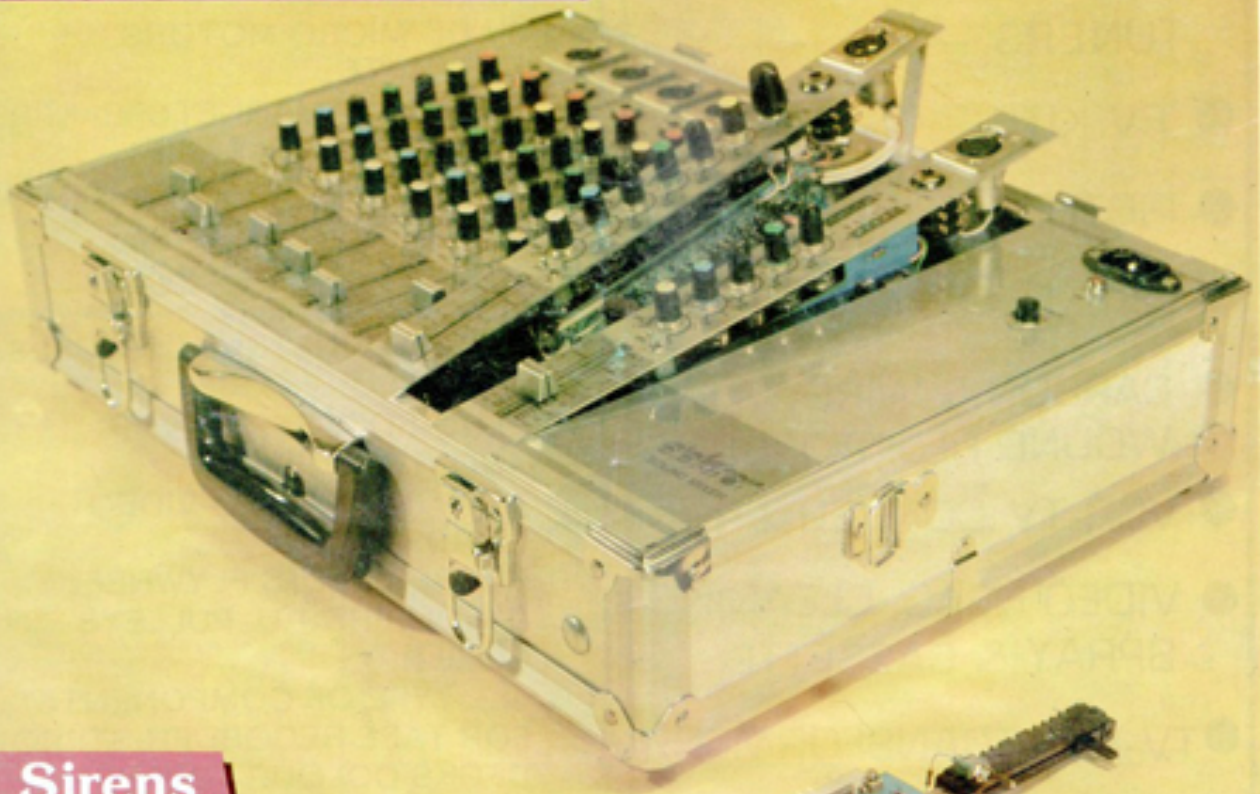
June
1986

elektor INDIA electronics

Rs. 7.50

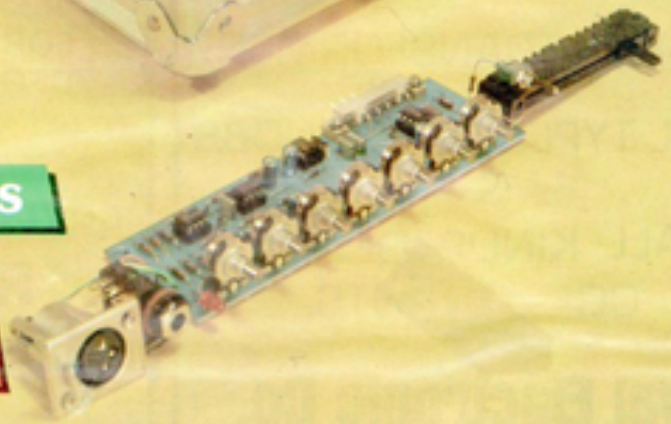
Portable mixer



Sirens

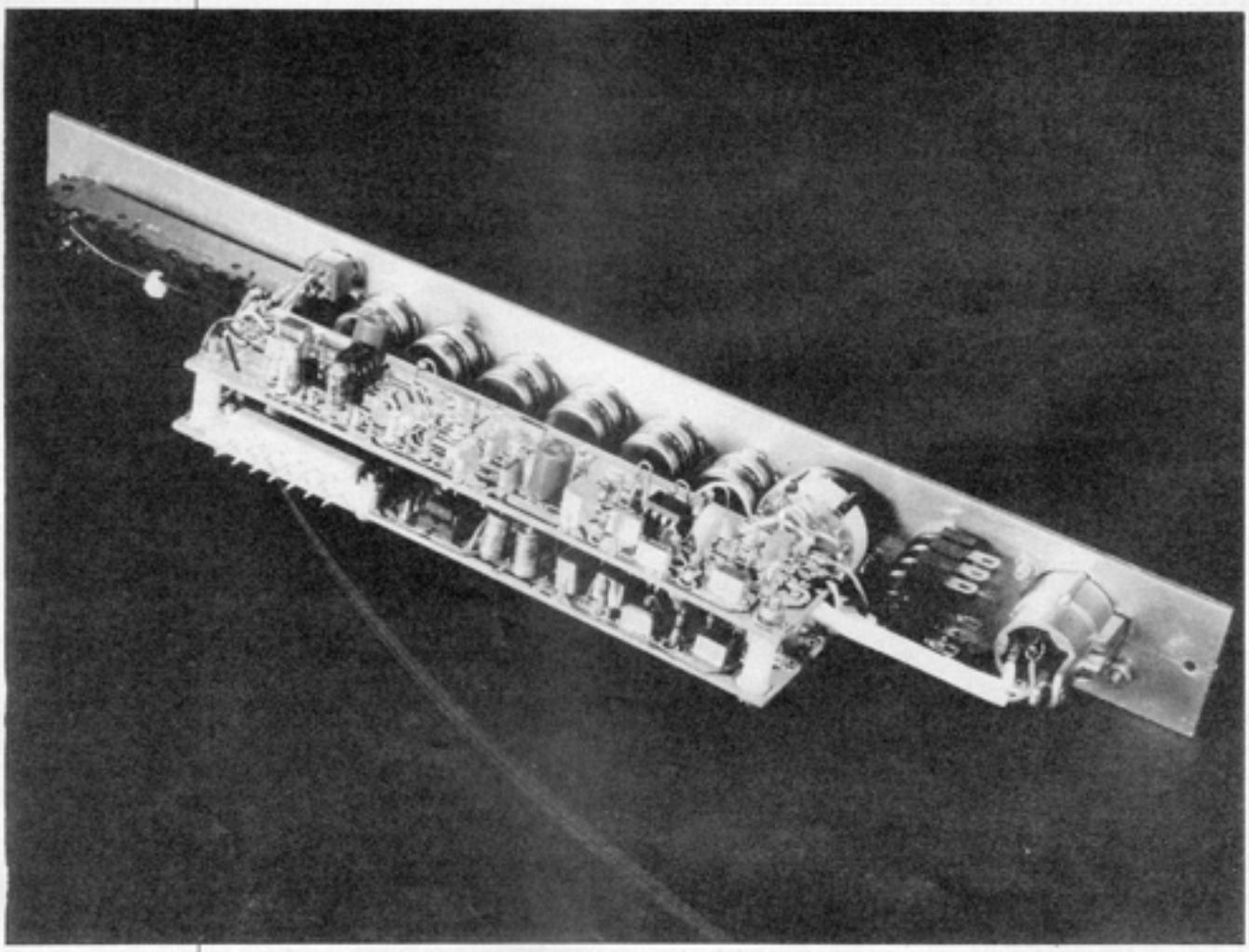
Flashing colours

Magnetic-field sensors



Versatile stereo amplifier

PORTABLE MIXER — 1



This mixer is not designed for the occasional party, where one slide control per channel will suffice. Rather, it is intended for the serious electrophonics enthusiast. And quite naturally, therefore, it has all the facilities such users have come to expect.

Professional mixers are expected to meet a long list of special requirements: balanced and unbalanced inputs and outputs; independent control of each channel for driving special effects equipment and monitors; automatic setting of input sensitivity to match the signal level; multiple tone controls per channel; and many more. No wonder that such mixers are, to put it mildly, pretty expensive. It is, however, possible, to build one of comparable quality at much lower cost, as described in the following pages.

Modular construction

The mixer is constructed from four modules. A fifth module provides the power for the entire mixer.

The mono input unit is almost certainly the most often used module. Its input sensitivity is adjustable between 0 dB and +60 dB. This enables all sorts of mono signal sources, from microphone to keyboard, to be connected to this module. The unit is provided with a three-way tone control; a peak indicator for possible overloads; a monitor; a multi-track or PFL (pre-fade listening) control; and

