circuitbenders.co.uk drumBs build guide

Read the ENTIRE guide before starting work. This guide is for the eurorack module version of the drumBs board. The guide for the standalone version can be found on the circuitbenders site.

The circuitbenders.co.uk drumBs module is a tweaked version of the Syntom II, which was an analogue percussion project first published nearly four decades ago in the April 1983 edition of the mighty Electronics & Music Maker Magazine. **ALL HAIL E&MM!**

The drumBs PCB can create a wide range of basic analogue percussive sounds. Essentially these are the kind of sounds that relate to modern drum machines like an Analog Rytm, Alpha Base or Tempest in the same way as a Commodore 64 relates to the latest Apple Mac. On paper its shit in comparison, but it's cheap and fun, and theres a certain dirty DIY magic to it! The drumBs synth section features both a VCO and a noise source, along with a resonant noise filter and an auto roll function. It can be built in both a Eurorack or standalone format.

The eurorack drumBs controls are:

DECAY: The decay of the percussion envelope.
BEND: The depth of percussion envelope applied to the pitch of the VCO and the filter cutoff of the noise source.
PITCH: The basic pitch of the VCO.
CUTOFF: The cutoff frequency for the noise filter.
REZ: The resonance of the noise filter.
PULSE: The level of an initial clicking attack at the start of the percussion sound .
MIX: The mix between the oscillator and the noise source.
ROLL: The repeat rate of the auto roll function.

TRIGGER INPUT: The trigger input accepts a standard +5v trigger pulse or gate to trigger the module.
ROLL GATE INPUT: The roll gate input activates the auto roll function whenever it receives a gate or longer trigger voltage. When the auto roll function is activated the module will automatically retrigger itself at a rate set by the roll knob for as long as the voltage is present at the input. This can be very useful for creating unusually timed fills and rolls, although at its highest trigger rate the roll function can sound like a constant VCO tone.
OUTPUT: You can probably work this one out for yourself.

PARTS LIST (MAIN PCB)

PART NUMBER	PART VALUE	NOTES
D1, D2	1N4148	Diode
D3	1N5817	Polarity protection diode
R19	680R	All resistors standard 1/4 watt carbon or metal film
R6, R7, R12, R13, R32, R33 R42	1K	
R3, R9, R14, R18, R28, R35	4.7K	
R8, R29, R37, R38	10K	
R11, R21, R25	22K	
R36	15K	
R2, R5, R16, R20, R24, R26 R27, R34, R41	47K	
R31	75K	
R15, R30, R39, R43	100K	
R1, R10, R22, R23	150K	
R40	470K	
R4, R17	2.2M	
C16	100nF	Ceramic
C2, C3	1nF	Poly Film
C17	2.2nF	Poly Film
C1	10nF	Poly Film

C4	22nF	Poly Film
C5	47nF	Poly Film
C9, C15	100nF	Poly Film
C6, C10, C11, C12, C13	1uF	Electrolytic*
C8	4.7uF	Electrolytic*
C7	22uF	Electrolytic*
C14	220uF	Electrolytic*
IC1	TL072	Op Amp
IC2	LM324	Quad Op Amp
IC3	LM13700	OTA
IC4	LM13700	OTA
Q1	BC108B	Noise transistor**
J1	Jumper Wire	This is a resistor in the standalone PCB version
NOISE ADJ	100K trimmer	Mounted on the rear***
Headers	11 pin	2.54mm pin header male
Headers	11 pin	2.54mm pin header male
Headers	4 pin	2.54mm pin header male
Headers	2 x 5 pin	Eurorack power header

*If the electrolytic capacitors are to be mounted on the component side of the board they should be low profile caps with a maximum height of 7mm or else they may interfere with the pots board. Alternatively if low profile caps aren't available then taller caps can be mounted on the solder side of the board. Positions and polarities are marked on the rear of the board for this purpose.

**The BC108B is commonly available in a metal can package and so that footprint is on the PCB. Other package versions can also be used as long as the pinout is matched to the PCB markings.

***The noise adjust trimmer pot should be mounted on the rear of the board so it can be adjusted when the module is put together. If you mount it on the component side you won't be able to get at it when the pots board is in place. See below for details.

