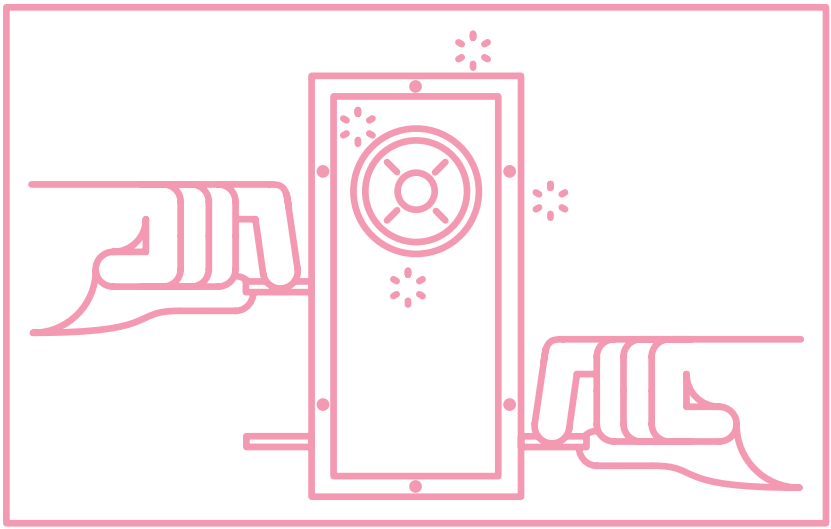
DIY Synth Kit - Manual

Welcome to the DIY Synth - Manual

TECHNOLOGY WILL SAVE US.

This is a step-by-step guide to making your own electronic Synth.
All you will need is your hands and your DIY Synth kit which includes everything you'll need to put it together.

We hope you enjoy this creative task, learn some new technological skills and apply them to your life in useful ways.



Getting Started

Top Tips

Keep an eye out for the top tips. They are highlighted in a orange box like this!

Making Time
The kit takes about a fun filled hour to complete, depending on how creative you get with the construction of your Synth box.

Useful Appendix
Further information on all the components in this kit can be found in the Appendix at the back of the manual. Learn about their use within the circuit you are building.

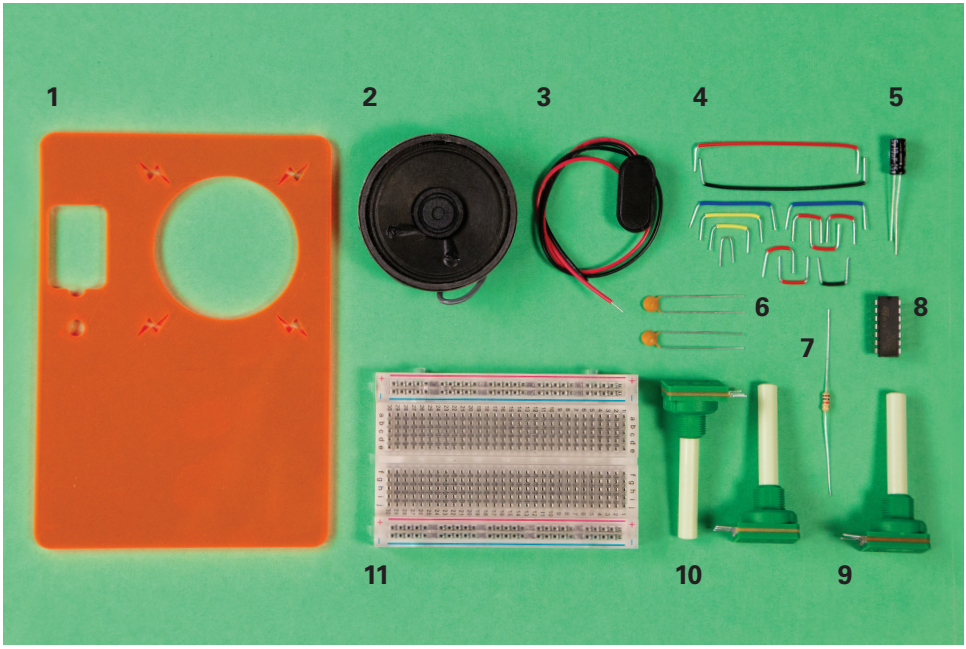
Further Resources
Information on how the circuit works alongside different ways to extend your Synth can be found on our resource page: **twsu.co**

Making your DIY Synth

Parts:

1) 1x Plastic Casing
2) 1x 8 Ohm Speaker
3) 1x 9v Battery Clip
4) Selection of Jumper Wires (Colour coded and cut to size)
5) 1x 10uf Electrolytic Capacitor (Cylindrical and Black)
6) 2x 10nf Ceramic Capacitor
7) 1x 1k Ohm Resistor
8) 1x NE556 Timer IC (Integrated Circuit)
9) 1x 2.2K Logarithmic Potentiometer (Volume Control)(Previously 4.7K)
10) 2x 470K Linear Potentiometer (Frequency and Pitch Control)
11) 1x Breadboard

Check your components to make sure you have all the parts to build your DIY Synth!

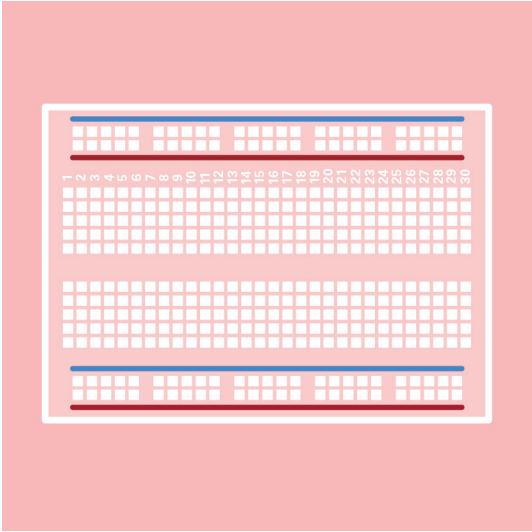


Top Tip
Some components may look slightly different to the ones above, don't be alarmed, this is normal!

