

SECTION 16147E (26 24 16.03)

INTELLIGENT PANELBOARD FOR LIGHTING CONTROL AND ENERGY MANAGEMENT

PART 1 GENERAL

1.01 SCOPE

- A. The Contractor shall furnish and install Lighting Control Panelboards as specified and as shown on the contract drawings.
- B. The Lighting Control System work shall be indicated on the drawings and by the requirements of this section. It is defined to include, but not limited to:
 - 1. Intelligent panelboards, containing both standard and remotely controlled circuit breakers, control electronics and metering options
 - 2. Intelligent panelboard accessories such as low voltage and digital (network) switches
 - 3. Software and system management equipment
 - 4. System startup and training

1.02 RELATED SECTIONS

- A. Section 16470 – Panelboards
- B. Section 16475 – Circuit Breakers and Fusible Switches – Low Voltage

1.03 REFERENCES

- A. NEMA Compliance: Comply with applicable portions of NEMA standards pertaining to types of electrical equipment and enclosures.
- B. CSA Listing: Lighting Control Panelboards shall be CSA listed under CSA C22.2 No. 29 Panelboard Interiors.

1.04 SUBMITTALS – FOR REVIEW/APPROVAL

- A. The following information shall be submitted to the Engineer:
 - 1. Breaker layout drawing with dimensions indicated and nameplate designation
 - 2. Component list
 - 3. Conduit entry/exit locations
 - 4. Assembly ratings including:
 - a. Short-circuit rating
 - b. Voltage
 - c. Continuous current
 - 5. Cable terminal sizes

6. Product data sheets. Submit manufacturer's data sheets on system submitted and components supplied, with complete descriptions of hardware and software components supplied
 7. Series rating information
 8. ⌘ Interface to Electrical Monitoring and Control System
 9. ⌘ Interface to Building Automation System/Energy Management System
- B. Wiring Diagrams – Submit typical wiring diagrams for all components including, but not limited to, smart panelboard, application specific controllers, override switches, daylighting components, dimming ballasts, telephone lines, network wiring, and the central operator's station.

1.05 SUBMITTALS – FOR CONSTRUCTION

- A. The following information shall be submitted for record purposes:
1. Final as-built drawings and information for items listed in Paragraph 1.04, and shall incorporate all changes made during the manufacturing process
 2. Panelboard Load Schedule: Show load placement and sizing
 3. Wiring Diagrams: Show typical interconnect wiring diagram for each system component supplied
 4. Installation Guide: Provide instructions on how to install system components
 5. Seismic certification and equipment anchorage details as specified

1.06 QUALIFICATIONS

- A. The manufacturer of the assembly shall be the manufacturer of the major components within the assembly. Panelboards specified in this section shall be of the same manufacture as those specified in Section 16470 Panelboards.
- B. For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 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.
- D. ⌘ Provide Seismic qualified equipment, when required, as follows:
1. The equipment and major components shall be suitable for and certified to meet all applicable seismic requirements of the [latest National Building Code of Canada (NBCC)] .
 2. The Project Structural Engineer will provide site specific ground motion criteria for use by the manufacturer to establish Sa(0.2) values required.
 3. The following minimum mounting and installation guidelines shall be met, unless specifically modified by the above referenced standards.

⌘ Note to Spec. Writer – Optional

⌘ Note to Spec. Writer - Optional

- a. The Contractor shall provide equipment anchorage details, coordinated with the equipment mounting provision, prepared and stamped by a licensed engineer in the province. Mounting recommendations shall be provided by the manufacturer based upon the above criteria to verify the seismic design of the equipment.
 - b. The equipment manufacturer shall certify that the equipment can withstand, that is, function following the seismic event, including both vertical and lateral required response spectra as specified in above codes.
 - c. The equipment manufacturer shall document the requirements necessary for proper seismic mounting of the equipment. Seismic qualification shall be considered achieved when the capability of the equipment, meets or exceeds the specified response spectra.
- E. The manufacturer of the lighting control panelboard shall be regularly engaged in manufacture of electrical distribution equipment, lighting control and/or energy management equipment of types and capacities required and shall be the manufacturer of the remote controllable circuit breakers contained in the system.

