SECTION 27 41 16 - CLASSROOM AV SYSTEM

PART 1 - GENERAL

1.1 WORK INCLUDES

A. Work in this section includes, but is not limited to, furnishing and installing a fully integrated Audio-Visual presentation system in each Classroom, Reading Room, Media Center, Conference Rooms and Field House, and all other areas as indicated on the Drawings.

1.2 DESCRIPTION

A. Each Classroom shall have an integrated audio and video system, as well as the required cabling, that shall include interactive monitor, and a voice amplification system, along with the associated cabling and audio/video connectivity.

B. Each conference Room shall be provided with the interactive monitor specified within this Section, along with the required cabling, as a function of this Section.

C. The voice amplification system shall include wireless RF microphones.

D. The voice amplification system shall include input/output to/from program sources as indicated in the riser diagrams, providing any required sound reinforcement for these devices.

E. The monitor shall provide both the selectivity of the video source switching, as well as providing audio switching to facilitate audio following video.

1.3 RELATED SECTIONS

A. Section 27 05 00 – Communications Common Work Results

B. Section 27 05 26 – Technology Grounding System

C. Section 27 05 28 – Pathways for Communications Systems

D. Section 27 15 01 - Structured Cabling System

1.4 PRODUCTS INCLUDE

A. Products include, but are not limited to,
   1. Interactive Display Monitors
   2. Display Monitors
   3. Active Video Splitter
   4. Ethernet to RS-232 Converter
   5. Classroom Sound Reinforcement System, including:
      a. Speakers
      b. RF Wireless Mic(s)
      c. Receiver/Mixer/Amplifier
      d. RF Sensors
   6. USB to RJ-45 Adapter
   7. Cabling

B. Refer to the Drawings for additional information and requirements.

1.5 CONTRACTOR QUALIFICATIONS

A. The Contractor shall currently maintain a locally run business for a minimum of five years and shall be an authorized distributor and service center for the supplied equipment having full warranty privileges.

B. The Contractor shall maintain at his facility the necessary spare parts in the proper proportions as recommended by the equipment manufacturer to maintain and service the equipment being supplied. This facilities and inventory shall be made available for inspection by the Engineer.

C. The Contractor shall maintain current applicable certifications for the systems being provided, including but not limited to Certified Technology Specialist (CTS) as provided by InfoComm, as well as certification by the specific manufacturer's where available, for the installation and servicing of all manufacturer's equipment being supplied and/or installed.

D. The Contractor shall have a minimum of five installations of like magnitude and complexity within the last two years.

1.6 RECORD DRAWINGS

A. As-built documentation for all variations of the systems provided under the scope of the Specification shall be provided to the Engineer for review and approval, upon approval of the Engineer, incorporate the drawings into the O&M manual provided to the Owner.

B. As-built documentation as defined elsewhere in these Specifications shall contain, at a minimum:
   1. Locations of all the systems provided, including, but not limited to any indications of variations,
   2. Riser(s) with all details of the individual installations, including, but not limited to,
      a. Device or component manufacturer and model numbers,
      b. Specific I/O points on the devices or equipment.
      c. Type of cable(s), and any cable ID installed.
      d. Nature of signal being transmitted, such as HDMI, RF or IR Control.
      e. Any other pertinent detail of the interconnection to assist in the ongoing maintenance and upkeep of the system.
      f. Note: Where the systems provided repeat in layout, a single riser may be provided. However, any deviation of the installation, such as varying quantity of speakers, shall require a separate and unique riser for each deviation. Each riser required shall be provided with a unique title so as to make it easily identifiable when being referenced. Should such deviations exist, the plans indicating the location of each of the systems shall clearly indicate which riser is applicable to each individual occurrence of the system.
   3. A complete list of all equipment with Manufacturer, Model Number, Serial Number, and location of the equipment shall be compiled and turned over to the Owner representative prior to final acceptance of the project.
   4. Listing of all user serviceable parts, including, but not limited to, Manufacturer and Model number of part(s).
   5. As built documentation shall be processed in compliance with Specifications Section 27 05 00.