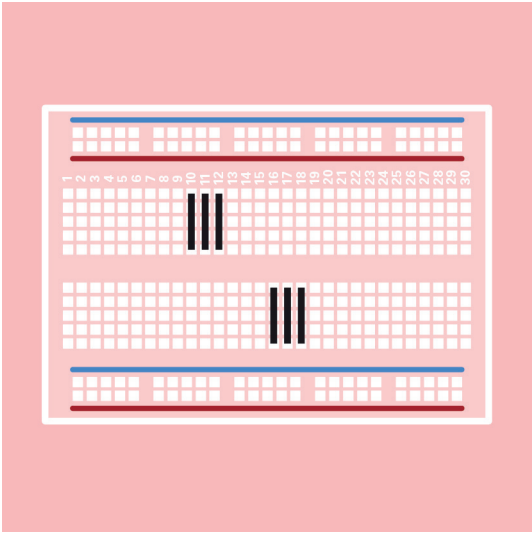
1

The Breadboard

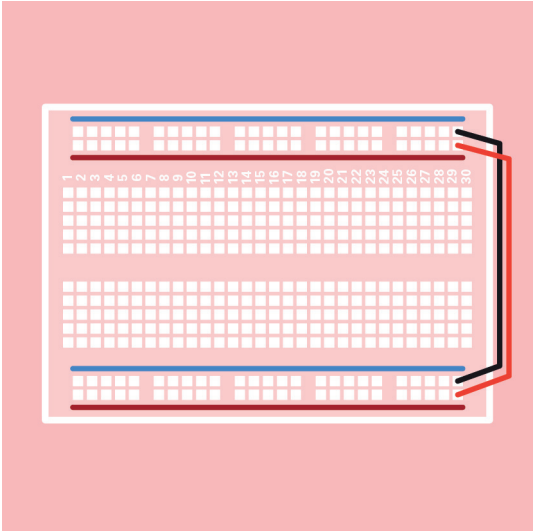
Take a look at the breadboard. The horizontal rows at the top and bottom of this image (marked in red and blue) are used as “power rails”. They provide a convenient way to supply components with electricity. The power rails are connected all the way along the edges of the breadboard.



However the inside rails on the breadboard run perpendicular to those on the outside. These are marked in black.



Connect the power and ground rails on each side of the breadboard together using two jumper wires, its a good idea to use red wire for the positive voltage supply and black for the ground. Top red rail connects to the bottom red rail and the top black rail to the bottom black.



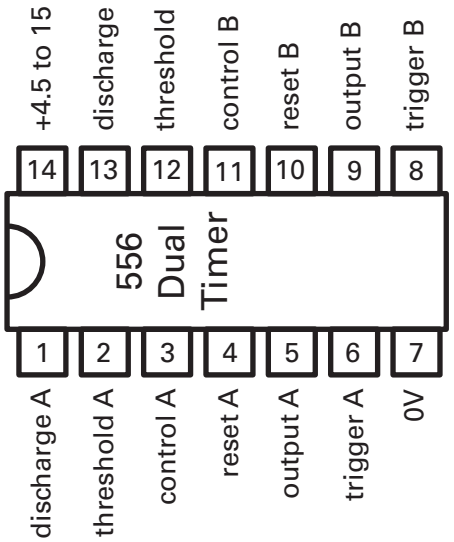
Top Tip

For this kit we have colour coded the wires for you. But as a general rule, red wires are positive and black are negative. Sticking to this will help you when building your own creations.

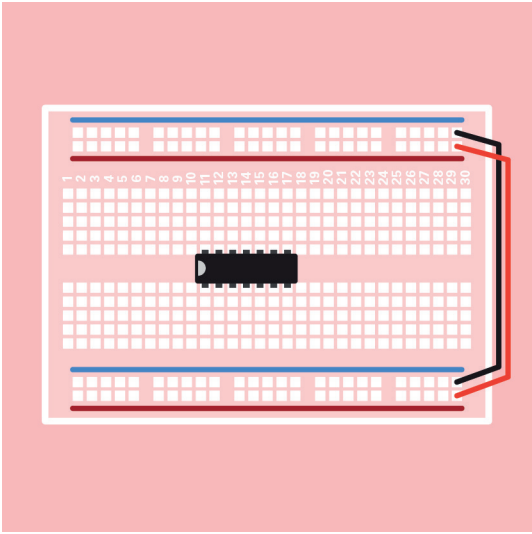
2

556 Timer IC (Integrated Circuit)

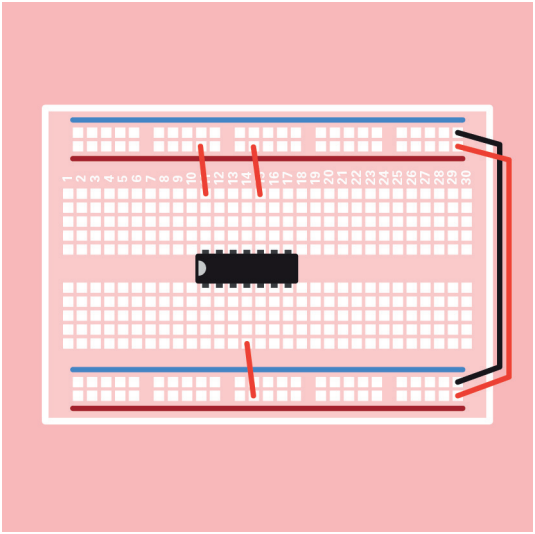
Find the 556 timer IC. The IC has 14 pins, starting at the end of the chip with the notch in it the left pin is (1) and finishing on the other side of the notch at pin (14)



Place the IC over the gutter of the breadboard with the notch facing towards number 1. Placing the IC near the centre gives you room to space out the other components around the board.



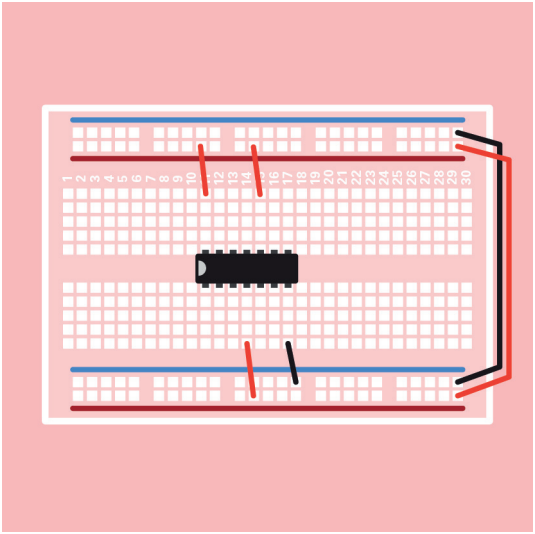
Now connect the IC to the power rails using the following wires. Use the small red wires to connect Pins 4, 10 and 14 of the IC to the positive red rail.



