

# Programmable Intelligent LED Drivers

**LED EVENEMENT 2013**

LED applicaties voor designers,  
engineers en lichtarchitecten

1931 CONGRESCENTRUM  
BRABANTHALLEN DEN BOSCH

WOENSDAG 27 NOVEMBER 2013

# Agenda

## Programmable Intelligent LED Drivers

- Quick Introduction FLS
- The LED Driver, more than a transformer
- Programmable LED Drivers, features
- Programmable LED Drivers in a SSL lighting system with regards to system reliability and lifetime
- How to program
- Portfolio
- Q&A

# Introduction

# Future Lighting Solutions

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# Future Lighting Solutions

A Division of Future Electronics



Commercialized and sold the first power LED in the world

Exclusive WW engagement with Philips Lumileds Lighting Company

Creation of the 'Future Lighting Solutions' division

Philips Lighting products added to line card and FLS launches the simpleLED™ program

Significant expansion of SSL portfolio with strategic WW relationship with LG Innotek

1999

2000

2003

2010

2012



**PHILIPS**  
LUMILEDS



simpleLED®  
**PHILIPS**  
sense and simplicity



Over 10 Years of enabling LED Lighting.....

# “Make or Buy”

## LED Driver

### Make

#### Components

Low

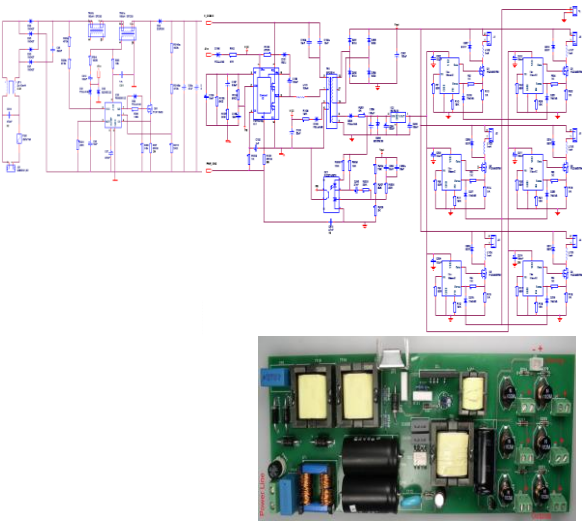
Slow

Must Certify

Required

Required

High/Medium



**BOM Cost**

**Time**

**Certification**

**Engineering**

**Manufacturing**

**Investment**

### Buy

#### Sub Systems & Modules

Medium/High

Quick

Provided

Limited

Limited

Low



# LED Driver, more than a transformer!

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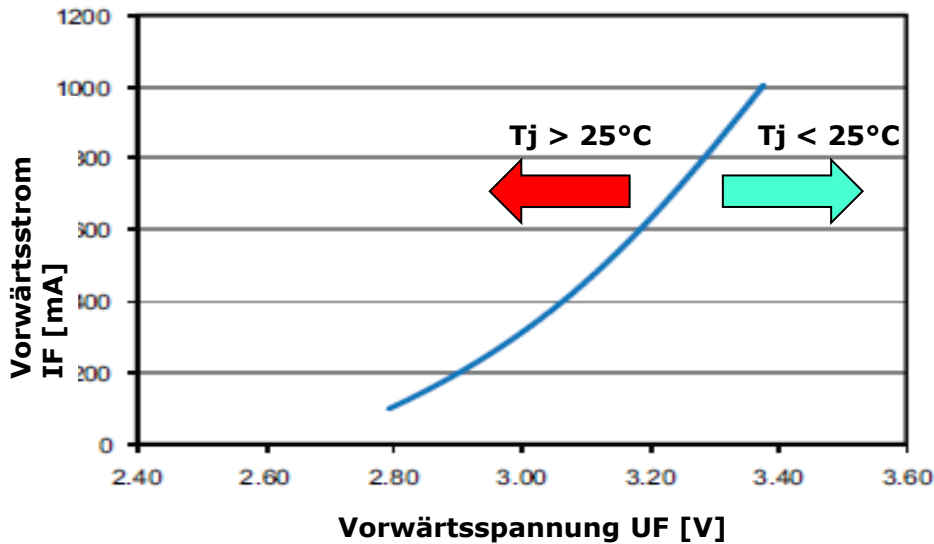
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# Electrical Behaviour of LEDs –

## Influence of drive current and junction temperature



Drive current and junction temperature are the main influencing factors for the lifetime of the LED component and determine the light output (flux).

