SECTION 26 09 43 - Network Lighting Controls

NETWORK LIGHTING CONTROLS - DISTRIBUTED DIGITAL LIGHTING CONTROL SYSTEM

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\*\* NOTE TO SPECIFIER \*\* Legrand: Wattstopper; Legrand Product Line: Digital Lighting Management (DLM) products.  
This section is based on the products ofLegrand: Wattstopper, which is located at:2240 Campbell Creek Blvd., Suite 110Richardson, TX 75082Toll Free Tel: 800-879-8585Email: [request info (charles.knuffke@legrand.us)](https://arcat.com/rfi?action=email&company=Legrand%253A%252BWattstopper&message=RE%253A%2520Spec%2520Question%2520(16575wat)%253A%2520&coid=36455&spec=16575wat&rep=&fax=)  
Web: <https://www.legrand.us/wattstopper.aspx> | <https://www.legrand.us//solutions/wattstopper-plus>   
 [ [Click Here](https://arcat.com/company/legrand-wattstopper-36455) ] for additional information.  
Wattstopper, a product brand of Legrand, offers the most comprehensive line of scalable and flexible energy efficient lighting controls and solutions for commercial applications. Wattstopper products, programs, and services have been helping customers save energy, meet green initiatives, and comply with energy codes for more than 30 years.  
A leading provider of products and systems for Power, Light, and Data wherever people live and work, Legrand delivers an unequaled depth and breadth of innovative solutions. Legrand North and Central America brands include: Cablofil, Da-lite, Finelite, Focal Point, Kenall, Middle Atlantic, OCL, On-Q, Ortronics, Pass & Seymour, Pinnacle, Raritan, Server Technologies, Vantage and Wiremold.

1. GENERAL
   1. SECTION INCLUDES

\*\* NOTE TO SPECIFIER \*\* Delete items below not required for project.

* + 1. Distributed Digital Lighting Control System: System includes
       1. Wired and Wireless Digital Lighting and Plug Load Controls
       2. 0-10V Relay Panels
       3. Emergency Lighting Control.
  1. RELATED SECTIONS

\*\* NOTE TO SPECIFIER \*\* Delete any sections below not relevant to this project; add others as required.

* + 1. Section 25 55 00 - Integrated Automation, building integrator shall provide integration of the lighting control system with Building Automation Systems.
    2. Section 26 05 33 - Raceway and Boxes for Electrical Systems.
    3. Section 26 51 00 - Interior Lighting Fixtures, Lamps, and Ballasts.
    4. Section 26 52 00 - Emergency Lighting.
  1. REFERENCES

\*\* NOTE TO SPECIFIER \*\* Delete references from the list below that are not actually required by the text of the edited section.

* + 1. FCC emission standards.
    2. NEMA - National Electrical Manufacturers Association.
    3. NFPA 70 - National Electrical Code; National Fire Protection Association.
    4. UL - Underwriters Laboratories, Inc. Listings.
    5. UL 20 - General Use Switches, Plug Load Controls.
    6. UL 924 - Standard for Emergency Lighting and Power Equipment.
    7. UL 2043 - Standard for Fire Test for Heat and Visible Smoke Release for Discrete Products Installed in Air-Handling Spaces.
    8. ULC - Underwriter Laboratories of Canada Listings.
    9. California Title 24, Part 6 Energy Code
    10. ISO 27001 Information Security Management Systems
    11. OpenADR - OpenADR Alliance
  1. DESIGN / PERFORMANCE REQUIREMENTS
     1. Distributed Digital Lighting Control System shall accommodate the square-footage coverage requirements for each area controlled, utilizing room controllers, digital occupancy sensors, switches, dimmers, daylighting sensors and accessories that suit the required lighting and electrical system parameters.
     2. System shall conform to requirements of NFPA 70.
     3. System shall comply with FCC emission standards specified in part 15, sub-part J for commercial and residential application.
     4. System shall be listed under UL sections 916 and/or 508.
  2. SUBMITTALS
     1. Submit under provisions of Section 01 30 00 - Administrative Requirements.
     2. Product Data: Manufacturer's data sheets on each product to be used, including:
        1. Catalog cut sheets and specifications.
        2. Ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.
        3. Storage and handling requirements and recommendations.
        4. Installation instructions.
        5. Network Lighting Controls Certification
     3. Shop Drawings: Wiring diagrams for the various components of the System specified including:
        1. Show location of devices, including at minimum load controllers, sensors, and switches/dimmers on reflected ceiling plans. Identify controlled circuits.
        2. Provide room/area typical wiring and/or installation details including products and sequence of operation for each room or area. Illustrate recommended room/area connection topologies.
        3. Network riser single line diagram including floor and building level details. Include network cable specification. Illustrate connections to any integrated systems. Coordinate integration with mechanical and/or other trades.
     4. Manufacturer's Certificates: Certify products meet or exceed specified requirements.
     5. Closeout Submittals:
        1. Project Record Documents: Record actual installed locations and settings for lighting control devices.
        2. Operation and Maintenance Manual:
           1. Include approved Shop Drawings and Product Data.
           2. Include Sequence of Operation,with operation for each room or space.
           3. Include manufacturer's maintenance information.
           4. Operation and Maintenance Data: Include detailed information on device programming and setup.
           5. Include startup and test reports.

\*\* NOTE TO SPECIFIER \*\* Include the following paragraph if lighting control acceptance testing required by California Title 24, Part 6 (California Energy Code) is specified in Part 3 under "COMMISSIONING".

* + 1. Title 24 Acceptance Testing Documentation: Submit Certification of Acceptance and associated documentation for lighting control acceptance testing performed in accordance with CALIFORNIA TITLE 24, PART 6, as specified in Part 3 of this specification under "COMMISSIONING".
  1. QUALITY ASSURANCE
     1. Manufacturer Qualifications: Company specializing in manufacturing of centralized and distributed lighting control systems with a minimum of 10 years documented experience.
     2. Installer Qualifications: Company certified by the manufacturer and specializing in installation of networked lighting control products with minimum three years documented experience.
     3. System Components: Demonstrate that individual components have undergone quality control and testing prior to shipping.
     4. Manufacturers should be able to demonstrate that any controls provided that can connect to the internet provide a reasonable level of security based on California�s SB-327 requirements. Ensure that devices that allow for communication between the controls system hierarchy and/or the internet are covered by a manufacturer certified via ISO/IEC 27001:2013 which has 114 cyber security related controls.

\*\* NOTE TO SPECIFIER \*\* Pre-Installation Meeting is recommended but not mandatory. Select if required and delete if not required.

* 1. PRE-INSTALLATION MEETINGS
     1. Convene minimum two weeks prior to commencing installation. Meeting to be attended by Contractor, Architect, system installer, factory authorized manufacturer's representative, and representative of all trades related to the system installation.
     2. Review installation procedures and coordination required with related Work and the following:
        1. Confirm the location and mounting of all devices, with special attention to placement of switches, dimmers, and any sensors.
        2. Review the specifications for low voltage control wiring and termination.
        3. Discuss the functionality and configuration of all products, including sequences of operation, per design requirements.
        4. Discuss differences between any wired or wireless products on the project.
        5. Discuss requirements for integration with other trades
     3. Inspect and make notes of job conditions prior to installation:
        1. Record minutes of the conference and provide copies to all parties present.
        2. Identify all outstanding issues in writing designating the responsible party for follow-up action and the timetable for completion.
        3. Installation shall not begin until all outstanding issues are resolved to the satisfaction of the Architect.
  2. DELIVERY, STORAGE, AND HANDLING
     1. Store products in a clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions until ready for installation
  3. PROJECT CONDITIONS
     1. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's documented limits.
     2. Do not install equipment until following conditions can be maintained in spaces to receive equipment:
        1. Ambient temperature: 32 to 104 degrees F (0 to 40 degrees C).
        2. Relative humidity: Maximum 90 percent, non-condensing.
  4. WARRANTY
     1. Product Warranty: Manufacturer shall provide a 5 year limited warranty on products within this installation, except where otherwise noted, and consisting of a one for one device replacement of any devices deemed faulty.
  5. MAINTENANCE AND OPERATIONAL SERVICES

\*\* NOTE TO SPECIFIER \*\* Include the following optional paragraphs if required. Delete entirely if not required.

* + 1. Remote Access and Enhanced Warranty for Networked Lighting Controls: Provide Manufacturer's Remote Access and Enhanced Warranty for Networked Lighting Controls as follows:
       1. Configure to allow the manufacturer remote access to the lighting control system. Configuration includes at a minimum: cellular modem, antenna for the modem, cellular service contract and any components required to enable communication to the specified Network Lighting Control system.
       2. Remote Access program automatically triggers a First Year Enhanced Warranty Agreement starting once lighting control system startup is complete and accepted by the Owner. During this one year period, the Owner's authorized site contact can request the manufacturer to check the system for proper operation and make any programmable changes desired. Manufacturer shall provide a phone number dedicated to customer calls concerning Remote Accessible systems and a support organization capable of enabling cellular communication to the system for troubleshooting and making requested changes to the system. Users requesting remote support on the system shall be fully verified by the Remote Operations Center (ROC) before providing remote support or making any changes to the system. Systems that allow the modem to be always accessible will not be acceptable. Access must be by a secured VPN connection to the private lighting control network that is completely isolated from the Owner's internal network. Remote access that requires a connection through the Owner's internal network is not acceptable.
       3. Owners may continue the Remote Access Program after the first year. However, if the Owner does not continue the enhanced warranty the cellular contract will lapse, and all hardware components, while still remaining property of the manufacturer, will remain in situ so that they can be re-activated at a later time should the Owner desire.
       4. Manufacturer's Remote Access capability shall provide at a minimum the following features:
          1. Ability to provide initial system diagnostics through LMCS Software to detect fault conditions in wiring or connected devices.
          2. Access to all devices via LMCS Software to program device functions. This will include scheduling of Time of Day Events and programming of individual device parameters to meet Sequence of Operation requirements.
          3. Access to the LMJA-8xxx browser-based interface (if included on project) to verify it is setup per project documentation and is completely functional.
          4. On demand access to manufacturer technical support via a Remote Operations Center (ROC) that will provide remote troubleshooting, diagnostics, and configuration/programming assistance.
          5. Additional client training and tuning on the Lighting Control System after building occupancy can be performed while remotely connected to the site.
          6. Site Readiness Check (SRC) which allows the Remote Operations Center to perform a remote discovery of all devices connected to the lighting control network during installation. DLM Networked projects that have a RACCESS cellular modem and have successfully completed the SRC process, defined as 80% or more of the networked devices are found during network discovery, will receive priority scheduling. After scheduled on site startup, all manufacturer provided startup work for a site with a successful SRC will be done remotely, or via complimentary return trips.

\*\* NOTE TO SPECIFIER \*\* The following optional sections can ONLY BE INCLUDED if "Remote Access and Enhanced Warranty for Networked Lighting Controls" is specified above. Delete entirely if not required.

* + 1. Technology-Enabled Service Contract: The manufacturer of the Lighting Control System shall provide a service contract for continued support of the system post installation that combines secure yet immediately accessible remote support with the backup assurance of onsite support when necessary. The coverage levels and features of the selected service contract would apply immediately upon completion of startup and supersede any enhanced remote support offered by the manufacturer during the first year after startup.
       1. Technology-enabled service contract requires a RACCESS (Remote Access) secure cellular connection that allows the manufacturer remote access to the lighting control system to provide remote troubleshooting, diagnostics, and configuration/programming assistance. Manufacturer shall ensure provision of a cellular service plan that keeps the modem active through the chosen Technology-Enabled Service Contract's duration.
       2. If the customer does not renew the Service Contract at the end of the contract term, the cellular service plan will lapse, and all hardware components will remain in situ so that they can be re-activated later should the customer desire.
       3. Technology-Enabled Service Contract Specifics

\*\* NOTE TO SPECIFIER \*\* Select either following paragraph a. or b. below and delete the other.

* + - * 1. Provide a complete "Connect Plus" Service Contract that includes the following features:

Priority access to manufacturer technical support via a Remote Operations Center

A complete system backup of LMCS and Front End hardware software files semi-annually

Semi-annual Device Health Checks to identify any devices that have been bypassed, disconnected, or not functioning with recommendations for resolution

An annual onsite training session by a certified factory-trained technician

Semi-annual system tuning visits to optimize the lighting configuration, fine tune the Sequence of Operations or make programming changes to the system

A 3 day onsite response time for unscheduled emergency visits provided by factory-trained technicians

* + - * 1. Provide a complete "Connect Prime" Service Contract that includes the following:

24/7 priority access to manufacturer technical support via a Remote Operations Center

A complete system backup of LMCS and Front End hardware software files quarterly

Quarterly Device Health Checks to identify any devices that have been bypassed, disconnected, or not functioning with recommendations for resolution

Semi-annual onsite training sessions by a certified factory-trained technician

Quarterly system tuning visits to optimize the lighting configuration, fine tune the Sequence of Operations or make programming changes to the system

A next day onsite response time for unscheduled emergency visits provided by factory-trained technicians

* + - 1. Length of Technology-Enabled Service Contract:

\*\* NOTE TO SPECIFIER \*\* Select one of the following for the length of contact required and delete the others.

* + - * 1. 1 Year
        2. 2 Year
        3. 3 Year
        4. 4 Year
        5. 5 Year

1. PRODUCTS
   1. MANUFACTURERS
      1. Acceptable Manufacturer: Wattstopper/Legrand: Digital Lighting Management, which is located at: 2240 Campbell Creek Blvd #110; Richardson, TX 75082; Tel: 1-800-879-8585; Email: request info; Web: https://www.legrand.us/wattstopper.aspx

\*\* NOTE TO SPECIFIER \*\* Delete one of the following two paragraphs; coordinate with requirements of Division 1 section on product options and substitutions.

* + 1. Substitutions: Not permitted.
    2. Requests for substitutions will be considered in accordance with the provisions of Section 01 60 00 - Product Requirements.
  1. DISTRIBUTED DIGITAL LIGHTING CONTROL SYSTEM
     1. System General: Provide a Wattstopper Digital Lighting Management System (DLM) complete with all necessary enclosures, wiring, and system components to ensure a complete and properly functioning system as indicated on the Drawings and specified herein. If a conflict is identified between the Drawing and this Specification contact the Architect for clarification prior to proceeding.

