SECTION 260923

EATON DISTRIBUTED LOW-VOLTAGE POWER SYSTEM

This specification was updated June 1, 2017 and supersedes all previous DLVP specifications.

This section includes editing notes. These notes are hidden and can be viewed by:
Microsoft Word: From the FILE menu select OPTIONS, then DISPLAY. Under the DISPLAY VIEW, select or deselect the HIDDEN TEXT option and click OK.

PART 1 –   GENERAL

1.1 SUMMARY

A. Section Includes:

1. Occupancy, Vacancy and Daylighting Sensor Control

2. Emergency Lighting Control (if applicable – requires Remote Relay Unit)

B. Related Section

1. Section [260926 – Lighting Control Panel Boards:] Lighting panels (switching) controlled by ControlKeeper

2. Section [262726 - Wiring Devices:] Receptacles

3. Section [25000 – Integrated Automation] Building integrator shall provide integration of the lighting control system with Building Automation Systems

4. Electrical Sections, including wiring devices, apply to the work of this Section

C. Control Intent – Control Intent includes, but is not limited to:

1. Defaults and pre-defined calibration settings for such items as daylighting, occupancy sensor times, sensitivity, fade rates, etc.

2. Zone wallstation pre-defined control sequences

3. Scene wallstation programmable control sequences

4. Daylight sensor and dimming zones

5. Receptacle controls

6. Time clock input for business and after-hours operation

7. Demand response control (if applicable)
8. Fixture-integrated emergency lighting

9. Centralized emergency lighting control (if applicable – requires Remote Relay Unit)

1.2 REFERENCES

A. American National Standards Institute/Institute of Electrical and Electronic Engineers (ANSI/IEEE)

B. Underwriter Laboratories of Canada (ULC)

C. International Electrotechnical Commission (IEC)

D. International Organization for Standardization (ISO)

E. National Electrical Manufacturers Association (NEMA)

F. WD1 (R2005) - General Color Requirements for Wiring Devices.

G. NEMA WD7 – Occupancy Motion Sensor Standard

H. Underwriters Laboratories, Inc. (UL)
   1. 2108 – Low-Voltage Lighting Systems
   2. 924 – Emergency Lighting

1.3 SYSTEM DESCRIPTION & OPERATION

A. The Power, Lighting, Control and Automation system as defined under this section covers the following equipment:

1. Low-Voltage Power Modules – Stand-alone controller providing three or six class 2 low-voltage power circuits of up to 100W each and control for three manual control zones suitable for LED light fixtures. Centralized UL924 emergency power provided when combined with contact closure from Remote Relay Unit (RRU).

2. Occupancy Sensors – Auto adjusting, MicroSet technology NEMA WD7 compliant occupancy sensors.

3. Zone Wallstations – Smart device that is pre-configured, pre-engraved digital pushbutton wallstations and dimmers.

4. Scene Wallstation – Smart device that is pre-configured, pre-engraved digital pushbutton scene wallstations, dimmers and programmable scene buttons.
5. Daylight Photosensor – Smart device that is a multi-zone open loop daylight sensor with two-way active infrared (IR) communications, which can provide dimming control for daylight harvesting and personal control and programming for the space.

10. Demand Response – OpenADR or other demand response input shall be connected to one or more Low-Voltage Power Modules. Each Low-Voltage Power Module shall respond to the demand response input and automatically reduce the light level by at least 10% but not more than 40% of target light level.

11. Low-Voltage Lighting Cables – pre-terminated lengths of plenum (CMP) rated twisted pair cable for power and communications with low-voltage LED light fixtures.

12. Low-Voltage Lighting Fixtures – addressable low-voltage LED lighting fixtures may be enabled with integrated sensors compatible with Low-Voltage Power Modules (per of the DLVP System) to provide closed loop daylighting to maintain the illuminance target of that fixture, passive infrared motion detection with minor motion coverage similar to that of the light distribution of the light fixture, and two-way active infrared (IR) communications, which can provide dimming control for daylight harvesting and personal control and programming for the space.

1.4 LIGHTING CONTROL APPLICATIONS

A. Minimum lighting control performance required, unless local Energy Code is more stringent.

1. Occupancy/vacancy requirements – Provide an occupancy/vacancy sensor(s) with Manual On/ Automatic Off or Automatic On/ Automatic Off functionality in all spaces. Manual On vacancy sensors should not be used for any enclosed space with a Manual On switch that requires hands free operation. Spaces with multiple occupants or where line of sight might be obscured ceiling or corner mount sensors and Manual wallstations would be required. Automatic On of lighting via occupancy sensor cannot exceed 50% of lighting. Systems that do that allow the user to select Occupancy or Vacancy Mode shall not be acceptable.

