LED EVENEMENT 2013

LED applicaties voor designers, engineers en lichtarchitecten

1931 CONGRESCENTRUM BRABANTHALLEN DEN BOSCH

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Transforming the world of light

De techniek achter een goede LED-driver

Edgar Langen

November 27th 2013

Lumotech®

De techniek achter een goede LED-driver

- Naast de prijs en generieke specificaties als voedingsspanning, vermogen en afmetingen zijn er veel thema's die belangrijk zijn bij de keuze van een juiste LED-driver.
- Zaken als power factor, efficiëntie bij lagere belastingen, inschakelpieken, rimpelspanning, hot swap mogelijkheden, EMC, keurmerken, levensduur en garantie bepalen de werkelijke kwaliteit van de LED-driver en daarmee een belangrijk deel van de kwaliteit en duurzaamheid van het totale verlichtingsconcept.

Introduction to Lumotech

Lumotech

Lumotech Introduction

- Since 1978 Manufacturer of (LED) lighting electronics
- Part of Nualight group
- Design & development in NL
- Manufacturing in Poland
- 5 year warranty

- LED drivers
  - 5-100W LED drivers
  - Wide current and voltage ranges
  - Low inrush current
- Motion sensors
  - Office motions detectors
  - High bay motion detectors
  - Low Voltage 1-10 Volt motion detectors



Lux Magazine

REVIEWED:
DALI DRIVERS

Jeremy Turner and Alan Tulla test out some market-leading Dali LED drivers

The best way to dim LEDs is with a two-wire approach. There are three principal ways to do this: DMX, used mainly for stage and event lighting; 1-10V, an analogue system for general lighting; and Dali, a digital dimming protocol for general lighting. Dali is the most advanced method, and is increasingly common.

Dimmable drivers are sophisticated electronic devices and many major luminaire manufacturers buy them from specialist component suppliers. We tested drivers from EldoLED, Harvard, Helvar, Lumotech and Lutron to see how they performed, studying their dimming, light output and power consumption. Overall, we were pleased to find that the performance of all the drivers we tested was good. But remember, no two drivers are the same – much depends on the functions you want and how much you are prepared to pay.

What we tested

We measured mains power, luminaire input current and light output for each driver at 100, 75, 50, 25 and 10 per cent output, as determined by the Dali scene level (we've omitted the 25 and 75 per cent values here, but if anyone wants the full data we'll provide it).

Our ratings also take into account price. Manufacturers were reluctant to have exact prices published so we have used ratings: £ = low, ££ = medium, £££ = high.

It's unfortunate that we were not able to test drivers from two of the largest suppliers, Osram and Philips, neither of whom were able to supply samples in time, despite the best efforts of their local sales reps.

● *Turn over for our verdict on five commonly available Dali drivers*

TEST RESULTS

MANUFACTURER	DIM LEVEL	MAINS POWER	LUMINAIRE INPUT CURRENT	LIGHT OUTPUT (lm)
EldoLED	100	9.8W	344ma	439
	50	5.4W	181ma	226
	10	1.5W	69ma	46
Harvard	100	9.5W	359 ma	438
	50	5.5W	181 ma	248
	10	2.3W	35 ma	53
Helvar	100	10.4W	367ma	439
	50	6.2W	257ma	219
	10	2.7W	112ma	43
Lumotech	100	9.3W	348ma	441
	50	5.3W	172ma	248
	10	1.6W	37ma	53
Lutron	100	19.2W	709ma	707
	50	8.6W	316ma	398
	10	2.5W	56ma	82

DRIVER CHECKLIST

- Decide the minimum dimming level you need. In commercial and hotel installations, 10 per cent is probably as low as you need to go (all the drivers featured here go at least that low). For upmarket residential, you will want a driver than can go to one per cent.
- Check the extras the manufacturer offers – these can make all the difference in some installations.
- Always check for flicker at the lowest light output level.
- If a driver is not available with rated current for the LED, always pick a driver with a lower current rating, never higher.
- Always test the driver you plan to use with the control system proposed.
- Check to see if a project has a controls consultant who can give advice.

HOW WE DID THE TESTS

To test the drivers, the Lighting Industry Association Labs in Telford kindly let us take over their lab for the day. To minimise variations, we used the same luminaire throughout – a Light Corporation SRA downlight (700mA max current) which uses a Cree XPE chipset.

All tests were conducted at 350mA, which gives a nominal 10W consumption (with the exception of the Lutron driver which was fixed at 700mA). The downlight was placed in a 2m integrating sphere and allowed to stabilise thermally. To control the Dali signal we used a USB PC interface with standard Dali command set. Details of the Dali protocol are set out in technical standard IEC 62386.