Top Tip

Refer back to step 2.0 for the numbering of the IC Chip pins.

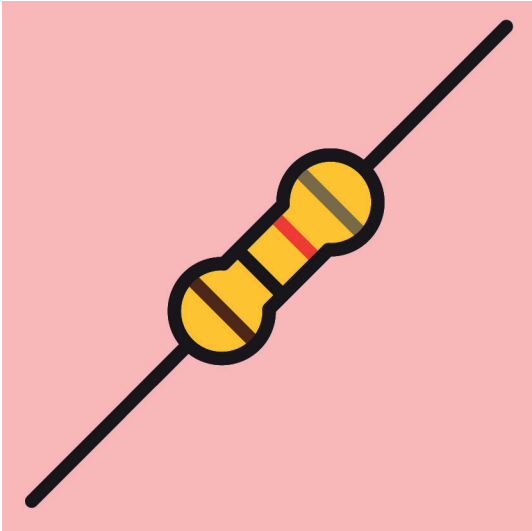
Use the small black wire to connect Pin 7 of the IC to the blue ground rail.



3

The Resistor

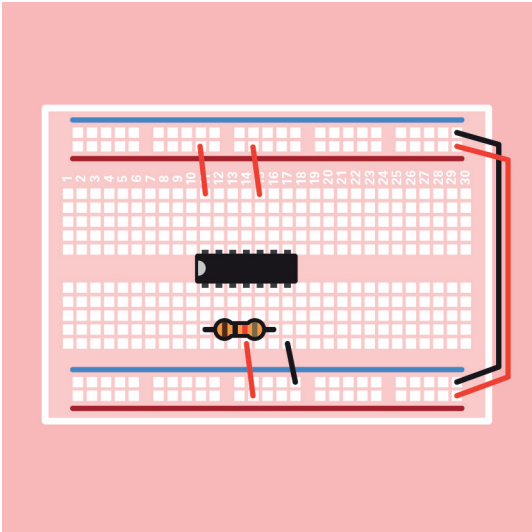
Take your 1K resistor.



Top Tip

Resistors can be plugged in any way around. Their legs are the same length - which is a way to tell that it can be plugged in both ways. Also, if you look at the body of the resistor, you'll see that there are different coloured stripes. These stripes tell us what value the resistor is. Brown, Black, Red = 1K Ohm.

Now add the 1K resistor across pins 1 and 6 of the IC.

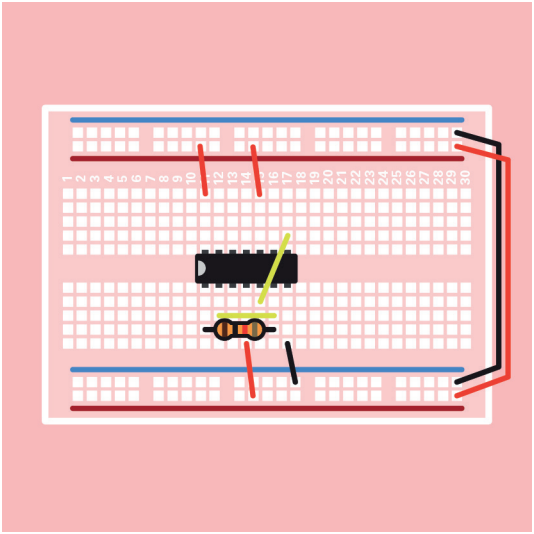


4

Connecting the Pins

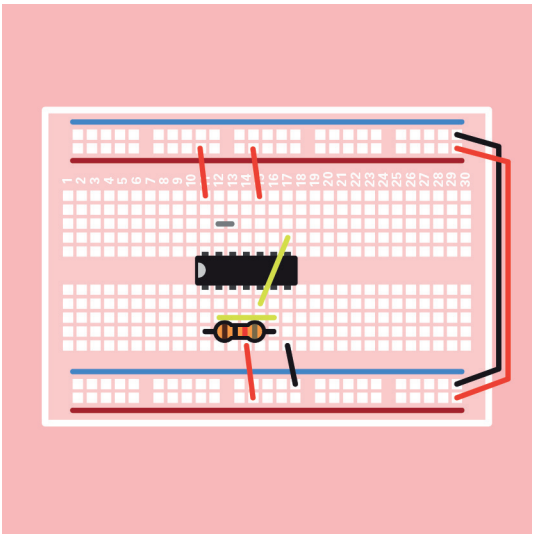
Use the 2 yellow jumper wires to connect the following IC pins together:

Pin 2 to 6
Pin 5 to 8



Use the small silver wire to connect the following IC pins together:

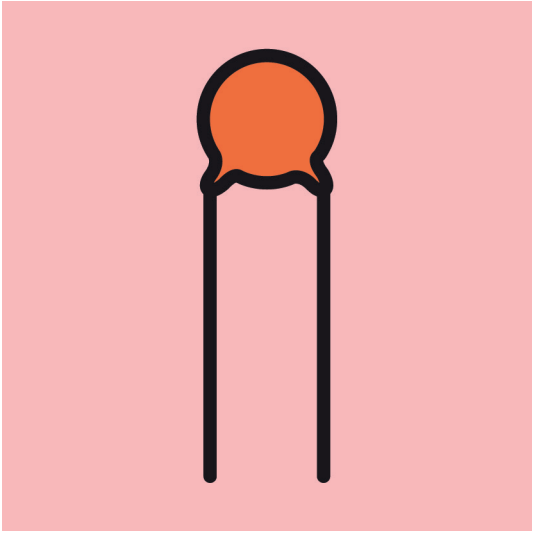
Pin 12 to 13



5

Capacitors

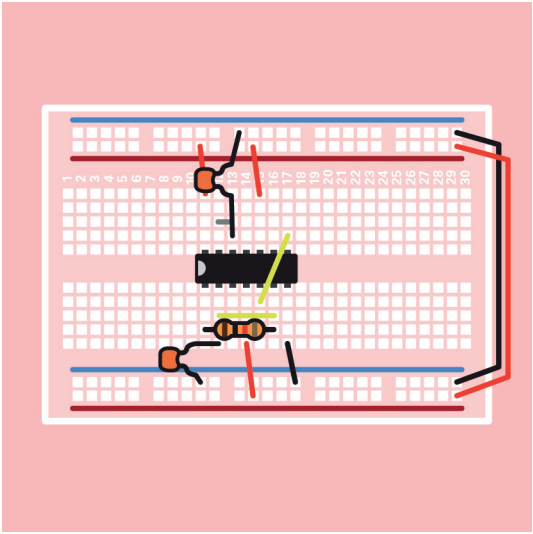
Take your two ceramic capacitors.



