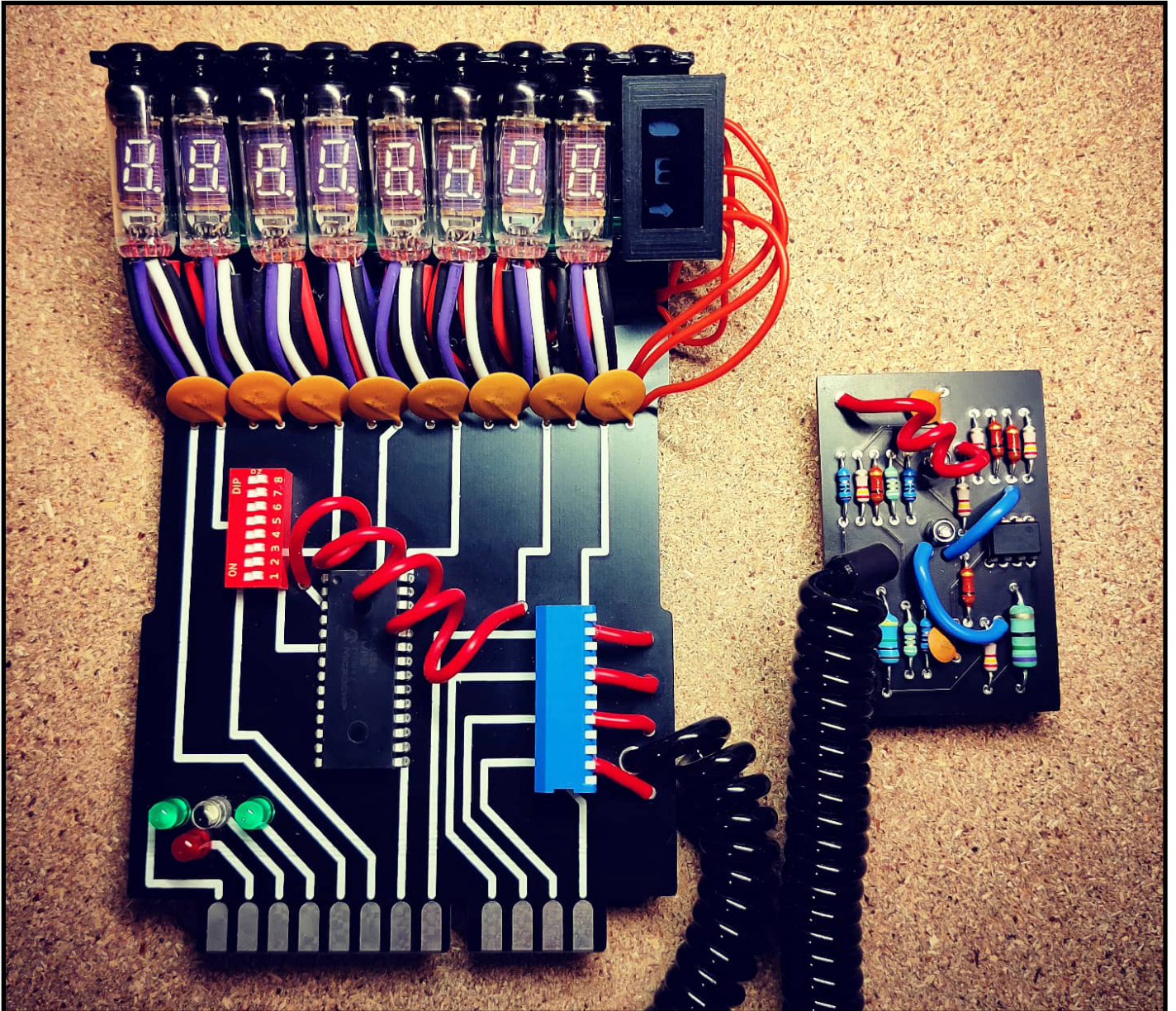


ECTØLABS

GIZMO 8910



Kit Assembly Guide & Operating Instructions

v1.2 – For kits purchased from July 2022

The **ECTOLABS GIZMO 8910** kit is an idealised rendition of the screen-used belt gizmos from Ghostbusters II in 1989.

If you have ordered a 'Standard' kit, you will need to use a soldering iron to assemble both the working electronics (that control the lighting effects) and the cosmetic components. If you have ordered a 'Non-Solder' kit, all working electronics and right-angle gold pins will have been assembled for you. You can then either solder or hot-glue the remaining components to the boards depending on you preference.

This manual is a step-by-step guide on how to assemble and operate your kit. It is fully illustrated with high-resolution photographs which are able to be zoomed in on to see highlighted details more clearly. We recommend reading through this guide before beginning your build so there are no surprises. Enjoy!

TOOLS NEEDED

- **Soldering Iron** (Not required if opting to hot glue components to the gizmo boards)
- **Hot-Melt Glue Gun** (*Only required if NOT using a soldering iron. Gun with precision nozzle recommended*)
- **Super Glue** (*Liquid type with precision nozzle recommended*)
- **Pliers** (*Narrow or needle-nose*)
- **Wire Cutters**
- **Wire Strippers** or **Craft/X-Acto Knife**
- **Small Phillips screwdriver** (*Suitable for M2.5 & M4 screws*)
- **Heat Source** (*Heat gun or lighter*)
- **1x 9V Battery**

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OPERATING INSTRUCTIONS

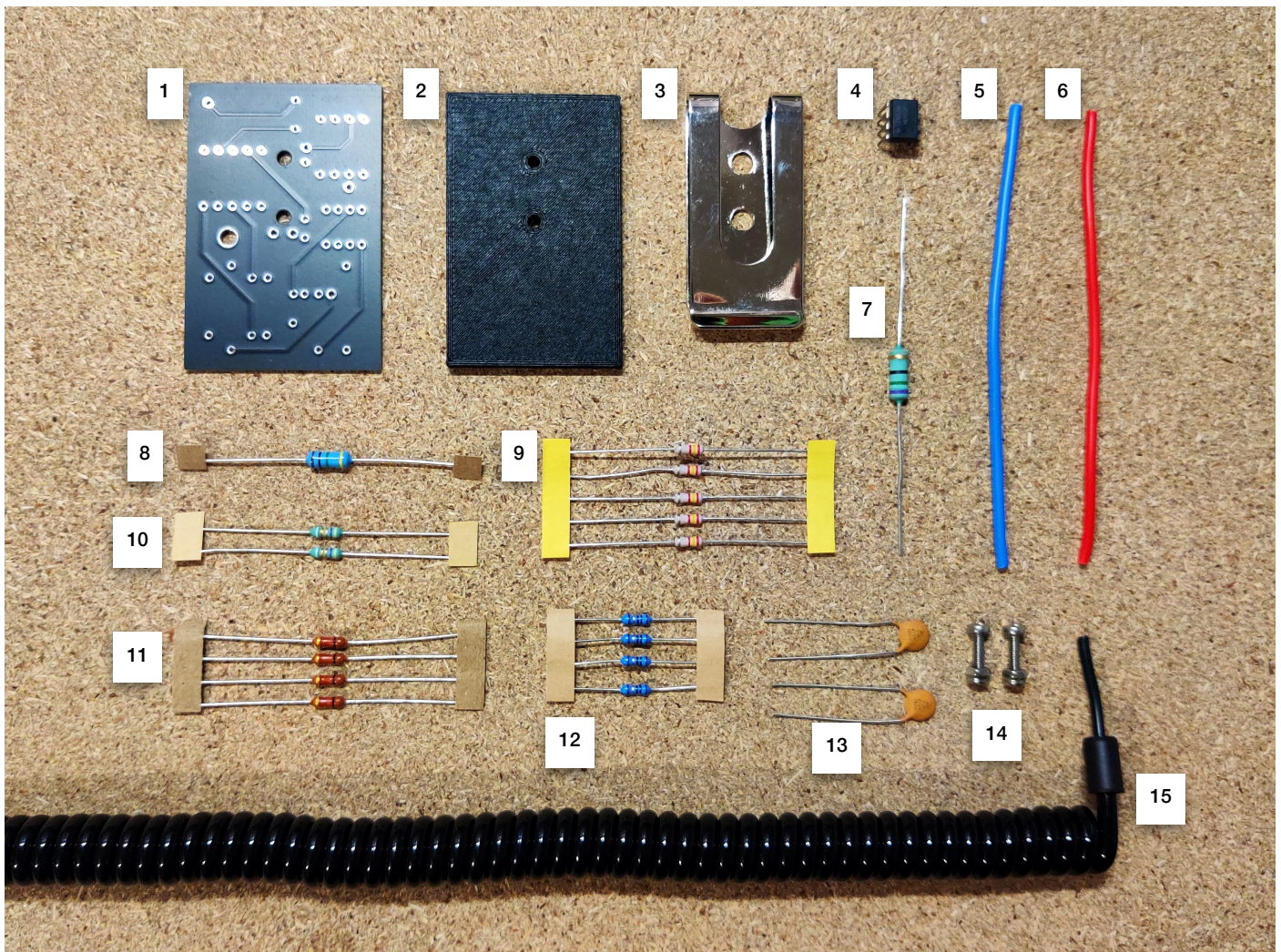
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DAUGHTERBOARD ASSEMBLY

Let's start the build with the easier of the two boards to put together. We'll go through the method of how to securely attach the real electronics components to the board – this can then be used later to attach most of the other components to the motherboard as well.

PARTS REQUIRED

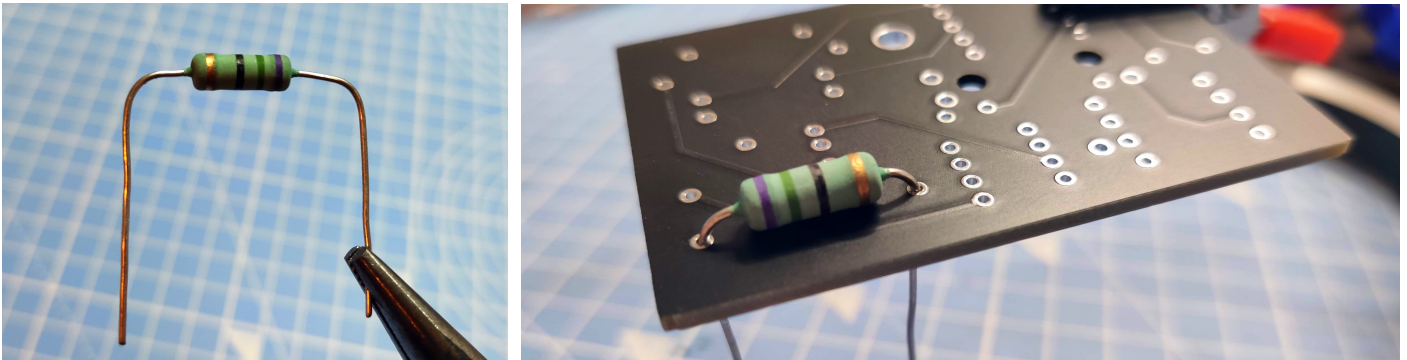
All the parts needed for the daughterboard assembly are shown in the photo below. Using the following list, double-check you have all of the parts from the bags in your kit and set them out on your workbench:



- | | |
|----------------------------------|-----------------------------------|
| ① 1x Daughterboard PCB | ⑨ 5x Small WHITE resistors |
| ② 1x Back panel | ⑩ 2x Small GREEN resistors |
| ③ 1x Belt clip | ⑪ 4x Small RED resistors |
| ④ 1x Timer chip | ⑫ 4x Small BLUE resistors |
| ⑤ 1x 100mm BLUE amp wire | ⑬ 2x Small disc capacitors |
| ⑥ 1x 100mm RED amp wire | ⑭ 2x M2.5 lock nuts and bolts |
| ⑦ 1x Large GREEN resistor | ⑮ 1x Coiled cable |
| ⑧ 1x Large BLUE resistor | |

1. ATTACH THE RESISTORS

The resistors are the variety of cylindrical components fixed in the centre of short lengths of silver wire. Each one has a colour band around the outside but, for the purpose of this build, we will refer to each one by its main body colour. Your kit contains various resistors in specific quantities (all in different colours) so make sure you select the right ones for the section you are working on.

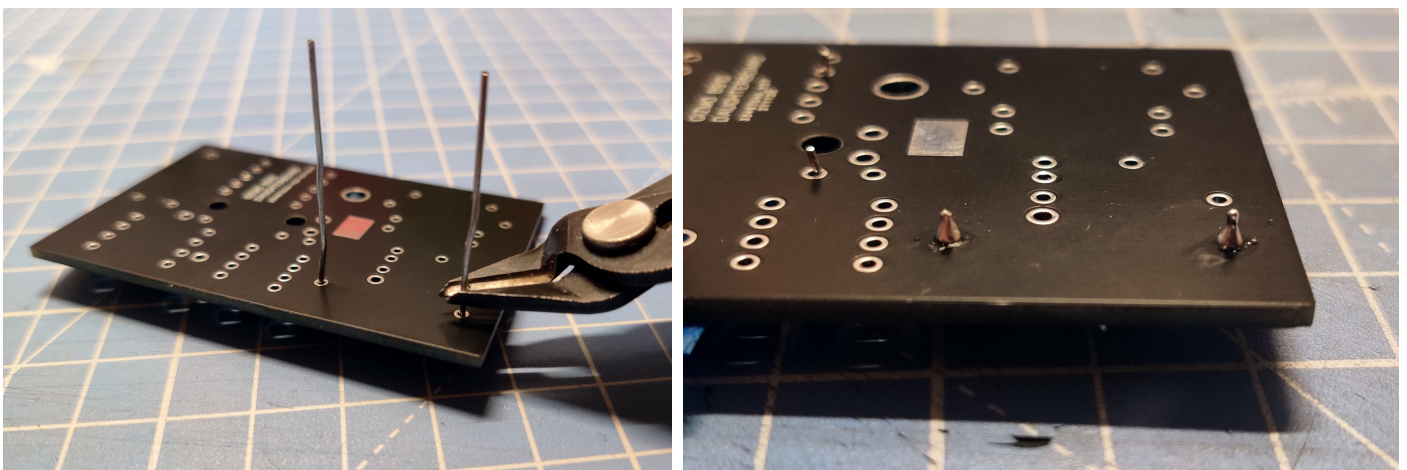


- Firstly, grab the daughterboard along with the largest **GREEN** resistor
- Using pliers or your fingers, gently bend both ends of the resistor wire to a 90 degree angle.
- Thread both ends of the resistor through the two holes in the daughterboard as shown in the photo above. Be sure to double-check the orientation of the daughterboard - **the side with white printed text is the back/bottom**.



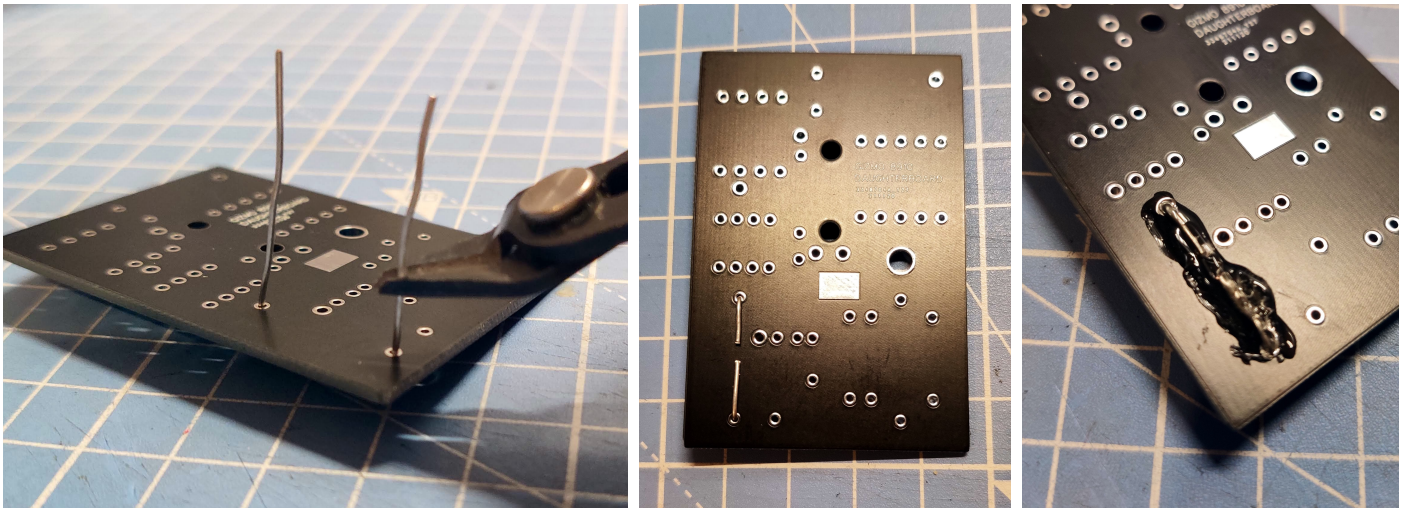
The orientation of the resistor does not matter as these can be placed in either direction on a real circuit board. However, for the sake of aesthetics, it's nice to keep them all consistent so let's position the gold band at the TOP of each resistor.

IF YOU ARE USING A SOLDERING IRON:



- With your wire cutters, cut down each end of the wire leaving about 2-3mm.
- Use your soldering iron to apply solder around the ends of the wires. Make sure the solder flows all the way around the wire and over the surface of the pad to create good bond with the board. As these components are only cosmetic and do not require any electronic connection, the quality of your soldering is not important - just make sure these components are good and secure!
- If needed, cut away any sharp points with the wire cutter.

