SECTION 26 5561

THEATRICAL LIGHTING & RIGGING SYSTEMS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. Drawings and general provisions of contract, including general and supplementary conditions and division 1 specifications section, apply to work of this section.

B. It is the responsibility of the electrical contractor to fully coordinate the integration and installation of all equipment and furnishings as described in this section with a theatrical systems integrator to ensure proper operation of the system.

C. One company shall be responsible for the installation of all aspects of the stage rigging equipment. Work under this section shall include furnishing all labor, materials, tools, transportation services, supervision, etc., necessary to complete installation of the stage rigging equipment as well as any other items as herein listed, all as described in these specifications, as illustrated on the accompanying drawings; or as directed by the owner's representative.

1.2 SYSTEM DESCRIPTION

A. The system shall be designed for the control of architectural and theatrical lighting and shall consist of factory pre-wired dimming and processing rack enclosures containing dimmers, relays, power supplies, breakers, terminals and/or control electronics.

B. System shall work in conjunction with specified low-voltage control stations.

C. The system shall include theatrical lighting fixtures and accessories as detailed herein.

D. The system shall be designed for the control of, and or interface with, peripheral devices including, but not limited to: rigging devices including hoists and curtain machines, motorized projection screens and other a/v components.

E. The system is designed to meet specific operational requirements of the Avenel School district. Performance deviations will not be accepted.

1.3 WORK INCLUDED

A. The electrical contractor, as part of the work of this section, shall provide, install and test a complete lighting control system as specified herein for areas indicated on the drawings and circuit schedules.

B. The electrical contractor shall furnish all conduit, wire, connectors, hardware and other incidental items necessary for the complete and proper operation of the lighting control system.

C. Be advised, it is the responsibility of the electrical contractor to obtain the services of a theatrical systems integrator to provide the system described herein.

D. Attach load wires in relay rack per load schedules.

E. Bring main power feed into new relay enclosure and terminate per manufacturers specifications.

F. Install front-of-house and over-stage lighting positions.

G. Zone control for the stage light system shall be programmed in the architectural control processor.

H. On-site training of operations personnel on the use and maintenance of the systems and equipment provided as part of this specification.

I. New relay and control equipment shall be appropriately sized to accommodate all existing loads, as well as leave room for future expansion.

J. To ensure the proper operation of all systems, the dimmer enclosure and control console shall be by a single manufacturer.

K. Coordination of all work described in this section shall be the responsibility of the electrical contractor, including, but not limited to:

1. General Conditions
2. Electrical Section General Provisions
3. Conduit
4. Wire and Cable

1.4 SCOPE

A. Furnish stage dimming and control equipment to division 26 contractor for installation.

B. Provide stage rigging and drapery, stage lighting fixtures, accessories, circuit distribution, repertory lighting plot, and hang and focus of fixtures.

C. Due to the complexity of this construction and the specific combination of equipment and services required for a professional installation, equipment in this specification shall be purchased from an approved theater systems integrator (TSI)

D. This is a single source specification, one theatrical systems integrator (TSI) shall be responsible for supplying the stage dimming and control equipment, dead hung rigging, stage curtains, project management, stage lighting fixtures, hanging, focusing and programming of the system prior to owner's possession.

E. The theatrical systems integrator shall be a sub-contractor to and fully coordinated by the division 26 electrical contractor.

F. The theatrical systems integrator shall be responsible for supervising the installation of the dimming and control equipment. Specifically; provide a dedicated project manager, to schedule shipments of equipment, coordinate deliveries, answer system inquiries, and generally oversee the installation of the dimming and control equipment, stage rigging, curtains and circuit distribution.

1. The theater systems integrator, in conjunction with the manufactures shall provide the following:
2. Verification of dimensions and conditions in contract documents prior to equipment installation.
3. Schedule coordination and shipping to job site.
4. Test and verify field and rack-side low voltage terminations.
5. Inspection and adjustment of completed installation by Factory Authorized personnel.
6. Programming of House lighting control system.
7. Electronic PDF sets of shop drawings and a physical set of fabric samples for approval by Engineer prior to fabrication.
8. Turn-on/Energization of the theatrical dimming system, initial programming of house lighting control system and training of all theatrical components.

9. Installation of dimming modules and programming of control processors.
10. Coordination with associated trades in the field.

Contractor Responsibility Matrix

		GC		EC		TSI	
Line	**Item**	**Furnish**	**Install**	**Furnish**	**Install**	**Furnish**	**Install**
	Relay and Control						
	Power Feeders and Discrete Circuits powering Branch Panels			X	X		
	Power Disconnects			X	X		
	Dimming Enclosures/DMX Controlled Relay Panels				X	X	
	Dimming Modules/Relays/Breakers				X	X	
	Lighting Control Equipment Rack				X	X	
	Assembly of Rack Components					X	X
	Control Stations (Flush Mount)				X	X	
	Control Stations (Surface Mount)				X	X	
	Lighting Control Plug Stations				X	X	
	Lighting Control Plug In Station Backboxes				X	X	
	Line Voltage Wire			X	X		
	Line Voltage Wire Terminations			X	X		
	Low Voltage Wire			X	X		
	Low Voltage Terminations			X	X		
	Conduit			X	X		
	Lighting Control Console/Accessories					X	X
	Power and Data Distribution						
	Prewired Connector Strips				X	X	
	Assembly of Connector Strips				X		
	Mount Connector Strips on Rigging Devices				X		
	Branch Wiring from Power Control Enclosures to Connector Strips and Outlet Boxes.			X	X		
	Gridiron Junction Boxes				X	X	
	DMX Distribution Enclosure				X	X	
	DMX Splitter				X	X	
	Stage Lighting Outlet Boxes				X	X	
	Containment			X	X		
	Stage Rigging						
	Schedule 40 Pipe and Spliced					X	X
	Connection of rigging device to building steel					X	X
	Building Connection/Supplemental Steel/Unistrut Bridging	X	X				
	Wall and Ceiling Blocking for Drapery Track	X	X				
	Gym Light Cage					X	X

		GC		EC		TSI	
Line	**Item**	**Furnish**	**Install**	**Furnish**	**Install**	**Furnish**	**Install**
	Stage Lighting Fixtures						
	Theatrical Lighting Fixtures and Accessories				X	X	
	Power Extension Cables				X	X	
	Data Extension Cables				X	X	
	Lighting Plot and Lightwright Paperwork (Including DMX Address table for all fixtures connected to Auditorium Lighting Control System)					X	X
	Theatrical Fixture Prep/Hang/Focus					X	X
	Vertical Access for Lighting Focus			X			
	Miscellaneous						
	Fire Stop			X	X		
	Cutting/Patching/Painting	X	X				
	Protection of Existing Floors/Walls/Surfaces	X	X				
	Disposal/Cleanup/Carting	X	X				
	System Commissioning					X	
	Lighting and Rigging System Training					X	
	Temporary Work Lights and Power			X	X		
	Ventilation			X	X		

1.5 CONTRACTOR COORDINATION

A. Due to the complex nature of the coordination of the work associated with the work of this contract, the following is a list of responsibility to be divided between the general contractor (GC), the theatrical systems integrator (TSI), and the electrical contractor (EC).

1. The GC shall provide protection for the stage flooring and finish during installation.
2. Installation of any support blocking or modification to existing structure shall be the responsibility of the GC.
3. The EC shall be responsible for furnishing and installing all wiring to the control and dimming system.
4. The TSI shall supply all theatrical lighting equipment for installation by the EC.
5. The TSI shall provide a list of DMX Addresses for all fixtures connected to the Auditorium Lighting Control System and program all fixtures controlled by the system. The TSI is responsible for ensuring the DMX Signal works on all TSI Provided fixtures and DMX Distribution
6. The EC shall be responsible for complete installation and wiring of all architectural lighting fixtures.
7. The TSI shall furnish and install all Rigging Equipment to Structural Steel. The GC will engineer, provide and install all required Structural Steel.
8. The TSI shall supply all system documentation, system commissioning, and end-user training.

