

## Low-Voltage Wiring Standards

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## **Preface:**

Salem State College has placed 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 IT/Networking Services or the CIO. With respect to Means & Methods, the Director of Facilities may also authorize exceptions. This document supercedes any specifications contained within formal Project Bid Documents. In the event of a conflict, the specifications contained within the Salem State College 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 IT/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 made to it. The most recent version is available on the Salem State College IT/Networking Services Homepage. Archival versions are available from Networking Services upon request.

## **Installer Credentials:**

Cabling contractors must be an approved vendor of the College, either by State ITT/ITC contract, MHEC contract or a College contract. All cabling products used must meet IEEE specifications. 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. Following termination, all cabling must be tested with a certification report given to IT/Networking Services.

## **Means & Methods:**

Installer will adhere to standards defined in the BiCSi Telecommunications Distribution Methods Manual for work environment, cable pulling – including handling and securing, termination and testing. Appendix E contains a boilerplate of procedures to be observed by the installer. A complete list may 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 in an Excel spreadsheet.

## **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 be in affect based on manufacturer's stated schedule.

## **Definitions:**

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

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."

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

Network port: A drop used for Network Access.

Voice port: A drop used for Voice Access.

Video port: A drop used for Video Access.

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 desktop computers and the College Network. It may contain "hub" connectivity for Video. The IDF will contain "passtru" patch panels for Voice.

MDF: The Main Distribution Facility. MDF's contain core network equipment, connectivity to the College 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.

## **Cable Type:**

All areas of the College are currently wired using at least Category 5 to the Desktop. Unless otherwise specified, all new wiring will be a minimum Category 5e. This includes both data and voice connections.

Fiber Optic Cable (62.5µ multi-mode) is used for connectivity between MDF and IDF (data only). In the event that an IDF is within 90 Meters from its MDF, some UTP will also be run between these facilities. Between MDF's, both multimode and single mode fiber is used. Quantities are defined as needed.

Voice-Grade Copper is run between MDF and IDF's to service voice needs on the riser. Either Voice-Grade Copper or Fiber is used between MDF's for voice, depending on the need and density of telephones serviced by the facilities.

Video cabling is standard RG-6 (less than 150') or RG-11 (greater than 150') terminated with F-connections. MDF to IDF coax is standard ½" coax. Two ½" cables are run between the MDF each IDF as well as between MDF's (intracampus only). Standard termination applies.

Audio Cabling will be specified based on specific application.

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

**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, 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:**

As of the Central Campus Renovation Project, the College has standardized on Ortronics Jacks and Faceplates. The Ortronics Series II System is to be used in Residence Halls and any environment where more durable systems are needed. The Ortronics TracJack System is used in all other areas. Previously, the College had used various other systems including AT&T, Hubble and Krone. In instances where these jacks/faceplates need to be replaced, they should be replaced with Ortronics products.

All cabling will be terminated under IEEE and BiCSi guidelines.

Under no circumstances with single-track raceway be used. The College has standardized on Panduit multi-track raceway. All raceway will be mechanically secured to the walls.

**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: 2 – 4 UTP lines per location
- Single Person Offices: 3 – 4 UTP lines + 1 coax (usually only 1 location)
- Office Cubes: 3 – 4 UTP lines per location
- Multi-Person Offices: 3 – 4 UTP lines per location; Add 1 coax to 1 location only
- Classrooms: 1 UTP in ceiling for wireless access point; 3 UTP + 1 coax in front and back
- Meeting Rooms: 1 UTP in ceiling for wireless; 3 UTP each location; 1 coax in front
- Labs: 1 UTP in ceiling for wireless; sufficient wiring at each desk/table for computers; 3 UTP + 1 coax in front of room
- Clerical Spaces (Copy/Storage Rooms): 4 UTP (usually 1 location)
- Wall Phones/Emergency Phones: 1 UTP
- Smart Classrooms: Wired as regular classrooms + 4 UTP/1 Coax in podium

NOTE: locations should only exist within a reasonable proximity to duplex outlets. Also, "Power Users" should have 1 or 2 extra UTP lines run to their work areas.

