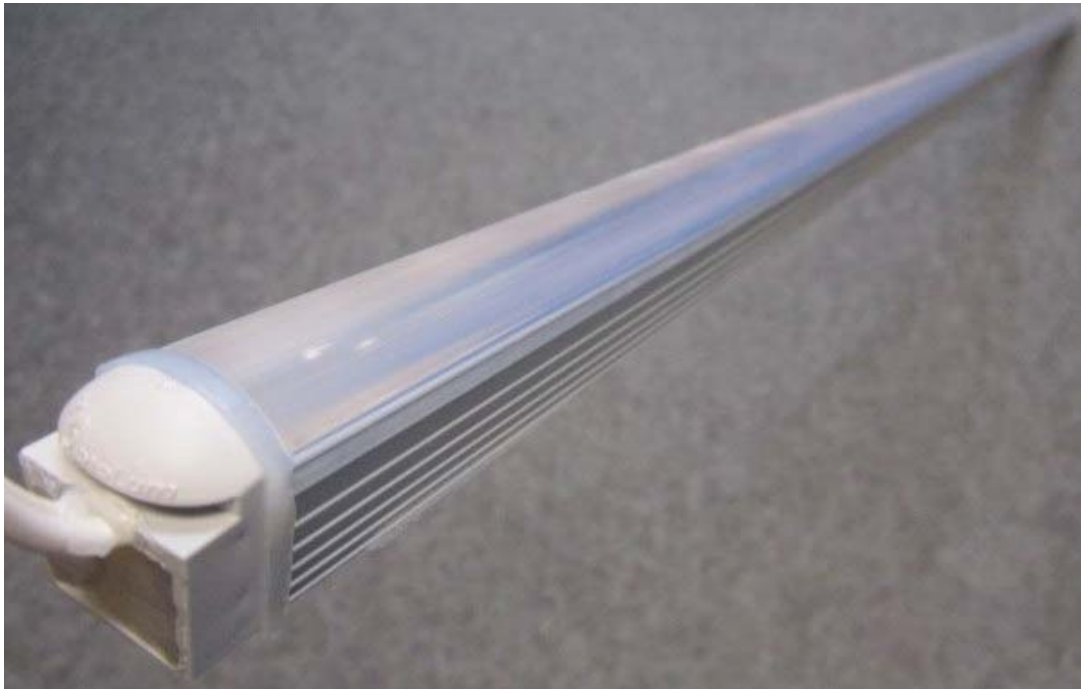


# Report of Test LLI-18230-12

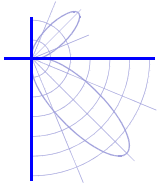
Optolum - Linear strip luminaire. Product ID: FL-LR-H--409SD-A058773  
Extruded aluminum housing with linear clear plastic solid convex lens.  
322 LEDs mounted in single row.  
No driver.  
Operating at 24v DC.



### Performance Summary

Total Light Output	3330 lm
Luminaire Power	35.5 W
Luminous Efficacy	93.8 lm/W
CCT	3940 K
CIE(x,y) 1931	(0.383, 0.376)
CRI	95

