SECTION 270500 - COMMON WORK RESULTS FOR COMMUNICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Basic electrical requirements, which are specifically applicable to all Division 27 Sections, in addition to the requirements of Division 1 - General Requirements.

1.2 SUBMITTALS

A. Provide submittals in accordance with Section 01330 - Submittal Procedures.

B. Submittal data containing manufacturer's data shall be sent to the Architect, Engineer and Owner for review.

C. Electronic submittal data shall be assembled in Adobe Acrobat's Portable Data Format (PDF) for review.

D. Electronic submittal data shall be assembled in one (1) complete PDF file and shall include an index sheet (TOC) listing each submittal item by specification number and its content. Each file shall also be organized with "Bookmarks" of each section. Submittals that do not have each submittal item referenced by "Bookmarks" shall be rejected.

E. All electronic submittal data for a trade shall be submitted at one time except as noted herein.

F. Data not submitted shall have a statement explaining why the data was not submitted.

G. Submittals not conforming to any of the above requirements shall be rejected.

H. The contractor shall go to each specification section to determine all technical information/data required and organize information/data using tabs for major headings as follows:
   1. Section 271301 - Voice and Data Communication Cabling and Network Equipment
      a. Product data
      b. Shop drawings
      c. Qualification data
      d. Field quality control test reports
      e. Warranty
   2. Section 274133 – Interactive Audio-Visual, IPTV and Video on Demand System
      a. Product data
      b. Shop drawings
      c. Equipment list
      d. Field quality control test reports

I. Manufacturer's data sheets shall be marked to clearly indicate the manufacturer, model number, size, color, accessories, required clearances, field connection details, weight loading, electrical characteristics, capacities, etc. being submitted. Variations from specifications shall be explained. Submittal preparer's name and telephone number shall be listed on the index sheet.

J. Only manufacturers listed in specifications or addendums will be considered.

K. Review, corrections, or comments made on the submittals do not relieve the Contractor from compliance with the requirements of the Drawings, Specifications and Addendums (Contract Documents). By entering into this Contract, the Contractor agrees that the purpose of submittals is to demonstrate to the Engineer that the Contractor understands the design concept and that he demonstrates his understanding by indicating which equipment and material he intends to furnish and install and use. Review of shop drawing will be general only for basic conformance with the design concept. The review of such drawings, schedules or cuts shall not relieve the Contractor from the responsibility for correcting all errors of any sort

contained in the submittals. The Contractor is responsible for confirming and correlating all quantities and dimensions; selecting proper fabrication processes, construction methods and installation techniques; coordinating this work with that of all other trades; and performing all work in a safe, workmanlike and satisfactory manner.

L. Below are the submittal item codes that will be used when reviewing the submittal data. These codes show up on the "Submittal Review" sheet. Only one copy of the submittal review sheet is returned upon completion of the submittal review.
   1. RNE - Reviewed, No Exceptions Noted
      a. Indicates the information provided has been reviewed and no exceptions are taken. Contractor must still comply with the contract documents.
      b. No corrective action required at this time.
   2. FNC - Furnish with Noted Corrections
      a. Indicates the contractor shall insure that all necessary or noted corrections are incorporated into equipment furnished to the project.
      b. Contractor shall incorporate items requested in review comments, but re-submittal not required.
   3. RES - Revise and Resubmit
      a. Indicates item is not presently acceptable as submitted, but may be accepted provided additional information and/or changes are made.
      b. Contractor shall revise and resubmit item to Engineer with additional information indicating compliance with Contract Documents prior to proceeding with work.
   4. PSD - Provide Submittal Data
      a. Indicates submittal data was not provided for this item or section.
      b. Contractor shall provide submittal data meeting the explicit requirements of the plans, specifications, and all addenda.

M. Shop drawings and data submittals for materials requiring extra long delivery time shall be submitted for approval as soon as possible after execution of contract. All sleeves must be precast in concrete or concrete block and accordingly provided to the mason in a timely manner. Accordingly, all items such as these shall be submitted for approval in a timely manner (prior to other submittals if necessary) so they may be properly incorporated in the building's structure. Allow a minimum of three weeks for review. No substitutions of materials or extensions of contract time will be allowed for Contractor’s failure to submit or order such materials sufficiently in advance of the work. See Architectural specification section for additional requirements for submittals.

1.3 REGULATORY REQUIREMENTS

A. All work installed under Division 27 shall conform to the current adopted Edition of Building/Electrical Codes and their appropriate amendments:
   1. NFPA 70 2023 National Electrical Code
   2. Life Safety Code, NFPA 101
   3. Requirements of the State of Georgia Fire Marshall's Office.
   4. GA State Energy Code.
   5. Standard Building Code
   6. Standard Mechanical Code (Georgia Edition)
   7. Standard for Health Care Facilities, NFPA 99
   8. National Fire Alarm Code NFPA 72
   9. Standard for Emergency and Standby Power Systems NFPA110
   10. Standard for Lightning Protection System NFPA 780
   11. City of McDonough and Henry County Codes

B. Obtain and pay for all permits, and request inspections from all authorities having jurisdiction, in a timely manner.

C. Materials and Equipment included in Underwriter's Label Service shall bear that label. Electrical equipment shall be UL approved as installed, and bear the UL label, unless noted otherwise herein.

D. Where requirements of these specifications differ from specified codes and ordinances, conform to the more stringent requirements.

1.4 CONTRACTOR GUARANTEE

A. All equipment and materials furnished and all work performed under these specifications, shall be guaranteed to be free of defective materials and workmanship for a period of one year (unless a longer period is specified elsewhere) after Architect's Final Certificate. Upon notice of failure of any part of the guaranteed equipment during the guarantee period, the affected part or parts shall be promptly replaced with new parts by the Contractor at no additional cost to the Owner. All labor required to perform guarantee shall be included as part of the complete guarantee warranty.

1.5 OPERATING AND MAINTENANCE (O&M) MANUALS

A. Three bound and indexed Operating and Maintenance Manuals shall be prepared by the Contractor and be submitted for approval prior to delivery to operating personnel. Binders shall be 3-ring commercial grade, complete with inside storage pockets, sheet protectors, spine and front cover labels.

B. Operating and maintenance manuals shall also comply with Division 1 Section “Operation and Maintenance Data.

1.6 PROJECT/SITE CONDITIONS

A. Install work in locations shown on Drawings, unless prevented by project conditions. Shift or relocate equipment or systems to avoid conflicts with other trades. Modifications to the work required to accommodate project conditions encountered in the field shall be made at no additional cost to the contract.

B. Prepare drawings showing proposed rearrangement of Work to meet Project conditions, including changes to Work specified in other Sections. Obtain permission of Architect/Engineer before proceeding.

C. Install items so that there are no obstructions (e.g., pipes, conduits, etc.) blocking service panels of the equipment, or preventing the removal of the equipment.

D. Electrical items are shown on drawings in approximate locations unless dimensioned. Install at location required to serve intended purpose. Include installation within ten (10) feet of location shown.

1.7 SEQUENCING AND SCHEDULING

A. Contractor shall coordinate work so as to avoid conflicts with other work in progress.

B. Work shall progress in a manner that will not interfere with other trades. The Division 27 Contractor shall have coordination meetings with all other Contractors to ensure that all systems installed in "share areas" (e.g. ceiling plenums, mechanical rooms, etc.) are coordinated and installed to insure proper fit and access. All costs required for the coordination of the work between trades shall be borne solely by the Contractor.

C. Contractor shall provide confirmation letters from the factory (not from the contractor) to the Owner that long lead items have been ordered. Long lead items are defined as items having longer than six-week fabrication schedules. See Section 01100 - Summary for additional requirements.

1.8 ACCEPTABLE PRODUCTS

A. Where a manufacturer has been listed as being acceptable in the various specification sections hereinafter for a certain product, it shall be understood that the manufacturer has been approved as being capable of producing this product. This does not necessarily constitute approval of his standard product. His product shall still comply with all of the requirements and standards of this specification and not necessarily his standard specification, to the extent that it might require special manufacture to meet the requirement and standards of this specification.

B. Prior Approval: Substitutions of specified items and prior approvals of other manufacturers will not be considered.

C. Addenda: If the substitution is allowed, such approval will be set forth in an Addendum.

D. Costs: All costs incurred by the acceptance of substitutions shall be borne by the contractor.

1.9 DRAWINGS

A. General: Both the drawings and specifications shall be considered supplemental to one another so that materials and labor required by one but not the other shall be supplied and installed as though specifically called for by both. Where drawings and specification conflict, Contractor shall conform to the more stringent or costly of the two requirements.

B. Scaling: The drawings are diagrammatic only and show generally the location of the equipment, ducts and pipes but are not to be scaled. All dimensions shall be verified at the building site. Prefabrication of work from the drawings shall be at the Contractor's risk.

C. Existing Conditions: It shall be the Contractor's responsibility to visit the site prior to bidding the project and prior to beginning work to make himself familiar with existing conditions.

1.10 PROTECTION OF MATERIALS AND EQUIPMENT

A. Delivery, Storage and Handling: Deliver products to site in factory-fabricated protective containers, with (where appropriate) factory-installed shipping skids and lifting lugs. Store in clean, dry place and protect from weather and construction traffic. Handle carefully to avoid damage to components, enclosures, and finish.

B. Prior to Final Construction Review: All materials and equipment shall be cleaned. Chipped or scraped paint shall be retouched to match.

C. Equipment Painting: Equipment which has been damaged beyond the point of retouching or has been retouched not to match the original finish shall be repainted in accordance with the Architectural painting section.

1.11 CLEANING

A. The Contractor shall maintain the site reasonably clean and free of excessive debris and leftover materials at all times. All trash and debris shall be hauled from the job site on a daily basis for disposal. Prior to testing and adjusting, equipment shall be clean and free of any construction debris and litter.

B. Contractor shall meet all contractual requirements as related to site cleanliness including dust control.

1.12 ROOM NUMBERS

A. The room numbers indicated on the Contract Documents were provided by the Architect to assist in identifying spaces during construction. These room numbers may not necessarily be the Owner's final choice of room numbers. The contractor shall obtain from the Owner the final choice of room numbers and shall use these numbers wherever required. (For example, room numbers are used in programming of fire alarm systems and intercom system, and shall match the Owner's final choice.)

END OF SECTION 270500

SECTION 271301 - VOICE & DATA COMMUNICATION CABLING & NETWORK EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following items for wiring systems used as signal pathways for voice and high-speed data transmission and network equipment:
   1. Main Distribution Frame
   2. Intermediate Distribution Frames
   3. Patch Panels
   4. Fiber Optic Cables
   5. Cat 6A Cables
   6. Patch Cords
   7. Outlets and Terminations
   8. Data Network Switches
   9. Voice Gateway Router and IP Telephone sets
   10. Wireless Local Area Network (WLAN) Access Points
   11. Wireless Local Area Network (WLAN) Configuration
   12. Equipment Programming, Licenses, and Configuration

1.2 DEFINITIONS

A. Backbone: A facility (e.g., pathway, cable, or conductors) between telecommunications rooms or floor distribution terminals, the entrance facilities, and the equipment rooms within or between buildings.