*Existing Locations:* If more wiring is needed in a given area, extra drops – beyond what is needed – should be added. E.g. if 1 drop is needed, 2 or 3 should be run.

**Jack Labeling:**

All Jack labels will be placed under the plastic inserts. Labels are not to be placed on the surface of the faceplate unless an insert does not exist.

Jacks are labeled using the following formats:

*1-4 Ports*

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

E.g. If the jack is connected to Port 35 on Panel C (Rack 2) in IDF MH215 the label would be (single or dual jack)

IDF MH215  
2C-35  
[jacks]  
2C-36

or (3 or 4 position jack)

IDF MH215  
2C-35 2C-36  
[jacks]  
2C-37 2C-38

Room numbers may take on different forms (e.g MH215, B1, etc). The racks, panels and ports remain consistent (see IDF Configuration section).

*5-6 Ports*

"IDF <IDF Room Number>"  
<Rack Number><Patch Panel Designation>-<Port Number>  
[jacks]  
<Rack Number><Patch Panel Designation>-<Port Number>  
<Rack Number><Patch Panel Designation>-<Port Number>

E.g

IDF MH215  
2C-35 2C-36  
[jacks]  
2C-37 2C-38  
2C-39 2C-40

More information is available in Appendix A.

**MDF Configuration:**

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 B for rack descriptions). In general, one (1) communications rack is sufficient for an MDF. If the MDF also acts as an IDF, an additional one (1) communications rack will be required as defined by "IDF Configuration" below.

A minimum of a 1.4KVA (rack-mount) or 1.5KVA (free-standing) SNMP-Manageable UPS will be placed in the MDF. UPS's will need to be sized, but in general one UPS is needed for every 300 watts of power consumption. All UPS's require a Network Management Card. A standard 110 duplex outlet is required for every communications rack in the room. Rack-mounted UPS's will require an open-box communications rack.

Fiber will be terminated using ST connections. Multimode and Singlemode will be terminated in separate fiber cans. The cans will be labeled with the Building and Room number of the other end of the fiber.

Voice trunks (copper) will either be terminated on the wall with 66 blocks, unless otherwise specified by Telecommunications. Blocks going to the Telecom Switch will be Green. Blocks going to the IDF will be Blue. 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.

*Environmentals:* The MDF must be a secure room and humidity levels must remain above 40% and non-condensing. If temperature remains between 55-75 degrees Fahrenheit, no cooling or heating is needed.

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

**IDF Configuration:**

In an IDF one (1) communications rack will be required for every 14 "u's" worth of patch panels (combination of Data, Voice and/or Video). A ratio of 2:1 u's of patch panel ports to cable management will be used. (ie for a 96-port panel – 2 u's – a 1 u cable management panel will be installed). For every fiber can and Category 3 voice patch panel installed, a 2 u cable management panel will be installed. For every 24-ports of data network equipment, a 1 u cable management panel will be used.

Two (2) communications racks (see Appendix B for rack descriptions) may be placed next to each other, with a minimum of 22" between the rack and the wall (standard relay rack) or 8" between the rack and wall (box rack). If more than two (2) racks will be placed next to each other, back-of-rack to wall clearances must be doubled. When placing racks in sets of two (2), a minimum of 30" is needed between sets. In all cases, a minimum of 36" is needed from the front of the rack to the front wall. If wall-mounted patch panels are to be used, measurements are to be taken from the front of these panels rather than the wall.

All UTP is to be terminated in a patch panel (Cat 5e or better). All new patch panels are to be Ortronics. Under no circumstances are 110/66 blocks to be used in IDF's for voice. A patch panel will be placed at the top of each communications rack for Voice Trunk ports only. If the IDF contains more than one (1) rack, the quantity of Voice Trunk ports will be divided equally to each rack. The Voice Trunk 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 Video cabling (RG-6 for distances less than 150', RG-11 for distances greater than 150') will be terminated in the same communications rack.

