Advantages of Using Siemon Shielded Cabling Systems

For Remote Powering Applications

Reading Time: 12 minutes

Remote powering applications utilize the copper balanced twisted-pair IT cabling infrastructure to deliver dc power to IP-enabled devices. The popularity of this technology and the interest in expanding its capabilities is staggering. Consider:

- The global Power over Ethernet (PoE) market is expected to reach USD 3.77 billion by 2025[1]
- While Type 1 and Type 2 PoE technologies employ two balanced twisted-pairs to deliver remote power, using four balanced twisted-pairs to deliver remote power offers many benefits, including improved efficiency and increased power. Type 3 (≥ 60W at the PSE output) and Type 4 (≥ 90W at the PSE output) PoE augments the capabilities of previous generation Power Sourcing Equipment (PSE) and Powered Device (PD) specifications with four-pair power delivery while maintaining backward compatibility.
- HDBaseT 3.0 enables the convergence of ultra-high speed uncompressed HDMI 2.0 audio and video, 1 Gb/s Ethernet, USB 2.0 control, and up to 100W of power using Power over HDBaseT (POH)[2] technology with zero latency. HDBaseT distribution is over 100m (328 ft) of category 6A/class E_A or higher performing cabling.

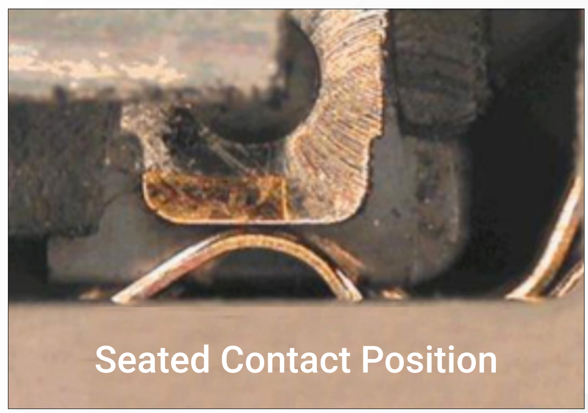
In the past decade, remote powering technology has revolutionized the look and feel of the IT world. Now, devices such as surveillance cameras, wireless access points, RFID readers, digital displays, IP phones, and other equipment all share network bandwidth that was once exclusively allocated for computers. It's common knowledge that the networking of remotely powered devices for autonomous data transmission and collection is driving the need for larger data center infrastructures and storage networks. However, many IT managers aren't aware that remote power delivery produces temperature rise in cable bundles and electrical arcing damage to connector contacts. Heat rise within bundles has the potential to cause higher bit errors because insertion loss is directly proportionate to temperature. In extreme environments, temperature rise and contact arcing can cause irreversible damage to cable and connectors. Fortunately, the proper selection of network cabling can completely eliminate these risks. Specifying shielded category 6A and category 7_A cables and components featuring Siemon's PowerGUARD™ Technology provides the following advantages that ensure a "futureproof" cabling infrastructure capable of supporting remote powering technology for a wide range of topologies and operating environments:

- Assurance that critical connecting hardware contact mating surfaces are not damaged when plugs and jacks are cycled under remote powering current loads
- Higher maximum operating temperature for IEEE 802.3 Type 2[3] and higher power PoE applications
- Fully compliant transmission performance for a wider range of channel configurations in environments having an ambient temperature greater than 20°C (68°F)
- An option to support remote powering currents up to 600mA applied to all four pairs and all networking applications up to and including 10GBASE-T in 70°C (158°F) environments over a full 4-connector, 100-meter channel topology
- Reliable and thermally stable patching solutions for converged zone cabling connections (e.g., device to horizontal connection point) in hot environments

