



Fluorescent dimming solutions

Presentation spaces

Higher performance, economical lighting controls for:

- conference rooms
- auditoriums
- lecture halls
- classrooms
- computer rooms



LEED™ is a registered trademark of the U.S. Green Building Council

LUTRON
Lutron controls your light.™

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The fluorescent light source

Fluorescent lighting is the primary light source in today's educational, institutional and commercial buildings. It is typically required in order to meet building codes and design criteria such as ASHRAE/IESNA 90.1 standards, and LEED™ guidelines.

- Fluorescent lighting provides uniform illumination and is nearly 4 times more energy-efficient than traditional incandescent lighting¹. This helps meet the power density (watts per square foot) requirements of today's building and energy codes.
- Fluorescent lamps last up to 20 times longer than incandescent lamps², reducing replacement and maintenance costs over the life of the building.
- Incandescent lamps are 4 times 'hotter' than fluorescent lamps during operation³. HVAC cooling requirements are reduced, resulting in both energy savings and reduced initial equipment costs.

The need for variable light levels

Presentation spaces, such as classrooms, meeting rooms, lecture halls and boardrooms, require a range of light levels between full on and off to accommodate the variety of activities that take place in these rooms. Variable lighting is usually required for optimum visual performance for the activities in these rooms⁴.

Typical approaches to lighting design in presentation spaces attempt to balance visual performance and energy efficiency requirements for reading, writing, audio-visual and live presentations, and other tasks.

Fluorescent dimming for optimum value and performance

Dimmable fluorescent lighting offers greater benefits and value than alternative approaches for lighting in any presentation space – from the most basic classroom spaces to more demanding spaces like a multimedia room.

Lighting for basic presentation spaces (pp. 3,4)

Meeting rooms and classrooms are often designed to provide appropriate light levels for discussions and visual presentation of information using chalkboards or whiteboards.

The design criteria for these rooms typically involve a simple means of providing one or two light levels between full on and off. Variable lighting creates a potential for energy savings and the ability to meet building codes or guidelines. Very low light levels are not critical in these applications.

Dimmed fluorescent solutions provide the energy performance required and combine lower costs with a simpler control solution.

Lighting for multimedia spaces (pp. 5,6)

Lecture halls, audio-visual classrooms, and boardrooms have demanding lighting requirements to accommodate a wide variety of activities including meetings, lectures, discussions and multimedia presentations⁴. Appropriate lighting is particularly important when cameras are used for videoconferences or distance learning activities.

To accommodate the variety of activities and achieve the optimum visual environment for each, full range dimming with light levels as low as 1% is often required. Fluorescent dimming solutions provide simpler control options, lower installed cost, and significant energy savings compared to the alternative lighting control design.

1. Based on light output in lumens. Average efficacy of fluorescent is 75 lm/W vs. 20 lm/W for incandescents.

2. Based on 1,000hr lifetime of incandescents and 20,000 hr lifetime of fluorescents.

3. Fluorescent lamps convert energy to light 4 times more efficiently than incandescents, as shown in footnote 1.

4. See IES RP-1, section 2.4. Reading and writing tasks require 40-50 footcandles (fcd). Viewing projection screens requires 3-5 fcd.

lighting control for basic spaces

Basic presentation spaces often use dual level switching as a method of independently switching lamps within each fixture to allow for a choice of light levels and potential for energy savings (see text below).

