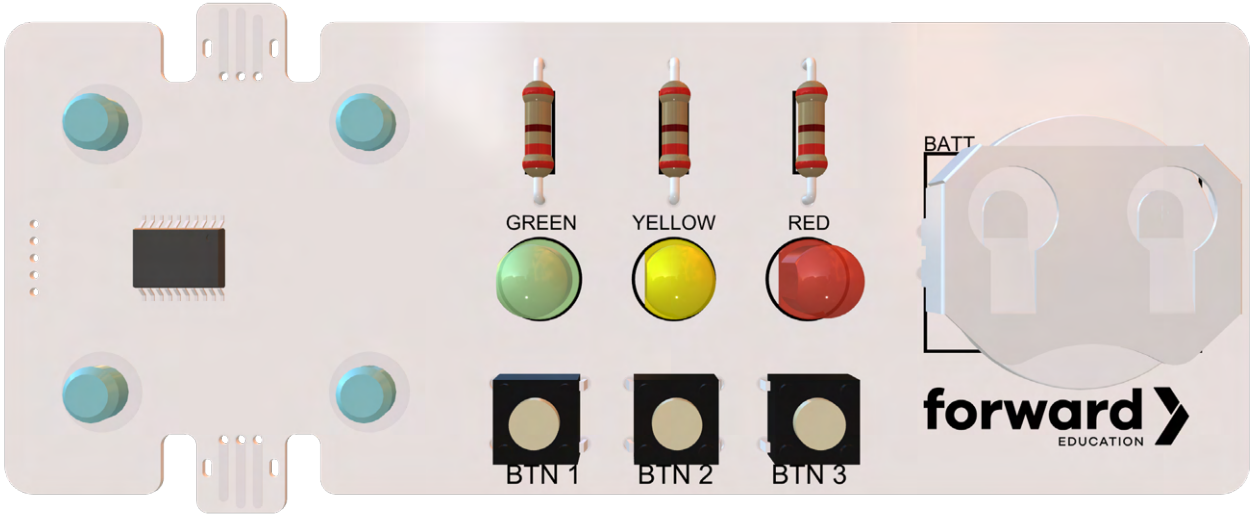
Smart Soldering Kit Assembly Instructions



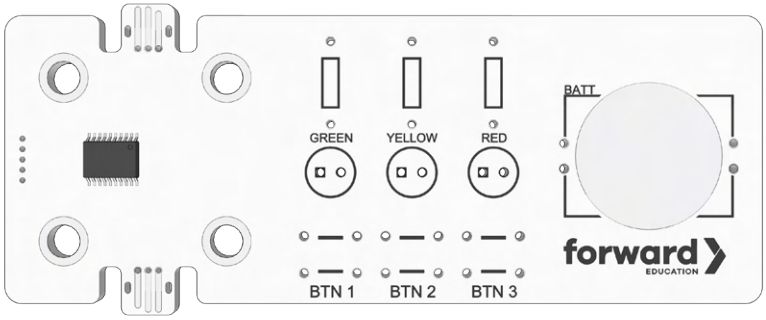
The Smart Soldering Kit is the perfect introduction to electronics and soldering. Once assembled, the 3-Button/LED component can be coded to perform all sorts of actions using a micro:bit and Forward Education Breakout Board (sold separately).

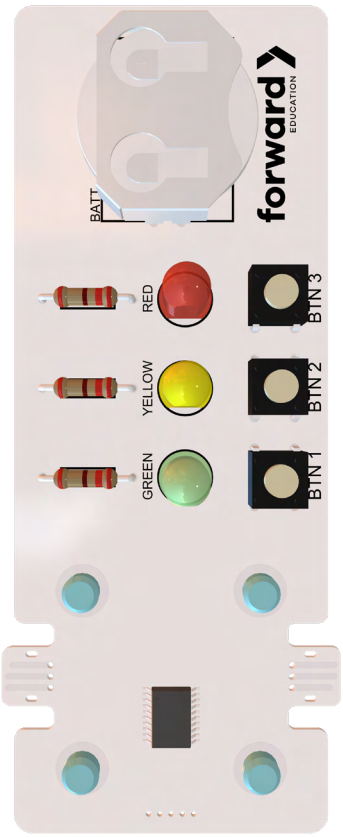
Printed Circuit Board Overview

Printed circuit boards—often referred to as PCBs or just "boards"—are the foundation of electronic devices. If you examine your PCB, you'll notice small silver-colored pads where electronic components are mounted.

