PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following lighting control devices:

1. Time controllers.
2. Indoor photoelectric control.
3. Occupancy sensors.
4. Outdoor motion sensors.
5. Lighting contactors.
6. Wall digital time switches.

B. Related Sections include the following:

1. Division 26 Section "Electrical General Requirements".
2. Division 26 Section "Wiring Devices" for wall-box dimmers and manual light switches.
3. Division 26 Section "Dimming Controls" for architectural dimming system equipment.
4. Division 26 Section "Programmable Lighting Control" for programmable lighting systems.

1.3 REFERENCES

E. UL 486A: Wire Connectors and Soldering Lugs for Use with Copper Conductors.
F. UL 486B: Wire Connectors for Use with Aluminum Conductors.
G. UL 773: Plug-in, Locking Photocontrols for Use with Area Lighting.
H. UL 773A: Nonindustrial Photoelectric Switches for Lighting Control.
I. UL 917: Clock Operated Switches.
J. UL 1449: Transient Voltage Surge Suppressors.
K. UL 1598: Luminaires.
L. NECA 130-2010: Installing and Maintaining Wiring Devices.

1.4 DEFINITIONS

A. LED: Light-emitting diode.
B. PIR: Passive infrared.
C. ULTRASONIC: Active emission of at least 35 kHz sound waves, using Doppler reflectance to detect motion.
D. MICROPHONIC: Passive reception to listen for continued occupancy, with circuitry to filter out white noise.
E. MULTI-Tech: Using PIR and ultrasonic or microphonic technologies in one sensor.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated including physical data and electrical performance.
B. Shop Drawings: Show installation details for occupancy and light-level sensors.
   1. Lighting plan showing location, orientation, and coverage area of each sensor.
   2. Interconnection diagrams showing field-installed wiring.
C. Field quality-control test reports.
D. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals. Include the following:
   1. Description of operation and servicing procedures.
   2. List of major components.
   3. Recommended spare parts.
   4. Programming instructions and system operation procedures.

1.6 QUALITY ASSURANCE
A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.7 COORDINATION
A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.
B. Coordinate interface of lighting control devices with temperature controls specified in Division 23

1.8 DELIVERY, STORAGE, AND HANDLING
A. Deliver products to the site under provisions of Division 26 Section “Electrical General Requirements”.
B. Store and protect products under provisions of Division 26 Section “Electrical General Requirements”.

PART 2 - PRODUCTS

2.1 GENERAL LIGHTING CONTROL DEVICE REQUIREMENTS
A. Line-Voltage Surge Protection: An integral part of the devices for 120- and 277-V solid-state equipment. For devices without integral line-voltage surge protection, field-mounting surge protection shall comply with IEEE C62.41 and with UL 1449.

2.2 TIME CONTROLLERS
A. Manufacturers:
   1. Intermatic, Inc.
   2. TORK.
B. General
   1. Provide NEMA Type 1-general purpose steel enclosure with corrosion-resistant primer and baked enamel finish in manufacturer’s standard color.
   2. Provide enclosure suitable for surface mounting with hinged front; padlock hasp; and side, bottom, and back knockouts for conduit connections.
3. Provide heavy-duty pressure terminals suitable for wire sizes up to no. 8 AWG.

C. Digital Time Controller: Electronic, solid-state programmable units with alphanumeric display complying with UL 917.
   1. Contact Configuration: SPDT.
   2. Contact Rating Normally Open: (20-A inductive or resistive, 120-277-V ac, 20-A ballast load, 120-277 V ac.) (10-A inductive or resistive, 120-277-V ac, 10-A ballast load, 120 277 V ac.)
   3. Contact Rating Normally Closed: 10-A inductive or resistive, 120-277-V ac, 10-A ballast load, 120-277 V ac.
   4. Input Voltage: 120 volts.
   5. Programs: 1-channel.
      a. For each channel, 7 day or full year load control, minimum 1,000 on/off operations with one-minute programming resolution; minimum 99 holiday event scheduling; automatic adjustment for daylight savings (with disable); automatic leap year compensation; manual override ON and OFF to the next scheduled event; LCD display.
   6. Circuitry: Allow connection of a photoelectric relay as substitute for on and off function of a program.
   7. Astronomical Time: Provide astronomic feature adjustable from 10 to 60 Northern and Southern latitudes with 1-99 minute adjustable offset from sunrise to sunset for All channels.
   8. Battery Backup: Field replaceable lithium battery with minimum 8 year life for schedules and time clock.

