

# **Low-Voltage Wiring Standards**

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Networking Services

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## **Preface:**

Salem State University places a strong commitment to the communications infrastructure that services the Administration, Faculty and Student body. As such, this infrastructure is governed by a defined set of standards as presented in this document. This document is more than a guide. ***The standards set forth in this document are to be adhered to unless otherwise agreed upon, in writing, by the Director of ITS/Networking Services or the CIO.*** With respect to Means & Methods, the Assistant VP, Campus Planning & Facilities Management may also authorize exceptions. In the event of a conflict, the specifications contained within the Salem State University Low-Voltage Wiring Standards will take precedence. It is the responsibility of the Bidding Contractor to understand the specifications and standards contained in this document and adhere to them. ***Bid Specifications in conflict with this document may only take priority with written approval by the Director of ITS/Networking Services or the CIO.***

## **Version Control:**

Every effort is made to distribute the most recent version of this document. While this document has been carefully compiled and edited, occasionally clarifications and additions are issued. The most recent version of this document is available <https://records.salemstate.edu/policies/low-voltage-wiring-standards>. Archival versions are available from Networking Services upon request. The Standards document that is current at the time a contract is signed will be the official Standards document for the life of that project, unless otherwise agreed upon in writing. A 12-month Document Change Log is included at the end of this document.

## **Installer Credentials:**

Cabling contractors must be an approved vendor of the University or an agency of the Commonwealth which legally represents the interests of the University, either by State ITT/ITC contract, MHEC contract, University contract or competitive bid. All cabling products used must meet IEEE specifications.

## **Materials and Installation:**

Installation must follow BiCSi guidelines and adhere to OSHA regulations. Installer must have a project manager who is BiCSi RCDD certified overseeing any project greater than \$5000. **All cabling must be tested and certification reports submitted to ITS/Networking Services.** All cabling will be fully terminated prior to any testing. Test results performed on unterminated cabling will not be accepted. Minimum cable certification requirements and sample reports are contained in Appendix H.

## **Site Means & Methods:**

Installer will adhere to standards defined in the latest published edition of the BiCSi Telecommunications Distribution Methods Manual for work environment, cable pulling – including handling and securing, termination and testing. Appendix G contains a boilerplate of procedures to be observed by the installer. A complete list must be obtained from the Facilities Department at (978) 542-HELP.

**Deliverables:**

Upon completion of work, the installer will present a full certification report detailing that all cabling falls within accepted industry standards. This report must be submitted in an electronic format. The installer will also submit a jack cut sheet in the format specified in Appendix C of this document. All station-lines run, whether coax or copper, must be documented in the cut sheet. The cut sheets must also be submitted as an Excel spreadsheet, in an .xls or .xlsx file. **All deliverables are due 7 calendar days prior to expected Certificate of Occupancy date.**

**NOTE: *No project is considered completed until Appendix H Certification Reports and Appendix C Cut Sheets have been submitted and accepted.***

**Warranty:**

Warranties and guarantees will be provided at time of quote. No work performed will be guaranteed for less than 5 years to be free of defect from installation error. Warranties will begin no sooner than the Certificate of Occupancy date.

**Workmanship and quality:**

Salem State University expects installations to be performed in a professional, clean and neat manner. Wiring will be terminated per BiCSi standards, and will be dressed in a professional and presentable fashion. All cable slack and service loops will be similarly dressed in and secured. It is expected that all terminations will be completed to industry standards, regardless of a "Pass" in testing. That is to say, Salem State will not accept minimal quality work. Samples of expected cable terminations, dressing and fiber polishing quality are presented in Appendix G.

**Definitions:**

CDF: The Core Distribution Facility. CDF's house the "collapse point" for infrastructure on each campus. A CDF may also act as an MDF and IDF.

Drop: A single *low/no voltage* line within a Location.

"Fiber can", "can", "Fiber enclosure", "enclosure" and LIU are used interchangeably throughout this document.

IDF: Intermediate Distribution Facility. The IDF is the central termination point for all station wiring. It contains the network equipment necessary to provide connectivity between computer workstations and the University Network. It may contain "hub" connectivity for Video. The IDF may contain "pass thru" patch panels for Voice. However, as Voice Over IP (VoIP) continues to roll out, these panels may become local to VoIP-to-Analogue gateways.

Location: A cluster of jacks containing any or all of the following *low/no voltage* wiring – Unshielded Twisted Pair (UTP), Coax, Fiber and Audio Wire – for use in Data, Voice, Video and Audio applications. "Location" is also referred to as "the Desktop."

MDF: The Main Distribution Facility. MDF's contain core or intermediate network equipment, connectivity to the University Data, Telephone and Video "networks", as well as Data, Telephone and Video connectivity to the IDF's. The MDF may also contain telephone equipment. An MDF may also act as an IDF.

Media Pack: AudioCodes-specific gateway (see VoIP Gateway)

Network port: A drop used for Network Access.

Rack Unit, "R.U.", "U": The standard measurement on a communications rack, amounting to 1  $\frac{3}{4}$ " (44.45mm). For the purposes of this document, "Rack Unit", "R.U" and "U" are synonymous.

Station Wiring: All wiring installed between an IDF and a Location.

Video port: A drop used for Video Access.

VoIP Gateway: Hardware device to convert Ethernet/VoIP to traditional Analog or Digital voice lines

Voice port: A drop used for Voice Access.

**Cable Type:**

**Unshielded Twisted Pair (UTP):** The University does not designate station wiring as Voice or Data at the faceplate. This wiring is ubiquitous to allow flexibility in usage. As such, all horizontal (station) cabling will *EXCEED* Category 6 Standards (Category “6+” or better) unless otherwise specified, in writing. Low-voltage cabling at Salem State is color-coded. For acceptable cable colors, please refer to Appendix H.

**Fiber Optic Cable:** Fiber optic cable will be used for the following interconnects: CDF/CDF, CDF/MDF, MDF/MDF (where needed) and MDF/IDF. If an IDF is within 90 Meters from its MDF, some UTP may, as defined by Project, be run between these facilities. As of 1/1/2023, only singlemode fiber will be run unless there is a need for multimode, defined by a specific project. Factory-terminated LC pigtailed with fusion splices are to be used for all new fiber installations, whether single or multimode. Quantities are defined by Networking Services, based on need. Fiber adapters in LIUs will be limited to 12 strands (6 pairs) per adapter. If a new LIU enclosure is required, it will be sized to accommodate a minimum 50% growth. Because of their difficulty to work with, 1U LIU’s are to be avoided.

**Voice Copper:** A minimal quantity of voice-grade copper may be run between MDF’s and IDF’s to support non-VoIP telephone lines, such as emergency/elevator phones.

**Coaxial Cable/Video:** From MDF to IDF’s, two standard ½” coax cables will be run for a standard installation. Unless otherwise specified, standard RG-6 (less than 150’) or RG-11 (greater than 150’) terminated with F-connections are to be used between IDF and end-stations. Terminations **MUST** be secure and not easily removed by pulling.

**Audio Cable:** Audio Cabling will be specified based on specific applications. ITS has no standard audio installation. However, Means & Methods apply.

**Cabling Means & Methods:**

For station-wiring, all wiring (data/voice/video, copper/fiber/coax) will be “home runs” from the IDF to the wall plate. Use of mechanical connectors (e.g “barrel connectors”) is not permitted nor are splice-points. This also applies to vertical risers from MDF to IDF with the exception of riser voice trunks, where splice-points are acceptable. For external wiring, mechanical/fusion splices may be used SPARINGLY as necessary or where required by code (indoor/outdoor transition, lightning projection, etc).

All cables must be tested and certification reports submitted. Refer to Appendix I for requirements and sample reports.

ALL WIRING MUST MEET IEEE SPECIFICATIONS AND BUILDING CODES FOR INTENDED USE AND INSTALLATION CONDITIONS.

ALL TRUNK AND FIBER OPTIC CABLING INSTALLATIONS WILL PROVIDE A MINIMUM 5 METER DIAMETER (APPROXIMATELY 16 LINEAR FEET) SERVICE LOOP AT THE IDF/MDF. THIS CABLING WILL BE NEATLY COILED ON A WALL FIELD OR CABLE TRAY.

**Flush Mounting:**

Flush Mounting is the preferred method of mounting jacks at any given location.

### **Surface Mounting:**

Surface Mounting is only acceptable under two conditions – Flush mounting is not possible due to construction of the wall or flush mounting is not practical because of the application. An example of the former is cinderblock or poured-concrete construction. For the latter, high-density areas such as computer labs.

### **Jacks/faceplates/raceway:**

*Residence Halls* – Wherever possible recessed faceplates from Semtron with Ortronics TracJack Clarity jacks are to be used. This applies to both new installations and repair/replacement. Because of the unique installation requirements for the Semtron faceplates, wherever its usage is not practical, the Ortronics Series II System is to be used.

***Other University Spaces*** – The University standard for Jacks and Faceplates is the Ortronics TracJack System. New installations will use Ortronics TracJack. Where repairs to legacy faceplates/jacks are required, these legacy systems are to be replaced by the TracJack system. If an environment requires the use of more durable systems, the Semtron should be used. When providing jacks to modular furniture, it is preferred that the jacks be placed above desktop height whenever practical and allowed. If it is necessary to install jacks under the work-surface, on the kick plate of modular furniture, it is preferred that the faceplates be flush-mounted. In this instance, it may be necessary to use Leviton 49910-Sx2 faceplates (for Steelcase furniture).

All cabling will be terminated under IEEE and BiCSi guidelines.

Under no circumstances will single-track raceway be used. The University has standardized on Panduit multi-track raceway. All raceway will be mechanically secured to the walls. Gluing is not acceptable.

## **Drop quantity:**

*New locations:* The number of drops at a location is defined by a complicated set of rules and needs. Exact numbers will be obtained through a location-specific identification.

The following can be used as **general guidelines:**

- Common Areas<sup>1</sup>: 2 – 4 UTP lines per location
- Single Person Offices<sup>1</sup>: 2 – 4 UTP lines + 1 coax (usually only 1 location)
- Office Cubicles<sup>1</sup>: 2 – 4 UTP lines per location
- Multi-Person Offices<sup>1</sup>: 3 – 4 UTP lines per location; Add 1 coax to 1 location only
- Classrooms: 1-2 UTP in ceiling for wireless access point<sup>2</sup>; 3 UTP + 1 coax in front and back; additional drops may be required for podiums or HyFlex carts.
- Meeting Rooms: 1-2 UTP in ceiling for wireless<sup>2</sup>; 3 UTP each location; 1 coax in front
- Labs: 2-3 UTP in ceiling for wireless<sup>2</sup>; sufficient wiring at each desk/table for computers; 3 UTP + 1 coax in front of room
- Clerical Spaces (Copy/Storage Rooms)<sup>1</sup>: 4 UTP (usually 1 location)
- Wall Phones/Emergency Phones<sup>3</sup>: 1 UTP
- Smart Classrooms: Wired as regular classrooms + 4 UTP/1 Coax in podium

### NOTES:

<sup>1</sup>These areas may require 1-2 UTP in ceiling for Wireless Access Points.

<sup>2</sup>May require more than 1 Wireless Access Point.

Non-Wireless Access Point locations should only exist within a reasonable proximity to electric outlets. Also, "Power Users" should have 1 or 2 extra UTP lines run to their work areas.

<sup>3</sup>Salem State is currently considering eliminating Wall Phones. Projects should verify their cabling need.

*Existing Locations:* –No area should be wired for *exactly* what is needed in order to accommodate future growth. E.g. if 1 drop is needed, 2 or 3 should be run.

