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The Mullard Wideband Tuner Stereophonic Pre-amplifier contains a Wideband AM tuner with selectable bandpass together with a four-valve stereophonic pre-amplifier. Although primarily designed for the Mullard Stereo "Ten-Ten" Amplifier, this unit may be used with most other high quality amplifiers.

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Blithe Spirits

The vast majority of us seem to keep our heads well above water in favourably balancing the household accounts—food, clothing, housekeeping and so on. In fact, we know and our children are trained to know it cannot be otherwise—barring poker machines, horses, dogs and games of chance! Blithe spirits all, paying our way and not unmindful of that breed of women, bless them, that insist on such measures and plod from store to store for the sheer joy and satisfaction of purchasing the specials.

If each household complex is a small business undertaking with fixed overheads, budgets, stock inventory and provision for most contingencies, what then of the need in successful business?

We feel "A Sense of Balance" is an apt heading for the short article Accountancy for Retailers and we trust, when read in conjunction with the wealth of comment, criticism and material appearing in regular trade journals on commonsense selling, that it may be helpful to our readers running relatively small businesses or contemplating starting a small business.

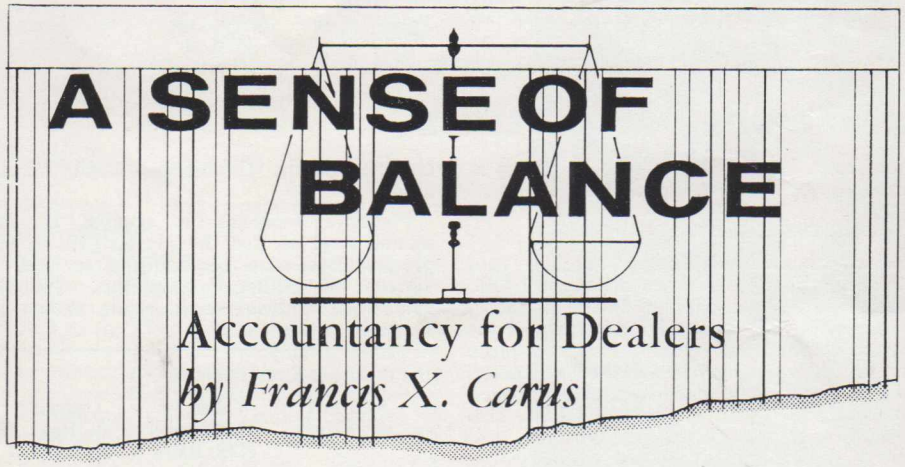
For confidence abounding, reduce your operating costs by using Mullard Valves, Semiconductors and Long Life Picture Tubes—the components with the Quality Bonus.

More Do-It-Yourself

This time not accounting, but the ultimate in valve operated wideband tuner stereophonic pre-amplifiers, for use with the successful Mullard "Ten-Ten" as described in Outlook Vol. 5 No. 4.

M.A.B.

VIEWPOINT WITH MULLARD



It's a fact that most dealers find book-keeping an irksome chore. The successful man's interests lie in selling—and rightly so. That's the basic purpose of his being in business at all. Yet it's just as true that well-planned accounting can help him to achieve even better results.

Limited companies are, of course, required by law to keep proper accounts. Also, good book-keeping helps them—and private traders too—to produce figures which will satisfy the Tax Inspector. Efficient accounting also ensures that bills are collected and paid on the due dates, that reliable financial records of a business are available, that the annual profit—or loss—can be readily calculated. And should the dealer wish to sell out or seek fresh capital by means of a bank loan, well-kept books clearly reveal the current value of the enterprise.

Double-Entry

A good book on **basic** accountancy will run to at least 500 pages. So there's no room in an article of this length to more than touch upon elementary principles.

What every busy dealer needs is a system which will give him all the information, keep down the errors and involve the minimum of labour. **Single-entry** book-keeping goes part of the way, but it has drawbacks. With it, errors are not easily detectable, it's not self-balancing and it doesn't give the full story in detail.

The immediate alternative is the **double-entry** system. Here the theory is that every transaction has two parts: the debit and the credit. When we receive goods we still owe their cost. When we pay the bill our debt is discharged. Two financial actions, two debits, two credits.

At any given time the totals of all the debit and credit balances must be equal. A 'trial balance,' usually struck when preparing the annual accounts, will either show that this is so or reveal errors.

Simplicity

The books needed to operate this system are:—

(a) The Cash Book which records all money movements in cash, cheques or other bank transfers.

(b) The Ledger—usually grouped into three classes: sales, purchases, private. This can occupy one or more books to suit convenience.

The sales section of the ledger deals with all the credit transactions between a dealer and his customers. The purchases section records a dealer's credit business with his suppliers. The private section, roughly speaking, holds the remainder of the accounts—those dealing with capital, cash sales and purchases, wages, etc.

In a radio and TV business the sales ledger might be broken down into separate accounts for different types of stock. This sort of sub-division is necessary in order to obtain the information a dealer needs to run his business profitably.

It must be emphasised that the simplest system which can be made to do the job is the best system for a particular business. Elaboration, unless it works for you, is a waste of time and money.

Breaking Down

Some of the modern systems do, in fact, greatly simplify traditional book-keeping while sticking to the proved principles of double-entry. Some of these employ mechanical devices to cut down operations, but they are only justified where the size of the business warrants it.

Books easily obtainable from stationers' shops can provide simplified systems. The Cash Book can be an analysis of sales and purchases and the column totals can be transferred to ledger accounts. Or the Cash Book can be simplified another way, using it only for bank transactions, the actual cash being entered into a Cash Day Book.

Some units sell at the rate of only a few a day. In the small concern there is little point in breaking down sales and purchases into many categories. For the larger firm, on the other hand, it is obviously valuable to have movements of some items broken down again into makes and models.

In passing it should be mentioned—if only because it is the law—that the Wages Book must show the gross wages of employees together with full details of deductions.

Not Expensive

Final accounts are best left to the professional. The services of an auditor are not expensive and can effect real economies by tax savings. Of course, in company accounts, other than those of an exempt private limited company, the employment of a qualified auditor to prepare final accounts is compulsory.

Nobody expects a dealer to be a skilled accountant any more than a car-owner needs to be a trained mechanic. But for sound economic reasons it is as well that both should know a bit about the machinery they're dealing with. And how to get the best from it.

This article is third in a series reproduced in Outlook and written by Mr. Francis X. Carus, managing editor of "The Dealer", the magazine of the Radio and TV Retailers' Association in the United Kingdom. The article was originally reprinted in Mullard Outlook, U.K. edition, the journal of our Parent Company.

MULLARD-AUSTRALIA PERSONALITIES

MR. L. E. NORRIS

Len Norris, our resident representative in Perth, came to Australia from the United Kingdom in 1948 after serving many years in the Royal Air Force in radio communications. He has been closely associated with our Mullard distribution in Western Australia for the past five years and, always a helpful fellow, has identified himself with our products and our service.

Much a family man, married with two children, his interests are close to the home life and gardening.

MULLARD WIDEBAND TUNER STEREOPHONIC PRE-AMPLIFIER

Circuit details are given of a wideband AM tuner with selectable band-pass characteristics combined with a four valve stereophonic pre-amplifier which will accommodate a variety of inputs. The performance of the circuit is discussed when magnetic and crystal pick-ups, tape recorder playback heads, and radio inputs are used. Although both units are housed in the one attractive cabinet, in the interest of clarity they will be dealt with separately.

STEREOPHONIC PRE-AMPLIFIER

This pre-amplifier is intended for use primarily with the Mullard Stereo "Ten-Ten" amplifier circuit. It may, however, be used with other amplifiers with different input requirements, such as the Mullard 5-valve 10-watt amplifier circuit or the Mullard 20-watt circuit, provided suitable gain adjustments are made.

Facilities are provided for magnetic and crystal pick-ups, tape recorder playback heads and radio inputs. An auxiliary input for any input source convenient to the user is also provided.

Equalisation for disc recordings conforms to the present R.I.A.A. characteristics, adopted by most major recording companies. The tape playback characteristic is intended for use with high impedance heads when playing pre-recorded tapes at a speed of 7½ in/sec.

Controls of comparatively low impedance have been adopted so that the capacitive effect will be minimised when using long coaxial lines between the pre-amplifier and the main amplifier. These provide sufficient control for most applications. A mode switch permits either or both channels to be used, whilst provision is also made for normal or reversed stereophonic or dual channel monophonic operation (see Fig. 1).

An auxiliary output signal suitable for programme monitoring or tape recording is provided for all input positions.

