

## LED Tips & Tricks



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# Common terms used in LED lighting

Term	Units	Definition
<b>LED</b>		Light Emitting Diode (clever bit of glowing silicon)
<b>Light Output</b>	Lumen	The total amount of light given out by the light – the flow of light
<b>Light Level</b>	Lux	The amount of light arriving at a surface some distance away – Lux is Lm/m <sup>2</sup>
<b>CCT – Colour Temperature</b>	K	The colour temperature of the white light. Most popular domestic lighting is 3000K (2700K is warm white -> 5000K is quite a cold white).
<b>CRI – Colour Rendering Index</b>		The ability of a white light to render (reflect) colours properly: <ul style="list-style-type: none"> <li>• &lt;80 Poor colours</li> <li>• 80+ Better (Classic)</li> <li>• 90+ Good (Professional)</li> <li>• 96+ Excellent (Art)</li> </ul>
<b>R9</b>		The amount of RED light, often missing in poor quality LED lights, leaving dull colours
<b>Beam Angle</b>	degree	The total angle of the light beam at the half brightness points, i.e. 60 means +/- 30
<b>Low &amp; Ultra Low Glare</b>		Special design to minimize the glare from the lights at wider angles
<b>IC-F &amp; IC-4</b>		Insulation Coverable Standard IC-F is the current standard, IC-4 will soon replace it
<b>Luminaire power</b>	W	The actual power used by each light fitting on its own
<b>System Power</b>	W	The total power of the light including the driver
<b>Efficacy</b>	L/W	The amount of light per Watt of system power used (similar to efficiency)
<b>PF – Power Factor</b>		An indication of how efficiently the AC power source is used
<b>Expected life (L70, TM21)</b>	Hours	The predicted life of the LED as it slowly reduces to 70% of its initial brightness (L70). TM21 is a standard governing how this prediction is calculated.
<b>HCB</b>	mm	Height clearance to building elements allowed between the top of the light and any flammable building elements such as wooden joists or battens
<b>SCB</b>	mm	Side clearance to building elements, allowed between the side of the light and any flammable building elements such as wooden joists or battens
<b>IP Rating</b>		Dust and waterproofing standard: <ul style="list-style-type: none"> <li>• IP44 is splash-proof</li> <li>• IP65 is dust and water-resistant (to water jets)</li> <li>• IP67 is dust and waterproof</li> <li>• IP67 (front face) means only the front face is waterproof</li> </ul>

## Causes of flashes or intermittent operation

Occasional flicker or flashing effects can have a number of possible causes:

- **Incompatible Dimmer**  
This is the most common cause by far  
Choose a dimmer module compatible with the product being installed (see tables page 5)
- **Interference on 230V supply**  
Caused by ripple current control (usually early morning and evening only, rarely a problem)  
Electrical noise from heavy machinery or pumps (e.g. big irrigation pumps)  
Contact Switch Lighting for advice

## Flicker

The term Flicker is used to refer to repetitive flicker usually caused by the 230V AC supply. It usually results in 100 Hz flicker of lighting. It is desirable that flicker is kept below 20% to avoid being noticeable. Some people are more sensitive to flicker than others. All Switch Lighting **E-LIGHTZ** and **D-LIGHTZ** are low flicker designs.

## Marker-LIGHTZ (SL231/SL241)

These useful little lights use an incredibly small amount of power and over 50 can be installed on small cable. Ten of these lights running 24/7 all year long will cost less than \$1 to run for the year. These lights are great for marking paths. They are not bright enough to illuminate objects – for this use **SL201**.

## LED Protector (SLP350/SLP700)

This device will prevent a lot of failures caused by intermittent connections during installation and subsequently due to damage.

It has been specially designed by Switch to protect strings of constant current lights, such as the **SL201**. In operation it acts like an incredibly fast fuse, isolating the lights from fault surges before they can do any damage. Often fault surges happen during installation due to intermittent wiring connections.

It is resettable by simply cycling the power on/off and has an LED indicator built in to indicate when a fault has been detected. It should be specified for all **SL201** and any other series connected LED system at 350mA or 700mA.



## LED Tester (SLAT301)

This versatile tool can be used to safely test most LEDs up to 40 Volts. The test current is controlled at just 5mA so that damage cannot be caused by reversed or intermittent connection.

