



**Columbus Regional Airport
Authority**

Technology Services

Cabling Standards

 COLUMBUS REGIONAL AIRPORT AUTHORITY	Version: 1.8	
	Date: 07/2011	
Official Documentation: Cabling Standards		

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NOTE: As of this publication, the current document is **95%** complete. Specific areas that are not complete include:

- Fiber Products Selection
- Equipment (Switches, UPS's, environmental monitoring units)
- Submittals
- Fire stopping.

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Introduction

This document includes and/or references all relevant standards to support, maintain, and install a structured cabling system.

Purpose

The purpose of this document is to provide manufacturer's specific standards. This will guide the installation process with specific elements involved in an acceptable CRAA structured cabling system. This document will present manufacturer's installation guidelines and part descriptions. The intent of this document is to be detailed enough to eliminate any confusion as to what is expected by CRAA. It is the installer's responsibility to make bids, quotes, or proposals compliant with the most recent version of this document. The standards in this document replace all previous standards. This document makes no guarantee that it is 100% up to date with the manufacturer's requirements for warranties. The installing company has the ultimate responsibility to be knowledgeable of any changes to warranty requirements. All exceptions and variances from this document require CRAA approval.

Referenced Standards

The design of the system and the selected equipment will conform to the following standards where applicable. It is assumed that all installers engaged in the installation and service of the network has access to and knowledge of the following current standards. It is the responsibility of the installer to be knowledgeable of all Federal, State, and local codes. If any of the standards conflict with any codes then the most stringent applies.

- Americans with Disability Act Accessibility Guidelines for Buildings and Facilities (ADAAG)
- American National Standards Institute (ANSI)
- American Society for Testing and Materials (ASTM)
- American Standards Association (ASA)
- Building Industries Consulting Services International (BICSI) Telecommunications Wiring Standards
- Building Officials and Code Administrators (BOCA) International Inc. Basic Building Code, BOCA Basic Plumbing Code, BOCA Basic Mechanical Code

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- Electronics Industry Association/ Telecommunication Industries Association (EIA/TIA) 568/569/606/607
- FCC Codes and Regulations
- Institute of Electrical and Electronics Engineers (IEEE), especially IEEE 802.2 and 802.3, 1100-19992 (Powering and Grounding)
- International Telecommunications Union (ITU)
- National Board of Fire Underwriters (NBFU)
- National Bureau of Standards (NBS)
- National Electric Code (NEC)
- National Fire Protection Association (NFPA) 101 Life Safety Code
- State Electrical Code and/or National Electrical Code (NEC)
- State Building Code
- Rural Electric Association - Telephone Division Standards
- Underwriters Laboratories, Inc. (UL), Federal Specifications
- Williams-Steiger Occupational Safety and Health Act of 1970 (OSHA) - Public Law 91-596

Submittals

- **Pre-Installation**
Information submitted at the time of Bid, Quote, or Proposal.
- **Installer Requirements (proof of current certifications):**
 - Employee Certifications
 1. Two fulltime employed RCDD's.
 2. On site supervisors is a BICSI level 2 Technician.
 3. 100% Employees performing terminations are BICSI and/or Manufacturer certified.
 4. Minimum of 50% onsite installers are BICSI certified.
 - Company Certifications
 5. Panduit PCI current certification (valid for two years).
 6. Corning NPI current certification.
- **Note: Approval is contingent upon installer's employees obtaining CRAA badges. Please contact our ID office for badge cost and identification requirements.**

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-Documentation listing all Part Numbers, Quantities, Spec Sheets, Installation Instructions, MSD Sheets, Tools and Methods of Installation of all elements.

- **Post Installation**

Test results

1. Copper - Hardcopy and electronic version will be provided from a Fluke tester only (field test results must contain all test data and not a modified electronic version). Model Fluke DTX1800 preferred, other models must be approved by CRAA.
2. Fiber (Single Mode) - Hardcopy and electronic version is to be supplied (field test results must contain all test data and not a modified version). Fiber is to be tested with dual wavelengths (1310 nm, 1550 nm) in both directions. If requested by CRAA, OTDR tests results will be provided in both directions for every fiber (OTDR test results will be required if any splices are done).

As Built Drawings

New construction, remodeling, or installations greater than 10 data lines require "As Built" drawings. Fewer than 10 data lines will require updates to current drawings.

All drawings will show:

1. Horizontal Cabling
2. Back Bone Cable
3. Pathways (including size and type)
4. Pull Boxes & Manholes
5. Fire Stop Pathways

All elements of the cabling infrastructure will be labeled on the prints as indicated in this document.

Three sets of drawings are to be provided on 24in x 36in paper. One set of drawings will be posted in the TR. One set presented folded in a pouch in the Post Insulation three ring binder. One set delivered in a protective tube.

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An electronic version of the drawings will be provided in a CAD & PDF format.

Warranties

-Panduit® Certification PlusSM System Warranty

The installer will provide the original copy of this certification.

The certification will be for a 25 year Warranty

-Corning Warranty

The installer will provide the original copy of this certification.

The certification will be for a 25 year Warranty

• **Installation is Complete When:**

1. All items on the Punch Out list are complete
2. All Post-Installation and copies of the Pre-Installation items are provided in a yellow two-inch three ring binder. The binder will be labeled on the spine with project name, project number and completion date.
3. Photographs of all fire pathways and outside plant access points have been provided.
4. Telecommunication Grounding Busbar TGB resistance to ground test results.
5. All items above have been reviewed, & approved by CRAA.

Installer Requirements

Installers must satisfy the following requirements:

PANDUIT CERTIFIED INSTALLER (PCI) CERTIFICATION

- Decision to offer PCI status is determined by the local sales team (Sales Rep, DSM, and RVP).
- Minimum Staffing Requirements:
 - Two (2) individuals or 20% of their techs, whichever is greater, on staff who are Panduit Certified Copper Technicians
 - Two (2) individuals or 15% of their techs, whichever is greater, on staff who are Panduit Certified Fiber Technicians
 - PCIs must maintain full-time technicians as direct employees as opposed to only working through sub-contractors.

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- One (1) full-time RCDD on staff.
- Note:** PCI certification is valid for two (2) years

CORNING CABLE SYSTEMS CERTIFIED INSTALLER (NPI)

CRAA ADDITIONAL REQUIREMENTS

- The installer must employ a minimum of two full-time RCDD's with current certifications. The onsite supervisor must have a minimum level two BICSI certification. There must be a minimum of 50% total on site installers having BICSI certification. Terminations must be performed by 100% BICSI and/or manufacturer certified installers. All certifications must be current and copies presented at time of pre-installation submittal.

Approved Cabling Infrastructure Manufacturers

Approved manufacturers include:

- Appendix A: Panduit® Copper Solution
- Appendix B: Cooper B-Line (Pathways)
- Appendix C: Corning® (Fiber Solution)
- Appendix D: STI® (Fire Stop Solution)

Telecommunications Outlet

The telecommunications outlet is the physical interface (typically RJ-45 female for copper) in the horizontal cabling system into which a network patch cable is usually connected. It is also sometimes referred to as a network "Module", "jack" or "port".