This example compares an economical solution using dimmed fluorescent fixtures with the existing practice of dual level switching.

switching option: dual level switching

typical wall control

2 ganged switches

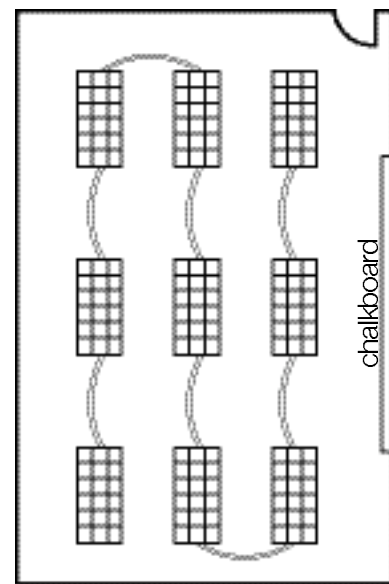


BUDGET ESTIMATE

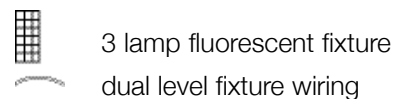
2' x 4' dual-switched fluorescent fixtures (9)	\$ 900
Fluorescent wiring materials & labor*	\$ 1,017
Fluorescent switches materials & labor (2)*	\$ 46

TOTAL \$1,963

* Based on labor rate of \$40.00 per hour



SYSTEM LAYOUT



This room has nine (9) 2'x4' fluorescent fixtures with 3 lamps per fixture. The fixtures are installed for dual level operation. In each fixture, there are two groups of lamps. The inside (inboard) lamps are controlled separately from the outer (outboard) lamps.

For maximum light, both switches are turned on; for 66% light, only the outboard lamps are turned on and for 33% light only the inboard lamps are turned on. The two switches operate the two groups of lamps. See page 7 for more details on dual level switching.

dimming solution: Eco-10™ fluorescent dimming

suggested wall control

1 fluorescent dimmer

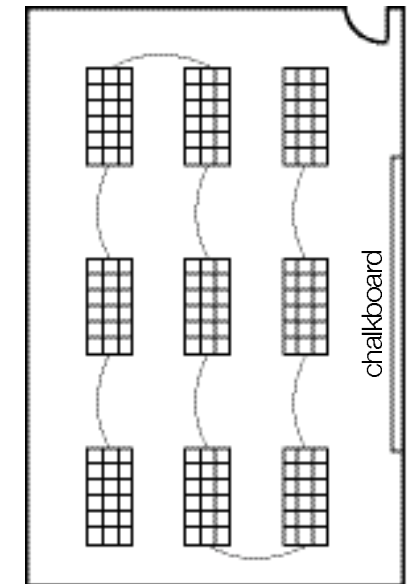


BUDGET ESTIMATE

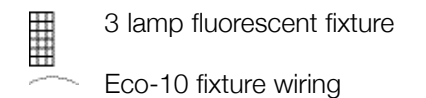
2' x 4' 10% dimmed fluorescent fixtures (9)	\$ 1,170
Fluorescent wiring materials & labor*	\$ 972
Fluorescent dimmers materials & labor (1)*	\$ 110

TOTAL \$ 2,252

* Based on labor rate of \$40.00 per hour



SYSTEM LAYOUT



The same room is now designed for dimming all nine (9) 2'x4' fluorescent fixtures. All lamps in each fixture belong to one (1) circuit and are dimmed together.

All fixtures are controlled by a single dimmer. Light output of the fixtures is controlled simultaneously from 100% to 10% of the maximum.

summary

Dual level switching provides only 3 discrete light levels of 100%, 66% or 33% of full light output, using different configurations of two switches. **Eco-10 dimming** from Lutron provides continuous fluorescent dimming from 100% down to 10% of full light output, using a single dimmer. Dual level requires adjusting of

multiple switches to achieve different light levels whereas dimming can be performed with the intuitive operation of the dimmer. Dimming offers a higher performance installation than dual level switching – at a comparable price.

full range dimming for multimedia spaces

Multimedia presentation spaces often use switched fluorescent lighting as the primary source of illumination, but add dimmable incandescent lighting as an economical means to achieve low light levels. The lighting near the projection screen is also controlled separately from the rest of the

room (see text below). This example compares the two methods of achieving full range 100% to 1% lighting. Full range fluorescent dimming is a lower cost alternative to switched fluorescents with dimmed incandescents.

