Daylighting Control

Design and Application Guide
Daylighting controls transform a day lit area into an energy-saving opportunity. The U.S. Environmental Protection Agency estimates that potential energy savings can exceed 40%. Furthermore, since peak electrical load patterns tend to parallel periods of the most plentiful daylight, daylighting control is a natural choice for load reduction.

An optimal daylighting control system saves energy while being virtually unnoticeable to the building occupants. Lights dim without distracting occupants, or switch off when daylight levels increase so that the light level change is not noticeable.

In this guide you’ll find:

- A decision matrix that helps identify the best daylighting controls for a specific project
- Detailed steps for designing and implementing a daylighting control project:
  1. Selecting a control method and product
     - ON/OFF switching
     - Dimming
     - Importance of closed vs. open loop technology
     - Control system vs. stand-alone controller
  2. Designing a daylighting control system
     - Creating control zones
     - Selecting a photocell location and controller location
     - Establishing target setpoints
  3. Integrating daylighting controls with other lighting controls
  4. Specifying a daylighting controls system
  5. Installation and commissioning
     - Startup, calibration and testing
     - Application examples for specific building spaces

Daylight is diffuse ambient light consisting of light reflected in the atmosphere and reflected from the ground. It is not direct sunlight. Many daylighting controls will not perform optimally when exposed to direct beam sunlight. Good daylighting design limits the entry of direct sunlight into a building with overhangs or shading devices on windows and diffusing skylights.
At the outset, when planning a daylighting control project, the initial decision involves choosing between ON/OFF switching and dimming. These considerations will help you make the right decision based on the unique factors of your application.

### Daylighting Control Decision Matrix

**ON/OFF Switching**

- **Controlled spaces receive a great deal of daylight** (2-3 times minimum electric light levels)
- **Not highly changeable during typical days. In climates with clear skies, lights can be switched off and remain off for a majority of daylight hours.**
- **Fixtures are mounted high, outside normal field of view**
- **Occupyants have limited view of lamps, primarily illuminated ceiling surface is visible** (i.e., pendant fixtures).
- **No concerns about distracting seated or concentrating occupants.**

**Dimming**

- **Daylight levels provide only a portion of required illumination.**
- **Changeable during typical days. Dimming controls can respond to fluctuating conditions without annoying occupants.**
- **Fixtures are mounted within occupant’s normal field of view.**
- **Lamps in a fixture are visible to an occupant.**
- **Concerns exist about distracting occupants.**

**Greater likelihood of success if:**

- **Daylight levels**  
- **Sky conditions**  
- **Location of controlled fixtures**  
- **Lamp visibility**  
- **Concerns about occupants**

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1. Selecting a Control method & product

ON/OFF switching turns lighting on or off respectively when the daylight contribution becomes sufficient or diminishes. Dimming systems continuously adjust the light output by signaling dimming ballasts.

<table>
<thead>
<tr>
<th>Consideration</th>
<th>ON/OFF Switching</th>
<th>Dimming</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ballast Costs</strong></td>
<td>Non-dimming ballasts are less expensive. However, some switching schemes require more ballasts than equivalent dimming strategy.</td>
<td>Dimming ballasts are more expensive. Certain dimming schemes (particularly those using T5 HO) may require fewer lamps and ballasts, reducing the premium often associated with dimming.</td>
</tr>
<tr>
<td><strong>Ballast Efficiency</strong></td>
<td>Opportunity to use the highest efficiency ballasts.</td>
<td>Dimming ballasts are less efficient than the most efficient non-dimming ballasts, using approximately 20% more energy than constant output ballast to produce equivalent light level.</td>
</tr>
<tr>
<td><strong>Energy Codes</strong></td>
<td>Codes may require multiple levels of control. For instance, California Title 24-2005 requires at least 2 levels of reduction in daylit areas under skylights.</td>
<td>If applicable code requires automatic daylighting controls, it may be simpler to install daylight dimming controls rather than multiple stages of ON/OFF switching controls.</td>
</tr>
<tr>
<td><strong>Occupant Control</strong></td>
<td>Switching provides limited options for occupant control.</td>
<td>Automatic dimming can be combined with the ability for occupants to adjust light levels to suit individual preferences, increasing the likelihood of greater energy savings.</td>
</tr>
</tbody>
</table>
1. Selecting a Control method & product:

**ON/OFF switching**

ON/OFF switching control can be as simple as a single step of control or it can combine multiple steps of control:

- **Stepped dimming**
  Reduces light output of a luminaire in steps. For instance, a 3-lamp linear fixture, if ballasted correctly, could be controlled to provide 100%, 66%, 33% and 0% by switching off individual lamps. This would result in a gradual reduction of the total light output.

