

## circuitbenders.co.uk CB55 - Revision 1.1

The circuitbenders.co.uk CB55 is an exact clone of the voice board of the Boss DR55 drum machine. It features four fully analogue sounds, bass drum, hat, snare, and rimshot. There is also an overall accent feature that adds a little extra punch to the whole mix when it is triggered.

The sounds and accent can be triggered using standard trigger pulses, or with the optional trigger conditioning circuit you can use gates or trigger pulses longer than 10ms.

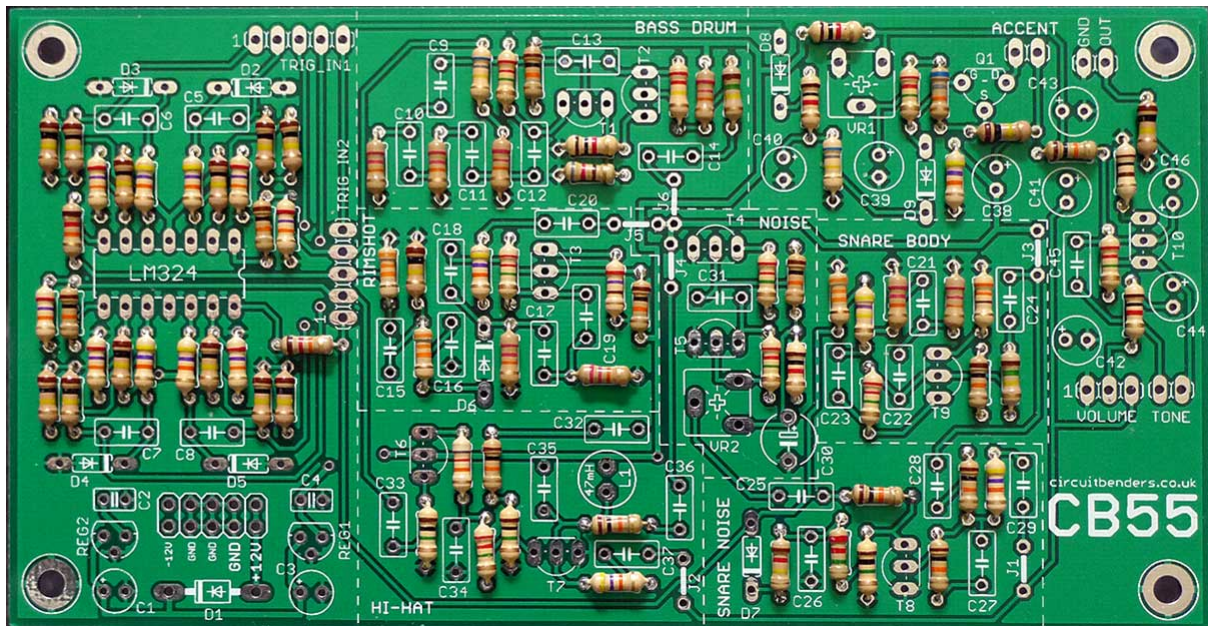
### **What is the trigger conditioning and do I need it?**

The CB55 voices are triggered using standard 5v trigger pulses that last for 10ms. Any longer than that and you may experience double triggering and flam sounds, any shorter and the sounds decay incorrectly. Unfortunately a lot of older drum machines such as the TR707 and TR606 have a fairly random trigger output length, and gate signals can be any length, so the trigger conditioning circuit takes any 5v trigger pulse of 10ms or more, and turns it into a 10ms pulse suitable to trigger the voices.

If you're using a midi to trigger convertor or a modular system where you know that the triggers are 10ms long, then you can use the TRIG\_IN2 connector and leave out all the trigger conditioning circuit (components marked in red on the parts list). If you don't know how long your triggers are, you want to use 5v gate signals, or you will be using a mixture of triggers, then its probably better to just install the conditioning and trigger the sounds via the TRIG\_IN1 connector.

