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Application Note: Emergency Battery Backup System (EBBS) Solutions for the XIM Platform

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The purpose of this application note is to outline design guidelines for implementing emergency battery backup systems with the Xicato XIM platform. (http://www.xicato.com/xim-led-module/overview). Emergency lights ensure that people can see clearly enough to navigate any obstacles, turn off equipment and ultimately find their way out of the building safely in the event of power outage. Emergency lights must operate for 90 minutes and shall be arranged to provide initial illumination that is at least an average of 1 foot candle on the floor of the defined pathway.

Typically there are two fundamental power distribution methods used to energize the lighting fixtures in a space. For the purposes of this document we will assume that mains AC voltage enters the building and is fed to either a centralized power distribution system or a discrete power distribution system.

1. Centralized System

In a centralized system, the power conditioning unit or power supply unit (PSU) is generally a high wattage unit that is capable of powering all of the lights in a space such as a retail shop, building floor, museum, gallery, home, etc. In this way, the power is centralized and the light points are distributed. Other centralized systems are possible, for instance, where one PSU powers several light points in a single luminaire such as a multi-head adjustable downlight or by powering an entire track segment in a track lighting system.

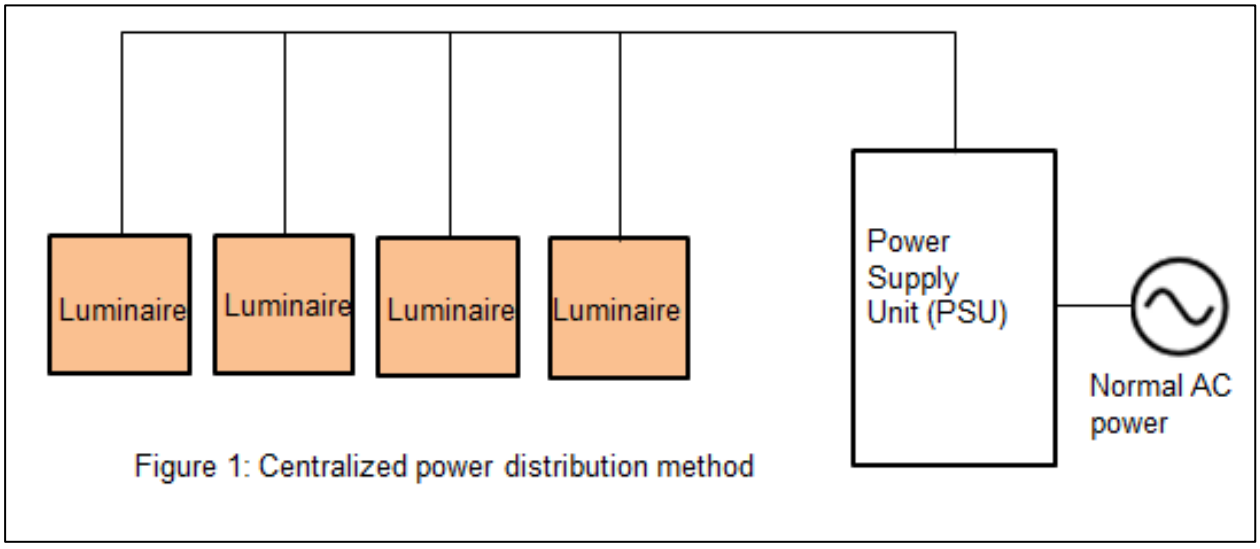

Figure 1: Centralized power distribution method

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2. Discrete System

In this building system, mains power is fed to each discrete luminaire where the power is conditioned to drive the light source. A track system could also fall into this category if the track is powered with mains voltage and each track head has its own AC/DC driver.