switching option: switched fluorescents and dimmed incandescents

typical wall control

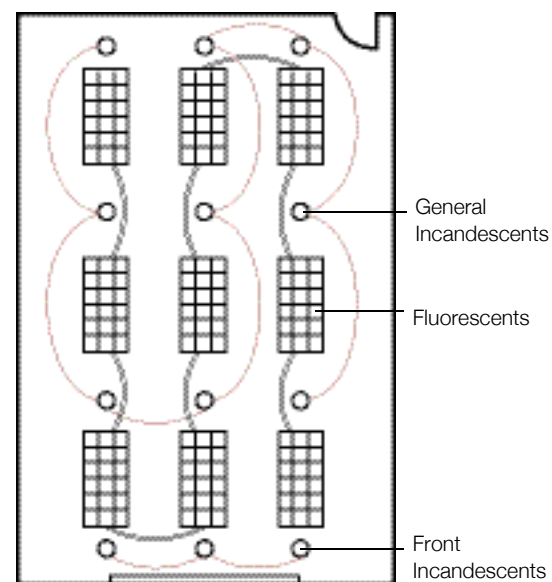
2 incandescent dimmers and 2 switches



BUDGET ESTIMATE

2' x 4' dual-switched fluorescent fixtures (9)	\$ 900
Fluorescent wiring materials & labor*	\$ 945
Fluorescent switches materials & labor (2)*	\$ 46
Recessed downlights (12)	\$ 480
Downlights wiring materials & labor*	\$ 1,368
Rotary dimmers materials & labor* (2)	\$ 70
TOTAL	\$ 3,809

* Based on labor rate of \$40.00 per hour



SYSTEM LAYOUT

- incandescent fixtures
- 3 lamp fluorescent fixture
- dual level fixture wiring
- dimming incandescent wiring

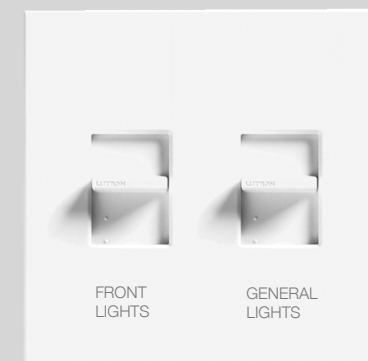
This room has nine (9) 2'x4' fluorescent fixtures with 3 lamps per fixture. The fixtures are installed for dual level operation by two switches. The room also has two zones of incandescent lighting. The front lights near the projection screen are controlled separately from the general incandescents. The two dimmers control the two incandescent zones of lighting.

For maximum light, both the incandescents and the fluorescents are switched on. For projector presentations, the general fluorescents are turned off. In addition, the front incandescents are dimmed to minimum to avoid screen washout and the remaining incandescents are dimmed to provide just enough light for note-taking.

dimming solution: Hi-lume® fluorescent dimming

suggested wall control

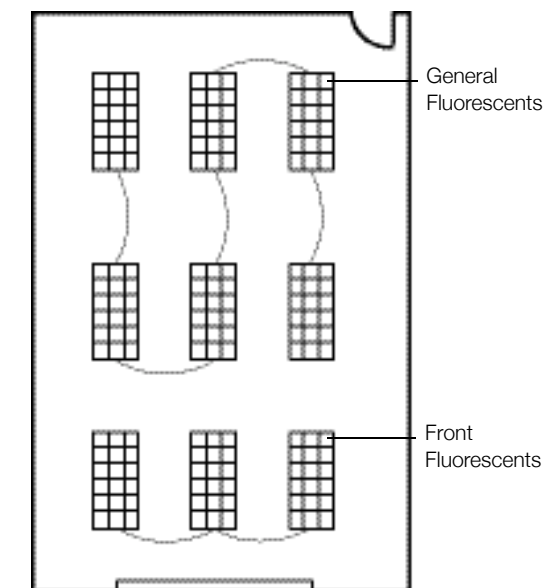
2 fluorescent dimmers



BUDGET ESTIMATE

2' x 4' 1% dimmed fluorescent fixtures (9)	\$ 1,620
Fluorescent wiring materials & labor*	\$ 972
Fluorescent dimmers materials & labor (2)*	\$ 220
TOTAL	\$ 2,812

