

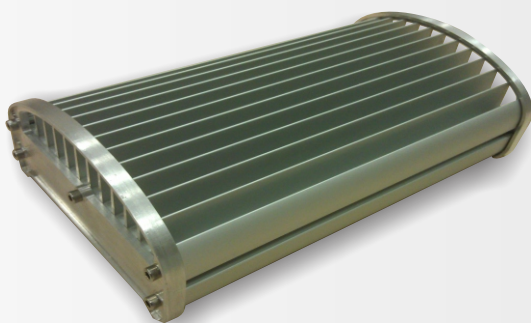


## ***LED luminaires and public lighting control system***



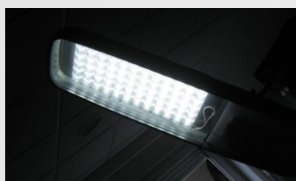
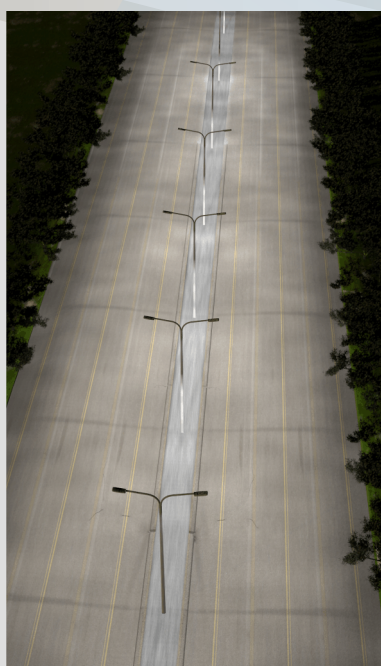
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- LED Highway Luminaire
- LED Street Luminaire
- Certificates
- Improving energy efficiency...
- Advantages of LED street lighting
- Line Control Unit
- Advanced LED public lighting system
- Public Lighting Control Software
- LED Luminaire for Tunnel Lighting
- Photo Sensor
- Tunnel Lighting Controller
- Industrial LED Luminaire
- Solar LED Street Luminaire
- LEDNG Luminaires Typology



## LED highway luminaire

*models: LEDNG-C-120-Lxx-Txx-S9  
LEDNG-C-150-Lxx-Txx-S9  
LEDNG-C-180-Lxx-Txx-S9  
LEDNG-C-210-Lxx-Txx-S9  
LEDNG-C-240-Lxx-Txx-S9*



The key feature of Elcom LED luminaire products is precisely designed and manufactured optics. The resulting lens provide a controlled distribution of emitted light, so each type of LED luminaire can meets the specific requirements of the space for which is functionally designed.

Elcom LEDNG highway luminaire models are designed for ambient lighting of urban and interurban high rank roads, their intersections at grade and grade separated, highways and other transportation facilities and areas (terminals, petrol stations, parking lots).

With basically three types of lenses high requirements of public lighting, as well as industrial or similar are covered. The need for different maximum intensity of light requires production of luminaires with variety of electric and lighting power within each of the luminaire types.

Thanks to the LED light source, the luminaires are reliable, durable, energy-efficient solution, thereby providing optimal light intensity and colour that are suitable and required for each of specific application.

Especially important is the ability of luminaire's full remote control via wired (using only 230 VAC power supply – there is no need for extra communicational wires) or through wireless serial communication. Light intensity is controlled automatically (by using light sensors or clock) or through an operator action, and can vary from 0 to 100%. At the same time the total energy consumption is in proportion to the intensity of light, enabling the development and application of "intelligent" and very energy efficient lighting control strategy.

## Technical features

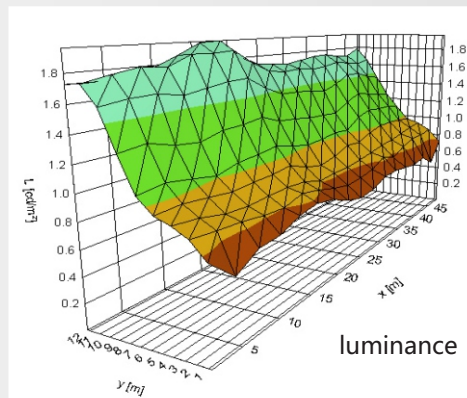
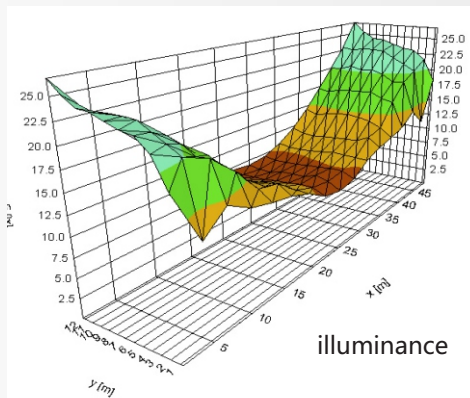
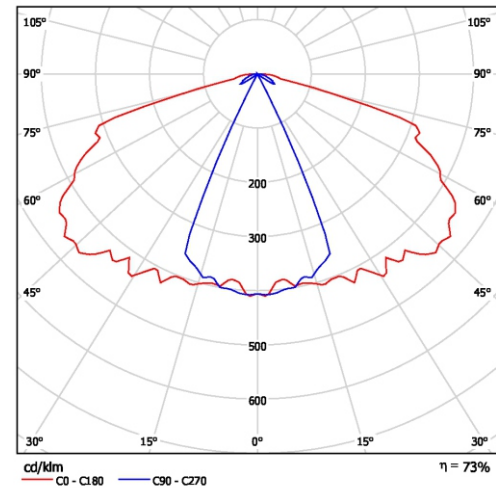
### a) Housing

- Body: robust, aluminum - cast under pressure,
- Dimensions: 730 x 320 x 75 mm (L x W x H),
- Face (bottom side): tempered glass protector,
- Protection class: IP65,

### b) Light sources

- White LEDs of high efficiency (about 150 lm/ W);
- Adjustable light intensity from 0 % to 100 % continuously (with proportional power consumption);
- Luminaire optical system (lenses L2, L3 or L4) directs light only to the surface of interest (carriageway, sidewalk, access areas, etc.); The remaining area in the region was virtually unlit (energy savings and reducing of "light pollution");
- The applied lenses satisfies norms (class ME3a), with luminance of  $1.17 \text{ cd/m}^2$  ( $>1 \text{ cd/m}^2$ ), transversely uniformity of 0.43 (min/avg $>0.4$ ), and longitudinal uniformity of 0.87 (min/avg $>0.7$ ); Illuminance of 15.4 lx and uniformity of 0.55 fulfill requirements of class CE3;
- Sample for LEDNG-C-120: radiation x:  $\pm 70^\circ$ , y:  $-15^\circ$  to  $25^\circ$  (luminaires on 15 m height, distance of 50 m, over 13 m wide road, provide luminance uniformity to satisfy road lighting norms - class ME3a);
- Colour temperature of light radiated is 3800–5000 °K - color type T2, T3, T4 or T5 (daylight close);
- CRI (colour reproduction index) is larger than 75;
- Automatic LED temperature control ( $<70^\circ \text{C}$ ) and adjustment for longer LED's lifetime;
- Environment friendly, fully recyclable, without dangerous elements like mercury, lead and natrium;

Luminous emittance 1:



software  
simulation

### c) Electrical features

- Voltage: from 90 to 250 V (frequency 50Hz),
- Power consumption: 120 W/ 150 W/ 180 W/ 210 W/ 240 W (different models),
- Power factor: 0.98,

### d) Temperature range

- $-40^\circ$  to  $60^\circ \text{C}$ ,

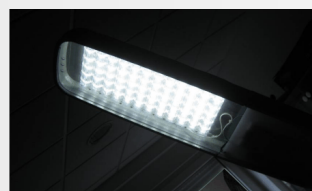
### e) Options

- Communicational connection to manage and monitor the intensity of the light.



## LED street luminaire

*models:* **LEDNG-C-30-Lxx-Txx-S3**  
**LEDNG-C-45-Lxx-Txx-S3**  
**LEDNG-C-60-Lxx-Txx-S3**  
**LEDNG-C-75-Lxx-Txx-S3**  
**LEDNG-C-90-Lxx-Txx-S3**  
**LEDNG-C-105-Lxx-Txx-S3**  
**LEDNG-C-120-Lxx-Txx-S3**



The key feature of Elcom LED luminaire products is precisely designed and manufactured optics. The resulting lens provide a controlled distribution of emitted light, so each type of LED luminaire can meets the specific requirements of the space for which is functionally designed.

LED street luminaire models are designed for ambient lighting of street scene (carriageway and pavement surface), urban intersections, squares, park areas and other transportation facilities and areas (terminals, petrol stations, parking lots).

With basically three types of lenses high requirements of public lighting, as well as industrial or similar are covered. The need for different maximum intensity of light requires production of luminaires with variety of electric and lighting power within each of the types.

Thanks to the LED light source, the luminaires are reliable, durable, energy-efficient solution, thereby providing optimal light intensity and colour that are suitable and required for each of specific application.

Especially important is the ability of luminaire's full remote control via wired (using only 230 VAC power supply – there is no need for extra communicational wires) or through wireless serial communication. Light intensity is controlled automatically (by using light sensors or clock) or through an operator action, and can vary from 0 to 100%. At the same time the total energy consumption is in proportion to the intensity of light, enabling the development and application of "intelligent" and very energy efficient lighting control strategy.

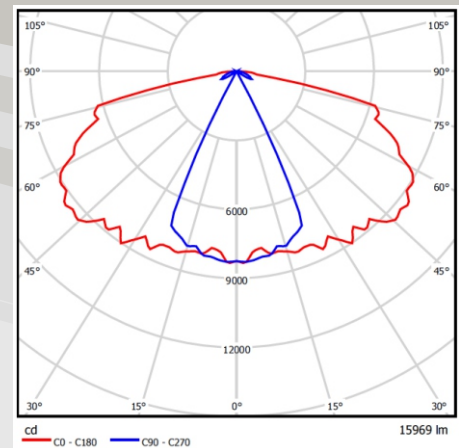
## Technical features

### a) Housing

- Body: robust, aluminum - cast under pressure,
- Dimensions: 430 x 230 x 60 mm (L x W x H),
- Face (bottom side): tempered glass protector,
- Protection class: IP65,

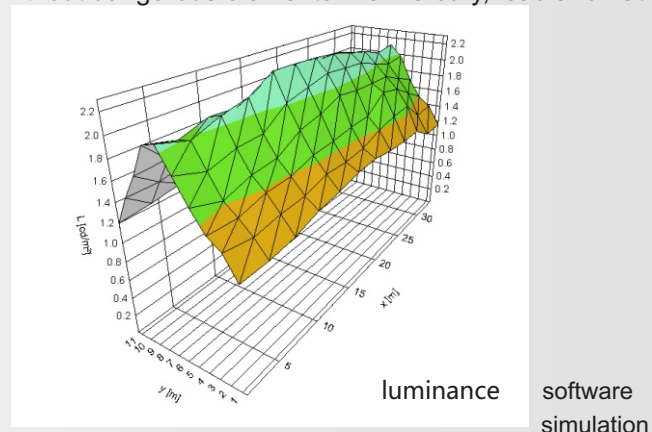
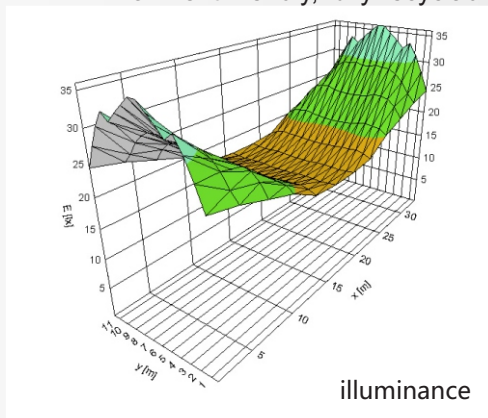
### b) Light sources

- White LEDs of high efficiency (about 180 lm/ W);
- Adjustable light intensity from 0 % to 100 % continuously (with proportional power consumption);
- Optical system (lenses type L2, L3, L4 or L5) directs the light only to rectangular surface of interest (roadway, sidewalk, etc.), providing energy savings and reducing of "light pollution";



type, model	power (W)	luminous flux (lm)	luminaire height (m)	interdistance (m)	carriageway width (m)	provided lighting class	Lav [cd/m <sup>2</sup> ]	U0	U1	TI [%]	Eav [lx]
LEDNG-C-30	30	4080	8,00	25,00	7,00	ME4a	0,93	0,47	0,78	7,00	13,00
LEDNG-C-45	45	5985	8,00	25,00	7,00	ME3a	1,37	0,47	0,78	8,00	20,00
LEDNG-C-60	60	8100	8,00	25,00	7,00	ME2	1,85	0,47	0,78	8,00	27,00
LEDNG-C-75	75	9975	11,00	35,00	7,50	ME3a	1,39	0,51	0,77	6,00	19,00
LEDNG-C-90	90	12060	11,00	35,00	7,50	ME2	1,68	0,51	0,77	7,00	23,00
LEDNG-C-120	120	15960	11,00	35,00	7,50	ME1	2,22	0,51	0,77	7,00	30,00

- Colour temperature of light radiated is 3800–5000 °K - color type T2, T3, T4 or T5 (daylight close);
- CRI (colour reproduction index) is larger than 75;
- Automatic LED temperature control (<70° C) and adjustment for longer LED's lifetime;
- Environment friendly, fully recyclable, without dangerous elements like mercury, lead and natrium;



### c) Electrical features

- Voltage: from 90 to 250 V (frequency 50Hz),
- Power consumption: 30 W/ 45 W/ 60 W/ 75 W/ 90 W/ 120W (different models),
- Power factor: 0.92,

### d) Temperature range

- -40° to 60° C,

### e) Options

- Power line communicational connection (PLC) to manage and monitor the intensity of the light.





