27 00 00
GENERAL COMMUNICATIONS REQUIREMENTS

1. **GENERAL**
   A. Related sections:
      i. 00 00 08 – Design Professional Documentation Requirements & Deliverables
      ii. 00 00 13 – Designing Learning Environments
      iii. 00 73 01 – Sole Source / Sole Brand
      iv. 01 41 26.06 – Dining Services
      v. 27 05 26 – Grounding and Bonding for Communication Systems
      vi. 27 05 29 – Hangers and Supports for Communications Systems
      vii. 27 05 36 – Cable Trays for Communications Systems
      viii. 27 05 43 – Underground Ducts and Raceways for Communications Systems
      ix. 27 05 46 – Utility Poles for Communications Systems
      x. 27 05 53 – Identification for Communications Systems
      xi. 27 08 00 – Commissioning of Communications
      xii. 27 11 16 – Communications Cabinets, Racks, Frames, and Enclosures
      xiii. 27 11 19 – Communications Termination Blocks and Patch Panels
      xiv. 27 11 23 – Communications Cable Management and Ladder Rack
      xv. 27 13 13 – Communications Copper Backbone Cabling
      xvi. 27 13 13.13 – Communications Copper Cable Splicing and Terminations
      xvii. 27 13 23 – Communications Optical Fiber Backbone Cabling
      xviii. 27 13 23.13 – Communications Optical Fiber Splicing and Terminations
      xix. 27 13 33 – Communications Coaxial Backbone Cabling
      xx. 27 13 43.43 – Cable Services Cabling
      xxi. 27 15 00 – Communications Horizontal Cabling
      xxii. 27 20 00.01 – Data Communications – Wireless
      xxiii. 27 41 00 – General Audio-Visual Systems Requirements
      xxiv. 27 41 00.01- Audio-Visual Control System
   B. Abbreviations
      i. ANSI – American National Standards Institute
      ii. APC – Angled Physical Contact (fiber connector)
      iii. CATV – Cable Television
      iv. CTL – Center for Teaching and Learning (UGA)
      v. EIA – Electronic Industries Alliance
      vi. EITS – Enterprise Information Technology Services (UGA)
      vii. FMD IT – Facilities Management Division Information Technology (UGA)
      viii. FCC – Federal Communications Commission
      ix. I.D. – Inside Diameter
      x. ICEA – Insulated Cable Engineers Association
      xi. IDF – Intermediate Distribution Frame
      xii. IEEE – Institute of Electrical and Electronics Engineers
      xiii. MDF – Main Distribution Frame
      xiv. MHz – Megahertz
      xv. MM – Multi Mode Optical Fiber
      xvi. NEC – National Electrical Code

xvii. OFNP – Optical Fiber Non-Metallic Plenum
xviii. OTDR – Optical Time Domain Reflectometer
xix. PAWS – Personal Access Wireless System
xx. RF – Radio Frequency
xxi. SC – Subscriber Connector (fiber connector)
xxii. SCS – Standard Cabling System
xxiii. SM – Single Mode Optical Fiber
xxiv. TDR – Time Domain Reflectometer
xxv. TR – Telecommunications Room
xxvi. TIA – Telecommunications Industry Association
xxvii. UPC – Ultra Physical Contact (fiber connector)
xxviii. UTP – Unshielded Twisted Pair

C. EITS is the primary unit responsible for the majority of the low-voltage systems installed at UGA. This responsibility includes but is not limited to any and all UGA property and structures including hand holes, maintenance holes, pull boxes, pedestals and enclosures as well as inside and outside plant installations. FMD IT is the primary unit responsible for the following low-voltage systems: building automation and temperature control systems, access control systems, and lighting control systems. CTL is the primary unit responsible for low-voltage audio-video system. The Design Professional and Contractor shall coordinate with the Project Manager to coordinate with EITS, FMD IT, and CTL as required within the Standards.
D. The Telecommunications Contractor shall mean either:
    i. A telecommunications Subcontractor retained by the Contractor.
    ii. A telecommunications Contractor contracted directly with UGA.
E. Wiring and cross connect locations within a building are referred to as Telecommunications Rooms (TR's). These rooms have traditionally been referred to as Main Distribution Frame (MDF) which serves the building, and Intermediate Distribution Frame (IDF) which is floor serving.
F. UGA's communications systems follow the codes and standards set forth by standard-making bodies, including but not limited to current editions of the National Electric Safety Codes, National Fire Protection Association, NEC, ANSI/TIA/EIA Telecommunications Infrastructure Standards, FCC, IEEE, and Building Industry Consulting Services International Telecommunications Distribution Methods Manual and Customer Owned Outside Plant Manual.
    i. When a discrepancy arises between the above mentioned standards and the standards contained in this document, it shall be brought to the attention of EITS immediately for resolution. Typically the more stringent of the two guidelines will be implemented.
G. The Telecommunications Contractor will obtain and supply copies of all required permits to Design Professional and Project Manager.
H. Periodic inspections to the telecommunications installation will be conducted by the Design Professional, Project Manager, and EITS ensure that supplied materials and workmanship conform to the project requirements.
I. All telecommunication and information technology related hardware devices and system configurations shall comply with the latest edition of the UGA EITS Office of

Information Security Policies and Regulations which can be located at: http://eits.uga.edu/access_and_security/infosec/pols_regs.

J. Design Review Requirements
   i. EITS shall be involved in all phases of design.
   ii. As the project moves toward the construction documentation and code review phases, it is required that the project construction documents be submitted to EITS for an internal review process for compliance with the Standards. Plans are to be submitted for review at:
      a. Completion of Schematic Design;
      b. Completion of Design Development;
      c. At 50% completion of construction documents;
      d. At 85% completion of construction documents;
      e. At 100% completion of construction documents.
   iii. EITS will document any comments on these documents and provide these comments to the Project Manager. The Project Manager will forward comments to the Design Professional and the Design Professional shall provide timely and coordinated responses to all review comments.
   iv. All drawings shall indicate the following information for copper feeder cable: cable type, size, gauge, year installed, cable no., pair counts, distance(s), and any and all splice location(s).
   v. All drawings shall indicate the following information for fiber feeder cable: type cable, size, cable number, fiber count, distance(s), splice locations and cable length.
   vi. All drawings shall indicate the following terminal information: terminal identity, quantity and type of protectors, quantity and type termination blocks, cable and pairs entering and/or leaving.
   vii. All drawings shall indicate the following information for riser cable: cable type, size, gauge, year installed, length, splice points, cable number and pair count(s).
   viii. Network Drop Spreadsheet: At the end of this section see sample template for Network Drop Counts. Design Professional shall submit this as an Excel spreadsheet at each milestone design phase review. Refer to Section 00 00 08 Design Professional Documentation Requirements & Deliverables.

K. Design Coordination
   i. During preliminary design, the Project Manager and Design Professional are to consult with EITS to ascertain the requirements for telecommunications use and installation. The Design Professional is to coordinate his/her work with other disciplines so that a cohesive set of documents is produced for the telecommunications work.
   ii. During preliminary design the demarcations of which Work may be performed by EITS and which Work will be designed by the Design Professional and installed by the Contractor shall be determined.
   iii. Typically for all Projects, empty racks are provided by the Contractor in the TR rooms and EITS is responsible for the design, procurement, and installation of electronic equipment in the racks and activation of the building system with the UGA network.

iv. Active telecommunications network equipment (electronics) will typically be supplied and installed by EITS but may be specified for installation by a telecommunications Contractor in accordance with specifications from EITS. Project Manager shall verify requirements for each specific project with EITS during the design phase.
v. For smaller projects EITS may provide the installation of the entire system including exterior infrastructure cabling, interior cabling, and terminations.
vi. Conduit and cable trays are typically provided by the Contractor's electrical Subcontractor.
vii. For larger projects, EITS typically provides administrative review and does not perform any of the cabling and termination installation.
viii. During preliminary design and design development the Project Manager and Design Professional are to consult with EITS to define system distribution strategies and to discuss any obstacles that might be preexisting in a building, or problems inherent in a particular design or structural system. For major renovations and new construction, the Design Professional shall consult with the Project Manager and EITS to determine if VOIP is appropriate for the particular project. VOIP requires the End-User to commit to the EITS Gold Network Support Partnership level which is an on-going cost once the facility is complete. Additionally, VOIP handsets shall be accommodated within the Project Budget or provided by the End-User.
ix. The planning process shall include all Telephone, Data, and CATV services.
x. EITS will provide information on design requirements for point of entry and TR. This information will be based on the number of outlets anticipated for the project, the length of wiring runs in the project, the distance of terminations from point of entry and TR, and any other pertinent information.
xi. The Design Professional shall coordinate installation of the necessary connections to the appropriate maintenance hole / vault serving the campus infrastructure, with guidance and input from EITS.
xii. The Design Professional shall coordinate the type and position of the connection of the conduit into the maintenance hole / vault with guidance and input from EITS.
xiii. The Design Professional shall be responsible for coordination and installation of any needed infrastructure that might be necessary "behind" the first serving maintenance hole / vault back to the service entrance / TR serving this building.

L. Telecommunication Rooms
i. Wiring and cross connect locations within a building are referred to as Telecommunications Rooms (TR's). There should be a minimum of one TR per floor. It is recommended that multiple TR be provided on the same floor if usable floor space exceeds 10,000 sq. ft. or the cable pathway length between the horizontal cross-connect in the TR and any telecommunication outlets being served exceeds 250 feet. The maximum allowable cable length of horizontal cable installed to outlets must not exceed 295 feet. When used for 10/100/1000BASE-T, the maximum allowed length of a Cat 6 cable Channel is 100 meters or 328 feet. This consists of 90 meters (295 ft) of solid "horizontal" cabling between the patch panel and the wall jack, plus 10 meters (33 ft) of

stranded patch cable between each jack and the attached device. Since stranded cable has higher attenuation than solid cable, exceeding 10 meters of patch cabling will reduce the permissible length of horizontal cable. Pathway lengths should be kept to a maximum of 250 feet to accommodate the cable length.

a. The number of TR shall be approved by EITS to ensure horizontal category cable runs do not exceed a distance of 295 feet (plus an additional 33 feet for equipment jumpers).

ii. All buildings shall have a minimum of one dedicated TR. This room may be used to terminate both backbone and horizontal cabling. In addition to cable terminations and cross connects, these rooms may serve to house equipment for data, video, other telecommunications equipment, and other low voltage systems like access control and building automation and temperature controls systems..

iii. These rooms are only for low-voltage systems and shall not to be shared facilities for other services such as, electrical, plumbing, or storage. Utilities such as HVAC duct work, sprinkler pipes, electrical conduits, drain pipes, or other water pipes or systems not providing direct service to the space shall not pass through the interior of the room.

iv. The TR shall be accessible from a hallway or other common space in the building. The room should have only one door to eliminate the possibility of the space being used as a passage.

v. NEC Section 110-16 provides requirements for working space and clearances around exposed electrical equipment. Per this requirement allow a minimum of 1 meter (3.3 ft.) of clear working space from equipment and equipment racks and any wall where wall mounted cross-connect fields are mounted when determining the size of the room. Design Professional shall indicate clearance areas on the plans.

vi. As a general rule, new construction will require a minimum of 8 square feet of telecommunications room space per 1000 square feet of building space, and one duplex communication outlet (2-Cat6 connections) for every 75 square feet of space for gross estimating purposes

vii. Individual telecommunication rooms shall be sized to appropriately accommodate equipment to serve maximum drops required for programmed space type. A typical TR would be 8’ x 10’. For larger communications or extraordinary drop quantities, the telecommunications TR may require slightly more space.

viii. In existing, retrofit, or other building types, minimum Telecommunications Room sizes may not be possible. If the use of a shallow closet is approved by EITS, the minimum dimensions shall be 6’ deep by 8’ wide by 8’-6” high. The door to the room shall be a minimum of 36 inches wide. If a double door is used, the center post shall be eliminated. Due to space limitations and safety concerns, no other equipment other than telecommunication related equipment and termination blocks shall be housed in the space. Refer to National Fire Protection Association 80.

