SECTION 26 09 23
LIGHTING CONTROLS

PART 1 - GENERAL

1.1 DESCRIPTION

A. The Digital Lighting Management (DLM) system as defined under this section covers the following equipment:
   1. Digital Room Controllers – Self-configuring, digitally addressable one, two or three relays controllers with 0-10 volt control for ballasts (if applicable) and single relay application-specific plug load controllers.
   2. Digital Occupancy Sensors – Self-configuring, digitally addressable and calibrated occupancy sensors with LCD display and two-way active infrared (IR) communications.
   3. Digital Switches – Self-configuring, digitally addressable pushbutton switches, dimmers, and scene switches with two-way active infrared (IR) communications.
   4. Configuration Tools – Handheld remote for room configuration provides two way infrared (IR) communications to digital devices and allows complete configuration and reconfiguration of the device / room from up to 30 feet away. Unit to have Organic LED display, simple pushbutton interface, and allow send and receive of room variables and store of occupancy sensor settings. Handheld configuration remote was provided under previous project, coordinate and obtain remote from COR.

1.2 RELATED WORK

A. Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC: Interface of lighting controls with HVAC control systems.
B. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General requirements that are common to more than one section of Division 26.
C. Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW): Cables and wiring.
D. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path to ground for possible ground fault currents.
E. Section 24 26 16, PANELBOARDS: panelboard enclosure and interior bussing used for lighting control panels.
F. Section 26 27 26, WIRING DEVICES: Wiring devices used for control of the lighting systems.

1.3 QUALITY ASSURANCE

Refer to Paragraph, QUALIFICATIONS, in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

A. In addition to the requirements of Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, submit the following:

B. Product Data: For each type of lighting control, submit the following information.

1. Manufacturer’s catalog data.
2. Wiring schematic and connection diagram.
3. Installation details.

C. Manuals:

1. Submit, simultaneously with the shop drawings companion copies of complete maintenance and operating manuals including technical data sheets, and information for ordering replacement parts.
2. Two weeks prior to the final inspection, submit four copies of the final updated maintenance and operating manuals, including any changes, to the COR.

D. Certifications:

1. Two weeks prior to final inspection, submit four copies of the following certifications to the COR:
   a. Certification by the Contractor that the equipment has been properly installed, adjusted, and tested.

1.5 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.

B. Green Seal (GS):

GC-12.....Occupancy Sensors

C. Illuminating Engineering Society of North America (IESNA):

IESNA LM-48.....Guide for Calibration of Photoelectric Control Devices

D. National Electrical Manufacturer's Association (NEMA)

C136.10.....American National Standard for Roadway Lighting Equipment-Locking-Type Photocontrol Devices and Mating Receptacles - Physical and Electrical Interchangeability and Testing

ICS-1.....Standard for Industrial Control and Systems General Requirements

ICS-2.....Standard for Industrial Control and Systems: Controllers, Contractors, and Overload Relays

Rated Not More than 2000 Volts AC or 750 Volts DC: Part 8 - Disconnect Devices for Use in Industrial Control Equipment

ICS-6.....Standard for Industrial Controls and Systems Enclosures

E. Underwriters Laboratories, Inc. (UL):

20.....Standard for General-Use Snap Switches

773.....Standard for Plug-In Locking Type Photocontrols for Use with Area Lighting

773A .....Nonindustrial Photoelectric Switches for Lighting Control

98.....Enclosed and Dead-Front Switches

917.....Clock Operated Switches

PART 2 - PRODUCTS

2.1 DIGITAL CEILING MOUNTED OCCUPANCY SENSOR SYSTEM

A. Description: Ceiling-mounting, digital units. All units shall be dual technology type unless noted otherwise on the drawings.

1. Operation: Unless otherwise indicated, lights shall be manually turned on and automatically turn off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
2. Provide contact relays for HVAC automatic temperature controls.
3. Mounting:
   a. Sensor: Suitable for mounting in any position on a standard outlet box.

