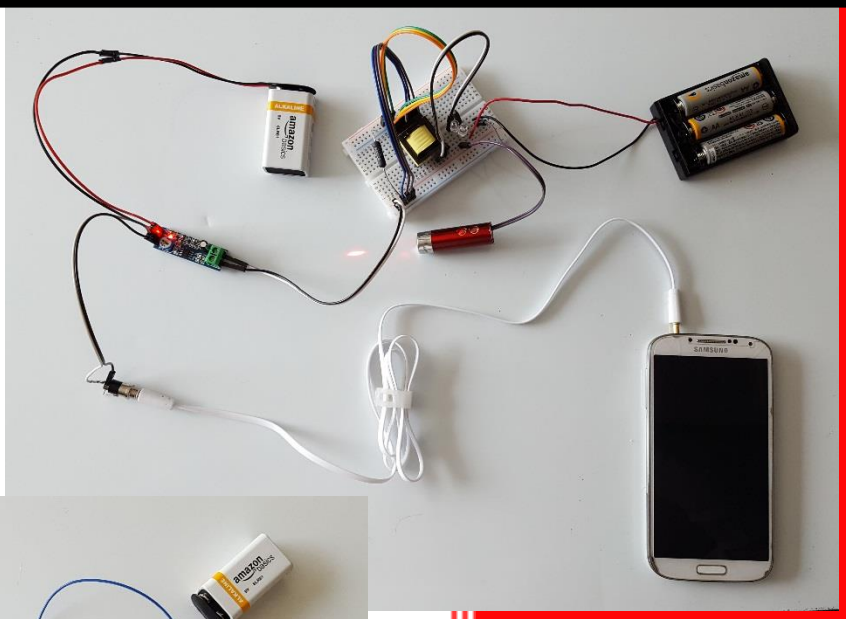
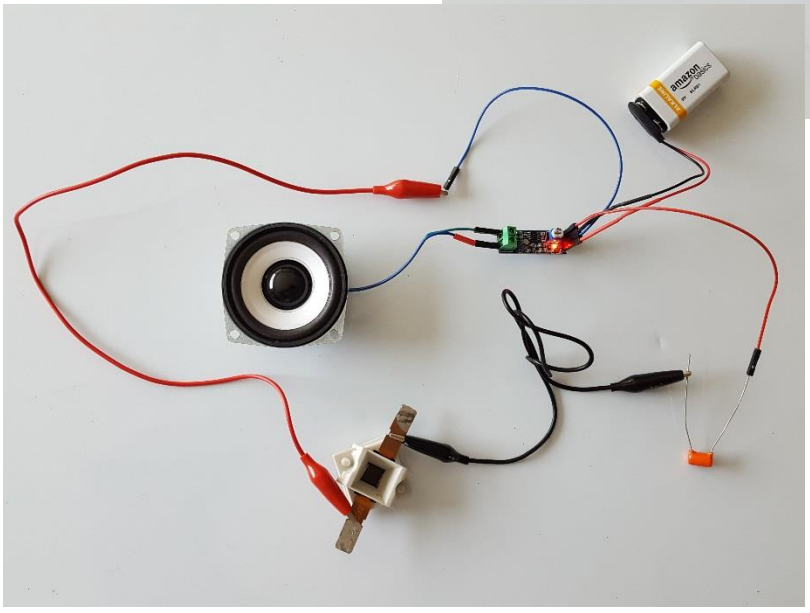
Solar Cell Audio Laboratory

UNLV Laboratory Experience





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SAFETY FIRST

★ ★ ★ ★

- ✓ NEVER Look Directly into a Laser!

  You can burn your retina and cause permanent damage.

- ✓ DO NOT Shine a Laser at a Person or an Animal

  You can burn eyes and skin causing lasting or permanent damage.

- ✓ NEVER Shine a Laser on/in Your or Another Person's Head, Face, or Eyes!

  Again, this is dangerous!

- ✓ Connect the Batteries Only AFTER the Circuit is Connected and Checked!

  It NOT safe to add current to an unfinished or incorrect circuit.

- ✓ Do NOT Store Batteries with Leads Touching or Able to Touch!

  Unsafe sparking and/or unsafe heating will occur.

