Mass Termination Xchange (MTX) Frame System Equipment Office Planning and Application Guide

CORNING

Discovering Beyond Imagination

Corning Cable Systems
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REVISION HISTORY

ISSUE	DATE	REASON FOR CHANGE
Issue 1	3/2005	Initial Release

Repairs or Returns

All inquiries regarding repairs should be directed to the Customer Service Department, Corning Cable Systems, PO Box 489, Hickory, NC 28603-0489; (828) 327-5000. This will assure you the fastest service possible.

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CHAPTER 1 : INTRODUCTION

This document provides basic guidelines for equipment office engineers and planners to design and plan facilities for managing optical fiber installations. While the various concepts can be implemented in a number of ways using different equipment, the examples presented are specific to the Mass Termination Xchange (MTX) Frame System and its components, a featured part of Evolant™ Solutions for Evolving Networks by Corning Cable Systems.

This guide is not intended to serve as an installation manual. Detailed installation guides are available with the MTX Frame products. A complete list of applicable installation guides can be found later in this section.

MTX FRAME PRODUCT PHILOSOPHY

The MTX Frame products are aimed at providing the most efficient and cost-effective solutions to managing optical fibers in the telephone central office or cable television (CATV) headend. The modularity and flexibility of the designs let the user take full advantage of the advanced features today, and yet still maintain an upgrade path for future growth. All MTX Frame products employ positive bend radius control over the entire fiber path, thus preserving the highest possible degree of optical path reliability.

MTX FRAME PRODUCTS

MTX Frame products are used for the termination, connection, and management of optical fiber in telephone central offices, cable television headends, Controlled Environment Vaults (CEVs), and customer premises. MTX Frame products include:

MTX Frame
MTX Fiber Termination Module Housing
MTX Fiber Termination Module
MTX Rear Patch Cord Trough
MTX Interbay Fiber Manager (IFM)
MTX Equipment Patch Cord Vertical Channel
MTX Equipment Patch Cord 2 mm/3 mm Transition Box
Universal Distribution Frame (UDF)-compatible Mounting Hardware
MTX End Guard
MTX Work Shelf

Other Corning Cable Systems equipment is compatible with the MTX Frame products, such as couplers, wave division multiplexers, and attenuators.

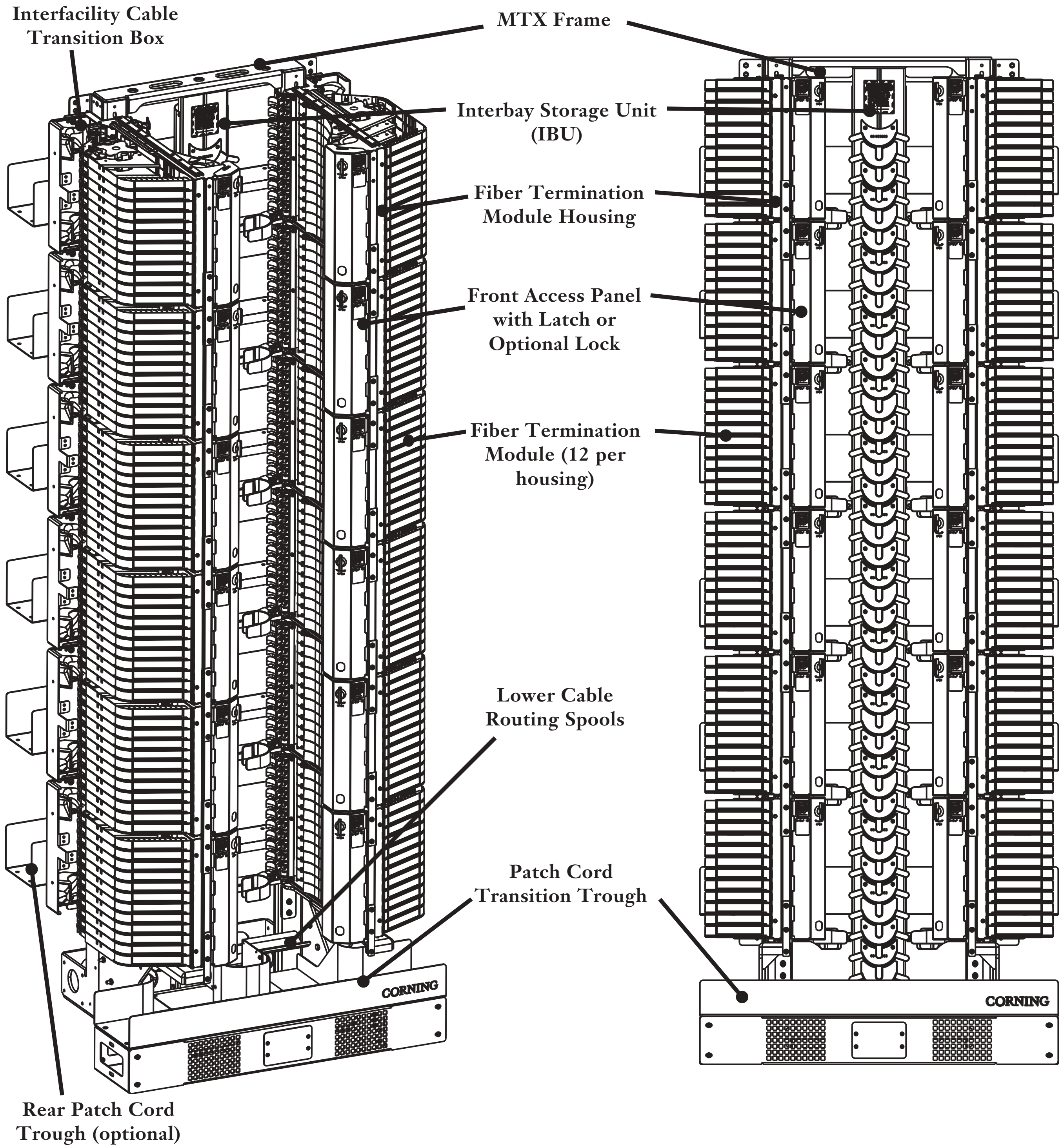


Figure 1 — MTX Frame Features

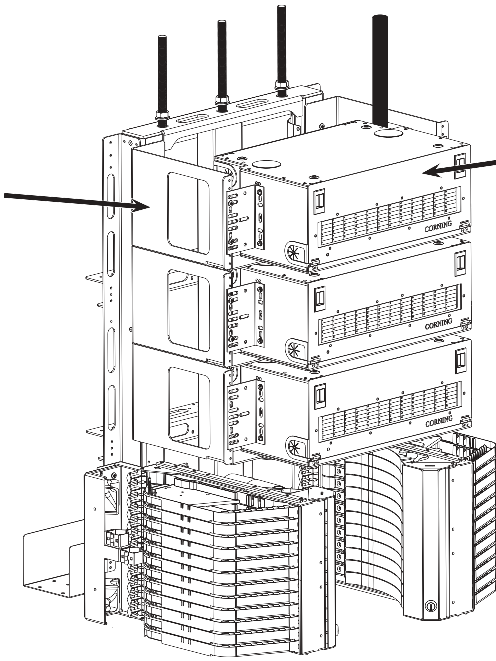


Figure 1 (Continued) —MTX Frame Features

MTX FRAME PRODUCT APPLICATIONS

The following table (Table 1-1) summarizes the most-common applications for MTX Frame products.

MTX Frame Products		Application
Frame	**Rack mounted**	Central Office, Headend, CEVs, CATV
Housings	**UDF-type Housing (such as LDC, LTS, & LHS)** **MTX Module Housing**	Central Office, Headend, CEVs, CATV, Hut
Modules	**MTX Fiber Termination** **MTX Coupler**	Central Office, Headend, CEVs, CATV, Hut
Interbay Fiber Manager (IFM) **Interbay Storage Unit (IBU)**	**Single unit between frames** **Standard unit between modules**	Central Office, Headend, CEVs, CATV, Hut

Table 1-1 — MTX Frame Applications

REFERENCE DOCUMENTATION

Detailed installation and planning guides for MTX Frame products are summarized in the following table:

MTX Products		Document Type	Reference
Equipment Planning Guide	**MTX Frame and Related Components**	**Planning Guide**	**003-664**
Frame System	**MTX Frame and Related Components**	**Installation**	**003-665**
Patch Cord Routing in the MTX Frame System	**MTX Frame and Related Components**	**Installation**	**003-666**

Table 1-2 — MTX Frame Reference Documentation

CHAPTER 2: FIBER NETWORK OVERVIEW

Over the next 20 years all aspects of the communications network will undergo a major transformation from copper-based to fiber-based equipment (see Figure 2-1). Of particular importance at the equipment office is the migration of fiber into the access network (for example, Fiber-To-The-Curb, Hybrid Fiber-Coax, Fiber-To-The-Business, and Fiber-To-The-Home). The large number of customers in the access network will result in a rapid growth of fiber at central offices and headends. Although the number of fibers is not expected to reach copper-pair proportions, equipment offices can still anticipate fiber counts in the thousands.

Outside plant fiber network architectures are evolving with the introduction of rings or alternate routes. Ring deployments increase the complexity of the physical fiber network, both in the outside plant and in the equipment office. To effectively cope with such diverse networks, and to provide an upgrade path to future growth, new concepts and strategies are needed in the area of physical fiber management.

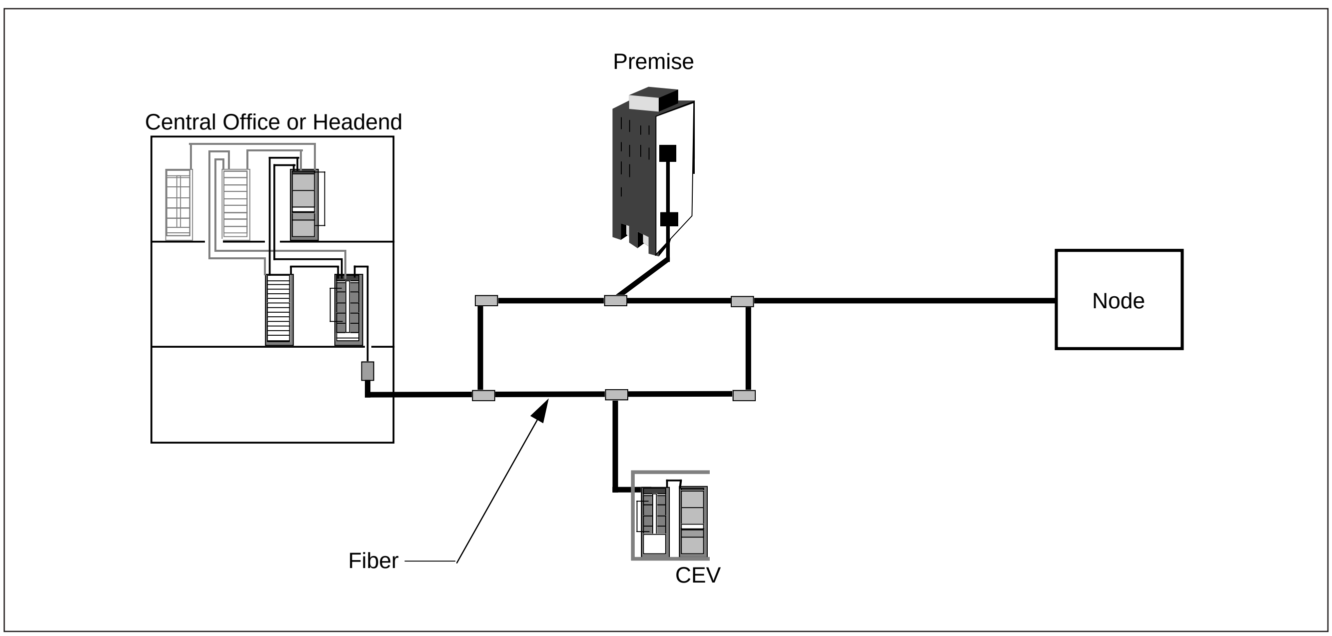


Figure 2 — Fiber Network

Within the equipment office, fiber will also replace copper and coax as the preferred medium for equipment-equipment and equipment-switch links. This growth will place additional demands for effective fiber management in the equipment office.

Eventually, fiber will replace copper in all LAN-based transmissions systems. As with the existing copper infrastucture, proper fiber management and administration will be key components for an evolvable and trouble-free fiber network.

CHAPTER 3: MTX FRAME PLANNING

BUILDING ENGINEERING

TYPICAL FLOOR PLANS

The MTX Frame is a single-sided seven-foot front-access frame. This means that the frame may be installed and operated from the front only, and as such may be placed against a wall. A minimal installation of one frame requires a minimum space of 30 inches wide by 24 inches deep by 84 inches high. Each additional frame added to the line-up requires the same amount of space. In huts, CEVs and customer premises installations, space restrictions usually require that the frame be installed against a wall. In equipment offices, where many frames may be placed in a single line-up, it is suggested that aisle space is left in front of and behind the frames. This strategy provides room for growth and cable access. The recommended clear space to leave in front of a frame is 3 foot 6 inches. The recommended maximum number of frames that can be placed in any one line-up is 20 (or a 50-foot maximum length). This limit is based on the trough capacity in each frame for inter-bay patch cords. Line-ups of greater than 20 frames are possible with careful planning. The MTX Frame System is compatible in line-ups with other vendors' high-density frames. Figure 3 shows a typical floor plan.

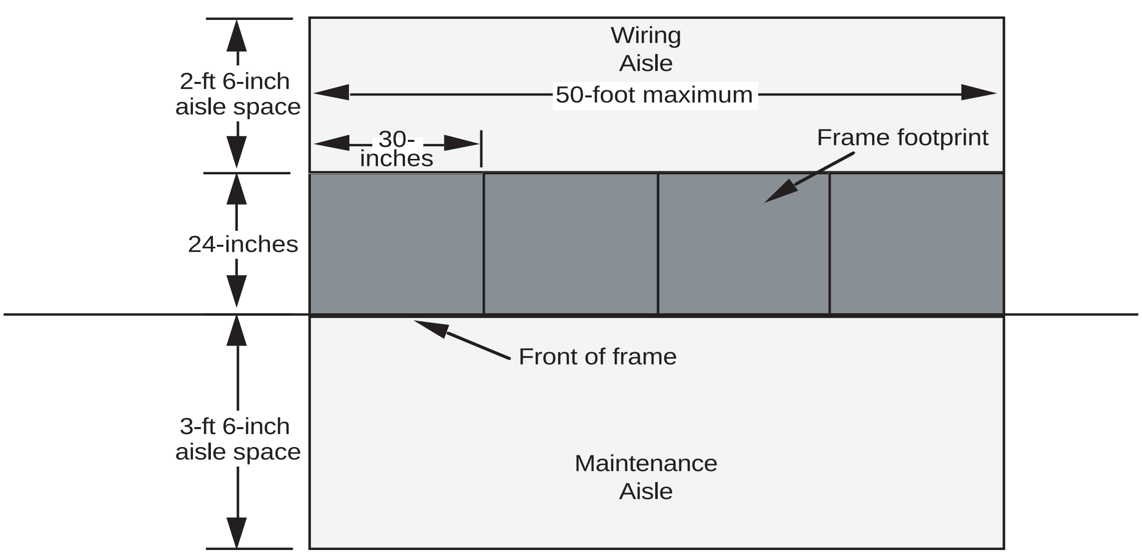


Figure 3 — Typical floor plan

Figure 4 illustrates a typical equipment office building with three line-ups in a network application. Troughs and overhead raceways may be added to increase fiber transition capability. Expansion and growth within a network application may be accomplished by adding additional line-ups as depicted in Figure 4. Space requirements for aisles and the frame footprint should conform to the dimensions and limitations recommended for a single line-up.

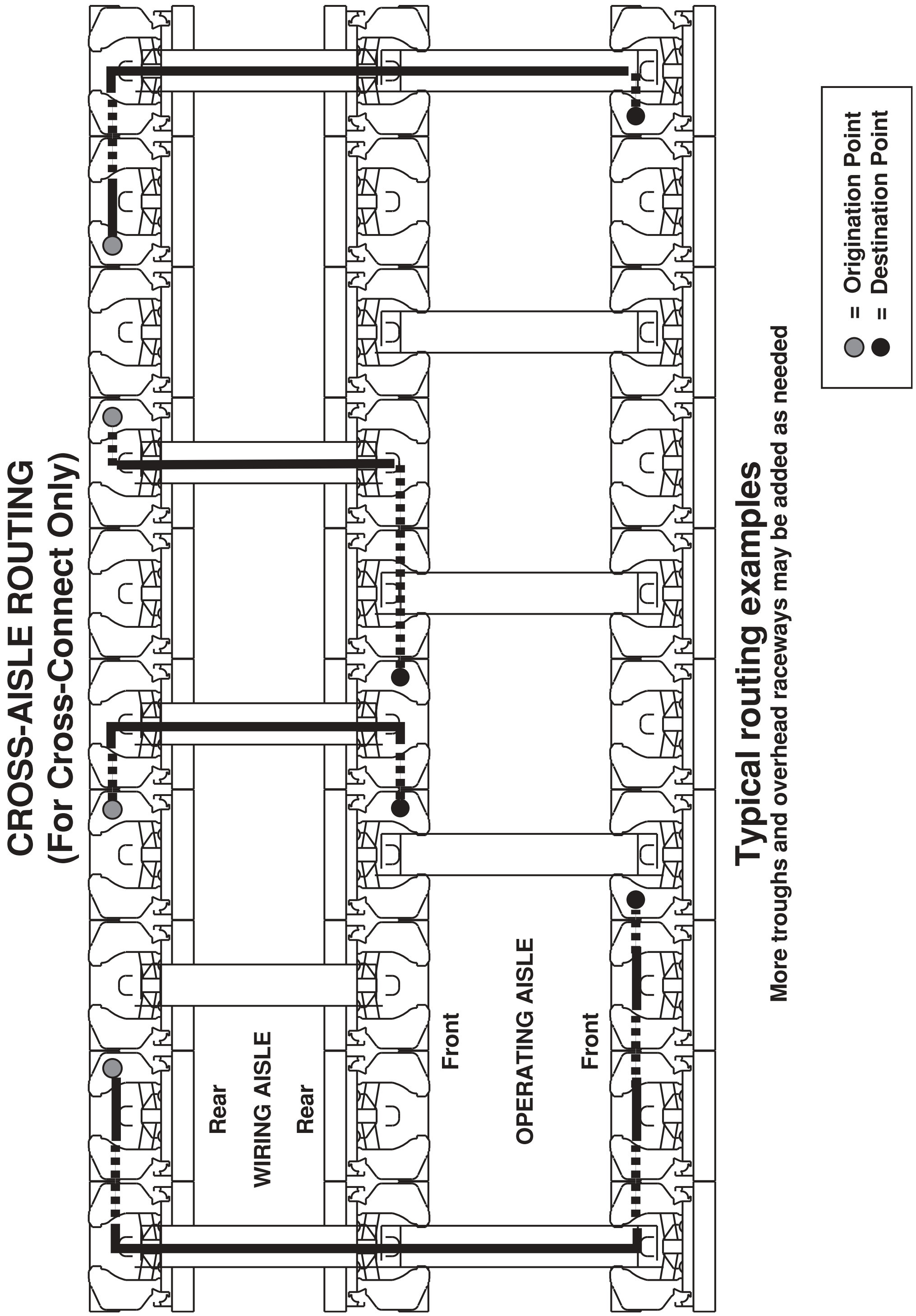


Figure 4 — MTX Frame Systems in a Typical Network Application

FLOOR LOADING DATA

The normal design floor load in typical equipment office buildings is 150 lb/ft^2. In general, a uniform floor load allowance of 100 lb/ft^2 is allocated to frames and 25 lb/ft^2 to cable distribution systems. The uniform floor load is calculated by taking the actual weight of the equipment and dividing by the area of the floor over which the weight will be distributed. The remaining 25 lb/ft^2 of the total 150 lb/ft^2 floor capacity is allocated to transient loads such as personnel, portable or rolling test equipment and equipment being transported.