## Construction:

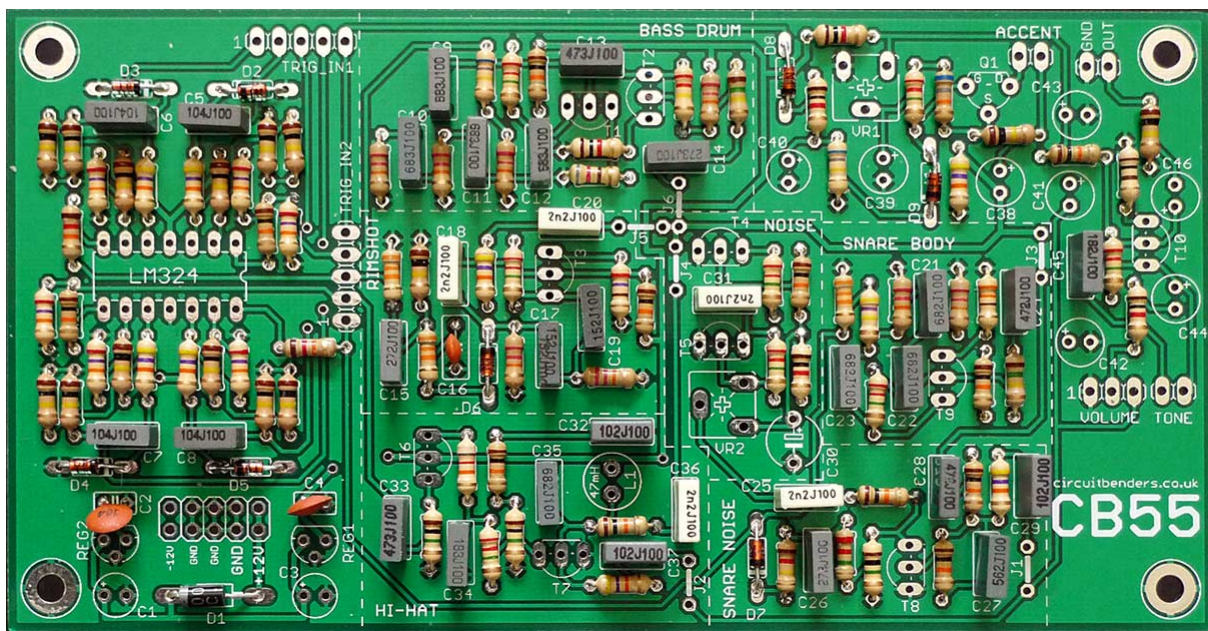
**The first thing to do is read through this entire guide**, make sure you sure you have all the correct parts, and check the notes section for boards labeled "**R1.1 CW**". Then get started by installing all of the resistors, as shown below:



Next install the diodes and if you're using them, the jumper links. The diodes need to be correctly oriented so that the band around one end of the component body is at the same end as the band shown on the board. D1 is a larger 1N4001



Next install the non-electrolytic capacitors. These include the poly film and ceramic caps.

