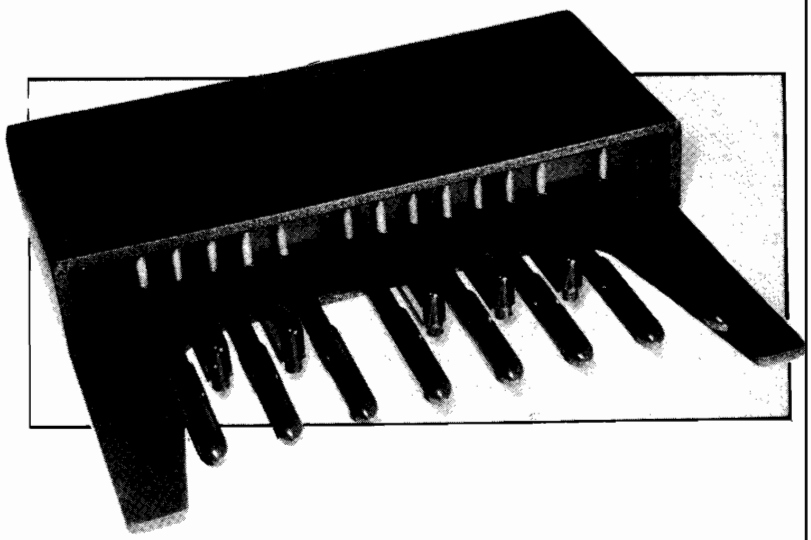
Universal Bass Pedal Synth

Paul White **describes the design and construction of a pedalboard that'll interface easily with any one-volt-per-octave synth with CV and gate sockets. All the parts are readily available, while the PCB can be bought direct from E&MM.**



Unlike the Moog Taurus bass pedals and similar self-contained instruments, the pedalboard described in this article is designed to interface easily with any conventional 1 volt-per-octave synth, providing that CV and gate sockets are fitted. The circuit provides a control voltage and a gate pulse featuring first-note priority and multiple triggering. This is a useful system for pedals since it avoids some of the problems that may be caused by clumsy footwork and is probably more practical than the usual high-or-low-note priority systems common to most keyboards.

Interfacing

One big advantage in having a system that will interface with a variety of synths is that you can choose a model with a bass sound suitable to your needs. Another point worth noting is that with the rapidly expanding polysynth market, there are a lot of secondhand monosynths to be found at bargain prices.

Circuitry

The pedalboard switch contacts are digitally scanned by IC1, a switch encoder of the type normally used to encode computer keypads.

This IC, the 74C922, can handle up to sixteen sets of switches, but only thirteen are used in conjunction with the C-to-C pedalboard. Unlike conventional keyboard switching, only one pair of contacts is required per key, and these are wired to form a matrix. (See Figure 3.)

When a key is depressed, the four-bit binary number appears on the output of IC1, pins 14 to 17 inclusive. A 'Data Available' signal simultaneously appears on pin 12 of IC1 and this is buffered by the emitter follower formed by Q1 and R10 to provide the gate output. The 74C922 features what is known as 'two-key roll-over', which simply means that the first key pressed takes priority and depressing a second key will have no further effect until the first key is released. On releasing the first key, the Data Available line goes low for a few milliseconds (the exact time being set by the debounce capacitor C8) before generating a new trigger pulse for the second key pressed.

The binary key code will remain latched until a new note is played, overcoming the problem of pitch droop when using long decay times, something many readers may have noticed on some analogue synths, especially in damp weather. Having released the key however, you are still at the mercy of the keyboard Sample and Hold circuit in your synth, so make sure that there is no undue 'droop' there.

IC2 is an 8-bit linear DAC that converts the binary key code into a proportional current, which in turn drives IC3 in order to produce the control voltage. VR1 sets the gain of IC3, and this is used to provide the correct 1 volt-per-octave relationship. VR2 provides the tuning voltage which, after being buffered by IC4, is summed into the inverting input of IC3, providing a tuning range of at least two octaves. The tuning range may be decreased by reducing the values of R8 and R9, while VR2 may be a preset or tuning pot on the back panel.

The power supply must be stabilised and Figure 1 shows a conventional split-rail power supply using two commonly available regulator ICs. Be careful with the pin connections here as the two ICs *are* different.

The circuit will work perfectly well from a half-wave supply, so if you have a transformer that needs using up, don't be afraid to depart from the design shown here – just double the values of C1 and C2.

Construction

Wire up the pedalboard switches first, referring to 2 and 3 and making sure that the eight wires are long enough to reach the PCB.

