Lighting Control Best Practice Guide

Office Buildings



Space by space best practices for office buildings:

- Control needs/solutions
- Design considerations
- Floorplan control layout
- Wiring diagrams and installation guidelines
- Equipment schedules

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ASHRAE 90.1-2001 Energy Standard 56-57

Lighting Control Best Practice Guide for Office Buildings

With nearly 20 years of experience developing and producing lighting controls, The Watt Stopper has helped thousands of organizations implement energy saving lighting control systems. For each facility, there is an optimal lighting control solution, one that meets the owner's, facility manager's, and occupants' needs, and which can be most effectively operated and maintained.

Toward achieving this goal, The Watt Stopper offers comprehensive lighting control products encompassing several product lines: occupancy sensors, lighting control panels, daylighting controls, HID controls, and products to promote integrated control among multiple building systems. With these product resources and unsurpassed technical expertise, The Watt Stopper helps ensure that the right combination of products are used to satisfy the control needs of today's offices and their occupants.

This Best Practice publication focuses on design, specification, and installation guidance for lighting controls in commercial office buildings. It features applications that illustrate the best control practices for a variety of spaces. Each best practice considers the space use characteristics, occupant needs, lighting operation costs, energy savings and compliance with the requirements of ASHRAE 90.1-2001 and 1999. With this resource, lighting control design professionals will save time and effort spent on projects.

Each Best Practice includes:

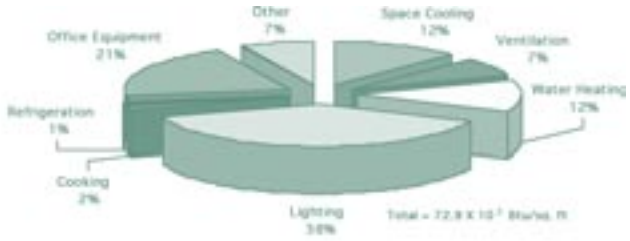
- Description of application
- List of control needs
- Product solution
- Design considerations
- A lighting plan sketch
- Installation notes
- Wiring and installation diagrams
- Equipment schedule



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Value of Lighting Control for Office Buildings

Energy codes and Green Building design trends share one common goal – saving energy. Lighting usage in today's office buildings accounts for approximately 38% of total energy use. As of 1999 there were 738,000 office buildings in the United States using approximately 18.7 kWh/ft^2 of electricity. This equates to spending approximately \$1.30/ft^2 on electricity, and \$0.50/ft^2 on lighting energy use.



Lighting controls can reduce energy costs significantly. One research project estimated the expected energy cost savings from the use of occupancy sensors in private offices, conference rooms, and restrooms to be approximately 26%, 27%, and 40%, respectively*. These savings are realized simply by turning lighting off when the rooms are unoccupied and lighting is not needed. In addition, daylighting controls can further reduce lighting energy use by switching or dimming electric lighting when sufficient daylight is present.

Office Building Space Usage

Space usage in an office building varies depending on the space type, occupant patterns, and type of work being done. Private offices, conference rooms, and restrooms are generally better suited for occupancy based control because of the unpredictable and varied occupancy of these spaces. Other areas, such as open offices and hallways, where schedules are more predictable, may be better suited for time based control.

Space ownership plays an equally important role in the design and selection of lighting controls. In areas where ownership is strongest, manual override controls might be desirable. Common areas, where no single occupant or group of occupants has ownership, may benefit more with automated control.

* IES paper JIES Summer 2001 "The Effects of Changing Occupancy Sensor Time-out Setting on Energy Savings, Lamp Cycling and Maintenance Costs", Maniccia, et. al.

Influential Factors for Lighting Control

Energy Code Requirements

The U.S. Department of Energy has ruled that every state must adopt an energy standard at least as stringent as ASHRAE 90.1-1999 by July 15, 2004. A major component of this standard requires automatic lighting shut off control for buildings greater than 5000 square feet. This means that occupancy sensing, time scheduling or signalling from building automation systems must be used to automatically turn lights off. In addition are requirements for controlling individual spaces, location of space controls and control of exterior lighting. A brief overview of the ASHRAE lighting control requirements is provided on pages 56-57 of this guide.

Green Building Design

The U.S. Green Buildings Council's LEED program encourages architects to use a holistic building design approach. This includes optimizing daylight penetration and views to the exterior and designing well-integrated systems that maximize energy savings. In a Green Building design, lighting control is important for three primary reasons. First, they enable compliance with ASHRAE 90.1-1999, which is a LEED prerequisite. Second, LEED encourages daylighting design, thereby allowing energy savings by dimming or turning off electric lights when they're not needed. Third, electrical energy usage can be further reduced by integrating the operation of lighting and mechanical systems.

Safety and Security

Providing lighting when and where needed is a key factor of safety and security. Proper design and use of lighting controls is an integral part of addressing these concerns. Location and accessibility to manual controls, adequate night lighting, timely exterior lighting control, reliable system operation as well as other lighting control elements, all play a part in ensuring safety and security in commercial office buildings.

Energy Efficiency

With rising energy costs, making commercial office facilities operate as efficiently as possible is of increasing importance. Good lighting control design not only reduces costs, but also supports our responsibility toward preserving non-renewable resources that are used to create energy.

Office Building Lighting Control Design Guidelines

A well designed control system requires the consideration of energy codes, the occupants' and building owner's control needs, building use patterns and the type of lighting that is used in each space. Listed below are some general lighting control principles for individual spaces, exterior lighting, and whole-building lighting control.

General

- Where daylighting is available, provide daylighting controls. Use continuous dimming for spaces with minor motion activity such as reading, writing, and conferencing. Use stepped dimming (on/off switching) for spaces with major motion activity such as walking and shelf stocking.
- Always mount ultrasonic occupancy sensors at least 6 to 8 ft away from HVAC ducts on vibration free surfaces and place so there is no detection out the door or opening of the space.
- In spaces of high occupant ownership such as private offices and conference rooms, always include switches for manual override control of the lighting.
- If there is concern that lighting could be turned off automatically or manually when people are still in the space, put in night lighting for safe egress.
- Many lighting control devices have specific voltage and load ratings requirements. Be sure to specify the device model that matches the correct voltage and load rating for the application.

Conference Rooms

- Use dual technology occupancy sensors in larger conference rooms for optimal detection of both small hand motion and larger body movement.
- Ceiling or corner-mounted passive infrared occupancy sensors are used for medium and small conference rooms.
- Always include switches that provide manual override control of the lighting.

Cubicles

- Control plug loads such as task lighting, computer monitors, portable fans and heaters with an occupancy sensor controlled plug strip.
- Mount personal occupancy sensor beneath binder bin or desk and position so that it cannot detect motion outside cubicle area.

Hallways/Elevator Lobbies/Common Areas

- Hallways and common areas are best suited for automatic on/off control of lighting using time scheduled or occupancy sensor control.

Kitchens/Lunch Rooms

- Ceiling or corner mounted passive infrared occupancy sensors are typically used.

Private Offices

- Ceiling mounted, corner mounted or wall switch passive infrared occupancy sensors are used for medium and small offices, dual technology sensors for larger offices.
- Always include switches that provide manual override control of the lighting.

Open Office Spaces

- The Best Practice for open office areas is dependent upon the building size and the owner's needs. For small, single floor office buildings or an open office area in a leased space, occupancy sensors are a good strategy. For larger, owner occupied, or multi-floor tenants, scheduling using lighting control panels is recommended because one time clock can control lighting on multiple floors. Combining both scheduled and occupancy sensor control offers the benefit and convenience of keeping lighting on during normal hours of operation, yet after hours allows occupancy based control for additional energy savings
- For maximum energy efficiency after hours, lighting control zones should be designed as small as reasonable so fewer lights are turned on by an occupant after hours and less energy is used.
- When occupancy sensors are used in spaces with partitions, use ceiling mounted ultrasonic sensors because they can detect motion over partition walls. Follow proper spacing guidelines for optimum sensor coverage (see page 36).

Restrooms

- Use ceiling mounted ultrasonic sensors for restrooms with stalls.

Stairwells

- Use ultrasonic sensor mounted above the doorway, or door swing, to control stairwell lighting.
- Use a normally closed power pack for "fail safe ON" operation.

Utility Closets

- Use a digital timer switch for allowing manual activation and for lights automatically turning off.

Exterior Lighting Control

- Use a lighting control panel with time clock and photocell to control exterior lighting to turn on at dusk and off at dawn and turn non-security lighting off earlier in the evening for energy savings.
- Circuit different exterior lighting fixtures to be controlled separately by the lighting control panel. This allows different lighting to turn on at different levels of illumination according to application need. For example, entry lighting may turn on earlier than parking lot lighting.

Whole-building Lighting Control Design

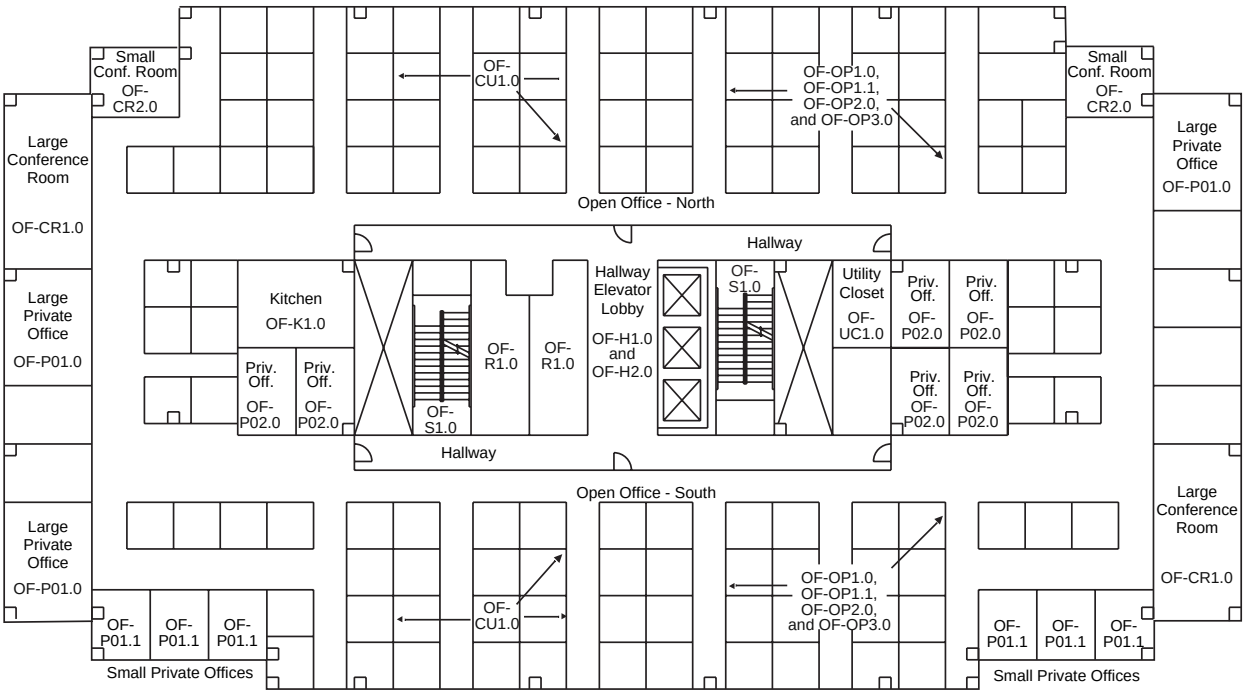
When designing lighting controls to meet individual space needs, one must recognize that spaces may be linked to an overall lighting control system. In a small office building, this may be a single lighting control panel and time clock located in an electrical room. In an office campus with multiple buildings, this may be multiple lighting control panels in each building sharing lighting control information over a dataline network – all centrally operated from a facility manager's office. Additionally, these lighting control systems may be linked to mechanical systems for integrated control.

- In buildings requiring multiple lighting control panels, it is more convenient to centralize the time clock and exterior photocell in a lighting control panel. Use a dataline network to communicate time schedules and light level events to other lighting control panels in the system.
- If the features of centralized lighting control programming, monitoring and trend analysis are needed (as would be typically needed for medium to large sized office buildings or multiple building sites), use a system with lighting control software that operates on a personal computer.

Office Building Best Practice Guide Roadmap

This Best Practice Guide uses the office building footprint below as a working key plan. Each space type in the floorplan has at least one lighting control best practice contained in the guide. Determine a best practice lighting control design for each building space by using the summary chart (next page) to find the solution that fits your space needs. Additional solutions are included for exterior lighting and for overall building-wide lighting control system design.

These best practice designs address typical control needs in common office spaces. Although not described in this guide, many other areas in an office building are ideal for lighting control including lobbies, atriums, cafeterias, warehouses, exercise rooms, IT server rooms and more.



Summary of Best Practices for Lighting Control in Office Buildings

Space/application	Best practice	Auto-off strategy	Daylighting strategy	Manual control	Plug load control	BAS/HVAC integration
Building (individual)	OF-B1.0	network communication		Y		Y
Building campus	OF-B2.0	network comm.; software access		Y		Y
Conference room (large)	OF-CR1.0	occupancy sensing; dimming		Y		Y
Conference room (small)	OF-CR2.0	occupancy sensing		Y		Y
Cubicle	OF-CU1.0	occ. sensing (plug load control)			Y	
Hallway/elevator lobby	OF-H1.0	scheduling		Y		Y
Hallway/elevator lobby	OF-H2.0	occupancy sensing				Y
Kitchen	OF-K1.0	occupancy sensing		Y		Y
Open office	OF-OP1.0	scheduling	1 daylit zone	Y	Y	Y
Open office (light shelf)	OF-OP1.1	scheduling	2 daylit zones	Y	Y	Y
Open office	OF-OP2.0	occupancy sensing		Y	Y	Y
Open office	OF-OP3.0	scheduling; occupancy sensing	1 daylit zone	Y	Y	Y
Private office (large perimeter)	OF-PO1.0	occupancy sensing	1 daylit zone	Y	Y	Y
Private office (small perimeter)	OF-PO1.1	occupancy sensing		Y	Y	
Private office (interior)	OF-PO2.0	occupancy sensing		Y	Y	Y
Restroom	OF-R1.0	occupancy sensing		Y		
Restroom (executive)	OF-R2.0	occupancy sensing		Y		
Stairwell	OF-S1.0	occupancy sensing		Y		
Utility closet	OF-UC1.0	time switch		Y		
Exterior lighting	OF-E1.0	scheduling; photocell		Y		



OF-B1.0 Building (individual): network communication

Control Needs	Solution
Time clock scheduling from main lighting control panel	Time clock in main lighting control panel with network communication to other panels (Smartwired Control)
Exterior lighting control from photocell	Photocell mounted on roof and photocontrol module in top floor lighting control panel (HPCP8SS)
Local switching and override control of lighting in open office areas, hallways	Dataline switches and time clock in Smartwired lighting control panel
Occupancy based shut-off control in private offices, conference rooms, bathrooms	Occupancy sensors

Application Description

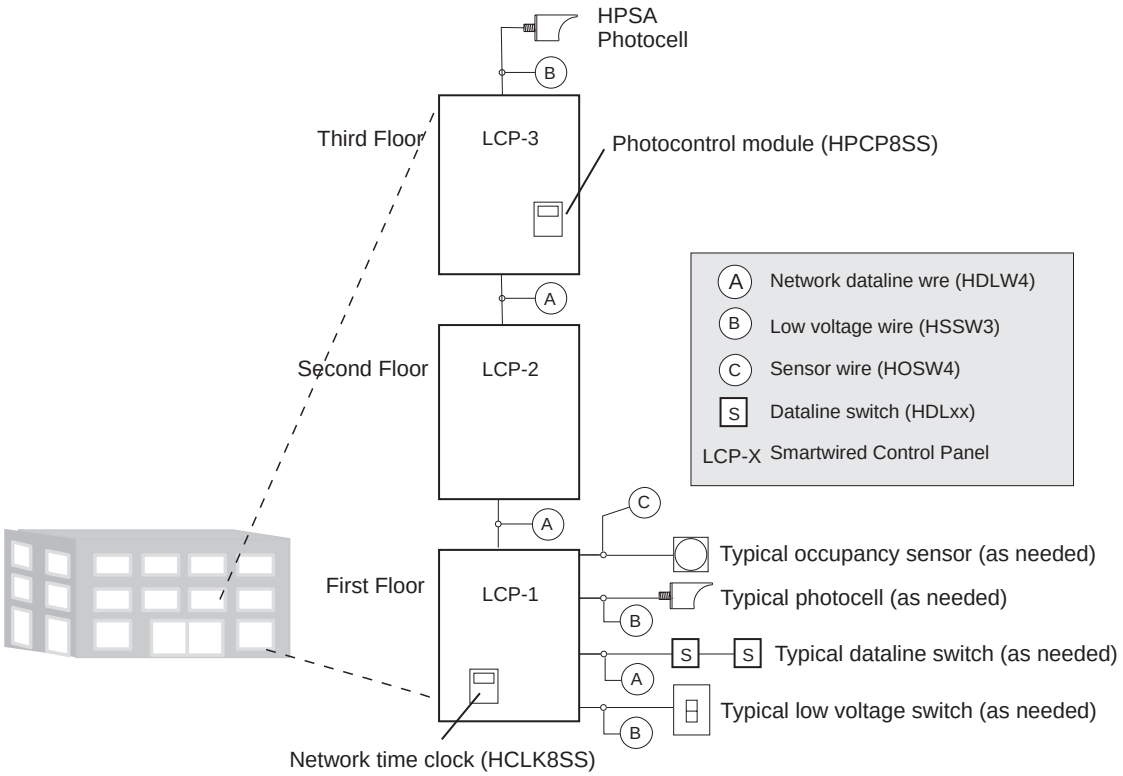
Single three story building with parking lot, walk way, building lighting and signs. Electrical distribution room on each floor in core area.

Building Requirements

Requires lighting control panels on each building floor with up to 24 relays per panel. Power for lighting control panels is 277 VAC. Refer to individual plan solutions for specific information on individual space, office and exterior lighting requirements.

Design Considerations

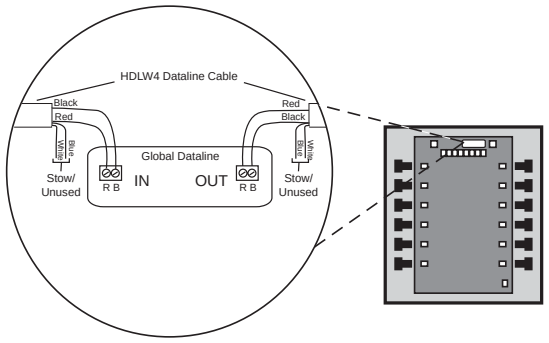
Smartwired lighting control panels on each floor are networked together by dataline cable. The main panel is located on the first floor and contains the lighting control system time clock. Time scheduling information is broadcast from the time clock to the other lighting control panels over the dataline network. The time clock schedule is programmed at the main panel without requiring software or a computer. The photocontrol module in the top floor lighting control panel broadcasts exterior light level information over the dataline. A riser diagram indicates the wiring required between each relay panel and lighting control device in the system.



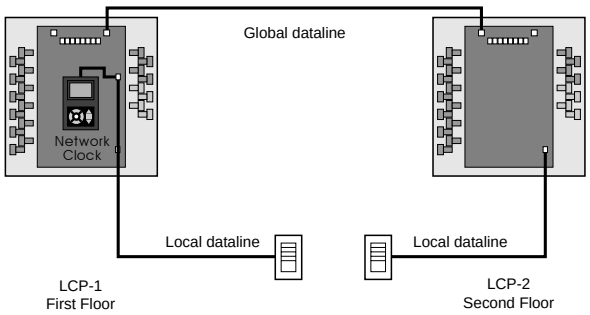
OF-B1.0 Installation Notes

1. Refer to Smartwired Control lighting control system installation and operation instruction for detailed information on the installation and operation.
2. Provide line voltage, dedicated circuit to power each lighting control panel.
3. Dataline wire must conform with The Watt Stopper specifications. Use dataline wire for wiring between lighting control panels and dataline switches.
4. Dataline cable must be run in a dedicated conduit and be isolated from all other power or system wiring.
5. Install photocontrol module (HPCP8SS) in top floor lighting control panel. Run low voltage cable (HSSW3) between controller and photocell mounted on the building roof.
6. Install outside photocell on the building roof using a weatherproof junction box. Point photocell toward northern sky.
7. Program and test the operation of the lighting control panels, photocell and all lighting control devices after installation.

Global Dataline Connection



Network Dataline Wiring



Equipment Schedule

Catalog No.	Qty	Description
HIN24R24SP	3	Smartwired Control lighting control panel interior, 24 relays
HTUB24	3	Tub enclosure for lighting control panel interior, up to 24 relays (30.5"x24"x4.5")
HCVR24SL	3	Surface mounted cover for lighting control panel, up to 24 relays (30.7"x24.2"x.75")
HPSM115/277	3	Power supply for lighting control panel, 115/277 VAC, 50/60 Hz
HCLK8SS	1	Network clock for Smartwired Control panel
HPCP8SS	1	Photocontrol module with photocell (HPSA) for Smartwired Control
HDLW4		Smartwired Control dataline wire, #18AWG two twisted pair (specify feet)
HSSW3		Low voltage wire, #20AWG three conductor (specify feet)

OF-B2.0 Business Campus: network communication • software access

Control Needs	Solution
Shared lighting control data across multiple floors and multiple buildings	Networked lighting control panels (Complete Control)
Centralized control, programming, monitoring, trending, and reporting of lighting control system	Lighting control software to operate on facility manager's PC (WinControl software package)
Graphical display of lighting control status matching facility layout	Graphics based lighting control software package (WinControl Graphics)

Application Description

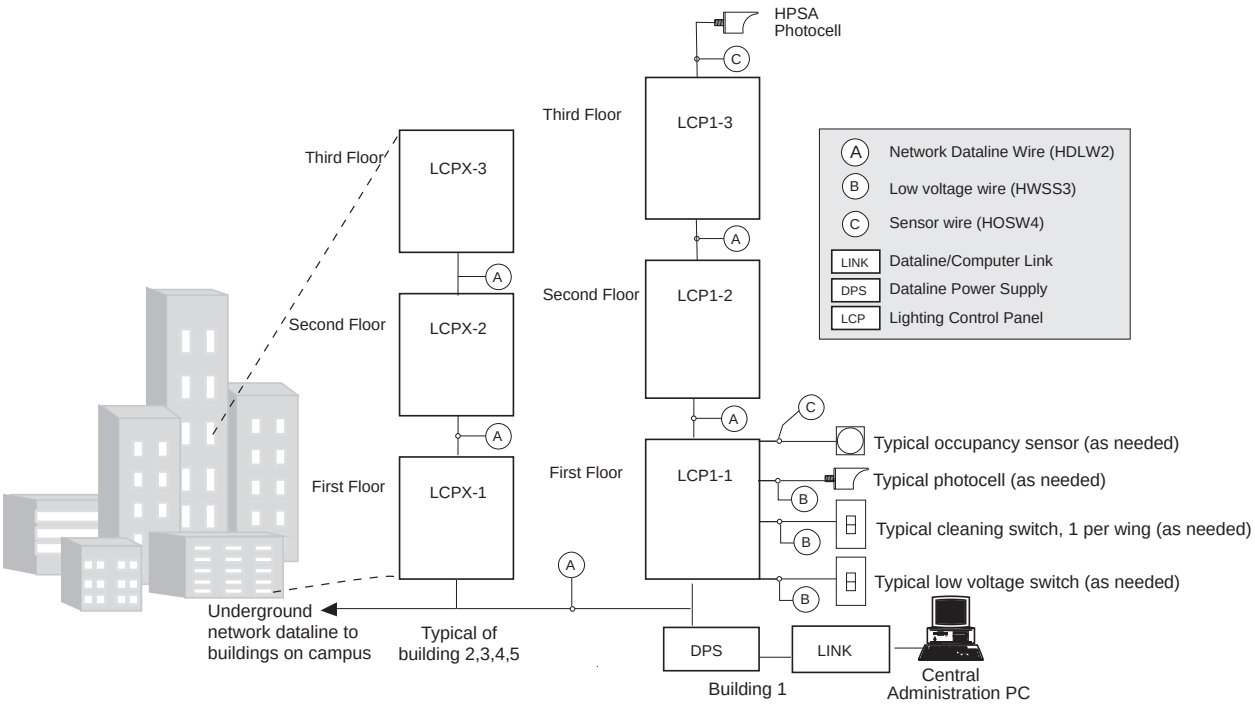
Five-building office campus with three stories per building. Includes parking lots, walkways, driveways, courtyards and signs. Underground conduit system provides access between buildings and exterior lighting. All security, building automation, fire alarm and lighting control systems to be monitored and controlled from facility manager's office on the first floor of building 1.