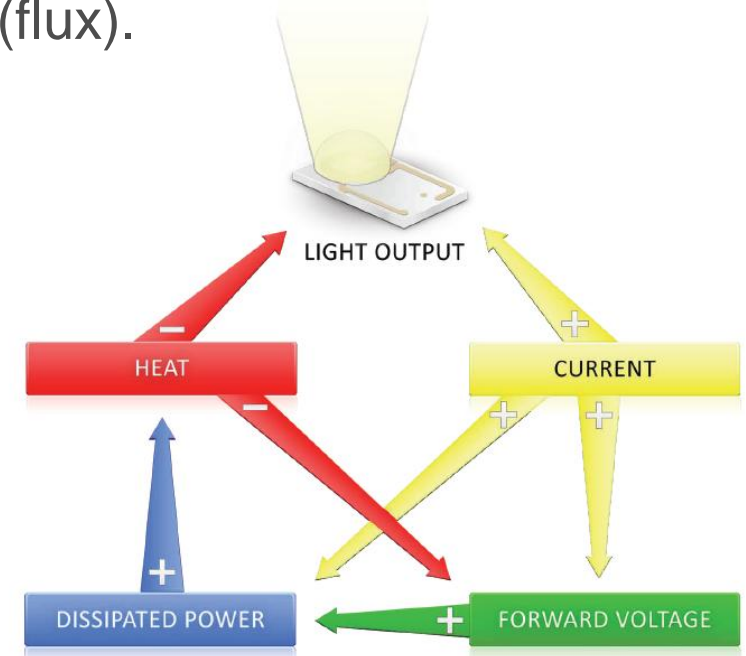
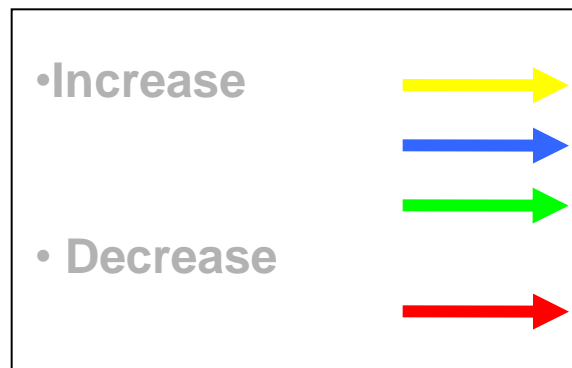
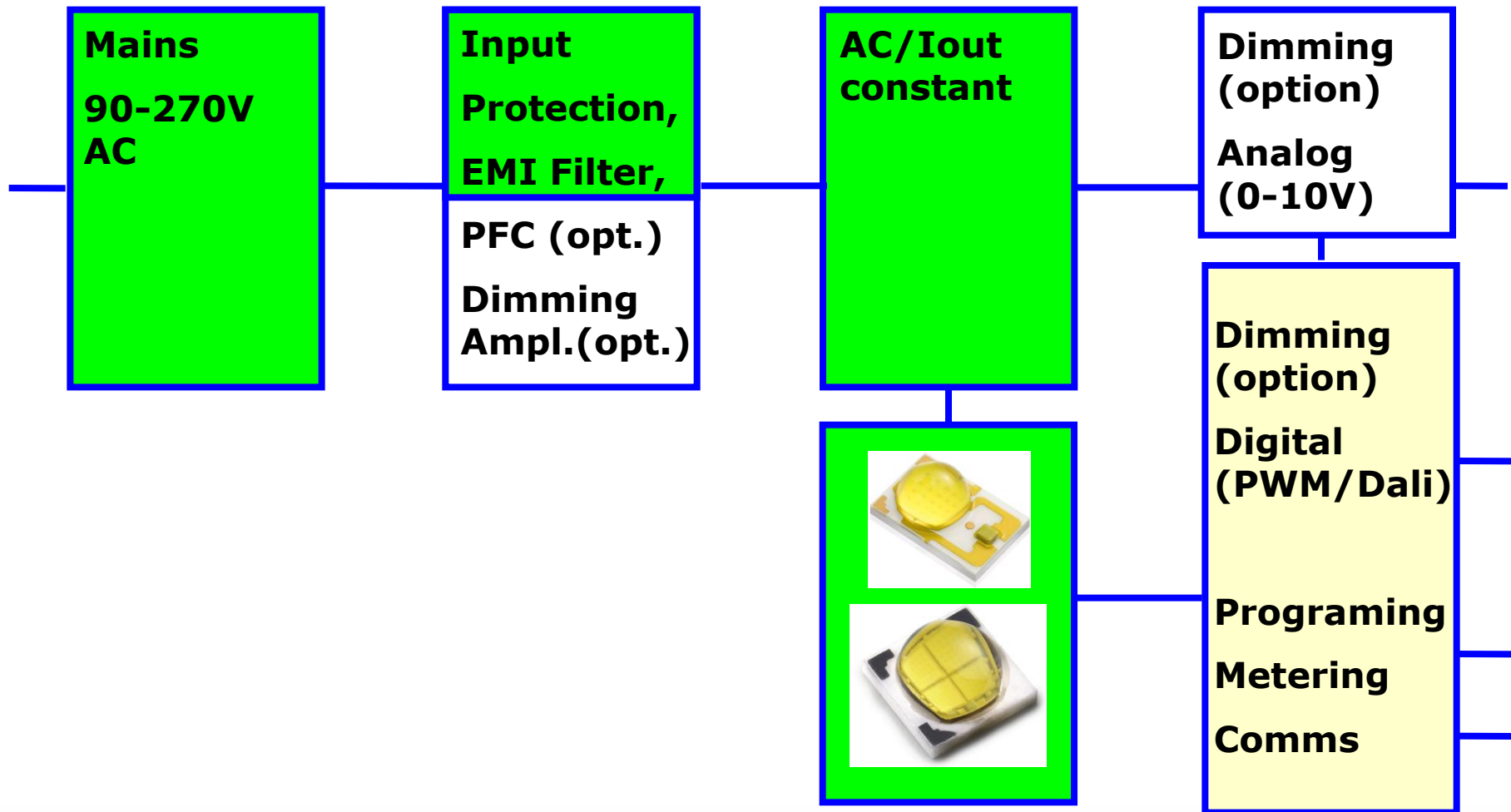


