

## **Application Note: XIM Distributed Low Voltage Design Guide**

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The purpose of this application note is to outline electrical class designations and design guidelines for low voltage systems with the Xicato XIM platform and remote mounted power supplies. There are several regulations, testing and certification procedures that may need to be taken into consideration in order to meet safety requirements in the various territories. This application note tries to present a comprehensive overview of the key regulatory requirements and safety marks for the European and U.S marketplace. Armed with knowledge of these key requirements, luminaire manufacturers or end users can decide the best way to design XIM into luminaires and ensure product safety compliance.

### **Regulatory Requirements for the USA**

UL Class 2 power supplies are power limited to 100VA and have maximum output voltage of 60VDC. Therefore the maximum current from a Class 2 source is limited to 2.08A for 48VDC. The UL safety standards criteria are typically less severe once the circuit achieves a Class 2 rating due to its power limitations, and is considered safe, from a fire and electrical shock standpoint.

UL 1598 applies to luminaires for use in non-hazardous locations that are intended for installation on branch circuits of 600V or less. Note that UL 1598 could be applied to a complete piece of LED lighting luminaire if the application for that equipment is not covered by an existing UL standard such as UL48 (Electric Signs), UL1574 (Track Lighting Systems) or UL 2108 (Standard for low voltage lighting systems).

In this application note, emphasis is very much on UL 2108 since XIM is low voltage rated. This standard covers power units in which output is limited to 25 amperes with a class 2 level requirement. These requirements do not cover low-voltage luminaires with integral power supplies or luminaires covered by other standards such as UL48, UL 1574 or UL 1598. Please refer to the UL standards for complete guidance.

### **International Regulatory Requirements**

The European safety regulations for low voltage lighting systems from CE (Conformité Européenne) and IEC (International Electrotechnical Commission) have more flexibility compared to the USA standards. The IEC defines Safety Extra-Low Voltage (SELV) circuits as an electrical system in which voltage between any two accessible parts or between a single accessible part and earth must not exceed a safe value, which is 42.4 VAC peak or 60 VDC for longer than 200 ms during normal operation. Circuits fed by SELV power supply outputs do not require extensive safety testing or creepage and clearance evaluations. The design of an SELV circuit typically involves isolation between the primary and secondary side of the power supply

unit or transformers. SELV circuits shall not have direct connection to the primary power (AC mains) and shall derive its power from a transformer, converter, or equivalent isolation device.

Categories are used to define different classes of circuits and the type of insulation needed. A Class III equipment category is designed to be supplied from a SELV power source. The voltage from a SELV supply is low enough that under normal conditions a person can safely come into contact without risk of electrical shock. Since XIM is rated for less than 60 VDC, the circuit complies with SELV circuit and can be certified as Class III lighting equipment when powered by a SELV PSU.

The Low Voltage Directive (LVD) sets down rules for the use of standards for gaining CE marking approval. LVD demands that products are designed, manufactured, and tested to give proof of electrical safety. Conformity to IEC standards guarantees compliance.

## **Low Voltage Systems with the XIM Platform**

With the rising popularity of low voltage lighting, end-users can combine easy installation and adequate safety considerations into one package. Low-voltage systems use smaller light sources, are easy to modify to accommodate changes in lighting layout, and are safer to operate and maintain than their line voltage counterparts.

XIM can be used in various low voltage applications including, but not limited to:

1. Distributed Room Based Downlights
2. Distributed Track Systems

## **Distributed Room Based Downlights**

Low-voltage lighting uses a power supply unit (PSU) to convert higher voltage, alternating current to low voltage direct current and maintain the voltage and current through an LED circuit at its rated level. The PSU can be integral in the luminaire housing or remote mounted.