PART 2 - PRODUCTS

2.1 PRODUCT SUBSTITUTIONS

A. As indicated elsewhere in these documents, the products specified on these Construction Documents shall be furnished as indicated. Substitution of materials or products considered to be functionally equivalent, where not previously approved in writing by the Engineer, shall be unacceptable. Any deviation from the use of materials or products shall be handled in accordance with terms and conditions established elsewhere in the documents.

2.2 PRODUCTS

A. All products shall be new, UL listed and comply with all applicable Federal, State and Local regulations.

B. Interactive Display Monitors
   1. The Interactive Display monitor shall have the following characteristics
      a. Type “CM”. Refer to Drawings for quantities
         1) Screen Size: 75” minimum
         2) Resolution: 4K UHD
         3) Touchscreen: Yes
         4) HDMI Inputs: (3)
         5) External Control: RS232, RJ45, Wi-Fi
         6) Sensor: IR
         7) Built-in Speakers: Yes
         8) CPU: Yes, internal Processor
         9) Passive Pen: Yes
         10) Audio Out: Yes
         11) Model: Match existing, LiteTouch 75
         12) In addition, provide (1) Google ChromeBox for each monitor
            a) Contractor shall match existing ChromeBox’s as directed by the District.
      b. Type “SG”. Refer to Drawings for quantities
         1) Same characteristics as “CM” above
         2) Provide sound bar with mounting bracket under display monitor
         3) Model: Match existing LiteTouch 75
         4) In addition, provide (1) Google ChromeBox for each monitor
            a) Contractor shall match existing ChromeBox’s as directed by the District.

C. Monitor Quantities
   1. All “CM” and “SG“ monitors and associated mounting brackets, and ChromeBox’s, shall partially be furnished by the Owner and partially furnished and installed by this Contractor.
   2. This Contractor shall remove and relocate all existing monitors, as directed by the Owner, and install complete with existing mounting brackets and hardware.
      a. Verify exact quantity of existing monitors with District prior to procuring new monitors.
      b. Contractor shall utilize District’s integrator to remove and install existing monitors into new school to keep existing warranty.
         1) Contact: Lite the Nite Technologies
            a) LTNTechnologies.com

3. This Contractor shall provide all remaining monitors and mounting brackets, and ChromeBox's, based on the quantity of monitors needed to complete 100% of the installations.
    a. Contractor shall match existing monitors, mounting brackets and ChromeBox's as directed above and by the Owner.

D. Active Video Splitter (Splitter)
1. The Splitter shall be actively buffered.
2. The Splitter shall have the following features:
    a. Input: one (1) HDMI input
    b. Output: two (2) HDMI output.
    c. Output impedance: 75 Ohm.
    d. Video input impedance: 75k Ohm.
    e. Minimum bandwidth:350MHz @ -3dB.
3. The Splitter shall be capable of passing VGA to 4K computer and video resolutions without significant measurable signal degradation.
4. The Splitter shall include the required power supply.
5. The Splitter shall be supplied with two factory fabricated and terminated jumpers one 3' jumper for the connection from the Splitter to the PC, and one jumper to provide the required connection from the Splitter to the connectivity at the work area outlet.
6. Acceptable amplifier manufacturer and model
    a. Extron DA2 HD 4K
    b. Equal by Altinex, Kramer, or RGB Spectrum

