

LIGHTING FIXTURES AND ACCESSORIES

1.1 SCOPE:

- a. The Contractor shall furnish and completely install Lighting Fixtures and Accessories as indicated on the drawings and as herein specified.
b. A lighting fixture shall be provided for each lighting outlet indicated. Outlets lacking fixture designations shall be brought to the attention of the Architect/Engineer before submitting proposal; otherwise units selected by the Architect/Engineer shall be furnished and installed at no additional charge.

1.2 SUBMITTALS:

- a. Submit for approval complete manufacturer's data sheets for all fixtures. Indicate all components, characteristics, and options.
b. Submit for approval Lighting Fixture samples as requested by the Architect/Engineer. Samples shall be equipped with lamps, cords, plugs, and ballasts for 120-volt operation.

2.1 LIGHTING FIXTURES:

- a. All fixtures shall be labeled by Underwriters' Laboratories, Inc.
b. Fixture designations on the drawings generally consist of a letter indicating the fixture type. Fixture types are identified in the Lighting Fixture Schedule or Symbol Schedule; however, the Schedule does not necessarily list all accessories and hardware necessary for the complete installation, nor does it detail the construction to be encountered at the fixture locations. It is the Contractor's responsibility to properly determine and provide correct components, accessories, and hardware required for the installation.
c. Pendant Fixtures shall be equipped with swivel hangers; twin stem for individual fixtures and single stem for continuous row fixtures, spaced according to the manufacturer's recommendations but not less than one per fixture unit plus one per row.

d. Recessed fixtures in plaster and gypsum board ceilings shall be equipped with plaster frames. In other ceilings they shall be equipped with plaster frames and/or other devices as approved by the Architect/Engineer, to facilitate removal of fixture and access to the concealed junction box from below.

e. Plastic materials indicated to be "acrylic" shall be of 100% virgin methyl methacrylate produced by Rohm and Haas, Dupont, or Cyanamid.

f. Recessed Fixtures (Troffers) shall conform to the following minimum requirements unless modified by notes and schedules on the Drawings:

1. Housings shall be 5" maximum depth and of 22-gauge minimum steel, with deeply formed transverse ribs for rigidity, primed, and finished in baked white enamel. The use of pre-painted steel is acceptable.

2. Lenses shall be of flat clear K-12 type acrylic of .125" nominal (.115" minimum) thickness in rigid hinged steel or extruded aluminum door frames finished in baked white enamel and secured with inconspicuous spring-loaded or rotary cam type steel latches. Lenses shall be maintained in a flat position with invisible clips and shall be removable from the door frames using a screwdriver without damaging the lens or the frame.

3. Joints between housings and door frames shall be totally free of light leaks. Gaskets, if used, shall be invisible and in compression when the door is closed. Gasket material subjected to rubbing when the door is opened or closed will not be accepted. Flexible and/or removable black baffles will not be accepted.

4. Top access plates to facilitate wiring are optional with the Contractor. Each fixture shall be individually connected to a concealed junction box with #16 TFN conductors in 6 feet of 3/8" flexible metal conduit.

5. Troffers for inverted tee exposed grid ceilings shall be designed to be raised through the ceiling opening and shall be supported independently of the grid system with two hangers on diagonal corners. Hangers shall be No. 12 AWG and shall be attached to the building structural system. They shall be secured to the ceiling grid at all four corners using sheet metal screws.

6. Troffers for plaster and gypsum board ceilings shall be furnished with plaster frames.

7. Troffers for ceilings with concealed suspension systems including plaster, gypsum board, and acoustical tile shall be equipped with suitable adjustable yokes or brackets designed to hook onto the plaster frame or ceiling channels, prevent the channels from spreading, and support the fixture.

8. Fixtures shall be a regularly cataloged and commonly manufactured product of an established, recognized lighting fixture manufacturer, with published photometric data and Zonal Cavity Coefficients of Utilization based on tests conducted by an independent photometric testing laboratory. Tests and calculations shall be in accordance with current IES standards.

