SECTION 26 09 33

ARCHITECTURAL LIGHTING CONTROL SYSTEM

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\*\* NOTE TO SPECIFIER \*\* Legrand: Wattstopper; Vantage lighting and shading control products.
This section is based on the products of Legrand: Wattstopper, which is located at:2240 Campbell Creek Blvd., Suite 110Richardson, TX 75082Toll Free Tel: 800-879-8585Email: [request info (charles.knuffke@legrand.us)](https://arcat.com/rfi?action=email&company=Legrand%253A%252BWattstopper&message=RE%253A%2520Spec%2520Question%2520(16570wat)%253A%2520&coid=36455&spec=16570wat&rep=&fax=)
Web: <https://www.legrand.us/wattstopper.aspx>
 [ [Click Here](https://arcat.com/company/legrand-wattstopper-36455) ] for additional information.
Wattstopper, a product line of Legrand, offers the most comprehensive line of simple, scalable and flexible energy efficient lighting and shading control solutions for commercial and residential applications. The Wattstopper range of products, programs, and services have been helping customers save energy, meet green initiatives and comply with energy codes for more than 30 years.
A leading provider of products and systems for electrical installations and information networks wherever people live and work, Legrand delivers an unequaled depth and breadth of innovative solutions. Legrand North America and Legrand Canada companies include: Cablofil, Electrorack, Middle Atlantic, On Q, Ortronics, Pass & Seymour, Vantage and Wiremold.

1. GENERAL
	1. SECTION INCLUDES

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

* + 1. Architectural Lighting Control System: System includes
			1. Enclosures.
			2. System Processors.
			3. Enclosure Based Load Control.
			4. Standard Dimming Module.
			5. Universal Dimming Module
			6. Relay Module
			7. Commercial Relay Module
			8. Fan Module
			9. DMX/DALI Gateway / DMX Splitter
			10. Pre-Configured Architectural Dimming Panel - LCAP Series
			11. Emergency Lighting Relays - UL924
			12. Stations
			13. Keypad Stations
			14. Backlit Keypad Stations
			15. Wall-box Dimmer Keypad Station (wired OR wireless)
			16. Wall-box Relay Keypad Station (wired OR wireless)
			17. Relay Station - DIN
			18. Lighting-Only Relay Station - DIN
			19. Low-Voltage Relay Station - DIN (wired OR wireless)
			20. Low-Voltage Output Station - DIN
			21. Contact Input Station - DIN (wired OR wireless)
			22. Low-Voltage Output Station - Standard
			23. Window Covering Control ILT Station
			24. Thermostat Station
			25. User Touch Panel Interfaces
			26. Sensors
			27. Programming Software
	1. RELATED SECTIONS

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

* + 1. Section 26 27 16 - Electrical Cabinets and Enclosures.
		2. Section 26 50 00 - Lighting.
		3. Section 26 52 00 - Safety Lighting.
		4. Section 41 67 19 - Plant Safety Equipment.
	1. REFERENCES

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

* + 1. NFPA 70 - National Electrical Code; National Fire Protection Association.
		2. NEMA - National Electrical Manufacturers Association
		3. FCC emission standards
		4. UL - Underwriters Laboratories, Inc. Listings
		5. ULC - Underwriter Laboratories of Canada Listings
	1. DESIGN / PERFORMANCE REQUIREMENTS
		1. Conform to requirements of NFPA 70.
		2. System shall comply with FCC emission standards specified in part 15, sub-part J for commercial and residential application.
		3. System shall be listed under UL sections 916 and/or 508.
	2. SUBMITTALS
		1. Submit under provisions of Section 01 30 00.
		2. Product Data: Manufacturer's data sheets on each product to be used, including:
			1. Catalog sheets and specifications.
			2. Ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.
			3. Storage and handling requirements and recommendations.
			4. Installation instructions.
		3. Shop Drawings: Wiring diagrams a for the various components of the System specified including:
			1. Composite wiring and/or schematic diagram of each control circuit as proposed to be installed.
			2. Show location of all devices, including at minimum sensors, load controllers, and switches/dimmers for each area on reflected ceiling plans.
			3. Provide room/area details including products and sequence of operation for each room or area. Illustrate typical acceptable room/area connection topologies.
			4. Network riser diagram including floor and building level details. Include network cable specification. Illustrate points of connection to integrated systems. Coordinate integration with mechanical and/or other trades.

\*\* NOTE TO SPECIFIER \*\* Delete selection samples if colors have already been selected.

* + 1. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and finishes.
		2. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square, representing actual product, color, and finishes.
		3. Manufacturer's Certificates: Certify products meet or exceed specified requirements.
		4. Closeout Submittals:
			1. Project Record Documents: Record actual installed locations and settings for lighting control devices.
			2. Operation and Maintenance Manual:
				1. Include approved Shop Drawings and Product Data.
				2. Include Sequence of Operation, identifying operation for each room or space.
				3. Include manufacturer's maintenance information.
				4. Operation and Maintenance Data: Include detailed information on device programming and setup.
				5. Include startup and test reports.
	1. QUALITY ASSURANCE
		1. Manufacturer Qualifications: Company specializing in manufacturing of centralized and distributed lighting control systems with a minimum of 25 years documented experience.
		2. Installer Qualifications: Company certified by the manufacturer and specializing in installation of networked lighting control products with minimum three years documented experience or a company with five years experience specializing in installation of networked lighting control.
		3. System Programming: Shall be performed by the manufacturer's field technical services technician or by a third party service technician certified by the manufacturer to program Architectural Dimming networked lighting control systems.
		4. System Components: Demonstrate that individual components have undergone quality control and testing prior to shipping.
	2. PRE-INSTALLATION MEETINGS
		1. Convene minimum two weeks prior to commencing Work of this section. Meeting to be attended by Contractor, Architect, system installer, factory authorized manufacturer's representative, and representative of all trades related to the system installation.
		2. Review installation procedures and coordination required with related Work and the following:
			1. Confirm the location and mounting of all devices, with special attention to placement of switches, dimmers, and any sensors.
			2. Review the specifications for low voltage control wiring and termination.
			3. Discuss the functionality and configuration of all products, including sequences of operation, per design requirements.
			4. Discuss requirements for integration with other trades
		3. Inspect and make notes of job conditions prior to installation:
			1. Record minutes of the conference and provide copies to all parties present.
			2. Identify all outstanding issues in writing designating the responsible party for follow-up action and the timetable for completion.
			3. Installation shall not begin until all outstanding issues are resolved to the satisfaction of the Architect.
	3. DELIVERY, STORAGE, AND HANDLING
		1. Store products in a clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions until ready for installation
	4. PROJECT CONDITIONS
		1. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.
		2. Do not install equipment until following conditions can be maintained in spaces to receive equipment:
			1. Ambient temperature: 32 to 104 degrees F (0 to 40 degrees C).
			2. Relative humidity: Maximum 90 percent, non-condensing.
	5. WARRANTY
		1. Products Warranty: Manufacturer shall provide a 5 year limited warranty on products within this installation and consisting of a one for one control replacement.
	6. MAINTENANCE AND OPERATIONAL SERVICES

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

* + 1. Remote Access and Enhanced Warranty for Architectural Dimming Systems: Provide Manufacturer's Remote Access and Enhanced Warranty for Architectural Dimming Systems as follows:
			1. Configure to allow the manufacturer remote access to the lighting control system. Configuration includes two options;

\*\* NOTE TO SPECIFIER \*\* Select one of the following two optional paragraphs as required and delete the one not required.

* + - * 1. Cellular modem, antenna for the modem, cellular service contract and any Ethernet connections required to enable communication to the specified Architectural Lighting Control system. The system administrator will provide a means for the ROC (Remote Operations Center) to access the network containing the controllers.
				2. Configure to allow the manufacturer direct remote access to the lighting control system. Configuration includes Direct Ethernet connection to the system controller with the project IT System Administrator providing secure VPN access to the controller and appropriately managed IP addresses to all connected controllers. The system administrator will provide a means for the ROC (Remote Operations Center) to access the network containing the controllers.
			1. Remote Access program will automatically trigger a First Year Enhanced Warranty Agreement that will start once lighting control system startup is complete and accepted by the Owner. During this one year period, the Owners authorized site contact can request the manufacturer to check the system for proper operation and make any programmable changes desired. Manufacturer shall provide a phone number dedicated to customer calls concerning Remote Accessible systems, and a support organization capable of enabling cellular communication to the system for troubleshooting and making requested changes to the system. Any user attempting to request remote support on the system shall be fully verified by the Remote Operations Center (ROC) before providing remote support or making any changes to the system. Systems that allow the modem to be always accessible will not be acceptable. Access must be by a secured VPN connection to the private lighting control network that is completely isolated from the Owner's internal network. Remote access that requires a connection through the Owner's internal network is not acceptable.
			2. Remote Access Program may be continued by the Owner after the first year. However, If the Owner does not continue the enhanced warranty the cellular contract will lapse, and all hardware components, while still remaining property of the manufacturer, will remain in situ so that they can be re-activated at a later time should the Owner desire.
			3. Manufacturer's Remote Access capability shall provide at a minimum the following features:
				1. Ability to provide initial system diagnostics through Design Center Software to detect fault conditions in hardware or connected devices.
				2. Access to all devices via Design Center Software allowing for programmability of device features. This will include all scheduling of Time of Day Events and programming of individual device parameters to meet Sequence of Operation requirements.
				3. Access to the Controller hardware and any other hardware connected to the controller via Ethernet, Station Bus, or Wireless connection to verify it is setup per project documentation, and all functional operations are working properly.
				4. On demand access to manufacturer technical support via a Remote Operations Center (ROC) that will provide remote troubleshooting, diagnostics, and configuration/programming assistance.
				5. Additional client training and tuning on the Lighting Control System after building occupancy can be performed while remotely connected to the site.
				6. Remote Site Readiness Check (SRC) which allows the Remote Operations Center to perform a remote discovery of all devices connected to the lighting control network during installation. Architectural Dimming projects that have a RACCESS cellular modem and have successfully completed the Site Readiness Check (SRC) process will receive priority scheduling (a SRC is considered successful if 80% or more of the Architectural Dimming system devices are found on the network during discovery). After the scheduled on site startup, all manufacturer provided startup work for a site with a successful SRC will be done remotely, or via later complimentary return trips.

