

Maintaining Polarity in MPO Systems

Introduction

Ribbon trunks factory terminated with multifiber MPO connectors have become the preferred way to deploy fiber optic cabling systems, particularly in highly concentrated equipment areas, such as data centers. In order to maintain bi-directional transmission paths, the cabling system must provide correct signal polarity so that the transmitter(Tx) on one end connects to the receiver(Rx) on the other end.

Ribbon cables terminated with MPO connectors require some unique design considerations when installing, maintaining, and re-configuring a cabling system. ANSI/TIA-568-B.1-7-2006, Commercial Building Telecommunications Cabling Standard, Part 1 - General Requirements, Addendum 7 - Guidelines for Maintaining Polarity Using Array Connectors, was approved and published to provide guidance for maintaining polarity when utilizing MPO connectors. The standard provides for 3 different methods. We will discuss each of these methods.

The standard provides guidelines for establishing transmit-to-receive polarity using array (MPO) connectors. A typical system consists of:

- Pre-terminated trunks with 12 fiber MPO connectors.
- MPO to duplex connector/adaptor transitions such as cassette modules.
- Duplex patch cords to connect the cabling system to transmission equipment.

Each 12 fiber (6 duplex circuits) MPO is plugged into a transition(cassette or harness) on each end. Patch cords are plugged in to transitions and the active equipment on each end. All connectors/adapters in this system are keyed to ensure that proper orientation is maintained when mated. While keying establishes proper orientation in the MPO, it does not ensure that duplex fiber pair polarity is maintained. Implementing Method A, Method B, or Method C of the TIA standard will. Each connectivity method requires a specific combination of three components to maintain polarity in the optical transmission system.

Method A

Method A uses Type-A “straight through” backbones mated to transitions using Type-A MPO adapters. All components in the link are mated key-up to key-down. One end of the link uses A-to-B patch cords(straight through) to connect to their respective duplex transceiver ports. The other end uses A-to-A patch cords(crossed or pair flipped) to connect to their respective transceiver ports. See Figures 1 and 2. In each optical path there can only be one A-to-A patch cord. In this connectivity method the polarity “pair flip” is done at the patch cord. When implementing this connectivity method be consistent. Locate all A-to-B on the same end of the link(near end or far end). Make sure you use A-to-B patch cords that are clearly marked and easily distinguished from A-to-A patchcords. Trunks can be concatenated without any special consideration to polarity. Angle polished singlemode MPO connectors can be used. Method A is easy to implement and is the most widely used method.

