

SECTION 26 09 23 - LIGHTING CONTROLS

PART I - GENERAL

1.1 RELATED DOCUMENTS

- A. *Drawing 26 56 00-4 – Campus Lighting Control Schematic*

1.2 DESIGN, SPECIFICATION, AND DOCUMENTATION

[Note to PSC: Lighting control systems present frequent problems due to inadequate detail included in bid documents. PSC shall carefully specify all components for a complete and accurate bid contract.]

- A. *The goal shall be to reduce total life-cycle cost of the complete lighting system. The simplest control system shall be used which meets the project design requirements.*
- B. *Pay special attention to ensure compatibility of control voltages, ballasts, and control interface with other systems such as HVAC controls, daylighting sensors, window shades, etc. If a building-wide master lighting control system is used, it shall output lighting energy usage information to the Building Automation System (BAS).*
- C. *Documentation and user training are critical to successful use of lighting control systems. Include in bid documents the requirement for complete manufacturer as-built documents, O&M manuals, and a minimum of 16 hours training for building users and F&S maintenance personnel.]*
- D. The location of all sensors, switches, user interfaces, relays, and load controllers shall be shown on the bid and construction document plans. Where there are multiple sensors, switches, or user interfaces in a room or space, the plans shall include labels, indexes, or other means to designate the light fixtures that are controlled by each device. Where sensors, switches, user interfaces of multiple types, ranges, or capacities are utilized on a project, the plans shall include labels, indexes, or other means to delineate the type, range, or capacity of each device. Where a specified sensor has a directionally specific sensing pattern, the intended orientation shall be indicated on the plans. The labeling, indexing or other means of indication shall clearly and unambiguously indicate the design intent.
- E. The bid and construction documents shall include wiring specifications and connection diagrams for the system that is the basis of design specific for each space. Typical diagrams for similar spaces shall be acceptable for spaces with similar devices and sequence of operations.
- F. The bid and construction documents shall include a specific sequence of operation indicated for each space with lighting controls. The plans shall include a label, index or other means of clearly and unambiguously indicating the intended sequence of operations for each space.
- G. Sequences of operations included in the bid and construction documents shall be reviewed with the users and approved by F&S engineering.
- H. Sequences of operations shall comply with the lighting control requirements of the Energy Code in force for the University at the time of bidding.

1.3 ENERGY CODE

For purposes of this section, the Energy Code in force for the University shall be the Illinois Energy Conservation Code's mandated Standards for State Funded Facilities as adopted and amended by the Capital Development Board including subsequent versions and amendments when adopted Capital Development Board.

PART 2 - PRODUCTS

2.1 EXTERIOR LIGHTING CONTROL

- A. Exterior lighting shall be controlled by the Campus Central Lighting control that is transmitted via the Signal Cable. Refer to *Drawing 26 56 00-4 – Campus Lighting Control Schematic*. Lighting control shall be located in the building transformer room.
- B. If the campus signal cable is not available, the method of control shall be a photocell with an adjustable on-off setting mounted on the roof of the building and a manual override test switch located in the building transformer room. The unit shall be mounted on 2-inch aluminum tubular stand, or other suitable manner, oriented to the north sky per manufacturer's specification. Provide the following in the transformer room:
 - 1. Toggle switch in pull box, wired in parallel with the photo-electric control on roof for testing.
 - 2. A street lighting contactor, 2-pole, with 120-volt, 60-cycle coil, actuated by the photo-electric control on roof. Size of the contactor shall be governed by the number of campus lighting fixtures controlled.
- C. In addition to the controls listed above, exterior lighting controls shall include the Exterior Lighting Control Requirements of the Energy Code in force for the University at the time of bidding.