*Wireless Arrays:* -- The current wireless technology for the University is Aruba wireless Access Points. Depending on the model required, these arrays require 1-3 data connections per location. The exact drop quantity should be obtained by Networking Services.



### **Jack Labeling:**

All Jack labels will be placed under clear plastic inserts. Labels are not to be placed on the surface of the faceplate unless an insert does not exist. In this instance, a single layer of clear tape is to be placed over the label. Further, a label is to be placed on the inside of the faceplate, also with a layer of clear tape over it.

Jacks are labeled using the following format:

<IDF Designation>  
<Rack Number><Patch Panel Designation>-<Port Number>

E.g. For a 2-port faceplate, the following labeling designates the station lines are terminated in Library IDF on the ground level. Within the IDF, the lines are terminated on the 2<sup>nd</sup> rack, 3<sup>rd</sup> panel (C), ports 35 and 36:

LIBID0  
2C-35  
**[jacks]**  
2C-36

Faceplates with 3 or 4 jacks:

LIBID0  
2C-35 2C-36  
**[jacks]**  
2C-37 2C-38

Faceplates with 5 or 6 jacks:

LIBID0  
2C-35 2C-36  
**[jacks]**  
2C-37 2C-38  
2C-39 2C-40

A chart listing “<IDF Designation>” names can be found in Appendix C. When adding jacks to existing areas where labels follow an older labeling scheme, the new standard will be used. For new IDF’s, see IDF Configuration section. For existing, using the new standard may conflict with existing panels. This will be resolved as needed.

**More information on labeling of faceplates is available in Appendix A.**

### **Data Center/Frame Room Configurations:**

Fiber terminations: Unless otherwise specified to meet specific services, only Single mode fiber will be run between Data Center/Frame Rooms and internal MDF/IDF's. All fiber terminations will be clearly labeled identifying the location of each strands' remote end, per Appendix C. If a multimode LIU exists at either side of the termination, it will not be used for single-mode terminations. Factory-terminated LC pigtailed with fusion splices are to be used for all new fiber installations. Fiber adapters in LIUs will be limited to 12 strands (6 pairs) per adapter. If a new LIU enclosure is required, it will be sized to accommodate a minimum 50% growth. 1U LIU's are to be avoided.

Coax: If coax trunk lines are being fed in to the Data Center, they will be terminated using the proper tap for the cable size per the standards of Salem State's Cable provider at the time of the project. This should be verified at the time of installation. The placement within the Data Center is not specifically defined, but there is an area set aside for coax.

ALL CABLE TYPES WILL BE TRANSITIONED FROM OUTSIDE TO INSIDE cable within the appropriate distances (in most cases 50') of where they become accessible. In the unlikely event that telephone trunks are run between buildings/outside, all such runs will be transitioned to lightning protection ON BOTH SIDES of any run that leaves a building, whether that run is exposed outside of the Data Center/Frame Room, in any manner, or not.

See Appendix E – Racks and Cable Trays, for more information.

### **MDF Configuration:**

Information Technology is open to sharing MDF space for tangential data-communications (e.g Energy Management, Door Access Panels, etc). However, the primary usage of these spaces is for Data Communication Infrastructure. If the secondary non-ITS functions cannot respect the sizing needed to support ITS' core usages of these spaces, they will need to be placed elsewhere.

An MDF will contain at least one (1) 19" Communication's rack. Depending on the type of equipment being placed in the MDF, this rack may be either an open box rack or a standard relay rack (see Appendix E for rack descriptions). In general, one (1) communications rack is sufficient for an MDF. If the MDF also acts as an IDF, additional racks will be required as defined by "IDF Configuration" below.

UPS's will need to be sized based on initial load and projected growth. However, in general 2KVA of backup power is required for every 300 watts of load. UPS's should be sized for a minimum runtime of 30 minutes. If the room is on a generator, the runtime can be sized appropriate to the generator's startup/stabilization.

All UPS's require a Network Management Card. The UPS will back a standard 125v NEMA 5-20R 20A duplex or NEMA L5-20R twistloc outlet to every communications rack in the room. Rack-mounted UPS's will require an open-box communications rack. The preferred standard for UPS's is a single, larger UPS supporting multiple closets. If this is not practical for the situation, fewer/larger UPS's supporting multiple closets is preferred.

Unless otherwise specified to meet specific services, only Single mode fiber will be run between CDF's and MDF's and internally between MDF/IDF's. These strands will be terminated in singlemode-only LIU's and clearly labeled with the location name of the other end of the fiber, per Appendix C. Factory-terminated LC pigtails with fusion splices are to be used for all new fiber installations. Fiber adapters in LIUs will be limited to 12 strands (6 pairs) per adapter. If a new LIU enclosure is required, it will be sized to accommodate a minimum 50% growth. All fiber terminations (CDF to CDF, CDF to MDF, MDF to MDF and MDF to IDF) will use Ultra Physical Contact (UPC) connectors. However, between CDF/CDF, CDF/MDF and MDF/IDF, one (1) fiber pair of singlemode fiber will be terminated using Angled Physical Contact (APC) connectors. The separation between UPC and APC strands will be defined per Project and specified by Salem State Networking Services.

To support Voice Over IP (VoIP) services, space will be made available to install a VoIP gateway/Media Pack (generally 1U) and horizontal cable management (2U). Unless impractical for a specific implementation, Media Packs will be placed in the MDF's, with voice riser trunks feeding IDF's. If a Media Pack that is greater than 8 ports is to be installed, an appropriate data panel will accompany it. Note that these panels may require a 50-pin telco/Amphenol connection. NOTE: 4 and 8 port Media Packs do not require an accompanying panel, but will require a shelf.

Blocks/panels supporting IDF voice copper trunks and/or Media Packs will be blue. If color panels are not available, icons are acceptable. Whether initially using them or not, all panels must support snap-on icons. Standard bundled voice-grade copper will be used for these trunks.

Specific lighting need not be specified beyond whatever is suitable for the room size. However, the lighting should produce a minimal amount of heat. It is also highly desirable that lights be placed both in front and behind communications racks rather than directly above.

Cable management in an MDF will follow the same specifications/requirements as IDFs.

*Environmentals:* The MDF must be a secure room and humidity levels must remain above 40% and non-condensing. At a minimum, active venting is required for all MDF's. If temperatures remain between 55-78 degrees Fahrenheit, no cooling is necessary. If a room cannot maintain a temperature above 55 degrees Fahrenheit, heating and humidification may be required.

*Room Size:* Appendix F contains drawings showing preferred layouts, room dimensions and spacing for MDF and/or IDF's. It also lists room requirements.

See Appendix F – Racks and Cable Trays, for more information

## **IDF Configuration:**

Information Technology is open to sharing IDF space for tangential data-communications (e.g Energy Management, Door Access Panels, etc). However, the primary usage of these spaces is for Data Communication Infrastructure. If the secondary non-ITS functions cannot respect the sizing needed to support ITS' core usages of these spaces, they will need to be placed elsewhere.

In an IDF, one (1) communications rack will be required for every 14 cumulative "u's" of patch panels (combination of Data, Trunk/Riser voice/VoIP and/or Video) and fiber cans. For each fiber LIU and each voice-trunk panel installed, a 2 u cable manager will be installed. For every 24-ports of data network equipment, a 1 u cable manager will be used. In addition, 6" wide x 13" deep vertical cable management will be installed at the ends/between all racks. If space does not permit the use of 6" wide cable management, 3.75" may be used on the ends only.

The Standard horizontal cable manager is TrippLite SRCABLEDUCT2UHD . The standard vertical cable manager is the Ortronics OR-DVMS706 (6") or OR-DVMS704 (3.75").

Refer to Appendix F for minimum room dimensions, rack placement and clearances.

All station wiring is to be terminated in a patch panel (See **Cable Type** for requirements). Voice trunk, riser panels and/or VoIP panels may be Category 3. Station wiring panels will minimally match the specification of the cable terminated on them. All new patch panels are to be Ortronics. Under no circumstances are 110/66 wall-blocks to be used in IDF's for voice. If installed, voice panel(s) will be at the top of rack.

Panel Colors: The Voice Trunk/VoIP panels will be color Blue to differentiate them from the station wiring panels. Station wiring panels will be black. Alternatively, blue or black "icons" may be used on the patch panels to differentiate between Trunk and Station ports. All panels, independent of copper category, must support the use of icons.

Cable Management Placement: If a voice panel exists at top-of-rack, a cable manager will be placed immediately below it. If the voice panel is 24-ports or less, a 1U cable manager may be used, otherwise a 2U manager. For each LIU, a 2U cable manager will be installed. For each 48 ports of station wiring panels and/or network switches, a 2U cable manager will be installed. To facilitate access to switch ports, when more than one switch is used, switches will be bundled together in pairs. Examples: one 48-port switch (switch, one 2U cable manager below) or for two 48-port switches (one 2U cable manager above; two switches; one 2U cable manager below). the preferred 2U cable manger is the TrippLite SRCABLEDUCT2UHD. See rack examples in Appendix F for more information.

Fiber/terminations: As defined in the MDF section, only single mode fiber will be run. In the event that the closet already contains fiber terminations, any new singlemode fiber will be terminated in singlemode-only LIU's. If space does not permit this, cabler is not to make assumptions on placement; placement must be clarified with Salem State. One pair of strands will be terminated using APC connectors. All others will be UPC.

All Video cabling (RG-6 for distances less than 150', RG-11 for distances greater than 150') will be terminated at a wall field, where University Cable TV distribution is located. One pair of RG-11 cables will be run between an MDF and any IDF serviced by it.

*Rack/Patch Panel Labels:*

**Definition** - Rack 1 is the “left-most” rack when entering a wiring closet. More information is available in Appendix A.

Starting at the top of rack 1 and moving down the rack, each patch panel, regardless of function, will be labeled sequentially starting with “A” (ie Rack 1 Panel A). Moving down Rack 1, the next panel will be “B”, and so-forth. Moving to the rack to the right, the patch panel at the top of the second rack is Rack 2 Panel A and so forth. A label may be placed at the top of each rack designating the Rack number and a separate label placed on each patch panel designating the panel letter. **Only copper panels (voice trunk and station cabling) are to be labeled with letters. LIU’s will be labeled to identify location of far end of fiber.**

If the patch panel comes with factory numbering, it will not be altered/overlaid. If the patch panel does not come factory numbered, each patch panel will be numbered independent of others (ie the first port on each panel will start at “1”).

*Environmentals:* The IDF must be a secure room and humidity levels must remain above 40% and non-condensing. At a minimum, active venting is required for all IDF’s. If temperatures remain between 55-78 degrees Fahrenheit, no cooling is necessary. If a room cannot maintain a temperature above 55 degrees Fahrenheit, heating and humidification may be required.

One duplex 20A 110 outlet per communications rack is required. If a multi-closet UPS is not servicing the building, a minimum of a 1.5KVA SNMP-Manageable UPS will be placed in each IDF. UPS’s will need to be sized, but in general 1.5KVA of battery backup is needed for every 300 watts of power consumption. All UPS’s require a Network Management Card. Rack-mounted UPS’s will require an open-box communications rack. The preferred standard for UPS’s is a single, larger UPS, placed in the MDF, supporting multiple closets. If this is not attainable, fewer/larger UPS’s supporting multiple closets is preferred.

*Room Size:* Appendix F contains drawings showing preferred layouts, room dimensions and spacing for MDF and/or IDF’s. It also lists room requirements.

