



**SPECIAL PROVISIONS
FOR
ARCH AESTHETIC COLOR CHANGING LIGHTING CONTROL**

**Scott County
IM-NHS-074-1(198)5--03-82**

**Effective Date
April 25, 2017**

THE STANDARD SPECIFICATIONS, SERIES 2015, ARE AMENDED BY THE FOLLOWING MODIFICATIONS AND ADDITIONS. THESE ARE SPECIAL PROVISIONS AND THEY SHALL PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.

150198.01 DESCRIPTION.

Furnish all work, apparatus, and materials according to the applicable portions of Section 2523 of the Standard Specifications, unless as modified herein.

150198.02 GENERAL.

- A.** Install lighting materials that meet the requirements of Division 41, except as modified here.
- B.** The work in this section includes furnishing the following elements and associated accessories to supply a complete and working lighting control system as per the drawings and specifications for the I-74 Bridge project including but not limited to:
 - Lighting control equipment
 - Lighting control hardware
 - Lighting control software
 - Lighting control system programming
 - Lighting networks interfaces
 - Control equipment enclosures.
- C.** The system shall be designed for the control of architectural lighting and shall consist of factory pre-wired control and processing rack enclosures containing electronic controls, relays, power supplies, terminals and control electronics.
- D.** System shall work in conjunction with all specified low-voltage control stations.
- E.** The system shall provide control signal from a central control processor to substation signal distribution points.
- F.** Substation distribution equipment shall provide control signal to fixture power and data supplies as required to fully and individually control all color-changing architectural fixtures.

- G. The control components shall be capable of utilizing the bridge fiber-optic network infrastructure.
- H. Control processor must be accessible from the location of the Bettendorf City Hall. Control must be coordinated for remote access to lighting system processor.
- I. System must be capable of scheduled events and sequences based on a standard calendar and astronomical time clock.
- J. Provide an override control for scheduled calendar events.
- K. Provide control input for live control and real time snapshots.
- L. All control equipment shall be installed in standard wall mounted steel equipment racks with locking doors.
- M. Equipment racks containing network equipment must provide appropriate network cable management and patching equipment as well as uninterruptable power supplies appropriately sized for the associated loads as a standard.
- N. Components of the Lighting System manufactured, supplied and installed shall comply with the requirements of NFPA 70, NFPA 101, all local codes and the requirements of OSHA.

150198.03 LIGHTING CONTROL SYSTEM INTEGRATOR.

- A. The provider of the system herein described shall be acknowledged in business as a Lighting Control Systems Integration Company, hereafter referred to as LCSi. 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 LCSi in this project shall be:
 - 1. To provide all equipment listed in this section to the Contractor for installation.
 - 2. To furnish a complete working system to the Contractor, meeting the intent of this specification.
 - 3. To coordinate delivery schedules and installation of equipment with the Contractor.
 - 4. To be responsible for all documentation for equipment in this section, system record drawings, final testing of the system and training of the City of Bettendorf's personnel as required by this specification.
 - 5. To conduct a wireless signal site survey.
 - a. The purpose of the wireless signal survey shall be:
 - 1) To determine the presence of other wireless signal operating in the 2.4 GHz spectrum
 - 2) To determine which signals from other wireless devices can and should be avoided
 - 3) To determine appropriate antenna types, antenna mounting locations, antenna mounting hardware and antenna connection hardware required for optimal wireless system performance
 - 4) To select the features that provide the best fidelity and lowest impact to other 2.4Ghz wireless systems in the environment
 - b. The wireless signal survey shall be conducted as follows:
 - 1) Set-up and perform a spectrum analysis of the environment, concentrating on the likely positions of wireless receivers and transmitters planned for the system
 - 2) Perform the survey at different times of the day to understand how the wireless activity may vary.

6. To provide onsite programming of the lighting control system with 40 static and ten kinetic lighting events as outlined in Section Color Changing Lighting Narratives below.
 7. To provide programming of the appearance and content of the lighting control system custom user interface.
 8. To provide programming of the lighting control system for remote user access.
- B. Description.** The LCS I shall have experience in the operation and installation of similar equipment associated with the construction and/or renovation of facilities similar in scope to this project. Additionally, the LCS I shall:
1. Have been in business for a minimum of 20 consecutive years and shall have no history of bankruptcy.
 2. 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. Lighting Control equipment
 - b. Lighting power and data distribution equipment
 3. Have on staff at least two full-time manufacturer-certified field service technicians and have technical support and assistance accessible 24 hours a day, 7 days a week.
 4. Offer a Maintenance and Service Contract.
 5. Provide a 1 year system warranty for the complete system, not including expendable supplies, effective from the date of system acceptance. Within this warranty period, the LCS I shall be responsible as the City of Bettendorf's sole contact for the remedy, repair, or replacement of system deficiencies (through the manufacturer's warranty where applicable).
 6. Designate a dedicated Project Manager. The LCS I's Project Manager shall be the main contact between the Systems Integrator, Manufacturers, Architects, Lighting Designers, Engineers and Contractors from contract award until final sign off. The LCS I's Project Manager shall be the same person throughout the entire course of the project, unless otherwise approved by the owner. The LCS I'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:
 - a. Introduce the Project Team Members.
 - b. Review the Project Schedule.
 - c. Review the Scope of Work and any additional materials and documents not in the Scope of Work.
 - d. Layout the creative intent of the project.
- C. Approved Lighting Control Systems Integration Companies shall be the following, or approved equal:**
1. Barbizon Electric.
456 West 55th Street
New York, NY 10019
(212) 586-1620
 2. Gopher Stage Lighting
4141 Cedar Ave S
Minneapolis, MN 55407
(612) 871-0138

3. Candela Controls Inc.
751 Business Park Blvd #101
Winter Garden, FL 34787
(407) 654-2420

150198.04 QUALITY ASSURANCE.

Entities manufacturing lighting equipment, and components specified herein, and as shown on the plans, shall have:

- A. A minimum of 10 years of manufacturing experience and shall demonstrate prior experience on at least two projects involving complexities similar to those required under this contract.
- B. Lighting Equipment for which there is a nationally recognized standard shall be safety tested and bear the conformance labeling of the third party inspection authority, such as Underwriters Laboratories Inc. (UL), ETL, Factory Mutual or approved equal, certifying that the lighting fixtures and equipment are listed as suitable for the purpose specified and shown on the Contract Drawings.
- C. Proposed equipment shall be UL and C-UL listed, and/or CE marked (where applicable) and bear the appropriate labels.