1.07 REGULATORY REQUIREMENTS

- A. The lighting control panelboard shall be labeled and listed under CSA C22.2 No. 29 Panelboard Interiors.

1.08 DELIVERY, STORAGE AND HANDLING



- A. Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment.

1.09 OPERATION AND MAINTENANCE MANUALS


- A. Equipment operation and maintenance manuals shall be provided with each assembly shipped and shall include instruction leaflets, instruction bulletins and renewal parts lists where applicable, for the complete assembly and each major component.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Eaton
- B.  _____
- C.  _____

The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety. Products in compliance with the specification and manufactured by others not named will be considered only if pre-approved by the engineer ten (10) days prior to bid date.

 Note to Spec. Writer – Insert data in blanks

2.02 GENERAL

- A. Intelligent Panelboard systems shall be comprised of Master Panelboards and optional Expansion Panelboards. Intelligent Panelboards shall use remotely controllable circuit breakers for automatic power switching. Intelligent Panelboards shall be integrated and modular; External time clocks, relay circuits and/or contactor circuits will not be accepted.
- B. Intelligent Panelboards shall accept non-controlled and low voltage remotely controlled thermal magnetic branch circuit breakers. Intelligent Panelboards shall use standard panelboard interiors and enclosures
- C. Control functionality shall be an integral part of the panelboard. Master Panelboards shall be capable of multi-zone, automatic power switching with integral time clock function and provisions for manual switch overrides.
- D. The Master Panelboard shall be furnished with a power supply to provide control power to electronic components and remotely controlled circuit breakers. The power supply shall have a local accessible ON/OFF switch and secondary thermal magnetic ON/OFF protection. The power supply shall be fed from panelboard bus. The power supply shall be capable of powering a total of 168 circuit breakers located in multiple panelboards.
- E. Standard Expansion Panelboards shall obtain all control power from the Master Panelboard. The control power and communication interconnections of Expansion Panelboards shall be listed as a Class 2 circuit for compatibility with standard communications cables and products, either at installation time or to support additions to the system in the future.
- F. Powered Expansion Panelboards shall further include a power supply so that they may be located at an extended distance. The power supply shall provide control power to electronic components and remotely controlled circuit breakers. The power supply shall have a secondary thermal magnetic ON/OFF protection. The power supply shall be fed from panelboard bus. The power supply shall be capable of powering a total of 168 circuit breakers and associated electronics located in multiple panelboards.
- G. Intelligent Panelboards shall provide for separation of Class 2 circuits. The panelboard shall be pre-wired and factory assembled.
- H. The lighting control panelboard shall be labeled and listed under CSA C22.2 no. 29 Panelboard Interiors.
- I. Remotely Controlled Branch Circuit Breakers:
 - 1. Circuit breakers marked "Remotely Controlled" on drawings shall be used to control the power to the branch circuit.
 - 2. The disconnect and protective functions of the circuit breaker shall have priority over remote control operation. The circuit breaker shall be fully OPEN when the ON/OFF handle is in the OFF or TRIPPED (center) position. Remote control operation shall only be possible when the circuit breaker handle is in the ON position.
 - 3. The circuit breaker shall provide a visible indication of remote control status in the absence of power.
 - 4. The circuit breaker shall have an integral manual override to allow local restoration of power to a branch circuit previously commanded OPEN. The manual override shall be mechanical and operate in the absence of power. The manual override handle shall be accessible with the panel trim installed.