- **Stepped switching**
  Switches off luminaires in groups or by alternate fixtures. Stepped switching can be accomplished by switching entire circuits, branches of circuits, or individual fixtures using power packs. For instance, in a warehouse, alternating individual fixtures may be switched off to achieve multi-zone control.

Stepped dimming may be used successfully in office applications with specially designed lighting, such as direct/indirect pendant fixtures. Stepped dimming can involve switching off one or two lamps while at least one lamp remains on after the ceiling is brightly illuminated with daylight. This approach lessens the possibility of occupant distraction.

ON/OFF switching devices should have two setpoints and two time delays. The setpoints are separated by a deadband, which is simply a separation where no switching occurs. Both the deadband and the time delays work to prevent unwanted cycling due to minor fluctuations in daylight levels.

When daylight increases, the task light level increases, first rising above the ON setpoint. Because the light level is now within the deadband, lights remain on. Continuing to increase, the light level rises above the OFF setpoint. The lights remain on until the time delay elapses, at which point, the switching control turns them off. They remain off until the task light level drops below the ON setpoint and the associated time delay elapses. Usually this time delay is much shorter to ensure occupants have adequate illumination.
1. Selecting a Control method & product: Dimming

Dimming systems continuously adjust the light output by signaling dimming ballasts. The controller varies the control signal to maintain the desired level. With standard 0 – 10V dimming ballasts, 10 volts signal the ballast to provide full light output. 0 volts signal the ballast to provide minimum light output. The range of dimming is specific to the type of dimming ballast. The minimum output can range from 10% to 1% depending on the type of ballast selected.

The LightSaver dimming controllers (LS-301 and LCD series) are compatible with any standard 0-10 VDC dimming electronic ballast (the industry standard is for the ballast to source a maximum of 0.5 ma).

Table 1. Dimming Ballast Specifications

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Product Name</th>
<th>Lamp Type</th>
<th>Dimming Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advance Transformer</td>
<td>Mark VII</td>
<td>T4, T5, T8</td>
<td>3%-100%</td>
</tr>
<tr>
<td>Lutron</td>
<td>TVE Series</td>
<td>T4, T5, T8</td>
<td>10% - 100%</td>
</tr>
<tr>
<td>Osram Sylvania</td>
<td>Quicktronic Helios</td>
<td>T8</td>
<td>5%-100%</td>
</tr>
<tr>
<td></td>
<td>PHO-Dim</td>
<td>T5</td>
<td>1%-100%</td>
</tr>
<tr>
<td>Universal Lighting Technologies</td>
<td>Ballastar, Super Dim 10</td>
<td>T4, T5, T8</td>
<td>5%-100%</td>
</tr>
</tbody>
</table>

Refer to the ballast dimming curve supplied by manufacturers to compare the response of different models. Each ballast model is likely to respond differently because of the difference in dimming curves.

Watt Stopper’s daylighting control products conform to the industry standard with the positive wire colored violet and the negative wire colored gray.
1. Selecting a Control method & product: Closed vs. open loop technology

Daylighting controls may be “closed loop” or “open loop” systems. These terms refer to the methods used to measure the daylight contribution.

Closed loop systems, such as the LS-301, measure the combined lighting from all lighting sources, including daylight and the controlled electric light. They “see” the results of their control. Based on this feedback, the control device raises or lowers the electric lights to obtain the desired illuminance level.

To work effectively, closed loop devices must use a sliding setpoint control, which allows the target level for the photocell signal to increase as the daylight increases. The result is that the task illuminance is maintained or even increased as the daylight increases. (Typically, a closed loop device using a sliding setpoint has both an electric light level setpoint and a daylight level setpoint.)

Before selecting any closed loop control, verify that it features a sliding setpoint. A closed loop device that features only one setpoint adjustment is likely to be a constant setpoint device. (Research indicates these devices do not provide acceptable daylight responsive dimming.)

Open loop systems have photocells that are designed to measure only incoming daylight, not the controlled lighting’s contribution to the space. In an open loop system, the controller proportionately dims the electric lights based on an estimated daylight contribution. This contribution is measured at startup. The photocell typically should not see any electric light.

An open loop device typically consists of a photocell, such as Watt Stopper’s LS-290c, which is ceiling mounted, and a controller, such as the LCD-203. The controller is remotely mounted in an accessible location.