2. Bi-Level switching – Provide multi-level switching and/or variable dimming for maximum energy savings.

3. Task Lighting / Receptacle Control – Provide automatic shut off of non-essential plug loads and task lighting in all spaces. Provide Manual On or Automatic On of receptacles whenever spaces are occupied. Receptacle Control will only be shut off when no occupancy is detected within the space. Systems that do not provide receptacle control for a full 20 Amp circuit shall not be acceptable.
4. Daylight Zones – Primary sidelit or toplit areas within an enclosed space shall be controlled separately and automatically by a multi-level photocontrol device without the need for programming. Adjustments to the daylight zones must be provided by a simple to use, intuitive remote handheld device.

5. Provide smooth and continuous daylight dimming for areas marked on drawings. Daylighting control system may be designed to dim electric light to the lowest light level.

6. Provide the ability to adjust the high end and low end trim of the dimmers to ensure the lighting automatically provides energy saving even when daylighting calls for full illumination.

7. Provide the ability for the dimmed manual control zones to be independent from daylighting sets. Systems that require that dimmed manual control zones only align with daylighting sets shall not be acceptable.

8. Provide the ability for light fixtures to become their own daylight set or zone through the use of light fixture integrated sensors to maximize energy savings and maintain task plane illuminance.

9. Provide a method to power, sense and manually control three separate areas from a single system controller (DLVP low-Voltage Power Module).

10. Provide the ability to provide occupancy status to a Building Automation System. Occupancy status shall happen automatically and be provided to the BAS without the need of programming any device in the DLVP System. Systems that require programming for BAS occupancy status shall not be acceptable.

11. Shall be capable of automatically responding to a Demand Response Signal and adjusting the lighting level, without the need of programming or software. Systems that require software or commissioning to provide Demand Response integration shall not be acceptable.

B. Additional controls:

1. Provide occupancy or vacancy sensing modes (Auto On or Manual On) for any enclosed office, conference, meeting or training rooms. Spaces with multiple occupants or where line of sight may be obscured require ceiling or wall/corner mounted sensors with Manual On switches.

2. Conference, meeting, training, and multi-purpose rooms shall have controls that allow for scene based and independent control of each dimmed zone. Rooms larger than 300 square feet shall support at
least four (4) pre-set lighting scenes. Occupancy or vacancy sensing modes shall ensure all lighting, receptacles, and HVAC in the space is turned Off when no occupancy.

3. Egress lighting control shall be available to the system. The system shall provide an automatic control of adjacent corridor and/or egress lighting based upon room occupancy without programming. Systems that do not ensure that adjacent corridor and/or egress lighting is controlled with room occupancy shall not be acceptable.

4.  

1.5 PERFORMANCE REQUIREMENTS

A. Low-Voltage Power Modules shall be accompanied by pre-terminated Low-Voltage Lighting Cables and addressable Low-Voltage LED Lighting Fixtures which may include integrated sensors for occupancy and daylight detection.

1.6 SUBMITTALS

A. Submittals Package: Submit the shop drawings and the product data specified below at the same time as a package including power, lighting, and controls.

B. Shop Drawings:

1. Composite wiring and/or schematic diagram of each control circuit, as proposed, to be installed (standard diagrams will not be accepted).

2. Scale drawing for each area showing exact location of each sensor, Low-Voltage Power Module, light fixture, and digital switch.

C. Product Data: Catalog sheets, specifications and installation instructions.

D. Include data for each device which:

1. Indicate best mounting and installation locations for each device. This may be contained within drawings or installation instructions depending upon the project.

E. Warranties: Standard and special warranty information.

1.7 QUALITY ASSURANCE


B. Products: All electrical components and devices shall be listed and labeled as defined in NFPA 70, Article 100, by a testing agency and marked for intended use.
C. Comply with NFPA 70.

D. Source Limitations: Obtain luminaires and control systems from a single manufacturer.

1.8 DELIVERY, STORAGE AND HANDLING

A. The contractor is responsible for complete installation of the entire system according to strict factory standards and requirements.

B. Packaging: All components of the lighting control system shall be packaged as individual components. Individual component packages will be marked with product catalog number.

