

SECTION 16011 TEMPORARY & PERMANENT ELECTRICAL SERVICE  
PART 1 - GENERAL  
1.1 RELATED DOCUMENTS  
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.  
1.2 SUMMARY  
A. This section includes temporary lighting and power with luminaires, panelboards, circuit breakers, and enclosures.  
B. Related sections include the following:  
1. Division 16 Section "Wiring Methods"  
2. Division 16 Section "Wiring Devices"  
3. Division 16 Section "Circuit Breakers"  
4. Division 16 Section "Panel Boards"  
1.3 IDENTIFICATIONS  
A. GFCI Ground Fault Current Interrupter.  
B. RMS: Root Mean Square  
C. SPT: Single Pole, Double Throw  
1.4 USE OF MATERIALS  
A. General: Cost or use charges for temporary facilities are not chargeable to Tenant, Architect, or Engineer and shall be included in the Contract Sum. Allow other entities to use temporary services and facilities without cost, including, but not limited to, the following:  
1. Tenant's construction forces.  
2. Occupants of Project.  
3. Architect.  
4. Engineer.  
5. Testing agencies.  
6. Personnel of authorities having jurisdiction.  
B. Permanent Service: Coordinate with building Tenant and utility company to establish permanent service upon completion of the project. Contractor shall pay for all permits, bid to construction charges, and related fees associated with the new service.  
1.5 NOTIFICATION  
A. Coordinate with Tenant to provide 72 hour written notification to other tenants of any power interruptions. Notification shall state the estimated time and duration of the electrical outage.  
1.6 QUALITY ASSURANCE  
A. Standards: Comply with ANSI A136, NEC's "Temporary Electrical Facilities," and NFPA 70E.  
1. Trade Jurisdictions: Assigned responsibilities for installation and operation of temporary utilities are not intended to interfere with trade regulations and union jurisdictions.  
2. Electric Service: Comply with NFPA 70E, NEC, and standards and regulations for temporary electric service. Install service to comply with NFPA 70E.  
3. Comply with OSHA standards and regulations.  
PART 2 - PRODUCTS  
2.1 MATERIALS  
A. Electrical Outlets: Properly configured, NEMA-polarized outlets to prevent insertion of 110- to 120-V plugs into higher-voltage outlets; equipped with ground-fault circuit interrupters, reset button, and pilot light.  
B. Power Distribution System Circuits: Where permitted and overhead and exposed for surveillance, wiring circuits, not exceeding 125V ac, 20-A rating, and lighting circuits may be nonmetallic sheathed cable.  
C. Main panelboard with disconnect.  
D. Temporary lighting.  
E. 120 volt receptacles with overcurrent protection.  
F. Enclosures: NEMA AB 1 and NEMA 1 to meet environmental conditions of installed location.  
1. Outdoor Locations: NEMA 250, Type 3B.  
PART 3 - EXECUTION  
3.1 INSTALLATION  
A. Electric Power Service: Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during construction period. Include meters, transformers, and overload protected disconnect means.  
1. Install power distribution wiring overhead and rise vertically where least exposed to damage.  
2. Electric Distribution: Provide receptacle outlets adequate for connection of power tools and equipment.  
3. Provide electrical connectors to connect separate lengths of electrical power cords if single lengths will not reach areas where construction activities are in progress. Do not exceed safe length-voltage ratio.  
3. Provide metal conduit, tubing, or metallic cable for wiring exposed to possible damage. Provide rigid steel conduits for wiring exposed on grades, floors, decks, or other traffic surfaces.  
3. Provide metal conduit enclosures or boxes for wiring devices.  
4. Provide 4-gang outlets, spaced so 1-DO-foot (30-m) extension cord can reach each area for power hand tools and task lighting. Provide a separate 125-V ac, 20-A circuit for each outlet.  
C. Lighting: Provide temporary lighting that provides adequate illumination for construction operations and traffic conditions.  
1. Install and operate temporary lighting that fulfills safety and protection requirements without operating entire system.  
2. Provide one 100-W incandescent lamp every 50 feet (15 m) in traffic areas.  
3. Install exterior yard lighting that provides adequate illumination for construction operations, parking and traffic conditions, and storage visibility when the Work is being performed.  
4. Install lighting for Project identification sign.  
END OF SECTION 16011