2.3 OCCUPANCY SENSORS

A. General
   1. Coordinate occupancy sensor locations, coverages and required quantities with manufacturer’s recommendations. Coverage areas indicated on the Drawings are for minor motion (6 to 8 inches of hand movement). Provide additional occupancy sensors and control units as required to achieve complete minor motion coverage of the space indicated.
   2. Adjust occupancy sensors and test that complete minor motion coverage is obtained in accordance with Part 3. Provide written confirmation of testing to owner, architect and engineer.
   3. Provide occupancy sensors with a bypass switch to override the “ON” function in the event of sensor failure.
   4. Provide occupancy sensors with an LED indicator indicating when motion is being detected during testing and normal operation of the sensor.
   5. Provide occupancy sensors and occupancy sensor control units from single manufacturer.

B. Wall Switch Passive Infrared Occupancy Sensor

C. Manufacturers:
a. Wattstopper PW-100.
c. Greengate OSW-P-0451-W.
d. Sensorswitch WSD.
e. Philips LRS2210.

2. Dual Level Switching: Provide occupancy sensor capable of controlling two switch legs independently where dual level switching is indicated.

a. Manufacturers:
   1) Wattstopper PW-200.
   2) Hubbell Building Automation SOM-102.
   3) Greengate OSW-P-0451-DMV.
   4) Sensorswitch WSD-2P.
   5) Philips LRS2215.

D. 360° Ceiling Mounted Dual Technology Occupancy Sensor

1. Manufacturers:
   a. Wattstopper DT 300
   c. Greengate OMC-DT-2000-R.
   d. Sensorswitch CM-PDT-R.
   e. Philips LRM2255.

E. Occupancy Sensor Control Units:

1. Description: Transformer and relay combined in single unit to provide 24DC power to sensors and provide 20A contact(s) for control of lighting loads at 120 or 277V. Control unit input power shall be from unswitched leg of lighting circuit it is controlling.

   a. Control units shall be provided as required to power ceiling mounted occupancy sensors, control lighting loads and provide a minimum of one auxiliary contact.
   b. Occupancy sensor control units shall mount external to 4" sq junction box in the ceiling space. Wiring between control unit and occupancy sensor shall be plenum rated.
   c. Locate control unit in accessible location in gyp-board ceilings, adjacent to return air grilles, or provide access panel.
   d. Additional auxiliary relay modules shall be provided as required to provide control of all lighting circuits and additional auxiliary contacts as required.
   e. It is acceptable to provide controls and auxiliary contacts as required integral to the ceiling sensor, provided all required contacts are provided.
   f. Maximum of 3 sensors per power pack. Verify exact quantities required with manufacturer.

2.4 LIGHTING CONTACTORS

A. Manufacturers:

1. Square D Co.

2. Square D Co; class 8903.
B. Contactor

1. Electrically-operated mechanically-held contactor, per NEMA ICS2, with 120 volt, 60 hertz coil and 240 volt, 60 hertz, 30 ampere contacts with size and number of poles indicated.

2. Provide contacts to be 100 percent, continuously rated for all types of ballast and tungsten lighting and resistance loads without the need for in-rush current derating.

3. Provide NEMA type 1 enclosure unless otherwise indicated.

4. Provide NEMA type 1 hinged cover cabinet enclosure sized as required for contactors as indicated on drawings. Mount switches and indicating lights required on front of enclosure. Install terminal strips for connection of all external control wiring connections.

5. Provide solderless pressure wire terminals.

6. Provide corrosion-resistant primer treatment with light gray baked acrylic enamel finish.

7. Provide the following control and indicating devices:
   a. Auxiliary contacts: One field convertible.
   b. Auxiliary relay to convert maintained-contact type control circuit to momentary-contact type control circuit necessary for contactor control.
   c. Hand-off-auto selector switch, of the heavy-duty “oil-tight”, maintained-contact type, mounted on the front cover with legend plate.
   d. Control transformer with primary voltage as indicated and 120-volt, single phase, 60 hertz secondary including fuse and fuseholder.
   e. Green pilot light to indicate “power on” condition. Mount on front cover with legend plate.

PART 3 - EXECUTION

3.1 LIGHTING CONTACTOR INSTALLATION

A. Install lighting contactors as indicated on plan. Install at accessible locations. Switch controls where provided shall be no higher than 54” or lower than 48”.

