



Constant Power vs. Constant Current

February 2022

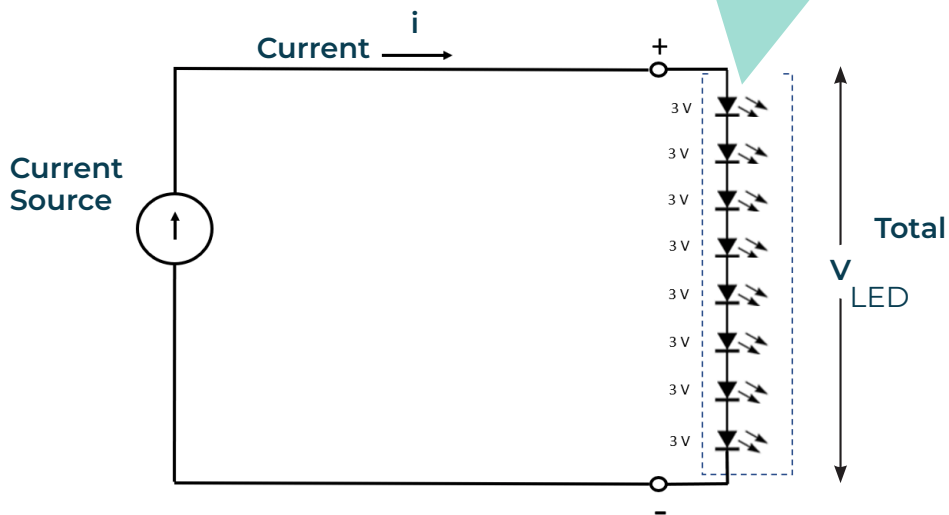


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Constant Power vs. Constant Current in Emergency LED Drivers

Driving current through LEDs

An **LED Array**: The LEDs are in series. They each have the same current i flowing through them. Each LED has approximately 3 V drop across it



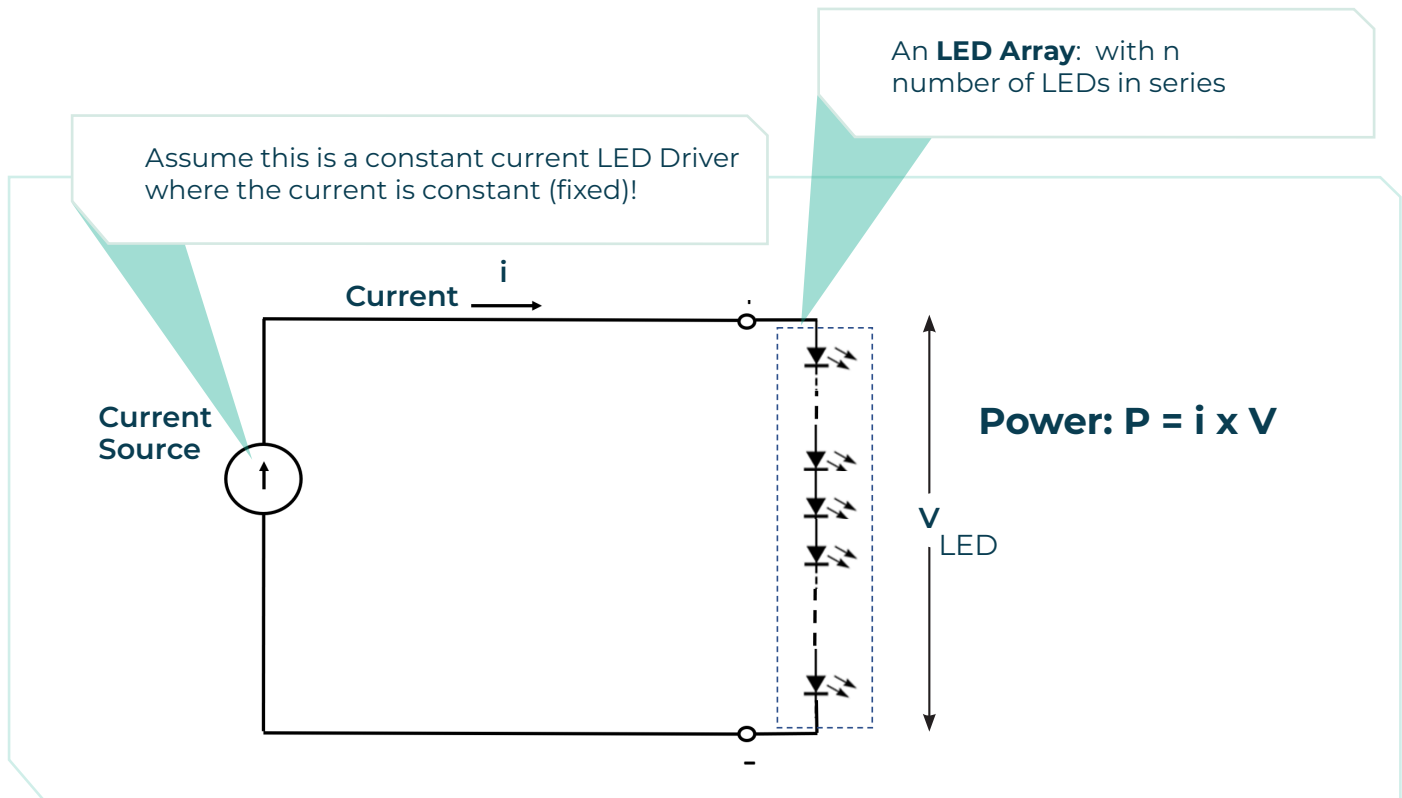
This is sometimes called the LED “stack voltage.” The total LED voltage, the “stack voltage” is simply the sum of all the LEDs times the individual voltages across each LED