Top Tip

There are two types of capacitors. Those that do care which way they are plugged in, and those that don't. The easy way to tell them apart is to check to see if their legs are the same length. If they are, then just like the resistor, they can be plugged in any way around. If not: Then the long leg always must be plugged into the voltage (+) and the short leg must be plugged into the ground (-). This kind of capacitor is called electrolytic or polarized.

Attach the two ceramic capacitors as follows:



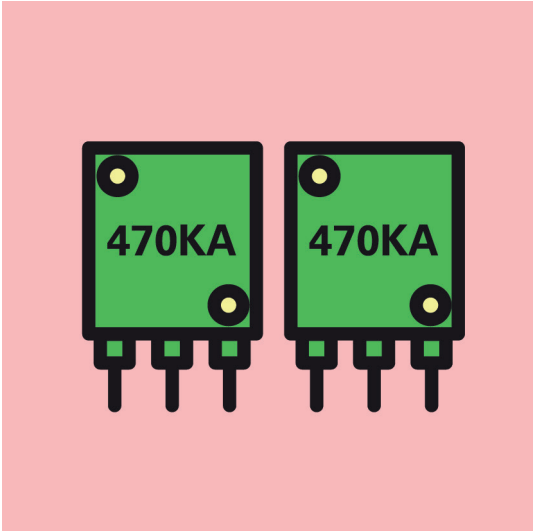
The first from the bottom ground rail (blue) to pin 2 of the IC.

The second from the top ground rail (also blue) to pin 12 of the IC.

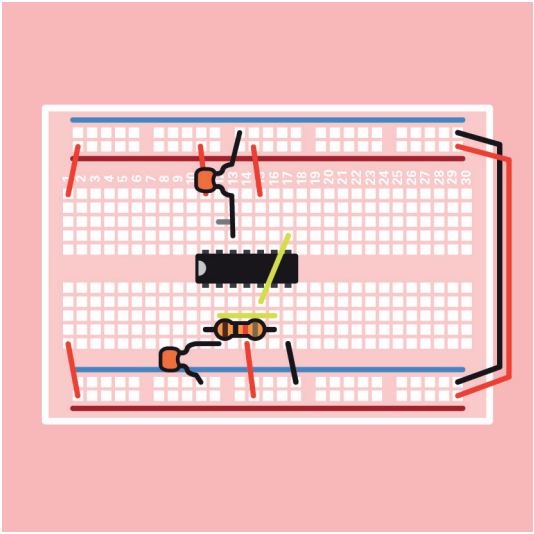
6

Frequency Potentiometers (470K)

Take a look at your potentiometers. A potentiometer is a variable resistor. As you rotate the knob or shaft, the resulting resistance changes. These are often used to control volume - increase the resistance, decreases the volume! The change in resistance takes place at what is called the “wiper” pin. Typically, the wiper pin is the middle pin on the potentiometer.



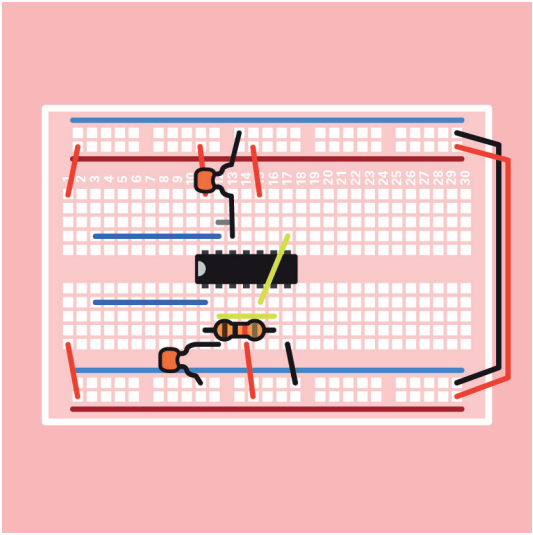
Add the two red wires on the far left hand side of the breadboard. These will be connected from the positive voltage rail (red) to the left pins of the two 470K potentiometers in the next step.



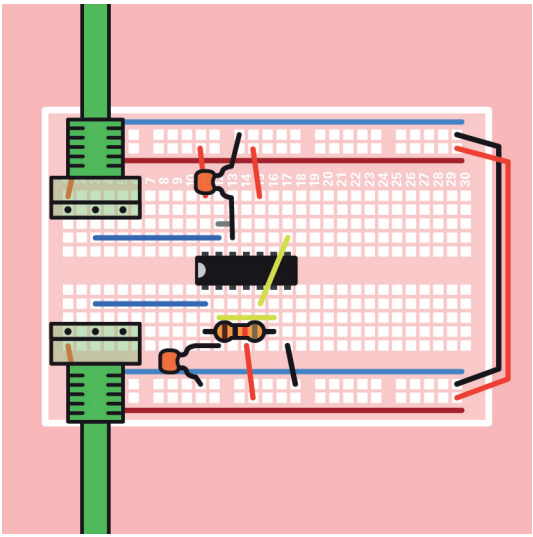
Add your two blue wires, these will be used to connect the middle ‘wiper’ pins of the potentiometer to the IC.

Connect the first blue wire from row 3 of the breadboard to pin 13 of the IC.

Connect the second blue wire from row 3 of the breadboard to pin 1 of the IC.



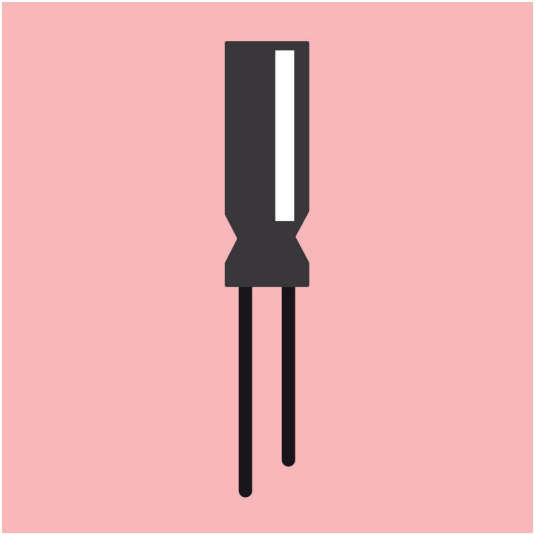
Add the two 470K potentiometers. (Their resistance is marked on the back of the casing.) Make sure that the red wires from the previous step connect to their left pin and the blue wires to their middle ‘wiper’ pins.