\*\* NOTE TO SPECIFIER \*\* Edit the following paragraphs to include the basic control features required for the project. Delete the paragraphs for the features that are not applicable.

* + - 1. Default to project's determined Energy Code requirements and specifier's Sequence of Operation (SoO); otherwise follow below narrative:
      2. Space Control Requirements: Provide occupancy/vacancy sensors with Manual- or Partial-ON functionality as indicated in all spaces except where hands-free operation is desirable and Automatic-ON occupancy sensors are allowed. Provide Manual-ON occupancy/vacancy sensors for any enclosed office, conference room, meeting room, open plan system and training room. For spaces with multiple occupants, or where line-of-sight may be obscured, provide ceiling, corner, or fixture mounted sensors, and set up for Manual-ON or Partial-On operation.
      3. Task Lighting / Plug Loads: Provide automatic shut off of non-essential plug loads and task lighting in spaces as required by the applicable energy code. Provide Automatic-ON of plug loads by time of day or occupancy sensors whenever spaces are occupied.
      4. Daylit Areas: Provide daylight-responsive automatic control in all spaces (conditioned or unconditioned) where daylight contribution is available as defined by relevant local building energy code:
         1. All luminaires within code-defined daylight zones shall be controlled separately from luminaires outside of daylit zones.
         2. Daytime setpoints for total ambient illumination (combined daylight and electric light) levels that initiate dimming shall be programmed in compliance with relevant local building energy codes.
         3. Multi-zone sensors may be utilized for daylight areas on the drawings.
         4. Provide smooth and continuous daylight dimming for areas marked on drawings. Daylighting control system may be designed to turn off electric lighting when daylight is at or above required lighting levels.
      5. Conference, meeting, training, auditoriums, and multipurpose rooms shall have independent control of local control zones. Rooms larger than 300 square feet shall instead have at least four preset lighting scenes unless otherwise specified. Occupancy / vacancy sensors shall be provided to turn off all lighting in the space. Spaces with up to four moveable walls shall include controls that reconfigured the room based on specific partitioning.
    1. Local Room Communication Network: DLM communications in room can either be over a wireless IPv6 network, a wired Cat 5e network referred to as local network or In Room Bus (IRB), or a hybrid with wired Room Controllers, a wireless bridge, and additional wired and/or wireless accessory devices.

\*\* NOTE TO SPECIFIER \*\* Select the communication required for the project and delete those that are not applicable.

* + - 1. Wireless Room Network: Local room network is a IPv6 wireless communication network between devices. Bluetooth Low Energy shall also be present for use with a commissioning APP.
         1. Features of the wireless DLM local network include:

All devices in the room are "wireless" - i.e., no low voltage Cat 5e communication cable required between devices. Room includes one or more Wireless 0-10V Room or Plug Load Controllers.

Devices in the room are paired together either manually, via an iOS or Android APP, or via front end software so that they create and join to an IPv6 wireless network.

Once devices are paired, they determine most efficient energy saving operation via patented Plug n Go capability.

After room has been set up, load binding assignments can be set up by patented Push n' Learn capability.

* + - * 1. Wireless room devices utilize a trusted hardware chip to ensure that only products by the manufacturer can access and participate in the wireless network.
      1. Wired Room Network with LMRJ Cat 5e cables: DLM local or In Room Bus (IRB) network is a free topology lighting control physical connection and communication protocol designed to control a room or small area of building.
         1. Features of the wired DLM local network include:

Plug n Go automatic configuration and binding of occupancy sensors, switches, and lighting loads to the most energy-efficient sequence of operation based upon the device attached.

Simple replacement of any device in the local DLM network with a standard off the shelf unit without requiring significant commissioning, configuration, or setup.

Push n' Learn configuration to change the automatic configuration, including binding and load parameters without tools, using only the buttons on the digital devices in the local network.

Two-way infrared communications for control by handheld remotes, and configuration by a handheld tool including adjusting load parameters, sensor configuration and binding, within a line of sight of up to 30 feet from a sensor, wall switch or IR receiver.

* + - * 1. Digital room devices connect to the local network using pre-terminated Cat 5e cables with RJ-45 connectors provide both data and power to room devices. Systems that utilize RJ-45 patch cords but do not provide digital communication from individual end devices are not acceptable.
        2. If manufacturer's pre-terminated Cat5e cables are not used for the installation, each contractor terminated cable must be individually tested and logged provided to any authorized service representative following installation.
      1. Hybrid Room Network: local room network is formed using a combination of wired room controllers, a wireless bridge, and wired and/or wireless occupancy sensors and switches/dimmers.
         1. Features of the Hybrid DLM local network include:

A wireless network bridge is included in the room to act as a bridge between devices that use a wired local IRB network and the devices that use a wireless local PAN network.

Wireless room devices utilize a trusted hardware chip to ensure that only the manufacture's products can access and participate in the wireless network.

Wireless bridge shall be capable of communicating with other wireless bridges, wired load controllers in the room, and a Secondary border router to enable a large-scale low power self-healing IPv6 mesh communication network between rooms in the PAN.

\*\* NOTE TO SPECIFIER \*\* Edit the following paragraphs to include the control features and product numbers required for the project. Delete the paragraphs for the features and product numbers that are not applicable.

* 1. WIRELESS FIXTURE SENSOR
     1. Wireless Fixture Sensors are load controllers meeting Luminaire Level Lighting Control device requirements with integral occupancy sensor, daylighting sensor, and fixture controller that can communicate to fixture ballasts or drivers via the DALI protocol or, with an interface module, 0-10V. Can communicate with other Wireless DLM products in the room.
     2. Fixture Sensors shall be of a size and format to be easily mounted by OEM fixture manufacturers in a standard 1/2 inch KO. To ensure solid mounting of the device, the fixture sensor shall fit tightly into a plastic carrier sleeve that fits inside the KO and is locked into place with a plastic locknut.
     3. Fixture Sensors are unitary devices providing features associated with three basic products - DLM Controllers, Occupancy Sensors, and Daylighting Sensors. Additionally:
        1. Wireless Fixture Sensors shall allow two types of wireless communication:
           1. IPv6 for device to device communication inside rooms.
           2. Bluetooth Low Energy for communication to an APP running on local phone or tablet using iOS or Android operating system. Using just the APP, multiple Fixture Sensor can be joined into individual rooms, be assigned to groups allowing courtesy vacancy levels to meet advanced open office energy codes and allow all load settings to be adjusted.
           3. The radio antenna used for both communication protocols shall be completely hidden behind the device's Fresnel lens.
        2. Product shall include a trusted hardware chip to ensure that only authorized devices by the lighting control system provider can communicate with devices on the network.
        3. When Wireless products are commissioned and formed into a room, they shall automatically configure to the most energy-efficient sequence of operation based upon the devices in the room.
        4. Since Fixture Sensors are powered directly off the Ballast, Driver, or a Fixture Interface Module, they are considered REED devices that help form the Wireless IPv6 mesh segment network or Personal Area Network (PAN), function 24/7, and do not require a battery.
        5. Units shall not use dip switches or potentiometers for field settings
     4. Fixture Sensor shall have similar functionality detailed for Wireless Digital Load Controllers, but instead of controlling loads directly via a relay, they shall use DALI communication or, via an interface device, 0-10V to control the ballasts or drivers.
        1. Each LMFS-601-W can control a single DALI driver or ballast, unless a Fixture Interface Module (described below) is used which can control 0-10V drivers or ballast together as a single group.
        2. Based on individual configuration, Fixture Sensors shall be capable of the following behavior on power up following the loss of normal power:
           1. Turn on to 100 percent
           2. Turn off
           3. Turn on to last level (lighting only)
        3. Each load be configurable to operate in the following sequences based on occupancy:
           1. Auto-on/Auto-off (Follow on and off).
           2. Manual-on/Auto-off (Follow off only).
        4. Polarity of each load output shall be reversible via a configuration setting so that an on command turns load off and an off command turns a load on.
        5. BACnet object information shall be available for the following objects:
           1. Load status
           2. Schedule state, normal or after-hours
           3. Demand response enable and disable
           4. Occupancy status
           5. Photocell lightl level
        6. Dimming Room Controllers shall share the following features:
           1. Each lighting load shall have an independently configurable preset on level for Normal Hours and After Hours events to allow different dimmed levels to be established at the start of both Normal Hours and After Hours events.
           2. The following dimming attributes may be changed or selected using a wireless configuration tool:

Establish preset level for each load from 0-100 percent

Set high and low trim for each load

Initiate lamp burn in for each load of either 0, 12 or 100 hours

* + - * 1. Each dimming output shall have an independently configurable minimum and maximum trim level to set the dimming range to match the true dynamic range of the connected ballast or driver.
        2. Each dimming output channel shall have an independently configurable minimum and maximum calibration trim level to set the dynamic range of the output within the new 0-100 percent dimming range defined by the minimum and maximum trim.
    1. Fixture Sensor's Occupancy Sensor component shall be capable of the following:
       1. Digital calibration for the following variables:
          1. Time delay, 1-30 minutes in 1 minute increments
          2. Sensor, Group, and Room Test modes with shortened time delay
          3. PIR Detection technology
          4. Walk-through mode
       2. Programmable control functionality including:
          1. Each sensor may be programmed to control the load connected to the Fixture Sensor, and well as other loads (Lighting and/or Plug Load) within a Wireless Room.
          2. Sensor shall be capable of activating user-definable lighting scenes.
          3. Sensors capable of implementing a Partial-On or Partial-Off Sequence of Operation.
          4. Adjustable retrigger time period for manual-on loads. Load will retrigger (turn on) automatically within a configurable period (default 10 seconds) after turning off.
       3. Device Status LEDs, which may be disabled for selected applications, including:
          1. PIR detection
          2. Room Pairing
          3. Load binding
       4. All digital parameter data programmed into an individual occupancy sensor shall be retained in non-volatile FLASH memory within the sensor itself. Memory shall have an expected life of no less than 10 years.
    2. Fixture Sensor's Daylight Sensor component shall be capable of the following:
       1. Sensor's internal photodiode shall measure light within the visible spectrum. The photodiode's spectral response curve shall closely match the photopic curve and not be significantly affected by ultraviolet or infrared energy.
       2. A single Fixture Sensor's Daylighting Sensor in each daylight zone shall be chosen as a "leader" and provide footcandle level information to all other Fixture Sensors and/or Wireless Room Controllers in the zone.
       3. For dimming daylight harvesting, the photosensor shall provide the option when the daylight contribution is sufficient of turning lights off or dimming lights to a field-selectable minimum level.
       4. Wall switches in the space shall allow occupants to reduce lighting level to increase energy savings or, if permitted by system administrator, raise lighting levels for a selectable period or cycle of occupancy. Each wireless load within a daylighting zone can be individually overridden (i.e., load independence).
       5. Use an internal photodiode that measures light in a 60-degree angle (cutting off the unwanted light from the interior of the room). A small arrow on the device indicates portion of sensor to be directed toward the daylight source.
       6. Automatically establishes application-specific setpoints following manual calibration using a wireless configuration tool or a PC with appropriate software and lighting measurement hardware. A proportional control algorithm shall maintain the design lighting level in each zone.
    3. Fixture Interface: When applications require the Fixture Sensor to control a driver or ballast via a 0-10V signal, an addition Fixture Interface module can be added. The module is meant to be mounted inside the fixture cavity and connect to 120/277VAC and the DALI output of the Fixture Sensor. Based on the DALI communication from the Fixture Sensor, the Fixture Interface shall provide 120/277VAC output to power the Ballast or Driver as well as a standard 0-10V signal pair of wires. Fixture Interfaces shall incorporate an internal relay to ensure power is fully off when commanded so by the Fixture Sensor, and each Fixture Interface shall be capable of communicating to up to 8 ballasts or drivers, controlling them all together to the same 0-10V dictated level.
    4. Wattstopper product numbers: Fixture Sensor: LMFS-601-W; DALI-to-0-10V Fixture Interface: LMFI-111.
  1. WIRELESS DIGITAL LOAD CONTROLLERS (ROOM AND PLUG LOAD)
     1. Wireless Digital Load Controllers for 0-10V Lighting or On/Off for Plug Load. Control units include the following features
        1. Load controllers shall utilize two separate wireless communication protocols:
           1. Wireless IPv6 for bidirectional communication with battery powered wireless DLM devices inside rooms. Additionally, all load controllers shall be able to use their IPv6 protocol to communicate with other wireless load controllers, wireless bridges, and a border router to enable a large-scale low power self-healing wireless mesh segment network between rooms.
           2. Bluetooth Low Energy for communication to an APP running on local phone or tablet using iOS or Android operating system. Using the APP, any load controller's settings can be adjusted.
        2. Load controllers shall include a trusted hardware chip to ensure that only devices by the lighting control system provider can communicate with devices on the network.
        3. Automatic room configuration to the most energy-efficient sequence of operation based upon the devices in the room.
        4. Multiple room controllers connected in a wireless room network must automatically arbitrate with each other, without requiring any configuration or setup, so that individual load numbers are assigned starting with load 1 to a maximum of 48.
        5. Device Status LEDs to indicate:
           1. Data transmission
           2. Device has power
           3. Status of the load
           4. Configuration status
        6. Quick installation features including:
           1. Standard junction box mounting via 1/2" inch (13 mm) knock out (KO).
        7. Based on individual configuration, each load shall be capable of the following behavior on power up following the loss of normal power:
           1. Turn on to 100 percent
           2. Turn off
           3. Turn on to last level (lighting only)
        8. Each load be configurable to operate in the following sequences based on occupancy:
           1. Auto-on/Auto-off (Follow on and off).
           2. Manual-on/Auto-off (Follow off only).
        9. Polarity of each load output shall be reversible, via digital configuration, so that an on command turns load off and an off command turns a load on.
        10. BACnet object information shall be available for the following objects:
            1. Load status
            2. Schedule state, normal or after-hours
            3. Demand response enable and disable
            4. Total room lighting watts
            5. Total room plug load watts (total of switched and unswitched switchleg of the plug load controller)
            6. Electrical current
            7. Total watts per controller
            8. Total room watts/sq ft.
            9. Occupancy status
            10. Photocell light level
        11. UL 2043 plenum rated
        12. LED On/Off status indication for each load
        13. Zero cross circuitry for each load
        14. All digital parameter data programmed into an individual room controller or plug load controller shall be retained in non-volatile FLASH memory within the controller itself. Memory shall have an expected life of no less than 10 years.
        15. Dimming Room Controllers shall share the following features:
            1. Each lighting load shall have an independently configurable preset on level for Normal Hours and After Hours events to allow different dimmed levels to be established at the transition of these events.
            2. The following dimming attributes may be changed or selected using a wireless configuration tool:

Establish preset level for each load from 0-100 percent.