Building Requirements

Requires lighting control panels on each building floor with no more than 24 relays per panel. Power for lighting control panels is 277 VAC. Refer to individual office plan solutions for specific information on individual space and exterior lighting requirements.

Design Considerations

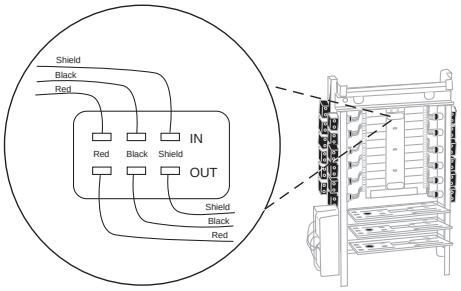
Complete Control lighting control panels on each floor and between each building are networked together by dataline wire. Each panel communicates lighting control activity over the dataline. A riser diagram indicates the wiring required between each panel and lighting control device in the system. A dataline power supply (HDPS1CC) powers the dataline and a dataline link (HLINK) connects the dataline to the PC in the facility manager's office in building 1. WinControl and WinControl Graphics software packages allow the manager to see the lighting activity in all areas controlled by the lighting control panels. All schedules and control programming is performed at the facility manager's office and downloaded over the dataline to the lighting control panels.



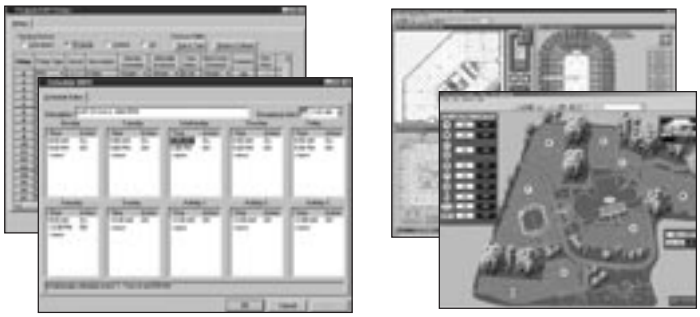
OF-B2.0 Installation Notes

1. Refer to Complete Control installation and operation instructions for detailed information on the installation and operation of the Complete Control lighting control system.
2. Provide line voltage, dedicated circuit to power each lighting control panel.
3. Dataline wire must conform with The Watt Stopper specifications. Use dataline wire for wiring between lighting control panels and between campus buildings.
4. Dataline wire must be run in a dedicated conduit and be isolated from all other power or system wiring.
5. Install outdoor lighting photocell controller in building 1, top floor lighting control panel. Run low voltage cable (HSSW3) between controller and photocell mounted on the building roof.
6. Install outside photocell on the roof of building 1 using a weatherproof junction box. Point photocell toward Northern sky.
7. Program and test the operation of the lighting control panels, photocell and all lighting control devices after installation.

Network Dataline Connection



WinControl Software



Equipment Schedule

Catalog No.	Qty	Description
HIN24R24CC	15	Complete Control lighting control panel interior, 24 relays
HTUB24	15	Tub enclosure for lighting control panel interior, up to 24 relays (30.5"x24"x4.5")
HCVR24SL	15	Surface mounted cover for lighting control panel, up to 24 relays (30.7"x24.2"x.75")
HPSM115/277	15	Power supply for lighting control panel, 115/277 VAC, 50/60 Hz
HCPU48CC	15	Controller card, programmable intelligence card for lighting control panel
HIOC12CC	30	Input/output card (one for each 12 relays) for lighting control panel
HPCP3BC	1	Outdoor lighting controller package with outdoor photocell
HDPS1CC	1	Dataline power supply and options module
HLINKCC	1	Dataline link module
HWCHSTD	1	WinControl lighting control software package
HWCHGR	1	WinControl graphics software package
PC	1	Personal computer or laptop
HDLW2		Complete Control dataline wire, #18AWG twisted, shielded pair (specify feet)
HSSW3		Low voltage wire, #20AWG three conductor (specify feet)

OF-CR1.0 Large Conference Room: *occupancy sensing • dimming*

Control Needs	Solution
Automatically turn lights ON/OFF based on occupancy	Corner-mounted dual technology occupancy sensor (DT series) with A/V interface
Manual ON/Manual override OFF/DIM	Architectural dimming system
Occupancy-based control of HVAC system	Isolated relay on occupancy sensor
Preset scene control	Architectural dimming system

Application Description

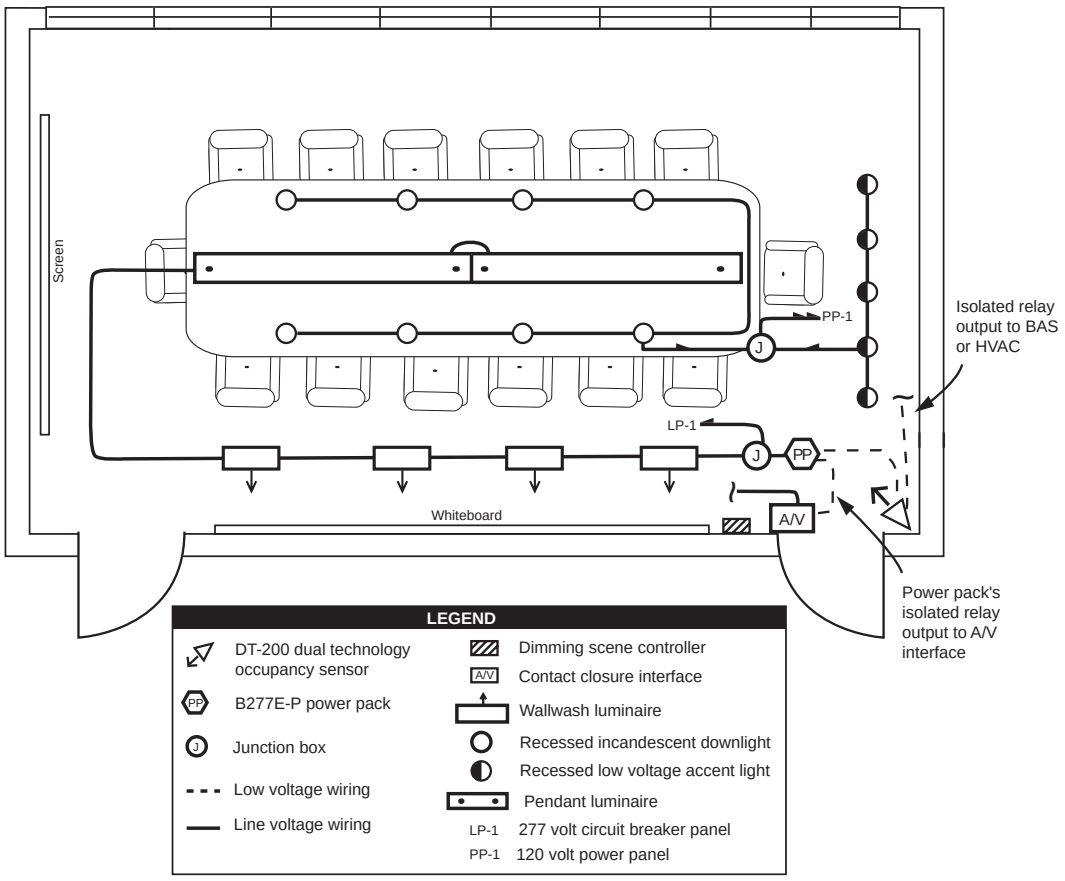
Space use:	Meetings, presentations, group projects
Dimensions:	30’ x 15’
Ceiling height:	10’
Windows:	Windows along one wall providing view to exterior
Window blinds:	Horizontal blinds

Lighting

Pendant mounted indirect luminaires using T8 lamps and electronic dimming ballasts, and 50 watt PAR 20 incandescent downlights over the conference room table. Recessed 40 watt long twin tube fluorescent wallwash luminaires lighting whiteboard and low voltage 20 watt MR-16 incandescent accents lighting artwork.

Design Considerations

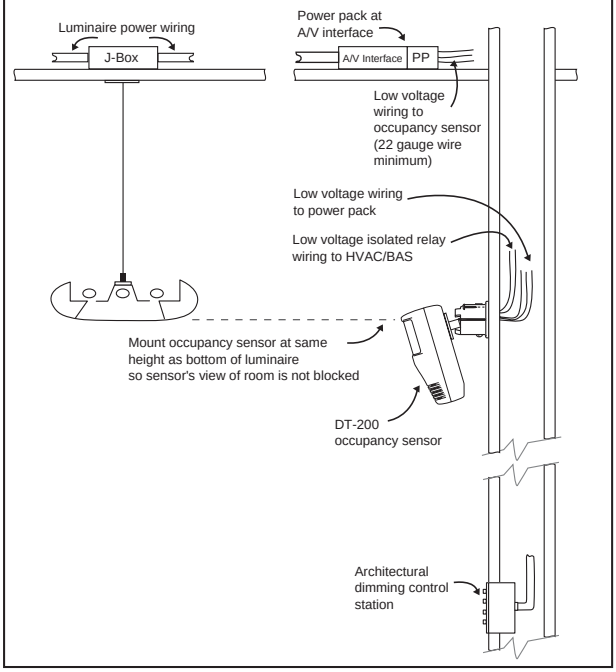
The DT-200 Dual Technology occupancy sensor is used to automatically turn lights off when the room is unoccupied and turn lights on upon occupancy. The sensor is mounted in the corner, to prevent a view out the doorway that might otherwise result in false activations. Upon occupancy, a signal is sent to the HVAC system using the isolated relay in the occupancy sensor and to the architectural dimming system using the contact closure in the power pack. Then during occupied times, the architectural dimming system is used for scene setting.



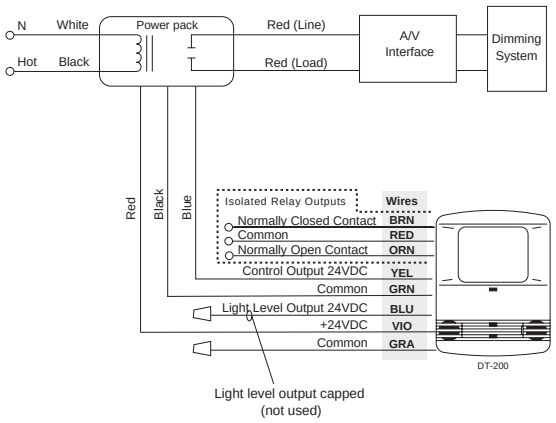
OF-CR1.0 Installation Notes

1. Mount DT-200 in corner and aim at opposing corner to provide a full view of the room but not out the door.
2. Mount DT-200 occupancy sensor at same height as luminaire so that sensor view is not blocked.
3. DT-200 is shipped with a factory preset time delay of 18 minutes, the recommended minimum for conference rooms and with sensitivity setting at maximum. Refer to installation instructions if adjustments are necessary.
4. DT-200 sensor's isolated relay can provide status information to the BAS and/or control HVAC loads.
5. Connect power pack's isolated contact to A/V interface. Confirm wiring diagram with dimming system manufacturer.
6. Configure dimming system to go to OFF preset scene when space is unoccupied and to ON scene when occupied.

DT-200 Occupancy Sensor Installation



DT-200 Occupancy Sensor Wiring Diagram



Equipment Schedule

Catalog No.	Qty	Description
DT-200	1	Dual technology occupancy sensor, isolated relay, wide angle lens
B277E-P	1	Power pack, 277 VAC, 60 Hz
A/V Interface	1	Contact closure for dimming system (by dimming system manufacturer)
Dimming System	1	Multi-scene preset dimming system (by dimming system manufacturer)

OF-CR2.0 Small Conference Room: *occupancy sensing*

Control Needs	Solution
Automatically turn lights ON/OFF based on occupancy	Corner-mounted passive infrared occupancy sensor (CX series)
Manual ON/Manual override OFF	Wall switches
Bi-level switching	Tandem-wired ballasts and wall switches
Occupancy-based control of HVAC system	Isolated relay on occupancy sensor

Application Description

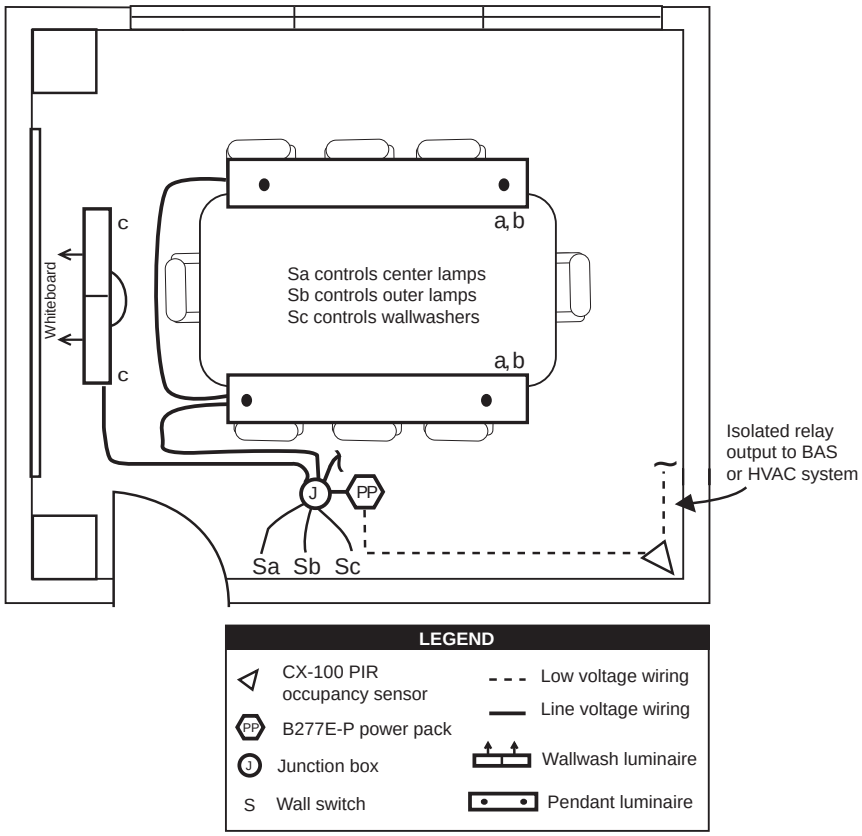
Space use:	Meetings of small groups, group projects
Dimensions:	10’ x 12’
Ceiling height:	10’
Windows:	Windows along one wall providing view to exterior
Window blinds:	Horizontal blinds

Lighting

Pendant mounted 4’ luminaires, using 3 T8 lamps and 2-lamp, tandem wired, 277 volt electronic ballasts. Recessed compact fluorescent wallwash luminaires highlighting whiteboard.

Design Considerations

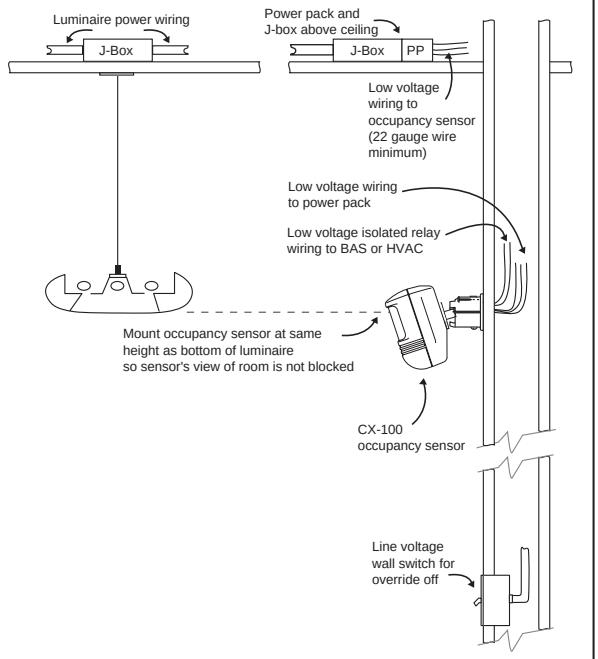
The CX-100 PIR occupancy sensor is used to automatically turn lights off when the conference room is unoccupied and turn lights on upon occupancy. The sensor is mounted in the corner, to prevent a view out the doorway that might otherwise result in false activations. Two wall switches are used for bi-level switching. A third wall switch is used for switching wallwashers.



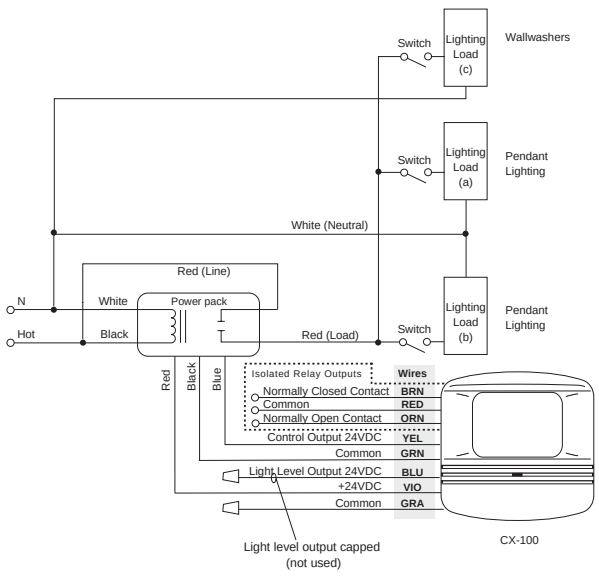
OF-CR2.0 Installation Notes

1. Mount CX-100 occupancy sensor at same height as luminaire so that sensor view is not blocked.
2. Mount CX-100 in corner and aim at opposing corner to provide a full view of the room but not out the door.
3. CX-100 is shipped with a factory preset time delay of 18 minutes, the recommended minimum for conference rooms and with sensitivity setting at maximum. Refer to installation instructions if adjustments are necessary.
4. Use a minimum of 22 gauge wire for low voltage wiring. See Technical Bulletin TB-124 on Voltage Loss at www.wattstopper.com.
5. CX-100 sensors isolated relay can provide status information to the BAS and/or control HVAC loads.

CX-100 Occupancy Sensor Installation



CX-100 Occupancy Sensor Wiring Diagram



Equipment Schedule

Catalog No.	Qty	Description
CX-100	1	Passive infrared occupancy sensor, isolated relay, wide angle lens
B277E-P	1	Power pack, 277 VAC, 60 Hz
AC1 Series	3	Wall switch, Pass & Seymour/legrand, AC1 series, single pole
SP Series	1	Wall plate, Pass & Seymour/legrand, SP series, 3-gang

OF-CU1.0 Cubicle Workstation: *plug load control*

Control Needs	Solution
Occupancy-based control of workstation plug loads	Isolé power strip with personal sensor (IDP-3050)
Protect essential equipment from surges	Isolé power strip with personal sensor (IDP-3050)

Application Description

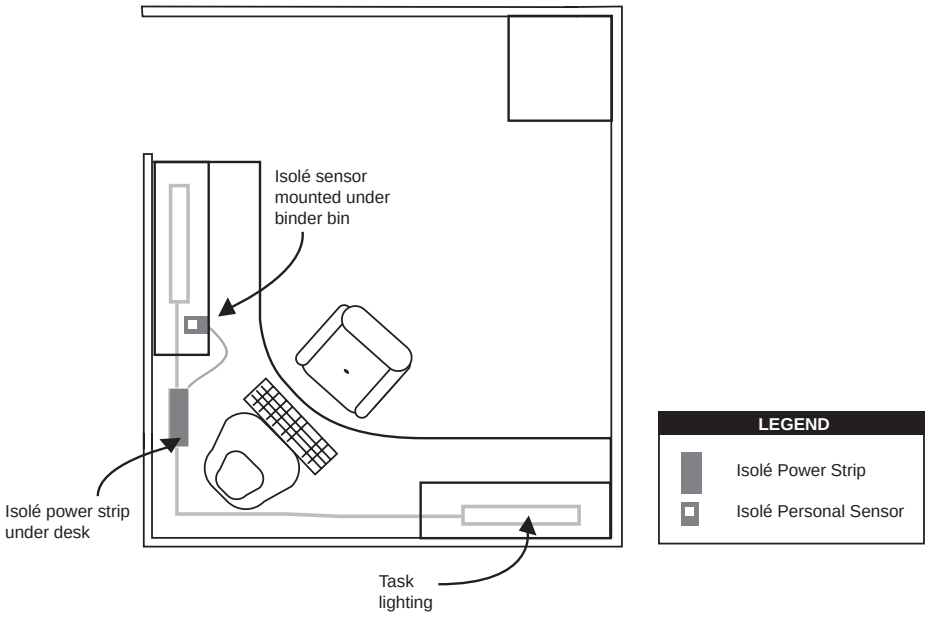
Space use:	Office activities such as reading, writing, computer work
Dimensions:	8’ x 8’
Cubicle height:	5’

Lighting

Fluorescent 120 volt task lighting mounted under cubicle binder bins.

Design Considerations

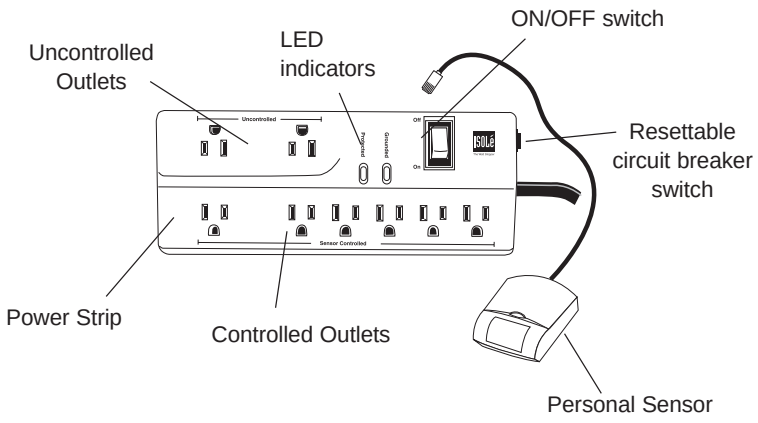
The Isolé IDP-3050 is used to turn desktop office equipment on and off based on occupancy. The personal sensor can be mounted under the binder bin or the desk so it can have a clear view of the occupant, but not outside of the cubicle. The power strip is located under the desk. Equipment such as monitors, printers and task lighting are plugged into “controlled” outlets to turn on and off based on occupancy. Essential equipment, such as computers and fax machines, are plugged into “uncontrolled” outlets. The IDP-3050 protects equipment from power surges.



