

## SECTION 16575 – SITE LIGHTING CONTROL SYSTEM

### PART 1 – GENERAL

#### 1.1 RELATED DOCUMENTS

- A. All of the Contract Documents, as listed on the Table of Contents and including General and Supplementary Conditions and Division 1, General Requirements, shall be included in, and made part of, this Section.

#### 1.2 DESCRIPTION OF WORK

- A. Furnish and install a complete lighting control system. System shall include lighting control relays and microprocessor based programmable lighting controllers. They system shall include switches and other control devices as required including, but not limited to, wire, conduit and other materials required for the installation. Exact quantities and equipment configurations shall be determined by the equipment manufacturer based on plans, specifications and control schedules. The system shall be provided with interface protocols to allow integration with BMS.
- B. The work under this Contract shall also include all labor, materials, tools, equipment, transportation, insurance, temporary protection, supervision and incidental items essential for proper installation and operation, even though not specifically mentioned or indicated on the drawings, but which are usually provided or are essential for proper installation and operation of all systems as indicated on the drawings and specified herein.
- C. The specifications and drawings describe the minimum requirements that must be met by the Electrical Subcontractor for the installation of all work as shown on the drawings and as specified hereinunder.
- D. Provide all required programming start and training for the entire system.

#### 1.3 RELATED WORK

- A. For work to be included as part of this Section, to be furnished and installed by the Electrical Subcontractor, refer to the following Sections:
  - 1. Section 16010 – Electrical Special Conditions
- B. Carefully examine all of the Contract Documents, criteria sheets and all other Sections of the specifications for requirements which affect work under this Section, whether or not such work is specifically mentioned in this Section.

#### 1.4 REFERENCES

- A. The control panels shall be tested and listed under the UL 916 Energy Management Equipment standards by a nationally recognized testing laboratory
- B. The control system shall comply with all applicable National Electrical Codes regarding electrical wiring standards.
- C. The control system shall comply with all applicable portions of the NEMA standards regarding the types of electrical equipment enclosures.
- D. All control equipment shall undergo strict inspection standards. The equipment shall be previously tested and burned-in at the factory prior to installation.

#### 1.5 QUALITY ASSURANCE

- A. The manufacturers listed within this specification have been preselected for use on this project. No submittal will be accepted from a manufacturer other than specified.
- B. To ensure system compatibility, all components of the lighting control system including panels, relays, etc. shall be the products of one manufacturer.

#### 1.6 WARRANTY

- A. Attention is directed to provisions of the General Requirements, Supplementary General Requirements, Section 01784 - Warranties and Section 16010 – Electrical Special Conditions regarding guarantees and warranties for the work under this Contract.
- B. The manufacturer shall warrant each new system for a period of two (2) years from the date of start-up of the equipment by one of the manufacturer's representatives, to be free from defects in the material and workmanship under the conditions of normal use and specified ambient temperature when installed and operated under the manufacturer's product specifications in accordance with the applicable National Electrical Code and Safety of Standards of Underwriter's Laboratory.
- C. This warranty covers the diagnostics of problems with the lighting control system and the cost of labor for repair, replacement, or adjustment of any and all the manufacturer's components, as necessary to restore the system to normal operation.
- D. The warrantee shall cover the complete system as specified herein including, but not limited to:
  - 1. Control panels
  - 2. Electronics
  - 3. Control stations
  - 4. Motion sensors
  - 5. Software

## 1.7 QUALIFICATIONS

- A. The manufacturer of the assembly shall be the manufacturer of the major components within the assembly.
- B. For the equipment specified herein, the manufacturer shall be ISO 9001 certified.
- C. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

## 1.8 MANUFACTURERS

- A. The following manufacturers shall be considered acceptable to supply the lighting control system as herein specified:
  - 1. GE Prosys LM
  - 2. Watt Stopper/Horton Controls SWS
- B. The listing of a manufacturer as "acceptable" does not imply automatic approval. It is the sole responsibility of the Electrical Subcontractor to ensure that any price quotations received and submittals made are for devices that meet or exceed the specifications included herein.

