

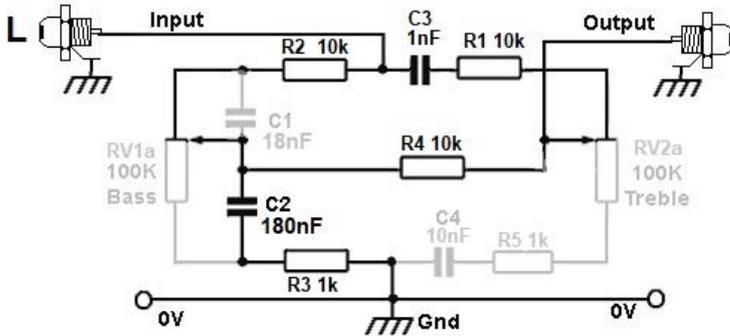
EXTERNAL TONE CONTROL BOX

Les Carpenter G4CNH April 2022

This tone control box is based on the standard Baxandall arrangement.

How the circuit works - Bass and Treble Boost.

With bass and treble controls set to maximum boost (both wipers at the top of potentiometers RV1a and RV2a), and the inactive components greyed out, the circuit will look like this.



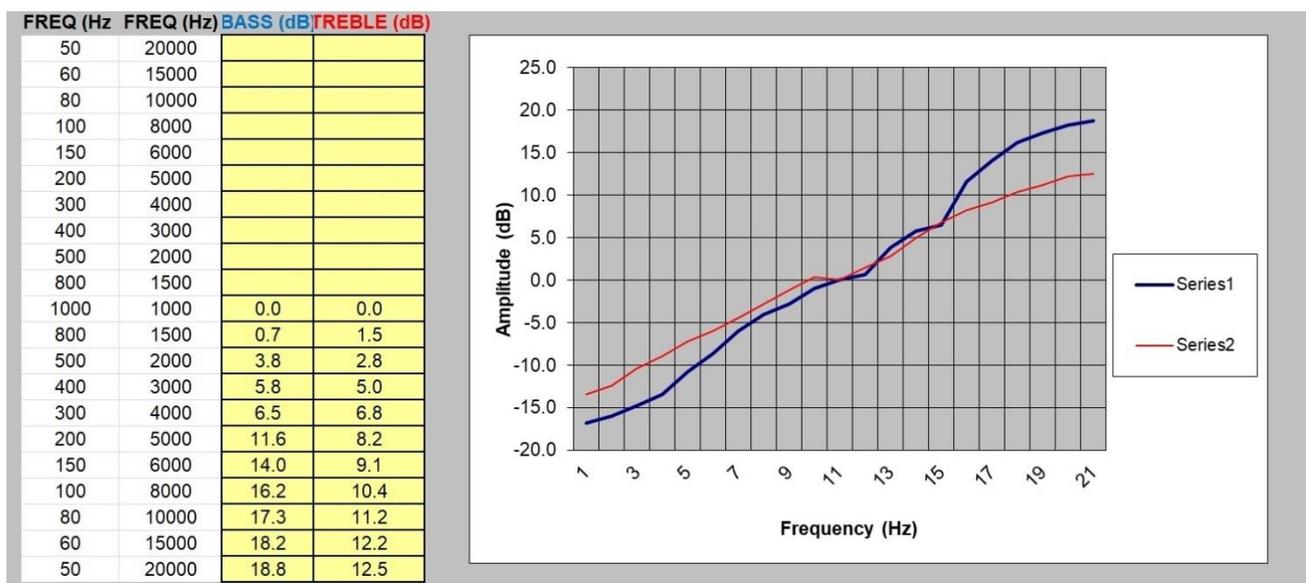
Both bass and treble potentiometers have much higher values than other components in the circuit, and so can be considered to be open circuit. C4 does not contribute to the operation of the circuit because of the high resistance of RV2a, and C1 is effectively shorted out by the wiper of RV1a being at the top end of its resistance track.

The full bandwidth of signal frequencies is applied to the input from the LesBox RIAA amplifier having low output impedance, and the higher frequency components of the signal are fed directly to the output of the tone control circuit via the 1nF capacitor C3 and R1 (10k).

