"VARISLOPE STEREO" PRE-AMPLIFIER

INSTALLATION, OPERATION and MAINTENANCE

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The "VARISLOPE STEREO" pre-amplifier is designed specifically for use with the "STEREO 20" or "STEREO 50" power amplifiers, though it may also be used with any combination of two Leak monaural power amplifiers (TL/12, TL/10, TL/12 PLUS, TL/25 PLUS, TL/50 PLUS).

CONNECTING THE "VARISLOPE STEREO" PRE-AMPLIFIER.

1. This unit may be used free-standing on a table, or it may be mounted on a panel of any thickness, through a cut-out of $10\frac{5}{8}'' \times 3\frac{7}{8}''$ (27 cms. × 9·85 cms.). To mount on a panel: remove the rubber feet by pulling smartly out of their retaining holes: pass the body of the pre-amplifier through the cut-out until the front plate butts against the panel, then pass the U-shaped bracket over the back of the pre-amplifier and fix it by passing the wing-screw through the hole in the bracket and into the threaded hank-bush in the centre of the rear panel on the pre-amplifier. Tighten the wing-screw just enough to prevent the metal backing of the front plate from slipping on the panel.

2. A brown multiple cable of 4 ft. (1·22 metres) is supplied for connecting the "VARISLOPE STEREO" to a Leak stereo power amplifier. The male plug on this cable fits the socket on the stereo power amplifier marked "PRE-AMP". The female plug on the cable fits the male socket on the "VARISLOPE STEREO" marked "FROM AMPLIFIER". Longer cables can be supplied to special order, up to a maximum of 16 ft. (5 metres).

3. To enable you to control the power amplifier from the "VARISLOPE STEREO" a switch is incorporated in the "VOLUME" control. To make use of this facility a 2-core flexible cable is supplied with the "VARISLOPE STEREO"; one end of the cable is fitted with a plug which inserts into the socket marked "SWITCH" on the rear of the "VARISLOPE STEREO"; the other end of the cable must be passed through the rubber grommet marked "SWITCH CABLE" on the associated Leak stereo power amplifier, knotted behind the grommet, and the two bared ends connected to the terminals marked "SWITCH" (situated underneath the mains transformer), after removing the wire link joining these terminals.
We strongly recommend that the power amplifier should be 'earthed' (grounded). If excessive hum is experienced, particularly with the power amplifier not 'earthed' (grounded) this can be reduced by reversing the mains input leads to the power amplifier. Reversing the "SWITCH" connections will not be effective.

4. When the "VARISLOPE STEREO" is used with two Leak single channel amplifiers the multiple interconnecting cable should be connected between the male socket marked "FROM AMPLIFIER" on the "VARISLOPE STEREO" and the socket marked "PRE-AMP" on one of the Leak power amplifiers, which becomes the left-hand channel. An earth connection should be taken to the third pin on the removable plug portion of the "A.C. POWER" connector on this left-hand channel power amplifier.
The co-axial socket marked "OUTPUT R" on the "VARISLOPE STEREO" should be connected via a screened co-axial cable to the octal socket on the second power amplifier marked "PRE-AMP"; the screening being connected to Pin 1 and the live inner conductor to Pin 8. This power amplifier becomes the right-hand channel, and will automatically be earthed via the screening of its co-axial input cable; to ensure freedom from hum (due to 'earth loops') no additional earth should be made.
N.B.—Only one Leak power amplifier should be connected to the "SWITCH" socket. The other power amplifier must be switched separately.

5. **BALANCE CONTROL**

The "BALANCE" control allows you to compensate for differences in sensitivity between loudspeakers, or the 'L' and 'R' sides of any stereo input device. The gain in each channel is identical when the pointer on the "BALANCE" control knob is vertical. A further function of the "BALANCE" control is mentioned in paragraph 16.