## 1.9 SUBMITTALS

- A. Prepare and submit shop drawings in accordance with the requirements hereinbefore specified, and with the Shop Drawings, Product Data and Samples Section 01330 in the manner described therein, modified as noted hereinafter.
- B. Submit complete manufacturer's product data of all materials and systems to the Architect for approval, consisting of complete product description and specifications, complete performance test data, complete preparation and installation instructions, and all other pertinent technical data required for complete product and product use information.
- C. All shop drawings shall have clearly marked the appropriate specification number or drawing designation for identification of the submittal.
- D. Disposition of shop drawings shall not relieve the Contractor from the responsibility for deviations from drawings or specifications unless he has submitted, in writing, a letter itemizing or calling attention to such deviations at time of submission and secured written approval from the Architect, nor shall such disposition of shop drawings relieve the Contractor from responsibility for errors in shop drawings or schedules. The manufacturer shall provide a

complete submittal package for approval prior to shipment. The package shall consist of the following:

1. Product cuts and specifications.
2. Bill of materials.
3. Warranty information.
4. Riser diagram indicating wiring requirements.
5. Point-to-point field wiring instructions.
6. Detailed layout of control stations. In addition to the submittals, a set of installation, operator and maintenance manuals shall be shipped with the equipment.
7. Panel wiring schedules.
8. Drawings for each panel.

## PART 2 - PRODUCTS

### 2.1 SMARTWIRED SWITCHING SYSTEM

#### A. Description

1. Modular Relay Panels shall be UL listed and consist of the following:
  - a. Tub: NEMA 1 enclosure that can accept an interior sized to accept up to 12, 24, or 48 mechanically latching relays.
  - b. Power Supply: Transformer assembly with two 40VA transformers with separate secondaries. Transformers include internal overcurrent protection with automatic reset and metal oxide varistor protection against power line spikes. 120 or 277 VAC as required, 60 Hz +/- 10%.
  - c. Cover: Surface with captive screws in a hinged, lockable configuration.
  - d. Interior: Bracket and intelligence board backplane with pre-mounted relays. Interiors shall be provided with up to 12, 24, or 48 installed and tested relays.
  - e. Panel shall be provided with an integral DIN rail mounting bar for easy installation of other system components (such as a time clock and/or photocell controller). Terminals shall be included in the interior to accept a dataline for the connection of dataline switches to the system, or to allow a dataline to be run between multiple panels for network communications.
  - f. Eight channels for grouping relays shall be provided in each interior regardless of size, each with an associated pushbutton to toggle the channel ON/OFF, and a terminal block for a separate dry contact input. Any number of relays in the panel can be assigned to each channel, with overlapping allowed. Channels shall be set up via Smartwiring, i.e. no hand held programmer or keypad is required. Systems that require programmers or keypads, or that change relay states during set up, are not acceptable. Each channel pushbutton shall provide LED status indication: RED shall indicate that all relays within the channel group are ON; NO LED shall indicate that all relays within the group are OFF, and GREEN shall indicate the channel's relays are in a MIXED state (some OFF, some ON).

## 2. Features

- a. Relays shall be momentary-pulsed mechanically latching contactors with plug in connector. Relays shall have mechanically latching contacts with single moving part design for improved reliability. Relays will have the following characteristics:
  - 1) Coil
    - a) Magnetically held, momentary coil activation (50 milliseconds).
    - b) 2.2 VA max per relay to allow up to 20 relays to be controlled in parallel using class 2 wiring.
    - c) Split coil – ½ for ON, ½ for OFF.
  - 2) Power Contacts
    - a) 20 amp tungsten and NEMA electronic ballast rated.
    - b) Rated for 50,000 ON/OFF cycles at full load.
    - c) Support #10 - #14 AWG solid or stranded wire.
    - d) 120, 277 and 347 volt rated.
    - e) Standard 1 year warranty.
  - 3) 30 VAC Isolated contacts for status feedback and pilot light indication.
  - 4) FCC approved for commercial and residential use.
- b. Next to each relay shall be an individual override button and a bi-color LED to indicate status.
- c. Panels shall support the “blink warning” function, with LED indication for each relay.
- d. Captive screw terminations will be provided for all wiring connections.
- e. Each channel button’s dry control contact input terminal shall accept either 2 or 3-wire, maintained or momentary inputs. They shall also accept a 2-wire toggling input.
- f. Each channel shall also have an associated 1 amp, 30 VDC isolated contact which may be used for status feedback or pilot light control.
- g. Each panel shall include simple dials for setting a 2-digit panel address.
- h. The Relay Panel shall use an EEPROM to record the channel’s smartwiring assignments and the current status of all relays, thus insuring a 20-year backup of information in the event of a power failure. Systems that require a chargeable battery with less than 10 year’s life shall not be allowed.
- i. The unit shall provide LED status indication of the power supply status. Access to 24VAC and 24V rectified power for accessory devices shall be provided within the panel.
- j. The panel shall have an integrated DIN rail for mounting dataline control modules.

