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Klinger-Neon
Hansen + Munk GmbH

Lighting Engineering

This information is available on the internet at www.hansen-neon.de or www.klinger-neon.de L30E/12/2002
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Lighting Engineering
Terms and Formulas

Luminous flux Φ (unit: lumen, lm)

"Total light output of a lamp"

The luminous flux Φ is the total amount of radiant energy emitted by a light source which is percieved by the spectral eye sensitivity.

The luminous flux is used to evaluate the total light quantity emitted by a light source.

Luminous intensity I (unit: candela, cd)

"Luminous flux per solid angle"

A light source usually emits its luminous flux Φ with varying intensity in different directions.

The luminous intensity I is the intensity of light emitted in a particular direction.

Solid angle Ω (unit: steradiant, sr)

The solid angle is a measure of the volume of the conical space enclosed by the light beams from the light source to the edge of the surface A.

Luminance L (unit: candela per square metre, cd/m²)

"Perceived brightness of a surface"

The luminance is a measure of the brightness, i.e. luminous intensity per luminous area.

The luminance L of a light source or an illuminated area governs the impression of brightness perceived by the observer.

Luminous efficiency of lamps η (unit: lm/W)

"Luminous flux per unit electrical power"

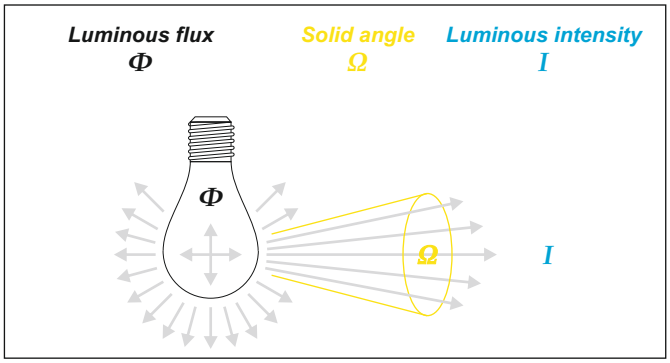
The luminous efficiency is a measure of the luminous flux generated from 1 watt electrical energy.

The luminous efficiency is used to evaluate and compare the efficiency of different light sources.

Illuminance E (unit: Lux, lx)

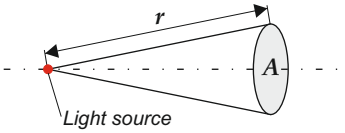
"Luminous flux per illuminated area"

The illuminance E is the ratio of the luminous flux per illuminated area.



Solid angle Ω

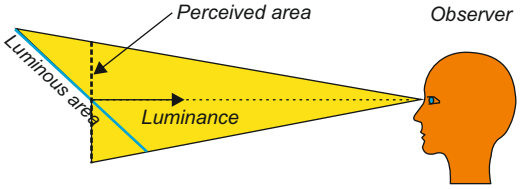
$\Omega = \frac{A}{r^2}$ r= distance to surface



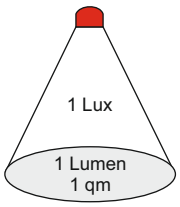
A= Area of spherical segment

Luminance L

The human eye "sees" luminance as brightness.



Illuminance E



$$1\ \text{Lux} = \frac{1\ \text{lm}}{1\ \text{m}^2}$$

The illuminance is 1 lx when a surface area of 1 m² is uniformly illuminated by a luminous flux of 1 lm.

Formulas in lighting engineering

Φ = luminous flux	unit: lm	lumen
Ω = solid angle	unit: sr	steradian
I = luminous intensity	unit: cd	candela
L = luminance	unit: cd/m²	candela / square metre
E = illuminance	unit: lx	lux
r = radius or distance	unit: m	metre
A = area / distance	unit: m²	square metre
Ap = perceived area	unit: m²	square metre
P = electrical power	unit: W	watt

Luminous intensity	$I = \frac{\Phi}{\Omega}$	(in cd)
Solid angle	$\Omega = \frac{A}{r^2}$	(in sr)
Illuminance (for point light source)	$E = \frac{\Phi}{A}$	(in Lx)
Illuminance	$E = \frac{I}{r^2}$	(in Lx)
Luminance	$L = \frac{I}{A_p}$	(in cd/m²)
Luminous efficiency	$\eta = \frac{\Phi}{P}$	(in lm/W)