SYSTIMAX®
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SYSTIMAX® GigaSHIELD™ X10D Category 6A shielded solution

Design and installation guidelines

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Introduction

The rise of the hyperconnected, AI-enabled enterprise is reshaping the network. As more devices are deployed, network noise—and the challenges of infrastructure management—increase, especially when it comes to your shielded Category 6A cabling.

That's why CommScope developed the SYSTIMAX® GigaSHIELD™ X10D platform.

About the GigaSHIELD X10D platform

The GigaSHIELD X10D solution is a unified, end-to-end shielded Cat 6A platform that delivers more of what's most important to you: optimal EMI/RF shielding, design flexibility, faster deployment, easier management and more.

Reflecting the endless innovation of SYSTIMAX, the GigaSHIELD X10D platform is manufactured and tested to exceed the standards-based specifications for channel performance. It is particularly suited for light industrial and high-security environments such as manufacturing, government and military networks.

As a member of the SYSTIMAX family, the GigaSHIELD X10D solution is fully backed and supported by SYSTIMAX Assurance™, among the industry's most comprehensive customer support programs; it warranties application assurance and provides total peace of mind.

About this guide

We have developed this guide to help customers design and install a SYSTIMAX GigaSHIELD X10D cabling system that meets the stated warrantied performance specifications. When designed and installed using the guidance provided below, the GigaSHIELD X10D cabling system is capable of supporting 10GBASE-T (10-gigabit Ethernet over twisted pair) LAN for the specified configurations, up to a full 100-meter, four-connection channel.

The guidelines in this document support copper cabling solutions that conform to existing architectures as defined by telecommunications cabling standards. Registered GigaSHIELD X10D cabling system installations that conform to this guide, and their performance specifications, are covered by the SYSTIMAX 25-year Extended Product Warranty and Application Assurance.

In this document, you will also find the standards-defined architecture for horizontal channels and permanent link, and design options for SYSTIMAX components used within the channel. This information, as well as support software and application guides for system- and vendor-specific practices (e.g., SYSTIMAX 10GBASE-T Application Guide), can also be found on the CommScope website.

Abbreviations used in this document

AHJ: Authority Having Jurisdiction
ANSI: American National Standards Institute
BICSI: Building Industry Consulting Service International
CENELEC: European Committee for Electrotechnical Standardization
EMI: electromagnetic interference
IEC: International Electrotechnical Commission
ISO: International Organization for Standardization
MET: Main earthing terminal
NEC: National Electrical Codes
NFPA: National Fire Protection Association
RP: Remote power(ing)
SBB: Secondary bonding busbar
TBB: Telecom bonding backbone
TIA: Telecommunications Industry Association

Reference standards

The GigaSHIELD X10D F/UTP, F/FTP and S/FTP solutions meet or exceed all Category 6A/Class EA requirements as outlined in the following standards:

- ANSI/TIA-568.2-D
- CENELEC EN 50173 series for generic cabling systems
- EN 50174 series for cabling installation
- ISO/IEC 11801 series

Additional relevant standards include:

- ANSI/TIA-568.2.D: Balanced twisted-pair telecommunications, cabling and components
- ANSI/TIA-942-C: Telecommunications infrastructure, data centers.
- ANSI/TIA-569-B: Telecommunications pathways and spaces, commercial buildings
- ANSI/TIA-607-E: Generic telecom bonding and grounding (earthing), customer premises
- (CENELEC) EN 50173 series: Generic cabling systems, information technology
- (CENELEC) EN 50174 series: Cabling installation standards, information technology
- (CENELEC) EN 50310: Telecom bonding networks, buildings and other structures
- ISO/IEC 11801: Generic customer premises cabling, information technology
- ISO/IEC 30129: Telecom bonding networks for information, buildings and other structures
- ISO/IEC 24764: Generic cabling systems for data centers, information technology

Further design information and industry guidance can be found in the following documents:

- SYSTIMAX Performance Specifications
- Telecom cabling and associated standards, including the reference standards listed below
- National and local codes, including the National Electrical Code (NEC) and equivalent documents
- BICSI Telecommunications distribution methods manual (14th ed. 2019)
- NFPA: National Electrical Code (revised 2020)

When installing telecommunications systems, it is crucial to adhere to local regulations and codes established by the authorities having jurisdiction (AHJ). These regulations ensure that installations meet safety, performance, and compliance standards specific to the region. Always consult and follow the applicable local codes and regulations to ensure that your installation is not only effective but also legally compliant and safe.

Pathways

Pathways and pathway systems are important to support the cabling throughout the building.

Several factors can influence the performance of the cabling system and must be taken into consideration when designing the pathway. These include pathway capacity, the separation of power versus non-power cables, and the cable operating temperatures.

Ambient operating temperature: The electrical performance of cabling is specified at 20 degrees Celsius.

Pathway capacity

The pathway system must be sized to hold and protect the cables currently needed as well as those that may need to be added throughout the building's lifetime. Thus, it is recommended to build pathways to every point where cabling could be needed in the future, even if no cabling is installed initially. Use the Pathway and Spaces Calculator on the CommScope website to ensure adequate capacity.

To support and protect the cabling, bend radius limiters should be installed wherever the cable changes direction. SYSTIMAX cables can be installed with a bend radius that is four times the cable's outer diameter. If cables are installed with a small bend radius, the electrical characteristics—particularly the cable's return loss—can change over time.

Power separation

To ensure consistent data communication, powered electrical cables should be physically separated from telecommunication data cables. CommScope provides power separation requirements to ensure adequate separation between power and non-power cables. Alternatively, channel designers can refer to the appropriate standard; note, however, that the standards do not always align with the local codes. If this is the case, the more demanding or restrictive guidelines should be followed.

Remember that the pathways and pathway systems must be designed to account for future expansions (including the SYSTIMAX cabling and electrical installation). These expansions must be accounted for when designing the separation between electrical and data cabling.

Operating temperature

For copper cabling, a standards-based permanent link includes up to 90 meters of Category cabling plus up to 10 meters of patch cords. This length is based on an operating temperature of 20 degrees Celsius. If the cable's operating temperature is greater than 20 degrees Celsius, the attenuation of the copper increases. To compensate for the signal loss, the cable length must be reduced.

There are several cases where the cable length needs to be reduced to maintain the expected performance:

- When using more than 10 meters of cord. In general, cords have higher attenuation than solid cable. That added attenuation will have to be subtracted from the length of installed cable. Consider, for example, a 20 m cord whose attenuation is 50% higher than the fixed cable. The additional 10 m of cord will have the attenuation of a 15 m fixed cable, meaning that—when used in conjunction with a 20 m cord—the PL can be up to 75 m. Check the data sheet of the cord to find the correct attenuation.
- When the ambient temperature is above 20°C. In many cases, the expected ambient temperature during the warmest period of the year is well above 20°C. If the cabling is installed in a building void, such as above a suspended ceiling, the temperature is often at least five degrees higher.
- When cabling is used for remote powering (e.g., PoE). Cables carrying remote power will get hotter as the power delivered over the cabling increases. Remote powering can deliver up to 100 watts over each cable, which will heat the cable—potentially necessitating a reduction in the cable length. Using the CommScope PoE calculator, you can easily calculate the required length reduction due to heat gain from remote powering, as well as ambient temperatures above 20°C (see the section below).

It is common to reduce the cable length for all three of the above cases. If not done correctly, however, there is an increased risk that the cabling will fail on a hot day.

Remote power categories

In Europe and other regions, the CENELEC EN 50174-1 standard defines three categories for remote powering (RP) over data network cabling:

- RP1: The average current for all conductors does not exceed 212 mA [PoE+].
- RP2: The average current for all conductors is restricted to a fixed value between 212 mA and 500 mA.
- RP3: Maximum current of 500 mA on all conductors, simultaneously four-pair PoE on all links.

RP2 cabling is used where an average of more than 30 W is needed but RP3 is not achievable. The installer needs to document where the RP cables are in the cable bundles. It is the customer's (user's) responsibility to maintain records of all remote powering use across the installation. The data includes the calculated average power per bundle and resulting operating temperature and associated length reduction.

As the highest level of RP cabling, RP3 is used for the most power-intensive RP applications. During installation planning, the installer calculates the temperature rise based on 100 W of remote power on all cables and the associated length reduction. Using the CommScope PoE Calculator enables the installer to generate the PDF documents required as part of the site documentation. Because the installation is designed for full remote powering on all cables, the customer (user) does not need to track PoE use or calculate temperature rise or length reduction.

