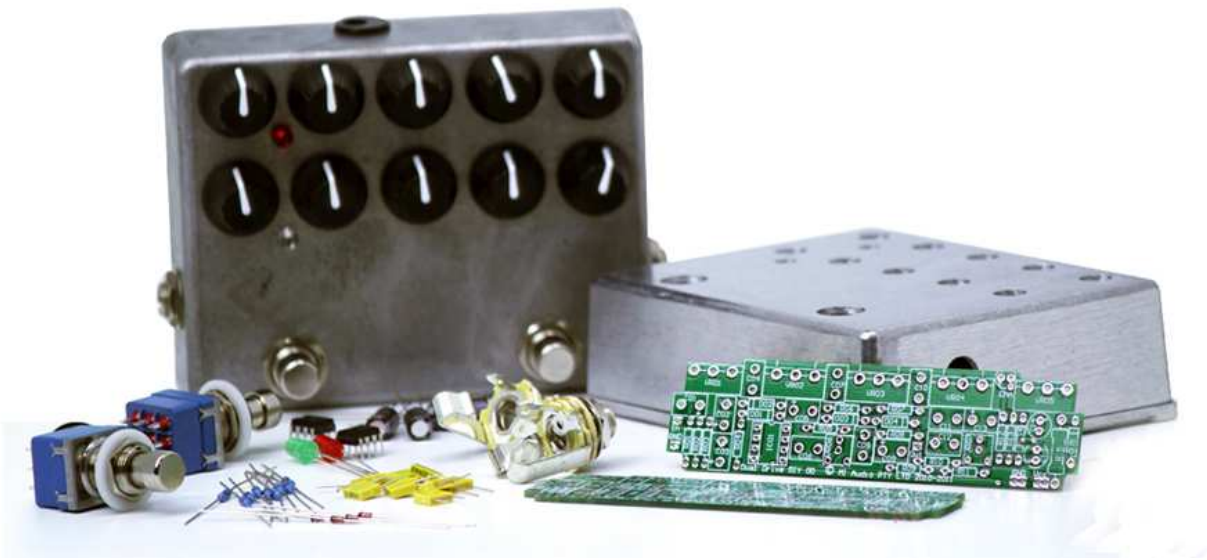
MI DIY DUAL DRIVE KIT



Kudos for taking on the MI DIY challenge with the MI DIY Dual Drive Kit! If you have ever wanted a custom boutique overdrive pedal, now is your chance– all you need are a few basic tools, this kit and a passion for tone. This is an intermediate level build with required knowledge of components and soldering/desoldering skills required. If you are not confident of your DIY level, perhaps attempt to build a boost pedal or single drive pedal to cut your teeth before attempting this MI DIY kit.

The MI DIY Dual Drive Kit allows you to build two channels of op-amp based overdrive and/or distortion designs – to your specifications! Each channel has a GAIN, VOLUME, and three-band EQ with the voicing in the hands of the builder. By adjusting stages of gain and clipping options or tailoring the low-end body and high-end presence (via internal trimmers), your pedal will sound like no other.

This document will provide all of the information you'll need to build (and troubleshoot!) your MI Dual Drive pedal. Included in this guide is a list of what you'll need to get started, a complete parts list, a PCB build guide, wiring diagrams and a troubleshooting guide to help with those probable faults. Included in your kit are two schematics for different options – you can have a dual OD, dual distortion or a combination of both. A generic schematic is also included so that you can begin your own tweaks and modifications to make this pedal your own!

IMPORTANT!!!

By opening your kit and beginning the build, you are taking full responsibility for the pedal's progress and all of the errors that will come with any pedal build. We at MI Audio cannot help with all of your questions, nor do we offer repairs on unfinished/non-working builds. Repairs and faults are half of every build and with every fault you fix, you earn some DIY cred. We want to emphasise the YOURSELF in DIY and reiterate MI Audio takes no responsibility for solder burns, melted components or nervous breakdowns!

Our MI DIY blog at www.miaudio.com/mi-diy/ will have some advice, modifications, input from some DIY masters as well as any other hints and tips we can offer along the way. If you have anything you would like to share, please email register@miaudio.com and we would be happy to show off your finished build.

Turn on your soldering iron and let's get to it!

MI DIY DUAL DRIVE KIT

WHAT YOU'LL NEED TO GET STARTED.

There are some things we cannot, or have not provided in order for you to complete this Dual Drive kit. As an intermediate builder, you should have most of this around your spare room, garage or workshop. But if not, or you are an adventurous newbie, here's what you'll need:

- Soldering Iron – preferably a temperature-regulated iron, but any iron will do that has a tip hot enough to flow solder. If your iron makes a ball when tinned with some solder, then you will need an upgrade. Proper solder technique and solder flow will reduce the number of cold solder joints, thus reducing troubleshooting time.
- Solder – Leaded solder will flow best as the melting point is lower than lead-free. Since this is DIY and not ROHS-compliance for export – go for some leaded solder and ensure you have a well-ventilated, clean workspace with a desktop fan (or fume extractor if you're a pro!).
- De-soldering pump/wick –Mistakes will happen and you will need a tool to help remove excess solder or to aid in removing components. Not everyone has access to de-soldering vacuum stations, so take the time to learn how to use a pump or wick as it will help speed up troubleshooting time and increase shredding time.
- Hook-up wire – to finish the build, you will need to wire the PCBs to the jacks and switches in order to complete the audio path. The amount of wire is more than what we could fit in the kit, so we have included links for some online places to buy some odd's and end's for modifications and, hook-up wire.
- Digital Multimeter – the must-have for all DIY builds. This small, inexpensive meter you can pick up at any electronics store will help you read resistances, voltages, amps, and perhaps most important, continuity. There are numerous videos on how to correctly use one and will be a vital part on your troubleshooting crusade.
- Various hand tools – you will need some tools such as side cutters, needle-nose pliers, wire-stripper and a wrench/socket set in order to build the PCB and general assembly of the pedal.

An excellent guide to these beginners must-have's can be found in the video series, Collin's Lab for MAKE Magazine. Here, http://bit.ly/o6Sh3f, Collin goes into more detail of what you need as part of your electronics tool set. Check out the complete playlist if you are a beginner for soldering tips and basic electronics information: http://bit.ly/187pyMC

On to the parts checklist…

MI DIY DUAL DRIVE KIT

DUAL DRIVE PARTS CHECKLIST.