PARTS LIST (POTS PCB)

PART NUMBER	PART VALUE	NOTES
VR2, VR4	A100K	9mm vertical snap in pot
VR3, VR7	B100K	9mm vertical snap in pot
VR1	A500K	9mm vertical snap in pot
VR5	B500K	9mm vertical snap in pot
VR6, VR8	A1M	9mm vertical snap in pot
IC1	4066	CMOS Quad Switch
R1	47K	
R2	10K	
R3	10K	
LED1	5mm LED	Trigger LED
T1	2N3904	Transistor
Sockets	PJ301M / PJ398SM / Thonkiconn or equivalent x 3	3.5mm PCB mount vertical jack socket
Headers	11 pin	2.54mm header female
Headers	11 pin	2.54mm header female
Headers	4 pin	2.54mm header female
Spacers	11mm M3 PCB hex spacer x 2	*
Machine Screws	M3 6mm length x 4	*
Knobs	8 of your choice.	

*These are for connecting connect the main PCB and the pots PCB together. You only really need to do this on two opposite corners, so you'll need two spacers and 4 screws, but you can use all four corners if you want.

Theres nothing particularly difficult involved in this build. Populate the main PCB and then the pots PCB after reading the guidelines below and you shouldn't have any problems.

Connecting the main PCB and pots PCB: The female headers should be mounted on the solder side of the pots PCB, and the male headers on the component side of the main PCB so that they slot into one another when the module is assembled. When you come to solder the headers into place, before actually soldering we would recommend pushing the pins into the sockets, placing the header assemblies between the boards in the correct positions, and then screwing the boards together with the PCB spacers and screws as shown.
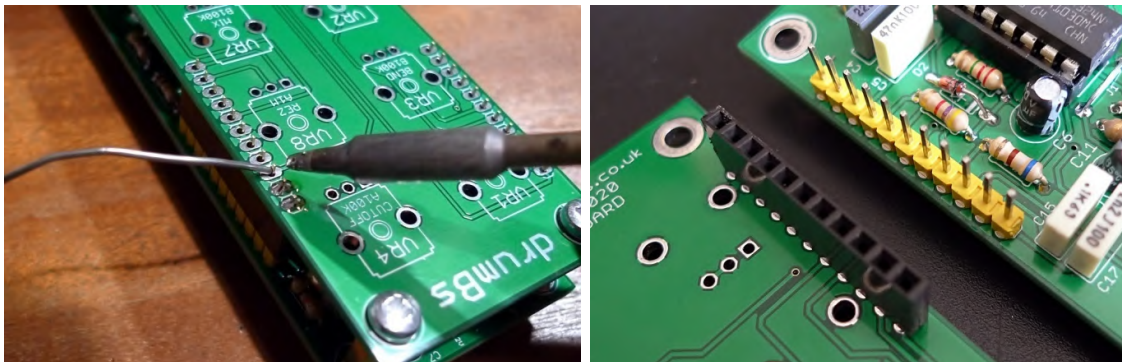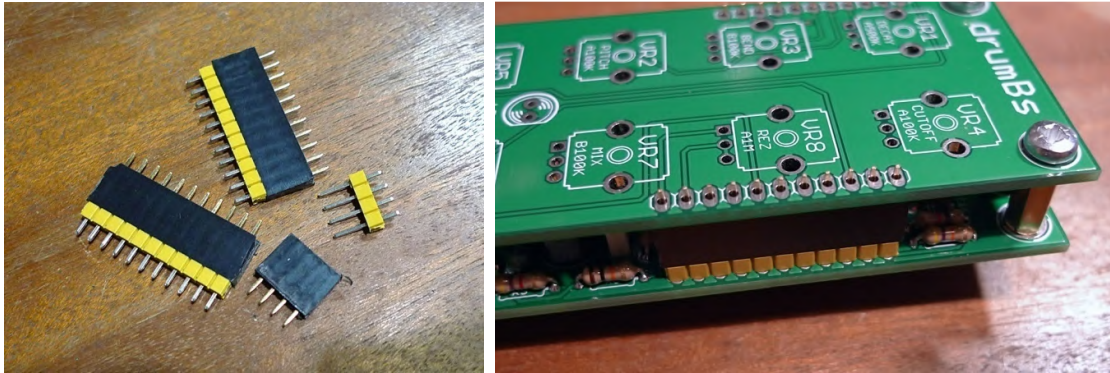

You can then solder the headers into place on both boards and know that you don't have any misalignments or issues with the headers not being flush with the boards that might prevent you screwing the spacers and boards together properly later. You can do this before or after installing the pots on the pots board.

