

## **AEE - sediul Stefan cel Mare**

Renovarea sistemului de iluminat al sediului AEE pe bd. Stefan cel mare 162, et. 10

Data: 02.04.2019  
Proiectant:

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Fax  
e-mail

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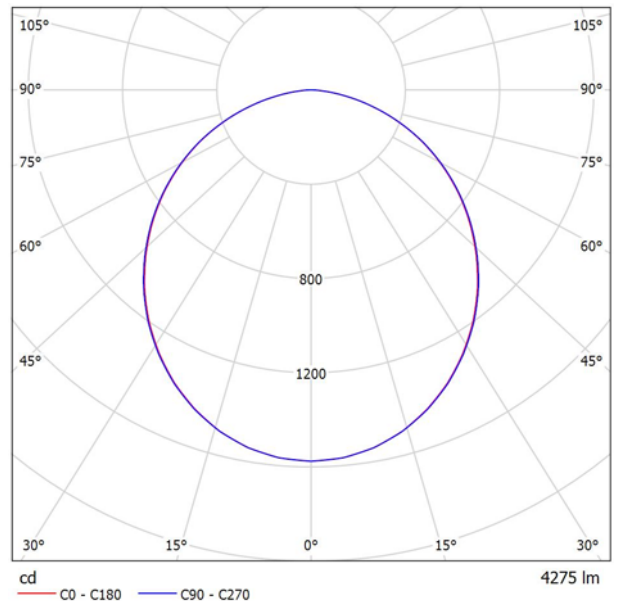


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**LUG Light Factory 903061.00918 6045 LUGCLASSIC LB 600x600 nt 4350lm 840 PLX  
biały / Fișă cu date corpuri de iluminat**

Distribuția luminoasă 1:

Vedeți catalogul nostru de corpuri de iluminat pentru o imagine a corpului de iluminat.



Clasificarea corpurilor de iluminat conform CIE: 100  
Cod flux CIE: 48 80 96 100 100

Distribuția luminoasă 1:

Evaluarea orbirii conform UGR											
ρ Tavan		70	70	50	50	30	70	70	50	50	30
ρ Pereți		50	30	50	30	30	50	30	50	30	30
ρ Podea		20	20	20	20	20	20	20	20	20	20
Dimensiunile spațiului X Y		Direcția vederii transversală la axa lămpii					Direcția vederii paralelă la axa lămpii				
2H	2H	18.1	19.4	18.4	19.6	19.8	18.1	19.4	18.4	19.7	19.9
	3H	19.6	20.8	19.9	21.0	21.3	19.6	20.8	20.0	21.1	21.4
	4H	20.2	21.3	20.5	21.6	21.9	20.2	21.3	20.6	21.6	21.9
	6H	20.5	21.6	20.9	21.9	22.2	20.6	21.6	21.0	21.9	22.2
	8H	20.6	21.6	21.0	22.0	22.3	20.7	21.7	21.1	22.0	22.3
4H	12H	20.7	21.6	21.1	22.0	22.3	20.7	21.7	21.1	22.0	22.4
	2H	18.8	19.9	19.1	20.2	20.4	18.8	19.9	19.1	20.2	20.5
	3H	20.4	21.4	20.8	21.7	22.1	20.5	21.4	20.9	21.8	22.1
	4H	21.1	22.0	21.5	22.3	22.7	21.2	22.0	21.6	22.4	22.7
	6H	21.6	22.4	22.1	22.7	23.1	21.7	22.4	22.1	22.8	23.2
8H	8H	21.8	22.5	22.2	22.9	23.3	21.8	22.5	22.3	22.9	23.3
	12H	21.9	22.5	22.3	22.9	23.3	21.9	22.5	22.3	22.9	23.4
	4H	21.4	22.1	21.9	22.5	22.9	21.5	22.1	21.9	22.5	22.9
	6H	22.0	22.6	22.5	23.0	23.5	22.1	22.6	22.5	23.1	23.5
	8H	22.2	22.7	22.7	23.2	23.6	22.3	22.8	22.8	23.2	23.7
12H	12H	22.4	22.8	22.8	23.2	23.7	22.4	22.8	22.9	23.3	23.8
	4H	21.4	22.1	21.9	22.5	22.9	21.5	22.1	21.9	22.5	22.9
	6H	22.1	22.6	22.6	23.0	23.5	22.1	22.6	22.6	23.1	23.5
8H	22.3	22.7	22.8	23.2	23.7	22.4	22.8	22.8	23.2	23.7	
Variația poziției observatorului pentru distanțele S ale corpurilor de iluminat											
S = 1.0H		+0.1 / -0.1					+0.1 / -0.1				
S = 1.5H		+0.2 / -0.4					+0.2 / -0.4				
S = 2.0H		+0.4 / -0.7					+0.4 / -0.7				
Tabel standard		BK05					BK05				
Suma corecțiilor		4.7					4.7				
Indici de orbire corecțai referitor la 4275lm Flux luminos total											

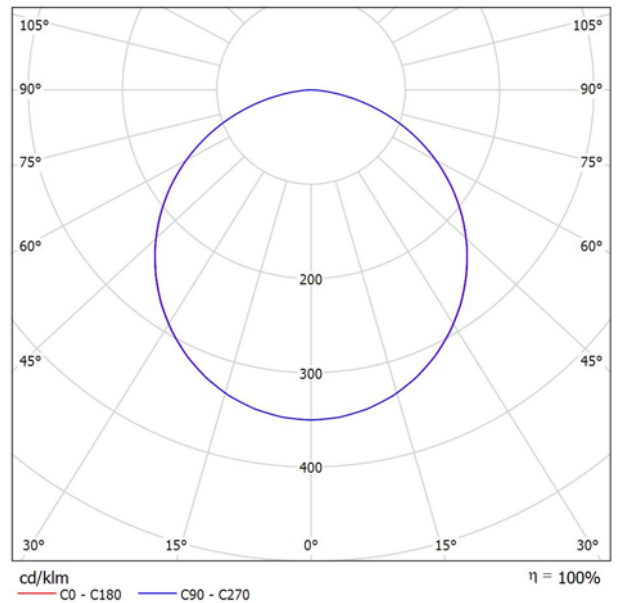


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## LUG LIGHT FACTORY 300061.00065 3361\_4 LUGCLASSIC ECO LB LED NT 4500 840 / Fișă cu date corpuri de iluminat

Distribuția luminoasă 1:

Vedeți catalogul nostru de corpuri de iluminat pentru o imagine a corpului de iluminat.



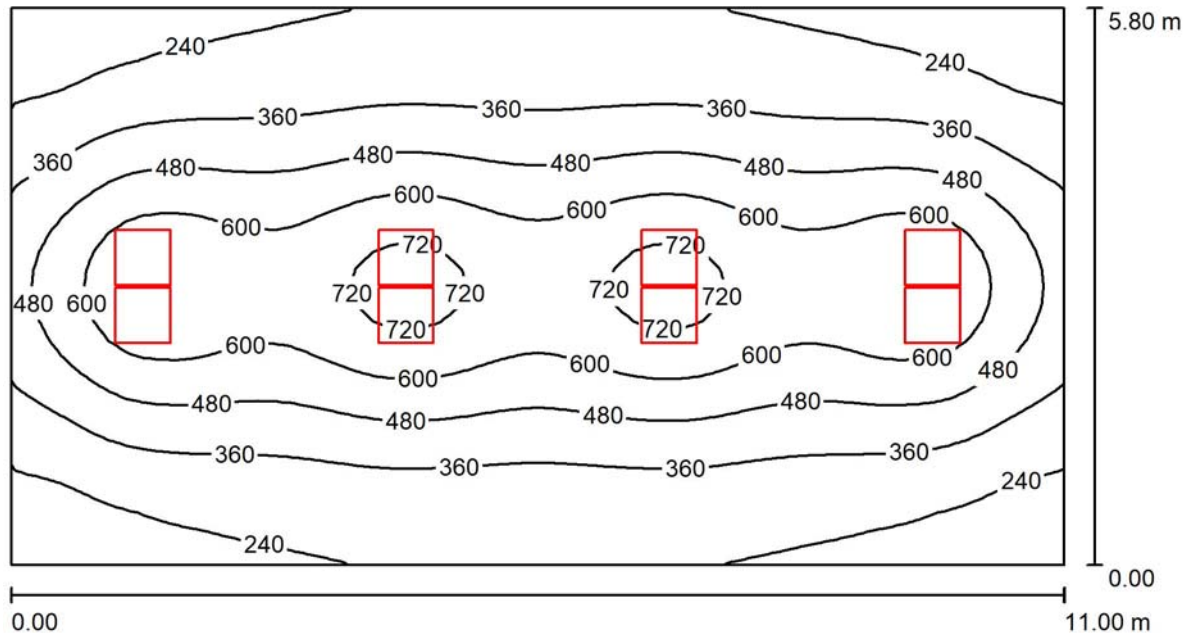
Clasificarea corpurilor de iluminat conform CIE: 100  
Cod flux CIE: 47 79 96 100 100

Distribuția luminoasă 1:

Evaluarea orbirii conform UGR											
ρ Tavan	70	70	50	50	30	70	70	50	50	30	
ρ Pereți	50	30	50	30	30	50	30	50	30	30	
ρ Podea	20	20	20	20	20	20	20	20	20	20	
Dimensiunile spațiului x y	Direcția vederii transversală la axa lămpii					Direcția vederii paralelă la axa lămpii					
	2H	2H	19.6	20.9	19.9	21.2	21.4	19.6	21.0	19.9	21.2
	3H	21.2	22.4	21.5	22.7	22.9	21.2	22.4	21.5	22.7	23.0
	4H	21.8	22.9	22.1	23.2	23.5	21.8	23.0	22.2	23.2	23.5
	6H	22.2	23.2	22.6	23.6	23.9	22.2	23.3	22.6	23.6	23.9
	8H	22.3	23.3	22.7	23.6	24.0	22.3	23.4	22.7	23.7	24.0
	12H	22.3	23.3	22.7	23.6	24.0	22.4	23.4	22.8	23.7	24.0
4H	2H	20.3	21.5	20.7	21.7	22.0	20.3	21.5	20.7	21.7	22.0
	3H	22.1	23.0	22.4	23.4	23.7	22.1	23.1	22.5	23.4	23.7
	4H	22.8	23.7	23.2	24.0	24.4	22.8	23.7	23.2	24.0	24.4
	6H	23.3	24.1	23.7	24.4	24.8	23.3	24.1	23.8	24.5	24.9
	8H	23.5	24.2	23.9	24.5	25.0	23.5	24.2	23.9	24.6	25.0
	12H	23.5	24.2	24.0	24.6	25.0	23.6	24.2	24.0	24.6	25.0
8H	4H	23.1	23.8	23.5	24.2	24.6	23.1	23.8	23.5	24.2	24.6
	6H	23.7	24.3	24.2	24.7	25.2	23.7	24.3	24.2	24.7	25.2
	8H	23.9	24.4	24.4	24.9	25.4	24.0	24.5	24.4	24.9	25.4
	12H	24.1	24.5	24.6	25.0	25.5	24.1	24.5	24.6	25.0	25.5
12H	4H	23.1	23.7	23.6	24.1	24.6	23.1	23.7	23.6	24.2	24.6
	6H	23.8	24.3	24.3	24.7	25.2	23.8	24.3	24.3	24.7	25.2
	8H	24.0	24.4	24.5	24.9	25.4	24.0	24.5	24.5	24.9	25.4
Variația poziției observatorului pentru distanțele S ale corpurilor de iluminat											
S = 1.0H	+0.1 / -0.1					+0.1 / -0.1					
S = 1.5H	+0.2 / -0.4					+0.2 / -0.3					
S = 2.0H	+0.4 / -0.7					+0.4 / -0.7					
Tabel standard	BK06					BK06					
Suma corecțiilor	6.8					6.8					
Indici de orbire corecțai referitor la 3700lm Flux luminos total											

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### Situatia 1. Sala sedinte 300061.00150 / Rezumat



Înălțimea spațiului: 3.000 m, Înălțime de montare: 3.000 m, Factor de menținere: 0.90

Valoare în Lux, Scară 1:79

Suprafață	$\rho$ [%]	$E_m$ [lx]	$E_{min}$ [lx]	$E_{max}$ [lx]	$u_0$
Plan util	/	434	172	768	0.396
Podea	20	380	193	553	0.509
Tavan	70	87	59	127	0.676
Pereți (4)	50	200	74	495	/

Plan util:	UGR	Pe lungime-	Transversal	la axa corpului de iluminat
Înălțime: 0.800 m				
Raster: 64 x 32 Puncte				
Zonă de margine: 0.000 m				
		Perete stânga 21	21	
		Perete inferior 21	21	
		(CIE, SHR = 0.25.)		

#### Listă bucăți corpuri de iluminat

Nr.	Bucăți	Denumire (Factor de corecție)	$\Phi$ (Corp de iluminat) [lm]	$\Phi$ (Lămpi) [lm]	P [W]
1	8	LUG LIGHT FACTORY 300061.00150 4040 LUGCLASSIC LB LED PLX PT 600 840 (1.000)	4350	4350	39.0
			Total: 34800	Total: 34800	312.0

Putere specifică:  $4.89 \text{ W/m}^2 = 1.13 \text{ W/m}^2/100 \text{ lx}$  (Suprafață:  $63.80 \text{ m}^2$ )

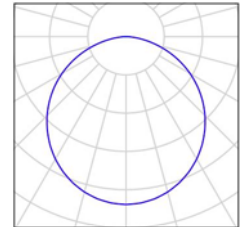


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### Situatia 1. Sala sedinte 300061.00150 / Listă număr corpuri de iluminat

8 Bucăți LUG LIGHT FACTORY 300061.00150 4040  
LUGCLASSIC LB LED PLX PT 600 840  
Nr.articol: 300061.00150  
Flux luminos (Corp de iluminat): 4350 lm  
Flux luminos (Lămpi): 4350 lm  
Putere corpuri de iluminat: 39.0 W  
Clasificarea corpurilor de iluminat conform CIE:  
100  
Cod flux CIE: 47 79 96 100 100  
Dotare: 1 x LED 4000K (Factor de corecție  
1.000).

Vedeți catalogul nostru  
de corpuri de iluminat  
pentru o imagine a  
corpului de iluminat.



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### Situatia 1. Sala sedinte 300061.00150 / Rezultate fotometrice

Flux luminos total: 34800 lm  
Putere totală: 312.0 W  
Factor de menținere: 0.90  
Zonă de margine: 0.000 m

Suprafață	Iluminare medie [lx]			Grade de reflexie [%]	Luminanță medie [cd/m <sup>2</sup> ]
	direct	indirect	total		
Plan util	356	78	434	/	/
Podea	296	83	380	20	24
Tavan	0.00	87	87	70	19
Perete 1	110	78	188	50	30
Perete 2	149	76	224	50	36
Perete 3	110	78	187	50	30
Perete 4	149	76	224	50	36

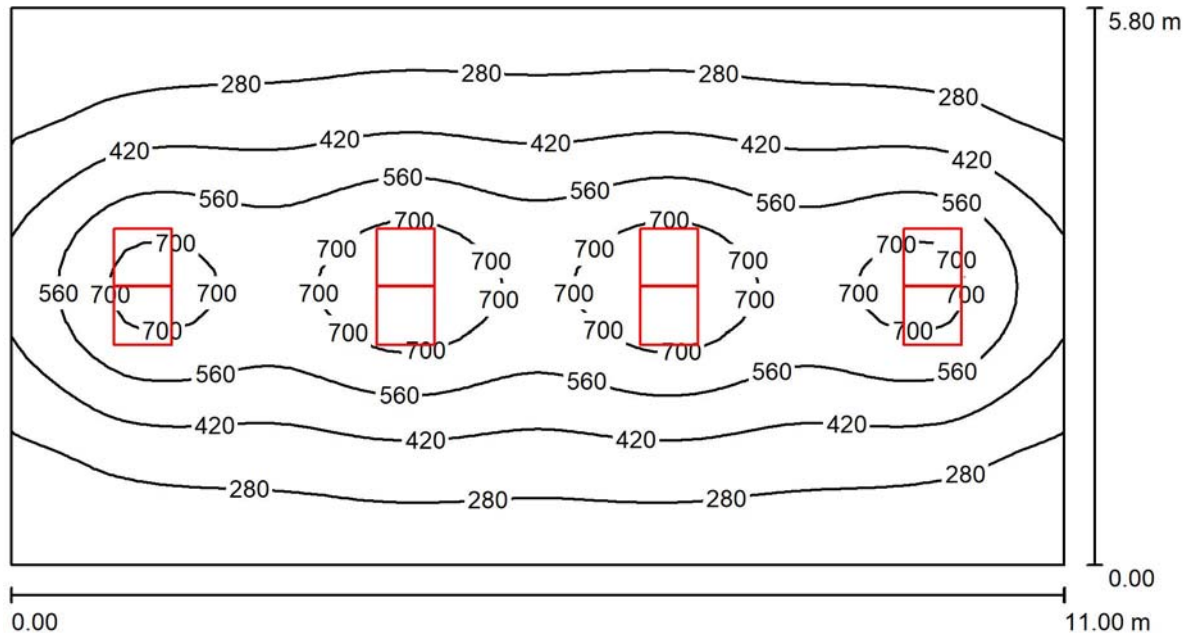
Uniformitate pe planul util  
u<sub>0</sub>: 0.396 (1:3)  
E<sub>min</sub>/E<sub>max</sub>: 0.224 (1:4)

**UGR** Pe lungime- Transversal la axa corpului de iluminat  
Perete stânga 21 21  
Perete inferior 21 21  
(CIE, SHR = 0.25.)