IF YOU ARE USING A GLUE GUN:



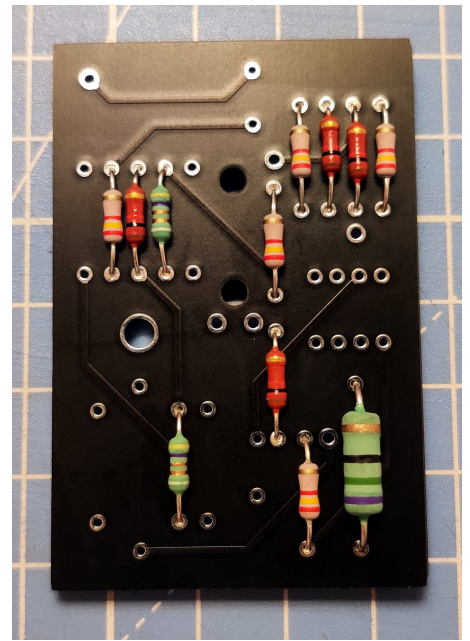
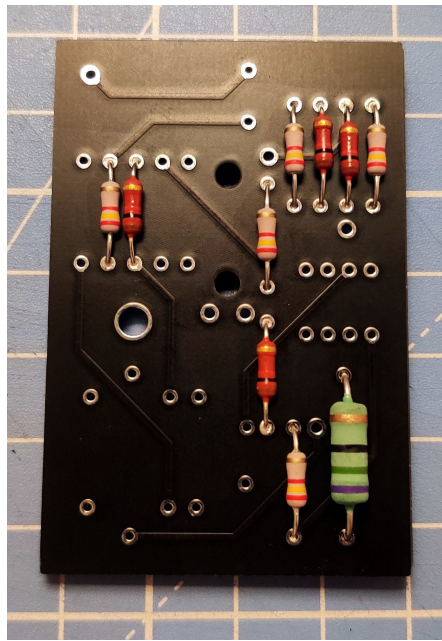
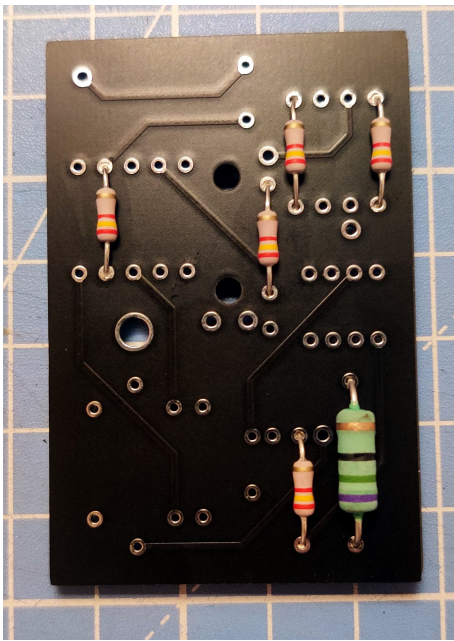
- With your wire cutters, cut down each end of the wire leaving enough to be able to folded over against the back of the daughterboard like a staple.
- Bend the shortened wires over until they sit flat on the back of the board as shown in the second photo above.
- Plug in your glue gun and wait until it has reached maximum temperature. This will help the hot melt glue flow better and create less mess.
- Apply hot glue to the folded wire, making sure you cover the holes and the ends of the wire. Be sure to avoid getting glue too close to any unused holes or to the edge of the board as this may make attaching the back panel difficult later.



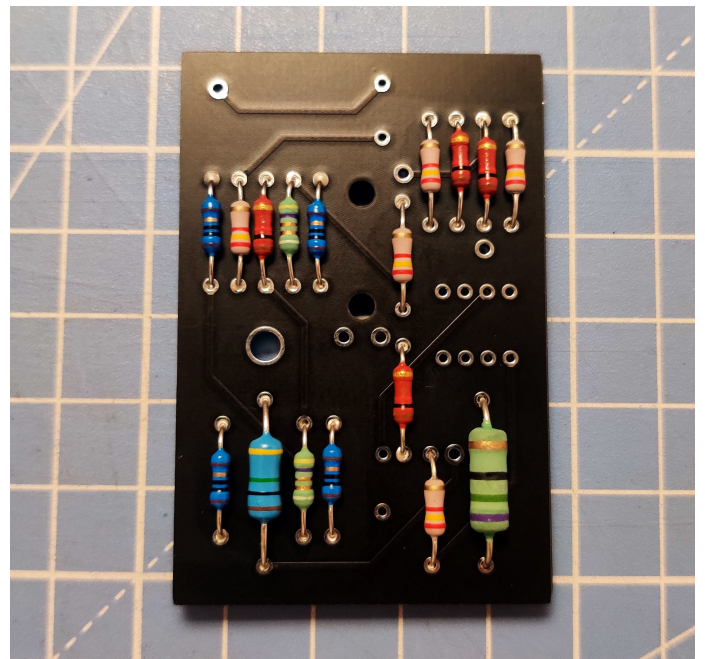
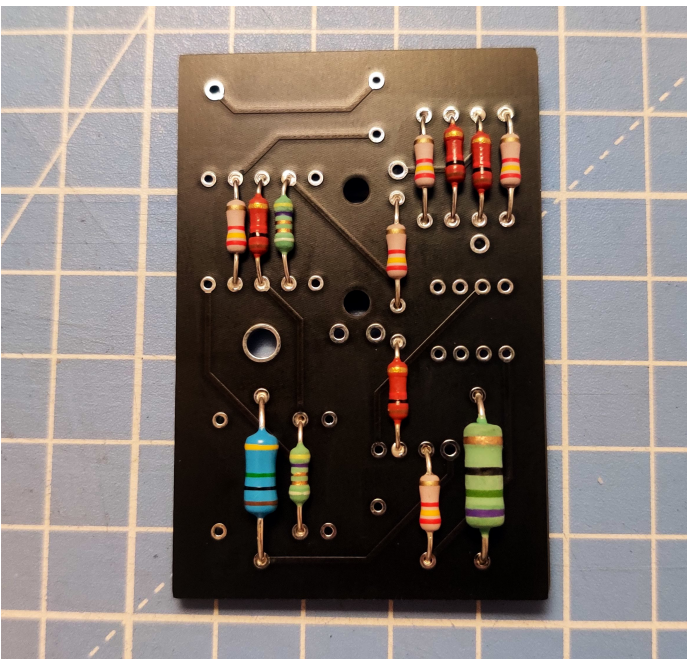
It's easiest to hold the resistors in place with one hand, while you glue with the other. However, be aware that the heat from the glue gun will transfer easily through the resistor itself and may cause it to become very hot, so be careful when handling.



Be very careful when cutting the wires, as the sharp ends can easily fly off in any direction. We recommend using safety goggles to protect your eyes when cutting.

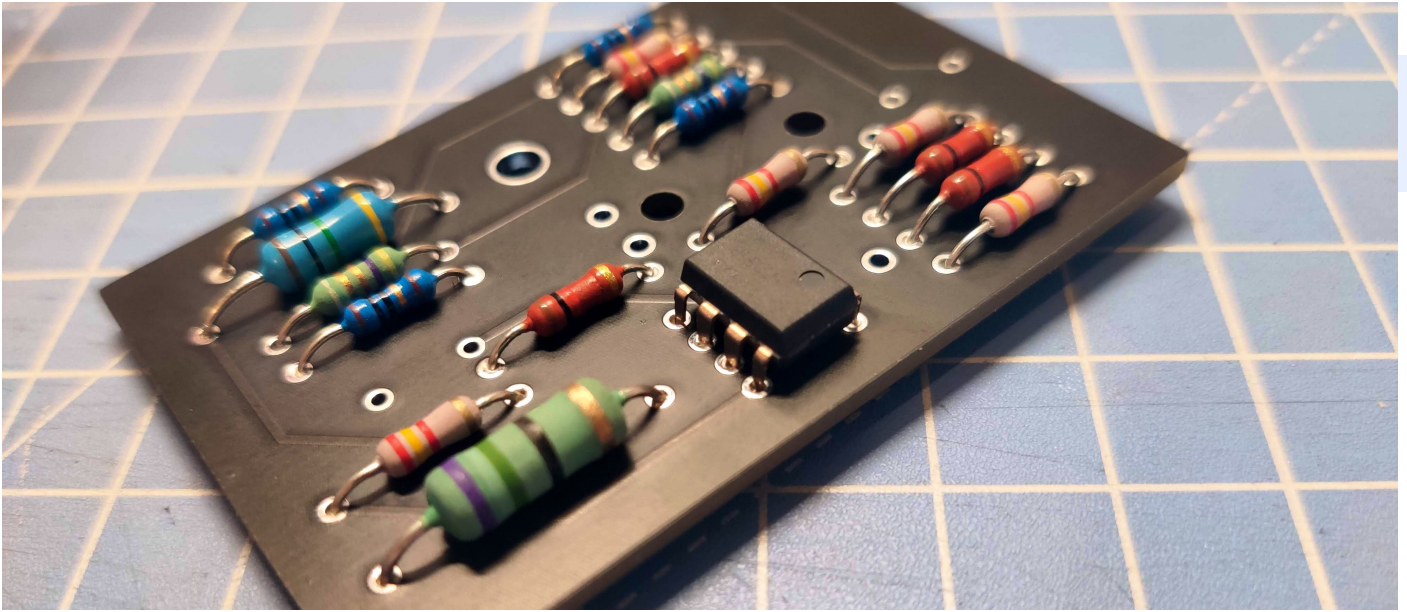


- Use your chosen technique to attach the five small **WHITE** resistors as shown in the first photo above. Be sure to zoom in for a clearer view of the holes in the board you need to use.
- Next add the four small **RED** resistors as shown in the second photo above.



- Now for the two small **GREEN** resistors as shown in the third photo.
- Next add the large **BLUE** resistor shown above in the first photo.
- Finally, attach the four small **BLUE** resistors as shown in the second photo.

2. ATTACH THE TIMER CHIP



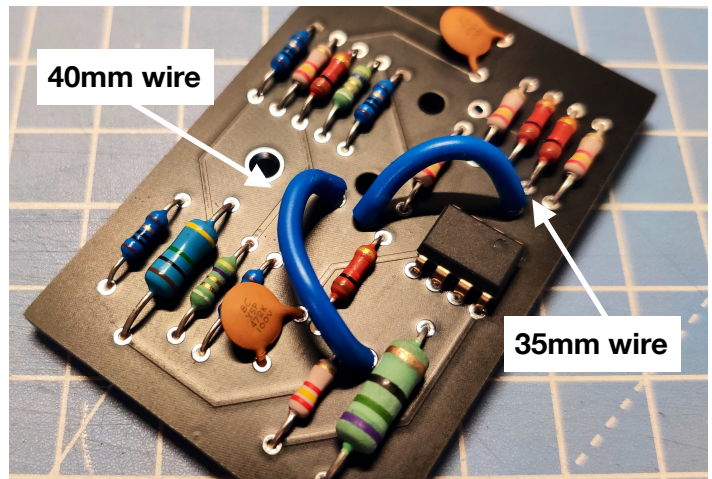
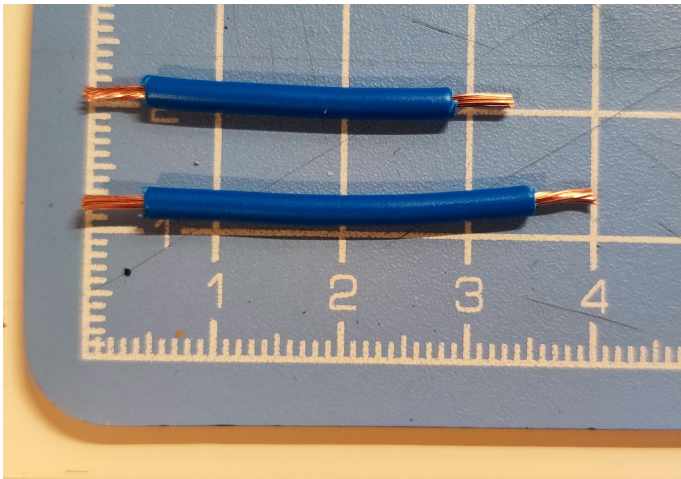
- Add the 8-pin timer chip by inserting it into the two parallel 4-hole rows as shown above. If the chip does not easily sit into the holes, check that the silver pins are straight and adjust with pliers if needed
- There is no need to cut any of the pins when flipping the board over - just solder into place or apply hot-glue along each row.

3. ATTACH THE DISC CAPACITORS

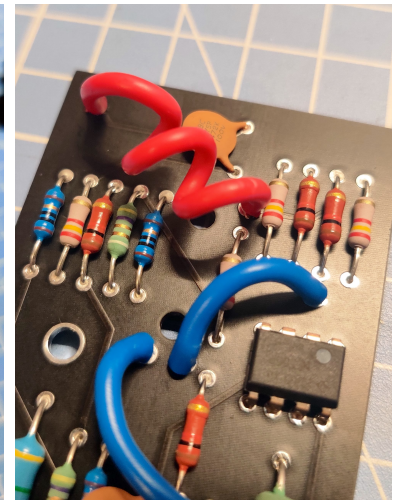
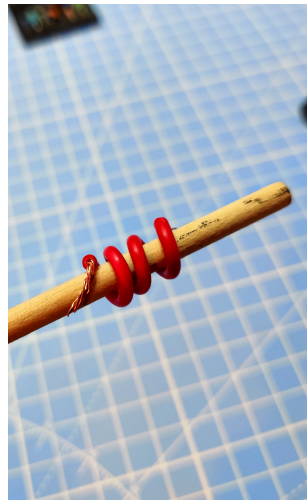
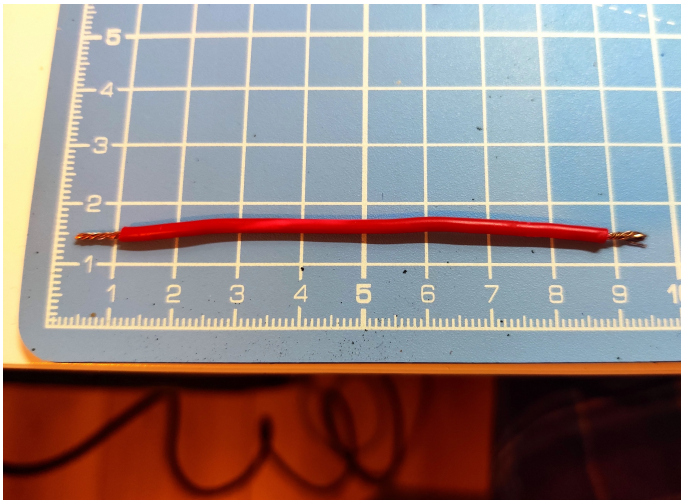


- Add the two small orange disc capacitors to the two positions as shown above. They should both be sitting over to the left rather than upright. If your capacitors are differing in size, attach the largest one to the top
- Trim the wires as we did with the resistors, then either solder or glue to the back of the board.

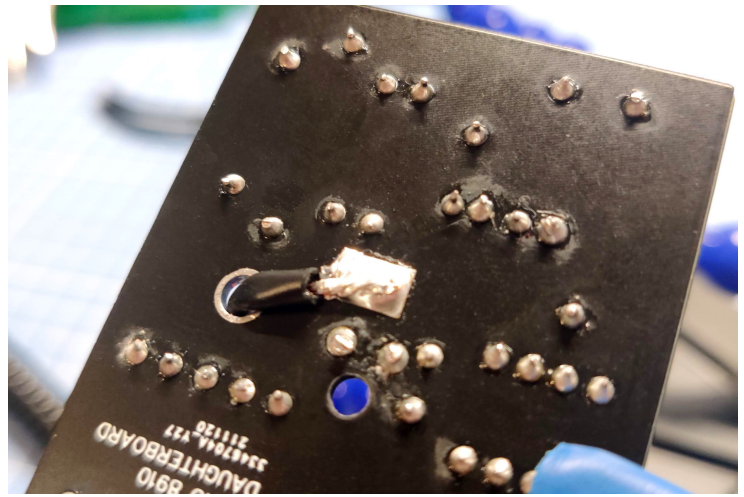
4. ATTACH THE WIRES AND CABLES



- Next, we need to create two sections from the **blue** amp wire. Make one section approximately 35mm and the other 40mm. Strip a section of the insulation away from each end and twist the bare wires together.
- Feed the ends of both wires into the holes as indicated in the second photo above - the longer 40mm wire in the lower position, and the 35mm in the upper.
- Secure the wires into place by soldering or hot-glueing to the back of the board. If glueing, make sure you glue away from the other free holes in the board. If the wire keeps lifting itself out of the hot glue, try pressing it back into the glue with the end of a small screwdriver for a few seconds until it sets into place. It may also help to strip a little more insulation away so you have more exposed wire to play with.