* Based on labor rate of \$40.00 per hour



SYSTEM LAYOUT

- 3 lamp fluorescent fixture
- Hi-lume fixture wiring

The same room is now designed for dimming all nine (9) 2'x4' fluorescent fixtures. All lamps in each fixture belong to the same circuit and are dimmed together. Lights near the

projection screen are controlled by one dimmer, and the remaining lights are controlled by the other dimmer. Light output of all the fixtures can be controlled from 100% to 1% of the maximum.

summary

Switched fluorescents with dimmed incandescents allow for full range lighting that is not continuously variable. **Hi-lume fluorescent dimming** from Lutron allows continuous dimming from 100% down to 1% light level with simple dimmers and a lower installation cost. On the other page fluorescents are used for general illumination, and switched off

when low light levels are required. Then the incandescents are dimmed to provide minimum light. In the Hi-lume dimming example, the room lighting only has one lamp type – efficient, long life fluorescents. This represents substantial energy-savings and lower maintenance costs compared to an incandescent solution.

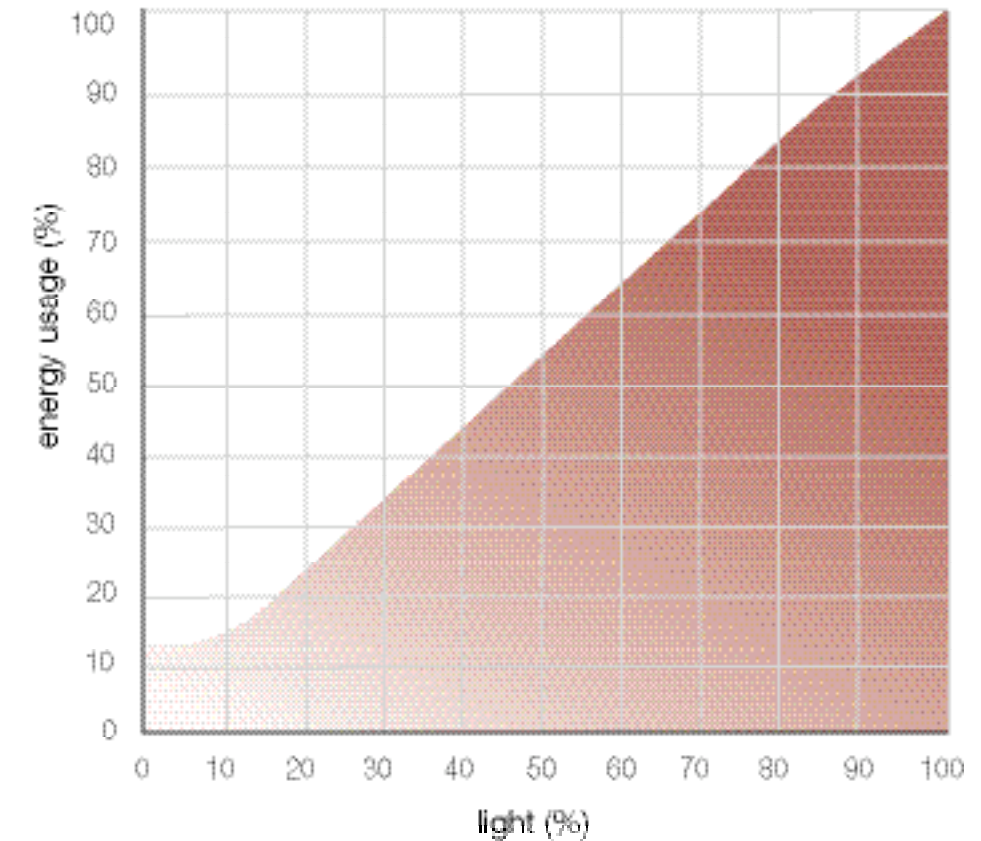
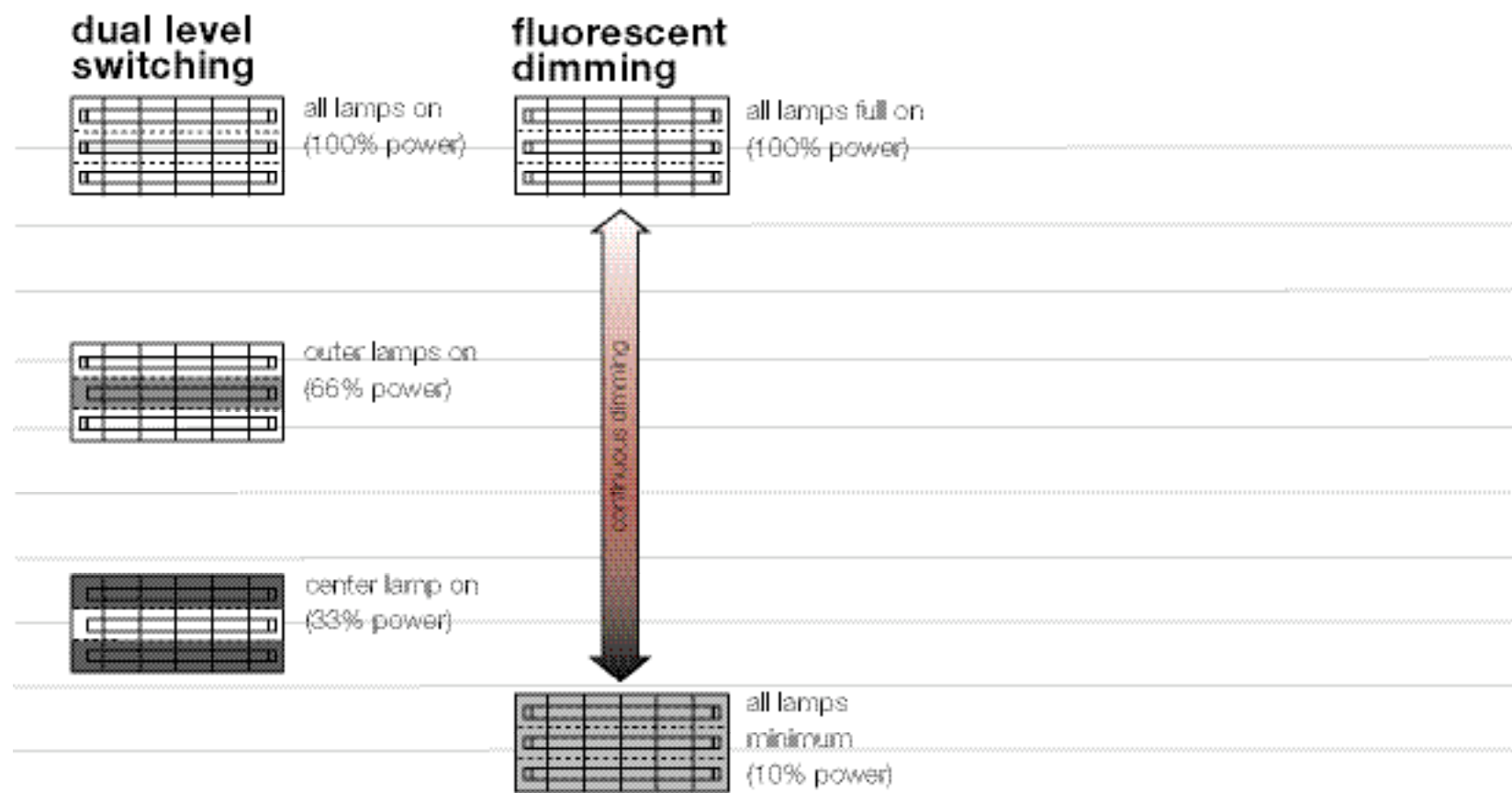
dual level switching and continuous dimming

The fixture diagrams below illustrate the potential lighting control and energy savings of a typical three-lamp fixture. A fixture installed with dual level switching (see example on page 3) is compared to a similar one with a three-lamp fluorescent dimming ballast.