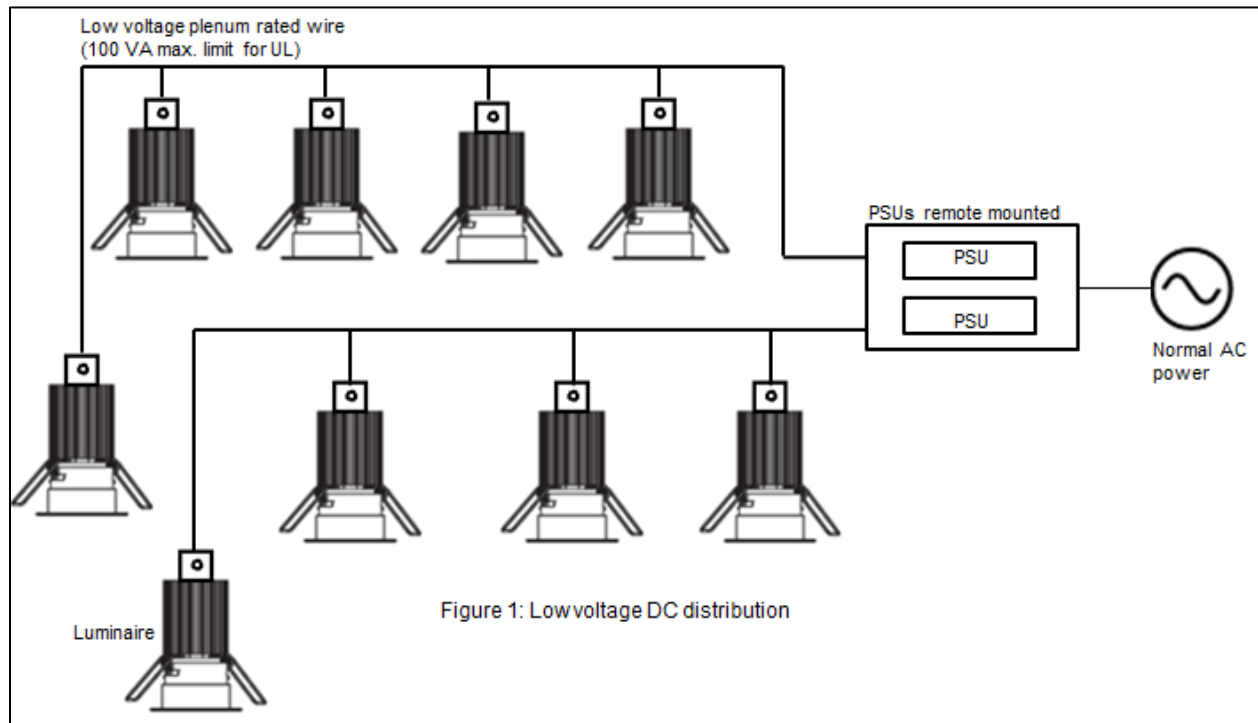
In remote mounting installations, power supply unit(s) are placed inside an electrical closet or junction box in the ceiling and low voltage plenum rated wires are routed from the luminaires to the PSU box. These remote mounting installations and low voltage DC distribution systems unlock the potential to design beautiful spaces with LED lighting with numerous advantages.

These systems can be certified under UL 2108. Under this standard, testing conditions are tailored specifically to the technical characteristics of luminaires. Refer to UL 2108 for complete compliance requirements for mechanical and electrical construction of the luminaires.

For IEC standards, these luminaires can be certified as Class III provided that power is supplied from an SELV power source. The extra safety features built into Class I and Class II appliances

are therefore not required. The great benefit of a Class III listing is that it provides simplified assessment with minimal test requirements.

Below image below represents low voltage DC distribution with remote PSU(s).



## Advantages of remote mounted PSUs in room based downlights

There are numerous advantages to remote mounted power supplies, per UL 2108, such as:

- Increased system reliability due to lower PSU temperatures.
- Maximize the output power limit of the PSUs.
- Luminaire height can be significantly reduced, thus allowing shallow plenum applications.
- Better thermal management by isolating the LED module and the power supply.
- Easy access to power supply for maintenance and service.
- Reduced wiring complexity and installation costs as low voltage Class 2 wiring and low voltage luminaires can be installed by an unlicensed electrician or general contractor.
- Reduction in shipping costs due to reduced size of luminaire.
- Savings in luminaires material cost.

## **XIM 48V Track Systems**

### **Worldwide Market (except North America)**

There are two basic types of track lighting systems: line voltage and low voltage. With line voltage track systems, line voltage is connected directly to the track conductors and each track head luminaire contains an integral PSU. For remote mounted PSU systems, the same track system can be used as long as it is fed with a SELV 48V power supply instead of line voltage. As mentioned previously for IEC standards, circuits fed by SELV PSU outputs do not require extensive safety testing or creepage and clearance evaluations and be certified as safety extra low voltage circuit.

### **North American Market**

If you are using line voltage track with the PSU being an integral part of the luminaire, these can be certified under UL 1574 (Track Lighting Systems). The track systems covered by this standard must be rated 300V or less and 50 amperes or less.

For remote mounted PSUs, UL 2108 can be applied to the track system, thus limiting track power to 100VA and current to 2.08A.

### **Advantages of remote mounted PSUs in track systems**

There are numerous advantages to remote mounted power supplies, such as:

- Track luminaires can be smaller and more refined, thus occupying less space in the ceiling area and enhancing the design aesthetic.
- Maximize the output power limit of the PSUs.
- Better thermal management by isolating the LED module and the PSU.
- Easy access to the power supply for maintenance and service.
- Track systems and luminaires can be installed by an unlicensed electrician or general contractor.
- Radio frequency interference (RFI) is reduced, thus reducing or eliminating the need for an RFI filter. This can be very beneficial since tracks have limited space.

### **XIM track recommendation**

Polarized track (i.e., can only plug the module in one way) that has separate control wire connections (i.e., the track should have at least 4 conductors – 2 for power distribution and 2 for control distribution) is the best solution.

## Conclusion

There are several workable solutions to comply with industry regulations for lighting with the Xicato XIM platform. A decision must be made at the outset of a new project as to the main strategy to be adopted for certification and the luminaire system must be designed accordingly. If you have any additional questions or need more information, please contact your Xicato technical representative.