Lighting Characteristics

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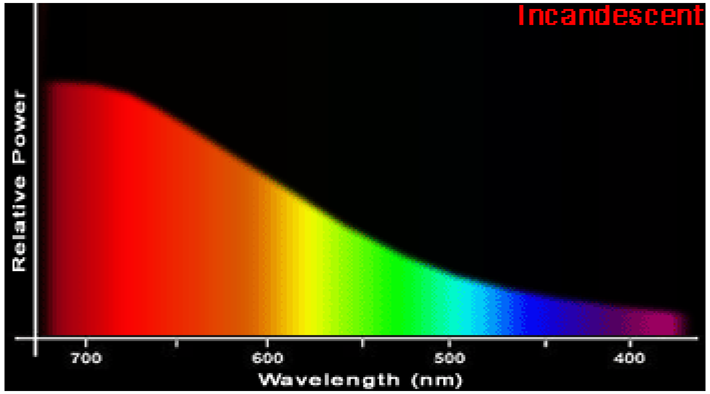
Comparison of lighting characteristics

	Filament bulb	230 V-halogen bulb	12 V-halogen bulb	12 V- IRC halogen bulb	Energy-saving bulb	LED
Energy efficiency class	E	D E	D [1)]	C [1)]	A	2)
Colour rendering	100	100	100	100	80	80 [5)]
Service life	1000 h	2000 h	2000 h - 4000 h	4000 h - 5000 h	10000 h	50000 h
Service life in years (daily burning time of 3 hours)	1	2	2 - 4	4 - 5	11	47
Colour of light	2700 K	2900 K	3000 K	3000 K	2700 K 3000 K [4)]	3500 K 5500 K [4)]
Shadiness	balanced	balanced	clear, distinctive	clear, distinctive	poor	balanced
Scattering losses	very high	high	low	low	very high	extremely low
Light character	pleasant, warm, soft light	pleasant, bright, clear light	brilliant, bright, clear light, provides for unobtrusive accents of light	brilliant, bright, clear light, provides for unobtrusive accents of light	wishy-washy light with very little shadow	strongly focused light with clear edges where light is emitted

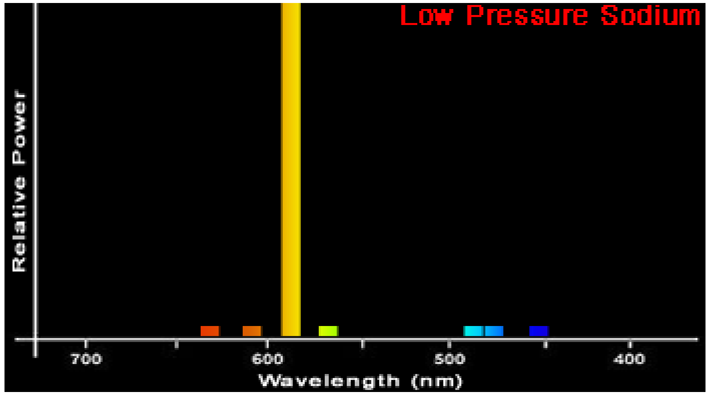
Tungsten Halogen/ Low Voltage

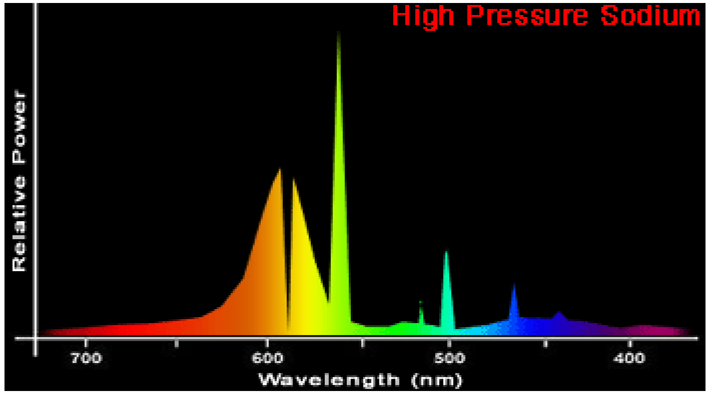
- Cheap to install
- Moderately expensive to run
- Good dimming characteristics
- Tungsten filament halogen gas



