

SECTION 260943 – LIGHTING CONTROL SYSTEM

PART 1 - GENERAL

1.1 INTRODUCTION

- A. The work covered in this section is subject to the requirements in the General Conditions of the Specifications. Contractor shall coordinate the work in this section with the trades covered in other sections of the specification to provide a complete and operable system.

1.2 SYSTEM DESCRIPTION

- A. Extent of lighting control system work is indicated by drawings and by the requirements of this section. Contractor shall furnish and install a complete, integrated, stand alone automatic lighting control system including programmable Lighting Control Panels with internal astronomic timeclock(s), Networking between panels, Dataline low voltage control switch inputs for zone control, Photocell input for outdoor lighting control, Occupancy Sensors, and Daylighting Controls from a single supplier. Contractor is responsible for confirming that the panels and sensors interoperate as a single system.

1.3 QUALITY ASSURANCE

- 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.

1.4 SUBMITTALS

- A. Submittals Package: Submit the shop drawings, and the product data specified below at the same time as a package.
 - 1. Shop Drawings: Building floorplans showing all proposed devices and composite wiring and/or schematic diagram of each control circuit as proposed to be installed (standard diagrams will not be accepted).
 - 2. Product Data: Catalog sheets, specifications and installation instructions.

1.5 APPROVED MANUFACTURERS

- A. Watt Stopper/Legrand – Lighting Integrator series
- B. Equal by Acuity Lighting
- C. Any other system wishing to be considered must submit descriptive information 10 days prior to bid. Prior approval does not guarantee final approval by the electrical engineer. The contractor shall be completely responsible for providing a system meeting this specification in its entirety. All deviations from this specification must be listed and individually signed off by the consultant.

PART 2 - PRODUCTS

2.1 LIGHTING CONTROL PANELS

- A. Provide lighting control panels in the locations and capacities as indicated on the plans and schedules. 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 indicated on the plans, 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, per enclosure. Multiple enclosures shall be provided where required for the specified quantities of relays/contactors.
 2. Cover shall be configured for surface or flush wall mounting of the panel as indicated on the plans. 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) Short circuit current capacity equal to (or greater than) that of the associated circuits (see associated panelboard schedules on drawings)
- 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
- 3) Isolated low voltage contacts provide for true relay status feedback and pilot light indication.
- 1. 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.

2.2 LONWORKS® BASED DIGITAL COMMUNICATIONS

- A. The lighting control panel shall support digital communications to facilitate the extension of control to include multiple panels and other intelligent field devices. Digital communications shall be LonWorks® based and use the LonTalk® protocol in an open topology architecture.
 - 1. Dataline communications wire shall be 18 AWG, 4 unshielded copper conductors (two independent twisted pairs) meeting Class 2P NEC code requirements. The dataline shall be topology free and can be run in a serial, "T" or star configuration.
 - 2. The Dataline wire will be supplied by the equipment manufacturer and will include the manufacturers name, catalog number printed on the wire jacket. The contractor, at their own expense will, replace an improper dataline wire.
 - 3. Panels shall be digitally addressed and support bi-directional communication between each other and other intelligent field devices specified elsewhere.
 - 4. Intelligent field devices supported shall include digital dataline switches, network clock/programmer, telephone interface module, BMS interface module, photocell control module, programmable thermostat, and universal switch module.

2.3 BROWSER BASED PROGRAMMING AND CONTROL

- A. The lighting control system shall include a web browser based user interface that shall allow programming and override of the system from any PC browser with network connectivity to the lighting controls. The Automation Appliance shall include as a minimum the following features:
 - 1. The interface shall be a TCP/IP based server device that is connected to the lighting control system global dataline and shall not require that software be installed on the client PC(s) for operation.
 - 2. Provide support for connection of one or more personal computers directly via Ethernet or enterprise connectivity via a local area network, wide area network or internet connection.
 - 3. Provide the option for a plug-in 56K baud modem to enable dial in connection via standard telephone line. All functionality of the browser interface shall be available through the dial-up connection.

