

University of Houston Master Specification

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SECTION 26 0943 - RELAY-BASED LIGHTING CONTROLS

Maintain Section format, including the UH master spec designation and version date in bold in the center columns of the header and footer. Complete the header and footer with Project information.

Edit and finalize this Section, where prompted by Editor's notes, to suit Project specific requirements. Make selections for the Project at text identified in bold.

This Section uses the term "Engineer." Change this term to match that used to identify the design professional as defined in the General and Supplementary Conditions.

Verify that Section titles referenced in this Section are correct for this Project's Specifications; Section titles may have changed.

Delete hidden text after this Section has been edited for the Project.

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Contractor's attention is specifically directed, but not limited, to the following documents for additional requirements:
 - 1. The current version of the *Uniform General Conditions for Construction Contracts*, State of Texas, available on the web site of the Texas Facilities Commission.
 - 2. The University of Houston's Supplemental General Conditions and Special Conditions for Construction.

1.2 SUMMARY

- A. Section Includes: Lighting control panels using mechanically held relays for switching.
- B. Section Includes: Networked lighting control panels using control-voltage relays for switching and that are interoperable with HVAC DDC system.

1.3 DEFINITIONS

- A. BAS: Building automation system.
- B. DDC: Direct digital control.

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- C. IP: Internet protocol.
- 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.

1.4 ACTION SUBMITTALS

- A. Submittals shall comply with Division 01 requirements and also comply with additional requirements indicated in this Section.
- B. Submittals shall indicate contact for each party responsible for preparing the submittals. Include for each party: company name and address, person's name with contact information including phone number, e-mail address and date prepared.
- C. Submit catalogs, brochures, product data, shop drawings and other submittal data that contain only information specific to equipment, products and materials to be furnished. Do not submit information that describes several different items or options other than those items or options to be used unless irrelevant information is marked out and relevant material is clearly marked.
- D. Quality Control Review:
 - 1. Carefully check the submittal to ensure there is no missing and contradicting information.
 - 2. Front page of submittal shall indicate "Quality Control Review By" with list of each person and company name who performed the quality control review.
 - 3. Do not submit without a formal quality control review.
- E. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for control modules, power distribution components, relays, manual switches and plates, and conductors and cables.
 - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
 - 3. Sound data including results of operational tests of central dimming controls.
 - 4. Operational documentation for software and firmware.
- F. Shop Drawings: For each relay panel and related equipment.
 - 1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
 - 2. Detail enclosure types and details for types other than NEMA 250, Type 1.
 - 3. Detail wiring partition configuration, current, and voltage ratings.
 - 4. Short-circuit current rating of relays.

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5. Address Drawing: Reflected ceiling plan and floor plans, showing connected luminaires, address for each luminaire, and luminaire groups. Base plans on construction plans, using the same legend, symbols, and schedules.
6. Point List and Data Bus Load: Summary list of all control devices, sensors, ballasts, and other loads. Include percentage of rated connected load and device addresses.
7. Wire Termination Diagrams and Schedules: Coordinate nomenclature and presentation with Drawings and block diagram. Differentiate between manufacturer-installed and field-installed wiring.
8. 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.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Submit evidence that lighting controls are compatible with connected monitoring and control devices and systems.
 1. Show interconnecting signal and control wiring, and interface 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 comply with interoperability requirements of the network protocol.
- B. Qualification Data: For testing agency.
- C. Field quality-control reports.
- D. Software licenses and upgrades required by and installed for operation and programming of digital and analog devices.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Accredited by NETA.
 1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Handle and prepare panels for installation according to NECA 407.

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PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- A. Sequence of Operations: Input signal from field-mounted manual switches, or digital signal sources, shall open or close one or more lighting control relays in the lighting control panels. Any combination of inputs shall be programmable to any number of control relays.
- B. Interface with BAS System: Hardware and software shall interface with BAS system to monitor, control, display, and record data for use in processing reports.
 - 1. Hardwired Points:
 - a. Monitoring: On-off status.
 - b. Control: On-off operation.
 - 2. Communication Interface: The communication interface shall enable the BAS system operator to remotely control and monitor lighting from a BAS system operator workstation. Control features and monitoring points displayed locally at lighting panel shall be available through the BAS system.
- C. Surge Protective Device: Factory installed as an integral part of control components or field-mounted surge suppressors complying with UL 1449, SPD Type 2.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- E. Comply with 47 CFR 15, Subparts A and B, for Class A digital devices.
- F. Comply with UL 916.

2.2 NETWORKED LIGHTING CONTROL PANELS

- A. Description: Lighting control panels using mechanically latched relays to control lighting and appliances. The panels shall be capable of being interconnected with digital communications to appear to the operator as a single lighting control system.
- B. Lighting Control Panels:
 - 1. A single enclosure with incoming lighting branch circuits, control circuits, switching relays, and on-board timing and control unit.
 - 2. A vertical barrier separating branch circuits from control wiring.
- C. Main Control Unit: Installed in the main lighting control panel only; powered from the branch circuit of the standard control unit.

