SPECDRUM DRUM SEQUENCER

Use a Spectrum to control your kit of drum synths — it's the only way to beat time, courtesy of Digisound.

The Specdrum drum sequencing package is a cost-effective and highly flexible method of generating rhythmic structures using a Spectrum or Spectrum + computer, a simple interface and cassette software running to about 15K of machine code. An external clock input is provided to allow synchronisation with tape machines or other devices and the hardware can also be used as a conventional joystick interface when not running the Specdrum software. It uses the Spectrum PSU and is compatible with Interface 1, microdrives and Sinclair-type printers.

The software incorporates a pattern editor (16 patterns of up to 32 events each), a chain editor (eight chains of up to eight patterns each), a sequence editor (eight sequences of up to 12 chains each with or without repeats) and a track editor (two tracks of 24 combined sequences, chains, patterns and repeats). There is real-time pattern modification and the facility for interfacing microdrives and tape. The external sync operates on a 10V p-p max. level. The interface allows around 60 events per second to be programmed and can store more than 70,000 events per track.

The events are trigger pulses intended to be sent to drum synthesizers under the control of the sequencer. There are four accented triggers and two unaccented triggers. Accenting affects the quality of the output of most drum synths. Data lines D0-D3 produce trigger pulses whose level (from 0V to 5V) can be controlled by four individual pots. All these pulses may be simultaneously accented by means of data line D6 — an accent effectively overriding the potentiometer setting and producing a 5V pulse at the output whenever it occurs (Fig. 1). Data lines D4 and D5 generate unaccented triggers called O and X, respectively. The O trigger consists of an uninterrupted output at either +5V or −5V (hardware selectable) between two or more consecutive events. This allows the unit to provide open/closed hi-hat control — an inverted, −5V, pulse being necessary to the hi-hat facility offered by the Digisound 'El-Cymb' unit (one of a series of Digisound Digi-Drum units which

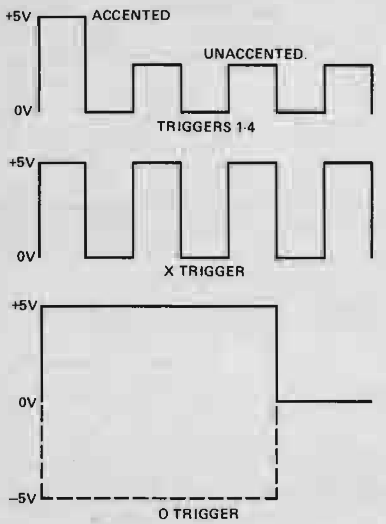


Fig. 1 Specdrum trigger pulses.

The completed unit

The complete circuit diagram for the interface is shown in Fig. 2. It may be divided up into a number of circuit blocks: address decoding; trigger generation and accenting; joystick interface; and a master clock.

Memory address decoding is performed by IC4 and IC5a, d, e and f, which generate two hardware control signals, WRSEL and RDSEl. The decoding checks for A5, so that the hardware appears at addresses 1F, 5F, 9F and DF (hex). This simplified I/O decoding is quite adequate in this application and does not conflict with other Sinclair hardware. In fact, the software is designed to make full use of microdrives if they are available.

The decoded $\overline{RDSEL}$ signal directly controls the two enable pins of an octal buffer (IC2), which is responsible for reading in the appropriate switch status from a standard Kempston joystick. With a logic 0 on the enable pins, the joystick position is passed to D_0-D_5 of the data bus. Data bit D_7 is used to transfer the hardware clock which is responsible for timing duties, synchronization of the display and memory latching. This clock is built around IC6, a 555 configured for astable operation. Potentiometers RV5 RV6 provide, respectively, fine and coarse speed/tempo control. The output of the 555 is taken to the break connection of jack socket J1. This allows an external clock to be used for synchronization. Any incoming clock signal is cut down by the resistor/zener diode network connected to the J1 'make' connection. The +5V signal is buffered and inverted by IC5b and reinverted to generate CLK and $\overline{CLK}$ signals, switchable at S1. This feature is included so that clock signals with extreme duty cycles may still be used. With such signals, inversion may be necessary to allow the software enough time to carry out the display routines. When there is insufficient time for the software, the display is drawn in stages. The third position of S1 grounds the clock, so that the hardware may be used as a conventional joystick interface. If this was not done, games software might mistake the ungrounded incoming clock signal for the fire button! The normal address location of joysticks in games software is 1Fh, making them compatible with this unit.