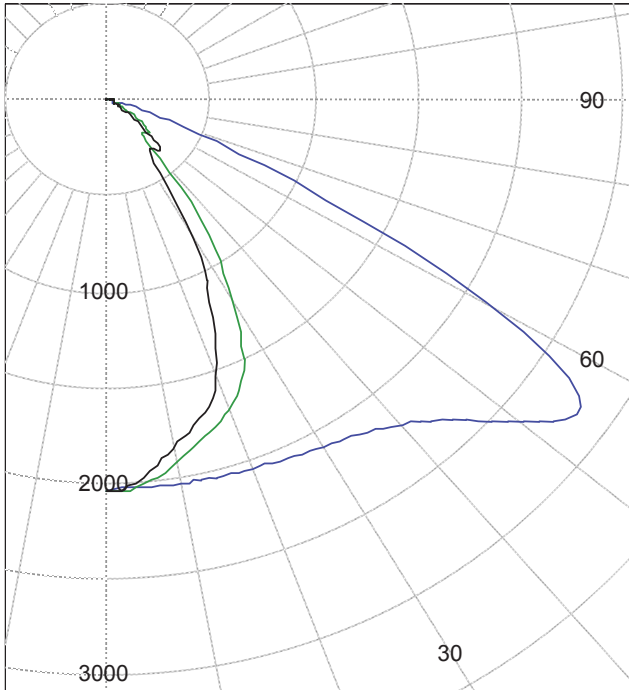
PREPARED FOR : Optolum, Tempe, AZ 85281



**Test Report No. LLI-18230-12**

Optolum - Linear strip luminaire. Product ID: FL-LR-H--409SD-A058773  
Extruded aluminum housing with linear clear plastic solid convex lens.  
322 LEDs mounted in single row.  
No driver.  
Operating at 24v DC.

Legend: C0-Black, C45-Green, C90-Blue (cd)



INTENSITY SUMMARY (cd)

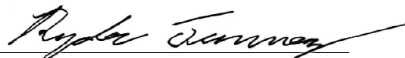
Gamma	C-Plane					Flux (lm)
	C0	C22.5	C45	C67.5	C90	
0.0	2044	2044	2044	2044	2044	
5.0	1982	1987	2011	2039	2033	189
10.0	1844	1857	1923	2008	2035	
15.0	1718	1746	1824	1954	2039	521
20.0	1535	1602	1716	1883	2047	
25.0	1166	1264	1558	1815	2062	715
30.0	839	948	1215	1728	2088	
35.0	400	477	861	1552	2135	651
40.0	331	303	399	1179	2212	
45.0	360	336	235	684	2364	507
50.0	247	274	255	248	2623	
55.0	117	140	201	136	2796	421
60.0	65	74	115	115	2119	
65.0	51	53	73	84	993	194
70.0	44	44	52	61	395	
75.0	38	38	41	44	140	60
80.0	33	33	34	30	46	
85.0	28	29	28	19	11	27
90.0	24	24	23	12	0	

ZONAL FLUX AND PERCENTAGES

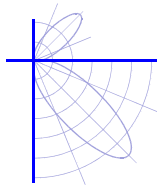
Zone	Flux (lm)	% Lamp	% Luminaire
0-30	1425	N / A	42.8
0-40	2076	N / A	62.3
0-60	3004	N / A	90.2
0-90	3284	N / A	98.6
40-90	1208	N / A	36.3
60-90	280	N / A	8.4
90-180	46	N / A	1.4
0-180	3330	N / A	100.0

Total Light Output = 3,330 lm

Signed:

  
Ryder Tunney  
Authorized Signatory

Date of test 21-Aug-2018  
Date of report 22-Aug-2018

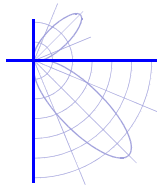


**Test Report No. LLI-18230-12**

Optolum - Linear strip luminaire. Product ID: FL-LR-H--409SD-A058773  
Extruded aluminum housing with linear clear plastic solid convex lens.  
322 LEDs mounted in single row.  
No driver.  
Operating at 24v DC.

**Intensity data (cd)**

Gamma	C-Plane				
	C0	C22.5	C45	C67.5	C90
0.0	2044	2044	2044	2044	2044
2.5	2028	2028	2039	2047	2033
5.0	1982	1987	2011	2039	2033
7.5	1910	1925	1975	2027	2033
10.0	1844	1857	1923	2008	2035
12.5	1787	1806	1871	1986	2037
15.0	1718	1746	1824	1954	2039
17.5	1656	1683	1775	1920	2042
20.0	1535	1602	1716	1883	2047
22.5	1360	1451	1655	1848	2054
25.0	1166	1264	1558	1815	2062
27.5	1031	1082	1404	1774	2073
30.0	839	948	1215	1728	2088
32.5	592	717	1031	1659	2108
35.0	400	477	861	1552	2135
37.5	329	341	625	1392	2168
40.0	331	303	399	1179	2212
42.5	355	317	267	940	2275
45.0	360	336	235	684	2364
47.5	323	325	244	430	2482
50.0	247	274	255	248	2623
52.5	171	201	242	164	2757
55.0	117	140	201	136	2796
57.5	84	98	153	127	2601
60.0	65	74	115	115	2119
62.5	56	60	90	99	1505
65.0	51	53	73	84	993
67.5	47	48	60	72	634
70.0	44	44	52	61	395
72.5	41	41	45	52	239
75.0	38	38	41	44	140
77.5	36	36	37	37	81
80.0	33	33	34	30	46
82.5	30	31	31	24	24
85.0	28	29	28	19	11
87.5	26	26	26	15	0
90.0	24	24	23	12	0