\*\* NOTE TO SPECIFIER \*\* Include the following optional paragraphs ONLY if "Remote Access and Enhanced Warranty for Networked Lighting Controls" is specified above. Delete entirely if not required.

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

\*\* NOTE TO SPECIFIER \*\* Delete either the �Connect Plus� or �Connect Prime� paragraph, whichever is not required.

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

Priority access to manufacturer technical support via a Remote Operations Center.

A complete system backup of LMCS and Segment Manager software files semi-annually.

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

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

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

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

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

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

A complete system backup of Design Center software files quarterly.

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

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

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

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

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

\*\* NOTE TO SPECIFIER \*\* Select one of the following paragraphs for the length of contact required and delete those not required.

* + - * 1. 1 Year.
				2. 2 Year.
				3. 3 Year.
				4. 4 Year.
				5. 5 Year.
	1. EXTRA MATERIALS
		1. See Section 01 60 00 - Product Requirements.
		2. Deliver extra sets of items for Owner's use in maintenance as follows:

\*\* NOTE TO SPECIFIER \*\* Insert project specific list below as required.

* + - 1. One extra system processor compatible with other processors within the system; same type and version.
			2. 5 percent extra touchscreens.
			3. 5 percent extra keypads, un-engraved.
			4. One extra dimming module of the types specified.
1. PRODUCTS
	1. MANUFACTURERS
		1. Acceptable Manufacturer: Legrand: Wattstopper, which is located at:2240 Campbell Creek Blvd., Suite 110Richardson, TX 75082Toll Free Tel: 800-879-8585Email: [request info (charles.knuffke@legrand.us)](https://arcat.com/rfi?action=email&company=Legrand%253A%252BWattstopper&message=RE%253A%2520Spec%2520Question%2520(16570wat)%253A%2520&coid=36455&spec=16570wat&rep=&fax=);Web: <https://www.legrand.us/wattstopper.aspx>

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

* + 1. Substitutions: Not permitted.
		2. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00.

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

* 1. ARCHITECTURAL LIGHTING CONTROL SYSTEM
		1. System General: Provide Wattstopper / Legrand, InFusion Lighting Control System indicated on the Drawings. Provide system with all necessary enclosures, wiring, and system components to ensure a complete and properly functioning system as indicated on the Drawings and this specification.
			1. Description: System shall be capable of switching and dimming incandescent, magnetic low voltage, electronic low voltage, fluorescent, LED, HID, neon, cold cathode, as well as non-lighting loads, such as motors and multiple-speed ceiling fans. Lighting Control System shall provide options for the following dimming requirements: leading-edge and trailing edge phase modulation; pulse-width-modulation; low-voltage (0-10VDC and variants); DALI (Digital Addressable Lighting Interface); DMX 512 and simple switching with latching and non-latching relay modules. Individual dimming loads shall be assignable to any power profile, specifically related to the fixture, and allowing for high-end and low-end trim, as well as pathway adjustment, allowing for best-fit dimming linearity.
			2. Features: System shall
				1. Include system with keypads and touch screens with buttons and software widgets that can be programmed without limitation and modified as per changing requirements.
				2. Provide the ability to automate events through occupancy sensors, ambient light sensors, magnetic door sensors, optical partition sensors as well as timed events.
				3. Provide for light-level maintenance (daylight harvesting) through use of ambient light sensor and adjustment of artificial lighting and window coverings.
				4. Provide multiple distributed sensor input points, including user keypads, multiple-input stations, and touch screens. Timed events shall be easily incorporated based on time of day, time intervals (every X seconds, minutes, hours), and relative to sunrise and sunset.
				5. Capable of incorporating centralized, panel-based load controls as well as distributed, switch-replacement load controls, communicating two-way with system controller via 2-wire low-voltage bus, wireless over-the-air radio frequency signals, and over Ethernet.
				6. Configurations capabilities should be available from a single system controller.

\*\* NOTE TO SPECIFIER \*\* Include the following optional paragraph if required for the project. Delete if not applicable.

* + - * 1. Capable of integrating with BMS (Building Management Systems) over BACnetIP through the system control.
			1. Software:
				1. All system definition, configuration and programming shall reside in a single project file, editable by means of a single Windows-based application software provided by Lighting Control System manufacturer. The software application shall enable non-lighting automation and control functions as required in project, including audio/video, HVAC, motorized window treatments, alarm systems, etc. Application will provide for definition of each individual control and shall provide for the use of time-based dependencies, occupancy dependencies, system component status and variable-based conditional logic dependencies.

\*\* NOTE TO SPECIFIER \*\* Include the following optional paragraph if required for the project. Delete if not applicable.

* + - * 1. Software shall enable the identification of loads to be controlled by a BACnet system and provide reports for integrator to enable the programming of said system. Identification of BACnet objects to be controller by the BMS is accomplished using checkboxes for each load, task, and sensor. The entire system can be BACnet enabled or just select objects.
		1. Enclosures: System Component products consist of one or multiple system processors, housed in enclosures together with centralized, modular load controls. System processors communicate to centralized load controls and each other over Class II cabling. System processors communicate with user interfaces over Class II cable networks and/or Ethernet connections and, where applicable, over-air RF signals. Distributed, switch-replacing load controls shall communicate via the same networks as user interfaces. Distributed third-party product integration devices, such as serial port interfaces, infrared devices, and sensor inputs shall also communicate via the same networks.
			1. Ship pre-wired from the factory.
			2. Provide physical isolation between low- and high-voltage compartments.
			3. Include neutral and ground terminals within enclosure.
			4. Provide screw terminal connections for breaker feeds, load feeds, neutrals, and all low-voltage connections.
			5. Use 600 volt rated wire throughout high-voltage areas.
			6. Designed for either recessed or surface mounting.
			7. Come in 24- or 48-load sizes (2 module or 4 module).
			8. Provided with hinged, securable covers.
			9. Convection cooled, and constructed of 16-gauge steel.
			10. Provide secured mounting positions for modules, not requiring screws and ship with terminal boards as required for specific module selection.
			11. Temporary Jumpers shall be available for the enclosure to test lighting load wiring and to provide module by-pass for temporary lighting.
			12. Provide knockouts on both the top and bottom of the enclosure for conductors (25 each 3/4 inch knockouts). Alternatively, unpunched top and bottoms shall be available to allow for custom punchwork. 2 inch knockouts shall be provided near top and bottom on both left and right side panels.
			13. Screw holes for mounting enclosure to studs shall feature strain relief.
			14. Enclosure door shall provide venting for heat as well as visual inspection of module indicator LEDs.
			15. Main Power Enclosure door shall provide opening for access to processor front panel without the need to open door.
			16. Enclosures Part Numbers:

\*\* NOTE TO SPECIFIER \*\* Select part number(s) required from the following paragraphs and delete those not required.

