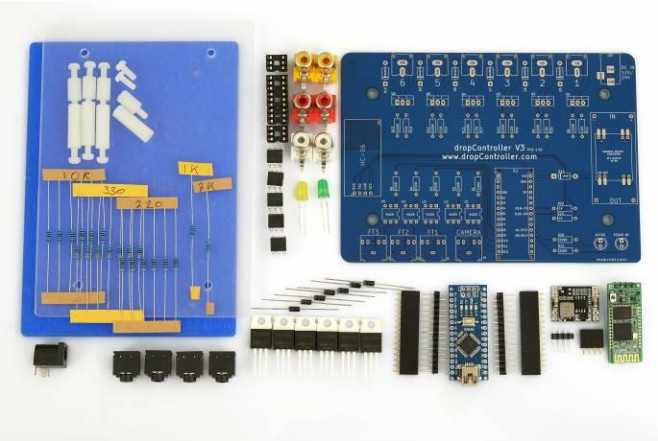
dropControllerV3 KIT Assembly Guide

This is a basic guide to assembling the dropControllerV3 Kit.



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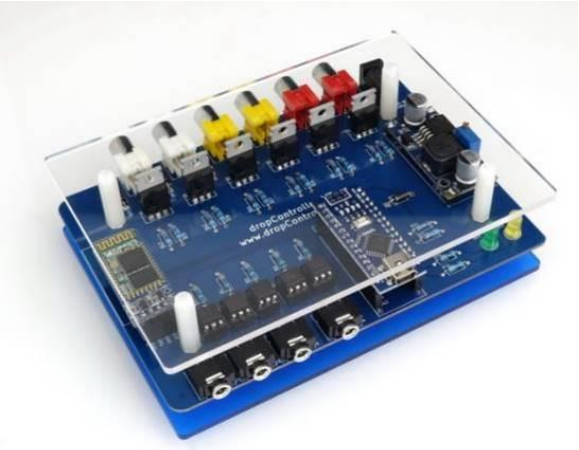


to this

Tools Required

A soldering Iron + solder.
Wire cutters/snips (the small kind not the large razor wire cutting kind).
A desoldering pump/solder wick, just in case.
Tweezers will come in handy.

Optional
A blob of Blutak (useful in many circumstances).
A stand or helping hands device maybe helpful.
Solder flux (if you are a soldering purist).
A multimetre to double check connections and shorts.

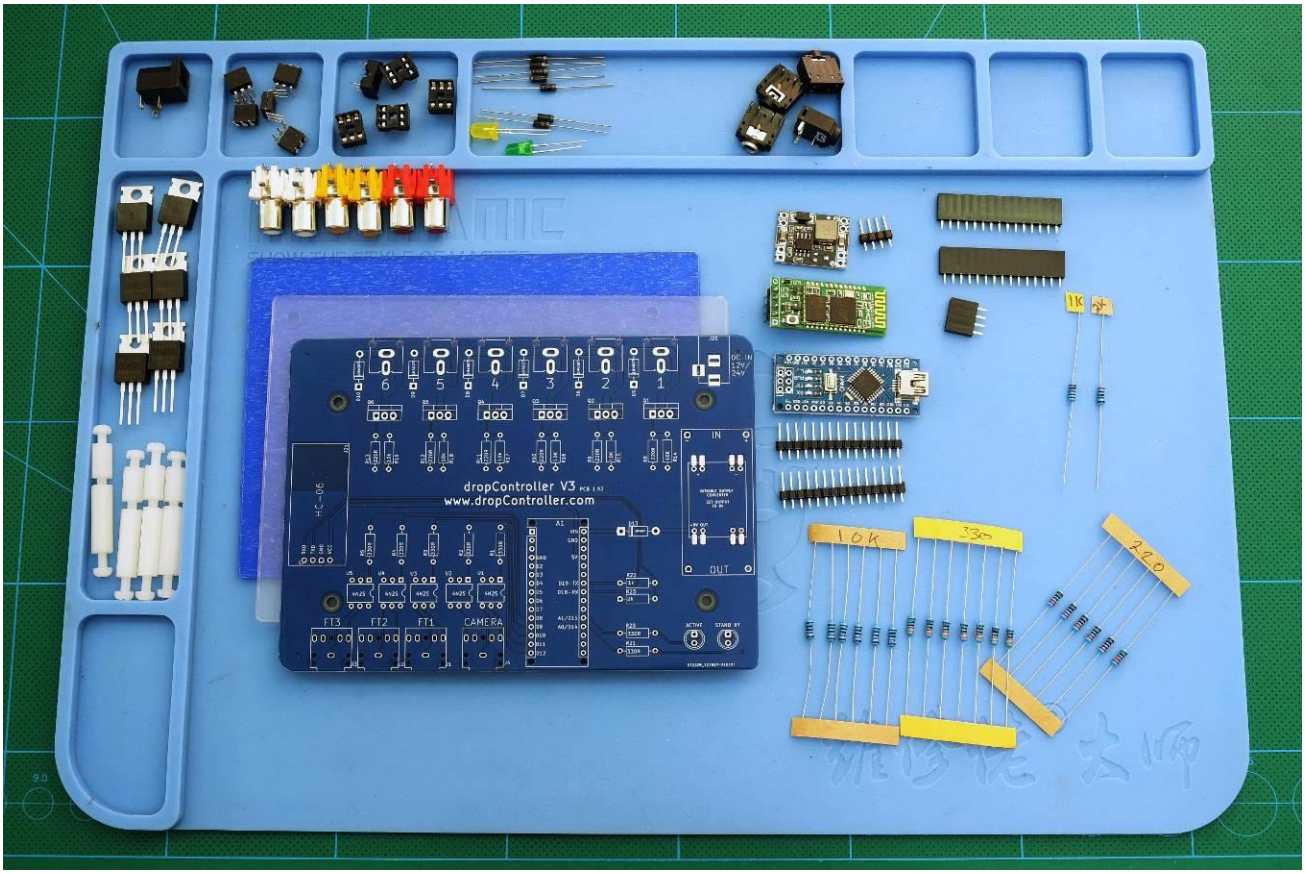
Skills Required

The ability to hold a soldering iron by the cold end and not poke yourself in the eye with the hot end.

Some soldering experience is required and I do not recommend this as a first soldering project.

Initial Preparation

Before doing anything else, lay out the parts and check you have everything. There is a parts list at the end of this guide.



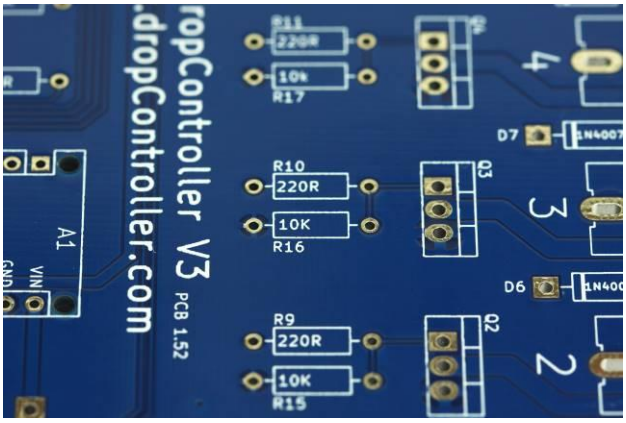
Parts may change without notice. For example the optocouplers may be white.

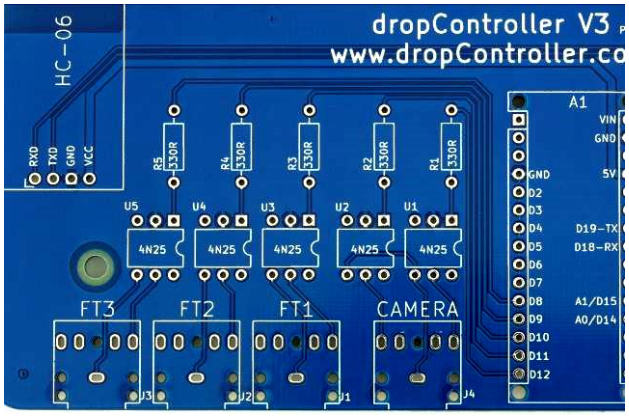
When soldering the PCB it is easiest if you start with the flattest or lowest profile components and work up to the tallest. This will allow you to place the PCB upside down and use the worktop to hold components in place while soldering. In order this is:

- Resistors
- Diodes
- 6 pin DIL sockets
- 3.5 audio sockets
- Barrel Jack
- LEDs
- Phono/RCA sockets
- Bluetooth module 4 pin header
- Buck Converter
- Arduino 15 pin headers (this is a special case)
- Mosfets

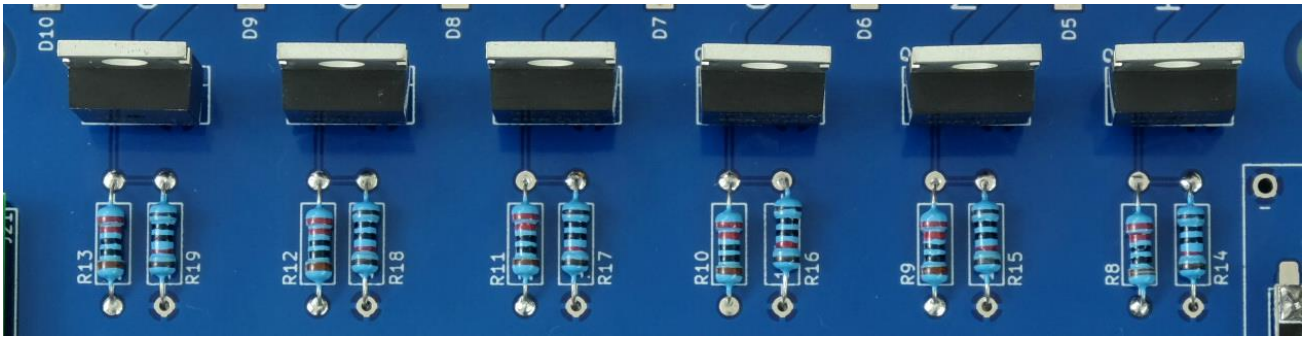
Parts of this guide have been updated using the latest version of the PCB

The components are clearly marked on the PCB but care is still required as some components can be put the wrong way around. If you are not a soldering ninja take your time and double check as you go.





To help make assembly a little easier extra space has been added to the PCB layout. There are some tight spaces though; such as the pins on the Arduino and the IC sockets.

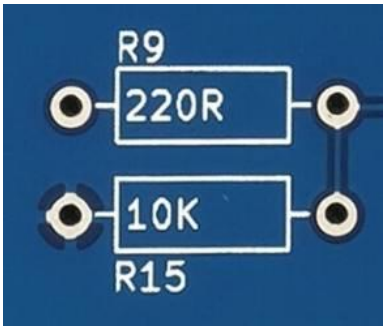


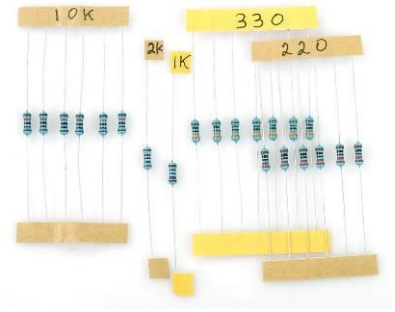
I like to try and make my projects as clean and tidy looking as possible. I have a thing for getting things lined up and straight and throughout this guide encourage you to do the same. However, if this is not you and you don't really care what the end project looks like as long as it works then a good portion of this guide can be ignored. Just make sure you get the right parts in the right holes the right way around.

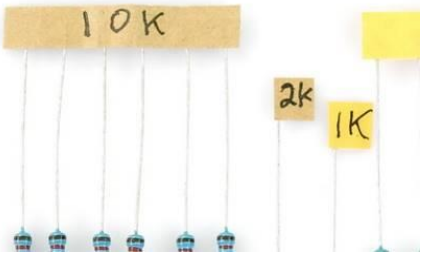
Some steps, like trimming the pins, aren't mentioned at every stage. If you forget you will soon find the untrimmed pins get in the way as a reminder.

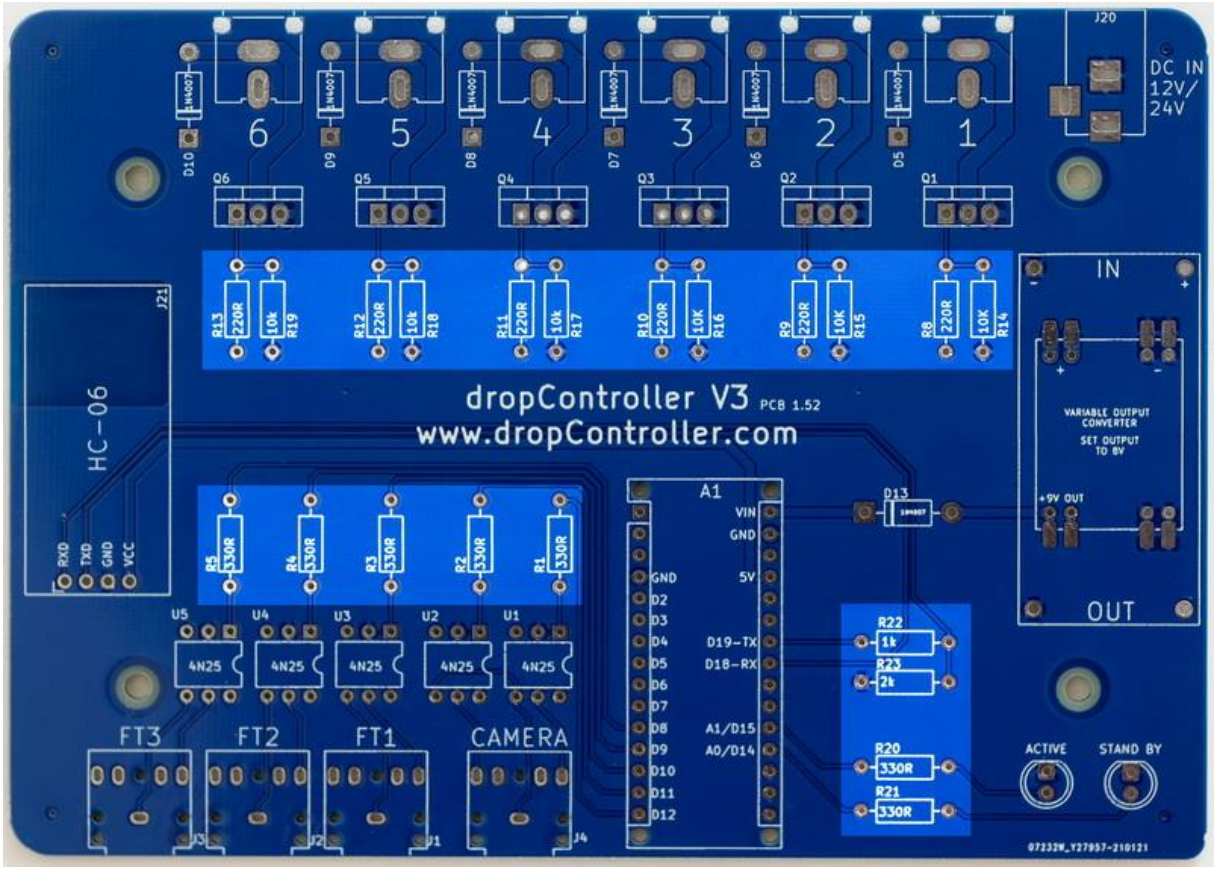
Resistors

The resistor values are marked on the PCB and also on the tabs holding the resistors together. There is also a colour code guide at the end.





