

TEEN SUMMER BREAK



Sewable Circuits

Caution: Kit contains coin cell batteries which are harmful if swallowed - keep them away from small children and pets.

Materials needed to complete project **Included in kit:**

- 2 pieces of felt, random colors
- 1 bobbin of thread
- 1 needle in a tube
- 3 yards conductive thread (in envelope)
- 1 battery holder
- 2 CR2032 coin cell batteries
- 2 LEDs (1 flashing, 1 random color)
- 1 set of snaps

Not included in kit:

- Scissors
- Ruler
- Chalk or a marker



- 1 container of beeswax thread conditioner
- Round nose pliers (helpful, but not strictly necessary)
- Additional decorations as desired

Instructions:

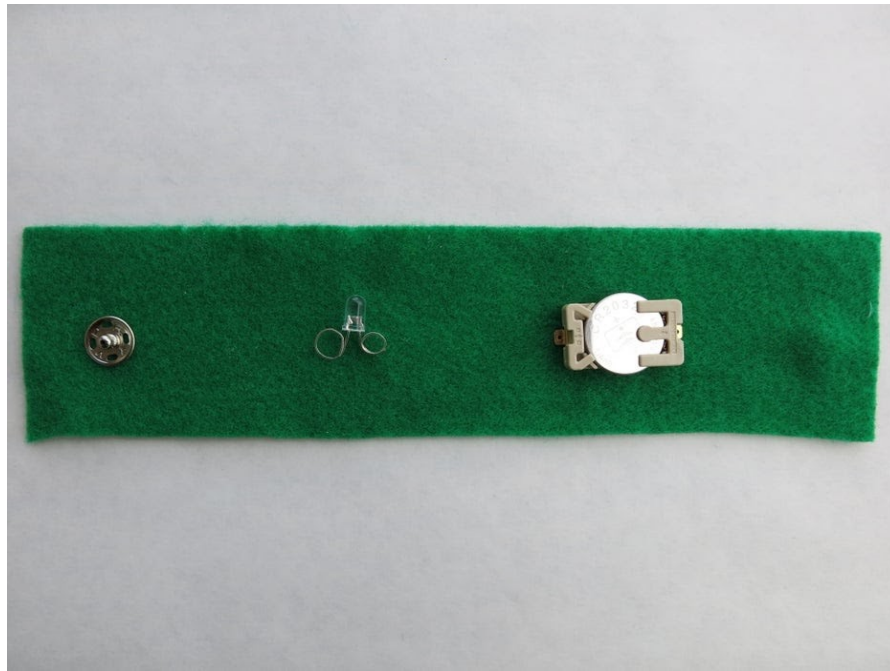
1. Test the Circuit

- The LED, battery holder, and battery have *polarity*. That means there is a positive (+) and negative (-) side to each component.
- For the LED, the positive (+) leg is longer than the negative (-). For the battery, the positive (+) side is the top and may have writing on it; the negative (-) side is the bottom and will be blank. For the battery holder, the positive (+) end is shaped like an 'E' when looked at from the top; the negative (-) side has a metal tab extending into the holder where it will touch the negative (-) side of the battery.
- To test the LED and battery, touch the LED positive (+) leg to the battery positive (+) side and the LED negative (-) leg to the battery negative (-) side. It should light up!
- If it didn't light up, switch the LED legs so they are touching the other sides of the battery - there may have been an issue with which side is positive (+) and which is negative (-). If this still doesn't fix the issue, the battery may be a dud - try another one!
- Tip: test both LEDs before sewing your circuit so you can decide how you want your bracelet to look. The kit includes one flashing and one (random color) non flashing LED, which will give different looks to the finished product.

2. Design your bracelet! Choose what you want it to look like, and where you'd like the LED to be (it's easier to sew the circuit if it's not in the exact middle of the felt, but if you go with that look you'll just need to make sure you sew the rest of the circuit in the right place).
3. To make your LED sewable, twist the legs into circles, using pliers if you have them. The wire the legs are made of twists pretty easily by hand too, just make sure you have good loops so the thread will stay in place when connected.

Tip: it helps to make the positive (+) leg into a larger loop than the negative (-) leg, so you can remember which side is which for your circuit!