150198.05 DELIVERY, STORAGE AND HANDLING.

- A. Lighting control equipment shall be wrapped for protection during delivery, storage, and handling.
- B. Wet or damp wrapping shall be removed, disposed of, and replaced with dry wrapping materials to prevent staining finish.
- C. Deliver materials in manufacturer's original, unopened, protective packaging. Store materials in original packaging in a manner to prevent soiling and physical damage, prior to installation.
- D. Handle in a manner to prevent damage to finished surfaces. Where possible, maintain protective covering until installation is complete and remove such coverings as part of final cleanup.

150198.06 SPARE PARTS.

Unless otherwise noted on the contract documents, provide 10% (or minimum of two) shelf stock for each type of switch, wireless transmitter, receiver and antenna installed.

150198.07 SUBMITTALS.

- A. Requirements for Approval: Lighting Control 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.
 1. A listing of three equivalent installations including:
 - a. Name, address, and current telephone number of Owner
 - b. Name, address, and current telephone number of Architect, Engineer or lighting consultant associated with the installation.
 - c. Scope of work of the installation including relevant sub-contractors and all lighting equipment manufacturers.
 - d. A brief written description of the LCS's operation, including facilities, departments and key personnel.
 - e. Biographical information of the Project Manager and integration team members who will be assigned to this project should the contractor be successful.
 - f. A full and complete financial statement sufficient to determine financial viability.
 - g. A list of all sub-contractors who the LCS proposes to use including their qualifications to

perform the work.

2. Manufacturer shall provide five sets of full system submittals. Submittals shall be 11 inch by 17 inch and include:
 - a. Full system riser diagram(s) illustrating interconnection of system components, how the system attaches to structure, and any special installation considerations.
 - b. Full set of printed technical data sheets.
 - c. Detailed set of drawings, including a complete list of all deviations from specifications.
3. Manufacturer shall provide any additional information, including equipment demonstration, as required by the Engineer to verify compliance with specifications.

B. Shop Drawings.

1. For Control System Equipment.

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 Lighting Consultant or Engineer before fabrication, installation, or erection has begun. Such approval does not relieve the LCS I of the responsibility of providing equipment in accordance with the specifications. Any deviations from the specifications shall be "starred" and noted in 3/8 inch high letters. Only deviations that are equal or upgrade the quality of the equipment or respond to field conditions will be considered.

2. Lighting Management System.

Submit schematic wiring diagrams, component specifications, enclosure dimensions, installation details, operation manual, and approvals of respective standards. Control system components: Submit schematic diagrams, component specifications, enclosure dimensions, installation details, and approvals of respective standards.

C. 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.

D. Samples.

The Lighting Control Systems Integrator shall submit samples without causing delay in work, as required. For items indicated on the plans submit working samples for review and approval upon request by the Engineer. Install and energize samples as shown on the Contract Drawings or as directed by the Engineer.

E. Mock-up.

If requested on the plans, provide mock-up installation for review and approval by the Engineer. The mock-up shall simulate specified lighting system conditions as shown on the plans. For each substitution item which is not specified on the plans provide mock-up installation at no cost to the Authority if requested, and as directed by the Engineer.

F. Programming Documents.

Written description and color pictorials outlining the 40 static and ten kinetic looks as described in the Lighting Narratives (see section Color Changing Lighting Narratives). Color combinations and events to be celebrated to be determined by owner following award of contract.

G. Manuals.

At time of hand over LCS I shall provide owner with five sets of drawings describing the system installed and copies of the instruction manual to operate the customized interface.

H. Training.

The LCSl shall coordinate and schedule up to 3 days of training for a maximum of 8 hours per day with the necessary operations and maintenance personnel.

150198.08 MANUFACTURERS.

All components for the complete color changing lighting control system shall be provided by one of the following companies:

- A.** Basis of Design: ETC, Inc. 3031 Pleasant View Rd, PO Box 620979, Middleton WI 53562-0979, 800-688-4116.
- B.** Approved Equal: Traxon Technologies, 200 Ballardvale Street, Wilmington, MA 01887, 978-570-3000.
- C.** Approved Equal: Pharos Architectural Controls Limited International House, 7 High Street, London W5 5DB, USA Contact: 888-374-2767 (Option 1), thomas_ladd@pharoscontrols.com

150198.09 MATERIALS.

- A.** Lighting Control Processor. The Lighting Control Processor shall be the Unison Mosaic Show Controller 2 and Rack Mount Kit (MSC2 + MSC-RACK-2) as manufactured by ETC, Inc. or approved equal. The Controller shall be a microprocessor-based system specifically designed for control of lighting and other related systems in an architectural or entertainment application. A personal computer running emulation software shall not be acceptable.

1. General

- a.** The Controller shall store show data in non-volatile solid-state memory. This memory shall be removable for purposes of backup or disaster-recovery.
- b.** Show data may be downloaded from a remote personal computer over an Ethernet or USB connection.
- c.** The Operating Software of the Controller shall be stored in a dedicated non-removable non-volatile solid-state memory. It shall be possible to update the Operating Software by download from a remote personal computer over an Ethernet or USB connection.
- d.** The Controller shall commence show playback automatically on receiving power without additional external inputs.
- e.** The Controller shall have an internal real-time clock that continues to operate when external power is absent. It shall be capable of adjusting for Daylight Saving Time automatically and can be updated over the Internet using the Network Time Protocol (NTP).
- f.** The Controller shall be able to calculate sunrise and sunset times based on longitude and latitude information, and use these as triggers for events.
- g.** The Controller shall have a capacity of 1024 channels of DMX512 with RDM.
- h.** The Controller shall output control data as ETCNet3, Philips KiNet, Pathway XDMX and Art-Net II protocols with one protocol active per output, in lieu of DMX512 output.
- i.** There shall be visual indicators on the Controller showing status of the controller and its interfaces.
- j.** The Controller shall operate a web server on its Ethernet interface. This shall allow status information, control and configuration options to be accessed remotely.
- k.** The appearance and content of the web interface is customizable.
- l.** The Controller shall allow lighting to be programmed as separate zones, with independent triggering and manual intensity control.
- m.** The Controller shall support multiple timelines, crossfades and effects running concurrently.
- n.** The Controller shall support playback of video media with individual pixels mapped to lighting fixtures in an array.
- o.** The Controller shall support a full-duplex RS232 Serial Port and eight local contact

closures.