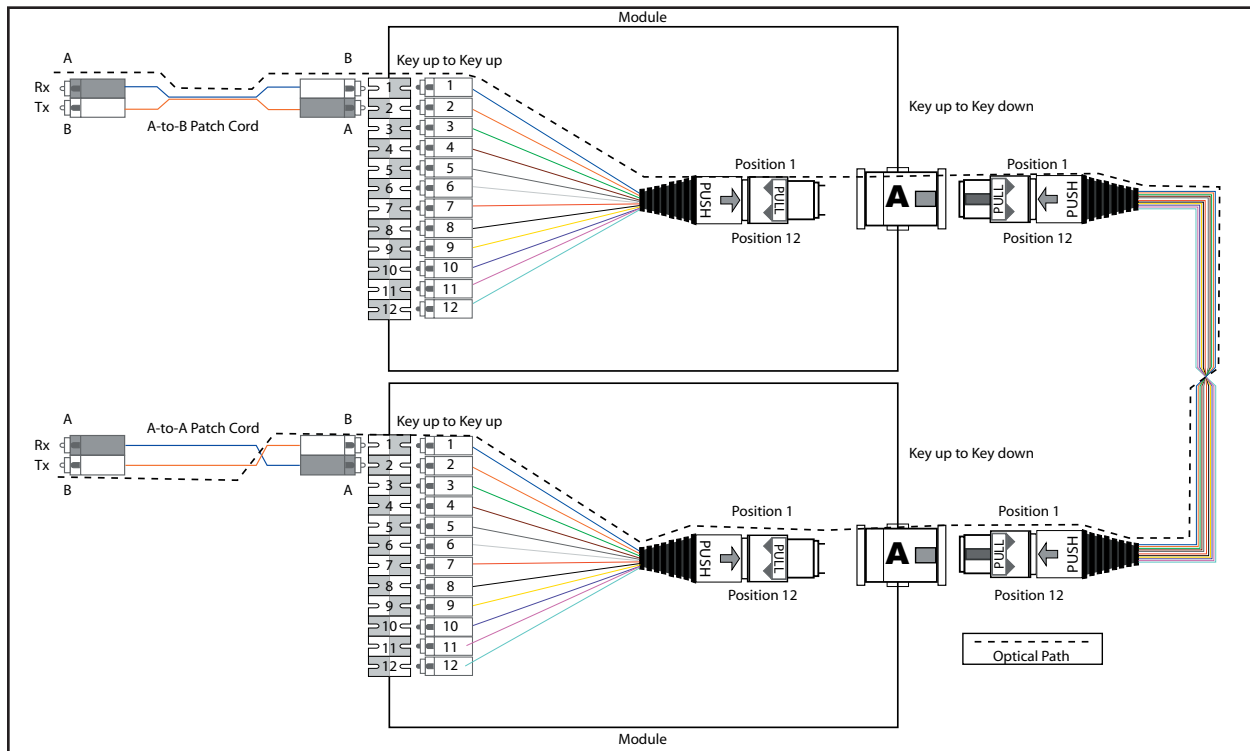


Figure 1: Method A Connectivity

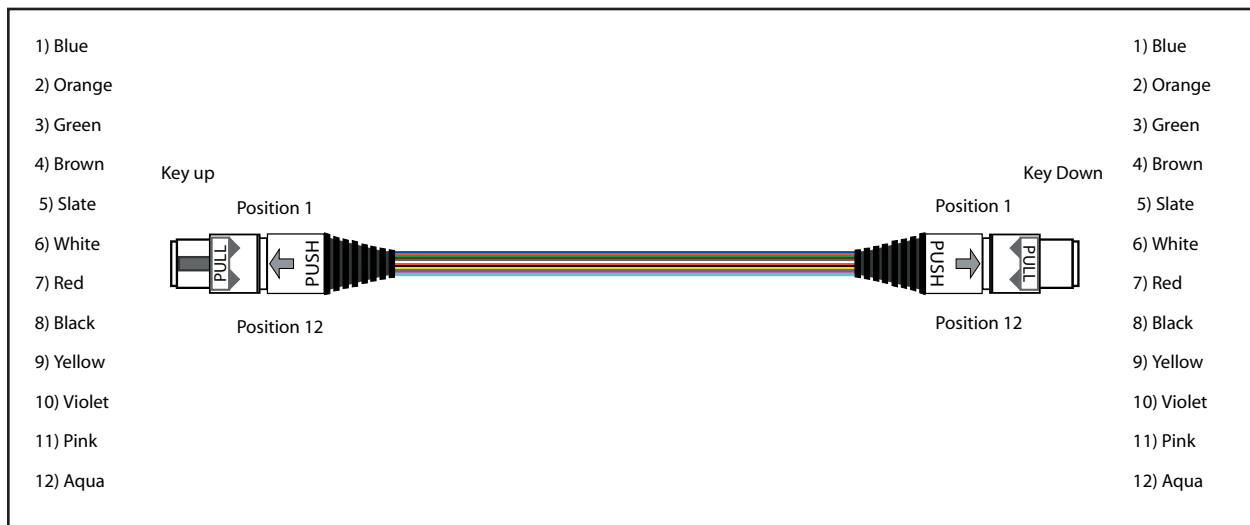


Figure 2: Method A Backbone

Method B

Method B uses Type-B “straight through” backbones mated to transitions using Type-B MPO adapters. All components in the link are mated key-up to key-up. Both ends of the link use A-to-B patch cords (straight through). See Figure 3 and 4. With this method physical position #1 goes to physical position #12 on the other end. A transition on one end is inverted so logically position #1 goes to position #1 on the other end. This method requires the use of two different transitions, one regular and one inverted. This method also does not support single mode MPO connectors. Because of the planning required and the failure of this connectivity method to support single mode MPO's, Method B is not widely implemented.