This is a great little test box to check out the system **BEFORE** connecting the driver and for general fault finding. Features include: battery powered, auto switch off and short and open circuit faults indicator.

# Dimming Switch Lighting lights (standard drivers)

Dimmer modules must be compatible with the LED Driver in use. We test a range of dimmer options so you don't have to. Please stick with our recommendations to avoid problems.

Switch Light Type	Compatible Dimmers				
<b>All E-LIGHTZ (SL35, SL40)</b>  <b>All D-LIGHTZ (Fixed and Tilttable)</b>  <b>sLED (SL50, 55, 56)</b>  <b>sLED DOME (SLED215F, 315F, 315T, 415F, 515F)</b>  <b>ZELA (Fixed and Tilttable)</b>	<b>Description</b>	<b>Model</b>	<b>Max%</b>	<b>Min%</b>	<b>Stability</b>
	Clipsal trailing edge	32E450TM	97	11	✓
	Clipsal universal	32E450UDM	96	12	✓
	Clipsal universal push button	31E2PUDM	96	9	✓
	Clipsal LED dimmer	32ELEDM	96	5	✓
	PDL trailing edge	624M/824M	97	11	✓
	PDL universal	654M/854M	96	12	✓
	PDL leading edge	634LM	94	9	✓
	PDL universal push button	654PBM	96	9	✓
	PDL universal ICON	354RDMLED-VW	94	1	✓
	PDL universal ICON push button	354PBMUN-VW	94	9	✓
	Legrand/HPM	EM400TR	94	6	✓
	Legrand push button	EM400A3P	92	5	✓
	Kiwi dimmer	K005U	96	5	✓
	Home DL dimmer	HLDIM-EXCL	96	0	✓
<b>SL900 with SL500D driver</b>	<b>Description</b>	<b>Model</b>	<b>Max%</b>	<b>Min%</b>	<b>Stability</b>
<b>Dimmers marked (*) may not turn on until the brightness is adjusted to &gt; 7%</b>	Clipsal trailing edge	32E450TM	97	11	✓
	Clipsal universal	32E450UDM	96	12	✓
	Clipsal universal push button	31E2PUDM	96	9	✓
	Clipsal LED dimmer*	32ELEDM	96	5	✓
	PDL trailing edge	624M/824M	97	11	✓
	PDL universal	654M/854M	96	12	✓
	PDL leading edge*	634LM	94	9	✓
	PDL universal push button	654PBM	96	9	✓
	Legrand/HPM*	EM400TR	94	6	✓
	Legrand push button*	EM400A3P	92	5	✓
	Kiwi dimmer*	K005U	100	6	✓
	Home DL dimmer*	HLDIM-ECL	100	4	✓
	<b>SL201, SL204, SL614, SL900</b>	<b>Dimmer</b>	<b>Min%</b>	<b>Min no. of LEDs</b>	<b>Comments</b>
<b>Used with L05021 350mA driver</b>	PDL 654M Universal	28	4	Slight start-up flash then stable	
	Clipsal 32E450TM Trailing	23	4	Stable	
	HPM CAT400T	15	4	Stable	

Please check website for latest information

## Dimming Switch Lighting lights (Dali driver IE-12D)

### Compatibility with Switch Lighting luminaires:

**Output current has been preset. Do not change!** Refer to table below to determine how many series connected lights may be used. Make all connections before applying power.

Switch Lighting	Driver Current		Lights	
Type	min	max	min	max
D-LIGHTZ	180	300	1	1
E-LIGHTZ	180	300	1	1
E-LIGHTZ-Mini	180	230	1	1
ZELA Fixed	180	230	1	1
ZELA (all other models)	180	260	1	1
SL900	180	350	2	3
SL900	500	500	2	2
SL204/214	180	300	2	3
SL204/214	350	350	2	2
SL201/211/SLDL614T	180	350	5	11
SLDL614T	500	500	5	7
SLBL122F/123F	180	500	3	3

Switch Lighting Order Code	
Suffix	Driver Current
D02	180mA
D03	230mA
D04	260mA
D05	300mA
D06	500mA
D07	350mA

### Unsuitable use:

The following lights are not suitable for use with this DALI driver:

SL41, SL910, SL231/241, SL224/234 SLBL120F/121F

## Constant current vs constant voltage outdoor lights from Switch Lighting

Ensure you match lights with the correct driver

### Constant current (SL201/SL211/SL204/SL214/SL614/SL900/SLBL122F/SLBL123F)

- Series wiring for multiple lights
- Smaller cable required for long runs
- Less fault tolerant – single fault can put all lights out
- Easily damaged during install – reversed or live connection destroys lights
- Use LED Protector (SLP350/SLP700) & LED Tester (SLAT301) to check wiring first

### Constant current cable size guide

(gives maximum end-to-end cable length vs wire CSA)

Current	Cable Size (mm <sup>2</sup> )				
	0.3mm <sup>2</sup>	0.5mm <sup>2</sup>	1mm <sup>2</sup>	1.5mm <sup>2</sup>	2.5mm <sup>2</sup>
350mA	35m	60m	120m	190m	320m
500mA	20m	30m	60m	95m	160m
700mA	20m	30m	60m	95m	160m

# How many constant current lights per driver?

Use the convenient table below to check max & min number of lights to connect:

## Switch Lighting Drivers

230V Constant current drivers											
Driver	Power max	Max V	Output	SL201 SL211 SLDL614T SLGL310 SLGL242 SLGL252 SLBL100F/101F SLDL624F SLDL644T SSW53 (all types)	SL204 SL214	SL42	SLGL310 SLGL242 SLGL252 SLDL614T SLDL624F SLDL644T (all types)	SL900 SL901	SLBL122F SLBL123F	Dimmable	Comment
<b>Current</b>				350mA	350mA	500mA	700mA	500mA	500mA		
<b>SE-9-350-700</b>	9W	2-12	350 / 400 450 / 500 550 / 600 650 / 700mA	1-3	N/A	1-3 @ 500mA	1-3	1	1	TE dimmable	Specify current on order
<b>SE-12-100-400</b>	12W	Varies	100 / 150 200 / 250 300 / 400mA	3-11 (4-14 Red) (3-10 Green)	1-2	3-9 @ 400mA	N/A	1-3 @ 400mA	2-4 @ 400mA	TE dimmable	Specify current on order
<b>SE-15-350-700</b>	15W	Varies	350 / 400 500 / 550 600 / 650 700mA	3-13 (4-17 Red) (3-12 Green)	1-3	3-9 @ 500mA	3-6 (4-8 Red)	2	2-4	TE dimmable	Specify current on order
<b>SE-40-200-1050</b>	40W	Varies	300-1050mA	3-13 (5-19 Red) (3-12 Green)	1-3	3-13	3-13 (5-19 Red) (3-12 Green)	1-4	2-6	1-10V 0-10V 10V PWM RX (variable resistor or rheostat)	Specify current on order
<b>AD-36-200-1200</b>	36W	Varies	200 / 350 500 / 600 700 / 900 1050 / 1200mA	4-17 (5-22 Red) (4-15 Green)	1-4	4-17 @ 500mA	4-16 (5-21 Red) (4-15 Green)	2-5	2-8	1-10V 0-10V Push Dim PWM RX (variable resistor or rheostat)	Specify current on order
<b>Mini350mA</b>	4W	3-12	350mA	1-3	N/A	1-3 @ 350mA	N/A	1 @350mA	1 @350mA	No	IP65
<b>Mini700mA</b>	4W	3-6	700mA	N/A	N/A	N/A	1	N/A	N/A	No	IP65
<b>IE-12D</b>	12W	Varies	180-500mA	5-11	2-2	5-7 @ 500mA	N/A		3 @500mA	Dali	Dali 1-100% dimming. Specify current on order

