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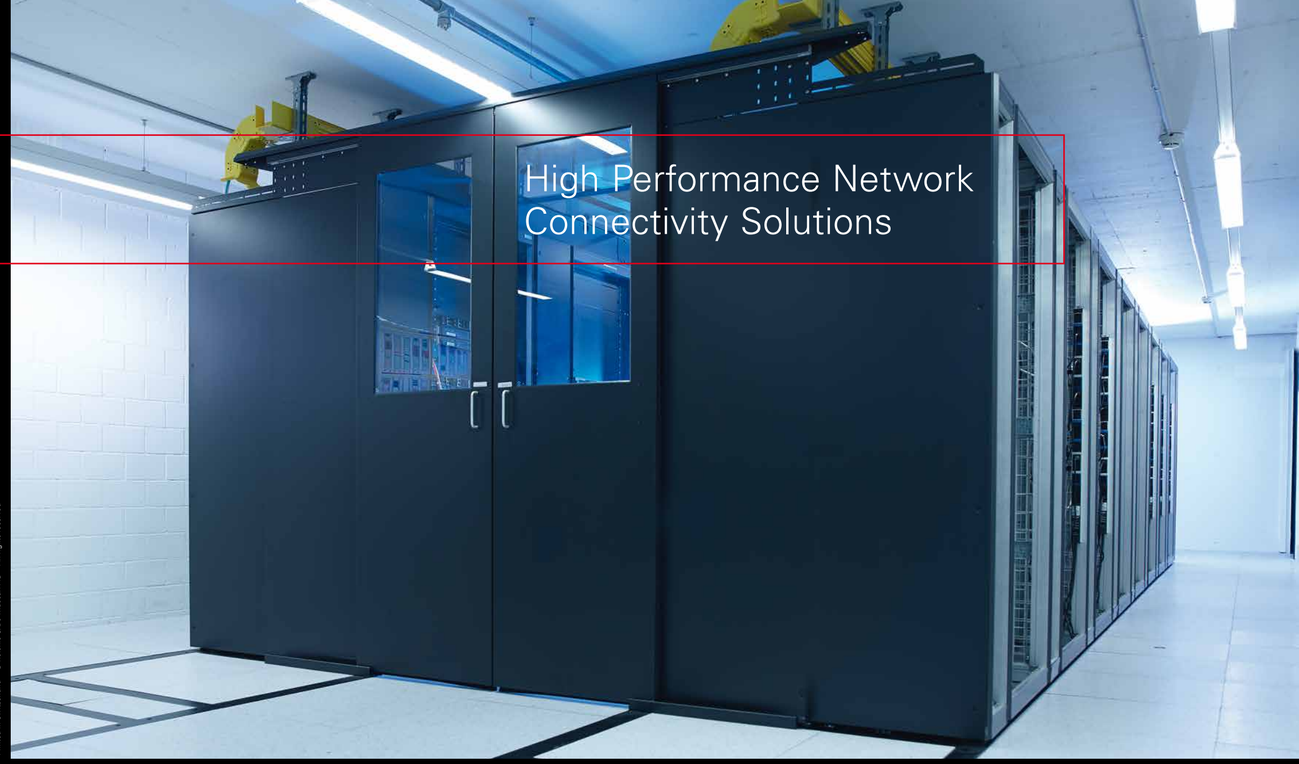

High Performance Network Connectivity Solutions

Data Center

R&M
Convincing cabling solutions

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High Performance Network Connectivity Solutions

Data center network cabling accounts for only 2 to 4% of all investments in data center projects. However, it is of crucial importance for the performance of networks. Between 40 and 50% of all breakdowns can be traced to low quality connectivity and the poor physical networks that result from it. But what is often forgotten is the fact that poor cabling could not only lead to a complete breakdown of a link but also significantly reduce its performance by leading to a high number of frame losses.

At the same time, the transformation from legacy to cloud data centers is consistently elevating the cable's importance. If a link to a physical server does not deliver the required performance in terms of latency, frame losses, and data throughput, this factor also affects access to all the other virtual machines running on the server.

