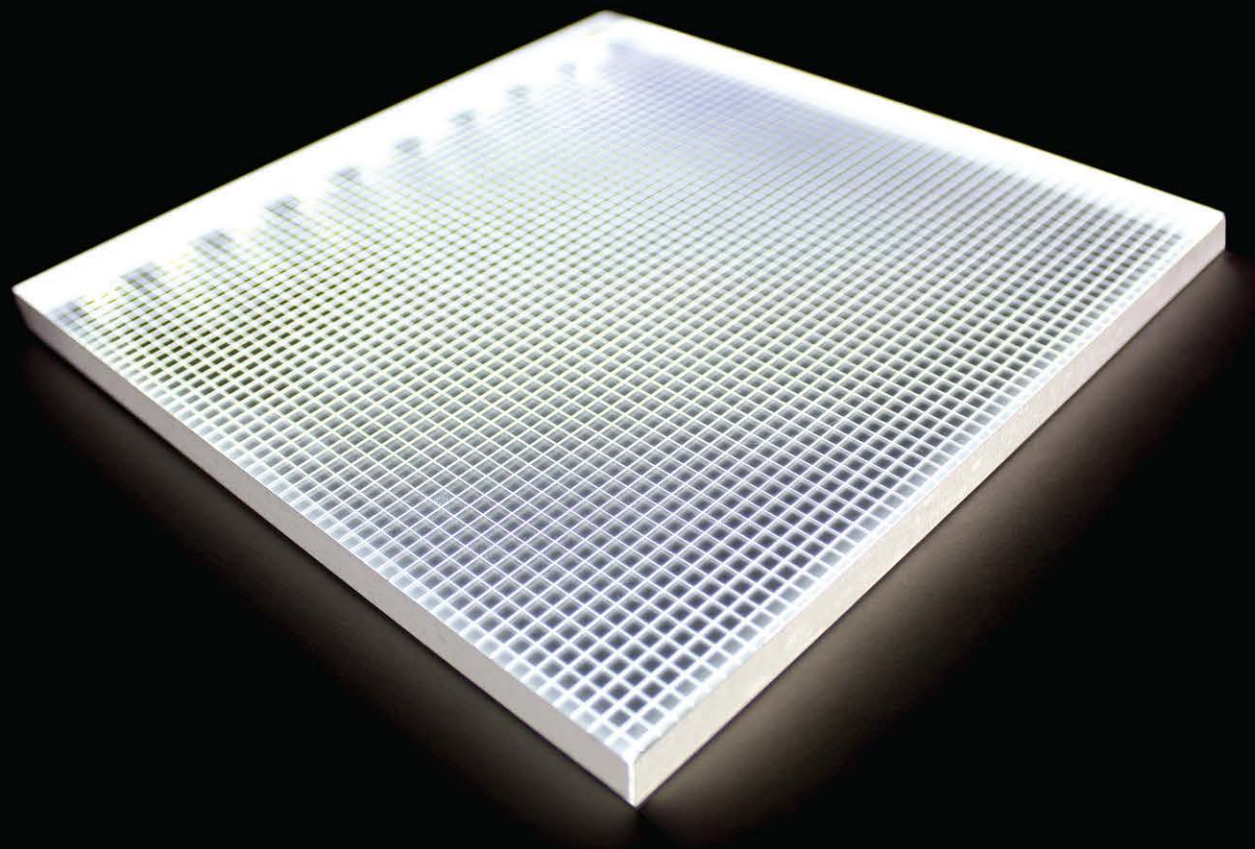
LED LIGHT SHEET
from Display Lighting



LED LIGHT SHEET / TECHNICAL MANUAL

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1. UNDERSTANDING LED LIGHT SHEET

1.1 Definition of LED Light Sheet

The unique construction of LED Light Sheet harnesses a number of patented processes which unite to create an innovative lighting unit. Produced by combining high intensity LEDs with a patented 3D V-Cutting system, this process allows light to be transmitted uniformly and evenly across the acrylic surface of the unit.
A unified backlighting unit, LED Light Sheet features thermally managed LEDs which are securely embedded inside an acrylic sheet. This second patented process delivers a unit which is robustly constructed and easily installed in comparison to traditional backlighting units in which LED modules are fixed externally to an acrylic sheet. Each LED Light Sheet unit is manufactured in the UK by Applelec to bespoke requirements.

1.2 Features and Benefits

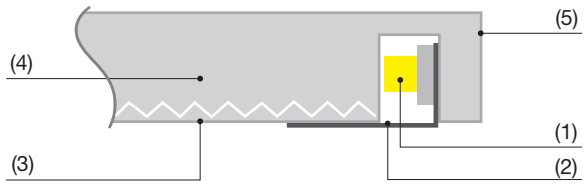
Super slim: The thickness of LED Light Sheet is 8mm (0.315")
Long lifetime and maintenance free: The longevity of LED Light Sheet is more than 50,000 hours/11years at 12 hours a day.
Low power consumption and cost saving: LED Light Sheet consumes up to 70% less power than T5 fluorescent lamps and up to 30% less energy than CCFL.
Eco-friendly product: LED Light Sheet contains NO mercury or other hazardous materials.
Water resistant: LED Light Sheet is available with an IP67 rating.
Bespoke sizes and shapes: LED Light Sheet can be made into any shape and size up to 3000mm x 1200mm.

1.3 General Specifications

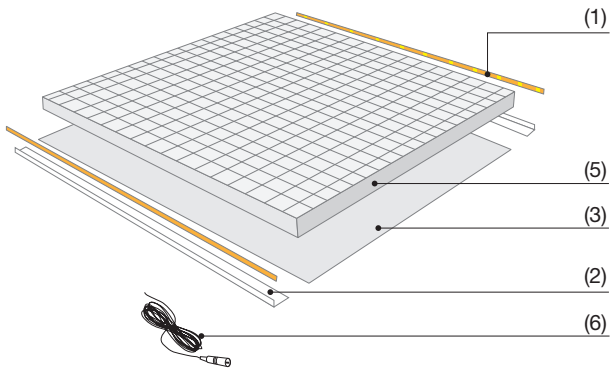
Item	Description	Remarks
Main Material	Acrylic (PMMA)	
Thickness	8mm	alternative thicknesses available
Power Supply	AC / DC 12V / 24V Adaptor	
Working Voltage	DC 12V / DC 24V	
Input Voltage	AC 100 ~ 240V 50/60Hz	
Lighting Source	3528 SMD TOP VIEW LED (8mm)	
Luminous Efficacy (LED)	80lm / W	
Power consumption (LED)	0.25W(Top View)	
Color Temperature (CCT)	3700K, 5300K	Other CCT is available
Max Size	3000mm(118") x 1500mm(59")	
Weight	Length(M) x Width(M) x Thickness(mm) x 1.19kg	
IP Rating	IP54 as standard	IP67 available on request
Lifetime	More than 50,000 hours	
Warranty on LED Light Sheet	3 years	
Warranty on Acrylic	5 years	
Operating Temperature	5 ~ 35°C (41 ~ 95°F)	

1.4 Unit Drawing - 2D and 3D Illustration

2D Drawing

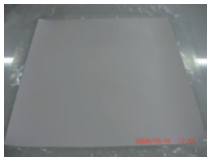
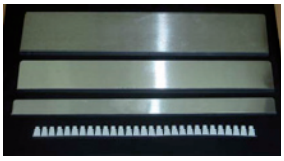
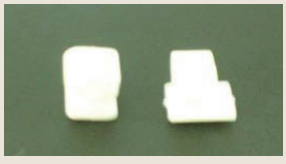


3D Drawing



No	Description	Remarks
(1)	High Intensity Flexible LED Module	80lm/W
(2)	Aluminium Heat Sink Plate	
(3)	Reflection Sheet	SW03G
(4)	3D V-Cut Light Guide Plate	PMMA
(5)	Reflection Tape	FASCAL 400
(6)	DC Power Cord (2468)	

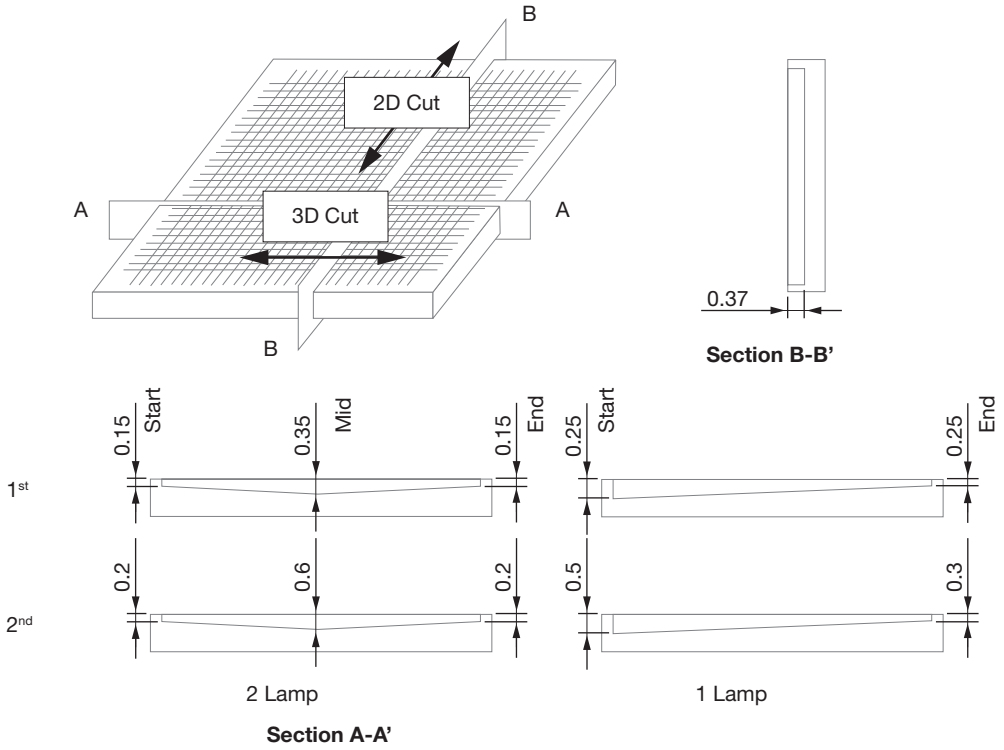
1.5 Part List of 8mm LED Light Sheet

Part Description	
Acrylic (PMMA), 8mm(0.315”)	
Reflection Sheet	
Reflection Tape	
3528 SMD Top View LED	
DC Power Cord (20 AWG)	
Aluminium Heat Sink Plate	
Strain Relief (Bushing)	
Rivet (Applicable for Pwr. Wire back)	

