PART 1 - GENERAL

1.1 RELATED DOCUMENTS

Refer to electrical drawings for additional information.

1.2 SUMMARY

1. The lighting control system specified in this section shall provide time-based, sensor-based (both occupancy and daylight), and manual lighting control.
2. The system shall be capable of turning lighting loads on/off as well as dimming lights (if lighting load is capable of being dimmed).
3. All system devices shall be networked together enabling digital communication and shall be individually addressable.
4. The system architecture shall be capable of enabling stand-alone groups (rooms) of devices to function in some default capacity even if network connectivity to the greater system is lost.
5. The system architecture shall facilitate remote operation via a computer connection.
6. The system shall not require any centrally hardwired switching equipment.
	1. DEFINITIONS

Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling and power-limited circuits.

1.4 SUBMITTALS

1. Product Data: For each type of product indicated. Include construction bill of materials, product data sheets, installation details, material descriptions, hardware and software operation manuals, dimensions of individual components and profiles, and finishes for control modules, power distribution components, manual switches and plates, and conductors and cables.
2. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
3. Dimensioned drawings of lighting control system and accessories including, but not limited to, relay panels, switches, digital time clock, photocells and other interfaces. Indicated exact location of each device or provide RFI to confirm location.
4. Detail equipment assemblies and indicate dimensions, weights, loads, required, clearances, method of field assembly, components, and location and size of each field connection.
5. Outline Drawings: Indicate dimensions, weights, arrangement of components, and clearance and access requirements.
6. Block Diagram: Show interconnections between components specified in this Section and devices furnished with power distribution system components. Indicate data communication paths and identify networks, data buses, data gateways, bridges, and other devices to be used. Describe characteristics of network and other data communication lines.
7. Wiring Diagrams: For power, signal, and control wiring. Coordinate nomenclature and presentation with a block diagram. Indicate the type, size and number of conductors between each component Submittals that show typical riser diagrams are not acceptable.
8. Example Contractor Startup/Commissioning Worksheet - must be completed prior to factory start-up.
9. Coordination Drawings: Submit evidence that lighting controls are compatible with connected monitoring and control devices and systems specified in other Sections.
	1. Show interconnecting signal and control wiring and interfacing devices that prove compatibility of inputs and outputs.
	2. For networked controls, list network protocols and provide statements from manufacturers that input and output devices meet interoperability requirements of the network protocol.
10. Software and Firmware Operational Documentation:
11. Software operating and upgrade manuals
12. Program Software Backup: On a magnetic media or compact disc, complete with data files
13. Device address list
14. Printout of software application and graphic screens
15. Field quality-control reports
16. Software licenses and upgrades required by and installed for operation and programming of digital and analog devices.
17. Operation And Maintenance Manuals:
	1. Submit operation and maintenance manuals. Complete manuals shall be bound in flexible binders and data shall be typewritten or drafted.
	2. Manuals shall include instructions necessary for proper operation and servicing of system and shall include complete wiring circuit diagrams of system, wiring destination schedules for circuits and replacement part numbers. Manuals shall include as-built cable Project site plot plans and floor plans indicating cables, both underground and in each building with conduit, and as-built coding used on cables. Programming forms of systems shall be submitted with complete information.
18. Warranty: A copy of the Manufacturer's warranty document for this project
19. Specification Conformance: Clearly indicate one of the following conditions:
	1. The equipment and systems submitted conform exactly to project specifications and drawings.
	2. The equipment and systems submitted meet the intent of the specification via an alternate means.
		* 1. Provide a detailed statement indicating paragraph by paragraph and line by line wherein the equipment submitted deviates from the specifications.
			2. Note all variations from the specified system on the Shop Drawings in ' high bold notations.
	3. Provide a narrative confirming specified function and detailing alternate means for achieving specified function

