

**READ THIS FIRST**

Notice to the Design Engineer, this document is part of Facilities and Infrastructure standards for Electrical Systems. Designers are advised to NOT use this template (\*.doc) document as part of any project contract documents. Designers shall use the Port of Seattle MasterSpec specifications from the following link:

**<https://www.portseattle.org/page/guide-specifications>.**

Designers shall edit the corresponding Port's MasterSpec specification to meet the F&I Electrical Standard outlined in this specification. Note that Port's MasterSpec specifications contain specifications and languages for both Aviation and Maritime Divisions. F&I Standards are strictly for Aviation Division, and any Maritime related specs or languages should be removed from the project specifications.

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY AND NOTES TO DESIGNER**

- A. Section includes microprocessor-based central dimming controls with the following components:
  - 1. Digital control network.
  - 2. Master-control stations.
  - 3. Partitioned-space master-control stations.
  - 4. Wall stations.
  - 5. Dimmer cabinets.
  - 6. Manual switches and plates for controlling dimmers.
- B. Centralized dimming control systems are not widely used in the airport. Coordinate with F&I on system requirements.

**1.3 DEFINITIONS**

- A. Fade Override: The ability to temporarily set fade times to zero for all lighting scenes.
- B. Fade Rate: The time it takes each zone to arrive at the next scene, dependent on the degree of change in lighting level.
- C. Fade Time: The time it takes all zones to fade from one lighting scene to another, with all zones arriving at the next scene at the same time.

- D. Low Voltage: As defined in NFPA 70, term for circuits and equipment operating at less than 50 V or for remote-control, signaling, and power-limited circuits.
- E. Scene: The lighting effect created by adjusting several zones of lighting to the desired intensity.
- F. SCR: Silicon-controlled rectifier.
- G. Zone: A fixture or group of fixtures controlled simultaneously as a single entity. Also known as a "channel."

#### **1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. For central dimming controls; include elevation, features, characteristics, and labels.
  - 2. For dimmer panels; include dimensions, features, dimmer characteristics, ratings, and directories.
  - 3. Device plates, plate color, and material.
  - 4. Driver types compatible with dimmer controls.
  - 5. Sound data including results of operational tests of central dimming controls.
  - 6. Operational documentation for software and firmware.
- B. Shop Drawings: Detail assemblies of standard components, custom assembled for specific application on Project. Indicate dimensions, weights, arrangement of components, and clearance and access requirements.
  - 1. Include elevation views of front panels of control and indicating devices and control stations.
  - 2. Include diagrams for power, signal, and control wiring.
- C. Sequence of Operations: Narrative indicating system operating conditions and programming instructions.

#### **1.5 INFORMATIONAL SUBMITTALS**

- A. Field quality-control reports.
- B. Sample Warranty: For special warranty.
- C. Commissioning plan with test procedures.

#### **1.6 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For central dimming controls with remote-mounting dimmers to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
  - a. Software manuals.
  - b. Adjustments of scene preset controls, adjustable fade rates, and fade overrides.
  - c. Operation of adjustable zone controls.
  - d. Testing and adjusting of panic and emergency power features.

## **1.7 WARRANTY**

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of central dimming controls that fail in materials or workmanship within specified warranty period.
  1. Failures include, but are not limited to, the following:
    - a. Damage from transient voltage surges.
  2. Warranty Period: Cost to repair or replace any parts for five years from date of Substantial Completion.
  3. Extended Warranty Period: Cost of replacement parts (materials only, f.o.b. the nearest shipping point to Project site), for eight years, that failed in service due to transient voltage surges.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Hubble
  2. Acuity
  3. Leviton Manufacturing Co., Inc.
  4. Lutron Electronics Co., Inc.

### **2.2 GENERAL SYSTEM REQUIREMENTS**

- A. Compatibility:
  1. Dimming control components shall be compatible with lighting fixtures, drivers, and transformers.
- B. Line-Voltage Surge Suppression: Factory installed as an integral part of 120- and 277-V ac, solid-state dimmers and control panels.
- C. Dimmers and Dimmer Modules: Comply with UL 508.

1. Audible Noise and Radio-Frequency Interference Suppression: Solid-state dimmers shall operate smoothly over their operating ranges without audible lamp or dimmer noise or radio-frequency interference. Modules shall include integral or external filters to suppress audible noise and radio-frequency interference.
2. Dimmer or Dimmer-Module Rating: Not less than 125 percent of connected load unless otherwise indicated.

