LED Driver Considerations

For Smart Lighting Applications

INVENTRONICS

LED Driver Considerations for Smart Lighting Applications

Smart Lighting provides a multitude of benefits such as energy savings, improved productivity, asset tracking and enhanced security, just to name a few. We've all heard that term hundreds of times, but what exactly does that mean for the LED driver in your luminaire design? The role of the LED driver is critical to successful controls implementation as it can facilitate deployment of different technologies, enable solutions and provide protection of low voltage controls from the AC source.

One traditional and easy to understand control implementation is On/Off lighting controls. Lighting control sensors have traditionally included a power supply to drive the electronics, a relay to disconnect the power from the luminaire, and a sensor to detect light levels, occupancy or both. Several solutions were created such as:

- NEMA 3-pin twist lock interface (dusk-to-dawn sensors, diagram A)
- Sensors with integrated dimming capabilities (diagram B)
- NEMA 7-pin twist lock interface (facilitate dimming and traditional on/off control, diagram C)
- Wireless controls systems (low power radio replacing the sensor, diagram D).

Diagram A:

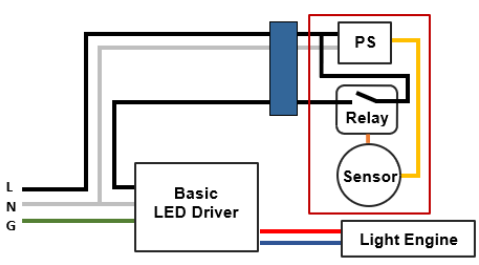


Diagram B:

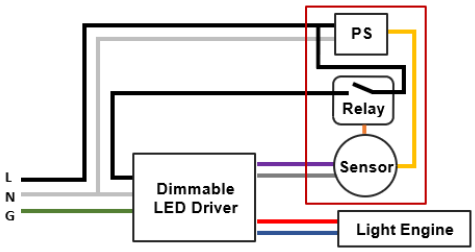


Diagram C:

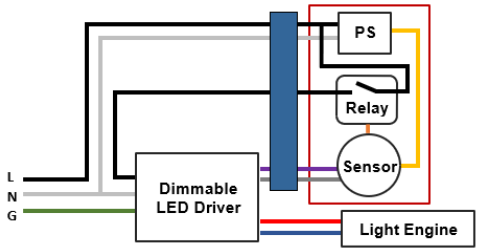
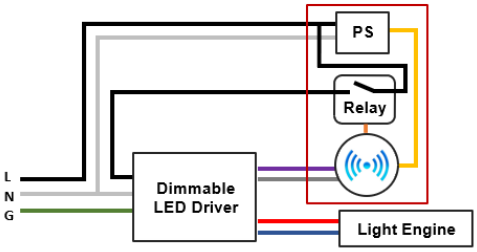


Diagram D:



With all these advancements, there are still several known issues with the implementation of smart lighting:

- The power supply must be selected for the right line voltage
- The power supply may not have the right level of surge protection
- The power supply and relay are both bulky and expensive
- The power supply and relay are both prone to failure
- The relay must be rated for line voltage and proper load
- Additional power wiring increases the cost of the interconnect

Many of these concerns can be resolved if careful consideration is provided to the LED driver selection. A controls ready driver provides a 12V always-on auxiliary power to the sensor or radio, as exemplified in Figure 1, which eliminates the need for a secondary power supply and reduces parts count and inventory. All LED drivers provide an output to the LEDs; however, the auxiliary voltage line is an additional output to help support other devices that require power. The auxiliary supply is protected by the drivers surge protection, increasing the reliability of the controls device. Since the auxiliary supply is a feature of every controls ready driver, the control device is now power and line voltage independent. From 120-480VAC inputs and 40-1200W drivers, the auxiliary supply allows the control solution to remain the same.

