SMART CITY

Smart Lighting System & Beyond

iNET™

IoT INTELLIGENT LIGHTING CONTROL SYSTEM

iNET™ IoT Intelligent Lighting Control System

INTRODUCTION

Background

Lighting is an essential element of modern society, influencing people's mood and sense of security. However, it is also a significant energy consumer, contributing to a substantial carbon footprint. In response to this challenge, the adoption of LED lighting technology has gained widespread acceptance, effectively upgrading outdated lighting systems and reducing electricity demand. This global transition not only presents an opportunity for energy-saving initiatives but also serves as a viable gateway for implementing an intelligent IoT platform, which is crucial for smart-city solutions.

In certain locations where connecting hardwire infrastructures is challenging, such as remote areas or areas with limited accessibility, the integration of solar panels becomes pivotal in LED light installations. By incorporating solar panels into streetlights, these installations can operate autonomously, harnessing renewable energy from the sun and eliminating the need for a traditional power source. This makes them an ideal solution for areas where establishing hardwire connections is impractical or costly.

By leveraging the existing LED lighting infrastructure and integrating solar panels into streetlights, a robust light sensory network can be established. With the addition of embedded sensor+control nodes, these solar-powered LED lights can collect and transmit a wide variety of data, ranging from environmental factors like humidity and PM2.5 levels to monitoring traffic patterns and detecting seismic activity. They can even capture audio and video, facilitating numerous city services and initiatives through a unified and efficient common platform, all while minimizing the need for additional physical infrastructure.

This integration of solar panels into streetlights not only contributes to the reduction of electricity demand and carbon footprint but also exemplifies a sustainable and environmentally friendly approach towards intelligent lighting control systems in the era of IoT. Moreover, it addresses the unique challenges faced in areas where establishing hardwire connections is not feasible, allowing for effective lighting solutions in even the most remote or inaccessible locations.

iNET™ IoT Intelligent Lighting Control System

SOLUTION OVERVIEW
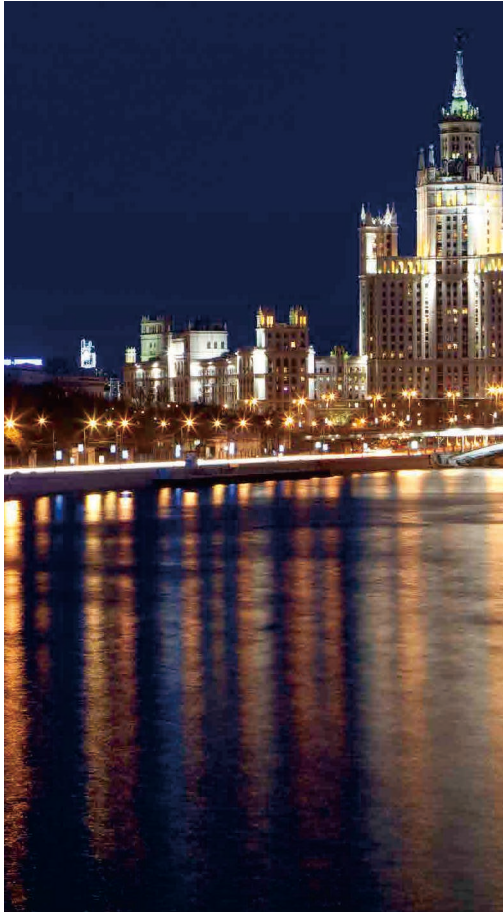
Solution Overview

E-LITE iNET IoT solution is a wireless based public communication and intelligent control system featured with mesh networking technology.

• Central Control & Management

iNET Cloud provides a cloud-based central management system(CMS) for provisioning, monitoring, controlling and analyzing lighting systems. This secure platform helps cities, utilities and operators reduce energy usage and maintenance costs, while also increasing safety. iNET Cloud integrates automated asset monitoring of controlled lighting with real-time data capture, providing access to critical system data such as power consumption and fixture failure. The result is improved maintenance and operational savings. iNET also facilitates development of other IoT applications.

• Gateway & Controller Node

The gateway communicates with server via cellular or ethernet wiring if available, and communicates with controller nodes using SUB-1GHz radio frequency (ISM 433/868/915MHz). The controller node

features mesh networking, which ensures each and every instruction from server could be received and performed via the gateway. All terminal performance could be monitored from mobile devices. Proven stable communication

distance from the gateway to the node is 1000m, each gateway may cover up to 300 nodes.

Applications

- Street light control system.
- Solar street light control system.
- Sports complex lighting control system.
- Industrial facility lighting control system.
- Agricultural facility light control system.

iNET™ IoT Intelligent Lighting Control System

SYSTEM FEATURES & SYSTEM TOPOLOGY

iNET™ IoT System
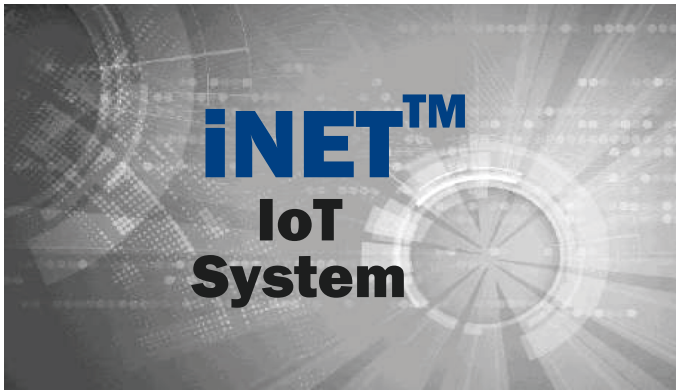
System Features

Automatic Light On/Off & Dimming Control
· By time setting
· On/off or dimming with motion sensor detection
· On/off or dimming with photocell detection