Figure 1 Different Factors Affecting the Light Output

# LED Driver with Mains Input as Block Diagram





# LED Driver with Mains Input: How to select?

1. Make or Buy?
2. Mains input voltage?
3. How many LEDs at what current? → Output Power?
4. How many LEDs in series?  
(Output Voltage: Check minimum rating at dimming!)  
/ or parallel (Multichannel, otherwise not recommended)
5. PFC needed ( $P > 25W$ )?
6. Isolation requirements?
7. Certifications (IEC, EN...)?
8. Analogue Dimming (1-10V),  
Digital Control (PWM, Dali, DMX, Wireless)
9. Programmability?
10. Environment (IP rating, Ambient Temperature)?
11. Lifetime?
12. Guarantee?

FLS can help here, check Driver Selector Tool:

<http://www.futurelightingsolutions.com/en/development/>

Watch out component lifetime and reliability (Electrolytic Capacitor)!

The screenshot shows the 'Driver Selector Tool' interface. At the top, there's a navigation bar with 'Login / Logout', 'Enter FLS Online Tools', 'DST Screenshots', and 'How DST Works'. Below this, a diagram shows 'Input Voltage', 'LED Count', 'Drive Current', and 'Several Options' feeding into a 'Driver Selector Tool' box, which then outputs a 'Driver Solution' represented by a circuit board. Below the diagram, there are bullet points: 'LED Drivers are an integral part of the lighting system', 'Driver Selector Tool assists in selecting the optimal driver for the application requirements', and 'Wizard assists users in entering input information'. Further down, a section titled 'Please fill out the form below:' contains a table for 'Required LED Driver Selection Inputs'. The table has columns for 'LED Driver Type', 'LED Driver Input Voltage', 'LED Driver Output Type', and a 'Collaps' button. The 'LED Driver Type' is set to 'Constant Current - AC/DC'. The 'LED Driver Input Voltage' is set to 'multiple selects' with a dropdown menu showing '100 - 120 Vac', '100 - 240 Vac', '100 - 277 Vps', '220 - 240 Vac', and '220 - 277 Vps'. The 'LED Driver Output Type' is set to 'Driver Output Current'.

Required LED Driver Selection Inputs:	Collaps
LED Driver Type: Constant Current - AC/DC	?
LED Driver Input Voltage - multiple selects: 100 - 120 Vac, 100 - 240 Vac, 100 - 277 Vps, 220 - 240 Vac, 220 - 277 Vps	?
Driver Output Type: Driver Output Current	?

# Programmable LED Drivers, Features

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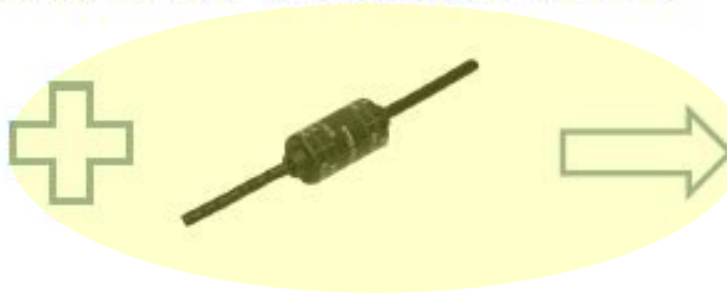
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# Programmable LED Driver Options

## Programmable Controller for Existing Drivers



0-10V Dimmable Driver



Programmable Controller



LED module

## Programmable Drivers



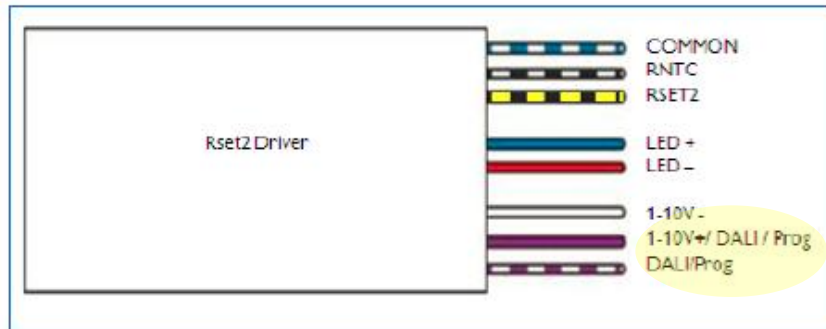
Programmable LED driver



LED Module

# Programmable LED Driver

## Connections: Example Philips



### ■ Input

- RNTC: Temperature Control LED Board
- RSET: Define LED current
- 1-10V (Diming)
- DALI (Digital Addressable Lighting Interface)
- Programming Interface

