

SWITCH ®

LED Tips & Tricks



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Common Terms used in LED Lighting

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

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 Lights (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, etc. They are not bright enough to illuminate objects – for this we 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. We recommend it should be specified for all **SL201** and any other series connected LED system at 350mA or 700mA.



LED Tester (SL307/SLAT301)

This very 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

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				
All E-LIGHTZ (SL35, SL40) All D-LIGHTZ (Fixed and Tiltable) sLED (SL50, 55, 56)	Description	Model	Max%	Min%	Stability
	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	96	5	✓
SL900 with SL500D driver Dimmers marked (*) may not turn on until the brightness is adjusted to > 7%	Description	Model	Max%	Min%	Stability
	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	✓	
SL201, SL204, SL614, SL900 Used with L05021 350mA driver	Dimmer	Min%	Min no. of LEDs	Comments	
	PDL 654M Universal	28	4	Slight start-up flash then stable	
	Clipsal 32E450TM Trailing	23	4	Stable	
	HPM CAT400T	15	4	Stable	

This list is updated from time to time. Please check website for latest information.

Switch Lighting Driver Dimmer Compatibility List

Description	Model	Lux Max	Lux min	Max%	Min%	Stability	Comment
Clipsal trailing edge	32E450TM	870	100	97	11	✓	
Clipsal universal	32E450UDM	860	110	96	12	✓	
Clipsal universal push button	31E2PUDM	860	80	96	9	✓	
Clipsal LED dimmer	32ELEDM	860	30	96	5	✓	
PDL trailing edge	624M/824M	870	100	97	11	✓	
PDL universal	654M/854M	860	110	96	12	✓	
PDL leading edge	634LM	850	80	94	9	✓	
PDL universal - ICON	354RDMLLED-VW	850	77	94	1	✓	Will not turn on if below 3%
PDL universal - ICON - push button	354PBDMUN-VW	850	77	94	9	✓	
PDL universal push button	654PBM	860	80	96	9	✓	
Legrand/HPM	EM400TR	850	57	94	6	✓	
Legrand push button	EM400A3P	830	27	92	5	✓	
Legrand push button	EM450UP	820	76	91	8	✓	Might flash when off but not seen in testing. Not recommended.
Kiwi dimmer	K005U	860	25	96	5	✓	
Home DL dimmer	HLDIM-ECL	860	12	96	0	✓	Dims to zero so will not turn on if below 3%
Lumex loadsmart	LT1D450LS	585	12	65	1	✓	Does not go to full brightness
Allsales dimmer	ASA500	870	0	97	1	No	Flickers. Not recommended.

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)

- **Series** wiring for multiple lights
- **Smaller cable** required for long runs
- **Less fault tolerant**
A 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 ²)				
	0.3mm ²	0.5mm ²	1mm ²	1.5mm ²	2.5mm ²
350mA (e.g. SL201)	35m	60m	120m	190m	320m
500mA (e.g. SL900)	20m	30m	60m	95m	160m
700mA (e.g. SL614)	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 at 1 August 2018

230V Constant current drivers									
Driver	Power max	Max V	Output	SL201 SL211 SLDL614T	SL204 SL214	SLDL614T	SL900	Dimmable	Comment
Current				350mA	350mA	700mA	500mA		
LO5020	12W	3-32	350/700mA	1-9	1-2	4 (5 just ok)	1-3 @350mA	No	NOT dimmable
LO5021	12W	3-32	350/700mA	4-9	1-2	4 (5 just ok)	1-3 @350mA	TE dimmable	TE dimmable
LO5049	40W	20-60	245-1050mA	9-18	3-4	9-18	3-6 @500mA	1-10V dim	Dimming is very poor. 125mA minimum. Spec current on order.
LO5016i	20W	3-32	350/700mA	1-9	1-2	1-5	1-3 @350mA	1-10V + switch	1-10V dimmable + switch dimmable
LO5011i	20W	3-32 + 12/24V	350/700/ 1050mA	1-9	1-2	1-5	1-3 @350mA	1-10V + switch	1-10V dimmable + switch dimmable
CL700S-240C	33W	9-48	350/700mA	4-14	1-3	4-14	1-5 @350mA	No	
CL350D-240-C	17W	15-48	350mA	5-15	2-3	N/A	2-5 @350mA	Dali	
CL500D-240-C	24W	15-48	500mA	N/A	N/A	5-15 @500mA	2-5 @500mA	Dali	
Mini350mA IP65	4W	3-12	350mA	1-3	N/A	1-3 @350mA	1	No	IP65
Mini700mA IP65	4W	3-6	700mA	N/A	N/A	1	N/A	No	IP65
IE-12D	12W	Varies	180-500mA	Please see PM105				Dali	Dali 1-100% dimming, specify current when ordering
230V Constant voltage drivers									
Driver	Power max	V	Output	SL41	SL224 SL234 SL910	SL231 SL241		Dimmable	Power
Q4-12V-20W	20W	12V	12V@1.7A	1-12	1-3	1-500		No	
SLDV-12V-75W	75W	12V	12V@6.25A	1-45	1-13	1-2000		No	
SLDV-24V-40W	36W	24V	24V@1.5A	N/A	1-6	1-1000		No	
SLDV-24V-75W	75W	24V	24V@3.15A	N/A	1-13	1-2000		No	
SLDV-24V-150W	150W	24V	24V@6.3A	N/A	1-26	1-4000		No	
Low voltage DC drivers (for battery and solar use)									
Driver	Power max	Input V	Output	SL201 SL211	SL204 SL214	SLDL614T		Dimmable	
LDD350LW	8W	9-36V	2-32V @350mA	Depends on i/p voltage from batteries etc				Yes, PWM dimming	Step down only. o/p volts=i/p volts - 3V
LDB300LW	12W	9-36V	2-40V @300mA	1-12	1-3	1-12 @300mA		Yes, 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
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	

1.0mm² 1.5mm² 2.5mm² 4.0mm² 6.0mm² 8.0mm²

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			

1.0mm²
 1.5mm²
 2.5mm²
 4.0mm²
 6.0mm²
 8.0mm²

Example 1:

10 x SL41 lights evenly distributed along a 50m cable. 10 x 0.13A = 1.3Amps. Use Table 1 to determine we need 1.5mm² 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 2.5mm² CSA for each core of the cable.

Contact Switch Lighting for longer cable runs.