5. The manual override shall comply with energy code requirements by not providing a means to defeat the intent of energy management applications. The manual override shall not require a return to the panelboard to restore automatic operation. Auto/manual override mechanisms that disable remote operation will not be accepted.
- J. Master Panelboard Controller:
1. Controller hardware requirements
 - a. The controller shall retain programming in the absence of control power for a minimum of 10 years. Time schedules, time clock, day/date and panelboard configuration parameters shall be stored in non-volatile memory. The controller clock shall continue to keep time for a minimum of at least 10 days in the absence of power.
 - b. The controller shall provide diagnostic LEDs for power, normal operation / fault, and network communication activity. Access to diagnostic indicators shall not require removal of the panelboard deadfront or trim.
 - c. The controller shall have general purpose low voltage I/O for local connection of override switches, occupancy sensors, fluorescent ballasts, LED drivers and photo sensors. The controller shall provide at least:
 1. Eight dry contact digital inputs for use with override switches, occupancy sensors, photocells, meter pulse contacts, or connection to other devices or control systems.
 2. Eight universal inputs (analog or digital) for use with override switches, occupancy sensors, photo sensors, light level override adjustment switches, temperature sensors, or connection to other devices or control systems.
 3. [OPTION] Eight 0-10Vdc analog outputs for use with dimmable lighting fixtures or connection to auxiliary devices or control systems. Each analog output shall be capable of operating with at least 40 fluorescent ballasts or LED drivers.
 4. One set of auxiliary power supply terminals with at least 100mA available current to supply external devices such as occupancy sensors.
 - d. The controller shall provide a local user interface panel. The user interface panel shall be designed such that operational functions of the controller do not require the user interface panel to be present if tampering is a concern. The user interface panel shall be located directly over the controller so that it does not consume additional area in the panelboard. The user interface panel shall be backlit for low-light conditions, be high-resolution color graphic to support intuitive operation and have an interactive touch overlay instead of separate buttons to allow for maximum visual area.
 - e. The controller shall have a wiring compartment to access low voltage I/O and external communication connections for inspection, testing and troubleshooting. The compartment shall be secured to prevent casual access but shall not require special tools to open. Access to this compartment shall not require removal of deadfront or panelboard trim. Accessible within this compartment shall be an industry standard USB port compatible with memory sticks, cellular modems, and other devices and a removable, industry standard memory card capable of non-volatile storage of files, logs and other data.
 - f. The controller shall have downloadable firmware capability, with adequate memory and processing resources to execute all potentially configurable control, communication, display and energy management functions simultaneously without

performance degradation with respect to initial functionality and future firmware upgrades. Memory resources shall be adequate for additional web pages to support new functionality and custom configured screens. Firmware download capability shall be supported both locally at the controller and remotely on controllers connected to an Ethernet communication network.

- g. Controller communication ports:
 1. General
 - a. All controller communication ports shall be independent. Use of a port and its corresponding functions shall not preclude the use of any other ports or functions to allow flexibility for future additions to the system.
 - b. Power for all communication ports shall be provided by the panelboard power supply.
 2. Expansion Panel Network (SLAN)
 - a. The controller shall provide a dedicated, industry-standard RS-485 "SLAN" communications port for connection to Expansion Panelboards.
 - b. The controller SLAN port shall be classified as a Class 2 circuit for compatibility with standard communications cables and products.
 - c. The maximum length of communications cable shall be at least 150 feet when the Expansion Panelboard is powered from the Master Panelboard using the manufacturer's specified cable type.
 - d. The maximum length of communications cable shall be 4,000 feet when all Expansion Panelboards are powered and interconnected with a standard communications grade cable of the manufacturer's specified type.
 - e. The SLAN communications port shall allow mixed connection to both standard and powered Expansion Panelboards at respective maximum distances without supplemental isolators.
 3. Front Panel Port
 - a. The controller shall provide an industry-standard Ethernet port that is accessible from the controller front. Access to this port shall not require any tools. Connection to the front panel Ethernet port shall be compatible with standard cables.
 - b. The Ethernet port shall be auto-switching and capable of operating with straight through and crossover cable types and be compatible with 10 Base-T and 100 Base-T systems. A computer set to obtain an IP address automatically shall not require reconfiguration.
 - c. The front panel Ethernet port shall provide access to information residing in the local controller using compatible PC software.
 - d. The front panel Ethernet port shall provide access to information residing in the local controller using web pages.
 - e. [OPTION] The front panel port shall provide access to information residing in any remote controllers that are permanently connected by a network.
 4. Digital Switch Network [OPTION]
 - a. The controller shall provide an independent communications port for connection to compatible digital switches. The digital switch network port shall support at least 99 digital switches.
 - b. The digital switch port circuit shall be on a replaceable circuit card located in an accessible area for future flexibility.

