

Report of Test

LLI-18230-2

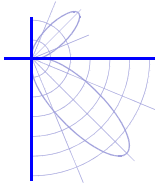
Optolum - Linear strip luminaire. Product ID: FL-VL-H--409U-D-A059220
Extruded aluminum housing with no lens.
329 LEDs mounted in single row.
No driver.
Operating at 24v DC.



Performance Summary

Total Light Output	3763 lm
Luminaire Power	36.4 W
Luminous Efficacy	103.4 lm/W
CCT	4030 K
CIE(x,y) 1931	(0.378, 0.375)
CRI	94

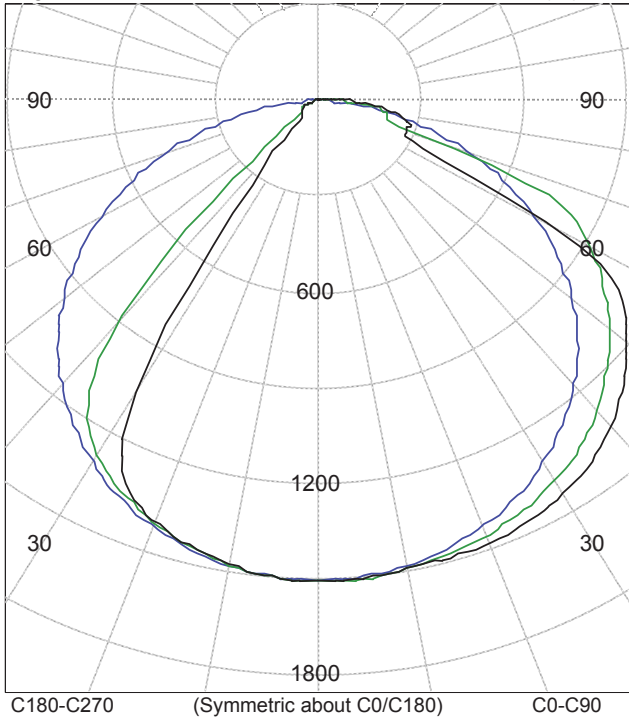
PREPARED FOR : Optolum, Tempe, AZ 85281



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Legend: C0/C180-Black, C45/C225-Green, C90/C270-Blue (cd)



INTENSITY SUMMARY (cd)

Gamma	C-Plane					Flux (lm)
	C0	C22.5	C45	C67.5	C90	
0.0	1507	1507	1507	1507	1507	
5.0	1504	1500	1505	1507	1497	143
10.0	1491	1489	1492	1493	1482	
15.0	1484	1478	1470	1468	1456	413
20.0	1474	1464	1448	1430	1418	
25.0	1454	1441	1416	1381	1368	635
30.0	1424	1407	1376	1328	1307	
35.0	1382	1362	1326	1266	1236	716
40.0	1328	1307	1263	1194	1158	
45.0	1261	1239	1190	1115	1066	656
50.0	1182	1160	1108	1025	963	
55.0	1088	1069	1013	923	850	583
60.0	762	912	908	814	729	
65.0	302	369	780	694	595	355
70.0	277	256	327	568	454	
75.0	272	256	205	438	312	184
80.0	229	220	194	129	176	
85.0	155	147	132	107	64	72
90.0	76	68	52	28	0	

ZONAL FLUX AND PERCENTAGES

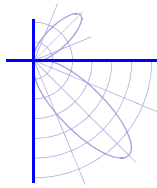
Zone	Flux (lm)	% Lamp	% Luminaire
0-30	1190	N/A	31.6
0-40	1905	N/A	50.6
0-60	3145	N/A	83.6
0-90	3755	N/A	99.8
40-90	1850	N/A	49.2
60-90	611	N/A	16.2
90-180	7	N/A	0.2
0-180	3763	N/A	100.0

Total Light Output = 3,763 lm

Signed:

