

~~~~~ **PROJECT NOTE** ~~~~~

ARCHITECT OF RECORD/ENGINEER OF RECORD IS RESPONSIBLE FOR REVIEWING THIS SPECIFICATION SECTION IN DETAIL FOR COORDINATION WITH THE PROJECT SCOPE OF WORK.

ALL “PROJECT NOTE” TEXT IS TO BE REMOVED FOLLOWING REVIEW OF THE CONTENT OF EACH NOTE BY THE ARCHITECT OF RECORD/ENGINEER OF RECORD.

EDIT THE DOCUMENT FOOTER TO INCLUDE THE PROJECT NAME AND NUMBER.

EDIT THE DOCUMENT HEADER TO INDICATE THE ARCHITECT OF RECORD PROJECT ISSUE” DATE. THE “CPS CONTROL” DATE SHOULD NOT BE EDITED.

ANY MODIFICATIONS TO THE TECHNICAL STANDARDS IN THIS SECTION - INCLUDING THE REMOVAL OR ADDITION OF MANUFACTURERS - MUST BE APPROVED BY CPS. REQUESTS FOR MODIFICATION ARE TO BE SUBMITTED TO THE DESIGN MANAGER DURING THE DESIGN PHASE FOR REVIEW AND APPROVAL.

~~~ **END OF PROJECT NOTE** ~~~

**SECTION 26 09 43
LIGHTING CONTROLS**

~~~~~ **PROJECT NOTE** ~~~~~

THIS SPECIFICATION SECTION IS INTENDED TO BE USED FOR NEW SCHOOLS OR FOR SCHOOLS WITH A COMPLETE LIGHTING SYSTEM REPLACEMENT. THIS SECTION IS APPLICABLE FOR A FULLY INTEGRATED AND NETWORKED SYSTEM.

THE USE OF THIS SECTION TO BE PRE-APPROVED BY CPS.

~~~ **END OF PROJECT NOTE** ~~~

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Manually operated, PC-based, digital lighting controls with external signal source relays and control module.

1.02 REFERENCE STANDARDS

- A. 47 CFR 15 - Radio Frequency Devices; current edition.
- B. ASHRAE Std 135 - A Data Communication Protocol for Building Automation and Control Networks; 2024.
- C. City of Chicago Building Code - Chicago Construction Codes, Title 14B; Current Edition.
- D. City of Chicago Electrical Code - Chicago Construction Codes, Title 14E, based on the National Electrical Code with amendments; Current Edition.
- E. Chicago Electrical Code - Municipal Code of the City of Chicago, Building/Electrical Code Requirements; 2018.
- F. Chicago Energy Conservation Code - Chicago Energy Transformation Code, based on the International Energy Conservation Code, with amendments; Current Edition.

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- G. TIA/EIA-568 - Commercial Building Telecommunications Cabling Standard. (consists of 3 Parts, listed below); Rev C, 2012, and latest addenda.
- H. TIA-485 - Electrical Characteristics of Generators and Receivers for Use in Balanced Digital Multipoint Systems; 1998a (Reaffirmed 2012).

1.03 DEFINITIONS

- A. BACnet: A networking communication protocol that complies with ASHRAE Std 135.
- B. BAS: Building automation system.
- C. Low Voltage: As defined in CEC for circuits and equipment operating at less than 50 V or for remote-control, signaling and power-limited circuits.
- D. Monitoring: Acquisition, processing, communication, and display of equipment status data, metered electrical parameter values, power quality evaluation data, event and alarm signals, tabulated reports, and event logs.
- E. PC: Personal computer; sometimes plural as "PCs."
- F. Power Line Carrier: Use of radio-frequency energy to transmit information over transmission lines whose primary purpose is the transmission of power.
- G. RS-485: A serial network protocol, similar to RS-232, complying with TIA-485.
- H. IP: Internet Protocol.

