



Portage Public Schools, Portage, Michigan is soliciting sealed proposals for:

Project Name: Middle School Theatrical Lighting Systems

RFP ISSUE DATE: March 7, 2018

PROPOSAL DUE: March 21, 2018, 2:00pm

Number of Copies Required: 2 (Two) paper, 1 (One) PDF on flash drive

Facsimile/Email Proposals Will Not Be Accepted

DELIVERY ADDRESS & INSTRUCTIONS

Portage Public Schools
Purchasing Department
8107 Mustang Drive
Portage, MI 49002

Bids will be publicly opened and read at the above address.

Include on the Envelope the Project Name (above). All Envelopes Must Be Sealed.

General questions regarding the submission of this RFP should be directed to:

Amanda Howard, Purchasing Agent, at (269) 323-5181 or ahoward@portageps.org.

***Addendums (if any) will be posted on our website: www.portageps.org under the Bids & Proposals link.**

Questions relative to the Technical Specification may be addressed to:

Steve Van Dyke, Data Center Systems Specialist, at (269) 323-5100 or svandyke@portageps.org

You are invited to submit a proposal for this equipment and or service. Specifications, terms, conditions and instructions for submitting proposals are contained herein. This Request for Proposal with all pages, documents and attachments contained herein, or subsequently added to and made a part hereof, submitted as a fully and properly executed proposal shall constitute the contract between the District and the successful proposer when approved and accepted on behalf of the District by an authorized official or agent of the District.

All proposers shall complete and return the Proposal and Award page(s) and submit all information requested herein in order for a proposal to be responsive. **FAILURE TO DO SO MAY RESULT IN THE PROPOSAL BEING REJECTED AS NON-RESPONSIVE.** The proposal document shall be returned in its entirety, in a properly identified and sealed envelope to the Purchasing Department at the above address. **PROPOSALS MUST BE RECEIVED BY TIME OF THE DUE DATE - LATE PROPOSALS WILL NOT BE CONSIDERED.**

Instructions to Proposers:

1. **EXAMINATION OF PROPOSAL DOCUMENT**-Before submitting a proposal, proposers shall carefully examine the specifications and shall fully inform themselves as to all existing conditions and limitations. The proposer shall indicate in the proposal the sum to cover the cost of all items included on the proposal form.
2. **PREPARATION OF PROPOSAL**-The proposal shall be legibly prepared in ink or typed. The proposal shall be legally signed and the complete address of the proposer given thereon. All proposals shall be tightly sealed and plainly marked SEALED PROPOSAL and identified by project name, bid opening date and time. Proposals opened by mistake, due to improper identification, will be so documented and resealed. The Purchasing Department will maintain and guarantee confidentiality of the contents until the specified opening date and time. Facsimile and/or e-mailed bids will not be accepted.
3. **LATE PROPOSALS**-Any proposal received at the office designated hereinafter the exact time specified for receipt, will not be considered. (Note: The District reserves the right to consider bids that have been determined by the District to be received late due to mishandling by the District, or circumstances beyond the control of the proposer, after receipt of the proposal and before an award has been made.)
4. **ADDITIONAL CHARGES** - No additional charges, other than those listed on the price breakdown sheets, shall be made. Prices quoted will include verification/coordination of order and all costs for shipping and insurance costs.
5. **DISCOUNTS** - List any discounts that may be applicable from programs such as MiDEAL, US Commodities, etc. Note the District will apply for eRate funding where appropriate. Awarded proposers are expected to participate in eRate funding.
6. **FEDERAL OR STATE SALES, EXCISE, OR USE TAXES** - Portage Public School is tax exempt. Do not include Federal, State, or Local taxes in your bid price except as related to enhancements to real property.
7. **ACCEPTANCE OF PROPOSALS** - Portage Public Schools reserves the right to accept or reject any or all bids, either in whole or in part; to award contract to other than low bidder; to waive any irregularities and/or informalities; and in general to make awards in any manner deemed to be in the best interest of Portage Public Schools.

1. RFP Requirements

1.1. Product/Vendor

All equipment provided shall be new and of the latest model version available. All equipment must be genuine. When applicable, bids will only be accepted from authorized retailers. All systems specified must be compatible with ANSI E1.11 USITT DMX512-A, sACN ESTA E1.31 and RDM ESTA/ANSI E.120, and be UL approved when appropriate.

1.2. Order Fulfillment

The district requires the fulfillment of their purchase order within 90 days of issuing a purchase order. Should the awarded vendor be unable to fulfill the order within 90 days the district may, at its discretion, cancel the undelivered balance of the purchase order. It is expected that a single purchase order for the entire purchase will be issued the week of May 7, 2018.

1.3. Freight

The base bid must include all freight charges for delivery of equipment to Portage Public Schools. Delivery will be to a single location.

1.4. Alternate Proposals

Any alternate proposals will be considered. Any equipment included in alternate bids must completely meet the specifications of the requested product. Alternates must be reporting with unit pricing and in the same format as the main part of the RFP.

1.5. RFP Response

All responses must have pricing information submitted on the included forms. Full product literature must be included with your response.

1.6. Bid Pricing

Bid responses, pricing, etc. must be valid for 90 days after the bid response due date and time, or the length of the contract if so applicable and specified. Vendors must include unit pricing should Portage Public Schools wish to add additional units to the order.

1.7. Contract Nullification

Any and all service contracts must include a nullification clause acceptable to Portage Public Schools should Portage Public Schools determine the included services, in whole or in part, are not fulfilling the needs of the District as outlined hereinafter.

1.8. Vendor Qualifications

Vendor must be able to provide or show proof of in this bid:

1.8.1 Must have at least one Electronic Theatre Controls factory certified technician on staff

1.8.2 Must have at least one ETCP Entertainment Electrician on staff

1.8.3 Must have a 24/7/365 emergency line

2. Description of Products/Services Requested

2.1. Theatrical Lighting Control Systems

Portage Schools is seeking equipment for two (2) theatrical lighting control systems as specified in Appendix A and Drawings TL-1 through TL-4. Please provide pricing for one individual system and two systems, if purchased at the same time.

2.2. Low Voltage Terminations Alternate

Portage Schools is requesting an alternate bid for low-voltage terminations to be completed by the vendor for both control systems.

2.3. Architectural Programming Services

Vendor must provide at least one (1) day of architectural systems programming, and ensure programming meets the needs of Portage Schools. A sequence of operation document must be delivered to Portage Schools at least twenty one (21) days prior to system commissioning.

3. Additional RFP Response Requirements

3.1. Proof of Appropriate Local/State/Federal Licenses and Certifications

As a part of your response, you must include copies of all applicable local, state, and/or federal licenses and/or certifications required for the scope of work contained within this RFP.

3.2. Proof of Insurance

As a part of their RFP response, all proposers shall provide proof of insurance for workers compensation, general liability, auto, and excess liability. Should the awarded vendor change insurance coverage companies, plans, or otherwise modify coverage, vendor shall notify PPS of said coverage change 30 days prior to said change taking effect.

3.3. Assumed Liabilities

The awarded vendor shall assume all liability for the following scenarios caused directly or indirectly by their employees or subcontractors:

- Damage to PPS property
- Damage to existing structured cabling or electric service
- Damage to fire alarm, fire control, or fire suppression systems
- Environmental damage, including but not limited to hazardous material spills or airborne contaminants
- Removal of any cabling, conduit, raceways, or other hardware without prior written consent from PPS

3.4. Use of Subcontractors

If a proposer intends to use sub-contractor(s) for any work, they must provide complete information on their subcontractor(s) with their response. This includes copies of the legal status forms, familial, Iran economic sanctions act, and proof of insurance as outlined herein.

BID PROPOSAL FORM

(Pages 6 – 10)

NAME OF BIDDER

Firm Name: _____
Address: _____
Telephone &
Fax: _____
Contact Name
and E-mail: _____

PROJECT NAME

Project Name: 10653 Middle School Theatrical Lighting Systems

AGREEMENTS

The Owner reserves the right to accept or reject any or all Bids in whole or in part, or to waive any informalities therein. If in the Owner's opinion it is in their best interest, the contract may be awarded to other than the lowest bidder, for reasons of establishing uniformity, delivery time, etc.

**The undersigned acknowledges the following are included with the Bid Proposal Form:
(please initial)**

Unit Pricing: _____

Detailed Product Specification Information (where applicable): _____

Warranty Specification Information (where applicable): _____

Legal Status of Bidder: _____

Iran Economic Sanctions Act Statement: _____

Notarized Familial Relationship Disclosure Statement: _____

Two (2) paper copies One (1) PDF of the Proposal: _____

Pricing Summary:

Proposer - you must complete the following.

Theatrical Lighting Systems:

1. Total cost per system: _____
2. Total cost for two (2) systems: _____

Requested Alternate:

Low Voltage Terminations provided by vendor (for two systems): _____

Proposers may attach additional pricing details. In the case of any discrepancies, unit costs as reported here shall prevail.

LEGAL STATUS OF BIDDER

CERTIFICATION REGARDING DEBARMENT, SUSPENSION, AND OTHER RESPONSIBILITY MATTERS. The Vendor and/or Bidder certifies to the best of its knowledge and belief that it and its principals: Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency; Have not within a three-year period preceding this agreement been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State, or local) transaction or contract under a public transaction; violation of federal or state antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property; Are not presently indicted for or otherwise criminally or civilly charged by a government entity (Federal, State, or local) with commission of any of the offences enumerated above in this certification; and Have not within a three-year period preceding this agreement had one or more public transactions (Federal, State, or local) terminated for cause or default; is not now or has been, within a three-year period preceding this date, been listed on the Excluded Parties List System website (EPLS).

Firm Name: _____

Name, title and signature of individual duly authorized to execute contracts:

Name: _____

Title: _____

Signature: _____

A Corporation organized and existing under the laws of the State of _____.

PORTAGE AFFILIATION (If it pertains):

Do you maintain a permanent office, factory, or other facility in Allegan, Barry, Branch, Calhoun, Cass, Kalamazoo, St. Joseph, or Van Buren counties with employees working in any of these counties? If yes, please provide the address:

Have you paid real or personal property taxes relating to said business in the previous tax year?

IRAN ECONOMIC SANCTIONS ACT

Effective April 1, 2013 all bids, proposals, and/or qualification statements received in the State of Michigan (MCL 129.313) must comply with the “Iran Economic Sanctions Act”. The following certification is to be signed and included at the time of submittal.

CERTIFICATION

Pursuant to the Michigan Iran Economic Sanctions Act, 2012 P.A. 517, by submitting a bid, proposal or response, Respondent certifies, under civil penalty for false certification, that it is fully eligible to do so under law and that it is not an “Iran linked business”, as that term is defined in the Act.

Signature

Title

Company

Date

FAMILIAL RELATIONSHIP DISCLOSURE STATEMENT

As required by Public Act 232 of 2005, all bids shall be accompanied by a sworn and notarized statement disclosing any familial relationship that exists between the owner or any employee of the bidder and any employee of the Portage Public School District or member of the Portage Public Schools Board of Education. The Board of Education shall not accept a bid that does not include this sworn and notarized disclosure statement.

The undersigned, the owner or authorized officer of _____ (the "Bidder"), pursuant to the familial disclosure requirement provided in the Portage Public Schools advertisement for construction bids, hereby represent and warrant, except as provided below, that no familial relationships exist between the owner(s) or any employee of the company and any employee of the Portage Public School District or member of the Portage Public Schools Board of Education. If such a relationship exists, please explain:

Attach additional pages if necessary

By: _____ (Bidder Signature)

Title: _____ (type or print)

Date: _____

Subscribed and Sworn to Before Me:

This _____ day of _____, 20____ A.D., in and for the

County of _____, Michigan.

My Commission expires _____.

Signature of Notary

Appendix A - Lighting Controls Specification

Part 1. GENERAL

1.01 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.

1.02 SUBMITTALS

- A. Manufacturer shall provide two (2) hard copy sets and one digital set of full system submittals. Submittals shall include:
 - a. Full system riser diagram(s) illustrating interconnection of system components, wiring requirements, back box sizes and any special installation considerations.
 - b. Full set of printed technical data sheets.
 - c. Detailed set of dimmer schedules
 - d. Detailed set of circuit and control schedules, including a complete list of all deviations from specifications.
- B. Manufacturer shall provide any additional information, including equipment demonstrations, as required by the engineer or specifier to verify compliance with specifications.

1.03 QUALITY ASSURANCE

- A. Manufacturer 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. The manufacturer shall have a factory authorized stocking service center with at least one full time service technician on staff located within 100 miles of the job site. In addition, the manufacturer shall have a toll free 24-hour hotline with a maximum response time of 20 minutes, 24 hours a day and 365 days a year.
- C. All equipment, where applicable standards have been established, shall be built to the standards of Underwriters Laboratories, Inc., the National Electric Code and the United States Institute for Theater Technology. Permanently installed power distribution equipment such as dimmer racks and distribution shall be UL and C-UL Listed, and/or CE marked (where applicable) and bear the appropriate labels. Portable equipment such as consoles and fixtures shall be UL and C-UL Listed, ETL Listed and/or CE marked (where applicable) and bear the appropriate labels.

1.04 ACCEPTABLE MANUFACTURERS

- A. The equipment herein specified shall be manufactured by
Electronic Theatre Controls
PO Box 620979
Middleton, WI 53562
Phone: 608/831-4116
Fax: 608/836-1736
- B. Alternative manufacturers must submit a full pre-approval package fourteen days prior to bid date. Package shall consist of items listed in Part 1, Section 1.02A.
- C. Permission to bid does not imply acceptance of the manufacturer. It is the sole responsibility of the vendor to ensure that any price quotations received and submittals made are for controls systems that meet or exceed the specifications.

1.05 THEATRICAL DEALER

- A. All equipment described herein to be provided by a Theatrical Equipment Dealer with at least ten years of experience supplying equipment on similar projects. Dealer to have a factory certified technician in its employ. Dealer to have a 24-hour emergency service phone line. All emergencies will be responded to within 24 Hours. Dealer to be a member of ESTA.
- B. Other Dealers seeking approval must submit qualifications prior to bid.