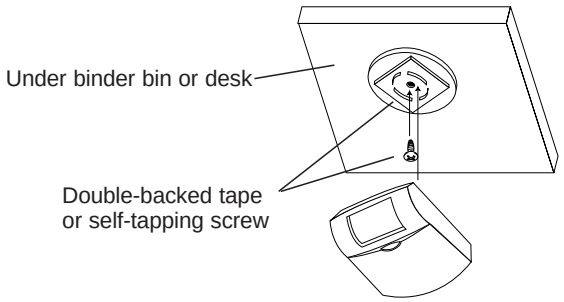
OF-CU1.0 Installation Notes

1. Isolé IDP-3050's power strip is mounted under the desk. The personal sensor is mounted under the binder bin or may also be mounted under the desk.
2. Isolé IDP-3050's personal sensor is shipped with a factory preset time delay of 30 min, the recommended setting.
3. Plug only the Isolé personal sensor into the power strip's sensor input jack – otherwise, damage may result.
4. Plug task lighting, monitors, and other devices into the controlled outlets. Plug items to remain on all day (computer CPUs) into uncontrolled outlets.

IDP-3050 Unit Layout



IDP-3050 Sensor Mounting



Equipment Schedule

Catalog No.	Qty	Description
IDP-3050-A	1	Isolé eight outlet power strip with auto-ON personal sensor

OF-H1.0 Hallway/Elevator Lobby : *time scheduling*

Control Needs	Solution
Manual ON and scheduled OFF during business hours	Dataline switches and time clock in Smartwired lighting control panel
Manual override ON with automatic shut off for after hours	Dataline switches and time clock in Smartwired lighting control panel
Occupancy-based control of mechanical system	Isolated relays in Universal Switch Module
Night lights ON all of the time	Night lights are not controlled
Night lights operate during power outage	Power night lights through emergency panel

Application Description

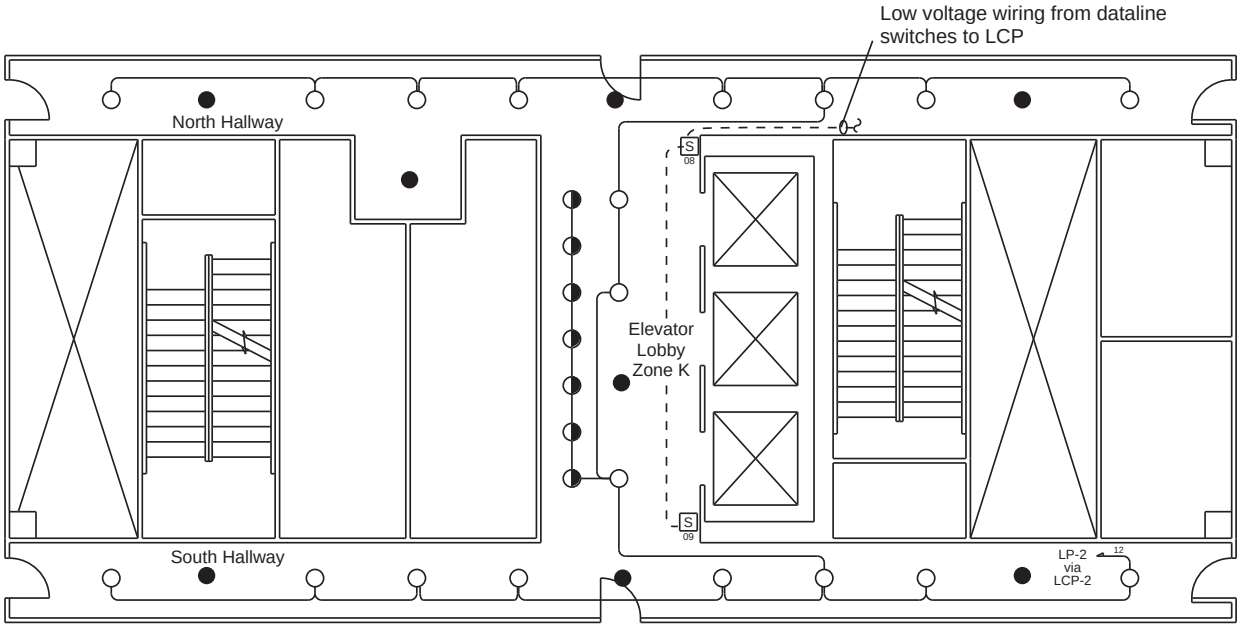
Space use:	General circulation
Corridor dimensions:	90’ x 6’
Elevator/Lobby dimensions:	30’ x 12’
Ceiling height:	10’
Window:	None
Window blinds:	None

Lighting

Recessed compact fluorescent downlights with compact fluorescent wallwashers in elevator lobby, using 42-watt triple tube CFL lamps and 277 volt electronic ballasts.

Design Considerations

Lighting in the hallway and elevator lobby is manually turned on using dataline switches and scheduled off using a time clock located in a Smartwired lighting control panel. All lights are controlled on the same channel and remain on during the day. Lighting status signals are sent to the HVAC/BAS system using the isolated relays in the Universal Switch Module.



LEGEND

○	Recessed compact fluorescent downlight	——	Line voltage wiring
●	Recessed compact fluorescent downlight on night light circuit	- - -	Low voltage wiring
◒	Wallwashers	S	Dataline switch
		LP-2	Circuit breaker panel
		LCP-2	Lighting control panel

Refer to **OF-OP1.0** on p. 25-30 for installation notes, diagrams, dataline switch wiring and equipment list

OF-H1.0 Installation Notes

1. Refer to Smartwired Switching System Installation and Operation Summary for detailed installation and operation instructions of the lighting control panel.
2. Commission the time clock according to the Network Clock Automation Scenarios documentation, and test the operation after commissioning.
3. Assign relays to the channels as shown on the Smartwired Relay schedule.
4. Confirm night light/egress lighting requirement with local code officials.

See OF-OP1.0 (pages 26-27) for:

• Wiring Diagrams

• Panel Documentation

Equipment Schedule *(per floor)*

Catalog No.	Qty	Description
Smartwired		
HIN24R24SP	1	Smartwired Control lighting control panel interior, 24 relays
HTUB24D	1	Tub enclosure for lighting control panel with DIN rail, up to 24 relays (30.5”x24”x4.5”)
HCVR24SLD	1	Surface mounted cover for lighting control panel, up to 24 relays (30.7”x24.2”x.75”)
HCLK8SS	1	Network clock/programmer for Smartwired control
HUSM8SS	1	Universal switch interface module
HPSM115/277	1	Power supply for lighting control panel, 115/277 VAC, 50/60 Hz
HDLS1SS	2	Dataline switch, 1 button, single gang, includes wall plate
HDLW4		Dataline wire, 18 AWG (7 strands x 26 AWG) using 2 independent twisted pair (specify feet)

OF-H2.0 Hallway/Elevator Lobby : *occupancy sensing*

Control Needs	Solution
Automatically turn lights ON/OFF based on occupancy	Ultrasonic occupancy sensors (WT series)
Occupancy-based control of mechanical system	Isolated relay in occupancy sensor
Night lights ON all of the time	Night lights are not controlled
Night lights operate during power outage	Power night lights through emergency panel

Application Description

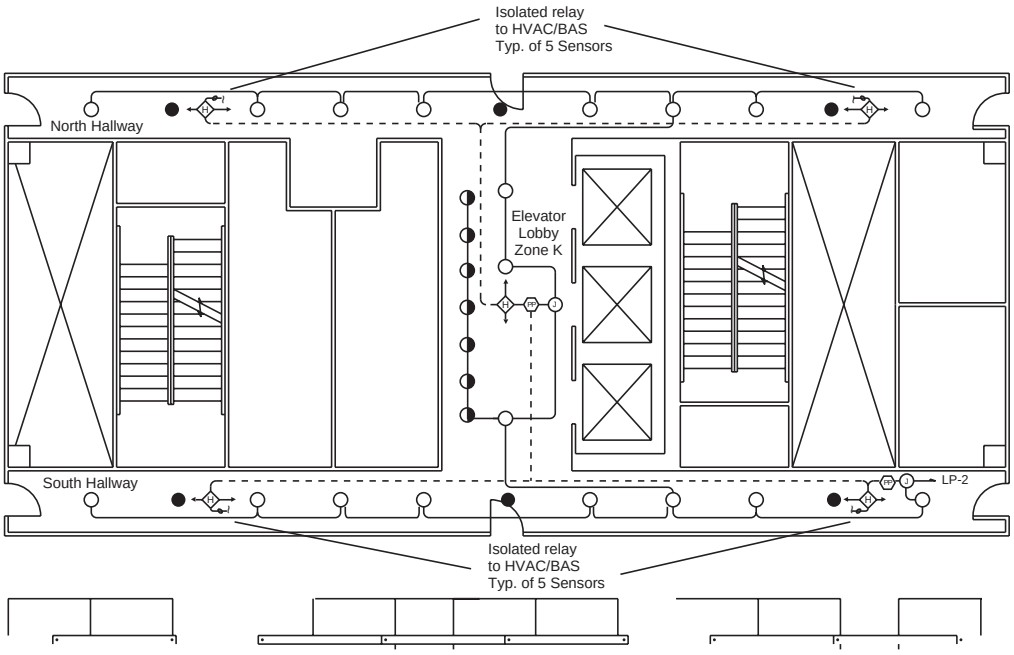
Space use:	General circulation
Corridor dimensions:	90’ x 6’
Elevator/Lobby dimensions:	30’ x 12’
Ceiling height:	10’
Window:	None
Window blinds:	None

Lighting

Recessed compact fluorescent downlights with compact fluorescent wallwashers in elevator lobby, using 42-watt triple tube CFL lamps and 277 volt electronic ballasts.

Design Considerations

Lighting in the corridor and elevator lobby is automatically turned on and off based on occupancy using the WT ultrasonic occupancy sensor. The WT-2250 has a coverage pattern that is designed specifically for hallway use. Lighting status signals are sent to the HVAC/BAS system using the isolated relay in the occupancy sensor.



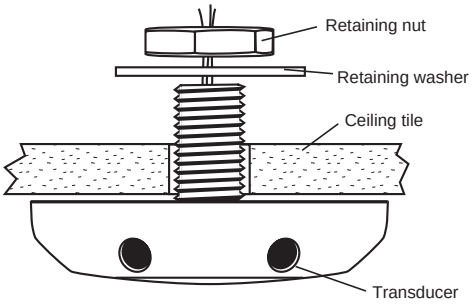
LEGEND

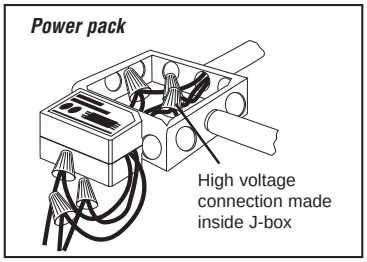
- WT-2250 ultrasonic occupancy sensor
- Recessed compact fluorescent downlight
- Recessed compact fluorescent downlight on night light circuit
- Wallwashers
- B277E-P power pack
- Junction Box
- Low voltage wiring
- Line voltage wiring

OF-H2.0 Installation Notes

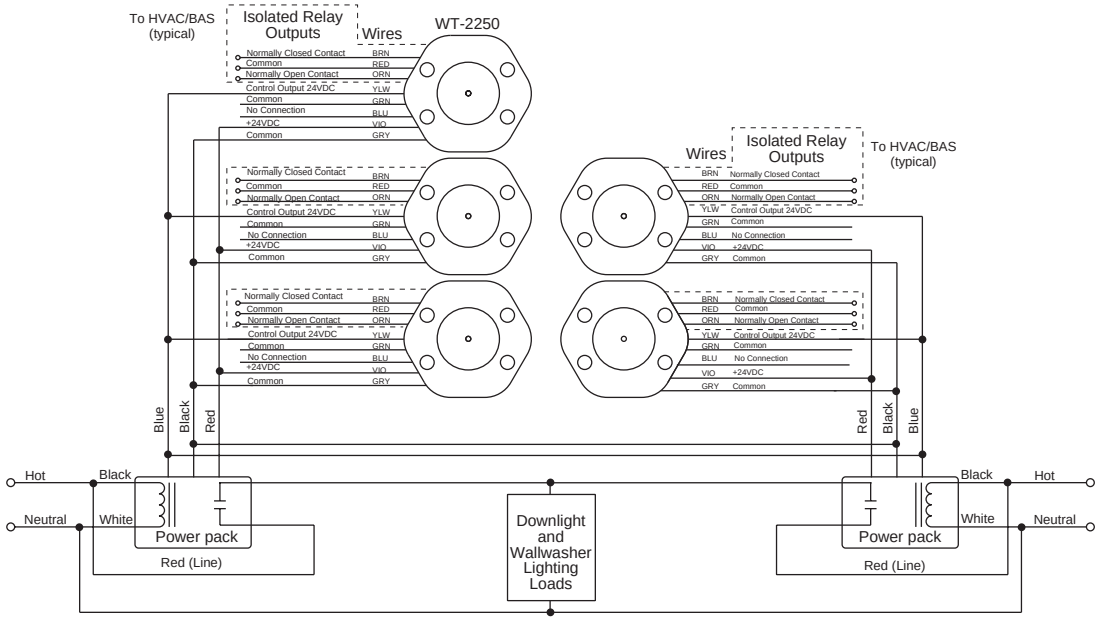
1. Mount the WT ultrasonic sensor on a rigid, vibration-free surface. Aim transducers down the hallway.
2. WT sensor is shipped with a factory preset time delay of 16 minutes and sensitivity set to 50%. Set time delay to at least 20 minutes by adjusting the dip switches according to the DIP switch setting table in the installation instructions.
3. Use a minimum of 22 gauge wire for low voltage wiring. See Technical Bulletin TB-124 on Voltage Loss at www.wattstopper.com.
4. Confirm night light/egress lighting requirement with local code officials.

WT Ultrasonic Occupancy Sensor Installation





WT Ultrasonic Occupancy Sensor Wiring Diagram



Equipment Schedule *(per floor)*

Catalog No.	Qty	Description
WT-2250	5	Ultrasonic sensor ceiling mounted in hallway, 90 linear ft, 360˚ coverage, isolated relay
B277E-P	2	Power pack, 277 VAC, 60 Hz

OF-K1.0 Kitchen: occupancy sensing

Control Needs	Solution
Automatically turn lights ON/OFF based on occupancy	Ceiling-mounted passive infrared sensor (CX series)
Manual ON/Manual override OFF	Wall switches
Bi-level switching	Wall switches
Night lights ON all of the time	Night lights are not controlled
Night lights operate during power outage	Power night lights through emergency panel
Occupancy-based control of HVAC system	Isolated relay on occupancy sensor

Application Description

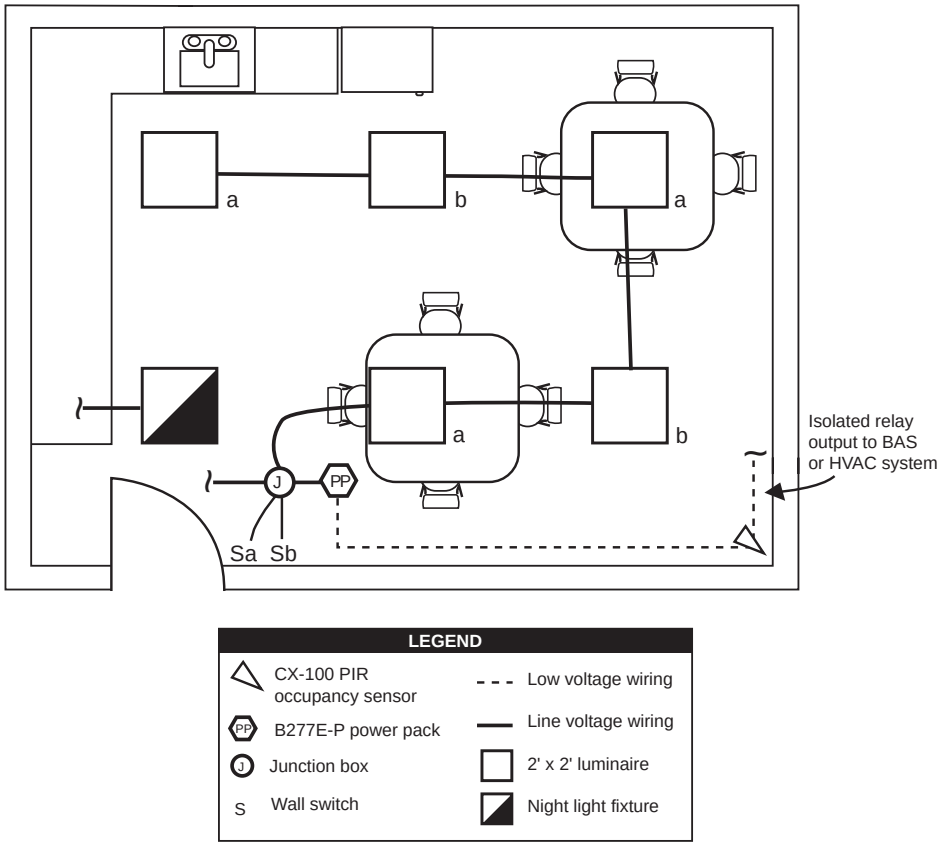
Space use:	Kitchen activities
Dimensions:	15’ x 20’
Ceiling height:	10’
Window:	None
Window blinds:	None

Lighting

Recessed 2’ x 2’, 2-lamp T8, 9-cell parabolic luminaires using 2-lamp, 277 volt electronic ballasts.

Design Considerations

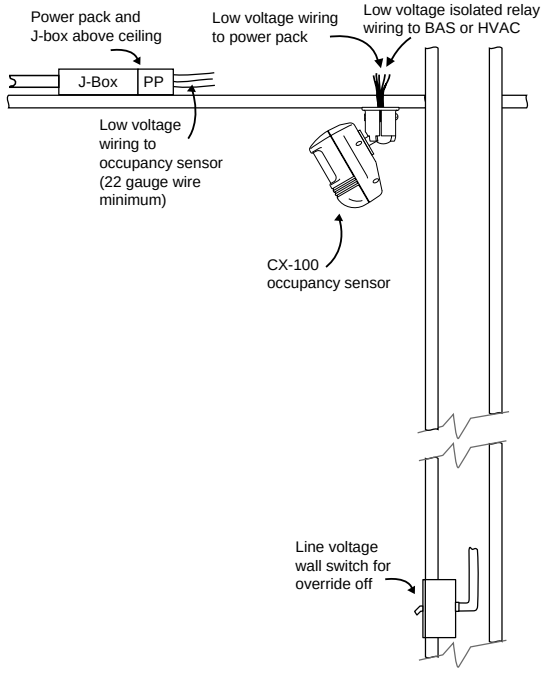
A CX-100 passive infrared occupancy sensor is used to automatically turn lights off when the room is unoccupied, and turn lights on upon occupancy. The sensor is mounted in the corner of the room, along the same wall as the door, so that detection outside the door does not occur. Bi-level switching is accomplished by switching alternate luminaires using the two wall switches. One luminaire is on a night light circuit and is not controlled by the occupancy sensor.



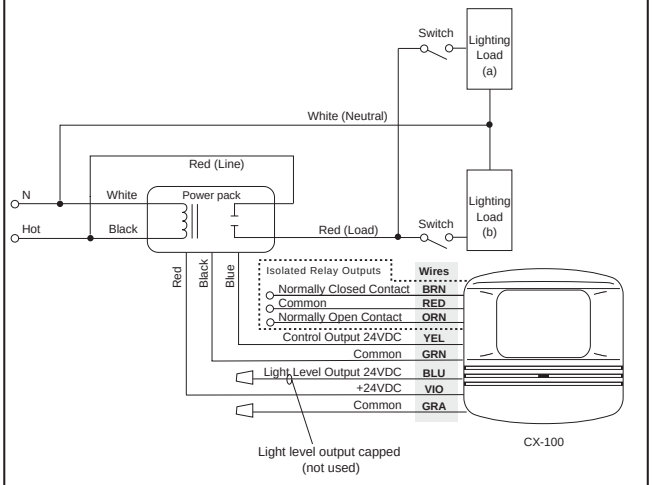
OF-K1.0 Installation Notes

1. Mount CX-100 in corner and aim at opposing corner to provide a full view of the room but not out the door.
2. CX-100 is shipped with a factory preset time delay of 18 minutes, the recommended minimum for kitchens and with sensitivity setting at maximum. Refer to installation instructions if adjustments are necessary.
3. Use a minimum of 22 gauge wire for low voltage wiring. See Technical Bulletin TB-124 on Voltage Loss at www.wattstopper.com.
4. CX-100 sensors isolated relay can provide status information to the BAS and/or control HVAC loads.
5. Confirm night light/egress lighting requirement with local code officials.

CX-100 Passive Infrared Sensor Installation



CX-100 Passive Infrared Sensor Wiring Diagram



Equipment Schedule

Catalog No.	Qty	Description
CX-100	1	Passive infrared occupancy sensor, isolated relay, wide angle lens
B277E-P	1	Power pack, 277 VAC, 60 Hz
AC1 Series	2	Wall switch, Pass & Seymour/legrand, AC1 series, single pole
SP Series	1	Wall plate, Pass & Seymour/legrand, SP series, 2-gang

OF-OP1.0 Open Office: time scheduling • daylighting

Control Needs	Solution
Manual ON and scheduled OFF during business hours	Dataline switches and time clock in Smartwired lighting control panel
Manual override ON with automatic shut off for after hours	Dataline switch and time clock in Smartwired lighting control panel
Continuously dim luminaire rows adjacent to windows based on daylight	Daylight dimming controller with photocell (LCD series)
Occupancy-based control of HVAC	Isolated relays in Universal Switch Module
Manual ON/automatic OFF of wallwash luminaires	Dataline switch
Night lights ON all of the time	Night lights are not controlled
Night lights operate during power outage	Power night lights through emergency panel
Bi-level switching (required for California Title 24 - not shown)	Tandem-wired ballast and additional dataline switch buttons (not shown)
Occupancy-based control of workstation plug loads	Isolé power strip with personal sensor (see OF-CU1.0 p.17)

Application Description

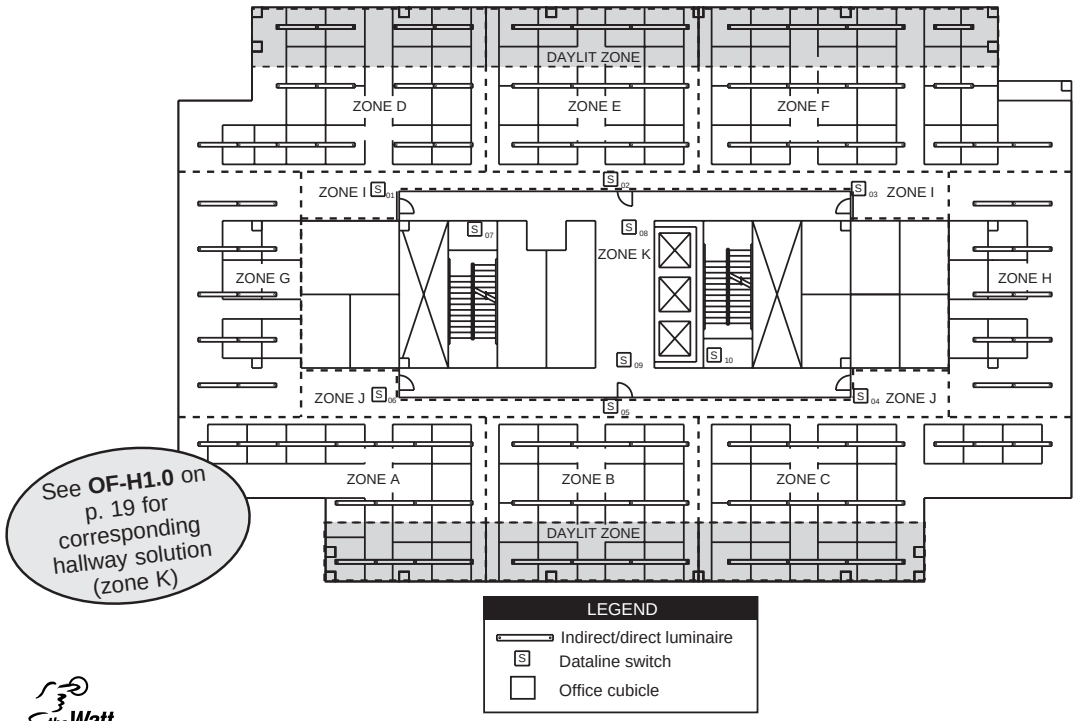
Space use:	Open office activities including administration, clerical, filing, copy areas, finance, engineering, sales
Dimensions:	Based on 30’ bays, irregular shape; approx. 16,500 sq ft
Ceiling height:	10’
Cubicle dimensions:	8’ x 8’ x 5’
Windows:	View windows along north and south facades
Window blinds:	Horizontal blinds

Lighting

Pendant mounted indirect/direct luminaires using two T8 lamps and 2-lamp 277 volt electronic, program start ballasts. 0-10 volt electronic dimming ballasts are used in luminaires in the daylit zone. Compact fluorescent wallwashers highlighting the north and south interior walls, using 42-watt triple tube CFL lamps and 277 volt electronic ballasts.

