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I Can Solder lvl. 1 Badge Soldering Project

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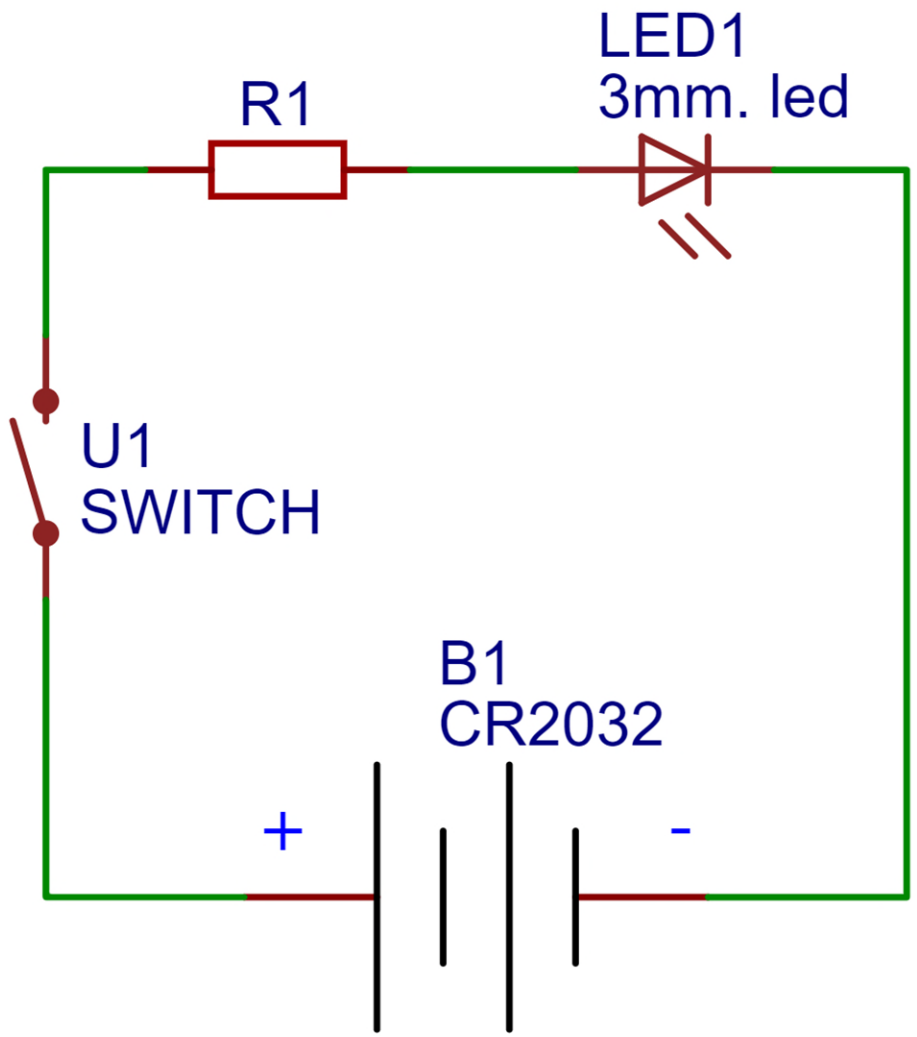
A circuit diagram is a visual representation of an electrical circuit that uses symbols to represent components and shows how they are connected together.



The PCB (Printed Circuit Board):

A PCB is a special board used to connect electronic components together in a circuit. It's like a puzzle where you fit all the pieces together to create a working electronic device.

A PCB has many tiny holes or pads where you can insert electronic components, such as resistors, capacitors, and LEDs. These components are then connected to each other using thin copper wires that are printed on the surface of the PCB. These copper wires are called **traces**. The traces on a PCB are like roads on a map. They help guide the flow of electricity through the circuit and ensure that each component is connected in the right way. By using a PCB, you can create a circuit that is more organized and reliable than if you were to connect the components together with wires by hand.

PCBs are used in all kinds of electronic devices, from smartphones to computers to toys. They allow electronic devices to be smaller, lighter, and more reliable.

The battery:

A battery is a device that stores energy and then releases it when it's needed.

Inside a battery, there are two different materials called electrodes. One electrode is made of a metal like zinc, and the other is made of a metal oxide like manganese dioxide. These electrodes are separated by a material called an electrolyte, which is usually a liquid or a gel.
When a battery is connected to a device, like a flashlight or a toy, the energy stored in the electrodes is released and travels through the device, making it work. The way this happens is through a chemical reaction that takes place inside the battery.
During this chemical reaction, ions are transferred from one electrode to the other through the electrolyte. This creates an electrical current that flows through the device and powers it.
Eventually, the chemicals inside the battery will run out, and the battery will stop working.

So that's the basic idea of how a battery works. It's a way to store energy and then release it when it's needed, using a chemical reaction inside the battery to create an electrical current.

In addition to the electrodes and the electrolyte, batteries also have a positive and a negative terminal. The positive terminal is usually marked with a plus sign (+), while the negative terminal is usually marked with a minus sign (-).
It's important to correctly connect the battery cell to a circuit because the polarity determines the direction of the electrical current flowing through the circuit. If you connect the battery backwards, the current will flow in the wrong direction, and the device won't work properly, or it may not work at all.
Connecting the battery the wrong way can also damage the device, or even cause the battery to leak or explode in extreme cases. Therefore, it's essential to pay attention to the polarity markings on the battery and the device you are connecting it to and make sure to match the positive and negative terminals correctly.

To recap, batteries have a positive and negative terminal, also known as polarity, which determines the direction of the electrical current flowing through the circuit. Connecting the battery incorrectly can damage the device or cause it to malfunction, so it's crucial to match the polarity markings correctly.

The switch:

A switch is a device that controls the flow of electricity in a circuit. Think of it like a traffic light that controls the flow of cars on the road. The switch can turn the flow of electricity on or off, just like a traffic light can turn the flow of cars on or off.

A switch consists of a conductor, which is usually made of metal, and two terminals. The conductor is like a bridge that connects the two terminals. When the switch is turned on, the conductor makes contact with the two terminals, allowing electricity to flow through the circuit. When the switch is turned off, the conductor breaks contact with the terminals, and the flow of electricity is stopped.

For example, let's say you have a flashlight that is turned on by a switch. When you turn the switch on, the conductor makes contact with the two terminals, allowing electricity to flow through the circuit and light up the flashlight. When you turn the switch off, the conductor breaks contact with the terminals, and the flow of electricity is stopped, turning off the flashlight.
Switches can come in many different shapes and sizes, and they can be used to control the flow of electricity in all kinds of devices, from toys to cars to airplanes.