These have a reactance of about 12.78 kΩ at 20 kHz but 7.96 MΩ at 20 Hz, so lower frequencies are blocked.

The full band of frequencies also appear at the junction of R2 and C2, which together form a low pass filter with a 3dB roll off frequency around 88 Hz and so frequencies appreciably higher than this (the mid and high frequencies) are conducted to ground via R3.

Having R3 in series with C2 prevents the attenuation of the mid band frequencies exceeding about -20dB. The lower frequencies are fed to the output via R4. Because R4 has quite a large value (to effectively isolate the effects of the two variable controls from each other), the input impedance (Z_{in}) of the circuit following the tone control must be very high to avoid excessive signal loss due to the potential divider effect of R4 and the Z_{in} of the following stage.

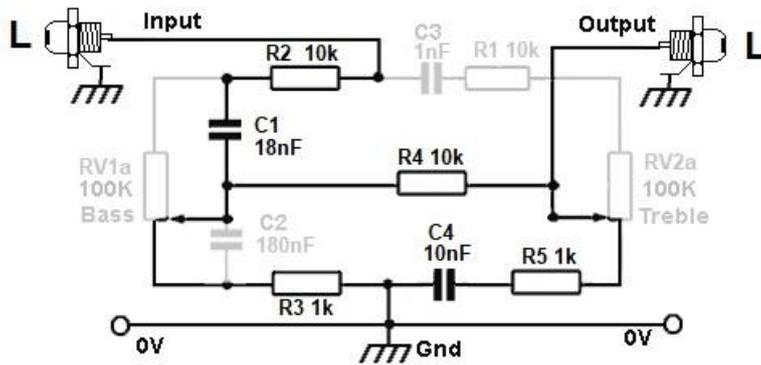


Graph interest is to the right of centre, insertion loss not included.

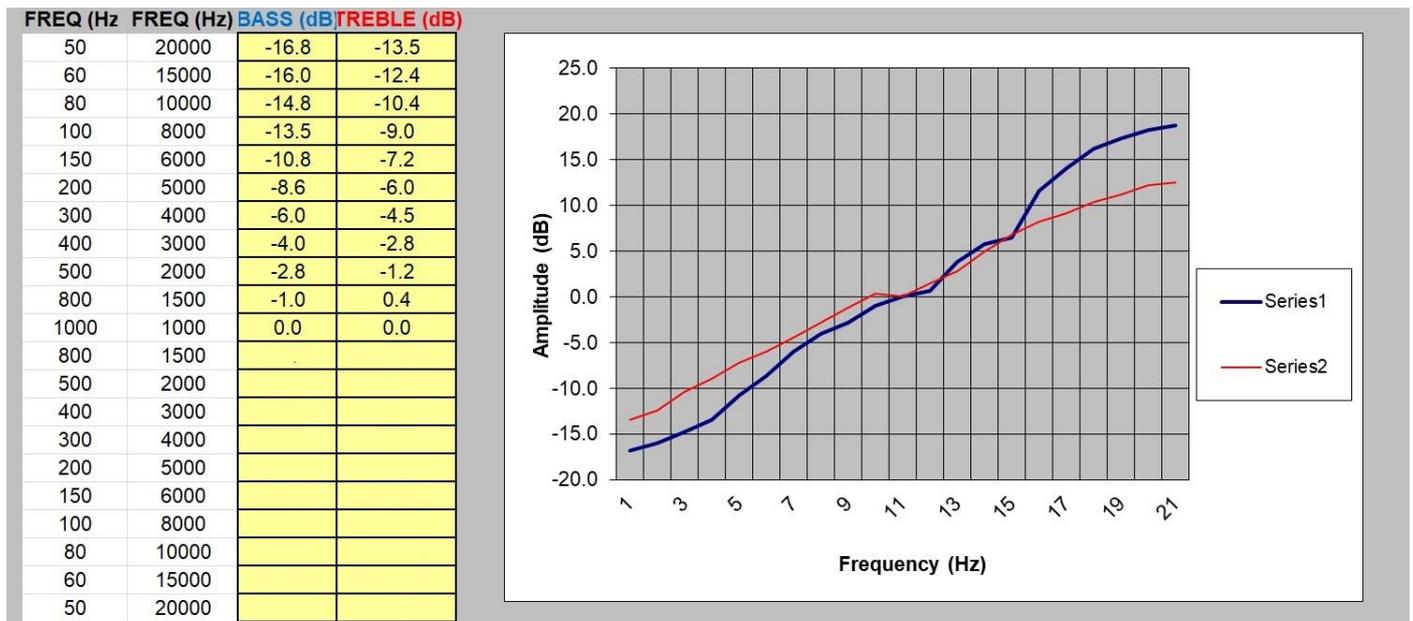
Bass Boost (in Blue) approximately 19dB at 50Hz

