SECTION 26 55 61 – THEATRICAL LIGHTING AND CONTROL SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes equipment for stage lighting systems, including fixtures, lamps, dimmers, controls, and distribution components.

B. Provide product demonstration and commissioning as listed in part 3.

1.2 SUBMITTALS

A. Product Data: For fixtures, lamps, distribution components, and control systems, including dimensions and data on features and components. Include data on ratings and features of devices.

B. Shop Drawings: Detail dimmer racks showing arrangements, characteristics, and circuit assignments of various modules. Include elevation views of front panels indicating devices and controls. Include illustrations and dimensioned drawings.

1. Wiring diagrams: Detail wiring for power and control systems and differentiate between manufacturer-installed and field-installed wiring.

C. Manufacturer Certificates: Signed by the manufacturer certifying that they comply with requirements. Include evidence of manufacturing experience.

D. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

E. Maintenance Data: For fixtures, distribution equipment, software operating manuals, instructional videotapes, and controls are to be included in maintenance manuals specified in Division 1.

F. Record Data: Show connections and circuit and channel assignments.

1.3 QUALITY ASSURANCE

A. Where rigging and other accessories are attaching to equipment provided by another contractor (i.e. stage electric bars, and/or front of house lighting truss when provided), review applicable rigging specifications and shop drawings to ensure appropriate attachment equipment is included in the bid and provided to the site for installation.

B. Installer Qualifications: An experienced installer who has installed systems of similar scope and function as the units required for this project.

C. Manufacturer Qualifications: A firm experienced in manufacturing equipment similar to that indicated for this project that maintains technical support service available by toll-free telephone number. Service capability to provide the user with training, parts, and emergency maintenance and repairs support within 48 hours maximum response time.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

E. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but not limited to, the following:

1. Electronic Theatre Controls, Inc. – **BASE BID**
2. Lehigh Electric Products Company – **ALTERNATE BID**

B. Listed products are by Lehigh Electric Products Company, unless noted otherwise, and are intended to present a basis of design. These products are note intended to limit manufacturers beyond those listed above.

2.2 FIXTURES AND DISTRIBUTION EQUIPMENT, GENERAL

A. Metal Parts: Free from burrs and sharp corners and edges.

B. Sheet Metal Components: Steel, unless otherwise indicated. Form and support sheet metal to prevent warping and sagging.

C. Pipe and connector strip rigging: Provide steel pipe clamps and braided steel cable, sized for the full load of pipe, connector strip, light fixtures and other accessories with industry standard safety factors. The use of chain shall not be acceptable.

D. Fixture Doors and Other Internal Access: Smooth operating, free from light leakage under operating conditions, and arranged to permit relamping without the use of tools. Arrange doors, lenses, diffusers, and other pieces to prevent accidental falling during relamping and when secured in operating position.

E. Pigtail: Factory wired 36-inch (900 mm) long, 3-wire cord and plug connector assembly with cord encased in woven fiberglass or silicone tubing.

F. Plug Connectors: Two-pole, 3-wire, 20-A twist-locking or parallel blade type as scheduled.

G. Pipe Clamps: Malleable iron and designed for clamping fixtures to 3/4- to 2-inch (20 to 51 mm) OD pipe and equipped with a T-bolt to lock alignment. Arrange fixture clamps for horizontal rotation of yoke for aiming.

H. Safety Cables: Heavy duty, flexible steel, 30-inch (760) nominal length, with spring clip at one end and steel ring at other.

I. Lamp Sockets: Unless LED, which are fixed, relampable without disturbing focus adjustment or alignment.

J. Fixture Ventilation Openings: Baffled against light leaks.

K. Fixture Operating Controls and Handles: Thermally insulated.

L. Lenses: Borosilicate glass in silicone mountings.

M. Color Filter Frame Holder: Attached to front of fixture.

N. Fixture Yoke: Rigid metal arranged for vertical aiming of unit and equipped with T-bolt or hand screw to lock alignment.

2.3 FIXTURES

A. General: Listed under UL 1573.

B. Standard Features: Equip each fixture with pigtail, yoke with pipe clamp, and safety cable for batten mounting, and filter holder.

C. Color mixing Ellipsoidal fixture

1. General

a. The fixture shall be a color-mixing high-intensity LED illuminator with DMX control of intensity and color. The fixture shall be a Source Four LED Series 2 as manufactured by Electronic Theatre Controls, Inc. or approved equal.
b. The fixture shall be UL 1573 listed for stage and studio use.
c. The fixture shall comply with the USITT DMX-512A standard.