7

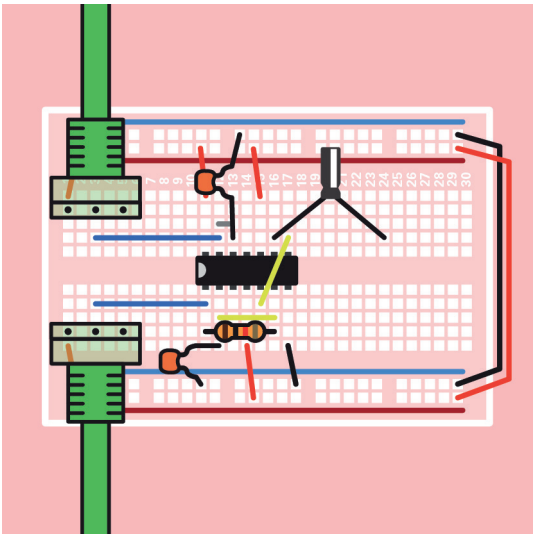
Electrolytic Capacitor

Take your Electrolytic Capacitor shown in the image to the right. The white strip down one side indicates the negative leg of the component. This is also indicated by the length of the component legs. The shorter one is negative and the longer is positive.



Connect the long leg (the one that wants voltage) to pin 9 on the IC.

The shorter leg should be placed a few holes along from the right hand side of the IC. In order to give space for the final potentiometer to be attached.



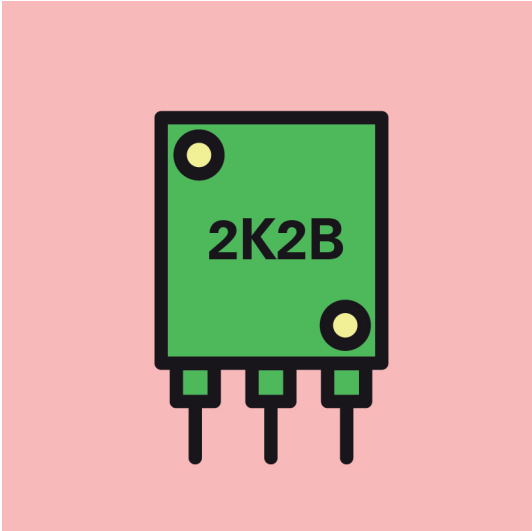
Top Tip

This capacitor has two different length legs. That means its polarized, and has to be connected in a specific way!

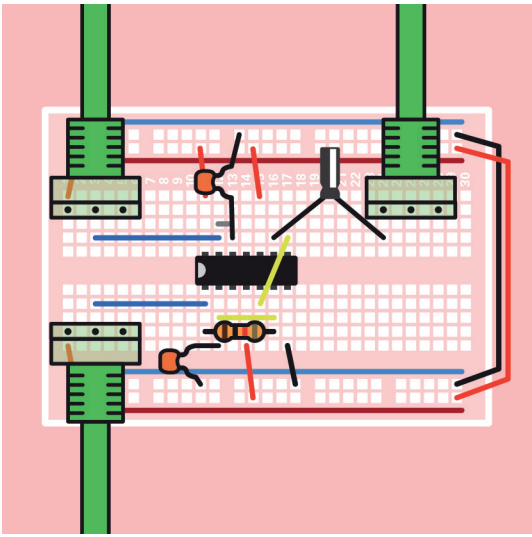
8

2.2K Potentiometer (Volume Control)

Take your 2.2K (Previously 4.7K) Potentiometer. You can tell it is the correct one of the three by the resistance which is marked on the back of its casing.



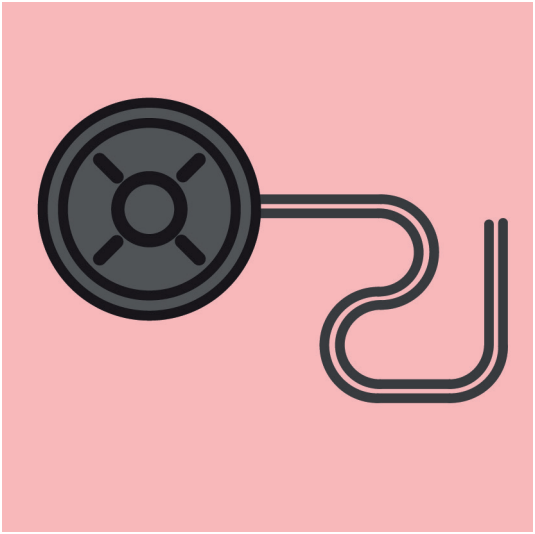
Connect the final potentiometer (2.2K). This will be the volume control! Align it with the shaft pointing away from the chip. The left leg should be in line (vertically) with the short leg of the capacitor from the previous step.



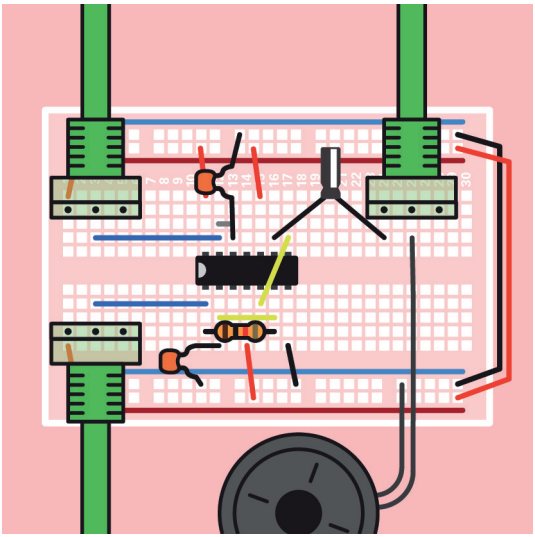
9

Speaker

Take your Speaker which is pictured on the right.