The remaining hardware is concerned with generating the six trigger pulses. With a logic 1 on WRSEL, IC1 (an octal D-type latch) is enabled and data lines D_0-D_6 pass valid trigger information to the rest of the cirlcuitry. D_0-D_3 are the four channel triggers to which an accent control may be added. This information is generated by D_6, and accents all triggers simultaneoously by ANDing the accent pulse with the outputs on D_0-D_3. It is possible to individually regulate the level from 0 to 5V on each trigger by means of pententionmeters RV1–4, which control the amount of feedback from the output to the indidivual channel inputs. The presence of an accent pulse takes all levels to 5V. The trigger outputs are taken off the potentiometer wipers and each is buffered by one of IC8's four op-amps.

The O and X triggers are treated in a different manner in software and are not provided with an accenting facility. The X trigger on D5 is treated like a fully accented trigger, providing a positive-going 5V pulse which returns to 0V between two adjacent events. The O trigger on D4 is used to generate an uninterrupted output bet-

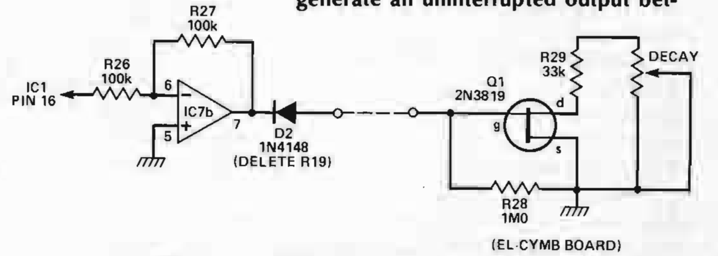


Fig. 2a Modification for use with El-cymb or other negative trigger device

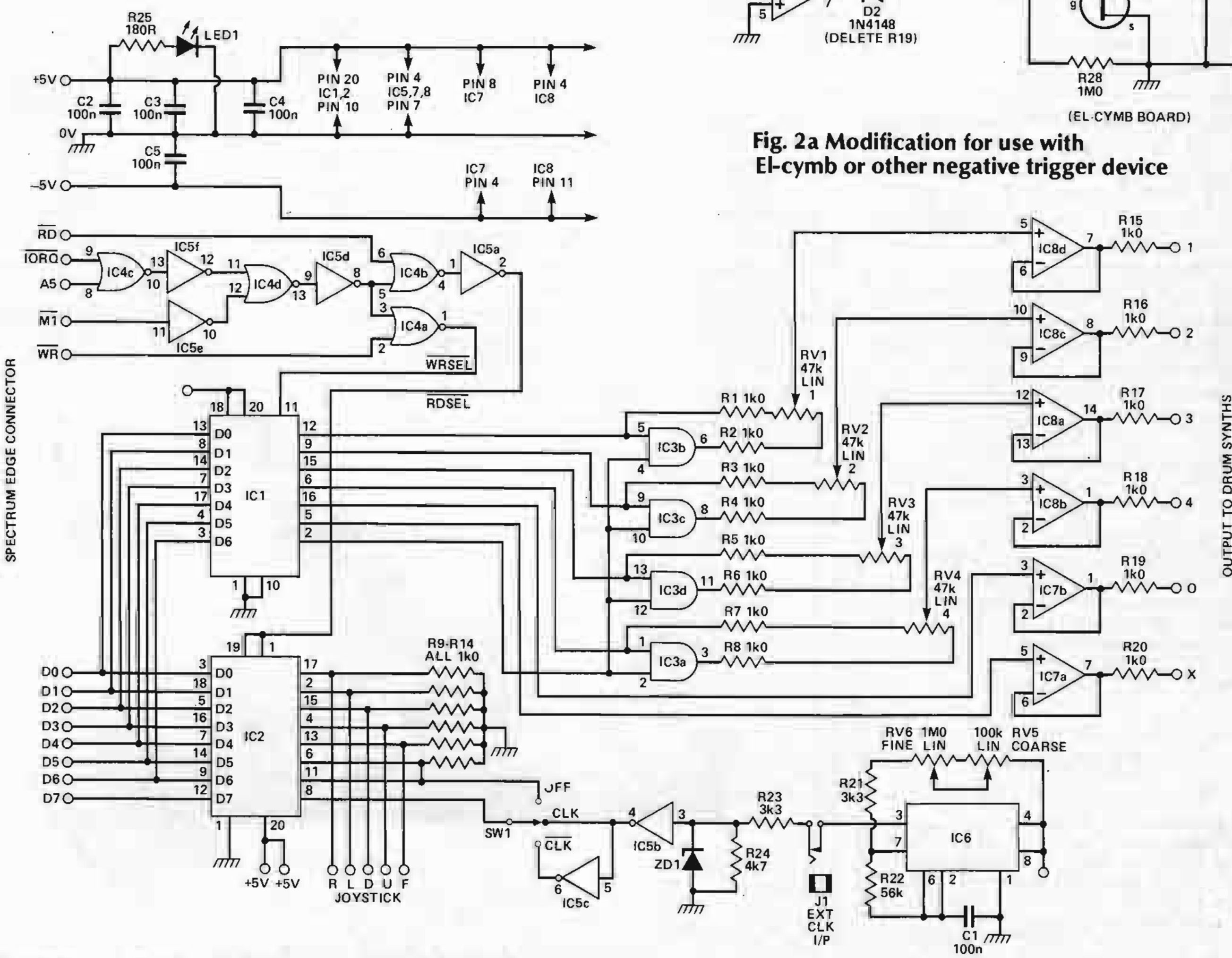


Fig. 2 Complete circuit diagram (positive 0 trigger)

