

White Paper

## How to Specify MTP Pre-terminated Optical Cabling

Published

January 2009

### The benefits of pre-terminated cabling

The two principal advantages of pre-terminated cabling are reduced time on site and improved quality of terminations.

Pre-connectorised, or pre-terminated, cabling is most popular when time on site is at an absolute premium. This may be in a new build, such as a data centre, where time scales are critical and many different trades are vying for the right to work on any particular bit of floor space. Related to the 'less time on site' issue is the fact that less people are required on site. In a dense cabling installation, such as a data centre, it may be impractical to expect a large number of cable installers and all their specialist optical termination equipment to fit together in the same area.

This leads to long periods required on site and a high probability of delays. Other time critical areas are live sites that need additional cabling but where the costs and implications of downtime are unacceptable, such as a trading floor or call centre. Such a facility may need to have all its cabling upgraded or extended in one overnight operation. Busy city centre facilities will also suffer from a lack of parking and loading bays, along with on-site storage restrictions and security worries associated with cable installers needing weeks of access time to the site.

Pre-connectorised cabling should reduce time needed on site by around 75% compared to traditional installation. Quality of the terminations should also be improved by allowing sophisticated optical fibre terminations to be made in a clean factory environment by skilled people. Each cable assembly can be 100% checked in the factory and whatever is sent to site is known to be of the highest quality.

According to a survey conducted by BSRIA of American data centre managers, pre-terminated fibre has already taken the lion's share of data centre optical cabling at 66% and is forecast to take 75% of this market by the end of 2009.

### Using the MTP optical connector



*Opal assembly, usually supplied on a wooden drum. This 10m LC to LC assembly has one pulling boot removed.*

Optical fibres can be pre-terminated using conventional LC or SC optical connectors, such as in the Connectix Opal system. In such a system each fibre has an individual connector on the end so for example a twelve-fibre cable would have twelve optical connectors on the end. With an MTP array connector one connector terminates the cable. This is simply connected into the back of a standard 1U patch panel which contains the industry standard LC or SC connectors on the front.



*Rear of Starlight™ XS cable panel. Showing 4 MTP cables connected, each supporting 6 x duplex LC connectors*

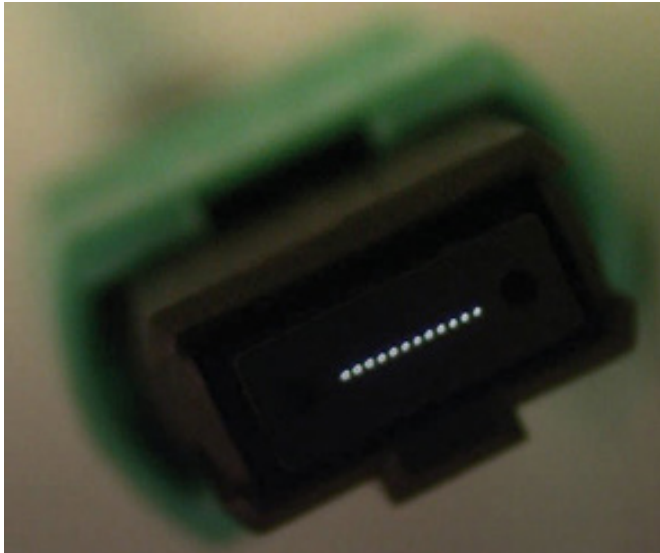
The new MTP array optical connector has the following advantages over conventional individual connector termination by offering:

- **Just one small connector at the end of a twelve-fibre cable** (other fibre counts are available).
- **An even smaller cable than conventional optical fibre.**  
The occupied space ratio between the 3mm MTP optical cable and an equivalent number of UTP Cat6A cables is 54:1. Imagine the impact reducing your cable volume by over fifty fold will have on cable management, cable containment and underfloor air flow management within your computer room.
- **One simple push-fit connector to terminate twelve fibres.**  
The traditional on site termination method for four twelve-fibre cables in a patch panel would take on average four hours and twenty six minutes. Even with inexperienced operators the equivalent number of fibres in an MTP terminated optical system is just thirteen minutes. That represents a 95% saving of on-site time.
- **The next generation of short range 40 and 100 gigabit Ethernet is likely to specify the MTP 12-fibre array connector as the standard interface.** Installing the MTP pre-terminated optical system now gives data centre managers an easy upgrade to this new technology. US data centre managers have reported that by the end of 2009 29% of them will have installed 40Gb/s technology and 17% will have installed 100Gb/s systems.