Quantities and Locations

- 2 jacks per Office
- 2 jacks per Cubical
- 1 jack per Printer
- 1 jack per Wireless Access Point

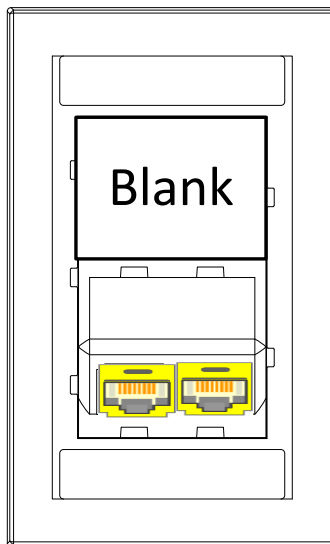
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- 1 jack per AMAG
- 1 jack per TUGMAN
- 1 jack per Key Box
- 1 jack per METASYS
- 1 jack per Time Clock

Types and Parts

- Face plate (one gang or two gang)
- Face plate will have the top half blanked off.
- Face plate will have jacks in the bottom ports only (to allow for proper bend radius of the cable).
- Face plates will be Off White in color
- Face plates will attach to:
 - A Low voltage wall board adapter capable of replacing an electrical box in Class 2 low voltage installations (with a deep internal wall clearance).
 - Deep two gang electrical outlet box with a one gang reducer plate.
 - Deep low voltage surface mount outlet box

Note: Exiting outlet box from the side and bottom of the box should be avoided if possible.
- Jacks at the outlet will be Cat 6A yellow and terminated 568B.



Typical One Gang Face Plate Assembly

Surface Mount Box (two port)

- Use Two Port Surface mount boxes in all other applications unless specified. Color to be specified by CRAA (black or off white)
- Time Clocks are to have one jack only (no surface mount box is required).

See [Appendix A](#) for all copper related part numbers and manufacturer's installation requirements.

Surface Raceway and Vertical Outlet Pole

"Surface raceway and vertical outlet poles" refers to a surface raceway system used for branch circuit wiring and/or data network, voice, video and other low-voltage cabling. Surface raceway will be used in solid wall applications or for applications where fishing the wall is not an option. The raceway system will consist of raceway, appropriate fittings and accessories to complete installation per electrical and/or data drawings. Non-metallic surface raceway is to be utilized in dry interior locations only, as covered in Article 388 of the NEC, as adopted by the NFPA and as approved by ANSI. No fittings will be used that violate the minimum bend radius requirements of the cable (4 x the outside diameter of the cable for cat6 A). See [Appendix A](#)

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Single Channel Surface Raceway System

Single Channel Surface Raceway will be a one piece design. Raceway dimensions will be: 1.51" wide x 0.94" deep with an approximate wall thickness of 0.055". The raceway will be available in 6', 8' and 10' lengths, have a tamper resistant hinge attaching the cover to the base, and have tamper resistant non-slip cover design. The raceway will be manufactured of rigid PVC compound, have a smooth texture, and be available in the color off white.

Fittings

A full complement of fittings (LD10 series) must be available including but not limited to entrance fittings, couplers, and end caps. The fittings will provide a means for connecting to the raceway and will be capable of maintaining a 1.25" minimum cable bend radius. Applicable fittings will be of cover only design (for low voltage cabling only), or base and cover design in order to maintain complete enclosure and to eliminate mitering.

Outlet Boxes

The junction boxes will be available in one gang deep version. The boxes will be available in the color off white and match the raceway.

Labeling Elements

- **Patch Panel Port Number**
 - 01 to 48
- **Patch Panel Identifier**
 - A to Z excluding O & I (eliminate confusion with zero and one)
- **Building (Columbus Airport)**
 - AF-ARFF
 - AM-Airfield Maintenance
 - BL-Blue Lot
 - CH-CEO House
 - CO-Cross Over
 - EP-Employee Parking
 - EV-Electrical Vault
 - GL-Glycol

- GR-Green Lot
- GS-Guard Shack
- HS-Hot Site
- LA-Lane Aviation
- NT-New Tower
- OT-Old Tower
- PA-Parking
- PT-Police Training
- RL-Red Lot
- SB-Shuttle Bus
- SR-Shipping/Receiving
- TE-Terminal
- TO-TOC
- NM- North Matrix (Inline Baggage)
- SM- South Matrix (Inline Baggage)

Building (Bolton Airfield)

Building (Rickenbacker Airport)

Campus

- B- Bolton Airfield
- C- Columbus Regional Airport (CMH)
- R- Rickenbacker Airport (LCK)

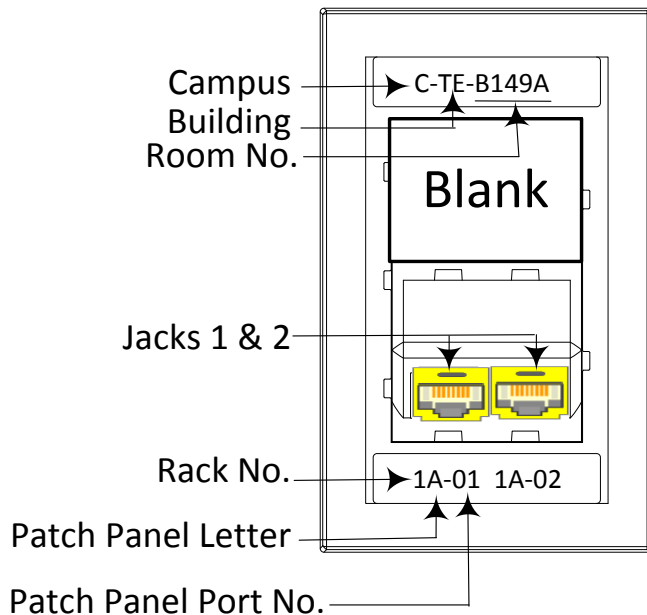
Face plate labeling format

The top label has the:

- Campus
- Building
- TR Room Number (Sector, Floor, Room, and Sub Sector)

The bottom label consists of:

- Rack Number
- Patch Panel Letter
- Patch Panel Port Number for two Jacks.



Typical Faceplate Labeling Format

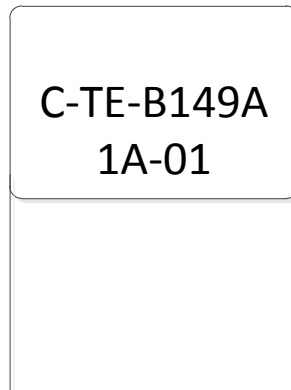
Horizontal Cabling (Indoor Copper)

All cable runs throughout a site will be done in accordance to the cable and module connector manufacturer's specifications to maintain the integrity of the run. Wire damaged through poor installation such as incorrect bends, kinks, knots, friction burns, smashed or installed on/near sources of EMI (See [Appendix E](#)) must be removed and replaced with properly installed cable runs. The length of the copper horizontal cabling connecting a telecommunications outlet to patch panel in the TR must not exceed 90 meters or 295 feet (the maximum distance as specified in the ANSI/TIA/EIA 568-B standards for Category 6A cabling). This cable must be plenum Category 6A performance at 500MHz and Yellow in color. The cable manufacturer's specifications are in [Appendix A](#).

Labeling Cables

Cable runs have a unique matching identifier at each end of the cable. The unique identifier is mechanically generated on a self-laminating wraparound label. One label will be placed 12 inches back from the faceplate jack and three inches back from the patch panel jack. All wraparound labels will have the same information that is on the face plate. The first line on the label will have **Campus – Building - TR Room Number**. The second line on the label

will consist of **Rack Number - Patch Panel Letter - Patch Panel Port Number**.



