

SECTION 26 09 23

LIGHTING CONTROL DEVICES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Lighting control relay panels.
2. Programmable time clocks.
3. Ceiling mounted occupancy sensors.
4. Photocells.
5. Low voltage wall switches
6. Dimmer buttons
7. Remote switches
8. Emergency control units
9. Override switches
10. Data communication links
11. Web links
12. Key switches
13. Scene control unit
14. Room controllers.

B. Related Sections:

1. Division 26 - Equipment Wiring Connections: Execution requirements for electric connections specified by this section.
2. Division 26 - Low-Voltage Electrical Power Conductors and Cables.
3. Division 26 - Raceway and Boxes for Electrical Systems: Product requirements for raceway and boxes for placement by this section.
4. Division 26 - Identification for Electrical Systems: Product requirements for electrical identification items for placement by this section.
5. Division 26- Network Lighting Controls
6. Division 26 - Panelboards.
7. Division 26 - Wiring Devices: Product requirements for wiring devices for placement by this section.
8. Division 26 - Interior Lighting

1.02 REFERENCES

A. National Electrical Manufacturers Association:

1. NEMA AB 1 - Molded Case Circuit Breakers and Molded Case Switches.
2. NEMA FU 1 - Low Voltage Cartridge Fuses.
3. NEMA ICS 2 - Industrial Control and Systems: Controllers, Contactors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC.
4. NEMA ICS 4 - Industrial Control and Systems: Terminal Blocks.
5. NEMA ICS 5 - Industrial Control and Systems: Control Circuit and Pilot Devices.
6. NEMA ICS 6 - Industrial Control and Systems: Enclosures.
7. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum).

1.03 SYSTEM DESCRIPTION

- A. Developer Design/Builder is to provide a complete lighting control system per the requirements of this section and as required to complete the work. It is the intent of this section to provide an integrated, energy saving lighting control system including Lighting Control Panels, Occupancy Sensors, and Daylighting Controls from a single supplier. Developer/Design Builder is responsible for confirming that the panels and sensors interoperate as a single system. All work is subject to the review and approval of the County's Representative.

1.04 SUBMITTALS

- A. Division 01 - Submittal Procedures: Requirements for submittals.
- B. The Design/Builder's electrical contractor shall submit 1/4"=1'0" scale sketches of lighting control equipment, all electrical rooms and areas including actual dimensions of all equipment in electrical rooms and indicate clearances per LACEC, as well as door swings or other obstacles. Sketches shall be submitted along with or prior to shop drawing submittals. Shop drawing submittal without sketches shall be returned and not reviewed.
- C. Shop Drawings: Indicate dimensioned drawings of lighting control system components and accessories.
 - 1. One Line Diagram: Indicating system configuration indicating panels, number and type of switches or devices.
 - 2. Include typical point-to-point wiring diagrams for each component.
- D. Product Data: Submit manufacturer's standard product data for each system component.
- E. Manufacturer's Installation Instructions: Submit for each system component.
- F. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.05 CLOSEOUT SUBMITTALS

- A. Division 01 - Execution and Closeout Requirements: Requirements for submittals.
- B. Project Record Documents: Record the following information:
 - 1. Actual locations of components and record circuiting and switching arrangements.
 - 2. Wiring diagrams reflecting field installed conditions with identified and numbered system components and devices.
- C. Operation and Maintenance Data:
 - 1. Submit replacement parts numbers.
 - 2. Submit manufacturer's published installation instructions and operating instructions.
 - 3. Recommended renewal parts list.

1.06 QUALIFICATIONS

- A. Manufacturers: Firms regularly engaged in the manufacture of lighting control equipment and ancillary equipment, of types and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Comply with NEC, NEMA, and FCC Emission requirements for Class A applications.

- C. UL Approvals: Relay panels and accessory devices are to be UL listed under UL 916 Energy Management Equipment. Configured to order or custom relay panels shall be UL Listed under UL 508, Industrial Control Panels.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Division 01 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Accept components on site in manufacturer's packaging. Inspect for damage.
- C. Protect components by storing in manufacturer's containers indoor protected from weather.

1.08 WARRANTY

- A. Division 01 - Execution and Closeout Requirements: Requirements for warranties.
- B. Furnish five year manufacturer warranty for components.

