

# EMPYREAN LIGHTING<sup>™</sup>

## WIRELESS CONTROL SOLUTION



User Overview - V01

25th August 2015

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# WIRELESS CONTROL SOLUTION

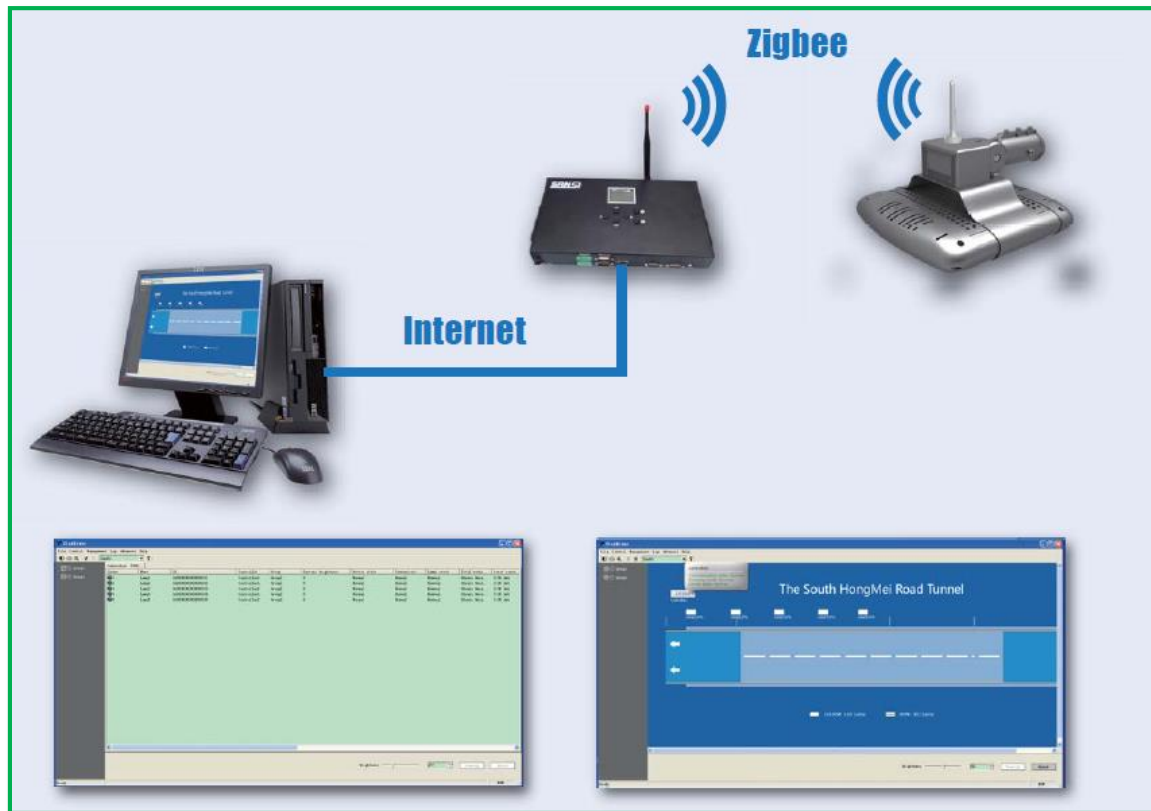


Empyrean Lighting™ have proudly developed a unique wireless control solution for use with Andromeda LED luminaires. The wireless control solution can be adapted for use on multiple application sites from mines and warehouses to stadiums, carparks and streets. The integrated wireless technology uses ZigBee protocol which provides lightning fast communication between the lights and the operating software.

Empyrean's operating software is available for use on various devices (including computers, tablets and smartphones) and can control the luminaire power, dimming capability and timing schedule. Further to this the software records light use and can generate usage reports.

The wireless control solution enables the user to operate the luminaires on site and externally, adding greater savings beyond the savings already achieved with the LED solution. In addition, the solution provides clients with added security measures and the ability to monitor lighting activity.

