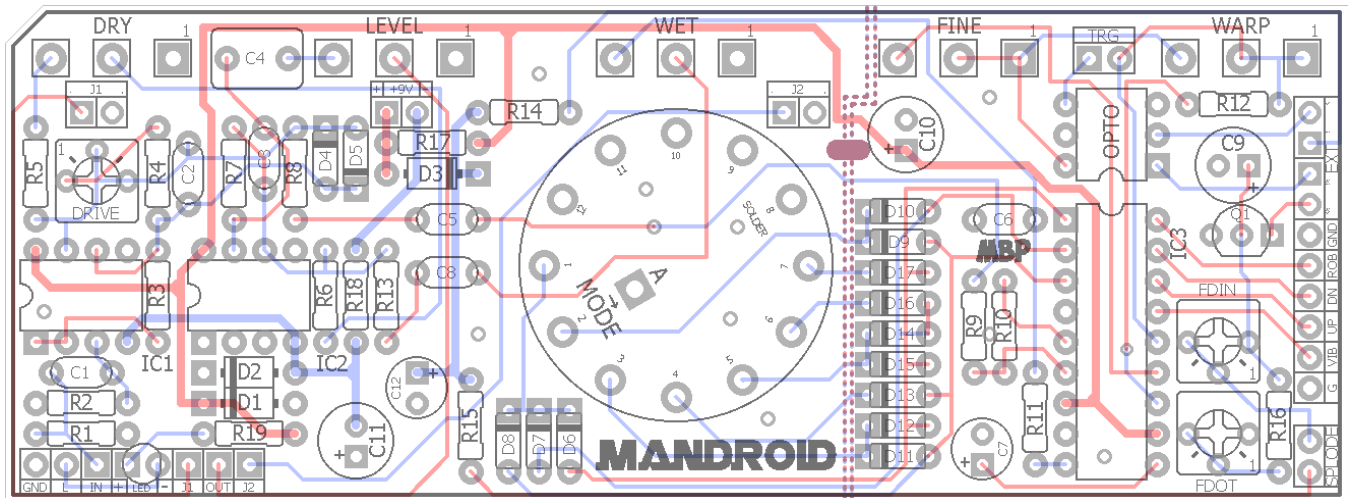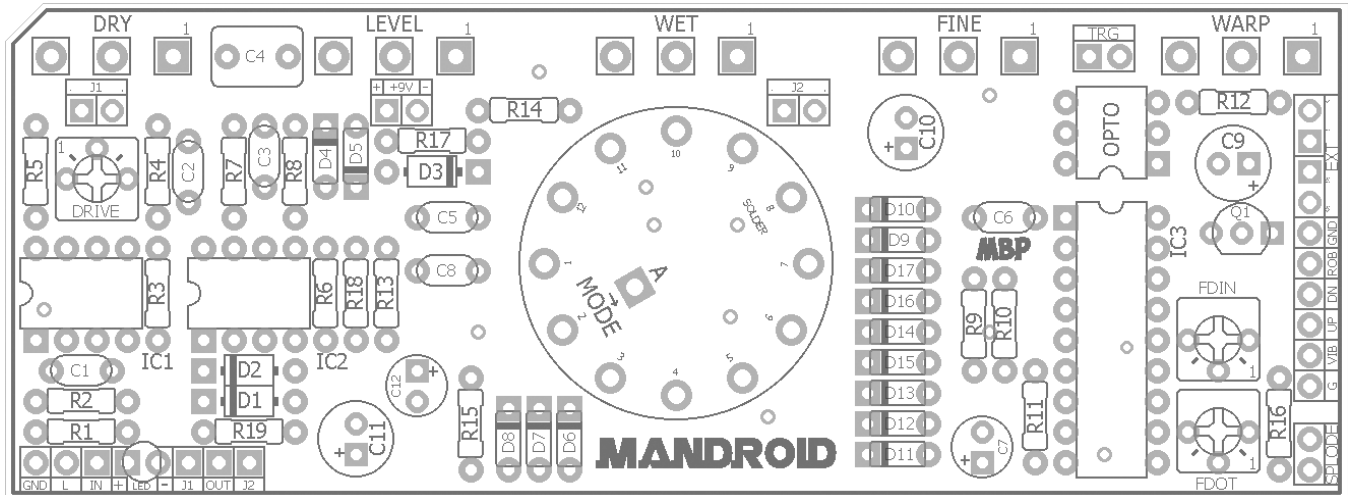# MANDROID

FX TYPE: Pitch Modulator
Based on Hazelwanter Pitch Shifter
© 2017 madbeanpedals
8.8 update: pgs. 11 & 12
4.4" W x 1.625" H

Due to the split-rail power scheme, this project requires an isolated 9v supply. Daisy-chained supplies (ex. One Spot using multiple taps) will not work for the Mandroid.

