PART 1 - GENERAL

1.1 Applicable provisions of the Conditions of the Contract and Division #1, General Requirements, govern work in this Section.

1.2 DESCRIPTION OF WORK

A. The work of this Section consists of the provision of materials, labor, and equipment and the like necessary and/or required for the complete execution of audiovisual equipment and related work for this project as required by the schedules, keynotes and drawings, including, but not limited to the following:
   1. Unless otherwise specified, supply only new equipment, parts and material, and protect equipment from construction dust and debris until final acceptance. Operate only as required for testing as part of installation procedure. Provision of manufactured components, installation, wiring, and testing is the responsibility of a single contractor.
   2. The system drawings indicate the general layout of the various items of equipment and their functional relationships. However, layout of equipment, accessories, and conduit systems are diagrammatic unless specifically detailed and do not necessarily indicate every item required for a complete installation. Provide any incidental equipment needed in order to result in a complete and operable system even if not specified or shown on drawings without claim for additional payment.
   3. Quantities of major installed and portable equipment, including any add- or deduct-alternates, are indicated on the system and electrical drawings. Quantities of portable equipment are indicated in schedules contained in the drawings or specifications; quantities of installed equipment are determined by examining the functional diagrams, plans, and riser diagrams.
   4. Refer to audiovisual plan drawings for receptacle back box location and quantity information. Also, refer to architectural reflected ceiling plans for exact location of ceiling-mounted devices.
   5. Verify correctness of parts lists and equipment model numbers and conformance of each component with manufacturer's specifications.
   6. Obtain permits necessary for the execution of the work. Comply with applicable local codes and regulations.
   7. Provide inserts; cover plates, etc. as required for a complete system.
   8. Supply and install strut channel hardware above finished ceiling for mounting of video projectors.

B. Functional Requirements of Systems:
   1. Classroom Presentation System:
      a. Short-throw interactive projector with Laser Light source.
      b. Wall mounted interactive screen.
      c. Wall mounted HDMI input jack.
      d. Simple wall mounted AV controller on teaching wall.
   2. Cafetorium.
      a. Tab-Tensioned motorized projection screens 106” high x 188” wide.
      b. Ceiling mounted WUXGA laser projector.
      c. Ceiling box for projector mount and accessories.

d. Digital Media Transmitter/Receiver.
e. BYOD HDMI receiver.
f. Two (2) dual-channel wireless microphone systems with lapel and hand held wireless microphone.
g. Audio DSP.
h. Media Player. In-room Bluetooth audio receiver.
i. Floor standing equipment rack for microphones, amplifiers, media player, audio mixers, video router.

C. Related Work Specified Elsewhere:
1. Metals (05 00 00)
2. Rough Carpentry (06 10 00)
3. Finish Carpentry (06 20 00)
4. Heating, Ventilating, and Air-Conditioning (23 00 00)
5. Electrical (26 00 00)
6. Communications (27 00 00)
7. Structured Cabling (27 10 00)

D. Definitions:
1. Owner: City of Fitchburg.
2. Architect: saam architecture.
3. Consultant: Acentech Incorporated.
4. Bidder: Audiovisual contractor or other entity generating the response to this set of audiovisual bid documents.
5. Audiovisual Contractor or Contractor: Company responsible for work under this section.
6. Furnish: procure, and deliver the equipment to the job site, freight prepaid, for receipt, staging, and installation by others.
7. Install: Provide, store, unpack, and securely attach or mount equipment to structure following industry standards, approved shop drawings, and manufacturer recommendations.
8. Provide: Furnish and Install equipment.
9. Provided by Others and Not in Contract (NIC): Work related to this contract, but will be provided by parties other than the AV Contractor.
10. Owner-Furnished Contractor Installed (OFCI) or Owner-Furnished Equipment (OFE): Equipment furnished by the Owner for installation by the Audiovisual contractor. The Audiovisual contractor shall be responsible for installing and integrating this equipment as detailed herein.
11. Installation Materials: Installed cable, loose cable, terminations, cable management, voice/data/video patch cords, adapters, I/O panels, cable dressing, lacing bars, copper bus bars, labels, rack shelves, rack mounts, power strips/distribution, and other materials as needed to install the systems.

1.01 Submittal requirements

A. General:
1. Contractor must provide four submissions as described in this specification. Those submissions include:
a. Bid submission
b. Shop drawing, bill of materials, and programming
c. Test reports
d. As-Built drawings and operation manuals

2. In keeping with the practices of LEED™, submittals shall be delivered in electronic format as Excel *.xls or *.xlsx, AutoCAD *.dwg (with bound XREFs), Revit *.rvt (with imported files), Word *.doc or *.docx, or combined PDF files via FTP posting, DVD, USB flash drive, or e-mail.
3. Delivery Schedule:
    a. Bid submittal package: By date specified, to include:
        1) Basis of bid documents, including:
            a) Itemized equipment costs for specified equipment or APPROVED substitutions.
            b) Qualifications/References
            c) Certifications (including certificate of bonding, if required)
            d) Proposed payment terms
    b. Bill of material submission: No later than 30 days following award of contract provide the following as one unified package:
        1) Bill of materials
        2) Manufacturer product data sheets
    c. Shop drawing submission: No later than 30 days following award of contract provide the following as one unified package:
        1) Shop drawings.
        2) Control system layouts and digital signal processing configurations.
    d. Test result submission: One week before acceptance testing provide the following:
        1) System test and certification reports
        2) Owner's manuals with manufacturers' equipment manuals
        3) One (1) draft copy of user operational manuals
        4) One (1) draft copy of "as-built" system diagrams
    e. As-built drawings and operational manual submission: Within 30 days after final acceptance testing visit provide the following:
        1) Final as-built system diagrams in hard copy and editable electronic file formats.
        2) Final user operational manuals in hard copy and editable electronic file formats.
        3) Control software for AV Control System, digital signal processors, and other programmable devices. Include complete job-specific source code files.
        4) Custom finish material samples, if applicable.
4. Unless otherwise directed by contract, do not order equipment until the bill of materials has been reviewed and approved by the AV consultant.
5. Approval for isolated items will not be considered, except by prior AV consultant authorization.
6. Rejected items and items requiring correction must be resubmitted together, unless authorized otherwise.

1.02 BID SUBMITTALS

A. Instructions to Bidders: To be considered, Bids must be made in accord with the Architect's Instructions to Bidders and this Article.

B. Examinations: Carefully examine the contract documents and the construction site to obtain first-hand knowledge of existing conditions. Contractors will not be given extra payments for conditions that can be determined by examining documents on-site, and will not be relieved of any obligations with respect to bid.

C. Equipment for the project is shown on the plans, reflected ceiling plans, elevations, and functional diagrams. The contractor must develop a list of equipment for each type of space detailed on the drawings. Contractor is responsible for providing miscellaneous parts to provide a complete and working audiovisual system in each of the spaces outlined in the drawings.

D. Questions: Submit questions about the contract documents in writing. Replies requiring changes to the contract documents will be issued to bidders as addenda and will become part of the Contract. The Architect and Owner may give, but will not be responsible for oral clarifications. Questions received less than 10 days before bid date cannot be answered in writing.

E. Acceptable Products: Model numbers and manufacturers identified herein indicate a standard of quality and performance. Other products will be considered, subject to approval of complete technical data, samples and results of independent testing of proposed equipment, submitted in accordance with Division 1 requirements and “Substitutions” section below.

F. Substitutions: To obtain approval for substitutions and for items identified as "approved equal", submit written requests at least 10 days before bid date. Requests received after this time will not be considered. Requests shall clearly describe the product for which approval is asked, including data necessary to demonstrate acceptability. If the product is acceptable, an Addendum may be issued to bidders.

G. Equipment Availability: Verify with manufacturers availability and cost of equipment proposed, including equipment specified herein. No cost increases will be allowed for manufacturers' cost increases, or for substitutions required because of unavailability of proposed equipment.

H. Performance Bond: The successful bidder will furnish a Performance Payment Bond and Labor and Material Bond, underwritten by a surety company approved by the Architect and Owner, for fulfillment of provisions of the contract.

I. Basis of Bids:
   1. Submissions will be provided in electronic format described below. Electronic submissions must be supplied in Microsoft Excel. *.xls or *.xlsx format.
   2. Include a complete itemized list for each base-bid system indicating the manufacturer, model number, unit cost and total costs for specified items. Itemization of miscellaneous equipment such as cable, switches, and receptacles is not required.
   3. Clearly indicate the total cost, including expenses, for each individual system to allow the Owner to select any or all systems to be included in the contract. Itemization of miscellaneous equipment such as cable, switches, and receptacles is not required.
   4. Organize each list with the information presented, in the order that it appears in this specification, in 6 columns from left to right:
      a. Paragraph number as it appears in this specification.
      b. Paragraph title as it appears in this specification.
      c. Manufacturer and model number.
      d. Quantity.
      e. Unit Cost.
      f. Extension (unit cost times quantity).

g. Example:

Paragraph #	Paragraph Title	Manufacturer & Model Number	Qty.	Unit Cost	Extended Cost
Section 2.1	Microphones				
2.1.B	Hand-Held Microphone	xxx	#	$$	$$$$

5. At the end of each list indicate the cost of other items, such as for miscellaneous equipment, engineering, installation labor, overhead, taxes, etc.
6. On a separate list, indicate costs of any specified add- or deduct-alternates with the information presented in the same manner as for the base-bid system.
7. Include a listing of any voluntary alternates proposed by the bidder as substitutions or additions to the specified systems.
8. Include any notes or comments if necessary to qualify the bid.
9. Identify any sub-contractors and indicate the work they are to do.
10. Provide documentation of ability in installing similar systems. Furnish the names, addresses, and telephone numbers of the System Designer, Architect, General Contractor, and Owner on three projects similar in scope, which the Contractor has installed within the last 5 years.
11. Include certification of ownership and full familiarity with the operation of the following minimum test equipment. Provide a list of the manufacturer, model, and serial number for each item of test equipment required.
    a. Audio Test Equipment:
        1) SMAART, EASERA or similar measurement platform that includes a laptop computer, audio preamp, Type 1 measurement microphone, cables, and stands, to complete the system test.
        2) AC impedance bridge.
        3) Sound level meter and octave band filter set.
        4) Digital Multimeter.
        5) Calibrator with appropriate microphone adapter similar to General Radio, Norsonic, or Rion calibrators.
        6) Random or pseudo-random pink noise generator.
        7) Plug and cable tester (suggested: Whirlwind DCT-9 or PylePro PCT40).
        8) Loudspeaker polarity indicator (suggested: BSS Audio AR130,).
    b. Video Test Equipment:
        1) Photometer with luminance and illuminance probes.
        2) TriStimulus Color Analyzer with Laptop computer (suggested: Sencor OTC1000-CM).
        3) HDMI (2.0) and HDCP (2.2) 18 GPS video generator. Murideo SIX –G
        4) 18 GBPS analyzer for resolution, data, EDID, and Infoframe, HDR Murideo SIX-A.
        5) 12G/6G/3G SDI test pattern generator. Output format SMPTE 292-M/259M/424-M/ST_2081/ST-2082. SIIG 4K X 2K 12-G SDI Video Generator.
        6) HDMI cable test instrument similar to the Quantum Data 780BH.
        7) Coaxial cable test kit (for testing whether in-place cable will support SDI signals): FM Systems CTG-500 kit.
    c. Video Studio/Production Test Equipment:
        1) Camera Test & Setup Charts (DSC Labs or equal; Grayscale, Colorbar, Skin Tone).

2) Handheld Waveform/Vectorscope (suggested Leader LV5333).
3) Handheld HD Generator (Hamlet Axiom or equal).

d. RF Test Equipment:
1) Signal Level Meter (Trilithic M3Plus or equal).
2) Software: Trilithic M3-PLUS-TOOLBOX).
3) Leakage Detector (Trilithic SEEKER LITE2 or equal).

e. Fiber Optic Test Equipment:
1) Optical Loss Test Set (Fluke Networks CertiFiber Pro Optical Loss Test Set).
2) OTDR (Fluke OptiFiber Pro OTDR or equal).

f. LAN Test Equipment:
1) CAT Cable Tester (Fluke DTX-1800 CableAnalyzer or equal).
2) Wi-Fi NetworkTester (Fluke AirCheck or equal).
3) Wi-Fi Analyzer (Fluke AirMagnet or equal).