* + - * 1. IMPE-4-IC36: InFusion Main Power Enclosure 4 Module 36V.
				2. IMPE-2-IC36: InFusion Main Power Enclosure 2 Module 36V.
				3. IMPE-4-IC24: InFusion Main Power Enclosure 4 Module 24V.
				4. IMPE-2-IC24: InFusion Main Power Enclosure 2 Module 24V.
				5. ISPE-4-IC: InFusion Secondary Power Enclosure 4 Module.
				6. Enclosures starting with the part number LCAP.
		1. System Processors:
			1. Plug into enclosure without the use of tools.
			2. IC-36-II or IC-24-II processor contains an advanced microprocessor-based computer, capable of controlling up to 1396 lighting loads, and seamlessly communicate with up to 30 other processors. There can be only two IC- DIN- LITE controllers per project. Processor has a readily-replaceable 15-year lithium battery to retain volatile system memory in the event of a power failure. Processor shall store system programming in non-volatile memory.
			3. Provide connection to PC-compatible computer for programming via Ethernet and USB connectors.
			4. Have no moving- or motor-operated parts such as hard drives or cooling fans.IC-36-II or IC-24-II Processor shall connect up to120 low-voltage or 96 Equinox 40 stations and 120 wireless stations, and up to 60 Ethernet connected stations.
			5. IC-DIN-LITE Processor connect up to Up to 20 low voltage stations or 15 EQ40 stations, up to 60 wireless stations, and up to 20 Ethernet stations.
			6. IC-36-II or IC-24-II - Processor has a 4 x 20 character LCD screen for display of system information, for adjusting system clock, and for setting connection parameters.
			7. Connect to Secondary Terminal Boards (in enclosures without processors) via 16-gauge, 4-conductor cable.
			8. Connect to additional processors via 16-gauge, 2-conductor cable or by using Local Area Network Ethernet.
			9. Provide Integral time clock functions to allow automatic execution of independent lighting or system functions, set to repeat on any increment of time, such as every minute, every hour, every day, every week, or on set calendar days. System clock shall provide astronomical function, enabling time triggers relative to sunrise and sunset and shall provide for auto-adjustment for daylight saving time.
			10. IC-36-II or IC-24-II Processors have five RS-232 ports. System RS-232 commands shall be readily available for use by system installers to enable communication with third-party RS-232 capable products. RS-232 connections shall be via screw terminal connection. IC-DIN-LITE has 2 RS232 connections.
			11. IC-36-II or IC-24-II Processor has two RS-485 ports. System RS-485 commands shall be readily available for use by system installers to enable communication with third party RS-485 capable products. RS-485 connections are via screw terminal connection. IC-DIN-LITE has 1 RS485 connection.

\*\* NOTE TO SPECIFIER \*\* Include the following optional paragraph if required for the project. Delete if not applicable.

* + - 1. By adding the BACNET-IP-IC option to any controller, the controller shall be BACnet enabled and be able to connect to a Building Automation System (BMS directly over IP without the addition of any additional hardware. The BMS shall be able to control any Loads, Buttons(Tasks), and Occupancy Status and receive status from the controller about above objects.
			2. Provide for fading of dimmable lighting load intensities over an unlimited range of time.
			3. Processor communicates to stations via a two-conductor system bus, with up to 4000 feet of wire per processor.
			4. Firmware is electronically upgradeable, via local connection. Firmware shall not be EPROM type, requiring physical replacement of memory chips.
			5. Processors are remotely accessible, via internet connection for programming and performing system diagnostics.
			6. Processor to Processor connections utilize transformer isolation circuitry for enhanced lightning surge protection.
			7. Processors have an SD card slot to store a backup copy of system programming. This backup program shall be utilized in the event that a Processor is changed, such that no external reprogramming is required. System programming must be downloaded simply to a new Processor, without requiring the use of a computer.
			8. Part Numbers:

\*\* NOTE TO SPECIFIER \*\* Select part numbers required from the following paragraphs and delete those not required. InFusion Controller - DIN requires a separate power supply.

* + - * 1. IC-36-1: InFusion Controller 36V.
				2. IC-24-1: InFusion Controller 24V.
				3. IC-DIN: InFusion Controller - DIN.
				4. IC-DIN LITE: LITE InFusion Controller for simple integration.
		1. Enclosure-based Load Control:
			1. Enclosure-based Load Control provided by addition of multiple (8 - 12) load modules.
			2. Modules allow insertion and removal within the enclosure without tools, and without the need to remove any wiring to access the modules.
			3. Modules positioned with either a positive spring steel retaining connector or hand-operated latches.
		2. Standard Dimming Module:
			1. Modules are 9.44 inches by 7.63 inches by 3.75 inches (240 mm by 194 mm by 95 mm) and weigh no more than 5.7 lbs (2.6 kg).
			2. Modules plug into enclosure without the use of tools and are positioned with latching connector.
			3. Modules contain an integrated heat sink, and are convection cooled.
			4. Modules have over-current and over-heat protection circuitry. Standard Dimming Module automatically resume operation once module has cooled to within operating temperature range.
			5. Modules use triacs for dimming control.
			6. Modules provide step-free ramping and dimming.
			7. Modules capable of driving Incandescent, Neon, Magnetic Low Voltage, Cold Cathode, and forward-phase-compatible dimmable Fluorescent ballasts and LED drivers.
			8. Any output of Standard Dimming Module can be software-configured to relay mode, whereby non-dimming loads can be controlled: non-dimming Fluorescent and LEDs, Constant speed motors.
			9. Modules rated at 64 amps, with a maximum of 16 amps per single load. Each module accommodates up to 12 loads. Modules must accept multiple phases. 64 amps shall be divided across four line feeds.
			10. Module loads have a minimum load rating of no higher than 5W.
			11. Modules multiple-voltage rated, from 120 - 277VAC, 60/50Hz.
			12. Modules accommodate GFI circuit breakers and arc-fault breakers, without changes or modifications to wiring. Software shall allow for indication of arc-fault on any linefeed.
			13. Modules have the following Status Indicator Lights: Line Feed Power, Fuse, Load Power, Microprocessor Status, Over-current, Over-temperature and Manual Override.
			14. Modules have load-by-load selectable manual override circuitry via a low voltage switch contact. Load override dimming level shall be software-adjustable.
			15. Modules are self-powered, without the need for external power supply.
			16. Modules are fuse-protected against overload and short circuits. Modules feature one fuse per each of 4 line feeds. Spare fuse holder shall be incorporated into Module.
			17. Field wiring shall not require the presence of the Module, allowing quick and tools-free installation at start-up and change-out of the Module. Manufacturer shall make easy to install jumpers available so that electricians can energize circuits before any module is installed.
			18. Module provides an air-gap relay per load that opens whenever the corresponding load is turned off.
			19. Modules provide current and power measurement per linefeed, providing for energy management applications including conditional logic programming and value recording / display.
			20. Module provide for reporting via email whenever an event occurs, as definable through software including over-current, over-temperature, entering or exiting any defined wattage range.
			21. Module firmware shall be electronically upgradeable via local connection.
			22. Standard Dimming Module shall have SCCR Rating of 65KA.
			23. Standard Dimming Module Part Number.
				1. SDM12-EM: InFusion Standard Dimmer Module.
		3. Universal Dimming Module:
			1. Modules measure 9.44 inches by 7.63 inches by 3.75 inches (240 mm by 194 mm by 95 mm) and weighs no more than 5.7 lbs (2.6 kg).
			2. Modules plug into enclosure without the use of tools and are positioned with latching connectors.
			3. Modules contain an integrated heat sink, and be convection cooled.
			4. Modules have over-current and over-heat protection circuitry. Modules contain automatically resume operation once module has cooled to within operating temperature range.
			5. Modules use triacs for dimming control.
			6. Modules provide step-free ramping and dimming.
			7. Modules are capable of driving Incandescent, Neon, Magnetic Low Voltage, Cold Cathode, and forward or reverse-phase-compatible dimmable Fluorescent ballasts and LED drivers.
			8. Supports control of up to 8 universal loads, Offers load by load selectable load type (Forward/Reverse Phase Control).
			9. Any output of Module can be software-configured to relay mode, whereby non-dimming loads can be controlled: non-dimming Fluorescent and LEDs, Constant speed motors.
			10. Modules rated at 32 amps, with a maximum of 10 amps per single load. Each module accommodates up to 8 loads. Modules must accept multiple phases. 32 amps be divided across four line feeds.
			11. Module loads shall have a minimum load rating of no higher than 1W at 120V and 3W at 277V.
			12. Modules are multiple-voltage rated, from 120 - 277VAC, 60/50Hz.
			13. Modules accommodate GFI circuit breakers and arc-fault breakers, without changes or modifications to wiring. Software shall allow for indication of arc-fault on any linefeed.
			14. Modules have the following Status Indicator Lights: Line Feed Power, Fuse, Load Power, Microprocessor Status, Over-current, Over-temperature and Manual Override.
			15. Modules have load-by-load selectable manual override circuitry via a low voltage switch contact. Load override dimming level shall be software-adjustable.
			16. Modules are self-powered, without the need for external power supply.
			17. Modules are fuse-protected against overload and short circuits. Module feature one fuse per each of 4 line feeds. Spare fuse holder is incorporated into Module.
			18. Field wiring for the Modules do not require the presence of the Module, allowing quick and tools-free installation at start-up and change-out of the Module. Manufacturer shall make easy to install jumpers available so that electricians can energize circuits before any module is installed.
			19. Modules provide an air-gap relay per load which opens whenever the corresponding load is turned off.
			20. Modules provide current and power measurement per linefeed, providing for energy management applications including conditional logic programming and value recording / display.
			21. Modules provide for reporting via email whenever an event occurs, as definable through software including over-current, over-temperature, entering or exiting any defined wattage range.
			22. Module firmware is electronically upgradeable via local connection.
			23. Modules have SCCR Rating of 65KA.
			24. Universal Dimming Module Part Number:
				1. UDM08-EM: Universal Dimming Module.
		4. Relay Module:
			1. Modules measure 7.62 inches by 6.9 inches by 3.38 inches (194 mm by 175 mm by 85 mm) and weighs nor more than 7.8 oz (221g).
			2. Modules plug into the enclosure without the use of tools, and be positioned with a positive spring steel retaining connector.
			3. Modules accommodate four 20 amp line feeds for up to 8 relay loads.
			4. Module contains latching relays for increased reliability.
			5. Each relay channel has an arc suppression circuit to eliminate relay switch contact arcing, and is rated for a full 20 amp load on each channel.
			6. Modules have the following Status Indicator Lights: Line Feed Power, Load Power, Microprocessor Status, Manual Override.
			7. Each relay has a minimum usage rating of 250,000 cycles.
			8. Modules are load by load selectable manual override circuitry via a low voltage switch contact.
			9. Field wiring shall not require the presence of the Module, allowing quick and tools-free installation at start-up and change-out of the Module. Manufacturer shall make easy to install jumpers available so that electricians can energize circuits before any module is installed.
			10. Relay Module Part Numbers:
				1. MDR8RW101: 120 Volt Latching Relay Module.
				2. MDR8RW201: 277 Volt Latching Relay Module.
		5. Commercial Relay Module:
			1. Modules measure 7.62 inches by 6.9 inches by 3.38 inches (194 mm by 175 mm by 85 mm) and weigh nor more than 7.8 oz (221g).
			2. Modules plug into the enclosure without the use of tools, and be positioned with a positive spring steel retaining connector.
			3. Modules accommodate eight 20 amp line feeds, for up to 8 relay loads.
			4. Module contains latching relays for increased reliability.
			5. Each relay channel has an arc suppression circuit to eliminate relay switch contact arcing, and is rated for a full 20 amp load on each channel.
			6. Module have the following Status Indicator Lights: Line Feed Power, Load Power, Microprocessor Status, Manual Override.
			7. Each relay has a minimum usage rating of 250,000 cycles.
			8. Modules have load by load selectable manual override circuitry via a low voltage switch contact.
			9. Field wiring shall not require the presence of the Module, allowing quick and tools-free installation at start-up and change-out of the Module. Manufacturer shall make easy to install jumpers available so that electricians can energize circuits before any module is installed.
			10. Commercial Relay Module Part Number:
				1. MDR8CW301: 8 Line Feed Relay Module 120-277V.
		6. Fan Module:
			1. Module measures 7.6 inches by 6.9 inches by 2.375 inches (194 mm by 175 mm by 60 mm) and weigh1 no more than 1.55 lbs (703g).
			2. Modules plug into the enclosure without the use of tools, and be positioned with a positive spring steel retaining connector.
			3. Module accommodate two line feeds, for up to 8 fan loads.
			4. Each fan channel controls one fan at four speeds and off.
			5. Each fan channel has built-in MOV surge protection and allows for 2 amp load on each channel.
			6. Modules have the following Status Indicator Lights: Primary Line Feed Power, Load Power, Microprocessor Status, and Manual Override. Field wiring shall not require the presence of the Module, allowing quick and tools-free installation at start-up and change-out of the Module.
			7. Fan Module Part Number:
				1. FANMOD: Fan Module 120 Volt.
		7. DMX/DALI Gateway:
			1. Device is simultaneously capable of controlling one universe of DMX and 64 DALI addresses.
			2. Device shall connect to the Vantage system using Ethernet and be programmed by Design Center.
			3. Gateway shall provide bidirectional feedback of the lighting loads being controlled.
			4. Controller shall take input signals from DMX consoles running shows and provide feedback to the system to control other connected lighting loads.
			5. Device contains a webserver for programming and feedback of lighting system status.
			6. Device is capable of RDM communication.
			7. DMX/DALI Gateway Part Number:
				1. DMX-DALI-GW.
		8. DMX-DALI-GW DMX SPLITTER:
			1. Splitter provides wiring flexibility when distributing DMX control over large scale DMX lighting systems rather than using a DMX/DALI Gateway alone.
			2. Splitter connects to the DMX/DALI Gateway using a single three wire connection.
			3. Splitter is an RDM capable device.
			4. Splitter has 4 opto-isolated output channels that repeat and re-generate the DMX signal.
			5. Up to 32 Splitters are allowed on a single DMX bus.
			6. Splitter provides up to a full DMX universe of control.
			7. DMX SPLITTER Part Number:
				1. DMX-SPLITTER.
		9. Pre-Configured Architectural Dimming Panel - LCAP Series:
			1. Panels are pre-configured and wired from the factory so that the installer only must connect land line, load, and neutral wires.
			2. LCAP panels are configured using a variety of load modules and controllers.
			3. Panels offered in two sizes (32 inches H by 24 inches or 44 inches H by 24 inches) with various load configurations offered.
			4. Panel types designated by L or H have a Power over Ethernet switch included to provide power and data to touch screens or other Ethernet connected devices.
			5. Panels have integrated UL924 switching capabilities. Panels are UL924 listed and either individual loads or the entire panel can become a UL924 device.
			6. Panels can be connected and integrated with Watt Stopper DLM systems. DLM interface devices or sensors can control LCAP loads and/or Vantage interface devices can control DLM loads. Capability shall be built into the panel itself.
			7. Multiple panels can be connected together via two wire bus connection or over Ethernet to provide integrated system wide control.

