

Casambi Whitepaper

Wireless lighting control for: Office



Introduction

Today's office spaces demand lighting solutions that are not only dynamic and adaptable to the ever-changing needs and preferences of occupants but also highly efficient in their energy utilization. Across Europe, lighting stands as the single largest consumer of electricity in office buildings, accounting for a substantial 40% of total electricity consumption ¹.

The integration of smart lighting controls, complemented by the strategic utilization of natural daylight, holds the potential to usher in remarkable energy savings of up to 60% within office settings. Furthermore, the implementation of occupancy detection systems can yield up to 44% in energy savings when compared to scenarios without any control mechanisms in place ².

End-user empowerment is another pivotal facet of the evolving office lighting landscape. Recent surveys ³ have revealed that 33% of office workers express a desire to personalize their ambient lighting, including overhead and desk illumination, as well as the levels of natural daylight permeating their workspace. Such personalized control aligns with the requirements set forth by green building certification systems like LEED and BREEAM ⁴.

The technological landscape is evolving in tandem with these needs, with user-friendly interfaces on mobile devices supplanting the complexities of touch panels that perplexed many in the previous decade. A recent study underscores the importance of accessible and comfortable lighting for one's daily well-being, with lighting ranking as the second most influential factor affecting work performance, following air quality.

The strategic incorporation of daylight not only contributes to energy efficiency but also significantly enhances employee productivity, as evidenced by research findings. Architectural approaches, such as biophilic design, have emerged to foster the comfort and well-being of office occupants by seamlessly connecting indoor spaces with the outdoors. This connection is facilitated through the harmonious integration of natural daylight and circadian lighting profiles, which mimic the tonality and intensity of outdoor light.

1. Building Stock Distribution and Electricity Use for Lighting: A Technical Report of IEA SHC Task 50. International Energy Agency (IEA). 2016. Available from: http://task50.iea-shc.org/data/sites/1/publications/Technical_Report_T50_D1_final.pdf

2. Lighting Energy Savings in Offices Using Different Control Systems and Their Real Consumption. B. Roisin, M. Bodart, A. Deneyer, P. D'Herdt. 2008. Available from: <https://www.sciencedirect.com/science/article/abs/pii/S037877880700134X>

3. Future Workplace Wellness Study. View. 2019. Available from: <https://view.com/sites/default/files/documents/workplace-wellness-study.pdf>
Research findings are based on a global survey conducted by Savanta across the United States and Canada between April 23 – 29, 2019. For this survey, 1601 respondents were asked general questions to explore thoughts on workplace environment, personalization of the work environment, and privacy and security at work. The study targeted 18 to 74 year olds that work in a corporate office environment at least 3 days per week.

4. LEED IEQ Credit 6.1 Controllability of Systems – Lighting : For at least 90% of individual occupant spaces, individual lighting controls should be provided to occupants to adjust the lighting to suit their individual tasks and preferences, with at least three lighting levels or scenes (on-off, midlevel)

BREEAM 5.0 Health and Wellbeing – Hea 01-Visual Control – 11. Zoning and occupant control : In office areas, internal lighting is zoned to allow for occupant control in zones of no more than four workplaces

How wireless smart lighting control can help solve today's challenges

Wireless smart lighting control caters well to today's office facilities by directly answering the need for powerful, highly customizable lighting control while tapping into further energy savings with sensors, switches, and other smart devices.

Application highlights:



Non-disruptive installation and rapid commissioning

Wireless lighting can be installed without the need for surface reconstruction or the pulling of wires, and can be commissioned remotely from an app.



Intuitive interface on mobile devices

Luminaires can be turned on and off remotely, and easily reconfigured and recommissioned from a smart device.



Occupancy detection

Sensors can detect motion to indicate the presence of a person and automatically turn on lights only when they are needed.



Scheduling and timers

It is possible to create time-based scenes that turn on, off, or dim selected luminaires to preset levels according to bespoke needs.



Daylight harvesting

Adjustable lighting strategies can be programmed and implemented – such as daylighting, whereby automated controls can adjust the lighting to maintain a target level, reducing energy costs.



Task tuning

Lighting can be adjusted to the optimal level for individual areas improving safety and saving energy across a site.



Human-centric lighting

As light can affect human circadian physiology, smart lighting can be programmed to follow sleep cycles to positively affect health, alertness, and productivity.



