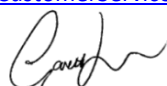


astro

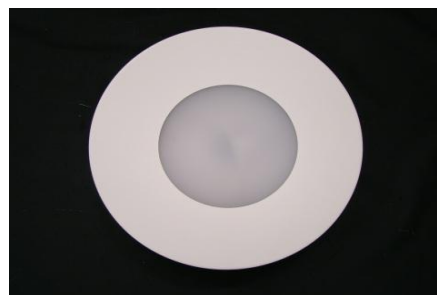
PHOTOMETRIC
TEST REPORT

Report Number	GNC-24029
Customer	Astro Lighting Limited
Contact	David Green
Product Type	LED Downlight
Test Purpose	Generation of photometric data
Quote Reference	Q-LUX18-300513
Works Order Number	WO-24029
Test Item Reference	TI-21181
LAB Test Method Reference	Goniometric (Type C) Intensity Scan - IES/LDT Files & Report - Scan Increments 15 degrees Azimuth by 2.5 degrees inclination
Test Standards	LM-79-08; (BS) EN 13032-4:2015; CIE S025:2015
Lab Location Reference	LUX-TSI
Tested by	Mike Sewell
Date of Test	22-03-19
Reviewed by	Gareth Jones
Number of products tested	1

Address: LUX-TSI Ltd.,
Pencoed Technology Park,
Pencoed, Bridgend,
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Telephone: +44 (0) 1656 864618
Authorised by: G. Jones
Email: CustomerService@lux-tsi.com
Signed:



Date: 22/03/2019



Zero Round

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Nomenclature

Lamp Orientation described below relates to the position in which a lamp is designed to operate for maximum performance and safety, these include:

BD - Base Down (bulb is vertically positioned with the metal base at the bottom, glass up)

BU - Base Up (bulb is vertically positioned with the metal base at the top, glass hanging down)

HBD - Horizontal $+15^{\circ}$ to Base Down

H45 - Horizontal to -45° only

VBU - Vertical Base Up $\pm 15^{\circ}$

VBD - Vertical Base Down $\pm 15^{\circ}$

HBU - Base Up $\pm 90^{\circ}$ (bulb can be operated in a base up or horizontal position)

HOR - Horizontal Burn (bulb is positioned with the metal base parallel to the ground)

H75 - Horizontal $\pm 75^{\circ}$ (bulb should not be operated within 15° of vertical)

U - Universal Burn (burn can be operated in any position)

Test Conditions

Measurements were made with an ambient temperature of $25^{\circ}\text{C} \pm 1^{\circ}\text{C}$. Measurements were taken only after sufficient time for thermal stabilisation has been allowed. Thermal stabilisation according to LM-79-08 was achieved before measurements are measured and reported.

Calibrations

The far field Type C Goniophotometer is calibrated using an intensity lamp calibrated by a NVLAP accredited calibration laboratory. The integrating sphere spectroradiometer system has been calibrated using a Reference Standard Lamp traceable to NPL.

Test Equipment

UL LSI Custom Far-Field Type C Moving Mirror Goniophotometer measures intensity as a function of angle. Spectral measurements are measured using a Labsphere 1 metre integrating sphere.

Data Formats

IES (15 deg azimuth and 2.5 deg inclination) and LDT (15 deg C planes and 2.5 deg gamma angles)

Spectral Data file from which the calculation of chromaticity and CRI etc. have been performed and the derived results from the LightMtrX software are provided as a text file format.

All photometric data for LED products will be provided in ABSOLUTE photometric format and all non-LED data will be in relative photometric format with lamp lumens measured separately, where possible, for LOR estimation.

