SYNTOM II

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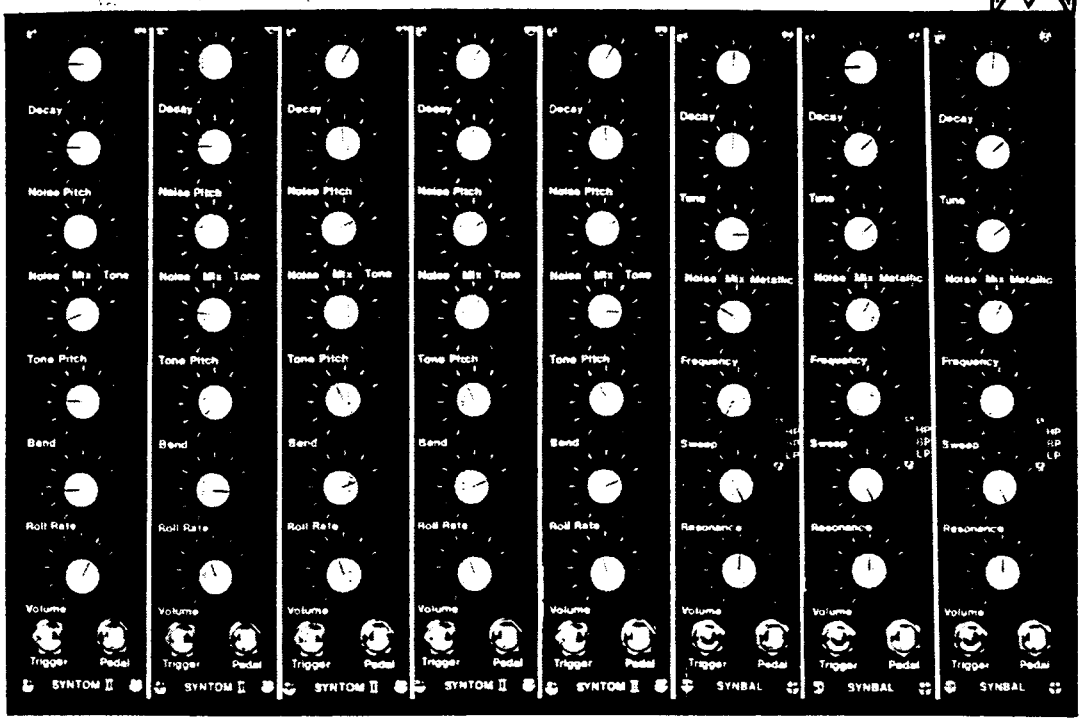
PARTS COST GUIDE with Pre-sets £11.50

by Kenneth McAlpine



Modular percussion system.

- ★ **Tone and Noise Voicings**
- ★ **Dynamic Response**
- ★ **Built-in Roll oscillator**
- ★ **Modular construction**
- ★ **Optional Stereo Output**

Syntom II is the second of our two modules which are intended to provide a complete range of electronic percussion. This unit can provide drum sounds such as Bass, Snare or Tom-Tom while the 'metallic' sounds such as Cymbal or Hi-Hat can be obtained using the Synbal circuit described in the February 1983 issue.

The modules can be built up in any combination to create a custom percussion system, sounds being continuously variable, or pre-set.

Drum Synthesis

When a drum is struck, sound is produced by the vibrating skin. This may seem obvious, but the nature of the tone is influenced by several factors, amongst which are: the size of the skin, larger diameters producing lower tones; the tension of the skin, slack skins producing longer decays and the striking force, hard hits 'bend' the skin causing a slight change in pitch as well as a louder sound.

To synthesise a drum correctly we must therefore have a sound source which can be varied in pitch and duration as well as responding to a striking force both in terms of pitch and amplitude. In the case of the Syntom II the basic layout is shown in the block diagram, Figure 1.

Since all drums have some noise content apart from the basic tone, two types of sound are provided, these are filtered noise and triangle wave tone. Both can be varied in pitch and the balance can be adjusted using the mix control.

When the circuit is triggered the envelope generator produces a voltage which is connected to the Voltage Controlled Amplifier (VCA) and controls the level of the Noise/Tone mix. Thus a percussive envelope of sound is produced with variable pitch and decay. Some of the envelope voltage can be fed to both the noise - Voltage Controlled Filter (VCF) and tone - Voltage Controlled Oscillator (VCO) to produce the required bend.