B.O.M.

Resistors		Diodes	
R1	1M	D1	3.6v
R2	1M	D2	3.6v
R3	10k	D3	1N5817
R4	10k	D4 - D17	1n914
R5	5k1	**Transistor**	
R6	5k1	Q1	2n3904
R7	22k	**ICs**	
R8	10k	IC1	4558
R9	4k7	IC2	4558
R10	33k	IC3	HT8950
R11	330R	**Optocoupler**	
R12	100k	OPTO	H11F1
R13	10k	**Switches**	
R14	330R	MODE	1P12T
R15	1k	SPLODE	Momentary
R16	1k	ROB/VIB	Momentary
R17	47R	TRIG	SPDT
R18	47R	**Jack**	
R19	1k	EXT	1/8" Jack
Caps		**Trimmers**	
C1	100n	FDIN	100k
C2	220pF	FDOT	100K
C3	330pF	DRIVE	50k
C4	1uF	**Pots**	
C5	100n	DRY	10kB
C6	100n	FINE	5kB
C7	4u7	LEVEL	100kA
C8	220n	WET	10kB
C9	220uF	WARP	250kB
C10	100uF		
C11	100uF		
C12	10uF		

Shopping List			
Value	QTY	Type	Rating
47R	2	Metal / Carbon Film	1/4W
330R	2	Metal / Carbon Film	1/4W
1k	3	Metal / Carbon Film	1/4W
4k7	1	Metal / Carbon Film	1/4W
5k1	2	Metal / Carbon Film	1/4W
10k	4	Metal / Carbon Film	1/4W
22k	1	Metal / Carbon Film	1/4W
33k	1	Metal / Carbon Film	1/4W
100k	1	Metal / Carbon Film	1/4W
1M	2	Metal / Carbon Film	1/4W
220pF	1	Ceramic / MLCC	16v min.
330pF	1	Ceramic / MLCC	16v min.
100n	3	Film	16v min.
220n	1	Film	16v min.
1uF	1	Film	16v min.
4u7	1	Electrolytic	16v min.
10uF	1	Electrolytic	16v min.
100uF	2	Electrolytic	16v min.
220uF	1	Electrolytic	16v min.
3.6v	2	Zener	
1N5817	1		
1n914	13		
2n3904	1		
4558	2		
HT8950	1		
H11F1	1		
1P12T	1	Rotary Switch	
Momentary	1	Footswitch	
Momentary	1	Pushbutton Switch	
SPDT	1	or, SPST	
1/8" Jack	1	see link	
100k	2	Bourns 3362p	
50k	1	Bourns 3362p	
10kB	2	PCB Right Angle	16mm
5kB	1	PCB Right Angle	16mm
100kA	1	PCB Right Angle	16mm
250kB	1	PCB Right Angle	16mm

This project requires parts that, unfortunately, no single supplier is likely to have. The following links should help locating everything you need.

3.6v Zener (3.3v Zener should work as a substitute)**:**
http://www.mouser.com/ProductDetail/Nexperia/1N4729A133/?qs=sGAEpiMZZMtQ8nqTKtFS%2fISyHb0gtGyW3gFTqySUy%252bs%3d

H11F1:
http://smallbear-electronics.mybigcommerce.com/photocoupler-h11f1/

HT8950:
eBay is probably a good source – ex: http://www.ebay.com/itm/HT8950-Holtek-Voice-Modulator-DIP-IC-3-EACH-/391320657847?epid=1726593497&hash=item5b1c875fb7:g:38EAAOSwlwhWR39M
or, http://www.futurlec.com/Others/HT8950pr.shtml
or, http://vakits.com/ht8950-voice-modulator
or, more expensive but you can get one out of this project (plus extra parts):
https://www.amazon.com/gp/product/B004XZQ6RE/ref=oh_aui_detailpage_o01_s00?ie=UTF8&psc=1