R&M knows that an optimized data center network is a mission critical component of a business-oriented IT infrastructure strategy. Experience shows that such a strategy is much more likely to succeed if the network is designed to anticipate growth and greater significance is attached to bandwidth increase.

Built on an understanding of the critical business and technology challenges of data center managers, R&M has established best of breed physical network solutions for High Performance Network Connectivity (HPNC). R&M HPNC solutions are a set of fiber, twisted-pair and twinax cabling technologies designed for our customers' bandwidth-demanding data center applications.

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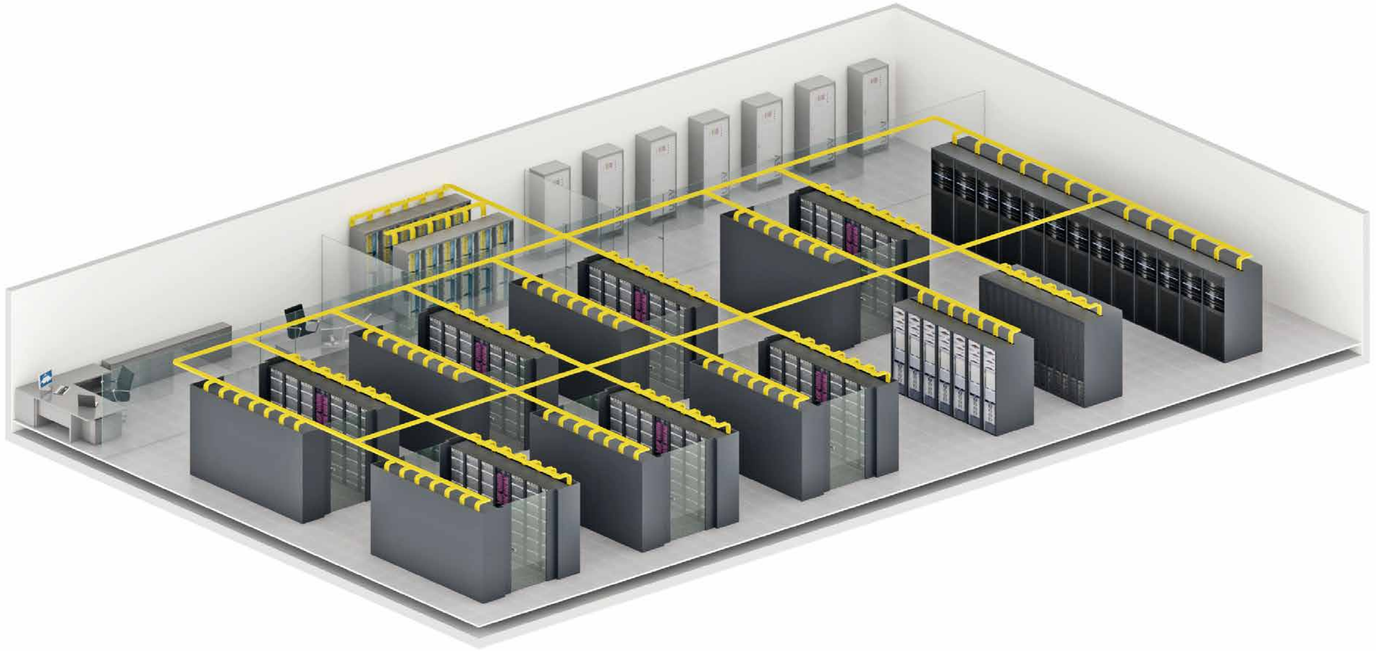

Impact of R&M's HPNC Solutions

Today, there are three types of traffic within a data center. The first one is the conventional application traffic which is steadily growing. The second type is called inter-process communications. This kind of traffic is driven by distributed systems used for virtualization and cloud computing. And finally, there is storage traffic – shooting up due to the proliferation of networked storage.

Each of these types of data traffic has a differing tolerance for frame loss, delay and jitter. Service Level Agreements dictate certain performance criteria that have to be met. Most of them document values such as network availability and mean time to recover, which can be easily verified. However, performance criteria for Ethernet and Fibre Channel are more difficult to verify. A simple Ping command cannot precisely depict inquiries about performance, data throughput, frame loss and service integrity.