Both closed loop and open loop dimming devices can be used to perform tuning. Tuning enables lighting output to be reduced from maximum output to design levels, and provides immediate energy savings. A closed loop device provides automatic lumen maintenance; as the lamp output decreases with age, the controller will measure a lower light output and increase its signal to the ballasts. Open loop controls, in contrast, require an annual adjustment in order to perform lumen maintenance.

Open loop systems tend to be easier to adjust, requiring setup only during the daytime. In addition, an open loop system offers the advantage of being able to control multiple zones from a single photocell.
1. Selecting a Control method & product (cont’d.)

**ON/OFF Switching**

For ON/OFF switching applications, open loop control is generally easier to adjust because the control device is only “seeing” the daylight and not the lights that it is controlling. If a closed loop control device is used in an ON/OFF switching application, its deadband must be adjusted to account for the electric light the device is viewing. This is because when the daylight contribution rises above the OFF setpoint, the electric lights will switch off and the light level viewed by the controller is likely to drop significantly. Unless the deadband is large enough, the controller will switch the lights back on in response, causing unwanted cycling. To avoid this result, the device’s deadband must be adjusted so that the differential (i.e., deadband) between the ON and OFF setpoints is greater than the light level drop when the lights turn off.

**Dimming**

The table below presents recommendations for selecting open or closed loop devices for several common dimming applications.

<table>
<thead>
<tr>
<th>Application</th>
<th>Open Loop</th>
<th>Closed loop</th>
</tr>
</thead>
<tbody>
<tr>
<td>High bay with skylights</td>
<td>Recommended (photocell mounted in lightwell of skylight, controller mounted in accessible location)</td>
<td>Generally not recommended because of difficulty in identifying good photocell viewing location.</td>
</tr>
<tr>
<td>Private office with windows</td>
<td>Generally not recommended because of cost</td>
<td>Recommended (lower cost solution)</td>
</tr>
<tr>
<td>Open offices</td>
<td>Recommended for larger areas (particularly if intent is dimming fixtures in adjacent areas to different levels)</td>
<td>Recommended for smaller areas with a single control zone</td>
</tr>
<tr>
<td>Classroom</td>
<td>Recommended if multiple control zones are desired</td>
<td>Recommended only if a single control zone is desired or lower cost solution is needed</td>
</tr>
<tr>
<td>Adjoining dimming zones</td>
<td>Recommended</td>
<td>NOT RECOMMENDED. Likely not to work.</td>
</tr>
</tbody>
</table>

Don’t forget that setting up a closed loop control device requires two light level readings, once during the day and once at night.
Daylighting controls are generally available in one of two configurations; as systems or as stand-alone controls. Control systems include controller modules and an external photocell as well as additional adjustment and configuration options (like the LCO and LCD systems). Stand-alone controls are self-contained units that operate independently (i.e., LS-301, LS-101).

### Control Systems vs. Stand-alone Controller

#### Pros

**Control Systems**
- Control of multiple lighting zones
- Multiple adjustable settings
- Panel-mounted for easier initial calibration and future adjustment
- Ideal in large rooms or facilities with lighting arranged into multiple zones (i.e., classrooms, open office areas, warehouses, cafeterias)

**Stand-alone Controls**
- Simpler installation with one low voltage device plus a power pack
- Generally lower cost, more suitable for installation in smaller spaces
- Ideal in small rooms or spaces where daylight contributions are relatively even or balanced (i.e., enclosed offices, hallways)

#### Cons

**Control Systems**
- Generally more expensive
- More extensive installation

**Stand-alone Controls**
- Fewer adjustment options
- Capable of controlling only a single lighting zone

Install a controller for a system with a remote photocell as close to the controlled zone as can be arranged. If the controller is mounted too remotely from the zone, both the setup and adjustment and future maintenance will be more difficult. Whenever possible, mount the controller so that the controlled lamps can be observed by the technician when adjusting the controller.

**Tip!**

Daylighting Control

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2. Designing a Daylighting Control Project

A control zone is a group of luminaires or individual lamps within luminaires that are controlled by one signal. The goal in creating a control zone is to define an area that receives a consistent amount of daylight at any given time AND has consistent light level requirements.

Important factors in defining control zones:
a. Identify areas that receive consistent daylight contribution
b. Define areas with consistent light level requirements
c. Identify different architectural finishes
d. Create zones that are visually and logically connected

a. Consistent daylight contribution

As a starting point for creating zones, attempt to control top lit areas separately from side lit areas [this separation of control zones is required by California’s Title 24]. In some applications, the natural zoning of the building into smaller functional areas may take precedence; for instance, a school classroom may have both skylights and windows.

