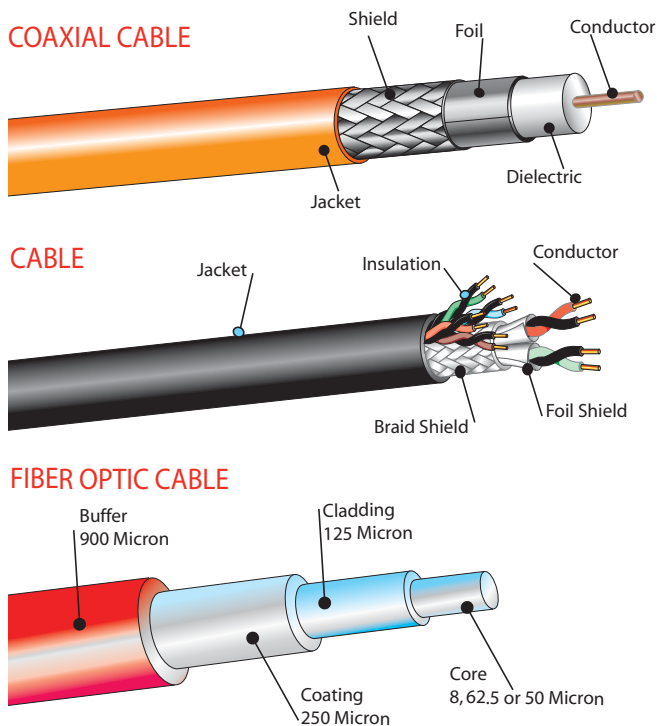


The know how. Understanding cable design, coaxial design and fiber optic design is pages away. You can also find the recommended connectors, tools and much more technical information that will help you understand cable design and implementation. We want to make your installation free from problems. If you are looking for more information on termination techniques, connector selection, or other technical data, see our web-sites. www.westpenn-wpw.com and www.westpenn-training.com.



MINI INDEX

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Basic Cable Construction

A cable type is determined by the specifications of the system installed, basic electronic principles, and environment and regulatory agencies. These various criteria dictate the type of conductor(s), gauge of wire, type of insulation, twisted or cabled construction, type of jacket and if any shielding is required. A basic understanding of cable construction should be helpful in selecting and installing the proper cable for a particular system.

Conductors

Conductors for electronic cables can vary greatly from stranded conductors for maximum flexibility to copper covered steel which provides a stronger cable that will withstand a greater physical strain than copper. The American Society For Testing and Materials (ASTM) standards are followed for all of West Penn Wire conductor material. The ASTM standard defines standard requirements such as tensile strength, elongation, resistivity, dimensions, permissible variations, finish, inspection, and testing.

Conductor Material

There are several types of material that conduct electricity well (aluminum, nickel, gold, silver). However, copper is the most popular due to its excellent conductivity compared to other material cost. West Penn Wire uses a variety of conductors in our cable. Material used can be bare copper, tinned copper, and copper covered steel. The conductor can consist of solid or stranded construction. The type of conductor selected is determined by the application the cable will be used for.

Solid Conductors

A copper rod provides a solid conductor for a wire. A solid conductor offers lower cost and is easily formed to any shape desired. A solid conductor does not have much flexibility and may break if flexed too much in one place. For these reasons, a solid conductor is best suited for use in a fixed or permanent installation.

Stranded Conductors

By combining several strands together a stranded conductor can be formed. A stranded conductor is easy to pull, flexible, and is less likely to break if subjected to frequent bending. The finer the strands and the more strands used to assemble a conductor, the more flexible the conductor becomes. Therefore, stranded cable is ideal for installations where frequent movement of the cable is required.

Bare and Tinned Conductors

Conductors can be either tinned or plain bare copper. Most electronic connectors today are designed to be used with bare copper. In cables that are terminated with soldered connectors, tinned plated conductors can help in soldering the wire to the connector.

Copper-Covered Steel

This type of conductor uses a steel conductor covered with copper. This type of conductor make-up is used for RF applications that require a cable to withstand added tension. The steel provides added strength, and the copper provides good conductivity for higher RF signals. This type of conductor is not good for low frequency transmission.

Conductor Size (AWG)

Conductors are measured in size/diameter through a gauging system. There is no industry standard. However, the American Wire Gauge (AWG) system has been generally accepted as the standard in the wire and cable industry. The sizes are derived through a logical, geometric progression. The smaller the number, the larger the wire, and likewise, the larger the number the smaller the wire. The AWG system is important because it provides a standard reference for comparison of various conductor materials based technically on the cross-sectional area of the wire.

Example: A #22 AWG wire is smaller than a #18 AWG wire.
A #14 AWG wire is larger than a #24 AWG wire.

Dielectric

Insulation is a highly resistive material that is applied to the conductor to resist the flow of electric current to other conductors and provide protection to the conductor. There are many types of insulation materials used and each has its advantages and limitations. The type of insulation select-

ed is based upon the application of the cable. Insulation is also referred to as the dielectric of a cable.

Dielectric Strength

This is the amount of voltage that insulation can withstand before it "breaks down". The material type and thickness determines the insulation's dielectric strength. The application and environment the cable will be used will determine the dielectric strength required.

Protection

Insulation also must provide flame retardancy in case of fire, provide resistance to abrasion and provide protection from electrical shock.

Dielectric Categories

Electrical insulations can be divided into four categories. Thermoplastics, Thermosets, Fluoropolymers, and Elastomers. Insulations are normally applied by an extrusion process. The extrusion process forces pre-heated plastic through dies which forms a continuous covering over the conductor. This is usually called the primary insulation.

Thermoplastics

Thermoplastic compounds are compounds that are softened by mechanical pressure and applied heat, and maintain their altered shape when cooled and/or the mechanical force is removed.

Polyvinylchloride (PVC)

This is probably the most widely used insulation for low voltage insulation. This compound is offered in a variety of formulations. Through different manufacturing processes, PVC can be made to resist sunlight, ozone, flames, oil, and most solvents. PVC insulation is fairly consistent, allowing for bright colors, and is very flexible and easy to strip.

Polyethylene

This compound offers excellent electrical properties such as low capacitance and low loss of a signal. Polyethylene is lightweight, water-resistant, and fairly chemical resistant. Polyethylene offers good abrasion resistance and is somewhat harder to strip than PVC.

Polypropylene

This material is similar to polyethylene as to electrical properties providing low loss properties with less material. Polypropylene also provides excellent mechanical properties and is very abrasion resistance although stiffer than Polyethylene. Of the four compounds listed in this category, polypropylene is the most difficult to strip.

Fluoropolymers

These compounds are commonly used for high temperature applications and areas such as plenums that require flame retardancy and low smoke characteristics. The NEC mandates the use of these types of materials in ducts, plenums, and other space used for environmental air. Using these types of compounds will allow for reduced cost in installation because there is no need to install conduit.

Halar®

A premium insulation with excellent electrical and mechanical properties. This compound offers a stable low dielectric constant over a wide range of frequencies. It is also chemical resistant, abrasion and impact resistant, and can withstand high temperatures.

Teflon®

A premium insulation with excellent electrical and mechanical properties. This compound is widely used as a solid or foamed dielectric, allowing for an extremely low loss cable. This compound can withstand high temperatures and has low flame and smoke characteristics.

Copolymer

Polyvinylidene Fluoride (PVDF). This compound has rather poor electrical properties. However, this compound has a very high temperature rating and excellent mechanical properties such as cut-through resistance, corrosion resistance, abrasion resistance, and high tensile strength.

Elastomers

This is a group of compounds that are "rubber-like" in appearance. They can be compressed or even stressed and will snap back to their original shape with the release of tension.

TPE - Thermo-Plastic Elastomer

Shielding

There are basically three types of shielding techniques: foil shielding, braid shielding, and combination shielding. Shielding is utilized to prevent radiation and signal loss of high frequencies used in electronic circuits and to reduce EMI/RFI interference. However, shielding tends to increase the overall capacitance of the cable.

Foil Shield

Foil shields are usually made of a thin layer of aluminum bonded to a polyester film. A foil shield allows for 100% coverage if applied with an appropriate overlap construction. A drain wire is used in conjunction with the foil shield to connect the shield to ground. This permits extraneous signals to be "drained off" to ground. It is very good in reducing Radio Frequency (RF) interference, but does not perform as well in blocking Electro Magnetic Interference (EMI). Foil shields do provide easy termination and low cost protection, although fragile (low tensile strength and impact resistance).

BiFoil

This type of foil shield allows for added protection by increasing the metallic coverage without adding increased thickness to the diameter of the cable. Mainly used in coaxial cable, the BiFoil shield is an aluminum-polyester-aluminum tape with 100% coverage.

Bonded BiFoil

This type of foil shield has the same aluminum-polyester-aluminum construction as the BiFoil shield, but is also bonded to the dielectric with adhesive. This allows for better shielding capabilities as well as providing excellent ease of stripping because the foil does not pull away from the dielectric.

Braid Shield

Braided shields can be constructed in various coverages, 95–98% being about the highest coverage available with this type of shielding. The

Basic Cable Construction

material can be bare copper, tinned copper, or aluminum. Depending on the amount of coverage, braid shields reduce EMI interference well, but are not as reliable in the RF range. Braid shields also allow for a much lower shield D.C. resistance than foil shields.

Combination Shielding

This technique offers the best of both types of shielding. First, a foil shield is applied around the primary conductors and then a braided shield is placed on top of the foil shield. This allows for greater coverage in blocking both EMI and RFI signals while allowing for a low D.C. resistance in the shield. There are also various versions of this basic technique such as triaxial and quad shielding.

Foil/Braid

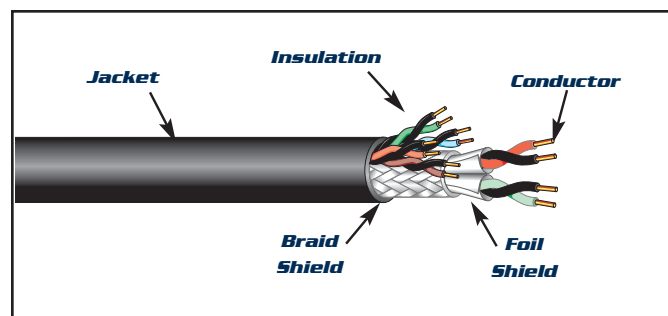
This is the most common type of combination shielding. The aluminum foil is wrapped around the cabled or twisted primaries and then a braided shield is applied over top of the aluminum foil. The metallic side of the foil shield is usually in contact with the braid. The braid is then used for shielding as well as ground termination eliminating the need for a drain wire.

Triaxial - A Braid-Separator-Braid combination shield construction.

Quad - A Foil-Braid-Foil-Braid combination shield construction. This provides for maximum shielding against EMI/RFI interference.

Jackets

The cable jacket is for strength, integrity, and overall protection of the primaries and/or shield inside the jacket. There are a variety of jacketing materials that are used in cable construction. Standard compounds and special variations of these compounds can be used in making the jacket. Selecting a cable with the proper jacket for the environment it will be installed in is an important consideration. Environmental parameters that should be considered include temperature variations, chemical reactance, sunlight resistance, mechanical and abrasion impact. Jackets are usually made up of the same material as insulation used on primaries. To learn more about the various compound properties, please refer to the Insulation Section.



Coaxial Cable Construction

This section provides an introduction to understanding coaxial cable construction. These fundamentals will allow you to understand the basic materials that are used in the construction of a coaxial cable. A coax cable type is determined by the specifications of the system installed, basic electronic principles, environment, and regulatory agencies. These various criteria dictate the type of conductor, gauge of wire, type of insulation, shielding, and type of jacket. A basic understanding of coaxial cable construction should be helpful in selecting and installing the proper cable for a particular system.

Conductors

Conductors for coaxial cables can vary greatly from stranded conductors for maximum flexibility to copper covered steel which provides a stronger cable that will withstand a greater physical strain than copper. The American Society For Testing and Materials (ASTM) standards are followed for all of West Penn Wire conductor materials. The ASTM Standard defines standard requirements such as tensile strength, elongation, resistivity, dimensions, permissible variations, finish, inspection and testing.

Conductor Material

There are several types of material that conduct electricity well (aluminum, nickel, gold, silver). However, copper is the most popular due to its excellent conductivity compared to other material cost. West Penn Wire uses a variety of conductors in our cable. Material used can be bare copper, tinned copper, and copper covered steel. The conductor can consist of solid or stranded construction. The type of conductor selected is determined by the application the cable will be used for.

Solid Conductors

A copper rod provides a solid conductor for a wire. A solid conductor offers lower cost and is easily formed to any shape desired. A solid conductor does not have much flexibility and may break if flexed too much in one place. For these reasons, a solid conductor is best suited for use in a fixed or permanent installation.

Stranded Conductors

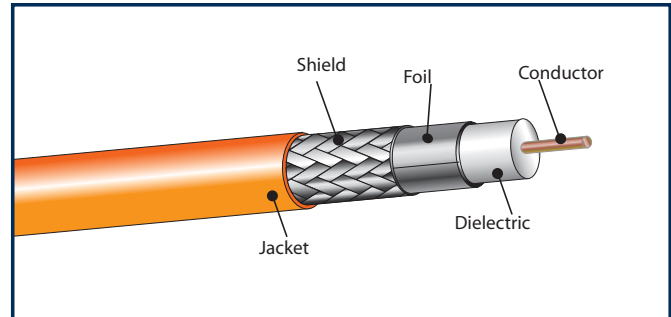
By combining several strands together, a stranded conductor can be formed. A stranded conductor is easy to pull, is flexible and is less likely to break if subjected to frequent bending. The finer the strands and the more strands used to assemble a conductor the more flexible the conductor becomes. Therefore, stranded cable is ideal for installations where frequent movement of the cable is required.

Bare and Tinned Conductors

Conductors can be either tinned or plain bare copper. Most electronic connectors today are designed to be used with bare copper. In cables that are terminated with soldered connectors, tinned plated conductors can help in soldering the wire to the connector.

Copper-Covered Steel

This type of conductor uses a steel conductor covered with copper. This type of conductor make-up is used for RF applications that require a cable to withstand added tension. The steel provides added strength and the copper provides good conductivity for higher RF signals such as CATV. This type of conductor is not good for low frequency transmission, such as CCTV.



Dielectric

A coaxial cables dielectric is a highly resistive material that is applied to the conductor to resist the flow of electric current to the shield. It also sets up a cables electrical characteristics. There are several types of insulation materials and constructions used and each has its advantages and limitations. The type of insulation selected is based upon the application of the cable. Insulation is also referred to as the dielectric of a cable.