CENTER FOR TESTING AND EUROPEAN CERTIFICATION  
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ctec@ctec-sz.com, www.ctec-sz.com

## CERTIFICATE

№ EMC- 12- 000 - (2emc-12-484)- 043E

"CTEC" Ltd. certifies that

### Product

**LED STREET LUMINAIRE**  
type: **LED LAMP LEDNG-C**  
model: **120-L4-T5-S3**  
90-260 V AC; 50/60 Hz; 120 W; IP65

### Manufacturer

**ELCOM d.o.o, SERBIA**  
Batajnici put 21, Zemun  
11080 Belgrade  
phone: +381 11 37 57 155; fax: +381 11 37 52 003  
e-mail: [office@elcombgd.rs](mailto:office@elcombgd.rs)

### Complies with the

**EN 55015:2006+A1:2007+A2:2009** Limits and methods of measurement of radio disturbance characteristics of electrical lighting and similar equipment - Conducted disturbance measurements  
**EN 61000-3-2:2006+A1:2009+A2:2009** Limits - Limits for Electromagnetic compatibility (EMC) Part 3-2: Limits for harmonic current emissions (equipment input current  $\leq 16$  A per phase)  
**EN 61547:2009** Equipment for general lighting purposes EMC immunity requirements  
**EN 61000-4-2:2009** Electromagnetic compatibility Part 4-2: Testing and measurement techniques - Electrostatic discharge immunity test  
**EN 61000-4-4:2004+A1:2010** Electromagnetic compatibility Part 4-4: Testing and measurement techniques - Electrical fast transient/burst immunity test  
**EN 61000-4-5:2006** Electromagnetic compatibility (EMC) Part 4-5: Testing and measurement techniques - Surge immunity test  
**EN 61000-4-8:2010** Electromagnetic compatibility (EMC) Part 4-8: Testing and measurement techniques - Power frequency magnetic field immunity test  
**EN 61000-4-11:2004** Electromagnetic compatibility (EMC) Part 4-11: Testing and measurement techniques - Voltage dips, short interruptions and voltage variations immunity tests

Certificate has been issued on the base of:

Test reports:  
№ 2emc-e-12-484/01.08.2012  
№ 2emc-i-12-484/01.08.2012

Date of issue: 2012-08-01  
Stara Zagora

Manager CTEC Ltd.  
/dipl. eng. Blagovesta Shineva/



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## CERTIFICATE

№ LVD- 13- 000 - (2e-13-599)- 004E

"CTEC" Ltd. certifies that

### Product

**CONTROLGAER FOR LED LAMP LEDNG**  
type: **LED Street Light\_0512**  
90-260 V AC; 50/60 Hz; 120 W  
**for lamps models:**  
**LEDNG-C-120-LYY-TZZ-S3; LEDNG-C-105-LYY-TZZ-S3**  
**LEDNG-C-90-LYY-TZZ-S3; LEDNG-C-75-LYY-TZZ-S3**  
**LEDNG-C-60-LYY-TZZ-S3; LEDNG-C-45-LYY-TZZ-S3**  
**LEDNG-C-30-LYY-TZZ-S3; LEDNG-C-15-LYY-TZZ-S3**

### Manufacturer

**ELCOM d.o.o, SERBIA**  
Batajnici put 21, Zemun  
11080 Belgrade  
phone: +381 11 37 57 155; fax: +381 11 37 52 003  
e-mail: [office@elcombgd.rs](mailto:office@elcombgd.rs)

### Complies with the

Essential requirements applicable to the product in compliance with **2006/95/EC Low voltage directive** and standards  
**EN 61347-1:2008**  
**EN 61347-1:2008/A1:2011** Lamp controlgear - Part 1: General and safety requirements  
**EN 61347-2-13:2006** Lamp controlgear - Part 2-13: Particular requirements for d.c. or a.c. supplied electronic controlgear for LED modules

Certificate has been issued on the base of:

Test report:  
№ 2e-13-599/14.02.2013

The conformity certificate is based on the evaluation of the technical file of the above mentioned product and does not imply assessment of the production.

According to the product's technical file the Low Voltage Directive 2006/95/EC requirements, the CE marking can be fixed and EC conformity declaration can be issued under the manufacturer responsibility.

Date of issue: 2013-02-14  
Stara Zagora



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## CERTIFICATE

№ LVD- 13- 000 - (2e-12-436)- 005E

"CTEC" Ltd. certifies that

### Product

**LED STREET LUMINAIRE**  
type: **LED LAMP LEDNG-C**  
model: **120-L4-T5-S3**  
90-260 V AC; 50/60 Hz; 120 W; IP65  
**representative of models:**  
**LEDNG-C-120-LYY-TZZ-S3; LEDNG-C-105-LYY-TZZ-S3**  
**LEDNG-C-90-LYY-TZZ-S3; LEDNG-C-75-LYY-TZZ-S3**  
**LEDNG-C-60-LYY-TZZ-S3; LEDNG-C-45-LYY-TZZ-S3**  
**LEDNG-C-30-LYY-TZZ-S3; LEDNG-C-15-LYY-TZZ-S3**

### Manufacturer

**ELCOM d.o.o, SERBIA**  
Batajnici put 21, Zemun  
11080 Belgrade  
phone: +381 11 37 57 155; fax: +381 11 37 52 003  
e-mail: [office@elcombgd.rs](mailto:office@elcombgd.rs)

### Complies with the

Essential requirements applicable to the product in compliance with **2006/95/EC Low voltage directive** and standards  
**EN 60598-1:2008**  
**EN 60598-1:2008/A11:2009** Luminaires Part 1: General requirements and tests  
**EN 60598-2-3:2003**  
**EN 60598-2-3:2003/A1:2011** Luminaires Part 2-3: Particular requirements - Luminaires for road and street lighting

Certificate has been issued on the base of:

Test report:  
№ 2e-12-436/06.07.2012  
№ 2e-13-600/14.02.2013

The conformity certificate is based on the evaluation of the technical file of the above mentioned product and does not imply assessment of the production.

According to the product's technical file the Low Voltage Directive 2006/95/EC requirements, the CE marking can be fixed and EC conformity declaration can be issued under the manufacturer responsibility.

Date of issue: 2013-02-14  
Stara Zagora

Manager CTEC Ltd.  
/dipl. eng. Blagovesta Shineva/



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FREE

ELCOM

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## Improving energy efficiency by replacing existing public lighting lamps with LED luminaires

### Analysis of examples

Case study was done for region which has about 600,000 installed public lighting lamps that are on average power of 250 W, close to 25 years old and spend about 430 GWh of electricity. That annually makes 1.5 % of total region consumption electric power. The costs for electricity are about 45 million EUR, and maintenance costs for lighting are about additional 5 million EUR.

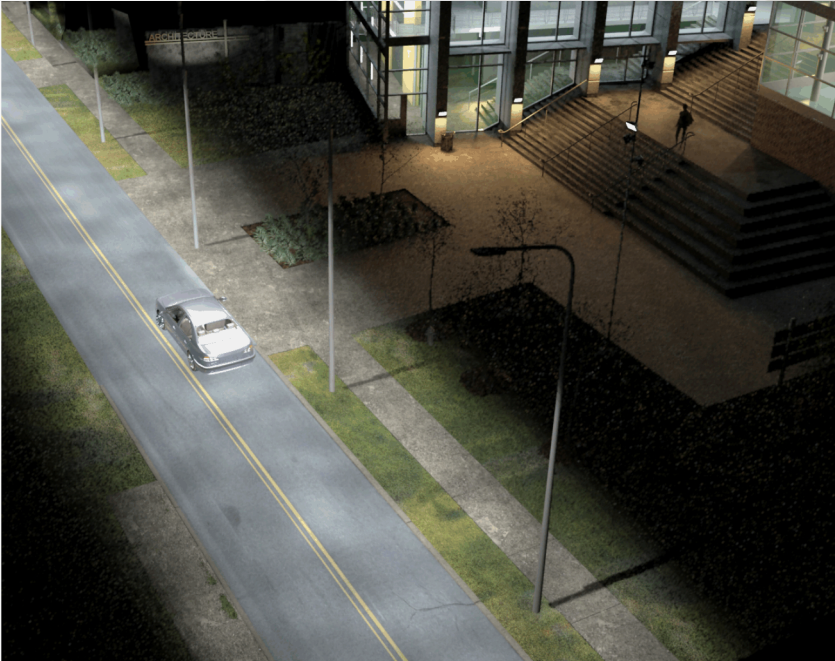
The high pressure lamps with mercury (Hg lamps) are dominated in structure of the existing lamps among the other types of less energy-efficient lamps. Significantly more efficient high-pressure sodium lamps (Na lamps) are intensively introduced only last ten years. As a hit at the lighting market appear luminaires with LED light sources as superior technologies in aspects of energy consumption, economic of use and environmental impact.

It is obvious that the future of public lighting belongs to LED products (the theoretical limits of intensity for Hg and Na sources are almost reached and the LED technology achieved just about 35 % of its limits). ELCOM as a LED luminaires manufacturer uses a series of unique technological solutions to maximally exploits the best features of LED light sources. The uniqueness of this product is reflected in following:

- Applied passive cooling solution offers the possibility of realization of electric luminaires up to 300 W power - the equivalent of over 45,000 lumen of light energy,
- Optical control of light by directing light through a specially designed lens allows that over 60 % of the light energy is directed to an area that should be highlighted,
- Electronic control of light allows programmable control over the intensity during night work,
- The lifetime of LED luminaires of about 12 years is more than twice compared to the till now the best Na lamps.

In Annex 1 "FEASIBILITY ANALYSIS OF REPLACEMENT STANDARD PUBLIC LIGHTING LAMPS WITH LED LUMINAIRES" the table shows a comparative calculation of the technical characteristics of the mostly used lamps on the market (Hg and Na lamps) with LED luminaire. There are two important results:

1. Elcom LED luminaire (LEDNG) has 74 % higher energy efficiency than Na lamp and 91 % higher than Hg lamp (Table 3). It follows that the simple substitution of Na and Hg lamps with LEDNG luminaires leads to achieve savings equivalent to these percentages. With the use of programmable light intensity control (dimming) with parameters from Table 4 (one third of the time the intensity is 100 %, two thirds of the time light intensity is 25 %) the increased efficiency is more significant - 88 % and 95 % compared to Na and Hg lamps respectively.



2. Taking into account the average cost of electricity of € 0.1/kWh, and the price of LED luminaires of about 4 €/W, lead to conclusions that the investment in replacing Na lamps is repaid in less than 2.7 years, and replacing Hg lamps less than year. The aforementioned does not include savings and benefit from reduced maintenance costs because the average time of failure-free operation for LED lights is significantly longer than for existing lamps.

In Annex 2 "CASE OF POSSIBLE ENERGY SAVING BY REPLACEMENT OF EXISTING LAMPS WITH LED LUMINAIRES IN THE CITY" analysis was focussed to a typical town with population of about 150 thousand. The results are as follows:

- Consumption of electric energy before replacing lamps is 11.5 MWh, and after replacement would be 0.72 MWh, which produce saving of about 94 %,
- Electricity costs would be reduced from € 1,152,000 to € 72,000.
- The investment is repaid through energy saving in 1.3 years.

Conclusion:

LED luminaires have the unique characteristics of energy efficiency, controllability and durability. Thanks to them a simple replacement of all lamps in region has a potential to reduce electricity consumption from amount of € 45,000,000 to below € 6,000,000. Maintenance costs for public lighting, which is estimated at more than € 5,000,000, would be reduced at least by half, owing to a longer service life of new luminaires. Investment costs would be so great that it would be paid off in less than 2 years, which is six times shorter than lifetime of LED luminaires.

