

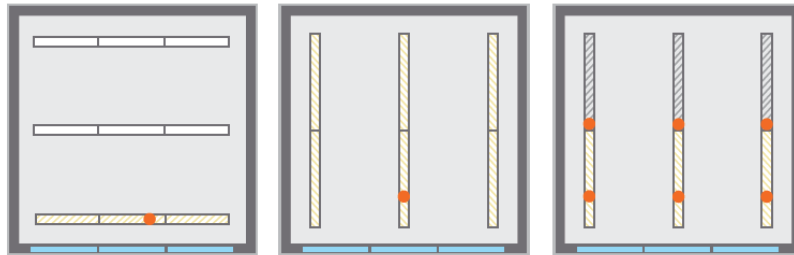
BRIEF DESCRIPTION

Automatic daylight control uses a light sensor to measure the light level in a space and then adjusts the dimming ballast to maintain the desired level of illumination.

Applications

Private office, Open office, Meeting room, Lobby, Hallway

- Open cubicles near windows and meeting rooms with windows or skylights are good candidates for daylight dimming control. Daylight switching can be used in the lobbies, hallways, and small offices with adequate daylight.
- Use of continuously dimming controls will maintain a smoother transition from one light level to another and reduce occupant distraction. Bi-level or multi-level switching, at less cost than dimming, is suitable for spaces with adequate daylight all day long and for non-critical visual tasks.



(Source: Peerless)

- A photosensor can be placed in the center of a row to control an entire row running parallel to a window or control luminaires in different rows running perpendicular to a window.
- Multiple sensors can be used to increase the number of control zones.
- Optimal placement for a 10-foot ceiling is 6-14 feet from the window.

Design Notes

Commissioning and Glazing

- Initial commissioning and calibration of light sensors and controls is critical for effective daylighting. Poorly calibrated daylight sensors can result in little or no savings and could create an unsuitable work environment.
- High performance windows are recommended to reduce heat gain where electric lighting represents a small portion of a building's cooling load.

Related Technologies

High-performance glazing

References/Useful Resources:

- [1] US DOE EERE, http://www1.eere.energy.gov/femp/procurement/eep_light_controls.html#automatic
- [2] WattStopper, <http://www.wattstopper.com/products/details.html?id=110&category=29&type=Commercial>
- [3] Peerless, <http://www.peerless-lighting.com/info/?pg=controls>
- [4] The Business Case for Federal Facilities Sustainable Design. U.S. DOE 2003.
- [5] Energy savings from daylighting: A controlled Experiment. Energy Center of Wisconsin Report No. 233-1.
- [6] Practical control strategies for harvest daylight savings. E-source ER-00-13.

Energy Savings

Lighting Energy

- Dimmable fixtures, compared with constant electronic ballast, could save 25 to 50 percent on electricity for lighting.
- The overall savings can be affected by occasional overcast conditions and shorter days during winter.

Cooling Energy

- Rooms equipped with daylight control systems require less cooling than standard rooms. The savings derive from the reduced need to remove heat from dimmed electric lighting and the reduced cooling necessary to condition ventilation air.

Ventilation Energy

- Rooms equipped with daylight control systems could require less fan energy during hot weather, due to a reduced need for VAV-system airflow to meet the cooling load.

Demand Charges

- Daylight control systems can yield a reduction in monthly demand charges by reducing the use of lighting energy during peak hours and cooling requirements in warmer months.

Guiding Principles¹

Optimize Energy Performance (Energy Efficiency)

- Reduce the energy use by 30 percent compared to the baseline building performance rating per ASHRAE Standard 90.1-2007.

Enhance Indoor Environmental Quality (Daylighting)

- Achieve a minimum daylight factor of 2 percent in 75 percent of all space occupied for critical visual tasks.
- Provide automatic dimming controls or accessible manual lighting controls, and appropriate glare control.

Associated LEED Credits (NC 2009)²

EAc1: Optimize Energy Performance (1-19 points)

- Demonstrate a percentage improvement in energy performance compared to a baseline performance per ASHRAE/IESNA Standard 90.1-2007.