Cable Label

Conduit (at Outlet)

Whenever conduit is used the minimum size for one work station (two data cables) is one inch trade size. The junction box required is a deep two gang box with a one gang reducer.

Horizontal Cabling Outdoor (copper & fiber)

All cable that travels below grade (regardless if it is inside a structure) will be outdoor rated cable. All out door cable terminations will be housed in a climate controlled environment or a weather proof environment (not a weather resistant environment).

- A **weather proof environment** is defined as an enclosure being rated to NEMA 4X or IEC IP66. A weather proof enclosure should be used as a last resort. When a weather proof enclosure is used it should contain a moisture absorbent material that can be changed periodically. The company that is installing the electronic equipment will provide specifications for acceptably temperature and humidity ranges for all equipment. The installing company will be responsible for implementing the equipment that can function in this environment. The enclosure will have an environmental monitoring system that is connected to CRAA's network.

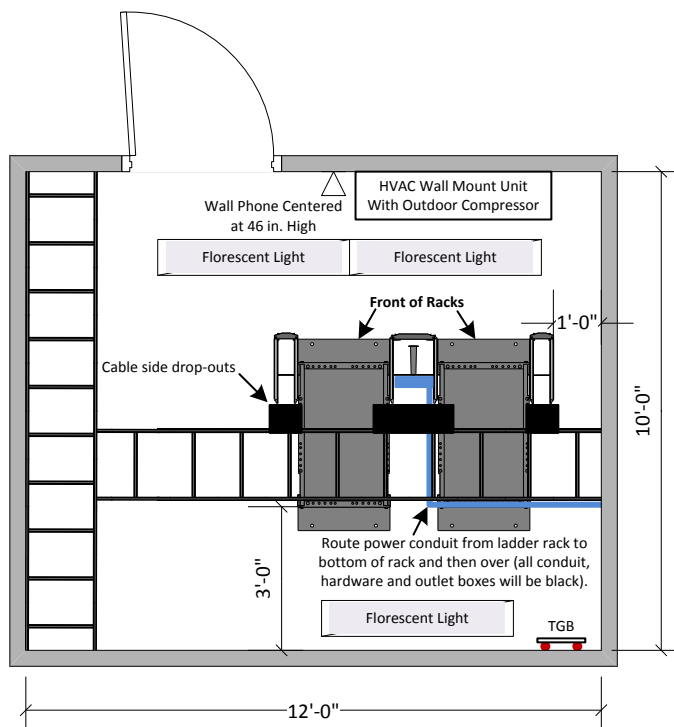
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Telecommunications Room (TR)

There are typically one or more rooms per floor in a building. The telecommunication room should be located at the center of a 200 ft. radius of the area serviced. The Horizontal cabling length from patch panel (in the TR) to outlet will not exceed 295 ft. There needs to be a 10 ft. service loop in the TR for all horizontal cabling. A 20 ft. service loop is required for all fiber backbone cabling located in the TR. The TR space is secured such that authorized personnel only are allowed entry. The access door to the TR will be card access with a key override. Entry door will be a minimum of 3 ft. wide and 7 ft. high without doorsills, windows, and hinged to open outward (code permitting). These spaces will not be dual-purposed or shared with anything (such as supply rooms). The size of the TR will not be smaller than 10 x 10 (10x12 preferred) and will be larger based on the number of locations served. A minimum of two 19-inch racks (four posts) should fit in the space with 3 feet of clearance on the front and back of equipment. The rack nearest the wall will have twelve inches of clearance between the side of the wire manager and the wall. TR rooms should not have drop ceilings. All TR's will have a wall phone located near the doorway at 46 inches high. All walls will be covered with $\frac{3}{4}$ inch fire rated plywood Class 1 per ASTM E84-01 Standard test Method for Surface Burning Characteristics of Building Materials. All plywood will be installed finish side out with the 8 ft. side vertical and 12 inches off the floor. If plywood is painted then one fire rating stamp on each sheet will be left unpainted (preferably up towards the top of the sheet). If plywood is painted then a white fire proof paint will be used (codes permitting painting).

Note:

- Keep florescent Lights a minimum of 3 ft. away from racks & ladder rack
- All walls covered with void free A/C grade plywood mounted finished side out. Fire rated plywood will be used and painted with white fire-retardant paint (two coats). Plywood will be mounted 8 ft. side vertical and 10 in. off the floor.
- All electrical outlets will be cut into the plywood at standard outlet height (18 in.).
- All electrical outlets and corresponding breaker boxes will be labeled with a machine generated label.



Typical Telecommunication Room

Ladder Rack (TR)

All ladder racks in the TR's will be 18 inches wide and supported a minimum of every 5 feet.

Fire Suppression (TR)

The fire protection system and hand-held fire extinguishers will comply with NFPA-75. Sprinkler systems should be a pre-action system. A hand-held fire extinguisher will be available in the room.

HVAC (TR)

The ambient room temperature and humidity should be controlled 24 hours a day, 365 days per year at temperatures between 64 and 75 degrees Fahrenheit, 30 and 55 percent humidity, positive pressure with independent power from telecommunications equipment.

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Electrical Power (TR)

There will be a minimum of two dedicated L6-30R, and two dedicated L5-30R electrical outlets, each on a separate branch circuit connected to the battery backup, which will be provided for equipment power. The circuits will be routed across the ladder rack and down to the back of the center vertical wire manager. The outlets will be located at standard outlet height (18 inches). All power installed to data racks will be ran in EMT. All conduit and hardware installed on data racks and ladder racks will be black.

Convenience duplex 5-20R outlets should be placed at 6 ft. intervals around the perimeter walls, at a height that is customary for each installation site.

Lighting (TR)

Lighting should be a minimum of 500 lx (50 foot candles) measured at the point of termination. Light switches should be easily accessible when entering the room.

Uninterruptible Power Supplies (UPS)

To be determined

Grounding

The TMGB, TGB, TBB, GE, all grounding and bonding of building backbone per ANSI J-STD-607 will be furnished and installed by a Division 26 Contractor. All metal infrastructures with in a communications space will be grounded and bonded by a Division 27 Contractor. All telecommunication rooms will adhere to the grounding guidelines set forth in TIA/EIA-607 (Commercial Building Grounding and Bonding Requirements for Telecommunications) plus any applicable codes in Articles 250 – (Grounding) and 800 – (Communications Systems) of the NEC. For an explanation of what constitutes a proper ground point for the Telecommunications Grounding Bar (TGB) to which the equipment will be grounded, see *NEC Article 800-40*. These ground points must meet all the detailed requirements of the above mentioned *TIA/EIA-607 (Commercial Building Grounding And Bonding Requirements For Telecommunications)* as well as any additional codes in Articles (250 – Grounding) and (800 - Communications Systems) of the NEC.

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A Telecommunication Grounding Busbar (TGB) will be located in each TR. The TGB will be grounded/earthed to the Telecommunication Main Grounding Bus Bar (TMGB). Each rack will be grounded to the TGB via #6 AWG cable with two-hole lugs on each end. If building steel is present in the room, it will be grounded to the TGB also. If metal ladder rack, basket tray, or fire stop pathways are used, they will be grounded to the TGB.