2.2 LED DRIVERS:

- a. General
1. Provide with ten-year operational life while operating at maximum case temperature and 90 percent non-condensing relative humidity.
2. Drivers shall be designed and tested to withstand electrostatic discharges up to 15,000 V without impairment per IEC801-2.
3. Electrolytic capacitors shall operate at least 20 degrees C below the capacitor's maximum temperature rating when the driver is under fully loaded conditions and under maximum case temperature.
4. Provide with a maximum inrush current of 2 amperes for 120V and 277V drivers.
5. Drivers shall withstand up to a 4,000-volt surge without impairment of performance as defined by ANSI C62.41 Category A.
6. Drivers shall be manufactured in a facility that employ ESD reduction practices in compliance with ANSI/ESD S20.20.
7. Drivers shall have a Class A Sound Rating - Inaudible in a 27-dBA ambient.
8. Drivers shall have no visible change in light output with a variation of plus/minus 10 percent line voltage input.
9. Drivers shall have Total Harmonic Distortion less than 20 percent and meet ANSI C82.11 maximum allowable THD requirements.
10. Drivers shall track evenly across:
a. Multiple fixtures.
b. All light levels.
11. Constant current drivers shall:
a. Support from 200mA to 2.1 Amps (in 10mA steps) to ensure a compatible driver exists.
b. Support LED arrays up to 40W or 50W (710mA to 1.05A in 10mA steps).
12. Constant voltage drivers shall:
a. Support from 10V to 40V (in 0.5V steps) to ensure a compatible driver exists.
b. Support LED arrays up to 40W.
13. Configuration tool shall be available to optimize the following for LED fixtures:
a. Light level.
b. Efficacy.
c. Thermal performance.
14. Drivers shall operate properly from a supply voltage of 120 through 277VAC at 60Hz.

- b. Three-wire Control
1. Driver shall provide continuous dimming from 100 percent to 1 percent relative light output.
2. Driver shall provide integral fault protection to prevent driver failure in the event of an input mis-wire.

- c. Digitally Addressable Control
1. Driver shall provide continuous dimming from 100 percent to 1 percent relative light output.
2. Driver shall operate properly with the specified lighting control system.
3. After a power interruption, the light output shall automatically return to its setting prior to power interruption.
4. Driver shall respond independently to:
a. Up to 32 occupant sensors.
b. Up to 16 daylight sensors.
5. Driver shall respond to a digital load shed command.
a. Sets high and trim.
b. Automatically scales light output proportional to load shed command.
6. Forward Phase Control (Neutral Wire Required)
1. Driver shall provide continuous dimming from 100 percent to 1 percent relative light output.

- d. LED 0-10V Dimming Drivers
1. LED Driver shall be installed inside an electrical enclosure.
2. Wiring inside electrical enclosure shall comply with 600V/105°C rating or higher.
3. LED Driver shall be certified by UL Class 2 for use in a dry or damp location.
4. LED Driver shall have a Class A sound rating.
5. LED Driver shall have a minimum operating ambient temperature of -40°C.
6. LED Driver shall have a life expectancy of 50,000 hours at Tcase of <=70°C.
7. LED Driver shall have a life expectancy of 100,000 hours at Tcase of <=62°C.

- 8. LED Driver shall have a maximum self-rise temperature of 25°C in open air without heat sink.
9. LED Driver shall have a maximum allowable case temperature rating of 75°C.
10. LED Driver shall reduce output power to LEDs if maximum allowable case temperature is exceeded.
11. LED Driver shall have a failure rate <= 0.01% per 1,000 hours at Tcase <=70°C.
12. LED Driver shall have a failure rate of 0.01% - 0.02% per 1,000 hours at Tcase of 70°C - 80°C.
13. LED Driver shall tolerate sustained open circuit and short circuit output conditions without damage.
14. LED Driver shall comply with FCC rules and regulations, as per Title 47 CFR Part 15 Non-Consumer (Class A).
15. The maximum available output parameters of the driver shall meet the Class 2 inherently limited parameters.
16. When the driver is installed in the end-use application, the measured case temperature at the (Tc) location specified on the marking label shall not exceed 77.6°C.
17. The driver shall be installed in compliance with the requirements of the end-product standard.
18. The case of the driver must be connected to Earth ground when installed in the end-use application.

