AMP NETCONNECT
CABLING SYSTEMS FOR DATA CENTERS & STORAGE AREA NETWORKS (SANS)

High-density, High Speed Optical Fiber and Copper Solutions

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INTRODUCTION

As anyone with an ear to the ground of data communications will tell you, the loudest buzz is coming from a growing collection of applications dedicated to data storage. Now that expansive optical networks are being deployed and the cost of bandwidth is dropping on even global transmissions, off-site data storage is a viable business option. Storage Area Networks (SANs) and Storage Service Providers (SSPs) are popping up and are gobbling up server and storage products manufactured by NASDAQ favorites such as EMC and Cisco. Even private networks are seeing a tremendous growth in their data center storage and data traffic needs, as 3-D graphics, medical scanning equipment, CAD/CAM documents, radio frequency identification (RFID) and radiation instrumentation all produce huge amounts of data requiring high-speed computers for analysis and high-speed networks for file access on a real-time basis. While the electronics vendors see the lion's share of the data center and SAN markets, even they will be the first to admit that all of those electronic boxes are useless if the cabling is incapable of supporting these high-speed applications.

CABLING OBJECTIVES

Cabling is often overlooked or taken for granted, even though the cabling is expected to last longer than several generations of electronics. Making the right decisions and investment initially will save time, money, and frustration in the near term and minimize disruptive upgrades in the future. The cabling needs for a data center or for a storage area network differ from that of a traditional structured cabling network, but there are some common factors.

The first objective for the cabling system is for it to reliably carry the data streams at the fastest possible rate. Large amounts of data have to move from the collection source to the storage media and back, and no one can afford the system to pause for days, hours, minutes or even seconds while transferring the information. Further, daily system back-ups are becoming

routine as part of disaster-recovery measures, so it can't take much of a day to download the information into storage without falling behind.

The second objective is fast deployment. Electronic equipment sitting on a pallet at the receiving dock cannot produce revenue. Accordingly, the ideal cabling solutions are comprised of modular, simple to use, and pre-tested components – components that are easy to order, inventory, replace in small amounts, and connect to servers and storage devices. Revenue is too valuable – particularly for start-up companies – to wait weeks, days or even hours for equipment to be installed, powered up, cabled up, and running on the system. Simplified installation reduces the need for bidding, quoting, and scheduling contracted labor that may already be booked weeks or months in advance.

The third objective is high density. Current installations may require more than 1,000 square feet of rack space just to house the storage devices. Servers, racks, and patch panels may consume whole floors of large buildings. While storage service providers may choose remote locations to reduce facility and real estate costs, any environmentally-controlled occupied space is expensive. High-density options reduce the amount of floor space, rack space, and the associated costs.

Traditional private network cabling may not be the best option for a data center or SAN because there are no remote work areas to populate with faceplates or connectors. This means that the cabling must meet a fourth objective: a common infrastructure to support servers, storage devices, and central processing units. Typically, these devices all connect via a point-to-point network, but storage devices may be connected via distributed network cabling. In any case, the cabling should support point-to-point and distributed architecture, support short and long distances between devices and still offer the high data rates needed for efficient data transfer.

A final objective, particularly important for start-ups, is a low initial capital investment. Traditional cabling installations are all-or-nothing deals, usually installed while the building is being built or during a renovation. The backbones, risers, and horizontal links are all fully populated to provide the most flexibility in the network. The upfront capital investment required for an installation in these cases is realized once the building becomes populated. Consider a SAN start-up, however, with limited funds and an immediate need for revenue. Cabling for the entire location represents a huge capital investment with no chance of revenue return until the location is fully populated with electronics. These users are more likely to install a network in phases – adding cabling as they add electronics, racks, and floor space on an as needed basis, then using the revenue from this equipment to invest in the next phase. This strategy couples the capital investment of the cabling and electronics to the generation of revenue, significantly increasing the chances of success over the long term.