SECTION 16090 - GROUNDING AND BONDING  
PART 1 - GENERAL  
1.1 SUMMARY  
A. This section includes grounding of electrical systems and equipment. Grounding requirements specified in this Section may be supplemented by special requirements of systems described in other Sections.  
1.2 QUALITY ASSURANCE  
A. Testing Agency Qualifications: Testing agency as defined by OSHA in 29 CFR 1910.7 or a member company of the International Electrical Testing Association and that is acceptable to authorities having jurisdiction.  
1. Testing Agency's Field Supervisor: Person currently certified by the International Electrical Testing Association to supervise on-site testing specified in Part 3.  
B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.  
1. Comply with UL 467.  
PART 2 - PRODUCTS  
2.1 GROUNDING CONDUCTORS  
A. For insulated conductors, comply with Division 16 Section "Wiring Methods."  
B. Material: Copper.  
C. Equipment Grounding Conductor: Terminations: Use bolted pressure clamps.  
D. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.  
1. Use insulated spacer; space 1 inch from wall and support from wall 6 inches above finished floor, unless otherwise indicated.  
2. At doors, route the bus up to the top of the door frame, across the top of the doorway, and down to the specified height above the floor.  
2.2 EQUIPMENT GROUNDING CONDUCTORS  
A. Comply with NFPA 70, Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specified, larger sizes, or more conductors than required by NFPA 70 are indicated.  
3. INSTALLATION  
3.1 APPLICATION  
A. Use only copper conductors.  
B. In raceways, use insulated equipment grounding conductors.  
C. Equipment Grounding Conductor: Terminations: Use bolted pressure clamps.  
D. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.  
1. Use insulated spacer; space 1 inch from wall and support from wall 6 inches above finished floor, unless otherwise indicated.  
2. At doors, route the bus up to the top of the door frame, across the top of the doorway, and down to the specified height above the floor.  
3.2 EQUIPMENT GROUNDING CONDUCTORS  
A. Comply with NFPA 70, Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specified, larger sizes, or more conductors than required by NFPA 70 are indicated.  
3.3 INSTALLATION  
A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated. Avoid obstructing access or plading conductors where they may be subjected to strain, impact, or damage.  
3.4 CONNECTIONS  
A. General: Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.  
B. Equipment Grounding Conductor: Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.  
C. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.  
D. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.  
END OF SECTION 16090

SECTION 16100 - WIRING METHODS (CONT.)  
PART 1 - GENERAL  
1.1 SECTION REQUIREMENTS  
A. Summary: Building wire and cable and associated splices, connectors, and terminations for wiring systems rated 600 V and less, and twisted pair and shielded twisted pair.  
PART 2 - PRODUCTS  
2.1 WIRING AND CABLES  
A. Connectors and Splices: Wiring connectors of size, ampacity rating, material, and type and class for application and service intended.  
2.2 RACEWAYS  
A. Wireways: Srewed cover type, with manufacturer's standard finish.  
B. Outlet and Device Boxes: Sheet metal boxes, except use cast metal boxes at exterior, interior exposed, and interior damaged locations.  
C. Pull and Junction Boxes: Sheet metal boxes, except use nonmetallic boxes with gasketed covers at exterior and interior damaged locations.  
2.3 ENCLOSURES  
A. Hinged Cover Enclosures: NEMA 250, steel enclosure with continuous hinge cover and flush latch, with inside door with manufacturer's standard enamel.  
B. Cabinets: NEMA 250, Type 1, unless otherwise indicated.  
PART 3 - EXECUTION  
3.1 INSTALLATION  
A. Install wires and cables according to the NEC's "Standard of Installation."  
B. Wiring at Outlets: Install with at least 12 inches of slack conduct to each outlet.  
C. Conduit wiring, unless otherwise indicated, within finished walls, ceilings, and floors.  
D. Boxes and Enclosures: In damp or wet locations use NEMA 250, Type 1, unless steel.  
E. Use raceway fittings compatible with raceway and suitable for use in raceway. For intermediate steel conduit, use threaded rigid steel conduit fittings, unless otherwise indicated.  
F. Raceways Embedded in Slabs: Install in middle third of the slab thickness where practical, and leave at least 1-inch concrete cover.  
G. Install exposed raceways parallel to or at right angles to nearby surfaces or structural members, and follow the surface contours as much as practical.  
H. Join raceways with fittings designed and approved for the purpose and make joints tight. Use bonding bushings or wedges at connections subject to vibration. Use bonding jumpers where joints cannot be made tight. Use insulating bushings to protect conductors.  
I. Install pull wires in empty raceways. Use No. 14 AWG zinc-coated steel or monofilament plastic line having not less than 200-lb tensile strength. Leave not less than 18 inches of slack at each end of the pull wire.  
J. Install raceway sealing fittings where required by the NEC and at wiring entrances to refrigerated spaces. Locate at suitable, approved, accessible locations and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces.  
K. Stub-up Connections for Equipment: Extend conductors to equipment with intermediate metal conduit; flexible metal conduit may be used 6 inches above the floor.  
L. Install a separate green ground conductor in surface metal raceway from the junction box supplying the raceway to receptacle and fasture ground terminals.

