

# **DIVISION 27**

## **Section 27 41 00**

**Technology Systems  
Design and Installation Guidelines  
for Architects and Engineers**



**Pinellas County  
Business Technology Services**

Published November 18, 2022

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## SECTION 27 41 00 – AUDIO/VISUAL SYSTEMS

### PART 1 - GENERAL

#### 1.1 PURPOSE OF THIS DOCUMENT

- A. The purpose of this specification section is to indicate to A&E and designers of low voltage infrastructure, working in construction or renovation projects for Pinellas County Government, the design requirements by BTS when it comes to such infrastructure. This document will be a starting point for completing a set of construction documents but **SHALL NOT** be used unedited as a bid document.

#### 1.2 SCOPE OF WORK (SOW)

- A. Audio/Visual Systems (AVS) are important to the operations of many users within Pinellas County facilities. As such, these systems need to be addressed during the design of any new or renovated facilities. Here are the typical responsibilities for AVS:
  - 1. Design: The design of the AVS shall be done by the A&E of the project, following recommended practices by BTS.
  - 2. Project requirements: The specific project requirements for the design of an AVS shall be provided by the building end users and IT groups. Those requirements shall be collected and incorporated in the system design by the A&E.
  - 3. Network: All components of an AVS that have Ethernet network connections must be authorized and approved by BTS. The use of isolated system specific networks is not allowed by BTS. See Specification Section 27 20 00 Voice/Data Communications Equipment for detailed forms to be used by Installer to obtain IP addresses from BTS for any system. There is a specific form to be used to request an IP address.
  - 4. Personal computers (PCs): Dedicated PCs for the use in AVS shall be programmed with all the software requirements for operating system, antivirus, and remote access as any other PC in the County.
  - 5. Budgeting/Funding: Funding sources for Audio/Visual systems shall be discussed during design. BTS does not provide funding for Audio/Visual systems. In most cases funding for AVS is included into the project budget. Budget should be completed before bid process.
  - 6. Installation: The installation of the AVS system will be included in the SOW of a project for the GC or the CM. BTS does not install AVS.
  - 7. Maintenance: BTS strongly suggests building users to discuss maintenance and technology refresh for AVS. Maintenance for AVS is provided by a third-party vendor not by BTS. User groups have different funding sources and multiple funding sources could be established.

- B. The project scope shall clarify the following:
  - 1. List the scope of work and responsibility matrix.
  - 2. List all the room(s) in the project that will have Audio/Visual systems.
  - 3. List of all provided and recommended consumables for the AVS.
  - 4. List of all recommended spare parts of the AVS.

### **1.3 RELATED DOCUMENTS**

- A. General: The General Requirements, Conditions of the Contract, Specifications, Drawings, Addendums, Contract Modifications (the Contract Documents), and definitions of legal entity (such as Contract, Installer, Engineer, Owner, etc.) shall apply to the work of this specification section.
- B. Supplemental: Refer to the specification sections identified below for additional requirements, which are supplemented by this section:
  - 1. 27 00 10 Technology General Provisions
  - 2. 27 05 28 Raceways for Technology
  - 3. 27 10 00 Structured Cabling System
  - 4. 27 05 26 Grounding and Bonding for Communication Systems

### **1.4 INSTALLER QUALIFICATIONS**

- A. General: The qualifications and requirements herein apply to the specific technology identified by this specification section. Refer to the specification sections identified in Part 1.3 "Related Documents", for additional requirements, which are supplemented by this section.
- B. Installer Qualifications: The Installer directly responsible for the work described in this specification section is also referenced as the AVS Installer. The Installer shall be a licensed and registered Contractor who is, and who has been, regularly engaged in providing the installation of audiovisual systems of similar size and complexity for at least the immediate past five years.
- C. Project manager requirements: The project manager for each company participating in the installation of the AVS shall be a Certified Technology Specialist (CTS) by Avixa, Inc. Proof of current certification shall be provided with the submittal.

- D. Programmer-Installer: The AVS Installer must have a factory-trained Programmer/Installer, for the provided project products, in full-time employment, as part of their staff. The AVS Installer needs to provide a certificate of completion of training for the staff that will be taking part in the execution of this project.
  
- E. Qualification Documentation: The Installer shall provide the following documentation with their bid package, as evidence that the requirements for the Installer qualifications have been satisfied:
  - 1. A list of not less than five references for jobs of similar size and complexity including:
    - a. Project Names
    - b. Locations
    - c. Contact Names
    - d. Contact Telephone Numbers
  - 2. Location (specific street address) of the office from which this installation and warranty work will be performed. It is preferred that the Installer has established and maintains a permanent office within 100 miles of the project site.
  - 3. Copies of Manufacturer certification certificates. It is required that the Installer possess the following certifications, at a minimum:
    - a. Control System certified dealer, Installer, and Programmer
    - b. List all that apply
  - 4. Copies of Licensure certificates.
  - 5. Copies of Insurance and Bonding certificates.
  - 6. The Installer shall commit to a response time to system problems, during the warranty period, as required by the system end users. [NOTE TO DESIGNERS OR CONSULTANTS] This information shall be collected before the AV specifications are sent to an Installer for pricing.

## **1.5 MATERIALS ALTERNATES AND SUBSTITUTIONS**

- A. General: See details for alternates and substitutions in Specification Section 27 00 10 Technology General Provisions.

## **1.6 SHOP DRAWINGS AND SUBMITTALS**

- A. The AVS Installer shall follow all requirements for shop drawings indicated in Specification Section 27 00 10 Technology General Provisions.