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- The MTP connector is already recognised as being compliant with Fibre Channel, Infiniband and HPPI.
- The MTP is a standards-based connector recognised by both the IEC and TIA.



*The Connectix Starlight™ MTP connector*

### How to specify the MTP pre-terminated optical fibre system

The essential questions to ask are:

- How many fibres are needed?
- What kind of fibre should be specified?
- What length of cable is required?
- What kind of connectors are required in the patch panel?
- How many connectors are required in the patch panel?
- Is a modular or standard panel required?
- How will the crossover be managed, type A, B or C?

#### How many fibres are needed?

12, 24, 48 and 72 fibre cables are possible. Twelve fibres could currently offer six separate full duplex ten gigabit Ethernet channels or one 40Gb/s full duplex Ethernet channel. This is usually enough for one standard server rack although very dense blade server applications may require more.

The higher fibre counts should be used in the higher level Horizontal Area Distribution (HAD) to Main Distribution Area (MDA) links.

#### What kind of fibre should be specified?

The current standards recognise five optical fibres; three multimode types called OM1, OM2 and OM3 and two singlemode fibres called OS1 and OS2. There is also a higher bandwidth OM3 fibre that is likely to be called OM4 in the next editions of the Standards.

Any of these optical fibres can be incorporated into the MTP cabling system. Although OM1 cables are now starting to become obsolete. Connectix recommends the use of OM2 and OM3 optical fibre. OM3 is specifically made to work with 10Gb/s LAN transmission up to 300m and is therefore the ideal optical fibre for data centres.

Connectix can supply any standard fibre type. Some high performance singlemode (OS2) systems require the very low return loss version of the connector called the Angle Polished Connector, or APC. Users should contact Connectix technical support for specialist advice if planning to use singlemode fibre or if rigid cables are required for hazardous areas.

#### What length of cable is required?

Users must carefully measure the path distances between patch panels so that the correct length of cable can be ordered. Excessively long cables can be as difficult to manage. Cables that are too short will add cost and delays to the install.

Connectix offers a measuring and survey service to remove this risk from either contractors or end users.

Just about any cable length is possible but as the MTP cable system is aimed at indoor LAN connections then it would make sense to limit the distances to within 300 metres as this is the maximum guaranteed distance to transmit 10Gb/s Ethernet over OM3 fibre.

Future 40 and 100Gb/s links over OM3 are likely to be limited to 100 metres.

It should be noted that the standard indoor optical cables supplied by Connectix are intended for indoor use and as such meets all European low flammability and smoke generation requirements. It is not intended for direct exposure to water or the elements.

#### Specifying the patch panel

(See Table 2).

Patch panels can either be modular or standard. A modular panel fits into a standard (19") 1 or 3U rack mounted space and is ideal for systems that are expected to grow substantially over the coming years.

A standard patch panel fills a (19") 1U rack space and can be specified with 12, 24, 36 or 48 fibres.

The connectors can either be LC or SC, and multimode or singlemode. The MTP adaptor at the back of the panel is connected to a fan-out assembly which sits within the panel. The fan-out assembly divides the incoming 12 fibres from the MTP connector to six duplex LC or SC connectors at the front.

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It is essential that the fibre type used in the fan out assembly is exactly the same as that used in the main cable. The optical adaptors on the front of the panel are only defined as multimode or singlemode.

For flexibility on cable length Connectix offers an XS cable management panel. This stores up to 10m of cable at the rear of the rack mounted panel.



LC patch cables installed into the Starlight™ LC panel.

	Distance (metres)		
Speed (Mb/s)	300	500	2000
10	OM1	OM1	OM1
100	OM1	OM1	OM1
1000	OM1	OM2	
10,000	OM3		

Table 1: Speed versus distance for different multi mode optical fibres.

How will the crossover be managed, type A, B or C?

Every optical link needs to ensure that the transmitter at end A is connected to the receiver at end B, and vice versa of course. If fibres were connected straight through then TX would go to TX and RX would go to RX and of course nothing would work. This is a fairly common fault in optical networks.

Fibre links therefore have to crossover at some point to ensure TX goes to RX and RX goes to TX. This can be managed in either the cable and its subsequent termination in the patch panel or by patch cords that in themselves crossover.