Circuit Description

Each channel of the pre-amplifier uses two Mullard high gain pentodes type EF86. The circuit of one channel and components common to both channels are shown in the circuit diagram. All equalisation takes place in the first stage and is achieved by means of frequency selective feedback between the anode and grid of the first EF86. This arrangement was chosen so that the grid circuit impedance of the first stage would be sufficiently low to minimise hum pick-up, and reduce the effect of connecting external low impedance circuits. Furthermore the resulting low gain in the first stage tends to reduce 'Miller Effect' between anode and grid which can be troublesome when high values of series grid resistance are used.

The values of components given in the circuit diagram are intended for sources most frequently encountered. However variation of these values to suit other input requirements may be made.

To compensate for differences in acoustical output that may occur between the two channels, a balance control consisting of a logarithmic potentiometer, connected in reverse, ganged to an antilogarithmic potentiometer, connected normally, is included between the two stages. The advantages of this arrangement are discussed in the Mullard publication "Circuits for Audio Amplifiers."*

Negative feedback is applied to the second stage so that the overall gain of the pre-amplifier may be adjusted to suit a variety of Mullard amplifiers. Suitable values of feedback resistor are shown in Table 1.

Table 1

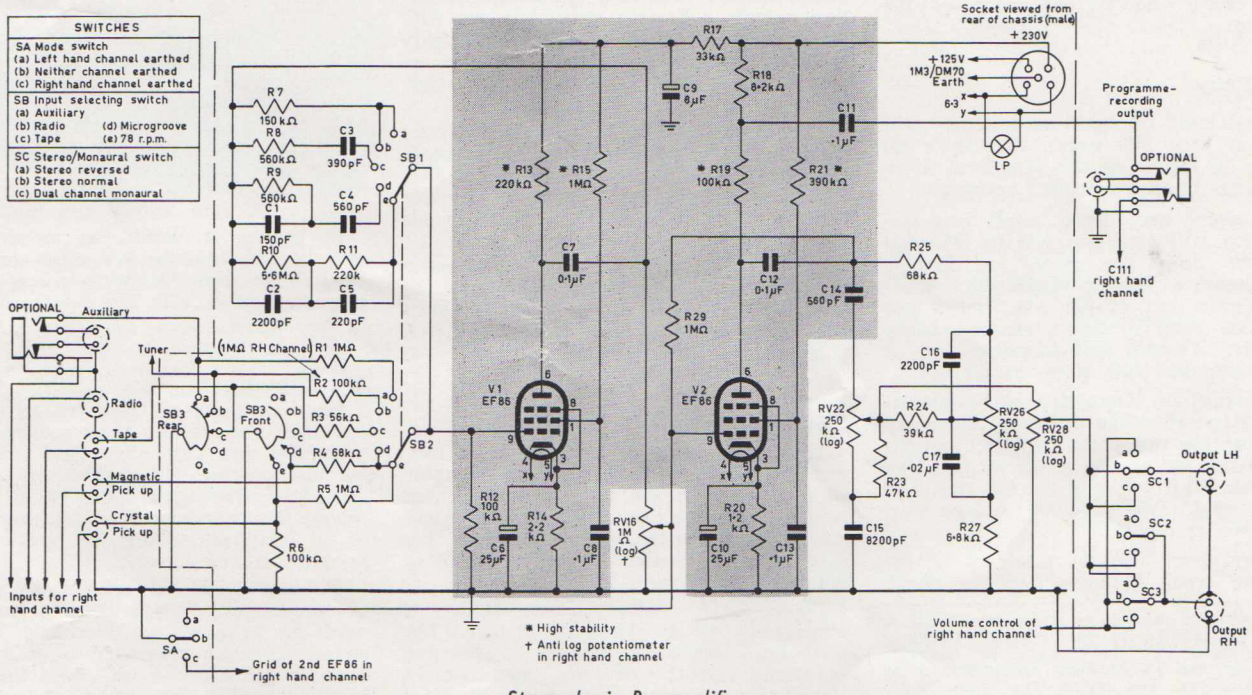
Mullard Amplifiers	Value of Resistance R29/R129	Output Voltage (mV)
"Ten-Ten"	1·0MΩ	26
5 – 10	1·8MΩ	40
5 – 20	No feedback	220
3-watt	required	220

Power for the pre-amplifier and tuner is derived from the main amplifier. Requirements for each channel are 230 V at 3 mA and 6·3 V at 0·4 A. The power supply of the "Ten-Ten" has been designed with sufficient reserve to provide this additional requirement.

Table 2 lists values of filter resistors and decoupling capacitors, recommended for use with other Mullard amplifiers. These components should be mounted in the main amplifier chassis.

*Available from Mullard Offices and Distributors throughout the Commonwealth, priced at 12/6d plus 1/5d postage.

This article is based on work carried out by D. J. Thomsen of the Mullard Applications Laboratory, Sydney.



Stereophonic Pre-amplifier
(Components within shaded area are mounted on printed wiring boards)

Table 2

HT Smoothing Components for Stereophonic Pre-amplifier

Amplifier† Mullard	Smoothing Resistor	Decoupling Capacitor
5 – 20	27 kΩ ±10% 2W	32μF
5 – 10	15 kΩ ±10% 2W	32μF
3-watt	15 kΩ ±10% 2W	32μF

Performance

The levels of hum and noise in the pre-amplifier quoted for each input position have been measured with each channel connected to the "Ten-Ten" amplifier. Measurements were made at the output socket of the power amplifier when the input terminals of the pre-amplifier were open-circuited.

Frequency response curves shown in Figs. 4 and 5 also were obtained with this combination of pre-amplifier and power amplifier. Sensitivity figures given below provide an output from the pre-amplifier of 26 mV. This is sufficient to drive the "Ten-Ten" amplifier to an output of 10 W. All measurements were taken with the balance control in the centre position and tone controls set for flat response.

1. Pick-up Input Channels

It is important that sockets for magnetic and crystal pick-ups are not used simultaneously, otherwise the two signals will be mixed.

Equalisation curves for the magnetic and the crystal pick-ups are shown in Fig. 2.