In this example, with 8 LEDs, the total LED voltage is:

$$V_{\text{LED Total}} = 3+3+3+3+3+3+3+3 = 8 \times 3 = 24 \text{ Volts}$$



Power



From the previous example, where the number of LEDs $n = 8$...

Then If $i = 0.417 \text{ A}$, and $V_{LED} = 24 \text{ V}$, then $P = 0.417 \times 24 = 10 \text{ Watts}$

Another example: If the number of LEDs $n = 6$...

Then If $i = 0.417 \text{ A}$, and $V_{LED} = (6 \times 3) = 18 \text{ V}$, then $P = 0.417 \times 18 = 7.506 \text{ Watts}$

Another example: If the number of LEDs $n = 12$...

Then If $i = 0.417 \text{ A}$, and $V_{LED} = (12 \times 3) = 36 \text{ V}$, then $P = 0.417 \times 36 = 15 \text{ Watts}$

Key observation:

With a constant current source LED driver, the power changes with LED voltage. As the LED voltage decreases, the power decreases. As the LED voltage increases, the power increases.



FINELITE

PHOTOMETRY

HPR LED-A-2X4-DCO-V

Very High Output - Angled Rail

Efficacy: 127 lumens per watt

Total luminaire output: 6979 Lumens
55.1 Watts

Peak Candela Value: 2741 @ 0°

CCT: 3500K

ITL LM79 Report 85145

POWER & LIGHT

What is the Relationship?

“LED light output is proportional to the power dissipated by it”

LED light output \propto Power

The unit for light output is Lumens (lm)

The unit for power is Watts (W)

LED efficacy = light output / power = lm/W

A typical LED fixture will give the efficacy in lumens per Watt.
Therefore, given efficacy and power, the light output is found by:

Light output = power x LED efficacy

Example: Given: LED power = 10 W
and LED efficacy = 127 lm/W
Then: **Lumens = 10 x 127 = 1270 lm**