The Low Frequency Oscillator (LFO) can be used to create drum rolls when a foot pedal is connected.

To allow the modules to be placed in the stereo field an optional panning network is also provided.

Trigger inputs are level sensitive which gives the sound a dynamic 'feel' when using a drum pad as the source - the harder the pad is struck the louder the output and greater the bend.

Circuitry

The complete circuit diagram is shown in Figure 2.

Noise is generated by making TR1 (a standard NPN) zener - reverse biasing the emitter - base junction. The value of R1 may have to be varied, however, to provide a suitable noise level although the value given is a good starting point. Signals from the transistor are decoupled by C1 and amplified by IC1a. This is then connected to a -12dB/Octave VCF based around IC3 a dual transconductance amplifier. A Bandpass output is provided at pin 8 and is connected to one side of the Mix control, RV6. The cut-off frequency of the filter is set by the current flowing into pins 1 and 16. This current is provided by the setting on RV4, via R21, for Noise Pitch, and RV3, via R20, for Bend. To prevent the filter cutting off when both

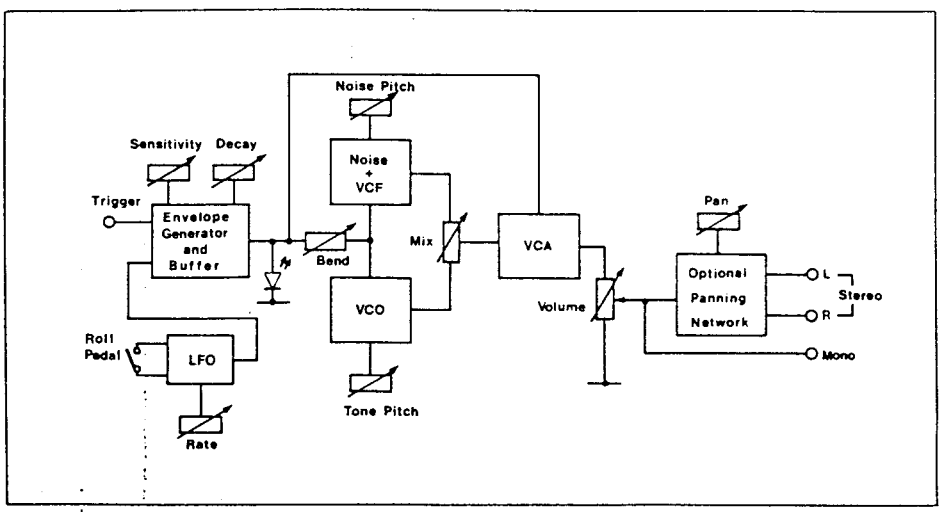


Figure 1. Syntom II block diagram.