- B. Project Start Submittals: A maximum of 60 days after the AVS Installer receives a notice to proceed with the project, but no sooner than a year before substantial completion, the following information shall be submitted:
1. Cut sheets with all specifications of every device, cables, and connectors to be used in the project.
  2. One-line diagrams with all devices included in the systems. Each system in a different sheet.
  3. User interface and faceplate color submittal. The AVS Installer shall prepare a separate submittal with the shape and color of all user interface plates to be approved by the Architect of the project or the Owner.
- C. Construction Submittals: During the construction process the AVS Installer shall submit various documents for approval prior to continuing with the installation process. Here is some of the information the AVS Installer needs to submit:
1. Before starting the programming process, the AVS Installer shall provide the following information:
    - a. A schematic presentation of the layout of all the user interfaces in the project. The AVS Installer needs to get approval of this submittal before starting any programming. These layouts shall include all graphics with all button sizes, shapes, colors, and wording to be used in all user interfaces. All keypads shall include working for engraving in the buttons.
    - b. Completely fill out Network Configuration Template. See **Appendix C** in Division 27 Appendices document.
    - c. Rack elevations of all AV equipment for all rooms in the project.
    - d. Conduit rough-in requirements of all wall and ceiling mounted devices for all equipment part of the AVS system.
    - e. Detailed layout of the DSP filters to be used in each DSP processor.
    - f. Any installation and rigging details for loudspeaker systems or other heavy equipment part of the AV system.
    - g. Any design changes whether originated by the Owner, Designer or by the AVS Installer as a VE suggestion are required to follow the same submittal process as described previously for all equipment involved on the change.

## 1.7 PROJECT SPECIFIC SOURCE CODE OWNERSHIP

- A. Definition of project specific source code: Project specific source code includes all source code created to generate an executable file intended to run any equipment used in the installation of the AVS. Examples of project specific source code include source code used to generate executable files for control processors, DSP processors, and touch panels. Project specific source code does not include source code used to create programming tools and compilers or source code used to generate operating systems or application programs running in PC based workstations.
- B. Ownership: Any project specific source code used in this project shall remain the exclusive property of the Owner. By accepting the contract to perform the work included in this project, the AVS Installer or designer and any other companies working creating project specific code during this project relinquish the right of Ownership of this source code and waive any licensing fees or royalties for the use of source code by the Owner or any company authorized by the Owner to perform changes in the source code after the project is substantially completed for an undefined period of time.

## PART 2 - PRODUCTS

### 2.1 ROOM CONFIGURATIONS

- A. General: The following descriptions provide common examples of room configurations. Although these are not mandated to be used for a project, they can be used as basis of design for any County project:
- B. HUDDLE ROOM
  - 1. A huddle room is defined as a meeting space for up to a maximum of five people.
  - 2. This type of room shall have the following capabilities:
    - a. Display system for appropriate room size with ability to view presentations easily
    - b. Sound for AV programs will be through standard speakers in the flat panel display
    - c. Voice conference shall happen in this room through a conference phone
    - d. County IT groups to decide how soft codec videoconference will take place
    - e. AV presentation shall be possible from the table, through wireless presentation device or a hard-wired connection (HDMI) on the table
    - f. Control shall be done through an IR remote control or with a control system with a tabletop touch screen, as an upgrade
    - g. Room scheduling is highly recommended. Solutions that interface directly with Outlook are preferred

3. The A&E shall coordinate conduit rough in as well as coordination with furniture vendor for proper table pop-up devices.
4. This type of room might not require a floor box or a poke through if the table is touching one of the walls.

#### C. SMALL/MEDIUM CONFERENCE ROOM

1. A small conference room is defined as a meeting space for up to 12 people.
2. This type of room shall have the following capabilities:
  - a. Display system for appropriate room size with ability to view presentations easily
  - b. Sound for AV programs will be through standard speakers in the flat panel display or a sound bar as an enhancement
  - c. Voice conference shall happen in this room through a conference phone.
  - d. Soft codec videoconference will happen in this room through a permanent PC in the room and a USB camera located behind the display
  - e. AV presentation shall be possible from the table, through wireless presentation device or a hard-wired connection (HDMI) on the table
  - f. Control shall be done through a control system with a tabletop touch screen
  - g. Room scheduling is highly recommended. Solutions that interface directly with Outlook are preferred
3. The A&E shall coordinate conduit rough in as well as coordination with furniture vendor for proper table pop-up devices.
4. This type of room requires at least one floor box or a poke through under the table. Power outlets are required on the table and around the room. Data jacks are only required for permanent devices in the room.
5. AV equipment could be in a credenza rack in a corner of the room.

#### D. LARGE CONFERENCE ROOM

1. A large conference room is defined as a meeting space for up to 24 people.
2. This type of room shall have the following capabilities:
  - a. Dual display system depending on room size. Both devices shall be located on the same wall as opposed to opposite walls. This will keep the focus in one direction
  - b. Sound for AV programs will be through ceiling speakers, or suspended speakers
  - c. Voice conference shall happen in this room through a voice conference system with ceiling microphones and an audio DSP system. Mix minus configuration is highly recommended

- d. Soft codec videoconference will happen in this room through a permanent PC in the room and a USB camera located behind the display. Hard codecs might be required in these rooms
  - e. AV presentation shall be possible from the table, through wireless presentation device or a hard-wired connection (HDMI) on the table, at two different locations
  - f. Control shall be done through a control system with a tabletop touch screen
  - g. Room scheduling is highly recommended. Solutions that interface directly with Outlook are preferred
3. The A&E shall coordinate conduit rough in as well as coordination with furniture vendor for proper table pop-up devices.
  4. This type of room requires at least two floor box or a poke through under the table. Power outlets are required on the table and around the room. Data jacks are only required for permanent devices in the room.
  5. AV equipment could be in a credenza rack in a corner of the room.

