When luminaires are being selected for a new installation,
the following characteristics need to be taken into consideration:

- COLOUR i.e. Color Appearance and Color Rendering
- LIGHT i.e. Light Output & Efficiency (As Installed)
- LIFE i.e. Frequency of replacement and performance (lumen maintenance)
- ENERGY use

1. Colour

Colour Rendering

The colour rendering of a light source is an indicator of its ability of realistically reproduce the colour of an object. According to the International Commission on Illumination CIE, colour rendering is given as an index between 0 and 100 Ra, where lower values indicate poor colour rendering and higher ones good colour rendering.

The colour rendering of a light source is compared to daylight if its CCT is >5000K and to a black body (i.e. a source that produces a continuous spectrum).

Some tasks industry have high demands in accurate colour rendering and require special attention from the lighting designer. For normal offices, the minimum colour rendering index required is **Ra 80**.

Group	Ra	Importance	Typical Application
1A	90…100	Accurate colour matching	Galleries, Medical examination, colour mixing
1B	80…90	Accurate colour judgement	Home, Hotels, Offices, Schools
2	60…80	Moderate colour rendering	Industry, Offices, Schools
3	40…60	Accurate colour rendering is of little importance	Industry, Sports Halls
4	20…40	Accurate colour rendering is of no importance	Traffic Lighting

2. Light Output and Efficiency

Luminous flux

Luminous flux describes the total quantity of light emitted by a light source, both visible and non-visible. The unit of measurement is Lumens (lm). The quantity of light (lumens) emitted by the lamp measured under standardized conditions.

Luminous Efficiency (Efficacy)

Luminous Efficiency is the ratio of the luminous flux or light output (lumens) to the electrical power consumed (watts) = lm/W. It is a measure of a lamp's economic efficiency. The recognized terminology is Efficacy.

Luminous Intensity

Luminous Intensity describes the intensity of light that is radiated in a particular direction. This is a useful measurement for reflector lamps, such as in halogen lamps. The unit of measurement is Candela (cd).

3. Life

Rated Life

The rated life of a lamp or light source is defined, per ANSI/IES RP-16, as "the life value assigned to a particular type lamp.

This is commonly a statistically-determined estimate of median operational life." The rated life in hours of an LED lamp or light source, specified by the manufacturer, applies under certain operational conditions and for defined failure criteria. The statistical measure for the rated life is designated Bp and is measured in hours, where p is a percentage.

For example, a B50 rated life of 1,000 hours means that 50% of the tested products have lasted 1,000 hours without failure. B50 is also known as the products' rated average life.

Lumen-Maintenance Life

Rated lumen-maintenance life is measured in hours with associated percentage of light output, noted as Lp.

I.e. L70 of 30,000 hours means that the tested LEDs produce 70% of the initial light output at 30,000 hours. If an LED has L50 of 30,000 hours, its lumen output decays faster than one with L70 of 30,000 hours.

Philips LED Achieve:

B50L70 [>70,000 hours], B10L80 [60,000 hours], B10L90 [30,000 hours].

Based on operating 10 hours per day, 5 days a week our MSCB luminaires should achieve B10L90 (only 10% failure with 90% of the original light output after operating for 600 weeks or approximately 12 years!

4. Energy Use

Energy consumption [kWh]

Of increasing importance now with the high cost of electricity and the need to introduce as efficient light as possible. The amount of electric energy consumed by a lamp over a certain period is expressed in kWh (kilowatt–hours).

Energy usage increase is directly related to the required lux levels on the working plane, hence a project which only requires 300lx will use much less energy than one with a 500lx lighting requirement; therefore to ensure a proposed lighting method is efficient, the energy consumption can commonly be specified to be less than a W/m2/100lx figure.

Lighting Control

Dimming lighting systems can be either:

- Centrally controlled with separate sensors feeding back to a central hub, this is usually used on very large installations.
- Locally controlled using intelligent sensor / controllers on board and controlling a limited number of ballasts.