1.04 SUBMITTALS

- A. Product Data: For control modules, power distribution components, manual switches and plates, and conductors and cables.
- B. Design Documents: Where Lighting Control Manufacturer Sensor Layout and Tuning service is specified in Part 2 under "SYSTEM REQUIREMENTS", Lighting Control Manufacturer to provide plans indicating occupancy/vacancy and/or daylight sensor locations and coverage.
- C. Shop Drawings: Detail assemblies of standard components, custom assembled for specific application on this Project.
 - 1. Outline Drawings: Indicate dimensions, weights, arrangement of components, and clearance and access requirements.
 - 2. Block Diagram: Show interconnections between components specified in this Section and devices furnished with power distribution system components. Indicate data communication paths and identify networks, data buses, data gateways, concentrators, and other devices to be used. Describe characteristics of network and other data communication lines.
 - 3. Wiring Diagrams: Power, signal, and control wiring. Coordinate nomenclature and presentation with a block diagram.
 - 4. Coordinate Lighting Controls with auditorium Lighting Controls and Audio Video System.
- D. Coordination Drawings: Submit evidence that lighting controls are compatible with connected monitoring and control devices and systems specified in other Sections.
 - 1. Show interconnecting signal and control wiring and interfacing devices that prove compatibility of inputs and outputs.
 - 2. For networked controls, list network protocols and provide statements from manufacturers that input and output devices meet interoperability requirements of the network protocol.
- E. Software and Firmware Operational Documentation:
 - 1. Software operating and upgrade manuals.
 - 2. Program Software Backup: On a magnetic media or compact disc, complete with data files.
 - 3. Device address list.
 - 4. Printout of software application and graphic screens.
- F. Field quality-control test reports.

- G. Software licenses and upgrades required by and installed for operation and programming of digital and analog devices.
- H. Operation and Maintenance Data: For lighting controls to include in emergency, operation, and maintenance manuals.
- I. Warranty: Special warranty specified in this Section.

1.05 QUALITY ASSURANCE

- A. Source Limitations: Obtain lighting control module and power distribution components through one source from a single manufacturer.
 - 1. Lighting control components to be from same manufacturer as Modular Dimming Controls and Central Dimming Controls.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in City of Chicago Electrical Code, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with 47 CFR, Subparts A and B, for Class A digital devices.
- D. Comply with the City of Chicago Building Code, City of Chicago Electrical Code and Chicago Energy Conservation Code.

1.06 COORDINATION

- A. Coordinate lighting control components to form an integrated interconnection of compatible components.
 - 1. Match components and interconnections for optimum performance of lighting control functions.
 - 2. Coordinate lighting controls with BAS. Design display graphics showing building areas controlled; include the status of lighting controls in each area.
 - 3. Coordinate lighting controls with that in Sections specifying distribution components that are monitored or controlled by power monitoring and control equipment.
- B. Coordinate with:
 - 1. Section 26 09 23 - Lighting Control Devices
 - 2. Section 26 09 33 - Central Dimming Controls
 - 3. Section 26 09 36 - Modular Dimming Controls
 - 4. Section 26 51 00 - Interior Lighting

1.07 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the placement of lighting control devices with millwork, furniture, equipment, etc. installed under other sections or by others.
 - 2. Coordinate the placement of wall switch occupancy sensors with actual installed door swings.
 - 3. Coordinate the placement of occupancy/vacancy sensors with millwork, furniture, equipment or other potential obstructions to motion detection coverage installed under other sections or by others.
 - 4. Coordinate the placement of photo sensors for daylighting controls with windows, skylights, and luminaires to achieve optimum operation. Coordinate placement with ductwork, piping, equipment, or other potential obstructions to light level measurement installed under other sections or by others.
 - 5. Notify Architect/Engineer of Record of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.
- B. Pre-Wire Meeting: Conduct on-site meeting with lighting control system manufacturer prior to commencing work as part of manufacturer's standard startup services. Manufacturer to review with installer:
 - 1. Low voltage wiring requirements.

