SECTION 26 09 23

LIGHTING CONTROLS

PART 1 - DESIGN DIRECTIVES

1.1 RELATED SECTIONS

A. Interior Lighting

B. Exterior Lighting

1.2 DESIGN CRITERIA

A. The Architect, Lighting Designer and Engineer: Create a Lighting Controls Narrative and Design Schematic Matrix derived from schematic phase project discussions.

1. Lighting Controls Narrative and Matrix: The controlling design document for lighting and lighting control systems.

a. Include with design development drawings listing each room, fixture type and control strategy.
b. Adjust as design is refined. Reflect changes made and incorporate additional information.
c. Document to include the following:

1) Description of Control Strategies: Include schedule, occupancy, and manual operation.
2) Sequences of Operation (SOO): Consultant shall develop a SOO for each room/space or type of room/space.
3) Description of Integrated Controls strategies.

a) Examples:

1) Occupancy sensor status to be accessed by the following:

a) HVAC system controls?
b) Window shade controls?

B. The electrical contractor shall coordinate with the BAS contractor to ensure compliance with this section and Section 25 00 00 – Integrated Automation.

1. The Division 26 lighting controls contractor shall be responsible for the complete installation, sequences of operation (SOOs), programming, and exposing all BACnet points for read/write or integration through open protocols.

C. Coordinate with Dartmouth FO&M for any Audio Visual (AV) integrations with the lighting controls platform.

1.3 DESIGN DRAWINGS/DOCUMENTS REQUIREMENTS

A. Lighting layout and control drawings.

B. Lighting controls matrix. Include all data listed under paragraph 3.7 for each space. A sample matrix will be provided on request.

C. Sequence of Operations (SOO) table for each room/space. See examples at end of this section.

1.4 DESIGN DIRECTIVES

A. General directives for buildings serving academic, laboratory/research, residential, dining, administrative uses:

1. See "3.7 Lighting Controls Requirements" at end of this Section.
2. Lighting Controls:
    a) Meet or exceed features and attributes required by current building code and controls already installed in the building.
    b) Must be functionally integrated with emergency power sources and fire alarm activation in assembly and egress areas.
    c) Match existing system/devices in building.
3. User Interface Devices: Match existing system/devices in building.
4. Application of emergency relays per UL 1008 and UL 924 to control emergency lights. and/or to bypass controls must be minimized.

B. Lighting Renovations and Retrofits: In addition to this section requirements.

1. Lighting Controls Operational Capability: Meet or exceed existing.
2. Occupancy Control Devices: Whether added or replace, to be a System device.
    a) Occupancy Sensor and associated load controllers along with system devices required for proper operation; minimum requirement.
3. Devices to be capable of 0 to 10 V dimming even if room is not currently set for dimming. Addition of dimming is preferred if possible.
4. Daylight Control: To be considered in spaces with wall or ceiling fenestration, even if not required by code.

C. Classroom Lighting: Follow standard for lighting and controls as follows:

1. Lighting to be dimmable.
2. Control Stations for Lights:
    a) Located at presenter's location.
    b) A single button for entry scene located at entry doors.
    c) Lights to be controlled by vacancy sensor.
    d) Zones to be controlled independently.
    e) See Section 3.9 for Sample Sequence of Operation (SOO).
3. Ceiling Lights: Zoned front to back to allow low levels at front of classroom.
4. Wallboard Lights: Each location or set of locations to be zoned.

1.5 EXTERIOR LIGHTING CONTROLS

A. See Section 26 50 02- EXTERIOR LIGHTING

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURERS

A. Building Interior Lighting Controls Systems:

1. Encelium EDGE
2. Encelium EXTEND
3. nLight
4. Crestron ZUM
5. Lutron Vive, with approval of FOM-Engineering.
6. Lutron Quantum, with approval of FOM-Engineering.

B. Smart Classrooms and Auditoriums with Crestron AV: Lighting control systems capable of integration with Crestron AV such as Crestron lighting controls or ETC.