SECTION 16100 - WIRING METHODS (CONT.)  
3.2 IDENTIFICATION MATERIALS AND DEVICES  
A. Install all locations for most convenient viewing without interference with operation and maintenance of equipment.  
B. Coordinate names, abbreviations, colors, and other designations used for electrical identification with corresponding designations indicated in the Contract Documents or required by codes and standards. Use consistent designations throughout Project.  
C. Identify raceways and cables with color banding as follows:  
1. Bands: Preinsulated, wrap-around, colored plastic sleeves or colored end-capping conduit, and place adjacent bands of two color markings in contact, side by side.  
2. Band locations: At changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.  
3. Colors: As follows:  
a. Telecommunication System: Green and yellow.  
D. Color-coding System: Secondary service, feeder, and branch-circuit conductors throughout the secondary electrical system as follows:  
1. 200/200V 277/480V  
1. Phase A: Black Brown  
2. Phase B: Red Orange  
3. Phase C: Blue Yellow  
4. Neutral: White Gray  
5. Ground: Green Green  
END OF SECTION 16100

SECTION 16140 - WIRING DEVICES  
PART 1 - GENERAL  
1.1 SECTION REQUIREMENTS  
A. Submittals: None.  
B. Comply with NEMA WD 1.  
C. Comply with NFPA 70.  
PART 2 - PRODUCTS  
2.1 DEVICES  
A. General: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.  
B. Color: As Maximal Schedule on sheet E100.  
C. Receptacles: Heavy-duty grade, NEMA WD6, Configuration 5-20R unless otherwise indicated.  
D. Ground-Fault Circuit Interrupter Receptacles: Integral duplex receptacle; for installation in box without an adapter. Feed-through type, with a 3/4-inch-deep outlet.  
E. Isolated Ground Receptacles: To the green grounding screw isolation from mounting strap. Equipment grounding contacts connected only terminal of the device with inherent electrical.  
F. Snap Switches: Heavy-duty, quiet type.  
G. Wall Plate: See Material Schedule on sheet E100.  
H. Floor Service Fittings: Modular, above-floor, dual-service units suitable for wiring method used.  
PART 3 - EXECUTION  
3.1 INSTALLATION  
A. Install devices and assemblies plumb and secure.  
B. Mount devices flush, with long dimension vertical, or receptacles on top unless otherwise indicated, under single, multi-gang wall plates.  
C. Protect devices and assemblies during painting.  
D. Install wall plates when painting is complete.  
END OF SECTION 16140

SECTION 16410 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS  
PART 1 - GENERAL (Not Applicable)  
PART 2 - PRODUCTS  
2.1 SWITCHES  
A. Enclosed, Nonfusible Switch: NEMA KS 1, Type II-D, with lockable handle.  
2.2 CIRCUIT BREAKERS  
A. Enclosed, Molded Case Circuit Breaker: NEMA AB 1, with thermal-magnetic trip unless otherwise indicated.  
1. Characteristics: Frame size, trip rating, number of poles, and auxiliary devices as indicated.  
2. Interrupting Rating: PER DRAWINGS  
3. Thermal-Magnetic Circuit Breakers, 225 A and larger: Trip units fixed  
4. Current-Limiting Trips: Less than ratings less than NEMA FU 1, Class RK-5.  
3. Enclosure: NEMA AB 1, Type 1, unless otherwise specified or required to meet environmental conditions of installed location.  
PART 3 - EXECUTION  
3.1 TESTING  
A. Perform visual and mechanical inspections and electrical tests as in NFPA 70E.  
END OF SECTION 16410