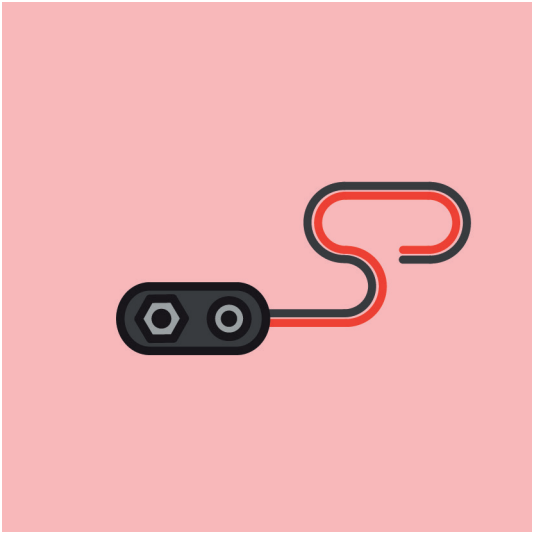
One wire of the speaker wires goes to the ground rail, the other to the wiper (middle leg) of the volume (2.2K) potentiometer.



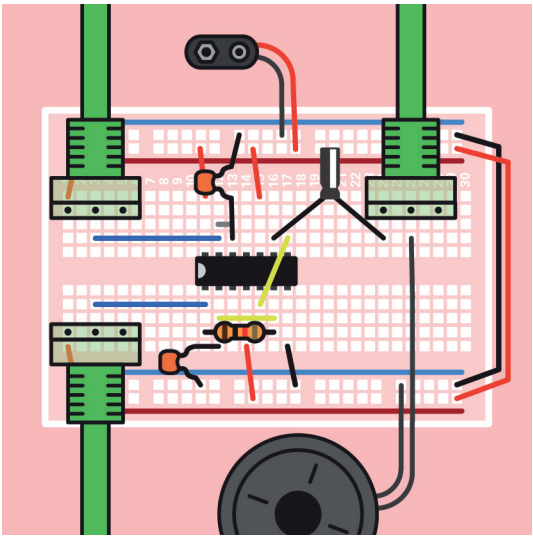
10

Battery Clip

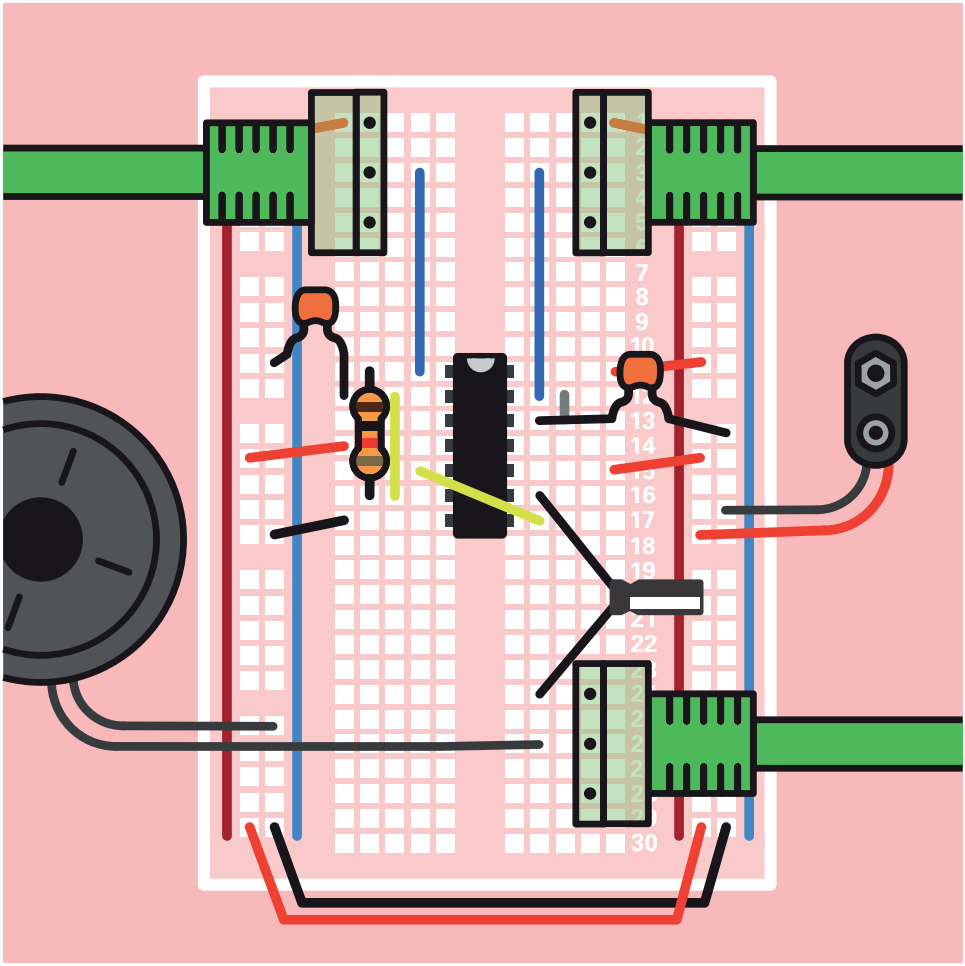
Take your Battery Clip which is pictured on the right. Noticing that it has a black and a red wire connected to it.



Connect the black wire of the battery clip to the ground rail and red wire to the positive rail. Add your battery and your done! Now your ready to create some musical madness!



Circuit Check

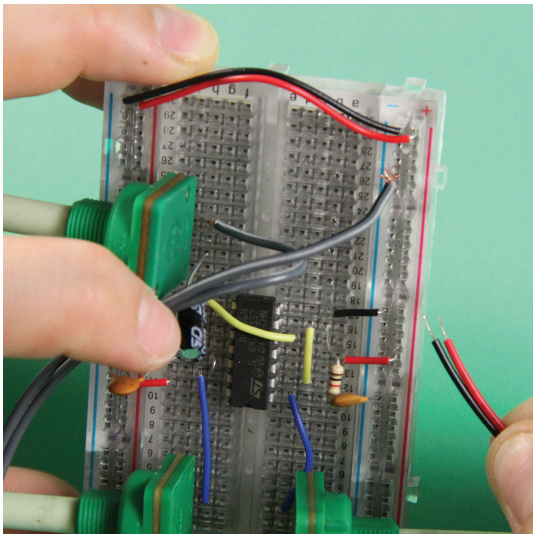


11

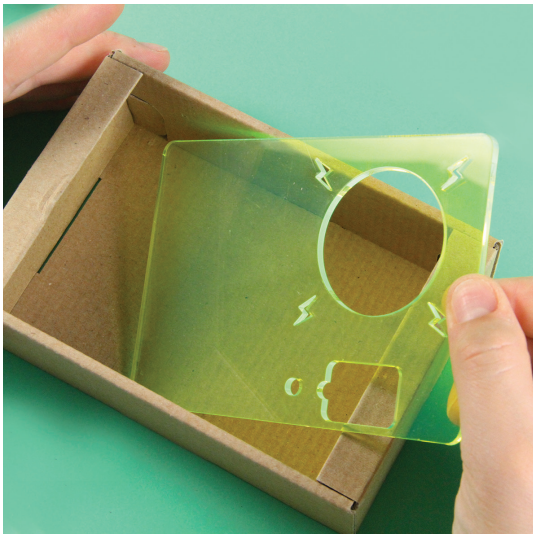
Synth Casing (Optional)

