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Applications Engineering Note

Plug & Play™ Systems with Multi-Fiber Connectors: Polarity Explained

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Introduction

Data Centers and other intrabuilding cable applications require high density data storage and communications networks which are easily installed and reconfigured. As evidenced by their growing popularity, modular cabling solutions such as Corning Cable Systems' (CCS) Plug & Play ™ solution have effectively addressed these needs. These systems are fundamentally composed of one or more cables which have been pre-terminated with multi-fiber connectors such as the 12-fiber MTP ® and which interface with a transition module or harness at each end. A harness is a cable assembly with a MTP connector at one end and six duplexed fiber pairs at the other end. A module is simply a harness enclosed in a compact piece of hardware with the connectors made accessible. Modules are typically mounted in a connectors housing in the same manner as a patch panel.

In order for a modular system to function properly it is necessary to design and integrate the components such that fiber polarity is properly maintained when the components are mated at installation. This involves using a fiber routing scheme which will ensure that the transceiver light sources at one end of the system are communicating with the appropriate receivers at the other end. The objective of this document is to describe some of the approaches that are commonly used to manage polarity in modular systems and to explain the relative benefits of each method.

There are numerous methods which can be used to manage polarity in modular systems. Four such methods are discussed below. CCS has used all of these methods at some point during the evolution of the Plug & Play product line.

MTP Connectors and Conventions:

A brief description of MTP connectors and conventions regarding their use in modular cabling systems will facilitate the discussion of system polarity management.

MTP connectors are aligned using precision guide-pins. Each connector type has a version with and without pins. The pinless version has guide-pin holes that accept the pins of the mating connector. A pinned connector should only be mated to a pinless connector. Attempting to mate two pinless connectors is possible, but in the absence of guide-pins to provide precise alignment, mating will result in high connector loss.

Proper fiber orientation between two connectors is maintained with a keying scheme designed into the connector and the mating adapter. MTP connectors are designed to mate in a “key up” to “key down” fashion, as shown in Figure 1.

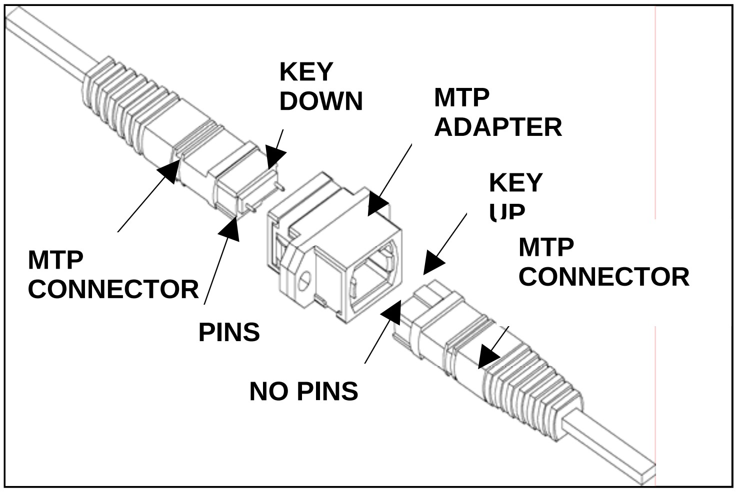

Figure 1: MTP Connectors Mating, “Key-up” to “Key-down”

“Key Up” is used to denote standard connector placement and “key down” is used to denote connector insertion 180 degrees from normal. Some panels may orient the adapter so that the keyway (and therefore the connector key) faces left or right in a panel.

Corning Cable Systems’ standard method for pin placement is shown in Table 1.

Location of Connector	**Pins or No Pins**
MTP on Primary Trunk	No Pins
MTP on Extender Trunk	Pins on one end
MTP inside Module	Pins

Table 1: Pin Placement for Corning Cable Systems Products

MTP connectors are commonly installed onto 12-fiber ribbon in two different ways. The standard method is to insert the ribbon fibers into the back of the connector ferrule in such a manner that when the connector is viewed from the polished end-face with the key oriented in the upward position, the blue fiber is viewed in the left-most position and the remaining fibers follow in standard color order. This will be referred to as standard ribbon positioning. The second method of MTP installation is to reverse the color order by turning the ribbon upside down prior to insertion of the fibers. This will be referred to as reverse ribbon positioning. Other methods of installation are possible if the ribbon is de-ribbonized and the fibers are re-ordered prior to fiber insertion. This approach is used in Method A as described later.