Part 2. PRODUCT

2.01 Architectural Control Processor Modules

1. Control Processor Modules
 - a. The Architectural Control Processor shall be the Unison Paradigm Series, P-ACP Control Processor as manufactured by Electronic Theatre Controls, Inc., or equal.
 - b. Mechanical

- i. The Architectural Control Processor (ACP) assembly shall be designed for use in DRd Series Power Enclosures and ERn Series Control Enclosures.
 - ii. The processor shall utilize microprocessor based, solid state technology to provide multi-scene lighting and building control.
 - iii. ACP module electronics shall be contained in a plug-in assembly.
 1. The module shall be housed in a formed steel body and contain no discrete wire connections.
 - a. No tools shall be required for module removal or insertion.
 - iv. The ACP shall be convection cooled.
 - v. User Interface
 1. The ACP shall utilize a backlit liquid crystal display capable of graphics and eight lines of text.
 2. The ACP shall provide an alpha-numeric keypad for data entry and navigation
 3. The ACP shall provide a touch-sensitive control wheel for navigation.
 4. The ACP shall provide shortcut buttons to assist in navigation, selection, and data entry.
 5. The ACP keypad, buttons, and wheel shall be backlit for use in low-light conditions.
 - a. The backlight shall have a user selectable time out, including no time out.
 - vi. The ACP shall provide a front-panel RJ45 receptacle for Ethernet connection to the processor for configuration, live control, and web-browser-based system access.
 1. The RJ-45 receptacle shall be secured behind the locking door.
 - vii. The ACP shall provide a Secure Digital (SD) Removable Media slot on the front panel for transfer of configuration data.
 1. The SD slot shall be secured behind the locking door.
 - viii. The ACP shall provide a Universal Serial Bus (USB) port on the front panel for transfer of configuration data.
 1. The USB port shall be secured behind the locking door.
 - ix. Architectural Lighting System configuration and program information shall be stored in flash memory, which does not require battery backup.
 1. The ACP shall provide a Compact Flash (CF) Card as backup flash memory and storage.
 2. The CF Card is located in the back of the ACP, and can be accessed only by removing the ACP.
 3. The ACP data can be exchanged by inserting the CF card into another ACP.
- c. Electrical
- i. The ACP shall require no discrete wiring connections; all wiring shall be terminated into Dimming or Control Enclosure.
 - ii. The ACP shall require low-voltage power supplied by the Dimming or Control enclosure.
 - iii. The ACP shall be hot-swap capable.
 - iv. The ACP shall support Echelon LonTalk with LinkPower communications with control stations and other remote devices, including button stations, button/fader stations, Touchscreen stations, sensors, and third party LonMARK compliant products.
 1. The LinkPower network shall utilize polarity-independent, low-voltage Class II twisted pair wiring, type Belden 8471 (unshielded) or Belden 8719 (shielded) or equivalent. One # 14 AWG drain wire will be required for system not using grounded metal conduit. Touchscreen stations, interface stations and portable stations connectors will also require (2) #16 AWG wires.
 2. The LinkPower network shall be topology free. Network wiring may be bus, loop, home run, star or any combination of these.
 3. Link power wiring shall permit a total wire run of 1640 ft. (500m) without a repeater. Repeater option modules shall be available to increase wiring maximums in increments of 1640 ft. (500m)
 4. Link power wiring between stations shall not exceed 1313 ft. (400m).
 - v. The ACP shall support 10/100BaseTX, auto MDI/MDIX, 802.3af compliant Ethernet networking using TCP/IP, ESTA BSR E1.17 Advanced Control Networks (ACN) and ESTA BSR E1.31 (sACN) Protocols for internal communication and integration with third-party equipment.
 - vi. The ACP shall support EIA-RS232 serial protocol for bi-directional command and communication with third-party equipment.
 - vii. The ACP shall support two discrete ESTA DMX512A ports, configurable as input or output ports.*
 1. *When used in a Dimming Enclosure, the second port is always an output port.
 - viii. The ACP shall provide four onboard dry contact closure inputs for integration with third-party products.
 - ix. The ACP shall provide four onboard contact closure outputs, rated at 1A@30VDC, for integration with third-party equipment.

- d. Functional
 - i. Capacity
 - 1. Shall support 1024 channels of control
 - 2. Shall support 2 physical DMX ports, each of which may be configured as an input or output
 - ii. System
 - 1. Runtime application shall utilize support Net3 system interoperability
 - 2. System shall support the use of Network Time Protocol for real time clock synchronization
 - 3. System shall support remote firmware upload an over Ethernet connection from a connected PC running the Light Designer software or another connected processor.
 - 4. System shall support local firmware upload from removable media (SD Card, USB Flash Drive)
 - iii. Diagnostics
 - 1. Shall output an Event log
 - 2. Standard log shall store a fixed-length history of recent activity
 - 3. Separate critical log shall only store important messages (such as boot-up settings)
 - iv. Configuration Data
 - 1. Configuration Data can be uploaded over an Ethernet connection from a PC running Light Designer application
 - 2. Configuration Data can be retrieved from another Paradigm Processor
 - 3. A Paradigm Processor shall make its configuration data available for retrieval by another Processor as a backup/recovery mechanism
 - 4. Configuration Data shall be stored on solid-state media that can be removed to facilitate transfer between Processor units
 - 5. Configuration Data may be loaded to and from removable media access provided on front panel
 - 6. Configuration Data for the entire System shall be available for download from any single Processor
 - 7. Shall store configuration data for Dimming enclosure processors and shall make available for download
 - v. Scalability
 - 1. Adding additional Processors to a System shall proportionately increase its overall capabilities up to a maximum project size
 - 2. The maximum number of Processors configured as a project shall be at least 12. The use of a Central Control Processor (P-CCS) shall allow for larger system sizes up to 72 processors
 - 3. Multiple Processors shall utilize the Ethernet network to remain time synchronized and share control information
 - 4. Multiple Processors shall utilize the Ethernet network to maintain configuration data synchronization as modifications are made
 - 5. Failure of a single Processor shall not prohibit continuing operation of the remaining Processors
 - 6. It shall be possible for multiple Systems to coexist on the same physical network with logical isolation between Systems
 - vi. Local User Interface
 - 1. Shall provide access to Processor setup (IP address)
 - 2. Shall provide access to Processor status and diagnostics
 - 3. Where the Processor is installed within a Dimming enclosure, shall provide access to Dimming enclosure setup, status and diagnostics
 - 4. Shall provide control functionality for Control Channels, Zones, Fixtures, Groups, Presets, Macros, Walls and Sequences within the current configuration.
 - 5. Shall provide functionality to schedule astronomical and real time events (add/edit/delete)
 - 6. Shall allow for display of local DMX information
 - 7. Shall allow for transfer of log files to local removable media
 - 8. Shall allow to perform firmware upgrades for connected Dimming enclosures
 - 9. Shall allow for transfer of configuration to and from Dimming enclosures using removable media
 - 10. Shall allow for transfer of configuration to and from LCD Stations using removable media
 - 11. Shall allow for binding of Stations
 - vii. Access Controls
 - 1. There shall be 2 user accounts - Administrator, and User with separate password protection
 - 2. Account and password settings shall be local to each Processor

3. Access Controls shall be applied to certain areas of the Paradigm Local User Interface and Web Interface
- viii. Web User Interface
 1. Shall be an internal web server accessible via Ethernet port
 2. Shall support common web browsers on Windows and Mac platforms
 3. Shall provide functionality to Activate and Deactivate Presets
 4. Shall provide functionality to schedule timed events (add/delete)
 5. Shall display status information
 6. Shall display log files
 7. Shall allow for configuration of Processor settings (date, time)
 8. Shall allow for upload and download of configuration data
 9. There shall be links to other web-enabled devices in the System, including other Paradigm Processors
- ix. Stations
 1. Stations shall be connected to a Paradigm Processor via a LinkPower network or Ethernet
 2. Station discovery and binding shall be accomplished from the Local User Interface or Light Designer
- x. Net3 and ACN Devices
 1. Paradigm Processors shall provide DMX-Net3 gateway functionality
 2. Net3 devices shall be connected to and controlled from the Processor via Ethernet
 3. It shall be possible to send and receive Macro triggers defined within the System configuration via Net3opto
 4. There shall be support for a maximum of 1024 Streaming ACN outputs configured to a maximum of 12 universes per Processor
- xi. Operation
 1. When contained in a dimming enclosure, a snapshot of the dimming enclosure output data shall be stored in persistent memory so that hardware can access it for immediate output on boot
 2. DMX output refresh rate shall be configurable
 3. There shall be support for 16-bit DMX Attributes
 4. DMX inputs may be patched to DMX and Streaming ACN outputs as external sources
 5. Streaming ACN inputs shall be patched to DMX outputs (gateway) as external sources
 6. Where there are multiple external sources then priority and HTP shall be used to perform arbitration
 7. External and internal sources shall be arbitrated based on user-selection of standard or custom rules
 8. On Preset Record, the values of Attributes within the Preset shall be updated to reflect the current output
 9. The total output may be the combination of many different Presets running concurrently
 10. There shall be no hard limit on number of concurrent cross fades
 11. Multiple Presets controlling the same Attribute shall first interact based on priority and second based on Latest Takes Precedence (LTP) or Highest Takes Precedence (HTP)
 12. LTP and HTP operation shall be supported simultaneously and interact (at the same priority) using HTP
 13. Settings due to LTP Presets may be automatically discarded from operation when overridden
 14. It shall be possible to specify that a Preset or Attribute Control will persist when overridden
 15. A Preset may be designated as an HTP Override and shall cause HTP values to be discarded
 16. It shall be possible to modify the rate of a Preset (Cross fades, Effects) from a Control within the System
 17. Each Preset shall have a status that can be Activated, Deactivated or Altered
 18. Preset status may be set based on matching levels in the current output as an option
 19. On startup the System shall be capable of automatically executing timed events within the previous 24 hours to synchronize its initial output state with the current time of day
- xii. Serial Input/output
 1. RS232 shall support 8-bit word length, parity selection and 1 or 2 stop bits
 2. RS232 shall support baud rates from 4800 to 115,200 bps
 3. Serial input and output messages are fully customizable

4. Serial output messages can be generated by any Control or Event

2.02 Unison ERn Series Control Enclosures

1. Control Enclosures

- a. The control enclosure shall be the Unison ERn Series Control Enclosure as manufactured by Electronic Theatre Controls, Inc., or equal.
- b. Mechanical
 - i. The External Processing enclosure shall be a surface mounted panel constructed of 18 gauge formed steel panels with a hinged, lockable full-height door containing an integral electrostatic air filter.
 1. The enclosure door shall have an opening to allow limited access to the control module face panel.
 2. Enclosures shall be convection cooled without the use of fans.
 - ii. Control Enclosures shall be sized to accept one or two Control Processors and one or two Station Power Modules, including various options and accessories
 1. The Control Enclosure for a single control processor (ERn2) shall support a single Station Power Supply module; The Control Enclosure for 2 control processors (ERn4) shall support a quantity of 2 modules.
 - iii. All enclosure components shall be properly treated and finished.
 1. Exterior surfaces shall be finished in fine textured, scratch resistant, powder based epoxy paint.
 - iv. Enclosure(s) shall also be available in a 19" rack mounted (RM) version.
 1. Rack-mounted version shall have an independent enclosure suspension kit, with a full height, locking door/cover attached to the kit.
 2. Rack-mounted version shall have an opening to access the control module face panel, and openings to view indicators on option modules.
 - v. Enclosure dimensions and weights (without modules) shall not exceed:
 1. ERn2 - 15" W x 9" H, 10" D, 15 lb.
 2. ERn2-RM - 19" W 11"H 10" D, 20 lb.
 3. ERn4 - 15" W x 14" H x 10" D, 20 lb.
 4. ERn4-RM - 19" W x 16" H x 10" D, 25 lb.
 - vi. Top, bottom, and side knockouts shall facilitate conduit entry.
 - vii. Enclosures shall be designed to allow easy insertion and removal of all control and option modules without the use of tools.
 1. Supports shall be provided for precise alignment of modules into power and signal connector blocks.
 2. With modules removed, enclosures shall provide clear front access to all power and control wire terminations.
 - viii. Option Modules
 1. Ethernet Switch
 - a. The Control Enclosure shall support an optional Ethernet Switch, with at least 4 ports supplying Power over Ethernet (PoE).
 - b. The Ethernet Switch module shall be 100BaseTX, auto MDI/MDIX, 802.3af PSE compliant.
 - c. The Ethernet Switch module shall contain power, status, and activity indicators. All indicators shall be visible when the enclosure door is open for both rack and wall mounted ERn.
 2. Redundant Power Supply (RRPS)
 - a. The Control Enclosure shall support an optional redundant power supply which shall automatically provide power to the control electronics upon failure or removal of the primary power supply.
 - b. The redundant power supply shall assert itself seamlessly without a loss of power to the control electronics.
 - c. The redundant power supply shall seamlessly remove itself when the primary power supply is reengaged
 - d. The redundant power supply shall provide visible indication that it is active.
 3. Station Bus Repeaters (ERn4 only)

- a. The Control Enclosure shall support an optional module to expand the station bus length an additional 400 meters, and the station count an additional 30 stations (60 maximum per processor/enclosure)
 - b. Wall-mount and 19" Rack-Mount versions shall also be available to support mid-span insertion away from the Control Enclosure
 4. Station Bus Dual Repeaters (ERn4 only)
 - a. The Control Enclosure shall support an optional module to expand the station bus length to two additional 400 meter segments (a total of 1200 meters from a single enclosure, and the station count to 60 stations (60 maximum per processor/enclosure).
 - b. Wall-mount and 19" Rack-Mount versions shall also be available to support mid-span insertion away from the Control Enclosure.
 - ix. Accessories
 1. RideThru Option (RTO)
 - a. The Control Enclosure shall support an optional, short-term backup power source for the control electronics.
 - b. RideThru Option (RTO) provides power for controls electronics during brief power outages or drop outs.
 - c. The short-term back-up power source shall automatically engage upon the loss of normal power, seamlessly transitioning the supply power for the control electronics power to itself.
 - d. The short-term back-up power supply shall detect the return of normal power, and seamlessly return the control electronics to normal power.
 - e. The short-term back-up power source shall support the control electronics for at least 10 seconds.
 2. BatteryPack Option (BPO)
 - a. The Control Enclosure shall support an optional, long-term back-up power source for the control electronics.
 - b. The long-term back-up power source shall automatically engage upon the loss of normal power, seamlessly transitioning the supply power for the control electronics power to itself.
 - c. The long-term back-up power source shall supply power to the control electronics for at least 90 minutes.
 - d. The long-term back-up power supply shall detect the return of normal power, and seamlessly return the control electronics to normal power.
 - e. A test switch/indicator shall be available without opening the rack door or removal of any modules/components.
 - c. Electrical
 - i. External Processing enclosures shall be available in 100, 120, 230 and 240 volt, single-phase configurations.
 - ii. External Processing enclosures shall be completely pre-wired by the manufacturer. The contractor shall provide input and control wiring.
 - iii. External Processing enclosures shall be designed to support the following wire terminations:
 1. AC (single phase)
 2. Echelon link power (Belden 8471 or equivalent)
 3. 24Vdc (2- 16AWG Wire)
 4. DMX512A Port A (In or Out) (Belden 9729 or equivalent)
 5. DMX512A Port B (In or Out) (Belden 9729 or equivalent)
 6. RS232 Serial In/Out (Belden 9729 or equivalent)
 7. Unshielded Twisted Pair (UTP) Category 5 Ethernet
 8. Contact Closure In (14AWG to 26AWG Wire)
 9. Contact Closure Out (14AWG to 26AWG Wire)
 - a. Contact Closure Out shall provide 1A @ 30vDC
 - iv. Station Power Modules
 1. Station power supply modules shall provide LinkPower for at 32 stations and 1.5A@24VDC of Auxiliary (AUX) power.