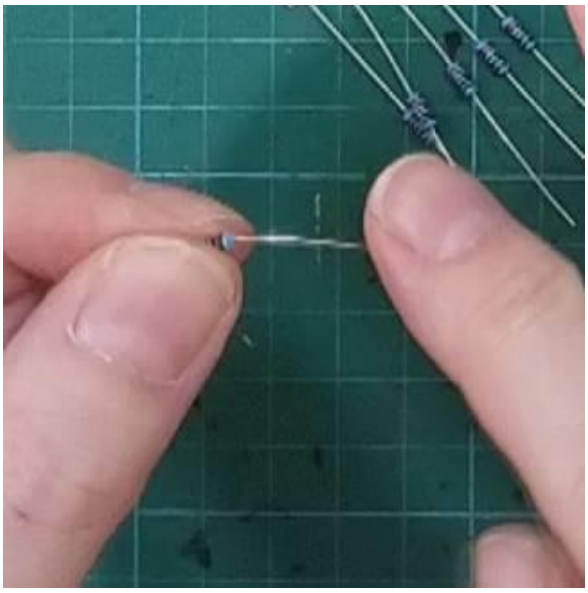


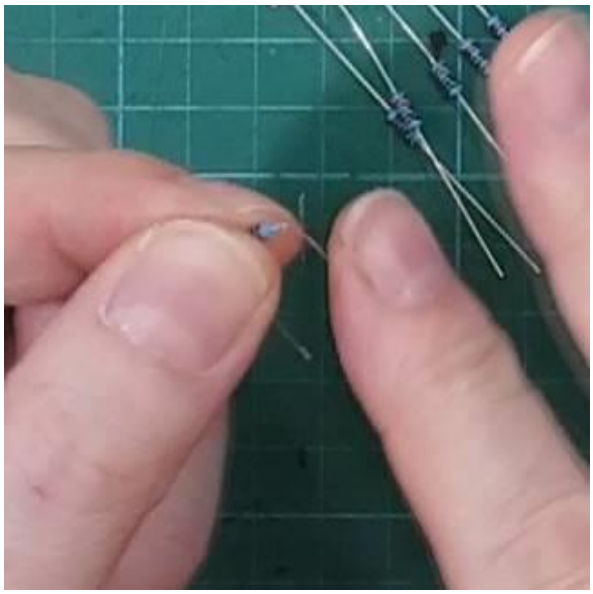


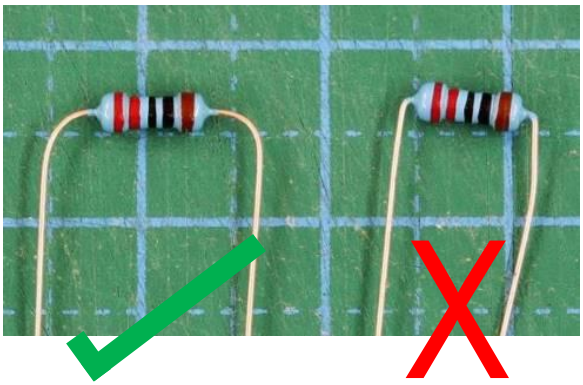
If you have a multimeter it is worth double checking the resistor values before soldering.

Bending the pins

When bending the pins on the resistors (and also the diodes) hold the resistor body and bend the pin from the pin end. This will give the bend a nice round shape and the resistor will fit the PCB better.

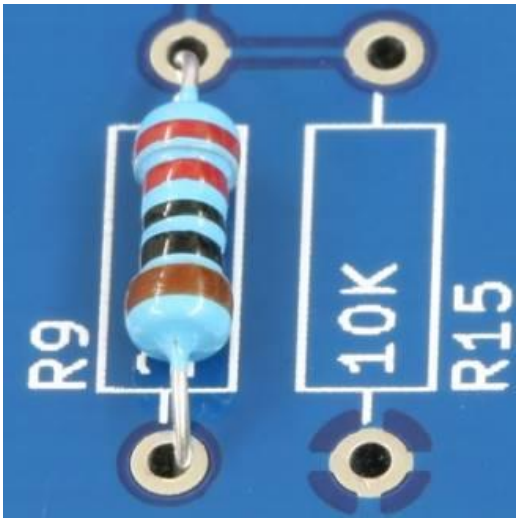




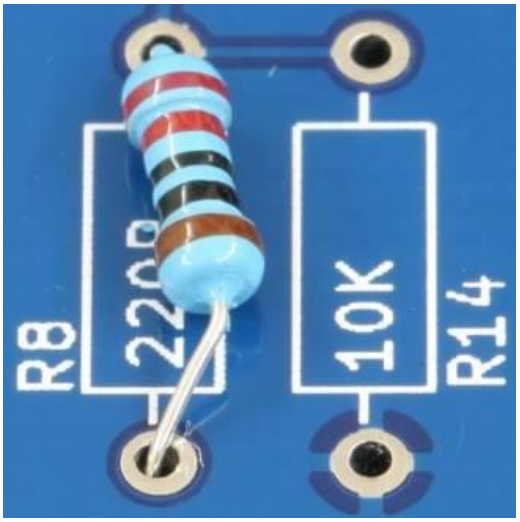


If you bend the pin too close to the resistor body you will find it doesn't fit the holes on the PCB very well, the resistor will want to sit at one end and will look messy.

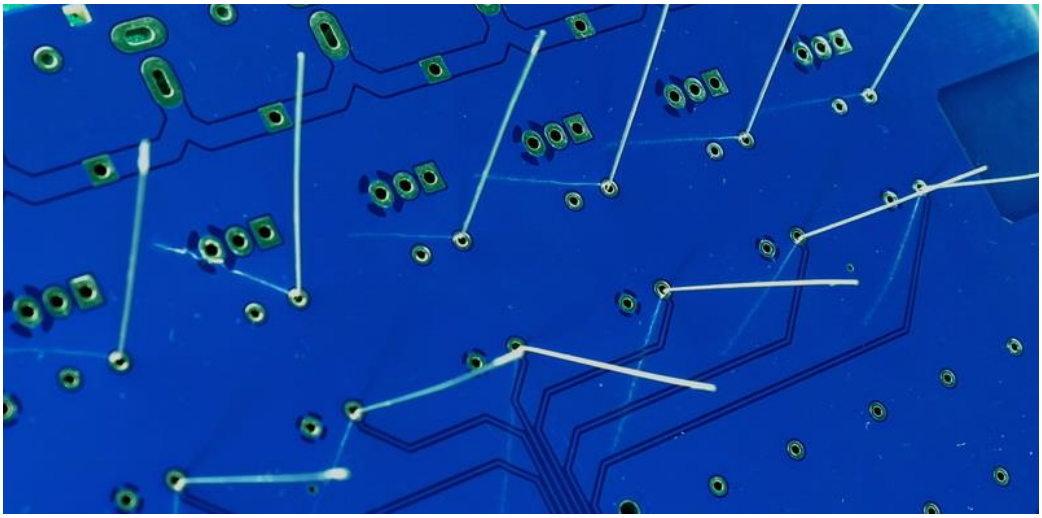
Bend from the end to give a nice curve and the resistor will sit better, and a nice looking dropController is a better dropController.



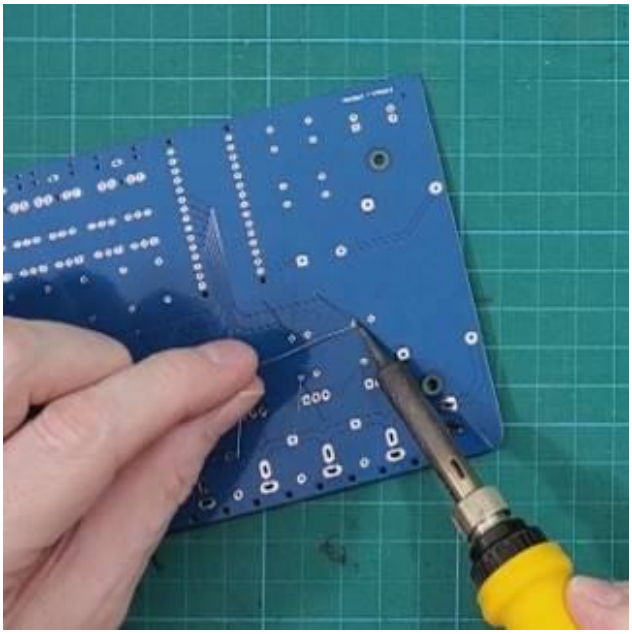
When the pins have rounded corners the resistor sits in the middle where it belongs

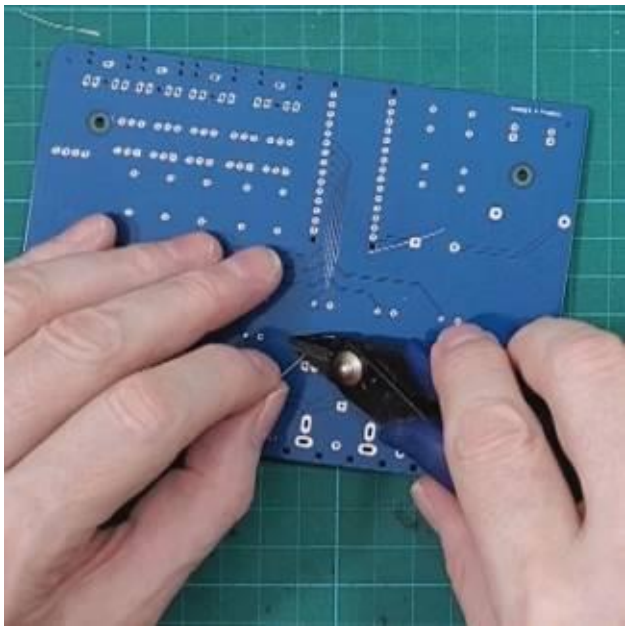


When the pins are bent sharply the resistor will want to sit at one end on top of a hole and will not lie flat.



When inserting the resistors, separating the pins slightly helps keep the resistors in place when flipping the board upside-down.



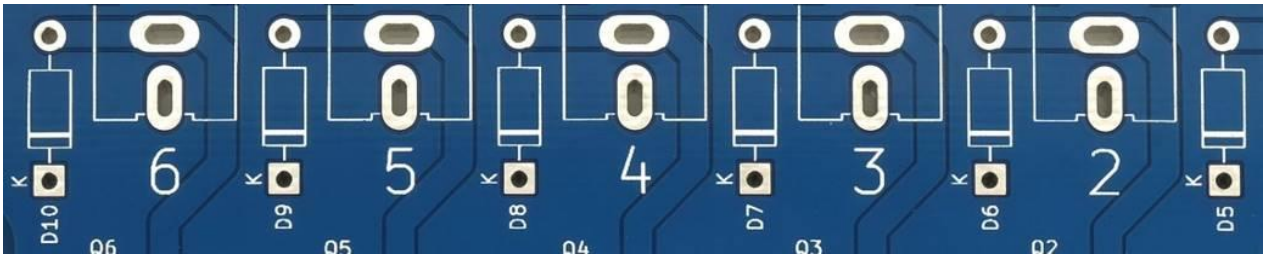


Solder then trim.

Note: as this guide progresses I include less detail, such as trimming, and try to keep the patronizing to a minimum.

A nice touch is to place all the resistors in the same orientation so the coloured bands line up.

Diodes

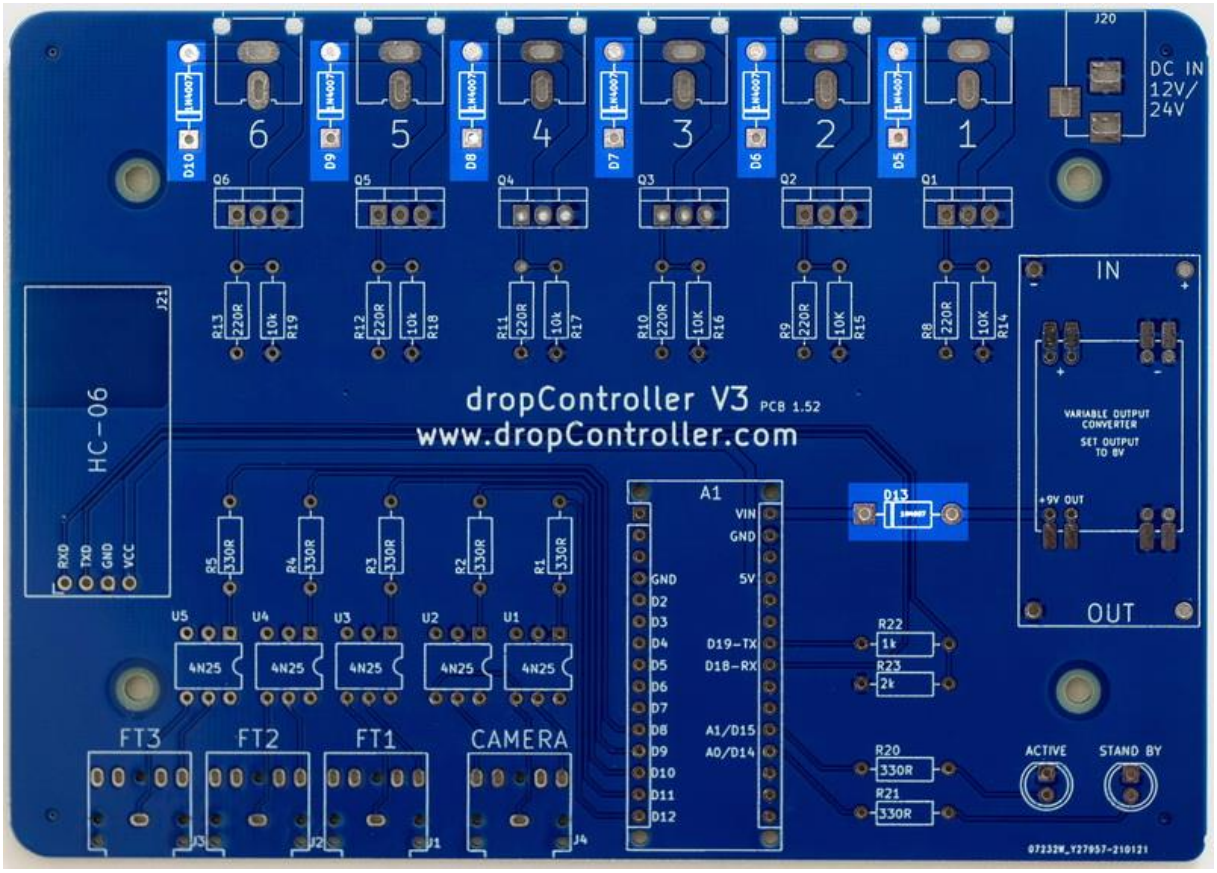


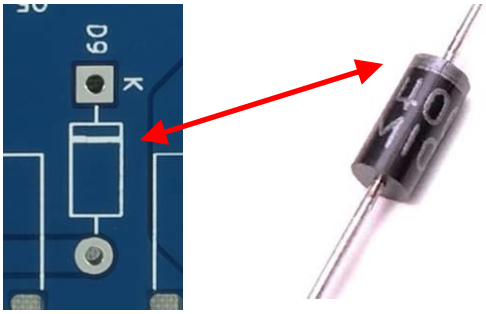
After completing the resistors move on to the diodes. Diodes are electrical one way devices (not really true but close enough) and if you get them the wrong way round the resultant explosion will destroy the planet*.

*Not quite the whole planet just the tiny part that is the dropController**. Look up flyback diodes if you want to know more.

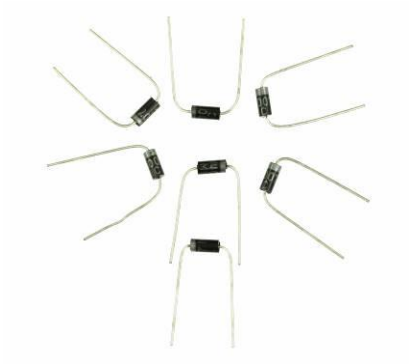
** Sorry. No actual explosion and no instant dropController death. When a solenoid valve turns off it can produce a large spike of electricity. The diodes stop this spike feeding back to the Arduino.

Press the red button to know more, or, Google what happens when a magnetic field collapses.



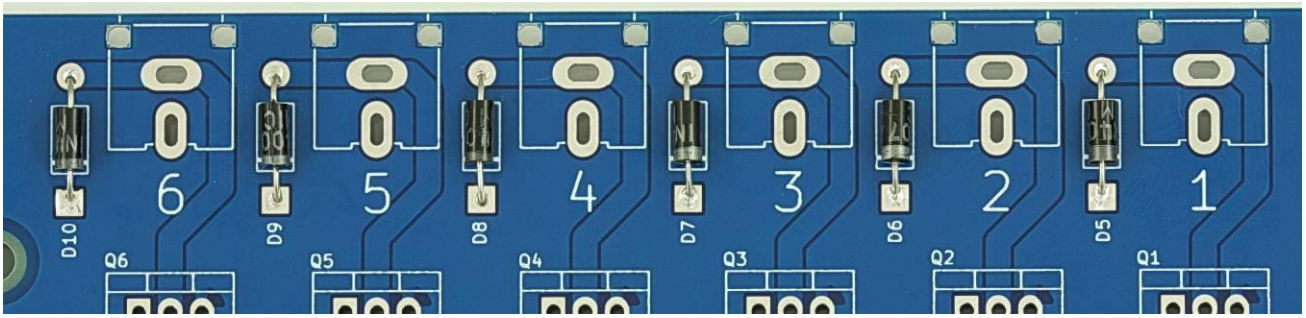


On the diode there is a white (it's actually grey or silver) line at one end, align this with the line on the PCB.