C. Theaters and Theatrical Performance Venues:

1. ETC.
2. Other equivalent system with additional consultation with and approval by the end user and FOM-Engineering.

D. Athletics Facilities Lighting Controls Systems: Field houses, pools, and fitness facilities.

1. Digital Lumens LightWorx
2. Other equivalent system with approval of FOM-Engineering and DC Athletic Department.

E. Exterior Lighting Controls Systems:

1. RAB Lightcloud
2. Other system may be considered. Must be vetted in design phase and approved by FOM-Engineering.

PART 3 - EXECUTION

3.1 INSTALLATION

3.2 TESTING, PROGRAMMING

A. Specified Lighting Controls and Associated Software: Must be calibrated, adjusted, programmed and operating in accordance with construction documents and manufacturer installation instructions.

B. Functional Testing of Lighting Controls: To be completed by lighting controls sub-contractor under review of the lighting designer, Commissioning Agent, or owner as required by ASHRAE/IES 90.1- 2010

1. Scheduled Control (Sweep): Setup and functional test.
2. Relay and Control Zones: Setup and test for each zone.
3. Occupancy Sensor Setup and Functional Tests: Reposition if required for proper function.
4. Automatic Daylighting Controls: Setup, calibration, and functional test with repositioning if required for proper function.

5. Software Programmable Controller: Setup and test.

C. Integration with Other Control Systems: To be programmed by BAS system provider and AV System provider where applicable. Functional testing to be coordinated between control system vendors to verify design intent is met under all operating conditions.

3.3 CONNECTION TO DARTMOUTH NETWORK

A. Data Jack: Installed adjacent to each ethernet gateway with 1 inch (25 mm) conduit from the data jack to the ethernet gateway enclosure/location.

1. Data Jumper Cable: Installed by Dartmouth College FO&M EL Shop.

a) Project Manager is to obtain IP address and internal BACnet ID for lighting control system gateways.

2. IP Address Procurement: Initiate a work order to DC FOM Electric shop a minimum of two weeks prior to lighting controls system startup.

a) Work Order: Describe system and location of each gateway and data jack.

3. IP address/BACnet ID: Must be provided by DC FOM-Electric Shop to Project Manager, Installing Electrician, FOM-Engineering and FOM-Energy Analyst.

a) Provide IP Address within two weeks of initial request.

4. FOM-Electric shop provides IP Addresses and names of IP Addresses.

a) IP Address Names: Include system description name, building, and location within two weeks of initial request.

1) Example: burke_hall-lutronvive-corridor301.

3.4 COMMISSIONING

A. Lighting Controls Commissioning: Required as a part of all projects.

B. Commissioning will proceed only after adjustments and functional testing of lighting controls have been completed.

C. Refer to ASHRAE/IES 90.1 latest version for a complete description of lighting controls commissioning requirements.

3.5 TRAINING

A. Scheduled Training Sessions:

2. Two Sessions: For maintenance and engineering staff.

a) Review building system infrastructure including devices and gateway locations.
b) Software system set-up, operation, schedules, and how to make changes to settings.

B. One Session: For building managers and occupants.

1. Include expected function of devices and lighting response.

3.6 RECORDS, AS-BUILT DOCUMENT REQUIREMENTS

A. Approved Lighting Controls submittal including floor plans

B. Controls Schedule – Sequence of Operation for all spaces

3.7 LIGHTING CONTROLS REQUIREMENTS BY ROOM AND AREAS

A. Stairwells:

1. Manual Control: None
2. TOD Scheduling: None
3. Occupancy: Low to high
4. Vacancy: N/A
5. Daylight: N/A
6. Dimming: Allowed as alternate to bi-level
7. Bi-Level: Preferred
8. Preset Scene Controls: N/A
9. Emergency Lighting Control: Required
10. Load Shed Control: Not allowed
11. Scene Notes: N/A
12. Interface Notes: N/A

B. Corridors:

1. Manual Control: None
2. TOD Scheduling: Open/Closed hours
3. Occupancy: Low to high during open hours. Off to high during closed hours
4. Vacancy: N/A
5. Daylight: If applicable
6. Dimming: Preferred
7. Bi-Level: N/A
8. Preset Scene Controls: N/A
9. Emergency Lighting Control: Required
10. Load Shed Control: Allowed
11. Scene Notes: N/A
12. Interface Notes: N/A

