Mozart

STEREO

AMPLIFIER

SERIES

HFS 20

TODAYS BEST LOOKING LISTENING

INSTRUCTION AND SERVICE BOOKLET

with the compliments of the

HIGH FIDELITY DIVISION

Blue Town, Sheerness, Kent, England

Telephone: Sheerness 3076

Telegrams: Faramarine, Sheerness

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CONTENTS

We respectfully remind you that whilst technical queries are welcomed by the High Fidelity Division, you should re-read the relevant section before so doing.

SPECIFICATION

PRE-AMPLIFIER each channel

Sensitivities: P.U. 7 mV Tape 100 mV Radio 100 mV. Tape record output 300 mV at above specified input sensitivities.

Hum and Noise: P.U. —58* db. Tape —65 db. Radio —65 db. on 9 watts output.

Frequency Response: P.U. Within 1½ db. of published replay curves.
Tape 20 to 20,000 cycles ±1½ db.
Radio 20 to 20,000 cycles ±1½ db.

Controls: Volume; Continuously variable. Bass; + 10 db. to –15 db. at 50 cycles. Treble; + 10 db. to –15 db. at 10,000 cycles. Balance; Variation of 6 db. per channel. On/off switch; illuminated push/push. Selector switch; Tape, Radio, 78 (all records) LP.O (Pre 1955 recordings) LP.N (recordings to R.I.A.A.).

Output: O.22V into 100K for above stated input sensitivities.

Pick-up Matching: By " Dialomatic " compensation (see pick-up section).

Dimensions: Front panel 10½" (27cm.) × 3⅜" (8.5 cm.), depth 3¼" (8.3cm.) plus ⅝" (1.5cm.) front and back for knobs.

Weight: 3 lb. 11 ozs. (1.7K.gms.) with small cover.

* *With the introduction of DC heaters this figure does include a considerable proportion of valve noise. The hum figure alone could well be —60 to —65 db.*

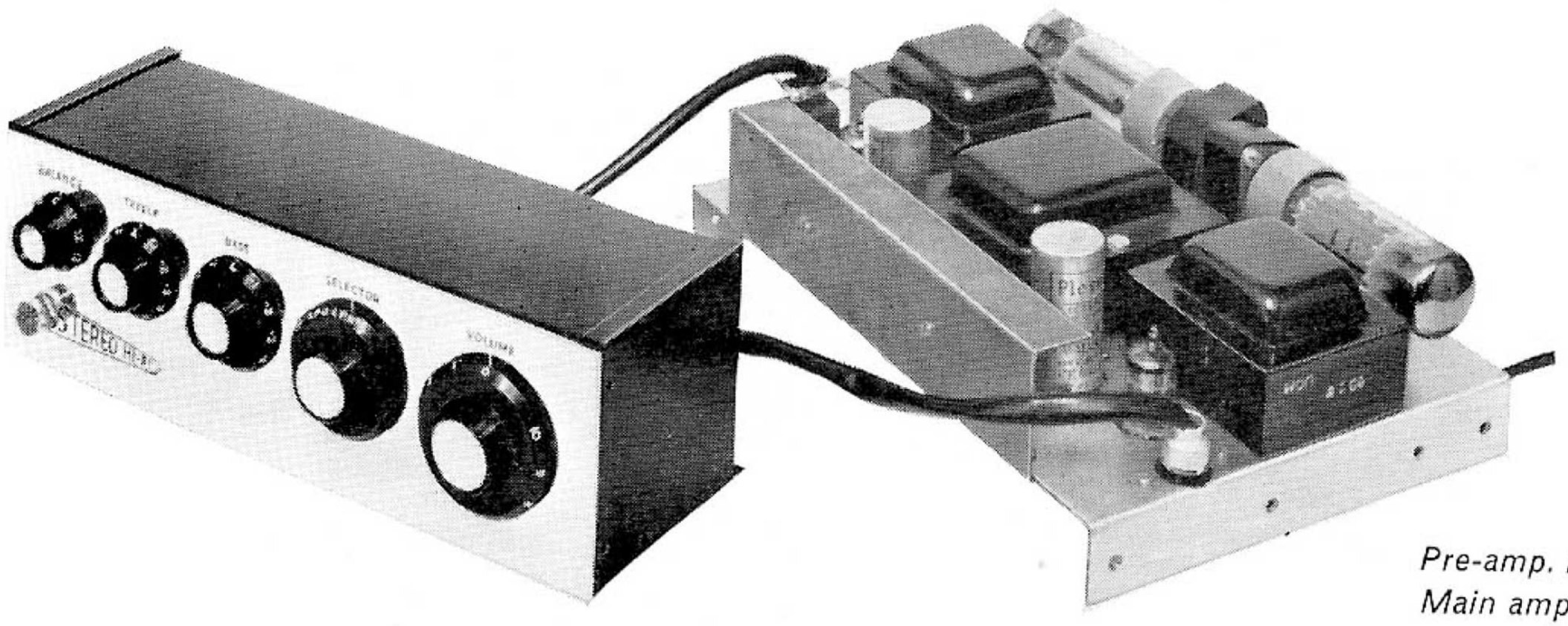
SPECIFICATION (Continued)

MAIN AMPLIFIER each channel

Sensitivity:	0.22V for 9 watts output.
Output:	9 watts r.m.s. per channel (at 1KC).
Distortion:	0.2% total harmonic at 8 watts (at 1KC).
L.F. Power Output:	7 watts r.m.s. at 40 cps.
Loudspeaker Impedance:	4, 8 or 15 ohms.
Damping Factor:	30.
Hum and Noise:	—70 db. on 9 watts output.
Frequency Response:	5 c/s —50,000 c/s ±2db.
Negative Feedback:	34 db. (in 3 loops).
Channel Separation:	Between —40 db. and —50db. overall (including pre-amp), in the audio range.
Total Power Consumption:	100VA (with pre-amplifier connected).
Mains Supply:	200V to 220V and 230V to 250V. AC. 50-60 c/s. Models HFS20E and HFS20EM 100V to 120V. AC. 50-60 c/s.
Dimensions:	Width $10\frac{3}{8}''$ (26cm.) × Depth $7\frac{1}{4}''$ (18.5cm.) Height $3\frac{3}{4}''$ (9.5cm.) including $\frac{1}{2}''$ for feet. Weight 14 lb. (6.4 kgrms.).
Overall Size (HFS20M):	Width $10\frac{3}{4}''$ (27.5cm.) overall. Depth 11″ (28cm.) plus $\frac{1}{2}''$ back and front for knobs and plugs. Height 4″ (10cm.) including feet. Weight 18 lb. 7 ozs. (8.4 kgrms.) in large cover.