Thank you to Light Corporation for the supply of the test fitting, and thank you to all the staff at Lighting Industry Association Labs who helped us conduct the tests.

Reviewed: Dal

HELVAR LC1

The Helvar LC1 has a number of OEM-specific features that help justify its relatively high price point, notably AC or DC input (central battery systems) and external thermal sensor input. It also dims all the way to one per cent.

PRICE £££

★★★

ELDOLED SOLODRIVE

The SoloDrive uses a proprietary dimming method which the manufacturer says will give a smoother dimming curve and produce no flicker all the way to zero. Although we didn't test extensively enough to verify EldoLED's specific claims, the driver's overall performance was excellent – and it's good value given the features it offers.

PRICE ££

★★★

LUTRON ECOSYSTEM

Lutron's Ecosystem driver will work with Dali and Lutron's proprietary control equipment. It's a good choice if you plan to pair it with Lutron's system but still want the option to use other manufacturers' Dali system later. It also offers mains voltage protection. At time of writing there was only a 700mA version, but a full range is on its way – we tested a production sample.

PRICE ££

★★★★

LUMOTECH ECOLINE

BEST VALUE FOR VARIABLE OUTPUT

Lumotech EcoLine is new to the market (we tested a production sample), and perfoms really well. It dims to five per cent and has variable current output. The build quality is excellent, inrush current is low and the driver can deliver up to 1,000mA.

PRICE ££

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PRICE ££

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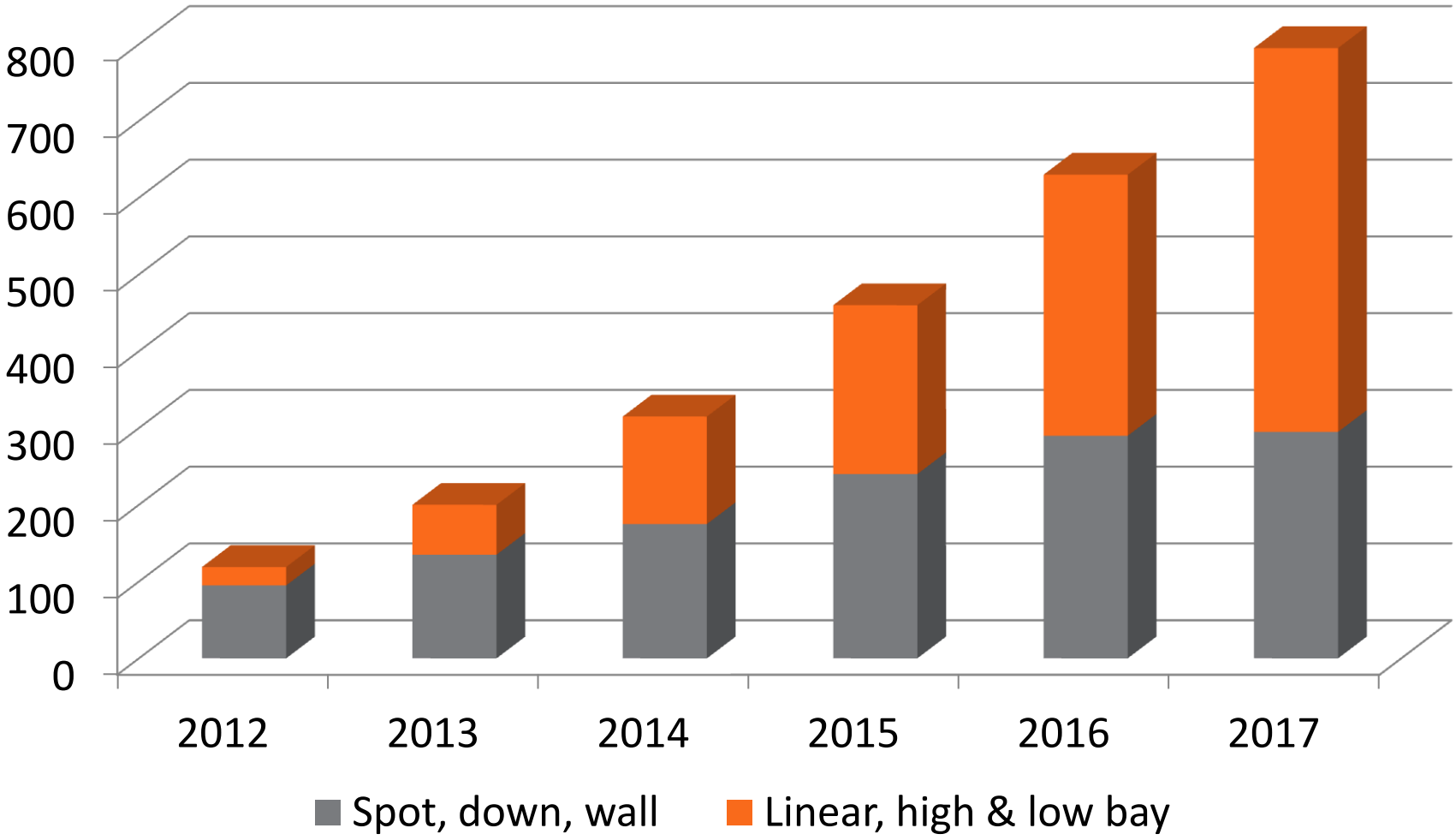
EMEA Lighting Driver Market