Product Name	Zero Round
Part/Serial Number	1382004
Type of Product	LED Downlight
Base Type	Not Applicable - Luminaire
Driver Type	Internal
Test Time	30 mins
Operating Orientation	Base Up
Test Orientation	Base Up
Ambient Temperature	25.3°C
Manufacturer	Astro Lighting Limited
Date of Manufacture	Not Available
Thermal Management	Passive
Dimmable	No
Pre-Burning Time	0 hours
Stabilisation Time	60 mins
Humidity	33.6% RH
Averaging Applied	NONE



Driver Details		
Manufacturer	ERP	
Model	ESS020W-0350-56	
Part/Serial #	REW035056CF0219A00220	
Rated Voltage	120-277V	
Output	Current	0.350 A
	Voltage	40-56

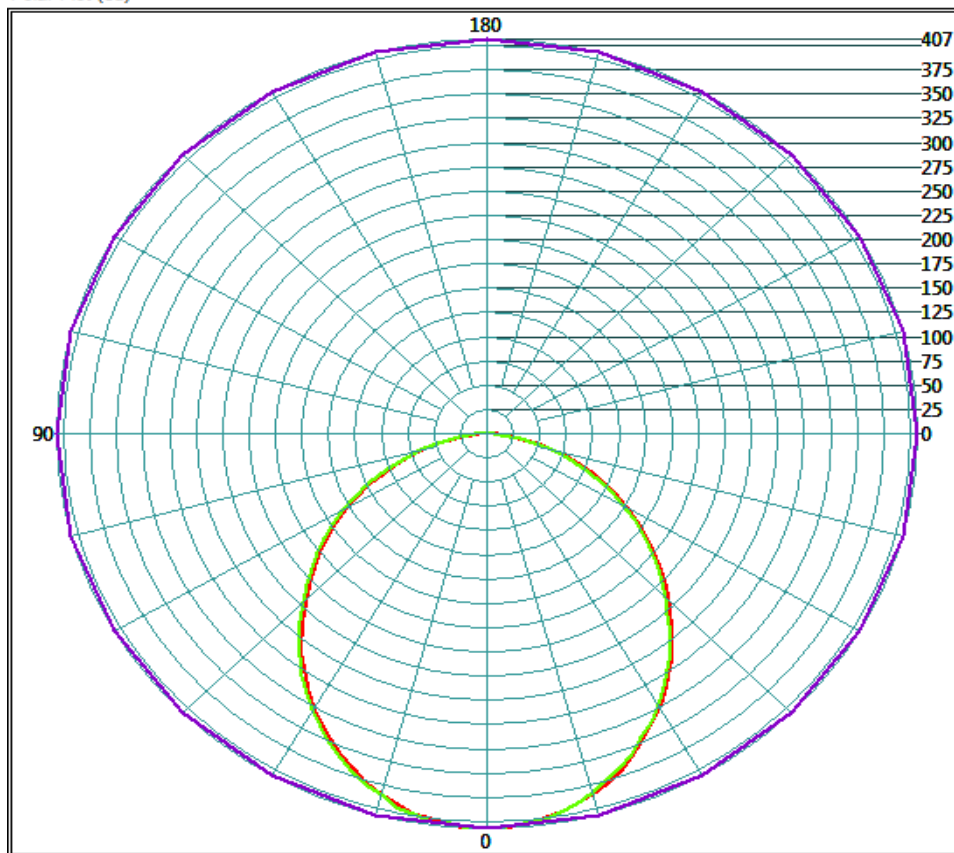
Photometric Measurements	
Luminous Flux	1052 lm
Luminous Efficacy	63 lm/W

Dimension	Sample	Luminous Opening
Diameter/Width	450 mm Φ	225 mm Φ
Length		
Height/Depth	50 mm	20 mm

Electrical Measurements	
Frequency	60 Hz
Voltage	119.9 V
Current	0.142 A
Power	16.8 W
Power Factor	0.989
Apparent Power	17.0 VA

Goniophotometric Measurements		
Beam Angle	Horizontal	103°
	Vertical	103°
On-axis Intensity		407 cd
Peak Intensity		407 cd
Peak Direction	Horizontal	75°
	Vertical	3°

Polar Plot (cd)