Common Fiber Routing Methods for Maintaining Polarity

Method A:

See Figure 1. All MTP connectors mate through adapters which facilitate key-up to key-down orientation. System polarity is managed in the primary trunk, which has an MTP installed in the standard ribbon position on both ends (blue fiber at left of side of MTP when the end-face is viewed in the key-up position), except that the ribbon on one end incorporates pair-wise fiber flips prior to connectorization. Extender trunks, if required, have MTPs mounted on both ends using the standard ribbon position. Extender trunks require a pinned MTP on one end. Identical "straight-through" transition modules are used on both ends. These modules have an MTP on the back installed in the standard ribbon position and are wired "straight-through" so that the fiber positioning exiting the trunk is maintained at the front of the module. Note that the module on the right of the drawing is represented schematically as upside down; however it would normally be mounted right side up in the hardware. Patch cords built as specified in ANSI/TIA/EIA-568-B.3 clause 6, connect the transition module to multiple transceivers on each end. Benefits to this method are: (1) Only one type of transition module and patch cord is required, which simplifies inventory practices for the manufacturer, distributor, and end-user. (2) This method eliminates possible installation errors as compared to other methods that require different types of modules or patch cords on opposing ends. The primary drawback of Method A is that of manufacturing complexity, which is a transparent matter to the-user.

