ISOLED KNOWLEDGE

PHOTO-METRIC SIZES

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CUSTOMISED LIGHT SOLUTIONS

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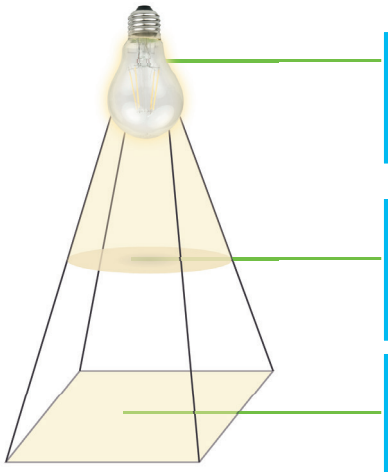
PHOTOMETRIC SIZES
(= OPTICAL MAGNITUDES)



Luminous flux (lumens, lm)
Describes the total light output emitted by a light source in all directi ons

Light intensity I (candela, cd)
Describes the part of a luminous flux which is emitt ed in a solid angle

Illuminance E (LUX, lx)
Describes how much does a light flux incide on a given area

Luminous flux

SI unit* : Lumen (lm)

The luminous flux is the total light output emitted from a light source in all directions. The lumen already considers the sensitivity of the eye. That is to say, two light sources with the same luminous flux are perceived as equally clear regardless of their light colour.

Lumen is the new Watt !

„Lumen is the new Watt “ means that bulbs are no longer rated on their specified watt age but by their lumens specification. As shown in the table, LED lamps reach much higher luminous flux (radiated light output) values with lower watts.

* Definition SI: SI is the Internati onal Unit System for physical quantities

LAMP OUTPUT COMPARISON

LIGHT BULB		HALOGEN LAMP		ENERGY SAVING LAMP		LED	
15 W	≙ **120 lm**	-	**-**	3 W	≙ **135 lm**	3 W	≙ **136 lm**
25 W	≙ **220 lm**	18 W	≙ **217 lm**	5 W	≙ **229 lm**	6 W	≙ **249 lm**
40 W	≙ **415 lm**	28 W	≙ **410 lm**	12 W	≙ **432 lm**	8 W	≙ **470 lm**
60 W	≙ **710 lm**	42 W	≙ **702 lm**	14 W	≙ **741 lm**	12 W	≙ **806 lm**
75 W	≙ **930 lm**	52 W	≙ **950 lm**	18 W	≙ **970 lm**	15 W	≙ **1055 lm**

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Luminous intensity

SI unit* : Candela (cd)

Lamps radiate in several directions - but with different strength. Light intensity indicates the luminous flux that is emitted at a solid angle (thus in a certain direction). Luminous intensity is a characteristic of the light source and has no relation to human perception. An ordinary household candle has a luminous intensity of 1 cd and therefore corresponds to one lumen per solid angle.

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COMPARITIVE TABLE CANDELA			
CANDELA CD	**HALOGEN GU10**	**HALOGEN MR16**	**ISOLED LED**
590cd	GU10 8W 30° 2800K	MR16 17W 36° 2800K	GU10 4,5W 32° 3000K
900cd	GU10 40W 30° 2800K		GU10 5,5W 38° 3000K
1900cd	GU10 75W 30° 2800K	MR16 25W 36° 2800K	PAR30 9W 32° 3000K
1050cd		MR16 35W 60° 2800K	GU10 6,5W 60° 5000K
4600cd			PAR38 15W 30° 3000K

OTHER EXAMPLES OF TYPICAL ILLUMINANCE FOR ORIENTATION:	
5 mW laser pointer, green (532 nm)	427.000 lx
Lightning in a modern OP	160.000 lx
Clear sunny day	100.000 lx
Cloudy summer day	20.000 lx
Cloudy winter day	3.500 lx
Sports stadium lightning	1.400 lx
Office lightning	500 lx
Street lightning	10 lx
Candle 1 meter away	1 lx
Full moon	0,25 lx

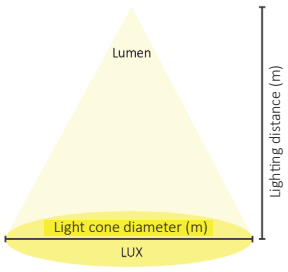
CALCULATION: $\frac{\text{Luminous flux (lm)}}{\text{Area (m}^2\text{)}}$ **= Illuminance (lx)**

Illuminance

SI unit* : Lux (lx)

Illuminance indicates how much luminous flux incides on a defined area and is therefore calculated as the quotient of the luminous flux (lm) by the illuminated area (m²).