J. QUALITY ASSURANCE

1. Project Management: Maintain the same person in charge of work throughout installation.
2. Contract Documents: Maintain a complete set of system drawings and specifications at the site during installation.
3. Fabrication and Installation: Completely fabricate equipment racks and subassemblies in contractor fabrication shop. Make field connections of audio, video, and control wiring including microphone, line level, loudspeaker, video, and control system circuits to equipment, equipment racks, and connection panels. Continuously supervise the installation and connection of cable and equipment.
4. Contractor Qualifications: To be considered qualified for this work; the contracting firm must be experienced in the provision of audiovisual systems similar in complexity to those required for this project, and meet the following:
   a. The Contractor's primary business is the provision, fabrication, and installation of professional audiovisual and related systems.
   b. The Contractor has been regularly engaged in the installation and service of professional audiovisual presentation systems for a period of at least five years.
   c. The Contractor is an authorized dealer for the specified Audiovisual Control System systems.
   d. The contractor employs a certified programmer for programming Audiovisual Control System, as required.
   e. The Contractor is, at a minimum, Avixa certified solution provider, with at least (1) CTS-I and (1) CTS-D certified employee on-site for the duration of the installation.
   f. The contractor has a Crestron/Extron/AMX/etc. Certified Installer onsite during the installation and termination of HDBaseT or similar digital transmission systems (DigitalMedia, XTP, DTP, or DGX) equipment, as required.
   g. At the request of the Architect, demonstrate the following capabilities:
      1) Adequate plans and equipment to complete the work.
      2) Sufficient staff with appropriate technical experience to oversee and execute the work.
5. Subcontractors: The Contractor may arrange for sub-contract field and special shop work to be done by others.

1.03 Substitutions

A. General: The Contractor has the burden of proving, at the Contractor's own cost and expense and to the satisfaction of the Architect, that the proposed product is similar and equal to the named product.
   1. Basis:
      a. Requests for acceptance of proposed equivalents made following the award of bid will be considered by the Architect only in the following cases:
         1) The named products cannot be obtained by the Contractor because of strikes, lockouts, bankruptcies or discontinuance of manufacturer and the Contractor makes a written request to the Architect for consideration of the proposed equivalent.
         2) The proposed equivalent, in the opinion of the Architect, is equal or superior to the named product and its use is to the advantage of the Owner.
      b. A formal request must be made for the substitution documenting fully the above reason. Include complete data on the proposed substitution substantiating compliance with the Contract Documents including: product identification and description, performance and test data, references and samples where applicable, and an itemized comparison of the proposed substitution with the products specified or named by Addenda, with data relating to Contract time schedule, design and artistic effect where applicable, and its relationship to separate contracts. Accompany the request by accurate installed cost data on the proposed substitution in comparison with the product specified.
   2. Consideration:
      a. A request for substitution is a representation by the Contractor that:
         1) The Contractor has personally investigated the proposed substitution and determined that it is equal or superior to that specified.
         2) The Contractor will provide the same warranty for the substitution that would be for that specified.
         3) The cost data presented are complete and include related costs under this Contract, but exclude costs under separate contracts and exclude Architect's re-design costs, and that the Contractor waives claims for additional costs related to the substitution, which subsequently become apparent.
         4) Indicate if there will be any cost impact on work by other trades.
         5) The Contractor will coordinate the installation of the accepted substitute, making such changes as may be required for the Work to be complete.
      b. Change Order modifying the Specifications will document an accepted substitution. The Contract Price will be changed only if the substitution results in cost savings to the Owner.

1.04 SHOP DRAWINGS AND BILL OF MATERIAL SUBMITTALS

A. Coordinate submittals with requirements set forth in Section 00 10 00 Solicitation.

B. CAD drawings will be in current AutoCAD .dwg format (with bound XREFs) or portable document format (PDF). Other submissions will be provided as PDFs, unless otherwise stated.

C. Shop Drawings and Bill of Materials Submittals:
1. General:
a. The following is required for approval, prior to ordering product, fabrication, and installation. Submit complete and at one time. Isolated items will not be considered for approval, except by prior authorization. Rejected items and items requiring correction must be resubmitted at one time, except by prior authorization.
b. Submittals shall be provided as complete electronic PDF files that include the following:
1) A single collated file of the Bill of Materials for each system, listed in the order it appears in this specification, configured to print on standard 8-1/2" x 11" or 11" x 17" paper.
2) A single collated file of cut sheets for equipment listed in this specification configured to print on standard 8-1/2" x 11" paper.
3) A single collated file containing drawings configured to print as a full-size set at project standard sheet size.
4) Control system touch panel layouts, as identified below.
5) Digital signal processing layouts, as identified below.
c. The diagrams and details included with these specifications, modified to reflect the stated requirements and to reflect the details of the system as awarded, and including additional required information, may be used in preparing shop drawings. Drawings that are submitted without the necessary modifications will be rejected.
2. Bill of Materials and Catalog Data Sheets:
a. Bill of Materials and Catalog Data Sheets of manufactured items. At the end of the Bill of Materials include Catalog Data Sheets ("cut" sheets) for product arranged in the order listed in the specifications and in the Bill of Materials. Include a cover page identifying the project and submittal. Organize the Bill of Materials in 6 columns from left to right:
3. Paragraph number as it appears in this specification.
1) Paragraph title as it appears in this specification.
2) Manufacturer.
3) Model number.
4) Quantity.
5) Comments (if any are needed).
6) Example:

Paragraph #	Paragraph Title	Manufacturer	Model No.	Qty.	Comments
Section 2.1	Microphones				
2.1.B	Hand-Held Mic	xxx	xxx	#	

4. Shop Drawings:
a. Block diagrams: Provide block diagrams of proposed connections of equipment that indicate equipment types and model numbers.
b. Room Layouts: Equipment/projection/control room/studios layout(s), and equipment rack and cabinet details.
c. Video Projectors: Provide plan and section drawings verifying image width, lens-to-screen distances and mounting methods. Provide detailed drawings of custom-fabricated or stock mounts and hardware, as well as locations of auxiliary electronic devices, such as digital media receivers.

d. Projection Screens: Provide elevation drawing for each projection screen showing floor, ceiling, and screen, with screen size and dimensions for extra drop and image height above the floor indicated.
e. Flat Panel Displays: Provide drawings showing displays, display mounts, method of attaching mounts to structure, and locations of auxiliary electronic devices, such as digital media receivers.
f. Cameras, Antenna, Monitors, and Control Panels: Provide drawings in plans and section the detail mount arrangements and orientation for video camera, video monitors, antenna and control panels.
g. Loudspeaker arrays or clusters: Provide drawings showing arrangement of arrayed loudspeaker components, showing physical arrangement and orientation as well as structural support and any nearby architectural components affecting the coverage provided by the arrayed loudspeakers. Provide drawings stamped by a certified structural engineer indicating review and approval of indicated structural supports.
h. Others as required by Architect or Consultant.
i. Audiovisual Control System and Digital Signal Processing:
    1) Detailed control panel layouts and control logic notes, prepared by the control system programmer:
        a) Provide tree diagrams indicating signal flow for review and approval by Owner and AV Consultant.
        b) Upon approval of the above by AV Consultant, and prior to beginning control system code development, provide color draft set of control system touch panel layout diagrams (Graphic User Interface) for review and approval by Owner and AV consultant, noting comments from prior review. Include text, buttons, colors, images, and backgrounds as well as page flips, sub-pages, and overall page logic flow.
        c) Upon approval of the above by AV Consultant, provide control system touch panel programming file for final review and approval by Owner and AV consultant, noting comments from prior review.
    2) Detailed layouts for digital signal processors:
        d) Signal flow diagrams.
        e) Detail presets and interconnection to audiovisual control system.

D. Samples:
1. Finish for control panels, racks, cabinets, and loudspeaker grilles.
2. Mechanical connectors for use in wiring.

1.05 Test report submittals

A. Test Reports: Upon completion of SYSTEM PERFORMANCE TESTS AND ADJUSTMENTS specified in PART 3 - EXECUTION, submit for approval in writing test results including numerical values for measurements. Also submit written certification that the installation conforms to specifications, is complete and operable, and is ready for FINAL ADJUSTMENTS AND ACCEPTANCE TESTS specified in PART 3 - EXECUTION. Provide three (3) copies unless otherwise specified.

1.06 AS-BUILT DRAWING AND OPERATION MANUAL SUBMISSIONS

A. Operation and Maintenance Data - Coordinate with Section 01700
   1. Draft Copies: At time of FINAL ADJUSTMENTS AND ACCEPTANCE TESTS specified in PART 3 - EXECUTION, provide draft copies of specified diagrams, schedules, and manuals for inspection during demonstration and acceptance testing. Submit final copies of documents within 30 days of project acceptance date. Drawings shall be drawn using the current version of AutoCAD. For Contractor-prepared drawings, schedules and instructions provide (1) draft copy and (2) final copies in electronic format for inclusion in the specified Complete Instruction and Maintenance Manual
   2. Functional Diagrams: Simplified single line block diagram showing interconnection of major equipment components and functional relationships. Illustrate receptacles, patch panel jacks, attenuators, transformers, switches, and loudspeakers. Key each patch panel jack to the patch bay by row and jack number. Diagram shall not illustrate terminal or interconnection cable number designations The Functional Diagram included with these specifications, modified to exclude details, transformer tap designations, etc., and to provide the information described above and any as-built changes, is suitable for this purpose.
   3. As-Built Diagrams:
      a. The intent of the diagrams is to provide sufficiently clear and complete information that a technician of average skill may efficiently troubleshoot and service the system, even if unfamiliar with the installation.
      b. Provide drawings showing terminal blocks, connectors, relays, switches, transformers, attenuators, equipment components, and wires. Label devices with manufacturer, model number, and reference number (e.g. "SW 15," "TB 6"); reference numbers shall be consistent across drawings with no repetitions. As a minimum, provide an expanded version of the functional diagrams with cables fanned out at termination points and labeling as specified above; provide additional drawings where system complexity does not permit complete information to be shown legibly on an individual sheet no larger than the project sheet size. Provide labels for cables continued onto another drawing, indicating termination device, terminal numbers, and drawing sheet on which the termination is shown.
      c. As-built drawings are to include full connection information for each termination of conductors within a cable, either on the drawing itself via cable breakouts or by designating the connection type and providing separate details for each connection type.
      d. Provide layout drawings of panels and other custom assemblies containing switches, relays, terminal blocks, receptacles, etc., using reference numbers to identify physical locations of devices or label devices with reference numbers in a location visible while viewing cable terminations. On wiring diagrams, label conductors within cables for insulation color or other identifier. Label connectors, barrier strips, switches, relay sockets, etc., for terminal number. If device does not provide terminal designations, provide key diagram for reference.
   4. Receptacle Location Plan: Plan of area showing locations and designations of receptacles.
   5. Building Plan: Plan drawing of the building indicating the areas covered by the various zone volume controls.
   6. Patch Panel Assignment Schedule: Mount a typed schedule of patch panel assignments behind acrylic at the equipment racks.

7. Spare Parts List: List of consumable spare parts (projector lamps, air filters, etc.) with part numbers.
8. Control Setting Schedule: Fully document the settings of non-user-adjustable controls. This includes power amplifier gain controls, equalizer settings, etc.
9. Complete Instruction and Maintenance Manual: Prepare in the form of an instructional manual for use by Owner's personnel. Provide one (1) draft copy and two (2) final copies unless otherwise specified.
10. Content of Manuals:
    a. Provide a table of contents arranged in systematic order. Identify each product by product name and other identifying symbols as set forth in Contract Documents.
    b. Contractor, name of responsible principal, address and telephone number.
    c. Certificate of Warranty for the system as a whole as well as copies of the manufacturer’s warranty for each equipment item.
    d. Service Contract. Include a preliminary schedule for the specified semi-annual site visits.
    e. Complete as-built diagram(s) for systems.
    f. Functional Diagram(s).
    g. Receptacle Location Plan(s).
    h. Patch Panel Assignment Schedule.
    i. Building Plan(s).
    j. Original copies, high-quality laser printer printouts of PDF files, or high-quality photocopies of manufacturers' installation, operation, and service manuals, including schematic diagrams for each equipment item.
    k. Shop drawings of custom-fabricated items.
    l. Control Setting Schedule.
    m. Audiovisual Control System:
        1) Color printouts of touch screens control panel graphic layouts, as installed.
        2) Listing of system brand, models and associated peripherals.
        3) DVD or USB flash drive containing the master program for the system, the touch screen display program (including macros), programming, communication, or other project-specific software required for re-programming, and a limited license agreement for the use and modification of contractor-generated source code in connection with the maintenance and modification of the system for which it was written.
    n. Software for Programmable Devices: Where a computer has been used in programming system components, provide DVD or USB flash drive containing the software, instructions for making interconnections to the programmed devices for the purpose of modifying the programming, and a limited license agreement for the use and modification of contractor-generated source code in connection with the maintenance and modification of the system for which it was written.
    o. Applicable software and hardware licenses to be documented and original copies of the licensed provided to owner.