1P12T:
 http://smallbear-electronics.mybigcommerce.com/26mm-enclosed-1p2-12t-0227b/

Momentary Footswitch (SPLODE):
http://www.bitcheslovemyswitches.com/#!/SPST-Soft-Touch-Momentary-Footswitch-Normally-Open/p/10220659
or, http://smallbear-electronics.mybigcommerce.com/momentary-spst-no-soft-touch/

Momentary Pushbutton (ROB/VIB):
http://www.bitcheslovemyswitches.com/#!/Green-SPST-Pushbutton-Momentary-Switch/p/30912900/category=7189610
or, https://www.mammothelectronics.com/collections/tactile-switches/products/spst-pbs-rbk-al
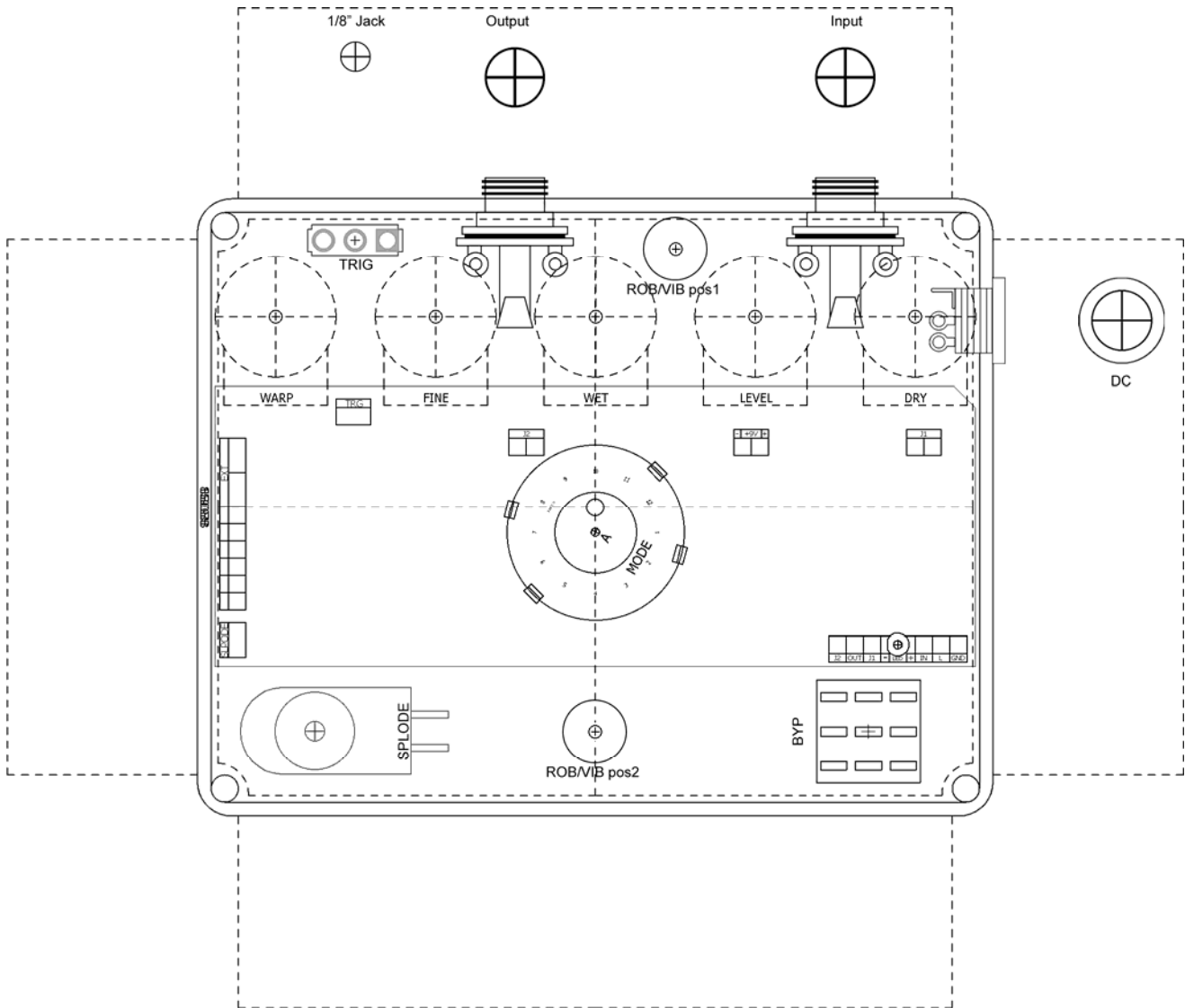
Mini SPDT Toggle (TRIG):
http://smallbear-electronics.mybigcommerce.com/spdt-on-on-0218a/