Wireless emergency lighting

If emergency services are called for, lights can be swiftly and remotely controlled to shine at maximum brightness for increased visibility.



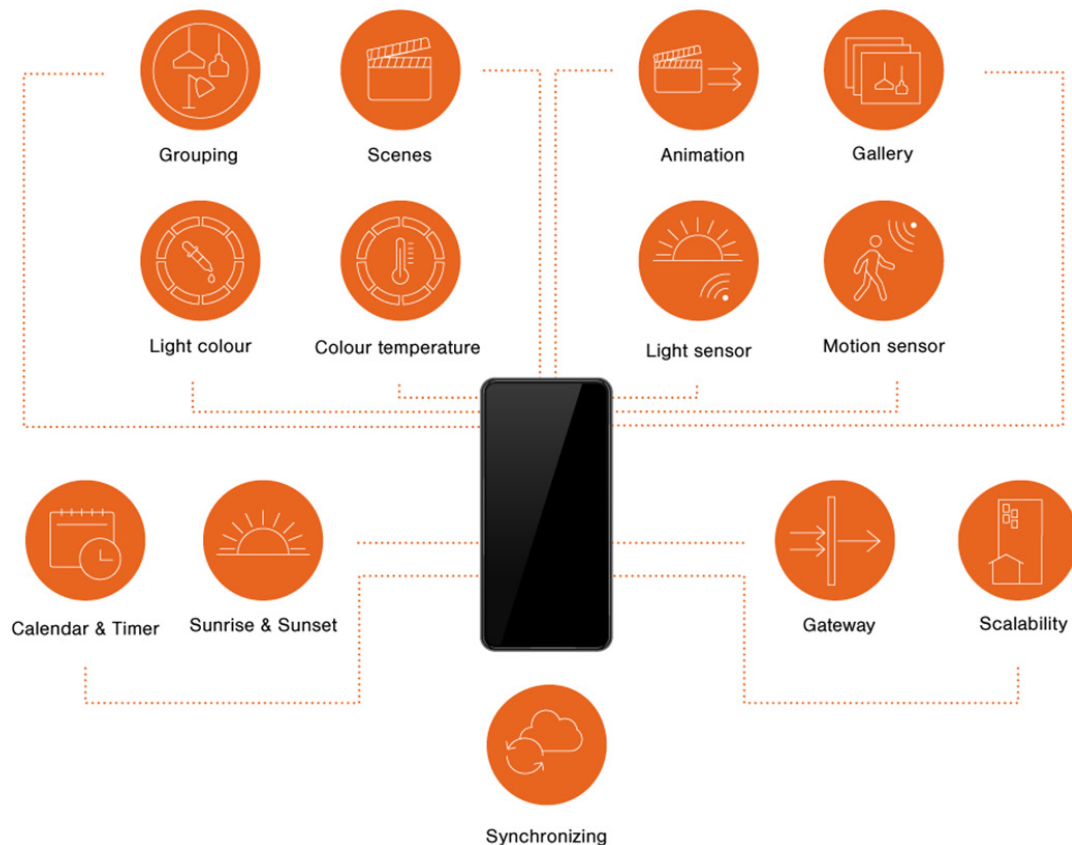
Environmental monitoring

Connected lighting can be used as an onramp for other applications such as remote air quality control, dangerous gas leak detection, or noise pollution monitoring.

How Casambi can help

The need for flexible, energy-efficient, and highly customizable office lighting solutions has become paramount. The modern workplace requires lighting systems that can adapt to changing functions and user preferences while maximizing energy savings. Casambi's technology meets these demands by revolutionizing the way we approach office lighting.

Casambi stands out by enabling lighting designers and manufacturers to effortlessly connect and control lighting devices wirelessly through the Casambi App, thus establishing intelligent and customizable smart lighting networks. This is achieved through the utilization of Bluetooth® Low Energy (BLE), a widely accessible technology found in modern smartphones, tablets, and smartwatches, eliminating the need for special wiring or complex hardware requirements. As a result, Casambi simplifies installation and allows for seamless adjustments to lighting control groups, all managed through the free Casambi App available on both iOS and Android platforms, giving users the power to effortlessly customize and control their lighting networks.