B. Upon request, bid drawings will be sent by egnyte file sharing. Requests must include the project name, project number, drawing numbers and type of files requested. Requests should be forwarded to:
    David Bateman
    Acentech Incorporated

33 Moulton Street
Cambridge, MA 02138
Tel: 617-499-8000, Fax: (617) 499-8074
Reference: Job Number: 631424

1.07 JOB CONDITIONS

A. Sequencing and Scheduling:
   1. Coordinate work with adjacent work of other trades to facilitate construction and prevent conflicts.
   2. Afford other trades reasonable opportunity for installation of work and for the storage of materials.
   3. Staff the job to keep pace with the other Trades.
   4. Abide by the decision of the Architect in case of conflict or interference by other trades.
   5. Refuse: Remove refuse from the job site to the satisfaction of the Architect and Owner.

B. Insurance on the work of this specialty trade shall be provided as specified in Section 00810.

1.08 WARRANTY

A. Warrant equipment to be free of faulty workmanship and defects, and from damage due to contamination by construction dust and debris for a minimum period of one year from date of final acceptance.

B. Warrant repairs to "existing" equipment for a period of 90 days.

C. Emergency service: Within 24 hours of notification, restore the system to operation, replacing defective materials and repairing faulty workmanship. Make temporary repairs and provide loaner equipment at no charge if defective materials cannot be permanently replaced or repaired within this 24 hour time period.

D. Paint and exterior finishes, fuses, lamps, and projection lamps excluded from above warranties except when damage or failure results from defective materials or workmanship covered by warranty.

E. The minimum warranty provisions specified above shall not diminish the terms of individual equipment manufacturers' warranties.

1.09 SERVICE CONTRACT

A. Provide a one-year service contract to commence after acceptance of installation without additional cost. Service to include two semi-annual visits to the site for routine adjustment and maintenance of equipment. Provide a preliminary schedule for the semiannual visits.

B. Toward the end of each year's Service Contract, provide the owner with a proposal for continued service during the next year.

1.10 TRAINING

A. The Owner may assign personnel to participate with the contractor during installation. Without delaying the work, familiarize the Owner's personnel with the installation, equipment, and maintenance.

B. During tests and adjustments, permit the Owner's personnel to observe. When feasible explain the significance of each test.

C. Provide sufficient training to personnel selected by the Owner on operation and basic maintenance of systems and equipment. Explain operation of control systems, set-up, and operation of individual pieces of equipment and functions of overall systems.

D. Separate from the bid response quotation; provide an hourly cost for additional training.

1.11 INSPECTION

A. Notify the Architect of any defects in work by other trades affecting installation.

PART 2 - Products

2.01 MICROPHONES AND ACCESSORIES

A. Portable Handheld Microphone

1. Dynamic microphone with On/Off switch and XLR M-F microphone Cable
2. Features:
   a. Frequency Response: 50 to 15,000 Hz
   b. Polar Pattern: Cardioid
   c. Sensitivity: -54.4 dBV/Pa
   d. Impedance: Rated at 150Ω
3. Acceptable Products:
   a. Shure SM58S with Atlas DS7E Desktop Microphone Stand
   b. Approved Equal

B. Wireless Microphone System

1. Features
   a. THD, total harmonic distortion
      1) ≤ 0.9 %
   b. Audio output
      1) 6.3 mm jack socket (unbalanced): +12 dBu
      2) XLR socket (balanced): +18 dBu
   c. Signal-to-noise ratio
      1) ≥ 110 dBA
   d. Switching bandwidth
      1) up to 42 MHz
   e. Peak deviation
      1) ±48 kHz
   f. Nominal deviation
      1) ±24 kHz
   g. Modulation
      1) Wideband FM
   h. Adjacent channel rejection
      1) Typically ≥ 65 dB
   i. Intermodulation attenuation
      1) Typically ≥ 65 dB
   j. Receiving frequency
      1) Max. 1680 receiving frequencies, adjustable in 25 kHz steps 20 frequency banks, each with up to 12 factory-preset channels, no intermodulation 1 frequency bank with up to 12 programmable channels
   k. RF sensitivity
      1) < 2.5 µV for 52 dBA eff S/N
   l. Squelch
      1) low: 5 dBµV, middle: 15 dBµV, high: 25 dBµV
   m. Receiver Principle
      1) True diversity
2. Acceptable Products
   a. Sennheiser EW 100 G4-ME2/835-S
   b. Approved Equal

C. Antenna Combiner
1. Features
a. 2 x 4:1 combiner at unity gain
b. Connector
1) BNC female, 50 Ω
c. RF input
1) +10 dBm max 10 mW / channel
d. RF output
1) IP 3: >37 dBm (typ.); 1 dB cp: >20 dBm
2. Acceptable Products
a. Sennheiser ACA 3
b. Approved Equal

2.02 AUDIO SOURCE EQUIPMENT

A. Media Player
1. Features
a. Frequency Response: 20 Hz - 20 kHz (±3dB)
b. Signal-to-Noise Ratio: 97dB
c. THD: 0.003%
d. Radio Frequency Range
1) US: 87.5 - 108MHz (FM)
2) FM Station Memory: 30 stations
e. Bluetooth Specifications
1) Version: 4.0
2) Profiles: A2DP, AVRCP
3) Range: Up to 100 feet / 30.5 meters
4) Maximum Transmission Power: Class 2, 4 dBm
f. WLAN
1) Wireless Transmission: WiFi 802.11 a/b/g/n compliant
2) USA (5 GHz 802.11n 40 MHz RF performance)
3) RF Frequency: 2.4 - 2.4835 GHz; 5.15 - 5.875 GHz
4) Wireless Transmit Power: 20 dbm (max)
g. Connectors
1) (2) XLR balanced outputs
2) Output Level: 1.3 Vrms
3) (1) RCA stereo output pair unbalanced
4) Output Level: 2.0 Vrms
2. Acceptable Products
a. Denon DN-350UI
b. Approved Equal

2.03 AUDIO MIXERS AND PREAMPS

A. Digital Mixer
1. Table/PC/Smartphone controlled digital mixer.
2. Features
a. XLR Mic Inputs: 8 Mic/Line, 4 Mic
b. Main Outputs: XLR, 1/4”
c. Aux/Monitor Sends: 6 balanced XLR
d. HDMI output
e. Headphone ¼” out: 2

f. Stereo RCA Line Input: Yes

3. Acceptable Products
   a. Soundcraft UI-16
   b. Approved Equal

2.04 AUDIO PROCESSING EQUIPMENT

A. Digital Signal Processor
   1. Provide system with inputs and outputs as indicated on the AV functional drawings.
   2. Features:
      a. Selectable audio inputs (balanced line level audio or microphone level).
      b. Any input assignable to any output.
      c. 24-bit DSP capable of limiters, matrix routing, delay, parametric/graphic equalizers, and high/low shelf equalization.
      d. RS-232 control port.
      e. Logic input/outputs for control.
      f. Dante audio transport.
   3. Minimum Performance Requirements:
      a. Frequency Response: 20-20,000 Hz, ±0.5 dB.
      b. Distortion: 0.01% THD, 20-20,000 Hz, +10 dBu.
      c. Dynamic Range: 105 dB minimum, (A-weighted, 20Hz to 20kHz).
      d. Maximum Output: +24 dBu.
   4. Acceptable Equipment
      a. QSC Core 110f. Provide with I/O-8 Flex audio input and output expansion modules, as required to meet I/O requirements as indicated in the AV contract drawings.
      b. Approved equal.

2.05 AUDIO DISTRIBUTION AND POWER AMPLIFIERS

A. 2-CH Amplifier, Type 1
   1. Two-channel power amplifier with continuous average output power all channels driven of 100 watts (minimum) at 8-ohms.
   2. Features:
      a. Frequency Response (8 Ohms, 20Hz-20kHz): +/- 0.1 dB
      b. Signal To Noise Ratio (A-weighted): > 100 dB
      c. Bridged output: 400 watts.
      d. Gain: 25 dB
      e. Input Impedance (nominal balanced, unbalanced): 10 kOhms
      f. Load Impedance (Stereo/Dual Mode):4-8 Ohms
      g. Load Impedance Bridge Mono: 4-8 Ohms; 70Vrms and 100Vrms
      h. Cooling: Convection Cooled.
   3. Acceptable Products:
      a. QSC SPA4-100 with mounting hardware, as required.
      b. Extron XPA series equivalent with mounting hardware, as required.
      c. Approved equal.

B. 70V Amplifier, Type 1

1. Two-channel power amplifier with continuous average output power all channels driven of 300 watts (minimum) at 4-ohms, 8-ohms, or at 70-volt.
2. Features:
   a. Frequency Response (8 Ohms, 20Hz-20kHz): +/- 0.25 dB
   b. Signal To Noise Ratio (A-weighted): > 108 dB
   c. THD (at full rated power, 20Hz-20kHz): 0.35%
   d. Voltage Gain: 34 dB
   e. Damping Factor (20 Hz to 100 Hz): >1000
   f. Input Impedance (nominal balanced, unbalanced): 10 kOhms, 5 kOhms
   g. Load Impedance (Stereo/Dual Mode):2-16 Ohms; 70Vrms and 100Vrms
   h. Load Impedance Bridge Mono: 4-16 Ohms; 140Vrms and 200Vrms
   i. Cooling: Continuously variable speed forced air, front to back airflow
   j. Maximum Fan Noise (re dBA SPL @ 1M): 45
3. Acceptable Products:
   a. Crown DCi 2|300 DA.
   a. QSC CX302V
   b. Approved equal.

C. 70V Amplifier, Type 2
1. Two-channel power amplifier with continuous average output power all channels driven of 600 watts (minimum) at 4-ohms, 8-ohms, or at 70-volt.
2. Features:
   a. Frequency Response (8 Ohms, 20Hz-20kHz): +/- 0.25 dB
   b. Signal To Noise Ratio (A-weighted): > 108 dB
   c. THD (at full rated power, 20Hz-20kHz): 0.35%
   d. Voltage Gain: 34 dB
   e. Damping Factor (20 Hz to 100 Hz): >1000
   f. Input Impedance (nominal balanced, unbalanced): 10 kOhms, 5 kOhms
   g. Load Impedance (Stereo/Dual Mode):2-16 Ohms; 70Vrms and 100Vrms
   h. Load Impedance Bridge Mono: 4-16 Ohms; 140Vrms and 200Vrms
   i. Cooling: Continuously variable speed forced air, front to back airflow
   j. Maximum Fan Noise (re dBA SPL @ 1M): 45
3. Acceptable Products:
   a. Crown DCi 2|600 DA.
   b. QSC CX602V
   c. Approved equal.

2.06 LOUDSPEAKERS

A. Surface Mounted Loudspeaker
1. Minimum Performance Requirements:
   a. Frequency Response (-10 dB): 70-23,000 Hz
   b. Sensitivity: 87 dB
   c. Coverate Angle: 100°x100°
   d. Available Taps (70V): 7.5, 15, 30, 60 watts.
2. Acceptable Products
   a. JBL Control 25AV
   b. Approved Equal

B. Pendant Loudspeakers
   1. Minimum Performance Requirements:
      a. Frequency Response (-10 dB): 65-15,000 Hz
      b. Sensitivity: 88 dB
      c. Beamwidth: 120° conical
      d. Available Taps (70V): 3.7, 7.5, 15, 30 watts.
   2. Acceptable Products
      a. JBL 64 P/T
      b. Approved Equal

C. Full-Range Loudspeaker
   1. Minimum Performance Requirements:
      a. Frequency Response (-3 dB): 52 Hz - 16 kHz
      b. Frequency Range (-10 dB): 43 Hz - 20 kHz
      c. Nominal Dispersion: 100° H x 40° V
      d. Maximum SPL @ 1 m: 132 dB SPL (peak)
      e. Rated Power: 1,000 W
      f. Acceptable Products
         1) Bose F1-812 with fly hardware
         2) Approved Equal

D. Surface-Mounted Loudspeaker (Gymnasium)
   1. Features:
      a. 2-way, full range.
      b. Symmetrical trapezoidal enclosure.
      c. LF subsystem & loading: 1x 12”.
      d. HF subsystem & loading: 1x25mm.
   2. Minimum Performance Requirements:
      a. Frequency Response: -3 dB, 80-20,000 Hz.
      b. Frequency Response: -10 dB, 55-20,000 Hz.
      c. Axial Sensitivity (dB SPL, 1 Watt @ 1m): 94dB.
      d. Nominal Impedance: 8 Ophms.
      e. Power Handling (IEC Standard): 400 watts.
      f. Maximum Output (dB SPL @ 1m): 119 dB.
      g. Nominal Coverage Angle: 90° x 90°.
   3. Acceptable Products
      a. JBL AWC129 with mounting hardware as necessary.
      b. Atlas FS12T-66 with mounting hardware as necessary.
      c. Community R.5 COAX with mounting hardware as necessary.
      d. Approved Equal

2.07 ASSISTIVE LISTENING

A. ALS Transmitter Type 1:
   1. Features:
      a. Operates on 72MHz.
      b. LED indicators for audio level, RF modulation, and RF output power.
      c. Tunable to 57 wide and narrow band channels.
   2. Minimum Performance Requirements:
      a. RF Frequency Range: 72.025 – 75.950 MHz.
      b. Transmitter Stability: 50PPM.
      c. Output Power: 100mW.

d. Signal to Noise: 44dB.