See Appendix F – Racks and Cable Trays, for more information

## ***Special Considerations***

### **Residence Halls:**

It has been our experience that the data jacks used in the offices, classrooms, labs and common areas throughout the University are not suited to the energetic behavior of resident students in their rooms. After extensive research, we found the Semtron recessed faceplates and Ortronics TracJack Clarity jacks to be the most durable. Wherever possible, the Semtron plates are to be used. When an existing faceplate is replaced, a Semtron faceplate should be used, when possible. If it is impractical to use the Semtron faceplate, Ortronics TracJack faceplates and jacks are to be used. To be consistent, Semtron faceplates (with TracJack Clarity jacks) should be used throughout residence halls, not just in living spaces. **Networking Services should be consulted to verify the current product to be used for faceplates as more durable products are continually being researched.**

### Wiring Quantities:

NOTE: This is a guideline. It is possible that Wireless Access Points that include switch ports will be used in these rooms, thus requiring considerably reduced wiring.

A philosophy of "1x + 2" will be used when wiring residence halls. That is to say, for "every pillow" there will be 1 location with 1 data drop (1x) AND a 2<sup>nd</sup> location with 2 data drops. For example, a room designated as a single will have 2 locations of data. One of those locations will have a single data drop. The other will have 2 data drops. A room designated as a double will have TWO locations with 1 drop each and a 3<sup>rd</sup> with 2 data drops. One of the locations containing a single data drop will also contain a single coax line.

Common Areas should have 2 UTP per location. At least one location per Common Area will have 1 coax.

### **Semtron part numbers (for use with Ortronics TracJack Clarity jacks):**

- Single port: 1-0RE-TJ
- Dual port: 1-0RE-2TJ
- 3-port: 1-000RE-TJ
- 4-port: 1-0000RE-TJ

## **ePhones & CCTV:**

The following section is a guideline for generic site definition/draft. As of 1/1/2024, Salem State will no longer be installing Pole ("blue light") emergency phones. As existing Pole ePhones require maintenance, they will be decommissioned. **However, as each security environment has its own subtleties, Salem State Police should be consulted before any security documents are finalized and/or sent to bid.**

Minimum ePhone & CCTV Cable specifications:

### ePhone

This is a deprecated technology. However, until all units are removed, this section will remain for historical context.

Category 3 or better UTP or STP

Light Red icon on patch panel (if legacy patch panels are in place that do not support icons a pink patch cable or other pink identifier may be used)

### CCTV Camera (Poles)

This is a deprecated technology. However, until all units are removed, this section will remain for historical context.

2 Strands Singlemode fiber

Local power

### Siren

This is a deprecated technology. However, until all units are removed, this section will remain for historical context.

2 Strands Multimode (62.5 $\mu$ ) fiber (less than 2000 meters) or Singlemode fiber (more than 2000 meters). If a camera is present, the siren may use the same fiber installed for that application. In this instance, a CM2 copper/fiber transceiver at the camera location will be used to satisfy both requirements.

### Power for CCTV and/or Strobe/Marker Light

Category 6E or better for runs < 100 meters

If a camera is to be mounted more than 100 meters from the closest IDF, 1 pair of singlemode fiber, per camera, will be run as well as local power for a transceiver or to power the camera.

Local power for external cameras (for heating element)

Once fully retired, the guidelines relating to each technology will be fully removed from this section.

## **Electronic Messaging System (Digital Signage)**

In 2006 the University designed and implemented an Electronic Messaging System utilizing existing plasma TV's, later expanding to LCD and now LED units. For the purposes of this document, the following components/cabbling standards/installation requirements apply:

It is beyond the scope of this document to specify the Screen hardware, however Networking Services should be consulted before any unit is purchased to ensure its compatibility and suitability. In general, the following specifications should be met:

- Standard Mounting Pattern
- HDMI Interface
- Coax interface with Clear/Open QAM tuner
- Serial Control Port

The mounting of the LED will, in most cases, be performed by the cable-installer. It is expected that the mount will be properly secured per the weight-based guidelines of the manufacturer using appropriate fasteners and adhering to the policies of the University's Facilities department.

The University has no specification for a standard TV mount. Each mount will be selected based on suitability for specific locations. When wall mounting, it is preferred that the mount be installed prior to running any cabling. This may not be consistently practical, but the goal is to place the electric outlet and data jack behind the LED such that they are minimally noticeable. If the electric and data wiring locations are placed prior to installation of mount, the mount should take aesthetics (hiding the cables) into consideration.

For each Signage TV, the data-run will consist of four (4) Category 6\* cables and one coax cable. Wherever possible, the Semtron recessed faceplate should be used in the installation of wall-mounted screens.

\*Specific manufactured cables must EXCEED Category 6 specifications (e.g Cat "6+"). See **Cable Types** for more information.

Independent of the function of a wall-mounted display, when wiring for a flat-panel TV, the Semtron recessed faceplates are preferred. Because of the torque that RG-11's place on the back of faceplates, a short "pigtail" transition from RG-11 to RG-6 OR a 45° connector on the RG-11 should be used.



### **Wireless Access Points**

The University has standardized on Aruba Wireless Access Points (WAPs) for wireless networking connectivity. For best coverage, these units need to be mounted parallel to the floor/ceiling. Wall mounting will require L-brackets. All deviations from this must be approved through Networking Services. Networking Services will provide locations for all WAP installations or relocations.

When mounting a wireless access point to an acoustical ceiling tile (ACT), the mounting bracket is to be centered on the tile. Spline-attached brackets are not acceptable. To add support to the tile, a 24" length of metal stud is to be placed above the tile such that this stud/brace sits in, and is supported by, the ceiling grid. The stud segment will have a hole punched in it to allow the necessary cabling to pass through. Any cut ends of these studs/braces will be covered with tape to eliminate sharp edges. The stud will also be chained in the same fashion that a light fixture would be secured in a suspended ceiling.

The responsibility of the low-voltage contractor with regard to hanging the actual electronics (provided by the University) will be project-dependent. In some cases, the contractor will only install the mount and SSU personnel will install the actual Access Points.

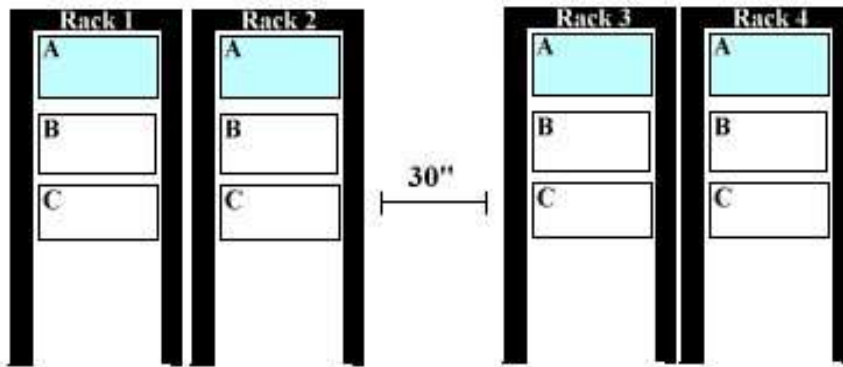
# Appendix A

## Jack Labels



NOTE: When installing a coax port on a recessed (Semtron) faceplate with 3 jacks, use a 4-position plate with a blank. Do NOT install coax on the bottom of a 3-position recessed plate.

## Rack/Patch Panel Labels



## Appendix B

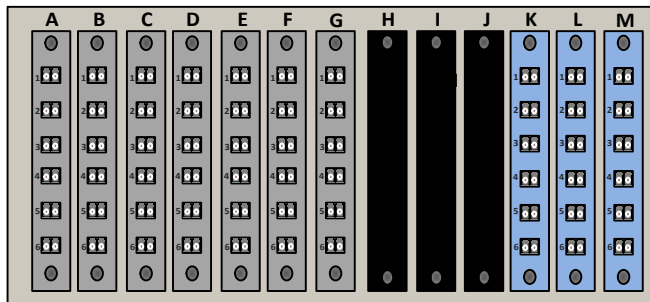
### Fiber LIU Labeling

While considerable legacy multimode (62.5 $\mu$  and 50 $\mu$ ) fiber with ST or LC terminations exist at Salem State, moving forward only singlemode fiber with LC connectors will be used. The labeling standards documented below are independent of the fiber type (single or multimode). ST connectors are being phased out. When re-terminating, unless otherwise specified LC connectors/packs should be used. Contractors should verify whether the connectors should be UPC or APC. This need will be installation specific.

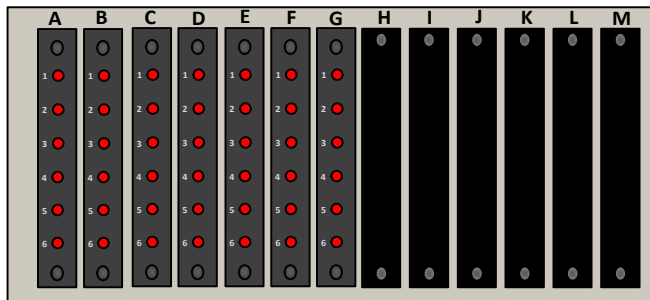
NOTE: ST and LC packs may be mixed in the same LIU. 62.5 $\mu$  and 50 $\mu$  multimode may be mixed in the same LIU, but never in the same pack. Every effort should be made to separate multimode and singlemode fiber into separate LIU's.

LIU fiber placement Examples:

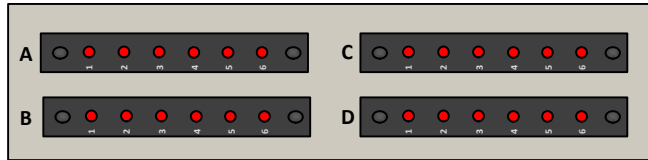
#### 1) 4u vertical pack LIU with 62.5 $\mu$ (A-G) & 50 $\mu$ (K-M) multimode, LC terminations



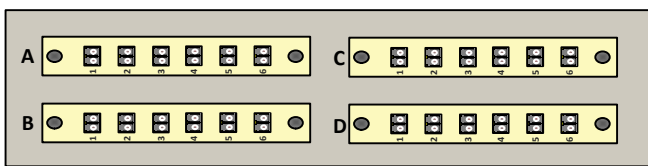
#### 2) 4u vertical pack LIU with 62.5 $\mu$ (A-G) multimode, ST terminations



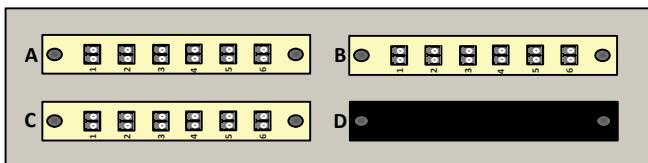
**3) 2u horizontal pack LIU with 62.5 $\mu$  multimode, ST terminations**



**4) 2u horizontal pack LIU with singlemode, LC terminations**



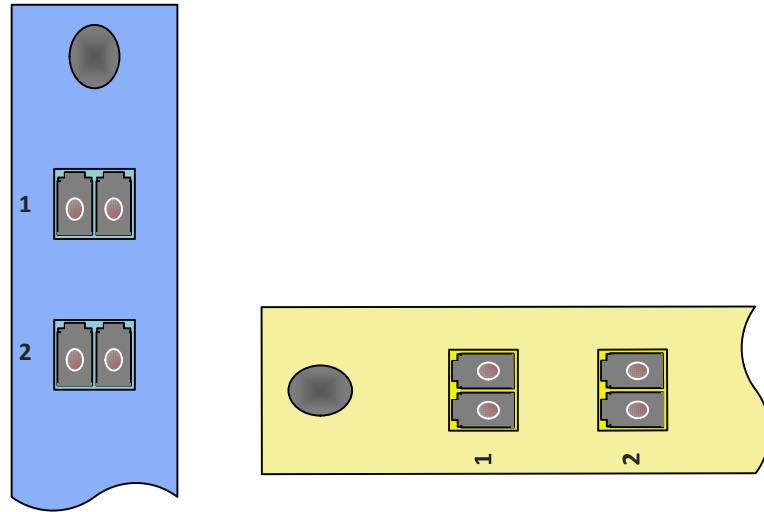
**5) 2u horizontal pack LIU with singlemode, LC terminations (A-C)**