a panorama control. Balanced inputs are standard, but any of these can be made unbalanced by connecting one of its terminals to earth.

The stereo input unit is intended for use with a wide variety of signal sources. Its input can be switched between MD (variable-reluctance pick-up), AUX (high-level stereo), and LINE (mono). The latter position is for use in the event the mono module is not available. The balance control functions as panorama control when the input is switched to LINE.

The headphone-monitor module contains a stereo headphone amplifier via which each module may be monitored. Unlike the other modules, this unit is provided with a parametric equalizer instead of a three-way tone control. This is a very useful facility, because it enables any tendency to acoustic feedback between the microphone and monitor loudspeaker to be suppressed effectively. The main controls and output terminals of the special effects channel are also fitted on this module.

The most important unit is the output module. Apart from the main tone control and other refinements, it has a stereo LED VU (volume unit) meter. The output is available as a balanced or as an unbalanced signal.

Power supply

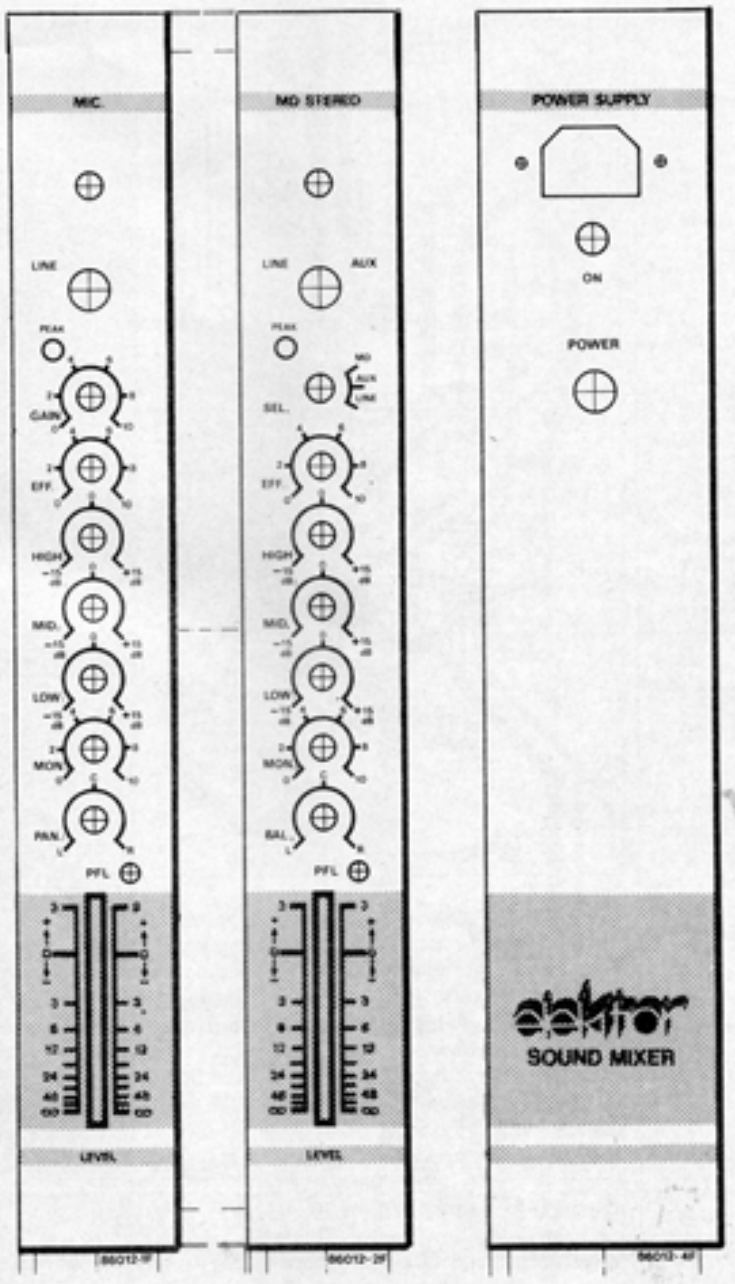
Since any equipment is only as good as its power supply, all the supply lines in the present mixer are stabilized twice: once in the power unit and once in the relevant module. Apart from its mains transformer and on/off switch, the power supply unit shown in Fig. 2 is contained on a separate printed-circuit board. It is suitable for the supply of up to eighteen modules.