*Rack/Patch Panel Labels:*

Starting at the top of rack 1 (defined in next paragraph) and moving down the rack each panel will be labeled sequentially starting with "A" (ie Rack 1 Panel 1). Moving 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.

Rack 1 is the "left-most" rack. Using the common left-to-right Western reading format, the "left-most" rack is the rack that is logically the starting point within the room. More information is available in Appendix A.

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 number independent of others (ie they will all start at "1").

*Environmentals:* The IDF must be a secure room and humidity levels must remain above 40% and non-condensing. Network equipment is more tolerant of temperature changes. If temperature remains between 50-85 degrees Fahrenheit, no cooling or heating is needed.

One duplex 110 outlet per communications rack is required. A minimum of a 1.4KVA (rack-mount) or 1.5KVA (free-standing) SNMP-Manageable UPS will be placed in each IDF. UPS's will need to be sized, but in general one UPS 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.

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

**Special Considerations**

**Residence Halls:**

It has been our experience that the data jacks used in the offices, classrooms, labs and common areas throughout the College are not suited to the energetic behavior of resident students in their rooms. After extensive research, we found the Ortronics Series II line to be the most durable. To provide additional protection against stress and torque, 45° inserts should be used.

**Wiring Quantities:** 2 UTP (voice and data) “per pillow” + 1 coax per room. It has been our experience that rooms get over booked. Rooms should have 1 location per designed capacity + 1 extra location (e.g. a double room should have 3 locations). Common Areas should have 3 UTP per location. At least one location per Common Area will have 1 coax.

**ePhones & CCTV:**

At present, there is no standard in place defining what the cable bundle to an ePhone should be. At a minimum, an ePhone requires a standard telephone line. If a strobe/emergency light will be installed, power will need to be supplied. Similarly, wherever a CCTV camera will be present, coax, power and pan/tilt/zoom (PTZ) control lines (UTP) will be needed.

Minimum ePhone & CCTV Cable specifications:

**ePhone**

- Category 3 or better UTP or STP
- Power line (see below) if using a strobe or marker light

**CCTV Camera**

- RG59U coax\* (less than 750') or
- RG6 coax\* (less than 1100') or
- RG11 coax\* (less than 1500') or
- Multimode fiber (less than 2000 meters) or
- Singlemode fiber (more than 2000 meters)

**CCTV PTZ Controls** (only needed if the video is transported over coax)

18/4 UTP

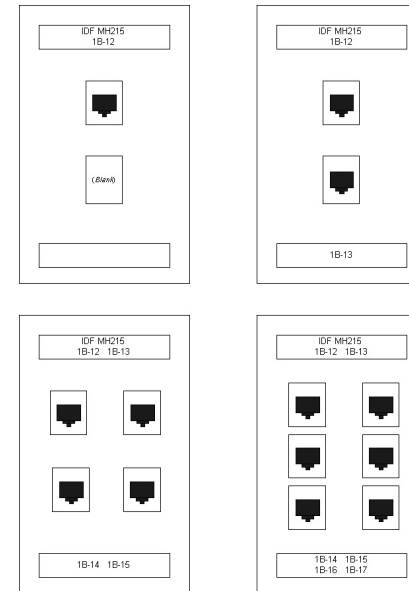
**Power for CCTV and/or Strobe/Marker Light**

- 18/2 UTP (less than 100')
- 16/2 UTP (less than 150')

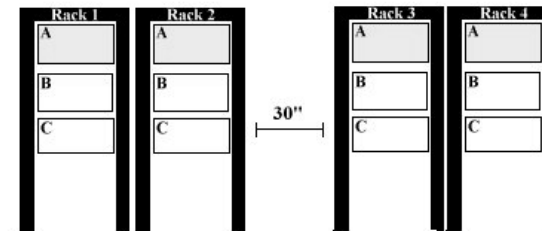
\*When using coax, 100% copper center conductor and a copper braid coverage of 96% or better.