\*\* NOTE TO SPECIFIER \*\* Include the following two optional paragraph if required for the project. Delete if not applicable.

* + - 1. Using a BACnet enabled controller allows an entire connected LCAP panel system to be controlled over BACnet by a BMS or similar system.
			2. Objects that can be controlled by a BACnet system are any loads, buttons (tasks), and sensor.
			3. Panels provided as main panels with controller or as secondary panels with no controller. In this way systems can be expanded efficiently without the burden of many controllers.
			4. Panels are capable of being connected to other Vantage products to form a distributed or wireless system allowing for nearly unlimited system expansion.
			5. Lighting Control and Automation Panels (LCAP) Part Numbers:

\*\* NOTE TO SPECIFIER \*\* Select part numbers required from the following paragraphs and delete those not required.

* + - * 1. LCAP32L (1, 2, 3, 4) opt S or E.
				2. LCAP32M opt (1, 2, C, F, U, X) X2.
				3. LCAP32S opt (1, 2, C, F, U, X) X2.
				4. LCAP44M opt (1, 2, C, F, U, X) X4.
				5. LCAP44S opt (1, 2, C, F, U, X) X4.
				6. LCAP44H (1 or 2) opt(1, 2, C, F, U, X) X2.
				7. LCAP44HS (1 or 2) opt (1, 2, C, F, U, X) X2.
				8. LCAP44A opt (1,2,3,4,5,6) X6.

\*\* NOTE TO SPECIFIER \*\* LCAP panels with part numbers 32M, 32S, 44M, 44S, and 44A shall have a Main Lug circuit breaker panel option. Include the following paragraph if required for the project. Delete if not applicable.

* + - 1. Main Lug: Pre-wired at the factory based on the Owner's project requirements and based on the number and type of modules and stations installed in the LCAP panel.
				1. Main Lug and LCAP panel will ship to the job site in one piece requiring no additional assembly by the Electrical contractor except for mounting on the wall and landing line and load connections
				2. Main Lug options will include:

Man Lug Feed Type: Main Lug or Main Lug with additional Main Breaker

Breaker Panel Bus type: 100 amp or 225 amp

Breaker panel size: 18 breaker size or 36 breaker size - with or without Main Breaker

Phase type; Single Phase or Three Phase

Main Lug Feed Voltage: 120/240V single phase, 120/2088 three phase, 277/480 three phase

Breaker SCCR ratings in the following range (kAIC at 20 amps): 10, 14, 22, 35, 65

* + - 1. LCAP (Lighting Control and Automation Panels) Part Number with Main Lug.

\*\* NOTE TO SPECIFIER \*\* Select part numbers required from the following paragraphs and delete those not required. See manufacturer's cutsheet or installation instructions for Ordering Key. Choice below should match choices made in Paragraph 2.2.L.12 "12. Lighting Control and Automation Panels (LCAP) Part Numbers:"