- p. The Controller shall support up to two expansion modules for support of other interfaces or protocols, including DALI, audio and linear timecode.
- q. The Controller shall support multiple remote modules connected via Ethernet for support of additional show control interfaces, such as contact closures, analogue inputs, relay outputs and serial.
- r. The Controller shall support multiple streams of timecode and audio data within a single networked system.
- s. The Controller shall have a recessed switch for resetting the unit without removal of power.
- t. The Controller shall have an internal security feature that will restart the unit in the event of program failure.
- u. Multiple Controllers shall automatically synchronize and share triggers when programmed as part of a single show and linked via Ethernet during playback.
- v. The Controller shall support conditional logic and execute user-defined Lua scripts to support advanced show control operations.
- w. The Controller shall be provided with a 5 year manufacturer warranty.

2. Mechanical.

- a. Enclosure and mounting shall comply with DIN43880 and EN60715(35/7.5) respectively.
- b. The controller shall be an eight unit DIN enclosure (143.5mm by 90.0mm by 58.0mm).
- c. The controller shall be entirely solid-state with no moving parts, fans or hard disc drives
- d. Controller shall be mounting in Rack Mount Kit.
 - 1) One - Rack Mount Tray for one Mosaic Show Controller & one Remote Device.
 - 2) Two - DIN rail mounting strips 20 units wide (power supply not included).
- e. The controller shall operate in a temperature range from 32°F to 122°F.

3. Electrical.

- a. The Controller shall be designed to support the following wire terminations (Camden Electronics CTB9208 5.08mm plug-in rising clamp terminals):
 - 1) 9V to 48V DC Power.
 - 2) Isolated DMX512 Out, RDM-compatible (two).
 - 3) Isolated Digital Inputs (eight, tri-mode: active high, active low or contact closure).
 - 4) Plug-in rising clamp terminals shall be provided for all connections.
- b. In addition there shall be the following standard connectors:
 - 1) RJ45 socket for 10/100Base-TX Ethernet.
 - 2) USB-B Socket for USB 1.1.
 - 3) 9-pin D socket for isolated RS232 serial input/output.
 - 4) 5-pin DIN socket for MIDI In.
 - 5) 5-pin DIN socket for MIDI Out.
 - 6) 25-pin D socket for Expansion Modules.
- c. The Controller shall be able to receive power over Ethernet as an alternative to direct DC power (IEEE 802.3af PoE powered device).

4. Software.

The Controller shall be supported by programming software running on either a PC or Mac platform. Programming features shall include:

- a. Comprehensive architectural and automated fixture library.
- b. Drag and drop placement of fixtures on plan.
- c. Drag and drop patching of fixtures to output addresses.
- d. Import of any media for mapping to fixture arrays.
- e. Timeline-based programming and playback.
- f. Extensive range of editable effect presets.
- g. Drag and drop placement of effect presets and media on timeline.
- h. Variety of triggering options for firing system-wide events.
- i. Each trigger event may be configured to initiate one or more lighting or show control

- action.
 - j. Each trigger event may be configured to test one or more conditions before executing its actions.
 - k. Simulation of individual timelines, and entire project with triggers.
 - l. Live output from software for programming verification purposes.
 - m. Controller and network management tools.
 - n. Export CSV reports for all aspects of programming.
- B.** Lighting control processor Touch Screen Controller shall be Unison Mosaic Tessera Panel Controller and Rack Mounting Kit (MTPC + MTPC-RK) as manufactured by ETC, Inc., or approved equal.
- 1. General.**
 - a. The Controller shall be a microprocessor-based system specifically designed for control of lighting and other related systems in an architectural or entertainment application.
 - b. The Controller shall be supported by control system configuration software running on either a PC or Mac platform. A personal computer running emulation software shall not be acceptable.
 - c. The Controller shall be provided with a 5 year manufacturer warranty.
 - 2. Mechanical.**
 - a. The controller shall have a fully integrated capacitive touchscreen driven by the application running on the microprocessor. A web browser displaying remotely served content shall not be acceptable.
 - b. The capacitive touch screen shall be 4.3 inches with a resolution of 480 by 272 pixels with 24-bit color depth.
 - c. The touchscreen application shall be dedicated to displaying a user interface for the controller. No other processes shall run on the touchscreen.
 - d. The Controller shall have a recessed switch for resetting the unit without removal of power.
 - e. No physical buttons shall be visible or exposed when the Controller is correctly installed.
 - f. There shall be visual indicators on the Controller showing status of the controller and its interfaces.
 - g. The controller shall be entirely solid-state with no moving parts, fans or hard disc drives.
 - h. Mounted in Mosaic Tessera rack mount kit.
 - i. The controller shall operate in a temperature range from 32°F to 122°F.
 - 3. Electrical.**

The Controller shall have the following standard connectors:

 - a. RJ45 socket for 10/100Base-TX Ethernet.
 - b. The Controller shall utilize Power over Ethernet (IEEE 802.3af PoE powered device).
 - c. The Controller shall be ETL/ cETL listed and CE compliant.
 - 4. Functional.**
 - a. The appearance and content of the user interface shall be customizable by the user.
 - b. The user interface shall support portrait or landscape orientation.
 - c. The Controller shall store show data in non-volatile solid-state memory. This memory shall be removable for purposes of backup or disaster-recovery.
 - d. Show data may be downloaded from a remote personal computer over an Ethernet connection.
 - e. The Operating Software of the Controller shall be stored in a dedicated non-removable non-volatile solid-state memory. It shall be possible to update the Operating Software by download from a remote personal computer over an Ethernet connection.
 - f. The Controller shall commence show playback automatically on receiving power without additional external inputs.
 - g. The Controller shall have an internal real-time clock that continues to operate when

external power is absent. It shall be capable of adjusting for Daylight Saving Time automatically and can be updated over the Internet using the Network Time Protocol (NTP).