Digital Addressable Lighting Interface (DALI)

All Frenger luminaires are DALI compatible (unless otherwise requested). DALI is a trademark for network-based systems that control lighting in building automation.

The underlying technology was established by a consortium of lighting equipment manufacturers as a successor for 0–10 V lighting control systems, and as an open standard alternative to Digital Signal Interface (DSI), on which it is based.

DALI is specified by technical standards IEC 62386 and IEC 60929. Standards conformance ensures that equipment from different manufacturers will interoperate. The DALI trademark is allowed on devices that comply with the current standards when manufactured.

Sensors:

Lux Level Sensors

These sense the light level on the working plane and adjust ballast output to maintain the preset light level.

Absence / presence detection Sensors

Generally using PIR or microwaves to sense movement in the sensing field. Microwave units tend to have a bigger sensing area.

Infra red control / override

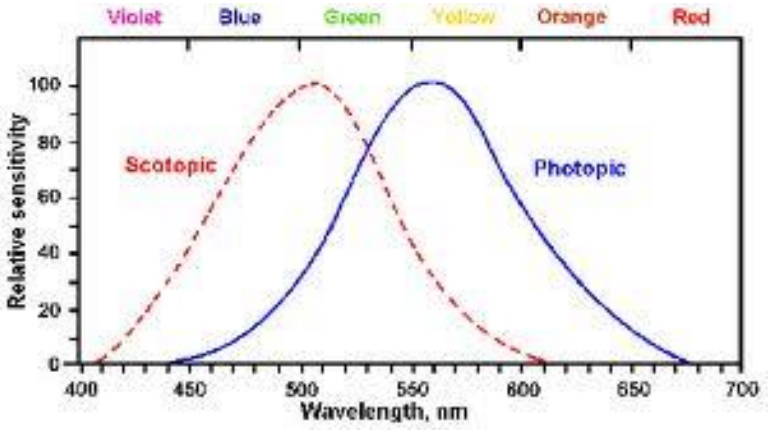
Some intelligent sensors allow control from a handset to set up and override sensor controller settings.

Relay output

Some units have a relay to cut power to the ballasts when lighting not required. Digital systems can put the ballasts in standby mode which consumes some power even when the lights aren't on.

Most sensors are a combination of some or all of the above.

5. Photometry



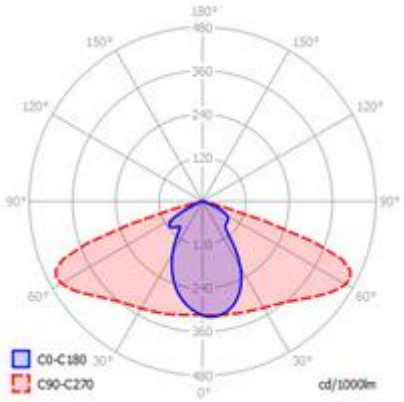
In order for designers to predict the light quality that will be achieved in an environment then they need accurate information about the amount and distribution of light from the luminaire. This is usually presented in an electronic file format.

The light from a luminaire can fall in a broad band of the spectrum from infra red to UV. The CIE has produced a "standard photopic curve" which is the luminous efficiency function and describes the average visual sensitivity of the human eye to light of different wavelengths.

All photometric readings are adjusted to account for the eyes varying sensitivity.

Frenger provide photometric files in EULUMDAT format which is a data file format used for specification of photometric data especially intensity distributions from light sources such as lamps and luminaries. The file extension is .ldt.

The format was proposed by Axel Stockmar (Light Consult Inc., Berlin) in 1990.



6. Lighting Design

The lighting of an interior should fulfil three functions:

- Ensure the safety of people in the interior.
- Facilitate the performance of visual tasks.
- Aid the creation of an appropriate visual environment.

In the UK office lighting design is usually in compliance with CIBSE LG7: Office Lighting.

Reflectance Values

Relative surface illuminances are typically 70% ceiling, 50% walls & 20% floor unless otherwise specified.