C. Lobbies:

1. Manual Control: None
2. TOD Scheduling: Open/Closed hours
3. Occupancy: Capable of low to high during open hours. Off to high during closed hours.
4. Vacancy: N/A
5. Daylight: If applicable
6. Dimming: Preferred
7. Bi-Level: N/A
8. Preset Scene Controls: N/A
9. Emergency Lighting Control: Required
10. Load Shed Control: Allowed

11. Scene Notes: N/A
12. Interface Notes: N/A

D. Restrooms:

1. Manual Control: None
2. TOD Scheduling: None
3. Occupancy: Required
4. Vacancy: N/A
5. Daylight: If applicable
6. Dimming: N/A
7. Bi-Level: N/A
8. Preset Scene Controls: N/A
9. Emergency Lighting Control: Required
10. Load Shed Control: Not Allowed
11. Scene Notes: N/A
12. Interface Notes: N/A

E. Offices:

1. Manual Control: Required
2. TOD Scheduling: None
3. Occupancy: N/A
4. Vacancy: Required
5. Daylight: If applicable
6. Dimming: Required
7. Bi-Level: N/A
8. Preset Scene Controls: N/A
9. Emergency Lighting Control: N/A
10. Load Shed Control: Allowed
11. Scene Notes: N/A
12. Interface Notes: N/A

F. Kitchen, Breakroom, Copy/Print Room:

1. Manual Control: Allowed
2. TOD Scheduling: None
3. Occupancy: Required
4. Vacancy: N/A
5. Daylight: If applicable
6. Dimming: N/A
7. Bi-Level: N/A
8. Preset Scene Controls: N/A
9. Emergency Lighting Control: N/A
10. Load Shed Control: Allowed
11. Scene Notes: N/A
12. Interface Notes: N/A

G. Smart Classrooms:

1. Manual Control: Scene buttons
2. TOD Scheduling: None

3. Occupancy: Required
4. Vacancy: N/A
5. Daylight: If applicable
6. Dimming: Required
7. Bi-Level: N/A
8. Preset Scene Controls: Required
9. Emergency Lighting Control: N/A
10. Load Shed Control: Not Allowed
11. Scene Notes: Front, Back, wall-boards zone control
12. Interface Notes: Interface with AV (Crestron) system.

H. Auditoriums:

1. Manual Control: Scene buttons
2. TOD Scheduling: None
3. Occupancy: TBD
4. Vacancy: N/A
5. Daylight: If applicable
6. Dimming: Required
7. Bi-Level: N/A
8. Preset Scene Controls: Required
9. Emergency Lighting Control: Required
10. Load Shed Control: Not Allowed
11. Scene Notes: N/A
12. Interface Notes: Interface with Fire Alarm and AV (Crestron) system.

I. Small Classrooms, Conference, Seminar:

1. Manual Control: N/A.
2. TOD Scheduling: None.
3. Occupancy: Required.
4. Vacancy: N/A.
5. Daylight: If applicable.
6. Dimming: Required.
7. Bi-Level: N/A
8. Preset Scene Controls: Preferred
9. Emergency Lighting Control: N/A
10. Load Shed Control: May be allowed
11. Scene Notes: Front, Back, wall-boards zone control
12. Interface Notes: N/A

J. Storage:

1. Manual Control: N/A
2. TOD Scheduling: N/A
3. Occupancy: Required
4. Vacancy: N/A
5. Daylight: N/A
6. Dimming: N/A
7. Bi-Level: N/A
8. Preset Scene Controls: N/A
9. Emergency Lighting Control: N/A

10. Load Shed Control: Not allowed
11. Scene Notes: N/A
12. Interface Notes: N/A

K. Custodial Closets:

1. Manual Control: N/A
2. TOD Scheduling: N/A
3. Occupancy: Required
4. Vacancy: N/A
5. Daylight: N/A
6. Dimming: N/A
7. Bi-Level: N/A
8. Preset Scene Controls: N/A
9. Emergency Lighting Control: N/A
10. Load Shed Control: Not allowed
11. Scene Notes: N/A
12. Interface Notes: N/A