COMPONENT	TOTAL QTY	PCB 1 DESIGNATOR	PCB 2 DESIGNATOR
RESISTORS			
100R (1W)	2	R15	R15
1k	4	R2, R6	R2, R6
10k	1	R7	
100k	5	R8, R9, R11	R9, R11
1M	2	R3	R3
10M	2	R1	R1
22k	4	R13, R14	R13, R14
330R	2	R10	R10
33k	1		R7
470R	1	R4	
4.7k	2	R12	R12
47k	1		R8
470k	2	R5	R5
680R	1		R4
POTENTIOMETERS			
A10K	2	VR02	VR02
A100K	4	VR03, VR05	VR03, VR05
A250K	1	VR01	
A1M	1		VR01
B25K	2	VR04	VR04
B1M TRIM (105)	2	VR06	VR06
B10K TRIM (103)	2	VR07	VR07
SEMICONDUCTORS			
1N914	4	D1, D2	D3, D4
1N4001	2	D5	D5
LM833	2	IC01	IC01
RED 5mm LED	1	CHN	
GREEN 5mm LED	1		CHN

COMPONENT	TOTAL QTY	PCB 1 DESIGNATOR	PCB 2 DESIGNATOR
CAPACITORS			
10p	2	C6	C6
100p	3	C2	C2, C4
1.5n	1		C11
100n	1	C10	
1u	1		C10
100uF	4	C14, C15	C14, C15
220p	1	C4	
22n	4	C1, C12	C1, C12
220n	6	C7, C9, C13	C3, C9, C13
2.2u	2	C5	C5
470p	2	C8	C8
4.7n	1	C11	
47n	1		C7
470n	1	C3	
HARDWARE			
BATTERY SNAP	1		
DC JACK	1		
STEREO JACK	1	INPUT JACK	
MONO JACK	1	OUTPUT JACK	
KNOBS	10		
FOOTSWITCH	2		
ENCLOSURE	1		

NOTE: For the potentiometers, your kit may contain B10k for VR02, and any of the logarithmic or audio pots marked with “A” may have “D” in its place.

This checklist has been provided as the first step in the Dual Drive build. It is always a good idea to make sure your components have been labelled correctly and stored in an orderly manner. When troubleshooting, one of the checks to be made will be if the correct value component is in the correct position. Taking the time in the beginning will save a lot more time in the end. So we suggest determining the value of the component, verifying the quantity, storing in a compartmentalised container of some sort and checking it off the list. Then we can get that soldering iron ready!

To help with some component values, here is a calculator and colour chart to help determine the value of each resistor:
http://www.digikey.com/us/en/mkt/4-band-resistors.html

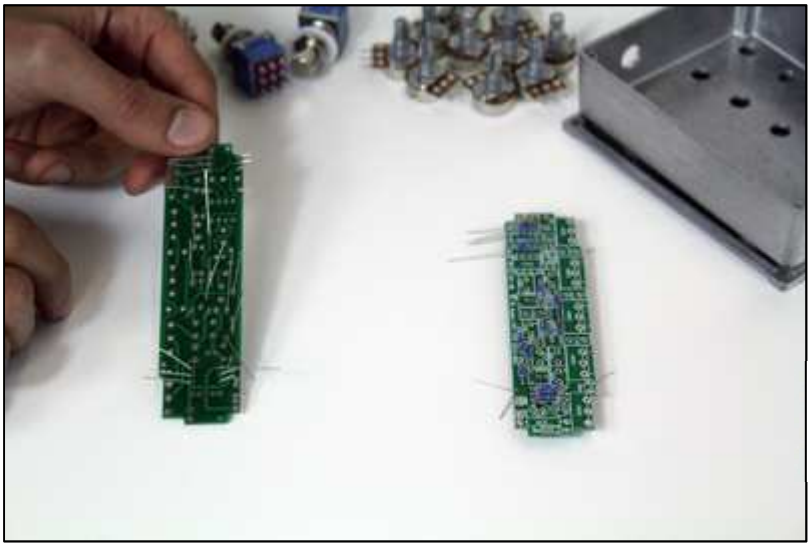
Here is a calculator to determine the values of each capacitor:
http://www.muzique.com/schem/caps.htm

Refer to the **LINKS** section for a video series that provides some background electronics knowledge for those interested.

MI DIY DUAL DRIVE KIT

STEP-BY-STEP GUIDE.

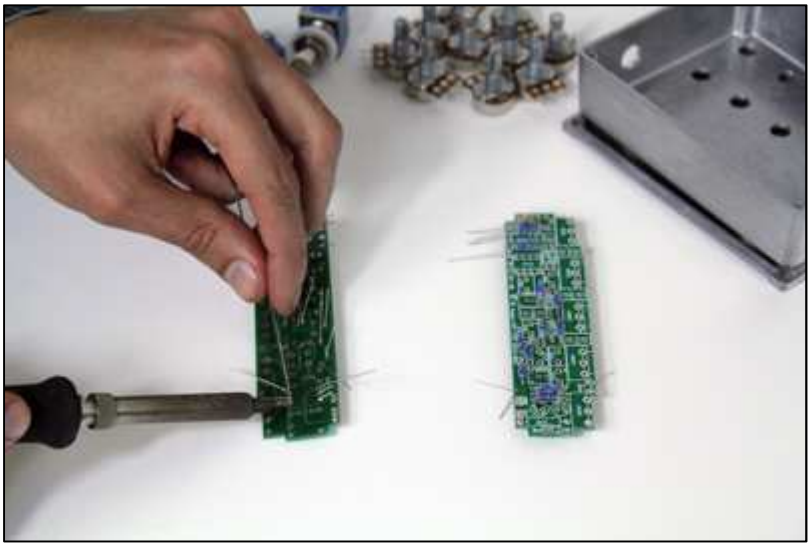
This photo guide is to help provide some direction for the more inexperienced builder. Once your parts are identified and sorted, we can begin loading components and soldering as we go. This guide shows both PCBs completed at the same time but for beginners we suggest working through the guide concentrating on PCB A first, then starting again from (1) for PCB B.
This is only one suggested method of assembly, and is one we use here at MI Audio. We start with the lowest lying components and work up, starting from resistors and ending in potentiometers. A systematic approach is best as it allows a clear workflow with less chances of mistakes.
Okay, let's flick on the soldering iron and start at (1).



(1) Load in resistors first. Once you have determined each of their values via a multimeter or colour code and have clearly labelled them, begin loading as per designator for each PCB, A and B. You will need to straighten the legs of the resistor and re-bend to fit the PCB spacing length.

TIP!

Before soldering, double check your resistor values and their respective positions. Double-checks save troubleshooting time!



(2) Turn over and pay attention to each solder joint. The higher the quality of the iron, the better the solder will flow and form proper joints – that is it should be conical in shape, glossy and have no holes or cracks.

If you are a beginner, it would be best to take it one solder joint at a time, inspecting the quality of work, trimming the leg and moving on to the next.