2. 3D V-CUTTING TECHNOLOGY

2.1 3D V-Cutting Technology

A significant advantage to LED Light Sheet lies in the production of the Light Guide Plate (LGP). Sourced for its rigidity and light transmission properties, a clear PMMA acrylic is etched with multiple grooves using patented 3D V-cutting technology to create a uniform matrix. This etched matrix acts as a vehicle to transport light from the unit's embedded LEDs across the entire surface of the panel to deliver homogeneous illumination.



2.2 Patent for V-cutting Technology

V-Cutting Machine Patent List
Korea 0423929 USA 6792842 Japan 3500466 Taiwan 155175

Cartridge for V-Cutting Patent List
Korea 0423729 USA 6619175 EU 01 901 599.9
Japan 3463060 China ZL 01818623.8 Taiwan 1638203.

3.1 Light Guide Plate

3.1.1 Specifications

A backlight unit including a light source for emitting light through a light guide plate made of light transmittable acrylic. The light source is located on one or multiple sides of the light guide plate. The light guide plate is provided with a pattern of grooves to guide an optical path, scattering the light emitted from the light source.

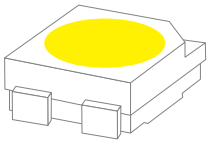
3.1.2 Properties

	Test method	Unit	Data
General Properties			
Specific Gravity	D-792		1.19
Water Absorption	D-570	%	0.30
Optical Properties			
Refractive Index	D-542		1.49
Light Transmission	D-1003	%	92
Haze	D-1003	%	0.2
Mechanical Properties			
Tensile Strength	D-638	Kg/cm^2	760
Elongation	D-638	%	6
Flexural Strength	D-790	Kg/cm^2	1.170
Flexural Modulus	D-790	Kg/cm^2	32,000
Zod Impact Strength	D-256	Kg cm/cm	2.0
Rockwell Hardness	D-785	M scale	95
Thermal Properties			
Heat Deflection Temperature	D-648	°C	92-96
Vlcat Softening Point	D-1525	°C	110
Specific Heat		Kcal/Kg.°C	0.35
Thermal Conductivity	D-177	Kcal/m.hr.°C	0.18
Shrinkage After Heating	D-1547	%	+2-4
Molding Temperature		°C	150~190
Maximum Usable Temperature		°C	70
Electrical Properties			
Volume Resistivity	D-257	Ω/sq	10^{15}
Dielectric Constant	D-150 (10^3Hz)		3.0

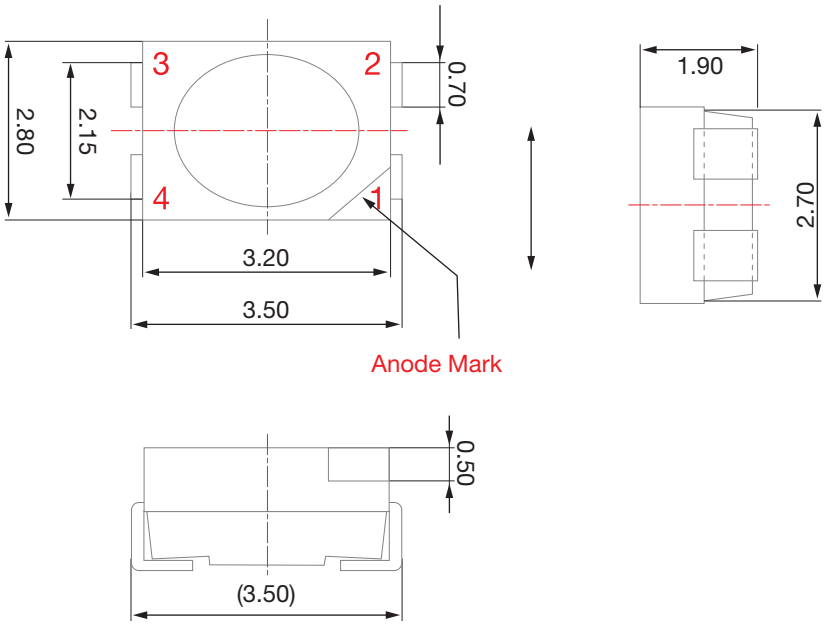
* The above specification provides standard data from acrylic manufacturer.

3.2 LED

3.2.1 General Information

General Information	
Producer	Lumimicro Co., Ltd
Product Name	LMFL4P35A3WHX09
Dimensions	3.5(W) x 2.8(L) x 1.9(T)mm
Features	3 chip LED
Viewing Angle	120

3.2.2 Outline and Dimensions



3.2.3 Specifications

Absolute Maximum Rating

Parameter	Colour	Symbol	Rating Value	Unit
Power Dissipation	Warm White	PD-1	300	m W
Forward DC Current	Warm White	IF-1	90	m A
Forward Pulse Current *[1]	Warm White	IPF-1	300	m A
Reverse Voltage	Warm White	VR-1	5	V
ESD Voltage	Warm White	ESD-1	HBM 3,000	V
Operating Temperature	Warm White	T0T	-30 to +85	°C
Storage Temperature	Warm White	TST	-40 to +100	°C
Soldering Temperature	Warm White	TSD	240C for 10 seconds	°C

*1 Forward Pulse Current. Pulse Width < 10msec / Duty Ratio < 1/10

Electro Optical Spec

Parameter	Symbol	Condition	Spec.			
			Min.	TYP.	Max	Unit
Forward Voltage 1	VF 1	IF=20mA/chip each	3.0	3.2	3.4	V
Forward Voltage 2	VF 2	IF=10uA/chip each	1.8	_	_	V
Luminous Intensity	IV	IF=20mA/chip each	7.5	_	11	cd
Reverse Current	IR	VR=5V	_	_	50	uA

The tolerance of intensity measurement: ± 10%, the tolerance of VF measurement: ±0.1V

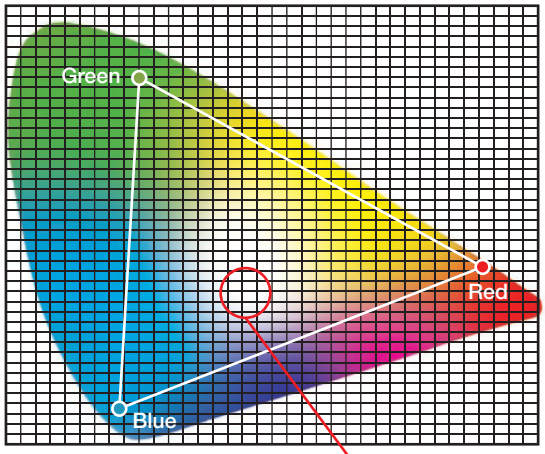
Parameter	Rank	Condition	Forward Voltage			
			Min.	TYP.	Max	Unit
Forward Voltage 1	3X1	IF=20mA/chip each	3.0	3.05	3.1	V
Forward Voltage 1	3X2	IF=20mA/chip each	3.1	3.15	3.2	V
Forward Voltage 1	3X3	IF=20mA/chip each	3.2	3.25	3.3	V
Forward Voltage 1	3X4	IF=20mA/chip each	3.3	3.35	3.4	V

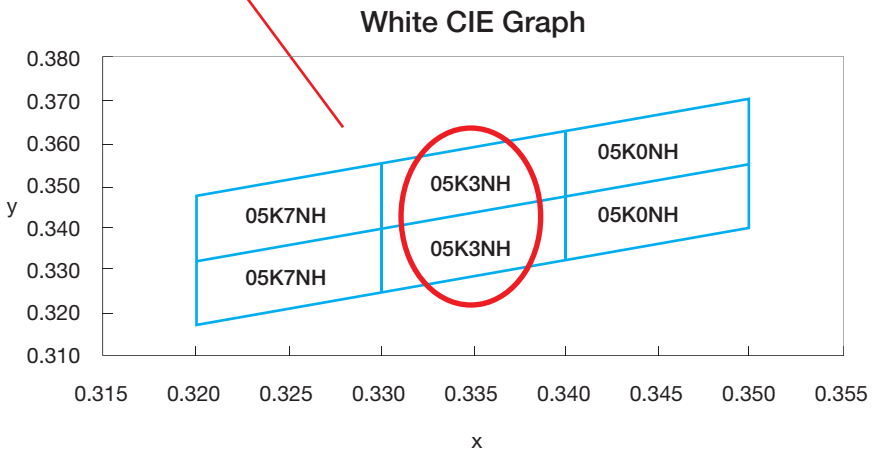
3.2.4 White CIE Specifications

White CIE Bin Spec [Condition: 60mA - Ta = 25°C]

