

CENTRAL CAROLINA COMMUNITY COLLEGE

1801 NASH ST. SANFORD NC 27330

ENERGY EFFICIENCY COMMUNITY BLOCK GRANT PROGRAM

RFP # 43-A-2010EECBGED1

DENNIS A. WICKER CIVIC CENTER

LIGHTING DIMMER SPEC SHEET

The system shall have a ballast dimming to 1%. The system will be started up by a factory employed technician and the manufacturer will provide the minimum warranty as stated below. Detailed performance specifications are below on the Lutron Energy Saver Node system with H-Series dimming ballast. These details are based on Lutron specifications and are provided as an example only. Lutron manufacturer equipment can be used or any equipment equal to. All equipment provided must meet all ARRA and Progress Energy requirements.

1.1 SYSTEM DESCRIPTION

- A. Modular dimming control: Factory assembled dimming control, interfaces, and modules. Low voltage wall stations, control interfaces, and sensors.

1.2 SUBMITTALS

- A. Submit under provisions of Section [013300].
- B. Specification Conformance Document: Indicate whether the submitted equipment:
 - 1. Meets specification exactly as stated.
 - 2. Meets specification via an alternate means and indicate the specific methodology used.
- C. Shop Drawings; include:
 - 1. Load schedule indicating actual connected load, load type, and voltage per circuit, circuits and their respective control zones, circuits that are on emergency, and capacity, phase, and corresponding circuit numbers.
 - 2. Schematic of system.
- D. Product Data: Catalog cut sheets with performance specifications demonstrating compliance with specified requirements.

1.3 CLOSEOUT SUBMITTALS

- A. Provide Operation and Maintenance Manuals:
 - 1. Including:

- a. Warranty Information
 - b. System Start-up Information
 - c. Installation Guide
 - d. Set-up and Programming Guide
2. Electronic format to be available on Lighting Control System manufacturer website.

B. [Sustainable Design Closeout Documentation (LSC-LEED-DOC)

1. Lighting Control System Manufacturer to provide Enhanced Start-up documentation that details the start-up procedure being performed including a process to follow, details on tests performed and an area that documents any test results.]

1.4 QUALITY ASSURANCE

- A. Manufacturer: Minimum 35 years experience in manufacture of architectural lighting controls.
- B. Manufacturer's Quality System: Registered to ISO 9001:2000 Quality Standard, including in-house engineering for product design activities.
- C. Central dimming control system:
 1. Listed by [CSA] [NOM] [UL] specifically for the required loads. Provide evidence of compliance upon request.

1.5 PROJECT CONDITIONS

- A. Do not install equipment until following conditions can be maintained in spaces to receive equipment:
 1. Ambient temperature: 0 degrees to 40 degrees C (32 degrees to 104 degrees F).
 2. Relative humidity: Maximum 90 percent, non-condensing.
 3. Lighting control system must be protected from dust during installation.

1.6 WARRANTY

- A. Provide manufacturer's 1 year parts warranty.
- B. [Provide manufacturer's Enhanced 8 Year Limited Warranty:
 1. 8-year limited parts warranty for the replacement of defective lighting components from the date of system startup completion.
 2. 2-year Silver Level Support and Maintenance Plan that covers 100 percent parts and labor from the date of the system startup completion.]
- C. [Provide manufacturer's full 4 year warranty covering 100 percent parts and 100 percent labor from the date of system startup completion.
 1. Silver Level Support and Maintenance Plan: includes 100 percent parts and labor coverage, 24 hours per day, 7 days per week telephone technical support, and can be renewed annually.
 2. Gold Level Support and Maintenance Plan: includes 100 percent parts and labor coverage, 24 hours per day, 7 days per week telephone technical support, annual renewal option, 72-hour on-site response time, an annual scheduled maintenance visit and an upgrade of initial 2-year Silver Level Support and Maintenance Plan to Gold Level Support and Maintenance Plan.
 3. Platinum Level Support and Maintenance Plan: includes 100 percent parts and labor coverage, 24 hours per day, 7 days per week telephone technical support, annual renewal option, 24-hour on-site response time, an annual scheduled maintenance visit and an upgrade of initial 2-year Silver Level Support and Maintenance Plan to Platinum Level Support and Maintenance Plan.]

- D. Ballasts: Fluorescent Electronic Dimming Ballasts. shall be dimmable to 1%. Basis of design is H-series Lutron ballast.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Make ordering of new equipment for expansions, replacements, and spare parts available to end user.
- B. Make new replacement parts available for minimum of 10 years from date of manufacture.