Protecting Your Connections

Telecommunications modular plug and jack contacts are carefully engineered and plated (typically with gold or palladium) to ensure a reliable, low resistance mating surface. Today's remote powering applications offer some protection to these critical connection points by ensuring that dc power is not applied over the structured cabling plant until a remotely powered device (PD) is sensed by the power sourcing equipment (PSE). Unfortunately, unless the PD is shut off beforehand, the PSE will not discontinue power delivery if the modular plug jack connection is disengaged. This condition, commonly referred to as, "unmating under load", produces an arc as the applied current transitions from flowing through conductive metal to air before becoming an open circuit. While the current level associated with this arc poses no risk to humans, arcing creates an electrical breakdown of gases in the surrounding environment that results in corrosion and pitting damage on the plated contact surface at the arcing location.

While it's important to remember that arcing and subsequent contact surface damage is unavoidable under certain mating and unmating conditions, contacts can be designed in such a way as to ensure that arcing will occur in the initial contact "wipe" area and not affect mating integrity in the final seated contact position. Figure 1 depicts an example of Siemon's Z-MAX® PowerGUARD design that features a distinct "make-first, break-last" zone that is separated by at least 2mm from the "fully mated" contact zone on both the plug and outlet contacts. Note that any potential damage due to arcing will occur well away from the final contact mating position for this design. To ensure reliable performance and contact integrity, Siemon recommends that only connecting hardware that is independently certified for compliance to IEC 60512-99-002[4] be used to support remote powering applications. This standard was specifically developed to ensure reliable connections for remote powering applications deployed over balanced twisted pair cabling. It specifies the maximum allowable resistance change that mated connections can exhibit after being subjected to 100 insertion and removal cycles under a load condition of 55V dc and 600mA applied to each of the eight separate plug/outlet connections. All Siemon Z-MAX and TERA® connecting hardware has been certified by an independent test lab to be in full compliance with IEC 60512-99-002.



