

SECTION 27 41 16

MEDIA SERVICES AUDIOVISUAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This section includes equipment and installation requirements for audiovisual systems in Lecture Hall K.
- B. This scope is intended to be an equipment replacement and upgrade.
- C. Note that this lecture hall, Lecture Hall K, is also a mock trial room and therefore has special seating consideration and besides an instructor desk has a smaller witness stand. The special seating consideration is an area designed for the mock jury.

1.2 FUNCTIONAL DESCRIPTION

- A. General Notes:
 - 1. Ceiling mounted Motorized screen will be replaced with a larger screen.
 - 2. Existing video projector to remain.
 - 3. Suspended flat panel locations to remain with new larger flat panels.
 - 4. New flat panels are provided and installed in the teaching desk.
- B. Lecture Hall K Functional Description:
 - 1. Owner furnished PC is mounted within the instructor's desk at the front of the room.
 - 2. Most of the existing wiring infrastructure remains and is reused.
 - 3. Two of the front wall mounted XLR mic receptacles are reconnected for wired microphones. Floor mounted microphone receptacles is not reconnected. Audio and video connections under the instructors' station are reused and reconnected to the new system.
 - 4. Ceiling mounted Motorized screen is upsized and changed to 16:9 aspect ratio. Existing front wall mounted control switch is reconnected.
 - 5. Existing video projector remains.
 - 6. Two front video monitors are replaced using the existing mounts.

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7. Three flat panels in the front lecture station flat panels are replaced. Smart panel for displayed image markup, video monitor panel to show what is being projected behind the instructor and also a touch panel for audio and video control.
8. One replacement new video monitor is also installed in the Witness stand.
9. Remote control system is installed and programmed to turn the video projector and all installed flat panels ON or OFF, select the input for display.
10. The control for the motorized screen is on the wall and duplicated on the remote control button panel.
11. The two front flat panels and the projected image all display the same image along with the monitor flat panel in the instructor's desk.
12. The instructors desk has an input connection plate for both analog (VGA plus audio) and a digital (HDMI) video.
13. The instructors desk also retains the Visualizer camera stand.
14. The video selection switch also can select a wireless receiver so the teaching staff or any student's computer can be selected. The person to be displayed simply enters the room name on their computer and the instructor select the wireless input.
15. A rear Pan/Tilt/Zoom ceiling mounted video camera connects this lecture room to the Trial Advocacy PC. A front wall mounted static mount camera is also connected to this recording PC.
16. The rear camera connection to the video switch provides a signal path to the video conferencing PC by the instructor.
17. Besides the camera stand, the Digital marking display (Smart Panel) is connected for instructional display.
18. Flush front wall mounted loudspeakers are installed for audio playback purposes.
19. Existing loudspeakers installed on the metal AV structure remain for speech reinforcement.
20. Existing wireless microphones remain and are reconnected.
21. A video switch is installed for selecting the sources for display.
22. Existing microphones are used to connect for connection to the existing lecture capture system. Recording is stored in the local rack and also in the control room.

1.3 AUDIOVISUAL CONTRACTOR BID

- A. Furnish and install an itemized bid with full pricing for each item. The Owner reserves the right to exclude items or rooms as the budgetary needs dictate.

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- B. The Owners Representative may also add or delete individual devices or items to the device list and will use current published list price as a negotiating point for installed price.
- C. The entire project includes all work shown on the AV drawings in addition to this specification section. Refer to this specification for relevant interconnections. Note some work is specified as Alternate, future or Owner Provided.
- D. Price quote documentation: Document individual dollar amounts and equipment list for all items in the bid. Note that this project may undergo post-bid negotiation. Unit pricing is required as a basis for this negotiation. Unit pricing for the Owner supplied devices is for installation and any modifications which may be required to make the existing device work in the new location.
- E. Provide an ADD and DELETE factor for changes to the system. This factor should be based upon current list price for the device or material added to the project or deleted from the project.
- F. ADD Factor: A multiplier for each device added to the project. This multiplier includes cost of the product, shipping, tax, engineering and installation. If the device being added is labor intensive, identify any other factor which may apply.
- G. DELETE Factor: A multiplier for each device deleted from the project. This multiplier includes cost of the product, shipping, taxes paid, restocking charge, engineering (documented as performed) and any installation (documented as performed).