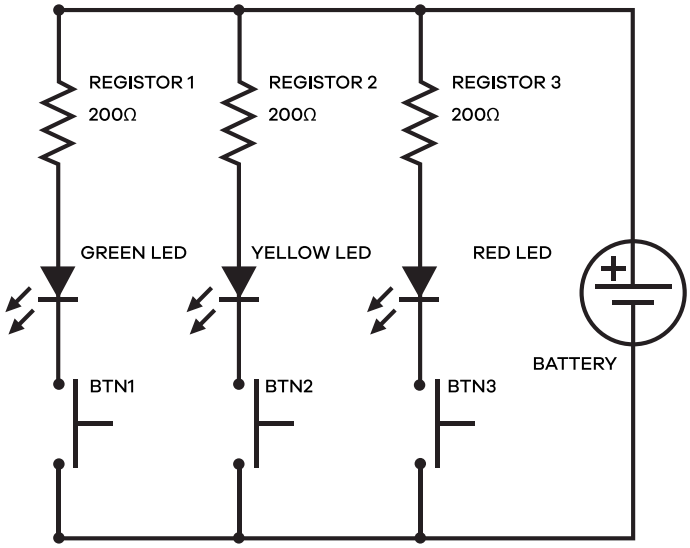
The thin lines connecting these pads are known as traces; they're made of copper and create the pathways that link the components together. These copper pathways match the lines shown between components on the adjacent circuit diagram.

Circuit diagrams use standard symbols to show the various components in a circuit and how they're connected.





Circuit Diagram



The illustration to the left shows the layout of your Forward Education PCB basic circuit.

You'll notice there are three separate branches, and each one includes a resistor, an LED, and a switch.

All three branches are connected to the same positive and negative terminals of the battery—this setup is called a parallel circuit.

However, within each individual branch, electricity flows through the resistor, then the LED, and finally the switch, one after the other.

When components are connected in this kind of sequence, they are said to be in series.

PCB Parts

Resistors

Resistors are among the most commonly used components in electronic circuits.

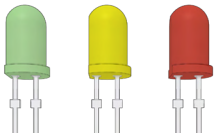
Like wires, they allow electricity to flow—but they're intentionally designed to reduce that flow.

Their main purpose is to limit the amount of current that passes through specific parts of a circuit.

This limiting effect is called resistance, and it's measured in units called ohms (Ω).

In the Smart Soldering Kit, each resistor has a resistance of 200 ohms.

Instead of having "200Ω" written on them, resistors typically use colored bands to show their value.



LEDs

LED stands for Light Emitting Diode. These components are widely used wherever a bit of light or color is needed.

An LED is a type of diode, which acts like a one-way gate for electrical current.

Because of this, the orientation of the LED in your circuit matters.

To get your Smart Soldering Kit PCB to light up, the LED must be inserted in the correct direction.

Switches

Each branch of the circuit is controlled using a momentary switch.

This type of switch only closes the circuit while it's being pressed.

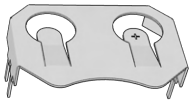
When the switch isn't pressed, the circuit remains open—so no current can flow.

Pressing the switch briefly completes the circuit, allowing electricity to flow and the LEDs to light up.

Battery

The Smart Soldering Kit PCB is powered by a 3-volt CR2032 battery, which is a non-rechargeable coin cell.

This type of battery is known for its long-lasting performance and is commonly found in devices like car remotes, calculators, and computer motherboards.



