Shielded Ethernet Cable FAQ

Most Ethernet cable used in home and office networks is unshielded, because there are usually not high levels of electrical noise present in these environments. However, shielded Ethernet cable typically becomes necessary when networks extend onto the factory floor. In this document, we answer some of the more common questions that LUTZE's cable experts have received about shielded Ethernet cable.

What is shielded Ethernet cable?

Shielded Ethernet cable has a conductive layer, or shield, around the overall cable or the individual twisted pairs. This conductive layer, which is usually thin foil or braided copper wire, helps protect the cable from unwanted electrical interference.

Doesn't unshielded Ethernet cable already protect against interference?

Copper Ethernet cables are manufactured with a balanced, twisted pair design. This twisted-pair design helps minimize the effects of electro-magnetic interference (EMI) on data that is sent across the pairs. In some cases, the twisted-pair design is enough to protect against the level of noise found in the environment. This is true for many installations in home and office networks where EMI is minimal. However, using unshielded cables in high-EMI environments like the factory floor can result in data loss, reduced network performance, and even total network disruption or failure.

Where does EMI come from?

Industrial machinery, particularly VFD and servo drives, large motors, and control electronics, radiate EMI in the areas that they operate. In addition, the power cables for these devices often follow the same routing path as Ethernet cables and can introduce interference along the shared cable pathway. Many common electrical fixtures such as fluorescent lighting and office machinery can also introduce EMI to nearby cables.

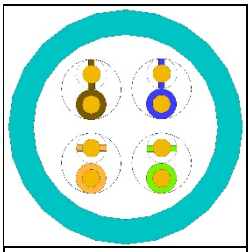
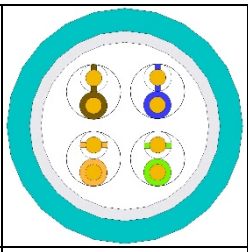
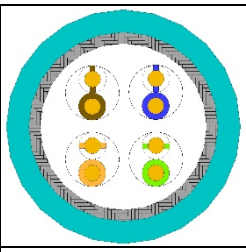
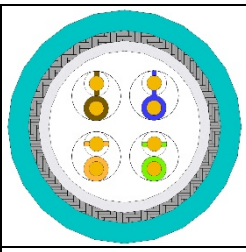
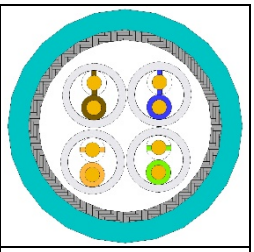
It is important to know where electro-magnetic interference is present within a network installation area. Best practice is to perform a site survey prior to installing an Ethernet network or link, which should include an evaluation of noise levels in the network area. This can be very helpful when deciding whether shielded Ethernet cabling is necessary for your installation.

When should I use shielded Ethernet cable?

Shielded cable is typically required in industrial networks to achieve high network speed and reliability. It is increasingly common to use Ethernet protocols for sensitive, real-time industrial applications such as motion control and machine automation. Where fast, reliable, and error-free industrial communication is required, shielded cable should be deployed to protect against harmful interference. The use of shielded cable can protect against excessive data loss, device timeout errors, and costly network and machine downtime caused by EMI. In a factory setting, unshielded Ethernet cable should only be used in areas where testing has confirmed that a harmful level of EMI is not present.

What do different shielding designations stand for?

Common designations for shielded and unshielded Ethernet cables, per ISO/IEC 11801:

				
UTP	F/UTP	S/UTP	SF/UTP	S/FTP
Unshielded Twisted Pairs	Overall Foil Shield with Twisted Pairs	Overall Braid Shield with Twisted Pairs	Overall Foil and Braid Shields with Twisted Pairs	Overall Braid Shield with Individually Foil Shielded Twisted Pairs

What are the benefits of each shielding type?

<u>Overall Foil Shield</u>

An overall foil shield, usually thin foil applied to a polyester backing, is the primary defense against external high-frequency electro-magnetic interference (EMI). Because of the very low copper mass found in standalone foil shields, they are at risk of becoming a relatively high impedance grounding path for noise returning to ground. For this reason, foil shields are often used in combination with braid shielding to provide lower impedance and additional EMI protection.

Overall Braid Shield

Braid shielding is typically constructed from thin copper wires braided together around the cable core to form a continuous shield. This shielding serves two purposes; to protect against low frequency EMI, and to lower the impedance of the shield's path to ground. Because the braid is woven and there are gaps where the weave intersects, it is impossible to achieve 100% coverage with a braid shield. Using a combination of braid and foil shields provides 100% coverage while still realizing the benefits that the braid provides.

PiMF Shields

A cable with Pairs in Metal Foil (PiMF), also called individually shielded pairs, provides optimal protection against cross-talk between pairs within the same cable. This can become an issue with high speed, high bandwidth cables operating at 500Mhz or more. For this reason, a PiMF design is typically only seen in Cat6a or Cat7 cables.

How should Ethernet cable shields be terminated?

There are differing opinions on the best practice for bonding and grounding Ethernet cable shields. Many factors contribute to the final decision, and each installation is different. The governing bodies for industrial Ethernet protocols provide best practices for shield grounding and termination, and the installation guidelines should be followed for each specific protocol and manufacturer. LUTZE offers a broad range of shielded, field-terminable Ethernet connectors to make proper grounding and reliable connectivity easy in every application.

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For more information on industrial Ethernet cables and connectors please contact your local LUTZE representative, visit www.lutze.com, or call (800) 447-2371 to speak with an application expert.

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