

Latest Smart Lighting Control Technologies with Simple BMS / IoT Integration

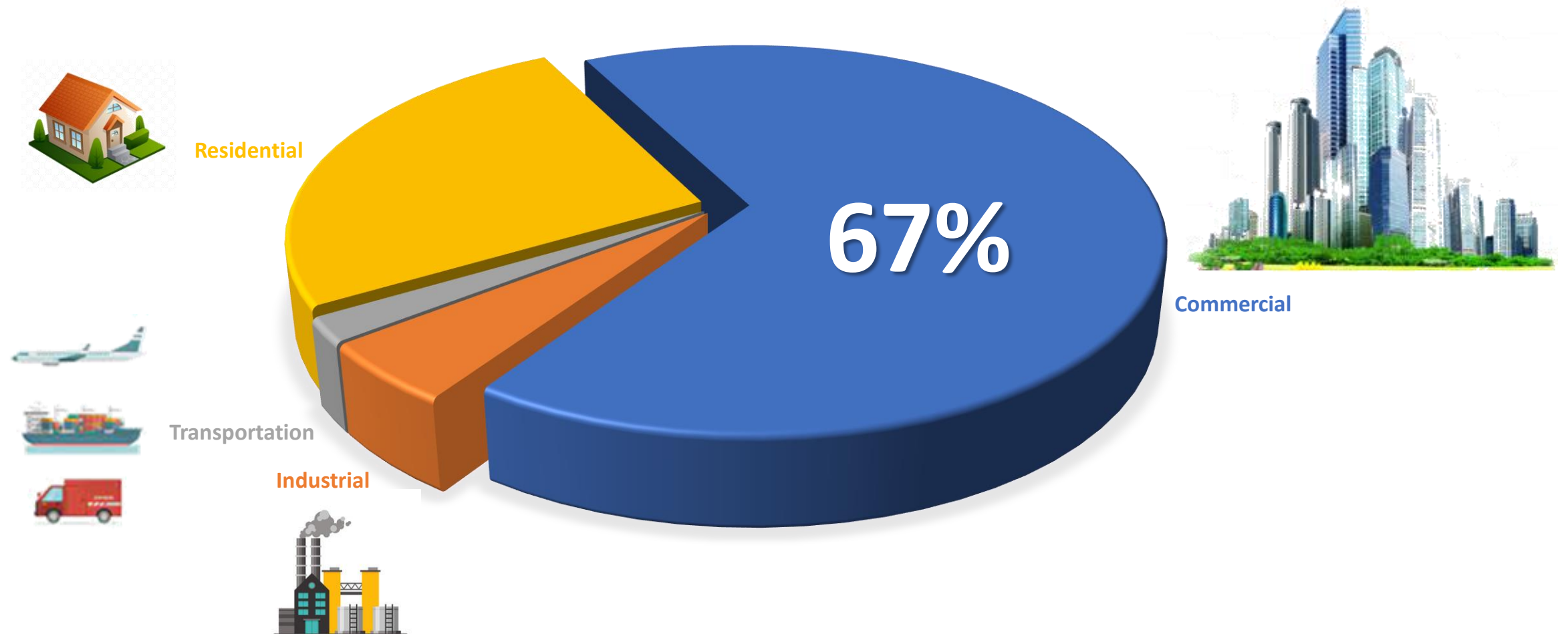


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LUTRON GL Ltd.

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Mobile: 90983540

ELECTRICITY CONSUMPTION BY SECTOR (2018)



Source: "Hong Kong Energy End-use Data 2020"

表格 Table 39

辦公室組別電力使用按最終用途劃分

Electricity Consumption in Office Segment by End-use

單位 Unit : 太焦耳 Terajoule

	空氣調節 Air Conditioning	照明 Lighting	辦公室設備 Office Equipment	垂直運輸 Vertical Transport	其他 Others	總計 Total
2008	6,395	1,700	1,505	-	2,294	11,894
2009	6,338	1,684	1,491	-	2,274	11,788
2010	6,557	1,743	1,543	-	2,352	12,195
2011	6,711	1,784	1,577	-	2,412	12,484
2012	6,809	1,809	1,599	-	2,446	12,663
2013	6,701	1,806	1,596	-	2,441	12,544
2014	7,031	1,773	1,571	-	2,416	12,791
2015	6,983	1,833	1,620	-	2,479	12,915
2016	7,158	1,862	1,646	-	2,517	13,182
2017	7,303	1,883	1,664	2,337	209	13,396
2018	7,247	1,929	1,705	2,394	214	13,489

Lighting is the second largest area of electricity consumption in H.K.'s offices!

Source: "Hong Kong Energy End-use Data 2020"



Advancing Net Zero

A World Green Building Council global project



WorldGBC definition:
A net zero carbon building is highly energy efficient with all remaining energy from on-site and/or off-site renewable sources

100% of buildings must operate at net zero carbon

2050

2030

All new buildings must operate at net zero carbon

GOVERNMENT
ENGAGEMENT

TRAINING &
EDUCATION

CORPORATE
ENGAGEMENT

CERTIFICATION

Key Principles

1. Measure and disclose carbon

Carbon is the ultimate metric to track, and buildings must achieve an annual operational net zero carbon emissions balance based on metered data



2. Reduce energy demand

Prioritise energy efficiency to ensure that buildings are performing as efficiently as possible, and not wasting energy



3. Generate balance from renewables

Supply remaining demand from renewable energy sources, preferably on-site followed by off-site, or from offsets



4. Improve verification and rigour

Over time, progress to include embodied carbon and other impact areas such as zero water and zero waste



Traditional



LED



Automation



Integration



**Fluorescent
Tube**



**Retrofit
LED Tube**



OR

**Module Type
LED Troffer**



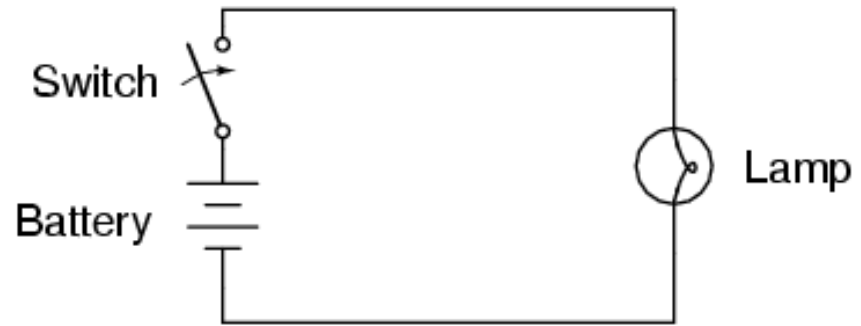
Incandescent / Halogen Lamps



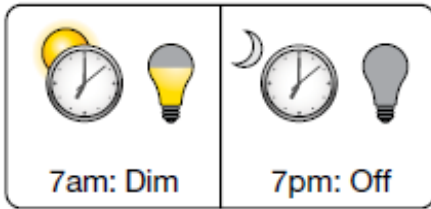
LED Lamps / Fixtures



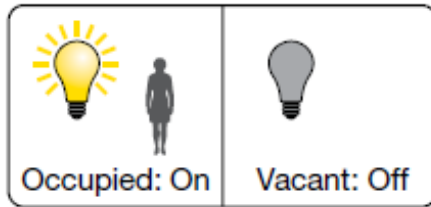
Traditional Lighting Control



Today's Lighting Control



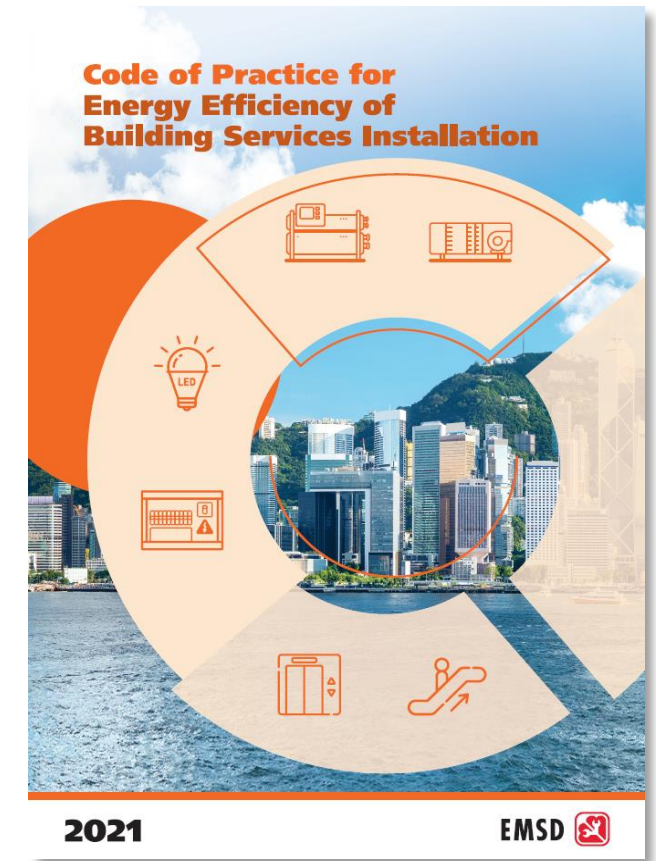
Time Scheduling



Occupancy Sensing



Daylight Harvest

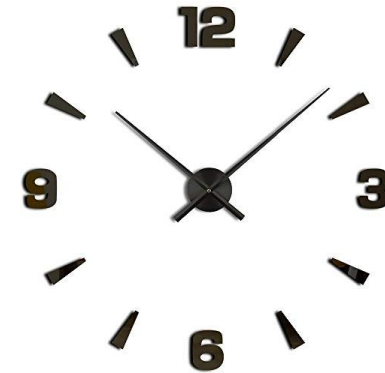


Automatic Lighting Control – Time Scheduling

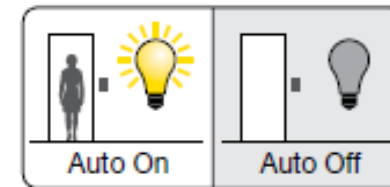
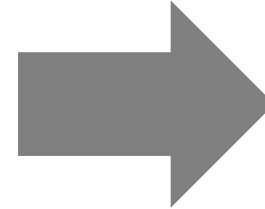
5.6 Automatic Lighting Control

5.6.1 The Basic Provision

- 5.6.1.1 Automatic lighting control should be provided to the space given in Table 5.4 unless the total electrical power consumed by the complete fixed lighting installations in the space does not exceed 150 W. The control should be able to shut off or reduce the general lighting power by at least 50% automatically of the lighting zone being controlled.

