

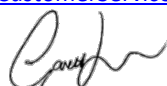
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PHOTOMETRIC  
TEST REPORT

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<b>Report Number</b>	GNC-1796
<b>Customer</b>	Astro Lighting Limited
<b>Contact</b>	Matthew Grainger
<b>Product Type</b>	LED Linear
<b>Test Purpose</b>	Generation of photometric data
<b>Quote Reference</b>	Q-LUX18-300167
<b>Works Order Number</b>	WO-1796
<b>Test Item Reference</b>	TI-20005
<b>LAB Test Method Reference</b>	Goniometric (Type C) Intensity Scan - IES/LDT Files & Report - Scan Increments 15 degrees Azimuth by 2.5 degrees inclination
<b>Test Standards</b>	LM-79-08; (BS) EN 13032-4:2015; CIE S025:2015
<b>Lab Location Reference</b>	LUX-TSI
<b>Tested by</b>	Mike Sewell
<b>Date of Test</b>	19-10-18
<b>Reviewed by</b>	Gareth Jones
<b>Number of products tested</b>	1

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Date: 24/10/2018



Dio

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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  $-45^{\circ}$  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  $15^{\circ}$  of vertical)

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

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### 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.

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### Calibrations

The far field Type C Goniophotometer is calibrated using an intensity lamp calibrated by a NVLAP accredited calibration laboratory.

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### 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.

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### 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	Dio
Part/Serial Number	1305006
Type of Product	LED Linear
Base Type	Not Applicable - Luminaire
Driver Type	Internal
Test Time	30 mins
Operating Orientation	Base Up
Test Orientation	Base Up
Ambient Temperature	24.7°C
Manufacturer	Astro Lighting Limited
Date of Manufacture	Not Available
Thermal Management	Passive
Dimmable	No
Pre-Burning Time	0 hours
Stabilisation Time	30 mins
Humidity	40.2% RH
Averaging Applied	NONE



Driver Details		
Manufacturer	Self	
Model	SLT6-700IL-4	
Part/Serial #	N/A	
Rated Voltage	100-240V	
Output	Current	0.500 A
	Voltage	12.0 V

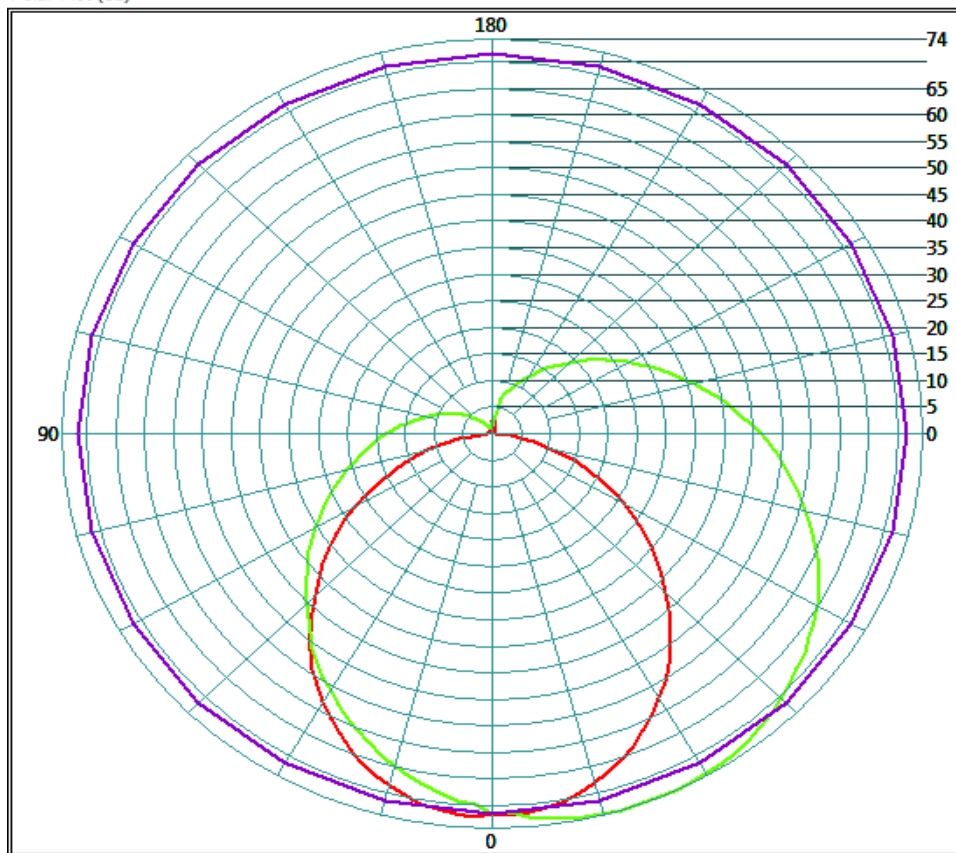
Photometric Measurements	
Luminous Flux	320 lm
Luminous Efficacy	50 lm/W