### ■ Output

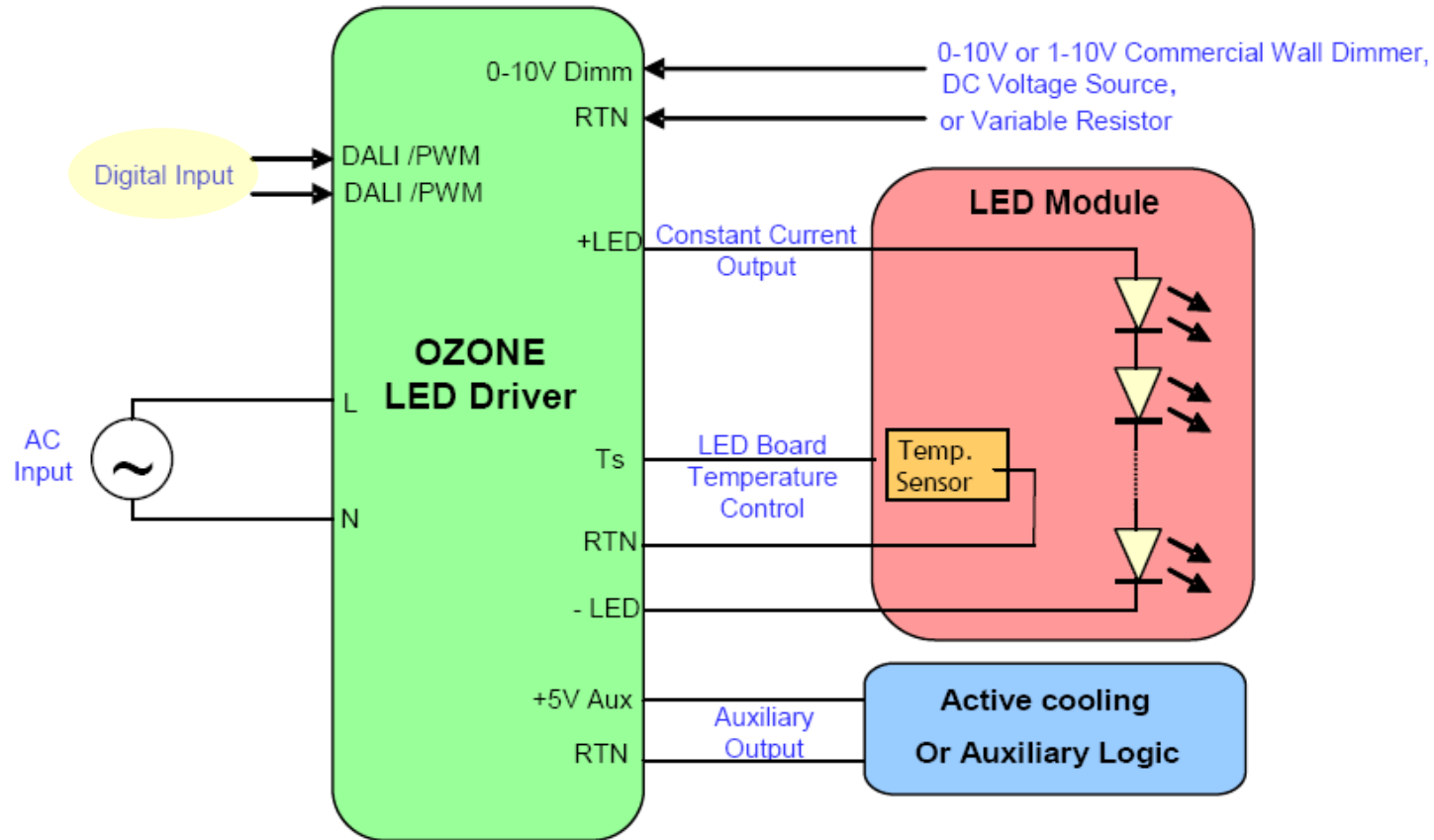
- LED Current

# Programmable LED Driver

## Connections: Example Roal



### Ozone Block Diagram Overview



Ozone: 70W Single Channel Constant Current LED Driver

# Programmable LED Driver

## Possible Features

- Programmable, adjustable Output Current
  - LED Current can be adjusted to match LED module requirements
  - Same drivers for multitude of different luminaires
  - Less inventory positions
- Programmable Constant Light Output
  - Additional energy savings
  - Eliminates “over-lighting” in the beginning of installation lif
- Temperature Control LED Module
  - Prevents overheating of LED Module by gradual reduction of LED current
- Amp Dim
  - Cabinet controlled dimming via reduction in amplitude of input mains
- Digital Control
  - Connection to network infrastructure to control the LED driver. (e.g. DALI)
- End of Live Indicator
  - Luminaire manufacturer can program the driver to signal via flash on start-up when the LED module should be replaced
- Power Factor correction
  - (Necessary at power > 25W)