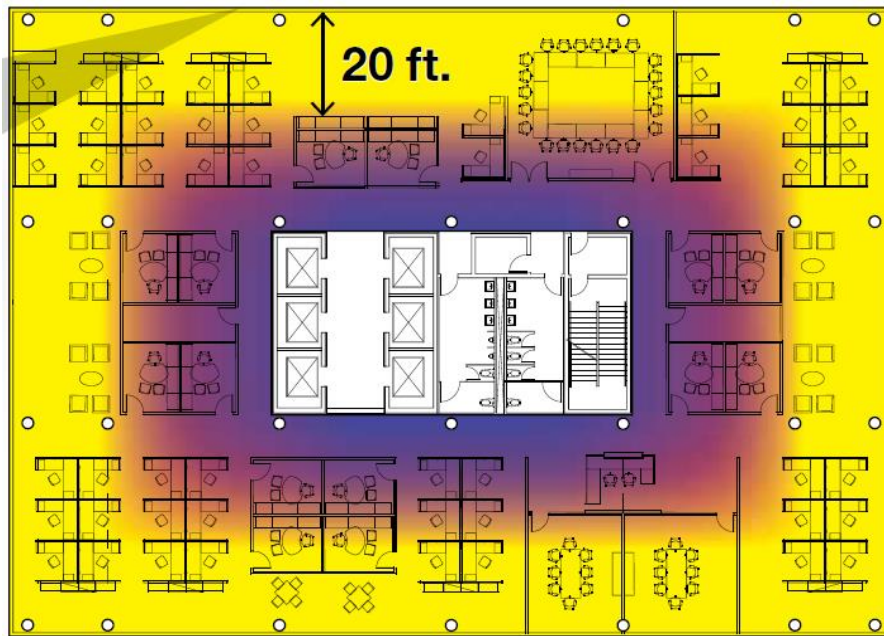


Automatic Lighting Control – Occupancy Sensing



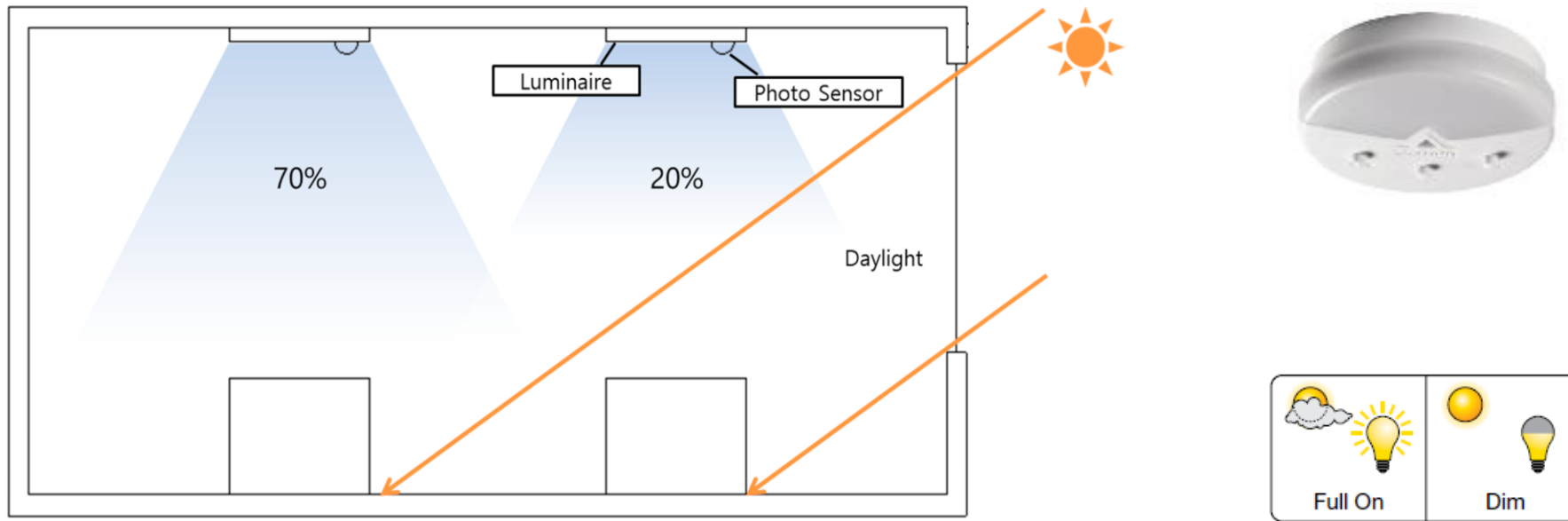
Despite energy saving, occupancy sensor also allows “**TOUCHLESS**” control when users enter a space

Automatic Lighting Control – Daylight Control



In modern buildings with curtain wall, researches show that natural light can penetrate into interior spaces up to 6m.

Automatic Lighting Control – Daylight Control



Smart lighting system automatically dims electrical lights at perimeter when there's sufficient natural light

Automatic Lighting Control – Potential Savings

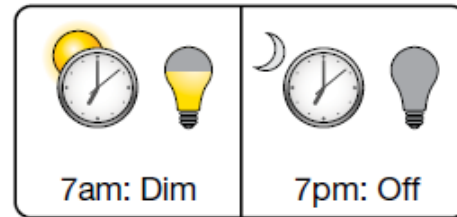
Building Type	Occupancy	Daylighting	Personal Tuning	Institutional Tuning	Multiple Types
Office	22% (n=23)	27% (n=18)	35% (n=13)	36% (n=11)	40% (n=24)
Warehouse	31% (n= 4)	28% (n= 1)	-	-	-
Lodging	45% (n= 2)	-	-	-	-
Education	18% (n= 5)	29% (n= 7)	6% (n= 2)	-	34% (n= 7)
Retail (other than mall)	-	29% (n= 3)	-	60% (n= 1)	-
Healthcare inpatient	-	-	-	-	35% (n= 1)
Public assembly	36% (n= 2)	36% (n= 1)	-	-	-
Healthcare outpatient	23% (n= 1)	-	-	-	-
Other	7% (n= 1)	18% (n= 1)	-	-	-

SOURCE : *Lighting Controls In Commercial Buildings* by Alison Williams, Barbara Atkinson PE, Karina Gabesi PhD, Erik Page PE, and Francis Rubinstein FIES

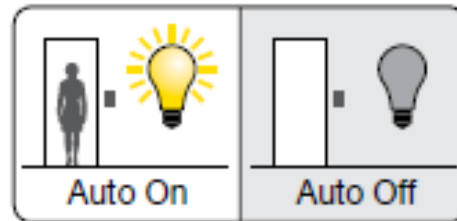
Automatic Lighting Control Requirements



Scheduling



Motion Detection



Daylight Control



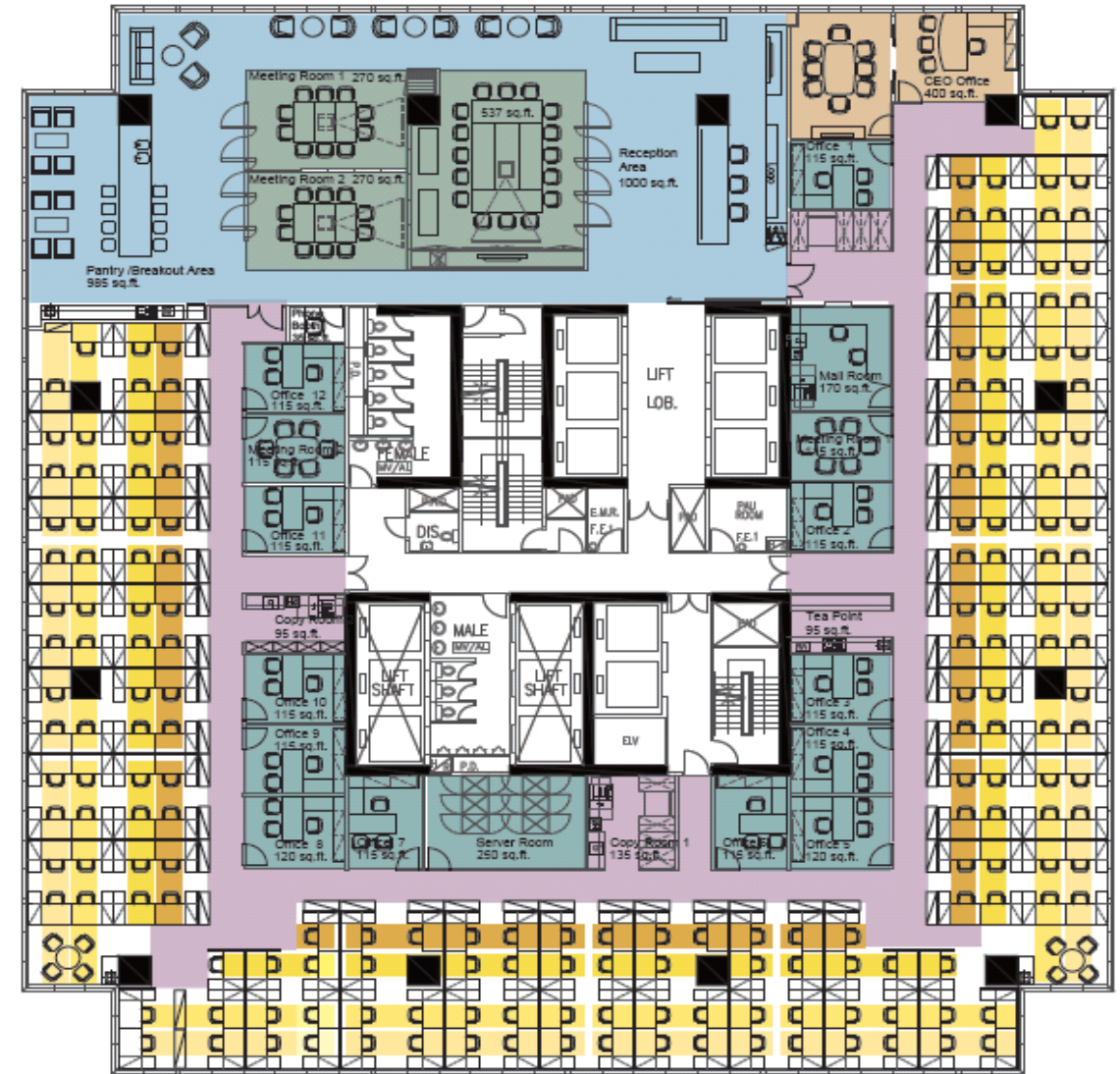
Different Control Needs

Open Office

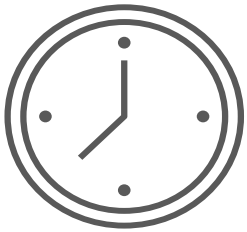
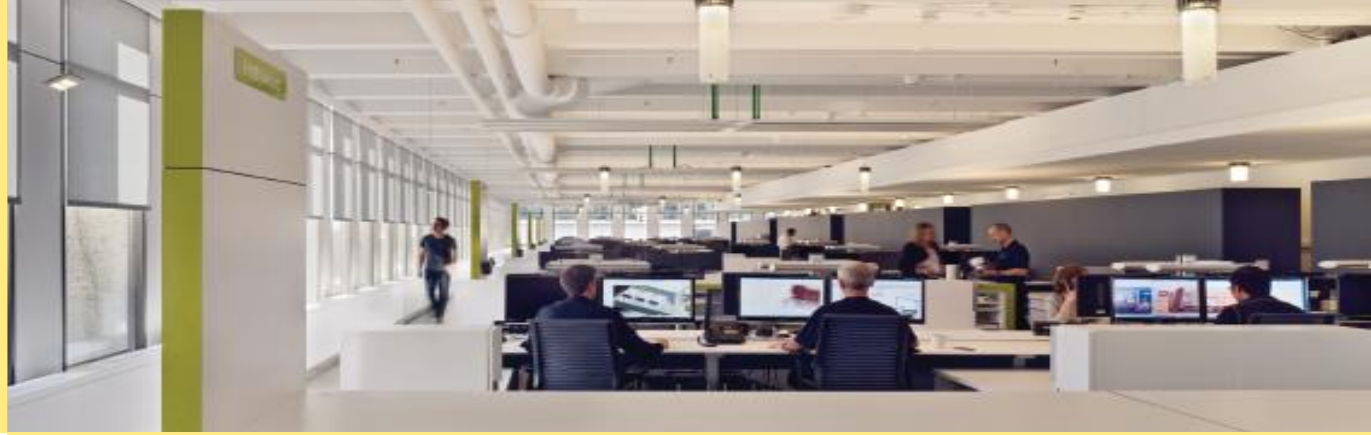
Conference Room

Executive Office

Enclosed Office



Open Office & Public Areas



Auto Scheduling

Lights are automatically controlled during office hours according to pre-define schedules



Wireless Occupancy Sensor

Automatically turns lights OFF (during non-office hours) when the space is vacant



Wireless Daylight Sensor

Automatically dim / turn OFF lighting fixtures at perimeter when there is sufficient natural light

- ✓ Fully automatic
- ✓ Save energy
- ✓ Easy to installation
- ✓ Touchless control

Enclosed Offices



2-button Wireless Switch

Controls 1 non-dim lighting zone



Wireless Occupancy Sensor

*Automatically turns lights OFF
when the space is vacant*

- ✓ Save energy
- ✓ Easy to installation
- ✓ Touchless control

Executive Offices



4-button Wireless Preset Keypad

*3 preset lighting scenes plus OFF
(optional custom engraving upon request)*



Wireless Occupancy Sensor

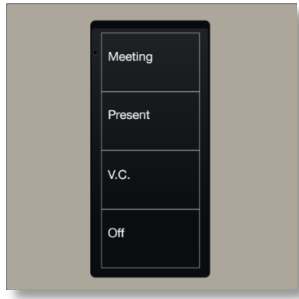
*Automatically turns lights OFF when
the space is vacant*