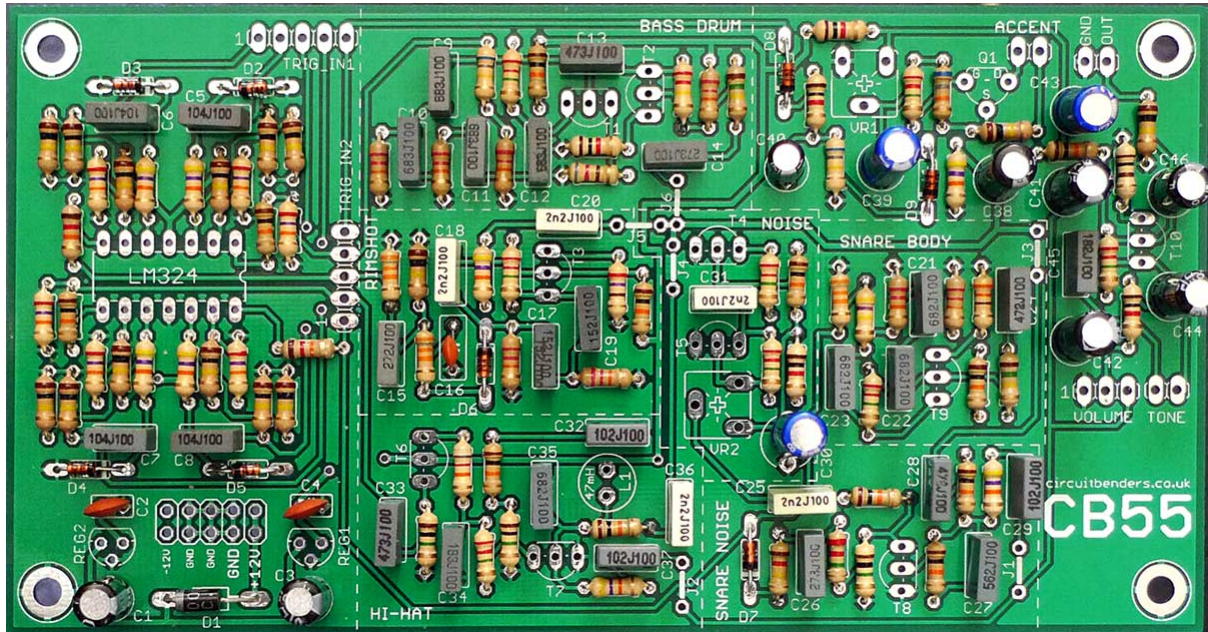


The original DR55 used those green resin dipped film caps that you find in just about everything from that era. If you wanted to use them for some reason they will work fine, although sound-wise they are exactly the same as the box caps we've used here. The 47pF cap at C16 will probably have to be ceramic, as alternative types tend to not



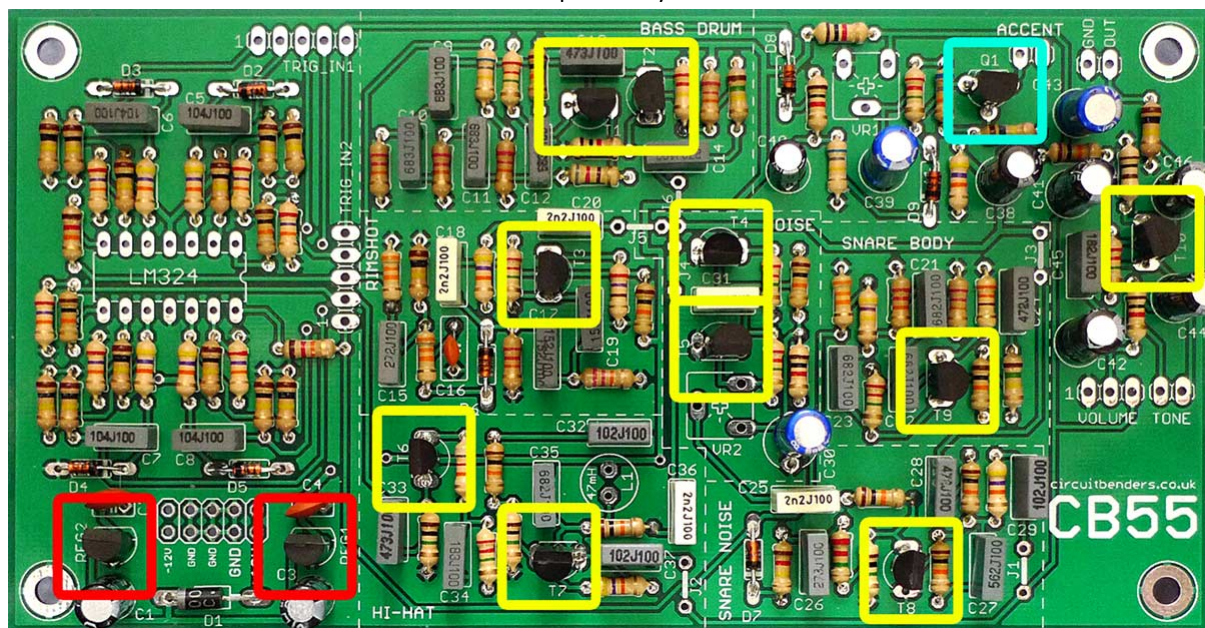
be available in values that small.

Next you should install the electrolytic capacitors. Be careful you get these the right way round as the polarity is important. The positive pin is shown on the board. C1 and C3 should be rated for at least 25v minimum, but the rest don't really matter that much as anything over 10v should be fine.



Now install the voltage regulators and transistors. REG1 is a 78L06 regulator that supplies the 6v power to the voice circuits. REG2 is a 78L09 that supplies 9v to the trigger conditioning circuit.