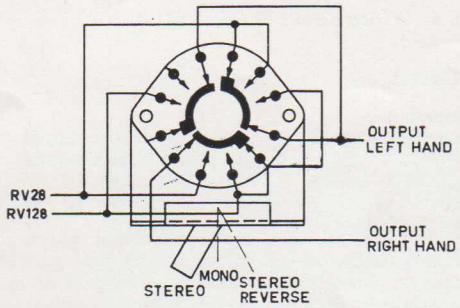


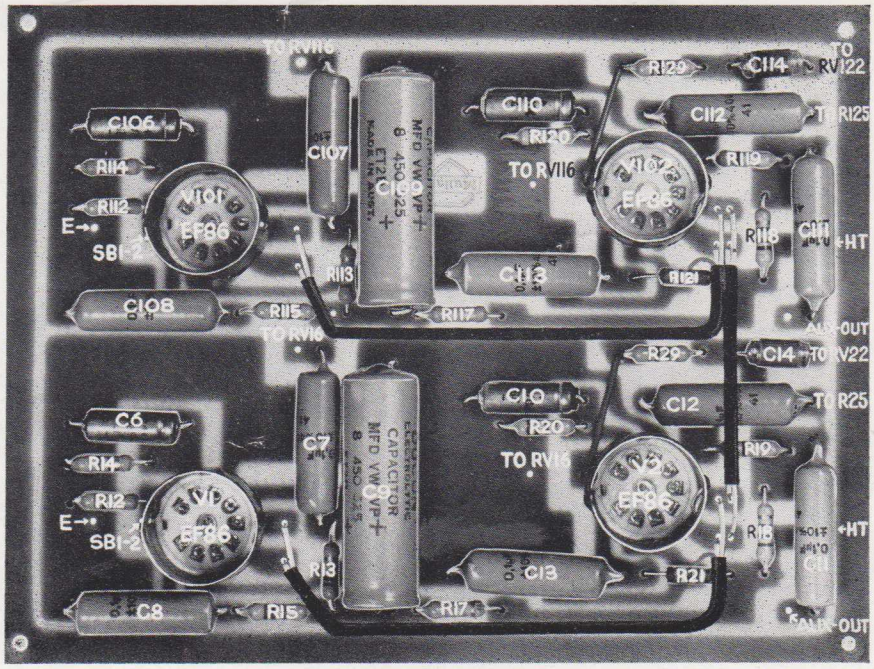
Fig. 1—Mode switch wiring details

2. Magnetic Pick-up

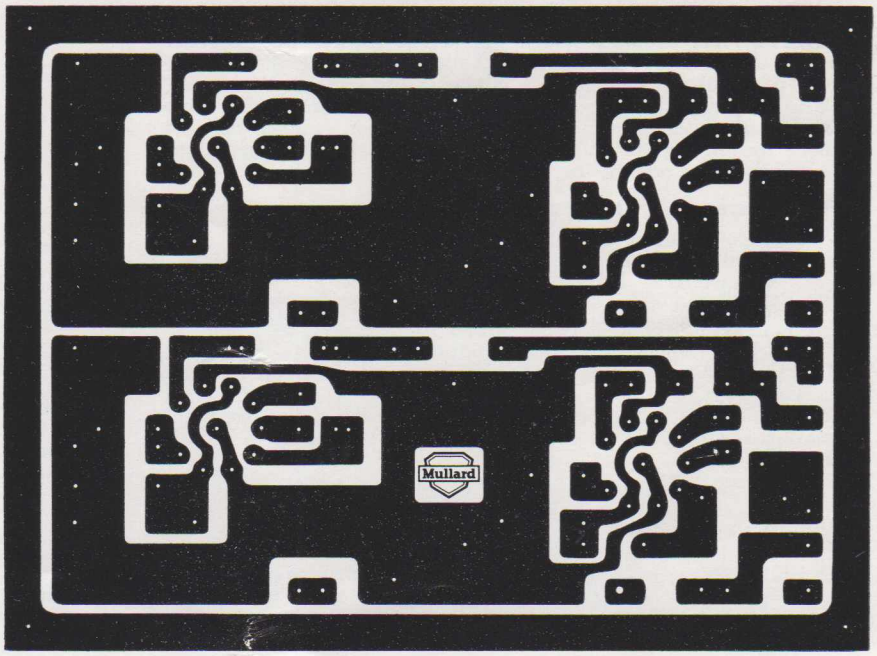
Input impedance	100 kΩ approx.
Sensitivity at 1 kc/s	
(a) LP	5·0 mV
(b) 78 rev/min	12·5 mV
Cross-talk at 1 kc/s	
(a) LP	45 dB below 10 W
(b) 78 rev/min	53 dB below 10 W
Hum and noise	
(a) LP	56 dB below 10 W
(b) 78 rev/min	61 dB below 10 W

This input channel is most suitable for variable reluctance type pick-ups, but moving coil types with higher outputs may be used if a larger value of series resistance (R5/R105) is included.

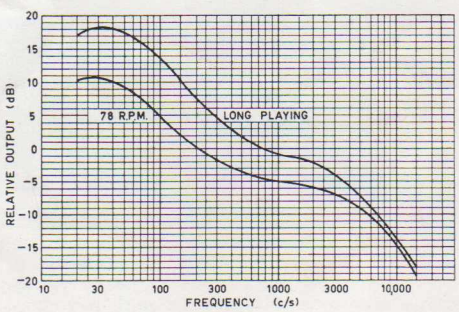
† These amplifiers are described in Mullard "Circuits for Audio Amplifiers" on pages 29, 39 and 53.



Printed Wiring Board Showing Components of Stereophonic Pre-amplifier



Stereophonic Pre-amplifier Printed Wiring Board



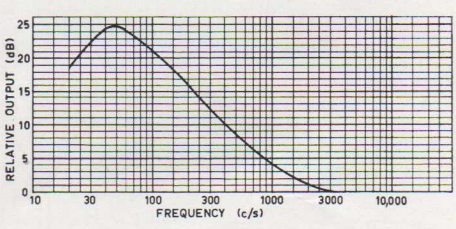


Fig. 2 (Left)—Equalisation curves for magnetic and crystal pick-ups
Fig. 3—Tape playback equalisation

DC CONDITIONS OF PRE-AMPLIFIER

Point of Measurement		*Voltage* (V)	*DC Range of Avometer** (V)
Amplifier HT		317	1000
Pre-amp HT Supply		230	1000
C9		208	1000
V2/V202 EF86	Anode	85	1000
	Screen Grid	120	1000
	Cathode	2·1	25
V1/V101 EF86	Anode	80	1000
	Screen Grid	75	1000
	Cathode	1·6	25

* Resistance of Avometer:
1000V range 20MΩ
25V range 500kΩ

3. Crystal Pick-up

Input impedance	100 kΩ
Sensitivity at 1 kc/s	
(a) LP	62 mV
(b) 78 rev/min	160 mV
Cross-talk at 1 kc/s	
(a) LP	47 dB below 10 W
(b) 78 rev/min	53 dB below 10 W
Hum and noise	
(a) LP	56 dB below 10 W
(b) 78 rev/min	61 dB below 10 W

Low and medium output crystal pick-ups can be used with this input circuit. The input is loaded with a 100 kΩ resistor R6/R106 in order that the crystal cartridge characteristic shall approximate that of a magnetic cartridge, thus allowing the same feedback network to be used. This produces the best compromise with most types of pick-up. However if the pick-up is not suitable for this form of loading, or its output is too high, it can be connected to the auxiliary input socket, the function of which is discussed below.

4. Tape Playback Input Circuit

Input impedance	80 kΩ (approx.)
Sensitivity at 5 kc/s	3·8 mV
Cross-talk at 1 kc/s	41 dB below 10 W
Hum and noise	53 dB below 10 W

The equalisation characteristic chosen for this position is shown in Fig. 3. For frequencies above 100 c/s the curve follows the CCIR characteristic, but below this frequency slightly less boost is used. This gives good performance with high impedance heads when replaying pre-recorded tapes. If a greater sensitivity is required, resistors R3/R103 may be reduced until the required sensitivity is obtained.

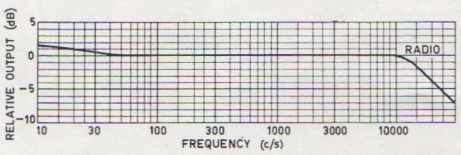


Fig. 4—Frequency response of radio input circuit

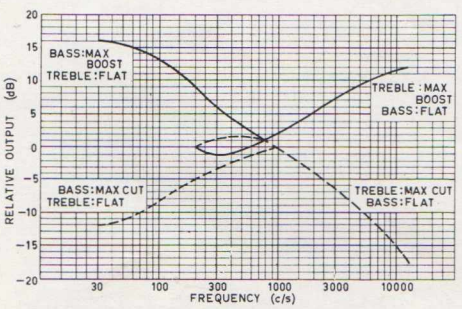


Fig. 5—Tone control characteristics of the pre-amplifier

WAFER DETAILS OF INPUT-SELECTING SWITCH

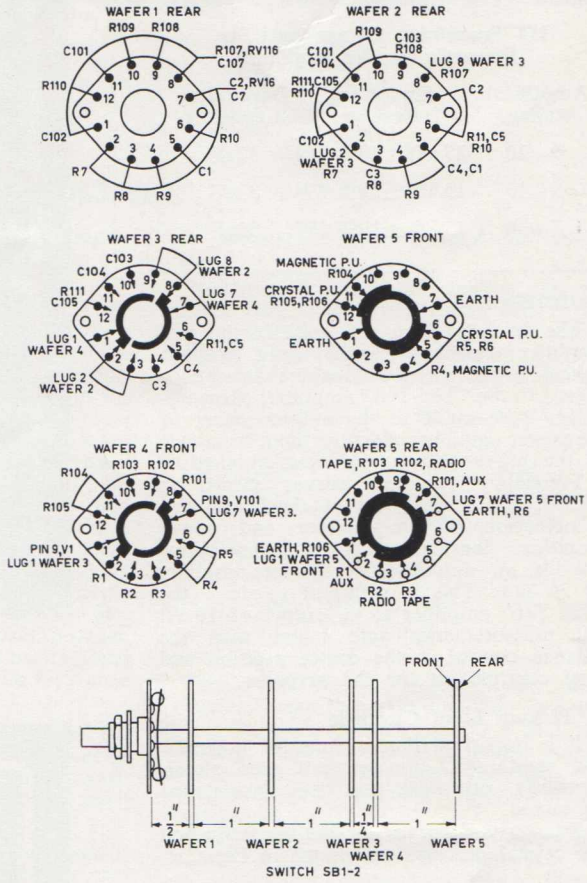


Fig. 6—Wiring details of switch SB1-2

5. Radio Input Circuit

Input impedance	1 MΩ
Sensitivity	300 mV RH channel
	27·5 mV LH channel
Cross-talk at 1 kc/s	48 dB below 10 W
Hum and noise	58 dB below 10 W

The frequency response of this input circuit is given in Fig. 4. The wideband tuner, which forms an integral part of the unit is connected to the left hand channel. The gain of this channel has been adjusted to suit the low output impedance of the tuner. An external tuner may be connected to the right hand channel so that stereophonic broadcasts may be reproduced. The values of impedance and sensitivity quoted for the right hand channel should meet most requirements.