1.09 EXTRA MATERIALS

- A. Division 01 - Execution and Closeout Requirements: Requirements for extra materials.
- B. Furnish five of each occupancy sensor type.
- C. Furnish two of each photocell type.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

- A. Watt Stopper
- B. LC&D
- C. Lutron
- D. Substitutions: Division 01 - Product Requirements

2.02 LIGHTING CONTROL PANELS

- A. Provide lighting control panels in the locations and capacities as required to complete the program. Each panel shall be of modular construction and consist of the following components:
 - 1. Enclosure/Tub shall be NEMA 1, NEMA 3R, or NEMA 4 as required to complete the work and comply with Code, sized to accept an interior with 1-8 relays, 1-24 relays and six (6) four pole contactors, or 1-48 relays with six (6) four pole contactors.
 - 2. Cover shall be configured for surface or flush wall mounting of the panel. The panel cover shall have a hinged and lockable door with restricted access to line voltage section of the panel.
 - 3. Interior assembly shall be supplied as a factory assembled component specifically designed and listed for field installation. The interior construction shall provide total isolation of high voltage (class 1) wiring from low voltage (class 2) wiring within the assembled panel. The interior assembly shall include intelligence boards, power supply, DIN rails for mounting optional Class 2 control devices, and individually replaceable latching type relays. The panel interiors shall include the following features:
 - a. Provision for one or two optional control and automation cards.

- b. Removable, plug-in terminal blocks with screw-less connections for all low voltage terminations.
 - c. Individual terminal block, override push button, and LED status light for each relay
 - d. Switch inputs associated with each relay and group channel shall support two or three wire, momentary or maintained contact switches or 24VDC input from occupancy sensors.
 - e. Automatic support for occupancy sensor sequence of operation. Low voltage inputs automatically reconfigure when connected to a Watt Stopper occupancy sensor head. Occupancy sensor shall switch lighting on and off during unoccupied periods but shall not turn lighting off during scheduled occupancy periods.
 - f. Isolated contacts within each relay shall provide true relay state to the electronics. True relay state shall be indicated by the on-board LED and shall be available to external control devices and systems.
 - g. Automatic sequenced operation of relays reduces impact on the electrical distribution system when large loads are controlled simultaneously.
 - h. Group, channel, and pattern control of relays shall be provided through a simple button-press interface within the panel. Any group of relays can be associated with a channel for direct on/off control or pattern (scene) control via a simple programming sequence using the relay and channel override push buttons and LED displays.
 - i. Relay group status for each channel shall be provided through bi-color operation of the LED indicators. Solid red indicates that all relays in the group are on, solid green indicates that the group is in a mixed state, and blinking green indicates that the relays have blink warned and are currently timing out.
 - j. Each relay and channel terminal block shall provide a 24V pilot light signal. It shall be possible to configure the system for support for any Class 2 pilot light voltage with the use of an auxiliary power supply.
 - k. Single pole latching relays with modular plug-in design. Relays shall provide the following ratings and features:
 - 1) Electrical:
 - a) 30 amp ballast at 277V
 - b) 20 amp ballast at 347V
 - c) 20 amp tungsten at 120V
 - d) 30 amp resistive at 347V
 - e) 1.5 HP motor at 120V
 - f) 14,000 amp short circuit current at 347V
 - 2) Mechanical:
 - a) Individually replaceable, ½" KO mounting with removable Class 2 wire harness
 - b) Actuator on relay housing provides manual override and visual status indication, accessible from Class 2 section of panel
 - c) Dual line and load terminals each support two #14 – #12 solid or stranded conductors
 - d) Tested to 300,000 mechanical on/off cycles
 - e) Isolated low voltage contacts provide for true relay status feedback and pilot light indication.
 - l. Power supply shall be a multi-voltage transformer assembly with rated power to supply all electronics, occupancy sensors, switches, pilot lights, and photocells as necessary to meet the project requirements. Power supply to have internal over-current protection with automatic reset and metal oxide varistor protection.
4. The dataline wire will be supplied by the equipment manufacturer and will include the manufacturer's name, catalog number printed on the wire jacket. The contractor, at its own expense, will replace an improper dataline wire.

