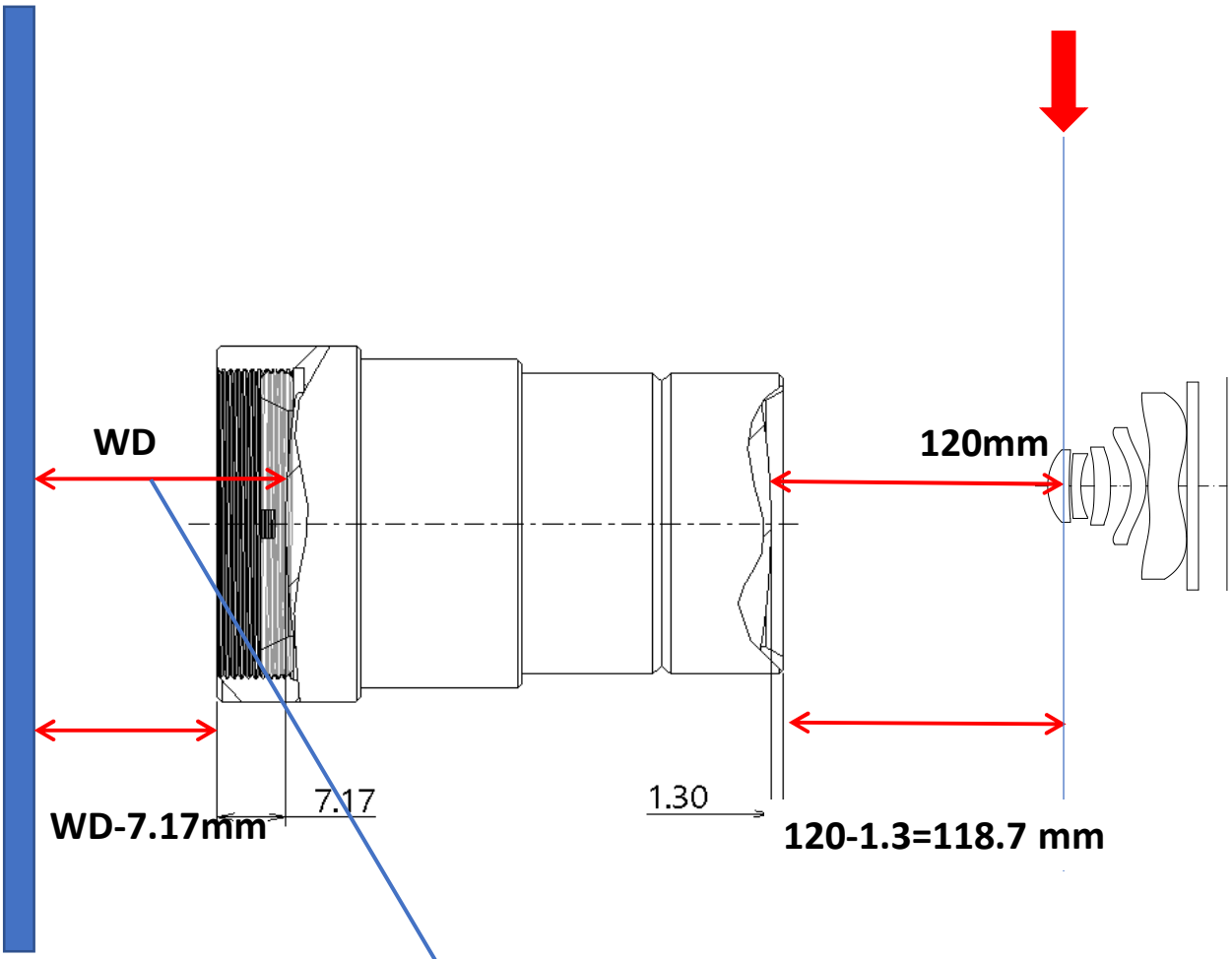
Object Distance : Real shooting distance with camera
Working Distance : Distance from 1st Lens R1 vertex of CL to chart.
※ This table is based on the FOV of camera lens.