INTRODUCTION TO THE DESIGN

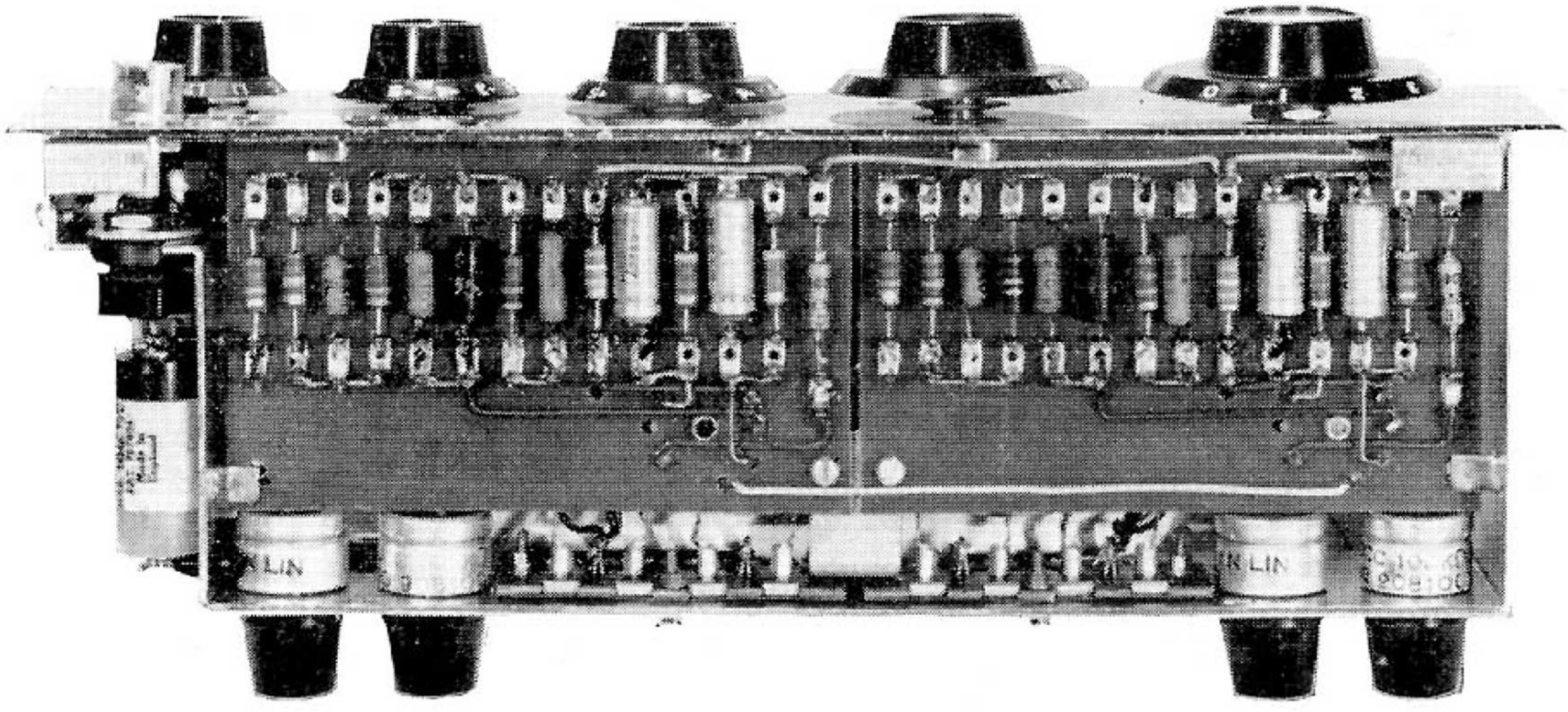
The "Mozart" series continues with the next logical step—the double nine watt amplifier. Considerable further development has been carried out on this successful design to comply with current market requirements without any major change in styling, but incorporating the latest design techniques. This specialist division of Pye Ltd. is further strengthened by the backing of the Parent Company with its vast technical resources and experience in electronics, so that the HFS20, is we believe, the most advanced design in the medium price field today. The extensive development of this unit with the most exhaustive tests at all stages and under all conditions, is your guarantee of long and satisfactory service. To maintain the well liked presentation and to match the thousands of Mozart FM tuners sold, the front dimensions have remained unaltered, but to accommodate the extra components the unit is twice as deep. This, of course, means that a single, heavy chassis 10″ or 11″ deep would be difficult to mount in a cabinet.
As many people require the amplifier to fit into cabinets, the problem can only efficiently be solved by a dual model, that is, one where the pre-amplifier is physically separated from the power amplifier, and only connected by plug leads (Model HFS20) and yet the two parts can be joined together and encased for bookshelf mounting (Model HFS20M). Either model being convertible should one's requirements change at a later date.



Pre-amp. leads to Main amp.

MECHANICAL FEATURES

The pre-amplifier follows the accepted practice of having all inputs and pre-set controls at the rear, giving maximum access to them when the unit is in a cabinet.
The unit has two leads each 3 ft. long, allowing the power amplifier to be situated in the most convenient place. Extra low loss extension leads can be fitted to the pre-amplifier as the audio output comes from a non-critical part of the circuit. The pre-amplifier cover is separate from the base cover, thus allowing a unique cover design that permits the pre-amplifier to be clamped into a cabinet (no fixing screws showing) and without the necessity to disturb all the plugs, etc., when removing or replacing the cover.
The main amplifier is very compact, due to the use of modern materials and the economical Mozart circuit, coupled with very careful attention to layout, so that no one group of components is cramped whilst leaving a large block of space at another part of the chassis.
When the two units are mechanically joined together and fitted with the mesh cover (HFS20M) they form a very clean looking combination which matches the HFT108M FM tuner and HFT113M AM/FM tuner. The problem of the inputs and pre-set controls on the pre-amplifier fouling the main amplifier, has been solved by a fold in the main amplifier base plate, thus allowing the cables from the inputs to travel under the main amplifier and out of sight.

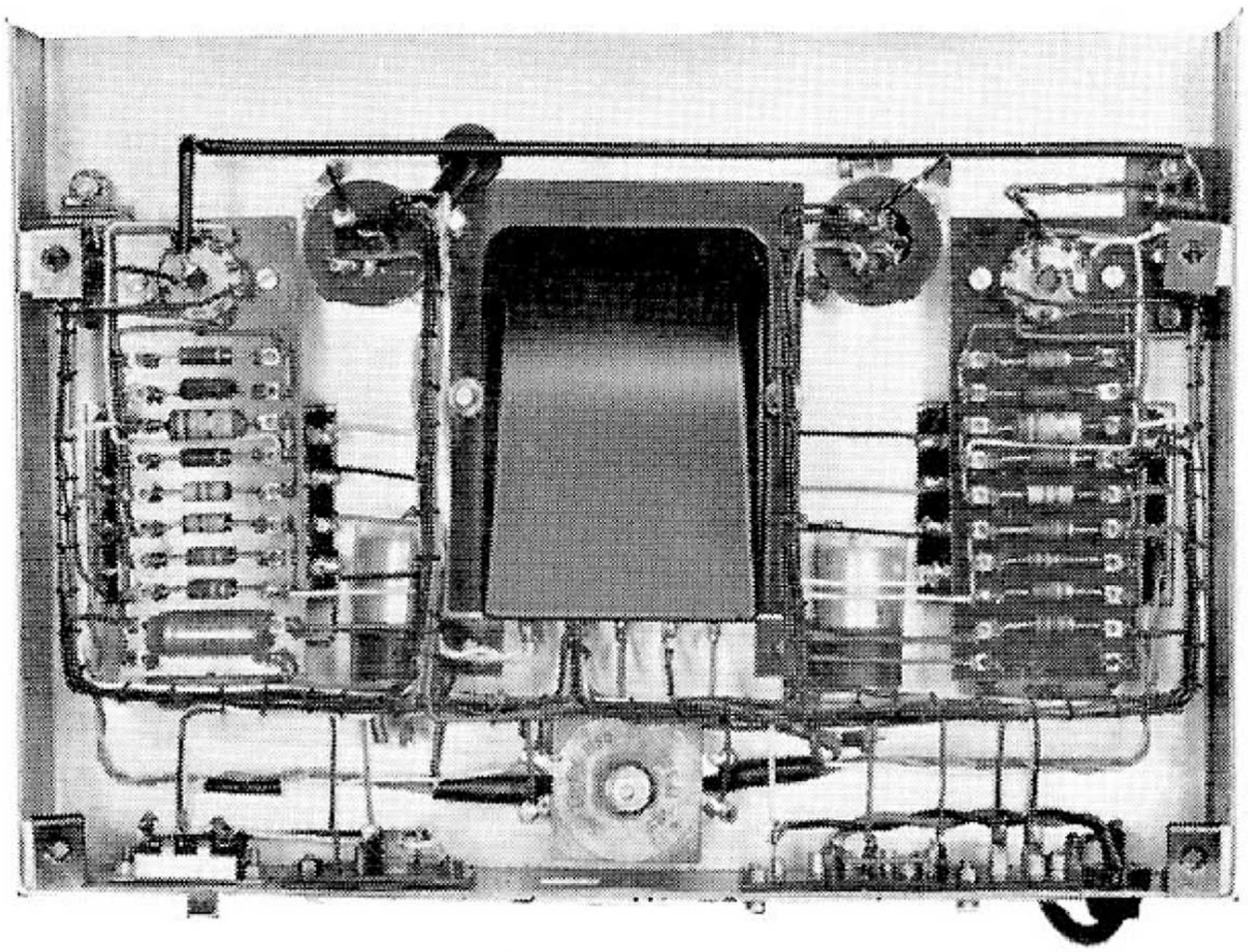


Inside of Pre-amp.