One of the distinctive features of Casambi's approach is its open ecosystem architecture, which outpaces the proprietary legacy systems prevalent in the market. This architecture ensures that all of Casambi's native products and "Casambi Ready" partner products are 100% compatible with each other. Casambi's technology is not limited to one type of device but seamlessly integrated into fixtures, drivers, switches, sensors, and various modules, allowing for a wide array of possibilities and compatibility.

Casambi's extensive collaborations with leading luminaire, driver, LED board, LED lamp, and lighting control module manufacturers have resulted in a growing ecosystem of over 1000+ Casambi-enabled products. This diversity in offerings provides a comprehensive and reliable foundation for creating smart lighting networks.

The strength of Casambi technology extends beyond its compatibility and wide range of applications. Its simplified system architecture and user interfaces make it easy to specify, install, commission, and operate. Whether you're looking to implement occupancy detection, scheduling, daylight harvesting, circadian lighting profiles, or simply provide individual lighting control via mobile devices, Casambi offers a streamlined and user-friendly solution.

With Casambi, you can effortlessly control direct and indirect lighting over workstations, change control groups or light scenes at any time, reduce operational costs, and even implement wireless emergency lighting with automated testing and reporting. Furthermore, its open platform allows you to monitor energy savings and control assets efficiently.



How it works

Casambi's innovative technology provides a seamless and efficient way to create smart lighting networks in office environments.

Casambi offers two ways to add its functionality to luminaires. The first option is to choose a Casambi Ready luminaire from an ecosystem partner. These luminaires come pre-equipped with Casambi technology, ensuring immediate interoperability and optimal performance. The second option is to go for luminaires with integral drivers (such as DALI, 0-10V, or 1-10V), decorative fixtures with LED lamps, or other such devices. These can be equipped with wireless connectivity by adding Casambi CBU devices.

Casambi extends beyond just luminaires. You can also incorporate Casambi Ready switches, sensors, or even air purifiers into your network. These devices provide wireless mesh functionality, expanding the interaction options and connectivity of your network.










Casambi Products

CBM = Casambi Bluetooth Module

This chip is integrated into Casambi Ready products. The current generation CBM-003 supports the latest Bluetooth® 5. Specification to offer long ranges of up to approximately 200 meters (650 feet) in real-world applications.

CBU = Casambi Bluetooth Unit

CBUs are multipurpose devices with an embedded chip.

Product	Image	Name	Description
CBM-003		Casambi Bluetooth Module	CBM-003 contains a powerful 32-bit ARM® Cortex® -M4 CPU and a 2.4 GHz transceiver with an onboard antenna.
CBU-ASD-LR		Analogue Stand-alone/Sensor DALI – Long Range	CBU-ASD-LR is a wireless control unit for LED drivers with 0-10V, 1-10V or DALI dimming interface. It is possible to configure to support “no voltage” push button or to work with a standard PIR sensor (via smart-switching).
CBU-TED-LR		Trailing Edge Dimmer– Long Range	CBU-TED-LR is a trailing-edge dimmer for operation of incandescent lamps, dimmable LED lamps and dimmable LED control gear. It can also be configured as a sensor unit.
CBU-PWM4		Pulse Width Modulation 4-ch	CBU-PWM4 is an enabled four channel PWM dimmer for constant voltage LED loads, such as LED strips and constant voltage LED modules. It is connected between a 12-24 VDC power supply and the constant voltage LED load.
CBU-DCS		DALI Controller Slave	CBU-DCS is a Casambi enabled DALI controller. It does not have its own power supply and it is powered directly from a DALI bus. CBU-DCS can be used with a DALI sensor for presence detection or daylight harvesting. CBU-DCS can be configurable as a DALI Gateway.
CBU-A2D		Analogue 2-ch. / 1x DALI	CBU-A2D can control one or two 0-10V controllable LED drivers, or it can control a tunable white LED driver with two 0-10V control interfaces. The product can also be configured into a DALI mode where it can be connected to a DALI LED driver or DALI sensor for the presence and/or daylight harvesting functions. CBU-A2D has a universal 100-277 VAC input voltage range.
Xpress-LR		“X” layout switch panel– Long Range	Xpress-LR is a wireless user interface for controlling Casambi enabled luminaires. The four target buttons can control individual luminaires, groups, scenes, animations, and elements. Xpress-LR has buttons for dimming and also up/down buttons that can either control the colour temperature or direct/indirect light ratio adjustment.
CBU-TDP-LR		Trailing-edge Dimming Pack – Long Range	CBU-TDP-LR is a trailing-edge dimmer for incandescent lamps, dimmable LED lamps and dimmable LED control gear. CBU-TDP-LR can control up to 50 W at 120 VAC. It features an overcurrent and over temperature protection.
CBU-ARP-LR		Analogue Relay Powerpack - Long Range	CBU-ARP-LR is designed to control a single 0-10V LED driver. If the LED driver cannot be turned completely off from the 0-10V control interface, CBU-ARP-LR has a built-in 2.0 A relay for cutting the power from the driver. It also has a 12-24 VDC input for motion sensor.

