DIMMING FLUORESCENT LIGHTING GUIDE

Dimming a fluorescent lamp is different from a standard dimming circuit for GLS or Halogen Lamps.
All of the dimming is managed by the ballast, not by the amount of voltage fed into the fitting as is the case with a traditional dimmer switch.

Types of Dimming- Quick Guide

Split into two main categories

ANALOGUE - also known as 0-10v or 1-10v

Switch type: A potentiometer, rotary, slider, with a separate control for turning on/off

Advantages

- An older system which some contractors feel more comfortable with
- No interference with the switching of the luminaire.

Disadvantages

- A separate 'dimming pair' must be wired to each fitting in the circuit.
- Limited control options, i.e. working with further applications, such as
- Daylight linked dimming, or movement detectors.

DIGITAL - also known as touch dim, switch dim, DSI or DALI

Switch type: Bell push, push to make, retractive.

Advantages

- Simple installation, only a 4 core cable needed, as in an emergency lighting fitting, so sometimes no need to re-wire.
- Greater control over dimming, down to as low as 1%.
- Can be used in simple applications in conjunction with PIR's and daylight sensors.

Disadvantages

- Interference can occur with switching, as control wire and switch wire run together.

Analogue Dimming

Analogue dimming is known as 1-10v dimming. This is because the dimmable ballast produces a 1-10v DC supply that can be increased or decreased by using a potentiometer (Also known as a high frequency push/rotary or slide dimmer switch). The DC supply can be increased or decreased by the switch to affect the resistance, hence the dimness of the lamp. This form of dimming requires a 'dimming pair 'of cables to be run around to each fitting in the circuit in order for it to operate.

Digital Dimming

Digital dimming can be split into 3 sub sections - **Switch dim/Touch dim, DSI and DALI**

Switch Dim/ Touch Dim

This is the most popular and simplest option for digital dimming. It is operated by a push to make or retractive switch, which is then wired to each luminaire in the circuit via a 4 core cable consisting of a switched live, (via a push to make) neutral, earth, and an un-switched live. The switch controls the switching on and off of the luminaire, and also the dimming. Each push on the button sends a pulse to the ballast which then reads it and controls the lamp accordingly,

Long push / Hold down-Dim down/up - **Short push**- Turns lamp on off

DSI

DSI stands for Digital Series Interface, and is a more controllable version of digital dimming. It enables the user to group luminaires, operate daylight linked dimming and other controlling options. This is wired using a dimming pair, run to each luminaire in the circuit (similar to the analogue system). DSI is am Tridonic based technology, and can be set up with a variety of control options and controllers, some of which are offered by other manufacturers, designed purely to work with the DSI ballast. DSI ensures there are no issues with interface from the switching of the luminaire and the dimming of the luminaire which can affect switch on.

DALI

DALI stands for Digitally Addressable Lighting Interface. This is a uniform standard employed by all ballast manufacturers that offer DALI ballasts. This system assigns an individual address to each luminaire, i.e. 001, 002, 003 and so on, for the complete installation. These ballasts can then be controlled via their address. This means that scenes can be set, groups controlled, all this is achieved through a desktop PC. It can be manually over ridden at a wall switch, or can be used in conjunction with a daylight sensor, or a PIR. DALI can offer 2 way communications between the fitting and the controller, and includes invaluable information such as ballast run time and operating status.

Emcogroup can supply Analogue dimming control gear for the Emcolite modular compact fluorescent range from stock. Should you require any other format; we can usually make conversions within a week. Please contact for quote.

The Principles of lighting Design

One of the most important aspects of lighting design is to determine the number of luminaires required, based on the given illuminance value. The room utilisation factor method is a sufficiently accurate , and relatively simple procedure for finding the required number of luminaires (n)

$$n = \frac{1.25 \times E \times a \times b}{\phi \times \quad \times h_{LB} \times h_R}$$

Status of the lighting system

The planning factor takes into account the reduction in luminous flux and soiling of light fittings. Planning factor =1.25

Rated illuminance E

According to DIN 5035, Part 2 for the room in question, depending on the type of activity and usage.