05K7NH		05K3NH		05K0NH		05K7NL		05K3NL		05K0NL	
x	y	x	y	x	y	x	y	x	y	x	y
0.320	0.347	0.330	0.355	0.340	0.363	0.320	0.332	0.330	0.340	0.340	0.348
0.330	0.355	0.340	0.363	0.350	0.370	0.330	0.340	0.340	0.348	0.350	0.355
0.330	0.340	0.340	0.348	0.350	0.355	0.330	0.325	0.340	0.333	0.350	0.340
0.320	0.332	0.330	0.340	0.340	0.348	0.320	0.317	0.330	0.325	0.340	0.333

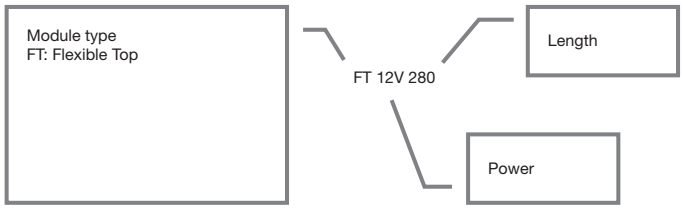
- The uncertainty of the C.I.E coordinates measurement: ±10%





3.3 LED Module

3.3.1 Definition of Model



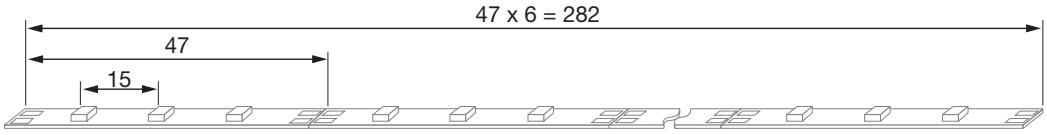
3.3.2 Model and Characteristic

FT12V280: Generally used in 8mm acrylics.
FT12VE280: Generally used for lighting(lamp).
FT24VE280: 24V powered. Only for a specific project.

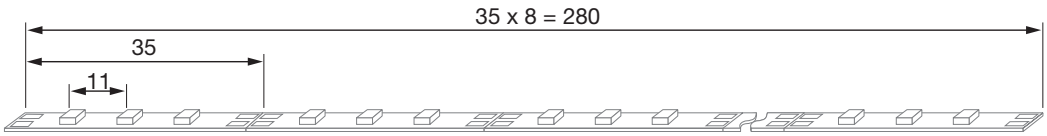
3.3.3 Specifications

	Length	LED Pitch	Number of LEDs	Power Consumption
FT12V280	47 x 6 = 282mm	P=15mm	18	3.5W
FT12V280	35 x 8 = 280mm	P=11mm	24	5.5W
FT24V280	Information supplied at the quotation stage			

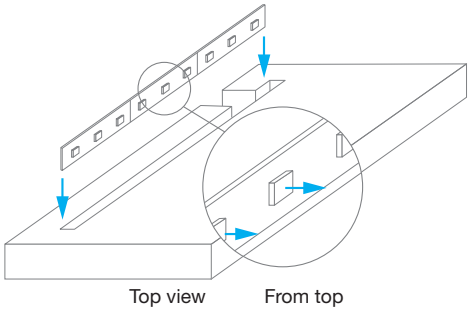
FT12V280
(P=15)



FT12V280
(P=11)



3.3.4 Top View



4. ACCESSORIES & OPTIONS

4.1 Adaptor

60W AC-DC Single Output Desktop

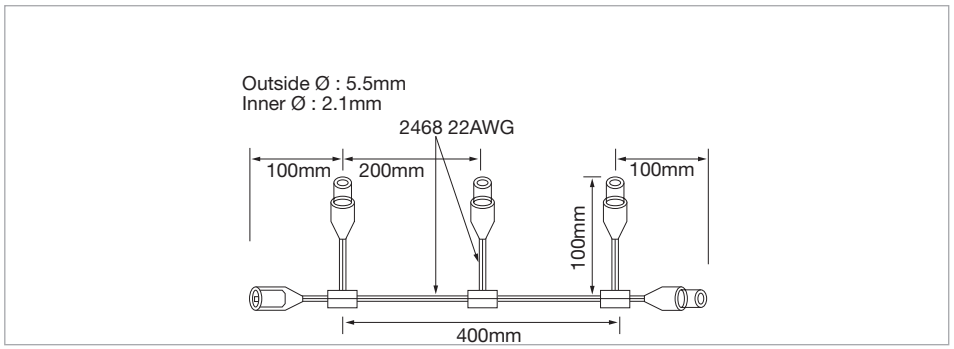
Features:

- Universal AC input / Full range
- No load power consumption <0.3W
- Pass energy star (CEC) level IV for full series
- Meet energy star (CEC) level for V for 12~48V
- Meet ISA 2007 (Energy Independence and Security Act)
- 3 pole AC inlet IEC320-C14
- Class I power (with earth pin)
- Protections: Short circuit / Overload / Over voltage
- Over temperature
- Fully enclosed plastic case
- LED indicator for power on
- Approvals: UL / CUL / TUV / BSMI / CCC / CB / FCC / CE
- Pass LPS for full series
- 2 years warranty

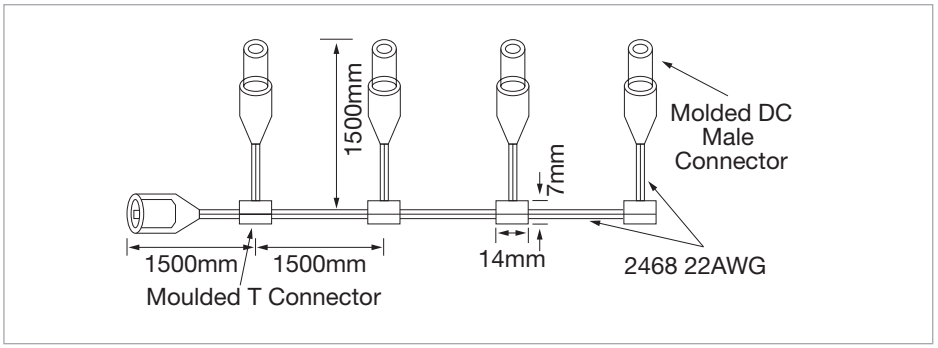
Output	Safety Model No.	GS60A12
	DC Voltage	12V
	Rated Current	5A
	Rated Power (max.)	60W
Input	Voltage Range	90 ~264VAC 135~370VDC
	AC Current	1.4A / 115VAC 1A / 230VAC
Safety and EMC (Note. 3)	Safety Standards	UL60950-1, TUV EN60950-1, BSMI CNS14336, CCC GB4943 approved
	Withstand Voltage	I/P-O/P:3KVAC I/P-FG:1.5KVAC O/P-FG:0.5KVAC
	Isolation Resistance	I/P-O/P, I/P-FG, O/P-FG:100M Ohms / 500VDC / 25°C / 70% RH
	EMI Conduction and Radiation	Compliance to EN55022 class B, FCC PART 15 / CISPR22 class B, CNS13438 class B, GB9254 class B
	Harmonic Current	Compliance to EN61000-3-2,3, GB17625.1
	EMS Immunity	Compliance to EN61000-4-2,3,4,5,6,8,11, light industry level, criteria A
Notes	1. All parameters are specified at 230VAC input, rated load, 25°C 70% RH ambient. 2. DC voltage. The output voltage set at point measure by plug terminal and 50% load. 3. The power supply is considered a component which will be installed into final equipment. The final equipment must be re-confirmed that it still meets EMC directives.	

4.2 Spider Connector Cables

4Way Short Spider Cable Connector



4Way Long Spider Cable Connector

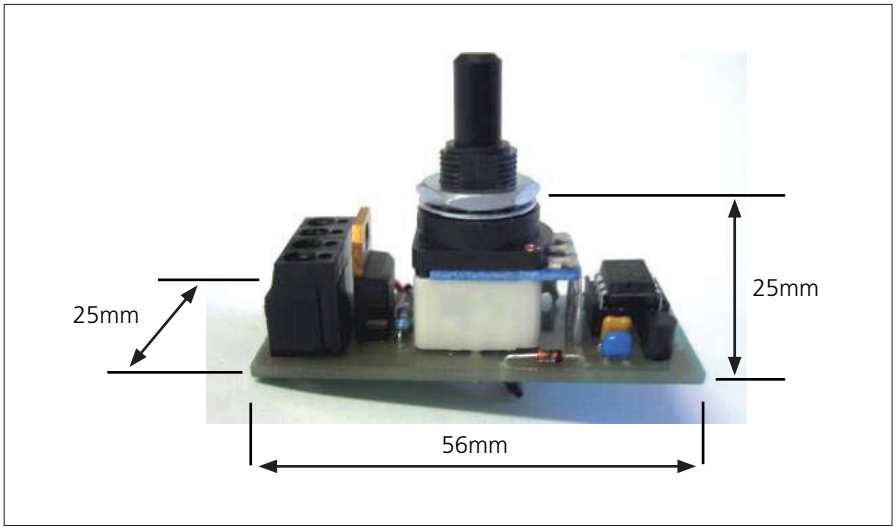


Allowing up to four LED Light Sheet panels to be linked together and run from a single power supply, spider connectors are available in two wire lengths. The short four-port spider links together panels positioned in close proximity, whilst the long spider features four-ports, each with a wiring range of 1500mm. Energy efficiency is maximized by utilising the LED load on the driver, whilst reducing the number of driver units required overall. Testing has been completed to ensure voltage drops do not occur when using the spider connectors with LED Light Sheet and that even over distance the unit's brightness is not affected.

