PE Sound Synthesiser 2

STABILISED POWER SUPPLY

By G. D. SHAW

IF the modular concept outlined last month, is to be followed in its entirety, this implies that not only must each circuit be entirely self contained but also that each circuit, complete with its various controls, should be capable of operating as a separate entity either within, or external to, the framework of the synthesiser as a whole.

These factors, coupled with the experience gained in building the prototype, contributed towards a decision to redesign the instrument into a fully modular form based on one of the many commercially available racking systems.

This month modifications to a standard racking system will be described together with constructional details of the twin stabilised power unit that will supply the various synthesiser card modules.

CHOICE OF RACKING SYSTEM

It was believed that, in the interests of economy, the Card Frame System 1 by Vero offered the greatest value. Utilisation of this particular system, however, means that the constructor will be obliged to manufacture his own modular inserts which may perhaps be a deterrent to those not having the facilities or experience to tackle sheet metal fabrication. In this case the modular racking system type 3E also by Vero has the advantage that it covers a range of components which may be easily assembled into modular inserts.

This latter system is extremely well designed and the component parts of the assemblies are precision made, these factors, naturally enough, being reflected in the price of the 3E System which is several times greater than that of System 1.

Fig. 2.1 shows a general view of the assembly of the card frame to be used as the mainframe of the synthesiser chassis. The aluminium end plates are already pre-drilled to suit the standard Vero components normally used in the assembly of a System 1 Card Frame. It will be necessary, however, to provide additional holes to allow for modifications to the standard assembly and to provide mounting facilities for a number of components. Drilling details are shown.

MAINTAINING A TIGHT ASSEMBLY

The slotted card support sections are made of plastic and are secured to the end plates by means of self tapping screws. Repeated removal and replacement of these screws will result in wearing of the threads which will, in turn, make the assembly sloppy. It is suggested therefore that assembly of the mainframe is only attempted when all necessary drillings, etc. have been completed, and that, once assembled, it is left so. If the constructor wishes, for any reason, to have the facility of stripping the assembly down repeatedly he would be well advised to redrill the securing screw holes and tap them to take a suitably sized metallic thread insert.

COMPONENTS . . .

RACKING SYSTEM

Card Frame

Kit of parts for a System 1 Card Frame with a pair of guide mouldings to suit (Part No. CFMN/1)

SK7–SK13 8 pin McMurdo sockets (Part No. RS8) (7 off)

PL1–PL7 8 pin McMurdo plugs (Part No. RP8) (7 off)

Frame parts above available from Vero Electronics Ltd., Industrial Estate, Chandler's Ford, Eastleigh, Hants., SO5 3ZR

MODULE FRONT PANELS

Fig. 2.2 shows the composite front panel layout with dimensions. It will be seen that the panel is divided vertically into eight separate sections. These sections represent the front panels of individual modular units and, with the exception of the strip on the extreme right of the panel, can be removed from the mainframe complete with their respective card supports and circuitry.

The right hand strip is permanently fixed to the mainframe by two small aluminium brackets.

The left-hand panel is slightly wider than the remainder mainly to act as "fill-in" on the full width of the front panel.