- c. The digital switch network port shall use an integrated RJ45 connector arranged per the T-568B wiring standard so that the corresponding plug-in communications cable is compatible with standard tools used to verify and troubleshoot low voltage communication wiring.
 - d. The controller shall accept direct connection of digital switches without a gateway to allow flexibility for digital switches to be added in the future.
 - e. The controller shall directly power up to 15 digital switches using controller power to a distance of 500 feet and be extensible to maximum capacity using distributed power injectors to allow flexibility for digital switches to be added in the future.
5. RS-485 Control Network [OPTION]
- a. The controller shall provide an independent, industry standard RS-485 port for connection to other controllers and devices.
 - b. The RS-485 port circuit shall be on a replaceable circuit card located in an accessible area for future flexibility.
 - c. The RS-485 Control Network shall support peer-to-peer global communications between up to 120 controllers per RS-485 network, globally communicating over a main shielded twisted pair network to a central operator's station. Control architecture shall allow up to 15 networks interconnected into one logical system.
 - d. The maximum length of each RS-485 network shall be 4,000 feet without repeaters.
 - e. The controller shall remove itself from the RS-485 control network should it fail. Network "Lock-Ups" due to failed controllers shall not be acceptable.
6. Meter Network [OPTION]
- a. The controller shall provide an independent, industry standard RS-485 port for connection to panelboard resident meters and branch current monitoring devices.
 - b. The Meter port shall support at least one main meter or branch current monitor for the local panelboard plus one main meter or branch current monitor for each Expansion Panelboard connected directly to the controller.
 - c. The controller shall provide a gateway function between the Meter and Ethernet ports for access to metering data by software or energy management systems.
 - d. Controller-resident energy applications that use metering data shall not interfere with the gateway function and software and energy management systems operating through the gateway function shall not interfere with controller-resident energy applications.
7. Ethernet Network [OPTION]
- a. The controller shall provide an industry standard Ethernet port for permanent connection of the controller to an Ethernet network.
 - b. The Ethernet port shall be auto-switching and capable of operating with straight through and crossover cable types and provide both 10 Base-T and 100 Base-T speeds for compatibility with standard cables, hubs, switches and routers.