B. BICSI: Building Industry Consulting Service International.

C. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.

D. EMI: Electromagnetic interference.

E. Horizontal Cabling: Cabling between and including the telecommunications outlet/connector and the horizontal cross-connect. Also the cabling between and including the building automation system outlet or the first mechanical terminations on the horizontal connection point and the horizontal cross-connect.

F. IDC: Insulation displacement connector.

G. LAN: Local area network.

H. RCDD: Registered Communications Distribution Designer.

I. RMC: Rigid metallic conduit.

J. UTP: Unshielded twisted pair.

1.3 SUBMITTALS

A. Product Data: For features, ratings, and performance of each component specified.

B. Shop Drawings:
   1. Include dimensioned plan and elevation views of telecommunications equipment rooms, labeling each individual component. Show equipment rack assemblies, method of field assembly, workspace requirements, and access for cable connections.
   2. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.
   3. System Labeling Schedules: Electronic copy of labeling schedules that are part of the cabling and asset identification system of the software.
   4. Cabling Administration Drawings.
   5. Wiring diagrams to show typical wiring schematics including the following:
      a. Workstation outlets, jacks, and jack assemblies.

b. Patch cords.
c. Patch panels.
d. Fiber-optic boxes.
e. Distribution cabinets.
f. Terminal racks.

C. Proof of Certification: Provide proof of the following current Certifications:
1. Approved cable manufacturer's Certification of Installers.
2. Corning Fiber Optic cable Certification of Installers.
3. Cisco Partner with Wireless LAN Specialization Certification.
4. Cisco Gold Certified Partner with the Master Unified Communications Certifications.

D. Qualification Data: For Installer.

E. Source quality-control test reports.

F. Field quality-control test reports.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Cabling installer must have on staff personnel RCDD certified by BICSI.
1. Layout Responsibility: Preparation of Shop Drawings and Cabling Administration Drawings by an RCDD.
2. Installation Supervision: Installation shall be under the direct supervision of a Registered Technician, who shall be present at all times when Work of this Section is performed at Project site.

B. Network Equipment Installer Qualifications: Network switches, gateways, routers, and server installer and configuration technicians must have the following certifications:
1. Cisco Partner with Wireless LAN Specialization Certification.
2. Cisco Gold Certified Partner with the Master Unified Communications Certifications.
3. Cisco Certified Design Expert (CCDE) Certifications.

C. Source Limitations: Obtain all products through sources from the approved manufacturers.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

E. Comply with NFPA 70, "National Electrical Code."

1.5 QUALIFICATIONS

A. Installer shall be Commscope, Panduit, Corning, S2 Access Control, and Avigilon certified as a company, no exceptions. Data cabling and complete S2 and Avigilon installation shall be performed by one contractor only. NetPlanner Systems and Wachter, Inc. are prequalified installers for Henry County Schools. Any proposed vendor other than NetPlanner Systems Inc. or Wachter, Inc. must have prior approval by Owner.

B. Acceptable low voltage Prequalified Installers:
1. NetPlanner Systems – Atlanta, GA
2. Wachter, Inc.- Suwanee, GA

1.6 COORDINATION

A. Coordinate layout and installation of voice and data communication cabling with Owner's telecommunications and LAN equipment and service suppliers. Coordinate service entrance arrangement with local communication service carrier, AT&T.
1. Meet jointly with specified herein telecommunications and LAN equipment suppliers, local exchange carrier representatives, and Owner to exchange information and agree on details of equipment arrangements and installation interfaces.
2. Record agreements reached in meetings and distribute to other participants.

3. Adjust arrangements and locations of distribution frames and cross-connect and patch panels in equipment rooms and wiring closets to accommodate and optimize arrangement and space requirements of Voice and LAN equipment.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Outlet Assemblies: One of each type for every 25 outlets shown on plans, but no fewer than one.
   2. Patch-Panel Units: One of each type.
   3. Connecting Blocks: One of each type.
   4. Device Plates: One of each type.
   5. Multiuser Telecommunications Outlet Assemblies: One of each type.
   6. Patch cords: quantity 25.
   7. Access Points: quantity 5

1.8 WARRANTIES

A. Contractor shall warrant all cabling items including applications, performance, and product for a period of twenty-five years. All cabling items shall be repaired or replaced without cost to Owner as well as restoring building conditions disturbed during the repair.

B. All Cisco switches, controllers, gateways, and devices specified herein shall include Cisco's "SmartNet 8x5xNBD" warranty in the Owner's name.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 SYSTEM REQUIREMENTS

A. Coordinate the features of materials and equipment so they form an integrated system. Match components and interconnections for optimum future performance.

B. Expansion Capability: Unless otherwise indicated, provide spare fibers and conductor pairs in cables, positions in cross-connect and patch panels, and terminal strips to accommodate five percent future increase in the number of workstations shown on Drawings. This expansion requirement does not apply to horizontal cable from workstation outlet to first terminal board.

C. The project encompasses a fiber optic backbone, and Category 6, Class A unshielded twisted pair (UTP) data cabling system to implement wired and wireless data networks, Voice cabling, data networking switches, VoIP Telephony, wireless LAN networking equipment, controllers, services, and all licensing etc. for this project. The completed network must be capable of supporting up to 250MHz transmission of data over the enterprise. The UTP must be able to support 400MHz for 100 meters (328 ft. including patch/line cords).

D. Cat 6A Performance Requirements:
   1. Highest Test Frequency 650 MHz

E. Input impedance shall be measured per ASTM 4566-94, 43.2 Method 2, Option 2, (Method 3 will not be allowed), input impedance shall be swept out to 650 MHz and meet the following:
   1. 1 MHz to 100 MHz is 100 ohms $\pm$ 15.
   2. 100 MHz to 200 MHz is 100 ohms $\pm$ 22.
   3. 200 MHz to 400 MHz is 100 ohms $\pm$ 32.
   4. Minimum ACR $\geq$10 dB @ 205MHz (100-meter worst pair NEXT) : $\geq$10 dB @ 190 MHz (100 meter power sum NEXT)
   5. Maximum Skew: 25 ns at 100 meters and 30 ns at 100 meters Channel

6. Maximum Attenuation: 43.21 dB/100 meters @ 400 MHz

F. UTP Termination Devices (connectors and patch panels) Performance Requirements:
1. All connectors to be used in a channel shall meet the following minimum requirements:

FREQUENCY	PSNEXT	ATTENUATION
MHz	dB	dB
1	90	.02
4	78	.04
8	72	.06
10	70	.06
16	66	.08
20	64	.09
25	62	.10
31.25	60	.11
62.5	54	.16
100	50	.20
200	44	.28

2. All connectors to be used in a channel shall meet the following minimum return loss requirements:

FREQUENCY	RL
MHz	dB
1 to 31.25	30
62.5	24
100	20
200	14

G. Channel Performance Requirements:
1. In addition to requirements stated above for individual product specifications, the end-to-end interconnected and installed channel shall meet the following requirements:
a. Channel PSELFEXT

FREQUENCY	CAT 6A
MHz	dB
1.0	61
4.0	49
8.0	43
10.0	42
16.0	37
20.0	35
25.0	33
31.25	31
62.5	25
100.0	21
200.0	15

H.

I. Channel Return Loss

FREQUENCY	CAT 6A
MHz	dB
1.0	19
4.0	19
8.0	19
10.0	19
16.0	19
20.0	19
25.0	18
31.25	17
62.5	14
100.0	12
200.0	9

1. Attenuation-to-Crosstalk ratio (Powersum)
   a. 16.0 dB @ 100 MHz

J. The above requirements contain only values at discrete frequencies. The entire swept frequency range must be compliant.

K. Plenum-rated cables shall use 100% FEP for the insulation.

L. Outlet configurations are indicated on the drawings.

M. Contractors shall ensure that cabling routing from above the ceiling to the racks is contained within cable management system.

N. The main distribution frame (MDF) for this building shall be in the MDF designated space of the building. Minimum two (2) floor mounted racks shall be placed within this room to house the termination patch panels and active hardware including uninterruptable power supplies.

O. There is one (1) intermediate distribution frames (IDF's). All IDF’s shall be connected to MDF via a fiber optic backbone. The IDF's shall be installed in minimum 30"D floor mounted racks unless noted otherwise. Wiring routing to the cabinets shall be contained within cable tray and management systems.

P. The contractor shall conduct the installation in accordance with NEC, NFPA and all applicable codes. The contractor shall obtain all permitting as required to conduct the installation. The contractor shall install the system and certify compliance with NEC, NFPA, IEEE 802.3, 100BaseT, EIA/TIA 568B, and all applicable codes.

Q. Access points for wireless networking shall be installed within the building as shown on the drawings and shall be configured as specified in this section.

R. Voice cabling shall be provided and installed within the building as shown on the drawings as specified in this section.

S. IP based video surveillance system specified in Section 282300 shall be part of this data network.

T. Grounding per Section 260525 shall be provided to the MDF, all IDF's, and telephone backboard.

2.3 IP TELEPHONY DESCRIPTION

A. The Internet Protocol Telephony (IPT) shall be implemented by utilizing the existing Cisco Unified Communication’s Manager (Call Manager), the existing Unified Messaging with Cisco Unity Server, and new Cisco Voice Gateway Router and IP Handsets as listed herein. The installer shall provide services of a Network Engineer to plan, design, configure, and install a complete IPT solution which shall be a Unified Communications solution.

B. Provide licensing for Call Manger, Unity Server, and new voice gateway to support the solution.

C. The IP Handsets shall be powered by Cisco's in-line power capable switches. The network switches shall be utilized to power up and connect IP Handsets to the IPT network.

D. The IP Handsets shall be configured and controlled by Cisco Unity Sever which resides in the school system's Data Center.

E. IP Telephony Implementation and Configuration:
   1. Implement the IPT solution into network including installation of equipment; migration to IP Telephony infrastructure; and functionality testing.
   2. The following steps describe the work required to implement a complete IPT solution for this building:
      a. Implementation of specified 4451 Unified Voice Gateway with SRST.
      b. Design traffic flows to comply with available Quality-of-Service metrics within the client Metro-Ethernet network.
      c. Implementation and configuration of all Cisco 8851 IP Handsets and expansion modules.
      d. User and Extension configurations in Call Manager and Unity
      e. Implementation of Cisco 8851 IP Phones and 8800-A-KEM Expansion Module – Attendant Phones.
      f. Auto Attendant configuration
      g. Implementation of ten (10) Cisco ATA port adapters for fax locations.
      h. Interface 4451 Voice Gateway with Analog Contingency lines via FXO ports. Provide eight (8) ports dedicated for Analog Contingency lines.
      i. Configure 4451 Voice Gateway for 911/SRST dialing using Analog Contingency lines
      j. Configure Inward Dialing on Analog Contingency lines to route to Attendant Phone.
      k. Installer shall provide complete configuration of the IPT solution in accordance with Owner's requirements.

