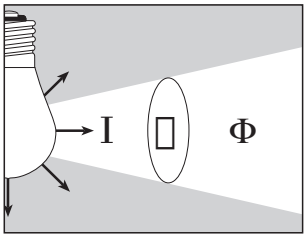
Glossary of the most important lighting terms

As with any technical or scientific discipline, lighting technology has its own special terms and concepts for defining the characteristics of lamps and luminaires and for standardizing the units of measurement.

The most important of these are described here.

Light and radiation
Light is taken to mean the electromagnetic radiation that the human eye perceives as brightness, in other words that part of the spectrum that can be seen. This is the radiation between 360 and 830 nm, a tiny fraction of the known spectrum of electromagnetic radiation.

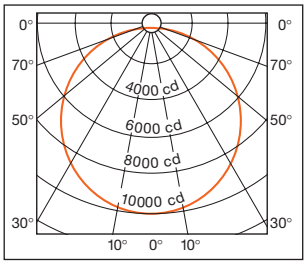
Luminous flux Φ
Unit of measurement: lumen [lm].
Luminous flux Φ is all the radiated power emitted by a light source evaluated with the spectral sensitivity of the eye and the photometric radiation equivalent k_m.



Luminous intensity I is a measure of the luminous flux Ω emitted in solid angle Φ.

Luminous intensity I
Unit of measurement: candela [cd].
Generally speaking, a light source emits its luminous flux Φ in different directions and at different intensities.

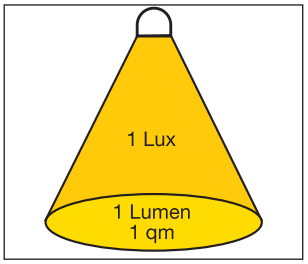
Luminous intensity is the luminous flux radiated in a particular direction (solid angle Ω).



Polar diagram

Illuminance E
Unit of measurement: lux [lx].
Illuminance E is the ratio between the luminous flux and the area being illuminated.

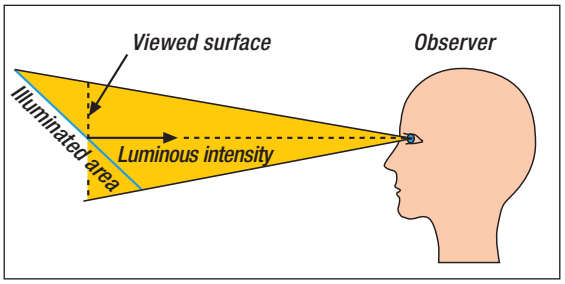
An illuminance of 1 lx occurs when a luminous flux of 1 lm is evenly distributed over an area of 1 m².



Illuminance E

Luminance L
Unit of measurement: candela per square meter [cd/m²].
The luminance L of a light source or an illuminated area is a measure of the impression of brightness.

Luminance L



The most important photometric formulae:

Luminous intensity [cd]	I	$\frac{\text{Luminous flux}}{\text{Solid angle } \Omega \text{ [sr]}}$	Luminance [cd/m²]	L	$\frac{\text{Luminous intensity [cd]}}{\text{Viewed luminous area [m²]}}$
Illuminance [lx]	E	$\frac{\text{Luminous flux falling on area [lm]}}{\text{Illuminated area [m²]}}$	Lum. efficacy [lm/W]	η	$\frac{\text{Generated luminous flux [lm]}}{\text{Electrical power consumed [W]}}$

Luminous efficacy η
Unit of measurement: lumens per watt (lm/W).
Luminous efficacy η indicates the efficiency with which the electrical power consumed is converted into light.

Color temperature
Unit of measurement: Kelvin [K].
The color temperature of a light source is defined in comparison with a “black body radiator” and plotted on what is known as the “Planckian curve”. The higher the temperature of this “black body radiator” the greater the blue component in the spectrum and the smaller the red component. An incandescent lamp with a warm white light, for example, has a color temperature of 2700 K, whereas a daylight fluorescent lamp has a color temperature of 6000 K.

Light color
The light color of a lamp can be neatly defined in terms of color temperature. There are three main categories here:
Warm White < 3300 K
Cool White 3300–5000 K
Daylight > 5000 K.
Despite having the same light color, lamps may have very different color rendering properties owing to the spectral composition of their light.