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Parts List:

1 # Audio cable

12 # Jumper Wires

1 # AA Battery Pack

2 # 9V Battery Snap

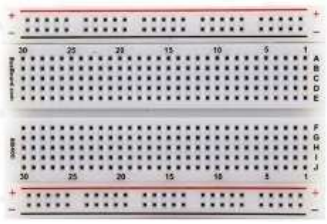
1 # 8 Ohm 3 Watts Resistor

1 # Speaker

1 # Capacitor

1 # Audio Transformer

1 # Solderless Breadboard



2 # Amplifier

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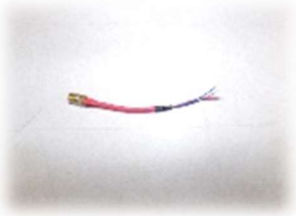
2 # Alligator (Banana) Clips

2 # LED Lights

1 # Laser Light

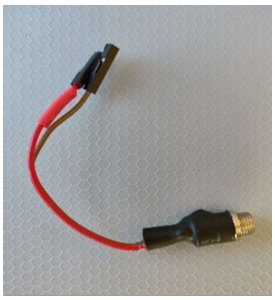


1 # Screwdriver

1 # 150 Ohm Resistor

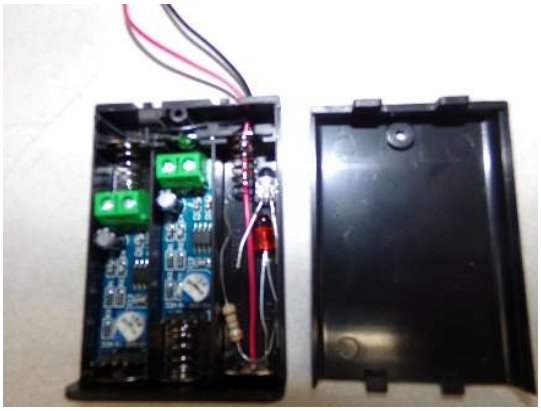
1 # Solar cell

1 # Female audio port



Storage Instructions:

Place the 2 amplifiers, the 150 ohm resistor and the 2 LED bulbs in the AA battery pack as shown in the picture below.



SOLAR CELL AUDIO KIT MANUAL

General information:

- You will notice that there is a transformer connected to the bread board. Keep it in this position, even when you take apart the kit at the end of the activity.
- LED[1] is an indicator light to know if something is wrong with the circuit.
- LED lights have two different ends and they must be connected in a specific way or the LED could be damaged.
- Wires and resistors do not have specific ends; they can be connected in either direction.
- All the jumper wires provided to you are of equal lengths and the colors of the jumper wires don't matter.
- There are different types of jumper wires in this kit:
    - Male-to-Male = both ends have a metal pin
    - Male-to-Female = one end has a metal pin and the other end has receptor to receive a pin into it
    - Female-to-Female = both ends have receptors to receive pins
- You need a digital audio source for this project. This could be a cell phone, tablet or laptop.

Follow the instructions step by step to set up the solar cell audio kit.

1. Take one end of the **150 Ω resistor** and connect it to **d10** while the other end should be connected to **j10.**
   Gently bend the wires into a curve. Do not bend the center of the resistor.
2. Connect the **positive** end (longer) of the **LED[1] bulb** to **i10** and the **negative** end (shorter) of the **LED[1] bulb** to **i7.**
3. Connect the **positive** end (longer) of the **LED[2] bulb** to **g7** and the **negative** end (shorter) of the **LED[2] bulb** to **g10.**
4. Connect the **positive wire (red)** of the laser to **b10** and **negative wire (black)** of the laser to **f4.**

5. Connect the **positive wire (red)** of the **AA battery pack** to **j7** and the **negative wire (black)** to **j4.**
6. Check the circuit to make sure that all the necessary parts are connected properly. You may want to ask the instructor to check your circuit. Now connect the AA **batteries** and see if the **LED[1] bulb glows**. If yes, then there is a **problem with the connections**. Recheck everything and try again.
7. Once your circuit is done (and the LED[1] bulb doesn't glow), remove the AA batteries and keep them removed until the entire kit is assembled.