Cable Entry

A raceway device needs to be designed to allow cables to penetrate fire-rated walls and floors without the need for fire stopping. This device will feature a built-in fire and smoke sealing system that automatically adjusts to the amount of cable installed. Once installed in a fire barrier, cables can be easily added or removed at any time without the need to remove or reinstall fire stopping materials.

A Fire Rated Pathway is needed that consists of an enclosed heavy gauge galvanized steel raceway lined with intumescent material engineered for rapid expansion when exposed to fire or high temperatures, quickly sealing the pathway and preventing the passage of flames and smoke. The pathway will have a three hour or four hour fire rating.

All self sealing Fire Rated Pathways will be painted yellow (for CRAA voice and data only) or orange (for general use) for easy identification. The pathway will have a compact square profile that allows a maximum number of cables to be installed in a relatively small area. The pathway will be approximately three inches by three inches. Four units for the horizontal TR Pathway will be installed side by side in a mounting bracket to form a twelve inch by three inch opening. See [Appendix D](#) for details.

Racks & Labeling

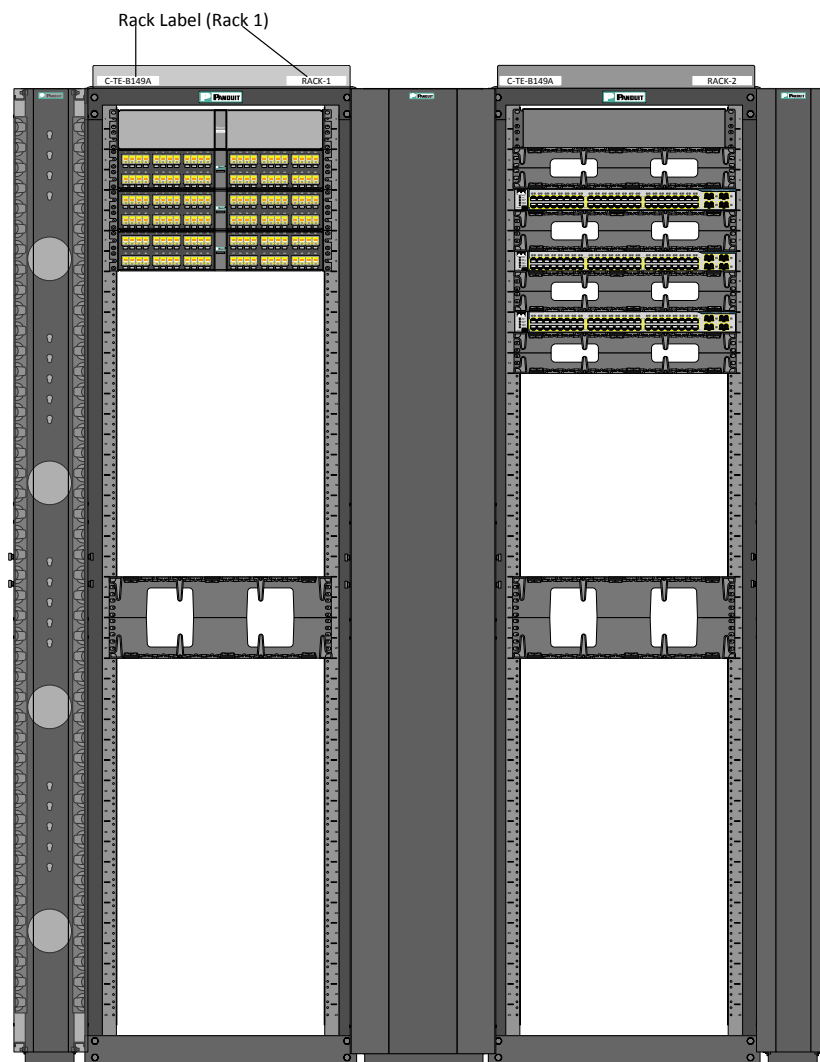
Racks will have 45 rack units (RU's) of space for equipment, wire management, & patch panels. They will have a black finish and support 19" rack mount equipment. Each rack will be grounded to the TR bus bar. Each rack will be labeled with **Campus – Building - TR Room Number** on the top left corner of trough. Each rack will be labeled with the **RACK – Rack Number** on the top right corner of the trough. All labels will be five inches long by one inch high using "Calibri" style print that is approximately 5/8 inches high. Rack labels will have white vinyl labels with black lettering. See [Appendix A](#) for an approved rack.



C-TE-B149A

RACK-1

Rack Labels



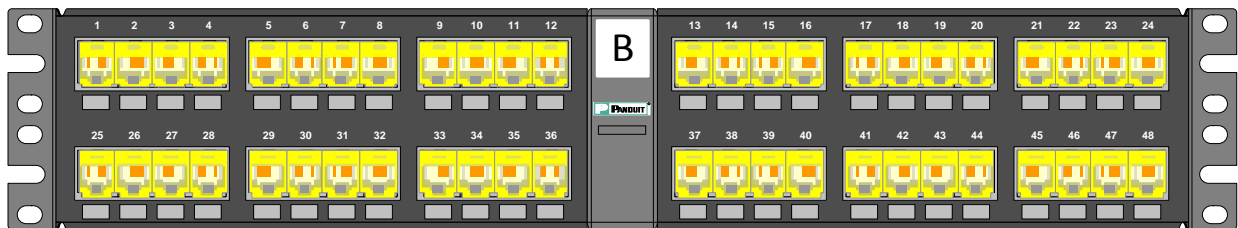
Typical Rack and Cable Management Layout with Labels

Cable Management (TR)

Vertical cable managers are required between all racks and at the end of each rack. Thus two racks side by side will have three vertical cable managers (one on each end and one between the racks). Horizontal cable managers will be used between Switches to provide for proper cable management. See drawing above for typical rack and cable management layouts. The approved cable managers are listed in [Appendix A](#).

Patch Panel Labeling (TR)

Label all patch panels with an alpha identifier. The patch panels are 48 ports and take up two units (RU's). Determine the alpha identifier by the location of the patch panel on the rack. Label the top two RU's "A", label the next two RU's down B and so on. Data Jacks will be cat6 A yellow and voice feed jacks will be black cat3 (both will be terminated 568B).



Patch Panel Labeling

Network Switches (TR)

To be determined

Copper Patch Cables (TR)

The equipment cords and patch cords will be chosen to match the horizontal cabling medium and rating. The manufacturer that provides the horizontal cabling and jacks will provide the patch cords. The total patch cord length at the work area is not to exceed ten feet. See [Appendix A](#) for details.