PART 2 – PRODUCTS

2.1 GENERAL

- A. Provide system hardware that is designed, tested, manufactured, and warranted by a single manufacturer.
- B. Architectural Lighting Controls: Ten-year operational life while operating continually at any temperature in an ambient temperature range of 0 degrees C (32 degrees F) to 40 degrees C (104 degrees F) and 90 percent non-condensing relative humidity.
- C. Designed and tested to withstand electrostatic discharges up to 15,000 V without impairment per IEC 801-2.
- D. Wireless Devices shall:
 - 1. Have addresses automatically assigned to them.
 - 2. Receive signals from other wireless devices and provide feedback to user.
 - 3. Work in conjunction with wireless occupancy sensors, wireless vacancy sensors, and wireless controllers.
 - 4. Use proprietary Radio Frequency (RF) protocol.
 - 5. Use RF communication in compliance with FCC Part 15.231.

2.2 DIMMING PERFORMANCE REQUIREMENTS

- A. Electrolytic capacitors to operate at least 20 degrees C below the component manufacturer's maximum temperature rating when device is under fully-loaded conditions in 40 degrees C (104 degrees F) ambient temperature.
- B. Load Handling Thyristors (SCRs and triacs), Field Effect Transistors (FETs), and Isolated Gate Bipolar Transistors (IGBTs): Manufacturer's maximum current rating minimum two times control's rated operating current.
- C. Capable of withstanding repetitive inrush current of 50 times operating current without impacting lifetime of dimmer.
- D. Design and test dimmers to withstand line-side surges without impairment to performance.
 - 1. Withstand surges without impairment of performance when subjected to surges of 6,000 volts, 3,000 amps per ANSI/IEEE C62.41.
 - 2. Other power handling devices: Withstand surges without impairment of performance when subjected to surges of 6,000 volts, 200 amps per ANSI/IEEE C62.41.
- E. Utilize air gap off – activated when user selects “off” at any control to disconnect the load from line supply.

- F. Power failure memory and dimmer/relay recovery:
 - 1. When power is interrupted and subsequently returned, within 3 seconds lights will automatically return to same levels (dimmed setting, full on, or off) prior to power interruption.
- G. Multiple load type, tested to UL 508 to specifically control incandescent/tungsten, magnetic low voltage, electronic low voltage, neon/cold cathode, digital fluorescent dimming ballasts, fluorescent dimming ballasts, and non-dim loads...
- H. Each dimmer to be assigned a load type that will provide a proper dimming curve for the specific light source.
- I. Possess ability to have load types assigned per circuit, configured in field.
- J. Minimum and maximum light levels user adjustable on circuit-by-circuit basis.
- K. Control all light sources in smooth and continuous manor. Dimmers with visible steps are not acceptable.
- L. Provide real-time cycle-by-cycle compensation for incoming line voltage variations including changes in RMS voltage (plus or minus 2 percent change in RMS voltage/cycle), frequency shifts (plus or minus 2 Hz change in frequency/second), dynamic harmonics, and line noise. Systems not providing cycle-by-cycle compensation to include external power conditioning equipment to meet these requirements.
- M. Systems not providing cycle-by-cycle compensation to include external power conditioning equipment as part of dimming system.
- N. Each dimmer to incorporate electronic "soft-start" default at initial turn-on that smoothly ramps lights up to the appropriate levels within 0.5 seconds.
- O. Line Voltage Dimmers; Meet following load-specific requirements:
 - 1. Magnetic Low Voltage (MLV) transformer:
 - a. Contain circuitry designed to control and provide a symmetrical AC waveform to input of magnetic low voltage transformers per UL 1472, Section 5.11.
 - b. Dimmers using back-to-back SCR construction that could fail open causing DC power to flow into magnetic low voltage load are not acceptable.
 - 2. Electronic Low Voltage (ELV) transformer: Dimmer to operate electronic low voltage transformers via reverse phase control. Alternately, forward phase control dimming may be used if dimming equipment manufacturer has recommended specific ELV transformers being provided.
 - 3. Neon and cold cathode transformers:
 - a. Magnetic transformers: UL listed for use with normal (low) power factor magnetic transformers. Electronic transformers: Must be supported by the transformer equipment manufacturer for control of specific transformers being provided.
 - 4. Fluorescent electronic dimming ballast: Refer to Section [265113] [] for dimming ballast specifications and performance.
- P. [Direct low-voltage control of digital ballasts (120V, 220/240V, and/or 277V lighting):
 - 1. Electronically link a digital fluorescent lighting ballast to a zone for both dimming and turn on/off
Electronically assign occupancy sensors for manual on/auto off and auto on/auto off
 - 2. Electronically assign daylight sensors to digital ballasts and line voltage dimmers for proportional daylight harvesting
 - 3. Single integral controller with Class 1 or Class 2 isolated digital output signal

conforming to IEC 60929; capable of direct (no-interface) control.]

- Q. Low Voltage Dimming Interface; Meet following requirements:
 - 1. Coordination between low voltage dimming module and line voltage relay: Capable of being electronically linked to single zone.
 - 2. Single low voltage dimming module; capable of controlling following light sources:
 - a. 0-10V analog voltage signal.
 - 1) Provide Class 2 isolated 0-10V output signal conforming to IEC 60929.
 - 2) Sink current via IEC 60929.