E. Ethernet to RS-232 Converter (Converter)
1. The Ethernet interface shall provide the following features:
    a. Connector:1 RJ-45 female integral to the housing
    b. Data Rate:10/100Base-T, half/full duplex with autodetect
    c. Protocols:TCP/IP, DHCP, HTTP, Telnet, SMTP, ICMP, UDP/IP, ARP
2. Serial Control interface shall provide the following features:
    a. Connector: DB-9 male, RS-232c
    b. BAUD Rate: 300 to 115200 baud
    c. Protocol: Adjustable
    d. Pin Configuration:2 = RX, 3 = TX, 5 = GND, 7 = RTS, 8 = CTS
3. The Converter shall be powered by means of an included class 2 power supply or by means of 802.3af Power over Ethernet (PoE).
4. The Converter enclosure shall be metal.
5. The Converter shall be compliant with CE and FCC Class A, as well as any other applicable safety standard.
6. The Converter shall be supplied with one RJ-45 factory fabricated jumper to connect the converter to the network, and one factory fabricated serial cable to connect the converter to the device being serviced.
7. The Converter shall include software to create a useful Windows based graphic user interface for control and ability to view all parameters exposed by the device being serviced, such as hours of life for a projector lamp, or status of device operation, i.e. device on.
8. Acceptable Manufacturer and Model
    a. Extron IPL T S1
    b. Kramer FC-1ETH
    c. Crestron QM-RMC

F. Classroom Sound Reinforcement System (SRS)

1. The SRS shall consist of a packaged sound reinforcement system including, but not limited to, wireless RF microphones and associated charger(s), receiver/mixer/amplifier, speakers, and wireless microphone receivers.
2. In the case of adjacent classrooms with divisible walls, Contractor shall combine the (2) SRS's to function as one, where one SRS acts as the primary SRS. Contractor shall provide all associated cabling and components to accomplish this scenario.
3. The SRS shall include a minimum of:
   a. One (1) wireless RF transmitter,
   b. One (1) RF receiver/amplifier,
   c. External remote RF sensors providing 100% RF coverage regardless of user position within the room,
   d. One (1) collar microphone,
   e. One (1) RF emitter for the transmitter,
   f. One (1) hand-held RF student microphone for 25% of the classrooms,
   g. Four (4) acoustical ceiling speakers, eight (8) where required by the application or where otherwise shown on the plan,
   h. Cabling to connect speakers and external sensors to receiver/amplifier,
   i. Four (4) nickel metal hydride batteries,
   j. One (1) battery charger compatible with the rechargeable batteries of the wireless transmitters,
   k. One (1) power supply for the receiver/amplifier.
   l. Mounting bracket(s) as required
4. The Receiver/Amplifier shall include the following performance criteria:
   a. Audio Power: 50 Watts peak, 50 Watts RMS
   b. Frequency Response: 50Hz to 15kHz
   c. Power Requirements: 24VDC, 2.5 amps with power supply
   d. Signal-to-Noise: >80dB
   e. Image rejection: >40dB
   f. Reception sensitivity: >25dBuV
   g. Reception selectivity: ±40kHz
   h. Feedback rejection:dedicated circuitry to actively control feedback
5. The Controls shall include, but not be limited to:
   a. One (1) master volume control
   b. Individual inputs and volume controls for each channel that shall consist of a minimum of:
   c. Two (2) teacher microphones
      1) TV/DVD
      2) Computer
      3) Auxiliary
   d. A minimum 3-band equalizer
   e. One (1) power switch
   f. Voice Mute on/off selection
   g. PA Mute which, when activated by means of receiving a public address announcement
   h. Provide remote level control of microphone via RF
   i. Provide automatic adjustable ducking to decrease the level of the multimedia presentation when the teacher speaks.
6. Connections, shall include, but not be limited to:

a. A minimum of four individual inputs corresponding to the channels of control listed above utilizing RCA type, Hi Z, Mixed inputs
b. A dedicated line output
c. Independent speaker connections for each speaker provided in any given space.
d. Screw Terminal Connections for a minimum of:
    1) PA Mute
    2) Control Signal, controlled by a dedicated, single duty, remote pushbutton