Putere specifică:  $4.89 \text{ W/m}^2 = 1.13 \text{ W/m}^2/100 \text{ lx}$  (Suprafață: 63.80 m<sup>2</sup>)

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### Situatia 1. Sala sedinte 903061.00918 / Rezumat



Înălțimea spațiului: 3.000 m, Înălțime de montare: 3.000 m, Factor de menținere: 0.90

Valoare în Lux, Scară 1:79

Suprafață	$\rho$ [%]	$E_m$ [lx]	$E_{min}$ [lx]	$E_{max}$ [lx]	$u_0$
Plan util	/	435	161	818	0.369
Podea	20	382	185	575	0.485
Tavan	70	84	55	103	0.660
Pereți (4)	50	188	65	478	/

Plan util:	Înălțime:	Raster:	Zonă de margine:	UGR	Pe lungime-	Transversal	la axa corpului de iluminat
	0.800 m	64 x 32 Puncte	0.000 m				
				(CIE, SHR = 0.25.)	22	22	
					21	21	

#### Listă bucăți corpuri de iluminat

Nr.	Bucăți	Denumire (Factor de corecție)	$\Phi$ (Corp de iluminat) [lm]	$\Phi$ (Lămpi) [lm]	P [W]
1	8	LUG Light Factory 903061.00918 6045 LUGCLASSIC LB 600x600 nt 4350lm 840 PLX bialy (1.000)	4275	4275	41.1
Total:			34200	34200	329.0

Putere specifică:  $5.16 \text{ W/m}^2 = 1.19 \text{ W/m}^2/100 \text{ lx}$  (Suprafață:  $63.80 \text{ m}^2$ )





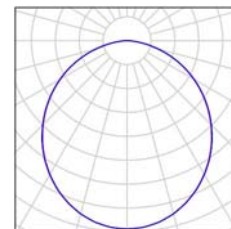
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### Situatia 1. Sala sedinte 903061.00918 / Listă număr corpuri de iluminat

8 Bucăți

LUG Light Factory 903061.00918 6045  
LUGCLASSIC LB 600x600 nt 4350lm 840 PLX  
bialy  
Nr.articol: 903061.00918  
Flux luminos (Corp de iluminat): 4275 lm  
Flux luminos (Lămpi): 4275 lm  
Putere corpuri de iluminat: 41.1 W  
Clasificarea corpurilor de iluminat conform CIE:  
100  
Cod flux CIE: 48 80 96 100 100  
Dotare: 1 x LED (Factor de corecție 1.000).

Vedeți catalogul nostru  
de corpuri de iluminat  
pentru o imagine a  
corpului de iluminat.



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### Situatia 1. Sala sedinte 903061.00918 / Rezultate fotometrice

Flux luminos total: 34200 lm  
Putere totală: 329.0 W  
Factor de menținere: 0.90  
Zonă de margine: 0.000 m

Suprafață	Iluminare medie [lx]			Grade de reflexie [%]	Luminanță medie [cd/m <sup>2</sup> ]
	direct	indirect	total		
Plan util	361	74	435	/	/
Podea	302	80	382	20	24
Tavan	0.01	84	84	70	19
Perete 1	100	75	175	50	28
Perete 2	139	73	212	50	34
Perete 3	100	75	175	50	28
Perete 4	139	73	212	50	34

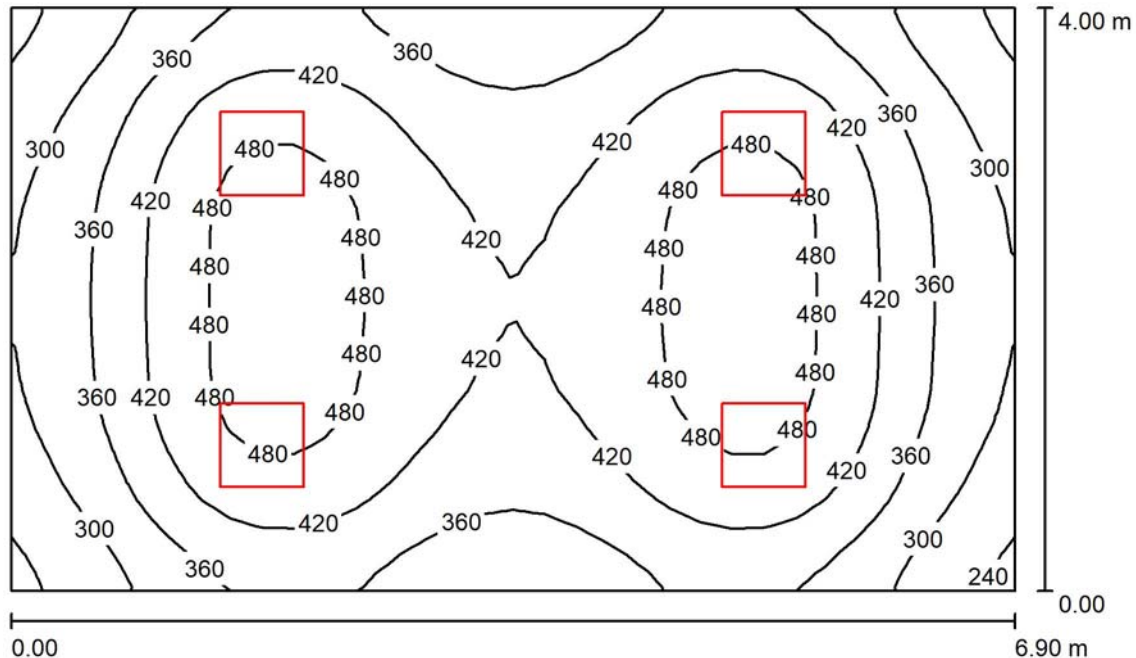
Uniformitate pe planul util  
u<sub>0</sub>: 0.369 (1:3)  
E<sub>min</sub>/E<sub>max</sub>: 0.196 (1:5)

**UGR** Pe lungime- Transversal la axa corpului de iluminat  
Perete stânga 22 22  
Perete inferior 21 21  
(CIE, SHR = 0.25.)

Putere specifică:  $5.16 \text{ W/m}^2 = 1.19 \text{ W/m}^2/100 \text{ lx}$  (Suprafață: 63.80 m<sup>2</sup>)

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## Situatia 2. Birou 6.9x4 30061.00150 / Rezumat



Înălțimea spațiului: 3.000 m, Înălțime de montare: 3.000 m, Factor de menținere: 0.90

Valoare în Lux, Scară 1:52

Suprafață	$\rho$ [%]	$E_m$ [lx]	$E_{min}$ [lx]	$E_{max}$ [lx]	$u_0$
Plan util	/	400	229	511	0.572
Podea	20	330	216	398	0.654
Tavan	70	97	67	116	0.690
Pereți (4)	50	229	88	514	/

### Plan util:

Înălțime: 0.800 m  
Raster: 32 x 32 Puncte  
Zonă de margine: 0.000 m

### UGR

Pe lungime-  
Perete stânga 20  
Perete inferior 18  
(CIE, SHR = 0.25.)

Pe lungime-

Transversal

la axa corpului de iluminat

### Listă bucăți corpuri de iluminat

Nr.	Bucăți	Denumire (Factor de corecție)	$\Phi$ (Corp de iluminat) [lm]	$\Phi$ (Lămpi) [lm]	P [W]
1	4	LUG LIGHT FACTORY 30061.00150 4040 LUGCLASSIC LB LED PLX PT 600 840 (1.000)	4350	4350	39.0
Total:			17400	17400	156.0

Putere specifică:  $5.65 \text{ W/m}^2 = 1.41 \text{ W/m}^2/100 \text{ lx}$  (Suprafață:  $27.60 \text{ m}^2$ )



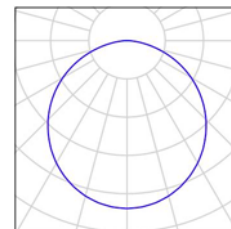
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## Situatia 2. Birou 6.9x4 30061.00150 / Listă număr corpuri de iluminat

4 Bucăți

LUG LIGHT FACTORY 300061.00150 4040  
LUGCLASSIC LB LED PLX PT 600 840  
Nr.articol: 300061.00150  
Flux luminos (Corp de iluminat): 4350 lm  
Flux luminos (Lămpi): 4350 lm  
Putere corpuri de iluminat: 39.0 W  
Clasificarea corpurilor de iluminat conform CIE:  
100  
Cod flux CIE: 47 79 96 100 100  
Dotare: 1 x LED 4000K (Factor de corecție  
1.000).

Vedeți catalogul nostru  
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pentru o imagine a  
corpului de iluminat.



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## Situatia 2. Birou 6.9x4 30061.00150 / Rezultate fotometrice

Flux luminos total: 17400 lm  
Putere totală: 156.0 W  
Factor de menținere: 0.90  
Zonă de margine: 0.000 m

Suprafață	Iluminare medie [lx]			Grade de reflexie [%]	Luminanță medie [cd/m <sup>2</sup> ]
	direct	indirect	total		
Plan util	302	98	400	/	/
Podea	233	97	330	20	21
Tavan	0.00	97	97	70	22
Perete 1	152	88	240	50	38
Perete 2	123	88	211	50	34
Perete 3	152	88	240	50	38
Perete 4	123	89	212	50	34