- c. The Ethernet port shall be independent of the front panel port and shall allow assignment of a unique IP address. Controllers having multiple Ethernet ports but only one address shall not be accepted.
 - d. The Ethernet port shall provide peer-to-peer sharing of data with other controllers for global control without RS-485 network connections between controllers. The Ethernet port shall allow simultaneous operation of all supported Ethernet protocols.
 - e. The Ethernet port shall provide BACnet/IP protocol for integration with other systems.
 - f. [OPTION] The Ethernet port shall provide web pages to remotely view controller information and provide the ability to remotely override loads and change controller programming.
2. Controller performance requirements:
- a. General
 1. All controller-resident programming functions shall be compatible with a non-proprietary, widely supported, industry standard operating system.
 2. Controllers shall have distributed intelligence and operate as a stand-alone device that can control its own process.
 3. A central device shall not be required for the controller to send and receive messages from other controllers on the network.
 4. The controller shall be capable of coordinating all logic, control, runtime data, status information and Expansion panel communications functions.
 5. Subsequent to any loss of control power, the controller shall automatically reset and return to normal operation.
 - b. User interface
 1. A local user interface panel shall provide a means to display and change controller information. Using touch screen navigation, a user may look at status, control the state of loads, modify load groups, revise schedules and revise configuration parameters. Local user access shall be restricted based upon passwords. The user interface panel shall automatically log out after access by an authorized user.
 2. Front-panel and network connected controllers shall support the ability to display and change controller information remotely using a remote desktop or laptop computer, or mobile device using application software and/or a standard web browser.
 - c. Time clock and scheduling
 1. The controller shall contain an internal time clock providing time of day, day of the week, and date. Automatic leap year and daylight savings' time adjustments shall be provided. Network-connected controllers shall be able to synchronize to a remote device.
 2. The controller shall be programmable with up to 50 schedules. Each load shall have a 7-day weekly schedule. The panelboard shall monitor its programmed time schedules and determine when to turn the loads on and off at the programmed times and days. In addition to time of day schedules, each panel shall be capable of astronomical scheduling from computed sunrise and sunset times.

3. The panelboard controller shall be capable of providing each load with the ability to preschedule up to 30 holidays
 4. OFF Warning shall provide a method of warning tenants before a scheduled OFF time by blinking the lights. The time between the blink and the scheduled OFF time shall be adjusted by changing the warning lead-time. Once a blink has occurred, the tenant shall be able to cancel the upcoming "OFF" by toggling their local override switch. Once done, the lights shall stay on until the next scheduled OFF time. The warning lead-time shall be user adjustable from 5 to 30 minutes.
- d. Overrides
1. Manual load override control shall be possible through the local user interface, remote desktop or laptop computer, and/or mobile device using application software or a standard web browser.
 2. It shall be possible for the user to toggle individual loads ON and OFF or issue ALL ON and ALL OFF commands.
- e. Programming
1. The Input-to-Output Matrix feature shall allow any load connected to any controller to be controlled by any switch, or any group of switches in the system.
 2. The controller shall provide the ability to construct user-defined control scenarios that logically combine switch operation, time schedules and timers.
- f. Logging and Alarms
1. The controller shall maintain an alarm log. The alarm log shall record where the alarm occurred, alarm reason, date and time of the alarm and log when the alarm was cleared and acknowledged. This log shall be maintained in non-volatile memory. The alarm log shall store up to 300 alarms
 2. Commands received from the web browser interface shall be logged to a message table audit trail.
 3. The number of times a load has been cycled or the duration of time the load has been in the ON position shall be individually stored per load.
 4. Hardware malfunctions shall be captured for quick and easy troubleshooting and servicing.

2.03 INTELLIGENT PANELBOARD ACCESORIES

A. Low Voltage And Digital Switches

1. General
 - a. The manufacturer of the Intelligent Panelboard system shall provide low voltage and digital switches to provide a means for local ON/OFF or dimming control.
 - b. Low voltage and digital switches shall have the same external aesthetic appearance and be compatible for adjacent mounting.
 - c. Low voltage and digital switches shall be sized to mount in a standard single-gang wall box. Switches shall comply with NEMA WD-1 standards and be sized to fit the minimum NEMA wall box width dimension.
 - d. Low voltage and digital switches shall be compatible with standard Decorator-type wall plates. They shall be available in 2-, 4-, and 6-button configurations. They shall be available in a selection of colors to include Black, White, Ivory and Almond.
2. Low Voltage Switches