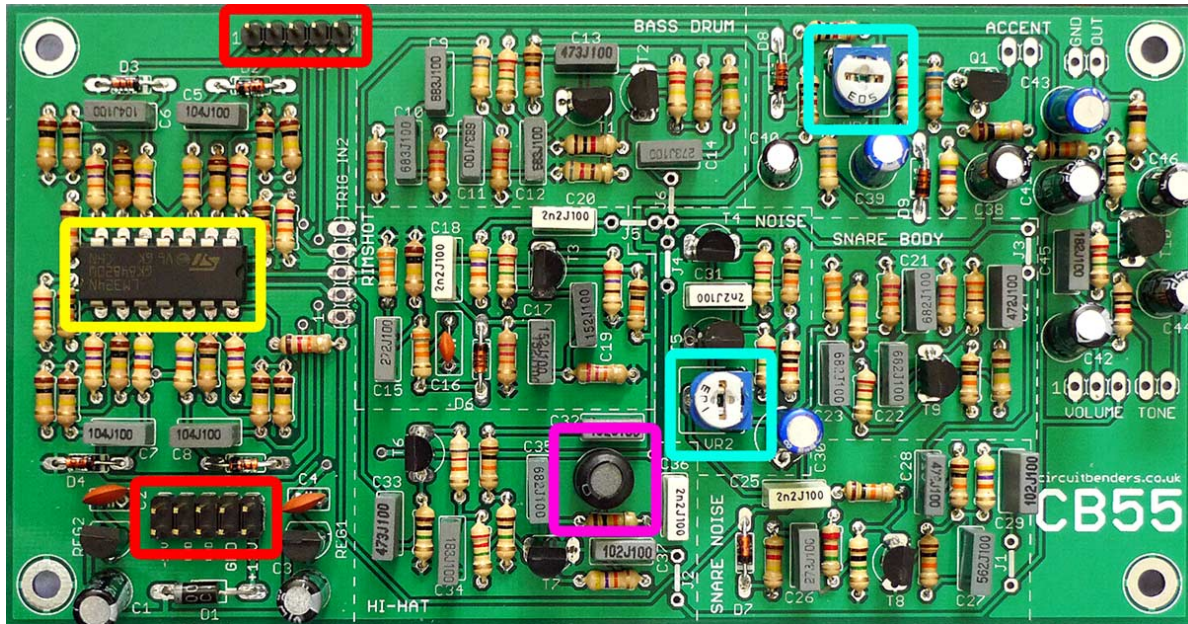
T1 to T10 are general purpose NPN transistors. Roland/Boss used 2SC945's is virtually everything they produced during this era, so this is what we've specified here, but you could probably get away with using any number of transistors with similar specs. We haven't actually tried it, but we would imagine it'd also work fine with the common 2N3904 or 2SC1815. Be sure to check the pinout if you use alternative transistors.





Q1 in the accent circuit should be a JFET transistor with a DSG pinout. A few different types will fit here. We've tried the J201, MPF102 and 2N5457, and they all seem to work okay. The DR55 actually uses a 2SK30AY in this position. This will also work but you'll have to check the pinout and rotate the part accordingly. The correct DSG pin positions are marked on the board.

Next install the trimmer pots at VR1 and VR2, the inductor at L1, the LM324 quad opamp, and any pin headers you want to use for the off board connections.



## **Power:**

The board is powered by 12v DC. On the bottom left of the board you can see a 2x5 pin power connector. Only the pins on the right labeled with the larger GND and +12V text are actually used, but the 10 pin connector is provided for the standard eurorack format. Please note that due to its size, this PCB is not designed specifically to be used in a eurorack module, but we used this connector just in case somebody wanted to try and bodge something together. In normal use you can just use the GND and +12V connections with the larger font.