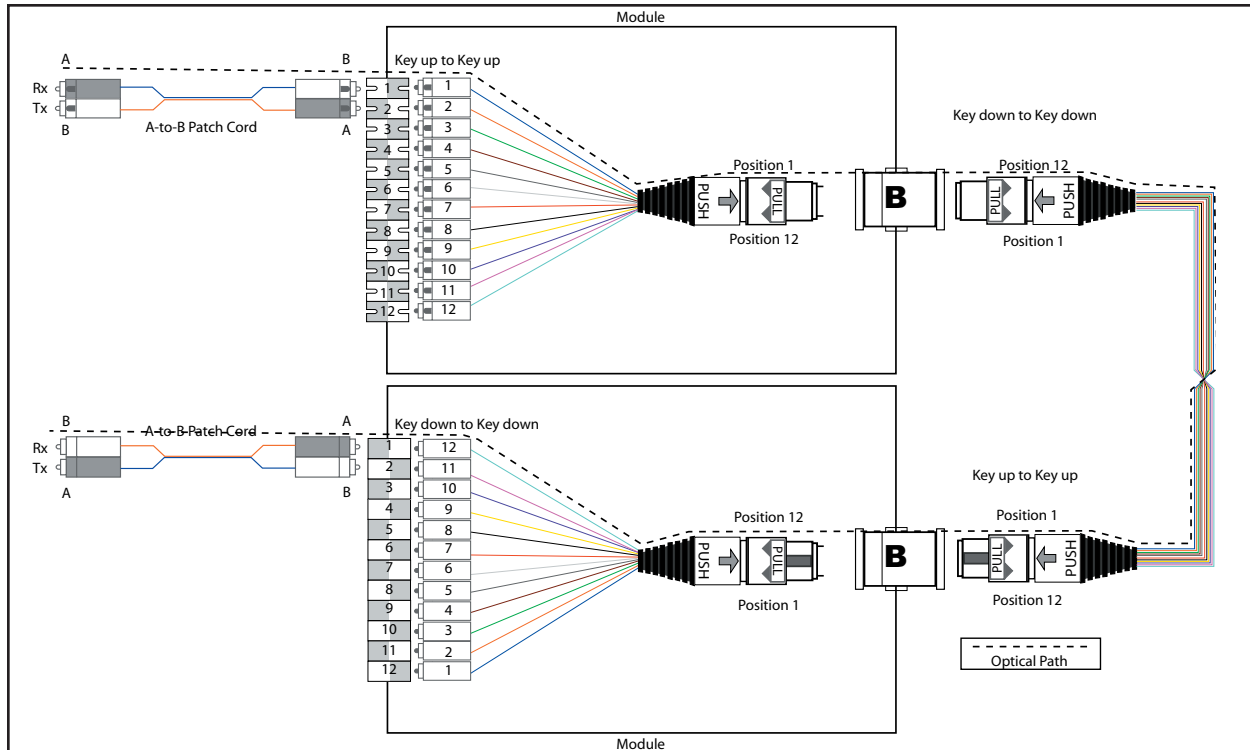


Figure 3: Method B Connectivity

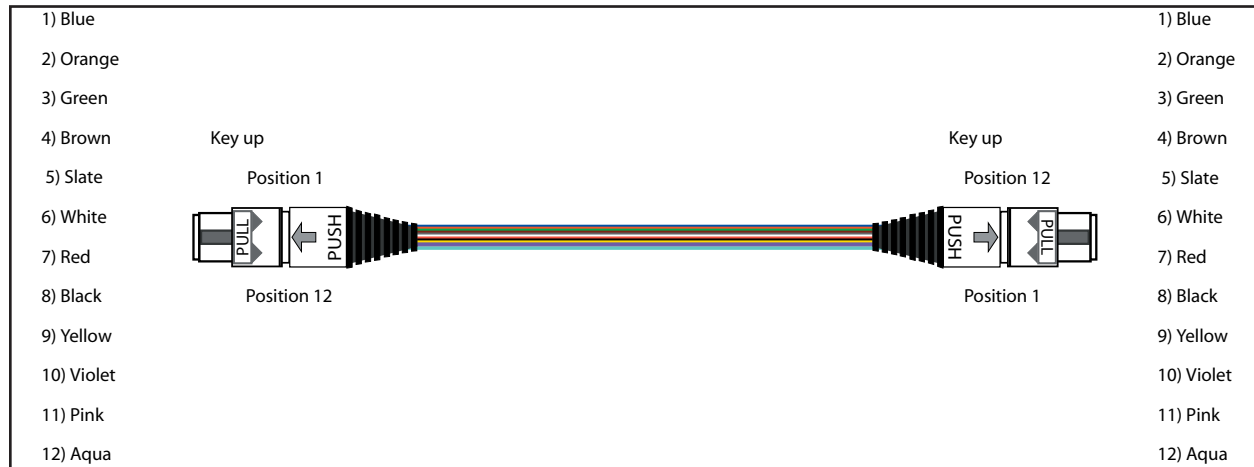


Figure 4: Method B Backbone

Method C

Method C uses Type-C “pair-flipped” backbones mated to transitions using Type-A MPO adapters. All components in the link are mated key-up to key-down. Both ends of the link use A-to-B patch cords(straight through) to connect to their respective duplex transceiver ports. See Figures 5 and 6. In this connectivity method the polarity “pair flip” is done in the backbone. When implementing this connectivity method be consistent. Extra planning is required if you concatenate backbones. If an even number of backbone lengths are concatenated, you must use an A-to-a patch cord to maintain polarity. Angle polished singlemode MPO connectors can be used. Method C requires more planning to implement and is not extensively used.