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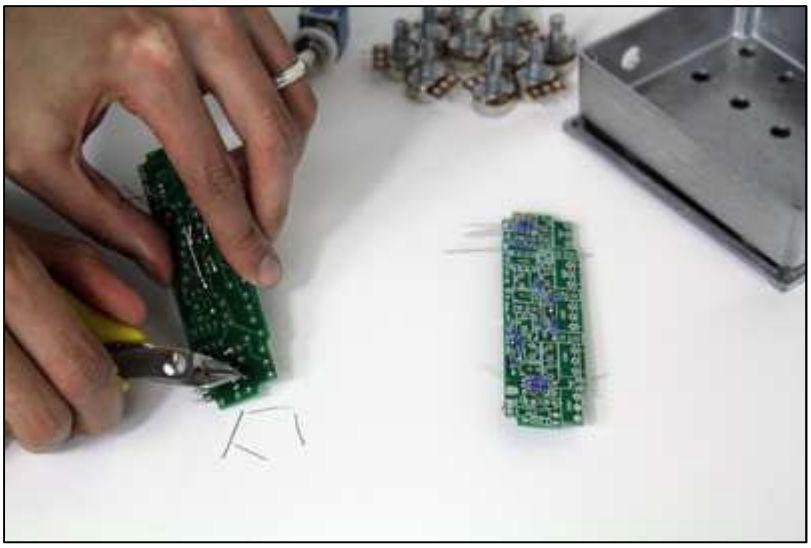
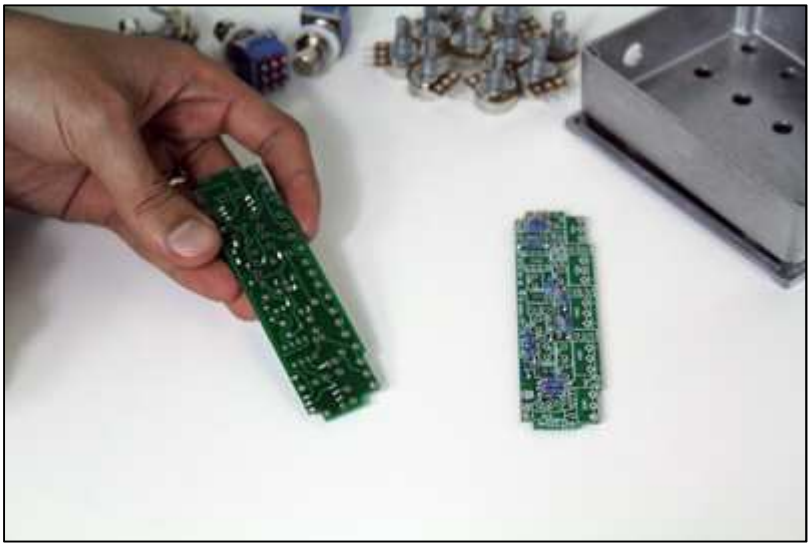
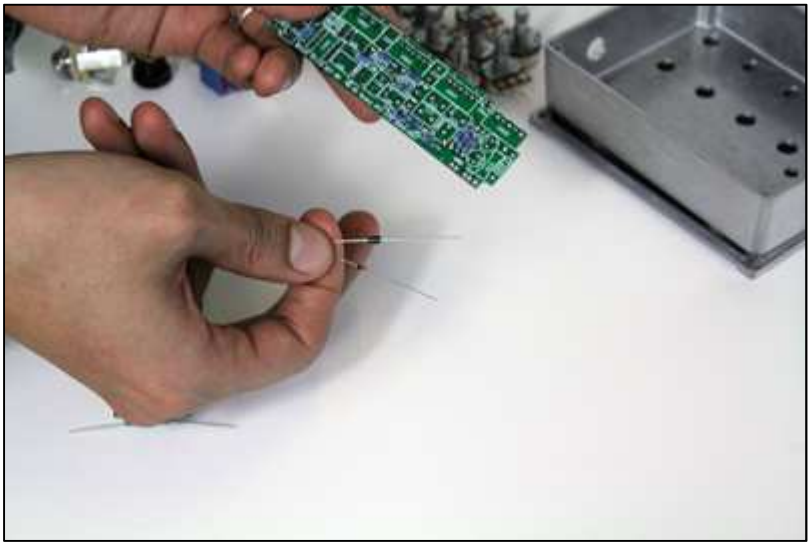


(3) Trim the component “legs” with a diagonal/side cutter. Try and cut as close to the board as possible without cutting off any of the solder joint.



(4) Once all component legs are trimmed, inspect each joint to ensure its quality. Re-flow the solder of any suspect joints and double-check the value of components and position if you haven’t already done so.

Ready for diodes!



(5) There are two kinds of diodes: the orange 1N914 and black 1N4004. Diodes are polarised i.e have a positive and negative end. The negative end is marked with a black (1N914) and silver (1N4004) band.
The PCB has a marking alongside the D01 for example showing which direction the band should be facing. Load in the diodes, solder and trim.

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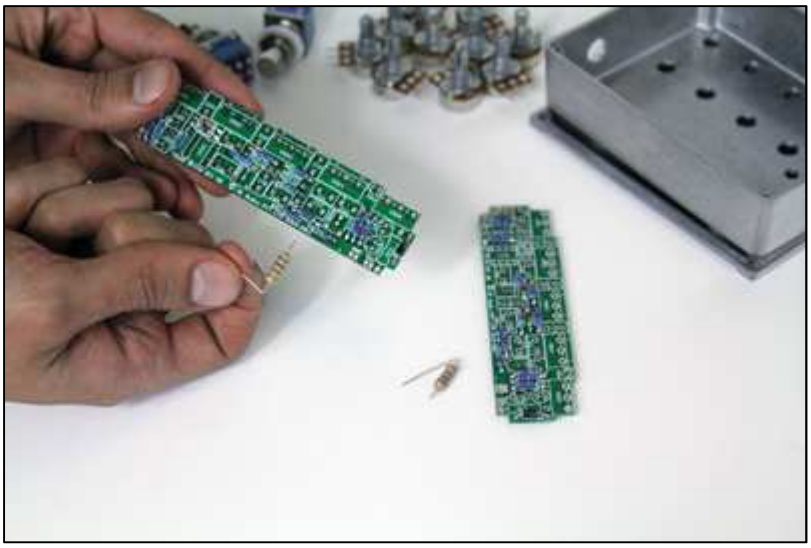
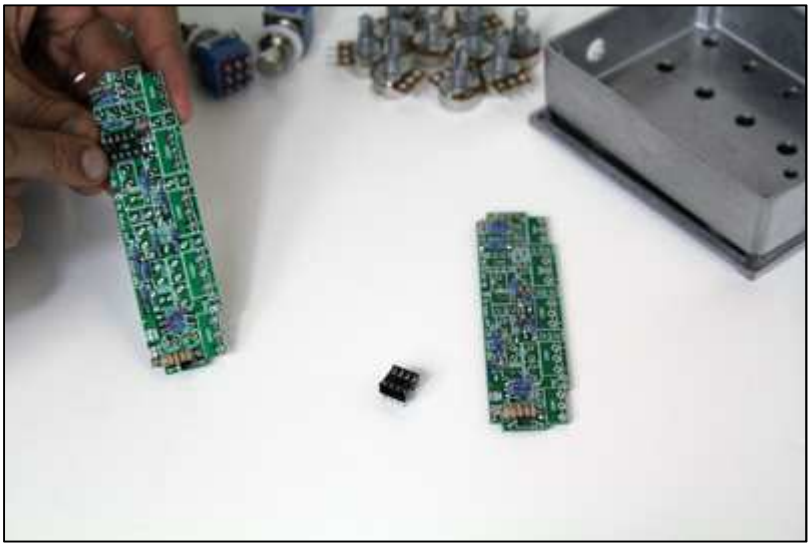


