

Audio and Video Wiring

Audio Wiring

Audio wiring refers to any wire or cable carrying audio (20 Hz to 20 kHz) signals like voice or music. Most audio wiring is associated with connections in home music systems where stereo or surround sound components are interconnected.

One type of wiring is that connecting the speakers to the power amplifiers.

Another kind of audio wiring includes the cables connecting audio signals at lower levels such as those from CD players, TV sets, cassette decks, turntables, or AM/FM receivers.

A third type of audio wiring is that associated with public address and sound systems for entertainment including microphone wiring and instrument (guitar, keyboard, etc.) cables.

Telephone wiring is also a kind of audio wiring.

Speaker Cables

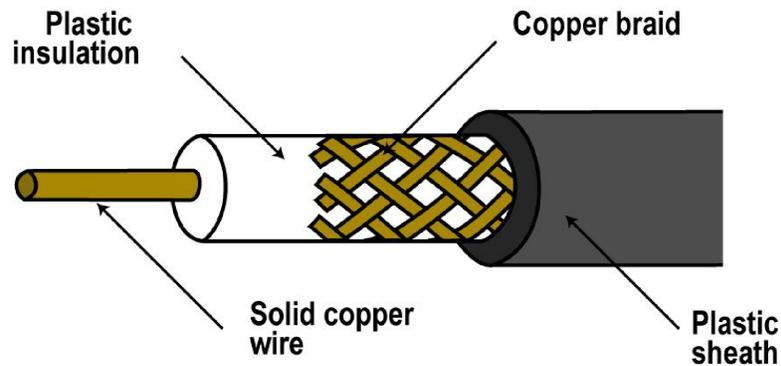
Speaker cables are two wire cables made up of stranded wire. These cables usually carry a very high current. The amount of current is dependent upon the power supplied to the speaker based on the volume control setting. The current is also a function of speaker impedance and power output.

Remember the power relationship: $P = I^2R$ where P is the power, I is the current and R is the speaker resistance or impedance. If the speaker impedance is 8 ohms and the power is 50 watts, the current in the cable is:

$$I = \sqrt{P/R} = \sqrt{50/8} = 2.5 \text{ amperes}$$

Large wires are normally used in speaker cables. The most common size is #18 but larger wires to size #12 are available. The wire is tinned copper strands.

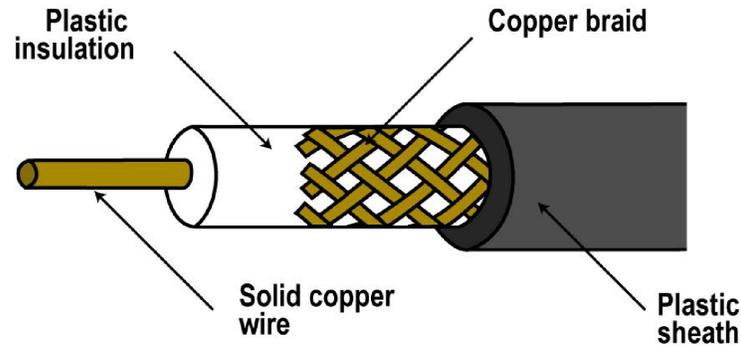
Low-Level Audio



Low-level audio signals are those at a level of several volts or less. The signals come from CD players or other sources of audio to be amplified by the larger stereo amplifiers.

Low-level audio signals are usually carried by a 75 ohm coaxial (coax) cables as shown in the figure. It is a single solid or stranded center conductor surrounded by an insulator. A fine wire braid around the insulator is used as a shield.