6. **VOLUME CONTROL.**

The input attenuators on the rear panel of the "VARISLOPE STEREO" should be set so that a normal level of reproduction is obtained with the main "VOLUME" control set to position "3" or higher. It is better not to listen with the "VOLUME" control below "3", as the channel balance below this setting may vary by more than 1db.

7. **FUNCTION SELECTOR.**

This five position switch allows the choice of:—

(*i*) Stereo reverse (i.e. one can change the left-hand side of the orchestra over to the right, and vice versa).
(*ii*) Stereo.
(*iii*) R (connects both channels to the 'R' input device—monaural reproduction).
(*iv*) L (connects both channels to the 'L' input device—monaural reproduction).
(*v*) Monaural P-U (this converts a stereo pickup so that it may play monaural L.P. records). See 11(d).

8. **PICKUP SELECTOR.**

This two position switch permits you to select either of two stereo pickups or, when used in conjunction with the function switch, two monaural pickups and one stereo pickup, or four monaural pickups.

9. **HUM.**

The " VARISLOPE STEREO " pre-amplifier has an extraordinarily low hum level, which can be checked by removing the input plugs and turning up the " VOLUME " control. The connection of any input device to the input sockets will lower the input impedance and should, therefore, reduce the hum level. If the hum level increases on making these connections, the cause of the hum must lie outside the pre-amplifier, and our instructions on the connection of the varying input devices should be read carefully in an attempt to locate the cause of the hum.

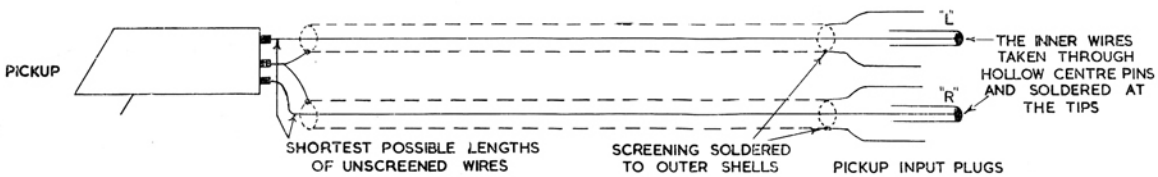
10. **HISS.**

With the input control switch to " MIC ", " TAPE ", or " PICKUP " and the " VOLUME " control at maximum, a certain amount of hiss will be heard. This hiss is as low as is possible to obtain at the present date, and it is inherent in high-gain vacuum-tube amplifiers.

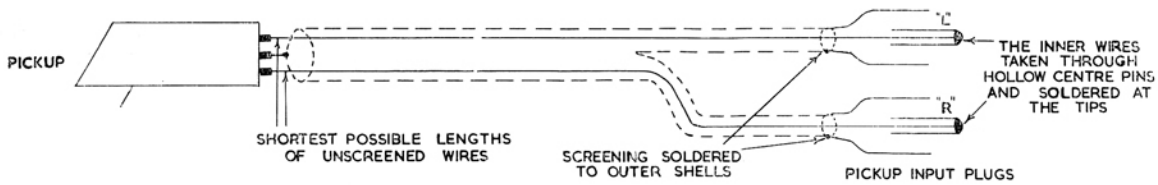
11. **CONNECTING STEREO PICKUPS.**

(*a*) The greatest care has been taken in the design of this pre-amplifier to ensure that any pickup generally available in the world can be connected to give optimum results, i.e. the highest quality obtainable from the chosen make of pickup. Our prime aim is for you to obtain optimum results from the pickup of your choice.

(*b*) The pickup should be connected via screened co-axial cables to the sockets marked " PICKUP " at the rear of the " VARISLOPE STEREO " pre-amplifier, as shown below.



(*c*) Some pickups will be fitted with two inner conductors covered by one outer screening ; in this case the user should make sure that the screening of both inner conductors is maintained right up to the plugs fitting the sockets marked " PICKUP ", as shown below.