R&M HPNC Solutions increase the data throughput and availability of your network, while reducing its latency by minimizing frame loss. R&M is committed to delivering connectivity that exceeds industry standards and yields more stability and security to your networks – and peace of mind. Our Swiss approach to superior quality standards ensures reliable, uninterruptible operation to satisfy the highest service levels. All components and solutions are thoroughly tested and examined before delivery.

That in turn means that fewer frames have to be retransmitted and the network obtains valuable bandwidth. Re-transmission means the task a frame was supposed to take over is delayed. The delay time can entail costly competitive disadvantage for many customer segments such as trading business at banks, simulations of a research data center or software as a service applications in a cloud.

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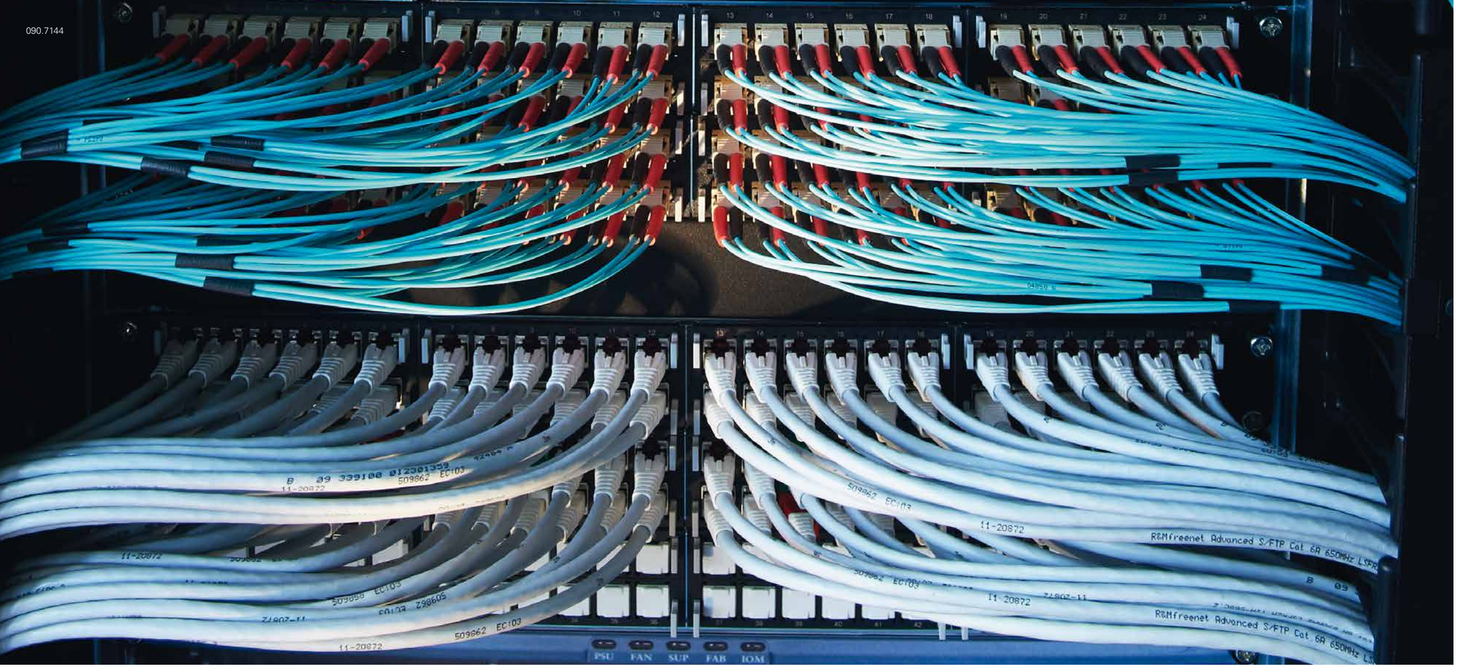

R&M High Performance Network Connectivity (HPNC) as Complementary Fiber and Copper Solutions

What HPNC Solutions mean for the data center sector is best of breed performance, a guaranteed future and a broad offering to find the most suitable and cost efficient option. This is the real focus of our convincing cabling solutions.