Regulators IC_1 and IC_2 hold the supply voltage, preset with the aid of R_3-R_4, at $\pm$18 V. Transistors T_1 and T_2 and associated RC networks ensure a sufficiently slow rise of the supply voltage to prevent loudspeaker clicks when the mains is switched on. Resistor R_8 is a voltage-dependent resistor that suppresses noise present on the mains.

Switch S_2 enables the mains earth to be isolated from the case earth, which may be necessary in certain theatres. If S_2 is open, and something goes wrong, neon lamp La_1 breaks down, and the mains fuse blows.

The values of resistors R_3 and R_4 can be ascertained precisely for any individual power unit by replacing them by two 5 k preset potentiometers. Adjust these presets until the output of the relevant regulator is 18.1 V. Switch off, remove the presets, and carefully measure their values with an ohmmeter. Fixed resistors with values so found should then be soldered in the R_3 and R_4 positions (this may, of course, entail making up a parallel combination to obtain the correct value). Check that the output voltages of the regulators are still $\pm$18 V.

1



MIC-LINE module

Although the number of presets may give the impression of complexity, the circuit in Fig. 3 shows that this would be misleading. Operational amplifiers A_1, A_2, and A_3 form an instrument amplifier that provides properly balanced inputs.

The sensitivity of the microphone input is about 20 dB higher than that of the line input.

Fig. 1. The front panels of (a) the MIC-LINE module; (b) the stereo module; and (c) the power unit.

2

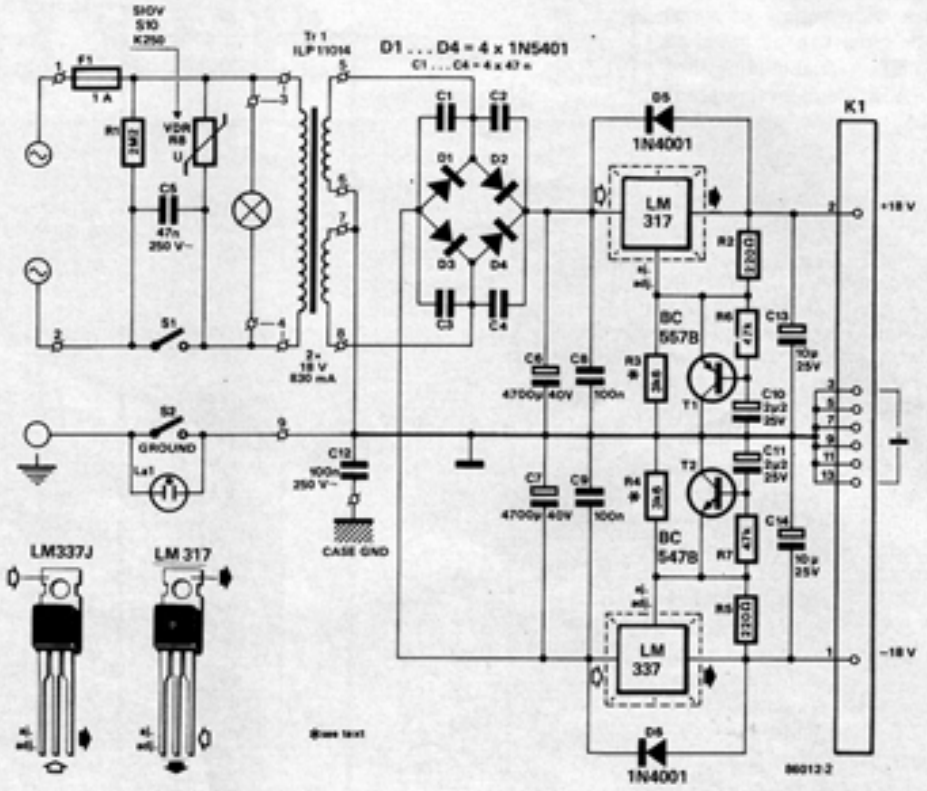


Fig. 2. Circuit diagram of the power unit.

To keep the overall noise level down, A_1 and A_2 are low-noise types, while R_1 to R_{13} incl. are high-stability (1%) metal film resistors.

Gain control P_1, which enables setting the gain between 20 dB and 60 dB, must be a high-quality type, because it is located in a noise- and scratch-sensitive position.

The peak indicator is formed by transistors T_1 and T_2. The threshold of operation is fixed at 9 V_{pp} or 3 V_{rms} by voltage divider R_{14}-R_{15}. These levels correspond to a microphone input of 3 mV_{rms} at maximum amplification. Reservoir capacitor C_3 ensures that short-duration overloads are also clearly indicated.

Coupling capacitor C_4 prevents any DC reaching the potentiometers and connects the amplified input to the three-way active (A_4) tone control. Effects control P_2, of course, precedes the tone control stage.

Potentiometer P_6 sets the wanted monitor output level.

Stereo slide potentiometer P_7 is the fade control.

Since a signal to drive a multi-track recorder is also required, slide control P_7 —the fader— is a stereo type to prevent any feedback between the stereo channel and the multi-track outputs. An alternative to this arrangement is to provide each channel with a PFL (pre-fade listening) facility; C_{12}-R_{28} can then be omitted, P_7 can be a single track control, and S_3 and R_{32} are fitted externally.