CIRCUIT FEATURES

The circuit is based on the well-proved Mozart design with several new features. Design of the original circuit was based on the simple theory that the fewer components used the less there are to go wrong. Therefore if one large output valve can give the same output and low distortion figures as two small ones in push-pull (and the phase-splitter that drives them!) then this must lead to a more reliable and consistent performance. For example, a single-ended circuit cannot suffer from getting out of balance! This very economical circuit allows a complete instrument to be designed that draws less power from the mains and consequently produces less heat than almost any other double 9W amplifier.

The new features include: extra gain to handle the lower outputs of Stereo pick-ups. A larger stack of the special grain-orientated steel used in the output transformer to give greater power at low frequencies. The exclusion of AC from the pre-amplifier. The most important technical development is the use of DC HEATERS in the pre-amplifier. This DC heater technique, as used on professional equipment, results in the virtual elimination of all hum from the pre-amplifier—even at full volume. It is the first time in this country that a commercial amplifier has used this feature which brings new standards of performance to the medium price field.



Inside of Main amp.

BRIEF SUMMARY

Before connecting to the mains, check that the fused voltage selector plug is correctly inserted.

The 3-core mains lead should be connected with red to live, black to neutral and green to earth.

BOTH plug leads from pre-amplifier must be connected before switching on.

All the connections input and output for the right hand channel are physically down the right hand side of the unit, and vice versa when looking from the front.

AC Power for a gramophone motor or self powered tuner is available from the rear of the power amplifier at the socket marked 'MOTOR'.

Mono pick-ups should be wired to feed into both channels, there is no Mono/Stereo switch.

Mono tuners or tape recorders need only be fed into one channel, as a link wire has been fitted on the Tape and Radio sockets.

If a four wire Stereo pick-up is to be used, do not common the earths.

Please check pick-up compensation settings listed separately in the booklet and check the wiring of the pick-up to the booklet.

If normal volume control settings are below 3 for records, reduce the setting of the numbered controls on the pick-up compensator at rear of unit.

CONNECTING LOUDSPEAKERS

Either channel will drive speakers of nominal 4Ω (3 to 5Ω), 8Ω (7 to 9Ω), and 15Ω (12 to 17Ω) impedances, but one wire must always be to the C. or common socket. Different impedance speakers can be used on opposite channels.

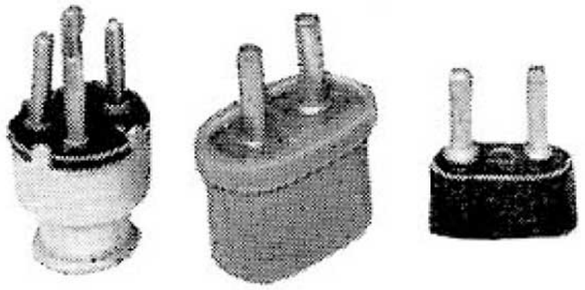
The phase switch reverses the speaker on the left channel, but only if the 4Ω and 15Ω sockets are used. To make the phase switch operate on 8Ω the brown and white wires on the left channel output transformer, should be changed over (the two end connections of the four), also the brown and white wires that feed the 8Ω and 15Ω loudspeaker socket of the left channel should be changed. The phase switch now only operates correctly on 8Ω.

The maximum length of wire used to connect your loudspeaker will depend on its impedance and the type of wire used. Assuming each core of the wire consists of the normal 14 strands of 36 s.w.g. a guide would be:—

15Ω	speakers	not	more	than	60 ft.	of	two	core	cable.
8Ω	,,	,,	,,	,,	30 ft.	,,	,,	,,	,,
4Ω	,,	,,	,,	,,	15 ft.	,,	,,	,,	,,

From this it can be seen that for 4Ω speakers thicker wire would be preferable for runs of over 15 ft.

The question of different types of loudspeakers for Stereo is the subject of some discussion, but in our opinion speakers of exactly the same type (or sound, on a changeover test) are most desirable especially if it is required to reproduce any soloists in a central position without the image drifting from left to right as the notes move up and down the musical register. This is as important as having very similar pick-up response curves on the two channels of a stereo pick-up.



Main amp. Rear Panel

CONNECTING PICK-UPS

As this is the most likely point where troubles can occur, we have devoted considerable effort to make connecting as easy as possible.

There is no need to worry about matching or loading your pick-up correctly, as the " Dialomatic " pick-up compensator does this for you. Merely consult the following table and set each channel accordingly. The inclusion or exclusion of any pick-up is no indication of preference. This list is strictly alphabetical.

We can supply a ready wired transcription turntable. This has direct plug in connections for the amplifier. The unit is the Goldring Lemco GL58 ready wired and tested with the American Stereo Sonotone 8T Ceramic Pick-up (see available extras).

COMPENSATOR SETTINGS

Pick-up		Setting
Acos:	Hi-Light	
	Black Shadow	2H
	HGP 39	2A
	GP 20	2A
	GP 67-1	2A
	GP 65-1	2A
	GP 65-3	2A
Acostereo:	71—5	2C
	73—1	2C
	81—2	2C
Bang and Olufsen:		6K
B.J.:	Non-magnetic	2A
	Elac. 210	2K
	Elac. 310	2K
	C 1 2	2A

Pick-up		Setting
Collaro:	Transcription	2F
	T X 88	2F
	Studio O	2I
	P	2F
	T	2I
	C	2F
	R	2F
Collel:	SC 1	2F
	SK 1	2H
Columbia:	CD	3F
Connoisseur:	MK II and III	3K
	CS 1	4F
	Stereo Head	2G
Decca:	FFSS	4K
	DERAM	3E
Dynaco:	Stereodyne	6K

COMPENSATOR SETTINGS—(Continued)

Pick-up		Setting
ER Ltd.	ER 60	2C
Elac:	M.S.T.1	3K
	M.S.T.2	3K
	STS 200 D	3K
	STS 300 D	3K
EMI:	EPU.100	5K
E S L:	C 60	4K
	G 100 with trans.	4K
Erie:		3F
Expert:	ALL	10K
E.V. Power Point:	53	2A
	51	2A
	56	2A
	Stereo 60	2C
Fairchild:		5K
Garrard:	GC 8	2G
	GMC 5	10K
	GCS 10	2F
Goldring:	500	6K
	580	6K
	600	6K
	700	6K
	MX1/D	2A
	SX10/D	2F
Heath:	MF 1	6K
Leak:	MK II with trans.	4H
London-Scott:	1,000	4K
Lowther:	with trans.	2K

Pick-up		Setting
Neumann:	with trans.	4K
Ortofon:	A with trans. 384	4K
	C with trans. 384	4K
	Stereo with trans. 384	4K
Pickering:	371	6K
	350	6K
Phillips:	NG 5400	5I
	NG 5400 S	3F
	AG 3016	2G
	AG 3025	2G
	AG 3060	2G
	AG 3301	2G
Reuter:	All types	2C
Ronnette:	BF 40	2F
	Stereo OV	2E
Sonotone:	8T	2C
	9T	2C
Shure:	M3D	5K
	M7D	5K
	M212	5K
	M8DM	3K
Tannoy:	Variluctance	5K
	Vari-twin	5K
Weathers:	MM1/MM5	4K
	C 501	4F
Westrex:		5K
Woollett:	Mono	10K
	Stereo	10K

Note—If volume control is normally used below 3 then reduce numbered setting from above given figures. This should only be necessary on high output crystal or ceramic pick-ups.