5. Panels shall be digitally addressed and support bi-directional communication between each other and other intelligent field devices specified elsewhere.
- B. Distributed Automatic Relay Packs: Provide Automatic Relay Pack distributed lighting controllers in the locations as required to complete the program. Each ARP shall be suitable for mounting within the ceiling plenum to a junction box through a standard ½" KO opening. ARP units shall be networked digital devices and share the dual pair digital communications network wire with the Digital Dataline Switches where specified. Each ARP shall provide the following features:
1. NEMA 1 housing, 6.63" x 6.13" x 2.13", shall be rated for use in return air plenum spaces.
 2. Each pack shall have two independent load control relays. Relays shall employ zero cross switching circuitry to extend relay life and mitigate the effects of switching high inrush ballasted loads.
 3. Relay load rating shall be 20 amps ballast at 120/277 VAC 60Hz, 20 amps incandescent at 120 VAC 60Hz, 1 hp at 250 VAC 60Hz.
 4. Provide two form C auxiliary relays; contacts rated 1 amp at 24VDC. Auxiliary relays shall track the state of the load control relays and be suitable for interfacing with HVAC or other external systems.
 5. Each pack shall provide a 200 mA, 24 VDC auxiliary power source suitable for operation of optional daylight and occupancy sensors.
 6. The ARP shall receive scheduled occupancy and override commands via the digital network. The logic shall allow for tuning the sequence of operation independently for normal and after hours operating periods.
 7. Provide support for direct connection of one or two low voltage switches. Control logic for interaction of manual switch operation with all sequence of operation shall be resident within the ARP and shall not depend upon the network connection for proper operation.
 - a. Input logic shall support three-wire or two-wire momentary type switches, DIP switch selectable.
 - b. Provision to bridge switch inputs for control of both relays from one switch.
 - c. Switches shall be individually programmable for manual on - automatic off operation for either scheduled or occupancy sensor based operation.
 8. Provide support for direct connection of a passive infrared, ultrasonic, or dual technology occupancy sensor. The occupancy sensor signal shall be directed to both relays and shall allow selection of a different sequence of operation for each relay. Sequence of operation shall include: on only, off only, on and off, or disabled. It shall be possible to set a different sequence of operation for each relay during normal occupancy hours and afterhours periods as determined by the system schedule.
 9. Provide support for direct connection of a daylight sensor. The daylight sensor signal shall automatically be directed to the second relay in the pack. A signal from the daylight sensor indicating that there is sufficient daylight in the space will initiate a shed condition in the logic that will turn off the second relay. When the daylight sensor indicates that sufficient daylight is present, the shed condition will be restored and the relay will return to the pre-shed logical state.
 10. Each ARP shall be located in the plenum above the door to the controlled room. Where conditions require variance in mounting location, the contractor shall accurately mark the location of each ARP on the as built drawings and include this information in the project manuals.
- C. Advanced Communications, Integration and Pc Connectivity: Provide an advanced communications network that supports optional features like PC connectivity, TCP/IP connections, advanced programming system documentation, enhanced diagnostics, historical and runtime accumulation, and graphic programming and control.
1. The system shall support the following advanced operating scenarios:
 - a. Adjustable override periods for after hour use based upon the day of the week.
 - b. Preemptive override before OFF to prevent blink warning and to start a new override time delay.

- c. Allow common areas to remain ON when specific relays in a panel are ON. Egress timer starts a countdown when the last watched relay turns OFF.
- d. Master Switch Control with blink option to provide a blink warning and five minute countdown for occupants when a master switch is turned OFF
- e. Interior daylighting control to turn OFF lights when available natural light meets occupants' lighting needs. Lights will only come on during occupied periods when enough natural light is not available.
- f. Occupancy Sensor Integration: Allows relays to automatically follow occupancy sensors' status, or interlock the sensors with daily schedules (Relays stay ON during scheduled ON time, and follow sensors only during afterhours).

2. Communications

- a. Each panel shall support RS232 twisted pair and optional RS-485 connections. Either protocol may be used for programming, monitoring, and control. The dataline shall allow simultaneous operation of multiple communications access points to support multiple operator terminals and communications with other building automation systems.
- b. Each panel shall be capable of stand-alone automatic operation and the network shall achieve full distributed processing.
- c. All programming shall be accomplished with a Windows based PC running compatible software package.

3. Hardware Features

- a. Each communication control card shall be capable of providing all logic, control, runtime data, status information, and communications functions for up to 48 relays in a panel.
- b. EEPROM power loss memory and clock holdup time: 30 days
- c. Self-diagnostics: Automatic diagnostics on all memory, input/output card modules, relays, and dataline.
- d. Clock: Digital with time, day of week, and date. Automatic leap year compensation. Programmable Daylight Savings Time and Standard Time adjustment.

4. WinControl Software

a. Schedules

- 1) Each communication control card shall support up to 24 unique weekly schedules out of a total of 1,000 available per system. Each schedule shall allow up to eight events per day for a repeating seven day week.
- 2) Up to 32 holidays may be defined for any specific date. On that date any of the three holiday schedules may be assigned.
- 3) Relays may be programmed to switch to a different weekly schedule on any specific date, and then revert back to normal at another time. This allows for future schedule changes to be programmed ahead of time.
- 4) "Spring Ahead" and "Fall Back" dates for daylight savings time changes may be entered full two years ahead. Software also supports the ability to "Auto fill" in the next two occurrences of each of these dates.

b. Time Delay / Blink Warning

- 1) Used during unoccupied periods, assignable for each relay.
 - a) Time delays from 2 to 1,440 minutes.
 - b) Blink Warning: 1-second OFF blink followed by a 5 minute grace period before OFF.
 - c) An optional second blink warning one minute before OFF.
- 2) Operates automatically for all scheduled OFFs and time delay overrides.