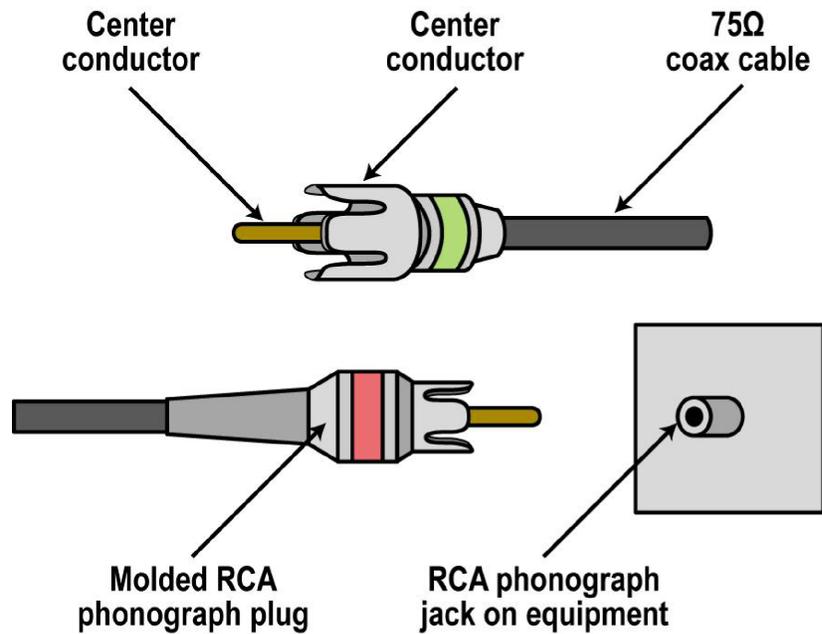
Low-Level Audio Shielding



Some cables use a solid aluminium or other metal foil surrounding the insulator. An outer jacket of PVC covers the entire cable.

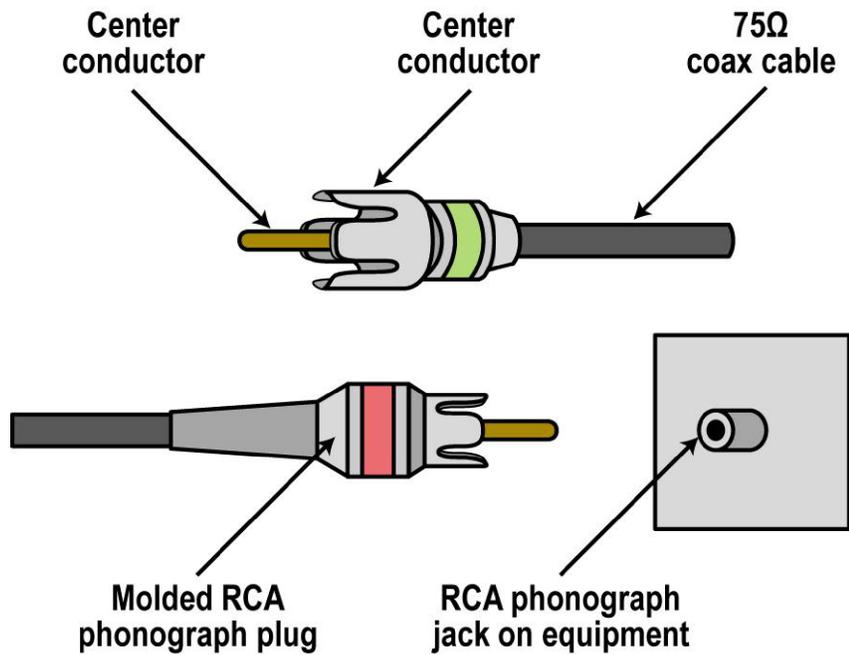
The braid or foil serves as one of the two conductors in the cable. This is usually the ground or common connection. It also serves as a shield for the center conductor. Shielding is important in low-level audio signals as noise from the 60 Hz power lines or other radiation can interfere with the signal.