The Listed settings should cover a very great percentage of pick-ups, but for those omitted, and new products appearing, the following explanation of the working of the pick-up compensators should enable a competent engineer to adjust them correctly for unlisted types.

The two controls each set a variable resistance (0 to 100K Ω linear) connected in series across the pick-up to earth. The junction of the two resistors feeds the input to the set. The first resistor (as seen by the pick-up) is the lettered control and is maximum when set to A. The other resistor is at maximum when set to 10. Example: When set to A.10 the pick-up is loaded with 200 KΩ and half of the output is fed into the set.

Crystal and ceramic pick-up should be " Low loaded " to give them a velocity characteristic (e.g. 3.F).

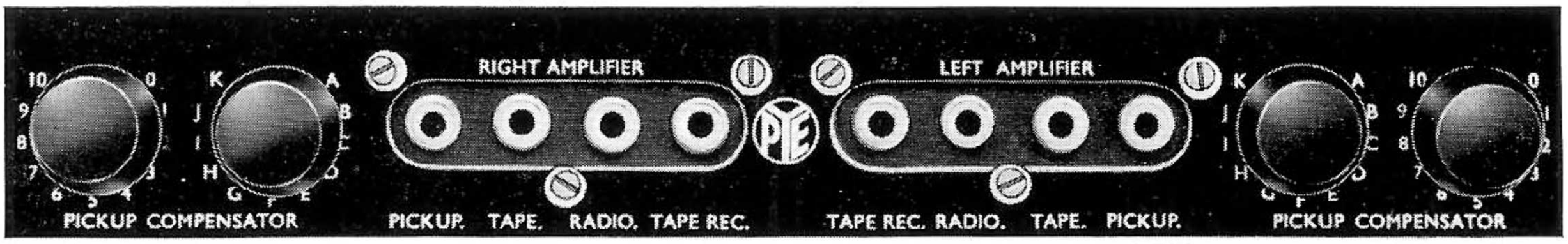
To avoid overload of early stages, check that **full** output for the set does **not** occur below 5 on the volume control. This will happen on high output crystal pick-ups and can be cured by slightly decreasing the number setting on the pick-up compensator.

Wiring of the pick-up is explained on the assumption that:

a. Where interchangeable heads are used, these will be of a similar type (see note for use of one crystal and one magnetic).

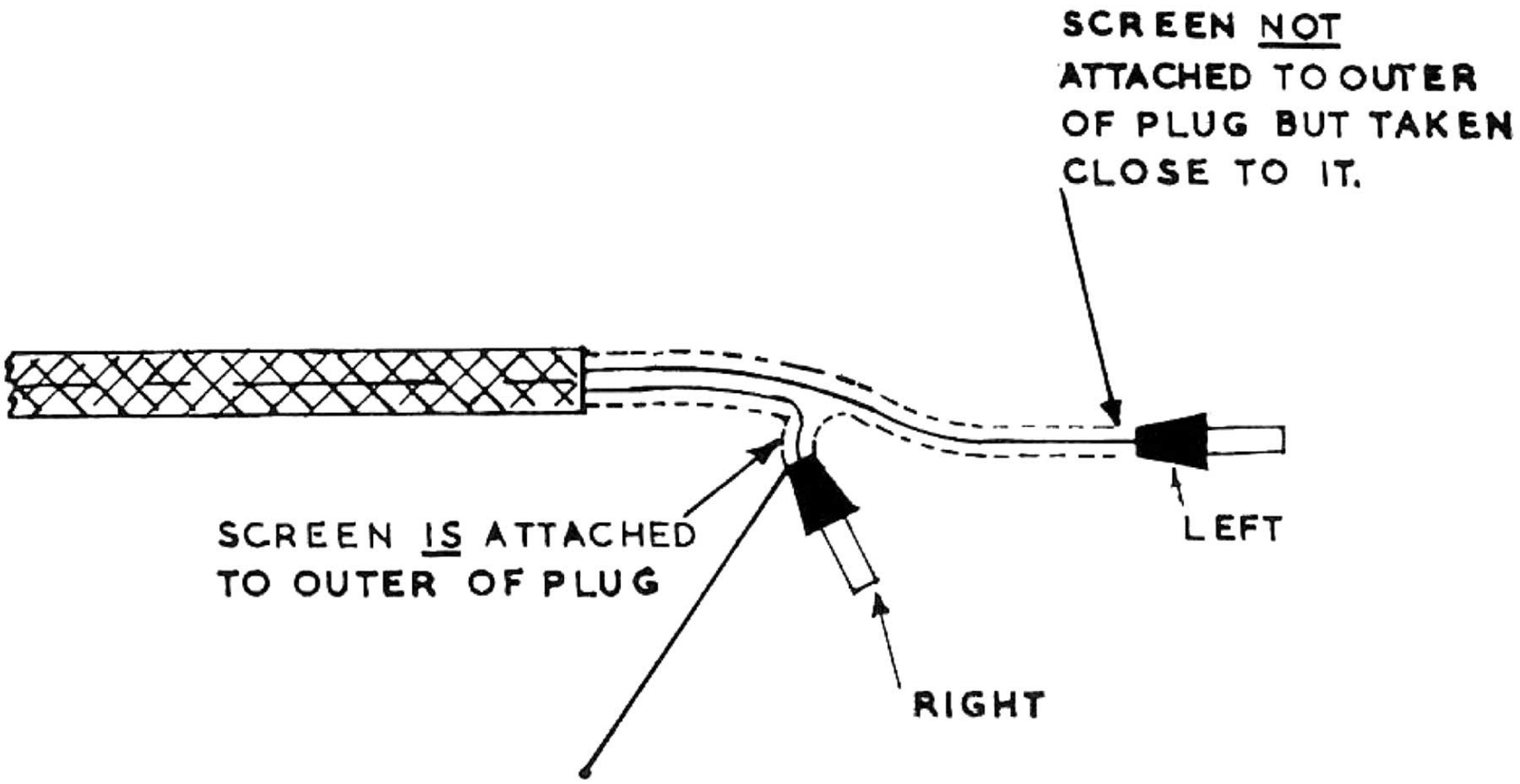
b. Where a good Stereo pick-up is available, this will also be used for mono.

c. If a mono pick-up is fed into both channels, the numbered compensator setting should be doubled wherever possible.