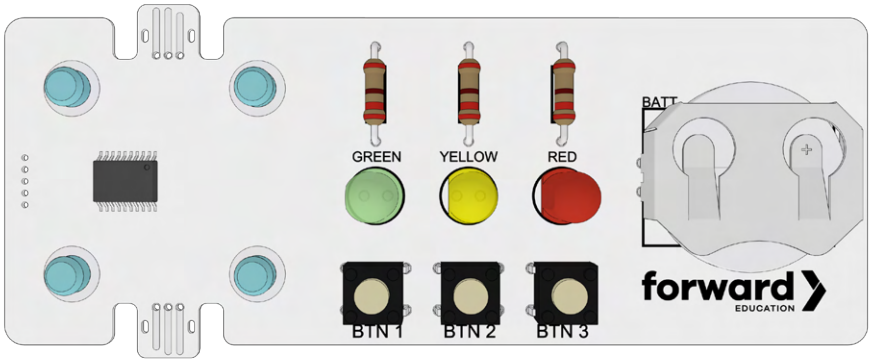
Battery Holder

The battery holder keeps the battery securely in place, ensuring it connects properly with the circuit.

The positive side of the battery touches the battery holder, while the negative side makes contact with the gold pad on the board.

The Smart Soldering Kit PCB contains two connector ports which make it compatible with the rest of the Forward Education coding & robotics ecosystem. This means that you can attach your PCB to our Breakout Board and code it using the micro:bit and MakeCode!

Additional robotic components required and sold separately.



Required Tools

Lead Free Solder

Pronounced “saw-der” (with a silent “L”), solder is used to connect components to a circuit board.

It comes in leaded and lead-free varieties and is melted with a soldering iron to form strong electrical and physical bonds.

Soldering Iron

Used to heat solder to its melting point, allowing you to make connections between components.

Soldering Iron Holder

This holder provides a safe spot to rest your iron between soldering joints.

Never leave a hot soldering iron unattended on a table or in a place where it could be knocked over.

Wire Snips

Also known as flush cutters or diagonal cutting pliers, these tools are essential not only for electronics but also for 3D printing and a variety of other projects.

Safety Glasses

Safety glasses should be worn whenever you’re working on activities that could pose a risk to your eyes.

Silicone Mat

We recommend using a heat-resistant silicone mat as a clean work surface to protect your table while soldering.

Optional Tools

As you keep soldering and exploring electronics, here are a few additional tools that can make your work easier!

Fume Extractor

Always solder in a well-ventilated area and avoid inhaling solder fumes.

If you plan to do a lot of soldering, consider getting a fume extractor.

These typically include washable or replaceable carbon filters to help keep the air clean.

Solder Sucker

A solder sucker works like an eraser for electronics.

If you make a mistake and need to remove a component or excess solder, a solder sucker can help.

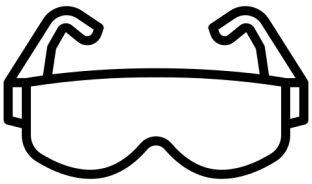
Simply heat the solder, then use the tool to remove the unwanted material.

To use the solder sucker, press down on the plunger to set it, then press the button on the side to trigger it and suck up the solder.

Helping Hands

There are many tools designed to hold your work and act as an extra set of hands while soldering. The most common of these are called “helping hands,” like the ones shown here.

Safety Precautions



Wear Safety Glasses

Always use caution when handling hand tools, especially when cleaning the soldering iron tip or trimming component leads.

Even with care, small bits of components or solder can fly off, and you definitely don't want these in your eyes.

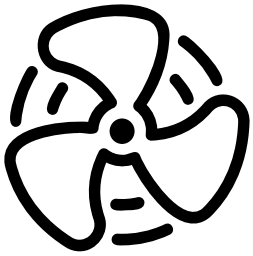
Make sure to wear proper eye protection whenever you're working with electronics.

Avoid Eating or Drinking

We recommend using lead-free solder with this kit.

However, it's still a good practice to wash your hands after working with electronics.

Keep your work area free of food and drinks to prevent contamination.



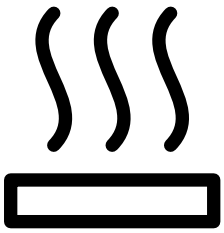
Use Adequate Ventilation

When soldering, the flux (a sticky substance that helps solder melt) turns into vapor and produces visible smoke.