Wireless Daylight Sensor

*Automatically dim / turn OFF light
when there is sufficient natural light*

- ✓ Personalized control
- ✓ Save energy
- ✓ Touchless control

Conference Rooms



Wireless Preset Keypad

*3 preset scenes (non-dim) plus OFF
(optional custom engraving upon request)*



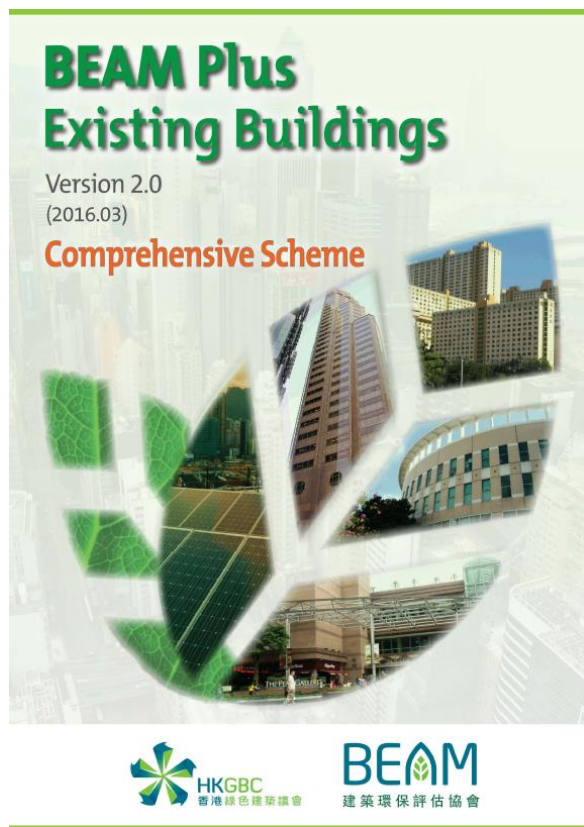
Wireless Sensors



AV Integration

*Lighting control system can seamlessly
integrates with AV Control System*

- ✓ User friendly
- ✓ AV Integration
- ✓ Save energy
- ✓ Easy to installation
- ✓ Touchless control



1 BEAM Plus for Existing Buildings

1.1 Introduction

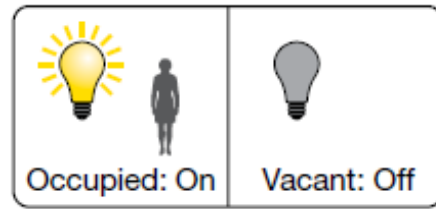
Building Environmental Assessment Method (BEAM) Plus is a comprehensive environmental assessment scheme for buildings on a voluntary basis. It defines the best practice criteria for a range of sustainability issues across the whole life-cycle of buildings and projects, such as how buildings should be designed, constructed, operated, etc. Recognised as one of the world's leading green building assessment systems, it provides a comprehensive set of performance standards that can be pursued by developers and owners.

Owned and operated by the BEAM Society Limited (BSL), BEAM Plus for Existing Buildings is one of a series of rating systems that covers the management, operation and maintenance of a building and may be initiated at any time.

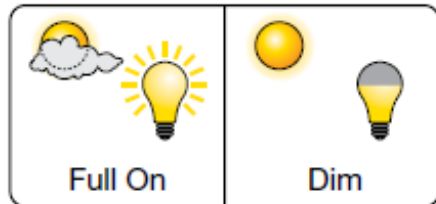
It aims to reduce the environmental impacts of existing buildings whilst improving quality and user satisfaction by the adoption of the best techniques available with reasonable cost.

1.1.1 BEAM Plus Existing Buildings Version 2.0

Hong Kong has over 42,000 existing buildings stocks. Majority of them are over thirty years old. Encouraging building owners of these buildings, especially in private sector, to adopt green building management and upgrading the building services systems can play a significant role in the world of sustainability. Improving their energy efficiency is also an essential step towards the achievement of Energy Saving Plan target by 2025.



Wireless Occupancy Sensors

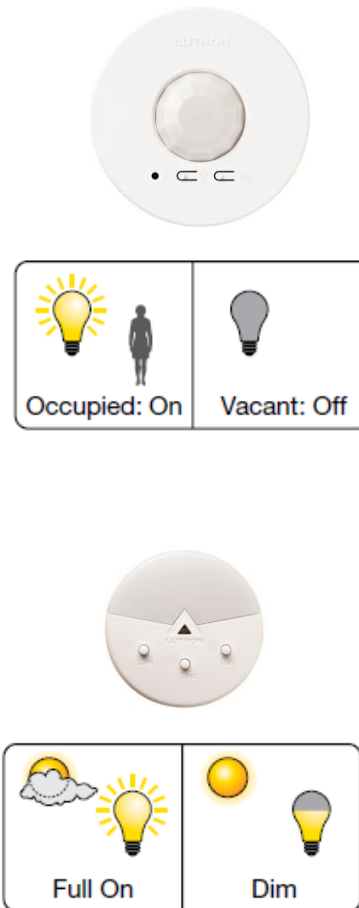


Wireless Daylight Sensors

	EU 5 Enhancement
Exclusion	None.
Objective	To encourage adoption of practices, new technologies and techniques that have yet to find application in Hong Kong or provision for performance enhancements over and above stated performance criteria in BEAM Plus for Existing Buildings.
Credit Attainable	7 Bonus
Credit Requirement	<p>Maximum of 1 Bonus credit for each energy conservation approach is allowed but the award of credit is subject to final approval of BSL's Technical Review Committee (TRC) based on the estimated energy reduction, justification and/or the innovation of the proposed approaches.</p> <p>Note: Energy saving measures that rely on building user's behaviour or manual control (such as, turning up the set temperature manually for air-conditioning; turning off lighting by hand in accordance to staff energy management manual) will not be considered energy saving features in this section.</p> <p>Some of the prescriptive approaches include:</p> <p>a) Research and Development in Energy</p> <p>1 Bonus credit for conducting research and development or participating in competition with published paper related to energy aspects.</p> <p>b) Compliance with the BEC</p> <p>Maximum 4 Bonus credits for compliance with the latest version of the following listed BEC (This bonus credit does not apply to those buildings that are required to comply with the latest version of the BEC):</p> <ol style="list-style-type: none"> Energy Efficiency Requirements of Air-Conditioning Installations; Energy Efficiency Requirements of Electrical Installations; Energy Efficiency Requirements of Lighting Installations; and/or Energy Efficiency Requirements of Lift and Escalator Installations.



'energy management opportunities (EMO)' means the ways to achieve energy efficiency and conservation.



7.5.3 For ensuring that the comparison is made on a consistent basis, the various conditions (e.g. the operation records, duration of measurement, utilization patterns etc.) affecting the measured energy use should be properly recorded allowing for the appropriate adjustments due to the changes in any of such conditions during the EMO implementation stage. Depends on the nature of the EMO, such conditions including operation records and utilization pattern to be monitored and recorded in the energy audit could cover the outdoor or ambient temperature, amount of space being air-conditioned, indoor environmental standard in terms of lighting levels and ventilation rate, occupancy type and schedule etc.

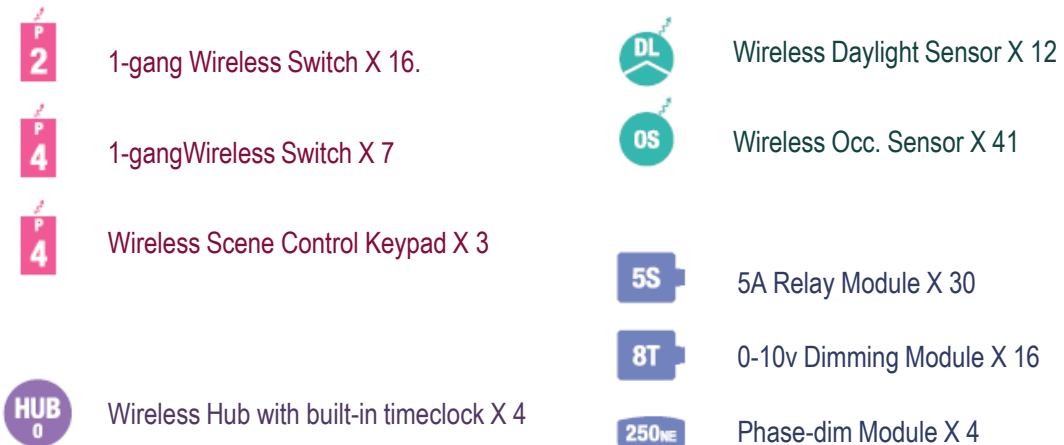
7.6.2 Describe each of the EMO, the intended result and procedure to implement/install the EMO under proper condition to achieve the expected energy savings potential and target. Such procedure may involve inspection, functional performance testing, and/or data trending with analysis and with the required measurement duration specified. Indicate and highlight also any specific function tests (e.g. automatic lighting control with multiple dimming levels in response to available daylight).

SUSTAINABLE OUTCOMES FOR TYPICAL OFFICE FLOOR

- Installation of wireless daylight sensors around perimeter and wireless occupancy sensors across whole floor
- 17,000 kWh saved per year
- 1.2 tones of CO₂-e saved per year
- Equivalent to about 400 trees, or 600m² of forest.

Fluorescent lamps have been assumed. If existing lamps are LEDs, savings roughly halve.

Estimates conducted by Inhabit: jason.gaekwad@inhabitgroup.com



Connectivity of Wireless Lighting Control

System Diagram



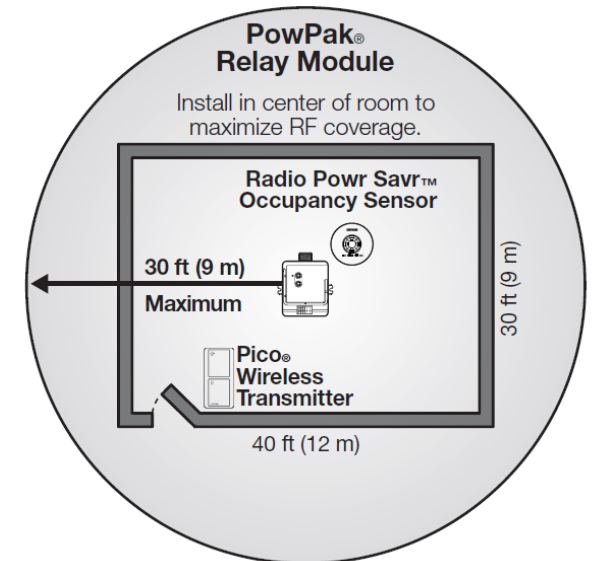
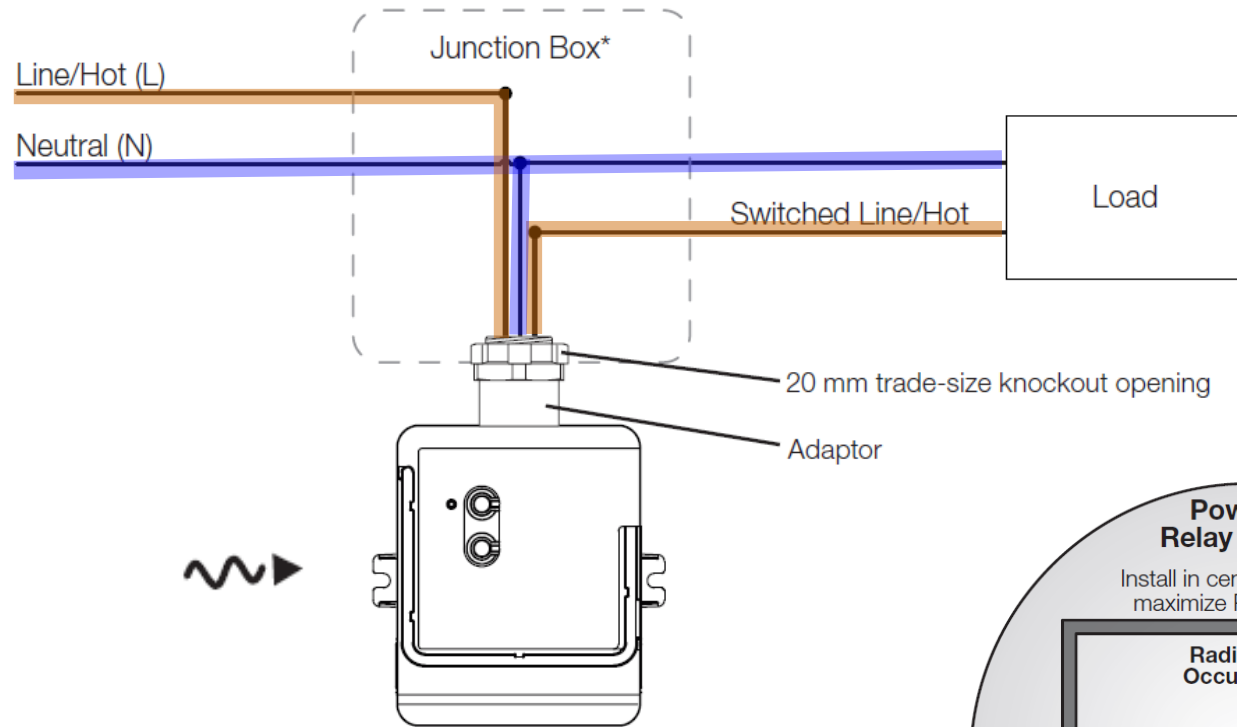
Pico Remote Control (up to 10)



