

THE BASICS OF TECHNICAL FUNCTIONALITY

TECHNICAL FUNCTIONALITY FOR DECORATIVE LIGHTING

A project by Contardi

Is it true that decorative lights do not illuminate? Not for Contardi!

Our aim today is to create products, which are decorative and functional at the same time. To do so, it is fundamental to define the "intended use" of a lighting fixture, i.e. the main function the lamp has been conceived for.

If you don't know what you want to illuminate, you won't be able to do it properly.

Through this short handbook, Contardi wants to give the ABC to allow anyone, not necessarily skilled, to choose the right illumination for each room.

The aim of this brief presentation is not to teach a lesson on lighting engineering.

Our wish is simply to give the basics of this topic to explain and understand better the "functional side" of decorative lighting.





LUMINOUS FLUX (Lumen)

How much can a product illuminate?

There is no longer a correspondence between the power used by old light bulbs and new LED light sources, which, the values being equal, emit a lot more light. This is why, to understand how much light a product emits, we need to use another yardstick: the lumen.

What is the lumen?

The LUMEN is the unit of measurement of the luminous flux, i.e. the visible light emitted by a source. We distinguish:

Raw lumen: this is a measure of the theoretical output of a light without anything screening the flux and corresponds to the value stated by the light source producer.

Effective lumen: it is a measure of the actual output of a light considering the alteration of the flux due to the shade.

OPTICAL EFFICIENCY

The ratio between raw lumens and effective lumens is called **optical efficiency**. This value, which is usually expressed as a percentage, varies between 60% and 85% (reduction of 15% - 40% compared to the raw lumens value).





7000 lm

The value of the luminous flux emitted by a light source is higher than the one of the lamp containing the light source. This happens because the lampshade (or other components) absorbs part of its power.

ILLUMINANCE (Lux)

What is the lux?

The LUX is the SI (International System of Units) derived unit of illuminance and luminous emittance, referring to the illuminated object and not to the light source. It measures luminous flux (Im) per unit area (m²).

In theory:

A 1000 lumens flux over a 1 m² surface lights up that space with about 1000 lux*. On the other hand, if 1000 lumens are spread on a 10 m² surface, the illuminance will be around 100 lux*.

On the technical data sheet of the products you will find the value of lumens produced by the LED source. Depending on the square footage of the room to be illuminated, you can calculate the lux value of the illuminance.

The obtained value is generic, as we have to take also other factors into consideration, which may influence the result:

- · luminous flux emission angle
- physical obstacles
- the distance between the source and the surface
- $\boldsymbol{\cdot}$ the main colours of the room

*Not considering the emission angle. See slide 21 for the real calculation.



LUMEN / LUX



between the light source and the illuminated surface: the illuminance value decreases as the distance increases.

FUNCTIONALITY

Designing an efficient lighting system, which is also functional and cosy, you have to take some factors into consideration:

- dimensions of the spaces
- intended use
- necessary light quantity
- atmosphere you want to create

The **intended use** is certainly one of the fundamental factors, as it determines the light sources choice, depending on the light you need to make the space functional.

Let's analyse this relevant aspect now: how to achieve the correct illuminance level depending on the intended use of the space.



Recommended illuminance values depending on the use:

- · []
 - PASSAGEWAYS: 50-150 lux
 - KITCHEN: 200-500 lux
 - KITCHEN (worktop): 500-600 lux
 - BATHROOM: 150 lux
 - BATHROOM (mirror): 400 lux
 - BEDROOM: 150-200 lux
 - **READING:** 200-500 lux
 - I · OFFICE (workstation area): 400 lux
- OFFICE (surrounding): 300 lux

KITCHEN WORKTOP (500-600 lux)



DORIAN PL

1 x Custom LED Board 55 W **Raw lumen:** 7500 lm **Effective lumen:** 5000 lm 3000 K ; CRI > 90 Dimmable

1,5 m to the worktop: about 750 lux

OFFICE (400 lux)



VEGAS SO

Rosette: $3 \times COB$ LED 12 W Rings: $2 \times Strip$ LED 12 W + 1 Strip LED 8 W

Raw lumen: 5800 lm Effective lumen: 4250 lm 3000 K ; CRI > 90 Dimmable

1,2 m distance from the table: about 470 lux

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READING (200-500 lux)



FLEXILED AP

1 x Custom LED 3 W **Raw lumen:** 500 lm **Effective lumen:** 400 lm 2700 K ; CRI > 90

0,5 m distance from the reader: about 380 lux

PASSAGEWAYS (50-150 lux)



UFFIZI AP

Amber onyx marble frames

1 x Strip LED 25 W Raw lumen: 2100 lm Effective lumen: 1000 lm 2700 K ; CRI > 90 Dimmable

1 m distance (midpoint of a 2 m corridor): about 230 lux

2 m distance (midpoint of a 4 m corridor): about 60 lux

What is the watt?

The WATT is the unity of power. This value gives us information only on the quantity of energy a light source uses, but not on how much light it emits, although there is a mathematical relationship between lumen and watt value.

Watts are no longer a reliable unit of measurement since the LED light sources have been introduced on the market. As shown in the chart below, LED energy saving lamps give a lot more light with less energy consumption.

Luminous flux	Led light source consumption	Incandescent bulb consumption
250 lumens	3 watts	20 watts
330 lumens	4 watts	25 watts
450 lumens	8 watts	40 watts
800 lumens	13 watts	60 watts
1100 lumens	17 watts	75 watts
1500 lumens	20 watts	100 watts
2000 lumens	25 watts	150 watts
3000 lumens	35 watts	200 watts



LUMINOUS EFFICACY

A lamp converts electrical power to visible radiation (light) and heath. The luminous efficacy of a light source is the ratio of luminous flux to power, dimensionally expressed as lumen/watt.