7. 4-Channel Body Pack Transmitter
    a. The transmitter shall have the following performance criteria:
        1) Sub-carrier frequencies:sufficient quantity of frequencies to avoid interference from other classroom microphones
        2) Audio distortion: <1.0% (±40kHz deviation @ 1kHz)
    b. The transmitter shall have the following features:
        1) Integrated microphone
        2) Internal charger circuit
        3) Built-in RF emitters
        4) Buttons:
            a) power on/off
            b) mute
            c) Function F1 – triggers the logic output of the receiver/amplifier
        5) External Inputs
        6) Remote volume control for the system from the teacher's transmitter
    c. The power for the transmitter shall be by means of a rechargeable Nickel Metal Hydride or Lithium Ion battery in a standard "AA" form factor.
    d. The transmitter shall utilize a pendant or lavaliere RF microphone.
8. 4-Channel Hand Held Transmitter
    a. The transmitter shall have the following performance criteria:
        1) Sub-carrier frequencies:sufficient quantity of frequencies to avoid interference from other classroom microphones
        2) Audio distortion: <1.0% (±40kHz deviation @ 1kHz)
    b. The transmitter shall have the following features:
        1) Integrated microphone
        2) Internal charger circuit
        3) Built-in RF emitters
        4) Buttons:
            a) power on/off
            b) push to talk
            c) Function F1 – triggers the logic output of the receiver/amplifier
    c. External Inputs – 3.5mm stereo mixed to mono within the microphone
    d. Remote volume control for the system from the teacher's transmitter
    e. The power for the transmitter shall be by means of a rechargeable Nickel Metal Hydride or Lithium Ion battery in a standard "AA" form factor.
    f. The transmitter shall utilize a handheld RF microphone.
9. External Dome Sensor (quantity as required for 100% RF coverage, regardless of teacher position in room)
    a. Power: Powered by receiver
    b. Cable: Factory pre-terminated coax cable, plenum as required by code, of sufficient length to route the sensors to any position in the room as may be required without splicing, or providing substantial excess,
    c. Mounting: Metal bracket

10. Speakers
    a. Type: Ceiling mount with mounting brackets and plenum rated speaker backbox
    b. Power handling: 50 Watts continuous
    c. Impedance: 8 Ohms
    d. Frequency Response:100 Hz to 14 kHz +/- 3dB
    e. Connection:Quick connect/disconnect speaker terminals
11. System Wiring
    a. Loudspeaker wiring shall be Class 2 or better. The wiring shall be classified for the environment in which it is installed. E.g. it shall be plenum-rated if it is installed in a ceiling plenum.
12. Acceptable Manufacturer and Model:
    a. Extron Pendant and Handheld VoiceLift Pro Microphone System
    b. Equal by Lightspeed 955, Audio Enhancements, Bose, Phonic Ear or Listen Technologies

G. USB to RJ-45 Adapter
1. The adapter shall be a bus powered.
2. The adapter shall be packaged with both the receiver and transmitter pair.
3. The adapter shall pass all required serial signaling to provision all operational aspects of the interactive whiteboard with the associated PC.
4. The adapter shall be Tripp-Lie model U007-40M
    a. Equal by APC or Sabrent

H. Cabling
1. Provide all cabling and patch cords per Riser Diagram Drawings.
2. HDMI cabling with cable equalizer
    a. Plenum rated
    b. Gold plated contacts
    c. Resolution range
        1) 4K/60 verified for 25 feet
        2) 4K/60 verified for 35 feet with a cable equalizer
        3) 4K/30 verified up to 75 feet with a cable equalizer
        4) 1080p/60 verified up to 125 feet with a cable equalizer
    d. Acceptable Manufacturer and Model
        1) Extron HDMI Pro series cabling with HD 4K 101 Plus cable equalizer
            a) Equal by Liberty and Crestron with associated transmitters, receivers and additional cabling needed to extend HDMI cabling over 25 feet.

I. Device and equipment receptacle stations and associated hardware.
1. All patch cords, cabling and related hardware, including mounting brackets, etc., implied and/or not explicitly indicated, but are required to complete the installation of the indicated systems shall be construed as being included in the requirements of the package, and shall be include in the base bid pricing. All aforementioned patch cords, cabling and related hardware shall be of high quality, compatible with the devices and equipment being provided and shall be manufactured by the same company as the other materials being provided whenever possible.