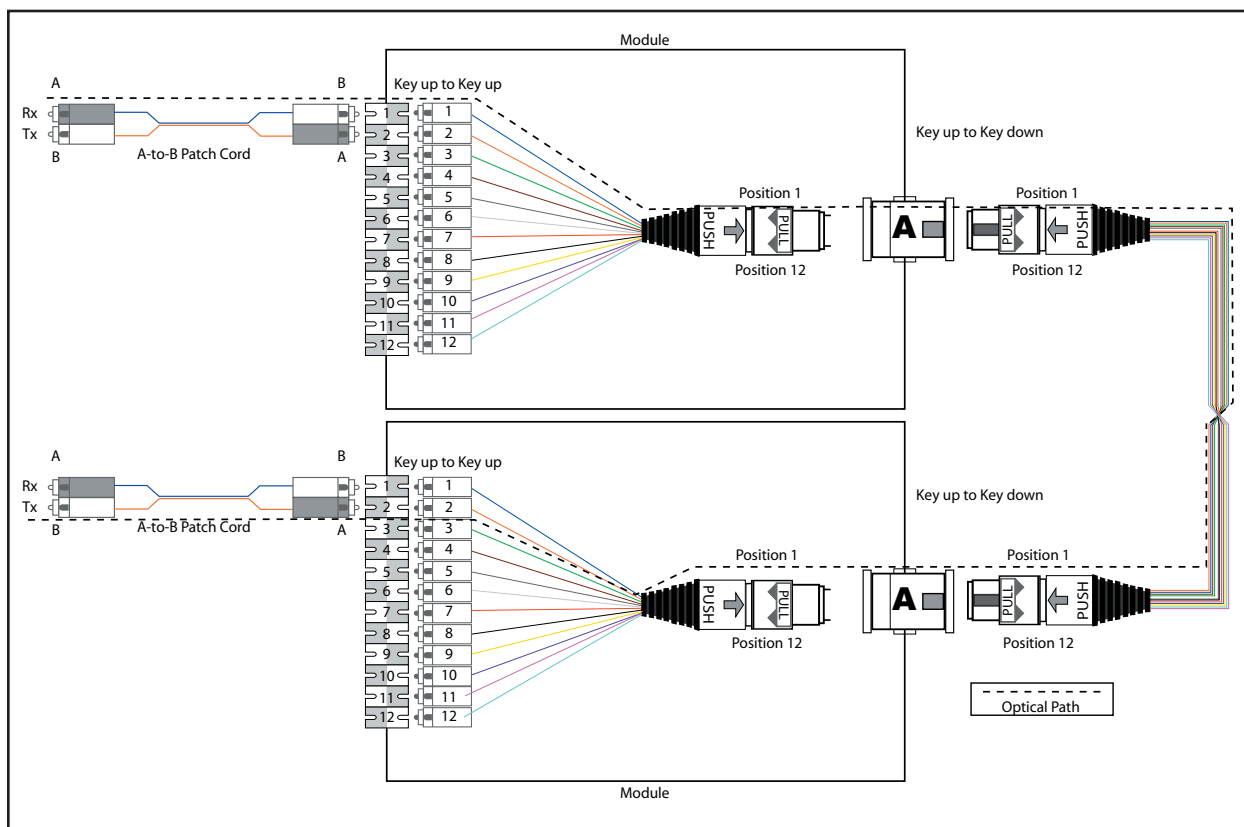


Figure 5: Method C Connectivity

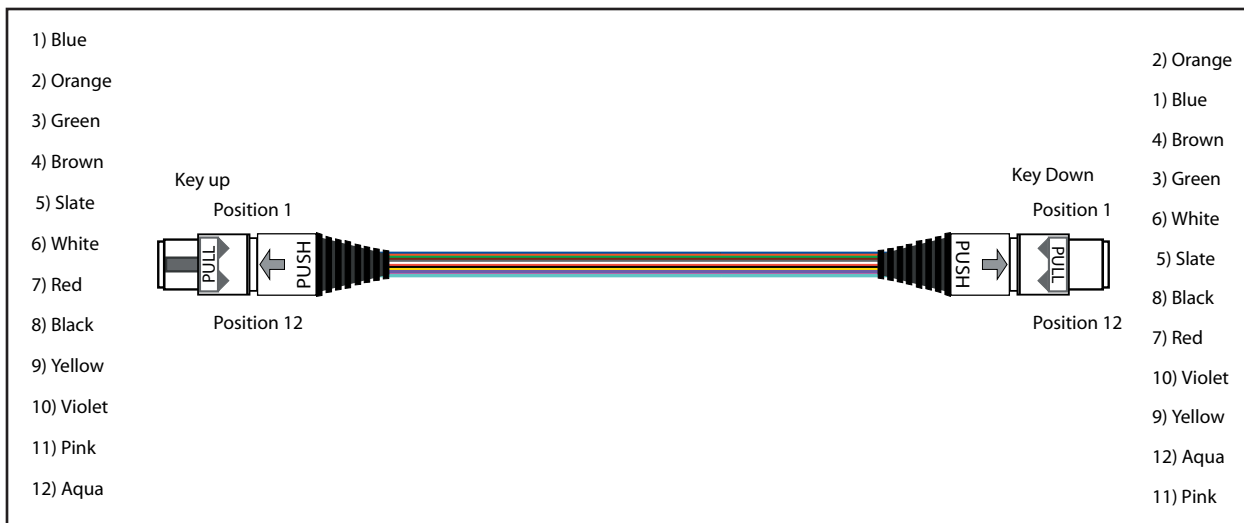


Figure 6: Method C Backbone

All the connectivity methods shown here have the same purpose: to ensure that the transmit port of one device is connected to the receive port on another device. Each method requires a specific combination of components to maintain the system polarity. These are outlined in Table 1.

| Method | Connector Type | Adapter Type | Patch Cord Type |
|--------|----------------|--------------|---------------------------|
| A | A | A | One A-to-B and one A-to-A |
| B | B | B | A-to-B |
| C | C | A | A-to-B |

Table 1: Method Components

It is recommended that you select and implement one method of connectivity and stick with it. Do not mix and match methods or the different components from each method. Your system may not work. Make sure that all of the components in your system are clearly identified, labeled and recorded.