4. Log in to the lighting control system through the browser interfaced shall provide multi-level security. Users shall be assigned log in access levels to restrict program modification to authorized users.
5. User programming shall include eight independent schedules for each lighting control panel, as well as, eight global schedules that affect channels in all panels on the network. Schedules shall overlap such that a panel specific schedule for any channel will override a global schedule for that channel.
6. Schedules shall be capable of seven day repeating and calendar date event based formats.
7. User programming shall be scenario based and shall include the following options:
 - a. Scheduled ON / OFF
 - b. Manual ON / Scheduled OFF
 - c. Manual ON / Auto Sweep OFF (for AS-100 Switches)
 - d. Astro ON / OFF (or Photo ON / OFF)
 - e. Astro and Schedule ON / OFF (or Photo and Schedule ON / OFF)
8. It shall be possible to view the status of and override any relay or channel group via the browser interface screens.
9. Provide support and user interface screens for integration of the photocontrol module, dataline switches, touch-tone telephone module, and universal switch module.
10. Provision for integration with the building automation system shall be via the industry standard BACnet protocol. Any of the eight global schedule channels shall individually be set to follow the BAS schedules rather than the internal Automation Appliance schedules. Relays in all panels shall be exposed to the BAS as binary output objects. It shall be possible for the BAS to read the status of each relay and to override each relay via BACnet.
11. The interface shall monitor all networked components and automatically generate alarms if any component fails to properly respond to control. Alarms shall be annunciated via the browser screens and via email to selected recipients where a proper SMTP server connection has been set up.
12. The user programming in the lighting control panels and dataline switches shall be available for viewing or download to the client PC as a standard PDF file.
13. A backup function shall permit the complete system program to be saved to the hard drive of any client PC connected to the lighting control system through the browser interface. A restore function shall allow a saved program to be reloaded to the interface.

2.4 EIGHT CHANNEL DIGITAL PHOTOCONTROL MODULE

- A. Provide a weatherproof Class 2 photocell for measuring exterior light levels. The photocell shall be mounted facing north as indicated on the plans. The photocell shall be connected to a photocontrol module mounted on the DIN rail inside the low voltage section of a lighting control panel and connected to the dataline communications wire.
 1. The photocontrol Module shall integrate seamlessly with either the Network Clock, Automation Appliance, or the BMS Interface Module. The control module shall measure the actual exterior light and display this level in foot candles (fc) on the unit LCD display.
 2. The controller shall have eight individual set point adjustments that are available to the lighting control network over the dataline communications wire.
 3. Features
 - a. Real time, 2 line LCD display of actual exterior light level up to 200 fc.
 - b. Channel set points and parameters programmed via the Network Clock or BMS Interface Module.
 - c. Choice of OPERATE or TEST modes, with simulated light level for testing.
 - d. Automatic dead band and 5 minute time delay to avoid cycling.

2.5 DIGITAL DATALINE SWITCHES

- A. 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 grey Lexan on all exposed parts and shall include a stainless steel wall plate, unless noted otherwise on plans.
 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.

2.6 AUTOMATIC LIGHTING CONTROLS

- A. System shall provide automatic lighting shutoff for all interior lighting circuits controlled by the system (excluding night lights and other similar circuits) per latest ASHRAE 90.1 & IECC standards, unless specifically shown otherwise on plans.
- B. System shall provide blink-warnings for interior lighting circuits (excluding circuits with HID light fixtures) controlled by the control panel 5 minutes prior to automatic shutoff.
- C. System shall include provisions for holiday scheduling, to allow automatic "ON" programming to be skipped on holidays and other scheduled off days per applicable energy code requirements.