2.3 POWER INTERFACES

- A. Provide power interfaces required as defined on project drawings: [PHPM-PA-DV], [PHPM-PA-120], [PHPM-3F-DV], [PHPM-3F-120], [PHPM-SW-DV], [GRX-TVI]
- B. Electrical:
 - 1. Phase independent of control input.
 - 2. Dimmer to meet limited short circuit test as defined in UL 20.
- C. Diagnostics and Service: Replacing power interface does not require re-programming of system or processor.

2.4 WALL STATIONS

- A. Line Voltage Control Unit:
 - 1. Product: GRAFIK Eye QS
 - 2. Preset lighting control with zone override:
 - a. Intensity for each zone indicated by means of one illuminated bar graph per zone.
 - b. Each zone and scene to be field customizable to indicate each zone and scene name.
 - c. Astronomical time clock and programmer interface
 - 1) Provide access to:
 - a) Scene selections.
 - b) Fade zone to a level.
 - c) Fine-tuning of preset levels with scene raise/lower.
 - d) Lock out scenes and zones.
 - e) Fine-tuning of light levels with individual zone raise/lower.
 - f) Terminal block for wired infrared signal input.
 - g) Enable/disable wall station.
 - d. Light intensity with real time energy savings by digital display.
 - e. Fade time indicated by digital display for current scene while fading.
 - f. Incorporate built-in wide angle infrared receiver.
 - g. For temporary local overrides, individual raise/lower buttons to allow zones to be adjusted without altering scene values stored in memory.
 - h. [Preset expandable shade control: Provide up to 3 columns of shade control. See Section [122413 – Roller Window Shades] [_____ - _____]]
 - 1) For temporary local overrides, individual raise/lower buttons to allow zones to be adjusted without altering scene values stored in memory.]
 - i. [Direct low-voltage control of digital ballasts (120V, 220/240V, and/or 277V lighting).]
 - j. [Wireless integration with occupancy/vacancy sensors, wireless controller, shades and other wireless control units by same manufacturer.]

3. Color:
 - a. [Match NEMA WD1, Section 2.] [Custom color to be selected.]
 - b. Color variation in same product family: Maximum $\Delta E=1$, CIE L^*a^*b color units.
 - c. Visible parts: Exhibit ultraviolet color stability when tested with multiple actinic light sources as defined in ASTM D4674. Provide proof of testing upon request.
- B. Architectural Low Voltage Wall Stations:
1. Product: see Touch QS.
 2. Electronics:
 - a. Use RS485 wiring for low voltage communication.
 3. Functionality:
 - a. LEDs to reflect the true system status. LEDs to remain illuminated if the button press was properly processed or the LEDs turn off if the button press was not processed.
 - b. Allow for easy reprogramming without replacing unit.
 4. Provide faceplates with concealed mounting hardware.
 5. Color:
 - a. [Match NEMA WD1, Section 2.] [Custom color to be selected.]
 - b. Color variation in same product family: Maximum $\Delta E=1$, CIE L^*a^*b color units.
 - c. Visible parts: Exhibit ultraviolet color stability when tested with multiple actinic light sources as defined in ASTM D4674. Provide proof of testing upon request.
- C. Designer Low Voltage Wall Stations
1. Product: [EcoSystem 1B – CC-1BRL-WH.] [EcoSystem 4B – CC-4BRL-WH.]
 2. General:
 - a. Class 2 (low voltage).
 - b. Integral IR receiver for personal control.
 - c. Wall stations can be replaced without reprogramming.
 - d. Color:
 - 1) Match NEMA WD1, Section 2 White.
 - 2) Color variation in same product family: Maximum $\Delta E=1$, CIE L^*a^*b color units.
 - 3) Visible parts: Exhibit ultraviolet color stability when tested with multiple actinic light sources as defined in ASTM D4674. Provide proof of testing upon request.
 3. One Button Control
 - a. Toggle on/off and master raise/lower control for group of fixtures.
 4. Four Button Control
 - a. Recall 4 Scenes plus all on or all off for one group of fixtures.
 - b. Master raise/lower control entire group of fixtures.
- D. Provide faceplates with concealed mounting hardware.
- E. Engrave wall stations in English with appropriate button, zone, and scene engraving descriptions furnished prior to fabrication.
- F. Silk-screened borders, logos, and graduations to use graphic process that chemically bonds graphics to faceplate, resistant to removal by scratching and cleaning.