The two types of patch cord are shown in diagrams 1 and 2. We can also see that most connectors are 'keyed' which identifies their polarity and such connectors are often referred to as 'Key Up' or 'Key Down' when establishing their polarity.

If the main permanent link fibre cable is straight-through then one, and only one, of the patch cords must be a crossover. Two crossover cables will of course cancel each other out.



Starlight™ XS fibre panel with 10 metres of OM3 multi-mode fibre optic cable.

For this reason most links effect the crossover in the main cable which allows two crossover or two straight-through patch cords. Using the same kind of patch cord throughout an installation is always going to be an easier management issue. Most optical patch cords are crossover, A to B.

If onward linking through two patch panels into another cable however then a double crossover will again happen. Optical links should be carefully considered when designing and installing them to ensure the correct connection is made but at worst case problems can always be sorted out by changing the patch cords on one end from A to A to A to B or vice versa.

Ribbon cables and array connectors such as the MPO and MTP take a bit more thought when considering how to manage the crossover. This is because the fibres are preformed into a ribbon of typically eight or twelve fibres and so there a number of crossover options that apply.



Diagram 1: A to B crossover patch cord



Diagram 2: A to A straight-through patch cord

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Because of the complexities a Standard has been published to give guidance to users. It is called 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.

In this Standard three options are described:

- **Method A** (see diagram 3): In this method the fibre ribbon is connected straight through; fibre 1 to fibre position 1, fibre 2 to fibre position 2 etc. The crossover is effected by having one crossover patch cord at one end and a straight through patch cord at the other end.
- **Method B** (see diagram 4): Method B effectively crosses the whole cable over so that fibre 1 goes to fibre position 12, fibre 2 goes to fibre position 11 etc. A to B crossover patchcords are used at both ends.
- **Method C** (see diagram 5): This method crosses each pair of fibres one pair at a time so fibre 1 goes to fibre position 2, fibre 2 goes to fibre position 1, fibre 3 goes to fibre position 4, fibre 4 goes to fibre position 3 etc. A to B crossover patch cords are used at both ends.

Method C is probably the easiest to manage in conventional duplex circuits and is the default product supplied by Connectix although every combination is possible from Connectix. Users must be aware of the combinations and make sure they are ordering the correct variant. The Connectix technical department is happy to give free advice to customers on this subject.

In the future we will see Local Area Networks based on array connectors and these will include Fibre Channel and 40 and 100Gb/s short reach Ethernet. In 40Gb/s Ethernet (up to 100 metre version) an MTP/ MPO connector will transit 10Gb/s in parallel over four of the fibres and receive four times 10Gb/s over another four of the fibres in either an 8 or 12 fibre array.

100Gb/s Ethernet will probably use 10 fibres with ten 10Gb/s lanes in parallel on one connector for the transmit channel and use another ten fibres for the receive channel on another connector. This will not require the same pair by pair crossover as a duplex system and the whole cable will need to crossover as described in the Method A and Method B styles. If Method C cabling has been deployed it can be converted back into a parallel system by changing the format of the fan out assembly in the patch panel.