Adjusting the noise trimmer: The noise trimmer should be mounted on the rear of the main PCB as shown below. This trimmer allows you to adjust the frequency response of the noise filter for the minimum amount of crackle or low end white noise. How you adjust it is a matter of personal taste, but we've found its best to turn both the filter resonance and cutoff up to maximum. Then with the mix set to fully clockwise, the bend set to zero and the decay set to maximum, trigger the module and adjust the noise trimmer until the crackle just disappears and you hear nothing but smooth noise.
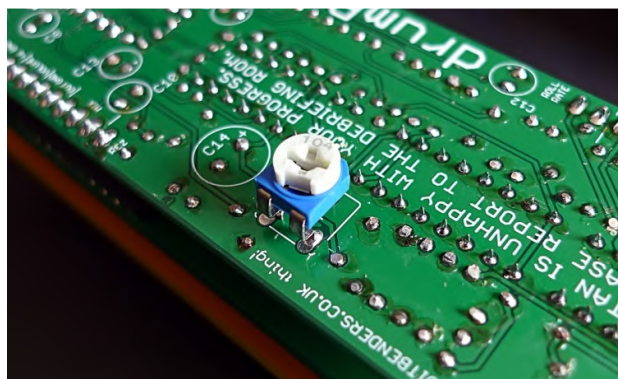
Power header: The eurorack power header should be mounted on the solder side of the main PCB.
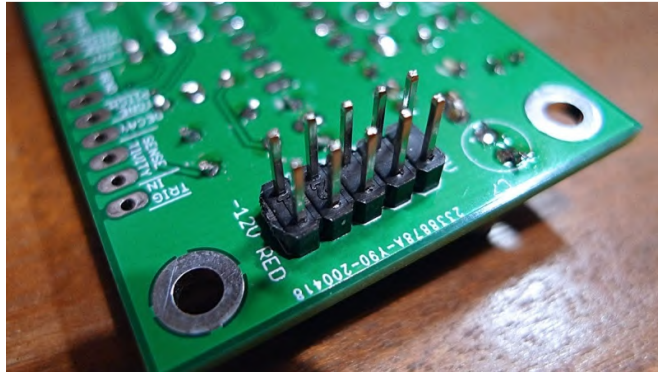
J1 jumper: On the standalone version of this PCB there is a resistor at J1 that attenuates the output to a level compatible with line level units. On the eurorack version J1 should be jumpered with a piece of component leg as shown below. **Make sure you remember to do this** or you won't get any sound.
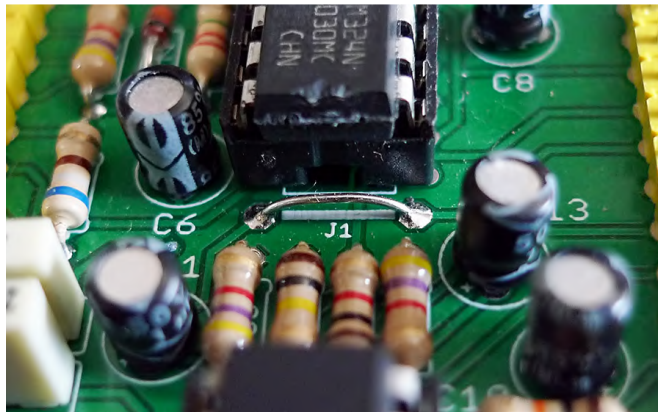
LED height: In order to get the pots board trigger LED soldered in at the right height it would probably be a good idea to install the pots onto the pots board, then stick the LED legs through the board and install the front panel using one or two of the pot nuts to keep it in place. Then push the LED into position from the rear of the pots board so its just slightly protruding from the front panel, and solder it in place.

Clicks: As with any analogue synth with a very fast attack envelope, you will sometimes experience clicks at the start of the sound. This mainly only happens with low frequency oscillator sounds and is caused by the envelope opening more or less instantly at a point where the VCO waveform is not crossing zero. This will vary in intensity depending on where the VCO is in its cycle when the envelope opens. With this basic a circuit it is unavoidable, but it can be mitigated to some extent using the pulse control to make the click more regular and predictable. In general use you may not even notice it.