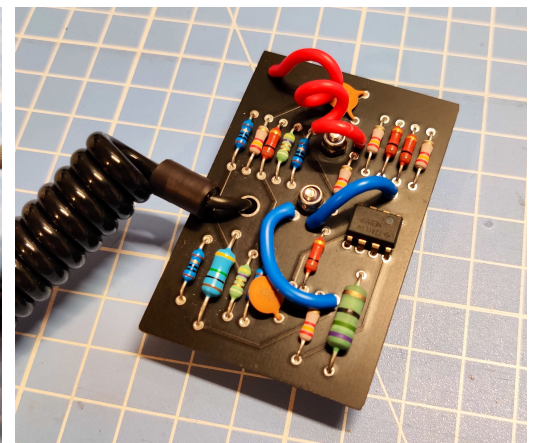
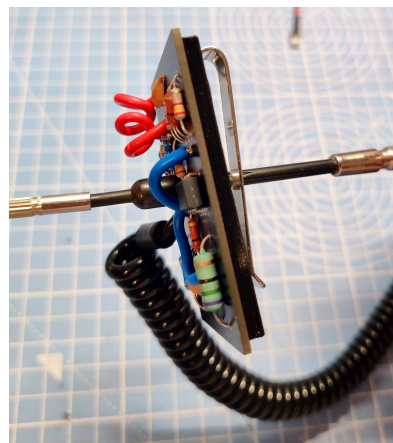
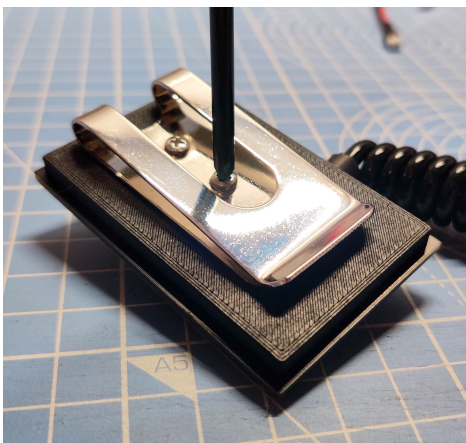


- Now take the 100mm **red** amp wire and strip some insulation from both ends. If you are using a hot-glue gun, strip around 8mm so that you have enough exposed wire to attach to the back of the board.
- This wire needs to appear coiled. To do this, wrap the wire tightly around a thin rod - we have used the wooden handle of a fine paintbrush. Pay attention to the direction of the coil.
- Slip the wire off the rod and add to the board using the holes indicated above. Solder or glue to the back of the board in the usual way.



- Finally, we add the black coiled cable that will link the daughterboard with the motherboard. Firstly, strip a few millimetres of insulation from the narrower, flexible end of the cable and feed it through the largest hole on the board.
- Bend the cable over until the exposed wire is over the silver rectangular pad and apply a generous amount of solder to secure the cable to the pad. If you are using hot glue, use as much as necessary for the cable to remain in place on the back of the daughterboard. You may wish to use a little superglue if the cable is moving.

5. ADD THE BACK PANEL



- Align the two holes in the back panel with the two centre holes on the board. If you have been using hot glue and there is some preventing the board from sitting flush, try cutting away some of the glue with your wire cutters and reseal the back panel.
- Add the belt clip on top of the back panel and use a Philips screwdriver to screw a 10mm bolt into the bottom hole until it just emerges through the front of the board.
- Screw one of the lock nuts onto the bolt. Lock nuts have a nylon ring inside which prevents them coming loose once they are tightened, but this makes gripping the nut with your fingers very difficult. Instead, grip the nut with pliers or a suitably sized socket screwdriver (shown above) from one side as you screw in the bolt from the other.
- Check the alignment of the belt clip on the back, straighten if needed and tighten the nuts until everything is nice and secure.

DAUGHTERBOARD COMPLETE!

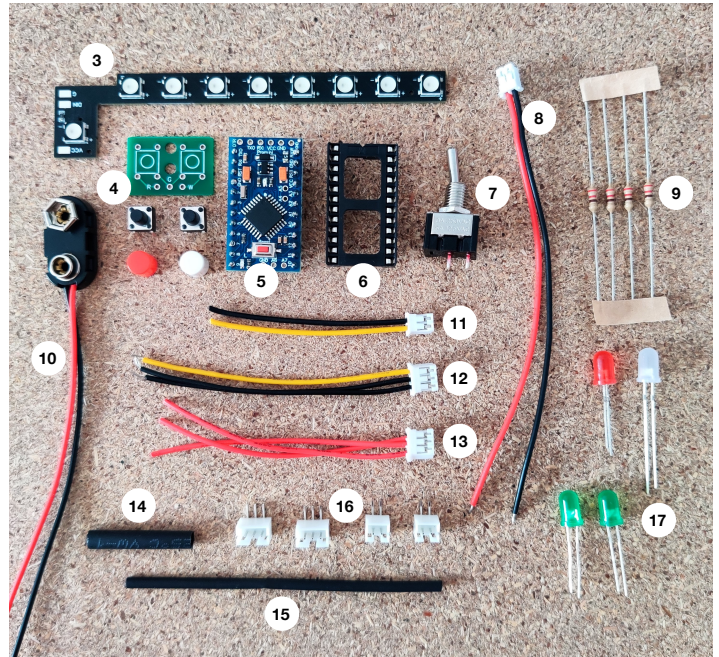
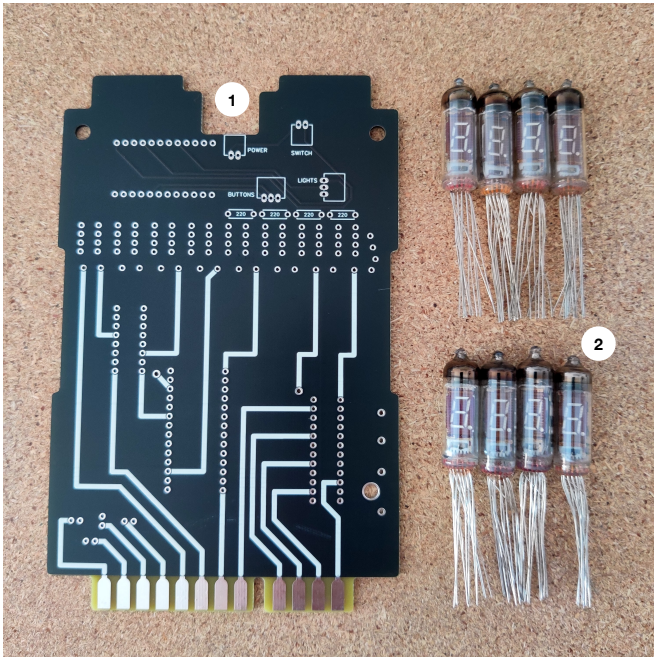
That's it... the daughterboard is done! Now that you have both the tools AND the talent, let's set the daughterboard aside for now and move on to the main event...

MOTHERBOARD ASSEMBLY

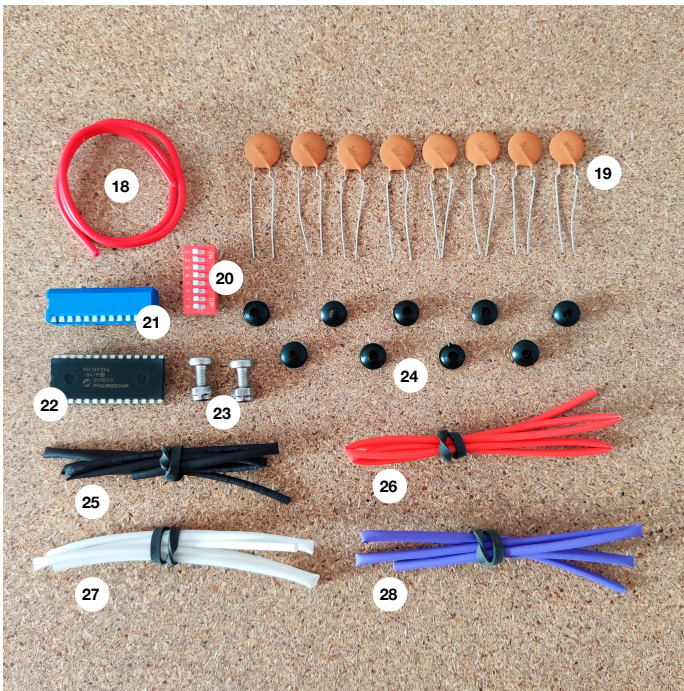
Attaching components to the main gizmo board uses the same technique we learned with the daughterboard. Depending on your kit, you may find that some of the following steps have already been done for you. In this case, we recommend looking over these steps anyway to check everything is as it should be. Remember that you will need to supply a 9V battery (not included) to power the electronics.

PARTS REQUIRED

All the parts needed for the motherboard assembly are shown in the photo below. Using the following list, find each part in your kit bags and set them out on your workbench:



1. 1x Motherboard PCB
2. 8x Vintage glass VFD display tubes
3. 1x LED PCB
4. Button assembly components:
1x Button PCB; 2x Momentary buttons;
1x Red button cap; 1x White button cap
5. 1x Pre-programmed microcontroller
6. 1x 24-pin IC socket
7. 1x Toggle switch
8. 1x 2-wire battery extension cable
9. 4x 220 Ohm resistors (red-red-violet-gold)
10. 1x battery snap connector cable
11. 1x 2-wire JST cable (yellow-black)
12. 1x 3-wire JST cable (yellow-black-black)
13. 1x 3-wire JST cable (red-red-red)
14. 1x Medium heat shrink tubing
15. 1x Narrow heat shrink tubing
16. Right-angled JST sockets
2x 3-pin; 2x 2-pin
17. 4x Indicator LEDs
2x Green; 1x White; 1x Red

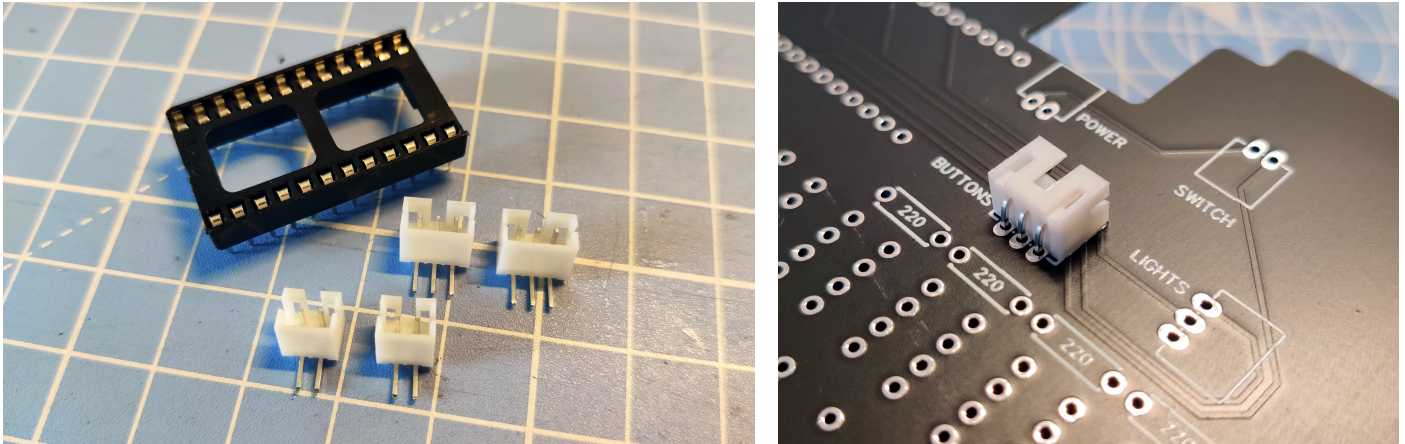


- 18. 1x 320mm **RED** amp wire
- 19. 8x 12mm disc capacitors
- 20. 1x **RED** DIP switch
- 21. 1x **BLUE** DIP switch
- 22. 1x 28-pin controller chip
- 23. 2x M4 lock nuts and bolts
- 24. 9x Rubber grommets
- 25. 1x 18" **BLACK** heat shrink tubing
- 26. 1x 17" **RED** heat shrink tubing
- 27. 1x 17" **WHITE** heat shrink tubing
- 28. 1x 17" **PURPLE** heat shrink tubing

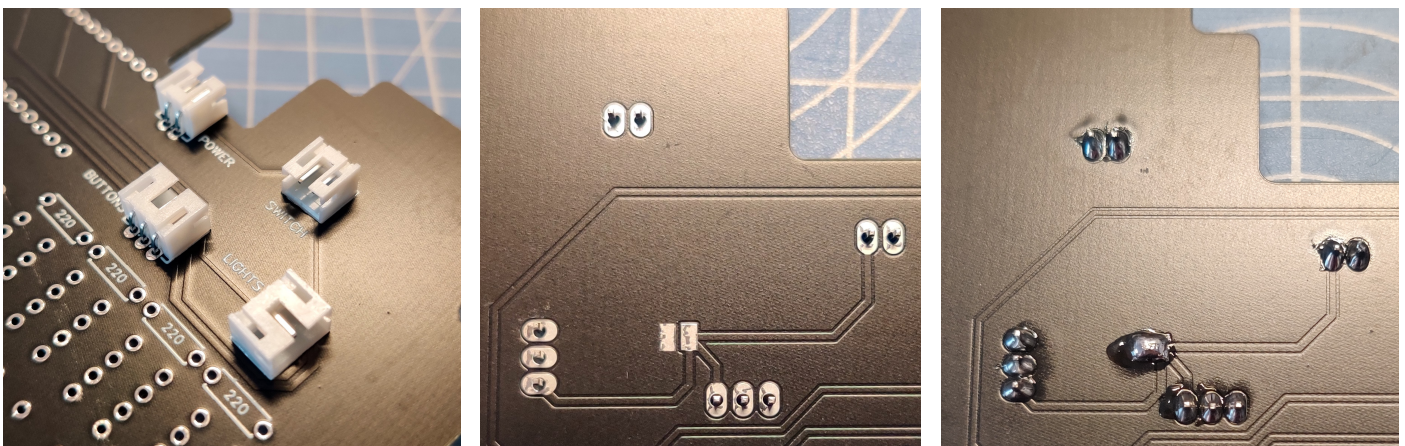
- 29. 1x 'Nixie Shelf'
- 30. 1x Shelf control panel
- 31. 2x Shelf feet
- 32. 1x 'Error Box'
- 33. 1x 240mm **red** silicone wire

1. ATTACH THE ELECTRONICS CONNECTORS (Standard kits only)

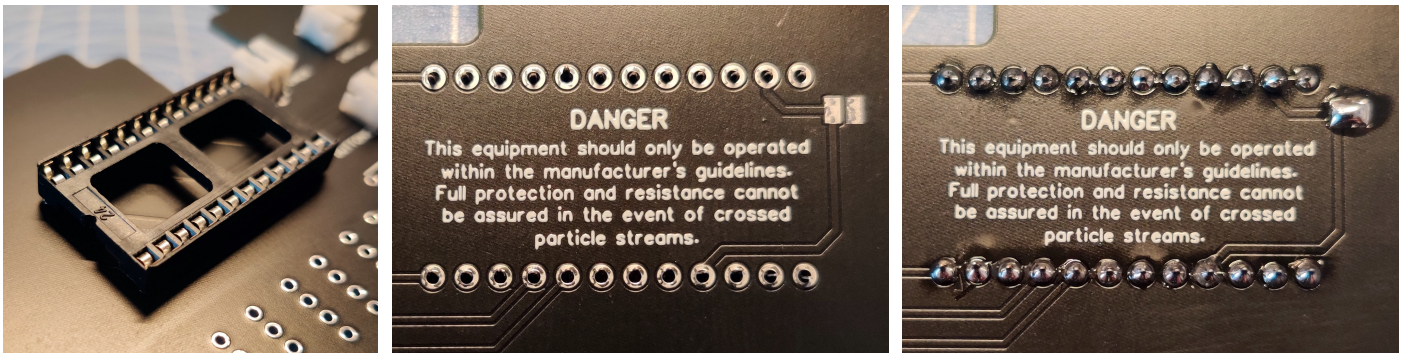
Let's begin by attaching the working connectors to the top section of the motherboard. Unlike the other components, which are purely cosmetic, these parts form the basis of the lighting effects system, so it is important that these are soldered correctly. Luckily, this is a relatively simple job...



- We require the two 3-pin and two 2-pin right angled JST connectors, and the 24-pin IC socket as shown in the first photo above.
- The JST connectors will be placed in the areas of the board labeled "POWER", "SWITCH", "BUTTONS" and "LIGHTS".
- The body of each connector should sit on top of the white boxes printed on the board - this denotes their correct orientation.