- a. Low voltage switches shall be compatible with the Intelligent Panelboard controller and shall provide the controller with user switch activity via controller terminals.
 - b. Each pushbutton of a low voltage switch shall be connected directly to a digital (or universal) input terminal and will provide a momentary dry contact signal between that terminal and circuit common.
 - c. Low voltage switches shall not require a power supply.
3. Digital Switches
- a. Digital switches shall be compatible with the Intelligent Panelboard controller and shall provide the controller with user switch activity via the dedicated digital switch network.
 - b. Digital switches shall be network addressable without software tools using onboard rotary switches. The digital switch network connector shall use an integrated RJ45 connector
 - c. Digital switches shall be microprocessor-based low voltage devices in which distributed intelligence is achieved through on board memory and storage on each device. Each digital switch shall allow custom configuration programming to meet the precise needs of the application. The configuration program shall be stored in the on-board memory for robust operation of the switch network. Digital switches shall include on-board algorithms for daylight harvesting and on-demand dimming for fast system response.
 - d. Digital switches shall provide momentary contacts for each pushbutton. The real-time status of each programmed pushbutton shall be displayed by an LED status indicator.
 - e. Each digital switch shall have on-board analog and digital I/O terminals to allow convenient connection of a light-level sensor, occupancy sensor, and dimmable fluorescent ballasts or LED drivers.
- B. Switch Override Control Unit
- a. A switch override control unit shall provide the ability to connect and monitor up to 60 two-wire dry-contact closures from wall switches, occupancy sensors, and building automation systems.
 - b. A switch override control unit shall provide up to 48 two-wire 24V outputs to power status LEDs.
 - c. The switch override control unit shall not require an Ethernet network or static IP address to function. Information shall be exchanged with controllers using a serial network connection.
 - d. Inputs shall be individually programmable as one of eight configurations:
 1. Demand accumulation (demand metering)
 2. Timed momentary (replaces mechanical "wind-up" timers)
 3. Timed maintained
 4. Momentary (toggle on/off function)
 5. Alarm (provides warning indication)
 6. Maintained (follow on/off function)
 7. Network (inputs are passed over the main operating network)
 8. Local (inputs remain within the connected controller module)

2.04 SOFTWARE AND SYSTEM MANAGEMENT EQUIPMENT

A. Programming Software

1. General

- a. The Programming Software shall provide fully interactive, easy-to-use screens for programming, monitoring and managing the data within Intelligent Panelboard controllers. The Programming Screens, as a minimum, shall provide access to all the capabilities that exist in the controller.
2. The programming software shall be compatible with an IBM-compatible personal computer, desktop or laptop, meeting the following minimum requirements:
 - a. CPU – Intel Atom or Core processor
 - b. Hard Drive – 500 GB
 - c. RAM Memory – 4 GB
 - d. Integrated Graphics
 - e. Display - 1024x768 pixel resolution
 - f. Optical Drive - DVD Read/Write
 - g. USB port - 2.0 or 3.0
 - h. Gbps Ethernet port or 100Mbps wired Ethernet (RJ-45) or 802.11n wireless
 - i. Keyboard
 - j. Mouse, Trackball or Trackpad
 - k. Operating System - Windows 7 or 8, Windows Server 2008 R2, 32 or 64 bit

3. Programming Screens Minimum Requirements (Features limited by controller type)

- a. Date and Time
- b. Time-of-Day On/Off Scheduling
- c. Holiday Scheduling
- d. Astronomical Scheduling
- e. Manual Override
- f. Alarms
- g. Occupant Warning
- h. Hardware Diagnostics
- i. Panel Descriptions
- j. Load Descriptions
- k. Panel Address
- l. Input-to-Output Matrixing
- m. Security Access Codes
- n. Switch Overrides
- o. Daylight Harvesting
- p. Remote System Access
- q. Internal data logs

B. System Software [OPTION]

1. General

- a. The system software shall consist of multiple Microsoft Windows-based application software programs residing on a hardware platform that together will function as a means of data manipulation and programming of the Intelligent Panelboard system.