Wireless control solutions are just the beginning for providing ultimate luminaire control. Future developments with this solution will include photo (daylight) sensors, motion sensors and the capability to cover the entire Empyrean Lighting™ range of lamps and luminaires.



# WIRELESS CONTROL SOLUTION



## PLANNING

Empyrean's wireless control solution can be modified to work in any application that fits the required criteria:

- Requires a lighting solution to be provided from the Andromeda™ range.
- Has an onsite computer or ability to house an onsite computer
- Is connected to a network or can be set up to run internet through a network system

Prior to choosing the wireless control solution, Empyrean can provide lighting designs (if required) to ensure target lux levels and Australia/NZ standards are met with the appropriate Andromeda™ luminaire. Further to this, Empyrean will conduct a comprehensive site visit to ensure criteria are met and can be achieved.

## IMPLEMENTATION

The implementation of the wireless control solution is done in two parts.

1. Lights are installed on site and set to the client's requirements. Details from the lights are recorded which are later programmed into the software.
2. Wireless control software is loaded on the site computer and set up to work with the installed lights.

Empyrean Lighting is responsible for installing the wireless control software, connecting the software to the lights and ensuring the lights can be controlled. Generally this takes on average 1-2 days (per 50 lights) depending on site size and any additional client requirements (e.g. setting up scenes).

## TRAINING

After the wireless control software is set up and running smoothly, Empyrean will train all nominated parties in how to operate the software. This will be done both theoretically and practically and assisted with a software user guide. The training is at set maintenance/review dates during the lifespan of the LED luminaires.

## MAINTENANCE

Any issues experienced by the client should be reported to Empyrean who will promptly assist. Over time, software updates will become available for the computer programs and, when required, will be updated or instructed to be updated by Empyrean.

## Device for Operation Software

Empyrean's wireless control solution is operated by control software which can be accessed on any wireless capable device. Wireless capable devices can include a PC, tablet or smartphone. Once the user has acquired and set up a wireless capable device, Empyrean will provide and install the control software.

The control software will mirror the wireless control solution set up on the site and allow the user to modify and change the light settings as required. As long as the wireless capable device is connected to a secure internet connection, the control software can be used.

## Internet Connection

In order to use the control software, there must be a compatible internet connection on site. If there is not a compatible existing internet connection available on site, a modem or equivalent will be required to establish a connection.

## Wireless Controller

A wireless controller is required to transmit instructions made by the control software to the lights. When the LC300 controller receives a command from the control software, it transmits a wireless signal to control the LED lamps. The LC300 controller is compact, has excellent anti-interference capability and can operate in high temperatures.

Each controller must have access to the internet. This can be achieved via an Ethernet cable (RJ45) or an RS232 connection. The controller uses the internet connection to transmit data back to the software. A controller can typically communicate with and operate lights within a 2km radius.

Each LC300 controller features:

- Integrated real-time clock which can provide accurate timing for the lamps supporting the time control
- Integrated flash memory to record data and log files and also provides power failure protection
- Has the ability to control data (on a real-time basis) and store information (status info) for multiple lights.
- An adjustable antenna which can be extended with a feeder cable.





## ZigBee Protocol

ZigBee protocol is installed in the controller and is based on IEEE 802.15.4 which allows the controller to communicate with and modify the light operation (or output).