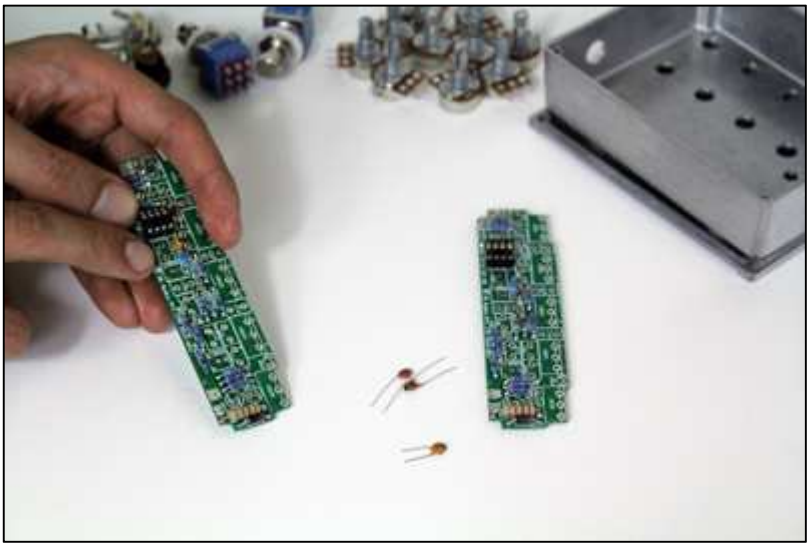
(6) Next to load is the large 100Ω 1W, carbon film current limiting resistor.
Bend the legs to fit the spot, solder and trim the legs.



(7) Now place in the IC socket. The orientation of the socket, therefore the IC, is very important as each pin has a different function. The PCB layout has a white outline for the socket with a small notch at the top. This notch is found on the socket and indicates the direction.

TIP!

Do not load in the IC until the very end. This component is heat-sensitive so we will wait until all soldering has finished.



(8) Once all eight pins of the IC socket have been soldered, we will load in the ceramic capacitors. These will need to be sorted via their codes and placed in their positions. These are not polarised so they may be placed in either direction, regardless of the print on the circuit board.

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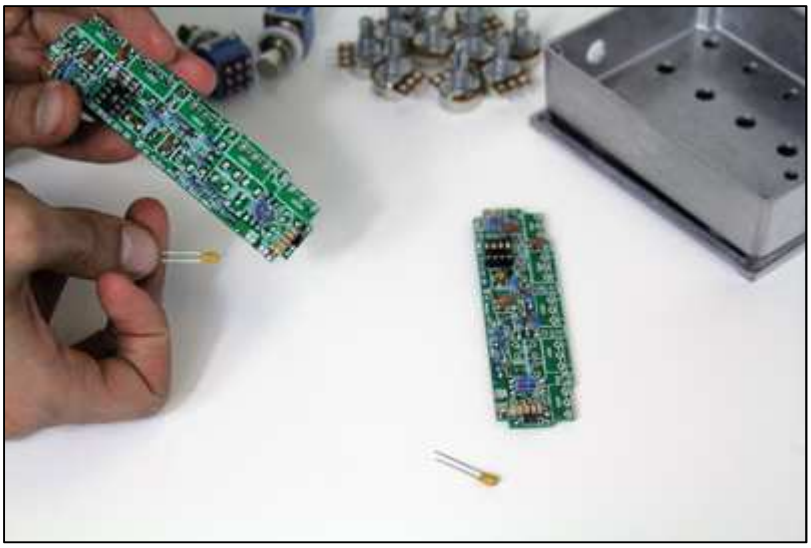
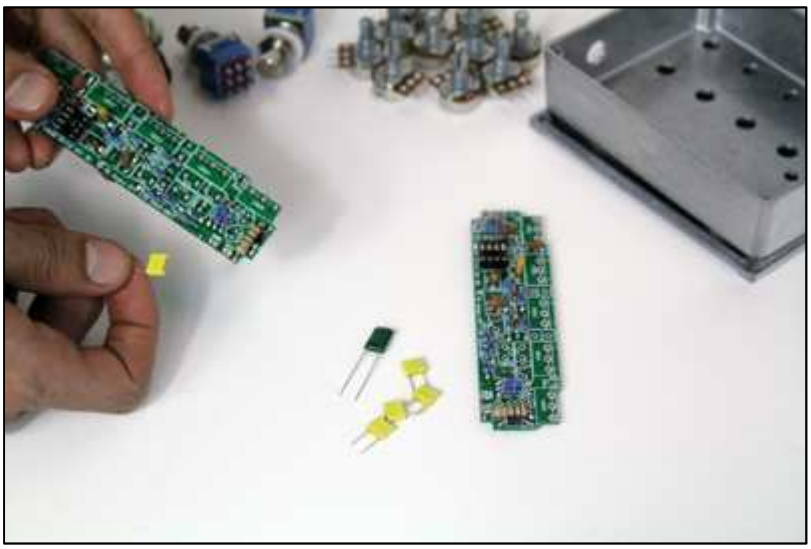
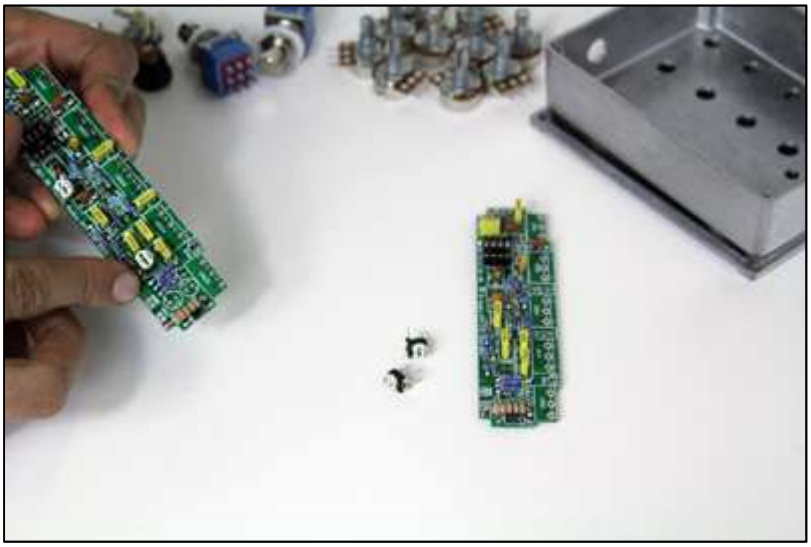


(9) Next up is the tantalum capacitor. This is polarised and the positive side is marked via two features; the side with the long leg is positive, and there is also a '+' marked on the cap itself. Place, solder and trim.