## 2.2 SMARTWIRED DATALINE SWITCHES

### A. Description

1. To allow individual overrides, dataline switches shall be terminated to each panel's 4-wire Local Dataline. Switches shall be available in single, dual, quad, or octal (1-button, 2-button, 4-button, or 8-button) designs. The single, dual, and quad devices shall mount in a standard single gang box; the octal version in a two-gang box.
2. Each button in a switch module can be individually programmed. Programming is done by smartwiring rather than with a handheld keypad or computer. Each button can control any one of the following options:
  - a. Any individual relay in any single panel.
  - b. Any group of relays in any single panel.
  - c. Any of the eight channels (A-H) in a single panel.
  - d. The same channel letter (A-H) in multiple panels in the system (requires Network Clock or BMS Interface Module).
3. For applications that require pattern switching, any button can perform its function using a ON/OFF/Not Controlled pattern of relays instead of the normal All ON/ALL OFF.

### B. Features

1. Switches shall be constructed of non-breakable Lexan on all exposed parts and shall include a matching screwless Lexan wallplate.
2. Individual buttons shall have a removable clear cover to allow standard 9 mm (3/8 inch) labeling tape to be used to identify the controlled loads.
3. Each switch module shall use a bi-color LED pilot light for the individual buttons to indicate status of the controlled relay or group of relays. LED indications are Red for All ON, Green for Mixed State (some relays in the group ON and others OFF), and No LED for All OFF.
4. Switch LED pilot lights shall flash green to indicate impending off sweep during the five-minute grace period following blink warning of the lights. Once the button is pressed, the LED will change to Red to acknowledge the occupant's override command to keep lights ON.
5. Multiple dataline switches smartwired to control the same relay or relay group shall indicate the same status automatically.
6. Each switch unit shall also include a locator light.
7. The dual, quad, and octal switches shall all include a single master button that will override all relays controlled by the individual buttons OFF, or Restore them to their original state. Each switch's master button configuration can be altered to perform a Master On/Off, OFF Only, or Disabled function if desired.
8. Switch modules can be configured to follow a "Cleaning" scenario. This specific scenario shall prevent the cleaners from overriding OFF any relays turned ON by the occupant.
9. Each switch module is available in a Keylock Override version. Once a key is inserted, the individual buttons will function for five minutes.

## 2.3 NETWORK CLOCK

### A. Description

1. Using the same dataline as mentioned above, provide a Network Clock. Network Clock can be used to schedule any of the 8 global channel groups (A-H) in the relay panel network. Schedules are defined using Occupied v. Unoccupied (after-hours) times to simplify data entry.
2. Network shall include user-selectable intelligent scenarios to handle standard lighting control functions for each channel independently, including:
  - a. Schedule ON / Schedule OFF
  - b. Manual ON / Schedule OFF
  - c. Astronomical ON / Astronomical OFF (with user selectable offsets)
  - d. Astronomical ON / Schedule OFF (with user selectable offsets)
  - e. Manual ON / Multiple OFF Sweeps using Automatic Control Switch
3. Network Clock shall automatically detect the presence of a dataline Photocontrol Module and alter the Astronomic scenarios to Dark, accepting actual light level readings for the following scenarios:
  - a. Dark ON / Dark OFF
  - b. Dark ON / Schedule OFF
4. Each channel can be assigned a standard time delay from 1-240 minutes (4 hours). During Occupied hours, the time delays do not take effect. During Unoccupied hours, the time delays will ensure that overridden lights are automatically turned off.
5. Each channel can be assigned an automatic blinking of the lights before they are turned off to allow occupants the opportunity to enter an override without being put in the dark.
6. Network Clock shall include a switch to change its function from Scheduling mode to Programming mode. In programming mode, the unit shall be able to smartwire relays to switch buttons or channels anywhere in the system using simple menus.
7. Network Clock shall include system diagnostic functions to identify devices anywhere on the network dataline.

### B. Features

1. Clear 8-line, 22-character per line display and a simple user interface.
2. Takes into account leap year, daylight savings time, and holidays.
3. Provide system diagnostics for all components connected to the system.
4. Allows the user to plug into each dataline switch, run diagnostics, and reprogram the switch to any relay or channel.
5. Retain memory and time for a minimum of 10 years.