1.6 THEATRICAL SYSTEMS INTEGRATOR

A. General

1. The provider of the system herein described shall be acknowledged in business as a Theatrical Systems Integration Company, hereafter referred to as TSI. This company shall employ full time Systems Integrators and Project Managers with experience in completing work of similar or greater size and scope. The role of the TSI in this project shall be to provide all equipment listed in this section to the Electrical Contractor for installation. The TSI shall furnish a complete working system to the Electrical Contractor, meeting the intent of this specification. The TSI shall coordinate delivery schedules and installation of equipment with the Electrical Contractor. Additionally, the TSI shall be responsible for all documentation for equipment in this section, system record drawings, final testing of the system and training of the Owner's personnel as required by this specification.

B. Description

1. The TSI shall have experience in the operation and installation of similar equipment associated with the construction of facilities similar in scope to this project.
2. The TSI shall have been in business for a minimum of 20 consecutive years and shall have no history of bankruptcy.
3. The TSI shall be an authorized dealer for an adequate number of manufacturers of system products necessary to provide a complete working system meeting the intent of this specification. System products shall include but are not limited to the following:

    a. Dimming Equipment
    b. Control Systems
    c. Lighting Fixtures
    d. Power Distribution Equipment
    e. Stage Accessories
    f. Dead hung Stage Line sets
    g. Stage Draperies and associated track

4. The TSI shall be located within 50 miles distance away from the project location
5. The TSI shall have on staff at least two full-time manufacturer-certified field service technicians and have technical support and assistance accessible 24 hours a day, seven days a week.
6. The TSI shall offer a Maintenance and Service Contract.
7. Through the Manufacturer's minimum 1-year warranty period, the TSI shall be responsible as the Owner's sole contact for the remedy, repair, or replacement of system deficiencies (through the manufacturer's warranty where applicable).

C. Project Management

1. The Systems Integration Company shall designate a dedicated Project Manager. The TSI's Project Manager shall be the main contact between the Systems Integrator, Manufacturers, Architects, Engineers and Contractors from contract award until final sign off. The TSI's Project Manager shall be the same person throughout the entire course of the project, unless otherwise approved by the Architect.
2. The TSI's Project Manager shall attend a Kick-Off Meeting at the project site office or a place to be designated. The objectives of the Kick-Off Meeting are:
3. Introduce the Project Team Members
4. Review the Project Schedule
5. Review the Scope of Work and any additional materials and documents not in the Scope of Work
6. Layout the creative intent of the Project

D. Approved Theatrical Systems Integration Companies shall be the following:

Barbizon Capitol
6437-G General Green Way
Alexandria, VA 22312
Phone: (703) 750-3900

4Wall Entertainment
9525 Berger Rd, Suite G
Columbia, MD 21046
Phone: (410) 242-3322

1.7 SUBMITTALS

A. Requirements for approval: theatrical systems integrators seeking acceptance must submit the following information along with the equipment submittal. Failure to submit any of the required information will automatically disqualify the contractor from consideration of approval.

B. A listing of 15 equivalent installations including:

1. Name, address, and current telephone number of Owner.
2. Name, address, and current telephone number of Architect or theater consultant associated with the installation.
3. Scope of work of the installation including all sub-contractors and manufacturers.
4. A brief written description of the TSI's operation, including facilities, departments and key personnel.
5. Biographical information of the Project Manager and integration team members who will be assigned to this project should the contractor be successful.
6. A full and complete financial statement sufficient to determine financial viability.
7. A list of all sub-contractors who the TSI proposes to use including their qualifications to perform the work.

C. Manufacturer shall provide full system submittals. Submittals shall be 11"x17", will be delivered in adobe pdf format, and include:

1. Full system riser diagram(s) illustrating interconnection of system components, how the system attaches to building structure, and any special installation considerations.
2. Full set of technical data sheets.
3. Detailed set of drawings, including a complete list of all deviations from specifications.

D. Manufacturer shall provide any additional information, including equipment demonstration, as required by the Engineer to verify compliance with specifications.

E. Samples: The TSI shall submit samples without causing delay in work, as required. It is assumed that all sample gear will count towards overall material quantities.

F. Catalog Cuts: The Contractor shall submit catalog cuts for equipment items. These shall contain full information on dimensions, construction, applications, etc. to permit proper evaluation. In addition, they shall be properly identified as to their intended use. Any options or variations shall be clearly noted.

G. Rigging: Submit shop and installation drawings and schedules showing all information necessary to explain fully the design features, appearance, function, fabrication, installation, and use of system components in all phases of operation. They shall be approved by the Architect before fabrication, installation, or erection has begun. Such approval does not relieve the TSI of the responsibility of providing equipment in accordance with the specifications. Any deviations from the specifications shall be “starred” and noted. Only deviations that are equal or upgrade the quality of the equipment or respond to field conditions will be considered. Approval of submitted equipment shall be obtained prior to equipment purchase or fabrication. If shop drawings are rejected, correct and resubmit in the manner specified. All shop drawing information shall be submitted at the same time; no partial submittal shall be accepted. Drawings shall indicate complete details, dimensions, product types and locations of all equipment, clearances required, guides, cables, sets, Contractor fabricated equipment, and all other details required to completely describe the work to be performed. Submittals drawings shall be presented at a scale not less than 1/4" for equipment layouts and ½" = 1'-0" for equipment details, mounting and other details. Each sheet shall allow space for approval stamps and have the name of the project, the contractors and/or the supplier's name, address telephone number, and the date submitted. Submit the following items for Engineer’s approval, prior to fabrication:

1. Stage plan view
2. Stage side section view
3. Gridiron layout indicating all stage equipment
4. Electrical riser diagrams indicating the necessary power and control wiring for all rigging equipment and systems
5. Plan and elevation views indicating all power, motor and control hardware locations and layout
6. Provide full dimensions for panel layouts with finishes and materials for all custom panels
7. Details of installation and erection, including adjoining conditions and necessary clearances
8. Indication by arrow and boxed caption of each variation from contract drawing and specifications, except those indicated as acceptable in specifications or on drawings

1.8 QUALITY ASSURANCE

A. Manufacturer of Lighting Control System shall be one who has been continuously engaged in the manufacturer of lighting control equipment for a minimum of ten years. All dimmer and cabinet fabrication must take place in a U.S. manufacturing plant.

B. Proposed equipment shall be UL listed, and/or ETL marked and bear the appropriate labels.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. The equipment herein specified shall be manufactured by the following, or approved equal:

Electronic Theatre Controls
3031 Pleasant View Road
Middleton, WI 53562

The Light Source
3935 Westinghouse Blvd.
Charlotte, NC 28273

Automatic Devices Company
2121 South 12th Street
Allentown, PA 18103

Rosebrand
4 Emerson Lane
Secaucus, NJ 07094

Pathway Connectivity
One Lithonia Way
Conyers, GA 30012

B. Permission to bid does not imply acceptance of the manufacturer. It is the sole responsibility of the Electrical Contractor to ensure that any price quotations received and submittals made are for systems that meet or exceed the specifications.