**Appendix A**

**Jack Labels**



**Rack/Patch Panel Labels**



## Appendix B

### Racks

#### Standard Single Relay Rack:

Single Relay Racks are the standard "flat" racks used for patch panels and equipment that requires only a two-point mount. The College standard is the Hergo 19" Super Relay Rack. It can be seen at:

<http://www.hergo.com/index.asp?category=3&xsection=14&xview=v&xitems=627>

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 a power distribution. The College standard is the Hergo Super 19" Relay Rack System, 30"D. It can be seen at:

<http://www.hergo.com/index.asp?category=3&xsection=14&xview=v&xitems=605>

The power management option can be seen at:

<http://www.hergo.com/index.asp?category=7&xsection=71&xview=v>

This rack type is used in MDF's only.

#### Rack Enclosure:

The traditional box enclosure with sides, top, door and back. These enclosures must have both a top-mount dual fan and internal power distribution. The standard system may be seen at:

<http://www.hergo.com/index.asp?category=2&xsection=9&xview=a>

This rack type is used in MDF's and where ever a lockable rack is needed.

## Appendix C

### Sample Cut Sheet:

IDF	RACK	PANEL	PORT	JACK Room Number
106	1	B	1	112
106	1	B	2	112
106	2	B	3	151
106	2	C	1	151
106	3	B	1	151
106	3	C	1	152
212	1	B	1	200
212	1	B	2	200
212	1	B	3	203
212	2	B	1	204
212	2	C	1	204
212	2	C	2	206

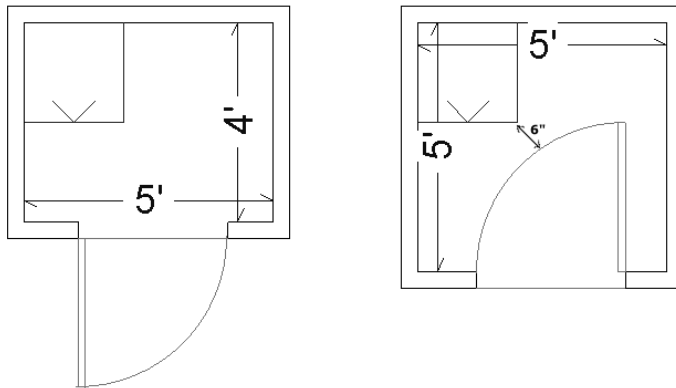
## Appendix D

### MDF/IDF Room Size Requirements:

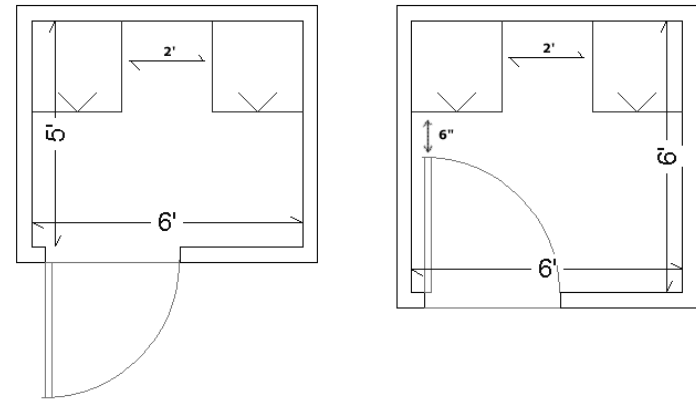
The following guidelines should be followed when configuring an MDF or IDF

- A margin of 6" must be maintained between the swing of the door and the front of a communication rack
- A margin of 2" must be maintained between the swing of the door and the side of a communication rack
- At least one side or the back of a communications rack must be accessible with a minimum of 2' clearance between that side and any obstruction (wall, rack, post, etc)
- If the layout of a room makes it necessary to walk between two racks to access other racks (ie creates a "hallway"), a 3' margin is to be maintained in that "hallway"
- For layout purposes, racks are assumed to be 2' x 2' (7'H)
- Ceiling heights are a minimum of 8'. Since fire codes usually require a minimum distance of 18" from a sprinkler head, a 9' ceiling is preferred.
- Port counts are determined by the TOTAL number of Voice Trunk Ports (Voice copper), Station Ports (Cat 5e) and Video ports (Coax) in a closet.