2. Physical

a. The unit shall be constructed of rugged, die cast aluminum, free of burrs and pits, finished in black.
b. The following shall be provided:

1) Lens secured with silicone shock mounts.
2) Shutter assembly shall allow for +/-25° rotation.
3) 20 gauge stainless steel shutters.
4) Interchangeable lens tubes for different field angles with Teflon guides for smooth tube movement.
5) Sturdy integral die cast gel frame holders with two accessory slots, and a top-mounted, quick release gel frame retainer.
6) Rugged steel yoke with two mounting positions allowing 300°+ rotation of the fixture within the yoke.
7) Positive locking, hand operated yoke clutch.
8) Slot with sliding cover for motorized pattern devices or optional iris.

c. Power supply, cooling and electronics shall be integral to each unit.
d. The unit shall ship with:

1) Theatrical-style hanging yoke as standard.
2) 5’ Neutrik PowerCon™ to Edison power cable as standard.
3) Gate diffuser.
4) A-size pattern holder.

3. Optical

a. The light beam should have a 2-to-1 center-to-edge drop-off ratio
b. The unit shall provide, but not be limited to:

1) 5, 10, 14, 19, 26, 36, 50, 70 and 90 degree field angles.
2) High-quality pattern imaging.
3) Sharp shutter cuts without halation.

4) Shutter warping and burnout in normal use shall be unacceptable.
5) Adjustable hard and soft beam edges.

c. 19, 26, 36, and 50 degree units shall have optional lens tubes available for precision, high-contrast imaging.

4. Thermal

a. Fixture shall be equipped with a cooling fan.

1) Fan speed control via a DMX channel shall be possible.
2) Fan speed software shall permit the fixture to override DMX fan speed setting to prevent heat damage to the fixture.

b. The fixture shall utilize advanced thermal management systems to maintain LED life to an average of 70% intensity after 54,000 hours of use (Lustr).

5. Electrical

a. The fixture shall be equipped with a 100V to 240V 50/60Hz internal power supply.
b. The fixture shall support power in and thru operation.
c. Power supply shall have power factor correction.

6. LED Emitters

a. The fixture shall contain a minimum of four different LED colors to provide color characteristics as described in the Color Section below.
b. All LEDs used in the fixture shall be high brightness and proven quality from established and reputable LED manufacturers.
c. Manufacturer of LED emitters shall utilize an advanced production LED binning process to maintain color consistency.
d. Fixtures shall have adjustable PWM frequency up to 25,000hz to avoid flicker on camera.

7. Calibration

a. Fixture shall be calibrated at factory for achieve consistent color and intensity output between fixtures built at different times and/or from different LED lots or bins.

1) Calibration data shall be stored on the LED array as a permanent part of on-board operating system.
2) All arrays, including replacement arrays shall be calibrated to the same standard to insure consistency.
3) Fixtures not offering LED calibration shall not be acceptable.

8. Color

a. The fixture shall utilize a minimum of 60 LED emitters
b. The fixture shall be available in specialized LED arrays as outlined below:

1) Red, Amber, Green, Cyan, Blue, Indigo and Lime LEDs in an array designed for broad spectrum color, light tints, and variable whites. This array shall be the Lustr array as manufactured by Electronic Theatre Controls, or approved equal.

a) Measured brightness of the Lustr array shall be greater than 6,500 field lumens.

9. Control and User interface

    a. The fixture shall be USITT DMX 512A-compatible via In and Thru 5-pin XLR connectors.
    b. The fixture shall be equipped with multi-line LCD display for easy-to-read status reports and configuration changes.

10. The fixture shall be capable of copying all performance settings to other fixtures of the same type via a 5 pin XLR DMX cable.
11. Fixtures shall be provided as follows:

    a. First Front of House Beam (front): 2 – 19 deg., 2 – 26 deg., 2 – 36 deg., 4 – 15-30 deg. zoom, 4 – 25-50 deg. zoom.
    b. Second Front of House Beam (back): 2 – 10 deg., 4 – 19 deg., 4 – 26 deg., 4 – 15-30 deg. zoom.
    c. Stage Electric #1: 2 – 36 deg., 2 – 50 deg. zoom.
    d. Stage Electric #2: 2 – 36 deg., 2 – 50 deg. zoom.
    e. Tormentors (typical for two): 2 – 19 deg., 2 – 26 deg., 2 – 15-30 deg. zoom.