Set high and low trim for each load.

Initiate lamp burn in for each load of either 0, 12 or 100 hours.

* + - * 1. Override button for each load provides the following functions:

Tap for on/off control.

Press and hold for dimming control (lighting only).

* + - * 1. Each dimming output channel shall have an independently configurable minimum and maximum calibration trim level to set the dimming range to match the true dynamic range of the connected ballast or driver.
        2. Each dimming output channel shall have an independently configurable minimum and maximum trim level to set the dynamic range of the output within the new 0-100 percent dimming range defined by the minimum and maximum trim.
        3. All configurations shall be digital. Devices that set calibration or trim levels, or any other load parameters, via trim pots or dipswitches are not acceptable.
    1. Wireless On/Off/0-10V KO Mount Dimming Room Controllers shall include:
       1. Dual voltage (120/277 VAC, 60 Hz) capable rated for 10A or 16A total load depending on product.
       2. Real time current and voltage metering.
       3. Contact Closure Low Voltage Outputs to indicate room occupancy status (only available on the 10A product).
       4. Include molded strain relief ring.
       5. Single relay configuration with dimming output.
          1. 0-10V Dimming - Where indicated, 0-10 volt analog outputs per relay for control of compatible ballasts and LED drivers. Units shall include a complimentary UL 924 rating for the ability of the 0-10 volt output to automatically open upon loss of power to the Room Controller to assure full light output from lighting connected to the 0-10V signal and powered by a live line voltage circuit.
          2. Units capable of providing both Class 1 and Class 2 wiring for the 0-10V output.
       6. For projects which require installation in full metal enclosures (i.e., Chicago Plenum), one product shall have an external antenna allowing it to be mounted in a Junction Box.
       7. Wattstopper product numbers: LMRC-611-MCC (10A), LMRC-611-16M (16A), and LMRC-611-MCC-A (10 A with external antenna).
    2. Wireless On/Off KO Mount Plug Load Controllers shall include:
       1. 120VAC, 60 Hz capable rated for 20A total load.
       2. Real time current and voltage metering. Metering shall provide a single total wattage measurement of both switched and unswitched switchleg wires from the device. This avoids the need to provide additional devices to measure unswitched power of any circuit connected to a plug load room controller.
       3. Include molded strain relief ring.
       4. Single relay configuration.
       5. Wattstopper product number: LMPL-611-20M.
  1. WIRELESS OCCUPANCY SENSORS
     1. Wireless Digital Occupancy Sensors for lighting zones. Units include the following features.
        1. Wireless Occupancy Sensors shall provide two types of wireless communication:
           1. IPv6 for device to device communication inside rooms.
           2. Bluetooth Low Energy for communication to an APP running on local phone or tablet using iOS or Android operating system. Using the APP, sensor's individual settings (in the Load Controllers) can be adjusted.
        2. Sensors shall include a trusted hardware chip to ensure that only devices by the lighting control system provider can communicate with devices on the network.
        3. Sensors shall be powered via readily available battery in an internal compartment. Battery life shall be up to 7 years under expected use.
        4. Automatic room configuration to the most energy-efficient sequence of operation based upon the devices in the room.
     2. Digital Occupancy Sensors shall be capable of the following:
        1. Digital calibration and pushbutton configuration for the following variables:
           1. Time delay, 5-30 minutes in 5 minute increments
           2. Test mode with shortened time delay
           3. PIR detection technology
           4. Walk-through mode
        2. Programmable control functionality including:
           1. Each sensor may be programmed to control specific loads within a local network.
           2. Sensor shall be capable of activating one of 16 user-definable lighting scenes.
           3. Sensors capable of implementing a Partial-On or Partial-Off Sequence of Operation.
           4. Adjustable retrigger time period for manual-on loads. Load will retrigger (turn on) automatically within a configurable period (default 10 seconds) after turning off.
        3. Device Status LEDs, which may be disabled for selected applications, including:
           1. PIR detection
           2. Room Pairing
           3. Load binding
        4. Cover shall act as a config button and allow for Manual override of controlled loads.
        5. All digital parameter data programmed into an individual occupancy sensor shall be retained in non-volatile FLASH memory within the sensor itself. Memory shall have an expected life of no less than 10 years.
     3. Use an approved selection of accessories to accommodate multiple mounting methods and building materials. Occupancy Sensors may be mounted on a ceiling tile, or backbox. Included threaded mounting accessory shall allow direct sensor mounting to a threaded rod. Optional Occupancy Sensor Recessed Mounting Plates shall be made of metal and allow ceiling occupancy sensors to be recess mounted in a ceiling tile and maintain required plenum rating.
     4. Units shall not have any dip switches or potentiometers for field settings
     5. Multiple occupancy sensors may be installed in a room
     6. Optional PIR Lens versions shall be available with lens for high ceiling areas, single aisleways, and areas where a high-density lens would be required.
     7. Wattstopper product numbers: Corner or Wall Sensor: LMPX-600, Ceiling Sensor: LMPC-600, Ceiling Occupancy Sensor Recessed Mounting Plate: LMPC-600-RMP.
  2. WIRELESS SWITCHES AND DIMMERS
     1. Low voltage momentary pushbutton devices offered in two different families. All wireless wall switches shall include the following features:
        1. Wireless Switches shall provide two types of wireless communication:
           1. IPv6 for device to device communication inside rooms.
           2. Bluetooth Low Energy for communication to an APP running on local phone or tablet using iOS or Android operating system. Using the APP, the switches individual settings can be adjusted.
        2. Switches shall include a trusted hardware chip to ensure that only devices by the lighting control system provider can communicate with devices on the network.
        3. Switches shall indicate low battery (2.5V or less) by lighting a red LED when button is pressed.
        4. Automatic room configuration to the most energy-efficient sequence of operation based upon the devices in the room.
        5. 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.
        6. Configuration button on device, and an LED that blinks to indicate data transmission.
        7. Removable ground wire included for when switches mounted in metal enclosure with line voltage devices separated by barrier.
        8. Programmable control functionality including:
           1. Button priority configurable to BACnet priority levels 1-16 allowing local actions to utilize advanced scenarios
           2. Scene patterns may be saved to any button other than dimming rockers.
        9. All digital parameter data programmed into an individual wall switch shall be retained in non-volatile FLASH memory within the wall switch itself. Memory shall have an expected life of no less than 10 years.
     2. Multiple digital wall switches may be installed in a room. No additional configuration shall be required to achieve multi-way switching.
     3. Button function may be reconfigured for individual buttons from Load to Scene, or scene to load.
        1. Individual button function may be configured to Toggle, On only or Off only.
        2. Switch buttons may be bound to any load on any load controller and are not load type dependent; each button may be bound to multiple loads.
     4. Wireless Slim Line of Switches shall include:
        1. Four different configurations available: 1 button (switch), 1 button with 1 rocker, 2 button with 2 rockers, and 4 button with 1 rocker.
        2. Can be mounted either in junction box, low voltage ring, or surface mounted to any number of smooth surfaces via included adhesive strip. Device depth off mounting surface shall be less than 0.43 inches (11 mm).
        3. Slim Wireless switches are mounted on a backplate with detachable metal sections allowing switches to be ganged together, used with a Pass and Seymour Radiant screwless wall plate or standard decorator wall plate.
        4. Switches shall be powered via readily available CR2032 coin cell battery in an internal compartment. Battery life shall be 7 years under expected use.
        5. Switch buttons and rockers will be Pre-Engraved with icons to help casual users understand their function.
        6. Wireless Slim Line Switches product numbers: LMSW-610-S 1 button (switch), LMSW-611-S 1 button with 1 rocker, LMSW-622-S 2 button with 2 rockers, and LMSW-641-S 4 button with 1 rocker. Available in white, light almond, ivory, grey, red, and black; compatible with wall plates with decorator opening. All engraving and color requirements shall be identified on the Reflected Ceiling plans.
     5. Wireless Classic Line of Switches shall include:
        1. Two different configurations available: 1 rocker device (dimmer) and a 1 rocker with 4 button (scene switch) configuration.
        2. Can be mounted either in junction box or low voltage ring.
        3. Switches shall be powered via readily available CR123 battery in an internal compartment. Battery life shall be up to 7 years under expected use.
        4. Manufacturer shall offer optional Pre-Engraved Dimmers and Scene Switches with the most requested text engravings that can be readily shipped direct from inventory and shall be designated with an "ENG#" suffix before the color descriptor.
        5. Wireless Classic Line Switches product numbers: LMDM-601 (dimmer), LMSW-605 (scene switch). Available in white, light almond, ivory, grey, red, and black; compatible with wall plates with decorator opening. All engraving and color requirements shall be identified on the Reflected Ceiling plans.
  3. WIRELESS DAYLIGHTING SENSORS
     1. Wireless Digital daylighting sensors shall work with wireless load controllers to provide automatic switching or dimming daylight harvesting capabilities for any load type connected to the controller.
        1. Wireless daylighting sensors shall provide two types of wireless communication:
           1. IPv6 for device to device communication inside rooms.
           2. Bluetooth Low Energy for communication to an APP running on local phone or tablet using iOS or Android operating system. Using the APP the sensor's individual settings can be adjusted.
        2. Daylight sensor's shall include a trusted hardware chip to ensure that only devices by the lighting control system provider can communicate with devices on the network.
        3. Sensors shall be powered via readily available battery in an internal compartment. Battery life shall be up to 7 years under expected use.
        4. Sensors measure incoming daylight in the space and can control up to three lighting zones.
     2. Wireless Digital daylighting sensors shall include the following features
        1. Sensor's internal photodiode shall only measure light within the visible spectrum. The photodiode's spectral response curve shall closely match the entire photopic curve. Photodiode shall not measure energy in either the ultraviolet or infrared spectrums. Photocell shall have a sensitivity of less than 5 percent for any wavelengths less than 400 nanometers or greater than 700 nanometers.
        2. Sensor light level range shall be from 1-1,533 foot-candles (fc).
        3. Capability of ON/OFF or dimming, for each controlled zone, depending on the selection of load controllers and load binding to controllers.
        4. For dimming daylight harvesting, the photosensor shall provide the option when the daylight contribution is sufficient of turning lights off or dimming lights to a field-selectable minimum level.
        5. Photosensors shall have a digital, independently configurable fade rate for both increasing and decreasing light level in units of percent per second.
        6. Wall switch shall allow occupants to reduce lighting level to increase energy savings or, if permitted by facility engineer, raise lighting levels above the daylighting sensor's cap level for a selectable period or cycle of occupancy.
        7. Configuration LED status light on device that blinks to indicate data transmission.
        8. Status LED indicates test mode, override mode and load binding.
        9. Config button on device to turn controlled load(s) ON and OFF.
        10. A choice of accessories to accommodate multiple mounting methods and building materials. Photosensors may be mounted on a ceiling tile or backbox. Included threaded mounting accessory shall allow direct sensor mounting to a threaded rod. Optional Daylighting Sensor Recessed Mounting Plate shall be made of metal and allow daylighting sensors to be recess mounted in a ceiling tile and maintain plenum rating.
        11. Any load or group of loads in a wireless room controller can be assigned to a daylighting zone
        12. Each wireless room controller load within a daylighting zone can be individually enabled or disabled for discrete control (i.e., load independence).
        13. All digital parameter data programmed into a photosensor shall be retained in non-volatile FLASH memory within the photosensor itself. Memory shall have an expected life of no less than 10 years.
     3. Open loop digital photosensors shall include the following:
        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 application-specific setpoints following manual calibration using a wireless configuration tool or a PC with appropriate software. For switching operation, an adequate deadband between the ON and OFF setpoints for each zone shall prevent the lights from cycling; for dimming operation, a proportional control algorithm shall maintain the design lighting level in each zone.
        3. Each of the three discrete daylight zones can include any non-overlapping group of loads in the room.
     4. Wattstopper Product Numbers: Daylighting Sensor LMDL-600, Daylighting Sensor Recessed Mounting Plate: LMDL-600-RMP
  4. WIRELESS CONFIGURATION APP
     1. Wireless Configuration APP shall be freely available for either iOS or Android phones or tables and allow users (electrical contractors, installers, and/or technicians) to wirelessly scan for, pair together, bind accessory devices to loads, and configure Wattstopper Wireless DLM device and network settings.
     2. APP shall utilize phone or tablet's Bluetooth Low Energy capability for communication to all Wireless Lighting Control Devices in the Room.
     3. APP shall allow for base room setup capability (defining room, binding loads).
     4. Wireless APP communicates via Bluetooth Low Energy. Features include:
        1. Works with Wattstopper Wireless DLM sensors, switches, and load controllers
        2. Scan for, pair devices into room, bind loads, configure, and test devices.
        3. Update device firmware via Bluetooth Low Energy
        4. Flash loads to identify wireless load controllers
        5. Check battery level of devices
        6. Manually adjust dimming levels
        7. View wireless network diagnostics and battery levels
        8. Set time delay and sensitivity for wireless motion detectors
        9. Enable light level settings for wireless daylighting control
        10. Program wireless room controller's ramp and fade rate (Note: In DLM, Ramp and Fades can be up or down)
        11. Individual user account and site management settings
        12. Create and assign scenes to scene buttons
     5. Required Phone or Tablet:
        1. Apple iOS
        2. Android OS
  5. WIRED DIGITAL LOAD CONTROLLERS (ROOM, PLUG LOAD AND FIXTURE)
     1. Digital Load Controllers: Digital controllers for lighting zones, fixtures and/or plug loads automatically bind room loads to the connected control devices in the space without commissioning or the use of any tools. Provide controllers to match the room lighting and plug load control requirements. Controllers are simple to install, and do not have dip switches/potentiometers or require special configuration for standard Plug n' Go applications. Control units include the following features:
        1. Automatic room configuration to the most energy-efficient sequence of operation based upon the devices in the room (Plug n Go)
        2. Simple replacement using the default automatic configuration capabilities, a room controller may be replaced with an off-the-shelf device.
        3. Multiple wired load controllers connected in a local wired IRB network must automatically arbitrate with each other, without requiring any configuration or setup, so that individual load numbers are assigned starting with load 1 to a maximum of 64, assigned based on each controller's device serial number from highest to lowest.
        4. Device Status LEDs to Indicate:
           1. Data transmission
           2. Device has power
           3. Status for each load
           4. Configuration status
        5. Quick Installation Features Including:
           1. Standard junction box mounting
           2. Quick low voltage connections using standard RJ-45 patch cable
        6. Based on individual configuration, each load shall be capable of the following behavior on power up following the loss of normal power:
           1. Turn on to 100 percent
           2. Turn off
           3. Turn on to last level
        7. Each load be configurable to operate in the following sequences based on occupancy:
           1. Auto-on/Auto-off (Follow on and off).
           2. Manual-on/Auto-off (Follow off only).
        8. Polarity of each load output shall be reversible, via digital configuration, so that an on command turns load off and an off command turns a load on.
        9. BACnet object information shall be available for the following objects:
           1. Load status
           2. Schedule state, normal or after-hours
           3. Demand Response enable/disable
           4. Room occupancy status
           5. Total room lighting and plug loads watts

\*\* NOTE TO SPECIFIER \*\* When metering is present in the Load Controllers, these additional objects shall also be available.