(*d*) The majority of stereo pickups are suitable for reproducing from monaural records when the two pickup outputs are short-circuited ; the " FUNCTION " switch on the pre-amplifier effects this short-circuit when turned to " MONAURAL P-U ".
Some pickups do not conform to this convention and have a separate monaural (or lateral) output. When using this type of pickup the stereo outputs should be connected to the input sockets of PICKUP 1 and the monaural output to the input socket marked " R " on PICKUP 2. For the reproduction of stereo records, the pickup selector should be turned to PICKUP 1 and the function switch to " STEREO ". For the reproduction of monaural records the pickup selector should be turned to PICKUP 2 and the function switch to " R ".

(*e*) We know from experience that the main troubles encountered by the music-lover at home are with the reproduction of records. There are five major reasons for these troubles :—

(*i*) No record can possibly give perfect reproduction, and many records (perhaps the majority) contain noticeable distortions due to imperfections in recording and/or processing. These imperfections may show up as " rattle ", high surface noise, recorded hum and rumble, and recorded " wow ". Shrill treble may be due to a poor record, and/or due to a pickup having its high-frequency resonance within the audible range.

(*ii*) No pickup is perfect and the majority have performances *very much* below those which are attainable.

(*iii*) **Hum.** This often arises because insufficient attention is given during the design of a pickup to the commonly-found circumstances in which it will operate, i.e. near an electric motor and near a power amplifier. Hum can also arise from incorrect connection of the pickup by the user.
If hum is to be kept to a minimum the outer screening of any pickup wiring should either have an insulated covering, or it should be prevented from touching any metal on the motor, motorboard or anywhere else. The outer screening *must not* be used for earthing any part of the motor and turntable assembly, which should be earthed by a separate wire taken to the third pin on the removable plug portion of the "A.C. POWER" connector on the Leak power amplifier. If the "tone-arm" is metal and the outer screening is connected to it, then the arm must not make metallic contact through its bearings with the metal turntable and motor assembly.
Unfortunately, on some record-players and record-changers the screen is connected to the body of the motor mounting-plate. This is bad practice on the part of the makers, and is very likely to cause hum, particularly when using the low output pickup. If you have this type of wiring, you are most strongly urged to insulate the screening from the metal parts of the motorboard.

(*iv*) **"Rumble".** Vibration from the motor is transmitted to the pickup stylus and appears in the sound output as a rumbling or humming noise. Rumble disappears when the pickup is lifted from the record.

(*v*) **Acoustic feedback.** If a loudspeaker is placed in the same cabinet as a pickup, then vibration from the movement of the loudspeaker can be transmitted to the stylus of the pickup. As the volume is increased a stage is reached where a sustained roaring noise is set up. At volume levels considerably below this point distortion is noticeable. Acoustic feedback disappears when the pickup is lifted from the record.

(*f*) The matching of stereo pickups.

(*i*) **Moving-coil, moving magnet and variable-reluctance (magnetic, moving-iron) pickups.**

The "VARISLOPE STEREO" pre-amplifier has an input impedance of 50,000 ohms with the input attenuator at "HI" and 100,000 ohms with the input attenuator at "LO". Some manufacturers state values of resistors to be placed across each channel of their stereo pickups. To follow these recommendations you should add resistors of values shown below. As these resistors can pick up hum unless screened, we strongly recommend that you solder the resistors across the co-axial input sockets inside the pre-amplifier.

Maker's Recommendation	Value of additional resistor for each channel with input attenuator at "HI"	Value of additional resistor for each channel with input attenuator at "LO"
50,000 ohms	No resistor required	100,000 ohms
33,000 „	100,000 ohms	50,000 „
25,000 „	50,000 „	33,000 „
10,000 „	15,000 „	12,000 „
5,000 „	5,000 „	5,000 „

(*ii*) **Crystal and ceramic pickups.**

For optimum results no additional resistors are required. The input loading on the pre-amplifier forces this type of pickup to give approximately the same frequency characteristic as moving-coil and variable-reluctance pickups. This type of pickup may be accompanied by recommendations that a high input impedance (1 megohm) should be used; these instructions must be disregarded as they apply only when you are using a pre-amplifier which does not incorporate record compensation.