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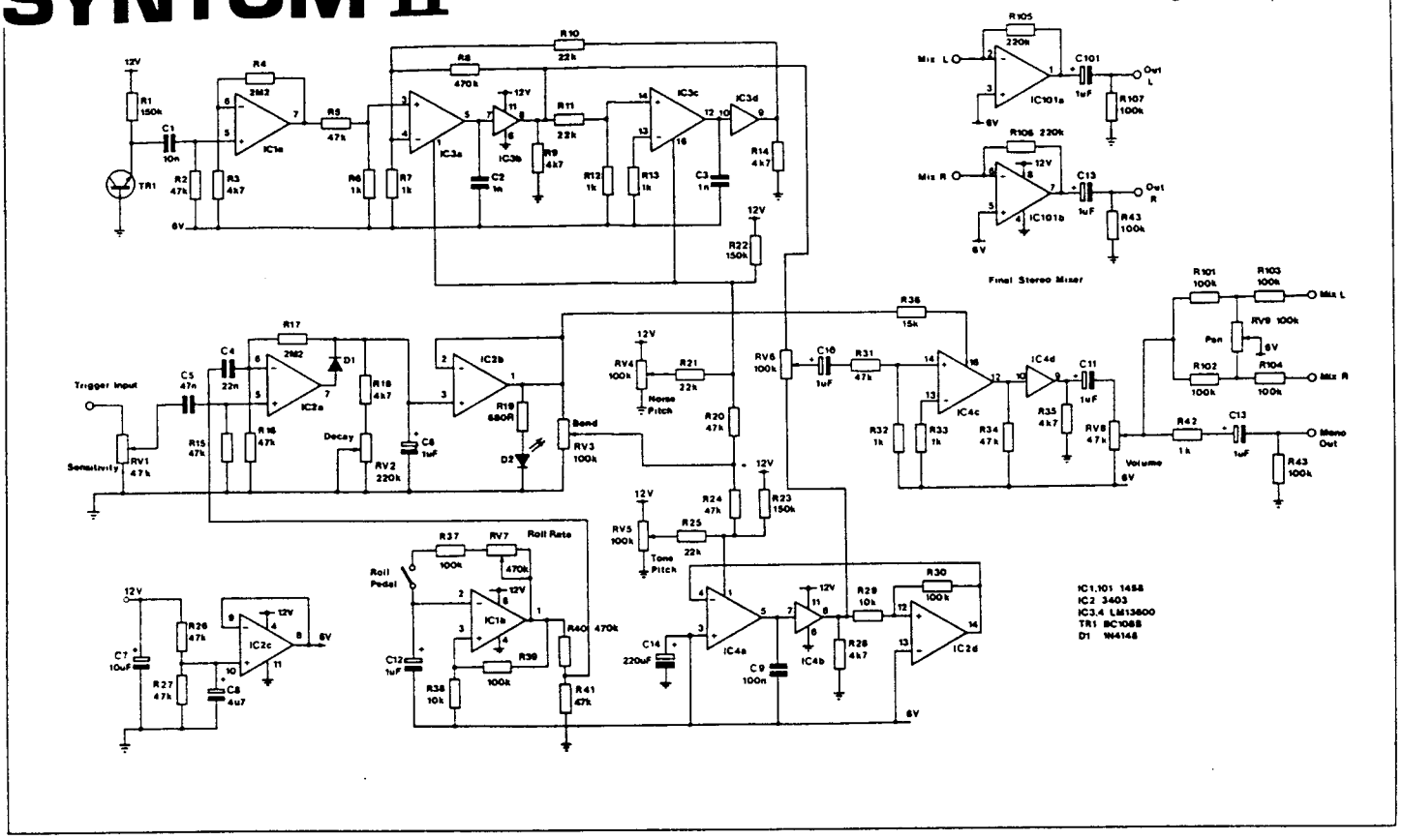


Figure 2. Syntom II circuit diagram.

controls are at zero a small amount of current is injected by R22.

A trigger input, which can be from a crystal mic or piezo pick-up, is connected to RV1, the Sensitivity control. Signals are then differentiated by C5/R15, which gives a short spike which is amplified by IC2a and used to charge C6. A discharge path is provided by R18 and RV2, the Decay control. This results in an envelope with a fast attack and variable decay. IC2b buffers this signal and is used to drive the LED, the VCA, via R36, and RV3 the Bend control.

The VCO is based around one half of IC4, a second dual transconductance amplifier. Current from pin 5 charges C9 until it reaches the threshold of Schmitt trigger, IC2d. When this happens the output at pin 14 switches and the capacitor begins to charge in the opposite direction until it reaches the opposite threshold and switches again. A triangle wave is therefore produced at the capacitor buffered by IC4b. This output is connected to the other end of the Mix pot, RV6.

Frequency of oscillation is set by the current into pin 1. This is provided by the voltage on RV5, via R25 and the setting of the Bend pot, RV3 via R24. To prevent the oscillator switching off R23 provides a small bias current.

Signals from the Mix control are decoupled by C10 and connected to IC4c, which is configured as a VCA. The gain of the amplifier is set by the current into R34, controlled by current flowing into pin 16 from the envelope circuitry, via R36.

Signals can now travel one of two paths depending on whether mono or stereo is required. If only a mono output is wanted then the components R42, C13 and R43 are included. If, however, stereo is required R42 is omitted and the panning network, R101-104, and RV9 included. The final stereo mixer IC101 then provides right and left signals.

The LFO circuit, around IC1b can be used to provide a 'Roll' when the Roll pedal switch is closed. This switch is included in the feedback loop to start the oscillator every time it is operated, the output being connected to the envelope generator via C4. Speed of oscillation, or Roll Rate, is controlled by RV7.

To keep things simple power is provided by a single rail 12V supply, which is split into two by IC2c, giving essentially a ±6V supply.