F. IP Telephony End User Training:
   1. Provide basic end user training. The following training tasks shall be performed:
      a. Phone Features - Placing Calls; Call and Phone Controls; Transferring Calls; Conference Calls
      b. Hands On Review - Review of the features on end user's phone; Question and answers on the phone features
      c. Voice Mail - Setup; Internal Access; External Access
      d. Unified Active Assistant Demonstration - Call Settings; Message Settings; Personal Settings
      e. View Mail Discussion - Discuss Play Voice Mail Features; Discuss Respond to Voice Mail Features, etc.

G. IP Telephony After Occupancy Adjustments: Provide after occupancy configuration adjustments. The Installer shall include minimum 24 hours of after substantial completion and occupancy IP Telephony programming and configuration adjustments per Owner's request. This service shall be available to the Owner in four (4) hour increments within one year of substantial system installation.

H. Provide all Cisco 8851 IP phones' MAC addresses and room numbers after placing the phones in the Owner identified spaces for addition to the Call Manager.

2.4 WIRELESS NETWORK DESCRIPTION

A. The Wireless Local Area Network (WLAN) shall be implemented by utilizing IEEE 802.11ac and 802.11an standards and Cisco's cloud managed Meraki MR56 series access points. The access points shall be installed in accessible ceiling tiles and on walls throughout the building as shown on the drawings. The access points shall be connected to the associated distribution frame with Green color patch panel punch block and patched in with Green color patch cables to the grouped switch ports (i.e. switch 01, ports 1-15).

B. In order to achieve optimal number of client log-on with maximum available throughput, there shall be one access point assigned to each classroom. The layout of access points shall utilize Meraki MR56's multiple radios. The access points shall be capable of being powered by Cisco's in-line power capable series switches, specified herein. The switches shall be utilized to power up and connect access points to the local area network.

C. The access points shall be configured and managed over cloud.

D. Wireless Access Point Configuration:
   1. The following steps describe the work required to configure access points and to implement a complete WLAN in the building:
      a. Develop a plan indicating each access point's location within the buildings which shall be uploaded into the Cisco Meraki Dashboard by the Wireless Engineer with each access point labeled AP-01, AP-02 with associated room number in the dashboard and required license file uploaded, IP address, transmit power and channel assignments.
      b. Identify and connect each access point's Green Color patch cord from associated labeled patch panel to network switch port within a distribution frame to activate access points. The Wireless Access Points' Green color patch cords shall be grouped in sequential ports, i.e., ports1-10. The Green color patch panel block shall be connected to sequential switch ports within a distribution frame, i.e., ports 1-15.
      c. Configure access points according to the owner defined, included herein, and system usage determined parameters by utilizing Cisco's guidelines.
      d. Test the entire WLAN for client log-on, security parameters, and coverage etc. in accordance with Cisco's published recommendations, and demonstrate the functionality of the WLAN to the owner and his representatives.
      e. All Access Points shall be mounted with the side LED status light facing the room's main entrance door.
   2. Access Point Data Network Configuration Parameters:

PARAMETER	SETTINGS
System Name	Owner will provide to the installer
IP Address Range for Access Points	Owner will provide to the installer
IP Subnet Mask for Access Points	Owner will provide to the installer
Default Gateway	Owner will provide to the installer
SSID (The SSID is case sensitive)	Owner will provide to the installer
Ensure Compatibility With	non-aironet 802.11
SNMP Admin Community	Owner will provide two (2) to the installer
DNS	Enable
Default Domain	Owner will provide to the installer
Domain Name Servers	Owner will provide to the installer
System Location	Owner will provide to the installer

3. User Defined Access Point Configuration Parameters:

PARAMETER	SETTINGS
Allow Broadcast SSID to Associate	No
SNMP Admin 1 Capability Settings	Write, SNMP, Ident, Firmware, and Admin
SNMP Admin 2 Capability Settings	Write, SNMP, Ident, Firmware, and Admin
User Manager	Enable
802.1X protocol version for EAP Authentication	Draft 10
Primary Server Reattempt Period	0
Server Name/IP	Owner will provide to the installer
Server Type	Owner will provide to the installer
Port	Owner will provide to the installer
Shared Secret	Owner will provide to the installer
Retran Int	Owner will provide to the installer
Max Retran	Owner will provide to the installer
Use Server For	EAP Authentication
Use of Data Encryption by Station	No Encryption
Accept Authentication Type	Open
File Transfer Protocol	TFTP
Default FTP File Server	Owner will provide to the installer

2.5 MOUNTING ELEMENTS

A. Backboards: 3/4-inch, interior-grade, fire-retardant-treated plywood.

B. Distribution racks: Freestanding modular-steel units designed for telecommunications terminal support and coordinated with dimensions of units to be supported.
   1. Module Dimension: Width compatible with EIA 310 standard 19-inch panel mounting.
   2. Finish: Baked-polyester Black powder coat.
   3. Manufactured by Chatsworth Products Inc. Provide free standing minimum 84"H x 19"W 6061 T6 aluminum rack. CPI # 55053-703.
      a. Rack-Mount Ground Bar; 19” W; Copper (CPI #10610-019)

C. Cable Management: Metal with integral wire retaining fingers.
   1. Baked-Polyester powder coat Black finish.
   2. Wire management panels, as required for the full height and width of racks. Wire management shall be manufactured by Chatsworth and shall be as follows:
      a. Single Sided Horizontal – Chatsworth #30130-719 (Anixter # 247659), to be installed above and below each network electronic switch.
      b. Vertical - Chatsworth 40098-703, to be installed on both left and right sides of the floor mounted racks.

D. Power Strips: For mounting in the racks, with 20-A, 120-V ac, NEMA WD 6, Configuration 5-20R receptacles, number as required, but in no case fewer than 6, and including the following:
   1. LED indicator lights for power and protection status.
   2. LED indicator lights for reverse polarity and open outlet ground.
   3. Circuit breaker and thermal fusing. When protection is lost, circuit opens and cannot be reset.
   4. Circuit breaker and thermal fusing. Unit continues to supply power if protection is lost.
   5. Rocker-type on-off switch illuminated when in on position.
   6. Peak Single-Impulse Surge Current Rating: 33 kA per phase.
   7. Protection modes shall be line-to-neutral, line-to-ground, and neutral-to-ground. UL 1449 clamping voltage for all 3 modes shall be not more than 330 V.

2.6 UNSHIELDED TWISTED-PAIR CABLING

A. Cable Manufacturers:
   1. Panduit Corp.
   2. Belden Inc.; Electronics Division.
   3. CommScope Properties, LLC.

B. Terminal and Connector Component and Distribution Cabinet Manufacturers:
   1. Panduit Corp.
   2. Systimax.
   3. CommScope Properties, LLC.

C. 100-Ohm UTP: Comply with UL 444.

D. Voice Backbone Copper Cable:
   1. No. 24 AWG, 25 pair.
   2. Comply with ICEA S-80-576 and TIA/EIA-568-B.2, Category 6A.
   3. NFPA 70, type CMR complying with UL 1666.
   4. Cable Jacket Color: Gray.

E. Voice Copper Cable:
   1. No. 24 AWG, 100 ohm, four pair.
   2. Comply with TIA/EIA-568-B.2, Category 6A.
   3. NFPA 70, types CMG and CMP.
   4. Cable Jacket Color: Gray.
   5. Basis of Design: Four pair minimum Cat 6, Class A plenum rated UTP cables with Gray color jacket.

F. Data Horizontal Copper Cable:
   1. No. 24 AWG, 100 ohm, four pair.
   2. Comply with TIA/EIA-568-B.2, Category 6A.
   3. NFPA 70, types CMG and CMP.
   4. Cable Jacket Color: Blue.
   5. Basis of Design: Four pair minimum Cat 6, Class A plenum rated UTP cables with Blue color jacket.
      a. Cable color for video surveillance system data cable shall be Yellow.

G. Cable Connecting Hardware: Comply with TIA/EIA-568-B.2, IDC type, using modules designed for punch-down caps or tools.
   1. IDC Terminal Block Modules: Integral with connector bodies, including plugs and jacks where indicated.
   2. IDC Connecting Hardware: Consistent throughout Project.

H. Cross-Connect Panel: Modular array of IDC terminal blocks arranged to terminate building cables and permit interconnection between cables.

I. Voice Patch Panel: Punch blocks – 110 type IDC blocks.

J. Data Patch Panel: Comply with TIA/EIA-568-B.2, meeting or exceeding cable performance. Modular panels housing multiple-numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables.
   1. Number of Jacks per Field: One for each four-pair UTP cable indicated and conductor group of indicated cables, plus spares and blank positions adequate to satisfy specified expansion criteria.
   2. Basis of Design: 72 port modular patch panels, as required, pinned for 568B. Manufactured by Panduit, # CPPKATP72WBLY (Anixter # 264798). Provide all patch panel jacks in black color. Provide black color inserts for all unused ports.

K. Jacks and Jack Assemblies: Modular, color-coded, RJ-45 receptacle units with integral IDC-type terminals.
   1. Basis of design: 8 pin RJ45 modular blue color jacks.

L. Patch Cords: Factory-made, four-pair cables in required lengths; terminated with RJ-45 plug at each end.
   1. Basis of design: System matched, Panduit TX-6 Plus blue in color for UTP and LC to LC aqua in color, 50/125um Corning # 050502S5120/xxxM, optical fiber patch cords.
   2. The installer shall determine the length of patch cords (3', 5', or 7' cords) in the distribution frames to adequately arrange and connect in workman like manner to electronic equipment specified herein. The length of patch cords from each outlet to IP Telephony handsets at desktop and Owner provided PCs shall be minimum 14 feet. Provide patch cords for IP based intercom system ceiling speakers.
   3. Provide patch cords from patch panel to switch for endpoints in the following colors:
      a. Wireless Access points – Green
      b. Video/IPTV – Orange
      c. IP Security Camera – Yellow
      d. Interactive Display Panel - Purple

2.7 FIBER-OPTIC CABLING

A. Cable, Terminal, and Connector Product Manufacturers:
   1. Corning Cable Systems.

B. Fiber-Optic Cable: 50/125um enhanced multimode, laser optimized fiber optic OFNP or OFNR cables as listed below. Manufactured by Corning Cabling Systems:
   1. Indoor/Outdoor application - Corning FREEDM LST Gel-Free part # 024S8P-31190-D3.
   2. Indoor only application - Corning MIC part # 024T88-33180-D3.

C. Backbone Fiber Cable: 24 fibers.
   1. Comply with TIA/EIA-492AAAA, tight buffer.
   2. NFPA 70, Type OFN complying with UL 1666.
   3. Maximum Attenuation: 3.50 dB/km at 850 nm; 1.25 dB/km at 1300 nm.
   4. Minimum Modal Bandwidth: 160 MHz-km at 850 nm; 500 MHz-km at 1300 nm.
   5. Cable Jacket Color: Orange.