Design Considerations

Lighting in the open office is manually turned on using the dataline switches, and scheduled OFF using a time clock located in a Smartwired lighting control panel. All pendant lights are controlled on the same channel and remain on during the day. Lighting status signals are sent to the HVAC/BAS system using isolated relays in the Universal Switch Module. For compliance with California’s Title 24, each lighting zone must have an additional button on the dataline switch to provide bi-level lighting control (not shown). To comply, wiring from relays in the lighting control panel must be circuited to turn off at least one half of the lighting in any zone while maintaining a uniform level of illuminance throughout the space.

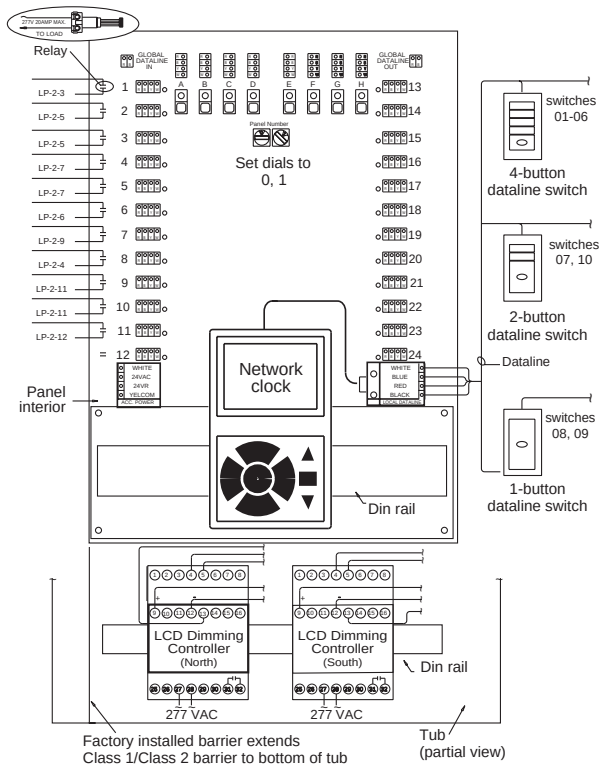


See **OF-H1.0** on p. 19 for corresponding hallway solution (zone K)

Time Scheduling

Lighting is scheduled off at 6:00pm using a time clock located in a Smartwired lighting control panel. A warning function is provided that blinks lights 5 minutes before turning lights off. Occupants can press the dataline switch to prevent lights from turning off, and extend operation for 2 hours. After hours and on weekends, lighting can be activated using the dataline switches. A 2 hour override is used during these off-hours.

Smartwired Panel Wiring Diagram



Panel Documentation

SMARTWIRED SWITCHING SYSTEM
RELAY SCHEDULE

PANEL NUMBER LCP-2

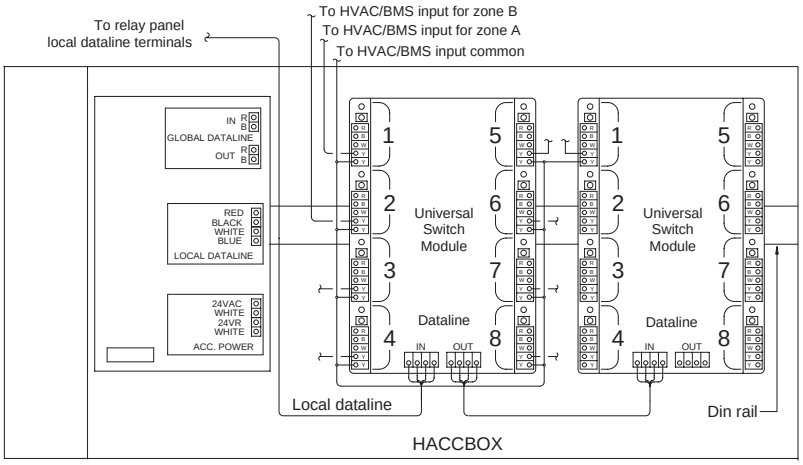
Note: Check those relays which are controlled b automation channel under that channel letter be (Each relay can only be associated with one cha

RELAY NUMBER	CIRCUIT	LOAD DESCRIPTION	AUTOMATION CHANNEL A	B	C	D	E	F	G
-01	LP-2-3	Open Office - Zone A	X						
-02	LP-2-5	Open Office - Zone B	X						
-03	LP-2-5	Open Office - Zone C	X						
-04	LP-2-7	Open Office - Zone D	X						
-05	LP-2-7	Open Office - Zone E	X						
-06	LP-2-6	Open Office - Zone F	X						
-07	LP-2-9	Open Office - Zone G	X						
-08	LP-2-4	Open Office - Zone H	X						
-09	LP-2-11	Wallwash - Zone I		X					
-10	LP-2-11	Wallwash - Zone J		X					
-11	LP-2-12	Elevator Lobby/Corridors - Zone K			X				
-12									
-13									
-14									
-15									

SMARTWIRED SWITCHING SYSTEM
NETWORK CLOCK AUTOMATION

CHANNEL	DESCRIPTION OF GROUP	AUTOMATION SCENARIO	DATA
A	Open Office	☐ SCHEDULED ON/OFF	Open 8am - 6pm M-F
		■ MANUAL ON/SCHEDULED OFF	Blink warning
		☐ MANUAL ON/SWEEP AUTO SW	Timed override 120min.
		☐ ASTRO (DARK) ON/OFF	
		☐ ASTRO (DARK) ON/SCHED OFF	
B	Wallwash North and South	☐ SCHEDULED ON/OFF	Open 8am - 6pm M-F
		■ MANUAL ON/SCHEDULED OFF	Timed override 120min.
		☐ MANUAL ON/SWEEP AUTO SW	
		☐ ASTRO (DARK) ON/OFF	
		☐ ASTRO (DARK) ON/SCHED OFF	
C	Elevator/Lobby Corridors	☐ SCHEDULED ON/OFF	Open 8am - 6pm M-F
		■ MANUAL ON/SCHEDULED OFF	Timed override 120min.
		☐ MANUAL ON/SWEEP AUTO SW	
		☐ ASTRO (DARK) ON/OFF	
		☐ ASTRO (DARK) ON/SCHED OFF	
D		☐ SCHEDULED ON/OFF	
		☐ MANUAL ON/SCHEDULED OFF	
		☐ MANUAL ON/SWEEP AUTO SW	
		☐ ASTRO (DARK) ON/OFF	
		☐ ASTRO (DARK) ON/SCHED OFF	

HVAC/BAS Interface - Universal Switch Wiring

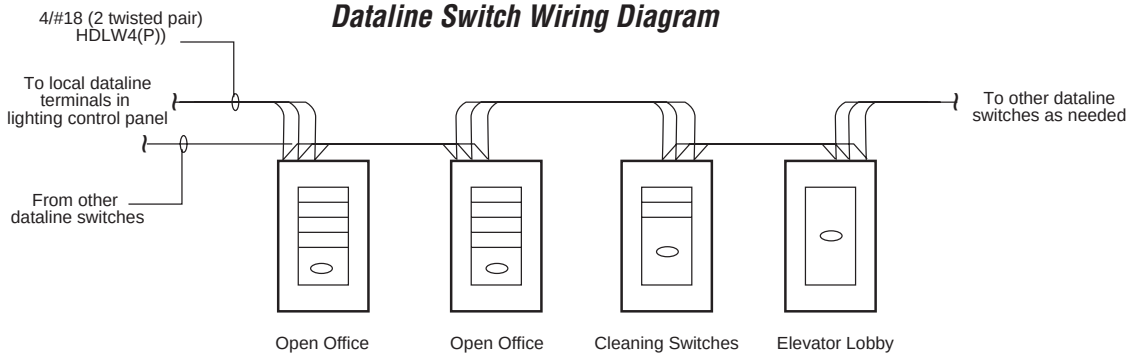


Each isolated relay in the universal switch controls a zone. For example, isolated relay 1 controls Zone A, Isolated relay 2 controls Zone B, etc.

Manual Overrides

Individual space control is required by ASHRAE 90.1-2001. Since the open plan area is greater than 10,000 sq ft, the maximum control zone size is 10,000 sq ft. However, the open office area is divided into 8 zones to provide local zone switching and overrides using the dataline switches. Each switch is programmed to control one relay, and must be manually activated to turn lighting on. If needed, reprogramming can be done simply at either the switch or lighting control panel locations.

Dataline Switch Wiring Diagram



Dataline Switch Documentation

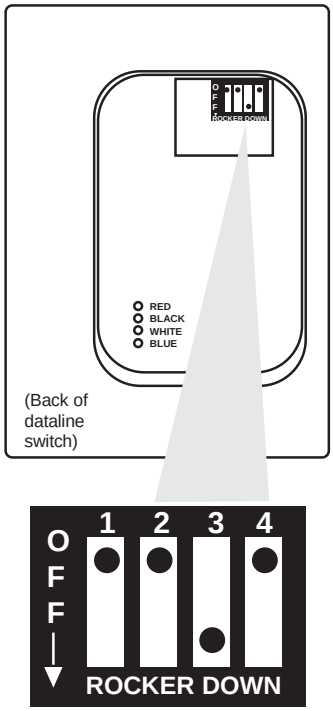
SMARTWIRED SWITCHING SYSTEM
DATALINE SWITCH DOCUMENTATION

PANEL NUMBER LCP-2

Note: Use this form for Dataline Switches and/or Universal Switch Modules connected to the local Dataline of the panel number indicated above.

SWITCH DESIGNATION	BUTTON# (8 MAX)[1]	RELAYS[2] CONTROLLED PANEL # - RELAYS[2]	DESCRIPTION	SPECIAL FUNCTION
1	1	R7	Zone G	
	2	R4	Zone D	
	3	R5	Zone E	
	4	R9	Zone I	
2	1	R4	Zone D	
	2	R5	Zone E	
	3	R6	Zone F	
	4	R9	Zone I	
3	1	R8	Zone H	
	2	R6	Zone F	
	3	R5	Zone E	
	4	R9	Zone I	
4	1	R8	Zone H	
	2	R3	Zone C	
	3	R2	Zone B	
	4	R10	Zone J	
5	1	R1	Zone A	
	2	R2	Zone B	
	3	R3	Zone C	
	4	R10	Zone J	
6	1	R7	Zone G	
	2	R1	Zone A	
	3	R2	Zone B	
	4	R10	Zone J	
7	1	R1 - R3, R8	Zones A,B,C,H	Cleaning Switch
	2	R4 - R7	Zones D,E,F,G	Cleaning Switch
8	1	R11	Zone K	
9	1	R11	Zone K	
10	1	R1 - R3, R8	Zones A,B,C,H	Cleaning Switch
	2	R4 - R7	Zones D,E,F,G	Cleaning Switch

Cleaning Switch Setting



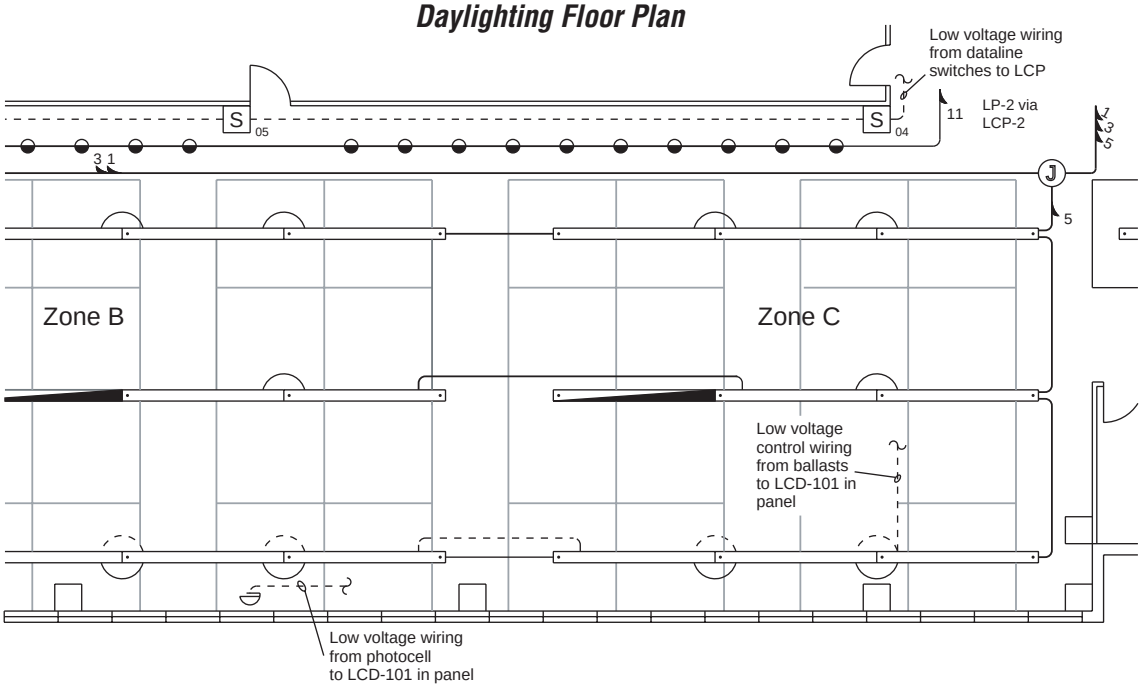
Cleaning Switches

Cleaning switches are provided in the janitorial closets located in the core area. The third DIP switch must be set to the off position in order to change operation to provide a cleaning function. This function allows the cleaning staff to turn on or off a large area without affecting occupants in the space. When in cleaning mode, any button on the switch will turn on the relays that are Smartwired to the switch button. This is similar to the standard configuration; however, when the button is toggled off, any relays that are on because of an occupant override will remain on.

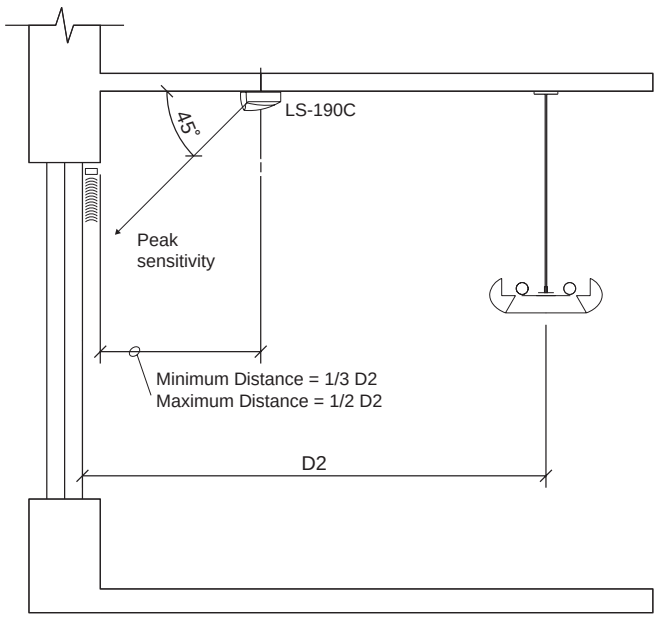
Daylighting

The single zone LCD dimming system is used for automatically dimming lights based upon available daylight. The LS-190C photocell reads light levels at the window and provides this information to the LCD control module, which raises or lowers light output accordingly. Each daylight control zone uses its own photocell, so that variations in daylight based upon compass orientation are accounted for. Since the LCD modules are located in the lighting control panels, long tubs (-D designation) are used.

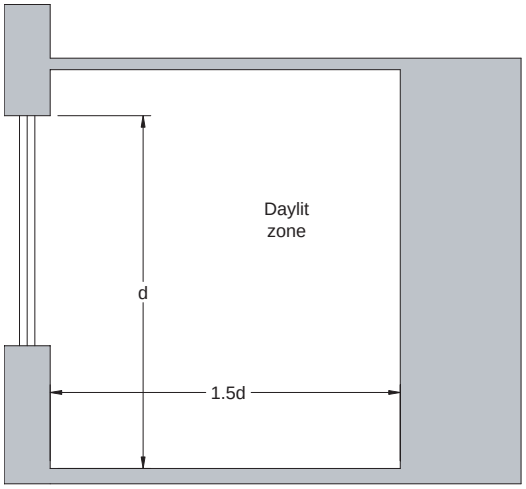
Daylighting Floor Plan



Photocell Placement Guidelines

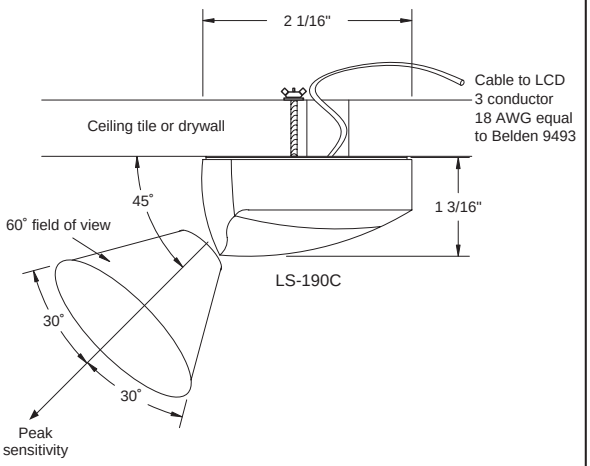


Daylit Zone Approximation

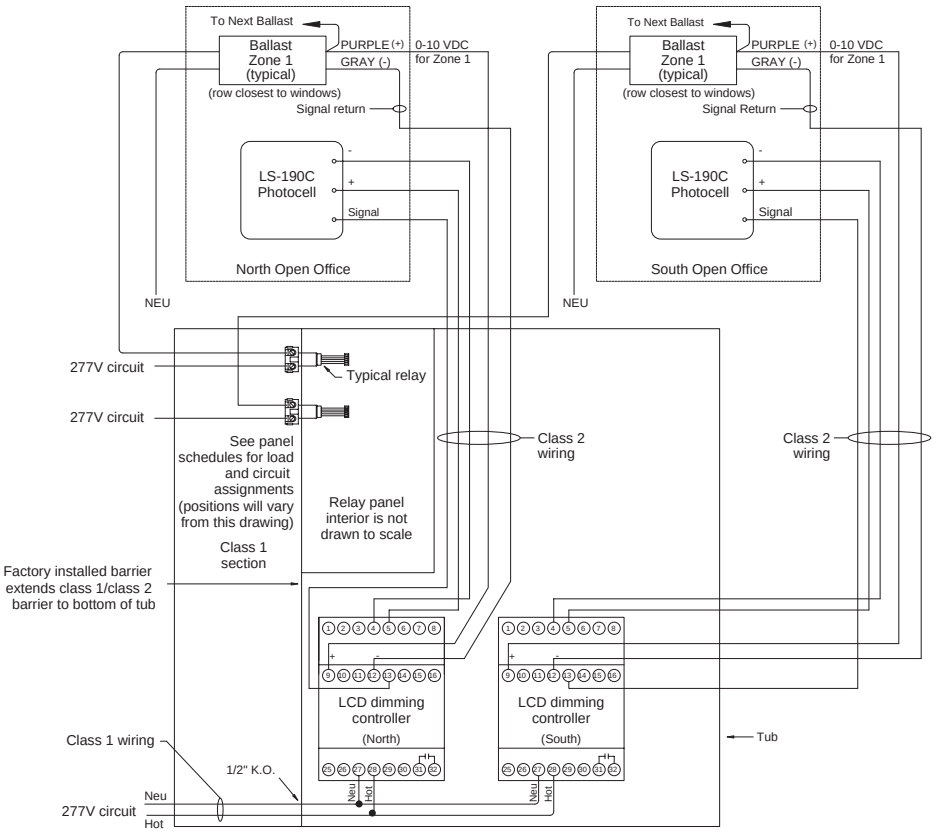


A rule of thumb for daylight penetration with typical depth and ceiling height is 1.5 times head height for standard windows. (Tips for Daylighting, LBNL-39945.)

LS-190C Installation



Smartwired Control Panel and Dimming Wiring Diagram



OF-OP1.0 Installation Notes

Smartwired Lighting Control Panel

1. Refer to Smartwired Switching System Installation and Operation Summary for detailed installation and operation instructions of the lighting control panel.
2. Commission the time clock according to the Network Clock Automation Scenarios documentation, and test the operation after commissioning.
3. Assign relays to the channels as shown on the Smartwired Relay schedule.

Daylighting

1. Mount the LS-190C photocell on the ceiling, and position it so that it has a view of the upper portion of the window, and minimal incident light from the luminaires. Secure with screws.
2. Use the dimming response worksheet, provided with the LCD system to set-up and calibrate the system.
3. Use the FX-200 Illuminometer digital light meter for taking illuminance measurements during system set-up and calibration.
4. Two dimming controllers (LCD-101-277) will be field installed on the DIN rail of the HTUB24D.