## 2.4 BMS INTERFACE MODULE

### A. Description

1. The BMS Interface Module shall be used in lieu of the Network Clock to provide the same lighting control functions (with the exception of the Astronomic function), but shall allow an external automation device to provide the signal that changes channel status from Occupied to Unoccupied (after-hours).
2. When the BMS Interface senses the presence of a Photocell Control module, it shall automatically add the two exterior daylighting scenarios to the menus.
3. Since the BMS module accepts timing signals from another system, and does not provide its own scheduling, it shall include an Egress delay option to allow time for occupants to clear the area before lighting is turned OFF.
4. Provide Relay Interface connection to Building Automation System.

### B. Features

1. 2-Line LCD display with simple data entry for each of 8 channels.
2. User-selectable intelligent scenarios to handle standard lighting control functions for each channel independently, including:
  - a. Schedule ON/Schedule OFF
  - b. Manual ON/Schedule OFF
3. Automatically detects the presence of the Photocontrol Module on the dataline and adds the Dark scenarios to the menus, accepting actual light level readings for the following scenarios:
  - a. Dark ON/Dark OFF
  - b. Dark ON/Schedule OFF
4. User-selectable egress delay up to 240 minutes (4 hours) to allow safe exit after channel status changes to Unoccupied.
5. Isolated, single-pole input contact for each channel, user-definable with choice of Occupied = Open or Occupied = Closed.
6. 24 VAC, 1 amp status output contacts, user-definable with choice of Closed contact = Any ON, All ON, All OFF, Any OFF

## 2.5 AUTOMATIC CONTROL SWITCH

### A. Description

1. The Automatic Control Switch shall be a line voltage, push-button wall switch capable of ON/OFF manual operation and also of receiving control signals through the temporary interruption of power to the circuit via the relay panel.



2. Relays controlling circuits with Automatic Control Switches shall be smartwired to one or more of the system's eight global channels. This channel(s) shall be assigned the Manual On/Multiple Off Sweeps scenario.
3. Each channel shall be assigned a sweep interval from 1-240 minutes (4 hours). During "Occupied" hours, power to the circuit shall be maintained. During "Unoccupied" hours (after-hours), the channel shall sweep off – by temporarily interrupting power to the circuit – at the specified intervals.
4. Occupants shall have a five-minute time delay to press the switch, keeping the lights on until the end of the next sweep interval.

B. Features

1. 120 VAC or 277 VAC models with matching wall plate included.
2. Audible beep during time delay can be enabled or disabled without removing the switch face plate.
3. Locator LED.

## 2.6 ACCESSORY ENCLOSURE

A. Description

1. Provide an Accessory Enclosure with integral DIN rail mounting area and connections for dataline and optional power supply as needed for remote mounting of intelligence modules.
2. Intelligence modules, to include the Network Clock, BMS Interface, Photocontrol module or Universal Switch Interface module, shall be simply snapped onto the DIN rail, and their dataline cables connected to a terminal board in the accessory enclosure.
3. Additional power may be supplied if needed by installing a standard dual-transformer power supply in the space provided in the enclosure.

B. Features

1. Enclosure shall be UL listed.
2. Surface mount, with hinged cover and locking latch.
3. Integral DIN rail for remote mounting of accessory modules.
4. Terminal board provides connections for local dataline, global dataline, and accessory power.

## 2.7 APPROVED MANUFACTURERS

A. The Watt Stopper or GE Prosys LM.

1. The Contractor shall be completely responsible for providing a system that meets this specification in its entirety. All deviations from this specification must be listed and individually signed off by the Engineer.

B. The Watt Stopper catalog numbers.

1. Smartwired Switching System Relay Panels:
  - a. Tubs: HTUB12, HTUB24, HTUB48
  - b. Power Supplies: HPSM115, HPSM277
  - c. Covers: HCVR12xx, HCVR24xx, HCVR48xx.
  - d. Interiors: HIN<sub>xy</sub>12SS, HIN<sub>xy</sub>12SP, HIN<sub>xy</sub>24SS, HIN<sub>xy</sub>24SP, HIN<sub>xy</sub>48SS, HIN<sub>xy</sub>48SP
  - e. Relays: H2R7P, RR7P, H2R9P, RR9P
2. Network Dataline: HDLW4, HDLW4P (plenum rated)
3. Dataline Switches: HDLS1SS, HDLS2SS, HDLS4SS, HDLS8SS
4. Network Clock/Programmer: HCLK8SS
5. Photocontrol Module package including photocell: HPCP8SS
6. BMS Interface Module: HBMS8SS
7. Universal Switch Interface module: HUSM8SS
8. Automatic Control Switch: AS-110-120, AS-110-277, AS-100
9. Accessory Enclosure: HACCB0X