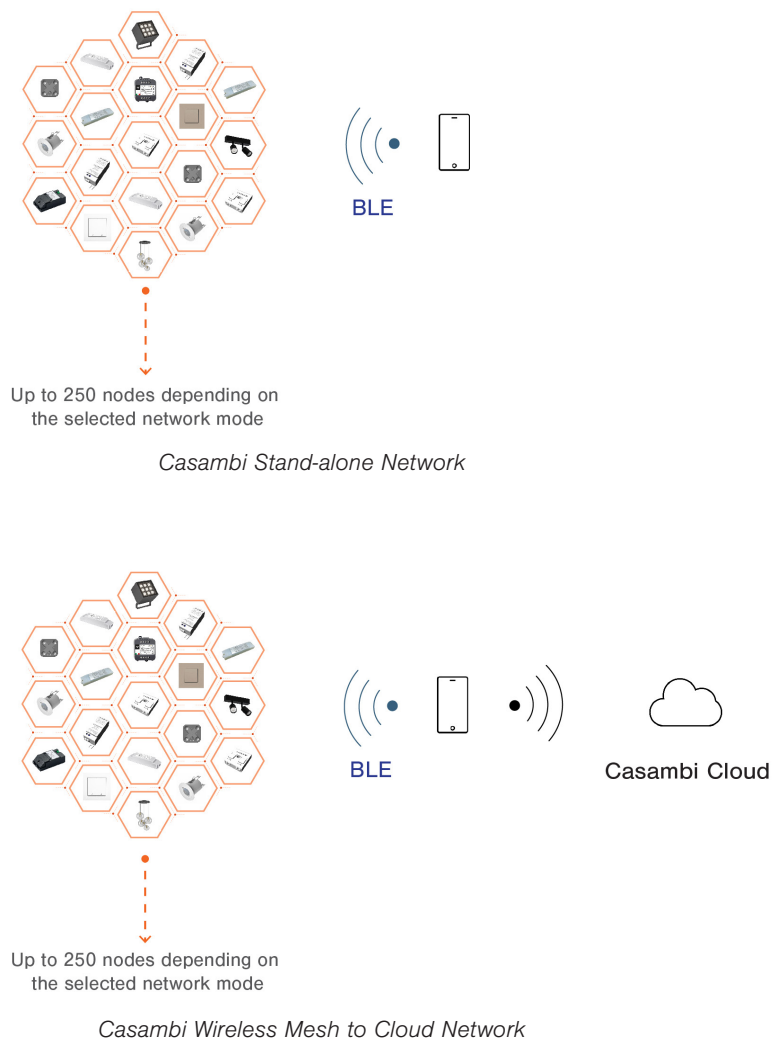
CBU-TDP-LR and CBU-ARP-LR are available exclusively for the USA and Canada markets.

All about the mesh:

Bluetooth® Low Energy serves as the means of communication between a mobile phone or other control device and a Casambi network. Casambi's technology establishes a specialized mesh network, known as the 'Casambi Mesh', tailored especially for lighting controls, facilitating secure, encrypted device-to-device wireless communication within the lighting network.

Unlike some other wireless communication technologies, all devices (nodes) within a Casambi mesh network carry the complete system intelligence. This means that there are no central communication units that could become weak links in the system. If one node fails, communication seamlessly continues via other nodes, ensuring uninterrupted performance.

Casambi mesh networks are highly scalable. A single network can contain up to 250 devices, and there is no limit to the number of networks that can be created within a single site. This scalability provides endless possibilities for expanding and tailoring the network to specific needs. If you have existing DALI networks in place, Casambi can seamlessly connect to them via the Casambi DALI Gateway (explained further down), enabling a harmonious coexistence of technologies. With its decentralized approach and options for integrating various devices, Casambi is well-suited to meet the diverse needs of modern office lighting systems.