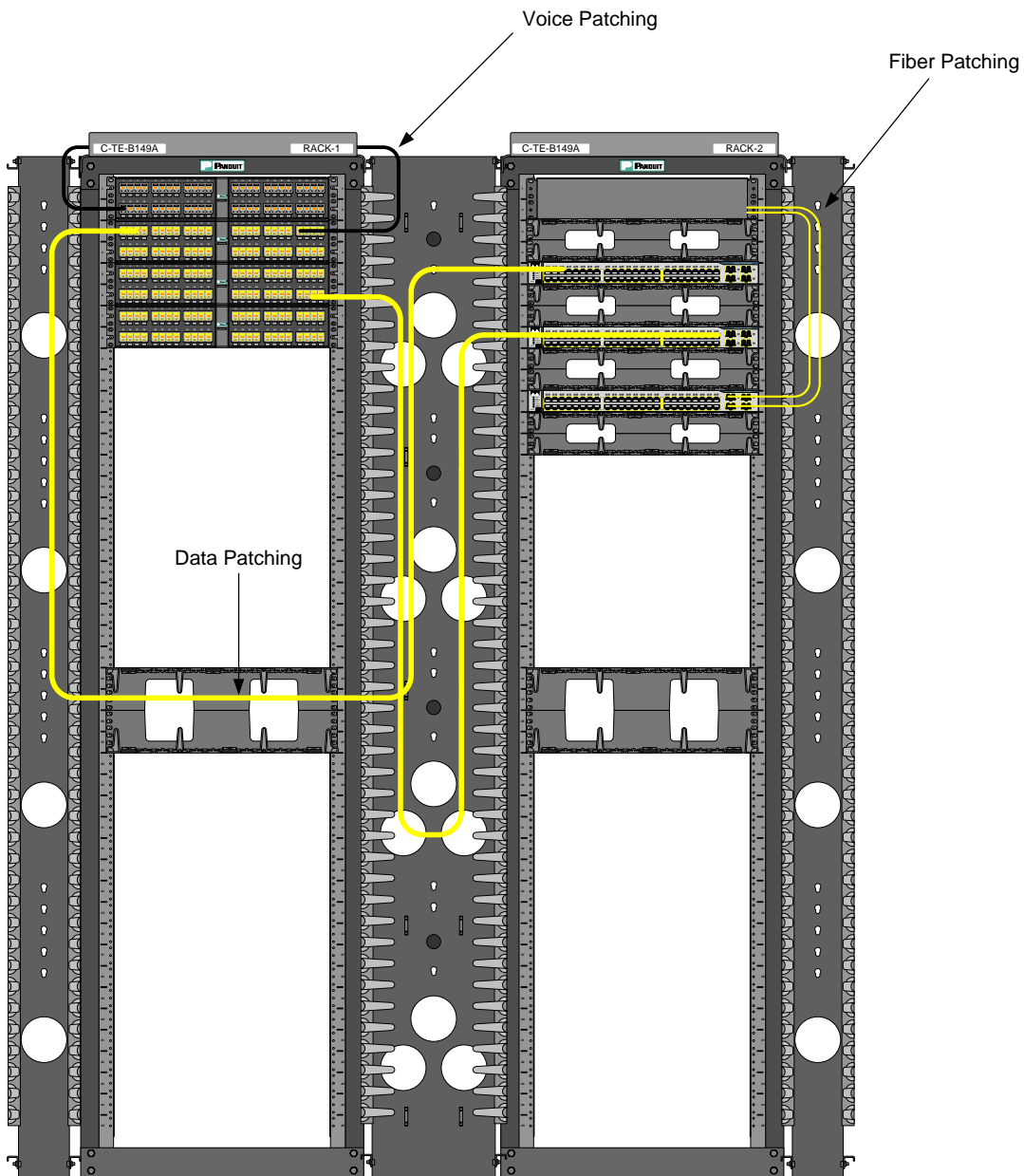
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Fiber Patch Cables

The manufacturer that provides the fiber, connectors, and connecting hardware will provide the patch cords. All fiber patch cords will be single mode (OS2) with duplex LC to LC connectors or LC to SC duplex connectors (were equipment requires).



Patching In Telecommunication Rooms (TR)



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Backbone Fiber Cabling

All fiber will be single mode (OS2) with LC or MTP connectors in the TR. Outdoor or Indoor/Outdoor fiber will be Gel-Free OS2 with MT or LC connectors. The same manufacturer will be used for fiber, connectors, and all fiber connecting hardware. All fiber passing through a manhole or outdoor pull box will have a 25 foot service loop. The service loop will not exceed the manufacturer's minimum bend radius requirements. Service loops will be supported by an outdoor rated hanger and located free and clear of the opening. All work requiring entry into a manhole or any other confined space will require the installer to be compliant with CRAA's Confined Space Program. Contact our *Safety and Health Specialist* for details regarding compliance. All intrabuilding backbone cable to TR's will consist of two twelve strand fiber trunks. The fiber trunks will take two separate pathways to provide redundancy. All interbuilding backbone cable terminated in an outdoor location will be terminated in a weather proof environment (NEMA 250 Type 4X & ICE 529 IP66 Rating). The fiber pathways will be defined by CRAA. See [Appendix C](#) for approved fiber products.

- **Indoor Backbone Cable**
All indoor fiber will be a pre-terminated optical fiber cabling system designed for building backbone. The trunks will be armored cables and maintain electrical continuity across their entire length. The armored cables will have a grounding wire bonded at both ends and be grounded to the TGB. All fiber will be Plenum rated cable
- **Indoor/Outdoor Backbone Cable (4300 feet or less)**
All indoor/outdoor fiber will be pre-terminated optical fiber cabling system designed for building backbone. The cable solution will provide a water tight connection MT at the intermediate main cross connect and MTP connection at the TR. All fiber will be riser-rated cable.
- **Indoor/Outdoor Backbone Cable (Greater than 4300 feet)**
All Indoor/outdoor fiber will be fully water blocking loose tube gel-free design. It will have a medium-density polyethylene jacket with an all-dielectric cable construction (requiring no bonding or grounding). All terminated fiber will have an Outdoor Buffer Tube Fan-Out Kit installed regardless if it is terminated indoors or outdoors. All outdoor cable will not be run indoors further than 50 feet without being in conduit. Field terminated cable can only be used when the fiber pull distance exceeds pre-terminated fiber length limits or there are conduit size restrictions. All fiber will be riser-rated cable.

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All Out Side Plant (OSP) cabling will require evaluation standards on an individual basis because of its unique nature.

Labeling Fiber Backbone

All fiber backbone cable will be labeled as illustrated below. Each fiber backbone cable will have a self-laminating weather proof yellow tag attached at the beginning, at the end and all pull points in between. The unique identifier will be labeled in the following order: "**Caution Fiber Optic Cable**" & **Campus-Building-Room Number 1/Room Number 2(highest number goes first)-Trunk Number. Fiber count & Fiber Type(SM for single mode)**. See [Appendix A](#) for approved label part numbers.



Fiber Backbone Label

Pathways (INDOOR)

The standard for horizontal cabling will be basket tray supported by a center/trapeze hanger with 3/8 inch threaded rod. There will be back to back J-hooks bolted to the bottom of the threaded rod. The threaded rod will be spaced no more than 5 ft. apart for a 12 inch tray and 4ft. apart for an 18 inch tray. The basket tray for the CRAA voice and data network will be yellow powder coated. The yellow colored cable tray is reserved for the exclusive use of CRAA voice and data network. The basket tray will be 12 inches or 18 inches wide. The height of the tray sides will be 4 inches high. Each basket tray will have a masked off area exposing bare metal for grounding. The pathways that have J-hooks only will be spaced four feet

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apart. All pathways will have self supporting hardware that attaches directly to the building’s structure. All newly installed pathways will allow for 60% cable growth (See [Appendix D](#) for details).