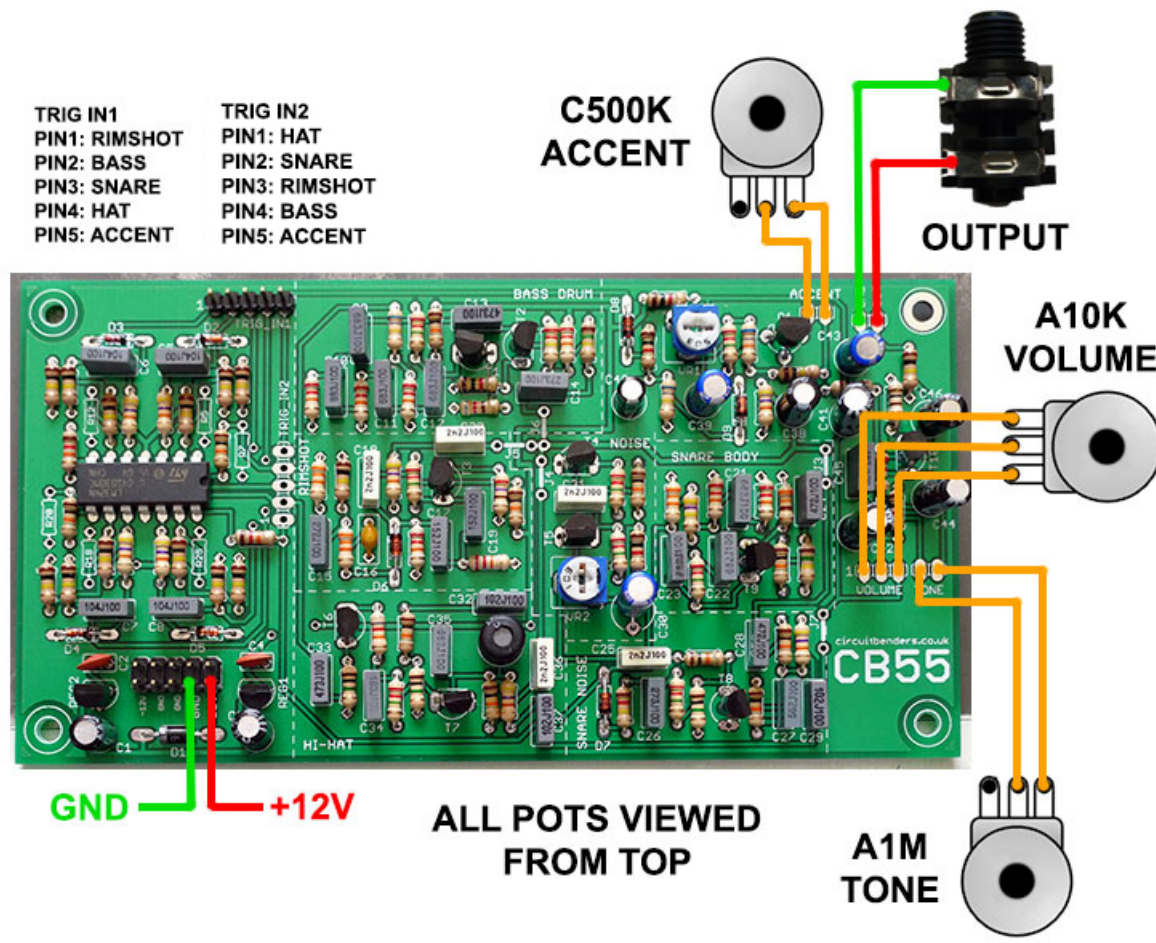
If you haven't installed the trigger conditioning circuit then you will have left out the 9v regulator. In this case you can run the voice circuits from a 9v input instead of 12v if you wanted to. Either will be fine.

## **Inputs, outputs and pots:**

The wiring diagram for the inputs, outputs and pots can be found on the next page.

The diagram shows all the pots viewed from above. The accent amount pot should ideally be an antilog pot, commonly known as a C curve pot, but a linear B curve pot can be used at a push, or a normal A curve log pot if you use the left hand pin and wire it in to operate backwards. You can use a 470K pot if you are in Europe and 500K is not readily available.

Note that the pin assignments for the two TRIG IN connectors are different.



## Individual outputs:

The jumpers at J1 to J6 are designed to make the installation of individual outputs fairly simple. The jumpers passively connect the output of each percussion circuit to the mix bus, so by replacing the jumper with a switched jack each sound can be sent to its own output, and automatically removed from the main mix output when a jack is inserted. Sounds sourced via individual outputs will not be affected by the accent.

The outputs are found at:

- J1 - Snare noise to submix
- J2 - Hat noise to submix
- J3 - Snare
- J4 - Hat
- J5 - Rimshot
- J6 - Bass drum