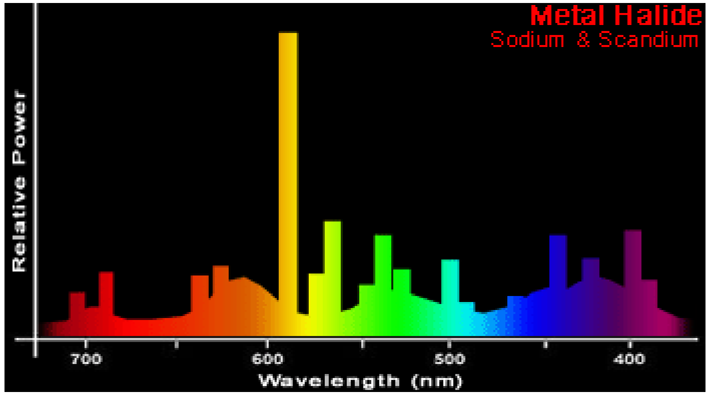
Low/High Pressure Sodium

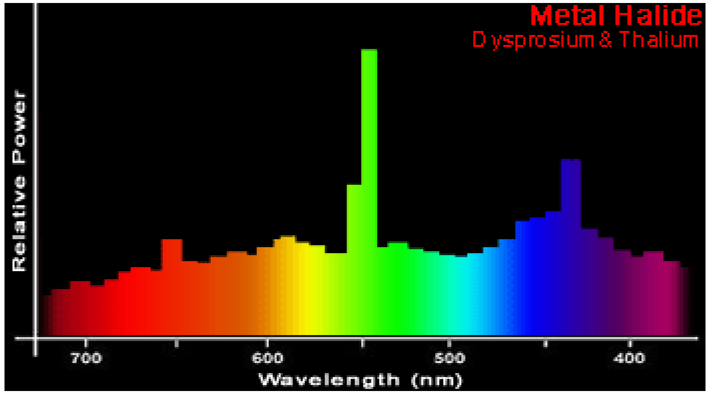
- Current through sodium vapour
- Inexpensive
- Poor colour rendering
- High output of light per watt