Stereo input module

The stereo input module —see Fig. 7— has no balanced input: instead, it is provided with an equalizing pre-amplifier, formed by A_1 and A_2 (A_1' and A_2'), for use with variable-reluctance pick-ups.

Input selection is effected by S_1: position 1 is for variable-reluctance pick-ups; position 2 for high-level inputs, such as from tape recorders; and position 3 for mono signals.

Position 3 is for use when the MIC-LINE module is not available, or, for instance, when more equipment is to be connected than was originally foreseen. Note, however, that only line signal sources can be connected: not microphones. The (unbalanced) signal is then taken from the right-hand AUX input, and amplified in A_2 and A_2' by a factor 3.

Stereo potentiometer P_1 provides a monophone effects signal, but is arranged such that its input and output resistance are equal, whatever the position of the wipers.

The active tone control is followed by the controls for the monitor output (P_5), the channel output (P_6), and the balance (P_7). With S_1 in position 3 (LINE), the balance control functions as panorama control.

The pre-fade listening facility is constructed with (external) components R_9, R_{10}, and S_2.

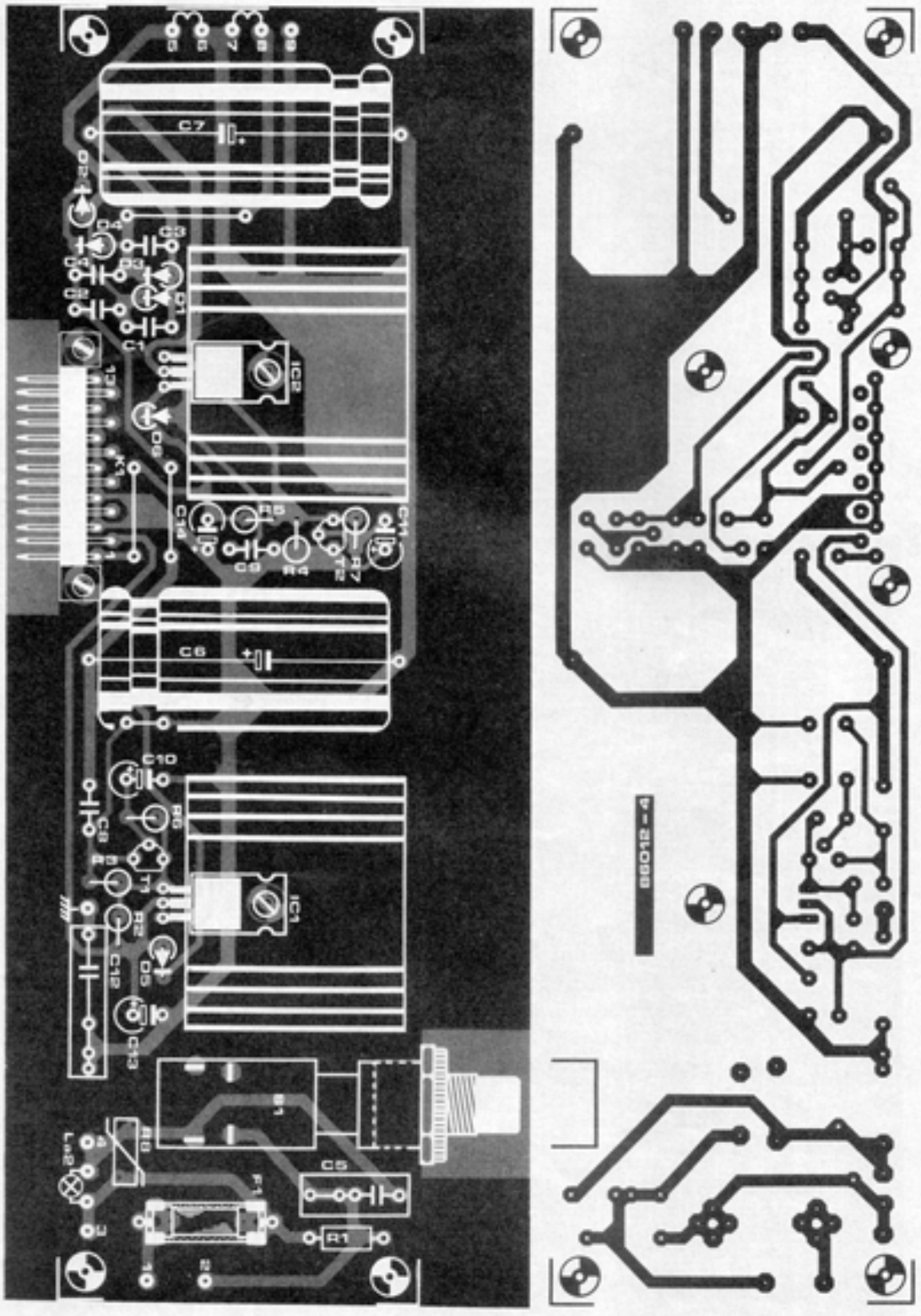
A multi-track output is not necessary in this module, because the unit is normally fed from a multi-track tape machine.

If the MD input is not required, the operation of A_1 (A_1') can be made linear by omitting C_4 and C_5 (C_4' and C_5'), and replacing R_4 and R_5 (R_4' and R_5') by R_x (R_x'). The value of the new resistor may be calculated from

$$R_x = R_3 (\alpha - 1) \ [\Omega]$$

where α is the amplification of the amplifier. If the amplification is large, $R_x = R_3$.

3



Parts list

Resistors:

R_1 = 2M2
R_2 = 220 Ω
R_3 = 3k6*
R_4 = 2 k*
R_5 = 120 Ω
R_6;R_7 = 47 k
R_8 = voltage-dependent resistor Siemens Type S10V-S10k250 (may be available from ElectroValue – telephone 0784 33603 or 061 432 4945)

Capacitors:

C_1...C_4 = 47 n
C_5 = 47 n;250 VAC
C_6;C_7 = 4700 µ;40 V
C_8;C_9 = 100 n
C_{10};C_{11} = 2µ2;25 V
C_{12} = 100 n;250 VAC
C_{13};C_{14} = 10 µ;25 V

Semiconductors:

D_1...D_4 = 1N5401
D_5;D_6 = 1N4001
T_1 = BC557B
T_2 = BC547B
IC_1 = LM317T
IC_2 = LM337T

Miscellaneous:

S_1 = SPST mains switch suitable for PCB mounting
S_2 = SPST switch
F_1 = miniature fuse; 1 A; delayed action; complete with PCB type carrier
La_1 = neon bulb without bias resistor
La_2 = neon bulb with bias resistor
Tr_1 = toroidal mains transformer; 2 × 18 V; 0.83 A secondary (e.g. ILP Type 11014)
K_1 = 13-pole PCB connector to DIN41617
Heat sinks for IC_1 and IC_2
Front panel foil 86012-4F**
PCB Type 86012-4**

* see text
** available through our Readers Services (see p. 82)

Fig. 3. The printed-circuit board for the power unit.