#### E. TRAINING/CLASSROOM ROOM

1. General: It is very important to determine early on if the classroom will be used for computer-based training or just standard lecture classrooms. Any room that requires computer-based training, will require power and hard-wired data connectivity.
2. This type of room shall have the following capabilities:
  - a. At least one large display device. Most likely a projector and screen. A flat panel display can be used if the size of the display falls into the 1/5 of the distance rule to the LFV. A second display device can be located if needed
  - b. Sound for AV programs will be through ceiling speakers, or suspended speakers
  - c. A podium mic with the ability to have a wireless microphone shall be included in the room
  - d. A connection on the wall for connecting a portable ADA audio transmitter shall be in these rooms
  - e. Voice conference shall happen in this room through a voice conference system with ceiling microphones and an audio DSP system. Mix minus configuration is highly recommended
  - f. This type of room typically is not used for videoconference if needed the location of cameras and microphones shall be carefully planned.
  - g. AV presentation shall be possible from the table, through wireless presentation device or a hard-wired connection (HDMI) on a podium location
  - h. Control shall be done through a control system with a wall mounted touch screen

- i. If classroom capture is required, equipment shall be planned for. This has a significant impact in the cost of the equipment and the functionality of the room, so it shall be added only if absolutely required for the project
  - j. Room scheduling is highly recommended. Solutions that interface directly with Outlook are preferred
3. The A&E shall coordinate conduit rough in as well as coordination with furniture vendors for proper podium furniture.
4. This type of room requires a floor box or a poke through under the podium. Power outlets are required on the table and around the room.
5. This type of room tends to be a flexible room, therefore evaluation of the equipment selection with all the room configuration types is highly recommended to make sure the AV equipment can be used properly in the various room configurations.
6. AV equipment could be in a credenza rack in a corner of the room, under a section of millwork, or in a room nearby, on a wall mounted rack. If mounted under a section of millwork, the millwork shall allow for 24 inches deep clear inside to hold all AV equipment.

#### F. COURTROOMS

1. Courtrooms are a very specific type of Audio/Visual rooms. These rooms shall be designed in conjunction with the input of the Technical Staff at the Administrative Office of the Courts (AOC). The contact information for is below:

Court Technology Office  
Sixth Judicial Circuit  
324 S. Ft. Harrison Ave.  
Clearwater, Fl. 33756

2. These rooms typically have the following elements:
  - a. Two display devices
  - b. Microphones in multiple locations
  - c. An audio DSP system to have multiple features, like voice conference, pink noise, audio streams for recording, ADA capabilities, etc.
3. Locations of floor boxes/or poke throughs must be carefully coordinated with furniture and all other devices.
4. Room layouts will vary depending on the courtroom type (unified family, delinquency, civil, first appearance, etc.).

## G. EMERGENCY OPERATIONS CENTERS

1. Emergency operations center are highly complex AV rooms. These rooms must be designed in conjunction with Emergency Management or the County organization that will be using the room. Some of the AV equipment located in this room includes:
  - a. Flat panel display, projectors, and video-walls with multiple input sources
  - b. Complex audio systems based on DSPs, with multiple microphones, filters, and audio capabilities
  - c. Ceiling speakers and the ability to broadcast multiple audio sources to multiple locations
  - d. Multiple connection points for hard wires presentation
  - e. Connections to broadcast equipment and broadcast quality cameras
  - f. These rooms will need connection for multiple PCs or Laptops
  - g. These rooms will need connections for Audio and video conference through hard codecs
2. Significant Owner inputs and documented decisions are required for these rooms.

## H. MEDIA/PRESS/PIO ROOMS

1. Several County facilities have media/press rooms and PIO rooms. These rooms shall have the ability to change functions. The A&E shall carefully describe the use of each of those rooms. Specific questions that need to be asked during the planning process of those rooms are:
  - a. Where exactly would the media briefings take place and how many people participate in the briefing?
  - b. Would the briefing be captured with equipment provided by the media, or would it be captured by County equipment to avoid too much equipment inside the room?
  - c. A media distribution system might be required to take AV signals from the location of the briefing back to a location where the media trucks can pick it up.
  - d. How is the media going to get to the room?
  - e. PIO offices shall have the ability to watch all local TV channels simultaneously and the ability to listen to any channel at any time.

## I. OTHER SPACES

1. There are many other room types besides what has been described in this document. The recommendation is to have significant dialog with the end users understanding the needs of the room from the AV perspective. It is highly recommended the A&E establish early on an Audio/Visual program and a budget to discuss with users to finalize the equipment to be used in those rooms.

## **2.2 OVERHEAD PROJECTORS**

- A. General: Overhead projectors shall be carefully selected for the application where they will be used. The recommended specifications for projectors are:
  - 1. Native aspect ratio of the projector shall match the aspect ratio of the projection screen.
  - 2. Light source for projectors under 9,000 lumens shall be a laser lamp.
  - 3. Light output of the projector shall be carefully selected by designer to create a good contrast ratio between dark and light colors given the size of the screen used.
  - 4. Use only commercial grade projectors with a three-year warranty. Consumer grade projectors with extended warranties are not acceptable.
  - 5. Projectors shall have control capabilities through RS-232 or EDI control.
- B. Accessories: This projector shall be supplied with a corresponding lens to achieve the throw distance based on the screen size and the distance from the projector to the screen. Projector mounts shall be provided with all projectors.
- C. Design Drafting: If a project has multiple projectors, each projector shall be clearly identified and classified in the design drawings.

## **2.3 FLAT PANEL DISPLAYS**

- A. General: The specifications of flat panel display are dependent on the space where the flat panel display will be used. If the display will be used in an office space, consumer grade displays are acceptable. For displays used as part of a complete AVS, use a commercial grade unit. If the display will be used outdoors, use only an outdoor unit with a high brightness.
- B. Screen size: The size of the flat panel displays shall be carefully selected given the size of the room and the type of content that will be displayed. To estimate the size of the display, use the 1/5 rule for distance to the LFV in the room.
- C. Accessories: Flat panel mounts shall be provided with all displays according to how the displays will be installed (pendant, ceiling, or wall mounted).
- D. Design Drafting: All flat panel displays in a project shall have the size, the mounting height, type, and purpose of the display. When multiple display types are used in a project a number system shall be used to identify each device.

## 2.4 PROJECTION SCREENS

- A. General: During the design process, it needs to be determined if the screens shall be electric manual, or fixed screens. The recommendations for the screens are:
1. The screen format shall match the aspect ratio of the projector.
  2. Electric screen shall be provided with low voltage controllers. Wireless or infrared controls are not recommended unless they are for retrofit applications.
  3. The size of the screen shall be carefully selected to provide good readability, per AVIXA guidelines for screen sizing based on the LFW rules.
  4. The lower part of the screen in a room shall not be lower than 40 inches from finished floor.
  5. It is recommended to use tensioned screens for larger screens. Pull down screens are acceptable for smaller rooms. To estimate the size of the projection screen, use the 1/5 rule for distance to the LFV in the room.
  6. It is recommended to use screens without gain.
  7. The selection of manual or electric screens shall be done with the end users of the system.
  8. Coordinate location of projection screens and MEP devices such as light fixtures and air diffusers to prevent light fixtures shining light directly to the screens and diffusers to avoid screen movement.