D. Color mixing PAR fixture

1. General

    a. The fixture shall be a color-mixing high-intensity LED illuminator with DMX control of intensity and color. The fixture shall be a ColorSource PAR as manufactured by Electronic Theatre Controls, Inc. or approved equal.
    b. The fixture shall be UL 1573 listed for stage and studio use.
    c. The fixture shall comply with the USITT DMX512-A standard.
    d. The fixture shall be provided with the minimum warranty of 5 years full fixture coverage and 10 years LED array coverage.
    e. The fixture shall have a LM-84 report with a L70 rating of no less than 55,000 hours.

2. Physical

    a. The fixture shall be contained in a rugged all-metal die-cast housing, free of burrs and pits, finished in black.
    b. Power supply, cooling and electronics shall be integral to each unit.
    c. Fixture housing shall provide two easy-access slots for secondary lenses and other accessories.

        1) Slots shall be equipped with locking retaining clip.

    d. The unit shall ship with:

        1) Theatrical-style hanging yoke as standard.
        2) 5’ power lead with Edison connector as standard.

    e. Light output shall be via a round aperture.

        1) Aperture and accessory slots shall accommodate standard 7.5” accessories such as used in other similar-sized fixtures.

3. Thermal

    a. The fixture shall be cooled with a variable speed fan.

b. The fixture shall utilize advanced thermal management systems to maintain LED life to an average of 70% intensity after 20,000 hours of use for color mixing versions.
c. The fixture shall operate in an ambient temperature range of 0°C (32°F) minimum, to 40° C (104°F) maximum ambient temperature.

4. Electrical

a. The fixture shall be equipped with 100V to 240V 50/60 Hz internal power supply.
b. The fixture shall support power in and thru operation.
c. Power supply shall have power factor correction.

5. LED Emitters

a. The fixture shall contain 4 different LED colors to provide color characteristics, as described in Section H below.
b. All LEDs used in the fixture shall be high brightness and proven quality from established and reputable LED manufacturers.
c. Manufacturer of LED emitters shall utilize an advanced production LED binning process to maintain color consistency.

6. Calibration

a. Fixture shall be calibrated at factory for achieve consistent color between fixtures built at different times and/or from different LED lots or bins.

1) Calibration data shall be stored in the fixture as a permanent part of on-board operating system.
2) All arrays, including replacement arrays shall be calibrated to the same standard to insure consistency.
3) Fixtures not offering LED calibration shall not be acceptable.

7. Color

a. The fixture shall utilize a minimum of 40 LED emitters.

1) These emitters shall be made up of Red, Green, Blue and Lime for ColorSource.

8. Control And User Interface

a. The fixture shall be USITT DMX512-A compatible via In and Thru 5-pin XLR connectors.
b. The fixture shall be equipped with a display for easy-to-read status and control.

9. Fixtures shall be provided as follows:

a. Stage Electric #1: 8.
b. Stage Electric #2: 8.
c. Stage Electric #3: 8.

E. Color Mixing Fresnel Fixture

1. General

a. The fixture shall be a color-mixing high-intensity LED illuminator with DMX control of intensity and color. The fixture shall be a Desire Fresnel as manufactured by Electronic Theatre Controls, Inc. or approved equal.

b. The fixture shall be UL 1573 listed for stage and studio use
c. The fixture shall comply with the USITT DMX-512A standard

2. Physical

a. The unit shall be constructed of rugged, die cast and extruded aluminum, free of burrs and pits, finished in black.
b. The following shall be provided:

1) Rugged aluminum yoke allowing 360° rotation of the fixture within the yoke
2) 5’ Neutrik powerCON TRUE1 power cable with Edison connector.

c. Fixture shall have integrated zoom with mechanical adjustment on the front and rear.
d. Fixture shall have adjustable yoke position to allow for weight balancing.
e. Fixture shall have two accessory slots on the front.
f. Power supply, cooling and electronics shall be integral to each unit.

3. Optical

a. The light shall be full homogenized without multi-colored shadows.
b. Fixture shall have a glass Fresnel lens.
c. Fixture beam shall allow barn door accessories that shape the beam with a single, soft edge.
d. Fixture shall have an integrated zoom of 13-55 degrees.

4. Thermal

a. Fixture shall be equipped with a cooling fan.
b. The fixture shall utilize advanced thermal management systems to maintain LED life to an average of 70% intensity after 54,000 hours of use.

5. Electrical

a. The fixture shall be equipped with a 100V to 240V 50/60Hz internal power supply.
b. The fixture shall support power in and thru operation.
c. Power supply shall have power factor correction.