PART 3. EXECUTION

3.1 COORDINATION:

a. Contractor shall verify ceiling or wall type in or on which each fixture is to be mounted, and shall furnish unit with appropriate trim type, mounting hardware, and accessories to fit the construction; and feed through junction boxes as required to maintain proper access to system wiring.

3.2 INSTALLATION:

a. Lighting fixtures shall be installed in accordance with the manufacturer's instructions.

b. Lighting fixtures shall be supported from the building structure using corrosion resistant steel hardware in compliance with Section 16100, Basic Materials and Methods.

c. A minimum of two No. 12 gauge wire supports attached to the structure shall be provided for each lighting fixture unless otherwise indicated or approved by the Architect/Engineer. The supports shall be located at diagonal corners of rectangular fixtures and angled away from fixture. A minimum of three full twists shall be made at each end to secure wire.

d. In addition to the supports from the structure, fixtures shall also be secured to suspended ceilings on which they are mounted, or in which they are recessed. Where fixtures are secured to suspended ceilings, the primary supports from the building structure shall be slack.

e. Where installed recessed in grid type ceilings, the fixtures shall be attached to the main runners of the suspended ceiling at all four corners using sheet metal screws.

f. Conductors in fixture taps shall be #16 AWG minimum, type TFN, in 3/8" flexible metal conduit of 72" maximum length. A green insulated equipment grounding conductor shall be included.

g. Mount fixtures plumb and square. Keep rows in perfect line.

h. At time of project completion, fixtures shall be clean and fully operational.

NETWORK LIGHTING CONTROLS

PART 1

1.1 SCOPE

- a. Digital-network lighting control system and associated components:
1. LED drivers.
2. Power interfaces.
3. Lighting control modules (Lutron Energi Savr Node).
4. Lighting management hubs.
5. Control stations.
6. Low-voltage control interfaces.

1.2 COORDINATION

- a. Coordination:
1. Coordinate placement of sensors and wall controls with millwork, furniture, equipment, etc.
2. Coordinate placement of wall controls with actual installed door swings.
3. Coordinate work to provide luminaires and lamps compatible with lighting controls to be installed.
4. Notify Architect of conflicts or deviations from contract documents to obtain direction prior to proceeding with work.

1.3 SUBMITTALS

- a. Product Data: Include ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.
1. Occupancy/Vacancy Sensors: Include detailed basic motion detection coverage range diagrams.
2. Shop Drawings:
3. Provide schematic system riser diagram indicating component interconnections. Include requirements for interface with other systems.
4. Provide detailed sequence of operations describing system functions.
5. Manufacturer's Installation Instructions: Include application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
b. Operation and Maintenance Data: Include detailed information on lighting control system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.

1.4 QUALITY ASSURANCE

- a. Conform to requirements of NFPA 70.
b. Manufacturer Qualifications:
1. Company with not less than ten years of experience manufacturing lighting control systems of similar complexity to specified system.
2. Registered to ISO 9001, including in-house engineering for product design activities.
Qualified to supply specified products and to honor claims against product presented in accordance with warranty.

1.5 DELIVERY, STORAGE, AND HANDLING

a. Store products in clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions until ready for installation.

1.6 FIELD CONDITIONS

- a. Maintain field conditions within manufacturer's required service conditions during and after installation.
1. Lutron System Requirements, Unless Otherwise Indicated:
a. Ambient Temperature:
1) Lighting Control System Components, Except Those Listed Below: Between 32- and 104-degrees F.
b. Relative Humidity: Less than 90 percent, non-condensing.