Connecting the jumper wires

1. Connect the male-to-male **jumper wires** to the breadboard as shown in **Fig 2** (3 long black wires, 3 short wires, 1 green and 1 blue)**.**
   (*Note: the color and length of the wires represented in Fig. 2 may not be the same color and length provided to you. It is just to indicate that the ends of a single jumper cable connect at the positions shown. The color and length does not matter.)
2. Connect the **8 ohm 3 Watt (8Ω 3W) resistor** to the breadboard as shown in **Fig. 2**.
   Gently bend the wires into a curve. Do not bend the center of the resistor.
3. Take a **jumper cable** and connect one end to **j17** and the other end to **f10.**
4. Take a **jumper cable** and connect one end to **j19** and the other end to **f7.**

	+	-	a	b	c	d	e	f	g	h	i	j	+	-
1														
2														
3														
4								Blk(-)-Laser				Blk(-)-AA Pack		
5														
6														
7								Transformer/j19	Long(+)-LED2		Short(-)-LED1	Red(+)-AA Pack		
8														
9														
10				Red(+)-Laser		150Ω Resistor		Transformer/j17	Short(-)-LED2		Long(+)-LED1	150Ω Resistor		
11														
12														
13														
14														
15														
16														
17			Transformer/-		P13 Transformer						P10 Transformer	Transformer/f10		
18			Transformer/-		P12 Transformer									
19			Transformer/-		P11 Transformer						P30 Transformer	Transformer/f7		
20														
21		Transformer/a21	Transformer/-		P9 Transformer						P40 Transformer			
22		Transformer/a22	Transformer/-		P8 Transformer									
23		Transformer/a23	Transformer/-		P7 Transformer						P60 Transformer			
24														
25														Transformer/a17
26														Transformer/a18
27		8Ω 3W Resistor											8Ω 3W Resistor	Transformer/a19
28														
29													Amplifier1/OUT	Amplifier1/GND
30														

Fig. 1 – Diagram of bread board connections.