6. Auxiliary Input Circuit

This channel is identical to the radio input channel and can be used for high output crystal pick-ups, for example, or for tape pre-amplifiers such as the circuit described in Chapter 12 of "Circuits for Audio Amplifiers".

7. Auxiliary Output Circuit

This output circuit is derived from the second EF86 and provides approximately 3·5mV. Equipment plugged into this socket should not have an impedance of less than 500 kΩ. The tone controls are inoperative when this output is used.

8. Tone Controls

Tone control characteristics of the pre-amplifier are shown in Fig. 5. These indicate that an adequate measure of control is provided in the unit for most applications.

9. Harmonic Distortion

The total harmonic distortion of each channel of the pre-amplifier at a level sufficient for 1 watt output is 0·15%. At outputs of ten times this level, the harmonic distortion is only 0·26%.

WIDEBAND TUNER

This tuner was released two years ago and is now widely accepted. Whilst the circuitry remains the same, one major change—the use of a printed wiring board—has been introduced to simplify assembly of the unit.

Particular attention has been paid to the principles of good design in the planning of the tuner and the following desirable features have been incorporated:—

1. Reasonable selectivity for the country user, together with a facility for increasing the IF bandpass to accept the full frequency range of local stations.

2. A tuning indicator in the narrow band position to facilitate precise station tuning.

3. A 10 kc/s whistle filter to reduce to inaudibility the adjacent station carrier beat, but of very high Q to minimise attenuation near the 10 kc/s point.

IF Bandpass

Special, readily obtainable IF inductors, enabling the IF bandpass characteristics to be varied, are used. These inductors consist of a single winding and a 100 pF capacitor housed in a standard IF can. Two inductors are connected between the 6AN7/ECH80 mixer and the 6N8/EBF80 IF amplifier. A choice of two values of bottom capacitive coupling between the two units allows for an IF bandpass of either 8·5 kc/s or 18 kc/s at the 6 dB points, as shown in Fig. 7. IFT3 is a slightly over-coupled conventional transformer and, with normal circuit damping, has adequate bandwidth.

Tuning Indicator

A 1M3/DM70/71 tuning indicator, which is operative only in the 'normal' position of the selectivity switch, assists in the accurate tuning of the desired station.

Whistle Filter

The 10 kc/s whistle filter consists of a 250 mH inductance tuned by a 1000 pF capacitor and is variable over small limits by means of an adjustable core. The 250 mH coil is wound on a Mullard Vinkor pot core type LA2303 resulting in an inductor of very high Q capable of providing 26 dB attenuation at 10kc/s and less than 6 dB attenuation at 200 c/s either side of this frequency.

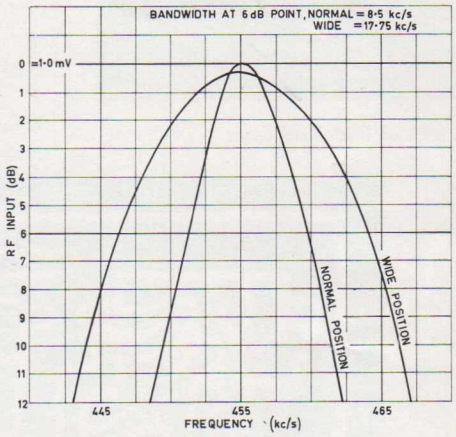


Fig. 7—IF response curves

The Circuit

Apart from the features mentioned, the remainder of the circuit is conventional. Standard aerial and oscillator coils and a standard two-gang broadcast tuning capacitor are used. In order to preserve space and for greater reliability, small by-pass capacitors of the polyester type have been utilised.

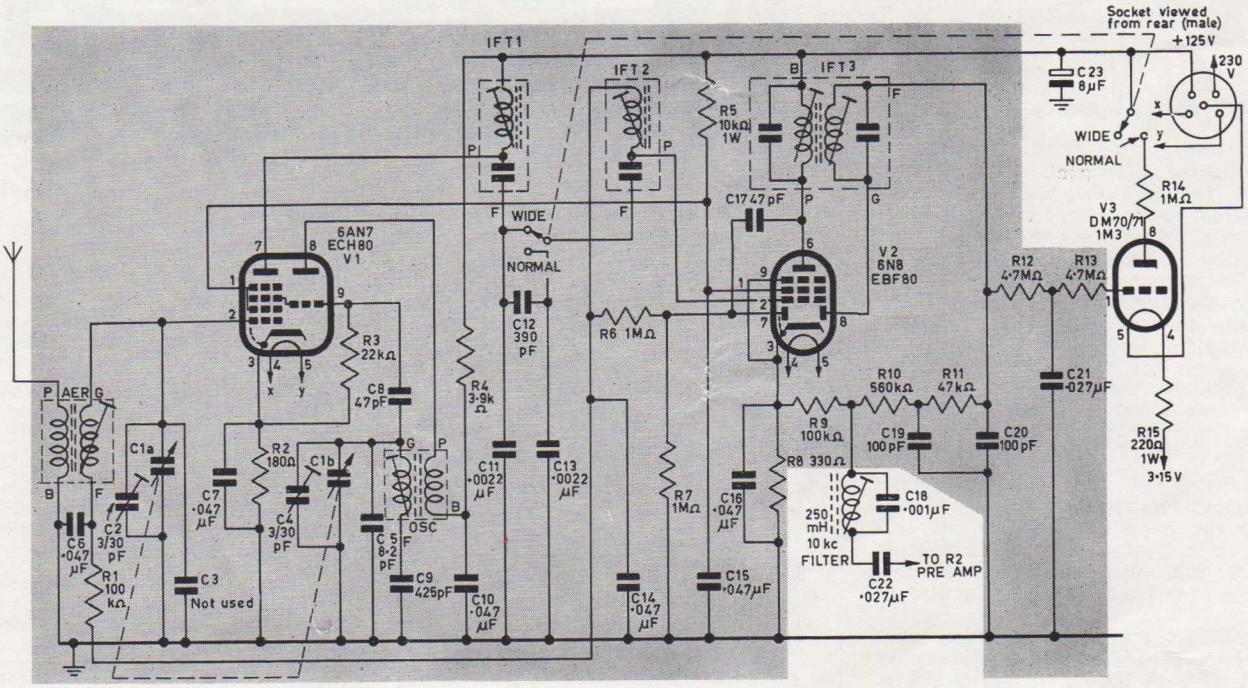
Assembly

The assembly of the tuner printed wiring board is similar to that described for the pre-amplifier. Care should be taken that all component leads are kept as short as possible and leads from the 'Wide-Normal' switch to IFT1, IFT2 and C13 should be screened.

Heater wiring shown is for a centre tapped 6·3 V winding. If a centre tapped winding is not available two resistors of value 22Ω 1W 5% and 25Ω 1W 5% may be wired in series across the 6·3 V line and the junction of the two resistors earthed. The 1M3/DM70/71 together with R15 may then be wired across the 25Ω resistor with pin 5 of the indicator connected to earth.

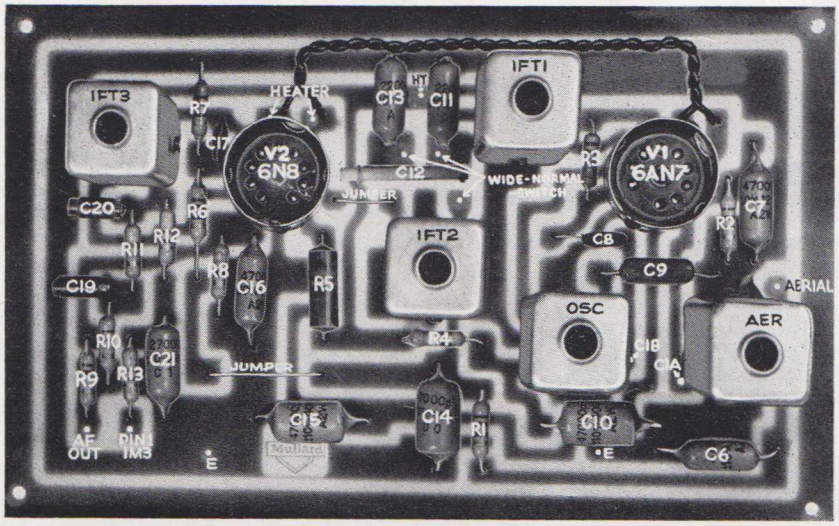
Alignment

Alignment should be carried out following the procedure shown in Table 3 with the 'Wide-Normal' switch in the 'normal' position.



Wideband Tuner
(Components within shaded area are mounted on printed wiring boards)

WIDEBAND TUNER (cont.)