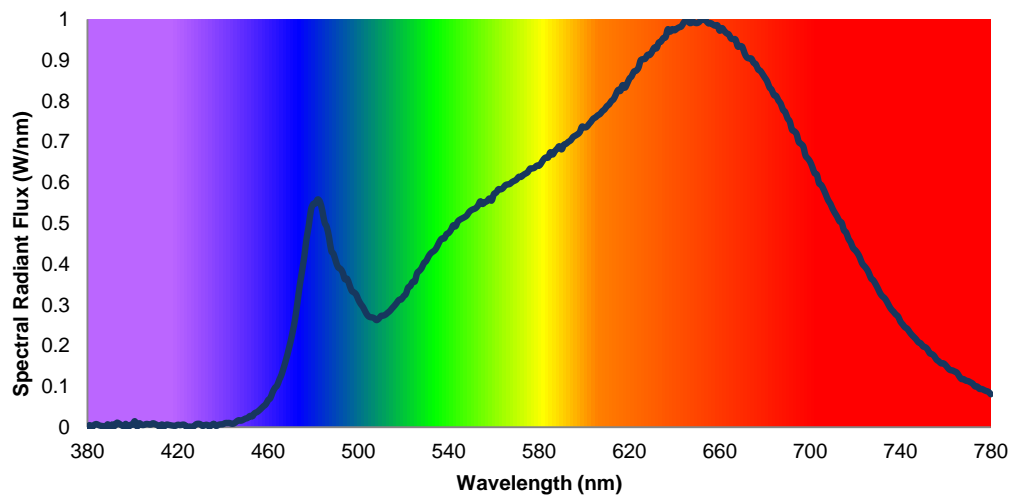
Mounting Height (m)	Beam Width (m)		Projected Illuminance (lux)
	C0-C180 plane	C90-270 plane	
0.5	1.3	1.3	1627
1	2.5	2.5	407
2	5.0	5.0	102
3	7.6	7.6	45
4	10.1	10.1	25
5	12.6	12.6	16
7.5	18.9	18.9	7
10	25.2	25.2	4
20	50.4	50.5	1

Spectral Results

Integrated Spectral Measurement using spectroradiometer and 1 metre integrating sphere

The following data was determined from an integrated spectral measurement using a spectrometer. This will produce spatially averaged spectroradiometric results measured in an integrating sphere.

Spectral Radiant Flux versus Wavelength



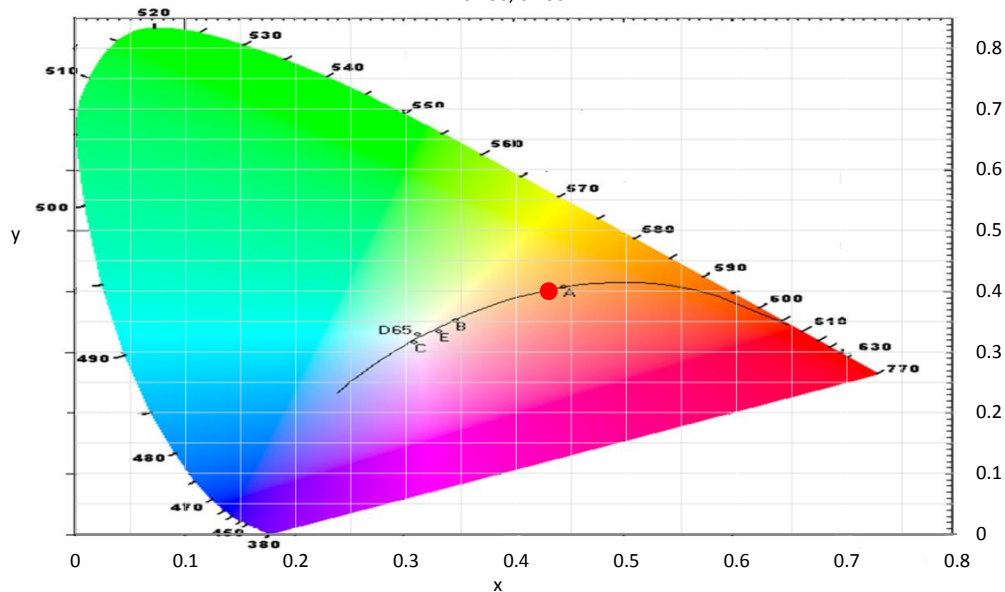
Colour Rendering Index Detail			
R1	95	R8	85
R2	98	R9	67
R3	99	R10	95
R4	95	R11	96
R5	95	R12	83
R6	97	R13	96
R7	93	R14	99