D. Horizontal Fiber Cable: Two fibers.
   1. Comply with TIA/EIA-492AAAA, tight buffer.
   2. NFPA 70, Types OFN and OFNP.
   3. Maximum Attenuation: 3.50 dB/km at 850 nm; 1.0 dB/km at 1300 nm.
   4. Minimum Modal Bandwidth: 160 MHz-km at 850 nm; 500 MHz-km at 1300 nm.
   5. Cable Jacket Color: Orange.

E. Cross-Connect and Patch Panels: Modular panels housing multiple-numbered, duplex cable connectors.
   1. Number of Connectors per Field: One for each fiber of cable or cables assigned to field, plus spares and blank positions adequate to satisfy specified expansion criteria.

F. MDF Fiber Optic cabinet Mount Enclosures: 12 LC adapter panel capacity fiber optic cabinet mount enclosure with fiber optic cable routing accessory kit and 6 LC adapter panel with phosphor bronze sleeves. Manufactured by Corning, # CCH-04U (Anixter # 180420) for enclosure and # CCH-CP24-E4 (Anixter # 355883) for adapter panel.

G. IDF Fiber Optic Cabinet Mount Enclosures: 6 LC adapter panel capacity fiber optic cabinet mount enclosure with fiber optic cable routing accessory kit and 6 LC adapter panel with phosphor bronze sleeves. Manufactured by Corning, # CCH-02U (Anixter # 180627) for enclosure and # CCH-CP06-E4 (Anixter # 355883) for adapter panel.

H. Patch Cords: Factory-made, dual fiber cables in required lengths.

I. Cable Connecting Hardware:
   1. Comply with TIA/EIA-568-B.3.
   2. Quick-connect, simplex- and duplex-Type LC couplers. Insertion loss not more than 0.7 dB.

2.8 WORKSTATION OUTLETS

A. Jacks: 100-ohm, balanced, twisted-pair connector; four-pair, modular, RJ-45. Comply with TIA/EIA-568-B.1.

B. Workstation Outlets: Dual jack-connector assemblies mounted in single or multi-gang faceplate.
   1. Faceplate: Metal, Satin finish.
   2. Mounting: Flush, unless otherwise indicated.
   3. Legend: Machine-printed, adhesive tape label identifying the circuit.
   4. Basis of design: 8 pin RJ45 modular blue color jacks.

C. Outlet Coverplate: Information outlets single gang, Stainless with satin finish, no exceptions.

D. Protective Enclosure for Access Points in Gymnasium and Commons area: Fiberglass molded construction in gray color, hinged cover with scratch resistant Lexan window. Manufactured by Hoffman #D16148CHSCFGWP (Anixter # 360893) with panel.

E. Patch Panel Icons: provide minimum 100 Pieces per Runner, 24 icons per runner.
   1. Access Points: Panduit #CIBWIREGR-V/N icon for access point port identification in patch panels. Provide in green color with white symbol.
   2. Access Control System: Panduit #CIBCABU-V/N icon for access control system port identification in patch panels.
   3. Video Surveillance System NVR: Panduit #CIBDVROR-V/N icon for video surveillance system DVR port identification in patch panels.
   4. Video Surveillance System Cameras: Panduit #CIBCAMERARD-V/N icon for video surveillance system IP camera port identification in patch panels.

2.9 BACKBOARDS

A. A-C, void-free plywood, 84 inches high and 3/4-inch thick, fire rated.

2.10 GROUNDING AND BONDING

A. Materials: Comply with NFPA 70, TIA/EIA-607, and UL 467.

2.11 IDENTIFICATION PRODUCTS

A. Manufacturers:
   1. Brady Worldwide, Inc.
   2. HellermannTyton.
   3. Panduit Corp.

B. Comply with TIA/EIA-606-A and with applicable requirements in Division 16 Section "Electrical Identification."

C. Cable Labels: Self-adhesive vinyl or vinyl-cloth wraparound tape markers, machine printed with alphanumeric cable designations.

D. Computer-based cable management system, with integrated database and graphic capabilities.
   1. Document physical characteristics by recording the network, TIA/EIA details, and connections between equipment and cable.
   2. Information shall be presented in database view, schematic plans, or technical drawings.
      a. Microsoft Visio Professional or AutoCAD drawing software shall be used as drawing and schematic plans software.
   3. System shall interface with the following testing and recording devices:
      a. Direct upload tests from circuit testing instrument into the PC.
      b. Direct download circuit labeling into labeling printer.

2.12 ELECTRONIC EQUIPMENT

A. Wireless Network Access Points: IEEE 802.11ac standards compliant, wireless LAN (WLAN) access point of modular design with cloud management. Access point shall have four radios with built-in diversity antennas approved for FCC configuration. Provide with flush-mounting kit for tiled ceilings, and accessories to mount in ceilings or walls as applicable. Access point shall be powered via Cisco line-power-enabled switches over Ethernet. Access point shall be manufactured by Cisco, Meraki MR56-HW with LIC-ENT-5YR.

B. Network Switches and Equipment - Provide the following Cisco *Catalyst* network switches and related supporting equipment in applicable distribution frames:

1. MDF Core and Copper Switches: Provide Cisco Catalyst C9300-48U, 48 port UPOE, each with two 10Gbit Ethernet SFP-10G-SR-S transceiver multimode fiber optic type, three GLC-SX-MMD. Each switch shall have dual PWR-C1-1100WAC-P 1100W AC Config 1 Power Supply front to back cooling and licensed with C9300-NW-A-48, C9300 Network Advantage, S9300UK9-1612, low-density license K12, DNA-A-48-3Y, PI-LFAS-AP-T-3Y, and PNP-LIC.
    a. Provide Cisco Catalyst C9300-24S, 24 port Fiber, with 8x10G Ethernet network module, C9300-NM-8X, transceiver multimode fiber optic modules, GLC-SX-MMD, and single mode fiber optic modules. Each switch is to have dual PWR-C1-715WAC-P 750W AC Config 1 Power Supply, Catalyst stack power cable 150CM, and licensed with C9300-NW-A24, C9300 Network Advantage, DNA-A-24-3Y, PI-LFAS-AP-T-3Y, and PNP-LIC.
2. Provide the following to make interconnections:
    a. Gbit SFP’s for MDF to each IDF interconnections.
3. IDF Switches: Provide Cisco Meraki C9300X-48HXN-M, each with 4x10Gbit Ethernet module, C9300X-NM-8Y Fiber Module, SX transceiver multimode fiber optic type, MA-SFP-1GB-SX, and 120G Data-Stack cable, MA-CBL-120G-50CM. Each switch is to have MA-PWR-1100WAC power supply and licensed with LIC- C9300X-48HXN -5Y. Provide rack mountable UPS, Liebert #PSI5-3000RT120LIN “3000VA PSI5 LIO with SNMP card, brackets, and support accessories for each IDF.
4. Spare Capacity: Provide minimum twelve (12) spare copper switch ports in each distribution frame.
5. Each switch port shall be capable of providing adequate power to both radios in the specified access points, and IP video surveillance cameras.

C. IP Telephones: Cisco Unified IP telephone #8851 with programmable backlit line/feature buttons and interactive soft keys, speaker phone, built-in headset port, and integrated Ethernet switch. The IP telephone shall have higher-resolution color display. Provide twenty five (25) IP telephone sets with complete programming, configuration, and installation per the Owner’s instructions and requirements herein.

2.13 SOURCE QUALITY CONTROL

A. Fiber-Optic Cable: Each cable spool tested at factory before shipping at 850 and 1300 nm.

B. UTP Cable Verification of Performance: Test every cable package or reel at factory to verify that cable complies with TIA/EIA-568-B.2 requirements.

PART 3 - EXECUTION

3.1 INSTALLATION STANDARDS

A. Comply with BICSI TCI, TIA/EIA-568-B.1, TIA/EIA-568-B.2, TIA/EIA-568-B.3, and TIA/EIA-569-A.

3.2 EXAMINATION

A. Examine pathway elements intended for cables.
   1. Verify proposed routes of pathways. Check raceways, cable trays, and other elements for compliance with space allocations, clearances, installation tolerances, hazards to cable installation, and other conditions affecting installation. Verify that cabling can be installed complying with EMI clearance requirements.
   2. Prepare wall penetrations and verify that penetrations of rated fire walls are made using products labeled for type of wall penetrated.
   3. Identify plan to support cables and raceways in suspended ceilings. Verify weight of individual types and sizes of cables. Verify that load capacity of cable support structures is adequate for each pathway.
   4. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 APPLICATION OF MEDIA

A. Backbone Cable for Data Service: Use fiber-optic cable for runs between equipment rooms and data closets and for runs between data closets.

B. Horizontal Cable for Data Service: Use UTP Category 6A cable for runs between data closets and workstation outlets.

C. Horizontal Cable for Voice Service: Use UTP Category 6A cable for runs between wiring closets and workstation outlets.

3.4 INSTALLATION

A. Comply with NECA 1.

B. Wiring Method: Install cables in raceway and cable tray except within consoles, cabinets, desks, and counters. Conceal raceway and wiring except in unfinished spaces. Cable trays are specified in Division 26 Section "Cable Trays." Raceways and boxes are specified in Division 26 Section "Raceways and Boxes."

C. Cable Installation:
   1. Install exposed cables parallel and perpendicular to surfaces or exposed structural members and follow surface contours where possible.
   2. Make splices, taps, and terminations only at indicated outlets, terminals, and cross-connect and patch panels.
   3. Pulling Cable: Do not exceed manufacturer's written recommended pulling tensions. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
   4. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
   5. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
   6. Install UTP cables using techniques, practices, and methods that are consistent with Category 6A rating of components and that ensure Category 6A performance of completed and linked signal paths, end to end.
      a. Do not untwist more than 1/2 inch of Categories 6A cables at connector terminations.

D. Wiring within Wiring Closets and Enclosures:
   1. Install plywood backboards on walls of equipment rooms and wiring closets from floor to ceiling.
   2. Mount patch panels, terminal strips, and other connecting hardware on cabinets.
   3. Group connecting hardware for cables into separate logical fields.
   4. Train conductors to terminal points with no excess.
   5. Use lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.