2. Station power repeater modules shall provide LinkPower for 30 stations and 1.5A@24VDC of Auxiliary (AUX) power.
3. Station power module shall support over-current/short protection for LinkPower and Aux. LinkPower shall support fault detection on each leg of the balanced data bus.
- v. All control wire connections shall be terminated via factory provided connectors.
- d. Thermal
 - i. Ambient room temperature: 0-40°C / 32-104°F
 - ii. Ambient humidity: 10-90% non-condensing

2.03 SIGNAL PROCESSING RACK(S)

- A. The Signal Processing Rack(s) shall be 19" equipment mounting rack(s) with a hinged front door.
- B. Rack(s) shall be surface wall mounted and completely wired internally. Rack shall include hinged "swing-away" mounting for rear access. Design and configuration as shown in the Drawings. Patch panel(s) shall include sufficient patching for all network receptacles, plus (12) spare receptacles.
 - a. The Panel(s) shall include wire management panel(s) as manufactured by Panduit or approved equal.
 - b. The Panel(s) shall include engraved labeling of each port. Port labeling shall refer to Control Receptacle Panel designation.
- C. Network switch will be provided by and configured by owner. Network switch will contain PoE.
- D. All wires shall be identified at the jacket with separate numbers.
- E. The rack shall contain the following elements as shown in the Drawings:
 - a. Network Patch Bay
 - b. Network Switch with PoE (BY OWNER)
 - c. Cable Management.
 - d. Uninterruptable Power Supply. (BY OWNER)
 - e. Architectural Lighting Processor.
 - f. Opto Splitters as needed
 - g. DMX Net3 Gateways as needed
 - h. Black panels as needed
- F. Install as shown in the Drawings.

2.04 Button and Fader Stations

1. Stations
 - a. Button Stations
 - i. The Lighting Control Stations shall be the Unison Heritage UH Series Control Stations as manufactured by Electronic Theatre Controls, Inc., or equal.
 - ii. Mechanical
 1. Unison Heritage Button stations shall operate using up to ten programmable buttons.
 2. All button stations shall be available with white, cream, ivory, gray or black faceplates, and buttons.
 - a. Manufacturer's standard colors shall conform to the RAL CLASSIC Standard.
 3. Stations shall have indicator lights at each button or fader.
 - a. Indicators shall be comprised of red, green and blue LED's
 - b. Indicator color and state (steady On, Blink, Off) shall be configured in software, and shall operate relative to the button or fader it is associated with.
 4. All faceplates shall be designed for flush or surface mounting.
 5. Station faceplates shall be constructed of ABS plastic and shall use no visible means of attachment.
 6. Station faceplates shall be indelibly marked for each button or fader function.
 7. The manufacturer shall supply back boxes for flush mounted half gang stations and for all surface mounted stations.
 8. All Button stations shall be designed to accept the infrared signal from a remote hand held IR transmitter.
 - a. The stations shall have a 60° reception angle and shall operate reliably within a 45' distance.
 9. IR Transmitters shall be available in five or ten button configurations.
 - a. IR transmitters shall be mounted in a hand-held black plastic controller.

- b. Transmitter dimensions shall be 1.875" wide, 6.625" long and 0.60" deep.
- iii. Electrical
 1. Unison control station wiring shall be an Echelon® Link power network.
 - a. Link power shall utilize low-voltage Class II unshielded twisted pair, type Belden 8471 or equivalent, and one #14 ESD drain wire (when not installed in grounded metal conduit).
 - b. Network wiring may be bus, loop, home run, star or any combination of these.
 - c. Wiring termination connectors shall be provided with all stations.
 2. Button Stations shall offer the following Regular markings
 - a. UL and cUL LISTED
 - b. CE Market
 - c. RHoS and WEE Compliant
- iv. Functional
 1. The Unison Paradigm Control System shall be designed to allow control of lighting and associated systems via Button, Button/Fader, and Interface or Astronomical time clock controls. System shall allow the programming of presets, sequences, macros and time clock events.
 - a. System presets shall be programmable via Button stations, Touchscreen stations, and LightDesigner software.
 - i. Presets shall have a discrete fade time, programmable from zero to 1,000 hours with a resolution of one millisecond.
 - ii. Presets shall be selectable via button, fader, IR transmitter, time clock event, macro activation or switch interface stations.
 - b. System macros and sequences shall be programmable via LightDesigner system software.
 - i. Macro and sequence steps shall provide user selectable steps, and allow the application of conditional logic.
 - ii. Macro and sequences shall be activated by button, time clock event or LightDesigner software.
 - c. System time clock events shall be programmable via LightDesigner system software, the processor user interface, or the internal web server.
 - i. Time clock events shall be assigned to system day types. Standard day types include: anyway, weekday, weekend, Sunday, Monday, Tuesday, Wednesday, Thursday, Friday and Saturday. System shall support programming of additional custom or special day types.
 - ii. Time clock events shall be activated based on sunrise, sunset, time of day or periodic event. System shall automatically compensate for regions using a fully configurable daylight saving time.
 2. Control components shall be designed to operate default or custom system functions. Components shall operate default functions unless reassigned via LightDesigner, the software-based configuration program.
 - a. Optional button functions include: preset selection, manual mode activation, record mode activation, station lockout, raise, lower, macro activation, or room join/separate.
 - b. Optional fader functions include manual master control, individual zone control, fade rate control or preset master control.
 3. Stations (Button and Button/Fader) shall allow programming of station and component electronic lockout levels via LightDesigner.
- b. Fader Stations
 - i. The Lighting Control Stations shall be the Unison Heritage UH Series Control Stations as manufactured by Electronic Theatre Controls, Inc., or equal.
 - ii. Mechanical
 1. Unison Heritage Fader Stations shall operate using up to sixteen programmable faders and twelve programmable buttons.
 2. All fader stations shall be available with white, cream, ivory, gray or black faceplates, fader knobs, and buttons.
 - a. Manufacturer's standard colors shall conform to the RAL CLASSIC Standard.
 3. Fader stations shall utilize standard 45-millimeter slide potentiometers.
 4. Stations shall have indicators lights at each button or fader.

- a. Indicators shall be comprised of red, green and blue LED's
 - b. Indicator color and state (steady On, Blink, Off) shall be configured in software, and shall operate relative to the button or fader it is associated with.
 5. All faceplates shall be designed for flush or surface mounting.
 6. Station faceplates shall be constructed of ABS plastic and shall use no visible means of attachment.
 7. Station faceplates shall be indelibly marked for each button or fader function.
 8. The manufacturer shall supply back boxes for flush mounted half gang stations and for all surface mounted stations.
 9. Fader stations shall be shall be designed to accept the infrared signal from a remote hand held IR transmitter.
 - a. The stations shall have a 60° reception angle and shall operate reliably within a 45' distance.
 10. IR Transmitters shall be available in five or ten button configurations.
 - a. IR transmitters shall be mounted in a hand-held black plastic controller.
 - b. Transmitter dimensions shall be 1.875" wide, 6.625" long and 0.60" deep.
- iii. Electrical
 1. Unison control station wiring shall be an Echelon® Link power network.
 - a. Link power shall utilize low-voltage Class II unshielded twisted pair, type Belden 8471 or equivalent, and one #14 ESD drain wire (when not installed in grounded metal conduit).
 - b. Touchscreen and Interface stations shall also require (2) #16 AWG stranded wires for 24Vdc operating power. 24Vdc wiring shall be topology free.
 - c. Network wiring may be bus, loop, home run, star or any combination of these.
 - d. Wiring termination connectors shall be provided with all stations.
 2. Fader Stations shall offer the following Regular markings
 - a. UL and cUL LISTED
 - b. CE Market
 - c. RHoS and WEE Compliant
- iv. Functional
 1. The Unison Paradigm Control System shall be designed to allow control of lighting and associated systems via Button, Button/Fader, and Interface, or Astronomical time clock controls. System shall allow the programming of presets, sequences, macros and time clock events.
 - a. System presets shall be programmable via Button, Button/Fader, Touchscreen, or LightDesigner software.
 - i. Presets shall have a discrete fade time, programmable from zero to 1,000 hours with a resolution of one millisecond.
 - ii. Presets shall be selectable via button, fader, IR transmitter, time clock event, macro activation or switch interface stations.
 - b. System macros and sequences shall be programmable via LightDesigner system software.
 - i. Macro and sequence steps shall provide user selectable steps, and allow the application of conditional logic.
 - ii. Macro and sequences shall be activated by button, time clock event or LightDesigner software.
 - c. System time clock events shall be programmable via LightDesigner system software, the processor user interface, or the internal web server.
 - i. Time clock events shall be assigned to system day types. Standard day types include: anyway, weekday, weekend, Sunday, Monday, Tuesday, Wednesday, Thursday, Friday and Saturday. System shall support programming of additional custom or special day types.
 - ii. Time clock events shall be activated based on sunrise, sunset, time of day or periodic event. System shall automatically compensate for regions using a fully configurable daylight saving time.
 2. Control components shall be designed to operate default or custom system functions. Components shall operate default functions unless reassigned via LightDesigner, the software-based configuration program.

- a. Optional button functions include: preset selection, manual mode activation, record mode activation, station lockout, raise, lower, macro activation, or room join/separate.
 - b. Optional fader functions include manual master control, individual zone control, fade rate control or preset master control.
 3. Stations (Button and Button/Fader) shall allow programming of station and component electronic lockout levels via LightDesigner.
- c. Portable Plug-in Stations
 - i. The Lighting Control Stations shall be the Unison Heritage UH Series Control Stations as manufactured by Electronic Theatre Controls, Inc., or equal.
 - ii. Mechanical
 1. Unison connector stations shall provide an interface to portable Unison stations.
 2. All connector stations shall be available with white, cream, ivory, gray or black faceplates.
 - a. Manufacturer's standard colors shall conform to the RAL CLASSIC Standard.
 3. All faceplates shall be designed for flush or surface mounting.
 4. Station faceplates shall be constructed of ABS plastic and shall use no visible means of attachment.
 5. Station faceplates shall be indelibly marked with station function.
 6. The manufacturer shall supply back boxes for all surface mounted stations.
 - iii. Electrical
 1. Unison control station wiring shall be an Echelon® Link power network.
 - a. Link power shall utilize low-voltage Class II unshielded twisted pair, type Belden 8471 or equivalent, and one #14 ESD drain wire (when not installed in grounded metal conduit).
 - b. Portable plug-in stations shall also require (2) #16 AWG stranded wires for 24Vdc operating power. 24Vdc wiring shall be topology free.
 - c. Network wiring may be bus, loop, home run, star or any combination of these.
 - d. Wiring termination connectors shall be provided with all stations.
 2. Portable Plug-in Stations shall offer the following Regular markings
 - a. UL and cUL LISTED
 - b. CE Market
 - c. RHoS and WEE Compliant
 - iv. Functional
 1. The Unison Paradigm Control System shall be designed to allow control of lighting and associated systems via Button, Button/Fader, and Interface or Astronomical time clock controls. System shall allow the programming of presets, sequences, macros and time clock events.
 - a. System presets shall be programmable via Button, Button/Fader, Touchscreen, or LightDesigner software.
 - i. Presets shall have a discrete fade time, programmable from zero to 1,000 hours with a resolution of one millisecond.
 - ii. Presets shall be selectable via button, fader, IR transmitter, time clock event, macro activation or switch interface stations.
 - b. System macros and sequences shall be programmable via LightDesigner system software.
 - i. Macro and sequence steps shall provide user selectable steps, and allow the application of conditional logic.
 - ii. Macro and sequences shall be activated by button, time clock event or LightDesigner software.
 - c. System time clock events shall be programmable via LightDesigner system software, the processor user interface, or the internal web server.
 - i. Time clock events shall be assigned to system day types. Standard day types include: anyway, weekday, weekend, Sunday, Monday, Tuesday, Wednesday, Thursday, Friday and Saturday. System shall support programming of additional custom or special day types.
 - ii. Time clock events shall be activated based on sunrise, sunset, time of day or periodic event. System shall automatically compensate for regions using a fully configurable daylight saving time.