ZigBee control features include:

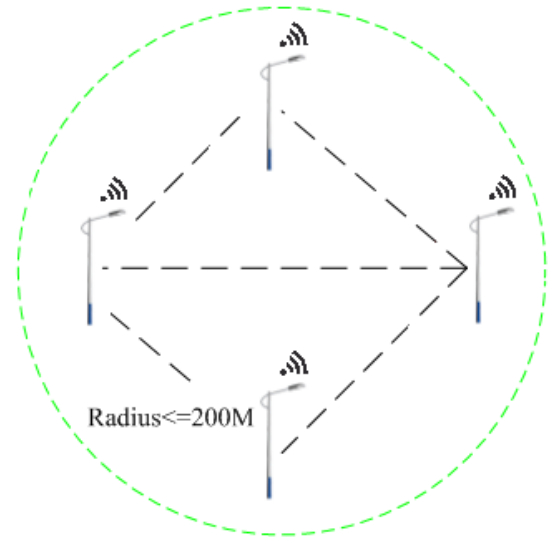
- **Transmission distance** is approximately 200m which may be increased up to 3km (with an increase in power). The transmission distance can be extended using neighboring nodes when node to node communication is adopted.
- **Data transfer rates** for the ZigBee control ranges between 250kps (2.4GHz), 40Kps (915MHz) and 20Kbps (868MHz) to work in conjunction with low-speed data transmission applications.
- **Response times** for ZigBee control is generally 15mili seconds (from sleeping status to resume operating mode). The node to node connections take 30mili seconds which helps to save further energy (WIFI connections take 3 seconds and Bluetooth connections take 3 to 10 seconds)
- **Supported network structures** include star and tile formats. A primary node can manage several sub-nodes up to 254. A primary node can also accept management from a higher level node. A maximum of 65,000 nodes can be supported in a single network.
- **High security.** ZigBee uses 3 levels of security as well as separate wireless security sections. Access Control Lists (ACL) are used to prevent illegal access to the data and Advanced Encryption Standard (AES 128) symmetric ciphers are used to ensure flexibility and security.
- **License-excepted frequency bands.** ZigBee uses three bands that have different physical layers and channel bandwidths. Within the Industrial Scientific Medical (ISM) band, ZigBee uses:
  - Global (2.4GHz)– 5Mhz physical layer with 16 channel bandwidths
  - United States (916MHz) – 2MHz physical layer with 1 channel bandwidth
  - Europe (868MHz) – 5MHz physical layer with 10 channel bandwidths

*Note: ZigBee wireless communication may be affected by structures, poor weather and power quality.*

## Wireless Control

Each light will contain a wireless communication module (LED driver) and an antenna. A wireless communication module (LED driver) supports a communication radius of 200m.

The controller and the lights use two-way communication while the control centre shows the real-time operation status of all lights.



