CUEVA DE ZUGARRAMURDI

MEJORA DE ACCESIBILIDAD

ANEJO Nº 7
CÁLCULO LUMINOTÉCNICO
EDIFICIO TAQUILLA

DIALux

Project

Created with DIALux

DIALux

Preface

Notes on planning:

The energy consumption quantities do not take into account light scenes and their dimming levels.

DIALux

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Description

Luminaire list

Φ_{total}	P_{total}	Luminous efficacy
24466 lm	244.8 W	99.9 lm/W

pcs.	Manufacturer	Article No.	Article name	P	Φ	Luminous efficacy
2	CELER	7100025301	INLINE 1200MM 36W 3000K 4300LM OPAL DALI 2 NG	36.0 W	4297 lm	119.4 lm/W
32	LUXIONA	19.4373.1363.04	LUXCAN MICRO TRACK 48V 600 36° EDD 04 827	5.4 W	496 lm	91.9 lm/W

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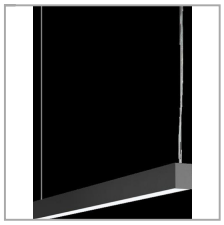
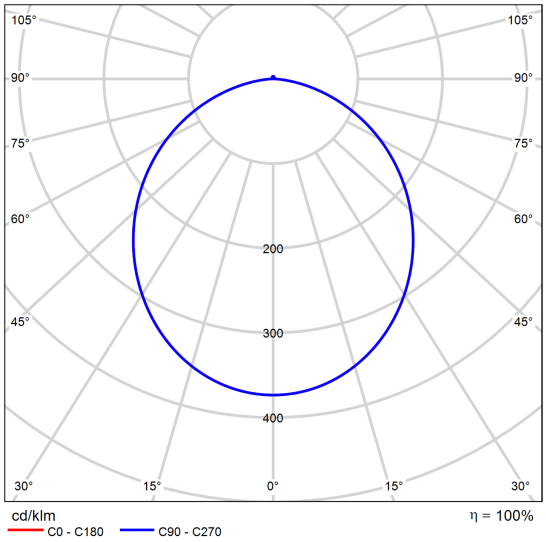
Product data sheet

CELER - INLINE 1200MM 36W 3000K 4300LM OPAL DALI 2 NG



Article No.	7100025301
P	36.0 W
Φ_{Lamp}	4297 lm
$\Phi_{Luminaire}$	4297 lm
η	100.00 %
Luminous efficacy	119.4 lm/W
CCT	3000 K
CRI	80

Luminaria lineal modular LED INLINE marca CELER. Potencia 36W. Temperatura color 3.000K. Flujo útil 4.300lm. Difusor opal con una apertura de 110º. Iluminación continua sin cortes. Medidas: 1.212x57x76mm. Protección IP20. IRC>80. Temperatura de funcionamiento de -10ºC a 45ºC. Cuerpo de aluminio pintado en color negro. Con driver regulable DALI.



Polar LDC

Glare evaluation according to UGR

ρ Ceiling		70	70	50	50	30	70	70	50	50	30
ρ Walls		50	30	50	30	30	50	30	50	30	30
ρ Floor		20	20	20	20	20	20	20	20	20	20
Room size X	Y	Viewing direction at right angles to lamp axis					Viewing direction parallel to lamp axis				
2H	2H	19.3	20.6	19.6	20.9	21.1	21.1	22.4	21.4	22.7	23.0
	3H	20.2	21.4	20.6	21.7	22.0	22.5	23.7	22.8	24.0	24.3
	4H	20.5	21.6	20.9	21.9	22.3	23.0	24.1	23.4	24.4	24.7
	6H	20.6	21.7	21.0	22.0	22.4	23.3	24.4	23.7	24.7	25.0
	8H	20.6	21.7	21.0	22.0	22.3	23.4	24.4	23.8	24.7	25.1
	12H	20.6	21.6	21.0	21.9	22.3	23.4	24.4	23.8	24.7	25.1
4H	2H	19.9	21.0	20.2	21.3	21.6	21.4	22.5	21.8	22.8	23.1
	3H	21.0	21.9	21.4	22.3	22.6	22.9	23.9	23.3	24.2	24.6
	4H	21.4	22.2	21.8	22.6	23.0	23.5	24.3	23.9	24.7	25.1
	6H	21.5	22.3	22.0	22.7	23.1	23.9	24.6	24.3	25.0	25.4
	8H	21.6	22.3	22.0	22.7	23.1	23.9	24.7	24.4	25.1	25.5
	12H	21.6	22.2	22.0	22.6	23.1	24.0	24.6	24.4	25.1	25.5
8H	4H	21.5	22.2	22.0	22.7	23.1	23.5	24.2	24.0	24.6	25.1
	6H	21.8	22.4	22.3	22.8	23.3	24.0	24.5	24.4	25.0	25.5
	8H	21.9	22.4	22.3	22.8	23.3	24.1	24.6	24.6	25.0	25.5
	12H	21.9	22.3	22.4	22.8	23.3	24.1	24.6	24.6	25.1	25.6
12H	4H	21.5	22.2	22.0	22.6	23.1	23.5	24.1	24.0	24.6	25.0
	6H	21.8	22.3	22.3	22.8	23.3	23.9	24.4	24.4	24.9	25.4
	8H	21.9	22.3	22.4	22.8	23.3	24.1	24.5	24.6	25.0	25.5
Variation of the observer position for the luminaire distances S											
S = 1.0H S = 1.5H S = 2.0H		+0.2 / -0.3 +0.4 / -0.8 +0.8 / -1.4					+0.1 / -0.2 +0.5 / -0.6 +1.2 / -1.3				
Standard table		BK03					BK04				
Correction summand		4.0					6.7				
Corrected glare indices referring to 4297lm Total luminous flux											