- 3) Occupant overrides may be entered before the blink warning to prevent a scheduled blink and shutdown.

c. Analog Photocell Configuration

- 1) Enable any group switch card input (eight per group switch card) to act as an analog input into the panel for use with photocells or other analog devices
- 2) Select the photocell from list of available types including:
 - a) Indoor, 0 - 500 foot candles
 - b) Indoor, 0 - 50 foot candles
 - c) Skylight, 0 - 6000 foot candles
 - d) Outdoor, 0 - 200 foot candles
- 3) Establish trigger parameters for each analog input with:
 - a) Separate on and off set points
 - b) Separate on and off time delays
 - c) Load to be controlled by the input
- 4) A total of 32 sets of trigger parameters may be established per panel
- 5) Analog Photocell Monitoring: Actual foot candle light levels per photocell and the current trigger state of the loads may be read using the Operators Software specified in section 2.21.
- 6) Telephone Override: Each relay shall respond to up to eight different telephone override codes. Maximum of 9999 telephone codes can be programmed.
- 7) Runtime Counters for Each Relay
 - a) Cumulative runtime (up to 31 years) and number of cycles (up to 17 million) since last reset. User re-settable.
 - b) Daily runtime for the current day and each of the prior 40 days.
 - c) Monthly runtime for current and 14 prior months.
- 8) Activity Logs
 - a) Store previous relay events including the time, new state, and cause for the change in state.
 - b) Annunciate over the dataline and RS232 port when the table is 25%, 50%, 75% and 100% full.

D. Operator's Software

1. User programming and editing may be conducted both online or offline in a Windows based software application.
2. Data shall be entered through a simple menu-driven user interface.
3. The software shall simplify integration with other software products by allowing the lighting control manufacturer's components to be embedded into other Windows applications. These features shall include the following:
 - a. BACnet connectivity with optional WebLink.
 - b. Drag and Drop interface programming supported throughout the program.
4. Basic operating software provides the following:
 - a. Site wiring documentation for all connected relay panels and system components.
 - b. English descriptions of each relay's circuit designation, circuit description, switch and calculated load.

- c. RS232 and TCP/IP Connection to Lighting Control Panel
- d. Monitor/Control all relays. Software shall show actual relay states, with an optional menu showing how and when the relay state occurred, and when next scheduled to change.
- e. Simulate all functions.

5. System Parameters

- a. System software to be sized based appropriately for the system – 250, 500, 750 or unlimited relays. Any number of sites may be programmed from a single software package (based on hard drive space).
- b. Passwords Matrix Features allowed per site.
- c. User defines functions accessible for each password (Document, Program, Initialize, Transfer from PC, Transfer to PC, Control, and Simulate/Test).
- d. Configure software to automatically contact remote sites using a modem or I/P address.

6. Other Features

- a. Online help brings up a context sensitive help screen.
- b. One step menu option to back up all site information to a backup drive.
- c. The software shall include Trends and Relay Runtime Analysis that will allow the operator to analyze the operation of specific areas and identify those exceeding normal runtimes. Individual relays may be assigned a kWh weighted value or simply analyzed on a runtime basis. In both cases, the relays may be assigned to logical groups and plotted for the last 30 days or 12 months.

- 7. System Design Capability: From the lighting control system software database, the software shall be able to automatically create a system single line drawing, panel schedules and specifications that can be exported in DXF format for use in standard CAD drawings.

E. Central Programming, Monitoring, And Control Work Station

- 1. Desktop Computer work station will provide monitoring, programming and control of the system.
- 2. The computer will be a Pentium 4 class personal computer with monitor for enhanced color graphics display. The system shall be shipped complete with all memory, cables, and peripheral devices. The complete system shall be factory tested prior to shipment. The system shall include at a minimum:
 - a. 3 GHz, Intel Pentium 4 based personal computer
 - b. 17" SVGA flat panel color monitor
 - c. 60 GB hard disk
 - d. 256 MB RAM
 - e. CD +R/+W drive
 - f. Lighting control software, WinXP Pro

F. Ethernet Multi-User Connectivity – Weblink

1. System Description

- a. A network appliance will provide multi-user, simultaneous access to the lighting system using standard TCP/IP and the WinControl software specified in Section 2.21 above.
- b. All IT infrastructure that is required for connectivity shall be specified elsewhere and is not considered part of the lighting control system requirements.
- c. The network appliance will include the following hardware:
 - 1) Ethernet, Serial and Parallel port
 - 2) Optional 56K BAUD internal modem
 - 3) Video graphics card

2. Features
 - a. Multiple users (each with a licensed copy of WinControl) will be able to simultaneously connect to the IP address of the WebLink.
 - b. Users may be connected via an Intranet, or Internet depending upon network security limitations.
 - c. Provide the capability to monitor the status of each relay and to override each relay using only a web browser
 - d. A single user may connect using WinControl, via the internal modem of the WebLink.
 - e. The WebLink will provide all the features of a direct connected site to the simultaneous users.

3. Events Scheduler Module (Schools, Retail and Event Centers)
 - a. 365 day event scheduling will allow "Events" to be defined as a series of commands to allow a preprogrammed timed sequence to occur by selecting the start time and stop time of the event. Events may be programmed as a repeating schedule with specific start and ending times or as one time scheduled events.
 - b. 365 day programming will simplify single day activities for schools, retail applications, or event centers. The schedules may be programmed up to two years in advance.