Accurate Operation & Fault Monitor
· Real-time monitor on each light working status
· Accurate report on fault dectected
· Provide location of fault, no patrol required
· Collect each light operation data, such as voltage, current, power consumption

Extra I/O Ports for Sensor Expandability
· Environment Monitor
· Traffic Monitor
· Security Surveillance
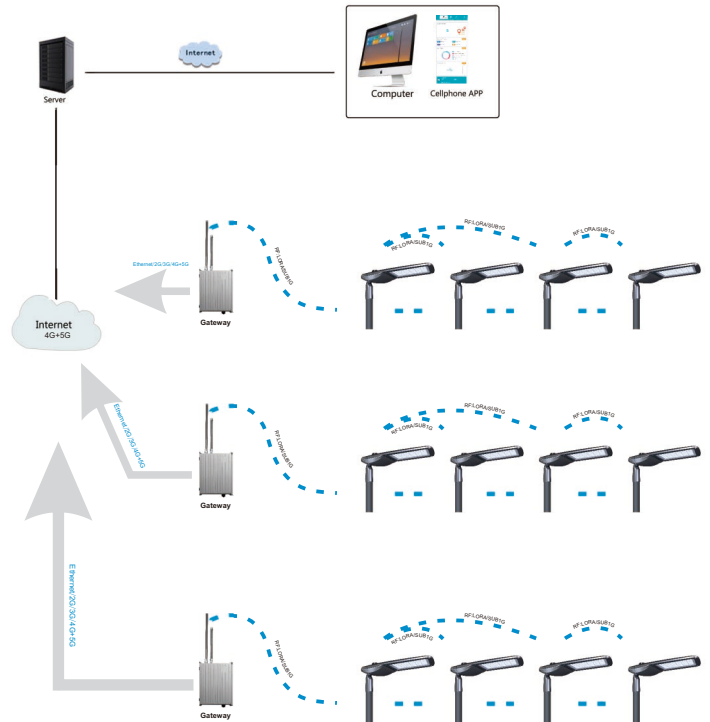· Seismic Activities Monitor
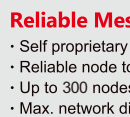
Reliable Mesh Network
· Self proprietary wireless control node
· Reliable node to node, gateway to node communication
· Up to 300 nodes per network
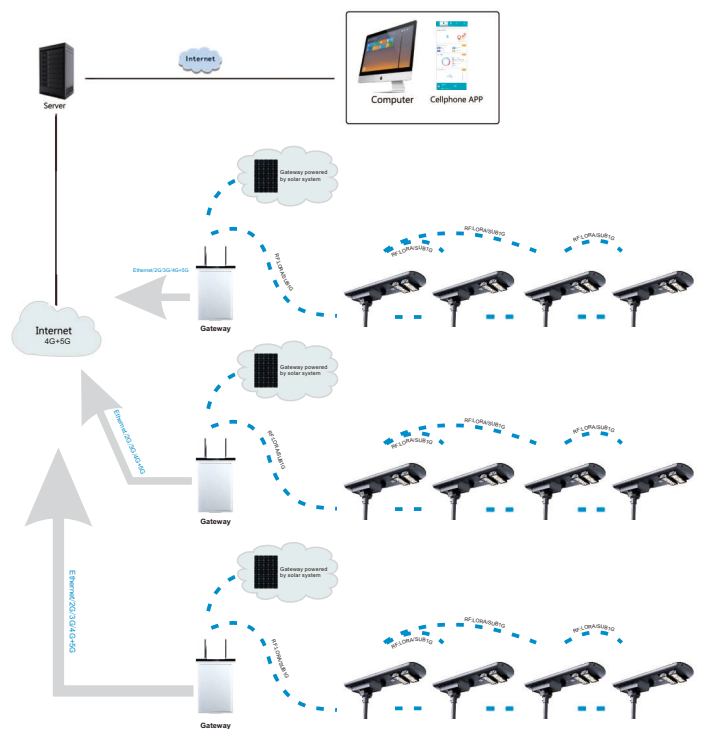· Max. network diameter 1000m

Easy-to-use Platform
· Easy monitor on each and all lights status
· Support lighting policy remote set-up
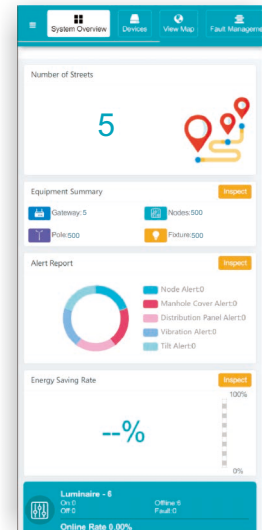· Cloud server accessible from computer or hand held device

Solar DC Application

iNET™ IoT Intelligent Lighting Control System

iNET CLOUD

Product Description

iNET Cloud provides a cloud-based central management system(CMS) for provisioning, monitoring, controlling and analyzing lighting systems. This secure platform helps cities, utilities and operators reduce energy usage and maintenance costs, while also increasing safety. iNET Cloud integrates automated asset monitoring of controlled lighting with real-time data capture, providing access to critical system data such as power consumption and fixture failure. The result is improved maintenance and operational savings. iNET also facilitates development of other IoT applications.