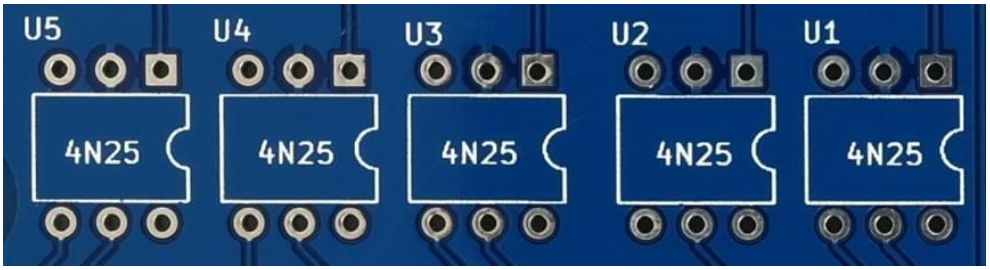
As with the resistors, bend the legs from the end of the leg so you get a nice round corner.

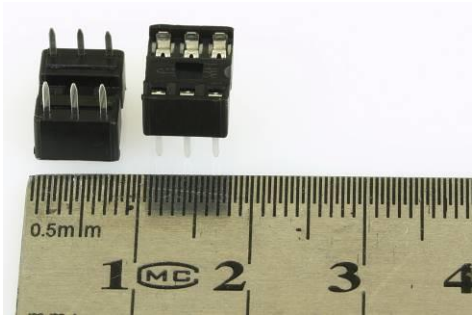
Don't forget the diode between the Arduino and the buck converter.



6 Pin DIL Sockets

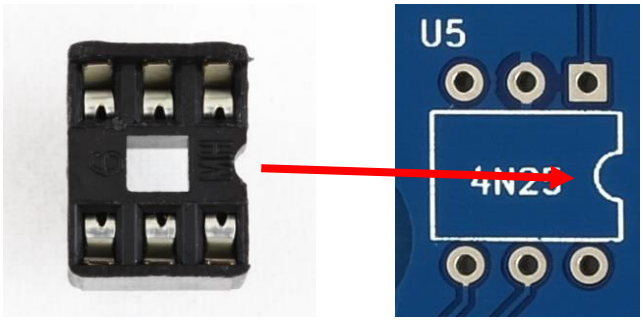
Next up are the sockets that hold the 4N25s/4N35s.

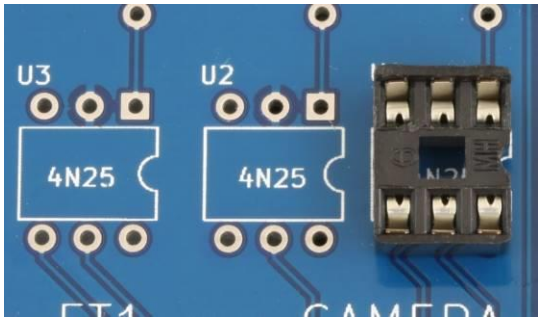


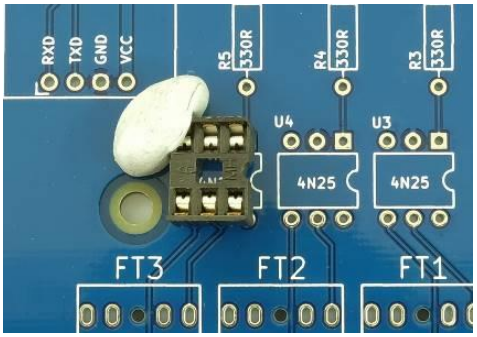


The pins are now starting to get closer together. If you are not that experienced with soldering just take your time and remember to heat the pin as well as the solder. We are not talking white hot here! About half a second contact with the soldering iron should be enough. Solder will flow nicely on a hot pin and recoil in horror from a cold one.

Not critical but follow convention and align the circular cut out in the socket with the cutout is the outline on the PCB.

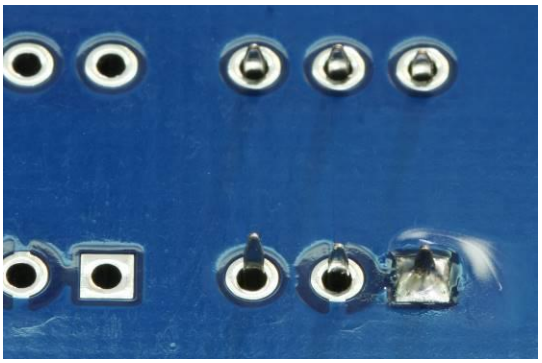




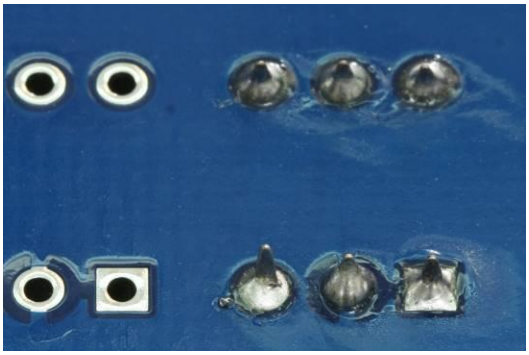


Getting the socket to stay in place when you flip the board over can be finicky. A small blob of Blutak can help.

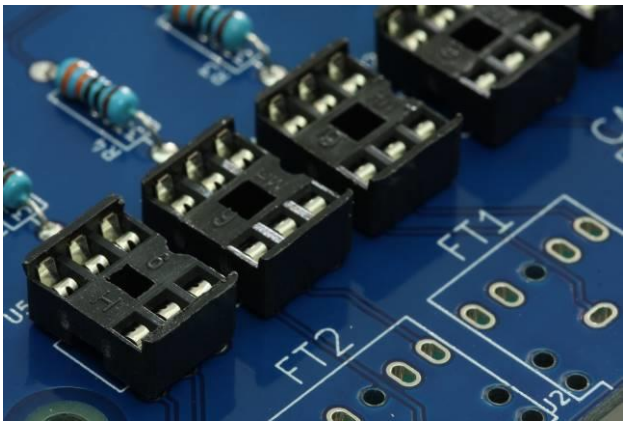
When soldering you want enough solder to hold the pins but not so much that you cause a flood and join all the pins together. Place one socket, flip the board over, solder a corner pin, check the position, and if the socket is still in place, solder the remaining pins.

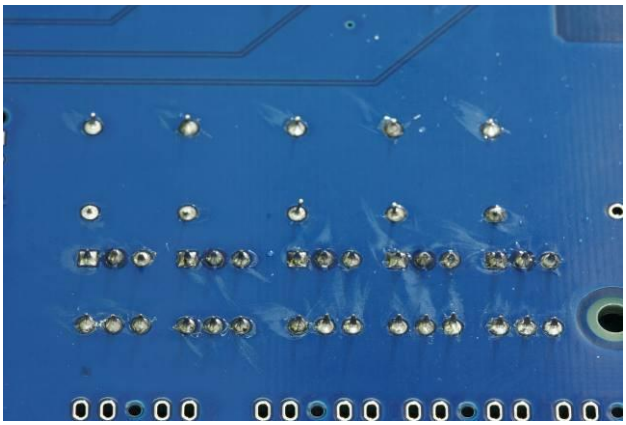


Solder a corner pin first then check the socket hasn't moved before soldering the remaining pins.



Remember you need to keep the pins separate.
If you inadvertently join two pins together, remove the solder and try again.



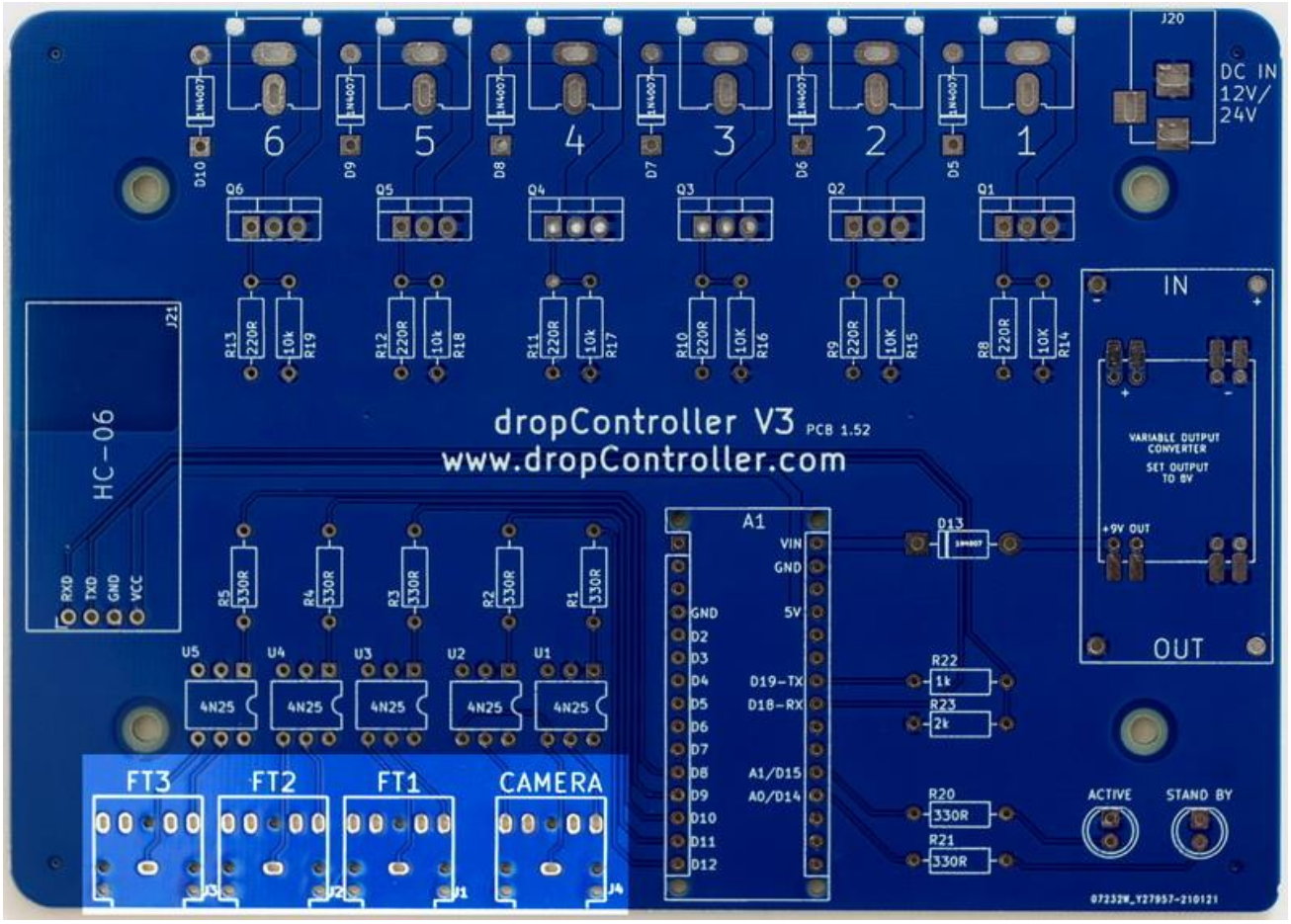


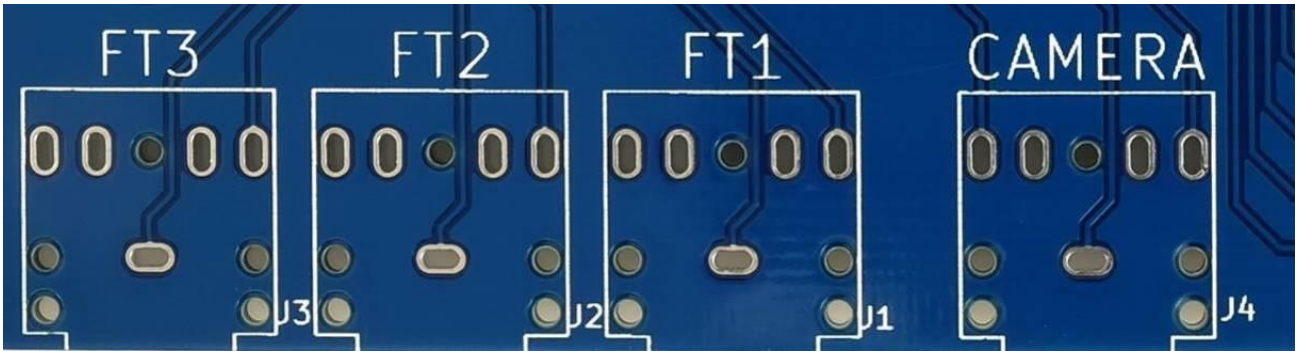
When done check for solder bridges/shorts that join pins together. If you have any shorts, remove the solder and re do. This is important. The camera and flash triggers will not work if pins are connected together.

Don’t put the 4N25/4N35 chips in yet. Leave them until the end.
Don't worry too much about the mess. That can be cleaned later.

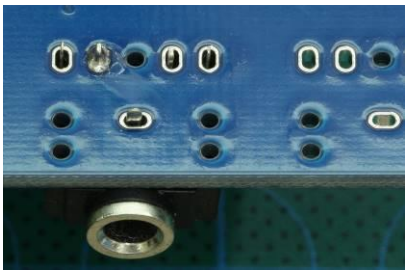
3.5mm Audio Sockets

While you are at the bottom of the PCB add the 3.5mm sockets as well.

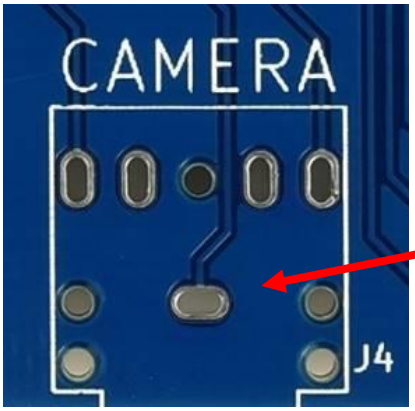




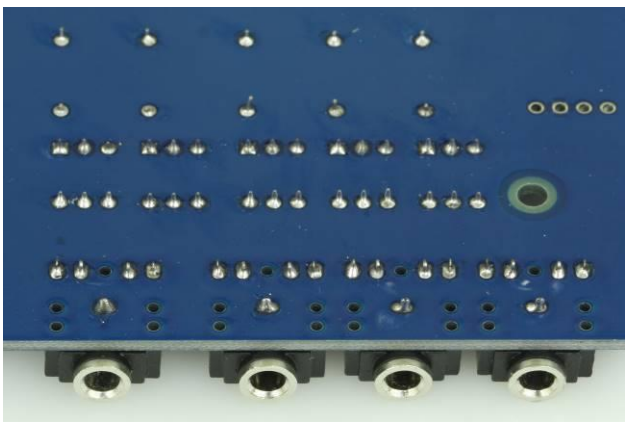
As with the optocoupler sockets, start by soldering one pin, check the position, then solder the other pins.



Make sure the socket is flush to the PCB. The pins should be fully through the PCB and the small tabs on the bottom of the sockets should be in the 4 holes.



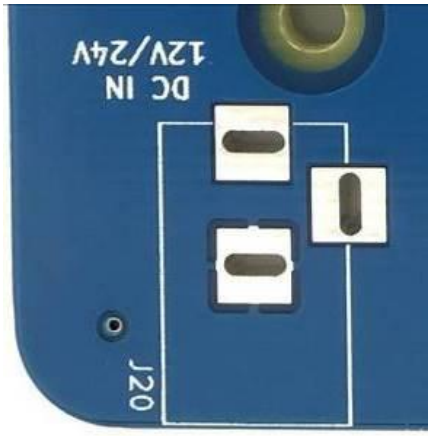
Add a little extra solder to the ground pin



Double check that pins are not joined together.

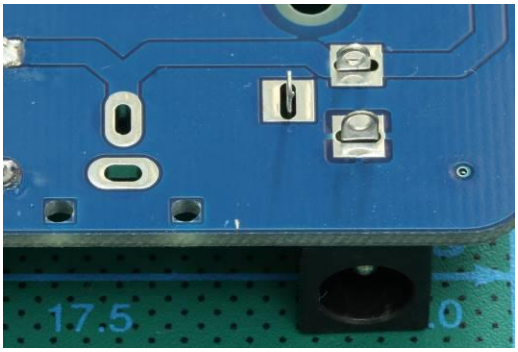
Barrel Jack

Spin the board round and add the barrel jack

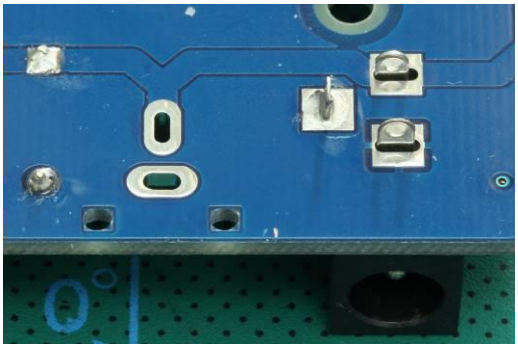


Don’t be shy with the solder here. The barrel jack will have stress from plugging in and pulling out the power supply plug so add a bit more solder.

