

# TECHNICAL REPORT



Lighting systems – Characteristics for selected outdoor applications

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INTERNATIONAL  
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## CONTENTS

FOREWORD.....	3
1 Scope.....	5
2 Normative references .....	5
3 Terms and definitions .....	5
4 Outdoor lighting system architecture.....	6
5 Configurations of outdoor lighting systems .....	6
5.1 Lighting poles .....	6
5.1.1 Lighting poles with luminaires for adaptive lighting .....	6
5.1.2 Multi-function lighting poles .....	6
5.2 Sensors .....	7
5.2.1 Sensors for lighting control .....	7
5.2.2 Sensor mounting configurations.....	8
5.3 Communication modules .....	8
5.4 Central management system.....	8
5.4.1 General .....	8
5.4.2 Luminaire control.....	8
5.4.3 Luminaire monitoring .....	8
6 Communication protocols .....	9
6.1 Wired communication protocols .....	9
6.2 Wireless communication protocols .....	10
6.3 Hybrid communication protocols .....	11
7 Characteristics of outdoor lighting systems .....	12
7.1 Lighting controls .....	12
7.2 Luminaire monitoring .....	12
8 Examples of outdoor lighting systems .....	12
8.1 Outdoor lighting system for parking areas .....	12
8.2 Outdoor lighting system for street lighting for vehicles .....	13
8.3 Outdoor lighting system for road lighting for pedestrian and cycle pathways .....	14
Bibliography.....	16
Figure 1 – Example of a multi-function lighting pole .....	7
Figure 2 – Example (for illustration only) of outdoor lighting system based on wired communication protocol .....	9
Figure 3 – Examples of outdoor lighting system based wireless communication protocols.....	11
Figure 4 – Example (for illustration only) of outdoor lighting system for outdoor parking area.....	13
Figure 5 – Examples (for illustration only) of outdoor lighting system for street lighting and adaptive control of luminaires depending on the volume of traffic.....	14
Figure 6 – Example of autonomous outdoor lighting system for pedestrian and cycle pathways .....	15
Figure 7 – Example of energy saving on autonomous outdoor lighting system for pedestrian and cycle pathways .....	15

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**LIGHTING SYSTEMS –  
CHARACTERISTICS FOR SELECTED OUTDOOR APPLICATIONS**

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The text of this Technical Report is based on the following documents:

Draft	Report on voting
34/1184/DTR	34/1205/RVDTR

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this Technical Report is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at [www.iec.ch/members\\_experts/refdocs](http://www.iec.ch/members_experts/refdocs). The main document types developed by IEC are described in greater detail at [www.iec.ch/publications](http://www.iec.ch/publications).

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# LIGHTING SYSTEMS – CHARACTERISTICS FOR SELECTED OUTDOOR APPLICATIONS

## 1 Scope

This document provides information on outdoor lighting systems for selected applications. This document provides an overview of configuration, interfaces with other devices, communications, control strategies and characteristics of various outdoor lighting systems with relevant functionalities.

Applications selected for inclusion are:

- outdoor parking area lighting;
- road and street lighting;
- pedestrian and cycle pathways lighting.

## 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60050-845, *International Electrotechnical Vocabulary (IEV) – Part 845: Lighting*, available at <https://www.electropedia.org/>

IEC TS 63105, *Lighting systems and related equipment – Vocabulary*

<https://standards.iteh.ai/catalog/standards/iec/1ce25d0e-f64a-44e3-b3d3-5bf08473a1ce/iec-tr-63540-2024>

## 3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60050-845 and IEC TS 63105, and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- IEC Electropedia: available at <https://www.electropedia.org/>
- ISO Online browsing platform: available at <https://www.iso.org/obp>

### 3.1

#### **astronomical time control**

device that actuates a load and adjusts power in steps based on the time of day or based on astronomical events

Note 1 to entry: Astronomical events can be sunset or sunrise, accounting for geographic location and day of the year.

### 3.2

#### **light sensor**

device that detects the quantity of light

## 4 Outdoor lighting system architecture

According to system architecture, outdoor lighting systems can be classified into three categories, as follows:

- lighting systems consisting of standalone luminaire(s);
- autonomous lighting systems;
- centrally controllable lighting systems.

Typical characteristics of these lighting systems are described in IEC TS 63116:2021/AMD1:2023, Clause 11.

## 5 Configurations of outdoor lighting systems

### 5.1 Lighting poles

#### 5.1.1 Lighting poles with luminaires for adaptive lighting

Luminaires and systems for adaptive lighting equipped with sensors and communication modules can provide various lighting control functions to support the city infrastructure. Examples of functionality in adaptive lighting are:

- timer-based light control;
- presence sensor light control;
- motion sensor light control;
- communication between luminaires;
- remote configuration.