Tyco Electronics offers two systems: the **AMP NETCONNECT MPO Optical Fiber Cabling System** and the **AMP NETCONNECT MRJ21 Copper Cabling System**. Both provide the necessary components for a quick and easy installation of high-performance Data Center and Storage Area Network cabling infrastructure

THE AMP NETCONNECT MPO OPTICAL FIBER CABLING SYSTEM

Whether the distances between devices are a few feet or hundreds of meters, or whether the data rates are 100 Mb/s, 1 Gb/s or even 10 Gb/s, the **AMP NETCONNECT MPO Optical Fiber System** is an excellent choice.

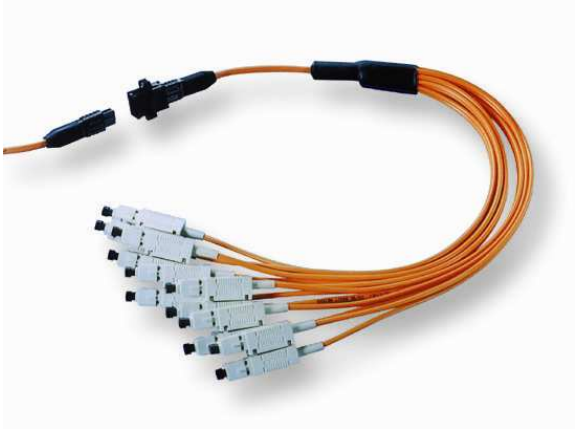
Basic modular components are the key to fast deployment, simple installation, capital-effectiveness and network flexibility. The traditional cabling process – pulling in cables, connectorizing the cables, populating the patch panels, testing and troubleshooting the

installation then making repairs as necessary – generates too many chances for delays and introduces uncertainties that can make or break a project. Pre-terminated trunk cables, cassettes, and cable assemblies are the basic modular components needed for a complete network.

Trunk cables are pre-terminated at the factory with high-density MPO connectors. Each MPO connector terminates 12 optical fibers in a single, push-pull connector about the same size as one SC or ST-style connector. The high fiber density of this connector means that a terminated cable can be placed into cable trays or even pulled in conduit without requiring a large pathway cross-section. Once in place, the cable can be connected into patch panels, twelve fibers at a 'click'. MPO trunk cables are available in all fiber types and fiber counts (multiples of 12 fibers) in standard and custom lengths. Because rack placement and location is generally known well in advance, cables of the appropriate length can be ordered and stored until such time they are needed. Since the cables are modular, a longer cable can always be used to get equipment connected to the network, and then that cable can be replaced at a convenient time with a cable of the correct length in a matter of minutes – so down time is minimal.

Most equipment interfaces today MT-RJ, LC, ST, or SC duplex interfaces – not MPO - so some means of transition from the 12 fibers of an MPO connector is needed. Modular, robust cassettes serve this purpose. Each cassette is small in size and designed to fit into existing patch panels and enclosures. On the backside of a 12-fiber cassette is one MPO coupler (24-fiber cassettes have two MPO couplers). Inside the cassette each fiber in the MPO

connector is routed to the appropriate port on the front of the cassette. On the front side of the cassette may be MT-RJ, LC, ST, or SC duplex ports. MPO connectors are plugged into the MPO port in the backside, and standard patch cords can connect the ports on the front side to the electronic equipment. The cassettes can be purchased and stored until needed and are easily restocked, and are available for all fiber types.



Fan-out cable assemblies offer option for bypassing patch panels. Using an MPO coupler, a trunk cable MPO connector can be mated to an MPO fan-out assembly, which is terminated in MT-RJ, LC, ST, or SC connectors. This option works best with cabinets or with MPO patch panels, but may reduce the flexibility of future modifications to the cabling infrastructure.

Once installed there is no testing necessary – all these modular components are pre-terminated and tested at the factory prior to shipment. Connect the pieces and your links will work. In the event a cable is mishandled, or a connector breaks, each component can be easily and quickly replaced with another component and the troubleshooting can take place off-line. Downtime is minimized.