### **2.3 SYSTEM DESCRIPTION**

- A. Description: Microprocessor-based, solid-state controls consisting of control stations and a separately mounted dimmer cabinet.
  1. Operation: Change variable dimmer settings of indicated number of zones simultaneously from one preset scene to another when a push button is operated.
  2. System control shall include master station(s), wall stations, occupancy sensors, daylight harvesting photosensors, partition sensors and dimmer panels.
  3. Each zone shall be configurable to control the following light sources:
    - a. Fluorescent lamps with electronic ballasts.
    - b. Line-voltage incandescent lamps.
    - c. Low-voltage incandescent lamps.
    - d. Cold cathode lamps.
    - e. Non-dimmed loads.
    - f. LED 0-10V drivers.
    - g. LED with low-voltage electronic drivers.
  4. Provide interface for AV system for control of curtains, drapes, and projector screens.
  5. Memory: Retain preset scenes and fade settings through power failures for at least 90 days by retaining physical settings of controls or by an on-board, automatically recharged battery.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with 47 CFR 15, Subparts A and B, for Class A digital devices.
- D. Comply with NFPA 70.

### **2.4 CONTROL NETWORK**

- A. Dimmers shall receive signals from control stations that are linked to dimmer cabinet with a common network data cable.
- B. Functions of network control stations shall be set up at master station that include the number and arrangement of scene presets, zones, and fade times at wall stations.

**2.5 MASTER-CONTROL STATIONS**

A. Functions and Features:

1. Control adjustment of the lighting level for each scene of each zone, and adjustment of fade-time setting for each scene change from one preset scene to another. Controls shall use pushbutton switches with LCD graphic display and LED indicator lights.
2. Master channel shall raise and lower lighting level of all zones.
3. Fade rate for each scene shall be adjustable from zero to 60 seconds.
4. Fade override control for each scene.
5. Recall each preset scene and allow adjustment of zone controls associated with that scene.
6. Lockout switch to prevent changes when set.
7. On and off scene controls for non-dim channel contactors.
8. Emergency-control push button to bypass all controls, turning all dimmers to full bright and turning on non-dim channel contactors.
9. Master on and off switch; off position enables housekeeping controls.
10. Provide for connecting a portable computer to program the master station.
11. Rear-illuminate all scene-select buttons.
12. Show lighting-level setting and fade-rate setting graphically using LEDs or backlighted bar-graph indicator.

B. Mounting: Flush wall box with manufacturer's standard faceplate. Provide hinged locking cover in areas accessible to general public.

**2.6 PARTITIONED-SPACECONTROL**

A. Functions and Features:

1. Automatically combine and separate lighting and accessory function controls as spaces are configured with movable partitions; with controls for adjustment of the lighting level for each scene of each dimmer, and adjustment of fade-rate setting for each scene change from one preset scene to another.
2. Master controls shall accommodate partitioning the space into up to six adjacent rooms.

**2.7 WALL STATIONS**

A. Functions and Features:

1. Wall stations shall function as a submaster to a master station, containing limited control of selected scenes of the master station.
2. Numbered push buttons to select scenes, with raise/lower of light levels and master off.

B. Mounting: Flush, wall box with faceplate color as selected by architect.

- C. Hand-Held Cordless Control: Scene-select and accessory function push buttons using infrared or radio-frequency transmission.

## **2.8 SENSORS**

- A. Occupancy Sensors
  - 1. Ceiling or wall mounted dual technology sensors with coverage pattern appropriate for application.
- B. Daylight Sensor
  - 1. Open loop or closed loop sensors, based on application and number of daylight zones.