C. All Substitutions must be submitted in writing 10 days prior to bid date.

2.2 EQUIPMENT

A. WALL MOUNT RELAY PANEL AND LOAD CENTER

1. General

a. The wall mount relay panel shall be the Echo Relay Panel as manufactured by ETC, Inc., or equal
b. Relay Panels shall be UL508, UL67, and UL924 Listed, and shall be so labeled when delivered
c. Relay Panels shall consist of a main enclosure with 30 pole breaker subpanel, relay/dimmer sub panel, integral control electronics, and a low voltage subpanel for data terminations and provision for accessory cards.
d. Up to two accessory cards shall be supported per relay panel

2. Mechanical

a. The panel shall be constructed of 16-gauge steel. All panel components shall be properly treated and finished in fine-textured, scratch resistant paint
b. Relay panels shall be available in 120 and 277 Volt AC configurations
c. 120V enclosures shall be 67.5” high by 14.36” wide and 4” deep with a weight not more than 80 pounds
d. 277V enclosures shall be 67.5” high by 20” wide and 6” deep with a weight not more than 130 pounds
e. The panel shall be capable of being mounted on the surface of a wall or recessed mounted
f. 120VAC panels shall support mounting between standard wall stud framing (16-inch on center spacing)
g. Choice of panel covers shall be available for surface or recess mount applications. This outer panel shall ship complete with a locking door to limit access to electronics and breakers, breakers
h. Optional center-pin reject security screws shall be available for all accessible screws
i. Recess mount doors shall extend 1” beyond all panel edges to hide wall cut-out
j. The unit shall provide interior cover over breaker panel to allow access only to class 2 wiring and prevent direct access to class 1 line voltage components
k. The Relay panel shall support up to twenty-four 20-amp single pole circuits made up of relays (120V and 277V enclosures) or 300W dimmers (120V enclosures only)

l. Two and three-pole relay circuits shall be supported at decreased density where each pole constitutes one of the available single-pole circuits. Mixing of circuits in any combination shall be supported
m. Panels that do not support an integral dimmer module shall not be acceptable
n. Relays shall include integral switches for manual control while power is unavailable to the panel such that critical lighting can be set to an on state, without the need for power to the panel
o. Relay output lugs shall accept 6-14AWG copper wire
p. Breaker subpanel may include up to twenty-nine 20-amp single pole, up to fourteen 20 amp double pole, or nine three pole breakers as required in any combination up to capacity
q. Control wiring for DMX, station bus, and Emergency input terminations shall land on removable headers for contractor installation.

3. User Interface

a. The user interface shall contain a graphical display with button pad to include 0-9 number entry, up, down back arrow navigation and enter
b. Test shortcut button shall be available for local activation of preset, sequence and set level overrides
c. The user interface shall have a power status LED indicator (Blue), a DMX status LED indicator (Green), a network status LED indicator (Green) and an LED indicator (red) for errors
d. Interface shall allow the backlight to timeout and shall provide user editable options to shut off backlight completely as well as adjust screen contrast
e. Ethernet interface shall default to automatic IP through link local and DHCP. Upon receiving IP address, the address of the Network Interface Card (NIC) shall display in the about menu. Static address and settings shall also be possible
f. The control interface shall support a USB memory stick interface for uploads of configurations and software updates

4. Functional

a. Panel setup shall be user programmable. The control interface shall provide the following relay setup features (per circuit):

(1) Type (1 pole, 2 pole, or 3 pole)
(2) Name
(3) Circuit Number
(4) DMX address
(5) sACN address
(6) Space Number
(7) Circuit Modes
(8) Normal (priority and HTP based activation and dimming)
(9) Latch-lock
(10)Fluorescent
(11)DALI
(12)On threshold level
(13)Off threshold level
(14)Include in UL924 emergency activation
(15)Allow Manual

b. Relay panels shall support discrete addressing of each relay. Panels that are restricted to use of start address with sequential addressing and cannot assign each 0-10V output control to any internal relay shall not be acceptable

c. The panel shall be capable of switching all relays on or off at once, or in a user-selectable delay per relay using a period of 0.1 to 60 seconds, in 0.1 second increments
d. An Ethernet connection shall provide advanced control of relays over streaming ACN (sACN) and transmit status, control override, and measured energy usage per branch circuit via an internal Web UI or central monitoring interface
e. Control electronics shall report the following information per branch circuit

(1) Breaker state (On/Off)
(2) Breaker state (Open/Closed)
(3) Current draw (In Amps)
(4) Voltage
(5) Energy usage
(6) Panels that do not report this information shall not be acceptable
(7) Built-in Control shall include:

(a) Ability to record up to 16 presets in each space from the control panel, connected control stations, or timed events
(b) Presets shall be programmable by recording current levels (as set by DMX or connected control stations), by entering levels on the control panel directly, manually selecting relay state on each relay or a combination of these methods. From the control panel, stations, or timed events it shall be possible to record values for up to 16 zones per space
(c) Up to 8 spaces in a single rack for total of up to 16 spaces shall be supported per system or system subnet
(d) Indication of an active preset shall be visible on the control panel display
(e) One 16-step sequence per space for power up and power down routines
(f) The panel shall have a UL924-listed contact input for use in Emergency Lighting systems. The panel shall respond to the contact input by setting included relays to “on”, while setting non-emergency relays “off”. Each relay can be selected for activation upon contact input
(g) Upon Data loss the system shall provide options to hold last look infinitely or hold for a configured time period set by the installing technician then fade/switch to the input of the next available priority
(h) Control electronics shall respond directly to control stations for zone, preset, and sequence control. Systems that require secondary control systems for this functionality are not acceptable
(i) After power loss, electronics shall be capable of holding the system in its previous state until new level data (DMX, architectural presets, sequences and zones, or local overrides) is received to make each relay change state
(j) The control of lighting and associated systems via real time and Astronomical clock controls

(8) The relay panel shall allow the activation of presets, sequence, and zone programming of up to 50 time clock events via a built in real and astronomical timeclock
(9) System time events shall be programmable via the control panel.
(10) Time clock events shall be assigned to system day types. Standard day types include: everyday, weekday, weekend, Sunday, Monday, Tuesday, Wednesday, Thursday, Friday and Saturday
(11) Time clock events shall be activated based on sunrise, sunset, time of day or periodic event
(12) System shall automatically compensate for regions using a fully configurable daylight saving time
(13) Presets shall be assigned to events at the time clock
(14) The time clock shall support event override

(15) It shall be possible to override the timed event schedule form the face panel of the time clock
(16) The time clock shall support timed event hold
(17) It shall be possible to hold a timed event from the face panel of the processor
(18) Timed event hold shall meet California Title 24 requirements
(19) The panel shall receive ESTA DMX512-A control protocol. Addressing shall be set via the user interface button keypad with any relay being patched to any DMX control address
(20) 2,500V of optical isolation shall be provided between the DMX512 inputs and the control electronics as well as between control and power components
(21) The relays shall respond to control changes (DMX or Stations) in less than 25 milliseconds. DMX512 update speed shall be 40Hz
(22) Setting changes shall be able to be made across all, some, or just one selected relay in a single action from the face panel
(23) DMX data loss shall allow for levels/relays to be held for ever or for a specified time before switching to a lower priority source
(24) Initial Panel setup
(25) The relay panel shall automatically detect the type of relay or dimmer installed in each location without need for manual configuration of the physical arrangement.

f. Quick rack setup shall be available to apply address settings across all circuits for rack number, DMX Start Address, sACN universe, and sACN start address.
g. Emergency Setup Menu shall provide optional delays when emergency is activated or deactivated, and option to turn off non-emergency circuits shall be available. Record function shall allow circuits that are turned on to be added to the emergency setting

5. Electrical

a. Relay Panels shall be available to support power input from:

(1) 120/208V three phase 4-wire plus ground

6. Conduit Entry:

a. Feeders:

(1) Top or top-side (upper 6” of either side)
(2) Bottom or bottom-side 6” of either side
(3) Feeders shall enter through the top or bottom according to the orientation of the enclosure
(4) Feeder entry shall be nearest to the location of the feeder lugs or main breaker

b. Load:

(1) Load wiring shall enter through the top or bottom of the enclosure
(2) Load wiring shall enter through the top/bottom surface nearest to the breaker sub panel
(3) Load wiring may also enter through left and/or right side provided a low voltage chase is not required through the same area. If class 2 chase is required, a field installable barrier panel shall be provided upon request. When installed, the left or right side of the panel, where the barrier has been installed, shall not permit load wiring

c. Low Voltage:

(1) Top or top-side (upper 6” of either side)

(2) Bottom or bottom-side (bottom 6” of either side)
(3) For low voltage conduit entry at the relay end of the cabinet, conduits shall be located at the outer 3” of the top/bottom panel
(4) Field installed low voltage channel shall be provided separately for installation on the left or right side of the panel to allow class 2 wiring to traverse the panel from top to bottom or bottom to top

d. All relays shall be mechanically latching
e. The relay shall be capable of switching 20A at up to 300V
f. The relay panel shall support a maximum feed size of 200 Amps
g. Relay panels shall support main circuit breaker options:

(1) Main breaker options shall be optional and available for purchase upon request
(2) Main breakers shall be field installable
(3) Main breakers shall be available in 100 and 200 Amps for 120V systems and 150 Amps for 277V systems
(4) Series rated SCCR ratings apply as follows with appropriate main breaker:

(a) 10,000A at 100A; 120/208V
(b) 10,000A, 22,000 or 42,000 at 200A; 120/208V

(5) Main breakers shall allow the following range of wire sizes:
(a) 3/0 to 300kcmil at 120/208V

7. Relay

a. Each relay shall have a manual override switch with on/off status indication
b. Relays shall be rated for use with:

(1) 16A Electronic Ballast loads @ 120, 240 and 277V
(2) 20A Tungsten loads at 120, 240, and 277V
(3) 20A 277V Ballast (HID)
(4) Motor loads with ratings of 20 FLA @ 120V, 17 FLA @ 240V, and 14 FLA @ 277V 100,000A symmetrical SCCR

c. Isolation shall be 4000V RMS
d. Relays shall be latching state
e. Rated Life:

(1) 1,000,000 mechanical activations
(2) 100,000 cycles at full resistive load
(3) 30,000 cycles full motor, inductive, tungsten, and electronic (LED)
(4) Decreasing loading shall increase the rated life of the relay inversely proportional the square of the load

f. Relays shall support reporting of current usage with an accuracy of five percent of the connected load

8. Dimmer Modules (120V enclosures only)

a. Dimmer modules shall be available as either forward-phase or phase-adaptive
b. Dimmer modules shall be fully rated for loads up to 300W
c. By default, phase-adaptive dimmers shall automatically detect the required dimming mode based on connected loads and lock the mode in at power-up

d. The forward-phase dimmer shall support tungsten/incandescent, 2-wire fluorescent, and magnetic transformer loads
e. The phase-adaptive dimmer shall support tungsten/incandescent, line-drive LED, and electronic transformer loads
f. Panels without available dimmers that support magnetic loads shall not be acceptable
g. The panel shall support a maximum phase dimming load of 7,200W if populated fully with (24) 300W dimmer modules. Panels that do not support phase dimmers and relays combined in a single panel shall not be acceptable

9. Relay Panel Accessories

a. A low voltage 0-10V dimming option shall provide up to 24 0-10v control outputs that are linked to relay circuits within the panel. Each output shall support up to 400mA of current sink per output
b. A contact input option shall provide 24 dry contact inputs to be linked for direct or group relay control, to activate a preset, or to activate a sequence. Controller software shall allow for normally open maintained, normally closed maintained, or momentary toggle
c. A DALI control option shall provide 24 control loops of broadcast DALI control, with each loop controlling up to 64 DALI devices
d. A RideThru option shall provide short-term power backup of control electronics by automatically engaging when power is lost, and recharging when normal power is present
e. A tamperproof hardware kit shall be available that provides center reject Torx head screws to prevent access to panel interior by unqualified individuals
f. Main Breaker options shall be available as specified in Section E.6 Thermal
g. The panel shall be convection cooled. Panels that require the use of cooling fans shall not be acceptable
h. The panel shall operate safely in an environment having an ambient temperature between 32ºF (0ºC) and 104ºF (40°C), and humidity between 5-95% non-condensing
i. Provide (1) ERP-24R1-24B1-ML3P with Surface-mount Door Kit

2.3 LIGHTING CONSOLE AND ACCESSORIES

A. General

1. The lighting control console shall be a microprocessor-based system specifically designed to provide complete control of stage, studio, and entertainment lighting systems. The console shall be the ColorSource 20 as manufactured by Electronic Theatre Controls, Inc., or equal.
2. The system shall provide control of 512 DMX512A addresses on a maximum of eighty (80) control channels. Any or all of the DMX512A outputs may be controlled by a channel.
3. A maximum of 999 cues may be contained in non-volatile electronic memory.
4. Twenty (20) or forty (40) faders shall provide access to individual intensity channels, intensity for devices as well as playbacks.
5. Four (4) configurable faders shall provide functionality for output of bump buttons, cue list control or crossfade control.
6. The console shall have one (1) built-in 7” color multi-touch touchscreen. The touchscreen shall provide the primary interface for system configuration, programming show data and multi-parameter control.
7. Six (6) softkey buttons shall be provided, five of which may be configured by the user.
8. Console shall be equipped with an on-board help system.
9. Console shall not require the use of an external monitor for normal use.
10. Console software upgrades shall be made by the user via USB drive. Changing internal components shall not be required.
11. The console shall provide a USB port allowing show data to be saved for archival or transfer to other consoles or a personal computer.
12. Systems that do not provide the above capabilities shall not be acceptable.

B. Controls and Playback

1. Patching

   a. The console shall provide patching facilities for dimmers and multi-parameter devices via a built in library of fixture definitions. The fixture library shall be updated via software based updates. It shall be possible to create custom fixture definitions using an offline application.
   b. The console shall support patching, address setting, and mode changes using Remote Device Management (RDM) on the local DMX/RDM port.

2. Channel or Playback Faders

   a. Twenty (20) or forty (40) proportional, fully overlapping faders shall be provided with 45mm potentiometers and bump buttons.
   b. The faders shall provide direct manual control of intensity for all channels. Channel levels can be changed at any time by using the individual channel faders or through the use of the touch screen interface.
   c. Faders shall also control up to ten (10) pages of twenty (20) (or forty (40)) recordable memories or sequences. Memories shall record user-selected channel levels. Sequences shall record user-selected memories or channel levels.
   d. With color mixing systems, output of color from fixtures shall appear to be a combination of the active memories in a color space.

3. Programming Tools

   a. The console shall provide a 7” color multi-touch touchscreen with six (6) softkeys, as well as touch-based controls. The LCD shall provide system configuration, programming show data and multi-parameter control.
      (1) Touch-based tools shall include:

         (a) White and color pickers.
         (b) Touch-based parameter controls with reference based palettes.
         (c) Virtual Level/Rate wheel.
         (d) Virtual keypad for level entry.
         (e) Customizable channel display using Stage Map. It shall be possible to rearrange the graphical representations for control channels to closely mimic the positions of fixtures in the venue.
         (f) Effects (intensity, color, shape, and parameter)

   b. It shall be possible to assign multiple effects to the same channel and parameters. The playback of those effects shall play levels back relative to the combination of the two effects.
   c. Fixture selection shall be made via:

      (1) Auto fixture selection on fader moves.
      (2) Pressing the selection button under channel faders.
      (3) Touching the channel icon in the stage map display on the touch screen.

   d. Fixture Tags for Quick Selects

      (1) Selection of multiple fixture shall be possible through a special controls dock that groups channels together based on the channel tile positions within a pre-defined area in the topographical view for channels.

(2) Selection shall be possible through the use of informational tags. Selecting a predefined tag selects all fixtures sharing that same tag. At least two tags may be assigned to any one channel.
(3) There shall be at least 27 Quick Select groupings.
(4) Two independent channels shall be provided with on/off functionality. Independents shall be patched in a location separate from patch.

4. Playback Controls

a. A cue list of up to 999 cues shall be provided. Cues may be made up of channel levels and parameter settings or contain a reference to a recorded memory. Cues shall be editable and shall be able to be individually deleted and inserted.
b. Playback Toy for filtered and timed execution of playbacks.
c. Multiple bump modes (Flash, Solo, SoloChange, Move/GO).
d. Full history rubberbanding for playbacks.

C. Interface Options

1. The console shall provide connectors for the following:

a. 12V AC or DC input for external power supply
b. DMX512-A/RDM output (one (1) 5-pin XLR connector)
c. USB connection (one (1) type A connector)

D. Physical

1. All operator controls and console electronics shall be housed in a single desktop console.
2. Size and weight:
3. Twenty (20) fader console shall be equal to or less than 18.31" (465mm) wide 11" (279mm) deep 2.36" (60mm) high (including controls), and6.9 lbs. (3.13 kg.)
4. Twenty (20) fader console shall be able to be mounted into a 19” equipment rack with the use of additional mounting hardware.
5. Console power shall be 12V AC or DC via an external power unit. The power unit shall operate with 90-265VAC line voltage, 50 or 60Hz. Console is provided with a universal power supply.