(10) The yellow and green film capacitors are next. These need to be sorted using their printed codes and are non-polarised. Place, solder, trim.



(11) Next up are the trimpots for DEPTH and PRESENCE. These three legged components should click into place. The 105 denotes 1M and the 103 is 10k.

TIP!

A popular mod is to have external Presence control so wire up a 10k pot in place of the trimpot and chassis-mount for more top-end control.

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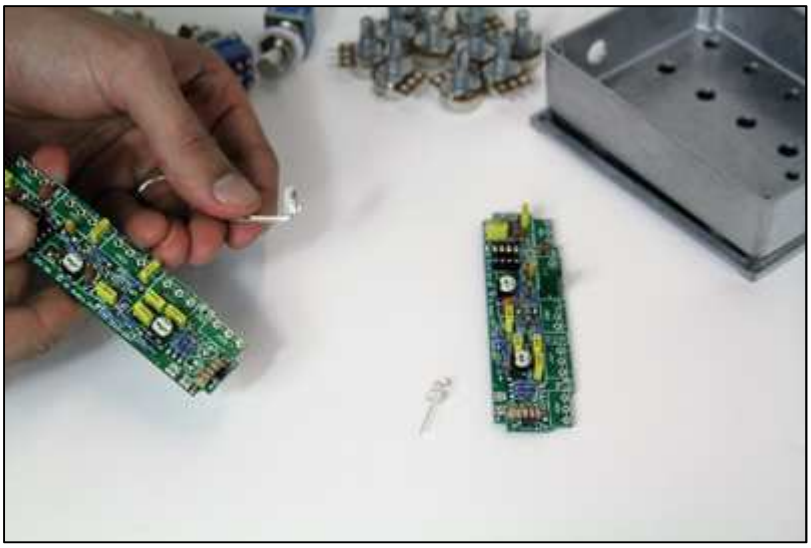
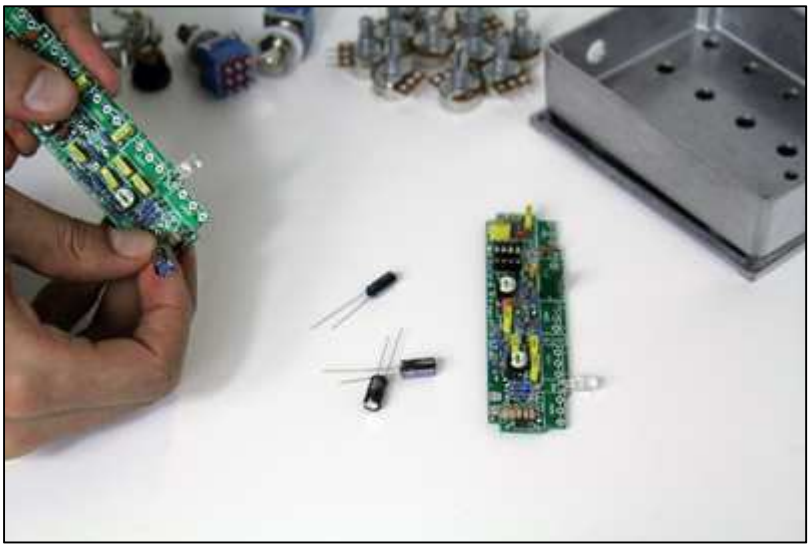


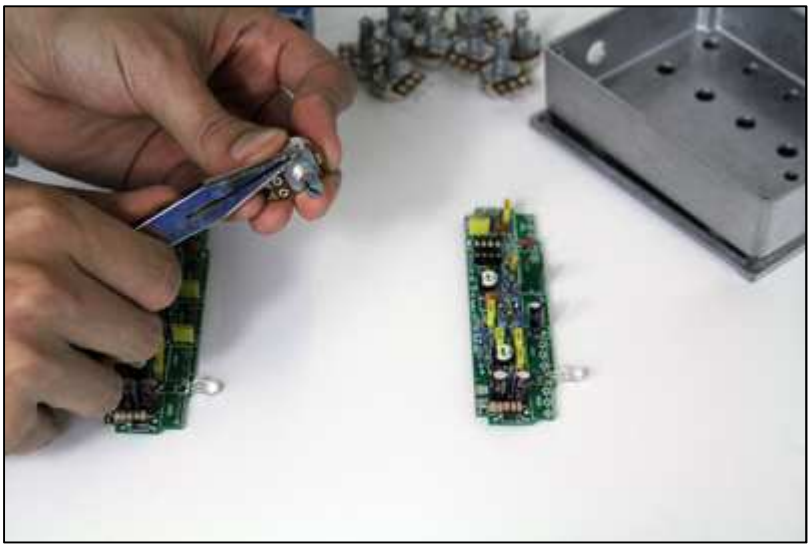
(12) Next components to load are the channel LEDs. These light-emitting diodes are polarised; again the long leg of the LED indicates the positive side.

The LED legs will need to be bent at a right-angle with the long leg to the left (marked with a '+' on the PCB).



(13) The electrolytic capacitors are next to load. These are polarised, again '+' marked by the long leg, and on the opposite side is a '-' strip printed on the side of the capacitor. Take care in ensuring these are loaded in the correct orientation. Load, solder and trim.

NOTE: The 1uF for C10 does not have a polarity on the PCB and can be inserted in any direction.



(14) Nearly there! Next to load are the potentiometers. Each pot has a small tab on the body (pictured). This will need to be snapped off with a set of needle-nose pliers or cutters. This will ensure the PCB will mount flush with the pedal case. All ten pots will need the tabs removed.

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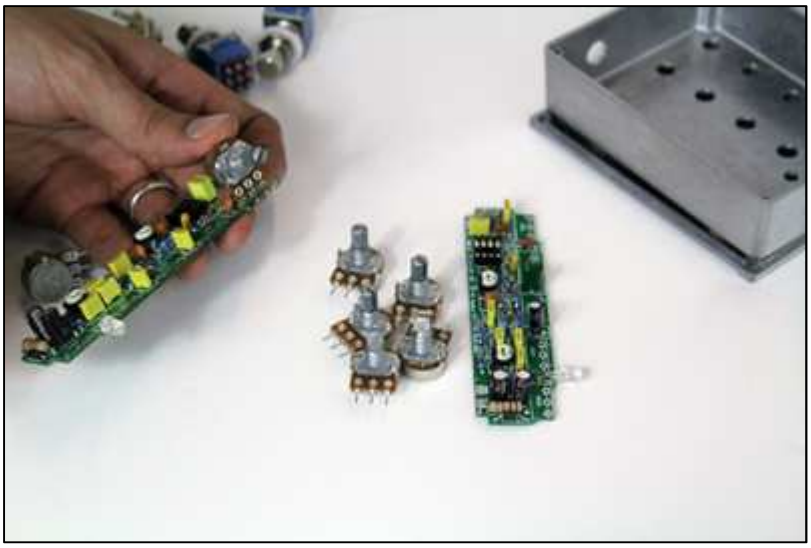
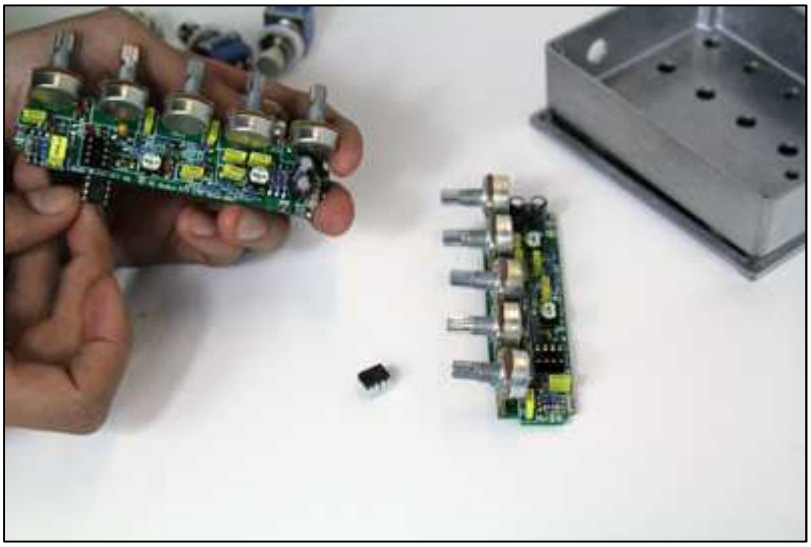