## 2.5 VIDEO CONFERENCE AND SOFT CODECS

- A. Video Conference and soft codes are being widely used in the workspace. When discussions with user groups require the use of soft codecs (i.e., Teams, Go-To-Meeting, Blue Jeans, etc.) the following considerations shall take place:
1. The County has county wide licenses for Microsoft Teams, so it is highly recommended to use this platform, but not required. The user groups for the project shall make the final decision on the platform to be used.
  2. The AOC uses Videxio.
  3. These codes shall be planned to run in dedicated PCs in the room.
  4. Cameras for capturing room video shall be USB high-definition cameras and shall be located at eye-level height, not ceiling mounted. It is recommended to install the cameras below flat panel displays not above.
  5. Audio pick up devices (microphones) shall be carefully selected to make sure all participants can be heard.

## **2.6 VOICE CONFERENCE SYSTEMS**

- A. Voice conference systems are very common in conference rooms throughout Pinellas County facilities. The recommendations for implementing voice conference systems are:
1. Voice conference systems be integrated into the County Wide Siemens VoIP phone system, as opposed to having conference phones with analog lines back to the service provider.
  2. For huddle rooms, small conference room and even medium conference rooms a regular Siemens phone terminal would be sufficient for good quality voice conference.
  3. For large conference room, training rooms and other large rooms that require voice conference with multiple participants, the use of a DSP based system, with microphones and speakers located in the room is recommended. The design and location of those devices shall be done by a design professional. In these cases, the A&E shall verify the DSP selected for this system has VoIP and 11 digit dialing capabilities. Also, the project shall allocate funding for the SIP licenses for the ATOS/Unify system required to connect the DSB devices to the existing Siemens PABX.

## **2.7 WIRELESS PRESENTATION SYSTEM**

- A. Wireless presentation is a feature that shall be considered for all presentation rooms. Currently Pinellas County does not have a standard for this system. Extron ShareLink is recommended by BTS, other devices should be vetted and approved by BTS. When planning on using those systems, the following consideration shall take place:
1. To date all the systems known in the market have a single wireless connection, it is required to be decided early on, who is going to be the most prevalent user of this feature. If non-Pinellas County employees will be the most prevalent users, the device shall be connected to the guest Wi-Fi. If the most prevalent users are Pinellas County staff, it shall be connected to the employee Wi-Fi. Those two Wi-Fi systems are physically isolated and BTS does not allow any “tunneling” of traffic between the two systems. If the room requires connections for employees and non-employees, consideration shall be given to using two devices in the room.
  2. The Wireless Presentation system shall have a secure connection and shall be tested for Network Security. BTS shall approve the use of such devices before they can be specified or purchased for a project.

## 2.8 LIGHTING CONTROLS

- A. For rooms that have front projection systems and hard videoconference codecs, room lighting shall be carefully planned. The following are recommendations for lighting controls:
1. Any light fixture close to the projection screens, that could have direct illumination to the screen shall be switched separately from other light fixtures in the room to avoid reflecting the light from those fixtures.
  2. Dimming is highly recommended for all fixtures in those rooms.
  3. For ideal performance, two sets of lights shall be planned: dimming down lights to assist users to take notes, and regular 2x4 lights shall be used for other uses of the room different from presentation.
  4. Pendant light fixtures shall be avoided in rooms with front projection systems to avoid conflicts between the fixture and the light from the projector.
  5. All fixtures shall have the same color temperature. If the room has windows, the color temperature shall match the ambient light.
  6. It is not required to have the AV control system integrated with the lighting control system. If desired by users; the following recommendations shall be followed:
    - a. The lighting control system shall be a complete system as well as the AV system. Both systems shall be able to operate on their own without the need of the other.
    - b. Both systems shall be on the same physical network.
    - c. The AV system shall be limited to recalling light presets from the lighting control system.
  7. For rooms with hard codecs, VTC style fixtures are recommended.
  8. Rooms with windows to the outside are recommended to have blinds, electric, or manual to enhance the visual aspect of the presentation.
  9. Integration with Building automation might be required. These features shall be discussed with the users.
  10. The user interface for the lighting control is recommended to be as simple as possible. Keypads are recommended, and touchscreens shall be provided only for programming in maintenance areas.

## 2.9 CONTROL SYSTEMS

- A. There are no Pinellas County-wide standards for control systems in Pinellas County Facilities. There are existing facilities with control systems such as:
1. Crestron control systems are used in multiple rooms by the Pinellas County Sheriff's Office, Pinellas County Emergency Management, Clerk of the Court, Tax Collector, Supervisor of Elections, and BTS.

2. AMX control systems are installed in rooms under the control of Pinellas County Communications and Pinellas County Transportation group.
  3. Extron control systems are installed at all courtrooms in Pinellas County.
- B. It is highly recommended to keep the same brand of control system being used for each user group in new facilities. As part of the planning exercise by the A&E, discussions with user groups shall take place to determine what control systems shall be used.
- C. The A&E shall check with BTS for a County contract for programming services.

#### **2.10 DIGITAL SIGNAL PROCESSORS (DSP)**

- A. There are no Pinellas County wide standards for DSP systems in Pinellas County facilities. There are existing facilities with DSP systems currently installed such as:
1. Biamp DSP systems are used in multiple rooms by the Pinellas County Sheriff's Office, Pinellas County Emergency Management, Clerk of the Court, and BTS.
  2. BSS DSP systems are installed in rooms under the control of Pinellas County Communications.
  3. QSC DSP systems are installed at all courtrooms in Pinellas County.
- B. It is highly recommended to keep the same brand of DSP system being used for each user group in new facilities.

#### **2.11 AUDIO AMPLIFIERS AND SPEAKERS**

- A. There are no specific guidelines for amplifiers and speakers in Pinellas County facilities. The selection of these devices shall be done by the A&E on every project.

