CommScope®

SYSTIMAX® GigaSPEED Xpress® Solution

Design Guidelines

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SYSTIMAX®
SOLUTIONS

Contents

1.0 Overview

The SYSTIMAX GigaSPEED Xpress Solution is a 500MHz UTP copper Solution guaranteed to support IEEE 10GBASE-T for up to 60 meters with unparalleled design freedom and space savings making it ideal for Data Center applications.

Some highlights of the GigaSPEED Xpress Solution include:

- Supports 10GBASE-T operation for up to 60 meters and 4 connections with no mitigation required for alien crosstalk suppression
- Guaranteed performance up to 500MHz
- Exceeds IEEE 802.3an Link Segment Specifications (Section 55.7), TIA TSB155 and ISO TR24750
- Category 6 UTP size profile
- No “15 meter rule” or minimum length requirement on cables and cords
- The flexibility of channel configurations comparable to the SYSTIMAX GigaSPEED XL Solution
- Excellent fit for Data Center environment

The GigaSPEED Xpress Solution includes the following components:

88 Series Cables (1088B/2088B/3088B)
GSXP Patch Cords
MGS500 Information Outlets
1100GS5 Panels
PATCHMAX® GS5 Panels
VisiPatch® 360 system
M2000, M2100, M3000 and M3600 Modular Patch Panels

Additional information for design purposes can be found in the following documents:

- SYSTIMAX Performance Specification
- IEEE 802.3an 10GBASE-T standard
- Telecommunications cabling and associated standards published by organizations such as the American National Standards Institute /Telecommunications Industry Association/Electronic Industries Association (ANSI/TIA/EIA; e.g., EIA-568-B.1, 569-B, ANSI/TIA/-942, TSB-155), International Standardization Organization /International Electrotechnical Commission (ISO/IEC; e.g., ISO/IEC IS 11801, TR24750), and Comite Europeen de Normalisation Electrotechnique (CENELEC; e.g., EN 50173 and EN 50174 series).
- National and local codes such as the National Electrical Code (NEC), or equivalent documents.
- BICSI Telecommunications Distribution Methods Manual

This set of guidelines supports copper cabling solutions that conform to existing architectures, The SYSTIMAX 20-year Extended Product Warranty and Application Assurance program provides coverage to cabling installations that conform to this guide and the SYSTIMAX Performance Specifications. These guidelines also include:

- The standards defined architecture for the horizontal channel and permanent link
- Design options for SYSTIMAX components used within the channel
- Information on software tools for cable design and administration

2.0 Power Separation

Refer to the SYSTIMAX PowerSUM, GigaSPEED XL and GigaSPEED X10D Cabling Design Guidelines for power separation guidelines. ANSI/TIA/EIA-942 has Data Center guidelines that should also be followed.

Always check with applicable codes and standards, and consult with authorities having jurisdiction before submitting final designs. Applicable local or national safety regulations take precedence whenever their required separation distances are larger or other requirements conflict with those specified in this document. For example:

- In the UK, BS 6701 and BS 7671
- In the USA, NEC
- In Europe, EN 50174-2

3.0 Bonding and Grounding

Always check with applicable codes and standards, and consult with authorities having jurisdiction before submitting final designs. Applicable local or national safety regulations take precedence whenever their requirements conflict with those specified in this document.

The proper bonding and grounding of the telecommunications cabling, pathways, equipment, and connecting hardware is critical to achieve optimal cabling performance, reduce electromagnetic interference (EMI), protect equipment, and maintain safety for building occupants and maintenance personnel. Refer to the ANSI-J-STD-607-A-2002 and ISO/IEC 60364 for accepted industry practices. Requirements for grounding and bonding include:

- A ground reference for telecommunications and equipment within the telecommunications entrance facility (EF), telecommunications rooms (TR), and equipment rooms (ER), and at all equipment locations and racks within a Computer Room.
- Bonding and connecting cable pathways, cabling, and connecting hardware at the TRs, ERs, and EF. Ground and bond backbone cables at both ends.

  The telecommunications grounding and bonding infrastructure also has interconnectivity to other building grounding systems (e.g., electrical, water piping, lightning protection) and is also bonded to the metal framework of a building. The primary components of a telecommunications grounding and bonding infrastructure include:
- Telecommunications Main Grounding Busbar (TMGB) – located at the telecommunications EF and connected to the electrical EF or building grounding electrode system.
- Telecommunications Bonding Backbone (TBB) – ties TMGB to TGBs (typically No. 6 AWG).
- Telecommunications Grounding Busbar (TGB) – located in the TRs and EFs and is also connected to the metal framework of a building.
- Grounding Equalizers (GE) – tie multiple TBBs together.

4.0 Administration and Labeling

Cabling administration and labeling is an important cabling element that allows for easy maintenance and management of the telecommunications cabling system. Use the labeling inserts supplied with the SYSTIMAX connecting hardware and faceplates to properly label the cabling components. Additionally CommScope offers a labeling tool located on the BusinessPartner and Consultant sites for use with both commercially available and proprietary card stock.

Color-coded labels for termination fields should be implemented as follows:

If a cabling element contains mixed categories of cabling, such as the horizontal, they should be identified by enhanced color-coding (i.e., white stripes on blue label to differentiate higher performance cabling) or suitable markings. Cables, as a minimum requirement, should also be identified at both ends with labels suitable for wrapping. The labels should be made of a durable material, such as vinyl, use a white printing surface, and wrap around the cable so that a clear label end self-laminates the printed area. Refer to the ANSI/TIA-606-A Administration Standard for the Telecommunications Infrastructure of Commercial Buildings for proper administration and labeling practices.

5.0 General Cable Guidelines

- Follow local regulations and applicable codes of the authority having jurisdiction.
- Refer to TIA-568-C for generic planning and installation practices.
- All cables and components should be visually inspected for proper installation.
- Avoid water, high humidity, chemicals, and cold temperature bending of cables.
- The use of cable lubricant is not allowed.
- Operation temperature range for SYSTIMAX copper cable is -4°F to 140°F (-20°C to 60°C).
- Installation temperature range for SYSTIMAX copper cable is 32ºF to 140ºF (0ºC to 60ºC).
- At the extreme temperatures care must be exercised to prevent excessive kinking or increases in pulling tension. If the cable has been stored below 32ºF (0ºC) for more than 8 hours, the cable must be conditioned at room temperature, 59ºF to 86ºF (15ºC to 30ºC) for at least 4 hours before installation.