NOTE the positions of packs B and C in this LIU compared to units #3 and #4

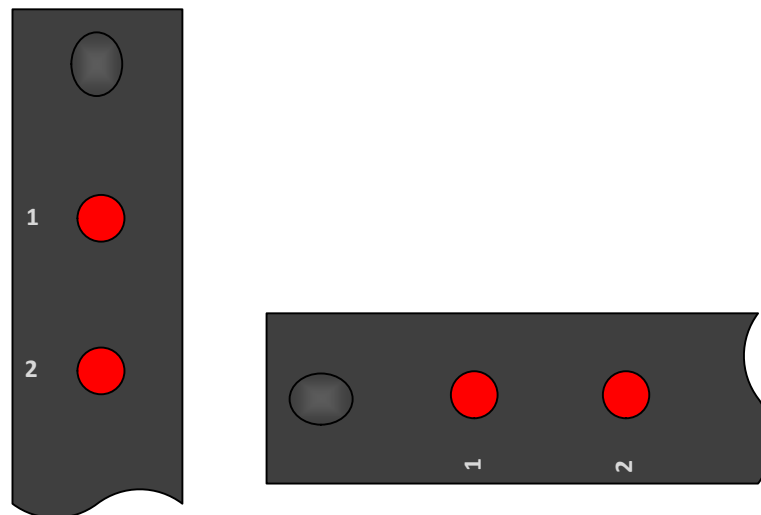
## Pack orientation

### LC Connectors



For vertical pack, fiber strand 1 is in the upper left. For horizontal pack, fiber strand 1 is in the lower.

### ST Connectors



For vertical packs, fiber strand 1 is on top. For horizontal packs, fiber strand 1 is on the left.

For all pack types, only factory labeling is used on packs. However, for internal use, ST strands are labeled as 1, 2, 3 etc, but LC strands are labeled as 1a, 1b, 2a, 2b ... That is to say, since LC fiber is terminated in pairs, PAIR 1 is considered 1a, 1b; PAIR 2 is considered 2a, 2b; etc.

More information on terminating and polishing fiber connectors is available in Appendix G.

## Appendix C

### MDF/IDF Names

Legacy labelling is present throughout the University. It is important that the labelling standards defined in this document are used, even if it conflicts with existing labels. If the installer feels that adhering to the Salem State labelling standard is not practical, the vendor **MUST** discuss this with Salem State Networking Services rather than make unilateral decisions. Any deviation from Standards not previously approved and subsequently found to be unacceptable by the University will be corrected by the installer at their expense.

#### Notes:

- B1 is the Central Campus Classroom Building. “Bertolon” is our School of Business, not the building name.
- Room numbers frequently change. For this reason, we utilize a generic naming structure for labels. The room numbers under “Description” were current as of this document’s publish edit date.
- Letters following IDF’s are to be lower case (e.g B1ID2a **NOT** B1ID2A)
- As of 11/7/2023 the Horace Mann Building and a new wing of Meier Hall are in design. The number and location of IDF’s is not yet determined so they are not yet reflected in this document. Consult the University’s Networking Services if more information is needed.

Wiring closet names and approximate space they serve are listed in the tables on the next page. Note that the Description is fluid due to changing room numbers. If there is any concern/confusion, it is up to the contractor to clarify with Networking Services.

<u>Label</u>	<u>Description/Approximate Location</u>		<u>Label</u>	<u>Description/Approximate Location</u>
ACBMDF	Academic Building MDF		MARSHID2a	Marsh 230
ADBMDf	Administration Building MDF		MARSHID2b	Marsh 268
ADBIDF	Administration Building IDF		MARSHID3a	Marsh 326
LORING35MDF	35 Loring Ave MDF		MARSHID3b	Marsh 368
AUDMDF	Auditorium Frame Room		MARSHID4a	Marsh 426
BHMDF	Bowditch Hall MDF		MARSHID4b	Marsh 468
BHID3	Bowditch Hall 3 <sup>rd</sup> Floor IDF		MARSHID5a	Marsh 526
BHID6	Bowditch Hall 6 <sup>th</sup> Floor IDF		MARSHID5b	Marsh 568
B1MDF	Building 1 MDF (Old Data Center)		MHMDF	Meier Hall MDF 213
B1ID1a	Building 1 126		MHID2	Meier Hall 216
B1ID1b	Building 1 170		MHID1	Meier Hall Fan Room
B1ID2a	Building 1 256		MHID3	Meier Hall 326
B1ID2b	Building 1 Navigation Center		OKCMDF	O'Keefe Center MDF
B1ID2c	Police Station CC-1209		OKCID1	O'Keefe Center Gassett IDF
BASEBALLMDF	Baseball Field		OKCID1b	O'Keefe Center Rockett Arena IDF
ATLANTICMDF	Atlantic MDF 117b		OKCID3	O'Keefe Center IDF 3 <sup>rd</sup> floor
ATLANTICID2a	Atlantic 225a		OCKFIELD	O'Keefe Center Field
ATLANTICID2b	Atlantic 234a		PHMDF	Peabody Hall MDF
ATLANTICID3	Atlantic 317		PHID3	Peabody Hall 3 <sup>rd</sup> Floor IDF
ATLANTIC4a	Atlantic 407b		PHID6	Peabody Hall 6 <sup>th</sup> Floor IDF
ATLANTIC4b	Atlantic 414		PPGMDF	Peabody Parking Garage MDF
DCMDF	Dining Commons IDF		PPGIDF	Peabody Parking Garage IDF
ECCMDF	Ellison Campus Center MDF		STANLEYMDF	Stanley Building MDF
ENTMDF	Enterprise Center MDF		STANLEYDC	Stanley Building Data Center
ENTIDF	Enterprise Center IDF		SBMDF	Sullivan Building MDF
HBMDf	Harrington Building MDF		SBIDF	Sullivan Building IDF Attic
HBIDF	Harrington Building IDF		TENNISMDF	Tennis Court
HMMDF	Horace Mann MDF		VHMDF	Viking Hall MDF (West bar)
LAMDF	Lafayette Annex (287 Lafayette)		VHID2W	Viking Hall West bar 2 <sup>nd</sup> Floor IDF
LA331MDF	331 Lafayette MDF		VHID3W	Viking Hall West bar 3 <sup>rd</sup> Floor IDF
LIBID0	Library Level 0 IDF		VHID4W	Viking Hall West bar 4 <sup>th</sup> Floor IDF
LIBMDF	Library Level 1 MDF		VHID1E	Viking Hall East bar 1 <sup>st</sup> Floor IDF
LIBID3	Library Level 3 IDF		VHID2E	Viking Hall East bar 2 <sup>nd</sup> Floor IDF
MARSHMDF	Marsh 105		VHID3E	Viking Hall East bar 3 <sup>rd</sup> Floor IDF
MARSHID1	Marsh 168		VHID4E	Viking Hall East bar 4 <sup>th</sup> Floor IDF

## Appendix D

### Sample Cut Sheet:

<b>Wiring Closet</b>	<b>RACK</b>	<b>PANEL</b>	<b>PORT</b>	<b>JACK's Room Number</b>
MHMDF	1	B	1	112
MHMDF	1	B	2	112
MHMDF	2	B	3	151
MHMDF	2	C	1	151
MHMDF	3	B	1	151
MHMDF	3	C	1	152
MHID3	1	B	1	200
MHID3	1	B	2	200
MHID3	1	B	3	203
MHID3	2	B	1	204
MHID3	2	C	1	204
MHID3	2	C	2	206

**Wiring Closet:** MDF/IDF name, based on Appendix C

**Rack:** Rack number, as defined in **IDF Configuration** section

**Panel:** Panel letter, as defined in **IDF Configuration** section

**Port:** Patch panel port number, as defined in **IDF Configuration** section

**Jack Room Number:** Room number where other side of cable is terminated. If the room is in an area where the building name has changed, include the building's abbreviation with the room number. This may need to be coordinated with Networking Service. For example, the Gassett Center may have room numbers that overlap with the main structure of the O'Keefe Center. In this case, room numbers should have "GC" prepended to the room number. Or, if a cable is run from OKCID1a (Gassett Center) to the main structure of the O'Keefe Center, "OKC" would be prepended to the room number.



## **Appendix E**

### **Racks & Cable Trays**

#### **Standard Single Relay Rack:**

Single Relay Racks are the standard “flat” racks used for patch panels and equipment that require only a two-post mount. The University no longer standardizes on a specific manufacturer; however, the following criteria must be met:

1. 19”
2. 84”/45-Rack Units
3. Threaded mounts (no clips)
4. Minimum 700lbs capacity
5. Rack Units must be stamped into finish of rack and visible
6. Black finish

When adding a rack to an existing IDF, the new rack must match existing racks as closely as possible, while adhering to requirements 1-6. This rack type is used in both MDF’s and IDF’s.

#### **Open Box Rack:**

An Open Box Rack is similar to the traditional Rack Enclosure, used for equipment that requires a four-point mount. However, the Open Box Rack does not have front, back, side or top panels. It does, however, have power distribution. At this time, the standard is not defined. However, 7’ x 36” racks are recommended. If an Open Box Rack is required, its specifications should be identified, for the specific need, by Salem State Networking Services.

This rack type is used in MDF’s only.

#### **Rack Enclosure:**

The traditional box enclosure with sides, top, door and back.

At this time, the standard is not defined. However, 7’ x 40” racks are recommended. If a rack enclosure is required, its specifications should be identified, for the specific need, by Salem State Networking Services.

This rack type is used in MDF’s and wherever a lockable rack is needed.

#### **Cable Trays**

Cable trays will be installed above communication racks, parallel to the face of the racks. Ceiling heights should accommodate trays for applicable usage and codes. Tray installations will be designed based on local need, however generally speaking they will be no less than 12” wide. Ladder tray is acceptable in most cases, however specific applications may call for mesh-basket or solid/enclosed trays. Trays should not hang below or obstruct rack lighting.

Trays will also be installed along the ingress/egress path inside an IDF/MDF/CDF to support cables not wholly contained in that space. If necessary and agreed upon, D-rings and/or J-Hooks may also be used.

## Appendix F

### MDF/IDF Room Size Requirements:

The following guidelines should be followed when configuring an MDF or IDF

- A margin of 6" must be maintained between the swing of the room's door and the front of a communication rack
- A margin of 2" must be maintained between the swing of the room's door and the side of a communication rack or its vertical cable management.
- Ceiling heights are a minimum of 8'. Since fire codes usually require a minimum distance of 18" from a sprinkler head and to accommodate cable trays, a 9 ½' or higher ceiling is preferred. A finished ceiling is not required in a wiring closet. However, if the decking material is prone to flaking, a ceiling is preferred.
- Port counts are determined by the TOTAL number of Voice Ports, Station Ports (Cat 6\*), fiber ports and Video ports (Coax) in a closet.

\*Specific cabling must exceed Category 6 specifications (e.g "Cat 6+"). See *Cable Types* for more information.