* + - * 1. LCAP32M opt (1,2,C,F,U,X) X2, (LO, CB), (1,2), (18, 36), (1,2), (1,2,4), (10,14,22,35,65)
				2. LCAP32S opt (1,2,C,F,U,X) X2, (LO, CB), (1,2), (18, 36), (1,2), (1,2,4), (10,14,22,35,65)
				3. LCAP44M opt (1,2,C,F,U,X) X4, (LO, CB), (1,2), (18, 36), (1,2), (1,2,4), (10,14,22,35,65)
				4. LCAP44S opt (1,2,C,F,U,X) X4, (LO, CB), (1,2), (18, 36), (1,2), (1,2,4), (10,14,22,35,65)
				5. LCAP44A opt (1,2,3,4,5,6) X6, (LO, CB), (1,2), (18, 36), (1,2), (1,2,4), (10,14,22,35,65)
		1. Emergency Lighting Relays - UL924:
			1. Electrical:
				1. VA-RRU-1 or VA-EPC-DFS shall automatically illuminate connected emergency loads to full brightness upon utility power interruption, regardless of switch/dimmer position. (NEC 700.24)
				2. VA-EPC-DFS shall be compatible with 2-wire, 3-wire, 0-10V, & DALI dimming systems and ballasts.
				3. The same local room switch, dimmer, or lighting control shall dim both regular and emergency luminaires at the same level during normal operation.
				4. VA-RRU-1 or VA-EPC-DFS have a minimum load rating of 20 Amps at 120V or 277V, 1800W Tungsten at 120V.
				5. VA-RRU-1 or VA-EPC-DFS accept (120 or 277V) 60Hz Input and Output with a voltage tolerance plus or minus 15 percent.
				6. VA-RRU-1 or VA-EPC-DFS include emergency power and regular power indicator LED's and a manual test switch which are visible to room occupants when installed flush. (UL924 Section 29).
				7. VA-EPC-DFS accept separate phases on the regular hot, emergency hot, and dimmed hot inputs.
				8. VA-RRU-1 or VA-EPC-DFS include high voltage input surge protection up to 50,000V.
			2. Load contacts shall be able to withstand 10 direct shorts while connected to 20 Amp breaker without permanent damage.
			3. VA-RRU-1 or VA-EPC-DFS shall not generate any objectionable electrical or mechanical noise.
			4. Mechanical:
				1. VA-EPC-DFS mount inside a 4-11/16 inch junction box with an extension box (total depth at least 4 inches) or into any LCAP panel.
				2. VA-EPC-DFS have UL94-V0 or UL94-5VA flame rating and approved for installation above the suspended ceiling.
				3. Dimensions: Flush mounted size: 6 inches by 6 inches by 1/4 inch, body size: 4-1/4 inches by 4-1/4 inches by 1-1/2 inches.
			5. General:
				1. VA-RRU-1 or VA-EPC-DFS shall be UL924 listed.
				2. VA-RRU-1 or VA-EPC shall comply with all applicable NEC, NFPA, OSHA, and local safety codes.
			6. Emergency Lighting Relay Part Numbers:

\*\* NOTE TO SPECIFIER \*\* Delete voltage requirement not required for shunt relays and surface mount switches.

* + - * 1. Voltage: 120 V:

Shunt Relays: VA-RRU-1-120V.

Surface Mount Switch: VA-EPC-DFS-120V.

* + - * 1. Voltage: 277 V:

Shunt Relays: VA-RRU-1-277V.

Surface Mount Switch: VA-EPC-DFS-277V.

* + 1. Stations:
			1. Provide for distributed load control as well as for interface with user, sensor, and third-party systems and components.
			2. System capacity of 3720 stations. Bus wiring topology shall be open, so long as no loops are introduced into bus.
			3. Each processor (IC) provides two wired station buses, each capable of 2000 foot wire run and 12 0 stations.
			4. Each IC-DIN-LITE processor provides 1 wired station bus capable of a 200 foot wire run and 60 wired stations.
			5. All Stations are low voltage type and use two-conductor Class II cables, electrically isolated from the power wiring. Low voltage cable type shall be 16 gauge, two-conductor, low capacitance non-shielded. Station connection must be non-polarized, with an isolated detachable connector that does not affect other stations on the bus. Stations must support make-up of connections while the system is energized.
			6. Faceplates on user interface keypads are mounted using no visible means of attachment.
			7. Unless otherwise noted on the Drawings, all stations shall mount in a standard back box. The width of each back box shall be determined by the number of stations being installed at a given location.
			8. Stations with RF communications shall not require the Class II cables.
		2. Keypad Stations:
			1. Stations connect to the two-conductor station bus without respect to polarity.
			2. Stations available with single-gang button configurations from 1 to 8 buttons, with up to 4 keypad stations ganged together under a single faceplate.
			3. Each Station has an additional two auxiliary contact inputs, configurable as infrared remote receiver, sensor inputs, or frequency sensitive data input such as light level indicator. 12 VDC @ 15ma shall be available via the auxiliary contact input connector, for each keypad station, to provide power to sensors. Auxiliary contacts are via six-wire pigtail harness, part number VDA-0015.
			4. Stations shall be available with an optional built-in infrared receiver.
			5. Keypads that require addressing via DIP switches, dials, or jumpers are not acceptable.
			6. Stations are capable of being unplugged and exchanged with the system operating and only affect corresponding Keypad.
			7. Each button on a Keypad Station shall be programmable such that it can control any single or group of loads on the entire system. Each button may be single- or multiple-step programmed with the ability to subject to conditions within the system, such as sensor status, load status, button status, time of day, variable values, etc.
			8. Keypad buttons are interchangeable without the use of tools. Provider must supply custom engraving. Button color options must include Legrand White, Black, Legrand Almond, Dark Bronze, and Nickel.
			9. Any keypad station can have the number of buttons on the station changed solely by changing the number of buttons, without changing the base assembly.
			10. Station faceplate color options include Legrand White, Black, Legrand Almond, Dark Bronze, and Nickel.
			11. Station buttons have the ability, based on system programming, to lock out certain keypad stations, buttons, timers, etc.
		3. Backlit Keypad Stations:
			1. Stations have 3-color LEDs to allow for any color as indicator of button state.
			2. Engraved text on each button are back-lit so as to be visible at night.
			3. Each Station incorporates an ambient light sensor so as to automatically adjust backlighting illumination level dependent on current ambient lighting conditions.
			4. Engraved text on each button serve as LED indicator.

\*\* NOTE TO SPECIFIER \*\* Select part number required from the following paragraphs and delete those not required. Note that @ represents number of buttons (1,2,3,4 or 5) %% represents color (LW for Legrand White, LA for Legrand Almond, BK for Black, DB for Dark Bronze, NI for Nickel), engraving option (Yes or No), faceplate material (P for Plastic and M for Metal).

* + - * 1. KS1@TE%%YM EasyTouch II Style with TrimLine II Trim, Engraved.
		1. Wall-box Universal Dimmer Keypad Station (wired OR wireless):
			1. Station shall connect to the two-conductor station bus OR shall communicate wirelessly with central processor via radio-frequency over-air signal, and shall be auto-addressing.
			2. Station is available with single-gang button configurations from 1 to 6 buttons, with as many as 4 stations ganged together under a single faceplate.
			3. Station are capable of dimming both forward or reverse phase lighting loads with phase auto-detect capabilities built-in. Optimal dimming phase can also be programmed to station from Design Center program.
			4. Universal Dimming Stations (DSU, RDU) are capable of driving incandescent, as well as forward or reverse-phase fluorescent ballasts and LED drivers.
			5. Forward Phase only Dimming Station (DS, RD) are capable of driving incandescent and magnetic low voltage loads as well as forward-phase fluorescent ballasts and LED drivers.
			6. Stations rated at 700W to 800W per load depending on lighting load type and ganging requirements. Stations have minimum load ratings of no more than 2W.
			7. Wall-box Dimmers without programmable buttons are unacceptable.
			8. Wall-box Dimmer Keypads shall appear identical to Keypad Stations, from user perspective, in both function and appearance; no button programmability restrictions are acceptable.
			9. Wall-box Dimmers that require addressing via DIP switches, dials, or jumpers are not be acceptable.
			10. Stations are available with built-in infrared receiver.
			11. Stations are capable of being unplugged and exchanged with the system operating and only affect corresponding keypad.
			12. Each Wall-box Dimmer Keypad button has multi-color LED indicator.
			13. Keypad buttons are interchangeable without the use of tools. Provider must supply custom engraving. Available button color options must include Legrand White, Black, Legrand Almond, Dark Bronze, and Nickel.
			14. Keypad faceplate color options includes Legrand White, Black, Light Almond, Dark Bronze, and Nickel.
			15. Wallbox Dimmer Keypad Station Part Numbers: Each part number below requires faceplate.

\*\* NOTE TO SPECIFIER \*\* Select part number required from the following paragraphs and delete those not required. Note that @ represents number of buttons per gang (1-5 for single-gang; %% represents color (LW for Legrand White, LA for Legrand Almond, BK for Black, DB for Dark Bronze, and NI for Nickel).

* + - * 1. DS1@TE%%YA WireLink EasyTouch II Style with TrimLine II Trim, Engraved Buttons.
				2. RD1@TE%%YA RadioLink EasyTouch II Style with TrimLine II Trim, Engraved Buttons.
				3. DSU1@TE%%YA WireLink Universal Dimmer EasyTouch II Style with TrimLine II Trim, Engraved Buttons.
				4. RDU1@TE%%YA RadioLink Universal Dimmer EasyTouchII Style with TriLine II Trim, Engraved Buttons.
		1. Wall-box Relay Keypad Station (wired OR wireless):
			1. Station connects to the two-conductor station bus OR communicate wirelessly with central processor via radio-frequency over-air signal, and shall be auto-addressing.
			2. Station is available with single-gang button configurations from 1 to 6 buttons, with as many as 4 stations ganged together under a single faceplate.
			3. Stations capable of switching non-dimming electrical loads.
			4. Stations rated at 16 amps per load.
			5. Station available in dual-relay configuration in a single gang, rated at 5A each and with hardware interlock switch.
			6. Wall-box Relays / Switches without programmable buttons are unacceptable.
			7. Wall-box Relay Keypads shall appear identical to Keypad Stations, from user perspective, in both function and appearance; no button programmability restrictions are acceptable.
			8. Wall-box Relays that require addressing via DIP switches, dials, or jumpers are not acceptable.
			9. Wall-box Relay Keypads Stations available with built-in infrared receiver.
			10. Stations capable of being unplugged and exchanged with the system operating and only affect corresponding keypad.
			11. Each Wall-box Relay Keypad button shall have multi-color LED indicator.
			12. Wall-box Relay Keypad buttons are interchangeable without the use of tools. Provider must supply custom engraving. Available button color options include Legrand White, Black, Legrand Almond, Dark B, Bronze and Nickel.
			13. Wall-box Relay Keypad faceplate color options include Legrand White, Black, Legrand Almond, Dark Bronze, and Nickel.
			14. Wallbox Relay Keypad Station Part Numbers: Each part number requires faceplate.