12. OPERATING THE CONTROLS WHEN PLAYING RECORDS.

(*a*) The extreme left-hand control is the input selector, which gives you the choice of four playback characteristics. These are the inverse of the record maker's stated characteristics, and we would warn you that the importance of this detail has often been over-emphasized. The recording characteristic does not take into account the acoustics of the recording studio, the position of the microphone relative to the artistes, your pickup, your loudspeaker system, the acoustics of your rooms and your particular ears! In other words, the playback characteristic is of use only as an approximation and it may well be necessary to adjust the final result by using the controls marked "BASS" and "TREBLE"; this is the reason for their presence.

You are advised to play records as follows:—

78 r.p.m. Records.

OLD EUROPEAN (prior to 1955). Switch to "78OE". Set "BASS" and "TREBLE" to "FLAT". Adjust "VOLUME" to your liking. Re-adjust "BASS" and "TREBLE" to your liking, and also try the "FILTER" and "SLOPE" facilities (see 12b below) to see if you prefer the results.

NEW EUROPEAN (1955 onwards). Switch to "78NE" (British Standard 1928/55 for Coarse Groove records) and proceed as above. (This is also the same characteristic as U.S. Columbia 'LP').

AMERICAN (prior to 1955). Switch to "NARTB" and proceed as above.
(1955 onwards). Switch to "RIAA" and proceed as above.

33⅓ and 45 r.p.m. Records.
Prior to 1955. Switch to either " NARTB " or " 78NE " and proceed as above.
(You will notice that " NARTB " gives more bass than " 78NE "). However, you may well find you prefer some of these older records when switched to " RIAA " ; if so, play them that way.
1955 onwards. Switch to " RIAA" (British Standard 1928/55 for Fine Groove Records) and proceed as above. (This is now an internationally agreed standard, but remembering the factors not taken into account, (see 12a above), you will find that records cut to this standard will vary between themselves ; therefore, use the " BASS " and " TREBLE " controls to please your ear).

(*b*) The " FILTER " knob can be used to give very comprehensive control of the treble frequencies. When the control is turned to "9" a filter is switched into circuit, the turnover frequency being 9 kc/s (i.e., the frequency at which the response falls 3db). Other turnover frequencies of 6kc/s and 4kc/s may also be obtained by setting the " FILTER " knob to "6" or "4" respectively. The " SLOPE " control varies the rate of attenuation above the turnover frequency from 5db per octave (fully clockwise) to 25db per octave (fully anti-clockwise). The " TREBLE " control is also operative at the same time, and it can be seen that all these three controls give increasing high frequency attenuation as they are turned anti-clockwise. These controls are very useful when reproducing music in which there is high distortion at high frequencies, making it possible to remove much of the offensiveness whilst losing a minimum of the musical content.
The " SLOPE " control is inoperative when the " FILTER " is at " OFF ".

SPECIAL NOTE
With our previous Varislope pre-amplifiers a number of users reported that the filter "does not work" on the 9kc/s and 6kc/s positions. In **every case** on our checking the pre-amplifier it was faultless.
The explanation must be that either the high frequencies were not being reproduced due to inadequate complementary equipment, i.e., pickups, loudspeakers, etc., and/or the particular listener could not hear large changes of intensity at high frequencies.

(*c*) **" BASS " CONTROL**
Consumer opinion in some countries insists on a magnitude of available bass boost which, if used at maximum can only result in a travesty of the original music. We have provided you with an availability of bass boost which you certainly should not need if your pickup and loudspeaker are moderately good. It is not possible to obtain **true** bass from small loudspeaker systems by turning the "BASS" control to maximum, though an intermediate setting may be helpful, particularly when listening at low intensity levels (as in an apartment late at night).