TABLE 1: CABLE WEIGHTS (IN LB/KFT AND KG/KM)

Cable Type	1088B	2088B	3088B
Weight	28.5/42.4	37.5/55.8	28.7/42.7

Telecommunications cables should be installed with proper pathway support. They:

- Must not be placed directly on fluorescent light fixtures
- Must not be supported by electrical conduits
- Must not be supported by gas or water pipes.
- Must not be supported by ceiling grid system

6.0 Bundling and Alien Crosstalk

A primary feature of the GigaSPEED Xpress Solution cabling is its Alien Crosstalk performance in support of the 10GBASE-T standard. This performance is achieved even under the worst case condition of all cables routed together in the most tightly packed form. This is usually referred to as a “combed and laced” cable bundle where all cables maintain their position within a bundle and the bundle is tie wrapped at regular intervals. The GigaSPEED Xpress Solution supports:

- Tie wrapping up to 5 times per meter (once every 8 inches). Tie wraps must not distort cable jacket.
- Cable Tray vertical depths up to 23 cm (9 inches) using hardware with sweeping edges and well controlled entry. Check with raceway manufacturer for tray support and design and limitations. Note that current standards call for 15 cm (6 inches) maximum.
- GSXP cords may also be bundled by combing to eliminate crossovers and tie wrapping. Bundling is typical for long equipment cords. Cross-connect cords and Work Area cords are generally not combed and tied. These cord applications are usually randomly placed or routed separately.

7.0 Fill Guidelines

The GigaSPEED Xpress Solution cable diameter is slightly larger than the other category 6 (GigaSPEED XL) cables. At 6.2 mm (0.245 inches), the fill guidelines are as follows:

- 2.3 cables per cm^2 (14 cables per in^2) in small tight packed spaces if the layout is done as follows –
  - cables are laid in place without tying in smaller bundles
  - crossovers are not made in the raceway
  - crossovers are not made where cables enter or exit the raceway
  - entries and exits are wide enough to sweep cables out from the raceway
- 1.6 cables per cm^2 (10 cables per in^2) in trays or other open raceways if cables have crossovers in the raceway and where individual cables randomly enter or exit the raceway. Note that density will be lowered further if tied bundles have crossovers in the raceway and randomly enter or exit the raceway, or if entry or exit openings are constrictive.
- Note that raceway manufacturers guidelines on fill and weight may be more restrictive. Standards generally call for 40% fill limits.
- The following table is a guide for different conduit sizes. Note that this can be increased where conduit is used for short sleeves and when careful feed and pulling is exercised.

TABLE 2: NOMINAL CONDUIT FILL

Conduit Size	Number of cables
3/4	3
1	6
1.25	10
2	26
3	59
4	106

Use the online Pathways Estimator for more specific fill calculations.

8.0 Faceplate, Boxes and the GigaSPEED Xpress Cables

The single gang six-plex faceplates (M16L, M16LE, M13FP, M26FP, M26C) can be utilized to load with MGS500 information outlets for the GigaSPEED Xpress Solution. If loaded with outlets of other cabling types, the MGS500 must be grouped together either from the top or from the bottom.

9.0 GigaSPEED Xpress Cable Installation Alongside Other Cabling

When installing GigaSPEED Xpress cable with other cable types (including PowerSUM, GigaSPEED XL7, XL8 and X10D), ensure that cable types are laid, routed, and/or bundled in separate groups. Spacing from PowerSUM, GigaSPEED XL7, XL8 and X10D is not required, but GigaSPEED Xpress cable bundles that include other cable types are not allowed. Each cable type must be routed together. Cable trays and baskets with different bundles can be used as long as cable types are not mixed, and the GigaSPEED Xpress cables are bundled together. When alternating pulls between different cable types, allocate tray positions for each so that different types will not end up bundled together.

When connector types other than MGS500 are installed in the same 6 port M2000/M2100, 8 port M3000, or 12-port M3600 panels, keep the MGS500s grouped together.

10.0 Cable/Cord Distance

The GigaSPEED Xpress Solution supports 10GBASE-T operation over channel length up to 60 meters. This design and installation guidelines call for no more than 50 meters of 1088B/2088B/3088B cable and 10 meters of GSXP cord/cordage length. However, site guidelines may alter this, provided the site guidelines are effectively documented and followed. Often, additional cordage length is called for, with a corresponding decrease in cable distance.

There are several motivations for such a tradeoff. Cordage to a Consolidation Point is a coordinated design replacement for cable. Additional length of Work Area Cords for Multi-User Telecom Outlet Assemblies requires the same coordination. Data Center Cords might need additional cord length to span large Equipment Distribution Areas. These changes are coordinated so that strict attenuation limits are preserved. The following formula and table, adopted from The TIA-568-C series standards may be used to determine alternate maximum cordage lengths useable with reduced cable length. These may be applied to any of the configurations outlined within this document.

Total Cord Length in Meters = (62 – Horizontal) / 1.2

Horizontal Length in Meters ≤ 62 – 1.2 (Total Cord Length)

TABLE 3: ALTERNATE MAXIMUM LENGTHS FOR CABLE AND CORDAGE

Maximum Length of Horizontal Cable	Maximum Combined Length of all cordage and cords
50 m (164 ft)	10 m (33 ft)
45 m (148 ft)	14 m (46 ft)
40 m (131 ft)	18 m (59 ft)
35 m (115 ft)	23 m (75 ft)
30 m (98 ft)	27 m (89 ft)