4. MyLights Personal Lighting Control Module
 - a. Provide personal lighting control for multiple users via an enterprise LAN connection between the WebLink and each user's desktop PC.
 - b. The system shall monitor the user's mouse and keyboard activity and maintain lighting in the space during periods of occupancy as indicated by the PC activity.
 - c. Provide an adjustable off time delay. At the expiration of the time delay after last PC activity, the lights shall blink warn and provide an adjustable grace period before turning off the lighting. Any PC activity by the user shall cancel the impending off action.
 - d. An icon on the user's PC system tray shall provide access to set up and override features that shall include:
 - 1) Override off
 - 2) Override on for set period of time
 - 3) Lighting zone selection with password protection

5. BACnet Integration with Building Automation System
 - a. Provide an Ethernet or BACnet IP connection as required for connectivity to the BAS
 - b. Each lighting control panel shall be exposed to the BAS as a BACnet Device with an individual BACnet Device ID.
 - c. The lighting control relays within each panel shall be exposed as BACnet Binary Output objects with read/write capability for control and status monitoring.
 - d. System group codes shall likewise be exposed as Binary Output objects and shall provide capability for a single command from the BAS to control multiple relays in multiple panels simultaneously via the lighting control network.
 - e. To facilitate a seamless integration with the BAS, the BACnet object Description Property fields shall be automatically populated with the relay, group code, and panel text descriptions from the lighting control system database as created by the WinControl software.

G. Realtime Color Graphics Software

1. System Description

- a. Color graphics software, WinControl Graphics, shall allow a user to monitor and control the low voltage relays through a graphical color interface. The system will allow the user to create drawings through a graphics generator provided with the system. The system will control the relays in a real-time environment; i.e. all system changes will be communicated immediately through the color graphic screens.
- b. The application will provide a visual representation of the floor plan, drawn to scale, with each fixture displayed on screen. Fixtures can automatically indicate the relay controlling them on screen. The software will include "fly overs" which will display fixture information when the mouse pointer is over a defined object on the screen.
- c. The software will fully integrate with the base software; all system databases including wiring documentation and system runtime information will be available to the graphic software.
- d. The software shall be based upon Microsoft's Component Object Model (COM) and shall support Active-X technology for integration.
- e. The software shall include color graphic screens created by a factory authorized representative. These screens will be provided based on the owner's requested illustrations.

2. Graphic Screen Features

- a. The graphic software will allow full programming of the system from the animated graphic floor plans.
- b. The operator will be able to zoom in and pan the floor plan for more detail.
- c. The system shall be provided with a matrix password table to allow any user access to individual, selectable features.
- d. Manual control of the relays, or simulation of system wide functions, shall be possible by a single click of the mouse.
- e. Programmable "action spots" will allow an operator to pre-define commonly used manual control functions, or allow the operator to jump to other color graphic screens.
- f. System animation will support multi-ballast control of a fixture representing multi-level lighting, as well as animation for monitoring of fans or other "animated devices." Animation will also include a "Failure" definition to occur in event of relay failure.
- g. Relay definitions and circuit numbers from the base software will be displayed on screen when requested by the user. Relay circuit numbers will be automatically displayed inside the fixture to provide useful information to the operator.

3. Graphic Screen Generation

- a. Contractor shall provide CAD floor plans to the manufacturer for generation of graphic screens.
- b. As-Built relay panel and reflected ceiling documentation must be provided to the manufacturer before graphic screen development can begin.

H. Digital Dataline Switches: Intelligent digital switching shall be provided operating on the dual twisted pair communication wire. Switches shall be available in single, dual, quad, or octal (1-button, 2-button, 4-button, or 8-button) designs. The single, dual, and quad devices shall mount in a standard single-gang box, the octal version in a two-gang box.

1. Each button shall be individually programmable. Programming of buttons shall not require the use of a computer or other programming device. It shall be possible to assign relays or channels to buttons using a simple button press interface. Each button can control any one of the following options:
 - a. Any individual relay in any single panel.