Metal Halide

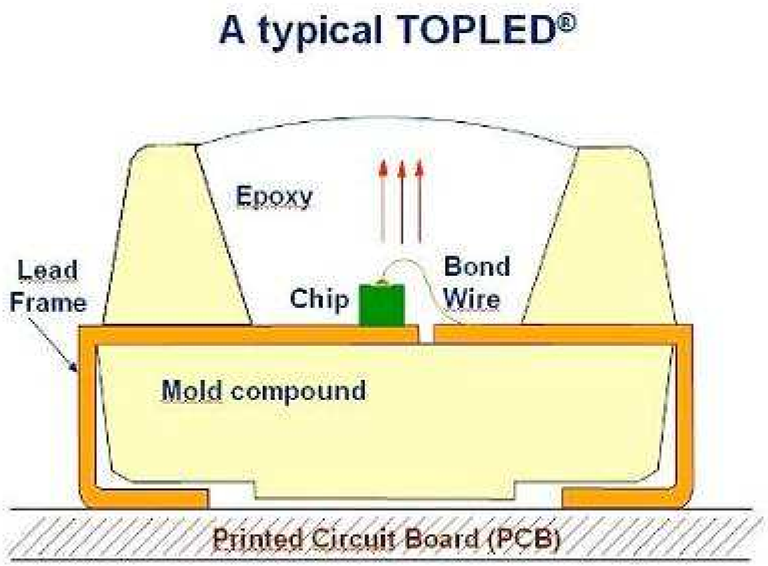




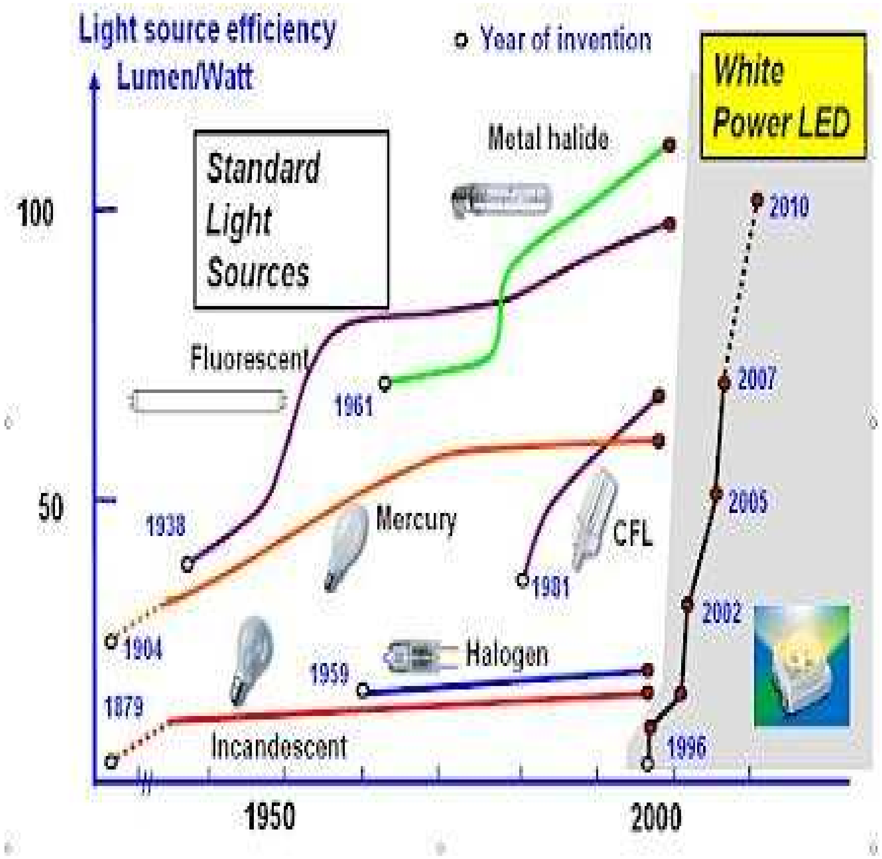
- Inexpensive
- Halide gas. Mercury vapour
- Slow re-strike
- Efficient light source
- Commercial light source - display

LED – Light Emitting Diode

- History
  - 1962 – Red luminescence diode
  - 1972 – Green, Orange, Yellow
  - 1993 – Blue and Green
  - 1995 – First white LED



LED – Light Emitting Diode



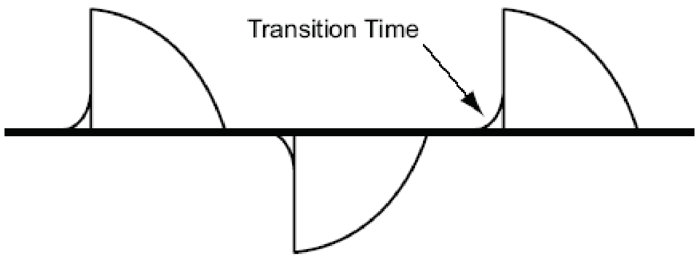
- 2006 – Coloured LED 100 LM/W
- White LED 40-100 LM/W
- LED emits light in certain colour
- White LED – light of blue LED passed through yellow phosphorous

Evolution of Lighting Control

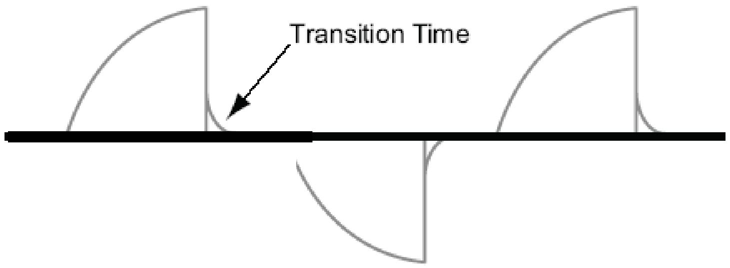
- 1961: energy-saving dimmer produced; first lighting control systems followed shortly thereafter
- 1980s: electronic dimming with SCRs, TRIACs introduced, along with DMX512 controls protocol
- 1990: Ethernet connectivity introduced
- 1991: programmed wall box systems
- Today – architectural LEDs, DALI, ZigBee and other technology advancements
- Tomorrow – smart, integrated, user-friendly, efficient control systems