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2. Separation of power and low voltage/data wiring.
 3. Wire labeling.
 4. Where Lighting Control Manufacturer Sensor Layout and Tuning service is specified in under "LIGHTING CONTROL SYSTEM - GENERAL REQUIREMENTS", sensor locations to be reviewed in accordance with layout provided by Lighting Control Manufacturer. Lighting Control Manufacturer may direct Contractor regarding sensor relocation should conditions require a deviation from locations indicated.
 5. Control locations.
 6. Load circuit wiring.
 7. Connections to other equipment.
 8. Installer responsibilities.
- C. Sequencing:
1. Do not install lighting control devices until final surface finishes and painting are complete.

1.08 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of lighting controls that fail in materials or workmanship or from transient voltage surges within specified warranty period.
1. Failures include, but are not limited to, the following:
 - a. Failure of software input/output to execute switching or dimming commands.
 - b. Failure of modular relays to operate under manual or software commands.
 - c. Damage of electronic components due to transient voltage surges.
 2. Warranty Period: Five (5) years from date of Preliminary Acceptance.
 3. Extended Warranty Period Failure Due to Transient Voltage Surges: Eight (8) years.
 4. Extended Warranty Period for Electrically Held Relays: Ten (10) years from date of Preliminary Acceptance.

1.09 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Electrically Held Relays: Equal to 10-percent of amount installed for each size indicated, but no fewer than two (2) relays of each type.
 2. Switches: Minimum one of each type.
 3. Switch Button Covers: equal to three percent of amount installed for each size indicated, but no fewer than three.

1.10 SOFTWARE SERVICE AGREEMENT

- A. Technical Support: Beginning with Preliminary Acceptance, provide software support for two (2) years.
- B. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two (2) years from date of Preliminary Acceptance. Upgrading software shall include operating system. Upgrade shall include new or revise licenses for use of the software.
1. Provide 30-day notice to Board to allow scheduling and access to system and to allow Board to upgrade computer equipment, if necessary.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Acuity Brands Lighting, Inc: <https://www.acuitybrands.com>
 2. Cooper Lighting Solutions, Inc: <https://www.cooperlighting.com>
 3. Current NX: www.currentlighting.com/controls-sensors

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4. ETC Company; <https://www.etcconnect.com>
5. Leviton Manufacturing Company, Inc: www.leviton.com
6. Lutron Electronics Company, Inc: www.lutron.com
7. WattStopper: www.wattstopper.com

2.02 SYSTEM REQUIREMENTS

- A. Expandability: System shall be capable of increasing the number of control functions in the future by 25 percent of current capacity; to include equipment ratings, housing capacities, spare relays, terminals, number of conductors in control cables, and control software.
- B. Sensor Layout and Tuning: Include as part of the base bid additional costs for Lighting Control Manufacturer's Sensor Layout and Tuning service:
 1. Lighting Control Manufacturer to take full responsibility for wired or wireless sensor layout and performance for sensors provided by Lighting Control Manufacturer.
 2. Lighting Control Manufacturer to analyze the reflected ceiling plans, via supplied electronic AutoCAD format, and design a detailed sensor layout that provides adequate occupancy sensor coverage and ensures occupancy and daylight sensor performance per agreed upon sequence of operations. Contractor to utilize the layouts for sensor placement.
 3. During startup, Lighting Control Manufacturer to direct Contractor regarding sensor relocation, as required, should conditions require a deviation from locations specified in the drawings.
 4. Lighting Control Manufacturer to provide up to two additional post-startup on-site service visits, within one calendar year from date of Preliminary Acceptance to fine-tune sensor calibration per the agreed upon sequence of operations.
- C. Performance Requirements: Manual switches, an internal timing and control unit, and external sensors or other control signal sources send a signal to a PC-based programmable-system control module that processes the signal according to its programming and routes an open or close command to one or more relays in the power-supply circuits, or routes variable commands to one or more dimmers, for groups of lighting fixtures or other loads.