ween two or more consecutive events. The O and X signals pass directly to output buffers configured around the two halves of IC 7. The O trigger buffer may be arranged to invert the incoming 0 to +5V pulse, generating a 0 to −5V signal. A negative voltage can be used to open and close the signal path between the drain and source pins of a 2N 3819 FET in order to control certain units, like the El-Cymb. R29, the resistor between the drain pin and the decay pot, is responsible for setting the difference in decay characteristics and may be altered. The modification for the El-Cymb is shown in Fig. 2a. The diode that replaces R19 is included to block any positive voltages which if they occurred would probably result in the destruction of the FET.

The unit is powered by +/5V from the Spectrum PSU and draws around 80mA on the positive rail. The Spectrum can withstand this for long periods of time even with Interface 2 and microdrives attached. Capacitors C2–C5 are for decoupling purposes and LED1 provides a power-on indication.

PARTS LIST

RESISTORS (5%, ¼W carbon film)

R1-20	1k0
R21, 23	3k3
R22	56k
R24	4k7
R25	180R
R26, 27	100k
RV1-4	47k lin.
RV5	100k lin
RV6	1M0

CAPACITORS

C1-5	100n polyester

SEMICONDUCTORS

IC1	74LS373
IC2	74LS244
IC3	74LS08
IC4	74LS02
IC5	74LS04
IC6	NE 555
IC7	MC 1458
IC8	LM 348
D1	5mm Red LED
D2	1N 4148
ZD1	5V6 400mW zener

MISCELLANEOUS

J1-7 3.5mm mono jack sockets, 9-way D-Plug, Spectrum edge connector, 8-way Molex sets (2 off), 16-way ribbon cable (1m), case with printed and punched panel, K9 control knobs and caps (7 off), SW1 1 pole, 3-way rotary switch, PCBs.