THE AMP NETCONNECT MRJ21 COPPER CABLING SYSTEM

The **AMP NETCONNECT MRJ21 Copper Cabling System** solution is the high-density, high performance, modular system for copper twisted-pair networks. This Tyco Electronics solution is designed to deliver Gigabit Ethernet ports, with or without power, in a high-density package. The twenty-four pair cable and connector solution supports all place-and-plug environments including data centers, zone-cabled offices or open office environments.

The MRJ21 technology has been expanded from the original printed circuit board design to a modular infrastructure solution. When utilizing this printed circuit board solution on a network switch or blade server, the MRJ21 connector enables much higher port density than the common RJ45 interface, which reduces the port costs of active equipment. From a cabling perspective, the MRJ21 Cabling System is similar to the MPO connectivity system. The MRJ21 Cabling System is comprised of modular, factory-terminated and tested components for simple and rapid installation.

The trunk cables are high performance Powersum 24-pair cables with factory-terminated MRJ21 connectors on each end. MRJ21 break-out cables are also available, with one end terminated with MRJ21 and the other end terminated with six RJ45 connectors. Thus, one MRJ21 trunk cable can replace six four-pair cables in less space and with less weight.

The MRJ21 connectors can be plugged directly into the electronic equipment, if equipped, or can plug into the high-density panel-mounted cassettes or into fixed-port straight or angled 1U patch panels. The cassettes and patch panels serve as the transition between the MRJ21 connectors and standard RJ45 jacks, which can accept standard 4-pair patch cords.

HIGH SPEED CONNECTIVITY

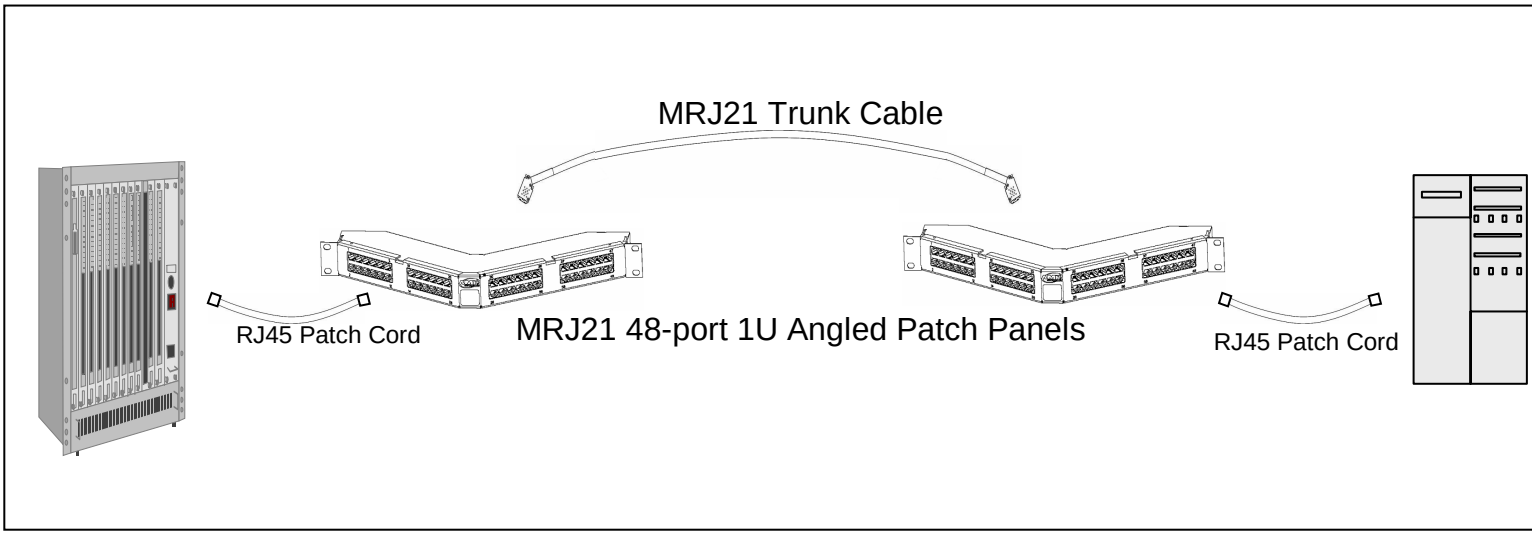
Constructing the cabling infrastructure with these modular systems is approximately six times faster than field-installing standard 4-pair wiring, and much faster than traditional epoxy/polish

fiber installations. As an example, a modular setup of eight pluggable MRJ21 connections takes only minutes compared to several hours for 48 individual RJ45 terminations. That means the system uptime is increased with reduced on-site labor.