Secure and robust

Casambi ensures a secure and robust lighting control ecosystem through several key features. Firstly, it implements full encryption for communication between mobile devices and end nodes, with stringent security measures for authorization, guaranteeing the absolute protection and safety of all transmitted data within the Casambi network. Secondly, all nodes in a Casambi mesh network maintain a backup of the entire system, enhancing communication speed and system robustness. Additionally, Casambi Ready products are built on standardized hardware and software platforms, with regular over-the-air updates provided for all Casambi components, ensuring continuous improvement and the addition of new functions at no extra cost to the user.

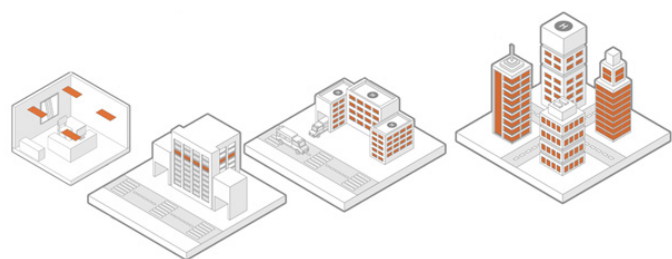
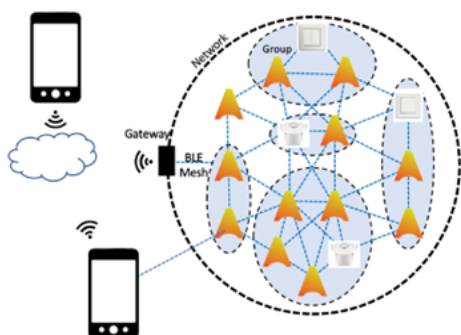


Casambi is ioXt certified for its wireless lighting control security. The ioXt Alliance was established to build confidence in Internet of Things products through multi-stakeholder, international, harmonized, and standardized security and privacy requirements, product compliance programs, and public transparency of those requirements and programs. It addresses device vulnerabilities with independent researchers, such as passwords, network, Bluetooth, gateway, and cloud issues.

What added value does Casambi bring to your project?

Maximum flexibility and scalability

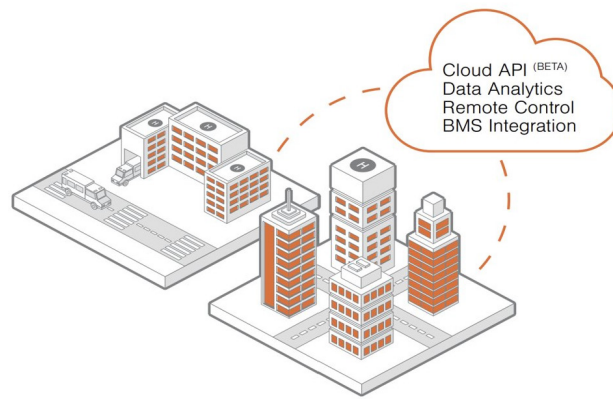
Configuring and operating a Casambi network is hassle-free, as it requires no additional tools or software; just your smartphone or tablet and the Casambi App. The app allows for easy modifications to control groups, light scenes, and the creation of new ones to accommodate changing office layouts, room partitions, or preferences. This flexibility stands in stark contrast to wired systems, where altering control groups is often cumbersome due to limitations imposed by originally installed communication cables during construction. With Casambi, such adjustments can be made remotely at any time, reducing the need for on-site visits and simplifying the process of updating lighting scenes.