- h. The Controller shall be able to calculate sunrise and sunset times based on longitude and latitude information, and use these as triggers for events.
 - i. The Controller shall have a capacity of 512 channels of network DMX protocols including streaming ACN (ANSI E 1.31), Philips KiNet, Pathway XDMX and Art-Net II protocols.
 - j. The controller shall be able to output multiple Ethernet DMX protocols simultaneously, up to the output control channel limit.
 - k. The Controller shall operate a web server on its Ethernet interface. This shall allow status information, control and configuration options to be accessed remotely.
 - l. The appearance and content of the web interface may be customized by the user.
 - m. The Controller shall allow lighting to be programmed as separate zones, with independent triggering and manual intensity control.
 - n. The Controller shall support multiple timelines, crossfades and effects running concurrently.
 - o. The Controller shall support playback of video media with individual pixels mapped to lighting fixtures in an array.
 - p. The Controller shall support an ambient light sensor to automatically adjust the touchscreen backlight level.
 - q. The controller shall support a proximity sensor to automatically wake up the screen.
 - r. The Controller shall support a learning IR receiver.
 - s. The Controller shall be capable of providing show feedback via the user interface.
 - t. The Controller shall support multiple remote modules connected via Ethernet for support of additional show control interfaces, such as contact closures, analog inputs, relay outputs, serial audio input, linear time code, MIDI and DALI.
 - u. The Controller shall support multiple remote button stations connected via Ethernet for use as triggers and user feedback.
 - v. The Controller shall support multiple streams of linear time code and audio data within a single networked system.
 - w. The Controller shall have an internal security feature that will restart the unit in the event of program failure.
 - x. Multiple Controllers shall automatically synchronize and share triggers when programmed as part of a single show and linked via Ethernet during playback. The Controller shall support conditional logic and execute user-defined Lua scripts to support advanced show control operations.
- C. Control system configuration software shall be the Unison Mosaic Designer 2 software as provided by Electronic Theatre Controls, Inc., or equal.

1. Definitions.

- a. A System is the configuration of one or more Mosaic Show Controllers.
- b. A Fixture is a controllable entity with one or more Attributes.
- c. An Attribute is a parameter of control such as Intensity, Pan or Gobo select.
- d. A Group is a selection of Fixtures that can be stored and recalled.
- e. A Trigger is a single point of control to the System (e.g. contact closure, serial command, timed event, etc).
- f. Actions are items of functionality that can occur within a running Mosaic system in response to events (e.g. Start Timeline, Pause Timeline, Set Intensity, etc).
- g. A Timeline is a series of connected steps referencing control with timing information.
- h. Effects are Attribute settings that result in continually varying levels following a specified curve and using additional timing parameters (e.g. period, offset).

2. System Configuration.

- a. The application interface shall be based around (i) a tree-view; (ii) a workspace area; (iii) item selector.

- b. There shall be a two-dimensional plan view that displays the layout of the project.
 - c. It shall be possible to represent data about the workspace area graphically (plan) or in tabular form.
 - d. Items displayed on the plan may be arranged using drag-and-drop interaction.
 - e. Plan views shall support zoom.
 - f. Plan views shall support a layout grid with user-defined spacing and color with associated snap-to-grid functionality.
 - g. There shall be an auto-backup feature.
 - h. It shall be possible to add Fixtures by selecting a Fixture Template from the provided library and create custom Fixtures.
 - i. It shall be possible to create a fixture layout based on data imported from a defined documentation format. (e.g. CSV).
 - j. There shall be provision for help functionality to be accessed from within the application.
 - k. It shall be possible to import images as a background image to the plan view.
- 3. Channel Configuration.**
- a. There shall be functionality to patch channels to DMX and/ or Ethernet Protocols including ETCNet3, Philips KiNet Pathway XDMX and ARTNET.
 - b. There shall be support for Channels with split patches (e.g. VL5).
 - c. It shall be possible to swap pan and tilt axes for a moving-light Fixture.
 - d. It shall be possible to invert pan and tilt axes for a moving-light Fixture.
 - e. It shall be possible to specify a minimum and maximum value for an Attribute.
 - f. It shall be possible to specify a default value for an Attribute.
- 4. Design and Simulation.**
- a. There shall be control of LED arrays supporting pixel mapping of static or video media in any Apple® QuickTime® supported file format.
 - b. There shall be control of moving lights (as a type of Fixture).
 - c. There shall be independent control of every Attribute of a channel or fixture.
 - d. Appropriate graphical controls shall be provided for non-intensity Attributes (e.g. color picker).
 - e. It shall be possible to create Groups as a selection shortcut.
 - f. The plan shall show simulation feedback for Channels in a graphical form.
 - g. It shall be possible to simulate control events.
 - h. The simulation may be linked to the actual online System to synchronize playback and inject control events.
- 5. Timelines.**
- a. Timelines may be displayed and modified in linear form.
 - b. Timelines may be set on an individual Attribute basis.
 - c. All timelines may include split timing.
 - d. Timelines shall be applied based on priority.
 - e. It shall be possible for all timelines to include effects.
 - f. The end state of a timeline shall be user configurable.
- 6. Triggers.**
- a. It shall be possible to trigger actions using external trigger or individual events.
 - b. It shall be possible to set conditions for each trigger.
 - c. It shall be possible to specify timed events, including repeat intervals such as daily, weekly etc.
 - d. It shall be possible to specify astronomical timed events.
 - e. Serial input data shall be treated as a trigger and shall be handled as a standard or custom action.
- 7. Actions.**
- a. There shall be a standard Actions for starting, stopping, pausing and resuming timelines.

- b. There shall be standard Actions to set timeline intensity.
- c. There shall be standard Actions to set timeline position.
- d. There shall be standard Actions for setting fixture color.
- e. There shall be standard Actions for working with external triggers connected to Expansion Modules.
- f. It shall be possible to initiate custom scripts as actions.

8. Network.

- a. Shall report online status of Paradigm Processors and Stations.
- b. Shall allow for configuration of network properties (IP) of Mosaic Show Controllers.
- c. Shall allow for upload of configuration data to all or individual Mosaic Show Controllers.
- d. Shall allow for download of configuration data from Mosaic Show Controllers.
- e. Shall allow for download of logging data from Mosaic Show Controllers.
- f. Shall provide for performing firmware upgrades to Mosaic Show Controllers.
- g. Shall allow for discovery of connected Mosaic Show Controllers.
- h. Shall supports an integrated web server for remote connectivity and control of programmed timelines.

9. Reports.

- a. It shall be possible to generate tabular reports and customize their layout and appearance.
- b. It shall be possible to print reports.

10. Resources.

- a. Effect Curves and Fade Profiles shall use a common format and allow custom variants to be generated by the user.
- b. Additional Fixture Templates may be defined by the user (custom Fixtures).

11. Minimum Computer Requirements.

The software shall require the Windows 7,8 or 10 (32/64bit) operating system running on a Windows-compatible computer (1 GHz Intel processor or better) with a minimum of 100 MB of hard drive space and 1 GB RAM, OpenGL graphics acceleration, a monitor capable of displaying at least 1024 x 768 screen resolution, Ethernet or USB port keyboard and mouse.