Solid Dielectric Construction

A solid dielectric construction uses a process of extruding a solid material over the center conductor of a coaxial cable. It provides good electricals, added cable strength and uniformity of termination. However, a solid dielectric provides poorer electricals and less velocity of propagation than cellular designs.

Foamed (Cellular) Dielectric Construction

A cellular dielectric construction uses a process of extruding a cellular material over the center conductor of a coaxial cable. This improves the dielectric constant of the dielectric material which improves the electricals of a coaxial cable. The dielectric material exhibits a lower capacitance, which in turn provides lower loss. This dielectric material also provides a higher velocity of propagation. With the advent of the "Gas Injection" process, cable manufacturers are able to improve their cellular design and provide a lower loss cable with higher velocity of propagation values.

Dielectric Materials

Polyethylene

This compound offers excellent electrical properties providing for low loss of a signal. However, it can only be used on a non-plenum rated cable because the compound has a poor flame and smoke retardancy.

Teflon® (FEP)

A premium insulation that provides excellent electrical and mechanical properties. This compound is widely used as a dielectric for coaxial cables providing low loss and the ability to withstand high temperatures and also having low flame and smoke characteristics.

Coaxial Cable Construction

Shielding

There are basically three types of shielding techniques:

1. Foil Shielding, 2. Braid Shielding, 3. Combination Shielding

Shielding is utilized to prevent radiation and signal loss of high frequencies used in electronic circuits and to reduce EMI/RFI interference. However, shielding tends to increase the overall capacitance of the cable.

Foil Shield

Foil shields are usually made of a thin layer of aluminum bonded to a polyester film. A foil shield allows for 100% coverage if applied with an appropriate overlap construction. It is very good in reducing Radio Frequency (RF) interference, but does not perform as well in blocking Electro Magnetic Interference (EMI). Foil shields do provide easy termination and low cost protection, although they are fragile (low tensile strength and impact resistance).

BiFoil

This type of foil shield allows for added protection by increasing the metallic coverage without adding increased thickness to the diameter of the cable. Mainly used in coaxial cables, the BiFoil shield is an aluminum-polyester-aluminum tape with 100% coverage.

Bonded BiFoil

This type of foil shield has the same aluminum-polyester-aluminum construction as the BiFoil shield, but is also bonded to the dielectric with adhesive. This allows for better shielding capabilities and also provides excellent ease of stripping and termination because the foil does not pull away from the dielectric.

Braid Shield

Braided shields can be constructed in various coverages (95% - 98% being about the highest coverage available with this type of shielding). The material can be bare copper, tinned copper, or aluminum. Depending on the amount of coverage, braid shields reduce EMI interference well, but are not as effective in the RF range. Copper braided shields also allow for a much lower shield D.C. resistance than foil shields.

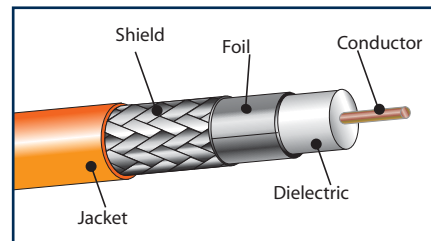
Combination Shielding

This technique offers the best of both types of shielding. First a foil shield is applied around the dielectric and then a braided shield is placed on top of the foil shield. This allows for greater coverage in blocking both EMI and RFI signals. There are also several versions of this basic technique such as triaxial, tri-shielding and quad shielding.

Foil/Braid

This is the most common type of combination shielding. The aluminum foil is placed around the dielectric and then a braided shield is applied over top the aluminum foil. The metallic side of the foil shield is usually in contact with the braid. The braid is then used for shielding as well as ground termination eliminating the need for a drain wire. There are various types of shieldings offered on West Penn Wire coaxial cable:

1. Quad Shield - A Foil-Braid-Foil-Braid combination shield construction. This provides maximum shielding against EMI/RFI interference.
2. Tri-Shield - A Foil-Braid-Foil combination
3. Triaxial - A Braid-Separator-Braid combination shield construction.



Jackets

The cable jacket is for strength, integrity, and overall protection of the other components inside the jacket. There are a variety of jacketing materials that are used in cable construction. Standard compounds and special variations of these compounds can be used in making the jacket. The selection of cable with the proper jacket and conditions of the environment the cable will be installed in are important considerations. Environmental parameters that should be considered include temperature variations, chemical reactance, sunlight resistance, mechanical and abrasion impact. Jackets are sometimes made up of the same material as insulation used on a dielectric. To learn more about various compound properties, please refer to the Dielectric Section.

Fiber Elements

Fiber optic cable provides the most advanced communication media available today. An increasing amount of fiber will be installed in the future as we find more and more uses for this technology. Fiber optic cable can support voice, data, video, and other types of transmission, and offers many advantages over standard copper circuits which we will discuss later in this section.

Core

This is the very center of the cable and is the light guiding area used for light transmission. The size of the core will determine the amount of light to be transmitted into the fiber. The larger the core, the greater the amount of light will that will be transmitted.

Cladding

The cladding surrounds the core glass and serves to refract the light back into the core. The cladding has a different index of refraction than the core so that the lightwaves are re-directed back into the core allowing continued light transmission through the fiber.

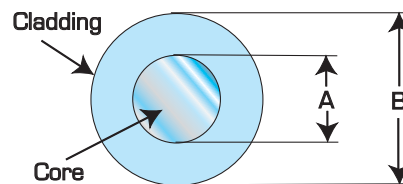
Coating

Several coatings of acrylate are usually applied to the fiber to provide tensile strength and protection to the glass fiber core.

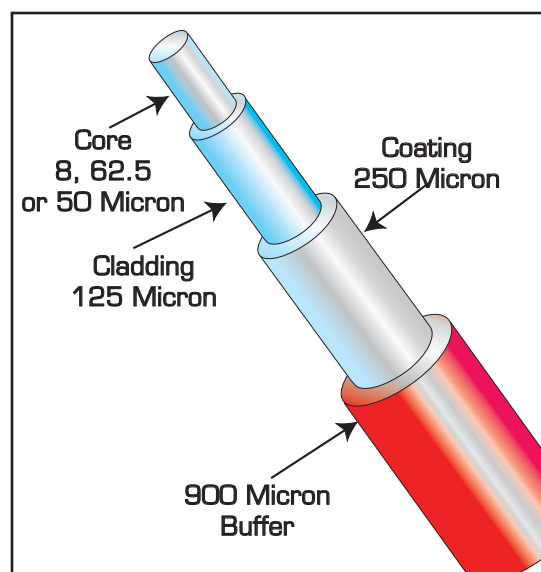
Jacket

The cable jacket works along with the aramid fibers to provide strength, integrity, and overall protection of the fiber member. There are a variety of jacketing materials that are used in fiber optic cable construction. Standard compounds and special variations of these compounds can be used in making the jacket. The jacket should be appropriate for the environmental conditions that the fiber optic cable will be subjected to. Environmental parameters that should be considered include temperature variations, chemical reactance, sunlight resistance, mechanical and abrasion resistance.

Fiber Optic Cable Construction



Buffered Fiber



Fiber Optic Cable Types

Fiber Optic Size - This is measured by comparing the core size to the cladding size. This is expressed by the core diameter and then the cladding with coating diameter.

Example: 62.5/125., 62.5 being the core diameter and 125 being the cladding with coating diameter.

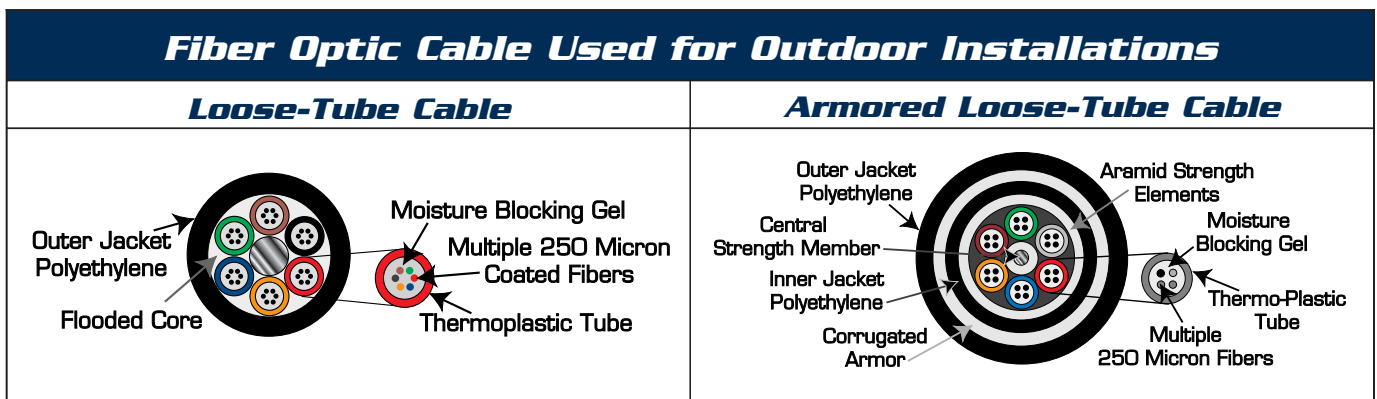
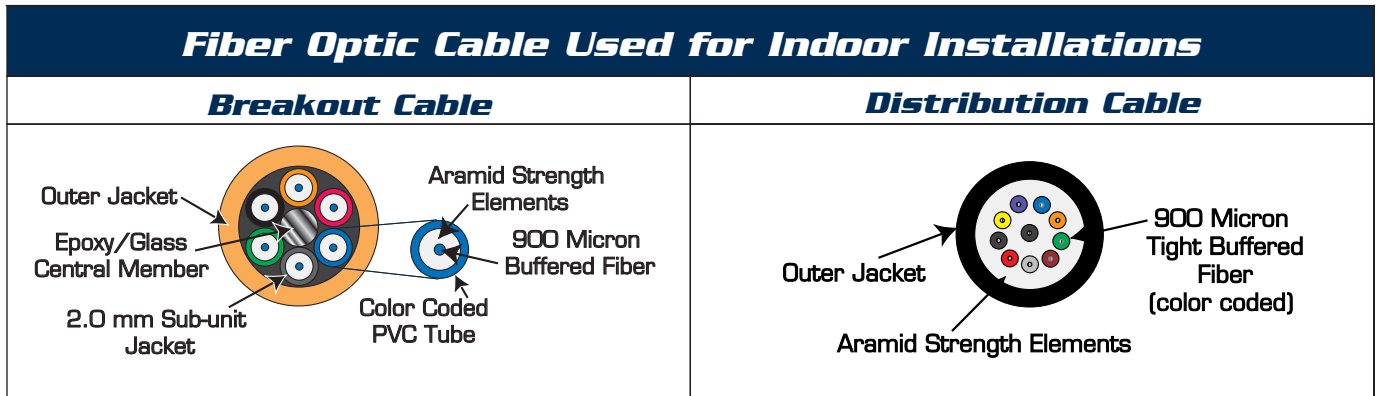
Fiber Optic Modes - There are basically two types or modes of fiber optic cable, single-mode and multimode.

Single-Mode - The core on single-mode is about 8-10 micron. This small core size allows only one mode of light to travel within the core at a time. The higher the bandwidth, the more information carrying capacity the cable has. This type of cable is good for long distances, and is often used by telephone companies for long transmissions.

Multimode - The core on multimode is about 50 - 100 micron. A larger core allows many light pulses or modes to travel through the core simultaneously. Mode overlap can occur over extremely longer distances and may cause bit errors. Multimode is best used for lengths up to 2 kilometers.



Fiber Optic Cable Construction



Fiber Optic Cable Benefits

High Bandwidth - The higher the bandwidth, the greater the information carrying capacity. A higher bandwidth allows for higher data rates, more users and longer distances.

Easy Upgrades - Fiber optic cable allows for easy future upgrades. Because a variety of transmissions can use fiber optics, it is only necessary to change the electronics. The cable can stay in place. There is no need to pull new cable in the future.

Low Attenuation - This is a reduction of signal strength or loss of light power over the length of the fiber. Fiber optic cable usually has low attenuation characteristics which allow signals to travel over longer distances without reamplification. However, attenuation can be affected by extrinsic (environmental and physical bends), intrinsic (absorption and scattering) and wavelength. The longer the wavelength, the lower the attenuation.

EMI/RFI Immunity - Since fiber optic cables transmit light instead of electrical current, immunity to electromagnetic and radio frequency interference provides better signal quality, ensuring low bit error rates and/or low noise on the system.

Security - Again, since there is no electrical signal, fiber optic transmission is almost impossible to tap into without being detected.

Lightweight - Fiber optic cable is smaller and lighter than copper cable allowing for easier installation, especially when conduit and/or raceway space is at a premium.

Understanding the National Electrical Code

The National Electrical Code (NEC) is a set of guidelines written to govern the installation of wiring and equipment in commercial buildings and residential areas. These guidelines were developed to ensure the safety of humans as well as property against fires and electrical hazards. Understanding the National Electrical Code is important from the cable manufacturer engineer and distributor, to the designer and installer. Anyone involved in specifying cable to installation of cable should be aware of the basics of the code.

In 1987, the National Electrical Code introduced some major changes that had a major impact on the wire and cable industry. The code now has listing requirements for communication and power-limited circuit cable. These requirements developed fire resistance levels for cable. The code covers initiation of fire by electronic cable as well as flame spread characteristics of the cable.

Code Organization

The NEC code book is made up of nine chapters, with each chapter divided into separate articles pertaining to specific subjects. There are about five articles that pertain to communication and power-limited cable. Each article describes wire and cable construction, material use, cable markings, installation environments and applications.

Article Categories

There are four articles that cover communication, power-limited and CATV wiring. There is another category that deals strictly with optical fiber. The following is a list of those articles and the applications or systems they cover:

Article 725 - Class 1, Class 2, Class 3, Remote-control, Signaling and Power-Limited circuits

Article 760 - Fire Protective Signaling Systems

Article 770 - Fiber Optic Systems

Article 800 - Communication Circuits

Article 820 - Community Antenna Television

Article Overviews

The NEC code can be somewhat confusing to the novice who has not studied the code in depth. In most cases, within an article, a listing will allow for a higher listed cable to be substituted for lower listed cable. Or some listings from one article may be substituted for another article listing with possible restrictions. This section will briefly cover the basis of the code to try to make things clearer for you. You should consult the NEC book for exact specifications, wording, and accuracy of the code. This is not in any way an exact excerpt from the code.

Article 725

Article 725 covers Class 1, Class 2, and Class 3 remote control and signaling cables as well as power-limited tray cable. Power-limited tray cable can be used as a Class 3 or Class 2 cable. Cable listed multi-purpose, communications, or power-limited fire protective can be used for Class 2 and Class 3 applications. A Class 3 listed cable can be used as a Class 2 cable.