Radio Powr Savr Occupancy Sensor (up to 10)

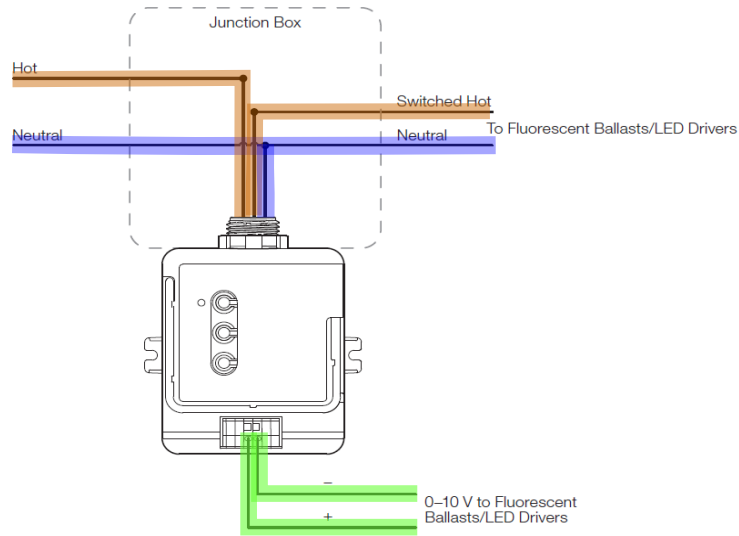


Radio Powr Savr Daylight Sensor (up to 1)



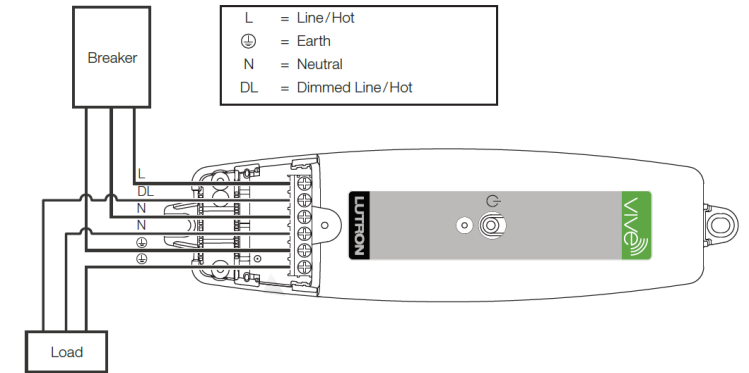
Dimming Options

0-10v Dimming Module



COB-Type Downlight / LED Troffer / LED strips

Phase Dim Module

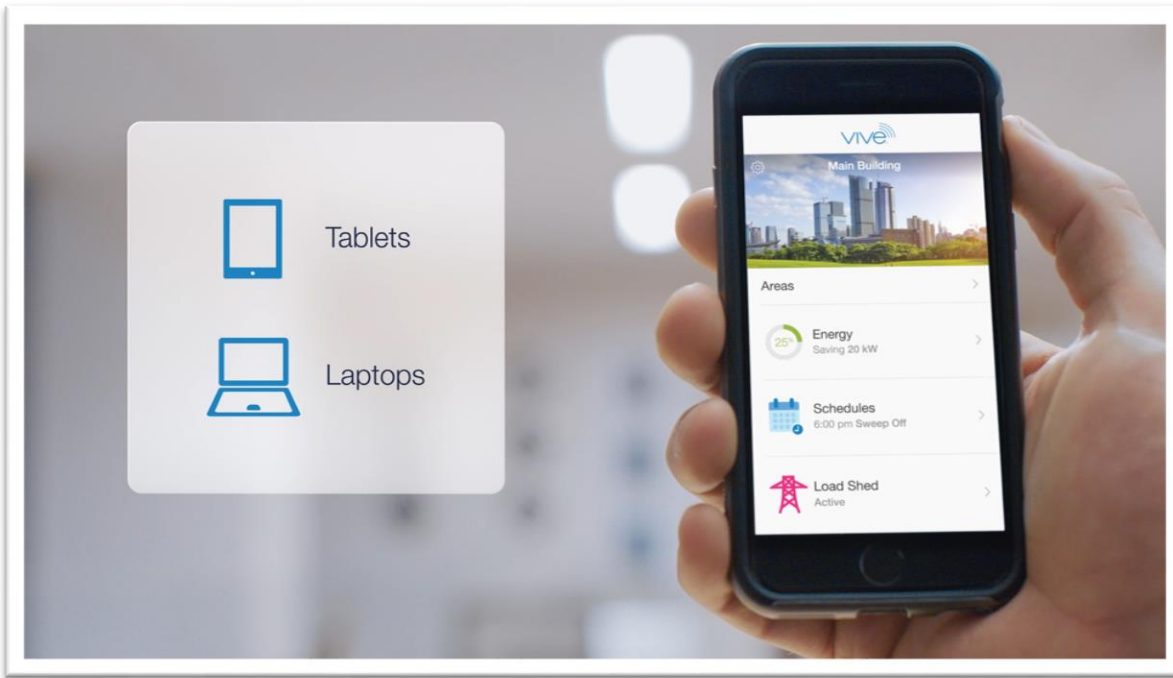


MR16 / Track Lights



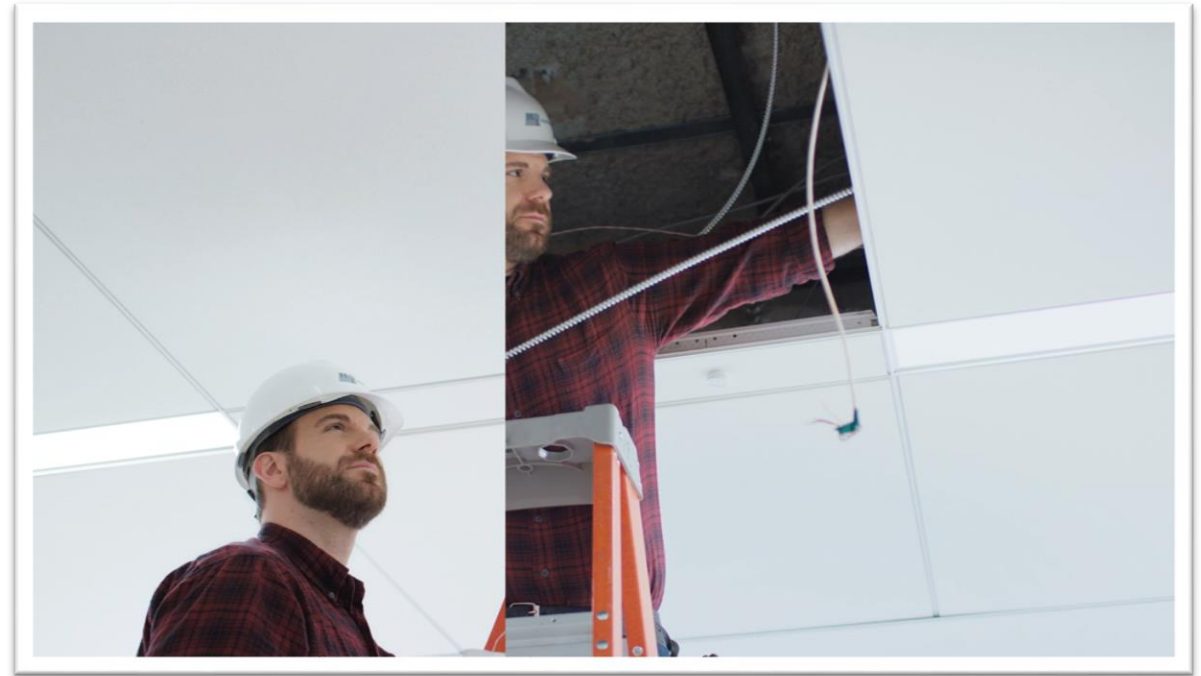
Wireless Sensors

Traditional Wired Sensors



- Labor intensive
- Destructive
- Complex to set-up

Wireless Sensors



- Install 70% faster
- Reducing labor costs
- Minimizing destruction

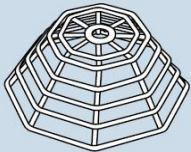
Wireless Sensors



**Wireless occupancy/
vacancy sensors**

Dimensions

W: 91mm (3.57")
H: 91mm (3.57")
D: 29mm (1.13")

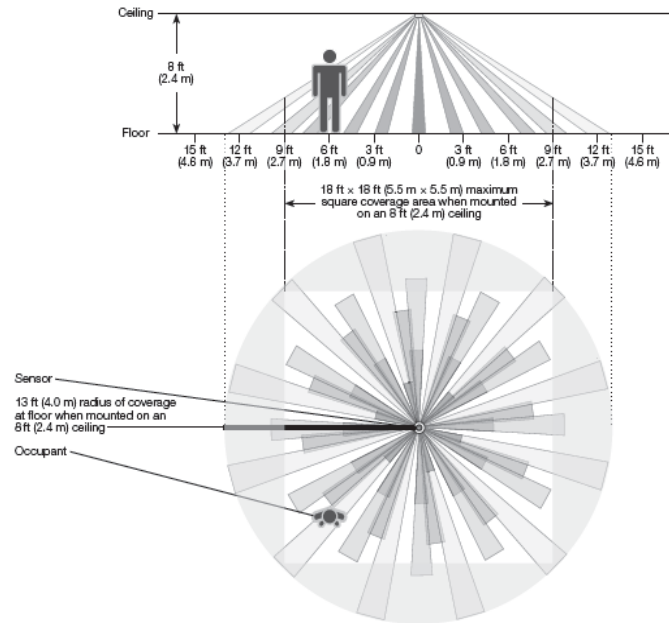


Wire cage guard

Dimensions

W: 178mm (7.0")
D: 83mm (3.25")

Range Diagrams



**Radio Powr Savr
Wireless sensors**

Dimensions

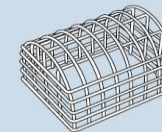
W: 46mm (1.8")
H: 110mm (4.35")
D: 34mm (1.35")