UGR diagram (SHR: 0.25)

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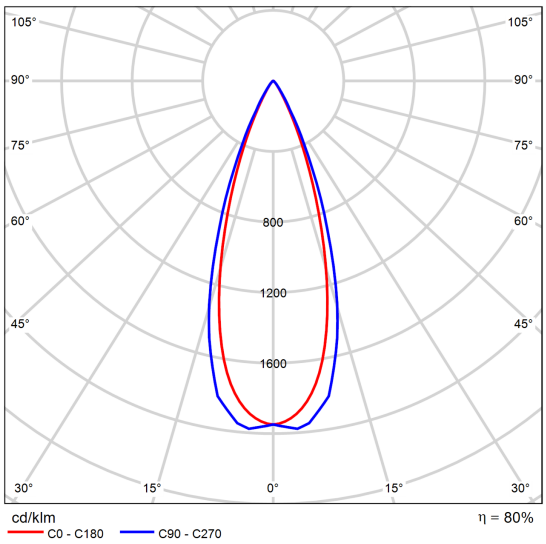
Product data sheet

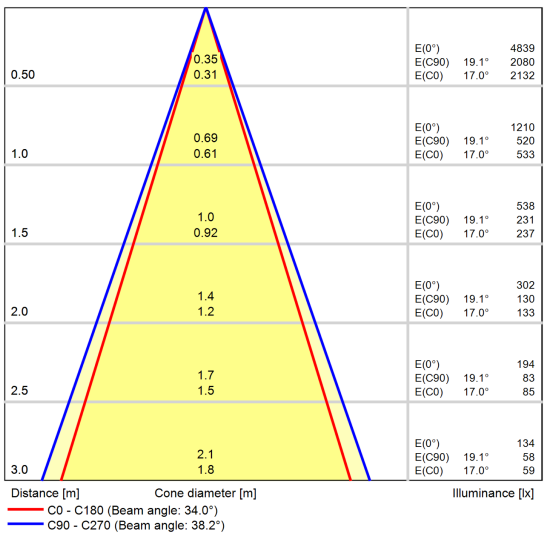
LUXIONA - LUXCAN MICRO TRACK 48V 600 36° EDD 04 827

Article No.	19.4373.1363.04
P	5.4 W
Φ_{Lamp}	621 lm
$\Phi_{Luminaire}$	496 lm
η	79.88 %
Luminous efficacy	91.9 lm/W
CCT	2700 K
CRI	80

Indoor luminaire. Assembly: mounted on 48 V track. The body material is aluminum. Colour - RAL 9005 (black). Luminaire dimensions: Ø33 x 65 mm. Diffuser: optical system based on PMMA lenses. The efficiency of the optical system is 79,88%. Beam angle: (C0-C180) / (C90-C270) - 34° / 38,2°. Light source type: LED. Colour of the light 2700 K. SDCM=3. CRI>80. Lifetime of LED sources: 100000 h L80/B10. Luminaire luminous flux: 495,9 lm. Power of luminaire: 5,4 W. Luminaire's light efficiency: 91,8 lm/W. Driver: DIM DALI (EDD). Voltage 48 V DC. Power factor cosφ: >0,95. Operating temperature range: 5 ÷ 35° C. Protection degree: IP20. Impact resistant: IK04. Protection against electric shock: III. Photobiological risk class (IEC/EN 62471): RG0.