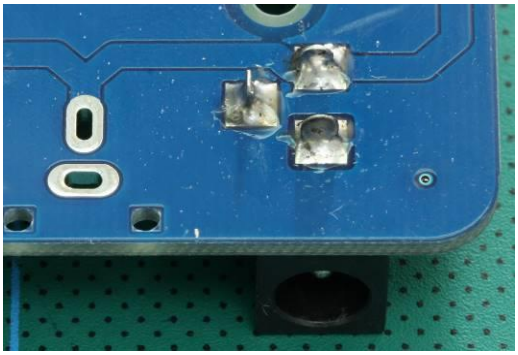
Get the pads and pins hot before adding solder. You will find the solder flows nicely when the contacts are warmer.



Place the barrel jack.



Partially solder one pin and check the socket hasn't moved.

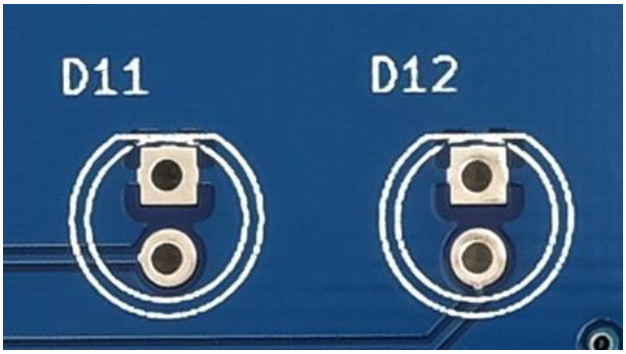


If you are happy with the position solder the remaining pins.

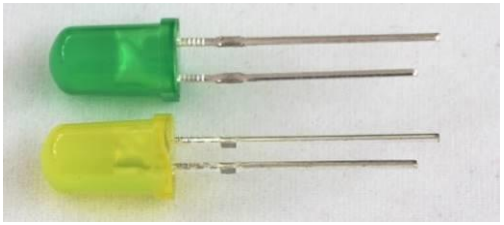
LEDs

Next up. Add the LEDs.

Green is ACTIVE and yellow is STAND BY



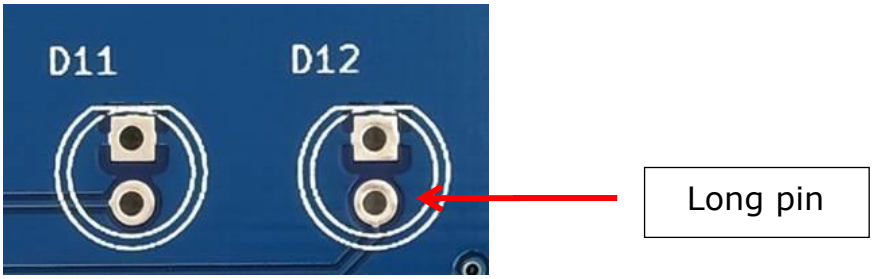
On the previous version D11 is green and D12 is yellow.

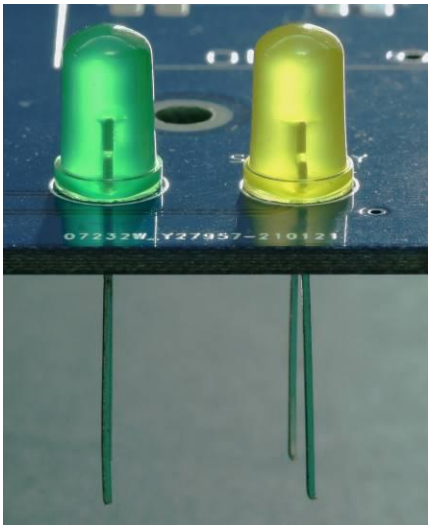


LEDs normally have a long pin and a short pin*. The long pin goes through the circular hole**. After inserting, separate the pins slightly to stop them falling out while you solder them.

*On the LEDs included with the kit, the long pin is the anode and is positive. While this is very common it is not guaranteed to be the same for all LEDs.

*** Hold on. Both holes are circular I hear you say. Er yes they are, it's the circular hole surrounded by the circular pad. Is that better?*



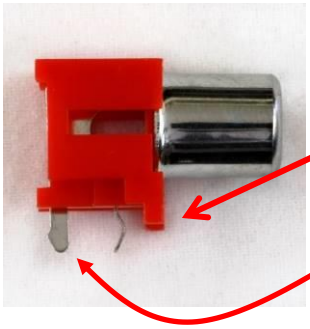


Try to get the LEDS flush to the PCB.

Solder and then trim.

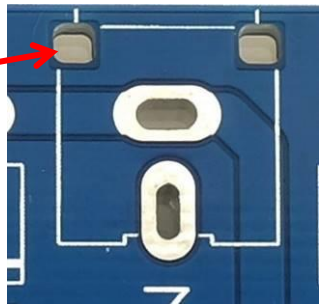
Phono/RCA sockets

Next up are the phono sockets. The sockets have little feet that fit in to the small square holes in the PCB. Aligning the feet and getting the pins all the way in can be a little difficult and to get them to lay flat you may need to jostle the socket a little.

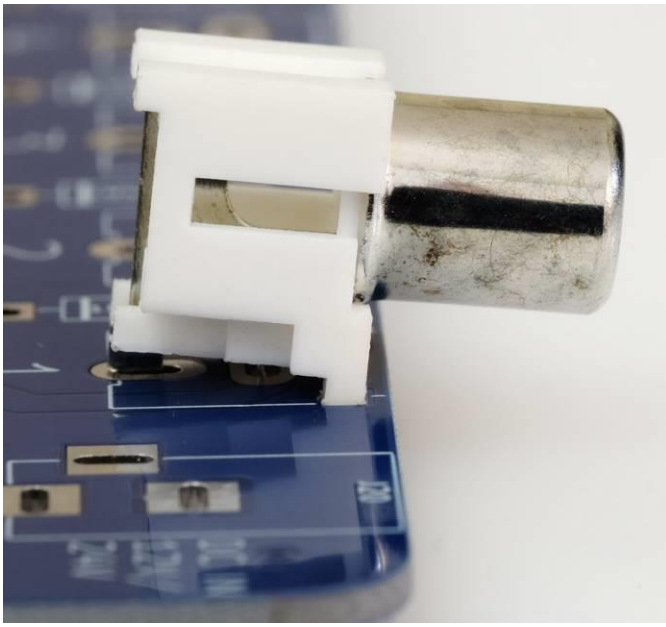


The feet at the front fit in to the holes in the PCB.

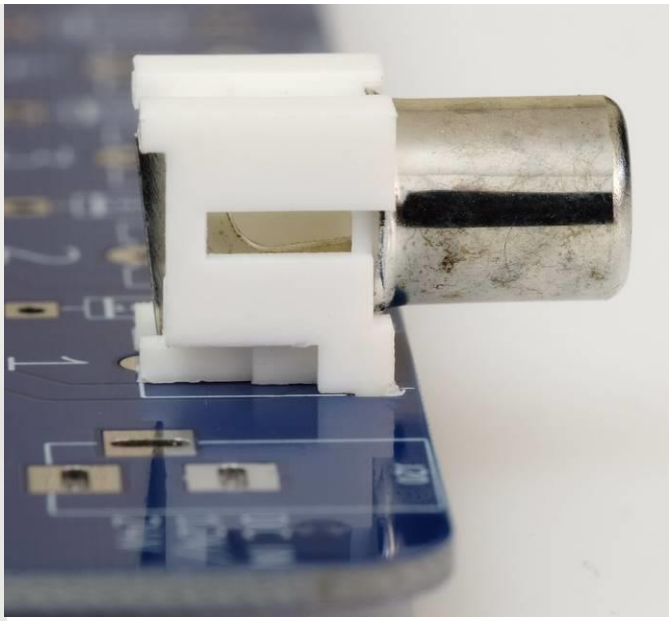
The cut out on the back pin can catch and cause the socket to not sit flat.



Double check that you have the socket in the correct position and that they are flush with the PCB before soldering. The should have a fairly tight fit so once you have them in the right place they should stay put while you solder them.

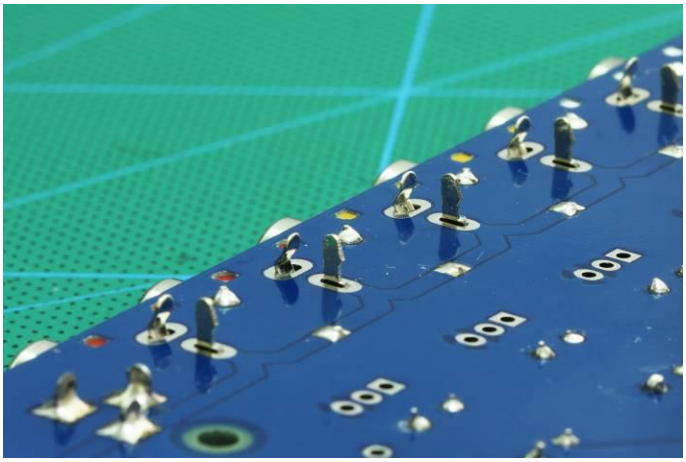


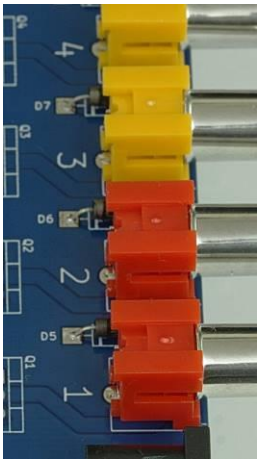
Note quite flat.
The back pin is not all the way through.



This is better

Make sure the rear pin is all the way through.





The phono sockets are another high stress part that benefit from a little more solder*. Warm the pins and pads before adding the solder and let the solder run around the joint. Do not get it that hot that you melt the plastic and set fire to the PCB though.

*Solder shouldn't really be used to add strength but a little bit more doesn't hurt.

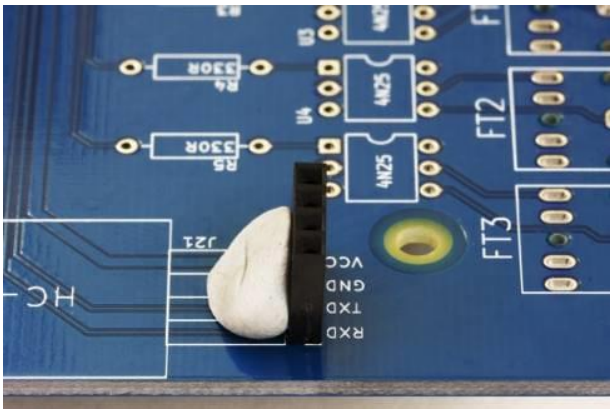
Bluetooth module 4 pin header

You can solder the Bluetooth module directly to the PCB or you can use the small 4 hole header.

When I first started making the dropControllers I used the socket but found the Bluetooth module could come loose in transit so started soldering them directly to the PCB. I now prefer to solder directly to the PCB.

Using the header

This is where the Blutack really shines. Without the Blutack getting the 4 pin header straight and level can be very frustrating.



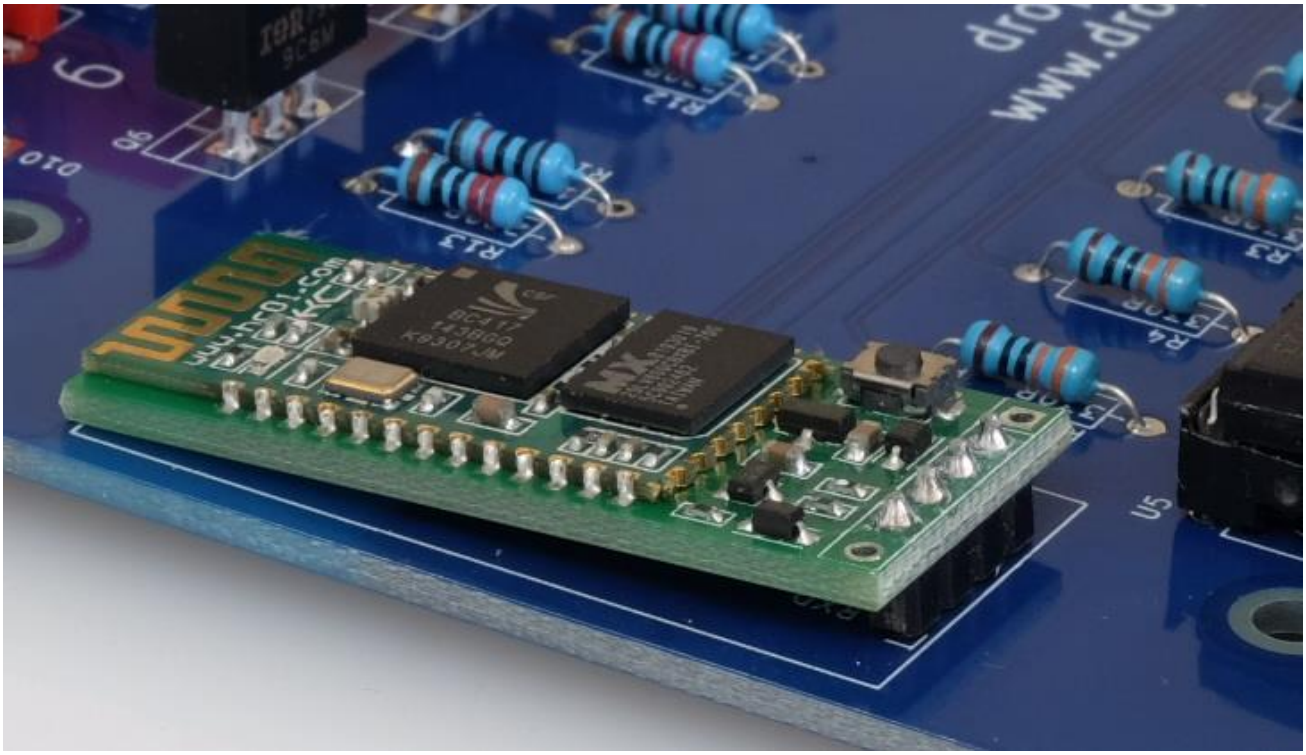
The photo is from an earlier version of the PCB. The layout for the Bluetooth modules has been updated in newer versions.

Place the header and fix it in place with the Blutack
Flip the board over and solder 1 of the end pins
Check that the header hasn't moved and if still straight solder the remaining pins
Remove the Blutack, you may need it later

When using the header, the Bluetooth module may move slightly. This is normal due to how the header works and does net effect the use of the Bluetooth module.

Soldering Directly to the PCB

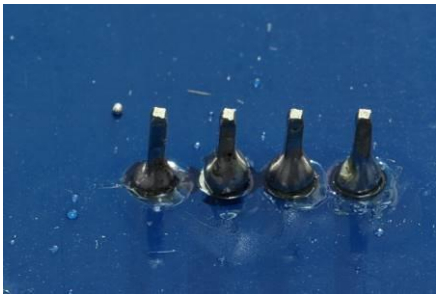
The Bluetooth module can be soldiered directly to the PCB.



The Bluetooth module is at a slight angle so that the bottom of the board is against the PCB.

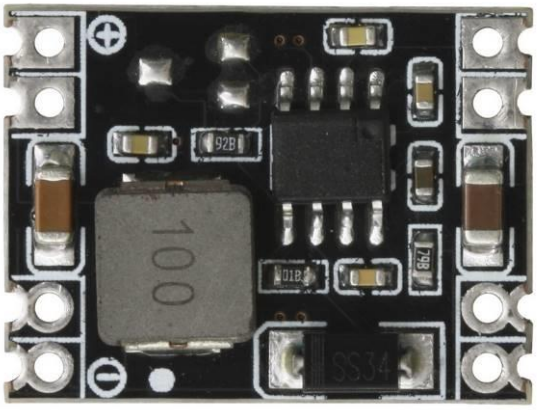
Flip the PCB over, solder one pin on the Bluetooth module, check that it is still straight and then solder the remaining 3 pins.

Not really required but the pins can be trimmed if desired.