Colorimetric Details	
CCT	3084K
CRI (Ra)	95

Chromaticity Coordinates		
CIE 1931	x	0.4298
	y	0.3996
CIE 1960	u	0.2479
	v	0.3457
CIE 1976	u'	0.2479
	v'	0.5185
Duv		0.0014

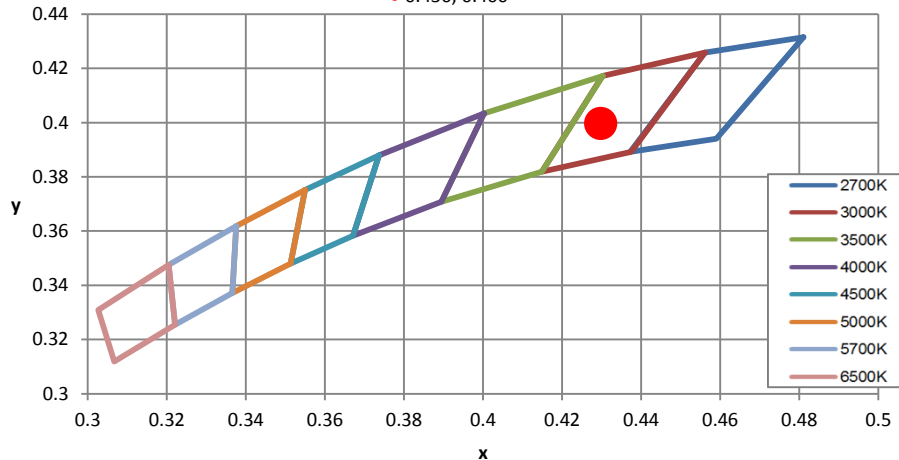
CIE 1931 Colour Chart

• 0.430, 0.400



CIE 1931 x, y Chromaticity Diagram - Nominal CCT Quadrangles

• 0.430, 0.400



Spectral Power Distribution

λ (nm)	W/nm	λ (nm)	W/nm	λ (nm)	W/nm	λ (nm)	W/nm
380	0.00E+00	430	7.20E-03	480	5.47E-01	530	4.07E-01
381	5.04E-03	431	2.94E-03	481	5.49E-01	531	4.18E-01
382	0.00E+00	432	4.92E-03	482	5.59E-01	532	4.26E-01
383	5.64E-03	433	5.76E-03	483	5.52E-01	533	4.30E-01
384	7.55E-03	434	1.45E-03	484	5.31E-01	534	4.35E-01
385	4.97E-03	435	5.26E-03	485	5.02E-01	535	4.44E-01
386	3.18E-03	436	8.24E-03	486	4.91E-01	536	4.56E-01
387	2.48E-03	437	2.85E-03	487	4.65E-01	537	4.63E-01
388	9.08E-04	438	5.65E-03	488	4.32E-01	538	4.63E-01
389	7.08E-03	439	6.87E-03	489	4.24E-01	539	4.73E-01
390	1.08E-03	440	7.14E-03	490	4.06E-01	540	4.76E-01
391	6.65E-03	441	1.00E-02	491	3.92E-01	541	4.84E-01
392	2.81E-03	442	1.01E-02	492	3.88E-01	542	4.95E-01
393	1.07E-02	443	1.02E-02	493	3.80E-01	543	4.92E-01
394	8.96E-03	444	8.25E-03	494	3.63E-01	544	5.04E-01
395	5.10E-03	445	9.39E-03	495	3.64E-01	545	5.09E-01
396	2.67E-03	446	1.37E-02	496	3.49E-01	546	5.12E-01
397	8.01E-03	447	1.70E-02	497	3.35E-01	547	5.15E-01
398	0.00E+00	448	1.58E-02	498	3.30E-01	548	5.19E-01
399	5.48E-03	449	1.82E-02	499	3.25E-01	549	5.27E-01
400	6.23E-03	450	2.11E-02	500	3.12E-01	550	5.32E-01