## LED Current Selection

SE-9-350-700-G1T	DIP Switch										 ON OFF
	Output Current	350mA	400mA	450mA	500mA	550mA	600mA	650mA	700mA		
	Output Voltage	2-12V	2-12V	2-12V	2-12V	2-12V	2-12V	2-12V	2-12V		
	Output Power	0.7-4.2W	0.8-4.8W	0.9-5.4W	1-6W	1.1-6.6W	1.2-7.2W	1.3-7.8W	1.4-8.4W		
SE-12-100-400-G1T	DIP Switch										 ON OFF
	Output Current	100mA	150mA	200mA	250mA	300mA	350mA	400mA			
	Output Voltage	9-42V	9-42V	9-42V	9-42V	9-40V	9-34V	9-30V			
	Output Power	0.9-4.2W	1.35-6.3W	1.8-8.4W	2.25-10.5W	2.7-12W	3.15-11.9W	3.6-12W			
SE-15-350-700-G1T	DIP Switch										 ON OFF
	Output Current	350mA	400mA	450mA	500mA	550mA	600mA	650mA	700mA		
	Output Voltage	9-42V	9-37.5V	9-33V	9-30V	9-27V	9-25V	9-23V	9-21.5V		
	Output Power	3.15-14.7W	3.6-15W	4.05-14.85W	4.5-15W	4.95-14.85W	5.4-15W	5.85-14.95W	6.3-15.05W		
AD-36-200-1200-E1A1	DIP Switch										 ON OFF
	Output Current	200mA	350mA	500mA	600mA	700mA	900mA	1050mA	1200mA		
	Output Voltage	10-54V	10-54V	10-54V	10-54V	10-52V	10-40V	10-35V	10-30V		
	Output Power	2W-10.8W	3.5W-18.9W	5W-27W	6W-32.4W	7W-36.4W	9W-36W	10.5W-36.75W	12W-36W		

## Switch Lighting Drivers – old run-out models

230V Constant current drivers									
Driver	Power max	Max V	Output	SL201 SL211 SLDL614T SLDL624F (all types)	SL204 SL214	SLDL614T SLDL624F (2700K, 3000K, 4000K)	SL900 SL901	Dimmable	Comment
<b>Current</b>				350mA	350mA	700mA	500mA		
<b>LO5020</b>	12W	3-32	350/700mA	1-9	1-2	2-4 (5 just ok)	1-3 @350mA	No	
<b>LO5021</b>	12W	3-32	350/700mA	4-9	1-2	4 (5 just ok)	1-3 @350mA	TE dimmable	
<b>LO5049</b>	40W	26-60	245-1050mA	9-18	3-4	9-18	3-6 @500mA	1-10V dimmable	Dimming is very poor. 125mA minimum. <b>Specify current on order.</b>
<b>LO5016i</b>	20W	3-32	350/700mA	1-9	1-2	1-9	1-3 @350mA	1-10V + switch	1-10V dimmable + switch dimmable
<b>LO5011i</b>	20W	3-32 + 12/24V	350/700/ 1050mA	1-9	1-2	1-9	1-3 @350mA	1-10V + switch	1-10V dimmable + switch dimmable
<b>CL700S-240-C</b>	33W	9-48	350/700mA	4-14	1-3	4-14	1-5 @350mA	No	
<b>CL500-240-C</b>	24W	9-48	500mA	N/A	N/A	3-15	1-4	No	
<b>CL500A-240-C</b>	24W	11-48	500mA	N/A	N/A	4-15	2-4	1-10V dimmable	Resistor programmable
<b>CL500D-240-C</b>	24W	15-48	500mA	N/A	N/A	5-15 @500mA	2-5 @500mA	Dali	

## How many constant voltage lights per driver?

Use the convenient table below to check max & min number of lights to connect:

### Switch Lighting Drivers

230V Constant voltage drivers									
Driver	Power max	V	Output	SL41	SL224 SL234 SLGL234 2700K, 3000K, 4000K, red, amber	SL224 SL234 SLGL234 Green, blue	SL231 SL241	SLBL120F SLBL121F SL910	Dimmable
<b>Q4-12V-20W</b>	20W	12V	12V@1.7A	1-12	1-3	N/A	1-680	1-4	No
<b>SLDV-12V-40W</b>	40W	12V	12V@3.3A	1-24	1-7	N/A	1-1300	1-8	No
<b>SLDV-12V-75W</b>	75W	12V	12V@6.25A	1-45	1-13	N/A	1-2000	1-15	No
<b>SLDV-24V-75W</b>	75W	24V	24V@3.15A	N/A	1-10	1-11	1-2000	1-15	No
<b>SLDV-24V-150W</b>	150W	24V	24V@6.3A	N/A	1-20	1-23	1-4000	1-28	No