Fig. 4. Circuit diagram of the MIC-LINE module.

Parts list

Resistors:
R_1 = 100 k*
R_2;R_3 = 1 k*
R_4;R_5;R_8;R_9;R_{12}; R_{13} = 10 k*
R_6 = 100 Ω*
R_7 = 6k8*
R_{10};R_{11} = 2k2*
R_{14} = 47 k
R_{15};R_{16} = 6k8
R_{17} = 1k5
R_{18};R_{25};R_{30};R_{31}; R_{32} = 22 k
R_{19};R_{20};R_{21};R_{24} = 10 k
R_{22};R_{23};R_{28};R_{29} = 3k3
R_{26};R_{27} = 100 k
R_{33} = 1 M

P_1 = 25 k linear potentiometer +
P_2;P_4 = 25 k logarithmic potentiometer +
P_3 . . . P_5 = 100 k linear potentiometer +
P_7 = 10 k log stereo slide potentiometer 58 mm long

* 1% metal film type
\+ with 4 mm spindle for PCB mounting

Capacitors:
(polycarbonate or polystyrene unless otherwise indicated)
C_1;C_2 = 15 p
C_3 = 2µ2; 16 V; electrolytic
C_4;C_{11} = 10 µ; 40 V; bipolar electrolytic
C_5 = 47 n
C_6 = 5n6
C_7 = 22 n
C_8;C_9 = 4n7
C_{10} = 10 p
C_{12} = 470 n
C_{13} = 220 n
C_{14};C_{15} = 100 n
C_{16};C_{17} = 100 p
C_{18};C_{19} = 10 µ; 16 V; electrolytic
C_{20} = 100 n

Semiconductors:
D_1;D_2 = 1N4148
D_3 = LED; red
T_1;T_2 = BC558B
IC_1 = NE5532 or LM833
IC_2 = LF356 or TL071
IC_3 = TL072
IC_4 = XR4195 (see fig. 6)

Fig. 5. The printed-circuit board for the MIC-LINE module.

Capacitor C_1 (C_1') may be adapted to match the output impedance of the tape machine used.

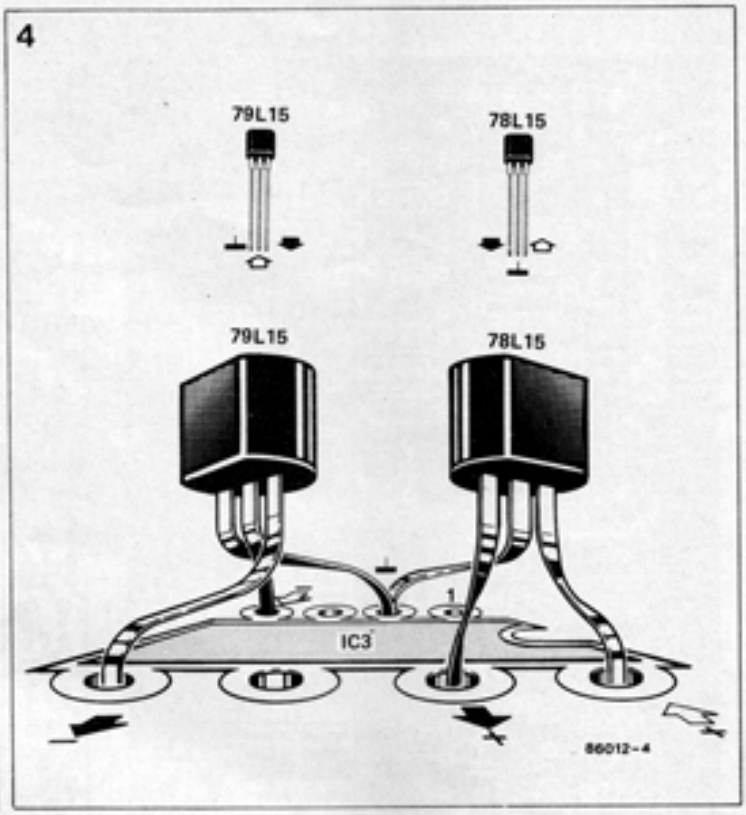
Construction

Before buying any new components, it is wise to determine how many modules are required.

Prepare the printed-circuit boards shown in Fig. 5, Fig. 8, and Fig. 9; note that the board in Fig. 8 consists of two parts, which must be separated before any components are fitted.

The dimensions of the front panels are given in Fig. 10: 10a is that for the MIC-LINE module; 10b that for the stereo module; and 10c that for the power supply. The overall length will, of course, depend on the cases used. The prototype was built in one aluminium case with compartments for the various modules. The construction of this will be described in next month's issue.

In the mean time, the completed modules may be tested by connecting their outputs to the TUNER or



Miscellaneous:
S_1 = mini SPST switch
3.5 mm insulated stereo chassis socket (6.3 mm dia. mounting hole)
XLR Cannon-type 3-pin chassis socket
13-pole PCB-type connector to DIN41617
Knobs for potentiometers as required
Front panel foil 86012-1F*
PCB Type 86012-1*

* available through our Readers Services (see p. 82)

Fig. 6. Where a Type XR4195 voltage regulator is not available, it may be replaced by a 78L15 and a 79L15 connected as shown here.