The illuminance developed by a light source over a given area decreases as a square of the increasing distance.



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ILLUMINANCE LEVELS ACCORDING TO WORKPLACE REGULATIONS		
REQUIREMENT ON VISUAL TASK	**RATED LUMINOUS STRENGTHEN**	**EXAMPLE**
very low	50 lx	Storage rooms, storerooms
low	100 lx	Break rooms, traffic zones
low	150 lx	Traffic zones with vehicles, loading areas
moderate	200 - 300 lx	Work on the workbench, machine tools, rough work, reception desk at hotel
medium	500 lx	Office
high	750- 1000 lx	Technical drawing, precision engineering, printing
very high	1500 lx	Watchmaker‘s workshop, electronics workshop
exceptionally high	2000 lx	Engraving, invisible mending

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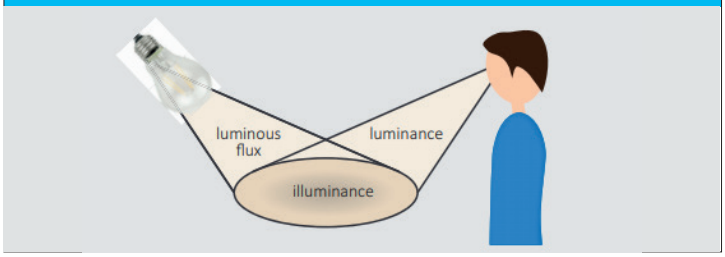
Luminance

The illuminance expressed in Lux is a recipient variable, i.e. it describes the light output inciding on a given surface. The luminance, however, describes the perceived light that is emitted by a surface (whether this is used as light source or as a reflector) Luminance is the quotient of the luminous intensity (cd) and the surface perpendicular to the radiation direction (A).

CALCULATION:	Luminous intensity (cd)	Area (m 2) = Luminance (LV)



CALCULATION:	Luminous flux (lm) Power (W)	= Luminous efficiency (s)

Bulb 60 W	10 lm/W
Bulb 100 W	15 lm/W
Energy-saving lamp	50 lm/W
Fluorescent tube 40 W	55 lm/W
LED	100 lm/W

Luminous efficiency

The luminous efficiency describes the efficiency of a lamp and is derived from the emitted luminous flux (lm) and the added electric power.

Its unit is therefore lm / W

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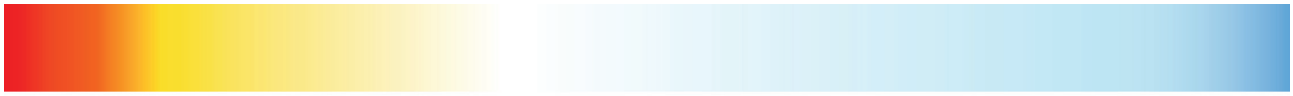
Colour temperature

SI unit* : Kelvin (K)

Colour temperature helps determine quantitatively the colour impression of a light source. Colour temperature is the temperature of a black body** belonging to a particular colour of light emanating from the lamp. Upon heating a black body, the light colour changes from dark red to orange and yellow white to blue white.

CHARACTERISTIC LIGHT COLOURS ACCORDING TO DIN 5035	
LUMINOUS SOURCE	**COLOUR TEMPERATURE IN KELVIN**
Warm white	< 3.500 K
Neutral white	< 5.300 K
Daylight white (also cool white)	> 5.300 K



* Definition of SI: SI is the International Unit System for physical quantities.
** A black body is a body that absorbs all radiation inciding thereon.

Colour Rendering Index CRI

The colour rendering index is specified in Ra and expresses the colour rendering quality of luminous sources. Unlike neutral and cold white light, warm white light has a high amount of red This leads to diff erent colour sensations. The Ra value indicates how much of the natural colour spectrum of sunlight is reflected by a lamp. A light bulb reaches a value of 100 Ra while a white LED lamp attains Ra values between 70 and 98. The higher the colour rendering index, the better the colours of an illuminated object are perceived.