Article 760

Article 760 covers power-limited fire protective cable. Cable listed as power-limited fire protective cable can also be used as Class 2 and Class 3 cable. Cable listed as communications and Class 3 can be used as power-limited fire protective cable with restrictions to conductor material and type, gauge size and number of conductors.

Article 770

Article 770 covers fiber optic cable. This article covers three general types: non-conductive, conductive, and composite. Non-conductive type refers

to cable containing no metallic members and no other electrically conductive materials. Conductive type refers to cable containing non-current carrying conductive members such as metallic strength members, etc. Composite type refers to cable containing optical fibers and current carrying electrical conductors. Composite types are classified according to the type of electrical circuit that the metallic conductor is designed for.

Article 800

Article 800 covers multi-purpose and communication cable. Multi-purpose cable is the highest listing for a cable and can be used for communication, Class 2, Class 3, and power-limited fire protective cable. Communication cable can be used for Class 2 and Class 3 cable and also as a power-limited fire protective cable with restrictions.

Article 820

Article 820 covers community antenna television and RF cable. CATV cable may be substituted with multi-purpose or communication listed coaxial cable.

Designation and Environmental Areas

Not only does listing by circuit types have to be adhered to, but installation in various environments have to also be considered. The NEC has designated four categories for various environments. These will be listed from the highest to the lowest listing. A higher listing can be used as a substitute for a lower listing.

Plenum - This listing is suitable for use in ducts, plenums, and other space used for environmental air without conduit and has adequate fire-resistant and low-smoke producing characteristics. It can also be used for applications below.

Riser - This listing is suitable for use in a vertical run, in a shaft or from floor to floor, and has fire-resistant characteristics capable of preventing the carrying of fire from floor to floor. It can also be used for applications below.

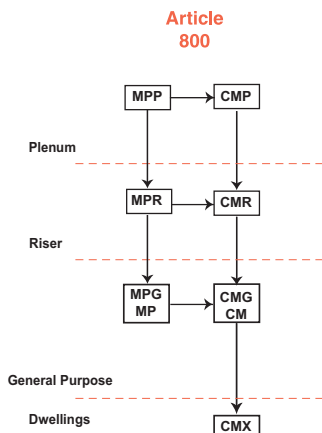
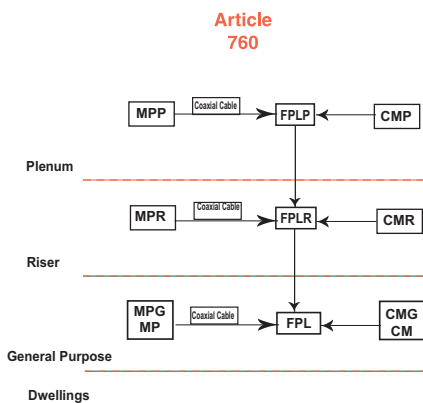
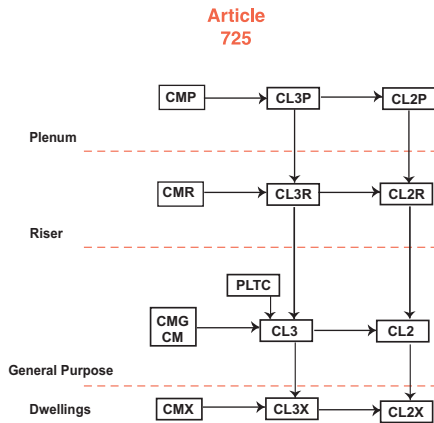
General Purpose - This listing is suitable for general-purpose use, with the exception of risers, ducts, plenums, and other space used for environmental air, and is resistant to the spread of fire. It can also be used for all applications below.

Restricted Applications - This listing is for limited use and is suitable for use in dwellings and for use in raceways and is flame retardant. Restricted use is limited to non-concealed spaces of 10 feet or less, fully enclosed in conduit or raceway, or cable with diameters less than .25" for a residential dwelling.

Understanding the National Electrical Code

National Electrical Code Substitution Chart

The following chart explains the NEC cable hierarchy and will give you a "picture" view of how this all fits together. The chart starts with the higher listed cable at the top descending to the lower listed cable. Following the arrows will allow you to find what listing can be substituted for others. Also note restrictions in which case you will have to review the NEC code in order to see if your cable is applicable.



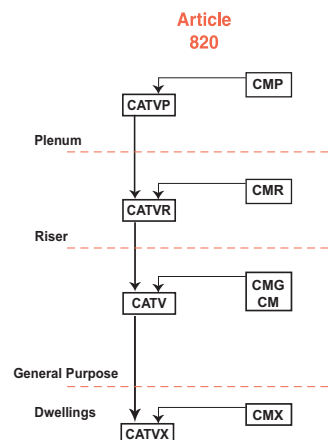
Final Considerations

The National Electrical Code is widely accepted as the suggested regulations governing the proper installation of wire and cable in the United States. The code is revised every three years to keep safety in the forefront in wire and cable manufacturing and installation. Even though the code is generally accepted, each state, county, city and municipality has the option to adopt all of the code, part of the code, or develop one of its own. The local inspectors have final authority of your installation. Therefore, the NEC is a good reference when questions arise about the proper techniques for a particular installation, but local authorities should be contacted for verification.

When choosing cable for your installation there are four guidelines to follow to keep problems to a minimum:

1. The application and environment determines which type of cable you can use and what rating it should have. Make sure the cable you're installing meets the proper ratings for your application.
2. If you will be substituting a cable with another, you must have a cable that is rated higher than what the code calls for. Check with your local inspector as to what is allowed in your local area.
3. The NEC code is a general guideline that can be adopted in whole or in part. Your local state, county, city, or municipal approved code is what you must follow. Contact your local authorities for verification of the code in your area.
4. The local inspector or fire marshal has the final authority to approve or disapprove any installation of cable based on the National Electric Code or on the local code.

If you remember these four guidelines, you should have fewer complications and headaches when installing cable in your area. Remember to always work closely with your local authorities.



Calculating Conduit Capacity

One Cable Type in Conduit

The following information is to provide you with a quick and easy reference for conduit fill requirements. This information is to be used as a general guideline. Each installation has different restrictions for installation environments and/or local codes to follow.

The Conduit Capacity Chart provided on the following page is for applications when only one type of cable is to be used in a conduit. For example, if you know the diameter of the cable you will be installing, use the cable O.D. column, and find the exact or next largest diameter cable O.D.. Follow this row over to the number of cables you need to install in a conduit. Then follow this column to the top of the chart and read the conduit size required for the number of cables you need to install.

Multiple Types of Cable in One Conduit

If you will be mixing various cable diameters in a conduit, then this overall chart does not apply. You will have to use the following guidelines to calculate the conduit fill requirements.

To determine the conduit size required for a particular installation of cable follow these steps:

1. Square the O.D. of each cable and total the results.
2. Multiply the total by .7854*. This is the total area of the cables in square inches.
3. From the Permissible Area row on the Conduit Capacity Chart shown on the following page, select the conduit size with an area equal to or greater than the total area you calculated.
 - * See Important Notes and Installation Suggestions
 - ** Permissible Area to be occupied (sq. in.) is based on the NEC standard of 40% fill, which applies to three or more non-lead covered cable installed in the same conduit.

Important Notes and Installation Suggestions

- A single cable is permitted to occupy 53% and two cables are limited to 31% conduit fill. For a single cable use .5927 in step 2, for two cables use 1.1034, and three or more cables use .7854.
- This chart is based on the maximum number of cable permitted in conduit under the National Electrical Code, and is calculated on the area of the cable with 40% of the conduit filled. For conduit runs of 50 to 100 feet, the installed number should be reduced by 15%, or use the next larger size conduit. If more than two 90 degree bends are to be used in the conduit run, or if the run is to be over 100 feet in length, insert a pull box.
- An anti-friction agent is recommended in pulling operations.
 - *CAUTION: Select an anti-friction agent which is suitable for the cable jacket material. The electronic characteristics of unjacketed cable may change due to the application of anti-friction agents.

* COLD ENVIRONMENT PRECAUTION: Due to the nature of PVC compounds to become non-pliable when stored or handled in ambient temperatures of 32 degrees F or less, we recommend the following:

"Prior to installation, condition the cable for at least 24 hours at room temperature to provide the best flex properties for ease of installation."

- Permissible area chart does not apply to metallic and non-metallic surface raceways; consult the NEC for recommendations.

**THE NATIONAL ELECTRICAL CODE FORBIDS
THE INSTALLATION OF COMMUNICATION CABLE
IN THE SAME CONDUIT AS POWER CABLE.**

Pulling Tensions

Under the stress of approximately 15,000 lbs./sq. in. annealed copper will begin to permanently stretch. The table below lists the absolute maximum recommended pulling tensions for conductor sizes. For multiple conductor cable, multiply the appropriate value by the total number of conductors. These pulling tensions must be equally distributed among the conductors.

**THESE LIMITS MUST NEVER BE EXCEEDED
EVEN MOMENTARILY!
DON'T JERK THE CABLE!**

The electronic characteristics of a cable may change due to excessive tension and crushing.

Gauge	Max. Pulling Tension
24 AWG	4 lbs
22 AWG	7 lbs
20 AWG	12 lbs
18 AWG	19 lbs
16 AWG	30 lbs
14 AWG	48 lbs
12 AWG	77 lbs

Coaxial Cable Termination Techniques

Cable Termination

There is a variety of termination methods for cable. The termination method utilized depends basically on the system installed, type of cable used and type of connector. Using the proper termination method allows for good mechanical and electrical integrity. No matter what type of termination you will be performing, the most important thing is to use the proper tools and materials for the type of termination. For example, a crimp using pliers will work, but using a crimp tool and the proper die designed for your type of cable and connector is better. Using the proper solder type and the right temperature for solder type connections will ensure a lasting connection. We will review four basic termination techniques. This is just to provide some general guidelines. The termination method may vary somewhat based on system requirements and connector manufacture design methods.

Termination Types

Solder Type

A solder type connection allows for a strong, solid mechanical and electrical connection. Clean the connection well. For electrical circuits you must use a rosin type flux to clean all connections. Do not use acid flux that is commonly used for plumbing installation. The acid based flux will cause corrosion and inherently cause intermittent problems with the electrical signal. The choice of solder is also important. Using a solder standard 60/40 formula will meet the majority of your soldering needs. However, lead-free and high-grade silver solder is available for special applications. Also, use a soldering iron of the proper wattage. If the soldering iron is not hot enough, you may not be able heat the connection enough to get a good solder joint. This may cause what is known as a "cold" solder joint and can cause intermittent problems like opens to occur. However, if the soldering iron is too hot, you can cause damage to the components of the system near the connection. This can also cause the insulation to possibly melt causing the bare primaries to make contact with each other resulting in a short.

Crimp Type

A crimp type connection allows for quick and simple installation while still maintaining a mechanical and electrical connection fairly close to a solder type termination. Solid or stranded wire can be used in this type of termination.

Some of the key points to remember for a good clean connection are as follows:

1. Make sure you use the proper size connector for the type of cable you are using.
2. Make sure all of your cuts and stripping are clean.
3. Avoid nicks as much as possible.
4. Use the proper crimp tool, don't try to improvise with pliers, etc.

The most common crimp method involves two crimps, one on the insulation for a stronger mechanical connection and one on the conductor or shield for a good electrical connection. A crimp tool is designed specifically for this type of termination for the type of connector you are using. This allows for good connections both mechanical and electrical. Using pliers will allow connection. However, it may not be a solid mechanical or electrical connection and can cause the connector to eventually come loose and intermittent problems with the electrical signal can occur.

Insulation Displacement

This type of termination is usually used in punch down blocks, wall connectors, and in the back of patch panels. This type of termination elimi-

nates the need for stripping the conductor insulation. As the conductor is pushed through the clip, the insulation is cut into and the metal clip contact makes contact with the wire.

The best type of wire to use is a solid conductor. If you use a stranded conductor the force of the termination may allow the clip to cut some of the strands. Also, stranded wire will "crush" somewhat which will not allow for a solid connection. However, both types of conductors are used in various systems.

The connection is made by using a punch down tool. Some patch panel manufacturers supply a termination cap that terminates several wires at once without the use of a tool. Some tools will allow use of different bits for use with various terminations. (i.e. 66 block, 110 block, etc.). Just like the crimping type termination, it is important to use the correct bit for the type of termination you are doing.

Direct Connection (Utility Block/ Screw Terminals)

This type of termination has several names. Utility block, barrier strip, or screw terminals are just a few. This type of termination can use either solid or stranded conductors. It allows for easy termination as well as quick changing of wire in the future. The main point to remember about a screw connection is to strip back the insulation only to the amount of conductor that will wrap around the screw and to place the wire in the same direction as the screw turns when tightening. This will "pull" the wire in tighter as the screw tightens. If you wrap the wire around the screw opposing the tightening rotation of the screw, the wire will be pulled outward and will become unwrapped around the screw.

Splicing

It is recommended to avoid splicing whenever possible, however, when splicing of cables becomes necessary, there are several methods to do this. Splicing can be as simple as twisting conductors together, soldering and then taping. Splicing can also be more elaborate by using a variety of inline connectors and adapters. The method used is based on the type of system used, the electrical signal characteristics, and type of cable used. A simple audio or intercom system can be spliced by just connecting the conductor together with the twist method. However, a CCTV or high speed data system will require inline connectors and adapters due to the construction of the cable as well as to maintain proper impedance, resistance, and capacitance characteristics for the cable run. If the location of the splice is outdoor or in underground environments, it is recommended that a waterproof splice kit be utilized.

Coaxial Connector Termination/Basic Guidelines

Cable Termination

There are a variety of termination methods for cables. The termination method utilized depends basically on the system installed, type of cable used, and type of connector. Using the proper termination method allows for good mechanical and electrical integrity. No matter what type of termination you will be performing, the most important thing to remember is to use the proper tools and materials for your type of termination. For example, a crimp using pliers will work, but using a crimp tool and the proper die designed for your type of cable and connector is better. Using the proper solder type and the right temperature for solder type connections will ensure a lasting connection. We will review some basic termination techniques. This is just to provide some general guidelines. The termination method may vary somewhat based on system requirements and connector manufacturer design methods.

Crimp Type Termination

A crimp type connection allows for quick and simple installation while still maintaining a mechanical and electrical connection fairly close to a solder type termination. Solid or stranded wire can be used in this type of termination.