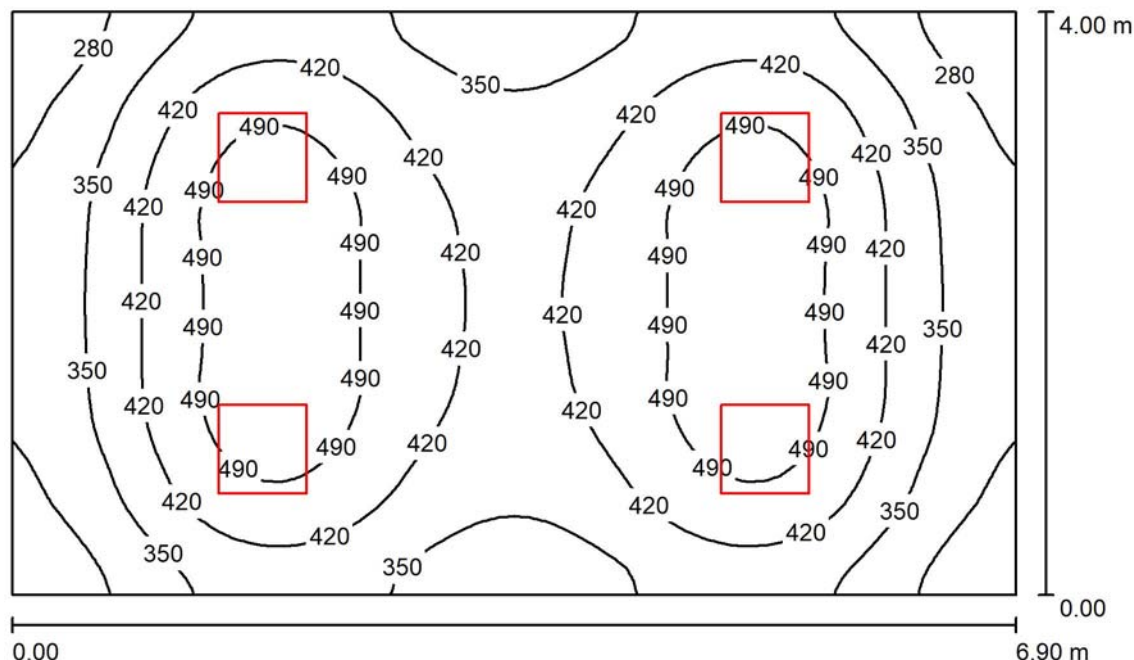
Uniformitate pe planul util  
u<sub>0</sub>: 0.572 (1:2)  
E<sub>min</sub>/E<sub>max</sub>: 0.448 (1:2)

**UGR** Pe lungime- Transversal la axa corpului de iluminat  
Perete stânga 20 20  
Perete inferior 18 18  
(CIE, SHR = 0.25.)

Putere specifică:  $5.65 \text{ W/m}^2 = 1.41 \text{ W/m}^2/100 \text{ lx}$  (Suprafață: 27.60 m<sup>2</sup>)

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## Situatia 2. Birou 6.9x4 903061.00918 / Rezumat



Înălțimea spațiului: 3.000 m, Înălțime de montare: 3.000 m, Factor de menținere: 0.90

Valoare în Lux, Scară 1:52

Suprafață	$\rho$ [%]	$E_m$ [lx]	$E_{min}$ [lx]	$E_{max}$ [lx]	$u_0$
Plan util	/	406	223	533	0.550
Podea	20	335	217	406	0.648
Tavan	70	92	62	107	0.669
Pereți (4)	50	218	75	494	/

### Plan util:

Înălțime: 0.800 m  
Raster: 64 x 64 Puncte  
Zonă de margine: 0.000 m

### UGR

Pe lungime-  
Perete stânga 20  
Perete inferior 19  
(CIE, SHR = 0.25.)

Transversal la axa corpului de iluminat

### Listă bucăți corpuri de iluminat

Nr.	Bucăți	Denumire (Factor de corecție)	$\Phi$ (Corp de iluminat) [lm]	$\Phi$ (Lămpi) [lm]	P [W]
1	4	LUG Light Factory 903061.00918 6045 LUGCLASSIC LB 600x600 nt 4350lm 840 PLX bialy (1.000)	4275	4275	41.1
Total:			17100	17100	164.5

Putere specifică:  $5.96 \text{ W/m}^2 = 1.47 \text{ W/m}^2/100 \text{ lx}$  (Suprafață:  $27.60 \text{ m}^2$ )

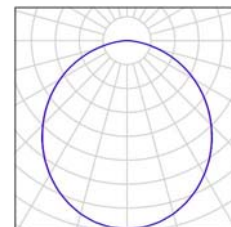


Proiectant  
Telefon  
Fax  
e-mail

## Situatia 2. Birou 6.9x4 903061.00918 / Listă număr corpuri de iluminat

4 Bucăți LUG Light Factory 903061.00918 6045  
LUGCLASSIC LB 600x600 nt 4350lm 840 PLX  
bialy  
Nr.articol: 903061.00918  
Flux luminos (Corp de iluminat): 4275 lm  
Flux luminos (Lămpi): 4275 lm  
Putere corpuri de iluminat: 41.1 W  
Clasificarea corpurilor de iluminat conform CIE:  
100  
Cod flux CIE: 48 80 96 100 100  
Dotare: 1 x LED (Factor de corecție 1.000).

Vedeți catalogul nostru  
de corpuri de iluminat  
pentru o imagine a  
corpului de iluminat.



Proiectant  
Telefon  
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e-mail

## Situatia 2. Birou 6.9x4 903061.00918 / Rezultate fotometrice

Flux luminos total: 17100 lm  
Putere totală: 164.5 W  
Factor de menținere: 0.90  
Zonă de margine: 0.000 m

Suprafață	Iluminare medie [lx]			Grade de reflexie [%]	Luminanță medie [cd/m <sup>2</sup> ]
	direct	indirect	total		
Plan util	312	93	406	/	/
Podea	241	94	335	20	21
Tavan	0.01	92	92	70	21
Perete 1	144	85	229	50	36
Perete 2	115	85	200	50	32
Perete 3	144	85	229	50	36
Perete 4	115	85	201	50	32

Uniformitate pe planul util  
u<sub>0</sub>: 0.550 (1:2)  
E<sub>min</sub>/E<sub>max</sub>: 0.419 (1:2)

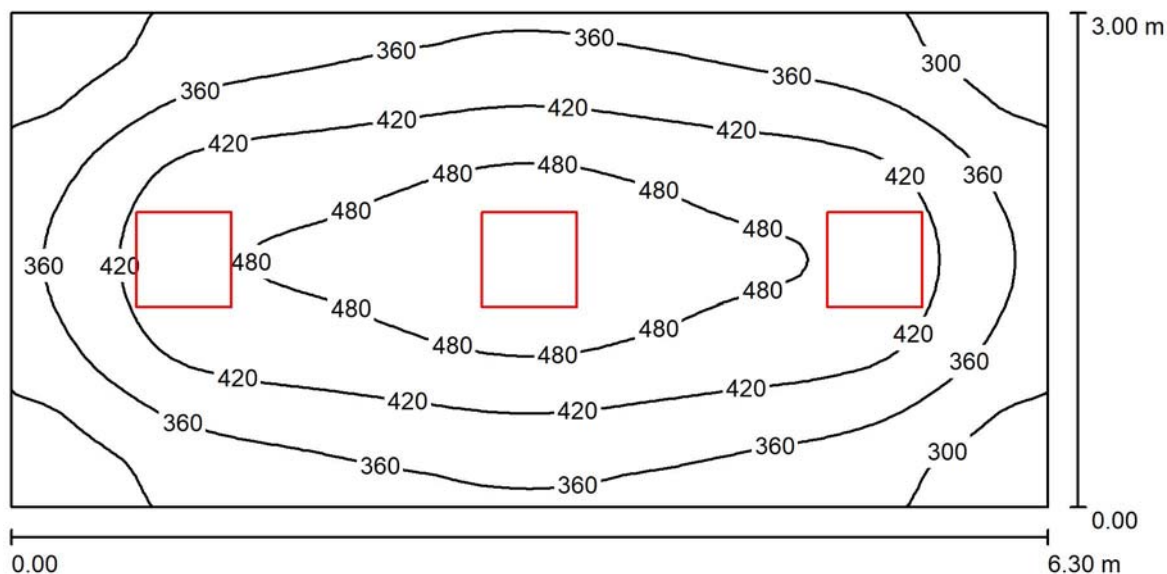
**UGR** Pe lungime- Transversal la axa corpului de iluminat  
Perete stânga 20 20  
Perete inferior 19 19  
(CIE, SHR = 0.25.)

Putere specifică:  $5.96 \text{ W/m}^2 = 1.47 \text{ W/m}^2/100 \text{ lx}$  (Suprafață: 27.60 m<sup>2</sup>)



Proiectant  
Telefon  
Fax  
e-mail

### Situatia 3. Birou 6.3x3 30061.00150 / Rezumat



Înălțimea spațiului: 3.000 m, Înălțime de montare: 3.000 m, Factor de menținere: 0.90

Valoare în Lux, Scară 1:46

Suprafață	$\rho$ [%]	$E_m$ [lx]	$E_{min}$ [lx]	$E_{max}$ [lx]	$u_0$
Plan util	/	398	241	520	0.606
Podea	20	314	209	384	0.666
Tavan	70	99	70	130	0.710
Pereți (4)	50	229	85	472	/

#### Plan util:

Înălțime: 0.800 m  
Raster: 64 x 32 Puncte  
Zonă de margine: 0.000 m

#### Listă bucăți corpuri de iluminat

Nr.	Bucăți	Denumire (Factor de corecție)	$\Phi$ (Corp de iluminat) [lm]	$\Phi$ (Lămpi) [lm]	P [W]
1	3	LUG LIGHT FACTORY 300061.00150 4040 LUGCLASSIC LB LED PLX PT 600 840 (1.000)	4350	4350	39.0
			Total: 13050	Total: 13050	117.0

Putere specifică:  $6.19 \text{ W/m}^2 = 1.56 \text{ W/m}^2/100 \text{ lx}$  (Suprafață:  $18.90 \text{ m}^2$ )

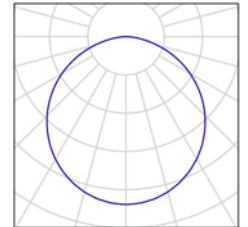


Proiectant  
Telefon  
Fax  
e-mail

### Situatia 3. Birou 6.3x3 30061.00150 / Listă număr corpuri de iluminat

3 Bucăți LUG LIGHT FACTORY 300061.00150 4040  
LUGCLASSIC LB LED PLX PT 600 840  
Nr.articol: 300061.00150  
Flux luminos (Corp de iluminat): 4350 lm  
Flux luminos (Lămpi): 4350 lm  
Putere corpuri de iluminat: 39.0 W  
Clasificarea corpurilor de iluminat conform CIE:  
100  
Cod flux CIE: 47 79 96 100 100  
Dotare: 1 x LED 4000K (Factor de corecție  
1.000).