E. Separation from EMI Sources: Comply with BICSI TDM and TIA/EIA-569-A recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment. Comply with the following minimum separation distances from possible sources of EMI:
   1. Separation between unshielded power lines or electrical equipment in proximity to open cables or cables in nonmetallic raceways is as follows:
      a. Electrical Equipment Rating Less Than 2 kVA: 5 inches.
      b. Electrical Equipment Rating between 2 and 5 kVA: 12 inches.
      c. Electrical Equipment Rating More Than 5 kVA: 24 inches.
   2. Separation between unshielded power lines or electrical equipment in proximity to cables in grounded metallic raceways is as follows:
      a. Electrical Equipment Rating Less Than 2 kVA: 2-1/2 inches.
      b. Electrical Equipment Rating between 2 and 5 kVA: 6 inches.
      c. Electrical Equipment Rating More Than 5 kVA: 12 inches.
   3. Separation between power lines and electrical equipment located in grounded metallic conduits or enclosures in proximity to cables in grounded metallic raceways is as follows:
      a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
      b. Electrical Equipment Rating between 2 and 5 kVA: 3 inches.
      c. Electrical Equipment Rating More Than 5 kVA: 6 inches.
   4. Electrical Motors and Transformers, 5 kVA or HP and Larger: 48 inches.
   5. Fluorescent Fixtures: 5 inches.

F. Conduit:
   1. Use minimum conduit size as follows:
      a. Data – 1".
      b. Voice – 1".
   2. Comply with TIA/EIA-569-A for maximum length of conduit and bends between pull points, and for pull-box sizing.
   3. Use manufactured conduit sweeps and long-radius ells whenever possible.
   4. In telecommunications rooms, position conduit ends adjacent to a corner on backboard (in case of a single piece of plywood) or in the corner of room (where multiple sheets of plywood are installed around perimeter walls of room). Use cable trays to route cables if conduits cannot be located in these positions. Secure conduits to backboard when entering room from overhead. Extend conduits 1 to 3 inches in finished floor.

G. Backboards: Install plywood with 84-inch dimension from floor up toward ceiling. Butt adjacent sheets tightly, and form smooth gap-free corners.

H. All components specified in this section shall be configured in accordance with the detail shown on the drawings.

I. Minimum bend radius for Category 6A cable shall be 12".

J. All cables shall be terminated.

K. Provide pull boxes as required to facilitate installation. No more than 270 degree of bends shall exist between pull boxes. Installation shall conform to the requirements of sections Division 16, and this section.

L. All cables shall be routed using conduit systems as specified to the cable tray systems.

M. Fiber optic cable shall be routed point to point in minimum 11/4" plenum rated innerduct paralleling corridor routings indoors and in minimum 4" rigid conduit outdoors. Fiber optic raceway shall have a minimum of 24" radius bends.

N. Fiber optic cable in the distribution racks shall be properly secured to the fiber tray and dressed neatly. All fibers shall be terminated with appropriate system-matched connectors, and connected to the connector housing panel.

O. All outlets, access points and cables shall be uniquely labeled, no exceptions.

P. WLAN access points shall be installed as shown on drawings. Access points shall be either ceiling or wall mounted, as applicable. Contractor shall provide all mounting hardware as well as data network drop to each access point.

Q. All wall mounted WLAN access points shall be installed in protective enclosures specified herein.

R. WLAN access points shall be mounted, adjusted and positioned to optimize the wireless network coverage within the building.

S. WLAN access points shall be migrated into Meraki Wireless Dashboard.

T. WLAN access points shall be mounted with side LED status light facing room's main entrance.

U. All specified network switches shall be mounted in racks, connected to power outlets, interconnected, and configured by the contractor per the Owner's instructions. Contractor shall provide and connect all patch cords to these switches as specified. Provide a horizontal wire manager below each switch in racks.

V. All specified network switches shall not be powered on until the Owner's technology representative has approved the installation.

W. Provide service loops of minimum six (6) feet in all data cables at access points. Support and secure loops in accordance with EIA/TIA requirements.

X. Provide patch cords from each outlet shown to Owner provided PC's.

Y. All access points and video surveillance cameras (PoE devices) shall be distributed evenly on all the switches in a distribution rack. There shall be twenty-four or less PoE devices per network switch.

Z. Provide Velcro (Panduit #HLS-15R0 type tie wraps for all data cable management and support within distribution frames.

AA. Install specified UPS at the bottom of MDF and IDF racks.

BB. Coordinate with the Owner for exact patching sequence requirements.

CC. All cables shall be arranged in accordance with the Owner's standards in all distribution frames.

DD. Identify wireless access point and video surveillance ports in patch panels with manufacturer's patch panel id tags.

3.5 TESTING AND DOCUMENTATION

A. All fiber optic strands shall be attenuation tested with a power meter set at both 850nm and 1300nm. The fiber optic cable shall also be length and integrity certified with an OTDR at 850nm. Strip charts covering the entire length of the cable segment shall be presented to the Owner at the project substantial completion. Each strip chart shall show the individual cable identifier. Any displayed anomalies shall be reported at the time of testing.

B. All data twisted pair cabling shall be tested for opens, shorts, grounds, and crosses. 100% of the pairs shall be guaranteed to Owner.

C. All twisted pair data cabling shall be additionally tested with a "Microtest Omni Scanner II" or Fluke "DTX" pair scanner for Category 6A compliance. All tests shall be "Permanent Link (TSB-67) tests.

D. The contractor shall be expected to provide electronic and hard copy documentation handbook at the project's completion. This handbook shall be organized in such a manner as to fully document all testing. All cable identifiers shall be used in the documentation for each test as applicable.

E. The contractor shall submit as-built drawings to the Engineer at the completion of the project.

F. The installer shall provide as-built documentation indicating each access point location within the buildings, IP address, transmit power and channel assignments.

G. The installer shall test the entire WLAN for client log-on, security parameters, and coverage, etc. in accordance with Cisco's published recommendations and demonstrate the functionality of the WLAN to the owner and his representatives.

H. The installer shall test the entire IP Telephony solution in accordance with Cisco's published recommendations and demonstrate the functionality of the IP Telephony to the owner and his representatives.

3.6 GROUNDING

A. Comply with Division 16 Section "Grounding and Bonding" and with TIA/EIA 607.

B. Grounding Points:
   1. Locate grounding terminals in each equipment room, wiring closet, rack, and cabinet.
   2. Telecommunications Grounding Busbars: Mount on wall of telecommunications entrance facility, equipment room, and closet, with standoff insulators.

C. Bonding Conductors:
   1. Extend from telecommunications entrance facility to electrical entrance facility and connect to grounding electrode.
   2. Where a panelboard for telecommunications is located in same room or space as a grounding busbar, bond to equipment ground bus of electrical panelboard.
   3. Extend from telecommunications entrance facility to grounding busbars.
   4. Extend from grounding busbars to ground terminals in equipment racks and cabinets.
   5. Extend from grounding busbars to building metal frame within room, or to metal frame external to room but readily accessible.

D. Special Requirements:
   1. Bonding conductors shall be insulated copper, No. 6 AWG minimum.
   2. Install only in nonmetallic conduit, unless specifically required for protection of conductor. Metallic conduit, if used, shall be RMC. For RMC that exceeds 36 inches in length, conductors shall be bonded at each end of conduit.
   3. Bonding conductors shall be installed without splices unless approved by Architect because of special circumstances. Where splices are necessary, they shall be accessible and shall be located in telecommunications spaces. Splices shall be by irreversible compression connectors or by exothermic welding.

3.7 IDENTIFICATION

A. In addition to requirements in this Article, comply with TIA/EIA-606-A and with applicable requirements in Division 16 Section "Electrical Identification."
   1. Administration class for this Project shall be Class 1.
   2. Color-code cross-connect fields. Apply colors to voice and data service backboards, connections, covers, and labels.

B. Using cable and asset management software specified in Part 2, develop Cabling Administration Drawings for system identification, testing, and management. Use unique, alphanumeric designation for each cable, and label cable, jacks, connectors, and terminals to which it connects with same designation. Use logical and systematic designations for facility's architectural arrangement. At completion, cable and asset management software shall reflect as-built conditions.

C. Use logical and systematic designations for facility's architectural arrangement and nomenclature, and a consistent color-coded identification of individual conductors.

D. Cable and Wire Identification:
   1. Label each cable within 4 inches of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
   2. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.

3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet.
4. Label each terminal strip and screw terminal in each cabinet, rack, or panel.
   a. All wiring conductors connected to terminal strips shall be individually numbered, and each cable or wiring group being extended from a panel or cabinet to a building-mounted device shall be identified with name and number of particular device as shown.
   b. Label each unit and field within distribution racks and frames.
5. Within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.
6. At Workstations: Label cables within outlet boxes and Attach label to device plate.

E. Cable Schedule: Post in prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.

F. Cabling Administration Drawings: Show building floor plans with cable administration-point labeling. Identify labeling convention and show labels for telecommunications closets, backbone pathways and cables, entrance pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors. Follow convention of TIA/EIA-606-A. Furnish electronic record of all drawings, in software and format selected by Owner.

3.8 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

B. Category 6A UTP Cabling Tests:
1. Tests shall include all tests of Category 6A, conducted from 1 to 250 MHz.
2. Channel and permanent link tests shall be performed with a tester that complies with performance requirements in TIA/EIA-568-B.2, Level III. Include tests for longitudinal or transverse conversion loss.
3. Performance shall comply with minimum criteria in TIA/EIA-568-B.2.

C. Fiber-Optic Cable Tests:
1. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.1. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
3. Link End-to-End Attenuation Tests:
   a. Horizontal and multimode backbone link measurements: Test at 850 or 1300 nm in 1 direction according to TIA/EIA-526-14-A, Method B, One Reference Jumper.
   b. Attenuation test results for horizontal links shall be less than 2.0 dB. Attenuation test results shall be less than that calculated according to equation in TIA/EIA-568-B.1.

D. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.

E. Remove and replace cabling where test results indicate that they do not comply with specified requirements.

F. Retest and inspect cabling to determine compliance of replaced or additional work with specified requirements.

3.9 DEMONSTRATION

A. Train Owner's maintenance personnel in cable-plant management operations, including changing signal pathways for different workstations, rerouting signals in failed cables, and keeping records of cabling assignments and revisions when extending wiring to establish new workstation outlets. Refer to Division 1 Section "Demonstration and Training."

END OF SECTION 271301

SECTION 274133 - INTERACTIVE AUDIO VISUAL AND IPTV VIDEO ON DEMAND SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Interactive Audio-Visual System.
   2. IPTV and Video on Demand System including all distribution head-end equipment, encoders, decoders, control components, media, software, etc.
   3. High Definition (HD) LCD monitors.
   4. Training Room Audio-Visual System.
   5. Interactive Display Panels.

1.2 SCOPE OF WORK

A. Furnishing of all labor, project management, materials, tools, equipment, and resources necessary for the complete installation of MediaMaster Video on Demand, IPTV, Digital Signage, and AV Control System as specified herein. The bidder shall be a factory authorized MediaMaster Integrator with technical expertise in audio visual display and control systems, unicast and multicast video distribution, and Ethernet networks. Dealers shall prove they have installed at least 5 replicate school systems of equal or greater magnitude in Georgia.

B. It is the intent of these specifications that the Manufacturer and or its' Authorized System Integrator expeditiously furnishes and installs a system complete in every respect and ready to operate. All miscellaneous items and accessories required for such installation, whether or not each such item or accessory as shown on the plans or mentioned in these specifications, shall be furnished and installed.