2.5 [ENERGI SAVR NODE QS] LIGHTING CONTROL MODULE

- A. Softswitch Lighting Control Module:
1. Product: QSN-4S16-S

2. Mechanical:
 - a. Listed to UL 508 (United States) as industrial control equipment. CSA (Canada) certified, or NOM (Mexico) approved as applicable.
 - b. Delivered and installed as a [UL] [CSA] listed factory assembled panel.
 - c. Panels passively cooled via free-convection, unaided by fans or other means.
 3. Surface mounted
 4. Switching:
 - a. Rated life of relay: Minimum 1,000,000 cycles.
 - b. Load switched in manner that prevents arcing at mechanical contacts when power is applied to and removed from load circuits.
 - c. Fully rated output continuous duty for inductive, capacitive, and resistive loads.
 - d. Module to integrate up to 4 individually controlled zones, each with a capacity of up to 16 amps, of high in-rush lighting load (magnetic fluorescent ballast, electronic fluorescent ballast, HID, incandescent, magnetic low-voltage, electronic low-voltage, neon/cold cathode and motor loads).
 5. Connection without interface to wired:
 - a. Occupancy sensors
 - b. Daylight sensors
 - c. IR receivers for personal control
 6. Connects to Lighting Management Panel via RS485.
 7. LED status indicators confirm communication with occupancy sensors, daylight sensors, and IR receivers.
 8. Thermal protection reports to Light Management System if module overheats.
 9. Contact Closure Input
 - a. Directly accept contact closure input from a dry contact closure or solid-state output without interface to:
 - 1) Activate scenes
 - 2) Enable or disable timeclock
 10. Emergency Contact Closure Input
 - a. Turn all zones to full output during emergency state via direct contact closure input from UL 924 Listed Emergency Lighting Interface, security system or fire alarm system
 - b. Allow configurable zone response during emergency state.
 - c. Disable control operation until emergency signal is cleared.
- B. 0-10V Lighting Control Module:
1. Product: QSN-4T16-S
 2. Meet the following requirements:
 - a. Coordination between low voltage dimming module and line voltage relay: Capable of being electronically linked to single zone.
 - b. Single low voltage dimming module; capable of controlling following light sources:
 - 1) 0-10V analog voltage signal.
 - a) Provide Class 2 isolated 0-10V output signal conforming to IEC 60929.
 - b) Sink current via IEC 60929.
 3. Mechanical:
 - a. Listed to UL 508 (United States) as industrial control equipment. CSA (Canada) certified, or NOM (Mexico) approved as applicable.
 - b. Delivered and installed as a [UL] [CSA] listed factory assembled panel.
 - c. Panels passively cooled via free-convection, unaided by fans or other means.
 4. Surface mounted

5. Switching:
 - a. Rated life of relay: Minimum 1,000,000 cycles.
 - b. Load switched in manner that prevents arcing at mechanical contacts when power is applied to and removed from load circuits.
 - c. Fully rated output continuous duty for inductive, capacitive, and resistive loads.
 - d. Module to integrate up to 4 individually controlled zones, each with a capacity of up to 16 amps, of high in-rush lighting load (magnetic fluorescent ballast, electronic fluorescent ballast, HID, incandescent, magnetic low-voltage, electronic low-voltage, neon/cold cathode and motor loads).
 6. Connection without interface to wired:
 - a. Occupancy sensors
 - b. Daylight sensors
 - c. IR receivers for personal control
 7. Connects to Lighting Management Panel via RS485.
 8. LED status indicators confirm communication with occupancy sensors, daylight sensors, and IR receivers.
 9. Thermal protection reports to Light Management System if module overheats.
 10. Contact Closure Input
 - a. Directly accept contact closure input from a dry contact closure or solid-state output without interface to:
 - 1) Activate scenes
 - 2) Enable or disable timeclock
 11. Emergency Contact Closure Input
 - a. Turn all zones to full output during emergency state via direct contact closure input from UL 924 Listed Emergency Lighting Interface, security system or fire alarm system
 - b. Allow configurable zone response during emergency state.
 - c. Disable control operation until emergency signal is cleared.
- C. [EcoSystem] Digital Fixture Lighting Control Module
1. Product: [QSN-2ECO-PS120]
 2. Mechanical:
 - a. Listed to UL 508 (United States) as industrial control equipment. CSA (Canada) certified, or NOM (Mexico) approved as applicable.
 - b. Delivered and installed as a [UL] [CSA] listed factory assembled panel.
 - c. Panels passively cooled via free-convection, unaided by fans or other means.
 3. Supports one or two independent links of up to 64 ballasts per link.
 4. Connect without interface to wired:
 - a. Occupancy sensors
 - b. Daylight sensors
 - c. IR receivers for personal control
 5. Connects to Lighting Management Panel via RS485.
 6. LED status indicators confirm communication with occupancy sensors, daylight sensors, and IR receivers.
 7. Thermal protection reports to Light Management System if module overheats.
 8. Contact Closure Input
 - a. Directly accept contact closure input from a dry contact closure or solid-state output without interface to:
 - 1) Activate afterhours mode
 - 2) Provide basic load shed functionality

9. Emergency Contact Closure Input
 - a. Turn all zones to full output during emergency state via direct contact closure input from UL 924 Listed Emergency Lighting Interface, security system or fire alarm system
 - b. Disable control operation until emergency signal is cleared.
10. Programming Connection:
 - a. Provide Ethernet input for wired connection to wireless router.
 - b. Provide ability for programming from an iPod touch or iPhone via wireless router.