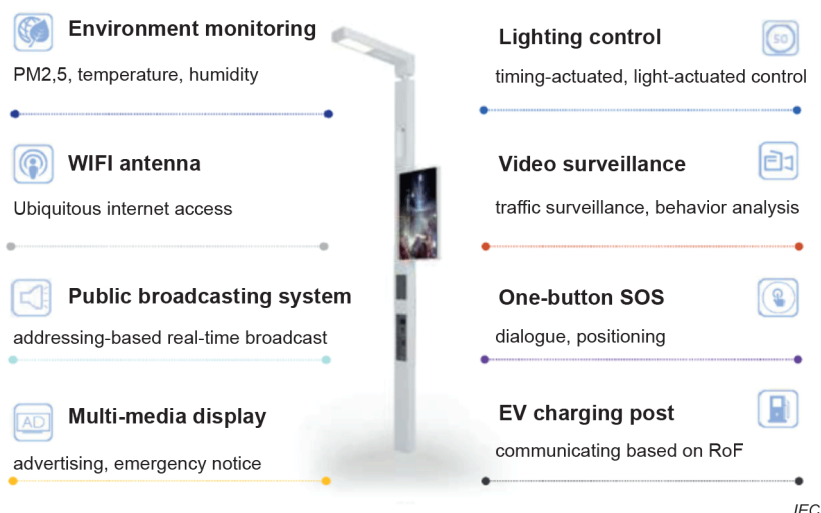
#### 5.1.2 Multi-function lighting poles

Various devices such as sensors, CCTV, speakers can be mounted onto a multi-function lighting pole. Besides the capabilities for adaptive lighting controls, a multi-function lighting pole can also provide various functions to support the city infrastructure. Examples of functionality in adaptive lighting are:

- weather conditions;
- air quality monitoring;
- vehicle to X services;
- traffic monitoring;
- traffic light controls;
- smart parking;
- ambient noise registration (e.g. gunshot detection and accident detection);
- public messaging or digital signage;
- high definition (HD) video surveillance (CCTV);
- waste management;
- EV charging station.

An example of a multi-function lighting pole is shown in Figure 1.





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**Figure 1 – Example of a multi-function lighting pole**

## 5.2 Sensors

### 5.2.1 Sensors for lighting control

Sensors can be used to detect activity in the surrounding area for an adaptive lighting control response. For example, a motion or presence sensor automatically activates when a vehicle or pedestrian is identified entering a specific area and can respond as required. If there is no vehicle or pedestrian in the specific area, the luminaire is adapted automatically to pre-set light levels, or switched off.

Another possibility is an ambient light sensor that can be used to control light levels. When an area to be illuminated is bright enough (according to the light level required by application standards such as CIE 115 or other regional lighting standards, such as the EN 13201 series), then the luminaire can be controlled to reduce light levels. This can help to save energy and provide an adequate amount of light regardless of weather conditions.

Various types of sensors can be added to the system to provide additional functions to the application. Examples of sensor inputs are as follows:

- weather conditions (e.g. temperature, humidity, wind, fog and air pressure);
- air quality;
- traffic monitoring;
- ambient noise;
- available parking space;
- pole tilt;
- flood detection;
- UV radiation.

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### 5.2.2 Sensor mounting configurations

In general, sensors are mounted where they can best capture the needed information. Sensors can be either integrated into the luminaire directly or connected to the luminaire by (standardized) interfaces (i.e. non-integrated). Sensors can be categorized as pole mounted or luminaire mounted.

Non-integrated sensors with standardized interfaces have specific requirements for physical and electrical interfaces to facilitate interchangeability. Examples of standardized interfaces for sensors are given in ANSI C136.41:2021 and IEC PAS 63421.

NOTE IEC PAS 63421 is being converted into IEC 63494-2-1.

### 5.3 Communication modules

A communication module is used to interact with other luminaires and to share data with a central management system (CMS). Currently, both wired communication technology and wireless communication technology already exist in the field. Integrated communication modules such as for power line communication, are normally built into luminaires at the factory.

Non-integrated communication modules with interfaces as listed in 5.2.2 can be used to upgrade outdoor lighting systems.

### 5.4 Central management system

#### 5.4.1 General

The main functions of a central management system are given in 5.4.2 and 5.4.3.

#### 5.4.2 Luminaire control

An individual outdoor luminaire or a group of luminaires can be controlled by a central management system. For instance, one of the motion sensors detects the movement of a vehicle or pedestrian on the road then the central management system can control the group of luminaires in a sequential way to increase the light level of the affected area. Or, using the information from multiple light sensors, the central management system can control several groups of luminaires individually with different light levels to provide recommended light levels.

A central management system can also control an individual or a group of luminaires remotely in accordance with the following:

- specific event;
- pre-arranged calendars;
- astronomical time control with geographical information;
- presence of pedestrians or vehicles;
- work on road;
- traffic accident;
- emergency transport.

#### 5.4.3 Luminaire monitoring

In addition to such advanced control functions, a central management system can also exchange information on the status of individual luminaires to maintain the outdoor lighting system more effectively.