C. The Video on Demand, IPTV, Digital Signage, and AV Control System must provide the following features:
   1. HD Digital Video On Demand, IPTV Video Distribution, Digital Signage, & AV Control Headend.
   2. HD 1080p 60fps solid state encoders for sources with perpetual licenses.
   3. HD 1080p 60fps solid state decoders, perpetual licenses, HDMI, Component, Composite, VGA outputs.
   4. Networked AV Control System, providing Web based computer control plus administrative control of OLED, DVLED, LCD, and laser flat panel displays and projectors via Ethernet, RS232, with real time status verification & error correction.
   5. Network Certified Interactive Displays, flat panel display, and institutional grade mounting brackets.
   6. Two HD 1080p digital signage creation and multicast systems with remote status & management for administrators.
   7. An 8 channel HD DirecTV on Demand IPTV Multicast System, providing Web based computer control and dynamic channel selection by teachers.
   8. A 6 channel HD CATV on Demand IPTV Multicast System, providing Web based computer control and dynamic channel selection by teachers.
   9. Portable Rolling Tripod, 1080p Camera, and Multicast Encoder System
   10. Web Controlled Central Headend located in the MDF or designated space.
   11. Backboxes and conduits shall be provided by the electrical contractor. Coordinate exact location of all equipment with the Architect prior to installation of conduits and boxes.

D. A highly detailed CAD schematic shall be submitted by the IPTV, VOD, and AV Control Integrator or Manufacturer showing the headend, mini-headend, classroom, and TV ports required. A detailed spreadsheet shall also be submitted listing: every room receiving a IPTV, VOD, and AV component, TV make & model, projector make & model, port speed required, proposed static IP or DHCP, proposed Netmask, proposed Gateway, proposed multicast or unicast address.

E. Data ports configured for unicast and multicast video distribution shall be provided by the District. The ports and their requirements shall meet the requirements detailed via the IPTV, VOD, and AV Control Integrator's and or Manufacturer's submittal.

1.3 CONTRACTOR QUALIFICATIONS

A. Furnishing of all labor, project management, materials, tools, equipment, and resources necessary for the complete installation and modification of the instructional technology network as specified herein. The bidder shall demonstrate The Contractor shall show proof of a contractual relationship with the manufacturer, that they are the trained and certified agent of the product. Submit the original manufacturer's certification.

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

C. The Contractor shall maintain at his facility the necessary spare parts in the proper proportion as recommended by the equipment manufacturer to maintain and service the equipment being supplied.

D. All cabling, termination hardware, and connecting cords shall be sourced from the certifying manufacturer to assure quality control and validity of the manufacturer's warranty.

E. The Contractor will accept complete responsibility for the design, installation, certification, and support of the cabling system. The Contractor must show proof that Contractor has the certifying manufacturer's support on all of these issues.

F. All work shall be performed and supervised by AV vendors who are qualified to install AV systems and to perform related tests as required by the manufacturer in accordance with the manufacturer's methods.

G. The AV vendor employed shall be fully trained and qualified by the manufacturer on the installation and testing of the equipment to be installed. Evidence that the Contractor is a current certified installer of the manufacturer must be provided in writing prior to work commencing on the structured cabling for the building.

H. Vendors providing equipment installation services shall use adequate numbers of skilled workmen who are certified by the component manufacturer, thoroughly trained and experienced with the necessary technology and systems, and completely familiar with the specified requirements and methods needed for proper performance of work. The system head-end installation, start-up and commissioning shall be by the manufacturer certified vendor.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.
   1. Submit in brochure from manufacturer’s latest product literature, specifications, installation instruction and other data required to demonstrate compliance of following products and systems with specified requirements:
   2. CATV amplifiers
   3. Multi-Taps
   4. MPEG Encoding Stations
   5. MPEG Encoder and Decoders
   6. Ethernet to Infrared Controllers
   7. DirecTV on Demand components
   8. Ethernet Controlled LCD Displays with decoders, Sound System and Mount
   9. Head-end equipment, including amplifiers, encoders, combiners, receivers, IR source control modules, equipment cabinets, shelves, UPS, etc.
   10. Extensive CATV & DirecTV channel lineup
   11. Finely detailed CAD headend schematic and cabinet configuration
   12. Finely detailed CAD mini-headend schematic and cabinet configuration

B. Shop Drawings:
   1. Include plans, elevations, sections, details, and attachments to other work.
   2. One Line Drawing: A one line drawing of the entire system including head-end configuration shall be included in the submittal
   3. Dimensioned plan and elevations of headend equipment.

C. Equipment List: Include every piece of equipment by model number, manufacturer, serial number, location, and date of original installation. Add testing record of each piece of adjustable equipment, listing name of person testing, date of test, and description of as-left set points.

D. Operation and Maintenance Data: For headend and distribution system to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section " Operation and Maintenance Data," include the following:
   1. Lists of spare parts and replacement components recommended to be stored at the site for ready access.
   2. Include dimensioned plan and elevation views of components and enclosures. Show access and workspace requirements.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NECA 1.

C. Comply with NFPA 70.

D. As a minimum standard of quality, these specifications are based on MediaMaster manufactured and supported by Educational Technology Resources Inc 631.589.4300 as distributed and supported by Cana Communications.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: System components shall be equipped and rated for the environments where installed.

1.7 COORDINATION

A. Coordinate size and location of raceway system, and provisions for electrical power to equipment of this Section.

B. Coordinate Work of this Section with requirements of cable and satellite television service provider.

C. Coordinate installation of curbs, equipment supports, and roof penetrations. These items are specified in Division 7 Section "Roof Accessories."

1.8 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, provide 36 months' full maintenance by skilled employees of IPTV system Installer. Include quarterly adjusting as required for optimum system performance.

B. Service Calls: Provide 24 hours of service calls on system for each school after final acceptance to make any adjustments necessary to keep system at peak operating condition. Service calls performed as requested by Owner. Warranty work is not included in the service call time.

C. Service Contract – Equipment Supplier: Accredited by proposed equipment manufacturers and prepared to offer service contract for system maintenance on completion of guarantee period and provide names, locations, and size of 3 recent successful installations in area; 24 hours per day service, with 24 hour non-emergency service response time provided, and including 1 hour remote emergency call response time and 8 hour on site emergency call response time on 365-day-per-year, 24 hours per day basis.

1.9 EXTRA MATERIALS

A. Furnish extra materials described below, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. Provide no fewer than one of each item listed below. Deliver extra materials to Owner.
   1. Display Decoder: Provide three; each type and rating.
   2. TV Monitor Decoder: Provide three; each type and rating.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Specification: Media Master
   1. Approved equal by Educational Technology Resource and ETR.

2.2 UNINTERRUPTIBLE POWER SUPPLY (UPS)

A. Provide a full time, on-line UPS system providing sine wave correction, voltage regulation, spike suppression, and a minimum of 20 minutes backup power. Standby UPS systems are not acceptable. The UPS shall provide full time protection for the MediaServer, Digital Video Server, Bulletin Board PC, DirecTV Receivers, CATV Receivers at a minimum.

B. The UPS must be capable of interfacing to the MediaServer, Digital Video Server, and Bulletin Board PC with an alarm function to enable an orderly shutdown prior to complete loss of power.

C. Provide rack mounted Lithium Ion UPS system as manufactured by APC or Liebert for Video system intelligent equipment.

2.3 MEDIA MENU CHANNEL

A. The independent Media Menu channel shall be continuously broadcast District wide via the video distribution system to provide teachers and students accurate information about video broadcasts. The scrolling menu channel is a NTSC representation of the most current video schedule.

B. The graphically based Media Menu channel shall be automatically produced by the MediaServer and shall not require human intervention.

C. The graphically based Media Menu channel shall be automatically produced by the MediaServer and shall not require human intervention.

D. A Media Menu channel icon shall appear on every client copy of MediaController Browser software. When the teacher selects the menu, channel bitmap the encoder switches to the appropriate stream.

E. The automatically produced menu channel shall be the factory installed MediaMaster MM-1020 MenuChannel software and hardware product as supplied by ETR, or pre-approved equal.

2.4 ADDRESSABLE MEDIA CONTROL MODULE (ACM) & MYCHANNEL

A. The ACM allows global control of multiple video playback source sites in an individual school, or as a district wide WAN Video-on-Demand system without adding or maintaining multiple servers. The ACM shall consist of, but not be limited to the following:
   1. The ACM shall have (8) eight Infrared output ports for controlling video playback devices such as VCRs, DVDs, LDPs, CATV STBs, DirecTV receivers, etc.

2. The ACM shall control infrared players and receivers via infrared emitter cables. Emitter cables shall be 10' long with 3.5mm mini jacks. Each emitter shall be affixed over each player's or receiver's IR receiver via self-adhesive tape, then covered with the included IR mask for additional protection and adhesion.
3. The ACM shall be locatable anywhere on the WAN/LAN. The ACM shall function as an Ethernet Network Interface Card (NIC) allowing local and remote control of infrared video playback sources. Each ACM shall have a unique IP address for identity on the network.
4. The communication protocol between the ACM and Video on Demand Server shall be TCP/IP.
5. The ACM shall have a standard 10BaseT connector for connectivity to the LAN/WAN. The 10BaseT connector shall have a Link status light and a Transmit Data light.
6. Each ACM shall have the inherent ability to learn IR control commands or accept downloaded command sets. Devices or systems that require a separate or master IR learner box or similar device are unacceptable.
7. The ACM shall have an RS-232 port which can be used for local control, local diagnostics, local IR learning, and local monitoring.
8. The ACM shall include graphical Windows based configuration and diagnostic utility software. Systems, which use character based configuration utilities, will be unacceptable.
9. The ACM microprocessor, real time clock and battery shall be self-contained on a 72 pin SIMM for quick and simple field servicing.
10. The ACM TCP/IP protocol stack shall support standard network diagnostic functions such as PING.
11. The ACM IP address shall be assigned from the MediaServer. Systems which use a dedicated device name, as an addressing scheme shall be unacceptable.

2.5 PORTABLE LOCAL ORIGINATION MULTICAST CART SYSTEMS

A. Interactive distance learning is a required teaching tool and an integral part of a curriculum. The ability to globally multicast media from any room in the district to all classrooms or selected groups of classrooms is equitable and required.

B. Multicasting from permanent and or temporary locations is essential. Broadcast components must be plug and play to allow "on the fly" multicasts. The ability for students to quickly configure a zone of TVs and or projectors to receive the broadcast is mandatory. All software and hardware shall be extremely user friendly to maximize broadcast opportunities.

C. The Owner also desires broadcasts to be viewed on every PC in the district. Thus, IPTV multicasting is deemed the most efficient and effective method of school wide or district wide distribution. The system Manufacturer and its Certified System Integrator shall coordinate installation of an MPEG capable media player on every PC the district wants to equip for viewing multicasts. Additionally, IGMP Snooping must be enabled on every Layer 2 or better network switch to permit multicasting without conflict to other data traffic.