Dimension	Sample	Luminous Opening
Diameter/Width	40 mm	40 mm
Length	340 mm	335 mm
Height/Depth	90 mm	35 mm

Electrical Measurements	
Frequency	50 Hz
Voltage	240.1 V
Current	0.069 A
Power	6.4 W
Power Factor	0.386
Apparent Power	16.5 VA

Goniophotometric Measurements		
Beam Angle	Horizontal	147°
	Vertical	113°
On-axis Intensity		72 cd
Peak Intensity		74 cd
Peak Direction	Horizontal	270°
	Vertical	18°

Polar Plot (cd)



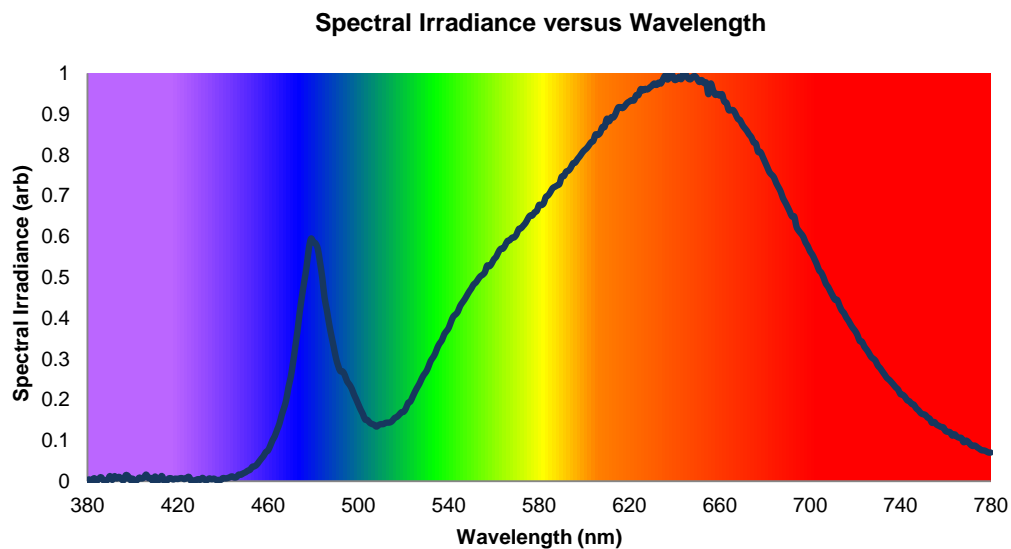
0.00	
180.00	
90.00	
270.00	
0.00	

Mounting Height (m)	Beam Width (m)		Projected Illuminance (lux)
	C0-C180 plane	C90-270 plane	
0.5	3.4	1.5	286
1	6.8	3.0	72
2	13.6	6.1	18
3	20.3	9.1	8
4	27.1	12.1	4
5	33.9	15.2	3
7.5	50.8	22.7	1
10	67.8	30.3	1
20	135.6	60.6	0