* + - * 1. Electrical current
        2. Total watts per controller
        3. Total room watts/sqft.
      1. UL 2043 plenum rated
      2. LED On/Off status indication for each load
      3. Zero cross circuitry for each load
      4. All digital parameter data programmed into an individual room controller or plug load controller shall be retained in non-volatile FLASH memory within the controller itself. Memory shall have an expected life of no less than 10 years.
      5. Dimming Room Controllers shall share the following features:
         1. Each load shall have an independently configurable preset on level for Normal Hours and After Hours to allow different dimmed levels to be established.
         2. Fade rates for dimming loads shall be specific to bound switch buttons, and the load shall maintain a default value for any bound buttons that do not specify a unique value.
         3. The following dimming attributes may be changed or selected using a wireless configuration tool:

Establish preset level for each load from 0-100 percent.

Set high and low trim for each load.

Initiate lamp burn in for each load of either 0, 12 or 100 hours.

* + - * 1. Override button for each load provides the following functions:

Tap for on/off control.

Press and hold for dimming control (lighting only).

* + - * 1. Each dimming output channel shall have an independently configurable minimum and maximum calibration trim level to set the dimming range to match the true dynamic range of the connected ballast or driver. LED level indicators on bound dimming switches shall utilize this new maximum and minimum trim.
        2. Each dimming output channel shall have an independently configurable minimum and maximum trim level to set the dynamic range of the output within the new 0-100 percent dimming range defined by the minimum and maximum calibration trim.
        3. Calibration and trim levels must be set per output channel. Devices that set calibration or trim levels per controller (as opposed to per load) are not acceptable.
      1. All configurations shall be digital. Devices that set calibration or trim levels per output channel via trim pots or dipswitches are not acceptable.
    1. Wired On/Off Room Controllers Shall Include:
       1. Dual voltage (120/277 VAC, 50/60 Hz) capable rated for 20A total load
       2. One or two relay configurations
       3. Simple 150 mA switching power supply - Only 4 100 series line voltage powered devices on a Cat 5e local network (LMRC-101, LMRC-102, LMPL-101, LMPB-100)
       4. Three RJ-45 DLM local network ports with integral strain relief and dust cover
       5. Wattstopper product numbers: LMRC-101, LMRC-102
    2. Wired On/Off/0-10V KO Mount Dimming Room Controllers Shall Include:
       1. Dual voltage (120/277 VAC, 50/60 Hz) capable rated for 10A total load, or 16A total load depending on product.
       2. Optional real time current and voltage metering (with - M Monitoring option).
       3. One or two relay configurations (10A) or one relay configuration (16A)
       4. Smart 150 mA switching power supply
       5. Two RJ-45 DLM local network ports. Provide molded strain relief ring
       6. One dimming output per relay
          1. 0-10V Dimming - Where indicated, 0-10 volt analog outputs per relay for control of compatible ballasts and LED drivers. Units shall include a complimentary UL 924 rating for the ability of the 0-10 volt output to automatically open upon loss of power to the Room Controller to assure full light output from lighting connected to the 0-10V signal and powered by a live line voltage circuit.
       7. Units capable of providing both Class 1 and/or Class 2 wiring for the 0-10V output
       8. Wattstopper Product Numbers: LMRC-111, LMRC-111-M, LMRC-112, or LMRC-112-M, or LMRC-111-16M
    3. Wired On/Off/0-10V Dimming Enhanced Room Controllers Shall Include:
       1. Dual voltage (120/277 VAC, 50/60 Hz) capable or 347 VAC, 50/60 Hz. 120/277 volt models rated for 20A total load; 347 volt models rated for 15A total load
       2. Built in real time current monitoring via transducer
       3. One, two or three relay configurations
       4. Smart 250 mA switching power supply
       5. Conduit adaptor available for applications where all wiring must be in conduit.
       6. Four RJ-45 DLM local network ports. Provide integral strain relief
       7. One dimming output per relay
          1. 0-10V Dimming - Where indicated, 0-10 volt analog outputs per relay for control of compatible ballasts and LED drivers. Units shall include a complimentary UL 924 rating for the ability of the 0-10 volt output to automatically open upon loss of power to the Room Controller to assure full light output from lighting connected to the 0-10V signal and powered by a live line voltage circuit.
       8. Wattstopper product numbers: LMRC-211, LMRC-212, or LMRC-213 (add -347 for Canadian voltage versions).
    4. Wired Plug Load Controllers shall include:
       1. 120 VAC, 50/60 Hz rated for 20A total load. Some Controllers carry application-specific UL 20 rating for receptacle control.
       2. One relay configuration with additional connection for unswitched switchleg.
       3. Factory default operation (Plug ' n Go) is Auto-on/Auto-off, based on occupancy, and loads not bound automatically to any switches in room.
       4. Optional real time current, or current and voltage metering depending on unit. Metering shall provide a single total wattage measurement of both switched and unswitched switchleg wires in plug in loads.
       5. Switching Power Supply:
          1. Simple 150mA - Only 4 100 series devices on a Cat 5e local network (LMRC-101 or -102, LMPL-101, LMPB-100). Limit devices to 24 total.
          2. Smart 150mA (LMPL-111-20M).
          3. Smart 250mA (LMPL-201).
       6. RJ-45 DLM Local Network Ports:
          1. Two RJ-45 ports (LMPL-111-20M).
          2. Three RJ-45 ports (LMPL-101).
          3. Four RJ-45 ports (LMPL-201).
       7. Plug Load Controllers: LMPL-101, LMPL-201, or LMPL-111-20M .

\*\* NOTE TO SPECIFIER \*\* Edit to include the following alternative wireless transmitter and controllable receptacles paragraph if required for the project. Delete if not applicable.

* + 1. Wireless Transmitter and Receptacles with Integral Relays:
       1. Provide a non-DLM wireless transmitter that can be connected to any Cat 5e network of the lighting controls that will communicate the room's occupancy state to receptacles mounted in the area with integral relays. Binding of the transmitter to the receptacles shall be accomplished by pressing a test button on the transmitter, and then a test button on the receptacle.
       2. Non-DLM Wireless Transmitter and Receptacles with Integral Relays: WRC-TX-LM, WRC-15-1 or -2, WRC-20-1 or -2.

\*\* NOTE TO SPECIFIER \*\* Edit the following paragraphs to include the fixture controller required for the project. Delete if not applicable.

* + 1. Fixture Controllers Shall Include:
       1. Product rating and form factor allows OEM fixture manufacturers to mount the device inside the interior cavity of standard-sized fluorescent or LED general lighting fixtures.
       2. One 3A 120/277V rated mechanically held relay.
       3. Require 7 mA of 24VDC operating power from the DLM local network.
       4. Fixture Controller does not require a connection to a neutral conductor to operate, and unlike other types of Load Controllers it does not contribute power to the DLM local network to drive accessory devices.
       5. Power to drive the LMFC Fixture Controller electronics can come from any wired Load Controller, LMPB-100 Power Booster and/or LMZC-301 Zone Controller (described later in the LMCP LIGHTING CONTROL PANELS specification section).
       6. 0-10V dimming capability via a single 0-10 volt analog output from the device for control of compatible ballasts and LED drivers. The 0-10 volt output shall automatically open upon loss of power to the Fixture Controller to assure full light output from lighting connected to the 0-10V signal and powered by a separate live line voltage circuit.
       7. Connect to a single or dual RJ-45 adaptor with 24 inch leads. Single adaptor mounts in a 1/2 inch KO and dual adaptor mounts in a 2.2 by 1.32 inch rectangular hole for connection to the DLM local network.
       8. Adaptor leads are insulated for use in a fixture cavity, and the lead length allows the OEM fixture manufacturer flexibility to position the Fixture Controller and the RJ45 jack in the best locations on each fixture.
       9. A complete set of dimming features described above in the paragraph detailing On/Off/Dimming Enhanced Room Controllers.
       10. Wattstopper Product Numbers: Fixture Controller: LMFC-011, DLM Cable Connector: LMFC-RJ-50-24 or LMFC-2RJ, Power Booster: LMPB-100.

\*\* NOTE TO SPECIFIER \*\* Edit the following paragraphs to include the digital wall or ceiling sensors required for the project. Delete if not applicable.

* 1. WIRED DIGITAL WALL OR CEILING MOUNTED OCCUPANCY SENSOR
     1. Wired Digital Occupancy Sensors with two way digital communications to Lighting Control system. Provide sensors of quantity and type to meet specific room applications. Features include the following:
        1. Digital communication and pushbutton configuration of the following variables:
           1. Sensitivity, 0-100 percent in 10 percent increments.
           2. Time delay, 1-30 minutes in 1 minute increments.
           3. Test mode, Five second time delay.
           4. Detection technology, PIR, Ultrasonic or Dual Technology activation and/or re-activation.
           5. Walk-through mode.
        2. Load parameters settings include Auto or Manual-ON and blink warning.
        3. Programmable control functionality including:
           1. Each sensor may be programmed to control specific loads within a local network.
           2. Sensor shall be capable of activating one of 16 user-definable lighting scenes or implementing a Partial On or Partial Off Sequence of Operation.
           3. Adjustable retrigger time period for manual-on loads. Load will retrigger (turn on) automatically within a configurable period (default 10 seconds) after turning off.
           4. On dual technology sensors, independently configurable trigger modes available for both Normal (NH) and After Hours (AH) time periods. The trigger and retrigger modes can be programmed to use the following technologies options:

Ultrasonic and Passive Infrared.

Ultrasonic or Passive Infrared.

Ultrasonic only.

Passive Infrared only.

* + - * 1. Independently configurable sensitivity settings for passive infrared and ultrasonic technologies (on dual technology sensors) for both Normal and After Hour time periods.
      1. One or two RJ-45 ports for connection to DLM local network.
      2. Two-way infrared (IR) transceiver to allow remote programming through handheld commissioning tool and control by remote personal controls.
      3. Device Status LEDs, which may be disabled for selected applications, including:
         1. PIR detection.
         2. Ultrasonic detection.
         3. Configuration mode.
         4. Load binding.
      4. Optional lens configurations for the PIR only Wall and Ceiling sensors to allow coverage of longer ranges, 1 way or 2 way aisles, higher density coverage in smaller areas, or mounting up to 40 foot heights.
      5. Assignment of occupancy sensor to a specific load within the room without wiring or special tools.
      6. Manual override of controlled loads is permitted.
      7. All digital parameter data programmed into an individual occupancy sensor shall be retained in non-volatile FLASH memory within the sensor itself. Memory shall have an expected life of no less than 10 years.
    1. BACnet object information shall be available for the following objects:
       1. Detection state for each sensor.
       2. Detection state for all sensors in room (Room status).
       3. Occupancy sensor time delay.
       4. Occupancy sensor sensitivity, PIR and Ultrasonic.
    2. Units shall not have any dip switches or potentiometers for field settings.
    3. 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.
    4. Wattstopper product numbers: LMPX-100 (optional -1, -3, -4), LMDX-100, LMPC-100 (optional -1, -5), LMUC-100-2, LMDC-100.

\*\* NOTE TO SPECIFIER \*\* Edit the following paragraphs to include the digital wall switch sensors required for the project. Delete if not applicable.

* 1. WIRED DIGITAL WALL SWITCH OCCUPANCY SENSORS
     1. Wired Digital Wall switch Occupancy Sensors with two way digital communications to Lighting Control system. Provide sensors of quantity and type to meet specific room applications. Features include the following:
        1. Digital calibration and pushbutton configuration for the following variables:
           1. Sensitivity: 0-100 percent in 10 percent increments.
           2. Time Delay: 1-30 minutes in 1 minute increments.
           3. Test Mode: Five second time delay.
           4. Detection Technology: PIR only or Dual Technology with PIR and Ultrasonic.
           5. Walk-through mode.
           6. Load parameters including Auto/Manual-ON, blink warning, and daylight enable/disable when photosensors are included in the DLM local network.
        2. Programmable Control Functionality Including:
           1. Each sensor may be programmed to control specific loads within a local network.
           2. Sensor shall be capable of activating one of 16 user-definable lighting scenes.
           3. Adjustable retrigger time period for manual-on loads. Load will retrigger (turn on) automatically during the configurable period (default 10 seconds) after turning off.
           4. On dual technology sensors, independently configurable trigger modes are available for both Normal and After Hours time periods. The trigger and retrigger modes can be programmed to use the following technologies options:

Ultrasonic and passive infrared.

Ultrasonic or passive infrared.

Ultrasonic only.

Passive infrared only.