Treble Boost (in Red) approximately 12.5dB at 20 kHz

Bass and Treble Cut.



With the bass and treble controls both set to minimum (maximum cut), the full bandwidth signal passes through R2 but with the slider of RV1a at the bottom end of its resistance track, C1/R2 now form a high pass filter having a corner frequency of around 7 to 7.5kHz so only frequencies appreciably higher than this are allowed to pass un-attenuated. The mid and higher frequencies are therefore fed to R4, R5 and C4, which now form a low pass filter to progressively attenuate frequencies above about 70 Hz, the mid-band frequencies (about 1kHz) are reduced by approximately 0dB but actually -21dB including the insertion loss, and at 20kHz by as much as -13.5dB (-34dB with insertion loss) , as can be seen from the response curve shown on the left from 0dB.



Graph interest is to the left of centre, insertion loss not included

Bass Cut (in Blue) approximately -17dB at 50Hz

Treble Cut (in Red) approximately -13.5dB at 20 kHz

Notice that although the circuit provides what is called bass boost and treble boost, with the passive version of the Baxandall circuit (with no amplification), all frequencies are in fact reduced.

The attenuation of the circuit at mid-band is typically around -21dB and the graphs shown are with respect to the signal being increased to give 0dB at 1 kHz.

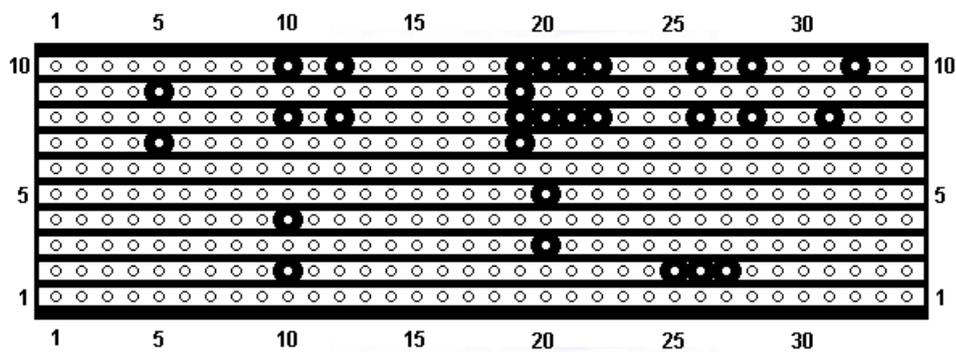
Construction.

This is left entirely up to the individual and the drawings shown in this document are how the Author built his prototype unit. He chose a Hammond Stomp Box 119x94x34 to house the circuitry which is mostly built on a small piece of stripboard, 10 Tracks each with 34 Holes.

The potentiometers serve as a mounting point for the board which otherwise requires no fixings of its own.

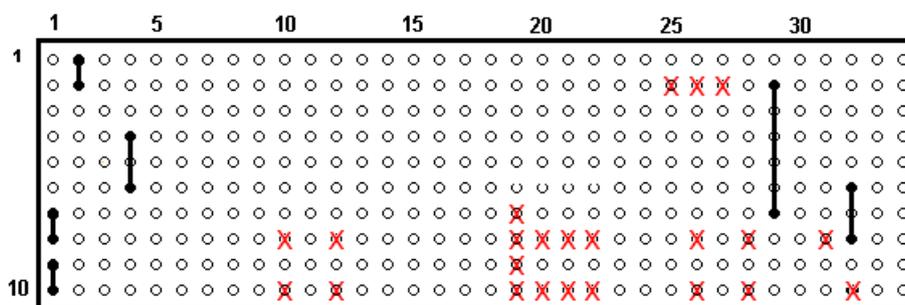
Start by cutting the strip board to size and cutting the tracks where shown.
 Ensure the tracks are well cut and no excess copper shorts across the cut track or to the adjacent tracks.