Printed Wiring Board Showing Components of Wideband Tuner

WIDEBAND TUNER ALIGNMENT PROCEDURE

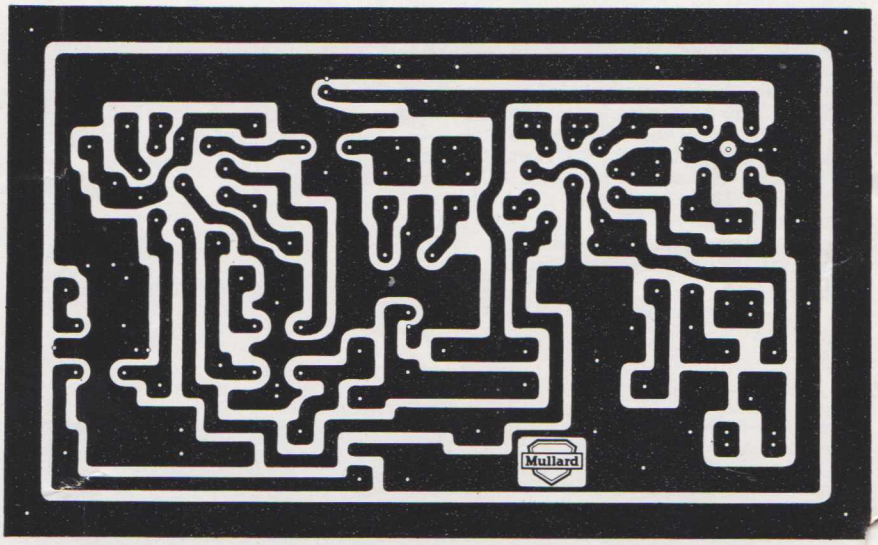
TABLE 3

Order	Connect Generator to	Tune Generator to	Tune Receiver to	Adjust for Maximum Peak Output
1	Grid 1 6N8	455 kc/s	525 kc/s (gang closed)	IFT3 Secondary (Top) (Connect 330Ω resistor between P and B of IFT3)
2	Grid 1 6N8	455 kc/s	525 kc/s (gang closed)	IFT3 Primary (Bottom) (Connect 330Ω resistor between G and F of IFT3)
3	Grid 1 6AN7	455 kc/s	525 kc/s (gang closed)	IFT2
4	Grid 1 6AN7	455 kc/s	525 kc/s (gang closed)	IFT1
REPEAT ADJUSTMENTS UNTIL MAXIMUM OUTPUT IS OBTAINED				
5	Aerial Terminal	525 kc/s	525 kc/s (gang closed)	Oscillator Core
6	Aerial Terminal	1605 kc/s	1605 kc/s (gang open)	C4 (oscillator trimmer)
7	Aerial Terminal	600 kc/s	600 kc/s	Aerial Core
8	Aerial Terminal	1400 kc/s	1400 kc/s	C2 (aerial trimmer)
REPEAT ADJUSTMENTS UNTIL MAXIMUM OUTPUT IS OBTAINED				

DC CONDITIONS OF TUNER

Point of Measurement		*Voltage* (V)	*DC Range of Avometer** (V)
Tuner HT Supply		125	250
V1 6AN7/ECH80	Anode	125	250
	Grid No. 2, 4	83	250
	Osc. Anode	103	250
	Osc. Grid	−2	25
	Cathode	2	25
V2 6N8/EBF80	Anode	125	250
	Grid No. 2	83	250
	Cathode	2	25

* Resistance of Avometer:
250V range 5MΩ
25V range 500kΩ



Wideband Tuner Printed Wiring Board

Printed Wiring Board

The printed wiring board is assembled by inserting the components in the positions indicated. The projecting leads should then be soldered to the copper foil on the reverse side. Waste leads are then cut-off. Care should be taken to ensure that excess heat is not transmitted to the copper foil, otherwise the bonding of the copper foil to the insulating material may be damaged, causing the foil to lift away. Care should also be taken not to use so much solder that it overflows the connection point and forms a short circuit to adjacent conductors.

Use of External Power Supply

At a voltage of 125V, the current drain of the Wideband Tuner is 18mA.

In order to supply power to the Tuner from an existing amplifier or other power supplies, R16 should be calculated as follows:

$$R16 = \frac{V_{supply} - 125}{0{\cdot}018}$$

Example:

Supply voltage = 300V

$$R16 = \frac{300 - 125}{0{\cdot}018} = 9722{\cdot}2\Omega \text{ or } 10000\Omega \text{ approximately.}$$

A rating of 10W should be adequate for any resistor used in this position.

CONSTRUCTIONAL DETAILS

The chassis of the Wideband Tuner Stereophonic Pre-amplifier is easily assembled by the home constructor. The unit consists of a chassis attached to a front and back panel and around this assembly is fitted a wrap-around top and flat bottom cover.

These pieces are made of 16BG steel sheet. However, 16 s.w.g. aluminium may be used. If it is desired to use a lighter gauge steel. it is recommended that three angle or channel supports be bolted or spot-welded at each end and between the printed wiring cut-outs. The dimensions of these pieces are as follows:—

(a) Back Panel	15″ x 6″
(b) Front Panel	15″ x 6″
(c) Chassis	15⅞″ x 9″
(d) Top Cover	25½″ x 8⅞″
(e) Bottom Cover	15⅞″ x 8⅜″

Each piece should be marked as shown in the chassis outlines and dimensions and the holes cut as indicated. Bends of 90° should be made accurately along the dotted lines. The fold lines shown are positioned to allow for shrinkage when using 16BG steel, thus providing correct final dimensions.

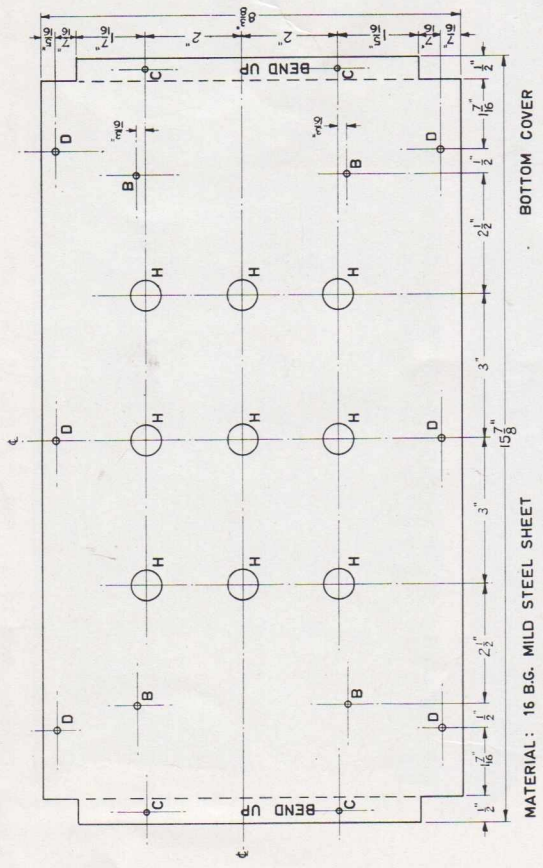
To simplify assembly all major components (printed wiring boards, controls, etc.) may be mounted on the respective panels before the unit is fitted together.

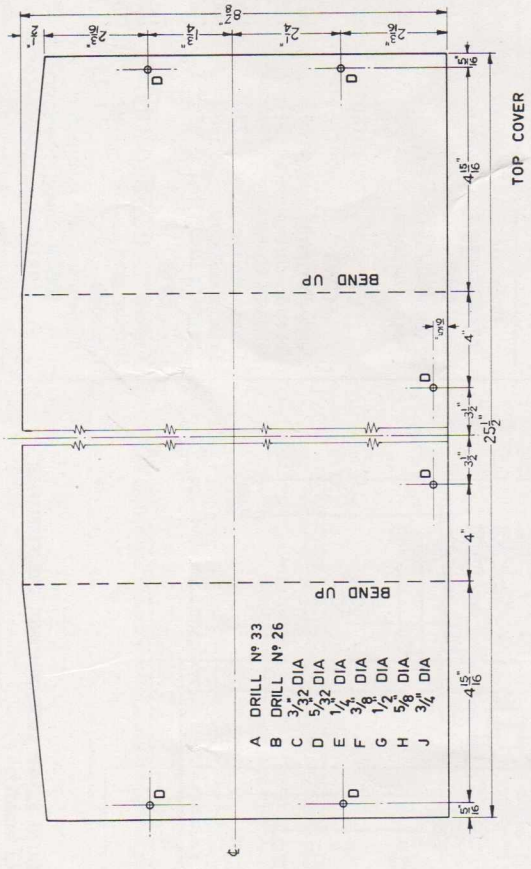
All input and feedback components for valves V1/V101 are assembled on switch SB as a sub-assembly. Wiring details are shown in Fig. 6.