- b. The software shall provide a consistent interface for the operator. Consistencies with standard Windows software conventions such as pull-down menus, dialog boxes, icons, etc. shall be maintained.
 - c. All elements of the software shall be compatible. The graphical environment shall dynamically interact with the programming screens. It shall be possible to run more than one software program at a time, transfer information between them, and organize and manage files.
2. Hardware Platform Requirements
- a. The hardware platform shall be connected to the Ethernet network or the main shielded twisted pair network through a network interface. It shall be possible to have more than one hardware platform per system.
 - b. The hardware platform shall be located in an area relatively free of moisture, dust and harsh environments.
 - c. The hardware platform shall consist of an IBM-compatible personal computer or server with the following minimum requirements:
 - 1. CPU – Intel Atom or Core processor
 - 2. Hard Drive – 500 GB
 - 3. RAM Memory – 4 GB
 - 4. Integrated Graphics
 - 5. Display - 1024x768 pixel resolution
 - 6. Optical Drive - DVD Read/Write
 - 7. USB port - 2.0 or 3.0
 - 8. Gbps Ethernet port or 100Mbps wired Ethernet (RJ-45) or 802.11n wireless
 - 9. Keyboard
 - 10. Mouse, Trackball or Trackpad
 - 11. Operating System - Windows 7 or 8, Windows Server 2008 R2, 32 or 64 bit
3. Programming Software
- a. Software for programming, monitoring and managing the data within Intelligent Panelboard controllers shall be fully compatible with the system environment and other software programs.
4. Custom Graphics Software [OPTION]
- a. The Custom Graphics software shall provide a fully interactive object oriented graphics interface for controlling the Intelligent Panelboard system. It shall be possible to create and depict objects such as light fixtures, switches, occupancy sensors, light sensors, floor plans, etc.
 - b. The Graphics Software shall provide server graphic web pages over local Ethernet connection to any computer using a standard Internet Browser.
5. Remote Access Software [OPTION]
- a. Software shall be available to allow the system to be accessed through the Internet through a secure line. Software is to reside on owner-provided server. Software shall provide security to the system.
6. Historical Data Logging [OPTION]
- a. Each Intelligent Panelboard controller shall provide data logging as an integral part. Data logging functions shall be divided into three functions: load logging, system logging and time interval monitoring.

1. The load logging function shall monitor load changes and be capable of storing 1,000 load state changes. Changes shall be logged by load changed, time and date.
 2. The system logging function shall record system-related events, these events shall be the alarms generated by the Intelligent Panelboard system. The date and time of the action, when the action occurred, when acknowledged and when cleared shall be stored. Controllers shall have the capacity to store 500 alarm actions.
 3. The time interval function shall be capable of taking snapshots of local network-wide parameters. These parameters shall be load states, energy levels and demand levels. These parameters shall be stored with a time and date stamp. A user-definable rate of sampling shall be assignable to each parameter. It shall be possible to log all loads by user selection. A snapshot of the states of all the loads connected to a controller, and the duration of time the loads have been on, shall be stored along with the date and time of the sampling. It shall be possible for the user to define the time that the sampling begins and ends and the time interval to sample. Up to a maximum of 1,000 samples may be stored. It shall be possible to log up to 500 network transmitted energy level samples from the low voltage switch override controller energy accumulators. It shall be possible to log up to 500 network transmitted demand level samples from the peak kW demand controller.
- b. The system software shall poll the Intelligent Panelboard controller and download controller historical logging information.
7. Data Management Software [OPTION]
- a. Data Management Software shall provide electronic worksheet capabilities for managing and presenting data accumulated by the system software.
 - b. The operator interface shall provide easy-to-use help screens, customizable smart icons, function menu, worksheet navigator, tabs for named worksheets, interactive status bar, drag-and-drop moving and copying of data, database querying, spelling checker, scenario and auditing tools, macro commands, charting, drawing, and database features.
 - c. It shall be possible to create a visual representation of worksheet data, the worksheet data shall be dynamic when required and update the trend chart as data changes. It shall be possible to create 3D bar, line, area, pie charts and High-Low-Close-Open (HLCO) charts to track data that fluctuates over time, such as kW usage, demand trends, etc.
 - d. Standard worksheet reports shall be able to provide for Tenant Billing, Power Usage, Fixture Life, Alarms, and Daylight Harvesting. Standard spreadsheet reports shall be customizable by the operator.
 - e. Software shall provide the ability to prevent others from changing or opening a file containing confidential data.
 - f. Software shall provide the ability to share information across applications by making a DDE connection between a file in one Windows application and a file in another Windows application.