(15) Each pot is to be loaded facing away from the PCB as shown left. Load and solder in place but take care in not bending the pots back and forth whilst soldered.

This design provides great mechanical strength once loaded but can easily be bent back placing strain on the PCB unloaded.



(16) Finally, we can load in the IC into its socket. Remember how the socket had a notch to denote its orientation? We want to load the IC in the same way, with the notch facing the same direction.

That's it for the PCBs! Grab a cup of tea, cold beer or shot of whiskey and let's work on the hardware.

(17) We will be working on the enclosure, facing in. This is how the wiring diagrams (next section) are shown.

Let's load in the footswitches, input/output jacks, PCBs and DC jack.

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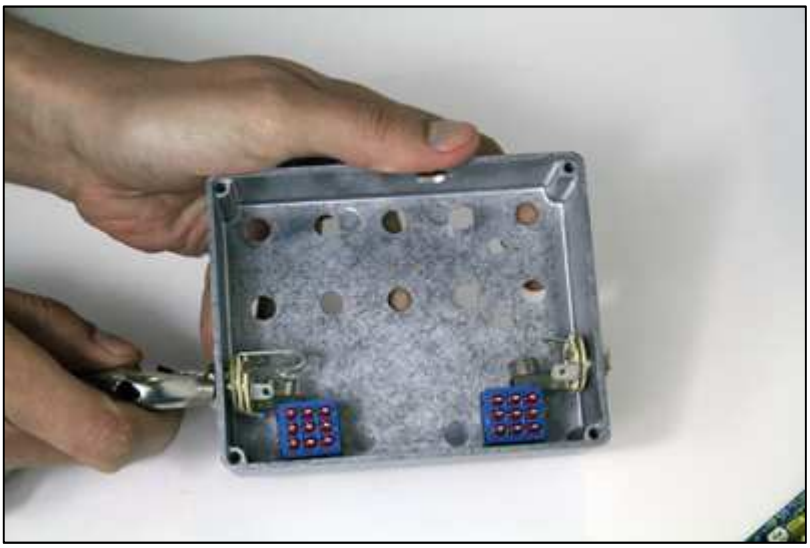
(18) Starting with the footswitch, before loading the footswitches, remove the nut and washers (plastic and tooth) and screw the final nut down to its base (shown).

These must be loaded into the case in a certain orientation, with the groove (shown) to point either up (towards the DC jack) or down.

(19) Holding the footswitch in place, fasten the switch with the washers and nut on the opposite side with a wrench or socket.

Do this for both footswitches.



(20) Next we will load in the jacks. The input jack (shown on the left hand side being tightened) is a stereo jack with a tip, ring and sleeve orientation. The output jack is mono and has only a tip and sleeve connection. Load and secure with the included nut and washer.

TIP!

Visit the links page for more information on jacks and their functions for the unfamiliar.

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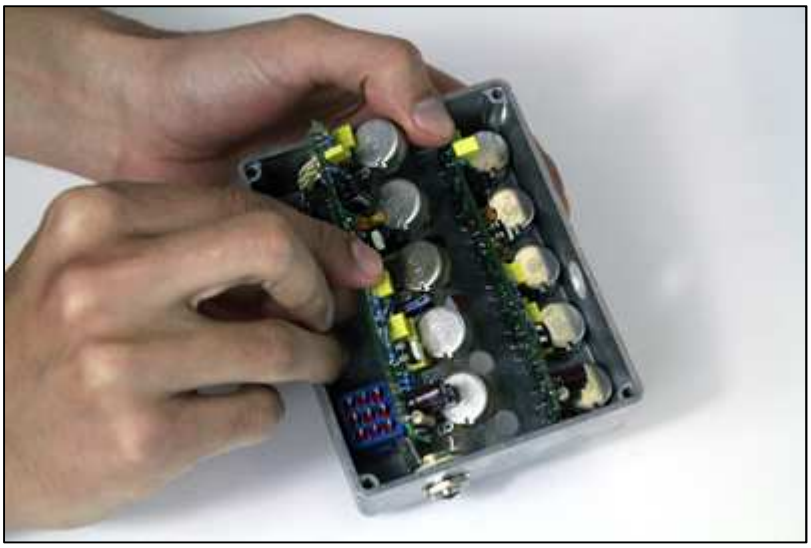

(21) Time to load in the PCBs, start with the top board (PCB A) and then the bottom board.

This will take some wiggling and realignment of the pots and LEDs to fit in the pre-drilled holes. Press through to ensure the pots are flush against the case.

(22) Tighten the pots using the included nuts and washers, and ensure each pot is properly secured.

DO NOT over tighten as this may damage both the pots and PCBs.

(23) Last step is to load the DC jack. Be sure to load it in as shown and tighten with the included black nut with needle nose pliers. Some inwards pressure will need to be to the outside barrel of the jack whilst fastening to ensure the jack doesn't rotate.

LET THE WIRING BEGIN!!!

MI DIY DUAL DRIVE KIT

WIRING.

This assembly guide assumes intermediate build knowledge from this point such as the labelling of a stereo/mono jack, DC jack, grounding etc., and links can be found in that section at the end of this guide. An intermediate builder should be able to cut and solder wires to length from Step (23) however we recognise that new builders (noobs!) might not have done this previously. The box below has some tips on additional steps to do to ensure you are ready for the challenge that is wiring a pedal!

NB: This kit does not include hook-up wire and you will need to purchase from any electronics store or online before proceeding. Refer to WHAT YOU'LL NEED TO GET STARTED at the front of this guide.

BEGINNER'S GUIDE TO WIRING.