3. Acceptable Products:
   a. Listen Technologies LT-800 72 MHz base unit with power supply, rack mount kit (LA-326), and ALS Signage (LA-304)
   b. Approved equal.

B. ALS Antenna:
1. Acceptable Products:
   a. LA-123 Antenna (mount on standard gang plate, finish approved by architect), provide RG-8/U cable as required; provide heat shrink tubing to color match as coordinated with Architect.
   b. Approved equal.

C. Receiver:
1. Features:
   a. 17 wide band channel / 40 narrow band channel digital receiver.
   b. LED indicators.
2. Minimum Performance Requirements.
   a. RF Frequency Range: 72.025 – 75.950MHz.
   b. Sensitivity: .6uV typical, 1uV maximum for 12dB SINAD.
   c. Signal to Noise: 80dB.
3. Acceptable Products:
   a. Listen Technologies LR-5200-072 with:
      1) LA-403 behind-the-head headphones
      2) LA-430 iDSP neck loop
   b. Approved Equal

D. Charging Station:
1. Features:
   a. 12-unit charging tray.
2. Acceptable Products:
   a. Listen Technologies LA-381-01. Provide charging stations to charge all receivers simultaneously.
   b. Approved equal.

2.08 VIDEO SOURCE EQUIPMENT

E. Document Camera
1. Acceptable Products
   a. Epson DC-21
   b. Approved Equal

F. BYOD Receiver
1. Provide a wireless collaboration appliance with the ability to connect via IP address and/or manufacturer provided application.
2. Features:
   a. Supports both wired and wireless IP communications
   b. AirPlay & Miracast support
   c. 4K UHD wireless streaming
   d. Intuitive drag-and-drop user interface
   e. Screen key authentication
   f. 4K UHD wireless streaming

g. Gigabit Ethernet with PoE+ support
h. Power supply, DC 12V at 2Amps (not included, order if needed)
i. 2x HDMI outputs (1x 4K or 2x 1080p displays)
j. HDMI in
k. Stereo out (3.5 mm), 8-channel 7.1 surround sound
l. 2x USB 3.0

3. Acceptable Products:
   a. Mersive Pod SP-8100-E1
   b. Approved Equal

2.09 VIDEO ROUTING AND PROCESSING

A. The functional diagram(s) connections shown on the bid documents are based on components manufactured by Extron, Crestron, or AMX. This manufacturer was used only as a reference to show the signal flow for the completed audiovisual system. Crestron and AMX are approved equals. The contractor must supply any additional equipment required to provide a complete audiovisual system.

B. Digital Video Transmitter, Type 1
   1. AV over IP decoder supporting 4K60 4:4:4 video via Gigabit Ethernet
   2. Features:
      a. Video Resolutions: Up to 4096x2160@60Hz (DCI 4K60), 4:4:4 color sampling, HDR10 and Deep Color support
      b. Audio Formats: Primary multichannel (up to 8-channel LPCM or encoded HBR 7.1 surround sound)
      c. Bit Rates: 200 to 950 Mbps
      d. Streaming Protocols: TCP, UDP, IP, IGMP V2
      e. Copy Protection: HDCP 2.2
      f. Power: POE+ switch or accessory +24VDC power supply
   3. Acceptable Products
      a. AVProEdge AC-MXNET-1G-D
      b. Approved Equal

C. Digital Video Receiver, Type 1
   1. AV over IP decoder supporting 4K60 4:4:4 video via Gigabit Ethernet
   2. Features:
      a. Video Resolutions: Up to 4096x2160@60Hz (DCI 4K60), 4:4:4 color sampling, HDR10 and Deep Color support
      b. Audio Formats: Primary multichannel (up to 8-channel LPCM or encoded HBR 7.1 surround sound)
      c. Bit Rates: 200 to 950 Mbps
   3. Streaming Protocols:TCP, UDP, IP, IGMP V2
   4. Copy Protection: HDCP 2.2
   5. Acceptable Products
      a. AVProEdge AC-MXNET-1G-D
      b. Approved Equal

D. Digital Video Transmitter, Type 2
   1. Acceptable Products
      a. AVProEdge AC-CXWP-HDMO-T
      b. Approved Equal

E. Digital Video Receiver, Type 2
   1. Acceptable Products
      a. AVProEdge AC-EX70-UHD-BR
      b. Approved Equal

2.10 VIDEO DISPLAYS

A. Short Throw Interactive Video Projector
   1. Minimum Performance Requirements:
      a. 3,600 lumens of color and white brightness
      b. Full HD 1080p resolution; project up to 110" (16:6) or 120" (16:9) diagonal
      c. 20,000-hour laser light source with no lamps
      d. Built-in wireless; share from up to 50 devices
      e. Built-in edge blending and split screen features for easy, scalable projection
      f. Content management software and creative content app for easy creation and management of content for digital signage.
   2. Acceptable Products
      a. Epson 735Fi
      b. Approved Equal

B. Ceiling Mounted Video Projector
   1. Minimum Performance Requirements:
      a. Projector type: 3-chip LCD Laser projector
      b. Resolution: 1,920 x 1,200
      c. Brightness: 9,000 ANSI Lumens
      d. Contrast ratio: 2,000,000:1
      e. Aspect ratio (native): 16:10
         1) Inputs & Outputs (min.):
            a) DVI-D
            b) HDMI
            c) HDBaseT
            d) VGA
            e) 3G-SDI
         2) Communication & Control:
            a) LAN
            b) RS232
      f. Optical lens shift, as required.
   2. Acceptable Products
      a. Epson Pro L1495UNL with zoom lens as required
      b. Approved Equal

C. Video Projector on Scissor Lift
   1. Minimum Performance Requirements:
      a. Projector type: 3-chip LCD Laser projector
      b. Resolution: 1,920 x 1,200
      c. Brightness: 15,000 ANSI Lumens
      d. Contrast ratio: 2,000,000:1
      e. Aspect ratio (native): 16:10
         1) Inputs & Outputs (min.):
            a) DVI-D
            b) HDMI
            c) HDBaseT

d) VGA
e) 3G-SDI
2) Communication & Control:
a) LAN
b) RS232
f. Optical lens shift, as required.
2. Acceptable Products
a. Pojector
1) Epson Pro L1755UNL with zoom lens as required
2) Approved Equal
b. Scissor Lift:
1) Acceptable Products
a) Draper SLX10 series lift with SLX ceiling closure panel, manufacturer-provided cable harness option, Peerless PJR125 mount and accessories, as required. AV contractor to coordinate finish and ceiling fill within bottom closure panel and with architect.
b) Approved equal.

2.11 CONTROL SYSTEMS

A. Wall-Mounted Button Panel Controller
1. Features:
a. Automated processor and control panel
b. Mounts flush on a wall or lectern and fits in a 2-gang U.S. electrical box
c. Four buttons customizable with replaceable labels, plus rotary volume control with circular volume gauge and additional power and mute buttons.
d. Gigabit Ethernet LAN port
e. Onboard RS-232, IR, relay control ports
f. Installer setup via software, web browser, or cloud
g. Enterprise-grade security and authentication
h. PoE+ network powered
2. Acceptable Products:
a. Extron MLC Plus 100
b. Approved equal.

B. Control Processor
1. Fully integrated, programmable system for control of audiovisual system equipment and other motorized, electronic or electrical devices that can be remote controlled.
2. Features:
a. Supports 8-wire LAN/Ethernet expansion of the control network.
b. Programmable with high level language via external computer (computer not provided.)
c. Rack mountable.
3. Control Ports:
a. Ethernet: 8-wire RJ-type connector.
b. Relays: (4) normally opened, isolated relays rated at 1A, 30VAC/DC.
c. Input/Output: (4) programmable input and digital outputs.
d. IR/Serial: (2) serial outputs for IR, or serial interface.

e. COM: (3) bidirectional serial ports for RS-232, RS-422 or RS-485 communication.

4. Acceptable Products:
   a. Extron IPCP Pro 360Q xi
   b. Approved Equal

C. 7” Wall-Mounted Touchpanel

1. 7" LCD panel with touch sensitive screen.

2. Features:
   a. Color touch-panel.
   b. Touchscreen:
   c. Display Type: TFT active matrix color LCD.
   d. Screen Dimensions: 7" diagonal.
   e. Resolution: 1024x600 pixels.
   f. Contrast: 700:1
   g. Communications protocol compatible with respective integrated control system.
   h. Communications:
      1) 10/100/1000 Mbps Ethernet with LAN PoE.

3. Acceptable Products:
   a. Extron TLP Pro 725M
   b. Approved Equal

D. Custom Audiovisual Control System Software/Programming:

1. Custom software and programming for AV control system control panels and mainframes to provide control of AV devices and user-friendly control interface.

2. Programming provided by a programming service company engaged in providing such services to third parties as a principal business activity.

3. Product to be developed using AV control system manufacturer's programming tools and to include touch panel layouts, programming source and compiled code, and written documentation. Product to exploit full graphical capabilities of control system hardware and maximum available feedback of controlled equipment.

4. Control functions as itemized in parts 1 and 3 of the audiovisual specification and on the contract drawings.

5. Product shall conform project standards, including colors, logos, etc.

6. Acceptable Products:
   a. Custom software and documentation from certified in-house programming staff or other sub-contractor as approved according to Division 1. Provide touchpanel layouts as required under Part 1.6 - Submittals.

2.12 NETWORK

A. Network Switch
   1. Features:

a. Most suitable applications: Fixed installations
b. RLinkX (Link redundancy): Yes
c. Groups (VLAN segmentation): Yes
d. MultiLinkX (Link aggregation): Yes
e. Profile manager: Yes
f. Memory: 4Mb
g. MAC address table:
h. Address learning / Aging: Self learning, Auto aging
i. Switching throughput: 52Gbps
j. IGMP support: Yes (V1/V2/V3)
k. IGMP snooping: Yes, enabled by default
l. Port sensing: Auto negotiation
m. Auto crossover: MDI / MDIX
n. Auto sensing: Full or Half Duplex (Gigabit is Full Duplex)
o. PoE budget (190 watts) minimum.

2. Connectivity:
   a. Ethernet connectivity: 24 x RJ45 connectors (incl. 4x dual media on ports 21-24)
   b. Fiber connectivity: 6 x SFP cages (incl. 4x dual media on ports 21-24)
   c. Ethernet port speed: 1Gbps
   d. Serial: 1 x serial RJ45 console port
3. Protocols:
   a. Supported protocols: Avnu AVB/MILAN, Dante©, RAVENNA/AES67©, Ethersound©, Q-LAN, REAC©, sACN, ArtNet, MANet2, HogNet, RTTrPL (BlackTraX), IEEE 802.1p CoS (Class of Service), DiffServ (DSCP), PoE (802.3af) (optional), PoE+ (optional), IEEE 1588 PTP V2
   b. Sound protocol compliance: Yes (low jitter)
   c. Ethernet compliance: IEEE 802.3, IEEE 802.3u, IEEE 802.3x Flow Control, IEEE 802.3ab Gigabit Ethernet
4. Acceptable Products:
   a. Luminex Gigacore LU 01 00052-POE (GigaCore 26i with PoE supply). Provide with accessories, as required. Configure with VLANs to separate AV network traffic from Owner network (coordinate with Owner).
   b. QSC NS-1124P with accessories, as required. Configure with VLANs to separate AV network traffic from Owner network (coordinate with Owner).
   c. Pakedge equivalent. Configure with VLANs to separate AV network traffic from Owner network (coordinate with Owner).
   d. Approved equal.

2.13 RACKS, CARTS, FURNITURE AND SCREENS

A. Wall-Mounted Equipment Rack
1. Acceptable Products
   a. Middle Atlantic EWR-16-22
   b. Approved Equal

B. AC Power Switch/Sequencer
1. Rack-mounted sequential power controller providing time-sequenced activation and de-activation of equipment with integrated system power switch.
2. Features:
   a. Six (minimum) sequencing steps.
   b. Two-second time delay between steps.

c. LED status indicator.

3. Acceptable Products:
   a. Middle Atlantic USC-6R.
   b. Approved equal.

C. AC Receptacle(s) & Raceway:
1. AC power receptacles for power distribution in equipment racks and cabinets.
2. Features:
   a. Compatible with power sequencer for remote control of AC outlet raceway.
   b. UL Recognized
   c. Multiple circuit strip.
   d. 20 Amp power rating.
   e. Isolated Ground.
3. Acceptable Products:
   a. Middle Atlantic MPR series, as required. Provide with compatible 20A remote controlled power raceway, as required.
   b. Lowell POWERSTAC Series, as required. Provide with compatible 20A remote controlled power raceway, as required.
   c. Equivalent.