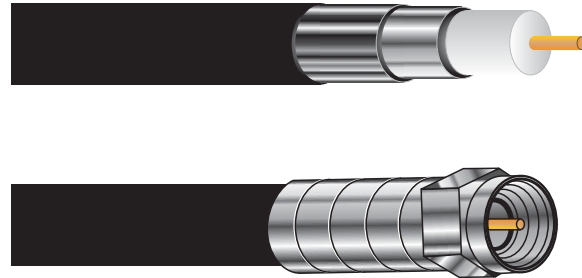
Some of the key points to remember for a good clean connection are as follows: make sure to use the proper size connector for the type of cable you are using. Make sure all your cuts and stripping are clean. Avoid nicks as much as possible. Use the proper crimp tool; don't try to improvise with pliers, etc.

The most common crimp method involves two crimps. One is on the insulation for a stronger mechanical connection and one is on the conductor or shield for a good electrical connection. A crimp tool is designed specifically for this type of termination, for the type of connector you are using. This allows for good connections, both mechanical and electrical. Using pliers will allow a connection; however, it may not be a solid mechanical or electrical connection, and can cause the connector to eventually come loose, which can cause intermittent problems with the electrical signal.

Splicing

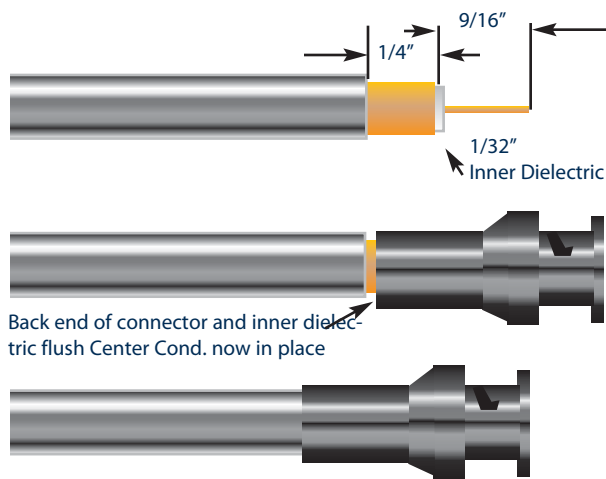
It is recommended to avoid splicing whenever possible. However, when splicing of cables becomes necessary, there are several methods to do this. Splicing can be as simple as twisting conductors together, soldering, and then taping. Splicing can also be more elaborate by using a variety of inline connectors and adapters. The method used is mainly based on the type of system used, the electrical signal characteristics, and type of cable used. A simple audio or intercom system can be spliced by just connecting the conductor together with the twist method. However, a CCTV or high speed data system will require inline connectors and adapters due to the construction of the cable as well as to maintain proper impedance, resistance, and capacitance characteristics for the cable run. If the location of the splice is outdoor or in underground environments, it is recommended that a waterproof splice kit be utilized.

"F" Type Connector- Crimp



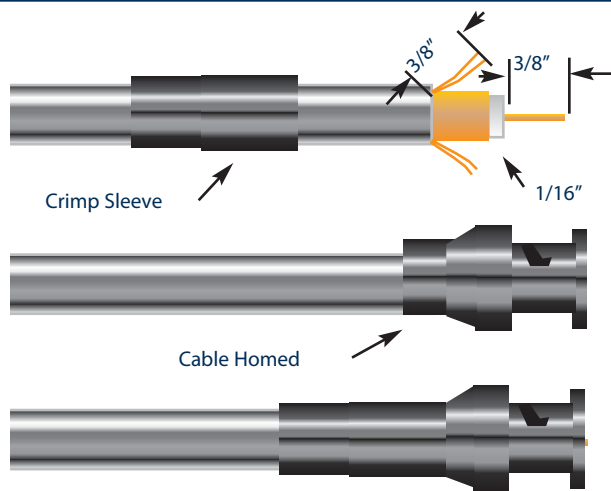
1. Strip 1/2" of the jacket to expose the braid shield.
2. Bend the exposed shield (Braid) back over the outer jacket. Do not disturb the foil shield beneath the braid.
3. Strip core back to expose conductor 1/4".
4. Slide the shank of the "F" connector over the foil shield and under the braid shield. Push the connector onto the cable, until the shoulder of the connector is firmly seated against the braid shield. Crimp connector with proper tool as recommended by your connector manufacturer.

BNC - Crimp Connector Termination



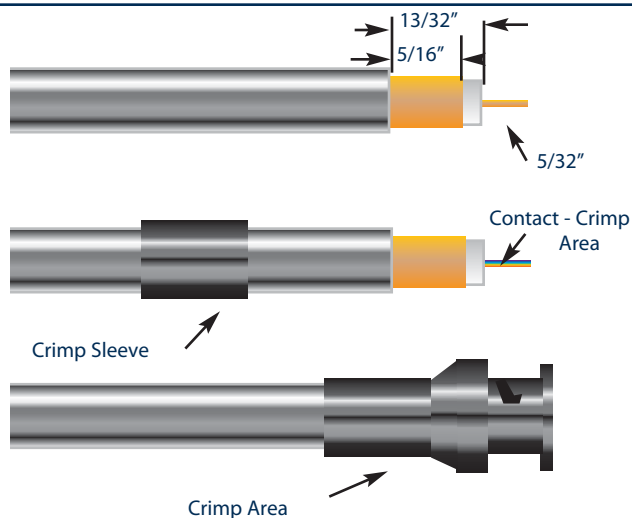
Twist On BNC Connector

1. Trim cable as shown, taking care not to nick the center conductor or outer braid.
2. Twist the outer braid in a clockwise direction in such a manner that at least $1/32$ " of the inner dielectric is bared, and the braid is left flat. (Stray or loose braid can cause shorts).
3. Gently insert the center conductor down into the back end of the connector, feeling it into the guide hole. When the center conductor is not in place approx. $1/8$ " of center conductor will show.
4. Firmly push the cable home as far as possible. Then screw the connector on the cable in a clockwise direction until it stops.



2 Piece BNC Connector

1. Run crimp sleeve down cable.
2. Trim cable as shown. Taking care not to nick the center conductor or outer braid
3. Gently insert the center conductor into the guide hole, in the rear of the connector, and firmly push the cable home.
4. Push crimp sleeve into place. Sandwiching the braid between the connector and sleeve.
5. Crimp the sleeve into place with the proper crimp tool.



3 Piece BNC Connector

1. Trim cable as shown. Taking care not to nick the center conductor or outer braid. For Miniature Coaxial Cable we recommend - TL-KLEIN
2. Slip crimp sleeve over cable. Place inner conductor into contact, note that the end of the contact and inner dielectric must be butting and square. Crimp with proper crimp tool.
3. Flair outer braid, and gently but firmly push the contact into the connector housing until a gentle snap is felt. Indicating the contact is in place. Slip the crimp sleeve in place, butting the flange against the connector body, and crimp with proper tooling.

Compression- Connector Termination



Using TL-SNSA Adjustment of the tool for BNC, RCA, & "F" Connector Types

BNC

BNC- Compression for Window Style Connectors

Set tool at 3

CN-BNCP-RGB

CN-BNCP-825

CN-BNCP-59

CN-BNCP-6

BNC- Compression for Longer Style Connectors

Set tool at 10

CN-FS1BNC

CN-FS59BNCPL4

CN-FS6BNCPL2

RCA

RCA- Compression for Window Style Connectors

Set tool at 3

CN-RCP-RGB

CN-RCP-825

CN-RCP-59

CN-RCP-6

RCA- Compression for Longer Style Connectors

Set tool at 1

CN-FS1RCA

CN-FS59RCAPL4

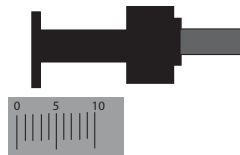
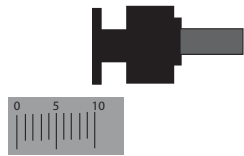
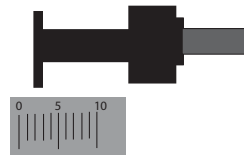
CN-FS6RCAPL2

"F"

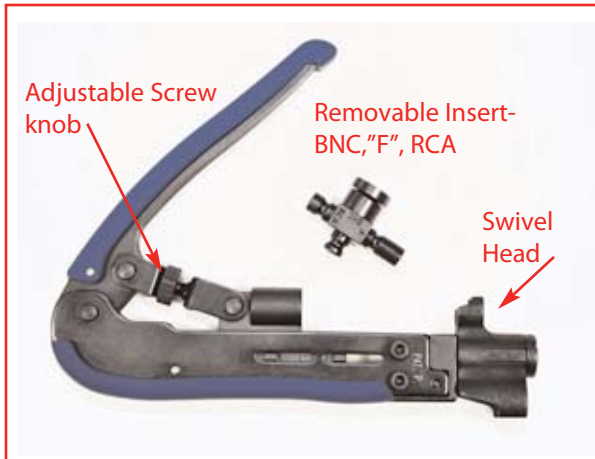
"F" Compression for both types of compression connectors:

Set tool at 0.

NOTE: THERE MAYBE IN THE FIELD ADJUSTMENTS TO THE TOOLS FOR COMPLETE FUNCTIONING.



Compression Tool Comparison



TL-548G Lever Style Compression Tool

- Recommended for the Small Profile (Window) Compression Connectors
- Accepts Miniature, RG59/U, RG6/U, and RG11/U Cables



TL-CPLCCT-SLM Lever Style Compression Tool

- Heavy duty design
- Accepts RG59/U, and RG6/U Cables
- Alternative for our Longer Compression Connectors
- Not recommended for the Small Profile (Window) Compression Connectors



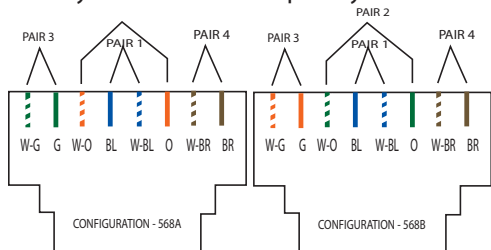
TL-SNSA Ratchet Style Compression Tool

- Will do both Longer and Smaller Profile Compression Connectors
- Accepts Miniature, RG59/U, and RG6/U Cables

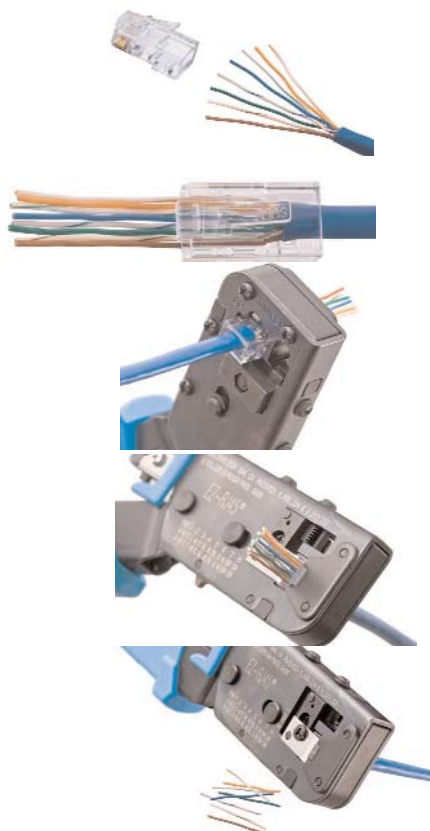
Category Cable Connector Termination

Plug Termination:

1. Strip off 2.00" of jacket
2. Straighten and align wires to T568B or T568A - Trim Pairs
3. Insert wires into connector body
4. Pull tight to ensure jacket is .250" inside connector body
5. Verify wire location and orientation
6. Insert **32-EZP** connector into crimp tool- **TL-EZRJ45**
7. Verify connector is completely seated and cable is fully inserted



8. Squeeze handle of **TL-EZRJ45**
9. Remove excess wires
10. Check jacket strain relief
11. Check that contacts are all engaged
12. Check that contact dividers are not damaged
13. Check to see if both ends of the cable have been terminated



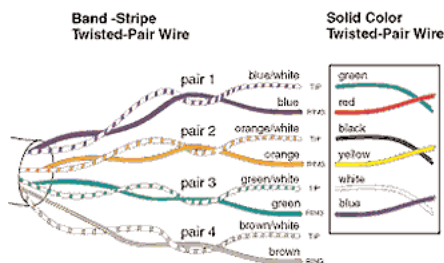
IDC

All Jacks have IDC- Insulation Displacement Connections. These connections are made with a punch down tool. The Punch down tool displaces the insulation while the individual cable is being pressed between two metal clips. The metal clips make contact with the conductor.