Flexible armature mounting kit

Dimensions

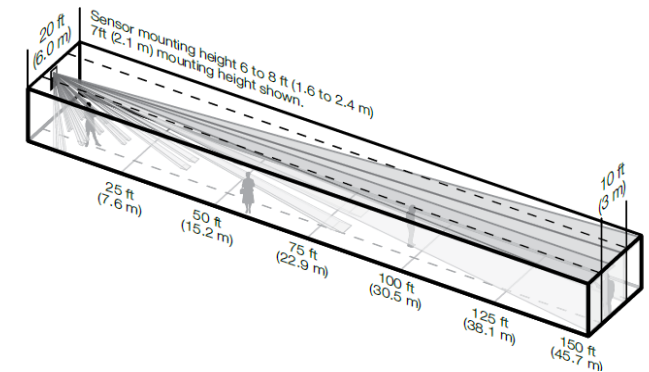
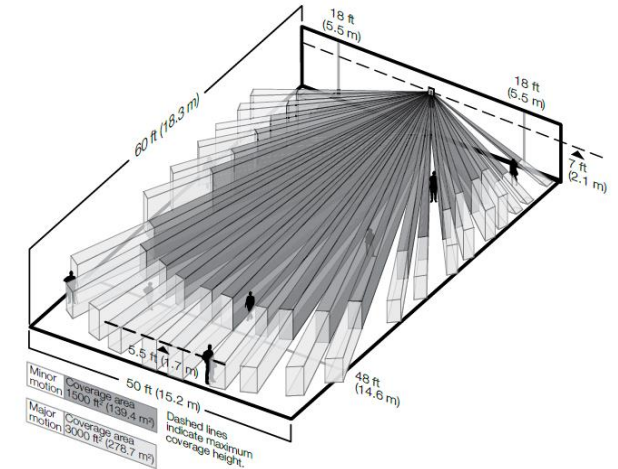
W: 92mm (3.62")
H: 55mm (2.18")



Wire cage guard

Dimensions

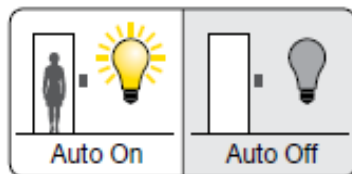
W: 178mm (7.0")
H: 146mm (5.75")
D: 114mm (4.5")



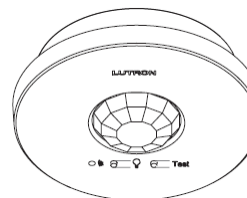
Two Different Sensing Modes

Occupancy sensors

An occupancy sensor automatically turns lights on when you enter a room and off when you leave, making this type of sensor the most convenient, since you never have to touch the lighting controls.



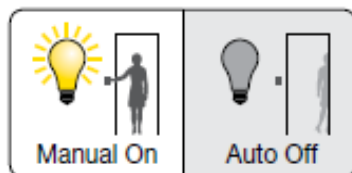
Auto ON / Auto OFF



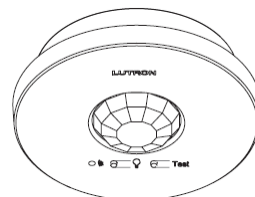
Vacancy sensors

A vacancy sensor also turns lights off when you leave a room—but you need to manually turn them on when you walk into a room. Vacancy sensing maximizes the energy savings from the sensor because it's not always necessary to turn lights on when you walk into a room.

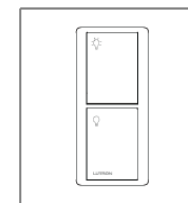
Many codes, such as California Energy Commission's Title 24, require vacancy, and not occupancy sensors, because occupants are less likely to turn the lights on when temporarily entering a space, or when there's sufficient daylight or hallway light.



Manual ON / Auto OFF



+

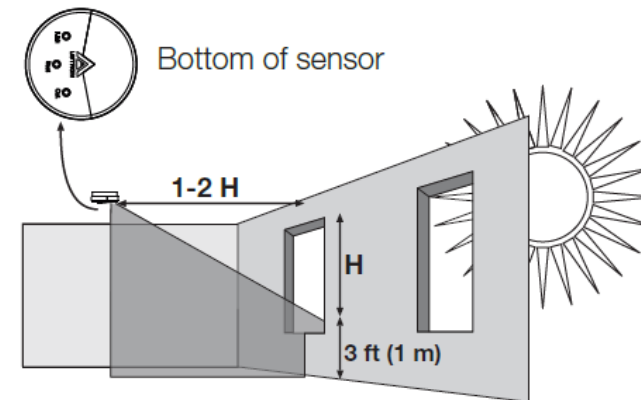




Wireless Daylight Sensor



- Requires no conduit / cable
- Supports dimmable or non-dim lights



H = Effective Window Height

Wireless Control

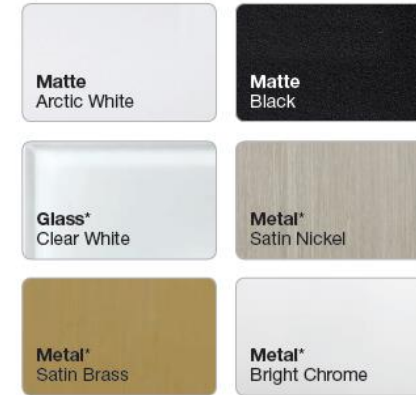


Control where you want it

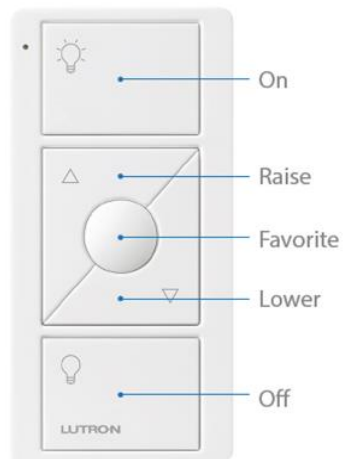
Mount a Pico wireless remote to a wall without cutting a hole or wiring anything. A screwless wallplate design adds a finishing touch to a wall-mounted Pico.



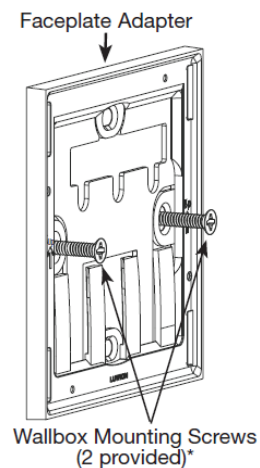
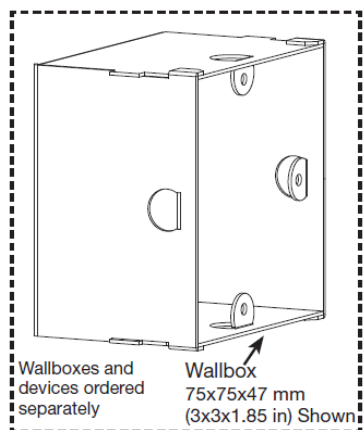
Wallplates