Vedeți catalogul nostru  
de corpuri de iluminat  
pentru o imagine a  
corpului de iluminat.



Proiectant  
Telefon  
Fax  
e-mail

### Situatia 3. Birou 6.3x3 30061.00150 / Rezultate fotometrice

Flux luminos total: 13050 lm  
Putere totală: 117.0 W  
Factor de menținere: 0.90  
Zonă de margine: 0.000 m

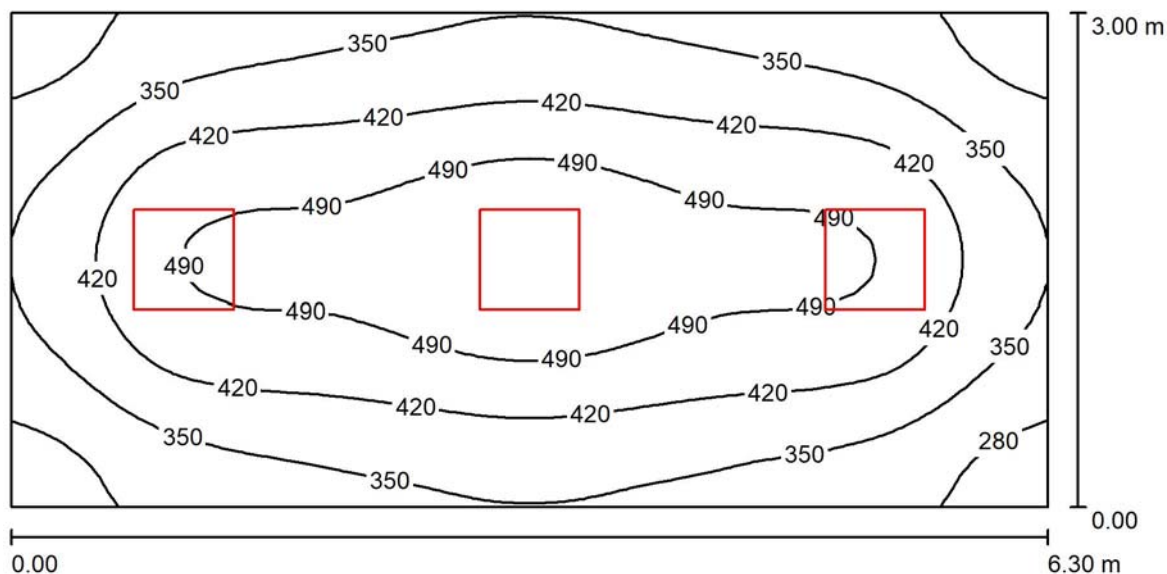
Suprafață	Iluminare medie [lx]			Grade de reflexie [%]	Luminanță medie [cd/m <sup>2</sup> ]
	direct	indirect	total		
Plan util	294	103	398	/	/
Podea	214	99	314	20	20
Tavan	0.00	99	99	70	22
Perete 1	135	92	226	50	36
Perete 2	145	89	234	50	37
Perete 3	135	92	226	50	36
Perete 4	145	90	235	50	37

Uniformitate pe planul util  
u<sub>0</sub>: 0.606 (1:2)  
E<sub>min</sub>/E<sub>max</sub>: 0.464 (1:2)

Putere specifică:  $6.19 \text{ W/m}^2 = 1.56 \text{ W/m}^2/100 \text{ lx}$  (Suprafață: 18.90 m<sup>2</sup>)

Proiectant  
Telefon  
Fax  
e-mail

### Situatia 3. Birou 6.3x3 903061.00918 / Rezumat



Înălțimea spațiului: 3.000 m, Înălțime de montare: 3.000 m, Factor de mentinere: 0.90

Valoare în Lux, Scară 1:46

Suprafață	$\rho$ [%]	$E_m$ [lx]	$E_{min}$ [lx]	$E_{max}$ [lx]	u0
Plan util	/	406	235	546	0.579
Podea	20	321	206	397	0.641
Tavan	70	94	64	105	0.687
Pereți (4)	50	219	73	458	/

#### Plan util:

Înălțime: 0.800 m  
Raster: 64 x 32 Puncte  
Zonă de margine: 0.000 m

#### Listă bucăți corpuri de iluminat

Nr.	Bucăți	Denumire (Factor de corecție)	$\Phi$ (Corp de iluminat) [lm]	$\Phi$ (Lămpi) [lm]	P [W]
1	3	LUG Light Factory 903061.00918 6045 LUGCLASSIC LB 600x600 nt 4350lm 840 PLX biały (1.000)	4275	4275	41.1
			Total: 12825	Total: 12825	123.4

Putere specifică:  $6.53 \text{ W/m}^2 = 1.61 \text{ W/m}^2/100 \text{ lx}$  (Suprafață:  $18.90 \text{ m}^2$ )

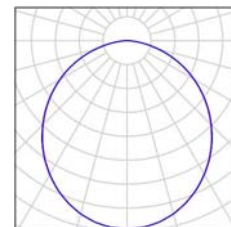


Proiectant  
Telefon  
Fax  
e-mail

### Situatia 3. Birou 6.3x3 903061.00918 / Listă număr corpuri de iluminat

3 Bucăți LUG Light Factory 903061.00918 6045  
LUGCLASSIC LB 600x600 nt 4350lm 840 PLX  
bialy  
Nr.articol: 903061.00918  
Flux luminos (Corp de iluminat): 4275 lm  
Flux luminos (Lămpi): 4275 lm  
Putere corpuri de iluminat: 41.1 W  
Clasificarea corpurilor de iluminat conform CIE:  
100  
Cod flux CIE: 48 80 96 100 100  
Dotare: 1 x LED (Factor de corecție 1.000).

Vedeți catalogul nostru  
de corpuri de iluminat  
pentru o imagine a  
corpului de iluminat.



Proiectant  
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### Situatia 3. Birou 6.3x3 903061.00918 / Rezultate fotometrice

Flux luminos total: 12825 lm  
Putere totală: 123.4 W  
Factor de menținere: 0.90  
Zonă de margine: 0.000 m

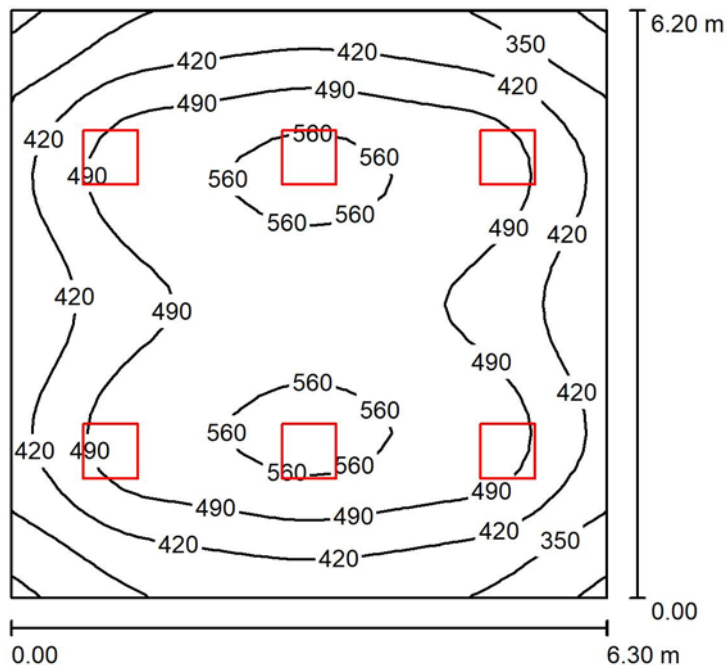
Suprafață	Iluminare medie [lx]			Grade de reflexie [%]	Luminanță medie [cd/m <sup>2</sup> ]
	direct	indirect	total		
Plan util	307	99	406	/	/
Podea	224	97	321	20	20
Tavan	0.00	94	94	70	21
Perete 1	127	88	216	50	34
Perete 2	138	86	224	50	36
Perete 3	127	89	216	50	34
Perete 4	138	86	225	50	36

Uniformitate pe planul util  
u<sub>0</sub>: 0.579 (1:2)  
E<sub>min</sub>/E<sub>max</sub>: 0.431 (1:2)

Putere specifică:  $6.53 \text{ W/m}^2 = 1.61 \text{ W/m}^2/100 \text{ lx}$  (Suprafață: 18.90 m<sup>2</sup>)

Proiectant  
Telefon  
Fax  
e-mail

### Situatia 4. Birou 6.3x6.2 30061.00150 / Rezumat



Înălțimea spațiului: 3.000 m, Înălțime de montare: 3.000 m, Factor de menținere: 0.90

Valoare în Lux, Scară 1:80

Suprafață	$\rho$ [%]	$E_m$ [lx]	$E_{min}$ [lx]	$E_{max}$ [lx]	$u_0$
Plan util	/	465	270	585	0.580
Podea	20	396	254	482	0.643
Tavan	70	108	77	133	0.714
Pereți (4)	50	261	104	498	/

#### Plan util:

Înălțime: 0.800 m  
Raster: 32 x 32 Puncte  
Zonă de margine: 0.000 m

#### UGR

Pe lungime-  
Perete stânga 20  
Perete inferior 20  
(CIE, SHR = 0.25.)