L. Mechanical, Electrical Rooms:

1. Manual Control: Manual only
2. TOD Scheduling: None
3. Occupancy: N/A
4. Vacancy: N/A
5. Daylight: N/A
6. Dimming: N/A
7. Bi-Level: N/A
8. Preset Scene Controls: N/A
9. Emergency Lighting Control: N/A
10. Load Shed Control: Not allowed
11. Scene Notes: N/A
12. Interface Notes: N/A

M. Labs:

1. Manual Control: Required
2. TOD Scheduling: None
3. Occupancy: N/A
4. Vacancy: N/A
5. Daylight: N/A
6. Dimming: Preferred
7. Bi-Level: N/A
8. Preset Scene Controls: N/A
9. Emergency Lighting Control: N/A
10. Load Shed Control: Not allowed
11. Scene Notes: N/A
12. Interface Notes: N/A

N. Residence Rooms:

1. Manual Control: Required

2. TOD Scheduling: None
3. Occupancy: N/A
4. Vacancy: Preferred
5. Daylight: If applicable
6. Dimming: Required
7. Bi-Level: N/A
8. Preset Scene Controls: N/A
9. Emergency Lighting Control: N/A
10. Load Shed Control: May be allowed
11. Scene Notes: N/A
12. Interface Notes: N/A

O. Additional Requirements:

1. Dimming: All LED lighting must be capable of being tuned to proper high-end trim level.
2. Occupancy: Occupancy device or system BACnet over IP connectivity may be required by Building Automation System (BAS)
3. Load Shed Capability: Determined during design phase. LS shall be capable of operation via the BAS.

3.8 ROOM-AREA LIGHTING CONTROLS SEQUENCE OF OPERATION (SOO)

A. SOO's shall be required for each room type in the building and may be required for each specific room.

B. Draft SOO's shall be reviewed with the Building Manager, FOM-Engineering, and other stakeholders as determined by Project Manager.

C. See sample of Room-Area Lighting Controls Sequence of Operation, below.

3.9 SAMPLE OF ROOM-AREA LIGHTING CONTROLS SEQUENCE OF OPERATION (SOO)

A. Building: Building name.

B. Location: Room number, Type of room (eg., Classroom, Lobby).

C. Lighting sources:

1. Dimmable and fixed-output lights are controlled in this area
2. Example: (9) 2x2 recessed, Type X, 2 zones
3. Example: (3) Wall mount whiteboard, Type Y; 3 zones

D. High-End Trim: XX%, as required to meet max light levels

E. Timeclock:

1. Example 1: None
2. Example 2:

a) 6am-11pm - On to high
b) 11pm - 6am - On only by occupancy sensor

F. Occupancy/Vacancy:

1. Describe either Occupancy/Vacancy Mode
2. Occupied Level: eg. Scene X
3. Unoccupied Level: eg. All Zones OFF/LOW
4. Occupancy Timeout: eg. 15-30 minutes

G. Manual Control: Example: (1) 2-button at entry, east wall, and via Crestron AV Control panel

H. Daylight Harvesting: If applicable

I. Emergency Lighting:

1. Emergency: If Emergency lights are fed from dedicated emergency circuits.
2. Emergency Operation: Upon loss of normal building power, all lighting controls to emergency lights are bypassed and lights operate at full output. Upon restoration of normal building power, emergency lights revert to normal operation with controls.

J. Zones (Example for Classroom):

1. 1 – (3) Ceiling 2x2, east row
2. 2 – (6) Ceiling 2x2, west three rows
3. 3 – (1) whiteboard light east
4. 4 – (1) whiteboard light west
5. 5 – (1) whiteboard light north

K. Scenes (Example for Classroom):

1. Scene 1 - Zone 1, 2: 50 percent Zone 3,4,5: OFF
2. Scene 2 - Zone 1, 2: 100 percent, Zone 3,4,5: 100 percent
3. Scene 3 - Zone 1: 10 percent, Zone 2: 50 percent, Zone 3,4,5: OFF

END OF SECTION 26 50 00