ix. Renovations and small new structures and spaces may require less space for providing telecommunications services. In those cases, a single TR with less total square footage is adequate to serve the space. Project Manager and Design Professional shall consult EITS to determine the actual size required for those TR.
x. In new buildings, TR shall be ideally designed to be vertically aligned directly above each other.
xi. All walls in TR will be furnished with full size panels of 4' x 8' x ¾" thick plywood backboards painted on all sides with fire retardant paint and mounted to all walls of the room.
xii. All access doors in the TR shall open outward unless prohibited by local codes. Inward swinging doors eliminate three (3) feet of useable wall space, therefore; room size shall be increased to compensate for the lost area.
xiii. The Design Professional is responsible for confirming that floor loading meets all applicable codes and shall confirm that the loads of the actual equipment to be housed are within the requirements.
xiv. To minimize dust and static electricity, floors shall be sealed concrete. Carpet is prohibited.
xv. TR shall not have ceilings other than exposed structure.
xvi. These rooms must not house, or be near equipment (minimum of 10 foot radius) that emits high RF / Electronic Magnetic Interference radiation, or be exposed to any other adverse environmental conditions.
xvii. For security reasons TR shall solely be used for network infrastructure and network electronics. Use of TR for storage, office space, etc. is prohibited.
xviii. It is highly recommended that these rooms be equipped with a pre-active (dry pipe) sprinkler system in lieu of the traditional fire control sprinkler approach.
xix. Each TR must be provided with a means of wiring egress. It is recommended that this be accomplished by providing four (4) 3-inch or 4-inch diameter (deemed as appropriate by EITS) "home run" conduits with pull string in each conduit with pull boxes if needed, running from MDF to IDF #1 to IDF #2, etc., or by providing four 4-inch conduit sleeves in each TR room. However if this latter sleeve approach is used, the sleeves must extend to the cable tray in the hall.
xx. Under no circumstances shall any conduit contain more than two (2) 90 degree bends nor exceed 180 degrees of total bend without the installation of pull box(s) to accomplish the above.
xxi. Cabling in walls is required to be in conduit; however, conduit home runs for telecommunications cabling are prohibited. At times, typically for security reasons, home run conduit may be necessary, but shall be approved through the variance process. Refer to Section 27 05 29 Hangers and Supports for Communications Systems.
xxii. Fire Wall Penetrations
    a. Assume that an existing TR wall that goes all the way to the decking of the floor above it, or to the roof, is a firewall. All such walls are assumed to be firewalls unless the Contractor has specific and documented evidence to the contrary. If the Work utilizes an existing penetration

through a fire rated wall, the Contractor is responsible for properly resealing the penetration per applicable codes.

b. All new fire wall penetrations in either existing or new TR room perimeter walls, floors, or ceilings shall utilize an engineered fire wall penetration system that does not require reapplication of fire caulking each time new cabling is pulled through the sleeve.
c. PVC conduit or metal conduit sleeves that are not part of a fire wall penetration system are prohibited.

xxiii. Air Conditioning
a. For spaces housing active equipment, the temperature range should be 64 °F to 75 °F, and the humidity range should be 30% to 55% relative humidity measured at 5 feet above the floor.
b. For spaces without active equipment, the temperature range should be 50 °F 95 °F. It is preferable that the temperature range is maintained to within +/- 9 °F of the adjoining office space and that humidity be kept below 85% relative humidity measured at 5 feet above the floor.

xxiv. Electrical
a. Ensure that lighting fixtures are located a minimum of 8.5 feet above the finished floor and that light switches are located near the entrance. Light levels shall be at least 500 lux (50 footcandles) measured at the points of cable termination.
b. Minimum requirement of four dedicated 20 amp, 120 volt circuits for electronic equipment power, each with double duplex receptacles placed at expected equipment locations, unless stated otherwise by EITS.
c. Convenience power outlets should be provided every 6 feet along walls at a height of 6 inches, and connected to different branch circuits than the electronic equipment.
d. If emergency (generator) power is provided for the building, it is strongly recommended that the network equipment in the TR be placed on these circuits.

M. Submittals
i. Prior to starting the Work, the telecommunications Contractor shall furnish the required information in a single consolidated submittal (including samples and manufacturer's product literature) to the Design Professional. The Design Professional will forward submittals to the Project Manager and EITS for additional review.
ii. The telecommunications Contractor shall provide a list of any and all deviations in materials, construction, and workmanship from those specified in the Standards or in the Contract documents. The Design Professional, Project Manager, EITS will review the list and declare each item as either an approved exception, or as one the telecommunications Contractor must correct.

N. Closeout
i. The UGA has records and drawings on paper of their telecommunications plant. As modifications or changes are made to the system, it is necessary to update the University drawings and records. Therefore, drawings and records must be

provided on each project. Telecommunication Contractors will be given paper prints and they are required to prepare and provide scaled drawings illustrating the new distribution system(s). The Telecommunications Contractor will prepare and submit two copies of drawings (to scale) on white paper with black print. Approximate size should be 24 inches x 36 inches. An electronic copy of all drawings produced in AutoCAD will also be required. The Telecommunications Contractor must deliver all drawings and test records to the Project Manager, Design Professional, and EITS.

ii. It is the Telecommunication Contractor's responsibility to insure that all building, outside plant, station, and all other records and drawings that would relate to the project are updated and provided to the Project Manager, Design Professional, and EITS. This will include additions that are performed by other parties such as the Contractor or other subcontractors.

iii. The telecommunications Contractor will furnish operating instructions, service and maintenance instructions, one-line diagrams, data sheets for the exact equipment installed, manufacturers parts lists and parts numbers or other identification established by the original manufacturer, schematic diagrams of the frames, and other diagrams included as part of the manufacturers data sheets. "As built and installed" drawings shall be included in the service manuals and shall show all cable and terminal markings corresponding with the equipment. Upon completion of all work, test results will be provided via actual records. One preliminary copy of the information shall be delivered to EITS for approval prior to the completion of the manuals. If additions or revisions are required, the telecommunications Contractor shall make them and resubmit a preliminary manual. After approval, deliver two completed copies to EITS, and / or the Project Manager.

iv. Refer to Section 27 08 00 Commissioning of Communications for testing requirements.

2. **PRODUCTS**
   A. All materials used in a plenum (wires, conduit, wire ties, etc.) must be plenum-rated.
   B. TR acceptable engineered fire wall penetration systems are equal to:
      i. EZ Path – 2" – #EZDP22-FWS, 3" – #EZDP33-FWS, 4" – #EZDP44-FWS
      ii. Hilti Speed Sleeve – 2" – #CP653-2"-BA, 4" – #CP653-4" – BA
      iii. Unique Fire-Stop, Split Sleeve for retrofit, 1" – #SSS-1, 2" – #SSS-2, 4" – #SSS-4
3. **EXECUTION**
   A. EITS reserves the right to exercise its discretion to require the Telecommunication Contractor to remove from the project any such employee that EITS finds to be incompetent, careless, or insubordinate.
   B. Telecommunications Contractor Qualification Requirements: In order to assure the quality and reliability of the telecommunications Contractor hired to perform Work, the UGA requires that telecommunications Contractors meet the following criteria:
      i. Shall be a firm normally employed in the low voltage cabling industry with a reference list of five (5) projects and contact names to confirm successful category-rated UTP and fiber-optic cable projects.
      ii. Must be licensed and bonded in the State of Georgia.
      iii. Be in business a minimum of five (5) years.

iv. Shall demonstrate satisfaction of sound financial condition and can be bonded and insured if the Project deems necessary.
v. Shall be able to obtain permits required to perform telecommunications installations in the specified jurisdiction.
vi. Shall have personnel knowledgeable in local, state and national codes and regulations. All Work shall comply with the latest revision of the codes or regulations. When conflict exists between local or national codes or regulations, the most stringent codes or regulations shall be followed.
vii. Shall possess current liability insurance certificates.
viii. Shall be registered with Building Industry Consulting Services International and have at least one RCDD on staff.
ix. Shall have personnel fluent in the use of Computer Aided Design and possess and operate CAD software using .dwg or .dxf format.
x. Required Telecommunications Contractor Training:
    a. The telecommunications Contractor shall have personnel trained and certified in fiber optic cabling, splicing, termination and testing techniques. Personnel must have experience using an optical light source and power meter plus OTDR.
    b. The telecommunications Contractor shall have personnel trained in the installation of pathways and support for housing horizontal and backbone cabling.
    c. All telecommunications Contractors doing telecommunications work at UGA shall hold and show proof of current certifications on the following manufactures equipment regardless of the connectivity being installed:
        1) Corning
        2) Panduit
        3) Siemon
        4) Uniprise

Template:
Network Drop Counts

Data Closet (MDF/IDF)	RM XXX MDF	RM XXX IDF	RM XXX IDF	RM XXX IDF	RM XXX IDF	TOTAL
Data	183	210	269	304	74	**1040**
Wireless AP	19	20	22	17	12	**90**
CCTV (IP Cameras)	6	6	23	3	10	**48**
Security Access Control	3	4	2	3	2	**14**
Environmental Controls (HVAC)	4	0	0	0	0	**4**
Digital Signage/AV	2	0	1	0	3	**6**
Copper Telephony	0	0	0	1	2	**3**
Emergency Copper Telephony (Fire alarms, Elevator, Emergency Phones)	2	1	1	1	1	**6**
CATV	0	0	1	0	0	**1**
TOTAL	219	241	319	329	104	**1212**

Note: Refer to electrical and mechanical drawings for locations of Environmental Controls (HVAC) Network Drop location.

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27 05 26
GROUNDING & BONDING FOR COMMUNICATION SYSTEMS

1. **GENERAL**
   - A. Related sections:
     - i. 27 15 00 – Communications Horizontal Cabling
   - B. Inside Horizontal Cabling
     - i. A 250 MCM ground wire, run from the main building electrical panel, must be provided with ground bar.
     - ii. The minimum telecommunications bonding backbone (TBB) conductor size shall be a No. 6 American Wire Gauge (AWG). The TBB should be sized at 2 kcmil per linear food of conductor length up to a maximum size of 750 kcmil. Bonding conductors used for telecommunications should be sized using engineering calculations. See table below.

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TBB Conductor Size vs Length	
TBB/GE linear length in meters (ft)	*TBB/GE size (AWG)*
Less than 4 (13)	6
4 – 6 (14 – 20)	4
6 – 8 (21 – 26)	3
8 – 10 (27 – 33)	2
10 – 13 (34 – 41)	1
13 – 16 (42 – 52)	1/0
16 – 20 (53 – 66)	2/0
20 – 26 (67 – 84)	3/0
26 – 32 (85 – 105)	4/0
32 – 38 (106 – 125)	250 kcmil
38 – 46 (126 – 150)	300 kcmil
46 – 53 (151 – 175)	350 kcmil
53 – 76 (176 – 250)	500 kcmil
76 – 91 (251 – 300)	600 kcmil
Greater than 91 (301)	750 kcmil

27 05 29
HANGERS & SUPPORTS FOR COMMUNICATIONS SYSTEMS

1. **GENERAL**
   A. Related sections:
      i. 27 00 00 – Communications
      ii. 27 05 36 – Cable Trays for Communications Systems
      iii. 27 11 16 – Communications Cabinets, Racks, Frames, and Enclosures
      iv. 27 11 19 – Communications Termination Blocks and Patch Panels
2. **PRODUCTS**
   A. ERICO CADDY, J-Hook, or equivalent
      i. p/n CAT32 (2”)
      ii. p/n CAT64 (4”)
3. **EXECUTION**
   A. Under no circumstances shall the walls, ceiling, floor, etc. of a stairwell be penetrated.
   B. Under no circumstances shall cable be installed below ceiling in an exposed fashion, i.e., all surface mounted cable shall be enclosed in conduit except when specified for architectural purposes.
   C. Cables shall not be tie wrapped or routed along electrical or gas conduit.
   D. Horizontal cable run in hallways above a suspended ceiling shall be in a cable tray or supported by J-hooks with a spacing of about 4 foot or 5 foot on center to minimize cable sag. Refer to Section 27 00 00 Communications for limitations of conduit use.

27 05 36
CABLE TRAYS FOR COMMUNICATIONS SYSTEMS

1. **GENERAL**
   A. Related sections:
      i. 27 00 00 – Communications
      ii. 27 05 29 – Hangers and Supports for Communications Systems
      iii. 27 11 16 – Communications Cabinets, Racks, Frames, and Enclosures
      iv. 27 11 19 – Communications Termination Blocks and Patch Panels
   B. In general, J-hook hanger installation method is preferred over cable trays due to ease of installation. Refer to Section 27 05 29 Hangers and Supports for Communications Systems.
   C. Under no circumstances shall the walls, ceiling, floor, etc. of a stairwell be penetrated.
2. **PRODUCTS**
   A. Cable Tray
      i. Hoffman Quick Tray Pro in 2”, 4”, or 6” depth, or equivalent.
3. **EXECUTION**
   A. The conduit for the telecommunications outlet shall run from a receptacle box (as marked on the building plans) to a cable tray in the hallway or as a minimum above the ceiling. Sleeves will need to be placed to the hallway cable tray if conduits do not run unbroken to cable tray from the outlet. From the hallway cable tray, cable will be routed to appropriate TR.
   B. Under no circumstances shall the walls, ceiling, floor, etc. of a stairwell be penetrated.
   C. Under no circumstances shall cable be installed below ceiling in an exposed fashion, i.e., all surface mounted cable shall be enclosed in conduit except when specified for architectural purposes.
   D. Cables shall not be tie wrapped or routed along electrical or gas conduit.
   E. Horizontal cable run in hallways above a suspended ceiling shall be in a cable tray or supported by J-hooks with a spacing of about 4 foot or 5 foot on center to minimize cable sag.