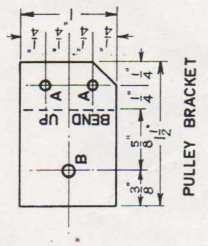
Input, output and heater leads should be screened to reduce the possibility of hum pick-up. Screen earthing should be at one point only so that earth loops are avoided.

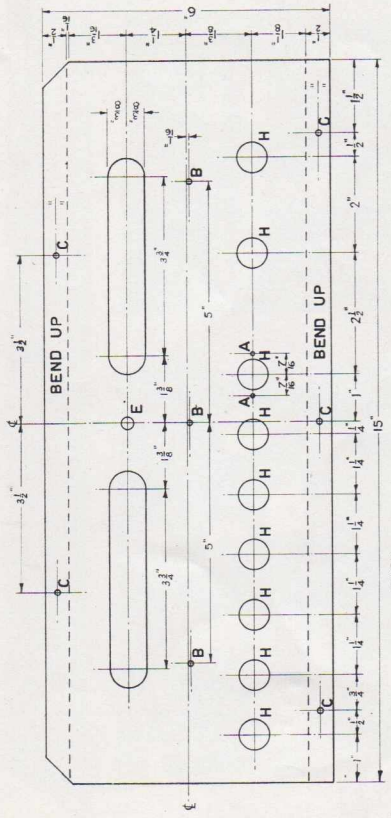
WIDEBAND TUNER (cont.)

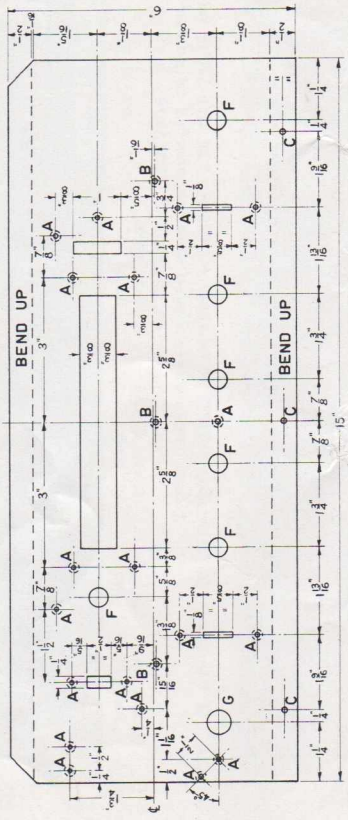
CHASSIS OUTLINES AND DIMENSIONS

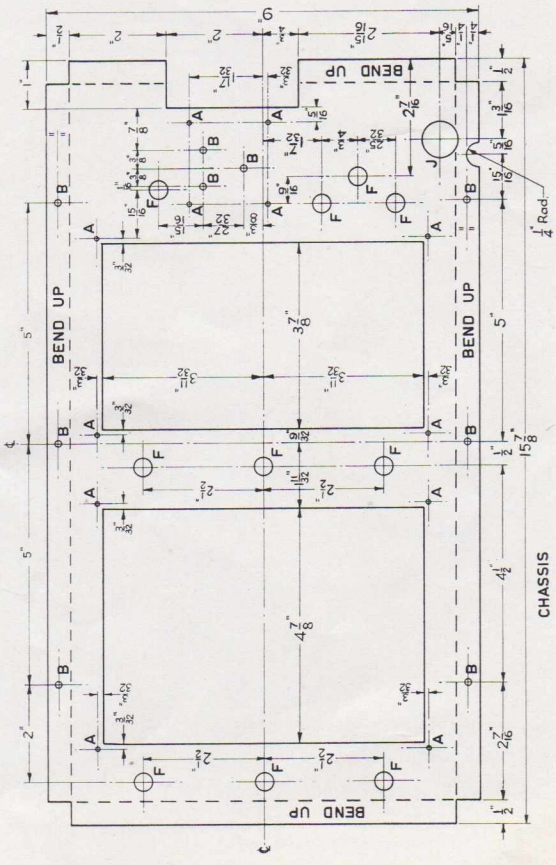




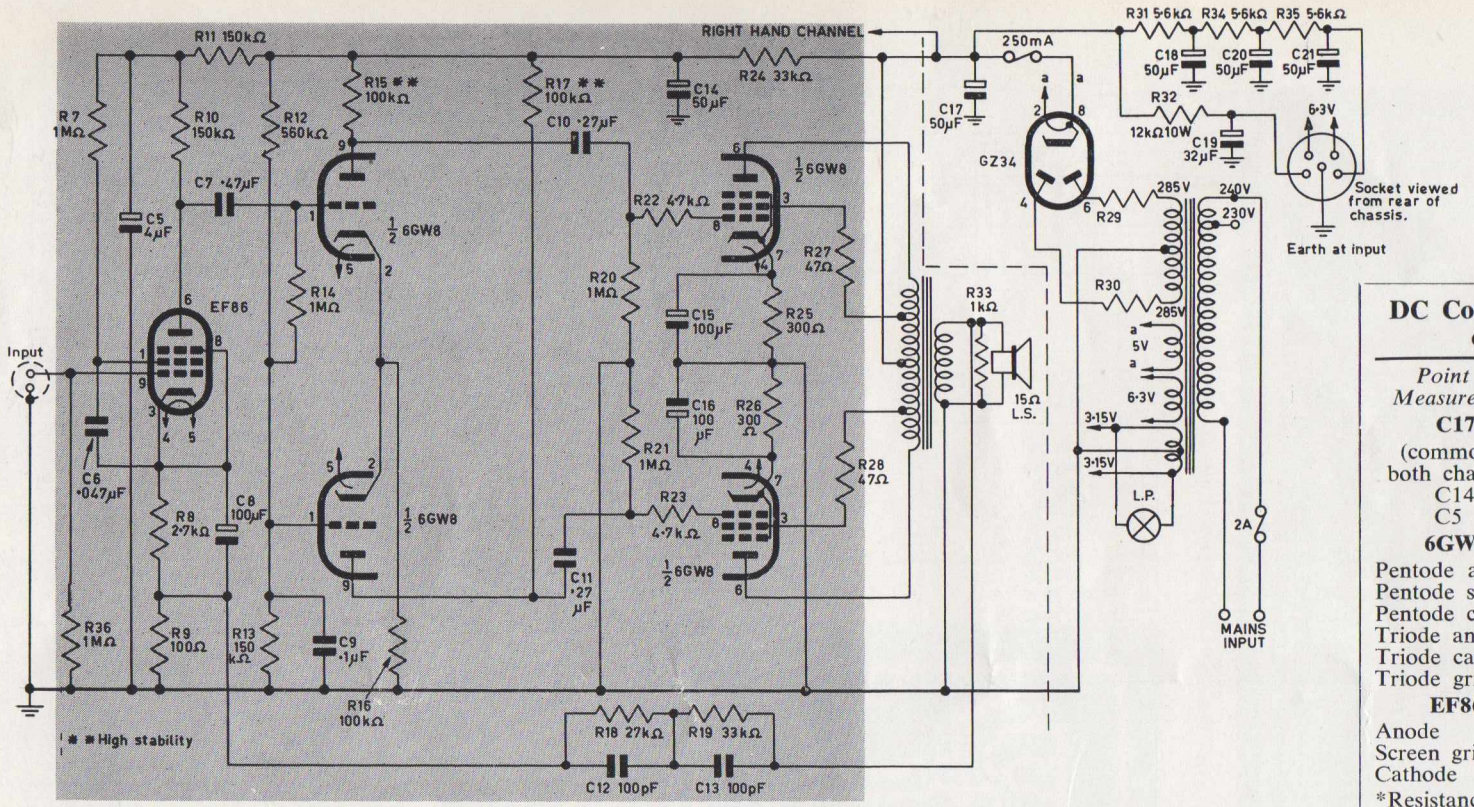








Mullard



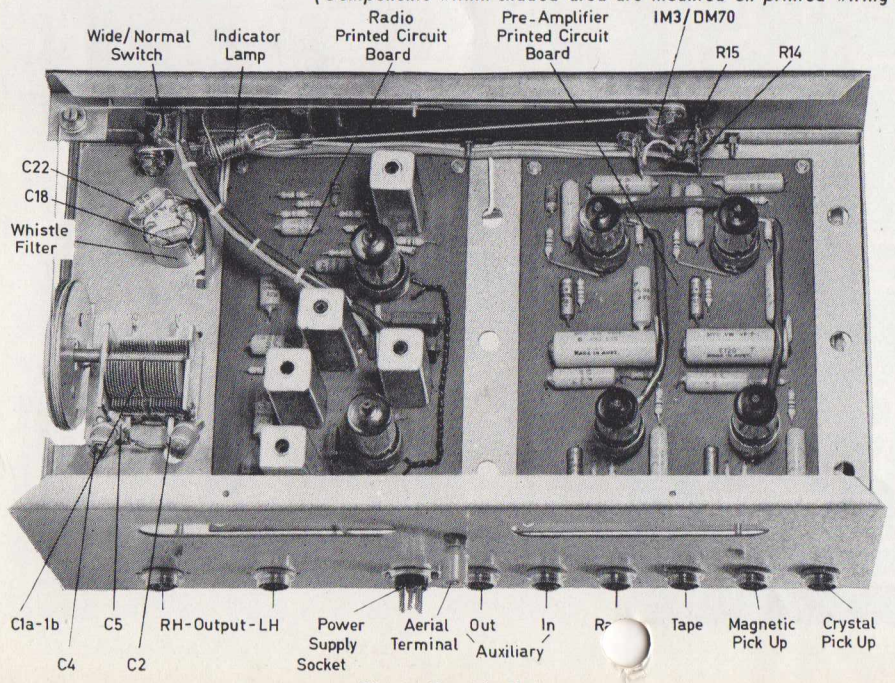
DC Conditions in Each Channel of 10W Amplifier