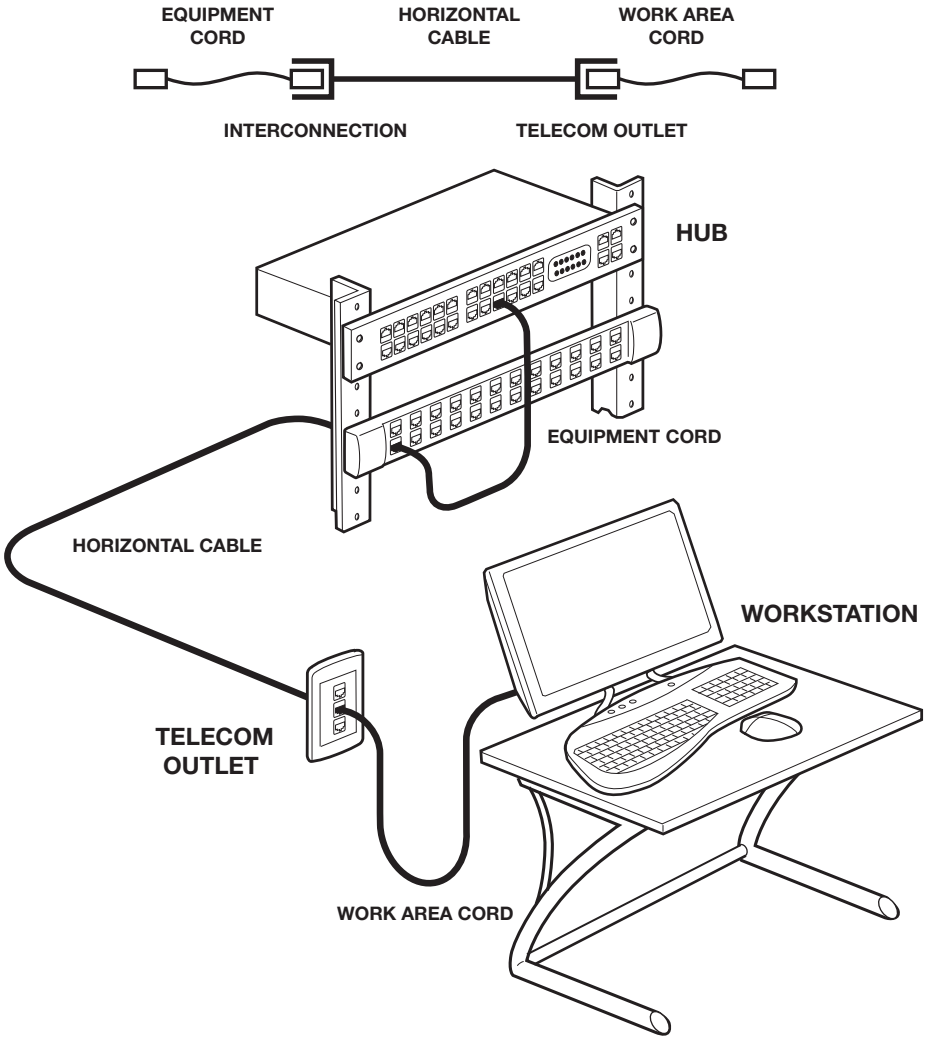
11.0 Work Area Channel Models

The following illustrations of the various channels identify connections from the central equipment (data hub, BAS controller, etc.) to the work area equipment (workstations, servers, etc.). They show the ANSI/TIA/EIA-568-B Commercial Building Telecommunications Cabling Standard and ISO/IEC IS 11801 Information Technology-Generic Cabling for Customer Premises defined configurations containing up to four connections. The connections on the end equipment are not counted. A connection is where two cabling segments come together.

Two Connection Model

The most basic channel model has only 2 connections and is typically referred to and tested (without the cords) as a permanent link. The horizontal with the cords may also be tested as a channel.

Figure 1. Two Connection Model, Interconnection to Telecommunications Outlet

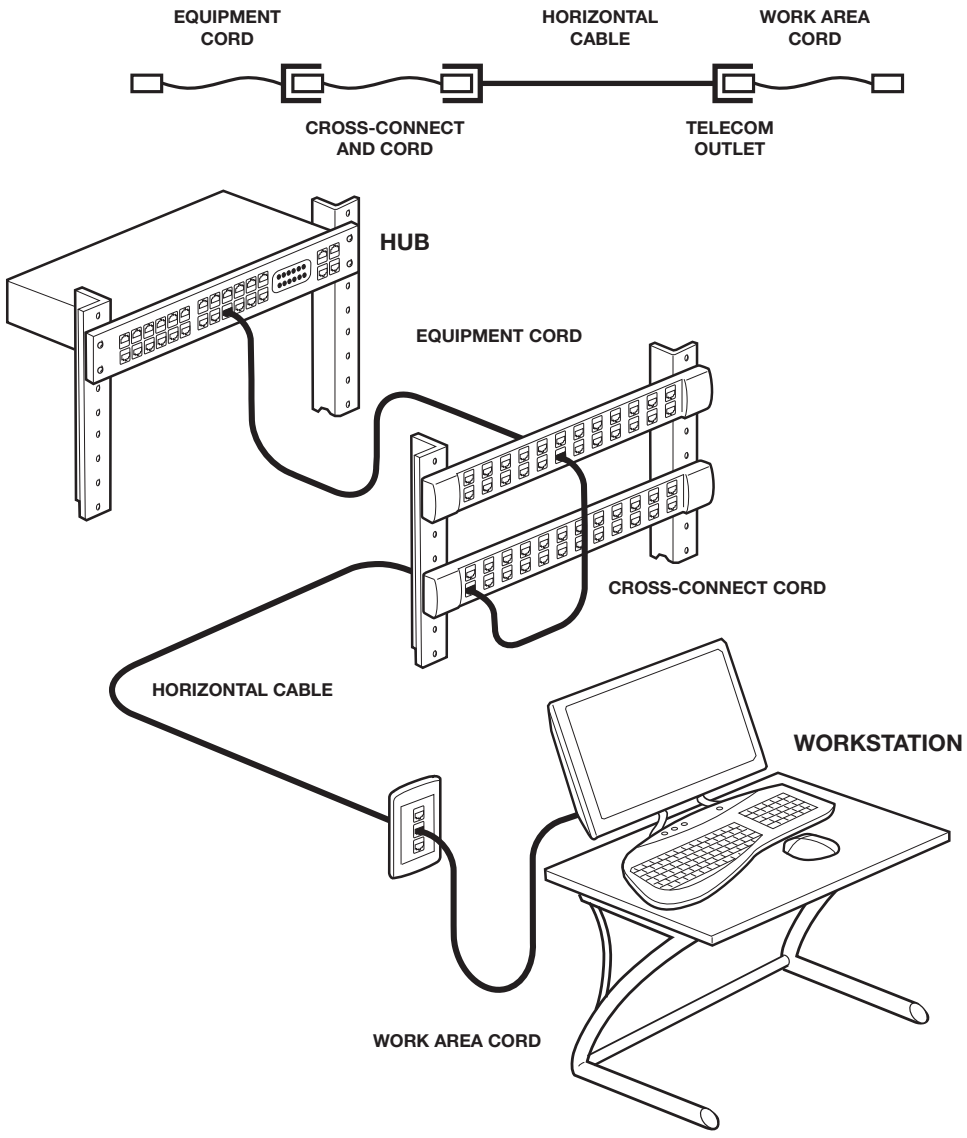


Three Connection Model

A third connection can support two different channel models, a cross-connection or a consolidation point.