PART 3 EXECUTION

3.01 FACTORY TESTING

- A. The factory service shall provide adequate testing of the supplied equipment and software to ensure that the system performs as intended by the specification. Building engineering personnel shall be trained on all aspects of operating and maintaining the system. Care shall be taken to ensure that the system load connections are to the electrical drawing and that the control scenarios are operating properly.

3.02 SYSTEM STARTUP AND TRAINING

- A. The Contractor shall be responsible for providing a fully functional system including all necessary programming and interfaces to other devices or systems.
- B. The Contractor shall meet with the owner's representative to identify the desired system operation prior to system start-up.
- C. Start-Up
 - 1. Manufacturer shall provide the services of a qualified factory-trained representative to assist the Contractor in starting-up and programming the system for a period of [] working days. The manufacturer's representative shall have a thorough knowledge of the software, hardware and system programming.
 - 2. Manufacturer shall schedule and confirm start -up and training after receipt of a written start-up request and required project documentation.
 - 3. The manufacturer's representative shall provide the following services:
 - a. Check installation of all Master Panelboards, Expansion Panelboards, central operator's station and other Intelligent Panelboard system components.
 - b. Test operation of all remote-controlled loads
 - c. Test operation of all switch override control units
 - d. Test operation of all digital and low voltage switches
 - e. Test operation of all network connections
 - f. Install central control software and test operation
 - g. Repair or replace any inoperative component
 - h. Test operation of complete Intelligent Panelboard system
 - i. Conduct system point-by-point walk through
 - 4. Manufacturer shall provide a qualified factory trained representative to perform system programming:
 - a. Assist the owner in defining a practical control scenario for each area
 - b. Program the owner defined control scenario
 - c. Explain the operation of the control programs to the owner and walk through their operation
 - d. Provide programs on digital media
 - 5. Manufacturer shall certify in writing that the equipment has been installed, adjusted and tested in accordance with the manufacturer's recommendations.
 - 6. Manufacturer shall provide three (3) copies of the representative's field startup report and representative's certification.
- D. Training

1. Manufacturer's qualified factory trained representative shall provide a training session for up to five (5) owner's representatives for [] normal workdays at a jobsite location determined by the owner.
2. Training session provided by the manufacturer's qualified factory-trained representative shall include instructions on the control system, programming, and other major components, including:
 - a. System review of all system components and their function
 - b. System review of all management software and its function
 - c. Operator training to develop experience with control applications

3.03 INSTALLATION

- A. The Contractor shall furnish, install and terminate all communication conductors and associated conduits external to any factory supplied equipment.
- B. All communication conductor wiring and routing shall be per the manufacturer's recommendations and as shown on the contract drawings.

3.04 FIELD TESTING

- A. Verify complete system operation including all hardware, software and communication devices.
- B. Verify networking performance with all interfacing systems by other manufacturers.

3.05 WARRANTY

- A. The warranty shall ensure that the Lighting Control System manufactured and supplied as specified will be the kind and quality described in the specification and will be free of defects in workmanship and material.
 1. Warranty shall be 1 year from date of startup not to exceed 18 months from date of shipment
 2. Equipment warranty shall be extended to two years from date of installation when service representatives employed by the equipment manufacturer perform installation.
 3. Warranty shall be valid if startup is completed by factory-trained representative
 4. Warranty replacement parts shall be available on a 24-hour delivery basis, if requested during normal working hours
 5. Warranty shall provide for on-site technical assistance if deemed necessary