INSTALLATION CONFIGURATIONS

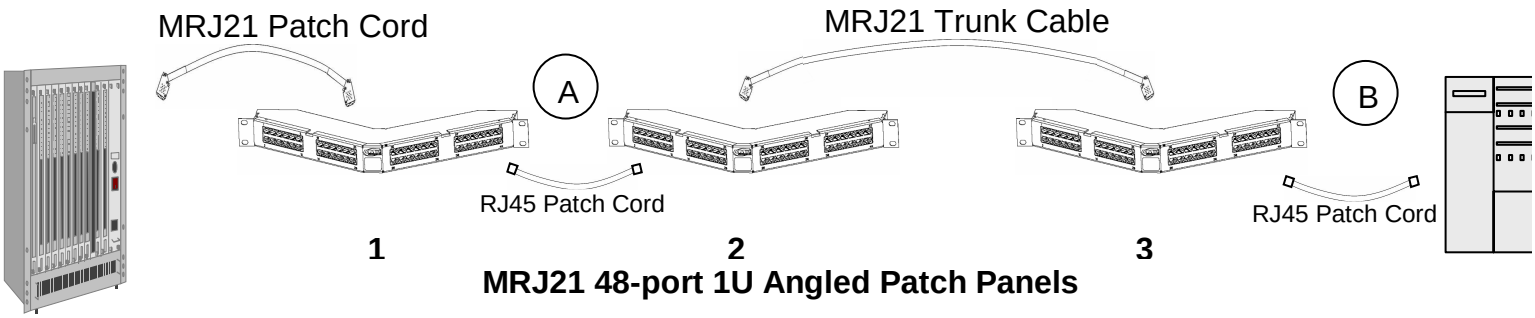
There are several ways to implement a modular cabling system, depending on the end equipment and the need or desire for patch panels.

The illustration below shows an example of a basic 48-port Gigabit Ethernet modular link with RJ45-based end equipment in a data center. The link is constructed with eight MRJ21 trunk cables, two 48-port 1U patch panels and 96 four-pair patch cords. Compare this to 48 four-pair cables, four 24-port 1U patch panels and 96 four-pair patch cords of a traditional installation. While the components list is similar, remember that the 48 four-pair cables have to be cut to length, then punched down – 96 ports with eight wires each (768 wires). The MRJ21 solution is ready for data traffic before the first 12-port block is terminated with four-pair cable. Space efficiency is realized in the higher density of the MRJ21 patch panels.



Infrastructure cabling between the panels utilizes the modular MRJ21 trunk cables for rapid installation, higher port density than traditional 24-port 1U panels, and better cabling efficiencies. Since this is a 2-connector, passive copper system (note: each patch panel is viewed as a single connection because of the PC board transition between the MRJ21 and the RJ45 interface), the overall channel length is limited to 100 meters with a total of 10 meters for the equipment cords.