- b. Any group of relays in any single panel.
 - c. Any group of relays in the system (via network clock, Automation Appliance, or WinControl software package).
2. For applications that require pattern switching, buttons shall function as a scene control using an ON/OFF/Not Controlled pattern of relays instead of the normal All ON/OFF.
 3. Switches shall be constructed of non-breakable Lexan on all exposed parts and shall include a matching screw-less Lexan wall plate.
 4. Individual buttons shall have a removable clear cover to allow standard 9 mm (3/8 inch) labeling tape to be used to identify the controlled loads.
 5. Each switch shall use a bi-color LED pilot light for the individual buttons to indicate status of the controlled relay or group of relays. LED indications are Red for All ON, Green for Mixed State (some relays in the group ON and others OFF), and No LED for All OFF.
 6. Switch LED pilot lights shall flash green to indicate impending off sweep during the five-minute grace period following blink warning of the lights. Once the button is pressed, the LED will change to Red to acknowledge the occupant's override command to keep lights ON.
 7. Multiple dataline switches programmed to control the same relay or relay group shall indicate the same status automatically.
 8. Each switch shall also include a locator light illuminating the switch for easy location in the dark.
 9. The dual, quad, and octal switches shall all include a single master button that will override all relays controlled by the individual buttons OFF, or Restore them to their original state. Each switch's master button configuration can be altered to perform a Master ON/OFF, OFF Only, or Disabled function if desired.
 10. Switches can be configured to follow a "Cleaning" scenario. This specific scenario shall prevent the cleaners from overriding OFF any relays previously turned ON by an occupant.
 11. Each switch is available in a Key lock override version. Once a key is inserted, the individual buttons will function for five minutes.

2.03 SINGLE / DUAL RELAY WALL SWITCH VACANCY SENSORS

- A. Type PW: Manual ON, Automatic OFF Wall switch type passive infrared occupancy sensor with built-in override control (off-auto). Furnish the Company's model which suits the electrical system parameters, and accommodates the square footage coverage and wattage requirement for each area (and type of lighting) controlled; Watt Stopper PW-100, PW-200.
- B. Type UW: Manual ON, Automatic OFF Wall switch type ultrasonic occupancy sensor with built-in override control (off-auto). Furnish the Company's model which suits the electrical system parameters, and accommodates the square footage coverage and wattage requirement for each area (and type of lighting) controlled; Watt Stopper UW-100, UW-200.
- C. Type DW: Manual ON, Automatic OFF Wall switch type dual technology, passive Infrared and ultrasonic occupancy sensor with built-in override control (off-auto). Furnish the Company's model which suits the electrical system parameters, and accommodates the square footage coverage and wattage requirement for each area (and type of lighting) controlled; Watt Stopper DW-100, DW-200.

2.04 DIGITAL WALL OR CEILING MOUNTED OCCUPANCY SENSOR SYSTEM

- A. Wall or ceiling mounted (to suit installation) passive infrared, ultrasonic or dual technology digital (passive infrared and ultrasonic) occupancy sensor. Furnish the Company's system which accommodates the square footage coverage requirements for each area controlled, utilizing Room Controller modules and accessories which suits the lighting and electrical system parameters.
- B. Digital Occupancy Sensors shall provide graphic LCD display for digital calibration and electronic documentation. Features include the following:
 1. Digital calibration and LCD entry for the following variables:
 - a. Sensitivity 0-100% in 10% increments
 - b. Time Delay – Fixed (1-30 minutes in 1 minute increments), and automatic

- c. Test mode – Five second time delay
 - d. PIR, Ultrasonic or Dual Technology activation and/or re-activation.
 - e. Walk-through mode
 - f. Load parameters including auto/manual ON, blink warning, and daylight enable/disable.
 - 2. RJ-45 digital connections for DLM local network.
 - 3. Two-way infrared communications port to allow remote programming through hand held commissioning tool.
 - 4. Self contained push buttons for programming and control of room devices.
 - 5. Device Status LED's including:
 - a. PIR Detection
 - b. Ultrasonic detection
 - c. Configuration mode
 - d. Load binding
 - 6. Assignment of occupancy sensor to a specific load within the room without wiring or special tools.
- C. Units will provide for digital calibration and commissioning and will not have any dip switches or potentiometers for field settings
- D. Multiple occupancy sensors may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration will be required
- E. Watt Stopper product numbers: LMPX, LMDX, LMPC, LMUC, LMDC

2.05 DIGITAL WALL SWITCHES

- A. Low voltage (RJ-45) momentary push button switches in 1,2,3,4 and 8 button configuration, decorator opening. Wall switches will include the following features:
- 1. Two way infrared communications port for use with personal and configuration remote controls.
 - 2. Engraveable buttons
 - 3. Dimming switches shall include seven LED's to indicate load levels.
 - 4. Scene switches shall include pilot indication of scene selection.
 - 5. Device Status LED's including:
 - a. One pilot LED for each button.
 - b. Power Indication
 - c. One locator LED per switch
 - d. Network status LED to indicate data transmission
 - e. Power LED to indicate the device has power
 - f. Configuration mode
- B. Switches shall have two RJ-45 ports to allow connection to any other digital room device.
- C. Multiple digital wall switches may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration will be required to achieve multi-way switching
- D. Watt Stopper product numbers: LMSW-101 / LMSW-102 / LMSW-103 / LMSW-104 / LMSW-108.