1/8" Jack (EXT):
http://smallbear-electronics.mybigcommerce.com/1-8-mono-pc-mount/

HT8950 Datasheet https://www.sparkfun.com/datasheets/Components/General/8950v110.pdf

1590BB Drill Guide

6.83"W x 5.81"H

Photoshop Drill Template:
http://www.madbeanpedals.com/projects/Mandroid/Mandroid_DRILL.zip

This template shows two possible locations for the ROB/VIB switch. If using the "tactile" pushbutton linked to Mammoth on pg.4, then use pos2 on the enclosure (that switch is fairly large). The small pushbutton switch linked to BLMS will work in either position.

7.26 Update: I modified this drill template for better placement of ROB/VIB pos1 and moved the DC Jack to the right side. This will make for a much easier build.

# Wiring (Isolated Power Supply Version)

TRIG

ROB/VIB

DRY

LEVEL

WET

FINE

WARP

MODE

MANDROID

SPLODE
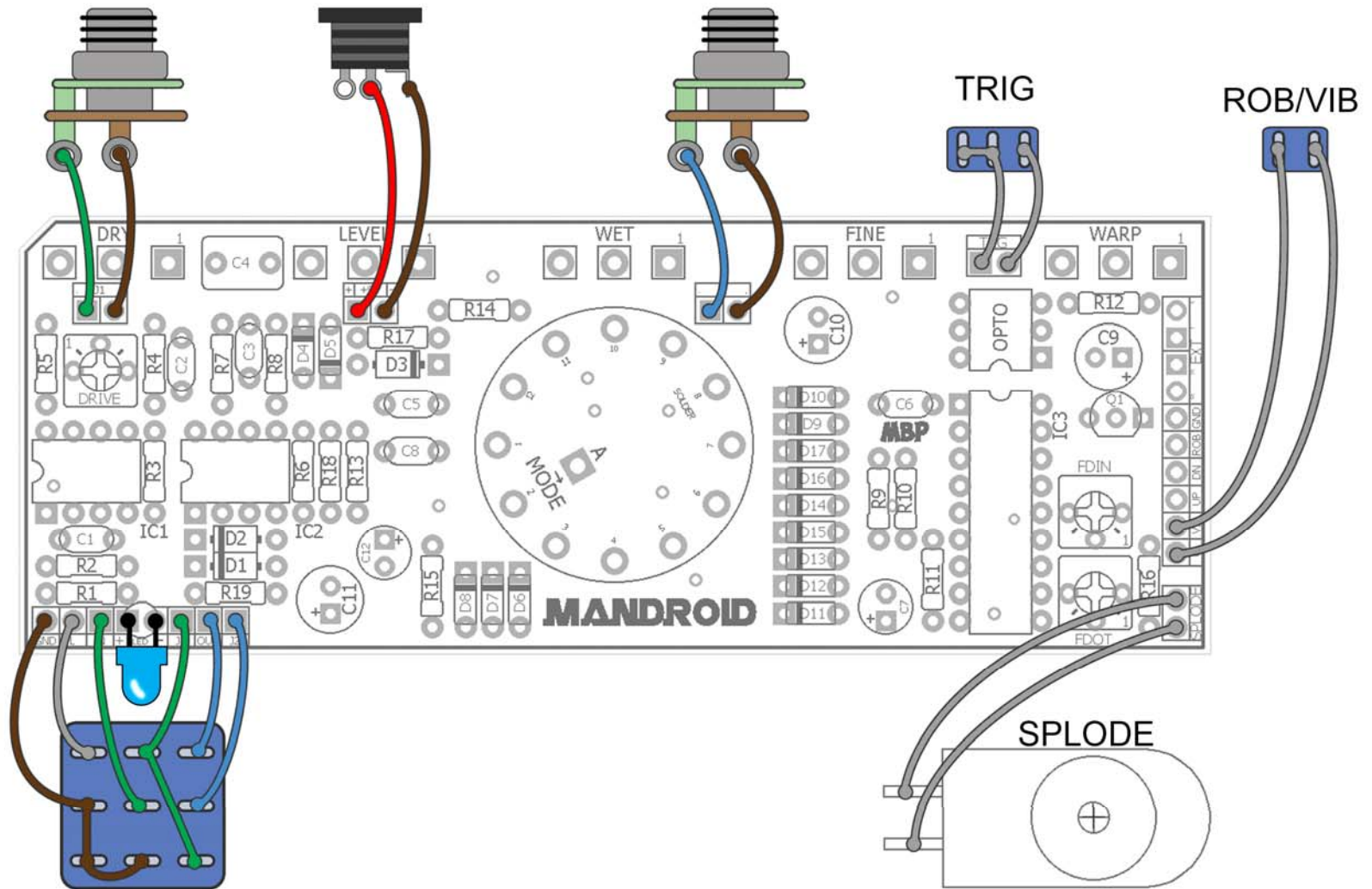
See next pg.8 for 1/8" jack wiring. Additional pads on the right of the PCB are explained in the Mods section.