Other

1. Confirm night light/egress lighting requirement with local code officials.

Equipment Schedule *(per floor)*

Catalog No.	Qty	Description
Smartwired		
HIN24R24SP	1	Smartwired lighting control panel interior, 24 relays
HTUB24D	1	Tub enclosure for lighting control panel with DIN rail, up to 24 relays (30.5”x24”x4.5”)
HCVR24SLD	1	Surface mounted cover for lighting control panel, up to 24 relays (30.7”x24.2”x.75”)
HCLK8SS	1	Network clock/programmer for Smartwired control lighting control panel (one per building)
HUSM8SS	1	Universal switch interface module
HPSM115/277	1	Power supply for lighting control panel, 115/277 VAC, 50/60 Hz
HDLS4SS	6	Dataline switch, 4 buttons plus master, single gang, includes wall plate
HDLS2SS	2	Dataline switch, 2 buttons plus master, single gang, includes wall plate
HDLS1SS	2	Dataline switch, 1 button, single gang, includes wall plate
HDLW4		Dataline wire, 18 AWG (7 strands x 26 AWG) using 2 independent twisted pair (specify feet)
Daylighting		
LCD-101-277	2	LightSaver dimming control module, 277 volt, single zone
LS-190C	2	Photocell, 30-3000 footcandle range
FX-200	1	Digital light meter, liquid crystal display, automatic zero adjustment (commissioning tool)
Other		
IDP-3050-A	1 per cubicle	See OF-CU1.0 on pages 17-18

OF-OP1.1 Open Office with Light Shelf: *time scheduling • daylighting*

Control Needs	Solution
Two-zone daylighting control of luminaire rows adjacent to windows and middle row	Multizone daylight dimming controller with photocell (LCD series)
Time scheduling, manual switching, night lighting, and plug load controls	See OF-OP1.0 p.25

Application Description

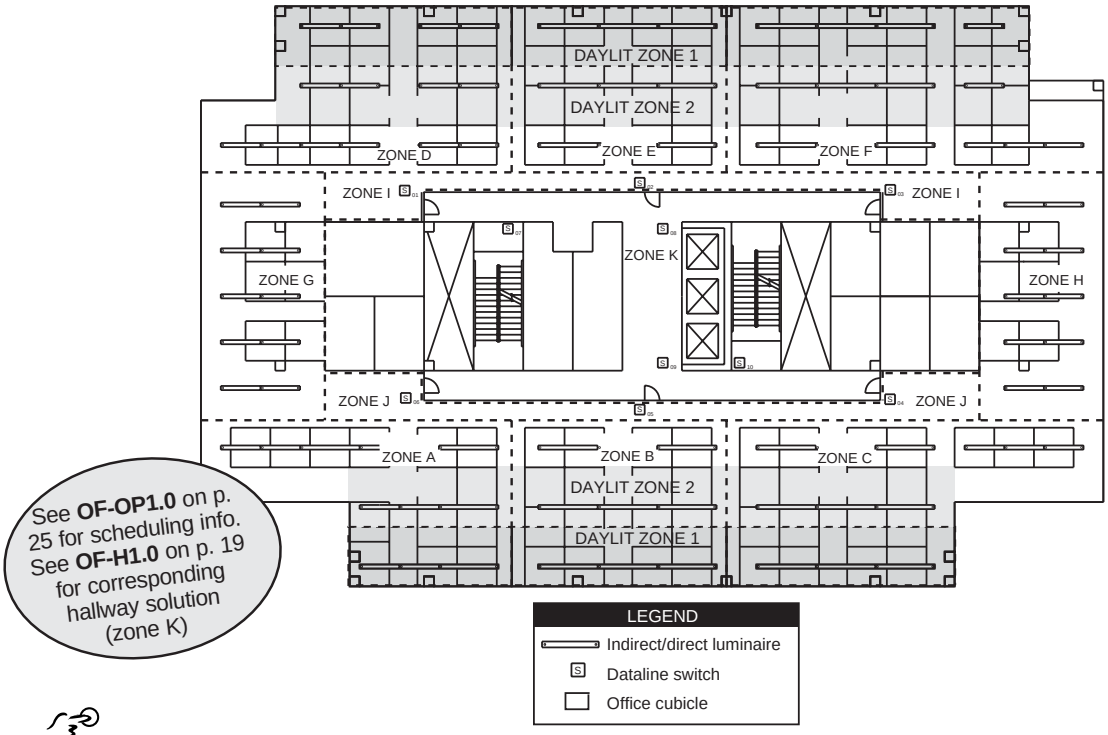
Space use:	Open office activities including administration, clerical, filing, copy areas, finance, engineering, sales
Dimensions:	Based on 30' bays, irregular shape; approx. 16,500 sq ft
Ceiling height:	12'
Cubicle dimensions:	8' x 8' x 5'
Windows:	View windows along north and south facades, with light shelf
Window blinds:	None

Lighting

Pendant mounted indirect/direct luminaires using two T8 lamps and 2-lamp 277 volt electronic, program start ballasts. Compact fluorescent wallwashers highlighting the north and south interior walls, using 42-watt triple tube CFL lamps and 277 volt electronic ballasts. Electronic 0-10VDC dimming ballasts are used in the luminaires that are dimmed.

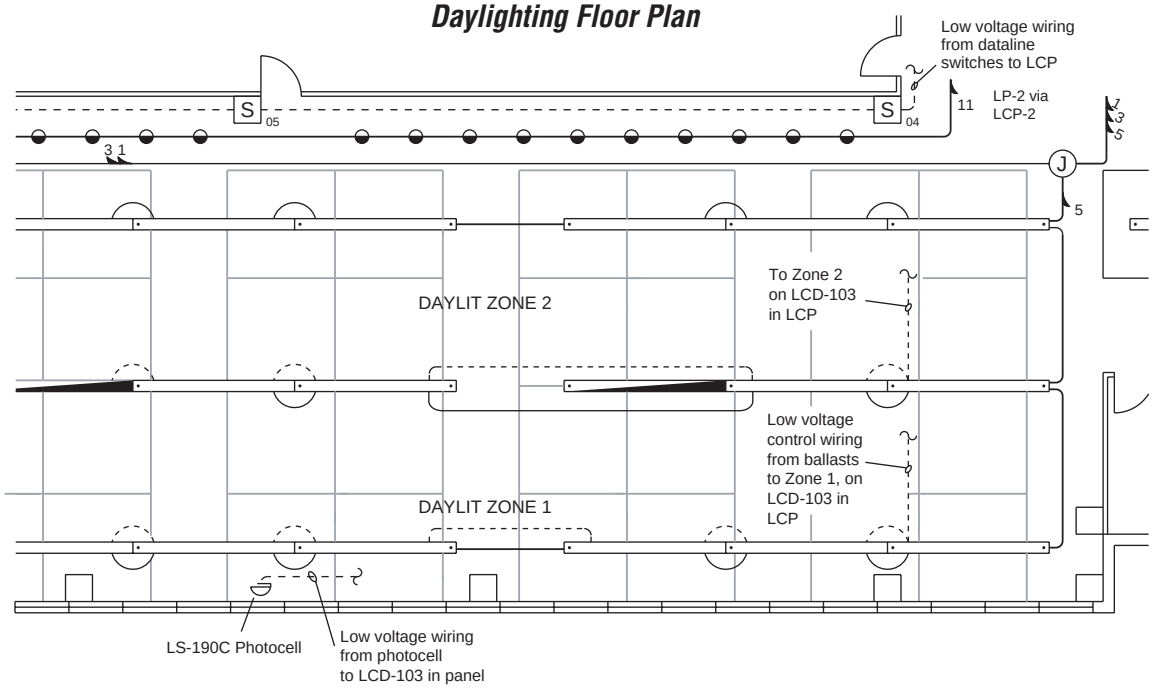
Design Considerations

Lighting is controlled based on time schedules, manual control and daylighting, as in OF-OP1.0 (see page 25). The LCD dimming system is used for automatically dimming two lighting zones based upon available daylight. The LS-190C photocell reads light levels at the window, and provides this information to the LCD control module, which raises or lowers electric light output accordingly. One photocell is used for the north facade, and one for the south, so that variations in daylight are accounted for. Each photocell is wired to one multizone LCD module, which is used for setting the calibration levels for each daylight control zone. The LCD modules are located in the lighting control panel to facilitate commissioning and maintenance. Long panels (-D designation) are required.

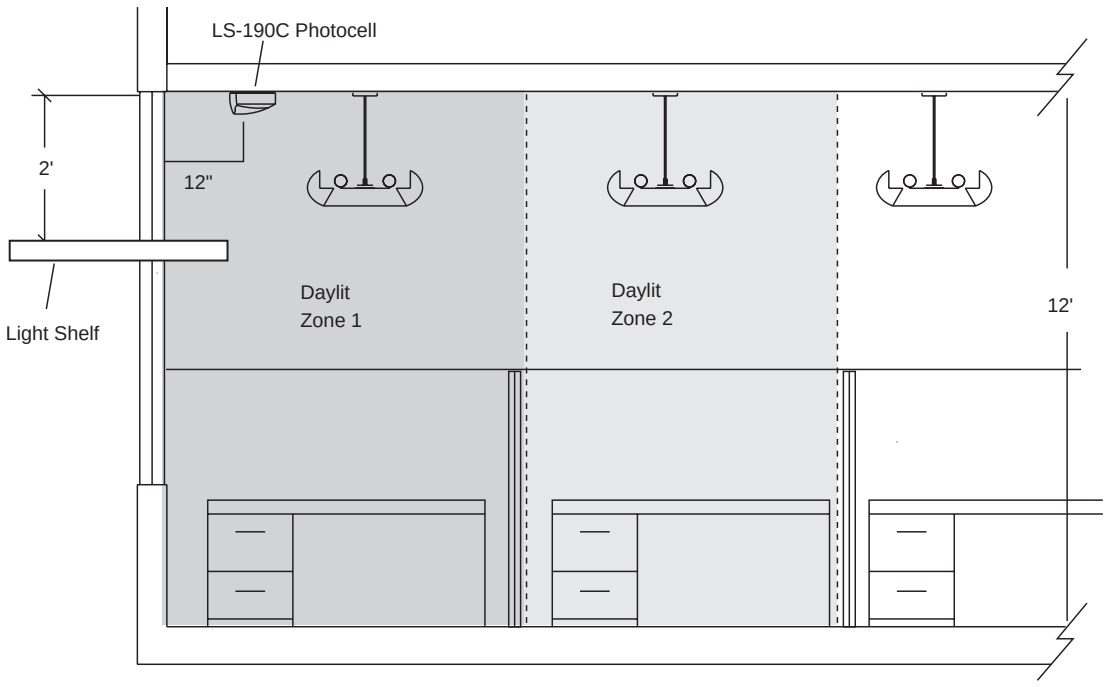


See **OF-OP1.0** on p. 25 for scheduling info. See **OF-H1.0** on p. 19 for corresponding hallway solution (zone K)

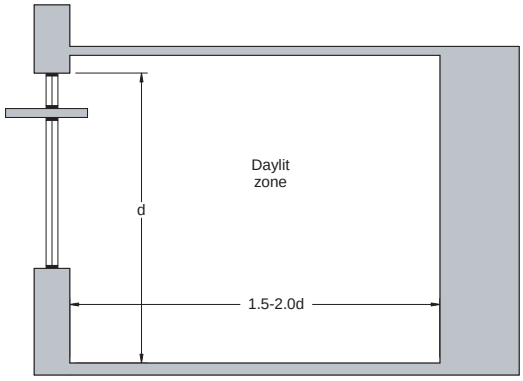
Daylighting Floor Plan



Photocell Placement Guidelines

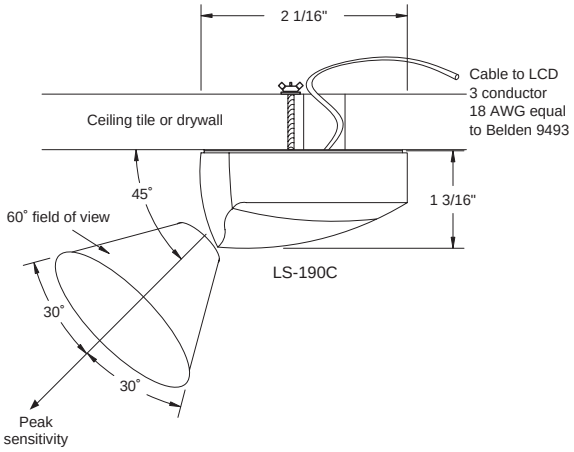


Daylit Zone Approximation

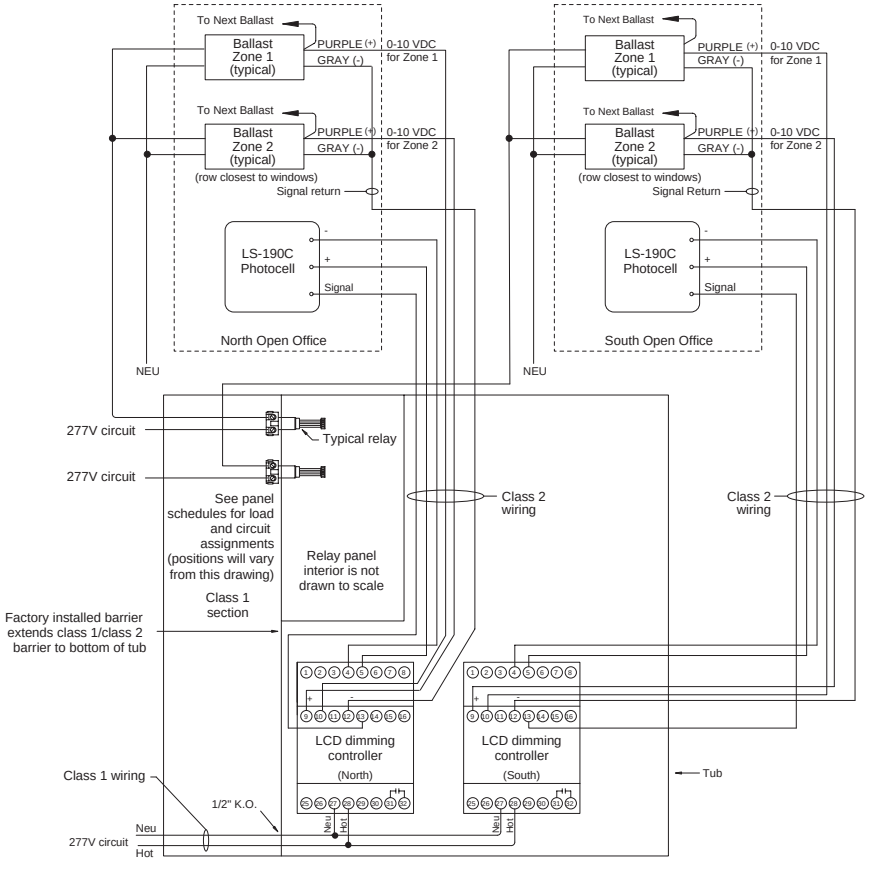


A rule of thumb for daylight penetration with typical depth and ceiling height is 1.5-2.0 times head height with light shelf, for southfacing windows under direct sunlight.
(Tips for Daylighting, LBNL-39945.)

LS-190C Installation



Smartwired Control Panel and Dimming Wiring Diagram



OF-OP1.1 Installation Notes

1. Mount the LS-190C photocell on the ceiling, and position it so that it has a view of the upper portion of the window, and minimal incident light from the luminaires. Secure with screws.
2. Use the dimming response worksheet, provided with the LCD system to set-up and calibrate the system.
3. Use the FX-200 Illuminometer digital light meter for taking illuminance measurements during system set-up and calibration.
4. Confirm night light/egress lighting requirement with local code officials.
5. For Smartwired Lighting Control Panel installation notes, see OF-OP1.0 on page 30.

See OF-OP1.0 (pages 26-27) for:

• Wiring Diagrams

• Panel Documentation

Equipment Schedule *(per floor)*

Catalog No.	Qty	Description
LCD-103-277	2	LightSaver dimming control module, 277 volt, three zone, mounted in lighting control panel
LS-190C	2	Photocell, 30-3000 footcandle range
FX-200	1	Digital light meter, liquid crystal display, automatic zero adjustment (LightSaver commissioning tool)
Lighting Control Panel		See OF-OP1.0 on pages 25-30
Dataline Switches		See OF-OP1.0 on pages 25-30
Plug Load Control		See OF-CU1.0 on pages 17-18

OF-OP2.0 Open Office: occupancy sensing

Control Needs	Solution
Automatically turns lights ON/OFF based on occupancy	Ultrasonic occupancy sensors (W series)
Occupancy-based control of mechanical system	Normally open isolated relay in power pack
Manual ON/automatic OFF of wallwash luminaires	Automatic control switch (AS-110) with normally open relay in power pack
Night lights ON all of the time	Night lights are not controlled
Night lights operate during power outage	Power night lights through emergency panel
Bi-level switching (required for California Title 24 - not shown)	Tandem-wired ballast and additional dataline switch buttons (not shown)
Occupancy-based control of workstation plug loads	Isolé power strip with personal sensor (see OF-CU1.0 p.17)

Application Description

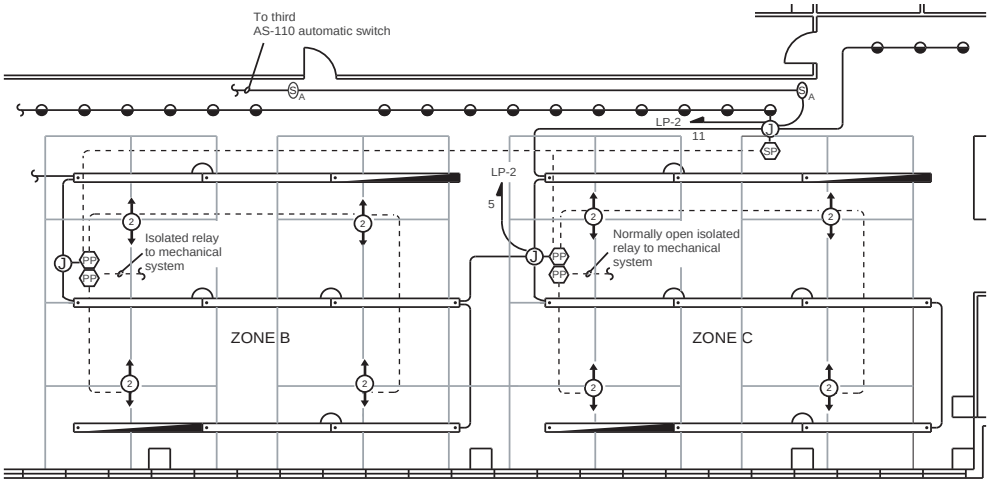
Space use:	Office activities including general administration, clerical, filing, copy areas, financial, engineering, sales
Dimensions:	Based on 30’ bays, irregular shape; approx. 16,500 sq ft
Ceiling height:	10’
Cubicle dimensions:	8’ x 8’ x 5’
Windows:	View windows along north and south facades
Window blinds:	Horizontal blinds

Lighting

Pendant mounted indirect/direct luminaires using two T8 lamps and 2-lamp 277 volt electronic, program start ballasts. Compact fluorescent wallwashers highlighting the north and south interior walls, using 42 watt triple tube CFL lamps and 277 volt electronic ballasts.

Design Considerations

Pendant lighting is automatically turned on and off using the W series ultrasonic occupancy sensors. The sensors are spaced on a 20’ x 16’ grid to control individual zones, and to assure adequate coverage with partitions. Wallwashers are manually turned on as a person enters the area using the AS-110 automatic control switch. While the area is occupied, the occupancy sensor will hold the lighting on. After the area is vacated and after the sensor’s time delay expires, power interruption to the load will occur and wallwashers will turn off. If this happens while the area is still occupied, movement in the area within 15 seconds will turn lighting back on. If no motion is detected within 15 seconds, the AS-110 will keep wallwashers off, and the switch will need to be pushed to turn lighting on again. Each AS-110 switch is wired for 3-way operation and can be used for turning wallwashers on or off, or for overriding a shut off signal. For compliance with California’s Title 24, two wall switches must be added for bi-level and area control of lighting in each space (not shown). To comply, the switches must be circuited to reduce the lighting by at least one half while maintaining a uniform level of illuminance.



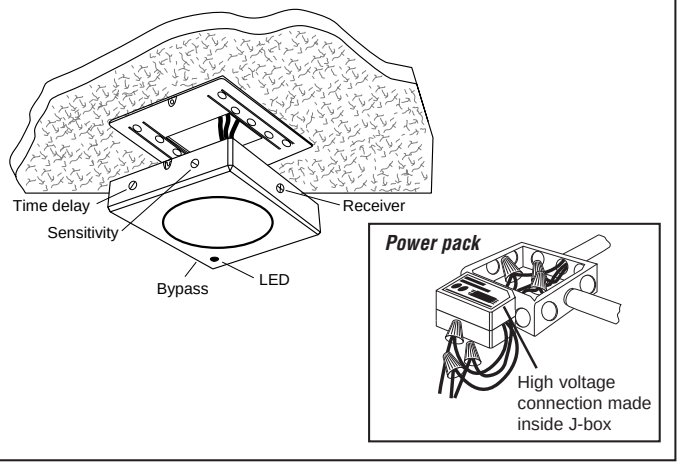
See **OF-H2.0** on page 21 for corresponding hallway solution

LEGEND			
2	W-2000A ultrasonic occupancy sensor		Night light fixture
PP	B277E-P power pack		Wallwashers
SP	S120/277E/347-P auxiliary pack		Indirect/direct Luminaire
J	Junction box		Low voltage wiring
S_A	AS-110 automatic control switch		Line voltage wiring
LP-2	Circuit breaker panel		

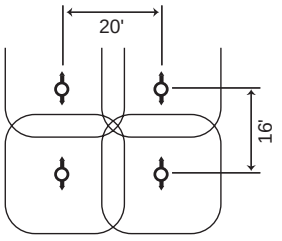
OF-OP2.0 Installation Notes

1. Mount the W series ultrasonic sensor on a rigid, vibration-free surface.
2. W sensor is shipped with a factory preset time delay of 15 minutes, which is the maximum setting, and sensitivity set to 50%. Refer to installation instructions if adjustments are necessary.
3. Use a minimum of 22 gauge wire for low voltage wiring. See Technical Bulletin TB-124 on Voltage Loss at www.wattstopper.com.
4. Confirm night light/egress lighting requirement with local code officials.