From basic single room controls up to multiple buildings with advanced IoT capabilities

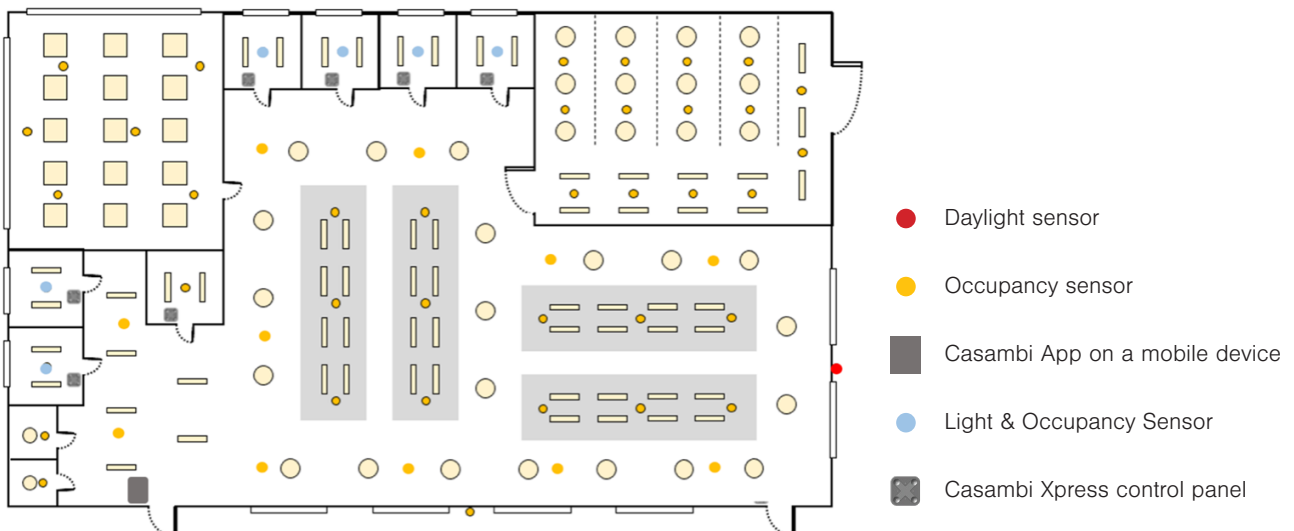
Tap into the IoT for office

Casambi offers seamless integration into the realm of IoT with its cloud API, enabling the incorporation of network monitoring and data utilization within the smart building infrastructure. This means that your lighting network can be transformed into an integral part of your intelligent building ecosystem. The Casambi API, comprising Rest API and Websocket services, facilitates data access in a human-readable JSON format, enhancing its accessibility. Casambi goes a step further by supporting iBeacon profiles for those seeking a fully connected office experience. In essence, the Casambi API serves as a powerful toolset for developers, allowing them to connect and interact with a Casambi system, offering the “building blocks” for custom software applications, including diverse user interfaces. It encompasses two distinct sets of software tools: the REST API, designed for requesting “static” network information, and the WebSocket service, tailored for real-time monitoring and control.



Optimizing energy services

In office settings, the implementation of a multiple control strategy that integrates occupancy detection and daylight harvesting can lead to substantial energy savings. Casambi offers a solution where any pre-existing lighting system can be easily upgraded to incorporate both occupancy and daylight sensors. These uncomplicated commissioning tasks can be managed by facility managers, or alternatively, our dedicated commissioning partners can deliver swift and dependable services. The inherent simplicity of Casambi networks not only streamlines the commissioning process in operational buildings but also results in time and cost savings, making it an efficient choice for optimizing energy efficiency.



Casambi X DALI

With Casambi, wired installations can be expanded wirelessly, making Casambi the ideal solution for office renovations or extensions.

A CBU-DCS from Casambi or an equivalent device from the Casambi Ecosystem can be used to act as a gateway between a wired DALI network (controlled by DALI controller hardware and software) and a wireless Casambi network. To ensure proper connectivity, you must apply the CBU-DCS DALI Gateway profile before connecting it to the same powered DALI bus as the DALI controller.