Wiring (Battery Power Version)
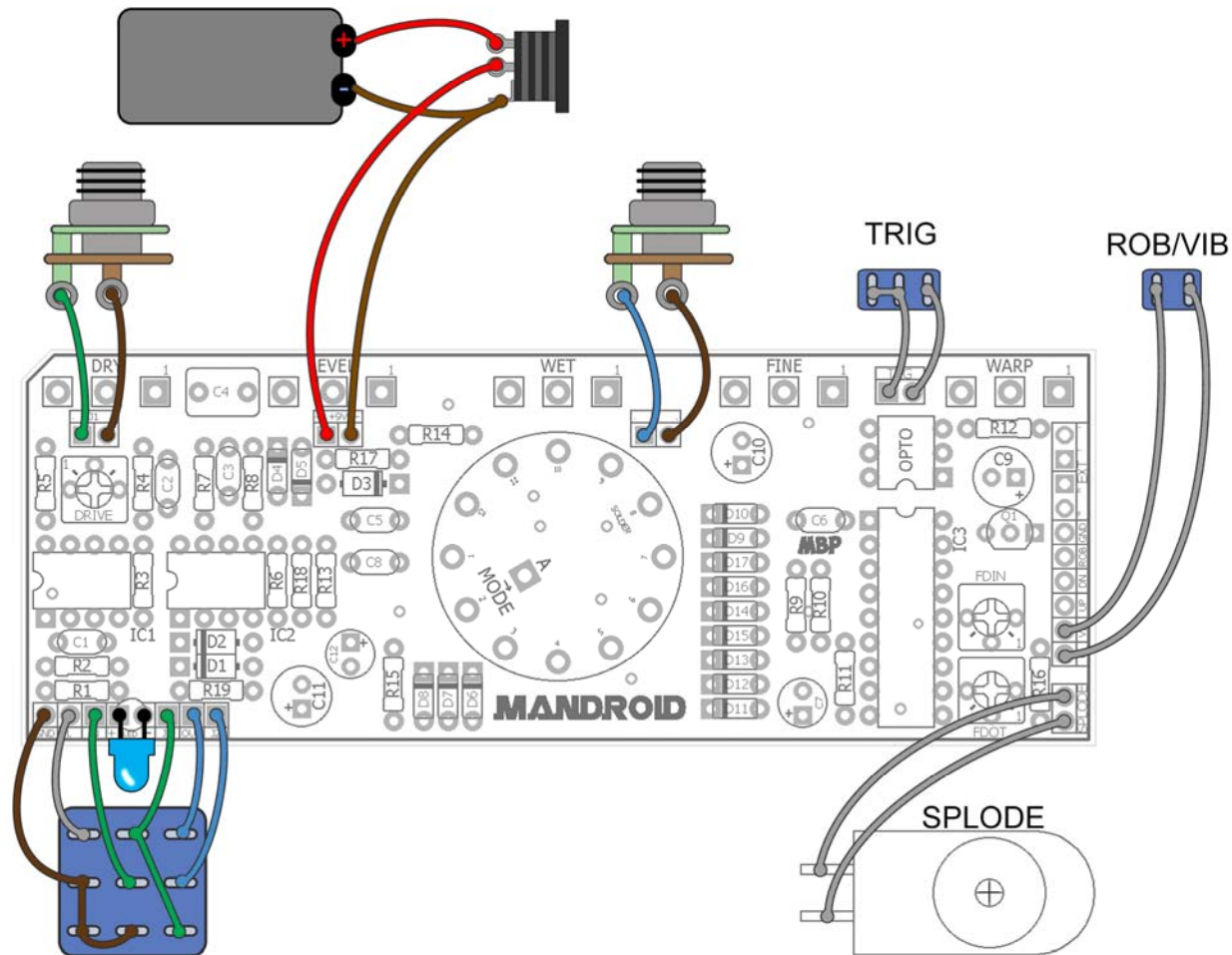
If you don't have an isolated power supply and want to use battery power instead, we have to make an adjustment. Normally a battery has its black lead wired to the ring of a stereo input jack. However, we use mono plugs for our guitars which means once a mono plug is inserted to a TRS jack, the ring and sleeve are grounded. That won't work for us because we need the black lead from the battery to provide -4.5v! Instead, wire the battery as shown above. The battery negative is always connected to the PCB. The battery positive is switched. What this means is when nothing is plugged into the DC Jack, both the positive and negative sides of the battery are connected to the PCB and power it. If an empty plug (not connected to anything) is inserted in the DC Jack, it disconnects the power and saves on the battery life.