C. Handling: Packaging will include clear installation instructions for all components with typical illustrations of installation locations and connections. The installing contractor can easily match each package to the layout on the design floor plans.

1.9 PROJECT CONDITIONS

A. Do not install equipment until following conditions can be maintained in spaces to receive equipment:
   1. Ambient temperature: 0° to 40° C (32° to 104° F)
   2. Relative humidity: Maximum 90 percent, non-condensing

B. Coordinate layout and installation of luminaries and controls with other construction.

C. If commissioning is required, site commissioning shall be coordinated with manufacturer no less than 21 days prior to required date.

1.10 WARRANTY

A. Manufacturer shall supply a 5-year warranty on all hardware and software. These warranties will be in effect for all installations. Systems that provide special warranties based on installation shall not be acceptable.

1.11 MAINTENANCE

A. Provide extra materials described below when needed. Products shall match those that are installed. Extra materials should be stored and identified with labels describing contents. Inclusion of extra materials on the bill of materials is not the responsibility of the manufacturer.

B. Recommended extra materials:
   1. Occupancy Sensors: Provide 1 of each product type for every 200 installed, to be used for maintenance.
2. Daylight Sensors: Provide 1 of each product type for every 100 installed, to be used for maintenance.

3. Wallstations: Provide 1 of each product type for every 200 installed, to be used for maintenance.

4. Receptacle Switchpack: Provide 1 of each product type for every 100 installed, to be used for maintenance.

5. Low-Voltage Power Module: Provide 1 of each product type for every 50 installed, to be used for maintenance.

6. Low-Voltage Lighting Cable: Provide 1 of each product type for every 200 installed, to be used for maintenance.

7. Pre-Terminated Control Cable: Provide 1 of each product type for every 200 installed, to be used for maintenance.

8. Addressable Low-Voltage LED Fixture: Provide 1 of each product type for every 200 installed, to be used for maintenance.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer:

1. Eaton Lighting Systems
   a. Distributed Low-Voltage Power System

2. Basis of design product: Eaton Distributed Low-Voltage Power System is subject to compliance and prior approval with specified requirements of this section, one of the following:
   a. Eaton Distributed Low-Voltage Power System (DLVP)
   b. <Insert manufacturer’s name>

B. Substitutions: [Not Permitted]

1. All proposed substitutions (clearly delineated as such) must be submitted in writing for approval by the design professional a minimum of 10 working days prior to the bid date and must be made available to all bidders. Proposed substitutes must be accompanied by a review of the specification noting compliance on a line-by-line basis.
2. Any substitutions provided by the contractor shall be reviewed at the contractor’s expense by the electrical engineer at a rate of [$200.00] per hour.

3. By using pre-approved substitutions, the contractor accepts responsibility and associated costs for all required modifications to circuitry, devices and wiring. The contractor shall provide complete engineered shop drawings (including power and control wiring) with deviations from the original design, highlighted in an alternate color, to the engineer for review and approval prior to rough-in.

2.2 WALL OR CEILING MOUNTED OCCUPANCY PERFORMANCE REQUIREMENTS

A. Sensing mechanism:

1. [Infrared]: Utilize multiple segmented lens, with internal grooves to eliminate dust and residue build-up.

2. [Ultrasonic]:
   a. Utilize an operating frequency of 32 kHz or 40 kHz that shall be crystal controlled to operate within plus or minus 0.005% tolerance.
   b. Utilize Doppler shift ultrasonic detection technology.

3. [Dual technology]:
   a. Utilize multiple segmented lens, with internal grooves to eliminate dust and residue build-up.
   b. Utilize an operating frequency of 32 kHz or 40 kHz that shall be crystal controlled to operate within plus or minus 0.005% tolerance.
   c. Incorporate Doppler shift ultrasonic and passive infrared motion detection technologies. Products that react to noise or ambient sound shall not be considered.

B. Power failure memory:

1. Controls incorporate non-volatile memory. Should power be interrupted and subsequently restored, settings and parameters saved in protected memory shall not be lost.

C. Designed and tested to withstand discharges of 15,000 volts per IEC 801-2 without impairment of performance.
D. Products tested in identical manner, complaint to NEMA WD 7 -2011 Occupancy Motion Sensors Standards.

E. Sensor shall have time delays from 10 to 30 min.

F. When specified, sensors shall automatically adjust time delay and sensitivity settings.

G. All sensors shall provide an LED as a visual means of indication at all times to verify that motion is being detected during both testing and normal operation.