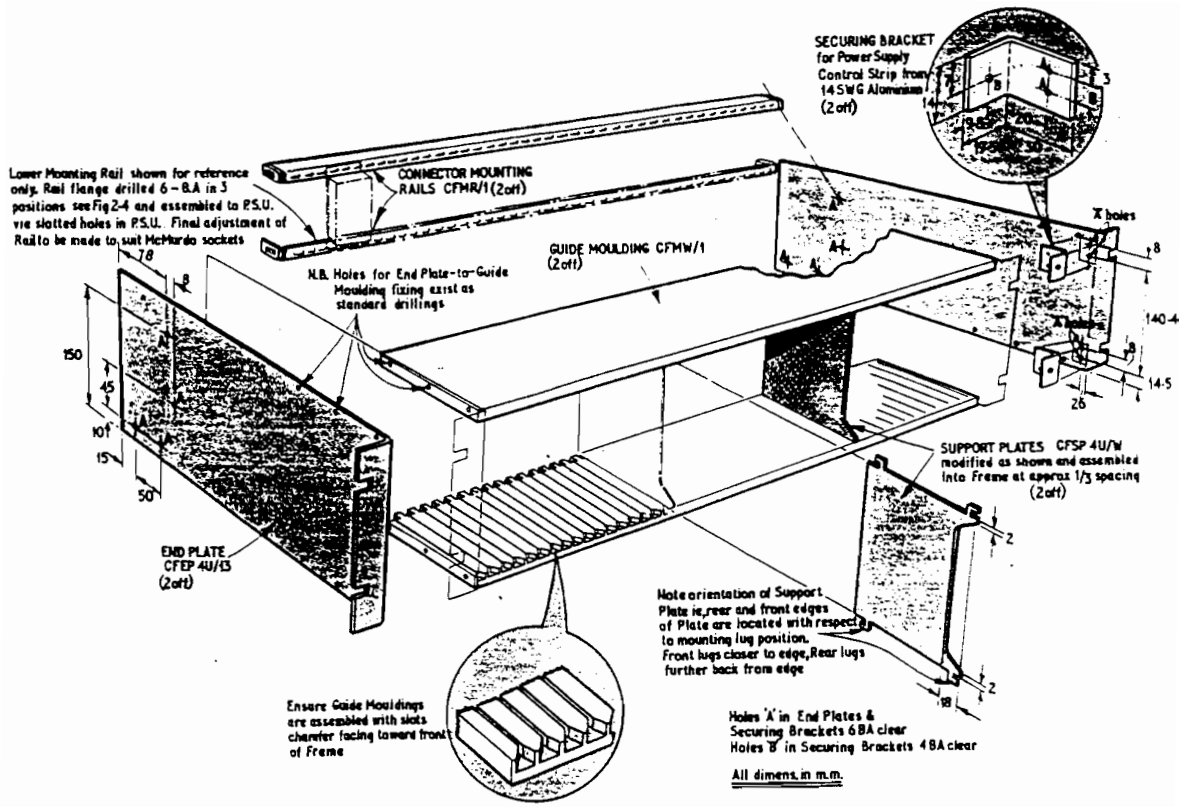


Fig. 2.1. Perspective view of the Card Frame System 1. The end slots on the upper mounting rail require to be elongated for future adjustment of McMurdo sockets