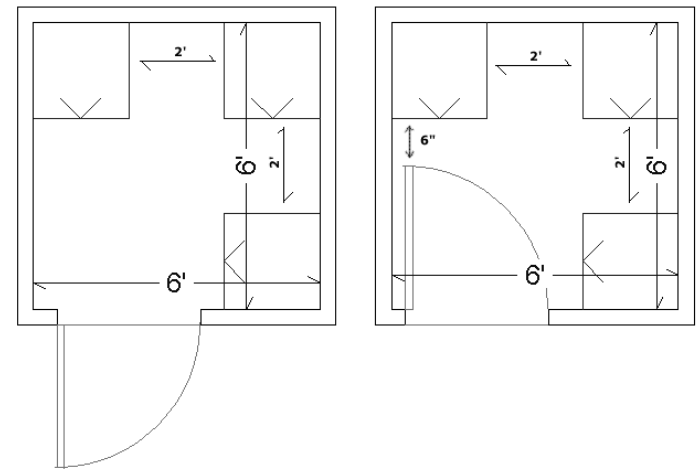
### IDF Minimum Sizes (less than 216 ports)



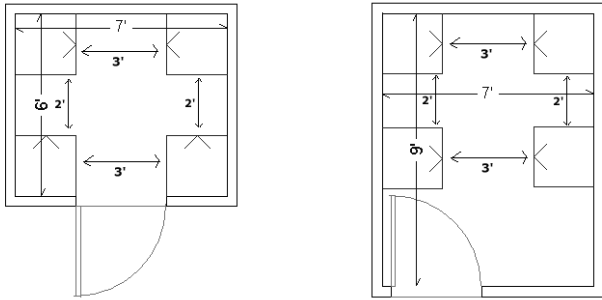
### IDF Minimum Sizes (216 - 408 ports)



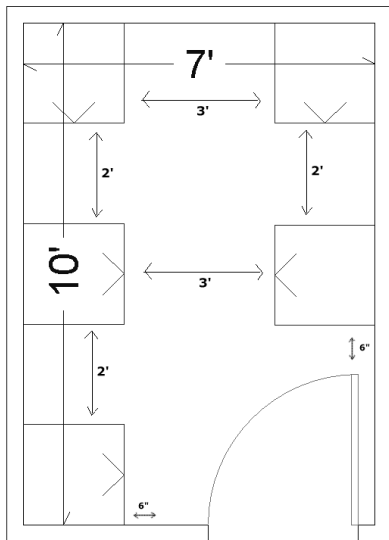
### IDF Minimum Sizes (408 - 696 ports)



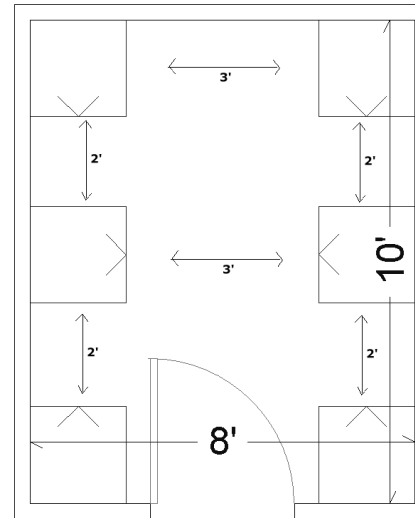
IDF Minimum Sizes (696 - 1080 ports)



IDF Minimum Sizes (1080 - 1488 ports)



IDF Minimum Sizes (1488+ ports)



## Appendix E

### 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 College. As of 27 February 2004, 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 reinserted by the close of business each day. It is the responsibility of the contractor to provide all ceiling tile replacements necessary. 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 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 College 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 College 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.

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