

Soldering Basics

Learn to Solder Kit

Assembly Instructions



The Soldering Basics Learn to Solder kit helps you learn or sharpen your electronic soldering skills.

This kit includes a through hole circuit board and 29 parts. The right portion of the board provides practice parts and test points for measuring resistance and capacitance.

The left portion of the board provides a circuit that blinks two LEDs back and forth. (Also known as an astable multivibrator.)

Visit [FVResearch.com/resources](https://www.fvresearch.com/resources) to watch a full-length instructional video for this kit.

FutureVision Research



It is very important to inventory all the parts in your kit to make sure you have all the parts listed in the following pages.

If any parts are missing, please contact Sales@FVResearch.com right away.

Safety Notice and Disclaimer of liability:

Your safety is your own responsibility, including proper use of equipment and safety gear, and determining whether you have adequate skill and experience. Power tools, electricity, and other resources used for these projects are dangerous, unless used properly and with adequate precautions, including safety gear. Some illustrative photos do not depict safety precautions or equipment, in order to show the project steps more clearly. You are responsible for proper supervision of children. Use of the instructions, kits, projects and suggestions on FVResearch.com is at your own risk. FutureVision Research and Brian Cox disclaims all responsibility for any resulting damage, injury, or expense. It is your responsibility to make sure that your activities comply with applicable laws, including copyright. Always check the webpage associated with each project before you get started. Products sold by FutureVision Research and Brian Cox are for educational purposes only.

Tools — You'll need the following tools to build this kit:



Soldering Iron

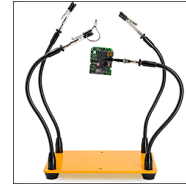
Use a pencil style soldering iron of 25-30 watts.

Never use a soldering gun on circuit boards!



Rosin Core Solder

60Sn / 40Pb leaded solder
or
99.3Sn / 0.7Cu lead-free solder



**Helping Hands or a
Circuit Board Holder**

Never hold parts or the PCB while soldering!



Flush Wire Cutters

Used to trim the leads of parts after soldering.

(But don't actually cut the leads flush!)



Long-Nose Pliers

Used to gently form (bend) leads of the parts.



Safety Glasses

Always wear safety glasses while soldering and trimming leads!



Digital Multimeter

Used for troubleshooting and if you want to measure the test points.

Additional Useful Tools — These aren't required but they are handy!



Brass Sponge

When it comes to keeping the tip of your soldering iron clean, this is an excellent alternative to a wet sponge.



Tip Tinner

Helps remove baked-on residue from the tip of your soldering iron and helps prevent oxidation from accumulating.



De-soldering Pump or
De-soldering wick

Two options for removing solder from a pad.



Isopropyl Alcohol
(or flux remover) and a
Soft Brush

Used to clean rosin flux residue from the PCB



Masking Tape

Useful for holding parts against the PCB while you solder them.

Basic Soldering Instructions

Visit FVResearch.com/resources to watch a full-length instructional video for this kit.