The dual level switching option only provides 3 discrete light levels of 100%, 66%, 33% of full light output, using a bank of two switches. One switch operates the outer two lamps and the other operates the center lamp. The dimmable fixture provides a smooth and continuous range of light levels from full on to minimum illumination, and the opportunity for greater energy savings.

The graph below illustrates the energy-saving capability of dimmable fluorescent lighting using Lutron electronic fluorescent dimming ballasts. Energy consumed and light level change is a linear

and nearly directly proportional relationship as lights are dimmed. Energy consumption decreases continuously as the lights are dimmed with maximum energy savings at minimum illumination.



Notes:
Measurements taken with Hi-lume[®] FDB-4827-120-3 ballast controlling three (3) 32W 48" T8 linear lamps

Dual level switching techniques typically provide a maximum energy savings of 66% at 33% light level. Lutron fluorescent dimming ballasts allow energy savings of nearly 90% at 1% light level.

The examples detailed above compare installations using typical three-lamp 2'x4' parabolic lay-in light fixtures. The same reasoning applies for linear direct/indirect pendant light fixtures.



Fluorescent dimming is a reliable, cost-effective method for flexible, energy-efficient lighting in commercial, educational and institutional applications. Lutron fluorescent dimming systems are designed to seamlessly integrate to other common control strategies



Occupancy Sensors

Automatically dim low or turn lights off when room is unoccupied



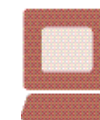
Daylight Sensors

Automatically adjust lights to save energy when daylight is present



A/V Control Systems

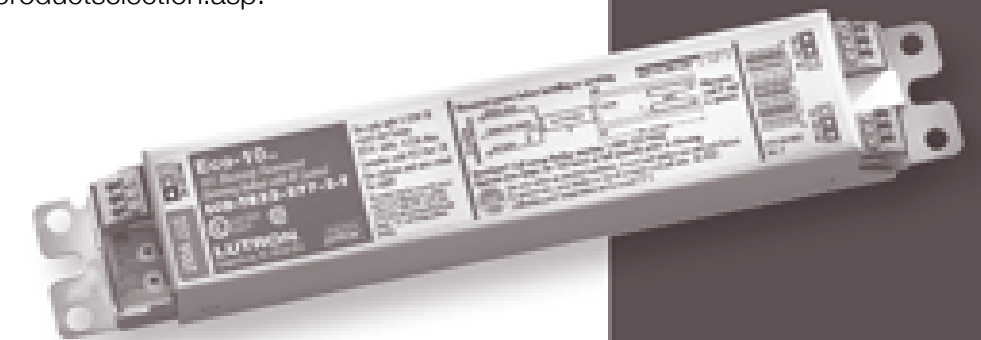
Simplify lighting control by integrating the flexibility of presentation control systems



Time Clocks or Building Management Systems

Manage the lighting load based on demand, time of day or peak energy rates

More information about dimming control options can be found in the Commercial Wallbox Catalog (P/N 367-572), the Commercial Systems Technical Guide (P/N 367-573) or at www.lutron.com/CLC/productselection.asp.



Lutron offers a range of dimming ballasts and controls for all types of fixtures and wiring schemes. Please refer to the Fluorescent Dimming Systems Selection Guide (P/N 366-002) or visit us at www.lutron.com/ballast for more information.

About Lutron

With over 40 years of experience in dimming, Lutron is the recognized world leader in residential and commercial lighting control systems. Lutron is the brand preferred by lighting designers and specifiers worldwide. Lutron invented the first electronic fluorescent dimming ballast over 30 years ago and has led the industry with successful fluorescent dimming applications with reliable performance and outstanding support.