Contents

Design guides and Characteristics

Simplified design guide for lighting distribution
Lighting-technology review

Selection of lighting levels

The table below indicates the necessary illumination in lux for different tasks.
In general, a higher level of illumination is required when:
- work involves small parts,
- objects are dark,
- the task requires a high level of visual attention,
- work is carried out at high speeds.

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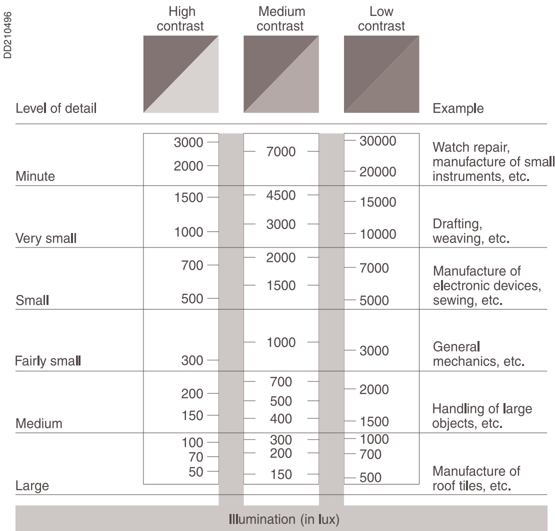

Selection of light sources

Visual comfort depends on the level of illumination (in lux) and the colour temperature (in degrees Kelvin).
The Kruithof diagram below can be used to make an optimum choice.
The blue zone represents a comfortable environment.

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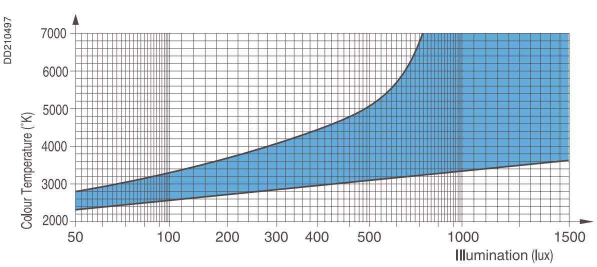
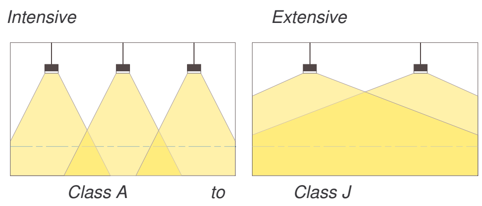


The table below sums up the essential characteristics of the main types of light source.

Type of light source		Colour temperature (°K)	Length of tubes (m)	Power (W)	Luminous flux (Lm)
Incandescent lamps		2800 to 3000	-	75	850
			-	150	2100
			-	300	4750
			-	750	13500
White industrial fluorescent tube	With starter	4250 to 4500	1.20	40	3200
			1.50	65	5100
			1.50	80	5900
	Instant start	4250 to 4500	1.20	40	2900
			1.50	65	4800
			2.40	105	8000
Mercury vapour	With starter	3300 to 4300	-	125	6500
			-	250	14000
			-	400	24000
			-	700	42000
			-	1000	60000

Simplified design guide for lighting distribution
Lighting-technology review



Selection of the lighting system

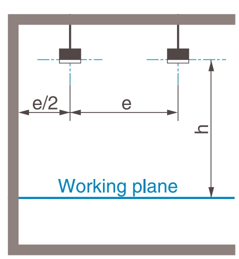
Direct lighting is used in offices, workshops and factories.
Semi-direct and indirect lighting is generally reserved for exhibitions, auditoriums, etc.
On industrial premises, direct lighting is generally used, from the most intensive to the most extensive, i.e. from class A to class J according to standards UTE 71-120 and 121.
Tables A and B determine the photometric class of luminaires depending on the rating of the sources and the illuminance.

Table A - Lighting in offices

Illuminance in lux	Fluorescent tubes		
	40 W 1.20 m	65 W 1.50 m	105 W 2.40 m
0 to 600	E	E	-
800	D	D	-
1000	D	D	C
1200	C	C	C
1500	C	C	C

Table B - Lighting in workshops and factories

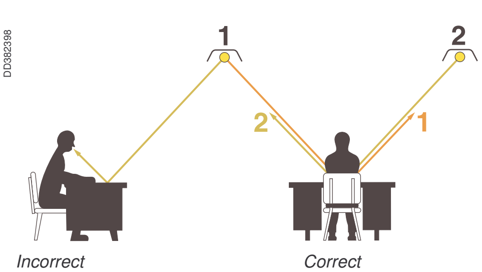
Illuminance in lux	Fluorescent tubes				
	40 W 1.20 m	65 W 1.50 m	80 W 1.50 m	105 W 2.40 m	Other lamps
0 to 200	G	G	-	-	E
400	F	F	-	-	D
600	E	E	-	-	C
800	D	D	-	-	C
1000	D	D	C	C	B
1200	C	C	C	C	B
1500	C	C	C	C	A



Distribution of light sources

The maximum distance between two luminaires is indicated in the table below, taking into account the photometric class and the height h.

Luminaire class	Maximum distance between two luminaires
A	e = 0.90 x h
B	e = 1.00 x h
C	e = 1.10 x h
D	e = 1.20 x h
E	e = 1.30 x h
F	e = 1.40 x h
G	e = 1.45 x h
H	e = 1.50 x h
I	e = 1.50 x h
J	e = 1.50 x h



Distribution is determined by the position of work stations (caution concerning reflection), which in turn determines the number of luminaires, on the condition that the total luminous flux is sufficient (see next page).

Simplified design guide for lighting distribution
Lighting-technology review

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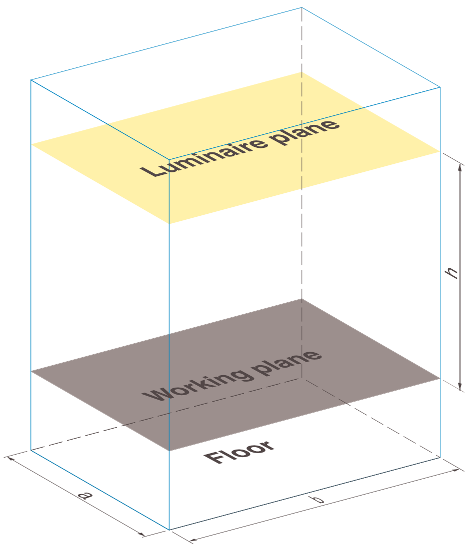

Total luminous flux

The total luminous flux required for the desired illuminance in a room is provided by the equation below:

$$F = \frac{E \times S \times d}{u}$$

F: Total luminous flux required (in lumens).
(Lumen: quantity of light per second reaching the working plane).
E: Illuminance (in lux).
(1 lux = 1 lumen/m²).
S: Surface area of room (in m^2).
d: Depreciation factor taking into account ageing of light sources and of the room *(1.3 to 1.5).*
u: The walls and ceiling absorb a part of the flux emitted by the light sources. The utilisation factor is the ratio between the luminous flux reaching the working plane and that emitted by the lamps.

- It depends on:
  - room proportions according to the K index:

$$K = \frac{a \times b}{h(a+b)}$$

  - reflectance factors of the walls and ceiling,
  - flux distribution of the luminaires.

Determining the utilisation factor "u"

Type of lighting	Room index	Reflectance factor					
		Ceiling 70 %			Ceiling 50 %		
	K	Walls 70 %	50 %	10 %	Walls 70 %	50 %	10 %
Direct lighting Polished-aluminium industrial reflector for mercury-vapour lamps	0.6	0.49	0.42	0.39	0.46	0.42	0.39
	0.8	0.58	0.51	0.48	0.54	0.51	0.48
	1	0.64	0.56	0.53	0.59	0.55	0.53
	1.25	0.69	0.60	0.58	0.62	0.60	0.57
	1.5	0.73	0.64	0.61	0.65	0.63	0.61
	2	0.78	0.68	0.66	0.69	0.37	0.65
	2.5	0.81	0.71	0.69	0.72	0.70	0.69
	3	0.84	0.73	0.72	0.73	0.72	0.71
	4	0.87	0.75	0.74	0.75	0.74	0.73
	5	0.88	0.76	0.75	0.76	0.75	0.74
Direct lighting Lacquered sheet-metal industrial reflector for two fluorescent tubes	0.6	0.31	0.24	0.20	0.28	0.23	0.20
	0.8	0.39	0.31	0.28	0.36	0.31	0.27
	1	0.45	0.37	0.33	0.41	0.36	0.33
	1.25	0.51	0.42	0.38	0.46	0.41	0.38
	1.5	0.56	0.46	0.43	0.50	0.45	0.42
	2	0.62	0.52	0.49	0.55	0.51	0.48
	2.5	0.67	0.56	0.53	0.58	0.55	0.53
	3	0.70	0.59	0.56	0.61	0.58	0.56
	4	0.74	0.63	0.61	0.64	0.62	0.60
	5	0.76	0.65	0.63	0.65	0.64	0.62

Simplified design guide for lighting distribution
Lighting-technology review

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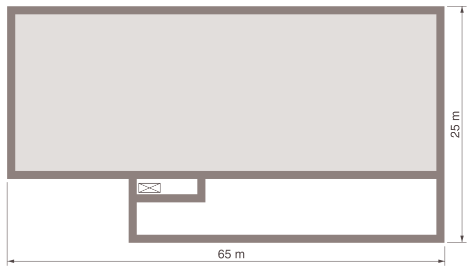

Example of a design project

Preliminary design of lighting for a factory:
- length: 65 m,
- width: 25 m,
- height: 6 m.

Selection of light sources taking into account the long daily use and the luminaire installation height set at 5 metres.
Luminaires in photometric class E are selected (table B, page 3).

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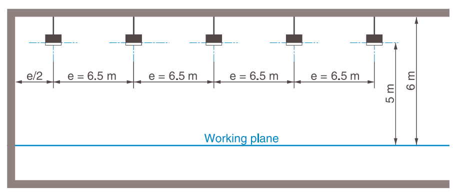

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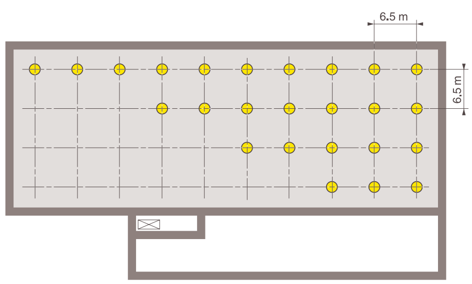

Distribution of luminaires

Distance between two class E luminaires: e = 1.30 x h = 1.30 x 5 = 6.5 m.
Number of luminaires over the length: 65 / 6.5 = 10 luminaires.
Number of luminaires over the width: 25 / 6.5 = 3.8 (i.e. 4 rows of 10 luminaires).
Total luminous flux:

$$F = \frac{E \times S \times d}{u}$$

E: Illuminance: 250 lux.
S: Surface area: 65 x 25 = 1 625 m^2.
d: Depreciation factor: 1.5.
u: Utilisation factor: the table on page 4 gives "u" directly as a function of K.

$$K = \frac{a \times b}{h(a+b)} = \frac{25 \times 65}{5(25+65)} = 3{,}6 \text{ that we round to 4}$$

Given a reflectance factor of 50 % for the ceiling and 10 % for the walls and the use mercury-vapour lamps:
u = 0.73.
Total luminous flux:

$$F = \frac{E \times S \times d}{u} = \frac{250 \times 1625 \times 1{,}5}{0,73} = 834760 \text{ lumens}$$

Rating of each source (f):

$$f = \frac{F}{\text{Number of luminaires}} = \frac{834760}{40} = 20869 \text{ lumens}$$

In the table on page 2, us allows to choose 400 W (24 000 lumens) mercury-vapour lamps which provide a lighting level of slightly above 250 lux.