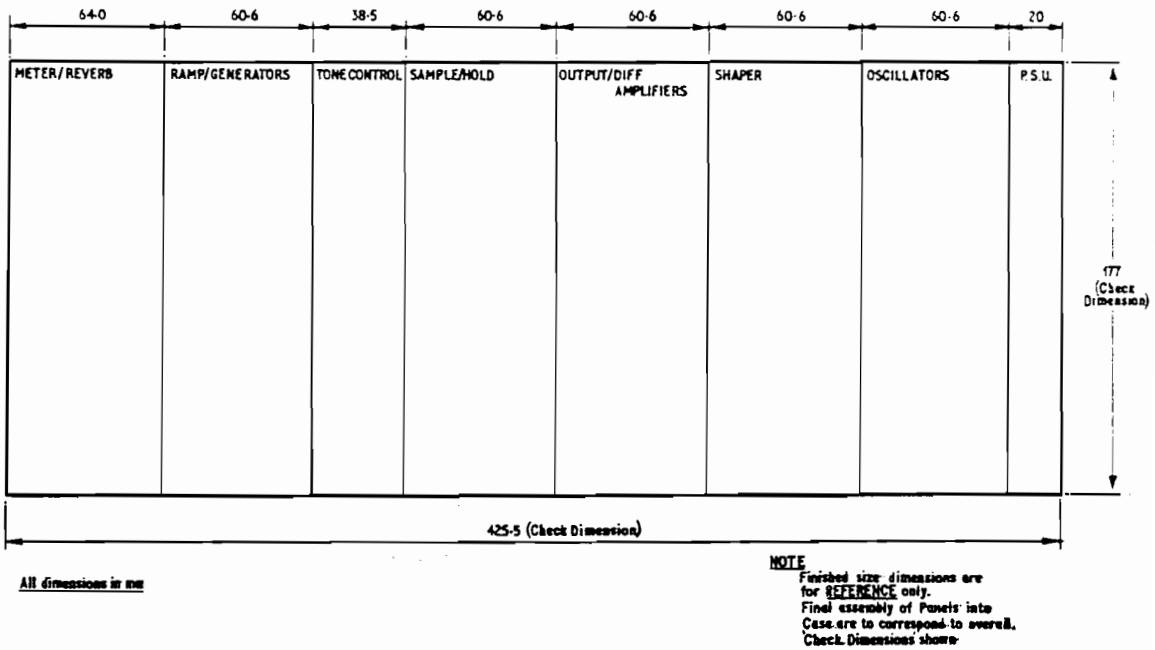


Fig. 2.2. Composite front panel. These sections represent the front panels of individual modular units as indicated

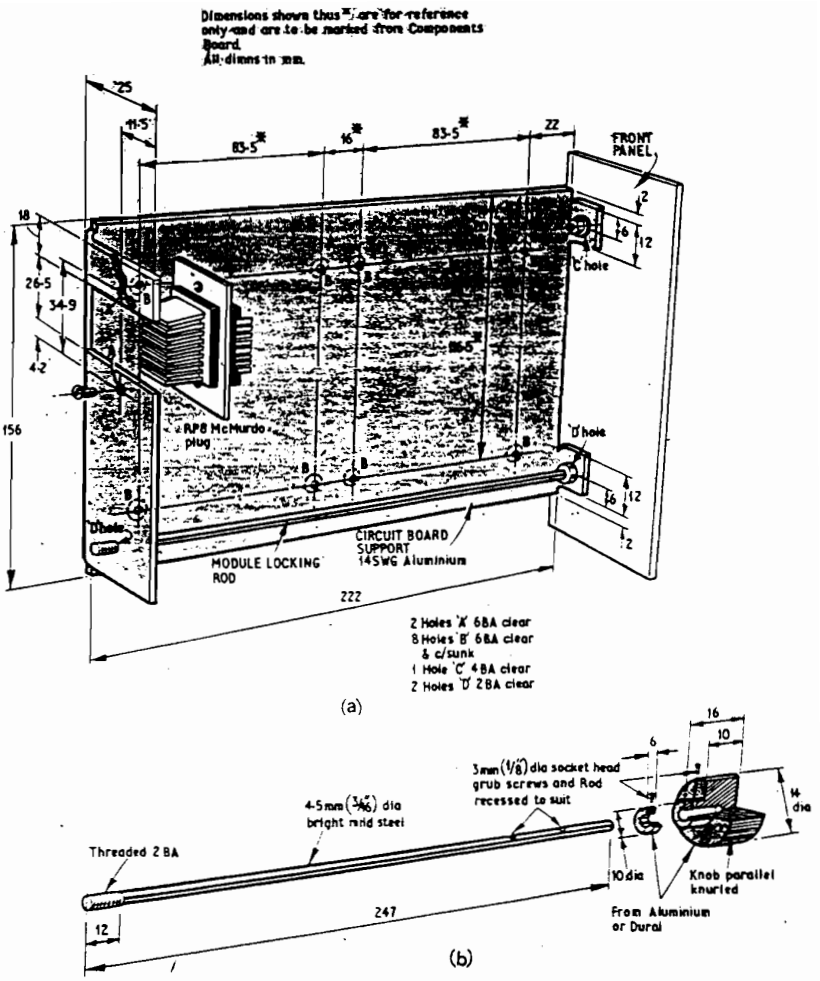


Fig. 2.3a. Drilling and bending details for circuit board support plate and McMurdo plug (b) details of retaining rod

MODULE SUPPORT PLATE

Circuit boards are supported on a plate to one end of which is attached the module front panel and to the other end a plug which mates with a socket at the rear of the mainframe assembly. Fig. 2.3a shows details of this support plate. Care should be taken in bending this item and the bends should be made as tightly as possible. Lack of attention to this point will mean that the overall depth of the plate is greater than specified with the result that the front panel, when attached, will not be flush with the card support moulding in the main frame.