Terminating RJ45 Jacks

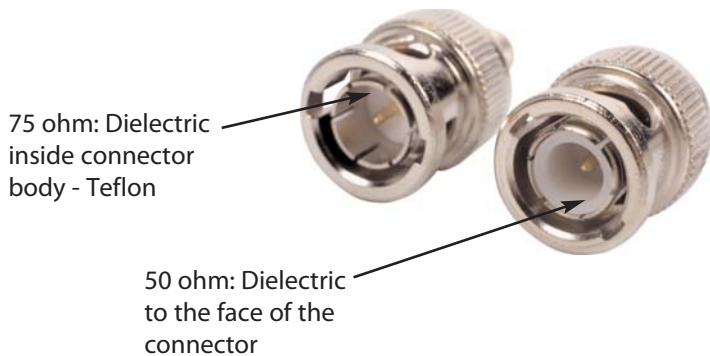
1. Strip cable .750" - 1.00" - Do not damage conductors
2. Fan out the individual Pairs. Do not untwist the individual pairs more than .500"
3. Place each wire into appropriate IDC slot color code
 - Choose between T568A or T568B
4. Punch down the individual wire - Do not punch down more than twice.
5. Place Protector Hood over the punched down wires

Cross-Compatibility:



Connector Cross Reference

Cable Part No.	Connector Type	Connector Part No.	Crimp Tool	Strip Tool	Cable Part No.	Connector Type	Connector Part No.	Crimp Tool	Strip Tool
1100	"F"	CN-F11ALX	TL-112	TL-124**	256100	Compression "F"	CN-FS6PL2	TL-SNSA	TL-CSST
	Comp. "F"	CN-FS11V	TL-CCT-SS59/11	TL-PS11		256300	Compression "F"	CN-DB6PL2	TL-CPLRBC
1110	"F"	CN-F11ALX	TL-112	TL-124**	256CR6B2P		Comp. BNC	CN-BNCP-RGB	TL-SNSA or TL-548G
	Comp. "F"	CN-FS11V	TL-CCT-SS59/11	TL-PS11		Comp. RCA	CN-RCP-RGB	TL-SNSA or TL-548G	TL-CSST-RGB
252815	3 Pc. BNC	CN-BM53-30	TL-103	TL-7503		75Ω 3Pc. BNC	CN-BM74-19	TL-105 or TL-803	TL-825
252815E	75Ω 3Pc. BNC	CN-BM74-32	TL-104	TL-7503	25806	3PC. BNC	CN-BM53-4	TL-107	TL-7503
	Comp. BNC	CN-FS59BNCPL4	TL-SNSA or TL-548G	TL-CSST		75Ω 3Pc. BNC	CN-BM73-4	TL-107	TL-7503
252825	75Ω 3Pc. BNC	CN-BM74-18	TL-105	TL-825		Comp. BNC	CN-FS6BNCPL2	TL-SNSA or TL-548G	TL-CSST
	Comp. BNC	CN-BNCP-825	TL-SNSA or TL-548G	TL-CSST		Comp. RCA	CN-FS6RCAPL2	TL-SNSA or TL-548G	TL-CSST
	Comp. RCA	CN-RCP-825	TL-SNSA or TL-548G	TL-CSST	25810	3PC. BNC	CN25810KBNC	TL-115	TL-124
	Female BNC	CN-BF74-18	TL-105	TL-825		25811	Comp. BNC	CN-CSBNC-11	TL-CCT-SS59/11
253CR6B 255CR6B 252CSVHS	Comp. BNC	CN-BNCP-RGB	TL-SNSA or TL-548G	TL-CSST	Comp. "F"		CN-FS11PL	TL-CCT-SS59/11	TL-PS11
	Comp. RCA	CN-RCP-RGB	TL-SNSA or TL-548G	TL-CSST	25812	3PC. BNC	CN-BM53-25	TL-105	TL-7503
	75Ω 3Pc. BNC	CN-BM74-19	TL-105 or TL-803	TL-825		25815	3PC. BNC	CN-BM53-30	TL-104
256350	"F"	CN-F56TFE	TL-111	TL-7502	75Ω 3Pc. BNC		CN-BM74-32	TL-104 or TL-803	TL-7503
	Comp. "F"	CN-CSF-6	TL-SNSA	TL-SNSST	25815E	Comp. BNC	CNF559BNCPL4	TL-SNSA or TL-548G	TL-CSST
	75Ω 3Pc. BNC	CN-BM73-4	107	TL-7503		Comp. RCA	CN-FS59RCAPL4	TL-SNSA or TL-548G	TL-CSST
	Comp. BNC	CN-FS6BNCPL2	TL-SNSA or TL-548G	TL-CSST	PTZ25815	Comp. "F"	CN-FCP-59	TL-SNSA	TL-CSST
	Comp. RCA	CN-FS6RCAPL2	TL-SNSA or TL-548G	TL-CSST		75Ω 3Pc. BNC	CN-BM74-32	TL-104 or TL-803	TL-7503
25819	Comp. BNC	CN-FS59BNCPL4	TL-SNSA or TL-548G	TL-CSST		WP258195	Comp. BNC	CN-FS59BNCPL4	TL-SNSA or TL-548G
	Comp. RCA	CN-FS59RCAPL4	TL-SNSA or TL-548G	TL-CSST	Comp. RCA		CN-FS59RCAPL4	TL-SNSA or TL-548G	TL-CSST
25821	"F"	CN-F11TFE	TL-115	TL-124**	25825	75Ω 3Pc. BNC	CN-BM74-18	TL-105	TL-825
	Comp. "F"	CN-FS11PL	TL-CSST-SS59/11	TL-PS11		Comp. BNC	CN-BNCP-825	TL-SNSA or TL-548G	TL-CSST
25825	75Ω 3Pc. BNC	CN-BM74-18	TL-105	TL-825		Comp. RCA	CN-RCP-825	TL-SNSA or TL-548G	TL-CSST
	Comp. BNC	CN-BNCP-825	TL-SNSA or TL-548G	TL-CSST		Female BNC	CN-BF74-18	TL-105	TL-825
PTZ25825	Comp. RCA	CN-RCP-825	TL-SNSA or TL-548G	TL-CSST	25841	"F"	CN-F56ALM	TL-111	TL-7502
	Female BNC	CN-BF74-18	TL-105	TL-825		Comp. "F"	CN-FS6PL2	TL-SNSA	TL-CSST
25841	"F"	CN-F56ALM	TL-111	TL-7502	25Q821	"F"	CN-F11TFE	TL-115	TL-124**
	Comp. "F"	CN-FS6PL2	TL-SNSA	TL-CSST		Comp. "F"	CN-FS11PL	TL-PS11	TL-CSST-SS59/11



Note: ** Center Conductor blade must be removed before using

Connector Cross Reference

Cable Part No.	Connector Type	Connector Part No.	Crimp Tool	Strip Tool
250841	"F"	CN-F56ALM	TL-111	TL-7502
	Comp. "F"	CN-DB6PL2	TL-CPLRBC	TL-CSST
2806B	75Ω 3Pc. BNC	CN-BM73-5	TL-107	TL-7503
	Comp. BNC	CN-BNCP-6	TL-SNSA or TL-548G	TL-CSST
	Comp. RCA	CN-RCP-6	TL-SNSA or TL-548G	TL-CSST
2815B 2815E	3PC. BNC	CN-BM53-2	TL-104	TL-7503
	75Ω 3Pc. BNC	CN-BM73-2 CN-BM74-32	TL-104	TL-7503
	Comp. BNC	CN-BNCP-59	TL-SNSA or TL-548G	TL-CSST
2825	75Ω 3Pc. BNC	CN-BM74-18	TL-105 or TL-803	TL-825
	Comp. BNC	CN-BNCP-825	TL-SNSA	TL-CSST
	Comp. RCA	CN-RCP-825	TL-SNSA or TL-548G	TL-CSST
	Female BNC	CN-BF74-18	TL-105	TL-825
3CRGB	75Ω 3Pc. BNC	CN-BM74-19	TL-105 or TL-803	TL-825
	Comp. BNC	CN-BNCP-RGB	TL-SNSA	TL-CSST-RGB
	Comp. RCA	CN-RCP-RGB	TL-SNSA	TL-CSST-RGB
4806	75Ω 3Pc. BNC	CN-BM73-5	TL-107	TL-7503
4811	3PC. BNC	CN-BM53-26	TL-113	TL-124**
4815	3PC. BNC	CN-BM53-2	TL-104	TL-124
	75Ω 3Pc. BNC	CN-BM74-32	TL-104	TL-7503

Cable Part No.	Connector Type	Connector Part No.	Crimp Tool	Strip Tool
5CRGB	Comp. BNC	CN-BNCP-RGB	TL-SNSA	TL-CSST-RGB
	Comp. RCA	CN-RCP-RGB	TL-SNSA	TL-CSST-RGB
6100	"F"	CN-F56ALM	TL-111	TL-7502
	Comp. "F"	CN-CSF-6	TL-SNSA	TL-CSST
6140	"F"	CN-F56AQ	TL-111	TL-7502
	Comp. "F"	CN-CSF-6	TL-SNSA	TL-CSST
6150	"F"	CN-F56ALM	TL-111	TL-7502
	Comp. "F"	CN-CSF-6	TL-SNSA	TL-CSST
6300 6310	"F"	CN-F56ALX	TL-111	TL-7502
	Comp. "F"	CN-FCP-6QD	TL-548G	TL-CSST
6325 6350	"F"	CN-F56ALM	TL-111	TL-7502
	Comp. "F"	CN-FCP-6	TL-SNSA	TL-CSST
	75Ω 3Pc. BNC	CN-BM73-5	TL-107	TL-7503
	Comp. BNC	CN-CSBNC-6	TL-SNSA or TL-548G	TL-CSST
	Comp. RCA	CN-CSRCA-6	TL-SNSA or TL-548G	TL-CSST
6CRGB2P 6CRGB4P	Comp. BNC	CN-BNCP-RGB	TL-SNSA or TL-548G	TL-CSST-RGB
	Comp. RCA	CN-RCP-RGB	TL-SNSA or TL-548G	TL-CSST-RGB
806	75Ω 3Pc. BNC	CN-BM73-5	TL-107	TL-7503
	Comp. BNC	CN-CSBNC-6	TL-SNSA or TL-548G	TL-CSST
	Comp. RCA	CN-CSRCA-6	TL-SNSA or TL-548G	TL-CSST
807	3PC. BNC	CN-BM53-8X	TL-119	--
	"N" Type	CN-NM53-8X	TL-119	--
810	3PC. BNC	CN-BM53-8	TL-113	TL-124
	"N" Type	CN-NM53/110	-	-
811	3PC. BNC	CN-BM53-26	TL-113	TL-124
	Comp. BNC	CN-CSBNC-11	TL-CSBNC11	TL-PS11
812	3PC. BNC	CN-BM53-13	TL-104	TL-7503
813	3PC. BNC	CN-BM53-13	TL-104	TL-7503
815 815E PTZ815	3PC. BNC	CN-BM53-2	TL-104	TL-7503
	75Ω 3Pc. BNC	CN-BM74-32	TL-104 or TL-803	TL-7503
	Comp. BNC	CN-CSBNC-59	TL-SNSA or TL-548G	TL-CSST
	Comp. RCA	CN-CSRCA-59	TL-SNSA or TL-548G	TL-CSST

Note: ** Center Conductor blade must be removed before using

Connector Cross Reference

Cable Part No.	Connector Type	Connector Part No.	Crimp Tool	Strip Tool
819	"F"	CN-F59ALM	TL-111	TL-7502
	Comp. "F"	CN-FCP-59	TL-SNSA	TL-CSST
	75Ω 3Pc. BNC	CN-BM74-32	TL-104	TL-7503
	Comp. BNC	CN-CSBNC-59	TL-SNSA or TL-548G	TL-CSST
	Comp. RCA	CN-CSRCA-59	TL-SNSA or TL-548G	TL-CSST
821	"F"	CN-F11ALX	TL-112	TL-124**
	Comp. "F"	CN-FS11V	TL-CCT-SS59/11	TL-PS11
825	75Ω 3Pc. BNC	CN-BM74-18	TL-105	TL-825 or TL-KLEIN
825182	Comp. BNC	CN-BNCP-825	TL-SNSA or TL-548G	TL-CSST or TL-KLEIN
45825	Comp. RCA	CN-RCP-825	TL-SNSA or TL-548G	TL-CSST or TL-KLEIN
2825	Female BNC	CN-BF74-18	TL-105	TL-CSST or TL-KLEIN
841	"F"	CN-F56ALM	TL-111	TL-7502
	Comp. "F"	CN-CSF-6	TL-SNSA	TL-CSST
AQC2806 AQC806	75Ω 3Pc. BNC	CN-BM73-5	TL-107	TL-7503
	Comp. BNC	CN-CSBNC-6	TL-SNSA or TL-548G	TL-CSST
	Comp. RCA	CN-CSRCA-6	TL-SNSA or TL-548G	TL-CSST
AQC815 AQC819	3Pc. BNC	CN-BM53-2	TL-104	TL-7502
	75Ω 3Pc. BNC	CN-BM74-32	TL-104 or TL-803	TL-7503
	Comp. BNC	CN-CSBNC-59	TL-SNSA or TL-548G	TL-CSST
	Comp. RCA	CN-CSRCA-59	TL-SNSA or TL-548G	TL-CSST
AQC841	"F"	CN-F56AQ	TL-111	TL-7502
	Comp. "F"	CN-CSF-6	TL-SNSA	TL-CSST

Cable Part No.	Connector Type	Connector Part No.	Crimp Tool	Strip Tool
HD825 HD25825	75Ω 3Pc. BNC	CN-BM74-18	TL-105	TL-825
	Comp. BNC	CN-BNCP-825	TL-SNSA or TL-548G	TL-CSST
	Comp. RCA	CN-RCP-825	TL-SNSA or TL-548G	TL-CSST
	Female BNC	CN-BF74-18	TL-105	TL-825
HQB41 HQ841R QB41	"F"	CN-F56ALX	TL-111	TL-7502
	Comp. "F"	CN-FCP-6QD	TL-548G	TL-CSST
QB21 QB21F	Comp. "F"	CN-FS11V	TL-CCT-SS59/11	TL-PS11
WP258195	75Ω 3Pc. BNC	CN-BM74-32	TL-104	TL-7503
	Comp. BNC	CN-F559BNCPL2	TL-SNSA or TL-548G	TL-CSST
	Comp. RCA	CN-F559RCAPL2	TL-SNSA or TL-548G	TL-CSST
WP8253 WP8255 WP258255	75Ω 3Pc. BNC	CN-BM74-18	TL-105	TL-825
	Comp. BNC	CN-BNCP-825	TL-SNSA or TL-548G	TL-CSST
	Comp. RCA	CN-RCP-825	TL-SNSA or TL-548G	TL-CSST
	Female BNC	CN-BF74-18	TL-105	TL-825
WP258263 WP258265	75Ω 3Pc. BNC	CN-BM74-19	TL-105	TL-825
	Comp. BNC	CN-CSBNC-26	TL-SNSA or TL-548G	TL-CSST-RGB
	Comp. RCA	CN-CSRCA-26	TL-SNSA or TL-548G	TL-CSST-RGB
WP6355	75Ω 3Pc. BNC	CN-BM73-5	TL-107	TL-7503
	Comp. BNC	CN-CSBNC-6	TL-SNSA or TL-548G	TL-CSST
	Comp. RCA	CN-CSRCA-6	TL-SNSA or TL-548G	TL-CSST
WP8195	75Ω 3Pc. BNC	CN-BM74-32	TL-104 or TL-803	TL-7503
	Comp. BNC	CN-CSBNC-59	TL-SNSA or TL-548G	TL-CSST
	Comp. RCA	CN-CSRCA-59	TL-SNSA or TL-548G	TL-CSST

SPECIALTY CABLES:

PAN TILT ZOOM CABLE:

PTZ815 - SEE 815 CABLE
 PTZ25815- SEE 25815 CABLE
 PTZ825 - SEE 825 CABLE
 PTZ25825 - SEE 25825 CABLE

HOMENETWORKING COMPOSITE CABLES:

•HN5161 • HN5162 • HN5261 • HN5262 • HN5262F
 •LSHN6262 • LSHN5262
 SEE HQ841 CABLE

MEDIA CONTROL CABLE: (ELAN)

