Selection of Electronic Control Gear (ECG)
(sometimes known as Drivers)
for LED Luminaires for Lighting Applications

1. Introduction

This document is designed to provide basic guidance in the type of ECG used to power and control the energy to LEDs in luminaires for lighting applications. This guidance document does not cover LED lamps with integral control gear as they are sold complete with their ECG integrated within the lamp construction.

2. Definition

A light emitting diode (LED) is a semiconductor diode that emits light of one or more wavelengths (colours). A diode is a device which passes electrical current in only one direction. The LED is encased in a plastic, epoxy resin or ceramic housing and driven from a dedicated dc electrical circuit. The housing/luminaire may incorporate one or many LEDs.

3. Electronic Control Gear (ECG)

The belief is that the ECG used for LED's is nothing more than a transformer, the reality of this is far from the fact. It is important that the correct ECG is specified as "Off the shelf" power supplies may not have the optimum characteristics for consistent and reliable LED operation. There are two distinct methods in providing power for LED products and generally fall into the following categories:

a) **Constant Current ECG -:** These are designed to power LEDs with a constant current, typically 350/700mA , these currents being directly related to the LED they are intended to drive. It is important to ensure that a constant current ECG has sufficient voltage to operate the number of LEDs connected to it, typically 3.5 volts per LED.

If several LEDs are used in the housing the normal method of connection would be in "series". If LEDs are connected in parallel any variation in forward voltage could lead to an imbalance in current of the individual LEDs affecting lumen outputs for each individual LED. This can also lead to short life for those LEDs driven at higher currents. Care should also be taken in considering that if a drive voltage of greater than 60 volts is required, the wiring is no longer covered by the SELV (Safety Extra Low Voltage) regulations.

b) **Constant Voltage** ECG **:-** These are designed to supply a specific voltage to the LED module which is designed to operate on constant voltage supplies. The LED module is provided with an internal current regulator to provide the actual LED with a controlled current supply. It is important that when using this style of ECG that a unit with the correct voltage is used. Voltage driven LED modules would normally be connected in parallel and the ECG should have sufficient current capacity for the modules connected to it **Multichip LED –** There are now a number of manufacturers offering multichip LEDs as an alternative to the discreet LED chips and these can be operated from a wide range of drive currents. Care should be taken to ensure that the correct drive current is selected to deliver the required performance.

Power factor – The effect of power factor correction should also be identified for the actual combination of ECG / luminaire(s), it cannot be assumed that an ECG designed for a range of LED's will have the same power factor over this range. It is possible that the power factor may be either leading or lagging which in commercial buildings may affect the maximum demand tariffs. You should refer to the manufacturer's minimum and maximum power loading recommendations to ensure best operation of the ECG.

4. Performance

One often overlooked aspect of LED ECG is the true system lumen output. Individual LEDs and modules are quoted as "x" lumens per watt, referring directly to the wattage of the LED and not the total circuit wattage of the system. What is important is the final lumen/watt output available from the LED luminaire. This will take into account the losses in the ECG and optical system employed.
It is necessary to measure the total power and the total lumen output produced by the system at the time photometry is carried out on the LED luminaire.

The key is to ensure that the system specification clearly states the power requirements that have been allowed for at the project design stage and that the correct ECG type, current and voltage are matched to the LED luminaire or module. This, coupled with the correct heat sinking of the actual LED will ensure optimum performance.

5. Dimming

Commercial LED ECG commonly use one of two methods to dim LEDs:

a) Continuous current reduction (CCR), which decreases the forward current, or

b) Pulse-width modulation (PWM), which changes the duty cycle of the applied current. PWM has been more common for LEDs because of its wide dimming range and linear relationship between light output and duty cycle. When PWM dimming, the LED current is modulated at several hundred Hz and this may have consequences for EMC compliance when using extended wiring runs.

There are now many systems available to control lumen output and colour change. These include DMX, DALI, DSI, 1-10 volt, and it is important to ensure that the end product or installation uses a matched set of LED's ECG of the correct type and control to ensure compatibility of the system.

6. Operation

Care should be taken not to overload the ECG as LED ECGs are rated for a maximum load. One of the most common mistakes is to connect too many LEDs in series. The wiring topology of whether to use a Series or Parallel circuit should also be confirmed prior to installation.

The actual IP rating of the ECG should be specified to suit the actual mounting location and that the thermal characteristics of the driver (control gear) are suitable for the chosen location. It is also advisable to position ECG in a location that will allow ease of maintenance.