1.5 QUALITY ASSURANCE

1. Source Limitations: Obtain lighting control module and power distribution components through one source from a single manufacturer.
2. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a Nationally Recognized Testing Agency acceptable to authorities having jurisdiction, and marked for intended use.
3. Control wiring shall be in accordance with the NEC requirements for Class 2 remote control systems, Article 725 and manufacturer specification.
4. A licensed electrician shall functionally test each system component after installation, verify proper operation and confirm that all lighting control system wiring and installation requirements conform to the Manufacturer's documentation. The Electrical Contractor (EC) is required to phone Sensor Switch a minimum of 7 days before turnover for system checkout. At time of Sensor Switch contact, all components to include CAT 5 connection to Owner network must be installed, powered and operational.
5. Comply with NFPA 70.and all local and state codes as applicable to electrical wiring work.
6. Lighting control panels controlling emergency circuits shall be ETL listed to UL 924. Emergency source circuits controlled in normal operation by a relay panel shall fully comply with NEC 700.10(b). Electrical contractor is responsible for verifying compliance.
7. All steps in sensor manufacturing process shall occur in the USA; including population of all electronic components on circuit boards, soldering, programming, wiring, and housing.
8. All components and the manufacturing facility where product was manufactured must be ROHS compliant
9. The lighting control system shall be listed, approved and comply as required with all national, state and local energy codes to include but not limited to ASHRAE 90.1-2013.

1.6 COORDINATION

1. Coordinate lighting control components to form an integrated interconnection of compatible components.
2. Coordinate and tune daylight sensor.
3. The installing Contractor shall be responsible for a complete and functional system in accordance with all applicable local and national codes.

1.7 EXTRA MATERIALS

1. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
2. Bridge: Equal to 10 percent of amount installed for each size indicated, but no fewer than 2.
3. Wall Pods with Dimming: Equal to 10 percent of amount installed for each size indicated, but no fewer than 6.
4. Wall Pods ON/OFF: Equal to 10·percent of amount installed for each size indicated, but no fewer than 4.
5. Photocells: Equal to 10 percent of amount installed for each size indicated, but no fewer than 6.
6. Occupancy Sensors: Equal to 10 percent of amount installed for each size indicated, but no fewer than 6.
7. Power Packs: Equal to 10 percent of amount installed for each size indicated, but no fewer than 6.
8. Provide CD version of manufacturers operating software to include graphical interface software.
9. Provide two (2) extra sets of as-built and operating manuals.

1.8 WARRANTY

Special Warranty: Manufacturers standard form in which manufacturer agrees to repair or replace components of lighting controls that fail in materials or workmanship or from transient voltage surges within specified warranty period.

1. Failures include, but are not limited to, the following:
	* + 1. Failure of software input/output to execute switching or dimming commands.
			2. Failure of modular relays to operate under manual or software commands.
			3. Damage of electronic components due to transient voltage surges.
2. Warranty Period: Five years from date of Substantial Completion for all devices in lighting control system.

1.9 SOFTWARE SERVICE AGREEMENT

1. Technical Support: Beginning with Substantial Completion, provide software support for five (5) years.
2. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within five (5) years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of the software. Provide 30 days’ Notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

1. This specification is based on the “nLight” Network Control System from Sensor Switch, an Acuity Brands Company (800-727-7483, www.sensorswitch.com).
2. Alternative Manufactures:
3. Watt Stopper
4. Lutron