#### **2.12 OVERHEAD PAGING SYSTEMS**

- A. Overhead paging (in hallways and common areas) are used in many Pinellas County facilities including the St. Petersburg - Clearwater International Airport (PIE).
- B. The use of overhead paging shall be discussed with the building users for each specific case. A connection with the phone system is always recommended for using the Paging system as well as to monitor or control the system through a network connection. The Installer shall check with BTS for the compatibility of the analog phone lines.

### **2.13 SOUND MASKING**

- A. Sound masking is used in select open office spaces in Pinellas County Facilities. These systems tend to be hard to fine tune to a level acceptable by all users. It is highly recommended that this type of system be designed by a professional with verified experience in the design and installation of these systems.
- B. When properly designed, these systems are beneficial for privacy in open office environments.

### **2.14 NETWORKING EQUIPMENT**

- A. General: All networking equipment required for the AVS shall be project provided but procured by BTS. The Projects A&E shall provide to BTS a list of all the network ports required for the AVS based on a telecom room by room basis. The use of standalone or dedicated switches to provide connectivity in areas where there are not enough data cable drops, or to provision new drops for the future is highly discouraged by BTS. Final authorization to use such switches shall be provided directly by BTS.
- B. Data drops for AVS shall be carefully planned. The use of little network Hubs or switches in AVS racks or podiums to feed multiple devices from a single drop in is not acceptable.

### **2.15 CABLE BOX (CABLE RECEIVER)**

- A. To date there are no unified cable TV (commercial TV service) distribution approaches by the County. In the past, TV service providers were required to provide TV signal to County facilities. This is no longer the case. If the use of cable TV is required in the facility, discussions need to take place with user groups and the TV service provider of choice by the users. BTS is considering a consolidated approach; there is no current solution available.
- B. Due to technology evolution, TV service providers are no longer providing analog or digital un-encrypted channels. It is highly probably that each TV outlet in a building may require a cable set top box, unless a CATV head end is planned for the facility.
- C. For planning purposes, TV outlets with coax to include data drops for the possibility of IP TV distribution is highly recommended.

## 2.16 WIRE, CABLE, CONNECTORS, AND ACCESSORIES

- A. General: The AVS Installer shall provide the system components and materials necessary to properly install, support, and terminate all audiovisual cabling, in accordance with the related documents identified in Part 1.3 of this specification. The AVS Installer shall coordinate and install all required cables into the provided raceway designated for use by the Project Electrical Installer. The AVS Installer shall also provide and attach all required cable connectors.
- B. Cable: The AVS Installer shall provide all cabling associated with and required to provide a complete, operable system per the Contract Documents. All cables provided by the AVS Installer shall be of manufacture quality consistent with the design intent and reviewed by the Engineer prior to installation.
- C. Cabling in Air Handling Spaces: The AVS Installer is responsible for determining the rating of the cables to be used for the AVS, as per the current version of the National Electrical Code. At the bidding point if the AVS Installer is not confident about the type of cables to be used in the project, the AVS Installer shall assume that all cables are to be plenum-rated cables.
- D. Cabling Below Grade: When the cable part of the AVS runs in conduits below slab and grade level, the AVS Installer shall only use cables with water-blocking jackets.
- E. Cable Signals: The following is a list of signal types and cables to be used for those signals:
  - 1. Line Level Audio Signal Cable: Provide one twisted pair cable for mono signals and two twisted pair cables for stereo signals. Twisted pair cables to be 22 AWG stranded (7X30) tinned copper conductors with overall foil shield (100% coverage), with 22 AWG stranded tinned copper drain wire.
  - 2. Microphone Level Audio Signal Cable: Provide one twisted pair cable, 20 AWG stranded (7X28) tinned copper conductor, overall foil shield (100% coverage) with a 20 AWG stranded tinned copper drain wire.
  - 3. Proprietary Control Cable (i.e., Cresnet® Signal): Provide one cable with one twisted pair 22 AWG stranded bare copper conductor with overall aluminum/polyester foil (100% coverage) and a 24 AWG tinned copper drain wire, and one unshielded twisted pair, 18 AWG stranded bare copper conductor.
  - 4. Control Cable (i.e., RS-232, RS-485 Signal): Provide one cable with one or two twisted pair 22 AWG stranded bare copper conductors with overall aluminum/polyester foil (100% coverage) and a 24 AWG tinned copper drain wire. Pair count contingent on manufacturer's specifications.

5. Digital Video, Audio, and Control Over Twisted Pair (HD-Base-T): Provide one, two, or more cables UTP or STP as required by the transceiver equipment manufacturer to ensure the digital signal is transported properly up to 328 ft., at maximum resolution. If the equipment manufacturer supports standard UTP Category (5e, 6, or 6A) for this application, the AVS Installer shall provide cables in compliance with Specification Section 27 10 00 Structured Cabling System. All cables part of the AVS shall be included in the same warranty as provided under Specification Section 27 10 00 Structured Cabling System. If the equipment manufacturer requires proprietary cables, only these specified cables shall be used in the project. The color jacket for these cables shall be different from voice/data cables.
6. UTP Category Cables: Provide UTP category cables for all Ethernet connections part of the AVS as indicated in design drawings, including horizontal cables, patch cords, and station cables. All cables part of the AVS shall have all specifications and be included in the same warranty as all cables provided under Specification Section 27 10 00 Structured Cabling System. The color jacket for these cables shall be different from voice/data cables.
7. Speaker Cable: Provide two unshielded bare high conductivity ETP copper 16 AWG stranded conductors, with overall jacket.
8. IR Control Signal Cable: Provide one pair, unshielded twisted pair cable with 22 AWG solid copper conductors.
9. Contact Closure Signal Cable: Provide one or more unshielded twisted pair cable with 22 AWG solid conductors. Quantity of pairs as required by the application.
10. HD-SDI Cable: Provide coaxial cable RG-59, AWG-20 solid 0.032 inch bare copper conductor, gas injected foam HDPE insulation, Duofold + tinned copper braid shield (95% coverage), PVC jacket. i.e., Belden 1505A. For cable runs with extended distances, the use of RG-6 shall be considered, with similar construction and properties as the RG-59 but with a thicker center core.
11. HDMI Cables: All HDMI cables exceeding 32.8 ft. must include an adaptive cable equalizer capable of providing no less than +40 dB of cable compensation @825 MHz. Such devices must be capable of operating automatically without human intervention and must include an external AC to DC power converter that can accept 100-240VAC @ 50/60 Hz. The device must also include I2C correction circuitry to mitigate the effects of long cable runs on the DDC clock and DDC data signals. HDMI cables shall meet the following requirements:
  - a. Support HDMI v1.3 with resolutions up to 1080P with 12-bit color depth
  - b. Support HDMI v1.3 Category 2 data rates (3.4 Gbit/sec.) with lengths up to 7.5 meters
  - c. Support HDMI v1.3 data rates up to 2.25 Gbit/sec. with lengths up to 40 meters
  - d. Support PC data rates up to 1.65 Gbit/sec. with lengths up to 60 meters
  - e. Supports PC resolutions up to 1600x1200 / 60 Hz and 1920x1200 / 60 Hz
  - f. Made of AWG-22-gauge wires
  - g. Triple shield for noise immunity