Polar LDC



Cone diagram

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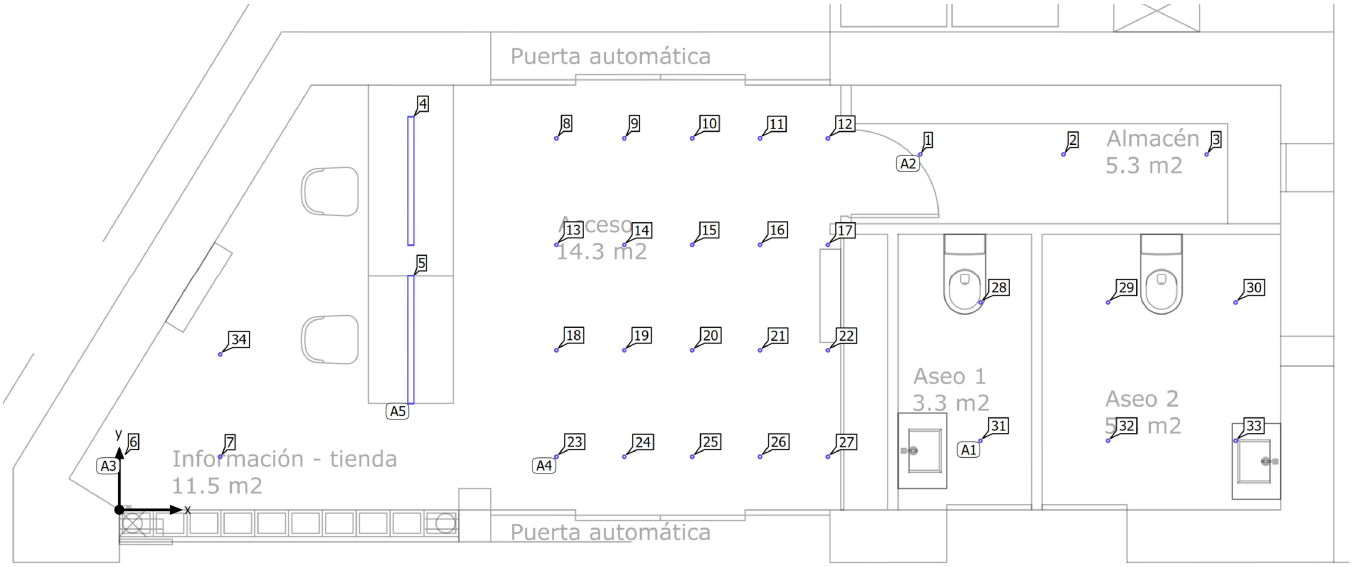
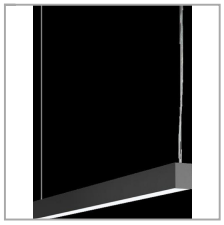
Acceso Información Tienda

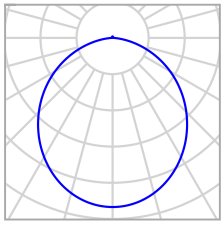
Luminaire layout plan



Acceso Información Tienda

Luminaire layout plan





Manufacturer	CELER	P	36.0 W
Article No.	7100025301	$\Phi_{Luminaire}$	4297 lm
Article name	INLINE 1200MM 36W 3000K 4300LM OPAL DALI 2 NG		
Fitting	1x LED		

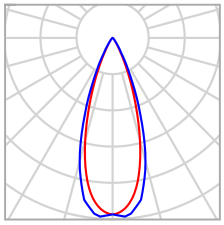
2 x CELER INLINE 1200MM 36W 3000K 4300LM OPAL DALI 2 NG

Type	Field Arrangement
1st luminaire (X/Y/Z)	2.749 m / 3.100 m / 2.200 m
X-direction	1 pcs., Centre - centre, Distances not equal
Y-direction	2 pcs., Centre - centre, Distances not equal
Arrangement	A5

X	Y	Mounting height	Luminaire
2.749 m	3.100 m	2.200 m	4
2.749 m	1.600 m	2.200 m	5

Acceso Información Tienda

Luminaire layout plan



Manufacturer	LUXIONA	P	5.4 W
Article No.	19.4373.1363.04	$\Phi_{Luminaire}$	496 lm
Article name	LUXCAN MICRO TRACK 48V 600 36° EDD 04 827		
Fitting	1x LED 2700 K 620,6 lm 4,3 W		

6 x LUXIONA LUXCAN MICRO TRACK 48V 600 36° EDD 04 827

Type	Field Arrangement
1st luminaire (X/Y/Z)	10.523 m / 0.649 m / 2.200 m
X-direction	3 pcs., Centre - centre, 1.203 m
Y-direction	2 pcs., Centre - centre, 1.299 m
Arrangement	A1

X	Y	Mounting height	Luminaire
8.117 m	1.949 m	2.200 m	28
9.320 m	1.949 m	2.200 m	29
10.523 m	1.949 m	2.200 m	30
8.117 m	0.649 m	2.200 m	31
9.320 m	0.649 m	2.200 m	32
10.523 m	0.649 m	2.200 m	33

2 x LUXIONA LUXCAN MICRO TRACK 48V 600 36° EDD 04 827

Type	Field Arrangement
1st luminaire (X/Y/Z)	0.009 m / 0.499 m / 2.200 m
X-direction	3 pcs., Centre - centre, Distances not equal

X	Y	Mounting height	Luminaire
0.009 m	0.499 m	2.200 m	6
0.950 m	0.499 m	2.200 m	7

Acceso Información Tienda

Luminaire layout plan

Y-direction	4 pcs., Centre - centre, Distances not equal
Arrangement	A3

20 x LUXIONA LUXCAN MICRO TRACK 48V 600 36° EDD 04 827

Type	Field Arrangement
1st luminaire (X/Y/Z)	4.120 m / 0.499 m / 6.800 m
X-direction	5 pcs., Centre - centre, 0.640 m
Y-direction	4 pcs., Centre - centre, 1.000 m
Arrangement	A4

X	Y	Mounting height	Luminaire
4.120 m	3.500 m	6.800 m	8
4.760 m	3.500 m	6.800 m	9
5.400 m	3.500 m	6.800 m	10
6.040 m	3.500 m	6.800 m	11
6.680 m	3.500 m	6.800 m	12
4.120 m	2.500 m	6.800 m	13
4.760 m	2.500 m	6.800 m	14
5.400 m	2.500 m	6.800 m	15
6.040 m	2.500 m	6.800 m	16
6.680 m	2.500 m	6.800 m	17
4.120 m	1.499 m	6.800 m	18
4.760 m	1.499 m	6.800 m	19
5.400 m	1.499 m	6.800 m	20
6.040 m	1.499 m	6.800 m	21
6.680 m	1.499 m	6.800 m	22
4.120 m	0.499 m	6.800 m	23
4.760 m	0.499 m	6.800 m	24
5.400 m	0.499 m	6.800 m	25
6.040 m	0.499 m	6.800 m	26