Abandoned Cable

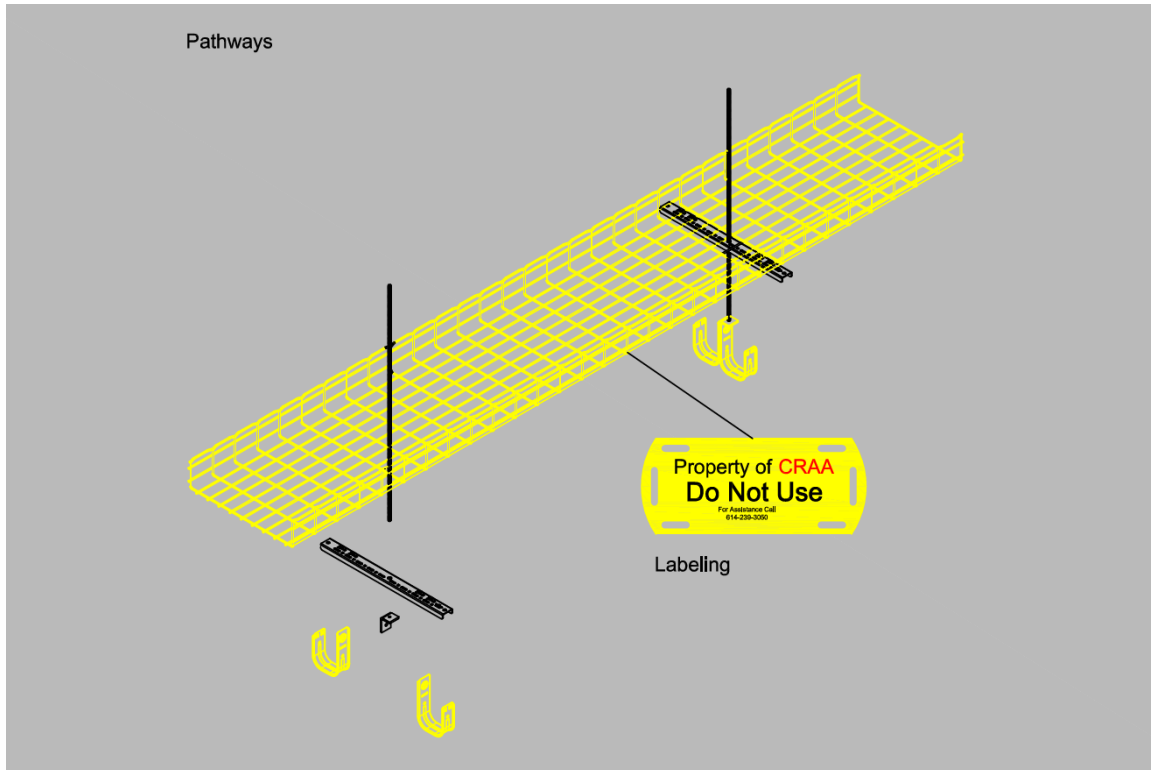
All cable that is replaced by new cabling will be removed back to the point of termination. All cable, jacks, faceplates, surface mount boxes, etc. that are obsolete will be removed. All faceplates that are removed will be blanked off.

Fire Rated Horizontal Pathways

All pathways penetrating any fire walls (or walls that extend from floor to decking) will have a minimum fire rating equal to the penetrated wall. All pathways that pass through any wall (regardless if is a fire rated wall) shall use a fire rated pathway to provide protection of the cables and additional fire protection. Fire Rated Pathways for the CRAA voice and data network will be yellow and is reserved for that exclusive use only. All other pathways will use orange. See [Appendix D](#) for details.

Fire Rated Riser Pathways

All floor penetrations will have a minimum of three hour fire rating. If the floor fire rating is greater than three hours than the fire rated penetration must match the floor rating. CRAA voice data network risers will be Yellow and is reserved for that exclusive use only. If there is a bank of risers it is the responsibility of the installer using that Bank to properly fire stop all penetrations. Orange pathways will be used when CRAA voice and data cables have to occupy the same riser with other cables. If the riser cannot use a self sealing pathway than a proper fire stopping method must be selected from the approved manufacturer listed. All risers requiring fire stopping will use a non hardening product (Fire Stop Putty) or pillows as specified by the manufacturer to obtain proper fire rating. The selected manufacturer’s fire stopping method (when the standard self sealing device can’t be used) and specifications must be provided with Pre-Installation Submittals. See [Appendix D](#) for details.



Labeling Pathways

All cable pathways will be marked with a self-laminating weather proof yellow tag attached as illustrated above. Every 10 feet of tag will be placed on each side of the basket tray. When a pathway is comprised of J-hooks only, a tag will be placed every other J-hook.

Grounding Basket Tray

The basket tray will be grounded with a minimum of 6 AWG green stranded wire. The ground wire will run along the outside of the cable tray and ground to the masked of area by a Grounding Split Bolt. All Basket Tray will be grounded to the TGB in the TR.

Glossary of Terms

Term	Description
Basic Link	The Basic Link test is only for the horizontal wiring, without the patch cores. This is when the circuit is being tested by the LanMeter to certify that it meets CAT 5e/6 A specifications.
Channel	The Channel includes the user's patch cord & the TC patch cords that connect the circuit to the network electronics. You should see network traffic on this circuit if it is properly working.
NEC	The abbreviation for National Electric Code, an international standards-making organization that is part of the National Fire Protection Association. They create code practices that must be adhered to on any electrical installation including having authority of low voltage.
OSP	The abbreviation for Out-Side-Plant refers to any cable or work performed between CRAA buildings or off of CRAA property. The construction of these products must withstand the elements and is usually unsuitable for indoor use.
OTDR	The abbreviation for Optical Time Domain Reflectometer. This device is used to show breaks and loss problems in fiber optic cable.
SM	Single Mode fiber 8.3 μm in size 1330nm or 1550 nm wavelengths. <i>Since it uses lasers to transmit data, take proper safety precautions to avoid permanent eye damage.</i>
TR	The abbreviation for Telecommunications Room, also called a Hub Room, MDF/IDF or Network Distribution Room. The point at which cables are terminated to patch panels and connected to network electronics.
WAO	Work Area Outlet. This is the faceplate location at the user site.

Appendix A: Panduit® Copper Solution

CRAA Approved Parts

All parts listed in this appendix are CRAA approved.

Jacks

Part Number	Style	Category	Color
CJ6X88TGYL	Mini-Com®	6A	Yellow

Cable

Part Number	Style	Category	Color
PUP6A04YL-UG	TX6A	6A	Yellow

Faceplate

Part Number	Gang	Description	Color
CBEIWY	1	Face Plate Frame	Off WHT
CBEIW-2GY	2	Face Plate Frame	Off WHT
CHBZIW-X	-	½ Size Blank	Off WHT
CHS2IW - X	-	½ Size Module 2 Jack Inserts	Off WHT
CMBIW-X	-	Blank Insert	Off WHT
MIWBAIW	2	Adapter to 1-Gang	Off WHT

Surface Mount Boxes (two ports)

Part Number	Part Description	Color
CBX2IW-AY	Surface Mount Box	Off White
CBX2BL-AY	Surface Mount Box	Black

Patch Cords (Copper)

Part Number	Length(ft.)	Length(M)	Category	Color
UTP6X20YLY	20	7	6A	Yellow
UTP6X14YLY	14	5	6A	Yellow
UTP6X10YLY	10	3	6A	Yellow
UTP6X7YLY	7	2	6A	Yellow
UTP6X3YLY	3	1	6A	Yellow