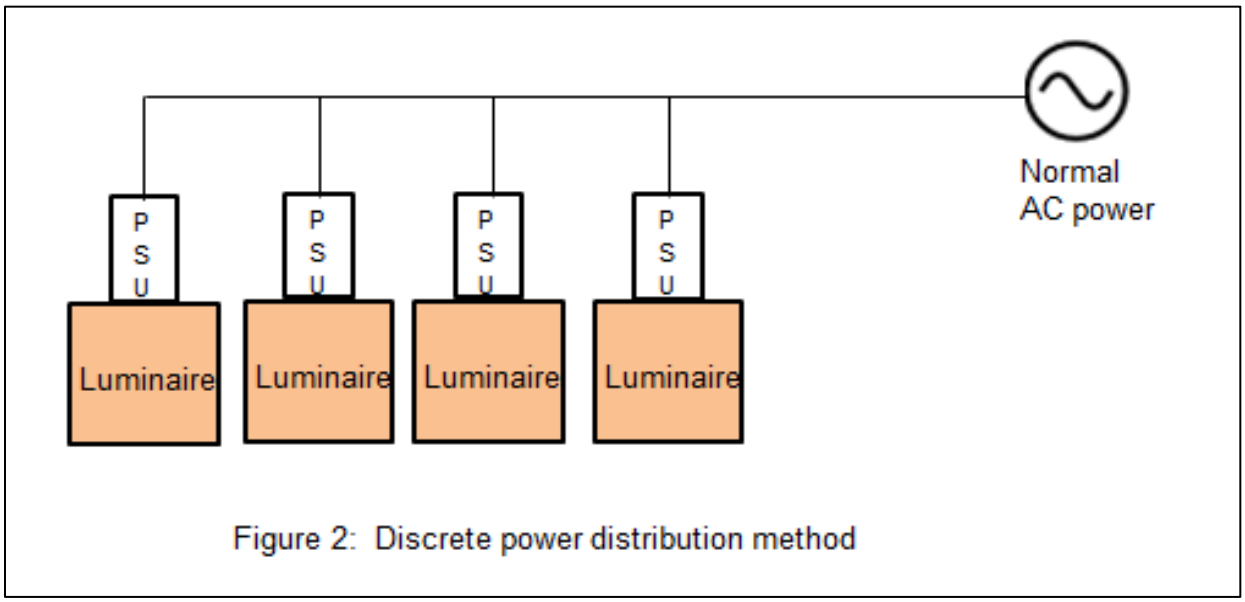

Figure 2: Discrete power distribution method

EBBS for Centralized Systems

For this approach two PSUs are used, instead of using a single PSU for a space where emergency lighting is required. The first PSU is the centralized supply for all of the luminaires that do not need to remain on during a power outage, while the second PSU distributes power to all of the luminaires that will need to remain on during a power outage. The second PSU will need to be hooked up to a battery backup inverter system that is sized appropriately to handle the load of all of the fixtures for the required minimum time period, typically 90 minutes. During normal daily operation, both PSUs will operate nominally to light the space.

For centralized track systems, a track with at least two circuits is required. The primary circuit is powered by a regular PSU and track heads on this circuit are powered normally. The secondary circuit is powered with a separate PSU that has a backup EBBS wired to it. Track heads on this secondary circuit then perform normally until power goes out, at which power switches to the battery operated power supply. In dimming applications, a third circuit on the track could be used to carry the dimming signals from the control source to the XIM modules directly.

The Automatic Transfer Switch (ATS) is a very important component in emergency lighting systems. The ATS is the device that detects when normal supply power cuts out and then

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switches the load (luminaire) over to the alternate battery power source in the event of an emergency. ATS is often installed where an inverter is located, so that the inverter may provide temporary electrical power if normal power goes out. ATS devices are required to meet standards. After the utility power is restored, the automatic transfer switch returns the load to the grid. ATS also regularly runs test cycles to make sure a standby inverter is ready when you need it. The automatic test feature can be set under load or under no load.

