TECH BRIEF

Choosing the Right Twisted-Pair Cabling

for Today's and Tomorrow's Converged LAN Technologies

In the era of the Internet of Things (IoT) and intelligent buildings, a wide range of low-voltage building systems including voice, data, Wi-Fi, distributed antenna systems (DAS), security, audiovisual (AV), lighting, building automation and more are converging onto a common cabling infrastructure and communicating with each other via Internet Protocol (IP). At the same time, advancements in remote powering technology means the cabling infrastructure is also delivering DC power to more low-voltage system devices than ever before—everything from IP phones, desktop computers and wireless access points (WAPs), to surveillance cameras, access control, digital displays, LED lighting fixtures, point of sale (POS) machines, building automation, life safety devices and more. To support this broad range of systems and devices, building owners, consultants and designers need to select the right cabling media for their infrastructure and should understand the considerations surrounding bandwidth and remote powering needs for current and future technologies.

When it comes to selecting a single cabling media to support the broad range of converging low-voltage systems, there can be plenty of confusion due to conflicting information from a variety of system vendors, application standards designed to run over the installed base, and diverse data transmission and power deliver needs. While category 5e/class D and category 6/class E balanced twisted-pair copper cabling have been around since 1999 and 2002 respectively, and they continue to account for the largest percentage of worldwide sales, they are predicted to decline over the next decade. On the other hand, higher-performing category 6A/class E_A ratified by industry standards in 2008 to support 10 Gb/s speeds is on the rise – and for good reason.

If you take a closer look at the latest technologies outlined below, as well as industry standards recommendations, it is more difficult than ever to make a case for deploying anything less than category 6A/class E_A. And when you combine those standards and technologies with the impact that higher Type 3 PoE at 60 Watts and Type 4 PoE at 90 Watts has on the cabling system, it becomes clear that category 6A/class E_A shielded cabling should be the minimum twisted-pair cabling type deployed for any new installation.

WIRELESS APPLICATIONS

Wi-Fi 6

The IEEE 802.11ax Enhancements for High Efficiency Wireless (HEW) LAN is the latest Wi-Fi standard known as Wi-Fi 6 that offers four times faster average throughput in dense deployment environments compared to Wi-Fi 5. Across all price points, Wi-Fi 6 WAPs will need at least one category 6A/class E_A connection to guarantee support of either 2.5 Gb/s or 5 Gb/s transmission speeds. And to take full advantage of Wi-Fi 6 technology as it matures to support greater than 5 Gb/s, two connections will be required to support link aggregation.

Wi-Fi 5

Category 6A/ Class E_A is also recommended for Wi-Fi 5 due to the fact that in some cases, Wi-Fi 5 data transfer rates are fast enough to saturate a 1 Gb/s copper balanced twisted-pair cabling link. In fact, TSB-162-A Telecommunications Cabling Guidelines for Wireless Access Points clearly states that cabling for wireless access points should be balanced twisted-pair category 6A/class E_A or higher.

While the IEEE 802.3bz™ Standard for 2.5GBASE-T and 5GBASE-T operation was developed as a means for the installed base of category 5e/class D and category 6/class E cabling to support of Wi-Fi 5, it does not operate over the entire installed base of these cable types and can require time-consuming retesting of the existing cabling plant to determine compliance. Only category 6A/class E_A and higher rated cabling is guaranteed to support 2.5/5GBASE-T over all installation environments and channel topologies up to 100 meters.

DAS & 5G

In addition to Wi-Fi 5 and Wi-Fi 6, copper-based distributed antenna systems that distribute cellular service throughout facilities also recommend minimum category 6A/class E_A cabling. In fact, TIA TSB-5018 Structured Cabling Infrastructure Guidelines to Support Distributed Antenna Systems clearly recommends category 6A/class E_A. Because DAS communication is highly sensitive to alien crosstalk and has high bandwidth and greater distance requirements, shielded category 6A/class E_A cabling is highly recommended. In addition, the emergence of 5G cell service with a minimum expectation for download speeds of 10 Gb/s will have even more of an impact on DAS. That is why copper-based DAS vendors require minimum category 6A/class E_A shielded for their 5G DAS solutions.

AUDIOVISUAL APPLICATIONS

HDBaseT

Since it was introduced by the HDBaseT Alliance, HDBaseT has evolved to support the transmission of ultra-high definition 4K video and audio along with 100 Mb/s Ethernet-based communication, USB, bidirectional control signals and 100W of power (power over HDBaseT [POH]) over a single twisted-pair cable for distances up to 100 meters using standard 8P8C (RJ45) connectivity.