The actual weight of a fully-equipped MTX Frame loaded with fiber and cable is 787 lb. If a 3-foot 6-inch aisle is left in front and a 2-foot 6-inch aisle is left in the rear of the frame, then the area over which the weight is distributed would be 12.5 ft^2 (5 ft. x 2.5 ft.) and the uniform floor load would be 73 lb/ft^2 (787 lb ÷ 10.8 ft^2) for the frame. This load is well within the allowance normally given to frames in an equipment office. However, the specific calculations must be done for each installation and checked against the floor load design of the building.

RAISED FLOOR APPLICATIONS

When installing the MTX Frame on a raised floor, cabling to the frame is routed through the appropriate raceway and then up or down the side of the frame. Strain-relief brackets are used to fasten the cables to the frame. Hardware for supporting the frame on a raised floor is also available. Figure 5 shows the frame on a raised floor and the cable routing options from an overhead raceway and from beneath the raised floor.

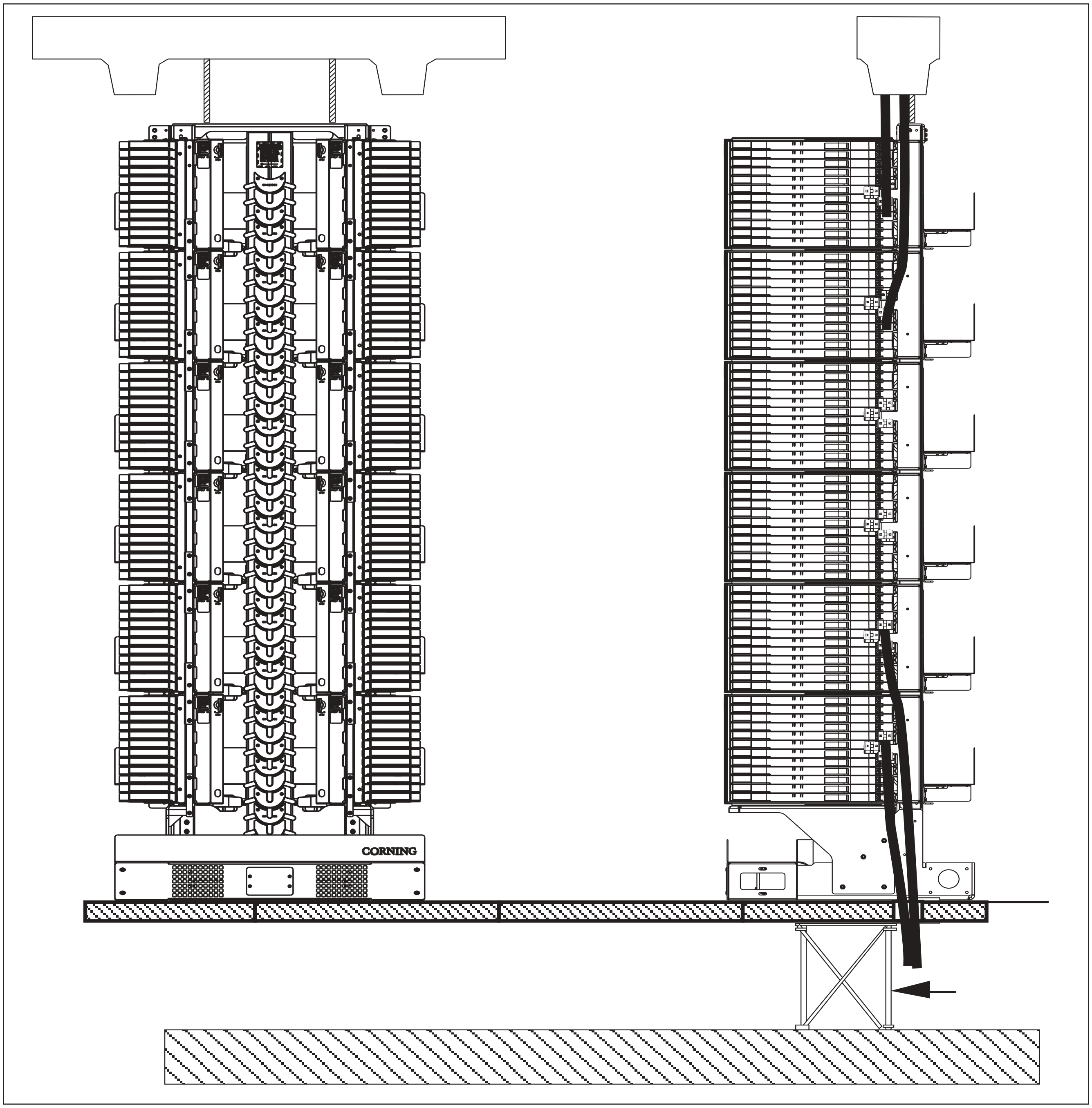


Figure 5 — Installation of raised floor

CABLE RACKING OPTIONS

Since the MTX frame systems conforms to NEBS standards for equipment, most standard racking and support systems are compatible with the frame. The following illustration shows various cable racking options.

Figure 6 shows a single frame line-up with cable being routed through the floor from below and up the side of the frame. In equipment office applications, outside plant cable is commonly routed through the floor from a cable vault, or it can be routed from overhead using ladder racks or raceways. OSP cable can enter the fiber termination modules from either the left or right side of the frame, although the convention established for the MTX Frame is to terminate outside plant or incoming cable appearances on the left-hand column and equipment appearances or outgoing cables on the right-hand column. Cabling from the optical equipment may be routed to the frame from overhead.

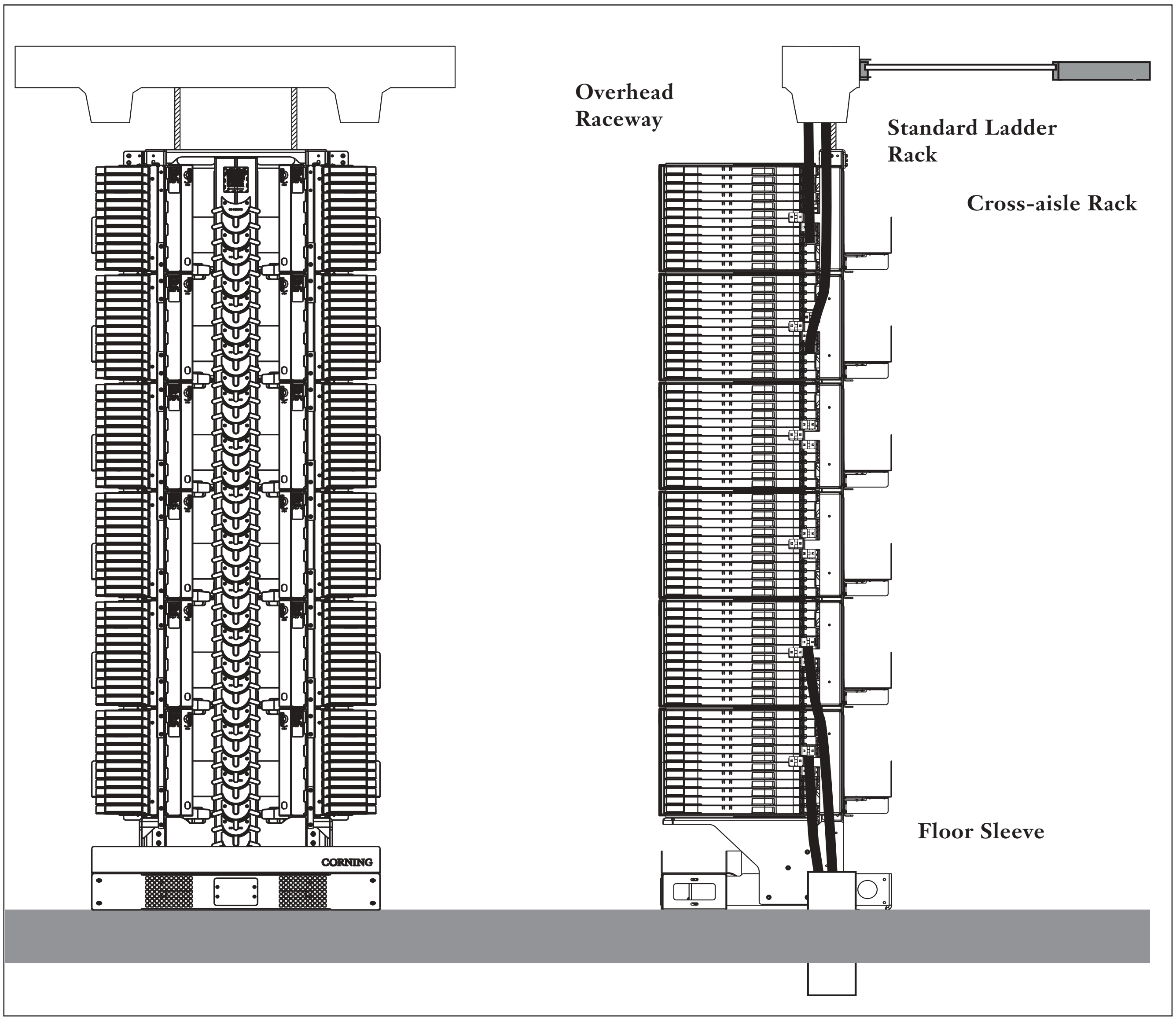


Figure 6 — Single line-up with cable routed through the floor

Figure 6 also shows a single frame line-up with cables entering the frame from above. This arrangement can be used in conjunction with parallel racking as well as cross-aisle racking. Typical applications for this arrangement would be in small central offices, CATV headends, computer rooms, or building closets for building distribution systems.

Figure 7 shows two parallel back-to-back line-ups with all cabling entering from the overhead cable management system. In a back-to-back line-up, a minimum of 2.6 feet should be maintained between the frames.

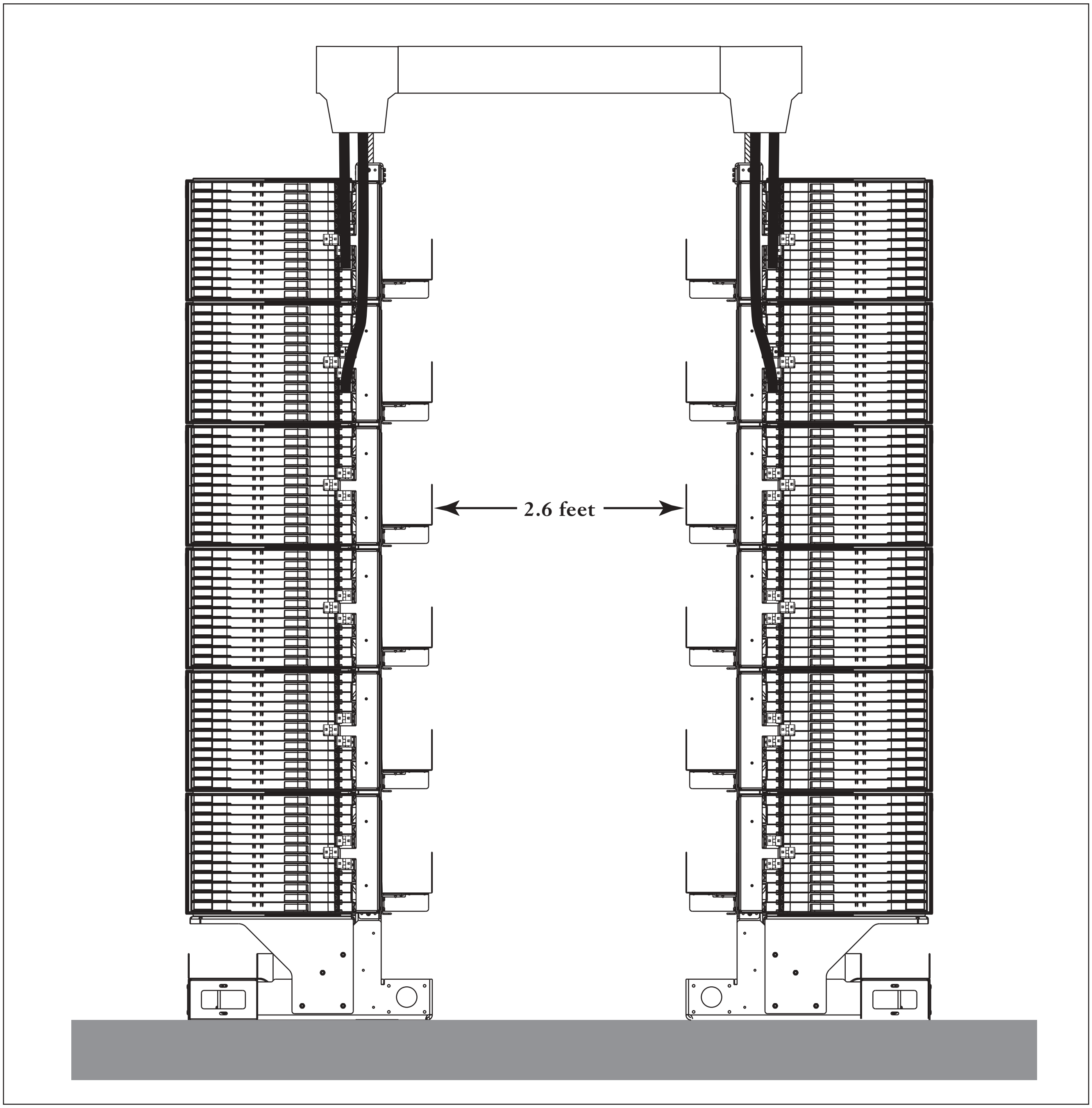


Figure 7 — Back-to-back line-up with cable routed from overhead

EARTHQUAKE APPLICATIONS

The MTX Frame is designed to withstand NEBS Level 3/Seismic Zone-4 earthquake conditions. Raised floor applications, however, require additional floor bracing supports to increase the survivability of all rack equipment. These support systems are available from suppliers specializing in earthquake pedestal systems.

EQUIPMENT OFFICE ENGINEERING

EQUIPMENT OFFICE PLANNING

The first step in planning the fiber network in equipment offices is to determine a Design Fiber Count and a category (business, residential) for the installation. These two factors have the greatest impact on equipment office engineering.

The Design Fiber Count is an estimate of long-term fiber requirements for a specific equipment office for a 25-year designed life. Design Fiber Count is based on current views of future architectures, deployment strategies, technologies, and services. These forecasts are then applied to existing equipment offices and assume a complete conversion to fiber of all customers serviced by that office location.

One approach to calculate Design Fiber Count begins by estimating the long-term fiber count for both fiber lean and fiber rich deployment scenarios.

A fiber lean deployment assumes the widespread use of approaches that minimize fiber counts by maximizing fiber sharing. Evolution and upgrades are achieved via equipment upgrades rather than outside plant fiber deployment. Examples of this type of long-term planning include:

- traffic grooming and multiplexing in the outside plant onto high speed links,
- reusing fibers for different customers, services, locations through multiple wavelengths,
- sharing fibers between customers through time division multiplexing approaches such as Passive Optical Networks.

A fiber rich deployment assumes the widespread use of approaches that result in high fiber counts. Dedicated fiber links would be commonplace, and evolution and upgrades are implemented via additional outside plant fiber deployment. Examples of this type of long-term planning include:

- dedicated fiber links for customers on a per service basis,
- use of low cost, low speed equipment located at the customer’s premises,
- traffic grooming and multiplexing in the equipment office.

Design Fiber Count is then chosen between the extremes of “lean” and “rich” by assuming a percentage for each such that the sum of the two percentages equal 100% (e.g. 40% lean and 60% rich). The percentages of lean and rich should be based on which of the scenarios the planner believes is more likely and then biasing the calculation of Design Fiber Count towards that scenario. This decision can be taken on an individual basis or more generally for a large number of equipment offices.

The following figure (Figure 8) illustrates an example Design Fiber Count for a network of telephone central offices. The Design Fiber Count is situated midway between a fiber lean deployment scenario and a fiber rich deployment scenario (50% lean, 50% rich). By examining in detail a limited number equipment offices and extrapolating for the network, the planner can establish a guideline for the network, thus reducing the need to perform specific Design Fiber Count calculations for each location.