27 05 43
UNDERGROUND DUCTS & RACEWAYS FOR COMMUNICATIONS SYSTEMS

1. **GENERAL**
   A. Related sections:
      i. 27 00 00 – Communications
      ii. 27 05 26 – Grounding and Bonding for Communication Systems
      iii. 27 05 46 – Utility Poles for Communications Systems
      iv. 27 13 13 – Communications Copper Backbone Cabling
      v. 27 13 13.13 – Communications Copper Cable Splicing and Terminations
      vi. 27 13 23 – Communications Optical Fiber Backbone Cabling
      vii. 27 13 23.13 – Communications Optical Fiber Splicing and Terminations
      viii. 27 13 33 – Communications Coaxial Backbone Cabling
   B. This section is for outside infrastructure for telephone, data, and cable TV services for new buildings and renovation of existing buildings where expanded services to the building will be required. This section also applies to the installation of additional network services in existing buildings not undergoing renovation.
   C. Service Entrance Requirements: The service entrance is the route by which telecommunication services and cables enter a building. Following are the guidelines to install service entrances to buildings and information for the termination of those cables. There are two types of service entrances:
      i. Underground Entrance – Buried Conduit. Conduit sizing and quantities between buildings, and/or maintenance holes and vaults shall be determined by the quantities and requirements for the cabling needed to serve the building.
         a. The recommended conduit size for use in an underground entrance is 4 inches in diameter. A minimum of one 4-inch conduit (with pull wire) for telephone, one 4-inch PVC conduit (with pull wire) for data / CATV, and two spare (empty) 4-inch PVC conduits (with pull wire) will be installed for most new buildings. Minimally, there needs to be one 4-inch conduit installed for each desired service (voice, data / CATV, and / or leased common carrier) along with one spare 4-inch conduit. Therefore, the minimum conduit run to any building would be two 4-inch conduits.
      ii. Buried Entrance – may be used for temporary service only. Permanent buried entrance method is prohibited.
   D. Telecommunications Vaults - UGA has an extensive network of telecommunications conduit and maintenance holes throughout the campus. Design Professional should assure that all projects connect to this system as needed. All new maintenance holes or telecommunication vaults shall be coordinated with EITS.
      i. Telecommunication vaults shall be placed in outside plant conduit runs at an interval no greater than every 400 feet if a direct path between structures is attainable (i.e. no 90 degree bends). The maximum distance between maintenance holes shall be reduced by 50 feet for every 90 degree bend installed in the pathway up to a maximum of two bends.
      ii. Conduit routing between two telecommunications vaults, or between a vault and a building, shall contain no more than two 90-degree bends or a total of 180

degrees of bend. If additional conduit bends are required, additional vaults shall be placed as needed.

iii. Telecommunications vaults are typically constructed of pre-fabricated cast concrete, and contain a floor section, wall section, and top section. Vaults shall be a minimum of 6' wide by 12' long by 7' headroom standard inside dimension. Smaller vaults may be used as a pulling point between the main conduit vaults and a building but only as a pass through with no splicing in them and shall be approved in advance by EITS.

2. **PRODUCTS**
   A. Underground Burial Conduit
      i. All buried conduit will be corrosive resistant, plastic polyvinyl chloride (PVC). Conduits shall be installed concrete encased; PVC conduit with concrete encasement is unacceptable.
      ii. Conduits shall have a nylon pull cord installed with a minimum test rating of 200 lbs pulling strength in each conduit or compartment within the conduit.
   B. Telecommunications Vault:
      i. Acceptable vault manufacturers and part numbers are equal to:
         a. Manhole – Old Castle Precast
         b. Handhole – Quazite or NewBasis
3. **EXECUTION**
   A. Underground Burial Conduit
      i. Conduit must be buried at a minimum depth of 24 inches to the top of the concrete and encased in concrete rated at 3,000 psi. Conduit that will be placed under load should be encased in concrete rated to 3,500 psi. To minimize accidental digging or damage, a detectable, warning tape shall be placed in the trench a minimum of 12 inches below the surface and directly over the conduit. Install a #6 ground wire at the bottom of the conduit path, terminate and ground in all pull boxes and terminate before entrance of any building with an 8 foot long ground-rod. This is used to bleed off static charges and to provide a signal path to locate non-metallic systems.
      ii. Telecommunications conduit is not to be placed in the same trench or duct banks with other utilities. Design of underground conduit should be fully coordinated with EITS.
      iii. Entrance conduit must not have more than two 90 degree bends without a pull box, handhole, or maintenance hole. Bends must be sweeping with a radius not less than 10 times the inside diameter of the 4 inch conduit.
      iv. All 4-inch conduits conveying fiber optic cable shall be compartmentalized into multiple channels via multi-cell duct liner.
      v. Conduits entering a building from below grade shall extend 4 inches above the finished floor.
      vi. Conduits entering the building through the ceiling shall extend to 8 ½ feet above the finished floor.
      vii. Conduits entering the building through walls shall have sweeps installed in a manor that allows the conduit to extend to 8 ½ ft. above the finished floor.
      viii. All conduits entering buildings will be sealed to prevent water, noxious gases and rodents from entering the building.

ix. All conduits shall be securely fastened to the structure to withstand typical cabling installation.

x. Telecommunications conduits are for the exclusive use of telecommunications cables. They shall not be shared with any other utility.

xi. Multiple service entrance conduits (two diverse routes) should be considered for buildings which provide crucial services, including research, health care, and emergency services.

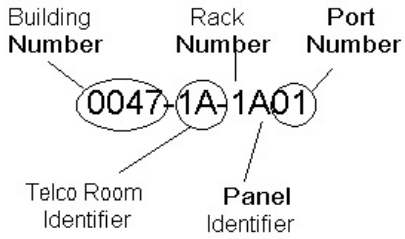
Revised Apr 30, 2018

27 05 46
UTILITY POLES FOR COMMUNICATIONS SYSTEMS

1. **GENERAL**
    A. Related sections:
        i. 27 00 00 – Communications
        ii. 27 05 43 – Underground Ducts and Raceways for Communications Systems
    B. Service Entrance Requirements
        i. Except for temporary service, aerial entrance method is prohibited.

27 05 53
IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

1. **GENERAL**
   A. Related sections:
      i. 27 00 00 – General Communications Requirements
      ii. 27 05 26 – Grounding and Bonding for Communication Systems
      iii. 27 05 29 – Hangers and Supports for Communications Systems
      iv. 27 05 36 – Cable Trays for Communications Systems
      v. 27 05 43 – Underground Ducts and Raceways for Communications Systems
      vi. 27 05 46 – Utility Poles for Communications Systems
      vii. 27 08 00 – Commissioning of Communications
      viii. 27 11 16 – Communications Cabinets, Racks, Frames, and Enclosures
      ix. 27 11 19 – Communications Termination Blocks and Patch Panels
      x. 27 11 23 – Communications Cable Management and Ladder Rack
      xi. 27 13 13 – Communications Copper Backbone Cabling
      xii. 27 13 13.13 – Communications Copper Cable Splicing and Terminations
      xiii. 27 13 23 – Communications Optical Fiber Backbone Cabling
      xiv. 27 13 23.13 – Communications Optical Fiber Splicing and Terminations
      xv. 27 13 33 – Communications Coaxial Backbone Cabling
      xvi. 27 13 43.43 – Cable Services Cabling
      xvii. 27 15 00 – Communications Horizontal Cabling
      xviii. 27 20 00.01 – Data Communications – Wireless
   B. For this section, outlet shall mean telecommunications outlet.
2. **PRODUCTS**
3. **EXECUTION**
   A. Label all telecommunications infrastructure and equipment components in accordance with ANSI/TIA/EIA-606-B.
      i. For new construction, the Design Professional shall coordinate with the Project Manager and EITS to determine the outlet labeling scheme to include in the Contract documents. See the following example:



      ii. For renovations, an existing telephone, data, and CATV labeling schemes are in place. The Design Professional and Telecommunications Contractor shall coordinate with the Project Manager and EITS to determine the outlet labeling schemes for the Project.
   B. All labeling shall be unique.
   C. All labeling shall be legible and made with a mechanical labeling system, not handwritten.
   D. All labeling shall be permanent enough to last the life of the component.

E. Labels at one end of cables, conduits, etc. shall exactly correspond with the label at the other end of the cable, conduit, etc.
F. The Telecommunications Contractor shall present all labeling schemes for approval to the Design Professional, Project Manager, and EITS before any components are labeled at the Project.
G. The identification assigned to the jack shall be the same as the corresponding label on the patch panel.

27 08 00
COMMISSIONING OF COMMUNICATIONS

1. **GENERAL**
   A. Related sections:
      i. 27 00 00 – General Communications Requirements
      ii. 27 05 26 – Grounding and Bonding for Communication Systems
      iii. 27 05 29 – Hangers and Supports for Communications Systems
      iv. 27 05 36 – Cable Trays for Communications Systems
      v. 27 05 43 – Underground Ducts and Raceways for Communications Systems
      vi. 27 05 46 – Utility Poles for Communications Systems
      vii. 27 05 53 – Identification for Communications Systems
      viii. 27 11 16 – Communications Cabinets, Racks, Frames, and Enclosures
      ix. 27 11 19 – Communications Termination Blocks and Patch Panels
      x. 27 11 23 – Communications Cable Management and Ladder Rack
      xi. 27 13 13 – Communications Copper Backbone Cabling
      xii. 27 13 13.13 – Communications Copper Cable Splicing and Terminations
      xiii. 27 13 23 – Communications Optical Fiber Backbone Cabling
      xiv. 27 13 23.13 – Communications Optical Fiber Splicing and Terminations
      xv. 27 13 33 – Communications Coaxial Backbone Cabling
      xvi. 27 13 43.43 – Cable Services Cabling
      xvii. 27 15 00 – Communications Horizontal Cabling
      xviii. 27 20 00.01 – Data Communications – Wireless
   B. The Telecommunications Contractor shall test every pair in every cable, on an end-to-end basis after splicing and termination for conformity to the design standards and specifications. The test procedures and results will be documented with certification that the system meets all applicable standards and specifications. The Contract shall state the beginning date and duration of system acceptance checkout. Performance detail sheets will be submitted for final review and system acceptance by the University. Test record forms are to be completed and turned over to the Design Professional, Project Manager, and EITS.
2. **PRODUCTS**
3. **EXECUTION**
   A. Testing Parameters
      i. Optical Fiber Testing: Singlemode and Multimode Fiber
         a. Fiber horizontal cables shall be 100% tested for insertion loss and length.
         b. Insertion loss shall be tested at 850 nm and 1300 nm for 50/125um and 62.5/125um multimode cabling in at least one direction using the Method B (1-jumper) test procedure as specified in ANSI/TIA/EIA-526-14A.
         c. Insertion loss shall be tested at 1310 and 1550 for singlemode cabling in at least one direction using the Method A.1 (1-jumper) test procedure as specified in ANSI/TIA/EIA-526-7.
         d. Length shall be tested using an OTDR, optical length test measurement device or sequential cable measurement markings.

e. The multimode backbone link performance guarantees are as follows:

Backbone Link Performance	
Parameter	**62.5/125µm (850nm/1300nm)**
Max. Insertion Loss (dB)	8.5/3.5
Bandwidth (MHz•km) [1]	200/500
Guaranteed Transmission Distance (m) [2]	275/550
Min. Return Loss (dB) [3]	20

[1] Bandwidth is an important performance parameter, but because it is intrinsic to the fiber and cannot be adversely affected by installation practices, it does not require testing in the field.

[2] The protocol pertinent to the transmission distances as noted is Gigabit Ethernet per IEEE 802.3:2000.

[3] If the insertion loss is within the limits as noted in the above chart, it is indicative that the Return Loss performance of the link will be within the limits as indicated.

Acceptable attenuation test results shall be determined using the following calculation:
Link Attenuation = Cable Attenuation + Connector Attenuation + Splice Attenuation
where:
Cable Attenuation (dB) = Attenuation Coefficient (dB/km) x length (km)
Attenuation Coefficient = 3.5 dB/km @ 850 nm
Attenuation Coefficient = 1.0 dB/km @ 1300 nm
Connector Attenuation (dB) = Number of Connector Pairs (n) x Connector Loss = n x 0.75 dB
Splice Attenuation (dB) = Number of Splices (s) x Splice Loss (dB) = s x 0.3 dB

f. The singlemode backbone link performance guarantees are as follows:

Backbone Link Performance	
Parameter	**Singlemode (1310nm/1550nm)**
Max. Insertion Loss (dB)	2.9/2.9
Zero Dispersion Wavelength (nm) [1]	1300 - 1322
Zero Dispersion Slope ($nm^2 \bullet km$) [1]	<0.092
Gigabit Transmission Distance (m) [2]	3,000/3,000
10 Gigabit Transmission Distance (m) [3]	3,000/3,000
Min. Return Loss (dB) [4]	40

[1] Dispersion is an important performance parameter, but because it is intrinsic to the fiber and cannot be adversely affected by installation practices, it does not require testing in the field.
[2] The protocol pertinent to the transmission distances as noted is Gigabit Ethernet per IEEE 802.3:2000.
[3] The protocol pertinent to the transmission distances as noted is 10 Gigabit Ethernet per IEEE 802.3ae.
[4] If the insertion loss is within the limits as noted in the above chart, it is indicative that the Return Loss performance of the link will be within the limits as indicated.