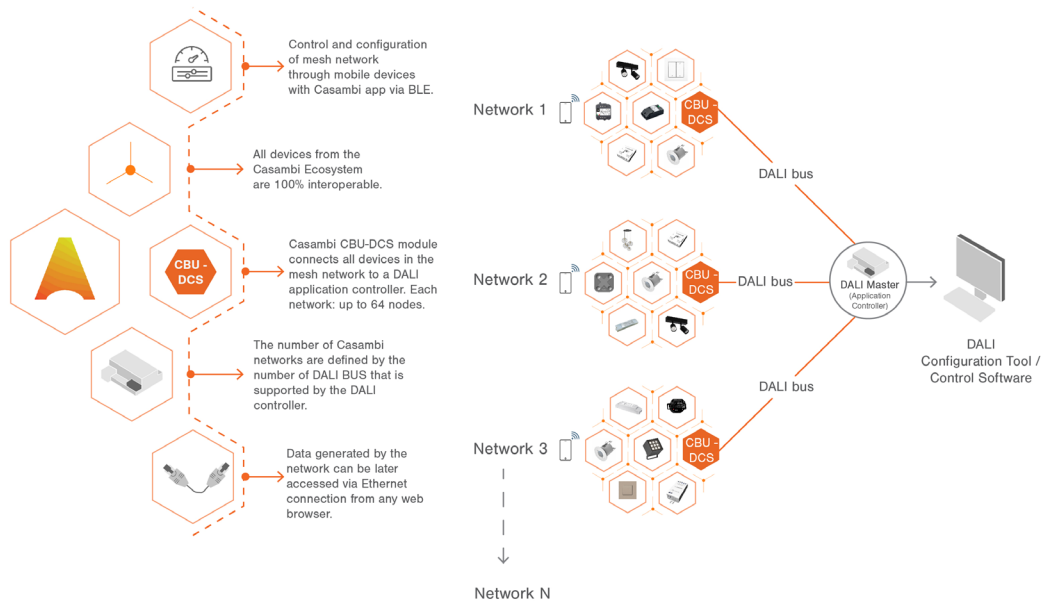
Any device that exists in the Casambi network will then appear as standard DALI gear to the wired DALI controller software. Each Casambi device occupies one DALI address but the CBU-DCS DALI gateway does not; instead, it appears transparent to the DALI controller software.

Casambi devices that control more than one channel appear as single-channel DALI gear to the DALI controller software, therefore the separate channels cannot be dimmed individually by the DALI controller software, only by the Casambi app.

Casambi devices that use TW, RGB or XY controls are presented to the DALI controller software as DALI or DALI DT8 (Tc/RGB/XY) devices.

All Casambi luminaires can be addressed by the DALI controller software, regardless of what type of Casambi device they are. i.e. the Casambi device does not need to be a DALI-controllable device.

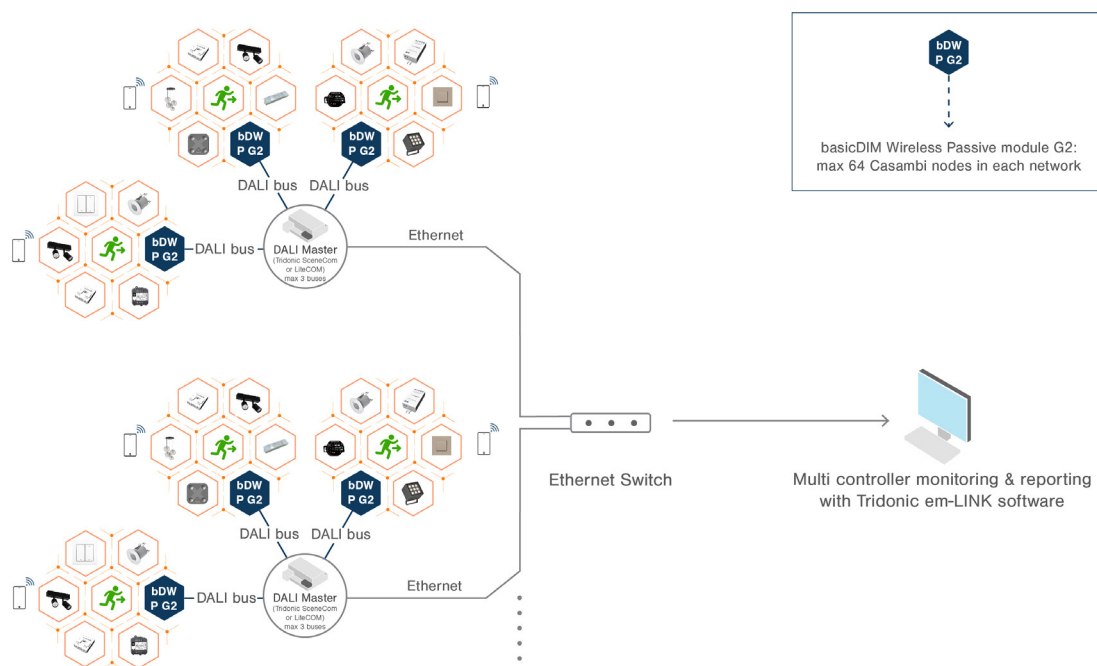
A CBU-DCS DALI Gateway enables 64 input devices to be addressed according to the DALI standard, but only 80 DALI-2 “instances” can be processed by the DALI Gateway. This means that the amount of input devices possible in the Casambi network may be limited depending on the number of instances the devices use. If you wish to control more than 64 devices or 80 DALI-2 instances you should create multiple Casambi networks with a DCS DALI gateway in each.