With R&M's HPNC Solutions, you can deploy your fiber or twisted-pair networks with the largest possible flexibility as both media are simultaneously supported by the HD Panel System.

MULTIMODE FIBER OPTIC CABLING

Benefits: Low latency, longest distance support, best power consumption footprint, enables structured cabling approach and thus a great number of deployment options, including top of rack, end of row, middle of row, and inter-cabinet connectivity.

Downside: Most expensive option.
Connectivity: LC duplex for SFP+, MTP® for QSFP+
Applications: 10/40/100 Gigabit Ethernet, 8/16 Gigabit Fibre Channel, Converged Networks, InfiniBand SDR/DDR/QDR

DIRECT ATTACH COPPER CABLES

Benefits: Lower costs than fiber, low power consumption, low latency, optimized for top of rack, uses same ports as fiber.

Downside: Reach limited to 7 meters (passive)
Connectivity: SFP+
Applications: 10 Gigabit Ethernet, Converged Networks, InfiniBand SDR/DDR/QDR

TWISTED PAIR COPPER CABLING

Benefits: Lowest costs, second longest distance support, backward compatibility, 10GBASE-T operates in low power mode on channels under 30 m, auto-negotiation and auto-selection of proper port speed, enables structured cabling approach and thus a great number of deployment options, including top of rack, end of row, middle of row, and inter-cabinet connectivity

Downside: Higher latency, higher power than other two options
Connectivity: Cat. 6_A RJ45 shielded and unshielded
Application: 10GBASE-T

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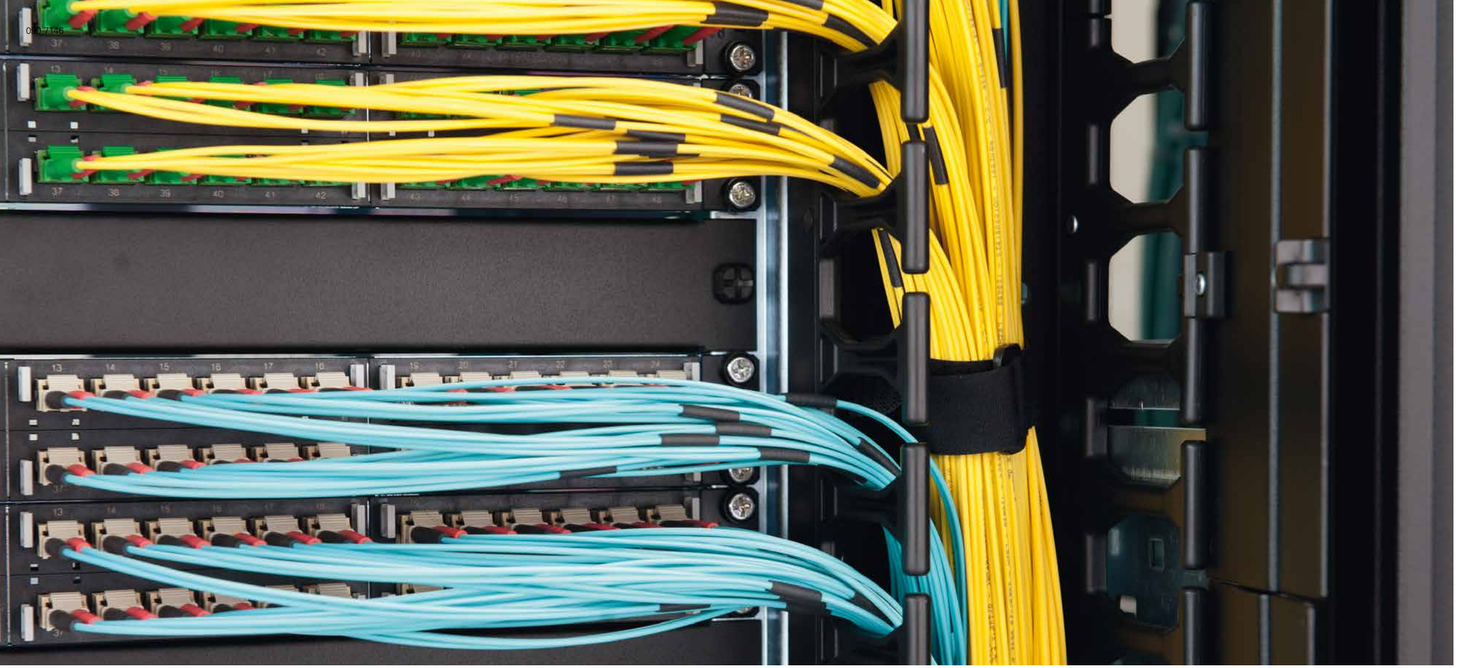