2. Control components shall be designed to operate default or custom system functions. Components shall operate default functions unless reassigned via LightDesigner, the software-based configuration program.
 - a. Optional button functions include: preset selection, manual mode activation, record mode activation, station lockout, raise, lower, macro activation, or room join/separate.
 - b. Optional fader functions include manual master control, individual zone control, fade rate control or preset master control.
- d. Locking Covers
 - i. The Lighting Control Station Locking Covers shall be the Unison Heritage UH Series as manufactured by Electronic Theatre Controls, Inc., or equal.
 - ii. Mechanical
 1. Locking covers shall be available in Sliding Locking for flush mount applications and Hinged Locking for flush and surface mount applications
 2. Sliding Locking Covers shall
 - a. Be available with white, cream, ivory, gray or black faceplates.
 - b. Be constructed of Extruded Aluminum with ABS plastic end caps
 - c. Provide a smoked Plexiglas window to allow for viewing control status and use of IR remote without opening cover
 3. Hinged locking covers shall:
 - a. Be available in standard black powder coat finish
 - b. Be constructed of 18 gauge steel and finished in standard black powder coat paint, or custom color as specified.
 - c. Provide a clear Plexiglas window to allow for viewing control status and use of IR remote without opening cover
 - d. Use internal Hinge that is not accessible when the cover is closed
 4. Standard colors shall conform to the RAL CLASSIC Standard.
 5. Locking covers of the same type shall be keyed alike
 6. The manufacturer shall supply back boxes for all hinged locking covers
 - iii. Functional
 1. All locking covers shall utilize 90-degree locking mechanisms
 - a. Keys shall be held captive in locks when covers are unlocked.
 - b. Locking covers shall allow for easy viewing of system status without opening the cover
 - c. Locking covers shall support IR remote activation of configured system functions without opening door

2.05 DMX/RDM ETHERNET GATEWAY – FOUR PORT

A. General

- a. The lighting control gateway shall be a microprocessor-based unit specifically designed to provide DMX-512 control of lighting systems and transport of RDM configuration and status messages. The gateway shall permit DMX-512 data to be encoded, routed over an Ethernet network and decoded back to DMX-512. The unit shall be a DMX/RDM 4- port Gateway as provided by ETC, Inc.
- b. Gateways shall communicate over Ethernet directly with at least ETC, Inc.'s entertainment and architectural lighting control products and other Ethernet interfaces.
- c. Connections shall be made between gateways, consoles, architectural systems, and PCs over standard Ethernet distribution systems using 10/100BaseT.
- d. The gateway shall support multiple protocols including:
 - i. ANSI E1.17 Architecture for Control Networks (ACN)
 - ii. ANSI E1.31 Streaming ACN (sACN)
 - iii. ANSI E1.11 USITT DMX512-A
 - iv. ANSI E1.20 Remote Device Management (RDM)
- e. The gateway shall be tested to UL standards and labeled ETL Listed.
- f. The gateway shall be RoHS Compliant (lead-free).
- g. The gateway shall be CE compliant.
- h. The gateway shall have a backlit graphic LCD display for identification (soft-labeling) and status reporting.
 - i. Labeling shall be user configurable using ANSI E1.17 Architecture for Control Network (ACN), or a purpose built software configuration tool.

- ii. The LCD display shall show DMX port configuration indication as well as indicate the presence of valid signal.
 - iii. Gateways that do not indicate port configuration (input/output) and valid data shall not be acceptable.
 - i. Each gateway shall have power and network activity LEDs on the front of the gateway
- B. DMX Ports
 - a. DMX Ports shall comply with the requirements of ANSI E1.11 USITT DMX512-A standards.
 - b. Each DMX port shall be software-configurable for either input or output functionality.
 - c. DMX input shall be optically-isolated from the gateway electronics.
 - d. DMX output shall be earth-ground referenced.
 - e. DMX Port shall be capable of withstanding fault voltages of up to 250vAC without damage.
 - f. Each port shall incorporate one DMX512-A Connection
 - i. Each DMX port of the portable unit shall be modular and hot swappable
 - ii. Each DMX port location shall support a single 5-pin male XLR, 5-pin female XLR, Ethercon RJ-45, or terminal strip module for DMX wiring.
 - g. Network gateways that do not indicate input/ output port configuration or presence of valid data shall not be accepted
- C. Processor
 - a. Each gateway shall have sufficient processing power to manage up to 63,999 universes (32,767,488 addresses).
 - b. Maximum delay time from input to output shall not be greater than one packet time (approximately 22 mSec.).
 - c. A minimum DMX update rate of 40Hz shall be sustained under all conditions unless specifically configured for a slower rate for the sake of compatibility with 3rd party DMX devices.
- D. Mechanical
 - a. The gateway shall be available in two versions
 - i. Rack-Mount/Portable
 - 1. The Gateway shall be fabricated of 16-gauge steel, finished in fine-texture, scratch-resistant, black powder coat (RAL 9004)
 - 2. Dimensions shall be 8.5" (22 cm) wide x 8.0" (20 cm) deep x 1.75" (5 cm) high.
 - 3. The weight of the gateway shall be 3.5 lbs. (1.6 kg) with four DMX modules. An individual module shall weight no more than .25 lbs. (.1 kg).
 - 4. The gateway shall support table top use
 - ii. DIN Rail Mount
 - 1. The DIN Rail mounted gateway shall be included in an extruded aluminum enclosure.
 - 2. Two wiring connections shall be required for connection to the lighting system a. Ethernet connection that supports standard Cat5 patch cables b. DMX input or output connection using is terminal strip style connector
 - 3. Dimensions shall not be more than 8.03" wide (204mm) x 4.13" (105mm) deep x 1.22" (31mm) high (not including mounting hardware)
 - b. Optional accessories for rack-mount and pipe applications shall be available from the manufacturer. These accessories shall support installation by an end-user
- E. Power
 - a. Power for the gateway shall be provided over the Category 5 (or better) cable, utilizing IEEE 802.3af compliant Power over Ethernet (PoE). Power consumption using shall not be greater than 5 watts.
 - b. An optional low-voltage DC power input shall be available utilizing an isolated in-line power supply capable of an operating range of 8-28vDC. The Power supply shall be provided by the gateway manufacturer.
 - c. The gateway electronics shall be electrically isolated from the power supplied over the Catagory5 (or better) cable.
- F. Configuration
 - a. Each gateway on the network shall be individually configurable using freely available software configuration tools. The primary configuration tool shall be Net3 Concert configuration software running on a network connected PC. The PC shall only be required for configuration, and shall not be required for normal operation of the system.
 - b. Each DMX gateway shall control up to 512 DMX addresses, within the confines of 63,999 universes.
 - c. The specific DMX data input or output by the gateway shall be freely configurable by the user.
 - d. Duplicate outputs of DMX lines (DMX splitter) and discrete outputs shall be fully supported.
 - e. Multiple DMX universes may be configured with any length up to 512 total addresses. Any range of DMX input addresses shall support selection and routing to the specified sACN output.
 - f. Multiple sACN sources may be combined with a priority may be assigned to each source sending data to the gateway

- g. All relevant routing information shall be stored in non-volatile memory at each gateway. The system shall recover from a power outage without requiring the PC to be online. Gateways that do not support non-volatile storage of data routing shall not be accepted

G. Network

- a. Communications physical layer shall comply with IEEE 802.3i for 10BASE-T, 802.3u for 100BASE-TX and 802.3af for Power over Ethernet specifications
- b. All network cabling shall be Category 5 (or better), conforming to TIA-568A/B, and shall be installed by a qualified network installer.
- c. Data transport shall utilize the TCP/IP suite of protocols to transfer the DMX data.
- d. ANSI E1.17 Architecture for Control Networks (ACN) and streaming ACN (sACN) shall be supported. Gateways that do not support ANSI E1.17 shall not be acceptable.
- e. Switches shall comply with power-over-Ethernet IEEE802.3af, unless a separate in-line power supply is provided.
- f. Multiple DMX signal routing patches and multiple facilities shall be supported and limited only by the file storage capacity of the computer with ETC Gateway Configuration Editor (GCE) Software installed.
- g. Each DMX gateway shall control up to 512 DMX addresses, per DMX port within the confines of up to 64,399 universes (32,767,488 addresses) using Streaming ACN (sACN).
 - i. Any range of DMX addresses may be selected for each universe.
 - ii. Multiple sources shall be supported by prioritized Highest Takes Precedence (HTP with priority). Each source shall support assignment of priority to allow override of default HTP behavior.
 - iii. Each DMX port shall support its own universe and start address.
- h. Gateways shall have built in DMX merger capability on a universe or channel-bychannel basis.
- i. Gateways shall support have built in priority on a per-universe or channel-by-channel basis. Gateways that do not support prioritized merging of multiple network sources at independent priorities shall not be accepted.

H. DMX Connector modules (Rack-Mount/Portable only)

- a. Each gateway shall support up to four connector modules containing a single DMX connector and its associated electronics
- b. Connector module options shall include
 - i. 5-pin Male DMX connector for DMX Input
 - ii. 5-pin female DMX connector for DMX output
 - iii. RJ-45 Ethercon connector for DMX input or output
 - iv. Eight position terminal connector for DMX input or output. Terminal connections shall support screw terminals or Insulation displacement (IDC) wire terminations.
- c. Each connector module shall be optically-isolated from the gateway electronics and from other DMX modules in the same gateway.
- d. DMX connector modules shall be capable of withstanding fault voltages of up to 250vAC without damage.

I. Environmental

- a. The ambient operating temperature shall be 0° to 40°C (32° to 104°F).
- b. The storage temperature shall be -40° to 70°C (-40° to 158°F).
- c. The operating humidity shall be 5% - 95% non-condensing.

J. Accessories

- a. Hanging bracket kit shall allow unit to be mounted in three orientations
 - i. U-Bolt or C-Clamp mounting hardware shall be available
- b. One E.I.A. rack space mounting bracket kit shall support either one or two complete units and allow for up to eight ports of DMX
- c. Front Access Panel kit shall allow the connectors on the rear of the gateway to be accessed from the front of an equipment rack. Options for 5-pin XLR style connectors that support DMX input or output shall be available
- d. A Universal Power Supply with international plug-set shall be available. Multiple power supplies shall be able to fit in a vertically stacked power strip.
- e. ETC Net3 Concert Configuration and monitoring Software

K. System Requirements

- a. Provide the quantity and type of gateways required, as scheduled. Gateways and software shall be as manufactured by Electronic Theatre Controls Inc. of Middleton WI
- b. Ethernet switch(es) will be provided by owner
- c. Current generation PC will be provided by owner
- d. Systems that do not provide the above capabilities shall not be acceptable

2.06 Wall Mount Relay Panel and load center

A. 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
 - i. Up to three accessory cards shall be supported per relay panel

B. 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
 - i. 120V enclosures shall be 67.5" high by 14.36" wide and 4" deep with a weight not more than 80 pounds.
 - ii. 277V enclosures shall be 67.5" high by 20" wide and 6" deep with a weight not more than 130 pounds.
- c. The panel shall be capable of being mounted on the surface of a wall or recessed mounted.
 - i. 120VAC panels shall support mounting between standard wall stud framing (16- inch on center spacing)
- d. 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
 - i. Optional center-pin reject security screws shall be available for all accessible screws.
 - ii. Recess mount doors shall extend 1" beyond all panel edges to hide wall cut-out
- e. 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.
- f. The Relay panel shall support up to twenty-four 20-amp single pole circuits made up of relays or 300W phase-adaptive dimmers
 - i. 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.
- g. 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.
- h. Relay output lugs shall accept 6-14AWG copper wire
- i. 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
- j. Control wiring for DMX, station bus, and Emergency input terminations shall land on removable headers for contractor installation.

C. 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 (when installed) 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

D. Functional

- a. Panel setup shall be user programmable. The control interface shall provide the following relay setup features (per circuit):
 - i. Type (1 pole, 2 pole, or 3 pole)
 - ii. Name
 - iii. Circuit Number
 - iv. DMX address
 - v. sACN address (network enabled panels only)
 - vi. Space Number
 - vii. Circuit Mode
 1. Normal (priority and HTP based activation and dimming)
 2. Latch-lock

3. Fluorescent
 4. DALI
 - viii. On threshold level
 - ix. Off threshold level
 - x. Include in UL924 emergency activation
 - xi. 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 userselectable delay per relay using a period of 0.1 to 60 seconds, in 0.1 second increments
 - d. Control electronics shall report the following information per branch circuit:
 - i. Breaker state (On/Off)
 - ii. Relay state (Open/Closed)
 - iii. Current draw (In Amps)
 - iv. Voltage
 - v. Energy usage
 - e. Built in Control shall include:
 - i. Ability to record up to 16 presets in each space from the control panel, connected control stations, or timed events
 - ii. 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.
 - iii. Up to 8 spaces in a single rack for total of up to 16 spaces shall be supported per system or system subnet
 - iv. Indication of an active preset shall be visible on the control panel display.
 - v. One 16-step sequence per space for power up and power down routines
 - vi. 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.
 - vii. 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.
 - viii. 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.
 - ix. 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.
 - f. The control of lighting and associated systems via real time and Astronomical clock controls.
 - i. 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.
 - ii. System time events shall be programmable via the control panel.
 1. 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.
 2. Time clock events shall be activated based on sunrise, sunset, time of day or periodic event.
 3. System shall automatically compensate for regions using a fully configurable daylight saving time.
 4. Presets shall be assigned to events at the time clock.
 - iii. The time clock shall support event override
 1. It shall be possible to override the timed event schedule from the face panel of the time clock
 - iv. The time clock shall support timed event hold
 1. It shall be possible to hold a timed event from the face panel of the processor
 2. Timed event hold shall meet California Title 24 requirements
 - g. 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
 - i. 2,500V of optical isolation shall be provided between the DMX512 inputs and the control electronics as well as between control and power components.
 - ii. The relays shall respond to control changes (DMX or Stations) in less than 25 milliseconds. DMX512 update speed shall be 40Hz.

- iii. Setting changes shall be able to be made across all, some, or just one selected relay in a single action from the face panel
- iv. 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
- v. Initial Panel setup
 - 1. 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.
 - 2. 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.
 - 3. 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.

E. Electrical

- a. Relay Panels shall be available to support power input from:
 - i. 120/208V three phase 4-wire plus ground
 - ii. 120/240V single phase 3-wire plus ground
 - iii. 277/480V, 230/400V and 240/415V three phase. 4-wire plus ground
- b. Conduit Entry:
 - i. 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.
 - ii. 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.
 - iii. 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.
- c. All relays shall be mechanically latching
- d. The relay shall be capable of switching 20A at up to 300V
- e. The relay panel shall support a maximum feed size of 200 Amps
- f. Relay panels shall support main circuit breaker options:
 - i. Main breaker options shall be optional and available for purchase upon request
 - ii. Main breakers shall be field installable
 - iii. Main breakers shall be available in 100 and 200 Amps for 120V systems and 150 Amps for 277V systems
 - iv. Series rated SCCR ratings apply as follows with appropriate main breaker:
 - 1. 22,000A at 120/240V
 - 2. 10,000A at 100A; 120/208V
 - 3. 10,000A, 22,000 or 42,000 at 200A; 120/208V
 - 4. 14,000A at 150A and 200A; 277V/480V
 - 5. 65,000A at 200A; 277V/480V
 - v. Main breakers shall allow the following range of wire sizes:
 - 1. 1AWG-300kcmil at 120/240V
 - 2. 3/0 to 300kcmil at 120/208V
 - 3. 6AWG-300kcmil at 277V/480V

F. Relay

- a. Each relay shall have a manual override switch with on/off status indication.