2.6 LOW VOLTAGE CONTROL INTERFACES

- A. Contact Closure Interface:
 1. Product: QSE-IO
 2. The contact closure input device will accept both momentary and maintained contact closures.
 3. The contact closure output device can be configured for maintained or pulsed outputs.
- B. Contact Closure Input Interface:
 1. Product: QS seeTouch keypads Model QSWS2
 2. The contact closure input device will accept both momentary and maintained contact closures.
- C. Ethernet Interfaces:
 1. Product:QSE-CI-NWK-E
 2. Provide ability to communicate by means of
 - a. TCP/IP over Ethernet to GRAFIK Eye QS system by means of user-supplied PC or digital audiovisual equipment. Control to be located within 300 feet (100 meters) of Ethernet source.
 - b. RS232 serial communication to GRAFIK Eye QS series system by means of user-supplied PC or digital audiovisual equipment. Control to be located within 50 feet (15 meters) of RS232 source.
 3. Provide access to:
 - a. Scene selections.
 - b. Fade zone to a level.
 - c. Set level of shade(s).
 - d. Fine-tuning of preset levels with scene raise/lower.
 - e. Lock out scenes and zones.
 - f. Fine-tuning of light levels with individual zone raise/lower.
 - g. Fine-tuning of shade levels with individual zone raise/lower.
 - h. Enable/disable wall station.
 4. Provide status monitoring through button feedback and scene-status updates.
- D. DMX Interface
 1. Product: QSE-CI-DMX
 2. Provide ability to:
 - a. Map a single zone intensity from a GRAFIK Eye QS control unit to a single DMX512 channel
 - b. Map a single zone intensity from a GRAFIK Eye QS control unit to 3 DMX512 channels for RGB/CMY color-control
- E. Sensor Module:
 1. Product: [QSM2-4W-C], [QSM3-4W-C]:

2. Provide wired inputs for:
 - a. Occupancy sensors
 - b. Daylight sensors
 - c. IR receivers for personal control
 - d. Digital Ballast Wall Stations
3. Wireless Integration
 - a. Provide wireless communication inputs for:
 - 1) Occupancy sensors
 - 2) Daylight sensors
 - 3) Wireless Controller
 - b. Provide RF range of 18 meters (60 feet) line of sight or 9 meters (30 feet) through walls.
 - c. RF frequency of [434 MHz] [868 MHz]
4. Communicate sensor information to wired QS link for use by compatible devices.

2.7 ECOSYSTEM DIMMING BALLAST AND SWITCHING MODULES

A. Product: [C5-BMF-2A], [C5-BMJ-16A], [C5-XPJ-16A]

B. General

1. Continuous 3-Wire signal dimming to Lutron 3-Wire electronic dimming ballast.
2. Connect without interface to:
 - a. Occupant sensor (motion detector).
 - b. Daylight sensor.
 - c. Personal control input (wall station or infrared receiver).
3. Generate digital communication commands to distribute ballast and sensor data on the digital bus.
4. If power is interrupted and subsequently returned, lights automatically return to the setting prior to power interruption.
5. Each ballast responds independently to:
 - a. Up to 32 occupant sensors.
 - b. Up to 64 personal control inputs.
 - c. 2 daylight sensors.
6. Unique internal reference number visibly displayed on module cover.
7. Averages 2 independent daylight harvesting inputs internally.
8. Responds to digital load shed command
 - a. Sets high end trim.
 - b. Automatically scales light output proportional to load shed command.
 - 1) Example: If light output is at 30 percent and a load shed command of 10 percent is received, the ballast automatically sets the maximum light output at 90 percent and lowers current light output by 3 percent to 27 percent.
9. Electrical: Dimmer to meet limited short circuit test as defined in UL 20.
10. Provide integral fault protection to prevent ballast module failure in the event of a mis-wire.

C. [2 Amp (BMF) 3-Wire Ballast Module

1. Ballast module to integrate up to 2 amps of Lutron 3-wire electronic dimming ballast into an EcoSystem control system as a single zone.]

D. [16 Amp (BMJ) 3-Wire Ballast Module

1. Ballast module to integrate up to 16 amps of Lutron 3-wire electronic dimming ballast

into an EcoSystem control system as a single zone.]