Note : *If changes in workshop layout require modifications in the illumination on the working plane, Canalis makes it easy to add or remove luminaires.*

Simplified design guide for lighting distribution
Installation

Due to its flexible design, KDP busbar trunking simplifies routing and thus reduces design and installation times.
It is the optimum solution for installations with false ceilings or floors.

KBA and KBB busbar trunking is ideal where the building structure cannot support the luminaires.
They offer an IP55 degree of protection which means they can be installed in all types of buildings.

The competitiveness and aesthetics of KBX busbar trunking, with built-in luminaires, are unmatched.
It is the optimum solution for intensely lighted stores and buildings.

Busbar-trunking selection

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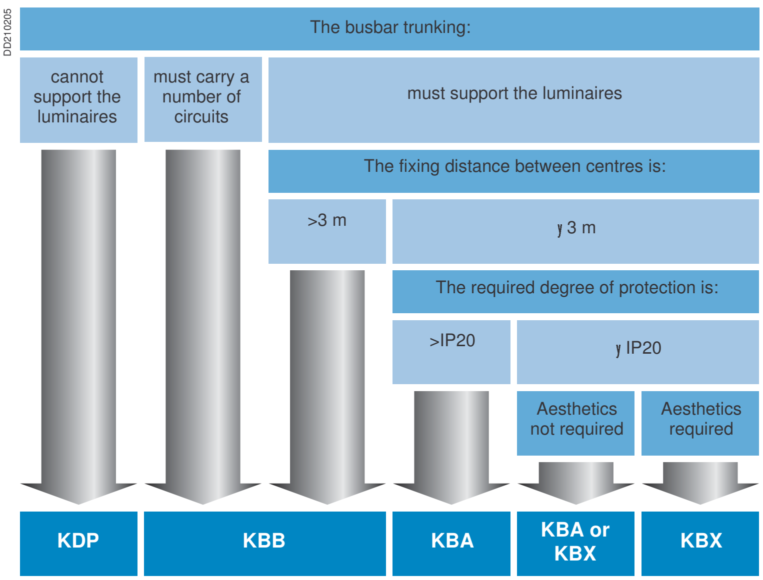

Fixing distance

KBA and KBB busbar trunking

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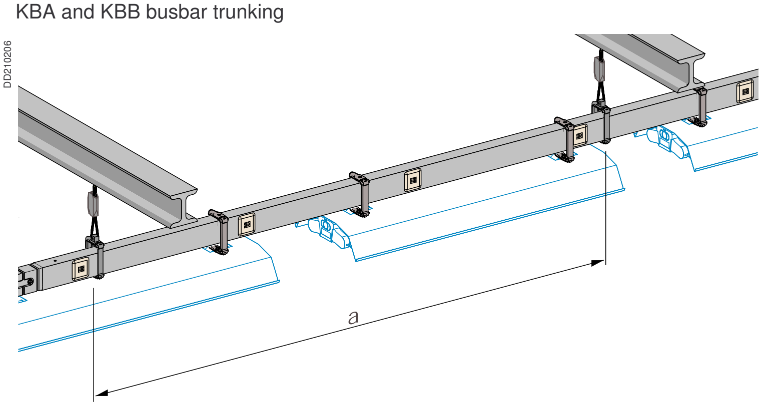

The fixing distance for KBA and KBB busbar trunking depends on the number and weight of the luminaires, as well as the building structure. The table below indicates the maximum permissible load (kg) between two fixing points for a deflection of 1/500. If the load is concentrated between two fixing points (mercury-vapour lamps), apply a coefficient of 0.6 to the values.

Maximum load (kg)										
Type of busbar trunking	tap-offs distance (m)	Fixing distance a (m)								
		2	2.5	3	3.5	4	4.5	5	5.5	6
KBA	1	34	22	15	no load					
	0.5	29	19	13	no load					
KBB	1 circuit	60	60	48	35	27	21	17	no load	
	2 circuits	60	51	41	30	23	18	15	no load	

Simplified design guide for lighting distribution
Selection of Canalis busbar trunking

The tables below indicate the possible fixing distances in metres for a deflection of 1/350, depending on the type of luminaire used and the installation method (trunking installed edgewise). .

Industrial reflector type fluorescent luminaires without protection grill
Industrial reflector type fluorescent luminaires with protection grill
Dust and damp-proof industrial reflector type fluorescent luminaires

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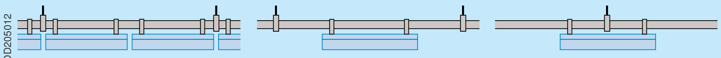
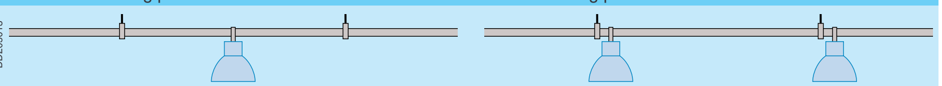


Power (W)	Unit weight (kg)			Possible spacing (metre)					
	Without protection gril	With protection gril	Dust and damp-proof	Close together		Far apart		Across fixing point	
				KBA	**KBB**	**KBA**	**KBB**	**KBA**	**KBB**
1 x 36	4.20	5.20	3.30	3.00	5.00	3.00	5.00	4.00	6.00
1 x 58	5.30	6.50	4.20	3.00	5.00	3.00	5.00	4.00	6.00
2 x 36	4.90	5.90	5.20	3.00	5.00	3.00	5.00	4.00	6.00
2 x 58	6.30	7.50	5.39	3.00	5.00	3.00	5.00	4.00	6.00

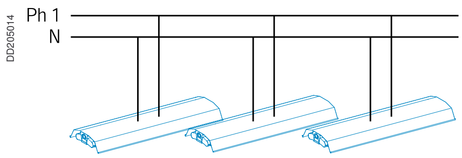
Mercury-vapour luminaires

DD205013

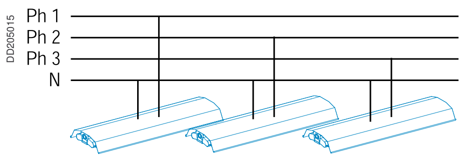


Power (W)	Unit weight (kg)	Possible spacing (metre)			
		Between two fixing points		Next to a fixing point	
		KBA	**KBB**	**KBA**	**KBB**
250	6.00	3.00	5.00	4.00	6.00
	8.50	3.00	5.00	4.00	6.00
	10.00	3.00	5.00	4.00	6.00
400	6.50	3.00	5.00	4.00	6.00
	9.00	3.00	5.00	4.00	6.00
	11.00	3.00	5.00	4.00	6.00

Simplified design guide for lighting distribution
Determining the operational current



Ph + N distribution



3Ph + N balanced distribution

The tables below show the **operational current** as a function of the type and number of luminaires installed on a **single-phase line** (L + N) supplied with 230 V AC current. For a three-phase + N (AC, 400 V between phases) line, with equivalent phase current, the number of luminaires is three times higher.

Procedure

- identify the type of luminaire (e.g. 2 x 58 W compensated fluorescent),
- on the corresponding line, select the number (or next highest) of installed luminaires (e.g. 26 if there are 23 luminaires),
- at the bottom of the table, read the corresponding operational current (e.g. 20 A).

Industrial reflector type fluorescent luminaires

Type of ballast	Power (W)	Number of luminaires on the line											
		Single-phase line						Three-phase + N line					
Compensated	1 x 36	33	53	66	-	-	-	99	-	-	-	-	-
	1 x 58	25	40	50	62	-	-	75	-	-	-	-	-
	2 x 36	21	33	42	52	67	-	63	99	-	-	-	-
	2 x 58	13	20	26	32	41	52	39	60	78	96	-	-
Non-compensated	1 x 36	22	35	44	55	-	-	66	105	-	-	-	-
	1 x 58	14	22	28	35	45	-	42	66	84	-	-	-
	2 x 36	11	17	22	27	35	44	33	51	66	81	-	-
	2 x 58	7	11	14	17	22	28	21	33	42	51	66	84
Operational current (A)		**10**	**16**	**20**	**25**	**32**	**40**	**10**	**16**	**20**	**25**	**32**	**40**

Mercury-vapour luminaires

Type of ballast	Power (W)	Number of luminaires on the line									
		Single-phase line					Three-phase + N line				
Compensated	250	7	11	14	17	22	21	33	42	51	66
	400	4	6	8	10	13	12	18	24	30	39
Non-compensated	250	4	7	9	11	14	12	21	27	33	42
	400	3	4	6	7	9	9	12	18	21	27
Operational current (A)		**10**	**16**	**20**	**25(1)**	**32**		**16**	**20**	**25(1)**	**32**
Type of busbar trunking		**20 A KDP 25 A KBA or KBB**				**40 A KBA or KBB**		**25 A KBA or KBB**			**40 A KBA or KBB**

High-pressure sodium-vapour luminaires

Type of ballast	Power (W)	Number of luminaires on the line									
		Single-phase line					Three-phase + N line				
Compensated	150	11	17	22	27	35	33	51	66	81	105
	250	7	11	14	17	22	21	33	42	51	66
	400	4	7	9	11	14	12	21	27	33	42
Non-compensated	150	5	8	11	13	17	15	24	33	39	51
	250	3	5	6	8	10	9	15	18	24	30
	400	2	3	4	5	6	3	9	12	15	18
Operational current (A)		**10**	**16**	**20**	**25(1)**	**32**	**10**	**16**	**20**	**25(1)**	**32**
Type of busbar trunking		**20 A KDP 25 A KBA or KBB**				**40 A KBA or KBB**		**25 A KBA or KBB**			**40 A KBA or KBB**

- Then refer to:
  - page 10 to determine the type of busbar trunking and cables sizes as a function of type of protection (circuit breaker or fuse),
  - page 13 to check voltage drop in the busbar trunking and the supply cable.

(1) For this type of luminaire, for 25 A and higher, select a 40 A KBA or KBB to take into account the overcurrent during starting.

Simplified design guide for lighting distribution
Overload protection

Precalculating XLPE or PVC cables + Canalis

Drawn from the Ecodial low-voltage installation-calculation software, the information provided here assists in defining busbar trunking (cables and Canalis) and their protection in compliance with installation standards and calculation guide.

Protection of the main busbar trunking (cable + Canalis)

- The tables below may be used to determine:
  - the rated current (In) or the setting current (Ir) of the overload-protection devices,
  - the rated current (Inc) of Canalis,
  - the thermal minimum cross-section of cables.
- These three characteristics are defined for the following installation conditions:
  - maximum ambient temperature 30°C,
  - cables placed in cable trays. Layout as a single horizontal layer or in groups of 2 or 3 cores.

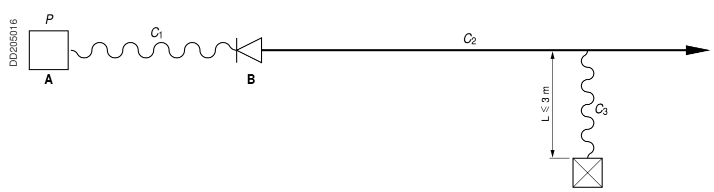
Tap-off protection

Canalis tap-offs must have overload protection. The tap-off is created using a fused tap-off unit to protect the cable (C_3) and the device against short-circuits.
This protection offers good discrimination during operation (continuity of service, trouble-shooting, etc.).
For lighting, it may be useful to take advantage of the **possibilities for dispensing with or remotely locating** the protection, offered by standard IEC 60-364-4-43 (§ 433 and 434) and summarised in the texts below, drawn from UTE C 15-107.
The tap-off is created using a pre-wired tap-off unit.

Supply to devices not subject to overloads

Exemption possibilities:

- the C_3 cable (connection to the device) does not need to be protected against overloads (NF C 15-100, 473.1.2b) or short-circuits (NF C 15-100, 473.2.2.1) because the cable :
  - is not subject to overload currents,
  - does not have tap-offs or power sockets,
  - is less than or equal to three metres,
  - is designed to reduce to a minimum the risk of short-circuits,
  - is not located near any flammable material.