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1. Ethernet Communications: Comply with TCP/IP protocol. The main control unit shall provide for programming of all control functions of the main and all networked slave lighting control panels including timing, sequencing, and overriding.
 2. Controllers shall support interface security panel via BACnet communication.
 3. Web Server: Display information listed below over a standard Web-enabled server for displaying information over a standard browser.
 - a. A secure, password-protected login screen for modifying operational parameters, accessible to authorized users via Web page interface.
 - b. Panel summary showing the master and slave panels connected to the controller.
 - c. Controller diagnostic information.
 - d. Show front panel mimic screens for setting up controller parameters, input types, zones, and operating schedules. These mimic screens shall also allow direct breaker control and zone overrides.
 4. Timing Unit:
 - a. 365-day calendar, astronomical clock, and automatic adjustments for daylight savings and leap year.
 - b. Clock configurable for 12-hour (A.M./P.M.) or 24-hour format.
 - c. Four independent schedules, each having 24 time periods.
 - d. Schedule periods settable to the minute.
 - e. Day-of-week, day-of-month, day-of-year with one-time or repeating capability.
 - f. 16 special date periods.
 5. Time Synchronization: The timing unit shall be updated not less than every hour(s) with the network time server.
 6. Sequencing Control with Override:
 - a. Automatic sequenced on and off switching of selected relays at times set at the timing unit, allowing timed overrides from external switches.
 - b. Sequencing control shall operate relays one at a time, completing the operation of all connected relays in not more than 10 seconds.
 - c. Override control shall allow any relay connected to it to be switched on or off by a field-deployed manual switch or by an automatic switch, such as an occupancy sensor.
 - d. Override control "blinking warning" shall warn occupants approximately five minutes before actuating the off sequence.
 - e. Activity log, storing previous relay operation, including the time and cause of the change of status.
 - f. Download firmware to the latest version offered by manufacturer.
- D. Standard Control Unit, Installed in All Lighting Control Panels: Contain electronic controls for programming the operation of the relays in the control panel, contain the status of relays, and contain communications link to enable the digital functions of the main control unit. Comply with UL 916.

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1. Electronic control for operating and monitoring individual relays, and display relay on-time.
 2. Nonvolatile memory shall retain all setup configurations. After a power failure, the controller shall automatically reboot and return to normal system operation.
 3. Integral keypad and digital-display front panel for local setup, including the following:
 - a. Blink notice, time adjustable from software.
 - b. Ability to log and display relay on-time.
 - c. Capability for accepting downloadable firmware so that the latest production features may be added in the future without replacing the module.
- E. Relays: Electrically operated, mechanically held single-pole switch, rated at 20 A at 277 V. Short-circuit current rating shall be not less than 14 kA. Control shall be via microprocessor. Microprocessor is part of the lighting control panel.
- F. Power Supply: NFPA 70, Class 2, UL listed, sized for connected equipment, plus not less than 20 percent spare capacity. Powered from a dedicated branch circuit of the panelboard that supplies power to the line side of the relays, sized to provide control power for the local panel-mounted relays, bus system, low-voltage inputs, field-installed occupancy sensors, and low-voltage photo sensors.
- G. Operator Interface: At the main control unit, provide interface for a tethered connection of a portable PC running MS Windows for configuring all networked lighting control panels using setup software designed for the specified operating system. Include one portable device for initial programming of the system and training of Owner's personnel. That device shall remain the property of Owner.
- H. Software:
1. Menu-driven data entry.
 2. Online and offline programming and editing.
 3. Provide for entry of the room or space designation for the load side of each relay.
 4. Monitor and control all relays, showing actual relay state and the name of the automatic actuating control, if any.
 5. Size the software appropriate to the system.
- I. Provide listed barrier between relays used for normal lights and relays used for emergency lights.

2.3 MANUAL SWITCHES AND PLATES

- A. Switches: Digital, for operating one or more relays and to override automatic controls.
1. Match color and style specified in Section 26 2726 "Wiring Devices".
- B. Wall Plates: Single and multigang plates as specified in Section 26 2726 "Wiring Devices".

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- C. Legend: Engraved or permanently silk-screened on wall plate where indicated. Use designations indicated on Drawings.

2.4 CONDUCTORS AND CABLES

- A. Power Wiring to Supply Side of Class 2 Power Source: Not smaller than No. 12 AWG. Comply with requirements in Section 26 0519 "Insulated Conductors, Cables, Wires and Terminations".
- B. Classes 2 and 3 Control Cables: Multiconductor cable with copper conductors not smaller than No. 18 AWG. Comply with requirements in Section 26 0519 "Insulated Conductors, Cables, Wires and Terminations".
- C. Class 1 Control Cables: Multiconductor cable with copper conductors not smaller than No. 14 AWG. Comply with requirements in Section 26 0519 "Insulated Conductors, Cables, Wires and Terminations".
- D. Twisted-Pair Data Cable: Comply with TIA/EIA-568-B.2, Category 5a for horizontal copper cable.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Receive, inspect, handle, and store panels according to NECA 407.
- B. Examine panels before installation. Reject panels that are damaged or rusted or have been subjected to water saturation.
- C. Examine elements and surfaces to receive panels for compliance with installation tolerances and other conditions affecting performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 WIRING INSTALLATION

- A. Comply with NECA 1.
- B. Wiring Method: Install cables in raceways except within consoles, cabinets, desks, and counters. Conceal raceway and cables except in unfinished spaces.
 - 1. Install plenum cable in environmental airspaces, including plenum ceilings.
 - 2. Comply with requirements for raceways and boxes specified in Section 26 0533 "Electrical Raceways".