Options

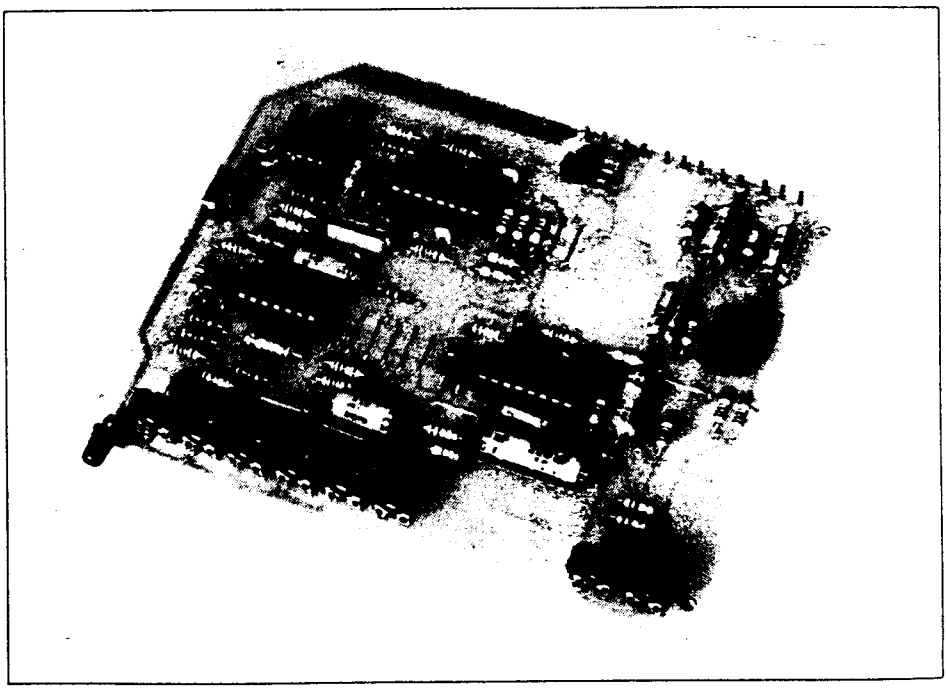
The Syntom II PCB has been designed to match the Synbal with the same dimensions, control spacing and input/output connections. It also offers the same flexible options which have to be selected before construction can begin.

Controls: 1) *Rotary* - The PCB can be mounted on a panel such as the one shown in the photo. All the pots, switch, LED and sockets are hard-wired to the board. This allows the sound to be continously variable.

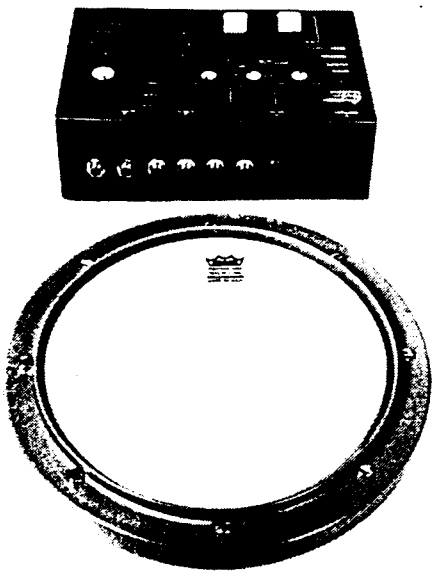
2) *Vertical Pre-sets* - The pre-sets can be mounted vertically, as shown in the photo. An extra 2 links must be inserted if this is the case, shown dotted in Figure 3. Boards can then be slotted into a case with the left hand edges at the front allowing occasional adjustments to be made.

3) *Horizontal Pre-sets* - The pre-sets can be mounted horizontally as shown in the component overlay. This allows adjustments to be made to a board mounted horizontally in an enclosure.

4) *Combinations* - Obviously any combination of controls could be used. The most



Completed PCB for the Syntom II.



methods of triggering, man or machine.

commonly used, such as the Decay, Tone Pitch and Mix, could be rotary and the rest pre-set.

Outputs: 1) *Mono* - If mono outputs are required then RV9 and components numbered 100 upwards are omitted. Resistor R42 should be inserted and Out R/Mono used as signal output.

2) *Stereo* - For stereo use R42 should be omitted with RV9 and the 100-up components inserted. Outputs are taken from Out L and Out R.