We recommend taking some extra time at this stage as wiring can be a confusing and frustrating part of the build, with around 30 connections to make! Taking the time to do it right will lead to less chance of incorrect wiring and troubleshooting time.

From step (23), it would be best to cut each wire to length using the chosen wiring scheme on the next page. Grab your hookup wire, identify the origin and end point and choose a path in which to route the wire –along the side of the enclosure is best practice. Once you are happy with the length, cut and label that wire and set aside. Do this for all wires that are to originate from, or end, at the PCB.

Once you have your wires cut and sorted, remove the two PCBs from the enclosure and place it in front of you. Strip the tip of the wire and insert into the origin point from the bottom side of the PCB. Make sure all stray strands of wire have properly inserted through to the other side, and solder in place ensuring a good joint on top and on the bottom side of the PCB.

Do this for all wires that originate from, or end, at the PCB. Reload the PCBs into the enclosure and tuck wires either side of the enclosure. You are now ready to finish the wiring.

Taking the time to solder all wires to length outside of the enclosure will ensure proper length wires, good solder contacts and no burnt wires/components from trying to squeeze the soldering iron into a tight spot.

NOTE: If you choose alternate (parallel) wiring you will need to drill an additional hole for a bypass (on/off) LED next to the BYPASS footswitch. The anode (+) of the LED will need to connect to a 4.7k resistor with the other end of the 4.7k connected to the DC jack (+).

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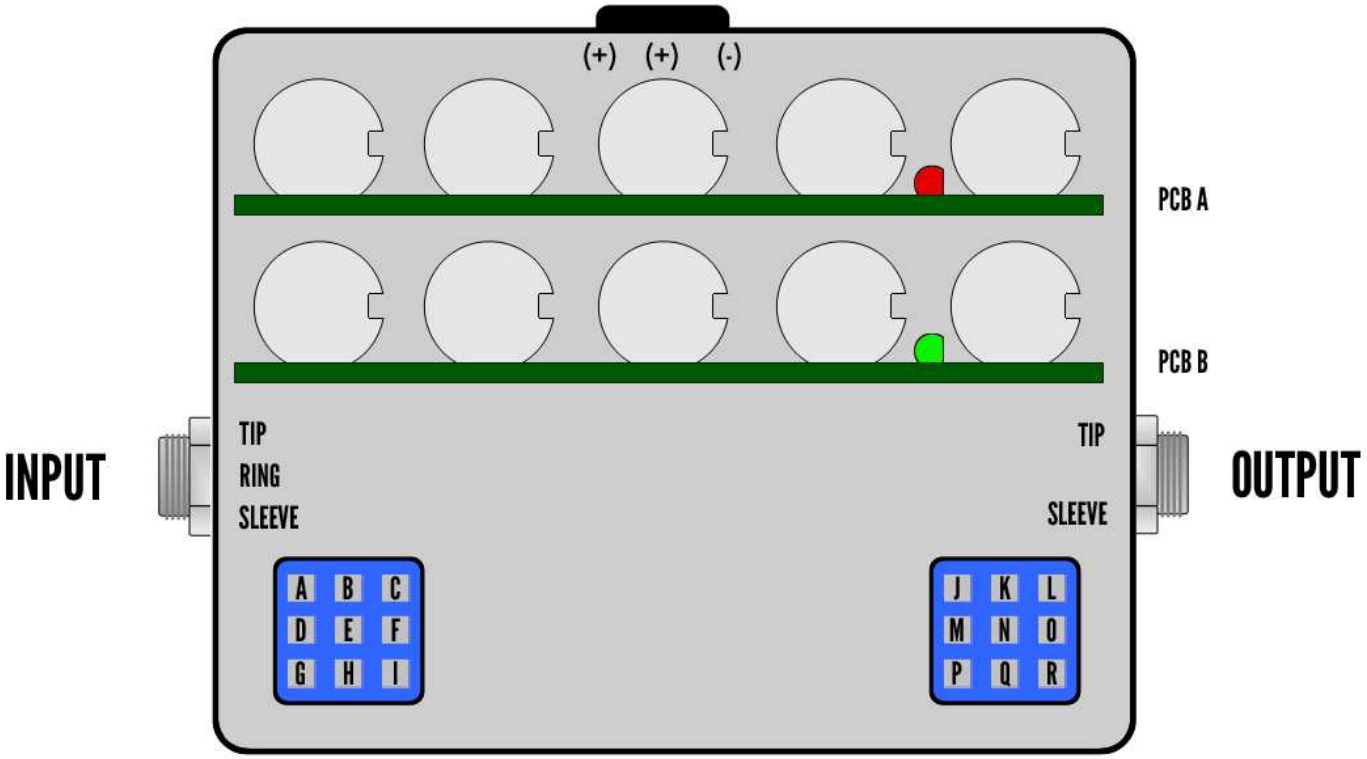
BYPASS WIRING DIAGRAMS.

Below are two options for wiring the pedal, either in series (stacked) or parallel (alternate). Series allows for either Drive A, Drive B or Drive A stacked into Drive B. Parallel has one switch for bypass on/off, and the other switch selects either Drive A or Drive B.



SERIES (STACKED)	
ORIGIN	END POINT
FOOTSWITCH 1	
A	NOT USED
B	INPUT JACK - GROUND/SLEEVE
C	INPUT JACK - TIP
D	INPUT JACK - GROUND/SLEEVE
E	IN PCB A
F	FOOTSWITCH 2 (L, Q)
G	LED A (CHN)
H	INPUT JACK - TIP
I	OUT PCB A
FOOTSWITCH 2	
J	NOT USED
K	INPUT JACK - GROUND/SLEEVE
L	FOOTSWITCH 1 (F)
M	INPUT JACK - GROUND/SLEEVE
N	IN PCB B
O	OUTPUT JACK - TIP
P	LED B (CHN)
Q	FOOTSWITCH 1 (F)
R	OUT PCB B

PARALLEL (ALTERNATE)	
ORIGIN	END POINT
FOOTSWITCH 1	
A	NOT USED
B	INPUT JACK - GROUND/SLEEVE
C	INPUT JACK - TIP
D	INPUT JACK - GROUND/SLEEVE
E	FOOTSWITCH 2 (M)
F	OUTPUT JACK - TIP
G	BYPASS LED (-)
H	INPUT JACK - TIP
I	FOOTSWITCH 2 (N)
FOOTSWITCH 2	
J	IN PCB A
K	OUT PCB A
L	LED A (CHN)
M	FOOTSWITCH 1 (E)
N	FOOTSWITCH 1 (I)
O	INPUT JACK - GROUND/SLEEVE
P	IN PCB B
Q	OUT PCB B
R	LED B (CHN)