D. Vent Panels:
1. 16-gauge flanged perforated steel with black smooth or textured enamel finish.
2. Acceptable Products:
   a. Middle Atlantic VTF series.
   b. Atlas Sound SVP19 series.
   c. Lowell SVP series.
   d. Approved equal.

E. Rack Drawer:
1. Lockable rack mount heavy-duty drawer with spring latch to keep drawer closed.
2. Acceptable Products:
   a. Middle Atlantic D series drawers. Size as indicated on drawings.
   b. Atlas Sound SD series, size as indicated on contract drawings.
   c. Lowell UDE series, size as indicated on contract drawings.
   d. Approved equal.

F. Pull Out Rack Shelf:
1. General: Slide out rack-shelf for support of portable equipment, capable of latching in open position.
2. Acceptable Products:
   a. Middle Atlantic SS.
   b. Lowell SLS.
   c. Approved equal.

G. Fixed Rack Shelf:
1. General: Universal rack-shelf for non-rack mount equipment.
2. Acceptable Products:
   a. Middle Atlantic U1.
   b. Middle Atlantic WUSS15.5
   c. Atlas Sound SH1-10.
   d. Lowell US-110.

H. Brush Grommet Panel
1. Acceptable Products:
a. Middle Atlantic BR2.
b. Lowell CBP -2.
c. Equivalent.

I. 4-RU Ceiling Enclosure
1. General:
a. Plenum rated equipment rack enclosure
b. Pull-down 4-RU rack cage with gas spring assisted ball-bearing slide
c. Enclosure is 12" high and capable of carrying 25lbs. of electric equipment
d. 1"/1.25"/1.50" trade size KO's for line voltage wiring
2. Acceptable Products:
a. FSR CB-224S

2.14 CABLING

A. The following tables list the cabling and connectors that have been approved for the project. This is not an all-inclusive list of the cabling required to complete the installation and fabrication of the audiovisual systems. The contractor may submit cable part numbers, models, and product data for cable that is not listed in the table for approval by the consultant.

Application	Description	Manufacturer	Model No.	Comments
Audio				
Microphone	22 AWG STP	West Penn Belden Liberty	291 8761 22-2C-SH-GRY	Equal
Microphone/Line Level (Plenum)	22 AWG STP	West Penn Belden Liberty	25291 88761, 87761 22-2C-PSH-WHT	Equal
Line Level	20 AWG STP	West Penn Belden Liberty	292 8762 20-2C-SH-GRY	Equal
Intercom	20 AWG STP	West Penn Belden Liberty	292 8762 20-2C-SH-GRY	Equal
Speaker Low Z - Mains and Subwoofers	10 AWG UTP	West Penn	HA210	Equal
Speaker Mains	12 AWG UTP	West Penn Belden Liberty	227 8477 10-2C-GRY	Equal
Speaker Mains (Plenum)	12 AWG UTP	West Penn Extron Liberty	25227 SPK-14 12-2C-P-WHT	Equal
Speaker General Purpose	14 AWG UTP	West Penn Belden Liberty	226 8473 14-2C-GRY	Equal

Speaker General Purpose (Plenum)	14 AWG UTP	West Penn Extron Liberty	25226 SPK-14 Plenum 14-2C-P-WHT	Equal
Speaker General Purpose	16 AWG UTP	West Penn Belden Liberty	225 8471 16-2C-GRY	Equal
Speaker General Purpose (Plenum)	16 AWG UTP	West Penn Extron Liberty	25225 SPK-16 Plenum 16-2C-P-WHT	Equal
Speaker General Purpose	18 AWG UTP	West Penn Belden Liberty	224 8461 18-2C-GRY	Equal
Speaker General Purpose (Plenum)	18 AWG UTP	West Penn Extron Liberty Belden	25224 SPK-18 Plenum 18-wC-P-WHT 89740	Equal
Video				
SMPTE 311M Hybrid Broadcast	2-Single Mode 9µ Mode Field 125µ Cladding 2-24 AWG UTP 4-20 AWG UTP 1-16 AWG Steel	Gepco Belden Camplex	HDC920 7804Ex LEMO FUW-PUW Outside Broadcast Version	Equal
Precision Video	75 Ohm Coax RG-6U	West Penn Belden Alpha	6350 1694A 6458	Equal
Precision Video	75 Ohm Coax RG-59U	West Penn Belden Alpha	819 8241 9102	Equal
Video In Rack	75 Ohm Coax RG-59U	West Penn Belden Alpha	819 8241 9102	Equal
CATV Trunk Lines	75 Ohm Coax RG-11/U	West Penn Belden Liberty	821 9064 RG11-CATV-BLK	Equal
CATV Trunk Lines (Plenum)	75 Ohm Coax RG-11/U	West Penn Liberty	25821 RG11-P-CATV-WHT	Equal
Control and Data				
ALS Antenna	50 Ohm Coax RG-8U	West Penn Belden Liberty	810 7733A RG8-CMP-BLK	Equal
ALS Antenna	75 Ohm Coax RG-59/U	Belden West Penn	1370P 25815	Equal
Category 5e	23 AWG UTP	West Penn Belden Liberty	4245 DataTwist 1200 24-4P-L5-EN	Equal
Category 6	23 AWG UTP	West Penn Belden Liberty	4246 DataTwist 2400 24-4P-L6	Equal

Category 6 (Plenum)	24 AWG UTP	Belden Liberty	DataTwist 7882A 24-4P-P-L6	Equal
RS232/422	24 AWG STP	West Penn Belden Black Box	D2404 9925 Series Extended Distance Data Cable	Equal
Crestnet/AXLink	2-18 AWG UTP with 2-22 AWG STP	West Penn Liberty Crestron	77350 Cresnet/AXLINK CRESNET-NP	Equal
Crestron/AXLINK (Plenum)	2-18 AWG UTP with 2-22 AWG STP	Crestron	Cresnet-P-BK-SP500	Equal
Crestron DigitalMedia	4 pr 24AWG STP (shielded)	Crestron	DM-CBL-ULTRA-NP-SP500	No Equal
Crestron DigitalMedia	4 pr 24AWG STP (shielded)	Crestron	DM-CBL-ULTRA-P-SP500	No Equal
Crestron Fiber Optic DigitalMedia	OM3 Type 50/125um x 4 Multimode Fiber	Crestron	CRESFIBER8G-NP	No Equal
Extron XTP DTP	4 pr 24AWG STP (shielded)	Extron	XTP DTP 24/1000	No Equal
Extron Fiber Optic XTP	OM4 Type 50/125um x2 Multimode Fiber	Extron	OM4 MM P	No Equal
Interface Cables				
HDMI Interface Cable	High-speed Category 2 HDMI Cable w/locking connectors	Crestron Perfect Path	CBL-HD-LOCK 700 Series	Equal
DVI Interface Cable	Dual Link DVI-D	Crestron	CBL-DVI	Equal
Display Port	DisplayPort 1.2 cable 25’	Extron	26-657-25	Equal
25' Microphone, Line, and Intercom	22 AWG STP	Whirlwind Wireworks	WMKPVC-25 C-25	Equal
50' Microphone and Intercom	22 AWG STP	Whirlwind Wireworks	WMKPVC-50 C-50	Equal
25' Monitor Speaker	12 AWG UTP	Whirlwind Pro Co	SK525G12 S12NN-25	Equal
Mulit-pin to Fan-Out	12 Pair Multi-conductor 23 AWG STP	Whirlwind	FM120NRW1IF12	Equal

2.15 Approved connectors

A. Connectors listed below are suggested for use with the specified cabling. The list may not include all of the connectors required to complete the installation of the systems. If a different cable is submitted for approval by the consultant, provide the appropriate connector for the cable as part of the cable submission.

Application	Description	Manufacturer	Model No.	Comments
Audio				
Mic/Line/Intercom	XLR Male Panel Mount	Neutrik Swtichcraft	NC3MX A3M	Equal
Mic/Line/Intercom	XLR Female Panel Mount	Neutrik Switchcraft	NC3FD D3F	Equal
Combo Line	XLR plus ¼" Phone Panel Mount	Neutrik	NCJ5FI-S	Equal
Mic/Line/Intercom	XLR Male Inline Cable	Neutrik Switchcraft	NC3MD A3M	Equal
Mic/Line/Intercom	XLR Female Inline Cable	Neutrik Switchcraft	NC3FD A3F	Equal
Mic/Line Multipin	12 Pair Female Panel Mount	Whirlwind	W1CM	Equal
Mic/Line Multipin	12 Pair Male Inline Cable	Whirlwind	W1IM	Equal
Mic Broadcast	DT-12 Male Inline Cable	Whirlwind	DT12IM	Equal
Mic Broadcast	DT-12 Female Panel Mount	Whirlwind	DT12CF	Equal
Speaker	4-Pole Panel Mount	Neutrik	NL4MP	Equal
Speaker	8-Pole Panel Mount	Neutrik	NL8MPR	Equal
Speaker	4-Pole Inline Cable	Neutrik	NL4FC	Equal
Speaker	8-Pole Inline Cable	Neutrik	NL8FC	Equal
Video				
Hybrid Broadcast	Hybrid Panel Mount Male	Lemo	FMW.3K.93C.TLMC96Z	Equal
Hybrid Broadcast	Hybrid Panel Mount Female	Lemo	PEW.3K.93C.TLCC96Z	Equal
Precision Video	75 Ohm Panel Mount	Neutrik Trompeter Kings	NBB75DFG UBJ28 KC-99-54	Equal

Precision Video	75 Ohm Inline Cable RG-6	Neutrik Trompeter Kings	NBNC75BTU11 UPL2000 Series 2065-10-9	Equal
Precision Video	75 Ohm Inline Cable RG-59	Neutrik Trompeter Kings	NBNC75BLP9 UPL-220-014 or -023 2025-51-9 or 2025-53-9	Equal
Recessed Video Receptacle	75 Ohm Pass-Thru	Canare	BCJ-JRU	Equal
Control and Data				
50 Ohm ALS Ant.	50 Ohm BNC Cable Mount	West Penn	CN-BM53-13	Equal
Ruggedized RJ-45 Cat 5 Receptacle	Ruggedized RJ-45 Panel Mount	Neutrik	NE8FDV-YK-B	Equal
Ruggedized RJ-45 Cat 5 Connector	Ruggedized RJ-45 Inline Cable	Neutrik	NE8MC-1	Equal
Ruggedized RJ-45 Cat 6 Receptacle	Ruggedized RJ-45 Panel Mount	Neutrik	NE8FDY-C6-B	Equal
Ruggedized RJ-45 Cat 6 Connector	Ruggedized RJ-45 Inline Cable	Neutrik	NE8MC6-M0	Equal
Cat 6a Panel Connector	D-shape $CAT6_A$ panel connector, shielded, IDC termination, nickel housing	Neutrik	NE8DX-Y6	Equal
Cat 6a Panel Connector	D-shape $CAT6_A$ panel connector, shielded, IDC termination, nickel housing	Neutrik	NE*FDX-Y6-B	Equal
RS232 Receptacle	RS232 Panel Mount Male	Amphenol	DB9S-SFJ	Equal
RS232 Receptacle	RS232 Panel Mount Female	Amphenol	DB9S-SMJ	Equal
RS232 Connector	RS232 Inline Cable	Amphenol	DB9S-SFJ or DB9S-SMJ w/metal backshell	Equal
Crestron DM Connector	Shielded RJ45	Crestron	DM-Conn	No Equal

Crestron DM Fiber Optic	SC 50um Fiber Connector	Crestron	CRESFIBER-CONN-SC50UM-12	No Equal

PART 3 - EXECUTION

3.01 General

A. Equipment will be installed by competent workers at locations shown on the drawings in strict accordance with approved shop drawings and manufacturer's instructions.

B. Equipment is to be firmly held in place, with the exception of portable equipment. This shall include loudspeakers, enclosures, amplifiers, cables, etc. Fastenings and supports adequate to support their loads with a safety factor of five, unless otherwise stated.

C. Take such precautions as necessary to prevent and guard against electro-magnetic and electro-static hum and to install the equipment so as to provide safety for the operator.

D. Protect equipment, including patch panels, connectors, receptacles, racks, consoles, and video projectors, from construction dust and debris until final acceptance of the system.

3.02 System DEMONSTRATION AND CHECKOUT (COMMISSIONING)

A. System installation will be certified complete and in fully adjusted working order by contractor. Fill in and submit the Avixa Audiovisual Systems Performance Verification Checklist form prior to scheduling formal commissioning.

B. Fully Adjusted Working Order requires a system to be functional, set for normal operating conditions, and ready to be demonstrated to the AV consultant and end users for training and operation. This includes: termination of field and internal equipment rack cabling, cable labels, equipment labeling, installation of control system code, testing of devices under touch panel or button panel control, remote control panels, external control sensors, IP and network settings, image adjustments, audio mixing, level and equalization adjustments, assistive listening tests, and external sub-system device control. Fully demonstrate spares or pool equipment supplied under the contract; including auxiliary interconnecting cables and accessories.