E. Provide (1) ETC Color Source 20 Console with dust cover and 25’ DMX Cable

2.4 DMX/RDM INSTALLATION REPEATER

A. General

1. The Installation Repeater shall permit star-wiring of DMX/RDM signals and shall isolate DMXRDM transmitters and DMXRDM receivers from common mode voltages, ground loop currents and other electrical faults.
2. Each Installation Repeater shall have one input port and eight output ports. No in-line processing of the input signal is permitted to ensure the highest reliability.
3. DMX signal splitting shall be provided using 12-port rack mounted modules for easy expansion and/or servicing.
4. The system shall be capable of repeating simplex protocols other than DMX512, provided they meet the electrical requirements of EIA-RS422 or RS485.
5. Provide (1) ETC Response Opto-Splitter – 12 Port Terminal Rack Mount

2.5 DATA PLUGGING STATIONS

A. General

1. Data Plug-In Stations shall be Plug-In Stations as manufactured by Electronic Theatre Controls or equal.
2. The Plug-In Stations shall consist of the appropriate connectors required for the functional intent of the system. These stations shall be available with DMX input or output, Remote Focus Unit, Network, or architectural control connectors. Custom control connectors shall be available.
3. The Plug-In Stations shall be available in standard surface or flush mount electrical back boxes from 1-gang up to 6 –gang in size
4. The Plug-In Stations shall mount to industry standard back boxes provided by the manufacturer (or Equivalent) using supplied mounting hardware
5. The back boxes shall be provided by the contractor
6. Gang-able back boxes shall not be acceptable.
7. Surface mounts boxes shall be provided by Electronic Theatre Controls or equal.

B. Connector Options

1. The following standard components shall be available for Plug-in Stations:

   a. 5-Pin male XLR connectors for DMX input
   b. 5-Pin female XLR connectors for DMX output
   c. 6-Pin female XLR connectors
   d. RJ45 connectors for Network connections - Twisted Pair
   e. Custom combinations and custom control connections shall be available.

C. Physical

1. Station faceplates shall be .80” aluminum, finished in fine texture, scratch-resistant black powder coat, stainless steel or white. Standard silk-screened graphics shall be white. Other color options shall be available.
2. The station panel shall mount into an industry standard back box, depending on size and quantity of connectors. A terminal block shall be supplied for contractor terminations.
3. Option for IP-65 rated plate or cover shall be available.

2.6 OUTLET BOX

A. General

1. NEMA connector plates shall be modular plug box as manufactured by Electronic Theatre Controls, or equal.
2. Connectors shall be available as 20A, grounded L5-20 “EDISON”; other connectors shall be available as specified.
3. Pigtails shall be three-wire cable sized for the maximum circuit ampacity.
4. Pigtails with 20 amp L5-20 Parallel blade “Edison” connectors shall be terminated using 12 gauge wire.
5. Terminations for pigtail connectors shall utilize feed- through terminals individually labeled with corresponding circuit numbers.
6. Terminals that place a screw directly on the wire are not acceptable.
7. Outlet and pigtail boxes shall be supplied with appropriate brackets and hardware for mounting as shown on the drawings.
8. Standard mounting options shall include pipe or wall mounting.
9. Brackets and hardware shall be rated steel.
10. A low voltage distribution system shall be available to incorporate DMX, Ethernet or other protocols as specified in the power distribution box.
11. A voltage barrier shall be used to separate the low voltage wiring for the electrical circuits.
12. Power distribution equipment shall be listed by a nationally recognized test lab (NRTL).

B. Physical

1. Outlet and pigtail boxes shall be 6.25” H x 3.3” D and fabricated from 18 gauge galvanized steel and finished in black fine-texture powder coat paint.
2. Outlet and pigtail boxes shall be available in any length specified in increments of 3-inches with a maximum.
3. Pigtails and outlets shall be spaced on 18” centers or as otherwise specified.
4. Outlets shall be mounted on individual 3” panels.
5. 1-inch die-cut white numbering label shall be standard.
6. Other labeling options shall be available.

2.7 LIGHTING CONNECTOR STRIP

A. General

1. The patented MegaBatten constructed from 1-1/2” extra strong schedule 80 aluminum pipe.

B. Features

1. Up to 100’ in length, built from 8’, 4’, 32”, 16” lengths with internal splices
2. From 1-6 20A circuits
3. Power and data outlet plates on 16” centers
4. Powder coated, available in matte black, eggshell white, or custom RAL colors
5. Pre-wired at the factory for ease of installation
6. Product shall be ETL rated.

C. Data Distribution

1. Product shall be available with or without DMX-512A/RDM data distribution.
2. DMX is connected to the MegaBatten in the DMX/RDM splitter.
3. The last plate of the DMX output is terminated.
4. DMX Output connectors available: 5pin XLR, 3pin XLR, RJ45

D. Power Input Options

1. Terminal box

E. Connector Options

1. 20A Flush Mount 5-20 “Edison” connectors shall be available.

2.8 GYM LIGHT CAGE

A. General

1. The Gym Light Cage With MegaBatten shall be easy to assemble and protect performance lighting instruments. It shall constructed from 2” extra strong schedule 80 aluminum pipe AMD include 19 or 27 pre terminated 1/8 Inch aircraft cables. Aircraft Cable Stiffeners for cage lengths over 118 inches shall be included.

B. Features

1. Up to 198 inches in length, or 54” minimum cage length.
2. 30” or 36” square end cap .
3. Up to 2 20A circuits .

4. Power and data outlet plates on 16” centers .
5. Powder coated, available in black, white, or custom RAL colors .
6. Pre-wired at the factory for ease of installation.
7. Ships Flat
8. Product shall be ETL listed.

C. Data Distribution

1. Product shall be available with or without DMX-512A/RDM data distribution.
2. DMX is connected to the MegaBatten in the DMX/RDM splitter.
3. The last plate of the DMX output is terminated.
4. DMX Output connectors available: 5pin XLR, 3pin XLR, RJ45.

D. Power Input Options

1. 12 foot power lead for connection to building junction box.

E. Connector Options

1. 20A Flush Mount 5-20 “Edison” connectors shall be available.

2.9 THEATRICAL LIGHTING FIXTURE GENERAL INFORMATION

A. TSI Shall provide fixtures listed for project scope. TSI shall unbox, prep, hang, and focus all theatrical portable style fixtures

B. Vertical Access (ladders/genie lifts/scaffolding to Overhead Lighting Positions to be provided by EC at direction of TSI.

C. TSI shall provide PDF light plot showing placement of each fixture, unit number, console control channel, and the DMX Address of each fixture connected to the control system. TSI shall provide Channel Hookup, Fixture Schedule, and Light Plot for focus crew.

D. Provide the following accessories per fixture:

E. All fixtures shall be supplied with all appropriate mounting hardware and safety cable.

F. All fixtures to be supplied with (1) power input cable with 5-20 Edison plug, (1) control cable and (1) power thru cable (to match fixture connector), minimum 10’ in length.

G. The TSI Shall provide a printed adhesive label per fixture indicating the control channel, Fixture control mode, DMX address, fixture purpose and other relevant fixture information.

H. The TSI shall Hang and Focus the lighting plot. All cables shall be tied to the pipe using black tie line. Each fixture shall have adequate cable slack for focus and minor adjustments.