BUYLINES

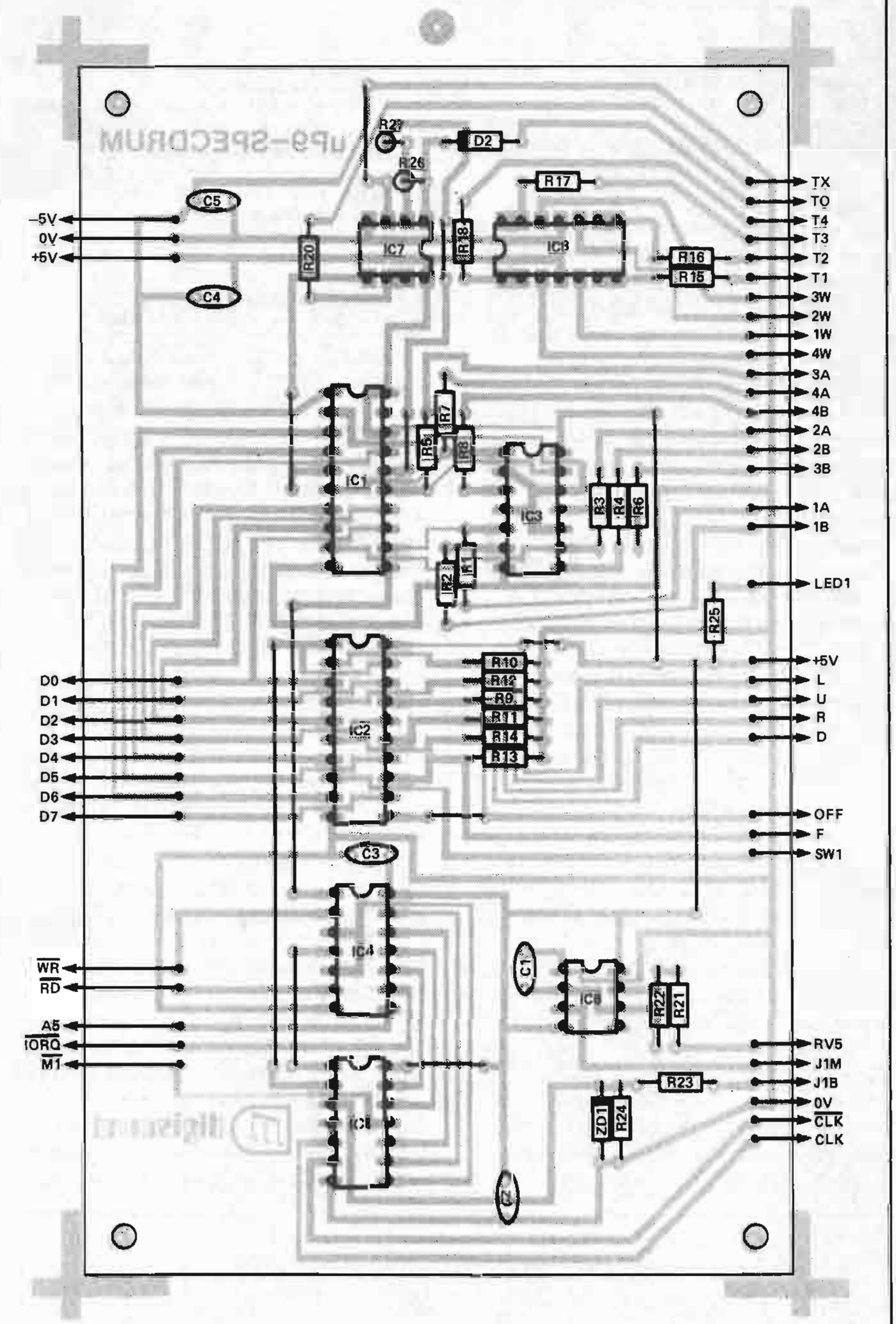


Fig. 3 Component overlay for main board.