So, to summarize, a switch is a device that controls the flow of electricity in a circuit. It consists of a conductor and two terminals. When the switch is turned on, the conductor makes contact with the terminals, allowing electricity to flow through the circuit. When the switch is turned off, the conductor breaks contact with the terminals, and the flow of electricity is stopped.

The resistor:

A resistor is an electrical component that resists the flow of electricity in a circuit.

It's like a speed bump on a road that slows down the flow of cars. Resistors are used in electronic devices to control the amount of electrical current flowing through a circuit.

A resistor usually looks like a small cylinder with two metal wires sticking out of each end. When you connect a resistor to a circuit, it creates a narrow pathway for the electricity to flow through. The resistor's material is designed to resist the flow of electricity and slow it down as it moves through the circuit.
Think of it like walking through a crowded hallway. If there are many people in the hallway, it's difficult to move quickly because there are so many obstacles in your way. The same is true for electricity flowing through a circuit. When there is a lot of electricity flowing, the resistor slows it down, making it more difficult for the electricity to move through the circuit quickly.
Resistors come in many different sizes and strengths, and they are measured in a unit called "ohms." The higher the number of ohms, the stronger the resistor is at resisting the flow of electricity.

In conclusion, a resistor is an electrical component that slows down the flow of electricity in a circuit. It looks like a small cylinder with two wires sticking out of each end. Resistors are used to control the amount of electrical current flowing through a circuit and come in many different sizes and strengths, measured in units called ohms.

The LED:

LED stands for "Light Emitting Diode." It's a special kind of electronic component that emits light when electricity passes through it. Think of it like a tiny light bulb that you can use in electronic devices.

LEDs come in many different colors, such as red, green, blue, and yellow. When electricity passes through an LED, it causes the electrons inside the LED to release energy in the form of light. This light is what you see when you look at an LED.
LEDs are used in all kinds of electronic devices, from toys to traffic lights to TV screens. They're a popular choice for lighting because they use less energy than traditional light bulbs and can last much longer.
To use an LED in a circuit, you need to connect it to a power source, such as a battery. You also need to connect a resistor to the LED to control the amount of electricity flowing through it. This is because LEDs can be easily damaged if too much electricity flows through them.
LEDs have two terminals, a positive (+) terminal and a negative (-) terminal. These terminals are usually identified by the length of the LED's legs. The positive terminal is usually longer, and the negative terminal is usually shorter.

It's important to connect LEDs correctly in a circuit because they only work when electricity flows through them in the right direction. If you connect an LED to a power source in reverse (i.e., negative terminal to positive and positive terminal to negative), it won't light up and can even be damaged. This is because LEDs are designed to only allow electricity to flow through them in one direction. When electricity flows through the LED in the correct direction, it causes the electrons inside the LED to release energy in the form of light. But when electricity flows through the LED in reverse, it can't pass through the LED and the LED won't light up.

To avoid damaging your LEDs, it's important to always check the polarity before connecting them in a circuit. Once you've identified the polarity, you can connect the LED to the power source and the resistor in the correct direction. This will allow the LED to light up and work properly in your circuit.

To sum up, LEDs have two terminals, a positive and a negative, and it's important to connect them correctly in a circuit to avoid damaging the LED. You can identify the polarity by the length of the legs or the shape of the casing, and you should always check the polarity before connecting the LED in a circuit.

Bill of Materials (for each kit) - datasheets are only for understanding of the type of part that is needed		
I Can Solder lvl.1 badge PCB	1 pc.	
3 mm led – Clear white	1 pc.	
Resistor 27 ohm 1/4W (R1)	1 pc.	Resistor value is a ballpark value. Value can be changed depending on the current you want to run the led on. Value can be calculated using Ohm's law.
2 pin momentary switch	1 pc.	https://octopart.com/search?q=CR1102H&currency=USD&specs=0
CR2032 SMD Battery holder	1 pc.	https://datasheet.octopart.com/BAT-HLD-001-TR-Linx-datasheet-127814514.pdf
Printed "Soldering is Easy" booklet	1 pc.	
Small plastic bags	1 pc.	

Tools and PPE (for each workstation)		
Soldering iron 60W		
Soldering iron holder (spring type)		
Soldering tip cleaning sponge (or similar)		
Soldering mat		
Solder wire - lead free		https://docs.rs-online.com/52ae/0900766b81273943.pdf
Wire snips		
Safety goggles		
Soldering helping hands/vice		
Blu Tack		
Portable fume extractor (optional)		

Before the meeting:

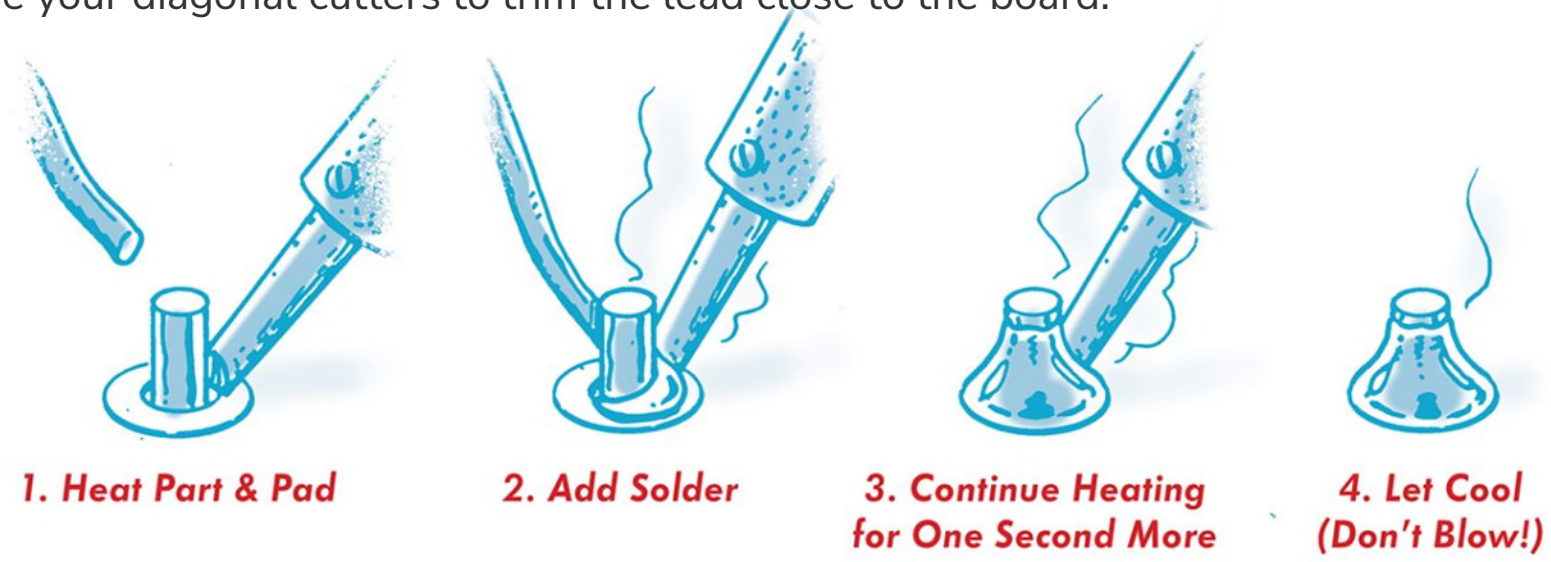
- Familiarize with soldering: what it means, how it works, how it's done and what are the main related H&S issues.
- Familiarize yourself with the basics of electronics: what is the role of the components and how they work, Ohm's law, understand why resistors are needed when working with leds.
- Try soldering a few badges to get a feel of it.
- Make sure the children don't have asthma or other respiratory issues that can be affected by the soldering activity (parent consent form or similar).
- If consent is asked for over OSM/email, attach the "Soldering is easy" booklet for parents and children to read at home beforehand, if possible.
- Arrive at the meeting place early and set up all working spaces with enough personal space to assure safe operation and arrange all necessary items on the tables.