Modules are retained in the main frame by means of a $\frac{3}{16}$in (4·5mm) rod, Fig. 2.3b, screwed 2B.A. at one end, which passes through the front panel and engages with a Rosan bush, or similar, in the power supply sub-frame. This arrangement also provides a means whereby the module may be withdrawn from the main frame and, for this purpose, a locking collar is provided to abut the lower lug on the circuit board support plate.

P.S.U. SUB-FRAME ASSEMBLY

Fig. 2.4 shows the bending and drilling details of the power supply sub-frame. As with the circuit board support plate care should be taken that the clamping and bending is carried out as shown and that the bends are made as tightly as possible. Details have not been provided about the positioning of holes for Rosan bushes or components within the sub-frame.

POWER SUPPLY UNIT

In a project of this kind the predictability of circuit performance depends largely on the ability of the power supply to maintain its voltage rails within relatively close limits. This is particularly true where the oscillators and hold circuits are concerned since quite small variations in supply rail voltage can cause significant changes in the low frequency and "droop" characteristics respectively.

The power supply unit is based on one of the latest regulator i.c.s to appear from Fairchild, the μA7815. This particular device is capable of passing up to 1·5 amps without the necessity of external series regulating transistors, thus it is operating well within its maximum capability. Output ripple and noise is around 500 microvolts or less while load regulation from zero to 400mA is better than 1 per cent. (Total current requirement for the basic synthesiser is 400mA per rail.)

The output voltage of the i.c. is specified as being plus or minus 5 per cent of its nominal rated voltage thus the constructor may find up to 1·5 volts variation across the two power supply rails. This is not necessarily a disadvantage since all the voltage dividers in the synthesiser which require an accurately set voltage are fitted with presets.

CIRCUIT

The circuit diagram of the power supply unit is shown in Fig. 2.5.

Construction is perfectly straightforward (see Fig. 2.6) the only recommendation being that the leads from the transformer to the bridge rectifiers be routed to avoid passing directly over the regulators and that they be twisted together in the interests of hum reduction.

Wires carrying a.c. to the power supply control strip on the front panel should pass through holes drilled in the rear of the sub-frame and fitted with rubber grommets. These leads should be 10in (254mm) in length measured from the rear face of the sub-frame.