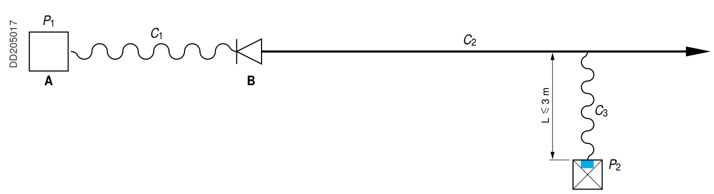


*Example: **luminaires**, convectors, etc.*

Supply to devices with built-in overload protection

Exemption possibilities:

- the device P_2 protecting C_3 cable against overloads is not positioned at the head (NF C 15-100, 473.1.1.2 b) of C_3 because the latter:
  - does not have tap-offs or power sockets,
  - is less than or equal to three metres,
  - is designed to reduce to a minimum the risk of short-circuits,
  - is not located near any flammable material.



NB: P_1 - P_2 are short-circuit protection devices.

Simplified design guide for lighting distribution
Overload protection

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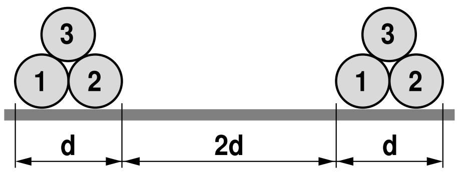

Cables spaced in cable trays.

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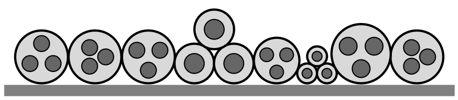


Cables touching in cable trays.

Precalculating XLPE or PVC cables + Canalis

The tables below determine, as a function of the type of overload protection (circuit breaker or fuse):

- the type of busbar trunking required,
- the size of supply cables (in mm²) as a function of the installation method, for all conductor configurations.

Protection by Merlin Gerin C60 (curve C) modular circuit breaker

Type of busbar trunking	Operat. current Circuit-breaker rating (A)	XLPE cable			PVC cable			
		Spaced	Touching (number of cables)		Spaced	Touching (number of cables)		
			2 to 5	6 or more		2	3	4 or more
20 A KDP 25 A KBA 25 A KBB	10	1.5	1.5	1.5	1.5	1.5	1.5	1.5
	16	1.5	1.5	1.5	1.5	2.5	2.5	2.5
	20	1.5	2.5	2.5	2.5	2.5	4	4
25 A KBA 25 A KBB	25	2.5	4	4	2.5	4	4	6
			2.5(1)	2.5(1)				
40 A KBA 40 A KBB	32	4	6	6	4	6	6	10
		2.5(1)	4(1)	4(1)				
	40	4	6	10	6	10	10	10
				6(1)				

Protection by gG fuses

Type of busbar trunking	Rated current (A)	XLPE cable			PVC cable			
		Spaced	Touching (number of cables)		Spaced	Touching (number of cables)		
			2 to 5	6 or more		2	3	4 or more
20 A KDP 25 A KBA 25 A KBB	10	1.5	1.5	1.5	1.5	1.5	1.5	1.5
	16	1.5	2.5	2.5	2.5	2.5	2.5	4
			1.5(1)					
	20	2.5	2.5	2.5	2.5	4	4	6
		1.5(1)						
25 A KBA 25 A KBB	25	2.5	4	6	4	6	6	6
				4(1)				
40 A KBA 40 A KBB	32	4	6	6	6	6	10	10
		2.5(1)	4(1)					

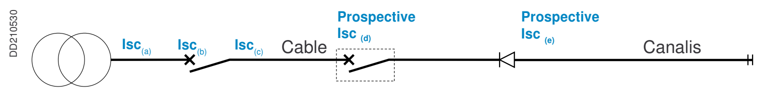
(1) Permissible cable cross-sections for single-phase distribution.

Simplified design guide for lighting distribution
Short-circuit protection

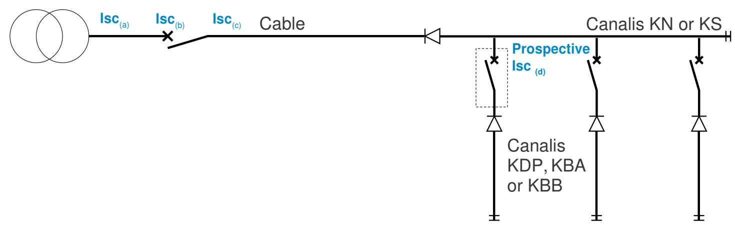
Determining the prospective short-circuit current at the origin of the Canalis

There are two possible situations:

- the busbar trunking for lighting is supplied by a secondary switchboard.



- the busbar trunking for lighting is supplied by another Canalis busbar trunking system.



Isc(a): rms short-circuit current across the transformer terminals.

Rms Isc (a) values across the transformer terminals (U = 400 V)													
Power (kVA)	50	100	150	200	250	315	400	500	630	800	1000	1250	1600
Isc(a) (kA)	1.8	3.6	5.7	7.2	8.9	11.2	14.2	17.6	22.1	24.8	27.8	31.5	36.7

Isc(b): downstream short-circuit current, less than Isc(a), limited by cable impedance.

Isc(c): short-circuit current across circuit-breaker terminals, less than Isc(b), limited by circuit breaker.

Isc(d): prospective short-circuit current, limited by cable impedance (case 1) or by impedance of cable + Canalis (case 2).

Isc(e): prospective short-circuit current, at head of Canalis by the circuit breaker (d) and the impedance of the Canalis supply cable.

Drawn from the Ecodial low-voltage installation-calculation software, produced by Schneider Electric for fast and precise evaluation of prospective short-circuit currents at different points in the circuit.

Please consult your regional sales office.

Canalis and protection coordination

Drawn from tests specified in standards (used in our guides and software), the table below determines the type of Merlin Gerin circuit breaker or fuse required for a particular type of busbar trunking depending on the prospective short-circuit current at the head of the Canalis trunking.

Type of busbar trunking	Circuit-breaker protection Isc (d) (Prospective Isc)					Fuse protection Prospective Isc
	10 kA	15 kA	20 kA	25 kA	50 kA	50 kA
20 A KDP	C60N20	C60H20	C60L20	C60L20	-	20 A gG
25 A KBA, 25 A KBB	C60N25	C60H25	C60L25	C60L25	NC100LH25	20 A gG
40 A KBA, 40 A KBB	C60N40	C60H40	C60L40	C60L40	NC100LH40	32 A gG

Characteristics of Canalis busbar trunking

Type of busbar trunking	Short-circuit withstand Rated peak short-circuit current (kA)	Permissible thermal stress for 0.1 s ≤ t ≤ 3 s (A^2S)
20 A KDP	3.6	12 x 10^4
25 A KBA	4.4	19.5 x 10^4
40 A KBA	9.6	90 x 10^4
25 A KBB	4.4	19.5 x 10^4
40 A KBB	9.6	90 x 10^4

Simplified design guide for lighting distribution
Check on voltage drop

Recommended design procedure

- Assign each circuit with a voltage-drop value expressed as a % of the rated voltage (Un), given that the voltage drop between the head of the circuit and any point must not exceed the values in the table below.

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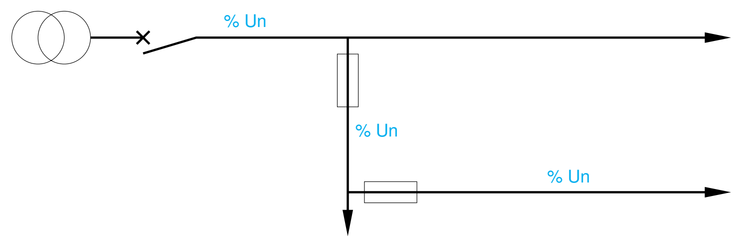

Type of installation	Voltage drop (for lighting)
Installations supplied directly from a public low-voltage distribution network	3 %
Installations supplied by a subscriber substation or a transformer substation from a high-voltage installation (1)	6 %

(1) Wherever possible, voltage drops in final lighting circuits must not exceed 3 %. When the main busbar trunking in the installation is longer than 100 metres, the permissible values may be increased 0.005 % per metre of trunking over 100 metres, on the condition that the total addition not exceed 0.5 %.

- Convert into volts the % of the rated voltage (Un) assigned to each circuit.

- Using the tables, check that the trunking and/or cables selected in the previous pages are compatible with the calculated voltage drops.
Otherwise, it is necessary to increase the size of the cables.

Remarks

- In a mixed circuit, the most economical option is to increase the size of cables and avoid the use of prefabricated trunking with a higher rated current (Inc).

- For certain loads, it may be necessary to take into account transient voltage drops.

Simplified design guide for lighting distribution
Check on voltage drop

Voltage drop in the supply cable (copper)

The table below indicates the single-phase voltage drop, in volts, at the end of the cable supplying Canalis.
The three-phase voltage drop is obtained by multiplying the single-phase voltage drop indicated below by 0.866.
If the exact operational current (Ib) and length are not available, select the next highest.

Cable size (mm^2)	Operational current (A)	Length of line (m)															
		6	8	10	12	15	20	25	30	35	40	45	50	60	70	80	100
1 x 1.5	**10**	1.4	1.9	2.4	2.9	3.6	4.8	6	7.2	8.4	9.6	11	12	14	17	19	24
	16	2.3	3.1	3.9	4.6	5.8	7.7	9.6	12	13	15	17	19	23	27	31	39
	20	2.9	3.9	4.8	5.7	7.2	9.6	12	14	17	19	22	24	29	34	39	48
1 x 2.5	**10**	0.9	1.2	1.4	1.7	2.2	2.9	3.6	4.3	5.1	5.8	6.5	7.2	8.7	10	12	14
	16	1.4	1.9	2.3	2.8	3.5	4.6	5.8	7	8.1	9.3	10	12	14	16	19	23
	20	1.7	2.3	2.9	3.5	4.3	5.8	7.2	8.7	10	12	13	14	17	20	23	29
	25	2.2	2.9	3.6	4.3	5.4	7.2	9.1	11	13	14	16	18	22	25	29	36
1 x 4	**16**	0.9	1.2	1.5	1.7	2.2	2.9	3.6	4.4	5.1	5.8	6.5	7.3	8.7	10	12	15
	20	1.1	1.5	1.8	2.2	2.7	3.6	4.5	5.5	6.4	7.3	8.2	9.1	11	13	15	18
	25	1.4	1.8	2.3	2.7	3.4	4.5	5.7	6.8	8	9.1	10	11	14	16	18	23
	32	1.7	2.3	2.9	3.5	4.4	5.8	7.3	8.7	10	12	13	15	17	20	23	29
	40	2.2	2.9	3.6	4.4	5.5	7.3	9.1	11	13	15	16	18	22	25	29	36
1 x 6	**16**	0.6	0.8	1	1.2	1.5	2	2.4	2.9	3.4	3.9	4.4	4.9	5.9	6.8	7.8	9.8
	20	0.7	1	1.2	1.5	1.8	2.4	3	3.7	4.3	4.9	5.5	6.1	7.3	8.5	9.8	12
	25	0.9	1.2	1.5	1.8	2.3	3	3.8	4.6	5.3	6.1	6.9	7.6	9.1	11	12	15
	32	1.2	1.6	2	2.3	2.9	3.9	4.9	5.9	6.8	7.8	8.8	9.8	12	14	16	20
	40	1.5	2	2.4	2.9	3.7	4.9	6.1	7.3	8.5	9.8	11	12	15	17	20	24
1 x 10	**20**	0.4	0.6	0.7	0.9	1.1	1.5	1.8	2.2	2.6	3	3.3	3.7	4.4	5.2	5.9	7.4
	25	0.6	0.7	0.9	1.1	1.4	1.8	2.3	2.8	3.2	3.7	4.2	4.6	5.5	6.5	7.4	9.2
	32	0.7	0.9	1.2	1.4	1.8	2.4	3	3.5	4.1	4.7	5.3	5.9	7.1	8.3	9.5	12
	40	0.9	1.2	1.5	1.8	2.2	3	3.7	4.4	5.2	5.9	6.7	7.4	8.9	10	12	15

Voltage drop in the Canalis busbar trunking

The table below indicates the single-phase voltage drop, in volts, in the Canalis busbar trunking (electrical power uniformly distributed).
The three-phase voltage drop is obtained by multiplying the single-phase voltage drop indicated below by 0.866.
If the exact operational current (Ib) and length are not available, select the next highest.