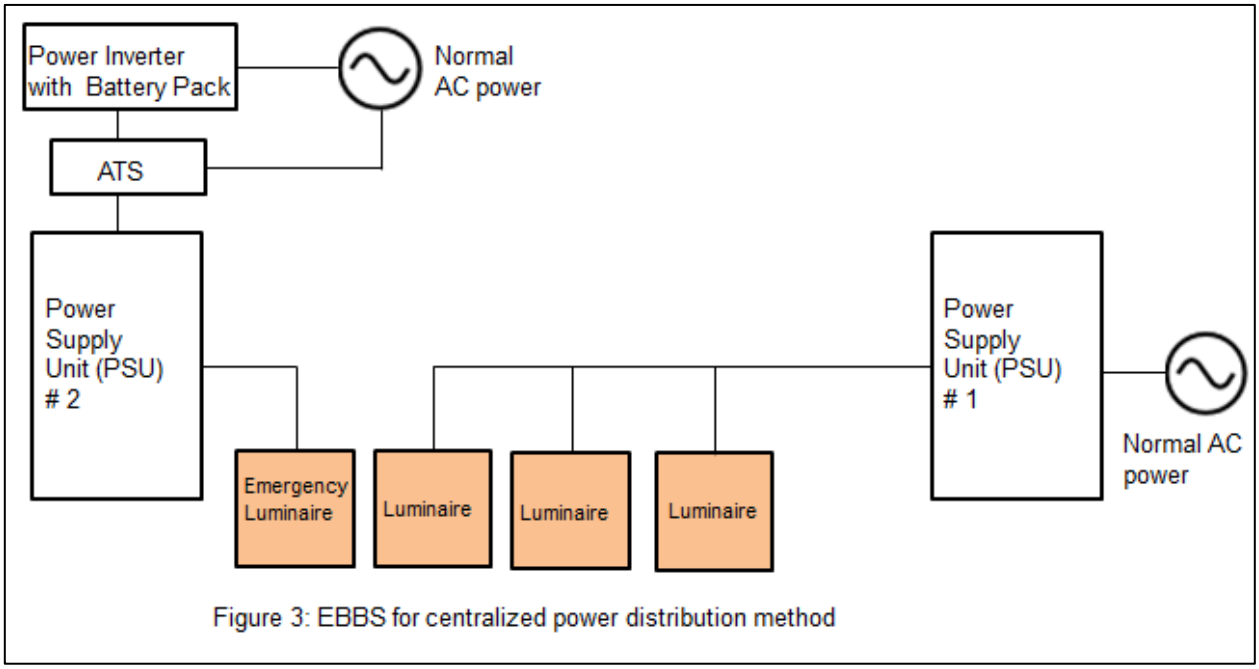

Figure 3: EBBS for centralized power distribution method

EBBS for Discrete Systems

For this approach, luminaires will typically have their own discrete PSU, one per fixture. Each discrete luminaire that needs to remain on during a power outage would be hooked up to an individual battery backup micro inverter system within the luminaire or surrounding plenum area.

A second option could be to use a constant current load such as an XTM in the luminaire with an emergency battery backup system that outputs constant current with the corresponding voltage range. Care should be taken with this second method to ensure that dimmed levels are consistent with other XIM based luminaires. This can be adjusted during commissioning for specific static levels with a DALI (Digital Addressable Lighting Interface) system. This second EBBS approach is recommended for track systems with discretely powered track, powered separately from XIM track.
Refer to the diagram below representing the first method.

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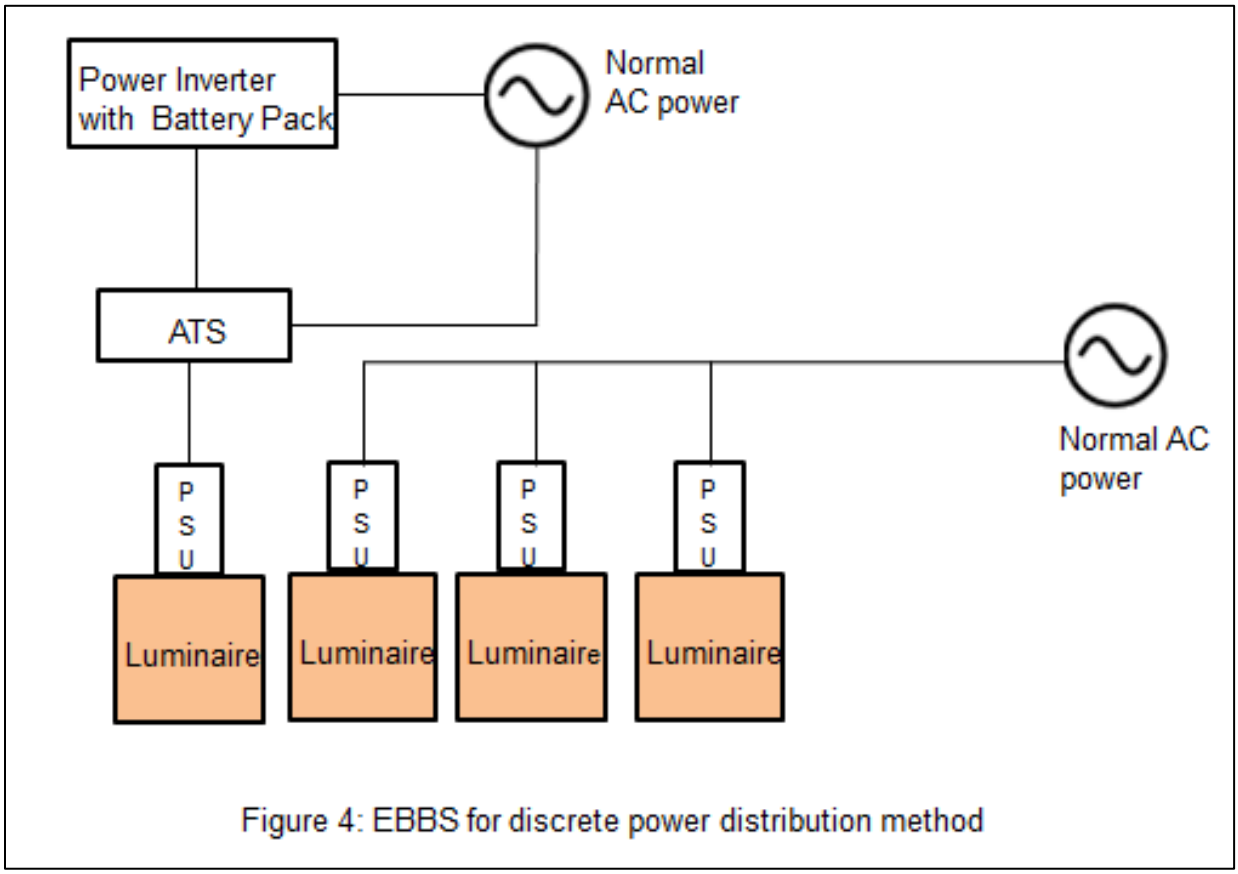