Lumotech

Market Development Indoor LED Drivers Europe



Driver specifications

and what they mean for your product!

Lumotech

CV, CC, Voltage and current ranges

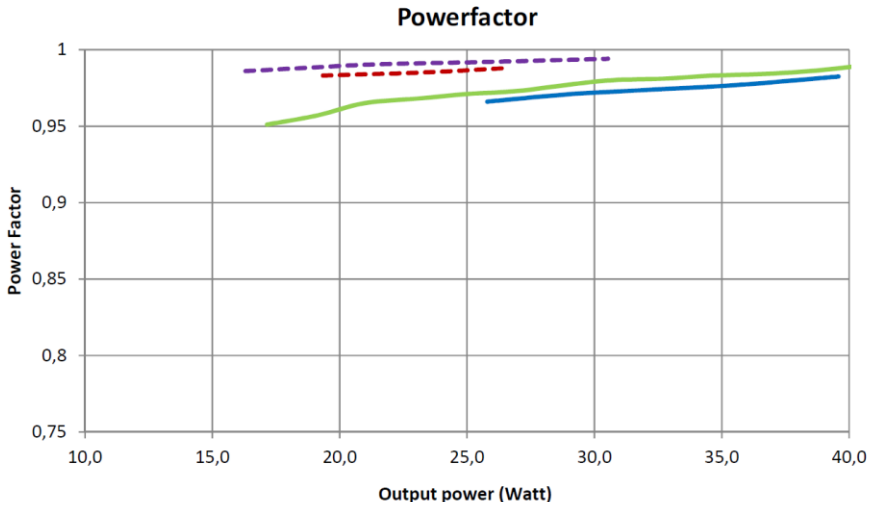
- Constant voltage for applications where the LED topology is not pre-defined.
- Constant current is the more efficient technology. Use where possible.

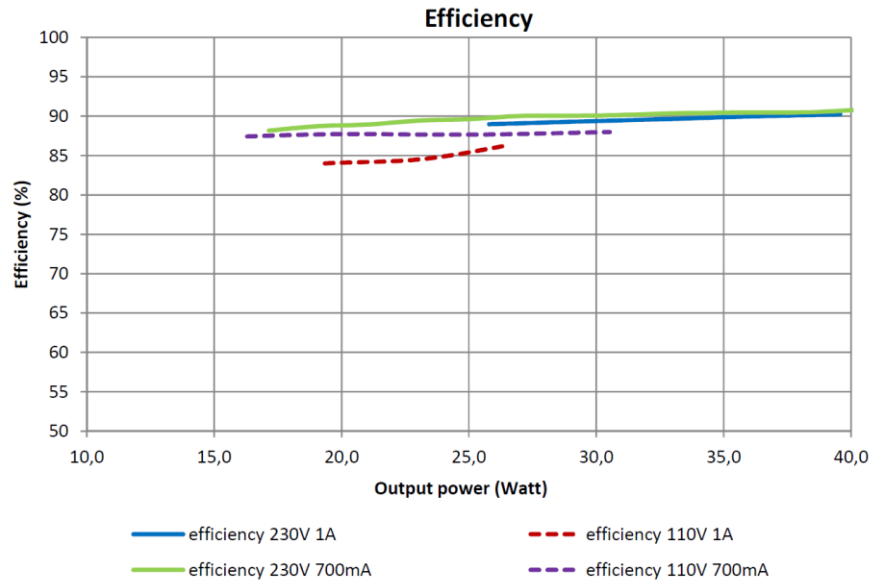
- Voltage range defines variety of LED emitter structures to be supported by one single driver.
  - This defines the amount of driver SKU's needed in stock.

- Fixed vs. variable current
  - Fixed is most cost effective and doesn't require configuration.
  - Variable current reduces SKU's
  - Variable current supports backward compatibility of fixtures for future generations of emitters (CoB, MP, HP LED's)

- Example L05040: 7-55V, 100-1000mA

High efficiency and PF for wide range of loading





- Flat PF and efficiency curves ensure that wide current and voltage range support is usable in practice.
- Check whether driver maintains its performance for all practical use cases.