(*d*) **" RUMBLE "**
This control appears on the front panel : " IN " indicates that you have the maximum level of rumble communicated from the motor to the pickup stylus ; " CUT " indicates that the rumble level is cut down (as also is the bass musical content of the record). The turnover frequency is 70c/s (see 11e [iv]).

13. NOTES ON THE CHOICE AND PERFORMANCE OF STEREO PICKUPS.

(*a*) **Pickup Arms.**
An arm should be as light and as rigid as possible with the lowest possible friction in the pivot. A heavy arm will be necessary with a pickup cartridge (head) which is inferior in respect of its bass-resonance frequency being initially too high. Ideally, an arm and cartridge should be designed conjunctively ; it is not possible to specify the performance of one without the other.

(*b*) **The Stylus.**
We most emphatically recommend *only* diamond. The initial cost will be greater, but the long term cost is much less, for diamond will last 100 times longer than the next best material, sapphire. Furthermore, because diamond does not chip and retains its contour, it is less likely to damage expensive records.

(*c*) **Pickup Cartridges for Stereo.**
There are presently four basic types :

(1) **Moving Magnet.** At the present time we believe that this type gives the best results. The magnet can have a smaller mass than the two moving coils of the moving coil type described below. Furthermore, as the coils in the moving magnet system are stationary their mass is of no importance ; they can therefore consist of many turns and a shielded step-up transformer is not needed.

(2) **Moving Coil or Dynamic.** Ideally, the moving coils should be wound on a non-magnetic former. A low impedance coil together with a shielded transformer is essential for the best signal/hiss ratio. (See Para 9 and 10).

(3) **Variable-reluctance (magnetic, moving-iron).** These are the most widely used type, being cheap to manufacture, robust and capable of good results when well designed. Their limitations stem from the inherent nature of the device, which is a producer of odd-order (mainly 3rd) harmonics.

(4) **Crystal and Ceramic types.** These are the cheapest, and because the output is high, the hum and hiss levels can be extremely low. However, to date these types give lower fidelity than the moving magnet, moving coil or variable-reluctance types of pickup.

14. GRAMOPHONE (PHONOGRAPH) MOTORS OR TURNTABLES.

The main trouble with cheaper turntables and record changers is vibration, which is transmitted to the pickup stylus and appears in the sound output as a low-pitched " rumble ". This " rumble " will be more obtrusive when reproducing from stereo records because a stereo pickup is sensitive to vertical vibrations. Expensive transcription turntables are relatively free from " rumble " because they are more precisely engineered than mass-produced units.

15. CONNECTING STEREO TAPE HEADS.

Tape heads can be connected directly to the " VARISLOPE STEREO " " TAPE HEAD " input sockets for the *reproduction* of tapes. For recording purposes it is necessary for you to have a bias and erase oscillator and recording amplifier.

Each coil of a high impedance stereo tape head should be connected via a screened co-axial cable to the co-axial plugs fitting the sockets marked " TAPE HEAD ". When using low impedance stereo tape heads it is, of course, necessary to use matching transformers, the secondaries of which should be connected via screened co-axial cables to the sockets marked " TAPE HEAD ".

The screening of the co-axial cables should not touch the metal parts of the deck if minimum hum levels are to be obtained. The deck and motors should be earthed to the third pin on the removable plug portion of the "A.C. POWER " connectors on the Leak power amplifier.

16. CONNECTING MONAURAL TUNERS, MONAURAL PICKUPS AND MONAURAL TAPE HEADS.

These input devices may be connected via a screened co-axial cable to either the right or left-hand socket of the appropriate input. The unwanted channel can then be muted by full rotation of the " BALANCE " control. If, however, monaural reproduction is required through both channels then the " FUNCTION " switch should be turned to 'R' or 'L' when the appropriate input socket will feed both channels simultaneously. When a tuner is used a separate earth (ground) connection should NOT be made to the tuner as this will be effected by the screening of the co-axial input cable.