Operation

Users access iNET Cloud securely over the Internet via a web browser on a computer or mobile device to manage, monitor, and control lighting networks. iNET Cloud includes a modern and intuitive graphical map with representative illustrations of individual control devices. For indoor applications, a floor plan is integrated with the map application for seamless control. Managers can set up notifications for critical alerts to update maintenance staff about faults in real time.

Features and Benefits

· Scales to thousands of locations with a unified single user interface for all.
· Accessible via browser on laptop, tablet or smartphone using highly secure encrypted communication.
· Enables monitoring assets in real time, validating and auditing energy code compliance, and identifying performance changes over time.
· E-mails and SMS notifications for fixture failures and other critical faults to improve lighting system up-time.
· Simplifies real-time schedule overrides using graphical map and floor plan views.
· Works with motion and photocell sensors to reduce energy use and extend lamp life.

# iNET™ IoT Intelligent Lighting Control System

iNET CLOUD

Platform

• iNET Cloud is a multi-tenant solution, developed using upto-date web technologies, which is portable across various platforms and web interfaces. The user interface is supported on modern browsers including Chrome, Firefox and Edge.

Security

• iNET Cloud is built on a highly secured platform. The security measures are applied at various levels through the system. All the communication interfaces with iNET use SSL encryption with AES security. It also provides rolebased user access which can be restricted at different levels of a geozone hierarchy. The iNET Cloud password policy requires users to create strong passwords based on industrial standards. The timeout mechanism after multiple failed login attempts also prevents attacks.
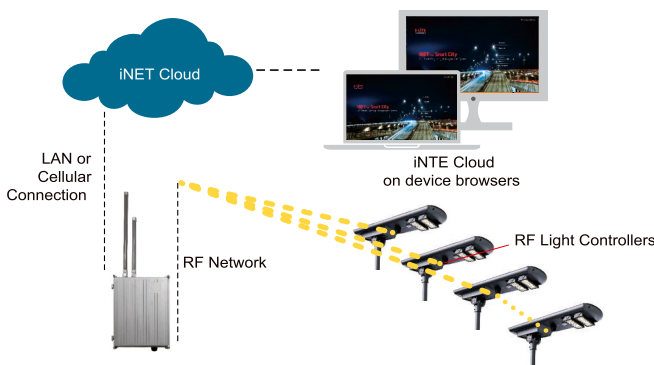
Typical smart city or campus RF communication network.
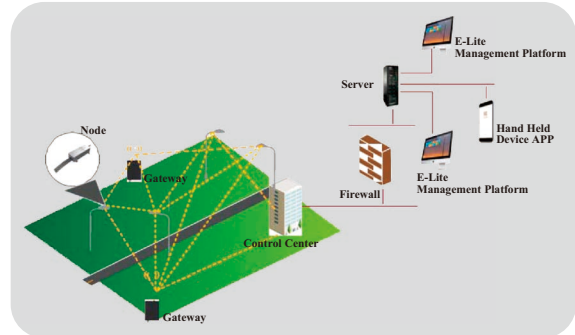
E-Lite Street Lighting & Control Network
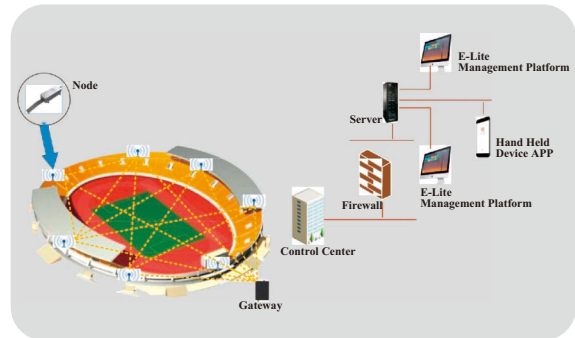
Sports Complex Lighting & Control Network