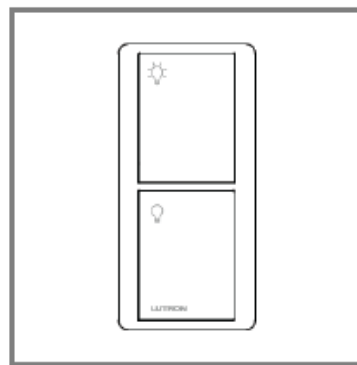
Colours and finishes



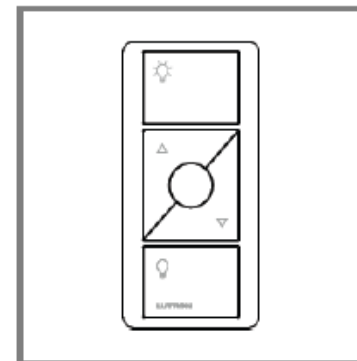
Different Control Functions



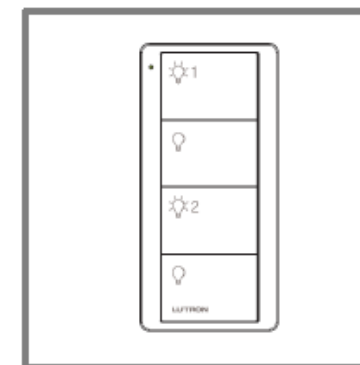
1-gang Switch



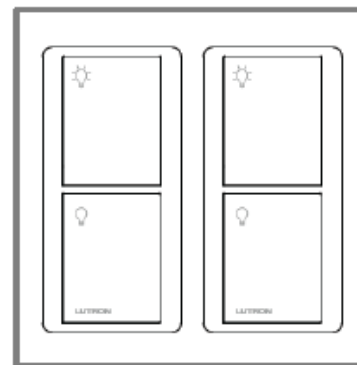
1-gang Dimmer



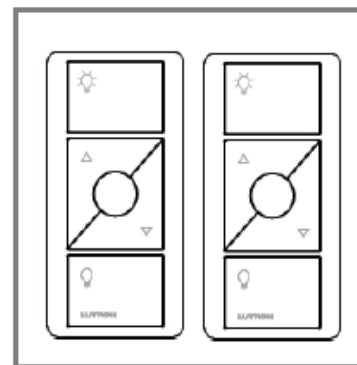
1-gang Dual-Zone Switch



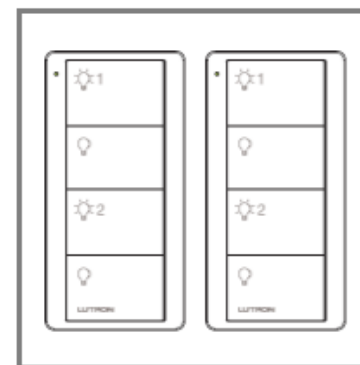
2-gang Switch



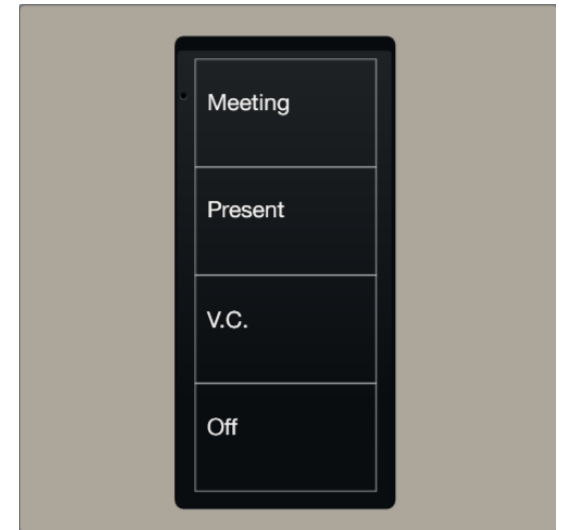
2-gang Dimmer



2-gang Four-zone Switch

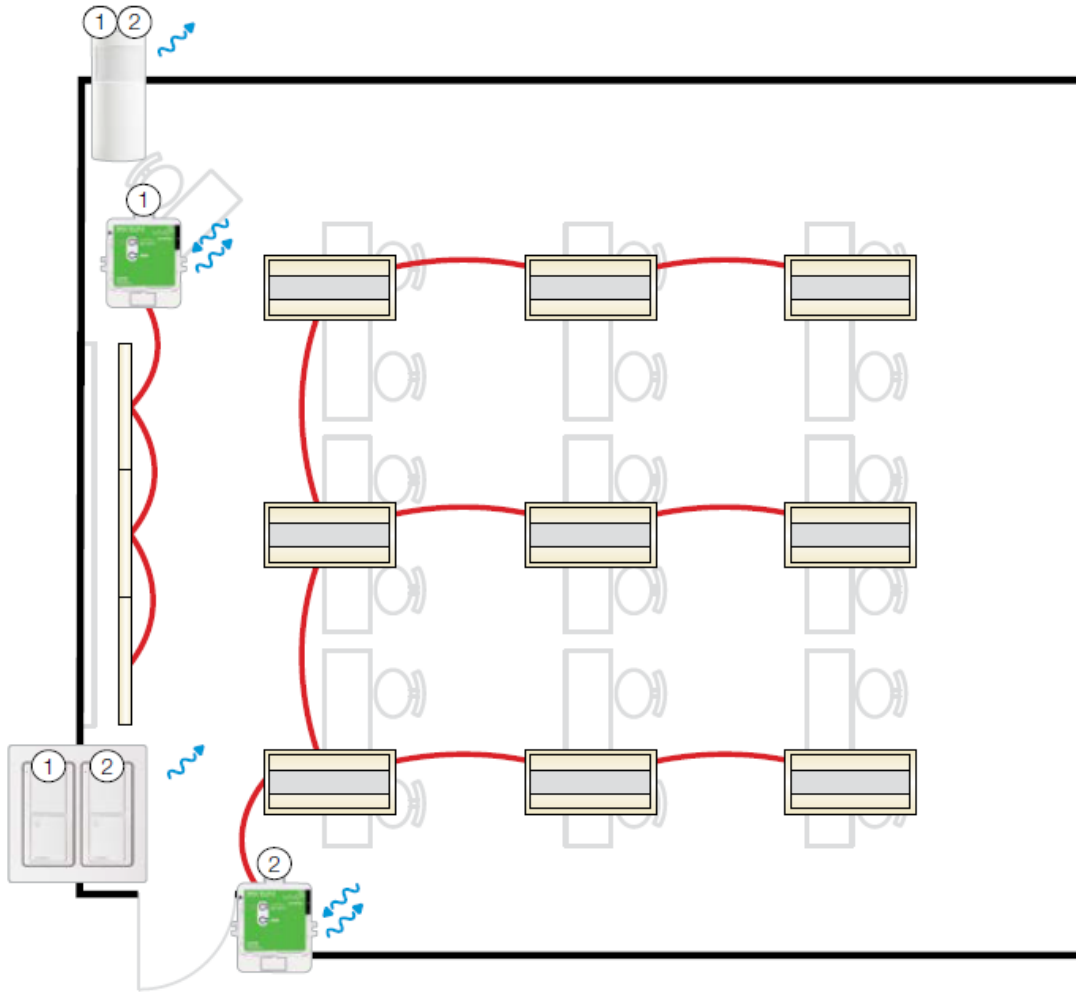





Preset Scenes Control To Create Multipurpose Spaces



Preset Lighting Scenes

Standalone Installation



Symbol	Model Number	Description	Qty
	RMJS-5R-DV-B	PowPak 5A Relay Module	2
	LRF7-OKLB-P-WH	Radio Powr Savr Wireless Corner Occupancy Sensor	1
	PQ2-2B-TAW-L01	Pico Wireless Control 2 Button On/Off	2
	LPFP-S2-TAW	Pico Wireless Faceplate (Dual)	1

Visible System Components

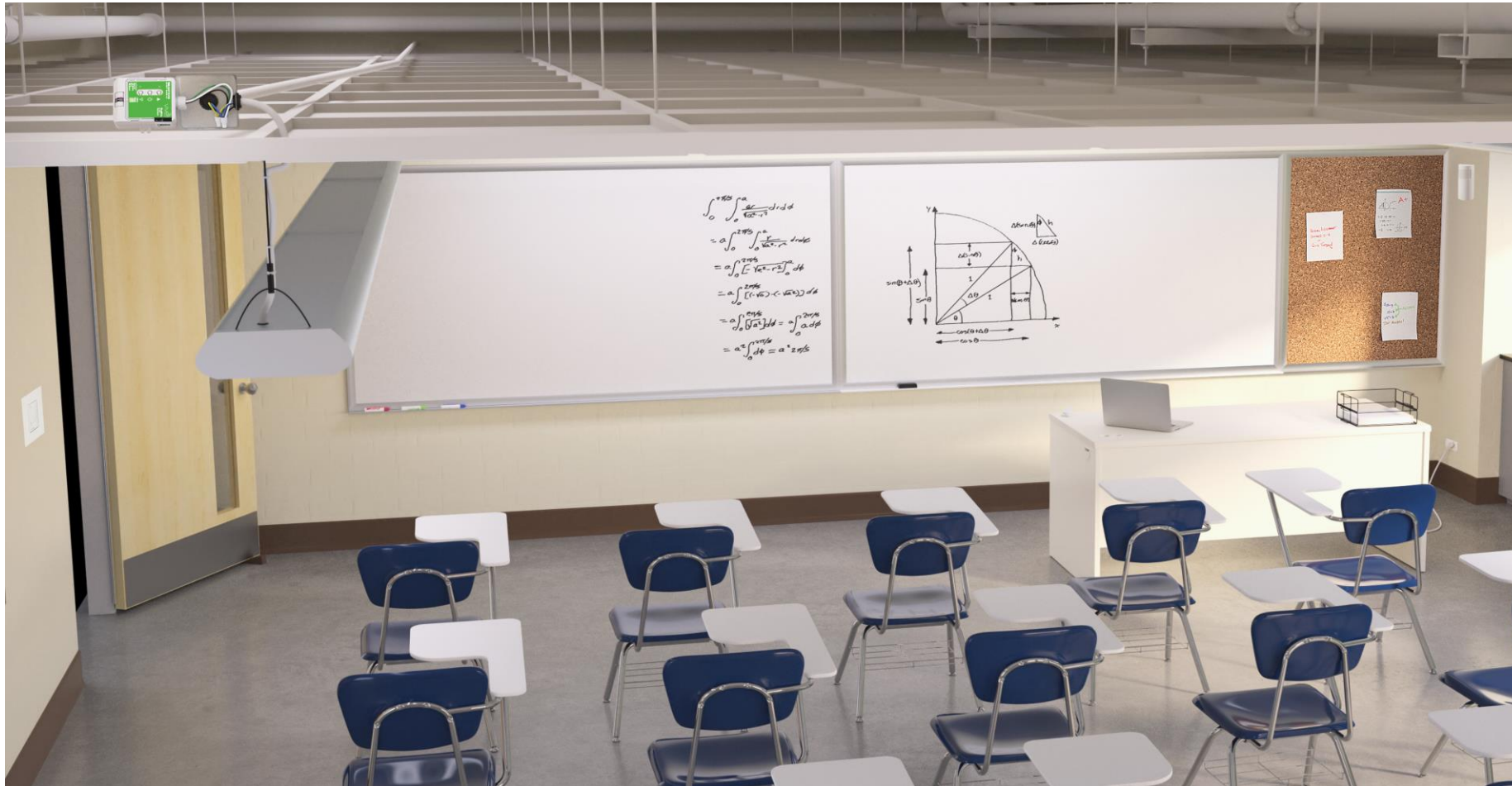


Pico wireless control



Radio Powr Savr
wireless corner-mount
vacancy sensor

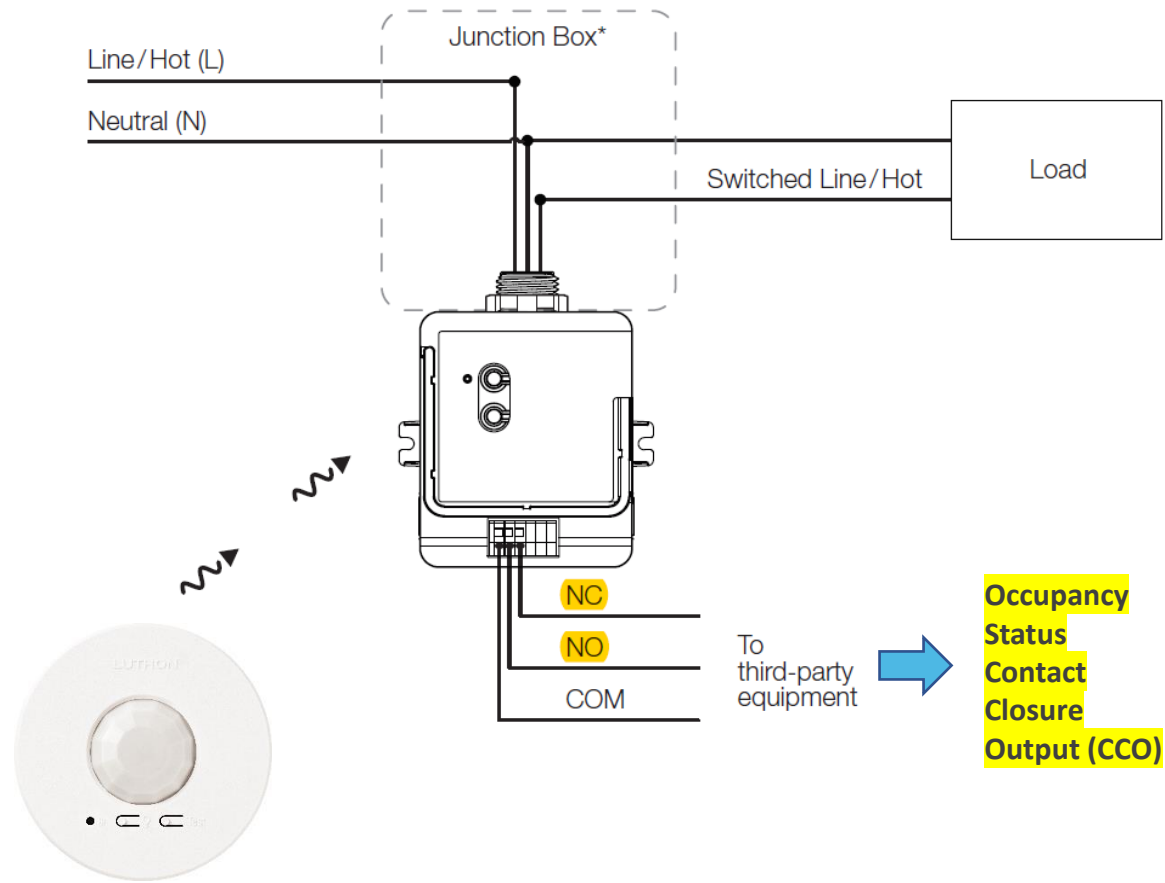
Standalone Installation



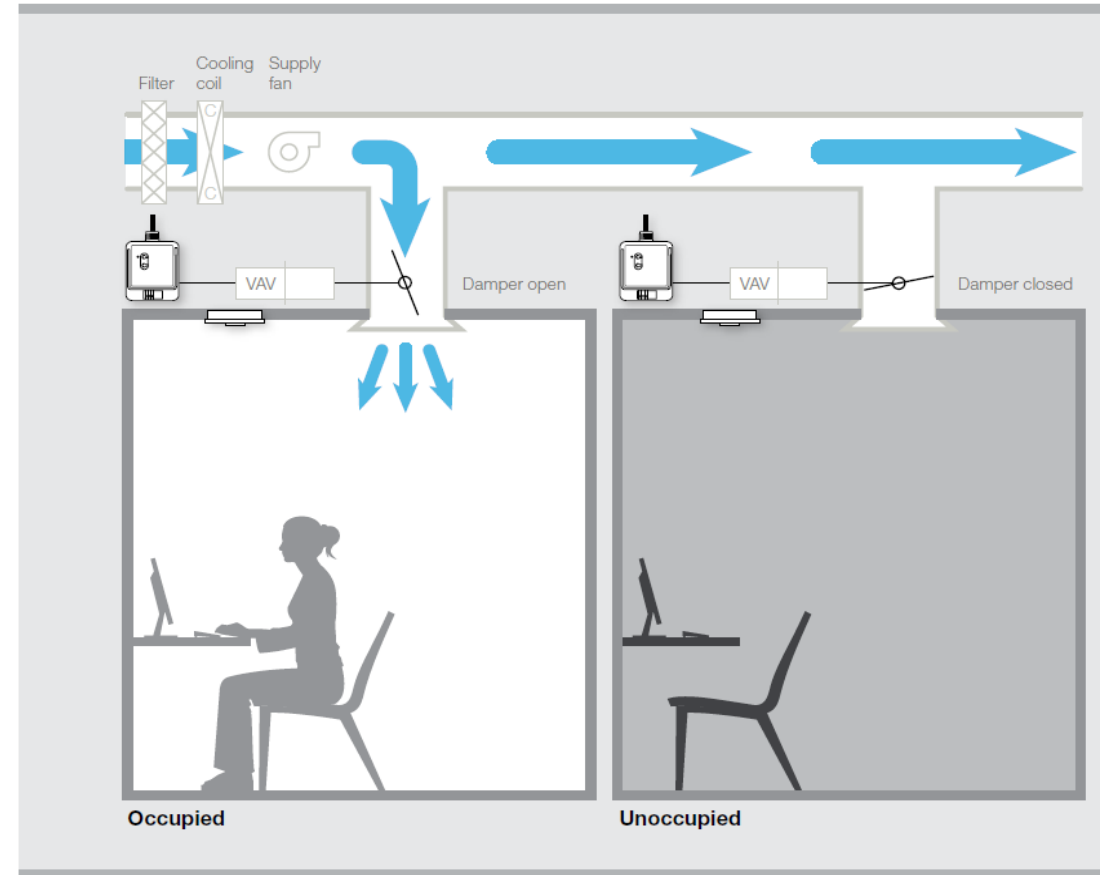
Standalone Installation



Low-level HVAC Integration (dry-contact output)