Bonding and grounding

Proper bonding and grounding of the telecom cabling, pathways, equipment and connecting hardware is critical to achieve optimal cabling performance and reduce electromagnetic interference (EMI).

Remember to consult the relevant standards and follow local regulations to ensure effective telecom bonding practices. Applicable local or national safety regulations take precedence whenever they conflict with those specified in this document.

Relevant standards for bonding and grounding include:

- ANSI/TIA-607-E: Generic Telecom Bonding and Grounding (Earthing), Customer Premises
- ISO/IEC 30129: Telecom bonding networks for buildings and other structures, Information technology
- EN 50310: Telecom bonding networks for buildings and other structures

The three standards above are very similar and provide two options for establishing a telecom bonding network:

1. Use the building's protective bonding network (earthing) and improve and extend where needed. The extension should, at least, include a connection to a busbar at each distributor. This approach is used to create a bonding network with low impedance. In a modern building with a proper electrical installation, this is normally the most cost-effective solution.
2. Build a dedicated telecom bonding network with a known resistance. In a building where the electrical installation is not well documented, this is often the most effective way to establish a good bonding network.

When using the standards, make sure to select one of the two options and follow only the requirements for that option.

Before cable installation, the proper function of the bonding network should be verified. This can be done, for example, by measuring the direct current (DC) loop resistance according to the International (ISO/IEC) or European (EN) standard, which establishes a maximum of 1.67 mΩ/m.

SYSTIMAX shielded cabling must be grounded wherever panels are installed, typically in each equipment room and telecom room.

Components of a standardized telecom grounding and bonding infrastructure can include:

- MET (main earthing terminal): This is the central part of the earthing system within the building's electrical system. Here, the telecom grounding and bonding infrastructure is connected to other building grounding systems (e.g., electrical, water piping and lightning protection) and is also bonded to building steel.
- Telecom Bonding Backbone (TBB): The TBB ties the main earthing terminal to the secondary bonding busbar.
- Secondary Bonding Busbar (SBB): The SBBs are located in the telecom rooms and can be connected to the building's metal framework.

Depending on how the standards apply to the bonding network and local electrical codes, there are minimum requirements for wire size. In general, the minimum bonding wire size is 4 square millimeters.

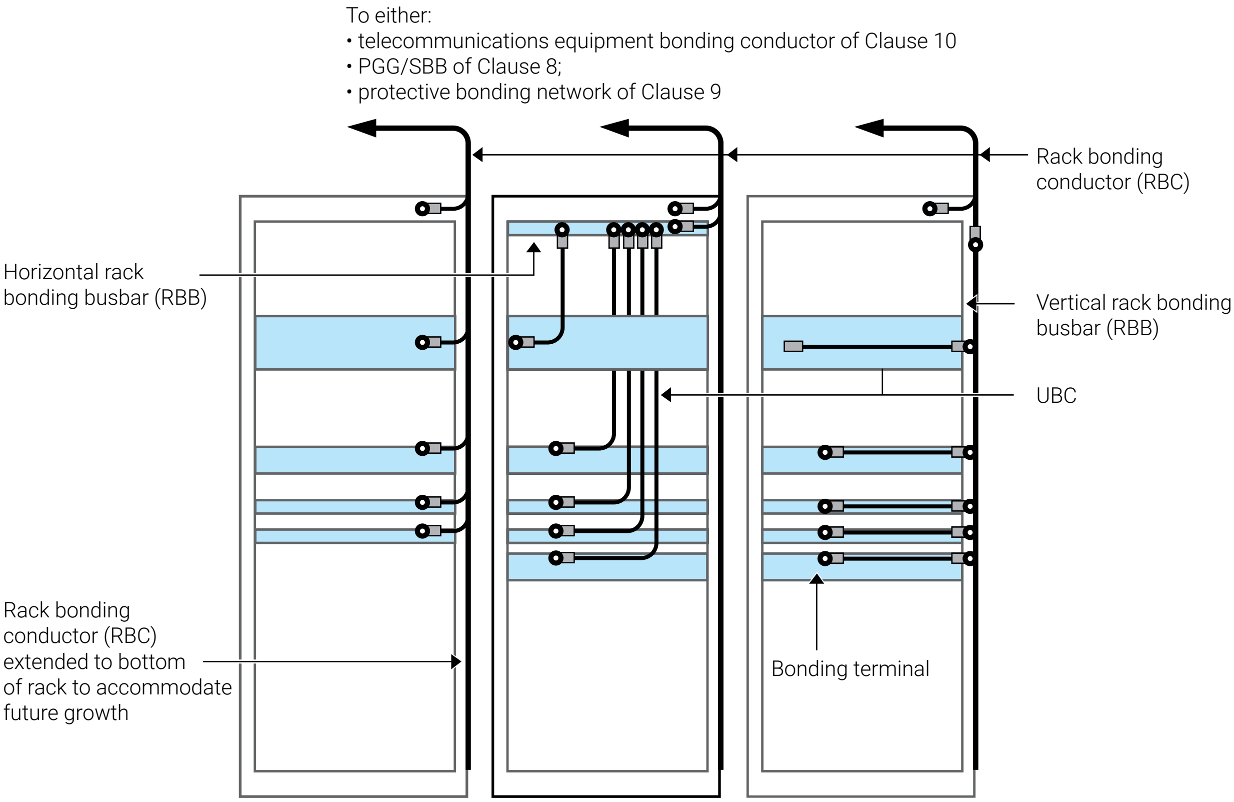


Figure 1 - Example of three methods of equipment and rack bonding

Figure 1 shows different standards-compliant methods of connecting panels for screened cabling with the bonding network.

Administration and labeling

Cabling administration and labeling allows for easy maintenance and management of the telecom cabling system. SYSTIMAX connecting hardware and faceplates are shipped with labeling inserts to make proper labeling easier. Product labels for SYSTIMAX panels can also be created using the Word templates available on mycommscope.com. An online label set creation tool can also aid in filling out label templates, enabling installers and customers to automatically generate label sequences for SYSTIMAX cables, connecting hardware and faceplates. Label sheets for these products include 8.5 x 11 inch or A4 format.

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

Cabling Element	Color Code
Backbone riser	White
Backbone tie	Gray
Backbone campus	Brown
Horizontal	Blue
Equipment	Purple
Network interface (Cust. side)	Green
Network interface (Co side)	Orange
Auxiliary circuits, alarms	Yellow
Key telephone systems	Red

Table 1: Color coding of connecting hardware fields

All cables 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.

If a cabling element contains mixed categories of cabling, such as a horizontal mixed with category 5E, they can be identified using enhanced color-coding such as white stripes on the blue label to differentiate X10D shielded cabling. Refer to the ANSI/TIA-606-D Administration Standard for the Telecommunications Infrastructure of Commercial Buildings for proper administration and labeling practices

General cabling guidelines

- Follow local regulations and applicable codes of the AHJ.
- Refer to the TIA-568-E series or CENELEC 50174 series for planning and installation practices.
- All cables, connecting hardware, interconnecting cords, bonding and grounding and support structures should be visually inspected for proper installation. Telecom cables should be installed with proper pathway support.
- Do not use cable lubricant—it is not allowed.
- Avoid water and water splatter, high humidity, and chemical contaminants, including lubricants, paint and cleaning solvents.
- Avoid cold temperature bending of cables.

The cabling must NOT:

- Be placed directly on fluorescent light fixtures.
- Be supported by ceiling grid systems, electrical conduits, gas or water pipes.

The operating temperature range for SYSTIMAX copper cable is -4°F to 140°F (-20°C to 60°C). The installation temperature is 32°F to 122°F (0°C to 50°C). At extreme temperatures, however, care must be exercised to prevent excessive kinking or increases in pulling tension. If the cable has been stored below 32°F (0°C) for more than eight hours, the cable must be conditioned at room temperature, 59°F to 86°F (15°C to 30°C) for at least four hours before installation.

