VEIN FINDER: PART NO. 2190080

Time Required: 3 Hours Depending on Experience | Beginner Level

Despite the somewhat frightening sight of your arm's veins being illuminated, it is essential for doctors, and anyone administering venipuncture, to be able to locate the veins. This is not only a useful tool for diabetics or others needing to regularly locate their veins, but also a fun project for kids and adults interested in the wonders of the human body.

Required tools and parts:
Screwdriver
Soldering Iron and Solder
Rotary tool for cutting plastic
Needle nose pliers
Wire Stripper & Wire Cutter
Ruler
Paper Clip
Cardboard (for obstructing stray light)

Bill of Materials:

Part No.	Qty.	Description
616690	1	Perforated prototype board
577221	1	Rocker Switch
690566	30	Resistor 56 Ohm 250mW 1%
2138863	30	LED 3mm 20mA 1.9V wavelength 628nm
2138281	1	Plastic enclosure with battery contacts
2180308	1	Spool of Wire
198707	2	AA Battery
---	1	Instructions

Project Steps – Schematic Download schematic here

Step 1: Cutting the Bottom of the Enclosure
Cut a rectangular hole in the bottom of the enclosure. The hole should be 50 mm long, and 47 mm wide. Begin the hole about 30 mm above the battery holder. Make it roughly centered on the horizontal.

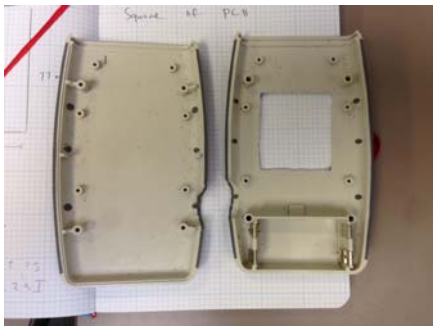


Fig 1: Holes

Fig 2: Switch Hole

Step 2: Cut Hole for Switch
This will require the rotary tool. A hole-saw would be best, but the rotary tool works fine. The hole should be about 26 mm in diameter. Make sure not to cut the battery enclosure or the screw holes.

Step 3: Cut Hole on Front of Enclosure
Now cut a rectangular hole 30mm x 45mm in the front cover of the enclosure. Position the hole so its bottom is about 7cm from the end of the enclosure.

Fig 3

Fig 4: Battery Contacts

Step 4: Battery Contacts
Slide on the battery contacts; these should have come in your plastic enclosure.

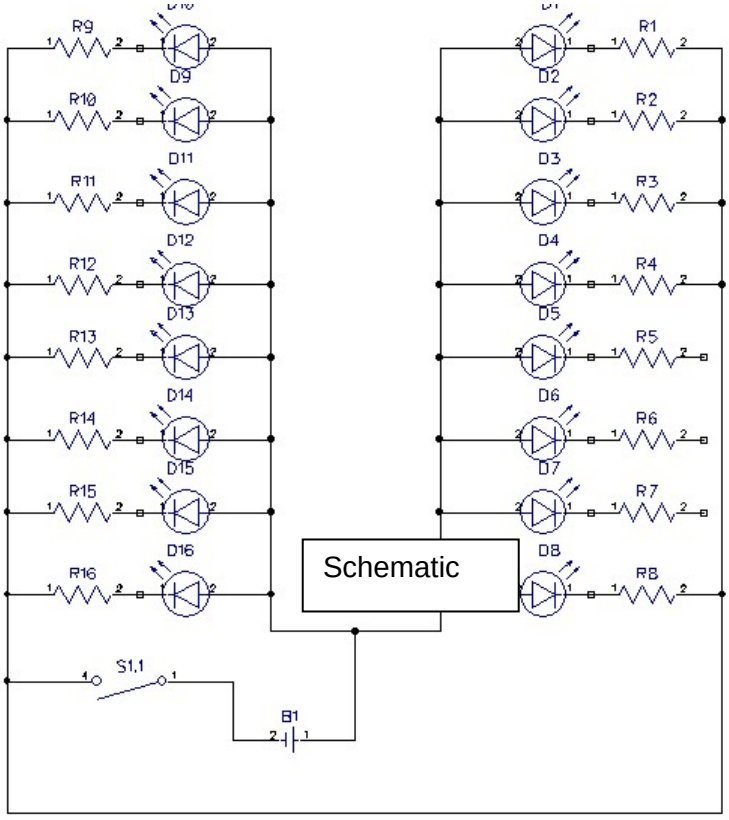
Step 5: Make PCB Square

- Cut the PCB to make a 77mm x 77mm square.
- **Note:** The PCB is tough, so use a strong tool such as a blade or saw.
- Now make a square cut-out in one corner of the PCB—about 23mm x 23mm square. **Note:** It does not matter yet which corner the cut-out is in because you have not put in the LEDs or resistors yet. I made the mistake of soldering in the