# Programmable LED Driver

## Possible Features (cont)

- Integrated automatic dimming
  - Diming levels and timing can be programmed
- Usage in combination with sensors (Daylight / Occupancy / Temperature)
- Energy measurement and reporting
- Connection to network infrastructure via
  - Cable
  - Wireless
  - Powerline
- Programming of illuminance level and system efficacy at installation

## Possible Protection Features

- Overvoltage, surge protection at input (partilly)
- Overload protection
- Overvoltage protection and undervoltage lockout
- Overcurrent and short circuit protection at constant current output
- Overtemperature protection of driver and LED module

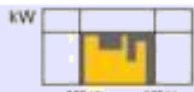
# Usage of Programmable LED Drivers:

## Energy saving potential

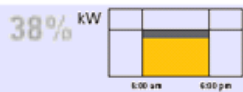
Easy

Performance

Innovation +  
Design



Personal  
Control



Task  
Tuning



Occupancy Control  
Daylight Harvesting

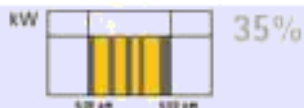
**FUTURE**  
Lighting Solutions

75% energy saving  
package



Occupancy Control  
Daylight Harvesting

40 % energy saving package



Occupancy Control

35 % Energy saving package



Daylight Harvesting

20 % energy saving  
Package

On / Off

Data courtesy of Philips Lighting



# Usage of Programmable LED Drivers:

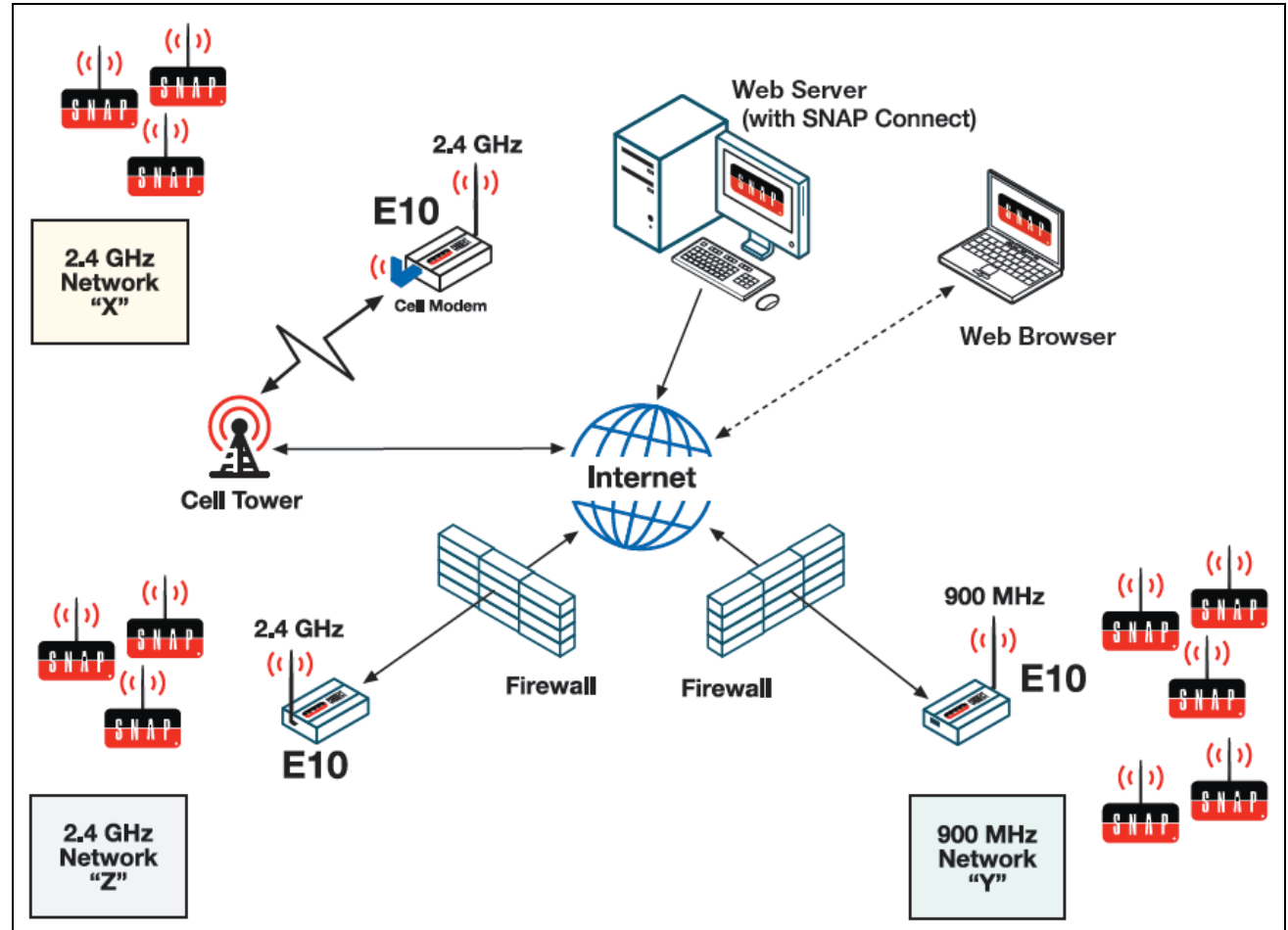
## Wireless Controls and Networks, Synapse



