

2.2 Types of Wires

A wire is defined as one electrical conductor, while a cable is defined as a group of individually insulated wires (conductors) encased together in sheathing. Sheathing is a non-conducting material with protective properties to shield the conducting part of the wire/cable. Although wire is a good conductor, it can still have some resistance. Wires and cables can be made from various materials, such as copper, gold, and aluminum.

The materials each have different resistances. Thick wire will have a lower resistance than thin wire made from the same material. Resistance of the wire can change proportionally with change in temperature or length of the wire. Wire size indicates the diameter of the metal conductor of the wire. When choosing the size of wire, you must consider the gauge of the wire, wire capacity, and what the wire will be used for. If the wire is too small, too much current will be sent through, causing the wire to drop more power, in the form of watts, because there is such high resistance.



Wire:

The two categories of single-conductor wires are solid and stranded (also called braided). Solid wire is rigid and conducts electricity better. Stranded wire consists of smaller wires braided together. Stranded wires are less prone to breakage when flexed repeatedly, which is why this type of wire is common in phone chargers.



Jumper wires are pre-cut flexible stranded wires of different lengths that have stiff ends to allow the wire to be easily inserted in a breadboard. Hook-up wire is typically single conductor insulated wire used in low current, low voltage (<600 Volts) applications for making internal connections. It comes in a range of gauges and lengths. Once the hook-up wire is cut to the desired length a wire stripper can be used to strip off the insulation, allowing the metal conductor to be attached to a circuit.

Magnet wire is a copper or aluminum wire coated with a very thin layer of insulation. Magnet wire allows multiple layers of wire to be wound together without short circuiting. When the wire is wound into a coil and energized, it creates an electromagnetic field. Magnet wire is often used in transformers, inductors, motors, electromagnets, Tesla coils, and other applications that require tight coils of insulated wire.

Wire-wrap wire is ideal for wire wrapping, hence the name. The silver-plated copper wire is highly flexible and well insulated, yet resistant to abrasion. Wire wrapping is great for prototypes because it

is easy to make point-to-point connections and to repair them. The connections made with wire wrapping is more reliable than soldered connections because of the amount of contact the wire makes with the post.

Muscle wire is an extremely thin wire made from Nitinol that is known for its ability to contract when an electric current is applied. It has been used for micro latches on Microsoft® Surface Book laptops. Check out this more in-depth article about what muscle wires are and how muscle wire works.

Cable

As mentioned earlier, a cable is a group of insulated wires encased together in sheathing. Typically, a cable has at least one hot wire to carry the current, one neutral wire, and one grounding wire. Cables are classified according to the number of wires it contains and their size/gauge. The cables are marked with a series of letters followed by a number, a dash, and another number. The letters indicate the type of insulation. The first number indicates the resistance of the wires in the cable. And the number following the dash indicates the number of individual conductors in the cable. If a G follows the final number, then it means the cable is also equipped with a non-current carrying ground wire.

AC Power Cords safely deliver the current and voltage from domestic power to an electronic device, usually an AC to DC power supply. The individually insulated conductors are inside a more durable protective outer jacket and are fitted with connectors on one or both ends. Conductor size and count, current and voltage rating, temperature rating and agency approvals are normally printed along the jacket.

Multi-conductor cable is a variation of stranded wire, where each cable hosts 2-60 distinct conductors inside a common jacket. There can be both stranded and solid conductors wound together within the jacket. These cables can be used to connect heavy appliances, in medical electronics, in audio systems, and more.

Ribbon cable is a series of single-conductor wires connected side-by-side to form a ribbon shape. It may also be called zip-wire because the conductors can be separated from the ribbon. The wires are not encased together in one protective jacket, like the other types of cables, but rather individually insulated.

Coaxial cable has an insulated center conductor surrounded by a braided wire shield, which is encased in a tough outer jacket/sheathing. Coaxial means two or more three-dimensional linear forms that share a common axis. This type of transmission line carries high frequency electrical signals with low losses. Some of the applications include carrying cable television signals, broadband internet networking cables, and connecting radio transmitters and receivers to their antennas. The composition of the coaxial cable is the outer plastic sheath, woven copper shield, inner dielectric insulator, and the copper core.

Speaker cable is two or more electrical conductors (typically copper) individually insulated by plastic or rubber. The two wires are electrically the same but are marked to identify the correct audio signal polarity. Speaker cable is used for the electrical connections between speakers and amplifier sources. There are three key electrical properties: resistance, capacitance, and inductance. Low-resistance allows more of the source's power through the speaker coil, which means more sound.