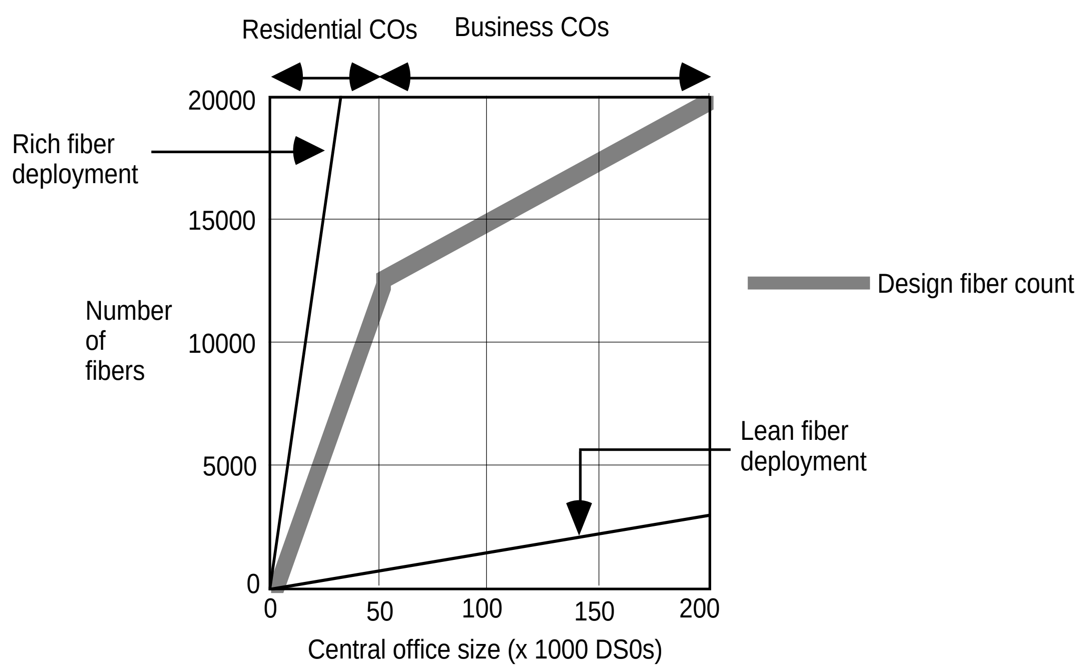


Figure 8 — Example design fiber count

For non-equipment office applications such as controlled environment vaults and equipment huts, a Design Fiber Count can be arbitrarily assumed. For example, where the total DSO’s (DSO = 64 kbit channel) are less than 1,000 assume a Design Fiber Count of 500.

As a planning aid, Design Fiber Count can be used to:

- estimate the ultimate number of fiber cables entering the equipment office
- estimate the ultimate vault space requirements
- estimate the ultimate MTX Frame lineup size
- estimate the ultimate fiber-frame space requirements
- estimate the ultimate fiber racking requirements.

There are two major equipment office categories, business and residential.

Business equipment offices will likely have diverse outside plant physical architectures due to LANs, dual-office fiber rings, and a wide variety of services. Residential equipment offices, on the other hand, have more consistent outside plant physical architectures because most customers have similar services requirements, and can therefore be served using only a few architecture variants.

It should be noted that Design Fiber Count should not be used to determine fiber cable or fiber-frame deployment, or select cable sizes or equipment types. Design Fiber Count is only an aid to assist in the long-term planning of equipment offices.

Expansion

It is recommended to expand an MTX frame system from both the left and the right sides of the initial frame to maintain a manageable growth of cable and patch cord distribution. The MTX frame can be added to existing telco frame line-ups either from the left, right, or both sides to take advantage of the high density capability of the MTX frame. Detailed instructions for installing frames is provided in SRP 003-665, MTX Frame System manual. Calculate the number of bays required in the expansion based on the Design Fiber Count above.

Adapter kits with rear troughs are available for the low-density frames to join them to the rear troughs of the high-density frames, allowing for full interoperability between the two frame systems. The addition of rear troughs to the low-density frames can also serve as a bridge for patch cord routing between two high-density frames on either side of a low-density frame. Installation procedures are fully described in SRP 003-665, Section 5.6, MTX Frame System manual.

TRANSMISSION REQUIREMENTS

Fiber Compatibility

The MTX frame system:

- Is compatible with optical components required to support the data transmission rates and various formats of optical fiber transmission systems.
- Is capable of handling the Synchronous Optical Networks (SONET) transmission and broadband analog signals, particularly using Amplitude Modulation (AM) or Frequency Modulation (FM).

- Is a passive device that does not affect and is not affected by optical fiber transmission system timing; and is not affected by the presence of jitter at its optical fiber transmission system equipment terminations and adds no measurable amount of jitter to any output.
- Supports wavelength division multiplexing systems using wavelengths in the region of 820 to 1,550 nanometers.

Bandwidth

The MTX frame system will accommodate optical fiber digital transmission systems with bit rates of 20 Gb/s and is capable of handling a fiber optic digital transmission bandwidth of 40 Gb/s minimum.

Intermodal Noise

The MTX frame system uses a fiber jumper length greater than two meters to prevent intermodal noise.

FRAME PLANNING

General

Operate the MTX frame sytem and its components in a controlled indoor environment with a temperature range of 68°F to 86°F at relative humidity. The products have been tested and conform to Telcordia Requirement GR-63-CORE for fire resistance and Federal Communications Commission (FCC), National Electrical Code (NEC), Underwriters Laboratories (UL), and Occupational Safety and Health Administration(OSHA) standards, where applicable. Local or state requirements may warrant an exemption or different criteria.

System planning for any installation in a line-up of one frame or several frames is important to ensure orderly growth and operating conditions without exceeding design capacity. The MTX Frame is designed so that 20 frames can be placed in a single lin-eup. Install a second line-up, if necessary, across the maintenance aisle from the first line-up and transition fiber to that aisle using cross-aisle racking systems. MTX frames can be installed without disconnecting or otherwise interfering with service or the normal functioning of existing telco equipment.

The MTX Frame should be the only interface between outside plant fiber and equipment office fibers. In fact, even connections between outside plant fibers should be made at the MTX Frame, rather than in the vault. Therefore, all outside plant fibers that pass through the equipment office wall into the vault should appear on the MTX Frame without passing through any other management point.

In central offices, headends, or remote switching centres, it is strongly recommended that the MTX Frame be used in a cross-connect configuration only, even if the fiber counts are low. This guideline results in the most orderly administration of cable-to-equipment connections, and gives the maximum flexibility for long-term growth. However, in installations where frames are not expected to grow beyond a single bay, an interconnect configurations may be appropriate. Examples of such installations are:

- customer premises
- equipment bays
- non-equipment offices, such as controlled environment vaults and equipment huts

Trough capacities

The MTX Frame contains two patch cord troughs as standard eqipment—a vertical trough for patch cords within the bay, and a horizontal trough for patch cords between bays. The vertical trough has maximum capacity of 864 patch cords (SC connector terminations), which is half the number of terminations in a bay. Therefore, the vertical trough will never exceed its working limit. The horizontal trough has a maximum physical limit of 1600, 2.4 mm patch cords, and a suggested working limit of 800, 2.4 mm patch cords. These maximum and working limits can be exceeded if an excessive number of long out-of-bay patch cords are used. The planner can avoid such situations by ensuring that proper planning, management, and operational procedures are applied. In instances where unexpected network changes are experienced, periodic checks should be made to identify any potential problems.

Outside plant vertical

The convention established for the MTX Frame is to terminate outside plant or incoming cable appearances on the left-hand column and equipment appearances or outgoing cables on the right-hand column. However, OSP cable can be terminatd on the right vertical and inside plant cable can appear on the left vertical column. Of the six housing positions, the top housing is normally left open for future growth and expansion. This practice also acts as a buffer for uncertainties with frame balance, and provides space for tie pairs between frame lineups or across aisles or gaps in the line-up. Installation and routing of tie pairs is explained in detail in the MTX Frame System Installation Instruction. Figure 9 illustrates the termination of outside plant and equipment appearances on the frame.

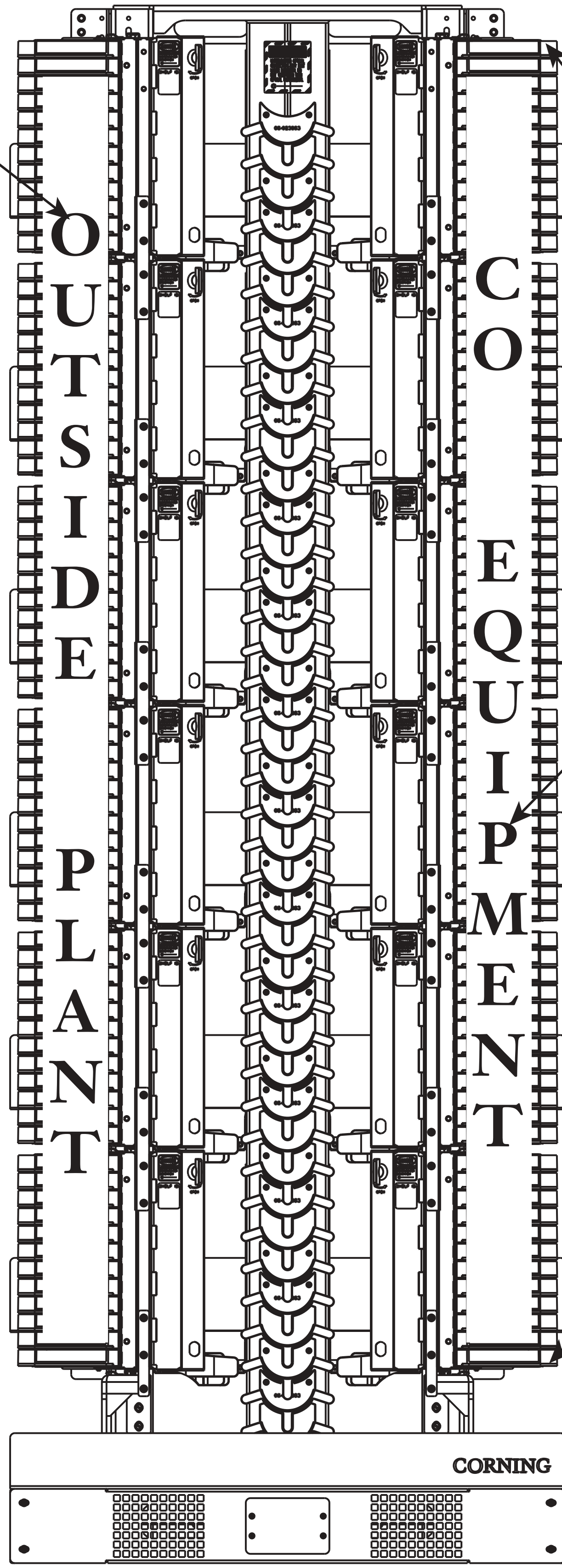


Figure 9 — Frame termination

Common outside plant cables have complements of 6 or 12 fibers, and are normally terminated 12 fibers to a module. The entire outside plant cable fiber count need not be terminated on a single vertical column. If the complete cable appearance cannot be terminated on one vertical, then the remaining fibers should be terminated on the next bay.

NOTE: *If a cable's fibers must be split between two bays, then the two fiber groups are spliced to different in-building cables in the vault, and the cables are individually brought into the separate bays.*

In general, there are no special spreading or zoning considerations for installing outside plant cables on the frame. Outside plant cables are terminated sequentially on the MTX Frame lineup, by filling each vertical according to a bottom-up approach, and then proceeding to the next bay. Again, keep in mind that the top housing should be left open for future expansion.

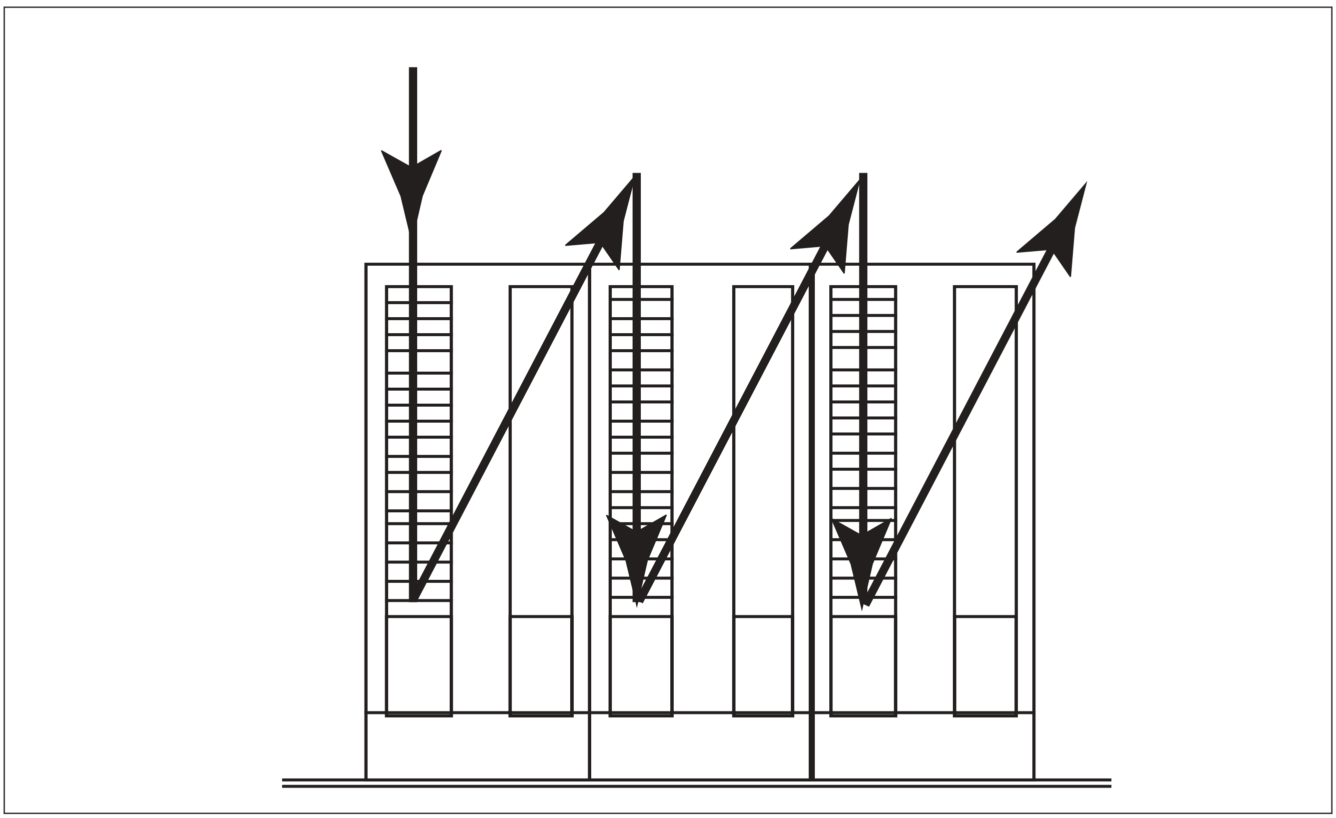


Figure 10 — OP cable termination

If both the working and protection fibers of an outside plant fiber ring are to be connected to ports of the same system, try to terminate both ends of the ring on the same outside plant vertical of the bay, and as close to the equipment termination as possible. This practice will minimize long out-of-bay patch cords in multi-bay line-ups. Figure 10 illustrates this concept.

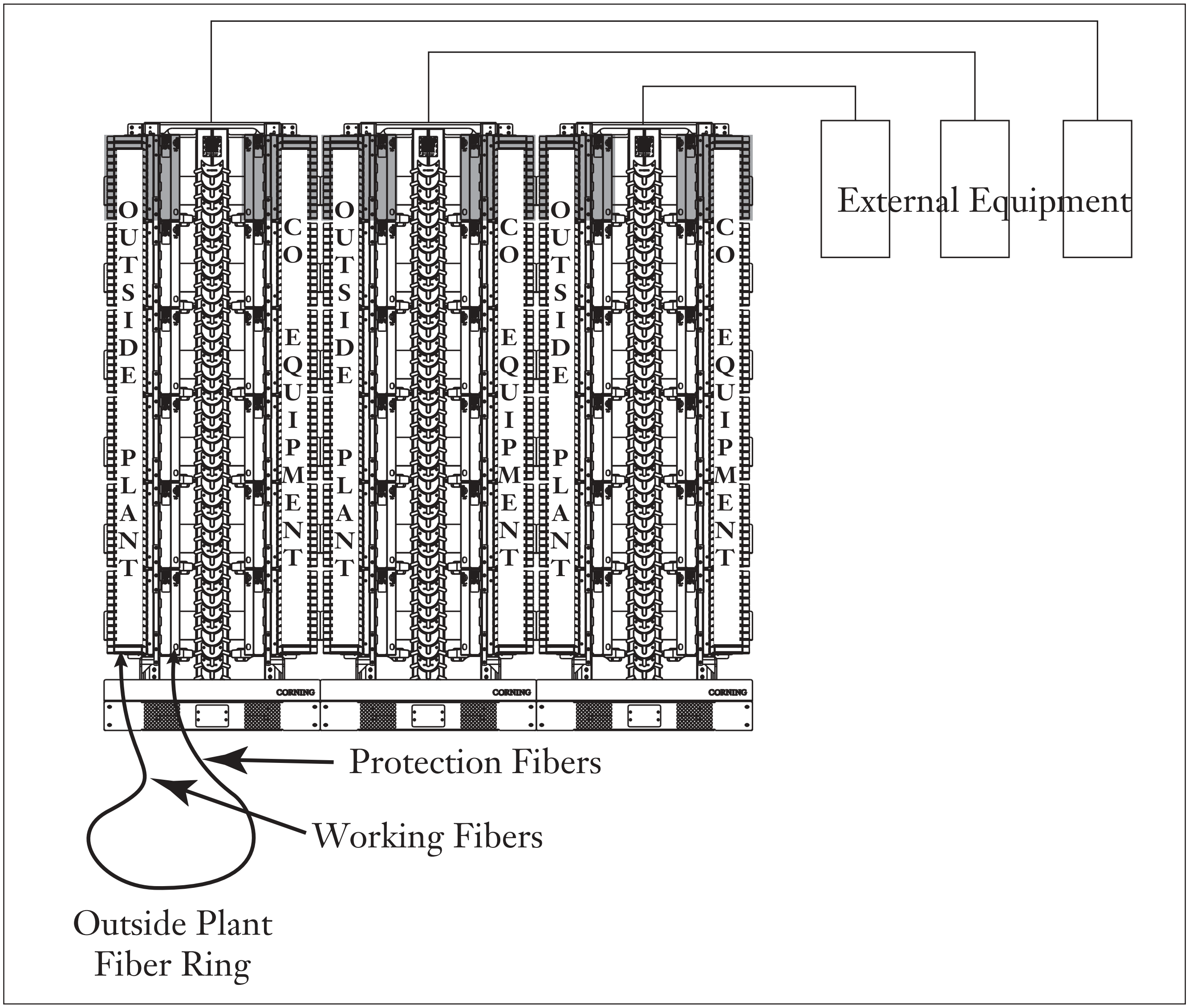


Figure 11 — Termination of outside plant fiber rings

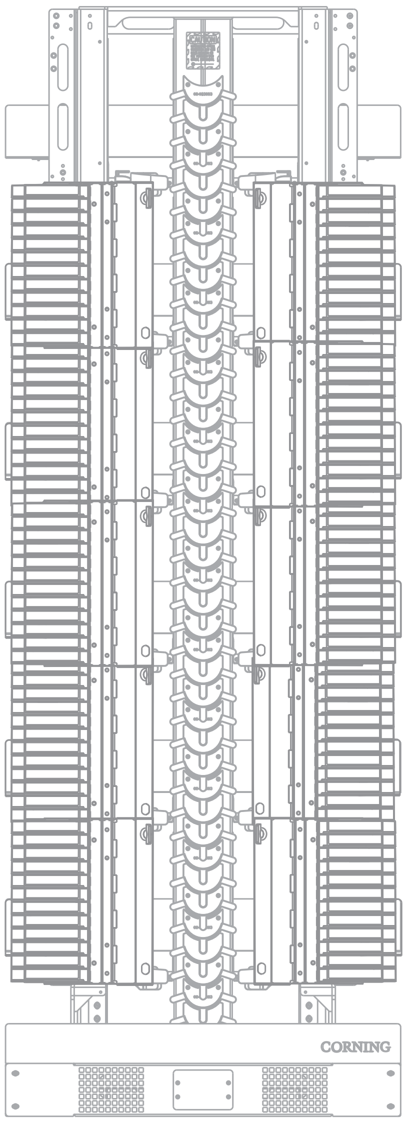
To determine the number of bays required in the near-term to terminate the incoming outside plant fibers, estimate the total number of fibers that will be terminated over the next planning period. Design Fiber Count is used to estimate the ultimate number of fibers and frames, and serves as a guideline for floor space planning. Outside plant fibers are normally terminated 12 per module, and 12 modules per housing. With the top housing left open initially, this yields a total of 720 terminations, with the potential to add another 144 terminations.