Acceso Información Tienda

Luminaire layout plan

X	Y	Mounting height	Luminaire
6.680 m	0.499 m	6.800 m	27

3 x LUXIONA LUXCAN MICRO TRACK 48V 600 36° EDD 04 827

Type	Field Arrangement
1st luminaire (X/Y/Z)	7.550 m / 3.349 m / 2.200 m
X-direction	3 pcs., Centre - centre, 1.350 m
Y-direction	1 pcs., Centre - centre, 1.302 m
Arrangement	A2

X	Y	Mounting height	Luminaire
7.550 m	3.349 m	2.200 m	1
8.900 m	3.349 m	2.200 m	2
10.250 m	3.349 m	2.200 m	3

Individual luminaires

X	Y	Mounting height	Luminaire
0.950 m	1.460 m	2.200 m	34

Acceso Información Tienda

Luminaire list

Φ_{total}	P_{total}	Luminous efficacy
24466 lm	244.8 W	99.9 lm/W

pcs.	Manufacturer	Article No.	Article name	P	Φ	Luminous efficacy
2	CELER	7100025301	INLINE 1200MM 36W 3000K 4300LM OPAL DALI 2 NG	36.0 W	4297 lm	119.4 lm/W
32	LUXIONA	19.4373.1363.04	LUXCAN MICRO TRACK 48V 600 36° EDD 04 827	5.4 W	496 lm	91.9 lm/W

Acceso Información Tienda (Emergency light scene)

Calculation objects

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Acceso Información Tienda (Emergency light scene)

Calculation objects

Notes on planning:
The emergency lighting scene was calculated without reflection and taking into account the placed furniture.

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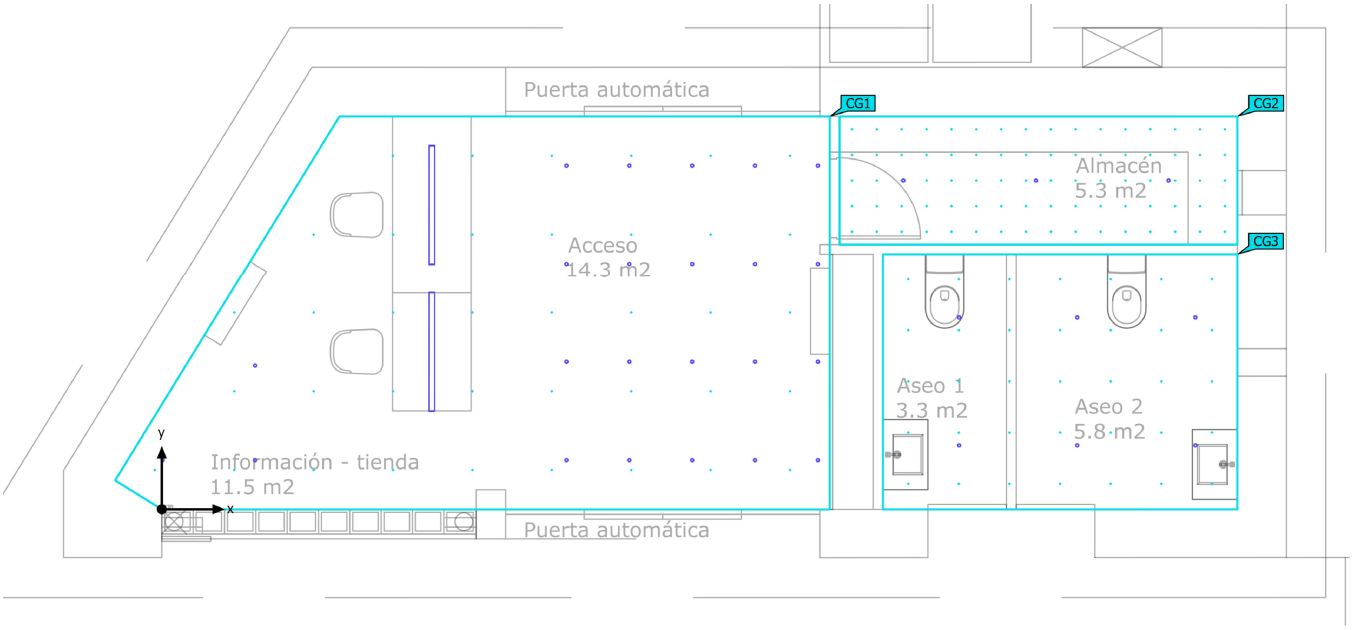
Acceso Información Tienda (Light scene 1)

Calculation objects



Acceso Información Tienda (Light scene 1)

Calculation objects

Calculation surfaces

Properties	$\bar{E}$	E_{min}	E_{max}	U_o (g_1)	g_2	Index
Acceso Información Tienda Perpendicular illuminance Height: 0.000 m	397 lx	251 lx	591 lx	0.63	0.42	CG1
Almacén Perpendicular illuminance Height: 0.000 m	210 lx	90.0 lx	309 lx	0.43	0.29	CG2
Aseos Perpendicular illuminance Height: 0.000 m	242 lx	125 lx	336 lx	0.52	0.37	CG3