PART 3 - EXECUTION

3.1 INSTALLATION

A. This Contractor shall provide all necessary coordination with the Electrical Contractor to assure proper location of all related rough-ins prior to installation of rough-ins, and pathway requirements for all cabling associated with this system. Should coordination not occur, it will be the responsibility of This Contractor to provide all corrective measures. Such required corrective measures shall be provided only as approved by the Engineer, Architect AND Owner.

B. This Contractor shall lead all discipline coordination for exact mounting height and location of power and data/AV rough-ins and faceplate for all projector and monitor locations. Provide exact wall and ceiling mounting templates for all trades to review and adhere to.

C. Route all cabling in a neat and workman-like fashion.

D. Terminate all field terminating cabling as recommended by the manufacture, and compliant with any applicable industry standards. All bare wire capture terminals shall be installed per manufacturer's recommendations. Where not specifically prohibited by the manufacturer, tin all bare wire compression connections.

E. All connectors utilizing compression as the method for mechanical attachment to the cable shall utilize connectors that provide a single uniform compression around the entire diameter of the cable.

F. Provide any/all recommended hardware to properly attach a ceiling or otherwise overhead devices and equipment, including, but not limited to, tile bridges or other ceiling anchor hardware.

G. Provide labeling of any cable run whether factory provided or field installed cabling. Refer to the labeling requirements herein for further information and requirements.

H. Configure the video monitor and projector switching such that audio follows video for the analog sources.

I. Support and dress all cables. The Contractor shall provide all necessary fixed and flexible wire management to achieve a high-quality installation both visually and operationally, and that would be considered to be within the standard practices of good workmanship. Provide J-Hook supports at regular, though slightly varying, intervals of no greater than 5' for all cabling that must be routed greater than 5'. Provide a removable non-metallic sheath over all exposed cable bundles utilizing an easily flexible braided sleeving solution such as Techflex from the point where the cabling leaves the protection of the pathway to the device(s) being serviced, such as where the cabling leaves the wall or faceplate to the monitor or projector, or where the cabling leaves the wall to the receiver/amplifier and program sources.

J. Within all equipment enclosures, and at the back of all equipment to the point where the cabling enters the equipment location, the Contractor shall utilize Velcro straps or Milli-Tie wraps for bundling of signal wires.

K. Test all cabling for shorts, opens or other undesirable conditions. Replace any cabling found to be damaged or compromised in its ability to perform to that of a new and undamaged or uncompromised cable.

L. Test all I/O and adjustability of the system, including providing any required test source or load that may be required to test any currently unused input or output.

M. Verify complete operation of all components and the system as a whole. Correct all issues prior to final punch walk through.

3.2 LABELING

A. The Contractor shall neatly label all cabling so as to assure easy maintenance and troubleshooting.

B. Label all cabling at both ends at easily readable location that are no greater than 6” from the ends of the cable.

C. Labeling shall be either laser-jet printed tags designed to adhere in a self-laminating fashion, or in field machine generated labels utilizing a commercial grade labeling machine designed for labeling cabling in such applications, and label stock designed for this specific application.

D. Labeling shall be created so as to state the function and/or meaningful ID of the cable in recursive rows down the entire length of the label so the label is readable around the entire diameter of the cable.

E. Label font shall be a clearly readable font, such as Arial, bold and no smaller than 1/8” high.

3.3 CALIBRATION AND COMMISSIONING

A. The contractor shall verify signal level and signal integrity during installation and operation of the system. Should it be required to provide sufficient signal level and signal to noise ratio, as well as other industry accepted signal metrics, the Contractor shall provide distribution or buffer amplifiers to assure these sufficient signal levels as specified previously in this document. These line drivers would be in addition to any explicitly called out in these Documents.