Figure 4: EBBS for discrete power distribution method

An emergency lighting micro inverter transforms LED luminaires into code-compliant emergency lighting. In the event of a power outage, the micro inverter immediately begins supplying emergency power and will continue to support the connected load for a minimum of 90 minutes. Upon restoration of normal power, the device automatically returns to the charging mode similar to emergency driver. Micro inverters allow luminaires to be on, off, switched or dimmed. This device provides power to the input side of the luminaires, including the PSU and is designed for use with indoor applications. It is listed for various wattages and also can be remote mounted depending upon wire gauge used. Micro inverters are in contrast to larger inverters that are typically centrally located because of size. These are much smaller, reliable and can be installed on a luminaire.

If you are utilizing a XIM in track luminaires, or an array of downlights and would like to have multiple emergency luminaires, higher wattage micro inverters can be used. Micro inverters provide flexibility to use with XIM modules with various drive currents and lumen packages and uses highly reliable NiCad batteries.

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Micro inverters feature sine wave form rather than square waveform output which is characterized by very low harmonic distortion and clean power similar to that produced by supplied electricity. It is well suited for LED lighting. However, extra care needs to be taken to size the micro inverters according to the sum of the max loads on each module wired to the emergency circuit.

EBBS For DALI (Digital Addressable Lighting Interface) and 1-10V

One of the features of XIM is integrated dimming (DALI or 1-10V) which provides the smoothest, deepest dimming that's possible with LEDs today. The XIM DALI module is capable of being programmed with an emergency mode setting per the standard DALI protocol. DALI management with battery systems (as a single DALI controller) can address, switch, dim and monitor DALI luminaires fed by both normal and battery supplies. Thus, the luminaires that are connected to the EBBS can be programmed to output a much lower light level to meet minimum emergency egress requirements. This feature can help reduce the overall size requirements of the EBBS battery and also incorporate self-testing and monitoring. Comprehensive performance data including battery pass/failure, as well as test date and duration are logged to the network computer providing records for any warnings and maintenance. The performance of smart lighting fixtures using XIM can be monitored, simplifying the maintenance of spaces over time.

Unlike the XIM DALI module, when using the XIM 1-10V module during a power outage, the XIM will remain at the light level that was most recently set by the user, which could be the maximum light level or could be off. For example, if there is a wall dimmer in the space that sets the light levels, then whatever the dimmer is set to when the power goes off, is the same light level that the XIM will come back to after emergency power is restored. Thus, if the XIM are at full intensity, the EBBS need to be sized such that it meets local and national codes for emergency lighting requirements. Currently, there is no option to set an emergency dimmed level within this module.

Setup & Commissioning for Dimming Systems

Special attention needs to be paid to the system when combining XIM dimming modules in a contiguous space with non-XIM modules that need to be dimmed on the same control circuit. In this case the dimming engines for each module type will be different. The intensity may be different at same set point if not taken into consideration. In the XIM, Xicato has a proprietary dimming technology designed to have extremely smooth, flicker free dimming to very low light levels. Whereas the driver that the non-XIM module is connected to will have some other dimming algorithm that could behave differently across the dimmer control range. Therefore, special care should be taken when specifying these drivers to function on the same control circuit as the XIM.

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Conclusion

There are several workable solutions to comply with industry regulations for emergency egress lighting with the Xicato XIM platform. While there are solutions for each of a centralized power system and discrete power system care must be taken to ensure the emergency systems are sized properly and the dimming performance is kept up to the desired standard. Emergency lighting systems should be tested as often as local codes require, or at least quarterly to insure that all components are operational. If you have any additional questions or need more information, please contact your Xicato technical representative.