

“VARISLOPE III” PRE-AMPLIFIER

INSTALLATION, OPERATION and MAINTENANCE

NOTES ON ASSOCIATED APPARATUS

* * *

The Varislope III pre-amplifier is designed for use specifically with Leak power amplifiers TL/12 Plus, TL/25 Plus and TL/50. It will also operate perfectly with any previous Leak power amplifier, though the facility of a socket for picking up heater and anode supplies for a tuner will not be available unless an additional octal socket is fitted to the power amplifier. Instructions for carrying out this modification will be sent on request.

CONNECTING THE VARISLOPE III 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. \times 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 on the front plate of the pre-amplifier from slipping on the panel.
2. A multiple cable of 4 ft. (1.22 metres) is supplied for connecting the Varislope III to the Leak power amplifier. The male plug on this cable fits the socket on the power amplifier marked “PRE-AMP.” The female plug on the cable fits the male socket on the Varislope III 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 III, a switch is incorporated in the “VOLUME” control. To make use of this facility a 2-core flexible cable is supplied with the Varislope III: one end of the cable is fitted with a plug which inserts into the socket marked “SWITCH” on the rear of the Varislope III: the other end of the cable must be passed through the rubber grommet marked SWITCH CABLE at the rear of the associated Leak power amplifier, knotted behind the grommet, and the two bared ends connected to the terminals marked “SWITCH” situated underneath the mains transformer. If excessive hum is experienced, particularly with the Leak 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. We strongly deprecate **NOT** earthing the power amplifier.

4. THE CONNECTION OF PICKUPS

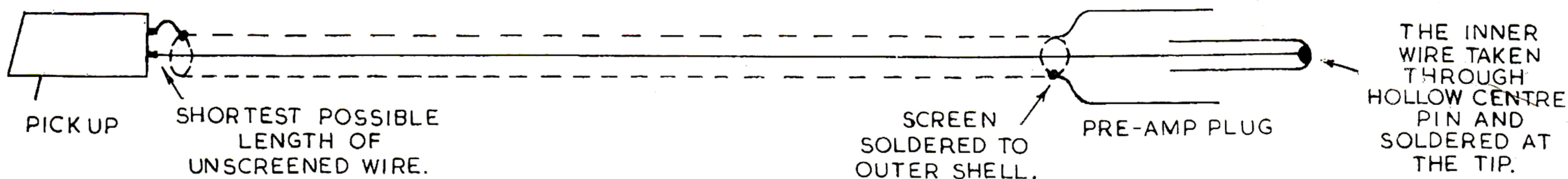
Two pickups can be connected to the co-axial sockets marked “PICKUP 1” and “PICKUP 2” at the rear of the Varislope III. Below these sockets are the associated input volume controls. On the front panel is the 2-way selector switch marked “PICKUP.”

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 the optimum results from the pickup of your choice. Please follow our instructions very carefully, even if they appear to conflict with other advice.

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:—

- (a) 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.
- (b) No pickup is perfect and the majority have performances **very much** below those which are attainable.
- (c) 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.
- (d) “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.
- (e) 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.

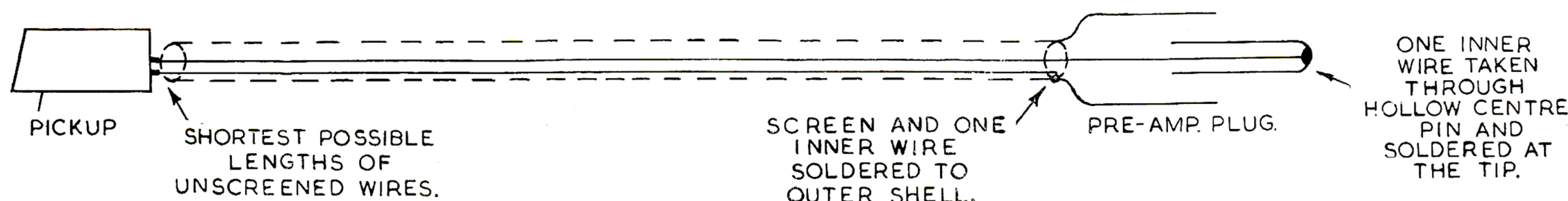
(f) **Connecting pickups having a single wire within a screen.**



If hum is to be kept to a minimum the outer screening should either have an insulated covering, or it should be prevented from touching any metal on the motor, motor-board 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 \perp terminal on the Leak power amplifier. If the "tone-arm" is of 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.