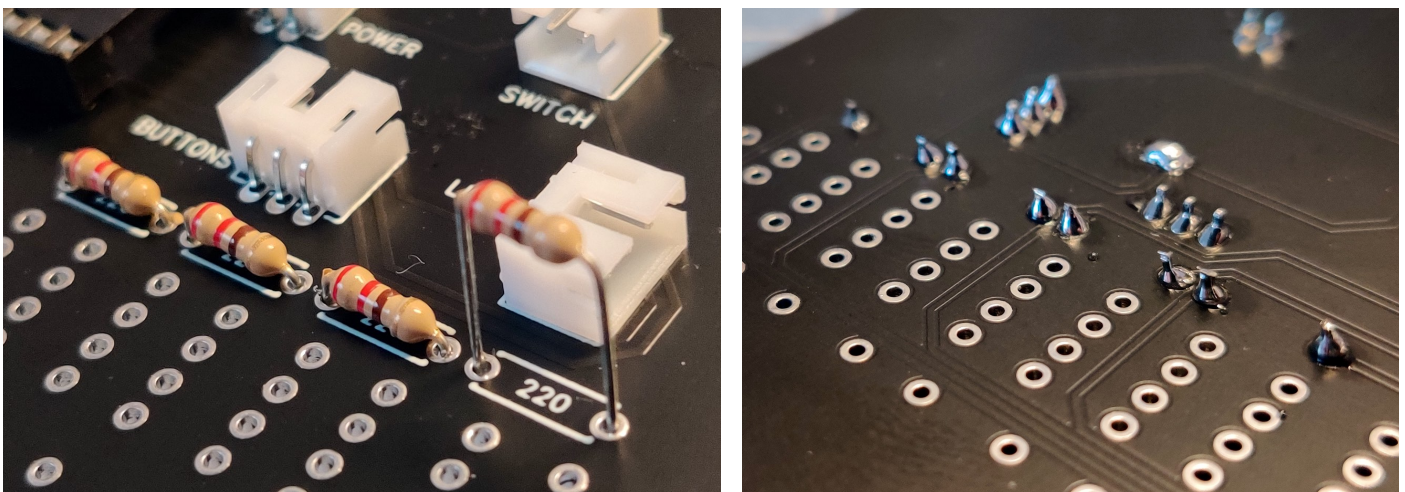
- Drop all four connectors into their corresponding locations, place some tape over them to hold them in place and flip the board over.
- The second photo above shows the 10 oval-shaped copper pads we need to solder the connector pins to. Also note the two separated rectangular pads in the centre - this is a jumper that connects three of the connector pins together.
- Proceed to solder the pins to the pads as shown in the third photo above.
- Complete the connection by joining the two jumper pads together - do this by applying one large blob of solder over the top of both pads as shown. **This is an important step - the two jumper pads must be soldered together in order for the electronics to function.**
- Make sure that your soldering is sound and each pin makes a good connection with the copper pad underneath. Also check that no pins have been accidentally soldered together.



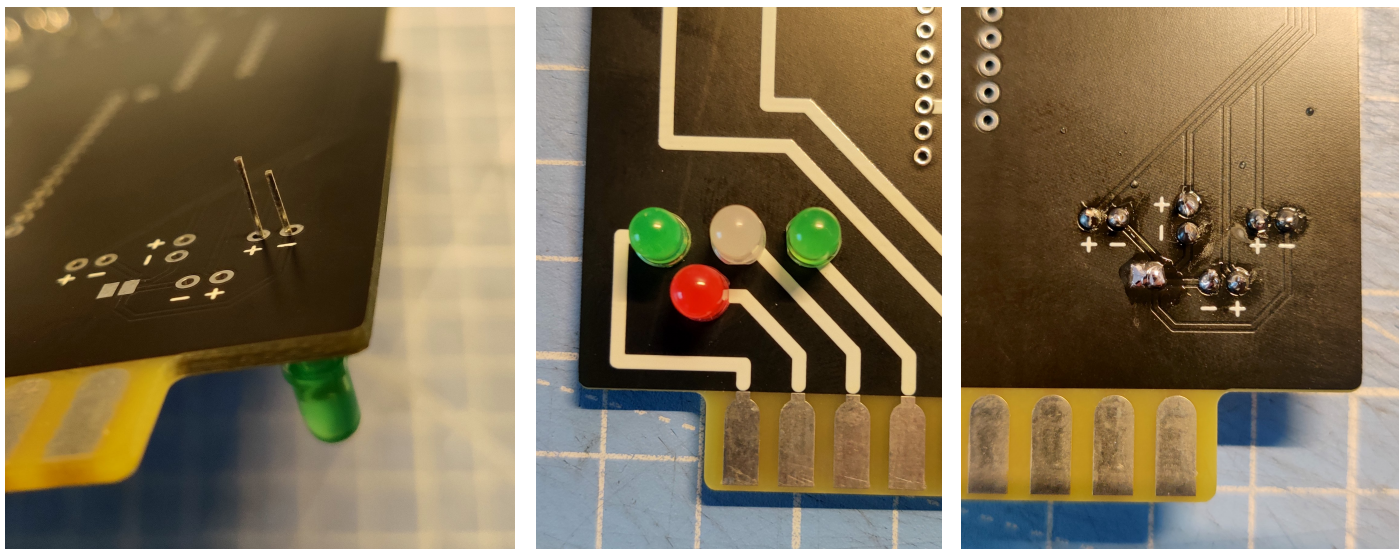
- Now let's add the black 24-pin IC socket. Slot the socket into the holes as show above making sure each pin passes through their respective hole in the board. Be aware the socket pins are thin and can bend very easily - you may need to carefully realign them before slotting the socket into the board.
- Once you are sure all 24 pins are correctly in place, add some tape over the socket and flip the board over.
- As with the JST connectors, solder each of the pins to the copper pads.
- You will see that there is a second jumper here connecting two of these pins together. As before, join the two rectangular pads together with a single large blob of solder.
- Verify all of your connections are correct as shown above before proceeding.

2. ATTACH THE BOTTOM LEDS AND RESISTORS (Standard kits only)

The four LEDs that sit on the bottom of the board are fully functional and linked to the rest of the lighting system. In order to protect them from the battery voltage, we must first add a resistor for each one. These are 220 Ohm resistors (**red-red-violet-gold**) which you will find in your 'Working Electronics' bag.



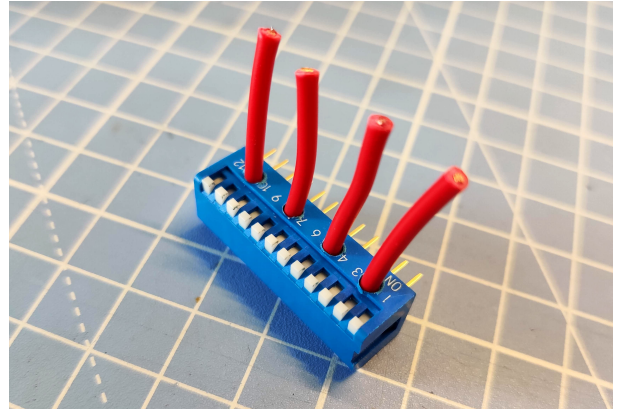
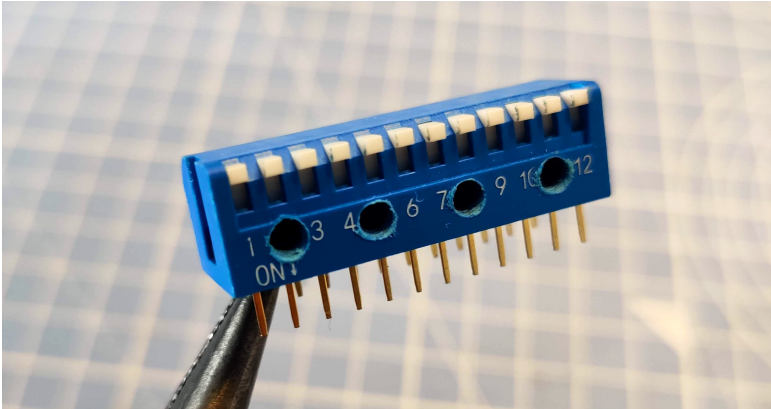
- Bend the wires of each resistor 90 degrees and insert into the holes beneath the JST sockets. Each resistor should sit on top of the areas labelled '220' as shown above. It does not matter about the orientation of the resistors as they will function the same way in either direction.
- Flip the board over, shorten the wires and solder into place.



- Now thread one of the the green LEDs through the holes in the bottom of the board.
- **It is very important that the longest leg of the LED is fed through the hole labeled '+'. This is the positive wire which will cause the LED to fail if placed incorrectly.**
- Hold or tape the bulb of the LED to prevent it from moving and flip the board over. Cut each wire short and solder into place.
- Repeat the process for the other three LEDs. These should be arranged as shown in the second photo above.
- Make sure each of the long positive wires are threaded through the + holes and solder into place.
- As with the connectors on the top of the board, you will see another pair of jumper pads here. Connect the two pads together by applying a blob of solder over both pads.

3. MODIFY THE BLUE DIP SWITCH

Before we add anything to the board, we need to modify the **blue** DIP switch to have four wires attached...



- Start by creating four shallow holes in the side of the DIP switch. You can do this with a drill bit or just dig out some of the plastic by hand with the end of a screwdriver. Each hole should be about 3mm in diameter and be

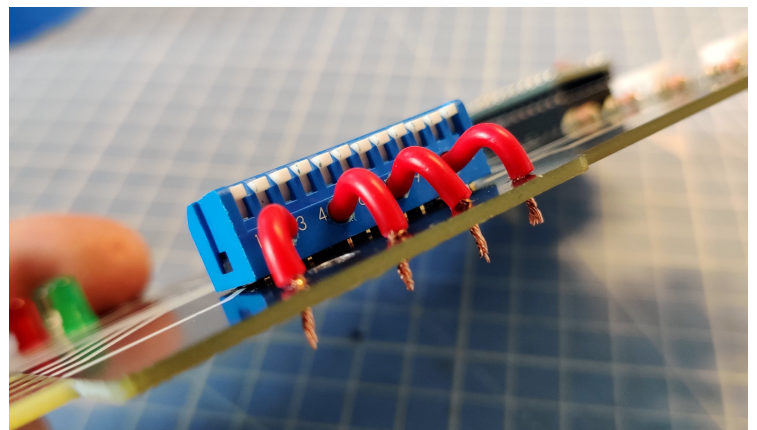
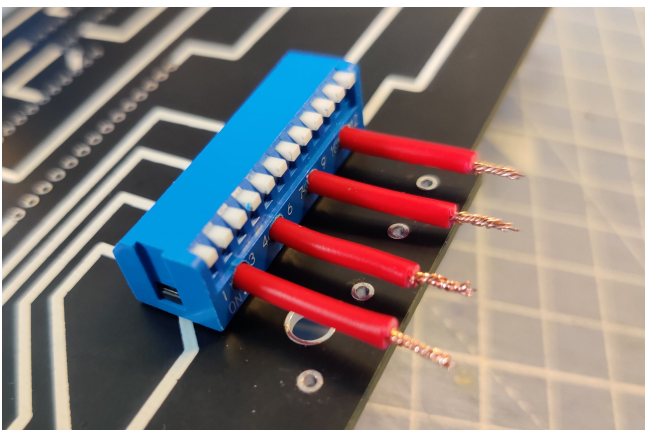


In order to keep them in place when attaching the shelf to the board, it is recommended to add a drop or two of superglue to the outside of each nut as you place them into the holes.

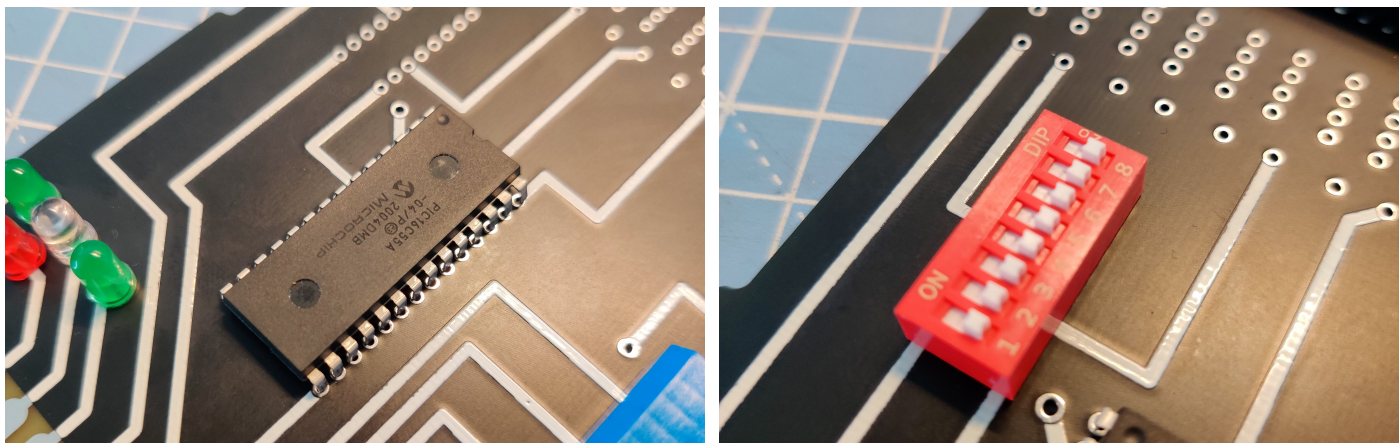
made in the flat section underneath the white 'piano keys'. Space the holes so they pass through the printed numbers **2, 5, 8** and **11**.

- Using the 320mm length of **red** amp wire, cut four 25mm sections and put the rest aside.
- Place the ends of each wire into the holes you have made in the DIP switch. If the wires do not stay in place, add a drop of super glue to one end of each wire and hold in position until the glue sets.

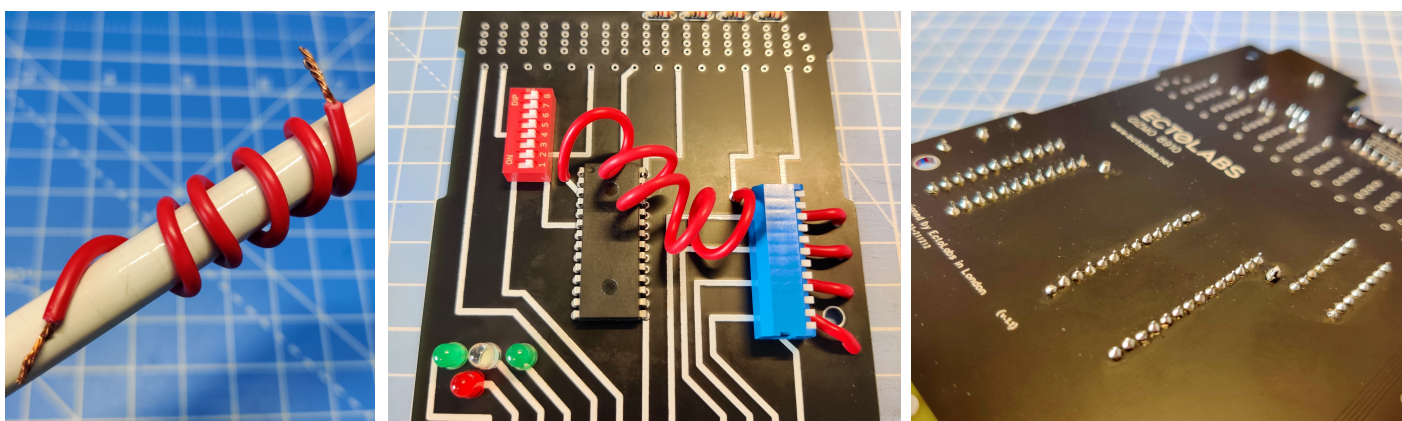
4 ADD THE ON-BOARD COMPONENTS



- Strip about 6mm of insulation from the ends of each red wire on your newly modified **blue** DIP switch.
- Slot the pins on the base of the DIP switch into the corresponding holes on the motherboard as shown above. The pins are very thin so may need straightening a little first before they will line-up. Make sure the red wires are facing outwards.
- Secure the DIP switch into place, flip the board over and solder the pins into place, or apply hot glue over the two rows of pins.
- Feed each end of the red wires through the corresponding four holes in the motherboard and solder or hot-glue as usual.



- Now install the black controller chip (with the small notch facing the top of the board) and **red** DIP switch to their positions as shown above, easing the pins into the holes carefully.
- Secure both components with solder or hot glue over the protruding pins on the rear of the board.

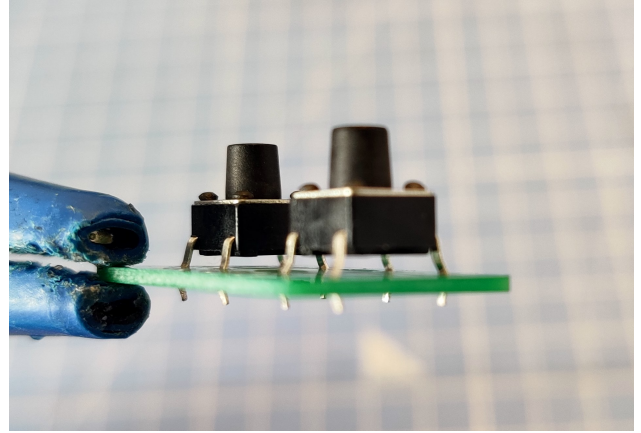
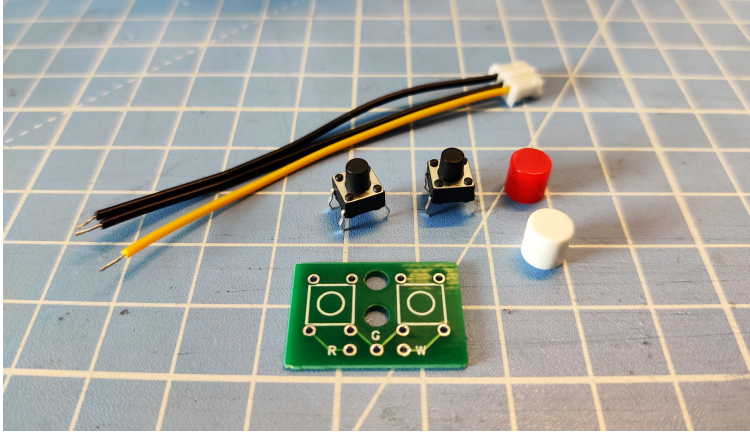


- Using the remaining **red** amp wire (this should be about 220mm), strip about 8mm of insulation from each end. Create a new coiled wire by wrapping it around a rod. This should be proportionately larger in appearance to the one on the daughterboard, so use a thicker rod such as a marker or larger paintbrush.
- Slide the coiled wire off the rod and insert the bare ends into the two holes on the board as shown above.
- Solder into place, or fold the ends of the wire over and hot-glue to the back the board.
- If soldering, the rear of the board should now resemble that shown in the last photo above. If glueing, check that all components are securely attached to the board and add extra hot glue if necessary.