The table below is an APPROXIMATION of space required for data closets. These measurements are based on open, unobstructed floor space. Obstructions may include support columns, floor-corings, security enclosures on walls, electrical conduits, wall-mounted panels, electrical sub-panels non-standard racks, etc. If such obstructions/additions are present, additional space will be needed. For security reasons, ONLY DEVICES RELATED TO IT SERVICES ARE TO BE INSTALLED IN MDF/IDFs UNLESS PREVIOUSLY AGREED UPON BY UNIVERSITY NETWORKING SERVICES.

<i>Total Ports</i>	<i>Racks Needed</i>	<i>Min Room Size</i>
<337	1	4'10" x 6'9"
337-768	2	7' x 6'9"
769-1200	3	9'3" x 6'9"
1201-1632	4	7' x 10'
1633-2064	5	9'3" x 10'
2065-2496	6	9'3" x 10'
2497-2928	7	11'6" x 10'

**NOTE, Electrical Requirements:** THESE ARE GENERAL GUIDELINES and should be verified with ITS/Networking prior to commitment and installation.

- All receptacles shown in diagrams are Quad outlets.
- If using option <sup>(2)</sup> below, only duplex outlets are required.
- Building-power (non UPS) outlets are required for both options <sup>(1)</sup> or <sup>(2)</sup>.
- ***Overhead lighting is required such that both the front and back of the racks are sufficiently illuminated to allow reading of labels without supplemental lighting.***

**<sup>1</sup>Central UPS:**

- If wired to a central UPS, outlets are to be placed above the Relay Racks, but not attached to the racks.
- At least 1 building-electric, non-UPS Quad will also be placed in each wiring closet.
- One UPS-quad outlet is required for every 2 racks, or fraction (ie 3 racks requires two quad outlets)
- **OR** if twistloc (e.g L5-20R) outlets are required, there should be one (1) receptacle per rack.
- Each UPS-Quad or twistloc outlet is to be on a separate circuit.

**<sup>2</sup>Local UPS's:**

- If not on a central UPS, outlets are to be placed at standard (16") height at locations marked.
- At least two Duplex outlets are required, and on separate circuits.
- For closets with more than 2 racks, each rack will require a separate duplex outlet.
- No more than 3 Duplex outlets are to be on the same circuit.

Unless otherwise specified, outlets are NEMA 5-20R. Power Distribution Units currently in use require L5-20R receptacles. If local Uninterruptable Power Supplies (UPS) are to be used to support more than 2 racks, 1 or more L5-30P receptacles may be needed. Because of an increased dependence on the network for security devices new, renovated and upgraded data closets should be placed on emergency generator power.

## Room and Equipment Measurements

### Rack-to-Front/Back Walls

Measurements based on standard 19" Relay Rack; Measurements taken from FRONT of vertical support, where equipment would be screwed to rack.

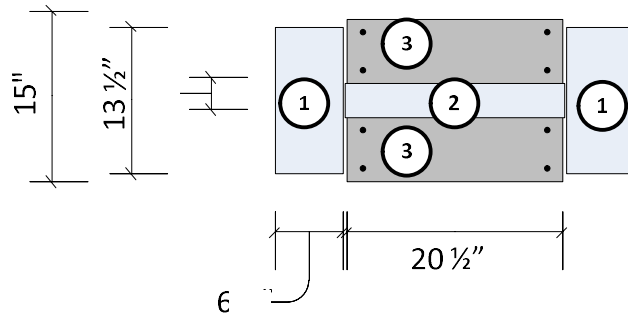
- A MINIMUM of 43" is required from the FRONT of a rack to the FRONT wall (or FRONT of opposite rack, if using two rows of racks).
- A MINIMUM of 38" is required from the FRONT of a rack to the BACK wall.


### Rack-to-Side Wall

- If vertical cable management is installed A MINIMUM of 24" is required from the end of the last communication rack in a row to the side wall;
- If vertical management is not yet installed, the MINIMUM distance from the end of the last rack to the side wall is 30".

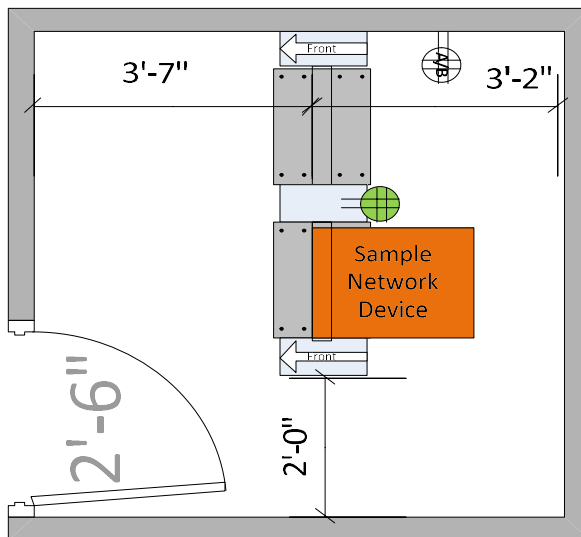
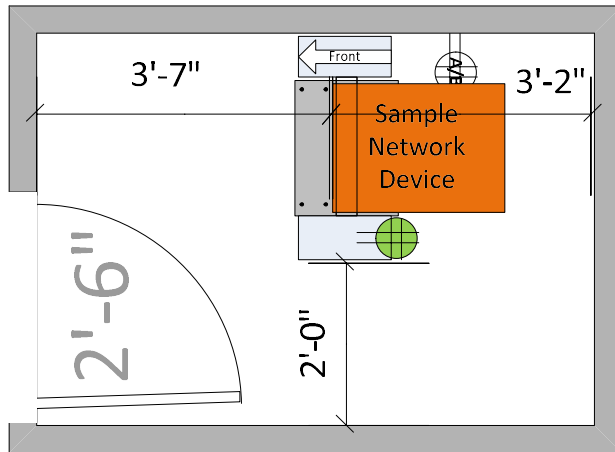
### Rack Measurements (looking down on rack)

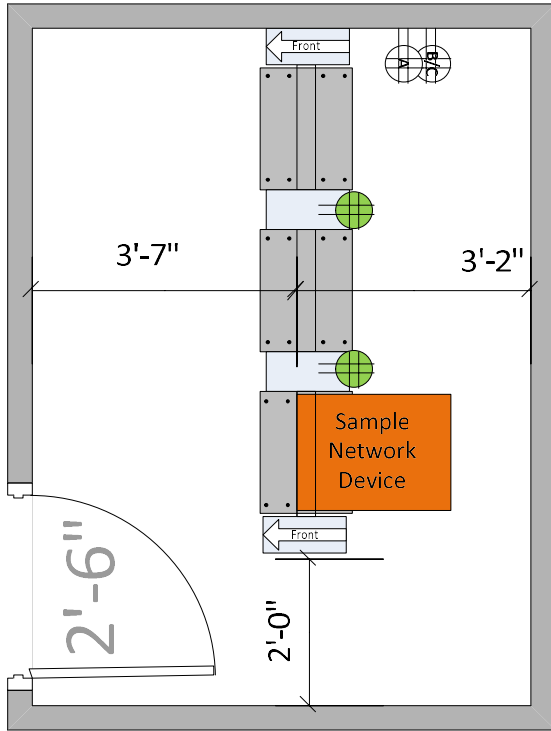
- ① Vertical cable managers (on sides of rack)
- ② Top horizontal support of rack
- ③ Floor brackets

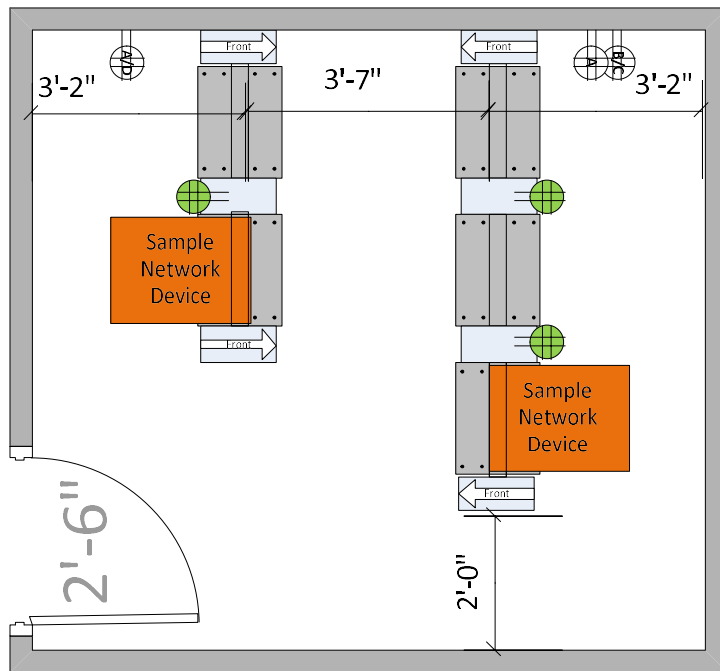
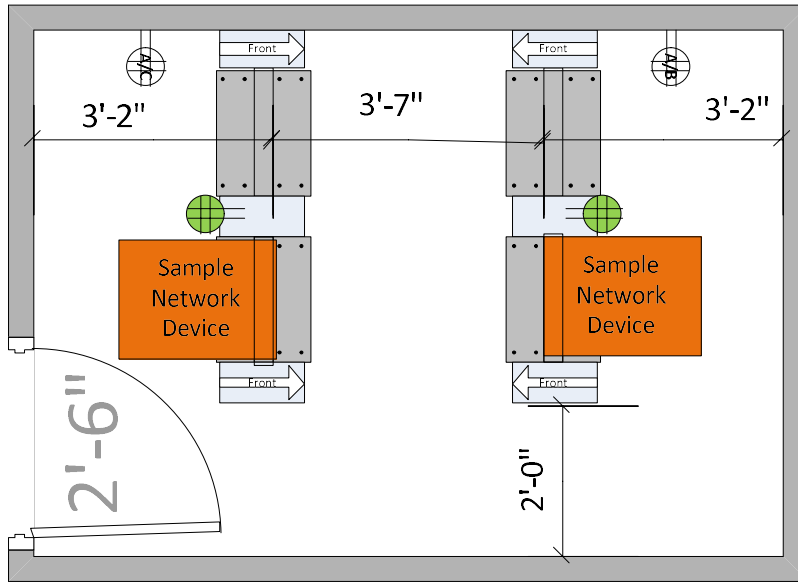


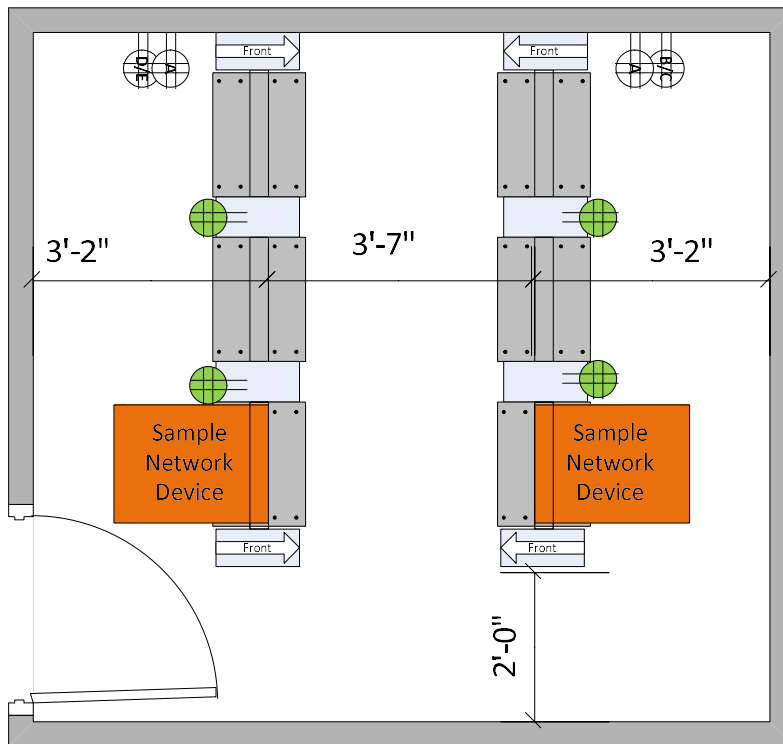
 <sup>1</sup> - Central UPS outlets (standard NEMA 5-20R). If twistloc (e.g L5-20R) outlets are required, there should be one (1) receptacle per rack, above rack.