2.10 LIGHTING FIXTURE AND CABLE QUANTITIES

Item	MCPS MS-Quantities
DMX Controlled Fixtures	
TL-01 (Refer to Fixture Schedule for Specifications)	12
TL-02 (Refer to Fixture Schedule for Specifications)	15
TL-03 (Refer to Fixture Schedule for Specifications)	5
PowerCon Power Cable (LEX PE700J or equal)	
10’	33
DMX Extension Cable (LEX 5-Pin XLR Extension or equal)	
5’ DMX Cable	5
10’ DMX Cable	33
5 Pin DMX Terminator	4
Fixture Accessories & Iron **(To be provided in addition to quantities specified in fixture schedule)**	
ColorSource Spot V gobo holder	4
ColorSource Spot V accessory holder	4
Expendables	
600’ Spool of Black, Unglazed Tie Line	1
Black Gaffers Tape 2” Roll	3
White Gaffers Tape 2” Roll	2
1” Wide Roll Console Tape	1

2.11 THEATRICAL FIXTURE SCHEDULE

TYPE	MANUFACTURER	MODEL	MOUNTING	PURPOSE	WATTAGE	FINISH	NOTES
TL-01	ETC	CSSPOTVMVS	C-Clamp	Color Mixing LED Ellipsoidal Fixture	197	Black	Per Fixture, Include (1) each: C-Clamp, Safety Cable, Edison Power Input Cable,26° EDLT lens tube, 10' 5-pin DMX cable.
TL-02	ETC	CSPARDB	C-Clamp	Color Mixing LED Wash Fixture	90	Black	Per Fixture, Include (1) each: C-Clamp, Safety Cable, Edison Power Input Cable, 10' 5-pin DMX cable, Medium round diffuser in frame
TL-03	ETC	CSCYC	C-Clamp	Color Mixing LED Cyc Light	133	Black	Per Fixture, Include (1) each: C-Clamp, Safety Cable, Edison Power Input Cable, 10' 5-pin DMX cable.

2.12 COLOR MIXING LED PROFILE FIXTURE (Type TL-01)

A. General

1. Five color light engine which uses a mix of red, green, blue, indigo and lime LED emitters. ETC optics, adapters, and accessories.

    a. Standards Compliance:

        (1) Listed: cETLus, UL 1598, UL 924, CSA C22.2 No. 250.0.
        (2) Compliance: CE.
        (3) USITT DMX-512-A

B. Features

1. Model ColorSource Spot V with shutter barrel, black.
2. Source:

    a. LED Details: 60 Lumileds LUXEON Rebel and LUXEON C LEDs.
    b. Max Lumens: 9300.

c. Lumens per Watt: 47.2.
d. L70 Rating: Greater than 54000 hours.

3. Colors:

a. Colors Used Spot: Red, green, blue, indigo, lime.
b. Color temperature Range: Color mixing.
c. Calibrated Array: Yes.
d. Red Shift: No.

4. Optical:

a. Beam Angle Range: 5 to 90 degrees. Swappable lens tubes.
b. Gate Size: 80 mm.
c. Aperture Size: 6.25 to 14 inches depending on lens tube.
d. Pattern Projection: Yes.
e. Pattern Size: A or B.
f. Camera Flicker Control/Hz Range: 5 kHz and 25 kHz.

5. Control:

a. Input Method:

(1) DMX-512 via 5-pin XLR connector. Protocols: DMX512, RDM.
(2) City Theatrical Multiverse. Protocols: DMX512, RDM

b. NFC Configuration: Yes, via Set Light app.
c. RDM Configuration: Yes.
d. User Interface Type:

(1) ColorSource Spot V: 7-segment 3 button interface.

e. Local Control: Yes. (ColorSource Spot V only)
f. Onboard Presets: Yes, 12. Onboard Sequences: Yes, 5. Onboard Effects: No.
g. Fixture-to-Fixture Control: Yes.
h. 15-bit virtual dimming engine.

6. Electrical:

a. Voltage: 100 to 240 VAC, 50 to 60 Hz.
b. Input Method: powerCON True1 TOP in and thru.
c. Inrush First Half Cycle: 55 A at 120 V. 59 A at 240 V.
d. Fixtures per Circuit:
(1) Eight. (R20 module or similar).

7. Thermal: Operating Temperature: 32 to 104 degrees F.

a. Fan: Yes. Controllable.
b. Droop Compensation: Yes.
c. BTUs/hour: 671.77.

8. Physical: IP Rating: ColorSource Spot V: IP-20.

a. Materials: Die-cast aluminum. Colors: Black, white, silver, or custom.
b. Mounting Options: Yoke.

c. Included Accessories: Hanging yoke, 39 inch power cable, soft-focus diffuser in an A-size gobo holder.

2.13 COLOR MIXING LED WASH FIXTURE (Type TL-02)

A. General

1. The fixture shall be a colour-mixing high-intensity LED illuminator with DMX control of intensity and colour. The fixture shall be a ColorSource PAR, ColorSource PAR Deep Blue or ColorSource PAR Pearl as manufactured by Electronic Theatre Controls, Inc. or approved equal.
2. All LED fixtures shall be provided by a single manufacturer to ensure compatibility
3. The fixture shall be CE compliant and UL 1573 listed for stage and studio use
4. The fixture shall comply with the USITT DMX512-A standard
5. The fixture shall be provided with the minimum warranty of 5 years full fixture coverage and 10 years LED array coverage
6. ColorSource PAR and ColorSource PAR Deep Blue

    a. The fixture shall have a LM-84 report with a L70 rating of no less than 55,000 hours Substitutes must provide evidence of minimum L70 rating of no less than 55,000 hours
    b. If no LM-84 report is available, an acceptable alternate is a LM-80 report on all emitters with a LM-79 report and an in situ temperature measurement test verifying the conditions of the fixture meet the conditions of the LM-80 report
    c. All tests and reports must be completed by a Nationally Recognized Testing Laboratory
    d. All tests must be conducted to IES standards

7. ColorSource PAR Pearl

    a. LED emitters must have a L70 rating of no less than 60,000 hours
    b. Substitutes must provide evidence of minimum L70 rating of no less than 60,000 hours via a LM-80 report on all emitters
    c. LM-80 report must be provided with a LM-79 report and an in situ temperature measurement test verifying the conditions of the fixture meet the conditions of the LM-80 report
    d. Tests and reports must be completed by a Nationally Recognized Testing Laboratory
    e. Tests must be conducted to IES standards

B. Physical

1. The fixture shall be contained in a rugged all-metal die-cast housing, free of burrs and pits.
2. The housing shall have a rugged black powder-coat finish
3. White or silver/gray powder-coat finishes shall be available as colour options
4. Other powder-coat colour options shall be available on request
5. Power supply, cooling and electronics shall be integral to each unit.
6. Fixture housing shall provide two easy-access slots for secondary lenses and other accessories
7. Slots shall be equipped with locking retaining clip
8. The unit shall ship with:

    a. Theatrical-style hanging yoke as standard
    b. 1.8m PowerCON to flying leads power cable
    c. Available options shall include but not be limited to:
    d. Floor stand conversion Kit
    e. PowerCON to PowerCON cables for fixture power linking
    f. Multiple secondary lens options to include multiple angles in the following patterns:
    g. Linear

h. Round
i. Oblong
j. Light output shall be via a round aperture
k. Aperture and accessory slots shall accommodate standard 190mmx190mm accessories such as used in other similar-sized fixtures
l. Accessories available as options shall include but not be limited to:
m. Gel/diffusion frames
n. Top hats
o. Barn doors
p. Egg crate louvres
q. Concentric ring louvres
r. Multiple secondary lensing options

C. Environmental and Agency Compliance

1. The fixture shall be CE compliant, and shall be so labelled when delivered to the job site.
2. The fixture shall be UL LISTED to the UL1573 standard for stage and studio use
3. The fixture shall be rated for IP-20 dry location use.