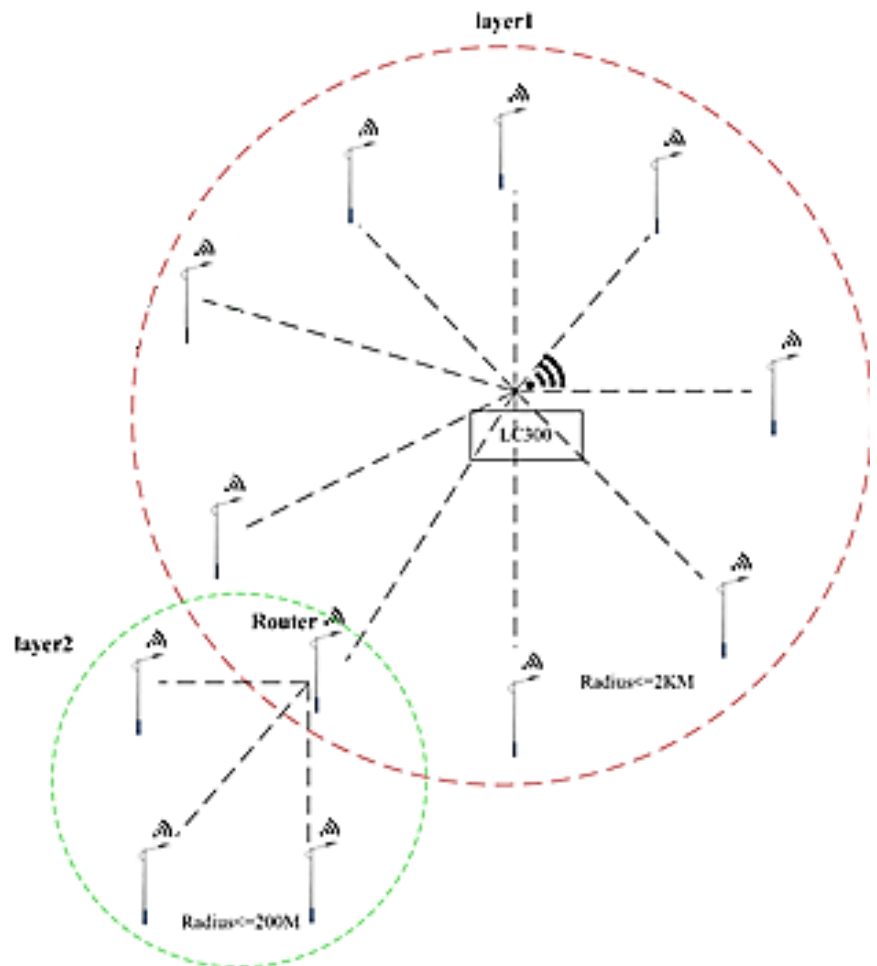
## Expanding the Controller Reach

Lights can act as “routers” to expand the reach of the controller. A light will be selected to act as a “router” when the controller cannot communicate with a light. When communication fails, the controller automatically selects a light to act as a “router”.

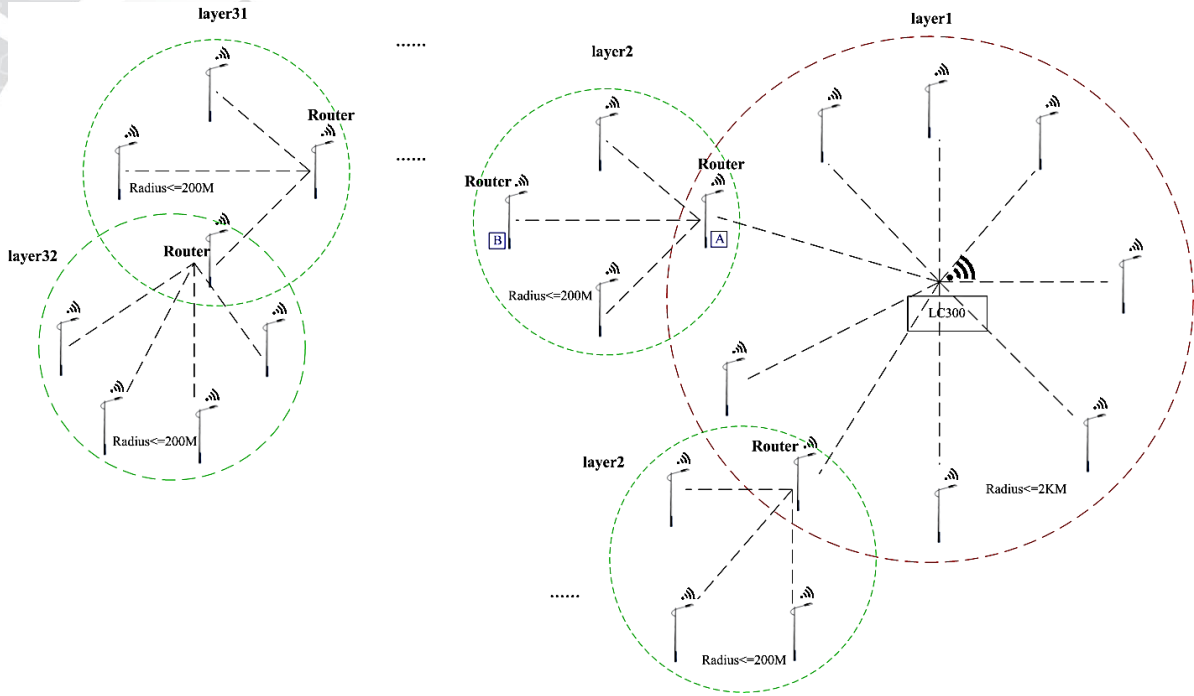
The light acting as a “router” expands the controller’s communication reach by an additional 200m.