W-2000A Installation

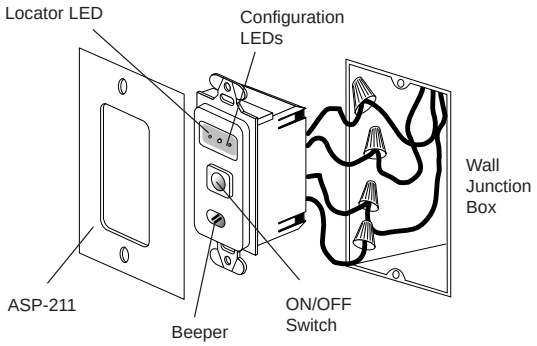


Open Office Sensor Placement

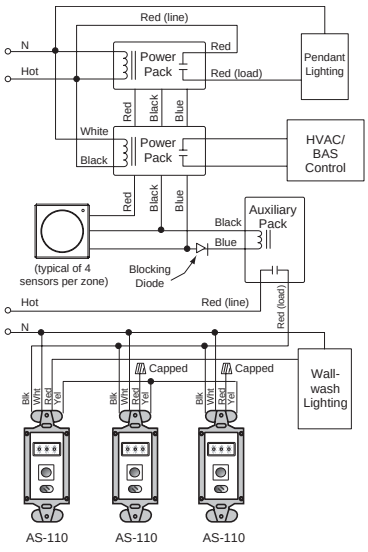


Maximum spacing between sensors is 25 feet

AS-110 Automatic Wall Switch Installation



Wiring Diagram



Equipment Schedule *(per zone)*

Catalog No.	Qty	Description
W-2000A	4 per zone	Ultrasonic occupancy sensor, 2000 sq ft, 360˚ coverage
B277E-P	2 per zone	Power pack, 277 VAC, 60 Hz
S120/277/347E-P	1 per bldg. side	Auxiliary pack, 120/277/347 VAC
1N4001	1 per zone	Blocking diode (by others)
AS-110-277-W	3 per bldg. side	Automatic control switch, 277 VAC, 60 Hz, White
IDP-3050-A	1 per cubicle	See OF-CU1.0 on pages 17-18

OF-OP3.0 Open Office: time scheduling • occupancy sensing • daylighting

Control Needs	Solution
Automatically turn lights ON/OFF based on occupancy after hours and on weekends	Ultrasonic occupancy sensor (WP series)
Time scheduling, daylighting, HVAC, manual switching, night lighting, and plug load control	See OF-OP1.0 p.25
Bi-level switching (required for California Title 24 - not shown)	Tandem-wired ballast and additional dataline switch buttons (not shown)

Application Description

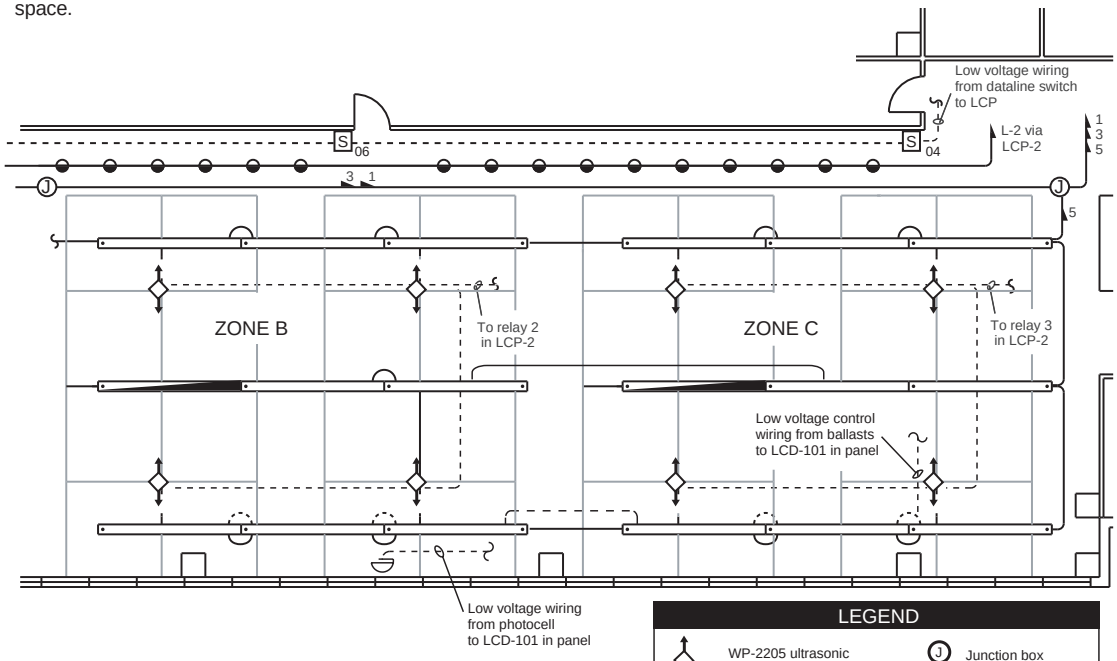
Space use:	Open office activities including administration, clerical, filing, copy areas, finance, engineering, sales
Dimensions:	Based on 30' bays, irregular shape; approx. 16,500 sq ft
Ceiling height:	10'
Cubicle dimensions:	8' x 8' x 5'
Windows:	View windows along north and south facades, with light shelf
Window blinds:	None

Lighting

Pendant mounted indirect/direct luminaires using two T8 lamps and 2-lamp 277 volt electronic, program start ballasts. 0-10 volt electronic dimming ballasts are used in luminaires in the daylit zone. Compact fluorescent wallwashers highlighting the north and south interior walls, using 42-watt triple tube CFL lamps and 277 volt electronic ballasts.

Design Considerations

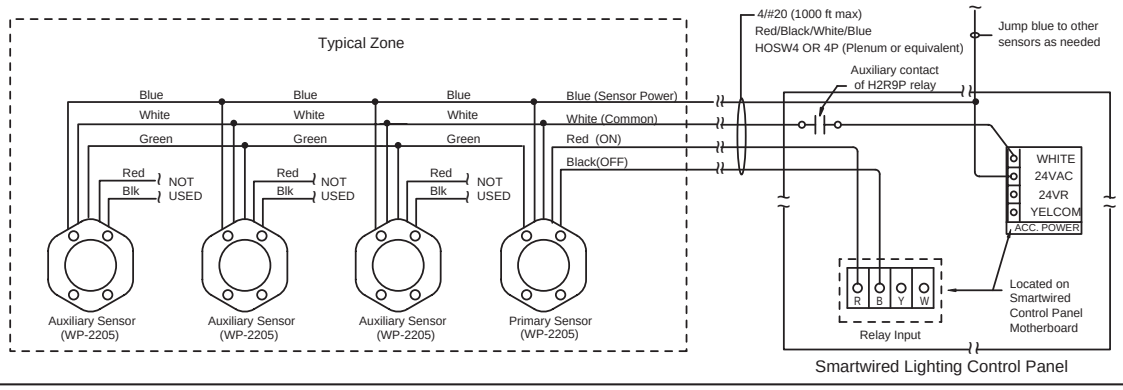
Lighting is controlled based on time schedules, manual control and daylighting, as in OF-OP1.0. In this solution, after hours occupancy-based control is added. After 6:00pm, lights are controlled using ultrasonic occupancy sensors. This turns on lighting only in areas that are occupied. This strategy also provides visual cues to occupants working at night or on weekends that other occupants are in the building. For compliance with California's Title 24, each lighting zone must have an additional button on the dataline switch to provide bi-level lighting control (not shown). To comply, the wiring from relays in the lighting control panel must be circuited to turn off at least one half of the lighting in any zone while maintaining a uniform level of illuminance throughout the space.



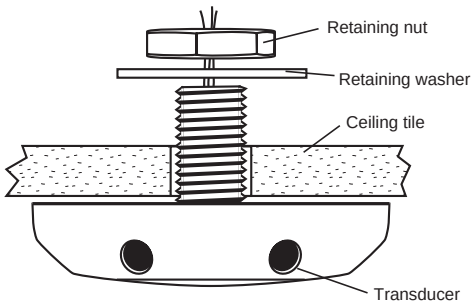
OF-OP3.0 Installation Notes

1. Mount the WP ultrasonic sensor on a rigid, vibration free surface.
2. WP sensor is shipped with a factory preset time delay of 16 minutes and sensitivity set to 50%. Set time delay to at least 20 minutes by adjusting the DIP switches according to the DIP switch setting table in the installation instructions.
3. Each zone of WP sensors are enabled and disabled through the relay's auxiliary contact in the Smartwired Control Panel.
4. Use an additional 24VAC (40A) transformer when more than 15 WP sensors terminate in one Smartwired panel.
5 If an additional transformer is required, only connect the common side and DO NOT connect both transformers in parallel or else the sensor wiring will no longer be Class 2.
6. Use a minimum of 22 gauge wire for low voltage wiring. See Technical Bulletin TB-124 on Voltage Loss at www.wattstopper.com.
7. Confirm night light/egress lighting requirement with local code officials.
8. For Smartwired Lighting Control Panel and Daylighting installation notes, see OF-OP1.0 on page 30.

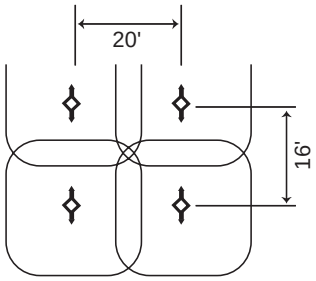
Typical Wiring From WP Sensors to Relay Input



WP-2205 Ultrasonic Occupancy Sensor Installation



Open Office Sensor Placement



Maximum spacing between sensors is 25 feet

Equipment Schedule *(per zone)*

Catalog No.	Qty	Description
WP-2205	4 per zone	Ultrasonic occupancy sensor, 2200 sq. ft., 360˚ coverage
Lighting Control Panel		See OF-OP1.0 on pages 25-30
Dataline Switches		See OF-OP1.0 on pages 25-30
Daylighting		See OF-OP1.0 on pages 25-30
Plug Load Control		See OF-CU1.0 on pages 17-18

OF-PO1.0 Large Private Office: occupancy sensing • plug load control • daylighting

Control Needs	Solution
Automatically turn lights ON/OFF based on occupancy	Corner-mounted dual technology occupancy sensor (DT series)
Manual ON/Manual override OFF	Wall switches
Bi-level switching	2-lamp ballasts controlling row of lamps
Automatically dim luminaire row parallel to windows	Ceiling mounted dimming light level sensor (LS-201)
Occupancy-based control of HVAC system	Isolated relay on occupancy sensor
Occupancy-based control of workstation plug loads	Isolé power strip with personal sensor

Application Description

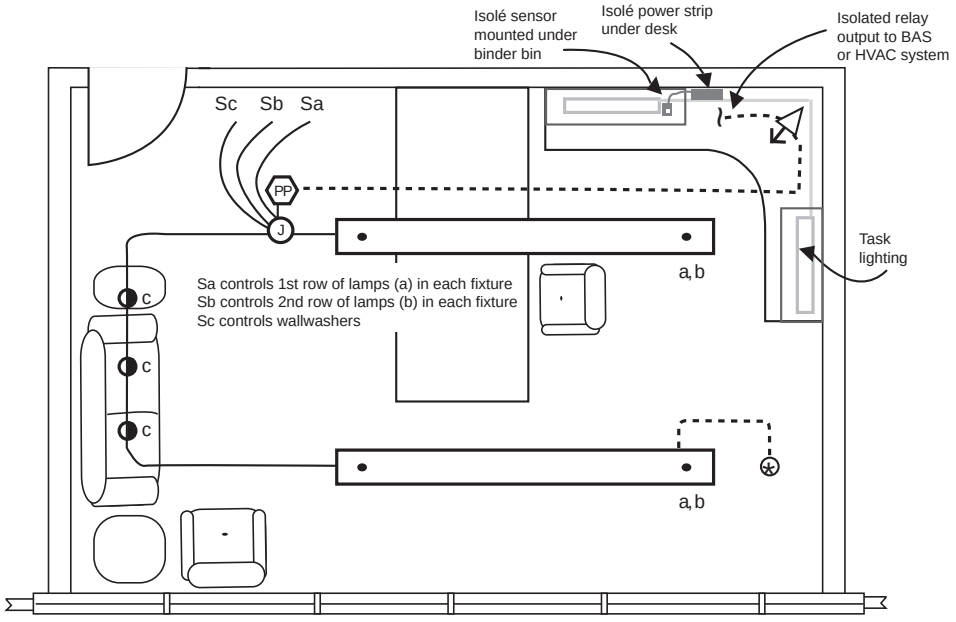
Space use:	Office activities such as reading, computer work
Dimensions:	20’ x 15’
Ceiling height:	10’
Windows:	Windows along one wall providing view to exterior
Window blinds:	Horizontal blinds

Lighting

Pendant mounted 8’ luminaires, using 4 T8 lamps and 2-lamp electronic ballasts. Each 277 volt ballast controls an 8’ run of lamps (end-to-end). Electronic dimming ballasts in luminaire row adjacent to the windows. Recessed compact fluorescent wallwash luminaires highlight artwork.

Design Considerations

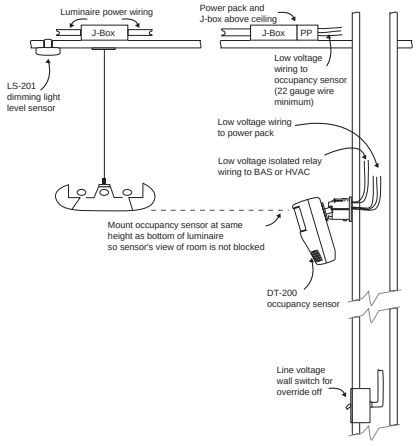
The DT-200 Dual Technology occupancy sensor is used to automatically turn lights off when the room is unoccupied, and turn lights on upon occupancy. The sensor is mounted in the corner, to prevent a view out the doorway that might otherwise result in false activations. An LS-201 dimming light level sensor, mounted on the ceiling, dims the lamps in the row parallel to the window when enough daylight is present. Two wall switches are used to manually override off each row of lamps within the fixtures. A third wall switch is used for switching wallwash lighting. The Isolé plug load control is used at the workstation for turning off plug loads (including task lighting) when the office is unoccupied. The personal sensor is mounted to the underside of the binder bin, so that it is not facing the door, and is facing the primary work area.



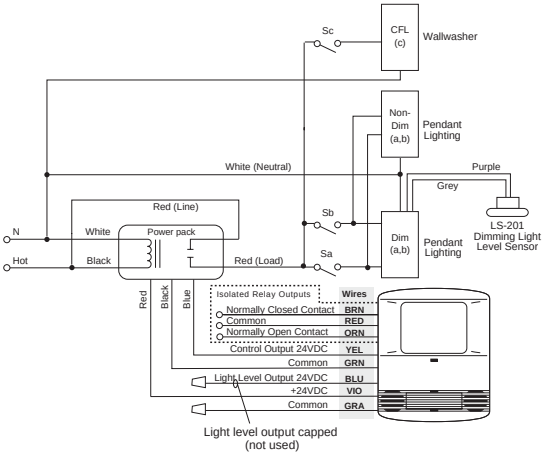
OF-PO1.0 Installation Notes

1. Mount DT-200 occupancy sensor at same height as luminaires so that sensor view is not blocked.
2. Mount DT-200 in corner and aim at opposing corner to provide a full view of the room.
3. DT-200 is shipped with a factory preset time delay of 18 minutes, the recommended minimum for private offices and with sensitivity setting at maximum. Refer to installation instructions if adjustments are necessary.
4. Use a minimum of 22 gauge wire for low voltage wiring. See Technical Bulletin TB-124 on Voltage Loss at www.wattstopper.com.
5. DT-200 sensor isolated relay can provide status information to the BAS and/or control HVAC loads.
6. Mount LS-201 dimming light level sensor between 2 and 3 feet from the end of the luminaire row.
7. Follow installation instructions for LS-201 light level sensor set-up guidelines.
8. Isolé IDP-3050's power strip is mounted under the desk. The personal sensor is mounted under the binder bin.
9. Isolé IDP-3050's personal sensor is shipped with a factory preset time delay of 30 minutes, the recommended setting.
10. Plug only the Isolé personal sensor into the power strip's sensor input jack - otherwise, damage may result.
11. Plug task lighting, monitors, and other devices into the controlled outlets. Plug items to remain on all day (computer CPUs) into uncontrolled outlets.

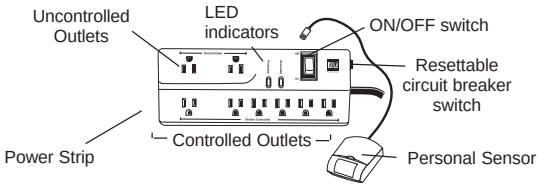
DT-200 Occupancy Sensor Installation



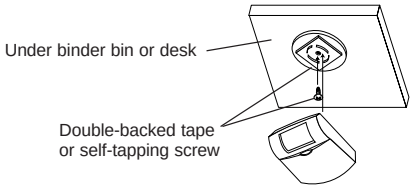
DT-200 Occupancy Sensor Wiring Diagram



IDP-3050 Unit Layout



IDP-3050 Sensor Mounting



Equipment Schedule

Catalog No.	Qty	Description
DT-200	1	Dual technology occupancy sensor, isolated relay, wide angle lens
B277E-P	1	Power pack, 277 VAC, 60 Hz
LS-201	1	LightSaver dimming light level sensor, 0-10 VDC, 60 degree field of view, 15 to 70 fc range
AC1 Series	3	Wall switch, Pass & Seymour/legrand, AC1 series, single pole
SP Series	1	Wall plate, Pass & Seymour/legrand, SP series, 3-gang
IDP-3050-A	1	Isolé eight outlet power strip with auto-ON personal sensor

OF-P01.1 Small Private Office: occupancy sensing • bi-level switching • plug load control

Control Needs	Solution
Automatically turn lights ON/OFF based on occupancy	Wall-mounted passive infrared dual relay wall switch sensor (WI-300)
Manual override ON/OFF	Wall-mounted passive infrared dual relay wall switch sensor (WI-300)
Bi-level switching	Tandem-wired ballasts and dual relay wall switch sensor (WI-300)
Hold OFF 50% lighting upon available daylight	Secondary relay in dual relay wall switch sensor (WI-300)
Occupancy-based control of workstation plug loads	Isolé power strip with personal sensor

Application Description

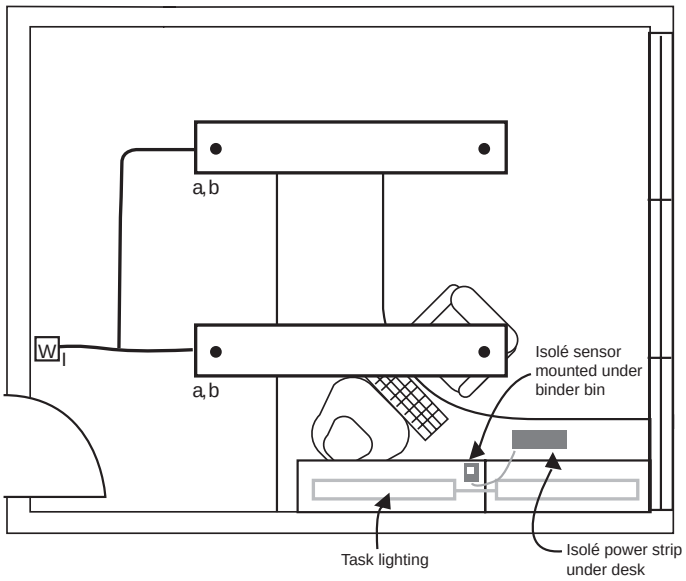
Space use:	Office activities such as reading, computer work
Dimensions:	10’ x 12’
Ceiling height:	10’
Windows:	Windows along one wall providing view to exterior
Window blinds:	Horizontal blinds

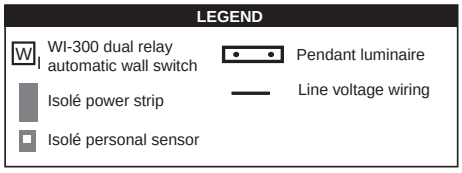
Lighting

Pendant mounted 4’ luminaires, using 3 T8 lamps and 2-lamp tandem-wired electronic ballasts.

Design Considerations

The WI-300 automatic wall switch sensor is used to automatically turn lights off when the office is unoccupied, and turn lights on upon occupancy. The sensor installs in place of a standard wall switch. It must have a clear view of occupants at the workspace and cannot be blocked by furniture such as file cabinets. Dual auto-off buttons, allow the user to manually turn on and off each of 2 loads, providing bi-level control. The WI-300’s built-in light level sensor only affects the secondary relay. If adequate daylight is present, the sensor will hold secondary lights off until natural light levels drop. The Isolé plug load control is used at the workstation for turning off plug loads (including task lighting) when the office is unoccupied. The personal sensor is mounted to the underside of the binder bin, so that it is not facing the door, and is facing the primary work area.

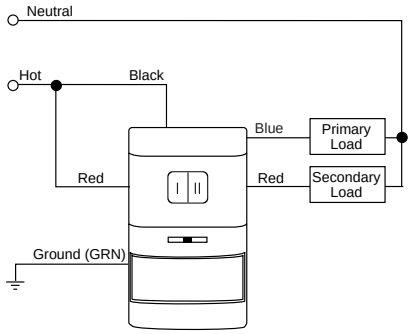




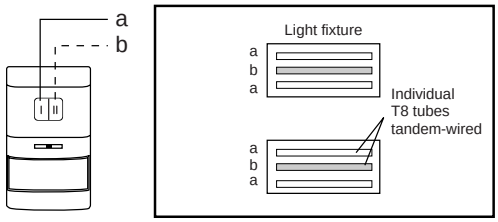
OF-PO1.1 Installation Notes

1. Install WI-300 dual relay PIR wall switch next to door facing occupant workspace so the lens view is not blocked.
2. WI-300 is shipped with a factory preset time delay of 30 minutes and with sensitivity setting at maximum. Refer to installation instructions if adjustments are necessary.
3. Isolé IDP-3050's power strip is mounted under the desk. The personal sensor is mounted under the binder bin.
4. Isolé IDP-3050's personal sensor is shipped with a factory preset time delay of 30 minutes, the recommended setting.
5. Plug only the Isolé personal sensor into the power strip's sensor jack – otherwise, damage may result.
6. Plug task lighting, monitors, and other devices into the controlled outlets. Plug items to remain on all day (computer CPUs) into uncontrolled outlets.

WI-300 Wiring Diagram

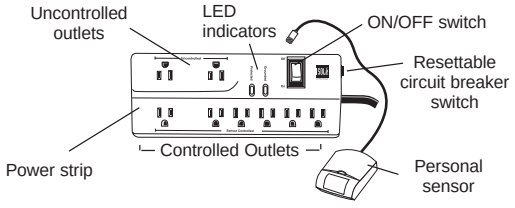


Automatic Bi-level Control

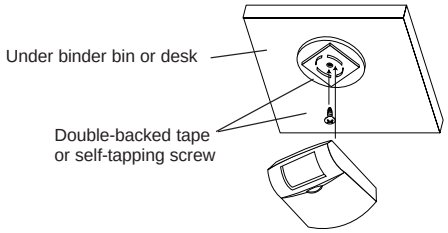


The WI-300 provides bi-level lighting control from a single switch location.

IDP-3050 Unit Layout



IDP-3050 Sensor Mounting



Equipment Schedule

Catalog No.	Qty	Description
WI-300	1	Automatic wall switch, passive infrared technology, 120/277 VAC, 60 Hz, dual relays
IDP-3050-A	1	Isolé eight outlet power strip with auto-ON personal sensor

OF-PO2.0 Private Office: occupancy sensing • plug load control

Control Needs	Solution
Automatically turn lights ON/OFF based on occupancy	Corner-mounted passive infrared occupancy sensor (CX series)
Manual ON/Manual override OFF	Wall switches
Bi-level switching	Tandem-wired ballasts and wall switches
Occupancy-based control of workstation plug loads	Isolé power strip with personal sensor
Occupancy-based control of HVAC system	Isolated relay on occupancy sensor

Application Description

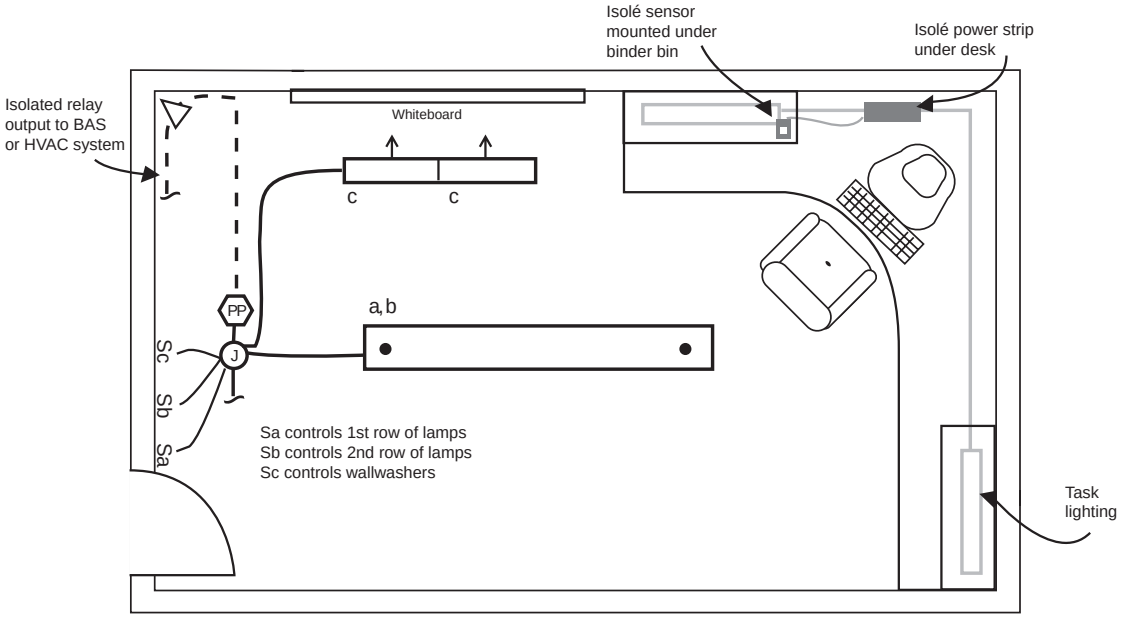
Space use:	Office activities such as reading, computer work
Dimensions:	10’ x 15’
Ceiling height:	10’
Windows:	None
Window blinds:	None

Lighting

Pendant mounted 8’ luminaires, using 6 T8 lamps and 2-lamp tandem wired, 277 volt electronic ballasts, recessed compact fluorescent wallwash luminaires highlight artwork; task lighting under binder bins.