Pe lungime-

Transversal

la axa corpului de iluminat

#### Listă bucăți corpuri de iluminat

Nr.	Bucăți	Denumire (Factor de corecție)	$\Phi$ (Corp de iluminat) [lm]	$\Phi$ (Lămpi) [lm]	P [W]
1	6	LUG LIGHT FACTORY 300061.00150 4040 LUGCLASSIC LB LED PLX PT 600 840 (1.000)	4350	4350	39.0
Total:			26100	26100	234.0

Putere specifică:  $5.99 \text{ W/m}^2 = 1.29 \text{ W/m}^2/100 \text{ lx}$  (Suprafață:  $39.06 \text{ m}^2$ )

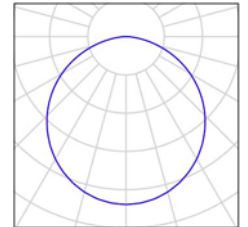


Proiectant  
Telefon  
Fax  
e-mail

#### Situatia 4. Birou 6.3x6.2 30061.00150 / Listă număr corpuri de iluminat

6 Bucăți LUG LIGHT FACTORY 300061.00150 4040  
LUGCLASSIC LB LED PLX PT 600 840  
Nr.articol: 300061.00150  
Flux luminos (Corp de iluminat): 4350 lm  
Flux luminos (Lămpi): 4350 lm  
Putere corpuri de iluminat: 39.0 W  
Clasificarea corpurilor de iluminat conform CIE:  
100  
Cod flux CIE: 47 79 96 100 100  
Dotare: 1 x LED 4000K (Factor de corecție  
1.000).

Vedeți catalogul nostru  
de corpuri de iluminat  
pentru o imagine a  
corpului de iluminat.





Proiectant  
Telefon  
Fax  
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### Situatia 4. Birou 6.3x6.2 30061.00150 / Rezultate fotometrice

Flux luminos total: 26100 lm  
Putere totală: 234.0 W  
Factor de menținere: 0.90  
Zonă de margine: 0.000 m

Suprafață	Iluminare medie [lx]			Grade de reflexie [%]	Luminanță medie [cd/m <sup>2</sup> ]
	direct	indirect	total		
Plan util	360	105	465	/	/
Podea	289	107	396	20	25
Tavan	0.00	108	108	70	24
Perete 1	155	99	254	50	40
Perete 2	171	99	269	50	43
Perete 3	155	98	253	50	40
Perete 4	171	97	268	50	43

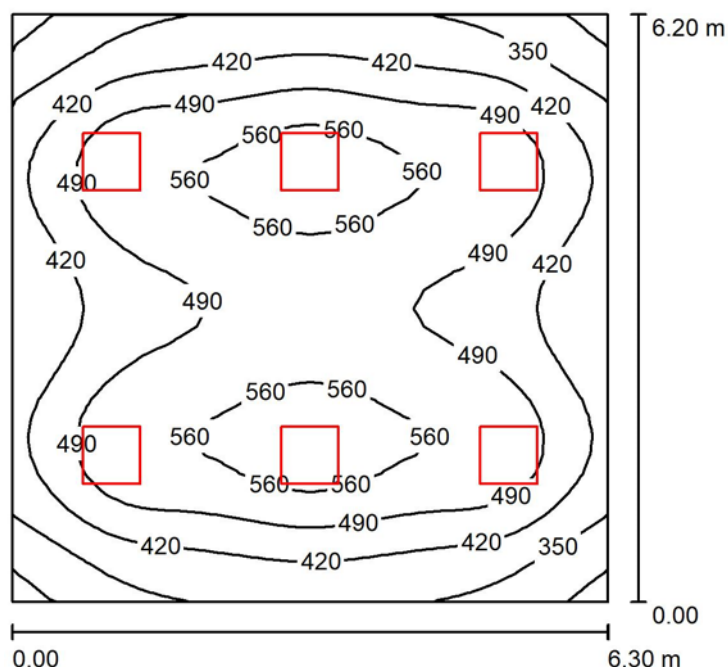
Uniformitate pe planul util  
u<sub>0</sub>: 0.580 (1:2)  
E<sub>min</sub>/E<sub>max</sub>: 0.461 (1:2)

**UGR** Pe lungime- Transversal la axa corpului de iluminat  
Perete stânga 20 20  
Perete inferior 20 20  
(CIE, SHR = 0.25.)

Putere specifică:  $5.99 \text{ W/m}^2 = 1.29 \text{ W/m}^2/100 \text{ lx}$  (Suprafață: 39.06 m<sup>2</sup>)

Proiectant  
Telefon  
Fax  
e-mail

### Situatia 4. Birou 6.3x6.2 903061.00918 / Rezumat



Înălțimea spațiului: 3.000 m, Înălțime de montare: 3.000 m, Factor de menținere: 0.90

Valoare în Lux, Scară 1:80

Suprafață	$\rho$ [%]	$E_m$ [lx]	$E_{min}$ [lx]	$E_{max}$ [lx]	$u_0$
Plan util	/	468	260	605	0.556
Podea	20	399	253	485	0.634
Tavan	70	103	72	122	0.700
Pereți (4)	50	246	88	477	/

Plan util:	UGR	Pe lungime-	Transversal	la axa corpului de iluminat
Înălțime: 0.800 m	Perete stânga	21	21	
Raster: 32 x 32 Puncte	Perete inferior	21	21	
Zonă de margine: 0.000 m	(CIE, SHR = 0.25.)			

#### Listă bucăți corpuri de iluminat

Nr.	Bucăți	Denumire (Factor de corecție)	$\Phi$ (Corp de iluminat) [lm]	$\Phi$ (Lămpi) [lm]	P [W]
1	6	LUG Light Factory 903061.00918 6045 LUGCLASSIC LB 600x600 nt 4350lm 840 PLX bialy (1.000)	4275	4275	41.1
Total:			25650	25650	246.8

Putere specifică:  $6.32 \text{ W/m}^2 = 1.35 \text{ W/m}^2/100 \text{ lx}$  (Suprafață:  $39.06 \text{ m}^2$ )



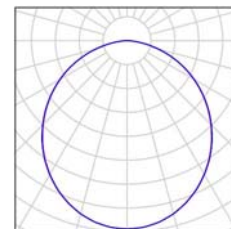
Proiectant  
Telefon  
Fax  
e-mail

#### Situatia 4. Birou 6.3x6.2 903061.00918 / Listă număr corpuri de iluminat

6 Bucăți

LUG Light Factory 903061.00918 6045  
LUGCLASSIC LB 600x600 nt 4350lm 840 PLX  
bialy  
Nr.articol: 903061.00918  
Flux luminos (Corp de iluminat): 4275 lm  
Flux luminos (Lămpi): 4275 lm  
Putere corpuri de iluminat: 41.1 W  
Clasificarea corpurilor de iluminat conform CIE:  
100  
Cod flux CIE: 48 80 96 100 100  
Dotare: 1 x LED (Factor de corecție 1.000).

Vedeți catalogul nostru  
de corpuri de iluminat  
pentru o imagine a  
corpului de iluminat.



Proiectant  
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e-mail

### Situatia 4. Birou 6.3x6.2 903061.00918 / Rezultate fotometrice

Flux luminos total: 25650 lm  
Putere totală: 246.8 W  
Factor de menținere: 0.90  
Zonă de margine: 0.000 m

Suprafață	Iluminare medie [lx]			Grade de reflexie [%]	Luminanță medie [cd/m <sup>2</sup> ]
	direct	indirect	total		
Plan util	369	99	468	/	/
Podea	297	102	399	20	25
Tavan	0.01	103	103	70	23
Perete 1	145	94	239	50	38
Perete 2	161	93	254	50	40
Perete 3	145	94	239	50	38
Perete 4	161	93	254	50	40

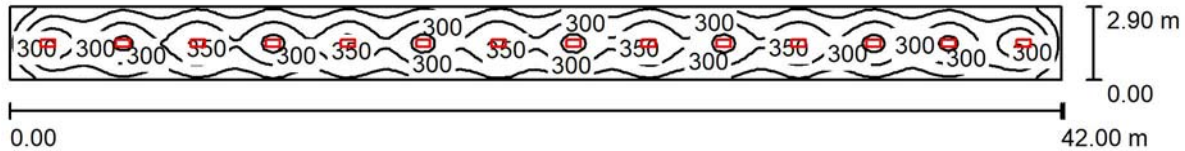
Uniformitate pe planul util  
u<sub>0</sub>: 0.556 (1:2)  
E<sub>min</sub>/E<sub>max</sub>: 0.430 (1:2)

**UGR** Pe lungime- Transversal la axa corpului de iluminat  
Perete stânga 21 21  
Perete inferior 21 21  
(CIE, SHR = 0.25.)