- b. Relays shall be rated for use with:
 - i. 20A 277V Ballast (HID)
 - ii. 16A Electronic Ballast loads @ 120, 240 and 277V
 - iii. 20A Tungsten loads at 120, 240, and 277V
 - iv. Motor loads with ratings of 20 FLA @ 120V, 17 FLA @ 240V, and 14 FLA @ 277V 100,000A symmetrical SCCR
 - c. Isolation: 4000V RMS
 - d. shall use latching state relays
 - e. Rated Life:
 - i. 1,000,000 mechanical activations
 - ii. 100,000 cycles at full resistive load \
 - iii. 30,000 cycles full motor, inductive, tungsten, and electronic (LED)
 - iv. Decreasing loading shall increase the rated life of the relay inversely proportional the square of the load
 - f. Shall support reporting of current usage with an accuracy of five percent of the connected load
- G. Relay Panel Accessories
- a. Ethernet Option shall provide advanced control of relays over streaming ACN (sACN) and transmit status, control override, and measured energy usage per branch circuit to web browser based interface or central monitoring interface
 - b. A Low Voltage 0-10V Dimming Option shall link each of the 24 0-10V outputs with a relay circuit in the panel. Each output shall support up to 400mA of current sink for support of at least 50 LED drivers of fluorescent ballasts
 - c. A Contact Input Option shall allow 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.
 - d. A DALI Control Option shall provide 24 control loops of broadcast DALI control with each loop controlling up to 64 ballasts.
 - e. 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
 - f. A Tamperproof Hardware Kit shall include center reject Torx head screws to prevent access to panel interior by unqualified individuals
 - g. Main Breaker options shall be available as shown in Section 2
- H. Thermal
- a. The panel shall be convection cooled. Panels that require the use of cooling fans shall not be acceptable
 - b. The panel shall operate safely in an environment having an ambient temperature between 32°F (0°C) and 104°F (40°C), and humidity between 5-95% (non-condensing).

2.07 Power Control System

- A. General
- a. The installation rack shall be the Sensor3 120V as manufactured by Electronic Theatre Controls, Inc., or equal. The Power Control System enclosure shall consist of up to 48 module spaces.
- B. Electrical
- a. Sensor3 racks shall operate at 120V, three phase, four wire + ground, 47-53 or to 57-63 Hz at 800 amps max. Other voltage and phase options are available upon request. Sensor racks shall automatically compensate for frequency variations during operation. Provisions shall be made for optional amp trap devices for fault current protection. Standard SCCR fault current protection shall be 100,000A
 - b. All load and neutral terminals shall accept up to #4 AWG (25mm²) wire. Systems providing smaller terminals do not allow contractor wire sizing flexibility and shall be deemed unacceptable.
 - c. Load terminals shall be located at the front of the wiring cavity. Front access racks having terminals located at the back of the rack or on the side near the back of the rack such that adjacent load cabling may block terminal access shall not be acceptable.
- C. Electronics
- a. Power control electronics (CEM3) shall be contained in a single module that can be plug-in capable without use of tools. Power control and dimming systems that require tools for removal of control electronics shall not be acceptable.
 - b. All data and power input for CEM3 control electronics shall be located on a separately removable/pluggable termination connector on the backplane such that backplane can be replaced without removal and discrete secondary

conductor terminations. Systems that require discrete termination of DMX, Ethernet, power input, and dimmer control output directly on terminals on the control module or pluggable backplane shall not be permitted.

- c. The power controller shall directly support the following network protocols:
 - i. Net3 protocol suite including ANSI E1.31 Streaming ACN (sACN)
 - ii. ANSI E1.17 Architecture for Control Networks (ACN)
- d. The power controller shall directly support 2 ports of control input using ANSI E1.11 USITT DMX512-A
- e. Control signals shall be sent between control module and dimmer/power modules using flat ribbon cables. Systems using cat5 cable and rj45 connections or discrete hand wired conductors as sole physical communication media between control module and dimmer/power modules shall be considered long term unreliable and shall be not be acceptable.
- f. System shall provide an optional low voltage connection to maintain power of control electronics through brown out, instantaneous, and sustained power outages. Systems that do not provide optional low voltage backup power connection to the power controller shall not be acceptable.
- g. Control electronics shall be housed in a formed steel body with cast-aluminum face panel.

D. Physical

- a. The Sensor3 rack shall be a free-standing, dead-front switchboard, substantially framed and enclosed with 16 gauge, formed steel panels. All rack components shall be properly treated, primed and finished. Exterior surfaces shall be finished in fine-texture, scratch resistant, epoxy paint. Removable top and bottom panels shall facilitate conduit termination on the 48 module rack. Knockouts shall serve the same purpose on 12 and 24 module racks.
- b. Sensor3 racks shall be available in three sizes, with the following dimensions.
 - i. SR3-12 (12 module) 25.8"H x 14.8"W x 13.3"D
 - ii. SR3-24 (24 module) 45.8"H x 14.8"W x 16.8"D
 - iii. SR3-48 (48 module) 83.1"H x 14.8"W x 22.8"D
- c. Racks shall be designed for front access to allow back-to-back or side-by-side installation.
- d. Racks shall be designed to allow easy insertion and removal of all modules without the use of tools. Supports shall be provided for precise alignment of modules into power and signal connector blocks. With modules removed, racks shall provide clear front access to all load, neutral and control terminations. Racks that require removable panels to access load, neutral or control terminations shall not be acceptable.
- e. An optional bus bar kit shall be available from the factory to allow adjacent racks to be powered by a single line feed. No soft buss rack-to-rack wiring shall be required. Racks that require discrete cabling to connect adjacent racks shall not be acceptable.
- f. Module spaces shall be mechanically keyed to accept only the 20A or below, 50A, or 100A module specified for that space. Racks that allow modules of varying wattages to plug into the same space shall not be acceptable. The rack shall be configurable to accept mixed dimmer types and sizes throughout the rack.
- g. Each rack shall provide a lockable full-height door containing an integral electrostatic air filter that shall be removable for easy cleaning. A single low-noise fan shall be located at the top of each rack. Design of the rack and modules shall draw all cool air intake air through the integral electrostatic air filter at the front of the rack, discretely through each module housing and directly out the top of the rack such that exhausted hot air from adjacent modules does not heat the module(s) above, below, or to the side of each other. System designs that draw the same heated air through multiple modules shall not be acceptable.
- h. The fan shall maintain the temperature of all components at proper operating levels with dimmers under full load, provided the ambient temperature of the dimmer room does not exceed 40°C/104°F. Racks that do not employ both locking doors and electrostatic air filters shall not be acceptable.
- i. The fan shall turn on whenever any circuit in the system is activated. In the event of an over-temperature condition, only the affected dimmer module(s) shall shut down and a message shall appear on the control module LCD. The fan shall remain on during thermal shutdown of individual dimmer modules. Systems that do not include overtemperature sensing and preventative thermal shutdown shall not be acceptable.
- j. A fan sensor shall be provided. In the event of momentary fan failure, error message will be displayed and sent remotely over Ethernet to optional logging systems. Systems that do not provide optional system event logging shall not be deemed acceptable.
- k. If the ambient room temperature drops below 0°C/32°F or rises above 40°C/104°F, a warning shall appear on the dimmer rack LCD. If the temperature rises above 46°C/115°F, the rack shall shut down until the condition is corrected.
- l. A 3 x .5inch LED status indicator (beacon) shall be mounted in the rack door. The beacon shall be visible throughout a wide viewing angle. In normal operating conditions, this LED is illuminated. If the rack's control module senses an error condition, the beacon shall flash until the error is corrected. An optional indicator shall be

available for remote locations. Racks have no external means of visually showing that an error is present shall not be acceptable.

2.08 POWER CONTROL ELECTRONICS

A. General

- a. The Power Control electronics shall be contained in one plug Power Controller. Each power controller shall plug into a dimming cabinet with no need for tools or discrete wire connections. A simple user interface shall be provided for group configuration, testing and diagnostics. The Power Control System shall be Sensor 3 as manufactured by Electronic Theatre Controls, Inc.
- b. Power control shall be UL/cUL Listed and CE Marked. Power and dimming control that require tools for removal of control electronics shall not be acceptable.

B. Physical (Control Interface)

- a. The control electronics shall be contained in one plug module, housed in a formed steel body with cast-aluminum face panel, and self-retaining ejection handles to ease removal from the rack.
- b. A backlit eight-line by 20-character graphical LCD shall be provided for system configuration, live control and status display.
- c. The following features shall be available in power control to reduce setup and tech times:
 - i. Full number pad shall be provided for quick access to dimmers. Power Control that does not provide 0-9 number pad and logic keys for AND, THRU, and AT for fast access, selection, and control of circuit/dimmer numbers shall not be acceptable.
 - ii. Power control shall provide NEXT and LAST buttons to progress through individual circuits/dimmers during pre-show lighting checks for lamp burnouts.
 - iii. Shortcut buttons for Setup, About and live control shall be provided. These functions shall be separated in such a way that user intending to check status or settings does not accidentally render their system unusable. These buttons shall also serve to reduce maximum time to access any feature or setting on a single dimmer, range of dimmers or an entire rack.
- d. The front panel shall have five status LED indicators: power, network activity, DMX A, DMX B, and panic state.

C. Control Signals and Physical Communications Media ports

- a. The power control shall be provided with an Ethernet control signal input. This input shall be fully configurable with a range of patching and priority programming capabilities. The Ethernet signal shall supply seamless integration between the dimmer racks and both the entertainment and architectural lighting control systems. The Ethernet signal shall also enable remote configuration, playback, file storage and monitoring features on a personal computer on the network. Dimming systems that require Ethernet to DMX translation devices for control of critical show lighting introduce a potential failure point and shall not be acceptable.
- b. All data and power input for control electronics shall be located on a separately removable/pluggable termination connector on the backplane such that backplane can be replaced without removal and discrete secondary conductor terminations. Systems that do not support tool-less replacement or that require removal of wires connected directly to the control electronics shall not be acceptable.
- c. Dimming systems that require discrete termination of DMX, Ethernet, power input, and dimmer control output directly on terminals on the power control or pluggable backplane shall not be acceptable.
- d. DMX connections shall be available with option for pluggable screw or punch-down type terminal. Systems that do not allow this option do not support both DMX over CAT5 and mule-strand conductors shall not be acceptable.
- e. Ethernet connection shall be available via standard Cat5 RJ45 connection. System requiring punch down direct to rack or controller cannot be Cat5 system certified and shall not be acceptable.
- f. Power Control shall provide a convenience Ethernet uplink to the lighting network at the front face of the control module. Network capable 3rd party control and monitoring devices shall be provided full access to control, editing and real time feedback.
- g. The following options shall be available to backup all controller setup UL924 Panic configuration, and recorded presets:
 - i. Automatic backup in non-volatile backplane memory
 - ii. Automatic backup in non-volatile Controller memory
 - iii. 3rd party FTP server
 - iv. USB storage device pluggable on the controller face panel
 - v. Data shall also be transferable to and from library storage on a personal computer on a per-rack basis
- h. Power Controller shall support Class 2 EchoConnect control communications

- i. The control network shall utilize unshielded twisted pair, type Belden 8471 or equivalent, and one #14 ESD drain wire (when not installed in grounded metal conduit). Use of Category 5, or better, control network wiring shall also be supported.
- ii. The control network wiring may be bus, loop, home run, star or any combination of these
- i. The control network wiring may be bus, loop, home run, star or any combination of these
- j. The power controller shall directly support the following network protocols:
 - i. Net3 protocol suite including ANSI E1.31 Streaming ACN (sACN)
 - ii. ANSI E1.17 Architecture for Control Networks (ACN)
 - iii. Systems that do not support the above listed industry standard ACN protocols for Ethernet setup, control, and feedback integrated directly between the power system and control system shall not be deemed acceptable.
- k. The power control shall directly support 2 optically isolated ports of ANSI E1.11 USITT DMX512-A for control input. Minimum 2,500V of optical isolation shall be provided between the DMX512 inputs and the electronics. Systems that do not have optical isolation on a prewired factory plug device shall not be acceptable.

D. Power Control Features

- a. The power control shall automatically compensate for frequency variations during operation.
- b. Dimmer outputs shall exhibit no oscillating or hunting for levels. Dimmers with the same choke type set to the same level shall output within $\pm 1V$ of each other, regardless of phase or input voltage.
- c. Power control shall maintain proper dimming performance for all line feed frequencies from 47-53Hz and 57-63Hz without flicker or misfire. Shifts in frequencies up to 3 Hz shall not result in flicker or loss of dimming timing. Systems that cannot perform to these frequency tolerances and shifts shall not be acceptable.
- d. Dimmer output levels shall be regulated for incoming line voltages. The regulation shall adjust for both RMS voltage changes and deformations in the incoming AC waveform. The power control shall monitor and adjust each dimmer's output to maintain a constant power to the load. Regulation shall maintain the desired output voltage $\pm 1V$ for the entire operating range (91-139V and 181-259 VAC) with the exception that the maximum output will be no greater than the line voltage minus dimmer insulation loss. The regulation shall compensate for dips and anomalies in the AC waveform on a dimmer basis. There shall be no interaction between dimmers in the system or any other equipment. The output shall be nominally regulated to 115V/230V appropriate for the market, but shall be field adjustable on a dimmer basis to allow for varying cable length. Systems that cannot maintain perform to the above stated voltage regulation shall not be acceptable.
- e. Power control shall support a rack filled with different types and sizes of dimmer modules. The properties of each dimmer shall be configurable, including dimmer name, output curve, dimmer firing mode, and scale voltage values.
 - i. The output curve selections shall include IES Modified Square, Square, Linear, Modified Linear and a Sensor v2.0 output curve. The power control shall also have the capability of storing up to three custom curves as well as an adjustable preheat level, assignable on a per-dimmer basis.
 - ii. Circuit control modes shall include: Always on, Dimmable, Dimmer Doubled, Switched (unregulated on/off with adjustable on-at level), Fluorescent with adjustable threshold and Off.
 - iii. Power Control shall support forward or reverse phase firing of appropriate modules.
 - iv. Dimmers set as Dimmer Doubled shall allow a single dimmer to set two different levels on one dimmer circuit by splitting the AC power into positive and negative half cycles with no resultant DC line current.
- f. User programmable parameters shall support onsite setup via the local interface in the rack. These parameters shall include, but not be limited to, defining module type, scale voltage for each dimmer, firing mode, curve, dimmer numbering, and DMX512/sACN network port assignments. Systems requiring factory programming shall not be acceptable.
- g. Hardware settings for rack type, available module types, availability of AF features, and operating voltage shall be configurable at the factory or in the field, and shall not require secondary setup after system commissioning even in the event of power controller replacement.
- h. Controller shall support two methods of automatic configuration during controller replacement in a rack.
 - i. Use backplane configuration: The backplane shall retain full setup and preset data in. In this recovery mode, when a new power control is inserted, the controller shall automatically come on-line fully functional without any manual intervention.
 - ii. Use controller configuration: Override backplane configuration such that replacement modules automatically use the configuration resident in nonvolatile memory of the power control
- i. Controller shall be capable of changing rack setup for multiple shows for an entire system with a single update command from a remote PC.