With outside plant cables, it is common practice to reserve or keep spare fibers for emergency or backup purposes. The working fibers are those that will be cross-connected on each vertical. If one were to assume an outside plant cable fill of 90 percent, then the number of working outside plant fibers per vertical would be 720 x 0.90 = 648 fibers.

Equipment vertical

Planning the termination of equipment on the MTX Frame equipment vertical is equally important to the outside plant vertical. This step is essential to keep the number of long (out-of-bay) patch cords in the horizontal trough within suggested working limits. There are two basic approaches to achieve this objective.

The first approach distributes the location of all services across all bays in a multi-bay line-up. This is accomplished by allocating space on each bay for each type of service or equipment (see Figure 12). Such a scheme gives all outside plant fibers an equal chance of connecting to an equipment port with a relatively short patch cord.



Top housing is reserved for future growth and expansion. Should systems require termination that was not originally planned, make those terminations on this housing.

Example assumptions:

1400 outside plant fibers are to be terminated over 3 years for an outside plant fill of 90 percent.

864 fibers terminated per vertical = 777 working/vertical (864 x .90)

Number of frames required: 1400/864 = 1.62 (2)

Figure 12 — Example equipment vertical termination calculation

To calculate the module requirements and the distribution of equipment terminations, it is necessary to estimate the make up of the ultimate installation by system or service type. This forecast does not have to be absolutely accurate but should reflect, by percentage, the expected system or service mix. Next, determine the number of fibers that will be connected to each service or system as a percentage of the working outside plant fibers per bay. Then determine the number of modules that will ultimately be required for each service type on each frame based on the number of fibers that will be terminated per module. Since cables will be placed between the equipment bays and the MTX Frame the size of the cables and their termination density on the modules must be known. Once the number of modules for each system type is established, the number of module positions for that service on each equipment vertical can be reserved. The result is that each bay in the line-up will resemble the example sketch shown in Figure 12. Note that it is not necessary to have a one-to-one correspondence between outside plant fibers and equipment fibers. In fact, simple economics would dictate that unused outside plant fibers are readily available on a frame, while equipment would only be installed on an as-needed basis.

Figure 9 represents the plan for the installation and as such should be updated each time equipment is added. Since the plan is only a guide based on initial estimates of service mix, it can change with time. This does not present a problem because only space has been allocated. If the equipment mix changes, one simply modifies the allocation. The important point to remember is that each equipment type is distributed uniformly across the frame.

The second approach to terminating equipment verticals is to install new equipment modules on the same bay where the outside plant service demand appears. Equipment terminations should “chase” outside plant appearances. With this approach no advanced planning or allocation is required, but equipment module terminations must be deployed quickly for each new service request to ensure rapid provisioning. As with the first approach, it is important to minimize mismatches to avoid out-of-bay patches.

Diversity

Diversity involves extending the single point of failure beyond the MTX Frame to the equipment bay or housing. This requires a separation on the MTX Frame of all outside plant protection and working fiber terminations, and equipment terminations and in-building cables. Tracking and maintaining diversity on all but the smallest installations can be very complicated, and requires meticulous or even automated record keeping.

EQUIPMENT CABLE PLANNING

Equipment cable is in-building cable connecting the MTX Frame to the equipment. The choice of cable size depends on the method of provisioning. Equipment can be provisioned on a system basis, housing basis, or bay basis. The objective is to always maximize the fill of the MTX Frame equipment modules, by using all 12 ports whenever possible.

Equipment cables can terminate either a system, a housing of equipment, or a bay of equipment.

EQUIPMENT TERMINATION PLANNING

Equipment termination refers to the termination and management of fiber at the equipment bay.

The preferred approach is to connect the equipment via patch cords to an interconnect panel located in the equipment bay. This interconnect panel is then spliced to the MTX Frame via an in-building equipment cable. In general, each equipment bay should have a dedicated interconnect panel.

An alternate approach is to use breakout cable connectorized at the equipment end. When using these assemblies, it is recommended that the excess cable slack be stored in a storage shelf at the equipment bay.

PASSIVE DEVICE MANAGEMENT

The MTX Frame can be used to manage passive devices such as optical splitters and wave division multiplexers. The passive devices are installed in modules with both the “in” and “out” ports of the device appearing as connections on the front of the module. Any number of splitter configurations is possible per module, so long as the number of input and output ports totals 12 or less. Splitter modules can be cascaded for large branch configurations.

Integrated

The integrated approach to passive device management puts these devices in a working MTX Frame line-up, wherever required. Typically, the passive devices are grouped together, either on a specific housing or vertical, and appear throughout the lineup. The number of passive devices in each bay are adjusted according to the current demand in that bay and are removed when no longer required, thus freeing up space.

Stand-alone

The stand-alone approach to passive device management features a dedicated MTX Frame line-up that contains only passive devices. No outside plant cables, transmission, switching, or other central office equipment are terminated in such a line-up. With this approach, all the passive device frames must use the interconnect configuration, and connections to the equipment frame is via patch cords or cable assemblies. A stand-alone passive device line-up gives a much higher capacity for growth, and provides for more organized administration. However, space must be planned and allocated in advance for such line-ups.

INTRA - OFFICE EQUIPMENT MANAGEMENT

There are two basic options for managing equipment-to-equipment fiber.

Where the total fiber count is very low and the equipment being connected is limited, dedicated fiber cables between the respective equipment bays can be used.

If higher fiber counts are expected, then a dedicated MTX Frame line-up to manage only intra-equipment fiber is more appropriate. Such a situation may arise where coaxial cables are being phased out, or where the new equipment uses only fiber. A frame used exclusively for managing intra-office fibers is known as a Fiber Intermediate Distribution Frame (Fiber IDF). This frame can be co-located with the transmission equipment or set up separately as a dedicated line-up, depending on the number of fibers and space availability.

CHAPTER 4: HARDWARE DESCRIPTION

MASS TERMINATION XCHANGE (MTX) FRAME

The MTX Frame (Figure 13) is designed for terminating and managing large numbers of fibers in telephone company central offices (COs), CATV headends, CEVs, huts, and customer premises (such as large commercial or institutional buildings). Many features have been designed into the MTX Frame:

- Standard NEBS-compliant frame
- Front-only access
- Modules with terminating functions
- Cross-connect and interconnect configurations
- High density - up to 1728 terminations per bay

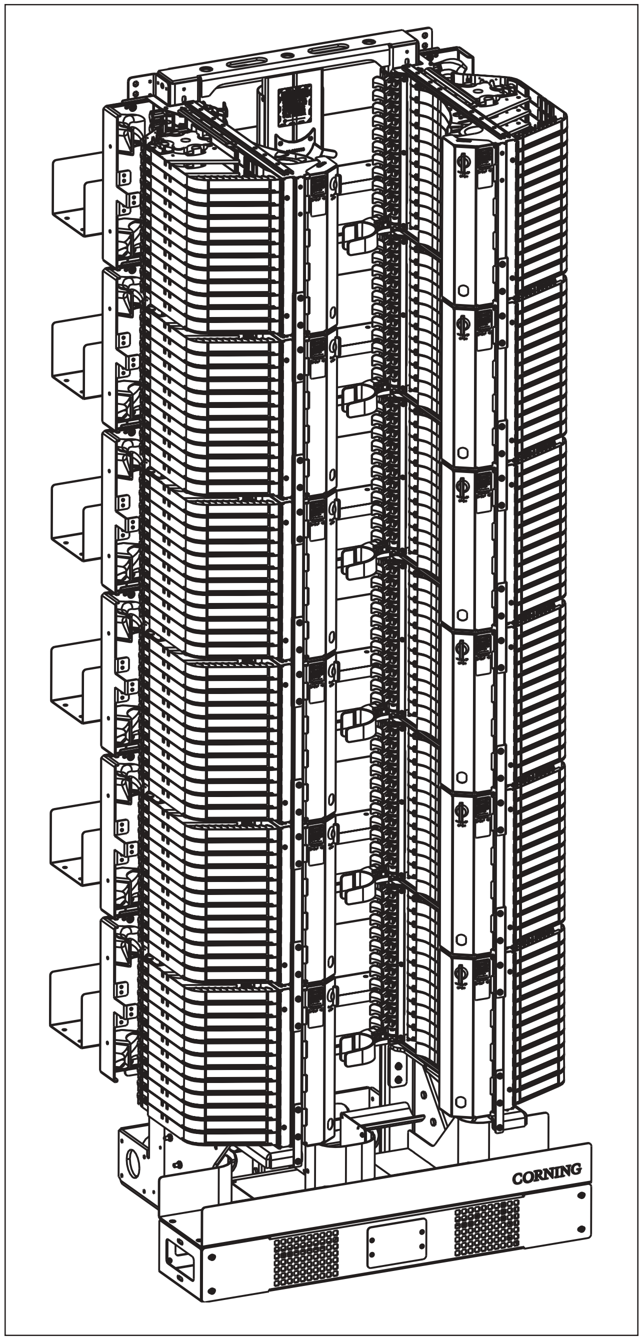


Figure 13 — MTX Frame

APPLICATIONS

The MTX Frame may be configured as either a cross-connect or interconnect frame.

Cross-connect

Cross-connects are normally used in medium to large equipment offices, or as a central terminating point in large commercial buildings or campuses. They may also be used in CEVs, huts, and apparatus closets if space permits. A cross-connect provides the greatest degree of flexibility for assigning and rearranging patch cords. In a cross-connect frame, outside plant cables are terminated on the left half of the frame and optical equipment are terminated on the right half. The total number of fibers that may be terminated is 1728, or 864 on each of the left and right columns. Cross-connections are made between the incoming cable appearances and the optical equipment appearances using patch cords. In telco and CATV applications the incoming cables are typically outside plant cables which may be brought directly to the frame or via in-building cables following a transition splice in the cable vault. Equipment appearances are appearances or ports of optical transmission systems located elsewhere in the equipment office. These are cabled to the frame using in-building type cables. Figure 14 represents a typical cross-connect configuration.

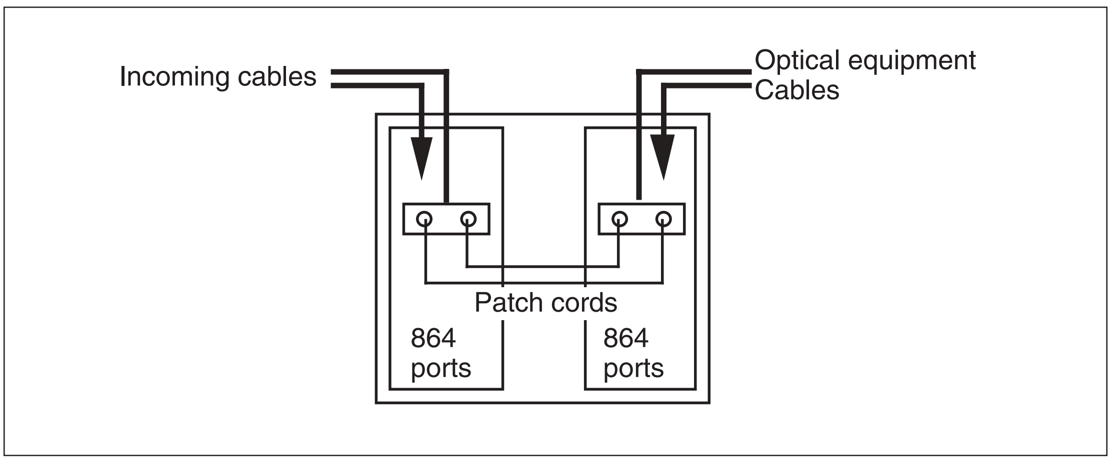


Figure 14 — Typical cross-connect

Interconnect

Interconnects are typically used in CEVs, huts, and apparatus closets of large commercial buildings or campuses. They are also installed in the occasional small equipment office, where the fiber counts are small and not expected to grow. An interconnect offers the highest terminating density for outside plant appearances but provides less flexibility for rearranging cable and equipment appearances. In an interconnect, up to 1728 fibers from incoming cables are terminated on the two sides of the frame. In this case, there are no equipment appearances on the frame, so connections between the incoming cable and equipment must be made using patch cords directly from the MTX Frame to the equipment frame. In telco and CATV applications the incoming cables are typically outside plant cables which are brought directly to the frame. The optical transmission equipment is usually located in close proximity to the MTX Frame. Patch cords are typically routed from the MTX Frame to the equipment frame via overhead racking. Figure 15 represents a typical interconnect configuration.

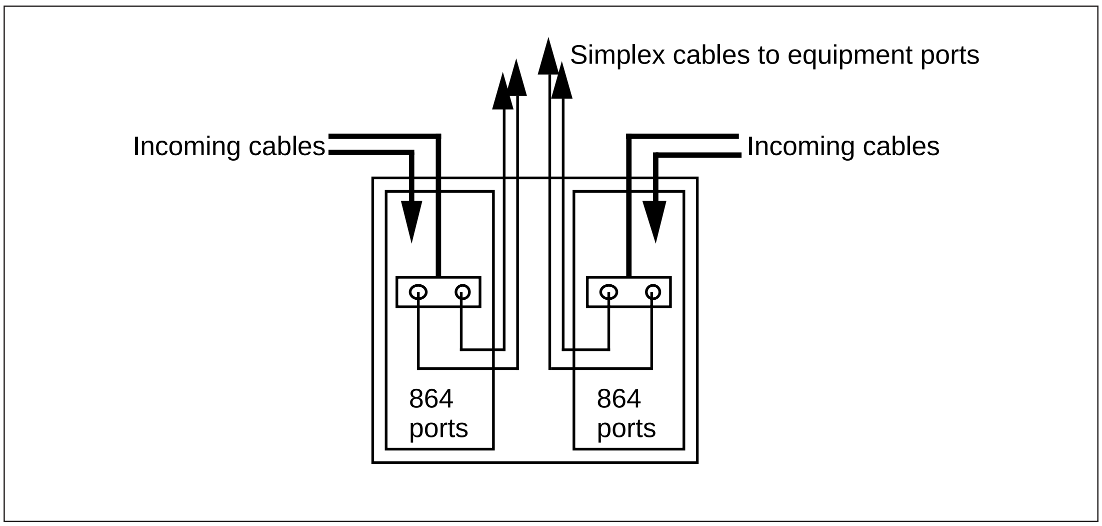


Figure 15 — Typical interconnect

General

Figure 16 shows the basic components of the MTX Frame in both the cross-connect and interconnect configurations. Both configurations are single sided assemblies, and can be installed and operated from the front only. The frame dimensions are such that it can be integrated into the same line-up with other vendors' high-density frames.