Type of Canalis	Operational current (A)	Length of line (m)															
		6	8	10	12	15	20	25	30	35	40	45	50	60	70	80	100
20 A KDP	**10**	0.4	0.6	0.7	0.9	1.1	1.5	1.8	2.2	2.6	2.9	3.3	3.7	4.74	5.1	5.9	7.3
	16	0.7	0.9	1.2	1.4	1.8	2.3	2.9	3.5	4.1	4.7	5.3	5.9	7.0	8.2	9.4	11.7
	20	0.9	1.2	1.5	1.8	2.2	2.9	3.7	4.4	5.1	5.9	6.6	7.3	8.8	10.3	11.7	14.7
25 A KBA	**10**	0.4	0.5	0.6	0.7	0.9	1.2	1.5	1.8	2.1	2.4	2.8	3.1	3.7	4.3	4.9	6.1
25 A KBB	**16**	0.6	0.8	1	1.2	1.5	2	2.4	2.9	3.4	3.9	4.4	4.9	5.9	6.8	7.8	9.8
	20	0.7	1	1.2	1.5	1.8	2.4	3.1	3.7	4.3	4.9	5.5	6.1	7.3	8.6	9.8	12.2
	25	0.9	1.2	1.5	1.8	2.3	3.1	3.8	4.6	5.3	6.1	6.9	7.6	9.2	10.7	12.2	15.3
40 A KBA	**16**	0.2	0.3	0.4	0.5	0.6	0.8	1	1.2	1.4	1.6	1.8	2	2.4	2.8	3.2	4
40 A KBB	**20**	0.3	0.4	0.5	0.6	0.7	1	1.2	1.5	1.7	2	2.2	2.5	3	3.5	4	5
	25	0.4	0.5	0.6	0.7	0.9	1.2	1.6	1.9	2.2	2.5	2.8	3.1	3.7	4.4	5	6.2
	32	0.5	0.6	0.8	1	1.2	1.6	2	2.4	2.8	3.2	3.6	4	4.8	5.6	6.4	8
	40	0.6	0.8	1	1.2	1.5	2	2.5	3	3.5	4	4.5	5	6	7.0	8	10
25 A KBX	**10**	0.4	0.5	0.6	0.8	0.9	1.3	1.6	1.9	2.2	2.5	2.8	3.2	3.8	4.4	5	6.3
	16	0.6	0.8	1	1.2	1.5	2	2.5	3	3.5	4	4.5	5	6	7.1	8.1	10.1
	20	0.8	1	1.3	1.5	1.9	2.5	3.2	3.8	4.4	5	5.7	6.3	7.6	8.8	10.1	12.6
	25	0.9	1.3	1.6	1.9	2.4	3.2	3.9	4.7	5.5	6.3	7.1	7.9	9.5	11	12.6	15.8

Voltage-drop conversion

Operational voltage (V)	Voltage drop in volts for a given %														
	0.3	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	6	7	8	9	10
230	0.7	1.2	2.3	3.5	4.6	5.8	6.9	8.1	9.2	10	12	14	16	18	21	23
400	1.2	2	4	6	8	10	12	14	16	18	20	24	28	32	36	40

Simplified design guide for power distribution
Power distribution via Canalis

Except for the most extreme environments, there is no reason to hesitate. Canalis can be installed everywhere.

The procedure presented below describes the steps in creating a simple installation. For a detailed design study, it is necessary to use the suitable tools, approved by certification organisations and in compliance with local installation standards. ***Ecodial*** software, published by Schneider Electric, is perfectly suited to the task.

Procedure

1 Identify external influences.
2 Layout the Canalis structure in the building according to the load locations.
3 Carry out a power sum.
4 Size the busbar trunking.

1 Identify external influences

The ambient temperature, the presence of dust or condensation, etc. are all factors in defining the degree of protection for the room containing the electrical installation. Canalis prefabricated busbar trunking provides an IP55 degree of protection and can be installed on virtually all sites.

- Examples:
  - mechanical workshops: IP32,
  - warehouses: IP30,
  - poultry farms: IP35,
  - greenhouses: IP23,
  - ...

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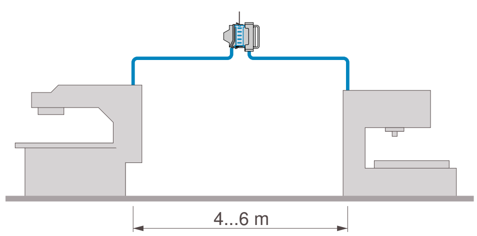

2 Layout of Canalis busbar trunking

Layout of the distribution lines depends on load and source locations as well as trunking fixing possibilities.

- A single distribution line can supply a zone four to six metres long.
- Load protection is located in the tap-off units, as close as possible to the loads.
- A single Canalis feeder can supply a set of loads with different power ratings.

3 Power sum

Once the busbar trunking has been laid out, calculate the currents drawn by the Canalis lines.

Calculation of the total operational current drawn by the line
(In) is equal to the sum of the currents drawn by the loads (Ib): In = Σ Ib.
The loads do not all operate at the same time or continuously at full rated load, i.e. it is necessary to calculate the diversity coefficient (K_S): In = Σ (Ib x K_S).

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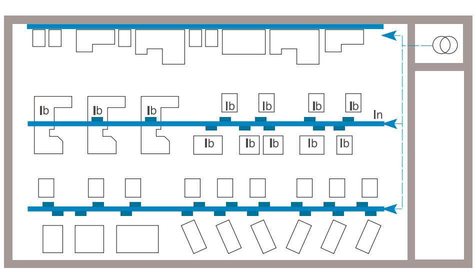


Diversity coefficient as a function of the number of loads

Application	Number of loads	K_S coefficient
Lighting, heating	-	1
Distribution (Mechanical workshop)	2...3	0.9
	4...5	0.8
	6...9	0.7
	10...40	0.6
	40 or more	0.5

***Caution**. For industrial installations, remember to allow for changes in types and numbers of machines. Similar to a switchboard, a margin of 20 % is recommended:*
In = Σ Ib x K_S x 1.2.

Selection of busbar trunking rating as a function of the operational current total In

Operational current total In (A)	Busbar trunking
0...40	**KNA 40**
40...63	**KNA 63**
63...100	**KNA 100 or KSA 100**
100...160	**KNA 160 or KSA 160**
160...250	**KSA 250**
250...400	**KSA 400**
400...500	**KSA 500**
500...630	**KSA 630**
630...800	**KSA 800**
800...1000	**KSA 1000**

4 Sizing the busbar trunking

Overload criterion

Ambient temperature
Canalis busbar trunking is sized for an ambient temperature of 35°C. For higher temperatures, the trunking must be derated as per the data in the tables on the technical characteristics.
Example: Canalis 400 A KSA at 45°C: In = 400 x 0.94 = 376 A.

Installation method
Canalis KN and KS trunking is designed to be installed edgewise.
In certain cases, it can also be installed flat (false floors) or vertically (KS rising mains).
These installation methods do not require derating for the KN and KS trunking.

Protection against trunking overloads
To enable future extensions, protection for prefabricated busbar trunking is generally sized for the rated current Inc (or the permissible current Iz if coefficient K1 is applied as a function of the ambient temperature).

- Protection using gG (gI) flues:
  - determine the standardised rated current In of the fuse such that In $\leq$ Inc/1,1 (K1=1,1 for the fuses),
  - select the standardised rating In equal to that value or just below.

Check that In $\geq \Sigma$ (Ib x K_S). If that is not the case, select the busbar trunking with the next highest rating.

Nota : *Protection using gI fuses results in a reduction of the permissible current in the trunking.*

- Circuit-breaker protection: select the setting current Ir for the circuit breaker such that Σ (Ib x K_S) $\leq$ Ir $\leq$ Inc.

Nota : *Circuit-breaker protection means Canalis busbar trunking can be used to the full rated load.*

Voltage-drop criterion

The voltage drop between the head and any other point in the installation must not exceed the values in the table below:

Installation supplied by a distribution network	Lighting	Other application
LV public system	3 %	5 %
High voltage	6 %	8 %

For Canalis, voltage drops are indicated in V/100 m/A in the "Characteristics" section.

U = Σ (Ib x K_S) x L / 100
Example: "Characteristics" page for KN, 40 to 160 A

For a cos φ of		Canalis KN			
		40 A	63 A	100 A	160 A
0,7	V/100 m/A	0.376	0.160	0.077	0.063
0,8	V/100 m/A	0.425	0.179	0.084	0.067
0,9	V/100 m/A	0.474	0.196	0.089	0.071
1	V/100 m/A	0,516	0.208	0.088	0.068

Short-circuit current criterion

For typical applications with power ratings up to 630 kVA, a Merlin Gerin solution including the low-voltage electrical switchboard, circuit breakers and Canalis busbar trunking ensures an installation sized to handle all short-circuit levels encountered.
To check the configuration of your installation (Isc up to 150 kA), refer to the coordination tables on page 304 to page 306.
We also invite you to discover Ecodial, our complete design software for low-voltage installations (selection of circuit breakers and cables, calculation of breaking capacities, short-circuit currents and voltage drops, etc.), available from your Schneider Electric representative.

Simplified design guide
Determining the degree of protection

Standard IEC 60364-5-51 categorises a large number of external influences to which electrical installations can be subjected, for instance the presence of water, solid objects, shocks, vibrations and corrosive substances.
The importance of these influences depends on the installation conditions.
For example, the presence of water can vary from a few drops to total immersion.

Degree of protection IP

Standard IEC 60529 (February 2001) indicates the degree of protection provided by electrical equipment enclosures against accidental direct contact with live parts and against the ingress of solid foreign objects or water.

This standard does not apply to protection against the risk of explosion or conditions such as humidity, corrosive gases, fungi or vermin.

The IP code comprises 2 characteristic numerals and may include an additional letter when the actual protection of persons against direct contact with live parts is better than that indicated by the first numeral.

The first numeral characterises the protection of the equipment against penetration of solid objects and the protection of people.
The second numeral characterises the protection of the equipment against penetration of water with harmful effects.

Remarks concerning the degree of protection IP

b The degree of protection IP must always be read and understood numeral by numeral and not as a whole.
For example, an IP31 enclosure is suitable for an environment that requires a minimum degree of protection IP21. However an IP30 wall-mount enclosure is not suitable.

b The degrees of protection indicated in this catalogue are valid for the enclosures as presented. However, the indicated degree of protection is guaranteed only when the installation and device mounting are carried out in accordance with professional standard practice.

Additional letter

Protection of persons against direct contact with live parts.

The additional letter is used only if the actual protection of persons is higher than that indicated by the first characteristic numeral of the IP code.
If only the protection of persons is of interest, the two characteristic numerals are replaced by the letter "X", e.g. IPXXB.

Degree of protection IK

Standard IEC 62262 defines a coding system (IK code) indicating the degree of protection provided by electrical equipment enclosures against external mechanical impact.

Installation standard IEC 60364 provides a cross-reference between the various degrees of protection and the environmental conditions classification, relating to the selection of equipment according to external factors.