2.2 SYSTEM REQUIREMENTS

1. System shall have an architecture that is based upon three main concepts; 1) intelligent lighting control devices 2) standalone lighting control zones 3) network backbone for remote or time based operation.
2. Intelligent lighting control devices shall consist of one or more basic lighting control components; occupancy sensors, photocell sensors, relays, dimming outputs, manual switch stations, and manual dimming stations. Combining one or more of these components into a single device enclosure should be permissible so as to minimize overall device count of system.
3. System must interface directly with intelligent LED luminaires such that only CAT 5e cabling is required to interconnect luminaires with control components.
4. Intelligent lighting control devices shall communicate digitally, require -2 mA of current to function (Graphic Wall Pod excluded), and possess at least two RJ-45 connectors.
5. Lighting control zones shall consist of one or more intelligent lighting control components, be capable of stand-alone operation, and be capable of being connected to a higher level network backbone.
6. Devices within a lighting control zone shall be connected with CAT-5 low voltage cabling, in a daisy-chain fashion, and in any order.
7. Lighting control zone shall be capable of automatically configuring itself for default operation without any start-up labor required.
8. Individual lighting zones must continue to provide a user defined default level of lighting control in the event of a system communication failure with the backbone network or the management software becoming unavailable.
9. Power for devices within a lighting control zone shall come from either resident devices already present for switching or dimming purposes (relay device), controls enabled luminaires, or from the network backbone. Standalone "bus power supplies" shall not be required in all cases.
10. All switching and dimming for a specific lighting zone shall take place within the devices located in the zone itself (i.e. not in a remotely located devices such as panels) to facilitate system robustness and minimize wiring requirements. Specific applications that require centralized or remote switching shall be capable of being accommodated.
11. System shall have a primary wall mounted network control "gateway" device that is capable of accessing and controlling all other system devices and linking into an Ethernet LAN.
12. System shall use "bridge" devices that route communication and distribute power for up to 8 lighting zones together for purposes of decreasing system wiring requirements.
13. System shall have a web-based software management program that enables remote system control, status monitoring, and creation of lighting control profiles.
14. Individual lighting zones shall be capable of being segmented into several channels of occupancy, photocell, and switch functionality for more advanced configurations and sequences of operation.
15. System shall be capable of operating a lighting control zone according to several sequences of operation:
16. Auto-On I Auto-Off (via occupancy sensors)
17. Manual-On I Auto-Off
18. Auto-to-Override On
19. Manual-to-Override On
20. Auto On/Predictive Off
21. Multi-Level On (multiple lighting levels per manual button press)
22. A taskbar style application shall be available for individual lighting control.
23. Control software shall enable logging of system performance data.
24. Control software shall enable a basic level of integration with a BAS.

