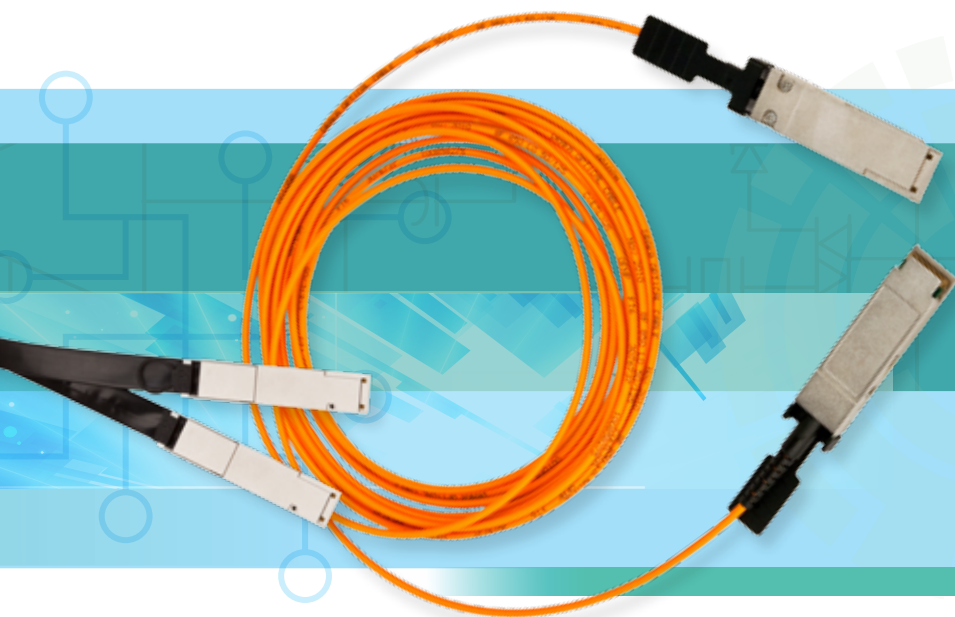


# Electronic Solutions

## 3M™ Cable Assemblies for High-Performance Computer and Data Center Applications



### It Pays to Select Your Cables With Care

*Wise HPC and data center designers offer six top tips for picking cables for the best price/performance.*

When Facebook launched the Open Compute Project in 2011, the initiative instantly popularized the DIY data center. The project shares hardware and data center designs for free, in an effort to help companies lower costs and increase energy efficiency. Since then, enterprises large and small have followed Facebook's lead in designing and installing data centers and high-performance computing (HPC) clusters in-house.

When taking this path, careful consideration should be given to each piece of equipment – cabling included. Too often, the cable assemblies used to interconnect equipment in the data center environment are considered commodity products and not given much thought. However, cable assemblies are an important part of your network, and there are differences among the myriad of cabling choices available on the market. Buy cheap and beware of the consequences – data errors, slow speeds, and hours upon hours of IT time spent searching for the offending cable.

These issues can be avoided by choosing the right cables to begin with. Here are six things to consider:

**1. Compatibility** Equipment built to industry standards are intended to be interoperable with other standards-based devices – but beware. That bargain-priced, no-name brand cable you have in the drawer may look like it meets a standard, such as InfiniBand™ FDR, but the internal electronics may actually be specific to an OEM, which could mean that it is not compatible with your piece of equipment. Consult the device's manual for the specified I/O cable. You may need to buy the cable from the same manufacturer or an authorized distributor to prevent voiding the warranty or creating technical support issues. If you are assembling your own computing equipment, make sure your cables

are not specific to a particular OEM's products by carefully reading the specs and consulting your distributor's technical service engineers.

**2. Performance** Cables can't speed up your system, but they can certainly slow it down. Make sure your cable can support the speed you need. Industry standards prescribe performance – for instance, a cable marked SFP+ should be capable of supporting 10 Gigabit Ethernet.

Another aspect of performance to consider is: How will the cable perform when routed? Because of the precise conductor geometry required to maintain signal integrity, many cables have a less-than-generous prescribed bend radius. If an installer bends it beyond its limit, cable performance can be compromised. Choosing a cable that can be bent and folded without significantly affecting signal performance, such as the 3M™ Twin Axial Cable, can help ensure that the cable will perform at a high level after it's deployed.

A case study is available from 3M which explains that Flextronics carried out electrical performance tests and showed good performance up to 20 Gbps, even when the cable was folded.

**3. Routability** Ease of routing is an issue, especially in horizontal runs, where copper cable assemblies are generally used to interconnect servers within the rack. Save space by using cables that can still perform well if bent or folded.

Traditionally, round twin axial cables are used within the rack. These cables typically need a generous bend radius. Bending them too much can distort the precise cable geometry needed to maintain impedance control, degrading signal performance.



On the other hand, the 3M™ Twin Axial Cable's innovative construction allows it to be tightly bent and folded – even multiple times – without significantly affecting signal performance. A small bend radius means it can be routed to consume less real estate in the rack and can be routed out of the way of air flow channels, potentially reducing cooling costs.