Bundling and alien crosstalk

A primary feature of the GigaSHIELD X10D shielded cabling is the alien crosstalk performance in support of the 10GBASE-T standard. This performance is achieved even under the worst-case conditions, where all cables are routed together in the most tightly packed bundle. 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 GigaSHIELD X10D shielded supports:

- Tie wrapping up to three times per meter (once per foot). Tie wraps must not distort the cable jacket.
- Cable tray vertical depths up to 23 centimeters (9 inches) using hardware with suitable protection, sweeping edges and well-controlled entry. Check with the raceway manufacturer for tray support and design and limitations. Note that general guidelines and current standards call for 15 cm (6 in) maximum.
- Shielded cords may also be bundled by combing to eliminate crossovers and securing with tie wraps. Bundling is typical for long equipment cords. Cross-connect cords and work area cords are often randomly placed or routed separately. They are typically not combed and tied, but may be in certain cases.
- Planning the cabling for a PoE type 4 application (90 W) reduces the bundle to a maximum of 24 cables. See the CommScope PoE Implementation Guide for more information.

Fill guidelines

GigaSHIELD X10D shielded cables are available in multiple designs (e.g., F/UTP vs S/FTP). For the 7.5 mm diameter, including cables from the x291 and x298 series, use the following fill guidelines:

- 1.4 cables per square cm (nine cables per square in) in trays or other open raceways, assuming:
  - Cables are laid in place without tying them into smaller bundles
  - There are no crossovers in the raceway or at raceway entrances or exits
  - Raceway entries and exits are wide enough to sweep cables out from the raceway
- 1.1 cables per cm^2 (seven cables per in^2) in trays or other open raceways where there are crossovers in the raceway and individual cables randomly enter or exit the raceway. Note that density will be decreased 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 manufacturer guidelines on fill and weight may be more restrictive. Consult the Cabling and Pathways Estimator tool on mycommscope.com. Plan for a 25% initial fill to allow space for later additions. Conduits generally have 40% fill limits. Table 2 provides a quick reference showing the fill limits for different conduit sizes. Note that these limits can be increased by using conduit for short sleeves and carefully feeding and pulling the cable.

Conduit size	x291	x296	x297	x298
3/4 in	2	3	3	3
1 in	4	5	5	5
1 1/4 in	8	10	8	8
2 in	19	22	20	19
3 in	51	59	53	51
4 in	85	98	88	86

Table 2: Conduit fill limits by conduit sizes

Source: https://calcpathways.commscope.com/

Note that the PoE requirements and design can influence the maximum capacity of a cable tray, especially close to the computer room where cable densities are highest.

Table 3 is provided for installers as they consider the maximum cable weight on conduits and pathways.

Cable type	x291B	x296A	x297B	x298A
(kg)	< 18.0	< 14.6	< 17.4	< 19.5
(lb)	< 40	< 32	< 38	< 43

Table 3: Cable weights per 1,000 ft (305 m)

Cable/cord distances

Typical channel guidelines call for no more than 90 m of 91-series shielded cable and 10 m of cord length. These distances, however, may be superseded by site-specific guidelines that are well documented and followed. For example, additional cord length is often required but comes at the expense of a corresponding decrease in cable length. There are several motivations for such a tradeoff.

- Where cordage to a consolidation point is a coordinated design replacement for cable.
- The coordinated use of longer work area cords to multi-user telecom outlet assemblies.
- Longer data center cords are needed to span large equipment distribution areas.

Such changes must be coordinated so strict attenuation limits are preserved. The following formula and Table 4, adopted from ANSI/TIA-568-D.2, can help determine the alternate maximum cord lengths that can be used with reduced cable lengths. The results may be applied to any of the configurations outlined within this document.

C <= (102-H)/1.2H <= 102 – 1.2 C

Length of horizontal cable (H)	Total cord length: Maximum length of work area cord + patch cords + equipment cord (C) m (ft)
90 (295)	10 (33)
85 (279)	14 (46)
80 (262)	18 (59)
75 (246)	22 (72)
70 (230)	27 (89)

Table 4: Alternate maximum lengths for cable and cordage

Cord and cable guidelines

Channel components	2-connection channel (Figure 1, 6)	3-connection channel (Figure 2, 7)	3-connection channel (Figure 3, 8)	4-connection channel (Figure 4, 9)	4-connection channel (Figure 10)
Equipment cord	1 m (3.3 ft)	2 m (6.6 ft)	2 m (6.6 ft)	2 m (6.6 ft)	2 m (6.6 ft)
Cross-connect cord	not applicable	1 m (3.3 ft)	not applicable	1 m (3.3 ft)	1 m (3.3 ft)
Horizontal cable	3 m (9.7 ft)	5 m (16.4 ft)	5 m (16.4 ft)	5 m (16.4 ft)	5 m (16.4 ft)
CP cord	not applicable	not applicable	5 m (16.4 ft)	5 m (16.4 ft)	not applicable
Remote cross-connect cord	not applicable	not applicable	not applicable	not applicable	1 m (3.3 ft)
Remote equipment cord/ work area cord	1 m (3.3 ft)	1 m (3.3 ft)	1 m (3.3 ft)	1 m (3.3 ft)	2 m (6.6 ft)

Table 5a: Minimum length and configuration guidelines for GigaSHIELD X10D solutions as they apply to the work area and data center channel models in Figures 1 to 8 below.

Channel components	Central cross-connect configuration
Equipment cord	1 m (3.3 ft)
Horizontal cable	5 m (16.4 ft)
Cross-connect cord	1 m (3.3 ft)
Horizontal cable	5 m (16.4 ft)
Remote equipment cord	1 m (3.3 ft)

Table 5b: Additional supported channel configuration with minimum lengths

Cable pathways

Refer to the TIA-569-B Commercial Building Standard for Telecommunications Pathways and Spaces and manufacturer's guidelines for more detailed information.

Using hangers

- Avoid using more than 144 cables in a single hanger pathway, including crossovers of cables along the pathway.
- Maintain proper distance (1.5 m) between hangers to avoid cable stress caused by tension in the suspended cable run.
- The cable surface of the hanger should have rounded or flexible edges to avoid damaging or deforming the cable sheath.
- When using cable ties to secure cables, be sure to wrap ties loosely and use the appropriate plenum or non-plenum cable tie. Hook-and-loop straps may be easier to use and adjust.
- Do not place cables on lighting fixtures or hot pipes.
- Follow local and national codes for proper pathway support of cables and note that telecom cabling standards require pathway support for cabling.

Using conduits

- Make sure conduits are properly reamed and bushed.
- Feed cables directly into the conduit end or use a suitable conduit shoe to avoid excessive pulling tension and possible cable tearing.
- See the NEC (Chapter 9, Table 4) for identifying different conduit types and sizes.
- Cable lubricants should not be used due to excessive drying time.

Using raceways

- Follow design specifications regarding the loading weight of cable trays or raceways.
- Standards require a minimum of 300 mm (12 in) of access headroom above a cable tray system or cable runway.
- Follow the manufacturer's specifications for cable fill limits. Cabling must not exceed 23 cm (9 in) depth or 15 cm (6 in) in height (depending on the standard) for compliance.
- Cable routing should be planned to avoid crossovers and entanglement when branching off the pathway. Plan all runs prior to installation.
- When using cable ties to secure cables to trays, be sure to wrap ties loosely and use the appropriate plenum or non-plenum cable tie. To prevent distorting the cable jacket, ensure the tie has enough play to slide up and down the cable.
- Telecom data cabling must be partitioned from power cabling or routed in a separate group when combined in the same tray or raceway. See the Power Separation Guidelines for more information.

Cable handling

- Check the manufacturer's design specifications and requirements for proper cable handling.
- Cable ties should be applied loosely to cable bundles and should allow sliding of the cable tie across the cable bundle. Tie wraps must not distort cable jacket. Use wide ties or hook-and-loop fasteners.
- Cable installation should not significantly deform the cable jacket.
- Cables should not be attached to the ceiling grid or lighting support wires.
- The maximum pulling tension for a four-pair balanced twisted-pair cable must not exceed 110 N (25 lb).
- Avoid slack loops; pull back excess cable along "slack runs" to store excess cable. Where slack looping is unavoidable, ensure that the cable is not twisted while creating loops (this can untwist the cable pairs). Disengage the outlet from the faceplate and form the slack loops without twisting the cable. Take care to avoid twisting the cable when unwinding and using the slack.
- Maintain the proper bend radius and avoid kinks. The minimum bend radius is four times the cable diameter for cables and one times the cordage diameter for cords.
- Avoid untwisting and separating cable pairs. Maintain twists to the point of termination and avoid pair wrapping.