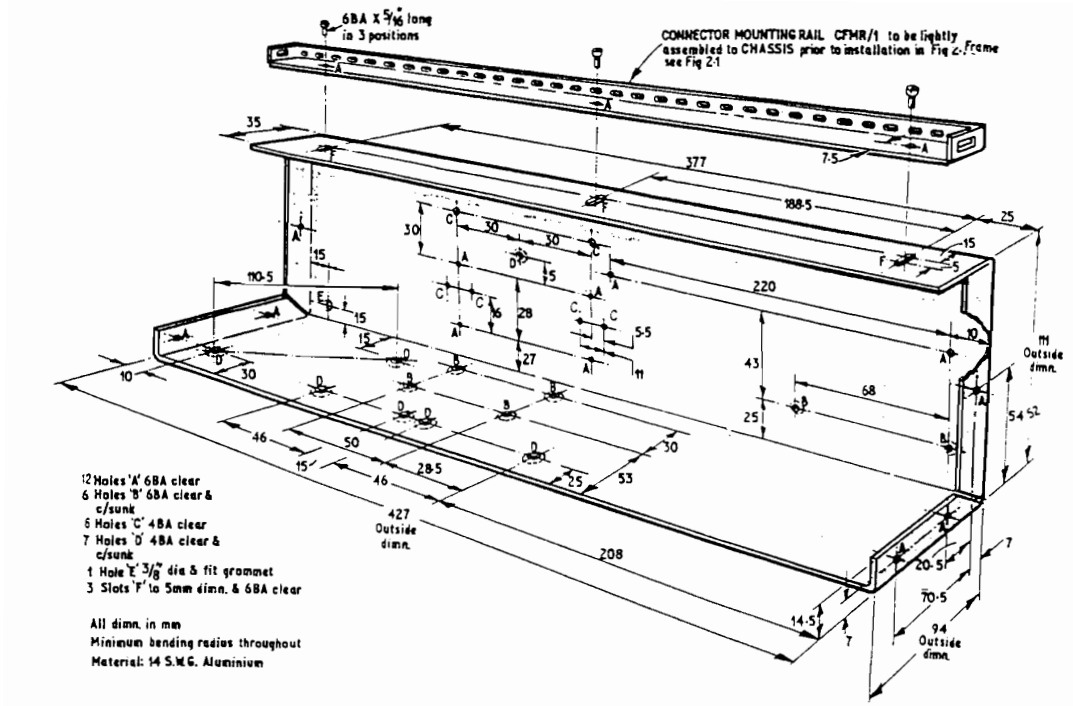


Fig. 2.4. Bending and drilling details of the p.s.u. sub-frame

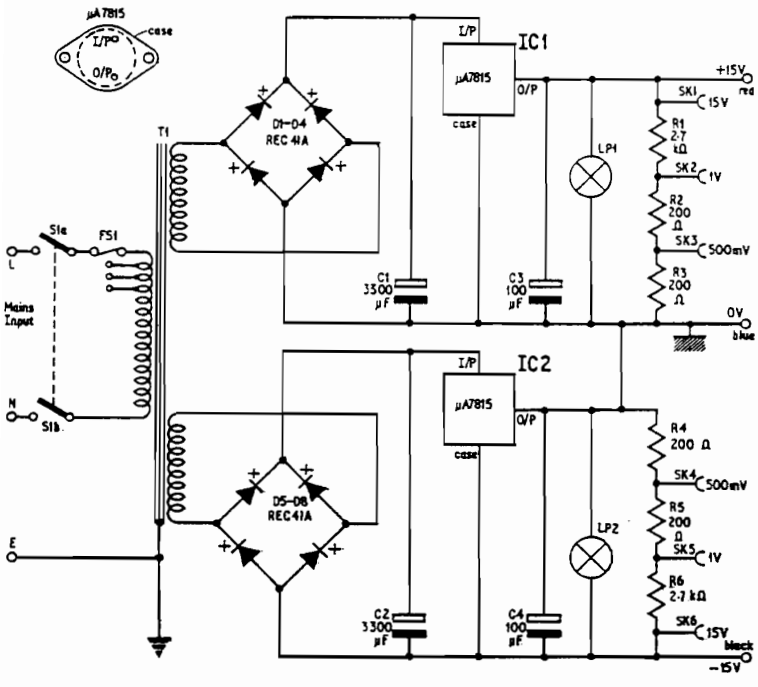


Fig 2.5 Circuit diagram of twin-stabilised p.s.u.

COMPONENTS . . .

TWIN STABILISED P.S.U.

Resistors

R1 2·7kΩ R2–R5 200Ω (2 off)

R6 2·7kΩ

All 2% ½ watt metal oxide

Capacitors

C1–C2 3,300µF 63V High rippie elect. (2 off)

C3–C4 100µF 25V elect. (2 off)

Bridge Rectifiers

D1–D8 REc 41A (2 off)

Integrated Circuits

IC1–IC2 µA 7815 (Fairchild) Macro Marketing Ltd., 396 Bath Rd., Slough, Bucks.

Transformer

T1—Main transformer, primary 240V; secondary 30–0–30V at 1·5A

Miscellaneous

S1—Miniature double pole, single throw on/off switch

LP1–LP2 miniature 28V filament lamps,

FS1—500mA fuse.

SK1–SK6 1mm miniature sockets. (6 off)