**LEDs facing the wrong way, so the cut-out did not line up with the switch. I had to make another cut-out on the other side, which is not a big problem, if you happen to make the same mistake.

Step 6: LEDs and Resistors

- The pictures below should help you. **Note:** If the LEDs are facing down, the switch cut-out should be on the left.
- Put the LEDs in the PCB along the inner edge of the center hole. The **anode lead** (long one) should be nearest the center cut-out on both sides.
- Slide in the resistors adjacent to the LEDs.
- **Note:** The image below shows 10 pairs on each side; fit as many pairs as you can, it need not be 10. Mine has 8 on each side.



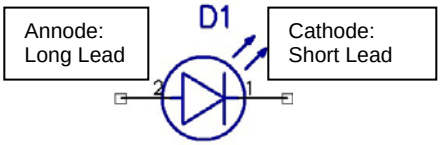


Fig 5: LED

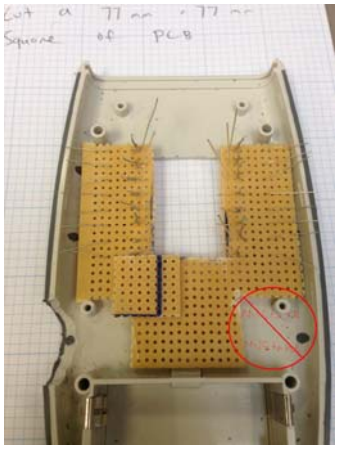


Fig 6: Board in Case

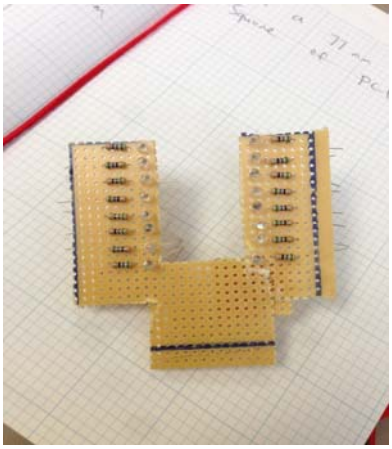


Fig 7: Front of PCB

Step 7: Begin Soldering
Twist and solder together one resistor lead and the **cathode lead** (short one) of each LED-resistor pair. You can trim the leads for convenience after you have soldered.

Step 8: Wire the First set of Resistors in Parallel

- Strip a piece of wire completely—about 7mm. This will be used to connect the resistors.
- Lay the 7mm wire on top of the resistors on the left side. Create a good physical connection.
- Solder the resistors to the wire.
- Leave the extra wire.

Step 9: Second set of Resistors

- Cut another wire, this one longer (15mm), and with some insulation left. Do not strip completely.
- Follow (b) and (c) from Step 8 for the second set of resistors on the right side.
- Connect the wires from Steps 8 & 9; twist and solder a good connection.
- **Note:** Leave extra wire, for it will be used to connect to the switch.

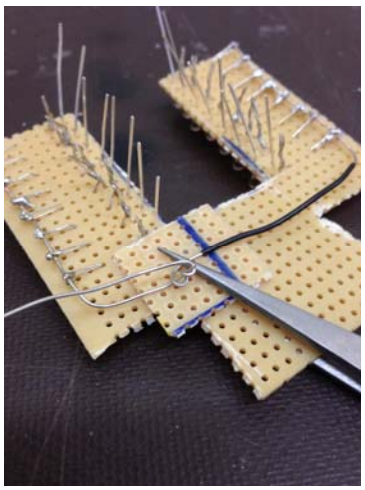


Fig 8: Wiring Resistors

Fig 9: Wiring LEDs

Step 10: Connecting the LEDs

- **Note:** This is the trickiest part of the project. Once you finish connecting the LEDs you're in the clear.
- Start by cutting, and stripping completely, 2 wires about 8mm long.
- Attaching the wire to the first LED is difficult. A clamp, a third hand, or a friend (whichever is easiest to come by) would help. To get a good physical connection on the first LED I suggest making a loop with the wire, then folding over the LED lead (similar to how you did with the resistors). Solder.
- Once you have the first one, run the wire along the rest of the LEDs, and fold over the leads. Solder the leads to the wire.
- Repeat (c) and (d) for the other set of LEDs.
- I suggest you trim the folded over leads with a precise wire cutter after you solder.
- **Finally,** twist and solder together the ends of the wires for the two sets of LEDs.