1.4 AUDIOVISUAL CONTRACTOR RESPONSIBILITY

- A. Furnish and install a complete and functioning audiovisual system including cabling, receptacle plates, loudspeakers, and electronic devices. Provide and install all components including the necessary equipment, interconnections, transducers, labor, and services required to meet specifications herein and as indicated on the drawings. Any item listed in the specification or shown on the drawings is to be included as part of this scope of work. Items specifically indicated on the drawings as, "Not in Contract" or "Future," are not to be provided. Items specifically indicated on the drawings as "Owner Furnished" or "OFE" are to be provided by the Owner and installed by the contractor. Items listed as "Owner Installed" are provided and installed by the Owner to work of this installation.
- B. Although no additional pathways are anticipated, propose any conduit, wire raceways, and back boxes that are required to maintain a neat and permanent installation for these systems.
- C. Due to the fact that this work is primarily renovation of existing systems, it is necessary to verify site conditions including dimensions, clearances, conduit sizes, and routing. In many cases, the infrastructure is existing, and is to be reused. The contractor is responsible for verifying existing infrastructure prior to beginning work. Coordinate the exact location of the equipment with the Owner's representative.
- D. Notify the Owner's Representative in writing prior to AV installation of any penetrations at walls, ceilings and floors required for the installation of audiovisual equipment and cabling.
- E. The College will be responsible for the structural engineering of suspended AV components. Verify that the systems have been engineered prior to installation of

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suspended devices including, but not limited to, loudspeakers, equipment racks, projectors, flat panel monitors, etc.

- F. Conduct preliminary testing and adjustment. Submit documentation required by this specification. Participate in approval testing for acceptance. Perform final adjustments as required to meet specifications.
- G. Deliver bound "as-built" system documentation. Transfer all warranties and equipment guarantees and provide a written description of system operation to the Owner at the time of acceptance of the work by the Owner. Provide system operation training as specified.
- H. Provide as-built drawings of all systems, including modifications to the as-built infrastructure if any. Provide CAD files on storage format preferred by the Owner.

1.5 QUALITY ASSURANCE

- A. All materials must be newly manufactured current production models and must conform to all applicable codes and the relevant standards listed below:
 - 1. American National Standards Institute (ANSI)
 - 2. Electronic Industries Association (EIA)
 - 3. Institute of Electrical and Electronic Engineers (IEEE)
 - 4. Underwriters Laboratories (UL)
- B. Coordination: The Contractor shall coordinate with all other trades in scheduling work. The Contractor is responsible for coordination of and compensation for any work or subcontractor work including but not limited to electrical, finish carpentry, metal work, and drywall.
- C. Experience:
 - 1. The Contractor will specialize in the installation of audiovisual professional/commercial systems.
 - 2. Installers and engineers must individually have a minimum of five years of documented experience in the field of audiovisual system installation.
 - 3. The Contractor will have documentation that they have successfully completed audiovisual installation projects within the University of California school system.
 - 4. The company must have an office and staff in the Bay Area.
 - 5. The company must be an approved dealer for devices and components installed. Dealership includes training and a path for warranty repair or replacement.
- D. Supervision:

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Lecture Hall K AudioVisual Upgrade**

1. The Contractor will designate a single supervisor to oversee the installation work for the duration of the project to ensure that the system is installed in accordance with the specification and drawings.
 2. The supervisor will maintain adequate staff and be responsible for installing and testing the system on schedule.
 3. The supervisor will have at least five years of documented, recent, and similar project experience.
- E. The Owner reserves the right to make use of the system prior to the final acceptance of the system. Temporary use of the equipment will not constitute an acceptance of the system or any part. The Owner will not pay additional cost to the Contractor and the commencement of the warranty period will not begin for the system or any device prior to the final acceptance of the system by the Owner.
- F. Codes: Contractor will comply with all applicable laws, regulations and codes.
- G. Dealership: The Contractor shall be a dealer for all devices provided and installed and shall provide full factory warranty on all products.
- H. Control System Programming: Contractor shall have all control system programming provided by a certified programmer.