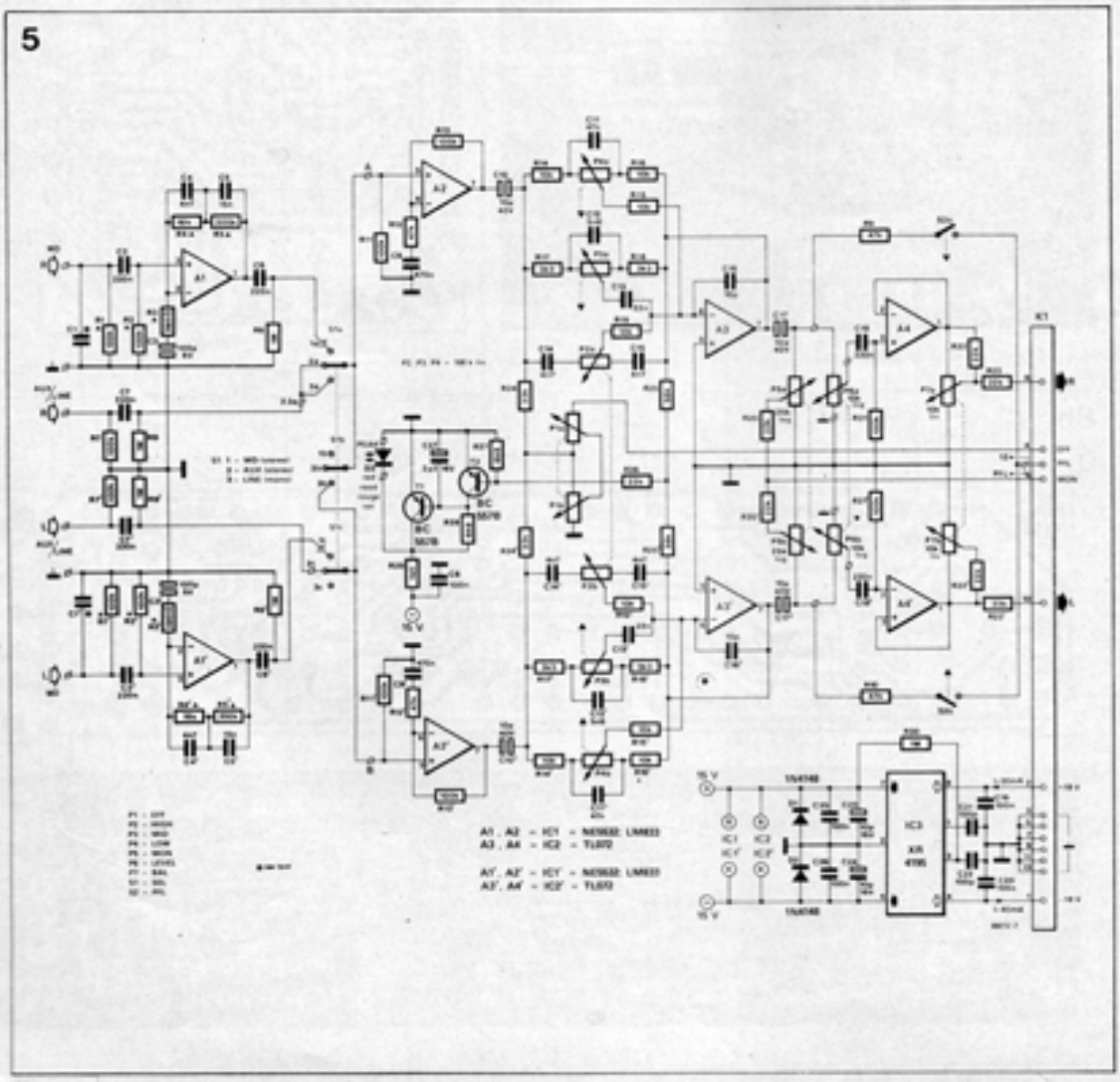
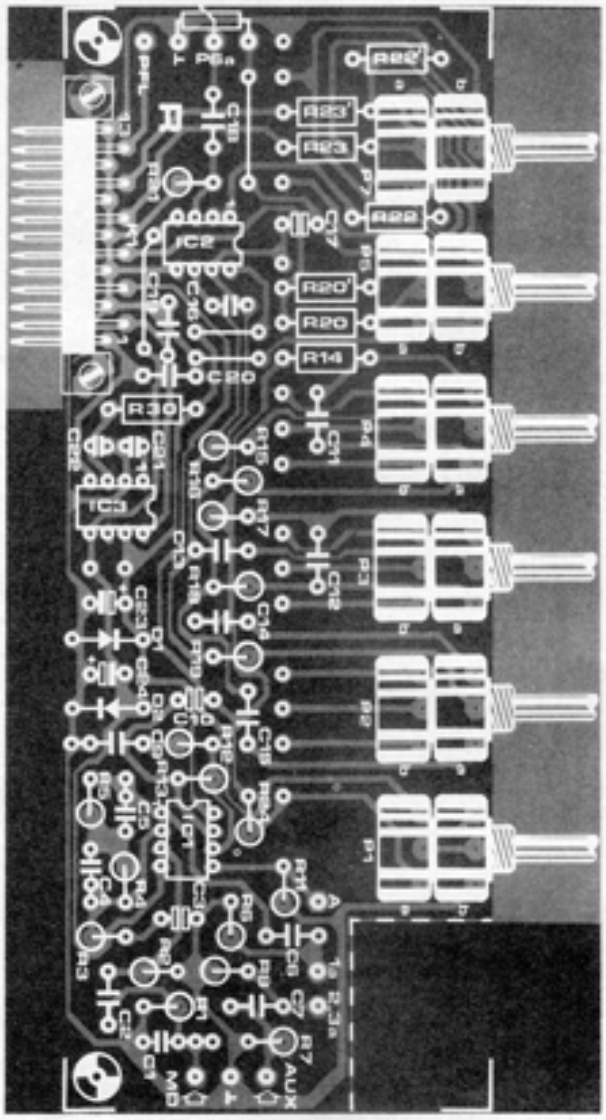
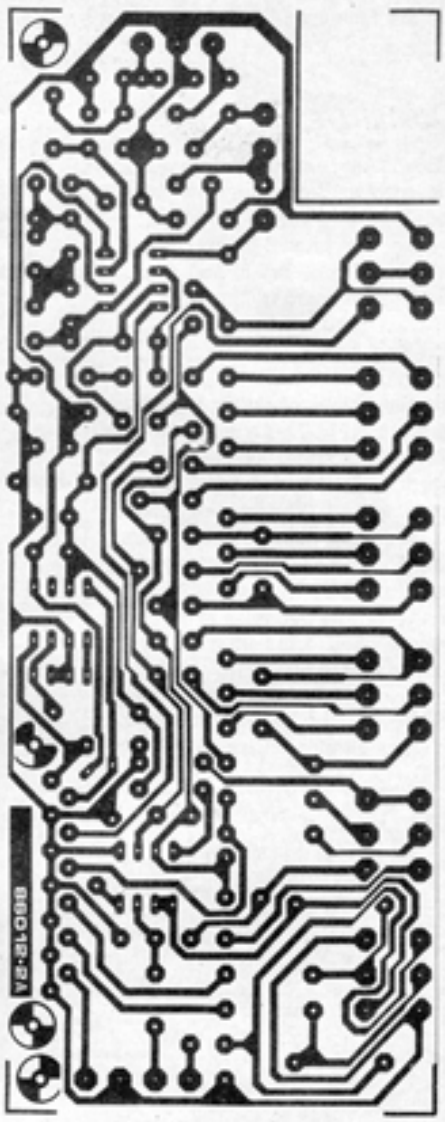


