

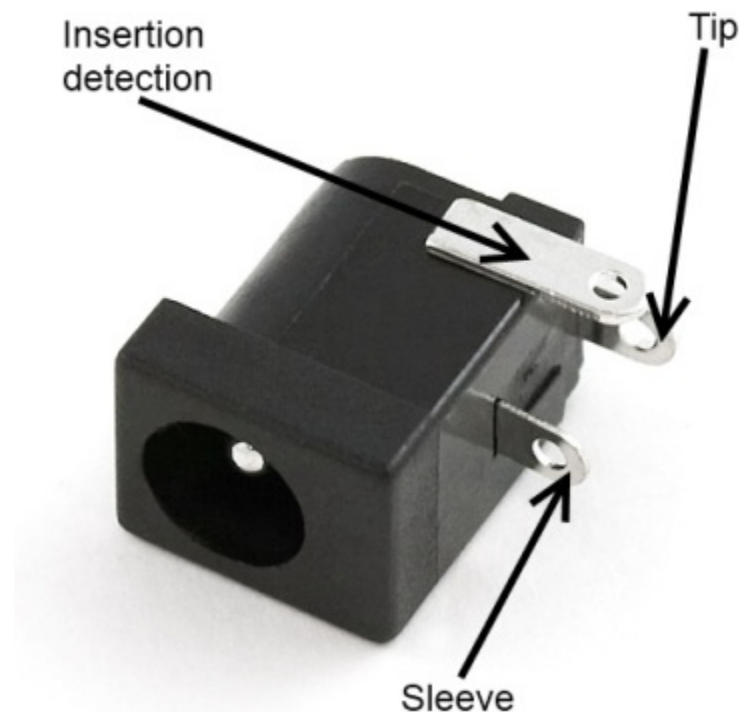
POWER CONNECTORS

While many connectors carry power in addition to data, some connectors are used specifically to provide power connections to devices. These vary widely by application and size, but we will only focus on some of the most common ones here.

Barrel Connectors

Barrel connectors are typically found on low-cost consumer electronics which can be plugged into wall power via bulky **AC wall adaptors**. Wall adaptors are widely available, in a variety of power ratings and voltages, making barrel connectors a common means for connecting power to small projects.

The female barrel connector, or “jack”, can be purchased in several varieties: PCB mounted (surface mount or through hole), cable mount, or panel mount. Some of these connectors will have an additional contact that allows the application to detect whether a power supply is plugged into the barrel jack or not, thus allowing the device to bypass batteries and save battery life when running on external power.



Female barrel connector. When no plug is inserted, the “insertion detection” pin will be shorted to the “sleeve” pin.

The male barrel connector, or “plug”, is usually only found in a wire termination variety, although there are multiple methods of attaching the plug to the end of the wire. It’s also possible to get plugs that come pre-attached to a cable.



Unattached male barrel plug, for attachment to any power supply. Note that the sleeve connection is designed to be crimped onto the wire for extra strain relief.

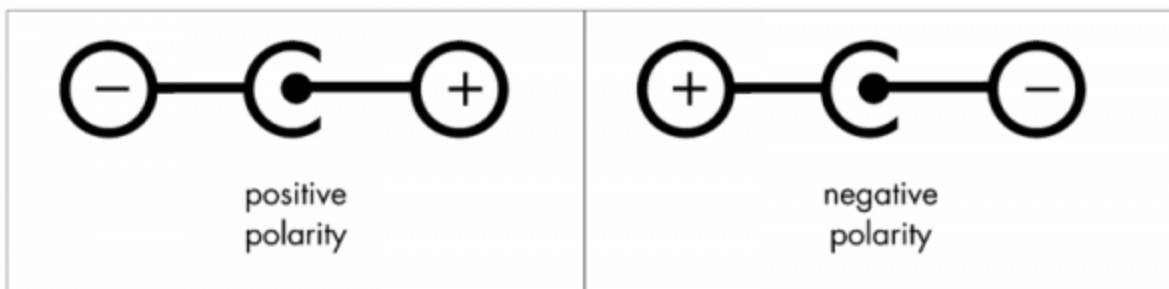
Barrel connectors provide only two connections, frequently referred to as “pin” or “tip” and “sleeve”. When ordering, there are three differentiating characteristics of a barrel connection- inner diameter (the diameter of the pin inside the jack), outer diameter (the diameter of the sleeve on the outside of the plug), and polarity (whether the sleeve voltage is higher or lower than the tip voltage).