E1854 - SEE 815 CABLE

Technical Reference

CAT NO.	PAGE	CAT NO.	PAGE	CAT NO.	PAGE	CAT NO.	PAGE
1100	68	25235B	30	254245	146	294	11
1110	68	25236B	31	254246	147	295	11
1975	56	25241B	29	25440B	36	296	11
1990	56	25242B	30	25441B	36	3CRGB	94
1991	56	25244B	30	255CRGB	95	300	12
1994	56	25245B	30	25510B	36	301	12
1995	56	25246B	31	256CRGB2P	95	3011	9
210454	133	25248B	31	256100	67	302	12
220	2	25270B	29	256300	67	3021	10
221	2	25271B	29	256350	92	303	12
222	2	25272B	29	25751B	31	3241	8
224	2	25273B	29	25752B	31	3244	10
225	2	25274B	29	25753B	31	3245	10
226	2	252815	77	25806	79	3251	18
227	2	252815E	77	25810	84	3252	18
230	3	252825	100	25811	80	3253	18
231	3	25290B	32	25812	84	3262	9
232	3	25291B	32	25815	77	3263	9
234	3	25292B	32	25815E	77	3264	9
235	3	25293B	32	25819	92	3265	9
236	3	25294B	32	25821	69	3270	8
238	3	25295B	32	25825	74	3271	8
240	4	25296B	32	25841	67	3272	8
241	4	253	15	25855B	29	3274	8
242	4	253CRGB	95	25Q821	69	3280	10
244	4	25300B	33	25Q841	67	3281	10
2452	101	25301B	33	270	5	3282	10
245	4	25302B	34	271	5	3283	10
246	4	25303B	34	272	5	351	14
248	4	253186B	34	274	5	352	14
251	15	253188B	34	280	7	355	14
25186B	30	253241B	33	2806B	78	356	14
25188B	30	253244B	34	281	7	357	14
252CSVHS	100	253270B	33	2815B	76	358	14
25210	26	253271B	33	2815E	76	359	14
25221B	28	253272B	33	282	7	360	14
25222B	28	253274B	33	2825	100	369	14
25224B	28	25352B	35	283	7	3651	19
25225B	28	25355B	35	284	7	3652	19
25226B	28	25357B	35	285	7	3653	19
25227B	28	25358B	35	290	11	3654	19
25231B	29	25359B	35	291	11	369	14
25232B	30	25372B	35	292	11	373	24
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3751	20	5222FM	61	752	17	AC1822	185
3752	20	5222FZ	59	753	17	AC251822B	185
3753	20	5222UM	62	77291	128	AC251822B3P	185
3855	8	5300FM	61	77292	128	AQ224	43
420	21	5302FM	61	77293	128	AQ225	43
422	21	5320FM	61	77294	128	AQ226	43
424	21	5320UM	62	77295	128	AQ227	43
4245	146	5322FM	61	77350	177	AQ244	43
4246	147	5322UM	62	77510	128	AQ245	43
425	21	6CRGB2P	94	806	78	AQ246	43
450	13	6CRGB4P	94	807	84	AQ293	44
451	13	60164B	52	808F	84	AQ294	44
452	13	603164B	53	810	84	AQ295	44
454 - (X)454	136	60700B	52	811	80	AQ296	44
455	133	60975B	53	812	84	AQ3244	44
45825	74	60977B	53	813	84	AQ3245	44
4806	79	60980B	52	815	75	AQC188	40
4811	80	60982B	52	815E	75	AQC224	40
4815	75	60990B	53	819	92	AQC225	40
5CRGB	94	60990BS	58	821	68	AQC240	40
5000FZ	59	60991B	52	825	74	AQC2806	42-78
5020FM	61	60991B S	57	825182	74	AQC290	39
5020UM	62	60992B	53	841	64	AQC291	39
5022FM	61	60992BS	58	855	5	AQC292	39
5022UM	62	60993B	52	970	51	AQC293	39
5100FM	61	60993B S	57	971	51	AQC3125	39-186
5100FZ	59	60994B	53	972	51	AQC3186	39
5100UZ	60	60994BS	58	975	49	AQC3274	39
5120FM	61	60995B	52	977	49	AQC3283	39
5120FZ	59	60995B S	57	980	48	AQC351	38
5120UM	62	60995BS	57	982	48	AQC352	38
5120UZ	60	6100	64	990	48	AQC355	38
5122FM	61	6140	65	990S	57	AQC357	38
5122UM	62	6150	65	991	49	AQC358	38
5200FM	61	6300	66	992	48	AQC359	38
5200FZ	59	6310	66	993	49	AQC369	38
5200UZ	60	6325	79	994	48	AQC373	38
5220FM	61	6350	92	994S	57	AQC420	41
5220FZ	59	651	16	995	49	AQC422	41
5220UM	62	652	16	995S	58	AQC424	41
5220UZ	60	653	16	998	48	AQC429	41
		663	6	998S	57	AQC430	41
		700	48	999	49	AQC432	41
		751	17	999S	58	AQC434	41

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AQC815	42-75	D434	22-130	LL5162	54	TC2980	45
AQC819	42	D436	22-130	LL5162SH	55	TC2990	45
AQC841	42-65	D438	22-130	LL5164	54	TC2991	46
C205	25	D439	22-130	LL5164SH	55	TC2994	45
C206	25	D440	23	LL5182	54	TC2995	46
C207	25	D441	23	LL5182SH	55	TC2998	45
C208	26	D442	23	LL5184	54	WP128P	25-184
C210	26	D4851	143	LL5184SH	55	WP258195	99
C2415	178	D4852	143	LSAV	184	WP258255	98
C2425	178	D4853	143	LS25AV	184	WP258263	96
CC2418	81-181	D4854	143	LS1822	184	WP258265	96
CC2416	81-181	D60975	53	LS251822	184	WP37123	180
CC252418	81-181	D60990	53	LSHN5262	176	WP37125	180
CC252416	81-181	D975	50	LSHN6262	176	WP37127	180
D2401	140	D980	50	M57562	148	WP37129	180
D2402	140	D990	50	M57622	148	WP45412	132
D2404	140	D991	50	M58762	148	WP4546	132
D252401	142	D995	50	M58772	148	WP4548	132
D252402	142	DA2401	135	M58813	101	WP54980	151
D252404	142	DA2402	135	M58814	101	WP54982	151
D25291	129	DA2406	135	M58854	101	WP54983	151
D25292	129	DA252401	136	M9X039	164	WP55211	149
D25293	129	DA252402	136	M9X042	164	WP55212	149
D25294	129	DA252406	136	M9X043	164	WP55216	149
D25350	177	E1854	178	M9X045T	165	WP55253	152
D253651	142	HA1624	175	M9X045	164	WP55254	152
D253652	142	HA210	26-174	M9X045T	165	WP55700	149
D253653	142	HA225	174	M9X048	164	WP55826	152
D25420	141	HA226	174	M9X048T	165	WP55827	152
D25430	131	HA227	174	M9X150	166	WP56081	149
D25431	131	HA245	175	M9X152	166	WP56126	149
D25432	131	HA246	175	M9X155	166	WP56129	149
D25439	131	HD25825	92	M9X172	167	WP56128	149
D25454	134	HD825	92	M9X175	167	WP58141	150
D254851	144	HN5161	176	M9X611T	165	WP58142	150
D254852	144	HN5261	176	P806	92	WP6355	99
D25510	131	HN5262	176	PTZ825	82-182	WP8195	99
D3651	140	HN5262F	176	PTZ815	82-182	WP8253	97
D3653	140	HQ841	66	PTZ25825	83-183	WP8255	97
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D430	22-130	LL5122SH	55	Q821	68		
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DISCONTINUED ITEMS

CAT NO.	Replacement
252	253
262	280
263	281
264	282
265	283
273	25273B
275	285
276	Call Eng.
277	Call Eng.
304	3245
305	Call Eng.
421	D431
423	424
429	422
654	Call Eng.
655	Call Eng.
656	Call Eng.
657	Call Eng.
754	Call Eng.
755	Call Eng.
962	Call Eng.
974	Call Eng.
1083	Call Eng.
1130	4811
1135	Call Eng.
1150	Call Eng.
1165	Call Eng.
1997	Call Eng.
3273	3274
3275	Call Eng.
3285	Call Eng.
3655	D433
3656	Call Eng.
3754	Call Eng.
3811	Call Eng.
3815	Call Eng.
5990	AQC815
5992	Call Eng.
5994	Call Eng.
6500	6150

CAT NO.	Replacement
25843	25841
77296	Call Eng.
251975	Call Eng.
251980	Call Eng.
251991	Call Eng.
251994	Call Eng.
251995	Call Eng.
251997	Call Eng.
253811	Call Eng.
253815	Call Eng.
25238B	25248B
25Q843	25Q841
806R	806
815R	815
A2815	2815B
974	998
AC251822	AC251822B
D2403	D2404
D252406	DA252406
DA2404S	Call Eng.
DA2408S	Call Eng.
DA2412S	Call Eng.
D3652	D3653
D982	Call Eng.
HQ841R	HQ841
LSHN5161	Call Eng.
LSHN5162	Call Eng.
LSHN6262F	Call Eng.
S221	221
S241	241
TC2981	Call Eng.
TC2982	Call Eng.
TC2992	Call Eng.
TC2993	Call Eng.
TC2997	Call Eng.
TC2999	Call Eng.
WP45416	Call Eng.
WP45424	Call Eng.
WP45432	Call Eng.

Call Eng. - Call our Engineering Department
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VIDEO



A RGB/HV- Red, Green, Blue, Horizontal and Vertical Sync
Application: Connection between video scalers and PC's to plasma screens or other video output devices

- Bulk Cable pgs- 94-97 • Cable Assemblies- pgs 104-105
- 75Ω BNC Connectors - pg.110 • Install Kits- pgs. 106-108
- Installation Tools- pg. 112 • Wall plates - pgs. 113-115

B VGA (Video Graphics Array) - High Density 15 pin - HD15 inputs.
Application: Connection between PC's to plasma screen or projectors.

- Bulk Cable pgs- 94-97 • Cable Assemblies- pgs 104-105
- VGA Connectors - pg.109 • Install Kits- pgs. 106-108
- Installation Tools- pg. 112 • Wall plates - pgs. 113-115
- Digital Signage VGA Products over Nanoskew- pg. 106

C HDMI- High Definition Multimedia Interface
Application: Connection for HDTV, Digital Audio, and IR communication between AV equipment.

- Cable Assemblies/ Extender over Cat5E- pg. 105

D Component Video- RCA or BNC - Y, Pb, Pr
Application: Consumer Analog Television for resolutions up to 1080i.

- Bulk Cable pgs- 95 • Cable Assemblies- pgs 102
- RCA Connectors - pg.111 • Installation Tools- pg. 112

E S-Video- SVHS- Super Video

Application: Y/C - Separation of Luminance/Chrominance for better quality video signals

- Bulk Cable pgs- 100 • Cable Assemblies- pgs 103
- 4 Pin Mini Connectors - pg.103 • Install Kits- pgs. 103
- Installation Tools- pg. 112 • Wall plates - pgs. 113-115

F Composite Video - BNC or RCA

Application: Standard video signalling. All video signals travel within one coaxial cable.

- Bulk Cable pgs- 92 • Bulk AV Composite Cable pg -184
- Cable Assemblies- pgs 102 • RCA Connectors - pg.111
- 75Ω BNC Connectors - Pg.110 • Installation Tools- pg. 112
- Wall plates - pgs. 113-115

G CATV- Cable Antenna Television

Application: CATV/MATV, Broadband signals

- Bulk Cable pgs- 64-69 • "F" Connectors - pg. 70
- Installation Tools - pg. 71

AUDIO AND DATA



A 3.5mm- Mini Phone Jack

Application: Audio from computer to output - line level
Small sized

- Bulk Cable pgs- 128-136 • Cable Assemblies- pgs 138
- 3.5mm Connectors - pg.137

B 1/4"- Phone Jack

Application: Microphone inputs

- Bulk Cable pgs- 128-136 • 1/4" Connectors - pg.137

C XLR- 3 Pin - Cannon "X" Series- L-Latched- R- Rubber

Most common audio connector used in professional, commercial, and music applications

Application: Line level balanced audio signalling.

- Bulk Cable pgs- 128-136 • XLR Connectors - pg.137

D Speakon- Loadspeaker

Application: Connection between amplifier and loadspeaker
Long wearing, locking connector

- Bulk Cable pgs- 2 & 28 • Speakon Connectors - pg.137

E RJ45- Data Connector- Registered Jack - 8 pin

Application: Data connections

- Bulk Cable pgs. 149-148 • Cable Assemblies- pg. 156
- Plug Connectors - pg.155 • Jack Connectors - pg. 153
- Data Cabinets - pg. 159-162

USB - A and B - Connect Computer Devices and Smartboards

- Over Cat5E Extender - pg. 109

F ST- Fiber optic connector- Bayonet Style- Straight Tip

Application: Fiber Optic Connections

G SC- Fiber optic connector- Subscriber connector- Push Pull Style

Application: Fiber Optic Connections

H LC- Fiber Optic Connector- Local connector - Small formed factor

Application: Fiber Optic Connections

- Bulk Cable pgs. 164-167 • Cable Assemblies- pg. 168
- Install Kits - pgs. 168-169 • Connectors - pg.168-169
- Install Tools - pgs. 169-170 • Testing Equipment - pg. 171

AWG	No.Cond.	Shield	Rating	Cat.No.	PG
8 (65x26)	2	none	TC	C208	26
10 (65x28)	2	none	CL2P	25210	26
10 (65x28)	2	none	TC	C210	26
10 (65x28)	2	none	CL2	HA210	174
12 (19x25)	2	none	CL3R	227	2
12 (19x25)	3	none	CL3R	238	3
12 (19x25)	4	none	CL3R	248	4
12 (19x25)	2	Overall Shield	CL3R	296	11
12 (19x25)	1 Pair	Overall Shield	CL2	77296	128
12 (19x25)	2	Aquaseal Tape	FPL	AQ227	43
12 (19x25)	2	Aquaseal + Shld	FPL	AQ296	44
12 (19x25)	2	None	FPLR	998S	48
12 (65x30)	2	none	CL2	C207	25
12 (65x30)	2	None	CL2	HA227	174
12 (65x30)	4	None	CL2	HA248	175
12 (Strnd)	1	none	TC	TC2998	45
12 Solid	2	None	FPLR	998	48
12 Solid	2	Overall Shield	FPLR	999	49
12 Solid	2	Overall Shield	FPLR-CI	5020FM	61
12 Solid	2	Overall Shield	FPCR-CIC	5020FZ	59
12 Solid	2	None	FPLR-CI	5020UM	62
12 Solid	2	Overall Shield	FPLP	60994B	53
12 Solid	2	None	FPLP	60995B	52
12 Solid	2	None	FPLP	LL5122	54
12 Solid	2	Overall Shield	FPLP	LL5122SH	55
14 (19x27)	2	none	CL3R	226	2
14 (19x27)	3	none	CL3R	236	3
14 (19x27)	4	none	CL3R	246	4
14 (19x27)	2	Overall Shield	CL3R	295	11
14 (19x27)	1 Pair	Overall Shield	CL2	77295	128
14 (19x27)	2	Aquaseal Tape	FPL	AQ226	43
14 (19x27)	4	Aquaseal Tape	FPL	AQ246	43
14 (19x27)	2	Aquaseal + Shld	FPL	AQ295	44
14 (19x27)	1	none	TC	TC2994	45
14 (19x27)	1	Overall Shield	TC	TC2995	46
14 (41x30)	2	none	CL2	C206	25
14 (65x32)	2	None	CL2	HA226	174
14 (65x32)	4	None	CL2	HA246	175
14 Solid	4	None	FPLR	700	48
14 Solid	2	None	FPL	972	51
14 Solid	2	None	FPLR	994	48
14 Solid	2	Overall Shield	FPLR	995	49
14 Solid	2	Overall Shield	FPLR-CI	5120FM	61
14 Solid	2	Overall Shield	FPCR-CIC	5120FZ	59
14 Solid	2	None	FPLR-CI	5120UM	62
14 Solid	2	None	FPCR-CIC	5120UZ	60
14 Solid	4	None	FPLP	60700B	52
14 Solid	2	Overall Shield	FPLP	60992B	53
14 Solid	2	None	FPLP	60993B	52
14 Solid	2	Overall Shield	FPLR	D995	50
14 Solid	2	None	FPLP	LL5142	54