\*\* NOTE TO SPECIFIER \*\* Select part number required from the following paragraphs and delete those not required. Note that @ represents number of buttons per gang (1-5 for single-gang EasyTouch, %% represents color (LW for Legrand White, LA for Legrand Almond, BK for Black, DB for Dark Bronze, NI for Nickel).

* + - * 1. SR1@TE-%%YA WireLink EasyTouch II Style with TrimLine II Trim, Engraved Buttons.
				2. RR1@TE-%%YA RadioLink EasyTouch II Style with TrimLine II Trim, Engraved Buttons.
				3. SDR1@TE-%%YA WireLink EasyTouch II Style with TrimLine II Trim, Engraved Buttons, Dual-Relay.
				4. RDR1@TE-%%YA RadioLink EasyTouch II Style with TrimLine II Trim, Engraved Buttons, Dual-Relay.
		1. Relay Station - DIN:
			1. Relay Station connect to the two-conductor station bus and are auto-addressing.
			2. Each Station provides 8 outputs. Four shall be SPST (for resistive, motor, fluorescent and incandescent loads) and four shall be SPDT (for resistive and motor loads only) relays. Each relay is capable of driving up to 10A at up to 120V.
			3. Station have pushbutton actuators with LED status indicators, for each of the 8 outputs. Button actuators provided for system testing, programming override, and be controllable via system programming.
			4. All connections to the Relay Station shall be through removable screw terminal connectors.
			5. Relay Station is in a DIN configuration, measuring 3.4 inches by 6.18 inches by 2.28 inches.
			6. Relay Station - DIN Part Numbers
				1. RS8-DIN: 8 Channel, 10 Amp Relay Station - DIN.
		2. Lighting-Only Relay Station - DIN:
			1. Station connects to the two-conductor station bus and is auto-addressing.
			2. Station provides 8 SPST outputs (for resistive, motor, fluorescent and incandescent loads). Each relay capable of driving up to 10A at up to 120V.
			3. Stations have pushbutton actuators with LED status indicators, for each of the 8 outputs. Button actuators provided for system testing, programming override, and shall be controllable via system programming.
			4. All connections shall be through removable screw terminal connectors.
			5. Lighting-Only Relay Station is in a DIN configuration, measuring 3.4 inches by 6.18 inches by 2.28 inches.
			6. Lighting Only Relay Station - DIN Part Numbers:
				1. RS8-L-DIN: Lighting Only Relay Station - DIN.
		3. Low-Voltage Relay Station - DIN (wired OR wireless):
			1. Station (LVRS) connects to the two-conductor station bus and shall be auto-addressing, or communicate wirelessly with central processor via radio-frequency over-air signal. If connected to station bus, LVRS shall be powered from bus; if wireless, shall require an external 12VDC, 250mA power supply.
			2. Each LVRS provides 8 outputs. Each output is via a latching relay, with Set and Reset terminals, also known as Normally Open (N.O.) and Normally Closed (N.C.) contacts.
			3. Each relay has a peak rating of 48VAC/30VDC at 1 amp.
			4. LVRS have pushbutton actuators with LED status indicators, for each of the eight outputs. Button actuators provided for system testing, programming override, and are controllable via system programming.
			5. All connections to the LVRS through removable screw terminal connectors.
			6. LVRS are in a DIN configuration, measuring 3.4 inches by 6.18 inches by 2.28 inches.
			7. Low-Voltage Relay Station - DIN Part Numbers:

\*\* NOTE TO SPECIFIER \*\* Select part number(s) required from the following paragraphs and delete those not required.

* + - * 1. LVRS8-DIN: DIN Low Voltage Relay Station, WireLink.
				2. STOLER821: DIN Low Voltage Relay Station with RadioLink.
		1. Low-Voltage Output Station - DIN:
			1. Low-Voltage Output Station - DIN connects to the two-conductor station bus and shall be auto-addressing.
			2. Each Station provides 8 outputs, each of which are capable of driving 0-10VDC dimming control ballasts or drivers. The first 4 outputs can alternatively be software-configured to drive pulse-width-modulated (PWM) dimming control ballasts or drivers.
			3. Each output capable of driving up to 100mA loads (source or sink in 0-10V mode).
			4. Station provides 4 contact inputs for dry contact sensors, as well as one IR receiver and one frequency-variable input such as light sensor.
			5. Station provides two override switches. When either switch is closed, typically through a simple toggle switch, all loads are ON or OFF depending on which override loop is closed, with ON override taking precedence over OFF if both are closed.
			6. Station requires an external 13.8-36VDC, 15W power supply.
			7. Station has pushbutton actuators with LED status indicators, for each of the eight outputs. Button provided for system testing, programming override, and shall be controllable via system programming.
			8. All connections to Station through removable screw terminal connectors.
			9. Station is in a DIN configuration, measuring 3.4 inches by 6.18 inches by 2.28 inches.
			10. Low-Voltage Relay Station - DIN Part Numbers:

\*\* NOTE TO SPECIFIER \*\* Select part number(s) required from the following paragraphs and delete those not required.

* + - * 1. LVRS8-DIN DIN Low Voltage Relay Station, WireLink.
				2. STOLER821DIN Low Voltage Relay Station with RadioLink.
		1. Contact Input Station - DIN (wired OR wireless):
			1. Station connects to the two-conductor station bus and shall be auto-addressing, or communicate wirelessly with central processor via radio-frequency over-air signals. If connected to station bus, CIS shall be powered from bus; if wireless, shall require an external 12VDC, 250mA power supply.
			2. Provide for 10 inputs of either dry contact closure with floating ground, or 0-12VDC with floating ground. Input status of any CIS channel when used for 0-12VDC input shall be as follows: 0-0.5VDC is determined to be an open switch; 3-12VDC is determined to be a closed switch. Inputs to the CIS have diode-clamped over-voltage and reverse-polarity protection.
			3. CIS has pushbutton actuators with LED status indicators, for each of the 10 inputs. Button actuators are provided for system testing, programming override, and be controllable via system programming.
			4. Changes in status of contact inputs capable of initiating events within the control system. Each contact closure or opening detected will carry the same level of programmability as a button press or release on a keypad station.
			5. All connections are through removable screw terminal connectors.
			6. Station is in a DIN configuration, measuring 3.4 inches by 6.18 inches by 2.28 inches.
			7. Contact Input Station - DIN Part Numbers:

\*\* NOTE TO SPECIFIER \*\* Select part number(s) required from the following paragraphs and delete those not required.

* + - * 1. CIS10-DIN Contact Input Station 10 - DIN, WireLink.
				2. STIDER121 Contact Input Station with RadioLink - DIN.
		1. Low-Voltage Output Station - Standard:
			1. Station connects to the two-conductor station bus and shall be auto-addressing and includes an Ethernet connection option.
			2. Each Station provides 8 outputs, 4 of which are capable of driving 0-10VDC dimming control ballasts or drivers, and 4 of which are capable of driving pulse-width-modulated (PWM) dimming control ballasts or drivers.
			3. Each output capable of driving up to 100mA loads (source only PWM, source or sink 0-10V).
			4. Station provides 4 contact inputs for dry contact sensors, as well as one IR receiver and one frequency-variable input such as light sensor.
			5. Station provides two override switches. When either switch is closed, typically through a simple toggle switch, all loads are ON or OFF depending on which override loop is closed, with ON override taking precedence over OFF if both are closed.
			6. Station provides 4 relays, each of which can be paired to corresponding PWM or 0-10VDC output through software.
			7. Station is powered by 120-277VAC, 50/60Hz.
			8. Station has pushbutton actuators with LED status indicators, for each of the eight outputs. Button actuators provided for system testing, programming override, and are controllable via system programming.
			9. All connections are through removable screw terminal connectors.
			10. Station is in a DIN configuration, measuring 3.4 inches by 6.18 inches by 2.28 inches.
			11. Low-Voltage Output Station - Standard Part Numbers:

\*\* NOTE TO SPECIFIER \*\* Select part number(s) required from the following paragraphs and delete those not required.