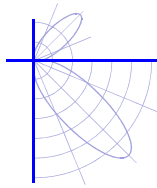


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Optolum - Linear strip luminaire. Product ID: FL-LR-H--409SD-A058773  
Extruded aluminum housing with linear clear plastic solid convex lens.  
322 LEDs mounted in single row.  
No driver.  
Operating at 24v DC.

**Intensity data (cd)**

Gamma	C-Plane				
	C0	C22.5	C45	C67.5	C90
90.0	24	24	23	12	0
92.5	22	22	21	10	0
95.0	20	20	19	8	0
97.5	19	19	17	7	0
100.0	18	17	16	6	0
102.5	16	16	14	5	0
105.0	15	14	13	5	0
107.5	13	13	12	4	0
110.0	13	12	10	4	0
112.5	12	11	9	4	0
115.0	12	11	8	4	0
117.5	11	10	8	4	0
120.0	11	10	7	4	0
122.5	10	9	7	0	0
125.0	10	9	7	4	0
127.5	10	9	7	0	0
130.0	10	9	7	0	0
132.5	9	9	7	0	0
135.0	9	9	7	0	0
137.5	9	9	6	0	0
140.0	9	8	6	0	0
142.5	8	8	6	0	0
145.0	8	7	5	0	0
147.5	7	7	5	0	0
150.0	7	6	4	0	0
152.5	6	6	0	0	0
155.0	6	5	0	0	0
157.5	5	4	0	0	0
160.0	4	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



**Test Report No. LLI-18230-12**

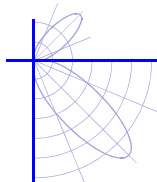
Optolum - Linear strip luminaire. Product ID: FL-LR-H--409SD-A058773  
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Operating at 24v DC.

**LM-79 Performance Data**

<b>Spectral</b>	CIE 1931 (x, y) <sup>(1)</sup>	(0.383, 0.376)
	CIE 1976 (u', v') <sup>(1)</sup>	(0.227, 0.502)
	Correlated Color Temperature (CCT) <sup>(1)</sup>	3940 K
	Spatial Δ (u', v') Uniformity <sup>(2)</sup>	4.67E-03
	Color Rendering Index (Ra) <sup>(1)</sup>	95.3
	Special CRI 9 (R <sub>9</sub> ) <sup>(1),(3)</sup>	81.0
	Distance from Planckian Locus (Duv) <sup>(1),(3)</sup>	-8.03E-04
	Scotopic/Photopic Ratio <sup>(1),(3)</sup>	1.76
<b>Electrical</b>	Voltage	24.00 V
	Current	1.480 A
	Power	35.5 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



**Test Report No. LLI-18230-12**

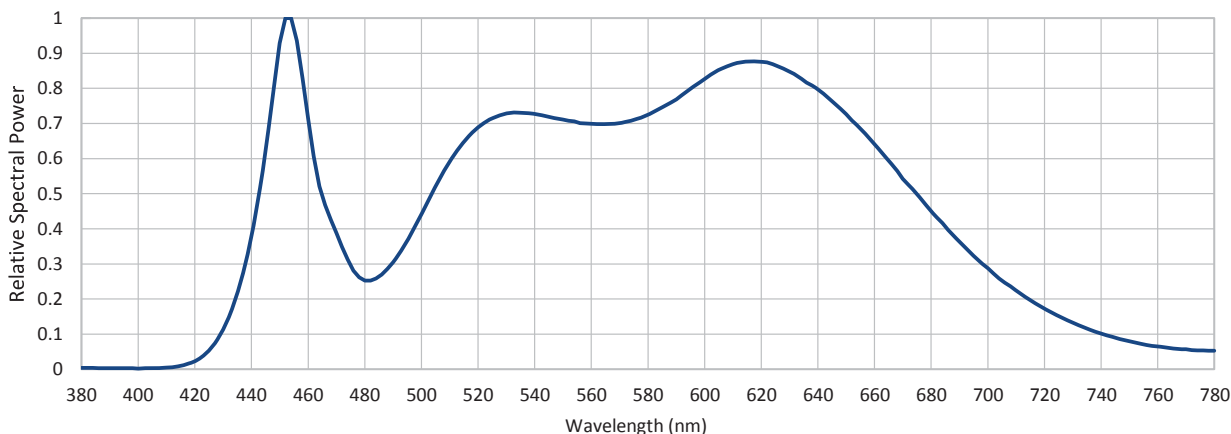
Optolum - Linear strip luminaire. Product ID: FL-LR-H--409SD-A058773  
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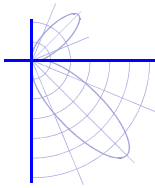
**LM-79 Performance Data**