### PART 3 - EXECUTION

#### 3.1 COOPERATION AND WORK PROGRESS

- A. The Electrical work shall be carried on under the usual construction conditions, in conjunction with all other work at the site. The Electrical Subcontractor shall cooperate with the Architect, General Contractor, all other Subcontractors and equipment suppliers working at the site. The Electrical Subcontractor shall coordinate the work and proceed in a manner so as not to delay the progress of the project.
- B. The Electrical Subcontractor shall coordinate his work with the progress of the building and other Trades so that he will complete his work as soon as conditions permit and such that interruptions of the building functions will be at a minimum. Any overtime hours worked or additional costs incurred due to lack of or improper coordination with other Trades or the Owner by the Electrical Subcontractor, shall be assumed by him without any additional cost to the Owner.
- C. The Electrical Subcontractor shall furnish information on all equipment that is furnished under this Section but installed under another Section to the installing Subcontractor as specified herein.
- D. The Electrical Subcontractor shall provide all materials, equipment and workmanship to provide for adequate protection of all electrical equipment during the course of construction of the project. This shall also include protection from moisture and all foreign matter. The Electrical

Subcontractor shall also be responsible for damage which he causes to the work of other Trades, and he shall remedy such injury at his own expense.

- E. Waste materials shall be removed promptly from the premises. All material and equipment stored on the premises shall be kept in a neat and orderly fashion. Material or equipment shall not be stored where exposed to the weather. The Electrical Subcontractor shall be responsible for the security, safekeeping and damages, including acts of vandalism, of all material and equipment stored at the job site.
- F. The Electrical Subcontractor shall be responsible for unloading all electrical equipment and materials delivered to the site. This shall also include all large and heavy items or equipment which require hoisting. Consult with the General Contractor for hoisting/crane requirements. During construction of the building, the Electrical Subcontractor shall provide additional protection against moisture, dust accumulation and physical damage of the main service and distribution equipment. This shall include furnishing and installing temporary heaters within these units, as approved, to evaporate excessive moisture and ventilate it from the room, as may be required.
- G. It shall be the responsibility of the Electrical Subcontractor to coordinate the delivery of the electrical equipment to the project prior to the time installation of equipment will be required; but he shall also make sure such equipment is not delivered too far in advance of such required installation, to ensure that possible damage and deterioration of such equipment will not occur. Such equipment stored for an excessively long period of time (as determined in the opinion of the Architect) on the project site prior to installation may be subject to rejection by the Architect.
- H. The Electrical Subcontractor shall erect and maintain, at all times, necessary safeguards for the protection of life and property of the Owner, Workmen, Staff and the Public.
- I. Prior to installation, the Electrical Subcontractor has the responsibility to coordinate the exact mounting arrangement and location of electrical equipment to allow proper space requirements as indicated in the NEC. Particular attention shall be given in the field to group installations. If it is questionable that sufficient space, conflict with the work of other Subcontractors, architectural or structural obstructions will result in an arrangement which will prevent proper access, operation or maintenance of the indicated equipment, the Electrical Subcontractor shall immediately notify the Contractor and not proceed with this part of the Contract work until definite instructions have been given to him by the Architect.

### 3.2 INSTALLATION

- A. The Electrical Subcontractor shall furnish all equipment, labor, system setup, and other services necessary for the proper installation of the devices as indicated on the drawings and specified herein. System setup shall include defining each switch zone, and setting the control functions.
- B. Unless specifically noted or indicated otherwise, all equipment and material specified in Part 2 of this specification or indicated on the drawings shall be installed under this Contract whether

or not specifically itemized herein. This Section covers particular installation methods and requirements peculiar to certain items and classes or material and equipment.