Room factor k

The room factor k makes allowance for the shape of the room.

$$K = \frac{a \times b}{h\,(a \times b)}$$

a= Room width
b= Room length
H= Room height
H = H – 0.85m

Luminous flux ϕ

Taken from the lamp catalogue, depending on the lamp to be used in the luminaire.

Luminaire efficiency h_{LB}

Taken from the luminaire catalogue, depending on the luminaire selected.

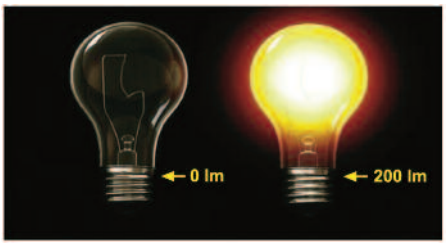
Room utilisation factor h_R

Taken from tables for the selected luminaire, on the basis of its classification.
The effect of the light distribution in the room is covered by the value from the appropriate table.
It is more common to use a recognised design program on your computer to enable accurate lighting design.

Reflectances

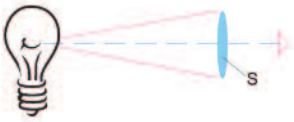
Reflectances properties of the rooms surfaces are measured in terms of the reflectanaces of the ceilings, walls and work surfaces or floors. Reflectances can be measured with the aid of reflectance tables. Modern computer design programs take all these factors into consideration to enable accurate lighting design.

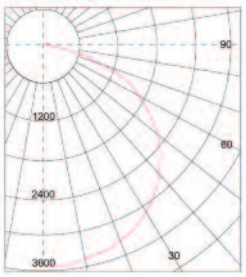
Basic terminology of lighting design



Luminous flux (lumen)
Unit: Lumen (lm)
Lumen is the measure of the perceived power of light.
It differs from radiant flux, the measure of the total power of light emitted. Lumen is adjusted to reflect the varying sensitivity of the human eye to different wavelength's of light.

Luminous Intensity (candela)





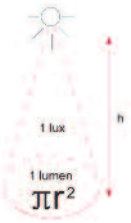
S. The surface resulted by the specific angle and the intensity
I. Luminous intensity

Unit: candela (cd)
The candela is the unit of measurement for luminous intensity and it used to indicate how bright a lamp is in a given direction. It is used when specifying the performance of reflector lamps. Candela is a measure of the wave length- weighted power emitted by a light source in a particular direction per unit solid angle.

Formula

$$\text{Luminous intensity (cd)} = \frac{\text{Luminous flux (lm)}}{\text{Solid angle (sr)}}$$

Illuminance (lux)



Unit: Lux (lx)
Lux is the ratio the quantity of light or luminous flux incident on a surface to the area of that surface (πr^2). Used when quantifying the amount of light falling onto a surface. Independent of the direction from which the luminous flux reaches the surface. One lumen of luminous flux, uniformly incident on:
1 square meter of area => produces 1 lux.

Note: It is also referred to as a light level, illumination level or illumination value.

Formula

$$\text{Illuminance (Lux) [lx]} = \frac{\text{Luminous flux (lm)}}{\text{Area } (\pi r^2)}$$

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Colour temperature

Unit: Kelvin (K)

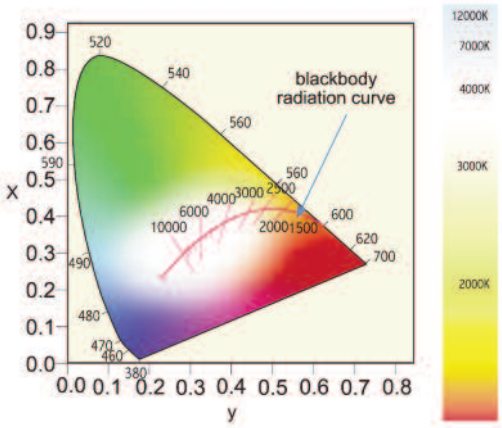
The specific colour shown at a particular temperature is the colour temperature. The colour temperature is normally shown in units of absolute temperature, Kelvin [K].
Colour temperature is related to Planck's law and to Wien's displacement law.