Ryder Tunney
Ryder Tunney
Authorized Signatory

Date of test 21-Aug-2018
Date of report 21-Aug-2018

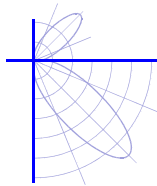


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Intensity data (cd)

Gamma	C-Plane				
	C0	C22.5	C45	C67.5	C90
0.0	1507	1507	1507	1507	1507
2.5	1507	1504	1508	1510	1500
5.0	1504	1500	1505	1507	1497
7.5	1498	1496	1500	1501	1491
10.0	1491	1489	1492	1493	1482
12.5	1486	1482	1482	1482	1470
15.0	1484	1478	1470	1468	1456
17.5	1480	1472	1459	1451	1438
20.0	1474	1464	1448	1430	1418
22.5	1465	1453	1433	1407	1395
25.0	1454	1441	1416	1381	1368
27.5	1440	1425	1397	1355	1339
30.0	1424	1407	1376	1328	1307
32.5	1405	1386	1353	1298	1273
35.0	1382	1362	1326	1266	1236
37.5	1357	1336	1296	1232	1198
40.0	1328	1307	1263	1194	1158
42.5	1296	1274	1228	1155	1113
45.0	1261	1239	1190	1115	1066
47.5	1223	1201	1150	1071	1016
50.0	1182	1160	1108	1025	963
52.5	1138	1116	1061	975	907
55.0	1088	1069	1013	923	850
57.5	1000	1016	961	870	790
60.0	762	912	908	814	729
62.5	459	643	852	754	661
65.0	302	369	780	694	595
67.5	273	264	604	632	525
70.0	277	256	327	568	454
72.5	277	258	210	504	383
75.0	272	256	205	438	312
77.5	256	244	204	307	242
80.0	229	220	194	129	176
82.5	194	186	170	119	116
85.0	155	147	132	107	64
87.5	115	107	92	69	22
90.0	76	68	52	28	0

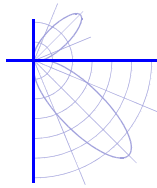


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Intensity data (cd)

Gamma	C-Plane				
	C0	C22.5	C45	C67.5	C90
90.0	76	68	52	28	0
92.5	41	34	22	6	0
95.0	22	17	6	3	0
97.5	3	1	2	2	0
100.0	0	0	2	2	0
102.5	0	0	2	1	0
105.0	0	0	1	0	0
107.5	0	0	0	0	0
110.0	0	0	0	0	0
112.5	0	0	0	0	0
115.0	0	0	0	0	0
117.5	0	0	0	0	0
120.0	0	0	0	0	0
122.5	0	0	0	0	0
125.0	0	0	0	0	0
127.5	0	0	0	0	0
130.0	0	0	0	0	0
132.5	0	0	0	0	0
135.0	0	0	0	0	0
137.5	0	0	0	0	0
140.0	0	0	0	0	0
142.5	0	0	0	0	0
145.0	0	0	0	0	0
147.5	0	0	0	0	0
150.0	0	0	0	0	0
152.5	0	0	0	0	0
155.0	0	0	0	0	0
157.5	0	0	0	0	0
160.0	0	0	0	0	0
162.5	0	0	0	0	0
165.0	0	0	0	0	0
167.5	0	0	0	0	0
170.0	0	0	0	0	0
172.5	0	0	0	0	0
175.0	0	0	0	0	0
177.5	0	0	0	0	0
180.0	0	0	0	0	0

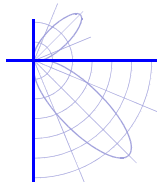


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Intensity data (cd)