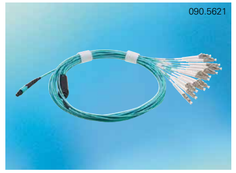

Fiber Optic Cabling Systems for 10, 40 and 100 Gigabit Applications

For some people it is just a mere detail behind sophisticated technologies. For R&M, fiber optic HPNC infrastructures are a promise in high performance connectivity, superior quality standards with high-end manufacturing processes, and guaranteed tested products.

The R&M fiber optic cabling system is a comprehensive suite of leading-edge optical components that empower your data center network to meet the next level of performance.

R&M thinks HD is not simply about the number of ports per rack unit. Rather, user-friendly cable management and a flexible modularity are the aspects that improve real-world network tasks. Modular systems should exactly be this – modular. That is why R&M has developed a patent pending polarity management method that yields minimally disruptive migration paths to parallel optics applications.

Although, next-generation network architectures bring more agility at reduced costs, they also leverage risk by bundling several VM I/Os on less cabling. Product quality is outstandingly important and ever since its foundation in 1964 R&M has been earning a reputation as global leader with its Swiss no-compromise approach to quality control.

The fiber optic cabling system features the same performance and quality that continues to set R&M apart. With LC/MTP® modules offering typical insertion loss of 0.3 dB, multiple connections in a link are allowed when deploying an ISO/IEC 11801:2011 or TIA-568-C.0-compliant system. Due to changing business environments, data center requirements are constantly evolving. Thus, an optical network is not effective if it cannot deal with today's as well as the future's requirements.

R&M's high aims for product quality and comprehensive in-house testing ensure superior performance and smooth deployment of 10, 40 and 100 Gb Ethernet and 16 Gb Fibre Channel network capabilities, to make the physical network a leverage for your future business applications.