1.7 WARRANTY

- a. Manufacturer's Standard Warranty, With Manufacturer Start-Up; Lutron Standard 2-Year Warranty; Lutron LSC-B2:
1. Manufacturer Lighting Control System Components, except Wireless Sensors, Ballasts/Drivers, and Ballast Modules:
a. First Two Years:
1) 100 percent replacement parts coverage, 100 percent manufacturer labor coverage to troubleshoot and diagnose lighting issue.
2) First-available on-site or remote response time.
3) Remote diagnostics for applicable systems.
b. Telephone Technical Support: Available 24 hours per day, 7 days per week, excluding manufacturer holidays.
2. Wireless Sensors: Five years 100 percent parts coverage, no manufacturer labor coverage.

PART 2

2.1 MANUFACTURERS

- a. Basis of Design Manufacturer: Lutron Electronics Company, Inc; Athena: www.lutron.com.
b. Other Acceptable Manufacturers:
1. Acuity nLight.
2. Legrand Wattstopper.
c. Substitutions:
1. Proposed substitutions (clearly delineated as such) must be submitted in writing for approval by Architect a minimum of 10 working days prior to bid date and must be made available to all bidders. Proposed substitutes must be accompanied by review of specification noting compliance on a line-by-line basis.
2. By using pre-approved substitutions, Contractor accepts responsibility and associated costs for required modifications to related equipment and wiring. Provide complete engineered shop drawings (including power wiring) with deviations from original design highlighted in

- alternate color for review and approval by Architect prior to rough-in.
d. Source Limitations: Furnish products produced by single manufacturer and obtained from single supplier.

2.2 DIGITAL-NETWORK LIGHTING CONTROL SYSTEM - GENERAL REQUIREMENTS

- a. Sensor Layout and Tuning: No Lighting Control Manufacturer Sensor Layout and Tuning service to be provided; Lutron LSC-NO-SENS-LT.
b. Contractor to utilize Lighting Control Manufacturer Installation Instructions to place/install sensors.
c. Provide products listed, classified, and labeled by Underwriter's Laboratories Inc. as suitable for purpose indicated.
d. Unless specifically indicated to be excluded, provide required equipment, conduit, boxes, wiring, connectors, hardware, supports, accessories, software, system programming, etc. as necessary for complete operating system that provides control intent indicated.
e. Design lighting control equipment for 10-year operational life while operating continuously at any temperature in ambient temperature range of 32 degrees F to 104 degrees F and 90 percent non-condensing relative humidity.
f. Electrostatic Discharge Tolerance: Design and test equipment to withstand electrostatic discharges without impairment when tested according to IEC 61000-4-2.
g. Dimming and Switching/Relay Equipment:
1. Designed so that electrolytic capacitors operate at least 36 degrees F below capacitor's maximum temperature rating when device is under fully loaded conditions at maximum rated temperature.
2. Inrush Tolerance:
a. Utilize load-handling thyristors (SCRs and triacs), field effect transistors (FETs) and isolated gate bipolar transistors (IGBTs) with maximum current rating at least two times rated operating current of dimmer/relay.
b. Capable of withstanding repetitive inrush current of 50 times operating current without impacting lifetime of dimmer/relay.
3. Surge Tolerance: Designed and tested to withstand surges of 6,000 V, 200 amps according to IEEE C62.41.2 without impairment to performance.
4. Power Failure Recovery: When power is interrupted and subsequently restored, within 3 seconds lights to automatically return to same levels, e.g., dimmed setting, full on, or full off, as prior to power interruption.
5. Dimming Requirements:
a. Line Noise Tolerance: Provide real-time cycle-by-cycle compensation for incoming line voltage variations including changes in RMS voltage (plus or minus 2 percent change in RMS voltage per cycle), frequency shifts (plus or minus 2 Hz change in frequency per second), dynamic harmonics, and line noise.
1) Systems not providing integral cycle-by-cycle compensation to include external power conditioning equipment as part of dimming system.

