

Cables Clarified

In [our last](#) article, we looked at the world of wireless networks. This month, we return to our most basic product: cables. While there is certainly a wide variety of cables and standards out there, all cables share certain properties, and a good understanding of cable construction and technical designations is always helpful.

Generally speaking, almost all cables fall into one of two basic classes, which we will refer to as "data cables" and "coaxial cables." This article will look at both groups, how they are constructed, and what the various specifications mean.

Data Cabling

Data cabling, in various forms, includes a wide range of computer cables, including serial, USB, SCSI, networking, and even phone cords. Generally speaking, data cables all have a similar, relatively straightforward, construction. They are comprised of one or more insulated copper wires surrounded by a PVC jacket, with connectors attached at either end. The signal travels through the wires inside in the form of a low-voltage electrical current. To prevent interference, an aluminum foil shield is often wrapped around the wires inside the jacket.

Here are some of the many connectors you will see on data cables:

DB-9 (serial)



DB-25 Female (serial)



DB-25 Male (parallel)



USB (A type)



RJ-45 (network)



RJ-11 (phone)



HD-15 (VGA)



MiniDin 6 (PS/2 keyboard)



HPDB68 (SCSI III)



Being able to recognize different connectors and knowing their names can be very helpful when trying to order cables. For example, a "USB cable" could have any one of four different connectors on it, depending on how it will be used. A "SCSI III cable" gets even worse. Therefore, it is important to know the technical name of each connector that is on the cable.

Beyond the connectors, of course, is the wiring inside. Here again, it is helpful to be able to read the often cryptic technical descriptions and designators.

Here is a typical line you might find on a spec page or stamped on the outer jacket.

9C 28AWG + DRAIN 26AWG WIRE, W/AL-FOIL, BEIGE OUTER PVC JACKET
UL2464 80c 300V E219485.

The first designation is 9C. That indicates that there are 9 connected wires inside this cable (a typical 9-pin serial cable). Each of these wires is 28AWG. AWG, or "American Wire Gauge", is a standard measurement classification for copper wiring; the lower the number, the thicker the cable. 28 AWG is common for computer data cables, although some cables require a slightly thicker wire (network cables, for example, require 24 AWG). The description above also indicates a "drain wire" that is 26AWG. In essence, this is a ground wire.

The designation "w/AL-Foil" indicates that there is an aluminum foil shield around the wires, again, a common construction with computer data cables (but less common in phone or network cables).

The "UL2464" style mark (also often written as "AWM 2464") indicates that this is a wire generally designated as an "external interconnect cable". UL stands for "Underwriters Laboratories", an internationally recognized safety certification lab. Almost all electrical components on the market today are UL-certified (you can find a UL sticker on the bottom of any power strip, lamp, extension cord on the market). Following the UL style number is a rated operating temperature (this cable is rated for up to 80 degrees Celsius) and voltage rating (300V). Finally, in the example above, there's a UL file number. Generally written as a letter "E" with five or six digits following it, the presence of this number indicates that Underwriter's Laboratories has certified this manufacturer to build this style of cable; this cable is, therefore, "UL Listed." You can look up the UL certification for any file number by visiting <http://www.ul.com/> and clicking on the "Certifications" link.

Note that not all computer data cables are UL listed; the testing is expensive, and safety testing on (for example) a short USB cable may be of dubious value. However, you should look for UL certification for cabling (such as network, phone, or cable TV) that you would run inside walls, as well as high-voltage electrical cables such as power cords and extension cords.

Coaxial Cables

Many consumers, when they think of "coaxial cable", tend to think it refers only to the cabling used by cable and satellite companies for cable TV. However, this is only one example of coaxial cable. Coax cable is defined as any cable with the following properties:

- A center copper conductor
- Insulation covering the center conductor, called a "dielectric"
- A braided copper shield surrounding the dielectric
- An optional foil shield
- An outer jacket

Each of these components plays a specific role. Let's take a look at each in more detail:

Center Conductor:

At the heart of a coaxial cable is a center conductor. Typically constructed of either pure copper (in higher-end cables) or copper-coated steel or aluminum (in less-expensive cables), the center conductor is responsible for transmitting the cable's signal. As such, it must meet certain electrical properties (such as wire resistance). The rest of the cable construction is primarily designed to help the center conductor maintain its electrical integrity.

