

Soldering

Basic Use and Safety



Square One Shop and Safety Policy:

In an emergency, dial 9-911

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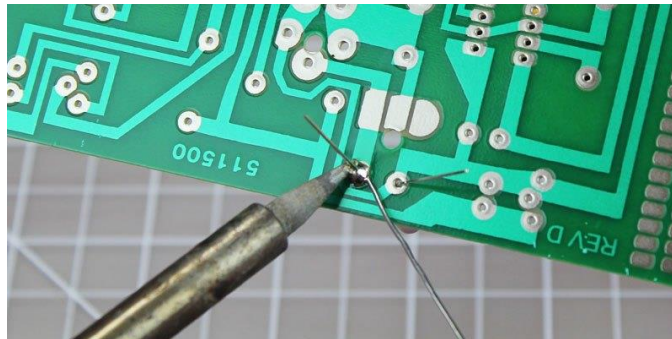
The most up-to-date policies are always available for review at the front desk.

- Be **Safe**: Pay attention, follow posted procedures, and ensure proper materials are being used including eye/ear protection in the woodshop.
- Be **Curious**: Experiment, try new things, watch what other people are doing.
- Be **Respectful**: Keep your chaos contained, clean up after yourself, don't touch other people's work without asking, don't interrupt.
- Be **Aware**: Alert staff if equipment isn't functioning properly, follow staff instructions, pay attention to your project.
- Be **Prepared**: Bring your photo ID and library card, wear closed-toe shoes, secure loose or dangly objects (i.e. hair, jewelry, keys), start cleaning up 30 minutes before closing time.

Notes:

How to Solder: A Beginner's Guide

If you're tackling an electronics project, you're tackling soldering as well. Learning how to solder with proper soldering techniques is a fundamental skill every maker should master. In this tutorial, we outline the basics of soldering irons, soldering stations, types of solder, desoldering, and safety tips. Whether you're building a robot or working with Arduino, knowing how to solder will come in handy.



Soldering Safety

Soldering poses a few different dangers: **The soldering iron itself gets very hot; the solder** [the material you heat with the iron] **also gets hot**; occasionally you even get an air pocket or impurity that can pop as you heat the solder and send bits of solder flying. Solder also produces strong fumes.

So, to stay as safe as possible, always follow these soldering safety guidelines:

Always wear safety glasses when soldering.

Never solder a live circuit [one that is energized].

Soldering irons come in models that use different wattages. **Use the right size soldering iron for your projects**; too much heat can ruin your board or components. Soldering irons can reach temperatures of over 896°F, so it is very important to **know where your iron is at all times**. We always recommend you use a soldering iron stand to help prevent accidental burns or damage.

Solder in a well-ventilated space to prevent the mildly caustic and toxic fumes from building up and causing eye or throat irritation. It is recommended to use a *fume*

extractor, which is a fan with a charcoal filter that absorbs the harmful solder smoke. The **air vent switch** is labelled “Laser Vent” and is located just above the laser cutter.

Always put your soldering iron back in its stand when not in use. Be sure that the stand is weighted enough or attached to your worktable so that it doesn't topple over if you brush against the cord.

Never place a hot soldering iron on your work surface; you could start a fire!

Never, ever try to catch a hot soldering iron if you drop it. Let it fall, buy a new one if you have to — **just don't grab it!**

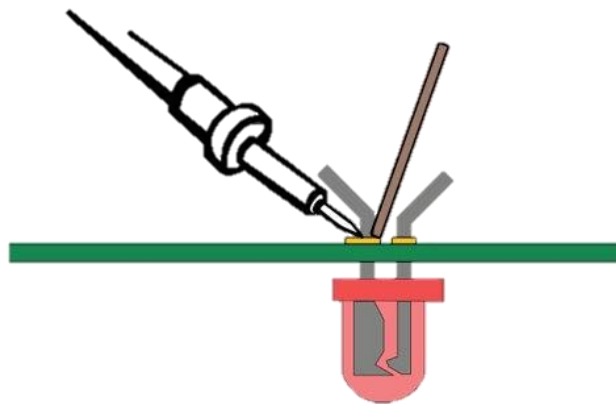
Give any soldered surface a minute or two to cool down before you touch it.