Work area channel models

The following illustrations of the various channels identify connections from the central equipment (data switch, building automation system controller, etc.) to the work area equipment (workstations, servers, etc.). The modeled configurations are based on the ISO/IEC IS 11801 and TIA-568-C standards for up to four cabling connections. A connection is where two cabling segments come together. These models are also commonly applied to backbone cabling subsystems, in addition to data center channel models.

Two-connection model

The most basic channel model has two connections and is typically referred to—and tested (without the cords)—as a permanent link. The horizontal link with the cords is tested as a channel.

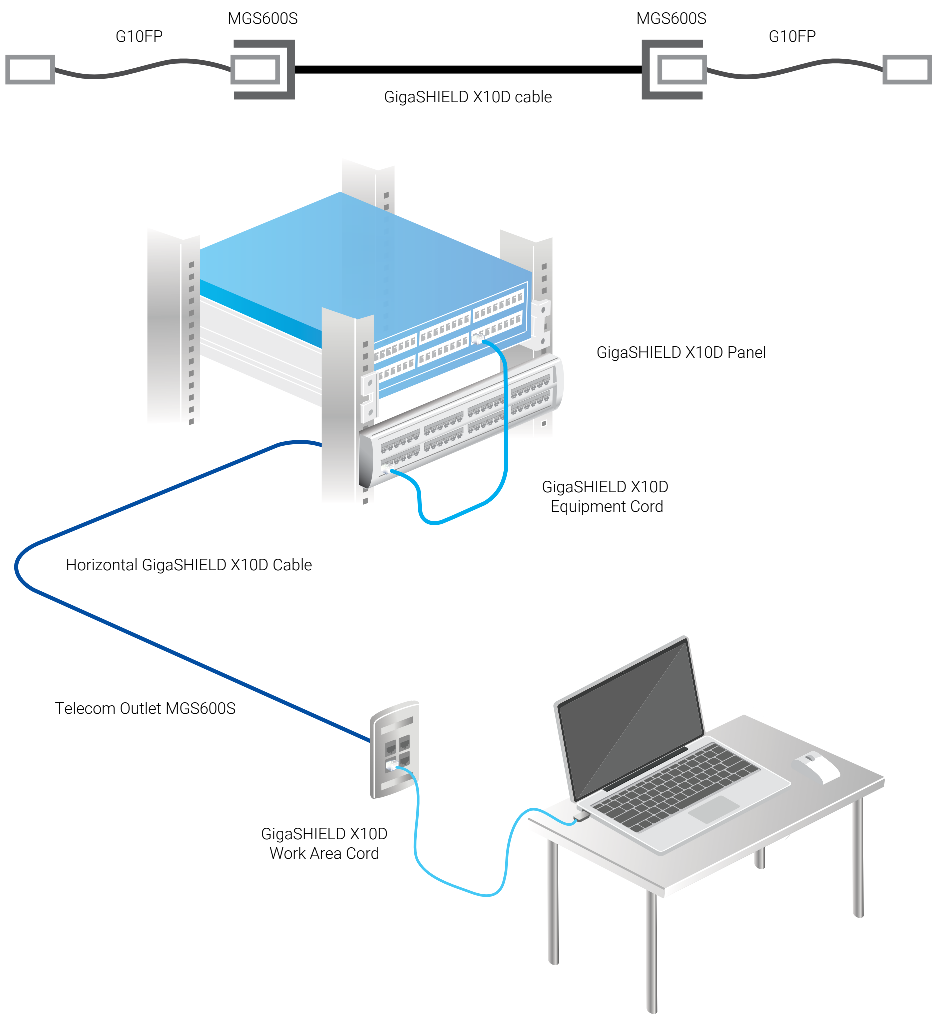


Figure 2. Two-connection model: interconnect to telecom outlet

Three-connection models

A three-connection model can support one of two different channel types: cross-connect or 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.

Three-connection model: cross-connect to telecom outlet

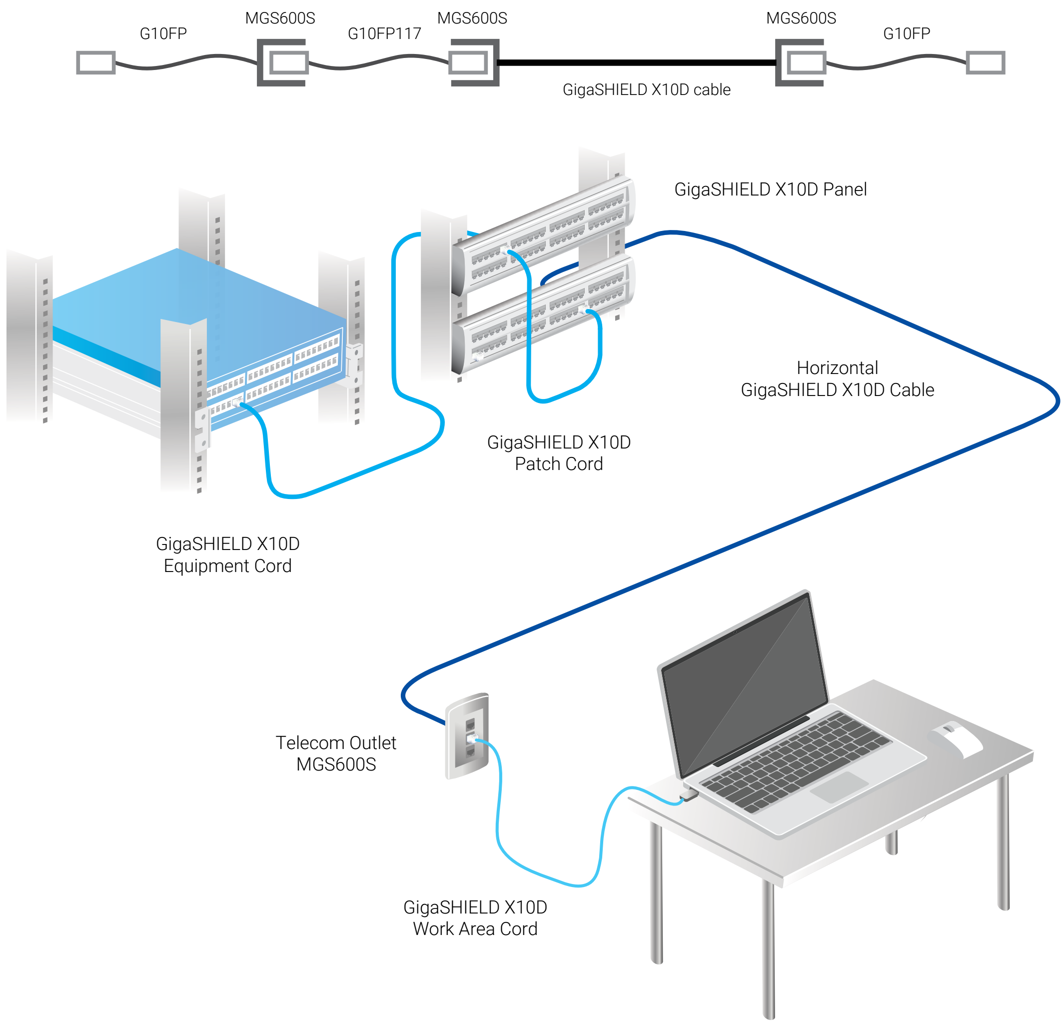


Figure 3a. Three-connection model: cross-connect to telecom outlet

Three-connection model: interconnect to consolidation point

Where open office spaces may have a high turnover or where installation may be staged, the horizontal cable can be terminated at a consolidation point. This is often done to support modular office designs. It allows easy cabling changes from the consolidation point to the telecom outlet after changes have been made to an 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.