E. [16 Amp (XPJ) Switching Ballast Module

1. Module to integrate up to 16 amps of high in-rush lighting load (magnetic fluorescent ballast, electronic fluorescent ballast, HID, incandescent, magnetic low-voltage, electronic low-voltage, neon/cold cathode and motor loads) into an EcoSystem control system as a single zone.]

2.8 SENSORS

A. Wireless Ceiling Occupancy/Vacancy Sensors

1. Product: [LRF2-OCRB-P-WH], [LRF2-VCRB-P-WH]
2. Wireless Ceiling Sensors shall:
 - a. Have an operational lifetime of 10 years without the need to replace batteries when installed per manufacturer's instructions.
 - b. Communicate directly to compatible RF receiving devices through use of a radio frequency communications link.
 - c. Not require external power packs, power wiring, or communication wiring.
 - d. Provide a clearly visible method of indication to verify that motion is being detected during testing and that the unit is communicating to compatible RF receiving devices.
 - e. Have a multiple segmented lens, with internal grooves to eliminate dust and residue build-up.
 - f. Utilize Infrared as its sensing mechanism coupled with Lutron XCT™ Technology for sensing fine motions. Signal processing technology detects fine-motion passive infrared (PIR) signals without the need to change the sensor's sensitivity threshold.
 - g. Have optional, readily accessible, user adjustable controls for timeout, automatic/manual-on, and sensitivity.
 - h. Have the ability to be placed in test mode to verify correct coverage and operation from the face of the unit.
 - i. Have a radio frequency range of up to 60' (18.3 m) between sensor and compatible RF receiving device(s).
 - j. Turn off lighting automatically after reasonable and adjustable time delay once the last person to occupy the space vacates a room or area.
 - k. Comply with the limits for a Class B device, pursuant to part 15 of the FCC rules.
 - l. Communicate with up to 10 compatible RF receiving devices.
3. Mounting:
 - a. Provide surface mounting bracket compatible with drywall, plaster, wood, concrete, compressed fiber ceilings.
 - b. Provide all necessary mounting hardware and instructions for both temporary and permanent mounting.
 - c. Provide temporary mounting means to allow user to check proper performance and relocate as needed before permanently mounting sensor. Temporary mounting method shall be designed for easy, damage-free removal.
 - d. Ceiling-mount wireless occupancy/vacancy sensors using passive infrared technology shall have a customizable mask to block off unwanted viewing areas.
 - e. Sensor lens shall illuminate during test mode when motion is detected to allow installer to verify coverage prior to permanent mounting.
4. Wireless occupancy/vacancy sensor can be programmed to operate as an occupancy sensor (automatic-on and automatic-off functionality), an occupancy sensor with low light feature (automatic-on when less than 1 fc (10 lux) of ambient light available and

automatic-off functionality), or a vacancy sensor (manual-on and automatic-off functionality).

5. A vacancy-only model shall be available to meet California Title 24 Energy Efficiency Standard requirements.

B. Wired Ceiling and Wall Mount Occupancy/Vacancy Sensors

1. Product: [LOS-CUS-500-WH], [LOS-CUS-1000-WH], [LOS-CUS-2000-WH], [LOS-CIR-450-WH], [LOS-CIR-1500-WH], [LOS-CDT-500-WH], [LOS-CDT-500R-WH], [LOS-CDT-1000-WH], [LOS-CDT-1000R-WH], [LOS-CDT-2000-WH], [LOS-CDT-2000R-WH], [LOS-WIR-WH], [LOS-WDT-WH], [LOS-WDT-R-WH].
2. Sensing mechanism:
 - a. [Infrared]: Utilize multiple segmented lens, with internal grooves to eliminate dust and residue build-up.
 - b. [Ultrasonic]: Utilize an operating frequency of 32kHz or 40kHz that shall be crystal controlled to operate within plus or minus 0.005 percent tolerance.
 - c. [Dual technology]:
 - 1) Utilize multiple segmented lens, with internal grooves to eliminate dust and residue build-up.
 - 2) Utilize an operating frequency of 32kHz or 40kHz that shall be crystal controlled to operate within plus or minus 0.005 percent tolerance.
3. Connect directly to EcoSystem ballast and modules without the need of a power pack or other interface
4. Sensors shall turn off or reduce lighting automatically after reasonable time delay when a room or area is vacated by the last person to occupy the space
5. Sensor shall accommodate all conditions of space utilization and all irregular work hours and habits.
6. Sensors shall be [UL], [CUL], [NOM] listed (as appropriate)
7. Sensors shall be fully adaptive and adjust their sensitivity and timing to ensure optimal lighting control for any use of the space
8. Sensors shall have field adjustable controls for time delay and sensitivity to override any adaptive features.
9. Power failure memory:
 - a. Controls incorporate non-volatile memory. Should power be interrupted and subsequently restored, settings and learned parameters saved in protected memory shall not be lost.
10. Provide all necessary mounting hardware and instructions.
11. Sensors shall be Class 2 devices.
12. Indicate viewing directions on mounting bracket for all Ceiling mount sensors.
13. Provide customizable mask to block off unwanted viewing areas for all ceiling mounted sensors using infrared technology.
14. Provide swivel mount base for all wall mount sensors.
15. [Provide an internal additional isolated relay with Normally Open, Normally Closed and Common outputs for use with HVAC control, Data Logging and other control options.]