2.06 ROOM CONTROLLERS

- A. Room Controllers automatically bind the room loads to the connected devices in the space without any tools or configuration requirements. Room Controllers shall be provided to match the room lighting load and control requirements and sequences. The controllers will be simple to install and will not have screw type connections, dip switches, potentiometers or require special mounting or configuration. The control units will include the following features:
1. Automatic room configuration to the most energy efficient sequence of operation based upon the devices in the room.
 2. One or two relay configuration
 3. Simple replacement – Using the default automatic configuration capabilities, a room controller may be replaced with an Off-the-Shelf unit without requiring any configuration or setup.
 4. Device Status LED's to indicate:
 - a. Data transmission
 - b. Device has power
 - c. Status for each load
 - d. Configuration status
 5. Quick installation features including:
 - a. Standard junction box mounting (inside or outside)
 - b. Quick low voltage connections using standard RJ-45 patch cable
 6. Plenum rated
 7. Manual override and LED indication for each load
 8. Universal voltage (120/230/277 VAC, 50-60 Hz)
 9. Zero cross circuitry for each load.
 10. Efficient 150 ma switching power supply
 11. Three RJ-45 DLM local network ports
 12. Watt Stopper product numbers: LMRC-101 / LMRC-102
- B. 0-10 Volt enhanced Room Controllers shall include all the features of the Room Controller plus the following enhancements:
1. One, two or three relay configuration
 2. Efficient 250 ma switching power supply
 3. Four RJ-45 DLM local network ports.
 4. One zero to 10 volt analog output per relay for control of dimmable ballasts.
 5. Optional BACnet MS/TP communications port.
 6. Current monitoring
 7. Watt Stopper product numbers: LMRC-301 / LMRC302 / LMRC303.
 - 8.
- C. Plug Load Room Controllers provide dedicated control of plug loads within the space. The controllers plug into the DLM local network using the RJ-45 free topology network. The room controllers include the following features
1. One relay configuration only
 2. Automatic ON/OFF configuration
 3. Default 30 minute (adjustable) time delay from lighting shut off to allow for electronic component use after an area is vacant
 4. Watt Stopper product number: LMPL-101.

2.07 DIGITAL PHOTOSENSORS

- A. Provide automatic daylight harvesting capabilities to the Room Controllers. The photo sensor / room controller configuration automatically configures the daylighting set points for ON/OFF or Dimming control. Using the automatic configuration replacing a photo sensor or room controller can be done without any special tools, programming or configuration. Photosensors include the following features:
1. The digital photosensor shall utilize an internal photodiode that measures light in a 100 degree angle cutting the unwanted light from bright sources outside of this cone
 2. The digital photosensor shall be capable of turning lighting on and off or Raise / Lower depending on the binding to the Room Controller. Sensor range shall be from 1 - 1400fc.
 3. For ON/OFF daylight harvesting the controller provides a "hold on while occupied" feature that prohibits high levels from turning OFF the controlled lights as long as the space remains occupied.
 4. The sensor has a threaded nipple that mounts on a ceiling tile and for more challenging applications such as a side wall or hard rock ceiling the nipple pops off and the unit can be screwed down
- B. Watt Stopper Product Numbers: LMLS-105, LMLS-305.

2.08 ROOM NETWORK

- A. The DLM local network is a free topology lighting control network and protocol designed to control a small area of a building. Digital room devices connect to the network using RJ-45 patch cords which provide both data and power to room devices. Features of the DLM local network include
1. Automatic configuration and binding of sensors, switches and lighting loads to the most energy efficient sequence of operation based upon the device attached.
 2. Simple replacement of any device in the network with a standard off the shelf unit without requiring commissioning, configuration or setup.
 3. Push and Learn configuration that can change the automatic binding process and load parameters by using only the digital devices in the room.
 4. Two way infrared communications that allow load parameters, sensor configuration and binding operations to be configured through a hand held configuration tool up to 30 feet from any device

2.09 EMERGENCY LIGHTING

- A. Emergency Lighting Control Unit – A UL 924 listed device that monitors a switched circuit providing normal lighting to an area. The unit provides normal ON/OFF control of emergency lighting along with the normal lighting. Upon normal power failure the emergency lighting circuit will close, forcing the emergency lighting ON until normal power is restored. Features include
1. 120 - 277 volts, 50/60 Hz., 20 amp ballast rating
 2. Push to test button
 3. Auxiliary contact for test / Fire Alarm system

2.10 AUXILIARY LIGHTING CONTROL EQUIPMENT

- A. Scene control switch for conference rooms (Watt Stopper #LMSW-105-W)
- B. Remote control switch for conference rooms (Watt Stopper #LMRH-105)
- C. Occupancy sensor for conference rooms (Watt Stopper #LMDC-100)
- D. Emergency control unit for generator power circuits (Watt Stopper #L/CA Series with UL924 listing.
- E. Data com link (Watt Stopper #HLINK-CC)
- F. Web link (Watt Stopper #WL-BASE)

- G. Override switch (Watt Stopper #HDLS435-7)

2.11 CONTROL OF EMERGENCY LIGHTING

- A. Where indicated, lighting control panels designated for control of emergency lighting shall be provided with factory installed provision for automatic by pass of relays controlling emergency circuits upon loss of normal power. Panels shall be properly listed and labeled for use on emergency lighting circuits and shall meet the requirements of UL924 and NFPA 70 - Article 700.