5. ASSEMBLE THE WORKING ELECTRONICS (Standard kits only)

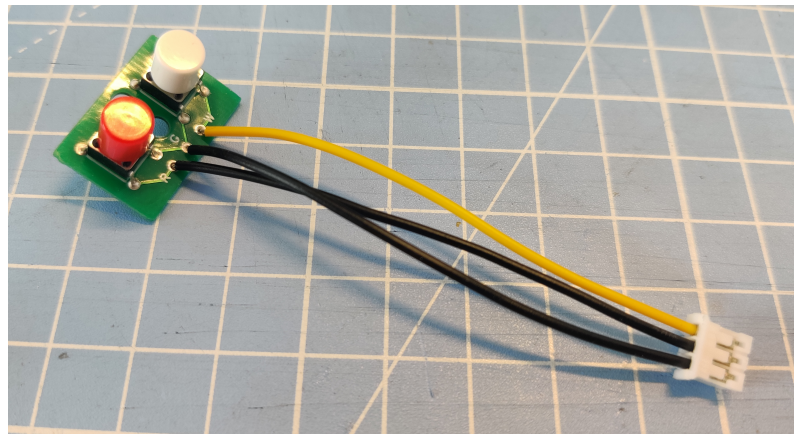
In your kit you will find an anti-static bag labeled “Working Electronics”. This contains all of the functional components that make up the lighting effects system. This is simple to assemble, but be sure to read this part of the guide carefully, always refer to the photographs and double-check any soldering you do to ensure correct operation.

NOTE: In some cases, some or all of these components may have already been assembled for you. If this is the case, we still recommend reading through this section to check you have everything before continuing.

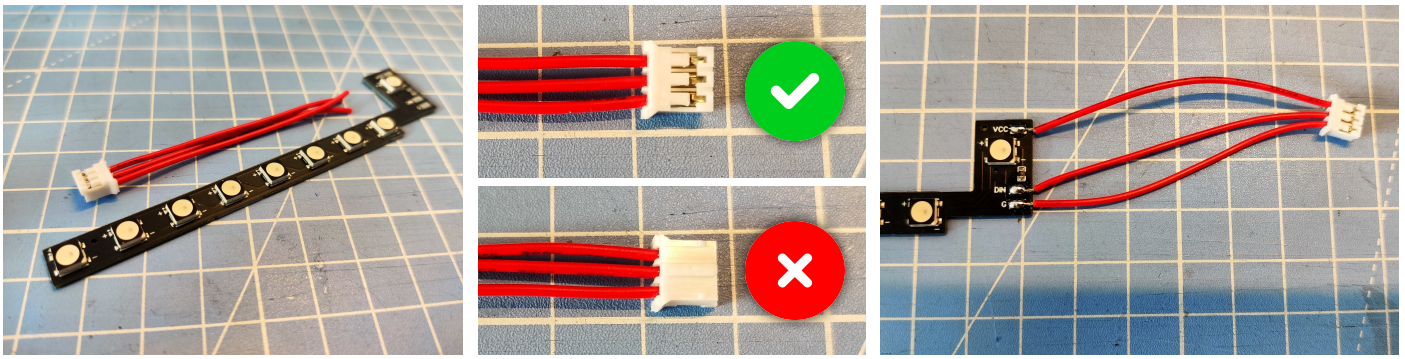


BUTTON ASSEMBLY:

- Collect together the parts needed: Mini circuitboard, momentary buttons x2, **red** cap, **white** cap and 3-wire JST cable [**YELLOW-BLACK-BLACK**]
- Making sure that the markings on the circuitboard (white square and circle) are facing upwards, insert the pins from the buttons into the holes on the mini circuitboard as shown above - the orientation of the buttons does not matter.
- Align the buttons so they are as level as possible and flip the mini board over.

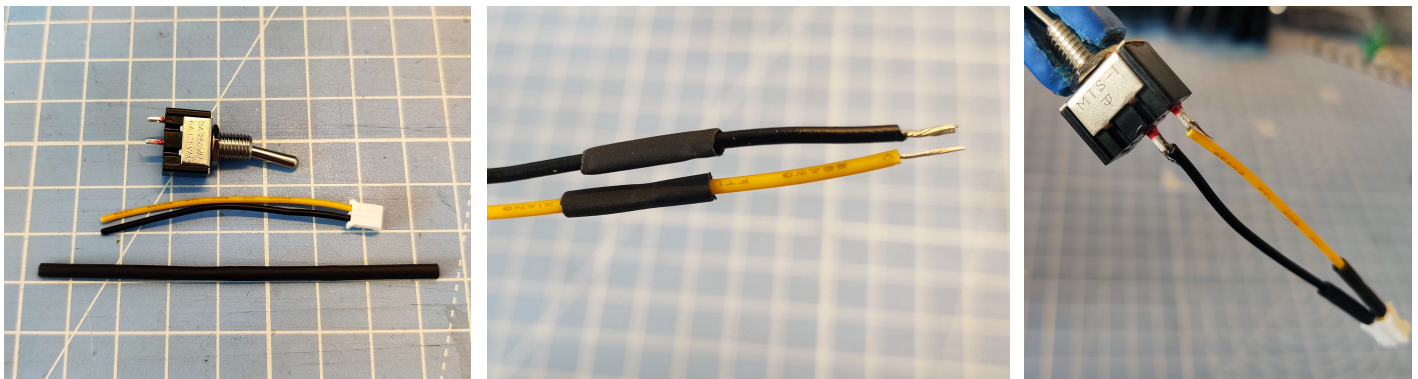


- Solder all eight pins on the back of the board and check your connections are sound and flip the board back over to the front.
- Push the two coloured caps firmly on to the buttons - **red** above the letter ‘R’ and **white** above ‘W’.
- Strip a little of the plastic shielding away from the end of each wire on the JST cable and solder in each wire as shown in the second photo above. This is as follows:
 - **YELLOW** wire: solder to hole labeled ‘W’
 - Centre **BLACK** wire: solder to hole labeled ‘R’
 - Outer **BLACK** wire: solder to hole labeled ‘G’
- Check that the wires are soldered to the correct positions (particularly the two **BLACK** wires which can be easily confused).



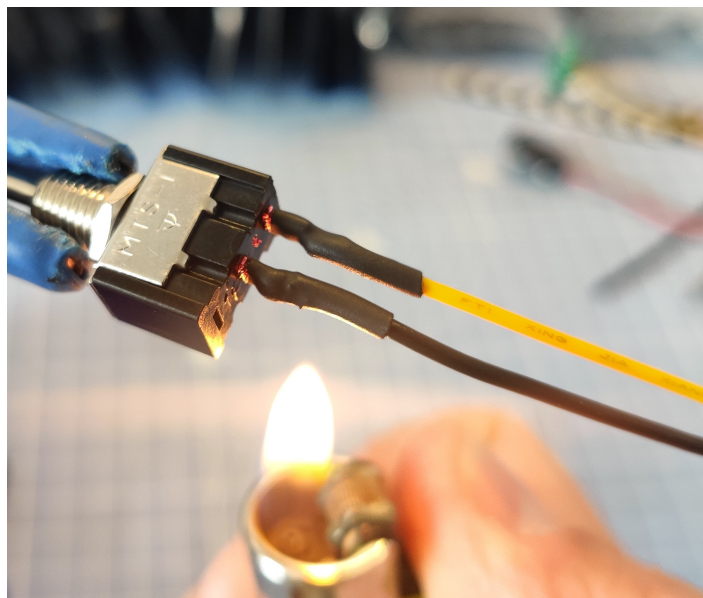
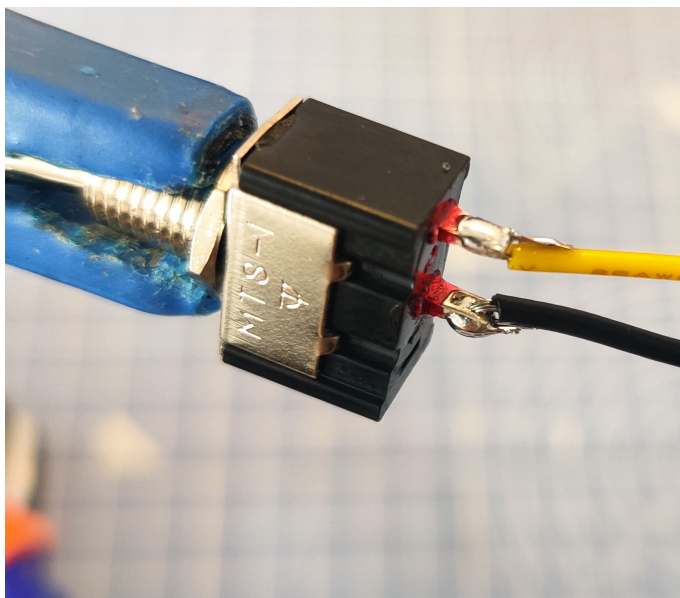
LED ASSEMBLY:

- Find the 'GIZMO DISPLAY LEDS' board from your kit, along with the 3-wire JST cable [RED-RED-RED]
- The LED board has three silver pads at one end which we will be using to attaching the cable wires.
- As each wire on this cable is the same colour, it is important that we know which way up the cable needs to be. To determine this, place the cable so that the connector plug looks like it does in the image above, next to the green tick. You should be able to see the silver connectors inside the the white plastic housing. This is the correct orientation - the three wires to the left of the connector plug are then our **top**, **middle** and **bottom**.
- With the LED board on your left and the cable in its correct orientation to the right, solder the three wires to the silver pads as shown above. This is as follows:
 - **Top** wire: solder to the pad labeled 'VCC'
 - **Middle** wire: solder to the pad labeled 'DIN'
 - **Bottom** wire: solder to the pad labeled 'G'

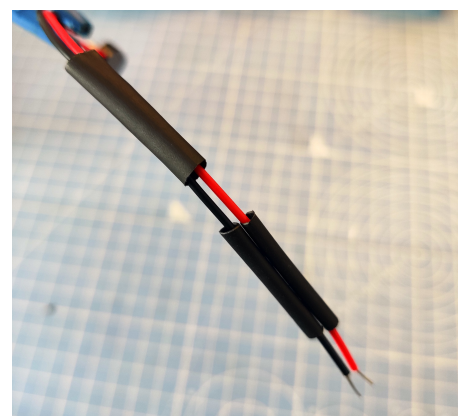
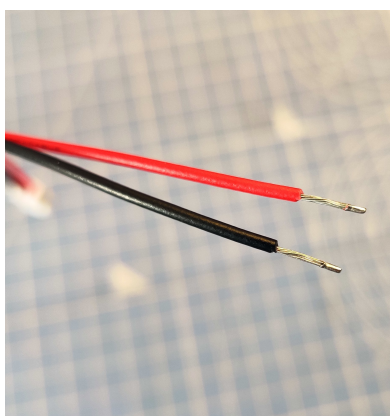
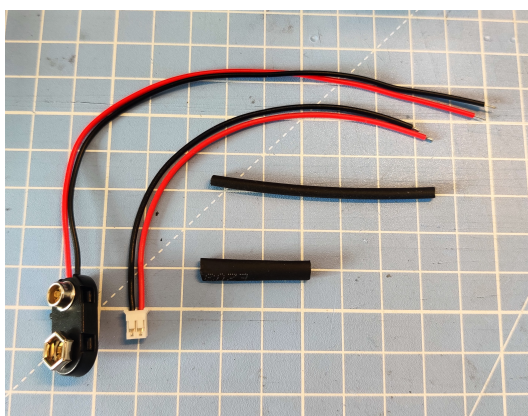


SWITCH ASSEMBLY:

- You will now require the metal toggle switch, the 2-wire JST cable [YELLOW-BLACK] and the short length of black narrow heat shrink tubing.
- Firstly, strip a few millimetres from the shielding of both wires.
- Cut two **10mm** sections of heat shrink tubing and pass one over each wire.
- Thread each of the bare wires through the eyes in the switch's pins and fold over as shown in the third photo above. As this is a simple on/off switch, it does not matter which wire you attach to which pin.



- Secure the wires by soldering them to the pins on the switch.
- Slide the two sections of heat shrink tubing over your soldered wires and apply your preferred heat source to shrink the tubing down and wrap tightly around the joints.

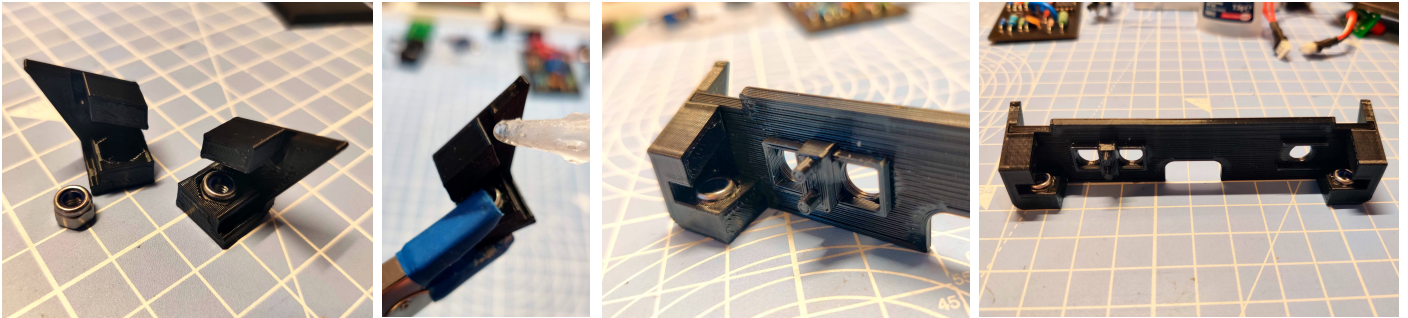


BATTERY CONNECTOR CABLE:

- The final component to assemble is the battery cable. For this, find the 9V battery snap, 2-wire JST cable [**RED-BLACK**], the small section of medium heat shrink tubing and the remaining amount of the narrow tubing.
- Strip at least 5mm of the shielding from each end of both the battery snap cable and the JST cable.
- Thread the medium section of heat shrink over **BOTH** wires on the battery snap cable.
- Cut two 25mm sections from the narrow heat shrink and place one on each individual wire as shown in the second photo above.
- Twist the bare ends of each wire together (**red->red** and **black->black**), apply solder and slide the two narrow sections of tubing over the joint and shrink down as shown above.
- Finally, slide the medium section of tubing over this and shrink down to secure the two wires together.

6. BUILD THE NIXIE SHELF AND CONTROL PANEL

Great!! With the main components now in place, the Gizmo is now starting to look more like a GB2 board. But here's where things really start coming together as it's time to get the real electronics working. For this, you will need the pre-made 'Electronics Assemblies' and the 'Nixie Shelf + Error Box' parts - you find these in anti-static bags in your kit. You will also need the larger two pairs of nuts and bolts (M4).

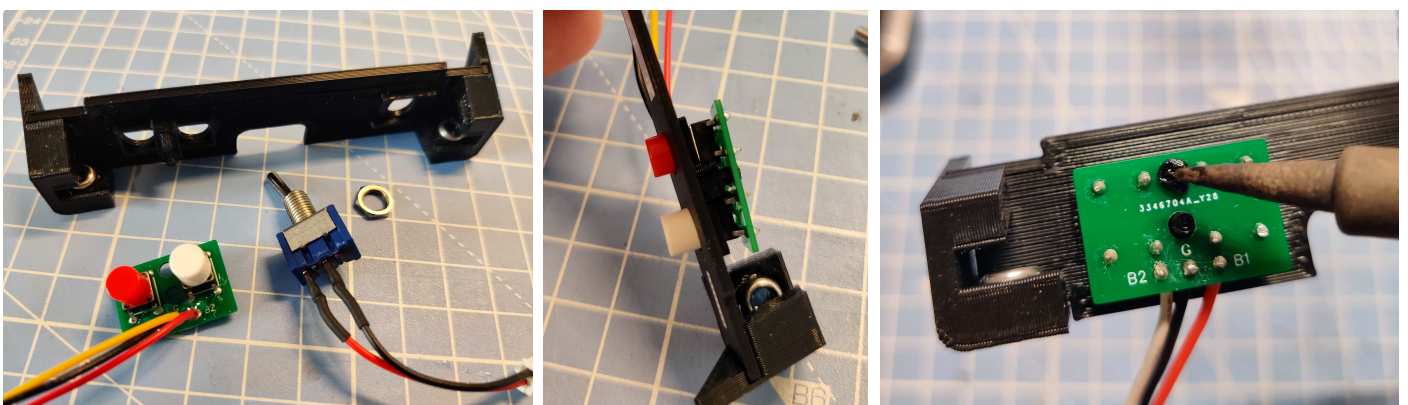


- First, take the the two shelf feet and seat the two nuts into the hexagonal holes. These 'lock nuts' contain a nylon ring which will prevent them from loosening over time, so make sure that the circular part of the nut is at the top.