# Annex 1

## FEASIBILITY ANALYSIS OF REPLACEMENT STANDARD PUBLIC LIGHTING LAMPS WITH LED LUMINAIRES (without and with lenses)

Table 1

INPUT VALUES	
Electricity price (€)	0,1
LED lamps cost (€/W)	4,00

**LEDNG - Elcom LED luminaire solution**  
with dimming and lenses focusing the light

Table 2

BASIC PARAMETERS OF PUBLIC LIGHT LAMPS (normalized at power of 100 W)									
Type	Power	Light efficiency of lamp	Ballast or power supply losses	Reflector or lens/ screen losses	Lamp efficiency	Light dissipation losses	Effective power	Effective light intensity	Lamp effective effectivity $\eta_{ef}$
	W	lm/W	%	%	%	%	W	lm	lm/W
Na	100	120	20	45	44	55	19,8	2376	23,76
Hg	100	60	20	50	40	65	14,0	840	8,40
LED	100	150	10	10	81	50	40,5	6075	60,75
LEDNG	100	150	10	20	72	15	61,2	9180	91,80

Table 3

Replacement of Na/Hg/LED with LEDNG lamps				
Type	Power	Transformation coefficient	Power equivalent for LEDNG lamp	Saving of replacement with LEDNG
	W		W (LEDNG)	%
Na	100	0,2588	26	74,12
Hg	100	0,0915	9	90,85
LED	100	0,6618	66	33,82

saving by focusing the light

Table 5

Type	OVERALL SAVING
	%
Na	87,71
Hg	95,65
LED	68,57

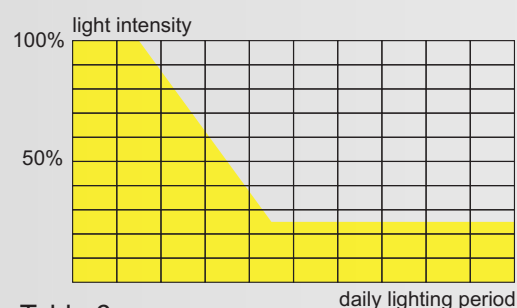


Table 4

LEDNG LAMP DIMMING		
Relative value of reduced power	Relative duration of reduced power	Saving by dimming
%	%	%
25	70	52,5

saving by light intensity control

Table 6

PAYBACK TIME FOR REPLACEMENT OF Na/Hg LAMPS WITH LEDNG LAMPS							
Type	Power	Relative work time - night (h)/24	Annual energy consumption	Annual energy cost	Overall saving	Lamps replacement cost	Payback time
	W	%	KWh	€	€	€	year
Na	100	50	438	43,80	38,42	103,53	<b>2,70</b>
Hg	100	50	438	43,80	41,90	36,60	<b>0,87</b>

## Annex 2

## CASE OF POSSIBLE ENERGY SAVING BY REPLACEMENT OF STANDARD PUBLIC LIGHTING LAMPS WITH LEDNG LUMINAIRES IN A CITY

**LEDNG - Elcom LED luminaire solution with dimming and lenses focusing the light**

Table 1

Type	Number	ANNUAL ENERGY COST			SAVINGS BY LAMP REPLACEMENT			
		Power installed	Energy consumption	Energy cost	Saving coefficient	LED power installed	Energy consumption	Energy cost
		W	kWh	€	%	W	kWh	€
Na	2479	636.170	2.786.424,60	278.642,46	87,71	164.656	342.566,32	34.256,63
Hg	11586	1.686.600	7.387.308,00	738.730,80	95,65	1.116.132	321.082,34	32.108,23
other	321	307.600	1.347.288,00	134.728,80	95,65	203.559	58.558,60	5.855,86
Total:		2.630.370	11.521.020,60	1.152.102,06		1.484.347	722.207,26	72.220,73

Table 2

Saving by replacement with LED lamps	Costs of old lamps replacement with LED	Payback time
€	€	year
1.079.881,33	1.388.526,33	1,29

## NEW INVESTMENT - COMPARATION OF ALTERNATIVE CHOICES

## CUSTOMER DECISION TO INSTALL NEW LED LUMINAIRES OR NEW STANDARD SODIOM TYPE

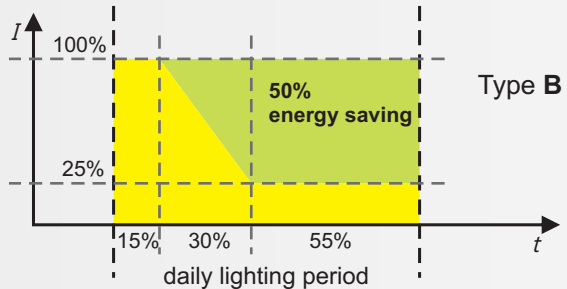
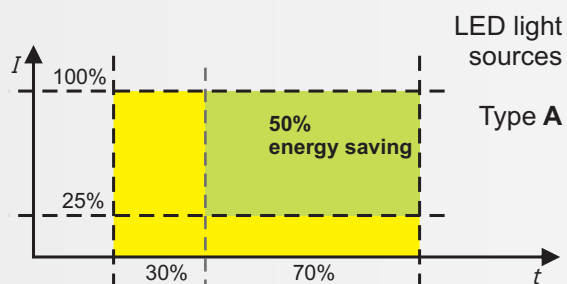
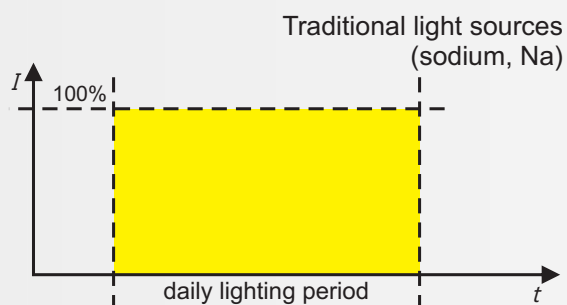
Table 3

Lamp type	Lamp power	Lamp price	annual energy consumption	annual cost of energy	annual saving	payback term	cost of ten years consumption	ten years savings
	W	€	kWh	€	€	year	€	€
Na	250	200	1095	110	0	0	1295	0
LEDNG	65	260	149	15	95	0,6	409	886

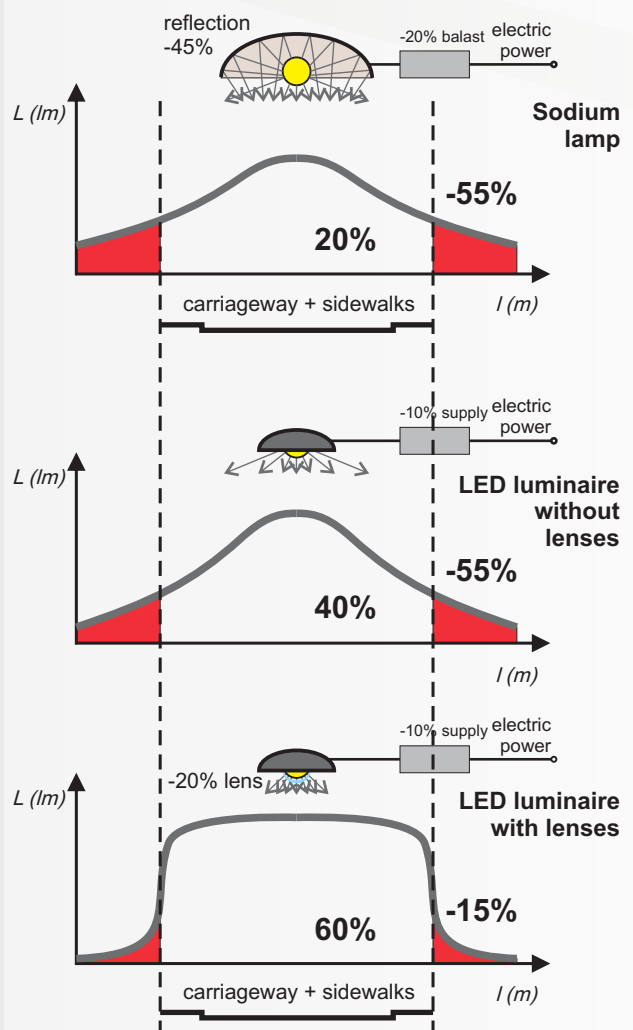


# Advantages of LED street lighting

## Public lighting saving by LED dimming

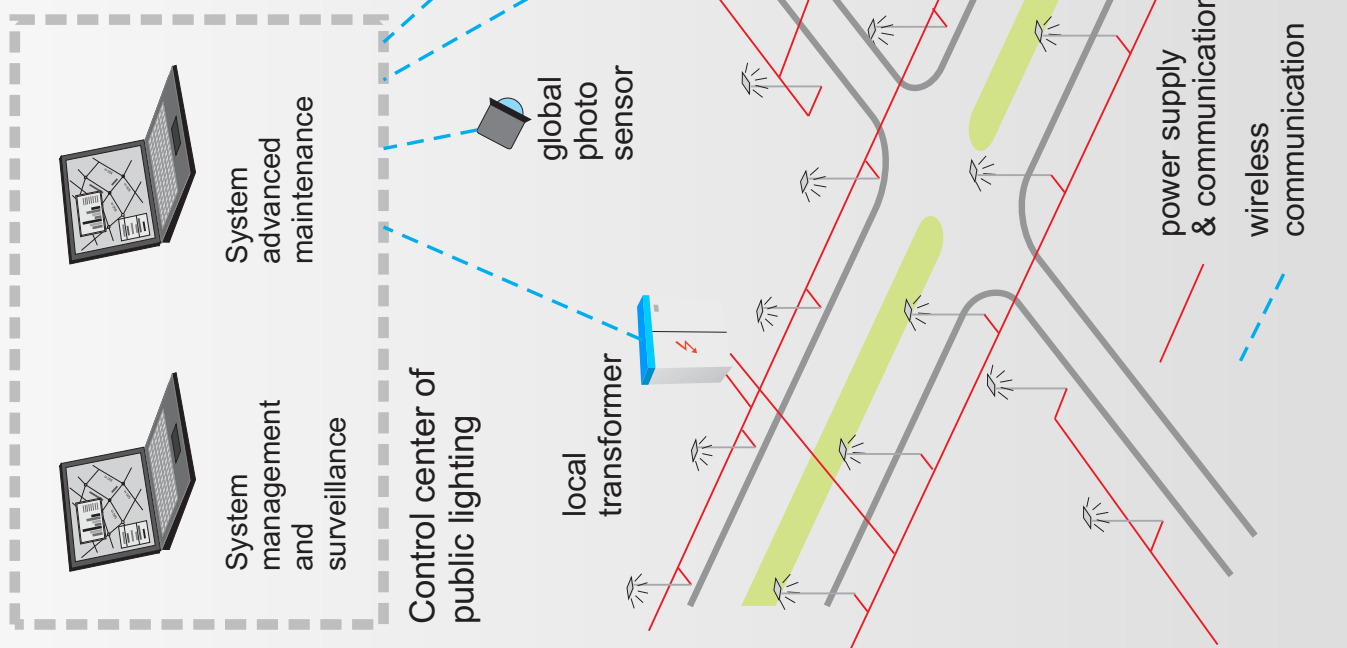


## Different light sources efficiency



# Advanced LED public lighting system by Elcom

- light intensity control by dimming LED sources,
- automatic light adaptation in accordance to photo sensors
- measurement of ambient light and detected traffic intensity,
- centralized system management and surveillance,
- subsystem for maintenance connected via GPRS with on site staff,
- ...



# ***Line Control Unit (LCU) for LED lighting control***

*models: with command console  
with communication access*



The one of the most important advantages of LED based lighting technology is high system manageability. Elcom has designed its LED lighting system with intention to make all potentials of LED lighting flexibility, high efficiency and economy available to the users.

LCU (Line Control Unit) is a key hardware component of a such system, providing comprehensive advanced communication between main system components: command centre, LED luminaires and system user who manage the system or do its maintenance and repairs.

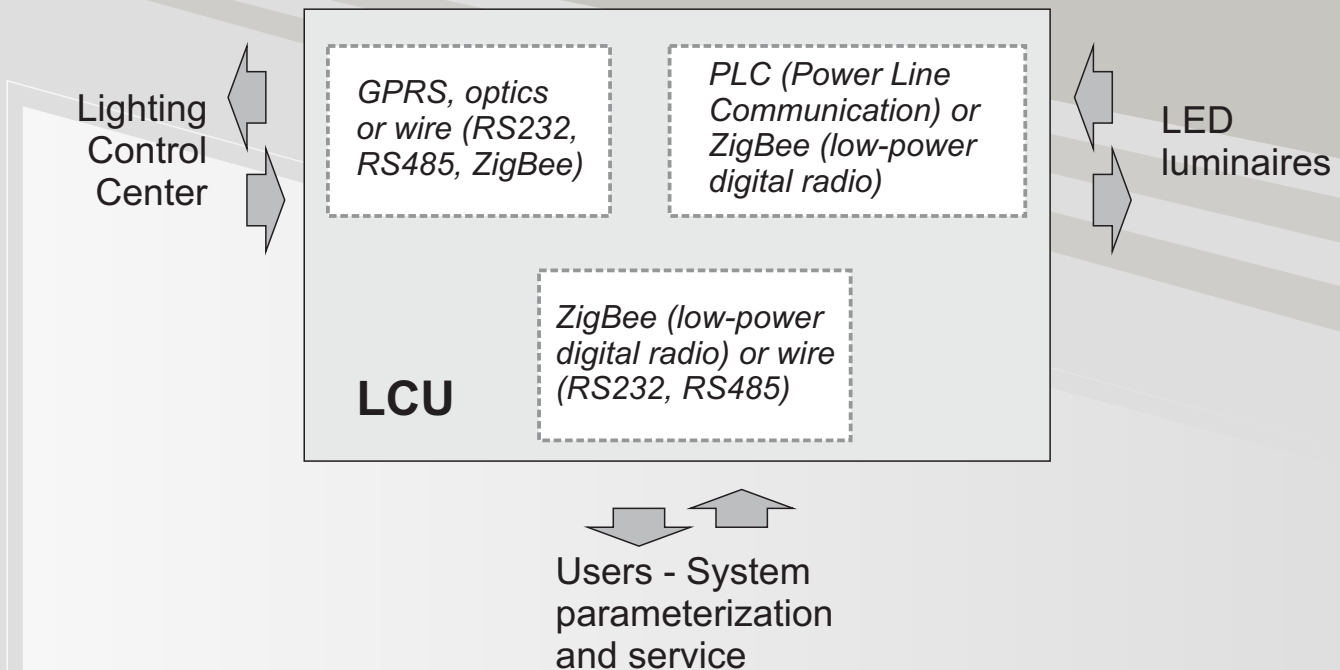
LCU is a multi functional device which can be use in different system configurations and for different regimes of users access to unit. Two of available access options and also the main attributes of two model categories are LCU with communication access (remote control) and LCU with manual users access (command console).

Models for remote control do not have facilities for direct (tactile) contact with device, while models for manual control (shown at the above pictures) have touch screen or linear screen with compact keyboard for user interactive communication with the system.

Communication of all LCU models with LED luminaires in lighting network is based on PLC (Power Line Communication), providing huge communicational advantages and great savings in necessary infrastructure (e.g. cabling). Only two power line wires are enough for the comprehensive control of the whole network of luminaires.

Manually accessible LCU units have tailor made LED lighting control software providing them logical and user friendly system control, with access to all of the system functions and features.