C. Sensor Power Packs

1. Control wiring between sensors and control units shall be Class 2, 18-24 AWG, stranded U.L. Classified, PVC insulated or TEFLON jacketed cable suitable for use in plenums, where applicable.
2. For ease of mounting, installation and future service, power pack(s) shall be able to mount through a 1/2" knock-out in a standard electrical enclosure and be an integrated, self-contained unit consisting internally of an isolated load switching control relay and a transformer to provide low-voltage power. Transformer shall provide power to a

minimum of three (3) sensors.

3. Power pack shall be plenum rated

D. Infrared Receivers

1. Product: EC-IR-WH
2. Use Class 2 wiring for low voltage communication
3. Can be replaced without reprogramming
4. 360 degree reception of wireless infrared remote controls
5. Immediate local LED response upon reception of hand held transmitter communication
6. Constructed with plastic meeting UL94 HB
7. Mountable on lighting fixtures or recessed acoustical ceiling tiles
8. Constructed via sonic welding
9. Color:
 - a. Match NEMA WD1, Section 2 White
 - b. Color variation in same product family: Maximum $\Delta E=1$, CIE L^*a^*b color units
 - c. Visible parts: Exhibit ultraviolet color stability when tested with multiple actinic light sources as defined in ASTM D4674. Provide proof of testing upon request.

E. Interior Daylight Sensors

1. Wired Daylight Sensor
 - a. Product: EC-DIR-WH
 - b. Use Class 2 wiring for low voltage communication
 - c. Can be replaced without reprogramming
 - d. Open-loop basis for daylight sensor control scheme
 - e. Stable output over temperature from 0 degrees to 40 degrees C
 - f. Partially shielded for accurate detection of available daylight to prevent fixture lighting and horizontal light component from skewing sensor detection
 - g. Provide linear response from 0 to 500 foot-candles
 - h. Integral IR receiver for programming
 - i. Constructed with plastic meeting UL94 HB
 - j. Mountable on lighting fixtures or recessed acoustical ceiling tiles
 - k. Constructed via sonic welding
 - l. Color:
 - 1) Match NEMA WD1, Section 2 White
 - 2) Color variation in same product family: Maximum $\Delta E=1$, CIE L^*a^*b color units
 - 3) Visible parts: Exhibit ultraviolet color stability when tested with multiple actinic light sources as defined in ASTM D4674. Provide proof of testing upon request.
2. Wireless Daylight Sensor:
 - a. Product: LRF2-DCRB-WH
 - 1) Open-loop basis for daylight sensor control scheme
 - 2) Stable output over temperature from 0 degrees to 40 degrees C
 - 3) Partially shielded for accurate detection of available daylight to prevent fixture lighting and horizontal light component from skewing sensor detection
 - 4) Provide linear response from 0 to 10,000 foot-candles
 - b. Wireless Daylight Sensors shall:
 - 1) Have an operational lifetime of 10 years without the need to replace batteries when installed per manufacturer's instructions.
 - 2) Communicate directly to compatible RF receiving devices through use of a radio frequency communications link.

- 3) Not require external power packs, power wiring, or communication wiring.
- 4) Have the ability to be placed in test mode to verify correct operation from the face of the unit.
- 5) Have a radio frequency range of up to 18.3 meters (60 feet) between sensor and compatible RF receiving device(s).
- 6) Comply with the limits for a Class B device, pursuant to part 15 of the FCC rules.
- 7) Color:
 - a) Match NEMA WD1, Section 2 White
- c. Mounting:
 - 1) Provide surface mounting bracket compatible with drywall, plaster, wood, concrete, compressed fiber ceilings.
 - 2) Provide all necessary mounting hardware and instructions for both temporary and permanent mounting.
 - 3) Provide temporary mounting means to allow user to check proper performance and relocate as needed before permanently mounting sensor. Temporary mounting method shall be designed for easy, damage-free removal.
- d. Shall meet California Title 24 Energy Efficiency Standard requirements.

F. Exterior Daylight Sensors

1. Calibrated with independent turn-on and turn-off thresholds; minimum 2 foot-candles difference between the turn-on and turn-off thresholds.
2. Enclosed in weatherproof housing with shading and lens protection visor.