7.26 Update: When using PCB mounted pots, you should offset them from the board. This is because these Alpha rotary switches are a bit taller than the lengths of the potentiometer pins.
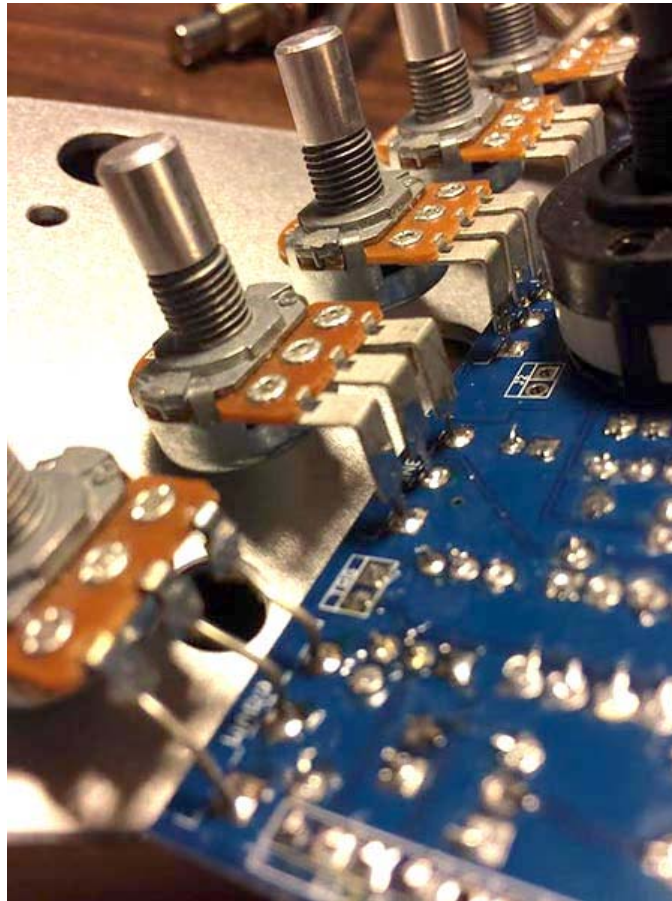
You can also use regular solder lug pots, too.