401	1.45E-02	451	2.25E-02	501	3.02E-01	551	5.35E-01
402	1.70E-03	452	2.77E-02	502	2.95E-01	552	5.37E-01
403	9.50E-03	453	2.63E-02	503	2.84E-01	553	5.44E-01
404	5.68E-03	454	3.40E-02	504	2.74E-01	554	5.54E-01
405	5.36E-03	455	3.65E-02	505	2.70E-01	555	5.47E-01
406	7.84E-03	456	4.08E-02	506	2.69E-01	556	5.52E-01
407	7.25E-03	457	4.60E-02	507	2.67E-01	557	5.54E-01
408	6.21E-03	458	5.15E-02	508	2.62E-01	558	5.61E-01
409	9.55E-03	459	5.61E-02	509	2.66E-01	559	5.56E-01
410	7.56E-03	460	6.62E-02	510	2.73E-01	560	5.72E-01
411	4.85E-03	461	7.11E-02	511	2.74E-01	561	5.75E-01
412	1.53E-03	462	8.54E-02	512	2.76E-01	562	5.83E-01
413	6.63E-03	463	9.59E-02	513	2.81E-01	563	5.83E-01
414	2.05E-03	464	1.02E-01	514	2.85E-01	564	5.86E-01
415	6.37E-03	465	1.16E-01	515	2.92E-01	565	5.93E-01
416	5.49E-03	466	1.29E-01	516	2.98E-01	566	5.95E-01
417	4.42E-03	467	1.48E-01	517	3.05E-01	567	5.96E-01
418	3.62E-03	468	1.66E-01	518	3.12E-01	568	6.01E-01
419	3.28E-03	469	1.88E-01	519	3.13E-01	569	6.04E-01
420	6.05E-03	470	2.11E-01	520	3.21E-01	570	6.07E-01
421	4.83E-03	471	2.37E-01	521	3.26E-01	571	6.14E-01
422	5.99E-03	472	2.67E-01	522	3.42E-01	572	6.14E-01
423	5.69E-03	473	3.05E-01	523	3.46E-01	573	6.18E-01
424	0.00E+00	474	3.46E-01	524	3.56E-01	574	6.22E-01
425	1.47E-03	475	3.81E-01	525	3.57E-01	575	6.25E-01
426	1.10E-03	476	4.17E-01	526	3.78E-01	576	6.34E-01
427	1.58E-03	477	4.61E-01	527	3.83E-01	577	6.34E-01
428	6.68E-03	478	4.93E-01	528	3.90E-01	578	6.36E-01
429	8.29E-03	479	5.33E-01	529	4.02E-01	579	6.41E-01
						580	6.41E-01