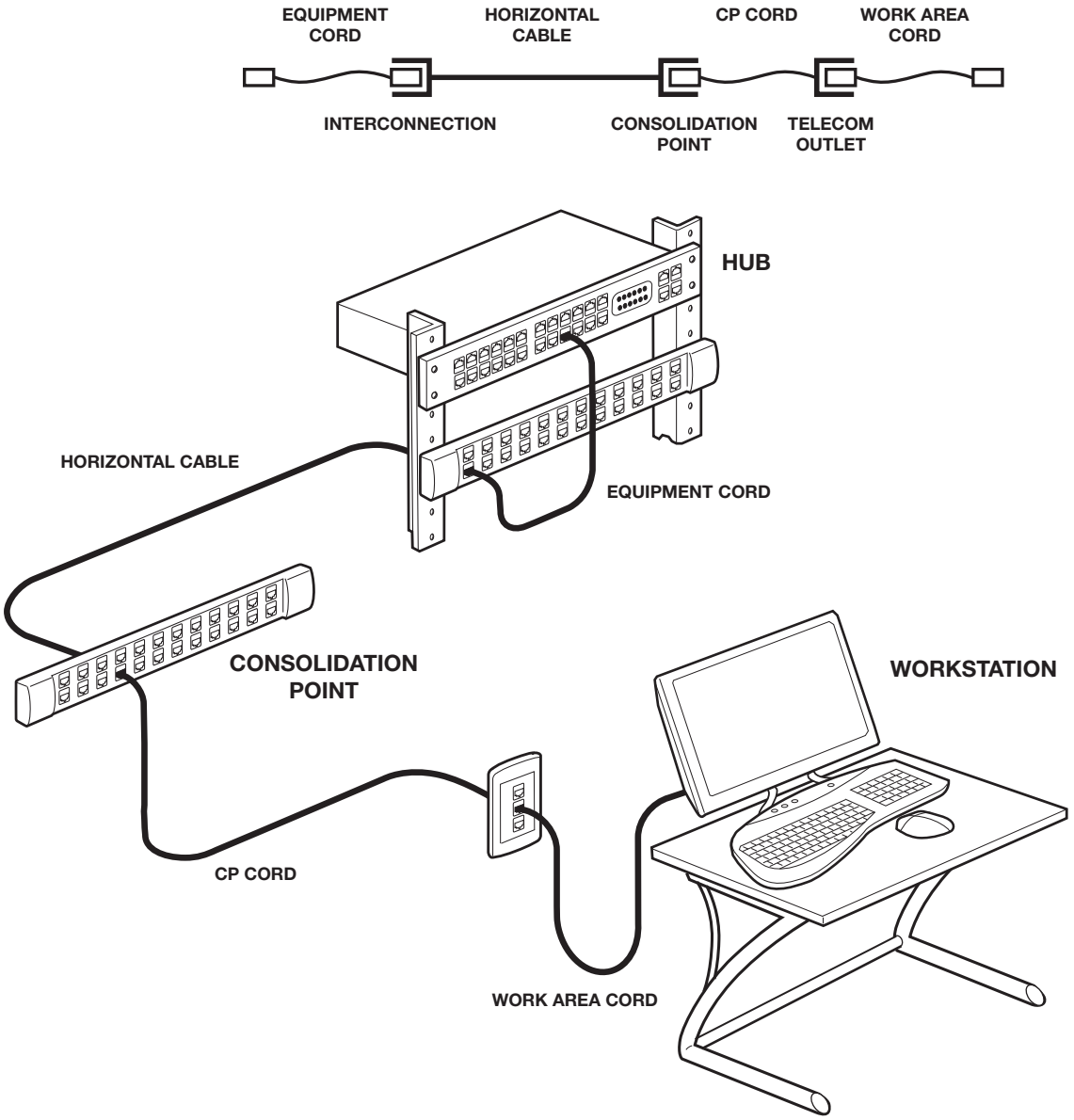
At large sites or sites with a high density of work stations or where space constraints might otherwise dictate, the telecommunication room can be configured with a cross-connection. The cross-connection is a solution that separates equipment administration from cabling administration, and provides maximum flexibility and protection for horizontal cabling. This configuration is tested with the cords as a channel.

Figure 2. Three Connection Model: Cross-connection to Telecommunications Outlet



Where open office spaces may have a high turnover or where installation may be staged, the horizontal cable can be terminated at a consolation point. This is often done for supporting modular office designs, allowing easy cabling changes from the consolidation point to the telecommunication outlet that follow changes made to the open office space. This configuration is typically called a permanent link. It may be tested without the cords as a permanent link, or with the cords as a channel.

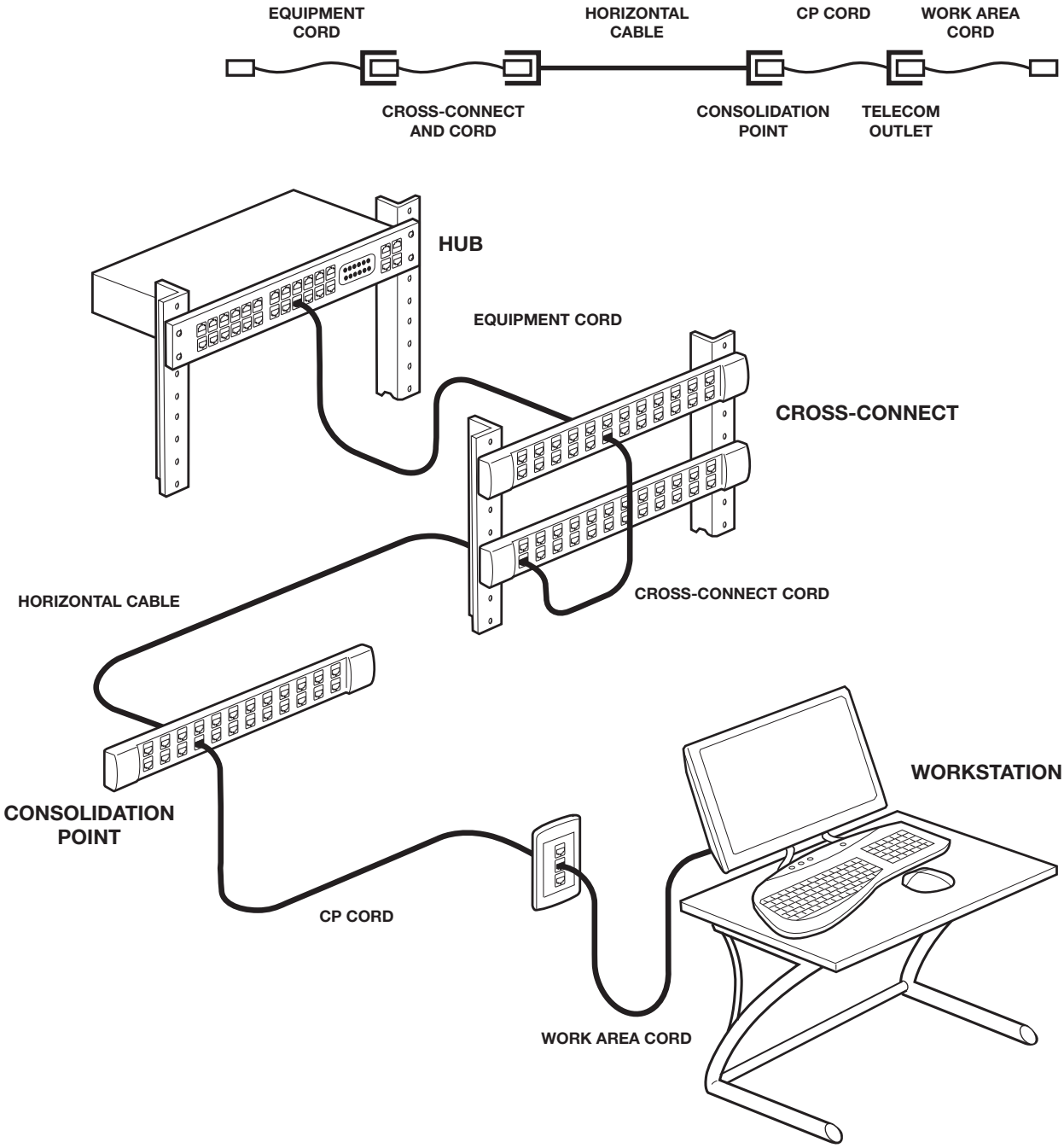
Figure 3. Three Connection Model: Interconnection to a Consolidation Point



Four Connection Model

At large open office sites where administration flexibility calls for it, four connections are often used in channels. This configuration offers flexibility and protection at both ends of the horizontal cabling, providing the advantages of cross-connection in the telecommunications room and the flexibility of the consolidation point for modular office design. This configuration is typically referred to and tested (with the cords) as a channel.