Acceptable attenuation test results shall be determined using the following calculation:
Link Attenuation = Cable Attenuation + Connector Attenuation + Splice Attenuation
where:
Cable Attenuation (dB) = Attenuation Coefficient (dB/km) x length (km)
Attenuation Coefficient (Inside Plant) = 0.5 dB/km @ 1310 and 1550 nm
Attenuation Coefficient (Outside Plant) = 0.4 dB/km @ 1310; 0.3 dB/km @ 1550 nm
Connector Attenuation (dB) = Number of Connector Pairs (n) x Connector Loss = n x 0.5 dB
Splice Attenuation (dB) = Number of Splices (s) x Splice Loss (dB) = s x 0.3 dB

g. OTDR (Optical Time Domain Reflectometer) Testing
h. In addition to insertion loss testing, OTDR testing shall be performed for each strand and OTDR traces provided. The wavelength(s) used in creating the OTDR trace should be the same as that used with the insertion loss testing. The OTDR trace characterizes elements along a fiber link, including fiber segment length, attenuation uniformity and attenuation rate, connector location and insertion loss, splice location and splice loss, and other power loss events such as a sharp bend that may have been incurred during cable installation.

ii. Twisted Pair / Copper Testing

a. The current field acceptance test parameters for twisted-pair cabling are:

1) All category 6 field-testing shall be performed with an approved level III balanced twisted-pair field test device.

2) All installed category 6 channels shall perform equal to or better than the minimum requirements as specified by the table below:

Parameter	Performance @ 100MHz	Performance @ 200MHz	Performance @ 250MHz
Insertion Loss	20.3 dB	29.7 dB	33.7 dB
NEXT Loss	42.1 dB	37.5 dB	36.1 dB
PS NEXT Loss	40.6 dB	36.1 dB	34.6 dB
ACR	21.8 dB	7.8 dB	2.4 dB
PS ACR	20.3 dB	6.4 dB	0.9 dB
ACR-F	23.9 dB	17.9 dB	15.9 dB
PS ACR-F	20.9 dB	14.9 dB	12.9 dB
Return Loss	14.0 dB	11.0 dB	10.0 dB
Propagation Delay	528 ns	527 ns	526 ns
Delay Skew	40 ns	40 ns	40 ns

b. Category 3, balanced twisted-pair horizontal and backbone cables, whose length does not exceed 90 m (295 ft) for the basic link, and 100 m (328 ft) for the channel shall be 100 percent tested according to ANSI/TIA/EIA-568-B.1. Test parameters include wire map plus ScTP shield continuity (when present), insertion loss, length and NEXT loss (pair-to-pair). NEXT testing shall be done in both directions.

c. All balanced twisted-pair backbone cables exceeding 90 m (295 ft) or 100 m (328 ft) shall be 100% tested for continuity if applications assurance is not required.

d. Category 6 balanced twisted-pair horizontal and backbone cables, whose length does not exceed 90 m (295 ft) for the basic link, and 100 m (328 ft) for the channel shall be 100 percent tested according to ANSI/TIA/EIA-568-B.1. Test parameters include wire map plus ScTP

shield continuity (when present), length, NEXT loss (pair-to-pair), NEXT loss (power sum), ELFEXT loss (pair-to-pair), ELFEXT loss (power sum), return loss, insertion loss, propagation delay, and delay skew.

e. Test Equipment Criteria
    1) All balanced twisted-pair field testers shall be factory calibrated each calendar year by the field test equipment manufacturer as stipulated by the manuals provided with the field test unit. The calibration certificate shall be provided for review prior to the start of testing.
    2) Autotest settings provided in the field tester for testing the installed cabling shall be set to the default parameters.
    3) Test settings selected from options provided in the field testers shall be compatible with the installed cable under test.

iii. CATV Coaxial Cable Testing
    a. CATV coaxial cabling at 75 Ohms will be tested for bi-directional use
    b. DC loop resistance
    c. Impedance
    d. Length
    e. TDR
    f. Frequency Attenuation variation
    g. Structural loss- physical damage to cable
    h. These are tested with Digital Multi-Meters, TDR's, Sweep Generation Testing, and other testing equipment.

iv. Telephone Cable Testing
    a. All telephony cables shall be 100% tested for continuity.

v. Optical Cabling
    a. Multimode – The fiber cable shall be a graded index fiber with a nominal 50/125µm core / cladding. The fiber shall conform to the following standards or international equivalents:
        ANSI/TIA/EIA-568-B (overall requirements)
        ANSI/TIA/EIA-492AAAC (Laser bandwidth DMD specification)
        ANSI/ICEA-83-596 (indoor optical cables)
        ANSI/ICEA-87-640 (indoor optical cables)
    b. Single-mode – The fiber shall be at least Class IVa Dispersion unshifted single-mode optical fiber. It shall conform to the following standards or international equivalents:
        ANSI/TIA/EIA-568-B (overall requirements)
        ANSI/TIA/EIA-492CAAA (fiber specifications)
        ANSI/ICEA S-83-596 (indoor optical cable)
        ANSI/ICEA S-87-640 (outdoor optical cable)

27 11 16
COMMUNICATIONS CABINETS, RACKS, FRAMES, AND ENCLOSURES

1. **GENERAL**
   - A. Related sections:
     - i. 27 00 00 – Communications
     - ii. 27 05 29 – Hangers and Supports for Communications Systems
     - iii. 27 05 36 – Cable Trays for Communications Systems
     - iv. 27 11 19 – Communications Termination Blocks and Patch Panels
     - v. 27 11 23 – Communications Cable Management and Ladder Rack
   - B. Wall mount cabinets and free standing cabinets are acceptable for use. The Project Manager and Design Professional shall consult EITS for the acceptable circumstances under which this equipment can be used.
2. **PRODUCTS**
   - A. TR Equipment
     - i. Acceptable rack manufacturer(s) and part numbers are equal to:
       - a. Hoffman, p/n EDR19FM45U
       - b. Siemon RS3 Series Racks, p/n RS3-07-S
   - B. Fiber cables shall be terminated in Rack Mount Interconnect (RIC) Fiber Connect patch panels or Wall Mount Interconnect Center. Acceptable fiber optic panels and enclosures are:
     - i. Corning Closet Connector Housing and Pretium Connector Housing
       - a. CCH-01U or PCH-01U up to 24 fiber capacity (48 with LC's)
       - b. CCH-02U or PCH-02U up to 48 fiber capacity (96 with LC's)
       - c. CCH-03U up to 72 fiber capacity (144 with LC's)
       - d. CCH-04U or PCH-04U up to 144 fiber capacity (288 with LC's)
       - e. PCH-96F-01U - 96 fiber capacity in 1U
     - ii. Corning Wall-Mountable Connector Housing
       - a. WCH-02P or PWH-02P up to 24 fiber capacity
       - b. WCH-04P or PWH-04P up to 48 fiber capacity
       - c. WCH-06P or PWH-06P up to 72 fiber capacity
       - d. WCH-12P or PWH-24P up to 144 fiber capacity
     - iii. Corning Closet Connector Housing Panels
       - a. CCH-CPXX-YY
         1) XX = Fiber Count
         2) YY = Adapter Code
         3) Panels fit in CCH, PCH, and Wall Mount Housing
     - iv. Siemon
       - a. Siemon Rack Mount Interconnect Center
         p/n RIC3-24-01
         p/n RIC3-36-01
         p/n RIC3-48-01
         p/n RIC3-72-01
       - b. Siemon Fiber Connect Panels
         p/n FCP3-DWR

Siemon Wall Mount Interconnect Center
p/n SWIC3-A-01
p/n SWIC3G-AA-01

C. Acceptable fiber adapter panels manufacturer and parts numbers:
    i. Corning
        a. Corning Closet Connector Panels
            1) CCH-CP06-3C (6 fiber SC/UPC)
        b. CCH-CPXX-YY
            1) XX = Fiber Count
            2) YY = Adapter Code
            3) Panels fit in CCH, PCH, and Wall Mount Housing
    ii. Siemon
        a. Siemon Quick-Pack Adapter Plates
        p/n RIC-F-SC6-01 (SC/UPC)

27 11 19
COMMUNICATIONS TERMINATION BLOCKS & PATCH PANELS

1. **GENERAL**
   - A. Related sections:
     - i. 00 73 01 – Sole Source / Sole Brand
     - ii. 27 00 00 – General Communications Requirements
     - iii. 27 05 29 – Hangers and Supports for Communications Systems
     - iv. 27 05 36 – Cable Trays for Communications Systems
     - v. 27 11 16 – Communications Cabinets, Racks, Frames, and Enclosures
     - vi. 27 11 23 – Communications Cable Management and Ladder Rack
     - vii. 27 13 13 – Communications Copper Backbone Cabling
     - viii. 27 13 13.13 – Communications Copper Cable Splicing and Terminations
     - ix. 27 13 23 – Communications Optical Fiber Backbone Cabling
     - x. 27 13 23.13 – Communications Optical Fiber Splicing and Terminations
     - xi. 27 13 33 – Communications Coaxial Backbone Cabling
     - xii. 27 13 43.43 – Cable Services Cabling
     - xiii. 27 15 00 – Communications Horizontal Cabling
     - xiv. 27 20 00.01 – Data Communications – Wireless
2. **PRODUCTS**
   - A. TR Equipment
     - i. Patch panel acceptable manufacturer(s) and part numbers are:
       - a. Siemon HD 6 Patch Panels
         p/n HD6-24
         p/n HD6-4
       - b. Siemon Angled Max Patch Panels
         P/n MX-PNLA-24
         P/n MX-PNLA-48
     - ii. Patch panel cables:
       - a. In an effort to easily identify one particular low voltage system connection from another where they are terminated on patch panel fields in TR, the following color-coding scheme of the exterior jacket of the various system patch cables shall be utilized. This scheme utilizes specific jacket colors for patch cords used between patch panels and switch ports to better and more quickly identify the various types of applications supported over the connection. The jacket color of the horizontal cabling from the patch panel to the low voltage connection will be blue in color for all systems regardless of the service provided by the system. It is only necessary to color-code the patch cabled used in the cross-connect fields of the TR.

         The color coding system is as follows:
         Blue = Data, White = Voice/VOIP, Yellow = Wireless, Green = A/V, Red = Camera/Security

b. Siemon MC-6 Modular Cat6 Patch Cable (use Blue unless otherwise approved by EITS)
p/n MC6-(XX)-(XX) MC6, double-ended, 4pr stranded modular cord colored jacket with clear boot, T568A/B, CM/LS0H

Use 1st (XX) to specify cable cord length:
03 = 0.9m (3ft), 05 = 1.5m (5 ft), 07 = 2.1m (7 ft), 10 = 3.1m (10 ft.) 15 = 4.6m (15 ft), 20 = 6.1m (20 ft.)

Use 2nd (XX) to specify cable color:
01 = black, 02 = white, 03 = red, 04 = gray, 05 = yellow, 06 = blue, 07 = green, 08 = violet, 09 = orange
Add "B" for bulk project pack of 100 modular cords custom lengths are available upon request.

iii. Voice termination block and / or panel acceptable manufacturer and part number is:
   a. Siemon S210 Field Termination Kits
   p/n S210AB2-64FT
   p/n S210AB2-192FT

iv. Single-mode fiber jumper acceptable manufacturers and part numbers are:
   a. Corning Single-mode 2 Fiber Jumper, SC/UPC Duplex
   727202R5131001M (1m)
   727202R5131002M (2m)
   727202R5131003M (3m)
   727202R5131005M (5m)
   b. Corning Single-mode 2 Fiber Jumper, SC/APC
   656502R5131001M (1m)
   656502R5131002M (2m)
   656502R5131003M (3m)
   656502R5131005M (5m)
   c. Siemon Single-mode Fiber Jumper, SC Duplex
   p/n FJ2-SCUSCUL-01 (1m)
   p/n FJ2-SCUSCUL-02 (2m)
   p/n FJ2-SCUSCUL-03 (3m)
   p/n FJ2-SCUSCUL-05 (5m)

v. Multi-mode fiber jumper acceptable manufacturers and part numbers are:
   a. Corning 2 fiber 62.5/125 Multi-mode Fiber Jumper, SC, Duplex
   575702K5141001M (1m)
   575702K5141002M (2m)
   575702K5141003M (3m)
   575702K5141005M (5m)
   b. Corning 2 fiber Standard 50/125 Multi-mode Jumper, SC Duplex
   575702C5131001M (1m)
   575702C5131002M (2m)
   575702C5131003M (3m)
   575702C5131005M (5m)

c. Corning 2 fiber Laser Optimized 50/125 Multi-mode Jumper, SC, Duplex
   575702S5180001M (1m)
   575702S5180002M (2m)
   575702S5180003M (3m)
   575702S5180005M (5m)
d. Siemon 62.5/125 Multi-mode Fiber Jumper, SC, Duplex
   p/n FJ2-SCSC6MM-01 (1m)
   p/n FJ2-SCSC6MM-02 (2m)
   p/n FJ2-SCSC6MM-03 (3m)
   p/n FJ2-SCSC6MM-05 (5m)

3. **EXECUTION**
   A. Refer to Section 27 05 53 Identification for Communications Systems for labeling of patch panels.