Point of Measurement	*Voltage (V)*	*Range of DC Avometer**
C17		
(common to both channels)	320	1000
C14	270	1000
C5	180	250
6GW8		
Pentode anode	315	1000
Pentode screen grid	317	1000
Pentode cathode	10	25
Triode anode	250	1000
Triode cathode	60	1000
Triode grid	55	1000
EF86		
Anode	110	1000
Screen grid	80	1000
Cathode	1·75	10

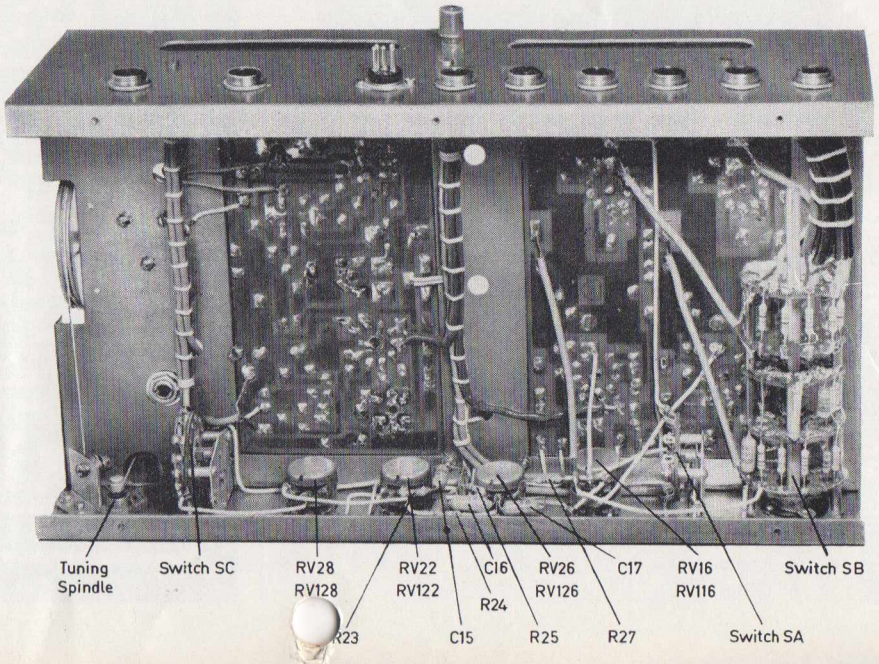
*Resistance of Avometer:
1000V-range, resistance = 20 MΩ
25V-range, resistance = 500 kΩ

CIRCUIT DIAGRAM OF MULLARD STEREO "TEN-TEN" MODIFIED FOR USE WITH WIDE BAND TUNER STEREOPHONIC PRE-AMPLIFIER

(Components within shaded area are mounted on printed wiring boards)



Chassis Topside View



Chassis Underside View

COMPONENTS PARTS LIST

WIDEBAND TUNER

Capacitors

Circuit Ref.	Value	Rating	Tolerance (±%)	Description
C1a–C1b				D2 tuning gang M.S.P.
C2	3–30 pF			trimmer Philips type
C3	NOT USED			
C4	3–30 pF			trimmer Philips type
C5	8·2 pF	500 VW	5	N.P.O. Ceramic
C6	0·047 μF	400 VW	10	Polyester
C7	0·047 μF	400 VW	10	Polyester
C8	47 pF	500 VW	5	N.P.O. Ceramic
C9	425 pF	500 VW	2½	Silvered Mica
C10	0·047	400 VW	10	Polyester
C11	2200 pF	500 VW	5	Silvered Mica
C12	390 pF	500 VW	5	N.P.O. Ceramic
C13	2200 pF	500 VW	5	Silvered Mica
C14	0·047 μF	400 VW	10	Polyester
C15	0·047 μF	400 VW	10	Polyester
C16	0·047 μF	400 VW	10	Polyester
C17	47 pF	500 VW	10	N.P.O. Ceramic
C18	1000 pF	400 VW	10	Polyester
C19	100 pF	400 V	10	Polystyrene
C20	100 pF	400 V	10	Polystyrene
C21	0·027	400 VW	10	Polyester
C22	0·027	400 VW	10	Polyester
C23	8 μF	350 VP		Electrolytic

Resistors

Circuit Ref.	Value	Rating (W)	Tolerance (±%)	Circuit Ref.	Value	Rating (W)	Tolerance (±%)
R1	100kΩ	½	10	R8	330 Ω	½	10
R2	180 Ω	½	10	R9	100kΩ	½	10
R3	22kΩ	½	10	R10	560kΩ	½	10
R4	3·9kΩ	½	10	R11	47kΩ	½	10
R5	10kΩ	1	10	R12	4.7MΩ	½	10
R6	1·0MΩ	½	10	R13	4.7MΩ	½	10
R7	1·0MΩ	½	10	R14	1.0MΩ	½	10
				R15	82 Ω	1	10

Mullard Valves

6AN7/ECH80 (one); 6N8/EBF80 (one); 1M3/DM70/DM71 (one).

Coils

Quantity	Description	Type	Supplier
1	IFT1	118	R.C.S.
1	IFT2	118	R.C.S.
1	IFT3	119	R.C.S.
1	Aerial Coil	221	R.C.S.
1	Oscillator Coil	223	R.C.S.
1	Whistle Filter Coil (Vinkor LA2303)		Special Transformers Pty. Ltd.

MISCELLANEOUS

Kit of parts for dial drive assembly available from:—
EFCO Manufacturing Co. Pty. Ltd.,
108 Princes Highway,
Arncliffe, N.S.W.

Quantity	Description	Supplier
2	Valve sockets B9A (printed wiring type with skirt nylon filled, Part No. X9A89C) or equivalent	M.S.P.
2	Valve shields to suit socket type X9A89C	
1	Switch, 2 pole, 2 position slide (OAK)	M.S.P.
1	Dial Assembly	
1	Printed Wiring Board, Wideband Tuner, type 608	R.C.S.
1	5-tag Strip	
1	2-tag Strip	
1	Aerial Terminal	
	Miscellaneous Hardware, Wire, etc.	

NOTE: If tuner only is assembled, additional parts are:

Quantity	Description	Supplier
1	Plug and Socket (Acme 2-pin)	
1	Plug 5-pin type B5 CUSP, Part No. 705	M.S.P.
1	Socket 5-pin type 5QMS S/A, Part No. 755	M.S.P.
1	Cover type 10B, Part No. 1626	M.S.P.