With side lighting, think small zones. With top lighting, zones may be bigger given areas with common skylight configurations, roof height and area function.

b. Consistent light level requirements

Identify areas that are used for similar types of activities with similar lighting requirements. For example in a large industrial space, create separate zones for production areas and storage areas, since the light level requirements will differ.

c. Different architectural finishes

Areas with different ceiling heights, flooring and wall colors are likely to reflect and distribute the daylight within the space differently. It is often a good idea to have control zones change when architectural finishes change.

d. Visually and logically connected zones

In side lighting applications, this is particularly important where the occupants can control the position and angle of window blinds. If the occupants cannot see that the blinds in one section of a zone are set differently than the blinds in another section than they may have no logical explanation for too much or too little illumination from the controlled lighting. If control zones in open areas are too small, lights controlled to different levels may draw attention.
2. Designing a Daylighting Control Project (cont’d.)

Creating control zones

It is also important to keep in mind the effect of having zones that are too small in open areas. In some cases, it may be important for the lighting to be controlled from one device so that the ceiling does not appear to have a checkerboard effect.

One way to facilitate logical control zones in new construction is to plan circuit wiring for the electric light fixtures around daylight sources such as windows and skylights. For instance, fixtures nearest a skylight may be circuited together, while fixtures farther from the skylight but still within the day lit zone would be on a different circuit. This will create lighting zones that facilitate daylighting control as well as integrating with relay panel control. When possible, match control zones with relays used for ON/OFF scheduling to make afterhours override switching more logical.

Special concerns for sidelit areas

A few particular guidelines on creating control zones in sidelit spaces are helpful to keep in mind:

• Be cautious in determining the daylit area. In sidelit spaces, this is generally defined as approximately 1.5 times the head height of the window in from the window. Be particularly conservative about zone depth when using ON/OFF switching. If any portion of the controlled area does not receive adequate daylight, then the controls are likely to frustrate or annoy occupants.

• Be very aware of shadows that may bisect a control zone and minimize their effect by reducing zone size. Shadows caused by nearby buildings, wings of the same building, trees and hills may cause unsatisfactory lighting levels in the shaded or unshaded portions of a control zone.

• Confine control zones to a single building exposure, because the quality of the daylight may be different along a different building exposure. [In some smaller spaces that have been designed with bilateral lighting, such as classrooms, a space with multiple exposures may have been designed for control of a single daylit zone.]

• Confine control zones to include consistent window types. When window types change, create a new zone.

• Understand and accommodate furniture and partition layouts. Be very cautious about controlling lights that are isolated from the windows by a partition five feet or higher (any partition parallel to a window will reduce daylight penetration).
2. Designing a Daylighting Control Project (cont’d.)

Selecting a photocell location

Photocell placement
Photocell positioning is critical. If the photocell does not correctly view daylight contribution, the daylighting controls will not work properly. Select a location where the photocell receives a representative sampling of entering daylight. Use a light meter to measure light levels at the potential locations before choosing a final location and orientation, since photocell performance might be improved by a slight change in orientation or location.

Never position a photocell on a roof for indoor lighting control, since it will not be able to read directly the daylight contribution to the controlled area. In addition, it will be exposed to precipitation and degradation from the sun’s ultraviolet rays.

Photocell placement is specific to the type of controller selected. Closed loop devices generally use a ceiling mounted photocell that views a representative area, such as a desk or floor. A closed loop controller should view the actual light level that it is controlling. They are mounted so that they do not directly view the window or directly view a pendant fixture.

An open loop photocell is also mounted on the ceiling, but looks toward the window or up into a skylight well to view only incoming daylight and not the contribution of the electric light.

Never install a photocell in a wall switch location. This is not an ideal location to view the daylight contribution, and could be tampered with easily.

Tip!
Tip!
Daylighting controls either dim or switch to maintain a target setpoint. Correctly determining the target setpoint is a key component of a successful daylighting control project. Use a target setpoint for reducing light levels that are higher than the design levels for electric light. For dimming, recommended practice is that minimum output dimming not occur until the daylight contribution is 150% of electric light design levels. For switching, the recommended target level is daylight contribution equal to 150-200% of the level to be reduced. If the nighttime electric light levels equal 40 footcandles, it is recommended that the daylight contribution reach 60-80 footcandles as a target level for reduction.