* + - * 1. LVOS-0-10-PWM-P: Low Voltage Output Station, Panel Mount.
				2. LVOS-0-10-PWM: Low Voltage Output Station with individual enclosure.
		1. Window Covering Control ILT Station:
			1. Station connects to the two-conductor station bus, and shall be auto-addressing.
			2. Station control Somfy ILT protocol motors for complete control of a variety of window coverings.
			3. Each Station shall control two independent ILT motors.
			4. Station has stand-alone up/down and single preset position control through external switches.
			5. Window Covering Control ILT Station Part Number:
				1. ILTSILT Station for use with Somfy ILT Motors.
		2. Thermostat Station:
			1. Station shall connect to the two-conductor non-polarized station bus, or communicate wirelessly with central processor via radio-frequency over-air signal and be auto-addressing.
			2. Station connects to standard heating and cooling plant via conventional 24V thermostat wiring.
			3. Station accommodates single-stage and multi-stage heating, as well as heat-pump plant.
			4. Station provides stand-alone control of heating and cooling plant independent of communication with the control system.
			5. Station permits setpoint and mode adjustment through system programmable triggers, including button, sensor and time-based control triggers.
			6. Station communicate mode, measured temperature, and setpoint data to control system for user and automated monitoring requirements.
			7. Station displays control system time.
			8. Station displays outdoor temperature when sensor is present (only one sensor required per system, regardless of number of Thermostats).
			9. Both indoor remote temperature sensors and outdoor temperature sensors available and wired directly into the Thermostat Station without the requirement of converters of any kind.
			10. Station allows for temperature averaging across multiple indoor remote temperature sensors.
			11. Station features a backlit touch-panel display for quick and simple operation.
			12. Station display shows zone temperature, operation and mode and setpoints.
			13. Station displays local relative humidity.
			14. Station may be configured alternatively as thermostat or humidistat.
			15. Station supports local and system-wide scheduling through system user interfaces.
			16. Thermostat Station Part Numbers:

\*\* NOTE TO SPECIFIER \*\* Select part number(s) required from the following paragraphs and delete those not required.

* + - * 1. CC-STAT-WL-KIT: Vantage Universal Thermostat Including CC-WLINT WireLink interface.
				2. CC-STAT-RL-KIT: Vantage Universal Thermostat Including CC-RLINT RadioLink interface.
				3. SENSOR-ODT: Outdoor Temperature Sensor.
				4. FLUSHSENSOR: Flush Mount Thermostat Sensor.
		1. User Touch Screen / Panel Interfaces:

\*\* NOTE TO SPECIFIER \*\* Select interface(s) required from the following paragraphs and delete those not required.

* + - 1. Equinox 40 (EQ40):
				1. Touchscreen 4.3 inch LCD panel with projected capacitive touch interface.
				2. Touchscreen surface with edge to edge glass for increased ease of use.
				3. Mini graphical user interface should aesthetically match with other Equinox family devices and mobile idevice interfaces.
				4. Device provides an ambient light sensor for auto day/night backlighting.
				5. Device provides an active IR sensors for approach on and auto sleep modes.
				6. Provides up to four possible mini widget combinations.
				7. Device powered by InFusion hardware and software for programming.
				8. Devices is connected and powered via a two wire Station Bus.
				9. Device is installed using standard using US and European single-gang wall box mechanics.
				10. Device is able to be dynamically updated for both content and firmware through the two wire bus.
				11. Device to be ultra-low power consumption of less than or equal to 3 watts.
				12. Device employs a user interface that allows for tap, swipe, press, and hold to navigate.
				13. Devise has three screens that can provide 5 scenes, lighting loads, shade functions or other functions as allowed by the system per screen.
				14. Device provides two mechanical buttons to add supplementary control functions; the home button brings the screen back to the home screen without having to swipe and; a programmable task button that allows for a customized function to be initiated.
				15. Equinox 40: 4 inch diagonal Single Gang Wall Box Touch Screen Part Number:

EQ40.

* + - 1. Equinox 41 (EQ41):
				1. Touchscreen 4.3 inch LCD panel with projected capacitive touch interface.
				2. Touchscreen surface with edge to edge glass for increased ease of use.
				3. Device provides an ambient light sensor for auto day/night backlighting.
				4. Device provides an active IR sensors for approach on and auto sleep modes.
				5. Device has multiple visible control widget with full screen and edit modes.
				6. Device interface is widget based with each widget corresponding to systems and components programmed into the system by the Design Center software. Specific widgets are provided for control of Lighting, Scenes, Shades, Schedules and Timers. Under the Lighting Widget Dynamic White (CCT) and Full Color Lighting control are graphically represented when using both native Luminetix drivers and other third party systems.
				7. User Interface provides 3 levels of access and permission control to limited system access for specific user types. Using a password system an end-user can be allowed access to a specific room, device or scene, or can be allowed access to the entire or partial system. The access can be limited to making changes to the system or just using the system.
				8. System provides integration of third party and native devices through software drivers.
				9. Multiple levels of system control and modification provided at different layers of the user interface without system reprogramming . For instance the end-user can change and adjust scenes and timers without the use of Design Center software and from the interface device.
				10. UI shall be consistency with smartphones (Android and iOS) and Equinox 73 providing the same end user experience across all platforms
				11. Use standard US and European single-gang wall box mechanics.
				12. Device is dynamically updated with sub-system status and feedback.
				13. Devices powered and controlled over Power over Ethernet (POE) CAT 5E standards using low (12V DC) power.
				14. Touchscreen User Interface shall allow for customizing the look of the screen with different color themes, font sizes, and custom graphics.
				15. Device provides two mechanical buttons to add supplementary control functions. The home button brings the screen back to the home screen without having to swipe, and a programmable task button that allows for a customized function to be initiated.
				16. Equinox 41: 4 inch diagonal Single Gang Wall Box Multi-Widget Touch Screen Part Number:

EQ41-LCAP.

* + - 1. Equinox 73 (EQ73):
				1. Touchscreen 7.3 inch LCD panel with projected capacitive touch interface.
				2. Touchscreen surface with edge to edge glass for increased ease of use.
				3. Device provides an ambient light sensor for auto day/night backlighting.
				4. Device provides active IR sensors for approach on and auto sleep modes.
				5. Device interface is widget based with each widget corresponding to systems and components programmed into the system by the Design Center software. Specific widgets are provided for control of Lighting , Scenes, Shades, Room Divide and Combine, and Schedules and Timers. Under the Lighting Widget Dynamic White (CCT) and Full Color Lighting control are graphically represented when using both native Luminetix drivers and other third party systems.
				6. User Interface provides 3 levels of access and permission control to limited system access for specific user types. Using a password system an end-user can be allowed access to a specific room, device or scene, or can be allowed access to the entire or partial system. The access can be limited to making changes to the system or just using the system.
				7. System provides integration of third party and native devices through software drivers.
				8. Multiple levels of system control and modification provided at different layers of the user interface without system reprogramming. For instance the end-user can change and adjust scenes and timers without the use of Design Center software and from the interface device.
				9. UI provides consistency with smartphones (Android and iOS) and Equinox 41 with the same end user experience across all platforms.
				10. Touchscreen User Interface shall allow for customizing the look of the screen with different color themes, font sizes, and custom graphics.
				11. Device dynamically updates with sub-system status and feedback.
				12. Devices s powered and controlled over Power over Ethernet (POE) CAT 5E standards using low (12V DC) power.
				13. Device provides two mechanical buttons to add supplementary control functions; the home button brings the screen back to the home screen without having to swipe and; a programmable task button that allows for a customized function to be initiated.
				14. Equinox 73: 7 inch diagonal Box Multi-Widget Touch Screen Part Number:

EQ73-LCAP.

* + - 1. Equinox Mobile Application:
				1. System provides app licenses through the use of system SD license cards. Available in 5, 10, and unlimited versions.
				2. App is downloadable from the iTunes App Store and Android Market.
				3. Device Systems Specification:

Works over Wi-Fi and 3G/4G/LTE.

Prescribed user interface - consistent interface across mobile and fixed interfaces.

Function is identical to EQ41 and EQ73 wall mounted touchscreens. The EQ41 interface corresponds to a phone device and the EQ73 interface corresponds to a table device.

* + - * 1. Device interface is widget based with each widget corresponding to systems and components programmed into the system by the Design Center software. Specific widgets are provided for control of Lighting, Scenes, Shades, Room Divide and Combine, and Schedules and Timers. Under the Lighting Widget Dynamic White ( CCT) and Full Color Lighting control are graphically represented when using both native Luminetix drivers and other third party systems.
				2. User Interface provides 3 levels of access and permission control to limited system access for specific user types. Using a password system an end-user can be allowed access to a specific room, device,or scene, or can be allowed access to the entire or partial system. The access can be limited to making changes to the system or just using the system.
		1. Sensors:
			1. System Sensor Capabilities:
				1. System provides multiple wiring point options for sensors, including keypads and contact input stations.
				2. Sensors capable of being unplugged and exchanged with the system operating and shall only affect the corresponding sensor.
				3. Each Sensor programmable such that it can control any single or group of loads on the entire system with ability to subject to conditions within the facility, such as motion, light intensity, time of day, etc.

\*\* NOTE TO SPECIFIER \*\* Select interface(s) required from the following paragraphs and delete those not required.