2.2 INTERIOR LIGHTING CONTROL

- A. Interior lighting control systems shall consist of occupancy sensors, daylight sensors, switches and user interfaces, load and level controllers, output relays, interconnecting wiring, and associated accessories.
- B. Provide lighting controls in each space as necessary to fulfill the project's program requirements for use of the space and the Energy Code's lighting control requirements for the space.
- C. Automatic lighting shutoff shall not be installed in electrical rooms, mechanical rooms, or elevator machine rooms. Automatic lighting shutoff shall not be installed in laboratories or workshops if automatic shutoff would endanger the safety or security of the room or building occupants. Automatic lighting shutoff shall not be installed in other spaces where automatic shutoff would endanger the safety or security of the room or building occupants. A list of all spaces being exempted from automatic lighting shutoff based on safety and security concerns shall be submitted and reviewed with the University during project design.
- D. Each controlled space shall include an isolated auxiliary relay contact for connection to the Building Automation System (BAS). The auxiliary contact can be, but does not have to be, integral to an occupancy sensor. The auxiliary relay shall indicate occupancy independent of the state of the lighting in the space (i.e. in an occupied room with the lights off, the auxiliary relay shall indicate occupied state to the BAS). Unless there is a specific design or operational reason for multiple auxiliary relay contacts, in a room or space with multiple occupancy sensors, there shall be one unique auxiliary relay that indicates if any of the occupancy sensors detect occupancy. *[Note to PSC: Sensors integrated with HVAC controls shall be shown on both the Electrical and Temperature Controls drawings. Typically, Occupancy Sensors will be provided by Electrical contractor.]*
- E. Interior lighting control systems shall include occupancy based automatic receptacle control where needed to meet the requirements of the Energy Code. Except where necessitated by project program requirements, the occupancy sensor(s) installed in a space for lighting control shall also provide the automatic receptacle control.
- F. Interconnections between control devices shall be wired. Wireless sensors and control devices are not allowed.
- G. Systems that utilize programming to set or adjust device operation or function shall include programming software and programming interface devices. Systems that require

proprietary programming devices shall include one of each required devices to the University for each project unless otherwise waived by the University. Software upgrades shall be included as ongoing manufacturer's support of the lighting control system.

- H. Switches and user interfaces shall be as simple as practical and include clear intuitive labels/markings indicating ON, OFF, RAISE, LOWER by text, symbols or both. Devices that require button sequences that are not discernable from the markings on the device are not acceptable.
- I. Occupancy sensors (auto on/off) and vacancy sensors (manual-on, auto-off) shall be used where appropriate.
 - 1. Occupancy sensors shall be dual-technology type unless specifically contradicted for the application.
 - 2. Occupancy sensors subject to abuse (such as wall switch type) shall have tamper resistant housing.
 - 3. Occupancy sensors shall have clearly defined coverage patterns suitable for the application.
 - 4. Occupancy sensors with active automatically adaptive sensitivity and timer adjustments are not allowed.
- J. Daylight sensors shall be used where appropriate for daylight responsive lighting control.
 - 1. Daylight sensors shall be solid state light level sensing units to automatically adjust the output of the controlled lighting fixtures.
 - 2. Daylight sensors shall control light fixtures directly or through associated load controllers
 - 3. Daylight sensors shall have adjustable sensitivity and output settings to tailor lighting control to the specific space and application.
 - 4. Daylight sensors shall have well defined coverage patterns and capacities suitable for application
- K. Load and level controllers
 - 1. Load and level controllers shall have voltage and amperage ratings for the loads being controlled.
 - 2. Load and level controllers shall provide dimming and level signal and control fully compatible with the light loads being controlled.
 - 3. Load controllers for automatic receptacle control shall have a load rating of no less than 20 amperes at 120 volts.
 - 4. Load and level controllers shall be fully compatible with sensors, switches and user interfaces, load and level controllers, relays, and accessories.
 - 5. Where allowed by the Energy Code, daylight responsive lighting level adjustments shall be continuous in nature. Daylight responsive level adjustments of discrete, observable steps shall not be employed except where required by the application or conditions.
 - 6. Where daylight responsive lighting level control is provided in a space where lighting is also subject to manual adjustment of the general lighting level, the level controller shall be capable of responding to the manual level control in conjunction with the daylight sensor adjustments.
- L. Sensors, switches and user interfaces, load and level controllers, output relays, interconnecting wiring, and associated accessories utilized throughout the lighting control system shall be mutually compatible and function as an integrated system.
- M. System Wiring