Assembly of the circuit-board is straightforward, but I would suggest inserting the PSU components first and checking this works OK before continuing. IC1 is a MOS device which means that you should avoid static electricity when handling. The manufacturers suggest not handling the pins, but have you ever tried inserting an IC without touching it? A more practical solution is to earth yourself to a cold water pipe and avoid tap-dancing on any nylon rugs. . . . Fit this IC last and then check the PCB for shorts, reversed electrolytics or backward ICs.

Finally, arrange the mains wiring so that all connections are sleeved and out of harm's way. You should also connect a wire between the metal part of the pedals and the ground point on the circuit board.

The case for the prototype was constructed from half-inch plywood and the pedalboard mounted on two blocks of wood glued to the baseboard. The important dimensions are shown in Figure 4 although a certain amount of artistic licence may be exercised. The pedalboard itself dictates most of the dimensions; just make sure that there's enough travel on the pedals to allow the switches to operate before the pedals hit the baseboard or the floor!

Testing and Calibration

Surround the unit with sandbags and switch on. Peer cautiously over the top and if there is no smoke or fire, measure the plus and minus twelve volt lines. If these are still OK, connect the gate and CV outputs to a convenient synth and press a pedal. The synth should play but the tuning will almost certainly be painfully bad at this point. Play top and bottom C alternately; and simultaneously adjust VR1 until they sound one octave apart. Next adjust VR2 until your C agrees with everybody else's and check that the octaves are still OK, tweaking VR1 again if required. If you can borrow a tuner at this stage it will make life a lot easier.

The gate output is approximately 12 volts positive going which should suit most synths. If you have a synth with an S-trigger requirement or a Transcendent 2000 which needs a negative gate pulse, substitute R10 for a reed relay and wire it as shown in Figure 6.

Well, that's the easy bit over with – now you've got to learn to play the things. . . .