Putere specifică:  $6.32 \text{ W/m}^2 = 1.35 \text{ W/m}^2/100 \text{ lx}$  (Suprafață: 39.06 m<sup>2</sup>)

Proiectant  
Telefon  
Fax  
e-mail

### Situatia 5. Hal 42 x 2.9 / Rezumat



Înălțimea spațiului: 3.000 m, Înălțime de montare: 3.000 m, Factor de menținere: 0.90

Valoare în Lux, Scară 1:301

Suprafață	$\rho$ [%]	$E_m$ [lx]	$E_{min}$ [lx]	$E_{max}$ [lx]	$u_0$
Plan util	/	284	156	369	0.551
Podea	20	234	149	267	0.635
Tavan	70	64	56	77	0.872
Pereți (4)	50	157	62	240	/

#### Plan util:

Înălțime: 0.850 m  
Raster: 128 x 32 Puncte  
Zonă de margine: 0.000 m

#### Listă bucăți corpuri de iluminat

Nr.	Bucăți	Denumire (Factor de corecție)	$\Phi$ (Corp de iluminat) [lm]	$\Phi$ (Lămpi) [lm]	P [W]
1	14	LUG LIGHT FACTORY 300061.00065 3361_4 LUGCLASSIC ECO LB LED NT 4500 840 (1.000)	3700	3700	37.0
			Total: 51799	Total: 51800	518.0

Putere specifică:  $4.25 \text{ W/m}^2 = 1.50 \text{ W/m}^2/100 \text{ lx}$  (Suprafață:  $121.80 \text{ m}^2$ )

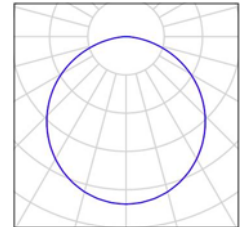


Proiectant  
Telefon  
Fax  
e-mail

### Situatia 5. Hal 42 x 2.9 / Listă număr corpuri de iluminat

14 Bucăți LUG LIGHT FACTORY 300061.00065 3361\_4  
LUGCLASSIC ECO LB LED NT 4500 840  
Nr.articol: 300061.00065  
Flux luminos (Corp de iluminat): 3700 lm  
Flux luminos (Lămpi): 3700 lm  
Putere corpuri de iluminat: 37.0 W  
Clasificarea corpurilor de iluminat conform CIE:  
100  
Cod flux CIE: 47 79 96 100 100  
Dotare: 1 x PCBL1402500 840 (Factor de  
corecție 1.000).

Vedeți catalogul nostru  
de corpuri de iluminat  
pentru o imagine a  
corpului de iluminat.



Proiectant  
Telefon  
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e-mail

### Situatia 5. Hal 42 x 2.9 / Rezultate fotometrice

Flux luminos total: 51799 lm  
Putere totală: 518.0 W  
Factor de menținere: 0.90  
Zonă de margine: 0.000 m

Suprafață	Iluminare medie [lx]			Grade de reflexie [%]	Luminanță medie [cd/m <sup>2</sup> ]
	direct	indirect	total		
Plan util	220	64	284	/	/
Podea	169	65	234	20	15
Tavan	0.00	64	64	70	14
Perete 1	98	61	159	50	25
Perete 2	84	57	141	50	22
Perete 3	98	60	158	50	25
Perete 4	84	57	141	50	22

Uniformitate pe planul util  
u<sub>0</sub>: 0.551 (1:2)  
E<sub>min</sub>/E<sub>max</sub>: 0.424 (1:2)

Putere specifică:  $4.25 \text{ W/m}^2 = 1.50 \text{ W/m}^2/100 \text{ lx}$  (Suprafață: 121.80 m<sup>2</sup>)





# **BIOTcloud**

## **Description of the system**

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- 4. BIOTcloud system features..... 8
- 5. Plans for extending the BIOTcloud system..... 14

## 1. Introduction

The purpose of this specification is to present the Smart City system, designed and created to monitor and manage lighting infrastructures with connected sensors.

## 2. BIOTcloud system

The BIOTcloud system consists of:

- a. the management system installed in the internet cloud,
- b. 'Urban' application and 'Urban Mobile' mobile application
- c. external devices:
  - hubs,
  - controllers placed inside the luminaires.

The following chapters present successively the functions and features of each system component.

### 2.1. Management system

The core solution of BIOTcloud is the management system installed on servers operating in the cloud. The purpose of this system is to manage the operation of the entire BIOTcloud environment, communication, collecting data from controllers, processing and analysing collected data, taking action based on implemented algorithms. The management system is responsible also for updating the software and configuring field devices.

The system includes an interface for communicating with the factory. It ensures that all the devices at the production stage are programmed in a secure manner, using the target, unique encryption and authentication data. This greatly simplifies and shortens the process of installing external devices, as the activation within the system requires only scanning of a QR code present at the housing of the device (hub) or the luminaire with integrated controller, and assigning it to the previously created installation point. With this solution start-up and first configuration are performed automatically, not requiring further action from the user of the system.

### 2.2. User interface

Urban application is a Web application that runs in a Web browser. It does not require installation of additional software. This application, depending on the assigned authorisations of the logged user (system administrator / manager of monitored

network /planner /installer etc.) provides the personalized data and enables the user to perform certain operating procedures.

The application provides:

- a. two-level authentication of the user,
- b. configuration of user settings,
- c. a function of administrator for the customer with the authorisation to manage other users from the customer organisation (creating, modifying, and deleting accounts, assigning roles and permissions to users),
- d. dashboard with the most important information for the user,
- e. a map with:
  - plan of streets,
  - plan of buildings,
  - lighting network layout,
  - icons illustrating points of installation on the map.

The user may also see a location of an incident or alarm on the map. Details are available by clicking on the selected object. After clicking on the selected object, the user gains access to other information and parameters of this object. In this way, the user may check the current status, history of operation and incidents, as well as measured parameters such as voltage, consumed power and energy or temperature. History of these parameters may be also presented on the charts.

- f. an overview of alarms for a single object on the map, as well as for a group in the current time and historically. The user may also define incidents that will be notified to him/her via SMS or e-mail (optionally). The incidents may relate to power decrease, exceeded temperature and many others.
- g. module for inventorying, which provides full visibility of owned assets. This includes devices in stock, but not installed yet and those installed and dismantled. The user may search and filter them based on selected attributes and export data to files, such as csv, txt and xlsx.
- h. a module for programming operation of lighting points, which provides an interface for defining work of both single points of light, as well as their groups. The user has the ability to create multiple work programs for individual days, selected periods (weekdays, weekends), as well as public holidays within the week. The may assign

priorities to individual plans. As part of the module of work programming, the user can also set individual luminaires (individually or in groups) and their power changes depending on the time of day and geographic position (astronomical clock). The defined programs are then sent to the controller as part of the configuration of devices. This ensures the operation according to the programmed settings even after the loss of the connection.

- i. network planning module gives the user ability to create new points of installation, modify existing ones and delete those unused. Each point of installation has assigned coordinates and attributes. It is also possible to define and limit the types and devices that can be installed within them, providing clear information for installation and maintenance teams to define actions to be taken and eliminate mistakes. Access to the planning module is restricted only to users with a defined role of the planner.

Urban Mobile application complements the options of access to the BIOTcloud system. Access to the system from mobile devices is particularly important from the point of view of network maintenance and servicing. Urban Mobile application is dedicated to mobile devices. i.e. phones or tablets working with the most common versions of Android or iOS operating systems. Urban Mobile application provides users with a map presenting the points of installation. Similarly as in the Urban web application, it presents a map with pre-defined alarms and incidents for the individual points. After selecting a certain point, full information is accessible in relation to the incident or alarm.

In order to facilitate the work of the field personnel, the Urban Mobile application works with a GPS receiver to facilitate displaying the current position of the user on the map and find a specific point on the map. Urban Mobile may operate with a QR code reader. This allows user to quickly and automatically identify a point on the map.

Installation of new devices does not require manually adding device data to the system (e.g. serial number, IMEI number). To complete the entire process of installing a new device, the installer only scans its QR code and selects a point of installation to enable the system adding the device to a specific location. A further configuration of the device (network connection, updating settings) is made automatically

In addition to presentation functions, the application also has a diagnostic module, available as an extension for a user with maintenance authorisation. This module enables the user, who works in the field, to check the status of the lighting point

(online/offline), perform ON/OFF test procedure, change operational settings by darkening/brightening of the lamp, read-out the operational time and temperature.

The management system also has implemented security mechanisms that detect and ignore the connection attempts from unauthorized devices. The system is also protected against theft of SIM cards.

### **3. External devices**

In addition to the server located in the cloud, the system also includes the field-installed devices. Their task is to control and check luminaires, as well as monitoring their selected factors (brightness, luminaire temperature, etc.) and communication with the management system. Field-installed devices may operate alone or be grouped in one or more clusters.

#### **3.1. Hub (gate)**

Hub acts as a bridge between the management system installed in the cloud and field- installed controllers and sensors. Communication between the hub and the management system is carried out using MQTT protocol and SSL certificates. The connection method is as follows:

- a. wireless via LTE network,
- b. optionally over Ethernet, if access is provided.

Communication between the hub and the controllers is wireless by using 802.15.4, 6lowpan technology and Thread protocol with extensions dedicated to the Smart City. Using Thread protocol makes it possible to organize devices in Mesh arrangement. This increases the reliability of communication, as in case of a single node failure, the network is automatically re-configured /repaired, ensuring that the communication is maintained. The hub has two independent radio interfaces operating in the 2.4GHz band and supporting protocols such as Thread, 802.15.4 or 6lowpan.