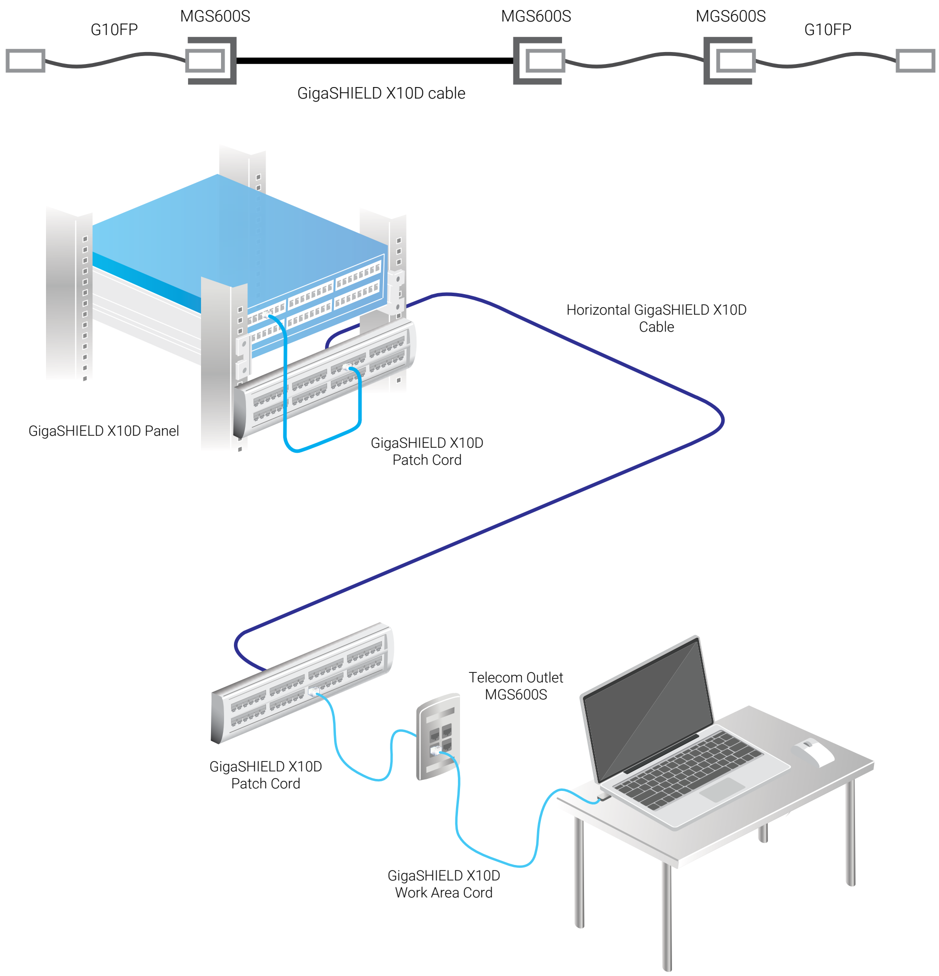


Figure 3b: Three connection model: interconnection to a consolidation point

Four-connection model

At large open office sites requiring administrative flexibility, a four-connection channel is often used. This configuration offers flexibility and protection at both ends of the horizontal cabling, providing the advantages of cross-connect in the telecom 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.

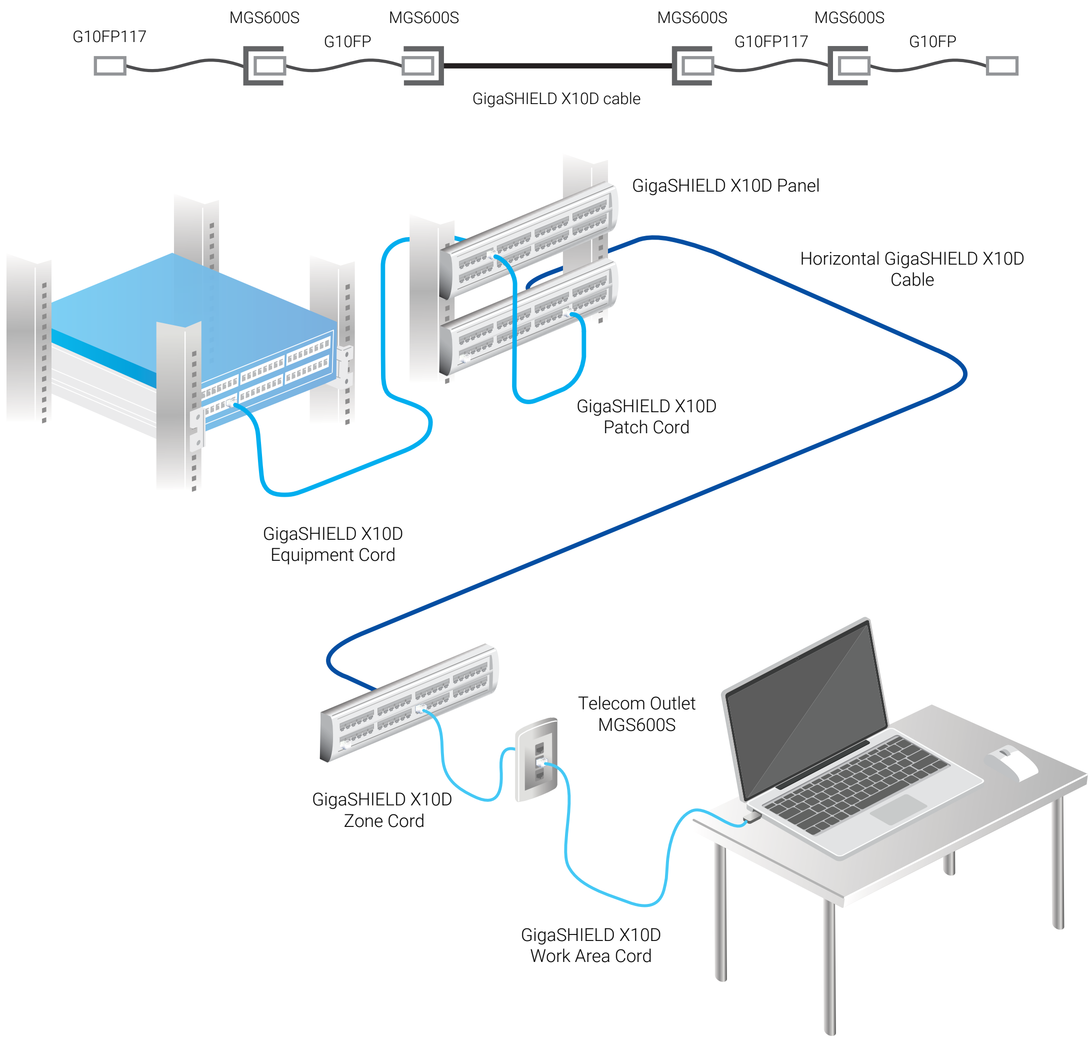


Figure 4. Four-connection model: cross-connection with a consolidation point

Data center computer rooms

SYSTIMAX GigaSHIELD X10D cabling is particularly well suited for use in data center computer rooms, as it enables upgrades to 10GBASE-T equipment. This section illustrates how GigaSHIELD X10D can be configured to comply with ISO/IEC 11801-5, EN50173-5 and ANSI/TIA-942-C standards for data centers. The configurations are based on the TIA-568-C standard for telecom cabling in commercial buildings because the commercial building environment uses many of the same LAN components as the data center computer rooms.

Due to the specialized and high-density nature of data center deployments, the cabling design must be tightly coordinated with other system designs, including electrical, HVAC, security and operations. Consult ANSI/TIA-942-C for additional information and details.

As a versatile copper cabling solution, GigaSHIELD X10D is well suited for out-of-band (OOB) data center management environments. It offers a variety of installation configurations (shown below) and supports up to four connectors per channel.

Data center computer room channel models

The following illustrations identify various channels between different areas within a data center's computer room. These configurations contain up to four connections, where two cabling segments come together. Note that the connections at the equipment are not counted in the models.

Two-connection computer room model

A basic channel model consists of only two connections and is typically called a permanent link when tested without cords. The horizontal channel, which includes the cords, can also be tested as a channel.