Low Voltage Load Types

FORWARD PHASE CONTROL



REVERSE PHASE CONTROL



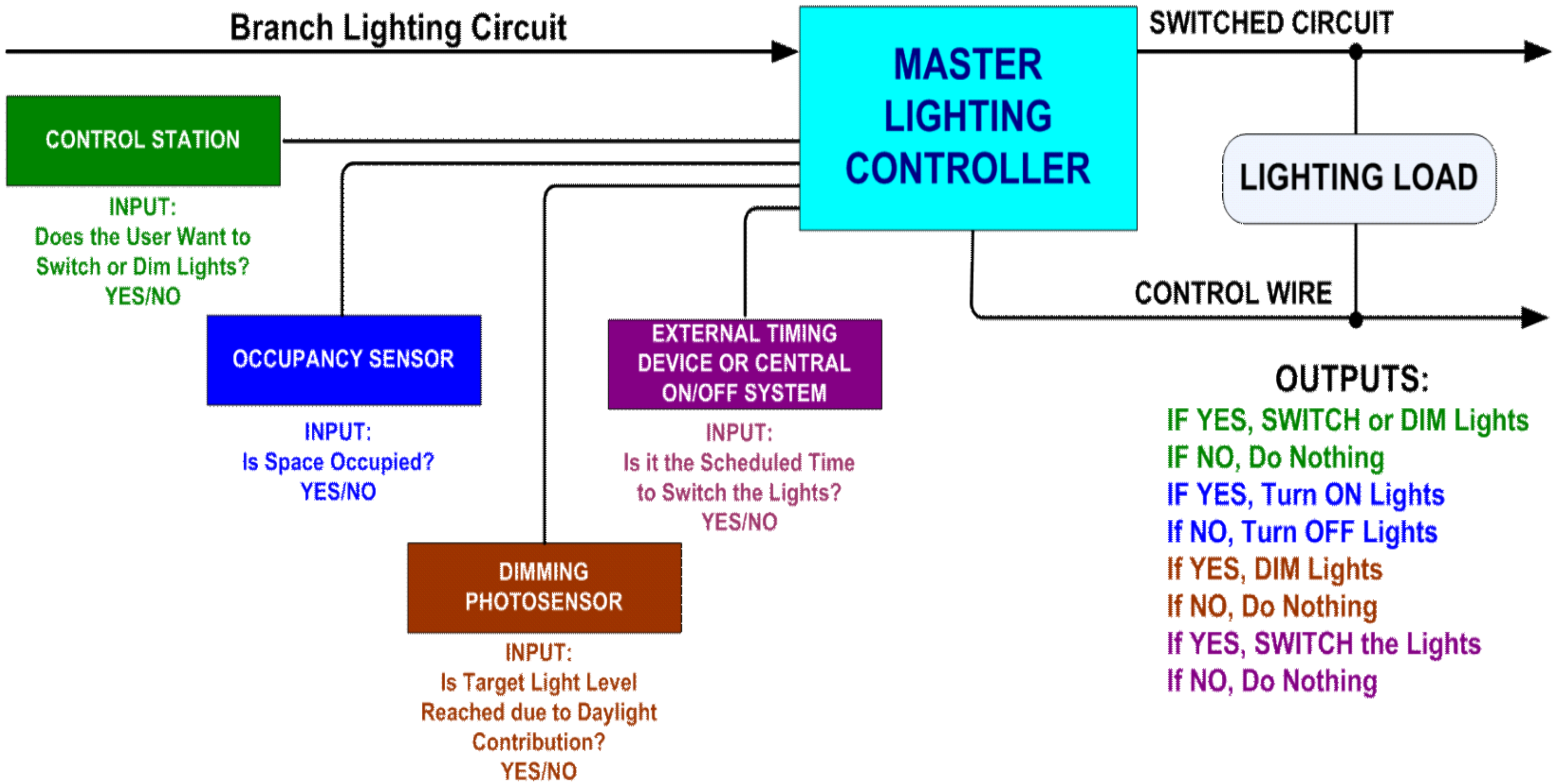
<u>Magnetic Low Voltage (MLV)</u>

MLV Fixtures are equipped with a magnetic transformer, can be controlled by standard forward phase dimming systems (the same dimmer used for an incandescent load) or reverse phase dimming systems

<u>Electronic Low Voltage (ELV)</u>

ELV fixtures are provided with an electronic transformer. Many electronic transformers require a reverse-phase dimmer. Reverse phase ELV fixtures will not operate correctly on a forward phase dimming system

Lighting Control Strategies



Energy Usage Dashboards

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Remote Control

Using standard IE Web browser

iPhone/iPod touch

What achieves colour effects?