- j. In the event of data loss each rack shall maintain the last level for a user time (zero to five minutes or indefinitely) or may be programmed to fade out or to play a specific preset. Systems that do not offer this feature shall not be acceptable.
 - k. The power control shall contain diagnostic routines to allow the user to test and troubleshoot the system. The power control shall also contain a Test/Bypass switch to turn all dimmers on to full for testing. This switch shall bypass all electronics and shall force the fan on. Systems that do not include local control, "all on" control bypass, and diagnostic routines shall not be deemed acceptable.
 - l. The power control shall be able to record up to 64 presets in a rack. Presets shall be user programmable by recording a snapshot of current dimmer levels (as set by the all control sources), by entering dimmer levels on the power control directly or by a combination of both methods. The system shall have the ability to program and activate group presets from the power control, remote station, console, networked computer or handheld device. Presets shall be activated in the default fade time of 2 seconds, but shall be have a user-programmable fade time between 0 and 60 minutes.
 - m. A system panic (emergency UL924) activation circuit shall be provided. Any dimmer in any rack may be assigned to the panic circuit. The panic closure shall be maintained. Upon activation the system shall:
 - i. Force all circuits selected to be included in panic to a master level between 80- 100%
 - ii. Optionally force all non-panic dimmers to zero
 - iii. Provide configurable fade time to and from "emergency" state
 - iv. Provide configurable delay to and from "emergency" state
 - n. DMX A and B as well as the Ethernet DMX (EDMX) data may be patched using a rack start address - assigned sequentially from a starting control channel or patched individually on a per-dimmer basis. Priority may be set per universe for the DMX inputs, and set per universe by the control source for Ethernet input. Each dimmer may have up to six network control inputs with either a highest takes precedence or priority patch. Each dimmer may also then be assigned to one of 16 spaces for additional specific preset control. Each preset shall have a separate priority for maximum flexibility of prioritization. Systems that do not support prioritization of multiple Ethernet sources beyond HTP shall not be acceptable. Systems that do not support the above listed flexibility in control source prioritization shall not be acceptable.
 - o. Power control shall provide the ability to set a single circuit, all circuits or a range of circuits to a level at the control interface in the rack. Systems that cannot locally control dimmers through local control override shall not be acceptable.
 - p. The power control shall be capable of monitoring and displaying incoming line voltage for all three phases on the LCD. With installed current sensors, the same display shall show amperage on each phase.
 - q. The power control shall support security protected access user shall to able to program passwords that restrict access, preventing unauthorized use of higher-level functions by unauthorized personnel Systems that do not provide security protected access to features that can render the system unusable shall not be acceptable.
 - r. Advanced Features (AF) option shall add an additional sensor in the individual dimmer modules. This option shall allow monitoring of current and output voltage on a dimmer basis and provide information on lamp burnouts, dimmer status and input voltages.
 - s. Power control shall allow the user to record the loads of all AF dimmers in the system. The power control shall, during operation, test each AF dimmer, determine its load and compare it to the recorded load. Any change from recorded loads of configured tolerance shall display an error on the power control and any monitoring device on the network. If a dimmer is driven on with no load, an optional message shall be available to notify the console operator and electrician that there is no load.
- E. Connect to Console Communications
- a. The Ethernet network shall provide an integral link to connect all racks in the system for remote rack-to-console and rack-to-network device communication of the below listed features of real-time control, configuration, and status/feedback using industry standard ANSI E1.17 ACN lighting protocol. Power control and dimming systems that do not use this protocol shall not be permitted. Reported system errors shall be given ACN access to be cleared remotely at the console with exception of system critical errors that require a person to go directly to the rack to manually clear the exiting fault.
 - b. Control
 - i. E1.31 sACN control
 - ii. Activate/Deactivate rack presets
 - iii. Set/Unset circuit levels as overrides to Preset, DMX, and sACN control
 - iv. Lock relays into On/Off/Remote switching states without patching to a console.
 - v. Lock dimmers into non-dim mode with On/Off/Remote switching states without patching to a console.

- c. Remote console configuration shall include, but not be limited to, real time reporting and editing the following:
 - i. Circuit' s control mode
 - 1. Dimmable
 - 2. Switched
 - 3. Latch-lock
 - 4. Always on
 - 5. Off
 - 6. Fluorescent
 - ii. Curves
 - iii. Control threshold
 - iv. Min Scale Voltage
 - v. Max Scale Voltage
 - vi. Preheat
 - vii. Scale load
- d. Standard rack feedback - Rack status messages shall include, but not be limited to, real time reporting of the following:
 - i. Identification
 - 1. Rack type
 - 2. Rack name
 - 3. Rack number
 - ii. State of UL924 panic closure
 - iii. DMX port A or B has an error or has failed
 - iv. Network has an error or has failed
 - v. Phase A, B or C is below 90 volts
 - vi. Phase A, B or C is above 139 volts
 - vii. Phase A, B or C did not start because it was outside of allowable voltage ranges at power up
 - viii. Phase A, B or C voltage headroom warning
 - ix. Frequency is not 50 or 60 Hz
 - x. Ambient temperature is below 0°C/32°F
 - xi. Ambient temperature is above 40°C/104°
 - xii. System Critical-Ambient temperature exceeds 46°C/115°F
 - xiii. Configuration memory error n. Run hours remaining before rack filter needs to be cleaned
 - xiv. IP address of the controller in the rack
 - xv. Software version of the controller in the rack
- e. Standard branch circuit feedback - Ethernet console access of the following circuit status shall be provided
 - i. Module type
 - ii. Circuit location
 - iii. Patched circuit addresses
 - iv. Output level
 - v. Control Source
 - vi. Overtemp
- f. Advanced branch circuit feedback - Dimmer Specific status messages shall include, but not be limited to, the following:
 - i. Load has dropped below recorded value
 - ii. Load has raised above recorded value
 - iii. DC detected on dimmer output
 - iv. One SCR has failed on/off
 - v. Dimmer has failed off or circuit breaker has tripped
 - vi. Dimmer has been removed
 - vii. Dimmer load has failed
 - viii. Dimmer has shut down due to over temperature

2.09 DIMMER MODULES

A. General

- a. The dimmer modules shall be the Sensor dimmer modules as manufactured by Electronic Theatre Controls, Inc., or equal. Sensor dimmer modules shall be designed for dependable, economical service in theatrical and video applications.
- B. Electrical
 - a. Each dimmer module shall contain two single-pole circuit breakers, a solid-state switching module, associated toroidal filters, and power and control connectors.
 - b. Modules shall not have any protruding pins subject to physical damage when the module is not installed.
 - c. Modules shall be keyed so that dimmer modules of different capacity shall not be interchangeable.
 - d. Circuit breakers shall be fully magnetic so the trip current is not affected by ambient temperature. Circuit breakers shall be rated for tungsten loads having an inrush rating of no less than 20 times normal current. Circuit breakers shall be rated for 100 percent switching duty applications. Dimmers that do not operate continuously at 100% load shall not be acceptable.
- C. SCR Assembly
 - a. Each dimmer module shall use a solid state module (SSM) consisting of two siliconcontrolled rectifiers (SCRs) in an inverse parallel configuration, and all required gating circuitry on the high voltage side of an integral, opto-coupled control voltage isolator. Rectifiers, copper leads and a ceramic substrate shall be reflow soldered to an integral heat sink for maximum heat dissipation. The SSM shall also contain a control LED, a thermistor for temperature sensing, and silver-plated control and load contacts. The entire SSM shall be sealed in a plastic housing requiring only a screwdriver to replace. Dimmers employing triac power devices, pulse transformers, or other isolating devices not providing at least 2,500V RMS isolation, shall not be acceptable. Dimmer modules requiring disassembly, heat sink grease or additional tools for repair shall not be acceptable.
 - b. All electronic components (current/voltage sensors and indicators) shall be contained in a single, field-replaceable housing. Modules requiring discrete wiring of electronic components shall not be acceptable.
 - c. SCR power switching devices shall have the following minimum ratings:
- D. Filtering
 - a. Dimmer modules shall include toroidal filters to reduce the rate of current rise time resulting from switching the SCRs. The filter shall limit objectionable harmonics, reduce lamp filament sing and limit radio frequency interference on line and load conductors. Modules shall offer 350 or 500 uS. filter rise times. Rise time shall be measured at the worst case slew rate (about 50 percent) from 10 to 90 percent of the output wave form with the dimmer operating at full load.
 - b. All dimmers shall maintain their published rise time and/or fall time regardless of duty cycle or rack temperatures. Dimmers that derate due to increased dimmer temperature caused by full load operation or high phase angles shall not be acceptable.
- E. Performance
 - a. Power efficiency for standard dimmers shall be at least 97 percent at full load with a no-load loss of 3V RMS. The dimmer shall accept hot patching of a cold incandescent load up to the full rated capacity of the dimmer.
- F. Physical I
 - a. Dimmer modules shall be fully plug-in and factory wired. Dimmer modules shall consist of a heavy duty, die-cast aluminum chassis with integral face panel. No tools shall be required for module removal and insertion. All parts shall be properly treated, primed and finished in fine-texture, scratch resistant, gray epoxy powder coat. With the exception of the circuit breaker, the module shall contain no moving parts. Each module shall be labeled with the manufacturer's name, catalog number and rating. Modules constructed of molded plastic for structural support are not equivalent and are not acceptable. Dimmer modules shall be UL Recognized.

2.10 EMERGENCY LIGHTING TRANSFER SYSTEM

- A. General
 - a. The Emergency Lighting Transfer System (ELTS2) shall provide automatic transfer of branch circuits from normal to emergency power when normal power fails. Each system shall consist of power transfer switches and a control circuitry interconnected to provide complete, automatic protection.
 - b. The ELTS shall transfer designated lighting load branch circuits from dimmers or secondary control outputs to a second power source in the event of a loss of power to the dimmer rack, a normal system failure, or activation of fire alarm.
 - c. The system shall comply with ANSI / UL1008 Transfer Switch Equipment, ANSI / NFPA 110 Standard for Emergency and Standby Power Systems, and ANSI / NFPA 70 (NEC), including Article 700, 701 and 702 safety standards. Emergency transfer systems that do not comply with the below stated NEC articles and sections shall not be permitted

- i. Satisfies requirements of the National Electrical Code (NFPA 70):
 1. Article 700 – Emergency Systems
 2. Article 701 – Legally Required Standby Systems
 3. Article 702 – Optional Standby Systems
 4. Section 518.3(C) – Assembly Occupancies
 5. Section 520.7 – Theatres and Similar Locations
 6. Section 540.11(C) – Motion Picture Projection Rooms
 - d. Emergency Transfer equipment shall comply with the US seismic requirements of the International Building Code (IBC) for equipment in the emergency life-safety chain and be approved for seismic applications. Seismic certification shall include installation applications for Roof, Grade, Below Grade, and Intermediate Level installation in the USA with an Ss level of 3.42 and SDS level of 2.28. Emergency transfer equipment that does not meet or exceed the seismic acceptance criteria for non-structural components and systems per the applicable building code or as set forth in the ICC AC-156 shall not be acceptable.
 - i. The following building codes are addressed under this certification.
 - e. The ELTS shall be a self-contained system for up to 24 circuits at 20 amps and available for single or three phase power (120/208V, 120/240V or 277/480V). The unit shall be available with either discrete emergency branch circuit feeds from an external circuit breaker panel (by others) or emergency main feed with built-in branch circuit distribution and over current protection.
 - B. Transfer Switch
 - a. The switch shall be a UL 1008 LISTED, electrically operated and mechanically held (maintained) transfer switch.
 - b. The switch shall be positively locked and unaffected by voltage variations or momentary outages so constant contact pressure is maintained and temperature rise at the contacts is minimized.
 - c. The switch shall be mechanically interlocked to ensure only one of the two possible positions, either Normal or Emergency.
 - d. Each switch shall be configured as guaranteed break-before-make
 - e. Built-in fuses shall provide up to 65000A Short Circuit Current Rating (SCCR) on connected emergency circuits.
 - f. Built-in fuses class G shall be provided on each output for compliance with NEC Section 700.27 Coordination – larger upstream breakers cannot be tripped by downstream branch circuit faults.
 - g. Switch contacts shall withstand transfer without welding, with 180° phase displacement between Normal and Emergency power sources, both sources energized and with 80% load.
 - h. Transfer switch contacts shall be rated for mixed loads, including electric discharge lamps and tungsten filament lamps. 9. Transfer switches shall be rated for 6000 cycles at full tungsten load.
 - C. Control Circuit
 - a. The control circuitry shall direct the operation of the transfer switch.
 - b. User configurable timing delays shall be provided for power transfer between:
 - i. Loss of normal power and the transfer to emergency up to 10 seconds.
 - ii. restoration of normal power and the transfer from emergency back to normal power up to 60 seconds
 - c. A normally closed dry contact closure fire alarm input shall be provided.
 - d. Transfer switch shall support connections for up to 5 Remote Stations which can manually switch between normal and emergency power.
 - D. Operation
 - a. Transfer to alternate supply will occur when normal supply voltage drops below 80V when used at 120V, or 185V for the A phase and 80V for the B and C phase when used at 277V.
 - b. A self-supervising isolated signal input shall be provided for connection to the facility fire alarm. The ELTS2 shall automatically transfer the loads to the Emergency power source when the facility fire alarm is activated as part of a normally-closed loop
 - c. A key-operated switch shall be provided to manually control the ELTS2. All automatic functions shall override this control. Two indicator lights shall be provided to show the position of the transfer switch.
 - d. All automatic functions shall override remote control functions. Any combination of open or shorted wiring to remote stations shall not affect automatic functions, or disable the local switch.
 - E. Remote Stations (Optional)
 - a. Optional remote control stations shall be available for the ELTS2. Each remote control station shall contain a 3-position key switch. The left and right positions shall be momentary and the switch shall always return to the center position.
 - b. The faceplate shall be labeled Normal for the left switch position, Emergency for the right switch position and Auto for the center position.

- c. The faceplate shall contain two LEDs to confirm transfer switch position.
- d. Each remote station shall mount in a standard, two-gang wall box (4" x 4" x 3.5").
- e. Remote stations shall not be incorporated into or mounted onto other equipment.
- f. All wiring to remote stations shall be by 5-conductor, Class 2 wiring (24V DC). A terminal strip shall be provided for contractor wiring.