Figure 4. Four Connection Model: Cross-connection with a Consolidation Point

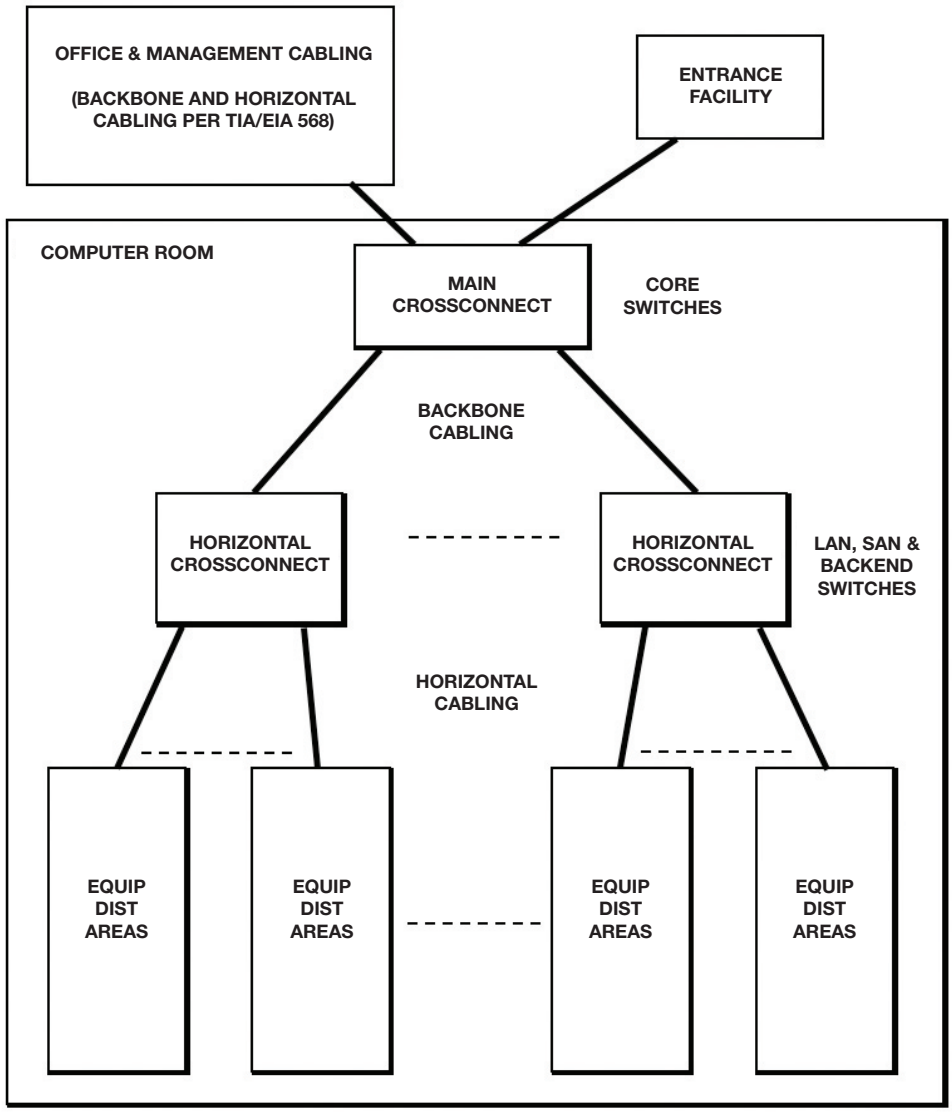


12.0 Data Center Computer Rooms

Data center cabling is an excellent application for the GigaSPEED Xpress Solution, allowing data center operations upgrades when 10GBASE-T equipment becomes available. The following pages show configurations for supporting ANSI/TIA/EIA-942 Telecommunications Infrastructure Standard for Data Centers).

The standardized channel configurations were developed based on those in the ANSI/TIA/EIA-568-B Commercial Building Telecommunications Cabling Standard because data centers utilize much of the same LAN equipment that was designed for these channels. However, data center equipment has become specialized and is typically deployed in high density. The cabling design must be tightly coordinated with other system designs, such as the electrical and HVAC. Security and operations also become significant design factors. Consult ANSI/TIA/EIA-942 for additional information and details.