**Relative spectral power distribution**

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

$\lambda$ (nm)	Relative Power	$\lambda$ (nm)	Relative Power	$\lambda$ (nm)	Relative Power	$\lambda$ (nm)	Relative Power	$\lambda$ (nm)	Relative Power
380	0.004	460	0.711	540	0.727	620	0.876	700	0.288
385	0.003	465	0.495	545	0.719	625	0.865	705	0.253
390	0.003	470	0.387	550	0.711	630	0.848	710	0.224
395	0.003	475	0.297	555	0.704	635	0.823	715	0.197
400	0.002	480	0.253	560	0.699	640	0.797	720	0.172
405	0.003	485	0.264	565	0.698	645	0.763	725	0.152
410	0.005	490	0.305	570	0.701	650	0.727	730	0.133
415	0.010	495	0.366	575	0.710	655	0.685	735	0.116
420	0.023	500	0.443	580	0.725	660	0.642	740	0.102
425	0.054	505	0.521	585	0.746	665	0.594	745	0.090
430	0.113	510	0.591	590	0.769	670	0.542	750	0.080
435	0.217	515	0.648	595	0.799	675	0.499	755	0.071
440	0.379	520	0.689	600	0.827	680	0.451	760	0.065
445	0.625	525	0.714	605	0.852	685	0.406	765	0.060
450	0.929	530	0.728	610	0.869	690	0.363	770	0.057
455	0.968	535	0.731	615	0.876	695	0.323	775	0.054
								780	0.053





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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	( 0.228, 0.502)	( 0.227, 0.502)
5.0	( 0.227, 0.502)	( 0.227, 0.502)
10.0	( 0.229, 0.503)	( 0.227, 0.502)
15.0	( 0.228, 0.502)	( 0.228, 0.502)
20.0	( 0.227, 0.502)	( 0.227, 0.502)
25.0	( 0.228, 0.504)	( 0.227, 0.502)
30.0	( 0.226, 0.502)	( 0.227, 0.501)
35.0	( 0.228, 0.503)	( 0.226, 0.500)
40.0	( 0.225, 0.500)	( 0.225, 0.500)
45.0	( 0.225, 0.500)	( 0.225, 0.499)

**Spatial measurements**

Vert. angle (°)	CIE 1976 (u',v') coordinates	
	Horiz. 0.0° plane	Horiz. ° plane
45.0	( 0.225, 0.500)	( 0.225, 0.499)
50.0	I <= 10% peak	( 0.225, 0.500)
55.0	I <= 10% peak	( 0.226, 0.502)
60.0	I <= 10% peak	( 0.228, 0.505)
65.0	I <= 10% peak	( 0.229, 0.506)
70.0	I <= 10% peak	( 0.229, 0.504)
75.0	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 1.75 / 2.75 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.

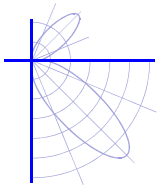
CIE (x, y) coordinates	± 0.003	CCT	± 100 K
CIE (u', v') coordinates	± 0.002	CRI (Ra)	± 2
Spatial Δ (u', v') uniformity	± 0.001	Scotopic / Photopic Ratio *	± 0.02
Rel. Spectral Irradiance *	± 2 %	R9 *	± 2
Duv *	± 5E-04		

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.