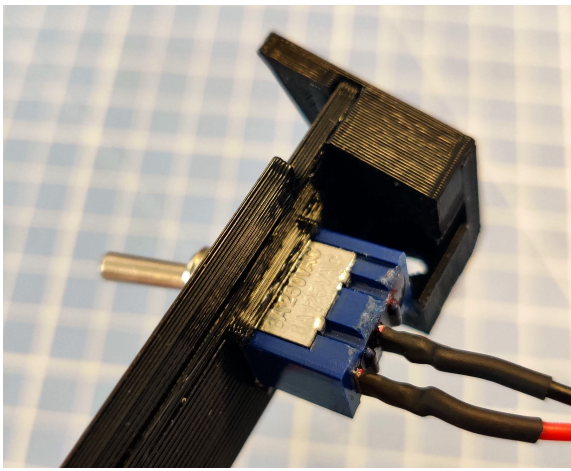


In order to keep them in place when attaching the shelf to the board, it is recommended to add a drop or two of superglue to the outside of each nut as you place them into the holes.

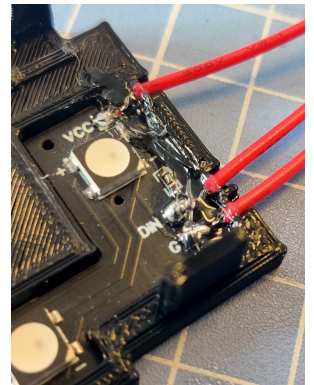
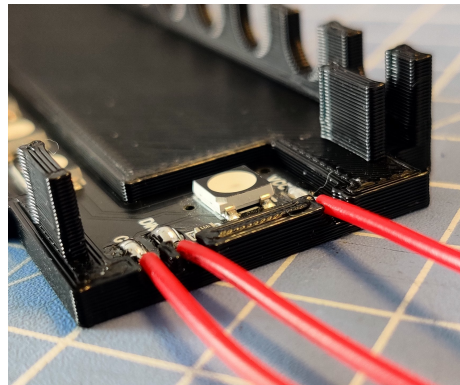
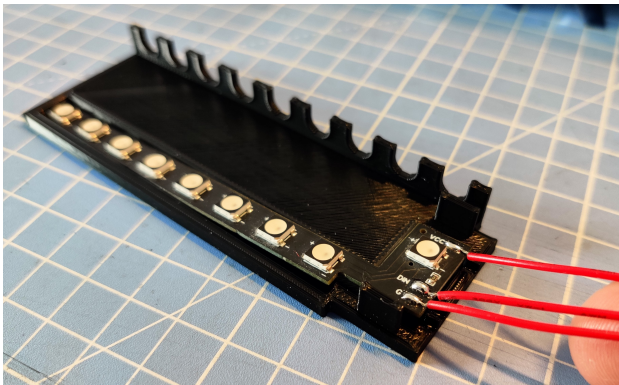
- Apply some super glue to the flat inner sections of one foot as shown in the second photo above.
- Slot the edge of the control panel into the grooves in the foot. The smooth side of the panel (with DANGER label) should be facing outward. The bottom corners of the control panel should sit flush with the bottom of the foot.
- Hold the two parts together with one hand and apply superglue to the inside joins that have been formed. Be careful not to let any glue seep through to the smooth side of the back panel as this can cause permanent whitening of the plastic. You may wish to also add hot-glue here on top for added strength. This area will be hidden once assembled, so do not worry about the appearance of the glue here.
- Repeat for the foot at the other end of the control panel, making sure that the whole structure is as sturdy as possible.



- Now take the button assembly we created earlier and slot the buttons into place by passing them through the two holes in the control panel - this will only fit one way.
- With a soldering iron, melt the top of the two plastic columns that pass through the holes in the small green circuit board. Melt enough so that, once cooled, they create rivets holding the board securely. Alternatively, you can hot glue or super glue the board into place. Just make sure that there is no wobble when pressing the buttons from the other side.

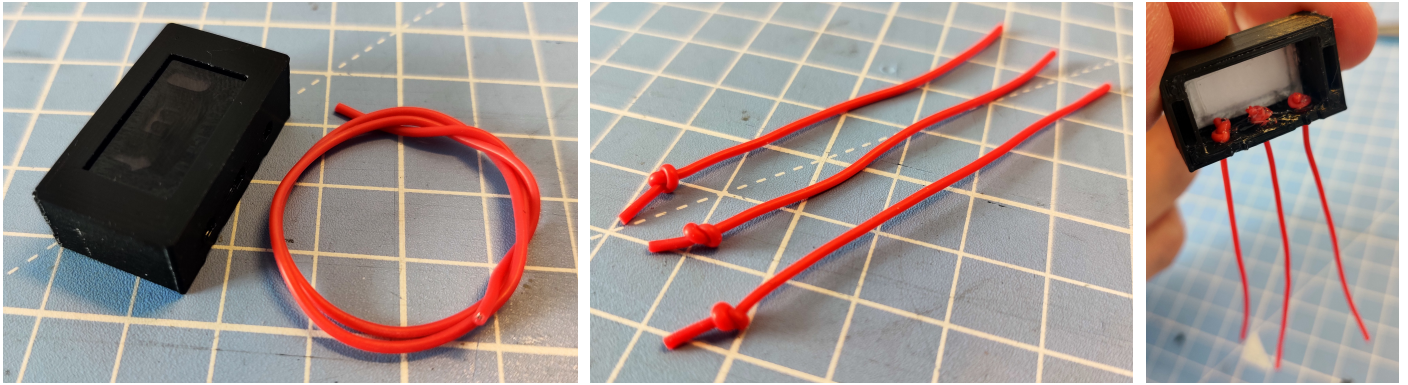


- Push the toggle switch through the remaining hole on the control panel. The main body of the switch will slot neatly between the raised bars to prevent the switch from rotating. Make sure the side of the switch marked “ON” and “OFF” is facing downwards.
- Replace the hexagonal nuts on the switch to secure it to the control panel. You can use pliers or socket wrenches to tighten the nut, but be careful not to scratch the panel as you do so. Tighten the nut and make sure that it is secure.

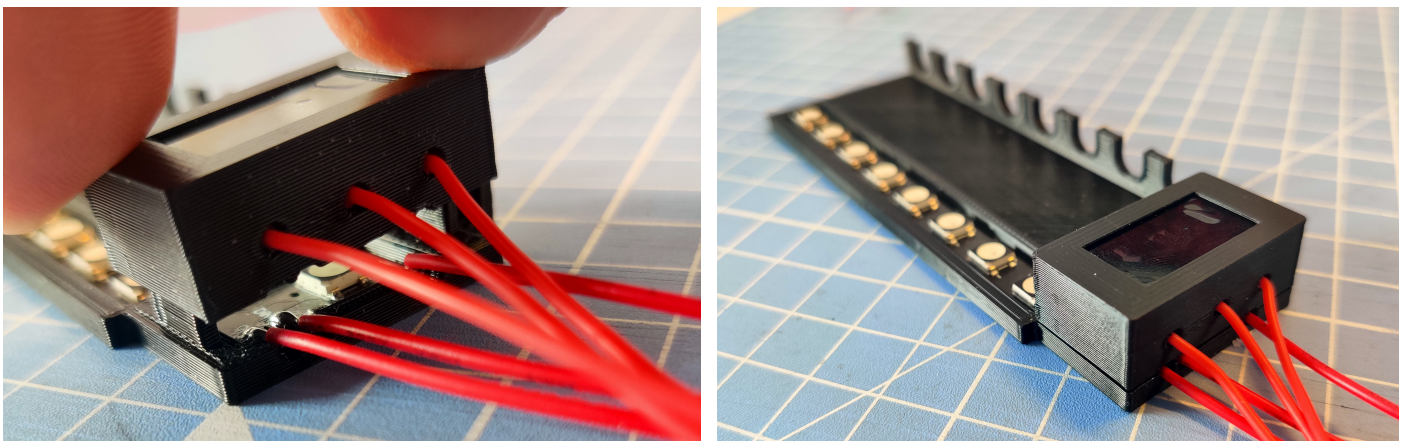


- Retrieve the LED assembly you completed earlier and place this into the recessed part of the ‘Nixie Shelf’. The black board should fit tightly and stay in place, however if you do find it is a little loose, try adding the little double-sided tape to the back of the board to prevent it from falling out.
- Make sure the three red wires attached to the board sit freely in the three cut outs in the side of the shelf.
- To help protect the wires from breaking, we recommend applying some hot glue over the ends of the each wire and the soldered pads, plus the inner edge of the shelf as shown in the third photo above.

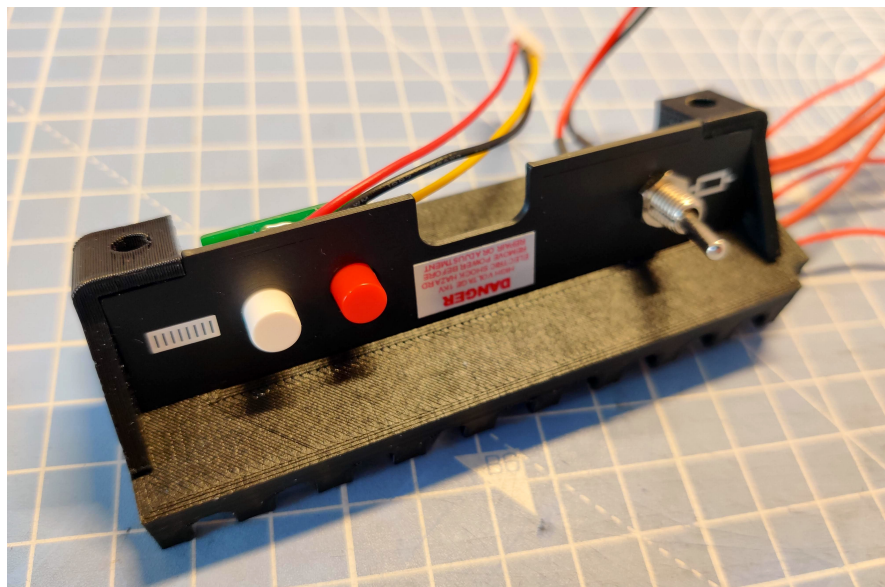
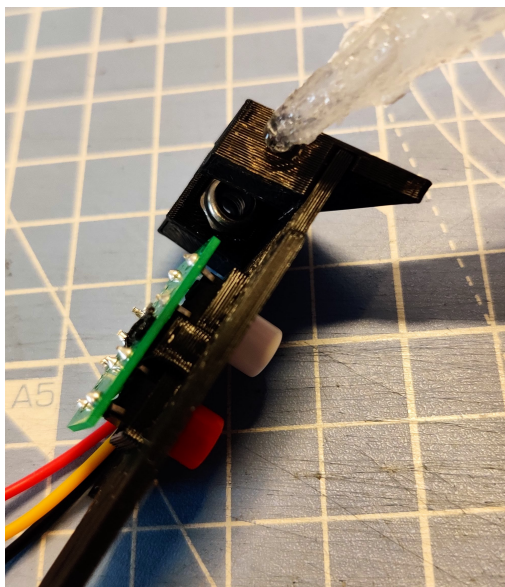
You will find that the 'Error Box' is partly assembled with the inner 'E' plate and light diffuser already in place. We just need to add three dummy wires to complete the look:



- Divide the 240mm length of red wire into three equal 80mm sections, then tie a single knot in the end of each one.
- Thread each wire through the holes in the side of the Error Box so that the knots sit along the inner edge as shown above.
- Cut any ends off from each knot and apply some hot-glue or superglue over each one to keep the wires from moving. This does not need to be tidy as it will be hidden once the Error Box is place.



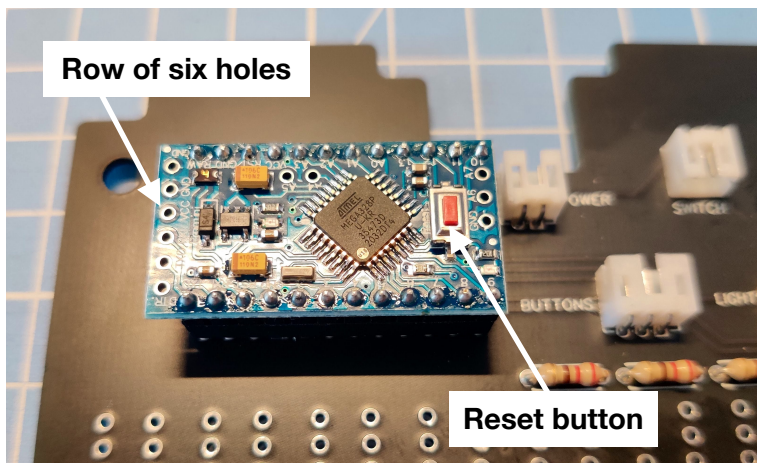
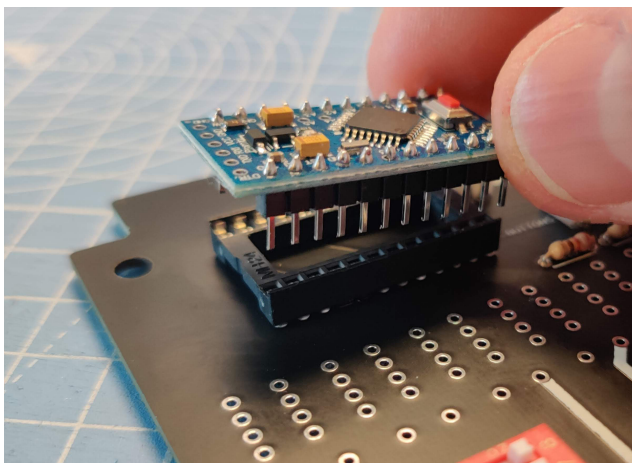
- Flip the Error Box over and press it onto the shelf so the rectangular columns slide into the holes in the box.
- Press down until the box sits tightly on the top of the shelf as shown above. You may need to wiggle the box slightly until it sits flush.
- Now turn the shelf assembly face down so we can attach the control panel...



- Add some super glue to the flat area on each of the panel feet.
- Place the rear panel with connected feet on top of the Nixie Shelf assembly as shown. The edge of the control panel will slot into the groove in the shelf at an angle so the top of the feet sit flush against the sides.
- Apply glue if necessary to the inner joins. Again, there's no need to be neat as this will all be hidden, just make sure all parts are securely fixed in place.

7. CONNECT THE WORKING ELECTRONICS

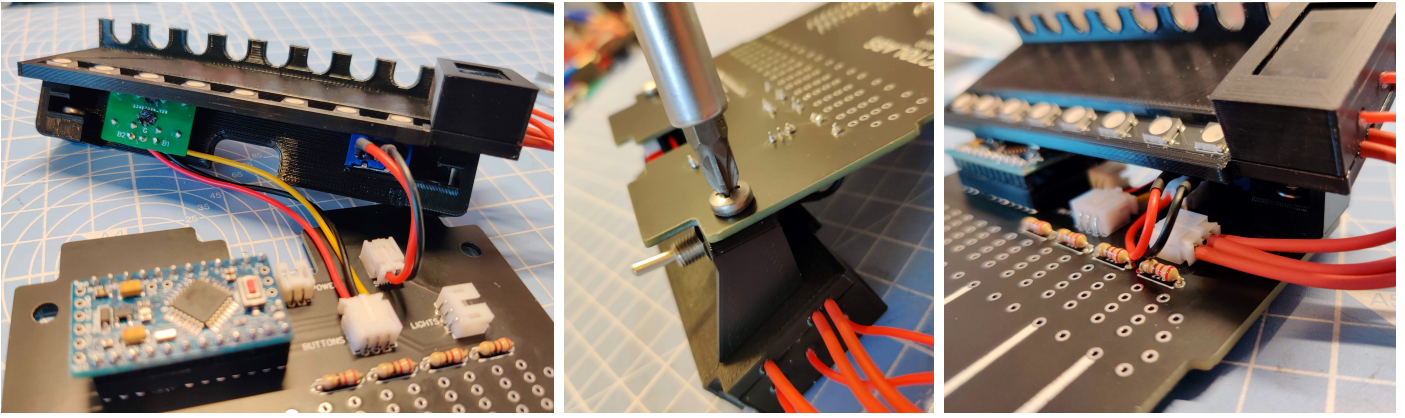
The gizmo motherboard includes plug-in connectors for all working electronics. This means that no soldering is required for these parts. They can also be easily disconnected or replaced when needed.



- Firstly, plug the blue microcontroller into the black 24-pin socket on the top left of the motherboard. Press down firmly until it is fully seated.
- Double check that the microcontroller is inserted the correct way as shown above - the vertical row of six holes should be on the **left** hand side, and the red reset button should be on the **right**.