Audio Connectors



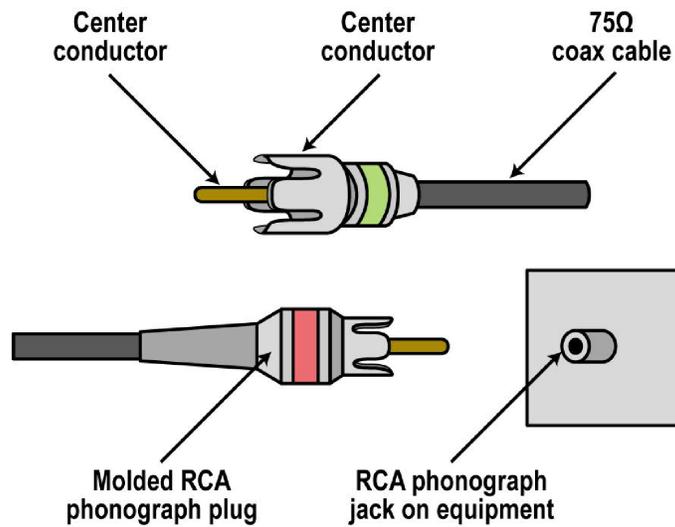
The connector used with coax audio wiring is the RCA phono connector. You have probably used these yourself or at least seen them. It was originally developed to connect the low level signal from a phonograph needle pickup head to the amplifier.

The Audio Connector



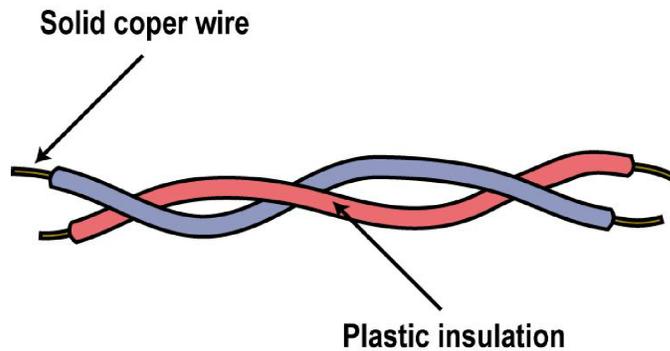
The center conductor wire of the cable is soldered to the center pin of the connector and the shield is attached to the outer shell of the connector. In some cases, a plastic outer covering is provided around the body of the connector.

Cable Assembly



While these cables are available individually, they usually are supplied as a cable assembly with two, three, or four cables attached in parallel as a set. Different color plastic covers help identify which cable is which.

Telephone Wiring



Telephone wiring uses twisted pair cable. This is a cable made up of two solid or stranded insulated wires loosely twisted together as shown.

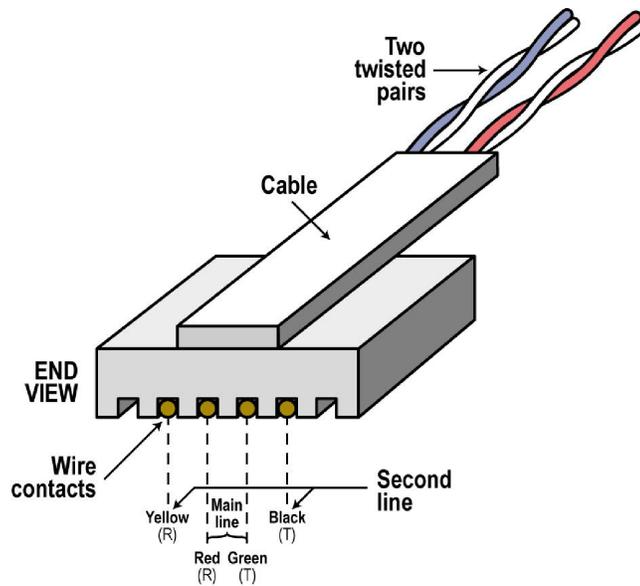
Indoor home telephone wiring is usually a cable with two twisted pairs made of #22 solid insulated wire. The insulation on the wires is PVC in red, green, yellow, and black. The outer insulation on the cable is usually gray or white. The red and green wires are used to connect a telephone line. The yellow and black wires are for a second line.

Telephone Wiring Installation

For business installations with many phone lines, larger cables are used. A common size is 25 twisted pairs per cable.