PCM Module	
FOV	10

Object Distance	Working Distance	Chart Size (Φ, mm)	Diopter
1.00E+100	203.65	**56.73**	**0.00D**
50000	201.56	**56.36**	**0.02D**
20000	198.49	**55.82**	**0.05D**
15000	196.80	**55.53**	**0.07D**
10000	193.49	**54.95**	**0.10D**
9000	192.40	**54.76**	**0.11D**
8000	191.05	**54.52**	**0.13D**
7000	189.33	**54.22**	**0.14D**
6000	187.06	**53.82**	**0.17D**
5000	183.95	**53.28**	**0.20D**
4500	181.90	**52.92**	**0.22D**
4000	179.39	**52.48**	**0.25D**
3500	176.22	**51.93**	**0.29D**
3000	172.09	**51.20**	**0.33D**
2750	169.53	**50.75**	**0.36D**
2500	166.51	**50.23**	**0.40D**
2250	162.90	**49.59**	**0.44D**
2000	158.51	**48.83**	**0.50D**
1900	156.48	**48.47**	**0.53D**
1800	154.26	**48.08**	**0.56D**
1700	151.82	**47.66**	**0.59D**
1600	149.13	**47.18**	**0.63D**
1500	146.14	**46.66**	**0.67D**
1400	142.81	**46.08**	**0.71D**
1300	139.06	**45.42**	**0.77D**
1200	134.82	**44.68**	**0.83D**
1100	129.99	**43.83**	**0.91D**
1000	124.42	**42.86**	**1.00D**

How to set Collimator Lens

The entrance pupil position(EPP) of Camera module lens. (Not necessarily the same EPP and 1st lens vertex of CM lens)



Chart

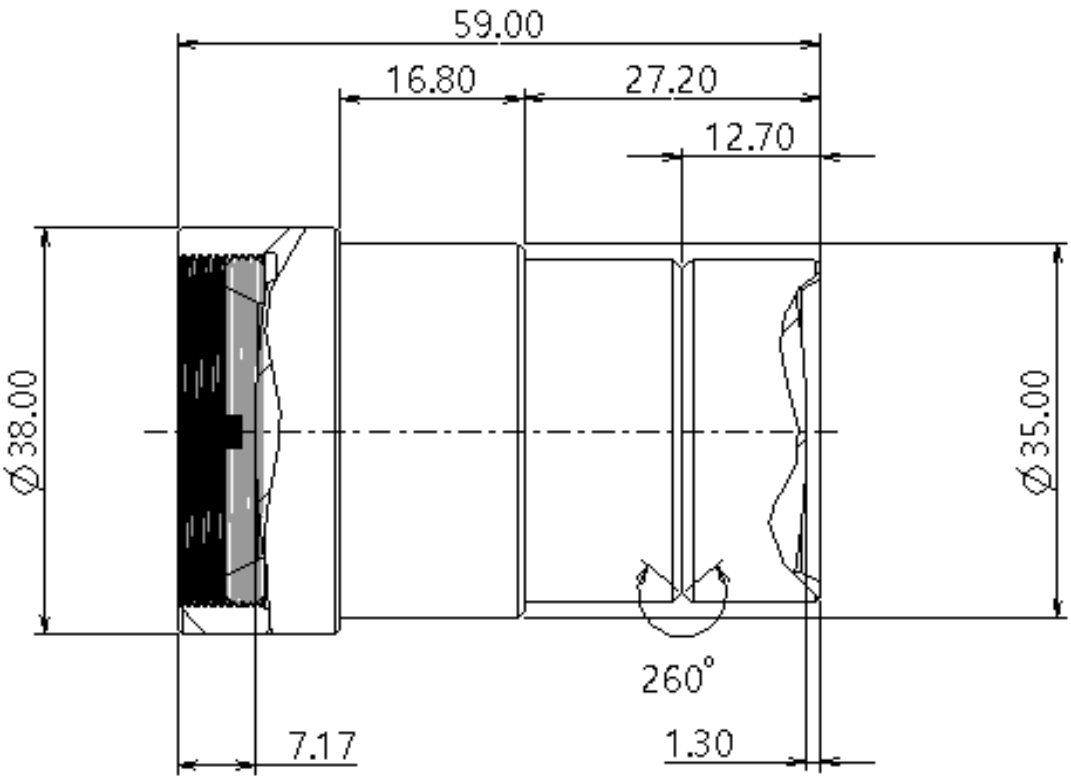
The Chart Size of CL-10120 (FOV=10.0°)

Object Distance : Real shooting distance with camera
Working Distance : Distance from 1st Lens R1 vertex of CL to chart.
※ This table is based on the FOV of camera lens.

PCM Module	
FOV	10

Object Distance (Object ~ PCM)	Working Distance (Chart ~ Relay Lens)	Chart Size (Φ, mm)	Diopter
1.00E+100	203.65	**56.73**	**0.00D**
50000	201.56	**56.36**	**0.02D**
20000	198.49	**55.82**	**0.05D**
15000	196.80	**55.53**	**0.07D**
10000	193.49	**54.95**	**0.10D**

CL-10120 Drawings



CL-10120 Picture