

# THE ABCS OF CABLING STANDARDS

There are two primary organizations dedicated to developing and setting structured cabling standards. In North America, standards are issued by the Telecommunications Industry Association (TIA), which is accredited by the American National Standards Institute (ANSI). The TIA was formed in April 1988 after a merger with the Electronics Industry Association (EIA). That's why its standards are commonly known as ANSI/TIA/EIA, TIA/EIA, or TIA.

Globally, the organizations that issue standards are the International Electrotechnical Commission (IEC) and the International Organization for Standardization (ISO). Standards are often listed as ISO/IEC. Other organizations include the Canadian Standards Association (CSA), CENELEC (European Committee for Electrotechnical Standardizations), and the Japanese Standards Association (JSA/JSI).

The committees of all these organizations work together and the performance requirements of the standards are very similar. But there is some confusion in terminology.

The TIA cabling components (cables, connecting hardware, and patch cords) are labeled with a “category.” These components together form a permanent link or channel that is also called a “category.” The ISO/IEC defines the link and channel requirements with a “class” designation.

But the components are called a “category.” Follow?

### **The Standards**

**Category 5 (CAT5)**, ratified in 1991, was the de facto standard for 100-Mbps networks during the 1990s. It is no longer recognized by the TIA/EIA for use in data networking.

**Category 5e (CAT5e)–ISO/IEC 11801 Class D**, ratified in 1999, is designed to enable twisted-pair cabling to support full-duplex, 4-pair transmission in 100-MHz applications. The CAT5e standard added more headroom and established new requirements to support Gigabit Ethernet over a worst case four-connector channel. These include stricter specs for Near-End Crosstalk (NEXT) and Return Loss (RL). The standard also introduced the required measurements for Power Sum Near-End Crosstalk (PS-NEXT), Equal-Level Far-End Crosstalk (EL-FEXT), and Power Sum Equal-Level Far-End Crosstalk (PS-ELFEXT). CAT5e is

still used in many organizations, although it is no longer recognized for new installations.

**Category 6 (CAT6)–Class E** has a specified frequency of 250 MHz, significantly improved bandwidth capacity over CAT5e, and easily handles Gigabit Ethernet transmissions. In recent years, it has been the cable of choice for new structured cabling systems. CAT6 supports 1000BASE-T and, depending on the installation, 10GBASE-T (10-GbE).

10-GbE over CAT6 introduces the problem of Alien Crosstalk (ANEXT), the unwanted coupling of signals between adjacent pairs and cables. Because ANEXT in CAT6 10-GbE networks is so dependent on installation practices, TSB-155 qualifies 10-GbE over CAT6 up to 55 meters and requires it to be 100% tested. To mitigate ANEXT in CAT6, it is recommended that you unbundle the cables and increase the separation between the cables.

**Augmented Category 6 (CAT6a)–Class Ea** was ratified in February 2008. This standard calls for 10-Gigabit Ethernet data transmission over a 4-pair copper cabling system up to 100 meters. CAT6a extends CAT6

electrical specifications from 250 MHz to 500 MHz. It introduces the ANEXT requirement. It also replaces the term Equal Level Far-End Crosstalk (ELFEXT) with Attenuation to Crosstalk Ratio, Far-End (ACRF) to mesh with ISO terminology. CAT6a provides improved insertion loss over CAT6. It is a good choice for noisy environments with lots of EMI. CAT6a is also well-suited for use with PoE+.

CAT6a UTP cable is significantly larger than CAT6 cable. It features larger conductors, usually 22 AWG, and is designed with more space between the pairs to minimize ANEXT. The outside diameter of CAT6a cable averages 0.29–0.35" compared to 0.21–0.24" for CAT6 cable. This reduces number of cables you can fit in a conduit. At a 40% fill ratio, you can run three CAT6a cables in a 3/4" conduit vs. five CAT6 cables. There are two types of CAT6a cable, UTP and F/UTP. For a discussion of the differences, see the white paper in our Resources section.

**Category 7 (CAT7)–Class F** was published in 2002 by the ISO/IEC. It is not a TIA recognized standard. Class 7 specifies minimum performance standards for fully shielded cable (individually shielded pairs surrounded by an overall shield) transmitting data at rates up to

600 MHz. It offers greater capacity for demanding applications such as broadband video. It's also well suited for applications where fiber optic cable would typically be used—but it costs less. Because each CAT7 pair is fully shielded, it's ideal for areas prone to EMI/RFI. Class 7 cable offers two connector styles: the standard RJ plug and a non-RJ-style plug and socket interface specified in IEC 61076-2-104:2.

**Category 7a (CAT7a)–Class Fa** is currently in ISO standards for channel performance in Amendment 1, recently component performance has been ratified in Amendment 2. The formal names are ISO 11801 Amendment 1 (2008) and ISO 11801 Amendment 2 (2010). Class Fa cable is a fully shielded cable that extends frequency from 600 MHz to 1000 MHz. It can easily handle 10-GbE and offers users a lifespan of 15 years or more. It has even been discussed that Class Fa cable is the future for 40GBASE-T or more.

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