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- C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

3.3 PANEL INSTALLATION

- A. Comply with NECA 1.
- B. Install panels and accessories according to NECA 407.
- C. Mount top of trim 90 inches above finished floor unless otherwise indicated.
- D. Mount panel cabinet plumb and rigid without distortion of box.
- E. Install filler plates in unused spaces.

3.4 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 0553 "Identification for Electrical Systems".
- B. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Section 26 0553 "Identification for Electrical Systems".
- C. Create a directory to indicate loads served by each relay; incorporate Owner's final room designations. Obtain approval before installing. Use a PC to create directory; handwritten directories are unacceptable.
- D. Lighting Control Panel Nameplates: Label each panel with a nameplate complying with requirements for identification specified in Section 26 0553 "Identification for Electrical Systems".

3.5 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- B. Perform tests and inspections with the assistance of a factory-authorized service representative.
- C. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection and electrical test for low-voltage air circuit breakers described below and low-voltage surge arrestors. Certify compliance with manufacturer's test parameters.

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- a. Circuit-Breaker Tests:
 - 1) Compare nameplate with Drawings and Specifications.
 - 2) Inspect physical and mechanical conditions.
 - 3) Inspect anchorage and alignment.
 - 4) Verify that the units are clean.
 - 5) Apply power and test relays.
 - a) Apply power to the lighting control relay panel power supply only. Do not apply power to the controlled circuit loads.
 - b) Using the internal Relay Driver card, toggle each lighting relay ON and OFF. Observe and verify that the relay mechanical override switch moves and the LED status indicator changes.
 - c) Confirm relay operation by measuring the continuity at the line voltage terminations of each relay.
 - d) Apply line-voltage power to the relays.
 - e) Exercise caution to avoid inadvertent contact with line-voltage wiring. Using the internal Relay Driver card, toggle each relay ON/OFF and confirm that each relay controls the appropriate load.
 - 6) Operational Test: Set and operate controls to demonstrate their functions and capabilities in a methodical sequence that cues and reproduces actual operating functions.
 - a) Include testing of modular dimming control equipment under conditions that simulate actual operational conditions. Record control settings, operations, cues, and functional observations.
 - b) After installing time switches and sensors, and after electrical circuitry has been energized, adjust and test for compliance with requirements.
 - c) Operational Test: Verify operation of each lighting control device, and adjust time delays, dimming levels, preset scenes, and sequences.
 - 7) Startup:
 - a) Provide the services of a Factory Authorized Engineer for system checkout, testing and commissioning. Refer to Section 01 9113 "General Commissioning Requirements" for procedures.
 - b) Provide check-out of all system hardware by a factory trained technician. Correct deficiencies noted by the factory technician. Provide additional services as required by the Commissioning Agent.

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- 8) A final inspection of the system shall be rendered by the authorized factory-trained technician. Factory technician shall confirm proper installation and operation of the system. Correct deficiencies noted by the factory technician.
 - b. Surge Arrestor Tests:
 - 1) Compare nameplate with the Contract Documents.
 - 2) Inspect physical and mechanical conditions.
 - 3) Inspect anchorage, alignment, grounding, and clearances.
 - 4) Verify that the units are clean.
 - 5) Inspect bolted electrical connections for high resistance using one or more of the following methods:
 - a) Low-resistance ohmmeter.
 - b) Verify tightness of bolted electrical connections by calibrated torque wrench.
 - 6) Verify that the ground lead on each device is individually attached to a ground bus or ground electrode.
 - 7) Perform an insulation-resistance test on each arrestor, phase terminal-to-ground using voltage according to manufacturer written instructions.
 - 8) Comply with requirements in Section 26 0526 "Grounding and Bonding for Electrical Systems" for grounding tests.
 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
 - D. Lighting control panel will be considered defective if it does not pass tests and inspections.
 - E. Prepare test and inspection reports, including a certified report that identifies lighting control panels and describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations made after remedial action.
- ### 3.6 STARTUP SERVICE
- A. Engage a factory-authorized service representative to perform startup service.
 1. Complete installation and startup checks according to manufacturer's written instructions.
 2. Confirm correct communications wiring, initiate communications between panels, and program the lighting control system according to approved configuration schedules, time-of-day schedules, and input override assignments.

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3.7 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.8 SOFTWARE SERVICE AGREEMENT

- A. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for two years.
- B. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.
 - 1. Upgrade Notice: At least 30 days to allow Owner to schedule and access the system and to upgrade computer equipment if necessary.

3.9 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain the control unit and operator interface.

END OF SECTION 26 0943

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