Never leave flammable items (such as paper) near your soldering iron.

Be sure to unplug your soldering iron when you're not using it.

Last but not least, make sure to wash your hands when done soldering, regardless of the solder you are using.

What Is Soldering?



If you were to take apart any electronic device that contains a circuit board, you'll see the components are attached using soldering techniques. **Soldering is the process of joining two or more electronic parts together by melting solder around the connection.** *Solder* is a metal alloy, and when it cools it creates a strong electrical bond between the parts. Even though soldering can create a permanent connection, it can also be reversed using a desoldering tool.

Soldering Tools

The good thing about learning how to solder is the fact that you don't need a lot to get started. Below we'll outline the basic tools and materials you will need for most of your soldering projects.

Soldering Iron



You won't get far into a soldering project without a *soldering iron*. This is a hand tool that plugs into a standard 120v AC outlet and heats an interchangeable metal tip up to a very hot 896° F in order to melt solder. Soldering irons come in several varieties, including pen or gun type. We recommend that you use a pen type soldering iron in the 15W to 30W range when you're learning to solder.

Soldering Station



A *soldering station* is a more advanced version of the basic standalone soldering pen. If you are going to be doing a lot of soldering, these are indispensable as they offer the ability to precisely adjust the temperature of the soldering iron, which is great for a range of projects. These stations may also include advanced temperature sensors, alert settings, and even password protection for safety

Soldering Iron Tips



At the end of most soldering irons is an interchangeable part known as a *soldering tip*.

There is a wide variety of tip shapes and sizes, with each tip useful for a specific purpose. The most common tips you will use in electronics projects are the *conical tip* and the *chisel tip*.

Conical Tip – Used in precision electronics soldering because of the fine tip. Because of its pointed end, it is able to deliver heat to smaller areas without affecting its surroundings.

Chisel Tip – This tip is well-suited to soldering wires or other larger components because of its broad, flat tip.

Image Credit – Sparkfun.com

Brass or Conventional Sponge



Use a sponge to remove the oxidization that forms at the end of the tip. You could use a conventional wet sponge to clean the tip, but this may shorten the lifespan of the tip due to expansion and contraction, and also drops the temperature of the tip temporarily when wiped. A better alternative is to use a *brass sponge* (shown below on the left).

Soldering Iron Stand



This is a basic but very useful and handy tool to have when soldering. A *soldering iron stand* helps to prevent the hot iron tip from coming in contact with flammable materials or causing accidental injury. Most soldering stations come with this feature built-in, and also include a sponge or brass sponge for cleaning the tip.

Solder



Some examples of rosin-core solder. It comes in a variety of diameters and metallic formulations. Be sure you buy the *rosin-core* variety; solid-core will be much harder to work with and require you to buy flux, while acid-core may damage your circuits and components!

Solder is a metal alloy that is melted to create a permanent bond between electrical parts. It comes in both leaded and lead-free variations with diameters of .032" and .062". Inside the solder core is a material known as *flux*, which helps improve electrical contact and mechanical strength.

For electronics soldering, the most commonly used type of solder is *lead-free rosin core solder*. This solder is usually made of a Tin/Copper alloy. You can also use leaded rosin core solder, but this type of solder is becoming less popular due to health and environmental concerns. Regardless of the solder you use, make sure you have proper ventilation and wash your hands after use.

When buying solder, make sure to **NOT** use *acid core solder* as this will damage your circuits and components. Acid core solder is sold at home improvement stores and is mainly used for plumbing and metalworking.

Helping Hand (Third Hand)



A *helping hand* is a device that has 2 or more alligator clips and sometimes a magnifying glass/light attached. These clips will assist you by holding the items you are trying to solder while you use the soldering iron and solder.