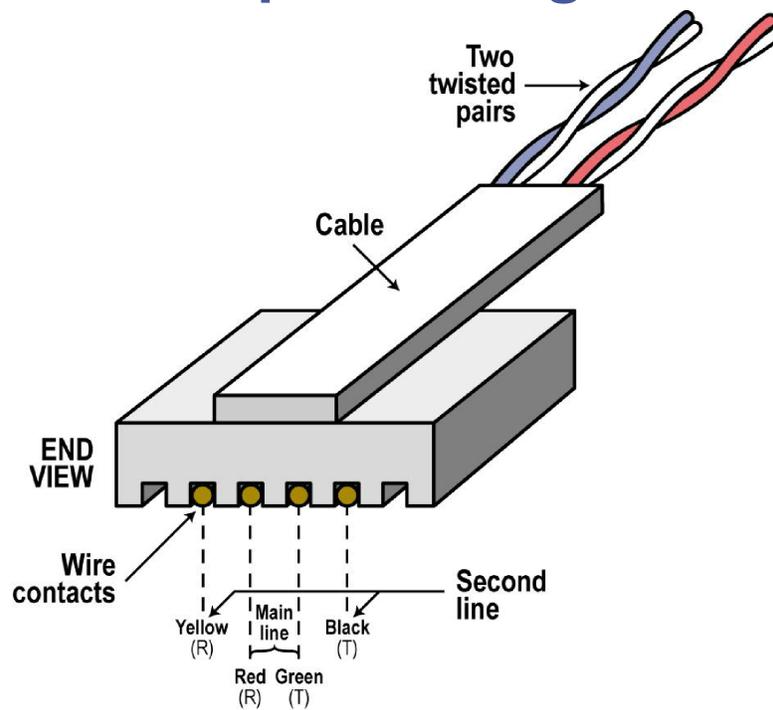
Telephone wires not installed inside the walls or ceilings are called modular wiring and are used to attach phones to the wall jacks. Modular wiring is made up of two, four, six, or eight insulated wires that are #28 (7 x 43) stranded wire.

Telephone Connectors



The connector used on the twisted pair is called a modular connector. It is also referred to as a RJ-11 connector. It has positions for 6 connections. It is used with cables of 2, 4, or 6 wires. When only two wires are used it is called an RJ-11. When 4 pins are used, the connector is called a RJ-14. When all 6 are used, it is called an RJ-25. The most common is the 4-pin (RJ-14) connector.

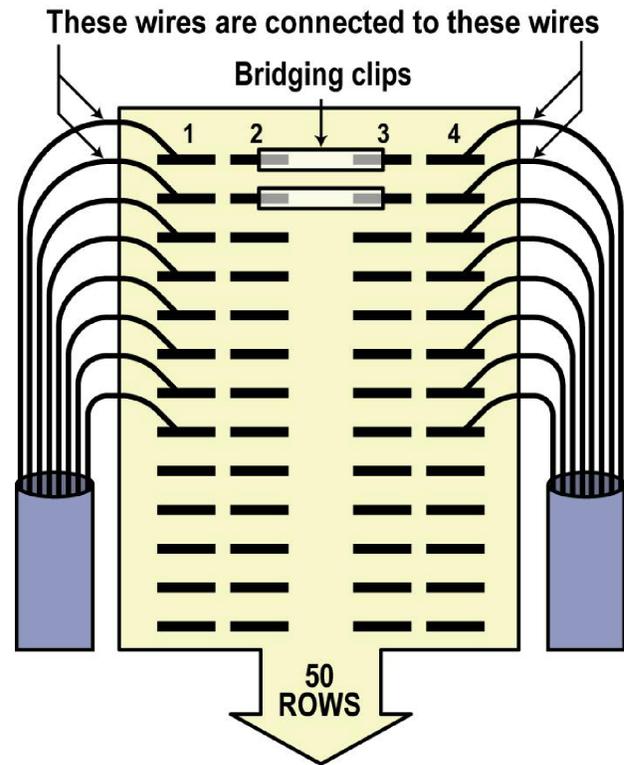
Tip and Ring



The designations T and R mean tip and ring, the names given to the parts of the old style telephone plugs to which the wires were connected.