In addition to the support of communication with controllers to manage the operation of lighting and monitoring its parameters, the hub serves also as the main point for distributing software updates among devices connected to it from Thread network side. In order to optimize the amount of data transmitted over the LTE network, it is possible to configure the hub as the main point for downloading software updates from the management system and distributing them to other hubs. The optimization results in savings on LTE transmission costs, because instead of 'n' transmissions of update files to 'n' routers, only one file is transmitted by the LTE network and Thread protocol sends it to other 'n-1' hubs. They, in turn, provide the updates to the controllers.

## 3.2. Controller

The controller has a range of analogue and digital interfaces, allowing for controlling and checking the lighting points. It is available in a basic version and in expanded version with an electricity meter. Power control of the luminaires may be analogue (ON/OFF function using a contactor, light intensity control using 1-10V protocol) or digital via DALI 2.0 interface. Each controller may be connected to 4 DALI devices of SLAVE type. The controller supports the connection of a NTC thermometer that monitors the temperature of the luminaire. This four-pin expansion socket allows user to connect devices by using UART, I2C, SPI, 1-Wire, RS485, GPIO, analogue-digital transducer and others.

The controller is designed in a modular manner by separating the radio part from the rest of the device. This makes it easy quickly adapted to customer requirements. This approach creates the option for applying the radio module using a different radio technology, reduces certification costs and decreases time-to-market.

The controller has the function of autonomous work with the last saved configuration in case of losing the connection with the management system. All defined lighting plans for individual days or periods, together with a reduction in power for a given point and the function of the astronomical clock are stored locally and available in case of lost connection. When the connection with the system is restored, the controller automatically checks whether a new configuration is available and if it is, the settings are updated.

The controller also has a built-in real time clock with battery backup. In case of a power failure (even lasting for a few days), after restoring it, the controller is able to precisely control the lighting, even without communication with the outside world. In addition, controllers synchronize time with each other using radio communication - so one device with the current time is sufficient to ensure the power work of entire cluster after a power failure, even in the absence of LTE connectivity.

In case of missing or improper configuration, serious damage or other unexpected incidents, the controller turns on the light permanently, to ensure maximum comfort of road users at night.

The data collected by the controller is transferred to the hub, where it goes into the management system. In case of missing connection with the hub, data is buffered in the controller for several hours and all of the historical data from the buffer is transferred to the system after the communication is restored. When the connection

between the hub and the management system is missing, the data is stored on the hub up to one week and sent to the system after the connection is restored.

## 4. BIOTcloud system features

### a. the management system:

- installed in the cloud,
- available for 24 hours, 365 days a year,
- it provides access through web interface without the need of installing dedicated software,
- it collects and uses a database to save statistics, configurations and incident logs from managed devices,
- fully scalable,
- manages the automatic software updates for the hub and the controller in a manner that does not require any action from the user,
- integrated with the factory producing external devices, making the installation of the hub and router simple - it requires only scanning the QR code and selecting the installation point,
- it has security mechanisms to protect against unauthorized access and theft of SIM cards
- includes full encryption of all communications from the user through the system and the hub up to the end device,

### b. user interface:

- Urban application:
  - dedicated Web application to run in a web browser without installing additional software,
  - supported browsers: Google Chrome, Firefox, Safari, Microsoft Edge,
  - secure access through a two-level logging-in using HTTPS protocol,
  - dashboard displaying key parameters from the point of view of the user,
  - 3D map showing the layer of buildings with marked points of installation and lighting network arrangement. Details of the selected luminaire are available after clicking it. In addition to technical details, information is displayed about



- incidents and alarms according to definable thresholds,
- the section for notification and reporting provides the following functionalities:
    - reporting alarms and events based on defined thresholds using templates with modifiable parameters,
    - notification of incidents and alarms via SMS and e-mail,
    - generating reports according to defined criteria,
    - presenting the history of alarms for selected points or a group of points,
  - the section for network inventory provides the following functionalities:
    - reporting assets basing on the user-defined queries,
    - displaying and exporting reports to files,
  - the section for network presentation provides the following functionalities:
    - presentation of the radio equipment layout on the map with indicated signal strength,
    - indication of notification or alarm,
    - presentation of detailed information regarding the equipment and radio parameters, notifications and alarms after click icon of the selected device,
    - presentation of diagram with connections between individual devices,
    - presentation of the amount of transferred data,
    - presentation of device status (online, offline, duration of specified status),
  - the section for network planning provides the following functionalities:
    - creating, deleting and editing points of installation (POI),
    - adding attributes,
  - the section of lighting plans provides the following functionalities:
    - defining a new lighting scheme,
    - modifying, deactivating the existing lighting schemes,
    - introducing an automatic change of light intensity depending on the time of day, fixed operation hours or depending on the astronomical

- clock for a given location,
- option for defining schemes for workdays (Mon. - Fri.), weekends (Sat. - Sun) and individual public holidays.
- defining a plan for a single light source and the ability to define any group,
- Defining a number of plans for a single point or for a group and ability to set priorities of the plans,
- the section of managing the users provides the following functionalities:
  - assigning the administrator from the customer's organisation, who manages all users of the organisation,
  - creating user accounts with different roles and access rights by the administrator from the customer's organisation,
  - option of editing the account at any time,
- Urban Mobile application
  - supported operating systems: Google Android (7 and later), Apple iOS 10 and later,
  - presentation of:
    - street maps,
    - points of installation (POI) with information about alarms and incidents based on defined criteria,
    - devices installed in POI's (available, and unavailable)
    - alarms and notifications,
  - customizable display settings,
  - access by logging in,
  - supporting different user profiles (supervision / installer mode),
  - GPS and displaying position on the map with an option of selecting the nearest point of installation (POI) on the map,
  - operation of QR code reader,
  - the extended maintenance mode for the user with the authorisations of the installer:

- installation/uninstallation of devices with the option of adding notes,
- remote diagnostics (status checked remotely, ON/OFF test / light intensity change),

c. external devices:

- hub:
  - power supply: 230V/50Hz,
  - processor: i.MX6,
  - Flash: 32MB
  - RAM: 256MB,
  - Operating System: Linux,
  - Secure boot (operating system protected against unauthorized alteration and access),
  - ambient temperature range: -30°C – 55 ° C
  - installation location: on the lighting pole,
  - housing: IP66
  - mechanical resistance of the housing IK: 08,
  - Protection class I and II,
  - communication with system in the cloud: wireless LTE or wired Ethernet 10/100. MQTT protocol and SSL certificates secure authentication and communication with the management system,
  - connection with controllers and sensors: wireless Thread standard (based on 802.15.4 and 6lowpan) and Mesh arrangement - the network has the self-repair and reconfiguration ability in case of failure of one of the devices,
  - Communication interfaces:
    - LTE: connection with the system,
    - 2.4GHz dual radio interface with support for protocols: Thread, 802.15.4, 6lowPan. Support for Mesh networks and self-repairs in case of a failure of any of the nodes.
    - Ethernet type 10/100base-T,

- Ready for the communication in the 868MHz band,
- option for connecting a power meter,
- Modbus support,
- slot for micro-SD card,
- expansion slots with support for:
  - I2C,
  - UART,
  - SPI,
  - 1-wire,
  - option for RS-485,
- Status indicated by four diodes.
- USB slot,
- option of autonomous work with the last saved settings in case of losing the connection with the management system. Automatically updated settings after the connection is restored.
- buffering data from controllers in case of losing connection with the system,
- built-in LTE antennas (optionally x2), 2,4GHz x2, 868MHz,
- controller
  - power supply: 230V/50Hz,
  - ambient temperature range: -40°C – 85 ° C
  - installation location: inside the luminaire,
  - communication interfaces:
    - nRF 2,4GHz: connection with the hub and other controllers,
  - control of lamp operation by:
    - ON/OFF relay, receiver with a power up to 400W,
    - 2.0 DALI protocol (DALI Master supporting up to 4 SLAVE devices),
    - 1..10V protocol,
    - temperature measurement with +/- 1°C accuracy

- other
  - 1-wire,
  - NTC
  - I2C,
  - option for RS485,
  - analogue-digital converter (ADC), 12 bits
- support for defined plans of illumination and light intensity changes, depending on the time of day,
- the extended version with power measurement option (active, passive, apparent power), power factor, voltage, current, frequency, power measurement,
- ability to work independently or in a defined group of devices,
- responding to commands sent to a single device and to a group of devices
- Individual addressing providing identification within the system,
- option of autonomous work with the last saved settings in case of losing the connection with the management system or hub.
- continued work without the connection to the hub using the last correctly functioning configuration. Automatic update of settings after restoring power supply.
- taking over the function buffering data gathered after connection with the system is lost, until it is restored.
- gathering information on:
  - operational hours of the controller,
  - lighting hours of the luminaire,
  - number of light switching cycles,
- "power panic" operation: system shutdown and immediate (a delay of several tens of milliseconds) information sent to the management system about switching off due to lack of power supply.
- The speed of communication between the controllers and controller-hub: 250 kbit/s.

## 5. Plans for extending the BIOTcloud system

In the future it is planned to extend the functionality of the BIOTcloud system by sensors measuring light intensity, monitoring air quality and detecting motion (tracking lighting). This will result in extending the portfolio of external devices with sensory devices and their integration with the BIOTcloud system the range of data use, configuration and maintenance.