Higher colour temperatures (5000K or more)
- cool colours (bluish white)

Middle colour temperatures (3700-5000K)
- neutral colours (nearly white)

Lower colour temperatures (2600-3700K)
- warm colours (yellowish white through red)

The colour temperature of light source is the temperature of an ideal blabkbody that emits light of comparable due to that light source. When the blackbody is heated enough and begins to emit light, it becomes dull red. When more heat is applied, it glows yellow and then white, and finally blue.
Like a piece of metal is heated, the colour of light of the metal emits will be changed in higher temperature.



4100K
Cool colour
CRI is lower

3000K
Warm colour
CRI is higher

Colour Rendering Index (CRI)

Visable Colour = CRI (Ra)

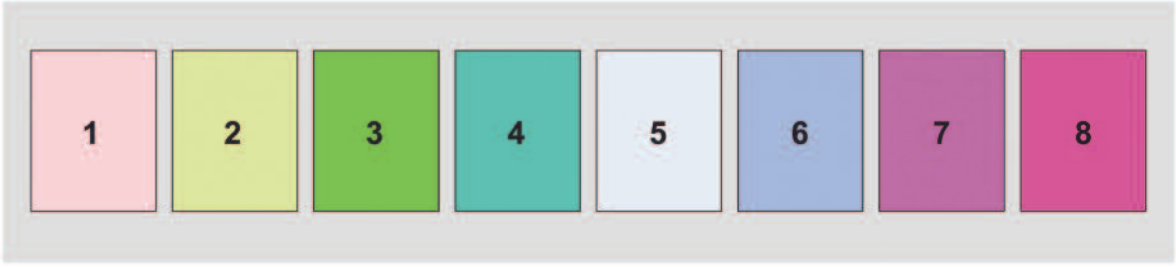
The criterion here is the colour rendering property of a light source. It is called "general Colour Rendering Index"[Ra].

Colour Rendering Index (CRI) is a quantitative measure of the ability of a light source to reproduce the colours of differenr objects faithfully in comparison with an ideal or natural light source.

The extent of which light is capable of making objects appear their true colour is known as colour rendering.

A lamp's value on the Ra scale is showing its Colour Rendering Index (CRI). The index from 0-100, for example, the incandescent has 100 Ra means the highest of CRI, if it is 0 Ra means the lowest of CRI.

The average "shift" in those eight colour samples is reported as Ra or CRI. In addition to the eight colour samples used by convention, some lighting manufacturers report an "R9" score, which indicates how well the light source renders a saturated deep red colour.



Basic terminology of lighting design

Light sources with a high CRI, which are depend with colour-critical functions.
Although light sources having the same colour temperature will also have the same colour apperance, this does not necessarily mean that coloured surfaces will look the same under them.
The spectral wavelengths contained in the incident light that are reflected, will determine the colour impression we obtain from the surface.

Luminous Efficacy

Unit: lm/w

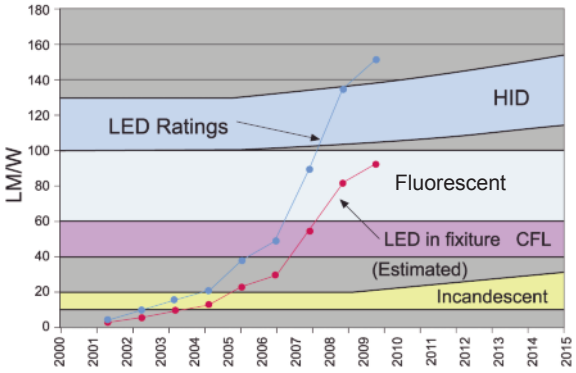
Energy efficiency of light sources is typically measured in lumens per wayy (lm/W).
It is indeed the luminous flux that is being emitted from a light source to the electric power by the source.
The luminous efficacies that can actually be attained vary depending on the lamp. Luminous efficiency of light source will be consumed by the representive of the efficiency of electrical energy into light.

Formula

$$\text{Luminous efficacy (lm/W)} = \frac{\text{Luminous flux (lm)}}{\text{Power of Lamp (W)}}$$

LED Development

Lumens Ratings vs. In Fixture



Rated lumens are measured under controlled thermal conditions (25C Junction temperature).... In-fixture lumens are reduced due to higher junction temperatures.