SECTION 16420 - PANELBOARDS  
PART 1 - GENERAL  
1.1 SECTION REQUIREMENTS  
A. Submittals: None.  
B. Comply with NFPA 70.  
C. Comply with NEMA AB 1.  
PART 2 - PRODUCTS  
2.1 PANELBOARDS AND LOAD CENTERS  
A. Manufacturers: Subject to compliance with requirement, provide products by one of the following:  
1. Panelboards, Over-current Protective Devices, Controllers, Contactors, and Accessories:  
a. Square D Co.  
b. Eaton Corp., Cutler-Hammer Products.  
c. General Electric Co., Electrical Distribution & Control Div.  
d. Siemens Energy & Automation.  
2. Receptacles: NEMA PB 1, Type 1.  
3. Load Center: Capacity as shown on drawings.  
4. Front: Secured to box with concealed trim clamps.  
5. Doors: With concealed hinges, flush catches, and tumbler locks, all keyed alike.  
6. Bus: Hard-drawn copper or 98-percent conductivity.  
3. Molded Case Circuit Breakers: NEMA AB 1, single-pole, single-handle for multiple circuit breakers. Appropriate for application, including Type SWO for repetitive switching I loads and Type HACR for heating, air-conditioning, and refrigerating equipment.  
D. Contactors: NEMA ICS 2, Class A combination contactors.  
PART 3 - EXECUTION  
3.1 INSTALLATION  
A. Install panelboards and accessory items according to NEMA PB 1.1. Indicate installed circuit loads in English and Spanish on a typed circuit diagram after balancing panelboard loads.  
B. Mounting Height: Top of one 74 inches above finished floor, unless otherwise indicated.  
C. Future Circuit Provisions at Flush Panel Boards: Sub 4-foot empty 3/4-inch conduits from panelboard into accessible or designated ceiling space.  
D. Wiring in Panelboard Gutters: Arrange conductors into groups, bundle and wrap with wire ties according to manufacturer's instructions.  
E. Tighten electrical connectors and terminals, including grounding connections, according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A.  
F. Perform visual and mechanical inspections and electrical tests as in NFPA 70E.  
END OF SECTION 16420

SECTION 16500 - LIGHTING  
PART 1 - GENERAL  
1.1 SECTION REQUIREMENTS  
A. Submittals: Product Data for each luminaire, including lamps.  
B. Fixtures, Emergency Lighting Units, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.  
C. Coordinate ceiling-mounted luminaires with ceiling construction, mechanical work, and security and fire-protection features mounted in ceiling space and on ceiling.  
PART 2 - PRODUCTS  
2.1 FIXTURES AND FIXTURE COMPONENTS - GENERAL  
A. Metal Parts: Free from burrs, sharp corners, and edges, unless otherwise indicated. Firm and support to prevent warping and sagging.  
B. Doors, Frames, and Other Internal Access: Smooth finish, free from oil, grease, dirt, and other contaminants. Doors, frames, and other internal access to be arranged to permit re-lamping without use of tools. Arrange doors, frames, and other internal access to prevent accidental falling during re-lamping and when secured in operating position.  
C. Lenses, Diffusers, and Globes: 100 percent virgin acrylic plastic or tempered crystal glass, unless otherwise indicated.  
PART 3 - EXECUTION  
3.1 INSTALLATION  
A. Units, Lenses, and Globes: Mount with leveling and leveling support for recessed and surface-mounted fluorescent fixtures. Install ceiling support system rods or wires at a minimum of 4 rods or wires per fixture. Rods and wires should not more than 6 inches from fixture corners.  
B. Coordinate for recessed fixtures according to manufacturer's recommendations.  
D. Lamps: Where specific lamp decisions are not indicated, lamp units according to manufacturer's written instructions.  
END OF SECTION 16500