G. Infrared Partition Sensor

1. Product: GRX-IRPS-WH
2. Provide contact closure based on status of the partition wall (open/close).

2.9 ACCESSORIES

A. Emergency Lighting Interface:

1. Product: LUT-ELI
2. Provides total system listing to UL924 when used with Lutron GRAFIK Eye QS system.
3. Senses all three phases of building power.
4. Provides an output to power panels or Digital Ballast Interfaces if power on any phase fails.
5. Accepts a contact closure input from a fire alarm control panel.

B. Infrared Transmitters:

1. Provide wireless remote control.
2. Designed for use in conjunction with compatible infrared receiver and lighting control; compatibility dependent on that receiver, not transmitter.
3. Operate up to 15 meters (50 feet) within line-of-sight to that receiver.
4. "Learnable" by other variable frequency remote controls.

C. Wireless Controller

1. Product: Pico Wireless Controller
2. Electronics:
 - a. Communicate via radio frequency to wireless control units within 9.144-meter (30-foot) range.
3. Functionality:

- a. Upon button press, LED to immediately illuminate.
 - b. Allow for easy reprogramming without replacing unit.
 - c. Provide wireless remote control of lighting zones or lighting and shade scenes on a wireless control unit.
4. Mounting:
- a. Controller shall be capable of being mounted with a car visor clip, table stand or directly to a wall with a Claro screwless faceplate.
 - b. Provide faceplates with concealed mounting hardware.
5. Color:
- a. [Match NEMA WD1, Section 2.] [Custom color to be selected.]
 - b. Color variation in same product family: Maximum $\Delta E=1$, CIE L*a*b color units.
 - c. Visible parts: Exhibit ultraviolet color stability when tested with multiple actinic light sources as defined in ASTM D4674. Provide proof of testing upon request.

2.10 SOURCE QUALITY CONTROL

- A. Perform full-function testing on completed assemblies at end of line. Statistical sampling is not acceptable.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install equipment in accordance with manufacturer's installation instructions.
- B. Provide complete installation of system in accordance with Contract Documents.
- C. Define each dimmer's load type, shade settings, and set control functions.
- D. Provide equipment at locations and in quantities indicated on Drawings. Provide any additional equipment required to provide control intent.
- E. Mount exterior daylight sensors to point due north with constant view of daylight.
- F. Ensure that daylight sensor placement minimizes sensors view of electric light sources; ceiling mounted and fixture-mounted daylight sensors shall not have direct view of luminaries.
- G. [Systems Integration:
 - 1. Equipment Integration Meeting Visit (LSC-INT-VISIT)
 - a. Facility Representative to coordinate meeting between Facility Representative, Lighting Control System Manufacturer and other related equipment manufacturers to discuss equipment and integration procedures.]

3.2 STARTUP AND PROGRAMMING

- A. Provide factory-certified field service engineer to a site visit to ensure proper system installation and operation under following parameters:
 - 1. Qualifications for factory-certified field service engineer:
 - a. Minimum experience of 2 years training in the electrical/electronic field.
 - b. Certified by the equipment manufacturer on the system installed.
 - 2. Make a visit upon completion of installation of modular dimming control system:
 - a. Verify connection of power feeds and load circuits.
 - b. Verify connection and location of controls.

- c. Program system data.
- d. Verify proper connection of digital control link.
- e. Verify proper operation of manufacturers interfacing equipment.
- f. Obtain sign-off on system functions.
- g. User to be trained on system operation.

B. [After Hours Start-up (LSC-AH-SU)]

- 1. Provide factory certified Field Service Engineer to perform manufacturer's start-up procedures outside normal working hours (Monday through Friday, 7a.m. to 5 p.m.)]

C. Tech Support

- 1. Provide factory direct technical support hotline 24 hours per day, 7 days per week.

3.3 FIELD QUALITY CONTROL

A. [Manufacturer Services

1. Aim and Focus Visit (LSC-AF-VISIT)

- a. Facility Representative [_____] to coordinate on-site meeting with Lighting Control System Manufacturer and Lighting Design Consultant to make required lighting adjustments to the system for conformance with the Lighting Design Consultant's original design intent.]

3.4 CLOSEOUT ACTIVITIES

A. [Training Visit (LSC-TRAINING)

- 1. Lighting Control System Manufacturer to provide [1] [] day additional on-site system training to site personnel.]

B. [On-site Walkthrough (LSC-WALK)

- 1. Lighting Control System Manufacturer to provide a factory certified Field Service Engineer to demonstrate system functionality to the Commissioning Agent.]

3.5 MAINTENANCE

A. Capable of providing on-site service support within 24 hours anywhere in continental United States and within 72 hours worldwide except where special visas are required.

B. Offer renewable service contract on yearly basis, to include parts, factory labor, and annual training visits. Make service contracts available up to ten years after date of system startup.

C. [System Optimization Visit (LSC-SYSOPT)

- 1. Lighting Control System Manufacturer to visit site [6] [] months after system start-up to evaluate system usage and discuss opportunities to make efficiency improvements that will fit with the current use of the facility.]