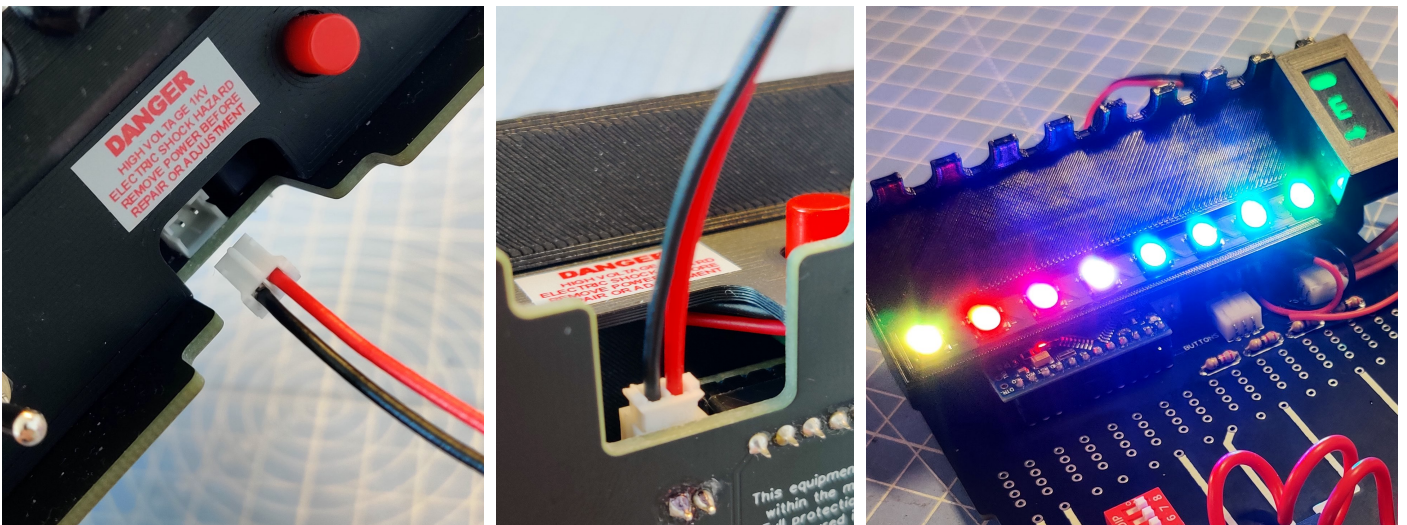
It is essential that the microcontroller is orientated correctly. Failure to do so may result in damage to the microcontroller when powered on.



- Now carefully insert the white plugs from the buttons and from the toggle switch into the connectors marked 'BUTTONS' and 'SWITCH' as shown in the first photo above.
- Place the shelf at the top of the motherboard so that the large holes in the board line up with the holes in the feet. The **red**, **black** and **yellow** wires from the buttons should be tucked under the shelf so it loops over the cutout in the back panel.
- Flip everything over and screw the two bolts through the motherboard and into the lock nuts in the feet until tight.

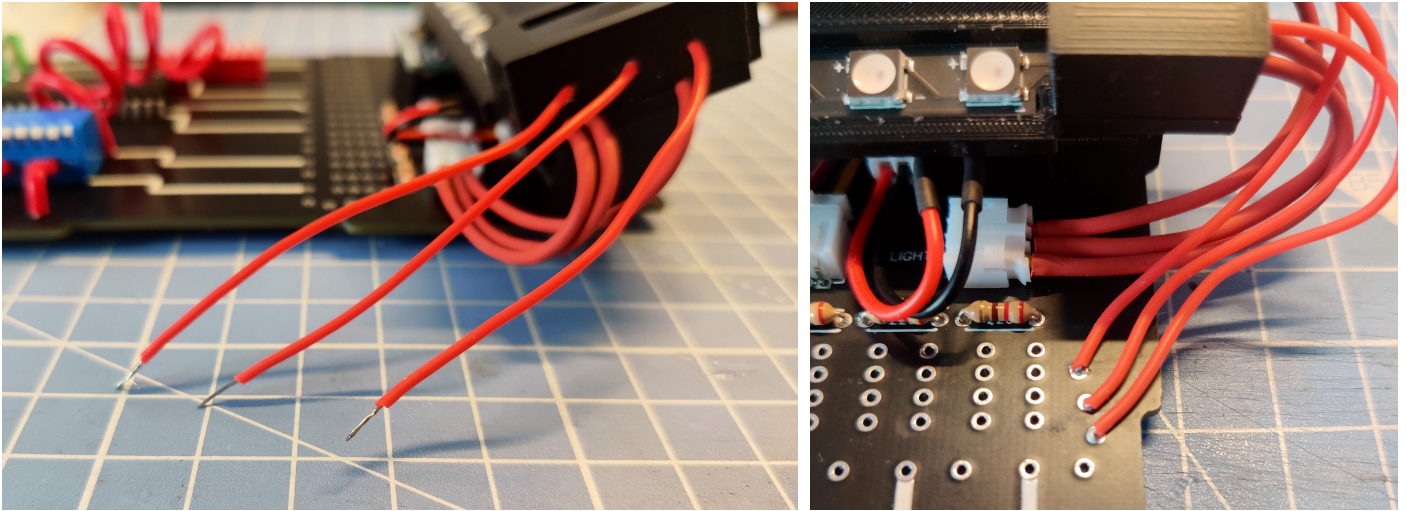


The nylon rings in the nuts will create some resistance when screwing in the bolts. Therefore, grip the corner of the back panel and the foot with your fingers as you slowly screw in each bolt. This will help prevent the shelf from coming apart in the glued areas.



- Once the shelf assembly is in place, connect the three lower red wires coming from the side of the error box into the connector underneath the shelf. The other three loose red wires are purely cosmetic and not part of the working lighting electronics. We will attach these to the board later, so leave them as they are for now.
- Plug-in the battery cable into the connector accessible at the top of the unit. Be very careful not to tug at the cables themselves as this may damage them - insert and remove the cable only by gripping as close to the plug as possible.
- It's time for the moment of truth... Snap the battery connector onto your 9V battery and flick the toggle switch. If all is well, the eight main LEDs on the shelf, plus the error box, should begin to light up. The default lighting effect will display in a loop.
- The four pre-installed LEDs at the bottom of the board should also light up.

- Now let's test the buttons on the control panel. Pressing the white button repeatedly will cycle through the light patterns, and the red button will cycle through the different colours. The corresponding LED on the bottom of the board will flash whenever each button is pressed. Full operating instructions, including information on all of the available modes are detailed at the end of this guide.
- Once you are happy that everything is working as it should, flick the toggle switch back to the off position, disconnect the battery and the battery cable and breath a sigh of relief!

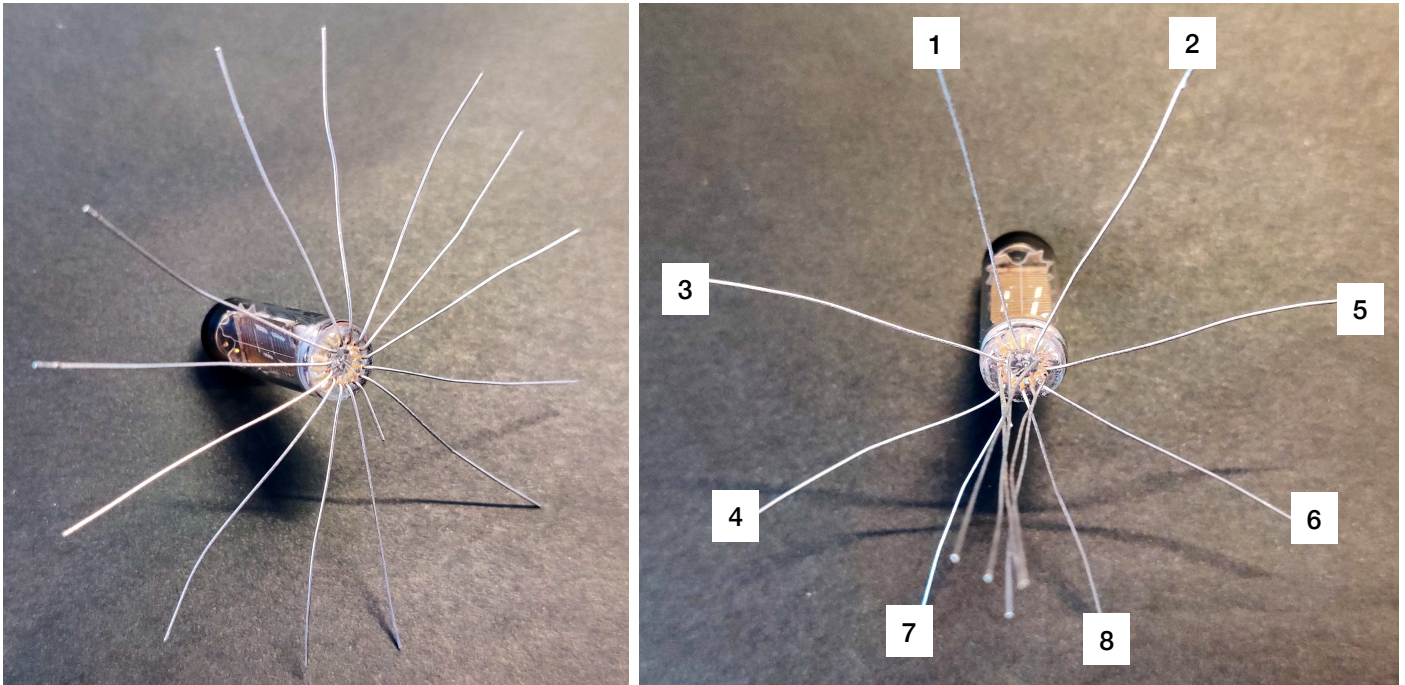


- Finally, strip a little of the red silicone away from the ends the three loose wires.
- Feed these bare wires through the three holes shown in the second photo above. As with the other components, solder into place or bend the wire over on the back of the motherboard and apply hot-glue.

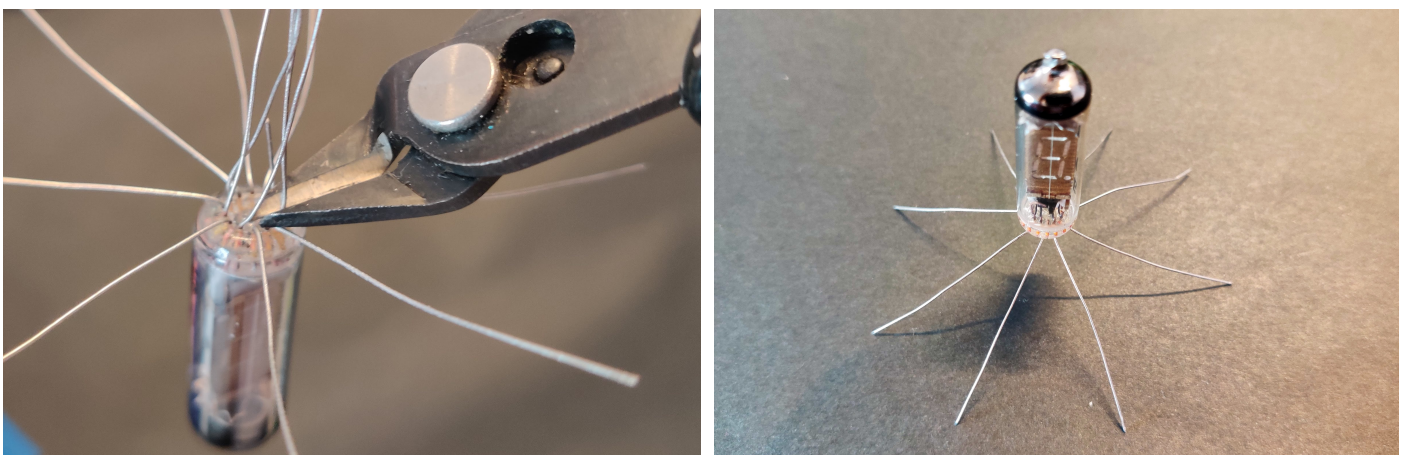
8. PREPARE THE VFD TUBES

Your kit contains 8 genuine vintage glass VFD tubes. Although we won't be able to light the numbers up themselves, the glass tubes will reflect the light from the LEDs underneath to create an awesome looking effect.

It's worth noting that, depending on availability, the exact model of the nixie tubes can differ slightly from kit to kit. Their appearance may have minor differences to those shown in the following photos, but they will always be the correct size and will always be shipped together in a matching set of eight.



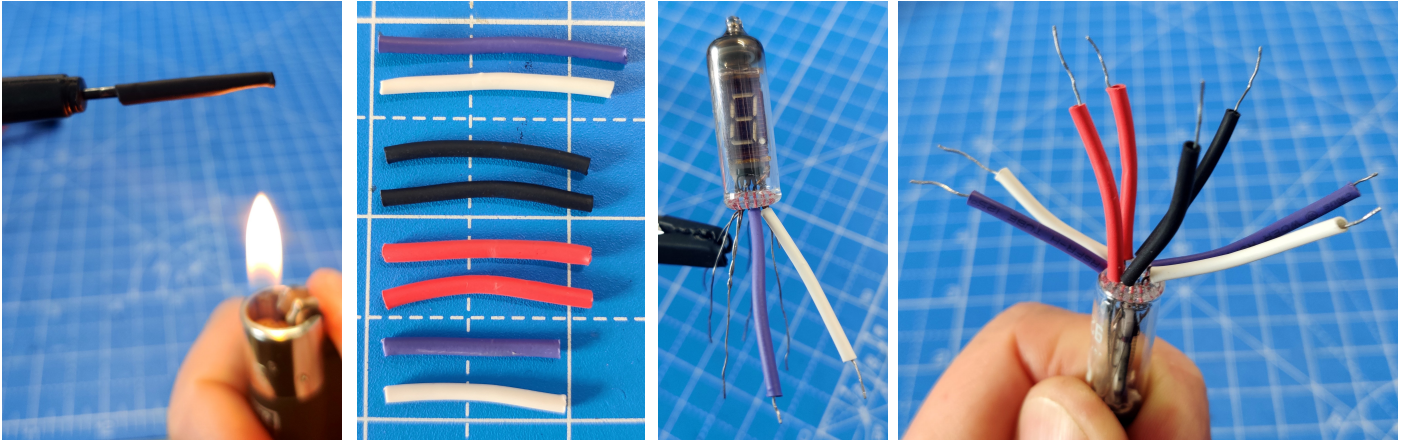
- Using one tube, separate and fan out each of the wires as shown in the first photo. Note that the number of wires attached to a tube can vary, so don't worry if yours has more or less than that shown above.
- We need to reduce the number of wires to just **EIGHT**. To do this, face the fan of wires towards you with the number segment of the tube facing upwards. Start by selecting the two wires that best create a V shape pointing upwards (as indicated by '1' and '2' in the second photo above). Then mirror this at the bottom with two wires pointing downwards (indicated by '7' and '8'). Next, repeat this with two wires pointing to the left (indicated by '3' and '4') and finally two wires pointing to the right (indicated by '5' and '6').
- Bunch all the other unselected wires towards you so the eight wires we will be using are clearly visible.



- With your wire cutters, snip off all the unwanted wires that you have bunched together. Be very careful not to remove any of the eight wires still fanned out as we will need these to attach to the motherboard.
- Once done, you should have a tube that looks like that in the second photo above with eight wires neatly spaced.
- Repeat this process for all the other seven tubes in your kit.

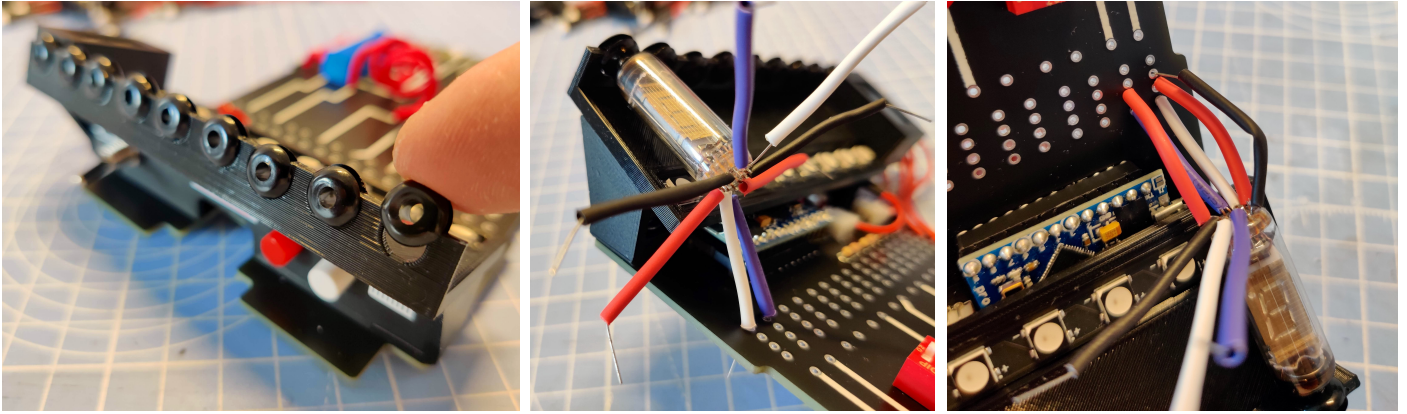
9. ADD THE COLOURED HEAT-SHRINK

Before we can mount the tubes to the shelf and attach them to the motherboard, we must add colour to the wires.