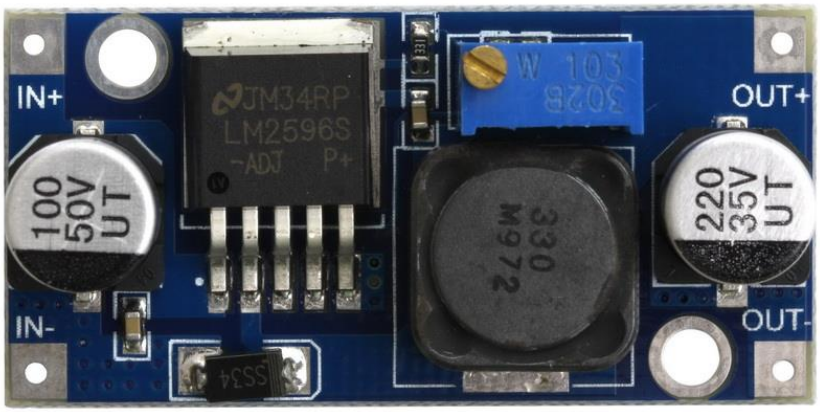


DC-DC Step Down Buck Converter

There are two types of buck converter; a variable voltage version and a fixed 9V output version. Most kits now come with the fixed 9V converter.



Fixed 9v out



Variable output

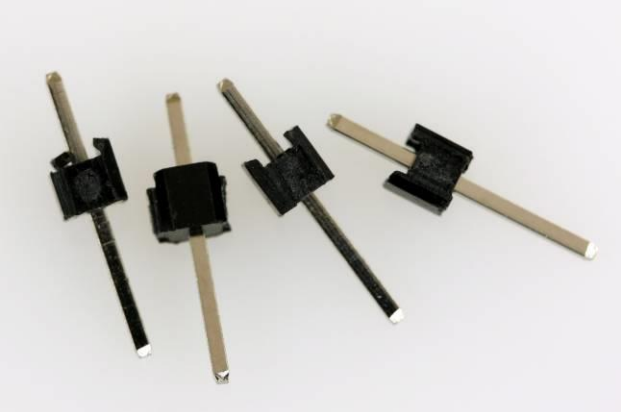
In the kit there is a 4 pin male header, you were probably wondering what this was for, wonder no more, it is to support the buck converter.

9V Fixed Output Buck Converter

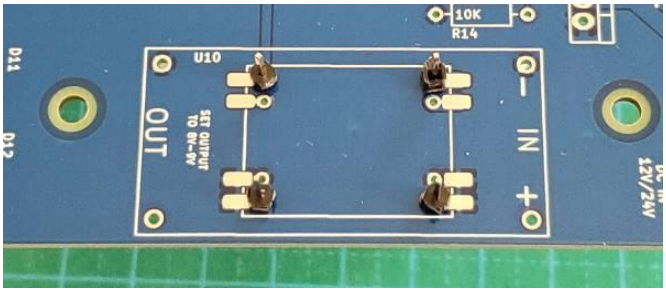
The 9v fixed voltage convertor can be attached using header pins or soldered directly to the PCB SMD style.

Using the header pins

Separate each pin, place a pin in each hole, put the buck converter on top and solder the pins to the buck converter.

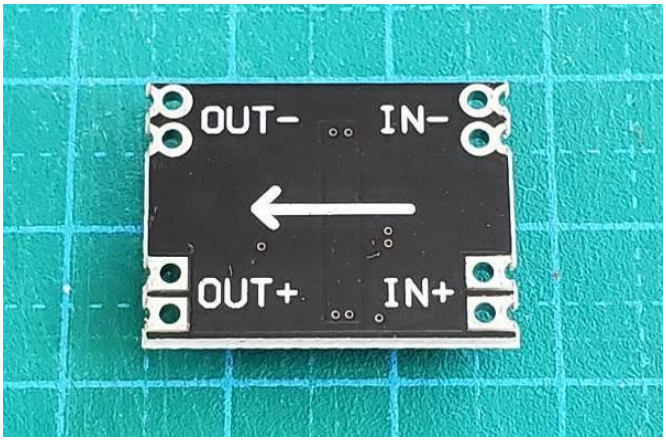


If you use wire cutters to separate the pins the pin(s) will fly off never to be seen again. Unless of course it hits you in the eye in which case it should be easy to find.

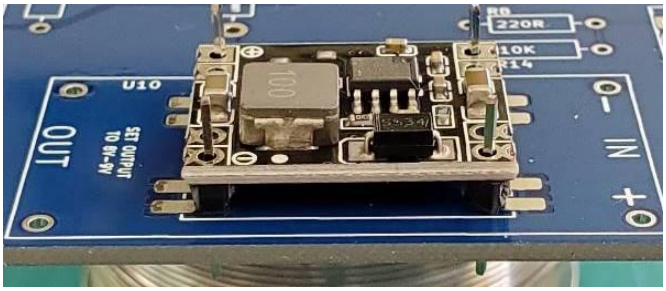


Place the 4 pins in the PCB as shown in the photo.

You may need to raise the PCB away from the work surface.

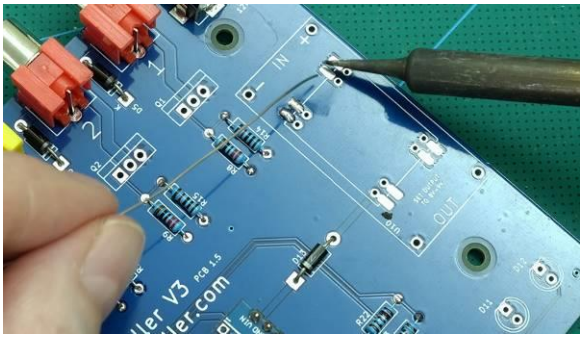


Make sure you have the buck converter in the correct direction

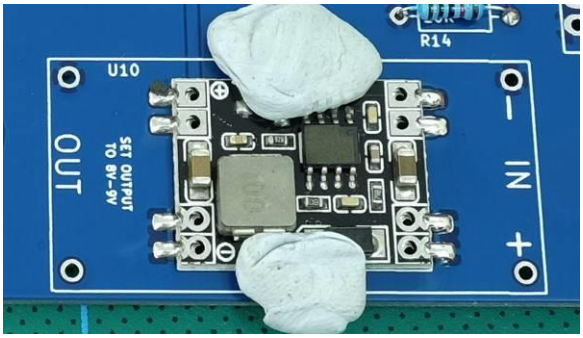


Place the buck converter on the pins
Solder the pins to the buck converter first. Then flip the PCB over and solder the bottom connections.

SMD Style

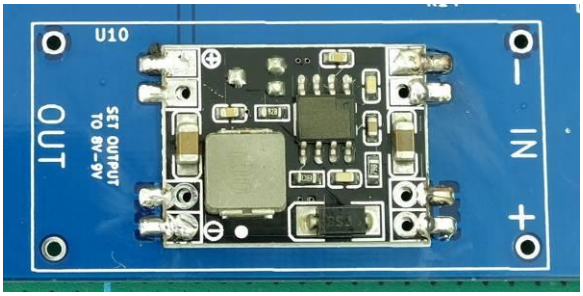


Tin the pads where the converter will go. Just need to add a small amount of solder.



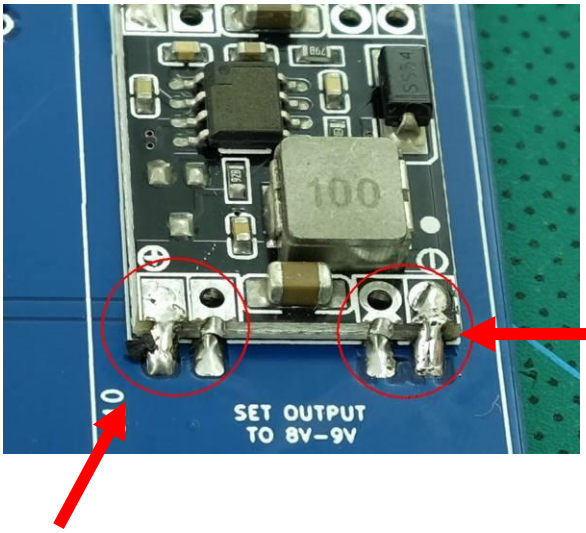
I like to hold the buck converter in place while I attach it.

Make sure you have the convertor the right way around.



Heat up the pad on the PCB and then solder in place by running solder from the pad on the PCB to the pad on the converter.

I probably used a little too much solder here but it is important to get a good connection.



Adjacent pads are the same so they can be soldered together if you wish.

These two pads are the same.

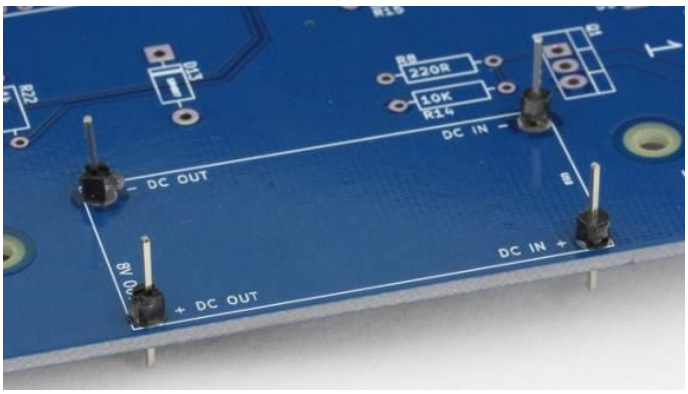
These two pads are the same.

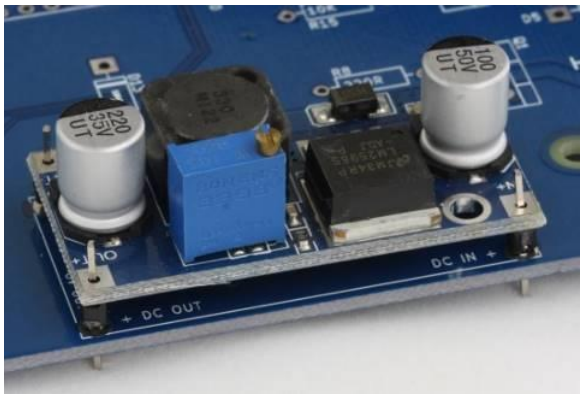
Variable Output Buck Converter

The variable output converter included in the kit is pre-set to around 8V output but it is still worthwhile checking before soldering to the PCB.

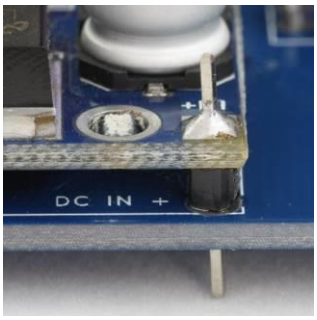
Important!
If you are not using the kit make sure you set the voltage out on the buck converter before you solder it to the PCB. I recommend 8v but this does not need to be exact, anywhere from 7v to 9v is OK.

Place the pins in to the PCB and then drop the buck converter on to the pins. Do not solder the pins to the PCB yet.





Make sure the buck converter is the right way around. Follow the arrow.



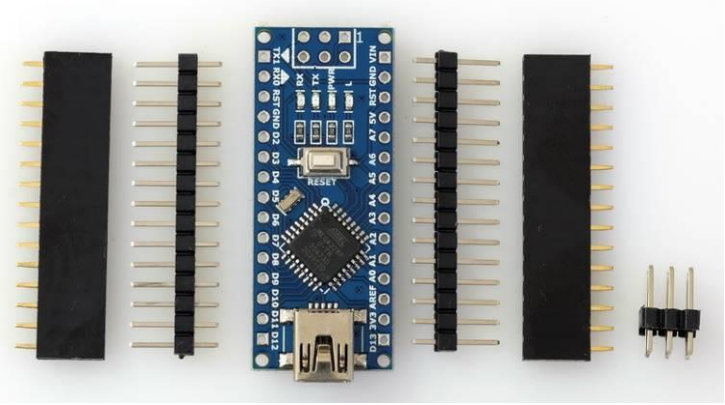
Solder the pins to the buck converter first. Then flip the board over and solder the pins to the PCB.

Remember to check the voltage out.
If you do not have a multimeter search on line for "Arduino volt meter" and make your own.

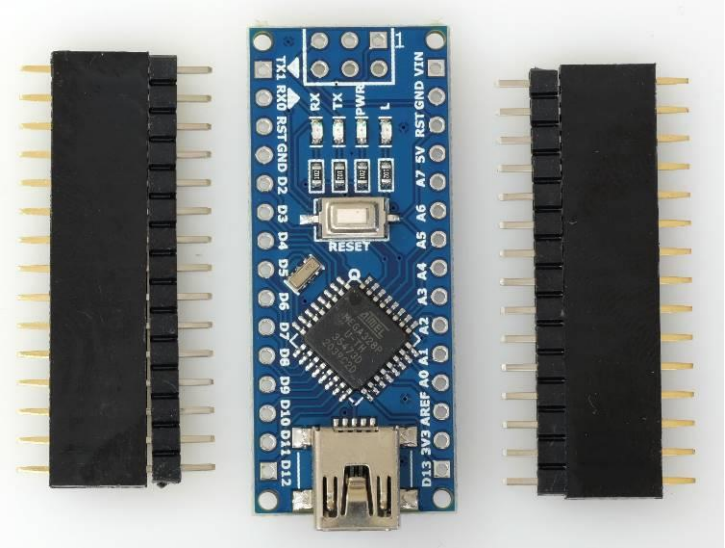
Arduino Pins

Adding the Arduino is a two part process
1 – solder the pins to the Arduino
2 – Solder the headers to the PCB.

Use the PCB to hold the Arduino while soldering the pins. This will keep the headers straight.

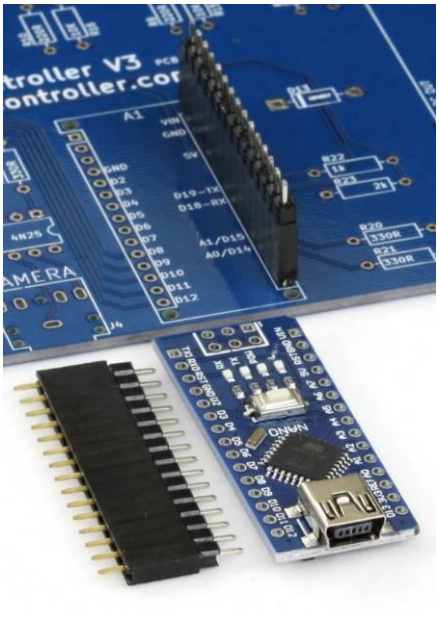


The Arduino may come without the pins attached.



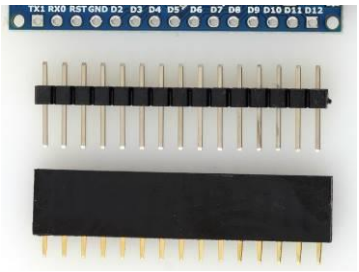
Start by inserting the Arduino pins into the headers

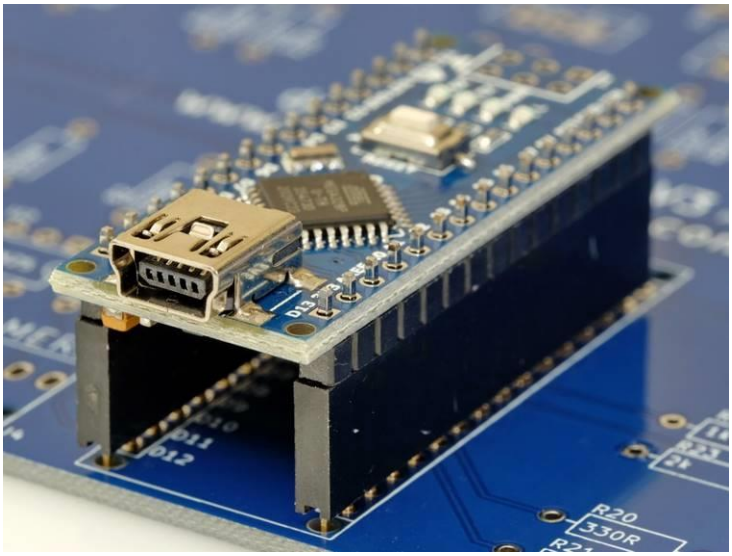
The programming pins are not used and can be discarded.



Use the PCB to support the headers with pins inserted.

The long side of the pin goes in to the socket. The short side inserts in to the holes on the Arduino.