B. PIR Type: Detect occupancy by sensing a combination of heat and movement in area of coverage.

1. Detector Sensitivity: Detect occurrences of 6-inch minimum movement of any portion of a human body that presents a target of at least 36 sq. in.
2. Detection Coverage (Room): Detect occupancy anywhere in a circular area of 1000 sq. ft. when mounted on a 96-inch- high ceiling.
3. Detection Coverage (Corridor): Detect occupancy within 90 feet when mounted on a 10-foot- high ceiling.

C. Ultrasonic Type: Ceiling mounting; detect occupancy by sensing a change in pattern of reflected ultrasonic energy in area of coverage.

1. Detector Sensitivity: Detect a person of average size and weight moving at least 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.

2. Detection Coverage (Small Room): Detect occupancy anywhere within a circular area of 600 sq. ft. when mounted on a 96-inch- high ceiling.
3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on an 8-foot- high ceiling.
4. Detection Coverage (Large Room): Detect occupancy anywhere within a circular area of 2000 sq. ft. when mounted on a 96-inch- high ceiling.
5. Detection Coverage (Corridor): Detect occupancy anywhere within 90 feet when mounted on a 10-foot- high ceiling in a corridor not wider than 14 feet.

D. Dual-Technology Type: Detect occupancy by using a combination of PIR and ultrasonic detection methods in area of coverage. Particular technology or combination of technologies that controls on and off functions shall be selectable in the field by operating controls on unit. All sensors on project shall be dual technology.

E. Furnish the Company’s system which accommodates the square-foot coverage requirements for each area controlled, utilizing room controllers, digital occupancy sensors and accessories which suit the lighting and electrical system parameters.

F. Digital Occupancy Sensors shall provide graphic LCD display for digital calibration and electronic documentation. Features include the following:
   1. Digital calibration and pushbutton programming for the following variables:
      a. Sensitivity – 0-100% in 10% increments
      b. Time delay – 1-30 minutes in 1 minute increments
      c. Test mode – Five second time delay
      d. Detection technology – 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 when photosensors are included in the DLM local network.
   2. One or two RJ-45 port(s) for connection to DLM local network.
   3. Two-way infrared (IR) transceiver to allow remote programming through handheld commissioning tool and control by remote personal controls.
   4. Device Status LEDs including:
      a. PIR Detection
      b. Ultrasonic detection
      c. Configuration mode

d. Load binding

5. Assignment of occupancy sensor to a specific load within the room without wiring or special tools.
6. Manual override of controlled loads.

G. Units shall not have any dip switches or potentiometers for field settings.

H. 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.

2.2 DIGITAL WALL SWITCHES

A. Low voltage momentary pushbutton switches in 1, 2, 3, 4, 5 and 8 button configuration; white in color; compatible with wall plates with decorator opening. Wall switches shall include the following features:

1. Two-way infrared (IR) transceiver for use with personal and configuration remote controls.
2. Removable buttons for field replacement with engraved buttons and/or alternate color buttons. Button replacement may be completed without removing the switch from the wall.
3. Red configuration LED on each switch that blinks to indicate data transmission.
4. Blue Load/Scene Status LED on each switch button with the following characteristics:
   a. Bi-level LED
   b. Dim locator level indicates power to switch
   c. Bright status level indicates that load or scene is active
5. Dimming switches shall include seven bi-level LEDs to indicate load levels using 14 steps.

B. Two RJ-45 ports for connection to DLM local network.

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. The following switch attributes may be changed or selected using a wireless configuration tool:

1. Load and Scene button function may be reconfigured for individual buttons (from Load to Scene, and vice versa).
2. Individual button function may be configured to Toggle, On only or Off only.
3. Individual scenes may be locked to prevent unauthorized change.
4. Fade Up and Fade Down times for individual scenes may be adjusted from 0 seconds to 18 hours.
5. Ramp rate may be adjusted for each dimmer switch.