- D.** Lighting control processor audio input accessory shall be Unison Mosaic Audio/Time Code Remote Device (MRIO-A) and Rack Mount Kit (MSC-Rack 7180A1305) as manufactured by ETC, Inc., or approved equal.

1. General.

- a. The Remote Device shall be a microprocessor-based system specifically designed as an input/output interface for integration with lighting and audio visual controllers in an architectural or entertainment application. A personal computer running emulation software shall not be acceptable.
- b. The Remote Device shall be provided with a 5 year manufacturer warranty.

2. Mechanical.

- a. Enclosure and mounting shall comply with DIN43880 and EN60715 (35/7.5) respectively.
- b. The unit shall be a four unit DIN enclosure (71.5mm by 90.0mm by 58.0mm).
- c. The Remote Device shall have an address wheel to aid simple addressing up to 15 remote devices, with a setting to allow additional addressing based on the serial number of the Remote Device.
- d. The Remote Device shall have a recessed switch for resetting the unit without removal of power.
- e. The unit shall be entirely solid-state with no moving parts, fans nor hard disc drives.
- f. There shall be visual indicators on the Remote Device showing status of the Remote Device and its interfaces.

- g. The unit shall operate in a temperature range from 32°F to 122°F.

3. Electrical.

- a. The Remote Device shall support a balanced stereo line level audio input.
- b. 6-pin stereo balanced line level analog audio input.
- c. Camden Electronics CTB9208 5.08mm plug-in rising clamp terminals.
- d. The Remote Device shall support a MIDI input and a MIDI output interface.
- e. The Remote Device shall support linear time code via either audio channel and transmit the data over Ethernet to controllers. Formats supported shall include 24fps (film), 25fps (EBU), 29.97fps (NTSC) and 30fps (SMPTE).
- f. All plug-in rising clamp terminals shall be provided.
- g. In addition there shall be the following standard connectors:
 - 1) RJ45 socket for 10/100Base-TX Ethernet.
 - 2) 5-pin DIN socket for MIDI In.
 - 3) 5-pin DIN socket for MIDI Out.
 - 4) The Remote Device shall be able to receive power over Ethernet (IEEE 802.3af PoE powered device).
 - 5) The unit shall be CE compliant.
 - 6) The unit shall be ETL/cETL listed.

4. Functional.

- a. The Remote Device shall be configured by a controller over an Ethernet connection.
- b. The Operating Software of the Remote Device shall be stored in a dedicated non-removable non-volatile solid-state memory. It shall be possible to update the Operating Software by download from a remote personal computer over an Ethernet connection.
- c. The Remote Device shall automatically connect to a controller over an Ethernet connection on receiving power without additional external inputs.
- d. The Remote Device shall perform up to 30 band spectrum analysis on each audio input channel and for combined channels. Data shall be transmitted over Ethernet to controllers for use as triggers.
- e. The Remote Device shall perform peak analysis for each audio frequency band and transmit the data over Ethernet to controllers for use as triggers.
- f. The Remote Device shall allow the audio input gain to be adjusted by controllers over Ethernet.
- g. The Remote Device shall support software flywheel, error correction routines and jump support for linear time code.
- h. The Remote Device shall support MIDI time code and transmit the data over Ethernet to controllers.
- i. The Remote Device shall support MIDI input and transmit the data over Ethernet to controllers for use in triggers.
- j. The Remote Device shall support MIDI output and receive the data to be transmitted over Ethernet from controllers.
- k. The Remote Device shall have an internal watchdog feature that will restart the unit in the event of program failure.
- l. The Remote Device and associated controllers shall be supported by programming software running on either a PC or Mac platform. Programming features shall include:
 - 1) Comprehensive architectural and automated fixture library .
 - 2) Drag and drop placement of fixtures on plan.
 - 3) Drag and drop patching of fixtures to output addresses.
 - 4) Import of any media for mapping to fixture arrays.
 - 5) Timeline-based programming and playback.
 - 6) Extensive range of editable effect presets.
 - 7) Drag and drop placement of effect presets and media on timeline.
 - 8) Variety of triggering options for firing system-wide events.
 - 9) Each trigger event may be configured to initiate one or more lighting or show control action.

- 10) Each trigger event may be configured to test one or more conditions before executing its actions.
 - 11) Simulation of individual timelines, and entire project with triggers.
 - 12) Live output from software for programming verification purposes.
 - 13) Controller, Remote Device and network management tools.
 - 14) Export TSV reports for all aspects of programming.
 - 15) Tools for remote management of content and show programming.
- E. Network switch with power over Ethernet (PoE). Provide Managed Ethernet Switches to permit interconnection of node devices, over a conventional 10/100/1000Base-T (twisted pair copper) Ethernet network.
1. **Port Configuration.**
 - a. 28 10/100BASE-T auto-sensing Fast Ethernet switching ports.
 - b. 2 Copper GbE ports.
 - c. 2 optional Fiber GbE via SFP transceivers.
 - d. Auto-negotiation for speed, duplex mode and flow control.
 - e. MDI/MDIX Port mirroring.
 - f. Broadcast storm control.
 2. **Performance.**
 - a. Switch Fabric Capacity 56.0 Gb/s.
 - b. Forwarding Rate 41.67 Mpps.
 - c. Up to 16,000 MAC Addresses.
 3. **Management.**
 - a. Web-based management interface.
 - b. Industry-standard CLI accessible via Telnet or Local Serial Port.
 - c. SNMPv1, SNMPv2c and SNMPv3 supported; four RMON groups supported (history, statistics, alarms, and events).
 - d. TFTP transfers of firmware and configuration files.
 - e. Dual firmware images on-board.
 - f. Multiple configuration file upload/download supported.
 - g. Statistics for error monitoring and performance optimization including port summary tables.
 - h. BootP/DHCP IP address management supported.
 - i. Syslog remote logging capabilities.
 - j. Temperature sensors for environmental monitoring.
 - k. LLDP and LLDP-MED; Switch stacking up to eight units per stacking group.
 4. **Quality of Service.**
 - a. Layer 2 trusted mode (IEEE 802.1p tagging).
 - b. Layer 3 trusted mode (DHCP).
 - c. Four priority queues per port.
 - d. Adjustable Weighted-Round-Robin (WRR).
 - e. Strict queue scheduling.
 5. **Security.**
 - a. IEEE 802.1x based edge authentication.
 - b. Switch access password protection.
 - c. User-definable settings for enabling or disabling Web, SSH, Telnet, SSL management access.
 - d. Port-based MAC address alert and lock-down.
 - e. IP address filtering for management access via Telnet, HTTP, HTTPS/SSL, SSH and SNMP.
 - f. RADIUS and TACACS+ remote authentication for switch management access.