### Communicational features



○ LCU with command console is designed dominantly for indoor lighting systems (workshops, warehouses, etc.). Owing to dedicated tailor made software, it is easy accessed and can act as a fully function center (for industria lighting systems), or as a local "center" for public lighting control (when the main control center exists). LCU with command console have to be placed indoor (area not exposed to atmospheric weather conditions, extreme moisture and dust).

○ LCU with communication access is intended primarily for the management of outdoor public lighting (streets, highways, parking lots, etc.). It is usually placed near the local power station which supply the lighting. Because the local sub-station is often located either on the "height" (on column) or in purpose-built facility, direct physical access to LCU is disabled or impractical (Pisture right). User approach for parameterization or service is provided through wireless communication resources (low-power digital radio / ZigBee) or through wire connection (RS232, RS485).

LCU with access communication may serve as a local "center" or completely „take over“ the function of the main lighting control center, but only over additional communications console access (tablet or other device with the installed software for lighting control).

Wireless communication with center is also possible with ZigBee. Where LCU communicates with itself closer to the LCU. The message is routed from one to another LCU until it reaches its destination, thus solves the problems of large distances.

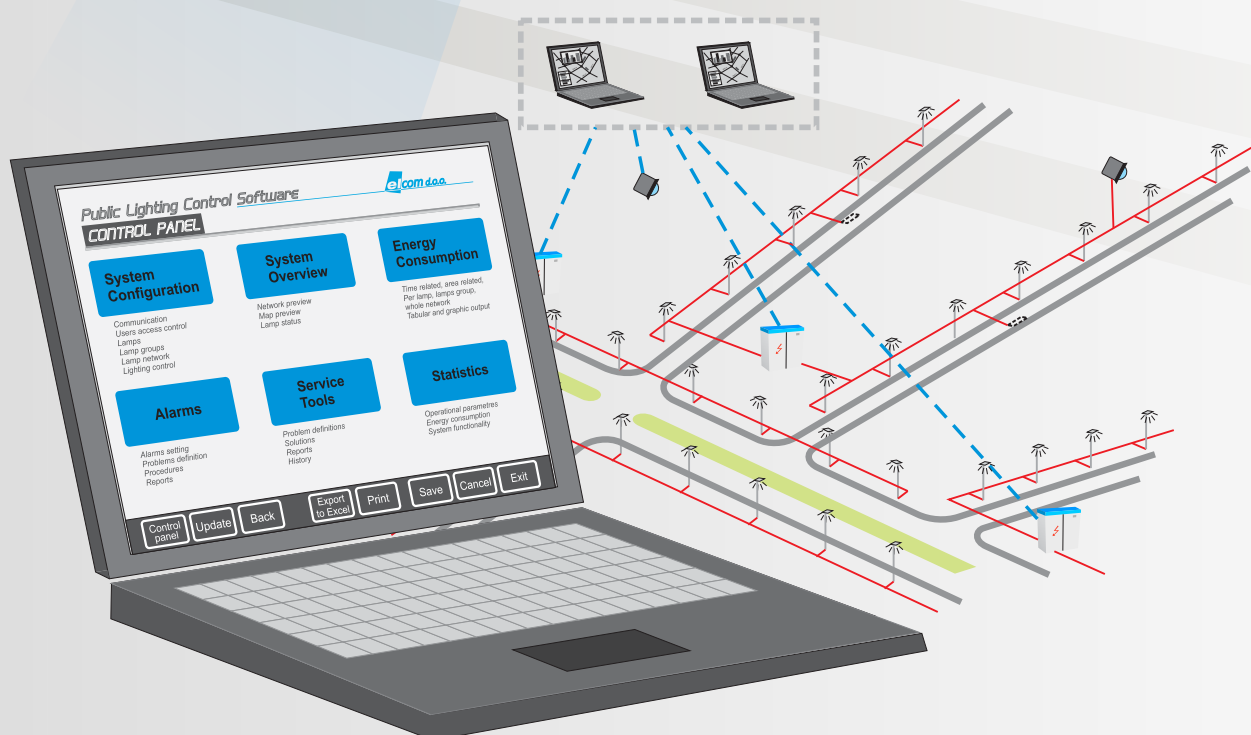


- Housing: Polycarbonate, ABS or aluminum,
- Dimensions: Approx. 200 x 300 x 100 mm, depending of content, mounting requirements or chosen touch screen format (for command console model),
- Voltage: from 90 to 250 V (frequency 50Hz),
- Power consumption: less than 5 W,
- Temperature range: -40° to 60° C



# ***PubLiCo Software***

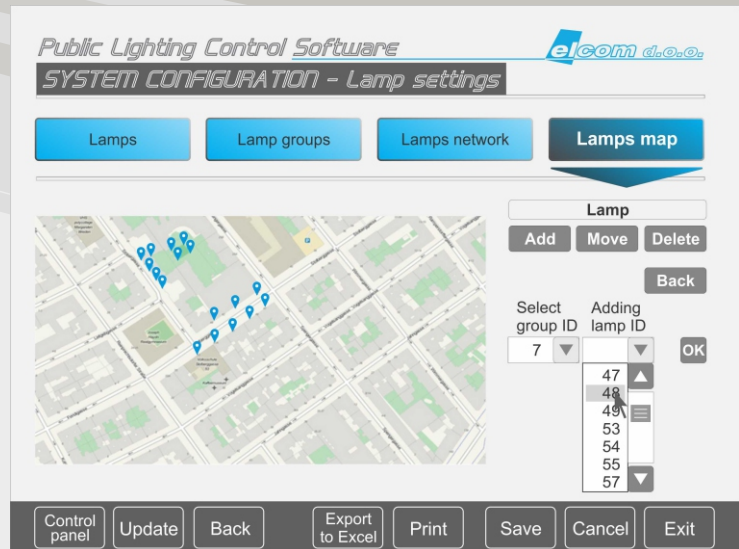
## ***Software for Public Lighting Control***



PubLiCo is Elcom made compact, comprehensive, user-friendly software dedicated to advanced and versatile control of public lighting system based on LED lighting technology. Different software users have selective access to the system segments which are of its professional interest or authorization.

Especially developed original communication protocol has provided suitable use of numerous advantages of LED lighting technology and achieving of significant savings comparing to traditional systems of public lighting. Through PubLiCo software all of the system hardware, communication or control components are available for detailed and guided configuration.

The comprehensive set of feedback information covers whole aspects of public lighting system operation in real time: its functional parameters, measured values of indicators needed for diagnostic of lamp conditions, automatic alarms for alerting in case of different kinds of failures, assistance to service staff for easy problem solution, archiving of any activity or event in the past, as well as detailed statistics with emphasis to energy efficiency.

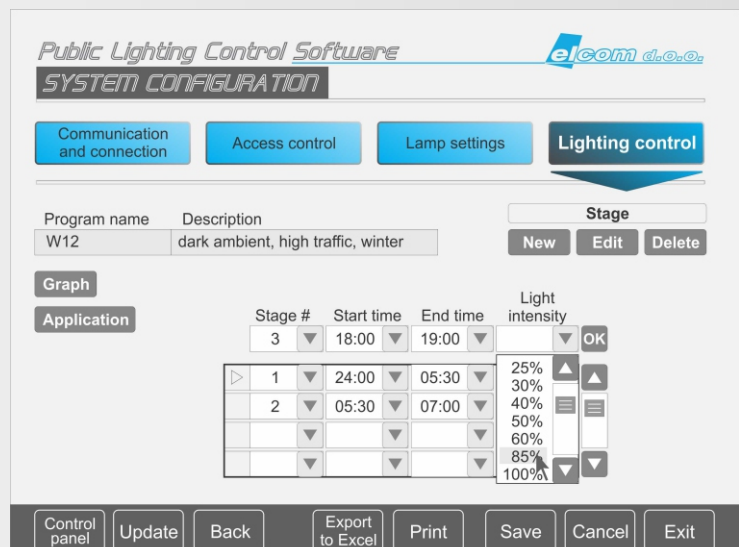


Lamp setting at the map

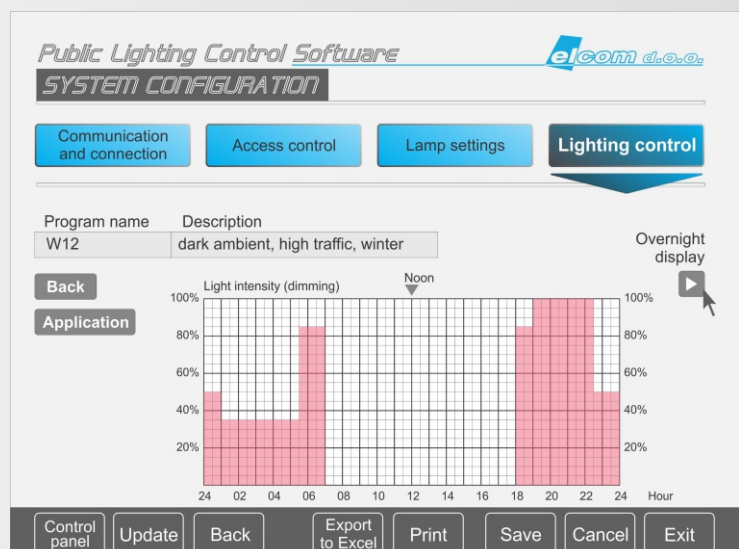
In the configuration block of software communication options for connecting users and for internal data exchange within the system have to be defined. The system administrator also defines for each of software user details of his specific access to the software, with respect to his professional needs and authorization (list of users, corresponding access level, user login, password).

Hardware structure of public lighting systems is configured by defining each lamp identity and attributes, declaring its membership in various lamp control groups (lamps that operate in the same mode), the defining of each LCU unit with all lamps connected to.

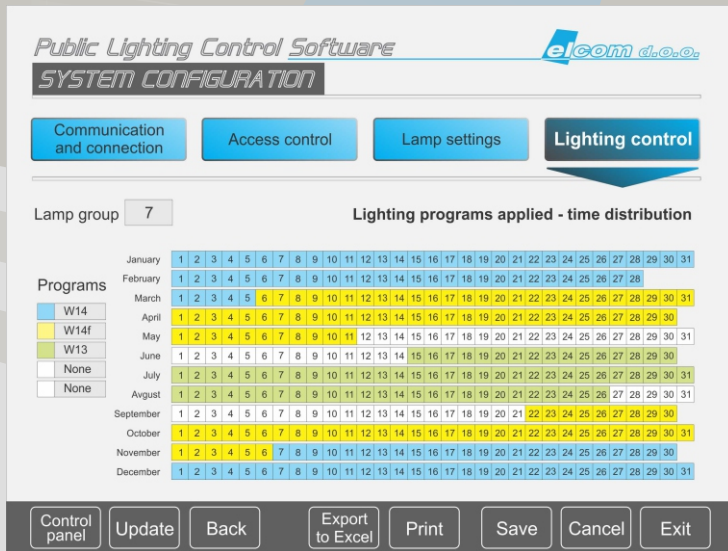
Set of different reasonable programs of lighting regime (time distribution of light intensity) have to be defined considering realistic (but dynamic) needs related to the intensity of the ambient light, the traffic, the nature of space and events that are "illuminated". Programs are defined filling interactive tables, showing on graph its actual shape, and, when finished, stored in a lighting programs database.



Lighting program editing



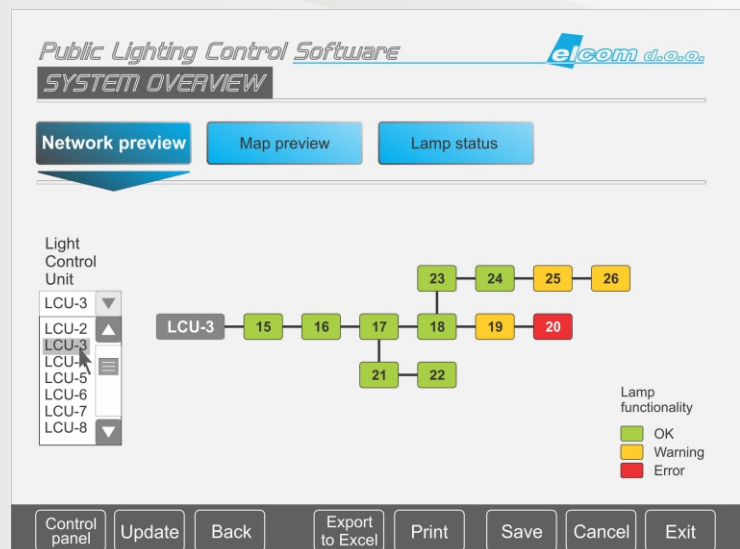
Graphic interpretation of one lighting program



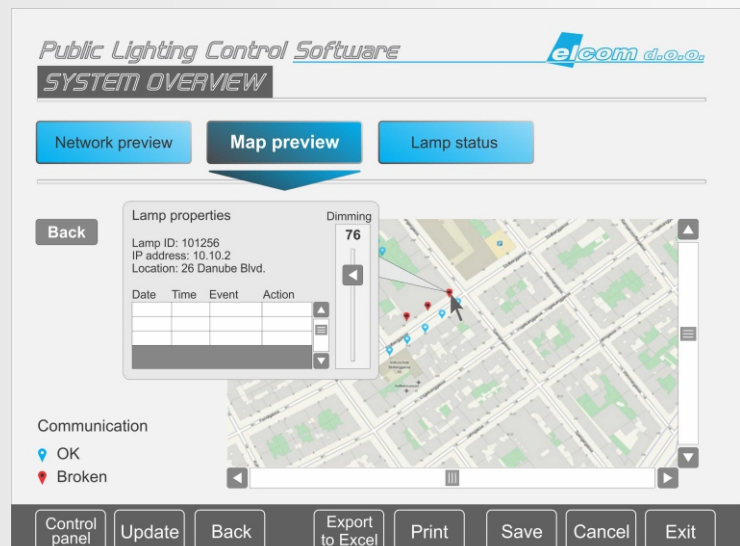
Overview of lighting programs applied to selected lamp group

At the end of lamps operational configuration, for each lamps group, and for selected future periods (from calendar) corresponding lighting program should be chosen from the list of pre-defined programs. Finally, each of lamp groups (each lamp) have to have attached program for all days in future period (for example, per year). Graphic overview of already “covered” days helps in completion of this requirement.