Utilisation profile: DIALux presetting (5.1.4 Standard (outdoor transportation area))

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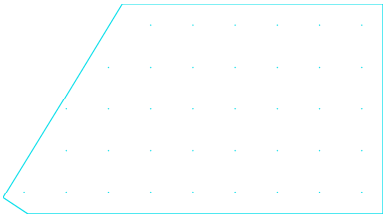
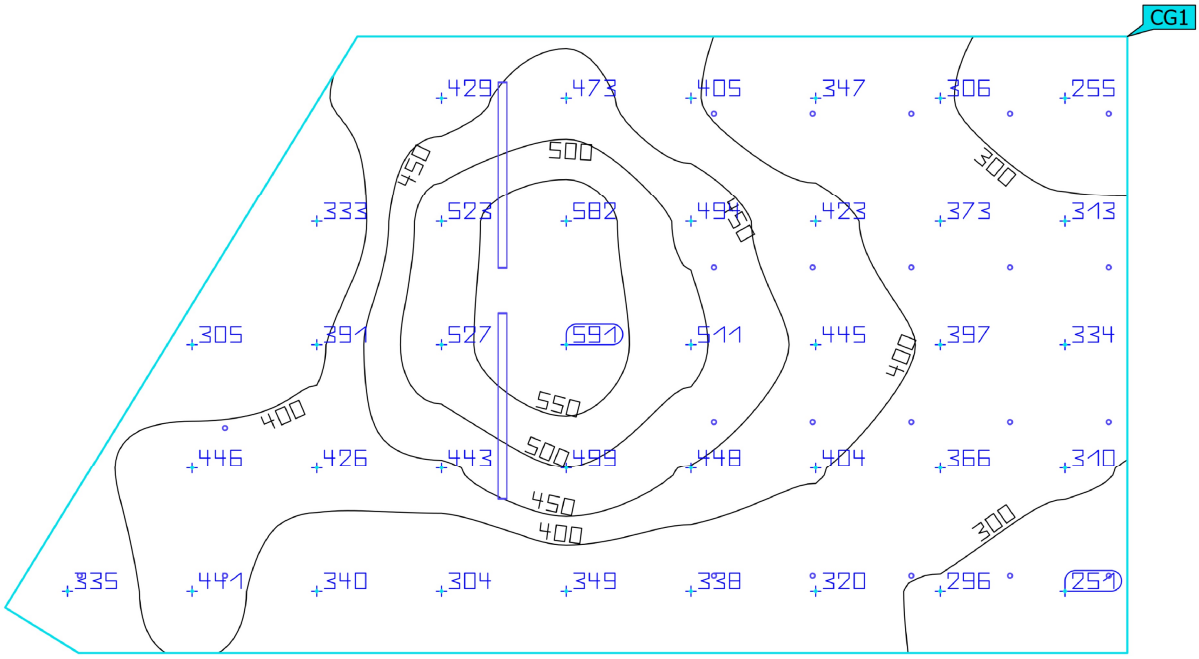
Acceso Información Tienda (Light scene 1)

Acceso Información Tienda





Properties	Ē	E_{min}	E_{max}	U_o (g_1)	g_2	Index
Acceso Información Tienda Perpendicular illuminance Height: 0.000 m	397 lx	251 lx	591 lx	0.63	0.42	CG1

Utilisation profile: DIALux presetting (5.1.4 Standard (outdoor transportation area))

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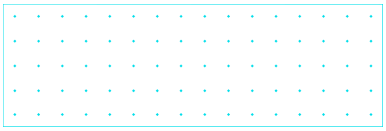
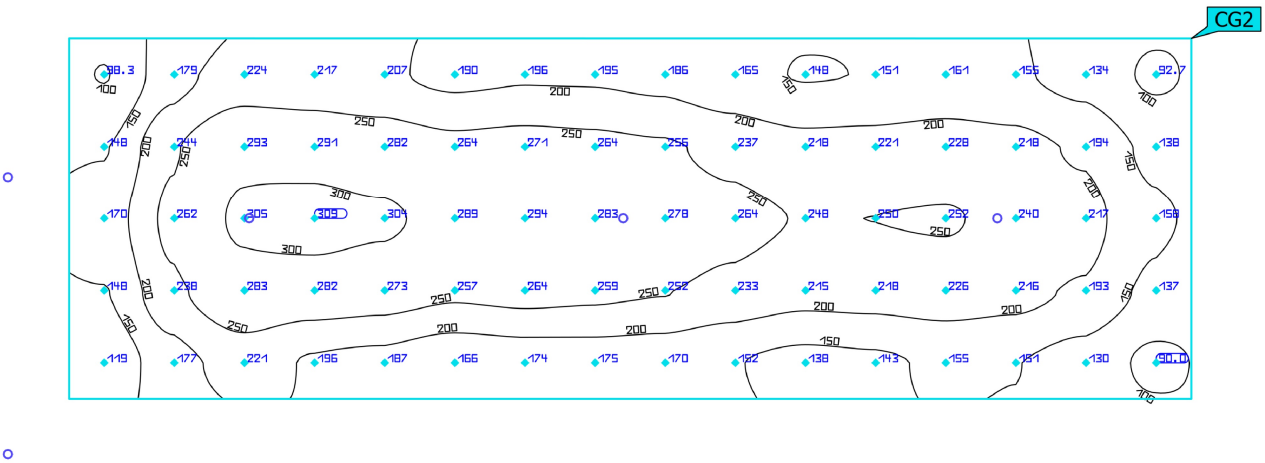
Acceso Información Tienda (Light scene 1)