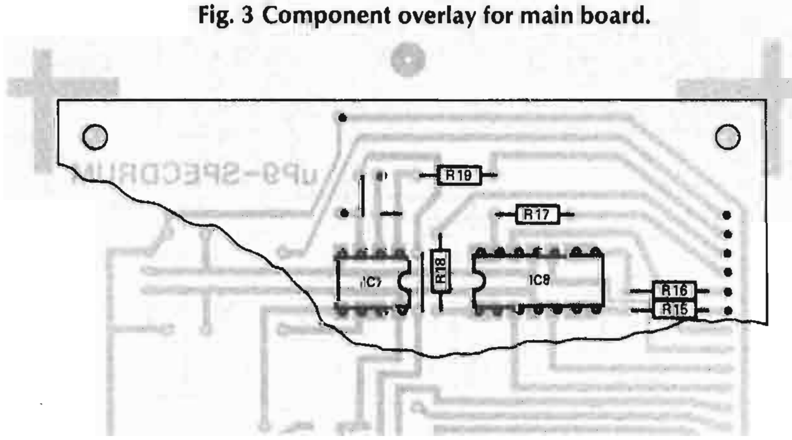


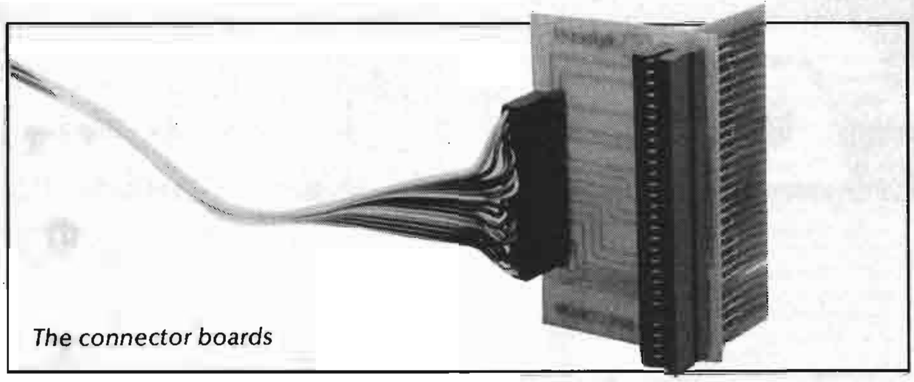
Fig. 4 Changes to overlay for positive 0 trigger generation.

can be operated with this sequencer).

Construction

The component overlay for the main PCB (marked uP9) is shown in Fig. 3 — this arrangement generates an inverted O trigger. The changes needed to generate a positive O trigger are shown in Fig. 4, Figure 2a shows the circuit of the inverted O outut and the modifications necessary to the 'El-Cymb' module to produce a variable decay. Assembly is a fairly simple matter and should proceed in the normal manner: links, resistors, IC sockets, capacitors and so on. When all of the components have been assembled on the main board, it should be thoroughly treated with a solvent cleaner and inspected for dry joints and solder bridges. Insert the 28-way edge connector into the PCB marked uP8 and with the PCB evenly towards the body of the connector solder the two parts together. Then bend the exposed ends of the pins so that they meet evently. Slide the edge connector PCB (marked uP2) between the two rows, ensuring that each pin lines up with a finger on this PCB and that the cut-out is in the correct location. Push the PCB against the rear of the connector and solder in place. Do not let solder flow closer than 1 cm from the exposed edge of this PCB, or it may interfere with the proper location of peripherals.

Using the available case and panel, the connections from the Spectrum edge connector



The connector boards

assembly to the interface are hardwired to the main PCB and made via Molex connectors on uP8. This necessitates the cutting of a small slot in the plastic case wide enough to pass the length of 16-way ribbon cable through. Be sure not to reverse the Molex connections when plugging onto the edge connector assembly — the easiest way to avoid this is probably to find (and if necessary mark) the earth connection on uP8 (two pads joined near the slot). Then, ensure that this is connected to earth on uP9 and the rest of the connections will follow in the correct sequence. The panel wiring is shown in Fig. 5 and is simply a matter of matching the connections on this diagram with the connections shown in Fig. 3.