- g. SSLv3 and SSHv2 encryption for switch management traffic.
 - h. Management access filtering via management access profiles.
 - i. DHCP Snooping.
 - 6. **VLAN.**
 - a. VLAN support for tagging and port-based as per IEEE 802.1Q.
 - b. Up to 4096 VLANs supported; Dynamic VLAN with GVRP support; Private VLAN Edge, Protocol VLANs, and Voice VLAN.
 - c. Switching Features.
 - d. Link aggregation with up to eight aggregated links and up to eight member ports per aggregated link (IEEE 802.3ad).
 - e. LACP support (IEEE 802.3ad).
 - 7. **Availability.**

Spanning Tree (IEEE 802.1D) and Rapid Spanning Tree (IEEE 802.1w) with Fast Link Support; Multiple Spanning Trees (IEEE 802.1s).
 - 8. **Layer2 Multicast.**
 - a. Static IP multicast.
 - b. IGMP snooping for IP multicast support.
 - 9. **Chassis.**
 - a. Size fits within 1U.
 - b. Mounting kit included.
 - c. No more than 17.6 pounds.
 - 10. **Peripheral Products.**
 - a. RPS-600.
 - b. Redundant Power Supply.
 - c. EPS-470 Extended Power Supply.
 - d. Fiber Add-On Kit to include Fiber transceiver card (short haul) for switch Fiber patch point Fiber patch cable.
- F. Net3 Project PC - 2U Computer for Desktop or Rack mount. Use to include:
 - Two - Display port connectors with DVI adapters.
 - Two - Network Interface Ports.
 - One - RS232 Serial Port.
 - Four - USB 2.0 ports.
 - One - Mouse.
 - One - Rack mount kit.
 - Windows7 Operating system or operating system compatible with lighting control configuration software at time of installation.
- G. UPS 1500VA/1340W rack mount UPS with 6 - NEMA 5-15R outputs –USB.
- H. Patch Panel 24 - 2U 19 inch rack-mount patch panel with 24 open slots. Cat5e Modular Jack for above Patch Panel.
- I. 2 foot CAT5 (or better) Patch cable, black.
- J. 15 inch SVGA LCD Flat screen Display in popup drawer.
- K. 1U Rack mount computer keyboard with touchpad.
- L. Lighting Control System Enclosure by ETC (RACK-DOOR+MAP BR2). Black 19 inch rack sized

as job requires and to include: rack, custom door, 2U brush grommet panels, quad power box, blank panels as required. The control enclosure shall be manufactured and sized to fit all control equipment by ETC, Inc., or equal.

1. Mechanical.

- a. The enclosure shall be constructed of 18 gauge formed steel panels with a hinged, lockable full-height door containing an integral electrostatic air filter.
- b. The enclosure door shall have an opening to allow limited access to the control module face panel and openings to view indicators on option modules.
- c. Enclosures shall be convection cooled without the use of fans.
- d. Enclosure shall be sized to accept:
 - 1) Lighting Control Processor.
 - 2) Touch Screen Controller.
 - 3) Lighting control processor audio input accessory (MRIO-A).
 - 4) Network switch with power over Ethernet.
 - 5) Net3 Project PC - 2U Computer.
 - 6) APC SMART UPS - APC Smart-UPS 1500VA/1340W rack mount.
 - 7) Patch Panel 24 - 2U 19 inch rack-mount patch panel with 24 open slots.
 - 8) Recortec RMM275 – 15 inch SVGA LCD Flat screen Display in popup drawer.
 - 9) MAP RM-KB - 1U Rack mount computer keyboard with touchpad.
 - 10) MAP BR2 - 2U Brush Grommet Panel.
- e. All enclosure components shall be properly treated and finished. Exterior surfaces shall be finished in fine textured, scratch resistant, powder based epoxy paint.
- f. Enclosure shall have an independent suspension kit, with a full height, locking door/cover attached to the kit.
- g. Top, bottom, and side knockouts shall facilitate conduit entry.
- h. Enclosures shall be designed to allow easy insertion and removal of all control and option modules without the use of tools.
- i. Supports shall be provided for precise alignment of modules into power and signal connector blocks.
- j. With modules removed, enclosures shall provide clear front access to all power and control wire terminations.

2. Electrical.

- a. Lighting Control enclosure shall be available in 100, 120, 230 and 240 volt, single-phase configurations.
- b. Lighting Control enclosure shall be completely pre-wired by the manufacturer.
- c. The contractor shall provide input and control wiring.
- d. Lighting Control enclosures shall be designed to support the following AC (single phase) wire terminations:
 - 1) 24Vdc (two- No. 16AWG Wire).
 - 2) DMX512A Port A (In or Out) (Belden 9729 or equivalent).
 - 3) DMX512A Port B (In or Out) (Belden 9729 or equivalent).
 - 4) RS232 Serial In/Out (Belden 9729 or equivalent).
 - 5) Unshielded Twisted Pair (UTP) Category 5 Ethernet.
 - 6) Contact Closure In (No. 14 AWG to No. 26 AWG Wire).
 - 7) Contact Closure Out (No. 14 AWG to No. 26 AWG Wire).
 - 8) Contact Closure Out shall provide 1A @ 30vDC.
 - 9) All control wire connections shall be terminated via factory provided connectors.

3. Thermal.

- a. Ambient room temperature: 32°F to 104°F.
- b. Ambient humidity: 10% to 90% non-condensing.

- M. Wireless DMX transmitter shall be ShoW DMX Vero Net DMX transceiver (CTI part # 7400-5708) with antenna (CTI part # 5632, 5633, 5634 or 5636, type TBD, based upon results of signal

survey conducted by LCSl) as manufactured by City Theatrical, Inc.