6. LED Emitters

a. The fixture shall contain a minimum of eight different LED colors to provide color characteristics as described in the Color Section below.
b. All LEDs used in the fixture shall be high brightness and proven quality from established and reputable LED manufacturers.
c. Manufacturer of LED emitters shall utilize an advanced production LED binning process to maintain color consistency.
d. Fixtures shall have a PWM frequency of up to 25,000hz to avoid flicker on camera.

7. Calibration

a. Fixture shall be calibrated at factory to achieve consistent color and intensity output between fixtures built at different times and/or from different LED lots or bins.

1) Calibration data shall be stored on the LED array as a permanent part of on-board operating system.
2) All arrays, including replacement arrays shall be calibrated to the same standard to ensure consistency.

3) Fixtures not offering LED calibration shall not be acceptable.

8. Color

a. The fixture shall utilize a minimum of 60 LED emitters.
b. Fixtures shall have a color temperature range of 1900 K – 10,450 K.
c. The fixture shall be available in specialized LED arrays as outlined below:

1) Desire Fresnel Lustr X8.

a) Deep Red, Red, Amber, Lime, Green, Cyan, Blue and Indigo LEDs in an array designed for broad spectrum color, light tints, and variable whites. This array shall be the Lustr X8 array as manufactured by Electronic Theatre Controls, or approved equal.

9. Control and User Interface

a. The fixture shall be USITT DMX 512A-compatible via In and Thru 5-pin XLR connectors.
b. The fixture shall be equipped with color LCD display for easy-to-read status reports and configuration changes.

10. The fixture shall be capable of copying all performance settings to other fixtures of the same type via a 5 pin XLR DMX cable.
11. Fixtures shall be provided as follows:

a. Stage Electric #1: 3.
b. Stage Electric #2: 3.
c. Stage Electric #3: 3.

F. Color Mixing Cyclorama Fixture

1. General

a. The fixture shall be a color-mixing high-intensity LED illuminator with DMX control of intensity and color. The fixture shall be a ColorSource® CYC as manufactured by Electronic Theatre Controls, Inc. or approved equal.
b. The fixture shall be UL 1573 listed for stage and studio use
c. The fixture shall comply with the USITT DMX512-A standard

2. Physical

a. The fixture shall be contained in a rugged all-metal die-cast housing, free of burrs and pits, finished in black.
b. Power supply and electronics shall be integral to each unit.
c. Fixture housing shall provide built in spill control
d. Fixture shall operate directly on the ground or by hanging via yoke.
e. The unit shall ship with:

1) Theatrical-style hanging yoke as standard.
2) 5’ power lead with Neutrik® PowerCON™ to Edison connector as standard.

f. Light output shall produce an asymmetrical beam

1) Lensing shall be designed to provide smooth coverage both horizontally and vertically for seamless blending from fixture to fixture.

2) With a minimum setback from the cyclorama of 2', the fixtures shall be able to achieve a 2-to-1 spacing ration and maintain smooth coverage.

3. Thermal

a. The fixture shall be natural convection cooled and shall not use a fan.
b. The fixture shall utilize advanced thermal management systems to maintain LED life to an average of 70% intensity after 50,000 hours of use.

4. Electrical

a. The fixture shall be equipped with 100V to 240V 50/60 Hz internal power supply
b. The fixture shall support power in and thru operation.
c. Power supply shall have power factor correction.

5. LED Emitters

a. The fixture shall contain 5 different LED colors to provide color characteristics as described below.
b. All LEDs used in the fixture shall be high brightness and proven quality from established and reputable LED manufacturers.
c. Manufacturer of LED emitters shall utilize an advanced production LED binning process to maintain color consistency.
d. Fixtures shall have a flicker free mode that will set the LED refresh rate to 25,000 Hz for flicker free operation on camera.

6. Calibration

a. Fixture shall be calibrated at factory for achieve consistent color between fixtures built at different times and/or from different LED lots or bins.

1) Calibration data shall be stored in the fixture as a permanent part of on-board operating system.
2) All arrays, including replacement arrays shall be calibrated to the same standard to ensure consistency.
3) Fixtures not offering LED calibration shall not be acceptable.

b. Fixture shall have droop compensation to overcome thermal droop in the LEDs to maintain output levels and color point.

7. Color

a. The fixture shall utilize a minimum of 42 LED emitters

1) These emitters shall be made up of Red, Green, Blue, Indigo and Lime.

8. Control and User Interface

a. The fixture shall be USITT DMX512-A compatible via In and Thru 5-pin XLR connectors or RJ45 connectors.
b. The fixture shall be equipped with a display for easy-to-read status and control.