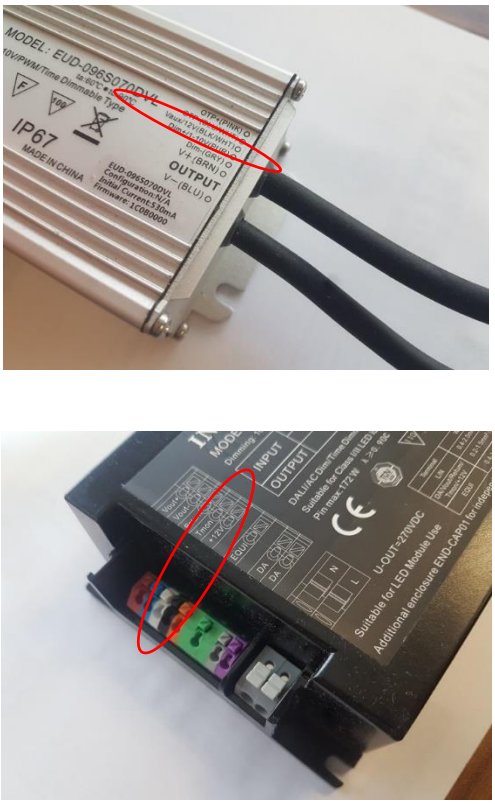


Figure 1: Example of LED drivers with auxiliary constant voltage supply

Controls ready drivers provide dim-to-off (DTO) capabilities that allow for the output of the driver to be shut off electronically, while still providing auxiliary power to the controls device. This state is achieved when the voltage is sensed to be below .5V (0-10V dimming models) with hysteresis or receives command (DALI models). This is also known as Standby Mode as the driver is actively waiting to receive its next command from the lighting controller. In the DTO state, the driver energy consumption is reduced to very low levels (typically less than .5W). This DTO capability allows for the driver to be turned on/off over the dimming leads, eliminating the need for an AC switch or relay. Relays and switches are both sensitive to inrush current and have a maximum power rating. By removing these devices, the installation is less bulky, has fewer points of failure, and more design flexibility; as zones are not limited by the amount of power flowing through the controller. (see Diagram E).

Diagram E:

When choosing the correct LED driver there are a few design considerations that must be made. You must ensure the 12V auxiliary output is rated with sufficient power to support sensors and controls, including peak requirements found during transmission. DTO controls must also have sufficient hysteresis to avoid an unstable state.

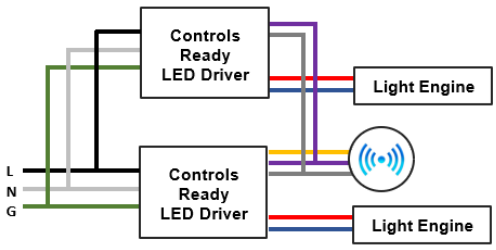
The LED driver can also provide the control device with surge protection for applications in challenging power conditions, such as frequent power outages, voltage spikes and hostile grid environments. Surge protection

must not only protect the driver, but the light engine and control modules as well.

If a controls ready driver is utilized, wiring and interconnect is greatly simplified since there is no need for extra power wiring on the AC input. The controls ready driver allows for a cost optimized fixture design ready for any input, simplifying assembly for both the manufacturer and for the electrician installing the luminaire.

Since the low voltage control interface present in controls ready drivers is power rating independent, the same controls can be used for any power level. Whether connecting several low-power or high-power luminaires (even +1200W), the same controller may be used for all applications. This allows for maximum design flexibility, reduced quantity of required controllers, and simplified installation to reduce errors and installation cost. The control device is also not limited by load and can easily control many luminaires if desired. One control module can easily manage multiple drivers to create a simple zone control (see Diagram F).

Diagram F:



Most controls ready LED drivers have their constant output current programmable by software, allowing for reduced part numbers in inventory, and removes the need to design-in a new LED driver for multiple LED configurations.

Another main advantage to controls ready LED drivers is that they provide control interface options. In the dimming system, the LED driver and controllers must be able to speak and hear the same language. The analog option of 0-10V is simple to use, easy to parallel for zones and there are many available products to choose from. Alternatively, there are solutions that utilize DALI and others that utilize proprietary protocols, such as UART or other data busses. DALI is a standard digital interface with a defined protocol that adds an extra level of functionality. The DALI standard is administered by the Digital Illumination Interface Alliance (DiiA), a manufacturers consortium (Inventronics is a participating member). This standard is continuing to grow with more products coming to market steadily. This includes the recently introduced DALI 2 standard that, among other changes, adds qualifications for associated components to improve interoperability. Proprietary interfaces are easy to implement and allows manufacturers to create unique advantages in their products firmware.

So, what's next for smart lighting and LED drivers? As we see smart lighting technology continue to develop, we can expect to see the need for more and more data to be made available from the luminaire. This will be done through intra-luminaire networks with digital interfaces between the driver and control module. We can expect to see the need for control modules with sensor inputs that are available to the entire network, instead of just to one luminaire. With these advances, modularity and standardization of interfaces is going to be essential to adoption and success, as well as creating a broad toolkit of solutions that are easy-to-use, robust, interoperable, and affordable. Controls ready drivers will continue to be easily integrated into applications that do not have defined controls, for retrofit applications that have shifting requirements, and for bidding on applications that vary in needs.

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Peter Resca is the technical marketing director for Inventronics and is responsible for identifying and developing the company's broad portfolio of LED drivers and Lighting Controls. Based in Boston, MA Resca manages the Global product offering for Inventronics, a leading manufacturer of LED drivers for the solid-state lighting market. He has a BSEE from Worcester Polytechnic Institute and an MBA from the University of Massachusetts. He began his career designing power electronics and has more than 20 years' experience in power and lighting with roles leading Engineering Development, Sales, Operations and Marketing.

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