1.6 SUBMITTALS

- A. Comply with submittal provisions of the Owner.
- B. Bid Submittals: Submit the following qualification documents:
1. Firm description.
 2. List of related projects. Related project list to include project name and location, description of project, contract amount, reference name, and telephone number. One of the related projects must have been completed within the last 12 months.
 3. Resumes of project supervisor documenting related experience. Project supervisor must have completed at least one installation in the past 12 months.
 4. Names and scope of work for any subcontractors whose work would be part of this contract.
 5. Clearly describe any deviations from and exceptions to the specifications or drawings.
 6. For the base bid, provide an equipment list including all major devices. The bid shall not be considered complete without this list.
 7. Along with the quoted price, provide a factor for additive changes and delete changes. The add change factor should include the product, installation, engineering, tax and shipping. Delete change factor should include listed devices, installation, tax, return shipping and verified restocking charges. No change in scope will be considered without

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line item documentation. These factors will also provide a basis for product changes necessitated by product advancement between the time of the writing of this specification, and the final integration.

C. Construction Submittals:

1. Submit complete equipment list by manufacturer, model number, and type. Include all accessories, options and functional components, and quantity to be supplied. Note that due to the project schedule, this may be submitted at the time of product ordering, and any changes required will be made knowing that restocking and expedited shipping charges will apply.
2. Submit shop drawings for each building space included in this specification with the following drawings (as required by specific system):
 - a. Point-to-point functional wiring diagrams for all audio, video, control, and related signal system wiring diagrams. Must be connector pin-specific. Re-used Audiovisual Consultant design drawings with wire run numbers added are not acceptable for field construction use. Devices and connections including connection plates noted "typical" with quantity designations and net acceptable as each plate is to have unique labels and numbers.
 - b. All receptacle plates and panels, including rackmount panels with labeling shown for engraving.
 - c. Installation is not to commence until approval has been received.
- D. Submit samples of engraved labels, cable marking system, and receptacle plate/panel etching.
- E. Submit all proposed button panel labels for all physically engraved button panels.
- F. Acceptance Test Submittals: Prior to requesting the completion of the acceptance tests, submit Preliminary Test Report including all information required in Part 3. The Contractor is to provide a letter on company letterhead verifying that all devices and signal inputs have tested and are operable. This letter is to be signed by the project manager and sent to the consultant before acceptance testing can proceed.

1.7 PERMITS AND INSURANCE

- A. Permits: Obtain any necessary permits for the execution of this work in conformance with applicable union regulations, local, State and Federal codes and regulations.
- B. Insurance: Provide evidence of insurance for the full value of equipment and material located on site. Insurance will cover all losses until the work is formally accepted. Maintain additional liability insurance to protect the supplier and/or Owner against damage claims for personal injury, including death, which may arise during the performance of this work.

1.8 WARRANTY

- A. Installation Contractor Warranty

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1. Contractor shall provide a one (1) year warranty. This warranty is to cover installed devices, wiring, terminations, and adjustments. This warranty is not to cover vandalism, mischief, Owner or user misuse, or subsequent activities out of the control of the installing contractor.
 2. Warranty period shall begin upon formal acceptance following execution and acceptance of all punch list items.
- B. Manufacturer Warranty
1. Standard products provided and installed by subcontractors shall be enforceable for the length of that warranty. If the extended specialty warranty is beyond the one-year contractor warranty, full contact information and warranty terms must be provided to the Owner. This information shall be provided as part of the Owner's manuals. The installing contractor will serve as the agent for these warranty returns.

PART 2 - PRODUCTS

2.1 GENERAL: ALL SUBMITTED EQUIPMENT MUST MEET THE PERFORMANCE REQUIREMENTS OF THIS EQUIPMENT. REFER TO DRAWINGS FOR QUANTITY VERIFICATION. ANY DEVICE SHOWN ON THE DRAWING OR LISTED IN THE SPECIFICATION IS REQUIRED.