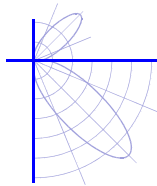
Gamma	C-Plane				
	C90	C112.5	C135	C157.5	C180
0.0	1507	1507	1507	1507	1507
2.5	1500	1509	1506	1502	1506
5.0	1497	1504	1500	1496	1499
7.5	1491	1496	1491	1486	1489
10.0	1482	1485	1479	1473	1477
12.5	1470	1471	1464	1458	1461
15.0	1456	1455	1446	1441	1444
17.5	1438	1436	1427	1420	1423
20.0	1418	1415	1404	1396	1399
22.5	1395	1391	1378	1368	1369
25.0	1368	1364	1350	1331	1321
27.5	1339	1333	1319	1273	1229
30.0	1307	1299	1283	1168	1057
32.5	1273	1263	1237	982	761
35.0	1236	1224	1167	682	427
37.5	1198	1183	1056	378	232
40.0	1158	1139	879	209	117
42.5	1113	1094	615	103	69
45.0	1066	1046	346	65	65
47.5	1016	993	190	63	62
50.0	963	931	94	60	59
52.5	907	849	57	57	56
55.0	850	740	55	54	53
57.5	790	584	52	51	51
60.0	729	365	49	49	48
62.5	661	173	46	46	45
65.0	595	76	43	43	43
67.5	525	38	41	41	40
70.0	454	35	37	37	35
72.5	383	32	35	31	27
75.0	312	29	30	20	14
77.5	242	26	21	4	2
80.0	176	22	6	0	0
82.5	116	16	0	0	0
85.0	64	3	0	0	0
87.5	22	0	0	0	0
90.0	0	0	0	0	0



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Intensity data (cd)						
Gamma	C-Plane					
	C90	C112.5	C135	C157.5	C180	
90.0	0	0	0	0	0	
92.5	0	0	0	0	0	
95.0	0	0	0	0	0	
97.5	0	0	0	0	0	
100.0	0	0	0	0	0	
102.5	0	0	0	0	0	
105.0	0	0	0	0	0	
107.5	0	0	0	0	0	
110.0	0	0	0	0	0	
112.5	0	0	0	0	0	
115.0	0	0	0	0	0	
117.5	0	0	0	0	0	
120.0	0	0	0	0	0	
122.5	0	0	0	0	0	
125.0	0	0	0	0	0	
127.5	0	0	0	0	0	
130.0	0	0	0	0	0	
132.5	0	0	0	0	0	
135.0	0	0	0	0	0	
137.5	0	0	0	0	0	
140.0	0	0	0	0	0	
142.5	0	0	0	0	0	
145.0	0	0	0	0	0	
147.5	0	0	0	0	0	
150.0	0	0	0	0	0	
152.5	0	0	0	0	0	
155.0	0	0	0	0	0	
157.5	0	0	0	0	0	
160.0	0	0	0	0	0	
162.5	0	0	0	0	0	
165.0	0	0	0	0	0	
167.5	0	0	0	0	0	
170.0	0	0	0	0	0	
172.5	0	0	0	0	0	
175.0	0	0	0	0	0	
177.5	0	0	0	0	0	
180.0	0	0	0	0	0	



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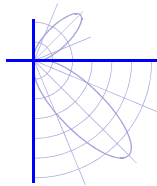
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LM-79 Performance Data

Spectral	CIE 1931 (x, y) ⁽¹⁾	(0.378, 0.375)
	CIE 1976 (u', v') ⁽¹⁾	(0.225, 0.500)
	Correlated Color Temperature (CCT) ⁽¹⁾	4030 K
	Spatial Δ (u', v') Uniformity ⁽²⁾	2.91E-03
	Color Rendering Index (Ra) ⁽¹⁾	94.0
	Special CRI 9 (R ₉) ^{(1),(3)}	74.0
	Distance from Planckian Locus (Duv) ^{(1),(3)}	-4.77E-04
	Scotopic/Photopic Ratio ^{(1),(3)}	1.78
Electrical	Voltage	24.00 V
	Current	1.515 A
	Power	36.4 W

Performance data in accordance with IESNA LM-79-08. Spectral calculations are for a CIE 2° observer