Breathing too much can irritate your lungs or cause health issues.

Stop and get fresh air if needed.

For long sessions, use a fan with a filter.



Hot Surface

A soldering iron heats up to several hundred degrees—hot enough to melt metal.

If you accidentally touch the tip, you'll quickly realize how hot it is!

Always use caution when handling a soldering iron to prevent burns, injury, or damage to your surroundings.

If you do burn yourself, rinse the affected area with cold water and follow basic first aid procedures.

Preparation

⚠ CAUTION

Ensure your soldering iron is securely placed in its holder before plugging it in.

Double-check that the cord is safe from being tripped over or tangled.

Place the sponge in the tray of your solder stand and dampen it with a bit of water to help it expand.

As you solder, the tip of your iron will start to oxidize, making it gunky and harder to work with.

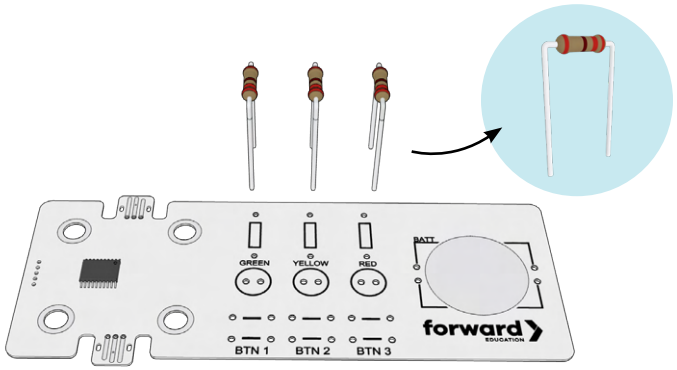
When this happens, simply wipe the tip on the wet sponge to clean it and keep working.

After plugging in the soldering iron, allow a minute or so for it to heat up and reach the desired temperature.

Set the dial to around 350°C to 400°C.

Soldering Steps

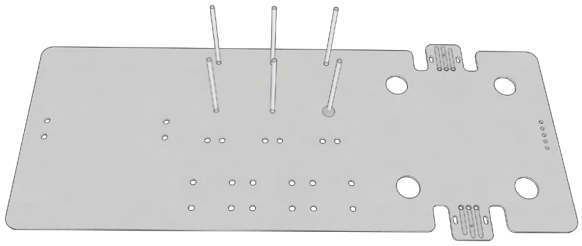
1



The first components you will solder are the resistors.

Bend the leads and insert them into the holes on the board.

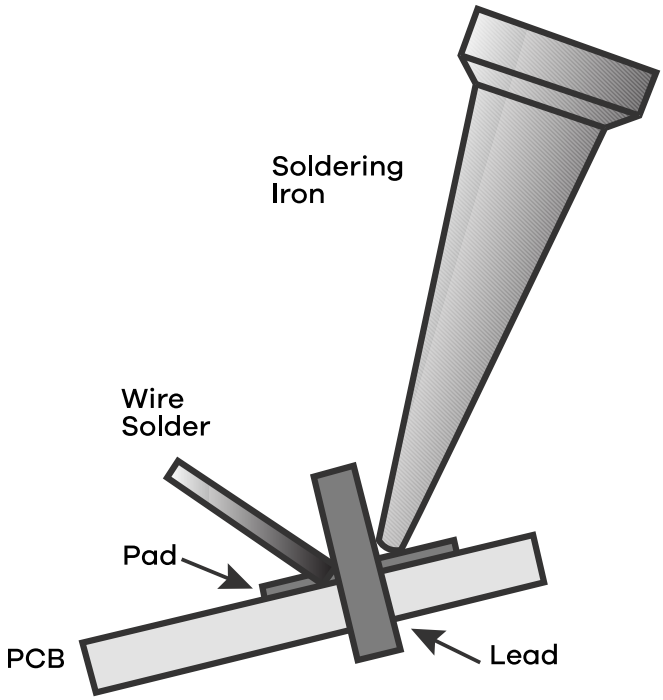
2



Soldering should be done from the bottom side of the board.