PART 3 EXECUTION

3.01 INSTALLATION

- A. When using wire other than RJ-45 connections provide detailed point to point wiring diagrams for every termination. Provide wire specifications and wire colors to simplify contactor termination requirements
- B. Install the work of this Section in accordance with manufacturer's printed instructions unless otherwise indicated.
- C. Calibrate all sensor time delays and sensitivity to guarantee proper coverage of occupants and energy savings.
 - 1. Adjust time delay so that controlled area remains lighted for 5 minutes after occupant leaves area.
- D. Provide written or computer generated documentation on the commissioning of the system including room by room description including:
 - 1. Sensor parameters, time delays, sensitivities, daylighting set points.
 - 2. Sequence of operation, manual ON, Auto OFF. Etc.
 - 3. Load Parameters - blink warning, etc.
- E. Re-commissioning – After 30 days from occupancy re-calibrate all sensors time delays and sensitivities to meet the County's Project Requirements. Provide a detailed report to the County's Representative of re-commissioning activity

3.02 FACTORY COMMISSIONING

- A. Upon completion of the installation, the system shall be commissioned by the manufacturer's factory authorized representative who will verify a complete fully functional system.
- B. The electrical contractor shall provide both the manufacturer and the electrical engineer with ten working days written notice of the system startup and adjustment date.
- C. Upon completion of the system commissioning the factory authorized technician shall provide the proper training to the County's personnel on the adjustment and maintenance of the system.

3.03 LIGHTING CONTROL APPLICATIONS

- A. Unless relevant provisions of the applicable local Energy Codes are more stringent, provide a minimum application of lighting controls as follows:
 - 1. Space Control Requirements: Provide occupancy/vacancy sensors with manual-on functionality in all spaces except toilet rooms, museum, or other applications where hands-free operation is desirable and automatic-on occupancy sensors are more appropriate. Provide manual ON occupancy/vacancy sensors for any enclosed office, conference room, meeting room, open plan system and media room. For spaces with multiple occupants or where line-of-sight may be obscured, provide ceiling- or corner-mounted sensors with manual-on switches.

2. Bi-Level Lighting – Provide multi –level switched dimming controls in all spaces except toilet rooms, museum, or applications where variable dimming is used.
 3. Daylighted Areas. All luminaires within 15' of windows or within 7' of skylights (the daylighted zone) shall be separately controlled from luminaires outside of daylighted zones. Luminaires closest to the daylight aperture shall be separately controlled from luminaires farther from the daylight aperture, within the daylight zone.
 4. Daytime set points for total illumination (combined daylight and electric light) level that initiate dimming shall be programmed to be not less than 125% of the nighttime maintained designed illumination levels.
 5. Multiple-leveled switched daylight harvesting controls may be utilized. Submit to County's Representative for review and approval.
 6. Provide smooth and continuous daylight dimming for areas indicated. Daylight system may be designed to turn off ambient lighting when daylight is at or above required lighting levels, only if system functions to turn lamps back on at dimmed level, rather than turning full-on prior to dimming.
- B. Additional controls: Provide occupancy/vacancy sensors for any enclosed office, conference room, meeting room, and media room. For spaces with multiple occupants or where line-of-sight may be obscured, provide ceiling- or corner-mounted with manual-on switches.

3.04 MANUFACTURER'S FIELD SERVICES

- A. Division 01 - Quality Requirements: Requirements for manufacturer's field services.
- B. Furnish services for minimum of two days for check, test, and start-up. Perform the following services:
1. Check installation of panelboards.
 2. Test operation of remote controlled devices.
 3. Repair or replace defective components.

3.05 ADJUSTING

- A. Division 01 - Execution and Closeout Requirements: Requirements for starting and adjusting.
- B. Test each system component after installation to verify proper operation.
- C. Test relays and low voltage switches after installation to confirm proper operation.
- D. Confirm correct loads are recorded on directory card in each panel.
- E. Provide relocation of occupancy sensors to eliminate false triggering.

3.06 DEMONSTRATION

- A. Division 01 - Execution and Closeout Requirements: Requirements for demonstration and training.
- B. Demonstrate operation of the following system components:
1. Operation of switches.
 2. Operation of each type of occupancy sensors.
 3. Operation of each type of photocell.
- C. Furnish 4 hours to instruct County's personnel in operation and maintenance of system. Schedule training with County's Representative. Provide at least 7 days notice to the County's Representative of training date.

END OF SECTION