- (1) Value is computed from the weighted average of the spatial measurements
- (2) Value is the maximum deviation of the spatial u' and v' measurements from the weighted average
- (3) Quantity is in addition to the scope of IESNA LM-79-08



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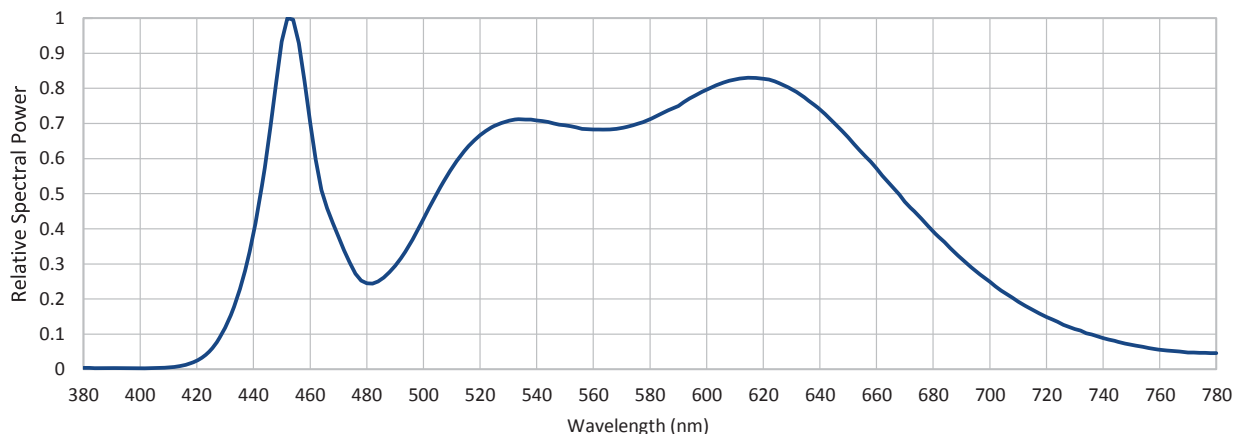
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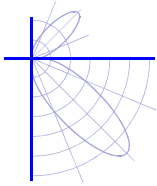
LM-79 Performance Data

Relative spectral power distribution

(Relative to peak = 1, weighted average of spatial measurements)

λ (nm)	Relative Power	λ (nm)	Relative Power	λ (nm)	Relative Power	λ (nm)	Relative Power	λ (nm)	Relative Power
380	0.004	460	0.701	540	0.709	620	0.828	700	0.249
385	0.003	465	0.485	545	0.702	625	0.816	705	0.219
390	0.003	470	0.377	550	0.695	630	0.798	710	0.193
395	0.003	475	0.288	555	0.687	635	0.771	715	0.170
400	0.003	480	0.245	560	0.683	640	0.740	720	0.149
405	0.003	485	0.256	565	0.683	645	0.701	725	0.131
410	0.005	490	0.295	570	0.687	650	0.661	730	0.115
415	0.011	495	0.354	575	0.697	655	0.616	735	0.101
420	0.025	500	0.429	580	0.712	660	0.572	740	0.089
425	0.057	505	0.504	585	0.731	665	0.525	745	0.079
430	0.118	510	0.572	590	0.750	670	0.477	750	0.070
435	0.224	515	0.627	595	0.775	675	0.436	755	0.062
440	0.387	520	0.667	600	0.797	680	0.393	760	0.056
445	0.633	525	0.693	605	0.814	685	0.354	765	0.051
450	0.933	530	0.707	610	0.825	690	0.315	770	0.048
455	0.963	535	0.711	615	0.830	695	0.280	775	0.047
								780	0.046