During the meeting:

- Distribute the booklet to each child and give them 5-10 minutes to read it.
- Explain what soldering is, how it works and all related safety concerns. Cover safety concerns around battery cells, they can be EXTREMELY DANGEROUS if swallowed.
- Show all equipment bits, explain what they do and how to be held in use.
- Demonstrate and explain how to put together one badge.
- Make sure that you have 1 to 1 adult supervision at all working stations.
- Make sure everyone is using safety goggles.

How to solder (briefly):

- **Heat the joint:** Heat the joint with the tip of the iron. Be sure to heat both the solder pad and the component lead or pin. A small drop of solder on the tip will help to transfer the heat to the joint quickly.
- **Apply the solder:** Touch the end of the solder to the joint so that it contacts both the solder pad and the component lead or pin. It should melt and flow smoothly onto both the pin and the pad. If the solder does not flow, heat the joint for another second or two and try again.
- **Let it flow:** Keep heating the solder and allow it to flow into the joint. It should fill the hole and flow smoothly onto both the solder pad and the pin or component lead.
- **Let it cool:** Once enough solder has been added to the joint and it has flowed well onto both the component lead and the solder pad, remove the iron from the joint and allow it to cool undisturbed.
- **Trim the leads:** Use your diagonal cutters to trim the lead close to the board.