C. Confirm test results and data obtained and submitted for review during final commissioning, as requested.

D. Provide as-built drawings, manuals, and configuration software available to consultant during the final testing and commissioning. System Demonstration and Testing does not define the entire scope of proof of performance of the AV systems. Detailed performance requirements are listed in Section 3.11 below.

3.03 LABELS:

A. Except where otherwise specified, label as shown on drawings and as specified each item of rack-mounted equipment, switches, controls, and receptacles.
   1. Connector and Rack Panels: Constructed of engraved and filled anodized aluminum plates. Minimum 1/8" plate thickness. Dry transfer or other types of adhesive labels not acceptable.
   2. Rack-Mounted Equipment: Labels constructed of engraved and filled plastic laminate engraving stock. Designate function and input and output line(s) or loudspeaker(s) served by labeled equipment. Key designations to system

functional and patch panel diagrams. Where possible, mount labels on blank panel directly above corresponding component. For modular equipment, provide label on inside of mainframe door identifying type of module for each slot (unless there is only one type) and gain setting as established at final checkout.

3. Identification Panel: Install panel with 1/8"-high engraved characters on the front of the bank of equipment racks serving each space. Clearly identify the Project, System Installation Contractor, Architect, and System Designer in the following format:

PROJECT:	Owner's Name Address Room or spaces served Owner's technical support telephone
SYSTEM DESIGNER:	Acentech Incorporated 33 Moulton Street Cambridge, MA 02138 (617) 499-8000
SYSTEM INSTALLER:	Company Name Address Telephone
PROJECT ARCHITECT:	Company Name Address Telephone

4. Receptacles: Engrave and fill receptacle label directly on mounting plate as indicated on Contract Drawings.

B. Identify wires and cables at every termination and connection point with the specified cable markers. The contractor is strongly encouraged to use a numbering scheme that identifies cables terminating at patch panel jacks with the patch bay row and jack designation; use A, B, and C suffixes to distinguish multiple cables terminating at the same jack.

C. Identify switches, relays, terminal blocks, etc., with reference numbers keyed to the as-built wiring diagrams.

D. Room numbers appear on the contract documents for reference only. Labels shall reflect the Owner's final room designations.

E. Labels and legends shall be as approved on shop drawings.

F. Cable Markers:
1. High-grade PVC clip-on or permanent-type cable markers with permanent markings, or printed vinyl tape protected by clear shrink tubing or adhesive wrap.
2. Acceptable Products:
   a. Wieland Electrovert Type C or Z.
   b. Brady B-702 with Alpha FIT-221 series clear tubing.
   c. Brady BMP21-PLUS.
   d. Dymo RHINO 6000

3.04 MICROPHONE EQUIPMENT

A. General:

B. Excluding wireless microphones, each portable microphone provided with case, stand adapter, and min. 15 ft. cable with attached XLR-type connector.

C. Condenser Gooseneck Microphone:
   1. Permanently mount to lectern.
   2. Locate to provide typical 6" to 18" working distance between microphone and lecturer's mouth.

D. Subminiature Microphones:
   1. Boundary Microphone:
      a. Mounted flush in ceilings (electrical boxes) and or furniture tops in locations as indicated.
      b. Provide isolation from air handling noise.
      c. Install with manufacturer provided isolation hardware.
   2. Multi-Element Array Microphone:
      a. Install with manufacturer supplied hanging or wall mounting brackets.
   3. Hanging Microphone:
      a. Suspended below ceilings at elevation shown or a minimum of 6” in locations as indicated.
      b. Install with manufacturer provided isolation hardware.

E. FM Wireless Microphone System:
   1. Orient antennas as recommended by manufacturer. Locate in positions shown on drawings.
   2. Antenna Cables: Use specified low-loss 6/U (75 ohm) or 8/U (50 ohm) cable, impedance as required.
   3. Except for transmitter equipment, equipment including preamps and active combiners requiring DC power provided with power supplies or powered by receivers (battery operation is not acceptable).
   4. Do not mount antennas or attached preamplifiers directly to any metal structure. Mount at least 3 ft. from any large metal object.
   5. Dual-Antenna Phase/Diversity System (Telex, Shure, Sennheiser): Use 2 antennas, both vertically oriented, observe manufacturer’s minimum required spacing.

F. Digital Wireless Microphone System:
   1. Install remote antennas min. ½ wavelength in distance from each other (UHF frequencies).
   2. Antenna Cables: Use specified low-loss 6/U (75 ohm) or 8/U (50 ohm) cable, impedance as required by manufacturer.
   3. For systems with Digital Transceivers (access point), mount with face aimed at desired coverage area.
   4. Do not obstruct the microphone/transceiver line of site.
   5. Observe minimum separation between mounted access point/transceivers.
   6. Use RF spectrum scanning utility where required for RFI (Radio Frequency Interference) conflicts.

3.05 AMPLIFIERS AND DIGIITAL AUDIO SIGNAL PROCESSORS

A. Gain Control Security:
   1. Amplifiers and Signal Processing Equipment: Power amplifiers and signal processing equipment with front panel controls or power switches which are to be permanently adjusted (not normally adjusted by the operator), such as equalizers, distribution amplifiers, limiters, and audio delays, shall be furnished with lockout of front-panel controls, security panels, or be mounted on subpanel behind blank panels. Provide transparent plastic panels for viewing of indicators such as meters or LED indicators.

B. Audio DSP and Surround Processing:
   1. Install all equipment to manufacture specifications and industry standards.
   2. Adjust the system gain and equalization to meet specifications. Adjust equalization curves as required for speech and program audio playback.
   3. Record and store all DSP configuration files.
   4. Test all functions of each piece of audio DSP equipment, including front panel and remote controlled functions.

3.06 LOUDSPEAKER EQUIPMENT

A. Loudspeaker Arrays:
   1. Carefully inspect the site to verify that no obstructions, such as beams, panels, large framing members, etc. exist between high-frequency horns and any seating area covered by the horns. Immediately notify Architect of any such obstructions.
   2. Provide and install safety cable to secure all loudspeaker components and mountings.
   3. Provide all structure and framework as required to properly support the loudspeakers in the indicated locations. Provide shop drawings of proposed structure for review prior to fabrication. Obtain the stamp of a structural engineer registered in the same state as the construction site on shop drawings which depict loudspeaker cluster structure, framework and support system(s).
   4. Paint all components and provide cloth grilles for loudspeaker enclosures as required by Architect.

B. Ceiling-Mounted Loudspeaker Enclosures and Grilles:
   1. Ceiling Enclosures: Enclosures supported directly from ceiling structure in an approved manner. Support directly by acoustical ceiling tile is NOT ACCEPTABLE.
   2. Flush and Surface-Mounted Ceiling Enclosures: Provide enclosures where indicated on drawings.
   3. Surface-Mounted Wall Enclosure: Located as indicated on drawings. Coordinate enclosure colors with the Architect.

3.07 Assistive Listening System

A. Infrared Assistive Listening System:
   1. Orient Infrared modulators panels as required by manufacturer noting mounting height, angle, coverage pattern. Locate in positions shown on drawings.
   2. Test all receivers with program material for noticeable dropouts in signal.
   3. Test all IR receiver accessory headphones and neckloops.

B. RF Assistive Listening System:

1. Orient external coaxial dipole antenna ground plane in proper direction.
2. Test all receivers with program material for noticeable dropouts in signal.
3. Test all bodypack receiver accessory headphones and neckloops.
4. Provide field strength data and commissioning report to AV consultant.

C. Loop Current Assistive Listening System:
1. Coordinate the initial site survey for magnetic interference (background noise) with the loop system designer or manufacturer. Use manufacturer supplied test kit for loop current measurements.
2. Adjust loop transmitters and antenna systems to meet IEC60118-4:2006 induction loop standards including; field strength 400mA/m, frequency response 100-5000Hz ±3dB relative 1000Hz., and background noise 47db S/N ratio.
3. Install any flat under-carpet cable with specified warning tape to alert carpet installers and others to presence of loop wiring.
4. Test loop receivers and accessory headsets using approved field strength meter.

3.08 Video Equipment

A. Video Projectors:
1. Verifications:
a. Verify lens selection, locations, and elevations shown on drawings using manufacturer's throw distance and elevation formulas for specified projector model.
2. Submittals:
a. Provide plan and section drawings verifying image size and format, lens-to-screen distances and mounting methods.
b. Provide detailed drawings of custom-fabricated or stock mounts and hardware.
c. Provide detailed drawings of millwork or finish items required for specified screen dimensions.
d. Where mirrors are required, provide detailed drawings of mounting angles, reflection rays, support structures and hardware.
e. Where projector mounts or motorized lifts are installed by others, provide drawings to guide installer indicating installation positions allowing optimal projector performance.
3. Mounting:
a. Install projector mount and suspend projector at location and elevation indicated on approved shop drawings.
b. Projector mounts and motorized lifts must meet all applicable safety and code requirements for ceiling mounted equipment.
c. Fixed projector mounts must be rigid and completely free of sway or rotation deviation.
d. Projector support pipes shall be only fixed-length pipes as required—do not use adjustable-length pipes.
e. For ceiling-mounted installations where screen surfaces are vertical, level projector at 0° front-to-back and side-to-side.
f. Position projector with lens centered on screen centerline in plan unless projector is provided with horizontal lens shift capability. Do not employ vertical or horizontal electronic keystone correction unless specifically authorized to do so.
g. Wherever possible, minimize hardware and cables visible from audience seating and presenter area viewpoints.

h. Paint exposed mounting hardware to match room interior or as instructed by Architect.
i. Where structural mounts or millwork openings are provided by others, verify correct positioning and dimensions before mounting projector. Provide written notification to the Owner or Architect of any discrepancies in mount positioning or stability deficiencies before projector installation.
j. Where rear projection screen millwork is provided by others, provide written notification to the Owner or Architect of any discrepancies in opening dimensions before screen or projector installation.
k. Provide all necessary projector brackets, fittings, pipes, miscellaneous hardware and wireways.
l. Run cabling from video projector box to projector within projector support pipe.
m. Provide approved security cable for video projectors to accept padlock provided by owner.
n. Confirm that the lift and or projector is isolated from building or external vibrations.
o. When using an external box for projector components make sure the box is adequately ventilated and has enough AC power receptacles.
p. Confirm that the projector fan noise is within the manufacturer's specification.

B. Video Display Panels:
1. Submittals:
a. Provide elevation drawings showing location of video displays for approval. Where display is part of a larger graphic display, verify exact location of display with Architect.
2. Mounting:
a. Install display mount and display at location and elevation indicated on approved shop drawings.
b. For wall –mounted displays, provide mount to support display from blocking, if provided, or from wall studs. If a recessed box is provided behind display for power outlets and electronic accessories, provide mount that does not obstruct access to box.
c. Wherever possible, minimize hardware and cables visible from audience seating and presenter area viewpoints.
d. Where display is mounted in an architectural recess, verify that sufficient clearance (2" minimum) is provided for ventilation airflow.
e. Provide display mounts with security provisions to accept owner-provided locking devices.
f. Confirm that all displays meet proper profile depth per ADA regulations.

C. Pan/Tilt Video Cameras:
1. Submittals:
a. Provide elevation drawings showing location of cameras for approval.
2. Mounting:
a. Install camera at location and elevation indicated on approved shop drawings using approved wall mount or ceiling mount bracket.
b. Maintain clearance for pan/tilt operational limits.
c. Identify and correct with the architect any light source that may interfere with the camera iris or backlight function.
3. Control:

a. Program control system to provide presets for principal views for each camera and provide means for users to modify presets.

4. Power Supply:
   a. Confirm overall PoE+ DC power loading.
5. NDI Cameras:
   a. Follow manufacturer's NDI Licensing and Activation Guide.

D. Digital Media Transmission and Switching Systems:
1. Extended Display Identification Data (EDID):
   a. Do not operate digital media transmission/switching equipment in "automatic EDID" mode, unless equipment provided has no other option.
   b. Do not include resolutions in the EDID table that cannot be handled by display(s).
   c. For systems where laptop computers will be used in "mirroring" mode, ensure that as many possible common resolutions are included in the EDID table without violating provision of preceding paragraph.
   d. For inputs where the source is a fixed device (i.e. a fixed part of the system) create the EDID table with a single entry, again without violating provision of preceding paragraph but one.
2. HDCP Implementation:
   a. For systems containing a non-HDCP-compliant display device, such as a class capture appliance or videoconference CODEC, and where switching equipment supports the capability, dynamically configure input devices for portable equipment such as laptops to report to the equipment as non-HDCP devices when the non-compliant device is in use.