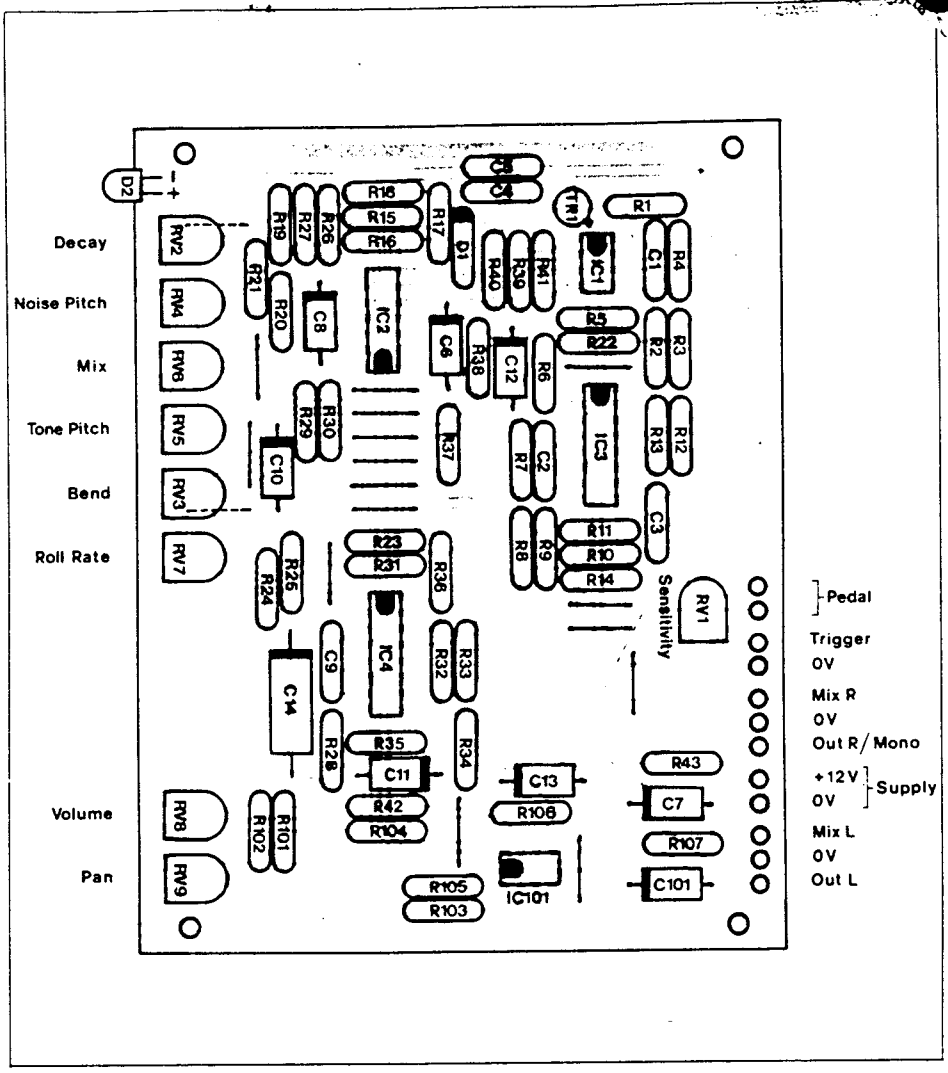
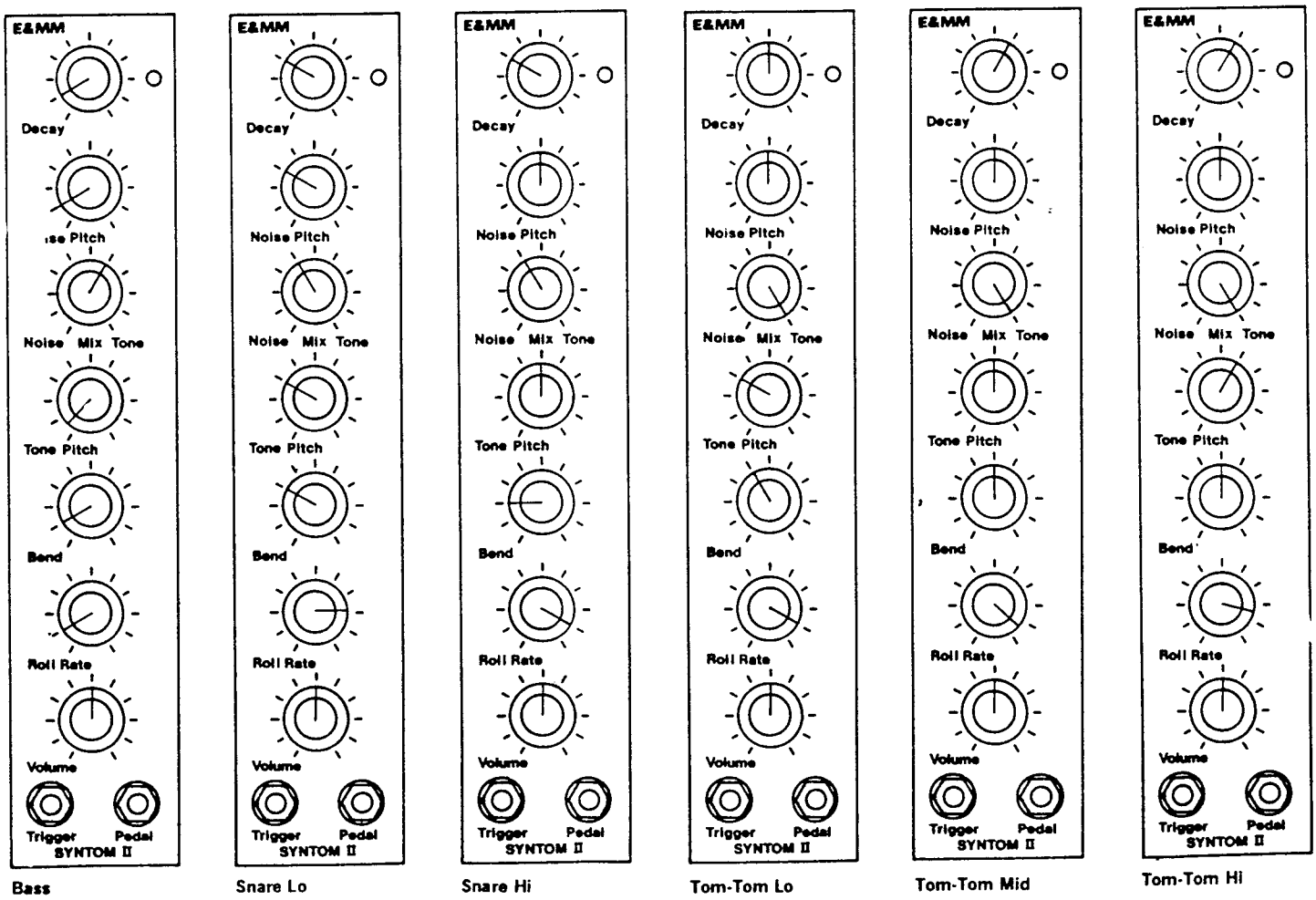