Labels & Cable Ties for Pathways

Part Number	Height(in.)	Length(in.)	Color
PST-FOBLNK	2	3.5	Yellow
PLT2S-C4Y	(Cable Ties)	7 3/8	Yellow

Surface Raceway & Related Parts

Part Number	Part Description	Color
LD10IW6-A	surface Raceway	Off White
LD10IW8-A	surface Raceway	Off White
LD10IW10-A	surface Raceway	Off White
DCF10IW-X	Drop Ceiling / Entrance Fitting	Off White
CF10IW-X	Coupler Fitting	Off White
ECF10IW-X	End Cap	Off White
JB1DIW-A	Single Gang Deep Outlet Box	Off White

Grounding

Part Number	Part Description	Length
RGS134-1Y	Grounding Strip Kit	
GJ6□□UH	Equipment Bonding Conductor	□□

Rack & Wire Managers

Part Number	Part Description	Color
R4P36	4-Post Rack	Black
PRV6	Vertical Wire manager	Black
PRD6	Vertical Wire manager Door	Black
CMR4PWF	Top Trough with Waterfall	Black
NMF2	Horizontal Wire Manager 2U One Sided	Black
NMF4	Horizontal Wire Manager 4U One Sided	Black

Patch Panel and Blank Panels

Part Number	Part Description	Color
CPPA48FMWBLY	Angled 48 Port Patch Panel	Black
CPATCBL	Angled Port Patch Panel Cover	Black
DPFP1	1RU Rack Filler Panel	Black
DPFP2	2RU Rack Filler Panel	Black
DPFP4	4RU Rack Filler Panel	Black

Cat 6A Cable Yellow Plenum (Indoor)

TX6A™ 10Gig™ UTP Copper Cable with MaTriX Technology

PUP6A04YL-UG



- Exceeds requirements of ANSI/TIA-568-C.2 Category 6A, IEEE 802.3an-2006, and ISO 11801 Class E_A channel standards
- Meets requirements of IEEE 802.3af and IEEE 802.3at for PoE applications
- Exceeds requirements of ANSI/TIA-568-C.2 Category 6A and IEC 61156-5 Category 6_A component standards
- Patent-pending cable design suppresses alien crosstalk with enhanced internal electrical performance
- Round cable design with reduced cable diameter enables improved cable bundling and optimizes fill capacity
- Cable diameter: 0.310 in. (7.9mm) nominal
- Installation temperature range: 32°F to 140°F (0°C to 60°C)
- Operating temperature range: -4°F to 167°F (-20°C to 75°C)
- Descending length cable markings enable easy identification of remaining cable which reduces installation time and cable scrap

• Part Number	PUP6A04YL-UG
• RoHS Compliancy Status	RoHS directive is not applicable

• Description	Category 6A, plenum (CMP), 4-pair, UTP copper cable. Copper conductors are 23 AWG with FEP insulation. Conductors are twisted in pairs, separated by an integrated pair divider, surrounded by a patent-pending matrix tape and protected by a low-smoke flame-retardant PVC jacket.
• Product Type	Copper Cable
• Color	Yellow
• Cable Color	Yellow
• Cable Type	UTP
• CE Compliant	No
• Flammability Rating	CMP
• Jacket Material	Flame-retardant PVC
• Performance Level	Category 6A/Class EA
• Pricing Description	Copper Cable, Category 6A, 4-Pair, 23 AWG, UTP, CMP, Yellow, 1000ft/305m
• Put-Up	Reel
• Min. Order UOM	FT
• Min. Order Qty.	9000
• BOM Qty. (# of Pkgs.)	
• xAdd to Favorite Product LIst	

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Cat 6A Jack Yellow

Mini-Com® TX6™ UTP Jack Modules

CJ6X88TGYL




- Exceed requirements of ANSI/TIA-568-C.2 Category 6A, IEEE 802.3an-2006, and ISO 11801 Class EA channel standards
- Exceed ANSI/TIA-568-C.2 Category 6A and IEC 61156-5 Category 6A component standards
- Meet requirements of IEEE 802.3af and IEEE 802.3at for PoE applications
- Each jack is 100% tested to ensure NEXT and RL performance and is individually serialized for traceability
- Utilize patent-pending enhanced Giga-TX™ Technology for jack terminations which optimizes performance by maintaining cable pair geometry and eliminating conductor untwist
- Contacts plated with 50 microinches of gold for superior performance
- No punch down tool required; termination tool (EGJT) ensures conductors are fully terminated by utilizing a smooth forward motion without impact on critical internal components for maximum reliability
- Optional termination tool (TGJT) reduces termination time by 25%, ideal for high volume installations
- Can be re-terminated a minimum of twenty times
- Blue termination cap designates Category 6A performance and provides positive strain relief; helps control cable bend radius and securely retains wires

- Terminate 4-pair, 22 – 26 AWG, 100 ohm, solid or stranded twisted pair cable
- Universal termination cap is color-coded for T568A and T568B wiring schemes
- Accept 6 and 8-position modular plugs without damage
- Can be clearly identified with optional labels and icons
- Compatible with Mini-Com® Modular Patch Panels, Faceplates, and Surface Mount Boxes
- Optional RJ45 Blockout device blocks out unauthorized access to jack modules and potentially harmful foreign objects, saving time and money associated with data security breaches, network downtime, repair and hardware replacement
- Optional Dust cap keeps out dust and debris while not in use
- Optional RJ45 Lock-in device blocks unauthorized removal of cable, IP phone, other networking equipment or critical connection
- Optional RJ45 blockout device blocks out unauthorized access to jack modules and potentially harmful foreign objects, saving time and money associated with data security breaches, network downtime, repair, and hardware replacement
- Optional dust cap keeps out dust and debris while not in use

• Part Number	CJ6X88TGYL
• RoHS Compliancy Status	Compliant
• Part Description	Category 6A, RJ45, 10 Gb/s, 8-position, 8-wire universal module.
• Product Type	UTP Jack Module
• Material	Module housing - ABS Wire Cap - Plastic Strain Relief Clip - Plastic
• Color	Yellow
• Depth (In.)	1.50
• Depth (mm)	38.1
• Height (In.)	0.71
• Height (mm)	18.06
• Width (In.)	0.63

• Width (mm)	16.1
• CE Compliant	No
• No. of Module Spaces	1
• Performance Level	Category 6A/Class EA
• Pricing Description	Mini-Com Module, Cat 6A, UTP, 8 pos 8 wire, Universal, Yellow, TG Style
• Wiring Scheme	T568A/T568B
• Min. Order UOM	PC
• Min. Order Qty.	1
• BOM Qty. (# of Pkgs.)	0

<i>CPPA48FMWBLY</i>	
	
<ul style="list-style-type: none"> • Rear mounted faceplates allow modules to be flush with front of patch panel • Accept Mini-Com® Modules for UTP, fiber optic, and audio/video, which snap in and out for easy moves, adds, and changes • Pre-printed numbers above each port for easy identification • White write-on areas for port and/or panel identification • Mount to standard EIA 19" racks or 23" racks with optional extender brackets • Angled patch panels facilitate proper bend radius control and minimize the need for horizontal cable managers 	
• Part Number	CPPA48FMWBLY
• RoHS Compliant Status	Compliant
• Note	CPPA48FMWBLY replaces CPPA48FMWBL

• Part Description	Angled 48-port flush mount patch panel supplied with rear mounted faceplates.
• Product Type	Flush Mount Modular Patch Panel
• Color	Black
• Depth (In.)	4.65
• Depth (mm)	118.2
• Height (In.)	3.47
• Height (mm)	88.1
• Width (In.)	19.0
• Width (mm)	482.6
• CE Compliant	No
• No. of Module Spaces	48
• No. of Ports	48
• No. of Rack Spaces	2
• Patch Panel Style	Angled
• Performance Level	Modular, Dependent on Populated Modules
• Pricing Description	Patch Panel, 48 Port, Modular Angled Flush Mount, Black
• Wiring Scheme	Modular, Dependent on Populated Modules
• Min. Order UOM	PC
• Min. Order Qty.	1
• BOM Qty. (# of Pkgs.)	0

Appendix B: Cooper B-Line Pathway

CRAA Approved Parts

All parts listed in this appendix are CRAA approved.