Further improvement of driver performance and life will be achieved by ensuring an uninterrupted flow of air around the ECG.

7. Life

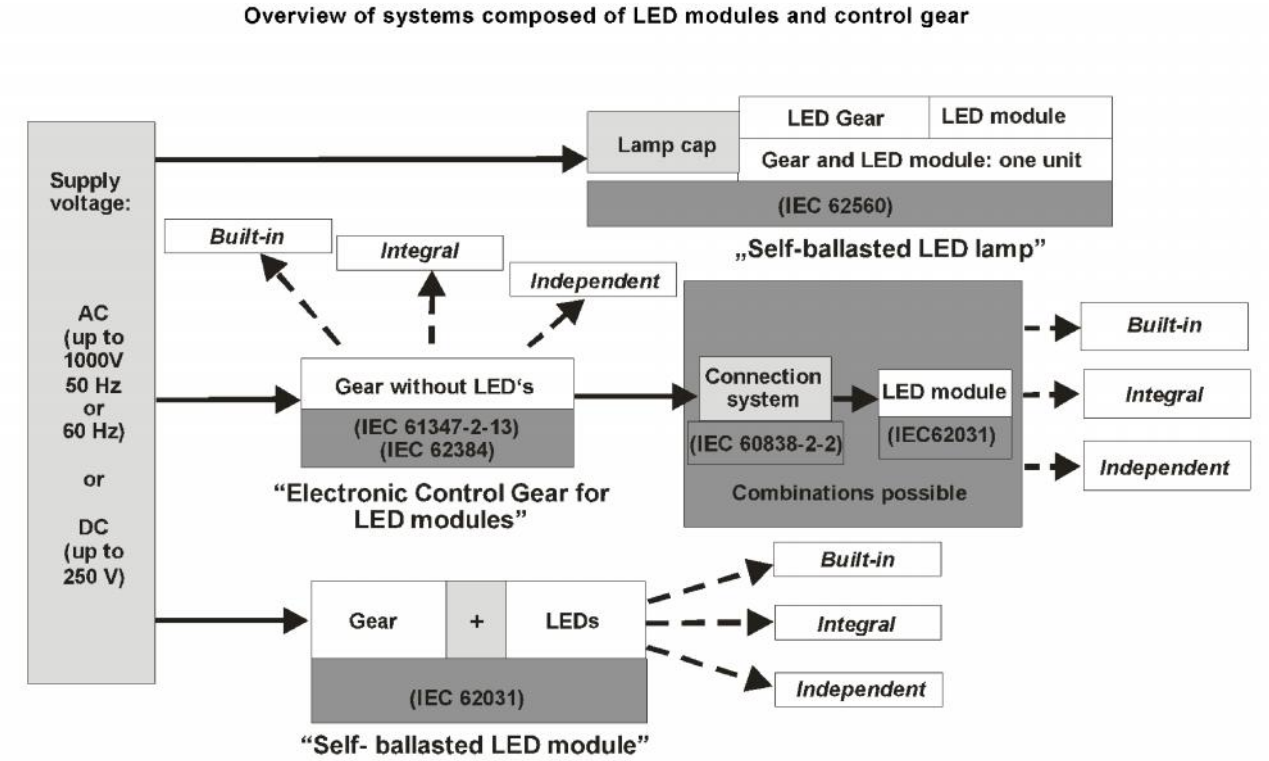
The life of the LED system may be limited not by the life of the LED but by the electronic circuit of the ECG. It is therefore important to identify the life of the complete system and not just the LED as it will affect the warranty period.

8. Key Standards See also LIA Technical Statement No 01.

Standards & Guidance

Key Standards for Production, Testing & Measurement of LED Based Luminaires

IEC TC 34 (Lighting)
Split into Sub committees (Luminaires, Lamps, Caps & Control Gear)
CIE Div 2 2007 Publication CIE127 (Methods of measurement)
CIE Div 6 / IEC62471 Photobiological safety / Optical radiation



IEC60598	(Luminaire requirements)
IEC62031	(LED Modules)
IEC62560	(Safety – Lamps)
IEC61341	(Measurement – Intensity & Angle)
IEC61231	(ILCOS)
IEC62504	(LED Terms & Definitions)
IEC60061	(Lamp Caps)
IEC60838-2-2	(Connectors for LED-modules)
IEC61347	(Control Gear & AC-DC Systems– Safety)
IEC62384	(Control Gear – Performance)
IEC62560	(>50V Lamp Safety Specs)