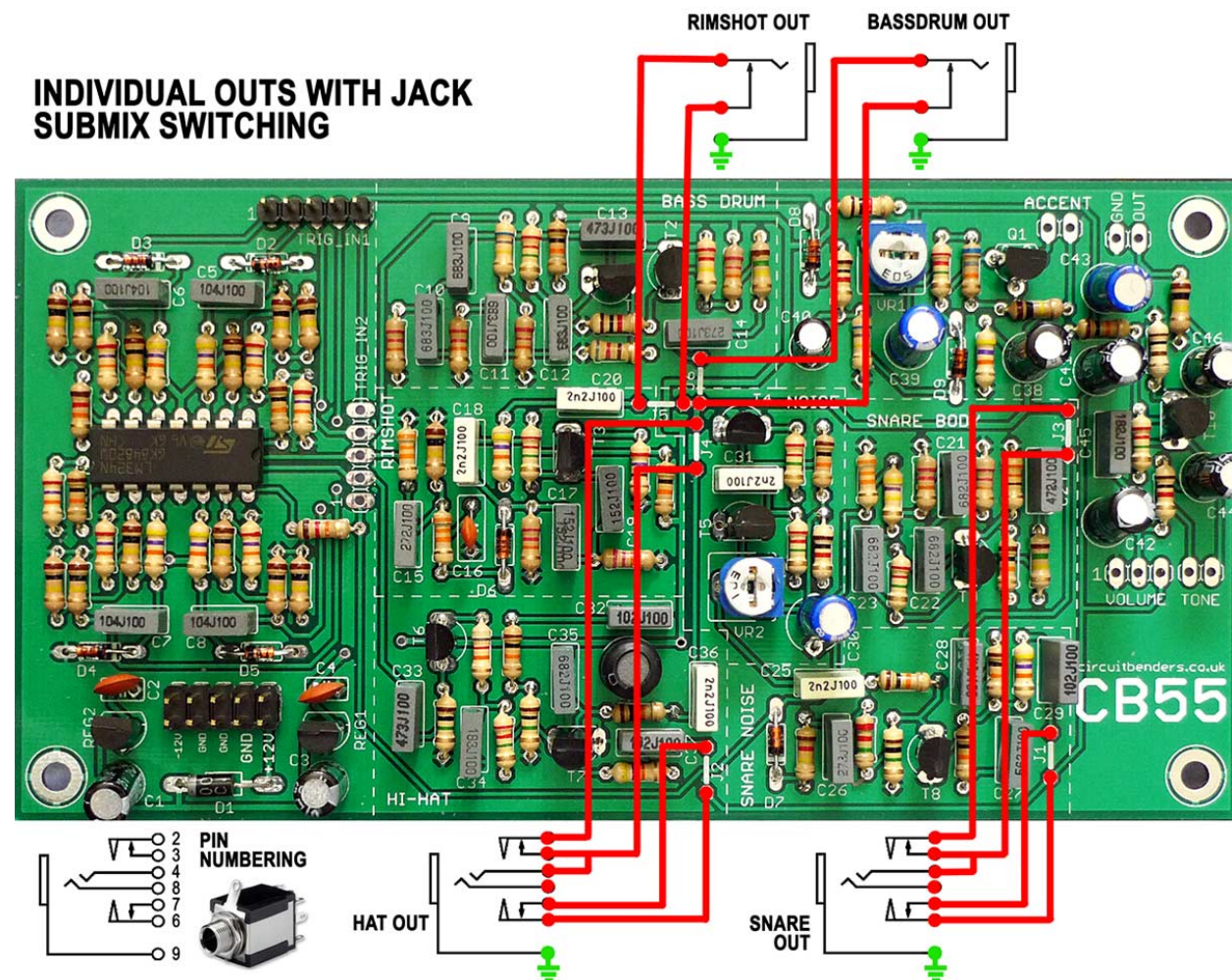
As with a DR55, on the CB55 part of the noise components of the snare and hats are also mixed together independently of the main mix bus into a submix via J1 and J2. This submix bypasses the accent circuitry and main mix bus, and is sent straight to the main output.

There is issue caused by this submix, in that if you remove the snare sound from the main mix using an individual



output wired across J3, then the snare noise in the submix is not removed from the main out, and the hat noise from the submix will leak back onto any individual snare output via R61. The same goes for the snare noise leaking back onto an individual hat output via R72.

Because of these issues we've added J1 and J2 so you can either wire switches to disconnect the submix noise sounds, or use a switched output socket to automatically disconnect J1 when a jack is inserted into the snare output wired to J3, and disconnect J2 when a jack is inserted into the hat output wired to J4. We use the [T-367S](#) and [T-367SI](#) from CPC electronics for this, as on these sockets the switched contacts are isolated from the signal pins by default. Similar sockets are available from plenty of places, but check out the datasheet for a switching diagram the same as the one on the bottom left of the image below.