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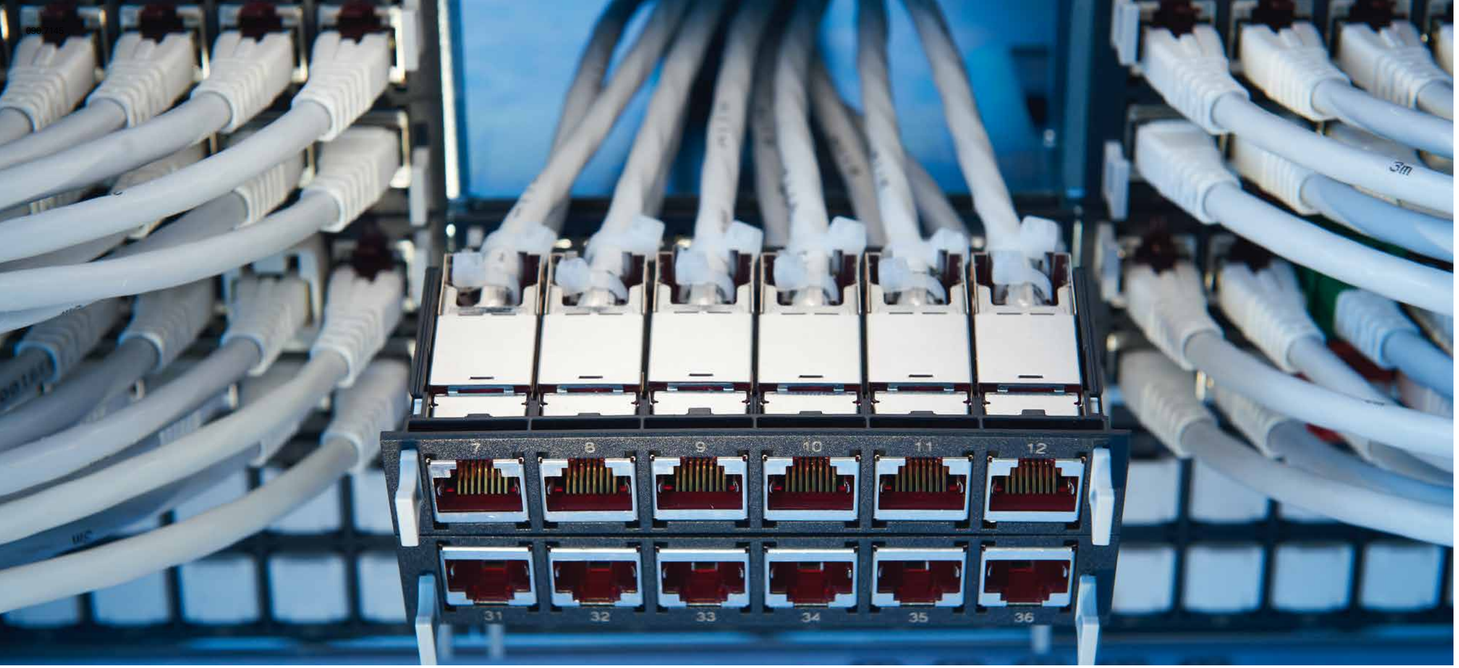

Twisted Pair Copper Cabling Systems for Shielded 10GBASE-T Applications

The broad usage of 10GBASE-T will simplify data center infrastructures. On the one hand it gives IT managers a far greater flexibility in terms of network connectivity by allowing both intra-, and inter-rack connections for Top of Rack, Middle of Row, and End of Row topologies. At the same time, it reflects the rapidly increasing bandwidth requirements of virtualized servers and storage systems. 10GBASE-T is the most flexible 10G technology with the lowest cost, and with the Category 6_A RJ45 connector it is also backwards compatible with existing Gigabit Ethernet networks.

Within its HPNC solutions, R&M offers a customized solution for easy, preterminated cables enabling up to 40% faster installations based on two shielded Category 6_A cable systems:

- AWG23 cable system for applications up to 100 meters
- AWG26 cable system for applications up to 55 meters

The system is reusable and can be moved and relocated as necessary to accommodate moves, adds and changes.

AWG23 SHIELDED COPPER CABLING SYSTEM

The AWG23 Shielded Copper Cabling System is designed for 10GBASE-T channel lengths up to 100 meters. Employing R&M's award winning Category 6_A module or the Category 6_A connector, it achieves channel bandwidth performance above industry standard requirements. Furthermore, this system includes an automatic termination method for earthing the entire system for more consistent EMC protection. The AWG23 Cabling System exceeds ISO 11801 Class E_A and TIA-568-C.2 Category 6A standards, offering guaranteed headroom of 4 dB in NEXT over Cat 6_A to ensure a fully functioning and reliable system.

AWG26 SHIELDED COPPER CABLING SYSTEM

Although the AWG26 Shielded Copper Cabling System supports channel distances of up to 55 meters, it especially targets data centers that employ 10GBASE-T NICs in their low-power mode for up to 30 meter applications. R&M's exceptionally thin 26 AWG cable with 5.7 mm outer diameter requires 50% less space in cable routing trays than standard Category 6A cables. Additionally, they bring a 25 to 30% weight reduction and allow the operation of short links with trunk cables as short as 2 meters.