4.3 Dimmers

4.3.1 LED Dimmer 'pot' - On / Off Push Button Rotary Dimmer Switch

Product Code: ASC – Pot –Dim



Features:

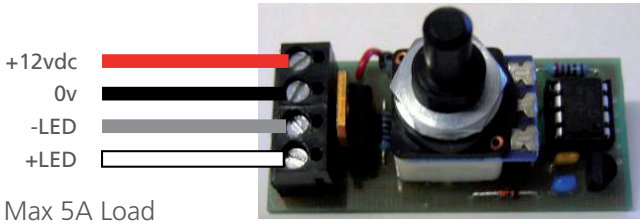
- Compact Design
- Switch On / Off without altering Dimmer Setting
- Suitable for most Constant Voltage 12vdc LED Systems

Specifications:

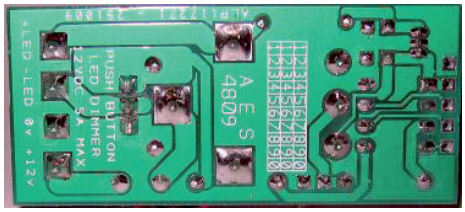
Input Voltage: 12vdc
Output Voltage: 12vdc, PCM
Max Current Load: 5A
Size Foot Print: 25mm x 56mm
Working Temperature: -10 to +60 degree C
Mounting Hole: 10mm
Spindle Shaft Diameter: 6mm
Suggested minimum mount depth: 28mm

Wiring Diagram:

See underside of unit for terminal details



Max 5A Load



Finished Package:

(The circuit board is mounted within a plastic housing box).

Black Box Dimensions:

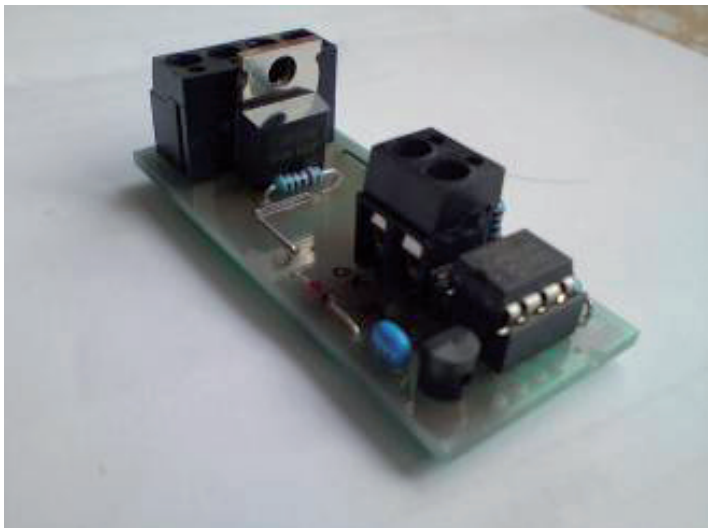
75mm long x 50mm wide x 27mm high (black box height) (47mm overall height = black box & pot switch)

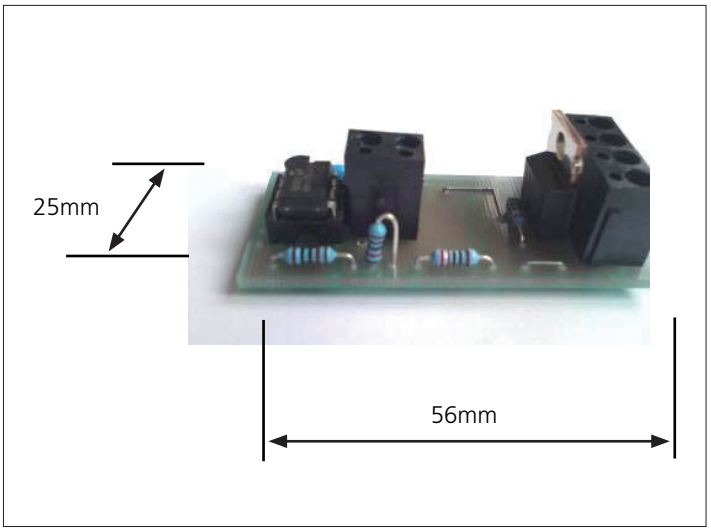
Black Box Wiring:

From the box through grommets is a wire extension with barrel connectors.

4.3.2 LED Dimmer: 0-10v unit

Product Code: ASC – 0-10v –Dim





Features:

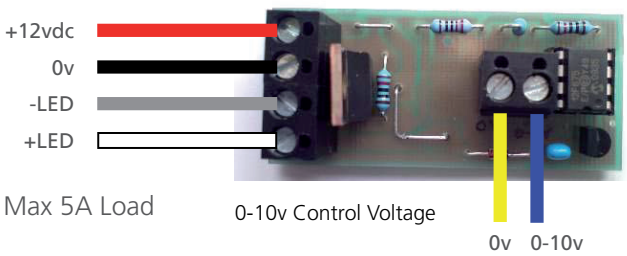
- Compact Design
- Interface to 0-10v control systems
- Suitable for most Constant Voltage 12vdc LED Systems

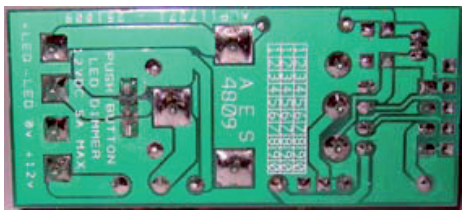
Specifications:

Supply Voltage: 12vdc
Output Voltage: 12vdc, PCM
Control Voltage: 0-10v
Max Current Load: 5A
Size Foot Print: 25mm x 56mm
Working Temperature: -10 to +60 degree C
Suggested minimum mount depth: 28mm

Wiring Diagram:

See underside of unit for terminal details





Finished Package:

75mm long x 50mm wide x 27mm high

Black Box Dimensions:

75mm long x 50mm wide x 27mm high (black box height) (47mm overall height = black box & pot switch)

Black Box Wiring:

From the box through grommets is a wire extension with barrel connectors. To the side is a grommet hole for the lighting system interface connection.

4.3.3 LINEARdrive DC - Constant Voltage LED Driver/ Controller

LINEARdrive DC Series
LINEARdrive DC is a highly integrated, enclosed and easy to configure constant voltage driver/controller for low-power, indoor LED lighting applications requiring up to 24A.

LINEARdrive DC can be integrated within a network or used as a standalone device. ShowMaster, supported on all eldoLED driver/controllers, can be used to upload show sequences for use in standalone mode. Show sequences can be created and managed with the TOOLbox and freely available PC software.

LINEARdrive DC is DMX, DALI and LedSync compatible, allowing 15-bit dimming, colour control and bidirectional communication for driver configuration and temperature read-out.

LINEARdrive 180/720
LINEARdrive 180 can supply up to 6A and LINEARdrive 720 up to 24A. LINEARdrive DC is broadly applicable as it supports low-power LED applications in DMX, DALI or 0-10V environments. LINEARdrive 180 supports DMX and 0-10V, LINEARdrive 720 supports DMX, 0-10V and DALI.

Setup
LINEARdrive DC is configured using its intuitive, 3-button user interface with display. The easy to navigate menu allows parameters to be set, such as the number of channels, DMX or DALI settings for networked mode, and show/colour/dim values for standalone operation. The driver's configuration can be locked to perform a visual test run of the connected LED groups.

Robust thermal management
Built-in over temperature protection protects the LINEARdrive DC against overheating.

Low EMI
LINEARdrive DC's EMI is very low due to the implementation of slew-rate controlled dimming and shielded conductors.

Easy to connect
Removing LINEARdrive DC's top cover exposes self-explanatory connections. The spring-cage connectors for LEDs, power and network leads are all clearly marked. Strain reliefs prevent leads from being pulled out accidentally.

Advantages
- LINEARdrive 180 supports up to 1.5A per channel (RGBW, 4 channels) or 2A per channel (RGB, 3 channels), LINEARdrive 720 supports up to 6A per channel
- DALI, DMX and 0-10V compatible
- Unprecedented ease of configuration
- Extremely smooth dimming and fine colour mixing.15-bit control resolution for each LED group
- ShowMaster: user-definable show sequences
- Very low EMI
- Compact form factor: 3x50x23mm/6.02"x1.97"x0.91"

Electrical data
Maximum load:
- LINEARdrive 180: 6A, irrespective of PSU voltage
- LINEARdrive 720: 24A, irrespective of PSU voltage

Maximum load per output channel:
- LINEARdrive 180: 4x1.5A or 3x2A
- LINEARdrive 720: 4x6A

Operating supply voltage range: 12V-28V DC
Processor: eldoLEDFluxLogic 850 Series
Independent LED groups: up to 4

Dynamic effects
- HydraDrive Algorithm Based Modulation
- Control of channel 1 (R), 2 (G), 3 (B) and 4 (W/A): 0 - 100% in 15-bit set point resolution
- Contrast ratio: up to 2,000:1

Thermal data
- Cooling LINEARdrive 180: passive (integrated heat spreader)
- Cooling LINEARdrive 720: second heat spreader on LINEARdrive 720 ensures ease of mounting onto required heat sink
- Built-in protection against overheating of driver/controller

Network control
- Network input: USITT DMX512A, LedSync or DALI (DALI only on LINEARdrive 720)
- Network output: LedSync, DALI (DALI only on LINEARdrive 720)
- DMX/LedSync: 8ms update rate, compatible with 8 and 16 bit network resolution
- LedSync: bidirectional communication for temperature read-out and driver configuration. For driver configuration, use the TOOLbox and freelyavailable PC software

ShowMaster
- Nine standard shows or up to 20 customer-defined shows set at factory
- User-defined shows (ShowMaster): up to 20 shows, via TOOLbox and PC software
- Show selection: via menu buttons