An alternative method of doing this would be to use a normal switching stereo socket for the snare output. In this case, J3 should be wired across the switched tip connection, and J1 across the switch on the ring connection. If this is wired correctly, when a jack is inserted the main snare sound is routed to the output, but the snare noise going to the submix is grounded via the sleeve connection of the mono jack shorting it to the ground contact. The only drawback of this method is that you will lose a small amount of top end on the snare output. The same technique can be used for the hat output, but likewise, you will lose a little top end bite on the hats.

If you are only going to be using the individual outputs and not the main mix or accent function, then you can just use normal mono jacks at J3-J6 and leave out J1 and J2 completely.

## Notes:

**Please check the back of your board. Boards marked "R1.1 CW" have one very small error that can be easily fixed.**

Boards just marked "R1.1" are fine, but those marked with "R1.1 CW" have a tiny missing connection between the bottom of R60 and R61 on the bottom right of the board. Once you have soldered in the resistors you can solve this issue by simply using a small piece of component leg to bridge the gap on the solder side of the board, as shown below. Alternatively just solder the resistors legs together as you solder them in.

If this error is not fixed then the noise component of the snare sound will be missing, and the snare will sound like a short oscillator blip.



For best effect, the timing of the accent trigger has to be very tight with the voice triggers. If the accent trigger occurs too soon before, or too late after the voice triggers you may experience flam or clicking sounds. If your midi to trigger converter has a dedicated accent output, then make sure you use that for the accent trigger input, as it will usually be less prone to midi lag. Triggers from a purely analogue system will usually have tighter timing than midi.

If you are using gate signals to trigger the CB55 instead of trigger pulses, the accent will stay activated for as long as the input gate remains high.

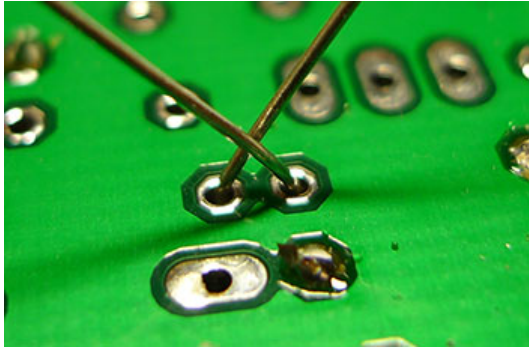
You should only ever use 5v trigger pulses or gate signals. Anything higher than 5v will cause unwanted effects and may damage the circuit.

## Troubleshooting and adjustment:

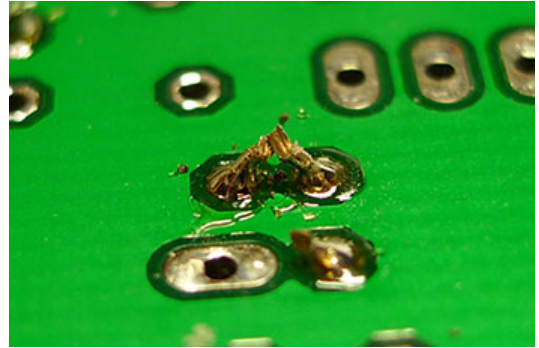
If you are having problems, please check the following:

- Parts orientation: The electrolytic capacitors and the diodes need to be soldered in with the correct orientation. The capacitors will have the negative pin marked on their body, and the positive pin marked on the board. Diodes will have a band on one end of their body. This band is marked on the board image.
- Have you got the power the right way around and are you using the correct GND and +12V connections?
- Do you have the transistors the right way round? Is the FET at Q1 of the correct type?
- Are your trigger pulses the correct length? See the start of this guide for details.

- Check your soldering on any joints that connect to the ground plane on the rear of the board. These are often more difficult to solder due to the heatsink effect of the ground plane itself.
- Have you shorted component legs together? This is very easy to do by accident when you are soldering in several adjacent parts at the same time. If you have component legs bent across each other to hold parts in place during installation, make sure that once you have soldered them in and cut off the excess leg, the remaining legs are not in contact with each other. See the images below for details.



Crossed component legs during installation



Shorted legs after soldering

- VR1 sets the difference between the normal and accented output levels. There's no real right or wrong way to set this, although the DR55 service manual does suggest you should adjust it to read 4.5v at the junction between R75 and the VR1 wiper (middle pin). What we would recommend would be to turn the accent pot to maximum and then play a pattern with accents while adjusting VR1 for best effect. Please note that the effect of turning VR1 is delayed, so adjustments should be made by moving the trimmer and then leaving the new value to settle for a few seconds before adjusting again.
- The noise level for the hat and snare sounds is adjusted using VR2. We'd recommend using a decent quality trimmer for this as there's sometimes a fairly thin range of adjustment between the noise level being too quiet, and it starting to resonate strangely.