IK codep p

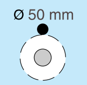
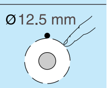
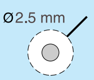
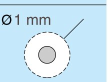
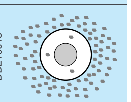
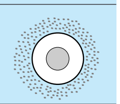
The IK code comprises 2 characteristic numerals (e.g. IK05).

Practical guide UTE C 15-103 shows, in the form of tables, the characteristics required for electrical equipment (including minimum degrees of protection), according to the locations in which they are installed.

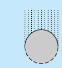
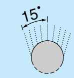
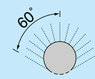
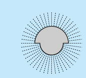
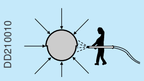
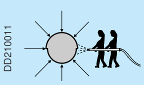
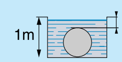
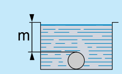
Simplified design guide
Determining the degree of protection

Meaning of the numerals and letters representing the degree of protection IP.

1st characteristic numeral: corresponds to protection of equipment against penetration of solid objects and protection of persons against direct contact with live parts.

Protection of equipment	Protection of persons		
Non-protected	Non-protected	0	
Protected against the penetration of solid objects having a diameter greater than or equal to 50 mm.	Protected against direct contact with the back of the hand (accidental contact).	1	DD210014 
Protected against the penetration of solid objects having a diameter greater than or equal to 12.5 mm.	Protected against direct finger contact.	2	DD210531 
Protected against the penetration of solid objects having a diameter greater than or equal to 2.5 mm.	Protected against direct contact with a 2.5 mm diameter tool.	3	DD210532 
Protected against the penetration of solid objects having a diameter greater than 1 mm.	Protected against direct contact with a 1 mm diameter wire.	4	DD210017 
Dust protected (no harmful deposits).	Protected against direct contact with a 1 mm diameter wire.	5	DD210018 
Dust tight.	Protected against direct contact with a 1 mm diameter wire.	6	DD210019 

2nd characteristic numeral: corresponds to protection of equipment against penetration of water with harmful effects.

Protection of equipment		
Non-protected	0	
Protected against vertical dripping water (condensation).	1	DD210006 
Protected against dripping water at an angle of up to 15°.	2	DD210007 
Protected against rain at an angle of up to 60°.	3	DD210008 
Protected against splashing water in all directions.	4	DD210009 
Protected against water jets in all directions.	5	DD210010 
Protected against powerful jets of water and waves.	6	DD210011 
Protected against the effects of temporary immersion.	7	DD210012 
Protected against the effects of prolonged immersion under specified conditions.	8	DD210013 

Additional letter

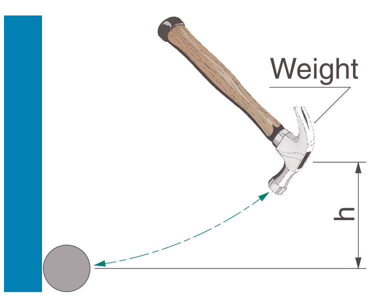
Corresponds to protection of persons against direct contact with live parts.

A	With the back of the hand.
B	With the finger.
C	With a 2.5 mm diameter tool.
D	With a 1.0 mm diameter tool.

Degrees of protection IK against mechanical impact

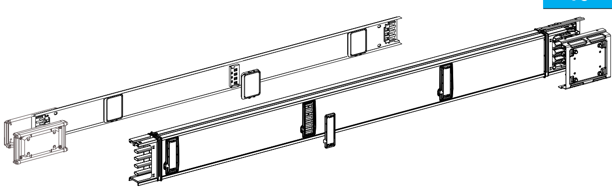
The IK code comprises 2 characteristic numerals corresponding to a value of impact energy, in joules.

DD210533



	Weight (kg)	Height (cm)	Energy (J)
00	Non-protected		
01	0.20	7.50	0.15
02		10	0.20
03		17.50	0.35
04		25	0.50
05		35	0.70
06	0.50	20	1
07		40	2
08	1.70	30	5
09	5	20	10
10		40	20

DD210130



The new Canalis KN and KS busbar trunking products are designed to provide IP55D and IK08 protection.

IP55
U_e = 230...400 V

Canalis KDP, 20 A
Busbar trunking for lighting and power socket distribution

Run component characteristics

Rating of trunking (A)		KDP	20
General characteristics			
Compliance with standards			IEC/EN 60439-2
Degree of protection:	IP		55
Mechanical impacts	IK		07
Rated current at an ambient temperature of 35°C	I_{nc}	A	20
Rated insulation voltage	U_i	V	690
Rated operational voltage	U_e	V	230...400
Rated impulse voltage	U_{imp}	kV	4
Rated frequency	f	Hz	50/60
Conductor characteristics			
Phase conductors			
Mean resistance at an ambient temperature of 20°C	R_{20}	mΩ/m	6.80
Mean resistance at I_{nc} and 35°C	R_1	mΩ/m	8.30
Mean reactance at I_{nc}, 35°C and 50 Hz	X_1	mΩ/m	0.02
Mean impedance at I_{nc}, 35°C and 50 Hz	Z_1	mΩ/m	8.30
Protective conductor (PE)			
Mean resistance at an ambient temperature of 20°C		mΩ/m	7.25

Fault loop characteristics

Symmetrical components method	Ph/N at 20°C	Mean resistance		$R_{0\ ph/N}$	mΩ/m	27.21
		Mean reactance		$X_{0\ ph/N}$	mΩ/m	0.85
		Mean impedance		$Z_{0\ ph/N}$	mΩ/m	27.22
	Ph/PE at 20°C	Mean resistance		$R_{0\ ph/PE}$	mΩ/m	27.21
		Mean reactance		$X_{0\ ph/PE}$	mΩ/m	0.85
		Mean impedance		$Z_{0\ ph/PE}$	mΩ/m	27.22
Impedance method	At 20°C	Mean resistance	Ph/Ph	$R_{b0\ ph/ph}$	mΩ/m	13.61
			Ph/N	$R_{b0\ ph/N}$	mΩ/m	13.61
			Ph/PE	$R_{b0\ ph/PE}$	mΩ/m	13.61
	For I_{nc} at 35°C	Mean resistance	Ph/Ph	$R_{b1\ ph/ph}$	mΩ/m	16.60
			Ph/N	$R_{b1\ ph/N}$	mΩ/m	16.60
			Ph/PE	$R_{b1\ ph/PE}$	mΩ/m	16.60
	For Inc at 35°C and 50 Hz	Mean reactance	Ph/Ph	$X_{b\ ph/ph}$	mΩ/m	0.04
			Ph/N	$X_{b\ ph/N}$	mΩ/m	0.04
			Ph/PE	$X_{b\ ph/PE}$	mΩ/m	0.04

Other characteristics

Short-circuit withstand capacity			
Rated peak withstand current	I_{pk}	kA	3.6
Maximum thermal limit I^2t		A^2s	120×10^3
Rated short-time withstand current (t = 1 s)	I_{cw}	kA	0.34
Voltage drop			
	Composite voltage drop (hot state) expressed in V/100 m/A (50 Hz) with the load uniformly distributed over the run. If the load is concentrated at one end of the run, the voltage drop is twice the value indicated in the table.		
For a power factor of	1	V/100 m/A	0.72
	0.9	V/100 m/A	0.65
	0.8	V/100 m/A	0.58
	0.7	V/100 m/A	0.50
Radiated magnetic field			
Radiated magnetic field strength 1 metre from the trunking	B	µT	$< 2 \times 10^{-3}$
Product selection when harmonics are present (for details, see the "Special Applications" section)			
Operational current as a function of 3rd-order harmonic content	THD ≤ 15%		20
	15% < THD ≤ 33%		16
	THD > 33%		14

Permissible current as a function of ambient temperature

Ambient temperature	°C	< 35	35	40	45	50	55
Cœfficient K1	%	n/a	1	0.93	0.85	0.76	0.66

Tap-off unit characteristics

See KBC tap-off unit characteristics on page 9

Canalis KBA, 25 and 40 A
Busbar trunking for lighting and power socket distribution

IP55
Ue = 230...400 V
Galvanised or RAL 9010 white

Run component characteristics

Rating of trunking (A)					KBA	25	40
General characteristics							
Compliance with standards						IEC/EN 60439-2	IEC/EN 60439-2
Degree of protection:				IP		55	55
Mechanical impacts				IK		06	06
Number of live conductors						2 or 4	2 or 4
Rated current at an ambient temperature of 35 °C				I_{nc}	**A**	25	40
Rated insulation voltage				U_i	**V**	690	690
Rated operational voltage				U_e	**V**	230...400	230...400
Rated impulse voltage				U_{imp}	**kV**	4	4
Rated frequency				f	**Hz**	50/60	50/60
Conductor characteristics							
Phase conductors							
Mean resistance at an ambient temperature of 20 °C				R_{20}	**mΩ/m**	6.80	2.83
Mean resistance at I_{nc} and 35 °C				R_1	**mΩ/m**	8.30	3.46
Mean reactance at I_{nc}, 35 °C and 50 Hz				X_1	**mΩ/m**	0.02	0.02
Mean impedance at I_{nc}, 35 °C and 50 Hz				Z_1	**mΩ/m**	8.33	3.46
Protective conductor (PE)							
Mean resistance at an ambient temperature of 20 °C					**mΩ/m**	1.57	1.57
Fault loop characteristics							
Symmetrical components method	Ph/N at 20 °C	Mean resistance		$R_{0\ ph/N}$	**mΩ/m**	27.21	19.40
		Mean reactance		$X_{0\ ph/N}$	**mΩ/m**	0.85	0.38
		Mean impedance		$Z_{0\ ph/N}$	**mΩ/m**	27.22	19.41
	Ph/PE at 20 °C	Mean resistance		$R_{0\ ph/PE}$	**mΩ/m**	19.40	13.83
		Mean reactance		$X_{0\ ph/PE}$	**mΩ/m**	0.38	0.73
		Mean impedance		$Z_{0\ ph/PE}$	**mΩ/m**	19.41	13.85
Impedance method	At 20 °C	Mean resistance	Ph/Ph	$R_{b0\ ph/ph}$	**mΩ/m**	13.61	5.68
			Ph/N	$R_{b0\ ph/N}$	**mΩ/m**	13.61	5.68
			Ph/PE	$R_{b0\ ph/PE}$	**mΩ/m**	11.01	7.66
	For I_{nc} at 35 °C	Mean resistance	Ph/Ph	$R_{b1\ ph/ph}$	**mΩ/m**	16.60	6.91
			Ph/N	$R_{b1\ ph/N}$	**mΩ/m**	16.60	6.91
			Ph/PE	$R_{b1\ ph/PE}$	**mΩ/m**	12.50	8.70
	For Inc at 35 °C and 50 Hz	Mean reactance	Ph/Ph	$X_{b\ ph/ph}$	**mΩ/m**	0.04	0.90
			Ph/N	$X_{b\ ph/N}$	**mΩ/m**	0.04	0.90
			Ph/PE	$X_{b\ ph/PE}$	**mΩ/m**	0.035	0.035
Other characteristics							
Short-circuit withstand capacity							
Rated peak withstand current				I_{pk}	**kA**	4.40	9.60
Maximum thermal limit I^2t					**A^2s**	$195x10^3$	$900x10^3$
Rated short-time withstand current (t = 1 s)				I_{cw}	**kA**	0.44	0.94
Voltage drop							
				Composite voltage drop (hot state) expressed in V/100 m/A (50 Hz) with the load uniformly distributed over the run. If the load is concentrated at one end of the run, the voltage drop is twice the value indicated in the table.			
For a power factor of				1	**V/100 m/A**	0.72	0.30
				0.9	**V/100 m/A**	0.67	0.28
				0.8	**V/100 m/A**	0.61	0.25
				0.7	**V/100 m/A**	0.54	0.22
Radiated magnetic field							
Radiated magnetic field strength 1 metre from the trunking				B	**μT**	$< 2x10^{-3}$	$< 2x10^{-3}$
Product selection when harmonics are present (for details, see the "Special Applications" section)							
Operational current as a function of 3rd harmonic content				THD ≤ 15%		25	40
				15% < THD ≤ 33%		20	32
				THD > 33%		16	28