Industrial Complex Lighting & Control Network

Agricultural Lighting & Control Network

System Description

- **Asset Management**: Users can create, import, export and modify any device attribute, such as pole information (coordinates, pole type, etc.) and fixture information (pre/post installation wattage, lamp type, etc.). Users can search assets by name, unique ID numbers, model numbers, etc., to locate the 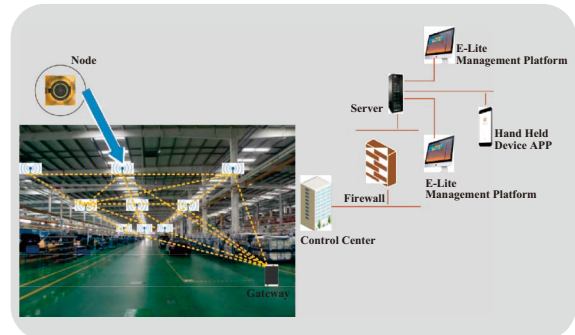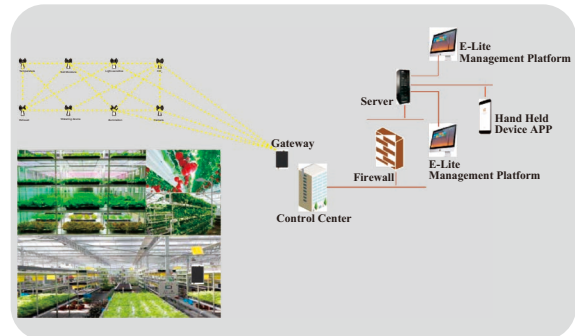correct asset for updating or editing. iNET also performs GIS to GPS matching on devices to correlate the pole Ids with according devices, eliminating the need to record the individual device IDs during installation.

- **Monitoring and Control**: iNET Cloud provides a map-based interface to monitor and control all the lighting assets. The mapping function is also extended to floor plans for internal structures such as parking garages. Users can view the fixture status（on，off，dim），device health，etc.，and perform overrides from the map/floor plans. When viewing alarms on the map, users can easily locate and troubleshoot faulty devices and configure replacement devices. User can also request collected data including wattage, current, etc. for specific assets or all data point.

- **Grouping and Scheduling**: iNET Cloud allows logical grouping of assets for event scheduling. The scheduling engine provides the flexibility to assign multiple schedules to a group, thereby keeping the regular and special events on separate schedules and avoiding user setup errors. The scheduling engine determines the daily schedule based on the event priority and sends appropriate information to various groups.

- **Data Collection**: iNET Cloud automatically collects granular data several times a day on various data points including light level, energy use, faults, etc. It enables users to establish different monitoring levels for selected data points such as voltage, current, power factor, etc. for analysis and trouble shooting.

- **Alarming and Logging**: iNET Cloud provides built-in alarms for different asset classes including lights, gateways，etc.，which can be configured to send email notifications. The system constantly monitors lighting controllers for failure conditions such as lamp failure, night outages, day burners,etc., and report status several times each day to expedite failure notifications. The map/floor plan view highlights assets with alarms enabling users to quickly and easily locate and troubleshoot problems. The alarm logs maintain a record of the all reported failures by asset, providing a way to search and filter for specific issues. The alarms logs can also be exported as a CSV data file for additional processing.

- **Reporting**: The reporting engine provides several built-in reports that can be run on an individual asset, selected assets, or an entire city. Energy reports provide an easy way to track energy use and compare performance across different lighting assets. Data log reports enable trending selected points (e.g. light level, wattage, schedules, etc.) for a defined period of time to help analyze behavior and track any anomalies. All reports can be exported to CSV or PDF formats.

iNET™ IoT Intelligent Lighting Control System

iNET GATEWAY ~ AC Version

Product Description

The Gateway connects installed wireless luminaire controllers with the central management system through an ethernet link for LAN connections or 4G link via an integrated cellular modem. The Gateway supports up to 300 controllers up to a 1000m line of sight, ensuring secure and robust communication to your lighting network.
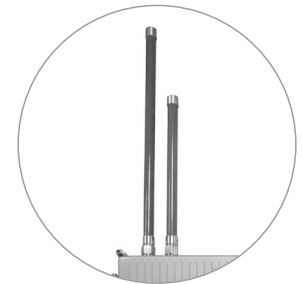
Product Specifications

Cellular and Ethernet Gateway Specifications

•Wireless parameters
--Network type: star-mesh repeater
--IEEE 802.15.4
--Operating frequency: 433/868/915 MHz
--RF power: +24 dBm
--Range: 1000m line of sight
--Number of controllers supported:300

•Connectivity
--Cellular: universal 4G carriers
--Ethernet: wired ethernet 10/100

•Mounting and interface
--Mounting: wall or pole

•Operation
--IP rating: NEMA 4x (IP66 certified)
--Temperature range: -30℃~+75℃
--Voltage: 120-277(50/60 Hz)

•5-year limited warranty

Features/Benefits

・Connects iNET controllers in the field through a secure, reliable, and scalable network to a central management system software.
• Ethernet link for LAN connection or cellular link via built-in 4G modem for compatibility with any wireless carrier service.
• Supports up to 1,000 controllers up to a 1000m line of sight.
• Secure AES 128-bit encryption for wireless data transmission.
• 110 ports for additional sensor input.
• Built-in lightning surge arrester on all antenna ports.
• Works in extended temperature range conditions without service interruptions.