Low Voltage Wall Board Adapter

Part Number	Part Description	Finish
BB10L	Single Gang Bracket	Pre-galvanized
BB20L	Double Gang Bracket	Pre-galvanized

Wire Basket & Hardware

Part Number	Part Description	Finish
FT4X12X10YL	Flex tray 4" X 12" X 10' Yellow (masked for grounding)	
FT4X18X10YL	Flex tray 4" X 18" X 10' Yellow (masked for grounding)	
FTSWN	Flex tray Wing Splice	
FTB12CT	Flex tray Center/Trapeze Hanger 12"	
FTB18CT	Flex tray Center/Trapeze Hanger 18"	
ATR3/8x144	3/8" Threaded Rod	
ARC-37-150	3/8" Rod Hanger Concrete	
3/8HN	3/8" Hex Nut	
3/8FW	3/8" Flat Washer	
3/8LW	3/8" Lock Washer	

Ladder Rack

Part Number	Part Description	Finish
SB17U18BFB	Tubular Runway 1-1/2" x 18"	

Ladder Rack Fittings and Accessories

Part Number	Part Description	Finish
SB2107BZ	Butt Splice Clamp Kit	
SB2101ABZ	90 Junction Splice Clamp Kit	
SB227R6FB	Stand-Off Kit	
SB21318KFB	Triangle Wall Support Kit 12"-18"	
SB211318FB	Wall Angle Support Kit 18"	
SB210509FB	Termination Kit (Blind End) 9"	
SB2129SD09FB	Side Drop-Out 9"	
SB2129SD18FB	Side Drop-Out 18"	
SB782M12	Cable Management Spool w/Hardware (Mushroom)	
SB110A1B	Ladder Rack End Cap	Black
SB1003JBZ	J Bolt 2 3/4 in long with nut and lock washer	Black Zink

Grounding

Part Number	Part Description	Finish
SBTMGB12	Grounding Bus bar 12"x4"	
SBTMGB20	Main Grounding Bus bar 20"x4"	
SBTGB	Grounding Bus bar 12"X2"	
SB4780x	Two-Hole Mechanical Lugs	
SBJCC	Joint Compound (Copper)	

J-Hooks

Part Number	Part Description	Finish
BCH32YL	J-Hooks w/ Yellow Powder Coat	
BCH64YL	J-Hooks w/ Yellow Powder Coat	
BCHK2	Multi-Tier Attachment Kit	

Rack Anchors

Part Number	Part Description	Finish
SB588A	Concrete Anchor 3/8 in-16-2 3/4 in	Clear Zink

The total cables allowed in basket tray based on NEC allowable fill is 50%.

FT4X12X10YL (4 in x 12 in) Basket Tray

Area of Cat 6A cable = $\pi (D/2)^2 = \pi (.310 \text{ in}/2)^2 = .0755 \text{ in}^2 / \text{cable}$

Actual area of the tray = 47.5 in^2

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Allowable fill = $[(.50) 47.5 \text{ in}^2] / .0755 \text{ in}^2/\text{ cable} = 314$

Fill for new installs = $(.40)314 \text{ cables} = 125$

FT4X18X10YL (4 in x 18 in) Basket Tray

Area of Cat 6A cable = $.0755 \text{ in}^2 / \text{cable}$

Actual area of the tray = 71.5 in^2

Allowable fill = $[(.50) 71.5 \text{ in}^2] / .0755 \text{ in}^2/\text{ cable} = 473$

Fill for new installs = $(.40)473 \text{ cables} = 189$

Appendix C: Corning® Fiber Solution

CRAA Approved Parts

All parts listed in this appendix are CRAA approved.

Indoor/Outdoor Pre-terminated ([AnyLaN™ Riser Rated](#))

Part Number	Part Description	Length
M1M112EBZD1X□□□F-P	12 strand Direct Trunk MT (fm) – MT(fm) SM OS2	□□□(4300 max)
M20212EBZD1X□□□F-P	12 strand Harness Assembly MT(male)-LC SM OS2	□□□(4300 max)

Indoor Pre-terminated ([Plug & Play™ Armored Plenum](#))

Part Number	Part Description	Color

Indoor/Outdoor ([FREEDM® Loose Tube, Riser Rated](#))

Part Number	Part Description	Color
□□□EWF-T410D20	SM OS2 Gel-Free Fiber Cable	Black

Fiber Connector Housing ([Pretium® Connector Housings](#))

Part Number	Part Description	Color
PCH-02U	2RU LIU	

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Generic Specifications (Hyperlinks)

[AnyLan](#)

[Universal Plug & Play](#)

[Pretium Connector Housing \(PCH\)](#)

[SM Fiber in Loose Tube & Ribbon Cable](#)

[Fiber Glossary of Terms](#)

Stencils

[Hardware Drawings](#)

Appendix D: STI[®] Fire Stop Solution

CRAA Approved Parts

All parts listed in this appendix are CRAA approved.

[STI[®] \(EZ Path™ SERIES 33\)](#)

Part Number	Part Description	Color
EZDP33FWS-Y	Fire-Rated Pathway Device Kit	yellow
EZDP33FWS	Fire-Rated Pathway Device Kit	orange

[STI[®] Fire Stopping Products](#)

Part Number	Part Description	Color

Total number of Cat 6A cables to be installed in an EZD33 is 55.

Appendix E: Data Sheets

EMI Minimum Distance Requirements for Telco Pathways & Spaces

Elements	Power	Shielded Separation	Unshielded Separation
Pathways	Less Than 3 kVA	0 inches	2 inches
Cross Connect Hardware	Less Than 3 kVA	0 inches	2 inches
Pathways	3 kVA but less than 6 kVA	2 feet	5 feet
Cross Connect Hardware	3 kVA but less than 6 kVA	2 feet	10 feet
Pathways	6 kVA or greater	3 feet	10 feet
Cross Connect Hardware	6 kVA or greater	3 feet	20 feet

Note: Shielded can refer to F/UTP cable, S/FTP cable, & UTP or power cable ran in MC, BX, EMT.
General: **EMI** sources are power Wires, transformers, electronic ballasts, copiers, RF sources & transmitters, large motors & generators, inductance heaters, arc welders, & x-ray equipment

Data Source: Siemon Cabling System Training Manual IS-1821-01 Rev. L

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