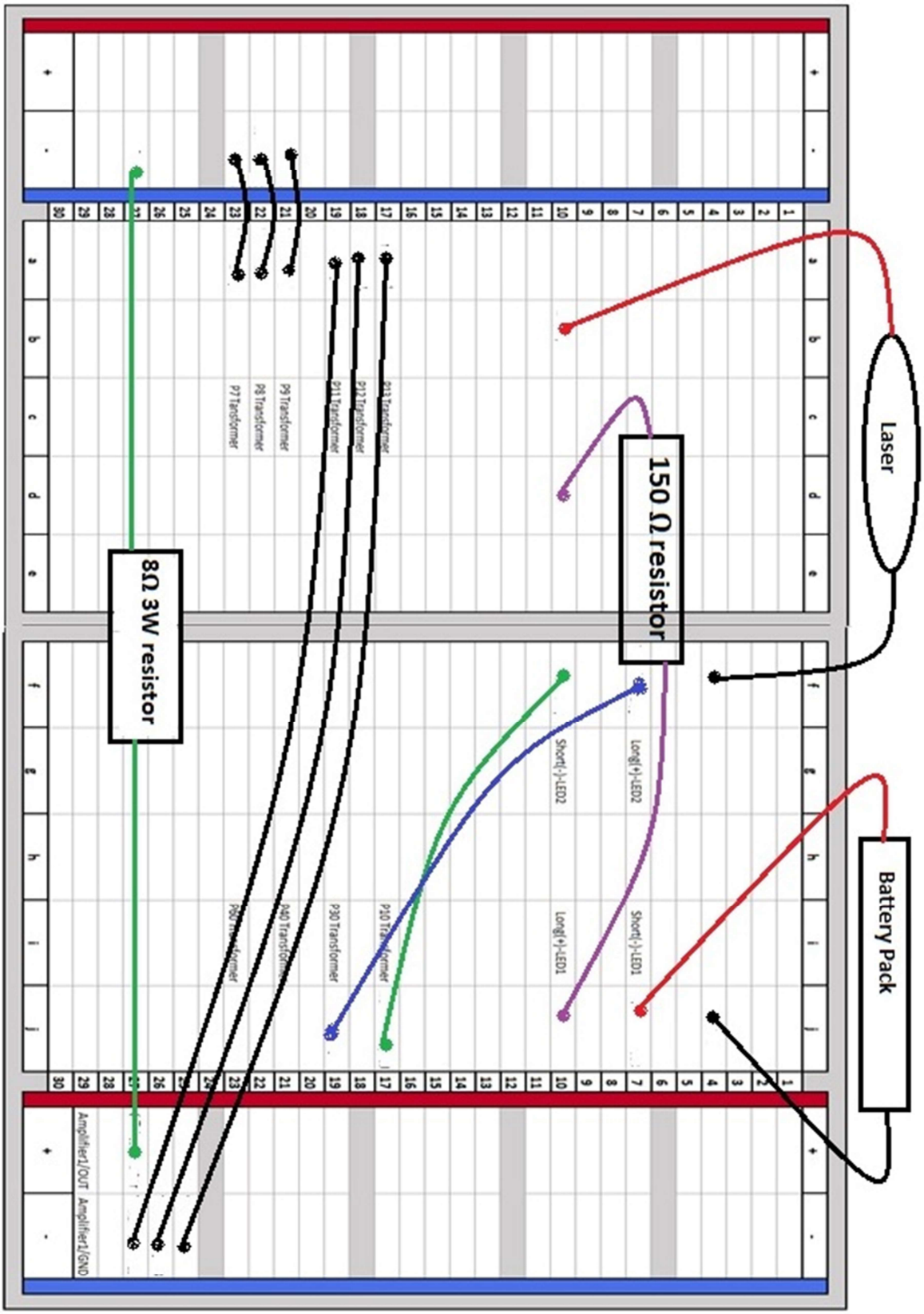


Fig. 2 – Diagram showing wired connections on bread board.

Setting up amplifier circuits:

1. Ensure amplifiers are not burned out by checking the black panel on each amplifier for holes or oil stains.
2. Connect the negative (black) and the positive (red) wires of the female audio port to the corresponding positions on the amplifier 1 as shown in **Fig. 3.**
3. Using a male-to-female jumper cable, connect the male end to the capacitor/GND port on amplifier 2 and connect the female end to either end of the capacitor as shown in **Fig. 4**.
4. Using a male-to-female jumper cable, connect the female end to the free end of the capacitor.
5. Connect the negative (black) and positive (red) ends of the speaker to the GND and OUT ports respectively to amplifier 2 as shown in **Fig. 4.**
6. Using a male-to-male jumper wire, connect one end to the IN/solar cell port of amplifier 2 as shown in **Fig. 4.**
7. Using alligator clips, connect one end of an alligator clip to the protruding flat metal end of the solar cell and connect one end of **another** alligator clip to the **other** protruding flat metal end of the **same** solar cell as shown in **Fig. 4**.
8. Connect the free ends of each of the 2 alligator clips to the male end of the jumper cable (the one from point number 4 above) and the free end of the jumper wire (the one from point number 5 above) respectively as shown in **Fig 4**.