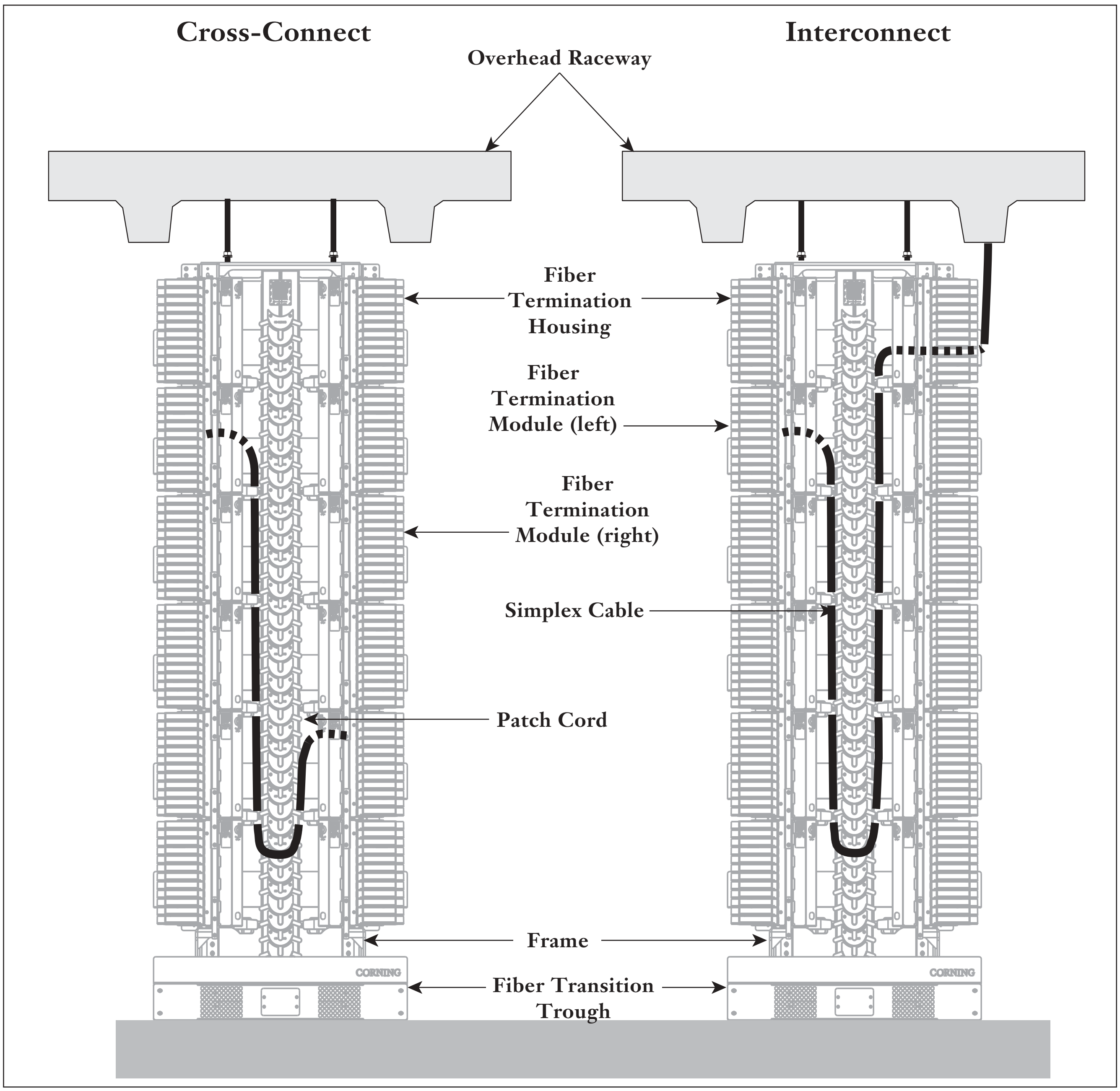


Figure 16 — Cross-connect and interconnect frame assemblies

Frame

The frame is designed to comply with Telcordia GR-63 and GR-449 standards. It is 30 inches wide by 24 inches deep and 84 inches high (Figure 17). There are two ground locations on the frame that can be used to ground the frame to a central ground point within the building per local codes, if required. There are six ground studs on the rear of the frame for grounding armored cable to the frame. Openings are provided in the base of the frame for installing electrical outlets as required.

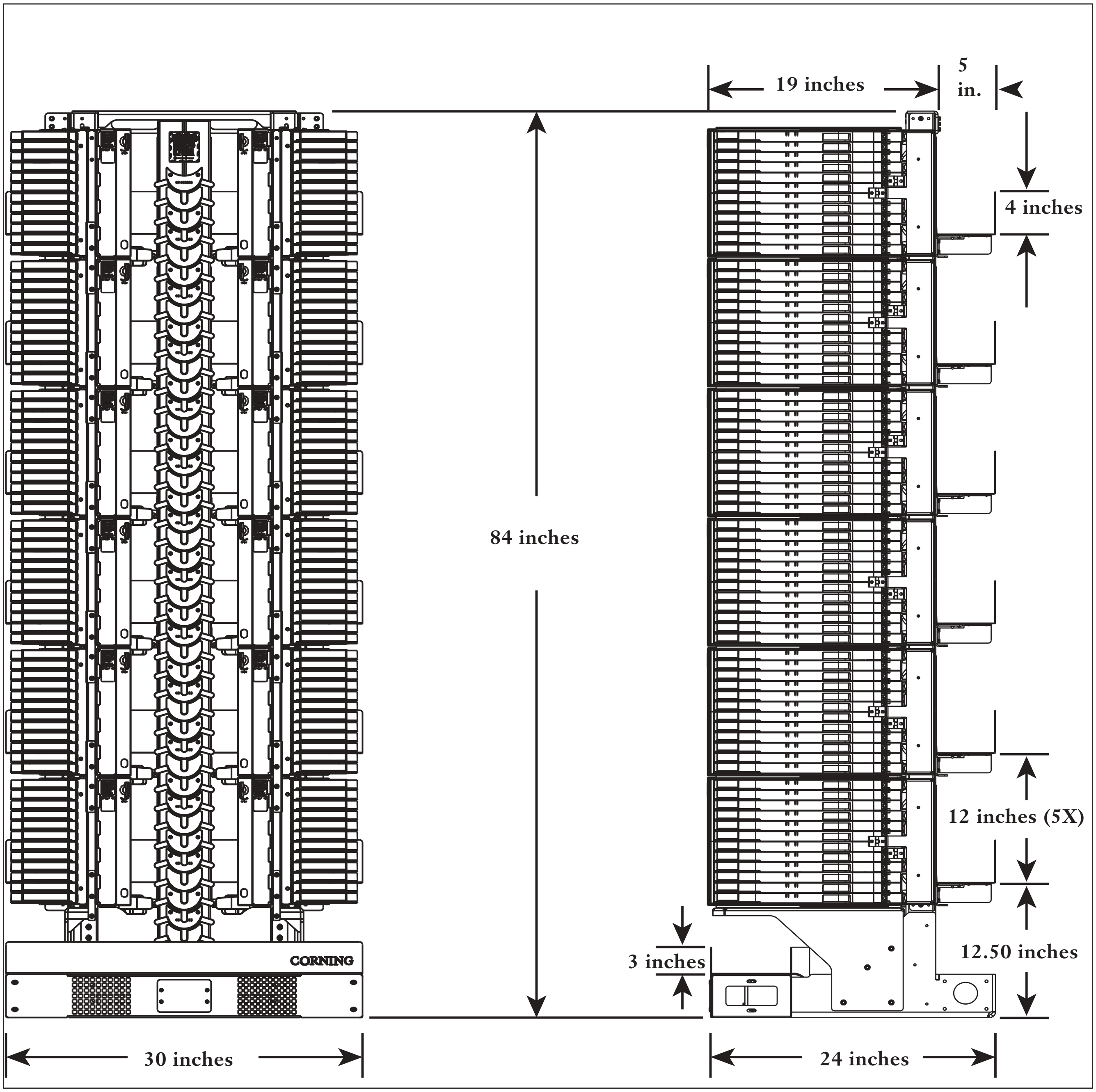


Figure 17 — MTX Frame Dimensions

Fiber termination housing / module (12 modules)

The fiber termination housing integrates connector mounting and fiber slack storage into a single assembly. There are two fiber termination housing configurations: one for the left side of the frame, and one for the right side. Fibers are brought into the modules within tubes, and slack fiber is routed through the transition box and stored within the module. Most popular connector formats are compatible with the module, including the SC, LC, and FC connectors. A designation label is provided with each module for identifying circuit connections.

Stubbed housings

To save on installation time, fiber termination housings can be ordered pre-terminated from the factory. The fiber cable stubs come in a variety of lengths up to 300 meters.

Due to the large number of possible pre-stubbed housing variants, the user is asked to consult the factory for availability of custom cable lengths.

Patch cords

All connections on the MTX Frame are accomplished using connectorized patch cords. All standard patch cords can be used, although patch cords with 2.0 mm outside diameter are preferred to minimize congestion. Both single-mode and multimode patch cords can be used depending on the application. Within a single frame, all connections can be completed using 6.0 meter (20 foot) patch cords .

For multiframe line-ups, different patch cord lengths in half-meter increments are required depending on the location of the ports to be interconnected. These lengths are pre-calculated to minimize excess slack. Specific patch cord selection details can be found in the frame installation guides.

Traceable patch cords

In a fashion similar to conventional copper-based installations, fiber cable-to-equipment cross connections are identified using on-frame labeling, log books, or computerized databases. But as with any manual system, there is always an opportunity for human error. If an item of data is erroneously recorded, or if an identification label is misread, an unintended disconnection can result in drastic consequences.

One way to safeguard against mis-identifying connections is to use a tracing feature on the patch cords.

The Corning Cable Systems SearchLite™ Tracing System is designed with integrated lamps and probe connectors at both connector ends. A simple power supply generates a flashing signal that creates a powerful and easily identifiable trace. The SearchLite Tracing System can be used with any manufacturer's fiber distribution frame or patch panel. The tracing feature can be used for all circuits in a system, or just special circuits such as high-speed links, banks, or military applications.

Workshelf

A workshelf is available for attaching to any fiber termination housing. This shelf is used to place tools, fusion sets, or other testing equipment on during installation or maintenance.

End Guards

End guards are used to enclose the sides of a frame. They may be used with an individual frame or at the ends of a frame line-up.

Lock

A lock is available to guard against casual or unauthorized access to the fiber termination module housings.

Passive devices

Passive devices such as attenuators, couplers, optical splitters, and wavelength division multiplexers can be installed in discrete modules in either an existing MTX Frame line-up or when creating an MTX Frame line-up dedicated to passive devices. In addition, certain fixed or variable attenuators may also be installed in the modules.

Due to the number of variants possible with passive device modules, the user is asked to consult the factory for availability of custom modules.

Co-existence with other vendors' frames

The MTX Frame is compatible with other commercial high-density fiber distribution frames compliant with Telcordia GR-449. In a multi-vendor line-up, it is important to pay particular attention to the patch cord trough placement, as different distribution frames may use different patch cord routing methods. The MTX Frame can be integrated into and share the same line-up with other frames. Transition hardware is available which will allow the MTX Frame to work with other frames even if the other patch cord troughs are not located at the bottom of the frame.

CHAPTER 5: OPERATIONS

FRAME

The MTX Frame is designed to function as either a cross-connect or an interconnect system under normal growth and operating conditions. To ensure orderly growth, careful recording of all termination locations are essential. To facilitate the task of record keeping, a standard method for designating the frames and connectors has been devised.

FRAME DESIGNATIONS

Figure 18 shows the preferential assignment of fibers within a single frame. Figure 19 illustrates the preferential assignment of fibers within a dual-frame line-up with an Interbay Fiber Manager (IFM). The left hand column of modules is designated vertical number 1, and the right hand column is designated vertical number 2. The shelves within each column are designated 1 through 6 beginning with the bottom shelf. The modules within each housing in the shelf are numbered 1 to 12 starting with the top module in the housing.

Connections are mapped and identified by specifying the column (V), shelf (S) (1 through 6), module (M) (1 through 12), and port (P), respectively, such as V1:S2:M12:P7.

SHELF DESIGNATIONS

The shelves within each column are designated 1 through 6 beginning with the bottom shelf. Two housings installed at the same height on the same frame—a left-hand housing installed in vertical column 1 and a right-hand housing installed in vertical column 2—constitutes one single shelf. Shelf number 1 is shown within the shaded box of Figure 18.

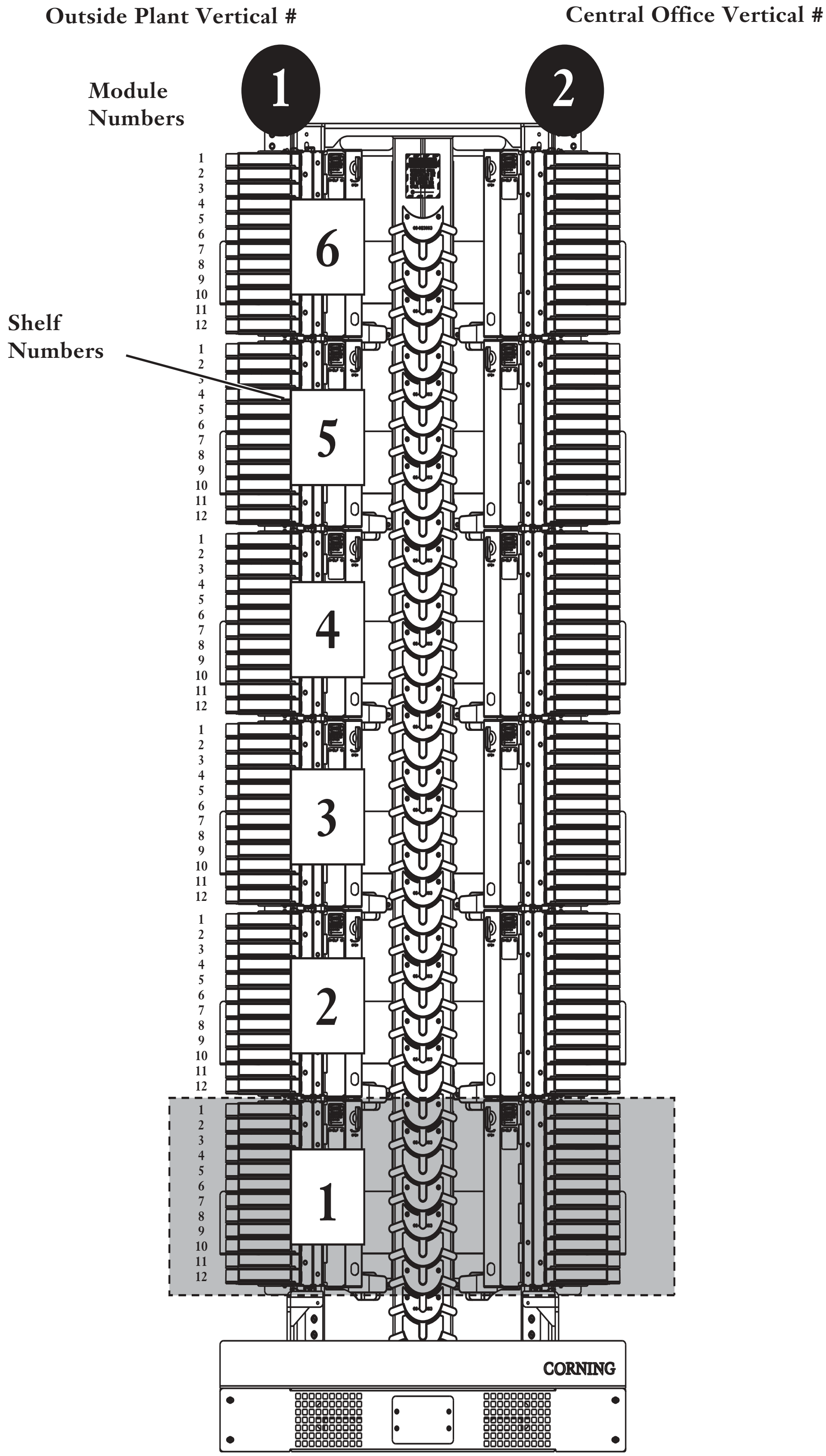


Figure 18 — Preferential Assignment within a Single Frame

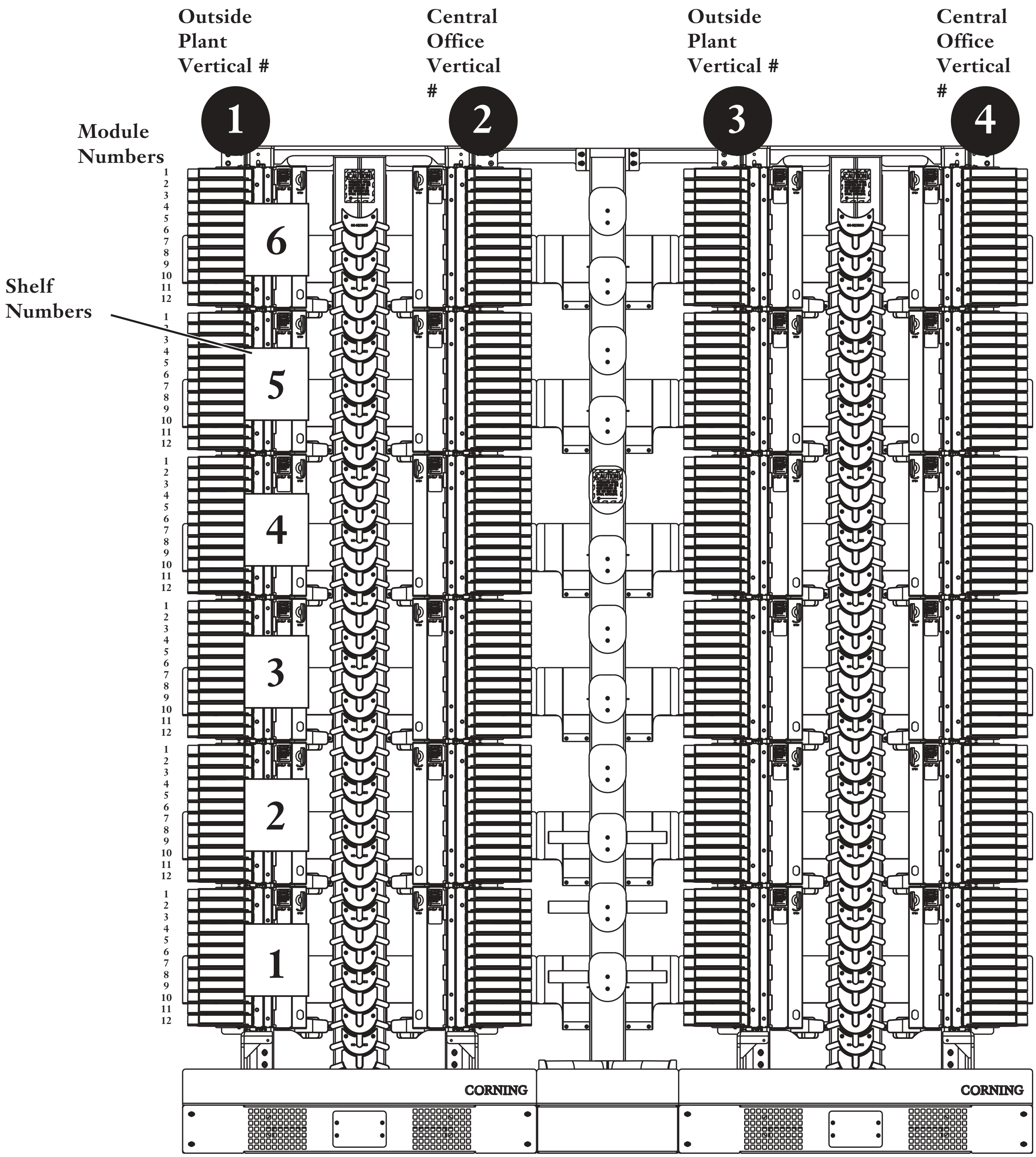


Figure 19 — Preferential Assignment within a Dual-Frame Line-up with an IFM

MODULE DESIGNATIONS

A left hand module is installed on the left column, or vertical number 1. Similarly, a right hand module is installed on the right column, or vertical number 2. Left and right modules are not interchangeable.

