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Data cabling in tertiary cabling –
in what cases is optical fiber the better alternative to copper?

Why are there standards for structured data cabling?

The first standards for structured data cabling were published in 1991 as ISO/IEC 11801 (international) and EN 50173 (European), and this cabling is now the standard type for office buildings worldwide. While the standardised performance at the time was 16 MHz, today we're already seeing up to 25 GbE in tertiary cabling (horizontal cabling). A whole raft of new technologies and megatrends such as IoT (Internet of Things), Industrie 4.0 and WiFi, plus the use of many more terminal devices, means that data volumes will continue to increase in the coming years – and especially within buildings. Structured data cabling aims to establish the physical foundation for high-performance, universal networks that are designed for the transmission of applications for data, voice and multimedia. Apart from the active components themselves, the properties of the various cable systems that are available are also key factors influencing performance.

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Criteria for selecting copper or fiber optic systems technology

The following factors should be considered when selecting the cable system (optical fiber or copper):

- Future-proofing (protecting investments)
- Simple, safe and mature approach to installation work
- Quick, low-cost installation
- High-quality components with a long service life
- Application-neutral and standardised (ISO/IEC 11801 and EN 50173)

To date, horizontal cabling has been dominated by copper systems technology. There are a great many reasons for this, including:

- PoE, PoE+ and 4PPoE (Power over Ethernet, up to 100 W)
- Robustness of cable systems
- Low-maintenance, cost-effective installation

These reasons will continue to be important over the next few years, since most LAN switches are equipped as standard with PoE ports and therefore support providing direct power to terminal devices via the data cable. In addition, copper-based systems are very robust, simple to install and low-maintenance. Link installation quality can also be quickly checked and documented using standard off-the-shelf scanners.

Advantages of fiber optic systems technology

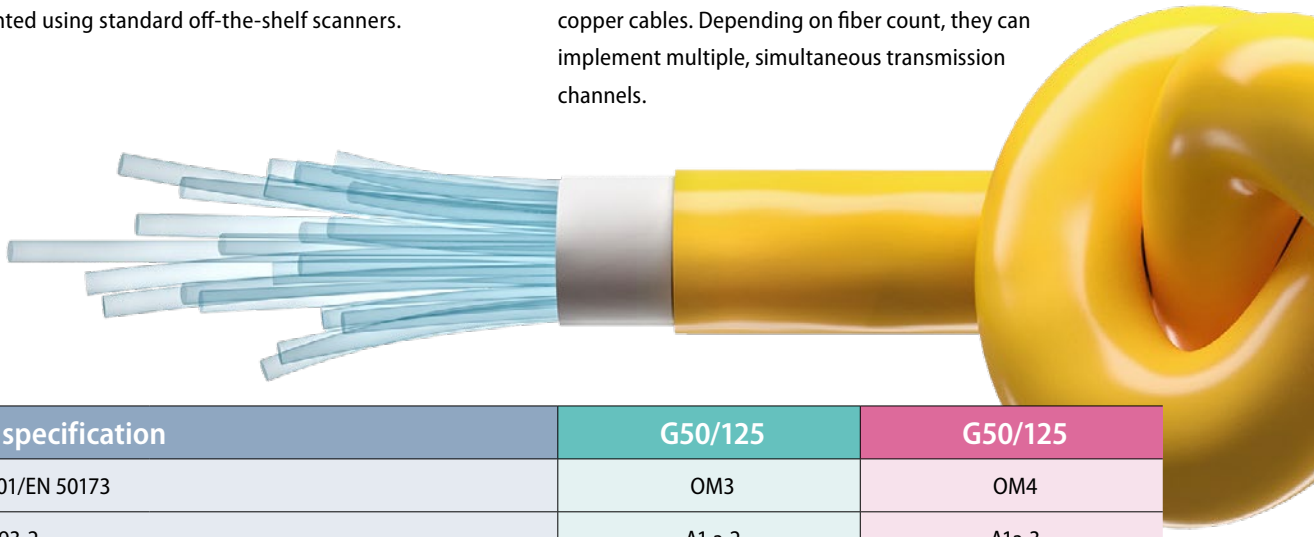
On the other hand, fiber optic systems technology offers a **decisive** set of benefits for horizontal cabling in the following instances:

- Transmission channels/link lengths over 100 m
- Structural conditions mean that only space-saving, 'lightweight' data cables can be used in the building (no cable trays or dado ducts available, for example)
- Fire loads
- ENC safety, overvoltage lightning protection, equipotential bonding

For certain kinds of applications, these technical and economic arguments offer very clear advantages for fiber optic technology – also in tertiary cabling.

Fire loads, space-saving and 'lightweight' fiber optic data cables

If high fiber-count fiber optic cables are used in critical areas – such as older buildings, hospitals, etc. – this can reduce fire loads while helping to keep compartmentation and firewalling solutions much smaller and more cost-effective. Fiber optic cables are lighter and typically have smaller diameters than copper cables. Depending on fiber count, they can implement multiple, simultaneous transmission channels.