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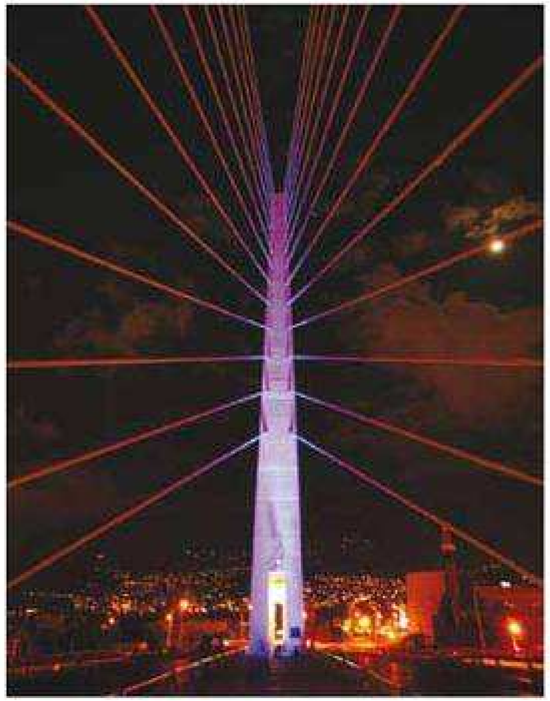
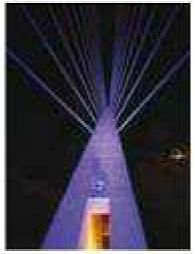
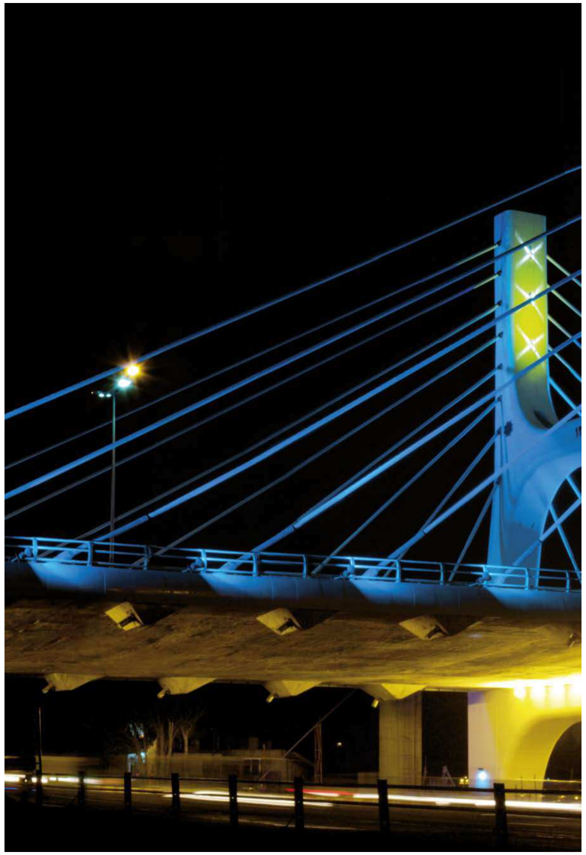
- LED
  - Instant response
  - Infinite colour range
  - Inexpensive to run
  - Reliable technology
  - DMX514 controlled
  - Always use quality product (installations can be difficult to get at for maintenance)



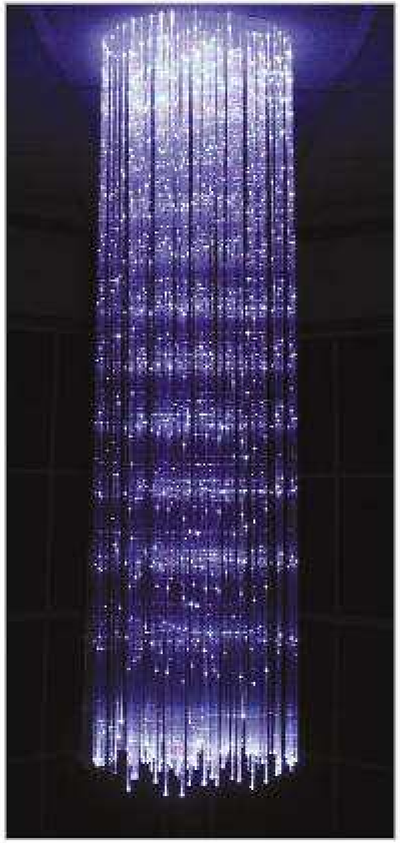


What achieves colour effects?