Applications

• Roadway lighting
• High mast lighting
• Site and large areas
• Campuses
• Auto dealerships

Dimensions

E-LITE semicon
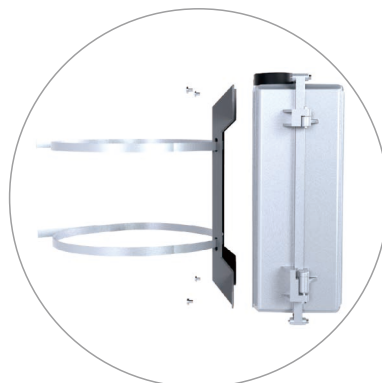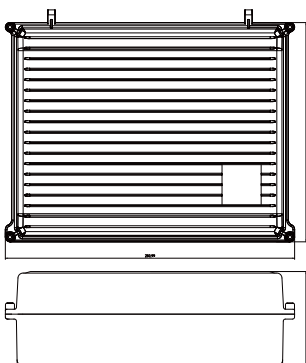
iNET™ IoT Intelligent Lighting Control System

iNET GATEWAY ~ DC Version

Product Description

The Gateway connects installed wireless luminaire controllers with the central management system through an ethernet link for LAN connections or 4G link via an integrated cellular modem. The Gateway supports up to 300 controllers up to a 1000m line of sight, ensuring secure and robust communication to your lighting network.

Cellular and Ethernet Gateway

•**Wireless parameters**
--Network type: star-mesh repeater
--IEEE 802.15.4
--Operating frequency: 433/868/915 MHz
--RF power: 20 dBm
--Range: 1000m line of sight
--Number of controllers supported:300
•**Connectivity**
--Cellular: universal 4G carriers
--Ethernet: wired ethernet 10/100
•**Mounting and interface**
--Mounting: wall or pole
•**Operation**
--Input 5-35V DC
--Power: 75W
--Weight: 3.4KG
--IP rating: NEMA 4x (IP65)
--Temperature range: -30℃~+75℃
•**5-year limited warranty**

Solar Panel

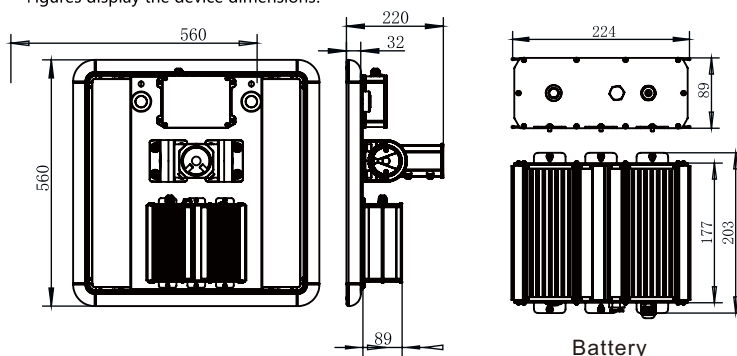High efficacy monocrystalline 20-25%
50W/18V
MPPT controlling
Size 560×560×32mm
Weight 4.5KG
Mount Tennon slip fitter Φ60mm
20 years lifespan

Battery

High efficacy LiFePo4 battery
Grade A+ cell
12.8V/24AH
Size 285×270×80mm
Weight 4KG
5 years lifespan

Dimensions

Figures display the device dimensions.

Battery

E-LITE semicon

iNET™ IoT Intelligent Lighting Control System

WIRELESS OUTDOOR LIGHTING CONTROLLER NODE

Product Description

The node is a small wireless controller that installs directly to the exterior of the lighting fixture, enabling energy metering, remote monitoring and control. The controller node gathers data regarding the operational condition of lamps, energy usage, voltage, current, power factor, and fixture location that is transmitted over the iNET control network and analyzed by the iNET central management system (CMS) software.

iNET CMS

LAN or Cellular Connection

RF Net work

RF Controllers

Wireless Gateway or Base Station
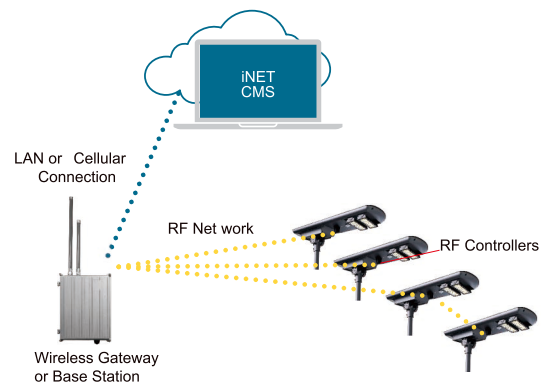
Typical smart city or campus RF communication network.

Operation

With the controller, fixtures can be addressed and grouped for unified ON/OFF, high-low stepped dimming with OFF, or 0-10 volt continuous dimming operation. A high end trim setting can enhance energy savings. The node provides adjustable photo-cell thresholds as well as time of day and astronomical clock functionality. It can operate without a network connection using its build-in intelligent control, which can store the data for up to a month.The node also supports peer to peer communications and wireless upgrades.

Features and Benefits

• Wireless communications for remote control, energy management and monitoring
• Provides auxilliary power for sensors
• Interfaces 0-10V driver
• Energy metering calibrated to 0.5% accuracy
• Built-in photocell
• Secure AES encryption
• Supports automatic repeater functionality for optimal coverage
• Mesh network supporting peer to peer communi-cations
• Supports continuous and up-to-the-moment status updates to the CMS
• Integral GPS receiver (optional)

Control parameters

• **Control profiles and interfaces**
-- Power to fixture ON/OFF
-- Bi-level with OFF
-- Continuous dimming control with OFF
-- High end trim for enhanced energy savings
• **Control events and schedules**
-- Calendar based scheduling
-- Scheduled events based on time of day and/or astronomical time
-- Scheduled use of photocell
-- Real-time commands and overrides
• **Photocell daytime override**
• **Data logging**
• **Failure detection and reporting**
• **Photocell thresholds synchronization**
• **Continuous status messages**
• **Over the air flashing (program updates)**

iNET™ IoT Intelligent Lighting Control System

WIRELESS OUTDOOR LIGHTING CONTROLLER NODE - NEMA AC

Node-NEMA Version (NEMA7)

The NEMA node is installed with the NEMA socket of the light fixture, it is commonly used for street light or area lighting fixtures. The node communicates with the gateway using SUB-1GHz protocol (ISM 433/868/915 MHz).