You can use the included plastic casing and your DIY Synth box to create a housing for your synth.

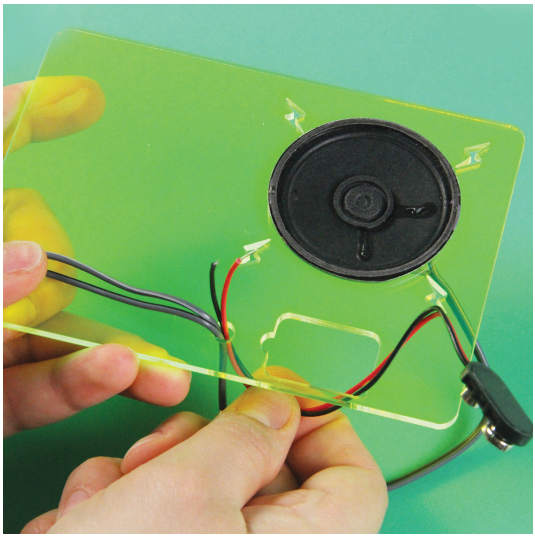
First remove your speaker wires and battery clip wires from your breadboard.



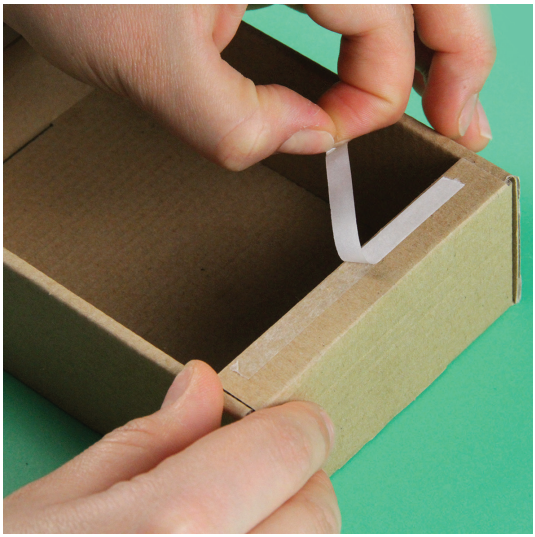
Remove your plastic casing from your box.



Place the speaker and batter clip on the top of the plastic casing. Then thread the speaker and battery clip wires up through the small hole in the plastic.



Put the plastic to one side and stick the two pieces of double sided tape on each end of the cardboard tray. Once stuck remove the second piece of film from the tape.

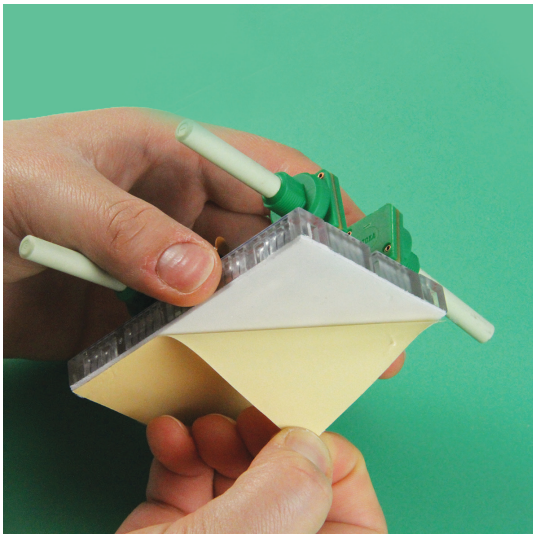


11

Synth Casing (Optional)

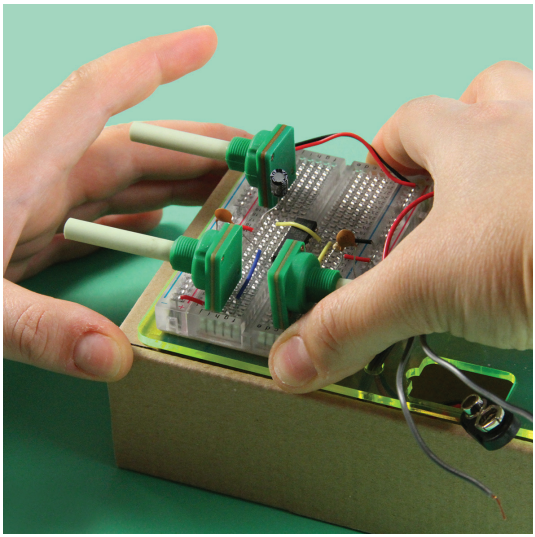
Place your plastic casing on to your double sided tape and press to make sure it is secure.

Take your breadboard and remove the film backing.

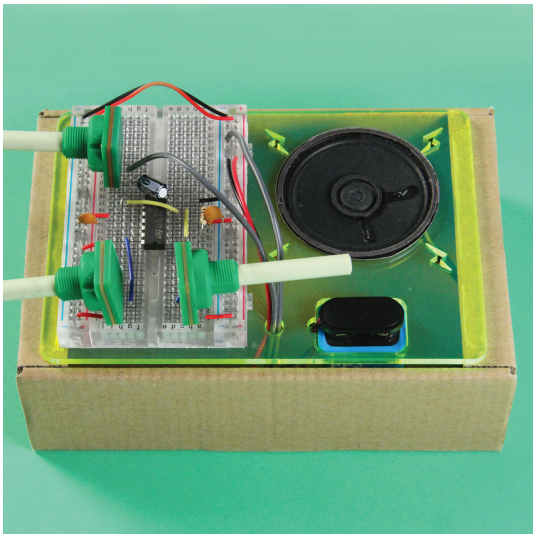


Place your synth on to your plastic casing in the space provided and press down so that it is stuck securely.