9. Fixtures shall be provided as follows:

a. Stage Electric #4: 5.

G. Power-Con Connectors: Provide minimum 5 - 10' and 5 - 5' powercon to powercon cables. Ensure sufficient cables and lengths are provided to connect fixtures.

2.4 LAMPS

A. Anywhere LED fixtures are specified, provide with LED array as specified and DMX communications. Provide with wattage and light output as per basis of design fixture.

2.5 DISTRIBUTION COMPONENTS

A. Connector Strips: Factory-wired wire ways and receptacle assembly.

1. Wireway: 16 Ga. steel construction with screw covers with a 4.25" X 2.5" cross section. Length as required in 5’ increments, unless as specified differently.
2. Receptacles:

a. Provide parallel blade flush (PBGF) and pigtail (PBGP) as specified.
b. Provide PBGF constant output receptacle (C) to provide power for future wireless DMX modules (all DMX shall be wired as part of this project, unless noted otherwise).

3. Receptacles Wiring: Connect to terminal blocks with 125-deg C, cross-linked, polyethylene insulated wire.
4. Ground lug.
5. Mounting: Steel mounting straps to wrap around the wireway and located at 5' intervals. Mounting straps to include a formed section to attach to 1-1/2" (2” OD max.) schedule 40 pipe.

a. **The use of chain to mount connector strips or pipes shall not be acceptable.**

6. Electrical Contractor to provide 1-1/2" schedule 40 black iron pipe with all joints made with bolted thru couplings as required for each front beam and stage connector strips. Pipe shall extend a minimum of 2 feet beyond each end of the wire way. Where connector strips are attached to a rigging contractor provided pipe, verify diameter of pipe before ordering attachment accessories to ensure appropriate mounting method is used.
7. Provide:

a. First and Second Front of House Beams (Back): 99+36’-(24AO/3ND)(1AO/1C(in center))(1DMX PassThruPanel(in center))-x-21.

1) Provide 45’ pipe below connector strip.
2) Circuit ND circuits A,B,C,A,B,C,…

b. Stage Electric #1: 99+32’-(24AP/3ND)(1AO/1C(in center))(1DMX PassThruPanel(in center)) -22.

1) Rigging Contractor providing first pipe. Division 26 contractor shall provide second pipe.
2) Circuit ND circuits A,B,C,A,B,C,…

c. Stage Electric #2: 99+32’-(24AP/3ND)(1AO/1C(in center))(1DMX PassThruPanel(in center)) -22.

1) Rigging Contractor providing first pipe. Division 26 contractor shall provide second pipe.

2) Circuit ND circuits A,B,C,A,B,C,…

d. Stage Electric #3: 99+32'-(24AP/3ND)(1AO/1C(in center))(1DMX PassThruPanel(in center))(3AO/1ND)-22.

1) Rigging Contractor providing first pipe. Division 26 contractor shall provide second pipe.
2) Circuit ND circuits A,B,C,A,B,C,…
3) Evenly distribute the (3) 'AO' receptacles along connector strip.

e. Auditorium Tormentors:

1) Typical of 2: 99+8'-(8AO/1ND)(1AO/1C(in center))(1DMX PassThruPanel(in center))-x-21.

a) Provide connector strip and new pipe at existing locations. Provide minimum 10' pipes, but no shorter than existing.

B. Receptacle Plug-in Boxes:

1. Box: Welded steel, minimum of 16 gauge, with removable cover.
2. Receptacles: Flush mounted, grounded parallel blade receptacles.
3. Receptacles Rating: Grounded 20A parallel blade.
4. Ground lug.
5. Mounting: Recessed at stage side walls.
6. Provide:

a. 4 – Surface box with (3) flush parallel blade receptacles, painted black.

1) (2) receptacles to be circuited to ND circuit, and remaining receptacle shall be circuited to contestant. Provide additional DMX jack at each location.

7. Locate plug-in boxes on stage walls to provide best use, and meet all ADA requirements.

C. Gridiron Junction Boxes: Grid mounted box with terminals for contractor termination of load circuits.

1. Box: Welded steel, minimum of 16 gauge, with removable cover.
2. Terminal Blocks: Molded barrier type with screw lugs to suit supply conductors.
3. Ground lug.
4. Mounting: Surface.
5. Provide: One (1) box per stage electric and front of house bar, sized to handle circuits.