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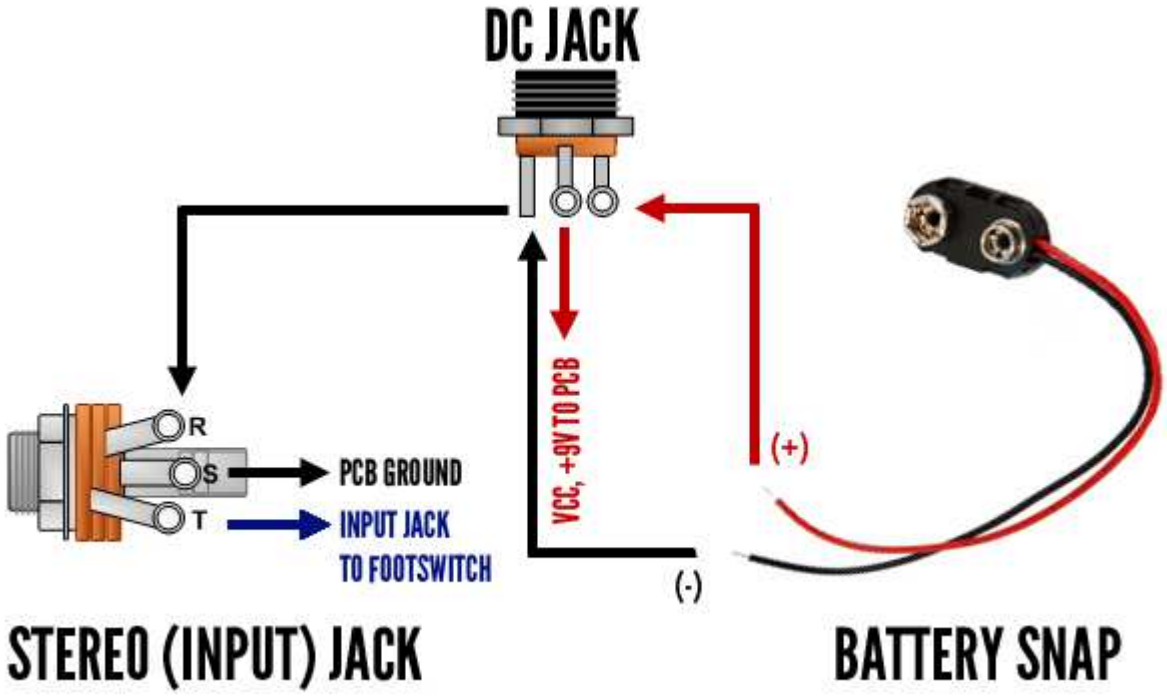
POWER UP!

Once all of your ground, input and output connections have been made, it's time to connect the DC jack and 9V battery snap. This final step is very important and requires a bit of knowledge on how the DC and input (stereo) jack works.

The DC jack has three pins; two parallel and one large tab perpendicular to the parallel pair. The latter large tab is the ground tab and will need to be connected to the stereo jack and PCBs for grounding the circuit. The other two pins are switched pins and are commonly used to switch between DC adaptor power or 9V battery power.

If you look at your DC jack in the orientation in the image above left you will see the tabs described above. The image below shows the connections to be made for the DC jack, input jack and battery snap. For more info on why these connections are made, check out our MI DIY section at www.miaudio.com.



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TROUBLESHOOTING CHECKLIST.

Here is a checklist to help if you are getting no power, bypass or audio signal. Please remember that troubleshooting is all part of the build and we at MI Audio cannot help with each individual case. Please check our MI DIY page on our website for feedback from other builders.

FIRST STEP	✓
Check the values of all resistors and capacitors and ensure they are in their correct place	
Ensure each polarised component (diodes, LEDs, electrolytic capacitor)has been inserted correctly	
Ensure all pins of the IC have been inserted into the socket and in the correct orientation	

GROUNDING	✓
Ensure ground continuity (multimeter required) for the following connections…	
• Pin 4 of IC on PCB A	
• Pin 4 of IC on PCB B	
• (-ve) of DC Jack to PCB A	
• PCB A to PCB B	
• PCB B to Input Jack	
• Input Jack to Footswitch A	
• Footswitch A to Footswitch B	

INPUT/OUTPUT/POWER	✓
Ensure continuity (multimeter required) for the following connections…	
• In of PCB A to Footswitch	
• In of PCB B to Footswitch	
• Out of PCB A to Footswitch	
• Out of PCB B to Footswitch	
• Input Jack to Footswitch	
• Output Jack to Footswitch	
• 9V DC Jack to Vcc of PCB A	
• Vcc of PCB A to Vcc of PCB B	

VOLTAGES	✓
Ensure correct voltages (multimeter required) for the following connections…	
• 9V at DC Jack	
• 9V at Vcc of PCB A	
• 9V at Vcc of PCB B	
• 9V at Pin 8 of IC on PCB A	
• 9V at Pin 8 of IC on PCB B	
• 4.5V at junction of R13/R14 on PCB A	
• 4.5V at junction of R13/R14 on PCB A	
• 4.5V at Pin 5 of IC on PCB A	
• 4.5V at Pin 5 of IC on PCB B	

MI DIY DUAL DRIVE KIT

LINKS.

For more information on the MI DIY Dual Drive Kit, you can visit our website: www.miaudio.com/mi-diy/. We encourage all of you to post comments and replies as any knowledge shared can help other builders in the same position. You are also welcome to share your builds or any hints/tips to register@miaudio.com.

SOLDERING

Collin's Lab on YouTube is a great resource on tips on starting a kit, how to read a schematic and many other electronics info nuggets and would be a good resource for those less confident in building: http://www.youtube.com/playlist?list=PLDE23FAC8A681FA46

COMPONENTS

This video series from MAKE provides some great basic electronics information:
RESISTORS: http://youtu.be/VPVoY1QROMg
CAPACITORS: http://youtu.be/ZYH9dGl4gUE
DIODES: http://youtu.be/AqzYsuTRVRc
LEDs: http://youtu.be/P3PDLsJQcGI
INTEGRATED CIRCUITS: http://youtu.be/uSRIc-sEgPw

EFFECTS PEDAL BUILDS

A great online resource for DIY-ers is Beavis Audio. The Tech pages are full of information on potentiometers and switches, modifications and basic circuits if you wish to take the MI DIY kit further (which we hope you do!): http://www.beavisaudio.com/techpages/

DIY COMMUNITIES

The one-stop shop for pedal DIY-ers is the DIY Stompbox Forum: http://www.diystompboxes.com/smfforum/. This is a valuable resource for ways to take your project to the next level and is full of very knowledgeable builders and hackers.

PARTS

There are a tonne of electronics parts suppliers, some come with a catalog the size of phonebooks. Below are some effects pedal specific suppliers and some general suppliers if you wish to find something particular:
SMALL BEAR: https://www.smallbearelec.com/
PEDALS PARTS PLUS: http://www.pedalpartsplus.com/
MAMMOTH ELECTRONICS: http://www.mammothelectronics.com/
PEDAL PARTS AUSTRALIA: http://www.pedalpartsaustralia.com/
MOUSER: http://www.mouser.com/
DIGIKEY: http://www.digikey.com/

Best of luck on your build and we hope it's the start of many more builds to come!