D. Provide one local origination broadcast system as follows: camcorders with 37X optical zoom, integral microphone, external mic jack, quick release mount, fluid head, professional lightweight tripod, rolling dolly, mounting plate system with MPEG-2 encoder, 120V duplex receptacle, power supplies, 25' permanently attached power and data cables, and AV cables. System shall allow School to quickly "broadcast" any event as a DVD quality MPEG-2 multicast stream. Video frame rates from 1.5 to 7.5 Mbits/s shall stream from the encoder's Ethernet port to any data port in the district. The encoder shall be globally manageable via Web interface or locally via RS232 port and a laptop.

E. Each encoder stream shall be assigned a unique channel logo or bitmap from the database in MMAdministrator/Channels/New Channel. These stream bitmaps shall work in concert with MyChannel.

F. MMAdministrator/Zones shall allow broadcast personnel to quickly configure an All Page Zone or Specific Page Zones to receive broadcasts, by simply selecting TVs and projectors via checkboxes.

G. MediaController shall be used to view IPTV multicasts on PCs or MACs equipped with MPEG-2 players. Selecting the broadcast icon will trigger the player to open and decode the multicast stream.

H. Activation of a Video Page shall automatically disrupt all TV and projectors with tuner/decoders from current activities, deliver the broadcast, then restore the system to its original configuration following the Video Page.

I. Activation of a Video All-Page Broadcast shall initiate a Power On command to any TV or projector that is Powered Off, all video sources in use will Pause, and all TVs and projectors monitors will tune to the School's local origination broadcast channel automatically.

J. Upon completion (deactivation) of the Video All-Page, all TVs and projectors will resume their previous status and sources will stay in pause mode until the teacher or student is ready to resume its use.

K. All local origination broadcast equipment shall include all cables and appurtenances required for a turn key system.

L. The MPEG-2 standard definition portable camera cart systems shall be the MediaMaster MM-1581 Single Stream MPEG-2 Standard Definition Camera Cart as supplied by ETR, or pre-approved equal.

M. The video page zone configurator and TV/projector controller shall be the MediaMaster MM-1185 MM Administrator as supplied by ETR, or pre-approved equal.

N. The IPTV controller for PCs shall be the MediaMaster MM-1150 MediaController product as supplied by ETR, or pre-approved equal.

2.6 MY CHANNEL ON DEMAND SYSTEM FOR CATV

A. Manufacturer and or it's Certified Integrator shall be the District's liaison to coordinate free CATV service with a flat, unsloped, strong +25dB signal strength @ CH2 and +25 dB signal strength @ CH70. Maintain, extend, modify, and connect School's CATV system to serve the new IPTV & VOD headend. Provide shelves and mounting components in the headend cabinets, on the wall, and throughout the building as required. The IPTV & VOD headend is the preferred CATV demarcation location.

B. The local CATV service provider is to supply School a free concentration of educational channels in analog and digital formats and various frequency ranges. Manufacturer and the Owner will request 4 integrated receiver/decoders to allow 4 unique and simultaneous on demand CATV streams. Provide shelves and mounting components in the headend cabinets.

C. Provide MediaMaster one MM-1210 Addressable Control Module and four MediaMaster MM-1202 Infrared Emitters. The emitters shall be affixed to the IR receiver on the integrated receiver/decoders for on demand network control.

D. Provide all work, materials, grounding, and manner of placement in strict accordance with requirements of latest edition of National Electrical Code.

E. Provide all materials listed as complying with available standards of Underwriter's laboratories or other similarly established standards and carry their label. Apply all materials in strict accordance with Underwriter's laboratories listing.

F. CATV streaming may be expanded at any time by adding receivers, shelves, splitters, cabling, encoders, etc. Systems that require additional licenses or software fees for this expansion are not acceptable.

G. is enabled it shall be available at every TV & projector via decoder/display controller, and every computer with MPEG Player.

H. Channels must be streamed via SD or HD encoders on the LAN/WAN. Bit rate shall be selectable from 1.5 Bbps to 7.5Mbps. Manufacturer and or Integrator shall initially set encoders @ 4 Mbps. Streaming via the Web is not acceptable. Channel streams shall be viewable on computers with MPEG Players, and on projectors & TV with decoders.

I. System shall allow channels to be “pushed” to any or all TVs & projectors manually via MediaAdministrator/Zone Page, or automatically via prescheduled Playlist. When pushed TVs & Projectors shall Power On, switch input, adjust volume, decode and display required channel.

J. The complete CATV on demand system and all peripherals shall be the MediaMaster MyChannel CATV on Demand System product as supplied by ETR, or pre-approved equal.

2.7 ULTRA HIGH DEFINITION 4K LED BACKLIT LCD FLAT PANEL DISPLAYS

A. Supply and install 4K UHD flat panel displays, in locations shown on the plans and as directed by the Construction Manager. 4K Flat panel display sizes are as listed in the specs or as shown on the plans and shall include advanced features that include but are not limited to: 4K resolution, 50:000 dynamic contrast ratio, 178 degree viewing, RGB/PC input, NTSC & Clear QAM tuner, 3 x 4K HDMI inputs with HDCP Digital Content Protection System, high definition (HD) component video inputs, composite inputs, front firing speakers, built-in audio amplifiers, external speaker outputs, side mounted AV input panel, automatic signal enhancement, firmware modified for front panel lockout, 60,000 hour life expectancy, one year warranty, Energy Star Compliant, MediaMaster Network Certified for RS232 control and status.

B. Provide and install tilting wall bracket and mounting hardware by Peerless. Bracket shall feature security hardware to prevent TV removal without the use of proprietary tools. Supply 2 security hardware tools to School at the close of the project.

C. For every 4K UHD flat panel display provide and install one HD IPTV decoder/display controller, Ethernet to RS232 network control converter, bi-directional control & polling port, RJ45 to DB9 RS232 control cable, CAT6 patch cable, and mounting brackets.

D. The MediaServer shall lock out all front panel controls on TVs installed in public spaces and classrooms to avoid building occupants selecting streams or media other than what the Administration wants viewed. Systems and components without this lockout feature are not acceptable.

E. TVs in public spaces shall not allow local control, they shall strictly perform as directed by Media Playlist to achieve automated broadcasting results such as Bulletin Board messaging.

F. TV1: The 50” UHD 4K flat panel LED backlit LCD displays shall be the MediaMaster Network Certified LCDTV product as supplied by ETR, or equal by Sony, Samsung, or LG.
   1. The tilting wall bracket for the 50” LCDTV shall be the MediaMaster TWB Tilting Wall Bracket product as supplied by ETR, or Peerless equal.

G. TV2: The 75” UHD 4K flat panel LED backlit LCD displays shall be the MediaMaster Network Certified LCDTV product as supplied by ETR, or equal by Sony, Samsung, or LG. Install in Lobby, Cafeteria, and main Corridor areas.
   1. The tilting wall bracket for the 70” LCDTV shall be the MediaMaster TWB Tilting Wall Bracket product as supplied by ETR, or pre-approved equal.

H. The HD IPTV stream decoder/display controller shall be the MM-1276 HD Decoder/Display Controller product as supplied by ETR, or pre-approved equal.

I. The low voltage cabling contractor shall provide one CAT6A Ethernet cable per TV/computer monitor location to serve the networking requirements of each TV/computer monitor. The electrical contractor shall provide 500 watts of filtered 120V power and a duplex receptacle to serve each TV/computer monitor power cord, and IPTV decoder power supply.

J. Provide and install MediaMaster Series MediaCable system to extend the rear input panel of the LCD display monitor to a wall jack adjacent to the front of room teacher workstation. The wall jack panel shall include a HDMI connector and USB connector. The cable system shall include a trunk cable and HDMI adapters. Provide MediaMaster MM-1400 Series MediaCable system as supplied by ETR, or pre-approved equal.

2.8 INTERACTIVE DISPLAY PANELS

A. Provide Interactive Display Panel in all Conference Rooms.

B. Interactive Display Panel and associated components, mounts, and accessories shall be as follows:
   1. Interactive Display Panel (75”, 6000K): Cleartouch CTI-6075K+UH20 with extended total five (5) year warranty, CTI-EXWTY-6075-2Y.
   2. PC Module: Intel i5 6-Core, 8GB DDR4, 256GB SSD, Ultra HD, Windows 11 OS with all licensing, Cleartouch CTI-PCMOD-PC55-ST.
   3. Web Camera: High Definition 2.07 MP / USB 2.0 / 83 deg. FOV, Cleartouch CTS-WC110-UHHD.
   4. Wireless Keyboard and Mouse for PC Module: Cleartouch wireless keyboard and mouse.
   5. Fixed Mobile Stand: Curve-Shaped Open Base with manual height adjustment & cable management, Cleartouch CTI-STAND-FIXM-V3. Provide for all instructional units. Interactive Display Panels in Conference Rooms shall be wall mounted.

C. Provide, assemble, and mount one fixed mobile stand per Interactive Display Panel. Fixed mobile stand shall include all mounting brackets for the Interactive Display Panel, computer, and MM-1275TT IPTV tuner/decoder, and security hardware.

D. For every Interactive Display Panel provide and install one HD IPTV decoder/display controller, Ethernet to RS232 network control converter, bi-directional control & polling port, RJ45 to DB9 RS232 control cable, CAT6e patch cable, and mounting brackets.

E. Provide and install MediaMaster MM-1400 Series MediaCable system to extend the rear input panel of the Interactive Display Panel to a wall jack adjacent to the front of room teacher workstation. The wall jack panel shall include USB-C femail, and a HDMI connector. The cable system shall include a DIN14 trunk cable and HD15/3.5mm & HDMI adapters. Provide MediaMaster MM-1400 Series MediaCable system as supplied by ETR, or equal by Rapid Run.

F. Provide Bogen self-amplified drop-in ceiling speakers (Bogen ACD2X2) in White finish with power supply or equal by JBL, Quam, Atlas, and Extron audio ceiling speakers, cabling, Audio Gear or equal by Extron audio amplification as detailed on the Contract Drawing detail “Typical Classroom Multimedia Equipment and Installation Diagram.” Provide Extron MPA 152 audio amplifier with priority page controller. The audio ceiling speakers shall be rated for the coverage in the area shown.

G. The dual amplified ceiling speaker system shall be the ACD2X2 with PRS2403 power supply products by Bogen Communications Inc, or equal by JBL and Quam.

H. The high-definition multicast decoder/projector controller shall be the MediaMaster MM-1276 High Definition IPTV Decoder product as supplied by ETR.

I. The low voltage cabling contractor shall provide one CAT6A Ethernet cable per location to serve the networking requirements.

J. Coordinate all work and locations of all outlets with the Owner and Architect. In addition, the Contractor under this specification section shall provide all floor, fire partition, ceiling, or other rated structure penetrations, sized as required, and including all fire proofing of such penetrations to maintain structure rated integrity and all conduit required. Comply with the requirements of Division 07.

