

Universal Douglas Driver Application Note: Cold Starting Behavior for Outdoor LED Drivers

Purpose:

This application note describes the start-up behavior of Universal Douglas Outdoor drivers and how it relates to operating LEDs in cold temperatures.

Background Information:

The ability to start a lighting fixture in cold temperatures is an important capability for outdoor applications. A major advantage to LED technology over other older technologies such as fluorescent lighting is the capability to produce light in very cold conditions. Despite this inherent advantage, some special behavior is required from LED drivers to ensure that the paired LED modules reliably start in very cold environments.

LEDs are solid-state devices that emit light proportional to the current that flows through them. The forward voltage of an LED is defined as the voltage difference between the anode and cathode terminals during operation, and the rated forward voltage is the typical voltage at which the LED will begin conducting current and producing light. The forward voltage of a particular diode is not static, but varies with current and temperature. For example an LED with a forward voltage of 2.55V at <10mA may have an effective forward voltage of 3V if the LED is driven at 200mA. Similarly, the ambient and junction temperatures of an LED also will have an affect on the Forward voltage of the device. Rated forward voltages of LEDs and LED module typically assume a junction temperature of 25°C, but operating at higher temperatures can cause the LED forward voltage to drop; and ambient temperatures at our below freezing can cause the effective forward voltage to be higher than nominal. When operating in very cold environments, it is not uncommon for the voltage required at initial turn-on to be as much as 10% higher than the LED modules' nominal forward voltage. Cold temperatures do not normally pose any extra challenges after initial start-up because LEDs are warmed up by the current flowing through them when in operation, which then brings the forward voltage down towards the nominal rated voltage.

Universal Douglas Driver Cold Start Behavior

Universal Douglas constant current outdoor drivers are designed to reliably start LED Modules in cold environments.

Newer Universal Douglas outdoor drivers such as the PW or PWX series outdoor drivers are capable of operating in a *constant power mode* to ensure that the connected LED modules can start properly in a cold environment. This mode allows the driver to deliver a higher voltage output by reducing the output current and keeping power supplied to the modules constant. This gives the connected LEDs time to warm up, lowering the forward voltage. As the forward voltage drops to normal levels, the output current will increase until it reaches the programmed level. For fixtures that are expected to be used in cold environments, a best practice is to pair the LED Modules with a driver with more headroom in the "constant power region" of the driver operating curve (See *Figure 1*).

Older Universal Douglas outdoor drivers such as the D14CC150UVT-F provide reliable cold-start operation by temporarily raising the overvoltage threshold. For example, the D14CC150UVT-F has a maximum output voltage of 107V, but at startup is capable of outputting up to 40% higher voltage to the connected LED modules. Within a few seconds of startup, the driver decreases the current set point until the output reaches the maximum output voltage. After the driver has regulated down to the maximum output voltage, the current set-point returns to normal and the driver operates normally. *If the output is overloaded and cannot decrease to the normal operating range, Open-Circuit behavior will be triggered.*

Figure 1: Driver Operating Range & Cold-Start Headroom