Almacén





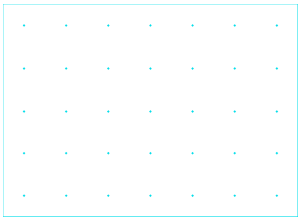
Properties	Ē	E_{min}	E_{max}	U_o (g_1)	g_2	Index
Almacén Perpendicular illuminance Height: 0.000 m	210 lx	90.0 lx	309 lx	0.43	0.29	CG2

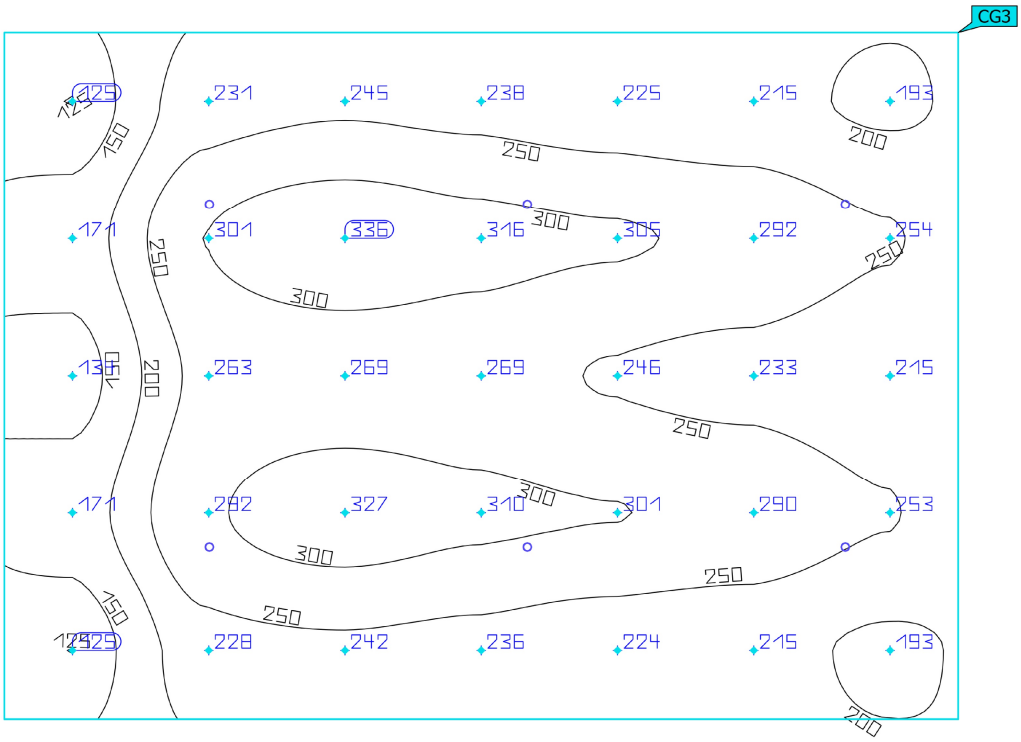
Utilisation profile: DIALux presetting (5.1.4 Standard (outdoor transportation area))

DIALux

Acceso Información Tienda (Light scene 1)

Aseos





Properties	Ē	E_{min}	E_{max}	U_o (g_1)	g_2	Index
Aseos Perpendicular illuminance Height: 0.000 m	242 lx	125 lx	336 lx	0.52	0.37	CG3

Utilisation profile: DIALux presetting (5.1.4 Standard (outdoor transportation area))

Glossary

A

A	Formula symbol for a surface in the geometry

B

Background area	The background area borders the direct ambient area according to DIN EN 12464-1 and reaches up to the borders of the room. In larger rooms, the background area is at least 3 m wide. It is located horizontally at floor level.

C

CCT	(Engl. correlated colour temperature) Body temperature of a thermal radiator which serves to describe its light colour. Unit: Kelvin [K]. The lesser the numerical value the redder; the greater the numerical value the bluer the light colour. The colour temperature of gas-discharge lamps and semi-conductors are termed "correlated colour temperature" in contrast to the colour temperature of thermal radiators. Allocation of the light colours to the colour temperature ranges acc. to EN 12464-1: Light colour - colour temperature [K] warm white (ww) < 3,300 K neutral white (nw) ≥ 3,300 – 5,300 K daylight white (dw) > 5,300 K
Clearance height	The designation for the distance between upper edge of the floor and bottom edge of the ceiling (in the completely furnished status of room).
Control group	A group of luminaires that are dimmed and controlled together. For each lighting scene, a control group provides its own dimming value. All luminaires within a control group share this dimming value. The control groups with their luminaires are automatically determined by DIALux on the basis of the created light scenes and their luminaire groups.
CRI	(Engl. colour rendering index) Designation for the colour rendering index of a luminaire or a lamp acc. to DIN 6169: 1976 or CIE 13.3: 1995. The general colour rendering index Ra (or CRI) is a dimensionless figure that describes the quality of a white light source in regards to its similarity with the remission spectra of defined 8 test colours (see DIN 6169 or CIE 1974) to a reference light source.