Fig. 7. Circuit diagram of the stereo module.

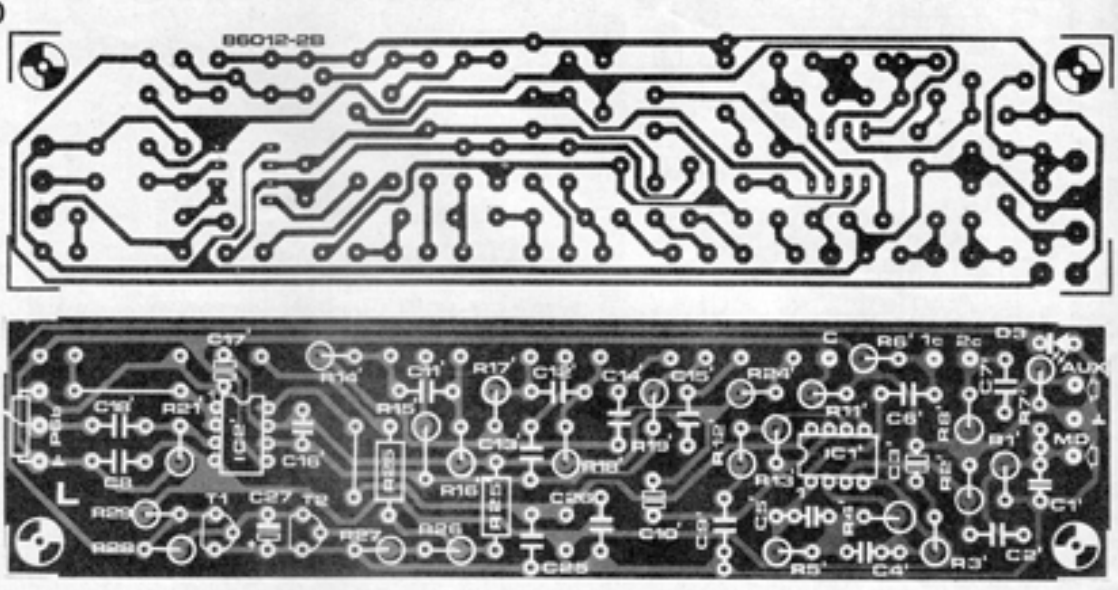
Fig. 8. The printed-circuit board for the stereo module consists of two parts, which must be cut apart before any components are fitted.

8a





8b



Parts list

Resistors:

$R_1;R_1';R_2;R_2'$ = 100 k*
$R_7;R_7';R_{11};R_{11}';R_{13};$
$R_{13}';R_{21};R_{21}'$ = 100 k
$R_3;R_3'$ = 390 Ω*
$R_4;R_4'$ = 16 k*
$R_5;R_5'$ = 200 k*
$R_6;R_6';R_8;R_8'$ = 1 M
$R_9;R_{10};R_{20};R_{20}';R_{22};R_{22}';$
$R_{23};R_{23}';R_{24};R_{24}';R_{25};$
R_{25}' = 22 k
$R_{12};R_{12}'$ = 47 k
$R_{14};R_{14}';R_{15};R_{15}';R_{16};$
$R_{16}';R_{18};R_{18}'$ = 10 k
$R_{17};R_{17}';R_{19};R_{19}'$ = 3k3
$R_{26};R_{26}'$ = 56 k
$R_{27};R_{28}$ = 6k8
R_{29} = 1k5
R_{30} = 1 M

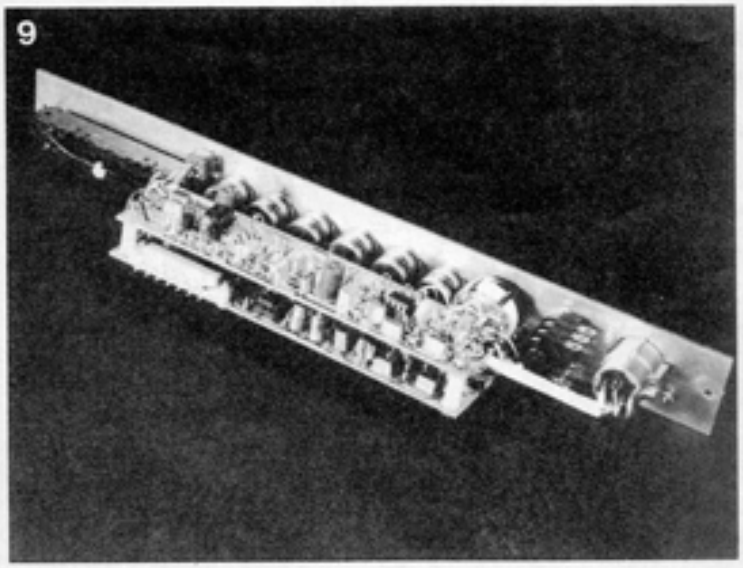
P_1 = 25 k linear stereo potentiometer +
P_2 . . . P_4 = 100 k linear stereo potentiometer +
P_5 = 25 k logarithmic stereo potentiometer +
P_6 = 10 k logarithmic stereo slide potentiometer 58 mm long
P_7 = 10 k linear stereo potentiometer