D. Multi-conductor Cable: Flexible, multiple conductor cable with a SO jacket.

1. Length as required to interconnect the border lights to the grid junction box.
2. Minimum 12-gauge, stranded wire with color-coded insulation.
3. Two wires per circuit plus ground and 10% spares.
4. Strain relief grips installed at each end of cable.
5. Provide cradle as required to support cable.
6. Provide: One (1) cable per connector strip sized to handle circuits.

a. The connector strip multi-conductor cable used for the tormentors shall be of sufficient length to extend up to ceiling. Wire size shall be 10 gauge for these connector strips.

E. Cable Management:

1. Provide spring wheels, sized to handle the power cable, for each stage electric and front of house bar(s) that is designed to be lowered.
2. Provide spring wheels, sized to handle the DMX and other control cable, for each stage electric and front of house bar(s) that is designed to be lowered.
3. Refer to architectural drawings and rigging specifications to determine which bars are designed to be lowered, and will subsequently require cable management.
4. Install cable management where required for full functionality. Coordinate exact location with the rigging installer.
5. Alternate solutions shall be submitted for approval.

2.6 LIGHTING CONTROL SYSTEM

A. Power Control System

1. General

a. The installation rack shall be the Sensor3 120V as manufactured by Electronic Theatre Controls, Inc., or equal. The Power Control System enclosure shall consist of up to 48 module spaces. Provide additional racks as needed to match dimmer count.

2. Electrical

a. Sensor3 racks shall operate at 120V/208V, three phase, four wire + ground, 47-53 or to 57-63 Hz at 800 amps max. Other voltage and phase options are available upon request. Sensor racks shall automatically compensate for frequency variations during operation. Provisions shall be made for optional amp trap devices for fault current protection. Standard SCCR fault current protection shall be 100,000A.
b. All load and neutral terminals shall accept up to #4 AWG (25mm2) wire. Systems providing smaller terminals do not allow contractor wire sizing flexibility and shall be deemed unacceptable.
c. Load terminals shall be located at the front of the wiring cavity. Front access racks having terminals located at the back of the rack or on the side near the back of the rack such that adjacent load cabling may block terminal access shall not be acceptable.

3. Electronics

a. Power control electronics (CEM3) shall be contained in a single module that can be plug-in capable without use of tools. Power control and dimming systems that require tools for removal of control electronics shall not be acceptable.
b. All data and power input for CEM3 control electronics shall be located on a separately removable/pluggable termination connector on the backplane such that backplane can be replaced without removal and discrete secondary conductor terminations. Systems that require discrete termination of DMX, Ethernet, power input, and dimmer control output directly on terminals on the control module or pluggable backplane shall not be permitted.
c. The power controller shall directly support the following network protocols:

1) Net3 protocol suite including ANSI E1.31 Streaming ACN (sACN)
2) ANSI E1.17 Architecture for Control Networks (ACN)

d. The power controller shall directly support 2 ports of control input using ANSI E1.11 USITT DMX512-A

e. Control signals shall be sent between control module and dimmer/power modules using flat ribbon cables. Systems using cat5 cable and rj45 connections or discrete hand wired conductors as sole physical communication media between control module and dimmer/power modules shall be considered long term unreliable and shall be not be acceptable.
f. System shall provide an optional low voltage connection to maintain power of control electronics through brown out, instantaneous, and sustained power outages. Systems that do not provide optional low voltage backup power connection to the power controller shall not be acceptable.
g. Control electronics shall be housed in a formed steel body with cast-aluminum face panel.