Permissible current as a function of ambient temperature

Ambient temperature	°C	< 35	35	40	45	50	55
Cœfficient K1	**%**	n/a	1	0.96	0.93	0.89	0.85

Tap-off unit characteristics

See KBC tap-off unit characteristics on page 9

KBL Industrial luminaires

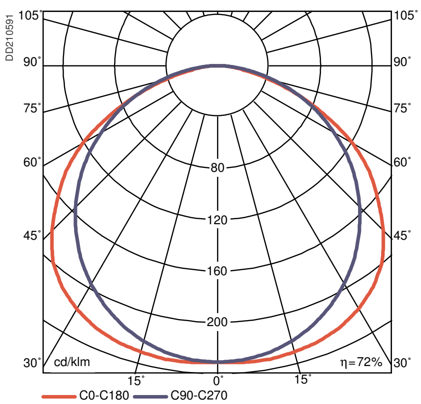
Ue = 230...400 V
RAL 9010 white

Luminaire characteristics

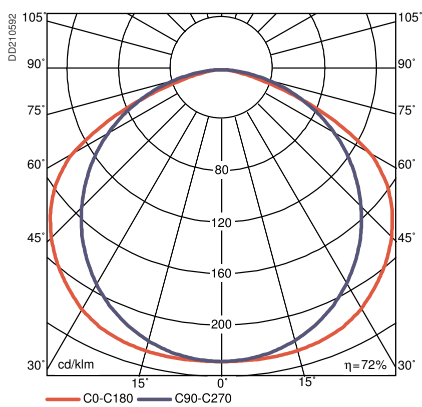
Type of luminaire	KBL	258C	258HF	235T5	280T5	258CE	258HFE	235T5E
General characteristics								
Compliance with standards	IEC/EN 60598-1							
Degree of protection	IP	20	20	20	20	55	55	55
Mechanical impacts	IK	07	07	07	07	10	10	10
Efficiency(1)	η	0.72	0.72	0.72	0.85	0.58G + 0.07T	0.58G + 0.07T	0.79G + 0.06T
Class		E	E	E	C	G	G	G
Operating temperature	°C	45	35	35	25	45	35	35

(1) G: Class of luminaires in direct lighting
T: Class of luminaires in indirect lighting

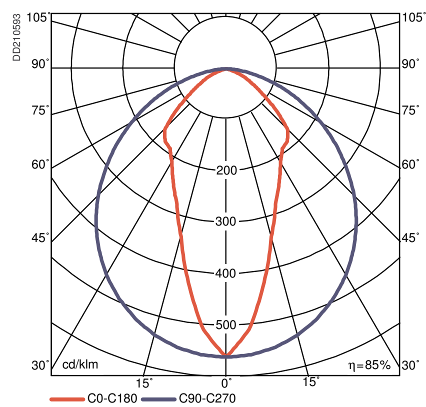
Photometric characteristics of fluorescent tubes



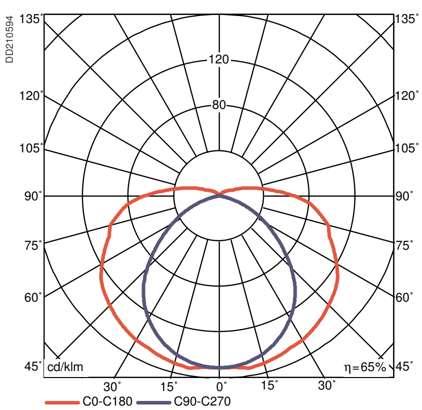
KBL 258C
KBL 258HF



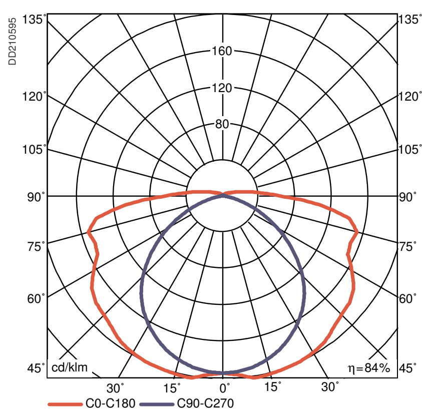
KBL 235T5



KBL 280T5



KBL 258CE
KBL 258HFE



KBL 235T5E

Canalis KBX, 25 A
Strip lighting distribution

IP20
Ue = 230...400 V
RAL 9016 white

Run component characteristics

General characteristics

			KBX25ED...	KBX25ED... + KBX25REF	KBX25ED... + KBX25REF + KBX25GAB
Compliance with standards				IEC/EN 60598-1	
Degree of protection (if KBX25CF)	IP		20	20	20
Efficiency	η		0.75	0.74	0.60
Class			E	D	D
Operating temperature	°C		55	55	55
Mechanical impacts	IK		08	10	08
Rated current at an ambient temperature of 35 °C	I_{nc}	**A**	25	25	25
Rated insulation voltage	U_i	**V**	690	690	690
Rated operational voltage	U_e	**V**	230...400	230...400	230...400
Rated frequency	f	**Hz**	50/60	50/60	50/60

Conductor characteristics

			KBX25ED...	KBX25ED... + KBX25REF	KBX25ED... + KBX25REF + KBX25GAB
Phase conductors					
Mean resistance at an ambient temperature of 20 °C	R_{20}	**mΩ/m**	7.25	7.25	7.25
Mean resistance at I_{nc} and 35 °C	R_1	**mΩ/m**	8.67	8.67	8.67
Mean reactance at I_{nc}, 35 °C and 50 Hz	X_1	**mΩ/m**	0.66	0.66	0.66
Mean impedance at I_{nc}, 35 °C and 50 Hz	Z_1	**mΩ/m**	8.69	8.69	8.69
Protective conductor (PE)					
Mean resistance at an ambient temperature of 20 °C		**mΩ/m**	7.25	7.25	7.25

Fault loop characteristics

						KBX25ED...	KBX25ED... + KBX25REF	KBX25ED... + KBX25REF + KBX25GAB
Symmetrical components method	Ph/N at 20 °C	Mean resistance		$R_{0\ ph/N}$	**mΩ/m**	27.68	27.68	27.68
		Mean reactance		$X_{0\ ph/N}$	**mΩ/m**	28.20	28.20	28.20
		Mean impedance		$Z_{0\ ph/N}$	**mΩ/m**	39.52	39.52	39.52
	Ph/PE at 20 °C	Mean resistance		$R_{0\ ph/PE}$	**mΩ/m**	17.70	17.70	17.70
		Mean reactance		$X_{0\ ph/PE}$	**mΩ/m**	20.57	20.57	20.57
		Mean impedance		$Z_{0\ ph/PE}$	**mΩ/m**	27.14	27.14	27.14
Impedance method	At 20 °C	Mean resistance	Ph/Ph	$R_{b0\ ph/ph}$	**mΩ/m**	13.84	13.84	13.84
			Ph/N	$R_{b0\ ph/N}$	**mΩ/m**	13.84	13.84	13.84
			Ph/PE	$R_{b0\ ph/PE}$	**mΩ/m**	10.51	10.51	10.51
	For I_{nc} at 35 °C	Mean resistance	Ph/Ph	$R_{b1\ ph/ph}$	**mΩ/m**	13.84	13.84	13.84
			Ph/N	$R_{b1\ ph/N}$	**mΩ/m**	13.84	13.84	13.84
			Ph/PE	$R_{b1\ ph/PE}$	**mΩ/m**	10.51	10.51	10.51
	For Inc at 35 °C and 50 Hz	Mean reactance	Ph/Ph	$X_{b\ ph/ph}$	**mΩ/m**	15.38	15.38	15.38
			Ph/N	$X_{b\ ph/N}$	**mΩ/m**	15.38	15.38	15.38
			Ph/PE	$X_{b\ ph/PE}$	**mΩ/m**	9.81	9.81	9.81

Other characteristics

Voltage drop

Composite voltage drop (hot state) expressed in V/100 m/A (50 Hz).

For a power factor of	1	**V/100 m/A**	0.75
	0.9	**V/100 m/A**	0.70
	0.8	**V/100 m/A**	0.63
	0.7	**V/100 m/A**	0.57

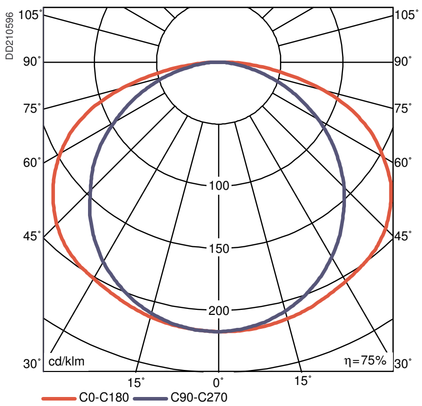
Permissible current as a function of ambient temperature

Ambient temperature	°C	< 35	35	40	45	50	55
Cœfficient K1	**%**	n/a	1	0.96	0.93	0.89	0.85

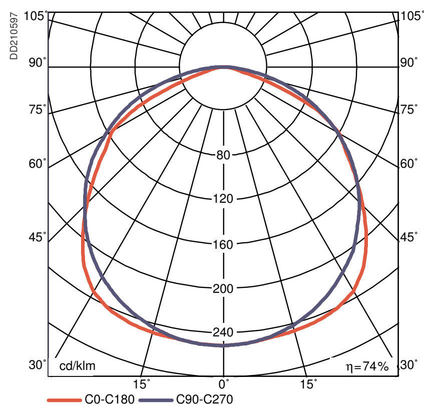
Canalis KBX, 25 A
Strip lighting distribution

IP20
Ue = 230...400 V
RAL 9016 white

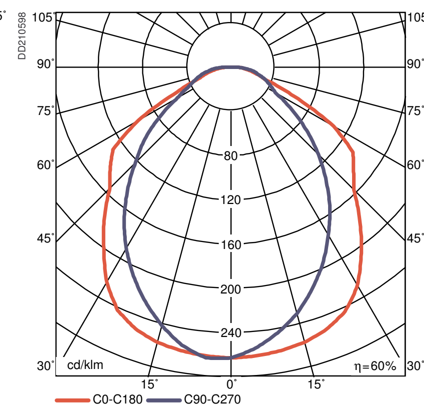
Photometric characteristics of luminaires



KBX 25ED...