27 11 23
COMMUNICATIONS CABLE MANAGEMENT & LADDER RACK

1. **GENERAL**
   - A. Related sections:
     - i. 00 73 01 – Sole Source / Sole Brand
     - ii. 27 00 00 – Communications
     - iii. 27 05 29 – Hangers and Supports for Communications Systems
     - iv. 27 05 36 – Cable Trays for Communications Systems
     - v. 27 11 16 – Communications Cabinets, Racks, Frames, and Enclosures
     - vi. 27 11 19 – Communications Termination Blocks and Patch Panels
2. **PRODUCTS**
   - A. TR Equipment
     - i. Acceptable cable management manufacturer(s) and part numbers are equal to:
       - a. Hoffman CableTek Horizontal Cable Managers
         p/n DCHS2
       - b. Hoffman CableTek Vertical Cable Managers
         p/n DV6D7, DV10D7, DV12D7
       - c. Siemon RS3 Series Horizontal Cable Managers
         p/n RS3-RWM-2
       - d. Siemon Vertical Patching Channels
         p/n VPC-6, VPC-12

27 13 13
COMMUNICATIONS COPPER BACKBONE CABLING

1. **GENERAL**
   A. Related sections:
      i. 27 00 00 – Communications
      ii. 27 13 13.13 – Communications Copper Backbone Cabling Splicing and Terminations
2. **PRODUCTS**
   A. Outside Cabling
      i. Telephone backbone cable shall be type PE-89, 24-AWG, 100-ohm, Category 3, filled cable. The number of planned telephone outlets shall determine the number of telephone pairs needed for the building. As a general rule, the building shall be provided telephone pairs using the following equation: the number of outlets times 4 + 20% growth.
      ii. Telephone – Superior Essex SEALPIC-FSF (Rural Utilities Service-PE-89) or equivalent sized in a pair count as required by the Project.
   B. Inside Cabling
      i. Twenty-four (24) gauge, plenum, CAT 3 or higher UTP copper cable (wire) shall be used for telephone riser and shall "home-run" from each IDF back to the MDF.
      ii. This copper cable (wire) shall be large enough to provide a minimum of 1 ½ pair of wires per receptacle box served by that individual TR.

27 13 23
COMMUNICATIONS OPTICAL FIBER BACKBONE CABLING

1. **GENERAL**
   - A. Related sections:
     - i. 00 73 01 – Sole Source / Sole Brand
     - ii. 27 00 00 – General Communications Requirements
     - iii. 27 11 19 – Communications Termination Blocks and Patch Panels
     - iv. 27 13 23.13 – Communications Optical Fiber Splicing and Terminations
   - B. All fiber optic cable shall have at least 30 feet of additional cable (slack) on each end upon entering each TR.
   - C. Outside Infrastructure Requirements
     - i. Fiber optic backbone cabling shall be comprised of singlemode cable with each buffer tube containing 12 fibers. The actual fiber counts will be determined by building use, occupancy, and future bandwidth needs. EITS should be consulted to determine the needs.
   - D. Inside Infrastructure Requirements
     - i. The MDF shall be connected to each IDF with 12 singlemode and 12 multimode strands of OFNP type (optical fiber, non-metallic, plenum rated) "home-run" fiber optic cable.
     - ii. The singlemode and multimode cables may be in separate sheaths.
2. **PRODUCTS**
   - A. Outside Cabling; Corning Cable Systems has UGA sole brand approval.
     - i. Each buffer tube shall contain a water-swellable yarn or water blocking element for water-blocking protection. The water-swellable yarn or water blocking element shall be non-nutritive to fungus, electrically non-conductive, and homogeneous. It shall also be free from dirt or foreign matter. This yarn or element will preclude the need for other water-blocking material; the buffer-tube shall be gel-free.
       - a. Singlemode backbone fiber shall meet Low Water Peak specifications per ITU-T G.652.C.
     - ii. Outside cable acceptable manufacturers and part numbers are:
       - a. Corning ALTOS All-Dielectric Gel-Free Cables
         Single-mode Cable XXXEU4-T4101D20
   - B. Inside Cabling; Siemon Network Cabling Solutions has UGA sole brand approval.
     - i. Singlemode Fiber Optic Cable acceptable manufacturer and part numbers:
       - a. Siemon 12-strand Singlemode Indoor Tight Buffered Distribution Fiber, OFNPp/n 9BB8P012G-E205A
     - ii. Multimode fiber shall be 50 micron and specified to accommodate 10 gigabit applications out to 300, 550, or 600 meters as required.
     - iii. Only 50/125 Laser Optimized multimode fiber shall be used.
     - iv. Multimode Fiber Optic Cable acceptable manufacturer and part numbers:
       - a. Siemon 12-strand 50/125 Multimode Indoor Tight Buffered Distribution Fiber, OFNP
         p/n 9BB5P012G-T312

v. Armored OFNP cable may be used in the ceiling space instead of placing fiber optic cabling in conduit or innerduct, or where otherwise practical.
   a. MIC Interlocking armored Plenum Cables acceptable manufacturer and part numbers:
      The Siemon Compay
      - XGLO Multimode Laser Optimized 50/125 OM3, OM4 (Aqua
      - Jacket)
      - Singlemode OS1 (Yellow Jacket)
      - LightSystem Multimode 62.5/125 OM1, 50/125 OM2 (Orange
      - Jacket)

      1) **9BC(X)(X)006D-(XXXX)A** Fiber Count = 6, Construction = 1 tube of 6 fibers
      2) **9BC(X)(X)012G-(XXXX)A** Fiber Count = 12, Construction = 1 tube of 12 fibers
      3) **9BC(X)(X)024L-(XXXX)A** Fiber Count = 24, Construction = 1 tube of 24 fibers
      4) **9BC(X)(X)036G-(XXXX)A** Fiber Count = 36, Construction = 3 tubes of 12 fibers
      5) **9BC(X)(X)048G-(XXXX)A** Fiber Count = 48, Construction = 4 tubes of 12 fibers
      6) **9BC(X)(X)072G-(XXXX)A** Fiber Count = 72, Construction = 6 tubes of 12 fibers
      7) **9BC(X)(X)096G-(XXXX)A** Fiber Count = 96, Construction = 8 tubes of 12 fibers
      8) **9BC(X)(X)144G-(XXXX)A** Fiber Count = 144, Construction = 12 tubes of 12 fibers

      - Use 1st (X) to specify fiber type: 5 = 50/125µm, 6 = 62.5/125µm, 5 = 50/125µm Laser Optimized, 8 = Singlemode
      - Use 2nd (X) to specify cable rating: R = OFCR, P = OFCP
      - Use (XXXX) to specify class performance: G109 = OM1 62.5µm, T109 = OM2 50µm,T312 = OM3 50µm Laser Optimized, T512 = OM4 50µm Laser Optimized, E205 = OS1 Singlemode

3. EXECUTION

A. All fiber shall not have a bending radius of more than ten (10) times the outside diameter of the cable, or exceed the bending radius specs of the cable manufacturer.

27 13 23.13
COMMUNICATIONS OPTICAL FIBER SPLICING & TERMINATIONS

1. **GENERAL**
   - A. Related sections:
     - i. 00 73 01 – Sole Source / Sole Brand
     - ii. 27 00 00 – General Communications Requirements
     - iii. 27 13 23 – Communications Optical Fiber Backbone Cabling
   - B. General communication services shall be terminated with duplex SC/UPC.
2. **PRODUCTS**
   - A. Outside Infrastructure; Corning Cable Systems has UGA sole brand approval.
     - i. Outside fiber closures acceptable manufacturers are:
       - a. Corning Advanced Splice Closures (SCF)
         1) SCF-6C22-01 72 Fiber Splices
         2) SCF-6C28-01 144 Fiber Splices
         3) SCF-8C28-01 240 Fiber Splices
         4) SCF-8C28-02 480 Fiber Splices
     - ii. The splice closure housing shall be non-metallic. It shall be resistant to solvents, stress cracking, and creep. The housing materials shall also be compatible with chemicals and other materials to which they might be exposed in normal applications. The splice closure shall be re–enterable. The closure end cap shall be capable of accepting additional cables without removal of the sheath retention or strength member clamping hardware on previously installed cables or disturbing existing splices. The optical fiber splice closure shall provide a clamping mechanism to prevent pistoning of the central member or strength members and to prevent cable sheath slip or pullout.
   - B. Inside Infrastructure; Siemon Network Cabling Solutions has UGA sole brand approval.
     - i. Fusion splice trays acceptable manufacturer(s) and part numbers are:
       - a. Siemon Fusion Splice Tray
         p/n TRAY-3
     - ii. Singlemode pigtail acceptable manufacturer(s) and part numbers are:
       - a. Seimon
         1) Siemon Singlemode Simplex Pigtail, SC/UPC, 1m
            p/n FP1B-SCUL-01
         2) Siemon Singlemode Simplex Pigtail, SC/APC, 1m
            p/n FP1B-SCA-01
     - iii. Multimode pigtail acceptable manufacturer(s) and part numbers are:
       - a. Siemon 50/125 Multimode Simplex Pigtail, SC, 1m
         p/n P1B-SC5MM-01
3. **EXECUTION**
   - A. All fibers shall be terminated with SC style connectors. Fusion spliced pigtails, epoxy minimal polish connectors and UNICAM style connectors are all acceptable methods of fiber termination for backbone cables.
   - B. Singlemode fiber should be terminated with a minimum of 1 pair of Angle Polish Connectors at each end of the cable to support video/CATV service.

27 13 33
COMMUNICATIONS COAXIAL BACKBONE CABLING

1. **GENERAL**
   - A. Related sections:
     - i. 00 73 01 – Sole Source / Sole Brand
     - ii. 27 00 00 – General Communications Requirements
     - iii. 27 13 43.43 – Cable Services Cabling
   - B. Any individual cable length over 250 feet will need to be approved by EITS in writing prior to installation.
   - C. For CATV services, fiber optic backbone cabling shall be terminated with a minimum 1 pair, green in color, single-mode SC/APC connector at both ends of cable.
2. **PRODUCTS**
   - A. Inside CATV Cabling
     - i. CATV coaxial cable shall be plenum rated, quad-shielded, RG-6, from each outlet back to the appropriate TR with no more than 250 feet of cable. Acceptable products are:
       - a. Commscope 2227V
       - b. General Cable C3525
       - c. Belden 1189AP.
     - ii. CATV Connectors
       - a. Compression style CATV connectors with rubber o-rings shall be used.
         Siemon RG6C Compression Connectors
         p/n RG6C
         PCT Compression connectors
         p/n DRS-6
     - iii. CATV Patch Panels/Connectors
       - a. Siemon MAX Patch Panel and F-Type MAX Modules
         p/n MX-PNL-24
         p/n MX-PNL-48
         p/n MX-F-FA-01
3. **EXECUTION**
   - A. Cable shall be terminated on wall mounted patch panels / taps.

27 13 43.43
CABLE SERVICES CABLING

1. **GENERAL**
   A. Related sections:
      i. 00 73 01 – Sole Source / Sole Brand
      ii. 27 00 00 – Communications
      iii. 27 05 53 – Identification for Communications Systems
      iv. 27 08 00 – Commissioning of Communications
      v. 27 13 33 – Communications Coaxial Backbone Cabling
      vi. 27 15 00 – Communications Horizontal Cabling
   B. EITS shall provide consultation and preliminary planning guidance to assist the Design Professional and Project Manager in determining the cabling requirements on a case-by-case basis for each building.
   C. The following general specifications will be required for buildings which are connected to the UGA Cablevision network.
      i. The network must be two-way capable with 862 MHz actives and 1 Gig passives. The downstream frequency will be from 54 MHz-862 MHz for digital / analog video and data transmissions. The upstream frequency will be from 5 MHz - 42 MHz for digital / analog video and data transmissions.
      ii. The network must deliver a signal at the following levels:
         a. The signal level at each outlet / drop should have minimum of 6 dBmV and a maximum of 15 dBmV on all channels.
         b. The signal to noise ratio must be 43 dB or better.
         c. The signal to composite triple beat must be 51dB or better.
         d. Network hum must be less than 1%.
         e. System response must be +/- 1 ½ dBmV within any channel.
         f. Signal to beat interference must be 57 dB or better.
         g. For digital signals, a 32 MER reading or better is required.
         h. Radiation must be within FCC Specifications, i.e., less than 20 uv/m within 10 feet with a tuned dipole antenna.
      iii. All rooms will be “home run” to TR equipment room(s). It is permissible for one loop-through within one room.
      iv. Cabling for CATV shall be placed in a 1-inch I.D. minimum conduit for up 6 cables.
2. **PRODUCTS**
   A. All outlets will be the standard CATV termination known as an F-81 barrel splice type connector (no solder or screw systems will be allowed).
   B. CATV: Coaxial Cable Preparation and Connection
      i. Hardline .500, .750, and .100 jacketed and unjacketed cables must be used.
      ii. The standard RG-6 connectors to be used are as follows:
         Siemon RG6C Compression Connector’s
         p/n RG6C
         PCT
         p/n DRS-6
   C. RG-11 and RG-6 CATV cable

i. Active and Passive RF Components:
   a. Fiber Node – Olsen Technology OTPN-400C, SC/APC or equal.
   b. Amplifier – Toner TIBA-37-1000 or equal.
   c. Taps – RMS brand Digitap's or equal.
ii. Coaxial cable acceptable manufacturer:
   a. RG-6:
      1) Commscope 2227V
      2) general cable C3525
      3) Belden 1189AP only.
   b. RG-11:
      1) Commscope 2287K
      2) general cable C3529
      3) Belden 1153A.
iii. Coaxial cable shall be plenum rated RG-6.