Sleeve diameter is most commonly either 5.5mm or 3.5mm.

Pin diameter is contingent upon sleeve diameter; a 5.5mm sleeve will have either a 2.5mm or 2.1mm pin. Unfortunately, this means that a plug designed for a 2.5mm pin will fit in a 2.1mm jack, but that the connection will be, at best, intermittent. 3.5mm sleeve plugs usually mate to a jack with a 1.3mm pin.

Polarity is the final aspect to consider; most often, the sleeve will be considered 0V and the tip will be a positive voltage relative to the sleeve. Many devices will have a small diagram indicating the polarity expected by the device; care should be taken to adhere to this, as an improper power supply may damage the device.

Plugs of both sleeve sizes are usually 9.5mm long, but longer and shorter ones do exist. All SparkFun products use a positive polarity 5.5mm sleeve and a 2.1mm pin; we recommend sticking to that standard where possible, as it seems to be the most common flavor found in the wild.



Common polarity diagrams for AC adaptors with barrel plugs. Positive polarity (tip positive, sleeve 0V) is most common. Diagram courtesy Wikipedia user [Three-quarter-ten](#).

“Molex” Connectors

Most computer hard drives, optical drives, and other internal peripherals get power through what is typically called a “Molex” connector. To be more accurate, it’s a Molex series 8981 connector—Molex is actually the name of the company which initially designed this connector back in the 1950s—but common usage has denuded that fact somewhat.

Molex connectors are designed to carry a lot of current: up to 11A per pin. For projects where a lot of power may be needed—a CNC machine, for instance, or a 3D printer- a very common method for powering the project is to use a desktop PC power supply and connecting the various system circuits through Molex connectors.

The Molex connector is one where the male/female terminology is a bit odd. The female connector is usually found on the end of a cable, and it slips inside of a plastic shell which surrounds the male pins on the male connector. Usually, the connectors are press-fit only, and very, very tight—they are intended to be connected and disconnected only a few times and, as such, are a bad choice for systems where connections will frequently be changed.



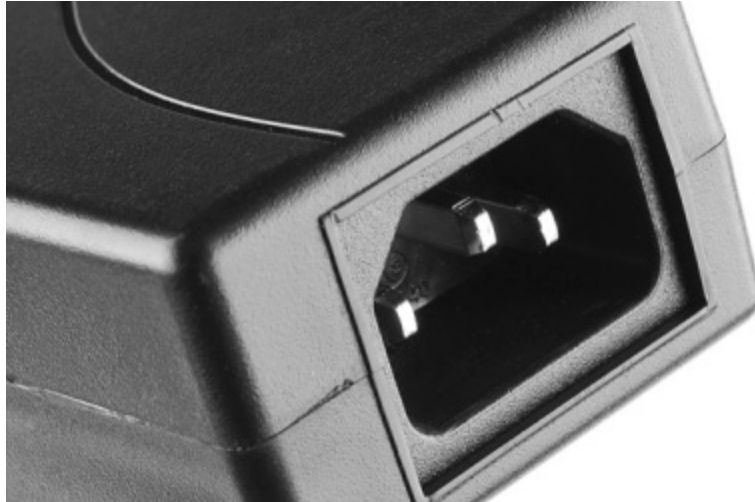
Male Molex connector. The gender of the pins inside the connector is what signifies the gender of the connector as a whole.



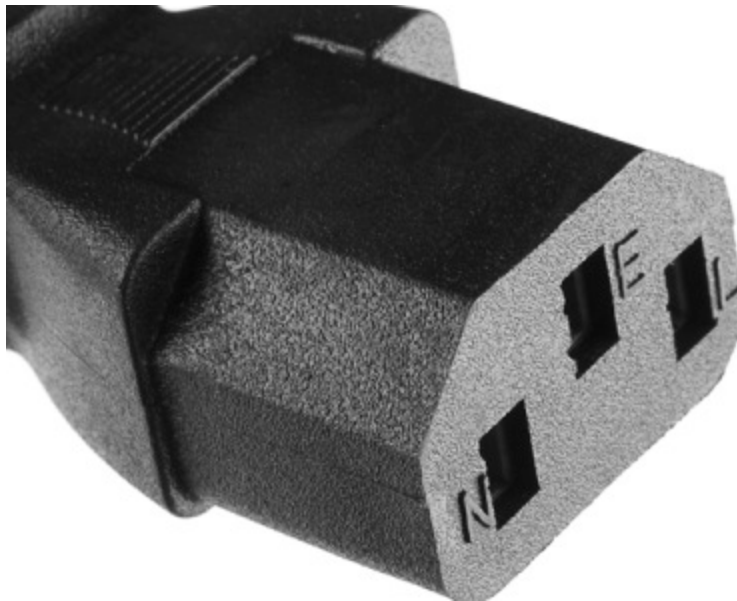
Female Molex connector on a project power supply.