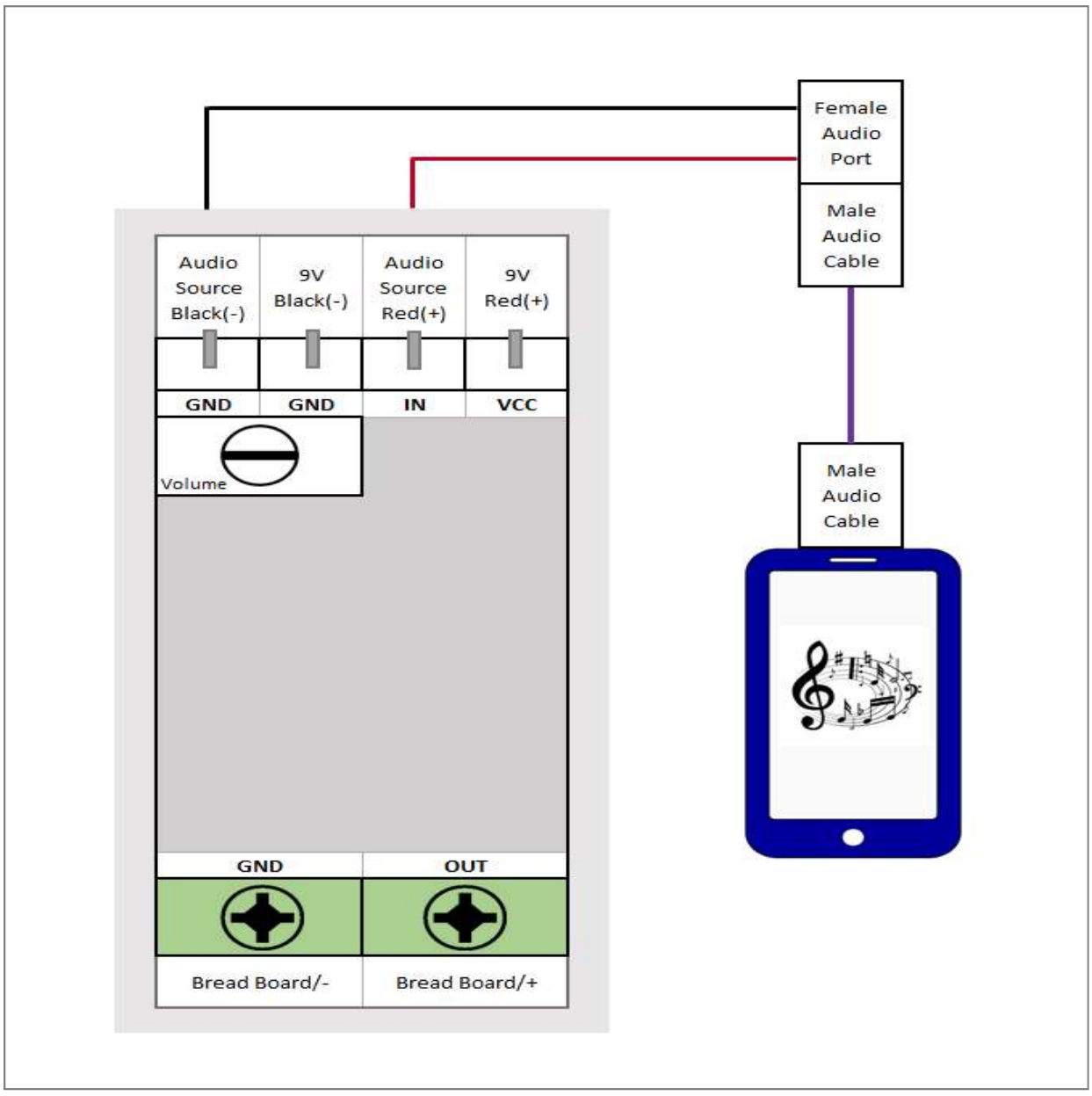


Fig. 3 – Amplifier 1 circuit.