Paul White **E&MM**

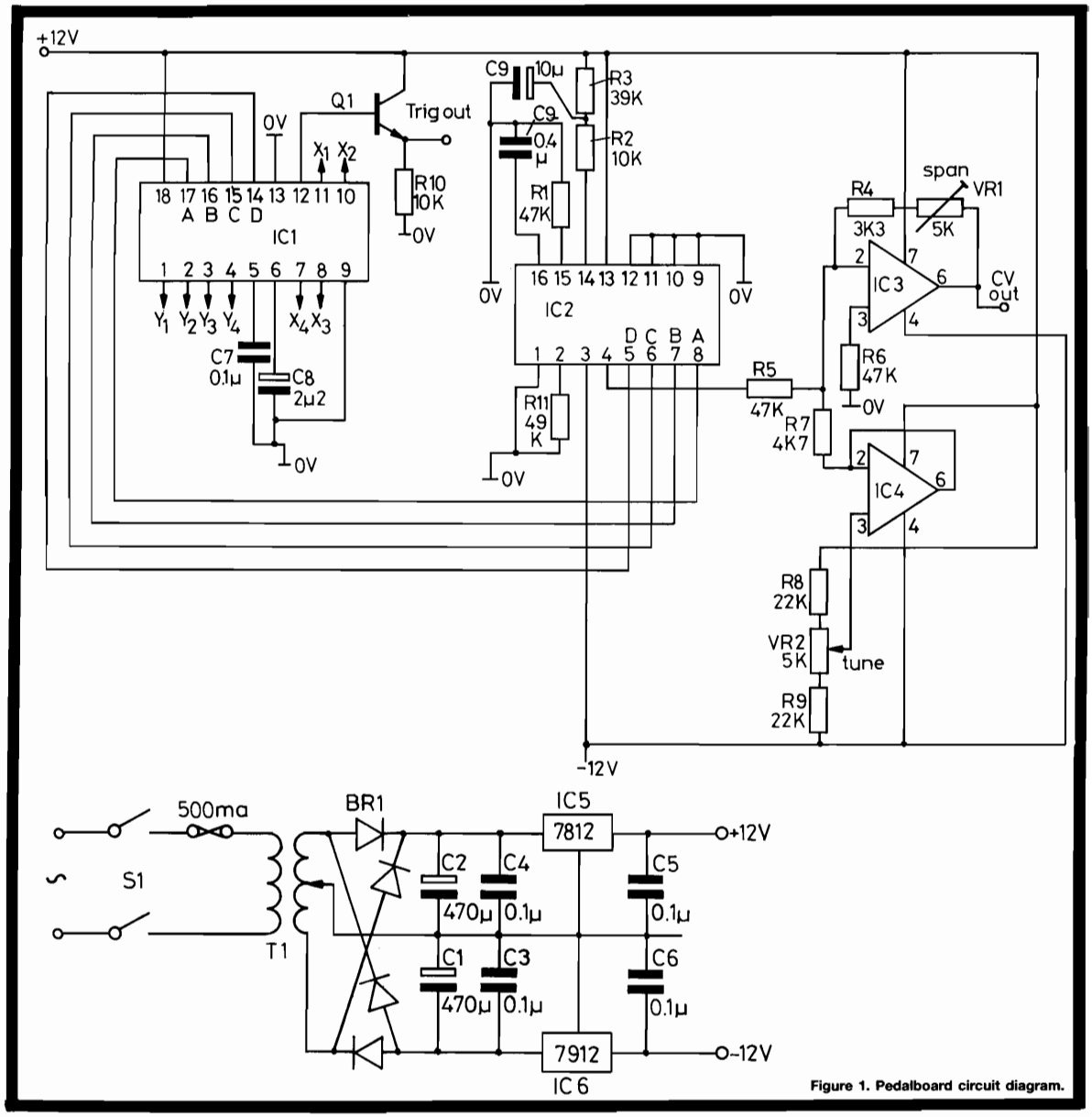


Figure 1. Pedalboard circuit diagram.

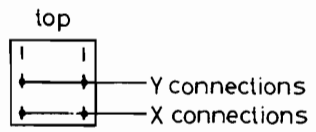


Figure 2.
Pedalboard switch contacts.

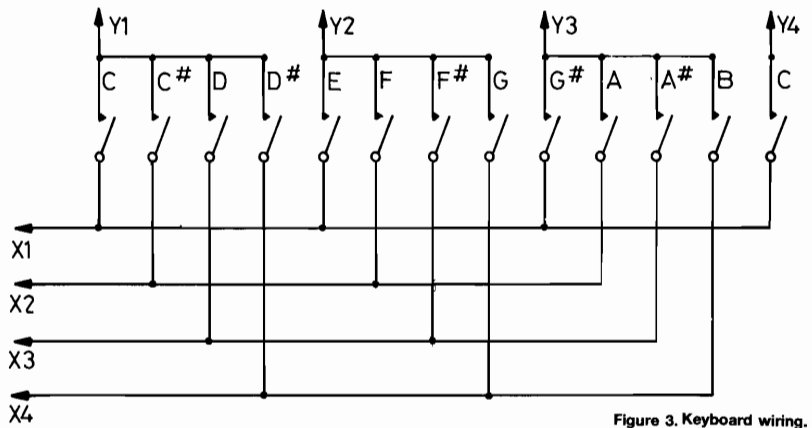


Figure 3. Keyboard wiring.

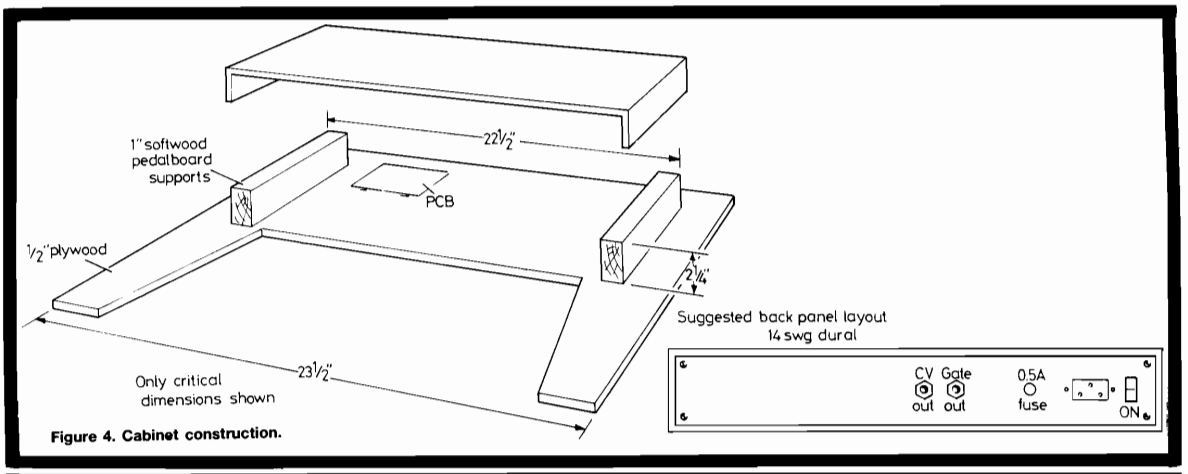


Figure 4. Cabinet construction.