* + - 1. Independently configurable sensitivity settings for passive infrared and ultrasonic technologies (on dual technology sensors) for both Normal and After Hour time periods.
      2. Two RJ-45 ports for connection to DLM local network.
      3. Two-way infrared (IR) transceiver to allow remote programming through handheld configuration tool and control by remote personal controls.
      4. Device Status LEDs including.
         1. PIR detection.
         2. Ultrasonic detection.
         3. Configuration mode.
         4. Load binding.
      5. Assignment of any occupancy sensor to a specific load within the room without wiring or special tools.
      6. Assignment of integral buttons and rockers on the device to specific loads or scenes within the room without wiring or special tools.
      7. Manual override of controlled loads.
      8. All digital parameter data programmed into an individual wall switch sensor shall be retained in non-volatile FLASH memory within the wall switch sensor itself. Memory shall have an expected life of no less than 10 years.
    1. BACnet Object Information Shall be Available for the Following Objects:
       1. Detection state.
       2. Occupancy sensor time delay.
       3. Occupancy sensor sensitivity, PIR and Ultrasonic.
       4. Button state.
       5. Switch lock control.
       6. Switch lock status.
    2. Units shall not have any dip switches or potentiometers for field settings.
    3. Multiple wall switch 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.
    4. Low Voltage Momentary Pushbuttons Shall Include the Following Features:
       1. Load/Scene Status LED on each switch button with the following characteristics:
          1. Bi-level LED.
          2. Dim locator level indicates power to switch.
          3. Bright status level indicates that load or scene is active.
       2. The following button 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, Off only, or Toggle Dim (toggles between press and hold to raise, release, then press and hold to lower).
          3. Individual rocker to provide raise and lower command for a selection of loads in the space. Additionally provides an Active Dim interface for scenes for 5 seconds after a scene has been selected.
          4. Individual scene buttons may be locked to prevent unauthorized change.
          5. Fade Up and Fade Down times for individual scenes may be adjusted from 0 seconds to 18 hours in preset increments.
          6. Ramp rate may be adjusted for each dimmer switch.
          7. Switch buttons may be bound to any load on any load controller or relay panel and are not load type dependent; each button may be bound to multiple loads.
          8. Wattstopper Part Numbers: LMDW-211 or LMDW-220 in new Standard Style includes Pre-engraving on Buttons and or Rockers to improve occupant�s understanding of their function. LMPW-101 or -102, LMDW-101 or -102. Optional Pre-engraved versions with most requested text available by adding a "-ENG#" before the final color suffix. Available in white, light almond, ivory, grey, red, brown (LMDW-2xx only), and black; compatible with wall plates with decorator opening. All engraving and color requirements shall be called out on Reflected Ceiling plans.

\*\* NOTE TO SPECIFIER \*\* Edit the following paragraphs to include the digital wall or ceiling sensors required for the project. Delete if not applicable.

* 1. WIRED DIGITAL WALL SWITCHES
     1. Low voltage momentary pushbutton switches in 1, 2, 3, 4, 5 and 8 button configurations. Wall switches shall include the following features:
        1. Buttons are used to control loads in a room, trigger scenes in a room, or control a network group of loads. Rockers are used to raise or lower the level of loads in a room.
        2. Two-way infrared (IR) transceiver for use with personal and configuration remote controls.
        3. Removable buttons/rocker insert for field replacement with engraved and/or alternate color buttons. Button replacement may be completed without removing the switch from the wall, only the switch plate.
        4. Configuration LED on each switch that blinks to indicate data transmission.
        5. Load/Scene Status LED on each switch button with the following characteristics:
           1. Bi-level LED.
           2. Dim locator level indicates power to switch.
           3. Bright status level indicates that load or scene is active.
           4. Dimming switches shall include seven bi-level LEDs to indicate load levels using 14 steps.
        6. Programmable control functionality including:
           1. Button priority may be configured to any BACnet priority level, from 1-16, allowing local actions to utilize force on or functions associated with the other priority levels.
           2. Scenes may be saved to any button other than dimming rockers. Once set, individual buttons may be digitally locked to prevent overwriting of the preset levels by an occupant in the room.
        7. All digital parameter data programmed into an individual wall switch shall be retained in non-volatile FLASH memory within the wall switch itself. Memory shall have an expected life of no less than 10 years.
     2. BACnet object information shall be available for the following objects:
        1. Button state
        2. Switch lock control
        3. Switch lock status
     3. Two RJ-45 ports for connection to DLM local network.
     4. Multiple digital wall switches may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration shall be required to achieve multi-way switching.
     5. Load and Scene button function may be reconfigured for individual buttons from Load to Scene, and vice versa.
        1. Individual button function may be configured to Toggle, On only, Off only, or , Toggle Dim (toggles between press and hold to raise, release, then press and hold to lower).
        2. Individual scene buttons may be locked to prevent unauthorized change.
        3. Fade Up and Fade Down times for individual scenes may be adjusted from 0 seconds to 18 hours in preset intervals.
        4. Ramp rate may be adjusted for each dimmer.
        5. Switch buttons may be bound to any load on any load controller or relay panel and are not load type dependent; each button may be bound to multiple loads.
     6. Manufacturer shall offer Pre-Engraved devices with the most requested text engravings that can be readily shipped direct from inventory and shall be designated with an "ENG#" suffix before the color descriptor.

\*\* NOTE TO SPECIFIER \*\* In the standard 200 Series, the second digit is the number or buttons and the third button is the number of rockers.

* + 1. Wattstopper Product Numbers: Standard 200 Series: LMSW-210, LMSW-211, LMSW-220, LMSW-222, LMSW-241, LMSW-250. Original 100 Series: LMSW-101, LMSW-102, LMSW-103, LMSW-104, LMSW-105, LMSW-108, LMDM-101. Pre-engraved 100 series versions with most requested text available by adding a "-ENG#" before the final color suffix. Available in white, light almond, ivory, grey, red, and black; compatible with wall plates with decorator opening. All engraving and color requirements shall be called out on Reflected Ceiling plans.

\*\* NOTE TO SPECIFIER \*\* Edit the following paragraphs to include the digital daylighting sensors required for the project. Delete if not applicable.

* 1. WIRED DIGITAL DAYLIGHTING SENSORS
     1. Digital daylighting sensors shall work with load controllers and relay panels to provide automatic switching, bi-level, tri-level or dimming daylight harvesting capabilities for any load type connected to the controller or panel. Daylighting sensors shall be interchangeable without the need for rewiring.
        1. Closed loop sensors measure the ambient light in the space and control a single lighting zone.
        2. Open loop sensors measure incoming daylight in the space and can control up to three lighting zones.
     2. Digital daylighting sensors shall include the following features:
        1. Sensor's internal photodiode shall only measure light within the visible spectrum. The photodiode's spectral response curve shall closely match the photopic curve. Photodiode shall not measure energy in either the ultraviolet or infrared spectrums. Photocell shall have a sensitivity of less than 5 percent for any wavelengths less than 400 or greater than 700 nanometers.
        2. Sensor light level range shall be from 1-1,533 foot-candles (fc).
        3. Capability of ON/OFF, bi-level, tri-level, or dimming for each controlled zone, depending on the selection of load controller(s) and load binding to controller(s).
        4. For switching daylight harvesting, the photosensor shall provide a field-selectable deadband (separation, between the �ON Setpoint� and the �OFF Setpoint�) to prevent the lights from cycling on and off excessively.
        5. For dimming daylight harvesting, the photosensor shall provide the option, when the daylight contribution is sufficient, of turning lights off or dimming lights to a field-selectable minimum level.
        6. Photosensors shall have a digital, independently configurable fade rate for both increasing and decreasing light level in units of percent per second.
        7. Photosensors shall provide adjustable cut-off time. Cut-off time defined as the number of selected minutes the load is at the minimum output before the load turns off. Selectable range of 0-240 minutes including option for no cut-off.
        8. Wall switch functions so occupants may always reduce lighting level to increase energy savings or, if permitted by facility engineer, optionally raise lighting levels for a selectable period or cycle of occupancy above daylight cap level.
        9. Integral infrared (IR) transceiver for configuration and/or commissioning with a handheld configuration tool, to transmit detected light level to wireless configuration tool.
        10. Configuration LED status light on device blinks to indicate data transmission.
        11. Status LED indicates test mode, override mode and load binding.
        12. Recessed switch on device to turn controlled load(s) ON and OFF.
        13. BACnet object information shall be available for the following daylighting sensor objects, based on the specific photocell's settings:
            1. Light level
            2. Day and night setpoints
            3. Off time delay
            4. On and off setpoints
            5. Up to three zone setpoints
            6. Operating mode - on/off, bi-level, tri-level or dimming
        14. One RJ-45 port for connection to DLM local network.
        15. A choice of accessories to accommodate multiple mounting methods and building materials. Photosensors may be mounted on a ceiling tile, skylight light well, suspended lighting fixture or backbox. Standard tube photosensors accommodate mounting materials from 0-0.62 inch thick (LMLS-400, LMLS-500). Extended tube photosensors accommodate mounting materials from 0.62 to 1.25 inches thick (LMLS-400-L, LMLS-500-L). Mounting brackets are compatible with J boxes (LMLS-MB1) and wall mounting (LMLS-MB2).
        16. Any load or group of loads in the room can be assigned to a daylighting zone.
        17. Each load within a daylighting zone can be individually enabled or disabled for discrete control (load independence).
        18. All digital parameter data programmed into a photosensor shall be retained in non-volatile FLASH memory within the photosensor itself. Memory shall have an expected life of no less than 10 years.
     3. Closed loop digital photosensors shall include the following additional features:
        1. An internal photodiode that measures light in a 100-degree angle, cutting off the unwanted light from bright sources outside of this cone.
        2. Automatic self-calibration, initiated from the photosensor, a wireless configuration tool or a PC with appropriate software.
        3. Automatically establishes application-specific setpoints following self-calibration. For switching operation, an adequate deadband between the ON and OFF setpoints shall prevent the lights from cycling; for dimming operation a sliding setpoint control algorithm with separate Day and Night setpoints shall prevent abrupt ramping of loads.
        4. Wattstopper Product Number: LMLS-400, LMLS-400-L.
     4. Open loop digital photosensors shall include 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 application-specific setpoints following manual calibration using a wireless configuration tool or a PC with appropriate software. For switching operation, an adequate deadband between the ON and OFF setpoints for each zone shall prevent the lights from cycling; for dimming operation, a proportional control algorithm shall maintain the design lighting level in each zone.
        3. Each of the three discrete daylight zones can include any non-overlapping selection of loads in the room.
        4. Wattstopper Product Number: LMLS-500, LMLS-500-L.

\*\* NOTE TO SPECIFIER \*\* Edit the following paragraphs to include the individual digital input and output controls required for the project. Delete paragraphs if not applicable.