How to Solder

Tinning the Tip

Before you can start soldering, you need to prep your soldering iron by **tinning the tip with solder**. This process will help improve the heat transfer from the iron to the item you're soldering. Tinning will also help to protect the tip and reduce wear.



Step 1: Begin by making sure the tip is attached to the iron and **screwed tightly** in place.

Step 2: Turn on your soldering iron and let it heat up. If you have a soldering station with an adjustable temp control, set it to **400°C/ 752°F**.

Step 3: **Wipe the tip** of the soldering iron on a damp wet sponge to clean it.

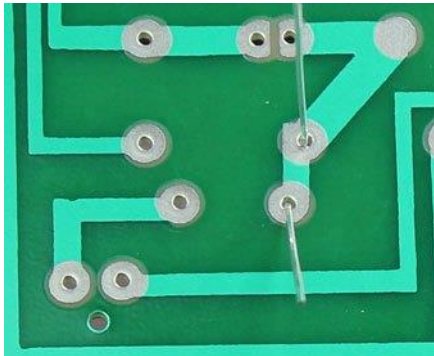


Wait a few seconds to let the tip heat up again before proceeding to step 4.

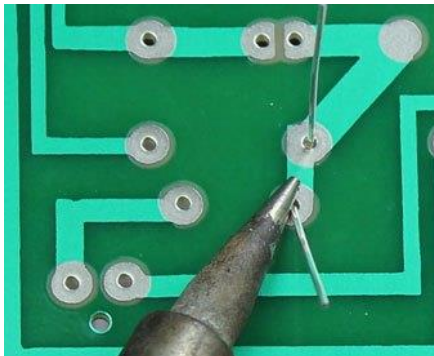
Step 4: Hold the soldering iron in one hand and solder in the other. Touch the solder to the tip of the iron and make sure the solder flows evenly around the tip.

You should tin the tip of your iron **before and after** each soldering session to extend its life. Eventually, every tip will wear out and will need replacing when it becomes rough or pitted.

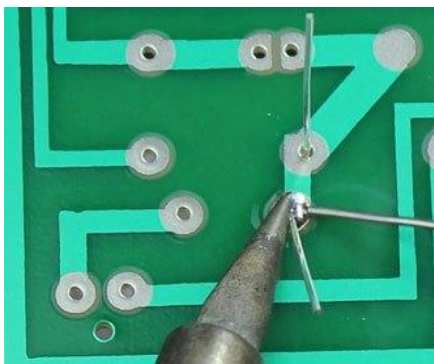
To better explain how to solder, we're going to demonstrate it with a real world application. In this example, we're going to solder an **LED to a circuit board**.



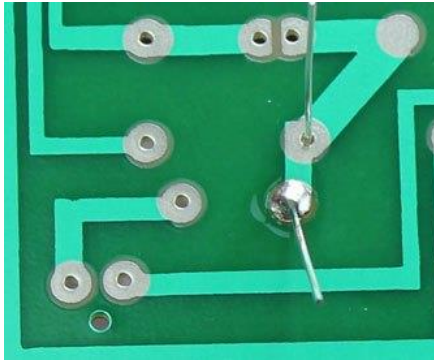
Step 1: Mount the Component – Begin by **inserting the leads of the LED into the holes of the circuit board**. Flip the board over and bend the leads outward at a 45° angle. This will help the component make a better connection with the copper pad and prevent it from falling out while soldering.



Step 2: Heat the Joint – Turn your soldering iron on and if it has an adjustable heat control set it to **400°C**. At this point, touch the tip of the iron to the copper pad and the resistor lead at the same time. You need to hold the soldering iron in place for **3-4 seconds** in order to heat the pad and the lead.



Step 3: Apply Solder to Joint – Continue holding the soldering iron on the copper pad and the lead and touch your solder to the joint. **IMPORTANT** – Don't touch the solder directly to the tip of the iron. You want the joint to be hot enough to melt the solder when it's touched. If the joint is too cold, it will form a bad connection.