Wireless emergency lighting

Tridonic provides wireless emergency lighting based on Casambi technology. This solution brings additional strength to the wireless mesh and overall system, as well as supporting DALI DT1 standard devices – meaning reliable interoperability with DALI local battery emergency control gear. DT1 interoperability provides advanced data extraction capabilities from devices for any other analytics that may be required.

The basicDIM wireless Passive module G2 connects all the wireless emergency luminaires to a sceneCOM evo controller. Once commissioned, the controller acts as the “brain” and takes over command of the entire lighting solution – fully automated and exactly as the user requires. This also applies to the required central monitoring and automated testing of emergency and safety lighting systems.



This solution for emergency lighting provides:

- Central monitoring of individual luminaires. The dashboard provides information at a glance about the current state of the system and the latest test results. The status of each luminaire in the network includes the condition of the battery as well as the status of the LEDs and associated electronics.
- Automatic testing of individual luminaires. The wireless emergency solution provides, via an onboard HTML page, the ability to schedule automated emergency tests at any time and any frequency. It greatly reduces commissioning time and eliminates the need to visit the site every month to action the emergency test.
- Standard-compliant logbook with all the relevant information for downloading as a PDF or XML file.
- The possibility to be integrated into existing installations without the need for additional wiring.

-
- External access via a PC, notebook, tablet or other internet-enabled device. The test and system data are accessed via Ethernet from any web browser.
 - On request, a software package can inform the asset manager about faults and errors via email.
 - Up to 200 sceneCOM evo controllers can be connected (as many as 38,400 individual luminaires).
 - Firmware updates are available wirelessly on any Android or iOS device.
 - The relevant components of the wireless emergency lighting system are BSI Kitemark™ certified and comply with all standards and regulations relevant to emergency lighting.

Case Study

The BBC installs Casambi controls across nine UK sites



The BBC's output reaches more than 400 million people worldwide every week, and its TV news operation is the biggest in the world. In 2020, the organization decided to bring the same forward-thinking approach to its buildings, which house numerous TV and radio studios, data centers, and offices. The BBC is on a mission to reduce energy use, improve comfort for staff, and introduce smarter, more flexible control. All upgrades had to achieve energy reductions of at least 20% to go ahead, in line with the BBC's sustainability strategy.

The broadcaster's technical services team originally decided to bring Casambi's lighting control solution to seven of its buildings, allowing lights to be controlled wirelessly from mobile devices. At Broadcasting House, the BBC's London HQ, 2,000 fluorescent light fittings in the new part of the building have been replaced with LED alternatives, together with new sensors and Casambi wireless control.

The eight-story Broadcasting House operates 24 hours a day and is home to BBC News – the world’s biggest TV news operation – and several radio stations, including the World Service. The installation at Broadcasting House was carried out during late evenings, and each area being upgraded had to be ready the following morning when staff returned to their desks, so there would be no disruption. Being completely wireless, Casambi was the ideal solution for quick and non-disruptive installation. The BBC finally installed Casambi’s wireless lighting control system across nine of its UK buildings, with several more sites to follow.

Sensors from Tridonic and Danlers have been installed to enable presence/absence detection and daylight dimming, ensuring lights are only on when they are needed. Energy-harvesting wireless switches from EnOcean have also been used, which provide another easy way for staff to control the lights.

Number of Casambi nodes: 10,000 +

Customer benefits:

- A wireless control system that enables the user to personalize their lighting via the intuitive Casambi App.
- A 1:1 replacement of the luminaires without changing the existing electrical installation.
- Energy savings using Casambi enabled presence/absence detection and daylight harvesting.
- Quick and non-disruptive installation.
- Improved lighting conditions with tunable white light.
- EnOcean energy-harvesting wireless switches, which provide another easy way for staff to control the lights.

CASAMBI

casambi.com