Target setpoints are crucial because:

1. Studies show that occupants like increased light levels when daylight levels increase.

2. Occupant awareness of switching or dimming decreases as the overall light level increases. In particular, when ON/OFF switching control is being used, light levels should rise between two and three times the electric light levels before lighting is switched off.

3. Daylight is dynamic, not a constant light source like electric lighting. Studies show that occupants tolerate light level changes due to daylight as long as task illuminance levels are met.

An approach using higher target setpoints also fits well with typical daylighting design practice, which may allow daylight levels to be two to three times higher than the target electric light levels. While these elevated targets may reduce the energy savings, they significantly increase the likelihood of long term success of a daylighting control project.
3. Integrating daylighting & other controls

Daylighting controls integrate particularly well with two other types of lighting controls: time-scheduled control and occupancy-based control.

With time-scheduled devices (i.e., relay panels), daylighting controls can be fully integrated, or the two could be separate systems with interconnecting wiring.

Integrating daylighting controls with relay panels provides ON/OFF switching capabilities for entire circuits, and combines scheduling and daylighting control. This strategy is appropriate in top lit spaces such as warehouses, in which a facility manager can switch large numbers of fixtures on or off from a single location using just one daylighting control. For instance, in a warehouse the relay panel might turn lighting on in the morning according to an occupancy schedule. Daylighting controls would determine when electric lighting was no longer required because the daylight contribution had increased and signal the panel to turn lighting off. In winter months, lighting might remain on longer than during summer months, and only switch off at midday when an adequate daylight contribution was achieved. Toward the later afternoon, lighting would turn back on for the remainder of the working hours. Then, lighting would be turned off according to the panel’s programmed control schedule.

Integrating daylighting controls with occupancy sensors enables lighting to be switched off or dimmed during periods when a space is unoccupied. This combination is particularly applicable to classrooms and private offices.

Daylighting controls such as the LCD-203 and LCO-203 can be combined with other control devices to reduce peak load. When signaled to load shed, the controllers turn controlled lighting to a reduced level. The load shed signal may be generated by a relay panel or from a signaling device operated by the utility.

In addition to combining daylighting with other types of controls, designers may add devices such as switches or handheld remotes for manual overrides and occupant adjustments. Studies have shown access to personal control improves occupant satisfaction, particularly with dimming systems.
4. Specifying a daylighting controls system

To ensure that all of the lighting and control components are compatible, specify the complete lighting system, identifying each of the necessary components by product name and model number. Project design documents should include:

- Descriptions of specific daylighting control devices to be used. For projects using dimming controls, dimming ballasts compatible with the controls should be specified.
- Location of control devices and controlled fixtures on an electrical plan that indicates which fixtures are assigned to specific control zones.
- Locations of all photocells should be indicated on the plans.
- A wiring diagram for the daylighting controls that shows all control devices and interconnecting wiring. Line and low voltage wiring should be identified.
- Sequence of operation for lighting controls describing the design intent for the system. It should identify the target illumination setpoints for electric lights and daylight control setpoints. This serves as a key reference for startup and commissioning of the system.
- Identification of lighting controls, compatible ballasts, and ballast configuration within fixtures.
- Startup, calibration and testing procedure for the installing contractor. A startup report form that must be completed by the installer for each daylighting control should also be included.
5. Installation and Commissioning

This phase is critical to the performance of any daylighting controls. To achieve the desired design results, the daylighting controls must be calibrated and tested carefully. Without proper setup, daylighting controls may not perform as expected. Improper setup may result in lights cycling inappropriately or otherwise not maintaining the desired illuminance levels.

Including startup, calibration and testing requirements and written reporting requirements in the project specifications will help ensure its successful completion. It is important to follow the specific product installation instructions for setup, calibration and testing. We strongly recommend that a setup, calibration and testing report form be completed for each control device. This form should be stored with the building commissioning records.

A checklist of specific items essential to a successful installation include:

• **Lamp Burn in**

New lamps must be burned in (i.e., operating lamps at full output for a prescribed period, generally 100 hours) per manufacturer recommendation prior to use with any dimming controls. Premature lamp failures have been reported when lamps are not properly burned in. It is critical to have the installer certify that the lamps have been burned in according to the lamp manufacturer’s requirements.

• **Calibrate controls when application is in move in condition**

For any dimming system, all room finishes and furniture must be installed (i.e., paint, carpets, ceiling tiles, shades or blinds, large artwork). Calibration should not be finalized unless this is the case. For instance, if a desk or table is within the controlled area, it should be unpacked and its surface cleaned prior to final calibration.