Dimming

- Visual effect vs. energy saving
  - Dimming to 20% provides high level of comfort and safety while providing significant savings
  - For really dimly lit environments you need 1% or less.
- Lowest dimming level
  - In % (for PWM dimming)
  - Or in minimum current level (for linear dimming)
- Flicker free dimming
  - PWM vs. linear

Ripple current

- Flicker
  - High level of 100Hz ripple can cause visual discomfort. <10% is advised.
- System reliability
  - Ripple current is important at high currents.
  - In order to ensure a good LED lifetime it is essential not to overdrive the LEDs
  - Current density is affecting catastrophic failures in LED’s
  - Lumileds advises <30% ripple at

Inrush current

- Inrush current defines the amount of drivers that can be connected to one circuit breaker
- Look for circuit breaker related specifications in driver datasheet

Maximum number of drivers on automatic circuit breakers

Automatic circuit breaker type	C10	C13	C16	C20	B10	B13
L05060	18	23	28	35	18	23

On/Off dynamic behaviour

- How long does it take for the driver to start?
- How long does it take for the driver to switch off?
- Does the driver start without flicker?
- Does the driver switch-off without flicker?
- Does the driver start at the original dimming level?

- Avoid surprises and test for multiple scenarios
  - High and low dimming settings.
  - Different loads

Protections

- Thermal protection
  - Shutdown vs dimming.
- Active overcurrent protection
  - Hot-swapping of LED strings without damaging them?
- Active overload protection
  - Active power limiting?
- Short-circuit protection
  - Automatic recovery?
- No-load operation
  - Look at the output voltage in no-load operation.
- Surge protection
  - diff. & common surge protection

EMI

- Check for headroom vs. standards. (EN55015, EN61000)
  - Driver behaviour with resistive load and short wires is not representative of real life fixture.

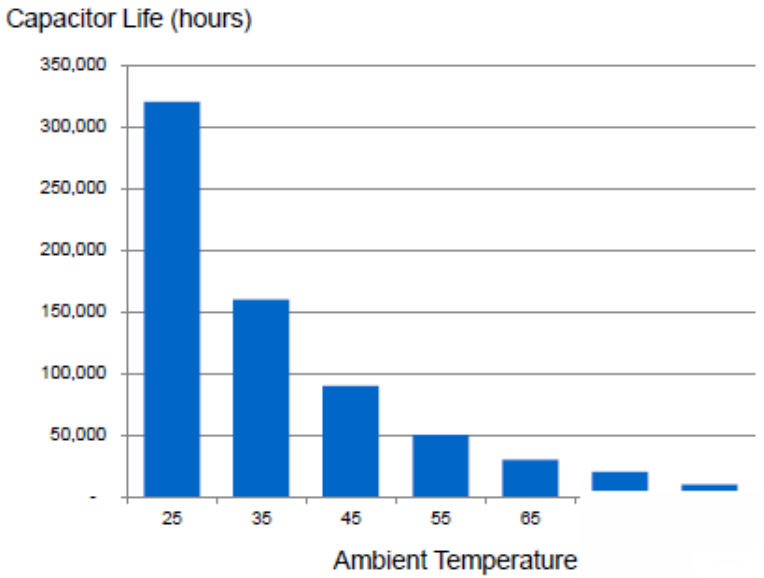
Safety

- IEC61347
  - Safety for lamp control gear
- SELV
  - Safe low voltage
- CE
  - Mandatory – self certification
- ENEC
  - Voluntary – external certification by accredited body

- Regional specific standards
  - CB, UL, CCC, Ghost, RCM,…….

Reliability

- MTBF (Mean Time Between Failures)
  - Failure mechanism: Semi-conductor components, MOSFETs, diodes, ICs, optocouplers…
  - Order of magnitude: >300Khours
- Lifetime
  - Primary failure mechanism in drivers: Electrolytic capacitors
  - Influence factors: load and temperature
- Elco's come in all quality grades…..
- Check for which Tc the lifetime has been specified!



Warranty

- Warranty duration
- Warranty conditions and exclusions
- For what usage (lifetime, max temperature, etc.) has the warranty been specified.

Checklist driver specification

- Voltage range
- Current range
- Dimming
- PF
- Efficiency
- Inrush current
- Output current ripple
- Protections
- EMC
- THD
- Approvals
- Reliability
- Warranty

There is so much more to selecting an LED driver than cost only!

Presentatie namens Elincom

www.Elincom.nl