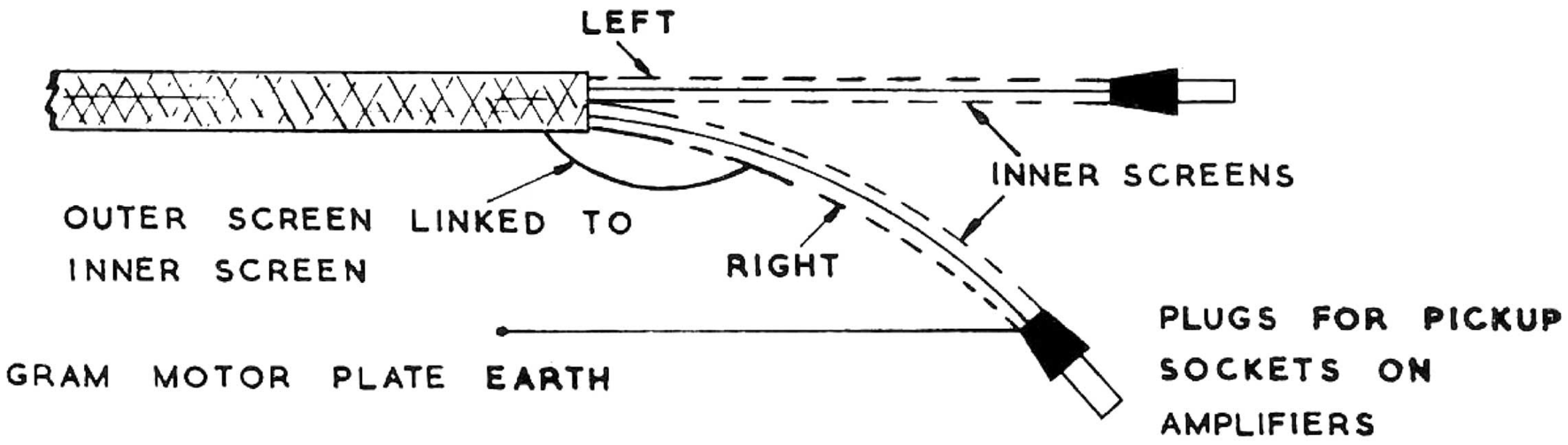


Pre-amp. Rear Panel

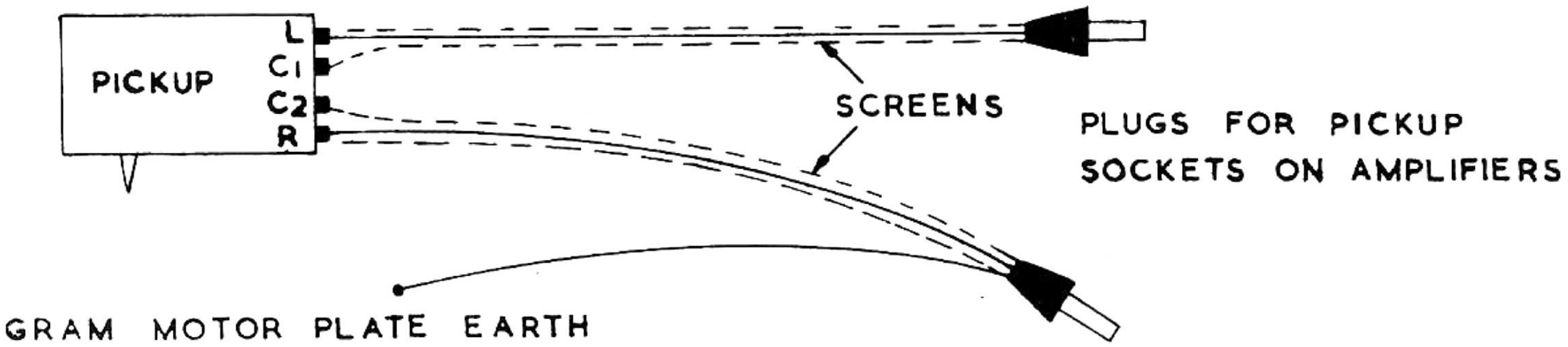
CONNECTIONS FOR 3 WIRE STEREO CARTRIDGE



CONNECTIONS FOR 4 WIRE STEREO CARTRIDGE



CONNECTIONS FOR UNWIRED STEREO CARTRIDGE



Note on P.U. Connection

1. If a pick-up is supplied ready wired with some cable on it, EXTREME CARE should be taken if an extension length is added. The absolute minimum of the inner wire should be allowed to be outside the screening. Our experience shows that the careless junction of this point accounts for more hum trouble than all other sources put together.

2. The outer shell of the small plug should not be in direct contact with the metal chassis or the blue facia label when plugged in.

3. If a magnetic cartridge is required for Mono, and crystal for Stereo, the output of the crystal will have to be reduced by the two resistors situated inside the head. At least 10: 1 reduction would be required (e.g. 100 KΩ and 10 KΩ).

4. Where two complete arms are used, one each for Stereo and Mono, then a switch (completely screened) will have to be fitted on the Motor board of the turntable to changeover from one to the other.

5. Out of balance from some crystal pick-ups may be encountered, and can be corrected at the compensators. With the BALANCE knob set to C slightly increase the numbered compensator setting on the low channel until correct balance is found.

6. Watch that the mains lead to the motor is not close to the pick-up lead.

CONNECTING TAPE RECORDERS

This section does not include any reference to tape decks, but only to complete recorders. If a tape deck is used, this must be in conjunction with a unit containing a head pre-amplifier and equaliser. This unit should also contain a bias oscillator for record and erase purposes. With this unit added to the deck, the remarks that follow for complete Recorders apply.
The recorder should not be earthed when used with the HFS20 as the latter should already be earthed, otherwise a hum loop may be caused. Unswitched mains is obtainable from the MOTOR socket at the supply voltage to power the recorder.

Connection for playback should be from a point in the recorder that does **not** include the small power amplifier contained in it. That is not from an external 15Ω or similar low impedance socket but from a socket marked " output ", " high Impedance output ", " Socket for external High Fidelity amplifier " or " Monitor ". This connection should be via screened cable into the " TAPE " socket on the amplifier.
For a mono recorder one cable only is required, and the output will come through both loudspeakers. For stereo, two cables are required and the internal link (orange) connecting the two sockets together inside the pre-amplifier must be disconnected.

Connection for recording any programme going through the amplifier (F.M., disc, etc.).
This can be carried out as the programme is being listened to and the VOLUME control will NOT affect the recording. The BASS and TREBLE WILL affect the recording, and care should be exercised not to boost too much, otherwise the quality of the recording may be impaired as the boost is set within the recorder. From this it will be seen that a programme can be set up for optimum balance, listened to and checked on your normal loudspeaker after which the volume may be turned down if desired, and a sample of the programme continues to be fed out from the TAPE REC. socket on the amplifier. This socket should be connected by screened cable to an input socket on the recorder that is designed for accepting high output feeds. This socket may be called " radio input ", " High output gram ", " min signal .1 V. peak ", or " high level input ". The feed should NOT be taken directly into a " mic " socket, as overloading WILL result.
The majority of problems when recording from an amplifier are caused by not having the correct amount of signal going into the Recorder. Briefly this means that if the signal from the TAPE REC. Socket operates the record level indicator with a slight rotation of the level control on the recorder, then too much is going in. Either use an alternative input or attenuate the signal by two resistors. With the reverse case (too little signal going in) either a more sensitive input

socket must be used on the recorder or as a last resort the recordings must be made from the 15Ω output and not from the TAPE REC. Socket.

CONNECTING TUNERS

'Mozart' Cabinet

For playing radio tuner units, the two channels (left & right) have been joined by an easily removable link (mauve wire). Thus by plugging a tuner into RADIO on one channel, the output will come from both loudspeakers (assuming SELECTOR is set to R). If, and when a Stereo tuner unit is fitted, the link should be removed.

The sockets marked " TAPE " can be used for another tuner if so desired, and are also linked (orange wire).

FITTING IN CABINETS

The split or chassis version (Model HFS20) should be used here and can be considered in two sections.