Once construction is complete and fully checked, the unit may be connected to the Spectrum computer and the latter switched on. At switch-on, the TV/monitor display should be as usual and the power-on LED on the unit illuminated. If anything seems wrong, turn off immediately and recheck all wiring and soldering until the error is located.

In Use

The users' manual which accompanies this package provides comprehensive information on how to use it. The unit will function with most analogue or digital percussion sound generators currently available. The sound generators may be connected to the triggers in any desired manner, bearing in mind the open/closed hi-hat function. As an example of the system's flexibility, it is possible to trigger two drum modules from a single output, adjusting the dynamic sensitivity of the modules so that one is triggered by an unaccented (low level) trigger and both by an accented (high level) trigger.

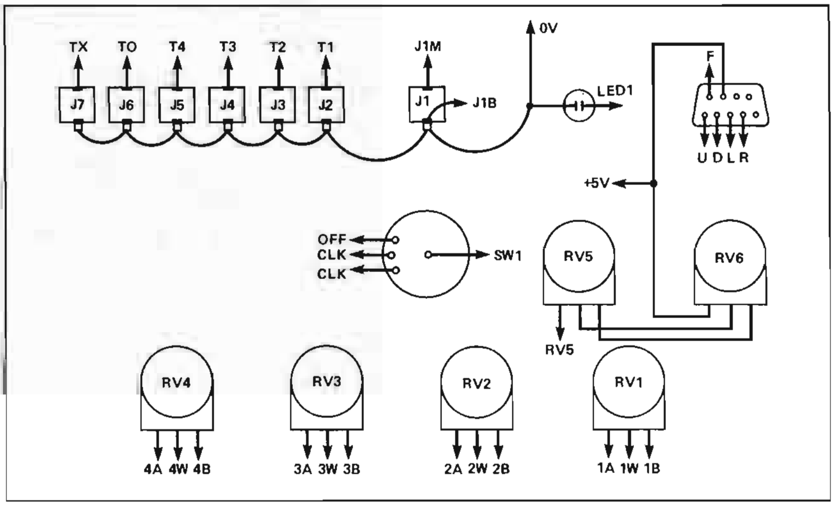


Fig. 5 Panel wiring diagram.

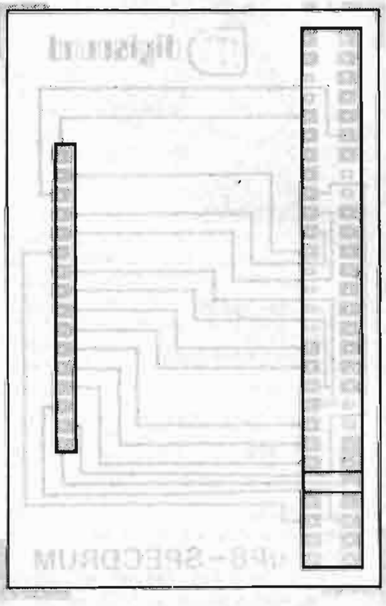


Fig. 6 Overlay of connector board.