- h. Cable jacket shall have dual UL Ratings: UL13 (CL2) and UL758 (AWM20276) for non-plenum spaces. In plenum environments cables shall have a CL2P rating or CMP rating
    - i. RoHS compliant
    - j. Gold plated connectors
  - 12. DVI Cables: All cables carrying DVI signals through conduit, floor slabs, or longer than ten feet shall be HDMI cables as described in previous section with HDMI to DVI adapters in both ends.

F. Connectors and Plates: The AVS Installer shall provide connector and plates to terminate all wiring parts of the AVS, regardless if shown or not in the design drawings. As a general guideline the AVS Installer shall follow these recommendations:

- 1. Only use crimp type BNC connectors on coaxial baseband video cables. Use crimp type F connectors on RF based coaxial cables. Use only connectors with the same impedance as the cable where they will be terminated.
- 2. When custom panels or plates are required in the project, the AVS Installer shall submit detailed drawings of all plates for approval by the Design Engineer.
- 3. Whether shown in the design drawings or not all cables coming out of an outlet box into equipment shall have a disconnect means at the outlet box with a face plate. Faceplates with grommets are not acceptable as pass-through connections to equipment.
- 4. All termination of UTP Category cables shall be CAT6A done in accordance with Specification Section 27 10 00 Structured Cabling System.

## **2.17 IDENTIFICATION AND LABELING TAGS**

- A. The AVS Installer shall follow labeling materials indicated in Specification Section 27 00 10 Technology General Provisions.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION PRACTICES**

- A. General: The AVS Installer shall follow all installation practices indicated in Specification Section 27 00 10 Technology General Provisions.

B. Workmanship: The AVS Installer shall adhere to, at a minimum, the following installation practices:

1. Securely mount equipment plumb and square in place. Where equipment is installed in cabinets and provide mounting bolts in all equipment rack fastening holes. All rack-mount equipment shall be secured with Rackmount Solutions HTX™ security screws (STAR-TYPE or similar) provided with nylon washers between bolt heads and equipment.
2. Where equipment (such as VHS players, monitors, DA's and other system devices) is packaged by the manufacturer without rack mount ears or braces, as part of a regular manufacture process, the Installer shall provide all required, accessory ears, brackets, and shelves, which are necessary to properly mount the equipment within the designated cabinets and rack locations.
3. Provide appropriate ventilation panels, vents, and/or fans to assure sufficient ventilation for adequate cooling of all equipment.
4. Confirm the polarity and phasing of system components before installation. Connect to maintain uniform polarity and phasing.
5. Insulate all non-insulated, stranded conductors before making termination when connecting to equipment terminals.
6. "Wire", "wing", and "twist" NUT type connections are not permissible for any type of signal connection.
7. All wiring is to be free from grounds loops, shorts, opens, and reversals.
8. Neatly tie all cabling within equipment cabinets, housings, and terminal cabinets with nylon cable ties at no more than 12-inch intervals for cables different from 4-pair CAT cables. Use Velcro straps to tie all 4-pair CAT cables. Install in accordance with the latest EIA installation standards. Engineer approved wiring trough may be used in lieu of tie wraps. Cable routing shall not braid or cross with other wires in parallel more than once.
9. Secure all cables in equipment cabinets and terminal cabinets to provide strain relief at all raceways exits in accordance with NFPA 70 including all supplements. All plugs and receptacles are to be the grounding type.
10. Connect all equipment power to surge/noise suppression outlet strips or associated power conditioning devices.
11. Where system cables are extended through an exposed umbilical connection, the Installer shall harness all associated cable within a common, manufactured, flexible, sheath (ex. Snakeskin™).
12. All racks and cabinets shall be bonded to a grounding system as required by NEC.

C. Space Sharing in Telecom Rooms:

1. AV equipment shall not be planned inside telecom rooms unless previously approved by BTS.

2. It is highly recommended that AV equipment be installed inside the room that is serving, in a nearby room, or in a dedicated AV equipment room.
- D. Raceways: All raceways for Audio/Visual devices shall have the following specifications:
1. Refer to 27 05 28 Raceways for Technology for all raceways specification.
  2. All cables for speaker level signals, regardless of their level shall be run in separate raceways from other low voltage cables.
  3. All cables for microphone level signals, regardless of their level, shall be run in separate raceways from other low voltage cables.
  4. Raceways for AV Outlets: Outlets for AV cables shall be composed of electrical boxes (sized for the number of connectors) and a conduit to the nearest accessible ceiling space. All AV outlet boxes shall be at least 2.5 inches deep.
  5. All indoor rated cables can be supported with J-Hooks or cable hangers above accessible ceiling spaces. J-Hooks shall be spaced no longer than four feet.
- E. Labeling System: The labeling system for all cables shall allow for unique identifiers for each cable. Each cable must have an indicator from where it is coming from and an indicator to where it is going to. The AVS Installer shall use the BTS data standard for labeling all data cables used by the AVS, and as a guideline for labeling all audio-visual cables.
- F. Engraving: All push buttons interfaces and connection plates that are part of the AVS shall be engraved with descriptive wording relating the use of the button/plate. The AVS Installer shall submit and receive approval for the proposed wording in each button/plate before doing the engraving. Failure to follow this step might cause the AVS Installer to replace the buttons, interfaces, and/or plates if the Owner is not satisfied with the wording of the label at no additional cost to the Owner. The color of the wording in the engraving shall have high contrast with the background color of the button.
- G. Installation of Screens: Whether shown in the drawings or not the AVS Installer shall install all projection screens following the following installation practices:
1. All electric screens shall be provided with a low voltage controller to be mounted inside the screen housing.
  2. All electric screens shall be provided with a control wall plate mounted at 48 inches A.F.F.
  3. All in-ceiling screens shall be level with the ceiling grid.
  4. All in-ceiling screen housings shall be plenum rated when installed in plenum spaces.