* 1% metal film type
\+ with 4 mm spindle for PCB mounting

Capacitors:

(polycarbonate or polystyrene unless otherwise indicated)
$C_1;C_1'$ = 100 n (see text)
$C_2;C_2';C_4;C_4';C_7;C_7';$
$C_{15};C_{15}'$ = 220 n
$C_3;C_3'$ = 100 µ/6.3 V; bipolair electrolytic
$C_4;C_4'$ = 4n7
$C_5;C_5'$ = 15 n
$C_6;C_{19};C_{20};C_{25};$
C_{28} = 100 n
$C_8;C_8'$ = 470 n
$C_{10};C_{10}';C_{11};$
C_{11}' = 10 µ/40 V;bipolair electrolytic
$C_{12};C_{12}'$ = 47 n
$C_{13};C_{13}'$ = 5n6
$C_{14};C_{14}'$ = 22 n
$C_{16};C_{16}';C_{18};C_{18}';$
$C_{18};C_{18}'$ = 10 p
$C_{21};C_{22}$ = 100 p
$C_{23};C_{24}$ = 10 µ/16 V electrolytic
C_{27} = 2µ2; 16 V electrolytic

9



AUX input of a stereo power amplifier, and injecting a suitable signal into the various module inputs. The correct operation of all potentiometer controls can then be checked.

Part 2 of the *Portable Mixer* will appear in the next month's issue.

Fig. 9. This illustrates how the boards can be screwed together.

Semiconductors:

D_1;D_2 = 1N4148
D_3 = LED; red
T_1;T_2 = BC557B
IC_1;IC_1' = NE5532 or LM833
IC_2;IC_2' = TL072
IC_3 = XR4195 (see fig. 6)

Miscellaneous:

S_1 = 3-pole 3-position rotary switch
S_2 = DPST mini switch
3.5 mm insulated stereo chassis socket (6.3 mm dia. mounting hole)
XLR Cannon-type 3-pin chassis socket
13-pole PCB-type connector to DIN41617
Knobs for potentiometers as required
Front panel foil 86012-2F*
PCB Type 86012-2*

* available through our Readers Services (see p. 82)

10

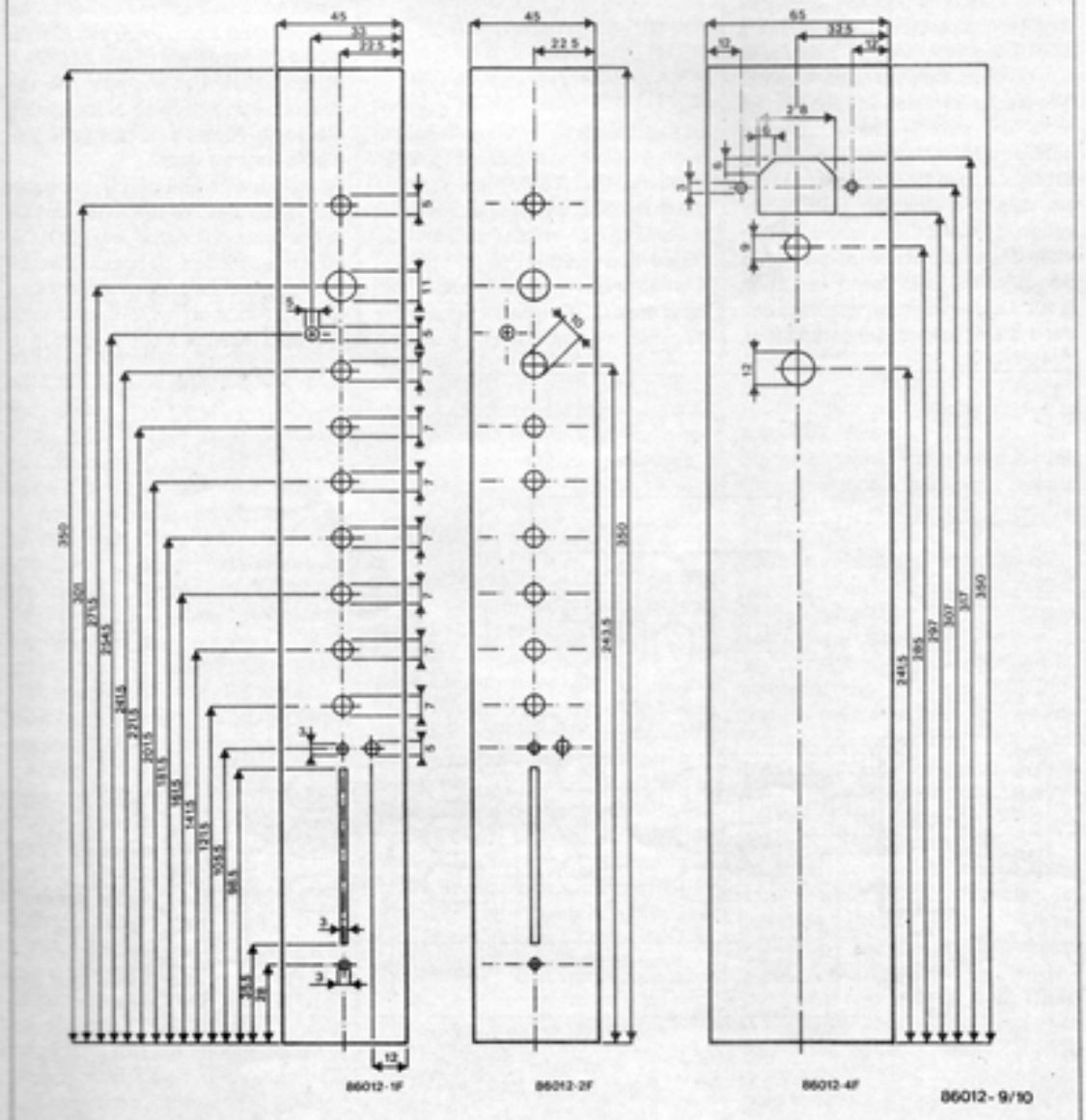


Fig. 10. Drilling plans for the front panals: (a) the MIC-LINE module; (b) the stereo module; and (c) the power unit.