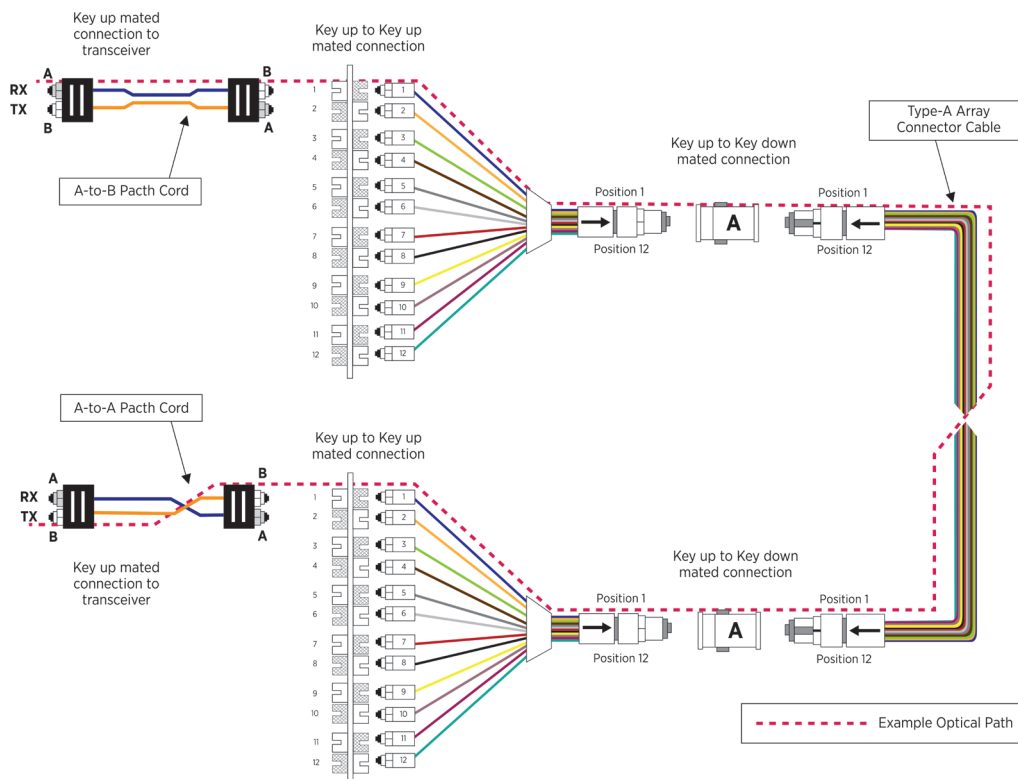


Diagram 3: Method A connectivity

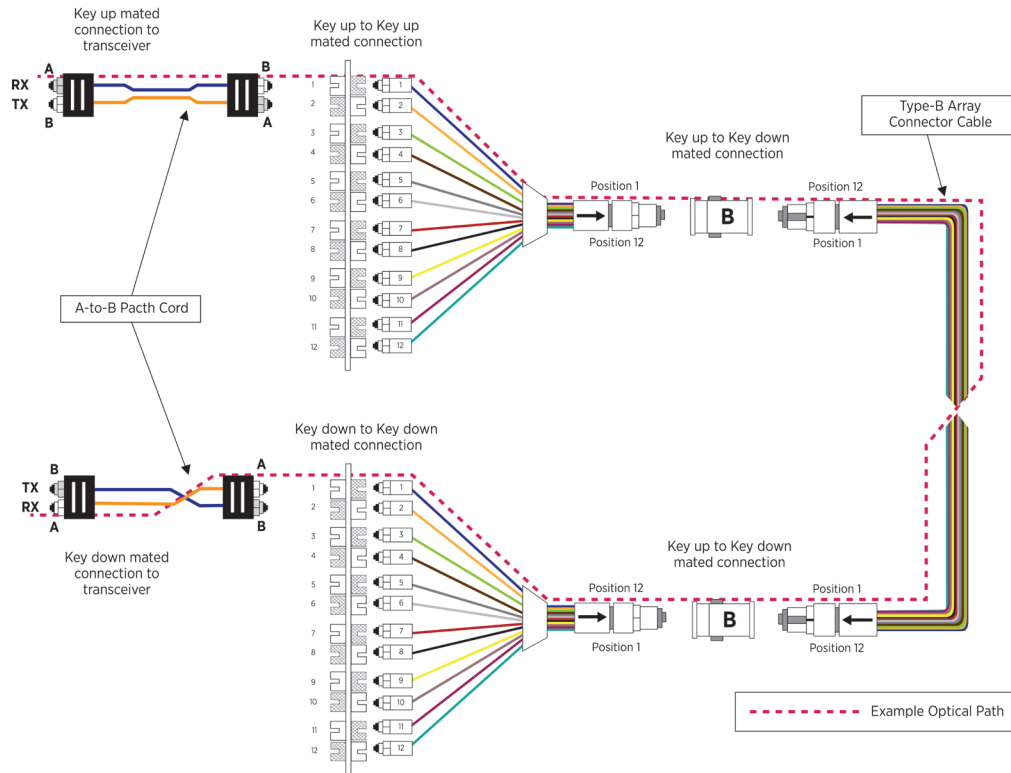


Diagram 4: Method B connectivity

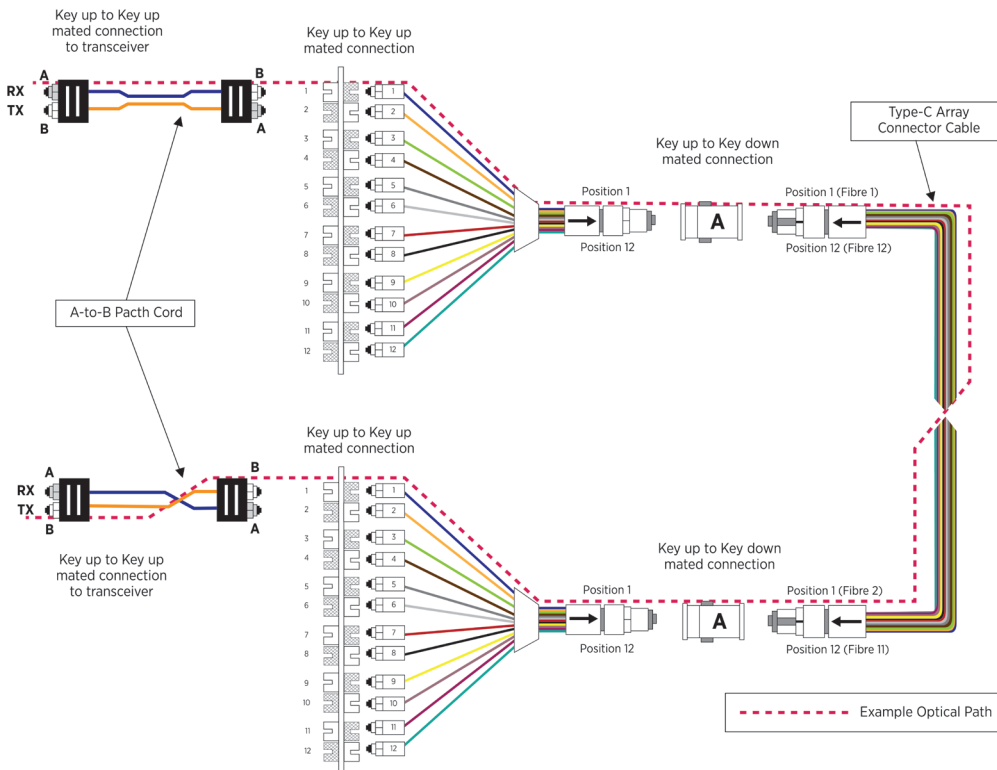


Diagram 5: Method C interconnectivity

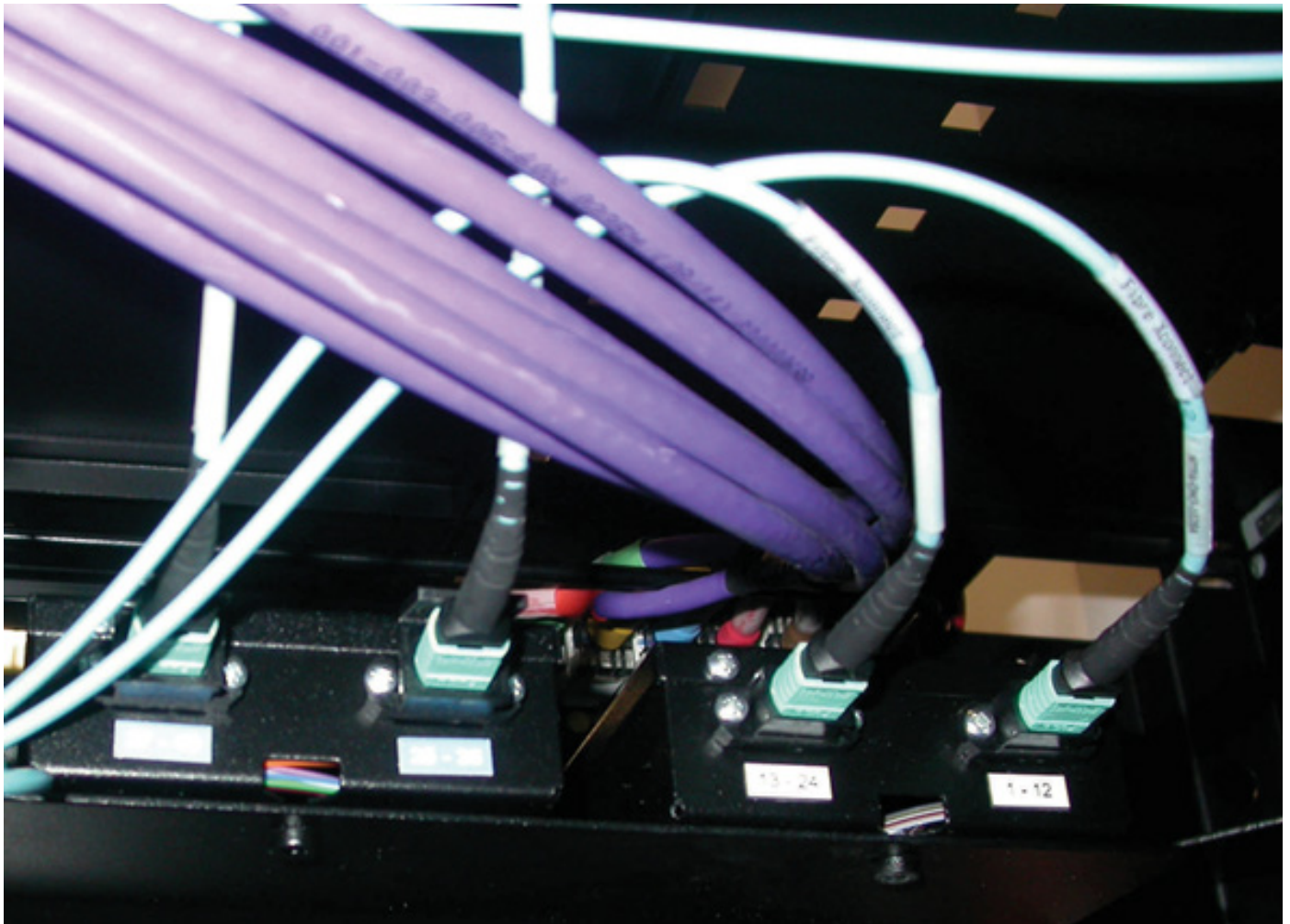


# Connectix Cabling Systems™

When the standards that will describe 40 and 100Gb/s short range Ethernet are more stable Connectix will publish more detailed information about correct connectivity models.

Connectix cabling systems features the MTP array connector in the new Starlight™ plug and go rapid fibre deployment cable system.













The Connectix range offers everything required to complete a pre-terminated optical cable system based on the MTP connector and offers additional services such as cable route surveys to determine accurate cable lengths. Starlight™ is covered under the Connectix 25-year product and application warranty package.