Punch Down Blocks

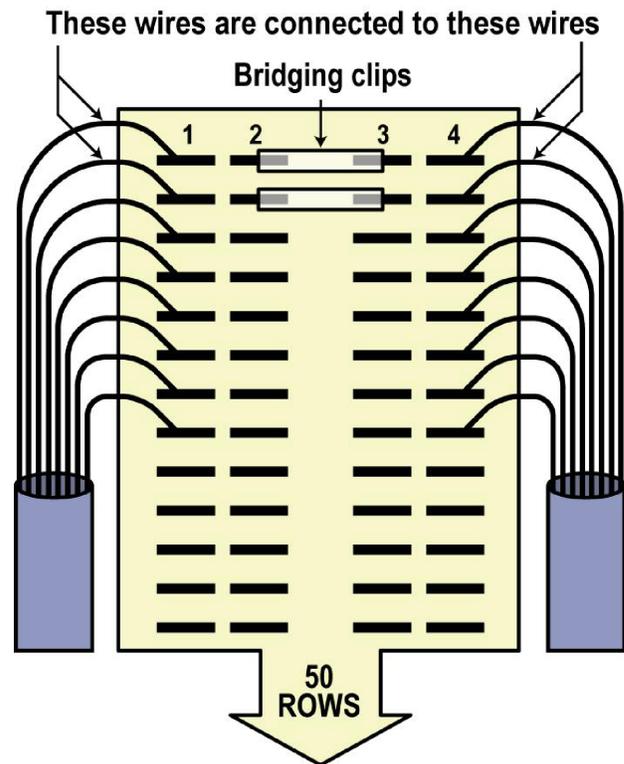
A punch down block is a special connection system originally developed by AT&T for telephone wiring in offices and larger buildings with many phones. It is designed for making connections between two sets of twisted pair cables. The basic connector block is referred to as a type 66-block. It actually has 50 rows of four connectors each so it can accommodate 25 twisted pairs on each side.



Connectors

The connectors in each row are labelled 1 through 4 from left to right. Note that connectors 1 and 2 are connected internally, and connectors 3 and 4 are connected internally.

The twisted pair cables on the left can be wired to the twisted pairs on the right by using bridging clips. The bridging clips are metal tabs that slide over connections 2 and 3 on the block.



Pin 1 is internally connected to pin 2
Same with pins 3 and 4

Connection Process

A key feature of the punch down blocks is that the wires are attached to the connection tabs by simply punching the insulated wire down between the two prongs on each connecting point. A special tool is used for this process. During the punch down process, the insulation is cut and the bare wire is forced between the two prongs. The prongs cut into the wire and make a good connection. The extra wire and insulation are automatically cut off by the tool during the process. The connection process is fast and easy and no solder or screw terminals are needed.

The type 66 blocks are used mainly for telephone wiring. A similar type of punch down block is called the type 110. It is used for data wiring in networks. They come in different sizes to handle from 25 to 500 twisted pairs. The punch down process is similar. The 110 blocks do not use the bridging clips but use #24 wire jumpers to connect one pair to another pair.

Video Wiring

Video signals are very high in frequency and can extend to as high as 500 MHz or so. These are usually low level signals of a few volts or less. As a result, they are subject to noise pick up. As a result, most video signals are carried by coax cable.

Video cables are definitely transmission lines so must be properly terminated in their characteristic impedance.

Most video is carried over 75-ohm coax cables, either RG-59/U or RG-6/U. The RG-59/U cables are preferred for inside cabling while the RG-6/U wiring is widely used in cable TV systems.

Types of Video Signals

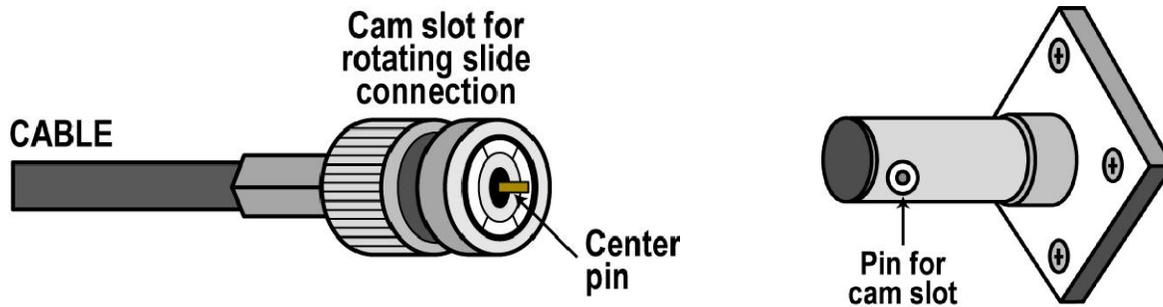
Video signals can be either composite video, S-video, or red, green, blue (RGB).