E. USB Video Transmission and Cameras:
1. Extension cabling for USB 3.0,3.1.:
   a. Use active extension cabling with power to transmit uncompressed (5 Gbps) UVC standard video.
   b. For USB cameras powered by PoE+, observe IEEE 802.3at for power and cable distance.
   c. External camera power supplies shall be installed in a plenum enclosure when the camera is ceiling mounted.
   d. Test pan/tilt fully for clearance from obstructions.

3.09 CONTROL EQUIPMENT

A. Audiovisual Control System:
1. Do not mount wireless receiver gateways or antennas near large metal objects.
2. Carefully coordinate with manufacturer and with Architect the dimensions and mounting conditions of all items.
3. Provide all required cable, relays, and miscellaneous hardware to interface the audiovisual control system with controlled equipment.
4. Install all components so as to use the maximum amount of any tally signals provided by the controlled equipment, including lighting dimmer systems and video playback and recording devices.
5. Mount infrared LED emitter probes to face of controlled equipment using thin layer of clear silicone caulk. Position probe to provide control of device while continuing to allow use of infrared control supplied with equipment. Secure probe cables to prevent probe from being accidentally pulled from equipment during normal system operation.

B. Ethernet/IP/Local Area Network Accessibility and Control:
   1. Coordinate Ethernet connectivity and IP addressing of control devices with Electrical Contractor and the Communications/Technology management of the facility. Owner will provide all required IP addresses to AV contractor.
   2. Provide owner with remote control and management software interfacing via Local Area Network access from PC to any IP addressed control devices.
   3. Coordinate with end-user and Communication/Technology management of the facility, on POP-3 email notification of system service issues where desired and /or where possible. Co-ordinate with Owner and Communications/Technology management of the facility on POP-3 email of service or security issues in case of failure or disconnection of any bi-directional (e.g. RS-232 or Cresnet/AXLINK) device.
   4. Verify requirements of system control via IP with or Owner and Consultant.

C. Local Area Network Management Programming:
   1. General:
      a. Verify requirements of room management/scheduling via IP with or Owner and Consultant.
   2. Room AV system control:
      a. Use included software and Ethernet connectivity hardware of control systems.
      b. Program remote site portal to replicate appearance and function of control touch panel.
      c. Control program can be launched locally from designated AV technician computers as stand-alone ".exe" Windows-based executable file.
   3. Remote System Status Monitoring and Management Programming:
      a. Use included software and Ethernet connectivity hardware of control systems.
      b. Provide system-wide and room-specific monitoring and management including:
         1) Room activity and system shut-down scheduling.
         2) Multiple user level password settings, including password change and lock-out of certain user passwords at certain times.

D. POP-3 Email Notification Programming and Set-up:
   1. Via included software and Ethernet connectivity hardware of control systems.
      a. Provide service issue notification via pre-programmed email messages to designated service accounts ONLY if requested by end-user AV support technicians and ONLY if control system includes POP-3 mail server.
      b. Coordinate with AV Consultant and Owner to determine proper conditions and destinations for email service.
      c. Provide notification of AV system service issues.

E. Audiovisual Control System Programming:
   1. All programming to be performed by programmer certified by the manufacturer of the AV control system equipment provided.
   2. Program system or instruct AV Control System Manufacturer to program system as instructed by the AV Consultant and the Owner, and as indicated on the drawings so that all devices are controlled in a logical manner, and to take full benefit of the capabilities of the Control System.
   3. Submit for approval changes to programming or control panels required by actual conditions (e.g. number of dimming system presets).

4. Refine and adjust, as required, programming to operate in a logical and consistent fashion. Make revisions to program as directed by the AV Consultant at checkout to correct operational inconsistencies or to properly control devices.
5. Ascertain that the system is optimally programmed for smooth transitions between media uses and for minimal wear-and-tear on equipment and audiovisual media.
6. Verify that video playback device transports, etc., are stopped when another input source is selected, unless playback device is routed to a different destination from the selected source.
7. Wherever possible, utilize status feedback of source equipment, dimming systems, etc., to indicate to the control system and user the actual operating mode of the equipment. When feedback is not available (e.g. consumer playback equipment) program control system to issue commands as required to minimize status reporting errors.
8. Provide color electronic drawing files of screen layouts of touchscreen control panels for approval prior to system programming. Indicate colors used for buttons on color panels.
9. Distinguish between primary and secondary control buttons by intensity or color. If available, use “3D” buttons to indicate button activation as visually “depressed”. Avoid excessive use of primary or other bold colors.

F. Color Video Touch-Screen Control Panels:
1. Submit panel graphics (including text, buttons, colors, images, backgrounds etc.), as well as panel flips, sub-panels and overall screen logic flow to the Owner and Consultant for review and approval.
2. Use Crestron Studio® or AMX TP Design 5 (G5 panel support) for panel logic programming and design; make software files available directly to the end user upon request, free of charge.
3. Join numbers (other than those reserved for panel logic), hardware programming and all other installation requirements including programming software and computers are the responsibility of the installing contractor.
4. Any adjustments, revisions, modifications, etc. to the panel graphics and control system required for complete operation are the responsibility of the installing contractor.

G. Lectern Control Panel:
1. Coordinate the touch panel cut-out with furniture manufacturer.
2. Provide furniture manufacturer with mounting template.
3. Verify size and mounting conditions with Architect.

H. Master and Portable Control Panels:
1. Install local control panels in associated backboxes, as required.
2. Verify size and mounting conditions with Architect.
3. Confirm operation of portable wireless panels, WAP access points, and Gateways.
4. Provide portable panels to Owner as part of Portable Equipment turnover.

I. Control System Functions:
1. Following are general descriptions and guidelines for control system panel functions and layouts:
    a. Turn system power on/off.
    b. Input Source selection.
    c. Separate speech and program audio volume controls. Preset microphone and audio playback levels on startup.

d. Recovery from power outage.
e. Control digital signal processors to provide system presets indicated in this specification or on the AV drawings or others as required.
f. AC power failure and switchover to UPS.
g. Others as identified elsewhere in the Contract Documents or required.
h. After system shut-down, system will restart with default settings restored.

2. Following are specific descriptions and guidelines for control system panel functions and layouts:
   a. Volume Control (provide separate microphone and program audio volume controls where applicable).
   b. Projection screen up/down.
   c. Transport controls for all applicable AV sources.
   d. Select which video input is actively displaying and playing audio through the AV system.
   e. Others as identified elsewhere in the Contract Documents or required.
3. Where applicable, configure the audiovisual control system(s) with the following operation(s):
   a. Control system shall communicate with video display devices (particularly video projectors) during start-up and shut-down. Feedback shall be provided on the control panel indicating when the projector is cooling down, and inform the user that the projector cannot be restarted until cool-down is complete.
   b. Control system, audio signal processors, and digital video switch equipment will connect to the UPS where these devices are specified. Control system shall communicate with UPS device. In the event of a power outage, after one minute has passed, control system shall instruct the other UPS-connected devices to shut-down properly in order to protect their programming. After power is restored, user will be required to restart system from control panel.
4. Interface with Fire Alarm System: The audiovisual system shall connect to the FAS as identified on the drawings. Systems shall be muted when triggered by the FAS.

3.10 Networked AV & Security

A. All equipment to be configured to prevent unauthorized users from access to the systems and network and prevent disclosure of confidential information.

B. Default passwords of internet connected audiovisual equipment are readily known and can be used as a means to access network equipment by unauthorized users. AV networked devices may include any device with a wireless or wired Ethernet port.
   1. Assign role based access control with different levels of access and permissions for each user type:
      a. Admin – Ability to make changes to network, security configurations, and user accounts.
      b. AV Configuration – Ability to make changes to AV Parameters.
      c. System User – System operation only.
      d. Others as required by the Owner.
   2. Change all passwords from default values to project specific passwords. Follow industry recommended password strength standards when choosing new passwords.
   3. Provide new passwords to the Owner.
   4. Provide instructions to change passwords.

C. AV Network Switches:
   1. Do not connect unauthorized AV network switches to the Owner's LAN.
   2. Provide logical separation of AV and IT networks through hardware and VLAN's.
   3. Disable unoccupied ports and services on managed switches.

3.11 Projection Screens

A. General: Install projection screens at locations indicated to comply with screen manufacturer's written instructions.

B. Install front-projection screens with screen cases in position and relationship to adjoining construction indicated. Securely anchor to supporting substrate in a manner that produces a smoothly operating screen with vertical edges plumb and viewing surface flat when screen is lowered.
   1. Test electrically operated units to verify that screen, controls, limit switches, closure, and other operating components are in optimum functioning condition.

3.12 RACKS, CABLES, CONNECTORS, AND MISCELLANEOUS EQUIPMENT

A. Wiring and Interconnections:
   1. General:
      a. Exercise care in wiring to avoid damage to cables and equipment.
      b. Make all joints and connections with rosin-core solder or approved mechanical connectors, except mechanical connectors are NOT acceptable on microphone lines. Connections to transformer leads for distributed loudspeakers may be made using properly-sized wire nuts or nylon-insulated pigtail crimp connectors such as Waldom CE series. Wire nuts are not acceptable except at individual loudspeakers.
      c. All connections to screw-type terminals shall be made using spade lugs. Bare or tinned wire is not acceptable.
      d. All connections to lugless compression-type screw terminals shall be made using bare wire only. Do not tin wire.
      e. All wiring executed in strict adherence to standard broadcast practices. This includes:
         1) Dress cables in conveniently sized bundles, combed into parallel runs, either laced or banded with sufficient plastic ties.
         2) For equipment mounted on glides, or otherwise requiring servicing from the front of the rack incorporate a cable "service loop" of sufficient length to permit the equipment to be pulled forward from the rack for servicing.
         3) Support cables and bundles with sufficient plastic ties and support bars to ensure that no strain is placed on any connections or connectors.
         4) Organize cables and cable bundles behind patch bays to permit easy access to the patch panels to add or remove cables.
         5) Place cable markers 3"-5" back from video connectors to permit easy viewing. Do not bind markers into cable bundles.
      f. All audio signal lines carried by twisted-pair cable and switched with two poles per line unless noted otherwise. Do not tie one side of audio line to other audio lines.
   2. Grounding:
      a. Ground equipment, racks, and audio line shields to independent audio system ground ONLY as shown on drawings. If not shown on drawings,

ground case of power striplines in equipment racks to the racks and directly to isolated ground buss in the power panel or to power system ground at the building AC service entry only.

b. Ground all conduits ONLY to power system ground. Insulate all conduits and electrical boxes from sound system, including equipment racks and audio system ground.
c. Insulate all conductors in conduit, including shields, from the conduit, back boxes, and from each other for the entire conduit length.
d. Equipment Racks:
e. Install equipment in racks to permit access to all equipment for service. Transformers, relays, terminal blocks, etc., mounted in rear of racks behind other equipment shall not prevent access to equipment connections or shall be mounted on hinged panels to permit access.
f. Wire all racks completely in the shop. No internal rack wiring to be done on the job site.
g. Install equipment in racks with ventilating panels as required to provide adequate ventilation and according to equipment manufacturer's recommendations.
h. Provide unused panel space with blank or ventilating panels.
i. Locate patch panels at least 30" above floor.
j. Locate free-standing racks as indicated and to provide access to rear without moving racks.
k. For permanently located racks containing equipment on glides, with desk/control surfaces, or which may be unsteady from cantilevered devices or personnel, bolt all racks to the concrete floor slab (through the access flooring if necessary).
l. Bolt adjacent racks together on at least 3 locations along both the front and rear edges.
m. Equip racks not bolted to the floor because of service access with "Anti-tip" bases, casters and brake.

3. Wall-Mount Equipment Racks:
   a. Drywall Partitions: Before installation of drywall material, install blocking or other bracing required to support weight of equipment rack.
   b. If internal wall bracing is not provided before wall is closed in, install ¾” plywood mounting plate secured with drywall screws to at least three separate studs. Size of plate and number of mounting screws as required to support weight of rack. Paint plywood to match wall finish. Strut channel hardware support frame attached to structure is also acceptable.
4. Conduit:
   a. Run lines in metallic conduit or wireways unless otherwise indicated. Run microphone level, line level, loudspeaker level, and DC control wiring each in separate conduit.
   b. Do not locate AC power lines in conduit containing network, audio or video lines.
   c. Do not splice lines in conduit.
5. Exposed Cables:
   a. Line level or mic level lines exposed above countertops (such as those lines serving mixing consoles, program source equipment, etc.) shall be rubber-jacketed, AWG #20 two conductor with braided shield such as Belden 8412 or equivalent. Plastic or vinyl jacketed cables are not acceptable.
6. Receptacles:

a. Wall-mounted receptacles in metal boxes at building standard receptacle height unless otherwise indicated.
b. Floor-mounted receptacles in flush floor boxes with flush lids.
c. Catwalk-mounted receptacles in metal boxes mounted on catwalk hangers at building standard receptacle height.