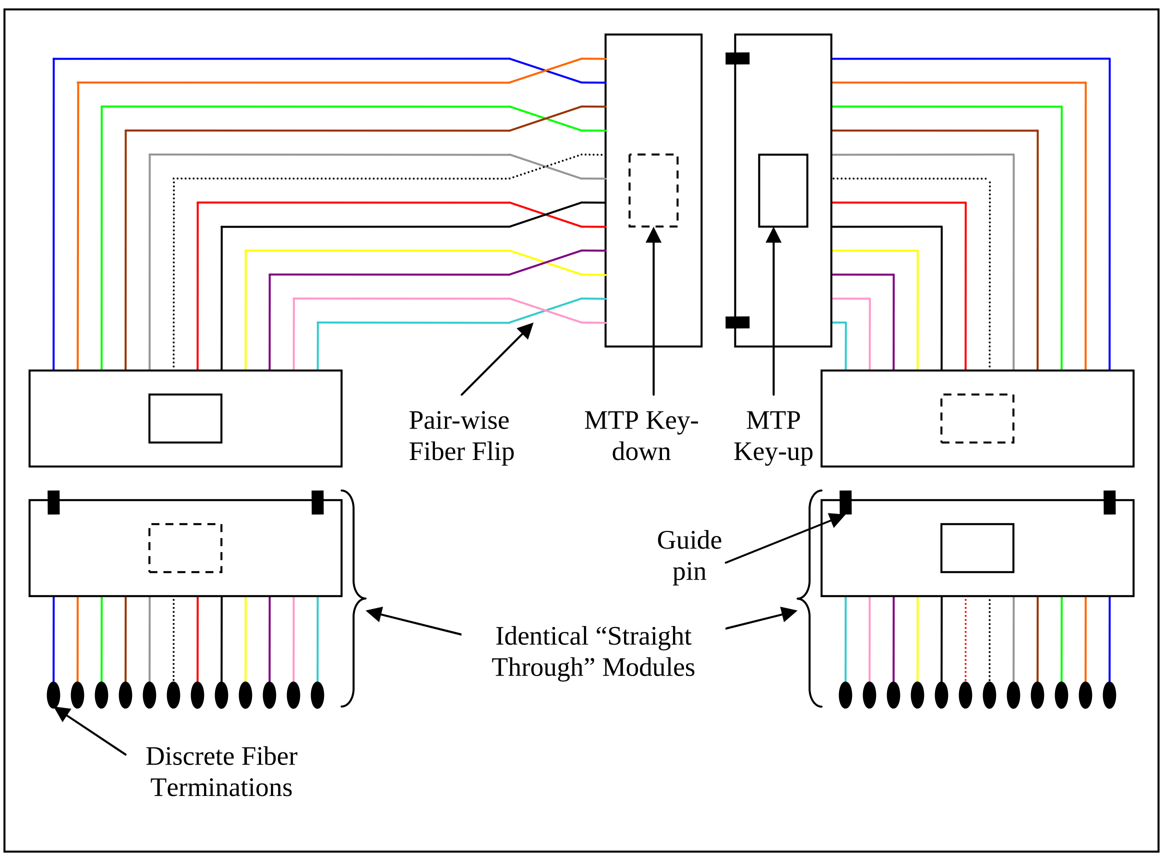

Figure 2: Fiber Routing Method A

Method B

See Figure 2. All MTP connectors mate through adapters which facilitate key-up to key-down orientation. Primary trunks are built with both MTPs installed in the standard ribbon position. Extender trunks, if required have MTPs installed in the same manner as the primary trunk, and require a pinned MTP on one end. Identical straight-through modules like those used in Method A are used on each end. In order for method B to maintain correct polarity for multiple duplex transceivers, it is necessary that two distinct types of patch cords be used to inter connect to the transceivers on each end. On one end standard 568-B.3 duplex patch cords are used. On the other end, straight pair positioning duplex patch cords are used which do not reverse the fiber positions (channel A routes to channel A). This method reduces the manufacturing complexity of the primary trunk, and like Method A, only requires one type of transition module. The primary drawback of Method B is that it requires the use of two distinct types of patch cords. This introduces an opportunity for installation error and creates an added cost and logistical burden of managing two types of patch cords in inventory.