## Parts List:

Part numbers in **RED** are not required if you are not installing the trigger conditioning circuitry. See the build guide for more details.

PART NUMBER	PART VALUE	NOTES
R1, R3, R4, R8, R10, R11, R14, R16, R17, R21, R23, R24, R39, R74, R84	100K	All resistors standard ¼ watt carbon, or metal film
R2, R9, R15, R22, R46, R61, R72, R73	47K	
R5, R7, R12, R18, R20, R25	27k	
R6, R19, R32, R44, R51, R57, R59, R60, R62, R69, R71, R81	10K	
R13, R26	12K	
R27, R78	680K	
R28, R29, R30, R35, R41, R42, R47, R49	22K	
R31, R43, R50, R56, R64, R65, R68, R76, R80	2.2M	
R33	820R	
R34	220K	
R36, R63, R77, R79, R82	1K	
R37, R53	150K	
R38, R40, R54	33K	
R45	270R	
R48	470K	
R52	330R	
R55	120K	
R58, R66, R70	1M	
R67	82K	
R75	68K	
R83	100R	
C1, C3	10uF	Electrolytic 25v or more
C30, C39, C43	22uF	Electrolytic
C38, C41, C44, C46	4.7uF	Electrolytic
C40	0.15uF	Electrolytic or tantalum. *
C42	47uF	Electrolytic
C5, C6, C7, C8	100nF	Poly Film
C2, C4,	100nF	Ceramic
C9, C10, C11, C12	68nF	Poly Film
C13, C33	47nF	Poly Film
C14, C26	27nF	Poly Film
C15	2.7nF	Poly Film
C16	47pF	Ceramic unless Poly Film is available
C17, C19	1.5nF	Poly Film
C18, C20, C25, C31, C36	2.2nF	Poly Film
C21, C22, C23, C35	6.8nF	Poly Film
C24, C28	4.7nF	Poly Film
C27	5.6nF	Poly Film
C29, C32, C37	1nF	Poly Film
C34	18nF	Poly Film

C45	1.8nF	Poly Film
D1	1N4001	Rectifier diode
D2, D3, D4, D5, D6, D7, D8, D9	1N4148 or 1N914	Or similar small signal diode
T1, T2, T3, T4, T5, T6, T7, T8, T9, T10	2SC945	Or similar transistor
Q1	J201 / MPF102 / 2N5457	Many DSG JFET's work here, or others according to pinout
REG1	78L06	6v regulator
REG2	78L09	9v regulator
L1	47mH inductor	Original DR55 uses 45mH **
IC1	LM324	Quad opamp
J1,J2,J3, J4, J5, J6	Wire links	Individual voice outputs ***
VR1	50K	Accent level trimmer pot
VR2	10K	Noise level trimmer pot
TONE	1MA	Tone pot
VOLUME	10KA	Volume pot
ACCENT	500KC	Accent amount pot.
TRIG_IN 1, TRIG_IN 2, POWER CONNECTIONS, OUTPUT	PIN HEADERS	You can use standard pin headers in any of these connections.

\* The DR55 uses a 0.15uF tantalum cap here. There doesn't seem to be a particular reason for this choice, so we can only assume the original designer wanted to use a polarized cap but couldn't get an electrolytic with a value that small. Either an electrolytic or a tantalum will work fine, but a tantalum will probably be a lot more difficult to get hold of these days.

\*\* The DR55 uses a 45mH inductor in the Hi-Hat. These are virtually impossible to get hold of, but you can substitute a 47mH, or even a 43mH one with no perceptible difference. The original part probably had a tolerance of +/-20% of the stated value anyway, so 2mH off in either direction won't make a difference to the sound. A Bourns RLB0812-473KL or Murata 22R476C will do the job.

\*\*\* These links connect the output from each voice circuit to the mix bus. They have been provided as links rather than permanent PCB traces to allow for easy modding for individual voice outputs. Pieces of cutoff component leg can be used here. You should have plenty lying around.

If you need any further support or want to discuss any potential mods for this PCB, we have started a dedicated CB55 board on our forum at:

<http://www.circuitbenders.co.uk/forum/index.php/board,32.0.html>