KBX 25ED...
KBX 25REF



KBX 25ED...
KBX 25REF
KBX 25GAB

Characteristics

IP55
Ue = 230...400 V
Galvanised or RAL 9010 white

Canalis KBB, 25 and 40 A
Busbar trunking for lighting and power socket distribution

Run component characteristics

Rating of trunking (A)		KBB	25			40		
General characteristics								
Compliance with standards			IEC/EN 60439-2			IEC/EN 60439-2		
Degree of protection:	IP		55			55		
Mechanical impacts	IK		06			06		
Number of live conductors			2 or 4	4 + 2	4 + 4	2 or 4	4 + 2	4 + 4
Number of circuits			1	2	2	1	2	2
Rated current at an ambient temperature of 35 °C	I_{nc}	A	25	25	20	40	40	32
Rated insulation voltage	U_i	V	690			690		
Rated operational voltage	U_e	V	230...400			230...400		
Rated impulse voltage	U_{imp}	kV	4			4		
Rated frequency	f	Hz	50/60			50/60		
Conductor characteristics								
Phase conductors								
Mean resistance at an ambient temperature of 20 °C	R_{20}	mΩ/m	6.80			2.83		
Mean resistance at I_{nc} and 35 °C	R_1	mΩ/m	8.30			3.46		
Mean reactance at I_{nc}, 35 °C and 50 Hz	X_1	mΩ/m	0.02			0.02		
Mean impedance at I_{nc}, 35 °C and 50 Hz	Z_1	mΩ/m	8.33			3.46		
Protective conductor (PE)								
Mean resistance at an ambient temperature of 20 °C		mΩ/m	0.80			0.80		
Fault loop characteristics								
Symmetrical components method – Ph/N at 20 °C – Mean resistance	$R_{0\ ph/N}$	mΩ/m	27.21			17.28		
Symmetrical components method – Ph/N at 20 °C – Mean reactance	$X_{0\ ph/N}$	mΩ/m	0.85			5.25		
Symmetrical components method – Ph/N at 20 °C – Mean impedance	$Z_{0\ ph/N}$	mΩ/m	27.22			18.06		
Symmetrical components method – Ph/PE at 20 °C – Mean resistance	$R_{0\ ph/PE}$	mΩ/m	17.28			13.83		
Symmetrical components method – Ph/PE at 20 °C – Mean reactance	$X_{0\ ph/PE}$	mΩ/m	5.25			0.73		
Symmetrical components method – Ph/PE at 20 °C – Mean impedance	$Z_{0\ ph/PE}$	mΩ/m	18.06			13.85		
Impedance method – At 20 °C – Mean resistance – Ph/Ph	$R_{b0\ ph/ph}$	mΩ/m	13.61			5.68		
Impedance method – At 20 °C – Mean resistance – Ph/N	$R_{b0\ ph/N}$	mΩ/m	13.61			5.68		
Impedance method – At 20 °C – Mean resistance – Ph/PE	$R_{b0\ ph/PE}$	mΩ/m	10.26			6.92		
Impedance method – For I_{nc} at 35 °C – Mean resistance – Ph/Ph	$R_{b1\ ph/ph}$	mΩ/m	16.59			6.92		
Impedance method – For I_{nc} at 35 °C – Mean resistance – Ph/N	$R_{b1\ ph/N}$	mΩ/m	16.59			6.92		
Impedance method – For I_{nc} at 35 °C – Mean resistance – Ph/PE	$R_{b1\ ph/PE}$	mΩ/m	11.77			7.14		
Impedance method – For Inc at 35 °C and 50 Hz – Mean reactance – Ph/Ph	$X_{b\ ph/ph}$	mΩ/m	0.35			0.90		
Impedance method – For Inc at 35 °C and 50 Hz – Mean reactance – Ph/N	$X_{b\ ph/N}$	mΩ/m	0.35			0.90		
Impedance method – For Inc at 35 °C and 50 Hz – Mean reactance – Ph/PE	$X_{b\ ph/PE}$	mΩ/m	0.07			1.85		
Other characteristics								
Short-circuit withstand capacity								
Rated peak withstand current	I_{pk}	kA	4.40			9.60		
Maximum thermal limit I^2t		A^2s	$195x10^3$			$900x10^3$		
Rated short-time withstand current (t = 1 s)	I_{cw}	kA	0.44			0.94		
Voltage drop								
	Composite voltage drop (hot state) expressed in V/100 m/A (50 Hz) with the load uniformly distributed over the run. If the load is concentrated at one end of the run, the voltage drop is twice the value indicated in the table.							
For a power factor of	1	V/100 m/A	0.72			0.30		
	0.9	V/100 m/A	0.67			0.28		
	0.8	V/100 m/A	0.61			0.25		
	0.7	V/100 m/A	0.55			0.22		
Radiated magnetic field								
Radiated magnetic field strength 1 metre from the trunking	B	µT	$< 2x10^{-3}$			$< 2x10^{-3}$		
Product selection when harmonics are present (for details, see the "Special Applications" section)								
Operational current as a function of 3rd harmonic content	THD ≤ 15%		25			40		
	15% < THD ≤ 33%		20			32		
	THD > 33%		16			28		
Permissible current as a function of ambient temperature								
Ambient temperature		°C	< 35	35	40	45	50	55
Cœfficient K1		%	n/a	1	0.96	0.93	0.89	0.85

Tap-off unit characteristics

See KBC tap-off unit characteristics on page 9

KBC tap-off units, KDP connections

IP55
Ue = 230...400 V

Tap-off unit characteristics

Type of tap-off unit			KBC 10	KBC 10 Lighting control	KBC 16CB	KBC 16CF
General characteristics						
Compliance with standards			IEC/EN 60439-2			
Degree of protection:	IP		55	55	55	55
Rated current at an ambient temperature of 35°C	I_{nc}	A	10	10	16	16
Rated insulation voltage	U_i	V	690	400	690	400
Rated operational voltage	U_e	V	230...400	230...400	230...400	230...400
Rated frequency	f	Hz	50/60	50/60	50/60	50/60

KDP connection characteristics

General characteristics						
Compliance with standards			EN 60320 and NFC 60050; IEC 227-53 for H05WF cable			
Degree of protection:	IP		40	40	40	40
Number of live conductors			2	2	2	2
Rated current at an ambient temperature of 35°C	I_{nc}	A	16	16	16	16
Rated insulation voltage	U_i	V	250	250	250	250
Rated operational voltage	U_e	V	250	250	250	250
Rated frequency	F	Hz	50	50	50	50
Conductor characteristics						
Phase conductors						
Mean resistance at an ambient temperature of 20°C	R_{20}	mΩ/m	12.4	12.4	12.4	12.4
Mean resistance at I_{nc} and 35°C	R_1	mΩ/m	14.5	14.5	14.5	14.5
Mean reactance at I_{nc}, 35°C and 50 Hz	X_1	mΩ/m	3.1	3.1	3.1	3.1
Protective conductor (PE)						
Mean resistance at an ambient temperature of 20°C		mΩ/m	12.4	12.4	12.4	12.4

Canalis KN, 40 to 160 A
Busbar trunking for low-power distribution

IP55
Ue = 230...500 V
RAL 9001 White

Run component characteristics

Rating of trunking (A)		KN	40	63	100	160
General characteristics						
Compliance with standards			IEC/EN 60439-2			
Degree of protection:	IP		55	55	55	55
Mechanical impacts	IK		08	08	08	08
Rated current at an ambient temperature of 35 °C	I_{nc}	A	40	63	100	160
Rated insulation voltage	U_i	V	500	500	500	500
Rated operational voltage	U_e	V	500	500	500	500
Rated impulse voltage	U_{imp}	kV	6	6	6	6
Rated frequency	f	Hz	50/60	50/60	50/60	50/60
Conductor characteristics						
Phase conductors						
Mean resistance at an ambient temperature of 20 °C	R_{20}	mΩ/m	4.97	2	0.85	0.61
Mean resistance at I_{nc} and 35 °C	R_1	mΩ/m	5.96	2.4	1.02	0.79
Mean reactance at I_{nc}, 35 °C and 50 Hz	X_1	mΩ/m	0.24	0.24	0.25	0.24
Mean impedance at I_{nc}, 35 °C and 50 Hz	Z_1	mΩ/m	5.96	2.41	1.05	0.83
Protective conductor (PE)						
Mean resistance at an ambient temperature of 20 °C		mΩ/m	1.09	1.09	1.09	1.09
Fault loop characteristics						
Symmetrical components method – Ph/N at 20 °C – Mean resistance	$R_{0\ ph/N}$	mΩ/m	19.96	8.16	3.72	2.67
Symmetrical components method – Ph/N at 20 °C – Mean reactance	$X_{0\ ph/N}$	mΩ/m	0.17	1.64	1.56	1.4
Symmetrical components method – Ph/N at 20 °C – Mean impedance	$Z_{0\ ph/N}$	mΩ/m	20.03	8.33	4.03	3.01
Symmetrical components method – Ph/PE at 20 °C – Mean resistance	$R_{0\ ph/PE}$	mΩ/m	8.43	5.23	3.84	3.34
Symmetrical components method – Ph/PE at 20 °C – Mean reactance	$X_{0\ ph/PE}$	mΩ/m	2.31	2	1.66	1.29
Symmetrical components method – Ph/PE at 20 °C – Mean impedance	$Z_{0\ ph/PE}$	mΩ/m	8.74	5.6	4.18	3.58
Impedance method – At 20 °C – Mean resistance – Ph/Ph	$R_{b0\ ph/ph}$	mΩ/m	9.93	4.01	1.71	1.21
Impedance method – At 20 °C – Mean resistance – Ph/N	$R_{b0\ ph/N}$	mΩ/m	9.95	4.1	1.73	1.24
Impedance method – At 20 °C – Mean resistance – Ph/PE	$R_{b0\ ph/PE}$	mΩ/m	6.245	3.24	2.03	1.71
Impedance method – For I_{nc} at 35 °C – Mean resistance – Ph/Ph	$R_{b1\ ph/ph}$	mΩ/m	11.88	4.81	2.05	1.58
Impedance method – For I_{nc} at 35 °C – Mean resistance – Ph/N	$R_{b1\ ph/N}$	mΩ/m	11.9	4.83	2.07	1.61
Impedance method – For I_{nc} at 35 °C – Mean resistance – Ph/PE	$R_{b1\ ph/PE}$	mΩ/m	6.24	3.89	2.43	2.22
Impedance method – For Inc at 35 °C and 50 Hz – Mean reactance – Ph/Ph	$X_{b\ ph/ph}$	mΩ/m	0.48	0.5	0.52	0.79
Impedance method – For Inc at 35 °C and 50 Hz – Mean reactance – Ph/N	$X_{b\ ph/N}$	mΩ/m	0.79	0.78	0.78	0.75
Impedance method – For Inc at 35 °C and 50 Hz – Mean reactance – Ph/PE	$X_{b\ ph/PE}$	mΩ/m	1.13	1.05	0.96	0.84
Other characteristics						
Short-circuit withstand capacity						
Rated peak withstand current	I_{pk}	kA	6	11	14	20
Maximum thermal limit I^2t		A^2s	0.29×10^6	1.8×10^6	8×10^6	8×10^6
Rated short-time withstand current (t = 1 s)	I_{cw}	kA	0.5	1.3	2.8	2.8
Voltage drop						
	Composite voltage drop (hot state) expressed in V/100 m/A (50 Hz) with the load uniformly distributed over the run. If the load is concentrated at one end of the run, the voltage drop is twice the value indicated in the table.					
For a power factor of	1	V/100 m/A	0.516	0.208	0.088	0.068
	0.9	V/100 m/A	0.474	0.196	0.089	0.071
	0.8	V/100 m/A	0.425	0.179	0.084	0.067
	0.7	V/100 m/A	0.376	0.160	0.077	0.063
Radiated magnetic field						
Radiated magnetic field strength 1 metre from the trunking	B	µT	0.039	0.063	0.106	0.186
Product selection when harmonics are present (for details, see the "Special Applications" section)						
Operational current as a function of 3rd harmonic content	THD ≤ 15%		40	63	100	160
	15% < THD ≤ 33%		32	50	80	130
	THD > 33%		28	40	63	100

Permissible current as a function of ambient temperature

Ambient temperature	°C	< 35	35	40	45	50	55
Cœfficient K1	%	Sans	1	0.97	0.94	0.91	0.87

Tap-off unit characteristics

General characteristics

Degree of protection:	IP		55
Mechanical impacts	IK		08
Rated insulation voltage	U_i	**V**	400, 500 depending on protective device
Rated operational voltage	U_e	**V**	400, 500 depending on protective device
Rated impulse voltage	U_{imp}	**kV**	4.6
Rated frequency	f	**Hz**	50/60

Electrical characteristics of remote control circuit (KNT)

Number of conductors			3
Material			Copper
Rated operational voltage	U_e	**V**	500
Rated insulation voltage	U_i	**V**	500
Rated impulse voltage	U_{imp}	**kV**	6
Rated current at an ambient temperature of 35°C	I_{nc}	**A**	6
Mean resistance at an ambient temperature of 20°C	R_{20}	**mΩ/m**	7,6
Mean resistance at I_{nc} and 35°C	R_1	**mΩ/m**	8,7