Figure 5. Data Center Computer Room Cabling Architecture



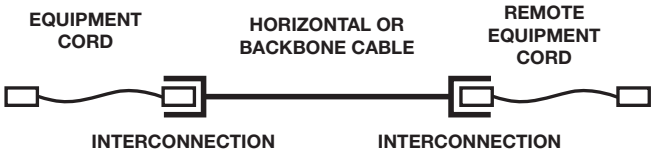
13.0 Data Center Channel Models

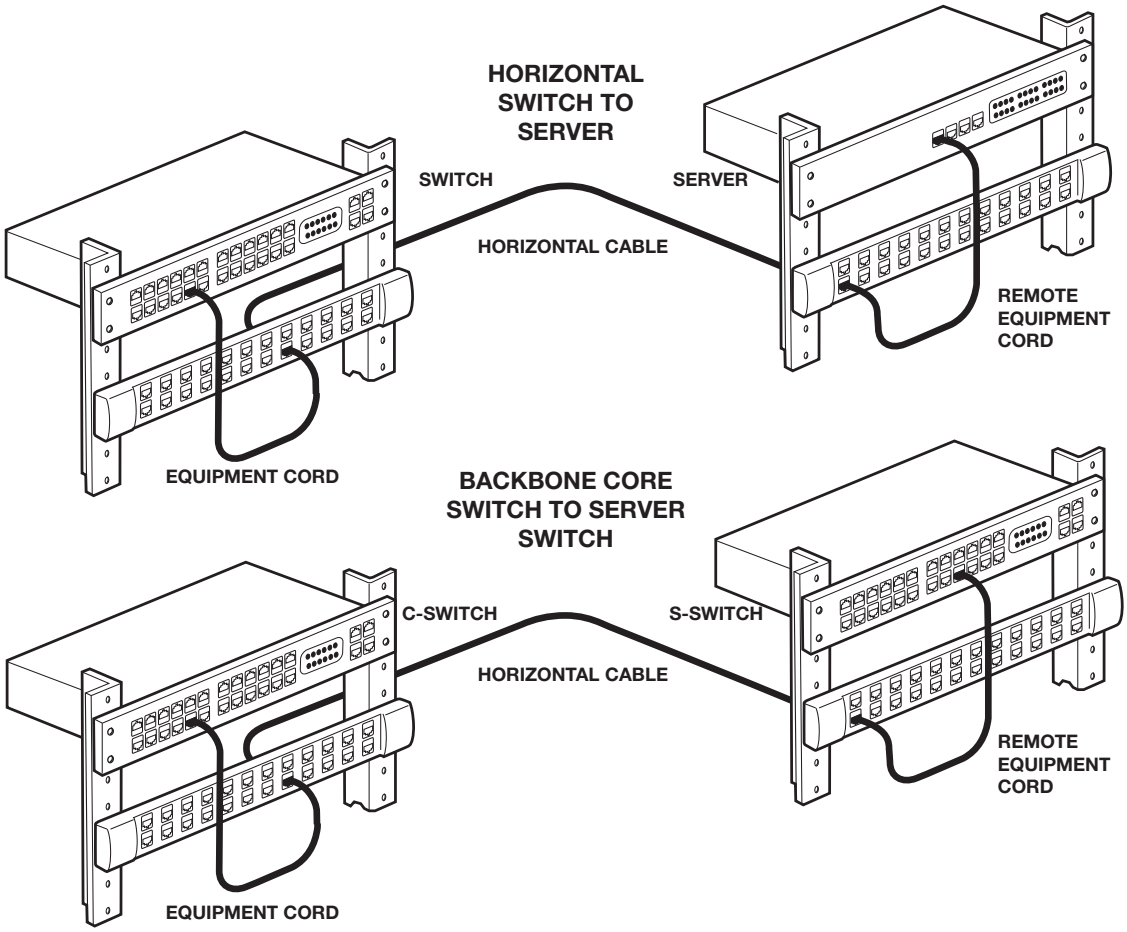
The following illustrations identify various channels between different areas within a data center's computer room. These standards-defined configurations contain up to four connections. A connection is where two cabling segments come together, while the connections on the end equipment are not counted in the models.

Two Connection Model

The most basic channel model has only 2 connections and is typically referred to and tested (without the cords) as a permanent link. The horizontal with the cords may also be tested as a channel.

Figure 6. Two Connection Model, Interconnection to Interconnection



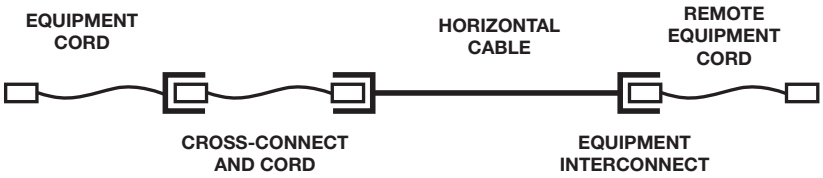


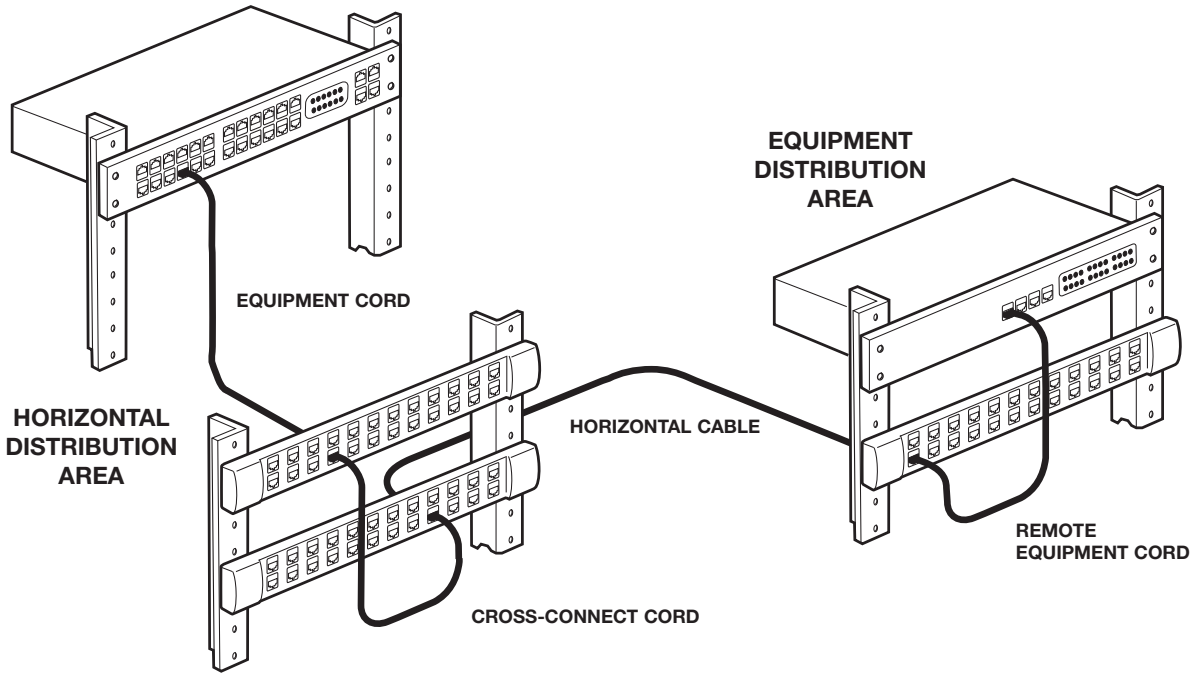
Three Connection Model

A third connection can support two different channel models, a cross-connection or a consolidation point.

At large sites or sites with a high density of switching equipment or where space constraints might otherwise dictate, the horizontal distribution area can be configured with a cross-connection. This configuration is typically referred to and tested (with the cords) as a channel. This configuration can also be applied to backbone cabling with a main cross-connect.