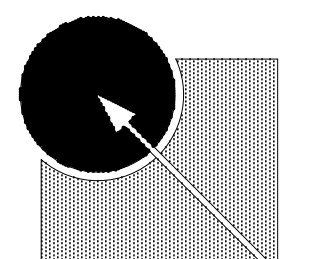
- b. Incorporate electronic "soft start" default at initial turn-on that smoothly ramps lights up to appropriate levels within 0.5 seconds.
c. Utilize air gap off to disconnect load from line supply.
d. Control light sources in smooth and continuous manner. Dimmers with visible steps are not acceptable.
e. Load Types:
1) Assign load type to each dimmer that will provide proper dimming curve for specific light source to be controlled.
2) Provide capability of being field configured to have load types assigned per circuit.
f. Minimum and Maximum Light Levels: User adjustable on circuit-by-circuit basis.
g. Line Voltage Dimmers:
1) Dimmers for Magnetic Low Voltage (MLV) Transformers:
(a) Provide circuitry designed to control and provide symmetrical AC waveform to input of magnetic low voltage transformers per UL 1472.
(b) Dimmers using unipolar load current devices, e.g., FETs or SCRs, to include DC current protection in event of single device failure.
2) Dimmers for Electronic Low Voltage (ELV) Transformers: Operate transformers via reverse phase control. Alternately, forward phase control dimming may be used if dimming equipment manufacturer has recommended specific ELV transformer being provided.
3) Dimmers for Neon and Cold Cathode Transformers:
(a) Magnetic Transformers: Listed for use with normal (low) power factor magnetic transformers.
(b) Electronic Transformers: Must be supported by ballast equipment manufacturer for control of specific ballasts being provided.

- 6. Switching Requirements:
a. Rated Life of Relays: Typical of 1,000,000 cycles at fully rated 16 A for all lighting loads.
b. Switch load in manner that prevents arcing at mechanical contacts when power is applied to and removed from load circuits.
c. Provide output fully rated for continuous duty for inductive, capacitive, and resistive loads.

2.3 LIGHTING CONTROL MODULES

- a. Provide lighting control modules as indicated or as required to control loads as indicated.
b. General Requirements:
1. Listed to UL 508 as industrial control equipment.
2. Delivered and installed as listed factory-assembled panel.
3. Passively cooled via free-convection, unaided by fans or other means.
4. Mounting: Surface.
5. Connection without interface to wired:
a. Occupancy sensors.
b. Daylight sensors.
6. Connects to lighting management hub via RS485.
7. LED status indicators confirm communication with occupancy sensors and daylight sensors.
8. Contact Closure Input (select models):
a. Directly accept contact closure input from dry contact closure or solid-state output without interface to:
1) Activate senses.
(a) Scene activation from momentary or maintained closure.
2) Enable or disable after hours.
(a) Automatic sweep to user-specified level after user-specified time has elapsed.
(b) System provides occupants visual warning prior to sweeping lights to user-specified level.
(c) Occupant can reset timeout by interacting with lighting system.
3) Activate or deactivate demand response (load shed).
(a) Load shed event reduces lighting load by user-specified amount.
9. Emergency Contact Closure Input:
a. Turn all zones to full output during emergency state via direct contact closure input from UL 924 listed emergency lighting interface, security system or fire alarm system.
b. Allow configurable zone response during emergency state.
c. Disable control operation until emergency signal is cleared.
10. Supplies power for control link for keypads and control interfaces (select models).
11. Distributes sensor data among multiple lighting control modules.
12. Capable of being controlled via wireless sensors and controls.
c. 0-10V Lighting Control Modules:
1. Products:
a. Lutron 0-10V Energi Savr Node; Model QSN-4T20-S: 20 A (16 A ballast) continuous-use per channel; capable of switching 20A receptacles.
2. Coordination Between Low Voltage Dimming Module and Line Voltage Relay: Capable of being electronically linked to single zone.
3. Single low voltage dimming module; capable of controlling the following light sources:
a. 0-10V analog voltage signal.
1) Provide Class 2 isolated 0-10V output signal conforming to IEC 60929.
2) Sink current per IEC 60929.
4. Switching:
a. Rated Life of Relays: Typical of 1,000,000 cycles at fully rated 16 A for all lighting loads.
b. Load switched in manner that prevents arcing at mechanical contacts when power is applied to and removed from load circuits.
c. Fully rated output continuous duty for inductive, capacitive, and resistive loads.
d. Module to integrate up to four individually controlled zones.
e. Utilize air gap off, activated when user selects "off" at any control to disconnect load from line supply.
d. DALI Lighting Control Modules:
1. Product: Lutron DALI Power Module; Model QSN-2DAL-S-CPN6916; provides bus power and control for two DALI buses.
2. Provide testing capability using manual test buttons.
3. Each DALI bus supports:
a. Control of up to 64 DALI compliant addressable loads, grouped into up to 64 zones.
b. Up to 250 mA bus power.
e. Phase Adaptive Power Modules:
1. Products:
a. Lutron Adaptive Power Module; Model QSN-4A5-D; 4-zone.