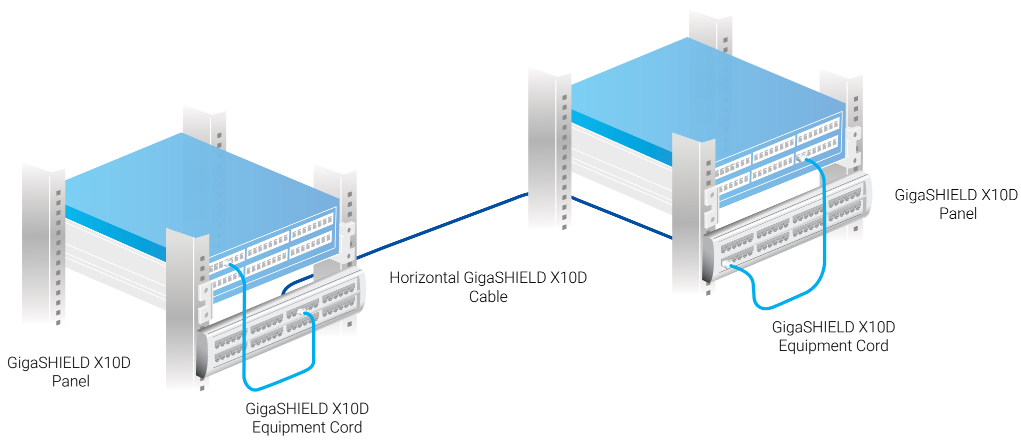


Figure 5. Two-connection computer room model: interconnect to interconnect

Three-connection computer room model

A three-connection design can support two different channel models: a cross-connect 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-connect. 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.

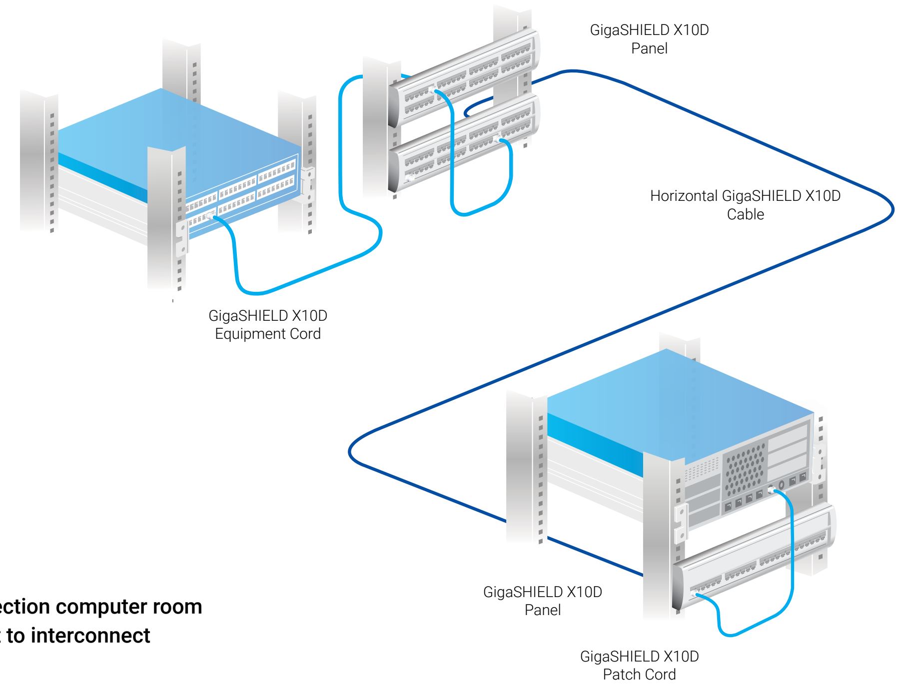


Figure 6. Three-connection computer room model: cross-connect to interconnect

Where a site administrator may need flexibility or where installation may be staged, the horizontal cable can be terminated at a consolation point. This enables, for example, terminating a horizontal bundle at the middle of a row where horizontal cables can be apportioned 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.

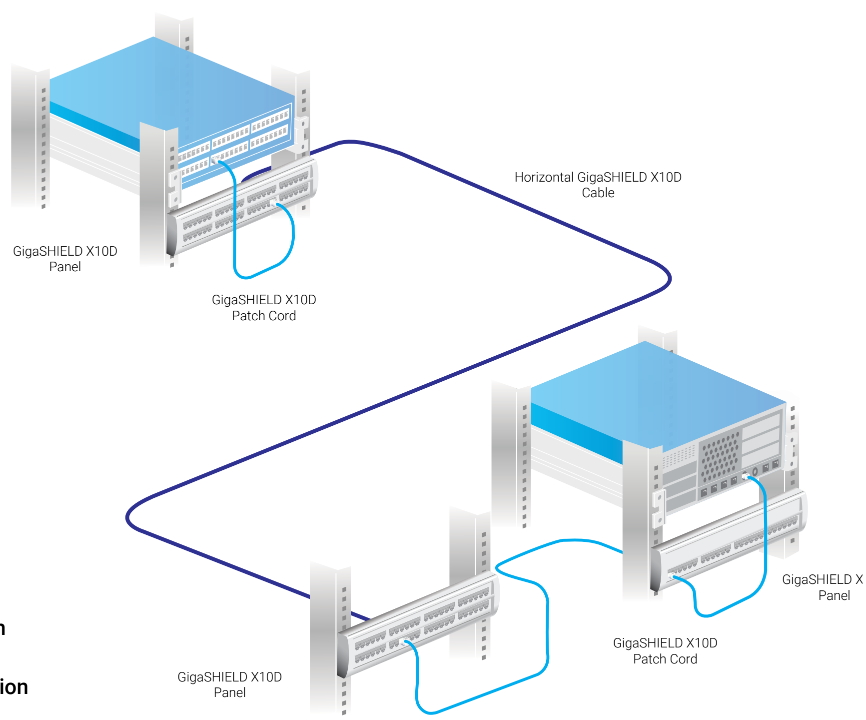


Figure 7. Three-connection computer room model: interconnect to consolidation point

Four-connection computer room models

In large data centers, the cabling distribution is typically consolidated at cross-connects with channels consisting of four connections. These configurations are typically referred to—and tested (with the cords)—as a channel. There are two configurations: a cross-connect with a consolidation point and a double cross-connect. The consolidation point configuration, shown in Figure 9a, enables two levels of administration to the server equipment as in Figure 8. Additionally, it provides a cross-connect for the switching equipment. The consolidation point provides flexible allocation of horizontal capacity to multiple smaller customers that must be independently maintained.

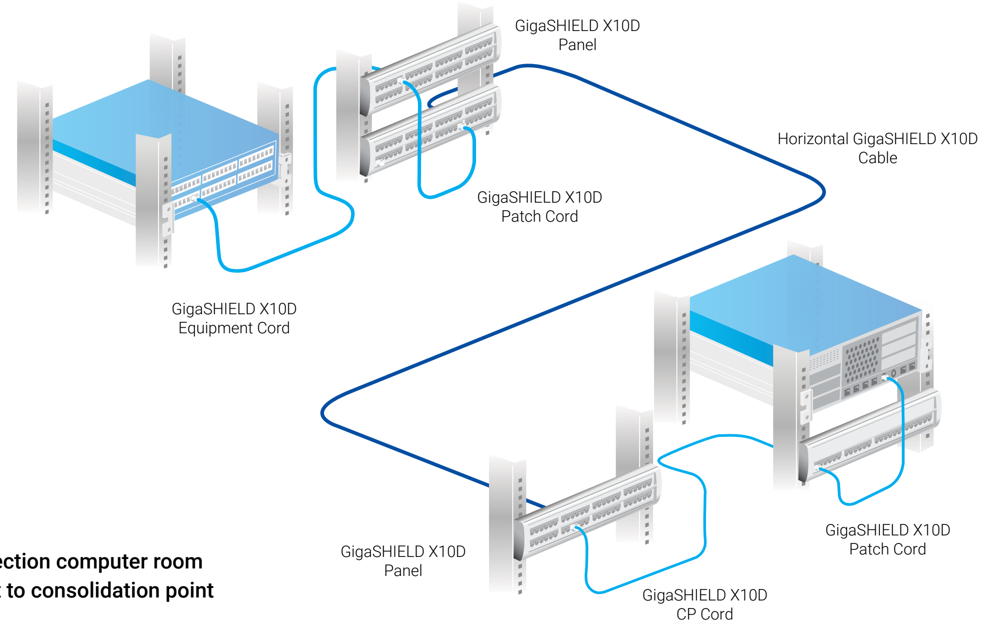


Figure 8a. Four-connection computer room model: cross-connect to consolidation point

The dual cross-connect configuration, shown in Figure 9b, 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.