* 1. WIRED DIGITAL INPUT AND OUTPUT LOW VOLTAGE CONTROL MODULES
     1. Wired DLM input and output low voltage modules allow control of DLM loads by other devices and systems or allow the DLM system to send signals to other devices and systems for integration. Interfacing with other systems can either be a dry (unpowered/with no voltage) contact closure, or via RS-232.
     2. Modules shall be plastic with a clamshell hinged lid, two Cat 5e wiring terminals for connection to a DLM wired Cat 5e IRB network and come with an accessory DIN mounting bracket. LEDs on the unit shall provide information on the status of the inputs or outputs, and a configuration button shall be provided to allow easy entry into Push 'n Learn(tm) programming sequence. Devices shall include a removable terminal block for ease of wiring, and label identifying each terminal contact.
     3. Wired Low Voltage Room Occupancy Status Isolated Relay Interface:
        1. Module provides a single Form C contact relay rated for 24VAC/DC.
        2. Relay module will provide a contact closure on the Normally Open side of the relay (and contact open on the Normally Closed side) when any occupancy sensor on the local Cat 5e IRB network is in the occupied mode. This function is non-programmable and works automatically via the unit's internal circuitry.
        3. LED on the device to provide status of the relay
        4. This device is ideally suited to connect to HVAC controls in the space that are looking for a dry contact whenever the space is occupied to enhance their specific sequence of operation.
        5. Wattstopper product number LMRL-100
     4. Wired Low Voltage Output Module features shall include:
        1. Two individual Form C contact relays rated from 0-24VAC/DC.
        2. Module relays shall act like line voltage relays in DLM Load Controllers; they can be assigned (bound) to any DLM system input including switch buttons, occupancy sensors, photocells, timeclocks, and/or low voltage input modules.
        3. In addition to providing a maintained contact, relays can be set to a �pulse� mode so that when turning on they stay on only for a short duration and then they automatically return to their normally Open state, allowing the module to interact with other devices that require momentary inputs from 0.1 to 25.4 or 1-254 seconds.
        4. Unit shall have two override buttons so each relay can be manually overridden On and Off to verify wiring and operation.
        5. LEDs on the device to identify status of the device's two relays.
        6. Wattstopper product number LMOR-102
     5. Wired Low Voltage Input Module features shall include:
        1. Ability to switch the module between three operating modes, allowing it to be used as a load control device (Normal use), a partition interface device, or an input for skylight or exterior photocells.
        2. When set in normal usage, the DLM Input Module shall accept up to 4 separate inputs, either 2-wire maintained, 2-wire momentary, or 24VDC signal inputs. Additionally, a pair of 2-wire inputs can be used as a 3-wire input to emulate up and down presses on a DLM switch rocker.
        3. In normal usage, the 4 inputs can be used to control loads, trigger a scene, send a network group command, or emulate an occupancy action so an occupied/unoccupied message is sent to loads.
        4. Input modules can trigger special load scenarios, taking advantage of DLM system's priority-based functions such as Force On, Force Off, Shed, Cleaning, Normal/After Hours, and Key Switch functions.
        5. Inputs can trigger different load and scene modes for controlled outputs, so loads can toggle status, go on, go off, or toggle dim. Scenes can be set to Recall, Recall/Off, or Scene Off.
        6. In partition mode, unit will send appropriate command to indicate whether movable partitions (up to 4) in the space are in the extended or retracked state and then changing the profile settings of the room allowing different bindings of switches, dimmers, and occupancy sensors (see �Section 2.17 Wired Digital Partition Controls� for more info).
        7. In exterior photocell mode, will provide an input for an external photocell to provide the system with a sensed footcandle (fc) level. This fc level can be used by DLM scheduling devices to determine when a group of loads should be turned on or off based on daylight level instead of dusk/dawn settings.
        8. All listed functionality to be accessible from IR handheld remote or from front end system software. Products that require functions to be set at the device, or that incorporate dip switches to select functions, shall not be allowed.
        9. Wattstopper product number LMIN-104. Optional photocell part numbers LMPO-200 for exterior, or LMPS-6000 for skylight.
     6. Wired RS-232 Interface Module features shall include:
        1. Ability to communicate with other devices and systems via standard RS-232 wiring and protocol.
        2. Via a standardized set of host commands, other systems can send messages to a RS-232 Interface Module in a DLM room, allowing loads to be overridden on, off or sent to a specific level (taking advantage of optional message parameters to dim over time), set scene, execute button lockout, changing room profiles, or sending a Normal Hours/After Hours command.
        3. By using the "Status" host command the RS-232 interface module can be instructed to share information with connected systems whenever changes occur in the room. Examples of message alerts include relay status chance, occupancy status change (by room or by sensor), scene status change, buttons are pressed, or profile's chance based on partitions, or daylight level.
        4. Wattstopper product number LMDI-100
  2. WIRED DIGITAL TOUCHSCREEN INTERFACE
     1. Install products needed to enable a wall mounted touchscreen that provides an enhanced control interface for a Wired or Hybrid DLM room's loads.
     2. Touchscreen Shall Have at a Minimum the Following Attributes:
        1. 4 inch high-resolution 480x800 pixel WVGA screen with capacitive touch interface and white bezel.
        2. Touchscreen shall have three dedicated interface screens: one primary interface for entire room functions and up to five scene buttons, one for lighting with up to five buttons for loads, and one optional screen for control of DLM Shades with one primary interface and three additional scene buttons.
        3. One or two touchscreens can be added to any Wired or Hybrid DLM Room, powered using a separate Power over Ethernet (PoE) network switch or 9-16VDC supply. Touchscreens in the same room can have unique settings if desired.
        4. For each touchscreen an individual, separately ordered LMDI-100 RS232 interface is required. A modified Cat 5e cable shall be used to connect the two devices - one end with RJ45 jack, other end with RJ45 removed so that three of the internal low voltage wires can connect a LMDI-100�s terminal block. RTI-KX4 shall be able to send commands to LMDI-100, which will be connected to the Wired or Hybrid DLM room via the normal Cat 5e room network and provide commands to the DLM loads.
        5. Touchscreen shall include an ambient light sensor for auto day/night backlighting and active IR sensors for approach on and auto sleep modes.
        6. Touchscreen User Interface shall be set up by a factory authorized technician using 3rd party proprietary design software. Software shall allow for customizing the look of the screen with different color themes. Software will allow editing of Touchscreen�s interface elements so that screen buttons can control specific loads or one of Wired DLM�s 16 room scenes. Touchscreens should be located inside the room or users should be able to see lights in the room as no screen status feedback indication is provided.
        7. Touchscreen includes 5 physical buttons to provide always available control functions.
        8. All connections to the Touchscreen shall be via low voltage wire or Cat 5e conductors. All connections to the Touchscreen shall be via low voltage wire or Cat 5e conductors. Install using two mounting wings that are located on the top and bottom of the KX4 Touchscreen, which can be used to secure the KX4 Touchscreen to drywall in retrofit installations. Mounting height shall be per contact documents.
        9. To power Touchscreens provide a network switch with 8 PoE+ ports. Unit should be a compact metal enclosure, fanless for silent operation, and plug in to a 120V receptacle for power.
        10. Wattstopper Touchscreen Product Number RTI-KX4. POE network switch Product Number COM-POE-SWITCH. Blank replacement for 5 physical buttons product number 1RTI40-210937-26.
  3. WIRED DIGITAL PARTITION CONTROLS
     1. Partition controls shall enable manual or automatic coordination of lighting controls in flexible spaces with up to four moveable walls by changing the rooms profile and reconfiguring the loads controlled by any connected digital switches and occupancy sensors (excludes daylight sensors).
     2. Four-button low voltage wall switch for manual control.
        1. Allows users to identify which walls are extended or retracked by pushing any of the 4 buttons for 10 seconds, each representing the status of a possible movable partition.
        2. Two-way infrared (IR) transceiver for use with configuration remote control.
        3. 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.
        4. Configuration LED on each switch that blinks to indicate data transmission.
        5. Each button represents one wall; Green LED per button indicates status.
        6. Two RJ-45 ports for connection to DLM local network.
        7. Wattstopper part number: LMPS-104. Available in white, light almond, ivory, grey and black; compatible with wall plates with decorator opening.

\*\* NOTE TO SPECIFIER \*\* Coordinate the following paragraph with Movable Walls and Partitions with automatic controls specified in other section of this specification.

* + 1. Coordinate contact closure interface for automatic control via input from limit switches on movable walls specified in Section 10 22 33 - Accordion Folding Partitions
       1. Operates on Class 2 power supplied by DLM local network.
       2. Includes 24VDC output and four input terminals for maintained third party contract closure inputs.
       3. Input max. sink/source current: 1-5 mA
       4. Logic input signal voltage High: Greater than 18VDC
       5. Logic input signal voltage Low: Less than 2VDC
       6. Four status LEDs under hinged cover indicate if walls are open or closed; supports LMPS-104 as remote status indicator.
       7. Two RJ-45 ports for connection to DLM local network.
       8. Wattstopper part number: LMIN-104

\*\* NOTE TO SPECIFIER \*\* Edit the following paragraphs as required for the project.

* 1. WIRED OR HYBRID ROOM HANDHELD CONFIGURATION TOOL
     1. Provide handheld configuration tool to facilitate customization of Wired DLM devices using two-way infrared communications. Can be used with or without PC software that connects to each local network via a USB interface (LMCS described later).
     2. Features and Functionality of the Handheld Configuration Tool Shall Include:
        1. Two-way infrared (IR) communication with DLM IR-enabled devices within a range of approximately 30 feet.
        2. High visibility organic LED (OLED) display, pushbutton user interface and menu-driven operation.
        3. Must be able to read and modify parameters for load controllers and relay panels, occupancy sensors, wall switches, daylighting sensors, network bridges, and identify DLM devices by type and serial number.
        4. Save up to eight occupancy sensor setting profiles and apply profiles to selected sensors in same room or other rooms.
        5. Adjust current light level of any load(s) on the local network and capture those levels in scene setting. If fixtures with DLM tunable white Blanco devices are present in room, handheld can also adjust their CCT level.
        6. Set room mode for testing of Normal Hours (NH) and After Hours (AH) parameter settings, enable or disable load shed status, and identify all IRB connected devices by their part number, and hardware/firmware versions.
        7. Adjust or fine-tune daylighting settings established during auto-configuration, and input light level data to complete configuration of open loop daylighting controls.
        8. Verify status of Bridge Devices connected to Wired or Wireless Segment networks.
     3. Wattstopper Product Numbers: Handheld LMCT-100-2
  2. DLM SEGMENT NETWORK TYPES
     1. DLM shall allow for three separate types of Room-to-Room ("Segment") communication so that information may be shared between them and any front-end hardware. The system shall allow either Wired, Wireless, or both Wired and Wireless (Hybrid) Room-to-Room Segment Networks communication types to be used.
     2. For a wired Segment Network, provide a linear topology, BACnet-based MS/TP conductor to connect DLM local IRB networks (rooms) and LMCP relay panels to allow for centralized control.
        1. Each connected DLM local room network shall include a single network bridge (LMBC-300). The network bridge is the only room-based device that is connected to the segment network.
        2. Network bridges, relay panels or network controllers with integral network bridges, shall include a terminal block with provisions for separate �in� and �out� terminations, for Wired segment network wire connections.
        3. Wired segment network utilizes 1.5 twisted pair, shielded, cable ordered from the lighting control manufacturer. Maximum cable run for each segment is 4,000 feet. Conductor-to-conductor capacitance of the twisted pair shall be less than 30 pf/ft and have a characteristic impedance of 120 Ohms.
        4. Network wire jacket for interior applications is available in high visibility green, white, or black. A black version for direct burial is also available.
        5. Substitution of manufacturer-supplied cable is not permitted and may void the warranty if non-approved cable is installed, and if terminations are not completed according to manufacturer's specific requirements.
        6. Network signal integrity requires that each conductor, ground wire and shield be correctly prepared and terminated at every connected device. Use of crimp on ferrules are highly recommended for each individual wire termination.
        7. Wired Segment networks shall be capable of connecting to any of the following: BACnet-compliant BAS (provided by others) directly via MS/TP, or BACnet/IP via an NB-ROUTER, or LMJA-8xxx-SM Segment Manager (which can also accept BACnet/IP). Systems whose room-connected network infrastructure require gateway devices to provide BACnet data to a BAS are unacceptable.
        8. Wattstopper Product Number: Room Bridge for Wired Segment Networks: LMBC-300. Wired Segment Communication wire: LM-MSTP, LM-MSTP-W, LM-MSTP-B, LM-MSTP-DB.
     3. For a wireless Segment Network, wireless Load Controllers, wireless fixture sensors, and/or wireless Bridges shall communicate with each other, or to a Border Router to create a IPv6 network.
     4. A Hybrid Segment Network indicates that both wired and wireless networks are being used to connect different areas of the building to the front end hardware. Each individual Segment in the network will either a wired segment, or a wireless segment, and by integrating the two networks with standard ethernet hardware the two networks will be able to exchange information with each other and, if needed, any other automation systems.
  3. WIRELESS NETWORK BRIDGES, LOAD CONTROLLERS AND BORDER ROUTERS
     1. Wireless Network Bridges shall connect to Wired DLM room devices via a local In Room Bus (IRB), or a mix of Wired and Wireless DLM room devices forming a hybrid room. Wireless Load Controllers shall have an integral wireless bridge capability allowing them to connect to only Wireless room devices, forming a Wireless room. The Wireless Bridges and the Wireless Load Controllers will use an IEEE 802.15.4 6LoWPAN mesh network for communication between rooms and a Border Router that oversees the formation and configuration of the overall wireless network.
     2. Features of the Wireless Network Bridges shall be as follows:
        1. Network bridge shall be provided as a separate module connected on the local IRB network through an available RJ-45 port.
        2. Wireless Bridges provide Plug 'n Go operation to automatically discover room devices connected to the local network and make all device parameters visible to the Border Router via the wireless network.
        3. Wireless Bridges shall incorporate dual internal omni-directional antennas with diversity to provide wide and robust communication. Antennas are inside the bridge to protect them against accidental contact with other objects.
        4. Tri-color LEDs shall be included on the bridge to provide feedback about the local Cat 5e IRB network (red), wireless network health (blue), and to help identify during commissioning (white).
        5. Wireless Boarder Routers shall automatically create standard BACnet objects for selected DLM devices allow any BACnet-compliant BAS to use lighting control and power monitoring data provided by the DLM devices on each local network. Products requiring that an application-specific point database be loaded to create or map BACnet objects, or those not capable of providing BACnet data for control devices via a dedicated BACnet Device ID per room are not acceptable. Standard BACnet objects shall be provided as follows:
           1. Read/write the normal or after hours schedule state for the room.
           2. Read the detection state of each occupancy sensor.
           3. Read the aggregate occupancy state of the room.
           4. Read/write the On/Off state of loads.
           5. Read/write the dimmed light level of loads.
           6. Read total current in amps, and total power in watts through the load controller.
           7. Read/write occupancy sensor time delay, PIR sensitivity and ultrasonic sensitivity settings.
           8. Activate a preset scene for the room.
           9. Read the current light level, in foot-candles, from interior and exterior photosensors and photocells.
           10. Set daylight sensor operating mode.
           11. Read/write wall switch lock status.
           12. Read watts per square foot for the entire controlled room.
           13. Write maximum light level per load for demand response mode.
           14. Read/write activation of demand response mode for the room.
           15. Activate/restore demand response mode for the room.
     3. Features of the Wireless Border Router Shall Be:
        1. The Wireless Border Router shall manage the formation and configuration of the IPv6 6LoWPAN wireless segment mesh network and provide connectivity via wired 10/100 Ethernet to a local area network that may include a LMJA-8xxx-SM JACE appliance, Wireless cellular modem, or Building BAS System.
        2. Border Router shall provide key information about the health of the mesh network in the form of signal quality, device status, network status, and other real-time network information such as energy monitoring.
        3. The LMBR-650 shall have dual internal omni-directional antennas with diversity to ensure reliable communication with Wireless Network Bridges and/or Wireless Load.
        4. Border Router shall include a Real-time clock with supercap back-up. Border Router shall get power for operation via a 120V outlet (in non-plenum applications), or a dedicated DLM LMPB-100 Power Booster connected to a Cat 5e to DC barrel connector (for plenum applications).
     4. Communication Between the Wireless Network Bridges, the Wireless Load Controllers, and the Border Router:
        1. Communication between the Wireless Bridges, the Wireless Load Controllers, and the Border Router shall be via a standalone wireless mesh network that does not require interface with any other wireless network in the space. The mesh network shall allow communication between all rooms as long as non-battery powered wireless devices are within 100 ft of each other.
        2. Wireless Bridges shall communicate over a IPv6 6LoWPAN 2.4 GHz IEEE 802.15.4 network and use AES128 Encryption.
        3. Wireless protocol shall allow BACnet communication to be transported transparently between the Wireless Network Bridges and Wireless Load Controllers to any front end BAS devices, i.e., LMJA-8xxx-SM JACE device.
     5. Wattstopper Product Numbers: Wireless Network Bridge LMBC-650. Wireless Load Controllers: 10A Room Controllers LMRC-611MCC or LMRC-611MCC-A, 16A Room Controller LMRC-611-16M, 20A Plug Load Controller LMPL-611-20M, Wireless Fixture Sensor LMFA-601-W. Wireless Border Router: LMBR-650.
  4. WIRED NETWORK BRIDGE
     1. Network bridge module connects a DLM local network to a BACnet-compliant segment network for communication between rooms, relay panels and a front end network controller or BAS. Each local network shall include a network bridge component to provide a connection to the local network room devices. Network bridge shall use industry standard BACnet MS/TP network communication and an optically isolated EIA/TIA RS-485 transceiver.
        1. Network bridge shall be provided as a separate module connected on the local network through an available RJ-45 port.
        2. Provide Plug n Go operation to automatically discover room devices connected to the local network and make all device parameters visible to the Network Controller via the segment network. No commissioning shall be required for set up of the network bridge on the local network.
        3. Network bridge shall support digital communications to facilitate the control of all devices in its local Cat 5e network to provide interoperation with building automation systems and other intelligent field devices. Digital communications shall be RS485 MS/TP-based using the BACnet protocol.
           1. Bridge shall have provision for an individual BACnet device ID and shall support the full 2^22 range (0 - 4,193,304). The device ID description property shall be writable via the network to allow unique identification of the lighting control panel on the network.
           2. Bridge shall support MS/TP MAC addresses in the range of 0 - 127 and baud rates of 9600k, 38400k, 76800k, and 115.2k bits per second.
           3. Setup and commissioning of panel shall not require manufacturer-specific software or a computer. All configuration of the lighting control panel shall be performed using standard BACnet objects or via the handheld IR programming remote.
           4. Description property for all objects shall be writable via the network and shall be saved in non-volatile memory within the panel.
           5. BO and BV 1 - 99 objects shall support BACnet priority array with a relinquish default of off and afterhours, respectively. Prioritized writes to the channel BV objects shall propagate prioritized control to each member relay in a way analogous to the BACnet Channel object described in addendum aa. (http://www.bacnet.org/Addenda/Add-135-2010aa.pdf).
        4. Network bridge shall automatically create standard BACnet objects for selected DLM devices to allow any BACnet-compliant BAS to include lighting control and power monitoring features as provided by the DLM devices on each local network. BACnet objects will be created for the addition or replacement of any given DLM device for the installed life of the system. Products requiring that an application-specific point database be loaded to create or map BACnet objects are not acceptable. Systems not capable of providing BACnet data for control devices via a dedicated BACnet Device ID and physical MS/TP termination per room are not acceptable. Standard BACnet objects shall be provided as follows:
           1. Read/write the normal or after hours schedule state for the room.
           2. Read the detection state of each occupancy sensor.
           3. Read the aggregate occupancy state of the room.
           4. Read/write the On/Off state of loads.
           5. Read/write the dimmed light level of loads.
           6. Read the button states of switches.
           7. Read total current in amps, and total power in watts through the load controller.
           8. Read/write occupancy sensor time delay, PIR sensitivity and ultrasonic sensitivity settings.
           9. Activate a preset scene for the room.
           10. Read/write daylight sensor fade time and day and night setpoints.
           11. Read the current light level, in foot-candles, from interior and exterior photosensors and photocells.
           12. Set daylight sensor operating mode.
           13. Read/write wall switch lock status.
           14. Read watts per square foot for the entire controlled room.
           15. Write maximum light level per load for demand response mode.
           16. Read/write activation of demand response mode for the room.
           17. Activate/restore demand response mode for the room.
     2. Wattstopper product numbers: LMBC-300.
  5. LMCP-10V ON/OFF/0-10V LIGHTING CONTROL PANELS AND LMZC ZONE CONTROLLER
     1. Hardware: Provide LMCP lighting control panels with On/Off relays and 0-10V terminals in the locations and capacities as indicated on the Drawing and schedules. Each panel shall be of modular construction with the following components:
        1. Enclosure/Tub shall be NEMA 1, sized to accept an interior with 1 - 8, 1 - 24, or 1 - 48 relays and 0-10V dimming outputs. 24 and 48 size panels shall also have space for up to 6 four-pole contactors at the bottom of the panel.
        2. Cover shall be configured for surface or flush wall mounting of the panel as indicated on the plans. LMCP-xx-10V panel cover shall have a hinged and lockable door to restrict 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. Interior construction shall provide isolation of high voltage (Class 1) wiring from low voltage (Class 2) wiring within the assembled panel. Interior assembly shall include intelligence boards, power supply, DIN rails for mounting optional Class 2 control devices, and individually replaceable latching type relays. For each relay a 0-10V output shall be available on the relay driver board. Panel interiors shall include the following features:
           1. Removable, plug-in terminal blocks with connections for all 0-10V wiring terminations.
           2. Override pushbutton (providing On/Off and Dimming capability) and LED ON/OFF status for each relay.
           3. Digital inputs (two pairs of RJ-45 jacks) shall support all Wired DLM digital switches, dimmers, input and/or output modules, daylighting sensors; occupancy sensors, and additional load controllers. Inputs are divided into two separate digital networks (A and B), each capable of supplying 250mA to connected devices.
           4. Relay and 0-10 V output states shall be available to external control devices and systems via BACnet.
           5. Automatically sequenced operation of relays to reduce impact on the electrical power input when large load groups are controlled together.
           6. Group control of relays shall be provided through an interface to the DLM LMCT handheld configuration tool. Each relay and 0-10V output can be associated with a group for direct on/off or dimming control or scene control via a simple programming sequence using the relay override pushbuttons for groups 1-8 or via LMCT for groups 1-99.
           7. Relay group status for shall be provided through LED indicators for groups 1-8 and via BACnet for groups 1-99. A solid LED indicates that the last group action called for an ON state and relays in the group are on or in a mixed state.
        4. Single-pole latching relays with modular plug-in design. Relays shall provide the following ratings and features:
           1. Electrical:

30 amp ballast at 277 V, 20 amp ballast at 347 V.

16 amp E-Ballast at 120 V, 10 amp E-Ballast at 277 V.

20 amp tungsten at 120 V.

30 amp resistive at 347 V.

1.5 HP motor at 120 V.

20 amp at 120 V for Receptacle Loads.

14,000 amp short circuit current rating (SCCR) at 347 V.

Relays shall be UL 20 listed for control of plug loads.

* + - * 1. Mechanical:

Replaceable, 1/2 inch KO mount with Class 2 wire harness and single 5-pin phenolic connector.

Actuator on relay housing provides manual override and visual status indication, accessible from Class 2 section of panel.

Dual line and load terminals each support two #12 - #14 solid or stranded conductors.

Capable of to 300,000 mechanical on/off cycles.

Internal ferrite to prevent electrical noise on low voltage wires.

Isolated low voltage contacts provide for relay status feedback and pilot light indication.

* + - 1. A 0-10V output shall be provided per relay. This output is linked to its individual relay, so they're controlled together automatically. The 0-10V signal from the panel shall meet requirements of NEMA ANSI C82.11-2011 - Annex A allowing it to control any fixtures providing a 0-10V control signal such that 10V or higher will drive the light to maximum, and 1V or less will drive the light to minimum output. A linear dimming curve is used between these levels.
      2. Power supply shall be a multi-voltage transformer assembly with rated power to supply all electronics, occupancy sensors, switches, pilot lights, and photocells as needed to meet the project requirements. Power supply to have internal over-current protection with automatic reset and MOV protection.
      3. Where indicated, lighting control panels designated for control of emergency lighting shall be provided with factory installed provision for automatic bypass of relays controlling emergency circuits upon loss of normal power. Panels shall be properly listed and labeled for use on emergency lighting circuits and shall meet the requirements of UL924 and NFPA 70 - Article 700. Relay Driver Cards providing 0-10V control shall automatically open their 0-10V single on loss of normal power, ensuring connected fixtures powered by a different source shall go full on.
      4. Integral system clock shall provide scheduling capabilities for panel-only projects without DLM segment networks or BAS control.
         1. Each panel shall include digital clock capability able to issue system wide automation commands to up to 11 other panels for a total of 12 networked lighting control panels. Clock shall provide capability for up to 254 independent schedule events per panel for each of the ninety-nine system wide channel groups.
         2. Clock capability of each panel shall support the time-based energy saving requirements of applicable local energy codes.
         3. Clock module shall provide astronomic capabilities, time delays, blink warning, daylight savings, and holiday functions and will include a battery backup for clock function and program retention in non-volatile FLASH memory. Clocks that require multiple events to meet local code lighting shut off requirements shall not be allowed.
         4. Clock capability of each panel shall operate on a basis of ON/OFF or Normal Hours/After Hours messages to automation groups that implement pre-configured control scenarios. Scenarios shall include:

Scheduled ON (or Goto Level)/ OFF

Manual ON / Scheduled OFF

Astro ON / OFF (or Photo ON / OFF)

Astro and Schedule ON / OFF (or Photo and Schedule ON / OFF)