H. All sensors shall have readily accessible, user adjustable settings for time delay and sensitivity. Settings shall be located on the sensor (not the control unit) and shall be recessed to limit tampering.

I. Where specified, sensor shall have an internal additional isolated relay with Normally Open, Normally Closed and Common outputs for use with HVAC control, Data Logging and other control options. Sensors utilizing separate components or specially modified units to achieve this function are not acceptable.

2.3 CEILING MOUNTED SENSORS

A. Product: [OAC-DT-2000], [OAC-DT-1000], [OAC-P-1500], [OAC-U-2000].

B. Provide all necessary mounting hardware and instructions.

C. Sensors shall be Class 2 devices.

D. Connect to Low-Voltage Power Module via pre-terminated control cable to eliminate wiring errors.

   1. [OCC-RJ45] Low-voltage accessory is used to allow any standard occupancy/vacancy sensor to utilize pre-terminated control cable connections.

   2. Two RJ45 connection ports for connection to Low-Voltage Power Module.

   3. Occupancy Sensor and Daylight sensor shall be capable of a daisy chain connection to the Low-Voltage Power Module.

E. Device calibration and features:

   1. Sensitivity – 0-100% in 10% increments.

   2. Time delay – 1-30, self-adjusts to 10 min based on room occupancy.

   3. Test mode – Fifteen second time delay.

   4. Detection technology – PIR, Ultrasonic or Dual Technology activation and/or re-activation.
5. Walk-through mode.

6. Ultrasonic and Dual Technology Sensors utilize two independent sensor detection circuits simultaneously to ensure optimum performance, regardless of location or proximity to walls and structures.

7. Ultrasonic and Dual Technology Sensors utilize Variable Drive Circuitry (VDC) in cases of over saturation from misapplication, which automatically adjusts the volumetric output without reducing detection capability. Systems that reduce detection coverage area shall not be acceptable.

8. Automatically and continually self-adjust ultrasonic frequency to ignore specific frequency, continuous noise from airflow to prevent detuning which can lead to inadvertent lights out. Sensors that require detuning shall not be acceptable.

9. All load parameters including Automatic On/Manual On, blink warning and daylight enable/disable when daylight sensors are pre-defined with the DLVP local bus.

F. Device Status LEDs including:
   1. PIR Detection
   2. Ultrasonic detection

G. Occupancy sensors are pre-defined to specific loads within the room without wiring or special tools for maximum energy savings.

H. Manual override of controlled loads.

I. Multiple occupancy sensors may be installed in a room by simply daisy-chaining them together to the Low-Voltage Power Module via pre-terminated control cable. No additional configuration will be required.

J. Where specified, sensor packaging shall be 100% recycled [made entirely from post-consumer waste (100% post-consumer fiber content) as well as, 100% recyclable].

K. Sensors shall be RoHS compliant.

2.4 WALL/CORNER MOUNTED SENSORS

A. Product: [OAWC-P-120W], [OAWC-P-009L-H], [OAWC-DT-120W],

B. Provide all necessary mounting hardware and instructions.
C. Sensors shall be Class 2 devices.

D. Connect to Low-Voltage Power Module via pre-terminated control cable to eliminate wiring errors.
   1. [OCC-RJ45] Low-voltage accessory is used to allow any standard occupancy/vacancy sensor to utilize pre-terminated control cable connections.
   2. Two RJ45 connection ports for connection to Low-Voltage Power Module.
   3. Occupancy Sensor and Daylight sensor shall be capable of a daisy-chain connection to the Low-Voltage Power Module.

E. Device calibration and features:
   1. Sensitivity – 0-100% in 10% increments.
   2. Time delay – 1-30, self-adjusts to 10 min. based on room occupancy.
   3. Test Mode – Fifteen second time delay.
   4. Detection technology – PIR, Ultrasonic or Dual Technology activation and/or re-activation.
   5. Walk-Through Mode.
   6. Automatically and continually self-adjust ultrasonic frequency to ignore specific frequency continuous noise from airflow to prevent detuning which can lead to inadvertent lights out. Sensors that require detuning shall not be acceptable.
   7. All load parameters including Automatic On/Manual ON, blink warning, and daylight enable/disable when daylight sensors are pre-defined with the DLVP local bus.

F. Device Status LEDs including:
   1. PIR Detection
   2. Ultrasonic detection

G. Occupancy sensors are pre-defined to specific loads within the room without wiring or special tools for maximum energy savings.