Wiring Correction

There is a routing mistake on the schematic with the EXT jack. The T/TN and S/SN connections are flipped. This is very easy to fix. Wire the EXT jack like this:
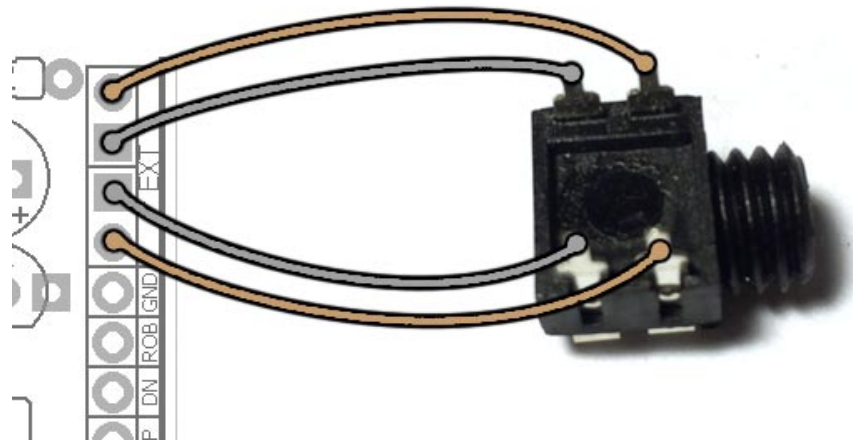
If you don't want to use the EXT jack at all, solder wires to the pads to like this:

Overview

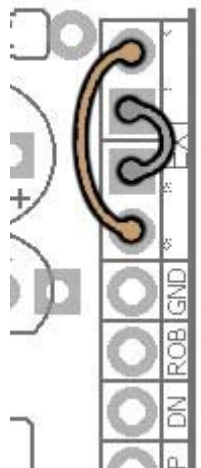The **Mandroid** is based on the Dean Hazelwanter Pitch Shifter project from General Guitar Gadgets and later popularized by the Death By Audio® Robot™. It uses an obscure "voice modulator" chip made by Holtek (now obsoleted). "Normal" operation receives audio input and then modulates it with strange pitching shifting and aliasing into a kind-of robotic voice. It also has the option to add vibrato to the robot voice because why not.

In terms of making it into a guitar effect, the Mandroid will produce strange pitch shifting whose frequency range is set by the Mode switch and Warp pot. It can make faux ring modulator type sounds, weird vibrato, runaway arpeggios and generally make your band members stare at you in disbelief.

The Mandroid has elements from both the "Pitch Shifter" and "Robot" designs and adds a new control: the Splode. Splode is a momentary trigger that will "explode" the pitch shift upward by utilizing a transistor to fade in and fade out an optocoupler in parallel with the Warp knob. Lastly, the Mandroid has an option to use an external trigger in place of the Splode control (to hopefully interface with the upcoming Wumpus capacitive touch project – or something else).

Controls

Pots

LEVEL – Total output of the effect.
DRY – Dry signal mix.
WET – Effect signal mix.
WARP – Oscillator/speed control for the modulator chip.
FINE – This allows for smaller adjustments to the Warp control (a few cents of pitch shift) – useful if you are trying to tune the pitch shift to a specific note on the guitar. Nominal position is halfway up.

Trimmers

DRIVE – Adds soft clipping to the dry and effect signal paths. Left to 1/3rd is cleanest, ½ to all the way up is dirty.
FDIN – Controls the fade-in time of the LED in the H11F1. Left is instant on, right is 1-2 seconds fade in.
FDOT – Controls the fade-out time of the LED in the H11F1. Left is instant off, right is 1-2 seconds fade out.

Switches

ROB/VIB - Pushbutton switch to select between the Robot and Vibrato modes.
MODE – Switches between the pitch shifting steps available on the HT8950 (**set for 8 steps**)
TRIG – Turns on the Splode control (this will change the WARP setting when turned on).
SPLODE – Momentary trigger that automatically changes the Warp control via the H11F1.
EXT – Allows for an external input to drive the H11F1 instead of the Splode footswitch. When an external trigger is plugged in, the FDIN and FDOT trimmers are disabled.

Notes

- The Mode rotary switch is a 1P12T. This switch has a small ring with a tab to set the maximum number of steps to the switch. For the Mandroid, insert this tab into the slot labeled "8".

- The Splode control is set for maximum range when pressed. If you want a more subtle control, socket R13 and try higher value resistors such as 1k, 2k, etc. This will reduce the maximum brightness of the LED in the H11F1.

- You might be wondering if a charge pump could have been used as a power inverter to do the split-rail supply used in this effect. The answer is you can but it sounds like crap. The typical charge pumps (LT1054, TC1044SCPA, etc) turn this effect into a noisy, heterodyning mess and make it completely unusable. The only downside of the method used here is that it requires an isolated supply which most of us are already using (PP2, etc).

- If you are using a testing rig for your builds (to rock before you box) make sure you have a ground connection between your input/output jacks on your testing rig and the Mandroid PCB. Normally this connection happens automatically with the sleeve connection on the 9v pads of PCBs, but in this case the sleeve is providing -4.5v for the effect!