1. Manufacturer to provide pre-installation DMX wireless site survey to confirm product specifications and locations.
2. **Wireless DMX Features.**
 - a. SHoW DMX Neo Mode.
 - b. DMX Synchronized Hopping.
 - c. Ultra Low Latency.
 - d. User selectable Full or Limited Bandwidth.
 - e. User selectable Full or Limited Burst.
 - f. User selectable Output Power.
 - g. Lost Data Replacement.
 - h. Advanced High Speed RDM functions.
 - i. Supports reduced DMX slot frames for higher refresh rates.
 - j. SHoW DMX Neo Adaptive Mode.
 - k. Adaptive Frequency Hopping.
 - l. Adaptive Modified Full Bandwidth.
 - m. Supports reduced DMX slot frames for higher refresh rates.
3. **RDM Features.**
 - a. Supports any RDM controller or RDM enabled console.
 - b. wireless RDM Proxy and Responder functions.
4. **Electronic / Functional Features.**
 - a. DMX In and Out via 3P Screw Terminal.
 - b. DMX In and Out via 3P Screw Terminal.
 - c. USB Port.
 - d. Ethernet Port via RJ 45 Jack.
 - e. Supports multiple Ethernet show control protocols including sACN, Art-Net, and KiNet.
5. **User Interface.**
 - a. 3 x ROTARY Switches for SHoW ID entry.
 - b. 5P DIP Switch for configuration.
 - c. 100-240 VAC 50/60 Hz 3W Mains Power Input via 3P Screw Terminal.
6. **Construction.**

NEMA 4 / IP 66 Aluminum enclosure.
7. **Compliance.**
 - a. CE Certified.
 - b. IC Certified.
 - c. FCC Certified.
 - d. RoHS Compliant.
 - e. ETL Listed.
8. Dimensions: 7.75 inches W by 8.75 inches H by 4 inches D.
9. Weight: 2.6 pounds.
10. Wireless DMX Directional Antenna (CTI part # 5632, 5633, 5634 or 5636 type TBD, based upon results of signal survey conducted by LCSl).
 - a. Manufacturer to provide pre-installation DMX wireless site survey to confirm antenna specifications and locations.
 - b. The directional antenna shall be a panel or Yagi type antenna capable of transmitting the 2.4 to 2.5Ghz broadcast spectrum. The antenna shall be suitable for outdoor applications

and be provided with mounting hardware for outdoor use. Antenna shall have a peak gain of between 8 and 12 dBi, excluding cable loss. Beam angles shall be between 30 degrees and 60 degrees.

- c. Mounting. Antenna shall be mounted above the ground and away from hard reflective surfaces. Weather resistant hardware and mounting brackets shall be used. A minimum of 9 inches shall be provided between antenna and mounting surfaces. All antennas must be properly grounded to protect against lightning strikes. Antenna cables shall not be excessively bent and shall not be excessively long.
 - d. All antenna polarity markings must be adhered to.
- N.** Wireless DMX receiver shall be ShoW DMX Vero DMX transceiver (CTI Part #: 7400-5707) with antenna (CTI part # 5632, 5633, 5634 or 5636 type TBD, based upon results of signal survey conducted by LCSi) as manufactured by City Theatrical, Inc.
- 1. Manufacturer to provide pre-installation DMX wireless site survey to confirm product specifications and locations.
 - 2. **Wireless DMX Features.**
 - a. SHoW DMX Neo Mode.
 - b. DMX Synchronized Hopping.
 - c. Ultra Low Latency.
 - d. User selectable Full or Limited Bandwidth.
 - e. User selectable Full or Limited Burst.
 - f. User selectable Output Power.
 - g. Lost Data Replacement.
 - h. Advanced High Speed RDM functions.
 - i. Supports reduced DMX slot frames for higher refresh rates.
 - j. SHoW DMX Neo Adaptive Mode.
 - k. Adaptive Frequency Hopping.
 - l. Adaptive Modified Full Bandwidth.
 - 3. **RDM Features.**
 - a. Supports any RDM controller or RDM enabled console.
 - b. Wireless RDM Proxy and Responder functions.
 - 4. **Electronic / Functional Features.**
DMX In and Out via 3P Screw Terminal.
 - 5. **User Interface.**
 - a. 3 x ROTARY Switches for SHoW ID entry.
 - b. 5P DIP Switch for configuration.
 - c. 100-240 VAC 50/60 Hz 3W Mains Power Input via 3P Screw Terminal.
 - 6. **Construction.**
NEMA 4 / IP 66 Aluminum enclosure finished to match mounting surface.
 - 7. **Compliance.**
 - a. CE Certified.
 - b. IC Certified.
 - c. FCC Certified.
 - d. RoHS Compliant.
 - e. ETL Listed.
 - 8. Dimensions: 6 inches W by 6.5 inches H by 4 inches D.
 - 9. Weight: 1.7 pounds.

10. Wireless DMX Directional Antenna (CTI part # 5632, 5633, 5634 or 5636 type TBD, based upon results of signal survey conducted by LCSi).
 - a. Manufacturer to provide pre-installation DMX wireless site survey to confirm antenna specifications and locations.
 - b. The directional antenna shall be a panel or Yagi type antenna capable of transmitting the 2.4 to 2.5Ghz broadcast spectrum. The antenna shall be suitable for outdoor applications and be provided with mounting hardware for outdoor use. Antenna shall have a peak gain of between 8 and 12 dBi, excluding cable loss. Beam angles shall be between 30 degrees and 60 degrees.
 - c. Mounting. Antenna shall be mounted above the ground and away from hard reflective surfaces. Weather resistant hardware and mounting brackets shall be used. A minimum of 9 inches shall be provided between antenna and mounting surfaces. All antennas must be properly grounded to protect against lightning strikes. Antenna cables shall not be excessively bent and shall not be excessively long.
 - d. All antenna polarity markings must be adhered to.

150198.10 COLOR CHANGING LIGHTING NARRATIVES.

- A. The contractor will provide programming/systems integration support for up to 40 static and 10 kinetic lighting "events." These events will be selected by the stakeholders and representatives of the Quad Cities with input and professional assistance from a programmer/systems integrator and a lighting designer. While the final selection of the 50 (total) events will be made by the stakeholders, the following will provide the basis for this work.

1. Static Lighting Looks (40 Total).

- a. All arches are a single, static color.
- b. Each pair of arches is a single, static color for a total of two, static colors.
- c. One half of the two pairs of arches is a single color and the other half of the arches is a different color for a total of two, static colors.
- d. One end of each pair of arches is a single color and the other end of the same pair of arches is a different color, with the colors reversed on the opposite structure, for a total of two, static colors.
- e. Each single arch is a different color, for a total of four, static colors.
- f. The two arches are divided into three parts, with one color on each part (east, center, west), for a total of three, static colors.
- g. Stripes of two alternating colors across the length of all arches.
- h. Stripes of three alternating colors across the length of all arches.