- (a) Zone 1: Rated for incandescent/halogen (800 W, 120/277 V), electronic low voltage (800 W, 120/277 V), magnetic low voltage (800 VA/525 W, 120/277 V), or neon/cold cathode (800 VA/525 W, 120/277 V), Lutron Hi-lume 1% 2-wire LTE LED Driver (maximum of 20 drivers), NEMA SSL 7A forward phase LED (400 W, 120 V), reverse phase LED (6.6 A, 120 V; 2.9 A, 277 V).
(b) Zones 2 through 4: Each zone rated for incandescent/halogen (500 W, 120/277 V), electronic low voltage (500 W, 120/277 V), magnetic low voltage (500 VA/375 W, 120/277 V), or neon/cold cathode (500 VA/375 W, 120/277 V), Lutron Hi-lume 1% 2-wire LED Driver (maximum of 13 drivers), NEMA SSL 7A forward phase LED (200 W, 120 V), reverse phase LED (4.2 A, 120 V; 1.8 A, 277 V).
2. Provides forward phase or reverse phase dimming, automatic or manual configuration.
3. Output Zones: One load type per zone.
4. Manual Mode Operation: Provide buttons to turn loads on/off or dim loads up/down for each zone.
5. Emergency Contact Closure Input:
a. Provides activation of emergency mode; turns all loads on and disables control from other devices.
b. UL 924 listed.
6. Provide cycle-by-cycle compensation for incoming line variations, including changes in voltage, frequency, harmonics, and line noise; accommodate up to plus/minus two percent change in frequency per second.
7. Systems not providing cycle-by-cycle compensation to include external power conditioning equipment as part of dimming system.
Comply with NEMA SSL 7A.



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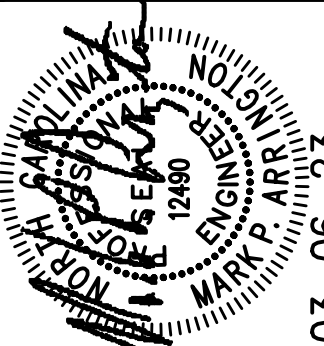


Table with 4 columns: JOB NUMBER, REVISION DATES, DEAN BY, CHECKED BY, DATE. Values include 22-168, CH, WPA, 03.06.23.

CLEVELAND COUNTY LEGRAND CENTER LIGHTING ELECTRICAL SPECIFICATIONS

JOB TITLE SHEET TITLE SHEET E402