2.03 CONTROL MODULE

- A. Control Module Description: Comply with UL 916 (CSA C22.2, No. 205); PC-based, solid- state, 365-day timing and control unit. Control units shall be networked and capable of receiving inputs from indicated sensors and hand-held programmer. Output circuits shall be pilot-duty relays or dimmer units compatible with power switching devices. Output circuits shall include digital circuits arranged to transmit control commands to remote preset dimmers. Modules and their associated control panels shall include the following features:
 1. Multiple output with number of channels as indicated in Schedules.
 2. Multiple inputs and multichannel output arranged as indicated in Schedules.
 3. Multiple inputs for occupancy sensors, daylight sensors, and dimming systems with associated daylight sensors.
 4. Display: Single graphic display for programming each lighting control unit.
 5. Interoperability: Control module shall be configured to connect with other control systems using RS-485 network to enable remote workstations to use control module functions.
 6. Interoperability: Control module shall be configured to connect to BACnet compliant network, resulting in extending control to any network-compliant devices such as occupancy switches.
 7. Interoperability: Lighting control shall be configured to allow individual users to turn lighting on and off from local control stations.
 8. System Memory: Nonvolatile. System shall reboot program and reset time automatically without errors after power outages up to 90-days' duration.

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9. Software: Lighting control software shall be capable of linking switch or sensor inputs to relay outputs, retrieving links, viewing relay output status, controlling relay outputs, simulating switch inputs, setting device addresses, and assigning switch input and relay output modes.
10. Time Based Control shall include:
 - a. 24-hour time-of-day programming.
 - b. Automatic daylight savings adjustment.
 - c. Holiday and weekend programming (365 days).
 - d. Astronomic capability (dusk on/dawn off).
 - e. A minimum of 8 ON and 5 OFF setpoints.
 - f. Tie indicated on AM/PM format.
 - g. Manual override to ON and OFF positions.
 - h. Manual skip to next scheduled event.
 - i. Battery backup to maintain time and program memory for a minimum of 7 days.
 - j. Each circuit has capability for a low voltage input for remote override.
 - k. Time Switch includes software for programming by computer and via Ethernet connection.
11. Confirmation: Each relay or contactor device operated by system shall have auxiliary contacts that provide a confirmation signal to the system of on or off status of device. On or off status confirmation of each electrically operated circuit breaker shall be provided by an auxiliary contact or by a sensing device at load terminal.
 - a. Software shall interpret status signals, provide for their display, and initiate failure signals.
 - b. Lamp or LED at control module or display panel shall identify status of each controlled circuit.
12. Remote Communication Capability: Allow programming, data-gathering interrogation, status display, and controlled command override from a PC at a remote location over data links. System shall include communications and control software, and remote computer compatibility verification for this purpose.
13. Local Override Capability: Manual, low-voltage control devices shall override programmed shutdown of lighting and shall override other programmed control for intervals that may be duration programmed.
14. Automatic Control of Local Override: Automatic control shall switch lighting off if lighting has been switched on by local override..
15. Automatic battery backup shall provide power to maintain program and system clock operation for 90 days' minimum duration when power is off.
16. Programmed time signals shall change preset scenes and dimmer settings.
17. Energy Conservation: Bi-level control of special ballasts or dimming circuits to comply with local energy codes.
18. Flick Warning: Programmable momentary turnoff of lights shall warn that programmed shutoff will occur after a preset interval. Warning shall be repeated after a second preset interval before end of programmed override period.
19. Diagnostics: When system operates improperly, software shall initiate factory-programmed diagnosis of failure and display messages identifying problem and possible causes.
20. Additional Programming: In addition to system programming by the PC, individual control modules shall be networked and remotely programmable.