* + - 1. Motion / Occupancy Sensors:
				1. Sensors shall be sourced by lighting control system manufacturer or s approved by manufacturer. System shall provide for both normally-open and normally-closed sensors and shall provide for variable timeout duration. A variety of sensors are available for both motion and occupancy applications as well as for multiple mounting locations and ranges.
				2. Passive infrared sensors are capable of detecting presence in the control area by detecting changes in the infrared energy. Small movements shall be detected such as when a person is writing while seated at a desk within an 8 feet radius of the sensor.
				3. To avoid false ON activations and provide high sensitivity to minor motion, Pulse Count Processing and Detection Signature Analysis shall be used to examine the frequency, duration, and amplitude of the signal received by the sensor to respond only to those signals caused by human motion.
				4. Sensor utilize mixed signal ASIC (application-specific integrated circuit) technology, which combines analog and digital processing into one chip package, to provide immunity to RFI and EMI.
				5. Sensor utilize a temperature compensated dual element sensor and a multi-element Fresnel lens.
				6. Fresnel lens shall be Poly IR 4 based material to offer superior performance in the Infrared wavelengths and filter short wavelength infrared, such as those emitted by the sun and other visible light sources. Lens has grooves facing in to avoid dust and residue build up which affects IR reception.
				7. To ensure sensitivity to small motion at the desktop, the sensor shall have a 34 element Extended Range lens (standard) or a 55 element High Density lens.
				8. Sensor shall cover 360 degrees, up to 140 square feet of walking motion when mounted at a ceiling height of 8 feet.
				9. Sensor shall not protrude more than 0.36 inches from the ceiling and blend in aesthetically.
				10. Mounting hardware shall be concealed under a removable cover to prevent tampering and adjustments to hardware.
				11. Multiple sensors shall be capable of programming to allow coverage of large areas.
				12. Sensor shall be manufactured by an ISO 9002 certified manufacturing facility and have a defect rate of less than 1/3 of 1 percent.
				13. Sensor shall have standard 5 year warranty.
				14. Sensor shall be UL and CUL listed.
				15. Motion Sensor Part Number:

EM-MOTIONSENSOR15 PIR Motion Sensor - 15 foot diameter.

* + - 1. Ambient Light Sensors:
				1. Ambient Light Sensors shall be provided by lighting control system manufacturer and provide for energy saving applications related to balance of artificial and natural lighting to achieved target lighting levels.
				2. Ambient Light Sensor Part Number:

EM-LIGHTSENSOR Ambient Light Level Sensor.

Optical Partition Sensors:

Optical Sensors shall be provided for partitioning or divide and combine room applications.

Optical Sensors shall have a range of up to 20 meters.

Sensor shall use a pulse modulated output in both the visible and infrared spectrum for high immunity to ambient and flashing light.

Partition Sensor Part Number: PARTITION-SENSOR.

* + 1. Programming Software:
			1. System uses a single, comprehensive Windows-based software program for all system programming and setup.
			2. Software allows for complete control of each and every load and every station button.
			3. Software allows for multiple functions to be set up for each and every load within the system, and to allow for multiple conditional (if...then) logic statements, as well as time delays.
			4. Software allows for multiple timed events, based on astronomical and/or real time clock features capable of accessing any and every load within the system.
			5. Software provides the capability to turn loads on and off based on load and switch conditions, auxiliary sensor conditions, and other system status as provided and determined by system designer.
			6. Software provides the ability to fade loads on and off over selectable time periods in increments of 0.1 second.
			7. Software provides a minimum of 400 pre-developed procedures to allow system programmers to quickly accomplish a wide variety of tasks.
			8. Software provides the ability to connect remotely to the system, via Internet, to modify system programming, monitor system status, and perform system diagnostics.
			9. System diagnostics provides the following capabilities: Processor testing, Module testing including dimmer module temperature status, Station testing, button press monitoring, button press history, manual override status, time and data, processor status, etc.
			10. Software provides interface capabilities via RS-232 serial connection and by TCP/IP via Ethernet to third party products for two-way control and communication. System command codes and responses shall be published and available for use by the system programmer.
			11. Software provides programmer with the ability to email status-specific messages to user, agent or maintenance personnel based on any predefined system event / status.
			12. Software provides access to an online library of drivers for third-party devices capable of communication via RS-232, RS-485, TCP/IP and IR. Such driver objects inserted into project file shall be programmed using standard programming procedures as if third-party objects were native to the system.
			13. System software allows for system programmer to develop custom drivers for third-party devices.
			14. Software which does not support the exportation of functions and customized objects to a library for re-use is not acceptable.
			15. Programming Software Name:
				1. InFusion Design Center.
1. EXECUTION
	1. EXAMINATION
		1. Do not begin installation until measurements have been verified and work areas have been properly prepared.
		2. If preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
	2. INSTALLATION
		1. Install system in accordance with the approved system shop drawings and manufacturer's instructions.
		2. Install all stations bus devices using manufacturer's two wire bus. Wire option are VDA-0143 for non-plenum application and VPLENUM CABLE for plenum applications. Use industry standard Ethernet cables and devices for Ethernet system connections.
			1. Low voltage wiring topology must comply with manufacturer's specifications.
			2. Route network wiring as indicated on the Drawings as closely as possible. Document final wiring location, routing and topology on as built drawings.
		3. All line voltage connections shall be tagged to indicate circuit and switched legs.
		4. Test all devices to ensure proper communication.
		5. Calibrate all sensor time delays and sensitivity to guarantee proper detection of occupants and energy savings. Adjust time delay so that controlled area remains lighted while occupied.
		6. Provide written or computer-generated documentation on the configuration of the system including room by room description including:
			1. Sensor parameters, time delays, sensitivities, and daylighting setpoints.
			2. Sequence of operation, (e.g. manual ON, Auto OFF. etc.).
			3. Load Parameters (e.g. blink warning, etc.).
		7. Post start-up tuning - Adjust sensor time delays and sensitivities to meet the Owner's requirements 30 days from beneficial occupancy. Provide a detailed report to the Architect / Owner of post start-up activity.
		8. Tighten all panel Class I conductors from both circuit breaker and to loads to torque ratings as marked on enclosure UL label.
		9. All Class II cabling shall enter enclosures from below within low-voltage wiring cage and shall remain within the wiring cage. No Class I conductors shall enter this low-voltage cage.
		10. Run separate neutrals for each branch load circuit. Each dimming load shall have separate neutral.
		11. Test all panel-based lighting load circuits using jumpers designed for the purpose, verifying no short circuits. Jumpers shall remain in place until all loads have been fully tested and until such time as modules are placed. Jumpers shall provide temporary power to lighting loads through construction phase.
		12. Verify all non-panel-based lighting loads to be free from short circuits prior to connection to dimmers and switches.
	3. FIELD QUALITY CONTROL
		1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
		2. Tests and Inspections: Manufacturer's service representative shall perform the following inspections and prepare reports. Tests shall be witnessed by Owner's Representative.
			1. Complete installation and start-up checks according to manufacturer's written instructions.
			2. Verify Class II connections.
			3. Check for completion of Class I wiring checks prior to connection to load controls.
			4. Set IP addresses and other network settings of system controller(s) as per facilities IT instructions.
			5. Load completed program file to controller.
			6. Configure all stations.
			7. Verify / complete task programming for all buttons, timers, and sensors.
			8. Coordinate with lighting specifier as to lighting levels, fade and ramp rates on button controls.
			9. Correct any system issues and retest.
		3. Provide a report in table format including each room or space that has occupancy sensors and/or light level sensors installed. Indicate the following for each space:
			1. Date of test or inspection.
			2. Pole Number and Fixture Address.
			3. Quantity and Type of each device installed.
			4. Sequence of Operation for the control each zone controlled.
			5. Verification that the control of each space complies with the Sequence of Operation.
			6. Test Reports for each device.
			7. Photo control Sensors, indicate the following:
				1. Ambient light level at which the lights turn on (low level).
				2. Ambient light level at which the lights turn off.
				3. Location of light level readings.
				4. Time delay settings.
			8. Manual Controls, indicate the following:
				1. Light fixture output steps up to 100% upon manual activation.
				2. Light fixture output steps down to low level upon manual activation.
				3. Light fixture output resets to default low level photocontrol operation after lights are turned off (by methods, manual or automatic means).
				4. Time delay settings.
	4. DEMONSTRATION AND TRAINING
		1. Before Substantial Completion, arrange and provide a one-day Owner instruction period to designated Owner personnel. Set-up, starting of the lighting control system and Owner instruction includes:
			1. Confirmation of entire system operation and communication to each device.
			2. Confirmation of operation of individual relays, switches, and sensors.
			3. Confirmation of system Programming, photocell settings, override settings, etc.
			4. Provide training to cover installation, maintenance, troubleshooting, programming, and repair and operation of the lighting control system.
	5. PRODUCT SUPPORT AND SERVICE
		1. Factory telephone support shall be available at no cost to the Owner following acceptance. Factory assistance shall consist of assistance in solving application issues pertaining to the control equipment.

END OF SECTION