Surface Luminance limits. E.g. Walls limited to 1500Cd/m²

Glare: Glare occurs when one part of an interior (including the luminaire) is much brighter than the general brightness in the interior. There are two types disability and discomfort Glare.

Glare is a function of:

- Luminance of the light source.
- Luminaire Source Size
- Position of the light source in relation to the viewer.
- The luminance of the general environment.

Where computer screens are used luminance limits are set at generally 65 degrees and above, to minimize Glare.

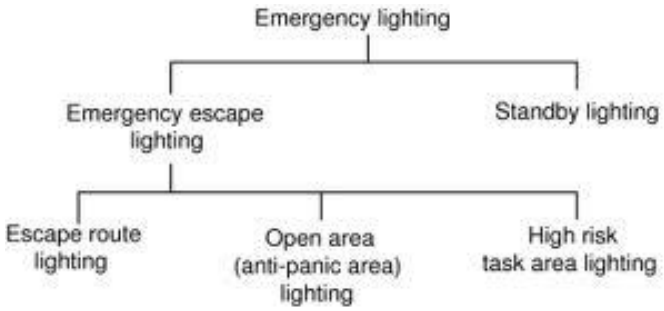
The luminance of the general environment.

Using the above and simple maths it is possible to calculate for any given installation a “Glare Index” (TM10)

LG7 lays down limiting Glare ratings for each lit environment.

Emergency Lighting

Emergency Lighting is provided for use when the supply to the normal lighting fails and is therefore powered from a source independent of that supplying the normal lighting. Emergency Lighting Luminaires are classified according to their operation:



Either Self Contained (complete with own battery pack and charger) or as Centrally Supplied.

Maintained or Non maintained operation.

Combined if the luminaire provides normal and emergency lighting from separate lamps.

Central Battery System

Batteries for a number of Luminaires are housed in one location, usually for all the emergency luminaires in one sub-circuit or the whole building.

Maintained Emergency Luminaire

A luminaire containing one or more lamps all of which operate from the normal supply or from the emergency supply at all material times.

Non-Maintained Emergency Luminaire

A luminaire containing one or more lamps, which operate from the emergency supply only upon failure of the normal mains supply.

Sustained or Combined Emergency Luminaire

Contains two or more lamps at least one of which is energised from the emergency supply and the remainder from the normal supply. The emergency lamp is either maintained or non-maintained.

Rated Duration

The time for which the emergency lighting will provide the rated lumen output after mains failure. This is normally 3 hours.

Self-Contained Emergency Luminaire

A luminaire providing emergency lighting in which all the elements such as battery, lamp and control unit are contained within or within 1 meter of the housing.

Slave or Centrally supplied Luminaire

An emergency luminaire without it's own batteries designed to work with a central battery system.

Central Battery Inverter

A Mains / Emergency changeover inverter to suit 24 – 110v central battery system to directly drive the emergency lamp from the central battery supply or Mains / Emergency changeover relay to suit 240v static inverter system.

BLF

Ballast Lumen factor. When the emergency lamp is operating from a battery supply the lumen output of the lamp is reduced. The ratio of emergency lumens to normal lumens is the BLF.

Escape Routes

Are recommended to be 2m wide with a centre line minimum illuminance of **1 lux** at all points, 50% of this over the 1m wide central band.

Open Plan Areas (>60m² or with an escape route passing through) - 1 lux average over the floor area (BS5266), or **0.5 lux** minimum anywhere on the floor level (EN 1838), excluding 0.5m border.

Emergency lighting calculations are with **zero** reflectance.

High Risk Task Areas

EN 1838 states > 10% of normal illuminance level at task level.

Emergency Testing

Emergency lighting systems have to be tested on a regular basis.

Self-test fittings can check occupancy patterns and then do a self-test and report any faults via a bi-colour LED and /or sounder.

DALI emergency inverters can also self-test and report lamp, battery etc faults direct to a central control system.