4. Cut the felt so that it fits your wrist, about 2 inches by 8 inches. The felt sheets are 12x8 inches. The bracelet should overlap about an inch when worn.
5. Lay out your components as shown:



- Make sure that the LED negative (-) loop faces the battery negative (-) side.
 - The prong (outie) snap will be sewn on the top of the bracelet, nearest you.
 - The hole (innie) snap will be sewn on the bottom of the bracelet, away from you (you may see it as a bump on the right side of the bracelet in the picture).
6. We'll start sewing on the left side of the bracelet (as shown in the picture above). Thread the needle with conductive thread (about 6 inches to a foot of it to begin with), and tie a knot in the loose end of the thread, opposite of the needle.

Tip: The conductive thread may be difficult to thread, so you can use the beeswax thread conditioner to help make it smoother. To do that, place the thread directly on the beeswax, press gently and hold the thread down with a finger while pulling the thread across the wax to coat it.
 7. Position the prong (outie) snap on the top of the felt, facing you. Start sewing with conductive thread at the prong snap, and sew through all of the holes in the snap to secure it. Sew all of the parts tightly, with small stitches for best results. Use a running stitch (sew in and out in a line).
 8. Sew from the prong snap to the LED positive (+) loop. Sew through the LED positive (+) loop three (3) times. Knot and cut the thread.
 9. Now working from the LED negative (-) loop to the battery holder negative (-) end, rethread the needle if necessary. Make a new knot on the loose end of the conductive thread, opposite of the needle. Start at the LED negative (-) loop, sewing through the negative loop three (3) times.

10. Sew from the LED negative (-) loop to the battery holder negative (-) end. **If the needle doesn't fit through the hole on the battery holder end, you may need to take the thread off the needle and thread it through the battery holder end without the needle, then put it back on the needle to finish stitching.** Either way, be sure to sew through the battery holder end at least twice if possible. Knot and cut the thread.
11. Now we will be testing the fit of the bracelet before we finish sewing the circuit in place. Position the hole (innie) snap on the back of the felt, away from you. The hole on the snap should face out so the snap (outie) prong can fit in it. Before sewing the hole snap, test fit the bracelet on yourself (holding the unsewn snap in place) to find the snap's best position. Mark the snap's spot on the bracelet with chalk or a dot of marker.
12. Now, rethread the needle if necessary and make a new knot on the loose end of the conductive thread, opposite of the needle. Start sewing again at the battery holder positive (+, 'E' shape) end. Sew from the battery holder positive (+) end to where you want the hole (innie) snap. Sew the hole snap on to the back of the felt, away from you - **it will not be on the same side as the rest of the circuit!** Knot and cut the thread.



13. Now put the battery in the holder (positive (+) side up) and test out your bracelet! Does it turn on when you snap it together? If not, let's troubleshoot:
- **Do you have the same piece of thread touching both sides of any component?**
 - ⇒ The LED positive (+, larger loop) **should not** be connected to the LED negative (-, smaller loop).
 - ⇒ The battery holder top (+) **should not** be connected to the battery holder bottom (-).
 - ⇒ If they are, then cut the thread, and resew each point. The positive (+) and negative (-) sides of the circuit should only be connected once, by the snap, for the circuit to run properly.
 - **Does your circuit flicker?**
 - ⇒ Your stitches may be making intermittent contact. Add some short stitches between components, or sew more stitches to tighten them down.
 - **Are your components floppy?**
 - ⇒ Add stitches to tighten them down. You may have used stitches that were too large.

14. The circuit is all done!

15. Now you can decorate your bracelet with shapes, thread, beads, and buttons. Add a flap to cover your battery holder, and leave room so you can change the battery, if you want! You can cover most parts of the circuit up with more felt if desired, but use the regular colored sewing thread to sew any extra pieces like this on, so you don't accidentally cross the circuit with conductive thread and stop it from working.

- *Tip: if you want your LED to stick through a piece of felt as part of your design, cut a very small hole in the felt and stick just the bulb of the LED through.*
- *These instructions are for sewing a light-up bracelet, but if you would rather design something different, go for it! Just make sure the circuit connects the right parts (negative to negative, positive to positive, with no overlap) and the design allows for the snaps to connect to close the circuit and light the LED!*