Electrical and operational specifications

Basic Specifications	Description
Operating voltage:	100-277VAC, 50/60 Hz
Power switching:	450W
Power consumption	1.5W@ 120/277V
Operating temperature	-40°C ~ +75°C
Surge protection	4KV
Relay protection	Zero crossing
Failsafe	Power ON, lamp level high
Wireless communication	IEEE 802.15.4; 433/868/915 MHz 10 channel DSSS (Direct Sequence Spread Spectrum) RF power +22 dBm (250 mW)
Node to node range	1km(line of sight)
Node to gateway range	1km(line of sight)
Range extender	Node can be used as repeater
Input/interface	Motion sensor
Outputs/interfaces	0-10V (sink) dimming, 12VDC (50mA)
Protection	IP66

Measurement and Control

The Node is connected to the NEMA socket, which is in serial connection between AC mains and the LED driver. Its MCU manages data communication, sensor control, remote switching, fault management and status reporting.

Sensors & Expandability

• Onboard sensor option - photocell.
• The node provides extra I/O ports for outside sensor connection.

Dimensions and Wiring

Dim-
Dim+

N
Dim(Motion detection)
Lo
12V
Li

Dimensions identical for all models.

Note: All wiring to the receptacle must be completed in the factory or by a qualified electrician with fixture completely disconnected from power.

NEMA EI-ENN

NEMA 7-pin connector (ANSI 136.41); mating receptacle is not provided.

Line Voltage Wires
100-277VAC, 50/60Hz
1000W

Black
White

Red
PURPLE

Brown
PURPLE
Orange   Black
Gray   Gray

Black
PURPLE

Gray

LED Dimming Driver

Motion Sensor ANT-5-4

RF Controllers mounting and wiring.
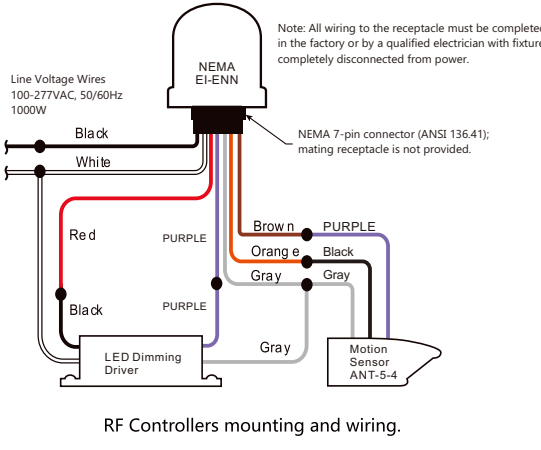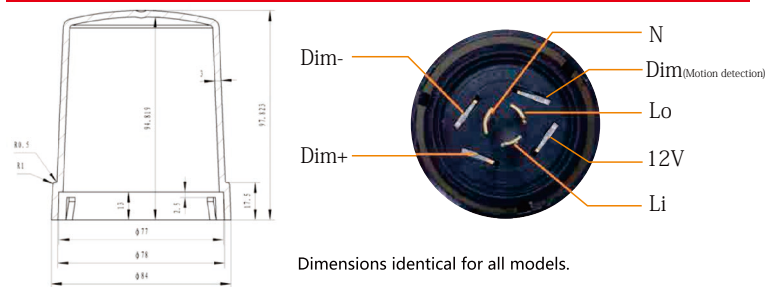
iNET™ IoT Intelligent Lighting Control System

WIRELESS OUTDOOR LIGHTING CONTROLLER NODE - NEMA DC

Node-NEMA Version (NEMA7)

The NEMA node is installed with the NEMA socket of the light fixture, it is commonly used for street light or area lighting fixtures. The node communicates with the gateway using SUB-1GHz protocol (ISM 433/868/915 MHz).

Electrical and operational specifications

Basic Specifications	Description
Operating voltage:	5~36V DC
Power consumption	1.5W
Operating temperature	-40°C ~ +75°C
Wireless communication	IEEE 802.15.4; 433/868/915 MHz 10 channel DSSS (Direct Sequence Spread Spectrum) RF power 20 dBm (250 mW)
Node to node range	1km(line of sight)
Node to gateway range	1km(line of sight)
Range extender	Node can be used as repeater
Input/interface	Motion sensor
Outputs/interfaces	RS485
Protection	IP66

Measurement and Control

The Node is connected to the NEMA socket, which is connected with the solar controller by RS485 interface; its MCU read and manages data communication, sensor control, remote switching, fault management and status reporting.

Sensors & Expandability

• Onboard sensor option - photocell.
• The node provides extra I/O ports for outside sensor connection.