IEC Connector

As with the Molex connector, this is a case where a generalized component name has come to be synonymous with a single, particular item. IEC connector usually refers to the power supply inlet which is commonly seen on desktop PC power supplies. Strictly speaking, that's an [IEC 60320-1 C13](#) (female) and C14 (male) connector.



*C14 male IEC power inlet, on a **DC project power supply**. Note that, as with the Molex connector, the gender of the connector is defined by the pins within the hood.*



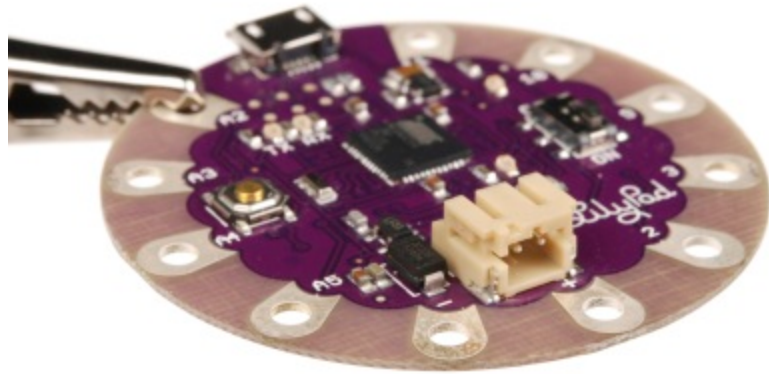
*C13 female IEC power connector, on a fairly standard **AC power supply cable**. Cables with this end can be found all around the world, usually with the dominant local AC connector at the other end.*

IEC connectors are used almost exclusively for AC power input. The nice thing about using one on a project is that IEC-to-wall cables are extremely common *and* available with localized wall plugs for most international locations!

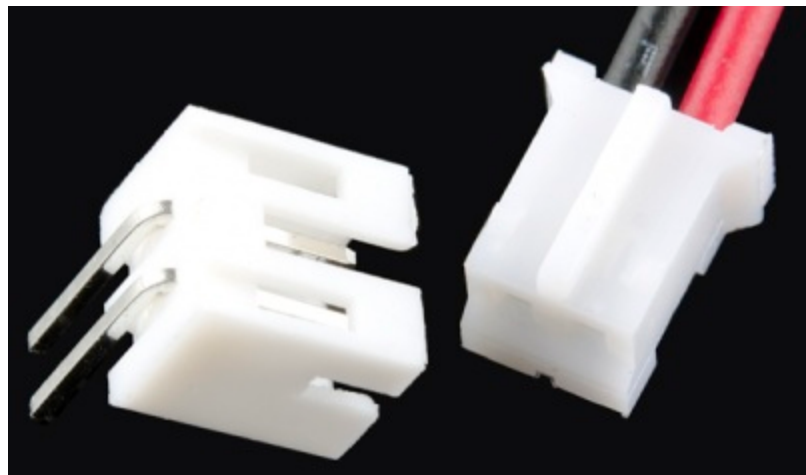
JST Connector

At SparkFun, we frequently refer to “2.0mm JST Connectors”. This is yet another generalization of a specific product- JST is a Japanese company which makes high-quality connectors, and our 2.0mm JST connector of choice is the PH series two-position polarized connector.

All of SparkFun's single-cell lithium-polymer ion batteries come standard with this type of JST connector, and many of our boards include this connector (or a footprint for it) as a power supply input. It has the advantage of being compact, durable, and difficult to connect backwards. Another feature, which can be an advantage or a disadvantage, depending on how you look at it, is that the JST connector is wicked hard to disconnect (although a **carefully applied diagonal cutter** can be helpful!) once it's mated. While this makes it unlikely to fail during use, it also means that disconnecting the battery for charging can damage the battery connector.



*2-Pin JST male connector on a **LilyPad Arduino USB** board. Again, as with the Molex, the pins inside the hood determine the gender of the connector.*



Male and female 2-pin JST connectors.

There are PH series connectors with more than two positions; SparkFun even sells them. However, our most frequent application is for the 2-position battery connection.

Source : <https://learn.sparkfun.com/tutorials/connector-basics#power-connectors>