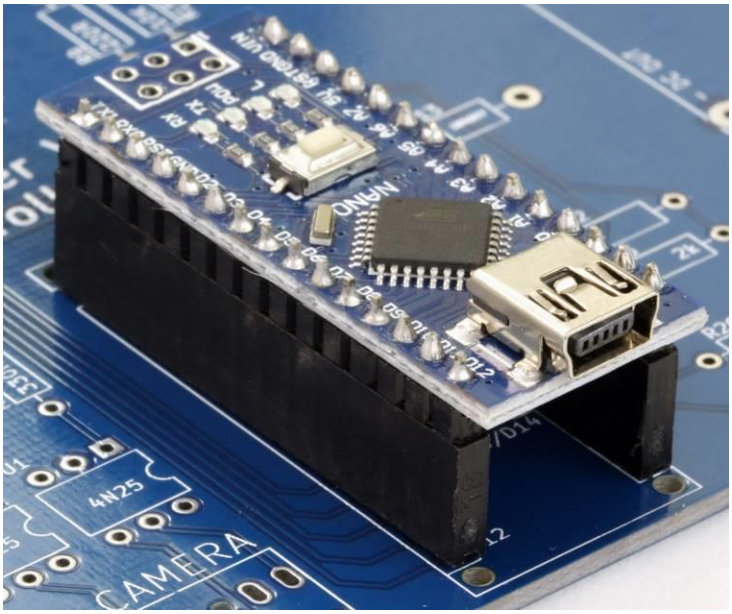




Add the Arduino on top of the pins.

At this point nothing is soldered.

Depending on what the PCB is laying on the headers may float a little bit above the PCB. This is OK as long as the pins at the bottom remain in the holes in the PCB.

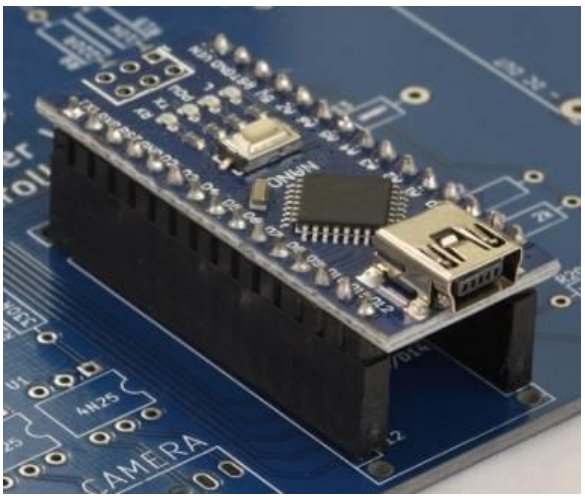


Solder the Arduino pins.

Solder one corner pin, check the position, solder the diagonally opposite corner, check again and if nothing has moved solder the remaining pins.

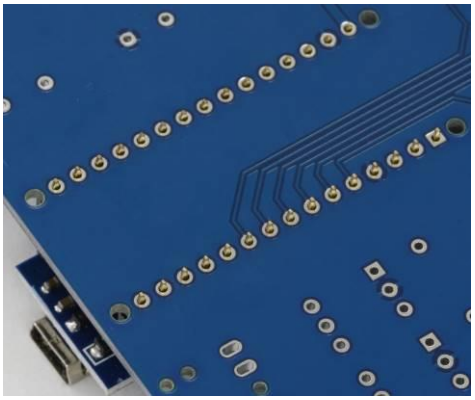
Make sure the solder is clean and tidy and that you haven't joined pins together.

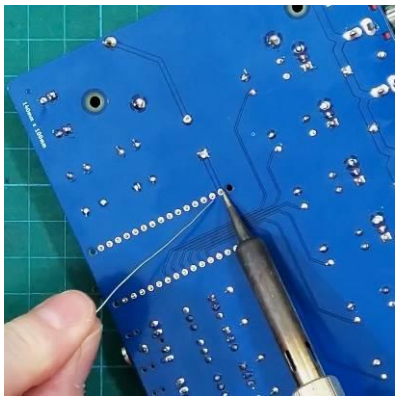
Arduino Support / Header Sockets

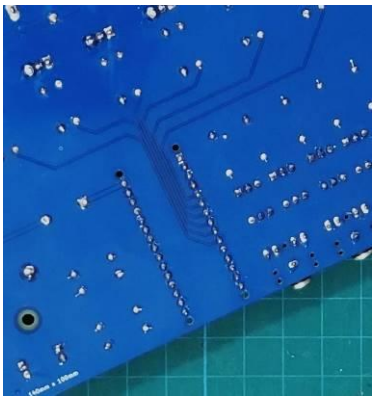


After soldering the Arduino pins, flip the PCB upside down and solder the headers to the PCB

Flip the board over and solder one of the corner pins.



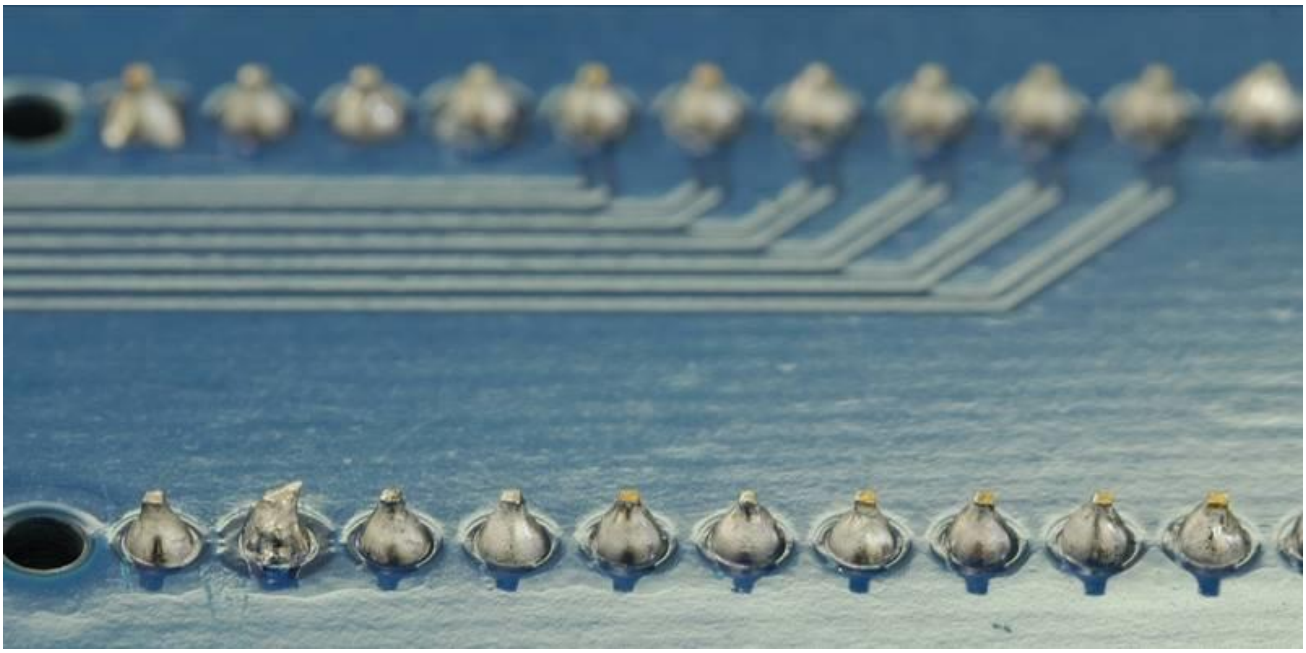




Solder one corner then check that the headers are still in position and are lying flat. Solder the opposite corner and check again.

If you are happy with the position solder the remaining pins.

The pins are fairly close together and it is easy to join two together. If you are not used to soldering take your time and check as you go along. The pins should separate.



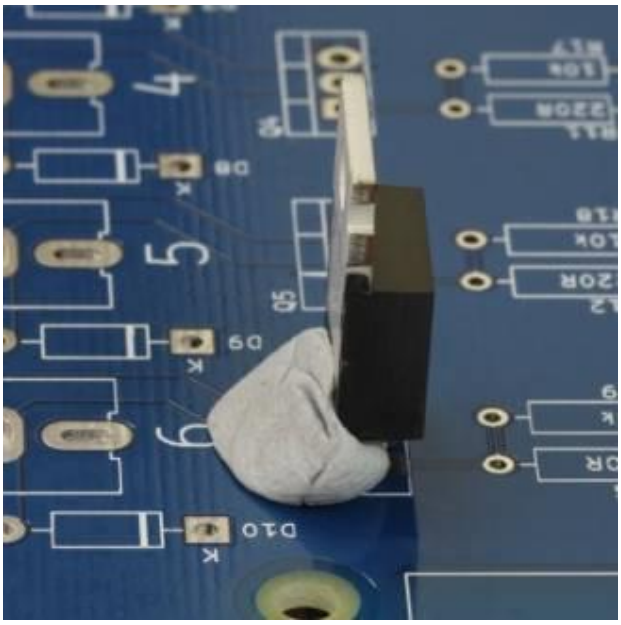
After doing the header pins, remove the Arduino from the sockets. This will help when adding the mosfets.

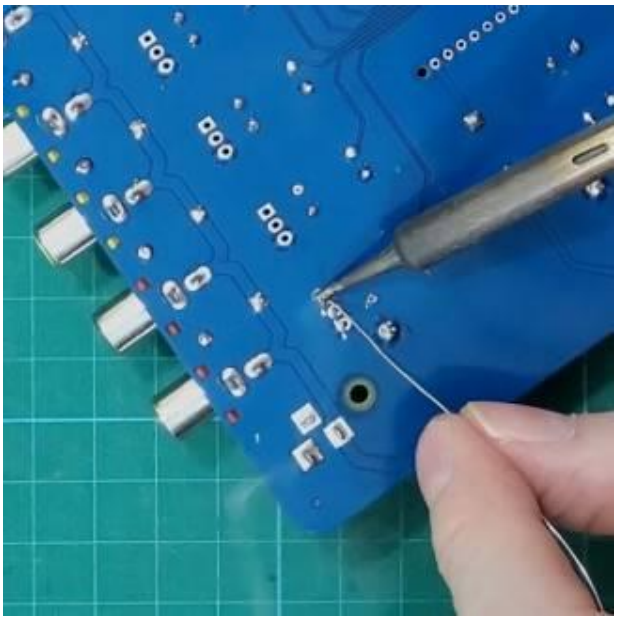
Mosfets

Last but not least are the mosfets. You can remove the Arduino while attaching the mosfet. It may make things a little easier, or, it might not.

Place one of the mosfets, secure in place with Blutack, flip over the PCB and solder one of the pins.

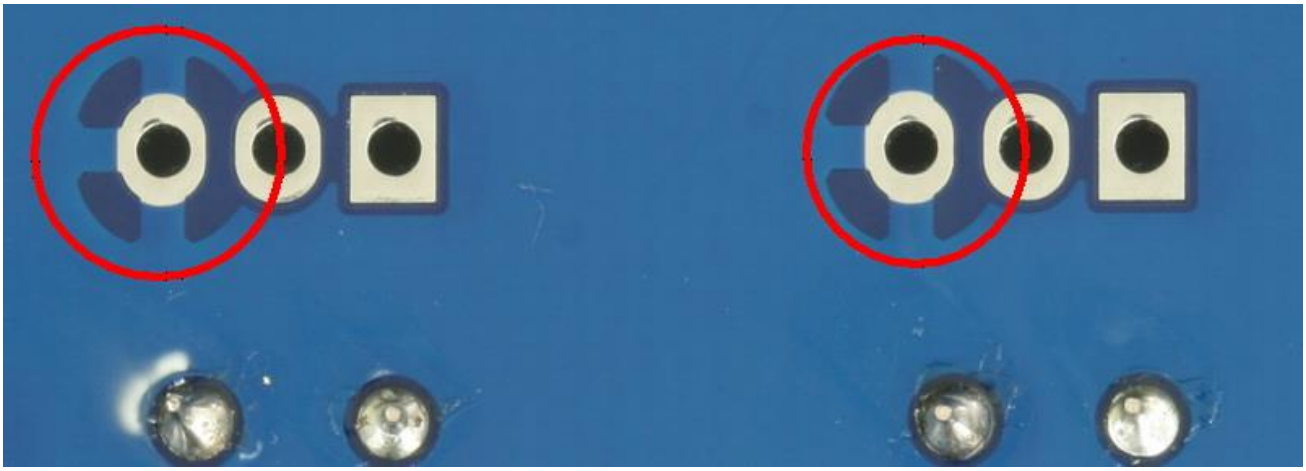
A helping hands may help here but I find the Blutak and a table top are sufficient (maybe even prefered).





After soldering the first pin, check the position of the mosfet and if it didn't move while soldering do the remaining two pins.

The mosfets do not solder as easy as some of the other components. The mosfest have thicker pins which require more heat especially the ground pin.



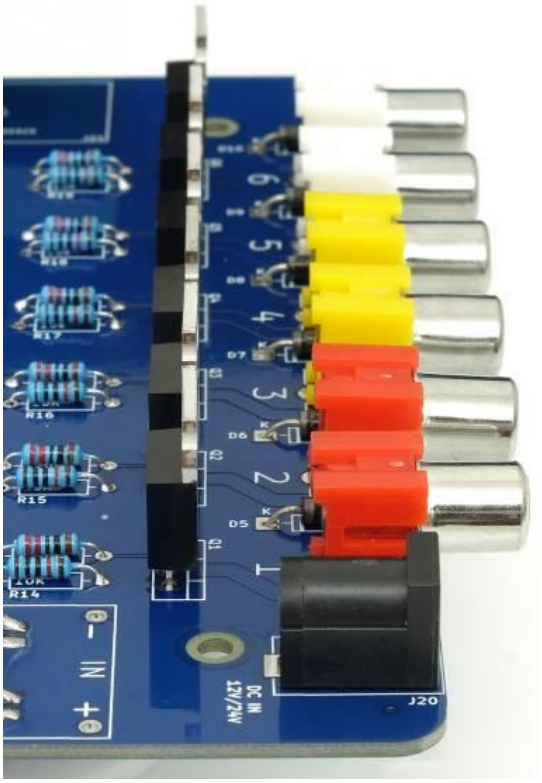
Mosfet GND Pins

The mosfet GND pin can be awkward to solder cleanly. It requires a fair amount of heat and it is very easy to make a mess and bridge with the centre pin.

I have learnt to start with the GND pin. This gives me a little bit more space while soldering.

Solder and then trim.

Make sure the pins are not joined together



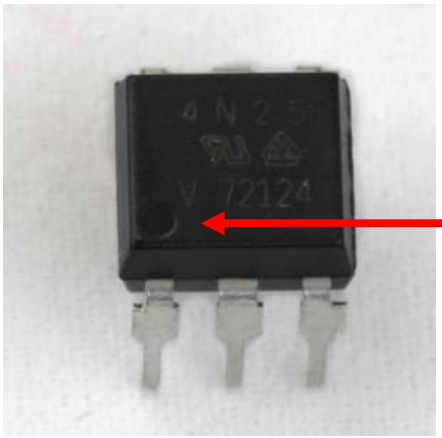
Try and get all the mosfets to line up straight.

At this point all the soldering should be finished. You can continue to build the dropController or you can clean up the PCB. I use a basic technique using alcohol and a brush. See below.

4N25s/4N35s

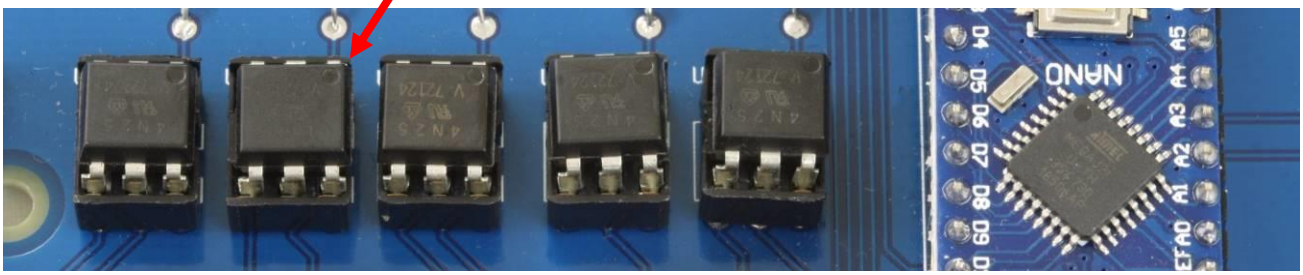
Add the opto-couplers.

You have already soldered the sockets so now insert the opto-coupler chips.



If you look closely at the chip you should notice a small circle at one corner. This denotes pin 1.

Pin 1 goes to the top right when the PCB is the correct way up (the writing is the correct way). Insert the chips and take care not to bend any of the legs. You may need to bend the pins on the chip in slightly before inserting in to the socket.