Environmental ratings
- Ta range: -20°C...50°C (-4°F...122°F)
- Tc max: 65°C (149°F)
- T heat sink max: 60°C (140°F)
- Relative humidity: non-condensing mounting data
- Mounting orientation: any
- Mounting holes: for M4 screws (4)

Certifications
- CE: IEC 61347, EN 55015, IEC 61003, EN 61547
- UL

User interface
- Menu buttons: M, - and + (3)
- Display: segmented (4 x 16)
- Modes: colour/show/DMX/DALI (DALI on LINEARdrive 720)
- Features: setup, lock, reset

Connectors LINEARdrive 180
- VDC: + and - (2)
- DMX in: +, - and shield (3)
- LedSync thru: +, - and shield (3)
- EXT in: + and - (2) for 10kΩ potentiometer, 0-10V orshow switch
- LED groups: - for group 1 through 4 (4)
- LED supply: + Connectors LINEARdrive 720
- VDC: + and - (2)
- DMX in: +, - and shield (3)
- LedSync out: +, - and shield (3)
- DALI: DA+ (2) and DA - (2)
- EXT in: + and - (2) for 10kΩ potentiometer, 0-10V orshow switch
- LED groups: GND and - for group 1 through 4 (8)

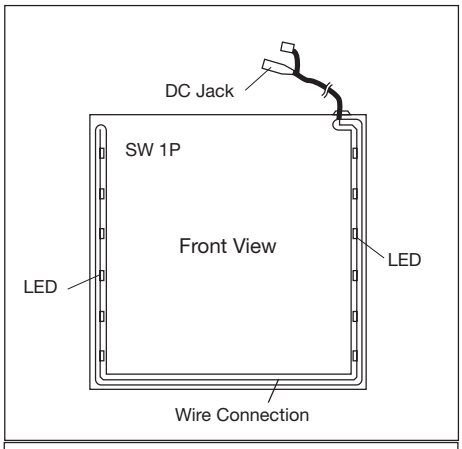
Dimensions
- LxWxH: 153 mm x 50 mm x 23 mm 6.02" x 1.97" x 0.91"

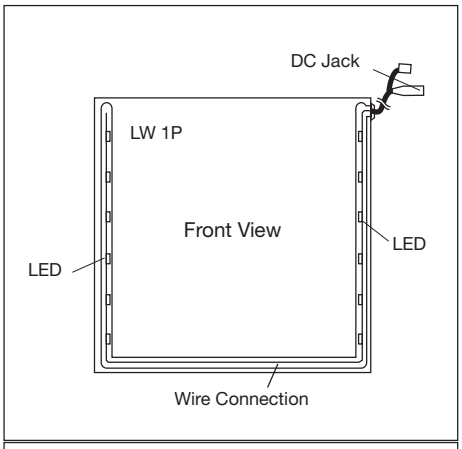
Ordering information

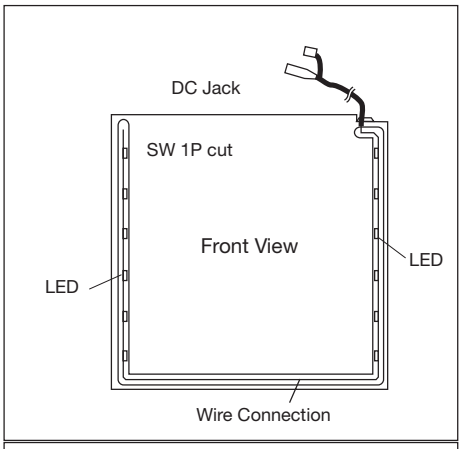
Description	Product	Order No.
LINEARdrive 180W Display	Linear 180/D	LIN180D1
LINEARdrive 720W Display	Linear 720/D	LIN720D1

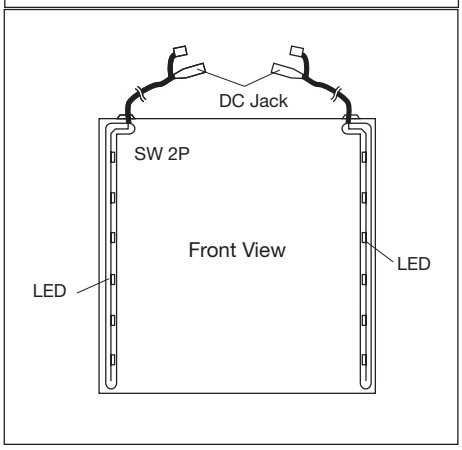
4.4 Options for Power Cord Exit

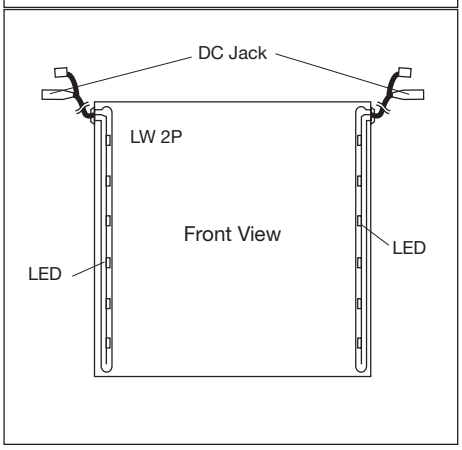
8mm LED Light Sheet, Power Cord Exit on the SIDE

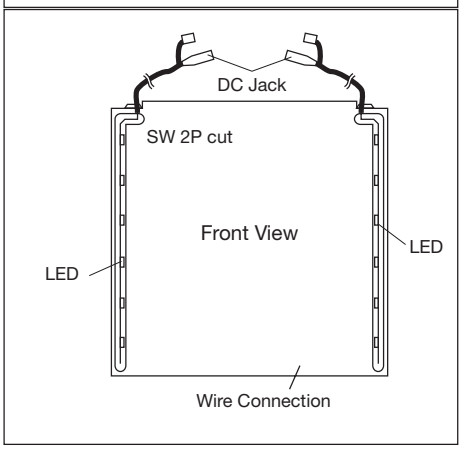




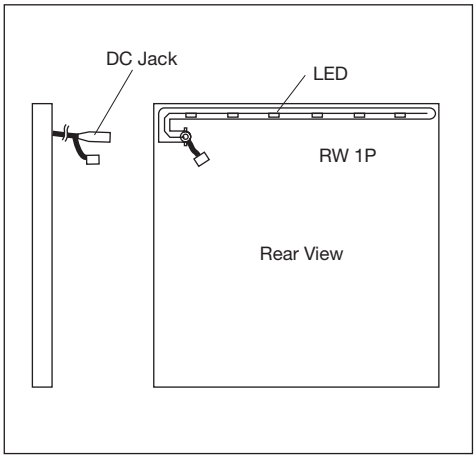


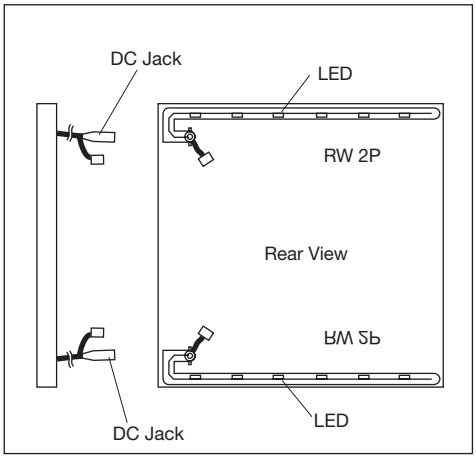






8mm LED Light Sheet,
Power Cord Exit on the BACK





5.1 Surface Brightness Data - LEDs on 1 side (S1)

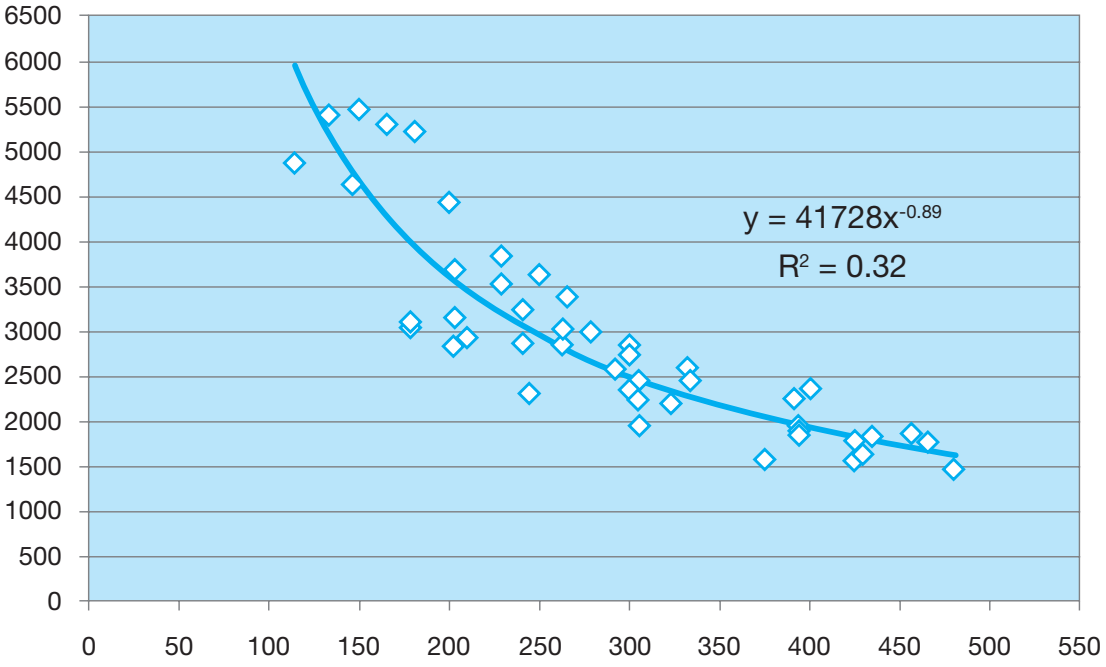
The below data was measured from Jan. to Aug. 2009. As the brightness of LEDs continues to improve, the 'real' brightness of LED Light Sheet may differ from the below data.