Lamps with Comparable Performance

Lamps with Comparable Performance

Light Output (lm)	400	800	1200	2000
Incandescent	40W A-line	60W A-line	75W A-line	15W A-line
Halogen	35W PAR	50W PAR	75W A-PAR	120W A-PAR
	35W MR16 35W Bi-Pin	50W MR16 50W Bi-Pin		
Compact Fluorescent	7W CEI	13W CEI	18W CEI	26W CEL
HID	-	-	-	35W MH
				35W HPS

Note: Lamp equivalents for available lumen options based or average conventional lamp performance

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Bulb Light

Energy saving: Power consumption is 1/2 comparing with current energy saving lamps

Durable: The life span of LED light is over 50000 hours. 50 times for incandescent lamp life, 6 times for energy saving lamps, costs of maintenance and replacement are largely reduced. It is a real enviromental friendly and energy saving product and it could be used to replace traditional bulb light series lighting directly.

Features:
LED Bulb light is high brightness, no infrared, no UV, no heat effect, no flicker, no noise, no pollution, no silver and other contamination. Non harmful to eye or skin.

It could be used to replace traditional bulb light series lighting directly.

LED Ceiling Light

Energy saving: Power consumption is 1/2 comparing with current energy saving lamps

Durable: The life span of LED light is over 50000 hours. 50 times for incandescent lamp life, 6 times for energy saving lamps, costs of maintenance and replacement are largely reduced. It is a real enviromental friendly and energy saving product and it could be used to replace traditional bulb light series lighting directly.

It could be used to replace traditional Ceiling light directly with Emco's single light source design.

Spot Lighting

Energy saving: Power consumption is 1/2 comparing with fluorescent energy saving lamps.

Durable: The life span of LED lights is over 50000 hours. 20 times of quartz lamp life, cost of maintenance and replacement are reduced.

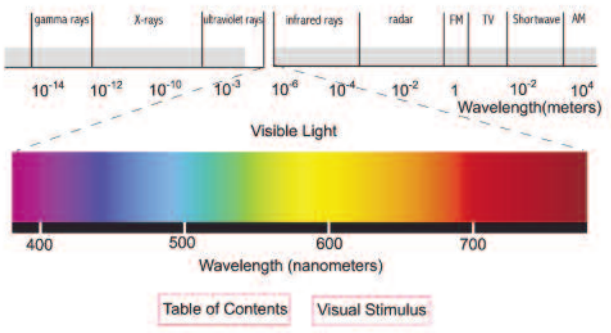
Application: Apply to all commercial use and especially for museum. LED spot lighting so not produce UV and infared. It will not damage the artware. It could be used to direct replace the original quartz lighting with Emco's single light source design.

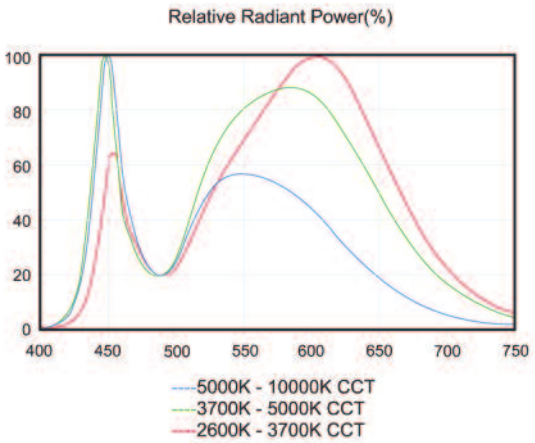
Beam angle

It is the angle between the two directions opposed to each other over th ebeam axis for which the luminous intensity is half that of the maximum luminous intensity. The angle between those points on opposite sides of the beam axis where the intensity drops to 50% of maximum.

LED of wavelength

Light-emitting diodes (LEDs) differ from other light sources, such as incandescent and fluorescent lamps, in the way they generate white light. We are accustomed to lamps that emit white light. But what does that really mean? What appears to our eyes as white is actually a mix of different wavelengths in the visible portion of the electromagnetic spectrum. The diagram below illustrates visible light as one small portion of the overall electromagnetic spectrum. Electromagnetic radiation in wavelengths from about 380 to 770 nanometers is visible to the human eye.