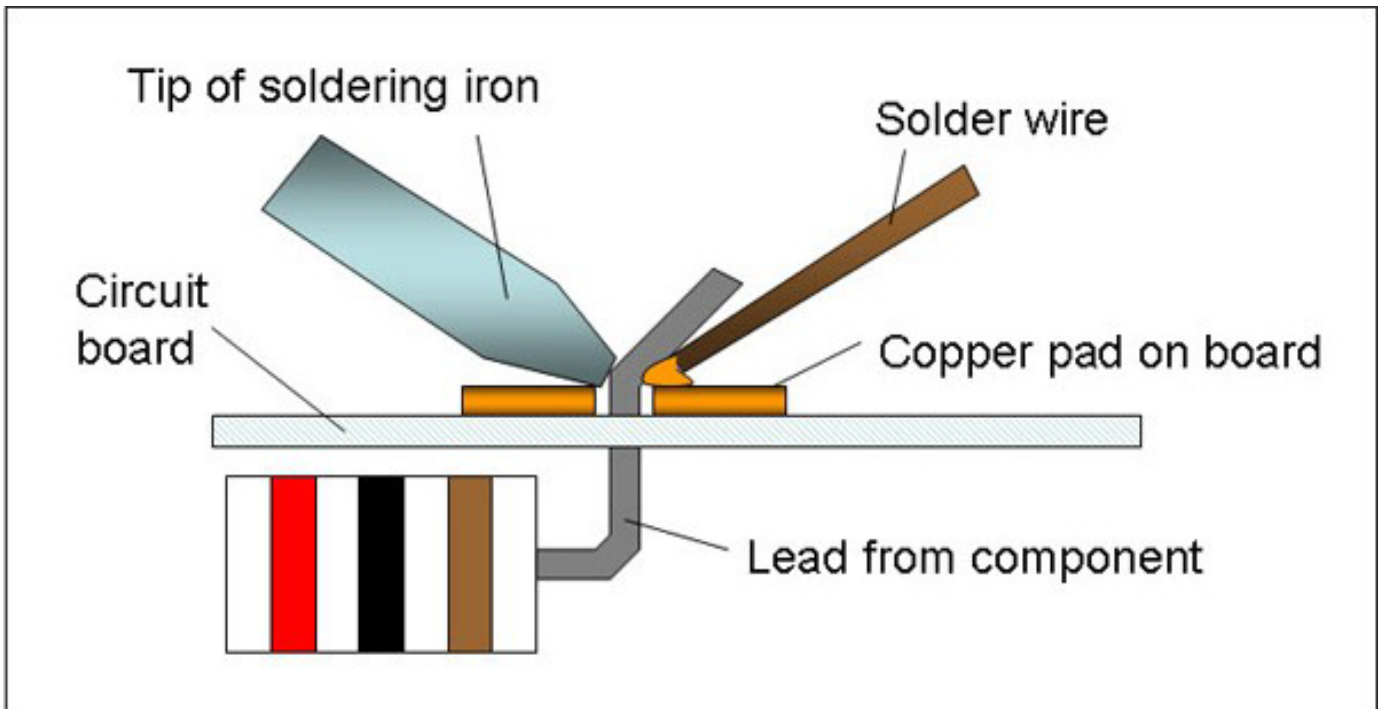
Preparing

Preparing the Soldering Iron: Tinning the Tip

1. Place the soldering iron in its stand and plug it in.
2. Wait for the soldering iron to heat up.
3. Wipe the tip of the iron using a moist sponge or brass sponge (preferred). This will clean the tip.
4. Melt a little solder on the tip of the iron.
 - This is called *tinning* and it will help the heat flow from the iron's tip to the joint.
 - The solder should flow onto the tip, producing a bright shiny surface.
 - If the solder will not flow onto the tip, try again to clean it by wiping it on the sponge.
 - If the solder still will not flow onto the tip, press the heated tip into tip tinner to clean residue (mentioned under additional useful tools.)
 - When tinned, wipe excess solder off on the sponge.
 - You do not need to tin the tip before every joint, but you should wipe the tip after two or three solder connections to keep it clean.
 - Check the manufacturer's instructions related to tinning the tip.
5. The tip of the soldering iron should be a shiny silver color. If it is black and pitted, and can't be cleaned using tip tinner and a brass sponge, replace it with a new one.

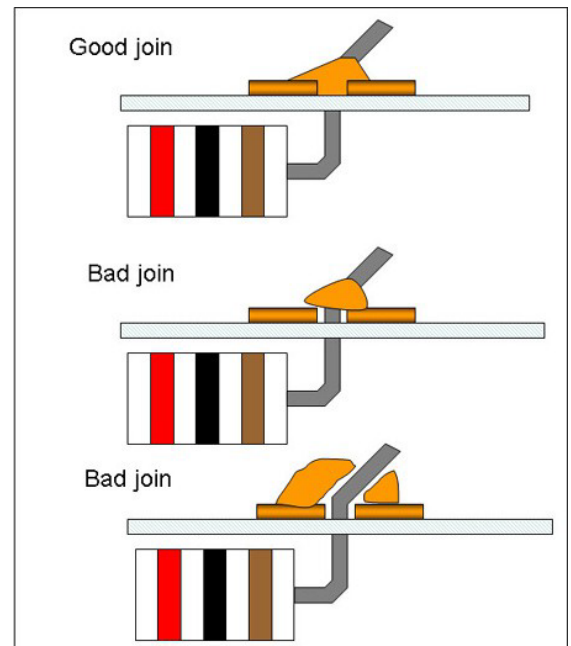
Soldering

1. If possible, prepare the circuit board by cleaning it with isopropyl alcohol (IPA) or rubbing alcohol and a lint free towel or makeup pad to clean both sides of the circuit board.
2. To solder, heat the connection with the tip of the soldering iron for a few seconds, then apply the solder.
 - Heat the connection, *not* the solder.
 - Hold the soldering iron like a pen, near the base of the handle.
 - Both parts being soldered need to be hot to form a good connection.