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LM-79 Performance Data

Spatial measurements

Vert. angle (°)	CIE 1976 (u',v') coordinates	
	Horiz. 0.0° plane	Horiz. ° plane
0.0	(0.227, 0.502)	(0.225, 0.500)
10.0	(0.226, 0.502)	(0.225, 0.500)
20.0	(0.226, 0.501)	(0.225, 0.501)
30.0	(0.225, 0.501)	(0.226, 0.501)
40.0	(0.225, 0.500)	(0.225, 0.501)
50.0	(0.224, 0.499)	(0.225, 0.501)
60.0	(0.223, 0.498)	(0.225, 0.501)
70.0	(0.224, 0.499)	(0.224, 0.501)
80.0	(0.224, 0.499)	(0.223, 0.500)
90.0	I <= 10% peak	I <= 10% peak

Spatial measurements

Vert. angle (°)	CIE 1976 (u',v') coordinates	
	Horiz. 0.0° plane	Horiz. ° plane
90.0	I <= 10% peak	I <= 10% peak
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-
-	-	-

Test procedure

All measurements were performed in an environmentally controlled laboratory employing suitable baffling to minimize stray light. The sample was mounted in its normal operating orientation on a rotating mirror goniophotometer and operated from a stabilized supply. The photometric output was monitored and measurements were performed once stability was achieved.

The goniophotometer was used to measure the spatial distribution of both luminous intensity and, in conjunction with a spectroradiometer, spectral irradiance. The distribution locus comprises points in two or more planes (as indicated in the table above) at no more than 10° vertical intervals. The CIE (x,y) coordinates and other derived metrics (CIE (u', v'), CCT and CRI) are calculated from the weighted sum (weighted for intensity and represented solid angle) of the measured spectral irradiances.

Sample Orientation Horizontal Stabilization & total operation time 1.0 / 1.75 hours

Equipment and uncertainties

LightLab International R80A C-gamma rotating mirror goniophotometer with a test distance of 8 m.

Luminous Intensity	± 4 %	Temperature	± 1 °C
Luminous Flux	± 4 %	Luminous Efficacy	± 4.5 %
Horiz., Vert. Angles	± 0.25°		

PhotoResearch PR-670 spectroradiometer (grating with 380 - 780 nm range, 2 nm / pixel, 5 nm bandwidth, incandescent/halogen calibration source). Measured at a distance from the sample deemed >5 times the maximum observed luminous opening dimension.

CIE (x, y) coordinates	± 0.003	CCT	± 100 K
CIE (u', v') coordinates	± 0.002	CRI (Ra)	± 2
Spatial Δ (u', v') uniformity	± 0.001	Scotopic / Photopic Ratio *	± 0.02
Rel. Spectral Irradiance *	± 2 %	R9 *	± 2
Duv *	± 5E-04		

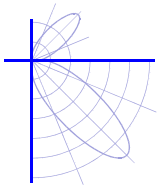
Yokogawa WT210 power meter connected in circuit to the sample electrical supply

Voltage	± 0.5 %	Frequency *	± 0.1 Hz
Current	± 0.5 %	Power	± 0.5 %
Current THD *	± 3 %	Power Factor	± 0.02

This report contains data that are not covered by the NVLAP accreditation. Quantities marked with * are not covered.

Calculator / report version 1.0.10 / 5.9 (14th Dec 2017)