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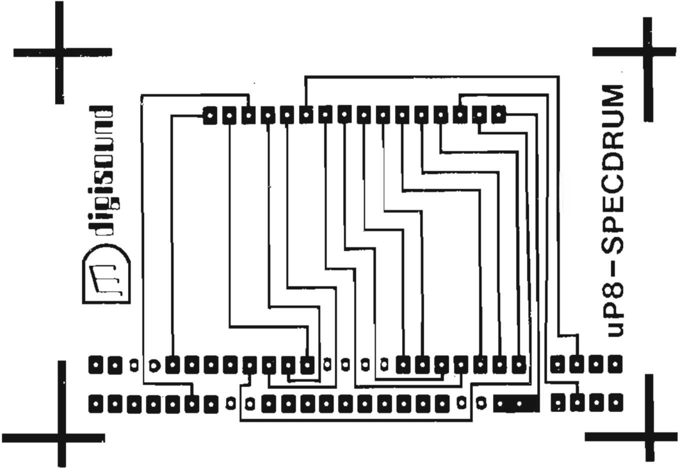
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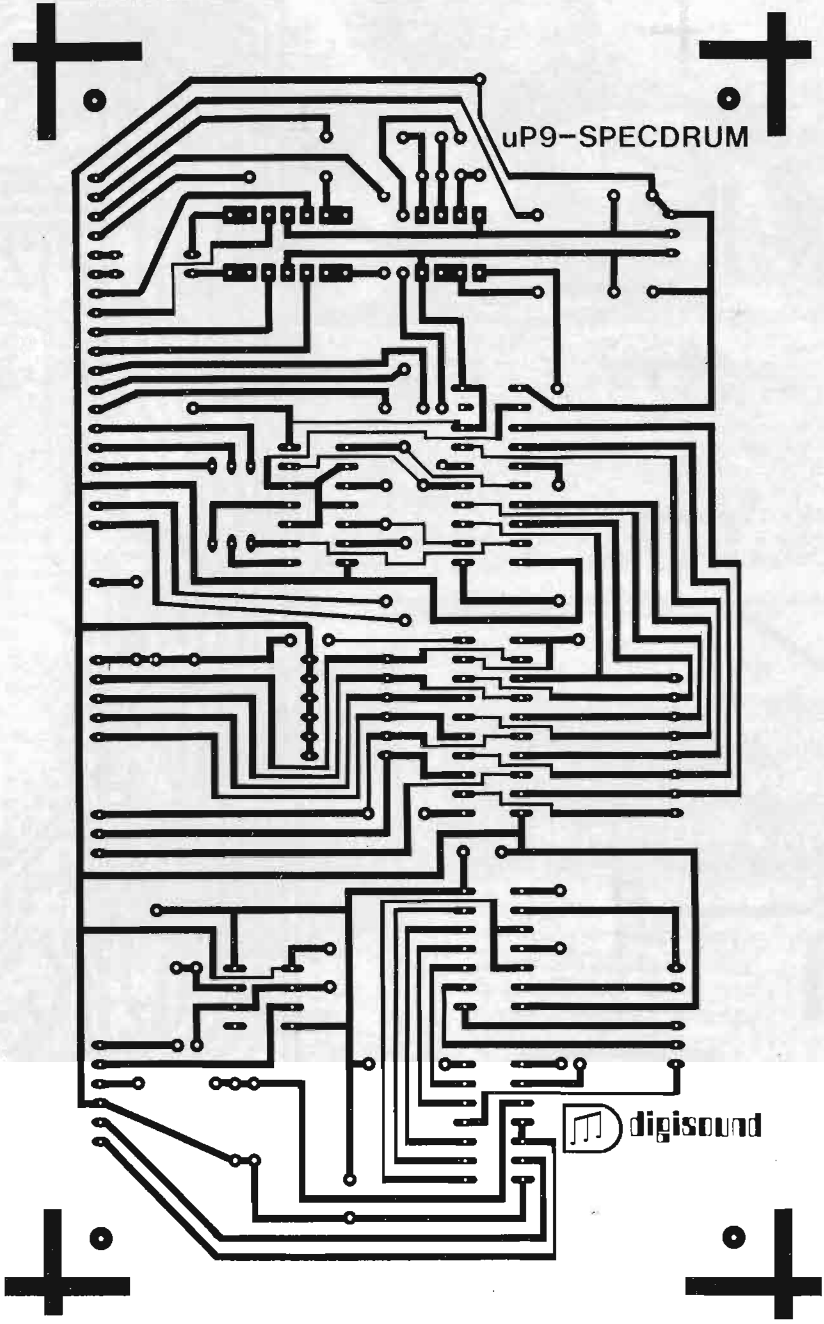

The foil pattern for the main board of the Specdrum.