Each router selected by the controller creates a new “Layer”. Layer 1 is the 2km radius established by the controller. The image on the right shows the router selected by the controller which creates “layer 2”.

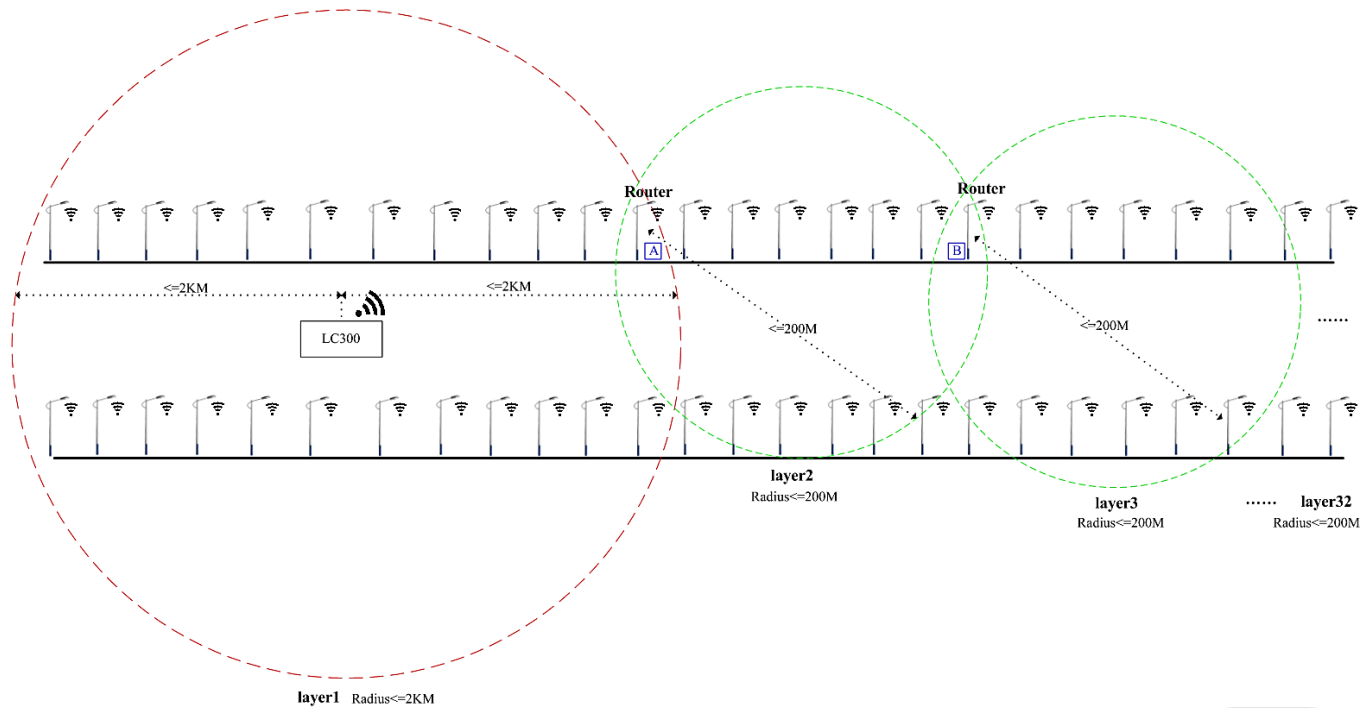
ZigBee network can support up to 32 layers.