F. Enclosure

- a. The ELTS2 shall be mounted in a NEMA 1 interior or NEMA 4 watertight type enclosure finished in textured epoxy paint. It shall be equipped with a hinged locking door. Material shall be no less than 14 gauge steel.
- b. An enclosure containing no more than 12 (twelve) 20A circuits shall be 36"H x 24"W x 8.5"D.
- c. An enclosure containing up to 24 (twenty-four) 20A circuits shall be 48"H x 30"W x 8.5"D.
- d. The enclosure shall provide power distribution and branch circuit protection for all emergency power circuits. Systems requiring external emergency power circuit protection shall not be acceptable.
- e. The enclosure shall be separate and independent of all other equipment. In no instance shall the ELTS2 be enclosed in a dimmer rack or in an enclosure containing other equipment.
- f. The system shall be provided with an approved overlay mounted on the front of the enclosure, stating, "EMERGENCY LIGHTING TRANSFER SYSTEM".
- g. The enclosure shall be provided with an approved label indicating that the system is UL1008 LISTED

2.11 GENERAL NETWORK

A. General

- a. The Electronic Theatre Controls Net3 network shall provide data distribution over TCP/IP Ethernet networks. Data shall be layer 3 routable. Systems using proprietary formats or formats other than 10/100/100Mbit wired Ethernet or non-layer 3 routable networks shall not be accepted.
- b. Connections shall be made between consoles, face panels, architectural processors, dimmers, Net3 Gateways, and computers over standard Ethernet distribution systems using 100BaseT, 100BaseFL, or greater wiring. All installations shall conform to established Ethernet wiring practice, and installation shall be performed by contractors qualified to do this type of work. All wiring shall be tested at Category 5e or higher for full bandwidth operation to the appropriate IEEE standard.
- c. The Lighting Control system must be supplied by a single manufacturer and must have seamless integration over Ethernet between the Entertainment and Architectural lighting control.

B. Capacities

- a. The network shall support DMX routing, patching, and prioritization for up to 63,399 universes (32,767,488 DMX addresses). Each address may be input or output from any port on any DMX gateway in the system. DMX input, routing and output shall be specifically supported on the system from multiple sources and locations up to the maximum number of gateways supported by the Ethernet topology.
- b. The network shall support multiple network hosts including consoles, gateways, dimming racks, computers, file servers, printers, and architectural control processors with discrete command lines and control. The lighting network shall support multiple venues within a system and discrete systems on the same network.

C. System Configuration and Monitoring

- a. Network device configuration shall be via Net3 Gateway Configuration Editor (GCE) software and/or ANSI E1.17 Architecture for Control Networks (ACN).
- b. Patch addresses shall support viewing and manipulation via ANSI E1.17 ACN.
 - i. The system shall permit complete user flexibility allowing the system operator to patch each DMX input address to any ANSI E1.31 streaming ACN address, and DMX output to span streaming ACN universes.
 - ii. The lighting system shall support assignment of DMX offsets, truncation of DMX universes, and provide choice of DMX port prioritization.
 - iii. The lighting system shall support the DD start code extension to ANSI E1.31 which provides priority per address such that multiple control sources can share universes with discrete control per address.
 - iv. Lighting systems that do not support the above mentioned address patching capabilities shall not be suitable.
- c. The system shall allow assignable labels for all network devices to allow easy identification by system users.
- d. Each network device shall have a discrete and unique IP address provided automatically by the software. The user may edit this IP address. Systems that do not support automated IP allocation with IP collision avoidance, and systems that do not allow complete reconfiguration of the above mentioned features over ANSI E1.17 ACN shall not be acceptable.

- e. All configuration data for each network device shall be held at the device and system operation shall not require continuous on-line operation of the network configuration software.
- f. Lighting console operators shall be able to backup the network configurations in the lighting control console. In the event of a network device failure, the operator shall be able to apply the configuration of the failed device to a replacement device of the same type without manually reentering settings. Systems that do not support configuration backup as described above shall not be accepted.
- g. Architectural and Entertainment systems connected to the same network shall be capable of arbitrating control over E1.31 Streaming ACN (sACN) level data. The system shall be capable of alternating control of individual address data between architectural and entertainment systems without intervention by the user. The user shall dictate the conditions under which system shall automatically take control. The network shall allow user override of the selected defaults. Systems which require direct user intervention to allocate control of dimmers between architectural and entertainment lighting systems shall not be accepted.
- h. The Net3 network shall allow multiple DMX input sources to be prioritized on the same universe as network native sources using E1.31 Streaming ACN prioritization. Multiple DMX inputs may be assigned to the same streaming ACN address (this provides multisource control for a particular address). Likewise, the system shall support E1.31 prioritization of multiple simultaneous network sources. Systems that cannot prioritize multiple DMX inputs and multiple native network sources on a network shall not be deemed suitable.
- i. The lighting network shall allow each DMX input address to be assigned a priority on the network allowing each DMX control level coming into the system to participate in full arbitration. Addresses with the highest priority shall have control, with lower priority addresses being ignored. Addresses assigned the same numeric priority, between 1 and 200, shall respond in highest level takes precedence (HTP) manner. The network shall require a valid DMX signal present at the input to initiate prioritization. Systems that do not allow for prioritized HTP for DMX inputs to the network shall not be allowed.

D. Operational Features

- a. Each DMX gateway shall control up to 512 DMX addresses per port, within the confines of up to 63,999 DMX universes (32,747,488 addresses). The specific DMX data input or output by the gateway shall be configurable by the user.
- b. Duplicate outputs of DMX data (DMX splitter) and discrete outputs shall be fully supported.
- c. Merging of multiple DMX input sources on a single gateway without gateway with DMX output on the same gateway shall be supported without connection to the network. The gateway shall support assignment of priority to each input source independently
- d. File transmission, synchronization and access to software shall be supported.

2.12 POWER DISTRIBUTION – OUTLET AND PIGTAIL BOXES

A. General

- a. Connectors shall be available as 20A, 50A and 100A grounded stage pin, 20A twist lock and 20A “U” ground (dual rated “T-slot”); other connectors shall be available as specified.
- b. Pigtails shall be three-wire type “SOW” rubber jacketed cable sized for the maximum circuit ampacity.
- c. Pigtails with 20 amp stage pin connectors shall be terminated using 12 gauge 4 way indent crimp (with inspection window) type where the wire is inserted and crimped directly in the socket.
- d. Terminations for pigtail connectors shall utilize feed- through terminals individually labeled with corresponding circuit numbers.
 - i. 20 amp circuits shall use screwless tension clamp terminals listed for 20 – 8 gauge wire.
 - ii. 50 amp circuits shall use compression terminals listed for 10 – 1 gauge wire.
 - iii. 100 amp circuits shall use compression terminals listed for 8 – 2/0 gauge wire.
 - iv. Terminals that place a screw directly on the wire are not acceptable.
- e. Outlet and pigtail boxes shall be supplied with appropriate brackets and hardware for mounting as shown on the drawings
 - i. Standard mounting options shall include pipe or wall mounting
 - ii. Brackets shall be made from ASTM A 36 steel
 - iii. Hardware shall be ASTM A307 grade 5.
- f. A low voltage distribution system shall be available to incorporate DMX, Ethernet or other protocols as specified in the power distribution box.
 - i. A voltage barrier shall be used to separate the low voltage wiring for the electrical circuits.
- g. Power distribution equipment shall be listed by a nationally recognized test lab (nrtl).

B. Physical

- a. 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.
 - i. Covers shall be fabricated from 16-gauge galvanized steel
- b. Outlet and pigtail boxes shall be available in any length specified in increments of 3-inches with a maximum length of up to 3-feet.
- c. Pigtails and outlets shall be spaced on 18” centers, or as otherwise specified.
- d. Outlets shall be mounted on individual 3” panels.
- e. Circuits shall be labeled with 1.25” lettering.
 - i. Circuit labeling options shall include:
 1. Circuits shall be labeled on the front side of the connector strip with white lettering on black background labels.
 2. Circuits shall be labeled on front and back sides of the connector strip with white lettering on black background labels.
 3. Circuits shall be labeled on the front side of the connector strip with engraved lamicoïd labels utilizing white lettering on black background labels.
 4. Circuits shall be labeled on the front and rear sides of the connector strip with engraved lamicoïd labels utilizing white lettering on black background labels.
 5. Circuits shall be labeled on one side of the connector strip using individual circuit cover plates with lettering engraved in the cover and filled with the specified color.
 6. Circuits shall be labeled using specified labeling per plans and drawings
- f. Outlet and pigtail boxes shall support optional LED indicators to indicate the presence of power at each local circuit. The indicator shall be red in color and mounted in outlet or pigtail box.
 - i. The LED indicator shall be mounted in the lower right corner of the outlet panel
 - ii. The LED indicator shall be mounted in the bottom of the outlet or pigtail box directly below the outlet panel.
 - iii. The LED indicator shall be mounted in the cover plate directly below the circuit label for pigtail circuits

2.13 POWER DISTRIBUTION – CONNECTOR STRIPS

A. General

- a. Connectors shall be available as 20A, 50A and 100A grounded stage pin, 20A twist lock and 20A “U” ground (dual rated “T-slot”); other connectors shall be available as specified.
- b. Internal wiring shall be sized to circuit ampacity and shall be rated at 125°C.
- c. Pigtails shall be three-wire type “SOW” rubber jacketed cable sized for the maximum circuit ampacity.
- d. Pigtails with 20 amp stage pin connectors shall be terminated using 12 gauge 4 way indent crimp (with inspection window) type where the wire is inserted and crimped directly in the socket.
- e. Terminations shall be at one end using feed-through terminals individually labeled with corresponding circuit numbers.
 - i. 20 amp circuits shall use screwless tension clamp terminals listed for 20 – 8 gauge wire.
 - ii. 50 amp circuits shall use compression terminals listed for 10 – 1 gauge wire.
 - iii. 100 amp circuits shall use compression terminals listed for 8 – 2/0 gauge wire.
 - iv. Terminals that place a screw directly on the wire are not acceptable.
- f. Connector strips shall be supplied with appropriate brackets and hardware for mounting as shown on the drawings
 - i. Connector strips shall have junction brackets on 5’ centers.
 - ii. Brackets shall be 1½” x .188” ASTM A 36 steel
 - iii. Hardware shall be ASTM A307 grade 5.
- g. A low voltage distribution system shall be available to incorporate DMX, Ethernet or other protocols as specified in the connector strip. Connector strips shall utilize a voltage barrier to accommodate these systems. Low Voltage signals shall enter the connector strip via a strain relief or connector mounted in a separate low voltage terminal box at the specified end of the connector strip. Up to four low voltage cables shall be supported for each connector strip.
 - i. Connector strips with multiple DMX outputs from the same source shall use DMX pass through assemblies consisting of a 6” panel with the one DMX output connector, one DMX input (Pass Through) connector, one DMX pass through (Bypass) switch, and a label detailing the use of the pass through assembly.
 - ii. The bypass switch shall be used when no DMX devices are present at that location. When activated, the DMX pass through switch shall pass DMX directly through to the next DMX panel on the strip. The pass through switch shall have a mechanical indicator to show the operator that it has or has not been engaged

- h. Connector Strips shall be listed by a nationally recognized test lab (nrtl).
- B. Physical
 - a. Connector strips 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.
 - i. Covers shall be fabricated from 16-gauge galvanized steel
 - b. Connector strips shall be available in any length specified in increments of 6” and shipped fully wired with all splicing hardware.
 - c. Pigtails and outlets shall be spaced on 18” centers, or as otherwise specified.
 - d. Outlets shall be mounted on individual 3” panels and there shall be
 - e. No external terminal boxes shall be required for connector strips with 28 or fewer circuits unless otherwise specified.
 - f. Circuits shall be labeled on the connector strip with 2” lettering.
 - i. Circuit labeling options shall include:
 - 1. Circuits shall be labeled on the front side of the connector strip with white lettering on black background labels.
 - 2. Circuits shall be labeled on front and back sides of the connector strip with white lettering on black background labels.
 - 3. Circuits shall be labeled on the front side of the connector strip with engraved lamicoïd labels utilizing white lettering on black background labels.
 - 4. Circuits shall be labeled on the front and rear sides of the connector strip with engraved lamicoïd labels utilizing white lettering on black background labels.
 - 5. Circuits shall be labeled on one side of the connector strip using individual circuit cover plates with lettering engraved in the cover and filled with the specified color.
 - 6. Circuits shall be labeled using specified labeling per plans and drawings
 - g. Connector strips shall support optional LED indicators to indicate the presence of power at each local circuit. The indicator shall be red in color and mounted in the connector strip
 - i. The LED indicator shall be mounted in the lower right corner of the outlet panel
 - ii. The LED indicator shall be mounted in the connector strip trough directly below the outlet panel.
 - iii. The LED indicator shall be mounted in the center of the 3” plate directly below the circuit label for pigtail circuits
- C. Junction Boxes
 - a. Gridiron junction boxes shall be available to accommodate SO or SOW cable wiring into connector strips mounted to non-fixed locations
 - b. Junction Boxes shall be fabricated from 16-gauge cold rolled steel with 14 gauge end panels. They shall be finished with fine-textured, scratch-resistant, black powder coat paint. Cover(s) shall be 16-gauge cold rolled steel and hinged to allow mounting in any direction.