17. CONNECTING TAPE RECORDERS AND/OR REPRODUCERS.

In general, any normally designed tape system may be connected, using the shortest possible lengths of screened wire to the co-axial sockets marked " EXTRA" on the rear of the ''VARISLOPE STEREO " pre-amplifier for replay purposes, or to the sockets marked " RECORD " for recording purposes.

The following points should be noted :—

(*a*) The input switch should be set to " EXTRA " for replay purposes. For recording purposes the input switch should be turned to the input from which it is desired to record.

(*b*) The input impedance of the recorder, when recording, should be at least 100,000 ohms.

(*c*) An earth (ground) connection should not be made to the tape recorder, as this may cause an ' earth loop ' and hum. The recorder will automatically be earthed through the pre-amplifier and Leak power amplifier.

(*d*) When recording it may be desired to monitor the signals going to the recorder using the loudspeakers connected to the Leak stereo power amplifier. The volume control in the pre-amplifier can be used, without affecting the level of recording.

(*e*) The tone and balance controls, rumble, filter, function and input switches are operative when recording or replaying.

18. CONNECTION OF MICROPHONES.

Any dynamic (moving-coil or ribbon) microphones, together with their associated grid-matching transformers, may be plugged into the sockets marked " MICROPHONE ". For stereo operation you must follow the maker's recommendations on the positioning of the microphones.

Sensitivities for 125mV output (sufficient to give full output from any Leak power amplifier) at 1,000 c/s.

	HI	LO
Pickup 1. Input Impedance	3·5mV 50k ohm	35mV 100k ohm
Pickup 2. Input Impedance	3·5mV 50k ohm	350mV 100k ohm
Tuner Input Impedance	50mV 100k ohm	250mV 600k ohm
Extra Input Impedance	50mV 100k ohm	1V 2M ohm
Microphone Input Impedance	2mV 120k ohm	
Tape Head (CCIR) Input Impedance	3mV 120k ohm	

Bass Control : ± 14db at 50/s.

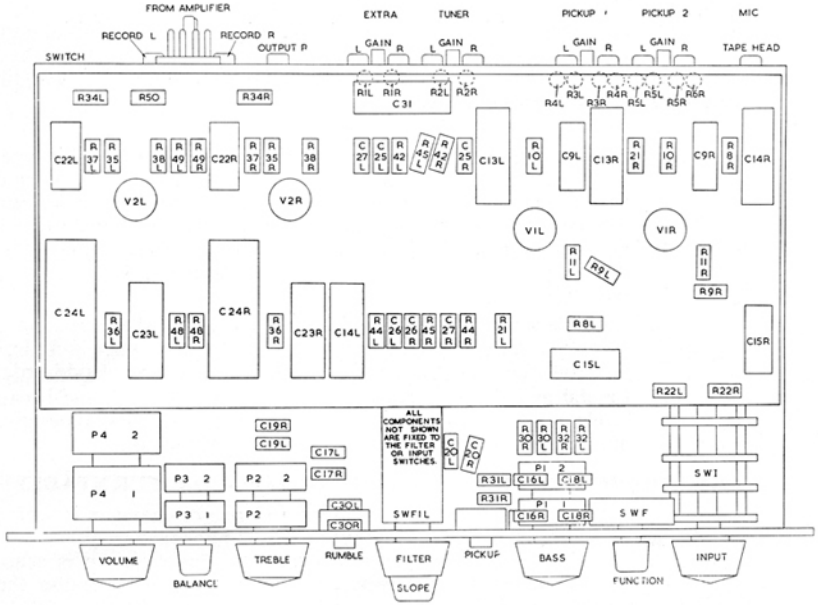
Treble Control : ± 14 db at 20 kc/s.