- The table below shows Standard Intensity of Illumination by width of LED Light Sheet
- This test is measured at mid-point out of 9 points on the surface level.
- Data may differ by measurement method and conditions of length and production method. (Tolerance : ±400 Lux)
- This data table is created based on final examination records and Lux data where this table is standard at final stage examination.

Width	Lux	Width	Lux
300	2684	**400**	2126
310	2614	**410**	2084
320	2547	**420**	2044
330	2485	**430**	2005
340	2425	**440**	1968
350	2369	**450**	1933
360	2316	**460**	1899
370	2265	**470**	1866
380	2216	**480**	1834
390	2170	**490**	1764

Surface Brightness Chart - S1

Chart of Illumination Intensity measured at LED Light Sheet surface mid-point



5. TECHNICAL DATA CONT.

5.2 Surface Brightness Data - LEDs on 2 sides (S2)

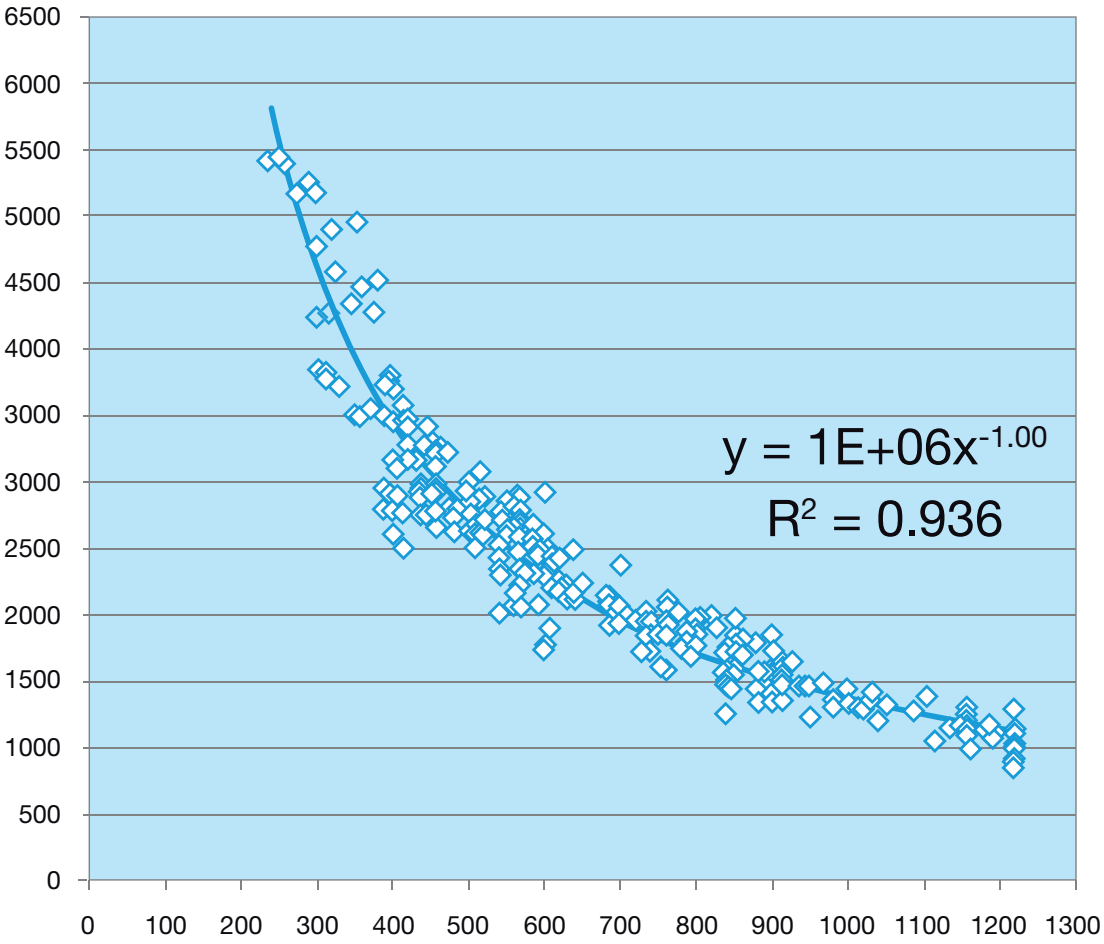
The below data was measured from Jan. to Aug., 2009. As the brightness of LEDs continues to improve, the 'real' brightness of LED Light Sheet may differ from the below data.

- The table below shows Standard Intensity of Illumination by width of LED Light Sheet
- This test is measured at mid-point out of 9 points on the surface level.
- D t diff Data may differ by measurement method and conditions of length and production method (Tolerance : ±400 Lux)
- This data table is created based on final examination records and Lux data where this table is standard at final stage examination.

Width	Lux	Width	Lux	Width	Lux
300	4481	**620**	2260	**940**	1526
310	4345	**630**	2226	**950**	1511
320	4217	**640**	2193	**960**	1496
330	4096	**650**	2161	**970**	1482
340	3982	**660**	2131	**980**	1468
350	3875	**670**	2101	**990**	1454
360	3773	**680**	2071	**1000**	1440
370	3677	**690**	2043	**1010**	1426
380	3586	**700**	2016	**1020**	1413
390	3499	**710**	1989	**1030**	1400
400	3416	**720**	1963	**1040**	1388
410	3338	**730**	1937	**1050**	1375
420	3263	**740**	1913	**1060**	1363
430	3191	**750**	1889	**1070**	1351
440	3123	**760**	1865	**1080**	1339
450	3057	**770**	1842	**1090**	1327
460	2995	**780**	1820	**1100**	1316
470	2935	**790**	1798	**1110**	1305
480	2877	**800**	1777	**1120**	1294
490	2821	**810**	1756	**1130**	1283
500	2768	**820**	1736	**1140**	1273
510	2717	**830**	1716	**1150**	1262
520	2668	**840**	1697	**1160**	1252
530	2620	**850**	1678	**1170**	1242
540	2574	**860**	1660	**1180**	1232
550	2530	**870**	1642	**1190**	1222
560	2488	**880**	1624	**1200**	1212
570	2446	**890**	1607	**1210**	1203
580	2407	**900**	1590	**1220**	1194
590	2368	**910**	1574		
600	2331	**920**	1558		
610	2295	**930**	1542		

Surface Brightness Chart - S2

- Chart of Illumination Intensity measured at LED Light Sheet surface mid-point
- 5300K, 8T, FT12V280 P=15 18chip, Type S2 only (excluding length and production method)



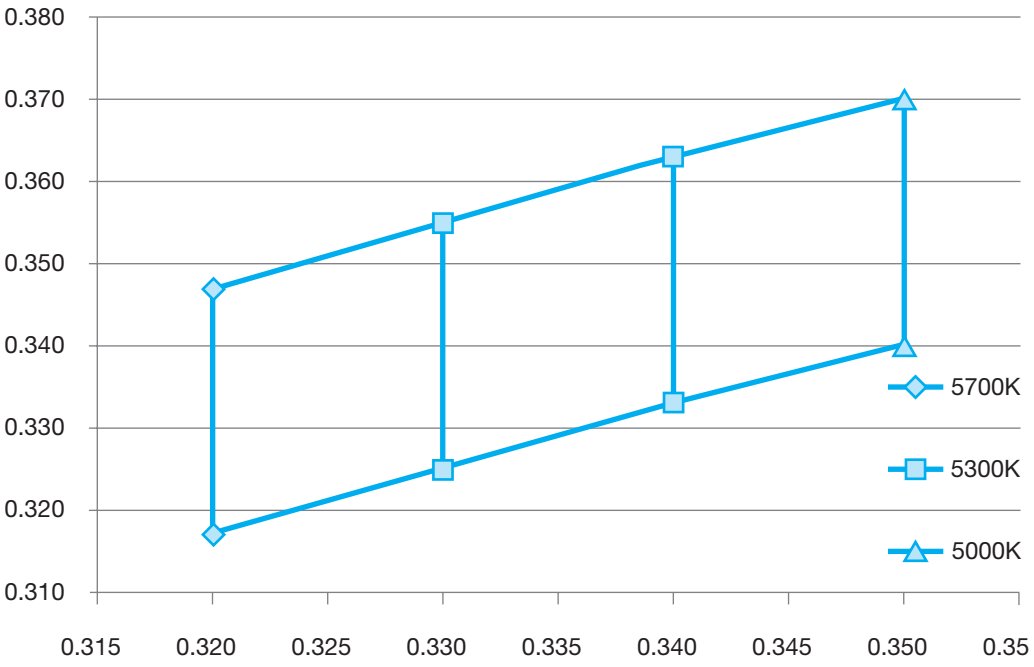
5.3 CIE Bin Spec. of Standard Colour Temperature

5.3.1 Pure White (5300K)

Model: LMFL4P35A3WHX09

5700K		5300K		5000K	
x	y	x	y	x	y
0.320	0.347	0.330	0.355	0.340	0.363
0.330	0.355	0.340	0.363	0.350	0.370
0.330	0.325	0.340	0.333	0.350	0.340
0.320	0.317	0.330	0.325	0.340	0.333
0.320	0.347	0.330	0.355	0.340	0.363