Figure 3. Component overlay of the PCB.



Bass | Snare Lo | Snare Hi | Tom-Tom Lo | Tom-Tom Mid | Tom-Tom Hi

Figure 4. Sample sound settings.

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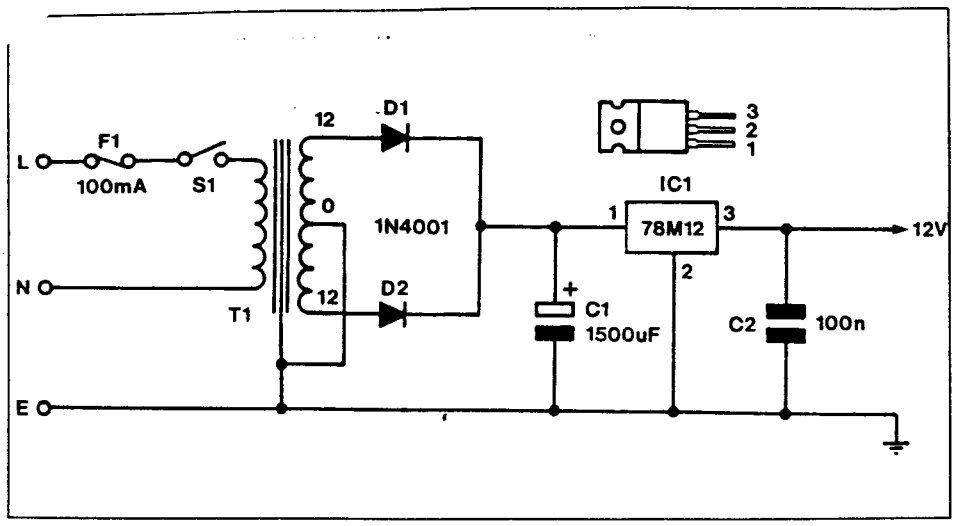


Figure 5. Suggested power supply circuit diagram.