System overview option offers access to virtually all configuration or operating parameters of public lighting system. User can monitor in details functional process at the whole lighting network and control system (actual operating mode for individual lamp, group of lamps, lamps under each LCU device).



The appropriate non editable tables and graphs are available with all of the data which may be of interest to different software users. For instance, at the graph of LCU unit and accompanying LED lamps user may find status of each lamp accuracy (OK, Warning or Error). For individual lamp the static “inventory” data (ID, model, type, nominal electrical parameters, pole ID and type, character of its micro location area and illuminated surface, etc.) are available in tables. In a map view user can easily recognize each lamp at the street network, and recall its ID data, list of recent events, actual level of dimming, etc.





Public Lighting Control Software **elcom d.o.o.**

**ENERGY CONSUMPTION**

**Lamps & time selection** **Indicators**

**Lamps selection**

☐ Select lamp ID ☐ Select group ID ☒ Select LCU # ☐ Entire lamps network

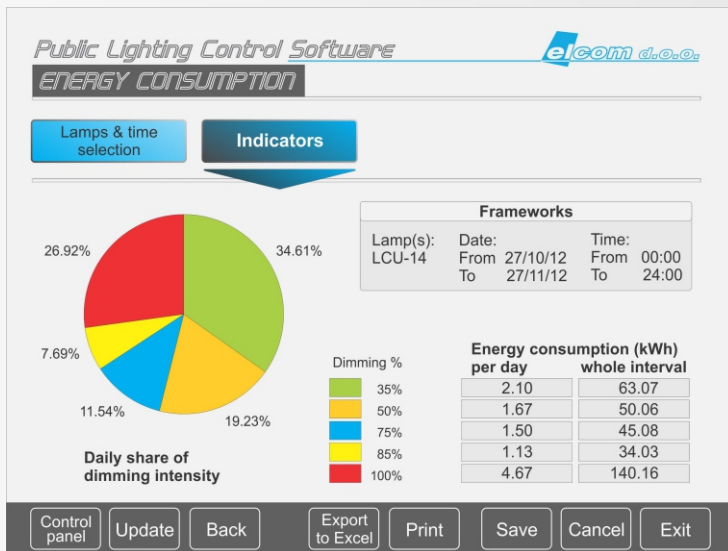
**Date & time selection**

Start date: 27/10/12 End date: 27/11/12 Start time: 16:00 End time: 17:30

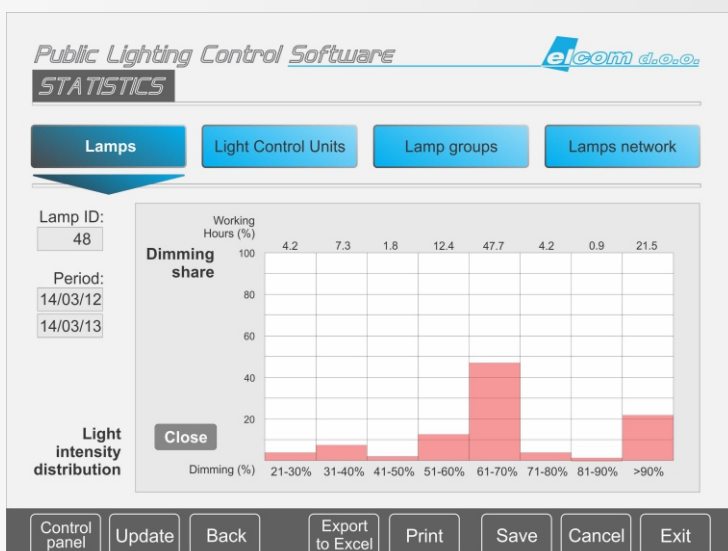
☐ Whole day

Control panel Update Back Export to Excel Print Save Cancel Exit

The needs of system technical maintenance service are specific, so related data and practical service tools are organized under the separate software block. Besides reports of system components accuracy, service staff can find "advisory" functions (expert system). For detected malfunction system automatically offers likely solution form build in service database. As the database is in constant upgrade, there is an option (table cell) where the service staff can enter the further details of solutions or answers to already uncovered problems. Periodically, say at 6 months, these records are analysed, formulated in the form of new recommendations and embedded in a block of software that is automatically recommending solutions to problems.



Various statistics are available for presentation and analytical purposes. Operational parameters are displayed in tabular or graphic form showing areal distribution of actual values or historic data for selected entity (Lamp, group of lamps, LCU or entire network).



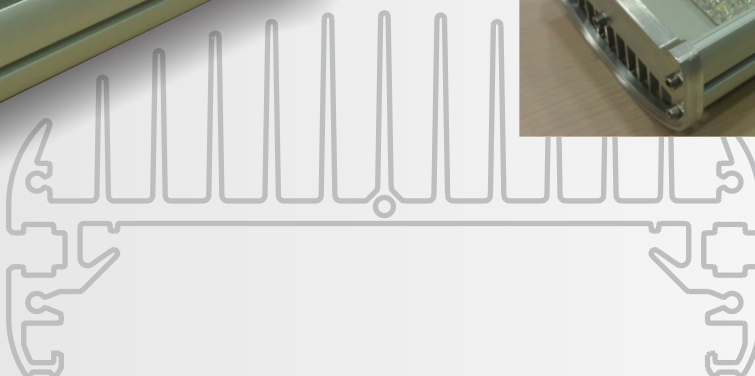
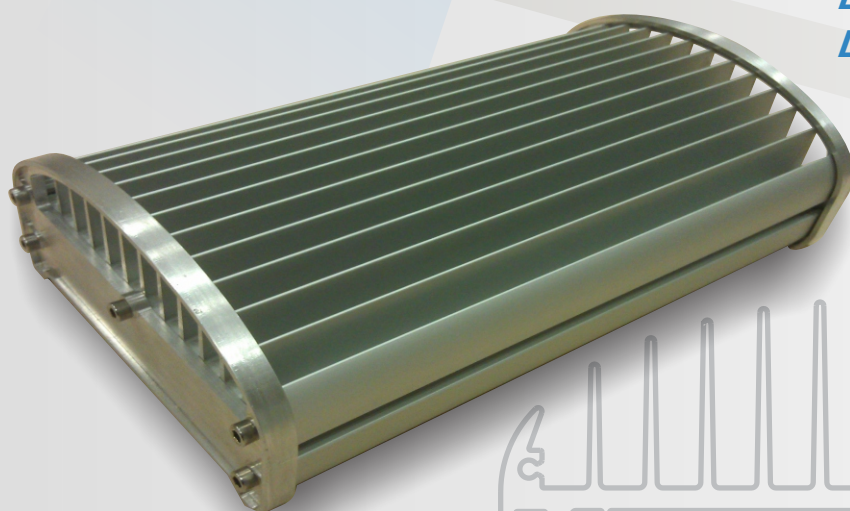
Emphasis was put on energy efficiency as one of the most favourable attribute of LED lighting. Statistics concerning this subject are collected under the separate block of software.

Owing to the fact that the PubLiCo software as well as the whole concept of LED public lighting system were developed by Elcom, it is relatively easy to adjust software to the each user particular requirements and to specifics of different public lighting networks. All software upgrades and improvements are available to the users in short time, and consultations are available practically non stop.



## ***LED luminaire for tunnel lighting***

*models: LEDNG-E-60-Lxx-Txx-S3  
LEDNG-E-120-Lxx-Txx-S5  
LEDNG-E-180-Lxx-Txx-S7  
LEDNG-E-240-Lxx-Txx-S9*



Tunnel LED luminaire is initially developed and adapted to the high demands of ambient lighting in road tunnels. It is also suitable as primary or additional lighting for applications at different transport and similar facilities (terminals, petrol stations, toll stations, border crossings, industrial halls etc.).

Thanks to the functional characteristics of the LED light source, the luminaire is reliable, durable, energy-efficient solution, thereby providing optimal light intensity and color, the custom requirements of each specific application. Different tunnel lighting demands connected to light radiation angularity can be precisely satisfied owing to precisely designed optics.

Optionally, luminaires can be fully remote controlled via wired (using only 230 VAC power supply – PLC) or wireless serial communication. This is especially important possibility for luminaires in tunnel adaptation zone.

Light intensity is automatically (by using light sensors, detectors qualifying event or the clock) or through an operator action controlled and can vary from 0 to 100%. The total energy consumption is in proportion to the intensity of light, enabling the development and application of “intelligent” and very energy efficient lighting control strategy.

## Technical features

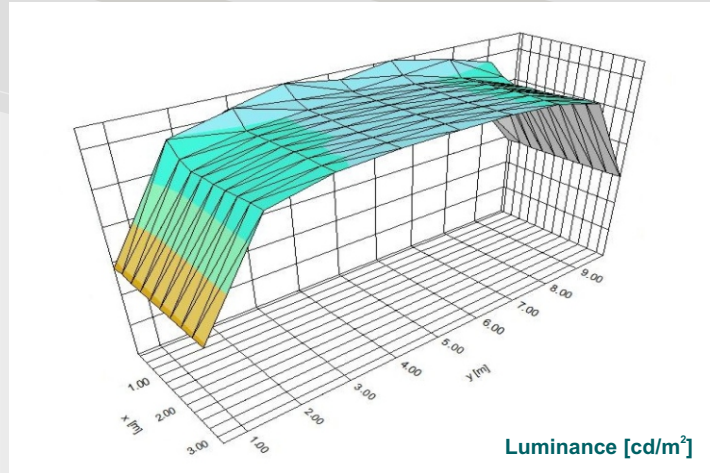
## LED luminaire for tunnel lighting

### a) Housing

- Material: extruded anodized aluminum,
- Dimensions: 360/ 600/ 850/ 1100 x 200 x 100 mm (L x W x H),
- Face (bottom side): tempered glass protector,
- Protection class: IP65,

### b) Light sources

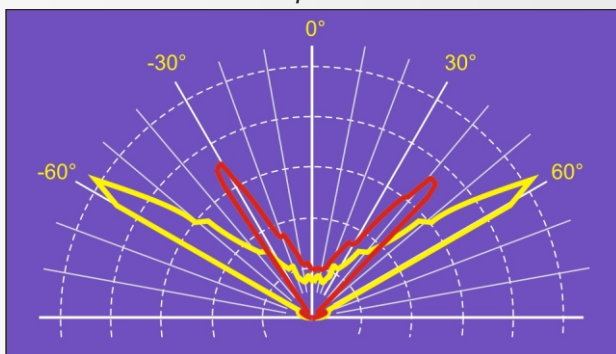
- White LEDs of high efficiency (about 150 lm/ W);
- Adjustable light intensity from 0 % to 100 % continuously (with proportional power consumption);
- Luminaire optical system (lenses L6, L7, L8 or L9) directs light only at the surface of interest (carriageway, etc.); The remaining area in the region was virtually unlit (energy savings and reducing of "light pollution");



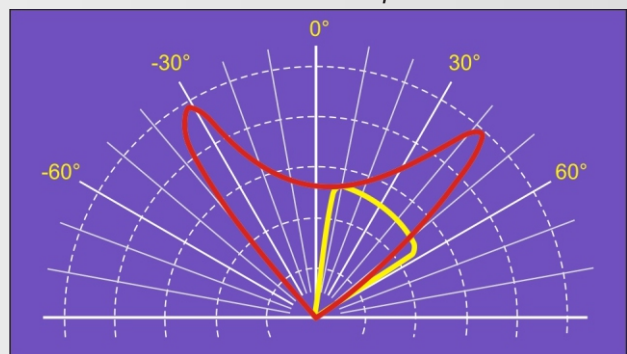
Optics type	Light radiation direction				Constant ...	Lighting type	Transversals radiation
	"straight"	"back"	"left"	"right"			
L6	10°	55°	-35°	35°	illuminance	adaptive	symetrical
L7	10°	55°	-30°	40°	illuminance	adaptive	asymetrical
L8	-60°	60°	-35°	35°	luminance	basic	symetrical
L9	-60°	60°	-30°	40°	luminance	basic	asymetrical

- Colour temperature of light radiated is 3800–5000 °K - colour type T2, T3, T4 or T5 (daylight close);
- CRI (colour reproduction index) is larger than 75;

tunnel central section - optics L9



tunnel entrance/ exit section - optics L7



### c) Electrical features

- Voltage: from 90 to 250 VAC (frequency 50 Hz),
- Power consumption: 60 W/ 120 W/ 180 W/ 240 W (depending of model),

### d) Temperature range

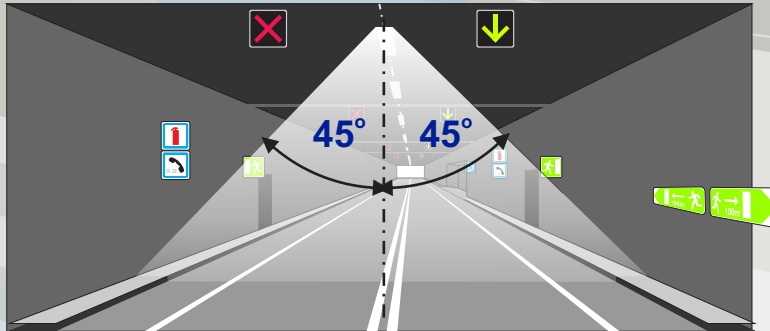
- -40° to 60° C,

### e) Options

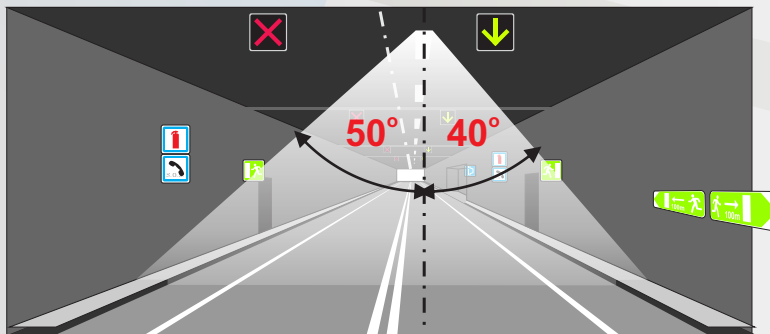
- Communicational connection to manage and monitor the intensity of the light.