SECTION 16515 - LIGHTING CONTROL SYSTEM  
PART 1 - GENERAL  
1.1 SUMMARY  
A. The work covered in this section is subject to all of the requirements in the General Conditions of the Specifications. Contractor shall coordinate all work in this section with all of the trades covered in other sections of the specification to provide a complete and operable system. All labor, materials, appliances, tools, equipment, facilities, transportation and services necessary for and incidental to performing all operations in connection with luminaires, delivery and installation of the work of this Section.  
1.2 DESCRIPTION OF WORK  
A. Furnish and install a complete system for the control of lighting and other equipment as indicated on the plans, detailed in the manufacturer's submittal and as further defined herein.  
1.3 SUBMITTALS  
A. Shop Drawings: Submit dimensioned drawings of lighting control system and accessories including, but not necessarily limited to, relay panels, switches, DTC, photoeyes and other interfaces. Shop drawings shall indicate exact location of each device or a 90° to confirm location. Plans are diagrammatical. EC to verify all lighting control material requirements from approved shop drawings. "Cut Sheet" submittal not acceptable.  
B. Product Data: Submit for approval manufacturer's data on the specific lighting control system and components. Submittal shall be electronic format with hard copy available. To prevent departures from approved system operation, electronic files submitted shall be able to be directly downloaded to the specified system at manufacturer facility. Submit a complete set of manuals with part numbers, description and voltage specifications.  
C. Manufacturer shall provide free software that can be used to specify the system, detail all programming and generate a single line in a format that can be dropped into industry standard CAD packages.  
D. One Line Diagram: Submit a one-line diagram of the system configuration indicating the type, size and number of conductors between each component. It differs from the riser diagram in these specifications. Submittals that show typical riser diagrams are not acceptable.  
1.4 QUALITY ASSURANCE  
A. Products shall be manufactured by:  
1. Lighting Control & Design, Los Angeles, CA, 800.363.4448  
The lighting control system shall be listed, approved and comply as required with all national, state and local energy codes to include but not limited to California Title 24 and ASHRAE 90.1-2004.  
1.5 SYSTEM DESCRIPTION  
A. The lighting control system is a networked system that communicates via RS485. The system must be able to communicate with fully digital centralized relays panels. The intent of the specification is to integrate all lighting control into one system. Distributed lighting control shall be provided using networked micro relay panels or bus connected fault level control. Lighting control system shall include all hardware and software. Software shall be resident within the lighting control system. Systems shall provide local access to all programming functions at the master relay panel.  
B. System software shall provide real-time status of each relay and each group.  
C. All programs, schedules, time of day, etc. shall be in non-volatile memory for an indefinite time exceeding 10 years in the event of power failure. At restoration of power, lighting control system shall implement programs required by current time and date. Time of day dial will be battery backed for at least 10 years.  
D. The system shall be capable of implementing On commands, Off commands, Raise (dimming) commands, Lower (dimming) commands for any relay, group or zone by means of digital wall switches, contact closure switches, time clock schedules including off/sets from dusk and dawn by up to 10 hours, photoeyes, or software or other devices connected to programmable inputs in a lighting control panel.  
E. The lighting control system shall provide the ability to control each relay and each relay group per this specifications requirement.  
PART 2 - PRODUCTS  
2.1 MATERIAL AND COMPONENTS  
A. Relay Panels:  
1. All CPUs shall be in NEMA 1 rated enclosure with screw cover or hinged door. Other NEMA rated types optional.  
2. A barrier shall separate the high voltage and low voltage components of the panel and separate 120VAC and 277VAC.  
3. CPU input power shall be capable of accepting 120VAC or 277VAC without rewiring.  
1. All switches shall be digital and communicate via RS 485. Contact closure style switches, except as specified for connection to the micro relay panel programmable contact closure inputs, shall not be acceptable. The programming for a digital switch shall reside in the switch itself, via double EPROM memory. Any digital switch button function shall be able to be changed locally at the DTC or by remotely, via modem, internet or ethernet.  
C. DTC: Digital Electronic Time Clock  
1. A Digital Time Clock (DTC) shall control and program the entire lighting control system and supply all time functions and accept modem (RS232) inputs.  
2. DTC shall be capable of up to 32 schedules. Each schedule shall consist of one set of On and Off times per day for each day of the week and for each of two holiday lists. The schedules shall apply to any individual relay or group of relays.  
D. PHOTOCELLS: Photoeyes to be mounted in location indicated on the plans. Photoeyes used for exterior lights shall provide multiple points from roof mounted units. All trip points shall be able to be set via modem. Photoeyes requiring remote dial up modems, photoeyes requiring remote point to point dial up modems, or photoeyes requiring remote dial up modems, shall be acceptable. Photoeye used for interior lighting control shall have multiple settings such as start-point, mid-point, end-point, fade-down, etc. All settings shall be remotely accessible and adjustable. Systems providing local adjustment only are not acceptable. Photoeyes shall be certified to comply with the current energy code covering this project at time of submittal of plans for building permit.  
PART 3 - EXECUTION  
3.1 EQUIPMENT INSTALLATION  
A. Mount relay control cabinets adjacent to respective lighting panel board. Cabinet shall be surface of the permanent, per plans. Wiring between relay control cabinets and panelboards shall be in accordance with local codes and acceptable industry standards. No circumstances where wiring placement be authorized for the IEC or EC's lack of knowledge or understanding of code and a building code or special code or special manufacturer's installation requirements. Neatly lace and rack wiring in cabinets. During construction process, protect all wiring components of each relay panel and each digital switch from dust and debris. Any damage done to electronic components due to failure to protect shall be the responsibility of the installing contractor.  