The illustrations below shows the fiber routing within the fiber termnation module. The connector positions are numbered 1 to 12 from left to right, for both the left and right hand modules (Figure 20).

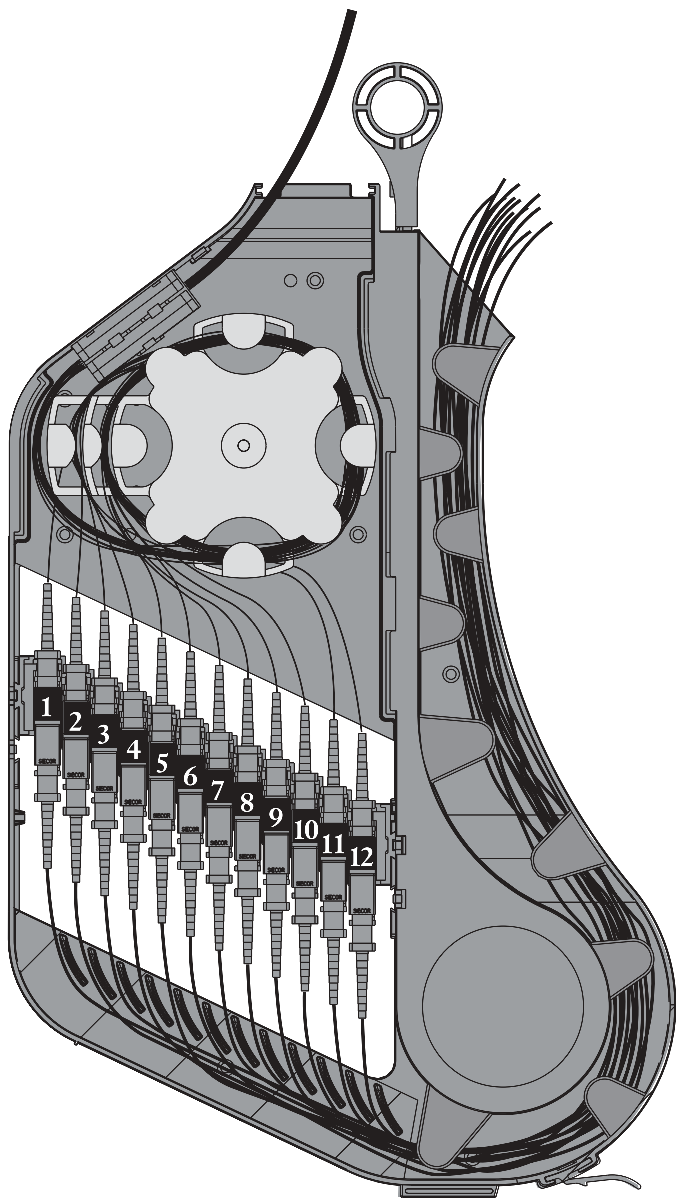


Figure 20 — Module designations (Left-hand module shown)

PATCH CORDS

Patch cord selection

Factory-terminated patch cords of various lengths are used to cross-connect incoming cables to optical equipment ports, or incoming cables to incoming cables. Connections can be made within a single frame, or between frames in a multi-frame line-up. To minimize patch cord congestion in full frame configurations, 2.0 mm diameter patch cords are recommended.

You may route patch cords within a single frame, utilizing patch cord lengths determined in Table 5-1, to make any termination between two columns of shelves specified as Vertical 1 or Vertical 2 (V1 or V2) (refer to Figure 18).

You may route patch cords routed across multiple frames if transitioning from one vertical column to an adjacent vertical column across an Interbay Fiber Manager (IFM) to make any termination between two columns of shelves specified as Vertical 2 and Vertical 3 (V2 and V3) (refer to Figure 19). Use rear troughs or overhead raceways to route patch cords to frames that are not adjacent to each other.

NOTE: *Use front transition trough only to route fibers to existing telco frames or for emergency restoration.*

Patch cords routed across multiple frame line-ups incorporating use of an IFM may utilize patch cord lengths according to Table 5-1.

Patch Cord Selection Table

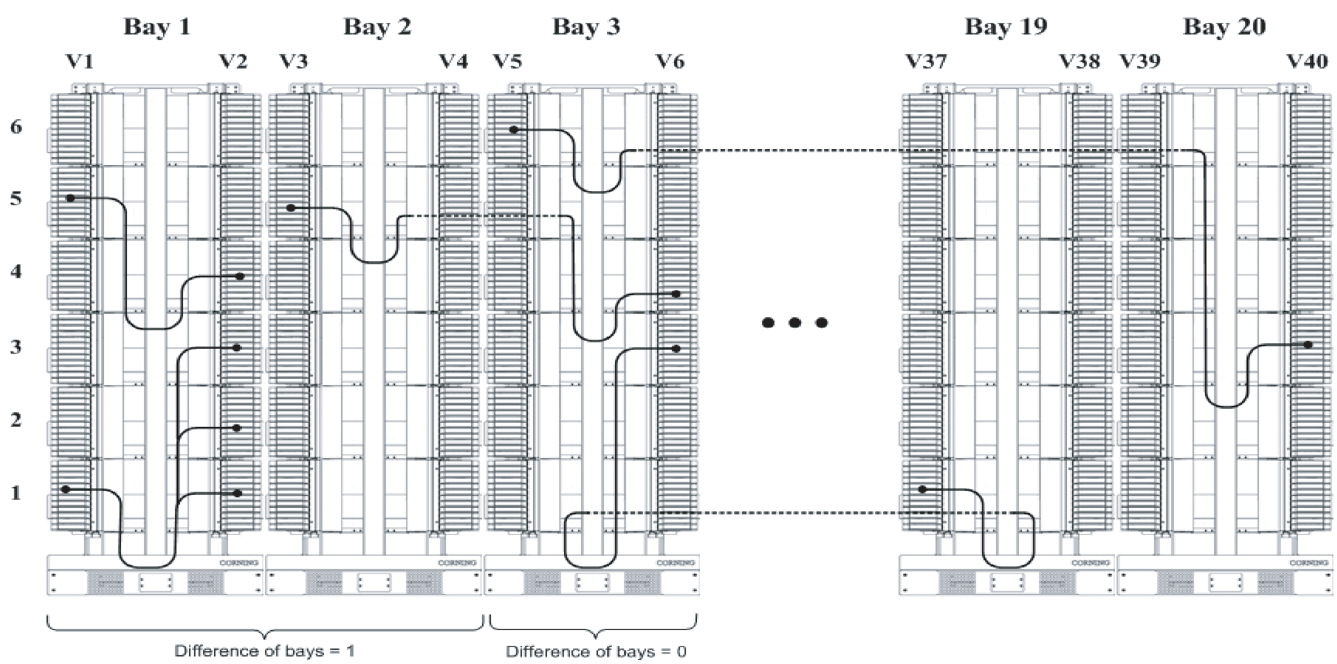


Table 5-1 — Recommended Patch Cord Lengths for Interconnect Applications

Patch Cord Selection Table (Continued)

Difference of bays	Originating shelf	Destination shelf					
		1	2	3	4	5	6
0	1	6 ft	7 ft	8 ft	9 ft	10 ft	11 ft
	2	7 ft	6 ft	7 ft	8 ft	9 ft	10 ft
	3	8 ft	7 ft	6 ft	7 ft	8 ft	9 ft
	4	9 ft	8 ft	7 ft	6 ft	7 ft	8 ft
	5	10 ft	9 ft	8 ft	7 ft	6 ft	7 ft
	6	11 ft	10 ft	9 ft	8 ft	7 ft	6 ft
1	1	11 ft	12 ft	13 ft	14 ft	15 ft	16 ft
	2	12 ft	11 ft	12 ft	13 ft	14 ft	15 ft
	3	13 ft	12 ft	11 ft	12 ft	13 ft	14 ft
	4	14 ft	13 ft	12 ft	11 ft	12 ft	13 ft
	5	15 ft	14 ft	13 ft	12 ft	11 ft	12 ft
	6	16 ft	15 ft	14 ft	13 ft	12 ft	11 ft
2	1	14 ft	15 ft	16 ft	17 ft	18 ft	19 ft
	2	15 ft	14 ft	15 ft	16 ft	17 ft	18 ft
	3	16 ft	15 ft	14 ft	15 ft	16 ft	17 ft
	4	17 ft	16 ft	15 ft	14 ft	15 ft	16 ft
	5	18 ft	17 ft	16 ft	15 ft	14 ft	15 ft
	6	19 ft	18 ft	17 ft	16 ft	15 ft	14 ft
3	1	16 ft	17 ft	18 ft	19 ft	20 ft	21 ft
	2	17 ft	16 ft	17 ft	18 ft	19 ft	20 ft
	3	18 ft	17 ft	16 ft	17 ft	18 ft	19 ft
	4	19 ft	18 ft	17 ft	16 ft	17 ft	18 ft
	5	20 ft	19 ft	18 ft	17 ft	16 ft	17 ft
	6	21 ft	20 ft	19 ft	18 ft	17 ft	16 ft
4	1	19 ft	20 ft	21 ft	22 ft	23 ft	24 ft
	2	20 ft	19 ft	20 ft	21 ft	22 ft	23 ft
	3	21 ft	20 ft	19 ft	20 ft	21 ft	22 ft
	4	22 ft	21 ft	20 ft	19 ft	20 ft	21 ft
	5	23 ft	22 ft	21 ft	20 ft	19 ft	20 ft
	6	24 ft	23 ft	22 ft	21 ft	20 ft	19 ft
5	1	21 ft	22 ft	23 ft	24 ft	25 ft	26 ft
	2	22 ft	21 ft	22 ft	23 ft	24 ft	25 ft
	3	23 ft	22 ft	21 ft	22 ft	23 ft	24 ft
	4	24 ft	23 ft	22 ft	21 ft	22 ft	23 ft
	5	25 ft	24 ft	23 ft	22 ft	21 ft	22 ft
	6	26 ft	25 ft	24 ft	23 ft	22 ft	21 ft
6	1	24 ft	25 ft	26 ft	27 ft	28 ft	29 ft
	2	25 ft	24 ft	25 ft	26 ft	27 ft	28 ft
	3	26 ft	25 ft	24 ft	25 ft	26 ft	27 ft
	4	27 ft	26 ft	25 ft	24 ft	25 ft	26 ft
	5	28 ft	27 ft	26 ft	25 ft	24 ft	25 ft
	6	29 ft	28 ft	27 ft	26 ft	25 ft	24 ft
7	1	26 ft	27 ft	28 ft	29 ft	30 ft	31 ft
	2	27 ft	26 ft	27 ft	28 ft	29 ft	30 ft
	3	28 ft	27 ft	26 ft	27 ft	28 ft	29 ft
	4	29 ft	28 ft	27 ft	26 ft	27 ft	28 ft
	5	30 ft	29 ft	28 ft	27 ft	26 ft	27 ft
	6	31 ft	30 ft	29 ft	28 ft	27 ft	26 ft
8	1	29 ft	30 ft	31 ft	32 ft	33 ft	34 ft
	2	30 ft	29 ft	30 ft	31 ft	32 ft	33 ft
	3	31 ft	30 ft	29 ft	30 ft	31 ft	32 ft
	4	32 ft	31 ft	30 ft	29 ft	30 ft	31 ft
	5	33 ft	32 ft	31 ft	30 ft	29 ft	30 ft
	6	34 ft	33 ft	32 ft	31 ft	30 ft	29 ft
9	1	31 ft	32 ft	33 ft	34 ft	35 ft	36 ft
	2	32 ft	31 ft	32 ft	33 ft	34 ft	35 ft
	3	33 ft	32 ft	31 ft	32 ft	33 ft	34 ft
	4	34 ft	33 ft	32 ft	31 ft	32 ft	33 ft
	5	35 ft	34 ft	33 ft	32 ft	31 ft	32 ft
	6	36 ft	35 ft	34 ft	33 ft	32 ft	31 ft

Difference of bays	Originating shelf	Destination shelf					
		1	2	3	4	5	6
10	1	34 ft	35 ft	36 ft	37 ft	38 ft	39 ft
	2	35 ft	34 ft	35 ft	36 ft	37 ft	38 ft
	3	36 ft	35 ft	34 ft	35 ft	36 ft	37 ft
	4	37 ft	36 ft	35 ft	34 ft	35 ft	36 ft
	5	38 ft	37 ft	36 ft	35 ft	34 ft	35 ft
	6	39 ft	38 ft	37 ft	36 ft	35 ft	34 ft
11	1	36 ft	37 ft	38 ft	39 ft	40 ft	41 ft
	2	37 ft	36 ft	37 ft	38 ft	39 ft	40 ft
	3	38 ft	37 ft	36 ft	37 ft	38 ft	39 ft
	4	39 ft	38 ft	37 ft	36 ft	37 ft	38 ft
	5	40 ft	39 ft	38 ft	37 ft	36 ft	37 ft
	6	41 ft	40 ft	39 ft	38 ft	37 ft	36 ft
12	1	39 ft	40 ft	41 ft	42 ft	43 ft	44 ft
	2	40 ft	39 ft	40 ft	41 ft	42 ft	43 ft
	3	41 ft	40 ft	39 ft	40 ft	41 ft	42 ft
	4	42 ft	41 ft	40 ft	39 ft	40 ft	41 ft
	5	43 ft	42 ft	41 ft	40 ft	39 ft	40 ft
	6	44 ft	43 ft	42 ft	41 ft	40 ft	39 ft
13	1	41 ft	42 ft	43 ft	44 ft	45 ft	46 ft
	2	42 ft	41 ft	42 ft	43 ft	44 ft	45 ft
	3	43 ft	42 ft	41 ft	42 ft	43 ft	44 ft
	4	44 ft	43 ft	42 ft	41 ft	42 ft	43 ft
	5	45 ft	44 ft	43 ft	42 ft	41 ft	42 ft
	6	46 ft	45 ft	44 ft	43 ft	42 ft	41 ft
14	1	44 ft	45 ft	46 ft	47 ft	48 ft	49 ft
	2	45 ft	44 ft	45 ft	46 ft	47 ft	48 ft
	3	46 ft	45 ft	44 ft	45 ft	46 ft	47 ft
	4	47 ft	46 ft	45 ft	44 ft	45 ft	46 ft
	5	48 ft	47 ft	46 ft	45 ft	44 ft	45 ft
	6	49 ft	48 ft	47 ft	46 ft	45 ft	44 ft
15	1	46 ft	47 ft	48 ft	49 ft	50 ft	51 ft
	2	47 ft	46 ft	47 ft	48 ft	49 ft	50 ft
	3	48 ft	47 ft	46 ft	47 ft	48 ft	49 ft
	4	49 ft	48 ft	47 ft	46 ft	47 ft	48 ft
	5	50 ft	49 ft	48 ft	47 ft	46 ft	47 ft
	6	51 ft	50 ft	49 ft	48 ft	47 ft	46 ft
16	1	49 ft	50 ft	51 ft	52 ft	53 ft	54 ft
	2	50 ft	49 ft	50 ft	51 ft	52 ft	53 ft
	3	51 ft	50 ft	49 ft	50 ft	51 ft	52 ft
	4	52 ft	51 ft	50 ft	49 ft	50 ft	51 ft
	5	53 ft	52 ft	51 ft	50 ft	49 ft	50 ft
	6	54 ft	53 ft	52 ft	51 ft	50 ft	49 ft
17	1	51 ft	52 ft	53 ft	54 ft	55 ft	56 ft
	2	52 ft	51 ft	52 ft	53 ft	54 ft	55 ft
	3	53 ft	52 ft	51 ft	52 ft	53 ft	54 ft
	4	54 ft	53 ft	52 ft	51 ft	52 ft	53 ft
	5	55 ft	54 ft	53 ft	52 ft	51 ft	52 ft
	6	56 ft	55 ft	54 ft	53 ft	52 ft	51 ft
18	1	54 ft	55 ft	56 ft	57 ft	58 ft	59 ft
	2	55 ft	54 ft	55 ft	56 ft	57 ft	58 ft
	3	56 ft	55 ft	54 ft	55 ft	56 ft	57 ft
	4	57 ft	56 ft	55 ft	54 ft	55 ft	56 ft
	5	58 ft	57 ft	56 ft	55 ft	54 ft	55 ft
	6	59 ft	58 ft	57 ft	56 ft	55 ft	54 ft
19	1	56 ft	57 ft	58 ft	59 ft	60 ft	61 ft
	2	57 ft	56 ft	57 ft	58 ft	59 ft	60 ft
	3	58 ft	57 ft	56 ft	57 ft	58 ft	59 ft
	4	59 ft	58 ft	57 ft	56 ft	57 ft	58 ft
	5	60 ft	59 ft	58 ft	57 ft	56 ft	57 ft
	6	61 ft	60 ft	59 ft	58 ft	57 ft	56 ft

Table 5-1 (Continued) — Recommended Patch Cord Lengths for Interconnect Applications

Patch cord installation

Installing patch cords is a simple procedure, but a few rules must be followed to ensure trouble-free growth within the frame. The key steps are explained below:

- Remove the patch cords from their shipping containers and spread them out in a straight line to remove the curl memory in the cord. This is a very important step which will ensure straight hanging cords.
- All connectors must be cleaned according to their manufacturer's instructions prior to termination. Connect the first end of the patch cord to the appropriate port, then rotate the module into the housing, connect the second end of the patch cord to its termination point, and dress the patch cord slack within the IBU as shown in Figure 21.