Glossary

D

Daylight autonomy	Describes what percentage of the daily working time the required illuminance is met by daylight. The nominal illuminance is used from the room profile, unlike described in EN 17037. The calculation is not done in the centre of the room but at the placed sensor measuring point. A room is considered sufficiently supplied with daylight if it achieves at least 50% daylight autonomy.
Daylight factor	Ratio of the illuminance achieved solely by daylight incidence at a point in the inside to the horizontal illuminance in the outer area under an unobstructed sky. Formula symbol: D (Engl. daylight factor) Unit: %
Daylight quotient effective area	A calculation surface within which the daylight quotient is calculated.

E

Energy evaluation	Based on an hourly calculation procedure for daylight in indoor spaces, considering the project geometry and any existing daylight control systems. Orientation and location of the project are also considered. The calculation uses the specified system power of the luminaires to determine the energy demand. A linear relationship between power and luminous flux in the dimmed state is assumed for daylight-controlled luminaires. Times of use and nominal illuminance are determined from the usage profiles of the spaces. Switched-on luminaires that are explicitly excluded from control also consider the specified times-of-use. The daylight control systems use a simplified control logic that closes them at an outdoor horizontal illuminance of 27,500lx. The calendar year 2022 is used as a reference only. It is not a simulation of this year. The reference year is only used to assign the days of the week to the calculated results. The changeover to summer time is not considered. The reference sky type used is the average sky described in CIE 110 without direct sunlight. The method was developed together with the Fraunhofer Institute for Building Physics and is available for review by the Joint Working Group 1 ISO TC 274 as an extension of the previous annual regression-based method.
Environmental zones	The assessment of intrusive light and light immission depends on the environment of the lighting installation. Depending on the standard, 4-6 different zones are defined, ranging from highly protected areas in natural settings to urban areas, commercial zones, and industrial zones.
Eta (η)	(light output ratio) The light output ratio describes what percentage of the luminous flux of a free radiating lamp (or LED module) is emitted by the luminaire when installed. Unit: %

Glossary

G

g_1	Often also U_o (Engl. overall uniformity) Designates the overall uniformity of the illuminance on a surface. It is the quotient from E_{min} to $\bar{E}$ and is required, for instance, in standards for illumination of workstations.
g_2	Actually it designates the "non-uniformity" of the illuminance on a surface. It is the quotient of E_{min} to E_{max} and is generally only relevant for certifying the emergency lighting acc. to EN 1838.

I

Illuminance	Describes the ratio of the luminous flux that strikes a certain surface to the size of this surface ($lm/m^2 = lx$). The illuminance is not tied to an object surface. It can be determined anywhere in space (inside or outside). The illuminance is not a product feature because it is a recipient value. Luxometers are used for measuring. Unit: Lux Abbreviation: lx Formula symbol: E
Illuminance, adaptive	For the determining of the middle adaptive illuminance on a surface, this is rastered "adaptively". In the area of large illuminance differences within the surface, the raster is subdivided finer; within lesser differences, a rougher classification is made.
Illuminance, horizontal	Illuminance that is calculated or measured on a horizontal (level) surface (this can be for example a table top or the floor). The horizontal illuminance is usually identified by the formula letter E_h.
Illuminance, perpendicular	Illuminance that is calculated or measured plumb-vertical to a surface. This needs to be taken into account for tilted surfaces. If the surface is horizontal or vertical, then there is no difference between the perpendicular and the horizontal or vertical illuminance.
Illuminance, vertical	Illuminance that is calculated or measured on a vertical surface (this can be for example the front of some shelves). The vertical illuminance is usually identified by the formula letter E_v.

K

k_S	The glare effect of a light source can be described by the glare metric k_S. It relates the solid angle of the glaring light source as seen from the point of immission, the ambient luminance, and the maximum allowable luminance.

Glossary

L

LENI	(Engl. lighting energy numeric indicator) Lighting energy numeric indicator acc. to EN 15193 Unit: kWh/(m^2 * a)
LLMF	(Engl. lamp lumen maintenance factor)/acc. to CIE 97: 2005 Lamp flux maintenance factor that takes the luminous flux reduction into account of a luminaire or an LED module in the course of the operating time. The lamp flux maintenance factor is specified as a decimal digit and can have a maximum value of 1 (no luminous flux reduction existing).
LMF	(Engl. luminaire maintenance factor)/acc. to CIE 97: 2005 Luminaire maintenance factor that takes the soiling into account of the luminaire in the course of the operating time. The luminaire maintenance factor is specified as a decimal digit and can have a maximum value of 1 (no soiling existing).
LSF	(Engl. lamp survival factor)/acc. to CIE 97: 2005 Lamp survival factor that takes the total failure into account of a luminaire in the course of the operating time. The lamp survival factor is specified as a decimal digit and can have a maximum value of 1 (no failures existing within the time concerned or prompt replacement after the failure).
Luminance	Dimension for the "brightness impression" that the human eye has of a surface. The surface itself can emit light thereby or light striking it can be reflected (emitter value). It is the only photometric value that the human eye can perceive. Unit: Candela per square metre Abbreviation: cd/m^2 Formula symbol: L
Luminous efficacy	Ratio of the emitted luminous flux Φ [lm] to the absorbed electrical power P [W] Unit: lm/W. This ratio can be formed for the lamp or LED module (lamp or module light output), the lamp or module with control gear (system light output) and the complete luminaire (luminaire light output).
Luminous flux	Dimension for the total light output that is emitted from one light source in all directions. It is thus an "emitter value" that specifies the entire emitting output. The luminous flux of a light source can only be determined in a laboratory. A difference is made between the lamp or LED module luminous flux and the luminaire luminous flux. Unit: Lumen Abbreviation: lm Formula symbol: Φ