Track cutting



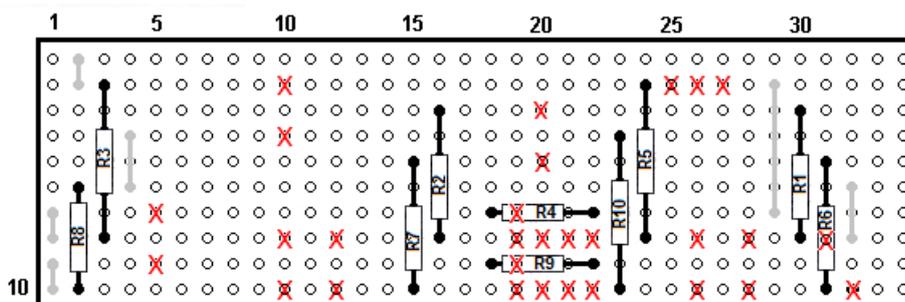
Installing wire links.

1 LINKS



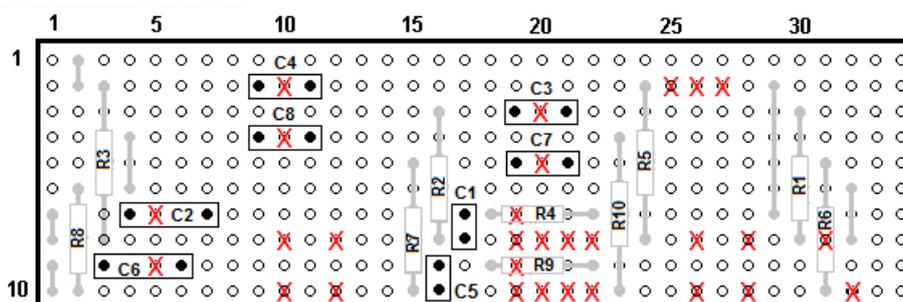
Installing resistors.

2 RESISTORS



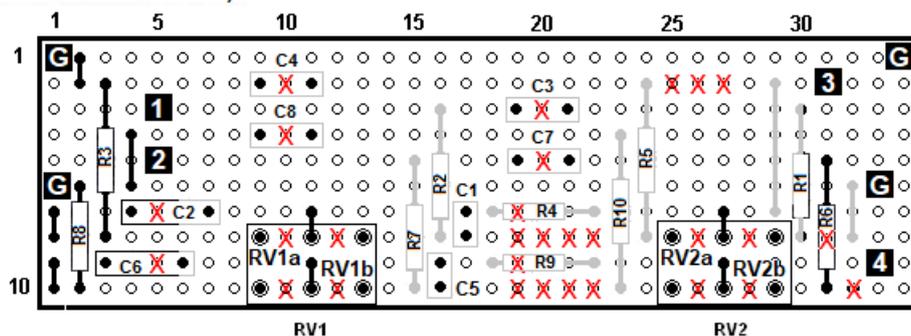
Installing Capacitors.

3 CAPACITORS

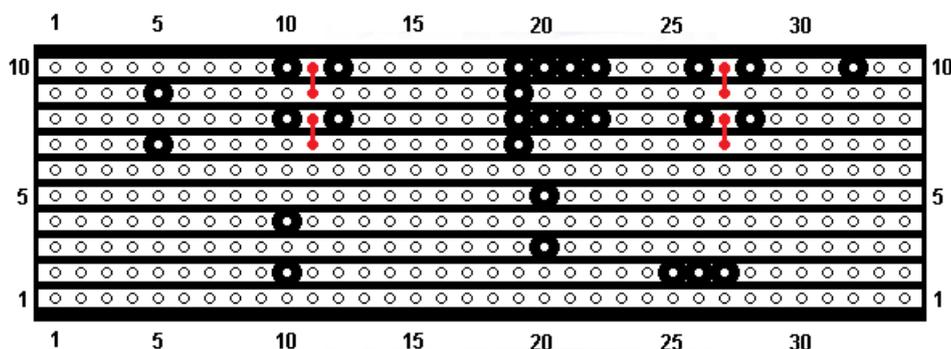


Installing Potentiometers and optional Pins, not forgetting under board solder links on RV1 and RV2.