Bending the leads slightly can help hold the resistor in place when you flip the board over.

3

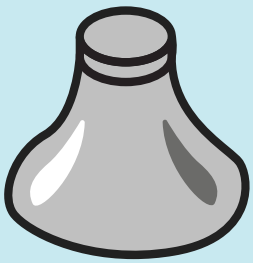


To solder, first touch the soldering iron to both the silver pad and the tip of the resistor lead.

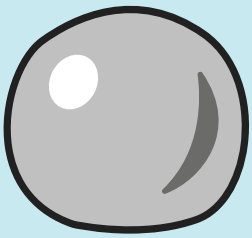
Then feed in the solder, allowing it to melt and form the joint.

Once the joint is complete, remove the solder and the iron.

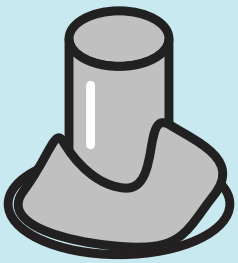
Repeat the process with the second lead.



Good solder joint



Too much solder

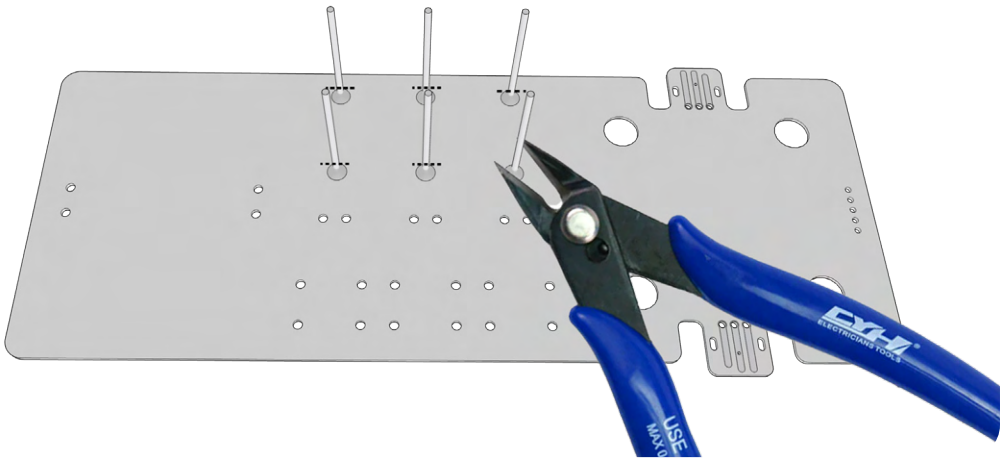


Too little solder

For more details please review page 12

4

Repeat the same process for the next two resistors.
Once done, trim each lead just above the solder joint.

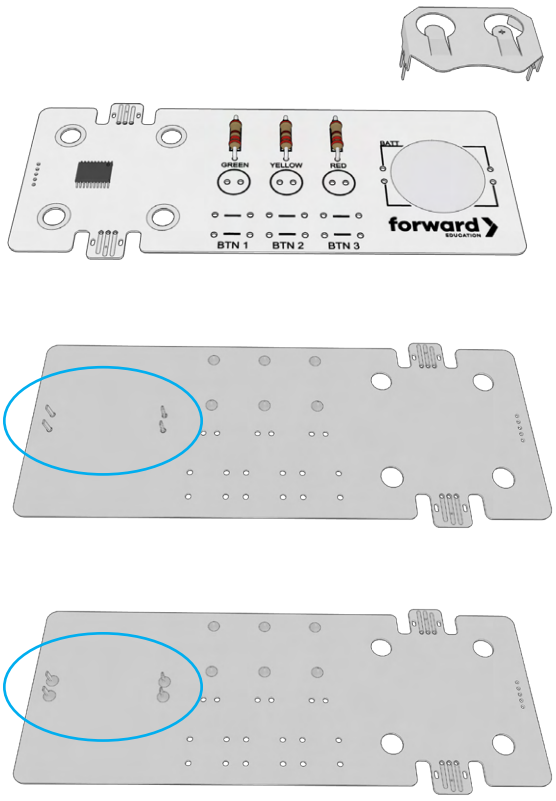


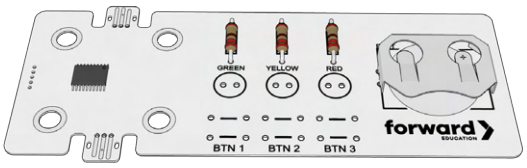
⚠ CAUTION

THESE LEADS HAVE A TENDENCY TO GO FLYING WHEN YOU TRIM THEM.