※ Tolerance: x = ±0.01, y = ±0.01



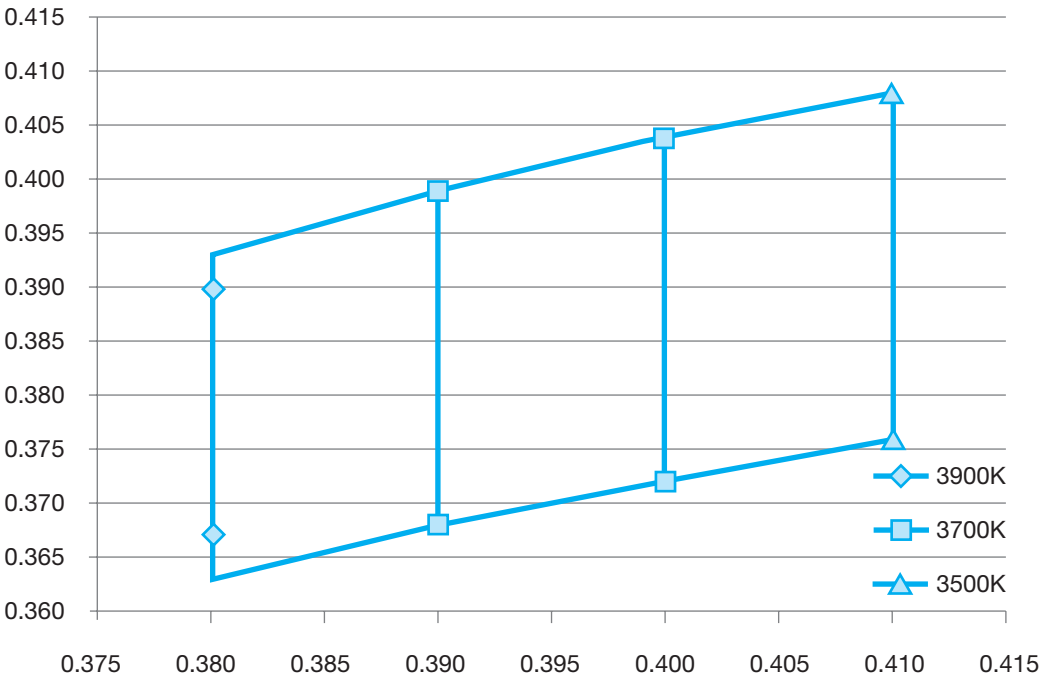
5.3 CIE Bin Spec. of Standard Colour Temperature

5.3.2 Warm White (3700K)

Model: LMFL4P35A3WWX09

3900K		3700K		3500K	
x	y	x	y	x	y
0.380	0.393	0.390	0.399	0.400	0.404
0 390	0 399	0 400	0 404	0 410	0 408
0.390	0.368	0.400	0.372	0 410	0.376
0.380	0.363	0.390	0.368	0.400	0.372
0.380	0.393	0.390	0.399	0.400	0.404

※ Tolerance: x = ±0.01, y = ±0.01



5. TECHNICAL DATA CONT.

5.4 IP 67 Ratings

LED Light Sheet has a resistance that acheives an Ingress Protection Test rating of IP54 as standard. An IP67 rating is available by request. LED Light Sheet can be completely protected from dust and sustain certain periods of immersion under pressure.

Understanding of IP Ratings

Example of rating: IP 67

First number (Protection against solid objects)	Definition	Second number (Protection against liquids)	Definition
0	No protection	0	No protection
1	Protected against solid objects over 50mm (e.g. accidental touch by hands)	1	Protection against vertically falling drops of water
2	Protected against solid objects over 12mm (e.g. fingers)	2	Protected against direct sprays up to 15° from the vertical
3	Protected against solid objects over 2.5mm (e.g. tools and wires)	3	Protected against direct sprays up to 60° from the vertical
4	Protect against solid objects over 1mm (e.g. tool, wires and small wires)	4	Protected against sprays from all directions - limited ingress permitted
5	Protected against dust - limited ingress (no harmful deposit)	5	Protected against low pressure jets if water from all directions - limited ingress permitted
6	Totally protected against dust	6	Protected against strong jets of water e.g. for use on shipdecks - limited ingres permitted
	2265	7	Protected against the effects of temporary immersion between 15cm and 1m. Duration of test: 30 minutes
	2216	8	Protected against long periods of immersion under pressure

5.4 IP 67 Rating

Dust testing

parc

Unit 10 Cuddidown Industrial Park
Clovelly Road Bideford Devon EX39 3DX
Telephone : +44 (0) 1237 421253
Facsimile : +44 (0) 1237 423561
e-mail:info@parcuk.co.uk Website:www.parcuk.co.uk

TEST REPORT

Customer Confidential

Page 1 of 3

Report No	Requested By	Customer Details
3500 -1	Ian Drinkwater	Applelec Sign Components Appleby House Walker Terrace Bradford West Yorkshire BD4 7HP

Date Samples Received	Date Started	Date Finished	Date of Issue
26/05/11	01/06/11	02/06/11	15/06/11

Product Description:

2 off LED Light Sheet units, denoted as samples 1 – 2 by PARC.

Tests Performed and Test Specifications:

Process 1 – Dust Ingress in accordance with BS EN 60598:2008, IP6X

Disposal of Samples:

Upon completion of testing the samples were returned to the customer.

Report Summary:

Sample Nos 1 & 2 were subjected to a dust ingress test, no signs of ingress were noted and both samples functioned correctly after the test had been completed.

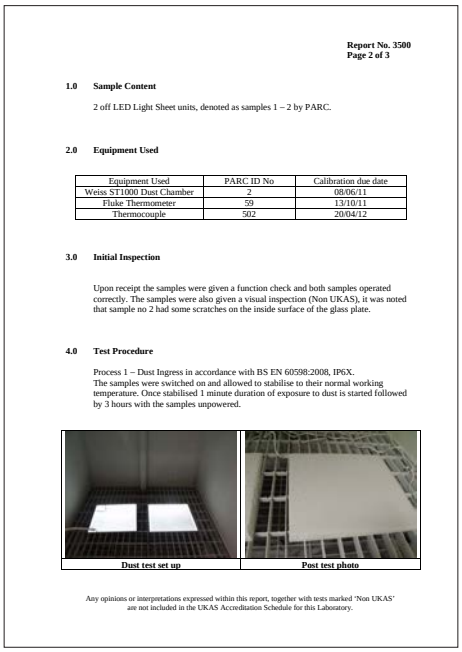
Distribution: I.Drinkwater, PARC File **Test Engineer: N.Edwards**

Approved: S.Wort (Senior Test Engineer)

2379

Any opinions or interpretations expressed within this report, together with tests marked 'Non UKAS' are not included in the UKAS Accreditation Schedule for this Laboratory.

Doc Ref: TR2 Rev D



Report No. 3500
Page 2 of 3

1.0 Sample Content

2 off LED Light Sheet units, denoted as samples 1 – 2 by PARC.

2.0 Equipment Used

Equipment Used	PARC ID No	Calibration due date
Weiss ST1000 Dust Chamber	2	08/06/11
Fluke Thermometer	59	13/10/11
Thermocouple	502	20/04/12

3.0 Initial Inspection

Upon receipt the samples were given a function check and both samples operated correctly. The samples were also given a visual inspection (Non UKAS), it was noted that sample no 2 had some scratches on the inside surface of the glass plate.

4.0 Test Procedure

Process 1 – Dust Ingress in accordance with BS EN 60598:2008, IP6X.
The samples were switched on and allowed to stabilise to their normal working temperature. Once stabilised 1 minute duration of exposure to dust is started followed by 3 hours with the samples unpowered.

Dust test set up | **Post test photo**

Any opinions or interpretations expressed within this report, together with tests marked 'Non UKAS' are not included in the UKAS Accreditation Schedule for this Laboratory.

Report No. 3500
Page 3 of 3

Inspection photos

5.0 Report Summary

The samples were subjected to the test regime outlined in this report.

No ingress of dust was noted on either sample and both samples functioned correctly after the test had been completed.

End of Report.

Any opinions or interpretations expressed within this report, together with tests marked 'Non UKAS' are not included in the UKAS Accreditation Schedule for this Laboratory.

Water testing

parc

Unit 10 Cuddidown Industrial Park
Clovelly Road Bideford Devon EX39 3DX
Telephone : +44 (0) 1237 421253
Facsimile : +44 (0) 1237 423561
e-mail:info@parcuk.co.uk Website:www.parcuk.co.uk

TEST REPORT

Customer Confidential

Page 1 of 3

Report No	Requested By	Customer Details
3500-2	Ian Drinkwater	Applelec Sign Components Appleby House Walker Terrace Bradford West Yorkshire BD4 7HP

Date Samples Received	Date Started	Date Finished	Date of Issue
26/05/11	01/06/11	02/06/11	15/06/11

Product Description:

2 off LED Light Sheet units, denoted as samples 3 & 4 by PARC.

Tests Performed and Test Specifications:

Process 1 – Water Ingress in accordance with BS EN 60598:2008, IPX7

Disposal of Samples:

Upon completion of testing the samples were returned to the customer.

Report Summary:

Sample Nos 3 & 4 were subjected to a water ingress test, no signs of ingress were noted and both samples functioned correctly after the test had been completed.