4. Physical

a. The Sensor3 rack shall be a free-standing, dead-front switchboard, substantially framed and enclosed with 16 gauge, formed steel panels. All rack components shall be properly treated, primed and finished. Exterior surfaces shall be finished in fine-texture, scratch-resistant, epoxy paint. Removable top and bottom panels shall facilitate conduit termination on the 48 module rack. Knockouts shall serve the same purpose on 12 and 24 module racks.
b. Racks shall be designed for front access to allow back-to-back or side-by-side installation.
c. Racks shall be designed to allow easy insertion and removal of all modules without the use of tools. Supports shall be provided for precise alignment of modules into power and signal connector blocks. With modules removed, racks shall provide clear front access to all load, neutral and control terminations. Racks that require removable panels to access load, neutral or control terminations shall not be acceptable.
d. An optional bus bar kit shall be available from the factory to allow adjacent racks to be powered by a single line feed. No soft buss rack-to-rack wiring shall be required. Racks that require discrete cabling to connect adjacent racks shall not be acceptable.
e. Module spaces shall be mechanically keyed to accept only the 20A or below, 50A, or 100A module specified for that space. Racks that allow modules of varying wattages to plug into the same space shall not be acceptable. The rack shall be configurable to accept mixed dimmer types and sizes throughout the rack.
f. Each rack shall provide a lockable full-height door containing an integral electrostatic air filter that shall be removable for easy cleaning. A single low-noise fan shall be located at the top of each rack. Design of the rack and modules shall draw all cool air intake air through the integral electrostatic air filter at the front of the rack, discretely through each module housing and directly out the top of the rack such that exhausted hot air from adjacent modules does not heat the module(s) above, below, or to the side of each other. System designs that draw the same heated air through multiple modules shall not be acceptable.
g. The fan shall maintain the temperature of all components at proper operating levels with dimmers under full load, provided the ambient temperature of the dimmer room does not exceed 40°C/104°F. Racks that do not employ both locking doors and electrostatic air filters shall not be acceptable.
h. The fan shall turn on whenever any circuit in the system is activated. In the event of an over-temperature condition, only the affected dimmer module(s) shall shut down and a message shall appear on the control module LCD. The fan shall remain on during thermal shutdown of individual dimmer modules. Systems that do not include over-temperature sensing and preventative thermal shutdown shall not be acceptable.
i. A fan sensor shall be provided. In the event of momentary fan failure, error message will be displayed and sent remotely over Ethernet to optional logging systems. Systems that do not provide optional system event logging shall not be deemed acceptable.
j. If the ambient room temperature drops below 0°C/32°F or rises above 40°C/104°F, a warning shall appear on the dimmer rack LCD. If the temperature rises above 46°C/115°F, the rack shall shut down until the condition is corrected.
k. A 3 x .5 inch LED status indicator (beacon) shall be mounted in the rack door. The beacon shall be visible throughout a wide viewing angle. In normal operating conditions, this LED is

illuminated. If the rack's control module senses an error condition, the beacon shall flash until the error is corrected. An optional indicator shall be available for remote locations. Racks have no external means of visually showing that an error is present shall not be acceptable.

5. Provide rack with the following dimmers/relays:

   a. 10 – 20A house dimmers (0-10V control, verify with fixtures to be connected).

      1) 3 – normal operation, 3 – normal/emergency operation, 4 – spare.

   b. 4 – 20A non-dim relays for aisle lighting.

      1) 2 – normal/emergency operation. 2 – spare.

   c. 20 - 20A non-dim relays for stage lighting.

      1) 18 – used, 2 – spare.

   d. 8 – 20A constant circuits.

      1) 5 – used, 3 – spare.

B. UL1008, 120V Emergency Lighting Transfer Cabinet

1. The Emergency Lighting Transfer Cabinet shall provide automatic transfer of both the phase and neutral legs of each branch circuit from normal to emergency power when normal power fails. The cabinet shall automatically reconnect circuits to normal power when normal power has been restored.
2. The transfer cabinet switches shall be electrically operated and mechanically held. The entire assembly shall be UL1008 listed and labeled. This equipment must comply with the regulations in NFPA 110 for Emergency and Standby Power Systems.
3. The Emergency Lighting Transfer Cabinet must satisfy the requirements of the following NFPA 70 (National Electric Code).

   a. Article 701 – Legally Required Standby Systems
   b. Article 700 – Emergency Systems
   c. Article 540-11c – Motion Picture Houses
   d. Article 520-7 – Theatres and Similar Locations
   e. Article 518-3c – Places of Public Assembly

4. The Emergency Lighting Transfer Cabinet shall be a wall-mounted, NEMA 1 enclosure constructed of 14-gauge steel finished in ANSI 61, gray powder coat paint. All terminations and wiring shall be accessible via a hinged lockable door. The cabinet shall be pre-wired and tested at the factory with clearly marked terminals for contractor wiring of normal feed, emergency feed, lighting loads and sensing feeds.
5. Standard transfer relays shall be available at 20A and 50A current ratings.
6. The Emergency Lighting Transfer Cabinet shall accommodate circuits of two wire, dimmed incandescent or fluorescent lighting as well as three wire, dimmed, fluorescent lighting.
7. Emergency Lighting Transfer Cabinets with Type 3 emergency power feeds shall provide for power distribution and branch circuit protection internally for all emergency power circuits.
8. The front panel of the Emergency Lighting Transfer Cabinet shall contain a key-switch to simulate power failure for testing purposes as well as indicator lights to visually signal the presence of normal or emergency power.