Dielectric Insulator:

The dielectric insulator's purpose is two-fold; first, it acts as an insulator between the center conductor and the outer copper / foil shielding. Second, it helps physically hold the center conductor in the center of the cable. This is important, as signal loss can occur if the center conductor strays too close to the outer area of the cable. Various materials are commonly used for the dielectric. A few of the more common materials, in order of quality (from best to worst), are below:

- Foamed Polyethylene (FPE)
- Teflon
- Polyethylene (PE)
- Polypropylene (PP)
- Polyvinylchloride (PVC)

When reading specifications on coaxial cables, you may see references to the dielectric constant. The closer this number is to 1.0, the better. Foamed Polyethylene (FPE), for example, generally has a dielectric constant somewhere around 1.5, while PVC's dielectric constant is around 3.0 to 4.0. (Foamed PE basically uses gas, often nitrogen, to create gas bubbles in the material to lower the dielectric constant. Marketing literature that refers to "gas-injected dielectric" usually indicates the use of FPE. It is one of the best dielectric materials in common use.)

Braided Copper Shield:

Long copper cables have a tendency to act like antennas, picking up stray signals from the environment. These unwanted signals, known as "interference", disrupt the signal that the cable is supposed to be carrying. Interference tends to come in two different flavors: electromagnetic interference (known as EMI) and radio frequency interference (RFI). EMI interference is often caused by heavy power lines, cell phone signals, etc. A braided copper shield protects the signal from EMI interference.

When looking at cable specs, the braided shield will often be expressed in a percent coverage, which often ranges anywhere from 30% to 95% coverage. The higher the coverage, the better the protection.

Foil Shield:

Although not always present on coaxial cables, the foil shield serves to protect from RFI interference. Foil shields are almost always made out of aluminum foil, and simply wrap around the inner parts of the cable. Unlike braided copper shields, which have a percent coverage, foil shields always cover 100%.

Outer Jacket:

The outer jacket, generally made out of flexible PVC (polyvinyl chloride), serves primarily to hold the cable together and protect it from the elements.

Examples of Coaxial Cables:

As mentioned earlier, there are many different types of coaxial cables on the market. The following are all examples of Coaxial cables:

RG58 BNC Cable:

Also called "10 Base 2" or "thinnet", this cable has traditionally been used in older networks. Although still in use, it has been made almost obsolete by RJ45 Category 5E copper network cables.

RG59 Cable:

One of the most common video cables in use today, RG59 cable is a 75-ohm video cable that has traditionally been used for analog Cable TV or video applications. Typically fitted with F-pin ends (for Cable TV) or BNC ends (used in professional video applications). Recently, RG59 cable has started to be phased out in favor of RG6 cable.

RG6 Cable:

RG6 cable is differentiated from RG59 cable by having a thicker copper center conductor. RG6 is primarily being used today for satellite and digital cable TV, where higher frequencies are required that RG59 cable cannot support. RG6 cable is most often sold with F-pin connectors for cable or satellite applications.

Composite Video:

The ubiquitous yellow RCA connector on the back of televisions, VCRs, and even DVD players is hooked up by a 75-ohm coaxial cable terminated with RCA plugs. Although sometimes constructed from RG59 spec cable, RCA video cables often are built to a specification that allows for a more flexible cable with better performance at lower video frequencies than typical RG59 cable.

Component Video:

Actually, three separate coaxial cables are generally molded together to form component video cables. Like composite video, they tend to be designed for flexibility and performance at lower video frequencies. Component video is most often found on DVD players and newer televisions.

Super VGA cables:

Technically, SVGA cables traditionally include three "mini coaxial" cables (for red, green, and blue signals) inside (along with additional wires for other required signals). The internal coaxial cables inside an SVGA cable allow the cable to deliver higher-resolution pictures over longer distances than older 15-wire VGA cables.