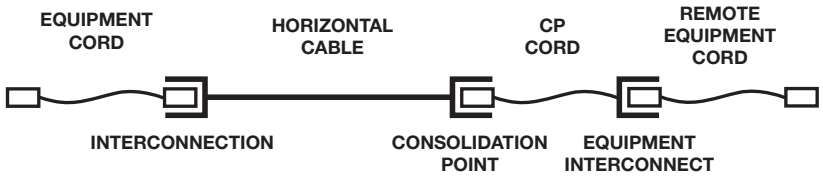
Figure 7. Three Connection Model, Cross-connection to Interconnection

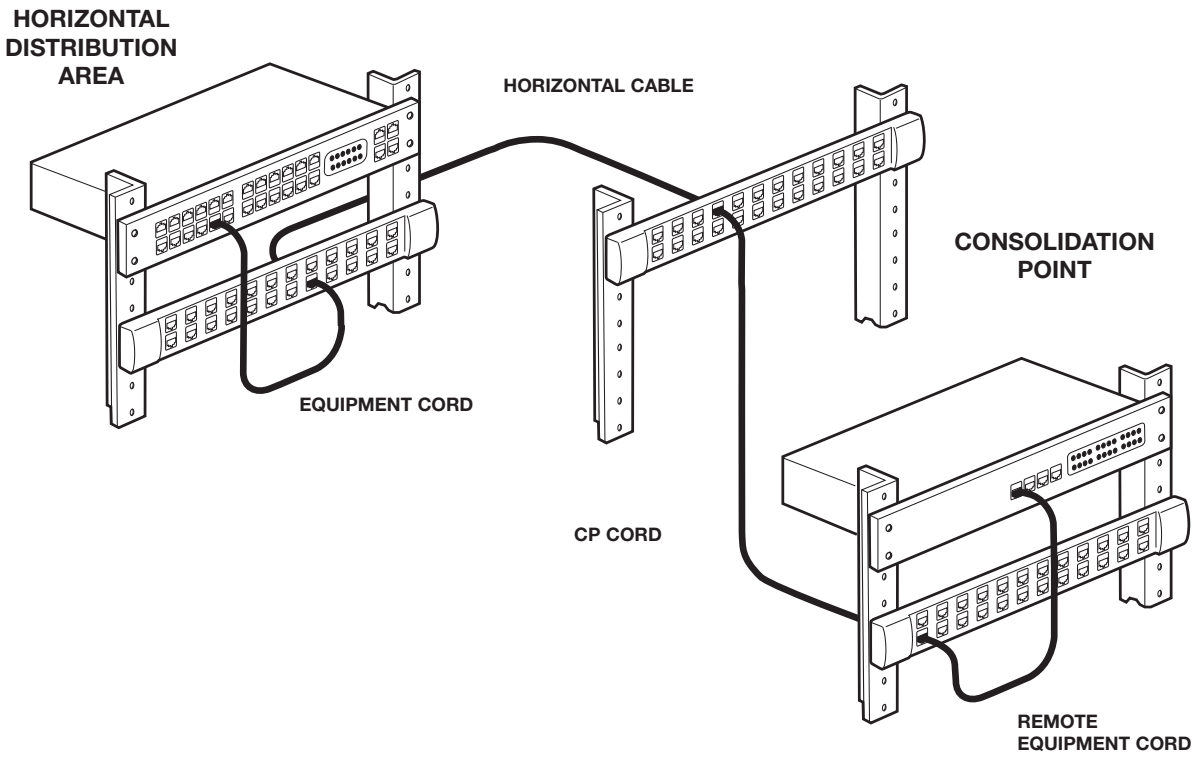




Where a site administrator may need flexibility or where installation may be staged, the horizontal cable can be terminated at a consolation point. It might be used for example to terminate a horizontal bundle at the middle of a row of equipment, and allow the site administrator to apportion horizontal cables between sections of the row as needed. This configuration is typically called a Permanent Link. It may be tested without the cords as a permanent link, or with the cords as a channel.

Figure 8. Three Connection Model, Interconnection with a Consolidation Point



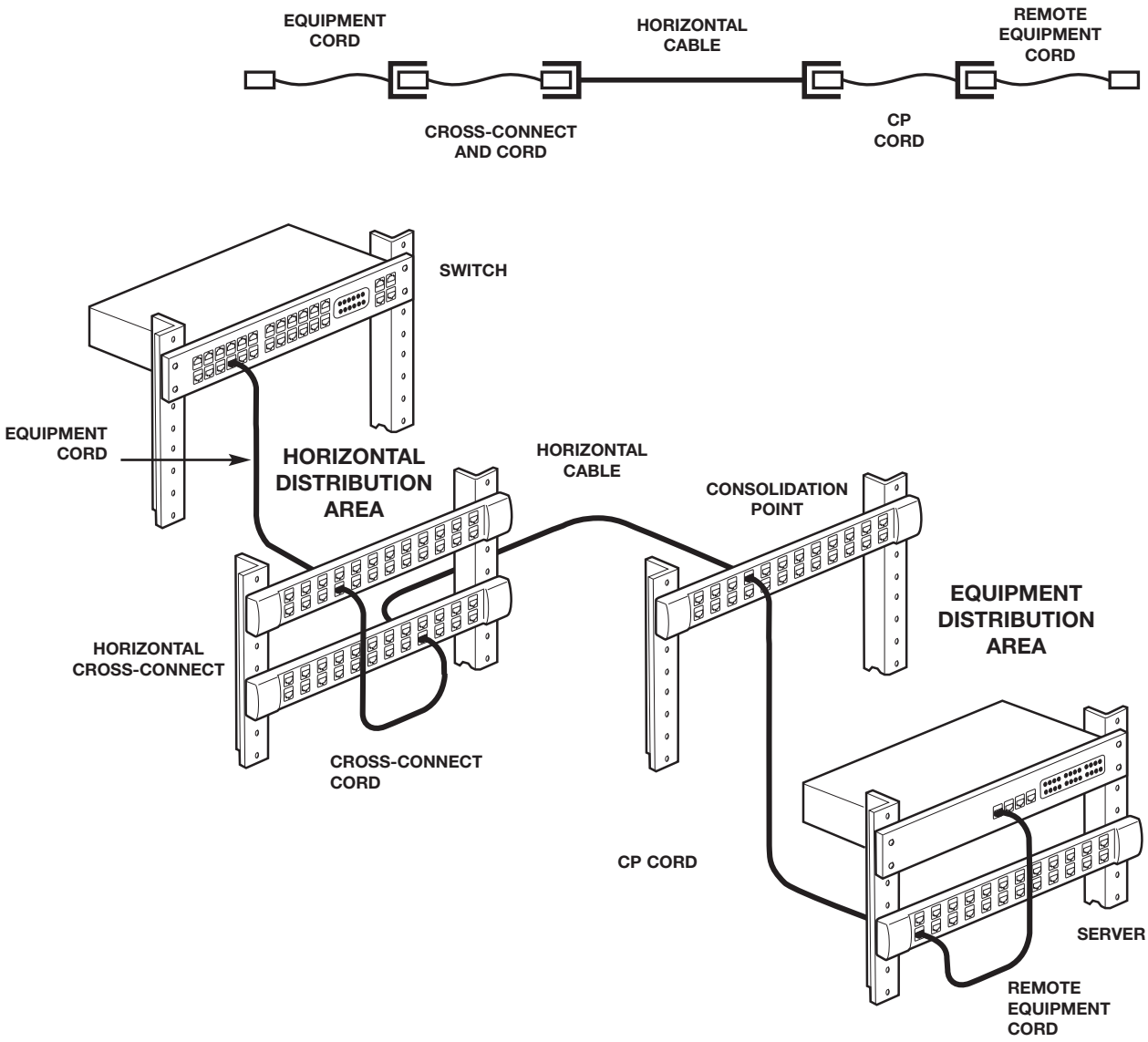


Four Connection Model

At large data centers the cabling administration is typically consolidated at cross-connects, and four connections would be used in channels. These configurations are typically referred to and tested (with the cords) as a channel. There are two configurations, a cross-connection with a consolidation point and a double cross-connect.