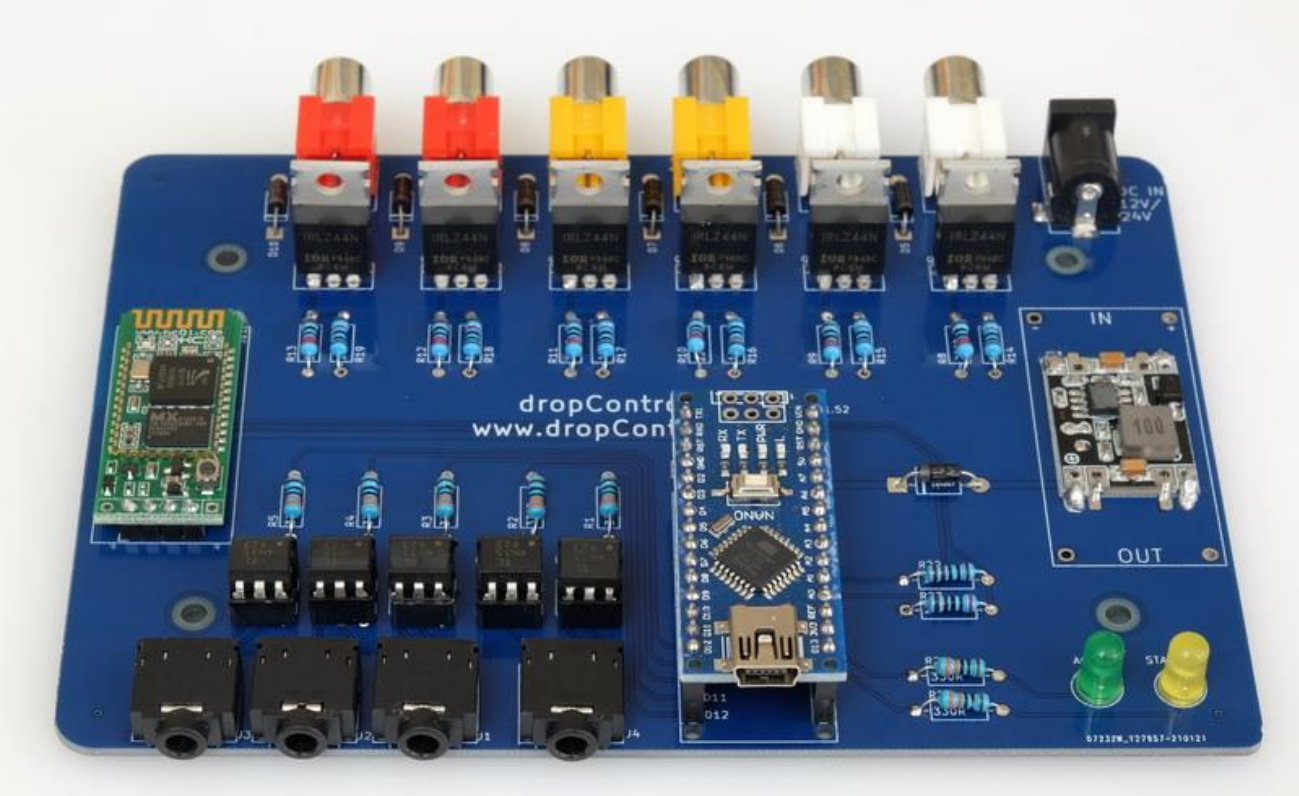


Make sure the pins are securely inserted in to the sockets and not bent.

At this point you should have either;

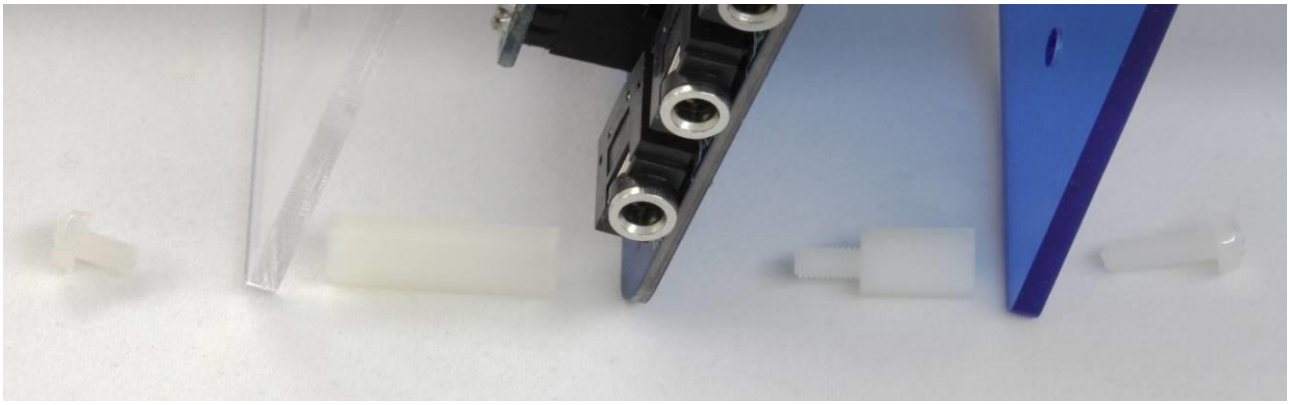
- a nice looking PCB, or
- hands in bandages and the lingering smell of burnt flesh.

Let’s hope you have the nice looking PCB.

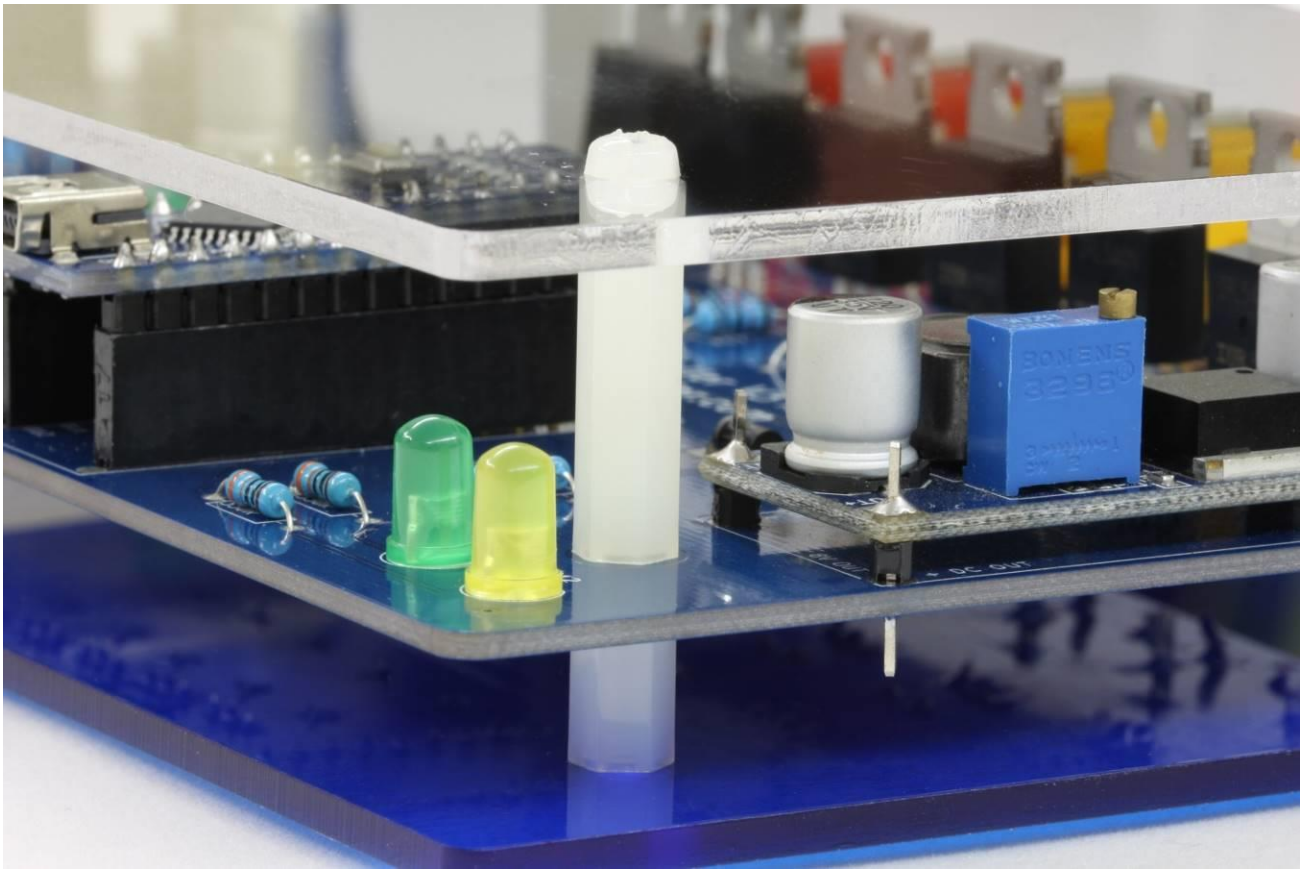


Cover

All that is left is the cover and base. This is 2 pieces of acrylic held by supports.



For each corner there is 1 short support, 1 long support and 2 screws. If you have short screws use them at the bottom. All the bits screw in to each other:



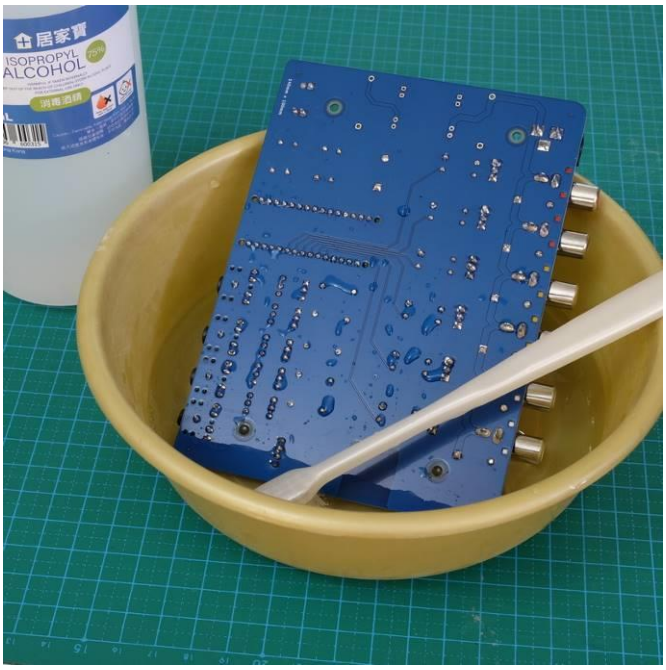
Done.

Note: The kit may include small connectors that are used as feet.

PCB Cleaning

After completing the soldering it is very likely you have residue from the flux that is inside the solder.

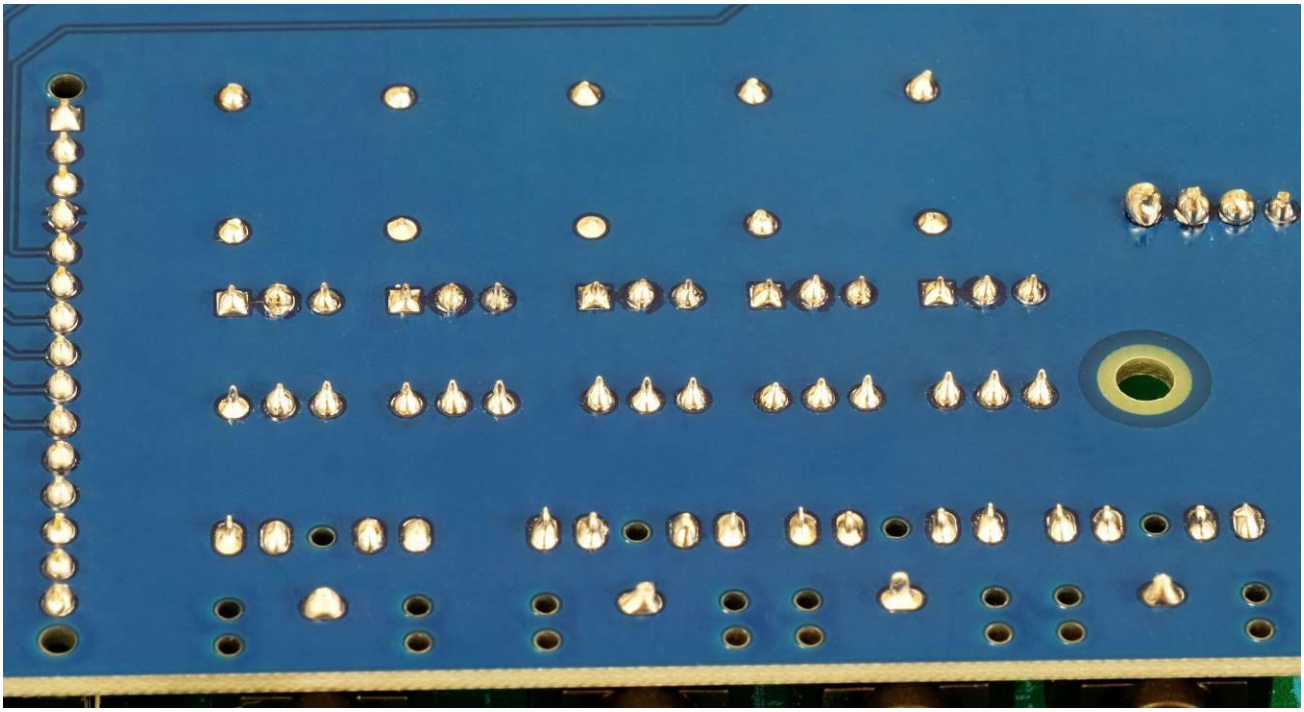
This can be cleaned up using Isopropyl Alcohol, a small brush (old tooth bush is fine), and some elbow grease.



I use an old plastic bowl and a hard bristle tooth brush.

Depending on the solder you use removing the residue can be easy or require a little time and effort. And, may take a couple of washes to get the PCB fully clean.

After washing in Isopropyl Alcohol rinse with water, ideally distilled water and let it dry.



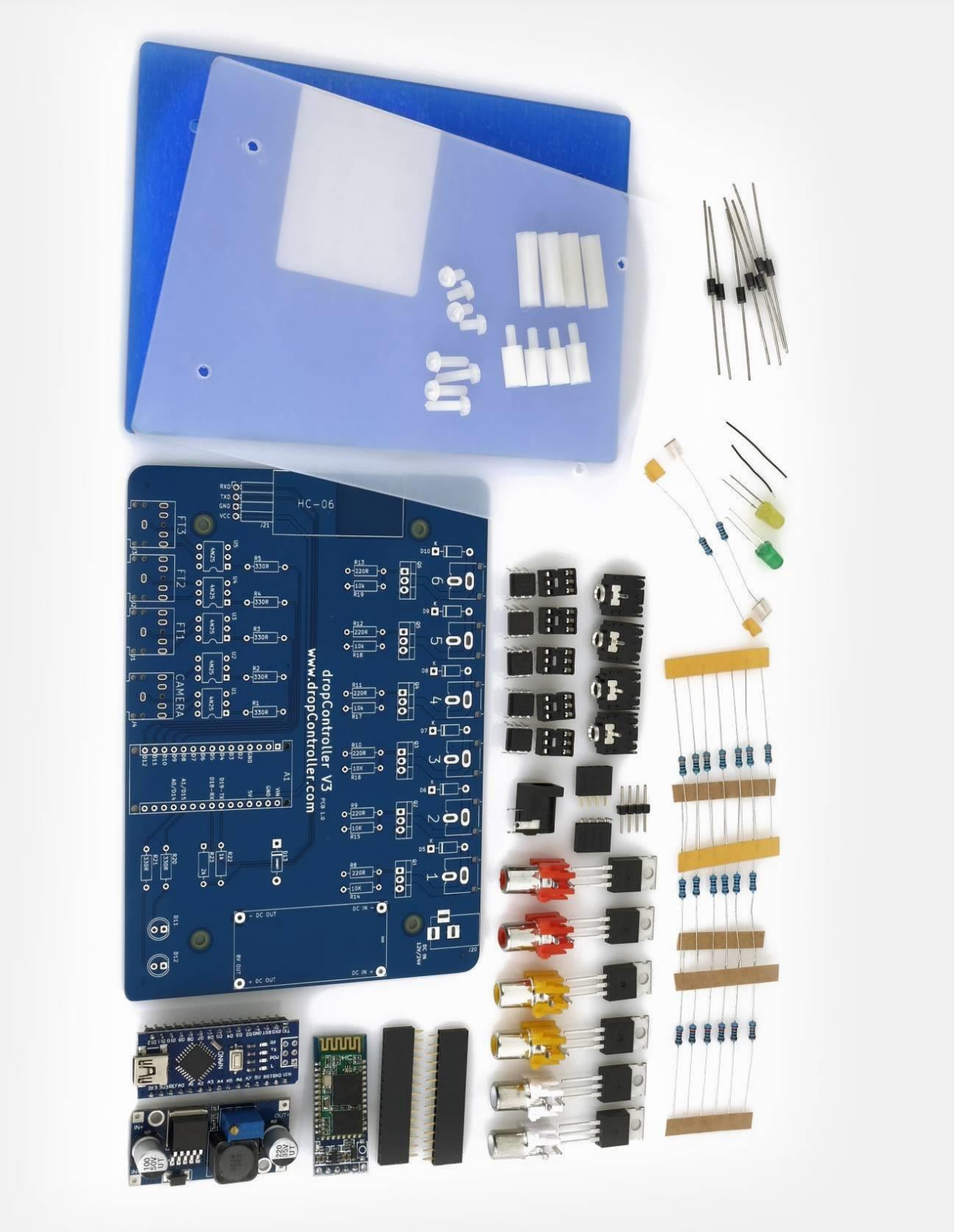
The end result

Important!
Let the PCB thoroughly dry, at least overnight. Do not be impatient.