6. Switch buttons may be bound to any load on a room controller and are not load type dependant; each button may be bound to multiple loads.

2.3 LOW VOLTAGE DIGITAL TIME SWITCHES

A. The digital time switch shall be programmable to turn loads off after a preset time.
B. Time switch shall be a five terminal, completely self-contained control system that replaces a standard toggle switch. Switching mechanism shall be a 30V @ 1A air gap relay.
C. Time switch shall operate at either 24 VAC/VDC/VAC-half wave rectified.
D. Time switch shall have no minimum load requirement.
E. Time scroll feature shall allow manual overriding of the preset time-out period. Selecting time scroll UP shall allow time-out period to scroll up throughout the timer possibilities to the maximum. Time scroll DN (down) shall allow time-out period to scroll down to minimum.
F. Time switch shall have the option for a one second light flash warning at five minutes before the timer runs out and twice when the countdown reaches one minute (when used to control lighting loads).
G. Time switch shall have the option for a beep warning that shall sound every five seconds once the time switch countdown reaches one minute.
H. Time switch shall have manual feature for timer reset where pressing the ON/OFF switch for more than 2 seconds resets the timer to the programmed time-out period.
I. Time switch shall have a Liquid Crystal Display that shows the timer’s countdown.
J. The time switch shall incorporate two pulsed, open collector NPN transistor outputs for external latching relay coil drives or lighting control panel inputs.
K. Time switch shall fit behind a decorator style faceplate. The calibration switch for setting time-out, time scroll, one second light flash, and beep warning shall be concealed to prevent tampering of adjustments and hardware.
L. Time-out period shall be adjustable in increments of 5 minutes from 5 minutes to 1 hour, and in increments of 15 minutes from 1 hour to 12 hours.
M. Time switch shall be capable of operating as an ON/OFF switch.
N. Time switch can operate with Watt Stopper power packs in order to control additional loads.
O. For ease of installation and cleaner wiring, the switch shall utilize terminal style wiring.
P. The time switch shall integrate with Watt Stopper low voltage lighting control.

Q. The time switch shall not protrude more than 1/8″ from the wall and should blend in aesthetically.

R. For safety, in the event there is an open circuit in the low voltage line, the time switch shall automatically switch to OFF mode.

S. To ensure quality and reliability, time switch shall be manufactured by an ISO 9002 certified manufacturing facility and shall have a defect rate of less than 1/3 of 1%.

T. Time switch shall have 5 year warranty and shall be UL and CUL listed.

2.4 LOW VOLTAGE WALL SWITCH, NON-DIGITAL

A. Low voltage momentary pushbutton switches in 1, 3, 5 or 9 button configuration; white in color; compatible with wall plates with decorator opening. Wall switches shall include the following features:

1. Pilot light next to each standard button for remote indication of lighting status.
2. Mounts in single or double gang outlet box.
3. Removable lens cap for labeling each standard button with 3/8" laminated tape.

2.5 ROOM CONTROLLERS

A. Room Controllers automatically bind the room loads to the connected devices in the space without commissioning or the use of any tools. Room Controllers shall be provided to match the room lighting load and control requirements. The controllers will be simple to install and will not have, dip switches, potentiometers or require special 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. 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.
3. Device Status LEDs to indicate:
   a. Data transmission
   b. Device has power
   c. Status for each load
   d. Configuration status
4. Quick installation features including:
   a. Standard junction box mounting
   b. Quick low voltage connections using standard RJ-45 patch cable
5. Plenum rated
6. Manual override and LED indication for each load
7. Dual voltage (120/277 VAC, 60 Hz)
8. Zero cross circuitry for each load.