2.3 INDIVIDUAL DEVICE SPECIFICATIONS

1. Control Module (Gateway)
	1. Module shall be a wall mounted user accessible device that is capable of communicating and controlling downstream system control devices and linking into an Ethernet.
	2. Gateway shall consist of a control unit and graphic touch screen. Both devices shall mount to 4" square boxes with or without device rings.
	3. User control shall be made available via finger-touch buttons with no moving parts. Buttons shall be capable of being locked for security.
	4. Device shall have three RJ-45 ports for connection to other backbone devices (bridges) or directly to a lighting control zones devices.
	5. Device shall automatically detect all devices downstream of it.
	6. Device shall have a standard and astronomical internal time clock.
	7. Device shall have one RJ-45 10/100 BaseT Ethernet connection.
	8. Each control gateway device shall be capable of linking 1500 devices to the management software.
	9. Device shall be capable of using a dedicated or DHCP assigned IP address.
	10. Network Control Gateway device shall be the following Sensor Switch model number: nGWY2.
2. Network System Occupancy Sensors
	1. Occupancy sensors system shall sense the presence of human activity within the desired space and fully control the on/off function of the lights.
	2. Sensors shall utilize passive infrared (PIR) technology, which detects occupant motion, to initially turn lights on from an off state; thus preventing false on conditions.
	3. For applications where a second method of sensing is necessary to adequately detect maintained occupancy (such as in rooms with obstructions), a sensor with an additional "dual" technology shall be used.
	4. Dual technology sensors shall have one of its two technologies not require motion to detect occupancy. Acceptable dual technology includes PIR/Microphonics (also known as Passive Dual Technology or PDT) which both looks for occupant motion and listens for sounds indicating occupants.
	5. Sensors shall be available with zero, one, or two integrated Class 1 switching relays, and up to one 0-10 VDC dimming output. Sensors shall be capable of switching 120/277 VAC. Load ratings shall be 800 W@ 120 VAC, 1200 W@ 277 VAC, and ' HP motor. Relays shall be dry contacts.
	6. Sensors shall be available with one or two occupancy "poles", each of which provides a programmable time delay.
	7. Sensors shall be available in multiple lens options which are customized for specific applications.
	8. Communication and Class 2 low voltage power shall be delivered to each device via standard CAT-5 low voltage cabling with RJ-45 connectors.
	9. All sensors shall have two RJ-45 ports.
	10. Every sensor parameter shall be available and configurable remotely from the software and locally via the device push-button.
	11. Sensors shall be able to function together with other sensors in order to provide expanded coverage areas by simply daisy-chain wiring together the units with CAT-5 cabling.
	12. Sensors shall be equipped with an automatic override for 100 hour burn-in of lamps. This feature must be available at any time for lamp replacements.
	13. Wall switch sensors shall recess into single-gang switch box and fit a standard GFI opening.
	14. Wall switch sensors must meet NEC grounding requirements by providing a dedicated ground connection and grounding to mounting strap. Line and load wire connections shall be interchangeable. Sensor shall not allow current to pass to the load when sensor is in the unoccupied (Off) condition.
	15. Wall switch sensors shall have optional features for photocell/daylight override, vandal resistant lens, and low temperature/high humidity operation.
	16. Wall switch sensors shall be available in four standard colors (Ivory, White, Almond, and Gray). Final color selection by architect.
	17. Wall switch sensors shall be the following Sensor Switch model numbers, with device color and optional features as specified:
3. nWSX (PIR, 1 Relay)
4. nWSX-PDT-LV (Dual Technology, No Relay)
5. nWSX-PDT (Dual Technology, 1 Relay)
6. nWSX-PDT-2P (Dual Technology, 2 Relays)
7. nWSX-LV (PIR, No Relay)
8. nWSX-LV-NL (PIR w/ Night Light, No Relay)
9. nWSX-PDT-LV-NL (Dual Technology w/ Night Light, No Relay)
10. nWSX-LV-DX (PIR, No Relay, Raise/Lower Dimming Control)
11. nWSX-PDT-LV-DX (Dual Tech, No Relay, Raise/Lower Dimming Control)
	1. Network system shall also have ceiling, fixture, recessed, & corner mounted sensors available.
	2. Network system shall have sensors that can be embedded into luminaire such that only the lens shows on the luminaire face.
	3. Embedded sensors shall be capable of both PIR and Dual Technology occupancy detection.
	4. Embedded sensors shall have an optional photocell.
	5. Embedded sensors shall be the following nLight model number:
		1. nES 7 (PIR, no relay)
		2. nES 7 ADCX (PIR w/ photocell, no relay)
		3. nES PDT 7 (Dual Technology, no relay)
		4. nES PDT 7 (Dual Technology, w/ photocell, no relay)
	6. Sensors shall have optional features for photocell/daylight override, dimming control, and low temperature/high humidity operation.
	7. Sensors with dimming can control 0 to 10 VDC dimmable ballasts/drivers by syncing up to 20 mA of Class 2 current (typically 40 or more ballasts).
	8. Sensors shall be the following nLIGHT model numbers, with device options as specified:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Model # Series | Occupancy Poles | # of Relays | Lens Type | Detection Technology |
| nCM(B) 9 | 1 | - | Standard | PIR |
| nCM(B) 9 2P | 2 | - | Standard | PIR |
| nCM-9-RJB | 1 | - | Standard | PIR |
| nCM-9-2P-RJB | 2 | - | Standard | PIR |
| nCM(B)-PDT-9 | 1 | - | Standard | Dual |
| nCM(B)-PDT-9-2P | 2 | - | Standard | Dual |
| nCM(B)-PDT-9-RJB | 1 | - | Standard | Dual |
| nCM(B)-PDT-9-2P-RJB | 2 | - | Standard | Dual |
| nCM(B)-10 | 1 | - | Extended | PIR |
| nCM(B)-10-2P | 2 | - | Extended | PIR |
| nCM-10-RJB | 1 | - | Extended | PIR |
| nCM-10-2P-RJB | 2 | - | Extended | PIR |
| nCM(B)-PDT-10 | 1 | - | Extended | Dual |
| nCM(B)-PDT-10-2P | 2 | - | Extended | Dual |
| nCM-PDT-10-RJB | 1 | - | Extended | Dual |
| nCM-PDT-10-2P-RJB | 2 | - | Extended | Dual |
| nWV-16 | 1 | - | Wide View | PIR |
| nWV-PDT-16 | 1 | - | Wide View | Dual |
| nHW-13 | 1 | - | Hallway | PIR |

