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Driver circuit effects in LED Lighting Systems

Muhammed EREN[1], İbrahim YAPICI[1], Selman YILDIRIM[1], ÇiğdemCENGİZ[2], Gamze GENCER[1],Olcay PALTA[1],Erdem AYBAY[3],Yılmaz Yurci[1*]
[1]*Department of Technical Vocational School, Bitlis Eren University, Bitlis, Turkey*
[2]*Department of Faculty of ScienceandArts, Bitlis Eren University Bitlis, Turkey*
[3]*Department of ForeignLanguages, Bitlis Eren University Bitlis, Turkey*
**Corresponding Author:yilmazyurci@gmail.com*

Abstract: *The life of the LEDs corresponds to 30% of the light output. The LED driver functions as a ballast in the fluorescent and HID systems. LEDs need a device to regulate the current passing through them. The driver performs the regulation function. Thanks to the drivers, the LEDs are protected from mains harmonics. In this report, LED driver has been examined and general information about LEDs has been tried to be provided.*
Keywords: *LED, LED driver, lighting systems,*

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I. Introduction

As the use of LEDs becomes more widespread, drivers, which are a component of the LED system, start to gain more importance [1-5]. LEDs are low-voltage light sources requiring an optimal operating current or a constant DC voltage [6,7]. Each of the LEDs used for lighting requires 2-4 V, DC voltage and several hundreds of mA, but high voltage is required because they are connected in series.

In addition, the light source must be protected against line voltage fluctuations during operation. The changes in voltage may lead to a disproportionate change in the current, which changes the light output [8-12]. The light output of the LED is proportional to the current and is defined for a specific current range. If the current exceeds the manufacturer's suggested range, the LED's luminance may increase, but the light outputs may drop rapidly due to heat rise inside the device, causing LEDs to have shorter life [13-19].

The lifetime of LEDs is defined as the point where light output drops by 30%. The LED driver is like a ballast in fluorescent and HID systems. LEDs need a device to convert the AC voltage to DC voltage and to regulate the current to flow through the LED during operation. While driver converts 220 V 50 Hz AC voltage to low voltage DC voltageit protects LEDs from line fluctuations [20-27].

Some practical approaches from LED lamp applications

LED drivers are usually in constant voltage types such as 10 V, 12 V and 24 V. Some drivers are specially designed and only run a certain group of LED index. Drivers are usually compact and work with high efficiency.

Obtaining the desired light output varies depending on the applied voltage, size of the LED, the material and the temperature. When the LED temperature increases, the voltage drops and the current increases. Increase in the current causes additional heating in the junction. If the current is not limited, the junction is broken downdue to heat. This is called thermal leakage [28-48].

Characteristics of LED

1. LED current-voltagecharacteristic

By driving LED light sources with a regulated constant current power supply, problems such as voltage variations and light output variation due to these changes and shortening of its life can be eliminated. For this reason, constant current drivers are recommended as a power source for LED lighting systems. Figure 1 shows the current-voltage characteristic of the LED lighting system.

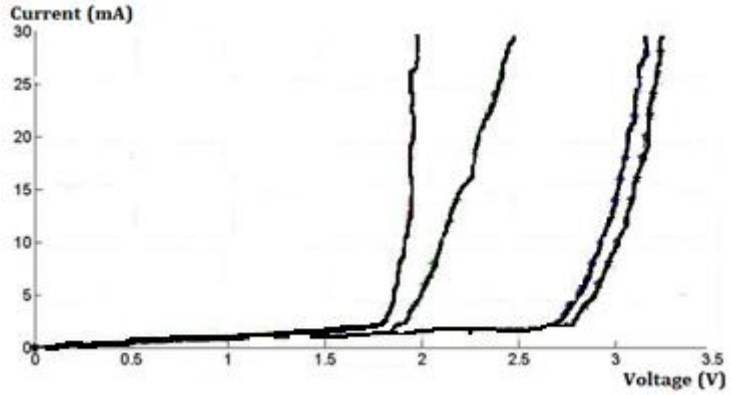

Figure 1. Current-voltage characteristic of the LED lighting system.

2. Changing voltage in LED lighting due to heat

The voltage drops as the temperature increases in LED lamps. In Figure 2, it is seen that the voltage drops in LED lighting due to heat.

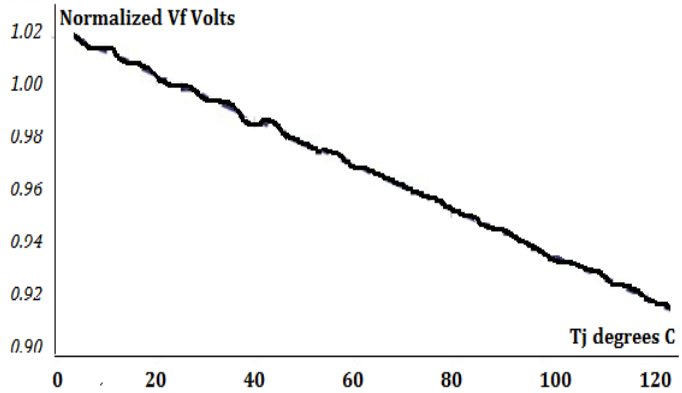

Figure 2. Change in voltage due to heat in the LED lighting

In some applications, current-limiting circuits, for example resistors, may be offered as cheaper alternatives to constant-current circuits. However, this has many disadvantages. First of all, resistors generate energy leakage due to heat. The heat generated by the resistors must be dissipated. In addition, there is no protection that will compensate the light output of the supply voltage and prevent the LEDs from being damaged by high voltage, in protections made only with resistors.

3. Light output in LED lighting

The light output of LED light sources increases with the increase of the drive current. But the efficiency is affected by this. Normally there is a current value specified on the data sheets of the LED lamps. This current value is a reference point for other technical information. Higher drive current than recommended causes overcurrent and low lumen.

4. Temperature increase effect on LEDs

The performance characteristics of a LED are given at an operating temperature of 25 ° C. However, since LEDs usually operate at a temperature of over 25 ° C, this value is taken as a reference value only. The light output of the LED source decreases as the temperature of the LED junction increases. Ambient temperature also affects the light output of the LEDs.

Red and Amber systems made of AlGaInP material are more sensitive to heat than Blue and Green LEDs with InGaN material. For this reason, it is necessary to consider the temperature of the system, especially when designing the light output or efficiency level. Temperature variations can cause slight color changes in white LED light sources.

If a larger number of LED groups are connected in series than the values designed for the driver, a significant amount of voltage drop is seen in the end groups of the chain.

When the wrong driver voltage is applied, the LED will either not run at all or will operate at higher current levels than designed. The person applying the voltage should compare the load voltage with the driver voltage. For example, if a 10 V load LED is fed with the 12 V driver, the LED life is shortened considerably. Attention should be paid to the mounting elements and ventilation conditions that allow the heat load to be thrown out.

II. Conclusion

The useful life time of LEDs is between 35,000 and 50,000 hours. The average life span of an incandescent lamp is between 1000 and 2000 hours, and the life of a fluorescent lamp is between 10,000 and 15,000 hours depending on operating conditions. This long life span reduces maintenance costs and energy savings reach significant levels when combined with high efficiency. The reduction in maintenance and operating costs and productivity in shift work of industry means a significant reduction in production costs. LEDs can be used where maintenance is difficult and costly, where better visibility is required and where instant lighting is needed. LEDs provide more light output per watt compared to incandescent lamps

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