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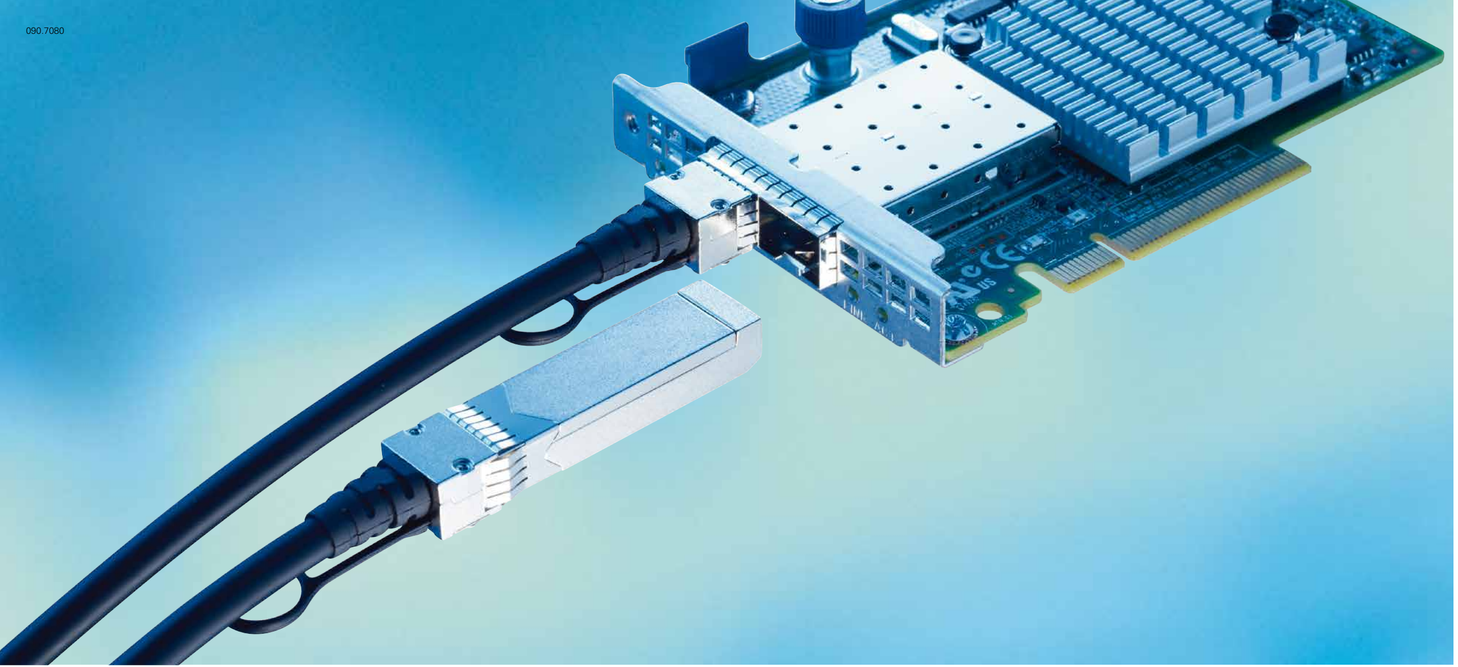

Direct Attach Twinax Cables

These cables are used for server-uplinks in top of rack (ToR) switching topologies. Passive direct attach cable (DAC) assemblies represent a cost-efficient connectivity alternative to fiber, with a limited reach of 7 meters. Integrating SFP+ direct attach cable assemblies into the physical network allows businesses to achieve 10G link performance without additional signal processing or optical-electrical conversion providing a low power, low latency server interconnect option for top of rack switching applications. Consisting of paired small diameter, high-speed twinax cables with factory-provided hot-pluggable SFP+ connectors, these cables provide improved cable management and cost advantage.

Additionally, DAC assemblies exhibit the same connector form factor as their optical transceiver counterparts. This means that switches and servers that are equipped with SFP+ ports can either employ DAC assemblies or optical transceivers and optical fiber cables.

R&M's SFP+ DAC assemblies feature:

- Available lengths: 0.5 m to 7 m – "A wider range than any network vender offers"
- Superior performance assures data throughput and minimal packet loss
- Robust, easy to use latching mechanism with excellent mechanical feedback
- SFF-8431 compliant

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