2.2 DISPLAYS

- A. Video Projector: Reconnect existing.
Acceptable material: Panasonic model PT-DW6300US.
- B. Front Left and Right Flat Panel Displays: 60-inch Prosumer flat panel with minimum of four HDMI inputs and remote control using RS 232.
Accepted Material: Sharp model LC60UQ17U
- C. Instructor station Video Flat Panel Displays: 24-inch Backlit widescreen desktop monitor wit ECO model for extended life and low power consumption. Prosumer flat panel with a digital input and fast wakeup from Eco Mode.
Accepted Material: NEC model AS242W-BK
Accessories required: DVI-D to HDMI adaptor
- D. Instructor Marking Video Flat Panel Displays: Specialty flat panel with minimum of four HDMI inputs and remote control using RS 232.
Accepted Material: See item 2.3A below
- E. Mock Witness stand Video Flat Panel Displays: 24-inch inch Backlit widescreen desktop monitor wit ECO model for extended life and low power consumption. Prosumer flat panel with a digital input and fast wakeup from Eco Mode.
Accepted Material: NEC model AS242W-BK
Accessories required: DVI-D to HDMI adaptor

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2.3 VIDEO SWITCHING

- A. Instructor Video touch screen: A touch panel with embedded Touch screen software for telestration. Labeled Smart Monitor on the functional diagram.

Accepted Material: Wacom model CINTIQ 22HD Touch

- B. Wireless video connection: A wireless connectivity solution is installed on the School network to gain WIFI access to the room display. The wireless receiver is connected to the video switch through the network connection.

Accepted Material: Kramer model VIA Connect Pro

- C. Wired extended length connection: An active cable extender for HDMI, display port, DVI and XVGA plus audio extends from the front lecture podium to the video switch for routing to the selected displays and recording PC.

1. Accepted Material: Transmitter Kramer model SID-X2N
2. Accepted Material: Receiver/Scaler Kramer model VP-427

- D. Video Switch: HDMI switch for selecting any of the HDMI inputs and wireless inputs.

Accepted Material: Kramer model VS-62H

- E. Video Distribution Amplifier: Distribution amplifier for sending the selected HDMI input to the video projector, the two student flat panels, the two recording computers and the witness stand monitor.

Accepted Material: Kramer model VM-8H

- F. Wired Display Connection: The HDMI cable from the HDMI DA to the video projector and all flat panels uses an active HDMI cable with an internal powered amplifier at the send end powered by the HDMI DA.

Accepted Material: FSR INC model DR-PCB-HxxM
(determine individual length by field measurement.)

2.4 CONTROL

- A. Desk Mounted Touch Panel Controller: 10" touch panel with individual soft buttons for flat panel ON and OFF and input select. Direct network enabled connection to the display, video switcher, DSP and screen for RS232 control. Touch panel also for dialing, hang-up, on hook and answer call. Display should indicate number called and number calling in. Allow backspace for changing dialed numbers.

Accepted Material: Extron

- a. Touch Panel: TLP Pro 1022M
- b. Mounting Backbox: Extron Model BB710M
- c. Individual device Remote controller: Extron model IPL T S1 (60-1412-01)
- d. Multiple Com device controller: Extron IPL Pro S3 (60-1413-01)
- e. Multiple CC Controller: Extron model IPL Pro CR88 (60-1416-01)

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- B. Wireless Touch Panel Controller: Network switch with wireless connect for iPad controller. iPad control screens duplicate the installed touch screen in appearance and function.

Accepted Material: TP Link

- a. Router: 8 port Easy Smart Model TL-SG-108PE
- b. Wireless Access Point Model N600

- C. Projection Screen Controller: Network driven controller for the projection screen raise and lower function.

Accepted Material: Extron Model IPL Pro S1 (60-1412-01)

2.5 CAMERAS AND RECORDING

- A. Room Rear Pan/TILT/Zoom Video Camera: reconnect existing.

Acceptable material: Panasonic model Existing

- B. Room Front Static Mount Video Camera: reconnect existing.

Acceptable material: Panasonic model AW-H2. Existing

- C. Rear Camera Extender: 60-inch RS 232.

Accepted Material: Atlona model Existing

- D. Front Camera Extender: 60-inch RS 232.

Accepted Material: Atlona model Existing

- E. Encoding PC: Dual input PC with 1 gig recording capability.

Accepted Material: Owner Furnished Existing

- F. Camera Stand: One HDMI input and one HDMI output camera stand with a 1920 x 1080 resolution 30 fps camera.