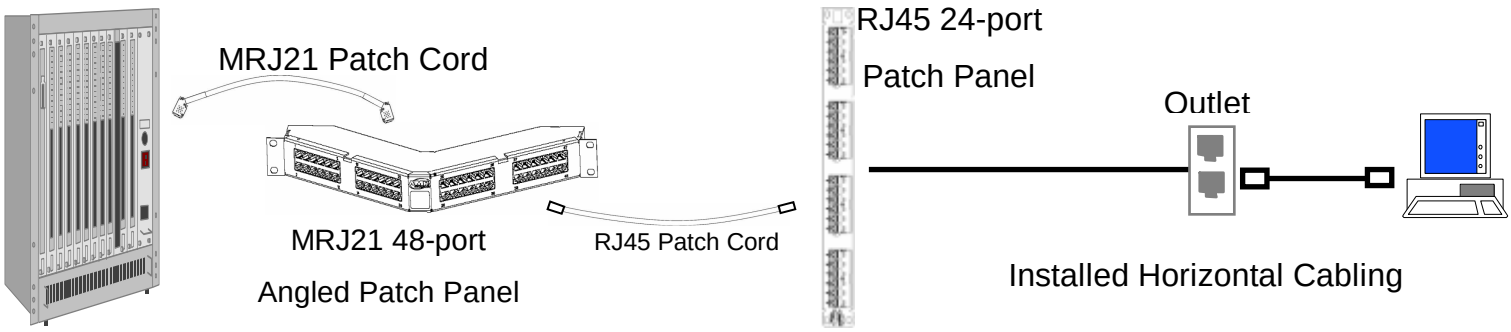
The next illustration shows a 3-connector model with MRJ21 equipment ports and the ability to route individual ports to separate applications. Service providers often use one patch panel to break out high-density switch ports and equipment cords (location A) to connect client applications with back-up or other application servers. In this example, the infrastructure cabling occurs between MRJ21 48-port angled patch panels numbered 2 and 3 utilizing the modular trunk cable. The connections at location B provide the server connections at the far end.



MRJ21 48-port 1U Angled Patch Panels

A third example, this one using the MRJ21 platform as an extension of the switch face, is similar to traditional RJ21 breakouts with the MRJ21 benefits of higher density and improved cabling efficiencies. This model also enables the easy migration to MRJ21-based equipment with the

ability to breakout individual ports to a desktop or to other horizontal applications, including wireless access points and security devices. See the next illustration.



In this example, the infrastructure cabling remains undisturbed between the RJ45 24-port patch panel and the outlet. This enables the use of the existing switch chassis to add active network ports without the need for more electronics space. Additional ports can be added incrementally without the need for a wholesale cutover. MRJ21 48-port angled patch panels can be added as needed.

THE AMP NETCONNECT SYSTEMS

Tyco Electronics offers a full line of AMP NETCONNECT MPO optical fiber and MRJ21 copper trunk cables, standard and AMPTRAC-ready cassettes, enclosures, and cable assemblies for data center and storage area network installations.

MPO trunk cables are available with 62.5/125, 50/125, XG (850nm LO 50/125), or standard (dispersion-unshifted) single-mode fiber in fiber counts up to 72 in multiples of 12 fibers. Standard cable lengths are available in ten-foot increments up to 300 feet, and custom lengths can be provided. All cassettes are available in 50/125, 62.5/125, and single-mode versions -

ST and SC cassettes accept one MPO connector; MT-RJ and LC cassettes are available in 12-fiber (one MPO connection) or 24-fiber (two MPO connections). MPO fan-out cable assemblies are also available for equipment interconnection. Custom configurations are also available.

MRJ21 assemblies are available in various lengths from 0.5 to 100 meters in plenum and PVC constructions. These cables are available in MRJ21 to MRJ21, to RJ21, or to RJ45 modular plug configurations. MRJ21 cassettes accept two MRJ21 connectors for twelve ports of 4-pair applications (like Gigabit Ethernet) or one MRJ21 connector for twelve ports of 2-pair applications (like Fast Ethernet). Straight 1U patch panels have up to 24 ports, and 1U angled panels have up to 48 ports.

No special racks are required with the MRJ21 or MPO cassettes. AMP NETCONNECT panels, which accommodate AMP NETCONNECT snap-in adapter plates, will also accommodate the cassettes. Panels, which hold three, four, eight and 12 cassettes in standard 19-inch racks, are available as are wall-mount boxes that hold adapter plates and cassettes.

SUMMARY

Fast data. Fast installation. It’s easy with AMP NETCONNECT modular products from Tyco Electronics.

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