3M Twin Axial Cables can also aid in designing high-density modular data center designs. For instance, Nor-Tech, a leading manufacturer of HPC solutions, used the cables in a sealed, portable data center solution for their client, who needed a custom super computer that would fit in tight quarters.

Nor-Tech designed a compact, sealed, portable data center solution comprised of 1,300 CPU cores, with InfiniBand™ cables connecting each compute core. Air flow within the cooled system was critical to keep it performing to its highest capability.

Nor-Tech faced a significant challenge in interconnecting the cores. Conventional InfiniBand™ cables allowed very limited bending and could have resulted in a “rat’s nest” of cable congestion in the confined space. Routing the cables away from air flow channels also proved difficult. The 3M Twin Axial Cable Assembly for QSFP+ Applications provided a better solution. Nor-Tech was able to route the cables away from air flow channels, helping the company’s engineers create a highly compact system that would not overheat.

“The ability to pack the 3M cables together and off to the side gave us greater density,” Dom Daninger, Vice President of Engineering at Nor-Tech, told 3M. “They allowed us to cut the product’s size by close to 50 percent” without encountering air flow problems.

Air flow is critical to performance. Nor-Tech’s portable data center is designed to self-throttle down when it reaches its maximum temperature. The throttle-down mechanism protects the hardware and the data against damage, but ideally should be avoided because it lowers performance, which “defeats the purpose of a super computer,” Daninger said. Using the 3M Twin Axial Cable, “we haven’t seen anything close to max temperature,” he said.

**4. Energy Efficiency** Active Optical Cables (AOCs) have become a common sight in data centers due to fiber’s ability to deliver high-speed data rates over long reaches. Be aware that these cable assemblies contain a transceiver on each end that performs the electrical-optical-electrical conversion, and those transceivers consume power – up to one-third of the power used by a 10 Gbps port, in fact, according to industry experts. Therefore, choosing a low-power AOC is essential to creating an energy efficient data center.

Interconnect suppliers have toiled to bring down power consumption of AOCs. Yet, even within the low-power category, power consumption varies from product to product. Compare the power usage specs of AOC products in order to make sure you are purchasing a cable assembly that will help maximize energy efficiency. 3M offers some of the lowest power AOCs available on the market for QSFP+ and SFP+ applications in order to help data centers reduce consumption and cost.

**5. Reliability** As data rates increase and customers become less tolerant of errors and failure, the reliability of all equipment becomes more critical. Like anything else, with cables, you get what you pay for. Look for a trusted cable manufacturer with expertise in interconnect technology who backs up its products with technical service and warranties. Go to the cable manufacturer’s website and download the very latest supporting technical documentation and reference materials. Authorized distributors and value added resellers are another good source of information. Above all, choose a cabling vendor that can show test data that confirms product reliability and that has a proven track record of producing robust products.

**6. Total Cost of Ownership** If you’ve read this far and you still insist on buying the cheapest cable available, consider this: the price of the cable itself provides only part of the cost picture. Like any piece of hardware, determining the true cost must include an evaluation of its associated operating expense.

One important aspect of total cost of ownership (TCO) to consider is ease of maintenance. For instance, in the Nor-Tech case, its customer required clearance between the nodes so that frequent maintenance and changes could be performed unencumbered. When an IT technician has to maneuver through a “rat’s nest” of cabling in order to perform a task, unproductive time on the clock ticks away. That’s another reason why Nor-Tech chose the 3M Twin Axial Cable. The cable’s ability to be bent at sharp angles allows it to be neatly folded out of the way for ease of maintenance.

“By packing the cable off to one side, we were able to create plenty of space for cable management,” Daninger said.

Making informed choices about cabling can make the difference between a system that performs reliably and one prone to errors. These six simple pointers will help you ask the right questions of your provider so your manager doesn’t have to.



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## Highly Routable Cable from 3M Helps Nor-Tech Create Winning HPC Design

Nor-Tech, a leading system integrator and manufacturer of HPCs, responded to a request for proposal (RFP) for a custom super computer. To meet the client's requirements, Nor-Tech designers faced the challenge of creating a high-density, easily maintainable mobile system with the ability to fit into tight quarters.

Nor-Tech devised a sealed, portable data center solution comprised of 1,300 InfiniBand™-connected compute cores. Interconnecting the compute nodes while minimizing system size presented a major design challenge. Air flow within the cooled system, which is designed to withstand 80 kilowatts of power, was critical to keep it performing to its highest capability. Conventional InfiniBand™ cables are round with a shielding construction that allows very limited bending, making it nearly impossible to route cables away from air flow channels. Moreover, the jumble of round cables would make hot swapping difficult, forcing the design to fall short of the client's specifications.

