



TECHNOLOGY INFORMATION SHEET

AUTOMATED LIGHTING CONTROLS

1. Description

Artificial light should be used not only where it is needed but also only when it is needed. Lighting controls should be used:

- to make maximum use of daylighting
- to reduce light levels when the task changes
- to turn off lighting when light is not needed
- to compensate for lamp lumen depreciation

Automated lighting controls provide an important element in "lighting management."

There are four different types of lighting controllers that can be used independently or in conjunction with one another: (1) timer/clock switches, (2) occupancy sensors, (3) photocell sensors, and (4) central control systems. Lighting controls can save the most energy in irregularly occupied spaces that are often vacant for extended periods of time and in spaces adjacent to windows with high daylighting. However, control strategies must be carefully planned. Of all lighting retrofit options controls are the most complex; they should be considered only after wattage-reduction options have been examined since their economics depends upon the amount of light being supplied.

2. Timer/Clock Switches

Timer switches turn the lights on for a prescribed period of time and then automatically turn them off. Mechanical spring-wound units allow the occupant to set the desired elapsed-time interval, electronic units have an internal controller that can be set with the proper tools but can not be easily altered by the occupants. Clock switches are used in areas with well-defined occupancy patterns to automatically turn the lights on or off at prescribed times through the day.

3. Occupancy Sensors

There are three different types of occupancy sensors: (a) ultrasonic, (b) passive infrared, and (c) microwave. Although audible sound sensors are also available their use is limited mostly to industrial and/or warehouse applications detecting equipment sound as opposed to human occupancy.

Ultrasonic (US) sensors detect and emit high frequency sound. When someone enters the controlled room or space an ultrasonic sensor detects the change in the frequency in the received sound and switches the lights on. In the same manner, if no differences in the received ultrasonic frequencies are

detected over a prescribed period of time the sensor switches the lights off. Ultrasonic sensors can be set to be extremely sensitive to frequency disturbances and can cover very large areas. Typical applications include long corridors, boardrooms, and warehouses.

Passive Infrared (PIR) sensors detect infrared radiation being emitted by hot objects. When a change in the received infrared level in a controlled room is detected, the lights are turned on. Once on, the sensor will shut off the lights when it detects no change in infrared levels for a prescribed period of time. PIR sensors are best suited to short range applications within a 5 to 7 metre range. Typical applications are bathrooms, small offices, and conference rooms.

Microwave sensors emit and receive radio wave signals. Like ultrasonic sensors, microwave sensors rely on differences in received radio frequencies to detect occupancy and control the lights. Presently, microwave sensors are not yet widely available and have only been sparsely tested to date.

4. Photocell Sensors

These sensors detect light levels in a space. Photocell sensors can only be used in areas that have some daylighting. Photocell sensors can be used either as on/off controllers at a prescribed light level or as automatic dimming controllers to continuously maintain a particular light level within a space as natural daylight levels fluctuate. If a dimming controller is to be used, the lighting system itself must have a dimming capability (e.g. incandescents or fluorescents with dimmable electronic ballasts). A photocell sensor and dimming

system can also be used to compensate for lumen depreciation

5. Central Control Systems

Also known as energy management systems (EMS), central control systems can take many forms; they can be simple central control panels with on/off switches activated by an operator only when someone is in the controlled areas, or complex computer-controlled systems incorporating multiple relays and lower-level controllers. Often simple, manually-operated, central control systems are the most cost effective type of lighting control, however computer controlled systems can also incorporate other controls for the HVAC and security systems in a building which may save significant amounts of otherwise wasted energy, albeit at a higher initial capital cost.

6. Design Tips

Lighting control techniques are application specific. The types of control, control sensitivity, range, and field of view to be used must match the space and occupancy characteristics. Savings from lighting controls depends on the nature of occupancy, the space characteristics, occupant acceptance, and the choice and positioning (if applicable) of the lighting control. Experience has shown, however, that in many buildings, savings of up to 30% can be achieved using occupancy sensors, and a further 25% can be saved through the use of photo cell sensors and dimming in perimeter areas.

Further information about automated lighting controls is available from the publications listed in the Efficient Lighting Reference List.