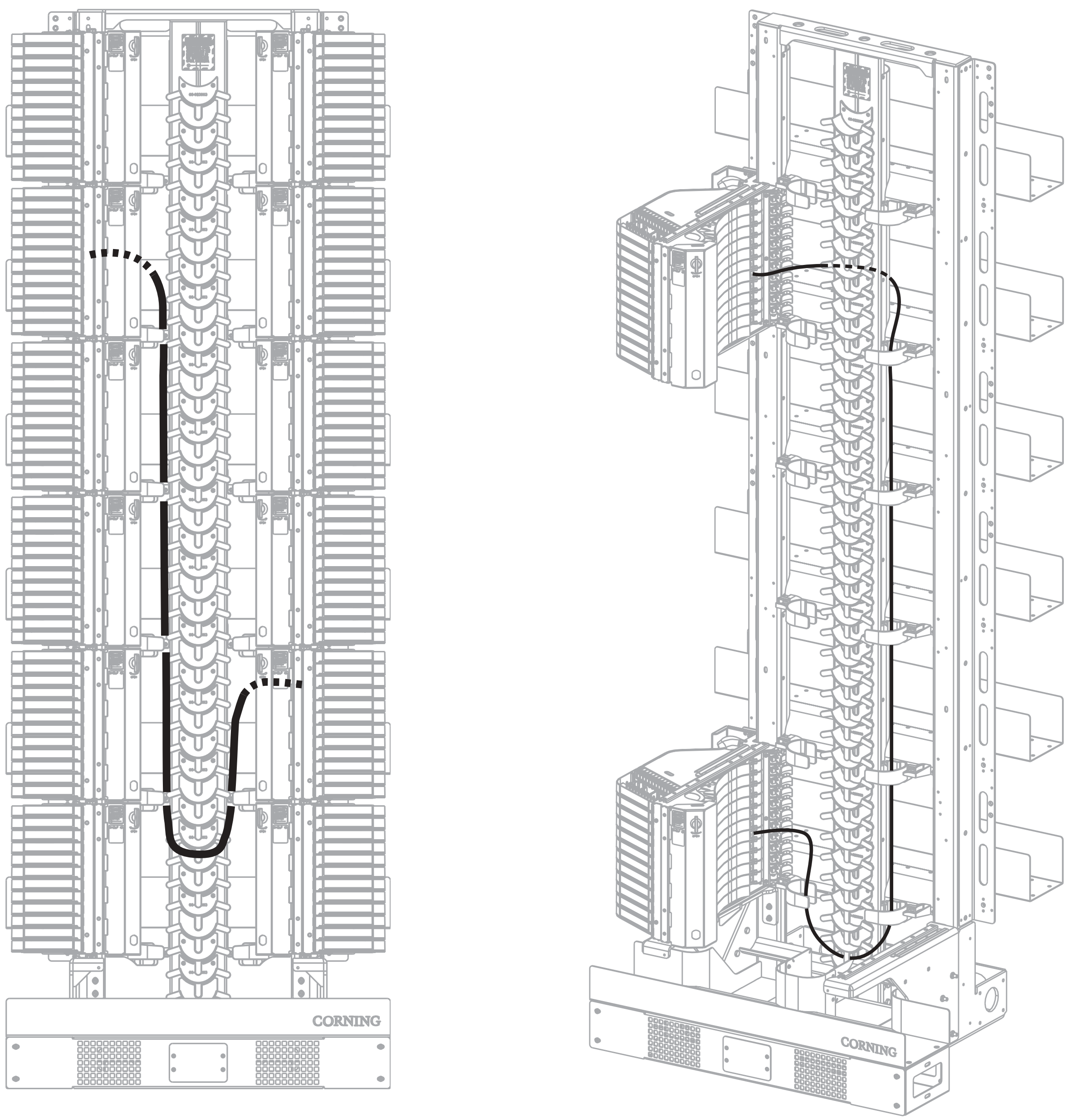


Figure 21 — In-bay patch cord dressing

- Some slack is always necessary so that the module can be pulled out later for maintenance. For an out-of-bay (interbay) patch cord, route the cord as indicated in Figure 22.

NOTE: *If rear troughs are used, refer to the routing instructions provided with the frame system guide.*

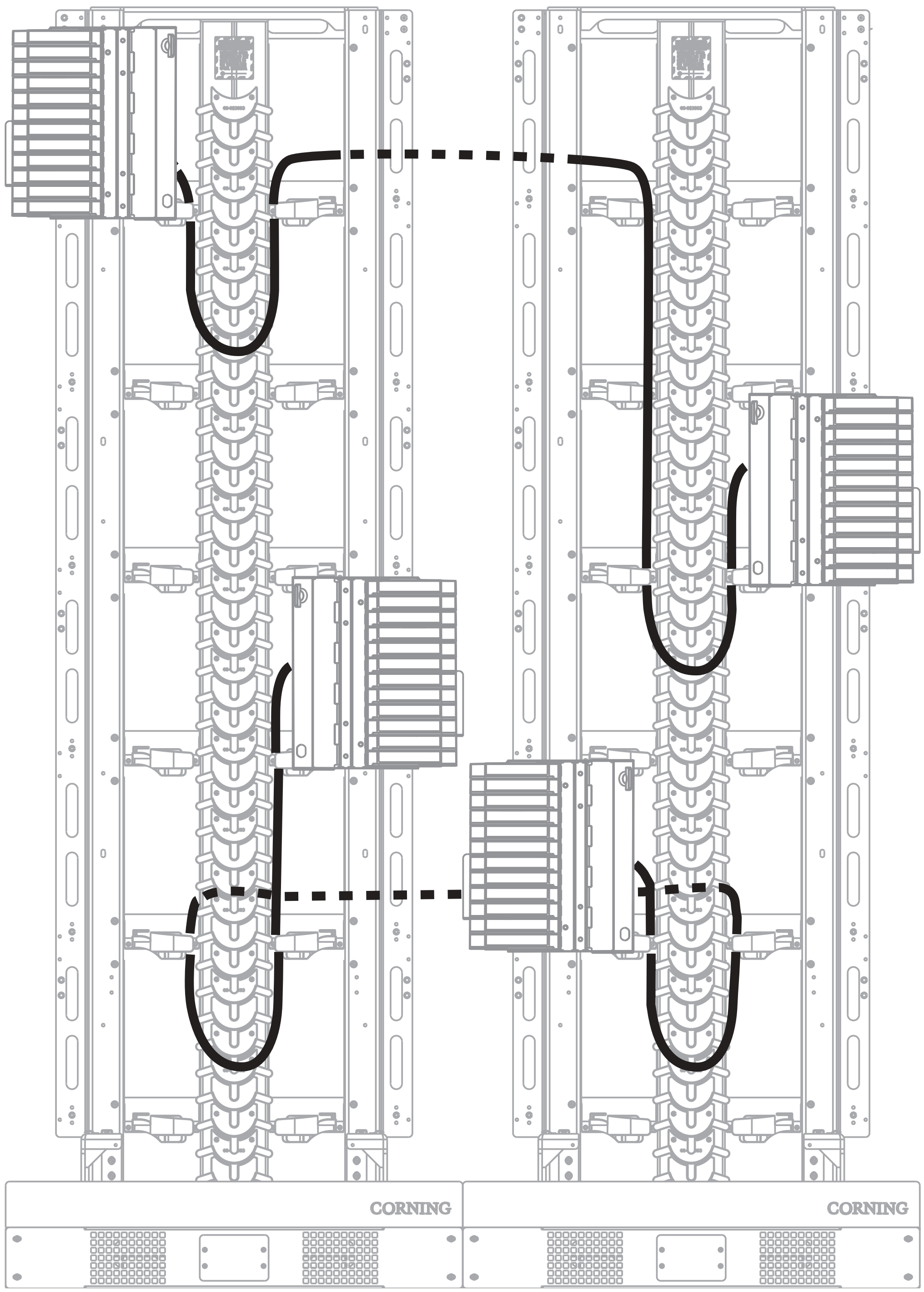


Figure 22 — Interbay patch cord slack storage

- Patch cord may also be stored in the optional Interbay Fiber Manager mounted between frames. Route the patch cord as shown in Figure 23.

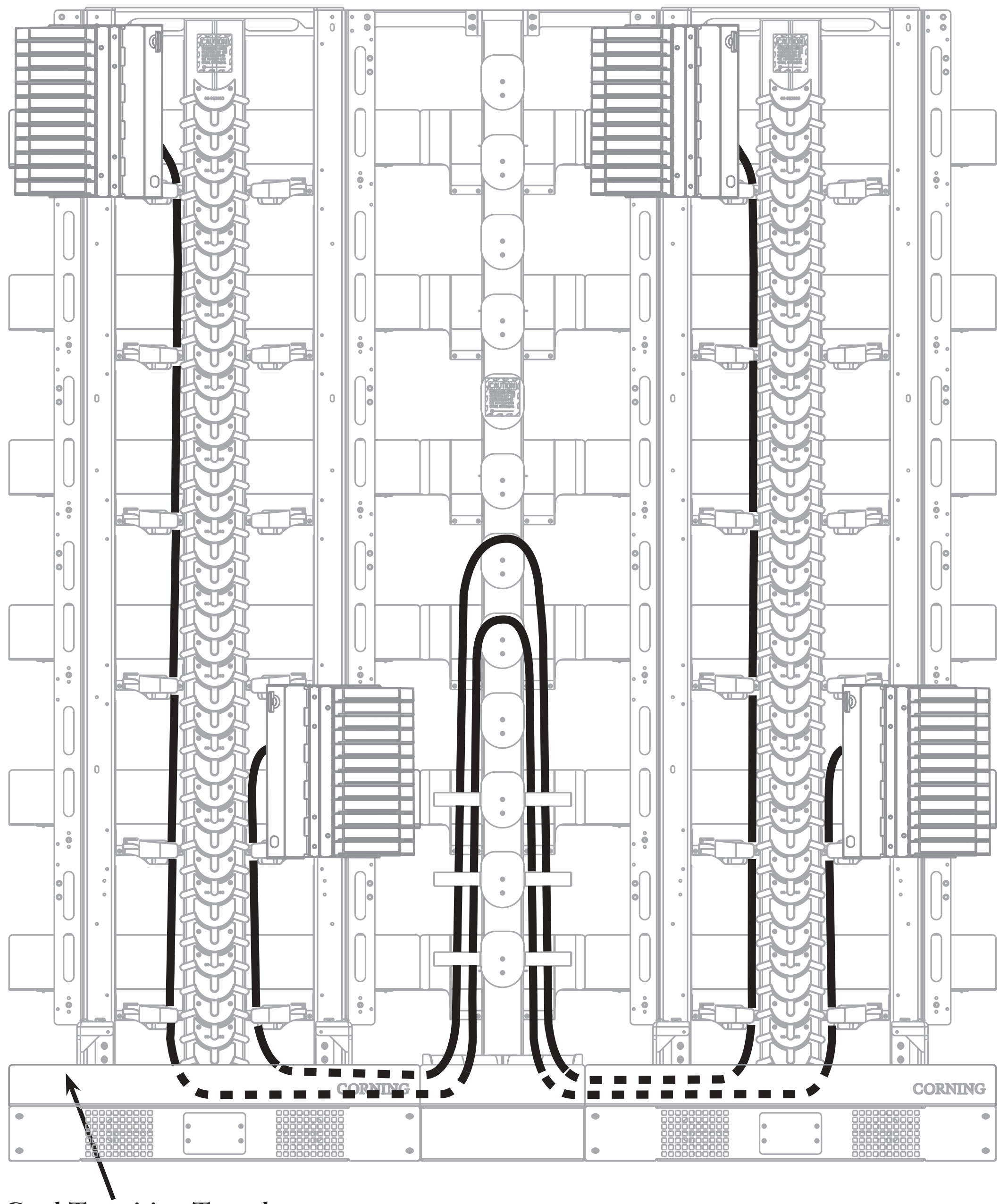


Figure 23 — Multiple frame patch cord storage in an Interbay Storage Device

Note:

- Excess slack must not be stored in the path cord transition trough at the base of the frame. Doing so will cause excessive congestion in large installations and will hinder subsequent patch cord service or removal.

Patch cord routing in multiple line-ups

Patch cords may be routed to frames in multiple line-ups through overhead cable management systems as described in the installation instruction for the MTX Frame System.

Patch cord tracing

Prior to removing a patch cord, it is important to verify that the correct patch cord has been identified. Two tracing methods are suggested.

Manual - Using standard patch cords for small fiber management installations, manual tracing may be sufficient. Starting at one end, gently push the patch cord and follow its movement throughout the frame, the transition trough, the far-end module, and finally the destination connector port.

Visual - The SearchLite™ visual tracing patch cord is designed with integrated lamps and probe connectors at both connector ends. A simple power supply generates a flashing signal that creates a powerful and easily identifiable trace. This method reduces time and ensures the accuracy of patch cord identification.

Patch cord removal

After the desired patch cord is identified, remove one end and place dust caps on the connector and corresponding module port. Gently remove the patch cord from the bay and lay it flat onto the transition panel cable trough. Push the patch cord carefully and follow the corresponding movement down the cable trough, a few meters away. Proceed to that point and pull the cord out of the patch cord pile. Repeat this procedure until the far end is reached.

Remove the opposite end of the patch cord and install dust caps. Update the information on the module label to show that the cross-connection no longer exists.

NOTE: *Do not remove more than one patch cord at a time. If an incorrect cord is removed, a protection switch will occur. Disconnecting two cords simultaneously may bring down both the protection and working channels.*

OPTICAL HYGIENE

Cleanliness is the key to a high performance fiber optic network. Contaminated connectors are the single biggest cause of poor attenuation performance. For this reason, proper handling and cleaning is especially important during installation and optical acceptance testing.

Each time a contaminated connector ferrule is inserted into the connector sleeve, some of the debris will inevitably remain inside the sleeve. When a mating connector plug is inserted, the contaminants are pushed into the mating surface. At the very least, this will have adverse affects on return loss and attenuation. In the worst case, the contaminants may cause permanent damage to the connectors.

All connector suppliers give recommended cleaning procedures for their products. The steps may be different, but the intent is identical.

Observe the following rules:

- Always keep dust caps on connectors when not in use.
- Ensure dust caps are clean before reuse.
- Use optical cleaning materials as standardized by your company.
- Clean the connector before every remate, especially for test equipment patch cords.

LIVE FIBER HANDLING PROCEDURES

MTX Frame products are designed to minimize any concerns regarding fiber macrobends during installation and normal operation. Handling live fibers within the frame is not an issue as long as the following guidelines are taken into account:

- Industry standards specify the minimum bend diameter of patch cord and 900-micron fiber to be 3 inches. In terms of physical handling, it is possible to bend the fiber down to 2 inches in diameter without affecting the optical level or jeopardizing the long-term reliability. It should be noted that bending loss is wavelength sensitive, and that for any given bend diameter, the loss is higher at 1550 nm than at 1310 nm.
- The design of the connector and its strain-relief boot plays an important role in preventing transient bending losses due to handling or pulling on the cable. Use patch cords which meet or exceed the latest industry standards for connectors.
- Ensure that the patch cords are installed without any curls which may become knotted during cord removal or manipulation.

RECORDKEEPING

Corning Cable Systems recommends that as a minimum the user maintain the following records per local practice.

- Record of frame identification and location
- Size of the frame and line-up
- Reserved space for expansion
- Record of network equipment and other pertinent termination locations on the frame

Figures 18 and 19 show the standard approach to preferential assignment within a single frame or within multiple frames. The left hand column of modules is designated vertical number 1, and the right hand column is designated vertical number 2. The housings within each column are designated 1 through 6 beginning with the bottom housing. The modules within each housing are numbered 1 to 12 starting with the top module in the housing.

Connections are mapped and identified by specifying the column (V), shelf (S) (1 through 6), module (M) (1 through 12), and port (P), respectively, such as, V1:S2:M12:P7.

This designation scheme allows for simple tracking and recording of activities which can be applied either manually or using software.

LABELING

A suitable space is provided on the end guard of the MTX for placement of frame labels. The installer should label the frame line-up per standard local practices.

Each MTX Frame termination module is supplied with a blank label as shown in Figure 24. The label is subdivided into sections. The upper left hand corner space is reserved for marking the number which corresponds to the module's position within a vertical. The remaining space on the upper portion of the label is used to identify the incoming cable or equipment terminations. The 12 boxes on the lower part of the label are intended for the 12 connector positions, and are used to identify the cable fiber count or equipment ports.

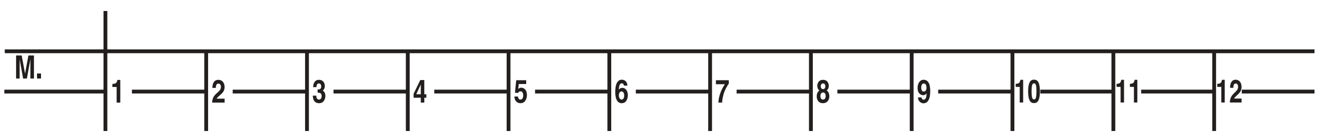


Figure 24 — MTX Fiber Termination Module Label Designations

MAINTENANCE

The MTX Frame System requires very little maintenance to ensure that fibers and parts are in good condition. At least annually perform the following maintenance:

- Clean external components with a damp, nonabrasive cloth.
- Check internal components for the following:
  - Loose Parts: Check nuts, bolts, and screws for looseness and tighten.
  - Fiber Bends: Check fiber optic cable to make sure bends do not exceed the minimum bend radius. Check cable for unnecessary strain. Check cable entries and exits for crimping or crushing.
  - Documentation: Check record labels to make sure all are clear and accurate.

Replacement adapters and patch cords should be maintained at each location for emergency restoration. Other spare parts are not normally required to be maintained in inventory; however, call Engineering Services at 1-800-743-2673 for assistance in ordering spare or replacement parts and optional test equipment if they become necessary.

SERIES TEST ACCESS

Series testing is any test performed by manually disconnecting the patch cord to interrupt the signal and then plugging in the test equipment. Attenuation testing, troubleshooting, or Optical time Domain Reflectometer (OTDR) testing are examples of series tests. The MTX frame system provides easy access to the equipment for performing series tests.