IEQc8.1: Daylight and Views—Daylight (1 point)

- Achieve daylighting in 75percent of regularly occupied spaces.

¹ Guiding Principles for Federal Leadership in High Performance and Sustainable Buildings www.wbdg.org/pdfs/hpsb_guidance.pdf

² USGBC LEED Reference Guide for Green Building Design and Construction, 2009 Edition

Product Images



(Source: WattStopper)



(Source: Peerless)

Components

Photosensor, Handheld calibrator, Dimming ballast

Cost Range

Components	Cost	Unit
Photosensor and calibrator	\$150 - \$200	per sensor
Dimming ballast	\$50 - \$200	per ballast

- Dimming control is at least twice expensive as switching control with the cost of dimming ballasts still high. Dimming ballasts are less efficient than the most efficient non-dimming ballasts, using approximately 20 percent more energy than a constant output ballast to produce equivalent light level.

Product Types

Set-point Control

- The photosensor signal is kept constant during the operation of the system.

Proportional control

- The photosensor signal is allowed to vary during the operation (usually the course of the day).

Closed loop

- The sensor signal is a mixture of daylight and electric light.
- Closed-loop systems usually control only a few lamps in relatively small spaces; payback periods for these systems tend to be longer than for open-loop systems.

Open loop

- The sensor eliminates the contribution of electric lighting completely.
- Open-loop multilevel switching uses step ballasts that allow for two or three levels of light output. They are best suited for large spaces where occupants are in motion.
- Open-loop continuous dimming systems are likely to save energy when the space tends to be evenly illuminated by daylight. These systems are most suitable in climates where there are few days with variable cloudiness that require frequent switching of electric light levels.

Daylighting Photosensor

[PRODUCT AND ECONOMICS]

Vendors

WattStopper LightSaver® LS-301 Dimming Photosensor

http://www.wattstopper.com/products/productline_list.html?category=6&type=Commercial

Peerless Automatic Daylight Dimming Option

<http://www.peerless-lighting.com/info/?pg=controls>

Lutron EcoSystem daylight sensor

<http://www.lutronbrasil.com/cms400/page.aspx?mn=737&id=5421>

Warranty Info

Unknown

Code Restrictions

None

DRAFT

Daylighting Photosensor

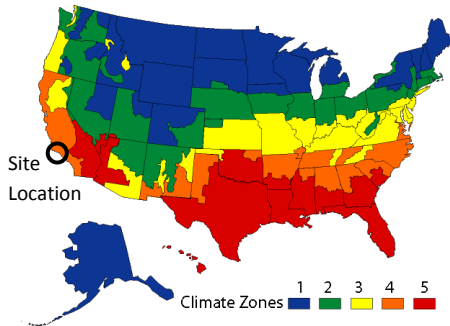
[SPECIFICATIONS]

- A. Dimming Ballast Controls: Sliding-handle type with on/off control; compatible with ballast and having light output and energy input over the full dimming range.
- B. Light Level Sensor: Detect changes in ambient lighting level and provide dimming range of 20 to 100 percent in response to change. Sensor shall be capable of controlling 40 electronic dimming ballast, minimum. Sensor shall have a bypass function to electrically override sensor control.

DRAFT

Naval Base Ventura County – Building 850³

Port Hueneme, California



Facility

- Building 850 fully demonstrated sustainable design and construction practices that can be applied to other Navy projects and facilities throughout the Federal government.
- The building serves as a learning center where technologies are highlighted and displayed, including an interactive touch screen computer kiosk that provides a real-time view of building energy demands and green features.

Approach

- The design makes use of 100 percent natural daylighting during normal working hours.
- A microprocessor lighting control system uses dimming ballasts and photo sensors to maintain desired lighting levels.

Results

- Daylighting incorporated with natural ventilation systems helped downsize HVAC equipment.
- The design team estimated that Building 850 would save 64 percent in lighting (including savings from high-efficiency lighting systems) and 43 percent in cooling expenses each year.



(Source: <http://www.p2pays.org/ref/41/40930.pdf>)

³ Case study courtesy of DOE High Performance Buildings Database.
<http://femp.buildinggreen.com/overview.cfm?projectid=51>