B. Switches: Provide outlet boxes, single or multi-gang, as shown on drawings and plans for the low voltage digital switches. Min. 1-gang boxes as per plans. Supply facilitates per plans and specifications. ECs specifically responsible to supply and install the required low voltage wire. Category 5, 4 twisted pair, with RJ45 connectors (commonly referred to as Cat 5 patch panels) between switches and panels. Field-test each Cat 5 patch cable with a recognized cable tester. All low voltage wire to be run in conduit or cable tray, unless otherwise specified in drawings. Field-test each Cat 5 patch cable with a recognized cable tester. A manufacturer to provide on all systems of more than 1000 ft. conduit or cable tray. Submit approved E-Brand RJ 45 connectors to populate the whole system. A single manual that shows all details of correct installation and how to test. Manual must be both provided and read by the installing contractor.  
D. Wiring:  
1. Do not mix low voltage and high voltage conductors in the same conduit or cable tray. No exceptions.  
2. Ensure low voltage and control wires do not run parallel to high voltage conductors.  
3. Place manufacturer's splice components at each end of the system's inter-manufacturer's instructions.  
4. Place manufacturer's lighting control system components at each end of the system's inter-manufacturer's instructions.  
5. Place Category 5 patch cables at all inter-manufacturer's voltage connections. Additional conductors may be required to compensate for voltage drop with the specified system and inter-manufacturer's instructions. (LDO) apply to the G2400 manual for further information. Use shielded cable for dry contact inputs on runs longer than 200 ft. for the system bus.  
6. All wires on the bus shall be protected in sequence (daisy chained). Star and spur topologies are not acceptable.  
PART 3 - EXECUTION  
A. Verify the conduit for low voltage wires enters panel in low voltage areas and conduit for low voltage control wires enters panel in low voltage areas. Verify the conduit for high voltage wires enters panel in high voltage areas and conduit for high voltage control wires enters panel in high voltage areas. Bases are to be installed in advance. It is the responsibility of the manufacturer to verify with lighting control manufacturer all catalog information and specific product acceptability.  
B. For approved contact closure switches, use #18 AWG stranded conductors. For all other digital switches, provide wiring required by system manufacturer.  
C. Contractor to test all low voltage cable for integrity and proper operation prior to turn over. Verify with system manufacturer all wiring and testing requirements.  
D. Before Substantial Completion, arrange and provide a one-day Tenant Instruction period to designated Tenant personnel. Set-up, commissioning of the lighting control system and Tenant instruction includes:  
1. Confirmation of entire system operation and communication to each device.  
2. Confirmation of operation of individual relays, switches, occupancy sensors and daylight sensors.  
3. Confirmation of system programming, photoeye settings, override settings, etc.  
4. Provide training to cover installation, maintenance, troubleshooting, programming, and repair and operation of the lighting control system.  
E. Before energizing the panelboard, the following steps shall be taken:  
1. Realign relay connections to the manufacturer's torque specifications. Verify that required connections have been furnished.  
2. Remove shipping blocks from component devices and the panel interior.  
3. Remove debris from panelboard interior.  
F. Follow manufacturer's instructions for installation and all low voltage wiring.  
G. Service and Operation Manuals  
1. Submit operation and service manuals. Complete manuals shall be bound in flexible binders and data shall be typewritten or drafted.  
2. Manuals shall include instructions necessary for proper operation and servicing of system and shall include complete wiring circuit diagrams of system, wiring destination schedules for circuits and replacement part numbers. Manuals shall include as-built cable Project site plot plans and floor plans indicating cables, both underground and in each building with conduit, and as-built coding used on cables. Programming files of systems shall be submitted with complete information.  
H. Comply with energy code lighting control system "Acceptance Requirements". Acceptance tests are used to verify that lighting controls were installed and calibrated correctly. These tests may require that a responsible party verify that controls are installed and calibrated properly. This is the installing contractor's responsibility. Verify requirements with building authority.  
3.3 DOCUMENTATION  
A. Each relay shall have an identification label indicating the originating branch circuit number and panelboard name as indicated on the drawings. Each line side branch circuit conductor shall have an identification tag indicating the branch circuit number.  
B. Provide a point-to-point wiring diagram for the entire lighting control system. Diagram must indicate exact mounting location of each system device. This accurate "as built" shall indicate the loads controlled by each relay and the identification number for that relay, placement of switches and location of photoeyes. Original to be given to Tenant, copies placed inside the door of each LCP.  
3.4 SERVICE AND SUPPORT  
A. Start Up: EC shall contact Lighting Control Vendor at least 7 days before turnover of project. Lighting Control Vendor will remotely dial in the lighting control system, run diagnostics and confirm system programming. EC shall be available at the time of dial in to perform any corrections required by Lighting Control Vendor. EC is responsible for coordinating with EC and the Tenant the installation of a dedicated telephone line or a shared phone line with an automatic fax/modem switch. Phone jacks to be mounted within 12" of Master LCP. Label jacks with phone number. EC to connect phone line from jack to Master LCP.  
B. Telephone factory support shall be available at no additional cost to the EC or Tenant both during and after the warranty period. Factory to pre-program the lighting control system per plans and approved submittal, to extent data is available. The specified manufacturer, at no added cost, shall provide additional remote programming via modem as required by the EC or Tenant for as long as a phone line is available for the life of the system. Upon request manufacturer to provide remote dial up software at no additional cost to system Tenant. No exceptions.  
END OF SECTION

