Advantages of Using Siemon Shielded Cabling Systems

To Power Remote Network Devices

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:

- Over 100 million Power over Ethernet (PoE) enabled ports are shipping annually
- Cisco® 60W Universal PoE (UPOE) technology is driving the adoption of virtual desktop infrastructure (VDI) and, when paired with Cisco's EnergyWise IOS-based intelligent energy management solution, supports using the IT network to monitor and control power consumption as well as turn devices on and off remotely to save power when the devices are not being used
- Published, but not yet commercially available, Power over HDBaseT (POH)[1] technology can deliver up to 100W over twisted-pair cable to support full HD digital video, audio, 100BASE-T, and control signals in television and display applications
- The IEEE 802.3 4-Pair Power over Ethernet (PoE) Study Group has been formed to investigate developing a new remote powering application that will provide superior energy efficiency than a 2-pair application and expand the market for PoE systems.

In less than a 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.

Choosing qualified shielded category 6A and category 7_A cabling systems provides the following advantages that ensure a "future-proof" 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 [2] PoE Plus 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 as 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 such a 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.-

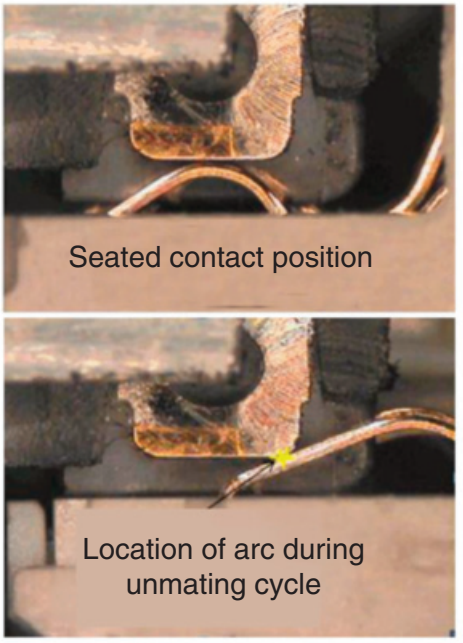

Figure 1: Arc location in "wipe" area occurs outside of final seated Z-MAX® contact position

To ensure reliable performance and contact integrity, Siemon recommends that only connecting hardware that is independently certified for compliance to IEC-60512-99-001[3] 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 60512-99-001.

Keeping it cool

The standard ISO/IEC 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 Table A.1 in TIA TSB-184[4] and Table 1 in ISO/IEC TR 29125[5]), 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, "IEEE 802.3 at PoE Plus Operating Efficiency: How to Keep a Hot Application Running Cool[6]"), 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.

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 20ºC (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 G in ANSI/TIA-568-C.2[7] and Table 21 in ISO/IEC 11801, 2nd edition[8]). For example, at 60ºC (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 60ºC (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 60ºC (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

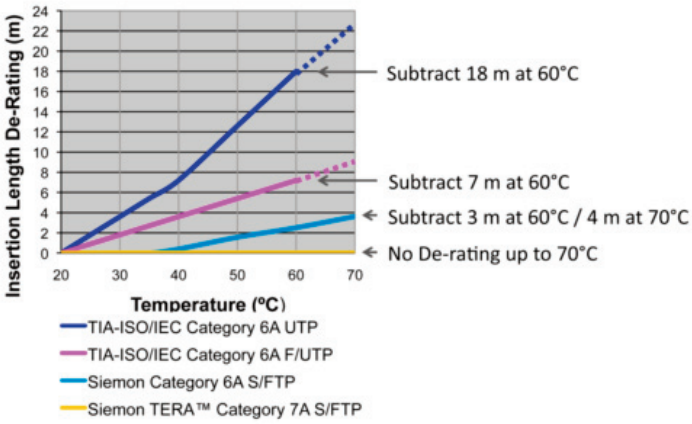

Figure 2: Horizontal cable length de-rating versus temperature for application speeds up to 10GBASE-T

600mA applied to all four pairs up to 60ºC (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 60ºC to 70ºC (140°F to 150°F) are extrapolated assuming that the de-rating coefficients do not change and are provided for reference only. 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 do solid conductor cables. 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 building automation systems (BAS) most likely to take advantage of remote powering solutions. However, most BAS 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 60ºC (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 70ºC (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 driving the market for PoE chipsets today. As the PD market matures, new and emerging remote powering technology continues to evolve to support advanced applications, improved efficiency, and increased power delivery. Power over HDBaseT, UPOE, and the work of the IEEE 802.3 4-Pair Power over Ethernet Study Group formed to investigate 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. All trends indicate that four pair power delivery is the future of remote powering technology. Choosing connectors and cables that are specifically designed to handle remote powering current loads, associated heat build-up, 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 grows and more advanced powering technology is developed, 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 that deliver power over twisted-pairs. Fortunately, cabling products designed to operate under demanding environmental and remote powering conditions are already available today. Siemon's shielded category 6A and category 7_A cabling systems provide the following implementation advantages when deploying remote powering technology:

- Siemon's Z-MAX® and TERA® connecting hardware complies with IEC 60512-99-001, 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 Z-MAX shielded category 6A and TERA category 7_A cabling solutions support the IEEE 802.3 Type 2 PoE Plus application over the entire ISO/IEC 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 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 - no length de-rating required
- Siemon's shielded category 6A and 7_A solid equipment cords are uniquely capable of maintaining highly reliable and stable performance with no mechanical degradation when used for converged zone cabling connections in hot environments.

References:

[1] HDBaseT Alliance, "Power Over HDBaseT Addendum to the HDBaseT 1.0 Specification", 2011

[2] IEEE Std 802.3™-2012, "IEEE Standard for Ethernet", 2012

[3] IEC 60512-99-001, "Connectors for Electronic Equipment - Tests and Measurements - Part 99-001: Test Schedule for Engaging and Separating Connectors Under Electrical Load - Test 99A: Connectors Used in Twisted Pair Communication Cabling with Remote Power", 2012

[4] TIA TSB-184, "Guidelines for Supporting Power Delivery Over Balanced Twisted-Pair Cabling", 2009

[5] ISO/IEC TR 29125, "Information Technology – Telecommunications Cabling Requirements for Remote Powering of Terminal Equipment", 2010

[6] Siemon white paper, "IEEE 802.3at PoE Plus Operating Efficiency: How to Keep a Hot Application Running Cool", 2010

[7] ANSI/TIA-568-C.2, "Balanced Twisted-Pair Telecommunications Cabling and Components Standards", 2009

[8] ISO/IEC 11801, 2nd edition, "Information technology – Generic cabling for customer premises", 2002

WP_ShieldAdv_ Rev. B 6/13

Worldwide Headquarters
North America
Watertown, CT USA
Phone (1) 860 945 4200 US
Phone (1) 888 425 6165

Regional Headquarters
EMEA
Europe/Middle East/Africa
Surrey, England
Phone (44) 0 1932 571771

Regional Headquarters
Asia/Pacific
Shanghai, P.R. China
Phone (86) 21 5385 0303

Regional Headquarters
Latin America
Bogota, Colombia
Phone (571) 657 1950

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