- Discharge Lamps
  - Rapid response to DMX protocol
  - Good range of colours
  - Requires frequent maintenance
  - Expensive to operate
  - Can produce large volume of intense light
  - Not suitable for inaccessible areas



Fibre Optics



The Use of Circuits

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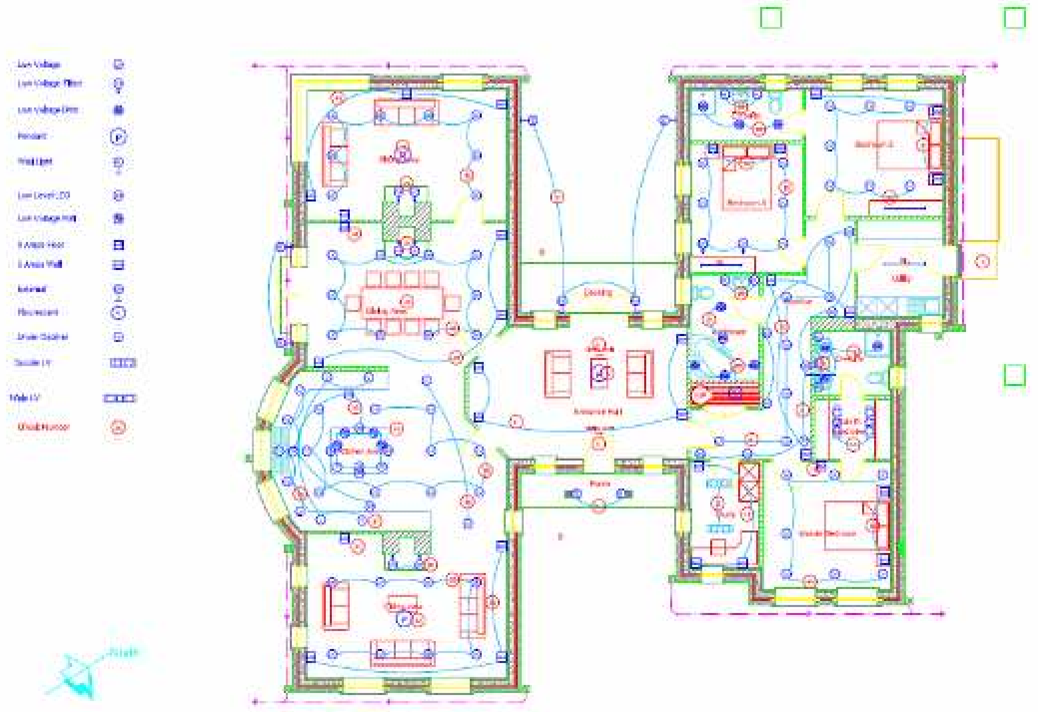
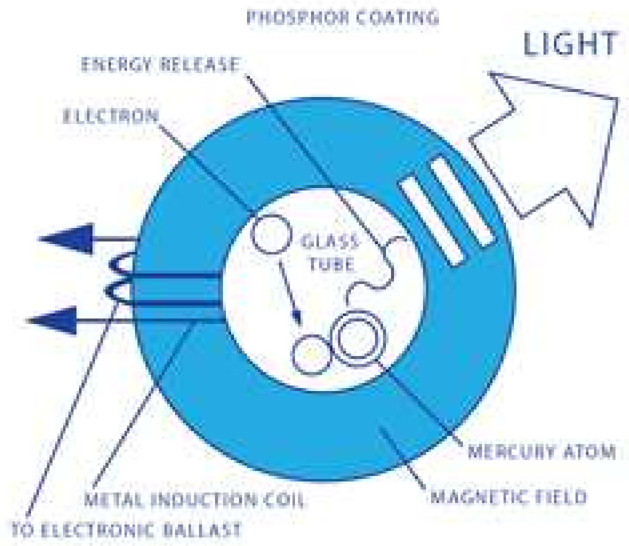