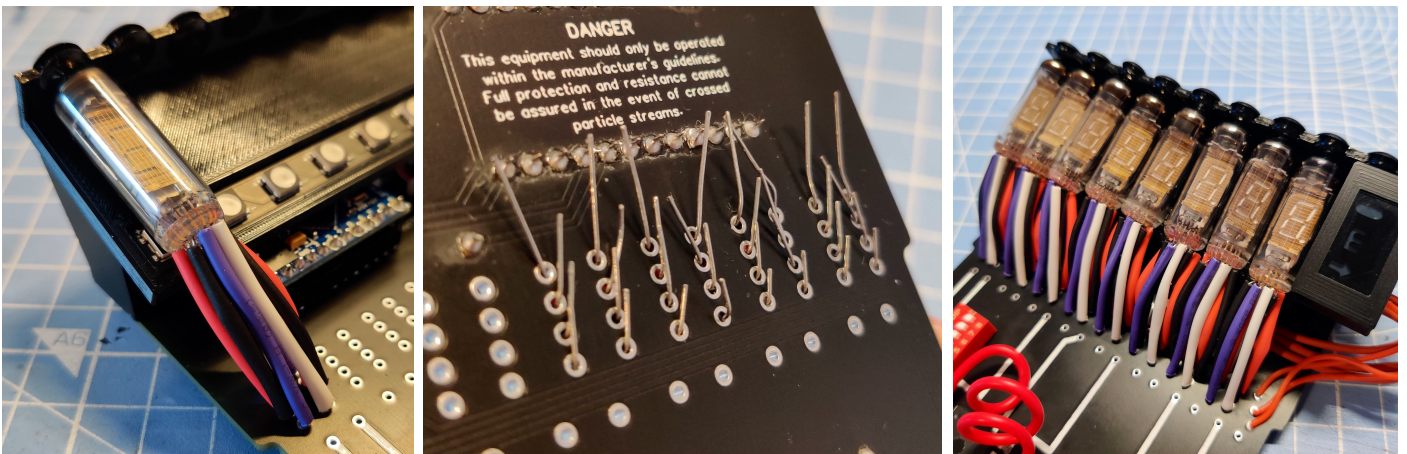


- From the **purple**, **black**, **red** and **white** lengths of heat shrink tubing, cut the following sections:
 - 2x 26mm **Red**; 2x 27mm **Black**; 1x 30mm **White**; 1x 30mm **Purple**; 1x 22mm **White**; 1x 22mm **Purple**
- Place a section of tubing over a wire or the end of a small screwdriver, and use a heat source to shrink it down. You can use a heat gun or lighter for this. If using a naked flame, be careful the tubing does not touch it, otherwise it will burn. Hold the lighter directly underneath and at a distance and apply even heat until the tubing is reduced to half its original size. Repeat for the remaining seven sections of tubing.
- With the display digit of one VFD tube facing you, arrange the eight wires into pairs from front to back.
- Slide the **longest** 30mm pieces of heat-shrink tubing over the front two wires. Place the **purple** one on the left and the **white** on the right as shown above.
- For the second two wires, repeat the process with the 27mm **black** tubing. For the third two strands, use the 26mm **red** tubing, and for the final two use the shorter 22mm tubing (alternate the **purple** and **white** so they are opposite to those at the front). The completed VFD tube should look like the last photo above.
- Repeat the process for the other seven VHD tubes.

10. MOUNT THE VFD TUBES



- Find the nine rubber grommets and press fit them into the notches in the nixie shelf.
- To attach the first tube to the motherboard, feed the **back two purple** and **white** wires into the top two holes of the first cluster of eight holes as shown in the second photo above. Once fully inserted, bend the wires over on the back of the board to prevent them from slipping back out. As you do so, push the top of the glass tube into the first rubber grommet - this will help keep the tube in place as you insert the other wires.
- Now hold the board upside down in your hand and guide the **red** wires into the next two holes, followed by the **black** wires into the next two, and finally the longer **purple** and **white** wires into the front two holes.



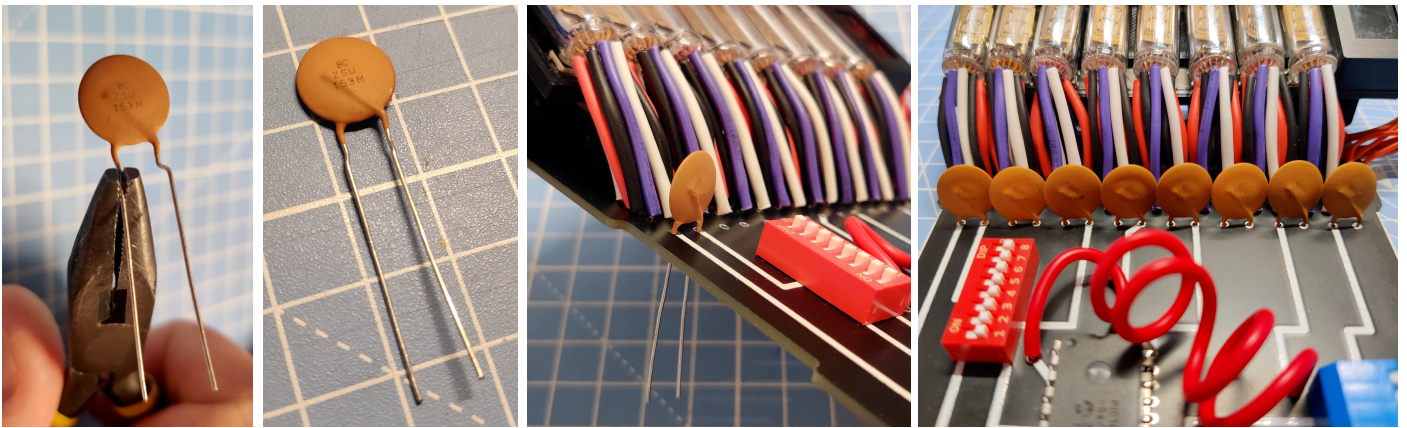
- Once all of the wires are in place, gently rotate the tube until the digit appears straight, facing directly upwards.
- You can now choose to either solder (or hot glue) the wires into place now, or attach the rest of the tubes first and secure them all in one go. If opting for the latter, bend the wires over on the back of the board to prevent them from slipping back out (as shown in the second photo above).
- Repeat the process until all eight VFD tubes are mounted on the shelf.
- Secure the wires if you haven't already. Cut them short and solder as usual, or keep them bent over and apply a generous amount of hot glue over the ends of the wires to keep them in place.



If any of the tubes are not staying in place on the shelf, slide the relevant grommet out of the notch and apply a drop of superglue inside the groove. Replace the grommet and allow the glue to set. Re-insert the top of the glass tube into the grommet to keep it firmly in position.

11. ATTACH THE DISC CAPACITORS

We've reached the home straight! All the fiddly stuff is finally out the way. Phew! Just a couple more things...



- Before adding the eight orange disc capacitors, we need to remove the kink in their wires. You can do this by bending the wires with a pair of pliers until they appear straight. This does not need to be neat - just enough so the wires slide through the holes unobstructed.
- Add each disc capacitor through the remaining holes in front of the VHD tube wires. Finish off by shortening the wires and soldering (or hot gluing) into place in the usual way.



To help attach the disc capacitors and keep them lined up, you can push the body of each capacitor back so they rest on the tube wires. Use some tape to hold them in position as you flip the board over and solder or glue to the wires to the back.

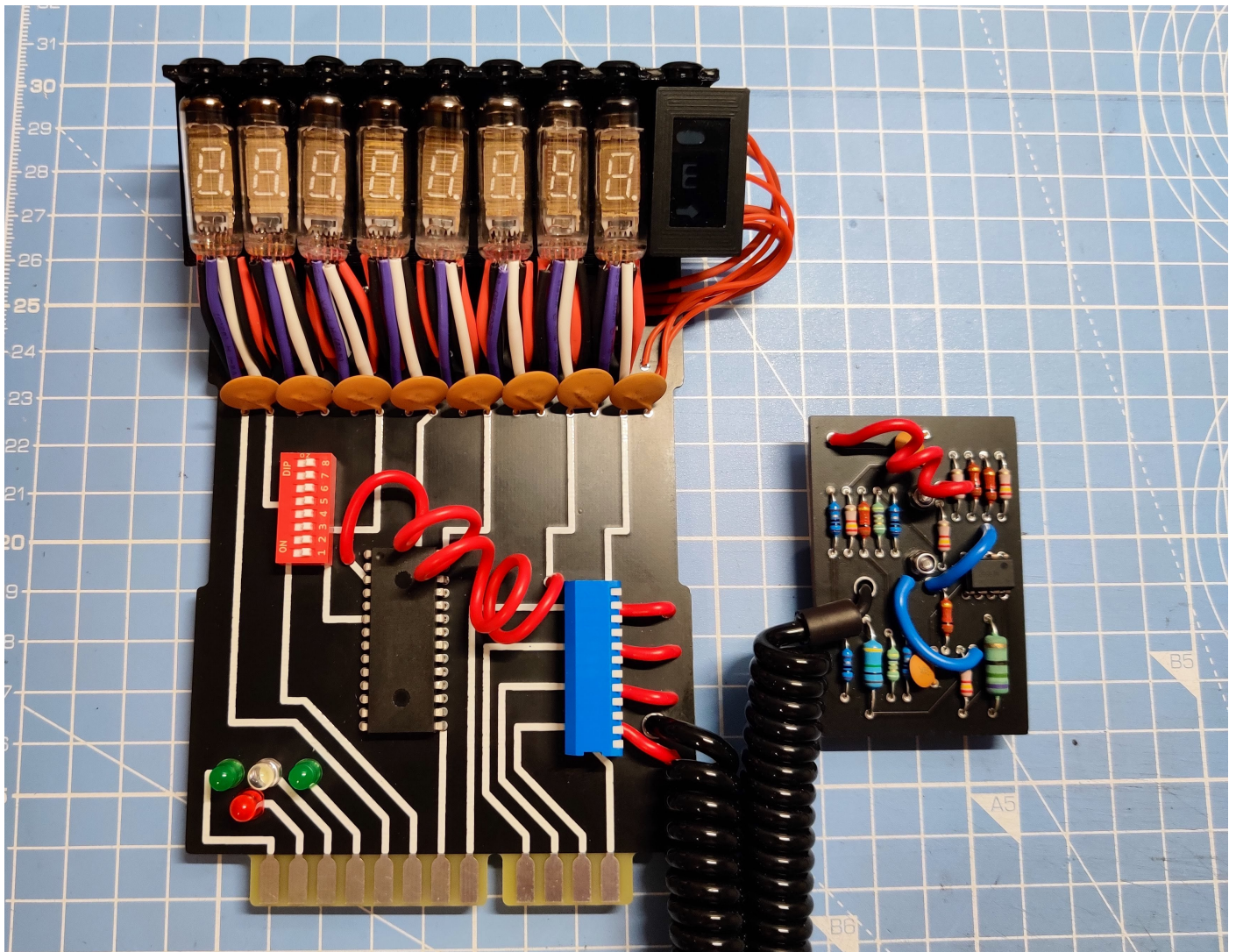
12. LINK THE DAUGHTERBOARD



- We're nearly there! Dust off the daughterboard and thread the loose end of the coiled cable through the large hole in the bottom right edge of the motherboard.
- The cable should be rigid enough to remain in place, yet easy to detach whenever you need.

GIZMO 8910 COMPLETE!

Congratulations!!! You've done it! Your GIZMO 8910 is finished! Continue to the next section for the full operating instructions...



OPERATING INSTRUCTIONS

Using the Gizmo lighting effects is simple. Once you have connected a 9V battery to the snap, flick the toggle switch to power on. The LEDs behind the VFD tubes (plus one inside the Error Box) will immediately display a pattern of light which will loop continuously. The four coloured lights mounted to the bottom of the motherboard will first display a startup sequence before remaining on. The **RED** and **WHITE** lights will then flash accordingly whenever the corresponding button is pressed on the control panel:

Pressing the **WHITE** button will cycle through the following patterns:

1. **“CHASE”** — A fast chasing pattern from left to right across the shelf in the currently selected colour, followed by a quick flash of the Error Box in red.
2. **“WIPE”** — Each tube is illuminated in the currently selected colour - one-by-one from left to right and immediately turned off one-by-one in the same way. The Error Box lights up in red for a full second.
3. **“BOUNCE”** — Each tube is illuminated in the currently selected colour - one-by-one from left to right and then from right to left. This is looped to simulate a bouncing motion. The Error Box illuminates in red quickly after every five cycles.
4. **“PULSE”** — A pulsating fade-in and fade-out of all tubes and the Error Box together in the currently selected colour.
5. **“RANDOM PULSE”** — A pulsating fade-in and fade-out a single tube in a random sequence using the currently selected colour. The Error Box remains on in red.
6. **“SPARKLE”** — Individual tubes flash quickly at random in the currently selected colour. The Error Box remains on in red.
7. **“STEADY ON”** — All tubes are turned on at full brightness in the currently selected color. The Error Box remains red. There is no motion effect in this mode.
8. **“RAINBOW”** — All nine LEDs display a continuously changing pattern in a full spectrum of colours. This mode overrides the currently selected colour.

Pressing the **RED** button will cycle through all of the available colours. Changing the colour during a running pattern will restart that pattern. The pre-programmed colours are:

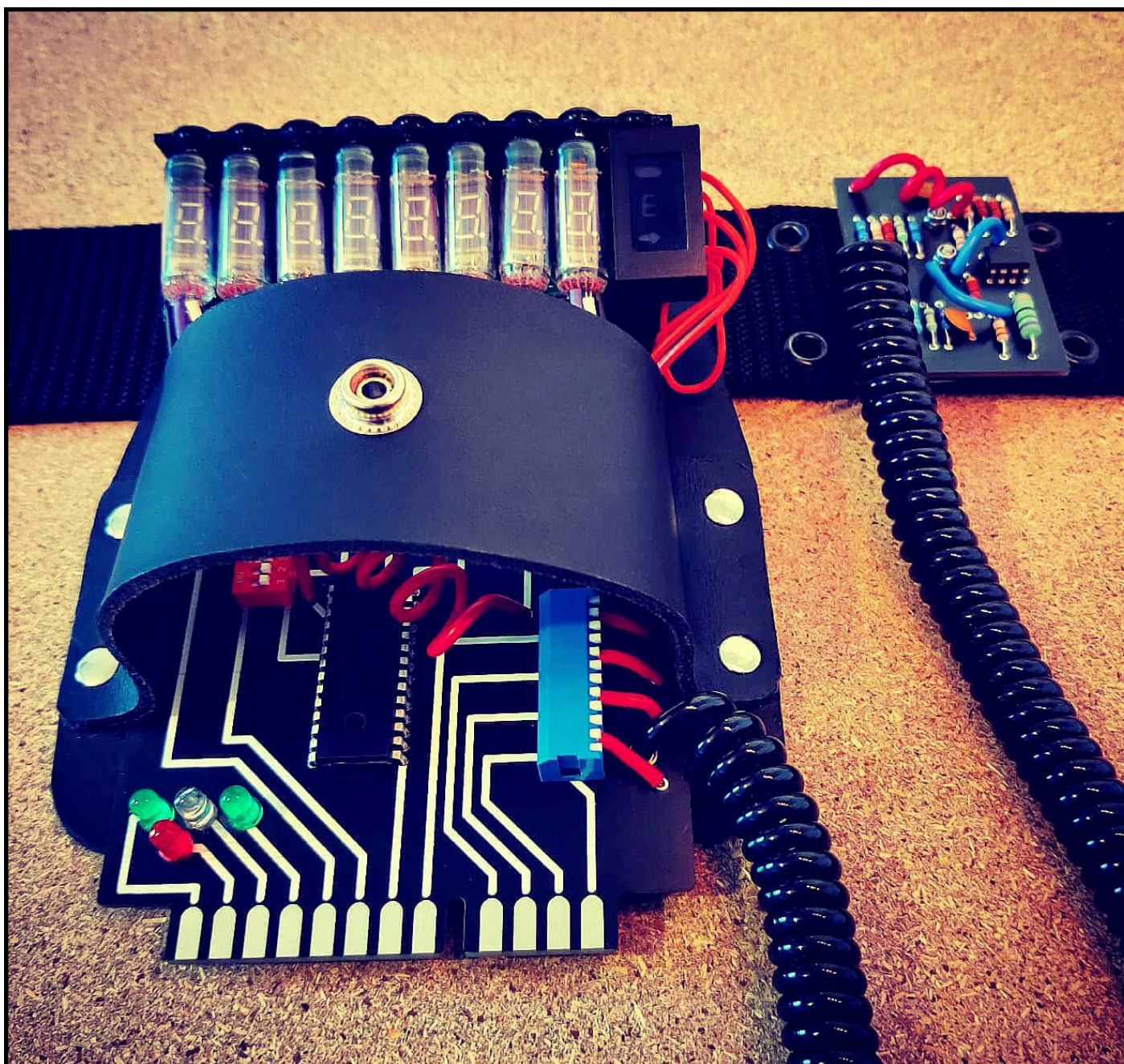
- | | | |
|------------------|---------------------|------------------|
| 1. RED | 4. GREEN | 7. PURPLE |
| 2. ORANGE | 5. TURQUOISE | 8. PINK |
| 3. YELLOW | 6. BLUE | 9. WHITE |

To power off the Gizmo, flick the toggle back to its original position. The microcontroller has been programmed to remember your last selections, so whatever pattern and colour you used previously will illuminate immediately when powering back on.



IMPORTANT: Make sure you are using a fresh battery with your Gizmo. Depleted or semi-depleted batteries may cause the lighting effects to behave erratically or not display at all.

THANK YOU SO MUCH FOR PURCHASING THIS KIT. WE HOPE YOU HAVE ENJOYED THE BUILD AND THAT IT BRINGS YOU MANY HAPPY YEARS OF PARANORMAL ELIMINATION!



Kit designed and assembled in London
by David Tremain, 2022

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