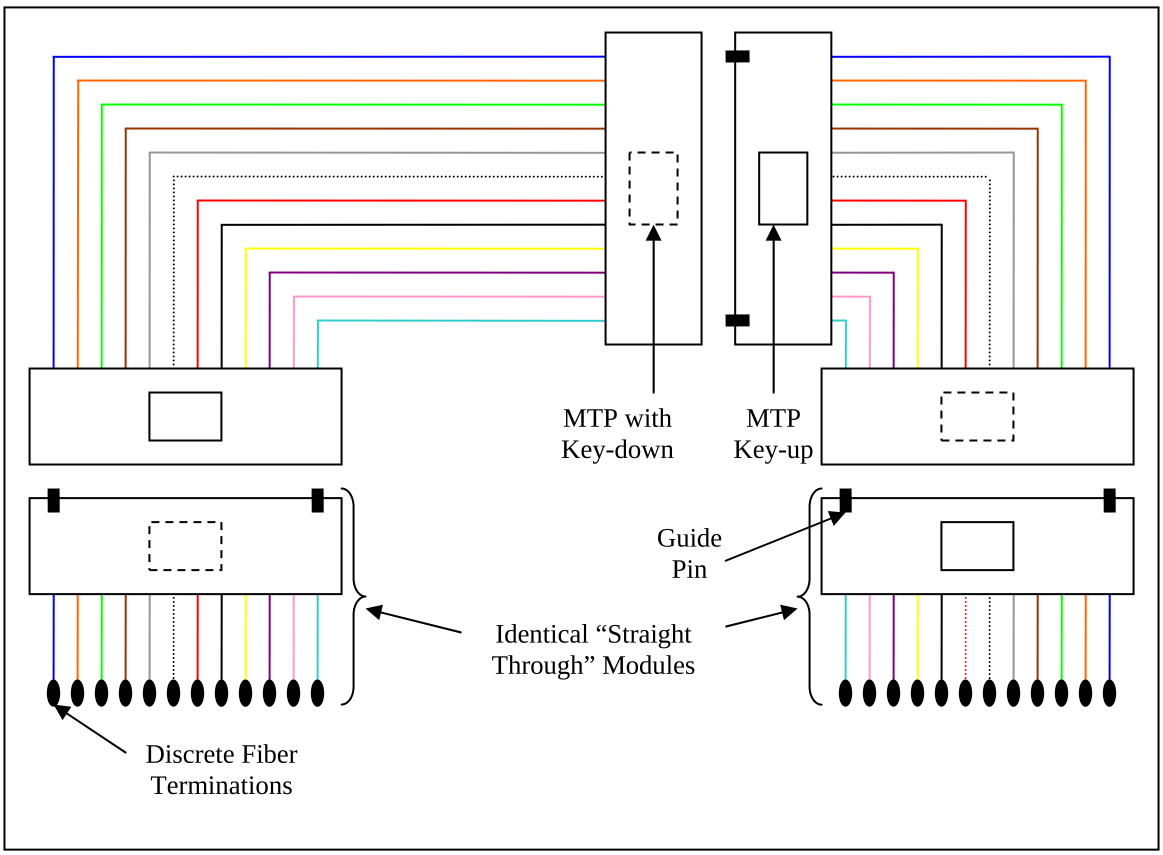

Figure 3: Fiber Routing Method B

Method C

See Figure 3. All MTP connectors mate through adapters which facilitate key-up to key-down orientation. Primary and extender trunks are identical to those used in Method B, however, Method C employs two distinct types of transition modules. One module is identical to those used in Method A and Method B, while the second module is used to manage system polarity. This may be accomplished by using pair-wise fiber flips within the module as shown below. Method C employs 568-B.3 duplex patch cords on both ends. Like Method A, Method C requires only one type of patch cord, however, the need for two different modules introduces an opportunity for installation error and creates an added cost and logistical burden of managing two types of modules in inventory.

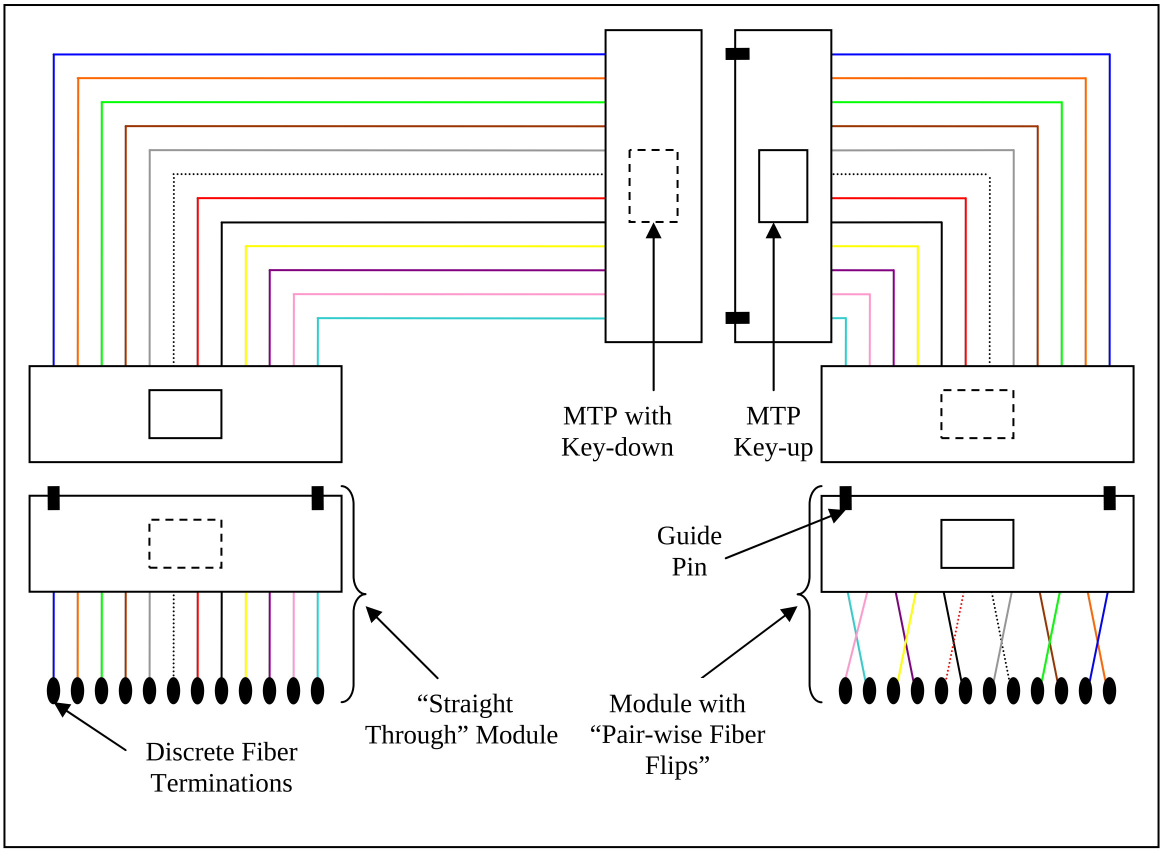

Figure 4: Fiber Routing Method C

<u>Method D</u>

In Method D, all MTP connectors mate through adapters which facilitate key-up to key-down orientation. The primary trunk has an MTP on one end installed in the standard ribbon position and the MTP on the other end is installed in the reverse ribbon position as denoted by the red outline. Extender trunks, if used, have MTPs installed in the standard ribbon position on both ends. Identical universal modules are used on both ends, and standard 568-B.3 patch cords are used on both ends to connect to the transceivers. Like Method A, only one type of transition module and patch cord is required, which simplifies inventory practices for the manufacturer, distributor, and end-user and eliminates possible installation errors as compared to other Methods B and C which require different types of polarity-correcting modules or patch cords on opposing ends. An additional benefit to polarity Method D is that it can easily migrate from duplexed serial applications to parallel applications.