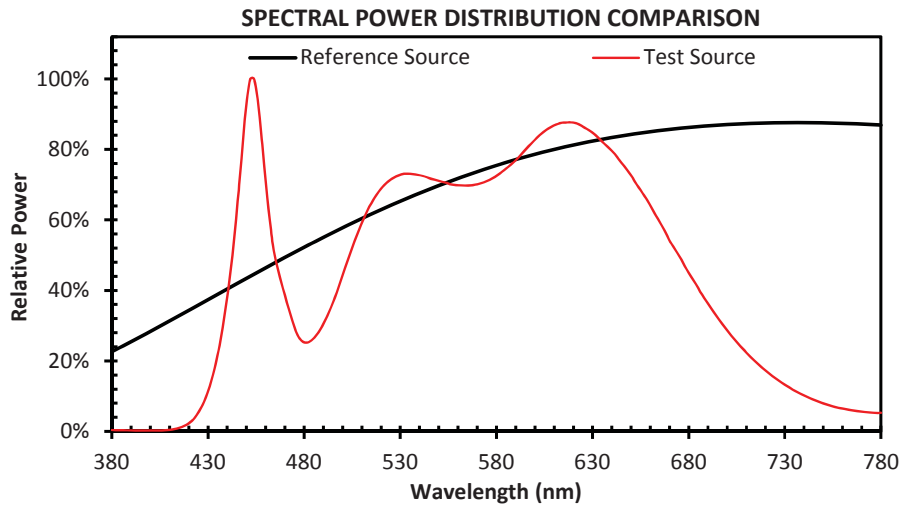
Calculator / report version 1.0.10 / 5.9 (14th Dec 2017)



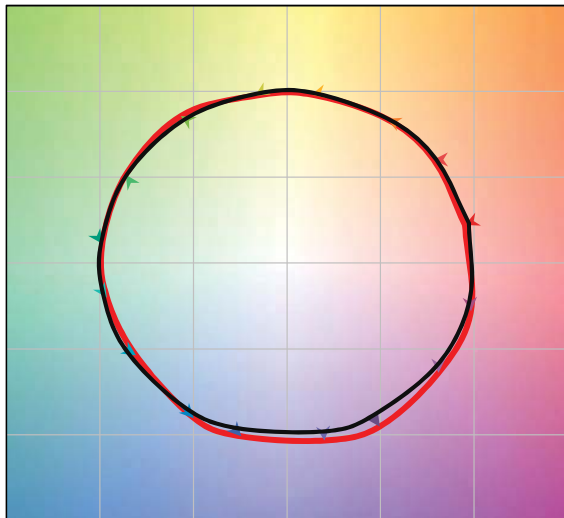
**Test Report No. LLI-18230-12**

Optolum - Linear strip luminaire. Product ID: FL-LR-H--409SD-A058773  
Extruded aluminum housing with linear clear plastic solid convex lens.  
322 LEDs mounted in single row.  
No driver.  
Operating at 24v DC.

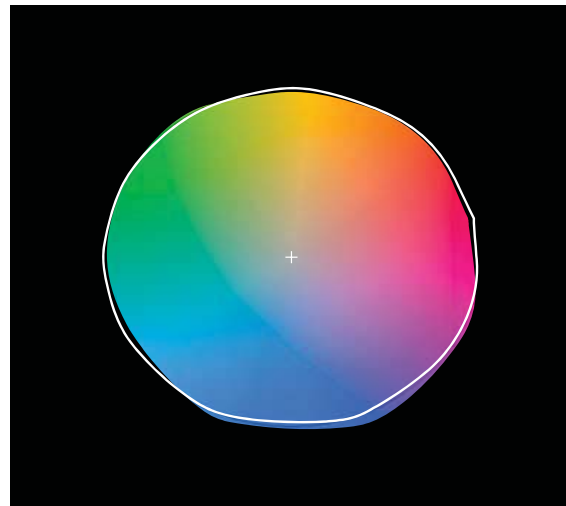
$R_f$	91
$R_g$	102



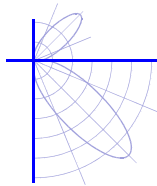
COLOR VECTOR GRAPHIC



COLOR DISTORTION GRAPHIC







**Test Report No. LLI-18230-12**

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322 LEDs mounted in single row.  
No driver.  
Operating at 24v DC.

**Test Distance** 8.0 m  
**Test Temperature** 25.5 °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.

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

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.