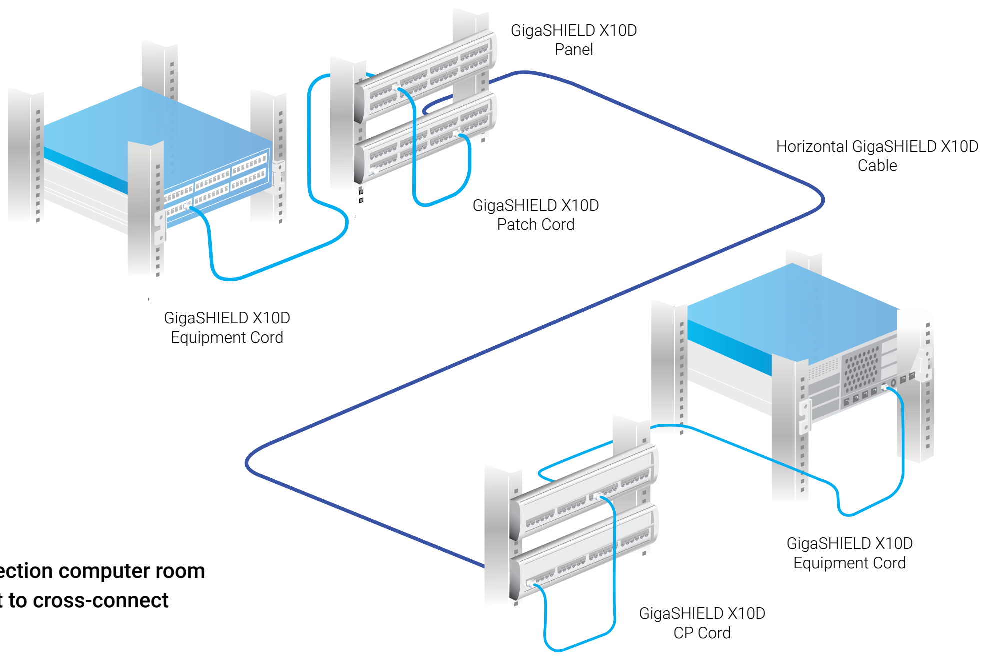


Figure 8b. Four-connection computer room model: cross-connect to cross-connect

Data center cabling can also be planned with a centralized cross-connect architecture. This is a useful extension of the two-connection model (Figure 6), although the cable lengths must be carefully planned. Two cable segments are cross connected into a single channel while keeping the total cable length within the maximum specified in Table 4 and the minimum specified in Table 5b.

Preparing GigaSHIELD X10D cable for termination

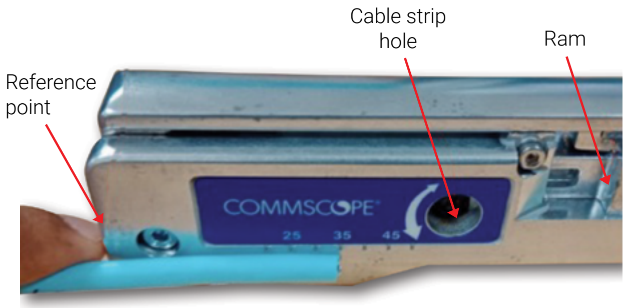


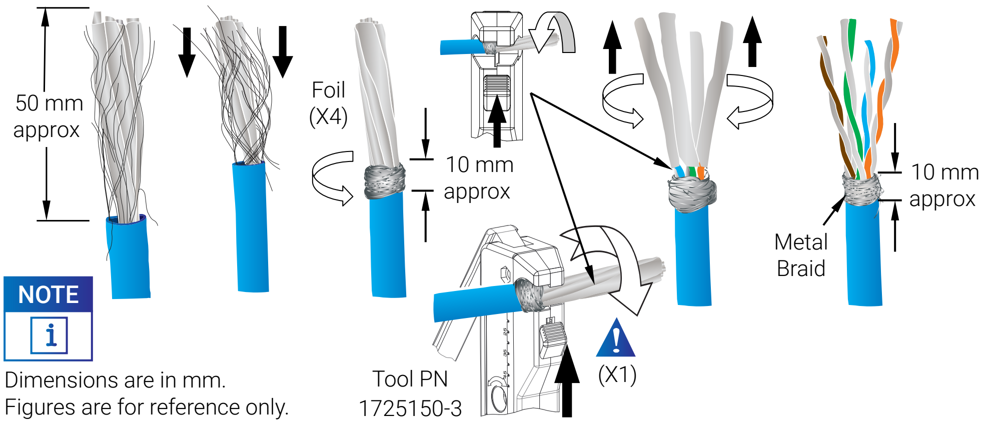
Figure 9

- Place the cable next to the scale on the side of the tool, with the end of the cable positioned at the desired strip length (indicated in mm). Refer to Figure 10 but note that—while Figure 10 shows a strip length of 35 mm—the recommended length is 50 mm (2 in).
- Grasp the cable where it aligns with the end of the tool. That is the reference point for the scale.

Figure 10

- Pull the ram completely forward and insert the cable through the strip hole until the reference point is flush with the side of the tool. Refer to Figure 11.
- Release the ram. The spring will provide the force for the cable stripping operation.
- Rotate the tool around the cable; approximately 1 1/4 turns are normally sufficient to cut through the cable jacket. An arrow next to the cable strip hole indicates the direction of rotation for different depth cuts.
- Pull the ram forward and remove the cable.
- Fold the foil and drain wire back over the cable jacket. If preparing an S/FTP cable, fold the braided wires all the way back. Wind the foil and drain wire (F/FTP and F/UTP) or the braided wires (S/FTP) around the jacket.
- If the cable uses clear cellophane wrapping, trim off any exposed cellophane.
- If the individual cable pairs are wrapped in foil, score the foil with the tool and remove the foil from the cable pairs.
- Separate the pairs, cut the flute flush with the end of the jacket, and restore the pairs to their original positions. Ensure the foil is wrapped tightly over the jacket and wrap the drain wire close to the end of the foil without overlapping.
- Review the following drawings for each type of cable used.

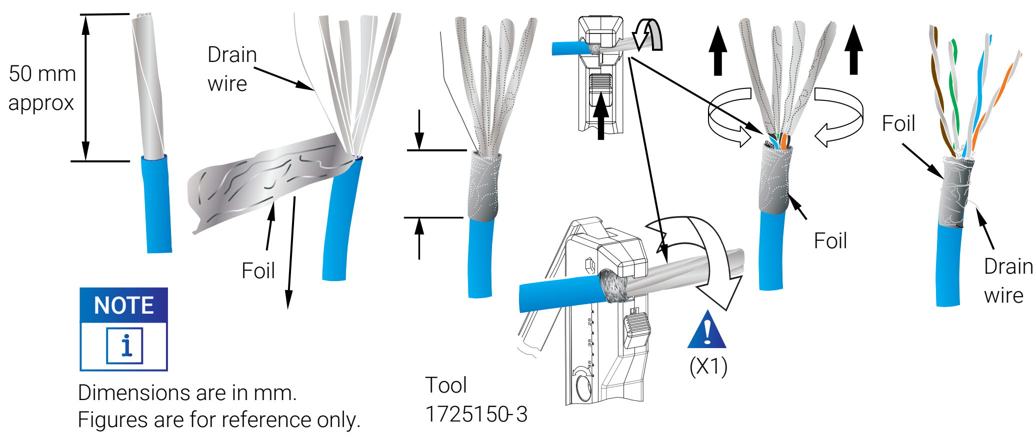
S/FTP CABLE PREPARATION: S/FTP ("PiMF")



NOTE

Dimensions are in mm.
Figures are for reference only.

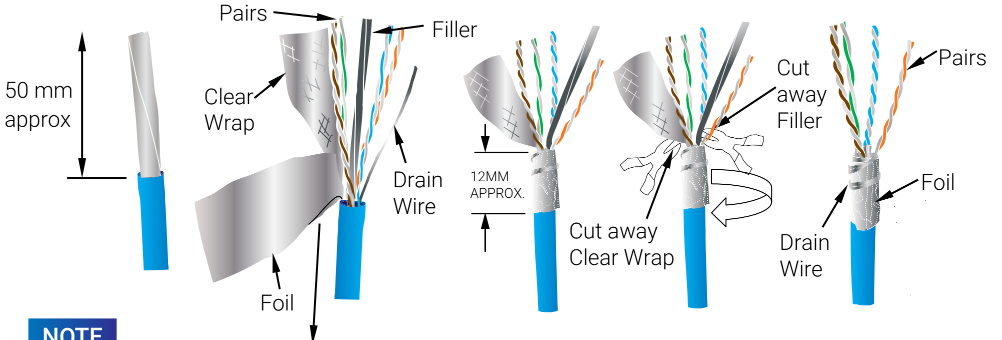
F/FTP CABLE PREPARATION: F/FTP ("Compact")



NOTE

Dimensions are in mm.
Figures are for reference only.