B. On/Off Room Controllers shall include:
   1. One or two relay configuration
   2. Efficient 150 mA switching power supply
   3. Three RJ-45 DLM local network ports
   4. Discrete model listed for connection to receptacles, for occupancy-based control of plug loads within the space.
      a. One relay configuration only
      b. Automatic-ON/OFF configuration

C. On/Off/Dimming enhanced Room Controllers shall include:
   1. Real time current monitoring
   2. One, two or three relay configuration
   3. Efficient 250 mA switching power supply
   4. Four RJ-45 DLM local network ports.
   5. One 0-10 volt analog output per relay for control of compatible ballasts and LED drivers.
   6. The following dimming attributes may be changed or selected using a wireless configuration tool:
      a. Establish preset level for each load from 0-100%
      b. Set high and low trim for each load
      c. Set lamp burn in time for each load up to 100 hours
   7. Discrete model listed for connection to receptacles, for occupancy-based control of plug loads within the space.
      a. One relay configuration only
      b. Automatic-ON/OFF configuration

2.6 ISOLATED RELAY INTERFACE

A. Isolated relay interface is for the DLM system, enabling integration of third party devices such as HVAC systems.

B. Interface device contains a single pole, double throw isolated relay with normally open, normally closed, and common outputs.

C. Features:
   1. Integrates with any analog low voltage device.
   2. Single LED for relay status.
   3. Over-current protection.
   4. Two RJ45 ports with hinged dust cover.
   5. UL 2043 plenum rated.
   6. RoHS compliant.

D. Ratings:
   1. Operating Voltage: 24VDC from DLM system.
   2. Single Pole/Double Throw Switch: 24VDC/VAC, 1A.

2.7 LIGHTING CONTROL PANEL – RELAY TYPE

A. Controller: Comply with UL 508; programmable, solid-state, astronomic 365-day control unit with non-volatile memory, mounted in preassembled relay panel with low-voltage-controlled, latching-type, single-pole lighting circuit relays. Controller shall be capable of receiving inputs from sensors and other sources, and capable of timed overrides and/or blink-warning on a per-circuit basis. Digital or analog, low-voltage control-circuit outputs shall be supported by control unit and circuit boards associated with relays.

B. Cabinet: Steel with hinged, locking door. Barriers separate low-voltage and line-voltage components. Provide custom over-sized cabinet with barriers to separate normal and normal/emergency circuits.

C. Directory: Identifies each relay as to load controlled.

D. Control Power Supply: Transformer and full-wave rectifier with filtered dc output.

E. Single-Pole Relays: Heavy duty relays, mechanically held unless otherwise indicated; split-coil, momentary-pulsed type, rated 20 A, 125-V ac for tungsten filaments and 20 A, 277-V ac for ballasts, 1.5 HP at 120V, 50,000 cycles at rated capacity. Circuits indicated on drawings shall feed through relay indicated before terminating at electrical panel indicated

F. Panel shall be furnished with communications module to connect and communicate with existing building central energy management system. Confirm exact system protocol with hospital COR.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Installation shall be in accordance with the NEC, manufacturer's instructions and as shown on the drawings or specified.

C. Aiming for wall-mounted and ceiling-mounted motion sensor switches shall be per manufacturer’s recommendations.

D. Set occupancy sensor "on" duration to 15 minutes.

E. Locate light level sensors as indicated and in accordance with the manufacturer's recommendations. Adjust sensor for the scheduled light level at the typical work plane for that area.

F. All programming of system devices shall be via handheld communications remote obtained from the COR

3.2 ACCEPTANCE CHECKS AND TESTS

A. Perform in accordance with the manufacturer's recommendations.

B. Upon completion of installation, conduct an operating test to show that equipment operates in accordance with requirements of this section.

C. Test for full range of dimming ballast and dimming controls capability. Observe for visually detectable flicker over full dimming range.

D. Test occupancy sensors for proper operation. Observe for light control over entire area being covered.

E. Program lighting control panels per schedule on drawings.

3.3 FOLLOW-UP VERIFICATION

Upon completion of acceptance checks and tests, the Contractor shall show by demonstration in service that the lighting control devices are in good operating condition and properly performing the intended function.

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