MATERIAL SCHEDULE		
CATEGORY	APPLICATION	ALLOWABLE MATERIAL
CONDUCTORS	#10 AWG AND SMALLER	SOLID CU, TYPE THHN/THWN OR XHHW
	#8 AWG AND LARGER	STRANDED CU, TYPE THHN/THWN OR XHHW
CONDUITS	OUTDOOR, EXPOSED OR CONCEALED	INTERMEDIATE METAL CONDUIT
	OUTDOOR OR INDOOR DAMP LOCATIONS, CONNECTION TO VIBRATING EQUIPMENT	LIQUIDTIGHT FLEXIBLE METAL CONDUIT
	INDOOR, EXPOSED	ELECTRICAL METALLIC TUBING (EMT) OR METAL CLAD CABLE
	INDOOR, WITHIN ELECTRICAL RACKS OR RACKS	INTERMEDIATE METAL CONDUIT
WIRING DEVICES	INDOOR DRY LOCATIONS, CONNECTION TO VIBRATING EQUIPMENT	FLEXIBLE METAL CONDUIT
	ON STAINLESS STEEL SURFACES	GRAY DEVICE WITH STAINLESS STEEL COVER PLATE
	WHITE TILE	WHITE DEVICE WITH WHITE COVER PLATE
	DARK TILE OR WOODEN SURFACES	BLACK DEVICE WITH BLACK COVER PLATE
	ON WHITE GYPSUM BOARD	WHITE DEVICE WITH WHITE COVER PLATE
	ON DARK PAINTED GYPSUM BOARD	BLACK DEVICE WITH BLACK COVER PLATE