Accepted Material: Wolfvision Model VS-8 Lite

2.6 AUDIO

- A. Audio Mixer: Provide and install an audio DSP microphone mixer for mixing microphones and playback inputs and interfacing with the telephone system for audio teleconferencing. Mixer to be mounted in the cabinet equipment rack.

Acceptable Material: BiAmp Tesira Model Forte TI

Accessories required: Telephone interface card

- A. Ceiling mounted Microphone: Cardioid microphone hung inside the overhead speaker and mic assembly. Whereas the existing MX 202 microphones are hung towards the students, these microphones are above the area in front of the instructor's desk to cover the "walk around" space for the instructor. Install 2 each split on the 1/3 point of the front overhead bar assembly.

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Acceptable Material: Shure MX202 (to match existing student mics)

- B. Speech Loudspeaker Power Amplifier: Provide single channel Energy Star power amplifier with 120 watts at 70 Volts.

Acceptable Material: Lucia model 120/1-70
Accessories required: Half rack mounting ears

- C. Playback Loudspeaker Power Amplifier: Provide two channel Energy Star power amplifier with 120 watts for low impedance load.

Acceptable Material: Lucia model 120/2
Accessories required: Half rack mounting ears

- D. Speech Loudspeaker System: Connect existing AV Bar mounted interior loudspeakers.

Acceptable Material: Tannoy Model Existing.

- E. Playback Loudspeaker System: Connect existing front wall flush mounted left and right loudspeakers.

Acceptable Material: Atlas model Existing

- F. Audio De-Embedder: De-Embedder removes encoded audio from a digital HDMI signal for use in a stand also audio system.

Acceptable Material: Extron HAE 100

- G. ADA Hearing Assistance System: Provide and install rack mounted transmitter and wall mounted antenna.

Acceptable Material: Media Vision

Accessories required:

- | | |
|--|--------|
| a. Transmitter Model MV-ALS-STFM | Qty 1 |
| b. Antenna Model MV-ALS-AT Dipole | Qty 2 |
| c. Portable receiver Model MV-ALS-PRFM | Qty 6 |
| d. Earphones Model MV-ALS-EP01 | Qty 2 |
| e. Neckloop Model MV-ALS-EP03 | Qty 2 |
| f. Receiver rechargeable Batteries Model MV-ALS-BT | Qty 12 |
| g. Charging case Model MV-ALS-CH12 | Qty 1 |
| h. Hearing assistance sign Model MV-ALS-SK01 | Qty 2 |

2.7 HARDWARE

- A. Equipment Rack: reuse existing.

- A. Front Projection Screen: Provide and install an HD aspect ratio 16:9 front projection screen ceiling recessed 58" by 104" wide and 119" diagonal. Screen surface is matte white, bordered, with extra drop to lower the bottom edge of the image to 4'-0" AFF.

Acceptable Material: DaLite Model Advantage model number 84328LS

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Accessories required:

- a. Three button Raise/Lower and Stop wall mounted switch. Existing
- b. LVC Low Voltage controller.

2.8 CABLE

- A. Pre-Terminated HDMI or DVI-D cables:
 1. Cables must be rated for HDMI 1.3a specifications or better, capable of passing 1080p or 1920x1200 resolution at distances under 10' without an active equalizer.
 2. Manufacturer
 - a. Extron
 - b. Crestron
 - c. Neutrik
 - d. Liberty
- B. UTP Cabling: CMR/CMP Rated. Tested to 550 MHz. Acceptable material: Liberty Category 6E.
- C. Provide plenum-rated cable for all audiovisual cabling where required by code.

2.9 HARDWARE, AND MISCELLANEOUS

- A. Provide matching manufacturer vents and blanks as required to fill all unused rack spaces.
- B. Rack Connections: AC power cables to the power strips shall be run in steel conduit. All in-going and out-going signal cabling shall be run in conduit independent of AC power conduit.
- C. Connectors: Provide compatible plugs as indicated on the drawing sheets; all cable connectors shall have black anodized finish where available. Connector parts subject to any possible structural loading or stress shall be metal.
- D. Portable Cables: For each wall, floor, or I/O panel receptacle that is not to be used by installed equipment, provide one portable cable with compatible connector for connection of portable devices to the system. Acceptable Material: Extron various models.
- E. Conduit: Provide removable seals at penetrations for acoustic isolation.
- F. Receptacle plates: steel or aluminum with etched and ink-filled labeling.