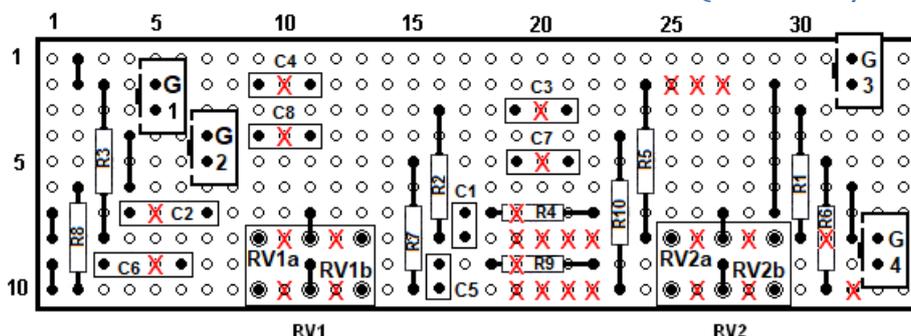
4 ADDING RV1, RV2 AND PINS



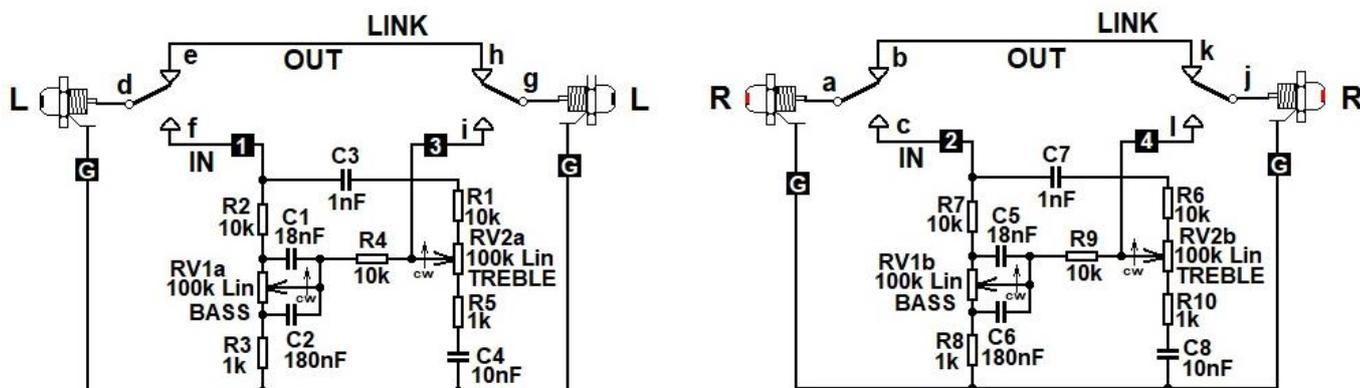
5 SOLDER LINKS UNDER BOARD



OPTIONAL BUILD USING 2 PIN CONNECTORS (XHB2.54/2P)