Characteristics

Canalis KS, 100 to 1000 A
Busbar trunking for medium-power distribution

IP55
Ue = 230...690 V
RAL 9001 White

Run component characteristics

Rating of trunking (A)		KS	100	160	250	400	500	630	800	1000
General characteristics										
Compliance with standards			IEC/EN 60439-2							
Degree of protection:	IP		55	55	55	55	55	55	55	55
Mechanical impacts	IK		08	08	08	08	08	08	08	08
Rated current at an ambient temperature of 35°C	I_{nc}	A	100	160	250	400	500	630	800	1000
Rated insulation voltage	U_i	V	690	690	690	690	690	690	690	690
Rated operational voltage	U_e	V	690	690	690	690	690	690	690	690
Rated impulse voltage	U_{imp}	kV	8	8	8	8	8	8	8	8
Rated frequency	f	Hz	50/60	50/60	50/60	50/60	50/60	50/60	50/60	50/60
Conductor characteristics										
Phase conductors										
Mean resistance at an ambient temperature of 20°C	R_{20}	mΩ/m	1.19	0.55	0.28	0.15	0.11	0.09	0.06	0.04
Mean resistance at I_{nc} and 35°C	R_1	mΩ/m	1.59	0.77	0.39	0.21	0.15	0.13	0.09	0.06
Mean reactance at I_{nc}, 35°C and 50 Hz	X_1	mΩ/m	0.15	0.15	0.16	0.14	0.07	0.07	0.06	0.06
Mean impedance at I_{nc}, 35°C and 50 Hz	Z_1	mΩ/m	1.6	0.79	0.42	0.25	0.16	0.15	0.11	0.09
Protective conductor (PE)										
Mean resistance at an ambient temperature of 20°C		mΩ/m	0.42	0.42	0.35	0.19	0.07	0.07	0.07	0.06
Fault loop characteristics										
Symmetrical components method – Ph/N at 20°C – Mean resistance	$R_{0\ ph/N}$	mΩ/m	4.85	1.1	1.28	0.74	0.5	0.45	0.32	0.23
Symmetrical components method – Ph/N at 20°C – Mean reactance	$X_{0\ ph/N}$	mΩ/m	0.95	0.22	0.86	0.67	0.36	0.35	0.31	0.27
Symmetrical components method – Ph/N at 20°C – Mean impedance	$Z_{0\ ph/N}$	mΩ/m	4.94	1.12	1.54	1	0.62	0.57	0.45	0.36
Symmetrical components method – Ph/PE at 20°C – Mean resistance	$R_{0\ ph/PE}$	mΩ/m	2.75	2.01	1.34	0.88	0.4	0.51	0.35	0.32
Symmetrical components method – Ph/PE at 20°C – Mean reactance	$X_{0\ ph/PE}$	mΩ/m	1.11	0.93	0.7	0.67	0.48	0.55	0.43	0.4
Symmetrical components method – Ph/PE at 20°C – Mean impedance	$Z_{0\ ph/PE}$	mΩ/m	2.96	2.22	1.51	1.11	0.63	0.75	0.56	0.51
Impedance method – At 20°C – Mean resistance – Ph/Ph	$R_{b0\ ph/ph}$	mΩ/m	2.4	1.15	0.65	0.41	0.25	0.23	0.18	0.15
Impedance method – At 20°C – Mean resistance – Ph/N	$R_{b0\ ph/N}$	mΩ/m	2.44	1.21	0.74	0.51	0.3	0.28	0.23	0.2
Impedance method – At 20°C – Mean resistance – Ph/PE	$R_{b0\ ph/PE}$	mΩ/m	1.87	1.3	0.78	0.55	0.31	0.3	0.28	0.26
Impedance method – For I_{nc} at 35°C – Mean resistance – Ph/Ph	$R_{b1\ ph/ph}$	mΩ/m	3.19	1.55	0.78	0.57	0.35	0.32	0.25	0.21
Impedance method – For I_{nc} at 35°C – Mean resistance – Ph/N	$R_{b1\ ph/N}$	mΩ/m	3.21	1.57	0.82	0.7	0.41	0.39	0.32	0.28
Impedance method – For I_{nc} at 35°C – Mean resistance – Ph/PE	$R_{b1\ ph/PE}$	mΩ/m	2.38	1.46	0.91	0.76	0.43	0.41	0.39	0.37
Impedance method – For Inc at 35°C and 50 Hz – Mean reactance – Ph/Ph	$X_{b\ ph/ph}$	mΩ/m	0.31	0.31	0.32	0.28	0.14	0.14	0.13	0.12
Impedance method – For Inc at 35°C and 50 Hz – Mean reactance – Ph/N	$X_{b\ ph/N}$	mΩ/m	0.45	0.45	0.45	0.39	0.2	0.2	0.18	017
Impedance method – For Inc at 35°C and 50 Hz – Mean reactance – Ph/PE	$X_{b\ ph/PE}$	mΩ/m	0.58	0.42	0.42	0.39	0.24	0.24	0.23	0.22
Other characteristics										
Short-circuit withstand capacity										
Rated peak withstand current	I_{pk}	kA	15.7	22	28	49.2	55	67.5	78.7	78.7
Maximum thermal limit I^2t (t = 1 s)		10^6 A^2s	6.8	20.2	100	354	733	1225	1758	1758
Rated short-time withstand current (t = 1 s)	I_{cw}	kA	2.6	4.45	10	18.8	26.2	32.1	37.4	37.4
Voltage drop										
	Composite voltage drop (hot state) expressed in V/100 m/A (50 Hz) with the load uniformly distributed over the run. If the load is concentrated at one end of the run, the voltage drop is twice the value indicated in the table.									
For a power factor of	1	V/100 m/A	0.138	0.067	0.034	0.018	0.013	0.011	0.008	0.005
	0.9	V/100 m/A	0.130	0.066	0.036	0.022	0.014	0.013	0.009	0.007
	0.8	V/100 m/A	0.118	0.061	0.035	0.022	0.014	0.013	0.009	0.007
	0.7	V/100 m/A	0.106	0.056	0.034	0.021	0.013	0.012	0.009	0.008
Radiated magnetic field										
Radiated magnetic field strength 1 metre from the trunking	B	µT	0.19	0.31	0.52	0.89	0.50	0.66	0.88	1.21
Product selection when harmonics are present (for details, see the "Special Applications" section)										
Operational current as a function of 3rd harmonic content	THD ≤ 15%		100	160	250	400	500	630	800	1000
	15% < THD ≤ 33%		80	125	200	315	400	500	630	800
	THD > 33%		63	100	160	250	315	400	500	630

Permissible current as a function of ambient temperature

Ambient temperature	°C	< 35	35	40	45	50	55
Cœfficient K1	%	n/a	1	0.97	0.94	0.91	0.87

Canalis KS, 100 to 1000 A
Busbar trunking for medium-power distribution

IP55
Ue = 230...690 V
RAL 9001 White

Tap-off unit characteristics

General characteristics

Degree of protection:	IP		55
Mechanical impacts	IK		08
Rated insulation voltage	U_i	**V**	400, 500 or 690 depending on protective device
Rated operational voltage	U_e	**V**	400, 500 or 690 depending on protective device
Rated impulse voltage	U_{imp}	**kV**	6.8
Rated frequency	f	**Hz**	50/60

Design and quotation tools

Tools and assistance by your side

Schneider Electric offers comprehensive software to help you design Canalis installations and prepare quotations.

CanFast brings you all the help you need.

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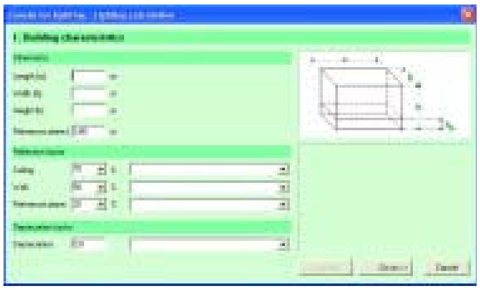


Lighting design guide.

CanFast software, from Schneider Electric, has been developed to accompany you when designing and preparing quotations for Canalis busbar trunking installations.

CanFast, a comprehensive tool

CanFast software helps you rapidly design the best installation for your project. It lets you:

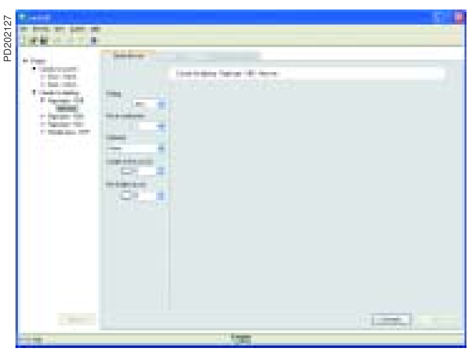
- easily choose the right products,
- compare the busbar trunking solution with an equivalent cable-based solution,
- list the catalogue numbers and quantities required,
- prepare a complete quotation including parts and labour.

Functions

The user enters the following information:

- for lighting circuits: current, length, number of luminaires and identical lines,
- for power circuits: current, length, number of machines and the rating and type of protection for each line.

PD202127



Data entry screen for a Canalis trunking line.

The software breaks the project down into quantities for the different product functions (fixings, straight lengths, etc.).

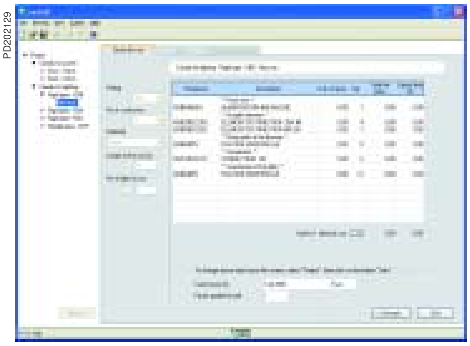
PD202128

Breakdown of the line into product functions.

Tools and assistance by your side

After confirming the breakdown of the line, the user accesses the costing table.

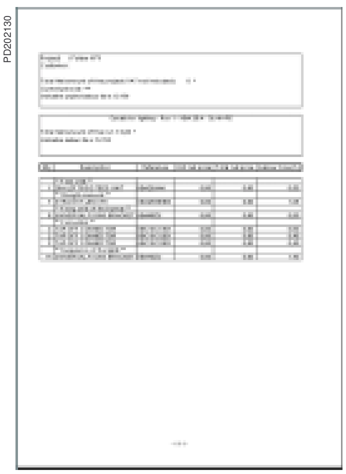
PD202129



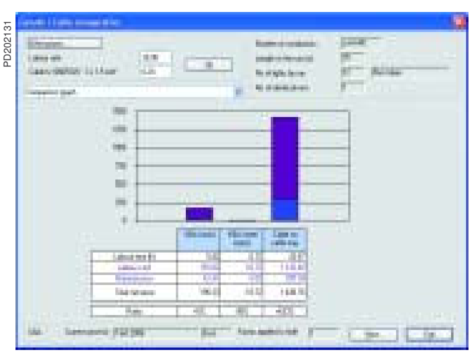
Breakdown of the line into catalogue numbers with price calculations and estimation of the time required for installation.

CanFast software can be used to produce a complete quotation (quantities, catalogue numbers, unit price, total net price and manhours required for installation).

PD202130

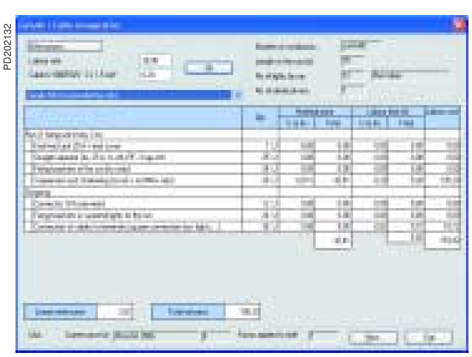


PD202131



Comparison of a Canalis lighting installation and an equivalent cable-based solution.

PD202132



Detailed costs for both solutions.