SYNTOM II PARTS LIST

Resistors - all ¼W, 5% carbon film

R1,22,23	150k	3 off
R2,5,15,16,20,24, 26,27,31,34,41	47k	11 off
R3,9,14,18,28,35	4k7	6 off
R4,17	2M2	2 off
R6,7,12,13,32,33,42	1k	7 off
R8,40	470k	2 off
R10,11,21,25	22k	4 off
R19	680R	
R29,38	10k	2 off
R30,37,39,43,101, 102,103,104,107	100k	9 off
R36	15k	
R105,106	220k	2 off

Capacitors

C1	10nF Polycarbonate	
C2,3	1nF Ceramic	2 off
C4	22nF Polycarbonate	
C5	47nF Polycarbonate	
C6,10,11,12,13,101	1uF 63V Axial Electrolytic	6 off
C7	10uF 25V Axial Electrolytic	
C8	4u7 63V Axial Electrolytic	
C9	100nF Polycarbonate	
C14	220uF 16V Axial Electrolytic	

Semiconductors

D1	1N4148	
D2	LED	
TR1	BC108B	
IC1, 101	CA1458 or 4558	2 off
IC2	LM324 or UA3403	
IC3,4	LM13600	2 off

Miscellaneous

	Veropins	
	16 pin DIL socket (2 off)	
	14 pin DIL socket (1 off)	
	8 pin DIL socket (2 off)	

Power Supply

Capacitors

C1	1500uF 16V Electrolytic	
C2	100nF	

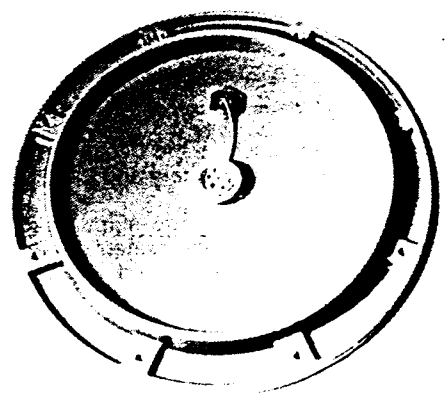
Semiconductors

D1,2	IN4001	2 off
IC1	78M12	

Miscellaneous

F1	100mA	
	Fuseholder	
S1	SPST mains switch	
T1	12-0-12 250mA Transformer	

The PCB for the Syntom II is available from E&MM, 282 London Road, Westcliff-on-Sea, Essex SS0 7JG at £3.25 inc. VAT and P&P. Please order as: Syntom II PCB.



Crystal mic fitted inside a practice pad.

3) *Modular Stereo* - To allow a modular stereo system to be built up the virtual earth busses of the final mixer are available. Only one of the system boards need contain the final mixer IC101. The rest only have R101 to 104 and RV9 inserted. All of the Mix R and Mix L outputs are connected together and the final output taken from the board with IC101 inserted.

Construction is fairly straightforward and components should be assembled in following order: Veropins, links, resistors, capacitors, diode, transistor and IC sockets (if required). Controls and LED can then be mounted with ICs inserted last.

Using the Syntom II

Triggers can be provided by crystal mic or piezo pick-up. The sensitivity can be varied to adjust the dynamic response. The drum pad used with the prototype was a Remo practice pad which was fitted with a crystal pick-up as shown in the photo. These pads are fairly inexpensive and available in 6, 8 or 10 inch diameters.

An alternative method of triggering is to use a rhythm machine. Most units have positive-going signals which can be tapped off the circuitry, as was done with the Amdek Rhythm machine described in the March '83 issue.

A footswitch connected across the pedal input can be used to provide 'rolls' when required, as well as the normal trigger.

A wide variety of sounds can be provided by the circuit, some of which are shown in Figure 4.

Only a single rail supply is required, such as the one shown in Figure 5. Each module requires a maximum of 20mA so for an eight module setup a 250mA transformer would be quite sufficient.

E&MM