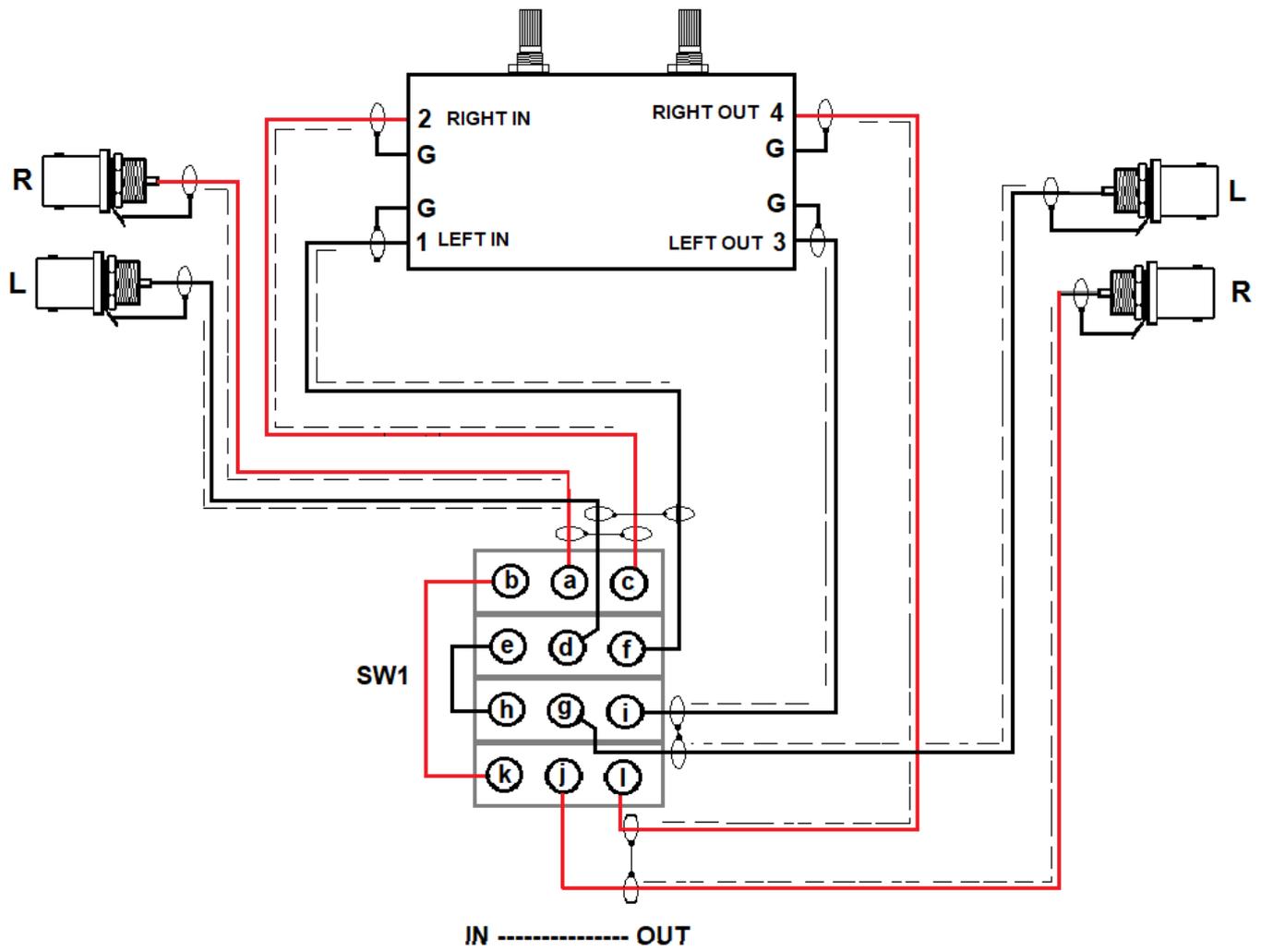
Circuit Diagrams



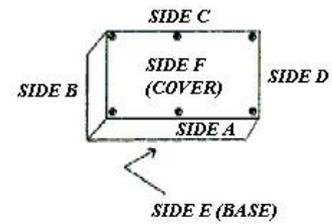
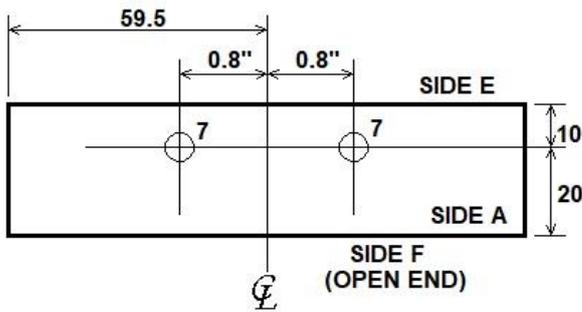
PARTS LIST - Feel free to use your own but C1 and C5 have to be 2.54mm spacing.