F/UTP CABLE PREPARATION: F/UTP

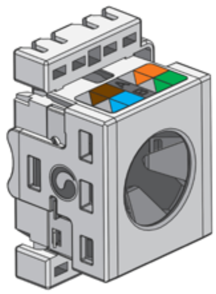


NOTE

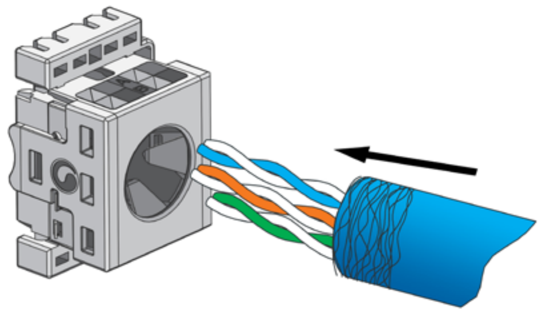
Dimensions are in mm.
Figures are for reference only.

- Once the cable is prepared, align the lacing element of the MGS600S tool with the correct colors of the cable.

STEP 1 (Align color coding)

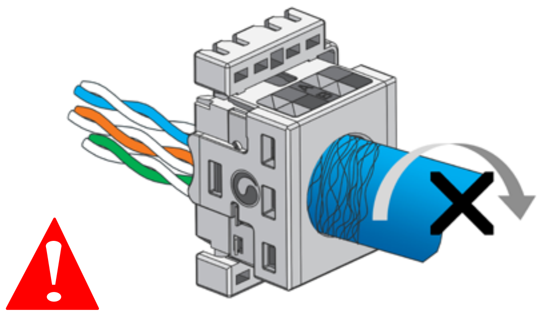


STEP 2

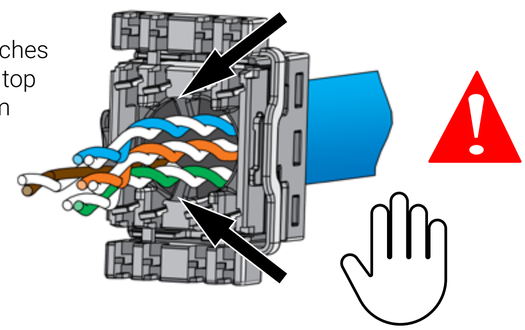


- Push the wires/cable through the lacing element until the jacket hits the notches on the inside of the connector. Do NOT rotate the cable!

STEP 3

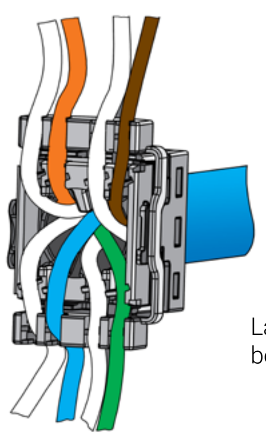


Step 4 (Cable depth)



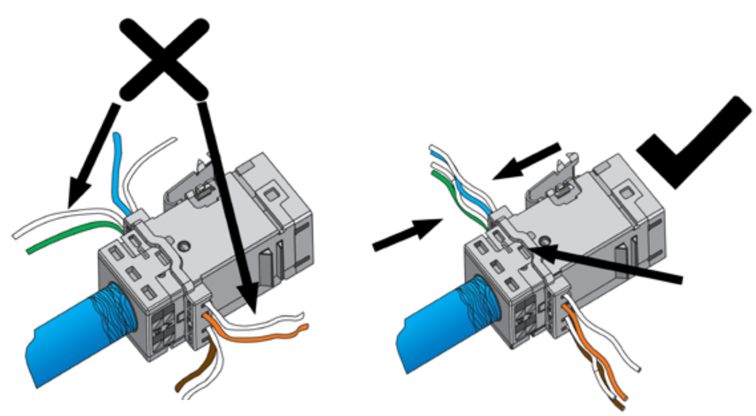
- Lace the wires according to the color code T568 A or B for your region; the visual above shows the color code for TIA568B is shown.

Step 5 (Lacing Wires)



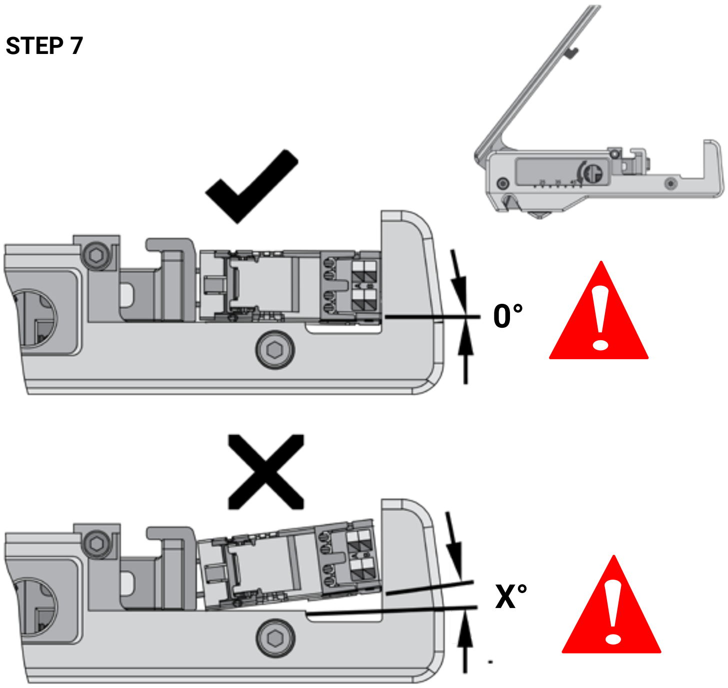
- Place the front of the connector onto the lacing element, respecting the key.

Step 6 (Locate Key Feature)



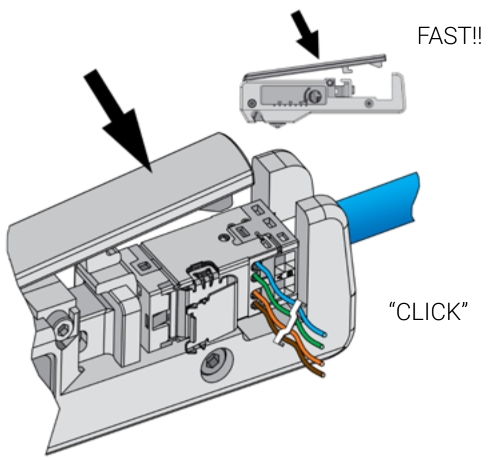
- Position the connector flat into the tool. Ensure the M-adapter is removed from the front of the connector.

STEP 7

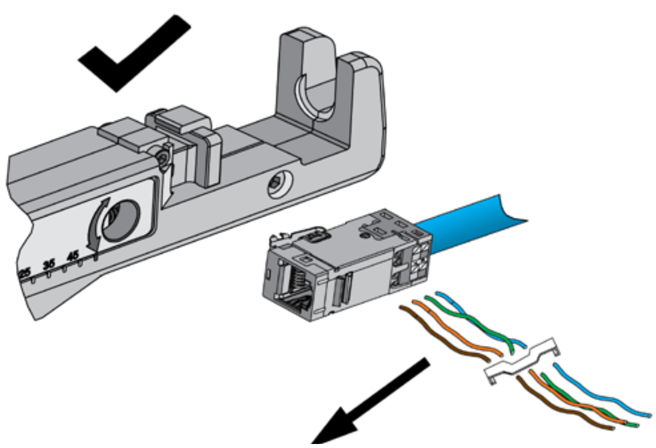


- Close the handle swiftly to avoid slowly squeezing the connector.

STEP 8 (Closing Process)



STEP 9



Video: Installing the CommScope MGS600S onto a S/FTP cable

Video: Installing the CommScope MGS600S onto a F/UTP cable

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