3. **EXECUTION**

A. CATV: Coaxial Cable Preparation and Connection
   i. For flooded cable, clean flooding compound off the aluminum sheath to keep the ground loop complete.
   ii. Clean, sharp, serviced, coring tools must be used.
   iii. Metallic knives may NOT be used when cleaning dielectric from center conductor. This will cause a problem with the 'skin effect' for higher frequencies to ride on the cable center conductor. Use plastic removal tools.

B. CATV: Activation and Testing
   i. Refer to Section 27 08 00 Commissioning of Communications.
   ii. Passives verification - use sweeping methods for verification.
   iii. All cables must be labeled with room number (where outlet is) both on the outlet and in the TR wiring closet. Refer to Section 27 05 53 Identification for Communications Systems.

C. RG-11 and RG-6 CATV Wire
   i. Use proper preparation tools for specific connectors for correct installation. Change blades when necessary.

27 15 00
COMMUNICATIONS HORIZONTAL CABLING

1. **GENERAL**
   A. Related sections:
      i. 00 73 01 – Sole Source / Sole Brand
      ii. 27 00 00 – General Communications Requirements
      iii. 27 05 26 – Grounding and Bonding for Communication Systems
      iv. 27 05 29 – Hangers and Supports for Communications Systems
      v. 27 05 36 – Cable Trays for Communications Systems
      vi. 27 41 00 – General Audio-Visual System Requirements
      vii. 27 05 43 – Underground Ducts and Raceways for Communications Systems
      viii. 27 05 46 – Utility Poles for Communications Systems
      ix. 27 05 53 – Identification for Communications Systems
      x. 27 08 00 – Commissioning of Communications
      xi. 27 11 16 – Communications Cabinets, Racks, Frames, and Enclosures
      xii. 27 11 19 – Communications Termination Blocks and Patch Panels
      xiii. 27 11 23 – Communications Cable Management and Ladder Rack
      xiv. 27 13 13 – Communications Copper Backbone Cabling
      xv. 27 13 13.13 – Communications Copper Cable Splicing and Terminations
      xvi. 27 13 23 – Communications Optical Fiber Backbone Cabling
      xvii. 27 13 23.13 – Communications Optical Fiber Splicing and Terminations
      xviii. 27 13 33 – Communications Coaxial Backbone Cabling
      xix. 27 13 43.43 – Cable Services Cabling
      xx. 27 20 00.01 – Data Communications - Wireless
   B. UGA's high-speed data network is designed to accommodate Ethernet applications up to 1 Gigabit with a manufactures guaranteed electrical performance up to 550 MHz for, 4 pair, 24 AWG, 100 ohm, UTP Category 6 cable. The applications for use would include; high-speed internet access, Voice Over IP (VoIP), and other current and emerging applications.
   C. For this section, outlet shall mean telecommunications outlet.
   D. Refer to Section 27 00 00 Communications for Contractor qualification requirements.
   E. Refer to Sections 27 05 09 Hangers and Supports for Communications and 27 05 33 Cable Trays for Communication Systems.
   F. Only one telecommunications color scheme, white, (faceplate, wiremold, etc.) shall be used throughout the Project. For areas that may require stainless steel or a different color, the Design Professional shall coordinate with the Project Manager and EITS to discuss options and approval must be obtained through the variance process.
   G. A minimum of two (2) blue jacketed plenum rated, Category 6 (Cat 6) UTP cables shall be run from the receptacle box (outlet) to the appropriate TR. Two (2) ports served by the Cat6 communication cables capable of delivering either data or voice services are typical per office space receptacle box.

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   H. Wiring shall be placed in 1-inch I.D. minimum conduit for up to 11 cables. There can be up to 44 cables in a 2-inch conduit, 98 cables in a 3-inch conduit, and 122 cables in a 4-inch conduit.

I. Under no circumstances shall any conduit contain more than two 90 degree bends nor exceed 180 degrees of total bend without the installation of pull box(s) to accomplish the above.
J. The outlet shall be a minimum of 1.75 inches deep, single gang box.
K. The outlet must be within 250 cable feet of the TR.
L. If divided raceway is used to serve both electrical and telecommunications, the raceway must be metal with dividers between.
M. At the outlet end, enough additional cable (slack) must be left to reach the farthest corner of the wall, plus five feet.
N. At the TR end, at least 15 feet of additional cable (slack) must be provided past the center point of the appropriate telephone or data racks.
O. For renovation projects when it is necessary to have exposed interior wiring runs, the wire shall be enclosed using wire molding or conduit. Under no circumstances should cable be installed below ceiling in an exposed fashion, i.e., all surface mounted cable should be enclosed in conduit.
P. For small projects, the extent of cabling replacement to current standards contained herein shall be determined on a case-by-case basis with the input of EITS, the Project Manager, and the departmental point of contact. Factors to be considered shall include a speed test of existing cabling (by EITS), the anticipated speed demands required by End-Users, funding availability, and project schedule.

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2. **PRODUCTS**
   A. Cabling / Cabling System
      i. The cabling system shall be the Siemon System 6 UTP Cabling System.
      ii. All cabling shall be blue jacketed and plenum rated.
      iii. All cable shall be Siemon cable or approved Siemon cable partners. Acceptable CAT6 cables are:
         a. Berktek LanMark 1000 10032093 (reel)
         b. Berktek LanMark 1000 10032094 (box)
         c. Berktek LanMark 1000 10065423 (reel in a box)
         d. Berktek LanMark 2000 10032251
         e. General Cable GenSpeed 6500 7131431
         f. General Cable GenSpeed 6600 7131721
         g. Mohawk AdvanceNet 6E M57193
         h. Mohawk GigaLan 6E+ M57414
         i. Siemon System 6 9C6P4-E3-06-RXA
         j. Siemon Premium 6 9C6P4-E4-06-RBA
         k. Superior Essex DataGain 450 66-272-2B (reel)
         l. Superior Essex DataGain 450 66-246-2B (brake box)
         m. Superior Essex DataGain 450 66-240-2B (POP box)
         n. Superior Essex Nextgain 54-272-2B (reel)
         o. Superior Essex Nextgain 54-246-2B (reel in a box)
      iv. All telephone, data, and CATV installations shall include, but may not be limited to, the following Siemon System 6 UTP Cabling System products:
         a. Category 6 Cross-Connect Wire
         b. HD6 Patch Panels

c. MAX 6 Modules
d. MAX Modular Faceplates
e. MAX Patch Panels
f. MC 6 Modular Cords
g. S210 Connecting Block
h. S210 Field Termination Kits

B. Outlets
   i. All surface mounted outlets shall be 4 port, white, Siemon MX-SM Surface Mount Box, part number MX-SM4-02 or MX-SM6-02 for 6 port box. All surface mount boxes will use Siemon Flat modules.
   ii. All flush mount, in wall outlets shall use white Siemon MAX Modular single gang or double gang style faceplates in whatever port configuration is necessary.
   iii. The following are suitable flush mount faceplate part numbers:
      a. MX-FP-S-01-02 single gang 1-port
      b. MX-FP-S-02-02 single gang 2-port
      c. MX-FP-S-03-02 single gang 3-port
      d. MX-FP-S-04-02 single gang 4-port
      e. MX-FP-S-06-02 single gang 6-port
      f. MX-FP-D-06-02 double gang 6-port
      g. MX-FP-D-08-02 double gang 8-port
      h. MX-FP-D-12-02 double gang 12-port

C. Jacks (Telephone, Data, and CATV, and modules)
   i. All voice and data jacks shall be Siemon white MAX 6 Modules, part number MX6-02 for angled jack or, part number MX6-F02 for flat jack with red icon to indicate data, and white slide-in icons to indicate voice connection. The cable must be installed so that mechanical strain does not reach the jack. Note: flat jack to be used for surface mounted boxes ONLY.
   ii. Flush mount faceplates, shall be Siemon, white, MAX 6 angled modules, part number MX6-02.
   iii. Surface mount boxes shall be Siemon, white, MAX 6 flat modules, part number MX6-F02.
   iv. CATV connections in flush mount faceplates shall use, Siemon, white, F-type coax MAX, flat module, part number MX-FA-02 mounted in a Siemon CT2-FP-02 faceplate in conjunction with bezel p/n CTE-MXA-01-01.
   v. CATV connections in surface mount boxes shall use part number MX-F-FA-02.

3. **EXECUTION**

A. For labeling of data, telephone, and CATV outlets, refer to Section 27 05 53 Identification for Communications Systems.

B. Cable installation
   i. Cable ties must be trimmed off cleanly at a locking hole.
   ii. Cables shall be secured at every corner.
   iii. Cables shall be run in a uniform fashion and shall not be woven among other utilities.
   iv. Under no circumstances should cable be installed below ceiling in an exposed fashion, i.e., all surface mounted cable shall be enclosed in conduit.
   v. Cables shall not be tie wrapped or routed along electrical or gas conduit.

vi. No cabling runs will exceed the specification of the cable used (receptacle box to serving TR wiring frame).

C. Jack installation shall conform to ANSI/TIA/EIA-568-B (Commercial Building Telecommunications Cabling Standards).
   i. Before wiring the actual jacks, EITS must be contacted for purposes of approving the proposed wiring method. Failure to do so will result in non-compliance with the Standards.

D. Jack Installation - Surface Mount
   i. Surface mount jacks shall be installed in accordance with NEC specifications.
   ii. Surface mount station jacks shall be mounted on wall at 1.5 feet from the floor (unless specified otherwise).
   iii. The modular jack opening shall face out, down, or to either side, but not up. Where the opening faces out, the notch for the locking tab shall be on the bottom.
   iv. Surface mount station jacks shall be secured to the wall with two or more screws.

E. Jack Installation - Flush Mount
   i. Flush mount station jacks shall be installed in metal or plastic outlet boxes in the wall at 1.5 feet above floor.
   ii. The boxes must be secured in the wall so that no movement occurs during installation use or during normal use.
   iii. The jack and wall plate must each be secured to the box by metal screws.
   iv. The jack shall be oriented so the locking tab is facing downward.
   v. All in-wall faceplates will use angled modules.

27 20 00.01
DATA COMMUNICATIONS – WIRELESS

1. **GENERAL**
   - A. Related sections:
     - i. 27 00 00 – General Communications Requirements
   - B. Introduction
     - i. This section specifies the wireless local area network (WLAN) standards for the University of Georgia for IEEE 802.11 Personal Access Wireless System (PAWS) wireless systems. These standards apply to the design and installation of all WLAN systems connected to the PAWS network which are installed on the UGA campuses or any remote locations directly connected to the campus network.
     - ii. Only hardware and software consistent with these standards shall be used in conjunction with the PAWS wireless network.
     - iii. New plans for buildings and gathering areas shall consider the need for and use of wireless networking, similar to the planning done currently for wired networking. Refer to Section 27 00 00 Communications.
   - C. Purpose
     - i. A coordinated, centralized delivery of wireless networking services is essential to provide a successful wireless service. The goal is to provide a common user experience across campus, efficiently support users, protect network resources, and provide a quality service. This coordinated effort is led by UGA's Enterprise Information Technology Services (EITS). To this end, EITS shall be solely responsible for the management of IEEE 802.11 and related access points at UGA.
     - ii. Since EITS is responsible for management of the system, the Design Professional shall coordinate design reviews and approvals with EITS through the Project Manager. EITS will assist with oversight of the installation and will provide final configurations.
     - iii. Wireless networks shall be installed only as extensions or additions to hard-wired networks and not as a replacement for cabled telephone, data, or CATV networks.
   - D. Frequency Use
     - i. The 2.4 GHz radio frequency used by 802.11b and 802.11g is an unlicensed shared spectrum band. The 5 GHz radio frequency is another unlicensed shared spectrum which is used by 802.11a access points. 802.11n radios may use either one of these frequency ranges. In addition, there are only three non-overlapping channels within the 802.11b and 802.11g specifications.
     - ii. Consequently, access points can interfere with each other and other communications devices or appliances if not administered or deployed properly. Microwave ovens and cordless phones are prominent examples.
     - iii. EITS will manage the shared use of unlicensed radio frequencies for the campus community and has campus authority to resolve interference issues.
   - E. Responsibility And Enforcement
     - i. All users connecting to the campus network will gain access through their UGA MyID which determines the identity of and authenticates the user.

ii. EITS is responsible for implementation of wireless technology, enforcing campus network standards, and has the authority to resolve frequency interference issues.