Note: Recessed mount versions of the above ceiling (fixture) mount versions also shall be available (e.g. nCM PC => nRM PC)

1. Network System Daylight (Photocell and or Dimming) Sensors
	1. Photocell shall provide for an on/off set-point, and a dead band to prevent the artificial light from cycling. Delay shall be incorporated into the photocell to prevent rapid response to passing clouds.
	2. Photocell and dimming sensor's set-point and dead band shall be automatically calibrated through the sensor's microprocessor by initiating an "Automatic Set-point Programming" procedure. Min and max dim settings as well as set-point may be manually entered.
	3. Dead band setting shall be verified and modified by the sensor automatically every time the lights cycle to accommodate physical changes in the space (i.e., furniture layouts, lamp depreciation, or lamp outages).
	4. Dimming sensors shall control 0 to 10 VDC dimmable ballasts by syncing up to 20 mA of class 2 current (typically 40 or more ballasts).
	5. Photocell and dimming sensors shall be equipped with an automatic override for 100 hour burn-in of lamps. This feature must be available at any time for lamp replacements. (Note: This function should be performed prior to any dimming of the lamps including the "auto set-point" setting.)
	6. Combination units that have all features of on/off photocell and dimming sensors shall also be available.
	7. A dual zone option shall be available for On/Off Photocell, Automatic Dimming Control, Photocell, or Combination units. The second zone shall be capable of being controlled as an "offset" from the primary zone.
	8. Line voltage versions of the above described photocell and combination photocell/dimming sensors shall be capable of switching both 120 VAC, 277 VAC, and 347 VAC. Load ratings shall be 800 W@ 120 VAC, 1200 W@ 277 VAC, 1500 W@ 347 VAC, and' HP motor load . Relays shall be dry contacts.
	9. Sensor shall be the following Sensor Switch model numbers, with device options as specified:
2. nRM PC (On/Off)
3. nRM ADCX (Remote Automatic Dimming Control Photocell)
4. nRM ADCX DZ (Remote Automatic Dimming Control Photocell)
5. nRM PC DZ (On/Off, Dual Zone)

Note: Recessed mount versions of the above ceiling (fixture) mount versions also shall be available (e .g. nCM PC => nRM PC)