Design Considerations

The CX-100 PIR occupancy sensor is used to automatically turn lights off when the office is unoccupied, and turn lights on upon occupancy. The sensor is mounted in the corner, to prevent a view out the doorway that might otherwise result in false activations. Two wall switches are used for bi-level switching of the lamps in the luminaires. A third wall switch is used for switching wallwash lighting. The Isolé plug load control is used at the workstation for turning off plug loads (including task lighting) when the office is unoccupied. The personal sensor is mounted to the underside of the binder bin, so that it is not facing the door, and is facing the primary work area. For applications not requiring the isolated relay for integration with HVAC or BAS, use a WPIR occupancy sensor.



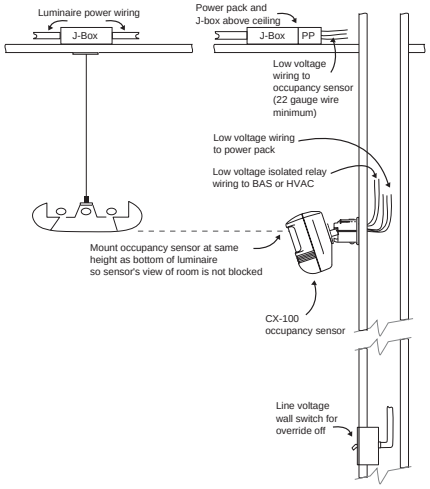
LEGEND

CX-100 PIR occupancy sensor	Junction box
B277E-P power pack	Pendant luminaire
Isolé Power Strip	Wallwash luminaire
Isolé Personal Sensor	Low voltage wiring
S Wall switch	Line voltage wiring

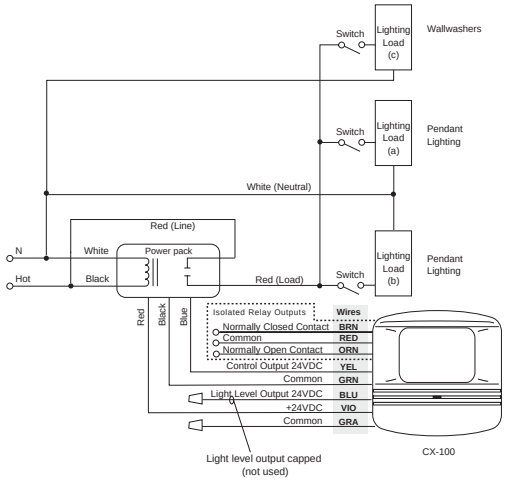
OF-PO2.0 Installation Notes

1. Mount CX-100 occupancy sensor at same height as luminaire so that sensor view is not blocked.
2. Mount CX-100 in corner and aim at opposing corner to provide a full view of the room but not out the door.
3. CX-100 is shipped with a factory preset time delay of 18 minutes, the recommended minimum for offices and with sensitivity setting at maximum. Refer to installation instructions if adjustments are necessary.
4. Use a minimum of 22 gauge wire for low voltage wiring. See Technical Bulletin TB-124 on Voltage Loss at www.wattstopper.com.
5. CX-100 sensors isolated relay can provide status information to the BAS and/or control HVAC loads.
6. Isolé IDP-3050's power strip is mounted under the desk. The personal sensor is mounted under the binder bin.
7. Isolé IDP-3050's personal sensor is shipped with a factory preset time delay of 30 minutes, the recommended setting.
8. Plug only the Isolé personal sensor into the power strip's sensor jack – otherwise, damage may result.
9. Plug task lighting, monitors, and other devices into the controlled outlets. Plug items to remain on all day (computer CPUs) into uncontrolled outlets.

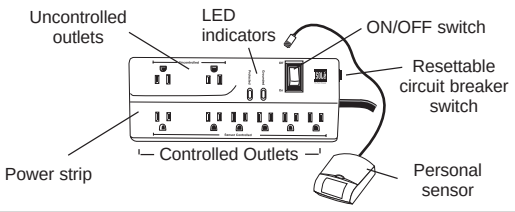
CX-100 Occupancy Sensor Installation



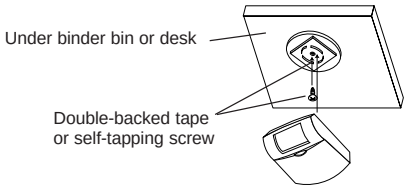
CX-100 Occupancy Sensor Wiring Diagram



IDP-3050 Unit Layout



IDP-3050 Sensor Mounting



Equipment Schedule

Catalog No.	Qty	Description
CX-100	1	CX-100 passive infrared occupancy sensor, isolated relay, wide angle lens
B277E-P	1	Power pack, 277 VAC, 60 Hz
AC1 Series	3	Wall switch, Pass & Seymour/legrand, AC1 series, single pole
SP Series	1	Wall plate, Pass & Seymour/legrand, SP series, 3-gang
IDP-3050-A	1	Isolé eight outlet power strip with auto-ON personal sensor

OF-R1.0 Restroom: occupancy sensing

Control Needs	Solution
Automatically turn lights ON/OFF based on occupancy	Ceiling mounted ultrasonic occupancy sensor (WT-1105)
Control 120 volt exhaust fan with lighting in either restroom	Auxiliary pack for controlling fan using occupancy sensor
Night lights ON all of the time	Night lights not controlled

Application Description

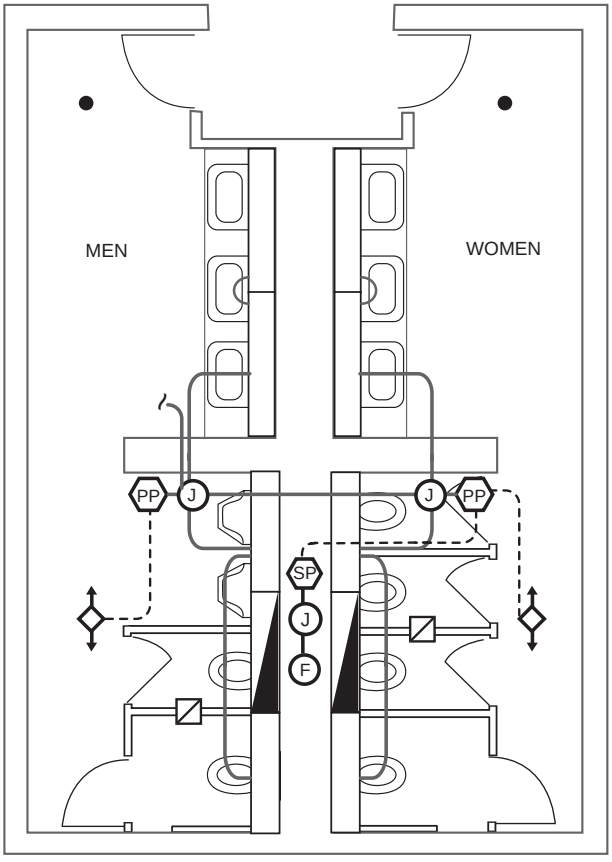
Space use:	Restroom
Dimensions:	11’ x 22’ with 6’ x 4’ alcove (each)
Ceiling height:	10’
Windows:	None
Window blinds:	None

Lighting

Recessed 1 x 4 luminaires using two T8 lamps and a 2-lamp, 277 volt electronic ballast

Design Considerations

A WT-1105 ultrasonic occupancy sensor is ceiling mounted in each restroom, turning lighting on when the restroom is occupied and off when unoccupied. The choice of ultrasonic sensor was made because it can detect occupancy around stall partitions and other obstacles. The sensor is powered by a power pack that is snapped into the junction box knockout. An auxiliary pack is used for controlling the exhaust fan using either restroom’s occupancy sensor. This is necessary since the fan is a different voltage than the lighting load and is on a separate circuit. Night lighting is not controlled and remains on at all times.



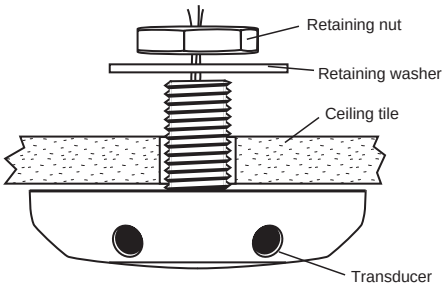
LEGEND

- WT-1105 Ultrasonic occupancy sensor
- PP — B277E-P power pack
- SP — S120/277/347-P auxilary pack
- Exhaust fan registers
- F — 120 volt exhaust fan (shared)
- J — Junction box
- Recessed luminaire
- Night light fixture
- Emergency light fixture
- Low voltage wiring
- Line voltage wiring

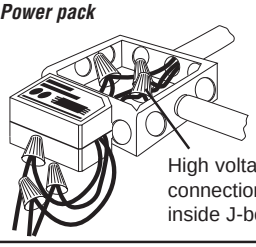
OF-R1.0 Installation Notes

1. Mount power and auxiliary packs to junction box knockout above acoustical tile ceiling. This minimizes wiring and simplifies installation. For drywall ceilings, mount power and auxiliary packs above access panel.
2. Mount WT-1105 in front of stall partitions and centered between privacy wall and far wall.
3. Mount the WT-1105 sensor on a rigid, vibration-free surface, at least six inches from the power pack, four feet from supply air ducts and six feet from horizontal discharge ducts.
4. WT-1105 sensor is shipped with a factory preset time delay of 16 minutes and sensitivity set to 50%, both recommended for restrooms. Refer to installation instructions if adjustments are necessary.
5. Use a minimum of 22 gauge wire for low voltage wiring. See Technical Bulletin TB-124 on Voltage Loss at www.wattstopper.com.
6. Confirm night light/egress lighting requirement with local code officials.

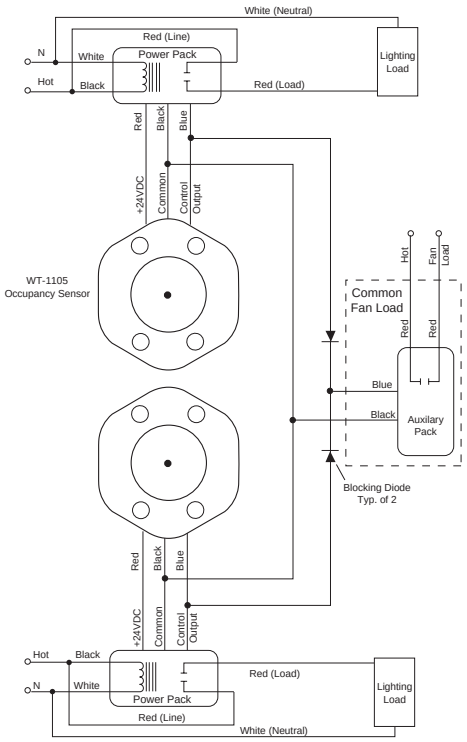
WT-1105 Ultrasonic Sensor Installation



Power pack



WT-1105 Ultrasonic Sensor Wiring Diagram



Equipment Schedule *(for both restrooms)*

Catalog No.	Qty	Description
WT-1105	2	Ultrasonic occupancy sensor, 1000 sq ft, 360° coverage
B277E-P	2	Power pack, 277 VAC, 60 Hz
S120/277/347-P	1	Auxiliary pack, 120/277/347 VAC
1N4001	2	Blocking diode

OF-R2.0 Individual Restroom: occupancy sensing

Control Needs	Solution
Automatically turn lights and fans ON/OFF based on occupancy	Ceiling-mounted passive infrared occupancy sensor (WPIR)
Manual override lighting and fan OFF	Wall switch

Application Description

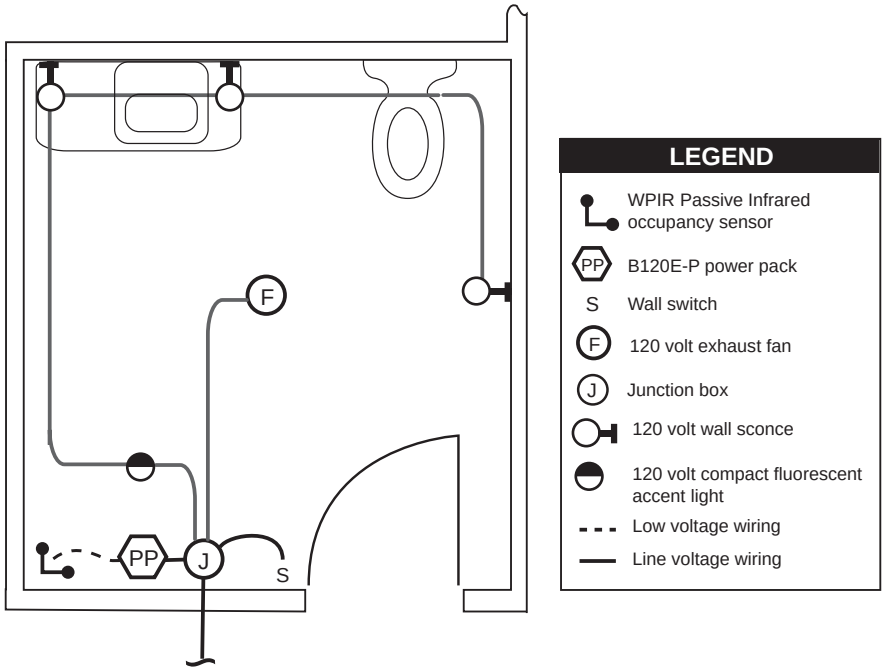
Space use:	Individual or executive restroom
Dimensions:	8’ x 8’
Ceiling height:	10’
Windows:	None
Window blinds:	None

Lighting

120 volt wall sconces mounted on each side of the mirror, and on the wall. One recessed 120 volt compact fluorescent luminaire lighting artwork on the wall.

Design Considerations

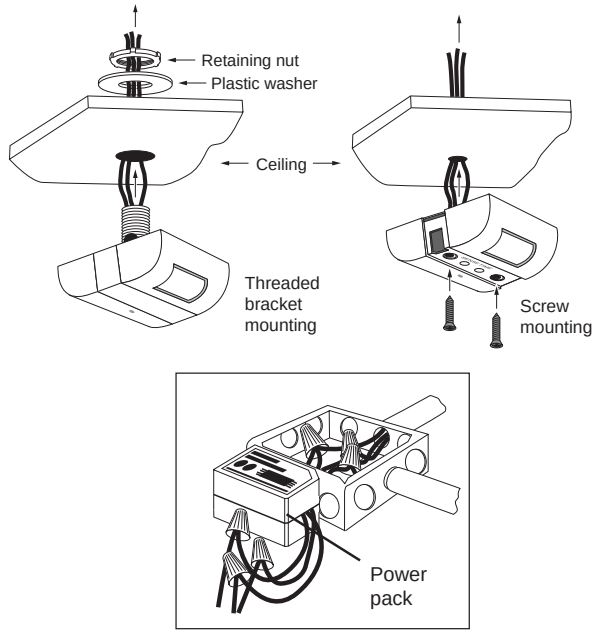
The WPIR passive infrared sensor is mounted on the ceiling, in the corner of the restroom, turning lights and the fan on when the space is occupied and off when vacant. The sensor is powered by a power pack that is located next to the junction box. In this application, the sensor choice is passive infrared because there are no stall partitions that could block the sensor’s view of occupants. The wall switch provides a manual override off of the lighting and the fan.



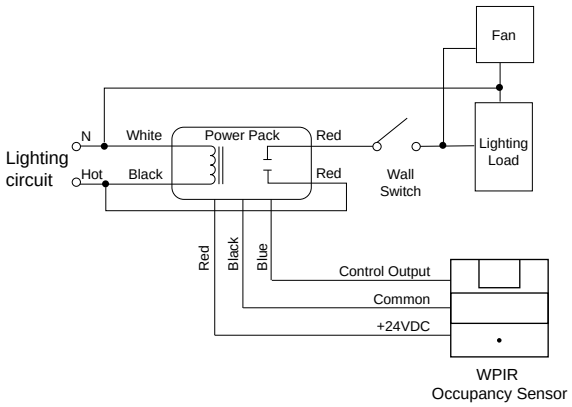
OF-R2.0 Installation Notes

1. Mount power pack next to junction box above acoustical tile ceiling. This minimizes wiring and simplifies installation. For drywall ceilings, mount power pack above access panel.
2. Orient WPIR occupancy sensor so that it is aimed at opposing corner.
3. The WPIR may be mounted to ceiling using either the supplied threaded bracket mounting accessories, or by screw mounting as shown in the installation drawing.
4. The WPIR is shipped with a factory preset time delay of 30 minutes and sensitivity setting at maximum, which should be used for this application. Refer to installation instructions if adjustments are necessary.
5. Use a minimum of 22 gauge wire for low voltage wiring. See Technical Bulletin TB-124 on Voltage Loss at www.wattstopper.com.
6. Confirm night light/egress lighting requirement with local code officials.

WPIR Installation



WPIR Wiring Diagram



Equipment Schedule

Catalog No.	Qty	Description
WPIR	1	Passive infrared occupancy sensor
B120E-P	1	Power pack, 120 VAC, 60 Hz
AC1 Series	1	Wall switch, Pass & Seymour/legrand, AC1 series, single pole
SP series	1	Wall plate, Pass & Seymour/legrand, single-gang

OF-S1.0 Stairwell: occupancy sensing

Control Needs	Solution
Automatically turn lights ON/OFF based on occupancy	Ceiling mounted ultrasonic occupancy sensor (WT-600)
Lights remain ON during power failure	Isolated relay in occupancy sensor
Egress safety	Normally closed power pack and isolated relay in occupancy sensor

Application Description

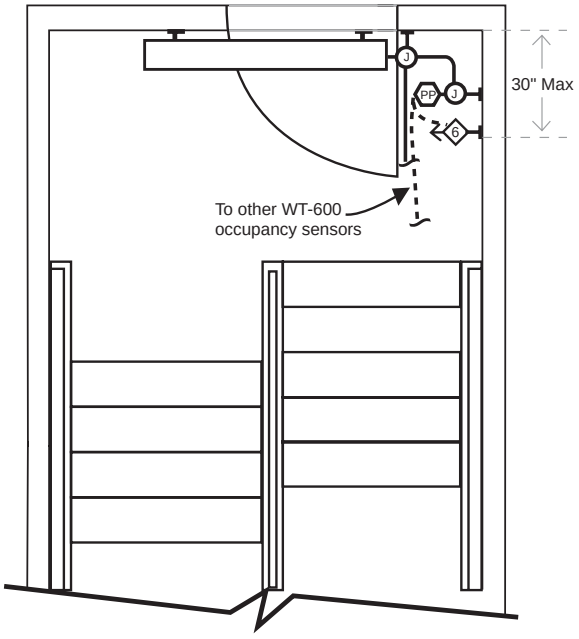
Space use:	Emergency egress, general circulation
Dimensions:	7' x 22'
Ceiling height:	12'
Windows:	None
Window blinds:	None

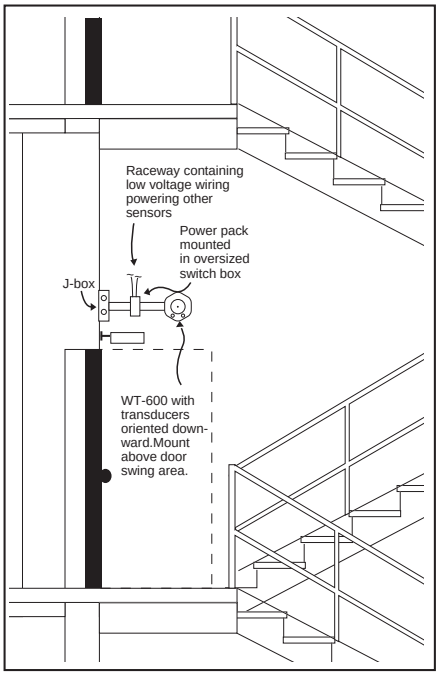
Lighting

Wall mounted indirect/direct luminaires using 2 F32T8 lamps and 277 volt electronic ballasts. Emergency lighting is on an independent emergency circuit.

Design Considerations

The WT ultrasonic occupancy sensor is used to automatically turn lights on and off based on occupancy. The sensor is commonly located on the wall, instead of beneath the stair landing, because there is typically less vibration at the wall. Because the luminaire is mounted on the wall above the door, the sensor is mounted on the stairwell wall, above the door swing area (on the wall perpendicular to the door location). The occupancy sensor detects the motion of the stairwell door opening, and turns the lighting on. Because all wiring is surface mounted, the sensor is mounted to an outlet box using screw mounts, rather than the threaded nipple, and the power pack is mounted in an oversized switch box. Emergency lighting is supplied by a separate emergency lighting circuit.