Low voltage DC drivers (for battery and solar use)									
Driver	Power max	Input V	Output	SL201 SL211	SL204 SL214	SLDL614T SLDL624F SLDL644T SSWS3 (all types)	SLBL120F SLBL121F	Dimmable	Comment
<b>LDD-350LW</b>	8W	9-36V	2-32V @350mA	Depends on i/p voltage from batteries etc. 3@12V i/p 6@24V i/p			1@12V 3@24V	PWM dimming	Step down only. o/p volts=i/p volts - 3V
<b>LDB-300LW</b>	12W	9-36V	2-40V @300mA	1-12	1-3	1-12 @300mA	2-6	PWM dimming	Step up/down. Can also power SL40/ SL50/SL55 from batteries

## Constant voltage (SL41/SL224/SL234/SL231/SL241/SL910)

- Parallel wiring for multiple lights
- Larger cable required for long runs
- More fault tolerant  
A single fault will normally only put one light out
- More rugged during install  
Reversed or live connection does not destroy lights
- Use LED Tester to check wiring (SLAT307)

To calculate the cable size required calculate the total current by multiplying the number of lights by the current per light:

Type	12V system: current per light (Amps)	24V system: current per light (Amps)
SL231/SL241	0.002	0.001
SL41	0.13	Do not use
SLBL120F/SLBL121F/SL224/SL234/SL910	0.44	0.22

## Size guide – constant voltage

Table 1 - evenly spaced lights (table shows maximum volt drop at cable end)

No. of lights	Total current	Total cable length (m)								
		10	20	30	40	50	60	80	100	150
1	0.1	0.04	0.09	0.13	0.17	0.22	0.26	0.35	0.44	0.65
2	0.3	0.07	0.13	0.20	0.26	0.33	0.39	0.52	0.65	0.98
3	0.4	0.09	0.17	0.26	0.35	0.44	0.52	0.70	0.87	0.87
4	0.5	0.11	0.22	0.33	0.44	0.55	0.65	0.87	0.73	0.65
5	0.7	0.13	0.26	0.39	0.52	0.65	0.79	0.70	0.87	0.79
6	0.8	0.15	0.31	0.46	0.61	0.76	0.92	0.81	0.61	0.92
7	0.9	0.17	0.35	0.52	0.70	0.87	0.70	0.93	0.70	0.65
8	1.0	0.20	0.39	0.59	0.79	0.98	0.79	0.63	0.79	0.74
9	1.2	0.22	0.44	0.65	0.87	0.73	0.87	0.70	0.87	0.82
10	1.3	0.24	0.48	0.72	0.96	0.80	0.96	0.77	0.96	0.90
11	1.4	0.26	0.52	0.79	0.70	0.87	0.63	0.84	0.65	0.98
12	1.6	0.28	0.57	0.85	0.76	0.95	0.68	0.91	0.71	0.71
13	1.7	0.31	0.61	0.92	0.81	0.61	0.73	0.98	0.76	0.76
14	1.8	0.33	0.65	0.98	0.87	0.65	0.79	0.65	0.82	0.82
15	2.0	0.35	0.70	0.70	0.93	0.70	0.84	0.70	0.87	0.87
16	2.1	0.37	0.74	0.74	0.99	0.74	0.89	0.74	0.93	0.93
17	2.2	0.39	0.79	0.79	0.63	0.79	0.94	0.79	0.98	0.98
18	2.3	0.41	0.83	0.83	0.66	0.83	0.99	0.83	0.69	0.78
19	2.5	0.44	0.87	0.87	0.70	0.87	0.65	0.87	0.73	0.82
20	2.6	0.46	0.92	0.92	0.73	0.92	0.69	0.92	0.76	0.86
21	2.7	0.48	0.96	0.96	0.77	0.96	0.72	0.96	0.80	0.90
22	2.9	0.50	0.67	0.60	0.80	0.63	0.75	0.67	0.84	0.94
23	3.0	0.52	0.70	0.63	0.84	0.65	0.79	0.70	0.87	0.98
24	3.1	0.55	0.73	0.65	0.87	0.68	0.82	0.73	0.59	
25	3.3	0.57	0.76	0.68	0.91	0.71	0.85	0.76	0.95	
26	3.4	0.59	0.79	0.71	0.94	0.74	0.88	0.79	0.98	
27	3.5	0.61	0.81	0.73	0.98	0.76	0.92	0.81	1.02	
28	3.6	0.63	0.84	0.76	0.63	0.79	0.95	0.84	1.05	
29	3.8	0.65	0.87	0.79	0.65	0.82	0.98	0.87	1.09	
30	3.9	0.68	0.90	0.81	0.68	0.85	1.01	0.90	1.13	