To avoid a hazard, hold onto the end of each lead as they are being snipped and wear safety glasses.

5





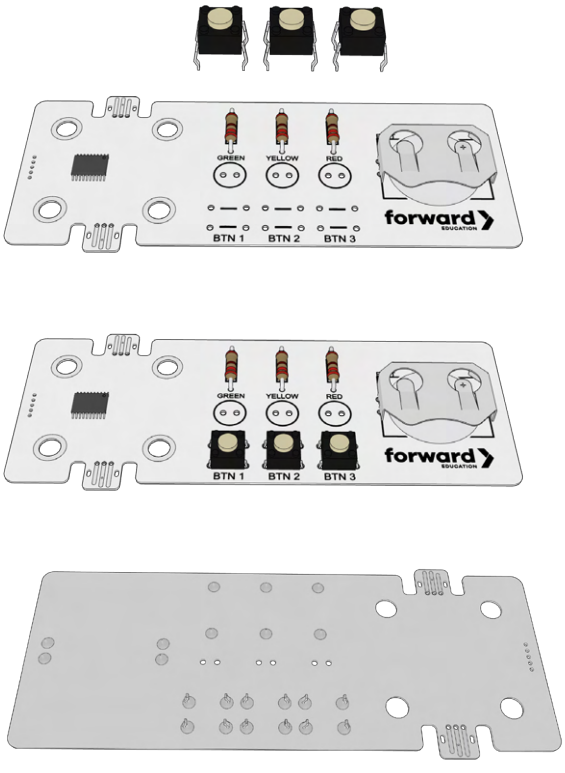
Next, solder the battery holder into place.

The curved part of the battery holder should be next to the Forward Education logo on the board.

ATTENTION

Make sure the battery holder is oriented as shown above before you solder it in. Otherwise it becomes slightly more awkward to slide the battery in and out.

6



Next you can insert the switches into the board.

The momentary switches should snap securely into the circuit as shown.

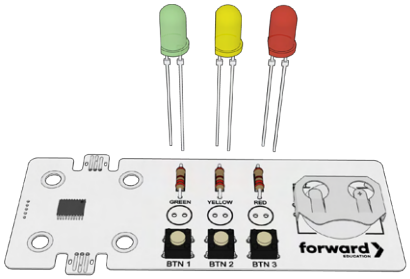
⚠ WARNING

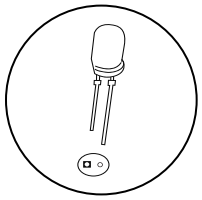
When pressing the switches into the board, avoid placing your fingers directly behind them.

Doing so might result in a sharp poke from the leads as the switch clicks into place.

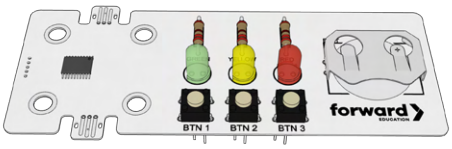
While the switches are mechanically secure in the board, it's crucial to solder them in place to ensure proper current flow through each one.

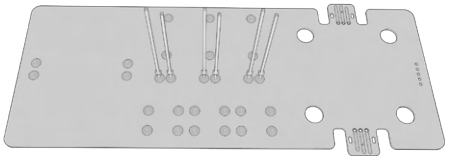
7

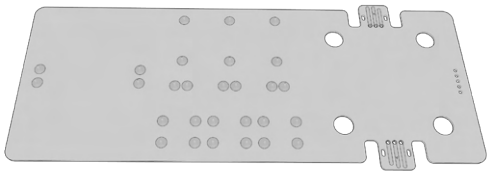




Insert the LEDs with the longer lead (the positive side) into the circular holes on the board.