Distortion :

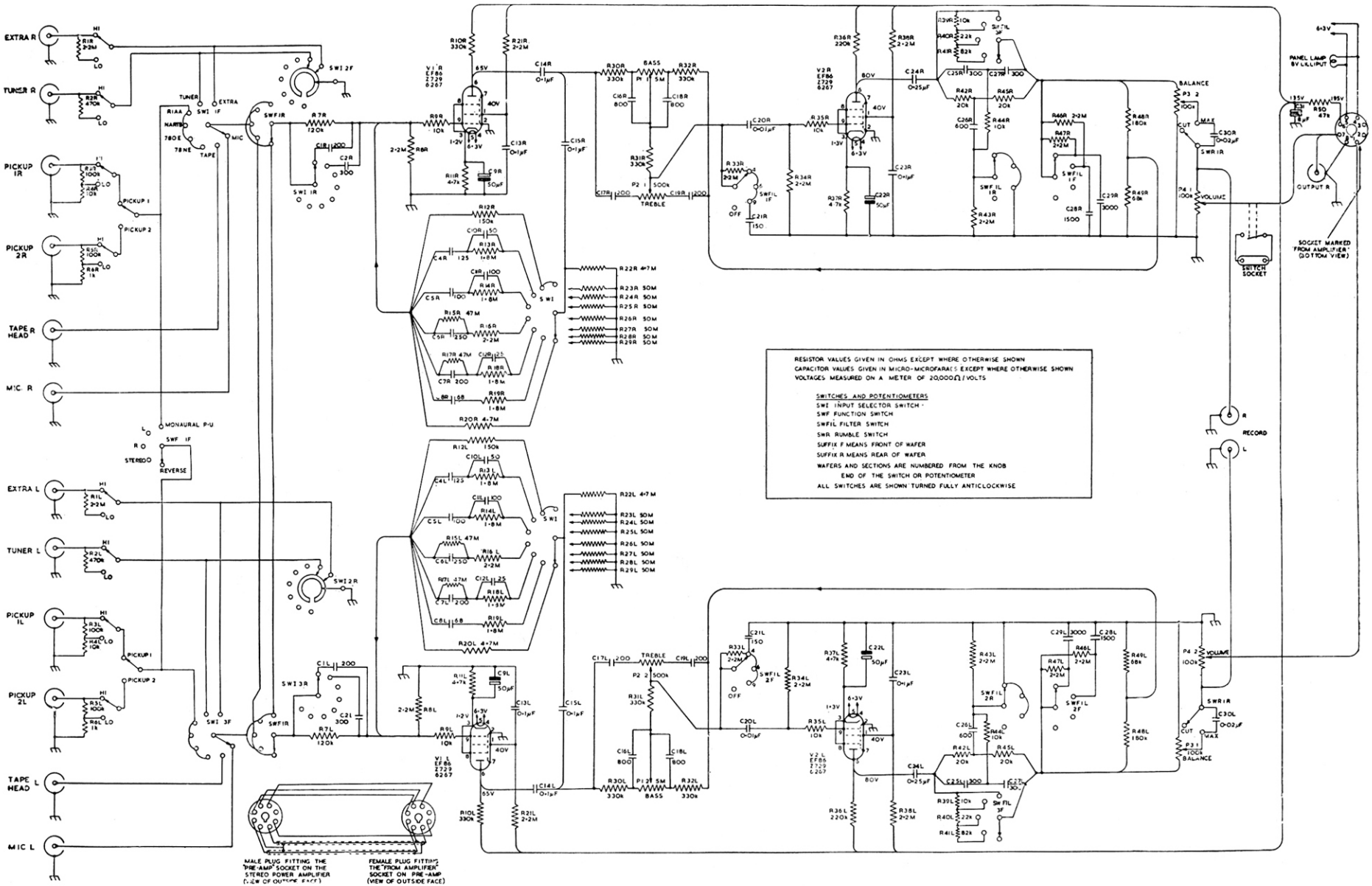
Less than 0·01% for 125mV output.

Hum and Noise :

When plugged into any Leak power amplifier approximately 60db below full power output on Tuner and Extra, and 52db below on other inputs.



CHASSIS LAYOUT



CIRCUIT DIAGRAM

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