Wireless Occ. Sensor



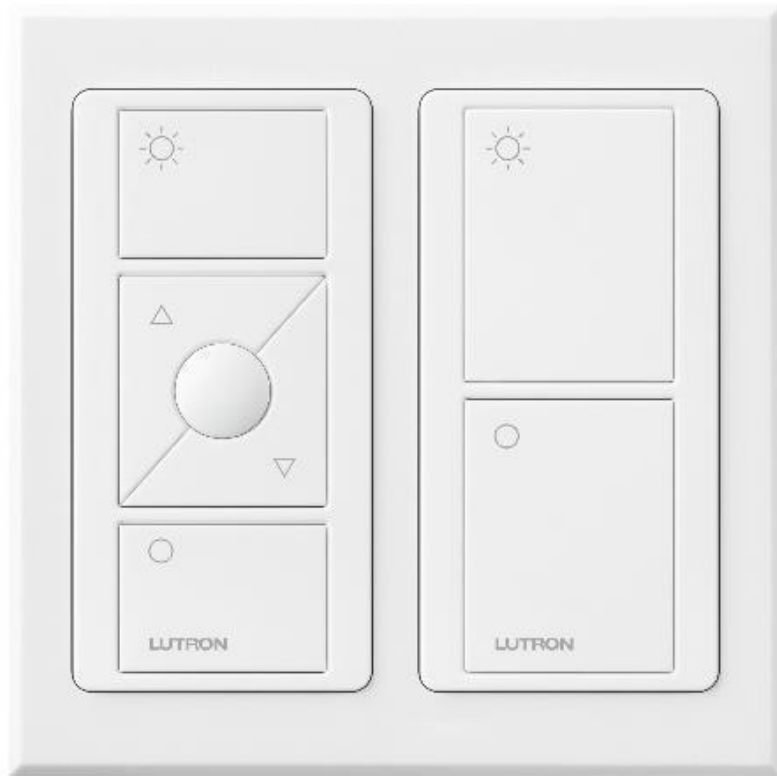
Radio Powr Savr
occupancy/vacancy
sensor (ceiling mount)



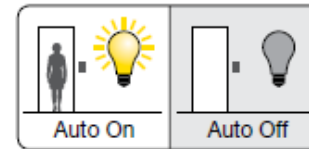
PowPak contact closure
output module

Complete Wireless Control

Wireless Dimmer / Switch



Wireless Occ. Sensor



Wireless Daylight Sensor



Advantages



- **Significant savings on installation costs** because ALL control devices require no conduit or cable

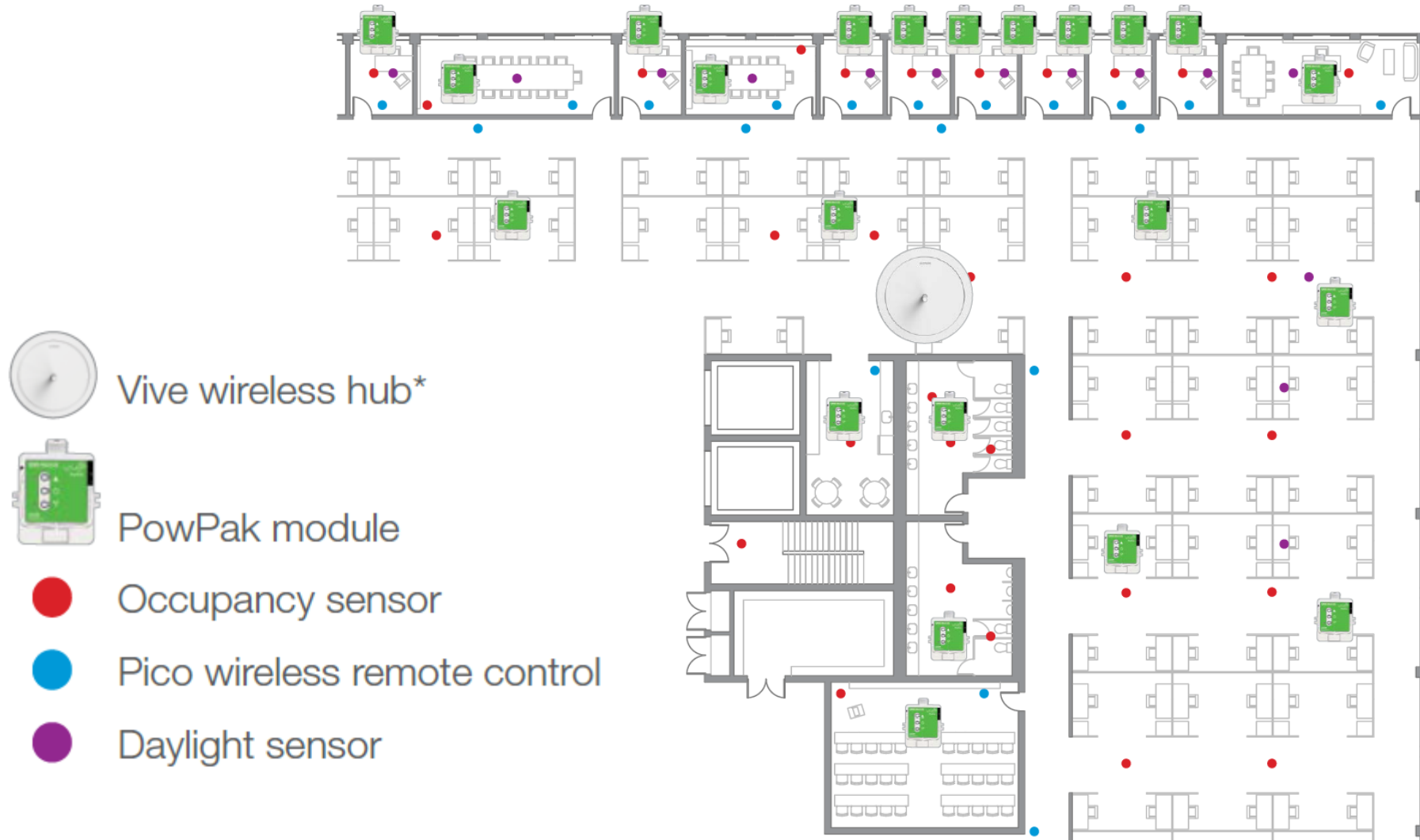


- **Reduction of construction materials** = environmental protection
- **Sustainable design** because clients can easily relocate, add or reduce control devices with maximum flexibility



- **Simple & quick installation** for both retrofit & new-built projects, with minimum disturbance to existing occupants

Installation with Hub



RF (434MHz) Coverage of Hub

Range Diagrams

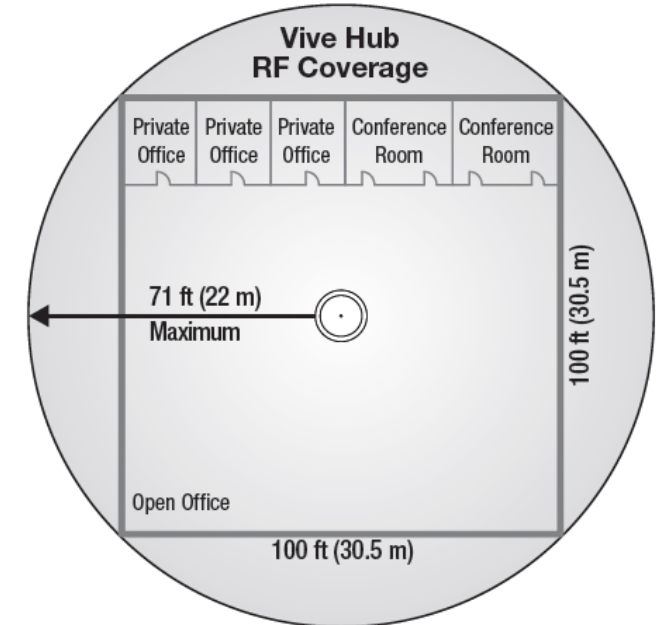
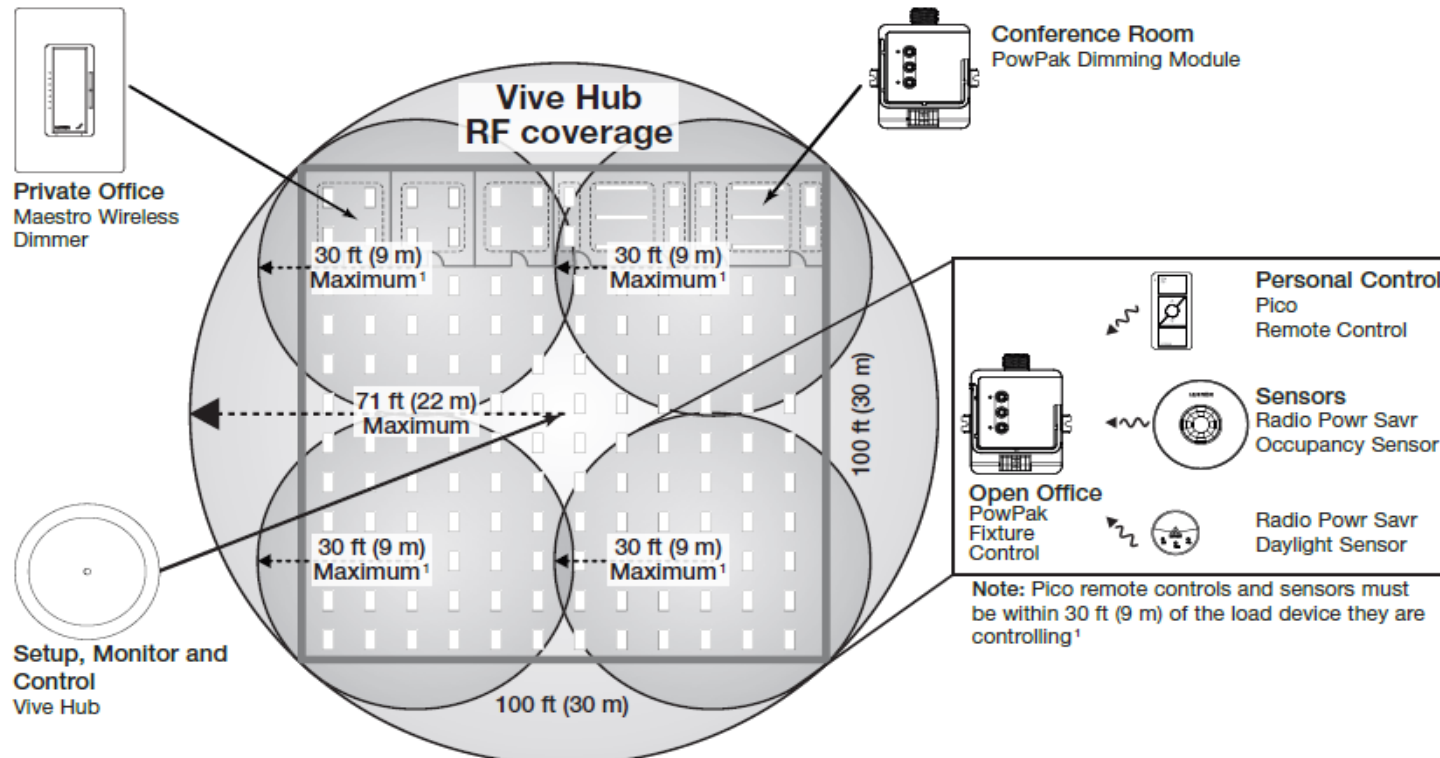
All wireless devices to be associated to the Vive hub must be within 71 ft (22 m) of the Vive hub and must be on the same floor as the Vive hub.