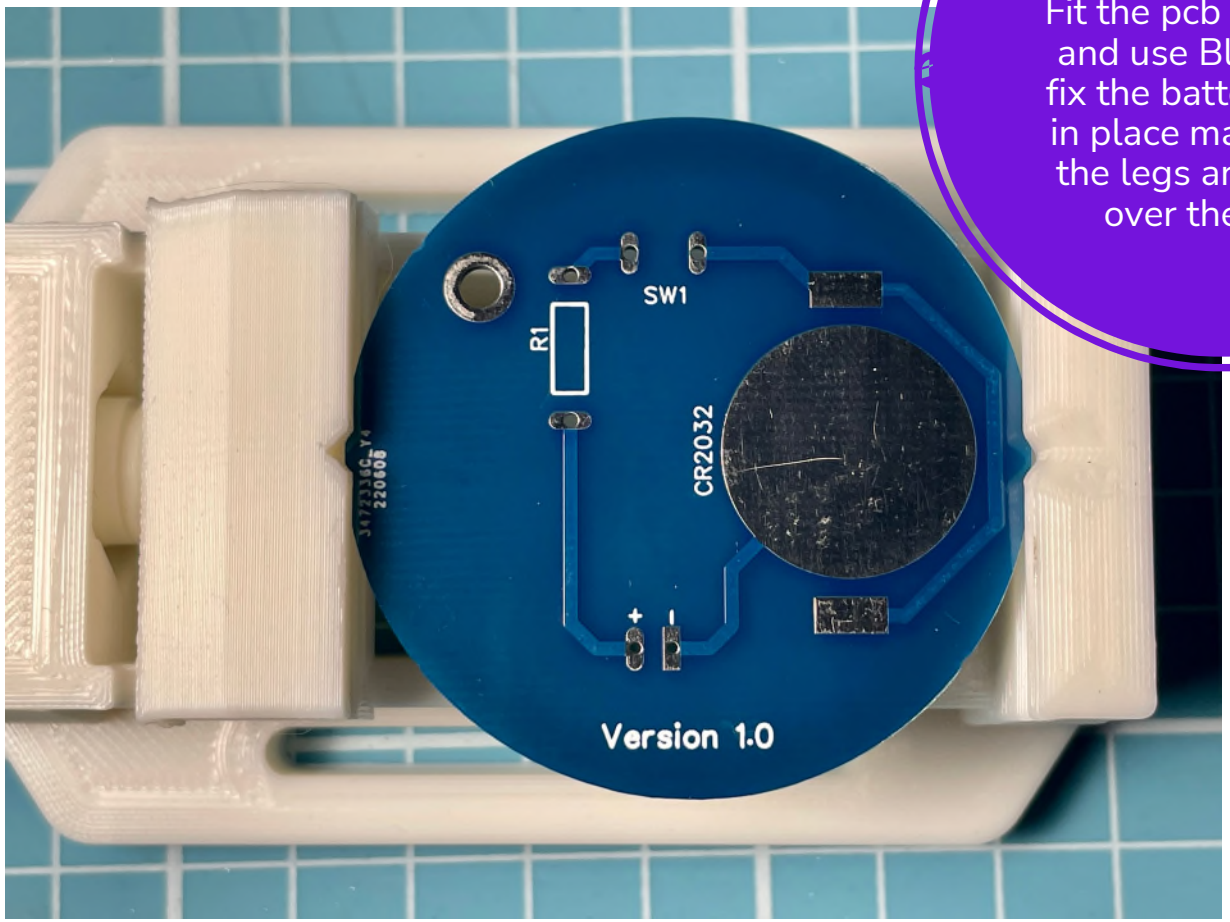


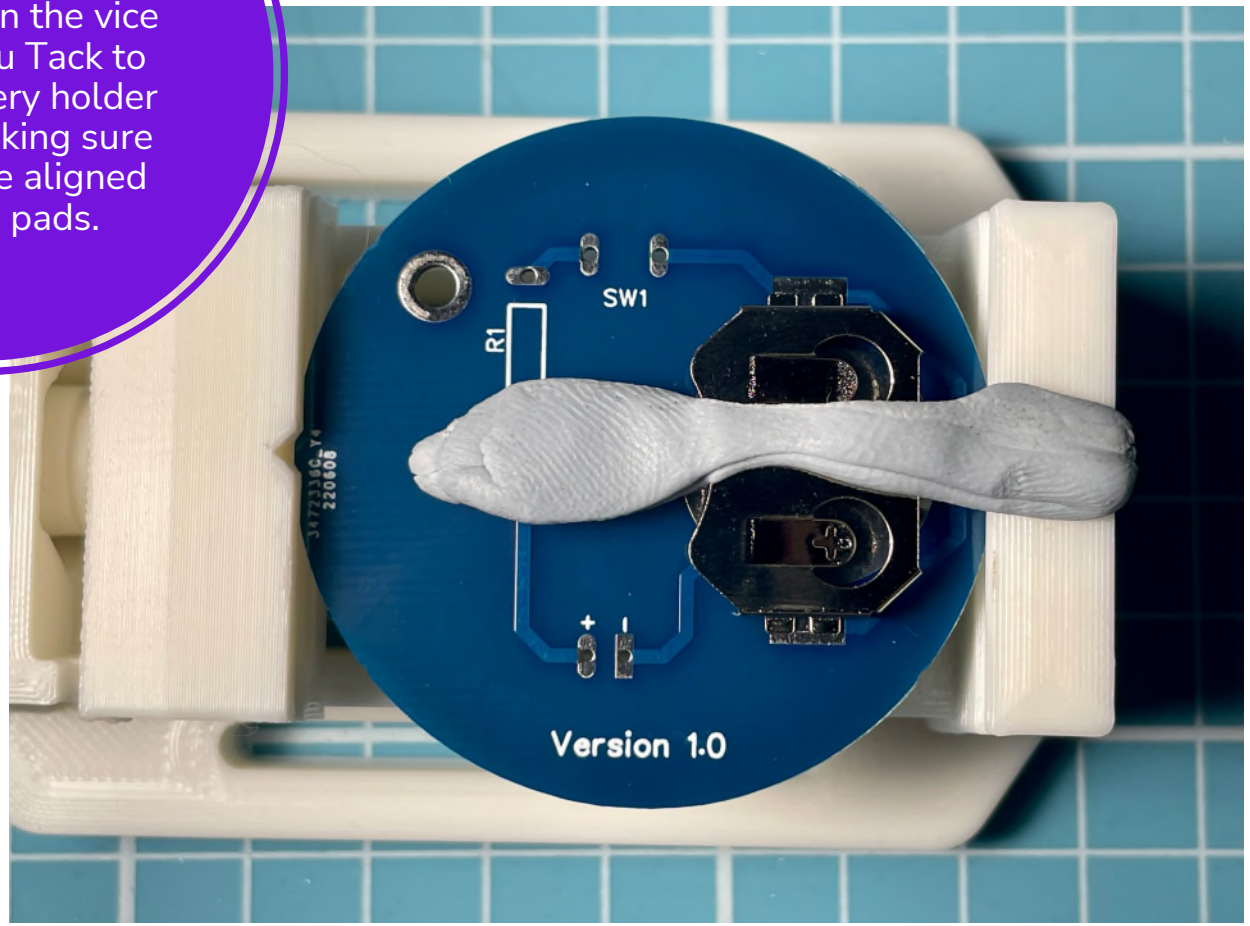
Step 1:

Prepare the components and the tools and make sure you have all of them.

Step 2:

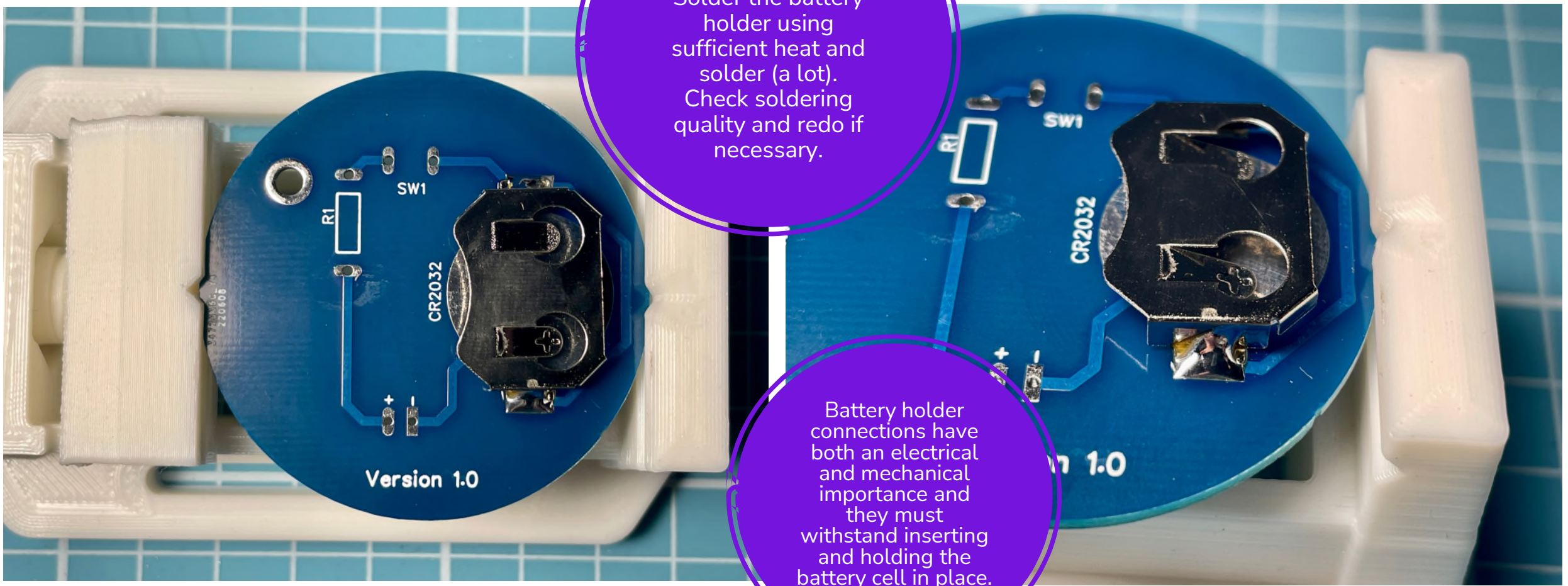
Fit the pcb in the vice and use Blu Tack to fix the battery holder in place making sure the legs are aligned over the pads.





Step 3:

Solder the battery holder using sufficient heat and solder (a lot). Check soldering quality and redo if necessary.



Battery holder connections have both an electrical and mechanical importance and they must withstand inserting and holding the battery cell in place.