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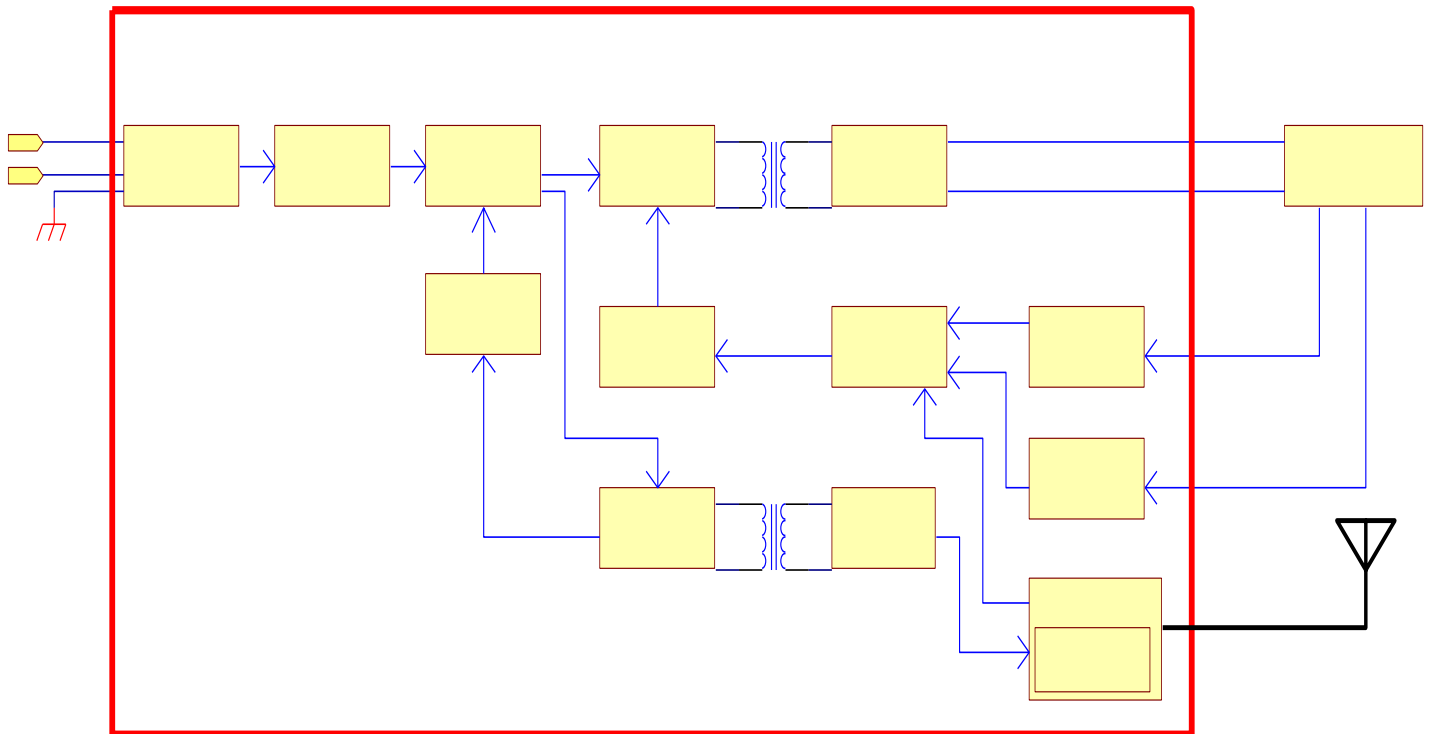
If the lights are positioned in a straight line, the “router” system would work in exactly the same way, see below image.





## LED DRIVER

The LED driver contains the wireless communication module which allows the controller to modify the light settings. The below image shows where the dimming circuit is located in each driver. ZigBee communications modules (based on IEEE802.15.4) are located in each optical circuit.



# WIRELESS CONTROL SOLUTION



## Outdoor Wireless Control Solution Example



## Indoor Wireless Control Solution