14 s.w.g. aluminium as required

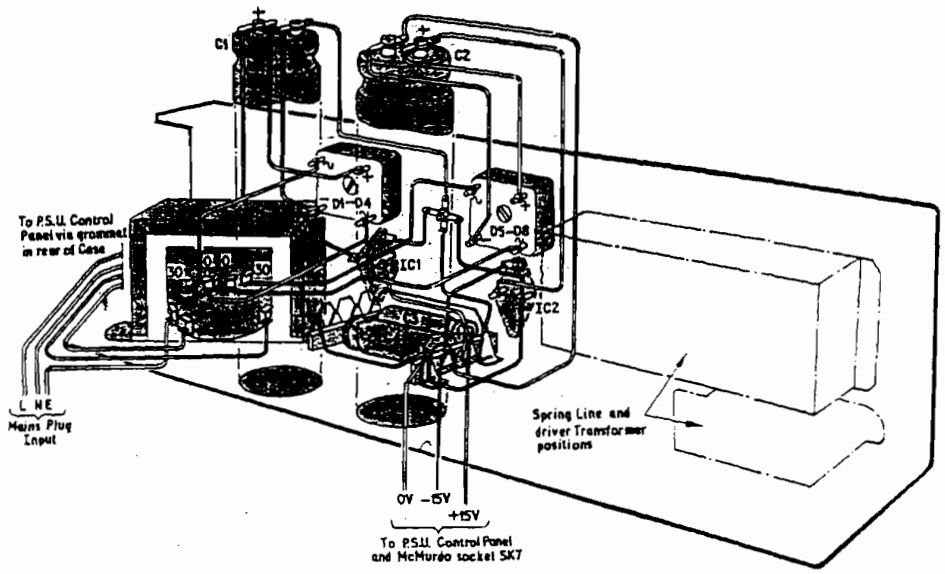


Fig. 2.6. Mounting and wiring details of p.s.u. components

Smoothed d.c. supplying the indicator lamps and calibrating voltage points is taken from the d.c. bus-bars coupling the McMurdo Red-Range sockets and thus may pass over the top of the sub-frame.

When the power supply unit has been wired up, with the exception of the d.c. to the indicators and calibrating voltage sockets, the mainframe assembly may be commenced.

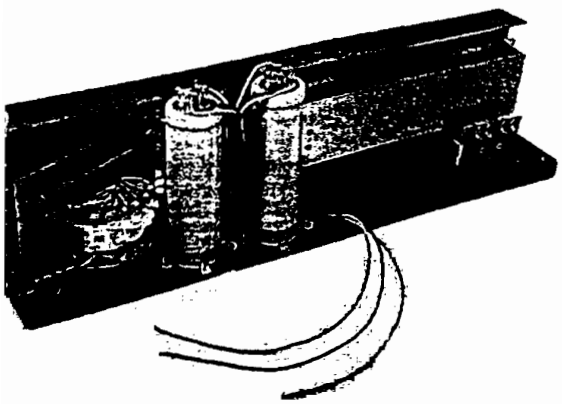
ARRANGEMENT OF PANEL UNITS

Referring for a moment to Fig. 2.2, the constructor should decide at this stage the actual arrangement or order in which he wishes the panel units to be placed relative to one another. The arrangement shown need not be adhered to with the exception of the meter and reverberation unit and the power supply control strip, which have to be sited as shown at the extreme left- and right-hand sides of the front panel respectively.

This decision is necessary at this time in order that the support plates may be correctly placed between the slotted mouldings. Viewed from the front of the assembly, the correct position of these plates is in the slot immediately to the right of the one occupied by a circuit-board support plate.

Since component placement on all front panels offers very little clearance at the left-hand side of the panel it is necessary to cut out the front face of the support plates as shown in Fig. 2.1. The 18mm depth of the cut-out is adequate to clear potentiometers and sockets on all front panels except that of the output amplifiers which will be fitted with ganged "pan-pots".

The optimum position for the support plates is approximately one third of the distance in from the end plates, the exact point, of course, depending upon the module arrangement chosen by the constructor.



MAIN FRAME ASSEMBLY

Assembly of the main frame should be started by loosely securing the bottom slotted moulding between the end plates. The support plates may then be dropped into their respective slots and the upper slotted moulding placed over the lugs on the top edge of the panels and loosely secured between the end plates. Ensure that the chamfered edge of the slots in the mouldings are towards the front face of the assembly and that the vertical panels are in the same respective slot in both mouldings.

This being so, the securing screws may be fully tightened and lugs on the vertical panels twisted through 45 degrees where they protrude through the upper and lower faces of the mouldings.

SECURING THE P.S.U.

The power supply sub-frame may now be secured to the rear of the end plates. The lower socket support should be drilled to mate with the slotted holes in the power supply sub-frame (Fig. 2.4) and loosely secured in position. Similarly the upper socket support should be placed loosely in position.