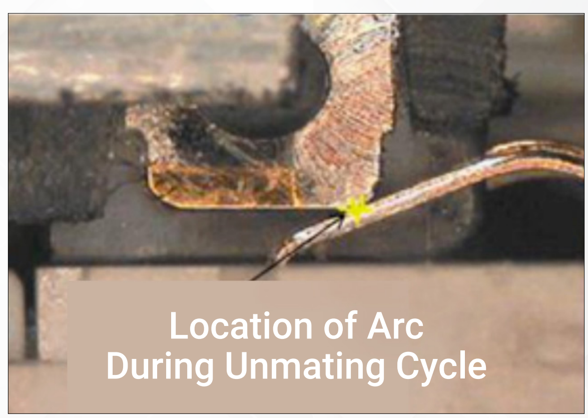


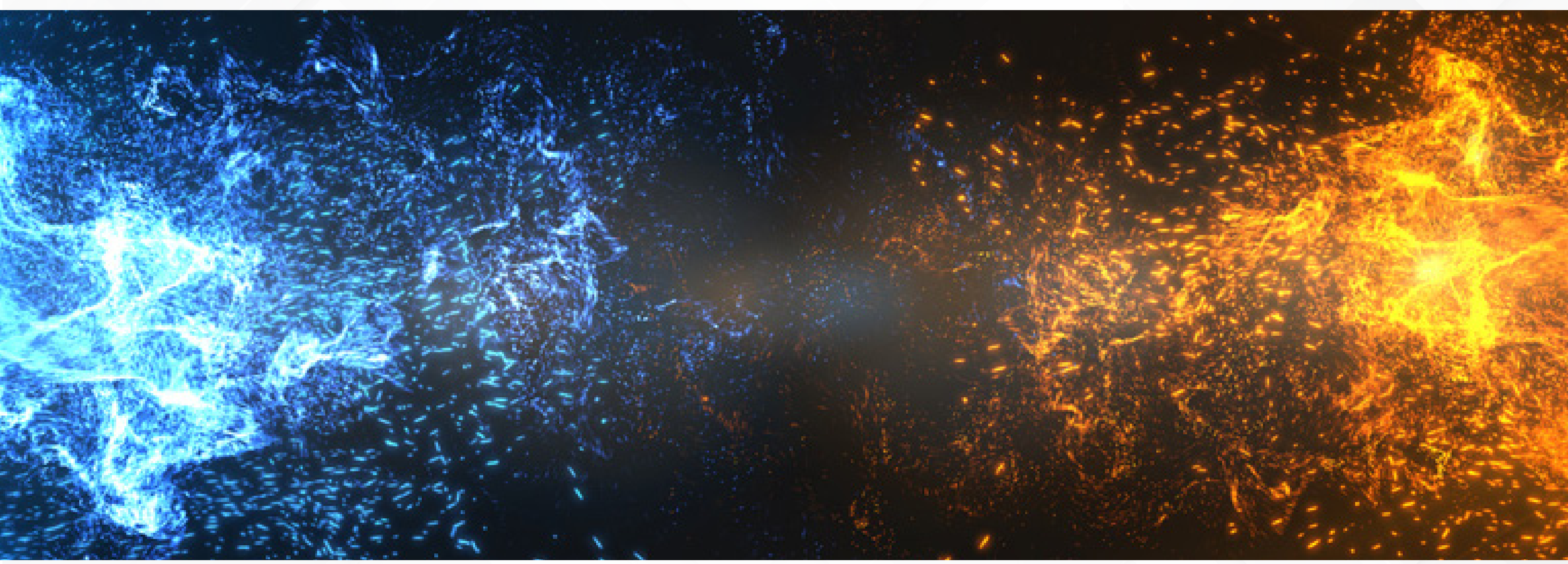
Figure 1: Arc location in "wipe" area occurs outside of final seated Z-MAX® contact position

Keeping it Cool

The standard ISO/IEC and TIA operating environment for structured cabling is -20°C to 60°C (-4°F to 140°F). Compliance to industry standards ensures reliable long-term mechanical and electrical operation of cables and connectors in environments within these temperature limits. Exceeding the specified operating range can result in degradation of the jacket materials and loss of mechanical integrity that may have an irreversible effect on transmission performance that is not covered by a manufacturer's product warranty. Since deployment of certain remote powering applications can result in a temperature rise of up to 10°C (50°F) within bundled cables (refer to Annex A in TIA TSB-184-A[5] and clause 6 in ISO/IEC TS 29125[6]), the typical rule of thumb is to not install minimally compliant cables in environments above 50°C (122°F).

This restriction can be problematic in regions such as the American southwest, the Middle East, or Australia's Northern Territory, where temperatures in enclosed ceiling, plenum, and riser shaft spaces can easily exceed 50°C (122°F). To overcome this obstacle, Siemon recommends the use of shielded category 6A and 7_A cables that are qualified for mechanical reliability up to 75°C (167°F). Not only do these cables inherently exhibit superior heat dissipation (refer to Siemon's white paper, "Higher Power PoE Operating Efficiency: How to Keep a Hot Application Running Cool[7]"), but they may be installed in high temperature environments up to the maximum 60°C (140°F) specified by TIA and ISO/IEC structured cabling standards without experiencing mechanical degradation caused by the combined effects of high temperature environments and heat build-up inside cable bundles due to remote power delivery.

Siemon provides bundling recommendations for Siemon cables supporting remote powering applications[8]. When in doubt about cable mechanical or heat dissipation capability, installation environment, or remote powering application, a conservative practice is to limit maximum bundle size to 24 cables.