The tip of the soldering iron heats both the copper pad and the lead from the electronic component. Solder melts when placed in contact with the hot metals. Feed solder on to the parts, not the iron.

3. Keep the soldering tip on the connection as the solder is applied.
 - Solder will flow into and around well-heated connections.
 - Use just enough solder to form a strong connection.
4. Feed solder into the connection until it flows all the way around the connection and slightly up the lead of the component. Remove the solder from the connection, then the iron.
5. Don't move the connection while the solder is cooling.
6. Soldering a connection should take just a few seconds.
7. Inspect the joint closely. It should look shiny (note: lead-free solder may appear dull, this is OK).
 - If you are soldering a wire (called the *lead*) onto a PC board (on the *track*), it should have a cone shape.
 - If the connection looks bad, reheat it and try again.
8. Be sure to wipe your iron on the sponge before setting it in the holder.
9. Unplug (or power off) your iron when not in use.

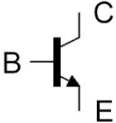
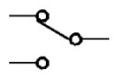
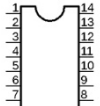


Step 1 — This list shows all parts in this kit. Use it as a checklist and confirm that you have everything.

Part Found?(✓)	Kit QTY	Symbol	Image	Description and Schematic Name
LEDs (Light Emitting Diode)				
☐	1			5mm Red LED, Forward Voltage (Vf) = 2V, Current = 20mA LED1
☐	1			5mm Green LED, Forward Voltage (Vf) = 2.4V, Current = 20mA LED2
Resistors These components oppose the flow of current. Their value is given in ohms (Ω)				
☐	2	 OR 		100 Ω 1/4W 5% Carbon Film Resistor Brown, Black, Brown, Gold R1, R4
☐	1	 OR 		1K Ω 1/4W 5% Carbon Film Resistor Brown, Black, Red, Gold R5
☐	1	 OR 		10K Ω 1/4W 5% Carbon Film Resistor Brown, Black, Orange, Gold R6
☐	1	 OR 		15K Ω 1/4W 5% Carbon Film Resistor Brown, Green, Orange, Gold R7
☐	1	 OR 		47K Ω 1/4W 5% Carbon Film Resistor Yellow, Violet, Orange, Gold R8
☐	3	 OR 		100K Ω 1/4W 5% Carbon Film Resistor Brown, Black, Yellow, Gold R2, R3, R9
☐	1	 OR 		220K Ω 1/4W 5% Carbon Film Resistor Red, Red, Yellow, Gold R10

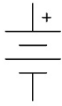
The parts list continues on the next page...

Step 1 — Continued

Capacitors The components temporarily store electrons. Their value is given in farads (f).				
☐	6		 104	.1μF Ceramic Capacitor 50V (code 104) C3-C8
☐	2	 OR 		22μF 16V Radial electrolytic Capacitor (color may vary) C1 & C2
Transistors This component is a semiconductor used to amplify or switch electrical signals.				
☐	3	 B C E	 2N3904	2N3904 NPN Transistor in TO-92 package T1-T3
Switches This component is used to mechanically open or close a circuit.				
☐	1			Slide Switch 1P2T (SPDT), .5A, 50VDC S1
Sockets This part is used to protect integrated circuits (ICs) from excess heat and to allow easy replacement of ICs.				
☐	1			14 pin DIL (Dual-In Line) socket (AKA DIP socket – Dual-In Line Pin) IC1

The parts list continues on the next page...

Step 1 — Continued

Batteries and Battery Connectors Provide a source of electrons through chemical reaction.				
☐	2			AAA Alkaline Battery (Brand may vary) B1 & B2
☐	2	N/A		Plastic AAA Battery Holder with solder pins B1 & B2 (Used with PCB version 1.3 and later)
Printed Circuit Board (PCB) Used to permanently hold all electronic parts and to provide the proper electrical paths based on a specific circuit design.				
☐	1	N/A		106-100 FutureVision Research Soldering Basics PCB



Step 2 – Set aside parts for LED blinker

We will assemble the practice side of the Soldering Basics kit first (Figure 1).