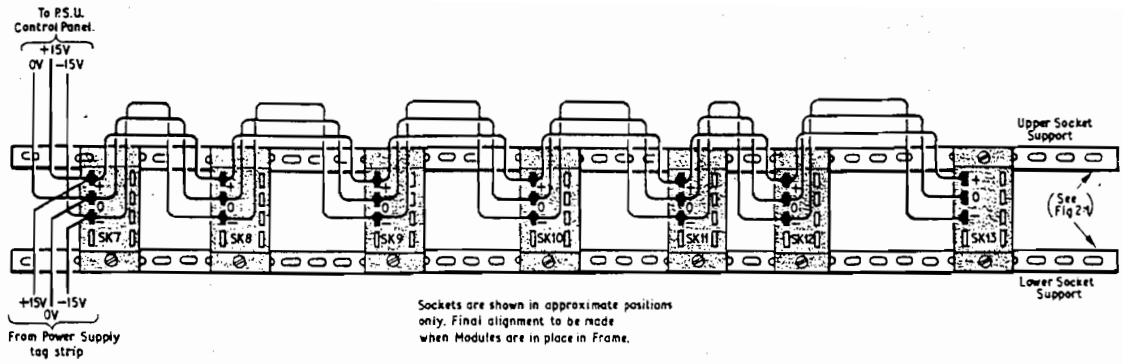


Fig. 2.7. Socket arrangement and wiring on connector mounting rails

POSITIONING THE SOCKET SUPPORTS

The final position of these latter supports is determined by inserting an assembled circuit support plate, complete with plug, into the slotted mouldings until the front panel is flush with the face of the mouldings.

A socket is now placed over the plug so that its securing lugs abut the supports at the rear face and the supports adjusted so that they align with the socket lugs and are parallel with the front face of the mouldings. The socket supports can now be secured firmly at this point and the socket placed in position for the first of the modules to be incorporated into the assembly.

Ideally all the sockets should be placed in position at this time; but if this is not possible the first socket to be positioned should be immediately adjacent to the power supply control module so that its terminals can provide a convenient jumping off point for the leads supplying d.c. to this latter assembly.

The arrangement for supplying power to the individual sockets is illustrated in Fig. 2.7, while Fig. 2.8 illustrates the arrangement for wiring up the rear of the power supply control strip.

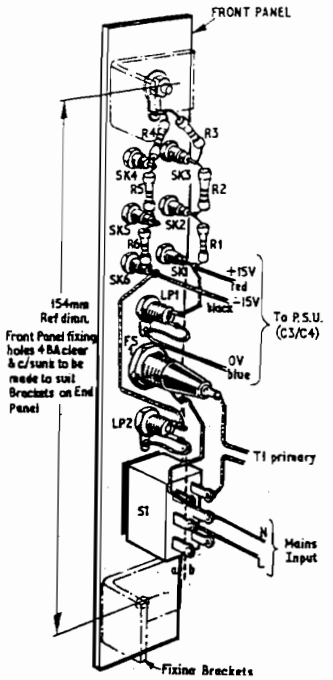


Fig. 2.8 Wiring details for rear of p.s.u. control strip

TESTING THE P.S.U.

The power supply may be tested on completion of assembly and wiring up the main frame. The main purpose of testing is to establish whether the ripple and noise and output voltage levels of each regulator are within their rated specification. Load regulation may also be checked by coupling a 30 ohm 10 watt wirewound resistor across each power rail and observing the change in output voltage on the oscilloscope. If the offset on the scope is not sufficient to enable the trace to be observed at a sufficient degree of sensitivity, a high resistance voltmeter should be used.

The level of change of output voltage at the moment of connecting the resistor across the power rails is likely to be of the order of 150 millivolts or less. Note that the resistor will be dissipating about 7·5 watts and is likely to get uncomfortably hot after a few moments across the power rails. It is best therefore to incorporate a switch in series with the resistor.

The main frame assembly is designed to be accommodated in a standard 19in. case in the Vero range. A later article will include details of the types of cases which may be used and modifications necessary in order to fit a.c., d.c., and keyboard sockets to the rear of the case.

Next month: The operation and construction of the voltage controlled oscillators and voltage inverter will be given.