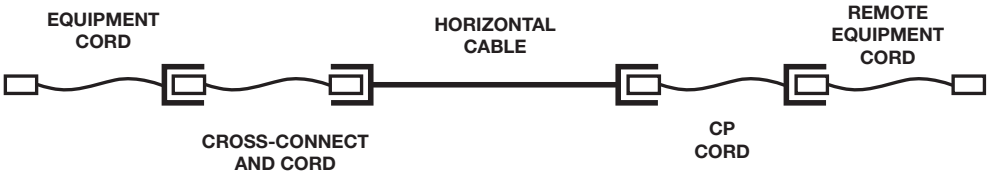
The consolidation point configuration (Figure 9) allows for two levels of administration to the server equipment as in Figure 8 on the previous page, but also provides a cross-connect for the switching equipment. The consolidation point may be useful for flexibility allocating horizontal capacity to many small customers that must be independently maintained.

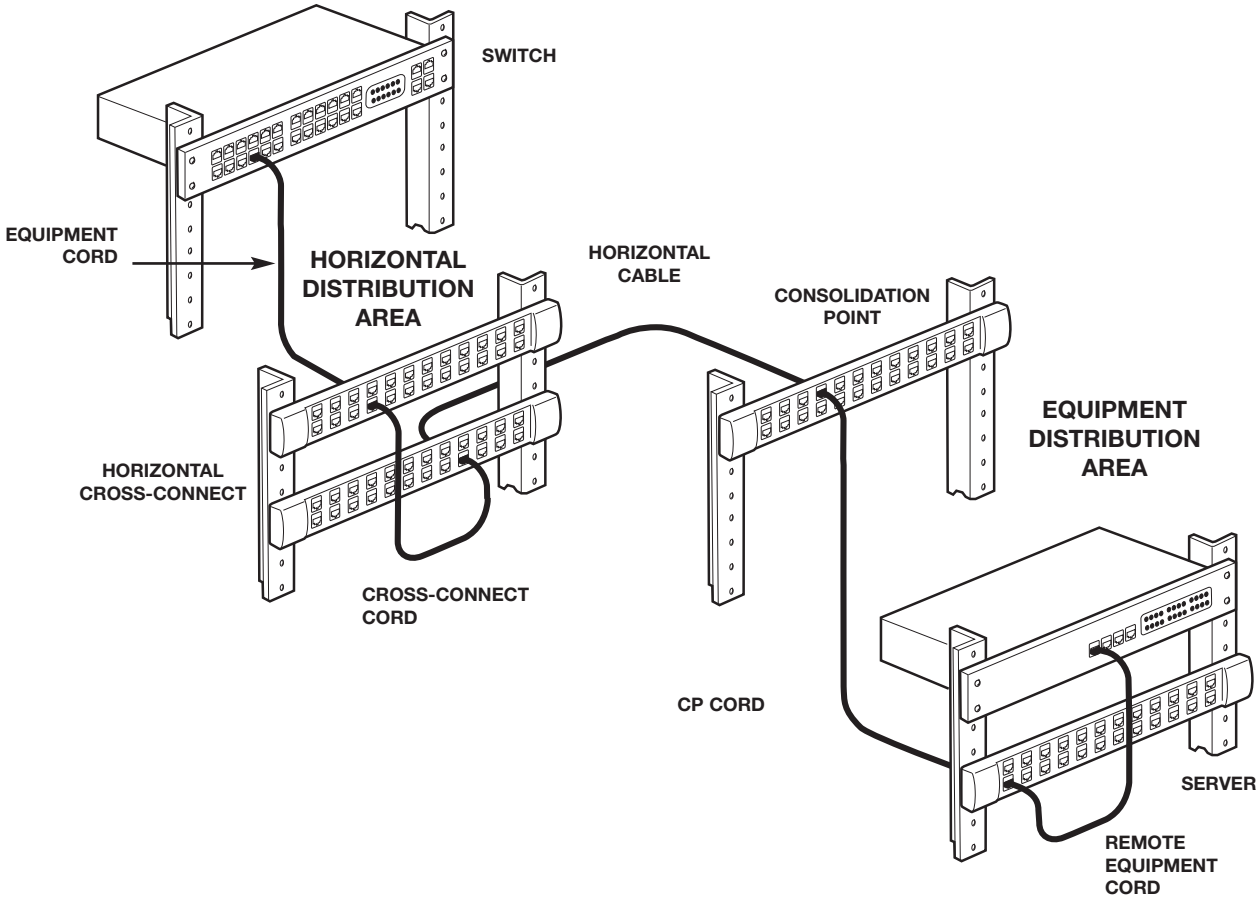
Figure 9. Four Connection Model, Cross-Connection to Consolidation Point



The dual cross-connect configuration is a classic backbone configuration. It provides uniform administration and is suited for large corporate data centers. This configuration is also applicable to backbone cabling from the main distribution area.

Figure 10. Four Connection Model, Cross-Connect to Cross-Connect





The installation of SYSTIMAX GigaSPEED Xpress is similar to SYSTIMAX GigaSPEED X10D and the installation information in SYSTIMAX® GigaSPEED® X10D Solution Design and Installation Guidelines should be followed. Note that 2088B cable and Xpress cordage does not utilize the separator tapes. You may also find the following documents useful for installing and handling the GigaSPEED Xpress cables, cords, and apparatus:

- SYSTIMAX GigaSPEED X10D Solution Design and Installation Guideline for UTP
- SYSTIMAX 1100 GS5-Type Modular Panel Installation Instructions
- SYSTIMAX M2000 Modular Patch Panel
- SYSTIMAX M2100 Modular Patch Panel
- SYSTIMAX M3000 Modular Patch Panel
- SYSTIMAX M3600 Modular Patch Panel Installation Instructions
- SYSTIMAX PATCHMAX GS5 Modular Panel Installation Instructions
- SYSTIMAX VP360-2U-RMBKT Kit for Rack Mounting VisiPatch® 360 Panel System Installation Instructions
- SYSTIMAX VisiPatch 360 Wall Mounted Panel System Installation Instructions
- RFE (Raised Floor Enclosure)

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