D. Thermal

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

   a. 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 colour mixing versions and 36,000 hours of use for Pearl variety
   b. Thermal management shall include multiple temperature sensors within the housing to include:

      (1) The LED array
      (2) The control board

2. The fixture shall operate in an ambient temperature range of 0°C minimum to 40° C maximum ambient temperature.

E. Electrical

1. The fixture shall be equipped with 100V to 240V 50/60 Hz internal power supply
2. The fixture shall support power in and thru operation
3. Power in shall be via Neutrik® PowerCON input connector
4. Power thru shall be via Neutrik ® PowerCON output connector
5. Fixture power wiring and accessory power cables shall be rated to support linking of multiple fixtures up to the capacity of a 15A breaker
6. The fixture requires power from non-dim source
7. Power supply outputs shall have self-resetting current limiting protection
8. Power supply shall have power factor correction

F. LED Emitters

1. The fixture shall contain 4 different LED colours to provide colour characteristics or two colour temperature white LEDs for the Pearl products, as described in Section H below.
2. All LEDs used in the fixture shall be high brightness and proven quality from established and reputable LED manufacturers.
3. Fixture shall utilise Luxeon® Z™ LED emitters

4. Manufacturer of LED emitters shall utilize an advanced production LED binning process to maintain colour consistency.
5. LED emitters should be rated for nominal 20,000-hour L70 rating for colour mixing versions and 36,000-hour L70 rating for Pearl variant
6. LED system shall comply with all relevant patents

G. LED Emitters

1. The fixture shall contain 4 different LED colours to provide colour characteristics or two colour temperature white LEDs for the Pearl products, as described in Section H below.
2. All LEDs used in the fixture shall be high brightness and proven quality from established and reputable LED manufacturers.
3. Fixture shall utilise Luxeon® Z™ LED emitters.
4. Manufacturer of LED emitters shall utilize an advanced production LED binning process to maintain colour consistency.
5. LED emitters should be rated for nominal 20,000-hour L70 rating for colour mixing versions and 36,000-hour L70 rating for Pearl variant.
6. LED system shall comply with all relevant patents.

H. Color

1. The fixture shall utilise an minimum of 40 LED emitters

   a. These emitters shall be made up of Red, Green, Blue and Lime for ColorSource
   b. These emitters shall be made up of Red, Green, Indigo and Lime for ColorSource Deep Blue
   c. These emitters shall be made up of 2700 K and 6500 K for ColorSource Pearl

I. Dimming

1. The LED system shall use 15-bit nonlinear scaling techniques for high-resolution dimming.

   a. The dimming curve shall be optimised for smooth dimming over longer timed fades.
   b. The LED system shall be digitally driven using high-speed pulse width modulation (PWM)
   c. LED control shall be compatible with broadcast equipment in the following ways:

      (1) PWM control of LED levels shall be imperceptible to video cameras and related equipment
      (2) PWM rates shall be adjustable by the user via RDM to avoid any visible interference to video cameras and related equipment

J. Control and User Interface

1. The fixture shall be USITT DMX 512A-compatible via In and Thru 5-pin XLR connectors
2. The fixture shall be compatible with the ANSI RDM E1.20 standard
3. All fixture functions shall accessible via RDM protocol for modification from suitably equipped control console
4. Temperature sensors within the luminaire shall be viewable in real time via RDM
5. Fixtures not offering RDM compatibility, feature set access or temperature monitoring via RDM shall not be compatible
6. The fixture shall be equipped with a 7-segment display for easy-to-read status and control
7. The fixture shall be equipped with a three-button user-interface
8. The fixture shall offer RGB control
9. The fixture shall operate in Regulated mode for droop compensation
10. The fixture shall offer stand-alone functionality eliminating the need for a console

11. Fixture shall ship with 12 preset colours accessible as a stand-alone feature
12. Fixture shall ship with 5 Sequences accessible as a stand-alone feature
13. Each colour and sequence can be modified by the end user
14. Fixtures can be linked together with standard DMX cables and controlled from designated master fixture
15. Up to 32 fixtures may be linked
16. Fixtures in a stand-alone state shall restore to the settings present prior to power cycling, eliminating the need for reprogramming
17. Fixtures without stand-alone operation features described in a, b, c, d, and e shall not be acceptable.

2.14 COLOR MIXING CYCLORAMA FIXTURE (Type TL-03)

A. General

1. The fixture shall be a colour-mixing high-intensity LED illuminator with DMX control of intensity and colour. The fixture shall be a ColorSource® CYC as manufactured by Electronic Theatre Controls, Inc. or approved equal.
2. All LED fixtures shall be provided by a single manufacturer to ensure compatibility
3. The fixture shall be CE compliant and UL 1573 listed for stage and studio use
4. The fixture shall comply with the USITT DMX512-A standard

B. Physical

1. The fixture shall be contained in a rugged all-metal die-cast housing, free of burrs and pits.
2. The housing shall have a rugged black powder coat finish
3. White or silver grey powder coat finishes shall be available as colour options
4. Other powder coat colour options shall be available on request
5. Power supply and electronics shall be integral to each unit.
6. Fixture housing shall provide built in spill control
7. Fixture shall operate directly on the ground or by hanging via yoke
8. The unit shall ship with:

    a. Theatrical-style hanging yoke as standard
    b. 1.8m power Neutrik® PowerCON to bare ends power cable
    c. Available options shall include but not be limited to:
    d. DMX input via XLR5 or RJ45 connector
    e. Light output shall be produce an asymmetrical beam
    f. Lensing shall be designed to provide smooth coverage both horizontally and vertically for seamless blending from fixture to fixture
    g. With a minimum setback from the cyclorama of 60cm, the fixtures shall be able to achieve a 2-to-1 spacing ration and maintain smooth coverage

C. Environmental and Agency Compliance

1. The fixture shall be Ce compliant and UL/ cUL Listed, and shall be so labelled when delivered to the job site.
2. The fixture shall be rated for IP20 dry location use.

D. Thermal

1. The fixture shall be natural convection cooled and shall not use a fan
2. The fixture shall utilise advanced thermal management systems to maintain LED life to an average of 70% intensity after 50,000 hours of use
3. Thermal management shall include multiple temperature sensors within the housing to include:

4. The LED array
5. The control board
6. The fixture shall operate in an ambient temperature range of 0°C minimum to 40° C maximum.

E. Electrical

1. The fixture shall be equipped with an 100V to 240V 50/60 Hz internal power supply
2. The fixture shall support power in and thru operation
3. Power in shall be via Neutrik® PowerCON input connector
4. Power thru shall be via Neutrik ® PowerCON output connector
5. Fixture power wiring and accessory power cables shall be rated to support linking of multiple fixtures up to the capacity of a 15A breaker
6. The fixture requires power from non-dim source
7. Power supply shall have power factor correction

F. LED Emitters

1. The fixture shall contain 5 different LED colours to provide colour characteristics as described in Section H below.
2. All LEDs used in the fixture shall be high brightness and proven quality from established and reputable LED manufacturers.
3. Fixture shall utilize Luxeon® C LED emitters
4. Manufacturer of LED emitters shall utilise an advanced production LED binning process to maintain colour consistency.
5. LED emitters should be rated for nominal 50,000 hour LED life to 70% intensity
6. LED system shall comply with all relevant patents
7. Fixtures shall have a flicker free mode that will set the LED refresh rate to 25,000 Hz for flicker-free operation on camera

G. Calibration

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

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

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

H. Color

1. The fixture shall utilise a minimum of 42 LED emitters
2. These emitters shall be made up of Red, Green, Blue, Indigo and Lime

I. Dimming

1. The LED system shall use 15-bit non-linear scaling techniques for high-resolution dimming.
2. The dimming curve shall be optimised for smooth dimming over longer timed fades.
3. The LED system shall be digitally driven using high-speed pulse width modulation (PWM)
4. LED control shall be compatible with broadcast equipment in the following ways:

a. PWM control of LED levels shall be imperceptible to video cameras and related equipment
b. PWM rates shall be adjustable by the user via RDM to avoid any visible interference to video cameras and related equipment

J. Control and User Interface

1. The fixture shall be USITT DMX512-A compatible via In and Thru 5-pin XLR connectors or RJ45 connectors
2. The fixture shall be compatible with the ANSI RDM E1.20 standard
3. All fixture functions shall accessible via RDM protocol for modification from suitably equipped control console
4. Temperature sensors within the luminaire shall be viewable in real time via RDM
5. Fixtures not offering RDM compatibility, feature set access or temperature monitoring via RDM shall not be compatible
6. The fixture shall be equipped with a 7-segment display for easy-to-read status and control
7. The fixture shall be equipped with a three-button user-interface
8. The fixture shall offer multiple control modes including but not limited to:

   a. RGB
   b. 5 channel (IRGBS)
   c. Direct
   d. Single channel

9. The fixture shall operate in Regulated mode for droop compensation
10. The fixture shall offer stand-alone functionality eliminating the need for a console
11. Fixture shall ship with 12 preset colours accessible as a stand-alone feature
12. Fixture shall ship with 5 Sequences accessible as a stand-alone feature
13. Each preset can be modified by the end user
14. Fixtures can be linked together with standard DMX cables and controlled from a designated master fixture
15. Up to 32 fixtures may be linked
16. Fixtures in a stand-alone state shall restore to the settings present prior to power cycling, eliminating the need for reprogramming
17. Fixtures without stand-alone operation features described in a, b, c, d, and e shall not be acceptable.