Spectral Power Distribution

λ (nm)	W/nm	λ (nm)	W/nm	λ (nm)	W/nm	λ (nm)	W/nm
581	6.48E-01	631	9.31E-01	681	8.48E-01	731	3.29E-01
582	6.57E-01	632	9.29E-01	682	8.34E-01	732	3.21E-01
583	6.61E-01	633	9.43E-01	683	8.27E-01	733	3.16E-01
584	6.61E-01	634	9.46E-01	684	8.14E-01	734	3.08E-01
585	6.74E-01	635	9.54E-01	685	8.12E-01	735	2.97E-01
586	6.68E-01	636	9.56E-01	686	8.01E-01	736	2.89E-01
587	6.77E-01	637	9.76E-01	687	7.93E-01	737	2.83E-01
588	6.83E-01	638	9.69E-01	688	7.78E-01	738	2.76E-01
589	6.89E-01	639	9.76E-01	689	7.73E-01	739	2.71E-01
590	6.81E-01	640	9.73E-01	690	7.58E-01	740	2.59E-01
591	6.92E-01	641	9.77E-01	691	7.49E-01	741	2.52E-01
592	6.95E-01	642	9.80E-01	692	7.29E-01	742	2.45E-01
593	7.00E-01	643	9.83E-01	693	7.25E-01	743	2.42E-01
594	7.03E-01	644	9.92E-01	694	7.19E-01	744	2.34E-01
595	7.11E-01	645	9.97E-01	695	6.99E-01	745	2.27E-01
596	7.15E-01	646	9.95E-01	696	6.95E-01	746	2.21E-01
597	7.18E-01	647	9.90E-01	697	6.88E-01	747	2.15E-01
598	7.23E-01	648	9.95E-01	698	6.66E-01	748	2.08E-01
599	7.37E-01	649	9.92E-01	699	6.59E-01	749	2.06E-01
600	7.35E-01	650	9.91E-01	700	6.51E-01	750	1.98E-01
601	7.36E-01	651	9.94E-01	701	6.38E-01	751	1.96E-01
602	7.42E-01	652	1.00E+00	702	6.23E-01	752	1.91E-01
603	7.49E-01	653	1.00E+00	703	6.19E-01	753	1.81E-01
604	7.56E-01	654	9.96E-01	704	5.98E-01	754	1.79E-01
605	7.59E-01	655	9.90E-01	705	5.93E-01	755	1.74E-01
606	7.65E-01	656	9.91E-01	706	5.83E-01	756	1.65E-01
607	7.68E-01	657	9.87E-01	707	5.70E-01	757	1.62E-01
608	7.75E-01	658	9.84E-01	708	5.56E-01	758	1.56E-01
609	7.79E-01	659	9.85E-01	709	5.48E-01	759	1.57E-01
610	7.87E-01	660	9.72E-01	710	5.35E-01	760	1.52E-01
611	7.91E-01	661	9.79E-01	711	5.25E-01	761	1.45E-01
612	8.00E-01	662	9.72E-01	712	5.16E-01	762	1.40E-01
613	8.04E-01	663	9.66E-01	713	5.05E-01	763	1.39E-01
614	8.16E-01	664	9.63E-01	714	5.01E-01	764	1.36E-01
615	8.27E-01	665	9.53E-01	715	4.83E-01	765	1.34E-01
616	8.24E-01	666	9.52E-01	716	4.77E-01	766	1.25E-01
617	8.39E-01	667	9.50E-01	717	4.62E-01	767	1.18E-01
618	8.32E-01	668	9.33E-01	718	4.53E-01	768	1.18E-01
619	8.42E-01	669	9.35E-01	719	4.40E-01	769	1.14E-01
620	8.54E-01	670	9.32E-01	720	4.34E-01	770	1.13E-01
621	8.61E-01	671	9.17E-01	721	4.27E-01	771	1.10E-01
622	8.72E-01	672	9.07E-01	722	4.16E-01	772	1.07E-01
623	8.74E-01	673	9.04E-01	723	4.02E-01	773	1.00E-01
624	8.81E-01	674	9.04E-01	724	3.95E-01	774	9.98E-02
625	9.00E-01	675	8.94E-01	725	3.88E-01	775	9.38E-02
626	9.02E-01	676	8.90E-01	726	3.78E-01	776	9.37E-02
627	9.03E-01	677	8.77E-01	727	3.65E-01	777	9.10E-02
628	9.13E-01	678	8.74E-01	728	3.60E-01	778	8.86E-02
629	9.12E-01	679	8.65E-01	729	3.51E-01	779	8.67E-02
630	9.20E-01	680	8.57E-01	730	3.40E-01	780	8.07E-02

Measurement Uncertainty

The following is the reported expanded uncertainty of the UL 6440T Type C Mirror Goniophotometer. Colrimetric expanded uncertainty is estimated using the 1 metre integrating sphere

Parameter	Uncertainty
Total Luminous Flux (%)	± 4.9
Luminous Intensity (%)	± 4.9
Correlated Color Temperature	± 100 K
CRI	± 2
Chromaticity x	± 0.005
Chromaticity y	± 0.005
Temperature ($^{\circ}$ C)	± 1.0
Voltage DC TY720 (%)	± 0.017
Current DC TY720 (%)	± 0.10
Voltage AC WT210 (%)	± 0.059
Current AC WT210 (%)	± 0.025
Power AC WT210 (%)	± 0.23
Frequency (50/60 Hz) WT210 (%)	± 0.004
Power Factor WT210 (%)	± 0.06

The reported expanded uncertainty is based on the combined standard uncertainty multiplied by a coverage factor of $k = 2$. This value of k gives a coverage probability of approximately 95%, assuming a normal distribution. This determination of the measurement uncertainty has been done in accordance with international requirements including UKAS, BIPM Guide to the Expression of Uncertainty in Measurement and CIE 198:2011 and CIE S 025/E:2015.

Electrical measurement equipment used for the determination of results for this report, are compliant and meet the performance requirements of the measurement standards used.

----- END OF REPORT -----



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Test Report Number: GNC-24029
Test Item: TI-21181