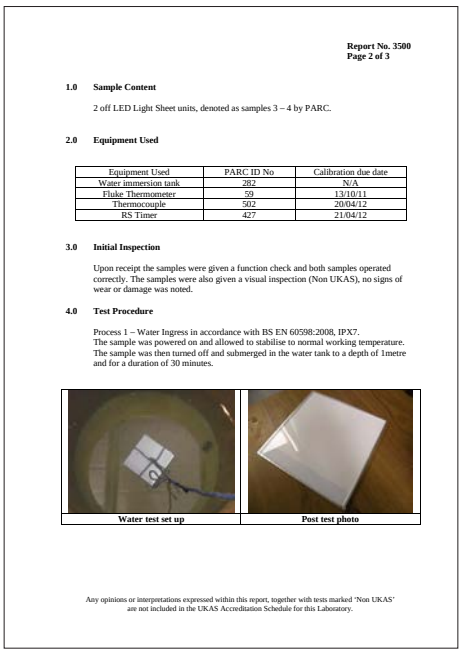
Distribution: I.Drinkwater, PARC File **Test Engineer: N.Edwards**

Approved: S.Wort (Senior Test Engineer)

2379

Any opinions or interpretations expressed within this report, together with tests marked 'Non UKAS' are not included in the UKAS Accreditation Schedule for this Laboratory.

Doc Ref: TR2 Rev D



Report No. 3500
Page 2 of 3

1.0 Sample Content

2 off LED Light Sheet units, denoted as samples 3 – 4 by PARC.

2.0 Equipment Used

Equipment Used	PARC ID No	Calibration due date
Water immersion tank	282	N/A
Fluke Thermometer	59	13/10/11
Thermocouple	502	20/04/12
RS Timer	427	21/04/12

3.0 Initial Inspection

Upon receipt the samples were given a function check and both samples operated correctly. The samples were also given a visual inspection (Non UKAS), no signs of wear or damage was noted.

4.0 Test Procedure

Process 1 – Water Ingress in accordance with BS EN 60598:2008, IPX7.
The sample was powered on and allowed to stabilise to normal working temperature. The sample was then turned off and submerged in the water tank to a depth of 1metre and for a duration of 30 minutes.

Water test set up | **Post test photo**

Any opinions or interpretations expressed within this report, together with tests marked 'Non UKAS' are not included in the UKAS Accreditation Schedule for this Laboratory.

Report No. 3500
Page 3 of 3

Inspection photos

5.0 Report Summary

The samples were subjected to the test regime outlined in this report.

No ingress of water was noted on either sample and both samples functioned correctly after the test had been completed.

End of Report.

Any opinions or interpretations expressed within this report, together with tests marked 'Non UKAS' are not included in the UKAS Accreditation Schedule for this Laboratory.

6. GENERAL SAFETY INSTRUCTION

6.1 Guide

Thank you for purchasing LED Light Sheet. This technical manual explains the necessary precautions and technical specifications of the product, and includes further information on warranty procedures. The information given in this technical manual should be sufficient for the end-user to handle LED Light Sheet safely.

Please be fully familiarised with the information included in this technical manual before beginning installation or use of LED Light Sheet. LED Light Sheet ("we","LEDLight Sheet") is not liable for any damages of any kind resulting from the purchase, use or misuse of, or inability to use the product or arising directly or indirectly from the use, or loss of use of the product, or from the original purchaser's ("you", "purchaser") lack of knowledge or comprehension, including incidental, special, consequential or similar damages, or loss of anticipated profits or benefits. Also be aware that LED Light Sheet is not liable for damages arising from any sort (including negligence or gross negligence) on the part of the purchaser or faults in this technical manual. If in doubt please contact LED Light Sheet.

6.2 General Instruction for LED Light Sheet

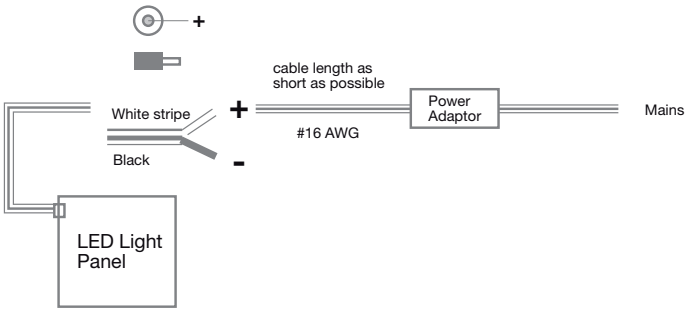
6.2.1 Warnings

1. DO NOT disassemble LED Light Sheet.
2. DO NOT apply AC power or any other DC power to LED Light Sheet which isn't described in the electric information label.
3. DO NOT drop or bend LED Light Sheet.
4. DO NOT tamper with LED Light Sheet from its original form.
5. DO NOT pull on the power wire.
6. DO NOT adhere graphics directly to LED Light Sheet.
7. Make sure LED Light Sheet is functioning correctly prior to assembly with or without other products.
8. When handling LED Light Sheet or any of its components prior to assembly, always wear cotton gloves or the quivalent to prevent scratching or staining (e.g. fingerprints) on the LGP.
9. DO NOT use any form of alcohol or solvent to clean the LGP or any component in direct contact with the LGP (see section 2.1.).
10. DO NOT remove the Aluminium Heat Sink Plate from the LED Light Sheet.

6.2.2 Electric Wiring

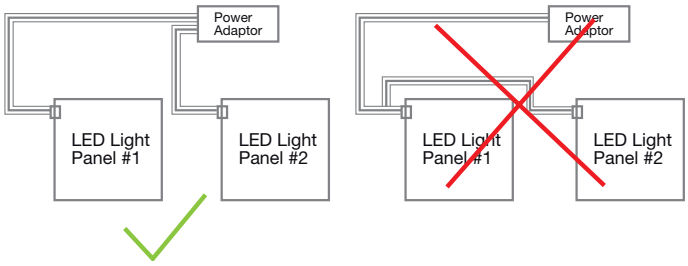
1. LED Light Sheet is powered by a DC 12V (constant voltage) adaptor. Warranty is void if any other adaptor that is not approved by LED Light Sheet is used.

2. Any adjusted cord from the adaptor to LED Light Sheet should be kept as short as possible to avoid a voltage drop of LED Light Sheet.

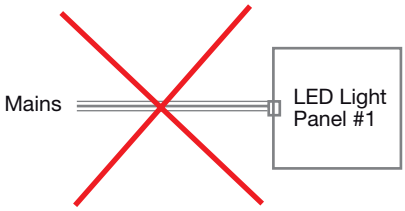


3. One adaptor can supply power to multiple LED Light Sheet units providing the total wattage is less than the capacity of the adaptor. Multiple LED Light Sheet units may be connected by using a spider connector cable.

4. If multiple LED Light Sheet units are wired to one adaptor, connect them in a "parallel" not as a "series" to avoid voltage drop and maximize lightoutput.



5. Never apply AC power directly to LED Light Sheet as this will instantly damage LEDs.

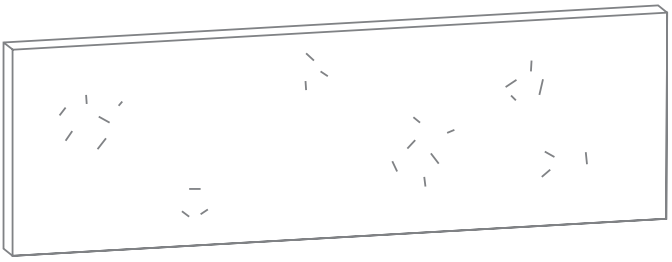


6.2.3 Protective Film

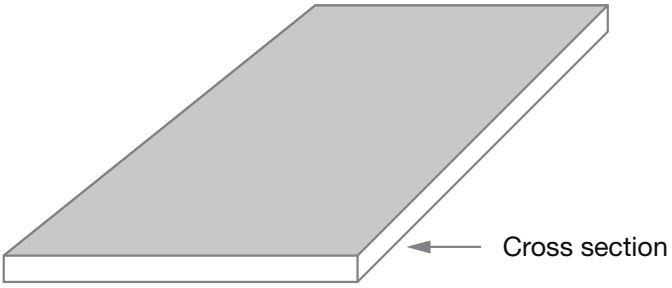
Prior to installation of LED Light Sheet please ensure the clear protective film has been removed from the face of the unit. Failure to remove the protective film will affect the brightness, clarity and even illumination of LED Light Sheet.

6.2.4 Cleaning

1. White cotton gloves should be worn to prevent scratches or fingerprints on the acrylic surface.
2. If fingerprints or other substances are visible on the acrylic surface, gently wipe off with a non abrasive cloth soaked in a watered down thinner.



3. With the cross section cut by a laser, the acrylic surface may crack if excessively exposed to thinner or alcohol.



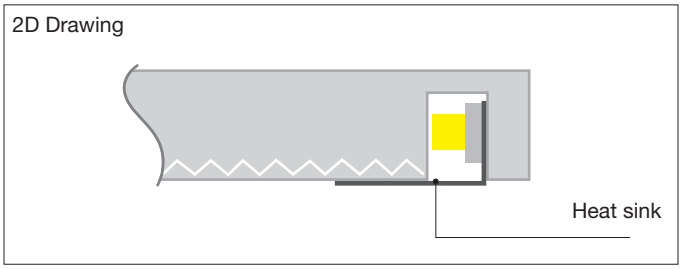
6.2.5 Moving

1. Please DO NOT HANDLE the acrylic plate as below when lifting up. The LED module embedded within the acrylic plate will be damaged.

2. LED Light Sheet should be placed on a clean and flat surface. (See picture below)

3. The longer side of LED Light Sheet should be lifted up slowly. DO NOT bend LED Light Sheet when lifting. Lift LED Light Sheet in a vertical position, keeping the unit straight and supporting each corner to maintain rigidity. (See picture below)

4. Do not cover the metal heat sink. The exposed metal on the back of the LED Light Sheet panel allows the heat generated by the LED to be dissipated thus cooling the LED over time maximising longevity.



6.2.6 Storage

Store LED Light Sheet in a dry area on a plain surface. Always keep LED Light Sheet covered to protect it from moisture and dust. Keep LED Light Sheet away from children.