A typical series test should be performed in the event of loss of service or low performance, or to verify the quality of a circuit. A series access test can verify the performance of the circuit from 1) the central office to either the remote terminal or to network equipment, or 2) directly from the remote terminal to the network equipment. Figure 98 illustrates a typical series test of the termination from the network equipment. P5Mass Termination Xchange (MTX) End Guard Kiterforming a series test of the OSP termination and the equipment termination provides test access in both directions.

To perform a series test —

- Locate the cross-connect fiber adapter to be tested and disconnect the patch cord from it. Place a dust cap on the connector. Connect a known good patch cord from the adapter to a test set.
- Monitor the signal to determine that the measurements meet the required specifications.

Similarly, WDM modules, attenuators, and splitters provided by Corning Cable Systems with the MTX frame system have front-facing connections to allow easy access for testing. Some Corning Cable Systems WDM modules contain a 90/10 split of power levels to allow monitoring of the system without interruption.

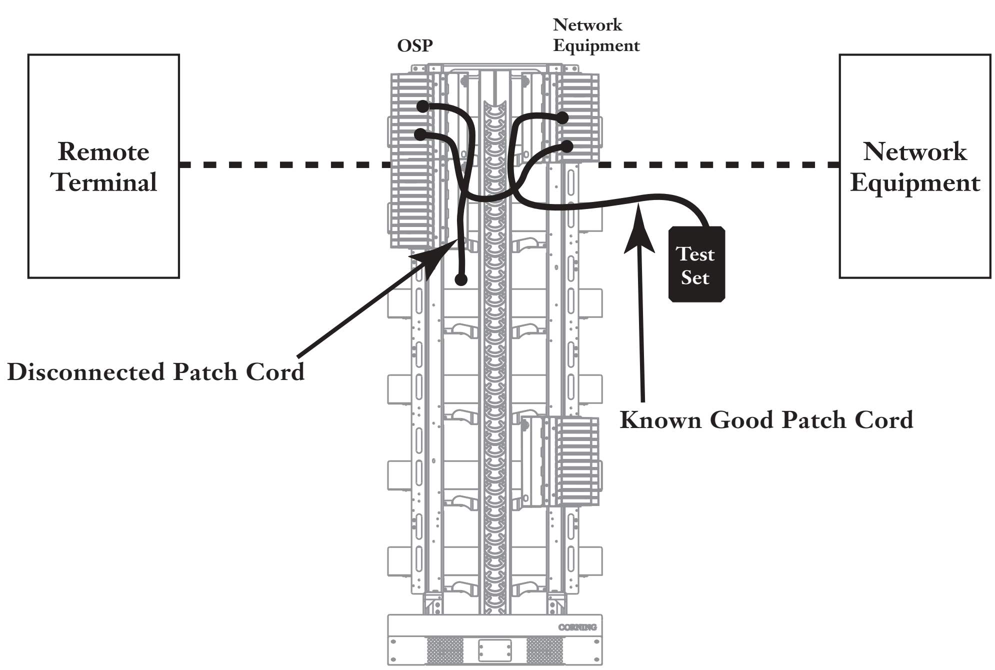


Figure 25 — Typical Series Testing

End-to-End Attenuation Test

The single-most important test of an installed link is end-to-end attenuation. This is a measure of the optical power loss between cable termination points. Acceptable loss values are dependent upon the system length, wavelength, and number and type of connectors and splices. The end-to-end loss should always be less than the link loss budget claculated in the system design. The best way to verify that the cable meets the loss limit is to measure each segment from patch panel to patch panel. Because of the stress and bending that cables can be subjected to during installation, Corning Cable Systems recommends measuring the attenuation of each connectorized link after installation.

End-to-end testing with a power meter and a light source is a three-step process used for bidirectional test access, which requires breaking the circuit in both directions. Equipment required:

- Optical Power Meter
- Optical Light source (850/1300 nm for multimode; 1310/1550 nm for single-mode)
- Test Jumpers (two at 2 meters each, with appropriate connectors)
- Connector Adapter (sleeve)
- Connector Cleaning Supplies

Step 1 Connect a short test jumper (containing the same fiber type as the system fiber) between the optical source and the optical meter. Record the reading as the reference power $P_{reference}$ in dBm. This power level is simply the output power of the light source coupled into the jumper.

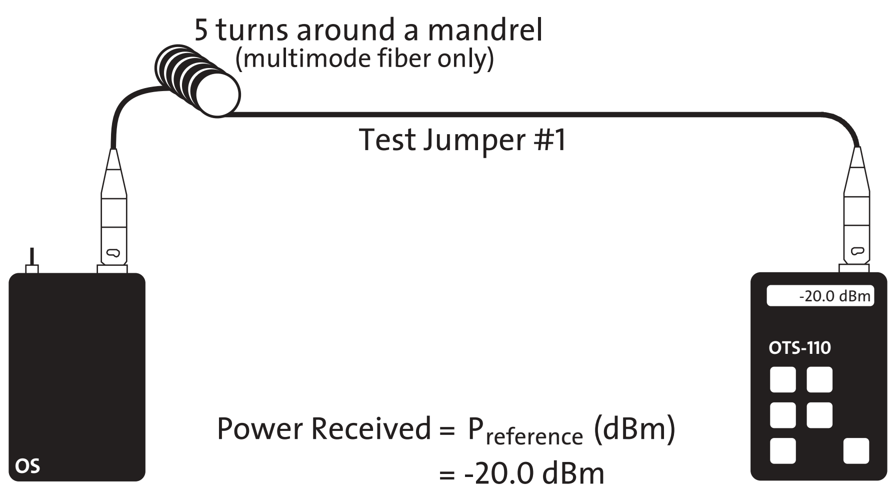


Figure 26 — End-to-End Attenuation Test: Step 1

NOTE: *Never disconnect or adjust the jumper connection at the optical source after recording the reference value. This can change the value and cause final test results to be inaccurate.*

Step 2 Disconnect test jumper #1 at the power meter and insert a second test jumper (test jumper #2), using an adapter, between the jumper used in Step 1 and the optical power meter. Verify that the two test jumpers are good by ensuring the power P_{check} is within the appropriate connector loss, typically 0.5 dB, of $P_{reference}$. If this criterion is met, continue to Step 3.

Otherwise, clean all connectors except the source connection point and repeat step 2. If the loss is still greater than 0.5 dB, replace test jumper #2 and repeat Step 2. If the loss is still greater than 0.5 dB, try replacing the adapter and repeat Step 2.

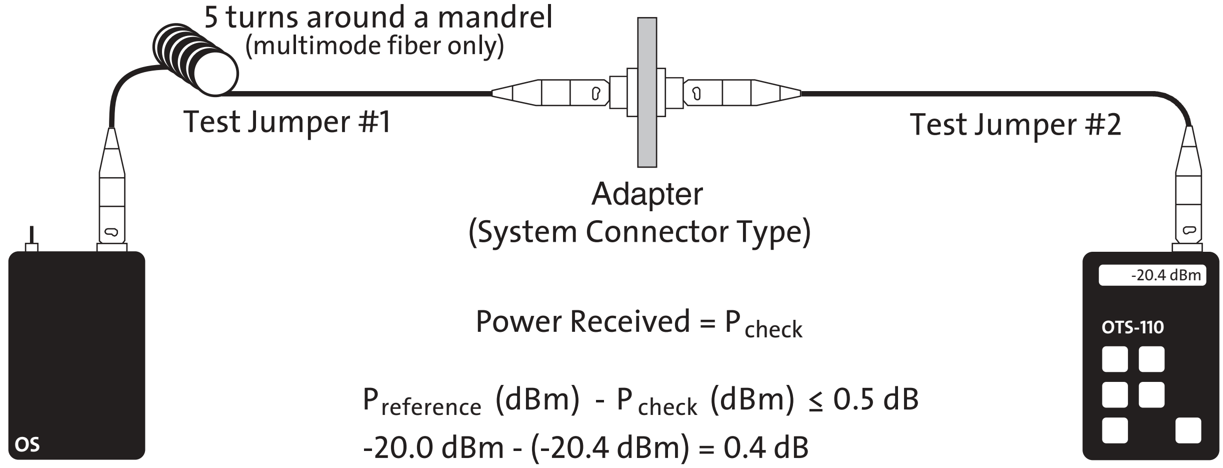


Figure 27 — End-to-End Attenuation Test: Step 2

Step 3 Leave the two test jumpers attached to the optical source and optical meter. Disconnect the two jumpers at the adapter. Attach the optical source/test jumper #1 to one end of the system fiber to be tested and the power meter/test jumper #2 to the other end of the same fiber. Record the power level in dBm as P_{test} and calculate the loss in dB. Repeat this step for each fiber to be tested.

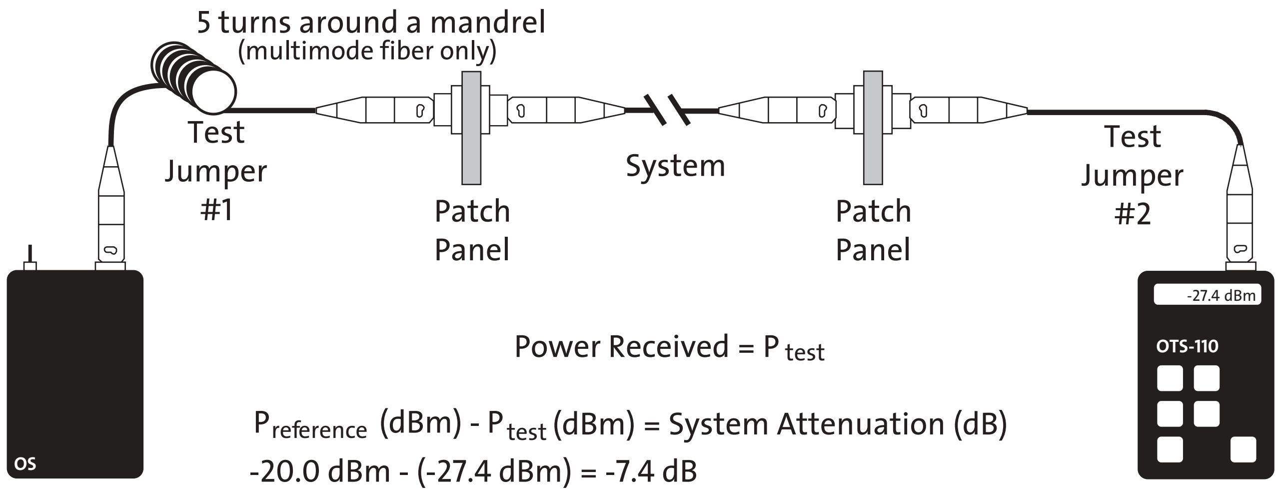


Figure 28 — End-to-End Attenuation Test: Step 3

TROUBLESHOOTING

Depending upon the tests being performed, service may be interrupted to the customer.

An optical power meter can be used to perform the first step in troubleshooting. Use a power meter designed for measuring only dBm power levels to determine that the power level is sufficient for your application.

Once a fault is isolated to the installed cable link, an OTDR is normally used to locate the fault within the cable. In cases where a fault is near an endpoint of within the connecting hardware, a visual fault locator is a good complement to the OTDR, whose weakness is near endpoints within the attenuation zone. Visual Fault Locators (VFLs) are optical sources that use a visible wavelength (approximately 650 nm) red laser to locate faults or points of high loss near end-points such as tight bends or crimps, faulty connectors, poor splices, damaged components, and fiber breaks.

OTDR Testing

End-to-end attenuation testing measures the total amount of loss between two endpoints. To find out what causes this loss and where it occurs in the cable system, an Optical Time Domain Reflectometer (OTDR) is needed. An OTDR can locate fiber events and measure the losses attributable to cable, connectors, splices, and/or other components. The graphical display of loss over a cable's entire length provides the most revealing analysis and documentation available on a cable link, commonly referred to as its signature trace. Corning Cable Systems recommends performing an OTDR analysis to document the integrity of the cable system, locate and measure each event or component, and uncover faults throughout the cable.

Equipment required:

- OTDR with appropriate fiber type capabilities (multimode or single-mode or both)
- Test Fiber Box (90 meters for multimode; 300 meters for single-mode)
- Pigtail and Mechanical Splice (On-The-Reel, Non-terminated cables only)
- Connector Adapter
- Cable Stripping/Mechanical splice Tools (On-The-Reel, Non-terminated cables only)
- Connector Cleaning Supplies

Follow the instructions provided with the OTDR tester you are using.

GLOSSARY

Acronyms

AWG	American Wire Gauge
BTF	Buffer Tube Fan-out
CATV	Cable Television
CEV	Controlled Environment Vault
CO	Central Office
FDF	Fiber Distributing Frane
IBU	Interbay Storage Unit
IFM	Interbay Fiber Manager
MTX	Mass Termination Xchange
NEC	National Electric Code
OSP	Outside Plant
OTDR	Optical Time Domain Reflectometer
TFM	Transition Fiber Manager
UCC	Universal Cable Clamp
UDF	Universal Distribution Frame

Terminology

Attenuation

The decrease in magnitude of power of a signal in transmission between points; a term used for expressing the total loss of an optical system, normally measured in decibels (dB) at a specific wavelength.

Buffer

In a fiber optic communication cable , one type of component used to encapsulate one or more optical fibers for the purpose of providing such functions as mechanical isolation, protection from physical damage and fiber identification. Note: The buffer may take the form of a miniature conduit, contained within the cable and called a loose buffer, or loose buffer tube, in which one or more fibers may be enclosed, often with a lubricating gel. A tight buffer consists of a polymer coating in intimate contact with the primary coating applied to the fiber during manufacture.

Buffer Tube Fan-Out Cable

Multifiber cable constructed in the tight buffered design. Designed for ease on connectorization and rugged applications for intra- or inter-building requirements.

Cable

An assembly of optical fibers and other material providing mechanical and environmental protection.

Cable Assembly

Optical fiber cable that has connectors installed on one or both ends. General use of these cable assemblies includes the interconnection of optical fiber cable systems and opto-electronic equipment. If connectors are attached to only one end of a cable, it is known as a pigtail. If connectors are attached to both ends, it is known as a jumper or patch cord.

Cable Bend Radius

Cable bend radius during installation infers that the cable is experiencing a tensile load. Free bend infers a smaller allowable bend radius since it is at a condition of no load.

Cable TV (CATV):

A television distribution method in which signals from distant stations are received, amplified, and then transmitted by (coaxial or fiber) cable or microwave links to users. The abbreviation *CATV* originally meant "*community antenna television.*" However, *CATV* is now usually understood to mean *cable TV.*

Central Office (CO)

A telephone company facility that handles the switching of telephone calls on the public switched telephone network (PSTN) for a small regional area.

Connecting Hardware

A device used to terminate an optical fiber cable with connectors and adapters providing an administration point for cross-connecting between cabling segments or interconnecting to electronic equipment.

Connector

A mechanical device used to align and join two fibers together to provide a means for attaching to and decoupling from a transmitter, receiver, or another fiber (patch panel).

Cross-connection

Connections between terminal blocks on the two sides of a distribution frame, or between terminals on a terminal block.

Federal Communications Commission (FCC)

The U.S. Government board of five presidential appointees that has the authority to regulate all non-Federal Government interstate telecommunications (including radio and television broadcasting) as well as all international communications that originate or terminate in the United States. Note: Similar authority for regulation of Federal Government telecommunications is vested in the National Telecommunications and Information Administration (NTIA).

Fiber Distributing Frame

In communications, a structure with terminations for connecting the permanent wiring of a facility in such a manner that interconnection by cross-connections may readily be made.

Interconnection

The linkage used to join two or more communications units, such as systems, networks, links, nodes, equipment, circuits, and devices.

Loose Tube Cable

Type of cable design whereby coated fibers are encased in buffer tubes offering excellent fiber protection and segregation.

Multifiber Cable

An optical fiber cable that contains two or more fibers.

Multimode Fiber

In optical fiber technology, multimode fiber is optical fiber that is designed to carry multiple light rays or modes concurrently, each at a slightly different reflection angle within the optical fiber core. Multimode fiber transmission is used for relatively short distances because the modes tend to disperse over longer lengths (this is called modal dispersion). For longer distances, single mode fiber (sometimes called monomode) fiber is used.

Multimode fiber has a larger core than single mode.

National Electrical Code® (NEC)®

An advisory document published by the NFPA and which includes building flammability requirements for indoor cables.

Note: Local codes take precedence but may refer to or require compliance to the NEC.

Optical Time Domain Reflectometer (OTDR)

An instrument that measures transmission characteristics of optical fiber by sending a series of short pulses of light down a fiber and providing a graphic representation of the backscattered light.

Patch Cord

Optical fiber cable that has a connector installed on one end.

Passive Network

A network that does not require a power source for its operation.

Single-mode Fiber

In optical fiber technology, single-mode fiber is optical fiber that is designed for the transmission of a single ray or mode of light as a carrier and is used for long-distance signal transmission. For short distances, multimode fiber is used.

Single-mode fiber has a much smaller core than multimode fiber.

telco

The generic name for telephone companies throughout the world.

Tight-Buffered Cable

Type of cable construction whereby each glass fiber is tightly buffered by a protective thermoplastic coating to a diameter of 900 micrometers. Increased buffering provides ease of handling and connectorization.

Wavelength Division Multiplexing (WDM)

A family of techniques in which two or more wavelengths are transported over the same fiber, either in the same or in opposite directions. Course WDM may use wavelengths in two windows (1310/1550 nm) or very wide spacing in one window (1520/1540/1560) — definitions vary. Dense WDM (DWDM) uses wavelengths that are very closely spaced, typically between 0.4 nm and 2.0 nm. Developmental systems may narrow this gap further.

Customer Service and Information

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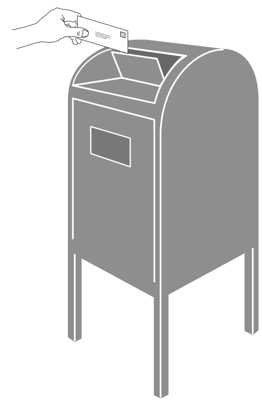

Product Information:

http://www.corning.com/cablesystems