



# Lumi Smart™

Intelligent Lighting Controller



Technical Explanation and  
Perception Guide.

# Fluorescent Lighting:

Fluorescent lighting is a more efficient and eco-friendly solution for lighting systems than its incandescent counterpart. It is easy to see how much more efficient fluorescent lamps are, a typical 32 watt fluorescent tube emits the same amount of visible light as a typical 100 watt incandescent bulb. Around the world electrical energy reduction strategies are mandated in many regions and countries, improving energy efficiency in fluorescent lighting is one response to those energy reduction requirements.

Incandescent lighting is a black body emitter, when power is reduced to the lamp the temperature of the filament is also reduced causing the bulb to emit less total light. The colour of the light shifts towards the red spectrum simultaneously.

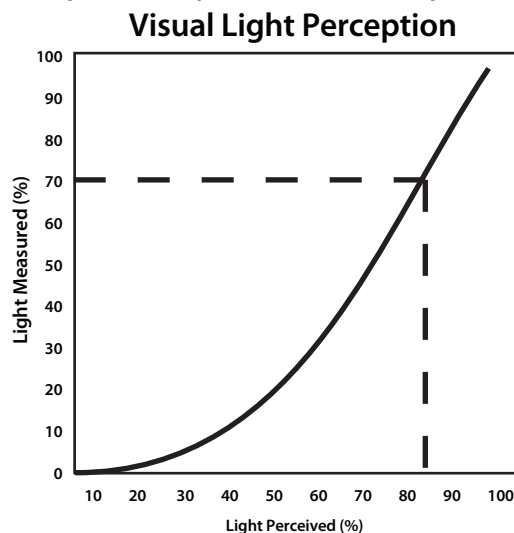
Fluorescent lamps convert more of the electricity input power to visible light than incandescent lamps. A typical 100 watt tungsten filament incandescent lamp may convert only 2% of its power input to visible white light, whereas typical fluorescent lamps convert about 22% of the power input to visible white light.

In the fluorescent lamp charged atoms, typically mercury atoms, produce short-wave ultraviolet light that then causes the lamp's phosphor coating to fluoresce, producing visible light. When power is reduced to a fluorescent tube, the lumen intensity is diminished, but the colour temperature is not shifted; the phosphor coating simply emits less light of the same colour..

The fluorescent tube generates 75% less heat and can reduce ongoing HVAC costs thus allowing for smaller HVAC systems to be installed. The reduced heat loss has the added benefit of reducing HVAC and maintenance costs. From a building maintenance perspective, fluorescent lamps last longer and require fewer lamp changes resulting in reduced maintenance costs. (Source: IESNA Lighting Handbook, 9th Edition, (New York: IESNA, 2000))

## The Controlled Lighting Effect:

Light meters measure the amount of light on a linear scale. The eye sensation (perception) measures light in a non-linear fashion. The human eye responds differently to changes in light than a light meter. For example as light (as measured by a light meter) is reduced the human eye automatically changes the size of the pupil to allow more light to enter, causing a brighter appearance. The effect of the eye causes measured light (%) to always be less than perceived light (%). A measured light level diminished by 30% is perceived as only a 16% reduction.



The human eye perceives light dimmed by 70% as being 84% as bright.

Source - "Square Law" IESNA Lighting Handbook, 9th Edition (New York: IESNA, 2000), 27-4.

If controlled reductions are applied quickly, the average person might notice a change. When the reduction is done slowly, the average person is less likely to notice any change has occurred. In an existing environment where the light has been reduced as described above, the eye notices little or no change at all. The eye sensation is the adjustment circle of the iris, this adaptation is commonly referenced as the "Square Law" response of the human eye.

(IESNA Lighting Handbook, 9th Edition, (New York: IESNA, 2000), 27-4.).

The human eye will be strained in a very bright environment or very dark environment. In typical environments that are neither very bright nor very dark the human eye can comfortably adapt to a wide range of lighting levels. This is commonly referred to as occupancy comfort. When lighting reduction is properly controlled, the lighting reduction is directly proportional to the reduction in electrical energy and costs. A fundamental understanding that allows light reduction is that most environments are commonly over lit. For example, a typical office measured 990 lux and the recommended lighting level is 750 lux; warehouse measured 452 lux, recommended 300 lux; conference room measured 442 lux, recommended 300 lux; stairway measured 332 lux, recommended 150 lux.

(Recommended values source: IESNA Lighting Handbook, 9th Edition, (New York: IESNA, 2000)).

Additionally the eye responds better to light sources that have a broad colour spectrum or high CRI (colour rendering index). Studies have shown that the eye perception is about 10%-15% brighter for light sources with the broader spectra.

(Source: IESNA Lighting Handbook, 9th Edition, (New York: IESNA, 2000)).

If a 5000k (CRI = 80) tube is replaced by a 4100k (CRI = 85) tube and the power is reduced by 30%, under controlled conditions, the eye might notice a 5%-7% change. In a typical building environment it would be difficult for anyone to perceive a difference with their eyes

## **The LumiSmart Intelligent Lighting Controller:**

The LumiSmart ILC uses patented wave-form modification techniques to adjust the power delivered to fluorescent lighting loads. LumiSmart ILC is rated at 20amps maximum load and is automatically adaptable to any circuit voltage from 120 volts to 347 volts at 50Hz or 60Hz. Lumismart ILC can be applied to any dedicated fluorescent lighting circuit.

The LumiSmart ILC is installed directly at or near the electrical circuit breaker that supplies the fluorescent lighting load. The Lumismart ILC controls the downstream lights without any modification being required to those lights or ballasts. This concept is referred to as the "router" control solution.

As Lumismart ILC is intended to control lighting loads only, any non-light loads should not be connected to the controlled lighting circuit (e.g. computers, printers, etc.). It should be noted that the ILC will comfortably control other light sources, such as incandescent and halogen lights.

The wave form modification of the LumiSmart ILC uses a pre-determined sequence that results in no flicker effects, does not require warm-up periods and is not impacted by down line switching (wall switches), lights can be switched on and off without a warm-up period and multiple zones (rooms) can be switched on and off without affecting each other. By reducing the lamp and ballast operating temperature an additional anticipated benefit is increased life of the fixture.

The LumiSmart ILC is an "install and forget" product which a qualified electrician can install in less than an hour. LumiSmart ILC automatically resets after a brownout or power outage and self-protects from unintended current overloads.



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