AWG	No.Cond.	Shield	Rating	Cat.No.	PG
14 Solid	2	Overall Shield	FPLP	LL5142SH	55
14 Stranded	2	None	FPLR	994S	57
14 Stranded	2	None	FPLP	60993S	57
16 (19x29)	2	none	CMR	225	2
16 (19x29)	3	none	CMP	25235B	30
16 (19x29)	4	none	CMR	245	4
16 (19x29)	2	Overall Shield	CMR	294	11
16 (19x29)	3	Overall Shield	CMR	304	12
16 (19x29)	7	none	CMR	663	7
16 (19x29)	4	Overall Shield	CMR	3245	10
16 (19x29)	1 Pair	Overall Shield	CL2	77294	128
16 (19x29)	2	Aquaseal Tape	FPL	AQ225	43
16 (19x29)	4	Aquaseal Tape	FPL	AQ245	43
16 (19x29)	2	Aquaseal + Shld	FPL	AQ294	44
16 (19x29)	4	Aquaseal + Shld	FPL	AQ3245	44
16 (19x29)	2	Aquaseal Tape	CM	AQC225	40
16 (19x29)	2	none	CL2	C205	25
16 (19x29)	1 Pair	Overall Shield	CMP	D25294	129
16 (65x34)	2	None	CL2	HA225	174
16 (65x34)	4	None	CL2	HA245	175
16 (7x24)	1	none	TC	TC2990	45
16 (7x24)	1	Overall Shield	TC	TC2991	46
16 (7x24)	2	None	FPLR	990S	48
16 (7x24)	2	None	FPLP	609901	48
16 Solid	2	None	FPL	971	51
16 Solid	2	None	FPLR	990	48
16 Solid	2	Overall Shield	FPLR	991	49
16 Solid	4	None	FPLR	992	48
16 Solid	4	Overall Shield	FPLR	993	49
16 Solid	2	Overall Shield	FPLR-CI	5220FM	61
16 Solid	2	None	FPLR-CI	5220UM	62
16 Solid	2	None	FPLR-CIC	5220UZ	60
16 Solid	4	None	FPLP	60164B	52
16 Solid	4	Overall Shield	FPLP	603164B	53
16 Solid	2	Overall Shield	FPLP	60990B	53
16 Solid	2	None	FPLP	60991B	52
16 Solid	2	Overall Shield	FPLP	D60990	53
16 Solid	2	None	FPLR	D990	50
16 Solid	2	Overall Shield	FPLR	D991	50
16 Solid	2	None	FPLP	LL5162	54
16 Solid	2	Overall Shield	FPLP	LL5162SH	55
18 (7x26)	2	none	CMR	224	2
18 (7x26)	3	none	CMR	234	3
18 (7x26)	4	none	CMR	244	4
18 (7x26)	5	none	CMR	280	7
18 (7x26)	7	none	CMR	281	7
18 (7x26)	9	none	CMR	282	7
18 (7x26)	12	none	CMR	283	7
18 (7x26)	15	none	CMR	284	7
18 (7x26)	20	none	CMR	285	7
18 (7x26)	2	Overall Shield	CMR	293	11
18 (7x26)	3	Overall Shield	CMR	303	12
18 (7x26)	4 (2 Shld)(2 Unshld)	Shld/Unshld	CMR	360	14
18 (7x26)	2 Pair	none	CMR	751	17
18 (7x26)	3 Pair	none	CMR	752	17

AWG	No.Cond.	Shield	Rating	Cat.No.	PG	AWG	No.Cond.	Shield	Rating	Cat.No.	PG
18 (7x26)	4 Pair	none	CMR	753	17	20 (7x28)	2	Overall Shield	CMR	292	11
18 (7x26)	6	Overall Shield	CMR	3021	10	20 (7x28)	3	Overall Shield	CMR	302	12
18 (7x26)	4	Overall Shield	CMR	3244	10	20 (7x28)	3 (2 Shld)(1 Unshld)	Shld/Unshld	CMR	358	14
18 (7x26)	5	Overall Shield	CMR	3280	10	20 (7x28)	4 (2 Shld)(2 Unshld)	Shld/Unshld	CMR	359	14
18 (7x26)	7	Overall Shield	CMR	3281	10	20 (7x28)	4	Overall Shield	CMR	3011	9
18 (7x26)	9	Overall Shield	CMR	3282	10	20 (7x28)	5	Overall Shield	CMR	3262	9
18 (7x26)	12	Overall Shield	CMR	3283	10	20 (7x28)	7	Overall Shield	CMR	3263	9
18 (7x26)	2 Pair	Overall Shield	CMR	3751	20	20 (7x28)	9	Overall Shield	CMR	3264	9
18 (7x26)	3 Pair	Overall Shield	CMR	3752	20	20 (7x28)	12	Overall Shield	CMR	3265	9
18 (7x26)	4 Pair	Overall Shield	CMR	3753	20	20 (7x28)	1 Pair	Overall Shield	CM	77292	128
18 (7x26)	1 Pair	Overall Shield	CM	77293	128	20 (7x28)	2	Aquaseal + Shld	CM	AQC292	39
18 (7x26)	2	Aquaseal Tape	FPL	AQ224	43	20 (7x28)	3 (2 Shld)(1 Unshld)	Shld/Unshld Aquaseal	CM	AQC358	38
18 (7x26)	4	Aquaseal Tape	FPL	AQ244	43	20 (7x28)	4 (2 Shld)(2 Unshld)	Shld/Unshld Aquaseal	CM	AQC359	38
18 (7x26)	2	Aquaseal + Shld	FPL	AQ293	44	20 (7x28)	1 Pair	Overall Shield	CMP	D25292	129
18 (7x26)	4	Aquaseal + Shld	FPL	AQ3244	44	22 (7x30)	2	none	CMR	221	2
18 (7x26)	8	Aquaseal Tape	CM	AQC188	40	22 (7x30)	3	none	CMR	231	3
18 (7x26)	2	Aquaseal Tape	CM	AQC224	40	22 (7x30)	4	none	CMR	241	4
18 (7x26)	2	Aquaseal + Shld	CM	AQC293	39	22 (7x30)	6	none	CMR	270	5
18 (7x26)	6	Aquaseal + Shld	CM	AQC3186	39	22 (7x30)	8	none	CMR	271	5
18 (7x26)	12	Aquaseal + Shld	CM	AQC3283	39	22 (7x30)	10	none	CMR	272	5
18 (7x26)	1 Pair	Overall Shield	CMP	D25293	129	22 (7x30)	15	none	CMR	274	5
18 (7x26)	2 Pair	Ind Shielded	CM	D440	23	22 (7x30)	2	Overall Shield	CMR	291	11
18 (7x26)	3 Pair	Ind Shielded	CM	D441	23	22 (7x30)	3	Overall Shield	CMR	301	12
18 (7x26)	4 Pair	Ind Shielded	CM	D442	23	22 (7x30)	3 (2 Shld)(1 Unshld)	Shld/Unshld	CMR	352	14
18 (7x26)	1	Overall Shield	TC	TC2975	46	22 (7x30)	4 (2 Shld)(2 Unshld)	Shld/Unshld	CMR	357	14
18 (7x26)	1	none	TC	TC2980	45	22 (7x30)	2	Overall Shield	CMR	452	13
18 Solid	2	None	FPL	970	51	22 (7x30)	1 Pair	Overall Shield	CMR	454	134
18 Solid	2	Overall Shield	FPLR	975	49	22 (7x30)	1 Pair	Overall Shield	CM	455	133
18 Solid	4	Overall Shield	FPLR	977	49	22 (7x30)	2 Pair	none	CMR	651	16
18 Solid	2	None	FPLR	980	48	22 (7x30)	3 Pair	none	CMR	652	16
18 Solid	4	None	FPLR	982	48	22 (7x30)	4 Pair	none	CMR	653	16
18 Solid	2	Overall Shield	FPCR-CIC	5220FZ	59	22 (7x30)	5	none	CMR	855	5
18 Solid	2	Overall Shield	FPLR-CI	5320FM	61	22 (7x30)	2 Pair	Ind. Shld + Jkt Pairs	CM	2452	101
18 Solid	2	None	FPLR-CI	5320UM	62	22 (7x30)	4	Overall Shield	CMR	3241	8
18 Solid	2	Overall Shield	FPLP	60975B	53	22 (7x30)	6	Overall Shield	CMR	3270	8
18 Solid	4	Overall Shield	FPLP	60977B	53	22 (7x30)	8	Overall Shield	CMR	3271	8
18 Solid	2	None	FPLP	60980B	52	22 (7x30)	10	Overall Shield	CMR	3272	8
18 Solid	4	None	FPLP	60982B	52	22 (7x30)	15	Overall Shield	CMR	3274	8
18 Solid	2	Overall Shield	FPLP	D60975	53	22 (7x30)	2 Pair	Overall Shield	CMR	3651	19
18 Solid	2	Overall Shield	FPLR	D975	50	22 (7x30)	3 Pair	Overall Shield	CMR	3652	19
18 Solid	2	None	FPLR	D980	50	22 (7x30)	4 Pair	Overall Shield	CMR	3653	19
18 Solid	2	None	FPLP	LL5182	54	22 (7x30)	6 Pair	Overall Shield	CMR	3654	19
18 Solid	2	Overall Shield	FPLP	LL5182SH	55	22 (7x30)	12 Pair	Overall Shield	CMR	3656	19
20 (7x28)	2	none	CMR	222	2	22 (7x30)	5	Overall Shield	CMR	3855	8
20 (7x28)	3	none	CMR	232	3	22 (7x30)	1 Pair	Overall Shield	CM	77291	128
20 (7x28)	4	none	CMR	242	4	22 (7x30)	2 Pair	Ind Shielded	CM	77510	128

AWG	No.Cond.	Shield	Rating	Cat.No.	PG
22 (7x30)	2 Pair	Ind. Shld + Jkt Pairs	CM	210454	133
22 (7x30)	2	Aquaseal + Shld	CM	AQC291	39
22 (7x30)	15	Aquaseal + Shld	CM	AQC3274	39
22 (7x30)	3 (2 Shld)(1 Unshld)	Shld/Unshld Aquaseal	CM	AQC352	38
22 (7x30)	4 (2 Shld)(2 Unshld)	Shld/Unshld Aquaseal	CM	AQC357	38
22 (7x30)	2 Pair	Aquaseal Ind.Shld	CM	AQC430	41
22 (7x30)	6 Pair	Aquaseal Ind.Shld	CM	AQC432	41
22 (7x30)	12 Pair	Aquaseal Ind.Shld	CM	AQC434	41
22 (7x30)	4 Pair	Aquaseal Ind.Shld	CM	AQC439	41
22 (7x30)	1 Pair	Overall Shield	CMP	D25291	129
22 (7x30)	2 Pair	Overall Shield	CMP	D253651	142
22 (7x30)	3 Pair	Overall Shield	CMP	D253652	142
22 (7x30)	4 Pair	Overall Shield	CMP	D253653	142
22 (7x30)	2 Pair	Ind Shielded	CMP	D25430	131
22 (7x30)	3 Pair	Ind Shielded	CMP	D25431	131
22 (7x30)	6 Pair	Ind Shielded	CMP	D25432	131
22 (7x30)	4 Pair	Ind Shielded	CMP	D25439	131
22 (7x30)	1 Pair	Overall Shield	CMP	D25454	134
22 (7x30)	2 Pair	Ind Shielded	CMP	D25510	131
22 (7x30)	2 Pair	Overall Shield	CM	D3651	140
22 (7x30)	4 Pair	Overall Shield	CM	D3653	140
22 (7x30)	2 Pair	Ind Shielded	CM	D430	130
22 (7x30)	3 Pair	Ind Shielded	CM	D431	130
22 (7x30)	6 Pair	Ind Shielded	CM	D432	130
22 (7x30)	9 Pair	Ind Shielded	CM	D433	130
22 (7x30)	12 Pair	Ind Shielded	CM	D434	130
22 (7x30)	19 Pair	Ind Shielded	CM	D436	130
22 (7x30)	27 Pair	Ind Shielded	CM	D438	130
22 (7x30)	4 Pair	Ind Shielded	CM	D439	130
22 (7x30)	12 Pair	Ind. Shld + Jkt Pairs	CM	WP45412	132
22 (7x30)	6 Pair	Ind. Shld + Jkt Pairs	CM	WP4546	132
22 (7x30)	8 Pair	Ind. Shld + Jkt Pairs	CM	WP4548	132
22 solid	2	none	CMR	220	2
22 solid	3	none	CMR	230	3
22 solid	4	none	CMR	240	4
22 solid	2 Pair	none	CMR	251	15
22 solid	4 Pair	none	CMR	253	15
22 solid	2	Overall Shield	CMR	290	11
22 solid	3	Overall Shield	CMR	300	12
22 solid	3 (2 Shld)(1 Unshld)	Shld/Unshld	CMR	351	14
22 solid	4 (2 Shld)(2 Unshld)	Shld/Unshld	CMR	355	14
22 solid	6 (2 Shld)(4 Unshld)	Shld/Unshld	CMR	369	14
22 solid	2 Pair	Ind Shielded	CMR	420	21
22 solid	6 Pair	Ind Shielded	CMR	422	21
22 solid	12 Pair	Ind Shielded	CMR	424	21
22 solid	15 Pair	Ind Shielded	CMR	425	21