B. Provide line voltage terminals capable of accepting #8 AWG conductors.

2.04 POWER DISTRIBUTION COMPONENTS

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- A. LRP Modular Relay Panel: Comply with UL 508 (CSA C22.2, No. 14) and UL 916 (CSA C22.2, No. 205); factory assembled with modular single-pole relays, power supplies, and accessory components required for specified performance.
 - 1. Cabinet: Steel with hinged, locking door.
 - a. Barriers separate low-voltage and line-voltage components.
 - b. Directory: Mounted on back of door. Identifies each relay as to load groups controlled and each programmed pilot device if any.
 - c. Control Power Supply: Transformer and full-wave rectifier with filtered dc output.
 - 2. Single-Pole Relays: Mechanically held unless otherwise indicated; split-coil, momentary-pulsed type.
 - a. Low-Voltage Leads: Plug connector to the connector strip in cabinet and pilot light power where indicated.
 - b. Rated Capacity (Mounted in Relay Panel): 20 A, 125-V ac for tungsten filaments; 20 A, 277-V ac for ballasts.
 - c. Endurance: 100,000 cycles at rated capacity.
 - d. Mounting: Provision for easy removal and installation in relay cabinet.
 - 3. Provide line voltage terminals capable of accepting #8 AWG conductors.
- B. Line-Voltage Surge Suppression: Factory installed as an integral part of 120- and 277-V ac, solid-state control panels.

2.05 LOCAL SWITCHES AND PLATES

- A. Push-Button Switches: See Section 26 09 23 – Lighting Control Devices for local wall control devices description and function.
- B. Manual, Maintained Contact, Full- or Low-Voltage Switch: Comply with Section 26 27 26 - Wiring Devices.
- C. Keyed Switch: Digital, low voltage type, ON/OFF or ENABLE/DISABLE switch.
 - 1. Pilot LED status indicator.
 - 2. Engraved position indicators.
- D. Wall Plates: Single and multigang plates as specified in Section 26 27 26 - Wiring Devices.
- E. Legend: Engraved or permanently silk-screened on wall plate where indicated.
Use designations indicated on Drawings.

2.06 CONDUCTORS AND CABLES

- A. Power Wiring to Supply Side of Class 2 Power Source: Not smaller than No. 12 AWG, complying with Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.
- B. Classes 2 and 3 Control Cables: Multiconductor cable with copper conductors not smaller than No. 18 AWG, complying with Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.
- C. Class 1 Control Cables: Multiconductor cable with copper conductors not smaller than No. 14 AWG, complying with Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.
- D. Digital and Multiplexed Signal Cables: Unshielded, twisted-pair cable with copper conductors, complying with TIA/EIA-568-B.2, Category 5e for horizontal copper cable and with Section 27 15 00 - Data Communications Horizontal Cabling.

PART 3 EXECUTION

3.01 WIRING INSTALLATION

- A. A. Comply with NECA 1.
- B. Wiring Method: Install wiring in raceways. Comply with Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables 26 05 83 - Wiring Connections and Section 27 15 00 - Data Communications Horizontal Cabling.
- C. Minimum conduit size shall be 1/2 inch (13 mm).

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- D. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Separate power-limited and non-power-limited conductors according to conductor manufacturer's written instructions.
- E. Install field-mounting transient voltage suppressors for lighting control devices in Category A locations that do not have integral line-voltage surge protection.
- F. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated in Contract Documents.
- G. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in terminal cabinets, equipment enclosures, and in junction, pull, and outlet boxes.
- H. Identify components and power and control wiring according to Section 26 05 53 - Identification for Electrical Systems.

3.02 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and assist in field testing. Report results in writing.
- B. Perform the following field tests and inspections and prepare test reports:
 - 1. Test for circuit continuity.
 - 2. Verify that the control module features are operational.
 - 3. Check operation of local override controls.
 - 4. Test system diagnostics by simulating improper operation of several components selected by the Architect/Engineer of Record.

3.03 SOFTWARE INSTALLATION

- A. Install and program software with initial settings of adjustable values. Make backup copies of software and user-supplied values. Provide current licenses for software.

3.04 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months of date of Preliminary Acceptance, provide on-site assistance in adjusting sensors and to assist Board's personnel in making program changes to suit actual occupied conditions. Provide up to two (2) visits to Project during other than normal occupancy hours for this purpose.

3.05 CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.
- B. Protect components from dirt and debris from subsequent construction activities. Training shall last a minimum of 4 hours and at the end of the session, the owner's maintenance personnel shall be thoroughly instructed in the proper operation of the system.

3.06 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Board's maintenance personnel to adjust, operate, and maintain lighting controls. Refer to Section 01 79 00 - Demonstration, Training and Commissioning.

END OF SECTION