Fiber specification		G50/125	G50/125
IEC 11801/EN 50173		OM3	OM4
IEC 60793-2		A1.a.2	A1a.3
ITU-T		G601	G601
Transmission lenghts	at 1 GBE at 850 nm (1000 BASE SX)	900 m	1000 m
	at 10 GBE at 850 nm (10G BASE – SR/SW)	300 m	550 m
	at 25 GBE at 850 nm (25G BASE – SR)	70 m	100 m

Fig. 1: Possible link lengths for 1/10/25 GbE

Network usage	Wavelength	OM3	OM4
IEC 11801, EN 50173		Max. loss budget for transmission length	
1000 BASE-SX, 1 GbE	850 nm	3.56 dB	3.56 dB
10G BASE-SR/SW, 10 GbE		2.60 dB	2.90 dB

Fig. 2: Max. loss budget in first transmission window (850 nm), based on applications 1 and 10 GbE

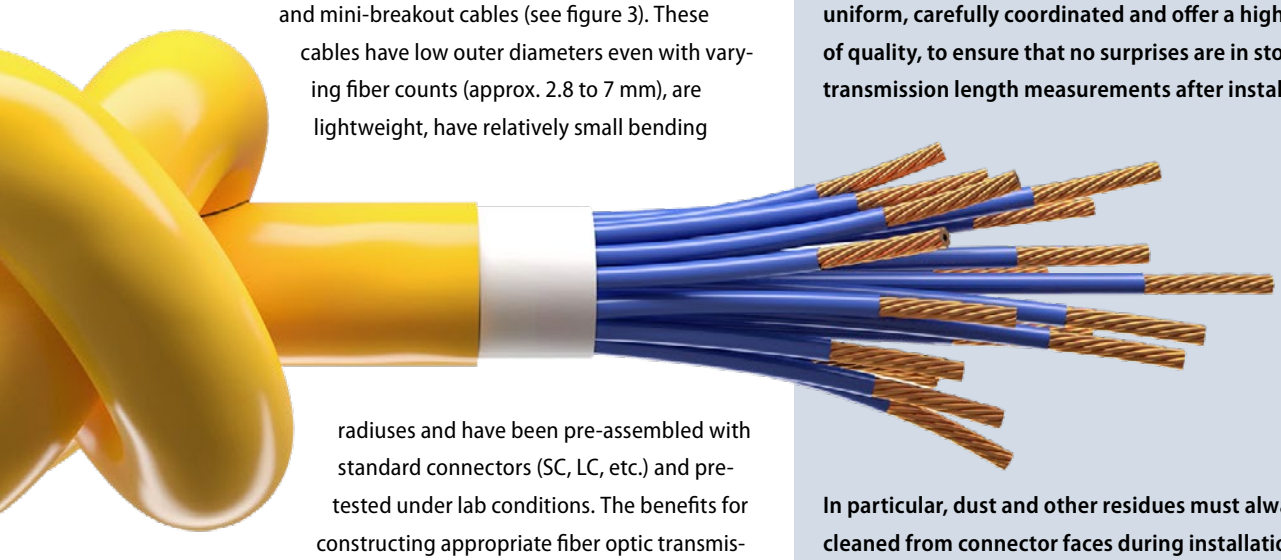
EMC safety, overvoltage and lightning protection

While power and copper data cable layouts may need to be kept physically separate – on cable trays, for example – due to EMC (electromagnetic compatibility) concerns (EN 50174), this is not necessary for fiber optic cables. All of the costly safety procedures necessary for overvoltage and lightning protection, as well as equipotential bonding, can also be avoided.

Why choose pre-assembled fiber optic cables?

If you've now decided to deploy fiber optic systems technology for the reasons mentioned above, you should also take a serious look at the option of using pre-assembled fiber optic cables.

Appropriate cable designs are offered here by breakout and mini-breakout cables (see figure 3). These cables have low outer diameters even with varying fiber counts (approx. 2.8 to 7 mm), are lightweight, have relatively small bending radiuses and have been pre-assembled with standard connectors (SC, LC, etc.) and pre-tested under lab conditions. The benefits for constructing appropriate fiber optic transmission channels are very obvious:



- No splicing work on site saves time and installation effort
- High-quality connector surfaces ensure trouble-free transmission
- Installation times easily calculated
- No special tools required

These preassembled fiber optic cables offer space-saving installations with small wall, ceiling or underfloor distribution boxes, from which they can be routed in a star layout to terminal devices or fiber optic connection boxes. This kind of structured fiber optic cabling is termed ***Fiber to the Desk*** or also, when used in conjunction with mini switches, as ***Fiber to the Office***. These kinds of cable structures have been 'state of the art' for several years now.

Summary

As has been shown in some detail above, the use of a fiber optic system in horizontal cabling is a good or even a better option in certain scenarios.

However, any system technology deployed must be uniform, carefully coordinated and offer a high level of quality, to ensure that no surprises are in store for transmission length measurements after installation.

In particular, dust and other residues must always be cleaned from connector faces during installation work. The use of appropriate cleaning tools as well as the use of a video microscope for evaluating connector quality (cf. DIN EN 61300-3-35) is essential in order to ensure that final transmission quality is as high as possible.

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