REF	DESCRIPTION	SUPPLIER	PART No.
1	Metal Box, Hammond 1590BBGR 119 x 94 x 34, colour Green	RS Components	229-1555
2	Feet and fixings (optional) - 4 off (16x10mm)	Cricklewood	FTB161
3	24SWG Tinned Copper Wire for board links.	RS Components	355-085
4	Heat-shrink sleeving 2.4 2:1 shrink, as required.	RS Components	666-868
5	Heat-shrink sleeving 6mm 3:1 shrink, as required.	RS Components	700-4535
6	Stripboard, cut to 10 Tracks, 34 Holes/Track	Cricklewood	CQ64
7	Optional solder pins (8 off)	Cricklewood	CQP1
8	Optional XHB2.54/2 Plugs and sockets	eBay Purchase	
R1	10k Metal Film 1%, 0.5W	Cricklewood	M10K
R2	10k Metal Film 1%, 0.5W	Cricklewood	M10K
R3	1k Metal Film 1%, 0.5W	Cricklewood	M1K0
R4	10k Metal Film 1%, 0.5W	Cricklewood	M10K
R5	1k Metal Film 1%, 0.5W	Cricklewood	M1K0
R6	10k Metal Film 1%, 0.5W	Cricklewood	M10K
R7	10k Metal Film 1%, 0.5W	Cricklewood	M10K
R8	1k Metal Film 1%, 0.5W	Cricklewood	M1K0
R9	10k Metal Film 1%, 0.5W	Cricklewood	M10K
R10	1k Metal Film 1%, 0.5W	Cricklewood	M1K0
RV1	100k LIN, Dual Ganged, 6mm Splined shaft,	Cricklewood	DJN100K
RV2	100k LIN, Dual Ganged, 6mm Splined shaft,	Cricklewood	DJN100K
C1	18nF 50V, 2.54mm spacing, Kemet MC0805B183K500A2.54MM	Farnell	1694114
C2	180nF CK06BX184K	Farnell	1740555
C3	1nF	Cricklewood	CMY1N0
C4	10nF	Cricklewood	CMY10N
C5	18nF 50V, 2.54mm spacing, Kemet MC0805B183K500A2.54MM	Farnell	1694114
C6	180nF CK06BX184K	Farnell	1740555
C7	1nF	Cricklewood	CMY1N0
C8	10nF	Cricklewood	CMY10N
SK1	RCA Jack, Panel Mount, Black	Cricklewood	PCAB
SK2	RCA Jack, Panel Mount, Red	Cricklewood	PCAR
SK3	RCA Jack, Panel Mount, Black	Cricklewood	PCAB
SK4	RCA Jack, Panel Mount, Red	Cricklewood	PCAR
SW1	4 Pole, 2 Way, Toggle Switch	Cricklewood	TM42N