H. Manual override of controlled loads.

I. Multiple occupancy sensors may be installed in a room by simply daisy chaining them together to the Low-Voltage Power Module via pre-terminated control cable. No additional configuration will be required.

J. Where specified, sensor packaging shall be 100% recycled [made entirely from post-consumer waste (100% post-consumer fiber content) as well as, 100% recyclable].
K. Sensors shall be RoHS compliant.

2.5 ZONE WALLSTATIONS

A. Low voltage momentary pushbutton switches in 2, 3, 4, 5 and 6 button configuration; available in white, ivory, grey and black; compatible with wall plates with decorator opening. Wallstations shall include the following features:

1. Removable buttons for field replacement with engraved buttons and/or alternate color buttons \([\text{ENGRV-*BTNL-*}}, \text{[ENGRV-*BTNS-*]}\). Button replacement may be completed without removing the switch from the wall.

2. Intuitive button labeling to match application and load controls.

3. Pre-defined digital button configurations. Each wallstation is shipped with pre-defined digital button configurations which are automatically sensed by the connected Low-Voltage Power Module and mapped to specific load controls for immediate out of the box functionality.

B. Two RJ-45 ports for connection to the DLVP control bus.

C. Multiple digital wallstations may be installed in a room by simply connecting them to the DLVP local bus. No additional configuration will be required to achieve multi-way switching.

D. Zone wallstations are delivered with pre-defined functions including, raise, lower, A/V Mode, Quiet Time, manual and scene control. No additional configuration is required to provide a fully functional system. Systems that require configuration or load binding and do not deliver maximum energy savings out of the box shall not be acceptable.

E. Optional custom labeling is available for application or location specific wallstation button labels.

F. Eaton Lighting Systems catalog numbers:

<table>
<thead>
<tr>
<th>Catalog Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RC-2TLB-ES1-*</td>
<td>Entry, All Off (2 large buttons *= W,V,B,G)</td>
</tr>
<tr>
<td>RC-6TSB-TS1-*</td>
<td>General, Whiteboard, Quiet Time, A/V Mode, Raise, Lower (6 small buttons *= W,V,B,G)</td>
</tr>
<tr>
<td>RC-6TSB-TS2-*</td>
<td>General, Whiteboard, Quiet Time, Raise, Lower, All Off (6 small buttons *= W,V,B,G)</td>
</tr>
<tr>
<td>RC-5TSB-TS3-*</td>
<td>General, Whiteboard, Quiet Time, A/V Mode, All Off (5 small buttons *= W,V,B,G)</td>
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<tr>
<td>RC-6TSB-TS4-*</td>
<td>General, Whiteboard, A/V Mode, Raise, Lower, All Off (6 small buttons *= W,V,B,G)</td>
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<tr>
<td>RC-4TSB-TS5-*</td>
<td>Entry, General, Whiteboard, All Off (4 small buttons *= W,V,B,G)</td>
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### Eaton's Lighting Systems - LIGHTING CONTROL DEVICES

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<th>Model</th>
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<td>RC-6TSB-TS7-*</td>
<td>Row 1, Row 2, Row 3, Raise, Lower, All Off (6 small buttons *= W,V,B,G)</td>
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<tr>
<td>RC-6TSB-TS8-*</td>
<td>Uplights, Downlights, Accent, Raise, Lower, All Off (6 small buttons *= W,V,B,G)</td>
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<tr>
<td>RC-6TSB-TS9-*</td>
<td>Entry, General, Quiet Time, Whiteboard, A/V Mode, All Off (6 small buttons *= W,V,B,G)</td>
</tr>
<tr>
<td>RC-6TSB-TS10-*</td>
<td>Main, Whiteboard, A/V Mode, Raise, Lower, All Off (6 small buttons *= W,V,B,G)</td>
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<tr>
<td>RC-6TSB-ZAD-*</td>
<td>Zone 1 UP, Zone 1 DN, Zone 2 UP, Zone 2 DN, Zone 3 UP, Zone 3 DN (6 small buttons *= W,V,B,G)</td>
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<tr>
<td>RC-3TLB-Z1D-*</td>
<td>Zone 1, Raise, Lower (3 large buttons *= W,V,B,G)</td>
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<tr>
<td>RC-3TLB-Z2D-*</td>
<td>Zone 2, Raise, Lower (3 large buttons *= W,V,B,G)</td>
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<tr>
<td>RC-3TLB-Z3D-*</td>
<td>Zone 3, Raise, Lower (3 large buttons *= W,V,B,G)</td>
</tr>
<tr>
<td>RC-4TSB-HC1-*</td>
<td>General, Exam, Reading, All Off (4 small buttons *= W,V,B,G)</td>
</tr>
<tr>
<td>RC-6TSB-HC2-*</td>
<td>General, Exam, Reading, Raise, Lower, All Off (6 small buttons *= W,V,B,G)</td>
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<tr>
<td>RC-3TLB-OS1-*</td>
<td>Half Lights, Full Lights, All Off (3 large buttons *= W,V,B,G)</td>
</tr>
<tr>
<td>RC-5TSB-OS2-*</td>
<td>Half Lights, Full Lights, Raise, Lower, All Off (5 small buttons *= W,V,B,G)</td>
</tr>
<tr>
<td>RC-6TSB-OS3-*</td>
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<tr>
<td>RC-2TLB-OS4-*</td>
<td>All On, All Off (2 large buttons *= W,V,B,G)</td>
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</table>