1.0mm<sup>2</sup>
 1.5mm<sup>2</sup>
 2.5mm<sup>2</sup>
 4.0mm<sup>2</sup>
 6.0mm<sup>2</sup>
 8.0mm<sup>2</sup>



**Table 2 - lights are near far end of the cable** (table shows maximum volt drop at cable end)

No. of lights	Total current	Total cable length (m)								
		10	20	30	40	50	60	80	100	150
1	0.1	0.04	0.09	0.13	0.17	0.22	0.26	0.35	0.44	0.65
2	0.3	0.09	0.17	0.26	0.35	0.44	0.52	0.70	0.87	0.87
3	0.4	0.13	0.26	0.39	0.52	0.65	0.79	0.70	0.87	0.79
4	0.5	0.17	0.35	0.52	0.70	0.87	0.70	0.93	0.70	0.65
5	0.7	0.22	0.44	0.65	0.87	0.73	0.87	0.70	0.87	0.82
6	0.8	0.26	0.52	0.79	0.70	0.87	0.63	0.84	0.65	0.98
7	0.9	0.31	0.61	0.92	0.81	0.61	0.73	0.98	0.76	0.57
8	1.0	0.35	0.70	0.70	0.93	0.70	0.84	0.70	0.87	0.65
9	1.2	0.39	0.79	0.79	0.63	0.79	0.94	0.79	0.98	0.74
10	1.3	0.44	0.87	0.87	0.70	0.87	0.65	0.87	0.73	0.82
11	1.4	0.48	0.96	0.96	0.77	0.96	0.72	0.96	0.80	0.90
12	1.6	0.52	0.70	0.63	0.84	0.65	0.79	0.70	0.87	0.98
13	1.7	0.57	0.76	0.68	0.91	0.71	0.85	0.76	0.95	
14	1.8	0.61	0.81	0.73	0.98	0.76	0.92	0.81	0.76	
15	2.0	0.65	0.87	0.79	0.65	0.82	0.98	0.87	0.82	
16	2.1	0.70	0.93	0.84	0.70	0.87	0.70	0.93	0.87	
17	2.2	0.74	0.99	0.89	0.74	0.93	0.74	0.99	0.93	
18	2.3	0.79	0.63	0.94	0.79	0.98	0.79	0.79	0.98	
19	2.5	0.83	0.66	0.99	0.83	0.69	0.83	0.83		
20	2.6	0.87	0.70	0.65	0.87	0.70	0.87	0.87		
21	2.7	0.92	0.73	0.69	0.92	0.76	0.92	0.92		
22	2.9	0.96	0.77	0.72	0.96	0.80	0.96	0.96		
23	3.0	0.67	0.80	0.75	0.67	0.84	1.00	1.00		
24	3.1	0.70	0.84	0.79	0.70	0.87	0.79			
25	3.3	0.73	0.87	0.82	0.73	0.91	0.82			
26	3.4	0.76	0.91	0.85	0.76	0.95	0.85			
27	3.5	0.79	0.94	0.88	0.79	0.98	0.88			
28	3.6	0.81	0.98	0.92	0.81	0.76	0.92			
29	3.8	0.84	1.01	0.95	0.84	0.79	0.95			
30	3.9	0.87	1.05	0.98	0.87	0.82	0.98			



**Example 1:**

10 x SL41 lights evenly distributed along a 50m cable.  $10 \times 0.13A = 1.3Amps$ .  
Use Table 1 to determine we need 1.5mm<sup>2</sup> CSA for the cable cores @ 50metres.

**Example 2:**

As with Example 1 however all lights near end of cable.  
Use Table 2. Now we need 2.5mm<sup>2</sup> CSA for each core of the cable.

**Contact Switch Lighting for longer cable runs**