The power amplifier can be situated in its most convenient position for maximum ventilation in the area of the output valves. Bolting the amp to the cabinet will require two holes of $\frac{1}{4}$" diameter spaced 4" apart. The line of these holes being $4\frac{1}{2}$" from the rear (where mains lead is) edge of the chassis. The rubber feet are permanently fixed. Should the amplifier have to be used in such a position that hum is picked up by a magnetic P.U. then a " U " shaped mu-metal shield is available to go over the three transformers on the main amplifier and serves to greatly reduce the magnetic field (see available extras).

The pre-amplifier is intended for mounting through a slot in the wood not greater than $10\frac{1}{4}$" $\times$ $3\frac{1}{8}$" (same as HF10 amplifier, HFT108 tuner, and HFT113 tuner) the corners being square, or rounded up to $\frac{1}{4}$" diameter.

The pre-amplifier without its cover is passed through this hole so that the front panel rests on the lip and covers the rough edges of the wood.

The pre-amplifier can now have its inputs plugged in and can be connected to the power amplifier. In fact the complete unit can be connected and tested (although not a final appraisal of the hum) before putting on the cover.

The cover is put on from inside the cabinet and the two long screws replaced. As these are tightened they clamp the pre-amplifier into position with the cabinet between the cover and the front panel.

Do not overtighten and be sure to leave on the shakeproof washers as these are necessary to earth the cover. Up to $\frac{3}{4}$" thick panels can be accommodated with the screws supplied. Thicker panels would require longer screws of 2 BA thread.

The previous page shows a very fine example of a well designed equipment cabinet. This, as can be seen from the illustration, will accommodate all units, turntable (or tape deck), tuner and amplifier (including Stereo), in a compact cabinet and still leave considerable record storage space. The right hand lid provides a convenient working surface for record sleeves, sponges, etc. The hinged equipment " fall " that holds the control panels, retracts, removing the amplifier and tuner from view, and a fitted micro switch removes the power supply from the equipment. The fall can also be dropped completely down to give excellent accessibility for fitting up or servicing. This cabinet, available in walnut or mahogany, can be obtained from your Pye High Fidelity agent at £22 11s. 0d.

OPERATING INSTRUCTIONS

The amplifier has been designed to give the maximum musical pleasure with the minimum of adjustment or consultation of charts and instructions. Consequently this section will be brief, assuming that the previous sections have been successful in helping you to connect the ancillary equipment correctly.

ON/OFF Switch

This is operated by depressing the PYE sign on the front panel which will be illuminated when ON (both plugs leads from pre-amplifier must be plugged into main amplifier before switching on).

Selector Switch

This selects any one of the three inputs which can be fed into the amplifier, Radio, Tape or Pickup, the latter having three positions. These are designed to give the maximum coverage of the different recording characteristics that have been widely used. 78 deals with all 78 r.p.m. records. L.P.N. is for most fine groove recordings since 1955 when the R.I.A.A. curve was accepted, this includes all stereo records. The extra L.P.O. and 78 positions enable you to play your older recordings without complicated tone control adjustments.

Volume

This merely controls the amount of signal going through the amplifier and has no effect on frequency response. For low level listening, however, it may be preferred (although not necessarily correct) to increase the bass and treble this being a matter of personal choice. Whichever method is used it should not be allowed to impair ones enjoyment of the music forthcoming.

Balance

The control gives at its extremes a 4:1 ratio of power between left and right and vice versa. The variation is limited at this so that any very large differences of, say output from the two halves of a Stereo pick-up, will not go unnoticed. (See note on compensator settings for out of balance pick-ups.)

By rotating to the R. settings the image should move to the right and vice versa but the numbers are arbitrary and are only intended for reference.

Bass and Treble

Both controls are continuously variable and have a central LEVEL position. The + and — numbers are again only intended as reference points for future use and if your favourite recording is found by trial and error to sound best with the controls set out, say, V6 B+2 T+1 and R.2, this could be noted on the sleeve. Thus optimum settings may be obtained to suit your personal taste or particular room characteristics and upon replaying a certain work these settings are easily repeated.

Phase Switch

Once set, this switch (on rear of main amplifier) should not require altering. To set in the correct position play a monaural record or radio and position yourself such that you are an equal distance from each loudspeaker and at a distance that is approximately equal to the distance between them. When the switch is set correctly the sound will then appear to come from between the two loudspeakers.

AVAILABLE EXTRAS

	Pye part No.	Price
Conversion Kit from HFS20 to HFS20M	9073113	£2 5 0
Conversion Kit from HFS20M to HFS20	9073114	19 0
3′ extension for AC lead to pre-amplifier (4 pin square plug)	9073115	15 0
3′ extension for audio lead to pre-amplifier (4 pin round plug)	9073116	7 6
Mu-metal screen for HFS20 main amplifier	9040123	£ 1 17 6
* Goldring-Lenco GL58 transcription turntable with Sonotone pick-up		£20 17 9

Available from your Pye agent through Pye High Fidelity Division, Blue Town, Sheerness, Kent.

* Available from your normal Pye depot.

EXPORT MODELS

All models with or without the suffix E are for tropical use as all components used in the " Mozart " Stereo are tropicalised. The two models available with the suffix E (for bookshelf mounting HFS20EM, and cabinet mounting HFS20E) indicates that they are for use on mains supplies of 110 to 120 V., 50-60 c/s.
Models can be supplied fitted with American type mains lead and plug to a U.L. approved type. Any enquiries are welcome and will receive prompt attention from the Export Department. Address enquiries to:

Pye Limited, High Fidelity Division,
Export Department, Blue Town,
Sheerness, Kent, England.

SPECIAL NOTES

Hum

To take advantage of the low hum levels inherent in the HFS20, it is advisable to note the following process of elimination if hum is present:—

a. Remove all inputs and turn the numbered pick-up compensators to O. The lettered compensator setting is not important.
b. Check if hum has gone, if so, then it must have come from outside the amplifier.
c. Plug in ancillary equipment, **one unit at a time** (turn compensator back to original setting).
d. Check hum level **each time** until the offending unit is located (see note on mu-metal shield in cabinet section).

Earths

An earth is normally recommended for safety reasons on the amplifier (green wire in three core mains lead) but it will function correctly without it.

Heat

The temperature of the amplifier may appear to be greater than the Mono " Mozart " (HF10) if checked by hand, but this is most misleading, as this only indicates surface temperature. Careful checks with the aid of humidity chambers (artificial tropical conditions) thermocouples and resistance change methods, indicate that all components are being under-run on their stipulated rating.

SERVICE NOTES

General Notes

1. The main difference between this unit and the HF10 " Mozart " amplifier is that the pre-amplifier uses DC heaters, provided by the LT rectifier situated in the pre-amp. with the smoothing condensers beside the mains switch. The lay-out of components has been arranged so that most faults (excluding power supply) are confined to any one half of the chassis. The **right** channel is physically on the **right** side of the main and pre-amplifiers (looking from the front), and uses the **rear** section of all ganged controls.

2. All DC voltages are included on the circuit diagram. The important ones for a check of normal operation being:—

Main amplifier: Bias on V2a (across 1.8KΩ) 0.9V.
Bias on V3 (across 150Ω) 14.0V.
Drop across anode winding of T1 approx. 15.0V.

Pre-amplifier: Bias on V1a and b (across R5 and R10) 0.9V.
DC heater volts on V1 (pin 4 to E) 4.8V.
DC heater volts on V1 (pin 5 to E) 7.8V.

3. Do not unplug audio lead (round plug) from the main amp. when switched on otherwise incorrect volts will appear even in the main amplifier. Also pre-amplifier valves or pilot lamp if removed, can upset these voltages (lamp must be 8.0V 0.2A). The bulbs outer shell is live and should not touch the chassis.