Color rendering
As a rule, artificial light should enable the human eye to perceive colors correctly, as it would in natural daylight. Obviously, this depends to some extent on the location and purpose for which light is required.

The criterion here is the color rendering property of a light source. This is expressed as a “general color rendering index” (R_a).

The color rendering index is a measure of the correspondence between the color of an object (its “self-luminous color”) and its appearance under a reference light source. To determine the R_a values, eight test colors defined in accordance with DIN 6169 are illuminated with the reference light source and the light source under test. The smaller the discrepancy, the better the color rendering property of the lamp being tested.

A light source with an R_a value of 100 displays all colors exactly as they appear under the reference light source. The lower the R_a value, the worse the colors are rendered.

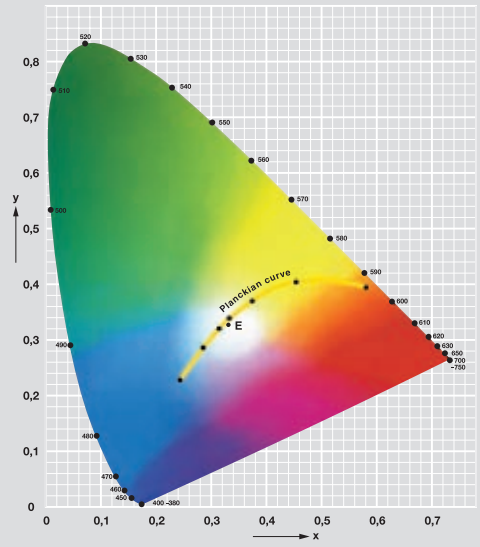
Luminaire efficiency
Luminaire efficiency (also known as light output ratio) is an important criterion in gauging the energy efficiency of a luminaire. This is the ratio between the luminous flux emitted by the luminaire and the luminous flux of the lamp (or lamps) installed in the luminaire.

For detailed information on indoor lighting with artificial light, see DIN 5035.

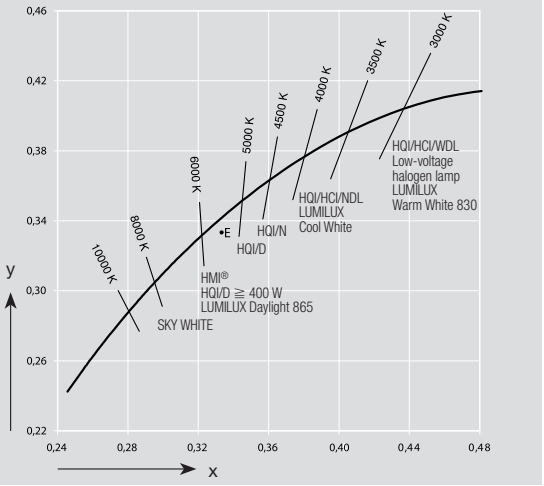
Average lamp life
The average life of a lamp is an average of the lives of individual lamps operated under standard conditions (50% failure = average life).

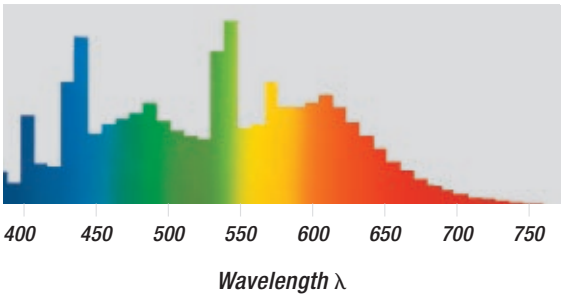
Service life
Service life is a simple practical measure of the economical life of a lamp. It is the number of hours of operation after which the system luminous flux (i.e. the product of the relative luminous flux and the relative proportion of lamps still in operation) is around 80% of the initial value.

Chromaticity diagram to DIN 5033



Extract from the chromaticity diagram showing the Planckian curve





Daylight spectrum of a BIOLUX® fluorescent lamp. The radiation is very evenly distributed over the entire visible range.