 <sup>2</sup> - Local UPS outlets

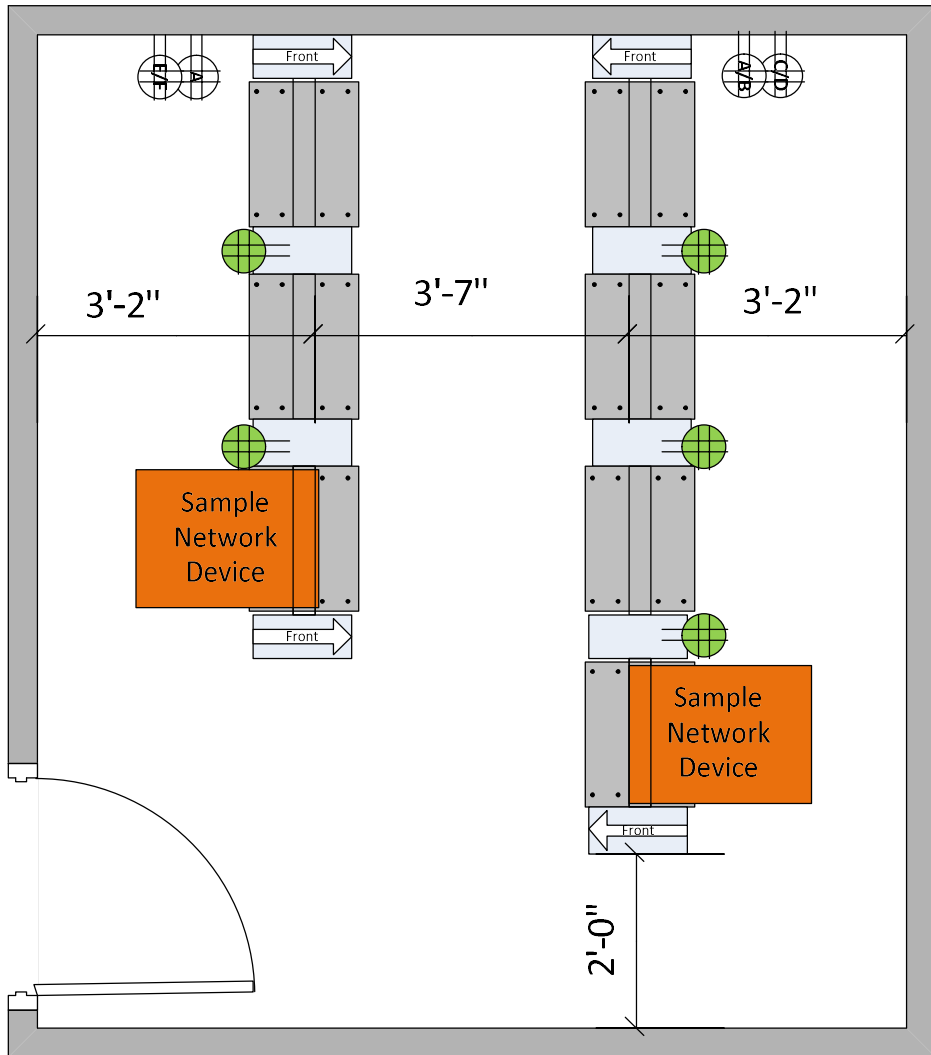










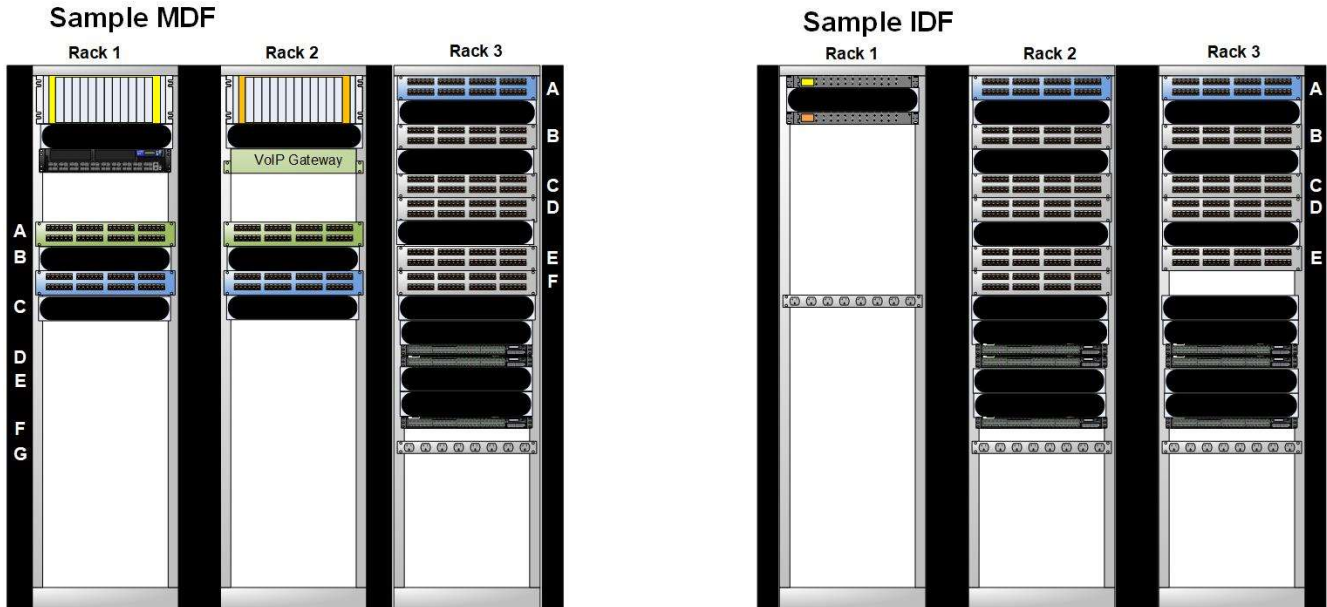


**IDF/MDF/CDF Room Signage**






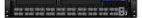



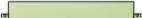



For security purposes, Communications Closets (IDF/MDF/CDF) should not be labeled as such. Only a room number should be placed at the door.

## Sample equipment, panel, shelf, LIU placement guide (within racks)

This section is meant as a guide for the placement of equipment, shelves, low-voltage wiring, etc within racks. As MDF's usually also act as IDF's, Rack 3 in "Sample MDF" reflects this.



### LEGEND

	Single Mode Fiber Panel		PDU
	Multi Mode Fiber Panel		Network Switch (devices)
	SM Fiber Panel		Network Switch (backbone)
	MM Fiber Panel		Cable Manager
	Voice Panel (to VoIP gateway)		VoIP Gateway/ Media Pack
	Voice Panel (IDF distribution)		Coax Panel (no longer used for new installations)
	Data Panel (Station wiring)		

Multimode fiber will only be installed if a specific need is identified.

**Data closets (IDF's, MDF's, Telecom Frame Rooms, etc) are secure facilities. They are not to be used for storage of non-IT equipment. Services unrelated to security and IT are not to be installed in data closets. Third party equipment relating to security is to be coordinated with Networking Services BEFORE mounting/installing/configuring in a data closet.**

## **Appendix G**

### **Means & Methods Boilerplate:**

The following is meant as a minimal set of guidelines for any installation/renovation of data, video or voice cabling at Salem State University. As of February 2017, these were the most up to date specifications. A more complete and up to date guide may be obtained through the Facilities Department by calling (978) 542-HELP.

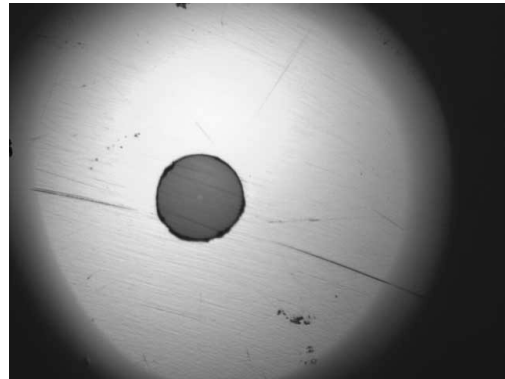
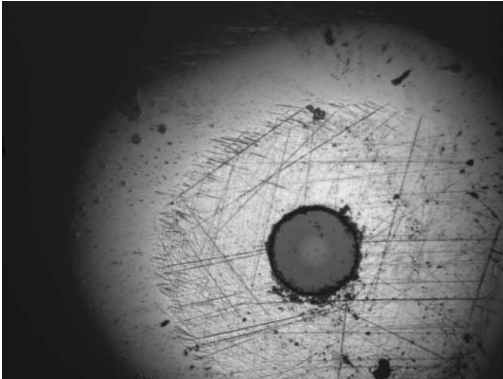
- All wiring/cabling will be installed as per BiCSi specifications and will be properly supported from the building's structural elements, independent of any drop ceilings or other suspended building systems.
- All ceiling tiles, removed or pushed away, will be properly re-placed by the close of business each day unless otherwise pre-arranged. It is the responsibility of the contractor to provide all replacement ceiling tiles necessary resulting from breakage during low-voltage installation. The contractor is also responsible for the repair of any property damage that may occur by them, their vendors or their subcontractors. ALL damage is to be reported as soon as possible to SSU Facilities to help facilitate timely repairs. Facilities can provide specifications for our institutional standards as required.
- All trash generated by the contractor must be removed from the University by the vendor at the close of each business day and the work area will be broom swept before the contractor leaves each day. Construction materials are not to be placed in University trash receptacles or dumpsters. Should a dumpster be required by the contractor, the Office of Facilities Management will assist in identifying a location.
- All exposed conduit/raceways will be installed in a neat and workmanlike manner. All conduit/raceway will be mechanically fastened to the support structure.
- All wall penetrations will be appropriately filled with material appropriate for the purpose. All firewall penetrations are to be specifically noted and reported to the Facilities Office for inspection. In the event that an existing penetration that was not previously filled is reused, the contractor must seal that penetration.

The photos on the following pages are meant as a guide to represent what is expected in the quality of cable terminations and fiber polishing. Salem State expects the quality of all work to meet or exceed these samples.