### Tunnel cross-section

Different positions of luminaires row require corresponding light distribution to provide uniform road surface lighting and light concentration only to area of interest.

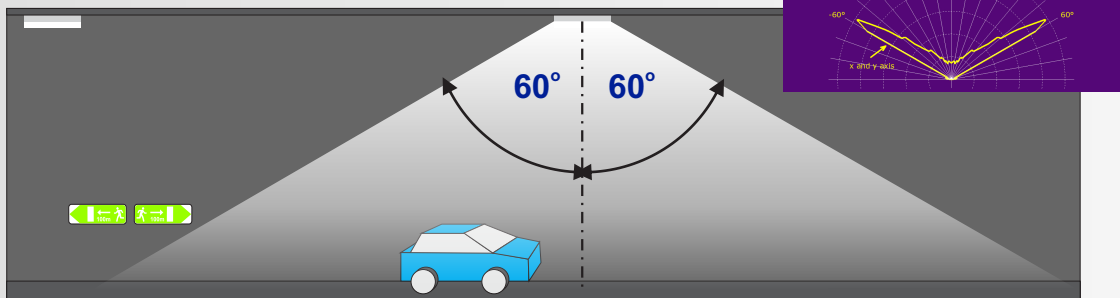


central position of luminaires row along the carriageway axis

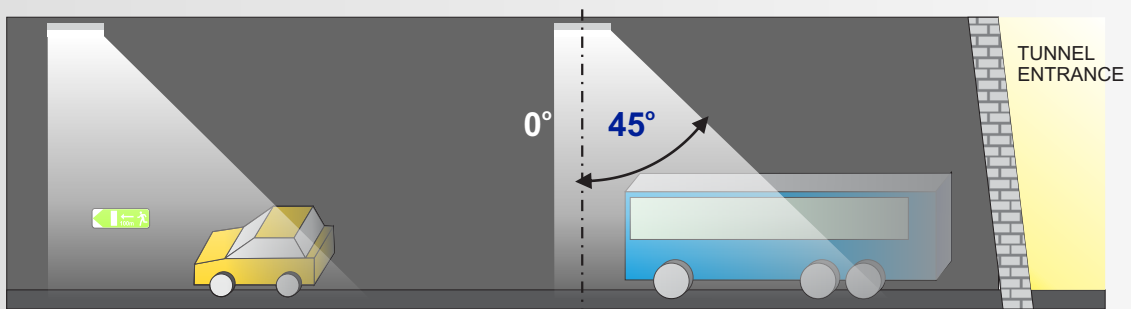


asymmetric position of luminaires row above one of traffic lanes

### Tunnel longitudinal section



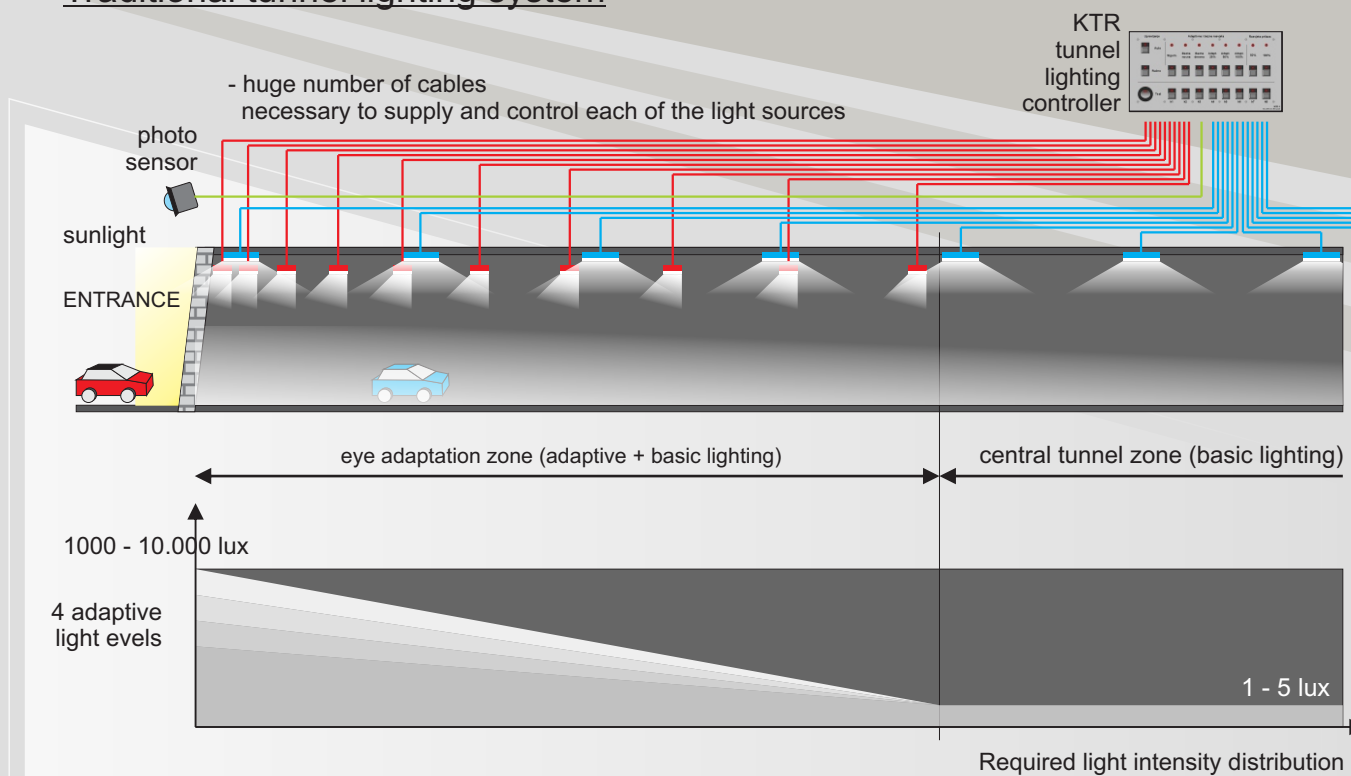
symmetrical light distribution inside the tunnel  
for larger section of road uniformly illuminated



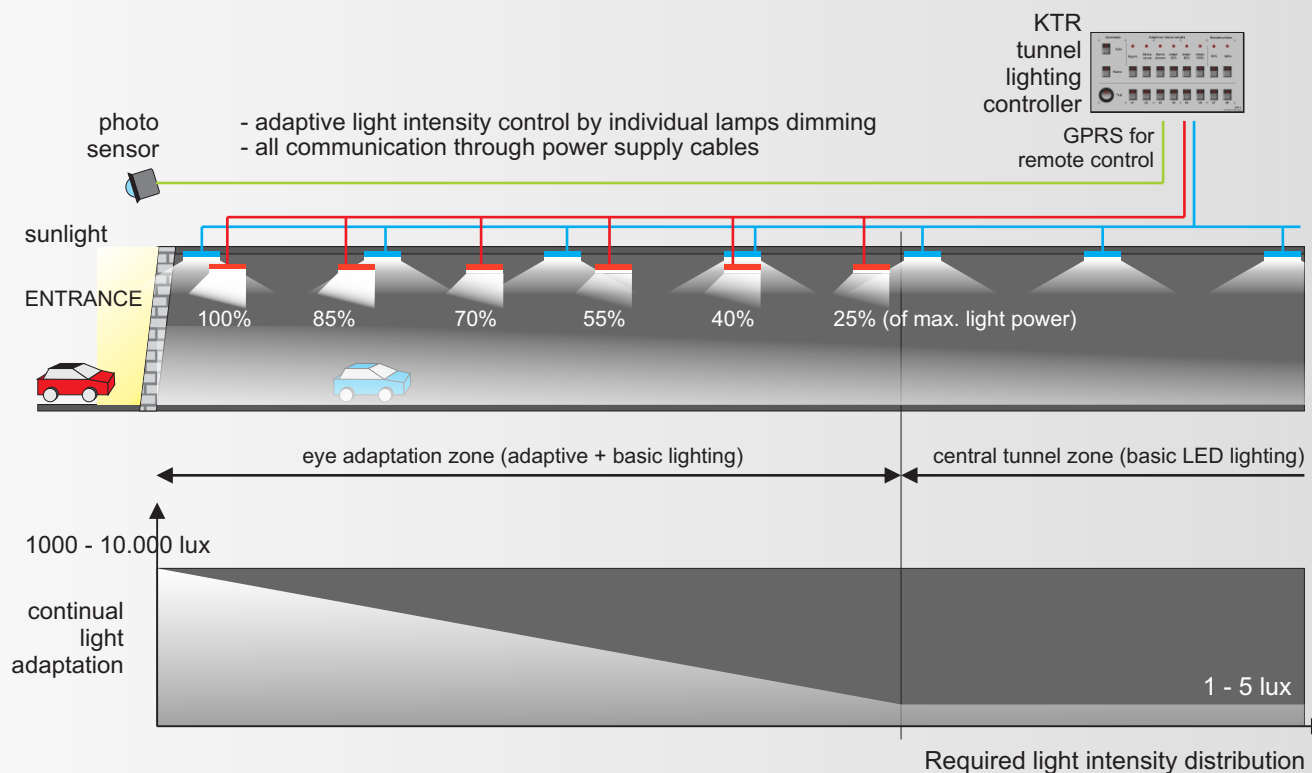
"contra flow" light distribution at the tunnel entrance/ exit  
for better vehicle noticeability when entering tunnel from daylight outside

# LED luminaire for tunnel lighting

## Traditional tunnel lighting system



## Advanced LED tunnel lighting system





# Photo sensor

*model: FS-1108*



Photo sensor is a device intended for measurement of light intensity, which can be used as a criterion for automatic selection of operating mode of different lighting subsystems or other parameters of various technical systems operation. Commonly is used in the tunnel lighting system, for intensity control of street lighting, for light intensity control of signs with internal illumination or displays based on LED technology. Photo sensor has a particularly significant role in flexible lighting system based on solar power and battery accumulation of energy, where it is necessary to ensure uninterrupted light operation at acceptable intensity level, with limited energy resources.

Photosensor FS1108 made by Elcom is a microprocessor device that consists of two units, one for light intensity measurement and units to connect to the (tunnel) installation. Based on intensity of external light unit generate four programmable digital outputs for controlling the adaptive lighting (in tunnel). The table below shows one of the possible and the usual combination of the measured intensity and programmed lighting modes.

Time of day / light conditions	Outside light intensity (lux)	Adaptive lighting
Nighttime	<15	0%
Dusk/ dawn	15 - 1,500	0%
Rainy day	1,500 - 15,000	25%
Moderately cloudy day	15,000 - 40,000	50%
Sunny day	>40,000	100%

## Technical features

### a) Housing

- Material: anodized aluminium,
- Outside dimensions: 254 x 180 x 90 mm,
- Sensor dimensions: 88 x 101 x 166 mm,
- Protection class: IP65,

### b) Electrical and light features

- Power supply: 220 VAC/ 5 V (+ 10%),
- Current: 300 mA (+ 10%),
- Lighting range: 0-65,000 lux,
- Adaptive lighting regime: 5 (when working alone),
- Programmable as a part of Tunnel Lighting Control System,

### c) Temperature range

- -25° to 55° C class T3 (EN 12966) minimal temperature,  
class T1 (EN 12966) maximal temperature,

### d) Communication type

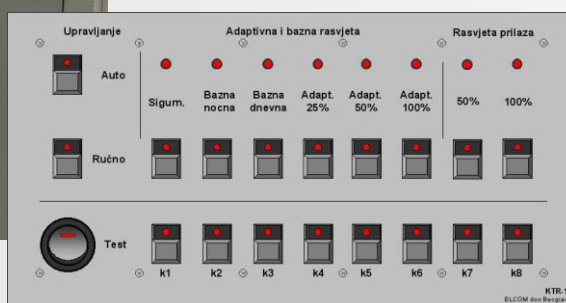
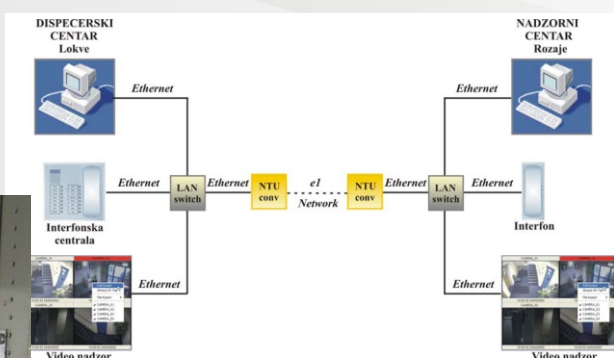
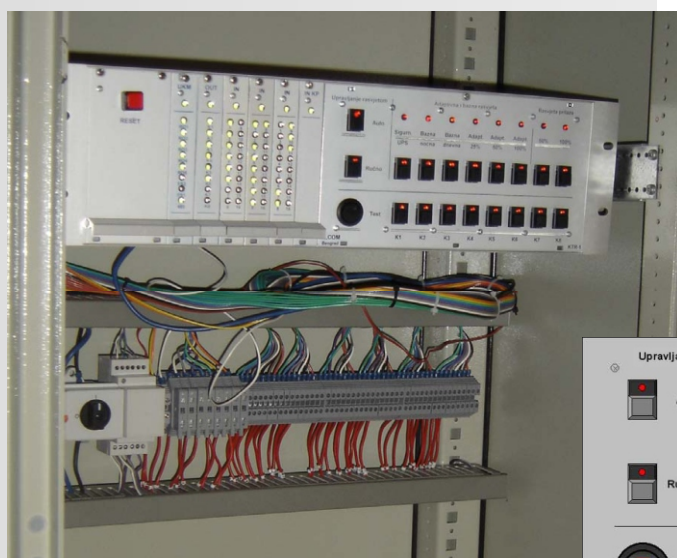
- Serial RS232: remote parameters programming,  
sensor state remote reading,

### e) Certification

- Device is manufactured in accordance with the professional findings of the Institute of Physics - University in Belgrade.