Then reattach your speaker and battery clip wires to your breadboard. If you need help remembering where the wires go into the breadboard refer to step 9 and 10.



Connect your battery clip to your 9v battery and place it into the slot in the acrylic casing.

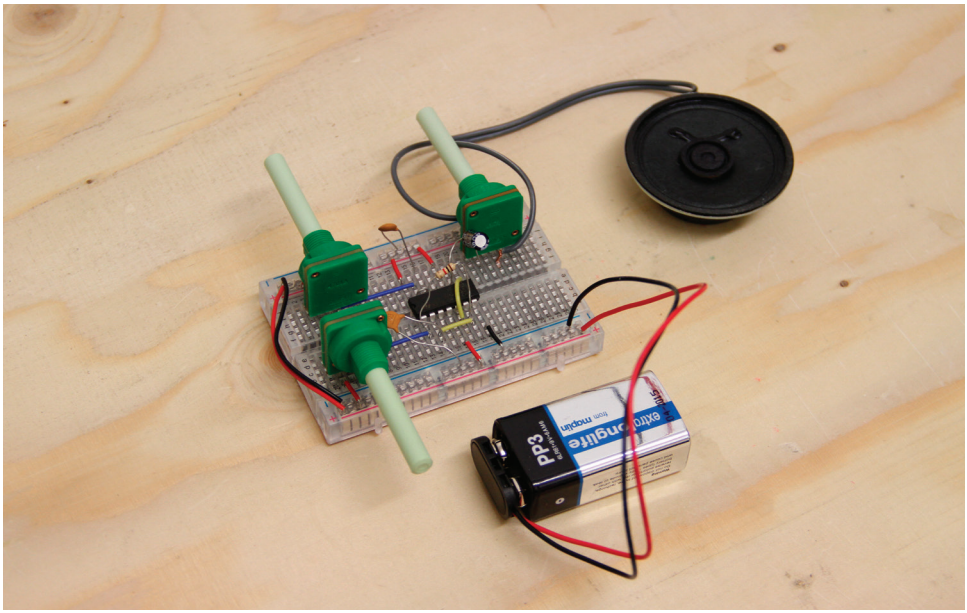


Congratulations!

You have finished making your DIY Synth Kit. Now make it your own! Create and customize the casing of your kit using whatever you want. You could use a cardboard box, that old tin that's sat on your windowsill or design your own personal housing for your synth. Then customise with stickers, Sharpies or paint. When you are happy with your creation all that is left to do is create sweet sweet music.

For those of you who want to test your skills and learn more check out: **twsu.co**

You will find many more creations and hacks to expand your technological orchestra.



Customising your Synth

By this stage you'll have a fully functioning Synth but we thoroughly recommend you keep the creativity flowing by creating some sort of housing for it. This will not only make it your own but also help protect the circuit and MAKE IT LOUDER if done well.

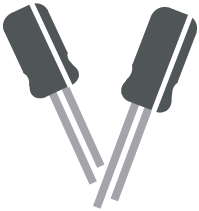
The example below is made from laser cut acrylic. But you could make it out of almost anything...

Whatever you make your casing out of, a few things to keep in mind are;

You need to be able to get at the battery to change it.
The speaker works best on a hard surface and you'll have to drill a hole through this to mount it.
The casing needs to have a few holes for your controls (potentiometers) so you can actually play it!

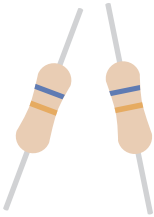
Aside from that, go wild! We want to see some crazy creations! Share them with us on our websites community page at: **twsu.co/community**

Component Appendix



Electrolytic Capacitor -

Electrolytic Capacitors are used for storing big charges. These are polarized, with the longer leg being positive and the shorter white striped side being negative.

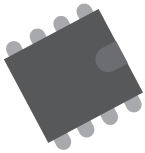


Resistors -

Resistors are used in a circuit to restrict the flow of electrical current and stop things from blowing up! The resistors in measured in Ohms.

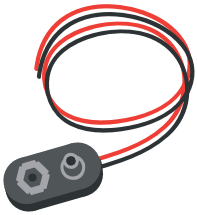
Speaker -

This is a loud speaker, this is where the signals are turned into audio through the movement of the surface.



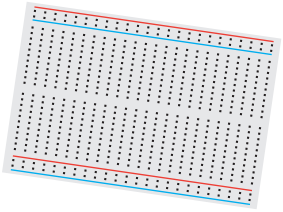
Integrated Circuit (IC) -

An Integrated Circuit also know as an IC is a whole circuit itself but very very small and made of Silicon. The chip in this circuit is a 556 timer chip one of the most commonly used chips in the world made up of 25 transistors, 2 diodes and 15 resistors.



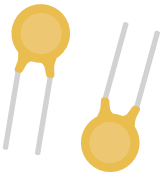
Battery Clip -

The battery clip allows a 9 volt battery to power the circuit. The battery can only connect in one direction with the red wire being positive and the black wire negative.



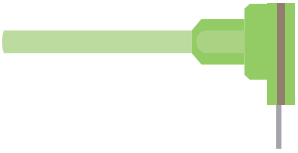
Breadboard -

No soldering required! A breadboard allows you to build circuits without having to solder due to its rows and columns each with contacts that allow current to flow through a regimented grid. This makes it perfect for playing and prototyping your projects.



Capacitors -

A capacitor is like a big bucket, it stores up charge, waits until its full and then releases it all in one go. How much charge depends on the size of the capacitor, measured in farads.



Potentiometer -

A potentiometer is a resistor that you can control! Turning the knob on the potentiometer increases and decreases the amount of resistance bit like a tap and the flow of water.

Thank You!

Technology Will Save Us exists to educate and inspire people to make, tinker and experiment creatively with technology as a way of unleashing new possibilities.

Devices, gadgets and computers are all a part of our everyday life and yet most people know so little about what these things are made of, let alone how to fix them or create new uses for them. We believe that the opportunity for technology to play a richer, more creative role in our lives has yet to be explored.

Contact

Interested in more classes? Have an idea for a workshop we should teach? Do you want to teach a class yourself? We'd love to hear from you. Contact us by email or find out more on our website.

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