Dimensions and Wiring

Φ81

56

NA

SENSOR

GND
RS485-B
NA
RS485-A
Vdc input

Line Voltage Wires
100-277VAC, 50/60Hz
1000W

Vdc input
GND

Black
White

NEMA
EI-ENN

Note: All wiring to the receptacle must be completed in the factory or by a qualified electrician with fixture completely disconnected from power.

NEMA 7-pin connector (ANSI 136.41); mating receptacle is not provided.

Brown   RS485-B
Orange   RS485-A
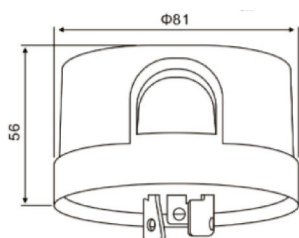
Solar Controller

Dimensions identical for all models.

RF Controllers mounting and wiring.

iNET™ IoT Intelligent Lighting Control System

MPPT Solar Controller Integrated with Wireless Smart Controller Node

Node-Integrated Version

The control node is integrated inside of solar street light controller well packed inside fixture. The node communicates with the gateway using SUB-1GHz protocol (ISM 433/868/915 MHz).
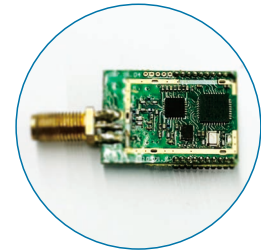
Electrical and operational specifications

Basic Specifications	Description
Operating voltage:	5~36V DC
Power consumption	1 W
Operating temperature	-40°C ~ +75°C
Wireless communication	IEEE 802.15.4; 433/868/915 MHz 10 channel DSSS (Direct Sequence Spread Spectrum) RF power 20 dBm (250 mW)
Node to node range	1km(line of sight)
Node to gateway range	1km(line of sight)
Range extender	Node can be used as repeater
GPS receiver	Optional
Protection	IP66

Measurement and Control

The Node read and manages data communication, sensor control, remote switching, fault management and status reporting.

Dimensions

163

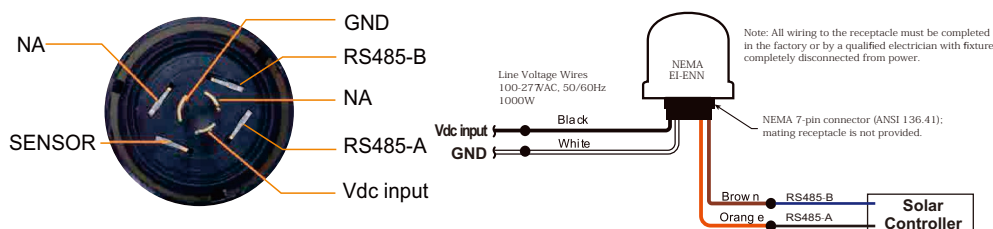91.50

⌀4.50

41

84

100
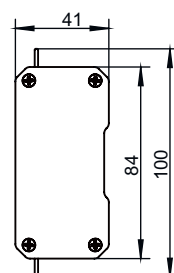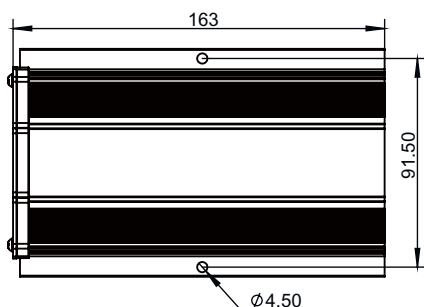
Figures display the device dimensions.

iNET™ IoT Intelligent Lighting Control System

WIRELESS OUTDOOR LIGHTING CONTROLLER NODE - Zhaga DC/DALI

Node-Zhaga Version

The Zhaga node is installed with the Zhaga socket of the light fixture, it is commonly used for street light or area lighting fixtures. The node communicates with the gateway using SUB-1GHz protocol (ISM 433/868/915 MHz).

Electrical and operational specifications

Basic Specifications	Description
Operating voltage:	5~36V DC
Power consumption	2W
Operating temperature	-40°C~+75°C
Wireless communication	IEEE 802.15.4; 433/868/915 MHz 10 channel DSSS (Direct Sequence Spread Spectrum) FRTX power +22 dBm (250 mW) /Mesh
Node to node range	1km(line of sight)
Node to gateway range	1km(line of sight)
Range extender	Node can be used as repeater
Input/interface	Motion sensor
Interfaces	Dali2, Di4
Protection	IP66

Measurement and Control

The Node is connected to the Zhaga socket, which is connect to the ends of LED driver output. Its MCU manages data communication, sensor control, remote switching, fault management and status reporting.

Sensors & Expandability

• Onboard sensor option - photocell.
• The node provides extra I/O ports for outside sensor connection.