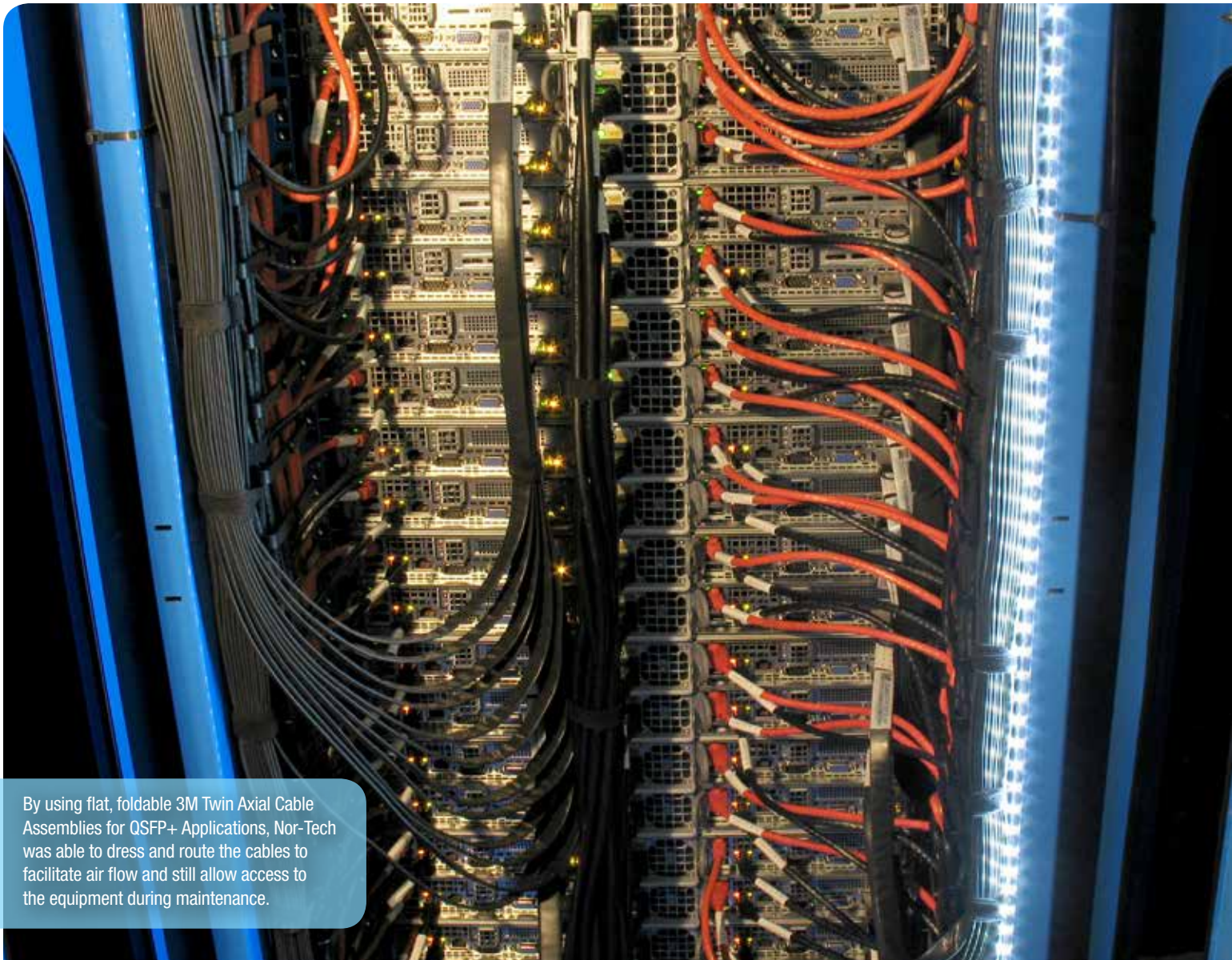
The 3M™ Twin Axial Cable Assembly for QSFP+ Applications, 9QA0 Series solved Nor-Tech's interconnect problem. The flat, thin cables can be bent and folded without significantly affecting signal performance, opening up novel routing possibilities. Nor-Tech was able to route the cables, in various lengths,

up to 3 meters away from air flow channels, helping to keep the system cool while leaving room for maintenance access.

Nor-Tech's design was accepted by the client. In fact, the client's reps told the system integrator personnel that their proposal was the only one that came close to what they had in mind. The 3M Twin Axial Cable Assembly helped achieve that winning design.



3M Twin Axial Cable Assembly for QSFP+ Applications, 9QA0 Series - flat, foldable and fast.



By using flat, foldable 3M Twin Axial Cable Assemblies for QSFP+ Applications, Nor-Tech was able to dress and route the cables to facilitate air flow and still allow access to the equipment during maintenance.



Flat 3M™ Twin Axial Cable Assemblies for QSFP+ Applications provided Nor-Tech engineers the density they needed to connect the units inside their space-constrained cabinet without significantly affecting signal performance when bent and folded.



3M is a member of InfiBand® Trade Association (IBTA).

For details on the products described here, please refer to the 3M customer drawings available for download at [www.3Mhighspeed.com](http://www.3Mhighspeed.com).

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Before using this product, you must evaluate it and determine if it is suitable for your intended application. You assume all risks and liability associated with such use.

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