## 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.



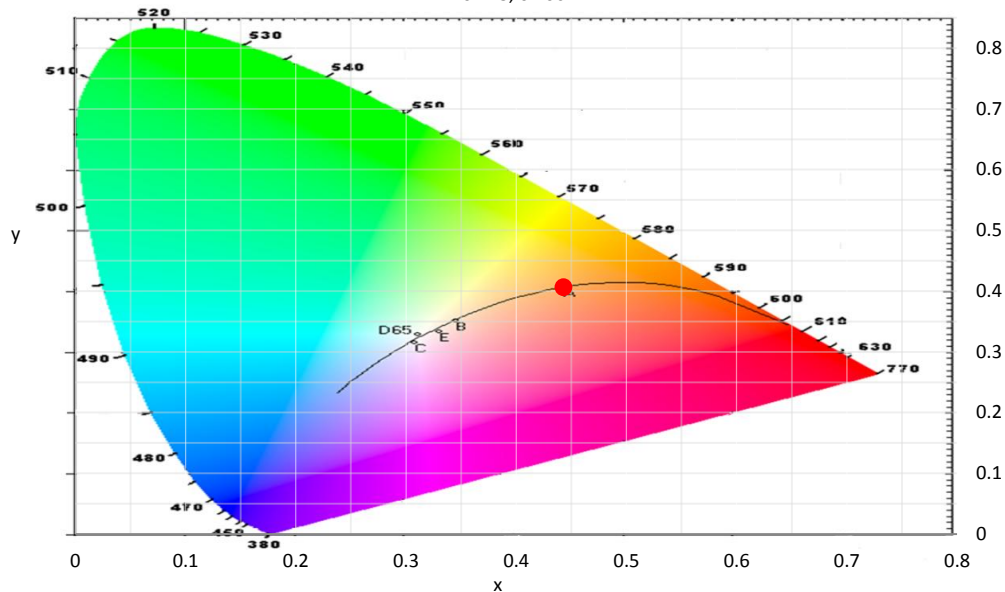
Colour Rendering Index Detail			
R1	83	R8	70
R2	89	R9	31
R3	94	R10	74
R4	83	R11	81
R5	82	R12	65
R6	85	R13	84
R7	88	R14	96

Colorimetric Details	
CCT	2917K
CRI (Ra)	84

Chromaticity Coordinates		
CIE 1931	x	0.4430
	y	0.4063
CIE 1960	u	0.2535
	v	0.3488
CIE 1976	u'	0.2535
	v'	0.5232
Duv		0.0002