2.9 VIDEO PRODUCTS

A. Video Projector in Training Room area: Provide minimum 10,000 lumen large venue projector to project on a 200” diagonal screen. The projector shall be by Epson, EB-PU2010W WUXGA 3LCD, Laser Projector with 4K Enhancement and with appropriate lens. Equals by Panasonic and Sony are acceptable.

2.10 IN-WALL AUDIO VISUAL CONTROLLER

A. Provide and install in-wall audio visual controller by Extron, model MLC 104 IP Plus in white color. The controller shall have Ethernet monitoring and control, bidirectional RS-232 port, three digital I/O ports, dedicated IR port, and support for Infrared Control Modules.

B. The buttons shall be labeled to identify the sources.

C. Provide connectivity and power cabling with programming per the Owner's instructions.

2.11 MULTIMEDIA PRODUCTS

A. CAT-5 to USB Extenders
   1. Extension over Category 5 UTP cable to up to 50'
   2. Provide USB to Cat 5 extender at both ends and all associated cables and connectivity.
   3. USB extender in the wall shall be wall plate device type.

2.12 MULTIMEDIA PRODUCTS

A. CAT-5 to USB Extenders
   1. Extension over Category 5 UTP cable to up to 50'
   2. Provide USB to Cat 5 extender at both ends and all associated cables and connectivity.
   3. USB extender in the wall shall be wall plate device type.

2.13 TRAINING ROOM AUDIO-VISUAL SYSTEM

A. Training Room Video Switcher / Control System
   1. The switcher shall support 4K signals.
   2. The switcher shall support EDID capture, HDC, and pass 3D signals.
   3. The switches shall serve as the control system for the room.
   4. There shall be an adequate number of HDBaseT (DM) type transports for longer I/O runs.
   5. Acceptable manufacturer:
      a. Crestron (P/O DMPS3-4K-350C)
      b. AMX
      c. Extron

B. Audio Speakers- Ceiling Mount
   1. Ceiling speakers to be flush mount and have plenum back-cans.
   2. Speakers to be 70V with easy access to wattage tap selector switch.
   3. Speakers to have nominal pattern coverage of 110°.
   4. Speaker shall have continuous program power rating of 75W.
   5. Acceptable manufacturers:
      a. Atlas (FAP62T)
      b. JBL (Control 16C-VA)
      c. Tannoy

C. Audio Power Amplifiers
   1. Amplifiers shall have either a barrier strip or XLR connector for their balanced input connections.
   2. Amplifier to have 70V output
   3. Amplifier shall have minimum of 100W
   4. Shall have no greater than 1% THD at 1 KHz at maximum power
   5. Acceptable manufacturers:
      a. Crestron
      b. Extron

D. Control System – Processors
   1. The control processor shall include the necessary power supply.
   2. The processor shall have Ethernet LAN connections as well as an Ethernet Control Subnet connections.
   3. The control processor shall have these available I/O options:
      a. (8) Relay contact closures
      b. (8) Digital I/O connections
      c. (8) IR / Serial outputs
      d. (1) RS-232/422 bi-directional output

e. (2) RS-232 Bi-directional
f. (1) USB connection
g. (1) Cresnet connection

3. Acceptable manufacturer
   a. Crestron
   b. AMX

E. Wired Touch Panels
1. Refer to drawings to verify the location, size, and type of touch panel. Provide minimum one touch panel in each Meeting Room space.
2. Display type shall be a TFT active matrix color LCD, 5-point multi-touch
3. Provide necessary mounting hardware/box for wall mounted touch panels.
4. Provide a PoE connection for power for wall mounted touch panels
5. Acceptable manufacturers:
   a. Crestron (TSW-560 or latest model)
   b. AMX

F. Miscellaneous Control System Devices
1. Provide remote sensor at moveable wall to activate control system for 2 rooms or 1 large 1 room.
   a. Acceptable model
      1) Crestron GLS-PART-CN
2. Provide 5 port PoE network switch.
   a. Acceptable manufacturer
      1) Crestron
      2) Meraki
      3) CISCO (SG300 or latest model)

G. Equipment Racks
1. Refer to drawings for location of equipment racks. Provide an equipment rack for each space as shown.
2. Provide rack panel blanks and vents to best fill in unused rack spaces.
3. Freestanding and Wall racks shall provide standard l9”W space to mount equipment.
4. The number of rack units shall be enough to house all equipment based on the system design. Population of rack to be 75%-80% with the remainder open for future growth.
5. Where rear access is not possible to rack, provide a sliding and swiveling rack instead.
6. Acceptable Manufacturers:
   a. Middle Atlantic CWR-26-17PD with Lowell Power Sequencer RPC-4
   b. Lowell Manufacturing
   c. Atlas
   d. Chatsworth Products (CPI)

2.14 MISCELLANEOUS PRODUCTS

A. Provide and install Audio Visual wall mounted metal device plate in satin finish.

B. Provide and install all Audio-Visual runner cables.

C. Audio Visual Flying Lead

D. Line Level Audio and Microphone Cable, Plenum Rated: Plenum rated line and microphone level audio cable.
1. Type: Shielded, twisted pair.
2. Conductors: Minimum 22 AWG, stranded conductors and 24 AWG drain wire with overall jacket.
3. NEC Rating: CMP.
4. Acceptable: Extron cable, or West Penn 25291 or comparable by Belden.

E. Speaker Cable, Distributed, Plenum Rated: Plenum speaker cable for Classroom Ceiling Speakers.
   1. Type: Unshielded, twisted pair.
   2. Conductors: 16A WG stranded conductors.
   3. NEC Rating: CMP.
   4. Acceptable: West Penn 25225 or comparable by Belden or Extron.

F. Control Cable, Plenum Rated: For use in control system wiring applications requiring a plenum rating.
   1. For Serial Communication:
      a. Type: One (serial or RS-232), two (RS-422) or three (where handshaking is required) twisted pairs with overall shield and jacket.
      b. Conductors: Minimum 24A WG stranded conductors and 26A WG stranded drain wire.
      c. NEC Rating: CMP.
      d. Acceptable: Extron, West Penn or comparable by Belden.

G. DC Power Cable, Plenum Rated: For DC power wiring requiring plenum rating.
   1. Type: Unshielded, twisted pair.
   2. Conductors: Minimum 8 AWG stranded conductors.
   3. NEC Rating: CMP.

H. Acceptable: West Penn Wire 25224 or comparable by Belden or Gepco.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Notify local cable service provider regarding project requirements and schedule. Ensure that cable service provider completes their portion of Work in timely manner to not interfere with project schedule or other trades. A flat signal of +25dB @ CH2 through +25dB @ CH70 shall be requested.

B. All cables originating from outside building grounded at nearest point of entry per NEC.

C. Extend or relocate incoming CATV service to connect to head end rack.

D. Seal all penetrations per electrical wiring methods specified for this Project.

E. All vertical cable runs installed in concealed conduit/raceways.

F. Install all horizontal cable runs above finished ceiling. Install cables with not more than 2-inches sag between supports. Support all cables and tie at maximum of 6 ft. centers within metal bridle rings, metal cable tie mounts or within bar joist.

G. Make any bends in cable in 90-degree increments while maintaining less than minimum cable bend radius. All cable routes parallel or perpendicular to building lines and installed to prevent any cable from crossing or wrapping around bundle. Service loops or excessive slack not allowed. Provide for neat tangle-free cable route.

H. Equipment cabinet(s) anchored to wall or floor utilizing an approved method.

I. All head-end equipment securely installed within equipment cabinet(s) by screws, bolts, nuts, etc. or by method approved by Engineer. All holes intended for equipment mounting used for securing equipment to rack. Provide all exposed hardware in same color and type, preferably matching cabinet finish (i.e. black cabinet-black rack screws).

J. All cabling entering video equipment cabinet(s) installed in conduit or raceway. All cabling within cabinet neatly bundled and secured with tie wraps to cabinet. Avoid cable strain on connectors/terminations. Do not use point of connection to serve as support for cable bundle.

K. All rack ground bars grounded to equipment ground bus, in nearest power panel, utilizing 6 AWG THHN. Ground wire concealed in metallic conduit containing no other power conductors. Ground rack-to-rack ground bar by NEC approved method.

L. After installation of wiring and equipment has been completed, test all cabling to ensure continuity, freedom from grounds (except "made" grounds and those required for protection), and insulation resistance, in accordance with "underwriter's requirements and electrical regulations. Furnish and use suitable instruments such as ammeters, voltmeters, meggers, etc.

M. Prior to final acceptance, provide accurate documentation listing all equipment installed under this Section, including following information: equipment description, equipment part number, equipment serial number, manufacturer's warranty period, suggested retail cost and location of equipment. Any information found to be inaccurate during one-year warranty period requires Contractor to physically re-verify all equipment information at no additional cost to Owner. Complete re-verifications within 1 week after notification of any discrepancy. Submit copy of all documentation.

N. For every piece of equipment installed under this Section, deliver, in one delivery, associated manufacturer's manuals in addition to maintenance manuals specified in other Sections of Project Manual. Obtain signed receipt from Owner's representative and submit two copies to Engineer.

O. Test every outlet in system as specified below.

P. Provide installation and startup of all systems under direct supervision of local agency regularly engaged on installation, repair, and maintenance of such systems.

3.2 FIELD QUALITY CONTROL

A. Testing by Prime Contractor:
   1. Test every television and projector for signal level, clear picture and remote origination/control (as applicable).
   2. Test all head-end equipment for proper frequency, audio/video carrier levels, and RF level outputs. Adjust all levels per manufacturer's recommendations.
   3. Perform all testing required for each building during same day.
   4. Perform tests to all systems under direct supervision of manufacturer's representatives or accredited agencies for all specified equipment and services.
   5. Submit all test results in tabular format with reference to or backed up by equipment/riser diagram that accurately represents installed system.
   6. Submit written test report from authorized representative of equipment manufacturer stating that system has been tested and is in working order prior to final inspection by Engineer.
   7. Engineer and/or Owner's representative reserves right to observe testing.

3.3 TRAINING

A. Owner's Training: Provide minimum 24 hours of training for Owner's personnel per building (48 total hours) used at Owner's sole discretion and scheduled by Owner to fit Owner's needs.

B. Training scheduled by Owner in blocks of 4-8 hours.

C. Begin training after Engineer deems system physically complete and fully operation. Service time not deemed as training.

D. Include following minimum content in training:
   1. General systems overview describing sub-systems and their relationships with each other.
   2. Specifics on sub-systems and how to maintain them to ensure reliable operations.
   3. Operation of equipment to perform intended tasks, including (but not limited to) remote origination, camera operation, television operation, cable patching, fuse replacement and so forth.
   4. Provide written documentation for all training attendees to supplement training (i.e. diagrams, training outlines/highlights, etc.). Revise number of training hours in paragraph below to suit Project. Coordinate with Division 1 Sections.

END OF SECTION 274133