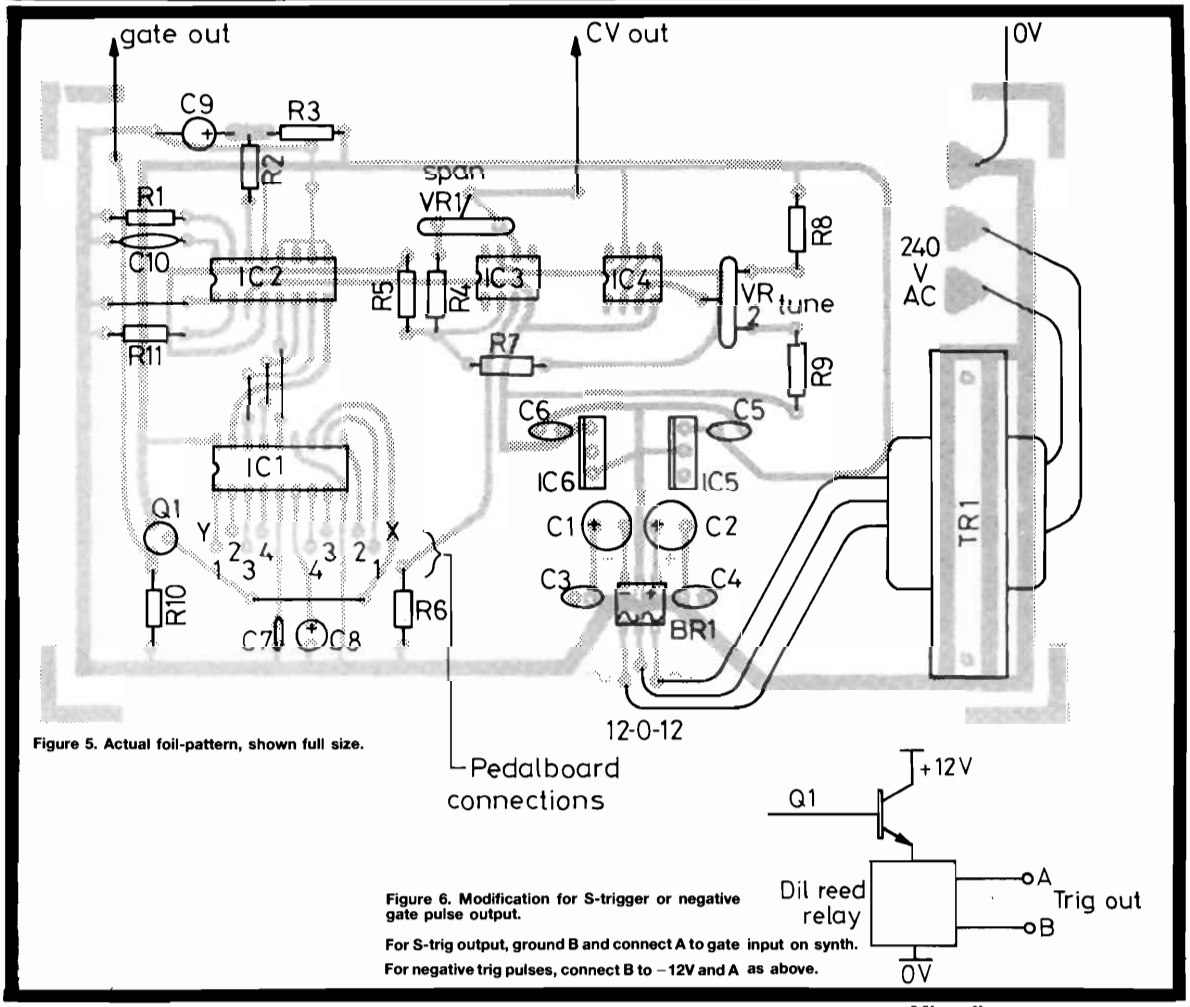


Figure 5. Actual foil-pattern, shown full size.

Figure 6. Modification for S-trigger or negative gate pulse output.

For S-trig output, ground B and connect A to gate input on synth.

For negative trig pulses, connect B to −12V and A as above.

Parts List for Bass Pedal Synth

Resistors (all ¼W oxide)

R1	47K
R2	10K
R3	39K
R4	3K3
R5,6,7	4K7
R8 9	22K
R10	10K
R11	47K
VR1	5K preset
VR2	5K preset or standard pot

Capacitors

C1,2	470/25V single-ended electrolytic
C3-7, 10	0.1uF disk ceramic
C8 2u2/63V	single-ended electrolytic
C9 10uF/35V	single-ended electrolytic

ICs

IC1	74C922*
IC2	0800
IC3,4	741
IC5	7812 voltage regulator (+12V)
IC6	7912 voltage regulator (−12V)
Q1	BC107
BR1	bridge rectifier (DIL-type) or 4-off IN4001s
TR1	12-0-12V/100ma transformer
S1	two-pole mains switch

Miscellaneous

Fuse holder
Maplin bass pedals
PCB
Jack sockets

All parts available from Maplin, except those marked (*), which are available from Watford Electronics.

PCBs available from E&MM at the editorial address, price £5.95, payable to Glidecastle Publishing Ltd.