4. **GAIN CHECK:** AC Signal voltages at 1K cps. to give an output of 10.0V r.m.s. at the 15Ω loudspeaker socket are as follows:—

MAIN AMPLIFIER: 0.2V into V2A. Leave both leads, from pre-amplifier connected. Feed signal into slide of VOLUME control set at 3.

PRE-AMPLIFIER: 0.35V into TAPE REC. socket (VOLUME SET to 10).
0.1V into RADIO socket (SELECTOR SET to R).
7.0mV into PICK-UP socket (SELECTOR SET to LPN and compensators to K.10).
Waveform to be a *pure sinewave* in all cases—input and output.

5. Check of correct BASS control can be accomplished by feeding 50 mV of 50 cps. signal into the RADIO input, adjusting VOLUME to give 3.0 volts output onto a 15Ω load, and reading that full boost gives approx. 9.0 volts out and full cut gives approx. 0.6 volt out. Check TREBLE control as above, but at frequency of 10,000 cps.

6. The fitting of pick-ups should be carried out with the utmost care and pages 10, 11, 12 and 13 of this Instruction booklet should be consulted. Particular note being made that the lead is screened **right up to the phono plug.** Note also that **both** sets of compensators should be adjusted.

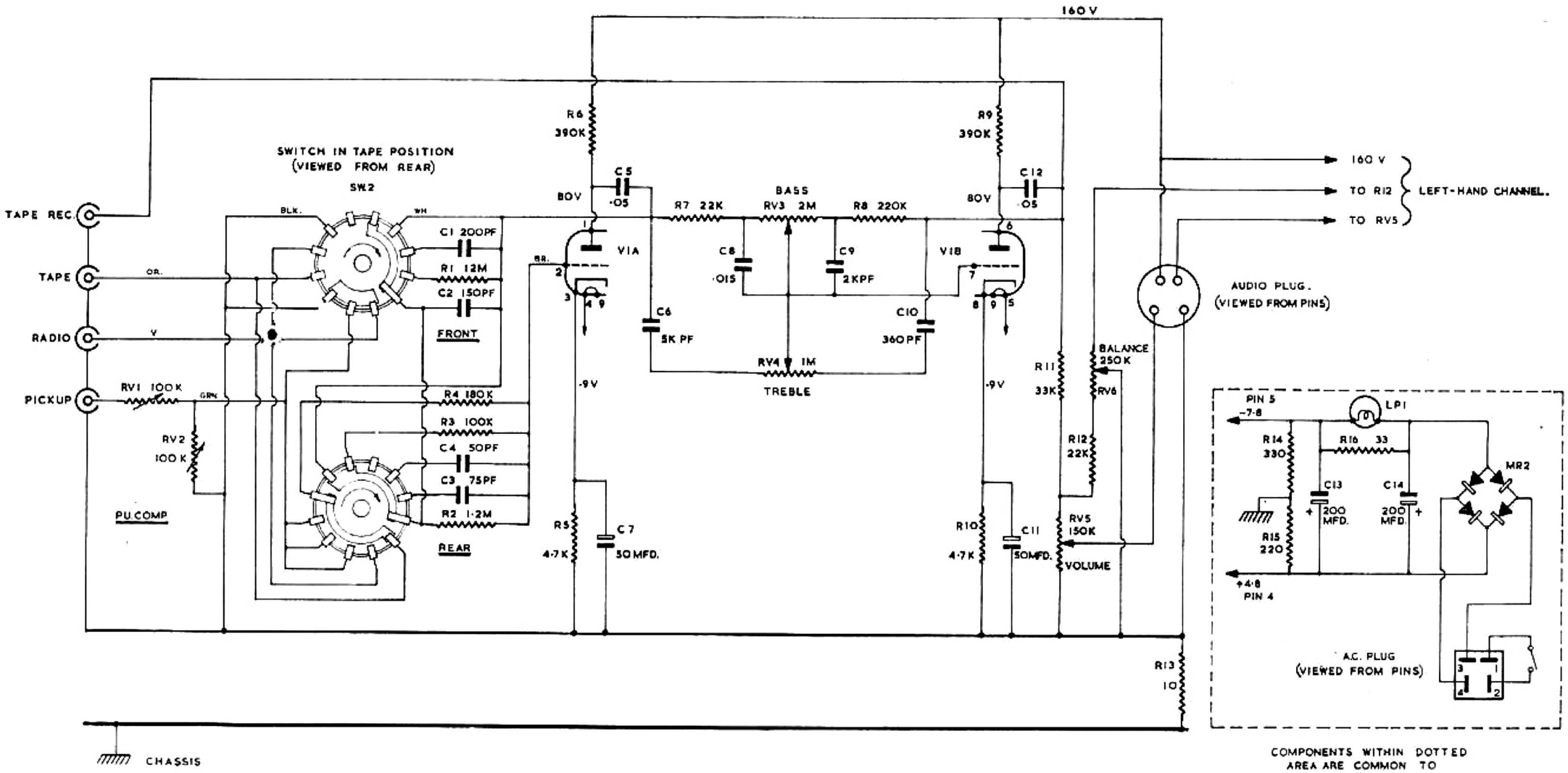
7. On the " M " version, the screens on the pre-amplifier valves are mu-metal to reduce hum induction from the main amplifier. The expanded metal cover slides **between** the base-plate and the chassis.

PARTS LIST

Cir. Ident.	Resistors	Part No.	Cir. Ident.	Capacitors	Part No.	Cir. Ident.	Resistors Variable	Part No.
R1	*12 Meg.Ω ¼ W. ±10%	675641	C1	*200 PF. Polystyrene 125 V. ±10%	653376	RV1	*100 KΩ Linear (A to K)	811324
R2	*1·2 Meg.Ω ¼ W. ±10%	671771	C2	*150 PF. Polystyrene 125 V. ±10%	653397	RV2	*100 KΩ Linear (0 to 10)	811324
R3	*100 KΩ ¼ W. ±10%	671758	C3	*75 PF. Polystyrene 125 V. ±5 PF.	653394	RV3	2 MΩ Inverse Log – 2 MΩ Inverse Log	9081012
R4	*180 KΩ ¼ W. ±10%	671761	C4	*50 PF. Polystyrene 125 V. ±5 PF.	653396	RV4	1 MΩ Inverse Log + 1 MΩ Inverse Log	9081011
R5	*4·7 KΩ ¼ W. ±10%	670659	C5	*·05 μF. 350 V. D.C. Metal cased		RV5	150 KΩ, Log + Log 150 KΩ	
R6	*390 KΩ ¼ W. H. Stab. ±5%	676889	C6	*5 K.PF. H1.K. Tub Ceramic ±10%	653122	RV6	250 KΩ Linear	9081014
R7	*22 KΩ ¼ W. ±10%	670635	C7	*50 μF. Electrolytic 6 V. D.C.	667810			
R8	*220 KΩ ¼ W. ±10%	670669	C8	*·015 μF. Tubular, 150 V. D.C.	669393		**Valves**	
R9	*390 KΩ ¼ W. ±10%	671765	C9	*2 K.PF. H1.K. Tub Ceramic ±10%	652097	V1	*ECC83 Mullard	860319
R10	*4·7 KΩ ¼ W. ±10%	670659	C10	*360 PF. H1.K Tub Ceramic ±10%	653152	V2	*ECC83 Mullard	860319
R11	*33 KΩ ¼ W. ±10%		C11	*50 μF. Electrolytic, 6 V. D.C.	667810	V3	*EL34 Mullard	860472
R12	*22 KΩ ¼ W. ±10%	670635	C12	*·05 μF. 350 V. D.C. Metal cased				
R13	10 Ω ¼ W. ±10%	671710	C13	200 μF. 25 V. D.C.	680100		**Miscellaneous**	
R14	330 Ω ¼ W. ±10%	671728	C14	200 μF. 25 V. D.C.	680100	F1	Fuse, 3 Amp., ¼" dia. x ·55" long (250v)	9070384
R15	220 Ω ¼ W. ±10%	671726	C15	16 μF. Electrolytic 275 V. D.C. ½ Of	667960	F1	Fuse, 5 Amp., ¼" dia. x ·55" long (117v)	9070385
R16	33 Ω 2 W. ±10%		C16	16 μF. + 16 μF. Electrolytic 275 V. D.C.	667960	LP1	Lamp, Mazda, 8 V., ·2 Amp.	709122
R17			C17			SW1	Swith, On/Off, 1 Amp, 250 V. Castelco	9083006
R18	*1·8 KΩ ¼ W. ±10%	671803	C18	*600 PF. H1.K. Tub. Ceramic ±10%		SW2	Switch, Selector, Double Banked	9083011
R19	22 KΩ ¼ W. ±10%	670635	C19	*·1 μF. 350 V. D.C. Metal cased		SW3	Switch, Phase Reversal, Type T225	9083010
R20	*180 KΩ ¼ W. ±10%	671800	C20	*100 μF. Electrolytic 350 V. D.C.	680069			
R21	*22 Meg.Ω ¼ W. ±10%	676802	C21	*1 μF. Electrolytic 25 V. D.C.	667846	T1	*Transformer, Output	9077053
R22	*270 KΩ ¼ W. ±10%	671818	C22	*200 μF. 25 V.	680100	T2	Transformer, Mains (250v)	9077052
R23	2 x 22 Meg.Ω ±10%	676802				T2	Transformer, Mains (117v)	9077054
R24	*120 KΩ ¼ W. H. Stab. ±5%	673576				MR1	Rectifier, Contact Cooled	709099
R25	*56 KΩ ¼ W. ±10%	671801				MR2	LT Rectifier Siemens Halsk	
R26	*470 KΩ ¼ W. ±10%	671766						
R27	*150 Ω 2 W. ±10%							