The last components to solder into place are the LEDs.

NOTE

LEDs are diodes, functioning as a one-way valve for electricity.

If inserted incorrectly, the electrical current won't pass through, and the LEDs won't light up.

The board is labelled where each color LED should go, however if you'd like to change the order of the colors you can.

If you struggle keeping all three in place when you flip the board over, it may be easier to insert and solder one LED at a time.

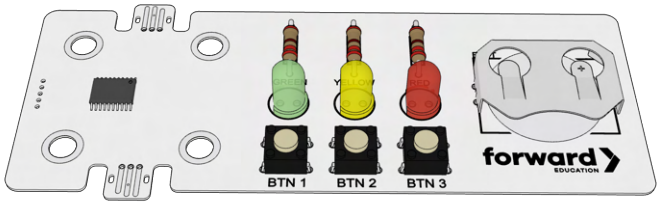
Trim up the LED legs just above the solder joint.

⚠ CAUTION

Just like the resistor legs, when you trim the excess wire hold onto the end to prevent it from becoming a projectile.

For safety, make sure to hold onto each lead as you clip them.

8



⚠ WARNING

Before cleaning up your station, be sure to allow your soldering iron sufficient time to cool down.

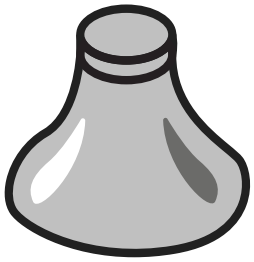
The final step is to insert the battery (with the + side facing up).

If everything has gone correctly, each LED should light up when you press the switch below it.

Congrats!

If your PCB is not working as expected *yet*, don't worry! Making mistakes and troubleshooting are all part of learning a new skill. Check out the next pages for some tips for resolving common issues!

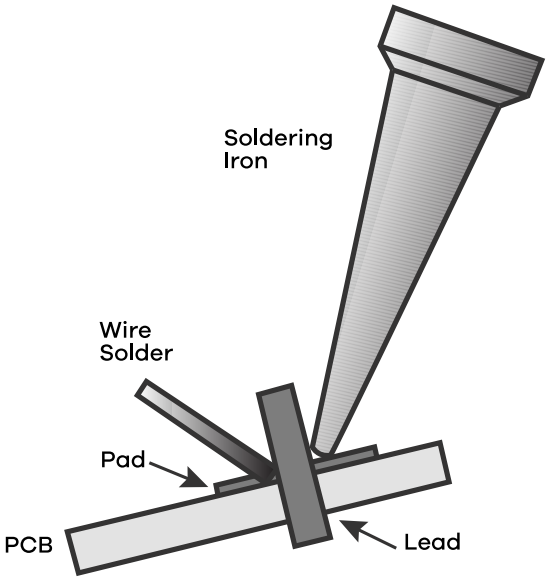
Good vs. Bad Solder Joints



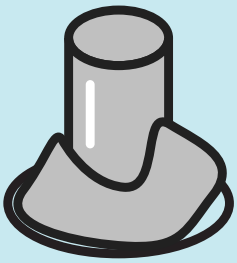
Good solder joint

A perfect solder joint should be shiny, cover the entire pad, and have a shape similar to a Hershey's Kiss.

While all good solder joints look similar, each imperfect joint tends to have its own unique flaw.



Here are a few things to watch out for:

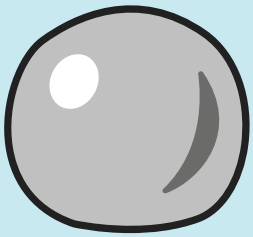


Too little solder

If you didn't use enough solder or didn't apply enough heat for the solder to flow properly, your joint may look like one of these.

While a joint like this might still work, it may not provide a strong enough connection for the circuit to function reliably.

If you can still see gold or the joint appears flat, it's an easy fix—simply tap your soldering iron on the joint and add a bit more solder.



Too much solder

If you've used too much solder, your joint may look like this, or it could appear blobby and uneven in its own way.