Maximizing Reach

Awareness of the amount of heat build-up inside the cable bundle due to remote power delivery is important because cable insertion loss increases (signals attenuate more) in proportion to temperature. The performance requirements specified in all industry standards are based on an operating temperature of 20°C. The temperature dependence of cables is recognized in cabling standards and both TIA and ISO specify an insertion loss de-rating factor for use in determining the maximum channel length at temperatures above 20°C (68°F). The temperature dependence is different for unshielded and shielded cables and the de-rating coefficient for UTP cable is actually three times greater than shielded cable above 40°C (104°F) (refer to Annex I in ANSI/TIA-568.2-D[9] and clause 8 in ISO/IEC 11801-1[10]). For example, at 60°C (140°F), the standard-specified length reduction for category 6A UTP horizontal cables is 18 meters. In this case, the maximum permanent link length must be reduced from 90 meters to 72 meters to offset increased insertion loss due to temperature. For minimally compliant category 6A F/UTP horizontal cables, the length reduction is 7 meters at 60°C (140°F), which means reducing maximum link length from 90 meters to 83 meters. The key takeaway is that shielded cabling systems have more stable transmission performance at elevated temperatures and are best suited to support remote powering applications and installation in hot environments.

Siemon's category 6A and 7_A shielded cables exhibit extremely stable transmission performance at elevated temperatures and require less length reduction than specified by TIA and ISO/IEC standards to satisfy insertion loss requirements; thus, providing the cabling designer with significantly more flexibility to reach the largest number of work areas and devices in converged building environments. As shown in figure 2, the length reduction for Siemon 6A F/UTP horizontal cable at 60°C (140°F) is 3 meters, which means reducing maximum link length from 90 meters to 87 meters. Furthermore, Siemon 6A F/UTP horizontal cable may be used to support remote powering currents up to 600mA applied to all four pairs up to 60°C (140°F). In this case, the maximum link length must be reduced from 90 meters to 86 meters. Note that the TIA and ISO/IEC profiles from 60°C to 70°C (140°F to 150°F) are extrapolated assuming that the de-rating coefficients do not change and are provided for reference only.

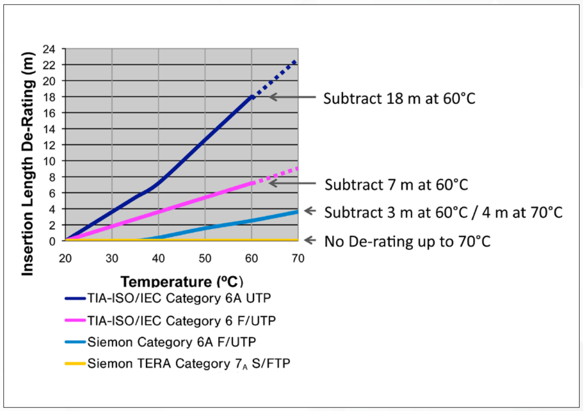


Figure 2: Horizontal cable length de-rating versus temperature for application speeds up to 10GBASE-T

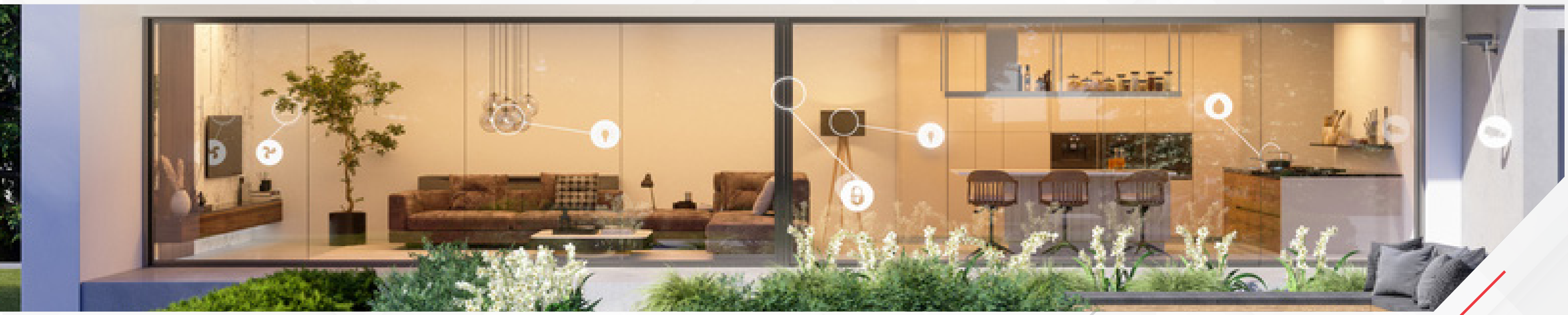
Due to their superior and stable insertion loss performance, Siemon's fully-shielded category 7_A cables do not require any length de-rating to support remote powering currents up to 600mA applied to all four pairs and all networking applications up to and including 10GBASE-T over a full 4-connector, 100-meter channel topology in environments up to 70°C (150°F)!