This means that the more efficient the light source is, the lower quantity of power it uses.

COLOUR TEMPERATURE (Kelvin)

What means "colour temperature"?

Every colour has its own "temperature", measured in Kelvin (K). This unit indicates the chromatic characteristics of light, as to say the colour tone of a specific light source.

Lower K values correspond to warm tones. Higher values correspond to cold tones.

- Candle light: around 1850 K
- 100W Incandescent light: 2700 K
- "Neutral white" Fluorescent light: 3500 K
- Daylight: around 5000 K
- Daylight overcast: around 6500 K



Depending on the colour temperature of the light bulbs we use, the light effect and the way the room is illuminated are different.

When we take lighting fixtures into consideration, we distinguish:

"warm white": 1000 ≤ K < 3300

It is the type of light we prefer in **houses and offices**, as it creates a sensation of warm and comfort.

"cool white": K > 5300

Appropriate for **big public spaces**, as supermarkets and hospitals, where details and efficiency count the most.

"neutral white": 3300 < K < 5300

It creates the maximum contrast between colours.

COLOUR RENDERING (CRI)

What is CRI?

CRI (*colour rendering index*) measures the ability of a light source to reveal the colours of an object faithfully.

The colours we see in an object, which doesn't radiate light itself, depend both on its way to reflect light and on the light illuminating it.

70	POOR LED
80	STANDARD LED
90	GOOD LED
97	BEST LED
98	HALOGEN
100	PERFECT

The picture below shows how the colour rendering index value changes the perception of the colours of an illuminated object. On the right, you can see how the lamp Kubric SO by Contardi, with a CRI > 90, renders the real colour of the illuminated armchair faithfully.

Contardi only uses LED light sources with CRI > 90.



DIMMABILITY

What is a dimmer?

A dimmer is a light regulator device, which can control the electricity supply tension and consequently regulate the luminous flux of the lamp.

What are the advantages of a dimmable LED light source?



Dimmers can be used with domotics.

DIMMING CONTROL SYSTEM

PUSH: this dimming system should be combined with a common switch and allows to get a perfect dimming control 0-100%. The switch becomes on/off if it is pushed quickly, while the prolonged pushing dims the light gradually.

DALI: DALI (Digital Addressable Lighting Interface) is the standard digital technology to manage lighting fixtures, based on a digital output, which can set the modules in a bidirectional way. **Remote control dimmer**.

0-10 V: the home automation system of the building directly controls and regulates the light with 0-10V output.



Dimming Timeless So Large (PUSH)

IP CODE

What is the IP Code?

The IP Code classifies and rates the degree of protection provided against intrusion of solid and liquid particles, like dust and water.

The first digit after "IP" indicates the level of protection against the ingress of solid foreign objects (0-6); the second digit indicates the level of protection against harmful ingress of liquid particles (0-8).

An inadequate IP rate could lead to problems, even serious, with the lighting system security.

As a general rule, lighting fixtures for indoor usage are IP20 rated (never lower), but if used in the bathroom area or in professional kitchens, where there are constant exhalations of steam, a more specific level of protection is required: IP44.

For outdoor usage, it is possible to find on the market products that have an IP level between IP44 and IP68. It is, however, fundamental to clarify that IP44 rate is recommended only if the product is not directly exposed to the rain. The minimum rate for real outdoor usage shall therefore not be lower than IP65.



X 0 - 8 LIQUID INGRESS PROTECTION X 0 - 6 SOLID PARTICLES PROTECTION

1st digit - Solid particles protection

- IP | Meaning
- 0 No protection
- 1 Protected against solid bodies over D 50 mm
- 2 Protected against solid bodies over D 12 mm
- 3 Protected against solid bodies over D 2.5 mm
- 4 Protected against solid bodies over D 1 mm
- 5 Protected against dust (no harmful deposit)
- 6 Complete protection against contact dust

2nd digit - Liquid ingress protection

- IP | Meaning
- 0 No protection
- 1 Protected against dripping water (vertically falling drops)
- 2 Protected against dripping water when tilted at 15°
- 3 Protected against dripping water when tilted at 60°
- 4 Protected against water splashing from any direction
- 5 Protected against water projected by a nozzle
- 6 Protected against water projected in powerful jets
- 7 Protected against temporary water immersions (up to 1 m depth)
- 8 Protected against continuous water immersions

CONCLUSION

This is the first of a series of projects, that Contardi has decided to develop, in order to help its partners and all the professionals to use lighting fixtures depending on their intended use.

The function of a product is what makes and will make the difference, never forgetting the aesthetic research and the pleasure of choice.

Thank you!

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Real calculation of the illuminance value

As explained, illuminance (E) is the result of the ratio of the luminous flux (Im), emitted by a light source, to the illuminated surface. It can generically be identified as the quantity of lumens per m².

$E = Im / m^2$

More specifically, for a calculation of the actual illuminance value on a surface, you have to take into consideration also the distance between the illuminated object and the light source.

The lux, the unit of measurement of illuminance, corresponds to the illuminance on a surface, which is perpendicular to the rays and 1 meter distantfrom the light source.

The illuminance of a point, which is perpendicular to the incidence direction of the light, corresponds to the ratio of the luminous flux (lm), in the direction of the mentioned point, to the distance (d) squared between the light source and the point itself.

$E = Im / d^2$

In case the illuminated surface is not perpendicular to the light source, the illuminance value corresponds to the luminous flux directed to the point, divided by the distance (d) squared and multiplied by the cosine (cos) of the luminous flux emission angle (α), included between the light incidence direction and the normal (perpendicular) to the plane.





Illuminated plan