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Luminous intensity	Describes the intensity of the light in a certain direction (emitter value). The luminous intensity is a matter of the luminous flux Φ that is emitted in a certain spherical angle Ω. The radiation characteristics of a light source are presented graphically in a light distribution curve (LDC). The luminous intensity is an SI base unit. Unit: Candela Abbreviation: cd Formula symbol: I

M

Maintenance factor	See MF
MF	(Engl. maintenance factor)/acc. to CIE 97: 2005 Maintenance factor as decimal number between 0 and 1 that describes the ratio of the new value of a photometric planning parameter (e.g. of the illuminance) to a maintenance value after a certain time. The maintenance factor takes into account the soiling of luminaires and rooms as well as the luminous flux reduction and the failure of light sources. The maintenance factor is taken into account either overall or determined in detail acc. to CIE 97: 2005 by the formula RMF x LMF x LLMF x LSF.

O

Obtrusive light/Light immission	To protect the nocturnal environment and minimize problems for humans, flora, and fauna, it is necessary to limit obtrusive light (also known as light pollution), which can cause serious physiological and ecological issues for individuals and the environment. Light immission refers to the disturbing influence of emitted light from artificial light sources.
Operating times	The assessment of obtrusive light and light immission depends on the operating times of the lighting installation. Depending on the standard, 1-3 different operating times are specified. In the absence of specific details, an operating time between 06:00 and 22:00 can be assumed.

P

P	(Engl. power) Electric power consumption Unit: watt Abbreviation: W

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R

$R_{(UG)}$ max	Measure of the psychological glare in indoor spaces. In addition to the luminance of luminaires, the level of the $R_{(UG)}$ value also depends on the observer position, the viewing direction and the ambient luminance. The calculation is made according to the table method, see CIE 117. Among other things, EN 12464-1:2021 specifies maximum permissible $R_{(UG)}$- values $R_{(UGL)}$ for various indoor workplaces.
R_{DLO}	The ratio of the luminous flux emitted below the horizontal plane to the total lamp luminous flux of a luminaire or lighting installation in its operational position.
R_G	The glare directly caused by luminaires of an outdoor lighting installation is determined using the CIE Glare Rating (RG) method. To calculate this, the equivalent veiling luminance of the surroundings is needed. There are four options for determining this: • An exact calculation according to CIE 112, based on the scene area. • A simplified method according to EN 12464-2, based on the scene area. • Using a custom calculation area to determine the equivalent veiling luminance. • Specifying a fixed value for easy comparability.
R_{UF}	upward flux ratio The ratio of the luminous flux emitted directly or reflected above the horizontal plane to the luminous flux that cannot be avoided under ideal conditions to achieve the illuminance level on a deliberately illuminated area.
R_{UL}	upward light ratio The ratio of the luminous flux emitted above the horizontal plane to the luminous flux of a luminaire or lighting installation in its operational position. The luminaire efficiency is considered in this calculation.
R_{ULO}	upward light output ratio The ratio of the luminous flux emitted above the horizontal plane to the total lamp luminous flux of a luminaire or lighting installation in its operational position.
Reflection factor	The reflection factor of a surface describes how much of the striking light is reflected back. The reflection factor is defined by the colour of the surface.
RMF	(Engl. room maintenance factor)/acc. to CIE 97: 2005 Room maintenance factor that takes the soiling into account of the space encompassing surfaces in the course of the operating time. The room maintenance factor is specified as a decimal digit and can have a maximum value of 1 (no soiling existing).
RUG (max)	(unified glare rating) Measure for the psychological glare effect in interiors. In addition to luminaire luminance, the RUG value also depends on the position of the observer, the viewing direction and the ambient luminance. Among other things, EN 12464-1 specifies maximum permissible RUG values for various indoor workplaces.

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RUG observer	Calculation point in the room, for the DIALux the RUG value is determined. The location and height of the calculation point should correspond to the typical observer position (position and eye level of the user).

S

Surrounding area	The ambient area directly borders the area of the visual task and should be planned with a width of at least 0.5 m according to DIN EN 12464-1. It is at the same height as the area of the visual task.

V

Visual task area	The area that is needed for carrying out the visual task in accordance with DIN EN 12464 -1. The height corresponds with the height at which the visual task is executed.

W

Wall zone	Circumferential area between working plane and walls which is not taken into account for the calculation.
Working plane	Virtual measuring or calculation surface at the height of the visual task that generally follows the room geometry. The working plane may also feature a wall zone.