The danger with a joint like this is that the excess solder could create a bridge, or "short circuit," between two areas on the board that should remain separate.

This could cause the electricity to take an unintended path, following the route of least resistance, and may lead to problems, such as damaging sensitive components or traces when the circuit is powered on.

If you have one, a solder sucker can help remove excess solder from the joint.

What to do if something doesn't work:

Nothing is turning on

This usually means that power from the battery isn't reaching the circuit. Start by checking if the battery is inserted correctly. If it still doesn't work, inspect the solder joints at the battery holder, as well as the switch and resistor closest to the battery. These are the key points where current must flow for the LEDs to work.

It's also rare, but possible, that you have a dead battery. If everything seems fine, try the suggestions below.

Do one or more LEDs not light up?

This could be caused by a few things:

LED(s) installed backwards – Try removing and flipping the battery to reverse the current. If the LED(s) light up after that, they were installed incorrectly.

Short circuit at the LED – Check the solder joints closely. If there's a solder bridge between two joints, the current may bypass the LED. A quick tap from a clean soldering iron can fix this.

Incomplete soldering – Make sure the resistor, LED, and switch are all properly soldered. Each joint should fully cover the gold pad and look like a Hershey's Kiss.

Broken switch – While rare, it's possible for a switch to be faulty. If you suspect this, send us an email with a photo of your board, and we'll assist you.

Is an LED lit up even when you're not pressing the switch?

This is an unusual issue. It might be caused by a solder bridge at the switch, allowing the current to bypass it entirely—think of it like a gap in a fence next to a locked gate.

If there's no visible bridge between two points on the switch, it's possible that the switch itself has been damaged or overheated, creating an internal bridge.

Send us an email with a photo of your board, and we'll assist you in resolving the issue.

OPTIONAL

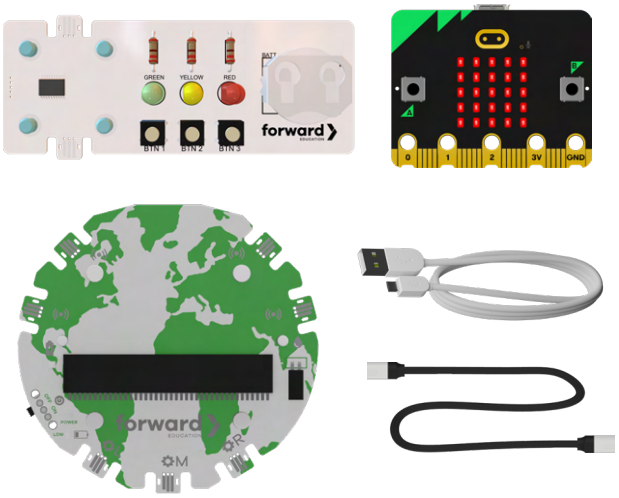
Let’s code your newly assembled PCB

To do this, you will need a Forward Education Breakout Board, connector cables, a USB cable, and a V2 micro:bit. All of these components can be purchased separately or be found in the Climate Action Kit.

Using the cable connector, connect the Smart Soldering PCB to one of the ‘Sensor’ ports on the Breakout Board.

From here, insert a V2 micro:bit into the Breakout Board and head over to Microsoft MakeCode. You will need to add the Forward Education “Smart Soldering Kit” extension to your MakeCode project. Now you can use the code blocks to program your component!

You can also use this component with any of the projects or other robotic components in the Forward Education hardware ecosystem!



Project Ideas

Use your Smart Soldering Kit PCB component to create an automated traffic light or pedestrian crosswalk!

For more projects and ideas on how to use this component, visit the Forward Education Learning Platform.

Here you’ll find dozens of curriculum-aligned coding & robotics projects using this component and others in the Forward Education hardware ecosystem.

Go to learn.forwardedu.com/start

PROJECT

Traffic Lights with Smart Soldering Kit

Create a traffic light model with the Climate Action kit and the Smart Solder component.

forward EDUCATION

472 Mill Street, Kitchener
Ontario, N2G 2Y6, Canada

forwardedu.com