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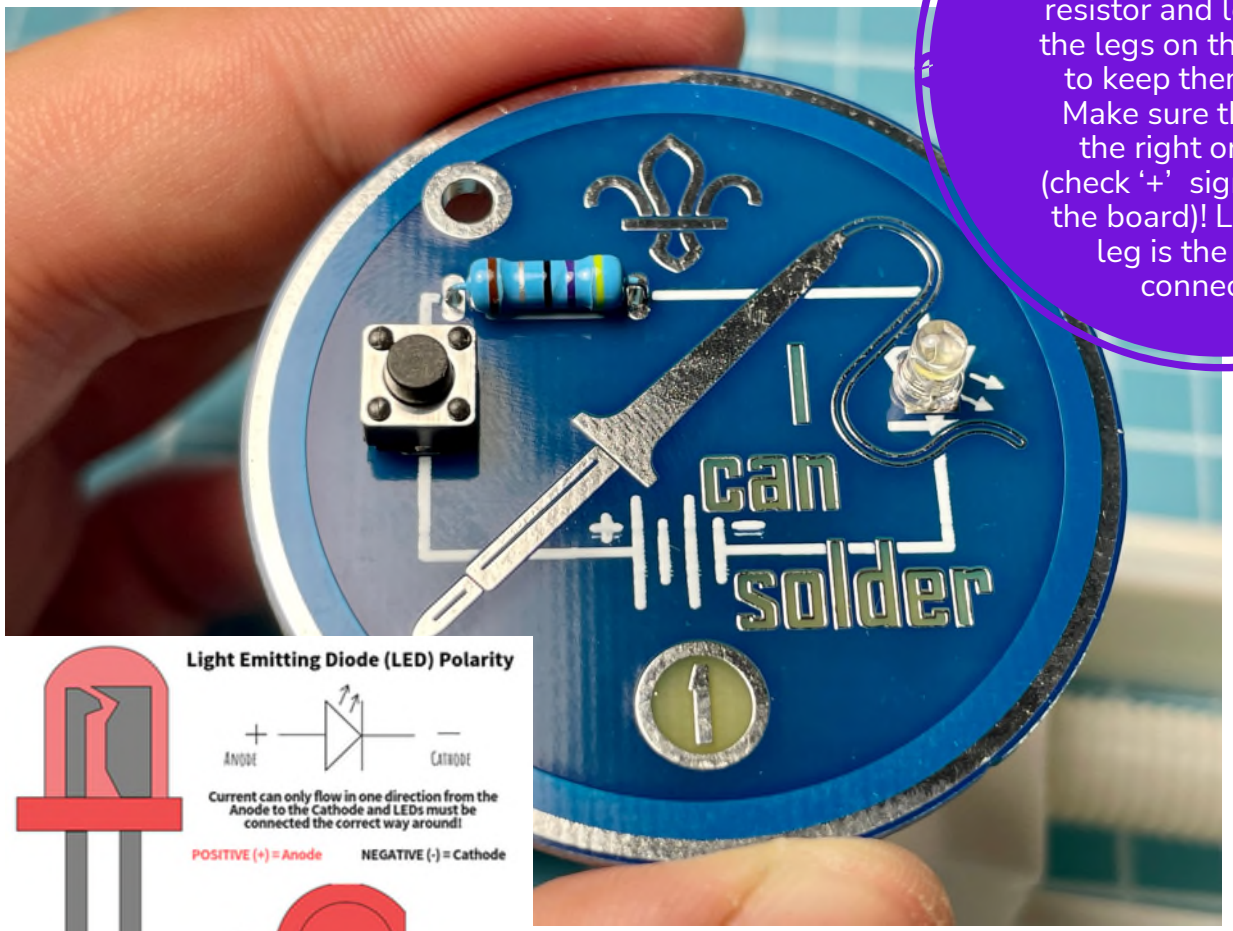
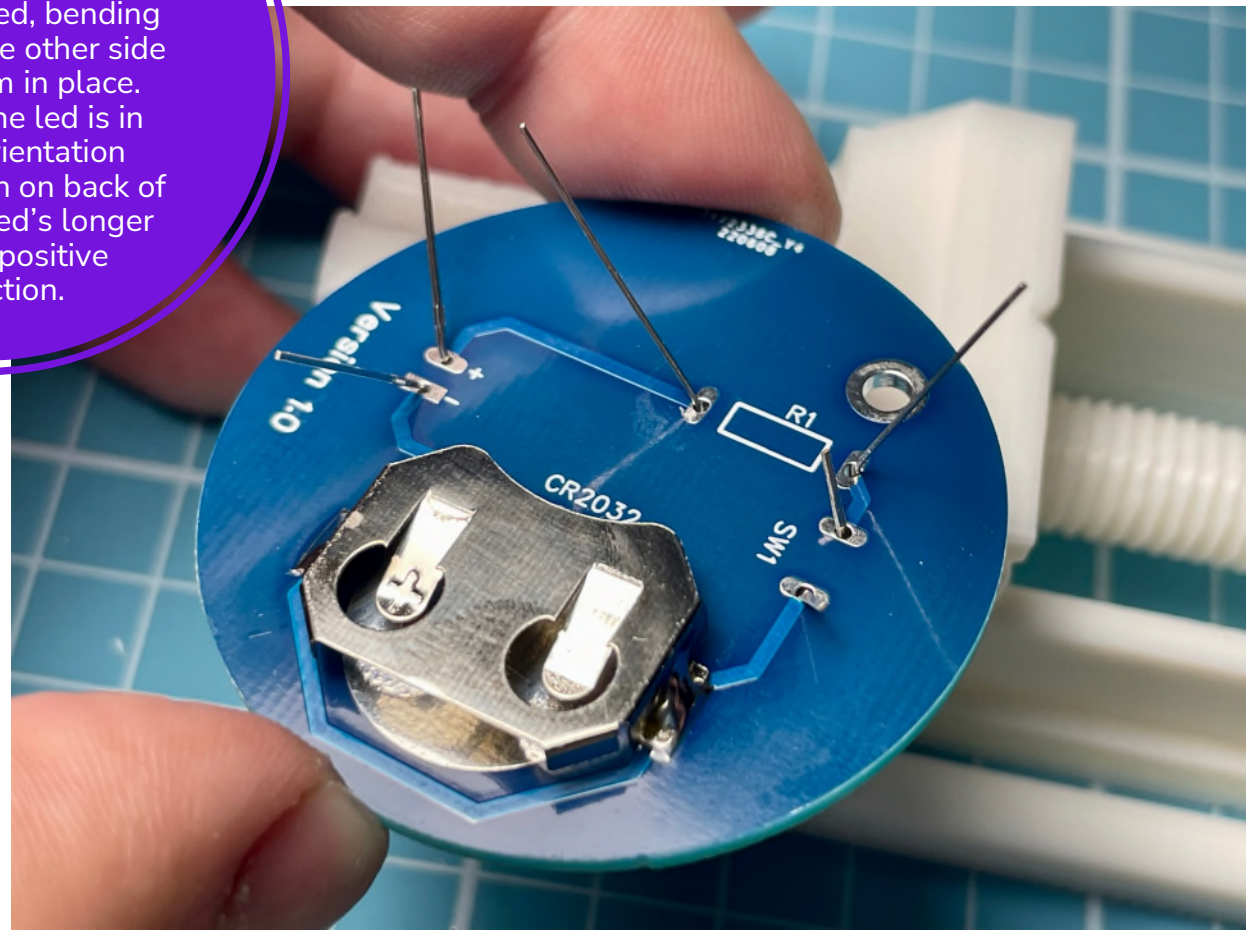
Step 4:

Remove the PCB from the vice, add the switch , resistor and led, bending the legs on the other side to keep them in place. Make sure the led is in the right orientation (check '+' sign on back of the board)! Led's longer leg is the positive connection.





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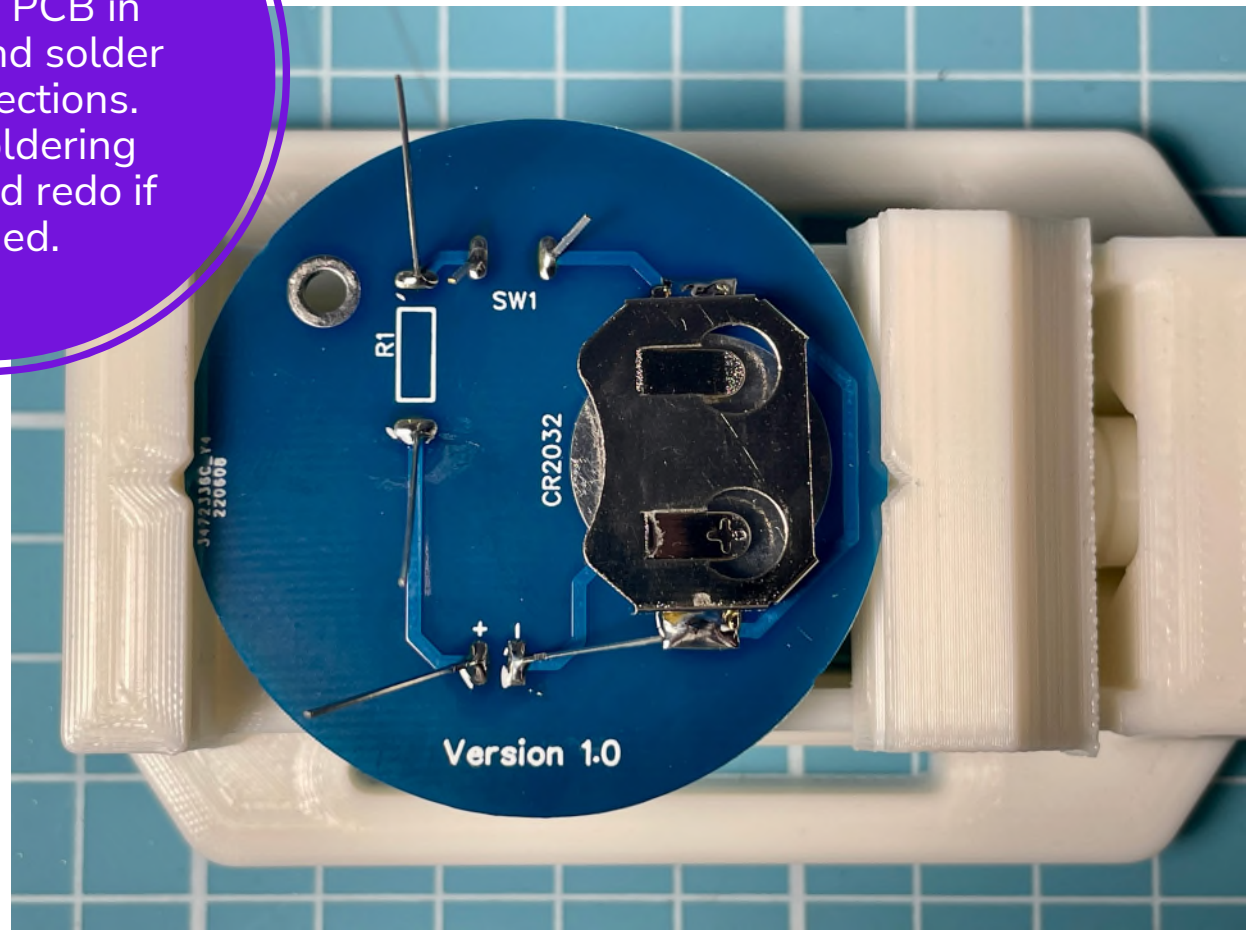
Step 5:

Refit The PCB in the vice and solder the connections. Check soldering quality and redo if needed.