F. Departmental Wireless Service
   i. Prior to purchase or deployment, EITS shall be consulted and will be responsible for approving and overseeing the design, planning, installation, and configuration.

G. Guidelines for Best Practice
   i. Wireless access points installed in public spaces, classrooms, etc. shall be securely mounted (and locked) or in places not easily accessible by the public.
   ii. Access points installed in private places shall be secured like other computing equipment.
   iii. Only connect access points to an Ethernet switch. Hubs shall not be used in wireless networking.
   iv. Use of 100 Mbps Ethernet is sufficient when connecting 802.11g and 802.11a access points to the campus network. Use of 1000 Mbps Ethernet when connecting 802.11n access points to the campus network is recommended.

H. Allowed Access Points
   i. Any Cisco LWAPP access points are compatible with the centralized PAWS system and shall be the only access points deployed on campus.

27 41 00
GENERAL AUDIO-VIDEO SYSTEMS REQUIREMENTS

1. **GENERAL**
   A. Related sections:
      i. 00 00 13 – Designing Learning Environments
      ii. 11 52 00 – Audio-Visual Equipment
      iii. 11 52 13 – Projection Screens
      iv. 12 56 52 – Audio-Visual Furniture
      v. 27 00 00 – General Communications Requirements
      vi. 27 41 00.01 – Audio-Visual Control System
   B. The information in this section establishes a baseline for audio-visual system design that conforms to current campus audio-video standards maintained by the UGA Center for Teaching and Learning (CTL). The CTL continually evaluates products, services and systems design in order to provide cost effective, dependable and supportable technology for the UGA campus. The CTL maintains standard equipment list and diagrams for audio, video and control systems currently installed in the CTL supported classrooms, conference rooms and other instructional spaces. It is the responsibility of the Design Professional and Contractor to request documentation for reference. Refer to Section 27 41 00.01 Audio-Visual Systems Requirements for additional control system specifications.
   C. Video conference and lighting systems shall operate independently from audio-video presentation systems, even when integrated together. Room lighting will be managed by a dedicated lighting controller. The primary controls for operating and configuring lighting scenes shall be part of the lighting control system. For convenience some lighting control may be accessible through the AV control interface. Refer to Sections 26 09 36 Modular Dimming Controls and 26 51 00 Interior Lighting for additional details regarding lighting and lighting presets.
2. **PRODUCTS**
   A. Audio-Visual Cabling Specifications
      i. All audio-visual twisted pair cabling shall use only Siemon Category 6A Shielded Twisted Pair cables and associated Siemon products installed to manufacturer's standards.
      ii. All horizontal cables should be green jacketed.
      iii. All patch cables should be green jacketed and pre-terminated.

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   B. Assisted Listening Devices
      i. Radio Frequency (RF) is the preferred ALS technology. All associated hardware must be in the 72 MHz frequency band.
      ii. All classrooms shall have either an installed assistive listening system (for large lecture halls) or the ability to easily connect a portable assistive listening system (ALS) in smaller classrooms. For large lecture halls that have speech reinforcement systems, a full mix of speech and program audio should be mixed and sent to ALS transmitters. For rooms that are small enough to not require speech reinforcement, an easily accessible output of the room's program audio system should be provided at the instructor station so that this audio feed can

be inserted into a portable ALS transmitter and mixed with a speech feed from the portable system.

C. Designing Learning Environments
   i. Comparable to the role room acoustics plays to the transmission of the spoken work, audiovisual (AV) systems similarly support the transmission of digital audio and video content within today's learning environments. As such, classrooms should be designed such that all students can easily hear and see instructional content.
   ii. A typical classroom AV system is comprised of several subsystems as noted below:
      a. An instructor workstation with connections for mobile presentation sources (e.g. laptop computers, tablets, etc.), as well as an array of installed source devices (e.g. room PC, document camera, DVD player, etc.) The exact complement of sources is dependent on the needs of each particular project / discipline / department.
      b. Video display(s) including front projection systems (projector and motorized screen) for larger spaces and flat-panel monitors (LCD, LED, etc.) for smaller spaces and / or for group tables
      c. Program playback speakers and associated amplifier(s), which include either a distributed speaker system with a left and right channel mix for small to medium sized rooms or separate left and right channel low impedance speakers for larger spaces. *Revised Apr 30, 2018*
      d. Audio and video routing / distribution / processing equipment which can be either installed within the instructor workstation or in a nearby AV rack closet. Increasingly, the trend in higher education is to specify multi-function AV processors which can replace several single purpose devices with one box.
      e. Control processors and associated instructor control interface, typically a touch panel at the instructor console, but potentially also control via instructor tablet.
      f. Speech reinforcement systems including wired and wireless microphones, digital signal processors (DSPs) and distributed ceiling speakers. *Revised Apr 30, 2018*
      g. Either portable or installed ALS systems to meet the ADA as noted in the previous section on Accessibility.
   iii. Please note that the UGA does not intend to equip each classroom on campus with lecture capture technology (i.e. cameras, digital recording / streaming capture stations, etc.) or distance learning systems (i.e. cameras, codecs, etc.). The Design Professional should assess on a case-by-case basis the extent to which lecture capture and distance learning is required on a project and respond accordingly understanding that lighting requirements, room acoustics, light control from windows are much more sensitive when recording and videoconferencing are added to a classroom environment. Likewise, AV costs per room are increased when these capabilities are included.
   iv. Voice amplification is required in 200-280 seat lecture halls and potentially in 100-120 seat rooms depending on the room geometry, background noise levels

and acoustical treatments. Voice amplification needs for all other room types should be determined on a case-by-case basis. In many instances, sound absorbing materials should utilized in classrooms to minimize the need for voice amplification systems. Students with hearing difficulties will receive individual assistive devices for classroom listening.

27 41 00.01
AUDIO-VISUAL CONTROL SYSTEM

1. **GENERAL**
   A. Related sections:
      i. 00 00 13 – Designing Learning Environments
      ii. 00 73 01 – Sole Source / Sole Brand
      iii. 01 77 00 – Project Closeout
      iv. 11 52 00 – Audio-Visual Equipment
      v. 11 52 13 – Projection Screens
      vi. 12 56 52 – Audio-Visual Furniture
      vii. 26 09 36 – Modular Dimming Controls
      viii. 26 09 43.16 – Addressable Fixture Lighting Control
      ix. 27 00 00 – General Communications Requirements
      x. 27 41 00 – General Audio-Visual System Requirements
   B. This section is intended as a minimum requirement for single projector classrooms with standard source devices and room infrastructure. More complicated installations (multiple projectors, video conference, etc.) will require additional design coordination with the Project Manager, Design Professional, and the CTL. UGA will provide existing example touch panel files for these more complicated systems. Regardless of system complexity the basic operation will still be as described here.
2. **PRODUCTS**
   A. The UGA requires AMX (by Harman) hardware and software touch panel interfaces for classrooms, conference rooms, and other spaces with sophisticated audio-visual technology. This is a sole brand, refer to Section 00 73 01 Sole Source/Sole Brand for more information. This section describes the minimum functionality required to insure uniformity of UGA systems. An example touch panel layout is included at the end of this section, and this, along with an accompanying AMX touch panel layout file, provide a general overview of how the final controls system shall function. This example touchpanel file "_UGA,CR5,Rev2_5_X700_dn.TP4" and a program viewer to read the TP4 file are available for download at www.architects.uga.edu/standards. Every aspect of the required system is not specified as project specific modifications and final programming are ultimately unique to each project.

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3. **EXECUTION**
   A. Final versions of all source code and touch panel files will be provided by the Contractor as part of the closeout submittal. All support files, code modules, IR files, etc. required to compile and reload a room shall be provided (to be included in the complete closeout submittal package that is given to FMD).
   B. Most recent source code should also be stored on each control processor.
   C. Software will be written in such a way that equipment changes can be made without major rewrite. Use prebuilt AMX NetLinx or Duet modules wherever they are available for a specific projector or hardware device.
   D. All bi-directional controlled devices (Ethernet, RS232, AXLINK, ICSNET, etc.) should provide true feedback on touchpanel buttons:

i. Projector ON, OFF and BLANK buttons feedback state will be based upon serial responses from projector (e.g. Projector ON button will be unlit when projector is off. Button will flash when in transition warming up. Button will light when projector is fully on). Periodic polling of projector status will regularly update this feedback.
ii. System ON button feedback state will be combination of projector state AND system power state (e.g. System ON button will light and stay on only if sequencer has been turned on AND projector is fully on. Button will flash while projector is in transition AND sequencer is on. Button will be off if projector is on but sequencer is off.) Periodic polling of projector status will regularly update this feedback.
iii. System OFF button feedback state will be combination of projector state AND system power state (e.g. Button will light and stay on only if sequencer has been turned off AND projector is fully off. Button will be off if projector is off but sequencer is still on). Periodic polling of projector status will regularly update this feedback.
iv. Document camera power ON, OFF, and LIGHT buttons will be based upon serial responses from document camera. *Revised Apr 30, 2018*
v. Volume mute buttons will follow state of audio volume control hardware.
vi. Volume bar graph will smoothly track actual audio level.

E. Unidirectional controlled devices (DVD, and etc.) should not simulate feedback on touch panel, e.g. the DVD transport buttons should have momentary feedback lighting only when the user presses the button.
F. Program source select buttons (e.g. Desktop Computer, Laptop VGA, Laptop HDMI, Document, DVD, etc.) shall be located along left side of touchpanel layout:
i. Button press will route all the signals necessary to send that multimedia source to the projector and to the audio system.
ii. Feedback to source select buttons will remain lit indicating the most recently selected source (radio button style).
iii. Most recently selected source button will remain lit even when the system is turned off. This simplifies the user experience since the most commonly used input is already preselected.
iv. When hardware is turned on (projector, switcher, etc.) they will be re-initialized to route the most recently selected source.
G. If there is not sufficient space for all the source buttons to fit along the left side of the touchpanel, additional sub-select buttons may be added on transport pages:
i. The computer sub-select buttons on transport page (e.g. Laptop VGA, Laptop HDMI, Windows PC or Mac Computer) will remain lit indicating the most recently selected source.
ii. The auxiliary sub-select buttons on transport page (e.g. Lectern Aux In, AV Cart Feed, or Control Rm Feed) will remain lit indicating the most recently selected source.
iii. The most recently selected source should remain routed and lit even when the system power cycles. This simplifies the user experience if the most commonly used input stays preselected.

iv. Pressing one of the main source buttons (along left of touchpanel, e.g. Laptop Select or Aux Select) will also reselect the previously selected sub-select source. Routing signals as previously selected and lighting the sub-select button e.g. Laptop VGA or Laptop HDMI.

H. Alternate audio source buttons are provided along the bottom of some of the transport pages.
   i. These buttons will allow break-away audio routing such that the currently selected video source can be combined with audio from another source device (e.g. Sheet music on doc cam and audio from CD player).
   ii. Some HDMI laptops provide audio embedded on HDMI. Some digital video devices don't provide embeded audio and must use the analog headphone jack (using 3.5mm audio cable which is provided for VGA laptops). The alternate audio buttons (Laptop HDMI and Laptop 3.5mm) allow the user to route the active audio regardless of the laptop's default system settings.
   iii. Alternate audio source select buttons will be unlit unless pressed. Once pressed the alternate source buttons will light showing the most recently selected source (radio button style).
   iv. Pressing any of the main program source buttons (along left of touchpanel) will disable the break-away routing and un-light all of the alternate audio source buttons.

I. Projector ON button press will start the following process:
   i. Un-blank the projector.
   ii. Turn projector on.
   iii. Turn on power sequencer to enable signal routing components for use.
   iv. Open "Power Up" pop-up page informing user of remaining time until projector will light (depending on projector, may be 30-60 seconds for cold start and as long as 60-120 seconds for cool down and restart).
   v. Show progress by updating the projector progress bar graph on pop-up page. Also update the small progress bar on main page below system power buttons.
   vi. Flash projector ON button while the projector is warming up.
   vii. While the projector is warming up ignore button presses of the projector power ON, OFF, BLANK and System ON and System OFF buttons. During this warm up period, a repeat button press should open "Message Box" pop-up page telling the user to be patient.
   viii. Poll the projector until it responds indicating either:
      a. It cannot start normally and reports an error then open "Message Box" pop-up page and report error to user. Also update RMS.
      b. It doesn't light within normal time (depends on projector model) then open "Message Box" pop-up page and report error to user. Also update RMS.
      c. It has started normally then stop flashing and light the ON button.
   ix. Initialize all of the signal routing hardware to display the source device which was most recently selected. Disable any break-away audio routing and un-light alternate audio source buttons.
   x. Poll projector after power-up and write lamp hours to variable text field 5 on projector tabbed pop-up page and update RMS.