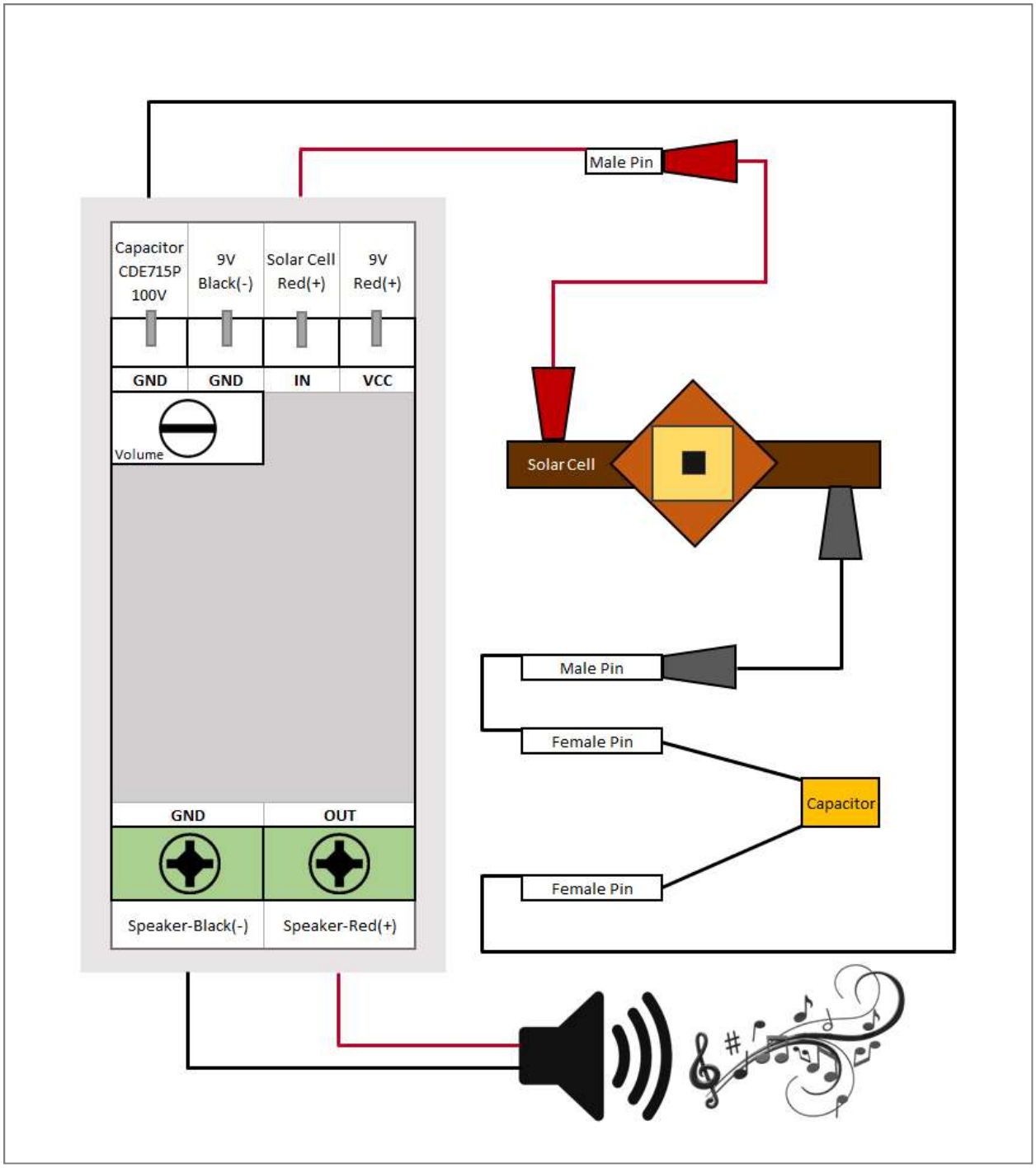


Fig. 4 – Amplifier 2 circuit.

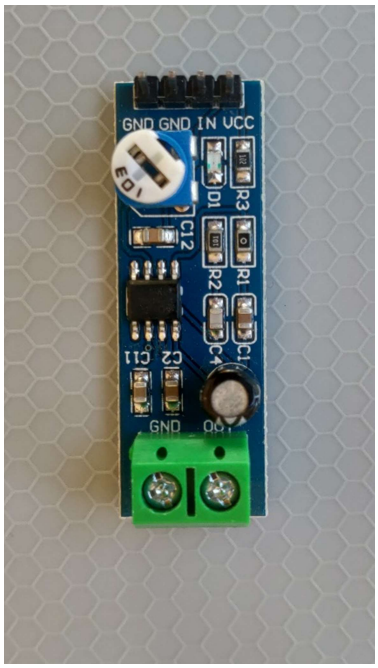


Fig. 5 – Picture of amplifier with the correct position for volume dial

9. While setting up the amplifiers, **turn the white volume dial on each amplifier to form a backward slash shape (\)** as shown in **Fig. 5.** This will ensure any sound produced is magnified accordingly.
10. Connect the positive wire (red) and the negative wire (black) of the battery snap to the corresponding positions of amplifier 1 in **Fig. 3.**
11. Connect the positive wire (red) and the negative wire (black) of the battery snap to the corresponding positions of amplifier 2 in **Fig. 4.**
12. Using male-to-male jumper wires, connect the **GND** and **OUT** junctions of **amplifier 1 in Fig. 3** to the corresponding positions on the breadboard as shown in **Fig. 2.**
13. Check the circuits to make sure that all the necessary parts are connected properly. You may want an instructor to check your circuits.

Finale:

- Connect the AA batteries to the battery pack.
- Connect the two 9V batteries to the two battery snaps, respectively.

- Now connect one end (male) of the audio jack to the female audio port and the other end (male) of the audio jack to a phone, tablet or a laptop and play an audio file.
- Tilt the solar cell on its side as per your comfort and aim the laser at it.
- You should be able to hear the music through the speaker in your circuit.
- If there is no sound, check the amplifiers again to ensure neither is burned out.
- Also check to ensure that the laser rays are not dim. If this is the case, change lasers.

If everything works fine, CONGRATULATIONS, you have successfully converted sound and light waves!