Note: Vive hubs should be mounted greater than 10 ft (3 m) apart on the same floor.

Note: A corporate Wi-Fi network can interfere with the Wi-Fi on the Vive hub. Where a corporate Wi-Fi network exists, it is recommended to do the following:

- Connect the Vive hub to the corporate network using the Ethernet connection on the hub and disable Wi-Fi on the hub.

Note: Vive hubs should be mounted greater than 10 ft (3 m) from a Wi-Fi router or access point.



¹ Wireless sensors and controls must be located within 60 ft (18 m) line of sight, or 30 ft (9 m), through walls, of the associated device.

Schematic of System with Hub

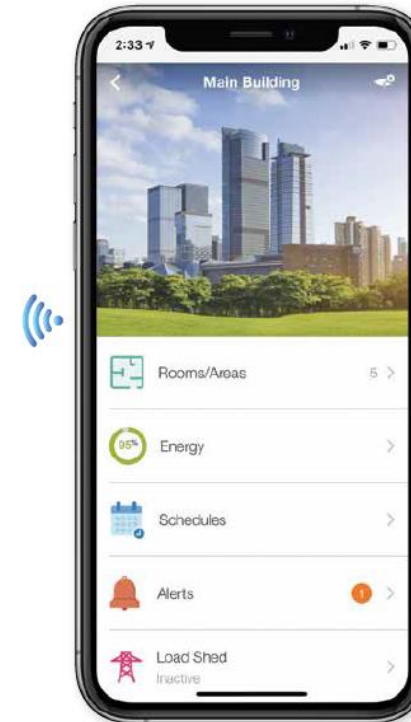
Wireless controls and sensors



Add wireless hubs for centralized control and integration (optional)



Simple-to-use software



Vive software

Built-in Wi-Fi



Mobile APP for FM



Energy Reporting

Quickly view and display energy-usage information to drive decision making and demonstrate savings.



Load shed Open ADR Compatible

Easily set lighting reduction levels that automatically respond during peak electricity usage times.



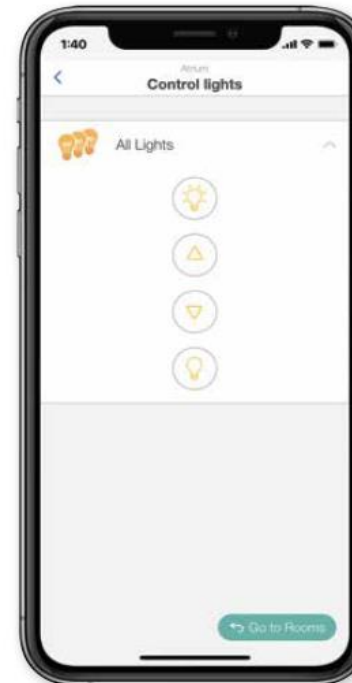
Schedules

Use a 365-day calendar to automatically adjust lights based on time of day, including single day and holiday events.



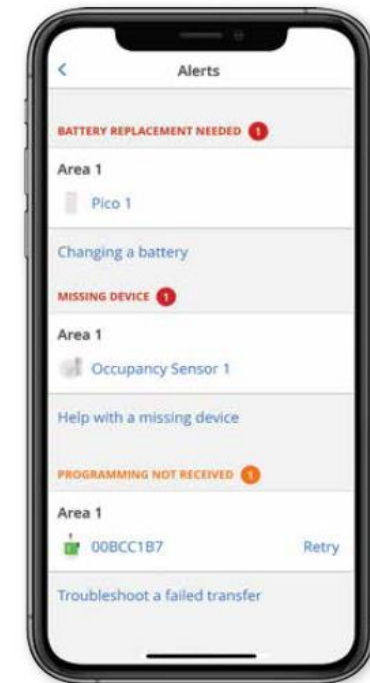
Light Control

Directly adjust the light levels.



Alerts

View proactive alerts that show issues such as low batteries or inactive devices to help improve building maintenance efficiency.



AV Integration



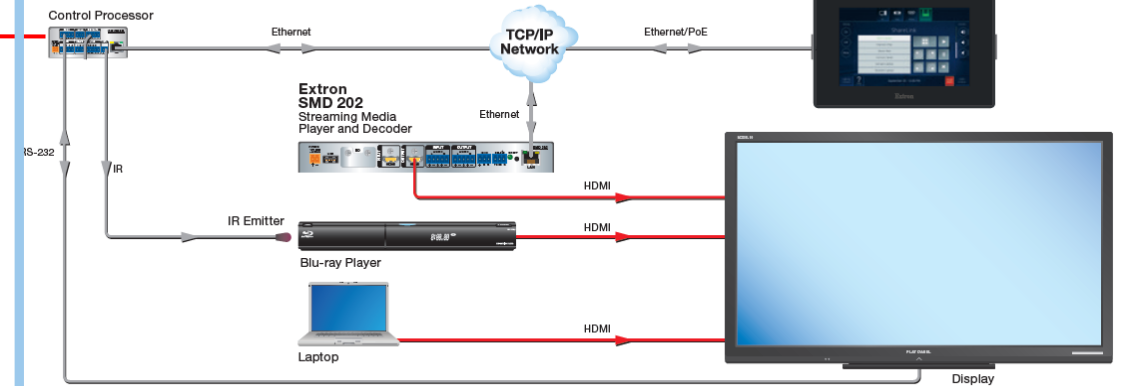
Wireless Keypad



Processor



LUTRON's Lighting Control System



AV Control System

BMS / CCMS Integration



Building/energy management systems (BMS/EMS)



Energy dashboards & analytics packages



Maintenance & work order management systems



HVAC



Fire & safety



Access & security



Audio & video

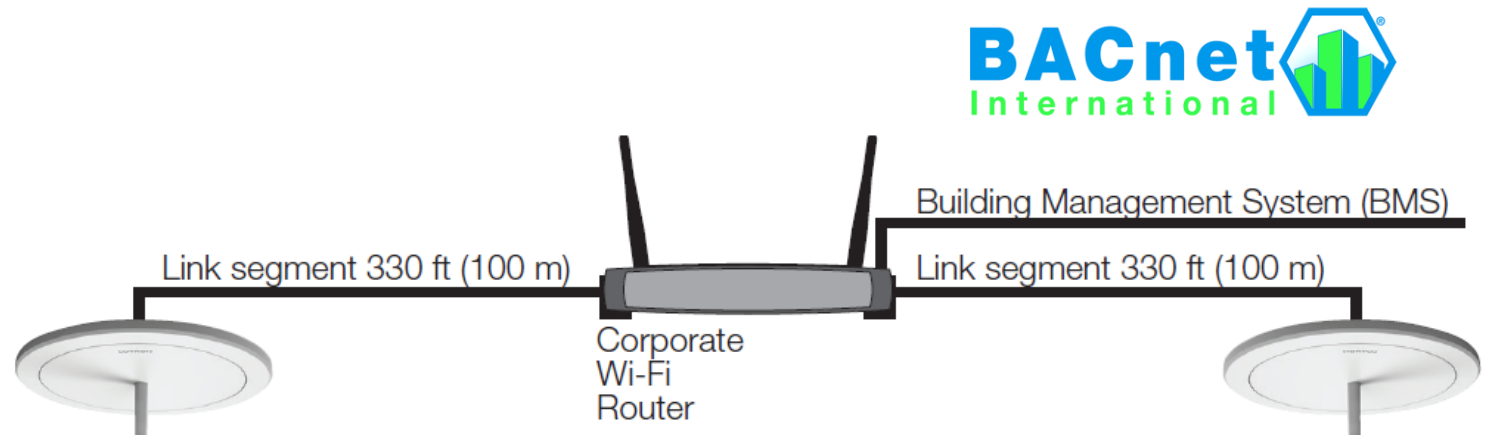


Metering



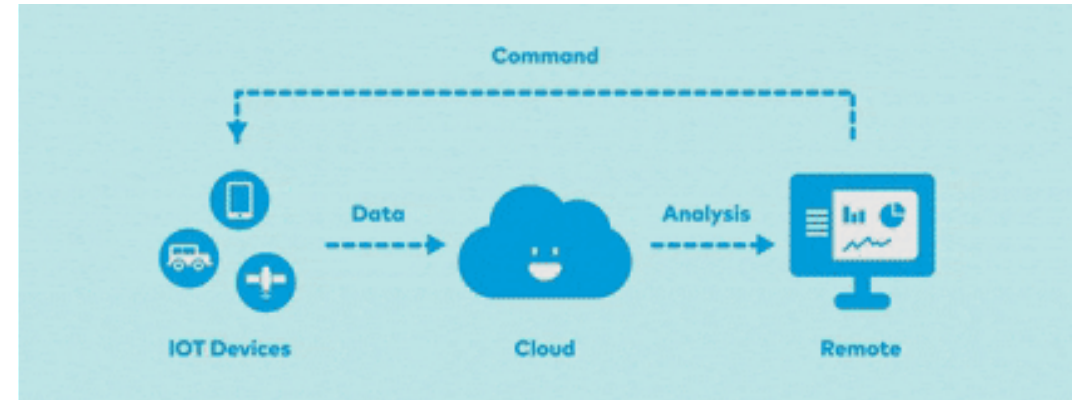
IT

- Integration with BMS via BACnet IP
- Allows BMS to **monitor** lighting & occupancy status by area
- Also allows BMS to **control** (switching or dimming) lights by area



Energy Mgt. & Other Features by BMS / IoT Platform

- Monitoring of occupancy status
- Monitoring of lighting status
- Analysis of space utilization
- Energy management
- Mobile APP control.....etc.



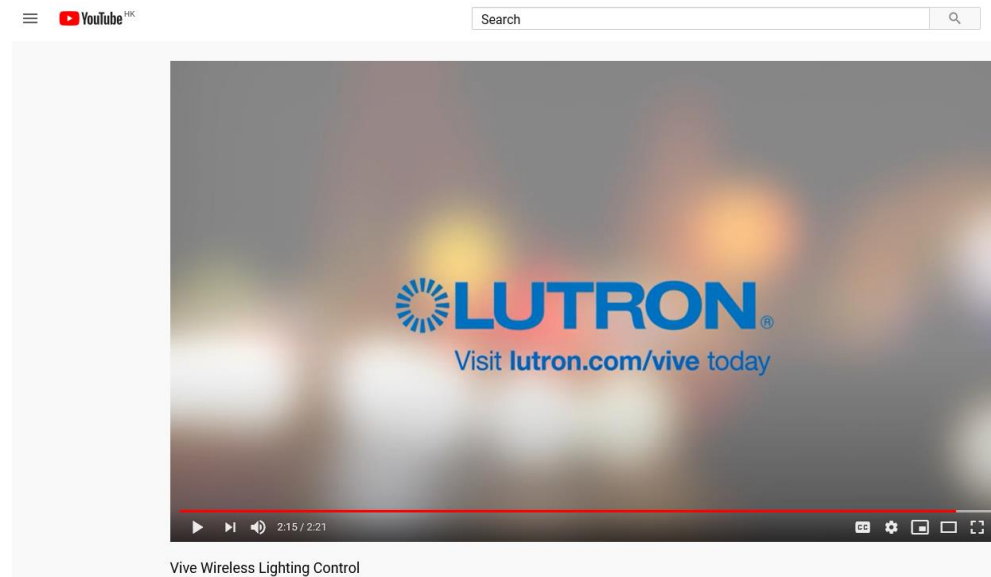
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<https://www.youtube.com/watch?v=NhGQ3ZvU8c4>