# Tunnel lighting controller

model: KTR-1



Tunnel lighting controller (KTR) is a micro-processor unit for monitoring and control of tunnel lighting. It is used in the management of adaptive lighting, basic lighting, and the lighting of tunnel entrances. By adapting tunnel lighting to light conditions in front of the object, KTR-1 provides optimum visibility conditions in the tunnel, the dynamic adjustment of the driver's eye light and energy saving.

The system can operate independently (in local mode) or in the system of remote monitoring and control equipment of the tunnel. It is designed for collecting data on the equipment and other systems in the tunnel section that covers, for performance of local automatic control sequences, for data sending to center for remote monitoring, for acceptance and execution of commands from the center.

# Tunnel lighting controller

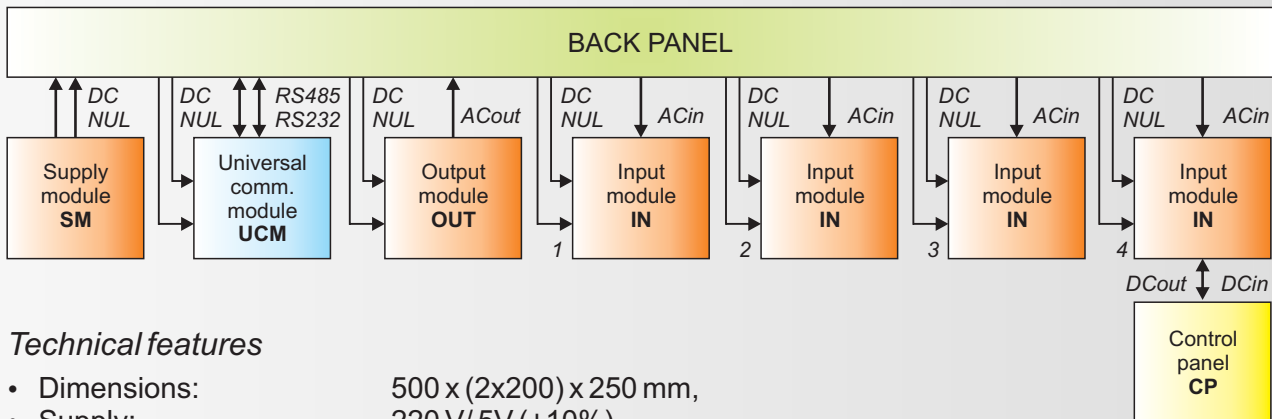
In local mode KTR provides three modes of tunnel lighting control:

- automatic control mode, in which the lighting mode is chosen by the control algorithm, depending on the parameters of light measured by sensor (luminance/ brightness),
- manual control mode, in which the lighting mode is chosen from the keyboard control panel device,
- test mode, in which every single AC/ DC output is controlled from control panel keyboard.

Remote control is provided via communication link between canter and tunnels. The type of communication links (Ethernet, GSM,...) depends of the type of used converters for RS232 / RS485 which transfer of all statuses and commands from the tunnel.

In a system of remote monitoring and control KTR provides automatic and manual control. In case of remote monitoring canter disconnection, KTR continues autonomously to perform a part of the local automatic control on the basis of available local signals. In case of cancellation of some of KTR the other communicate and work without interruption, owing to relay protection of communication channels.

**KTR-1 - electric scheme**



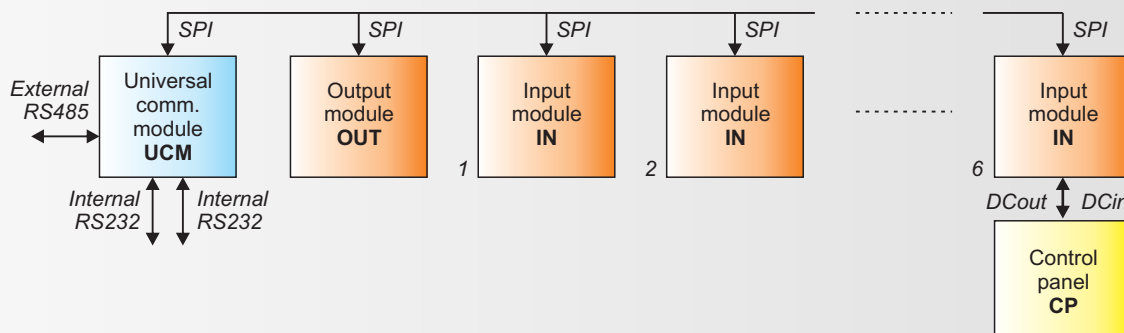
## Technical features

- Dimensions: 500 x (2x200) x 250 mm,
- Supply: 220 V/ 5V (+10%),
- Temperature range: -25° to +50 °C,

## Standard configuration

- SM - supply module 5 VDC, 25 W,
- UCM - universal communication module (RS485 - external channel, RS232 - two internal channels),
- OUT - output control module (maximal 8 AC/ DC outputs),
- IN - input indication module (maximal 16 AC/ DC inputs),
- CP - control panel (three modules for lighting control, programmable modes of lighting, test for maximum 8 AC/ DC outputs).

**KTR-1 - communicational scheme**





## ***Industrial LED luminaire***

***models: LEDNG-E-30-Lxx-Txx-S1  
LEDNG-E-45-Lxx-Txx-S1  
LEDNG-E-60-Lxx-Txx-S1  
LEDNG-E-75-Lxx-Txx-S1  
LEDNG-E-90-Lxx-Txx-S1***



LEDNG-E luminaire was initially developed and adapted to the lighting requirements of limited indoor and outdoor areas of public and technical facilities. It is also suitable as primary or additional lighting for applications at different transport and other industrial facilities and applications (terminals, petrol stations, toll stations, border crossings and other facilities with access control).

Thanks to the functional characteristics of the LED light source, luminaires are reliable, durable, energy-efficient solution, thereby providing optimal light intensity and color, the custom requirements of each specific application.

Especially important is the ability of luminaires full remote control via wired (using only 230 VAC power supply – there is no need for extra communicational wires) or through wireless serial communication. Light intensity is automatically (by using light sensors, detected qualifying event or the clock) or through an operator action controlled and can vary from 0 to 100%. The total energy consumption is in proportion to the intensity of light, enabling the development and application of “intelligent” and very energy efficient lighting control strategy.

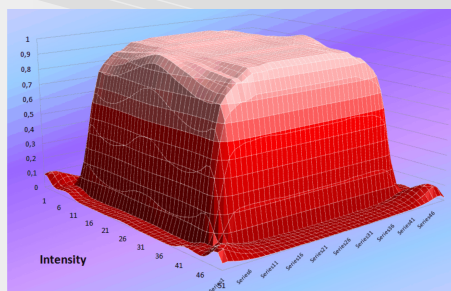
## Technical features

### a) Housing

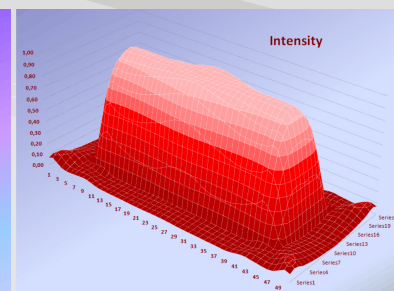
- Body: extruded, anodized aluminum,
- Dimensions: (840/ 575/ 310 - different models) x 80 x 50 mm (L x W x H),
- Face (bottom side): polycarbonate or glass protector,
- Protection class: IP65,

### b) Light sources

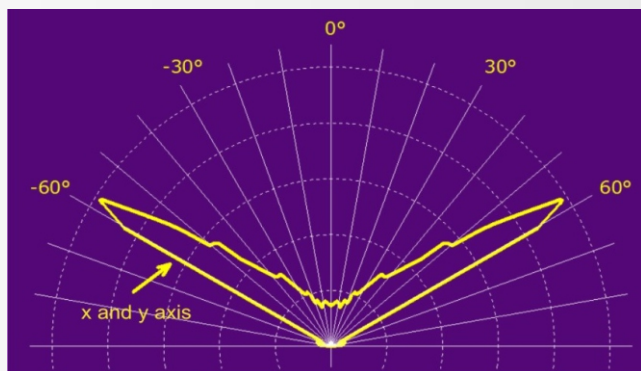
- White LEDs and RGB LEDs of high efficiency;
- Efficiency of LEDs about 150 lm/ W;
- Adjustable light intensity from 0 % to 100 % continuously (with proportional power consumption);
- Optical system (lenses type L2, L3, L4 or L5) directs the light only at the surface of interest (carriageway, sidewalk, access areas, etc.); The remaining area in the region was virtually unlit (energy savings and reducing of "light pollution");
- Example 1: Radiation  $x: \pm 60^\circ$ ,  $y: \pm 60^\circ$  (from a height of 2.5 m illuminates "rectangle" 8 x 8 m, uniformity within  $\pm 20\%$  limits);
- Example 2: Radiation  $x: \pm 60^\circ$ ,  $y: \pm 25^\circ$  (from a height of 5 m illuminates "rectangle" 17 x 5 m, uniformity within  $\pm 20\%$  limits);
- Colour temperature of light radiated is 3800–5000 °K - colour type T2, T3, T4 or T5 (daylight close);
- CRI (colour reproduction index) is larger than 75;
- Environmentally friendly, fully recyclable, without dangerous elements such as mercury, lead and sodium;



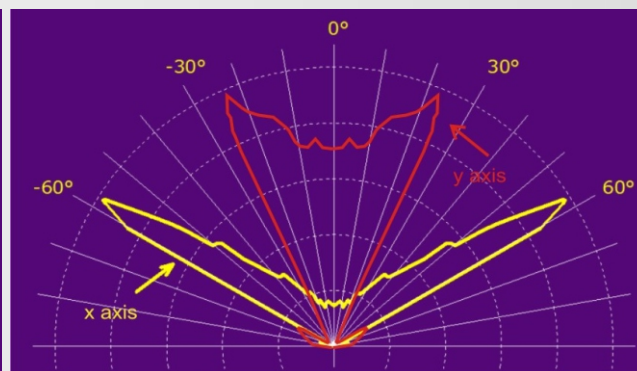
$x: \pm 60^\circ$ ,  $y: \pm 60^\circ$



$x: \pm 60^\circ$ ,  $y: \pm 25^\circ$



$x: \pm 60^\circ$ ,  $y: \pm 60^\circ$



$x: \pm 60^\circ$ ,  $y: \pm 25^\circ$

### c) Electrical features

- Voltage: 200 to 250 V (frequency 50 Hz),
- Power consumption: 30 W/ 45 W/ 60 W/ 75 W/ 90W (different models),
- Power factor: 0.98,

### d) Temperature range

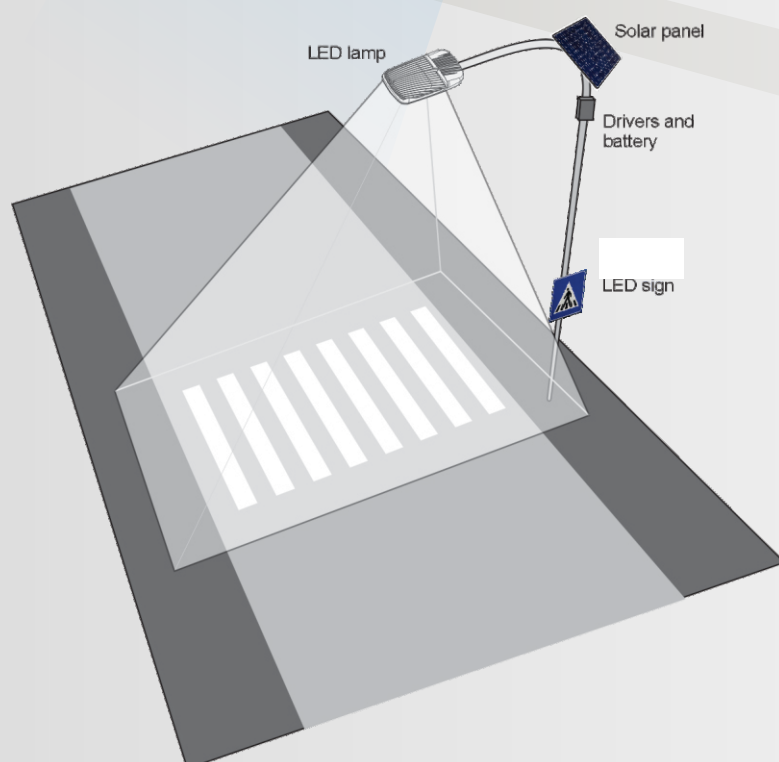
- $-40^\circ$  to  $60^\circ$  C,

### e) Options

- Communicational connection to manage and monitor the intensity of the light.