Window treatments should be installed and operable. Blinds should be lowered to cover the window with the blades set horizontally (parallel to the floor). In the event that direct beam sunlight enters the area with blinds positioned in this manner, they should be angled to block the sunlight prior to calibration.

• **Calibrate controls under suitable daylight conditions**

Accurate calibration requires a consistent daylight condition. Avoid calibrating controls when there are fast moving or intermittent clouds or other changeable sky conditions. Do not calibrate dimming controls under overcast skies because controls adjusted under these conditions are likely to overdim the lights under sunny conditions.
Applications from large warehouses to small private offices benefit from the use of daylighting controls. This guide covers major applications typical to most office buildings or schools.

Note: Use the design consideration portion of this guide to complement this application section.
Applications in Specific Building Spaces

Private Office

Application description:
Enclosed single-occupant office with a window. Primary activities are computer work, reading and meetings.

Control needs:
Daylight responsive dimming with automatic shutoff.

Solution:
The LS-301 provides continuous dimming. The occupant can adjust light levels using the occupant remote control. For automatic shutoff, a ceiling-mounted occupancy sensor such as the CI-300 is added.

Classroom

Application description:
Classroom with multiple daylight sources. Primary activities are reading, computer work, testing, and presentations.

Control needs:
Daylight responsive dimming in multiple control zones, automatic shutoff, and manual override capability.

Solution:
The LCD-203 provides continuous dimming in two zones. The teacher can override the automatic dimming when necessary using the optional LS-4 wall switch. For automatic shutoff, a ceiling-mounted occupancy sensor such as the DT-300 is added.
Applications in Specific Building Spaces

Private office or Classroom (alternative to dimming)

ON/OFF Switching Alternative:

ON/OFF switching (the LS-101 provides a single level of reduction while the LCO-203 provides two or three levels of reduction) may be used in either of the above examples (p. 17) if the following conditions exist:

1. Considerable amount of daylight is available (2-3 times the minimum electric light).
2. Sky conditions in the climate are generally not changeable (i.e., southern California).
3. Direct/indirect pendant fixtures installed and configured to accommodate stepped dimming.
4. Lamps are gradually reduced by switching off rows of lamps when a considerable amount of daylight exists (i.e., >2 times electric light level).
5. At least one lamp remains on in every fixture during occupied periods.

Many design considerations are combined in this design to reduce potential distraction to occupants that noticeable lamp switching might cause. First, lamps are not directly viewable. Second, switching occurs at higher light levels. Third, switching can be successful because pendant fixtures illuminate the ceiling while daylight from windows also throws significant light onto the ceiling. Consequently, a gradual reduction will be less distracting because the ceiling will remain bright.

Gymnasium

Application description:
Gymnasium with skylights and T5 high bay fixtures. Activities include regularly scheduled classes and games throughout the daytime and early evening hours.

Control needs:
Multi-level ON/OFF switching. Automatic shutoff to comply with energy codes.

Solution:
The LCO-203 will provide two levels of reduction when combined with 4-lamp T5HO fixtures. Each fixture will have two 2-lamp ballasts. In a 6-lamp fixture, the LCD-203 could be used to provide three levels of reduction. The lights will be turned off when the area is unoccupied and will instantly turn on when occupancy resumes. Using the LCO-203, the lighting may be configured for Manual-ON and Auto-OFF.
Applications in Specific Building Spaces

Open office area

Application description:

Open office area divided by four and one-half foot partitions. Pendant fixtures are mounted perpendicular to windows.

Control needs:

Multi-zone dimming across three control zones

Solution:

LCD-203 for three zones of control with an LS-4c for manual override control. Two zones are set up for daylight-responsive dimming during daylight hours. Dimming in the third zone is used for task tuning.

Retail store

Application description:

Big box retail with 15' ceilings, skylights, and metal halide ambient lighting mounted at elevated heights. These ambient lights supplement merchandising lighting mounted at lower levels.

Control needs:

Multi-level ON/OFF control. Automatic shutoff.

Solution:

LCO-203 system to switch ambient lighting on and off during daylight hours. A Lighting Integrator relay panel with time clock turns ambient lighting on prior to store’s operating hours. The panel also turns on merchandising lights at the beginning of store hours. The LCO-203 turns off one-third of ambient lighting as daylight increases. It turns off an additional one-third of the lighting as daylight continues to increase.