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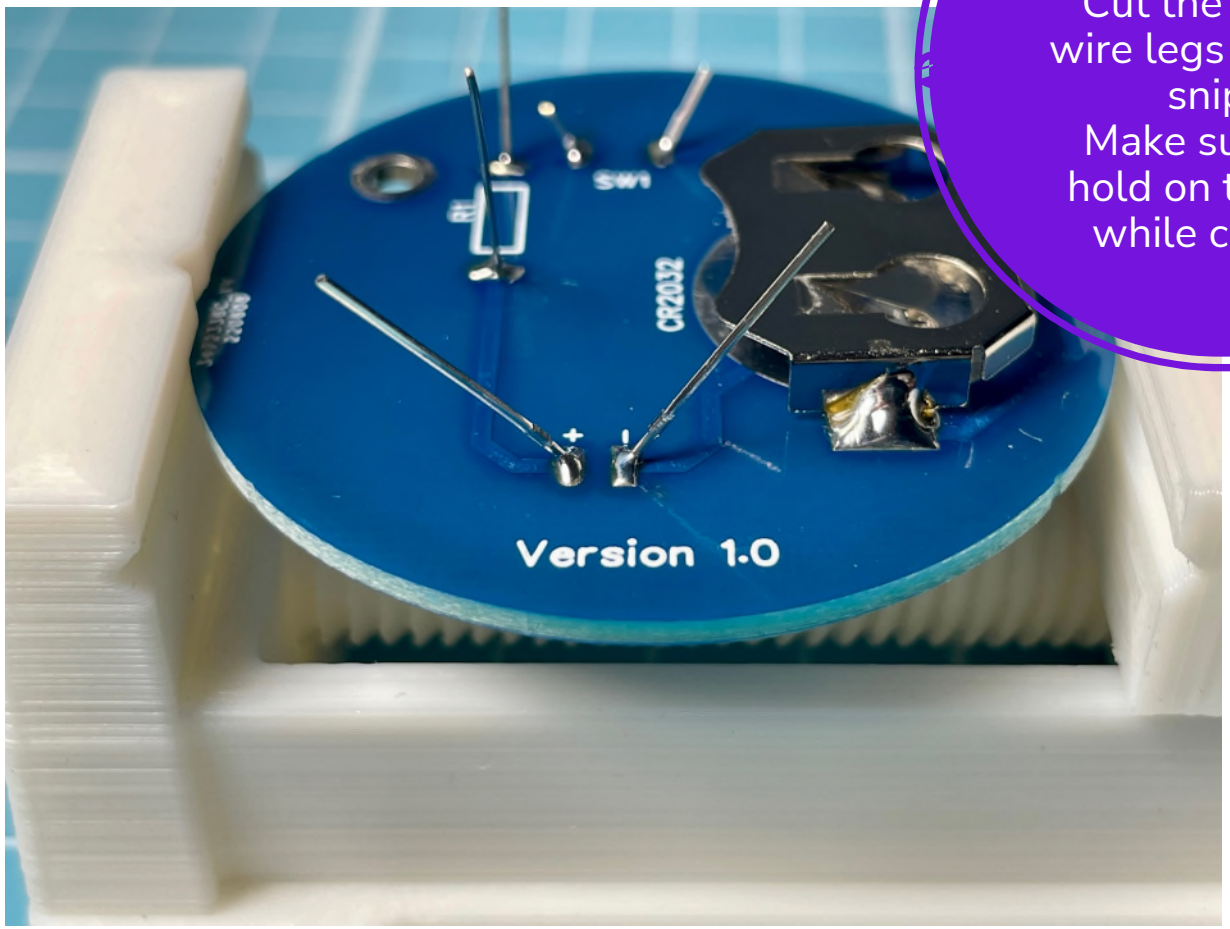
Step 6:

Cut the excess wire legs with the snips.
Make sure you hold on the legs while cutting.



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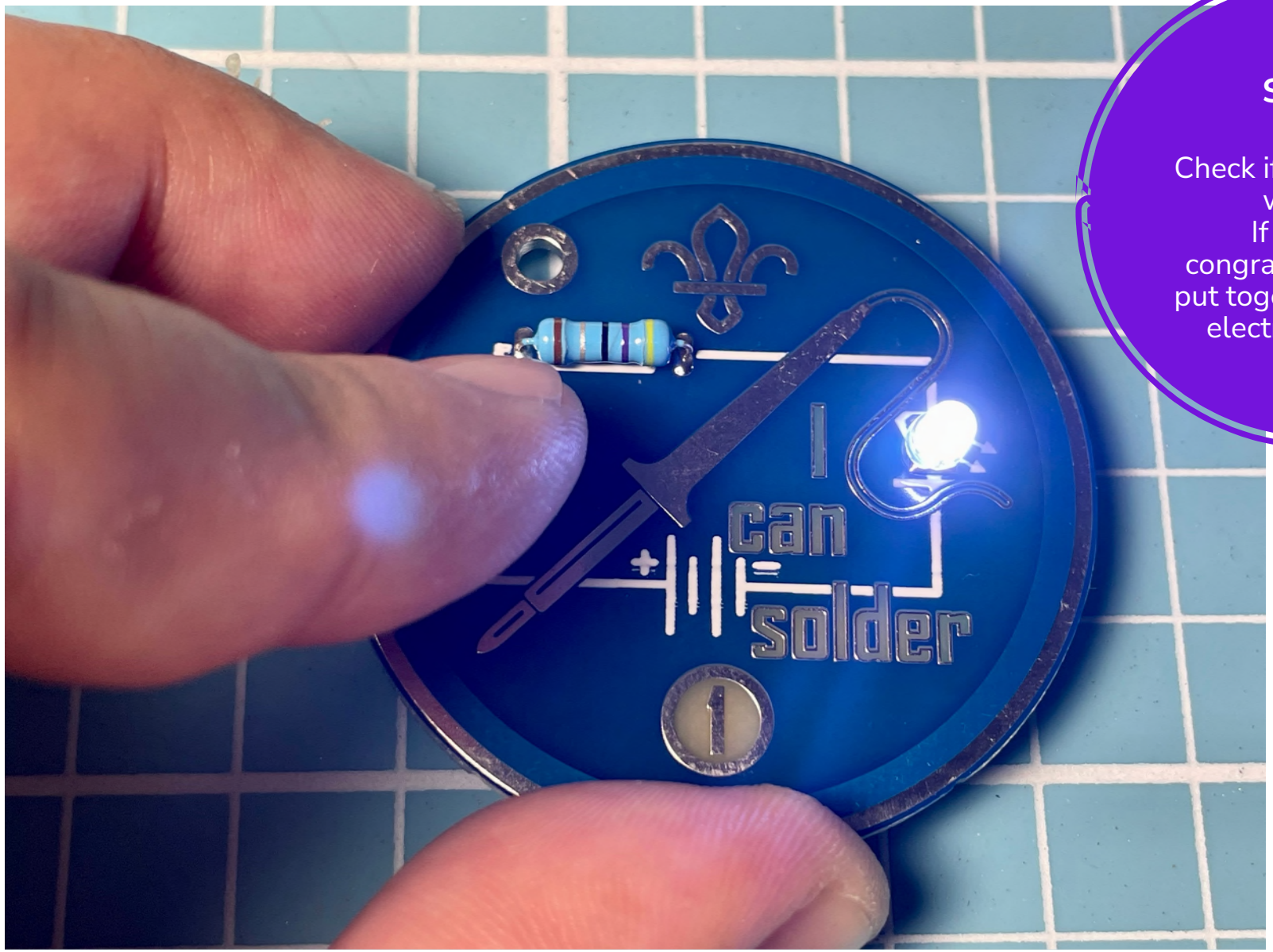

Step 7:

Check if your badge is working.
If yes then congratulations, you put together your first electronic badge!