PART 3 - EXECUTION

3.1 GENERAL

- A. The following is required for acceptance of the audiovisual system by the Owner:
 1. Coordinate with the Owners representative for all OFE equipment. Coordinate for equipment type and connectivity for function.
 2. Install complete and functioning audiovisual systems specified.
 3. Label equipment and cables with names and corresponding to functional diagram. Label both ends of any installed or portable cables. Labels can be names.
 4. Conduct adjustments and preliminary testing.

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5. Report results of preliminary testing along with system documentation.
6. Participate in acceptance test and deliver final system and documentation.
7. Conduct any adjustments or re-testing required to meet specifications.
8. Provide training to individuals designated by the Owner.

3.2 GENERAL REQUIREMENTS

- A. All equipment except portable equipment shall be held firmly in place. This includes racks, conduits, cables, amplifiers, and other electronic equipment. A licensed structural engineer shall approve fastenings and supports.
- B. Submit shop drawings for custom fabrications including custom panels, receptacle plates, and rack elevations to the Owner for review and approval. Make submittals at least fifteen (15) working days prior to scheduled fabrication. Note on the submittal the dates of scheduled fabrication.
- C. Do not commence work on any portion of the project requiring Owner's approval prior to obtaining such approval. Work commenced and installed prior to review and approval shall be accepted at the Owner's discretion. Installation does not imply acceptance or review for acceptance.
- D. Keep at the job site an up-to-date complete record set of prints and specification. Make daily corrections and show all changes from the original contract drawings. Final As-Built drawings will be required at the conclusion of the project.
- E. Keep the job adequately staffed at all times. A qualified engineer approved by the Owner and employed by the Audiovisual Contractor shall exercise engineering supervision over the entire installation. Unless through illness, loss of personnel, or other circumstances beyond the control of the Audiovisual Contractor, keep the same individual in charge throughout the execution of the work.
- F. Cooperate with other trades in order to achieve well-coordinated progress and satisfactory results. Watch for conflicts with work for other contractors on the job. Execute, without claim for additional payment, moderate moves or changes as necessary or required by the Owner prior to installation to accommodate minor design changes, rack layout changes, or to preserve symmetry and pleasing appearance.
- G. Cables and wiring in racks, consoles, connector boxes and on terminal strips shall be clearly marked between 2" and 4" from end of cable gasket/harness. Provide maximum label visibility. Indicate the signal type, wire number, source and destination and jack, receptacle or socket to which connector should be mated. Use appropriate diameter clear shrink tubing over surface of label for protection and permanence. Extend shrink tubing over label by approximately 1/4" at each end.
- H. Label all devices including switches, control panels, monitors, and equipment. Label to be logical and permanent with clarity and legibility. Submit samples for approval.

3.3 EQUIPMENT CONNECTION

- A. Wiring: All wiring shall be installed in strict accordance with broadcast standard practices. Cabling jacket color shall be coordinated to maintain consistent identification.

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Lecture Hall K AudioVisual Upgrade**

- B. Cabling: Install vertical cable runs in conduit. All cable is to be continuous and without splices. Permanently label all cabling at termination points. Cables shall be bundled and laced neatly to maintain convenient access to all equipment connections. All audiovisual signal cabling are to be separate from all power lines.
- C. Power: Power conduit to be separated from other conduits containing signal lines. Connect AC power to the equipment from junction boxes designated by the Electrical Engineer.
- D. Connectors: Connections to screw clamp or binding post terminals require flanged or snap spade type lugs appropriately color-coded. Bare wire connected to a binding post is not acceptable. Soldered connections shall be soldered with rosin core solder.
- E. Grounding: Use the equipment chassis as a common point of grounding the sound system; the equipment chassis is to be grounded to earth. Cable shields shall only be used for shielding (not signal) and connected to ground at the rack. All equipment shall be checked for ground continuity.
- F. Fasteners, Hangers, Supports: Provide fasteners, supports and seismic restraints to adequately support the load as required by local codes.
- G. Markings: Permanently mark all connectors, cables, and cable terminations to indicate their function corresponding to the wiring diagram. All cable pairs shall be coded with permanently attached numbers on the cable ends with consistent color-coded markings to indicate their function.