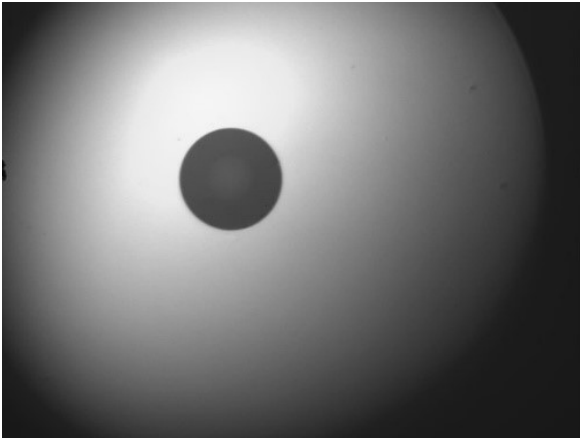


**Note that strain-relief is to be used for all copper cabling. Cables will be dressed to the strain-relief with either Velcro or zip ties. Further, all cable bundles will be dressed at no greater than 36" segments where visible and no more than 60" segments where not in cable tray.**

The following are examples of incomplete polishing of fiber connectors. These connectors will pass testing, but are not acceptable (magnification 200X using JDSU P5000i microscope):



The following is a completely polished fiber connector:



**Networking Services requires that all fiber strands that are field-terminated use factory-terminated LC pigtailed with fusion splices. In the event this is not practical Epoxy/Polish terminations rather than Unicam are to be used.**

## **Appendix H**

### **Reserved Cable and Icon Colors**

Unless otherwise specified or agreed upon in writing, the following colors will be used for copper wiring:

#### **Station Wiring (in-wall):**

Category 6 family: Black<sup>2</sup>, Purple  
Category 5e: Blue<sup>2</sup> or White<sup>2</sup>  
Wireless: Orange, Black<sup>2</sup>  
Low-skew: Grey, Maroon

#### **Patch cables:**

Category 6 family: Black<sup>2</sup>  
Category 5e: Blue<sup>2</sup>, White<sup>2</sup>  
Wireless: Orange, Black<sup>2</sup>  
Crossover: Red

Security devices (ePhones, CCTV, etc) do not require a different color cable (horizontal wiring or patch). However, they are to be marked using light red icons at each Patch Panel port.

#### **RESERVED ICON COLORS**

Light Blue (Ortronics OR-40326500) –	Telephone (non-security)
Light Red (Ortronics OR-40322500) –	Security (ephones, cameras, etc)
Light Orange (Ortronics OR-40323500) –	Wireless Arrays
Purple (Ortronics OR-40327500) –	A/V devices
Light Green (Ortronics OR-40325500) –	Low Skew
White (Ortronics OR-40309200) --	Facilities (Energy Management, etc)

#### **RESERVED CABLE COLORS (in wall)**

Black	Category 6 family horizontal wiring AND patch cables
White	Category 5e horizontal wiring AND patch cables
Blue	Category 5e horizontal wiring AND patch cables
Grey	Low-skew
Maroon	Low-skew
Orange	Wireless Access Point/Array
Purple	Facilities' Functions/Building Controls
Red	Crossover patch cables

#### **Color Consistency**

Patch cables are to be a consistent color within a closet for a given application (ie Category 5e cables may be Blue or White, but only one of those colors is to be used in any single IDF). Similarly, horizontal station cabling for each wiring closet will be the same color for each Category-grade of copper. Do NOT confuse colors used for cabling with colors used for icons. Due to legacy installations, they are not always the same.

**CONTRACTORS ARE RESPONSIBLE FOR PROVIDING ENOUGH ICONS OF EACH COLOR BASED ON CABLE TYPES INSTALLED.**

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<sup>2</sup> Wireless feeds will be Orange, whether Cat 5e, Cat 6 or better. If orange is not available, Black Cat 6 (or better) may be used

## Appendix I

### Cable Certification Requirements & Sample Cable Test Reports

The following are the minimum testing requirements to be submitted for Coax (video), UTP (xBaseT/Data), Telco trunk and Fiber Optic (Single and Multimode). Note, a value of "Pass/Fail" is only acceptable for non-quantifiable values (e.g presence of mechanical connectors) and for an overall rating of the cable. Actual values are otherwise expected.

#### Coax (75Ω)

Length  
Continuity  
Short identification  
Splitter/mechanical connector identification  
Overall Pass/Fail

#### UTP (Category 5e @ 100MHz, Category 6 family @ 250MHz)

Length  
Crossed-wire identification  
Crossed pair identification  
Continuity/Split-wire identification  
Insertion loss fault  
Bandwidth fault  
Delay skew  
dB loss  
Mechanical connector/splice identification  
Overall Pass/Fail

#### Telco trunk

Open-loop conductor identification  
Low-loop current  
High-loop current  
Short identification  
Crossed-pair identification  
dB loss  
split connections

#### Fiber Optic cable (Multimode @ 850/1300nm, Singlemode @ 1310/1550nm)

OTDR trace, identifying:  
Wavelengths  
Cable length  
Power loss (dB)  
Faults (breaks, splits, cracks, faulty connectors)  
Presence of mechanical/fusion splices  
Overall Pass/Fail

**NO WIRING JOB IS CONSIDERED COMPLETE, NOR WILL IT BE CONSIDER SUCH, WITHOUT THE SUBMITAL AND ACCEPTANCE OF TEST REPORTS.**

The following are sample Certification Reports. Not all cable types are represented in these samples. The samples are meant as a guideline. Graphs are required for all fiber documentation. They are preferred, but not required, for Category 6 family of cabling. Graphs are not necessary for copper cables of quality less than Category 5e. While the samples below come from Fluke, Salem State University does not endorse or require the use of any particular cable reporting tool.



**Cable ID: 3A-K017**

**Test Summary: PASS**

Date / Time: 03/02/2007 11:52:11am  
 Headroom: 10.7 dB (NEXT 12-36)  
 Test Limit: TIA Cat 6 Channel  
 Cable Type: Cat 6 UTP

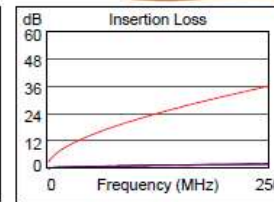
Operator: Helmut  
 Software Version: 1.3100  
 Limits Version: 1.0200  
 NVP: 69.0%

Model: DTX-1800  
 Main S/N: 8582197  
 Remote S/N: 8649008  
 Main Adapter: DTX-CHA001  
 Remote Adapter: DTX-CHA001

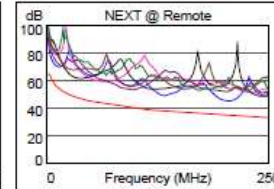
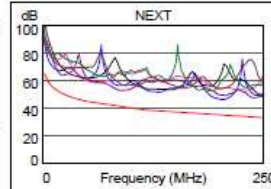
Wire Map (T568B)  
**PASS**



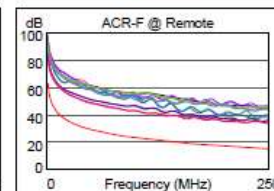
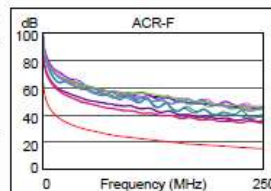
Length (ft), Limit 328	[Pair 12]	16
Prop. Delay (ns), Limit 555		23
Delay Skew (ns), Limit 50		0
Resistance (ohms)	[Pair 12]	1.0
Insertion Loss Margin (dB)	[Pair 45]	33.9
Frequency (MHz)	[Pair 45]	250.0
Limit (dB)	[Pair 45]	35.9



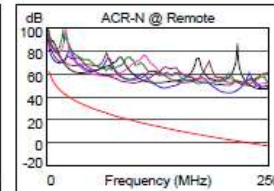
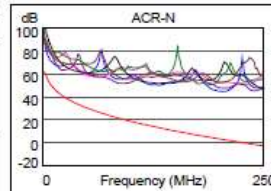
	Worst Case Margin		Worst Case Value	
	MAIN	SR	MAIN	SR
<b>PASS</b>				
Worst Pair	12-36	12-36	12-36	12-36
NEXT (dB)	11.7	10.7	11.7	10.7
Freq. (MHz)	202.5	202.5	202.5	204.5
Limit (dB)	34.7	34.7	34.7	34.6
Worst Pair	36	36	36	36
PS NEXT (dB)	12.7	12.7	12.7	12.7
Freq. (MHz)	202.5	202.0	202.5	204.0
Limit (dB)	31.8	31.8	31.8	31.7



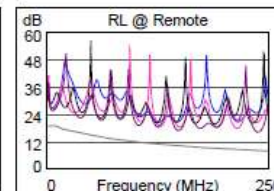
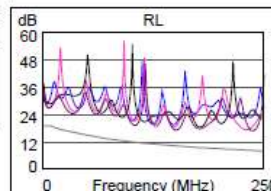
	Worst Case Margin		Worst Case Value	
	MAIN	SR	MAIN	SR
<b>PASS</b>				
Worst Pair	36-78	78-36	78-36	36-78
ACR-F (dB)	17.9	17.9	18.6	18.6
Freq. (MHz)	155.0	155.0	247.0	247.0
Limit (dB)	19.5	19.5	15.4	15.4
Worst Pair	36	36	36	36
PS ACR-F (dB)	18.0	18.2	18.4	18.4
Freq. (MHz)	223.0	215.5	247.5	242.0
Limit (dB)	13.3	13.6	12.4	12.6



	Worst Case Margin		Worst Case Value	
	MAIN	SR	MAIN	SR
<b>N/A</b>				
Worst Pair	12-36	12-36	12-36	12-36
ACR-N (dB)	20.9	18.8	41.9	41.0
Freq. (MHz)	8.5	4.9	202.5	204.5
Limit (dB)	51.9	57.2	2.9	2.7
Worst Pair	36	36	36	36
PS ACR-N (dB)	22.1	19.8	42.9	43.0
Freq. (MHz)	9.3	4.9	202.5	204.0
Limit (dB)	48.5	54.7	0.0	-0.2



	Worst Case Margin		Worst Case Value	
	MAIN	SR	MAIN	SR
<b>N/A</b>				
Worst Pair	78	78	78	78
RL (dB)	6.9	6.4	8.6	7.9
Freq. (MHz)	149.5	36.5	238.0	238.5
Limit (dB)	10.3	16.2	8.2	8.2



Compliant Network Standards:  
 10BASE-T      100BASE-TX      100BASE-T4  
 100BASE-T      ATM-25      ATM-51  
 ATM-155      100VG-AnyLan      TR-4  
 TR-16 Active      TR-16 Passive





**Cable ID: FIBER 11**

**Test Summary: PASS**

Date / Time: 04/16/2007 07:41:57am  
 Test Limit: General Fiber  
 Cable Type: Multimode 62.5

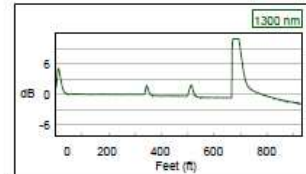
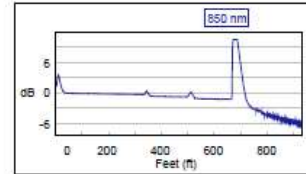
Operator: JOHN ADAMS  
 Software Version: 1.4516  
 Limits Version: 1.2000  
 End1: EQUIPMENT ROOM  
 End2: FLOOR 9 TR

Model: DTX-1800  
 Main S/N: 9348009  
 Main Adapter: DTX-OTDR-QMOD

**OTDR End1 PASS**

Date / Time: 04/16/2007 07:41:56am  
 Cable Type: Multimode 62.5  
 Tester: DTX-1800 (9348009 v1.4516)  
 Module: DTX-OTDR-QMOD (8000011 v1.4516)  
 Overall Length: 666.7 ft. **PASS**  
 Overall Loss  
     850 nm: 1.24 dB **PASS**  
     1300 nm: 0.70 dB **PASS**  
 ORL: N/A