But, before we do that, we need to gather and set aside the following parts, which are needed for the LED Blinker. We'll assemble the LED Blinker during Step 4.

Gather these components and put them back in the parts baggy.

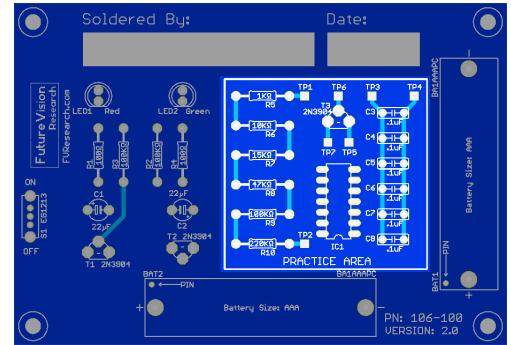


Figure 1: Soldering Basics Practice Area



Red LED



Green LED



Both 100Ω Resistors



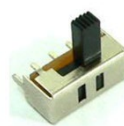
Two 100K Resistors
(Hold on to the third 100K resistor to use on the practice side of the PCB)



Two Transistors
(Hold on to the third transistor to use on the practice side of the PCB)



Both 22μF Electrolytic Capacitors



Slide Switch



Both Batteries



Both Battery Holders

A note about trimming leads on your parts:

All leads need to be trimmed before you insert the batteries. You can trim leads after soldering each part, or you can trim them all at once when you finish.

Double check that each part is in the correct place
and the right direction **BEFORE** trimming the leads.

The IC socket, battery holders, and power switch do not need to be trimmed.

Step 2 – Continued... The Practice Area

- All parts will be inserted into the side of the board silkscreened with the part name and value.
- When you're first learning how to solder, it is best to insert only one part, solder that part, then insert the next one.
- Then, once you get more comfortable, you can insert more parts at a time.
- Use the parts reference page to help you confirm the value or color code for each part.
- Double check and make sure you put the right part in the correct holds **BEFORE** you solder it in place.

Recommended order for installing the practice parts:

1. Resistors R5 through R10.
Resistors sit flush against the PCB. They are not polarized, but you should place the resistors so the color code can be read the same direction and the value silkscreened on the PCB.
2. Ceramic capacitors C3 through C8.
Install these capacitors so there is a small gap between the disc and PCB. They are not polarized, but you should place the capacitors so the value shown on the disc is facing the value printed on the PCB.
3. Transistor T3.
Install the transistor so there is a small gap between the package and the PCB. This is a polarized part. The flat side of the transistor package should match the flat side of the silkscreened outline.
4. IC Socket IC1.
Install the socket so it sits flush against the PCB. Be sure to match the indent on one edge of the socket with the indent on the silkscreened outline. This indent is used to indicate pin 1 of an integrated circuit. (continues on next page...)
Tip: Solder two pins only, at opposite corners. Then, before you soldering any more pins, confirm that the socket is still sitting flush against the PCB.

Step 3 – LED Blinker

Now it's time to assemble the LED Blinker portion of the kit. Retrieve the parts you set aside, and install them in the order shown below. Remember to use the parts reference list to confirm each part.

Recommended order:

1. LEDs LED1 and LED2

Match the color of the LED to the color marked on the PCB. Install each LED so it sits flush against the PCB.

These parts are polarized. Negative is marked by the shorter lead. Also, the flat side of the bezel (plastic part) is negative. Place the LED so that the flat size of the bezel matches the flat side of the silkscreen outline.

2. Resistors R1 and R4 – 100Ω resistors (NOTE: **These two resistors go on either side of R2 & R3**)

Reminder: Resistors sit flush against the PCB. They are not polarized, but you should place the resistors so the color code can be read the same direction and the value silkscreened on the PCB.

3. Resistors R2 and R3 - 100KΩ resistors (NOTE: **These two resistors sit next to each other**)
4. Capacitors C1 and C2 – 22μF electrolytic capacitors – (Note: **Short leads (negative) face each other**)

Electrolytic capacitors are polarized. There is an arrow on the body of the capacitor pointing towards the negative lead. The negative lead is shorter than the other lead. Install each electrolytic capacitor so the long lead matches the side marked positive (+) on the silkscreen. These two parts will not sit completely flush.

5. T1 and T2 – 2N3904 transistors – Flat side of T1 faces down, flat side of T2 faces up
Reminder: Install the transistor so there is a small gap between the package and the PCB. This is a polarized part. The flat side of the transistor package should match the flat side of the silkscreened outline.