2. Kinetic Lighting Looks (Ten Total).

- a. Allow for two unique, dynamic, kinetic events, perhaps for July 4th and/or New Year's Eve, with the lighting changing color in a multi-step, multi-color, pre-programmed event of the client's choosing or based on music input to the control system.
- b. The arches scroll through a range of colors (related to the season, a cultural or sporting event or just a random scroll), from one end of the arches to the other. The program will occur over the course of 15 minutes from one end of the bridge to the other, then loop through the sequence repeatedly until the lights are turned off for the evening or the program indicates that it is to change to another kinetic or static program.
- c. The colors of the arches separately and randomly change over the course of the evening, with each pair of arches on a different color sequence. Each color change will occur over the course of fifteen minutes and then stay at the selected color for one hour, so it will be barely perceptible to motorists. After going through a preselected sequence of up to six colors, it will loop through the sequence repeatedly until the lights are turned off for the evening or the program indicates that it is to change to another kinetic or static program.
- d. All arches are the same, single color, but that color changes slowly over the course of the evening. Timing of each color change will occur over the course of one hour, so it will be

imperceptible to motorists, though the change will be occurring continuously, without stopping at a particular color. After going through a preselected sequence (for example, all colors in the red-blue range), it will loop through the sequence repeatedly until the lights are turned off for the evening or the program indicates that it is to change to another kinetic or static program.

- B. Renderings of the looks can be made available to the Contractor after the Iowa DOT awards the Contract.

150198.11 EXECUTION.

- A. The LCSi shall create a Custom User Interface that allows for both astronomical time clock and calendar based programming that can be scheduled to run via the astronomical time clock for ten years. The interface will also allow for an interruption in the schedule to override the scheduled look with a different one and then revert automatically back to the calendar schedule the next night. These override selections shall be able to be scheduled in advance or triggered to override the scheduled look happening on the same night.
 1. Each static and kinetic look will have a button which can be used to select it for adding it into the schedule.
 2. Calendar schedule shall show month, day and year.
- B. Upon completion of the installation, including testing of load circuits, the contractor shall notify the LCSi's Project Manager that the system is available for formal checkout by the lighting control system manufacturer.
 1. Notification shall be provided in writing, 21 days prior to the time factory-trained personnel are needed on the job site.
 2. No power is to be applied to the lighting control system unless specifically authorized by written instructions from the LCSi's Project Manager.
 3. The purchaser shall be liable for any return visits by the factory engineer as a result of incomplete or incorrect wiring.
- C. Upon completion of the formal check-out, the LCSi / factory engineer shall demonstrate operation and maintenance of the system to the City of Bettendorf's representatives. Initial training session shall not exceed eight hours per day for up to 2 days.
 1. A second training session shall be provided six months after the first training session. Training session shall not exceed eight working hours.
 2. Additional training shall be available upon request. Additional training shall be paid for as extra work. The additional training shall be approved by the Engineer prior to scheduling.
 3. Scheduling for training sessions shall be made in writing, 21 days prior to the time factory-trained personnel are needed on the job site.
 4. LCSi shall coordinate control signal and hardware requirements with owner for remote user interface of lighting controls system.

150198.12 RECORD DRAWINGS AND MANUALS.

- A. **Record Drawings.**
The LCSi shall submit two sets of full sized as-built to the City of Bettendorf 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 LCSl.

1. Each drawing shall be dated and stamped as a Record Drawing.
2. Prints shall be full sized, stapled into sets. They shall be fully legible.
3. Any future revisions or modifications during the warranty period shall require that the Record Drawings be updated also.

B. Manuals.

1. Manuals shall be bound by the LCSl in loose-leaf binders and labeled with tabbed dividers for easy reference.
2. The LCSl shall provide five sets of Instructions and Maintenance manuals to the City of Bettendorf. The manuals shall consist of, but not be limited to:
 - a. System Description.
 - b. User Operating Instructions.
 - c. User Maintenance Instructions.
 - d. Catalogue Cut Sheets from all equipment purchased.
 - e. Spare Parts Listing.
 - f. 11 inch by 17 inch reduced drawings of all system assemble drawings needed to perform system maintenance.

150198.13 INSTALLATION.

Contractor shall install all lighting control equipment and accessories in the locations shown on the Contract Drawings in accordance with the manufacturer's written instructions. All control system equipment shall be properly secured to structural elements.

- A. Lighting control system equipment shall be carefully supported and aligned with necessary brackets, and supporting members for proper installation, all as shown in the plans and the specifications, and as approved by the Engineer. Lighting control system equipment shall be supported to satisfy seismic requirements described in applicable local codes.
- B. All lighting control system equipment shall be properly wired and connected to branch circuits, tested, and left ready for programming and operation.

150198.14 ADJUSTMENTS.

- A. Prior to final inspection, contractor shall replace all lighting control system equipment and fixtures which have failed and contact LCSl for readdressing.
- B. Contractor shall leave all lighting fixtures, control system equipment, and accessories in good, uniform operating condition.
- C. The Contractor shall replace any failed lighting control system equipment and fixtures during the first 100 days after the completion of the Contract.
- D. **Cleaning.**
 1. Contractor shall clean all components of the lighting system to remove conductive and deleterious materials.

2. Contractor shall remove dirt and debris from all fixtures and lenses.
 3. Contractor shall clean finishes and touch up damage.
- E. The contractor shall notify the US Coast Guard office in St Louis, Missouri (USCG) 2 weeks in advance of activating the decorative lights. The USCG will notify mariners and conduct a test over a 30 day period. If these lights (or certain color combinations of these lights) cause a problem for navigation, they shall be immediately extinguished. The Contractor shall then be responsible to alter the lighting schemes as approved by the Engineer to reduce interference with navigation and gain the USGC's approval.

150198.15 METHOD OF MEASUREMENT.

The Arch Aesthetic Color Changing Lighting Control will not be measured for payment.

150198.16 BASIS OF PAYMENT.

This work will be paid for at the contract lump sum price for Arch Aesthetic Color Changing Lighting Control, which price shall include all material, hardware, storage, and labor required for a complete installation of the Arch Aesthetic Color Changing Lighting Control, as shown on the contract plans and as specified herein. The associated lighting fixtures shall be installed under separate pay items.