Location (ft)	850 nm (n=1.4560)		1300 nm (n=1.4510)	
	Loss (dB)	Status	Loss (dB)	Status
0.0	N/A	N/A	N/A	N/A
336.6	0.32	PASS	0.26	PASS
501.0	0.32	PASS	0.17	PASS
666.7	N/A	N/A	N/A	N/A





**Cable ID: SM Length/Loss**

**Test Summary: PASS**

Date / Time: 04/04/2003 02:28:55pm  
 Headroom: 0.57 dB (Loss)  
 Test Limit: TIA-568B Fiber Backbone  
 Cable Type: AFL Singlemode, SMF

Operator: TOM  
 Software Version: V1.3.138  
 End1: MAIN END1  
 End2: MAIN END2

Model: OptiFiber

**Loss End2-1 PASS**

Date / Time: 04/04/2003 02:28:40pm  
 Cable Type: AFL Singlemode, SMF  
 Tester: OptiFiber (HM22 V1.3.138)  
 Module: OFTM-5632 (9999904 V1.3.138)

Propagation Delay (ns)	1374.8	
Length (ft)	922.5	PASS
Limit 10405		
	1310 nm	1550 nm
Result	PASS	PASS
Loss (dB)	0.55	0.38
Loss Limit (dB)	2.24	2.24
Loss Margin (dB)	1.69	1.88
Reference (dBm)	-10.74	-10.87

n = 1.4860  
 Number of Adapters: 2  
 Number of Splices: 2  
 Reference Date: 04/03/2003 04:33:08pm  
 Method A.1

**Loss End1-2 PASS**

Date / Time: 04/04/2003 02:28:55pm  
 Cable Type: AFL Singlemode, SMF  
 Tester: OptiFiber (8129031 V1.3.138)  
 Module: OFTM-5632 (9999908 V1.3.138)

Propagation Delay (ns)	1374.8	
Length (ft)	922.5	PASS
Limit 10405		
	1310 nm	1550 nm
Result	PASS	PASS
Loss (dB)	1.67	1.28
Loss Limit (dB)	2.24	2.24
Loss Margin (dB)	0.57	0.98
Reference (dBm)	-10.80	-10.62

n = 1.4860  
 Number of Adapters: 2  
 Number of Splices: 2  
 Reference Date: 04/03/2003 04:33:08pm  
 Method A.1

**Compliant Network Standards:**

- |                            |                           |                           |
|----------------------------|---------------------------|---------------------------|
| FDDI                       | 1000BASE-LX               | 10GBASE-LX4               |
| 10GBASE-L                  | 10GBASE-E                 | ATM 52 Fiber Optic        |
| ATM 155 Fiber Optic        | ATM 622 Fiber Optic       | Fibre Channel 268         |
| Fibre Channel 100-SM-LC-L  | Fibre Channel 200-SM-LC-L | Fibre Channel 400-SM-LC-L |
| Fibre Channel 1200-SM-LC-L |                           |                           |

Fibre Channel 1200-SM-LC-L: This channel is certified for 1200 Megabytes per second Fibre Channel application over singlemode fiber with long wavelength 1310 nm laser source.



**Cable ID: SM OTDR**

**Test Summary: PASS**

Date / Time: 04/14/2003 04:55:18pm  
 Test Limit: General Fiber  
 Cable Type: Generic, SMF

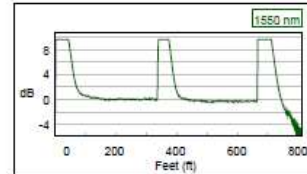
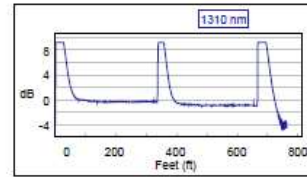
Software Version: V1.3.143  
 End1: DATA CENTER  
 End2: CLOSET

Model: OptiFiber  
 Main S/N: HM21  
 Main Adapter: OFTM-5632

**OTDR End1 PASS**

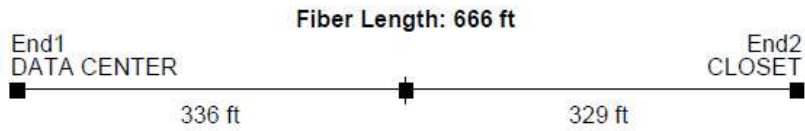
Date / Time: 04/14/2003 04:54:06pm  
 Cable Type: Generic, SMF  
 Tester: OptiFiber (HM21 V1.3.143)  
 Module: OFTM-5632 (9999909 V1.3.143)  
 Operator: PV PERSON  
 Comment: 100M SPOOL  
 Overall Length: 668.8 ft  
 Overall Loss  
 1310 nm: 0.92 dB **PASS**  
 1550 nm: 0.33 dB **PASS**  
 ORL: N/A

Location (ft)	1310 nm (n=1,4660)		1550 nm (n=1,4670)	
	Loss (dB)	Status	Loss (dB)	Status
93.1	0.25	PASS	N/A	N/A
336.5	0.56	PASS	0.31	PASS
666.0	0.00	PASS	N/A	N/A
668.8	N/A	N/A	N/A	N/A



**ChannelMap**

Date / Time: 04/14/2003 04:51:56pm  
 Tester: OptiFiber (HM21 V1.3.143)  
 Module: OFTM-5632 (9999909 V1.3.143)  
 Operator: PV PERSON



## Appendix J

### Design & Bid Document Inclusion Checklist

The following items should be included in Bid Specifications for Construction and Renovation Projects. All items below are relevant to new construction. With respect to renovated spaces, ITS/Networking should be consulted prior to issuing bid documents to verify applicable items.

This appendix is meant as a template to remind those creating bid documents of the items that should be included in those documents. By including these items, it is implied that these items will comply with the standards defined in this document with respect to material, quality, quantity and installation.

#### MDF/IDF

- Racks
- Rack placement
- Pathways in to MDF/IDF, Cable Tray, Capacity
- Room Size
- Cable Management – vertical and horizontal
- Electric – PDU's, UPS's (local or central), outlets (quantity, location, type), Room Lighting
- HVAC – Cooling, Venting
- Fiber Optic LIU's – existing (need to be converted to LC?), placement
- Layout of room
- Rack Elevation design
- Panels – Coax, Voice, Data; icons
- Non-IT equipment in IDF/MDF\* – card access panels; AV equipment; Alarm panels
- Card Access to room
- Patch Cables
- Labeling of panels, LIU's, racks

#### Work/Living Spaces

- Jacks
- Faceplates
- Cable types and colors
- Placement of jacks in modular work spaces (location and type, to be coordinated with furniture manufacturer)
- Installation of wireless antennas/access points/arrays
- Labeling of jacks

#### Interconnect/Backhaul feeds

- Existing capacity
- New copper, fiber (epoxy/polish), wireless connectivity – fiber types/connectors, pair counts
- Conduits, pathways

#### Global

- Required** documentation – test results (fiber, copper, coax); cut sheets. Test results and cut sheets must be submitted 1 week prior to facilities opening.

**\*MUST be coordinated with Networking Services BEFORE bid.**

## 12-Month Change Log

This log documents changes to this document over the previous 12 months.

### 11/7/2023

- Page 3
  - Changed <http://www.salemstate.edu/18860.php>
  - TO: <https://records.salemstate.edu/policies/low-voltage-wiring-standards>
- page 4
  - Changed Warranties will be in effect based on manufacturer's stated schedule.
  - TO: Warranties will begin no sooner than the Certificate of Occupancy date
  - Changed Samples of cable terminations; dressing; fiber polishing are presented in Appendix G.
  - TO: Samples of expected cable terminations, dressing and fiber polishing quality are presented in Appendix G.
- Page 5
  - Sorted Definitions
  - Added definitions for VoIP Gateway, Media Pack
- page 6
  - corrected typo "not" to "no" under Audio Cable.
  - corrected inconsistency in service loop requirement from "1.5 meter" to "5 meter"
  - clarified service loop requirements to trunk and fiber optic cabling
- page 8
  - clarified that Non-Wireless Access Point locations should only exist within reasonable proximity to electric outlets.
  - added note 3-Salem State is currently considering eliminating Wall Phones. Projects should verify their cabling need
- Page 9
  - clarified example for 2-port faceplate label
- Page 10
  - MDF Configuration:
  - Added paragraph
    - "Information Technology is open to sharing MDF space for tangential data-communications (e.g Energy Management, Door Access Panels, etc). However, the primary usage of these spaces is for Data Communication Infrastructure. If the secondary non-ITS functions cannot respect the sizing needed to support ITS' core usages of these spaces, they will need to be placed elsewhere."
  - 2nd paragraph -
    - Changed "If the room is on a generator, this sizing can be halved"
    - To "UPS's should be sized for a minimum runtime of 30 minutes. If the room is on a generator, the runtime can be sized appropriate to the generator's startup/stabilization"
- Page 11
  - Changed "To support Voice Over IP (VoIP) services, space will be made available to place a VoIP gateway/Media Pack. Unless impractical for a specific implementation, SBC's will be placed in the MDF's, with riser trunks feeding IDF's. In the MDF, blocks/panels supporting IDF copper trunks will be blue."
  - TO "To support Voice Over IP (VoIP) services, space will be made available to install a VoIP gateway/Media Pack (generally 1U) and horizontal cable management (2U). Unless impractical for a specific implementation, Media Packs will be placed in the MDF's, with voice riser trunks feeding IDF's. Blocks/panels supporting IDF voice copper trunks will be blue. "

- added sentences "If a Media Pack that is greater than 8 ports is to be installed, an appropriate data panel will accompany it. Note that these panels may require a 50-pin telco/Amphenol connection. NOTE: 4 and 8 port Media Packs do not require an accompanying panel, but will require a shelf."
- Page 12
  - IDF Configuration
    - Added paragraph
      - "MDF Configuration:
    - Added paragraph
      - "Information Technology is open to sharing IDF space for tangential data-communications (e.g Energy Management, Door Access Panels, etc). However, the primary usage of these spaces is for Data Communication Infrastructure. If the secondary non-ITS functions cannot respect the sizing needed to support ITS' core usages of these spaces, they will need to be placed elsewhere."
- Page 13
  - Removed redundant phrase "Using the common left-to-right Western reading format, the "left-most" rack is the rack that is logically the starting point" from 1st paragraph
  - added "If a multi-closet UPS is not servicing the building," to 2nd paragraph under Environmentals
- Page 14
  - Moved section discussing use of Semtron faceplates for flatpanel TV installations to Page 16, Digital Signage Section
  - Added "The following section is a guideline for generic site definition/draft. Salem State Police should be consulted before any documents are finalized and/or sent to bid." to ePhones & CCTV section
- Page 15
  - **\*\*Skipped section on CCTV. Talk with Nick DiFranco about this\*\***
- Page 17
  - Changed first sentence from "When mounting a wireless access point to an acoustical ceiling tile (ACT), the mounting bracket is to be centered on the tile and not attached to the supporting bracket."
  - to "When mounting a wireless access point to an acoustical ceiling tile (ACT), the mounting bracket is to be centered on the tile. Spline-attached brackets are not acceptable. "
- Page 19
  - Removed redundant sentence "All new installations will use LC connectors." from first paragraph
- Appendix C
  - Added word "subsequently" to 1st paragraph, 4th sentence.
  - Changed "current" to "published" in 2nd bullet (Notes:).
  - Changed data on 4th bullet from 1/1/2023 to 11/7/2023
  - Reformatted Wiring Closet Abbreviation Table
- Appendix F
  - Changed requirements under Central UPS and Local UPS's to bulleted lists from paragraph format, for easier reading
- Appendix G
  - Changed date of most recent Means & Methods from 27 February 2004 to February 2017

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