- C. The Electrical Subcontractor shall obtain detailed information from manufacturers of equipment provided under Part 2 of this specification as to proper methods of installation.
- D. The Electrical Subcontractor shall obtain final roughing dimensions and other information as needed for complete installation of items furnished under other Sections or furnished by the Owner.
- E. The Electrical Subcontractor shall keep fully informed of size, shape and position of openings required for material and equipment provided under this and other Sections. Ensure that openings required for work of this Section are coordinated with work of other Sections. Provide cutting and patching as necessary.
- F. All miscellaneous hardware and support accessories, including support rods, nuts, bolts, screws and other such items, shall be of a galvanized or cadmium plated finish or of another approved rust-inhibiting coating.
- G. Throughout this Section where reference is made to steel channel supports, it shall be understood to mean that the minimum size shall be 1 5/8" mild strip steel with minimum wall thickness of 0.105", similar to Unistrut P1000 or equal products manufactured by Kindorf or Husky Products Co. Where reference to channel supports is made under "Lighting Fixtures" paragraph of this Section, the maximum length of span shall be 10'-0". If longer spans are required, the size and wall thickness of the steel channel support shall be as specifically approved by the Engineer.

### 3.3 MATERIALS AND WORKMANSHIP

- A. All materials and equipment shall be new and unused and shall meet requirements of the latest Standards of NEMA, UL, IPCEA, ANSI and IEEE. Equipment shall have components required or recommended by OSHA, applicable NFPA documents and shall be UL listed and labeled.
- B. Despite references in the specifications or on the drawings to materials or pieces of equipment by name, make or catalog number, such references shall be interpreted as establishing standards of quality for materials and performance.
- C. Finish of materials, components and equipment shall not be less than Industry good practice. When material or equipment is visible or subject to corrosive or atmospheric conditions, the finish shall be as approved by the Architect.
- D. Provide proper access to material or equipment that requires inspection, replacement, repair or service. If proper access cannot be provided, confer with the Architect as to the best method of approach to minimize effects of reduced access.
- E. All work shall be installed in a neat and workmanlike manner and shall be done in accordance with all Local and State Codes.

- F. The Owner will not be responsible for material, equipment or the installation of same before testing and acceptance.

### 3.4 FIELD SUPPORT

- A. Manufacturer shall be capable of providing on-site service support within 24 hours anywhere in the continental U.S.A., and within five business days anywhere in the world, except where special visas are required.

### 3.5 SYSTEM COMMISSIONING

- A. The system manufacturer shall provide on-site, factory technicians to thoroughly inspect the lighting control system installation and verify proper operation. The commissioning shall include three (3) separate visits to the project as defined below:

#### 1. First Visit: Pre-Wire Inspection

- a. Review all low voltage wiring requirements
  - 1) Network wiring
  - 2) Maximum run lengths
  - 3) Control switching panel links
  - 4) Cable requirements
- b. Review separation of power and low voltage/data wiring
- c. Review wire labeling
- d. Review information required on load schedules
- e. Review lighting control panel locations and installation
- f. Review control locations and addressing
- g. Review analog phone lines requirements and computer jack locations
- h. Review load circuit wiring
- i. Review connections to "equipment by others"
- j. Develop project schedule, including:
  - 1) Contractor completion dates
  - 2) Building opening dates
  - 3) End user training
  - 4) Contact names and numbers

#### 2. Second Visit: Start-Up of System and Installation of System Software/data

- a. Verify proper connection of
  - 1) Power feeds
  - 2) Load circuits

- b. Verify proper connection of all controls
  - c. Energize the main panel and download system data program
  - d. Verify proper connection of panel links (low voltage/data) and address panels
  - e. Download system panel data to lighting control panels
  - f. Verify system operation control by control, circuit by circuit
  - g. Verify proper operation of interfacing equipment.
  - h. Verify operation of PC and installed programs
  - i. Verify operation of PC modem and test dial up access if phone line provided
  - j. Program and provide fine-tune adjustments of the following for each individual area with the Owner, Architect and Lighting Consultant present.
    - 1) All switch zones for each area.
    - 2) Time clock events and functions.
    - 3) Programming sequences
  - k. Obtain sign off on systems function
3. Third Visit: Operator/End-User Training
- a. Upgrade systems software to the latest revision level, if necessary
  - b. Train the end users on system operation and software (Set-Up and Operate programs)
    - 1) Database file management
    - 2) How to set switch controls
    - 3) How to set timeclock events
    - 4) How to set sequences, if applicable
  - c. System maintenance and trouble shooting
    - 1) Job telephone numbers
    - 2) Who to call
    - 3) Diagnostics available
    - 4) Modem
    - 5) Telephone support
    - 6) Service visit
  - d. Persons to be available for this visit should include:
    - 1) Manufacturer's Service Engineer
    - 2) Electrical maintenance staff
    - 3) System operators

B. The manufacturer shall carry in his bids sufficient time to accomplish the above requirements to the satisfaction of the Owner, Architect, Lighting Consultant and Engineer.

END OF SECTION