- D. Low voltage remote override switches shall be provided as shown on drawings.
- E. Exact preset times for lighting control zone controls (where applicable) and lighting control system operation shall be per owner's direction. Contractor shall submit a proposed lighting control schedule indicating type of "ON" control (occupancy, time-of-day, manual, etc.), type of "OFF" control (occupancy, time-of-day, manual, etc.) and proposed preset times for all zones to owner for review prior to implementation. The following general control schemes shall generally be used where the owner has no preferences unless shown otherwise on plans:
 - 1. Exterior Security Lighting (at doorways, etc.):
 - a. On: Photocell or Astronomic – dusk.
 - b. Off: Photocell or Astronomic – dawn.
 - 2. Other Exterior Lighting:
 - a. On: Photocell or Astronomic – dusk.
 - b. Off: Preset Time (as directed by the facility operator).
 - 3. Interior Lighting with Occupancy Sensor Controls:
 - a. Corridors, restrooms, lobbies and other similar public spaces
 - 1) On: Occupancy Sensor.
 - 2) Off: Occupancy Sensor.
 - b. Storage rooms, janitor's closets, telecommunications rooms, and other similar unoccupied spaces:
 - 1) On: Manual Local Switch.
 - 2) Off: Occupancy Sensor.
 - c. Offices, classrooms, breakrooms, conference rooms, work areas, kitchens, gymnasiums, and other similar occupied spaces:
 - 1) On:
 - a) Manual Local Switch (if digital controls are provided) or
 - b) Occupancy Sensor (if hardwired controls are provided). Partial on only where required by code.
 - 2) Off: Occupancy Sensor (A "grace period" shall be provided, in which the occupancy sensor can turn lights back "on" for a short period of time (approximately 15 seconds) after lights are turned off automatically).
 - 4. Interior Lighting with Time-of-Day Controls:
 - a. Corridors, restrooms, lobbies and other similar public spaces
 - 1) On: Preset Time (as directed by the facility operator).
 - 2) Off: Preset Time (as directed by the facility operator).
 - b. Storage rooms, janitor's closets, telecommunications rooms, and other similar unoccupied spaces:
 - 1) On: Manual Local Switch
 - 2) Off: Preset Time (as directed by the facility operator).
 - c. Offices, classrooms, breakrooms, conference rooms, work areas, kitchens, gymnasiums, and other similar occupied spaces:

- 1) On: Manual Local Switch
- 2) Off: Preset Time (as directed by the facility operator).

2.7 WIRING

- A. See Specification Section 270500 for additional requirements.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Refer to Specification Section 270500 for additional cable installation requirements.
- B. Master/centralized lighting control switches (particularly switches located in areas where not all associated lighting fixtures are visible from the switch) and individual buttons of other lighting control stations with more than two (2) buttons shall be labeled (on switch coverplate or directly on buttons) with factory-engraved labeling. Exact wording of labeling shall be per owner's direction unless shown otherwise on plans.

3.2 SUPPORT SERVICES

- A. Pre-installation Coordination
 1. Exact occupancy sensor and daylight sensor types and locations shall be determined by the lighting control system supplier for a fully-functional system with adequate coverage throughout areas controlled by occupancy sensors. Exact locations shall be coordinated with actual HVAC register locations, furniture/casework/etc. locations, sensor coverage patterns, etc. for proper coverage in all areas. In no case may fewer devices or lower-quality devices be used in each area than indicated on contract documents.
- B. System Start Up and Commissioning
 1. The electrical contractor shall provide the manufacturer, the facility owner and the electrical engineer with ten working days written notice of the system startup and adjustment date.
 2. Manufacturer shall provide a factory authorized technician to confirm proper installation and operation of all lighting control system components. The startup requirement is intended to verify:
 - a. That all occupancy and daylighting sensors are located, installed, and adjusted as intended by the factory and the contract documents.
 - b. The occupancy sensors and daylighting sensors are operating within the manufacturers specifications.
 - c. The sensors and relay panels interact as a complete and operational system to meet the design intent.
 3. Manufacturer to provide a written statement verifying that the system meets the above requirements.
- C. Re-commissioning – After 30 days from occupancy re-calibrate all preset times, sensor time delays and sensitivities and relocate occupancy sensors if so required to meet the Owner's Project Requirements. Provide a detailed report to the Design Team and Owner of re-commissioning activity.
- D. System Training

1. Manufacturer shall provide factory authorized technician to train owner personnel in the operation, programming and maintenance of the lighting control system including all occupancy sensors and daylighting controls.

E. System Programming

1. Manufacturer shall provide system programming including:
 - a. Wiring documentation.
 - b. Switch operation.
 - c. Telephone overrides.
 - d. Operating schedules.

3.3 WARRANTY

- A. The contractor shall warrant the completed lighting control system to be free from inherent mechanical and electrical defects for a period of one (1) year from the date of the completed and certified test or from the date of first beneficial use.

END OF SECTION 260943