Dimensions and Wiring

58.65
ø30.40
ø38.65
ø79.70

Motion Sensor
S+
GND
24VDC+

Black

Driver

Blue

Gray

Brown

DALI+
GND/DALI-
24VDC+
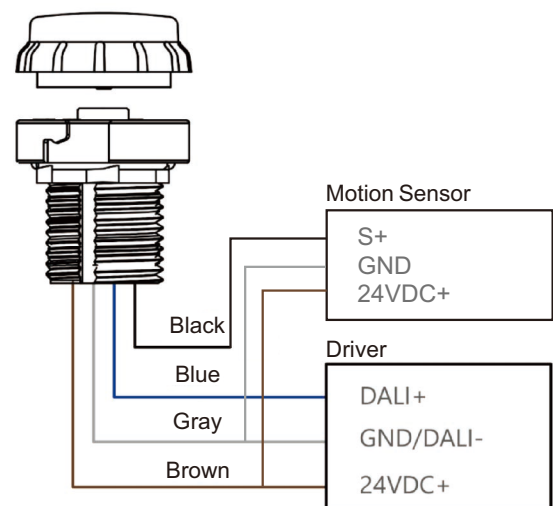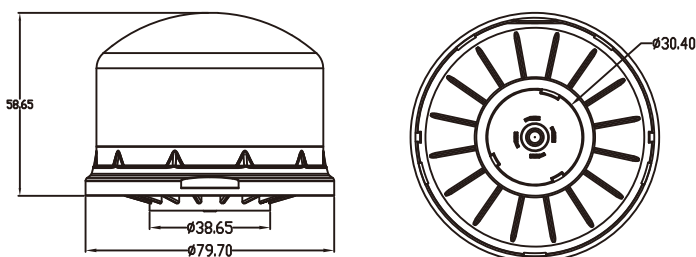
iNET™ IoT Intelligent Lighting Control System

ORDERING INFORMATION

iNET GATEWAY (Standard)

EI	IoT Gateway	Protocol	Server Port	Operating Temperature	Gateway-to-Node Antenna	4/5G Antenna	Power Cable	Input Voltage	Mounting	IP Rating	Color
	GWA - Gateway, AC Version	01 - SUB1G	02 - Ethernet	01 - (-40~75)	01 - 433MHZ Fiberglass	01 - Fiberglass		02 - AC 100~277V	01 - Wall Mount	03 - IP66	04 - Sliver
	GWS - Gateway Solar Version		08 - K7+EG25-G					05 - DC 5~35V	02 - Pole Mount		
			09 - EG25-G								

EI - E-Lite IoT System Product

Power Cable:
- 27 - 4m European Standard Cable
- 28 - 4m American Standard Cable
- 29 - 2m European Standard Cable with Plug
- 30 - 2m American Standard Cable with Plug

WIRELESS OUTDOOR LIGHTING CONTROLLER NODE (Standard)

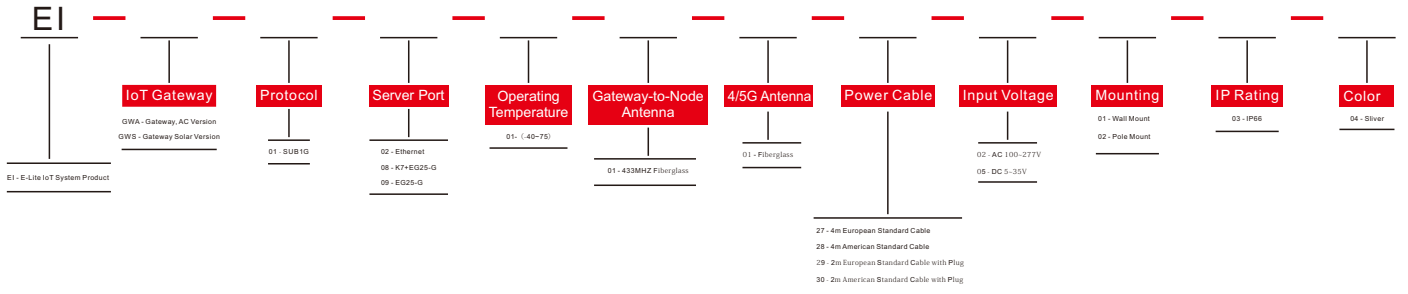| EI	Product Range	Power Input	GPS	Sensor	Antenna	Dimmability	Protocol	Operating Temp	Power Cable	Input Voltage	Mounting	IP Rating	Color
		01 - AC	00 - GPS Not Included	00 - No Sensor		00 - Non Dimmable	01 - SUB1G(433Mhz)	01 - (-40~75)	17 - Others	05 - AC 100~277V	01 - Screw Mount	01 - IP30	05 - RAL7022
		02 - DC	01 - GPS Included	02 - Photocell		02 - 0-10V Dimming	03 - RS485		20 - 350mm European Standard	08 - DC 5~36V	02 - 5-Pin NEMA	02 - IP54	06 - RAL8019
				16 - Tilt Sensor		03 - 1-10V Dimming	05 - SUB1G(915Mhz)		21 - 350mm American Standard		03 - 7-Pin NEMA	03 - IP65	07 - RAL7004
						06 - DIGITAL Dimming	09 - SUB1G(868Mhz)				04 - ZHAGA	04 - IP66	11 - Gray
						08 - DALI						05 - IP67	13 - Blue

EI - E-Lite IoT System Product

Product Range:
- NDS - Node Standard
- NDN - Node NEMA Standard
- NDM - Node NEMA MultiCCT
- NDZ - Node ZHAGA Type

Antenna:
- 01-433MHZ Rubber Rod
- 08-433MHZ