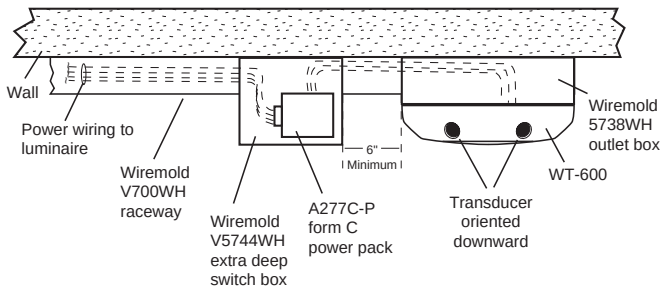
LEGEND

6 WT-600 ultrasonic occupancy sensor (wall mounted)	Wall mounted indirect/direct luminaire
PP A277C-P power pack	Low voltage wiring
J Junction box (wall mounted)	Line voltage wiring

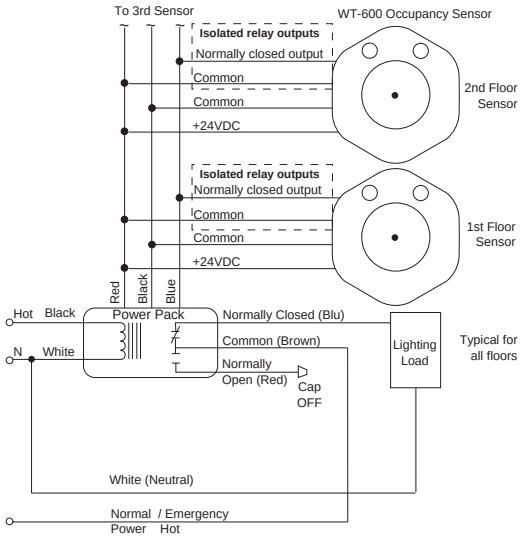
OF-S1.0 Installation Notes

1. Mount the WT-600 sensor on a rigid, vibration-free surface, at least six inches from the power pack.
2. Mount sensor to Wiremold box V5738WH using the sensor's two screw slots.
3. Mount power pack in an over-sized switch box (Wiremold V5744) at least 6 inches from the outlet box and occupancy sensor. Each power pack can control a maximum of 4 WT-600 occupancy sensors. Wire all low voltage in parallel.
4. Mount the WT-600 so that it detects the door motion, and orient the transducers so that they are facing downward.
5. The WT-600 sensor is shipped with a factory preset time delay of 16 minutes and sensitivity set to 50%, both recommended for stairwells. Refer to installation instructions if adjustments are necessary.
6. Use a minimum of 22 gauge wire for low voltage wiring. See Technical Bulletin TB-124 on Voltage Loss at www.wattstopper.com.
7. Confirm night light/egress lighting requirements with local code officials.
8. Use the normally closed contact on the form C power pack and the normally closed contact in the WT-600 for fail-on operation.

WT-600 Ultrasonic Sensor Mounting in Stairwell



WT-600 Ultrasonic Sensor Wiring Diagram



Equipment Schedule

Catalog No.	Qty	Description
WT-600	1 per doorway	Ultrasonic occupancy sensor, 600 sq ft, 180˚ coverage, isolated relay
A277C-P	1 for every 4 sensors	Form C Power pack, 277 VAC, 60 Hz, normally closed and normally open contacts
V-5738WH	as needed	Oversized outlet box (by Wiremold)
V-5744WH	as needed	Extra deep switch box, white (by Wiremold)
V700WH	as needed	Raceway (by Wiremold)

OF-UC1.0 Utility Closet: time switch

Control Needs	Solution
Automatically turn lights OFF	Digital time switch (TS series)
Manual ON/Manual override OFF	Digital time switch (TS series)

Application Description

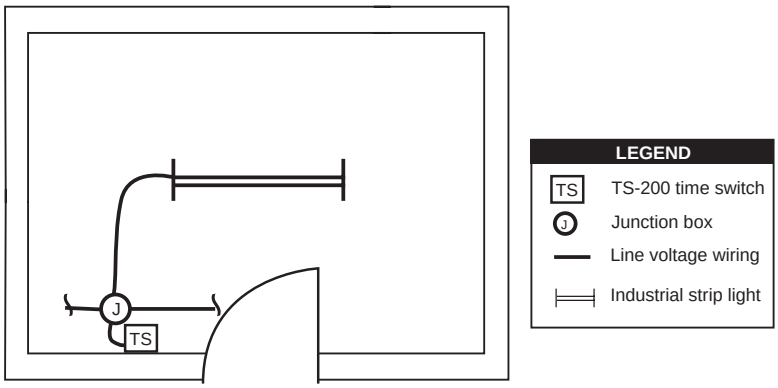
Space use:	Location of mechanical panels such as power, lighting, lighting control panels, and other electrical distribution equipment. Short-term occupancy patterns
Dimensions:	8’ x 6’
Ceiling height:	10’
Windows:	None
Window blinds:	None

Lighting

Ceiling mounted industrial fluorescent strip light, using two T8 lamps and 277 volt electronic ballasts.

Design Considerations

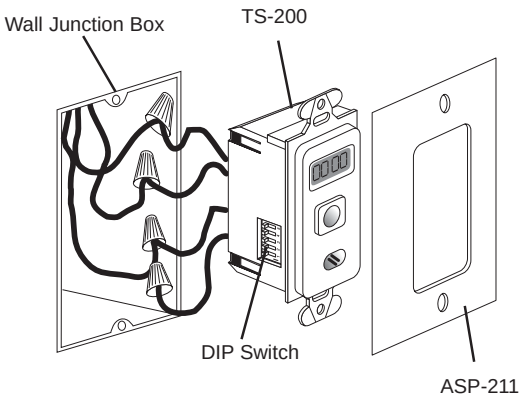
The InteliSwitch TS-200 Digital Time Switch is used in the utility closet for automatically turning lights off. In addition to closets, this strategy is appropriate for other rooms intermittently occupied such as mechanical rooms, electrical rooms, penthouses, and copy rooms. The TS-200 can be set to a 3 hour time out period which complies with ASHRAE 90.1-2001, and can be set to shorter time outs to comply with Title 24. The 1 minute flash and beep warnings allow time for the occupants to reset the switch before lights time out if the room is still occupied. Simply pushing the button will reset the timer to the preset time out setting.



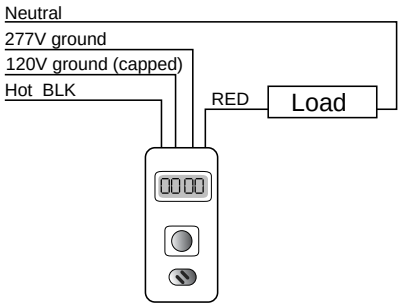
OF-UC1.0 Installation Notes

1. Adjust the TS-200 time switch DIP settings for time-out period, time scrolling, flash and beeper options before installing the switch. Refer to installation instructions for details.
2. Time switch time-out is factory preset at 3 hours. The time-out setting should be set to allow for the completion of common tasks in the space. If complying with ASHRAE 90.1-1999 or 2001, the maximum allowable time-out setting is 4 hours. If complying with California Title 24, the maximum allowable time-out setting is 2 hours.
3. Time scrolling allows the user to manually and temporarily override the time-out periods. Scrolling is factory preset for scrolling “up” which means that the time-out setting will increase while the button is held down (this is the recommended setting for utility closets).
4. Confirm night light/egress lighting requirement with local code officials.

TS-200 Digital Time Switch Installation



TS-200 Digital Time Switch Wiring Diagram



Equipment Schedule

Catalog No.	Qty	Description
TS-200	1	Digital time switch, 120/277 VAC, 60 Hz, with ASP-211 single gang cover plate

OF-E1.0 Exterior: time scheduling • photocell

Control Needs	Solution
Parking lot/walkway Turn lighting ON at dusk and OFF at 10pm leaving a portion on all night for security	Photocell ON/scheduled OFF using time clock in lighting control panel
Building-mounted Turn lighting ON at dusk and leave on all night for security lighting	Photocell ON/OFF controlled through lighting control panel
Entrance/exit canopies Turn lighting ON at dusk and leave on all night for security lighting	Photocell ON/OFF controlled through lighting control panel
Manual override for special events	Dataline switch located in security office

Application Description

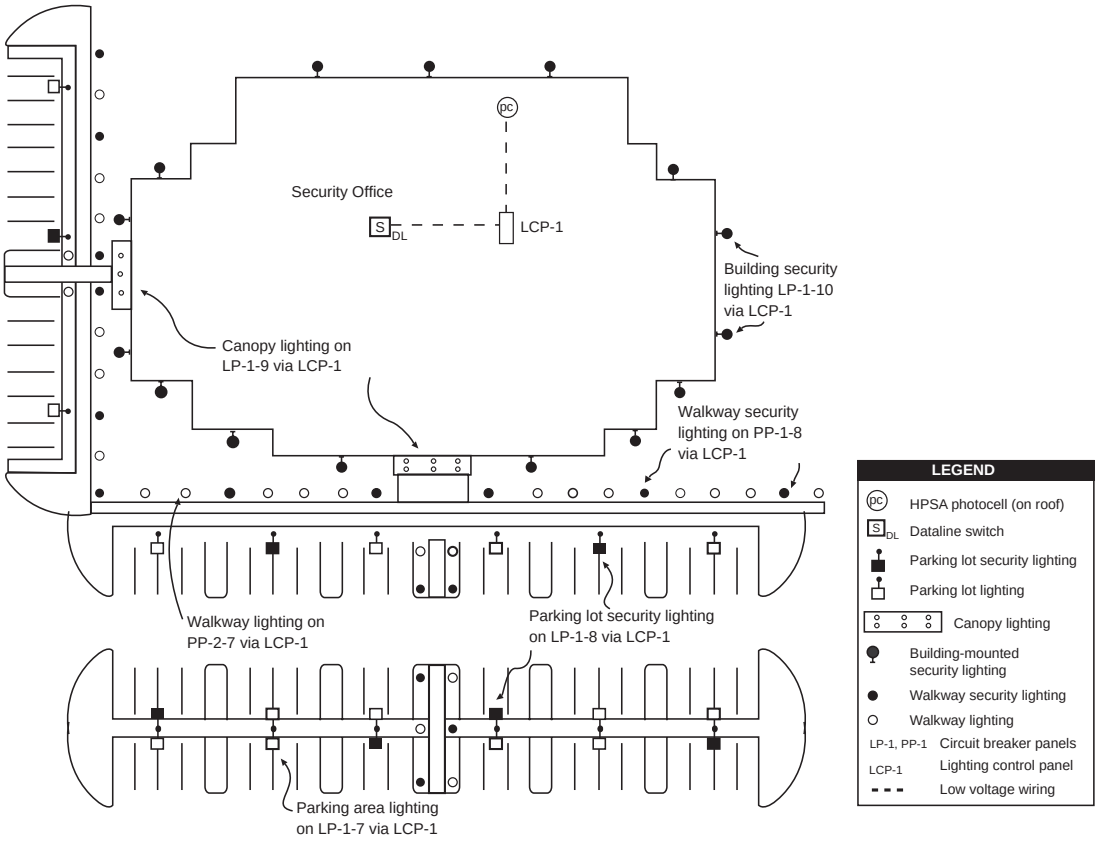
Exterior lighting control of building, parking lot, walkway, and canopy lighting

Lighting

Building-mounted wallpacks for perimeter security lighting, bollards for lighting walkways, recessed downlights lighting entrances and exits, and pole-mounted “shoebox” luminaires lighting parking lots. All luminaires are operated using 277 volt power, except bollards, which are 120 volt.

Design Considerations

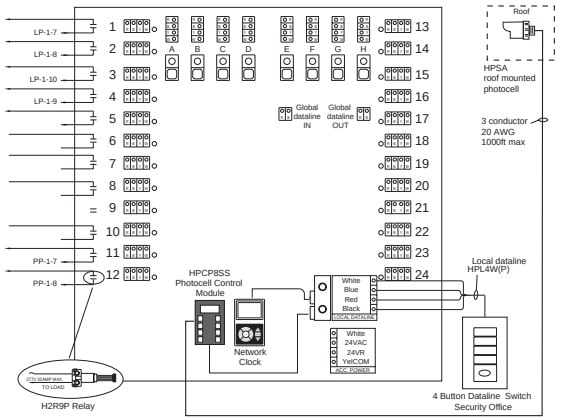
All the exterior and security lighting is turned on at dusk using the Smartwired lighting control panel with the Photocontrol Package and the HPSA photocell mounted on the roof. This system allows specific on/off setpoints based on the required level of illuminance. Parking lot and walkway luminaires, not on security lighting circuits, are scheduled off at a predetermined time in the evening with the Smartwired panel’s time clock. Canopy lighting turns on at 20 footcandles, walkway lighting at 10 fc, and parking lot lighting at 2 fc. All security lighting turns off at dawn. A dataline switch is located in the security office for manual override of all exterior lighting groups.



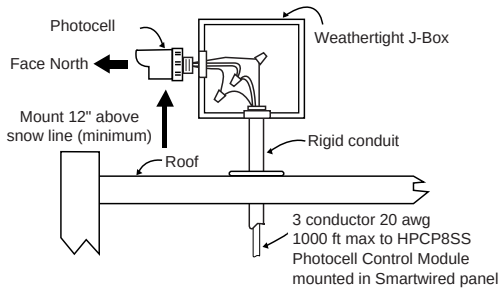
OF-E1.0 Installation Notes

1. Refer to Smartwired Switching System Installation and Operation Summary for detailed installation and operation instructions.
2. Test the operation of lighting control panels and photocell controls after installation.
3. Commission time clock according to Network Clock Automation Scenarios documentation, test operation after commissioning.
4. Assign relays to the channels as shown on the Smartwired Relay Schedule.
5. Install the photocell on the roof facing north. Mount underside of photocell at least 12 inches above the snow line.

Smartwired Lighting Control Wiring Diagram



Photocell Installation & Wiring Diagram



Panel Documentation

SMARTWIRED SWITCHING SYSTEM
RELAY SCHEDULE

PANEL NUMBER LCP-1

Note: Check those relays which are controlled by e automation channel under that channel letter below (Each relay can only be associated with one channe

RELAY NUMBER	CIRCUIT	LOAD DESCRIPTION	AUTOMATION CHANNEL A	B	C	D	E	F	G
-01	LP-1-7	Parking Area Lighting	X						
-02	LP-1-8	Parking Area Security Lighting		X					
-03	LP-1-10	Building Security Lighting		X					
-04	LP-1-9	Entrance/Exit Canopy Lighting			X				
-05		Other Building Loads							
-06		Other Building Loads							
-07		Other Building Loads							
-08		Other Building Loads							
-09		Other Building Loads							
-10		Other Building Loads							
-11	PP-1-7	Walkway Lighting				X			
-12	PP-1-8	Walkway Security Lighting		X					
-13		Other Building Loads							
-14									

SMARTWIRED SWITCHING SYSTEM
NETWORK CLOCK AUTOMATION

CHANNEL	DESCRIPTION OF GROUP	AUTOMATION SCENARIO	DATA
A	Parking Area, Lighting,	☐ SCHEDULED ON/OFF	Open 7 am - 10 pm M-F
		☐ MANUAL ON/SCHEDULED OFF	
		☐ MANUAL ON/SWEEP AUTO SW	
		☐ ASTRO (DARK) ON/OFF	
		■ ASTRO (DARK) ON/SCHED OFF	Dark at 2fc
B	Building Walkways & Parking Lot Security Lighting	☐ SCHEDULED ON/OFF	
		☐ MANUAL ON/SCHEDULED OFF	
		☐ MANUAL ON/SWEEP AUTO SW	
		■ ASTRO (DARK) ON/OFF	
		☐ ASTRO (DARK) ON/SCHED OFF	Dark at 2fc
C	Entrance / Exit Canopy Lighting	☐ SCHEDULED ON/OFF	
		☐ MANUAL ON/SCHEDULED OFF	
		☐ MANUAL ON/SWEEP AUTO SW	
		■ ASTRO (DARK) ON/OFF	
		☐ ASTRO (DARK) ON/SCHED OFF	Dark at 20fc
D	Walkway Lighting	☐ SCHEDULED ON/OFF	
		☐ MANUAL ON/SCHEDULED OFF	
		☐ MANUAL ON/SWEEP AUTO SW	
		■ ASTRO (DARK) ON/OFF	
		☐ ASTRO (DARK) ON/SCHED OFF	Dark at 10fc
		☐ SCHEDULED ON/OFF	

Equipment Schedule

Catalog No.	Qty	Description
HIN24R24SP	1	Smartwired Control lighting control panel interior, 24 relays
HTUB24	1	Tub enclosure for lighting control panel, up to 24 relays, 22.5”x24”x4.5”
HCVR24SL	1	Surface mounted cover for lighting control panel, up to 24 relays, 22.6”x24.1”x.75”
HCLK8SS	1	Network clock/programmer for Smartwired Control lighting control panel
HPCP8SS	1	Photocontrol package for Smartwired lighting control panel, with HPSA photocell
HPSM115/277	1	Power supply for lighting control panel, 115/277 VAC, 50/60 Hz
HDLS4SS	1	Dataline Switch, quad, 4 individual buttons plus master, single-gang, includes plate
HDLW4		Dataline wire, 18 AWG (7 strands x 26 AWG) using 2 independent twisted pair (specify feet)



ASHRAE 90.1 - 2001 Energy Standard

The ASHRAE 90.1-2001 Standard is available for purchase through ASHRAE. Visit ***www.ashrae.org*** to purchase the standard through its online bookstore. Lighting control highlights include:

Automatic Lighting Shut off*

- Buildings larger than 5000 sq ft must use an automatic control device to turn off lighting in all spaces. The automatic control device shall be either:
  - A programmable time scheduling device, where an independent program schedule shall be provided for areas less than or equal to 25,000 sq ft, and at least one program schedule per floor, or
  - An occupancy sensor that turns lighting off within 30 minutes after the space is vacated, or
  - An unoccupied control signal from another control or alarm system

Space Control

- Each space that's enclosed by ceiling-height partitions must have at least one control device that independently controls the general lighting in the space. Each control device shall be activated either by an occupancy sensor, or manually by an occupant.
  - For spaces equal to or less than 10,000 sq ft, each control device shall control a maximum of 2500 sq ft
  - For spaces greater than 10,000 sq ft, each control device shall control zones no larger than 10,000 sq ft
  - Each control device shall be capable of overriding the automatic lighting shut off for no more than four hours
  - Each control device shall be readily accessible and located so that the occupant can see lights from the controlling switch**

Exterior Lighting Control

- Lighting for all exterior applications not exempted in the Standard, shall be controlled by a photocell or astronomical time clock.

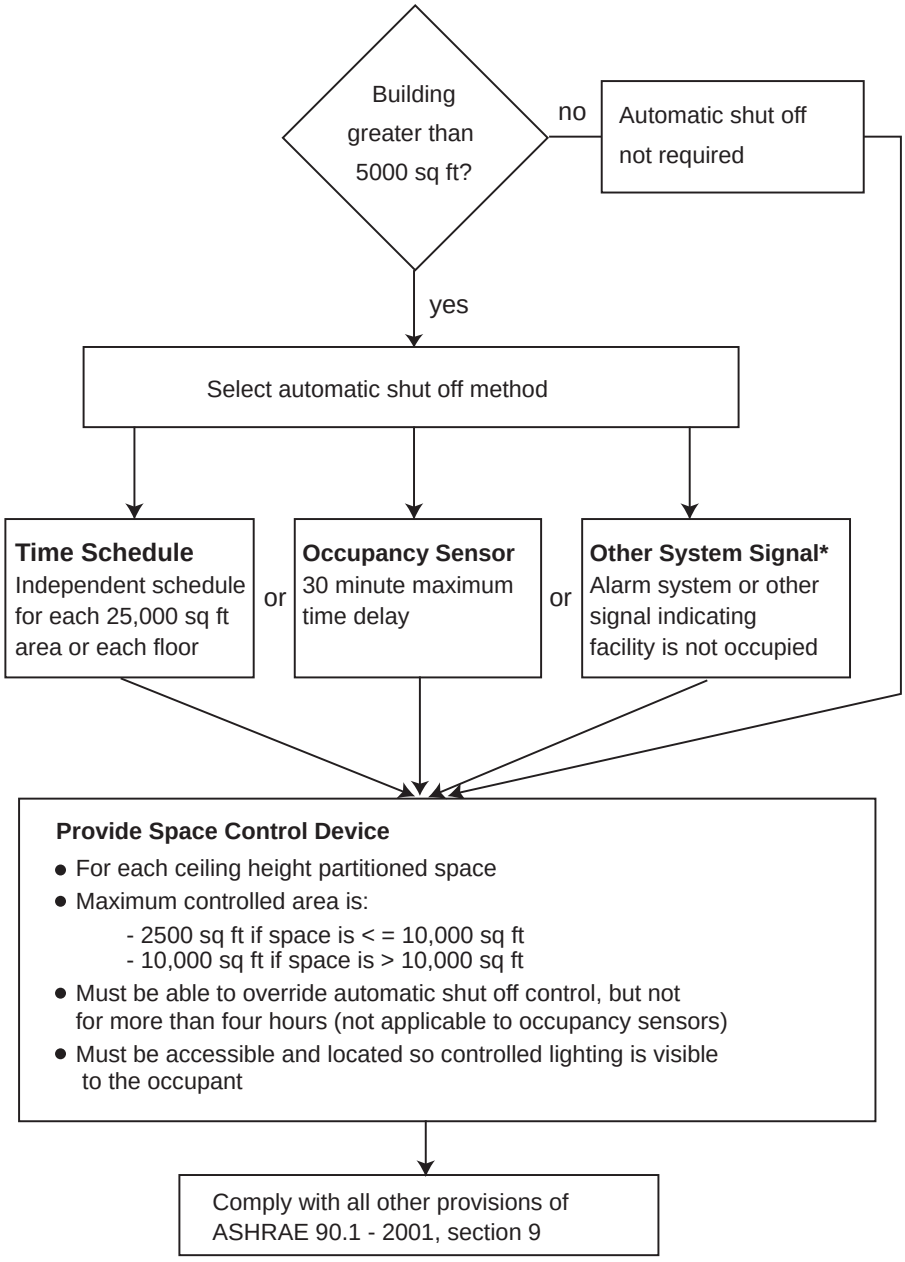
Tandem Wiring

- Luminaires that are in the same space and on the same control device, using one or three linear fluorescent lamps greater than 30 watts each, shall use two-lamp tandem-wired ballasts in place of single-lamp ballasts.

Energy code provisions vary from state to state. For more information, visit the Department of Energy website at www.energycodes.gov, which provides current information on the status of state energy codes as well as compliance and training tools.

*Lighting intended for 24 hour operation does not require an automatic control device.
**Remote location is permitted for reasons of safety or security.

Automatic Lighting Shut Off Compliance Guideline for ASHRAE 90.1 - 2001



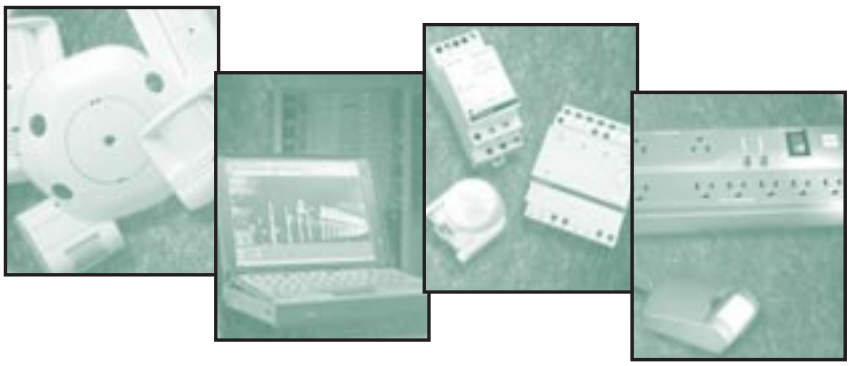
*ASHRAE 90.1 is under continuous maintenance. ASHRAE 90.1-2001 is the first revision of 90.1-1999. One of the most significant changes clarified the language for automatic-off methods. The 1999 version listed scheduling, occupancy sensing, or by occupant intervention as acceptable auto-off methods. 90.1-2001 replaces “by occupancy intervention” with “by other system signal” as shown above.

Lighting Control Best Practice Guide

Office Buildings

Founded in 1984, The Watt Stopper is committed to developing efficient, energy saving lighting control solutions. Beginning with our first product line, occupancy sensors, we have continually worked to develop highly innovative, reliable products that offer a vast array of features.

Today, our product solutions include lighting control panels, daylighting controls, and plug load controls. These versatile products offer ideal energy control solutions for every type of building.



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WS-05-20028