* + - * 1. User interface shall be a portable IR handheld configuration tool for any panel in the system (LMCT-100-2) or Front End System Software.
        2. Clock capability of each panel shall employ non-volatile memory and shall retain user programming and time for a minimum of 10 years.
        3. Schedules programmed into the clock of any one panel shall be capable of executing panel local schedule or Dark/Light (photocell or Astro) events for that panel should segment network communication be lost. Lighting control panels that are not capable of executing events independently of the global network shall not be acceptable.
      1. Lighting control panel can operate as a stand-alone device supporting schedule, group, and photocell functions or as a networked device via a Wired room-to-room segment network.
      2. Lighting control panel shall support digital communications to facilitate interoperability with building automation systems and other intelligent field devices through an integral digital Wired Network Bridge on the panel�s intelligence board. All features associated with the LMBC-300 Wired Network Bridge shall extend to the panel and its controlled loads, and all devices connected to the panel by Cat 5e local IRB network. Digital communications shall be RS485 MS/TP-based using the BACnet protocol.
      3. In addition to the LMCP Relay Panels, an LMZC Zone Controller panel shall be available. This panel is designed for applications where LMFC-011 Fixture Controllers or other distributed load controllers are used to switch and/or dim the controlled loads. Key similarities to and differences from the LMCP panel design shall include:
         1. Use the same intelligence board as the LMCP relay panel.
         2. Shall not include relay driver boards or relays, or 0-10V outputs.
         3. Have a removable interior section to facilitate installation, and a Tub/Cover. Cover is for surface mounting applications only.
         4. Tub shall have two interior KOs to allow installation of LMPB-100 Power Boosters. Each installed Power Booster can provide an additional 150 mA for either of two available DLM local IRB networks.
         5. All programming and networking (whether DLM Local Network and/or Segment Network) capabilities in the LMZC Zone Controller shall be similar to capabilities for LMCP relay panels, except for functions designed for panel-mounted HDR relays and 0-10V outputs.
      4. For retrofit applications, or where direct low voltage override switches and pilot contacts are required, an LMCP panel with only On/Off capability can be provided using On/Off relay driver cards. These cards are NOT capable of providing 0-10V outputs but will include a removable terminal that provides a direct wired switch inputs associated with each relay (2-wire momentary switches only) and a pilot output.
      5. Wattstopper Product Number: On/Off/0-10V Relay Panels: LMCP-8-10V, LMCP-24-10V, LMCP-48-10V; On/Off Only Relay Panels: LMCP-8, LMCP-24, or LMCP-48; Zone Controller: LMZC-301.
    1. User Interface: Each system of lighting control panels shall be supplied with at least one handheld configuration tool (LMCT-100-2). As a remote programming interface, the configuration tool shall allow setup, configuration, and diagnostics of the panel without the need for software or connection of a computer. User interface shall have the following panel-specific functions as a minimum:
       1. Set network parameters including panel device ID, MS/TP MAC address, baud rate and max master range.
       2. Relay Group creation of up to 99 groups. Group creation shall be capable of programming of seven key relay parameters for member relays. The seven parameters are: After-hours Override Time Delay, Normal Hours Override Time Delay, Action on Transition to Normal Hours, Action on Transition to After Hours, Sensor Action During Normal Hours, Sensor Action During After Hours, Blink-Warn Time for After Hours.
       3. Program up to 254 separate scheduled events. Events shall occur on seven day intervals with each day selectable as active or inactive and shall be configurable as to whether the event is active on holidays. Holidays can also be defined through the User Interface.
       4. Program up to 32 separate Dark/Light events. Events shall have a selectable source as either calculated Astro with delay, or a digital IO module with an integral 0-5V or 0-10V analog photocell. Dark/Light events shall occur on seven day intervals with each day selectable as active or inactive and shall be configurable as to whether the event is active on holidays.
       5. Button binding of digital switches to groups shall be accessible via the handheld IR remote and accomplished from the digital switch station.
       6. Programming of panel location information shall be accomplished by the handheld IR remote and include at a minimum LAT, LON, DST zone, and an approximate city/state location.
       7. Wattstopper Product Number: LMCT-100-2
  1. FRONT END NETWORK CONTROLLER WITH SEGMENT MANAGER STATION
     1. For networked applications, the Digital Lighting Management system can include one or more Front End Network Controllers with Segment Manager Interface (referred to as a Network Controller below) to manage network communication. It shall be capable of serving up a user interface to a standard web browser.
     2. Each Network Controller shall have integral support for two wired MS/TP segment networks. Segment networks may alternately be connected to the Network Controller via external BACnet/IP interface routers or Wireless Border Routers and Network switches using Ethernet structured wiring. Each router shall accommodate one "segment" - respectively a wired MS/TP run or Wireless Mesh Segment Network. Provide the quantity of routers and switches as shown on the Drawings.
     3. Operational features of the Network Controller shall include the following:
        1. Connection to PC or LAN via standard Ethernet TCP/IP via standard Ethernet TCP/IP with the option to use SSL encrypted connections for all traffic.
        2. Easy to use graphical user interface, compatible with current Chrome or equivalent browser. The Network Controller shall not require installation of any lighting control software on an end-user PC, but if Manufacturer's Lighting Control Software is installed, it shall be able to work in tandem with the Network Controller without issue.
        3. Log in security capable of restricting some users to view-only or other limited operations.
        4. Network Controller with N4 operating systems shall include two main sets of interface screens - those used to initially configure the unit (referred to as the config screens), and a those used to allow users to dynamic monitor the performance of their system and provide a centralized scheduling interface. Capabilities using the Config Screens shall include:
           1. Automatic discovery of DLM devices and relay panels on the segment network(s). Discovery function shall provide communication, monitoring or control of all local devices and lighting control panels.
           2. Allow information for all discovered DLM devices to be imported into the Network Controller via a single XML based site file from the Wattstopper LMCS Software, reducing the time needed to make a system usable by the end user. Importable information can include text descriptions of every DLM component and individual loads, and automatic creation of room location information and overall structure of DLM network. Info entered in LMCS should not have to be re-entered manually via keystrokes into the Network Controller
           3. After discovery, all rooms and panels shall be presented in a standard navigation tree format. User selection of a device in the tree will allow its settings and operational parameters to be viewed and changed.
           4. Ability to view and modify DLM device operational parameters. It shall be possible to set device parameters independently for normal hours and after-hours operation including sensor time delays and sensitivities, and load response to sensor of Manual-On or Auto-On.
           5. Provide capabilities for integration with a BAS via BACnet protocol. Depending on project hardware, previously mentioned BACnet points shall be available to the BAS via BACnet/IP connection to the Network Controller: room occupancy state; room schedule mode; room switch lock control; individual occupancy sensor state; room lighting power; room plug load power; load dimming level. BACnet items shall be capable of being moved into an "Export Table" that will provide any integrator with only the data they need, and by using the Export Table effectively create a firewall between the integrator's request for info and the overall system performance.
        5. Capabilities using the Network Controller with N4 operating system's Dashboard Screens shall include:
           1. Ability to set up schedules for DLM local networks (rooms) and panels. Schedules shall be capable of controlling individual rooms or groups of loads with either on/off or normal hours/afterhours commands. Support for annual schedules, holiday schedules and unique date-bound schedules, as well as Astro On or Astro Off events with offsets. Schedules shall be viable graphically as time bars in a screen set up to automatically show scheduled events by day, week, or month.
           2. For fixtures that have CCT capability as specified under paragraph "Digital Wall Switch and Timer For Correlated Color Temperature", the Network Controller will provide schedule functionality similar to the CCT Wall Timer.
        6. If indicated by the Drawings, Network Controllers shall be integrated into a larger overall network by the addition of a Network Supervisor package. The Supervisor is a server level computer running a version of the Network Controller software with dedicated communication and networking capability, able to pull information automatically from each individual Network Controller. Using a Supervisor, information from individual Network Controllers can be accessed and stored on the Supervisor�s hard drive, eliminating the risk of data being overwritten due to Network Controller memory limits.
     4. Wattstopper Product Numbers: NB-ROUTER, LMJA-8125-SM, LMJA-8300-SM, LM-SUPERVISOR, NB-SWITCH, NB-SWITCH-8, NB-SWITCH-16.
  2. PROGRAMMING, CONFIGURATION AND DOCUMENTATION SOFTWARE
     1. PC-native application for optional programming of detailed technician-level parameter information for all DLM products, including parameters not accessible via BACnet and the handled IR configuration tool. Software must be capable of accessing room-level parameter information locally within the room when connected via the optional LMCI-100 USB programming adapter, or all products over a wired or wireless segment network utilizing standard BACnet/IP communication.
     2. Additional parameters exposed through this method include but are not limited to:
        1. Occupancy sensor detection LED disable for performance and other aesthetic spaces where blinking LEDs present a distraction.
        2. Six occupancy sensor action behaviors for each controlled load, separately configurable for normal hours and after hours modes. Modes include: No Action, Follow Off Only, Follow On Only, Follow On and Off, Follow On Only with Override Time Delay, Follow Off Only with Blink Warn Grace Time, Follow On and Off with Blink Warn Grace Time.
        3. Separate fade time adjustments per load for both normal and after hours from 0 - 4 hours.
        4. Configurable occupancy sensor re-trigger grace period from 0 - 4 minutes separate for both normal hours and after hours.
        5. Separate normal hours and after hours per-load button mode with modes including Do nothing, on only, off only, on and off.
        6. Load control polarity reversal so that on events turn loads off and vice versa.
        7. Per-load DR (demand response) shed level in units of percent.
        8. Load output pulse mode in 254 steps either 0.1 seconds or 1 second.
        9. Fade trip point for each load for normal hours and after hours that establishes the dimmer command level at which a switched load closes its relay to allow for staggered On of switched loads in response to a dimmer.
     3. Generation of reports at the whole file, partial file, or room level. Reports include but are not limited to:
        1. Device list report: All devices in a project listed by type.
        2. Load binding report: All load controller bindings showing interaction with sensors, switches, and daylighting.
        3. BACnet points report: Per room Device ID report of the valid BACnet points for a given site's BOM.
        4. Room summary report: Device manifest for each room, aggregated by common BOM, showing basic sequence of operations.
        5. Device parameter report: Per-room lists of all configured parameters accessible via handheld IR programmer for use with O and M documentation.
        6. Scene report: All project scene pattern values not left at defaults (i.e. 1 = all loads 100 percent, 2 = all loads 75 percent, 3 = all loads 50 percent, 4 = all loads 25 percent, 5-16 = same as scene 1).
        7. Occupancy sensor report: Basic settings including time delay and sensitivities for all occupancy sensors.
     4. Network-wide programming of parameter data in a spreadsheet-like Network Grid programming environment including but not limited to the following operations:
        1. Set, copy/paste an entire project site of sensor time delays.
        2. Set, copy/paste an entire project site of sensor sensitivity settings.
        3. Search based on room name and text labels.
        4. Filter by product type (i.e. LMRC-212) to allow parameter set by product.
        5. Filter by parameter value to search for product with specific configurations.
     5. Network-wide firmware upgrading remotely via the BACnet/IP network.
        1. Mass firmware update of entire rooms.
        2. Mass firmware update of specifically selected rooms or areas.
        3. Mass firmware upgrade of specific products
     6. Wattstopper Product Number: LMCS-100, LMCI-100
  3. OPENADR DEMAND RESPONSE SOLUTION
     1. If the project's lighting control system includes Wired or Wireless networking capability to all rooms from a front end hardware station, the system can respond to BACnet demand response commands from other systems acting as a Virtual End Node (VEN) that are integrated with the lighting systems front end controls:
     2. For sites that do not plan on integrating the lighting controls with a separate on premise Virtual End Node and wish the lighting control system to be a standalone VEN that can communicate via OpenADR 2.0b, lighting control manufacturer shall provide a solution using Cloud communication capability between the grid operator's Virtual Top Node (VTN) and the Lighting Control System via a cellular hardware called out in Section 1.12 as RACCESS remote access platform, or via a Public IP connection.
     3. Wattstopper Product Numbers: RACCESS: LMDR-VEN, Public IP: LMDR-VEN-VPN.
  4. INPUT PHASE CONVERTERS, 0-10 V
     1. When a project has loads that require phase dimming instead of 0-10 V dimming, include 0-10 V interface devices that monitors a 0-10 V signal from a room controller and, using that as an input, will alter the electrical sine wave to the loads by forward phase (leading edge) or reverse phase (trailing edge) dimming. These devices are interfaces acting on the line voltage circuits and will not have to communicate to other DLM devices in the area via Cat 5e or wireless communication.
     2. Use an Interface Device with Two 1/2 inch KO Mounting Nipples: One for the incoming and exiting line voltage circuit, and the other for the 0-10 V signaling wires. Unit will automatically sense whether the line voltage circuit is 120 or 277 VAC and provide a reverse phase only dimming switchleg. This device will handle loads of 450 W for 120 V and 1000 W for 277 V and have a molded polycarbonate body. Wattstopper Part Number: LDCM-PL-120-277-010V.
     3. Use an interface device that uses a slotted bracket for surface mounting and is rated for install in plenum spaces. The device will automatically determine optimum dimming type for the load of either forward or reverse phase. This device will handle loads of 750W for 120V and 1300W for 277V. Wattstopper part number BF-SDS10V-AST.
  5. EMERGENCY LIGHTING CONTROL DEVICES
     1. Emergency Lighting Control Unit - A UL 924 listed device that monitors a switched circuit providing normal lighting to an area. The unit provides ON/OFF control of emergency lighting based on status of associated normal lighting. Upon normal power failure the emergency lighting relay will close, forcing the emergency lighting ON until normal power is restored. Features include:
        1. 120/277 volts, 50/60 Hz, 20 amp ballast rating
        2. Push to test button
        3. Auxiliary contact for remote test or fire alarm system interface
     2. Wattstopper Product Numbers: DIN Rail Mount: ELCU-100, 1/2 inch KO Mount: ELCU-200.

1. EXECUTION
   1. PREPARATION
      1. Do not begin installation until measurements have been verified and work areas have been properly prepared.
      2. If preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

\*\* NOTE TO SPECIFIER \*\* Include the following paragraph if Pre-Installation Meeting is specified in Part 1 of this specification. Delete if not required

* + 1. Verify that pre-installation meeting specified in Part 1 of this specification has been completed, recorded meeting minutes have been distributed and all outstanding issues noted have been resolved prior to the start of installation.
  1. INSTALLATION
     1. Install system in accordance with the approved system shop drawings and manufacturer's instructions.
     2. Install all room/area devices using manufacturer�s factory-tested Cat 5e cable with pre-terminated RJ-45 connectors.
        1. If pre-terminated cable is not used for room/area wiring, each field-terminated cable shall be tested following installation and testing results submitted to the Manufacturer's Representative for approval prior to proceeding with the Work.
        2. If fixtures have internal Wired Fixture Control Modules, ensure that they are also connected with Cat 5e cable. (Fixtures with Wireless Fixture Sensors do not require Cat 5e cables.)
        3. Install all Wired room-to-room network devices using manufacturer-sourced LM-MSTP network wire or wireless devices. Network wire substitution is not permitted and may result in loss of product warranty.
        4. Low voltage wiring topology for each type of connector must comply with manufacturer's specifications.
        5. Route network wiring as indicated on the Drawings as closely as possible. Document final wiring location, routing, and topology in as built drawings.
     3. All line voltage connections shall be tagged to indicate circuit and switchleg designations. Junction box covers should also provide circuit and switchleg info.
     4. Test all devices to ensure they are powered and communicate properly with each other.
     5. Following manufacturer's recommendations, calibrate all sensor sensitivities and adjust mounting/locations to ensure proper detection of occupants and energy savings. Adjust time delay so that controlled area remains lighted while occupied.
     6. Provide written or computer-generated documentation on the configuration of the system including room by room description including:
        1. Sequence of Operation, (e.g., Auto On, Partial ON, Partial Off, etc.)
        2. Load parameters (e.g., blink warning, group integrations, etc.)
        3. Sensor parameters, time delays, sensitivities, and daylighting setpoints.
     7. Post start-up tuning - Adjust sensor time delays and sensitivities to meet the Owner's requirements 30 days from beneficial occupancy. Provide a detailed report to the Architect / Owner of post start-up activity.
     8. Tighten Class 1 conductors at circuit breaker and termination point to torque ratings marked on enclosure or device�s UL label or installation instructions.
     9. Class 2 cabling shall enter enclosures from within low-voltage wiring areas and shall remain within those areas. No Class 1 conductors shall enter a low-voltage area.
     10. Run separate neutrals for any phase dimmed branch load circuit. Different types of dimming loads require separate neutrals and should not be mixed within any individual room controller or multiple 0-10V input phase converters.
     11. Verify all lighting loads to be free from short circuits prior to connection to room controllers or relays inside panels.

\*\* NOTE TO SPECIFIER \*\* The following optional paragraph is required ONLY when the Lighting Control Manufacturer also provides a Shade System that uses the same in room communication protocol, and the project specifications and drawings indicate that the Lighting Controls and Shade Controls shall be integrated in the room.

* + 1. Lighting Control installer to take steps needed to co-ordinate with the installer of the same manufacturer's Shade products to ensure both systems will be integrated into the room's local Cat 5e In Room Bus or Wireless communication network. Contractor to verify whether local Shade override devices should be mounted with those for the Lighting Control system. Each installer shall verify that their hardware has been set up properly for independent operation, and that once connected, still operates properly. The Lighting Control installer should verify if a single network communication bridge is to be installed in the room so both systems be connected to other rooms and a single set of front end devices.

\*\* NOTE TO SPECIFIER \*\* The following optional paragraph is required ONLY for paragraph "REMOTE ACCESS AND ENHANCED WARRANTY FOR NETWORKED SYSTEMS" specified in Part 1 under "Warranty" and "Maintenance and Operational Services"of this specification. Delete entirely if not required.

* + 1. Remote Access for Network Systems: If �REMOTE ACCESS AND ENHANCED WARRANTY FOR NETWORKED SYSTEMS� is specified in Part 1 of this specification, ensure DLM Network Cabinet (LMNC) is installed in a location with good to excellent cellular phone coverage based on building orientation and geographic location, mount magnetic antenna, and connect to the modem. When alternate mounting locations are not available and a stronger cellular signal is needed, the manufacturer shall offer additional antenna options to improve signal quality. Verify mounting location with Engineer and Owner prior to proceeding.
  1. FIELD QUALITY CONTROL
     1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing. Notify Architect and Manufacturer in writing a minimum of 3 weeks prior to system start-up and testing.
     2. Tests and Inspections: Manufacturer's service representative shall perform the following inspections and prepare reports.
        1. Verify Class 1 and 2 wiring connections are terminated properly by validating system performance.
        2. Set IP addresses and other network settings of system front end hardware per facilities IT instructions.
        3. Verify / complete task programming for all switches, dimmers, time clocks, occupancy sensors, daylighting controls, and input/output modules to meet project.
        4. Verify the control of each space complies with the Sequence of Operation. If no Sequence of Operation provided, manufacturer will set up based on best practices.
        5. Correct any system issues and retest.
     3. Provide a report in table format with drawings or using a software file that can be opened in the manufacturer's system software including each room or space that has lighting control installed. Include the following:
        1. Date of test or inspection.
        2. Loads per space, or Fixture or Wireless Device Address identification.
        3. Quantity and Type of each device installed
        4. Reports providing each device's settings.

\*\* NOTE TO SPECIFIER \*\* Include the following paragraph to specify that lighting control acceptance testing required by California Title 24, Part 6 (California Energy Code) be performed while a technician is on site by Lighting Control Manufacturer. Required documentation associated with this service is also specified in Part 1 under "SUBMITTALS".

* 1. COMMISSIONING ASSISTANCE
     1. Title 24 Acceptance Testing Service; Include additional costs for Lighting Control Manufacturer to provide a technician for one additional day while the CLCATT performs lighting control acceptance testing in accordance with CA TITLE 24 P6 including submission of required documentation.

\*\* NOTE TO SPECIFIER \*\* Include the following paragraph to specify demonstration and training services.

* 1. DEMONSTRATION AND TRAINING
     1. Before Substantial Completion, arrange and provide a one-day Owner instruction period to designated Owner personnel. Set-up, starting of the lighting control system and Owner instruction includes:
        1. Confirmation of entire system operation and communication to each device.
        2. Confirmation of operation of individual relays, switches, and sensors.
        3. Confirmation of system Programming, photocell settings, override settings, etc.
        4. Provide training to cover installation, programming, operation, and troubleshooting of the lighting control system.
  2. PRODUCT SUPPORT AND SERVICE
     1. Factory telephone support shall be available at no cost to the Owner following acceptance. Factory assistance shall consist of assistance in solving application issues pertaining to the control equipment.

END OF SECTION