3.4 INSTALLATION AND PROGRAMMING REQUIREMENTS

- A. Remote Control Software Programming: Provide all necessary software programming to access all commonly used features for each item to be controlled. Submit control panel layouts for approval prior to on-site installation, either electronically or as printed screen copies. Revise control panels as required prior to the acceptance of the system. Provide at no extra charge, any reprogramming of the control system or control panels requested by the Owner's Representative within thirty days of acceptance of the system for user functionality issues. Provide all necessary programming for the functions listed below to be controlled individually via the control panel. Refer to the functional diagrams for additional information.
 - 1. Power On/Off: Provide a master On/Off control switch, which can be used to power down all equipment (except 'always on' control devices). All devices will be powered down from the master On/Off switch, including displays.
 - 2. Volume Controls: Provide Up/Down/Mute controls for playback volume levels, with appropriate level control ranges set to prevent extremely loud playback levels. All volume and mute buttons are to operate in parallel between all available control panels. Buttons should "track" and actively update to display the current state with minimal delay.
 - 3. Source Select: Provide audio-follow-video source selection for all sources and receptacle plate inputs.
 - 4. Projector Control: Seamless source switching as necessary, and projector on/off. Provide a projector lamp-life query upon system power-up and display this number in hours next to the projector power on button. Projector control is to be bi-directional RS232, not 1-way serial control. Remote monitoring and control shall be possible via the network connection.
 - 5. Screen Control: Provide control system programming for screen controls.

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Lecture Hall K AudioVisual Upgrade**

6. The control system and all audio and video switchers will feature some capacity for future growth, and will not be completely filled by the system outlined in this specification. Switching capacity is not to be reduced, and all unused video inputs should be properly terminated.
 7. Power Sequencing: Provide power up sequencing such that power amplifiers turn on last and power down first.
- B. Custom Back boxes: Provide custom back boxes for wall-mount control panels and docking stations to the project Electrical Contractor for installation and conduit termination at appropriate time based on the construction schedule.
 - C. Loudspeaker Installation: Use rigid support members to prevent movements of mounted loudspeaker components. All loudspeakers will be wired in positive phase.
 - D. Equipment Mounting Coordination: Audiovisual Contractor is responsible for coordination with the General Contractor and Electrical Contractor to ensure cable management solution provided to the AV equipment maximizes the usable lower rack-space, and minimizes the visibility and exposure of installation wiring.
 - E. Audiovisual Contractor will review and assess the appropriate focal length between the video projectors and the video screens to ensure optimum picture sizing and focus. The image should completely fill the screen height available.
 - F. Coordinate with Architect and Owner's Representative for finish preferences. Submit for finish approval prior to ordering.

3.5 WORKMANSHIP

- A. Installation of all work including cabling will be neat. All boxes including the loudspeaker enclosures, equipment, racks, etc., will be plumb, squarely located and, where appropriate, flush with adjacent surfaces. Replace all ceiling and floor tiles removed for this work when the work is complete. Leave the job site clean and free from marks and blemishes.

3.6 AUDIOVISUAL CONTRACTOR'S PRELIMINARY TESTING AND ADJUSTMENTS

- A. Furnish all equipment and personnel to conduct these tests in accordance with the performance specification requirements. ANSI S1.13 and EIA Standards RS-160, RS-219 and RS-189A will apply.
- B. Initially adjust all system gain controls for optimum signal to noise ratio. After all adjustments required to meet specification requirements are made, measure and report the resulting system electrical signal to noise ratio at the amplifier outputs from 20 Hz -20 kHz in 1/3 octave bands.
- C. System Frequency Response: Measure the sound pressure level in audience areas using a calibrated type 1 precision sound level meter as defined by ANSI S1.4. Measure using the slow time constant. Report the unequaled house curve with the equalizer controls set to "0", by space.