## ***Solar LED street luminaire***

*models: LEDNG-C-30-Lxx-Txx-S3-solar  
LEDNG-C-45-Lxx-Txx-S3-solar  
LEDNG-C-60-Lxx-Txx-S3-solar*



Thanks to the characteristics of LED light sources LEDNG luminaire is highly energy efficient, highly reliable, light intensity is fully controlled, without waste of light out of target area. These make it an ideal luminaire for solar "stand alone" applications.

LEDNG solar luminaire is designed for ambient lighting of street scene (carriageway and pavement surface), urban and interurban roads, their intersections and other transportation facilities and areas (terminals, petrol stations, parking lots, pedestrian crossings, walkways).

Solar LEDNG luminaire is designed to regulate its own light intensity depending of time of night, battery charge status and pre-programmed parameters (i.e., dates of interest). The communicational control can be realized using wires or wireless option.

LEDNG solar system consists of solar panel, LED luminaire, accumulators, power regulator, cabinet, pillar, and luminaire holders. Pillar and holders are made according to customer requirements, and in accordance to design of surrounding street scene mobilier.



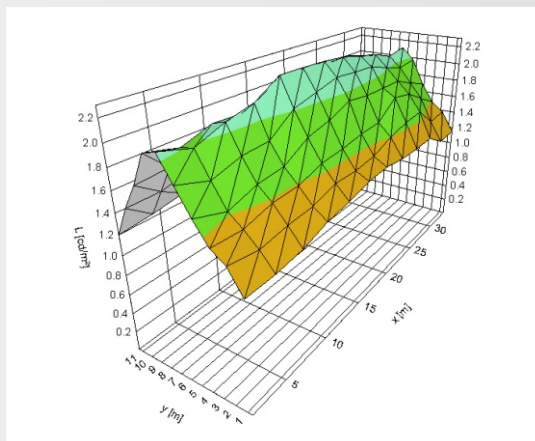
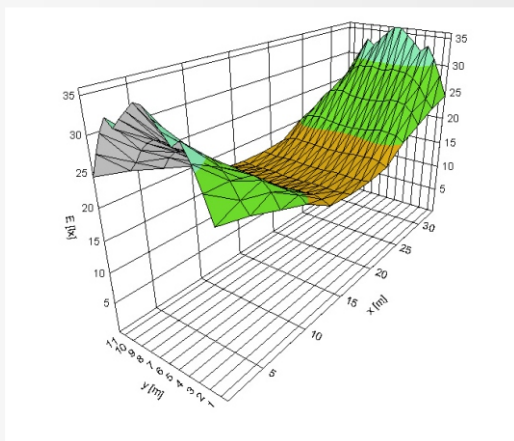
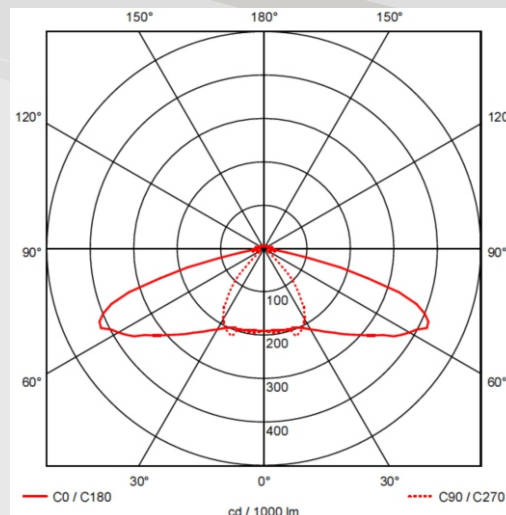
## Technical features

### a) Housing

- Body: robust, aluminum - cast under pressure,
- Dimensions: 430 x 230 x 60 mm (L x W x H),
- Face (bottom side): tempered glass protector,
- Protection class: IP65,

### b) Light sources

- White LEDs of high efficiency (about 150 lm/ W);
- Adjustable light intensity from 0 % to 100 % continuously (with proportional power consumption);
- Light directed only at the surface of interest (carriageway, sidewalk, access areas, etc.); The remaining area in the region was virtually unlit (energy savings and reducing of "light pollution");
- Radiation x:  $\pm 60^\circ$ , y:  $\pm 25^\circ$  (luminaire on a height of 10 m illuminates "rectangle" 35 x 11 m, uniformity within  $\pm 20$  % limits);
- Colour temperature of light radiated is 3800–5000 °K - colour type T2, T3, T4 or T5 (daylight close);
- CRI (color reproduction index) is larger than 75;
- Environmentally friendly, fully recyclable, without dangerous elements such as mercury, lead and natrium;



RELUX software simulation

### c) Electrical features

- Voltage: 75 Wp solar panel, accu 12 V, 60 Ah; optionally 120 Wp, accu 24 V, 60 Ah,
- Power consumption: 30 W/ 45 W/ 60 W (depending of model),
- Power factor: 0.92,

### d) Temperature range

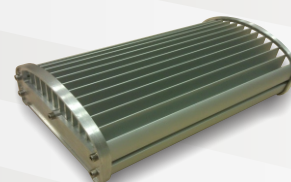
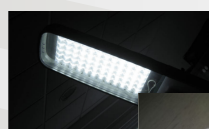
- $-40^\circ$  to  $60^\circ$  C,

### e) Options

- Communicational connection to manage and monitor the intensity of the light.



## ***LEDNG luminaires typology***



Available LEDNG luminaires:

	Type of housing	Nominal power (W)	Optics type	Light colour temperature	Housing size
Highway luminaire	C	120 150 180 210 240	L2 L3 L4 L5	T3 T4 T5 T6 T10	S3 S9
Street luminaire	C	30 45 60 75 90 105 120	L2 L3 L4 L5	T3 T4 T5 T6 T10	S3
Tunnel and object lighting luminaire	E	60 120 180 240	L2 L3 L4 L5	T3 T4 T5 T6 T10	S3 S5 S7 S9
Industrial luminaire	E	30 45 60 75 90	L2 L3 L4 L5	T3 T4 T5 T6 T10	S1 S3 S5
Solar luminaire	C	30 45 60	L2 L3 L4 L5	T3 T4 T5 T6 T10	S3

**LEDNG–a – bbb – Lcc – Tdd - See**

a mark of housing type  
 bbb mark of nominal power  
 Lcc mark of optics type  
 Tdd mark of light colour temperature  
 See mark of housing size

The name of LEDNG luminaire model is combination of available parameters:

Type of housing	Nominal power (W)	Optics type	Light colour temperature	Housing size
C	15 135	L2	T3	S1
E	30 150	L3	T4	S3
	45 165	L4	T5	S5
	60 180	L5	T6	S7
	75 195		T10	S9
	90 210			
	105 225			
	120 240			

Housing type (position “a”):

C – cast,  
 E – extruded;

Optics type (position “cc”):

Optics label	Angle* of light radiation - direction** “straight”	Angle* of light radiation - direction** “back”	Angle* of light radiation - direction** “left”	Angle* of light radiation - direction** “right”	Optics dominant feature: E- constant illuminance L- constant luminance
L2	-70°	70°	-15°	20°	L
L3	-25°	45°	-40°	30°	L
L4	-60°	60°	-25°	25°	E
L5	-30°	30°	-30°	30°	E

<sup>\*)</sup> Typical values are listed; Specific values are the result of application requests

<sup>\*\*) Relative to drivers eyes position</sup>

Light colour temperature (position “dd”):

T3 LED light temperature is 3000°K,  
 T4 LED light temperature is 4000°K,  
 T5 LED light temperature is 5000°K,  
 T6 LED light temperature is 6000°K,  
 T10 LED light temperature is over 6000°K.

Housing size (position “ee”):

S1 small housing,  
 S3 medium 1 housing,  
 S5 medium 2 housing,  
 S7 large 1 housing,  
 S9 large 2 housing.

Manufacturing and installation of 1042 LED luminaires at bridge “Mihajlo Pupin” over River Danube, *Belgrade Nord Tangent Infrastructure Project (2014)*

Design, manufacturing and installation of industrial LED lighting system (39 luminaires) and software for its full control, *FLASH, Belgrade (2013)*

Manufacture and supply of street LED lighting (20 luminaires) at residential area in Weissenstein, *Bilfinger Infrastructure GmbH, Vienna, Austria (2012)*

Two portal mounted multi-functional VMS displays in LED technology, and dot-matrix full colour LED displays for presentation of standard traffic signs at “Zeleznik” and “Lipak” tunnels built at Belgrade bypass road, *Belgrade Land Development Public Agency; “Roads of Serbia” Public Enterprise, Belgrade (2009)*

Manufacture and installation of automatic control and surveillance systems for public lighting, traffic lights remote control, automatic collection of parking-services fee, video surveillance of public areas, *Municipal Administration Authorities, Cacak (2006-2008)*



## Selected References

Manufacture and supply of LED lighting (10 luminaires) for FES, industrial facility in Frankfurt, *Bilfinger Infrastructure GmbH, Vienna, Austria (2012)*

Maintenance of Automatic Traffic Management System (SAUS), *Municipal Administration – Department of Transports, Belgrade (2007-2012)*

Manufacture, supply, installation of 16 intersections with adaptive traffic control, KSS-1 signal controller, remote control from control centre, video surveillance, pedestrian crossings additional LED lighting, *Municipal Administration, Cherkassy, Ukraine (2010-2012)*

Manufacture, supply and installation of road LED lighting pilot system (8 luminaires) at motorway section near city of Mongomo, *SOGECO S.A. & ECOC S.A., Malabo, Equatorial Guinea, Africa (2012)*

Design, manufacturing, installation of toll-collection and LED lighting equipment for pay-toll station at Malabo airport, *SOGECO S.A. & ECOC S.A., Malabo, Equatorial Guinea, Africa (2011)*

System for monitoring and management of TAXI service at Airport “Nikola Tesla”- Belgrade, *Municipal Administration - Public Transport Directorate, Belgrade (2011)*

Design, manufacturing, installation of equipment for passing control, toll-collection, road approaches and indoor LED lighting, with solar energy supply of 7 pay-toll stations along the road network, *SOGECO S.A. & ECOC S.A., Malabo, Equatorial Guinea, Africa (2007-2010)*

Remote control and surveillance system for 31 controllers at corridors Takovska-Kneza Milosa, Nemanjina, Sarajevska and Karadjordjeva street, *Municipal Administration – Department of Transports, Belgrade (2010)*

Multifunctional VMS display in LED technology, portal type, installed on access road to urban network, *Utility Services, PC; Traffic Control Centre, Podgorica, Montenegro (2009)*

Manufacture and installation of traffic signalization and equipment for lighting control of “Lipak” and “Zeleznik” tunnels, *Belgrade Land Development Public Agency; “Roads of Serbia” Public Enterprise, Belgrade (2008)*

Traffic Study and Preliminary Design of Traffic Control System and Video Surveillance System, *Province of Luanda Administration Office, Luanda, Angola, Africa (2008)*

Manufacture, supply and installation of 25 units of KSS-1 traffic light controllers, including equipment for Remote Control and Surveillance Centre, *Utility Services, PC; Traffic Control Centre. Podgorica, Montenegro (2008)*

Manufacture and installation of traffic signalization and lighting control equipment of “Ovcar banja” tunnel, *Municipal Administration Authorities and Public Utility Companies, Cacak-Uzice (2007)*

Manufacture, supply and installation of 20 units of KSS-1 traffic signals controllers, *The Government, Department of Transports, Republic of Ghana, Africa (2007)*

Manufacture, supply and installation of over 170 units of KSS-1 traffic signal controllers, *Municipal Administration Authorities and Public Utility Companies, Serbia and Montenegro (2002-2007)*

Remote control and surveillance system for 48 signal-controlled intersections, *Urban Construction Office, Novi Sad (2002-2007)*

Design, manufacture and installation of hardware and software for remote control and surveillance of lighting system in “Krznice” and “Manajle” tunnels, *Urban Construction Office, Nis-Vranje (2006)*

Manufacture, supply and installation of 8 units of KSS-1 traffic signal controllers, *The Government of the Republic of Gambia, Gambia, Africa (2006)*

Manufacture, supply, installation of 77 units of traffic KSS-1 signal controllers (12 for detector operation), *Municipal Administration – Department of Transports, Belgrade (2004-2006)*

**Elcom** was a privately owned company founded in 1994, now operating within Q-Free company. . Presently, it has a creative team of specialists in electronics, telecommunications, programming and traffic. The basic business orientation comprises the following: design, development, manufacturing, incorporation, and maintenance of advanced processing, public lighting and communication technology in traffic based on electronics.



**Our  
Coordinates**

In the last years, the developing and manufacturing programs of **Elcom** have been directed towards the components and integrated systems of traffic light signalization, detector control over traffic processes, remote control over equipment and devices by wire and wireless communication, firmware, use of LED and video technology within ITS applications, LED luminaires and intelligent control systems for public lighting, tunnels, industrial facilities, etc.

In addition to its creative potentials and with respect to the development of equipment, **Elcom** relies on cooperation with the relevant entities (colleges/ faculties, institutes, companies) among which the outstanding contribution is given by the Institute of Physics, Faculty of Electrical Engineering and the Traffic Engineering Faculty in Belgrade, "Mihajlo Pupin" Institute, Traffic Engineering Institute CIP, Highways Institute, etc.

One of the principles of **Elcom's** business operation applied to distant markets is based on providing corresponding strategic partners. Such partners are suitable for the transference of technology in order to establish an efficient and economical manufacturing of major portion of the equipment to be offered, or with the aim to provide prompt and efficient maintenance of the equipment already installed.

The striking **Elcom's** creative developing potentials provide meeting of users' particular demands and offering tailor made solutions well adjusted to his requirements of any kind.

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