*These components are repeated in left hand channels.

CIRCUIT DIAGRAM - HFS 20 - STEREO PRE-AMPLIFIER.

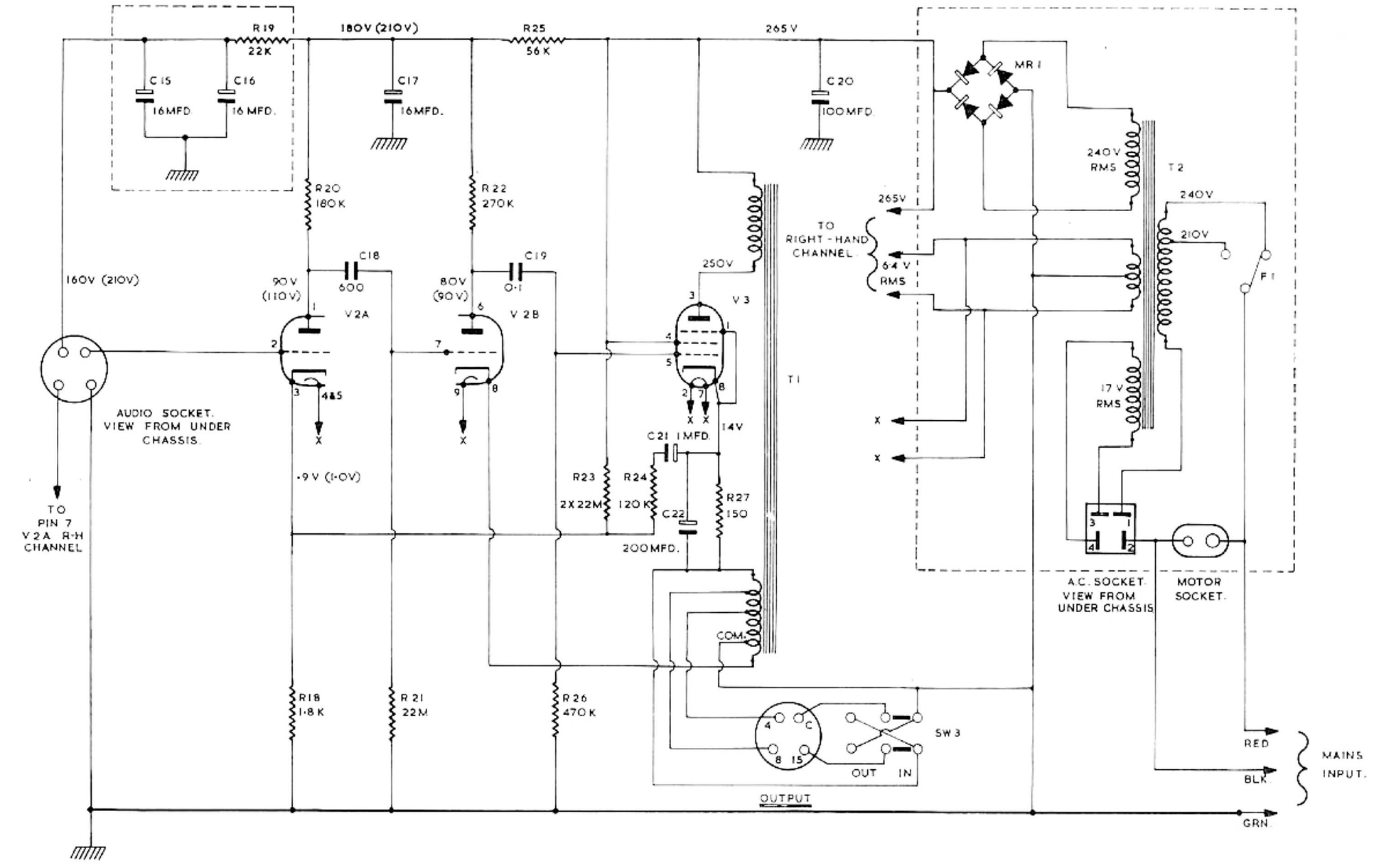


COMPONENTS WITHIN DOTTED AREA ARE COMMON TO BOTH CHANNELS.

R	1 4 3 2 — 6 5 — 7 — 8 — 9 10 — 11 — 12 — 13 — 14 15 — 16	R
C	1 2 4 3 — 5 7 — 6 — 8 — 9 — 10 — 11 — 12 — 13 — 14	C
MISC.	RV1 RV2 — SW2 — RV3 RV4 — RV6 RV5 — MR2	MISC

UNITS PRIOR TO SERIAL No. 168901 HAVE THE LT RECTIFIER MOUNTED IN THE POWER AMPLIFIER

CIRCUIT DIAGRAM – HFS 20 – STEREO MAIN AMPLIFIER.



R	19 18 20 21 22 25 26 23 24 27	R
C	15 16 18 17 19 21 22 20	C
MISC.	T1 SW3 MR1 T2 F1	MISC.

NOTES.

1. DRAWING SHOWS LEFT-HAND CHANNEL.
2. COMPONENTS SHOWN WITHIN DOTTED AREAS ARE COMMON TO BOTH CHANNELS.
3. IN RIGHT-HAND CHANNEL V2A PIN CONNECTIONS WILL BE AS SHOWN FOR V2B AND VICE VERSA.
4. PHASE REVERSAL SWITCH-SW3-DOES NOT APPEAR IN THE RIGHT-HAND CHANNEL.
5. THE PHASE REVERSAL SWITCH-SW3-ONLY OPERATES THE 4Ω AND 15Ω TAPS(SEE BOOKLET FOR 8Ω TAP)
6. VOLTAGES SHOWN IN BRACKETS ARE OBTAINED WITH THE PRE-AMPLIFIER DISCONNECTED.