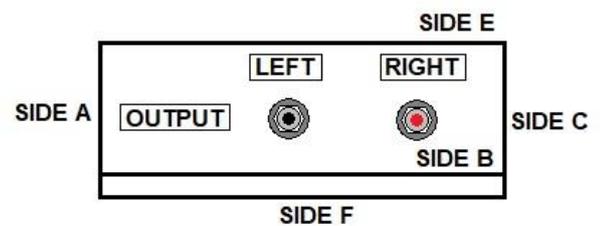
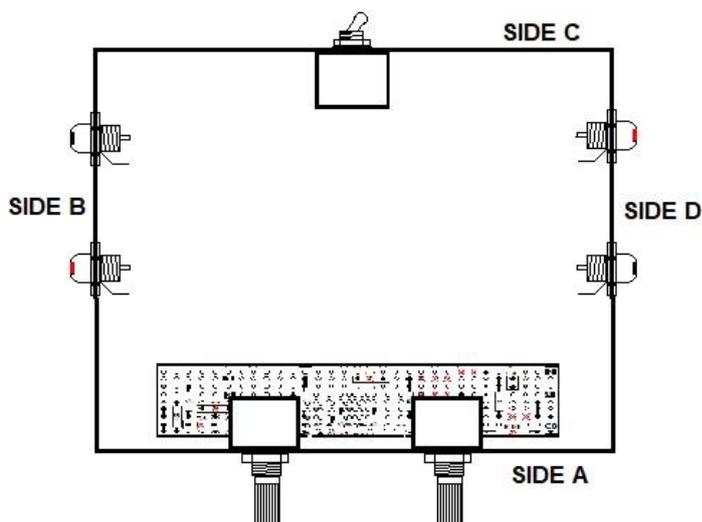
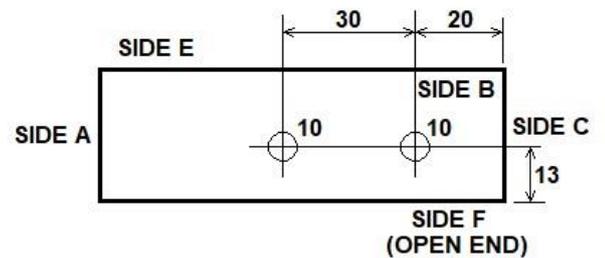
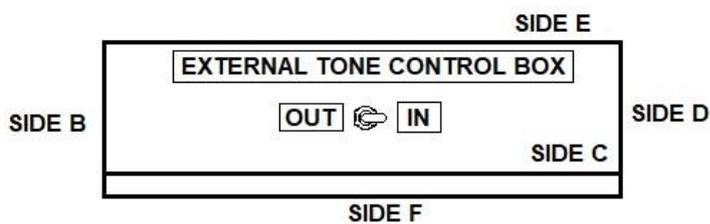
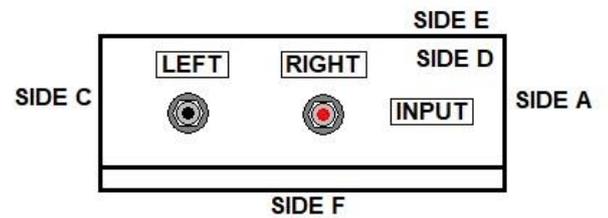
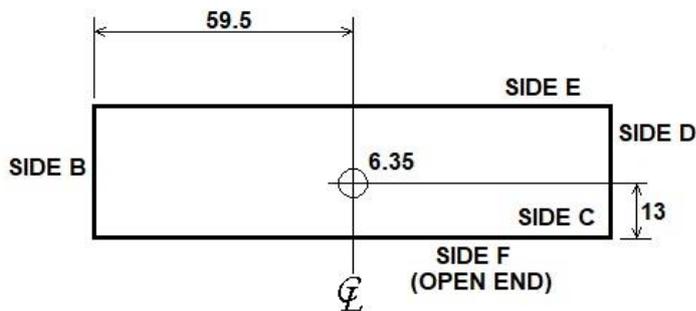
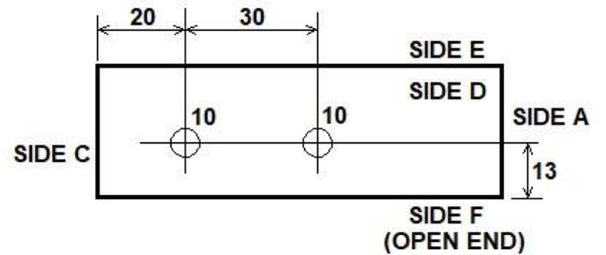
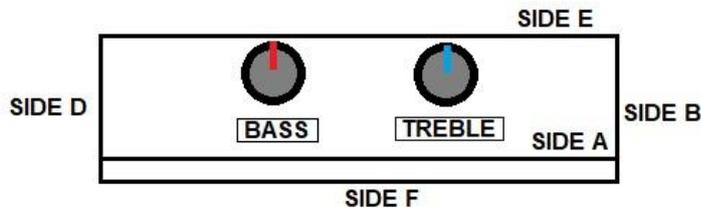
Physical with switch wiring.



Box Drilling and Assembly



BOX SIDE IDENTIFICATION DRAWING



Views of completed prototype.

LEFT HAND SIDE



FRONT PANEL



RIGHT HAND SIDE



REAR PANEL