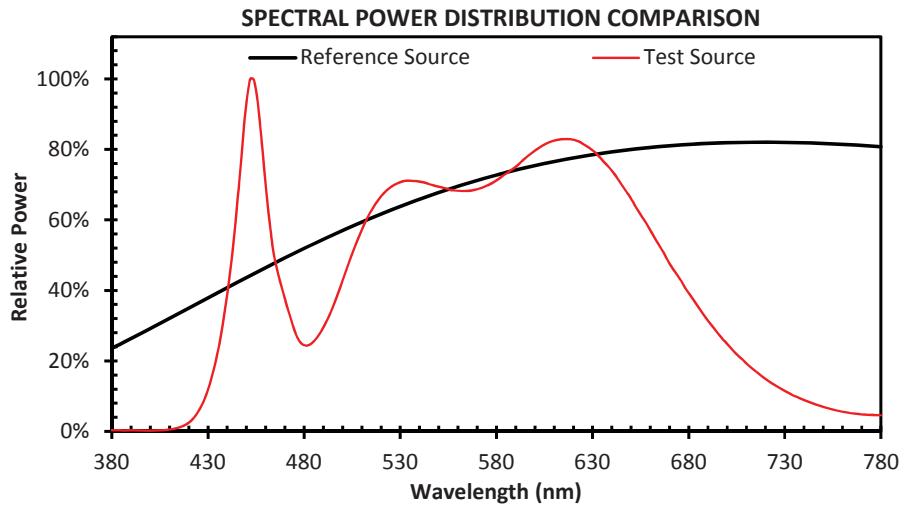
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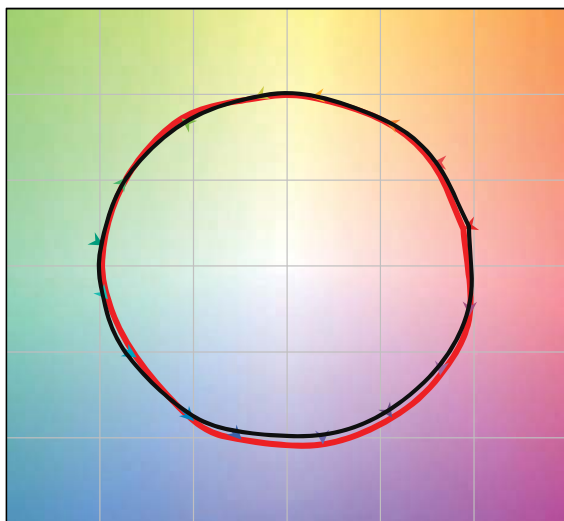
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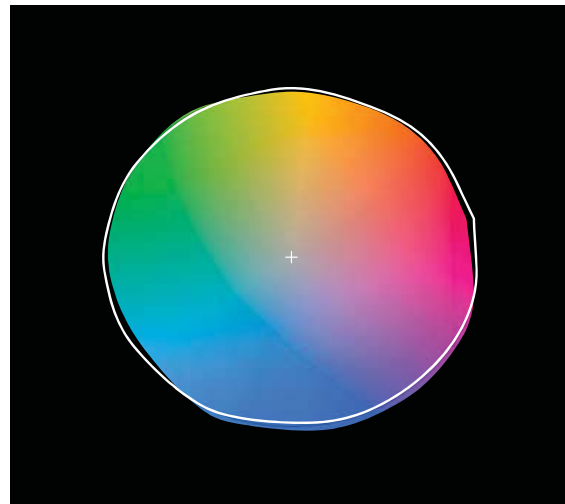
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R_g	101

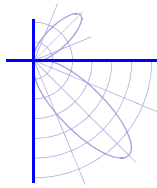


COLOR VECTOR GRAPHIC



COLOR DISTORTION GRAPHIC





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Test Distance 8.0 m
Test Temperature 25.4 °C

Notes The laboratory has not participated in the selection of samples to be tested. All testing is performed on the understanding that the significance of the report is limited to the extent that the test sample is representative of production units.

Tested in accordance with the applicable sections of publications: IES LM-79-08 (Sec. 12), IES LM-16-93, IES LM-58-13, CIE 13.3:1995, CIE 15:2004, ANSI C78.377:2015, ANSI C82.77-10:2014.

The luminous intensity values, and other derived quantities, contained in this report are based on the absolute data, as measured.

Prorating the performance of the sample for the use of other component combinations (such as lamp / LED / Ballast / driver), or for use in different environmental conditions than that tested, may produce erroneous results.

This report is free of erasures and corrections.

Photometric intensity values are reported using the CIE Gamma coordinate system as defined in CIE publication number 121.

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This report must not be used by the customer to claim product certification, approval or endorsement by NVLAP, NIST, or any agency of the Federal Government.