*Starlight™ cassette patch panel installed at Business Systems Group, Level 3 data centre, London.*

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	Design & Number of Ports	Multimode		Singlemode
		OM2	OM3	OS2
	LC Standard 48 Duplex Ports	009-025-012-96	009-025-010-96	00-025-011-96
	LC XS 48 Duplex Ports	009-025-032-96	009-025-030-96	009-025-031-96
	LC Standard 36 Duplex Ports	009-025-012-72	009-025-010-72	009-025-011-72
	LC XS 36 Duplex Ports	009-025-032-72	009-025-030-72	009-025-031-72
	LC Standard 24 Duplex Ports	009-025-012-48	009-025-010-48	009-025-011-48
	LC XS 24 Duplex Ports	009-025-032-48	009-025-030-48	009-025-031-48
	LC Standard 12 Duplex Ports	009-025-012-24	009-025-010-24	009-025-011-24
	LC XS 12 Duplex Ports	009-025-032-24	009-025-030-24	009-025-031-24
	LC Standard 6 Duplex Ports	009-025-012-12	009-025-010-12	009-025-011-12
	LC XS 6 Duplex Ports	009-025-032-12	009-025-030-12	009-025-031-12
	SC Standard 24 Duplex Ports	009-025-022-48	009-025-020-48	009-025-021-48
	SC XS 24 Duplex Ports	009-025-042-48	009-025-040-48	009-025-041-48
	SC Standard 12 Duplex Ports	009-025-022-24	009-025-020-24	009-025-021-24
	SC XS 12 Duplex Ports	009-025-042-24	009-025-040-24	009-025-041-24
	Modular Panel	009-025-050-10		
	LC Cassette 12 Duplex Ports	009-025-072-24	009-025-070-24	009-025-07-24
	LC Cassette 6 Duplex Ports	009-025-072-12	009-025-070-12	009-025-071-24
	SC Cassette 6 Duplex Ports	009-025-062-12	009-025-060-12	009-025-061-12
	Panel Blank	009-025-050-00		

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