9. Voltage sensing of the Normal source shall cause automatic transfer when the voltage of one or more phases drops below 55% of 120VAC.
10. Factory default settings for time delay of transfer are as follows: Normal to Emergency – 0 Seconds, Emergency back to Normal 3 Seconds. These settings shall be field adjustable.
11. Provisions for optional remote signal, fire alarm and other input signals shall be incorporated into the control circuit.
12. The Emergency Lighting Transfer Cabinet shall control the circuits indicated on the drawings and be provided with 10% spare relays, minimum of two (2).
13. The Emergency Lighting Transfer Cabinet shall be provided with a main 30A, 3 phase, 120/208V power feed and be provided with overcurrent protection.

C. Stage Manager's Panel: surface mounted steel cabinet with a hinged locking cover and a baked enamel finish. Mount on the stage area as shown on the drawings.

1. Provide a 7” touchscreen similar to Unison series control.
2. Provide additional 10-button preset station for simplified control.

D. House Controls:

1. Provide 2-button preset station at entrance stations for on/off control of selected auditorium house light dimmers, unless noted otherwise. Label accordingly.

E. Provide the following:

1. Stage Manager's Panel with 7” touchscreen and additional 10-button preset station.
2. Entrance stations. Provide quantity indicated on drawings.
3. Additional Portable Control: Provide portable 7” touchscreen and additional 10-button preset station with associated wiring, receptacle and cable at Lighting Control Console location to provide simplified control.
4. Additional wall Control: Provide 7” touchscreen and additional 10-button preset station with associated wiring at the rack in the projection booth.

F. Lighting Control Console

1. Existing ETC Element 2 console shall remain. Vendor shall provide two (2) minimum 17” diagonal multi-touch monitors to connect to the existing console. The vendor shall also provide additional owner training on the console.

a. Provide additional accessories as required to fully support all capabilities of specified light fixtures.
b. Provide accessories, wiring, programing and support to implement a graphical layout of the system (ETC Magic Screen).

2.7 DMX Distribution

A. Provide DMX jacks at each front of house beam, tormentors, stage electrics, lighting console locations, stage boxes, and anywhere else indicated on the drawings.

B. All DMX jacks shall be wired; however, the system shall be capable of wireless control in the future.

C. Provide sufficient DMX universes to accommodate the entire lighting control system, allowing a minimum 10% spare capacity in the system.

2.8 FINISHES

A. Manufacturers' standard, unless otherwise indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install equipment according to the manufacturer's written instructions. Set permanently mounted items plumb and level and square with ceilings and walls.

B. Mounting of Equipment: Conform to manufacturer's instructions and Division 26 Section "Supporting Devices". Mounting heights indicated are to bottom of unit for suspended items and to center of unit for wall-mounted ones.

C. Provide miscellaneous power as required from the nearest 120/208V panel.

3.2 CONTROL WIRING INSTALLATION

A. Install wiring between control devices as specified in Division 26 "Wires and Cables – 600V and Below" for hard-wired connections. Install wiring in raceway except cable and plug connections.

B. Wiring in Enclosures: Bundle, train, and support.

3.3 IDENTIFICATION

A. Identify components and power and control wiring according to Section 260553 "Identification for Electrical Systems."

B. Label each luminaire, lighting outlet, distribution device, and dimmer module with unique designation. Labels on elevated components shall be readable from the floor.

C. FIELD QUALITY CONTROL

D. Manufacturer's Field Services: Arrange and pay for the service of a factory-authorized service representative to test, adjust, and program the lighting control system.

E. Schedule visual and mechanical inspections and electrical tests with at least 21-days advanced notification.

F. Electrical Tests: Perform according to manufacturer's instructions. Exercise caution when testing devices containing solid-state components.

3.4 CLEANING AND ADJUSTING

A. Remove paint splatters and other spots, dirt, and debris. Repair scratches and mars of finish to match original finish. Clean fixtures, devices, and equipment internally and externally using methods and materials as recommended by manufacturers.

3.5 DEMONSTRATION

A. Demonstrate the system to prove compliance with requirements.

B. Direct Training: Arrange and pay for the services of a factory-authorized service representative to demonstrate the lighting control system and train the Owner's personnel.

1. Conduct a minimum of 2 days of up to 8 hours of training each time in operation and maintenance to allow training of multiple groups of people. The training is to include system operation and maintenance procedures.
2. Schedule each day of training at least two (2) weeks apart.
3. Schedule training with at least a 21-day advance notification.

3.6 COMMISSIONING

A. Operational Tests: Energize lighting controls systems, program controls, and check controlled outlets for light levels.

B. Correct deficiencies and retest deficient items. Verify by the system tests that specified requirements are met.

END OF SECTION 26 55 61