1. Networked Power (Relay) Packs
	1. Power Pack shall incorporate one or more Class 1 relays and contribute low voltage power to the rest of the system. Slave Packs shall incorporate the relay{s), shall have an optional 2nd relay or 0-10 VDC dimming output, but shall not be required to contribute system power. Power Supplies shall provide system power only, but are not required to switch line voltage circuit. Auxiliary Relay Packs shall switch low voltage circuits only.
	2. Power Packs shall accept 120 or 277 VAC, be plenum rated, and provide Class 2 power to the system.
	3. All devices shall have two RJ-45 ports.
	4. Every Power Pack parameter shall be available and configurable remotely from the software and locally via the device push-button.
	5. Power Pack shall securely mount to junction location through a threaded 1/2 inch chase nipple. Plastic clips into junction box shall not be accepted. All Class 1 wiring shall pass through chase nipple into adjacent junction box without any exposure of wire leads. Note: UL Listing under Energy Management or Industrial Control Equipment automatically meets this requirement, whereas Appliance Control Listing does not meet this safety requirement.
	6. When required by local codes, Power Pack must install inside standard electrical enclosure and provide UL recognized support to junction box. All Class 1 wiring is to pass through chase nipple into adjacent junction box without any exposure of wire leads.
	7. Class 1 Relays used in Power (Slave) Packs shall provide 16 Amp switching of all load types, and be rated for 400,000 cycles.
	8. Power (Relay) Packs and Supplies shall be the following Sensor Switch model numbers:
2. nPP16 (Power Pack w/ relay)
3. nPP16 D (Power Pack w/ relay and 0-10v Dimming)
4. nPP16 ER (Emergency Power Pack w/ relay)
5. nPP16 D ER (Emergency Power Pack w/ relay and 0-10V Dimming)
6. nSP16 (Secondary Pack w/ relay)
7. nSP5 PCD ELV 120 (Secondary Phase Dimming Pack)
8. nPS 80/150/250 (80 /150 / 250 mA Power Supply)
9. nPS 250 (250 mA Power Supply)
10. nAR 40 (Low voltage auxiliary relay pack)
11. Wall Switches & Dimmers
	1. Devices shall recess into single-gang switch box and fit a standard GFI opening.
	2. Devices shall be available with zero or one integrated Class 1 switching relay.
	3. Communication and Class 2 low voltage power shall be delivered to each device via standard CAT-5 low voltage cabling with RJ-45 connectors.
	4. All sensors shall have two RJ-45 ports.
	5. All devices shall provide toggle switch control. Dimming control and low temperature/high humidity operation are available options.
	6. Devices shall be available in four colors (Ivory, White, Almond, and Gray). Final color selection by architect.
	7. Devices with dimming control outputs can control 0 to 10 VDC dimmable ballasts by syncing up to 20 mA of Class 2 current (typically 40 or more ballasts).
	8. Wall switches & dimmers shall be the following nLight model numbers, with device options as specified:
12. nPODM (single on/off)
13. nPODM DX (single on/off & raise/lower)
14. nPODM 2P (2-pole on/off)
15. nPODM 2P DX (2-pole on/off & raise/lower)
16. nPODM 4P (4-pole on/off)
17. nPODM 4P DX (4-pole on/off and raise/lower)
18. nPODM 2L (2 level)
19. nPODM 4L DX (4 level and raise/lower)
20. nPODM 2L AB (Hi/Lo Step Control for [2] relay packs)
21. Graphic Wall Station
	1. Device shall have a 3.5" full color touch screen for selecting up to 16 programmable lighting control presets or acting as up to 16 on/off/dim control switches.
	2. Device shall enable configuration of lighting presets, switches, and dimmers via password protected setup screens.
	3. Device shall enable user supplied .jpg screen saver image to be uploaded.
	4. Device shall surface mount to single-gang switch box
	5. Device shall have a micro-USB style connector for local computer connectivity.
	6. Device shall have two RJ-45 ports for communication.
	7. Device shall be the following Sensor Switch model number: nPOD GFX.
22. Scene Controller
	1. Device shall have two, three, four, or eight buttons for selecting programmable lighting control profiles or acting as on/off switches.
	2. Device shall recess into single-gang switch box and fit a standard GFI opening.
	3. Device shall provide LED user feedback.
	4. Communication and Class 2 low voltage power shall be delivered to each device via standard CAT-5 low voltage cabling with RJ-45 connectors.
	5. All sensors shall have two RJ-45 ports.
	6. Device shall be capable of reprogramming other devices in its zone so as to implement user selected lighting scene.
	7. Device shall be capable of selecting a lighting profile to be run by the system’s upstream gateway so as to implement selected lighting profile across multiple zones (and not just its local zone).
	8. Device shall have LEDs indicating current selection.
	9. Scene Selector device shall be the following nLight model number:
23. nPODM 2S (2 Scene, Push Button)
24. nPODM 4S (4 Scene, Push Button)
25. nPODM 4S DX (4 Scene, Push Button, On/Off/Raise/Lower)
26. nPODM 2L (2 Adjustable Preset Levels, Push Button, On/Off)
27. nPODM 2L AB (2 Scene, Push Button, On/Off/High/Low)
28. nPODM 4L (4 Adjustable Preset Levels, Push Button, On/Off/Raise/Lower)
29. Communication Bridges
	1. Device shall surface mount to a standard 4" x 4" square junction box.
	2. Device shall have 8 RJ-45 ports.
	3. Device shall be capable of aggregating communication from multiple lighting control zones for purposes of minimizing backbone wiring requirements back to Control Gateway.
	4. Device shall be powered with Class 2 low voltage supplied locally via a directly wired power supply or delivered via a CAT-5 cabled connection.
	5. Device shall be careful of redistributing power from its local supply and connect lighting control zones with excess power to lighting control zones with insufficient local power. This architecture also enables loss of power to a particular area to be less impactful on network lighting control system.
	6. Communication Bridge devices shall be the following nLight model numbers:

nBRG 8 (8 Ports)

2.5 LIGHTING CONTROL PROFILES

1. Changes to the operation of the system shall be capable of being made in real-time or scheduled via lighting control profiles. These profiles are outlines of settings that direct how a collection of devices function for a defined time period.
2. Lighting control profiles shall be capable of being created and applied to a single device, zone of devices, or customized group of zones.
3. All relays and dimming outputs shall be capable of being scheduled to track or ignore information regarding occupancy, daylight, and local user switches via lighting control profiles.
4. Every device parameter (e .g. sensor time delay and photocell set-point) shall be configurable via a lighting control profile.
5. All lighting control profiles shall be stored on the network control gateway device and on the software's host server.
6. Lighting control profiles shall be capable of being scheduled to run according to the following calendar options: start date/hour/minute, end date/hour/minute, and sunrise/sunset +/- timed offsets.
7. Sunrise/sunset times shall be automatically derived from location information using an astronomical clock.
8. Daylight savings time adjustments shall be capable of being performed automatically, if desired.
9. Lighting control profile schedules shall be capable of being given the following recurrence settings: daily, weekday, weekend, weekly, monthly, and yearly.
10. Software shall provide a graphical tool for easily viewing scheduled lighting control profiles.

2.6 NETWORKED LED LUMINAIRES

1. ­Networked LED luminaire shall have a mechanically integrated control device

1. Networked LED luminaire shall have two RJ-45 ports available (via control device directly or incorporated RJ-45 splitter)

1. Networked LED luminaire shall be able to digitally network directly to other network control devices (sensors, photocells, switches, dimmers)
2. Networked LED luminaire shall provide low voltage power to other networked control devices (excluding EMG versions)
3. System shall be able to turn on/off specific LED luminaires without using a relay, if LED driver supports “sleep mode”

1. System shall be able to maintain constant lumen output over the specified life of the LED luminaire (also called lumen compensation) by varying the input control power (and thus saving up to 20% power usage)

1. System shall indicate (via a blink warning) when the LED luminaire has reached its expected life (in hrs.)

 2.7 MANAGEMENT SOFTWARE

1. Every device parameter (e.g. sensor time delay and photocell set-point) shall be available and configurable remotely from the software.
2. The following status monitoring information shall be made available from the software for all devices for which it is applicable: current occupancy status, current PIR Status, current Microphonic Status, remaining occupancy time delay(s), current photocell reading, current photocell inhibiting state, photocell transitions time remaining, current dim level, device temperature, and device relay state(s).
3. The following device identification information shall be made available from the software: model number, model description, serial number, manufacturing date code, custom label(s), and parent network device.
4. A printable network inventory report shall be available via the software.
5. Software shall require all users to login with a User Name and Password.
6. Software shall provide at least three permission levels for users.
7. All sensitive stored information and privileged communication by the software shall be encrypted.
8. All device firmware and system software updates must be available for automatic download and installation via the internet.
9. Software shall be capable of managing systems interconnected via a WAN (Wide Area Network).

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION

During construction process, protect all components from moisture, damage, dust, and debris. Any damage done to electronic components due to non-protection shall be the sole responsibility of the installing contractor.