J. Projector OFF button press will start the following process:
   i. Open "Power Down" pop-up page with 20 second count-down bar graph, querying user if they in fact want to turn off the projector.
   ii. Immediately blank the projector image.
   iii. If the user hits CANCEL then close pop-up page, un-blank the projector and do nothing else.
   iv. If the user does nothing while the bar graph counts down to zero then assume that the user intends to turn off the projector (same as below).
   v. If the user hits TURN OFF then do the following:
      a. Turn the projector off.
      b. The projector OFF button will flash indication that the projector is cooling down.
      c. Show progress by updating the projector progress bar graph on pop-up page. Also update the small progress bar on main page below system power buttons.
      d. While the projector is cooling, ignore button presses of the projector power ON, OFF, BLANK and System ON and System OFF buttons. During this cool down time a repeat button press should open pop-up "message box" telling the user to be patient.
      e. Poll the projector until it responds indicating it has turned off normally then light the OFF button.

K. Projector BLANK button can be used to temporarily hide the projected image. The projector will remain on but show only a black screen so that the image can be immediate re-displayed as required by the user. The BLANK button is a toggling function and will follow the blank status reported by the projector.

L. If user leaves projector "blanked" for longer than 60 minutes then start the following process:
   i. Touchpanel should beep once loudly.
   ii. Open "Power Down" pop-up page with 20 second count-down bar graph, querying user if they in fact want to turn off the projector.
   iii. If the user hits CANCEL then close pup-up page and do nothing.
   iv. If the user does nothing while the bar graph counts down to zero then assume that the user intends to turn off the projector (same as below).
   v. If the user hits TURN OFF then do the following:
      a. Turn the projector off.
      b. Projector OFF button will flash indication that the projector is cooling down.
      c. Show progress by updating the projector progress bar graph on pop-up page. Also update the small progress bar on main page below system power buttons.
      d. While the projector is cooling ignore button presses of the projector power ON, OFF, BLANK and System ON and System OFF buttons. During this cool down time a repeat button press should open pop-up "Message Box" pop-up page telling the user to be patient.

e. Poll the projector until it responds indicating it has turned off normally then light the OFF button.

M. System ON button press will start the following process:
   i. Un-blank the projector.
   ii. Turn projector on.
   iii. Turn on power sequencer to enable signal routing components for use.
   iv. Open "Power Up" pop-up page informing user of remaining time until projector will light (depending on projector may be 30-60 seconds for cold start and as long as 60-120 seconds for cool down and restart).
   v. Show progress by updating the projector progress bar graph on pop-up page. Also update the small progress bar on main page below system power buttons.
   vi. Flash projector ON and System ON button while the projector is warming up.
   vii. While the projector is warming up ignore button presses of the projector power ON, OFF, BLANK and System ON and System OFF buttons. During this warm up time a repeat button press should open pop-up "message box" telling the user to be patient.
   viii. Poll the projector until it responds indicating either:
      a. It cannot start normally and reports an error then open "message box" and report error to user. Also update RMS.
      b. It doesn't light within normal time (depends on projector model) then open "message box" pop-up page and report error to user. Also update RMS.
      c. It has started normally then stop flashing and light the projector ON and System ON buttons.
   ix. Poll projector after power-up and write lamp hours to variable text 5 field on projector tabbed pop-up page and update RMS.
   x. Projection screen down.
   xi. Set lights to a scene appropriate for projection. Refer to Section 26 09 36 Modular Dimming Controls.
   xii. Initialize all of the signal routing hardware to display the source device which was most recently selected. Disable any break-away audio routing and un-light alternate audio source buttons.
   xiii. After the power up sequence is complete unmute the audio and return levels to where they were when last used.

N. System OFF button press will start the following process:
   i. Open "Power Down" pop-up page with 20 second count-down bar graph, querying user if they in fact want to turn off the system.
   ii. Immediately blank the projector image.
   iii. If the user hits CANCEL then close pup-up page, unblank the projector and do nothing else.
   iv. If the user does nothing while the bar graph counts down to zero then assume that the user intends to turn off the system (same as below).
   v. If the user hits TURN OFF then do the following:
      a. Turn the projector off.
      b. System OFF button will flash indication that the projector is cooling down.

c. Show progress by updating the projector progress bar graph on pop-up page. Also update the small progress bar on main page below system power buttons.
d. While the projector is cooling down ignore button presses of the projector power ON, OFF, BLANK and System ON and System OFF buttons. During this cool down time a repeat button press should open pop-up "Message Box" pop-up page telling the user to be patient.
e. Poll the projector until it responds indicating it has turned off normally then light the OFF button.
f. Document camera turned off.
g. Mute all audio levels.
h. Projection screen up.
i. Lights set to normal on scene. Refer to Section 26 09 36 Modular Dimming Controls.
j. Power sequencer turned off. *Revised Apr 30, 2018*
k. Do not turn off power to players with removable media (DVD, etc.) so that users will be able to remove media after system is off.
l. Do not turn off power to desktop computers and peripheral devices. Computer shutdown should be properly performed as controlled by the operating system.
m. Turn off other devices as appropriate.

vi. The projector's built-in closed caption decoder will be used to provide onscreen captions for composite video sources. There is a toggling Closed Caption button on the projector control tabbed page and on each of the AUX IN, DVD, transport pages (button feedback lit based on projector response).

O. Audio controls consist of two sets of audio level control with up, down, mute and bar graph:
   i. One set will simultaneously control both the right and left channels of the program audio. There will be no balance control on the touch panel.
   ii. In rooms which have a dedicated voice amplification system a second set of controls will set the master audio output level of the microphone mix.
   iii. Mute button will toggle mute on and off.
   iv. Up button will cancel mute and raise volume.
   v. Up button will turn on power sequencer to enable audio components for use (microphones, computer audio, etc.).
   vi. Down button will lower volume but will not affect mute.
   vii. Volume bar graph will smoothly follow the actual level of the volume device.
   viii. Volume bar graph will go to zero when the volume mute is activated.
P. Lighting control will be provided by bi-directional communication interface (either RS232 or Ethernet) to an external dedicated lighting controller. The command language of this external lighting controller should include:
   i. Command for recalling preset lighting scenes.
   ii. Command for turning on a specific circuit (relay or dimmer).
   iii. Command for turning off a specific circuit (relay or dimmer).
Q. Lighting scene buttons on the touchpanel will simply recall preset lighting scenes from the external lighting controller. These preset lighting scenes are setup independently

using the keypad on the external lighting control system. The preset lighting scenes stored on the external controller will depend on the rooms use and size but might include:

i. Lights On – all normal room lights on.
ii. Projection Mode – lights near screen turned off, rest of room on.
iii. Cinema Mode – lights near screen turned off, rest of room dim.
iv. Whiteboard Mode – lights near white board all on, rest of room 50%.
v. Stage Mode – directional lights ON, front lighting on, rest of room 50%.
vi. Video Conference Mode – directional spotlights on, lights near screen off, rest of room on.
vii. Lights Off – all lights off.

R. A "more controls" lighting pop-up page will provide discrete control of each of the electrical lighting circuits. This will allow the user to fine tune the lighting beyond those choices provided in the presets above.

S. If electric window shades are controlled from the touchpanel then include up and down controls on the tabbed lighting controls pop-up page.

T. The document camera control page will function as follows:

i. Power ON button will turn on document camera.
ii. Top Light button will toggle upper lamp on and off.
iii. Bottom Light button will toggle lower lamp on and off.
iv. Power OFF button will turn off document camera.
v. Zoom, iris and focus buttons will send start command on press and stop command on release. *Revised Apr 30, 2018*

U. When the control processor is reset perform the following initialization:

i. Trigger an RMS event recording the fact that the control processor has been reset.
ii. On each of the pages for desktop and laptop computers write the native resolution of the projectors. This provides a guide for the user if they need to manually set their computer to the correct resolution to match the projector. Touchpanel variable text field 7. *Revised Apr 30, 2018*
iii. Write AV help desk telephone number (as requested by End-User) to touchpanel variable text field 3.
iv. Write current lamp hours as reported by projector to touchpanel variable text field address port 5 code 14.
v. Write maximum lamp hours to the projector pop-up page as a guide to user (maximum as defined in projector manual). This will be printed beside the current lamp hours, in variable text field 4, as a guide to the user.

V. When the touch panel wakes from sleep mode the "help_page" pop-up page should be displayed for 15 seconds and then closed to expose whatever pages had last been visible.

W. Periodically poll the projector for power state and error status. Update feedback on all touchpanel power buttons. Also update all fields linked to RMS for projector monitoring, error status and theft detection.

X. When the touchpanel wakes from sleep mode poll the projector for power state and update feedback on all touchpanel power buttons.

Y. Hidden button in upper left-hand corner of touch panel must be held for 3 seconds and then panel will switch to technician's page (refer to "Technician" page on sample touch panel file).

Z. The control system software should include code to interface with UGA's campus-wide "AMX RMS Enterprise" asset management system. This will allow remote control and monitoring as follows: *Revised Apr 30, 2018*
   i. Report device status: System power state, Projector power state, bulb life, online status of system devices, etc.
   ii. Report alarms: projector bulb error, projector filter error, projector offline (or stolen?), system offline, system rebooting, etc.
   iii. Record usage statistic for each source device. Usage time will be based on a count of minutes during which a source is selected while projector is on.
   iv. Maintain server database of all equipment serial numbers in real-time for inventory purposes.
   v. Synchronize controller date and time with RMS server.
   vi. Support RMS server scripting to remotely shut down and control equipment.

AA. By default an automated shutdown will occur every night at 23:59 midnight. In addition automated system shutdown can also occur as scripted by user via RMS. Regardless, at the designated shutdown time do the following:
   i. Touchpanel should beep once loudly.
   ii. Open "Power Down" pop-up page with 20 second count-down bar graph. Querying user if they in fact want to turn off the projector.
   iii. Immediately blank the projector image.
   iv. If the user hits CANCEL then close pup-up page, unblank the projector and do nothing else.
   v. If the user hits Turn Off then turn off projector (same as below).
   vi. If the user does not intervene to cancel the process then:
      a. Turn the projector off.
      b. Projector OFF and System OFF buttons will flash indication that the projector is cooling down.
      c. Show progress by updating the projector progress bar graph on pop-up page. Also update the small progress bar on main page below system power buttons.
      d. Poll the projector until it responds indicating it has turned off normally then light the OFF button.

BB. Ethernet connected Audio-Video control devices should use DHCP in private 172.19.xx.xx range which are part of the campus-wide VLAN1024. (Do not manually configure NIC or use public 128.192.153.xx ranges or shared VLAN with PC. This avoids interference due to other traffic, IP conflicts due to typos and does not allow off-campus connectivity.)
   i. EITS will designate new 172.19.xx.xx range with adequate space for AV equipment in building on VLAN1024.
   ii. Provide MAC addresses to CTL for all AV devices for registration using the Proteus management system for DHCP.

iii. EITS extends VLAN1024 to building edge device. This VLAN1024 has open TCP ports to RMS server and other maintenance requirements and doesn't allow any off campus connectivity.
iv. Multiple dedicated Ethernet jack must be activated. Lectern tether has dedicated cables to connect AV devices (Computer and other non-AV devices must have separate Ethernet cabling).
v. Label jack to indicate that it is for AV devices on VLAN1024 (also label other jacks for PC, etc. to avoid confusion).
vi. EITS will extend VLAN1024 only to specific jack with AV devices connected.
vii. Jacks configured for VLAN1024 must not connect Non-AV devices such as Computers, VC CODECs, and other devices with off-campus access or which might interfere.
viii. AV devices receive DHCP service to setup IP address, mask, gateway and DNS settings for network interface card.
ix. Configuration of AMX System number should use the convention: RRRBB where RRR = first three digits are room number and BB = last two digits are building number defined by CTL.
x. Peripheral AMX devices should connect to Master device using AMX "Auto-connect" mode pointing at the master system number.
xi. Where practical, the touchpanel should connect directly to the processors ICSLAN bus RJ45. This isolates the touchpanel from the building LAN for reliability. The touchpanel will receive DHCP service directly from the control processor in the range 198.18.xx.xx (in this case there is no need to register touchpanel MAC address with CTL).
xii. NetLinx code for Non-AMX devices must use URL names and must not be hardcoded with numeric IP addresses.
xiii. During installation and testing, the device security settings can use default passwords. But after commissioning, the systems will be configured for LDAPS access control using UGA MyID authentication.
xiv. Connectivity to RMS server will require the inclusion of SDK code modules into control processor code. When the control processor see RMS server it will initiate connections and await approval by RMS server administrator. After administrator approval the SDK code will communicate to auto-populate database on RMS server.