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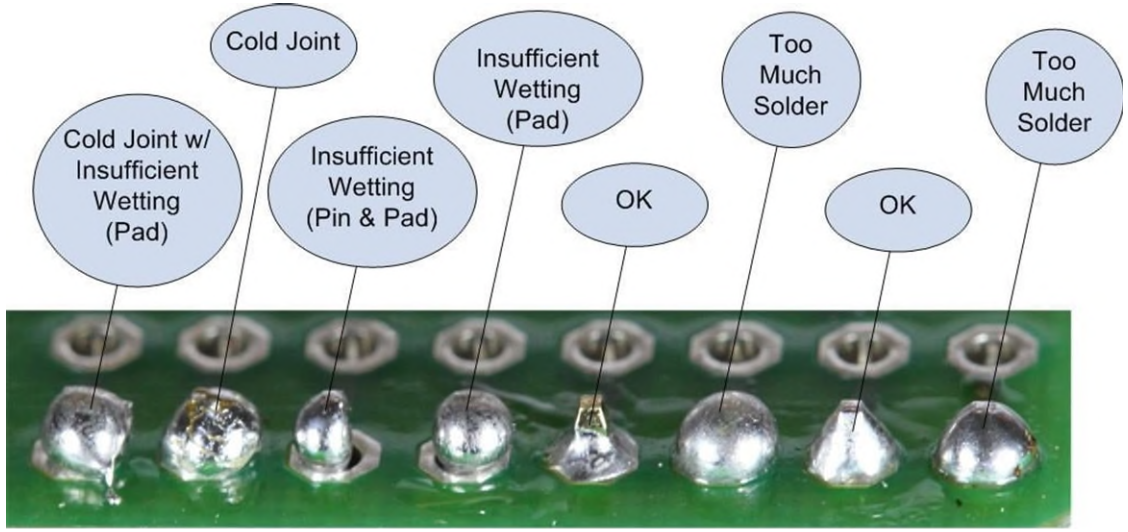
During soldering:

- ✓ **Check your soldering iron:** Make sure your soldering iron is heated up to the correct temperature for the components you are working with. A soldering iron that is not hot enough can cause cold solder joints.
- ✓ **Inspect the components:** Check that the components you are working with are not damaged, such as cracked or bent leads. Also, ensure that you are using the correct components and that they are placed in the correct orientation.
- ✓ **Check your solder joints:** Inspect your solder joints to ensure that they are properly formed and that the solder has flowed correctly. A cold solder joint, where the solder did not flow completely or evenly, can cause electrical problems.
- ✓ **Use a multimeter:** Use a multimeter to test the electrical connections and continuity of the circuit after soldering. This will help you identify any shorts or open circuits that may be causing problems.
- ✓ **Re-solder as necessary:** If you identify a problem with a solder joint or connection, reheat the joint and add additional solder as needed to create a good, solid connection.



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After soldering:

- ✓ **Check the battery:** Make sure the battery is inserted with the "+" side facing up, and that it has enough power to light up the LEDs. You can check this by using a multimeter or by testing the battery in another device.
- ✓ **Check the soldering:** Make sure that all the components are securely soldered onto the circuit board. If any of the connections are loose or not properly soldered, use a soldering iron to reheat the joint and add more solder if necessary. Make sure you don't overheat the components or damage the circuit board.
- ✓ **Check the polarity of the LEDs:** Make sure the longer leg of the LED (the positive leg) is connected to the "+" side of the battery, and the shorter leg (the negative leg) is connected to the "-" side of the battery. If the LEDs are connected backwards, they won't light up.
- ✓ **Check the switch:** Make sure the switch is turned on and is properly connected to the circuit. If the switch is turned off, the LEDs won't light up.
- ✓ If you've checked all of these things and the circuit still isn't working, you may need to troubleshoot further by checking the resistor values or testing the LEDs with a multimeter. Remember to always be safe when working with electronic components, and ask an adult for help if you're not sure what to do.

Risk assessment – Please do not copy/paste the RA. Adapt it and update it to fit own activity.

What could go wrong?	Who is at risk?	What are you going to do about it?	Review & revise
Tables and chairs (and other obstructions)	Young people and leaders	Leaders and Young Leaders oversee setting up and moving tables and chairs. No one carries tables alone – at least two people carry each table. Stack chairs facing side to the wall so they don't fall. Leaders help with stacking and unstacking chairs. Leaders set out tables and chairs at the start of the meeting (based on the planned activities).	
Tools & equipment	Young people and leaders	Tools and equipment provided are in good enough condition, appropriate for the activity, and the right size for everyone taking part. Supervision during use of potentially dangerous equipment (eg. Soldering irons). Electrical equipment to be checked for safety (eg no damaged wires). Electrical items used near to socket to avoid trailing wires. Make sure there's enough space between participants.	
Sharp items	Young people and leaders	Leaders count out the sharp items and are clear on how many are being used. Leaders count sharp items back in to make sure that all are returned. Adults or Young Leaders supervise young people when they're using sharp items – at least one adult or Young Leader for each group. Leaders brief young people on using the sharp item safely before they use it.	
Heat sources	Young people and leaders	Adults or Young Leaders supervise young people when they're using hot items – at least one adult or Young Leader for each group. Leaders brief young people on using the heat sources safely before they use them. Be careful while handling the hot soldering iron and avoid touching the tip directly. Do not touch hot components or circuit board immediately after soldering.	
Behaviour/ overexcitement	Young people and leaders	Section code of conduct in place to set clear expectations of behaviour. Activity process and outcomes clearly explained at beginning of each session.	

Risk assessment - Please do not copy/paste the RA. Adapt it and update it to fit own activity.

Chemical exposure to fumes	Young people and leaders	Solder in well-ventilated area, avoid inhaling fumes. Use lead-free solder.	
Electrical shock	Young people and leaders	Use low voltage (e.g. 3V battery.) Only leaders and young leaders plung and unplug the soldering irons. Visual inspection of soldering equipment. Avoid touching metal parts while circuit is on, and ensure the children are wearing dry shoes and are not standing in water.	
Eye damage	Young people and leaders	Wear safety glasses.	
Swallowing button cell battery	Young people and leaders	Store button cells securely and supervise children closely to prevent them from putting them in their mouths. Use cell holder that makes cells difficult to remove.	
Fire	Young people and leaders	Work on a fire-proof or fire resistant surface. Do not leave the soldering iron on unattended. Always return the soldering iron to its stand when not in use. Never put it down on the workbench. Turn unit off and unplug when not in use. Avoid flammable materials near the soldering area. Have a fire extinguisher or water source nearby.	
Lead exposure from solder	Young people and leaders	Use lead-free solder. Wash hands with soap after activity. Avoid eating and drinking during the activity.	

Disclaimer (for kits that are being sold and delivered on behalf of 1st Radford Semele group):

- All kits and parts are supplied as received from the factory and reliance is placed on factory testing. Some individual parts may be faulty, but this should be minimal. It is suggested that one or two parts more than are required should be ordered just in case of individual faults.

- We cannot take responsibility for individual parts possibly not working, however if there is a problem with a batch then that will be replaced f the batch is returned so that we can return it to the supplier.

- If there is a fault with a batch, then the faulty parts will be replaced rather than a refund given.

- Any injuries or damage sustained in running a soldering activity are not our responsibility.