Part 3. EXECUTION

3.01 MANUFACTURER'S SERVICES

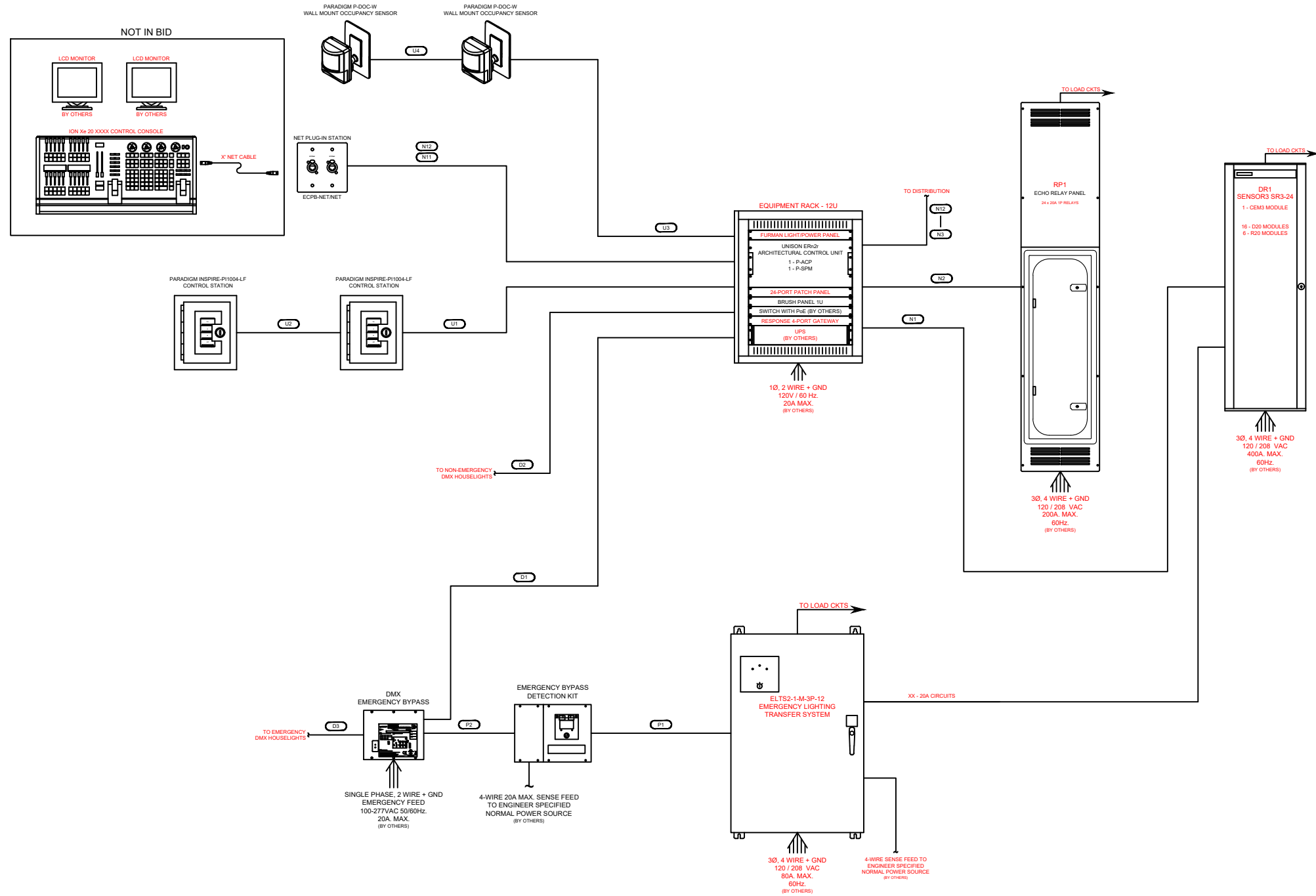
- A. Upon completion of the installation, including testing of load circuits, the contractor shall notify the dimming system manufacturer that the system is available for formal checkout.
- B. Notification shall be provided in writing, two weeks prior to the time that factory-trained personnel are needed on the job site.
- C. No power is to be applied to the dimming system unless specifically authorized by written instructions from the manufacturer.
- 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 shall not exceed four working hours. Additional training shall be available upon request.
- F. Training shall be Digitally Video recorded by Dealer for future reference.

3.02 WARRANTY

- A. Manufacturer 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.

PRELIMINARY - NOT FOR CONSTRUCTION



CONTROL WIRING LEGEND

SYMBOL	WIRE TYPE(S)	SIGNAL
D*	(1) BELDEN 9729	DMX
N*	(1) BELDEN 1583A	ETCNet (Cat5e)
U*	(1) BELDEN 8471 (1) #14 AWG. STRANDED WIRE	UNISON
P*	(2) #16 AWG. STRANDED WIRE	PANIC

* = WIRE IDENTIFICATION NUMBER, NOT QUANTITY

- NOTES:**
- ALL CONTROL WIRING SHALL BE PROVIDED BY OTHERS UNLESS NOTED OTHERWISE.
 - TOTAL LENGTH OF UNISON/ECHO WIRING RUNS SHALL NOT EXCEED 1640 FEET (500M).
 - TOTAL LENGTH OF NETWORK WIRING RUNS SHALL NOT EXCEED 320 FEET (100M).
 - DISTRIBUTION OMITTED FOR CLARITY.
 - ENGINEER TO DETERMINE APPLICABILITY OF ALL BYPASS / TRANSFER SYSTEMS.
 - UNISON WIRE IS TOPOLOGY FREE (CAN BE DAISY-CHAIN, T-TAP)
 - DMX WIRE TOPOLOGY MUST BE DAISY-CHAIN



West Michigan Lighting & Controls

116 54th St SW
Grand Rapids, MI 49548

Tel 616 364 6241

westmichiganlighting.com

UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS ARE IN INCHES.

CONTRACT WITH:

REPRESENTATIVE:
WEST MICHIGAN LIGHTING & CONTROLS

ETC PROJECT MANAGER:

DRAWING TITLE:
CONTROL RISER

JOB:
PORTAGE SCHOOLS

LOCATION:

DK	2-19-18	A

BY	DATE	REV.

DESIGN:

DRAWING:
TL001

PRELIMINARY - NOT FOR CONSTRUCTION



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REPRESENTATIVE:
WEST MICHIGAN LIGHTING
& CONTROLS

ETC PROJECT MANAGER:

DRAWING TITLE:
DISTRIBUTION

JOB:
PORTAGE SCHOOLS

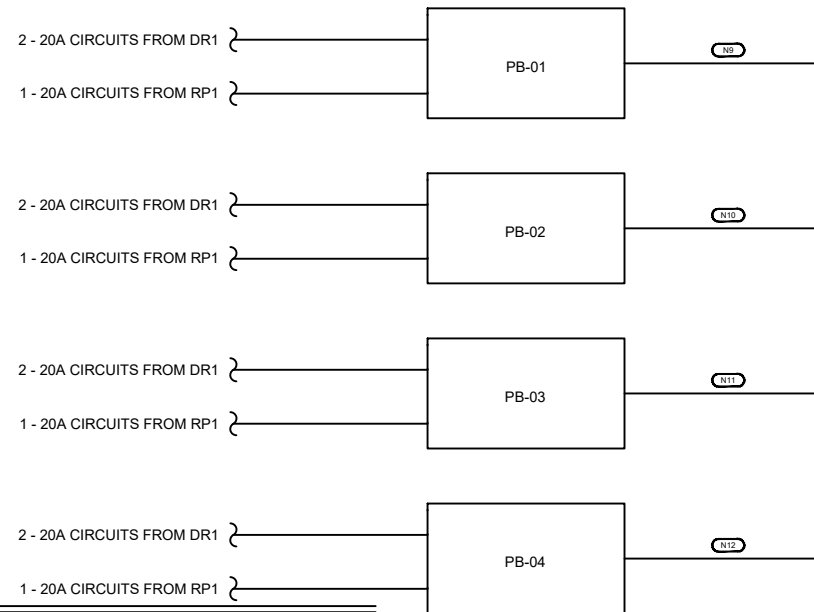
LOCATION:

DK	2-19-18	A
BY	DATE	REV.

DESIGN:

DRAWING:

TL002



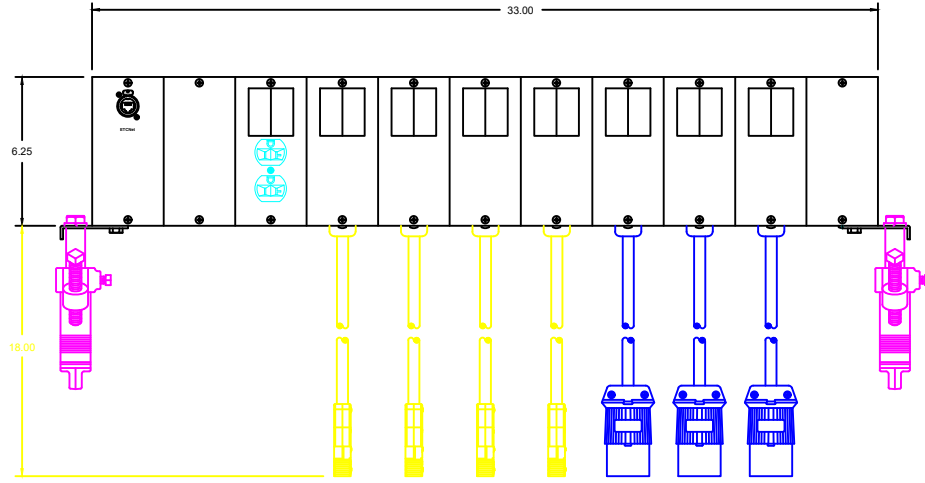
CONTROL WIRING LEGEND		
SYMBOL	WIRE TYPE(S)	SIGNAL
D*	(1) BELDEN 9729	DMX
N*	(1) BELDEN 1583A	ETCNet (Cat5e)
U*	(1) BELDEN 8471 (1) #14 AWG. STRANDED WIRE	UNISON
P*	(2) #16 AWG. STRANDED WIRE	PANIC

* = WIRE IDENTIFICATION NUMBER, NOT QUANTITY

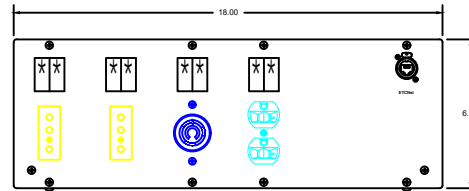
NOTES:

- ALL CONTROL WIRING SHALL BE PROVIDED BY OTHERS UNLESS NOTED OTHERWISE.
- TOTAL LENGTH OF UNISON/ECHO WIRING RUNS SHALL NOT EXCEED 1640 FEET (500M).
- TOTAL LENGTH OF NETWORK WIRING RUNS SHALL NOT EXCEED 320 FEET (100M).
- DISTRIBUTION OMITTED FOR CLARITY.
- ENGINEER TO DETERMINE APPLICABILITY OF ALL BYPASS / TRANSFER SYSTEMS.
- UNISON WIRE IS TOPOLOGY FREE (CAN BE DAISY-CHAIN, T-TAP)
- DMX WIRE TOPOLOGY MUST BE DAISY-CHAIN

PS 1-4 & DB 1-2



PB 1-4



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CONTRACT WITH:

REPRESENTATIVE:
WEST MICHIGAN LIGHTING
& CONTROLS

ETC PROJECT MANAGER:

DRAWING TITLE:
DISTRIBUTION DETAILS

JOB:
PORTAGE SCHOOLS

LOCATION:

DK	2-19-18	A

BY	DATE	REV.
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DESIGN:

DRAWING:

TL003

ENTRY STATION SCHEDULE									
LOCATION	DEVICE TYPE	DEVICE #	MOUNTING	LABELS	CHANNELS	CONTROL TYPE	ACTION TYPE	FADE TIME	COMMENTS
MAIN ENTRY	EP	201	FLUSH			Inspire 4-Button			LATCHING COVER; EC TO PROVIDE RECESSED BACKBOX
ALTERNATE LOCATION	EP	202	FLUSH			Inspire 4-Button			LATCHING COVER; EC TO PROVIDE RECESSED BACKBOX

CONTROL RECEPTACLE SCHEDULE					
LOCATION	DEVICE #	DEVICE TYPE	MOUNTING	SIGNAL PROCESSING	COMMENTS
Grid	201	CRP	C-Clamp	SPR-1	Incorporated in PS-1
Grid	202	CRP	C-Clamp	SPR-2	Incorporated in PS-2
Grid	203	CRP	C-Clamp	SPR-3	Incorporated in PS-3
Grid	204	CRP	C-Clamp	SPR-4	Incorporated in PS-4
Surface Wall	205	CRP	C-Clamp	SPR-5	Incorporated in PB-1
Surface Wall	206	CRP	C-Clamp	SPR-6	Incorporated in PB-2
Surface Wall	207	CRP	C-Clamp	SPR-7	Incorporated in PB-3
Surface Wall	208	CRP	C-Clamp	SPR-8	Incorporated in PB-4
Drop Box	209	CRP	C-Clamp	SPR-9	Incorporated in DB-1
Drop Box	210	CRP	C-Clamp	SPR-10	Incorporated in DB-2

WIRING DEVICE SCHEDULE																						
LOCATION	DEVICE TYPE	DEVICE #	MOUNTING	CONNECTOR	LENGTH	PRODUCTION DIMMED					PRODUCTION 120V RELAY				HOUSELIGHTS 120V RELAY				COMMENTS			
						QTY	QTY	QTY	DMX ADDRESS		QTY	RELAYS	DMX ADDRESS		QTY	RELAYS	DMX ADDRESS					
									CKTS	D20			R20	FROM			TO	CKTS		FROM	TO	CKTS
Grid	PS1	201	C-CLAMP	2P&G	18"	4	2															
				L5-20	18"	3		1.5														
				Edison Duplex	Flush							1	1									
Grid	PS2	202	C-CLAMP	2P&G	18"	4	2															
				L5-20	18"	3		1.5														
				Edison Duplex	Flush						1	1										
Grid	PS3	203	C-CLAMP	2P&G	18"	4	2															
				L5-20	18"	3		1.5														
				Edison Duplex	Flush						1	1										
Grid	PS4	204	C-CLAMP	2P&G	18"	4	2															
				L5-20	18"	3		1.5														
				Edison Duplex	Flush						1	1										
Surface Wall	PB1	205	Surface	2P&G	Flush	2	1															
				L5-20	Flush						1	1										
				Edison Duplex	Flush						1	1										
Surface Wall	PB2	206	Surface	2P&G	Flush	2	1															
				L5-20	Flush						1	1										
				Edison Duplex	Flush						1	1										
Surface Wall	PB3	207	Surface	2P&G	Flush	2	1															
				L5-20	Flush						1	1										
				Edison Duplex	Flush						1	1										
Surface Wall	PB4	208	Surface	2P&G	Flush	2	1															
				L5-20	Flush						1	1										
				Edison Duplex	Flush						1	1										
Drop Box	DB1	209	C-CLAMP	2P&G	18"	4	2															
				L5-20	18"						3	3										
				Edison Duplex	Flush						1	1										
Drop Box	DB2	210	C-CLAMP	2P&G	18"	4	2															
				L5-20	18"						3	3										
				Edison Duplex	Flush						1	1										
HOUSE LIGHTS																						
Pendant	Ceiling	211-220															1	1				
Pendant	Ceiling	221-230															1	1				



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REPRESENTATIVE:
WEST MICHIGAN LIGHTING
& CONTROLS

ETC PROJECT MANAGER:

DRAWING TITLE:
SCHEDULES

JOB:
PORTAGE SCHOOLS

LOCATION:

DK	2-19-18	A

BY	DATE	REV.
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DESIGN:

DRAWING:

TL004