7. Balanced Receptacles:
   a. Attach "XLR" type connectors to mounting plates with machine screws unless using single-hole mounting types with threaded sleeve and mounting index to prevent rotation.
8. Unbalanced Receptacles:
   a. Install 1/4" phone jacks to mounting plates with insulating washer and sleeve to electrically isolate the jack from the electrical box and conduit.
   b. Install isolation/balancing transformers in electrical boxes or wireways adjacent to each unbalanced receptacle as indicated.
   c. Wire input receptacles to short the line except with connector inserted.
9. Video Receptacles: Install feed-through BNC receptacles to mounting plates with insulating washer and sleeve to electrically isolate the receptacle from the electrical box and conduit.
10. Loudspeaker Wiring:
    a. Note that Functional Diagrams or Conduit Drawings indicate required home runs for loudspeakers and loudspeaker zones. Home run requirements depend on line power loss as well as functional considerations and shall be strictly adhered to.
    b. Loudspeaker lines above ceilings installed using specified UL listed plenum-rated cable. Lines installed as high as possible, directly to undersides of floor or to roof decks above, using strain reliefs, cable ties, or other approved method to attach lines securely and neatly to building structure. Lines installed loosely or otherwise on top of ceiling tiles, ductwork, etc., are NOT ACCEPTABLE.
    c. Floor-to-floor lines installed using specified UL listed plenum-rated cable. Attach lines securely and neatly to building structure using Owner-approved method.
11. Fiber Optic Cables:
    a. Terminate fiber optic strands with connectors compatible with connectors on equipment and with fiber optic cables provided.
    b. Use of compatible quick-connection system is recommended (e.g. Corning UniCam® Pretium Installation Tool Kit for Corning fiber cable; Belden FiberExpress System or West Penn Wire Fiber products with Optimax Installation Tool Kit).
    c. Neatly coil surplus fiber cable using bend radius larger than manufacturer’s minimum bend radius and secure to rack to prevent crimping or damage to cable, or provide rack-mount fiber management.

3.13 SYSTEM PERFORMANCE TESTS AND ADJUSTMENTS

A. Test equipment to verify conformance with manufacturer's performance specifications and with this specification.
   1. Verify systems meet the requirements identified in this section or otherwise within the contract.
   2. Adjust systems as required to conform to testing requirements for any failed tests.

3. Provide results of final, re-calibrated system testing to Architect and AV Consultant for review and approval prior to scheduling of commissioning testing by AV Consultant or any user training provided to Owner.

B. Audio Systems:
   1. Absolute Impedance:
      a. Set any loudspeaker level controls at zero attenuation. Measure absolute impedance value of each loudspeaker line at 250, l000, and 4000 Hz, without amplifier connected but with loudspeakers connected. Impedance shall be at least 90% of rated load impedance of respective amplifier. Check resistance of lines to loudspeaker and microphone receptacles, with receptacles open and short circuited.
   2. Hum and Noise Level:
      a. Adjust gain controls for optimum signal-to-noise ratio and full amplifier output with -55 dBm level at a microphone input and 0 dBm at line-level input.
      b. Without changing gain, terminate microphone and line-level inputs with shielded resistors of l50 and 600 ohms, respectively.
      c. Measure overall hum and noise level at each power amplifier output for each input channel. Level shall be at least 80 dB below rated power output of amplifier over a bandwidth of 20-20,000 Hz.
   3. Electrical Distortion:
      a. Load power amplifiers with resistors matching nominal impedance of output terminals used in system in place of actual loudspeaker loads.
      b. Adjust gain controls as for hum and noise level tests.
      c. Apply 1000 Hz size-wave signal from an oscillator having less than 0.l% total harmonic distortion to each microphone and line-level input at level required to produce measured full amplifier output.
      d. Distortion shall measure less than 0.l%.
   4. Parasitic Oscillation and RF Pickup:
      a. Set up system for each specified mode of operation.
      b. Use 50 - 100 MHz bandwidth oscilloscope and loudspeaker monitoring.
      c. Check to ensure that system is free of spurious oscillation and RF pickup in the absence of any input signal and also with system driven momentarily to full output at l60 Hz.
   5. Buzzes, Rattles, Distortion:
      a. Apply a high-quality music signal to the system. Adjust the loudness for frequent peaks at its specified maximum sound pressure level.
      b. Apply sine-wave sweep from 50-50,000 Hz at 6 dB below full amplifier power.
      c. In both cases, listen carefully for buzzes, rattles, and objectionable distortion.
      d. Correct causes of such defects. If cause is outside the system, promptly notify the Architect and his Consultant, indicating cause and suggested corrective procedures.
   6. Level Balance: Adjust level controls for items of similar equipment for identical measured voltage gain.
   7. Measure system acoustical performance using a sound level meter set for "slow" meter damping except as otherwise noted, and flat response with random incidence at a height of 4 to 5 feet. Interior finishes and furnishings shall be in place, and system gain shall be adjusted to provide levels of 70 to 80 dB and at least 10 dB above background noise at the measuring locations for these tests, except as otherwise noted. Include the following tests and adjustments:
      a. Frequency Response:

1) Measure loudspeaker frequency response with control equalization set for flat response, using 1/3-octave bands of filtered pink noise centered on ANSI preferred frequencies, or broadband calibrated pink noise measured in 1/3-octave bands using a calibrated real-time analyzer.
2) Adjust equalization to provide average system response within ± 3 dB of a response (0 dB) which is flat from 63-2500 Hz and slopes uniformly from 0 dB at 2500 Hz to -5 dB at 10,000 Hz.

b. Uniformity of Coverage:
1) Use 4000 Hz octave band of random noise as test signal output to loudspeakers.
2) Lateral Uniformity: ± 2 dB at positions equidistant from front of hall.
3) Front-to-Back Uniformity: Decreasing linearly within ± 2 dB from 0 dB at front of hall to -6 dB at rear as measured on the hall center line.

c. Maximum Output Level:
1) Measure with standard "fast" meter damping.
2) Loudspeaker Cluster: Capable of providing 95 dB SPL in the audience area on axis of any high-frequency horn and employing wideband recorded music as a test signal.
3) Distributed Loudspeaker Systems: Capable of providing 95 dB SPL on axis of any loudspeaker and using wideband recorded music as a test signal.

d. Speaker Polarity:
1) Using a NTI Minirator MR-PRO, use the generator Sawtooth (WAV) pattern to check the polarity of each program loudspeaker. When the speaker polarity is normal the measuring meeting will display POSITIVE.
2) Correct the polarity of any speaker out of phase.
3) Record results.

C. Video Systems: Test the video system following the approved Proof-of-Performance Test Plan to verify that it meets these minimum performance requirements. .
1. Video Standards:
a. Frequency Response: ± 0.5 dB, 60 to 4.l8 MHz.
b. Crosstalk: -40 dB at 3.58 MHz.
c. S/N Ratio: 45 dB, DC to 4.l8 MHz, unweighted, peak to RMS.
d. Hum: <10 mV peak to peak.
e. Line and Field Tilt: 2% with 60 Hz square wave.
f. Differential Gain: 1% at 3.58 MHz, l0-90% APL.
g. Differential Phase: ± 1° at 3.58 MHz, l0-90% APL.
h. Envelope Delay: ± 0.l microseconds, 0.2 to 2.1 MHz; ± 0.05 microseconds at 3.58 MHz.
i. Color Production: Primary and Complementary Colors (R, G, B, Cy, Yl, Mg) at 75% saturation within inner 50% of the inner boxes (± 2.5°) when viewed on vectorscope.
j. Signal Levels: 1 V p-p, ± l IRE, at 100% peak white color bar.
2. Audio Standards:
a. Frequency Response: ± l dB, 30-l5, 000 Hz.
b. Hum and Noise: -80 dBu, 30-l5,000 Hz, unweighted.
c. Distortion: 0.25% THD, 30-l5,000 Hz.
d. Signal Levels: +4dBu.

D. Video Display Systems: Calibrate each video display system as follows:

1. For projected displays align the image with the black borders of the screen:
   a. If the display uses a variety of aspect ratios use the zoom lens to align the image with the black borders of the screen. If the image does not fill the screen (e.g., a 16:9 screen with 4:3 image) then align top and bottom of image with black border of screen.
2. Allow projector or flat panel display to warm up for a minimum of 30 minutes.
3. Turn off video enhancement circuitry options including image overscan.
4. Set factory color LCD to warm, D65, or other setting to achieve closest approximation to 6500°K color temperature. Set sharpness control to minimum.
5. Adjust black level and video gain:
   a. Reduce ambient light to less than 2 foot-candles of ambient light on screen.
   b. Using the PLUGE (Picture Lineup Generating Equipment) pattern from the signal generator, adjust the brightness (brightness control on most displays) until the “blacker-than-black” bar is visible on the screen and then decrease brightness until the bar just disappears.
   c. Using the grayscale pattern from the signal generator, adjust the contrast control so that the highest grayscale transition disappears and then decrease contrast to make the transition just visible.
   d. Repeat steps b and c as required for stabile results. Record control settings.
6. Adjust color level or gain:
   a. Display SMPTE color bar test pattern. Shut off red and green channels on display or use a blue filter to observe the display.
   b. Adjust color and tint controls for optimum blue balance.
   c. With only red channel operating or with red filter check red balance. Repeat for green channel. If red and/or green balance is significantly out of balance, make minor changes to color and tint controls to achieve best compromise for color control settings.
   d. Record control settings.
7. Adjust sharpness:
   a. Using the S802B or similar pattern, adjust sharpness control for maximum sharpness without ringing (duplicate lines).
   b. Record control setting.
8. Brightness, Uniformity, and Contrast Ratio:
   a. Using the ANSI 9-zone pattern and a spot photometer, measure screen brightness in each zone. Calculate screen brightness as the average of the nine zones and uniformity as the maximum variation from the average.
   b. For a projected image, use the ANSI 16-zone checkerboard test pattern and viewing locations measure the contrast ratio of representative white squares vs. adjacent black squares. Repeat contrast measurement with room lighting at representative viewing level (typically 7fc in seating area).
   c. Record measurements.

E. Digital Video Systems: Provide the following information for systems employing HDMI and/or digital media signals:
1. The video timing (e.g. 1080p 30 fps Deep Color or 1366x768 30 Hz), HDCP use, and audio format of each non-portable digital source when operating.
2. The video timings and supported audio formats for each connected sink.
3. The video timings and supported audio formats presented in the EDID of sinks to each source – indicate the preferred video timing.
4. The length of cable used on HDMI or shielded twisted pair cables used for AV distribution.

5. The data rate supported by each shielded twisted pair cable used for AV distribution.

F. Video Projectors:
1. Provide written verification of completion of the above procedures.
2. After completion of projector set-up, record the following items for inclusion in pre-acceptance test reports:
   a. Current lamp life hours shown on projector (include date), (if lamps are used as a light source).
   b. Provide security service code if required by owner.
   c. Set-up software version number.
   d. Projector, input modules, and decoder card serial numbers for each system.
   e. Date of manufacture.
   f. Date of installation.
   g. List of supplied accessories (remotes, lens caps, tools, cables, backup discs, owner's manuals).

G. Remote Control Systems: Test each function of each control station or touch panel to verify proper operation and that each illuminated button and indicator operates properly when the associated function is selected.

H. Test Reports and Certificates: Submit results of tests and adjustments conducted above and certification that the installation is complete and ready for checkout as specified under SUBMITTALS in PART l - GENERAL.

3.14 FINAL ADJUSTMENTS AND ACCEPTANCE TESTS

A. Upon approval of the contractor's test report, and at a time set by the Architect, assist the Consultant(s) in performing final system adjustments and acceptance tests. Provide labor, material, tools, and measurement equipment necessary for these tests and adjustments, including the test equipment and material specified in Article 1.1, except as otherwise specified.

B. Supply sufficient representatives who are thoroughly familiar with details of the system to assist in the performance of these tests, and include the field supervisor in charge during the course of the installation work.

C. Budget 24 working hours for the performance of these tests and adjustments. If final acceptance is delayed beyond this period because of installation not in accordance with these specifications, pay for additional time and expenses of Consultant(s) during any resultant extension of the acceptance testing period.

D. Acceptance tests may include speech intelligibility surveys and subjective evaluations by observers listening at various positions under various operating conditions, using speech, music, and live or recorded effects material.

E. Measurement of frequency response, distortion, noise, or other characteristics may be performed on any item or group of items deemed necessary to determine conformity with specifications.

F. Adjustments: Adjust the system as instructed by the Consultant. Adjustments may be required to any portion of the system including:

1. High-frequency horn aiming.
2. Loudspeaker digital beam steering.
3. Equalization and level balance.
4. Timing and functioning of the audiovisual control system.
5. Video projector alignment, contrast, brightness, and color content.
6. Video wall uniformity and color balance.

END OF SECTION