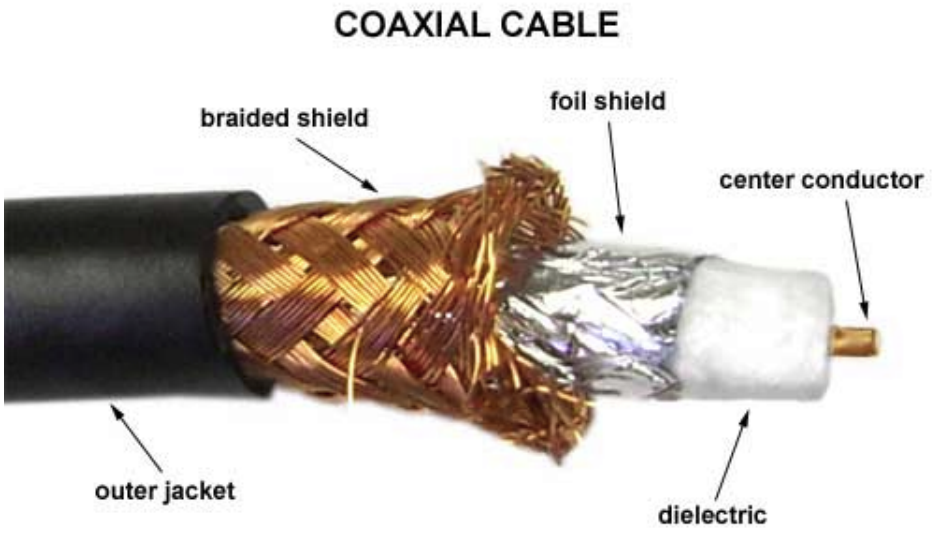
Coaxial Cables

The Cable

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. In this article we will breakdown what makes up a typical coaxial cable as well as go over a few common types.



Coax cable is defined as any cable with the following properties:

A center conductor
Insulation covering the center conductor, called a "dielectric"
An optional foil shield
A braided shield surrounding the dieletric
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 braided / 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 dialetric 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 dialetric 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 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 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 shields, which have a percent coverage, foil shields always cover 100%.

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

Connectors

There are many different connectors that can terminate a coaxial cable. We will now go over a few of the more common connectors.

RCA: The RCA connector was developed in the early 1940s by the Radio Corporation of America to connect record players to amplifiers. The same basic connector is still in wide use today, and it represents a large portion of the connectors used for home theater cables. The fact that they are so easy to connect and disconnect makes RCA connectors a popular choice for home theater applications. RCA cables can be used for audio, video and digital audio. The biggest drawback with RCA devices is that each signal is sent on a different cable. For example, a single RCA-terminated coax cable only carries the left audio channel, or only the right, etc. Three RCA cables are needed for high-def video, along with two more for the audio. This makes for a mess of cables behind your equipment. This is one reason that has made HDMI cables so popular. Attaching RCA connectors can be a bit more time-consuming as, with some types of RCA connectors, the coaxial cable's wires need to be soldered to the connector after stripping the cable with a stripping tool . RCA connectors come in solder-on, weatherproof and compression styles. A special tool is required for compression connectors, and a soldering iron is needed for solder-on connectors.

BNC: The BNC connector has two bumps on the female side that slide into corresponding grooves on the male side. The connector is then rotated a quarter turn to lock into place. BNC connectors are widely used in commercial applications such as closed circuit television systems, where its ability to lock in place (unlike the slip-on RCA) makes BNC cables a perfect fit. BNC connectors come in a wide variety as well, including twist-on and weatherproof connectors.

F-Pin: The F-pin connector is probably the most recognized of the coaxial connectors as it's been in use with televisions and VCRs for decades. The familiar threaded connector makes for a secure connection that will not easily slip out of a device. This connector is also one of the easiest to attach to a coax cable as it does not require any soldering. Many different types are available including twist-on, crimp-on and compression. For outdoor use, weatherproof connectors are also available to create an

F-Pin cable with a secure connection and loss-less signal transfer. Many manufacturers are doing away with the F-pin connector on their TVs. This is because that little F-pin connector is actually part of a device called a tuner. The tuner is what sifts through the signal coming through the cable and separates all of the TV channels. Since so many people change channels using a cable box or satellite receiver, these tuners are becoming obsolete. This can pose a problem for folks who have standard cable TV that still requires the TV to have an F-pin connector. Unfortunately, a small adapter or special cable won't do the trick. A tuner is required. There are a couple ways to do this. One way is to use an old VCR. VCRs have built in tuners. The other way is to use a device called an RF demodulator . A demodulator is essentially a TV tuner that will let you change the channels.

RF DEMODULATOR

Crimp-on, solder or twist-on?

There are 3 main styles of each connector available on the market. With each of these styles the coaxial cable must be stripped in such a way that a portion of each component of the cable is exposed:

Crimp: This encompasses compression as well as crimping connectors. Crimping connectors slide onto the cable and then pinche the base of the connector onto the outer jacket. The compression connectors require a special tool to press the cable into the connector and pinch it all at the same time. Weatherproof connectors are most often compression style, where the connector seals to keep water out.

Solder: This style, like its name implies, requires the center conductor and the braided shield to be soldered to parts of the connector. These offer the best connection, but are more labor-intensive to install.

Twist-on: These are for the consumer that just wants a quick and easy solution. Especially handy if you are only trying to fix a single broken cable, these don't require any solder or tools. Simply twist the connector onto the cable and you're done. They're not the best for durability, but they get the job done.

Types of Coaxial Cable

RG58: Largely used in the commercial security camera industry, RG58 cable is a low profile, inexpensive choice for large projects where a high-bandwidth cable is not needed. Most often terminated with BNC connectors, this type of cable can also be found attached to testing equipment and 2-way radio systems.

RG59: Once the standard for cable TV, RG59 cables are still found packaged with VCRs and televisions. RG59 was a good low-cost option for cable TV for years until the cable industry recently began its move into digital cable television, which needs a thicker cable. Modern satellite television also requires a higher-bandwidth-capable cable and so RG6 coaxial cable is becoming much more popular, making RG59 no longer the industry standard.

RG6 : 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.

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