PART 3 - EXECUTION

3.1 INSTALLATION

A. It shall be the responsibility of the electrical contractor to receive and store the necessary materials and equipment for installation of the dimmer system. It is the intent of these specifications and plans to include everything required for proper and complete installation and operation of the dimming system, even though every item may not be specifically mentioned. The contractor shall deliver on a timely basis to other trades any equipment that must be installed during construction.

B. The electrical contractor shall be responsible for field measurements and coordinating physical size of all equipment with the architectural requirements of the spaces into which they are to be installed.

C. The electrical contractor shall be responsible for removal and disposal of all waste materials created by this installation process including but not limited to:

1. Shipping and packaging materials.
2. Items removed from existing system.

D. The electrical contractor shall be responsible for all lifts, ladders, scaffolding and/or other devices required for the complete installation of this system.

E. The electrical contractor shall be responsible for all painting and patching that may be required as a product of this installation process.

F. The electrical contractor shall run all conduit so that it is concealed above hung ceiling, below floors or in walls whenever possible. Any exposed conduit shall be run in an aesthetically pleasing manner and painted to match existing conditions.

G. The electrical contractor shall install all lighting control and dimming equipment in accordance with manufacturer's approved shop drawings. All minimum spacing requirements between 120/208v and various low voltage wire types must be maintained. All installation must be in accordance with national, state and local codes.

H. The electrical contractor shall be responsible for resolving all union disputes and jurisdictional issues.

I. All branch load circuits shall be live tested before connecting the loads to the dimmer system load terminals. Each circuit shall require separate neutrals.

J. It shall be the responsibility of the electrical contractor to provide all bonding, job permits and related fees as applicable.

K. The electrical contractor shall provide a copy of their license to operate as an electrical contractor in the state of Maryland. The electrical contractor shall also submit an insurance certificate for this project.

L. The electrical contractor shall be responsible for coordinating the installation and configuration of this system with the theatrical systems integrator.

M. All work shall be performed in accordance with OSHA and local codes.

N. Any on site welding shall only be performed per current AWS D1.1 standards and with advanced approval from the architect or owner's representative.

3.2 SYSTEM ENERGIZATION AND END USER TRAINING

A. Upon completion of the installation, including testing of load circuits, the contractor shall notify the TSI'S project manager that the system is available for formal checkout by the dimming system manufacturer.

B. Notification shall be provided in writing by the purchaser of the system 21 days prior to the time factory-trained personnel are needed on the job site.

C. No power is to be applied to the dimming system unless specifically authorized by written instructions from the TSI'S project manager.

D. The purchaser shall be liable for any return visits by the factory engineer as a result of incomplete or incorrect wiring.

E. Upon completion of the formal check-out, the factory engineer shall demonstrate operation and maintenance of the system to the owner's representatives. Training session shall not exceed four working hours. This session shall not exceed 4 hours. Videotaping of this training session by the owner shall be allowed.

F. For venues with motorized rigging, a separate training session will be provided and the training session shall not exceed eight working hours.

G. A second training session shall be provided six months after the first training session. Training session shall not exceed four working hours. Additional training shall be available upon request. Scheduling for training sessions shall be made in writing, 21 days prior to the time factory-trained personnel are needed on the job site.

3.3 RIGGING INSTALLATION

A. Installation of this equipment shall only be performed by ETCP approved theatrical rigging installers. Where necessary, the installer may make adjustments to accommodate unforeseen impediments to installation. The completed work must achieve all electrical, safety and appearance requirements as established in these specifications.

B. Work shall be performed in accordance with OSHA and local codes.

C. On site welding shall only be performed per AWS D1.1 standards and with advanced approval from the architect or owner's representative.

D. Division of responsibilities

1. The TSI shall be responsible for providing and installing:
2. Loft blocks, where applicable.
3. Wire rope lift lines and terminations
4. On electrics line sets: cable management system for distribution outlet/raceways, including low-voltage, ground and data wiring
5. On electrics line sets: factory prewired electrical termination boxes that are part of the cable management system.
6. On electrics line sets: factory prewired distribution outlet/raceway mounted at the bottom of the wire rope on the stage electrics sets
7. Pipe batten attached to racas or hanger brackets
8. Batten end caps
9. Batten labels

E. The electrical contractor shall be responsible for providing and installing:

1. All pipe, wiring and termination providing line voltage to all the power and control distribution boxes
2. All pipe and wiring connecting data lines between the first power and control distribution box and the control station
3. Back boxes for all power and control distribution boxes, the control stations
4. All pipe and wiring and all terminations of line voltage of dimmed and non-dimmed circuits that terminate at the termination boxes.

F. The general contractor shall be responsible for providing and installing:

1. All required supplemental steel and Unistrut bridging required.
2. any required blocking for wall-mount torm positions, if applicable.
3. Any required cutting/patching/painting/retreatment of surfaces or structure required.

3.4 RECORD DRAWINGS AND DATA

A. Record Drawings

1. The TSI shall submit a set of Record Drawings to the owner for final acceptance. These drawings shall be fully revised and reflect the actual finished installation. The drawing set shall be 100% complete and shall include all schematics, details and Bill of Materials for future maintenance and repair of all systems supplied by the TSI. This drawing set is to be submitted in Adobe PDF Format.
2. Each drawing shall be dated and stamped as a Record Drawing.
3. Prints shall be full sized, stapled into sets. They shall be fully legible.
4. Any future revisions or modifications during the warranty period shall require that the owner's Record Drawings be updated also.
5. Theatrical systems integrator shall provide a repertory lighting plot for the purpose of hanging and focusing theatrical lighting fixtures prior to project completion.
6. The contractor or their representative, fully knowledgeable and qualified in lighting systems operation, shall provide, per school, (2) sessions instruction to the owner-designated personnel on the use and operation of this system. Sessions shall be 4-hours long, as described in designated instruction times shall be arranged through the engineer or owners rep.

B. Manuals

1. Manuals shall be provided on archive quality digital media such as a data CD or a portable USB flash storage device. The TSI shall also retain copies of all media for any eventual replacement, should the need arise.
2. The TSI shall provide a digital set of Instructions and Maintenance manuals to the Owner in Adobe PDF Format. The manuals shall consist of, but not be limited to:

    a. Entire System Description
    b. User Operating Instructions
    c. User Maintenance Instructions
    d. Catalogue Cut Sheets from all equipment purchased
    e. Spare Parts Listing
    f. 11" x 17" reduced drawings of all system assemble drawings needed to perform system maintenance.

3.5 WARRANTY

A. Manufacturers shall warrant products under normal use and service to be free from defects in materials and workmanship for a period of two years from date of delivery.

B. Warranty shall cover repair or replacement of such parts determined defective upon inspection.

C. Warranty does not cover any product or part of a product subject to accident, negligence, alteration, abuse or misuse. Warranty does not cover any accessories or parts not supplied by the manufacturer.

D. Warranty shall not cover any labor expended or materials used to repair any equipment without manufacturer's prior written authorization.

E. Installation shall be warranted by the installing contractor as required by the project specifications.

F. Warranties shall be in effect on from the date of system commissioning.

END OF SECTION