Ground Floor Plan 1:50

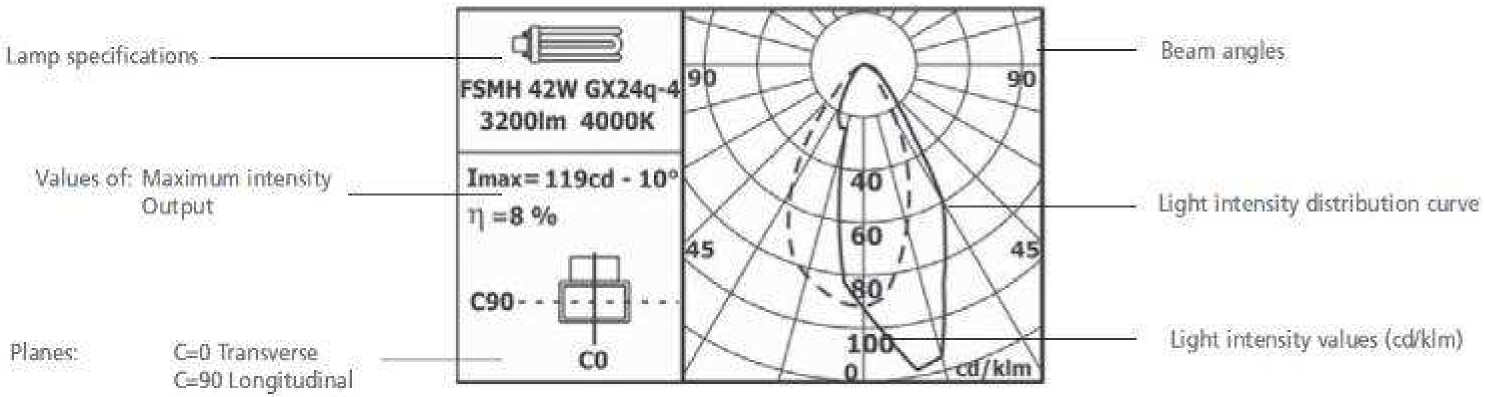
Back, Direct & Indirect Lighting

Induction Lighting

- Fluorescent Lamp without electrodes or filament
- Operates with electrons discharged by magnetic coil collide with mercury atoms
- Conversion to visual light through a phosphor coating

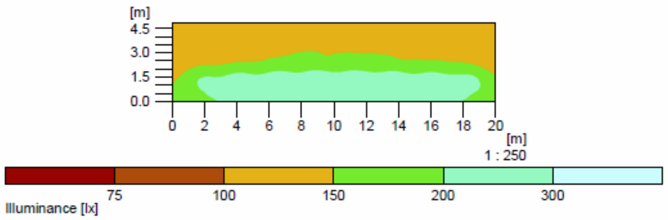


Photometric Data

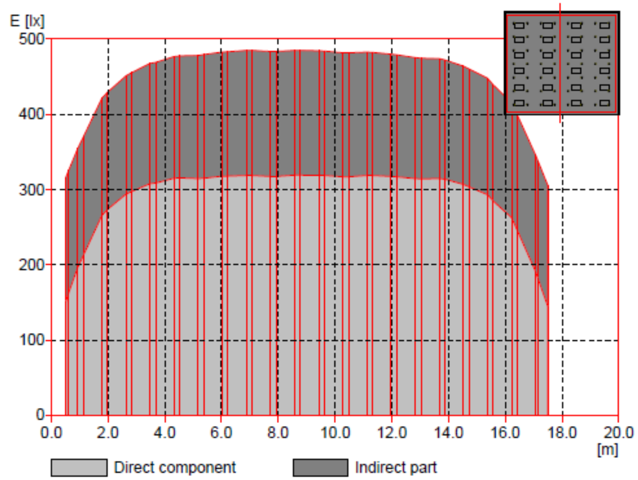


Light Calculations

2.2.2 Pseudo colours, Wall No. 1 (E)



2.2.9 Cross section, Reference plane 1 (E)



3D Visualisation

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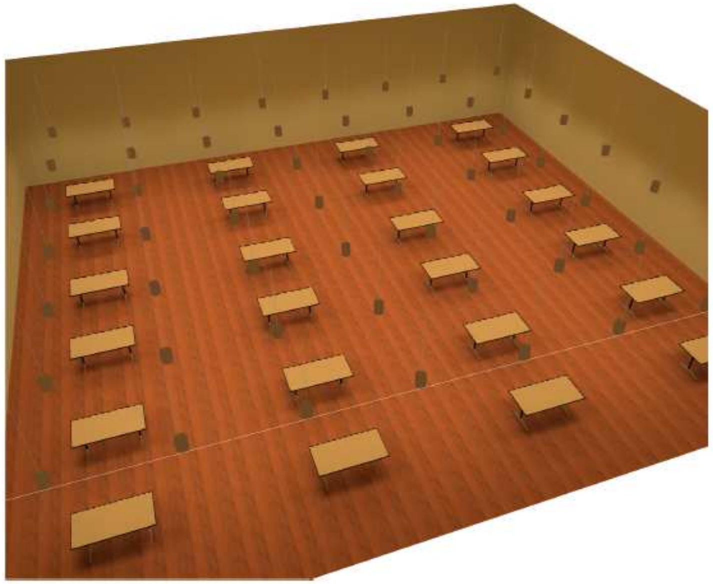
2.2.11 3D luminance, View 1