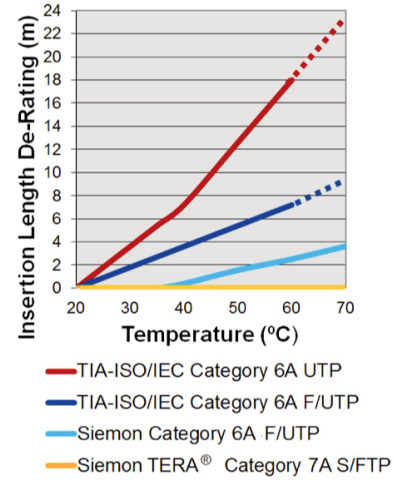
While HDBaseT can run over category 5e/class D and category 6/class E cabling to limited distances (10 and 40 meters respectively) the HDBaseT Alliance and HDBaseT equipment vendors all recommend the use of category 6A/class E_A at a minimum to support the bandwidth required for 4K signals and to reach the full 100-meter distance. Many AV vendors recommend increasing that to shielded category 6A/class E_A or even category 7A/class F_A cabling to ensure robust performance—especially for installations with unmanaged environmental factors. Shielded category 6A/class E_A and category 7A/class F_A offers better resistance to alien crosstalk, which has a significant impact on HDBaseT signals wherever multiple cables are bundled together.

SDVoE

Introduced in 2017, Software Defined Video over Ethernet (SDVoE) supporting uncompressed 4K video, audio, control and 1 Gb/s Ethernet-based communication leverages standards-based network cabling, TCP/IP and low-latency switching. When it comes to network cabling media for SDVoE, category 6A/class E_A cabling is not just recommended; it is required. SDVoE requires a 10 Gb/s-capable network which can only be supported by a minimum of category 6A/class E_A cabling. For the same alien crosstalk concerns present with HDBaseT, shielded category 6A/class E_A or higher cabling is also recommended for SDVoE.

SECURITY, LIGHTING AND OTHER APPLICATIONS USING REMOTE POWERING

Some devices such as access control, LED lights, and security and surveillance equipment do not currently require the higher bandwidth offered by category 6A/class E_A cabling. However, because advancements in technology could ultimately require higher bandwidth, category 6A/class E_A or higher cabling is recommended for future proofing. Security cameras, LED lights and other devices can also be powered over the structured cabling infrastructure via remote powering technology such as power over Ethernet (PoE) or power over HDBaseT (POH), which produces temperature rise in cable bundles and can increase insertion loss and result in premature aging of jacketing materials.



To offset insertion loss caused by heat build-up, overall channel length may need to be reduced (i.e., derating). To prevent heat build-up within cable bundles, the size of the bundles may also need to be reduced. To better support PoE, it is recommended to use cables that are more thermally stable. For example, cables with larger gauge conductors exhibit less heat rise, which is why category 6A/class E_A cabling has less temperature rise than category 5e/class D and category 6/class E cabling as clearly shown in the graph.

It is also worth noting that shielded cables exhibit about half the heat build-up of unshielded cables because metal shields have a higher conductivity to dissipate heat than jacketing materials. As a result, category 6A/class E_A shielded cabling at a minimum is recommended for devices being remotely powered via PoE or POH as it reduces restrictive bundling and insertion loss derating. Additionally, cables rated for higher operating temperatures such as Siemon's solid shielded category 6A/class E_A cabling and category 7A/class F_A cables that are qualified for mechanical reliability up to 75°C are even more thermally stable and offer better heat dissipation.

SUMMARY

When considering the latest technologies and applications, as well as the fact that all EIA/TIA, ISO/IEC and BICSI industry standards recommend a minimum of Category 6A/class E_A for all new installations it is clear that the time has come to shift away from considering category 5e/class D and category 6/class E cabling for any new installation. Further, with convergence and more devices than ever connecting to and being powered by a single cabling infrastructure, it is more flexible and cost effective to deploy one type of cabling that can support all current and emerging technologies. The reasons to always deploy a minimum of category 6A/class E_A for all new installations are clear:

- Category 6A/class E_A offers enhanced flexibility for converged cabling infrastructures to support a wider range of current and future devices and systems, while enabling less costly moves, adds and changes.
- Category 6A/class E_A is required to take full advantage of the latest Wi-Fi 6 (802.11ax) technology and is the only media to guarantee support for Wi-Fi 5 (802.11ac). It is also required to meet the bandwidth and greater distance requirements of wireless DAS systems, and to leverage higher speeds expected with 5G cellular.
- Category 6A/class E_A is required to support SDVoE and HDBaseT audiovisual applications to the full 100-meter distance, and shielded category 6A/class E_A is recommended due to alien crosstalk concerns in these applications.
- Category 6A/class E_A shielded cables qualified to a higher operating temperature of 75°C (167ºF) better supports PoE and POH powered devices such as WAPs, security cameras, LED lights and digital displays.
- Category 6A/class E_A cabling is the minimum recommended cabling by industry standards.

Siemon's Z-MAX Category 6A Shielded System features the highest performance margins across all transmission parameters and the fastest and most reliable termination process. The end-to-end Z-MAX Category 6A F/UTP shielded system includes cable, outlets, modular cords, patch panels, trunking cable assemblies, work area solutions and the Z-PLUG® field-terminated plug – everything you need to support today's and tomorrow's converged LAN technologies. For more information, visit **www.siemon.com/z-max**

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