B. The Contractor shall calibrate all signals so that distribution of the signals shall be of a consistent and acceptable level minimizing and cascading signal to noise ratios while maintaining usable signal level.

C. All installation and calibration of equipment shall be by qualified and certified personnel. All calibrations shall be checked by appropriate calibration equipment. Calibrations made by authoritative and/or experienced eyes and/or ears are not acceptable.

D. All calibrations and adjustments shall be documented in machine generated print in a neat and organized fashion for transmission to the Owner. All documentation shall clearly identify the location of the equipment being documented, including, but not limited to manufacturer, model number and serial number. The Engineer reserves the right to review, reject or require modification or further documentation prior to completion of the project.

E. The Engineer shall be given a minimum of 72 hours’ notice prior to all final calibrations and commissioning and reserves the right to observe any and all final calibrations and commissioning. Should such courtesies not be extended to the Engineer prior to the final calibrations and commissioning, the Engineer reserves the right for the procedures to be completely repeated prior to considering job completion.

3.4 WORK COMPLETION

A. The Contractor shall provide a complete and functioning system, based on the design intent set forth in these Construction Documents. Any and all equipment, either implied or intentionally omitted from these documents, but generally accepted as being required for the completion of the installation, as represented in these Construction Documents, shall be provided by the Contractor at no additional cost to the Owner.

B. Each system component shall be individually tested, as well as tested in the complete system configuration, to assure 100% operability of each device, and compatibility of all components. All products and system configurations will be fully tested and operational prior to final payment.

C. Contractor shall verify and produce documentation that every Sound Reinforcement system does not experience interference from every other Sound Reinforcement system.

D. The Contractor shall provide a copy of all testing documentation to the Owner at the time of system commissioning and training.

E. System Commissioning, including testing and certifications, shall be completed by a factory authorized representative prior to final payment. Said representative shall be fully certified by the manufacturer, and not simply an employee of the Contractor relying upon the Contractors company certifications. All system operation or installation deficiencies shall be documented and submitted to the Owner at time of commissioning and shall be resolved prior to final training and final payment. Final payment shall be held until such time that final commissioning and training is completed to the satisfaction of the Owner and Engineer.

F. The Contractor shall give a two week notice to the Engineer and Owner prior to system commissioning. The Engineer and Owner reserve the right to be present during the commissioning process to approve system configurations prior to the final punch list.

G. Complete As-Built documentations shall be a pre-requisite for consideration of job completeness.

3.5 TRAINING

A. The Contractor shall perform formal training with permanent staff personnel under the employ of the Owner.

B. The Contractor shall utilize a formal sign in sheet that shall be included with the as-built documentation.

C. Provide forty (40) hours training for School/District personnel on the operation, programming, and maintenance of the classroom sound reinforcement system and twenty (20) hours training for the School/District personnel on the operation, programming and maintenance of the interactive audio-video equipment.

D. Provide two (2) digital video copies of all training.

3.6 WARRANTY

A. Warranty of the system, including parts and on-site labor, shall be provided by the Contractor for all materials and workmanship for a period of three (3) years, or for the duration of the manufacturer's documented warranty whichever is greater. Should for some unforeseeable reason, the installer not be able to complete the term of the warranty, the manufacturer shall bear the complete responsibility

of the warranty for both parts and labor and shall appoint a certified service organization to complete the term of the warranty. The manufacturer shall inform the Owner of this appointment in writing. The Contractor shall present assurance of this stipulation from the Manufacturer to the Owner, in writing prior to commencement of work. Should the Contractor not provide this written assurance, the Owner shall retain the right, as outlined elsewhere in these Documents, to obtain satisfaction, including but not limited to, financial restitution to the Owner.

B. The warranty period shall begin after substantial completion of all work, including Technology Bid Package systems, at which time, the installer shall provide service within a 24-hour period after notice by the Owner, for the duration of the warranty.

END OF SECTION 27 41 16