5. All in-ceiling screens installed in hard ceilings shall include an access panel no smaller than 16"X16" to access the electrical junction box of the screen. Access panel shall be a metal panel, with a hinged door, and painted the same color as the finished ceiling.
- H. Projector Installation: The Installer shall adhere to, at a minimum, the following installation practices for projectors:
1. Projector shall be provided with corresponding mounting brackets depending on the projector selected.
  2. All anchors and supports, whether prefabricated or custom, required to mount the projector where indicated in the design drawings are in the scope of work of the AVS Installer.
  3. When electronics are provided next to the projector (receivers, controllers, etc.), provide an enclosure to mount all electronics suitable for the space above the ceiling (plenum).
- I. Flat Panel Display Installation: The AVS Installer shall adhere to, at a minimum, the following installation practices for flat panel display devices:
1. All anchors and supports, whether prefabricated or custom, required to mount the displays where indicated in the design drawings are in the scope of work of the AVS Installers.
  2. All walls where flat panel displays will be installed shall be re-enforced with sheet metal behind the drywall. The extent of the re-enforcing shall be the contour of the flat panel display to be installed.
  3. When flat panel displays are installed inside a wall niche, the AVS shall provide a wall mount with adjustable depth that allows the flat panel display to be installed flush with the exterior wall.
  4. Power and AV outlets installed behind flat panel displays shall use a Wiremold Evolution Wall backbox or approved equal.
  5. For flat panel displays mounted on structures, the Installer shall provide anchoring as approved by structure manufacturer.
  6. For flat panel displays suspended from the structure above, the Installer shall provide all custom brackets and pipes properly secured to the structure to mount the displays.

- J. Speaker Installation: The Installer shall adhere to, at a minimum, the following installation practices for speakers:
1. Each ceiling mounted speaker shall have a support wire tied to the building structure. Ceiling speakers shall not be supported from the ceiling grid.
  2. All ceiling mounted speakers shall be installed with a backbox to prevent sound from dispersing into the plenum space and causing noise issues in adjacent rooms.
  3. When ceiling speakers are mounted in fire rated partitions, the speakers shall have UL listed speaker back boxes with a fire rating no less than the rating of the partition.
  4. All in-wall speakers shall be installed with pre-construction brackets.
- K. Equipment Rigging: When speaker assemblies or arrays weigh more than 100 lbs., the AVS Installer shall follow all rigging instructions from the manufacturer. This work shall be done by an experienced rigger. The AVS Installers shall also adhere to the following practices:
1. Only the rigging equipment and method listed by the manufacturer of the equipment are approved for the installation no substitutions are accepted.
  2. Only the rigging points available in the speaker assembly are accepted as means of support.
  3. All anchors and supports, whether prefabricated or custom, required to mount the displays where indicated in the design drawings are in the scope of work of the AVS Installers.
  4. Shop drawings for rigging methods shall be signed and sealed by a licensed structural engineer.
- L. Millwork Opening: When AV equipment such as flip tops and plates will be mounted in millwork provided by the Owner or third parties, the AVS Installers shall provide cut out dimensions for all AVS equipment listing locations in the millwork where the cuttings need to be done. It is the AVS Installer's responsibility to install those devices in the millwork once the openings have been completed. All millwork openings shall be done by the furniture manufacturer or the AVS Installer.
- M. Floor Boxes: Floor boxes used for connection to lecterns, podiums, conference tables, or mixing boards shall have at least the following minimum requirements:
1. Floor boxes shall be large enough to have at least three different compartments, one for power, one for voice/data cables, and one for AV.

2. Each low voltage compartment shall have a separate raceway back to the accessible ceiling space. If speaker wires are run from the lectern, the AV compartment shall have one inch and one 3/4 inch conduit to the nearest accessible ceiling space. If no speaker wires are run from the lectern, a one-inch conduit from the AV compartment to the accessible ceiling shall be provided. Additional conduits might be required depending on the application.
  3. There shall be no daisy-chaining of AV conduits between adjacent floor boxes. Floor boxes shall recess the connectors from the umbilical cord tied to the lectern.
  4. Floor boxes shall have a recessed compartment to hold connectors. Floor boxes that leave AV connectors flushed with the floor are not desirable since they become tripping hazards and could be easily broken when moved.
  5. AV compartments shall have termination plates and connectors for all cables coming from the accessible ceiling space. Pass-through cables are not permitted in floor boxes. All connectors shall be properly secured to the plates in the floor box. All unused compartments shall have blank plates.
- N. Structured Cabling Infrastructure: The AVS Installer shall adhere to Specification Section 27 10 00 Structured Cabling System for all requirements of structured cabling components to be used as part of the AV system. The structured cabling components include but are not limited to:
1. All unshielded twisted pair Category cables and fiber optic cables.
  2. Termination devices like termination jacks, patch panels, and faceplates.
  3. All UTP and fiber optics patch cords.
  4. All testing procedures for Category and fiber optic cables.

### **3.2 REQUEST OF IP ADDRESS**

- A. General: The AVS Installer shall follow all requirements indicated in Specification Section 27 20 00 Voice/Data Communications Equipment for the request of IP addresses for devices part of the AVS.