5. S1 – Slide switch – knob faces edge of board

This slide switch sits flush against the PCB. Solder the two outside pins, then confirm that the switch is still sitting flush before soldering the remaining three pins. **Set the slide switch to “off”.**

6. Battery holders – Insert and solder the two battery holders now, **but don't insert the batteries until the proper time during step 4 below.**

Each holder has a small plastic pin next to one of the two metal leads. That pin marks the positive terminal.

Insert the lead closest to the plastic pin into the solder pad marked positive (+). Then gently press sideways on the battery holder to insert the negative lead into the other pad.

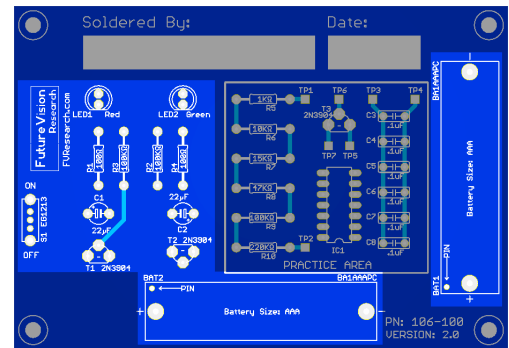


Figure 2: LED Blinker area

Step 4 – Inspection and battery placement

Inspect your board and insert the batteries

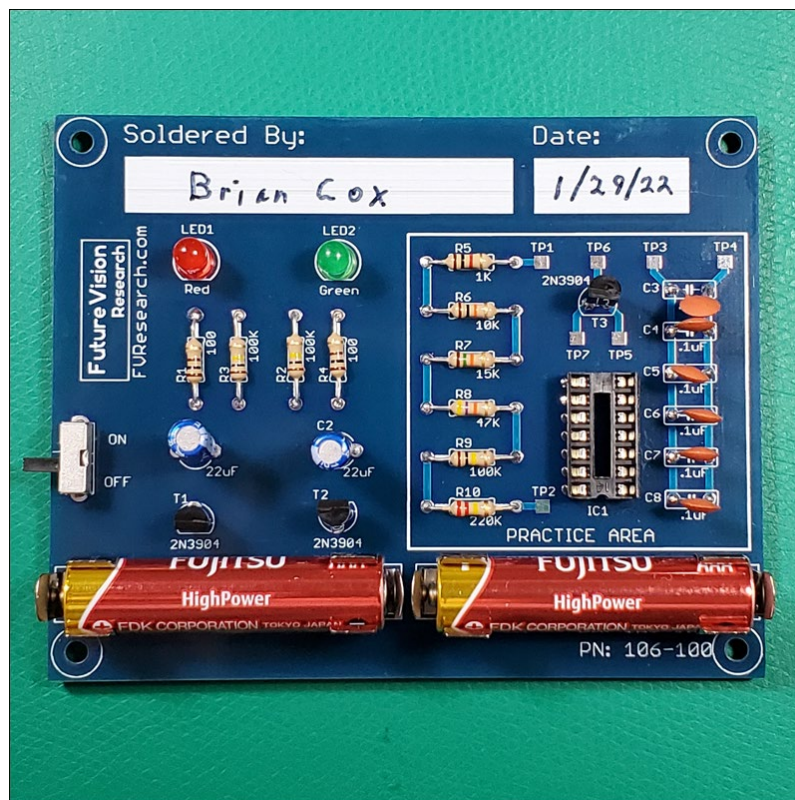
Recommended steps:

1. Ensure all component leads are trimmed
2. Inspect your solder connections and check for
 - a. Poor connections
 - b. Cold solder joints
 - c. Solder bridges
 - d. Pieces of trimmed leads that might be stuck to the PCB
3. Correct any faulty connections
4. Clean the solder side of your PCB to remove any remaining flux.
 - a. If you used rosin flux use rosin flux remover or isopropyl alcohol and a soft brush.
 - b. If you used organic flux, rinse with water a soft brush.

Ensure your PCB is completely dry before continuing.

5. Insert the two AAA batteries provided with the kit, and move the slide switch to “on”.
6. The two LEDs should blink back and forth

Congratulations on completing your Soldering Basics kit!



Soldering Basics Display Stand

You can order one from us, or print your own.

Visit FVResearch.com/resources for details.