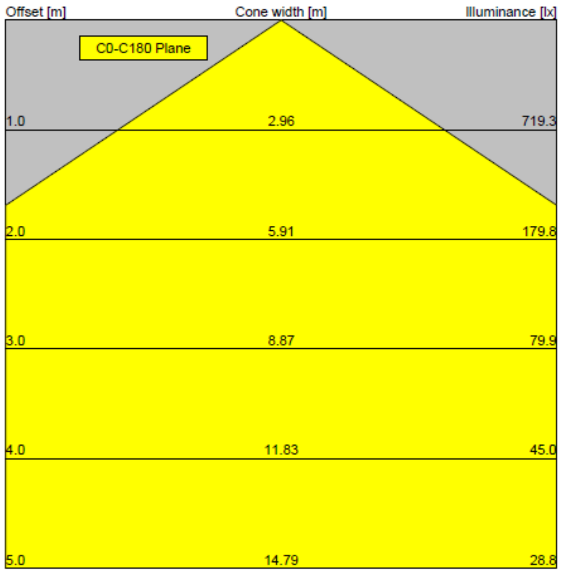
Luminance in the scene
Minimum: : 0 cd/m²
Maximum: : 124 cd/m²

2.2.12 3D luminance, View from the front

Luminance in the scene
Minimum: : 0 cd/m²
Maximum: : 124 cd/m²

Beam Angles

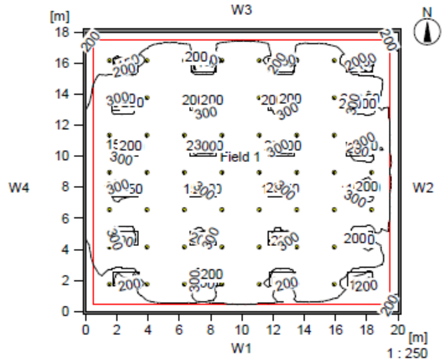
1.1.2 Cone diagram



Note: The illuminance is calculated with I(gamma=0)!

Manufacturer	: Aurora	Efficiency factor	: 80.06% (A40)
Order number	: !AU-P224	Light distribution	: rotationally symmetric
Luminaire name	: P	Beam Angle	: 111.9° C0-C180
Equipment	: 1 x CFL 50 W / 2700 lm		
Dimensions	: D 245 mm x H 300 mm		
File name	: AU-PC24.ldt		

2.3.14 Isolines representation, Floor (E)



Illuminance [lx]

Average illuminance	Eav	: 341 lx
Minimum illuminance	Emin	: 181 lx
Maximum illuminance	Emax	: 460 lx
Uniformity g1	Emin/Eav	: 1 : 1.89 (0.53)
Uniformity g2	Emin/Emax	: 1 : 2.55 (0.39)

Overall View

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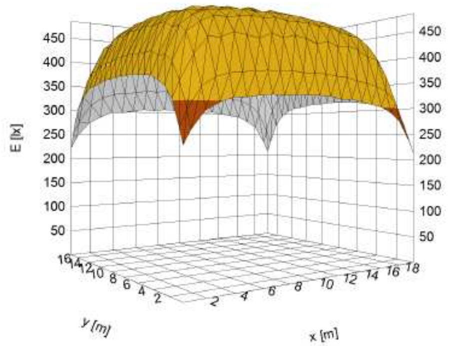
2.3.28 3D mountain plot, Reference plane 1 (E)

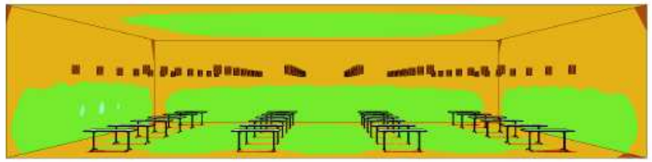


200	300	500	750	1000

Illuminance [lx]

Average illuminance	Eav	: 435 lx
Minimum illuminance	Emin	: 262 lx
Maximum illuminance	Emax	: 485 lx
Uniformity g1	Emin/Eav	: 1 : 1.66 (0.60)
Uniformity g2	Emin/Emax	: 1 : 1.85 (0.54)

2.3.30 3D pseudo colours, View from the front (L)



20	30	50	75	100

Luminance [cd/m²]