PIRS and 2D lamps

The PIR must be set to 15 minute operation minimum as a 2D lamp is designed for only 10 switchings a day otherwise the lamp will burn out within 6 weeks and the ballast could fail.

The use of PIR and HF control gear operating 2D lamps should be avoided, soft start ballasts are more favourable but it is better to switch PL lamps with PIRs as the control gear is more compatible.

ANNEALING POINTS FOR MANUFACTURING MATERIALS USED IN LIGHTING

Zinc = 390°
Aluminium = 600°
Steel = 1200°

RAL COLOUR CHART

The following RAL colour codes are the closest match to the finishes on our fittings and are used as a guide only.

WHITE	RAL 9003
MATT WHITE	RAL 9016
BLACK	RAL 9004
SILVER/GREY	RAL 9022

CLASS I luminaries in this are electrically insulated & provided with an earth connection. Exposed metal that could become live in the event of insulation failure are protected by earthing.

CLASS II luminaries are designed so that protection against electric shock does not rely on basic insulation only. This is achieved by means of reinforced or double insulation. No provision for earth is provided.

CLASS III Protection against electric shock relies on supply at Safety Extra Low Voltage,(SELV) and in which voltages higher than those of SELV are not generated (max. 50V acrms)

LOUVRE CATEGORISATION CATEGORY 2 - 65°

In this category, the limiting angle is 65° elevation above which the calculated luminaire should not exceed 200 cd/m at all angles of azimuth. This category of luminaire should be used in areas where there is fairly widespread usage of VDT's maybe one per desk for general usage or a few terminals used continuously.

The photometric data shown in this publication relates solely to Emcolite luminaries. All testing is completed by a reputable independent testing house in accordance to BS5225 part 1.

The full photometric data is online on our website for you to down load.

Typical illuminance levels

Activity/Location	Illuminance (fx)
Reception	**200 - 300**
General office	**500**
Conference/meeting room	**500**
Drawing board	**750**
Machine shop	**300 - 750**
Inspection and testing	**500 - 1000**
Supermarket	**750**

Typical illuminance levels

Activity/Location	Illuminance (fx)
Specialist store	**500**
Showroom	**500 - 750**
Covered arcade and mall	**50 - 300**
Canteen	**200**
Kitchen/food preparation	**500**
Warehouse storage	**150**
Precision work	**1500**

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ALUMINIUM REFLECTORS

We use super (pure aluminium reflectors) in our luminaries, which give the following advantages over other types.

- Lower temperatures around the light source.
- Longer life time for the light source.
- Stays cleaner longer.
- Easier to clean.
- Better stability in colour rendering.

ALUMINIUM REFLECTOR

Same direction for heat and luminous beam

DICHROIC REFLECTOR

Luminous beam temperature reduction

LIGHT QUANTITY INDICATOR FOR 4MTR X 4MTR X 2.8MTR ROOM

LAMP / LUX	12V 50W 38°	230V PAR16 50W 40°	230V PAR30 100W	2x18W CFL	2x26W CFL	35W CDMT	70W CDMT	150W CDMT	12V 50W EAR111	70W HQI	150W HQI
200	9	16	4	4	3	4	1	1	9	1	1
300	12	24	5	6	4	6	2	1	12	2	1
500	16	32	6	9	6	9	3	1	20	3	1

This is only meant as a guide as there are many contributory factors to determine light level.

IP RATING TABLE

Table from BS775 defining IP numbers, protection of persons against contact with live or moving parts inside the enclosure. Protection of equipment against ingress of solid bodies and protection against liquids, that might cause danger to persons.

FIRST NUMBER

Protection against solid objects

IP Test

0 No Protection
1 Protected against solid objects up to 50mm e.g. accidental touch by hands.
2 Protected against solid objects up to 12.5mm e.g. fingers.
3 Protected against solid objects over 2.5mm e.g. tools small wires.
4 Protected against solid objects over 1mm e.g. tools small wires.
5 Protected against dust-limited ingress permitted (no harmful deposit).
6 Totally protected against dust.