Step 11: Wire Positive Battery contact

- Strip completely another wire that will reach from the battery contact to the LED wires you just soldered.
- Make sure you solder this wire to the **positive** battery contact (it's the flat one).
- **NOTE:** You should glue down the PCB to the bottom of the enclosure before wiring the battery contact.
- Now you can solder the wire from the positive battery contact to the wire from the LEDs.

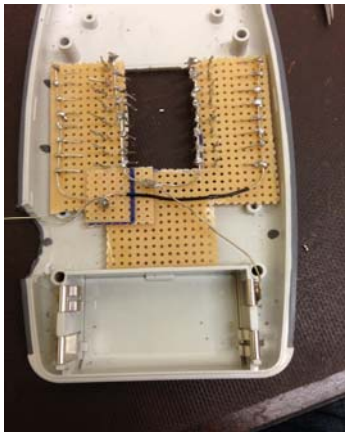


Fig 10: Circuit

Fig 11: Switch & Battery

Step 12: The Switch

- I suggest gluing down the switch to the edge of the bottom enclosure before you start wiring. Hot glue works well.
- If there is no extra wire from the resistor connection you will need to cut and strip a small piece of wire.
- Solder the wire to one of the switch leads (it does not matter which).
- Next, cut a wire to connect the switch to the negative battery contact (on the same side as the positive contact). Leave some insulation on this wire.
- Solder the wire to the negative battery contact (the one with the bumps) and to the other lead of the switch.

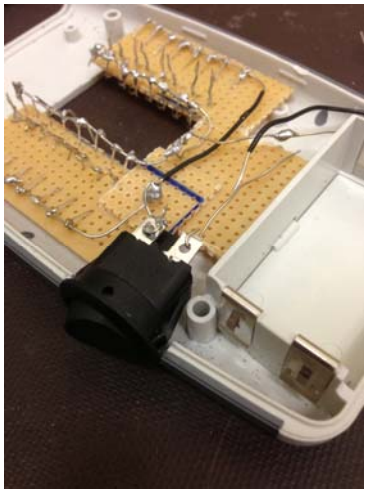


Fig 12: Wiring Switch

Fig 13: Battery Contacts

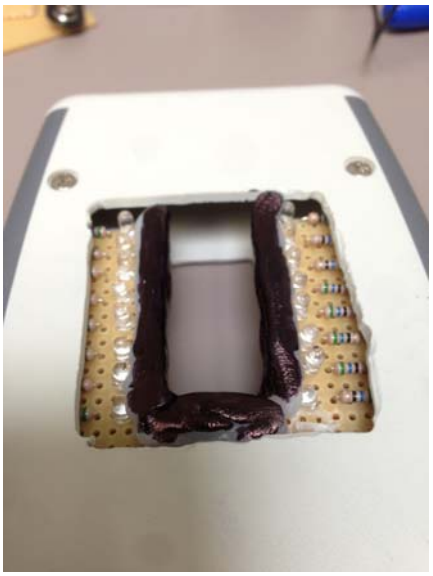
Step 13: Completing the Circuit
Complete the circuit by connecting the positive and negative battery contacts on the opposite side. A paper clip, a wire, or any small piece of metal will work.

Step 14: Screw on the Top Cover
Screw on the top cover….

Step 15: Stray Light Blocker

- The divider is necessary to block out some light in the center hole, so you can see through to your veins.
- You can likely cut up the cardboard box in which your kit was shipped.
- Cut four pieces to form walls within the array of LEDs.
- Tape or glue the dividers to the inside case.

Fig 14: Window/ Light Blocker



Once you have completed the build, press the bottom of the case against your forearm. Turn on the LEDs and look through the front viewing window at your illuminated veins!