## **2.9 DIMMER CABINETS**

- A. Factory wired, convection cooled without fans, with barriers to accommodate 120- and 277-V feeders and suitable to control designated lighting equipment or accessory functions.
- B. Ambient Conditions:
  - 1. Temperature: 32 to 104 deg F.
  - 2. Relative Humidity: Less than 90 percent, noncondensing.
  - 3. Filtered air supply.
- C. Dimmer Cabinet Assembly: NRTL listed and labeled.
- D. Cabinet Type: Plug in, modular, and accepting dimmers of each specified type in any plug-in position.
  - 1. Integrated Fault-Current Rating: Rated for available fault current at location.
- E. Lighting Dimmers: Solid-state SCR dimmers.
  - 1. Primary Protection: Magnetic or thermal-magnetic circuit breaker, also serving as the disconnecting means.
  - 2. Dimmer response to control signal shall follow the "Square Law Dimming Curve" specified in IESNA's "IESNA Lighting Handbook."
  - 3. Dimming Range: 0 to 100 percent, full output voltage not less than 98 percent of line voltage.
  - 4. Dimmed circuits shall be filtered to provide a minimum 350- $\mu$ sec. current-rise time at a 90-degree conduction angle and 50 percent of rated dimmer capacity. Rate of current rise shall not exceed 30 mA/mic.sec., measured from 10 to 90 percent of load-current waveform.
- F. Non-dim modules shall include relays with contacts rated to switch 20-A tungsten-filament load at 120-V ac and 20A electronic ballast load at 277-V ac.

- G. Accessory function control modules shall be compatible with requirement of the accessory being controlled.
  
- H. Emergency Power Transfer Switch: Comply with UL 1008; factory prewired and pretested to automatically transfer load circuits from normal to emergency power supply when normal supply fails.
  - 1. Transfer from normal to emergency supply when normal-supply voltage drops to 55 percent or less.
  - 2. Retransfer immediately to normal on failure of emergency supply and after an adjustable time-delay of 10 to 90 seconds on restoration of normal supply while emergency supply is available.
  - 3. Integrated Fault-Current Rating: Same value as listed for the panel.
  - 4. Test Switch: Simulate failure of normal supply to test controls associated with transfer scheme.
  - 5. Fabricate and test dimmer boards to withstand seismic forces defined in Section 260548.16 "Seismic Controls for Electrical Systems."

## **2.10 MANUAL SWITCHES AND PLATES**

- A. Switches: Modular, momentary push-button, low-voltage type.
  - 1. Color: White unless otherwise indicated; red when associated with emergency circuits.
  - 2. Integral Pilot Light: Indicate when circuit is on. Use where indicated.
  - 3. Locator Light: Internal illumination.
  - 4. Wall Plates: Comply with requirements in Section 262726 "Wiring Devices" for materials, finish, and color. Use multigang plates if more than one switch is indicated at a location.
  - 5. Legend: Engraved or permanently silk-screened on wall plate where indicated. Use designations indicated on Drawings.

## **2.11 CONDUCTORS AND CABLES**

- A. Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- B. Provide cable per manufacturer's recommendations.

## **PART 3 - INSTALLATION**

### **3.1 WIRING INSTALLATION**

- A. Comply with NECA 1.
- B. Wiring Method:

1. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
  2. Install unshielded, twisted-pair cable for control and signal transmission conductors, complying with Section 271500 "Communications Horizontal Cabling."
  3. Minimum conduit size shall be 1/2 inch.
- C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.
- D. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.
- E. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.
- F. Install dimmer cabinets for each zone.

### **3.2 IDENTIFICATION**

- A. Comply with requirements in Section 260553 "Identification for Electrical Systems" for identifying components and power and control wiring.
- B. Label each dimmer module with a unique designation.
- C. Label each scene control button with approved scene description.

### **3.3 FIELD QUALITY CONTROL**

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
  1. Continuity tests of circuits.
  2. Operational Test: Set and operate controls to demonstrate their functions and capabilities in a methodical sequence that cues and reproduces actual operating functions.
    - a. Include testing of dimming control equipment under conditions that simulate actual operational conditions. Record control settings, operations, cues, and functional observations.
  3. Emergency Power Transfer: Test listed functions.
- B. Remove and replace malfunctioning dimming control components and retest as specified above.
- C. Test Labeling: After satisfactory completion of tests and inspections, apply a label to tested components indicating test results, date, and responsible agency and representative.

- D. Reports: Written reports of tests and observations. Record defective materials and workmanship and unsatisfactory test results. Record repairs and adjustments.

**3.4 DEMONSTRATION**

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain central dimming controls.
- B. Coordinate demonstration of products specified in this Section with demonstration requirements for low-voltage, programmable lighting control system specified in Section 260943.13 "Addressable-Fixture Lighting Controls" and Section 260943.23 "Relay-Based Lighting Controls."

**3.5 COMMISSIONING**

- A. Provide controls commissioning according to Washington State Energy Code requirements.

END OF SECTION 260933