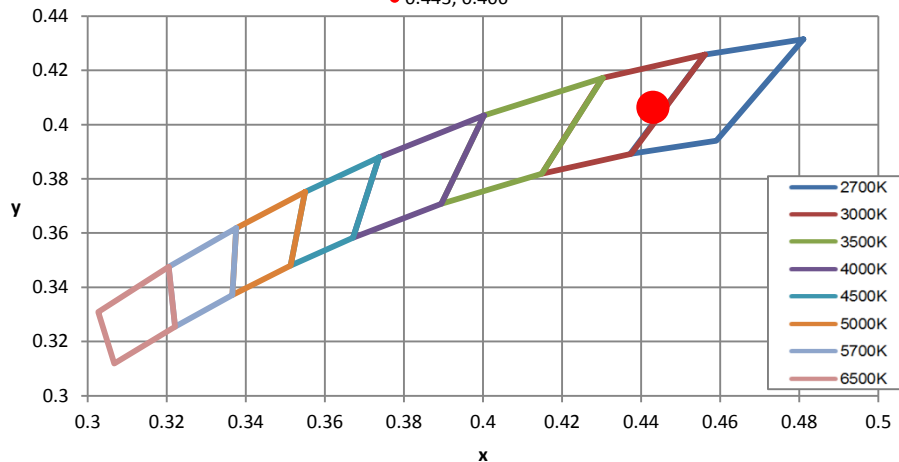
CIE 1931 Colour Chart

• 0.443, 0.406



CIE 1931 x, y Chromaticity Diagram - Nominal CCT Quadrangles

• 0.443, 0.406



### Spectral Power Distribution

$\lambda$ (nm)	Arb units	$\lambda$ (nm)	Arb units	$\lambda$ (nm)	Arb units	$\lambda$ (nm)	Arb units
380	2.77E-03	430	2.98E-03	480	5.87E-01	530	2.68E-01
381	4.31E-03	431	8.08E-03	481	5.83E-01	531	2.80E-01
382	0.00E+00	432	2.89E-03	482	5.70E-01	532	2.95E-01
383	7.36E-03	433	2.62E-03	483	5.37E-01	533	3.03E-01
384	0.00E+00	434	6.79E-03	484	4.99E-01	534	3.13E-01
385	5.65E-03	435	4.35E-03	485	4.50E-01	535	3.28E-01
386	9.72E-03	436	6.18E-03	486	4.20E-01	536	3.38E-01
387	2.55E-03	437	2.84E-03	487	3.87E-01	537	3.46E-01
388	4.11E-04	438	3.07E-03	488	3.58E-01	538	3.60E-01
389	3.88E-03	439	2.76E-03	489	3.31E-01	539	3.68E-01
390	1.25E-02	440	7.61E-03	490	3.03E-01	540	3.76E-01
391	3.01E-03	441	6.74E-03	491	2.84E-01	541	3.91E-01
392	1.23E-02	442	7.43E-03	492	2.70E-01	542	4.03E-01
393	6.58E-03	443	9.56E-03	493	2.69E-01	543	4.09E-01
394	1.06E-02	444	1.18E-02	494	2.60E-01	544	4.15E-01
395	5.39E-03	445	9.01E-03	495	2.45E-01	545	4.29E-01
396	1.92E-03	446	9.72E-03	496	2.37E-01	546	4.38E-01
397	1.47E-02	447	1.60E-02	497	2.27E-01	547	4.45E-01
398	1.22E-02	448	1.56E-02	498	2.13E-01	548	4.55E-01
399	2.73E-03	449	1.92E-02	499	2.01E-01	549	4.64E-01
400	6.18E-03	450	2.16E-02	500	1.88E-01	550	4.72E-01
401	0.00E+00	451	2.57E-02	501	1.75E-01	551	4.82E-01
402	2.65E-03	452	2.77E-02	502	1.64E-01	552	4.87E-01
403	8.74E-03	453	3.51E-02	503	1.51E-01	553	4.95E-01
404	6.52E-03	454	3.65E-02	504	1.50E-01	554	5.02E-01
405	8.90E-03	455	4.05E-02	505	1.43E-01	555	5.06E-01
406	1.62E-02	456	4.78E-02	506	1.40E-01	556	5.13E-01
407	7.58E-03	457	5.51E-02	507	1.38E-01	557	5.29E-01
408	7.82E-03	458	6.20E-02	508	1.34E-01	558	5.27E-01
409	9.75E-04	459	7.12E-02	509	1.38E-01	559	5.34E-01
410	1.15E-02	460	7.53E-02	510	1.40E-01	560	5.44E-01
411	2.41E-04	461	8.74E-02	511	1.40E-01	561	5.50E-01
412	6.15E-03	462	1.01E-01	512	1.43E-01	562	5.62E-01
413	1.26E-02	463	1.11E-01	513	1.44E-01	563	5.70E-01
414	0.00E+00	464	1.26E-01	514	1.44E-01	564	5.70E-01
415	0.00E+00	465	1.40E-01	515	1.48E-01	565	5.78E-01
416	6.57E-03	466	1.61E-01	516	1.55E-01	566	5.89E-01
417	7.03E-03	467	1.79E-01	517	1.57E-01	567	5.91E-01
418	4.08E-03	468	1.98E-01	518	1.63E-01	568	5.97E-01
419	6.31E-03	469	2.30E-01	519	1.69E-01	569	5.98E-01
420	5.02E-03	470	2.54E-01	520	1.70E-01	570	6.05E-01
421	7.21E-03	471	2.88E-01	521	1.78E-01	571	6.18E-01
422	7.19E-03	472	3.28E-01	522	1.92E-01	572	6.20E-01
423	4.90E-03	473	3.68E-01	523	1.95E-01	573	6.26E-01
424	8.30E-03	474	4.14E-01	524	2.07E-01	574	6.33E-01
425	1.04E-02	475	4.53E-01	525	2.19E-01	575	6.43E-01
426	0.00E+00	476	4.89E-01	526	2.29E-01	576	6.51E-01
427	1.60E-03	477	5.23E-01	527	2.39E-01	577	6.51E-01
428	2.60E-03	478	5.69E-01	528	2.51E-01	578	6.59E-01
429	5.05E-03	479	5.95E-01	529	2.61E-01	579	6.63E-01
						580	6.77E-01