AWG	No.Cond.	Shield	Rating	Cat.No.	PG
22 solid	2	Overall Shield	CM	450	13
22 solid	3	Overall Shield	CM	451	13
22 solid	2 Pair	Overall Shield	CMR	3251	18
22 solid	3 Pair	Overall Shield	CMR	3252	18
22 solid	4 Pair	Overall Shield	CMR	3253	18
22 solid	4	Aquaseal Tape	CM	AQC240	40
22 solid	2	Aquaseal + Shld	CM	AQC290	39
22 solid	3 (2 Shld)(1 Unshld)	Shld/Unshld Aquaseal	CM	AQC351	38
22 solid	4 (2 Shld)(2 Unshld)	Shld/Unshld Aquaseal	CM	AQC355	38
22 solid	6 (2 Shld)(4 Unshld)	Shld/Unshld Aquaseal	CM	AQC369	38
22 solid	6 (2 Shld)(4 Unshld)	Shld/Unshld Aquaseal	CM	AQC373	38
22 solid	2 Pair	Aquaseal Ind.Shld	CM	AQC420	41
22 solid	6 Pair	Aquaseal Ind.Shld	CM	AQC422	41
22 solid	12 Pair	Aquaseal Ind.Shld	CM	AQC424	41
22 solid	4 Pair	Aquaseal Ind.Shld	CM	AQC429	41
22 solid	2 Pair	Ind Shielded	CMP	D25420	141
22 solid	2 Pair	Ind Shielded	CM	D420	141
23 Solid	4 Pair	None	CMR	4246	147
23 Solid	4 Pair	None	CMP	254246	147
23 Solid	4 Pair	None	None	WP57622	148
24 (7x32)	1 Pair	Overall Shield	CM	D2401	140
24 (7x32)	2 Pair	Overall Shield	CM	D2402	140
24 (7x32)	4 Pair	Overall Shield	CM	D2404	140
24 (7x32)	1 Pair	Overall Shield	CMP	D252401	135
24 (7x32)	2 Pair	Overall Shield	CMP	D252402	135
24 (7x32)	4 Pair	Overall Shield	CMP	D252404	135
24 (7x32)	1 Pair	Overall Shield + Braid	CMP	D254851	144
24 (7x32)	2 Pair	Overall Shield + Braid	CMP	D254852	144
24 (7x32)	1 Pair	Overall Shield + Braid	CM	D4851	143
24 (7x32)	2 Pair	Overall Shield + Braid	CM	D4852	143
24 (7x32)	3 Pair	Overall Shield + Braid	CM	D4853	143
24 (7x32)	4 Pair	Overall Shield + Braid	CM	D4854	143
24 (7x32)	1 Pair	Ind Shielded	CM	DA2401	135
24 (7x32)	2 Pair	Ind Shielded	CM	DA2402	135
24 (7x32)	6 Pair	Ind Shielded	CM	DA2406	135
24 (7x32)	1 Pair	Ind Shielded	CMP	DA252401	136
24 (7x32)	2 Pair	Ind Shielded	CMP	DA252402	136
24 Solid	4 Pair	None	CMR	4245	146
24 Solid	4 Pair	None	CMP	254245	146
24 Solid	100 Pair	None	CMR	WP55211	149
24 Solid	200 Pair	None	CMR	WP55212	149
24 Solid	50 Pair	None	CMR	WP55216	149
24 Solid	25 Pair	None	CMR	WP55700	149
24 Solid	50 Pair	None	CMP	WP56126	149
24 Solid	100 Pair	None	CMP	WP56128	149
24 Solid	200 Pair	None	CMP	WP56129	149
24 Solid	25 Pair	None	CMP	WP56081	149
24 Solid	4 Pair	None	Out	M57562	148

AWG	No.Cond.	Shield	Rating	Cat.No.	PG
24 Solid	25 Pair	None	CMR	WP58141	150
24 Solid	25 Pair	None	CMP	WP58142	150
24 Solid	4 Pair	None	CM	M58762	148
24 Solid	4 Pair	None	CM	M58772	148

Video Cables

RG Size	Application	AWG	Copper	Shielding	Rating	Cat.No.	PG
Miniature	RGB- 5 Coax	25 Solid	Bare copper	100% Foil + 95% Spiral Shield	CM	5CRGB	94
Miniature	RGB- 3 Coax	25 Solid	Bare copper	100% Foil + 95% Spiral Shield	CMP	253CRGB	95
Miniature	RGB- 3 Coax	25 Solid	Bare copper	100% Foil + 95% Spiral Shield	CM	3CRGB	95
Miniature	RGB- 5 Coax	25 Solid	Bare copper	100% Foil + 95% Spiral Shield	CMP	255CRGB	95
Miniature	RGBHV + Audio	25 Solid	Bare copper	100% Foil + 95% Spiral Shield	CM	6CRGB2P	94
Miniature	RGBHV + Audio	25 Solid	Bare copper	100% Foil + 95% Spiral Shield	CMP	256CRGB2P	95
Miniature	RGBHV + Cat5E	25 Solid	Bare copper	100% Foil + 95% Spiral Shield	CM	6CRGB4P	94
Miniature	RGB- 3 Coax	26 (7x34)	Tinned Copper	100% Foil + 95% Spiral Shield	CMP	WP258263	98
Miniature	RGB- 5 Coax	26 (7x34)	Tinned Copper	100% Foil + 95% Spiral Shield	CMP	WP258265	98
Miniature	SVHS	25 Solid	Bare copper	100% Foil + 95% Spiral Shield	CMP	252CSVHS	100
RG11/U Type	CATV	14 Solid	Copper Covered Steel	Dual Shield 100% foil + Al.Braid	CATV	1100	68
RG11/U Type	CATV	14 Solid	Bare copper	Dual Shield 100% foil + Al.Braid	CATV	821	68
RG11/U Type	CATV	14 Solid	Bare copper	Dual Shield 100% foil + Al.Braid	Outdoor	1110	68
RG11/U Type	CATV	14 Solid	Bare copper	Quad-Shielded	CATV	Q821	68
RG11/U Type	CATV	14 Solid	Bare copper	Dual Shield 100% foil + Al.Braid	CATVP	25821	69
RG11/U Type	CATV	14 Solid	Bare copper	Quad-Shielded	CATVP	25Q821	69
RG11/U Type	CCTV	14 Solid	Bare copper	95% Bare Copper Braid	CL2	811	80
RG11/U Type	CCTV	14 Solid	Bare copper	95% Bare Copper Braid	Outdoor	4811	80
RG11/U Type	CCTV	14 Solid	Bare copper	95% Bare Copper Braid	CMP	25811	80
RG179 MINIMAX	SDI	25 Solid	Bare copper	100% Foil + 95% Tinned Braid	CMR	HD825	92
RG179 MINIMAX	SDI	25 Solid	Bare copper	100% Foil + 95% Tinned Braid	CMP	HD25825	92
RG179 MINIMAX	RGB- 3 Coax	25 Solid	Bare copper	100% Foil + 95% Tinned Braid	CM	WP8253	97
RG179 MINIMAX	RGB- 5 Coax	25 Solid	Bare copper	100% Foil + 95% Tinned Braid	CM	WP8255	97
RG179 MINIMAX	RGB- 5 Coax	25 Solid	Bare copper	100% Foil + 95% Tinned Braid	CMP	WP258255	98
RG179 MINIMAX	SVHS	25 Solid	Bare copper	100% Foil + 95% Tinned Braid	CM	2825	100
RG179 MINIMAX	SVHS	25 Solid	Bare copper	100% Foil + 95% Tinned Braid	CMP	252825	100
RG179 MINIMAX	CCTV	25 Solid	Bare copper	95% Bare Copper Braid	CM	825	74
RG179 MINIMAX	CCTV	25 Solid	Bare copper	95% Bare Copper Braid	CMP	25825	74
RG179 MINIMAX	CCTV + 22 AWG. POWER	25 Solid	Bare copper	95% Bare Copper Braid	CM	45825	74
RG179 MINIMAX	CCTV + 18 AWG. POWER	25 Solid	Bare copper	95% Bare Copper Braid	CM	825182	74
RG58/u Type	50 ohm RF	20 Solid	Tinned Copper	95% Tinned Copper Braid	none	813	84
RG58/u Type	50 ohm RF	20 (19x32)	Tinned Copper	95% Tinned Copper Braid	CMP	25812	84
RG58A/u Type	50 ohm RF	20 (19x32)	Tinned Copper	95% Tinned Copper Braid	none	812	84
RG59/u Type	SDI	20 Solid	Bare copper	100% Foil + 95% Tinned Braid	CMR	819	92
RG59/u Type	SDI	20 Solid	Bare copper	100% Foil + 95% Tinned Braid	CMP	25819	92
RG59/u Type	SDI	20 Solid	Bare copper	100% Foil + 95% Tinned Braid	CM	AQC819	42
RG59/u Type	RGB- 5 Coax	20 Solid	Bare copper	100% Foil + 95% Tinned Braid	CM	WP8195	99
RG59/u Type	RGB- 5 Coax	20 Solid	Bare copper	100% Foil + 95% Tinned Braid	CMP	WP258195	99
RG59/u Type	CCTV	20 Solid	Bare copper	95% Bare Copper Braid	CM	815	75
RG59/u Type	CCTV Economy	20 Solid	Bare copper	95% Copper Alloy	CM	815E	75
RG59/u Type	CCTV	20 Solid	Bare copper	95% Bare Copper Braid	CM	AQC815	75

RG Size	Application	AWG	Copper	Shielding	Rating	Cat.No.	PG
RG59/u Type	CCTV	20 Solid	Bare copper	95% Bare Copper Braid	Outdoor	4815	98
RG59/u Type	CCTV + POWER	20 Solid	Bare copper	95% Bare Copper Braid	CM	2815B	76
RG59/u Type	CCTV + POWER	20 Solid	Bare copper	95% Copper Alloy	CM	2815E	76
RG59/u Type	CCTV + POWER	20 Solid	Bare copper	95% Bare Copper Braid	CMP	252815	77
RG59/u Type	CCTV + POWER Economy	20 Solid	Bare copper	95% Bare Copper Braid	CMP	252815E	77
RG59/u Type	CCTV	20 Solid	Bare copper	95% Bare Copper Braid	CMP	25815	77
RG6/u Type	SDI	18 Solid	Bare copper	100% Foil + 95% Tinned Braid	CMR	6350	92
RG6/u Type	SDI	18 Solid	Bare copper	100% Foil + 95% Tinned Braid	CMP	256350	92
RG6/u Type	RGB- 5 Coax	18 Solid	Bare copper	100% Foil + 95% Tinned Braid	CM	WP6355	99
RG6/U Type	CATV	18 Solid	Bare copper	Dual Shield 100% foil + Al.Braid	CATV	841	64
RG6/U Type	CATV	18 Solid	Copper Covered Steel	Dual Shield 100% foil + Al.Braid	CATV	6100	64
RG6/U Type	CATV	18 Solid	Copper Covered Steel	Dual Shield 100% foil + Al.Braid	CATVP	256100	67
RG6/U Type	CATV	18 Solid	Bare copper	Dual Shield 100% foil + Al.Braid	CM	AQC841	65
RG6/U Type	CATV	18 Solid	Copper Covered Steel	Dual Shield 100% foil + Al.Braid	Outdoor	6140	65
RG6/U Type	Dual CATV	18 Solid	Copper Covered Steel	Dual Shield 100% foil + Al.Braid	CATV	6150	65
RG6/U Type	CATV	18 Solid	Bare copper	Quad-Shielded	CATVR	HQ841	66
RG6/U Type	CATV	18 Solid	Bare copper	Quad-Shielded	CATV	Q841	66
RG6/U Type	CATV	18 Solid	Copper Covered Steel	Quad-Shielded	CATV	6300	66
RG6/U Type	CATV	18 Solid	Copper Covered Steel	Quad-Shielded	CATVP	256300	67
RG6/U Type	CATV	18 Solid	Copper Covered Steel	Quad-Shielded	Outdoor	6310	66
RG6/U Type	CATV	18 Solid	Bare copper	Dual Shield 100% foil + Al.Braid	CATVP	25841	67
RG6/U Type	CATV	18 Solid	Bare copper	Quad-Shielded	CATVP	25Q841	67
RG6/u Type	CCTV	18 Solid	Bare copper	95% Bare Copper Braid	CM	806	78
RG6/u Type	CCTV	18 Solid	Bare copper	95% Bare Copper Braid	Outdoor	4806	79
RG6/u Type	CCTV	18 Solid	Bare copper	95% Bare Copper Braid	CM	AQC806	78
RG6/u Type	CCTV + POWER	18 Solid	Bare copper	95% Bare Copper Braid	CM	AQC2806	78
RG6/u Type	CCTV + POWER	18 Solid	Bare copper	95% Bare Copper Braid	CM	2806B	78
RG6/u Type	CCTV	18 Solid	Bare copper	95% Bare Copper Braid	CMP	25806	79
RG8/u Type	50 ohm RF TRANSMISSION	13 (7X21)	Bare copper	95% Bare Copper Braid	none	810	84
RG8/u Type	50 ohm RF TRANSMISSION	13 (7X21)	Bare copper	95% Bare Copper Braid	CL2P	25810	84
RG8/u Type	50 ohm RF TRANSMISSION	10 (19X23)	Bare copper	100% Foil +Tinned Braid	none	808F	84
RG8/X Type	50 ohm RF TRANSMISSION	16 (19X29)	Bare copper	95% Bare Copper Braid	CM	807	84
UTP	VIDEO OVER UTP	23 Solid	Bare copper	Unshielded	CM	M58813	101
UTP	VIDEO OVER UTP	23 Solid	Bare copper	Unshielded	CMP	M58814	101
UTP	VIDEO OVER UTP	23 Solid	Bare copper	Unshielded	CM	M58854	101

Specialty Cables

HomeNetworking: HN5261 - HN5262 - HN5262F -
LSHN5262 - LSHN6262 - LSHN6262F

Media Control Cables: 77350 - D25350 - E1854 - HA1624

Access Control Cables: AC1822 - LS1822 - LS251822

Video over UTP: CC2418 - CC2416 - CC252418 - CC252416

PTZ Composite Cables: PTZ825 - PTZ815 - PTZ25825 - PTZ25815

Composite A/V Cables: LS25AV, LSAV

FFlat Parallel Cables: WP37123 - WP37127 - WP37125 - WP37129

Low Skew UTP Cables: M58813, M58814