Do not attempt to use the PCB if you think any part is still damp.

dropControllerV3 Kit: Contents

DESCRIPTION	QTY	CHECK
PCB	1	
ACRYLIC BASE	1	
ACRYLIC TOP	1	
STAND 20MM	4	
STAND 5MM	4	
3M SCREW	8	
ARDUINO NANO	1	
HC-06	1	
DC-DC BUCK CONVERTER (+ 1x4 MALE SIL)	1	
1x15 SIL FEMALE 2.54	2	
1x 4 SIL FEMALE 2.54	1	
BARREL JACK - TYPE A: 5.5 mm OD, 2.1 mm ID	1	
RCA/PHONO SOCKET - RCA-RCJ-04x	6	
3.5MM STEREO SOCKET - PJ-307	4	
6 PIN DIL SOCKET	5	
4N25 or 4N35	5	
MOSFET IRL540N or IRLZ44N	6	
LED 5mm - YELLOW	1	
LED 5mm - GREEN	1	
1N4007	7	
1/4W RESISTOR 10K	6	
1/4W RESISTOR 2K	1	
1/4W RESISTOR 1K	1	
1/4W RESISTOR 330 OHM	7	
1/4W RESISTOR 220 OHM	6	



Some parts may change without notice depending on availability.
Kits now include a fixed 9v output DC-DC buck converter.

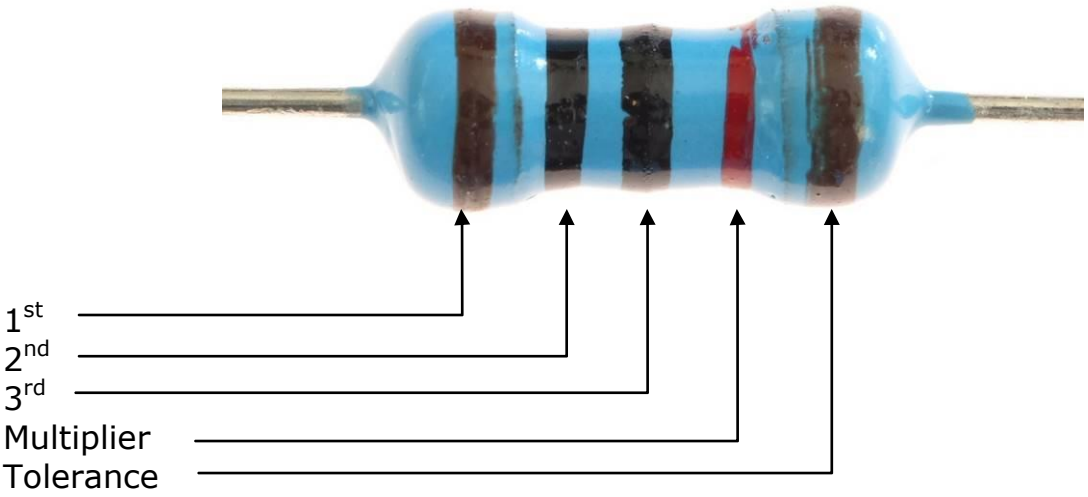
Resistors

Resistors are colour coded and, rumor has it, there are old, wise, long bearded men who can read the value purely by looking at the colours. Me, I use an online calculator.

The resistors supplied with the dropController kit are normally 5-band.

5 Band color code resistor

Color	1st digit	2nd digit	3rd digit	Multiplier	Tolerance
Black	0	0	0	10^0	
Brown	1	1	1	10^1	1% (F)
Red	2	2	2	10^2	2% (G)
Orange	3	3	3	10^3	
Yellow	4	4	4	10^4	
Green	5	5	5	10^5	0.5% (D)
Blue	6	6	6	10^6	0.25% (C)
Violet	7	7	7	10^7	0.10% (B)
Gray	8	8	8	10^8	0.05%
White	9	9	9	10^9	
Gold				10^{-1}	5% (J)
Silver				10^{-2}	10% (K)



If you have a multimetre, check the value of the resistors using the Ohm setting.

10K (10,000 Ohm)

Brown, black, black, red, brown.

The first 4 bands give the value. The 5th band gives the tolerance.

Within the 4 value bands; the first 3 are the main digits, the 4th is a multiplier. Brown = 1. Black = 0. Black = 0. Red = X 100. 100x100 = 10,000 or 10K

The brown on the end is the tolerance. Brown = 1 so the tolerance is 1%.

If you do not have resistors with brown, black, black, red, brown. Find the resistors that have brown, red, black, black, brown and turn them around.

2K (2,000 Ohm)

Red, black, black, brown, brown.

Red = 2. Black = 0. Brown when used as the multiplier = 10.
200 x 10 = 2000 or 2K

1K (1,000 Ohm)

Brown, brown, black, black, brown

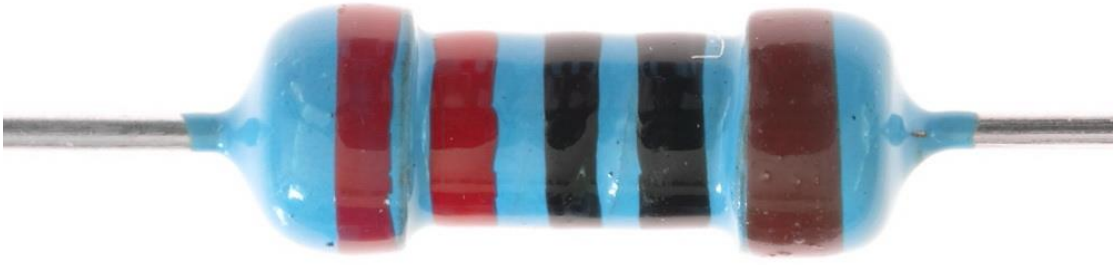
100 x 10 = 1000

330 Ohm

Orange, orange, black, black, brown.

Orange = 3. Black multipler = 1. 330 x 1 = 330

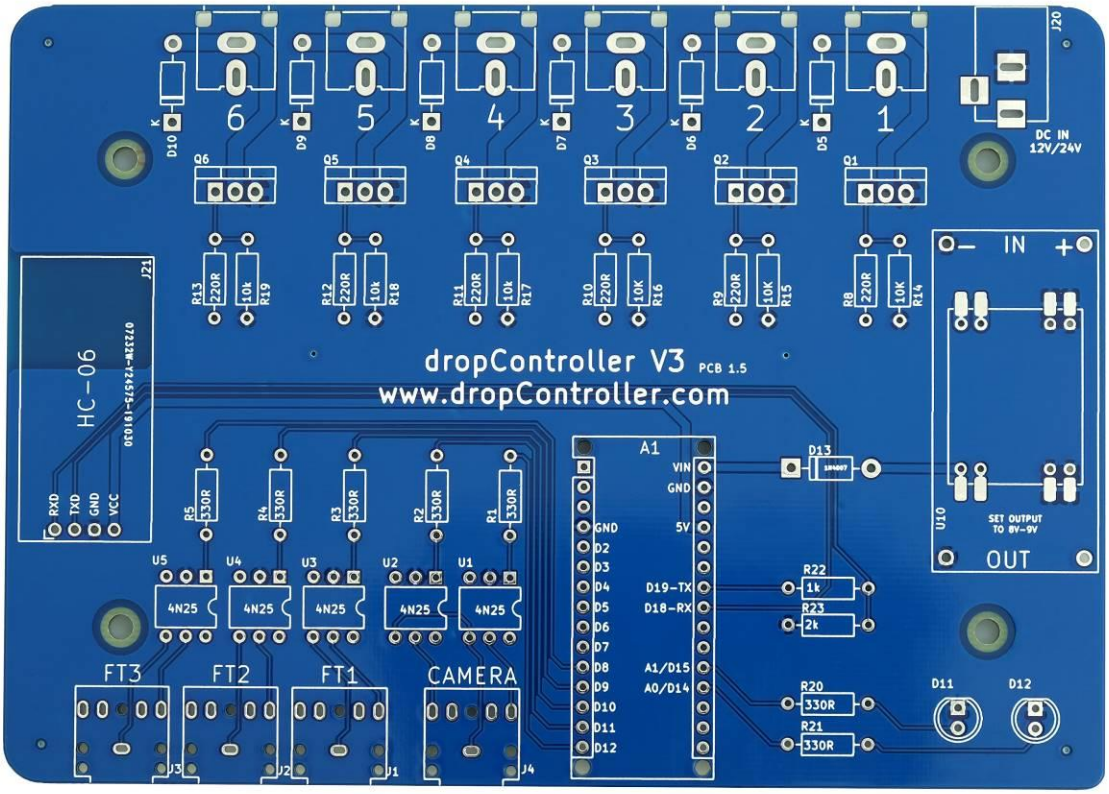
220 Ohm

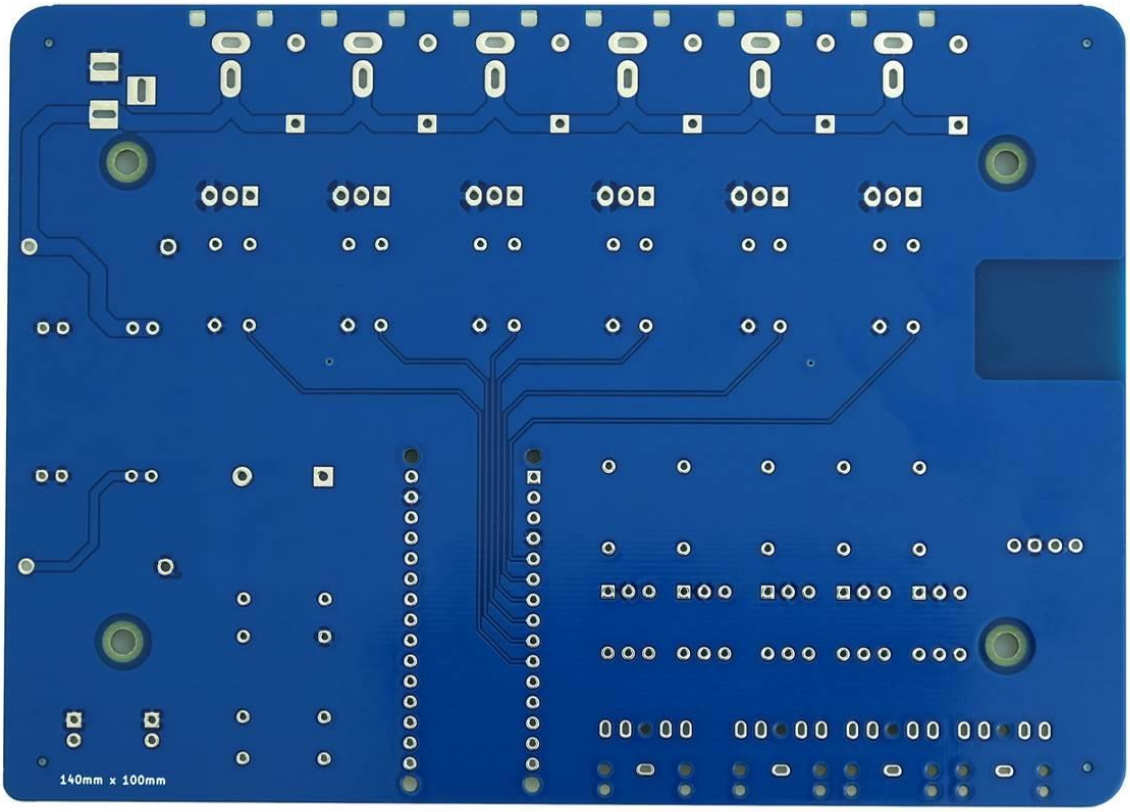


Red, red, black,black, brown.

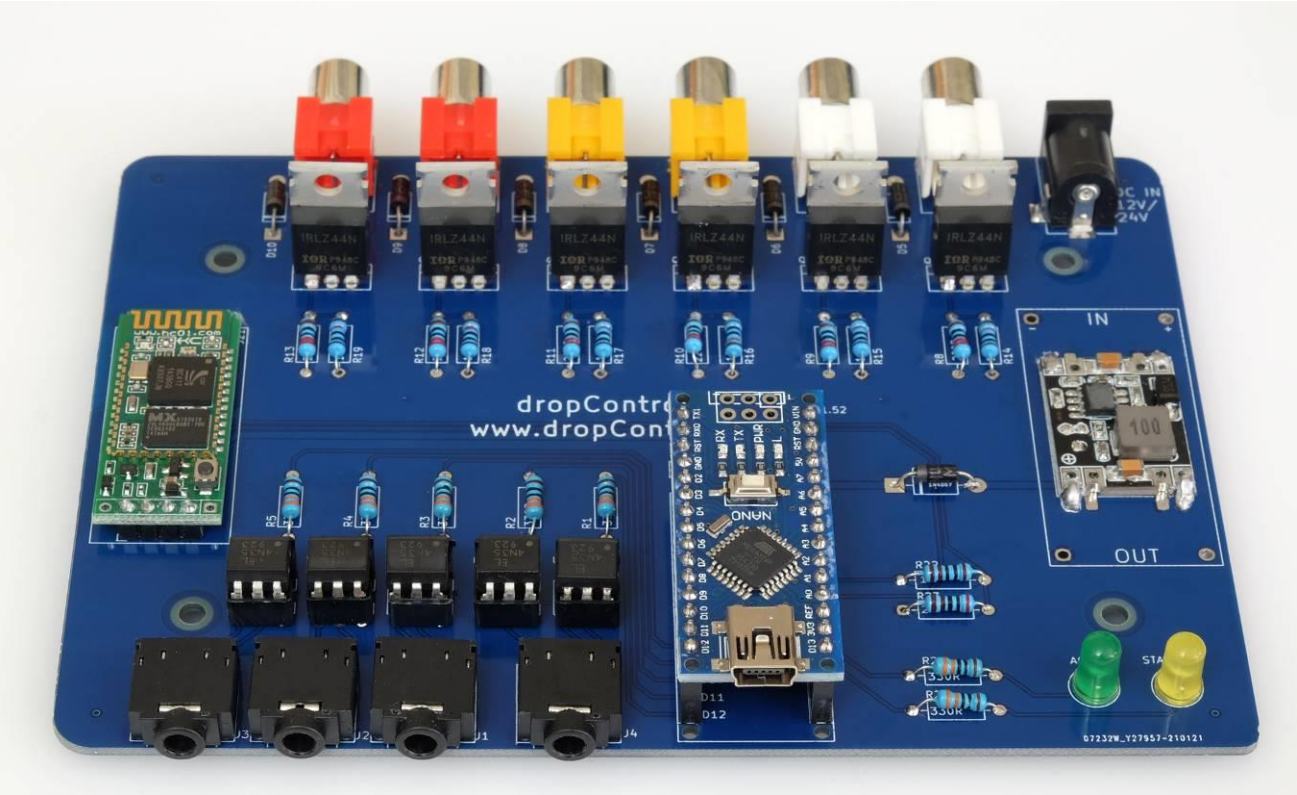
220 x 1 = 220.

PCB Version 1.5





Completed PCB



PCB v1.52 with the 9v DC-DC buck converter.

PCB v1.52 is exactly the same as v1.5 except the labels on the LEDS have been updated.

Notes

If you are not that experienced in soldering, take your time and keep checking your work. Especially check for bridges or shorts. Bridges are 2 or more pins joined together. It is important that each pin is separate and not connected to other pins.

While soldering, if you find the solder does not stick to the pin then the pin is not hot enough. Warm up the pin a little before adding solder. Flux will also help. The pins & pads should not be red hot though.

You also check the specs for the melting point of the solder and make sure your iron is hot enough.