**Synapse RF Engine**  
(Digital  
and/or  
analogue IO)

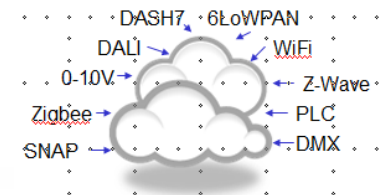
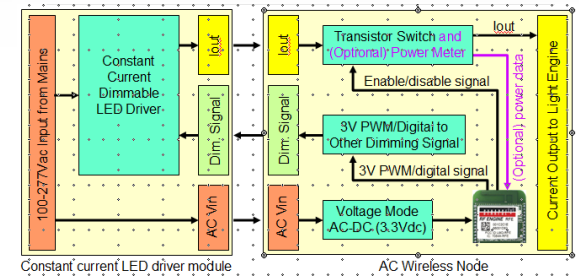


**Cloud Appliance (E10)**



# Programmable LED Driver: Future

- Measurement of actual power and temperature of driver
- Measurement of actual power and temperature of LED Module
- Energy measurement at fixture level and accurate energy costing
- Permanent status monitoring of driver and LED module,  
Reporting via network infrastructure
- Value recording over time, lifetime calculation.  
Reporting via network infrastructure
- Detection of dirt
- Each Luminaire with own IP address



# Programmable

# LED Drivers

in a SSL lighting system with regards to  
system reliability and lifetime

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# Programmable LED Driver:

## Impact on system reliability and lifetime

Lighting controls such as daylight harvesting, occupancy sensors or other dimming techniques can reduce the power dissipated in the fixture and thus significantly lower driver temperatures.

A difference of 10°C can yield a 2x difference in product life!

These controls not only can produce significant energy savings, they can greatly extend the life of the product.

Conclusion:

Leverage lighting controls to extend the life of the product by running at lower power levels whenever possible.

From Inventronics Marshall Miles

# How to program

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# Programmable LED drivers

## Programming: Example Philips

Philips Xitanium programmable LED Drivers are programmed using the Philips MultiOne Programming Interface.



Figure 33 - Philips MultiOne programming interface



# Programmable LED drivers

## Programming: Example Philips

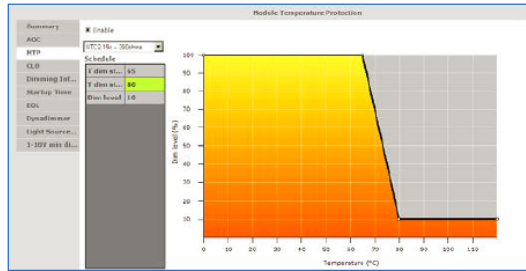


Figure 14 - Module Temperature Protection

### 6.1. Module Temperature Protection (MTP)

This feature helps to protect the LEDs when operated in a hot ambient environment. The driver helps to regulate LED module temperature by regulating current. An NTC (Negative Temperature Coefficient resistor) must be present on the LED module and connected to BLACK/WHITE and BLUE/WHITE wires of the driver in order to use this feature. Two specific NTC part numbers are supported by this driver, while the third option enables correct operation in combination with Philips LED modules

1. 10 k NTC - Murata 10 k  
Part number NCP18XH103J03RB
2. 15 k NTC - Murata 15 k  
Part number NCP15XW153E03RC (with a separate 390 ohm resistor in series with the NTC)
3. Philips LED light engines

### 5.2. Driver output current

The driver output current can be selected via the Rset resistor or with the programming interface. Xitanium programmable LED drivers use two resistor types. In all documentation, **Rset** may refer to either Rset1 or Rset2, depending on the driver type. Please check the driver datasheet for the specific resistor and corresponding current values. See Figures 5 and 6 for resistor value/output current curves.