#### 2.6 DLVP SCENE WALLSTATIONS

B. Low voltage momentary pushbutton switches in 2, 3, 4, 5 and 6 button configuration; available in white, ivory, grey and black; compatible with wall plates with decorator opening. Wallstations shall include the following features:

1. Removable buttons for field replacement with engraved buttons and/or alternate color buttons [ENGRV-*BTNL-*], [ENGRV-*BTNS-*]. Button replacement may be completed without removing the switch from the wall.

2. Intuitive button labeling to match application and load controls.

3. Pre-defined digital button configurations. Each scene wallstation is shipped with a pre-defined digital button configuration which is
automatically sensed by the connected Low-Voltage Power Module and mapped to specific load controls for immediate out-of-the-box scene based functionality.

B. Two RJ45 ports for connection to the DLVP control bus.

C. Multiple digital wallstations may be installed in a room by simply connecting them to the DLVP control bus. No additional configuration will be required to achieve multi-way switching.

D. Scene Wallstations are delivered with pre-defined scene control. No additional configuration is required to provide a fully functional system. Systems that require configuration or load binding and do not deliver maximum energy savings out of the box shall not be acceptable.

E. Optional custom labeling is available for application or location specific wallstation button labels.

F. Scene wallstation’s scene control shall be adjustable through a simple interface or handheld control for flexibility of lighting scenes. This personal remote shall allow individual zone control, scene control and scene setting capabilities. [LVHH-02]

G. Eaton Lighting Systems catalog numbers:

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<thead>
<tr>
<th>Catalog Number</th>
<th>Scene Control Details</th>
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<tbody>
<tr>
<td>RC-3TLB-P1-*</td>
<td>Scene 1, Scene 2, All Off</td>
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<tr>
<td></td>
<td>(3 large buttons *= W,V,B,G)</td>
</tr>
<tr>
<td>RC-6TSB-P2-*</td>
<td>Scene 1, Scene 2, Scene 3, Scene 4, Scene 5, All Off</td>
</tr>
<tr>
<td></td>
<td>(6 small buttons *= W,V,B,G)</td>
</tr>
<tr>
<td>RC-6TSB-P3-*</td>
<td>All, On, Scene 1, Scene 2, Scene 3, Scene 4, All Off</td>
</tr>
<tr>
<td></td>
<td>(6 small buttons *= W,V,B,G)</td>
</tr>
<tr>
<td>RC-6TSB-P4-*</td>
<td>Scene 1, Scene 2, Scene 3, Raise, Lower, All Off</td>
</tr>
<tr>
<td></td>
<td>(6 small buttons *= W,V,B,G)</td>
</tr>
</tbody>
</table>

2.7 DAYLIGHTING ADJUSTMENT HANDHELD REMOTE CONTROLS

A. Battery-operated handheld programming remote for daylight sensor configuration. Remote controls shall include the following features:

1. Two-way infrared (IR) transceiver for line of sight communication with the DLVP daylight sensors within up to 30 feet.

2. Red communication LED on the daylight sensor confirms button press.

3. Inactivity timeout to save battery life.

B. Three intuitive daylight sensor range pushbuttons.

C. Intuitive daylight zone adjustment raise/lower pushbuttons.
D. Eaton Lighting Systems catalog numbers: [LVHH-01].

2.8 PERSONAL ADJUSTMENT HANDHELD REMOTE CONTROLS

A. Battery-operated handheld remote for space personal control. Remote controls shall include the following features:

1. Two-way infrared (IR) transceiver for line-of-sight communication with the DLVP daylight sensors within up to 30 feet.