ABBREVIATIONS  
AFF ABOVE FINISHED FLOOR  
AFG ABOVE FINISHED GRADE  
CONDUIT CONDUIT  
G GROUND  
GFCI GROUND FAULT CIRCUIT INTERRUPT  
IG ISOLATED GROUND  
JUNCTION BOX JUNCTION BOX  
NL NIGHT LIGHT  
S SURFACE MOUNTED  
W WEATHERPROOF  
WP LIGHT FIXTURE TAG, switch system

ELECTRICAL SYMBOLS  
CONDUIT CONCEALED IN THE CEILING, IN A WALL, OR IN A CONDUIT CONCEALED BELOW THE SLAB  
RUN TO PANELBOARD AND CIRCUIT NUMBER SHOWN  
PLAN REFERENCE: SEE PLAN LISTED ON THE SAME SHEET FOR DETAILED MEANING  
DISCONNECT SWITCH:  
X = SWITCH RATING  
Y = FUSE SIZE (NF = NON-FUSED)  
Z = NUMBER OF POLES  
JUNCTION BOX  
ELECTRIC PANELBOARD  
GENERAL PURPOSE 1-POLE SWITCH  
MANUAL STARTER WITH PILOT LIGHT  
W/P WEATHER-PROOF SWITCH  
OCCUPANCY SENSOR ACTIVATED WALL SWITCH (MANUFACTURER: WATTS/OPPER)  
NEMA 5-20R DUPLEX RECEPTACLE  
NEMA 5-20R DOUBLE-DUPLEX RECEPTACLES  
NEMA 5-20R DUPLEX COMBINATION ISOLATED GROUNDING RECEPTACLE PASS A SEMI-OUR MODULAR 200S/6TRIO  
OTHER RECEPTACLE - SEE PLAN FOR RATING AND TYPE  
JUNCTION BOX FOR RJ-45 DATA OUTLETS. PROVIDE 1" CONDUIT WITH PULLSTRING FROM BOX TO TELEPHONE BACKBOARD.  
JUNCTION BOX FOR COMBINATION RJ-11 TELEPHONE OUTLETS AND RJ-45 DATA OUTLETS. PROVIDE 1" CONDUIT WITH PULLSTRING FROM BOX TO TELEPHONE BACKBOARD.  
TERMINATE CONDUIT WITH CONDUIT BUSHING.  
JUNCTION BOX FOR RJ-11 TELEPHONE OUTLETS. PROVIDE 1" CONDUIT WITH PULLSTRING FROM BOX TO TELEPHONE BACKBOARD.  
TERMINATE CONDUIT WITH CONDUIT BUSHING.  
CEILING MOUNTED OCCUPANCY SENSOR  
CEILING MOUNTED DAYLIGHT SENSOR  
LIGHTING FIXTURE TAG:  
W = LIGHTING FIXTURE TYPE  
X = POWRAC DESIGNATION  
Y = CEILING MOUNTED SENSOR (IF NECESSARY)  
Z = SWITCH DESIGNATION

ELECTRICAL GENERAL NOTES  
A. GENERAL NOTES APPLY TO ELECTRICAL SHEETS.  
B. ELECTRICAL WORK SHALL BE DONE IN ACCORDANCE WITH THE ELECTRICAL CODE AND IN ACCORDANCE WITH THE AUTHORITY HAVING JURISDICTION. SEE ARCHITECTURAL FLOOR SHEET FOR THE PREVAILING CODES.  
C. WIRING SHALL BE IN 2"X12" #12 G IN 3/4" C UNLESS NOTED OTHERWISE.  
D. INDIVIDUAL CONDUIT RIMS SHOWN SHALL NOT BE CONSOLIDATED.  
E. CIRCUIT EMERGENCY EGRESS LIGHTS, ILLUMINATED EXIT SIGNS, AND NIGHT LIGHTS AHEAD OF LOCAL SWITCHING.  
F. INSTALL WALL SWITCHES AT 48" AFF TO CENTER OF SWITCH AND RECEPTACLES AT 18" AFF TO CENTER OF RECEPTACLE UNLESS NOTED OTHERWISE.  
G. INSTALL CONDUIT CONCEALED ABOVE THE CEILING, IN WALLS, OR IN RACEWAYS.  
H. ALL MATERIALS USED ABOVE CEILING SHALL BE PENUM RATED.  
I. INSTALL DATA OUTLETS AT 18" AFF TO CENTER OF OUTLET UNLESS NOTED OTHERWISE.

FUSION

FUSION ACADEMY - Charlotte, NC  
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ELECTRICAL SPECIFICATIONS

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**NATIONAL ENGINEERING**  
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ISSUANCE/REVISIONS  
 ▲ ISSUE FOR PERMIT 08/19/19  
 ▲ REV 1 PER CITY 08/21/19  
 ▲ REV 2 PER CITY 08/21/19  
 ▲ REV 3 PER CITY 08/26/19  
 ▲ REV 4 PER CITY 08/29/19  
 ▲ REV 5 PER CLIENT AND ISSUE FOR BID 08/30/19

North Carolina Firm Registration  
NCBOE: P-0612  
Sec of State: 0909178

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Drawn by: JEJ  
Checked by: RTJ

Scale: 1/4" = 1'-0"  
Date: 07.23.2019

Sheet No: 1902037  
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