### Spectral Power Distribution

$\lambda$ (nm)	Arb units	$\lambda$ (nm)	Arb units	$\lambda$ (nm)	Arb units	$\lambda$ (nm)	Arb units
581	6.77E-01	631	9.75E-01	681	7.71E-01	731	2.77E-01
582	6.81E-01	632	9.71E-01	682	7.58E-01	732	2.69E-01
583	6.97E-01	633	9.77E-01	683	7.51E-01	733	2.61E-01
584	7.01E-01	634	9.75E-01	684	7.45E-01	734	2.53E-01
585	7.09E-01	635	9.87E-01	685	7.31E-01	735	2.49E-01
586	7.18E-01	636	9.95E-01	686	7.21E-01	736	2.43E-01
587	7.22E-01	637	9.85E-01	687	7.10E-01	737	2.36E-01
588	7.25E-01	638	9.97E-01	688	6.94E-01	738	2.30E-01
589	7.29E-01	639	9.96E-01	689	6.84E-01	739	2.24E-01
590	7.47E-01	640	9.84E-01	690	6.73E-01	740	2.13E-01
591	7.48E-01	641	9.86E-01	691	6.61E-01	741	2.12E-01
592	7.59E-01	642	9.92E-01	692	6.49E-01	742	2.07E-01
593	7.61E-01	643	9.86E-01	693	6.49E-01	743	1.98E-01
594	7.68E-01	644	1.00E+00	694	6.24E-01	744	1.96E-01
595	7.79E-01	645	9.97E-01	695	6.14E-01	745	1.90E-01
596	7.81E-01	646	9.88E-01	696	6.07E-01	746	1.87E-01
597	7.90E-01	647	9.85E-01	697	5.99E-01	747	1.78E-01
598	7.96E-01	648	9.91E-01	698	5.85E-01	748	1.74E-01
599	8.04E-01	649	9.94E-01	699	5.76E-01	749	1.67E-01
600	8.11E-01	650	9.87E-01	700	5.63E-01	750	1.64E-01
601	8.16E-01	651	9.79E-01	701	5.55E-01	751	1.63E-01
602	8.23E-01	652	9.84E-01	702	5.44E-01	752	1.56E-01
603	8.31E-01	653	9.76E-01	703	5.32E-01	753	1.53E-01
604	8.34E-01	654	9.77E-01	704	5.17E-01	754	1.43E-01
605	8.50E-01	655	9.49E-01	705	5.11E-01	755	1.45E-01
606	8.49E-01	656	9.75E-01	706	4.99E-01	756	1.39E-01
607	8.54E-01	657	9.60E-01	707	4.84E-01	757	1.36E-01
608	8.68E-01	658	9.47E-01	708	4.76E-01	758	1.33E-01
609	8.68E-01	659	9.50E-01	709	4.65E-01	759	1.32E-01
610	8.88E-01	660	9.45E-01	710	4.55E-01	760	1.23E-01
611	8.82E-01	661	9.49E-01	711	4.45E-01	761	1.21E-01
612	8.92E-01	662	9.31E-01	712	4.44E-01	762	1.20E-01
613	8.92E-01	663	9.28E-01	713	4.31E-01	763	1.12E-01
614	9.03E-01	664	9.10E-01	714	4.19E-01	764	1.15E-01
615	9.16E-01	665	9.10E-01	715	4.12E-01	765	1.09E-01
616	9.17E-01	666	9.09E-01	716	4.02E-01	766	1.07E-01
617	9.15E-01	667	9.00E-01	717	3.94E-01	767	1.06E-01
618	9.20E-01	668	8.89E-01	718	3.84E-01	768	9.55E-02
619	9.27E-01	669	8.85E-01	719	3.75E-01	769	9.95E-02
620	9.31E-01	670	8.74E-01	720	3.68E-01	770	9.64E-02
621	9.34E-01	671	8.66E-01	721	3.58E-01	771	8.99E-02
622	9.34E-01	672	8.59E-01	722	3.44E-01	772	8.62E-02
623	9.46E-01	673	8.50E-01	723	3.42E-01	773	8.72E-02
624	9.47E-01	674	8.43E-01	724	3.30E-01	774	8.30E-02
625	9.61E-01	675	8.31E-01	725	3.23E-01	775	7.94E-02
626	9.58E-01	676	8.28E-01	726	3.14E-01	776	7.56E-02
627	9.62E-01	677	8.07E-01	727	3.05E-01	777	7.53E-02
628	9.60E-01	678	8.07E-01	728	3.00E-01	778	7.32E-02
629	9.65E-01	679	7.96E-01	729	2.95E-01	779	7.02E-02
630	9.70E-01	680	7.83E-01	730	2.83E-01	780	7.02E-02

### Measurement Uncertainty

The following is the reported expanded uncertainty of the UL 6440T Type C Mirror Goniophotometer.

Parameter	Uncertainty
Total Luminous Flux (%)	$\pm 4.9$
Luminous Intensity (%)	$\pm 4.9$
Temperature ( $^{\circ}\text{C}$ )	$\pm 1.0$
Voltage DC TY720 (%)	$\pm 0.017$
Current DC TY720 (%)	$\pm 0.10$
Voltage AC WT210 (%)	$\pm 0.059$
Current AC WT210 (%)	$\pm 0.025$
Power AC WT210 (%)	$\pm 0.23$
Frequency (50/60 Hz) WT210 (%)	$\pm 0.004$
Power Factor WT210 (%)	$\pm 0.06$

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 -----