B. Demonstrate proper operation of all lighting control functions to the Owner and Engineer.

3.2 OCCUPANCY SENSOR INSTALLATION

A. Install wall mounted occupancy sensors as noted on plan. Arrange occupancy sensors with adjacent switch devices so that device plates line-up and are equally spaced.

B. Install ceiling mounted sensors at approximate locations as indicated on plan. Sensor manufacturer shall provide quantity of sensors as required to provide complete coverage for rooms.

C. Locate sensors such that motion through open doors will not falsely activate sensors.

D. Do not locate ultrasonic sensors within six feet of supply air diffusers.

E. Locate infrared sensors to avoid obstructions.
F. Provide the services of a manufacturer’s representative for commissioning of occupancy sensor installation. This shall include consultation on layout and location prior to installing sensors, testing of each sensor for compliance with Contract Documents and field adjustment and fine tuning after installation is complete. Provide written confirmation of testing to the Owner, Architect and Engineer.

G. Field adjustments shall take place in the presence of the owner and the engineer. This shall include owner training on adjustment techniques for the occupancy sensors.

3.3 WIRING INSTALLATION

A. Wiring Method: Comply with Division 26 Section "Conductors and Cables".

B. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.

C. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.

D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

E. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.4 IDENTIFICATION

A. Identify components and power and control wiring according to Division 26 Section "Electrical Identification."

B. Label time switches and contactors with a unique designation.

3.5 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. After installing time switches and sensors, and after electrical circuitry has been energized, adjust and test for compliance with requirements.

2. Operational Test: Verify actuation of each sensor and adjust time delays.

B. Remove and replace lighting control devices where test results indicate that they do not comply with specified requirements.

C. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.6 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sensors to suit actual occupied conditions. Provide up to two visits to site outside normal occupancy hours for this purpose.
1. Multiple Switching: The use of multiple switching shall be evaluated for each space and condition. Where possible, switching shall be circuitted to effectively use natural lighting from windows; to permit light reduction during partial occupancy; and to permit reduced lighting for custodial activity.

2. Occupancy sensors shall not be used as the sole means of switching. Manual switches will be provided in all areas with occupancy sensors. Occupancy sensors shall not be used in mechanical rooms or rest rooms. At installation, set all sensors to maximum sensitivity and maximum time delay.

3. Remote switching by means of a central control should be evaluated for new construction and for large renovation projects.

4. Dimming Control:
   a. Where dimming is required it shall be used to control incandescent lighting and may be used for Hi-Lume and approved solid state dimming ballast fluorescent fixtures for low lighting levels. The control panel/panels required for the dimming system shall have the UL label. Each dimming module shall be UL tested and tested specifically for the type of load it is controlling. Each dimmer module shall possess a means of easily disconnecting power on an individual module-by-module basis.
   b. Dimming panels shall be cooled without the use of cooling fans with no exception and shall be capable of operating as such in an environment of 0 degrees to 40 degrees centigrade. Satisfactory independent laboratory test results shall be required, that a +40 degree centigrade and at full load, the maximum temperatures of both filter chokes and SCRs/Triacs are not exceeded.
   c. There shall be one air gap positive off relay for dimmer, either integral to the dimmer or mounted elsewhere in the same panel. Other advanced technological approaches that give the same or better operational result is highly recommended by this standard.
   d. All controls shall have the capabilities of reverting back to their previous status after any duration of power outage (power failure memory), without the use of any type of rechargeable or trickle-charge type of battery.
   e. Lutron dimming systems with ten (10) year warranty meet University standards. Other systems must be submitted to the University Facilities Principal Electrical Engineer for approval.
      i. Special Requirements for Fluorescent Dimming Systems: Before specifying fluorescent dimming systems, the Associate shall consider the following:
         1. 100 hour “burn-in” time is required for the fluorescent lamps when using the dimming ballasts.
         2. The cost of replacing the ballast and lamps when needed is 200-300% more than replacing standard systems.
      ii. This standard requires the Associate to review the application of dimming devices and submit recommendations to Facilities Design and Construction before incorporating into specifications.

5. Parking ramp interior lighting shall be circuitted to permit lighting of dark interior areas during the day without lighting those areas which receive sufficient natural light. Automatic control of ramp lighting by photocell is required.

6. All exterior area and security lighting shall be dusk on and dawn off, powered from one location in the building and controlled from the photo control, with provisions for manual override. Time clock control may be used on exterior or security lighting with approval of the Facilities Design and Construction Department.

**END OF SECTION**