Step 4: Snip the Leads – Remove the soldering iron and let the solder **cool down naturally**. **Don't blow on the solder** as this will cause a bad joint. Once cool, you can snip the extra wire from leads. A proper solder joint is smooth, shiny, and looks like a volcano or cone shape. You want just enough solder to cover the entire joint but not too much so it becomes a ball or spills to a nearby lead or joint.

How to Solder Wires

Now it is time to show you how to solder wires together. For this process, it is recommended to use helping hands or a type of clamp device.



Step 1: Begin by removing the insulation from the ends of both wires you are soldering together. If the wire is stranded, twist the strands together with your fingers.



Step 2: Make sure your soldering iron is fully heated and touch the tip to the end of one of the wires. Hold it on the wire for **3-4 seconds**.



Step 3: Keep the iron in place and touch the solder to the wire until it is **fully coated**. Repeat this process on the other wire.



Step 4: Hold the two tinned wires on top of each other and touch the soldering iron to both wires. This process should melt the solder and coat both wires evenly.



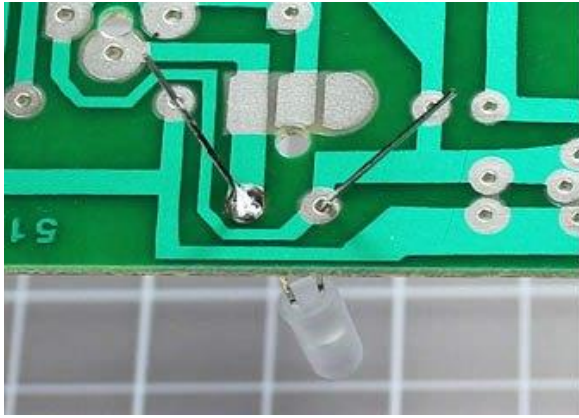
Step 5: Remove the soldering iron and **wait a few seconds** to let the soldered connection cool and harden. Use heat shrink to cover the connection.

Desoldering

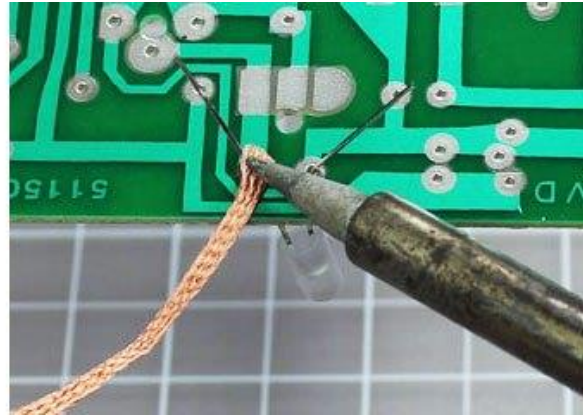
The good thing about using solder is that it can be removed easily in a technique known as desoldering. This comes in handy if you need to remove a component or make a correction to your electronic circuit.



To desolder a joint, you will need *solder wick*, which is also known as *desoldering braid*. It is essentially copper wire that is braided together and dipped in flux to allow it to absorb solder with the application of heat. Solder wick is particularly helpful when hand-reworking boards with *surface-mount devices* (SMDs), as the wide contact area and absorbing action is very useful for cleaning the small copper pads that surface-mount integrated circuits connect to.



Step 1: Place a piece of the desoldering braid on top of the joint/solder you want removed.



Step 2: Heat your soldering iron and touch the tip to the **top** of the braid. This will heat the solder **below**, which will then be absorbed into the desoldering braid. You can now remove the braid to see the solder has been extracted and removed. Be careful touching the braid when you are heating it because it will get very hot.



Optional: If you have a lot of solder that you want removed, you may want to use a device called a *solder sucker*. This is a handheld mechanical vacuum that sucks up hot solder with a press of a button. To use, **press the plunger down** at the end of the solder sucker. **Heat the joint** with your soldering iron and **place the tip of the solder sucker over the hot solder**. Press the **release** button to suck up the liquid solder. In order to empty the solder sucker, **press down on the plunger**.

Make sure to **wash your hands when done soldering**.