Mods

If you want to go all out, there is an additional mod you can do. The 8th step on the Mode switch gives you access to the "TGU" and "TGD" functions on the HT8950. This means you can use yet another momentary switch to cycle the Modes up or down instead of the rotary switch. This could be fun for rapidly toggling through the modes while you are playing. Doing the mod is simple:

1) Set the tab on the Mode switch to 8 steps (even if you are not doing this mod).
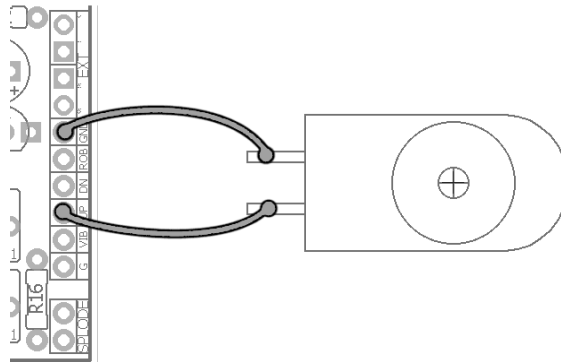
2) Wire up another momentary footswitch. One connection goes to GND (ground) and the other goes to either the UP or DN pads. The ROB pad is not used at all in this project, btw.

Of course, you will need to consider available space when using this mod if you stick with the 1590BB enclosure.

8.8 update: *Previously I instructed to set the Mode switch to 7 steps for normal operation and 8 steps if doing the Up/Down momentary switch. This is incorrect. The Mode switch should be set or 8 steps regardless. The 8th step on the switch also gives you the arpeggiator…one of the best parts of the effect!*

Voltages

IC1	V
1	22mV
2	22mV
3	22mV
4	-3.19
5	0
6	0
7	-0.8mV
8	3.16

IC2	V
1	2.8
2	0
3	0
4	-3.19
5	0
6	0
7	80mV
8	3.16

IC3	V
1	0.402
2	0.404
3	0.402
4	0
5	1.16
6	1.16
7	3.16
8	varies
9	3.06
10	1.16
11	3.16
12	1.15
13	1.15
14	1.13
15	3.13
16	3.13
17	3.13
18	3.13

8.8 update: Corrected voltages (I had previous 8950 voltages transposed on pins). These measurements were taken with the Mode switch in the 8th position. Some voltages will change in other positions.

MANDROID
based on the Hazelwanter Pitch Shifter
(c)2017 madbeanpedals

IN
BYP.1_IN
C1 100n
R1 1M
R2 1M
GND
R3 10k
4558 IC1_A
3 + 1
2 −
GND
5 + 7
6 −
4558 IC1_B
C2 220pF
D4 1n914
D5 1n914
R4 10k
50k DRIVE
R8 10k
R5 5k1
10kB DRY
R6 5k1
4558 IC2_B
5 + 7
6 −
GND
C3 330pF
R7 22k
C4 1uF
BYP.1_OUT
100kA LEVEL
OUT
GND
R13 10k
C8 220n
WET 10kB
GND
MODE 1P12T
S0 S1 S2
all 1n914

+4.5V
+3.3V
+9V
R17 47R
R18 47R
R19 1k
BYP.1_LED
BYP.1_L
BYP.1_GND
IC2_PWR 8
IC1_PWR 8
D1 3.6v
C10 100uF
C11 100uF
DIP
D2 3.6v
GND
-3.3V
J1 T S
BYP.1_J1
GND
J2 T S
BYP.1_J2
GND
4558 IC2_A
1
3 +
2 −
GNDGND

C5 100n
R9 4k7
R10 33k
C6 100n
GND
S2 S1 S0
1 2 3 4
GND
IC3 HT8950
18 17 16 15 14 13 12 11 10
R11 330R
C7 4u7
GND
+3.3V
+3.3V
ROB
DN
UP
VIB

5kB FINE
R12 100k
250kB WARP
TRG
OPTOB
OPTOA
EXT
TN T SN S
This is a wiring error - see notes for correction
R14 330R
C12 10uF
GND
R15 1k
D3 1N5817
+4.5V
SPLODE
100k FDIN
C9 220uF
Q1 2n3904
R16 1k
GND
100K FDOT
GND