3.2 WIRING INSTALLATION

1. Comply with NECA 1
2. Wiring Method: Comply with requirements in Section 26 05 19 "Building Wire and Cable." Provide Manufacturer recommended control wiring exposed above ceilings or in conduit for non-accessible ceiling areas or in walls from switches up to accessible ceilings. Control wiring shall be plenum rated. Minimum conduit size for wiring in non-accessible ceiling areas shall be 3/4 inch. Provide bushings on open conduit ends and box knock-outs to protect wiring. Support control wiring in accessible ceilings using J-hooks, provided every four feet and within 24 inches from boxes, devices, luminaries, or system components. Do not support wiring from ceiling or other system supporting components.
3. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.
4. Size conductors according to lighting control device Manufacturer's written instructions unless otherwise indicated.
5. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.
6. Bending Radius of Wiring: Follow manufacturer's recommendations for bending radius of low voltage wiring.

3.3 IDENTIFICATION

1. Comply with requirements in Section 26 05 53 "Electrical Identification" for identifying components and power and control wiring.
2. Label each Network Lighting Control System module, component, device, junction box, and conduit with a unique designation.
3. Label each scene control button with approved scene description.

3.4 FIELD QUALITY CONTROL

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, startup, program, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.
2. Perform tests and inspections and prepare test reports.
3. Tests and Inspections:
	1. Continuity tests of circuits.
	2. Contractor to test all low voltage cable for integrity and proper operation prior to turn over. Verify with system manufacturer all wiring and testing requirements.
	3. Field-test all Cat 5 cables with a recognized cable tester.
	4. Operational Test: Set and operate controls to demonstrate their functions and capabilities in a methodical sequence that cues and reproduces actual operating functions.

Include testing of dimming controls, low voltage switching, daylighting, occupancy sensing, and vacancy sensing control equipment under conditions that simulate actual operational conditions. Record control settings, operations, cues, and functional observations.

1. Lighting controls will be considered defective if they do not pass tests and inspections.
2. Remove and replace malfunctioning modular dimming control components and retest as specified above.
3. Test Labeling: After satisfactory completion of tests and inspections, apply a label to tested components indicating test results, date, and responsible agency and representative. Install label on interior of outlet box or wall plate.
4. Reports: Written reports of tests and observations. Record defective materials and workmanship and unsatisfactory test results. Record repairs and adjustments.

3.5 ADJUSTING

Occupancy Adjustments: When requested within 11 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two (2) visits to Project during other-than-normal occupancy hours for this purpose.

3.6 START-UP FEATURES

A. To facilitate start-up, all devices daisy-chained together (using CAT-5) shall automatically be grouped together into a functional lighting control zone.

B. All lighting control zones shall be able to function according to default settings once adequate power is applied and before any system software is installed.

C. Once software is installed, system shall be able to auto-discover all system devices without requiring any commissioning.

D. All system devices shall be capable of being given user defined names.

E. All devices within the network shall be able to have their firmware reprogrammed remotely and without being physically uninstalled for purposes of upgrading functionality at a later date.

F. Set-up, commissioning of the lighting control system includes:

* 1. Confirmation of entire system operation and communication to each device.
	2. Confirmation of operation of individual switches, occupancy sensors, and daylight sensors.
	3. Confirmation of system Programming, scheduling, photocell settings and tuning, and override settings, etc.

3.7 DEMONSTRATION

1. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain lighting controls. Provide 2 hours of factory on-site training minimum.
2. Owner instruction includes:
	1. Confirmation of entire system operation and communication to each device.
	2. Confirmation of operation of individual relays, switches, occupancy sensors and daylight sensors
	3. Confirmation of system Programming, photocell settings, override settings, etc.
	4. Provide training to cover installation, maintenance, troubleshooting, programming, and repair and operation of the lighting control system.

3.8 CLEANING

1. On completion of installation, inspect interior and exterior of panel boards. Remove paint splatters and other spots. Vacuum dirt and debris from interior; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.
2. Clean photocell lens as recommended by manufacturer.
3. Clean all switch faceplates.

**END OF SECTION**