Composite video is a signal consisting of the brightness or luminance signal (designated Y), the color signals, and the synchronizing signals. This is the signal received by a TV set over the air or via cable TV. It is also typically what comes out of a VCR or camcorder.

S-video is a special signal used for higher quality video installations. It separates the brightness signal (Y) from the color signals designated C.

Red, green, blue video separates the video into its red, green, and blue signals. It is used in high end video installations and in computer monitors. A fourth signal is the synchronizing pulses.

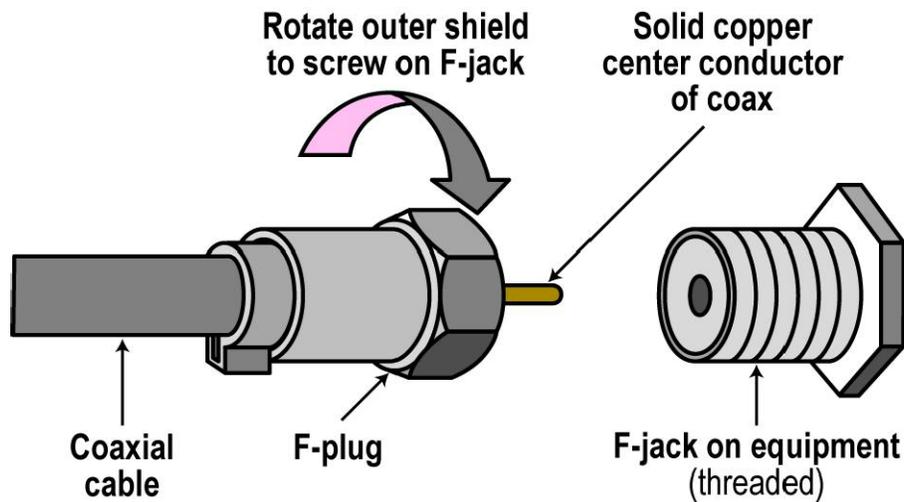
Video Connectors



The RCA phono connector described earlier is widely used for video signals. It is commonly used with RG-59 coax to carry composite video in most home or commercial TV systems. It is also the primary connector used for RGB video signals.

An improved more durable connector used in commercial studios is the BNC connector. It has a thin center conductor surrounded by a shield flange. The flange incorporates what is called a bayonet cam mechanism similar to that which was used to attach a bayonet to a rifle. The connector is installed with just a half turn twist. The connector is normally used with RG-59 75 ohm coax cable. BNC connectors are widely used with test equipment as well.

Additional Video Connectors: F

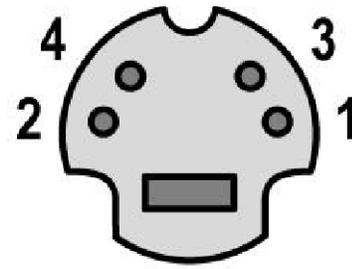


The connector used for cable TV signals is called the F-connector shown here. It is used with RG-6 75 ohm coax. This type of coax has a very stiff solid center conductor that is actually used as the center connection. This is surrounded by a screw thread outer shield.

Additional Video Connectors: S

A special connector, shown here, is used for S-video. It is called a mini-DIN and has four pins for the Y and C signals. Each video signal has its own ground.

The S-video cable itself is made up of two very small coax cables connected together. The wire size is #30. The cable is very flexible but somewhat delicate. It is usually intended only for short runs between TV sets, VCRs, DVD players, and some cameras. Maximum length is said to be 150 feet although most cables are never longer than 6 to 12 feet.



Pin	1	Y ground
	2	C ground
	3	Y
	4	C

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