SECOND NUMBER

Protection against solid objects

IP Test

0 No Protection
1 Protected against vertical drops of water.
2 Protected against direct sprays of water up to 15" from the vertical.
3 Protected against direct sprays of water up to 60° from the vertical.
4 Protected against water sprayed from all directions limited ingress permitted.
5 Protected against low pressure jets of water from all directions-limited ingress permitted.
6 Protected against strong jets of water e.g. for use on ship decks-limited ingress permitted.
7 Protected against the effects of immersion.

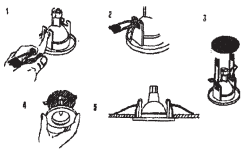
EMCOLITE TECHNICAL

We want you to choose the right lighting fittings for installation, we hope you find the following safety guidelines of use. Most of our fittings are designed for indoor use, in normal dry conditions where they will not be splashed. Some Emcogroup downlights are rated at IP44/IP65 and are suitable for damp areas, but they are only suitable for use where they will not be exposed to moisture from behind. We also supply IP65 fittings, which are designed for external applications. (Underground Fittings).
All light fittings run hot. It is important that you consider the risk of fire and take appropriate precautions. Fittings should not be installed close to flammable materials and should not be any closer than 0.8m to the surface to be lit. Emcogroup fittings are designed for use in areas where the ambient temperature does not exceed 40°c, downlights and transformers should not be covered by insulation of any kind, which should be removed from around each fitting and transformer. You may be required to maintain the fire rating integrity of the ceiling and this should be checked with local building inspectors.

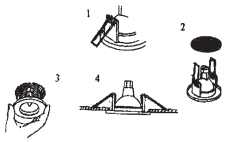
GENERAL WIRING INSTRUCTIONS

1. Select the required position for the down light, ensuring that the clearances we recommend are observed. Ensure you have a minimum distance on all models of 75mm between the fitting and nearest surface. Care should be taken to avoid damage to joists, electric cables and pipe work.
2. Once a desirable area has been selected, carefully cut a hole ready to accept the fitting. (Cut out dimension on box). We advise the installer to double check the cut out size before cutting holes.
3. Once the transformer has been connected to the mains, connect the secondary cable (output leads) to the fitting.
4. To secure the fittings follow the relevant fixing diagram. (a, b or c) Ensure the fitting is securely located. Reinforce soft tiles where necessary.
5. Fit the appropriate rated lamp into the lamp holder and secure.
6. When wiring is complete, switch on mains.

A **DOUBLE CLIP:**
Suitable for ceilings between 5-20mm

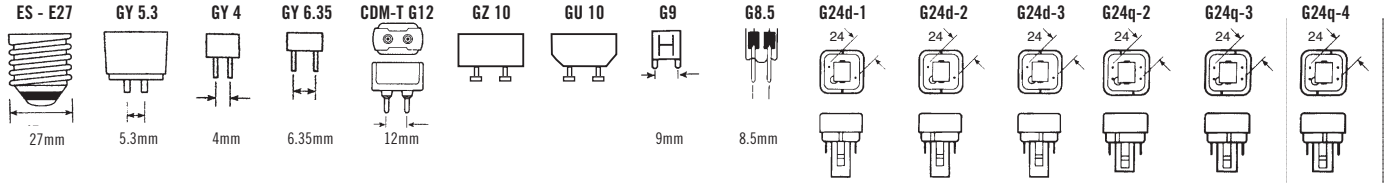


B **SINGLE CLIP:**
Suitable for ceilings between 5-20mm



C **BUTTERFLY CLIP:**
Suitable for most types of ceiling over 6mm

DETAILS OF CAP ENDS



All of our fixing springs ensure quick and easy installation without tools. The different types of springs are used depending on the size and weight of the fitting. Each is suitable for installation in ceilings as above, and allows removal for maintenance and decoration.

LIGHTING IN BATHROOMS

When installing lighting in new or refurbished bath/shower rooms, there are some important safety factors to consider. The installation must comply to amendment no3 of BS 7671: 1992 which in brief states that zone 0 is the interior of the bath tub or shower tray. Zones 1, 2 and 3 extend vertically and horizontally beyond the bath tub or shower tray. You should refer to this prior to installing lighting in a bath/shower room.
A low voltage IPX4 or IPX5 light fitting is suitable in the ceiling above a bath or shower(zone 2).
(IPX5 suitable for communal baths or showers where water jets are likely to be used for cleaning purposes.

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