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- D. Audiovisual Contractor will ensure optimum picture sizing and focus. Make all adjustments necessary, including LCD projector keystone correction and lens shift to achieve the image size and shape required.
- E. Provide full video projector calibration and adjustments for optimal picture quality. Set all projector configuration presets required for control system recall coordination, and provide documentation with final system documentation.
- F. Controls: Adjust all controls to achieve the specified performance. Audiovisual Contractor will confirm that all control system operations are properly programmed and repeatable. Provide shaft-locks or covers for all level controls, as appropriate to prevent unauthorized gain changes.
- G. Report: Provide a letter/report documenting the results of these preliminary tests, including equalization curves for review by the Design Consultant.

3.7 ACCEPTANCE TESTS

- A. Qualification for Acceptance: Subsequent to completing preliminary testing, the Audiovisual Contractor shall furnish the Construction Manager with the letter/report documenting the results of the preliminary tests and two (2) copies of "as-built" wiring diagrams of the entire system including the connection numbers, and their locations. The receipt of this documentation will constitute the Audiovisual Contractor's acknowledgment that the installation is complete and conforms to this specification.
- B. Acceptance Test: The Owner's Representative and/or Construction Manager will be present during the acceptance testing and require the assistance and cooperation of the Audiovisual Contractor. In addition, provide the personnel who participated in the installation, preliminary testing and adjustment of the audiovisual systems.
- C. Equipment cabinet keys and any tamper-proof fastener tools must be available to the Owner's Representative.
- D. Each major component shall be demonstrated to function, as specified.
- E. Measurements: Further electrical and acoustical measurements may be performed at the discretion of the Owner and/or Owner's representatives. Such measurements may include sound pressure levels, uniformity of coverage, distortion, or other pertinent characteristics.
- F. The Audiovisual Contractor shall provide a laptop with all manufacturer supplied configuration software necessary for communicating with the Control System. A review of system settings may be required and settings may be adjusted if necessary.
- G. Such tests may be performed on any piece of equipment or system. If any test shows the equipment or system is defective or does not comply with the specifications, the Audiovisual Contractor shall perform any remedies at his expense and pay the subsequent expenses of any retesting required.
- H. Delays: If the acceptance of the system is delayed because it does not meet the specification requirements, the Audiovisual Contractor shall reimburse the Owner for all expenses of consultants retained to represent the Owner during the final acceptance

testing. This will include costs associated with travel to the site, and include reimbursable business travel expenses.

3.8 SYSTEM DOCUMENTATION, TRAINING, AND FIELD SUPPORT

- A. Operation and Maintenance Manuals: For each system, provide three (3) copies of system manuals per system, two (2) for the Owner and one (1) for the Design Consultant. Manuals shall be in adequately sized three-ring binders, clearly labeled on spine. Manuals shall contain the following:
 - 1. Service Reference Cover Sheet: Provide a cover sheet with Audiovisual Contractor name, address, telephone and Fax numbers.
 - 2. System Operation Instructions: Step-by-step operating instructions for the basic day-to-day use of the system including power activation, connection of microphones and other source devices, adjustment of volume levels, selection of sources and loudspeaker zones, etc. Include illustrations and references to individual equipment manuals as necessary.
 - 3. Equipment Manuals: Include copies of individual equipment operation manuals separated by tabbed dividers. Order manuals in nominal signal path order (i.e. sources first, amplifiers/loudspeakers last), followed by control system manuals, followed by miscellaneous manuals.
 - 4. Equipment List: List all system equipment including, connectors and specialty hardware, by manufacturer and model.
 - 5. As-built Drawings: Provide reduced 8-1/2"x11" or 11"x17" foldout "as built" functional diagrams in clear plastic binder sleeves. Fold and insert drawings so that drawing title is clearly visible at the front of the sleeve.
- B. Provide software programmable device configuration files to the Owner for all control system source code files. Store files on site in the system documentation binders in disk sleeves. Provide the files on CD-ROM. Store files on site in the system documentation binders in disk sleeves.
- C. Digital Documentation: Provide all technical and training documentation as files on a CD ROM to the Owners representative. All files are for use, reprinting and sharing within the Owners organization and are to be current will all changes and the final installation.
- D. Training: Provide up to 4 hours of system training to user(s) designated by the Owner. Training time is to be non-contiguous, in at least two separate sessions. Some training time is to be used as live "first event" assistance. Assist and oversee user(s) during these events.

END OF SECTION 27 41 16