Power Supply Components

Quantity	Value	Rating	Tolerance	Description
1	12 kΩ	10 W	10%	wire wound resistor
1	32 μF	350 VW		electrolytic capacitor

STEREOPHONIC PRE-AMPLIFIER

Capacitors

Circuit Ref.		Value	Rating	Tolerance (±%)	Description
C1	C101	150 pF	600 V	10	Polystyrene
C2	C102	2200 pF	400 V	10	Polyester
C3	C103	390 pF	600 V	10	Polystyrene
C4	C104	560 pF	600 V	10	Polystyrene
C5	C105	220 pF	600 V	10	Polystyrene
C6	C106	25 μF	12 V		Electrolytic
C7	C107	0·1 μF	400 V	10	Polyester
C8	C108	0·1 μF	400 V	10	Polyester
C9	C109	8 μF	450 VW		Electrolytic
C10	C110	25 μF	12 VW		Electrolytic
C11	C111	0·1 μF	400 V	10	Polyester
C12	C112	0·1 μF	400 V	10	Polyester
C13	C113	0·1 μF	400 V	10	Polyester
C14	C114	560 pF	600 V	10	Polystyrene
C15	C115	8200 pF	400 V	10	Polyester
C16	C116	2200	400 V	10	Polyester
C17	C117	0·022	400 V	10	Polyester

Resistors

Circuit Ref.		Value	Rating (W)	Tolerance (±%)	Description
R1	R101	1 MΩ	½	10	
R2		100 kΩ	½	10	
	R102	1 MΩ	½	10	
R3	R103	56 kΩ	½	10	
R4	R104	68 kΩ	½	10	
R5	R105	1 MΩ	½	10	
R6	R106	100 kΩ	½	10	
R7	R107	150 kΩ	½	10	
R8	R108	560 kΩ	½	10	
R9	R109	560 kΩ	½	10	
R10	R110	5·6 MΩ	½	10	
R11	R111	220 kΩ	½	10	
R12	R112	100 kΩ	½	10	
R13	R113	220 kΩ	½	10	High Stability
R14	R114	2·2 kΩ	½	10	High Stability
R15	R115	1 MΩ	½	10	High Stability
RV16	RV116	1 MΩ log. + 1 MΩ antilog.			Potentiometer
R17	R117	3·3 kΩ	½	10	
R18	R118	8·2 kΩ	½	10	High Stability
R19	R119	100 kΩ	½	10	High Stability
R20	R120	1·2 kΩ	½	10	High Stability
R21	R121	390 kΩ	½	10	High Stability
RV22	RV122	250 kΩ log. + 250 kΩ log.			Potentiometer
R23	R123	47 kΩ	½	10	
R24	R124	39 kΩ	½	10	
R25	R125	68 kΩ	½	10	
RV26	RV126	250 kΩ log. + 250 kΩ log.			Potentiometer
R27	R127	6·8 kΩ	½	10	
RV28	RV128	250 kΩ log. + 250 kΩ log.			Potentiometer
R29	R129	1 MΩ	½	10	

Mullard Valves

EF86 (four).

MISCELLANEOUS

Quantity	Description	Supplier
4	Valve Sockets B9A (printed wiring type with skirt type X9A89C) or equivalent	M.S.P.
4	Valve Shields to suit socket type X9A89C	
1	Printed Wiring Board, Pre-amplifier, type 607	R.C.S.
1	Chassis Assembly (Chassis, Back, Front, Bottom Cover, Top Cover)	Heating Systems Pty. Ltd.
1	Front Escutcheon	R.C.S.
1	Selector Switch, Oak H type, No. AK51392	M.S.P.
2	Mode Switch, 3-pole, 3-position, Side Action Oak	M.S.P.
8	Sockets, 2-pin Acme (+ plugs)	
1	Plug, 5-pin type B5 CUSP, Part No. 705	M.S.P.
1	Socket, 5-pin, type 5QMS S/A, Part No. 755	M.S.P.
1	Cover, type 10B, Part No. 1626	M.S.P.
1	Lamp Holder and Bezel	
1	Indicator Lamp, 6·3V 0·3A	
4	Rubber Feet	
6	Knobs	
1	Tagstrip, 4 lugs	
1	Front Decorative Trim, 40½" approx.	
	Miscellaneous Hardware, Wire, etc.	

Planar Transistors for High-Speed Computer Logic

These silicon n-p-n planar transistors, types BSY38 and BSY39, in TO-18 encapsulation, are intended for high-speed computer logic and fast switching applications.

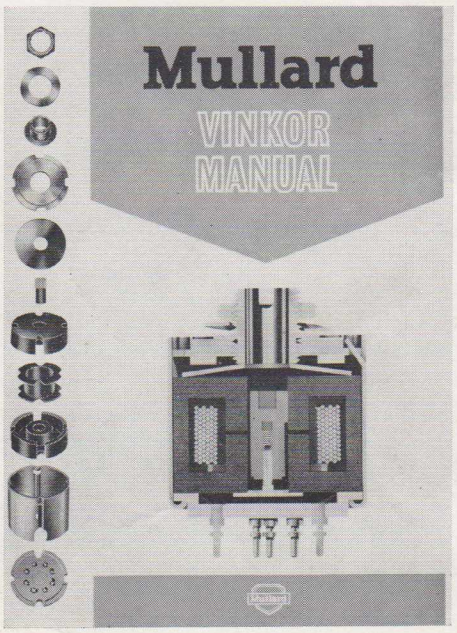
Features include high stability, high working temperature, low bottoming voltage and a high emitter current rating. In addition their linear characteristics render them suitable for use in video and narrow-band IF amplifiers. Abridged data is as follows:—

V_{CB} max. ($I_E = 0mA$)	+ 20	V
V_{CE} max. (cut-off)	+ 15	V
I_{CM} max.	200	mA
P_{tot} max. ($T_{amb} = 25°C$)	300	mW
BSY38		
h_{FE} ($I_C = 10mA$)	30-60	
BSY39		
h_{FE} ($I_C = 10mA$)	40-120	
f_t	300	Mc/s

Vinkor Manual

This Manual has been prepared to show at a glance the extensive range of Mullard Vinkor Adjustable Pot Cores. It will enable designers to select the Vinkor most suitable for a specific application and shows all the basic technical characteristics set out in a convenient form. Lift-out Broadsheets are included for quick design reference.

The Vinkor Manual is available from Mullard Offices and distributors throughout the Commonwealth priced at 5/3d plus 8d postage.



The Mullard Display at the I.R.E. Convention

A number of new developments from the Mullard Research Laboratories, together with various applications of recent additions to the Mullard range of products demonstrated by practical working models, stimulated considerable interest at the Mullard Display Stand.

Solid State

The focal point of the Mullard Display was a comprehensive control system illustrating some of the many applications of solid state devices.*

Floating Sphere

A further demonstration of a closed loop feedback system was provided by a floating metal sphere supported by a magnetic field from an electro-magnet whose field strength was varied by a three-stage transistor DC amplifier and a photoconductive cell. As the sphere was attracted towards the electro-magnet it interrupted a beam of light falling on the cell, thus reducing the current flowing in the magnet and the sphere tended to fall. This in turn resulted in more light falling on the cell with a consequent increase in the magnetic field intensity. A condition of equilibrium was eventually reached where the sphere remained suspended by the electro-magnetic field which counteracted the effect of gravity.

Microminiaturisation

The Mullard technique of microminiaturisation† using film resistors and capacitors deposited onto a wafer together with their inter-connections was shown for the first time in Australia.

* See article "Solid State Power Conversion and Control" Outlook Vol. 6 No. 2 page 17.

† See article "Mullard Microcircuits" Outlook Vol. 6 No. 2 page 17.

P-N-P Audio Power Transistor

The ADY26 germanium transistor of the p-n-p alloy-diffused type is one of the latest additions to the Mullard professional design range. This power transistor features a dissipation of 100W at room temperature. Abridged data is as follows:—

V_{CB} max. ($I_E = 0A$)	− 80	V
V_{CE} max.	− 60	V
h_{FE} ($I_E = 5A$)	40 − 120	
f_{hfb}	>100	kc/s
I_{CM} max.	30	A
I_{BM} max.	3	A

The ADY26, for which TO-36 encapsulation is used, is suitable for high-powered audio amplifiers, vibration amplifier service and inverter applications. For these applications, a pair of ADY26 transistors, mounted on a heat sink, could provide power levels of 500W or more.

New Publication

The Mullard Bulletin is a further addition to the already extensive range of Mullard publications. It contains a summary of recent Mullard announcements, including new developments in electronic valves, tubes, semiconductor devices and components. The Bulletin is issued four times per year to recipients of Mullard Technical Communications and to subscribers to the Mullard Technical Handbook. Copies are available, on request, to key personnel within the Industry; Government Departments; training establishments and libraries.

CHANGE OF ADDRESS

Kindly notify Mullard-Australia Pty. Ltd. as soon as possible. Thirty days' notice will enable our mailing system to operate more efficiently. THANK YOU.

I.R.E. Convention Paper on DC Converters

A paper on the subject of "Transient Operating Conditions of Transistors in DC Converters" was read by Mr. R. L. Webb of the Mullard Applications Laboratory at the I.R.E. Convention of May this year, in Melbourne. Mr. Webb's paper dealt particularly with factors influencing peak currents, peak voltages and dissipation during the switching phase of DC converter operation and used for illustration experimental results obtained from a 5 kc/s medium-power converter using OC28 transistors. It was believed that the analysis contained in the paper might prove useful where exceptionally stringent conditions appeared to make doubtful the satisfactory operation of DC converters designed by straightforward methods.

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