A Better Patching Solution

While TIA and ISO/IEC temperature dependence characterization focuses on the performance of solid conductor cables, it is well known that the stranded conductor cables used to construct patch cords exhibit significantly greater insertion loss rise due to elevated temperature than solid conductor cables do. To maximize flexibility and minimize disruptions when device moves, adds, and changes are made, a zoned cabling solution is the topology of choice for the intelligent building systems most likely to take advantage of remote powering solutions. However, most horizontal connection points in a zoned topology are located in the ceiling or in plenum spaces where high temperatures are most likely to be encountered. Fortunately, the risk of performance degradation due to elevated temperatures in zone cabling environments can be mitigated by using solid conductor cords for equipment connections. Equipment cords constructed from Siemon shielded category 6A solid conductor cable are recommended for support of remote powering applications in environments up to 60°C (140°F) and equipment cords constructed from Siemon shielded category 7_A solid conductor cable are recommended for support of remote powering applications in environments up to 70°C (150°F).

The Future of Remote Powering Applications

The advent of remote powering technology has significantly increased the number of networked devices, with surveillance cameras, IP phones, and wireless access points dominating the PoE chipset market today. As the PD market evolves, Type 3 PoE, Type 4 PoE, and POH remote powering technology supporting advanced applications, improved efficiency, and increased power delivery over four balanced twisted-pairs will have an increased presence. These more efficient power injection schemes are enabling remote powering applications that will support new families of devices, such as lighting fixtures, high-definition displays, digital signage, and point-of-sale (POS) devices that can consume more than 30W of power. Choosing connectors and cables that are specifically designed to handle remote powering current loads, associated heat buildup, and contact arcing are important steps that can be taken to minimize the risk of component damage and transmission errors.



Conclusions

As the market for remotely powered IP-devices utilizing advanced powering technology grows, the ability of cables and connectors to operate in higher temperature environments and perform under dc load conditions will emerge as critical factors in the long-term reliability of cabling infrastructure used to support PoE and other low voltage applications. Fortunately, cabling products designed to operate under demanding environmental and remote powering conditions are already available today. Siemon's PowerGUARD technology provides the following remote powering implementation advantages:

- Siemon's Z-MAX and TERA connecting hardware complies with IEC 60512-99-002, which ensures that critical contact seating surfaces are not damaged when plugs and jacks are mated and unmated under remote powering current loads
- Siemon's shielded category 6A and 7_A cables are qualified for mechanical reliability up to 75°C (167°F), thus ensuring support of all PoE and POH applications over the entire ISO/IEC and TIA operating temperature range of -20°C to 60°C (-4°F to 140°F)
- Siemon's Z-MAX shielded category 6A cabling solutions require less than one-fifth the length de-rating than minimally compliant category 6A UTP cables at 60°C (140°F)
- Siemon's TERA fully-shielded category 7_A cabling solutions support data rates up to at least 10GBASE-T in 70°C (150°F) environments over a full 4-connector, 100-meter channel topology with no length de-rating required
- Siemon's shielded category 6A and 7_A solid equipment cords maintain highly reliable and stable performance with no mechanical degradation when used for converged zone cabling connections in elevated-temperature environments

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