### **3.3 SOFTWARE PROGRAMMING AND INSTALLER TESTING**

- A. The software programming and testing of the AVS system will be a multi-step process. The AVS Installer shall provision in the proposal for the time indicated in each of the following steps:
- B. Verification Step: The AVS shall first verify with the users if there is a programming standard for each room that is part of the scope. Some users, like the Administrative Office of the Courts (AOC) have specific standards to be used for Courtrooms. If no standard is provided by the users, all steps indicated below shall be followed.

- C. Briefing Step: A maximum of 45 days after the AVS Installer receives the NTP for this project, the AVS Installer shall request one or more briefing sessions with the Owner and/or Design Engineer to go over the expectation of each room and clarify any points that might not be clear to the AVS Installer.
- D. Shop Programming Step: Once the briefing step has been completed and approved, the AVS Installer shall allocate off-site programming time to accomplish all the requirements listed in this specification and the clarifications done in the previous step. It is the sole responsibility of the AVS Installer to estimate how many man hours are required for this step. This step does not require approval by the Owner and/or A&E.
- E. Field Verification Step: After the AVS equipment has been installed on site and the system has been programmed the AVS Installer shall request one or more working sessions with the Owner and/or Design Engineer to verify, in the field, the functionality of the AVS system. Some important notes about this step are:
  - 1. The AVS Installer shall have different AV media and sources to test all features in the AVS system.
  - 2. Physical installation of all devices will be checked by the Owner and/or the Design Engineer. Any deviations in the installation of the equipment part of the AVS from this specifications and previous meeting will be noted by the Design Engineer in a "punch list". This punch list will be sent to the AVS Installer within the next five days of the meeting for immediate corrective action. One punch list will be prepared for each room with AVS.
  - 3. The AVS Installer shall prepare meeting minutes of the key decisions made during these meetings that affect the programming sequence. The approval of these meeting minutes by the Owner and Design Engineer will be accepted as approval notice of this step.
- F. Final Adjustment Step: Once the previous step has been approved, the AVS Installer shall allocate time to make any corrections to the AVS system on site based on the conclusions of the previous step. It is the sole responsibility of the AVS Installer to estimate how many man hours are required for this step. This step does not require approval by the Owner and/or Design Engineer.
- G. Data Wiring and Fiber Optic Testing: Testing of UTP data wiring, copper patch cords, fiber optic cables and fiber optic patch cords shall be done as indicated in Specification Section 27 10 00 Structured Cabling System. Testing results shall be submitted as indicated in the same Specification Section.

- H. Signal Adjustment: The AVS Installer shall ensure that the following adjustments, tests, and measurements have been completed:
1. The system shall be measured and adjusted for optimum signal quality and minimum signal loss, to all audio and video signals, through the system channel, using appropriate test equipment and standardized testing procedures.
  2. The system shall be measured and adjusted for optimum signal-to-noise ratio and maximum headroom in the system electronics.
  3. The system shall be measured and adjusted to eliminate distortions or degradation of signal resulting from, but not limited to, clipping, hum, noise, and RFI interference.
  4. The Installer shall check the quality of each signal, at its source, and compare it against the quality of the signal at various points of its transmission through the system. The Installer shall correct the system for any significant (the lesser of 2dB or the manufacturers throughput requirements) signal distortion or loss.

### **3.4 SYSTEM WARRANTY AND SERVICE**

- A. General: The AVS Installer shall follow all warranty and service requirements indicated in Specification Section 27 00 10 Technology General Provisions.

### **3.5 ENGINEER'S FINAL ACCEPTANCE TEST**

- A. General: All AVS systems shall be tested and accepted by the Design Engineer.

### **3.6 TRAINING AND INSTRUCTION**

- A. General: The AVS Installer shall follow all training requirements indicated in Specification Section 27 00 10 Technology General Provisions. The AVS Installer shall provide the Owner with different types of training as described herein.
- B. System Administration Training: The AVS Installer shall provide system administration training at the job site as described below:
1. The objective of the system administration training will be to properly operate, trouble shoot, calibrate, and perform specific field repairs to AVS equipment.
  2. Field repair and calibration training will be limited to those repairs noted by the manufacturer of the equipment as field repairs done by non-factory trained personnel.
  3. Training shall be done at the job site with all the equipment operational after final acceptance.

4. Operation and Maintenance manuals shall be delivered at the beginning of this session.
- C. User Training: The Designer or Consultant shall check with the users to determine who will perform the training of the end users. They may be trained by the AVS Installer, or by other end users if they have the staff to perform this task. In cases where it is determined that the end user does not have staff capable of providing training, the AVS Installer shall provide system administration training at the Job site as described below:
1. The objective of the user training will be to properly operate the AVS.
  2. User short form guides shall be provided to all attendees of the sessions.
  3. Short form guides shall provide the users with quick finding ways to operate the system. If AVS operation is different from one room to the other, one separate short form guide shall be provided for each room. Each form shall be provided with a plastic laminate and frame, so it can be wall mounted inside the room or attached to the touch panel interface.
- D. Factory Training: Factory training shall only be required if specifically requested by end users and approved by Pinellas County REM.

### **3.7 AS-BUILT DOCUMENTS AND CLOSEOUT INFORMATION**

- A. General: The AVS Installer shall follow as-built and closeout information requirements indicated in Specification Section 27 00 10 Technology General Provisions. All as-built information shall be provided on or before the end user occupies the space.
- B. The following information shall be included in the as-built drawings:
1. Drawings indicating final floor plan locations of all AV devices.
  2. One-line diagrams with all devices connected in the system.
  3. Mounting details.
  4. Any signed and sealed structural calculations required for the AVS.
- C. Additional closeout information to be delivered by the AVS Installer:
1. All programming source code done by the AVS for this project for all pieces of equipment in digital format (no printed copies required).
  2. All JPEGs and graphics used for all interfaces, including all code used to create the interfaces.
  3. List of all IP addresses assigned to each equipment part of the AVS.

4. All master passwords for all devices shall be provided to the end users. Details on how these passwords shall be delivered and coordinated with the end users. Passwords shall not be emailed. These passwords shall be delivered in a secure manner.
5. Compiled executable files as requested for Computer based user interface.
6. All printed test results.

**END OF SECTION 27 41 00**