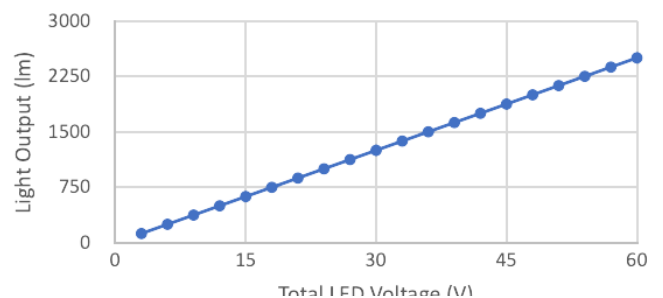
ACE LEDS

Constant Power vs. Constant Current in Emergency LED Drivers

Problems with Constant Current LED Drivers and Emergency Lighting

1. The power (thus light output) depends on the total voltage.
 - Each different model of LED fixture with a different total voltage requires a different model Emergency LED Driver.
 - The “one-size” Emergency LED Driver does not “fit-all” LED fixtures!
2. The energy needed to drive the LEDs must be provided by the battery; however, the battery only has a finite amount of energy.
 - The battery must be selected for the maximum power (highest possible LED voltage).
 - If the customer does not use the Emergency LED Driver in a fixture that matches the highest LED voltage specified, then the battery is underutilized which decreases the value of their purchase.
3. UL will not allow these problems to be addressed in the field. The Emergency LED Driver must be installed at the factory where it can be properly matched to the LED array with predictable light output performance. Field installation is only allowed under the “classified” listing program.

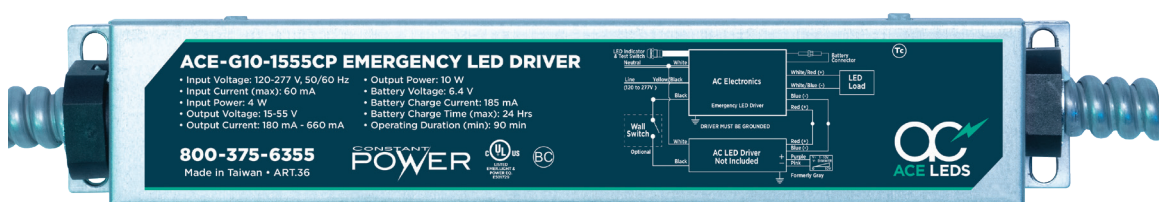
Light Output



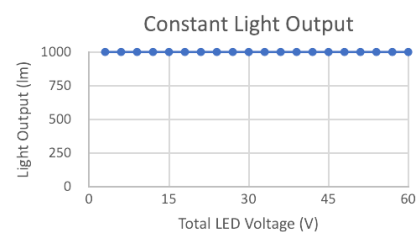


CONSTANT POWER

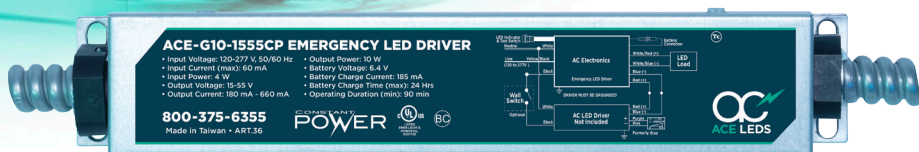
Constant Power Emergency LED Drivers deliver a constant (fixed) power to the LED array for all voltages within the range.



10 Watts delivered



Benefits of Constant Power Emergency LED Drivers



- Many different models of LED fixtures can be used with one model Emergency LED Driver. The power delivered is constant across voltage.
- The “one-size” Emergency LED Driver really does “fit-all” LED fixtures...within operating range! This **allows OEM customers to stock fewer Emergency LED Driver SKUs**. This reduces supply chain complexities, improves inventory efficiencies, and reduces operating costs.
- The battery capacity size is selected to match the power output required by the Emergency LED Driver. This reduces the number of different battery SKUs based on power.
- The customer is at liberty to use the Emergency LED Driver across all fixtures with a LED voltage within the operating range. The Emergency LED Driver will utilize fully the battery's capacity, which avoids underutilization, thus maximizing the value of the customer's purchase.
- UL allows these Constant Power Emergency LED Drivers to be UL Listed for factory or **field install**. The Emergency LED Driver can be easily properly matched to the LED fixture with predictable light output performance. This allows for reduced risks to performance concerns and for more efficient stocking plans and “go-to-market” channels such as distribution or field install.