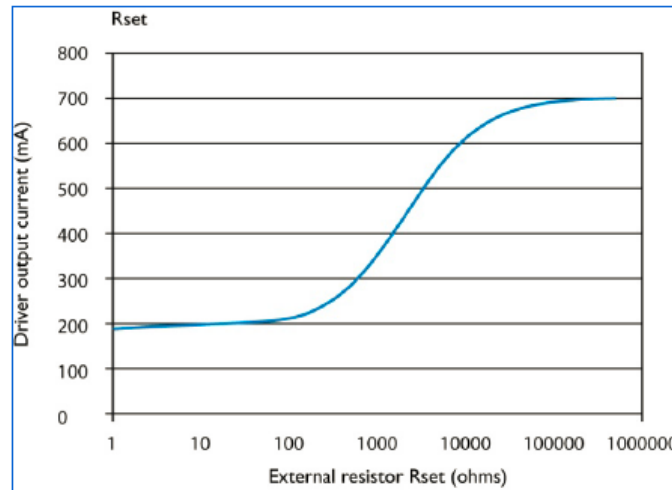


Figure 5 - Rset1 curve

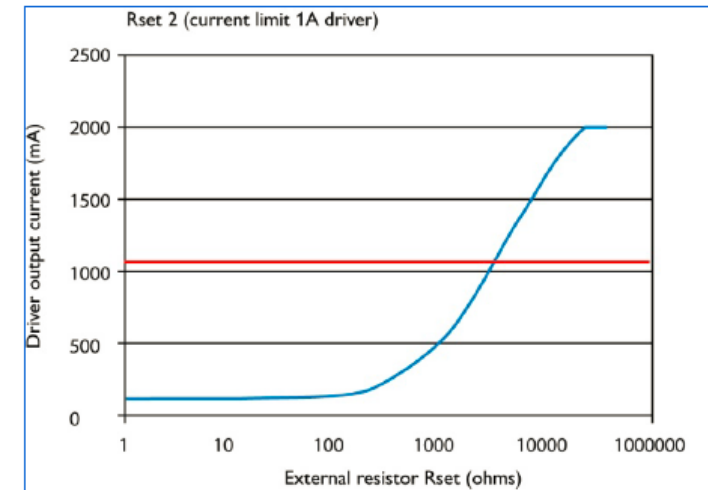


Figure 6 - Rset 2 curve

# Programmable LED drivers

## Programming: Example Roal



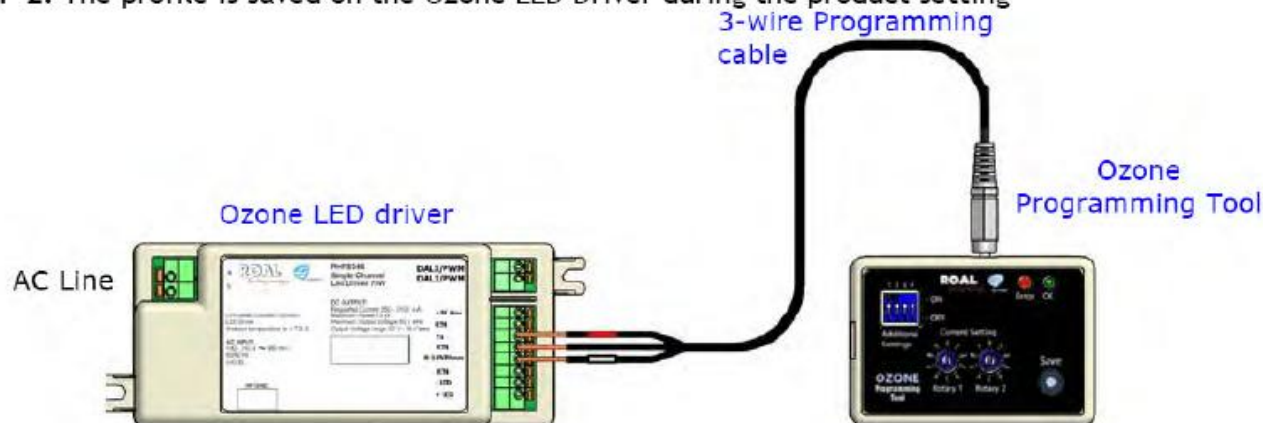
] How store the Driver settings and current profile



STEP1: The current profile is defined using the dedicated sw (Ozone Toolset PC SW) and then it is stored on the Programming Tool