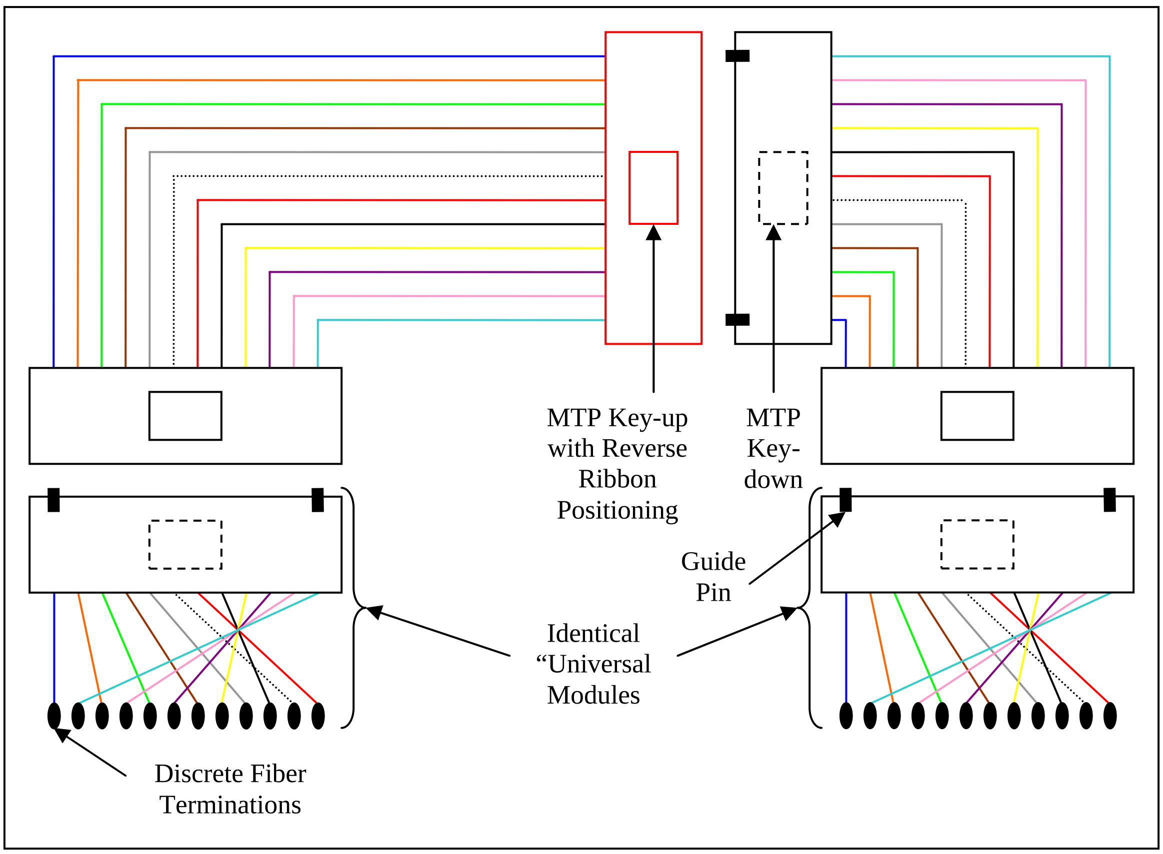

Figure 5: Fiber Routing Method D

Cross-Compatibility of Components Between Methods:

As already noted, the method used for managing polarity in modular cabling systems varies from manufacturer to manufacturer and may also vary for a given manufacturer from one product generation to another. While cross-compatibility of system components between manufacturers or between product generations should not be assumed, it is possible to cross-connect any two of the systems while maintaining polarity. In order to do this, each system must be properly implemented and the connection between the two must be made via duplex patch cords installed only at the front access of any of the systems' duplex patch panels/modules. CCS products generally contain visible physical attributes which can be used by end users to distinguish between current generation products and legacy products.

Should questions arise regarding compatibility of newly received CCS Plug & Play components with components previously obtained from CCS, Customer Service should be contacted.