1. Line voltage source and load wiring shall be individual conductors in conduit in accordance to sections 26 05 19 CONDUCTORS AND CABLE and 26 05 33 RACEWAYS of the UI Facility Standards.
2. Line voltage control wiring shall be individual conductors in conduit in accordance to sections 26 05 19 CONDUCTORS AND CABLE and 26 05 33 RACEWAYS of the UI Facility Standards.
3. Low voltage control wiring exposed and concealed in walls and shall be conductors or cables in raceways in accordance to section 26 05 34 LOW VOLTAGE RACEWAYS of the UI Facility Standards.
4. Low voltage control wiring above accessible ceilings shall be conductors or cables in raceways in accordance to section 26 05 34 LOW VOLTAGE RACEWAYS of the UI Facility Standards or manufacturer specified multi conductor cables neatly installed and tied/attached to the conduit system serving the light fixtures controlled by the associated control system. Splices, taps, and terminations shall be enclosed in electrical boxes, device covers or device jacks that have no exposed contacts or live surfaces. Cables entering boxes or device enclosures shall be protected by grommets.

N. Auditorium and Lecture Hall systems

1. A system controlling multiple lighting zones and capable of storing and recalling multiple scenes shall be provided in Auditorium and Lecture halls where called for by the project's program requirements.
2. In addition to Energy Code requirements, the system shall include a Lecture/Presenter control station and scene control, and entrance control stations as appropriate.
3. The system shall include an interface for integration of the room's lighting control and scene selection with the room's instructional audio visual system. Coordinate requirements with UI Technology Services. Provide a 3/4" conduit from the lighting system's interface module to AV equipment location.

O. Manufacturers:

1. Hubbell Control Solutions, Wattstopper, Leviton, Acuity Brands/Sensor Switch.
2. Lutron is also acceptable in auditoriums, lecture halls, and other spaces with multiple lighting zones requiring multiple scenes and AV interface.
3. For projects involving a partial portion of a building, consideration should be given to maintaining consistency of manufacturer with previously installed systems if present. Basis of Design should be based on manufacturer's system(s) already present in the building with other acceptable manufacturers listed as alternates as necessary to provide competitive bidding. If the existing system's manufacturer is not one listed above, consult F&S engineering for approval of continued use.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Manufacturers Instruction: Install in accordance with manufacturers instruction.
- B. Verify Locations: Verify locations of switches, user interfaces and sensors before installation.
- C. Load and Level Controller Installation: In spaces with accessible ceilings, mount room controllers above ceiling as near to the main door to the space as practical. In spaces with inaccessible ceilings mount room controllers in accessible location near the room being controlled. In spaces with exposed ceilings, mount room controllers at ceiling as near the main door to the space as practical. Controllers in exposed locations shall be installed in junction boxes or suitable enclosures. Locations of centralized relay/control panels shall be reviewed and confirmed by F&S Engineering.

- D. Test and Adjust: After completion of installation, test and adjust control equipment and programming to function in accordance with project requirements, sequences of operations and the Energy Code.

3.2 COMMISSIONING

- A. Lighting control systems shall be in place, functional, and tested, prior to demonstration to the UI inspection and commissioning agent. Complete operational function shall be demonstrated to the UI inspection and commissioning agent prior to acceptance. A factory authorized representative shall be present during demonstration to provide adjustment and programming modifications as necessary.

3.3 TRAINING

- A. Upon completion of the work and after User acceptance of Functional Performance testing, on-site training shall be provided by an instructor thoroughly familiar with the installed system. Training will be provided to the Owner's operating personnel who have responsibility for the lighting and control systems. The training shall focus on operation and maintenance of the installed system. *[Note to PSC: The amount of training shall be provided and shall match the size of the project (e.g., no less than eight hours for small projects and up to 40 hours for large projects). Specify exact hours in the Contract Documents].*

- B. *[Note to PSC: Upon completion of the work and after User acceptance of Functional Performance testing, on-site training shall be provided by an instructor thoroughly familiar with the installed system tailored specifically for the equipment and controls, and any other unique systems on project. Training will be provided to the Laboratory personnel and simultaneously to the Owner's operating personnel who have responsibility for the mechanical and controls systems. The training shall focus on operation and maintenance of the installed systems for the Laboratory and Systems that support it. The amount of training shall be 40 hours.]*

- 3.4 *[Note to PSC: Personnel factory training shall be provided for User if an approved manufacturer is new to the University or if User deems necessary during project design phase.]* Personnel Factory training shall be provided for User- F&S Electricians.

END OF SECTION 26 09 23

This section of the *U of I Facilities Standards* establishes minimum requirements only. It should not be used as a complete specification.