2. Red communication LED on the daylight sensor confirms button press.

3. Inactivity timeout to save battery life.

B. Intuitive individual Control of each dimming manual control zone.

C. Six user adjustable scene pushbuttons for simple selection and control of space lighting.

D. Eaton Lighting Systems catalog numbers: [LVHH-02].

2.9 LOW-VOLTAGE POWER MODULES

A. Low-Voltage Power Modules are fully functional out-of-the-box to the connected devices in the space without commissioning or the use of any tools. Low-Voltage Power Modules shall be provided to match the room lighting load and control requirements. The controllers will be simple to install and will include line voltage wiring space and will not require additional electrical junction boxes. The control units will include the following features:

B. Fully functional room configuration to the most energy-efficient sequence of operation based upon the connected devices in the room.

C. Simple replacement – Using the automatic configuration capabilities, a Low-Voltage Power Module may be replaced with an off-the-shelf unit with minimal configuration.

D. Quick installation features including:

1. Included line voltage space to simplify wiring and eliminate the need for separate junction boxes.

2. Breakouts or knockouts for direct conduit connection.

3. Line voltage section include conduit connection points. Systems that require special accessories for direct conduit connections may not comply with local building codes and shall not be acceptable.
4. Quick low-voltage lighting connections using pre-terminated Low-Voltage Lighting Cable.

5. Quick low voltage control connections using standard pre-terminated control cable.

6. Wide input voltage range (120 - 277 VAC, 50/60 Hz).


8. Six pre-terminated control cable local bus ports.

9. All models shall be available in plenum rated metal enclosure for simplified installation in appropriate spaces.

10. All models support local bus connections of wallstations, occupancy-based controls and receptacle controls.

E. On/Off/Dimming Low-Voltage Power Modules shall include:

1. Up to 300W of low-voltage class 2 power and three dimming manual control zones [LVPM-03-100-03]
   a. All models support local bus connections of wallstations, occupancy and daylight-based controls and receptacle controls.

2. Up to 600W of low-voltage class 2 power and three dimming manual control zones [LVPM-06-100-03]
   a. All models support local bus connections of wallstations, occupancy and daylight-based controls and receptacle controls.

2.10 DAYLIGHT PHOTORESISTORS/IR RECEIVER

A. Daylight photosensors work with Low-Voltage Power Modules to provide automatic daylight dimming capabilities for any load type connected to a Low-Voltage Power Module. Open loop daylight sensors measure incoming daylight in the space, and are capable of controlling up to three lighting zones. Daylight sensors shall be interchangeable without the need for rewiring. Daylight sensors shall be capable of daisy-chain connection with occupancy sensors in each room.

B. Digital daylight sensors include the following features:

1. An internal photodiode that measures only within the visible spectrum and has a response curve that closely matches the photopic curve.

2. The daylight sensor has three light level ranges: Low (3-300 lux), High (30-3000 lux), and Direct Sun (300-30000 lux).
3. For dimming daylight harvesting, the daylight sensor shall provide the capability of controlling multiple (up to three) daylight zones immediately upon connection without programming.

4. Optional digital wallstations to allow occupants to reduce lighting level to increase energy savings and lower lighting levels for a selected period of time or cycle of occupancy.

5. Infrared (IR) transceiver for daylight sensor range and daylight zone gain adjustments via handheld programming remote. [LVHH-01]

6. Infrared (IR) receiver for personal control and scene programming via handheld personal remote. [LVHH-02]

7. Red configuration LED that blinks to indicate data transmission.

8. Green Mode status LED that blinks to indicate Daylight Commissioning Mode.

9. Green Mode status LED that remains constant ON when daylight range is set to low for available natural light.

10. One RJ45 port for connection to DLVP sensor bus.

11. An adjustable head and an optional mounting bracket to accommodate multiple mounting methods and building materials. The daylight sensor may be mounted on a ceiling tile, skylight well, suspended lighting fixture or backbox.

C. Open loop digital daylight sensor includes the following additional features:

1. An internal photodiode that measures light in a 60 degree angle cutting off the unwanted light from the interior of the room.