STEP 2: The profile is saved on the Ozone LED Driver during the product setting



lev.02\_19 May 2012



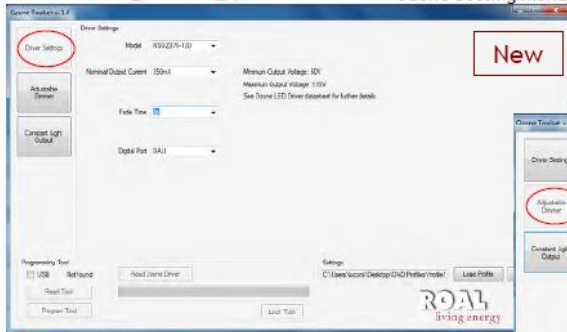
# Programmable LED drivers

## Programming: Example Roal

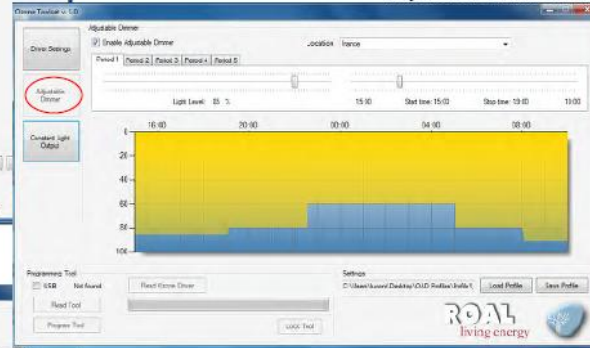


**ROAL**  
living energy

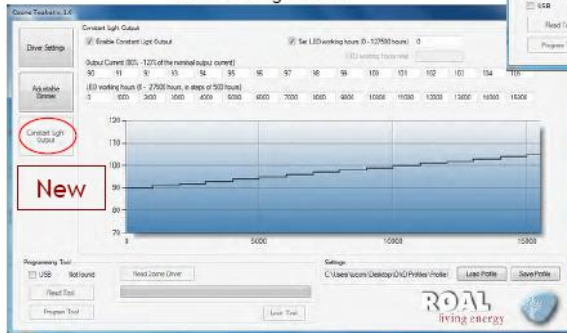
Ozone Toolset PC Software



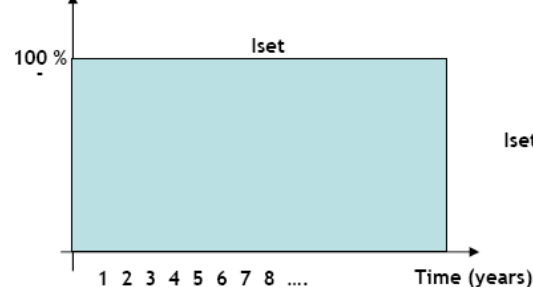
Adjustable Dimmer Menu



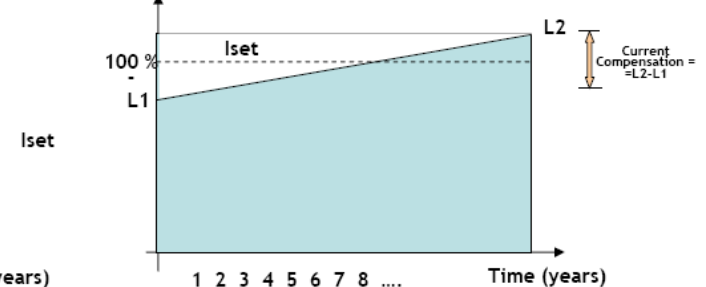
Constant Light Menu



$I_{out}/I_{set}$  **CONSTANT CURRENT MODE**



$I_{out}/I_{set}$  **CONSTANT LIGHT MODE**



# Portfolio

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# More Information:

<http://www.futurelightingsolutions.com>

The screenshot shows the homepage of the Future Lighting Solutions website. The header includes the company logo, tagline "Making LED Lighting Solutions Simple™", and navigation links for Home, Company Info, Press Room, and Contact Us. A secondary navigation bar offers Login/Register, My Account, and Cart options. The main content area features a large banner for Philips Lumileds Chip On Board, a sidebar for "The 2013 All in 1 LED Lighting Solutions Guide", and a "Latest News" section with three articles. The footer contains a "Sign-up for our Newsletter!" form and a Japanese language link.

**FUTURE Lighting Solutions** Making LED Lighting Solutions Simple™

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**Philips Lumileds Chip On Board**  
Uniform, High Lumen Output Arrays

**The 2013 All in 1 LED Lighting Solutions Guide**  
NOW AVAILABLE

**Our Products**

- High Power LEDs
- Mid Power LEDs
- Integrated Solutions
- Optics
- Power Solutions
- Lighting Controls
- Remote Phosphor
- Interconnect
- Thermal Management

**Latest News**

May 07, 2013  
Future Lighting Solutions and TECH TOP Collaborate to Illuminate Shengli Street in Dongying, Shandong | <read more>

April 16, 2013  
Future Lighting Solutions to Present Solid-State Lighting Solutions at LIGHTFAIR® International 2013 | <read more>

April 02, 2013  
Future Lighting Solutions and AZZ | R-A-L Collaborate to Design Explosion Proof LED Fixtures | <read more>

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**FUTURE Lighting Solutions**  
Making LED Lighting Solutions Simple™

The image shows the cover of the "All in 1 LED Lighting Solutions Guide". It features a dark background with vibrant, colorful light streaks in shades of blue, green, and purple. The title "All in 1" is prominently displayed in a large, white, sans-serif font, with "LED Lighting Solutions Guide" written in a smaller font below it. The Future Lighting Solutions logo is visible in the bottom right corner.

**All in 1**  
LED Lighting Solutions Guide

**FUTURE Lighting Solutions**  
Making LED Lighting Solutions Simple™

# Thank you, Any Questions?

[www.FutureLightingSolutions.com](http://www.FutureLightingSolutions.com)

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