2. Automatically establishes dimming set-points upon power up without any programming. Optional calibration using the wireless IR handheld programmer. [LVHH-01]

3. Eaton Lighting Systems Catalog Number: [DS-FMOIR].

2.11 DLVP LOCAL BUS

A. The DLVP local bus is a physical connection and communication protocol designed to optimally control a space within a building. DLVP devices connect to the local bus using CAT 5e cables with RJ45 terminations which provide both data and power to devices. Features of the DLVP local bus include:

1. RJ45 default functionality of occupancy sensors, wallstations, daylight sensors, receptacle controls, BMS status output and lighting
loads to the most energy-efficient sequence of operation based upon the device attached.

2. Replacement of any control device on the bus with a standard off the shelf unit without requiring commissioning, configuration or setup.

B. Eaton Lighting Systems  Catalog Number:

1. [GGRC-COUPLER] (Joins two pre-terminated control cables)
2. [GGRC-SPLITTER] (Joins three pre-terminated control cables)
3. PLENUM CABLES: [GGRJ45-10P-G], [GGRJ45-25P-G], [GGRJ45-50P-G], [GGRJ45-100P-G]

2.12 OPENADR VIRTUAL END NODE (VEN) FOR DEMAND RESPONSE

A. The Low-Voltage Power Module shall be capable of receiving a signal from a Demand Response or OpenADR Virtual End Node device. When received the Low-Voltage Power Module will automatically adjust lighting to provide optimal energy savings and comply with Demand Response code requirements. Systems that do not support Demand Response capability out-of-the-box shall not be acceptable.

1. Automatically adjust the target lighting level by at least 10% but not more than 40%.
2. System does not permit user override of the Demand Response system except in the cases of emergency or normal power loss. Systems that allow the user to adjust the lights higher than the demand response target light level shall not be acceptable.
3. Each Low-Voltage Power Module shall be configurable for individual Demand Response reduction levels. Systems that only support global Demand Response reduction levels shall not be acceptable.

B. Eaton Lighting Systems  Catalog Number:

1. [EBOX-2B-DC], [EBOX-ASF]

2.13 EMERGENCY LIGHTING

A. A minimum of two (2) Emergency Lighting / Power Control strategies shall be available.

B. Light fixture level emergency lighting – A UL924 listed emergency light fixture may be connected to the system and a part of a manual control zone allowing full control when in normal operation (ON/OFF/DIM). This UL924 listed light fixture, like other non-UL924 listed fixtures, shall connect to a Low-Voltage Power Module via Low-Voltage Lighting Cables – requiring no line voltage connection for proper operation.
C. System level emergency lighting – Low-Voltage Power Modules shall be hardwired to a typical centralized UL924 listed source utilizing an industry typical UL1008 transfer switch. A Remote Relay Unit (RRU) shall be wired to normal power providing a low-voltage contact closure to the Low-Voltage Power Module indicating an ALERT. During this condition, lighting control inputs shall be ignored and light fixtures shall be driven to full output.

PART 3 – EXECUTION

3.1 INSTALLATION

A. The control system shall be installed and fully wired as shown on the plans by the installing contractor. The contractor shall complete all electrical connections to all control circuits.

B. All low voltage smart devices shall connect using pre-terminated control cables provided by Eaton's Lighting Systems. When using cable for connections other than the pre-terminated control cable (pre-defined lengths of pre-terminated control cable), provide detailed point to point wiring diagrams for every termination. Provide wire specifications and wire colors to simplify contractor termination requirements.

C. Install the work of this Section in accordance with manufacturer's printed instructions unless otherwise indicated.

D. Provide written or computer-generated documentation on the commissioning of the system including room by room description including:

1. Sensor parameters, time delays, sensitivities and daylighting setpoints.

2. Sequence of operation, (e.g. manual ON, Auto OFF. etc.).

3. Load parameters (e.g. blink warning, etc.).

3.2 PRODUCT SUPPORT AND SERVICE

A. Factory telephone support shall be available at no cost to the owner. Factory assistance shall consist of solving programming or application questions concerning the control equipment.

3.3 FACTORY COMMISSIONING

A. May not be required if installed by a manufacturer certified contractor

B. Upon completion of the installation by a contractor not factory certified, the system shall be commissioned by the manufacturer's factory authorized representative who will verify a complete fully functional system.
C. The electrical contractor shall provide both the manufacturer and the electrical engineer with twenty one working days written notice of the system startup and adjustment date.

D. Upon completion of the system commissioning the factory-authorized technician shall provide the proper training to the owner's personnel on the adjustment and maintenance of the system.