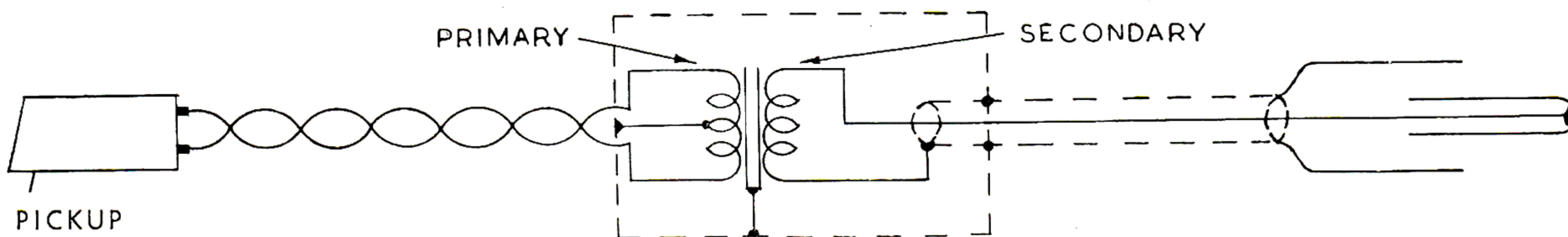
Unfortunately, some record-players and record-changers are wired as shown above, the screen then being connected to the body of the motor mounting-plate. This is bad practice on the part of the makers, and is very likely to cause hum, particularly when using a low output pickup. If you have this type of wiring, you are most strongly urged to replace it with the system (g) below.

(g) **Connecting pickups having two wires within a screen.**



Again, as in (f) above, the outer screen should either have an insulated covering, or it should be prevented from touching the motor, motor-board or anywhere else. If, however, the screening does touch, then hum is less likely to be caused than by using the single-wire system of (f).

(h) **Connecting low impedance pickups using a transformer.**



NOTE WELL.

The transformer **must** be enclosed in a screening can of high-permeability metal, i.e., mu-metal or permendur. The primary winding **must** be balanced, the centre-tap being taken to the chassis.

The primary terminals are to be as small as possible and to be as close together as is practiceable, in order to obviate a loop in the wiring. The primary leads to be tightly twisted for the same reason. The "live" secondary terminal to be screened and to be as small as possible. Ideally **all** terminals should be inside the can. The above precautions are not yet universally followed, though they have been standard practice on Leak pickups for ten years. These precautions are **essential** if the lowest hum level is desired.

(i) **Hum.**

The Varislope III pre-amplifier has an extraordinarily low hum level, which can be checked by removing the pickup plug and turning up the "VOLUME" control. The connection of any input device to the pickup socket will lower the input impedance and should, therefore, reduce the hum level. If the hum level increases on connecting the pickup, the cause of the hum must lie outside the pre-amplifier, and our instructions on the choice and connection of pickups should be carefully read in an attempt to locate the cause of the hum.

Hiss.

With the input control switched to a pickup position 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 day, and it is inherent in high-gain vacuum tube amplifiers.

It is a fact that with the highest quality pickups (moving-coil types used with a transformer) the "VOLUME" control will not need to be anywhere near the maximum position, and therefore the hiss will be unobtrusive; but with competitively-priced variable-reluctance (moving-iron) pickups the output will be so low, for reasons explained later (see 6c (2), p.5), that hiss will be more noticeable. This is the price that the user has to pay in return for a modest outlay with reasonably good results!

(j) **Connecting specific makes of pickups.**

Some pickup manufacturers state a value of resistor to be placed across their pickups. Please do not take this information literally when connecting pickups to the Varislope III pre-amplifier. In general, the fitting of a resistor across the pickup will lower the high frequency response from magnetic (variable-reluctance, moving-iron) pickups, and will lower the bass response from crystal and ceramic pickups. Any external resistor will tend to pick up hum voltages, so it must be small ($\frac{1}{4}$ -watt rating) and, if possible, be screened.

Type of pickup	Suggested load resistor in ohms to be placed across the pickup	How to set input volume control (back-of-pre-amplifier) and main volume control (on front panel)
Dynamic, (moving-coil)		
Leak (non-magnetic core) with transformer	None	Turn input control to maximum (fully clockwise). Adjust "VOLUME" as desired.
Garrard (non-magnetic core) with transformer	None	As above
Ortofon (Danish) and ESL (U.S.A.) (magnetic cores) with 211 transformer ...	None	As above
Fairchild 225 (magnetic core) without transformer	None	As above
Fairchild 225 with 235 transformer (transformer is strongly recommended if a low hiss/signal ratio is desired)	None	As above
Variable-reluctance (moving-iron)		
General Electric	47,000	As above
Pickering Flux-valve	47,000	As above
Goldring types 500 and 600	100,000	As above
Connoisseur Super lightweight Mark II ...	10,000	As above
Tannoy	47,000	As above
Crystal and ceramic		
Acos HGP39/1	None, but if more bass is desired insert 100,000 ohms in series with "live" lead.	Turn "VOLUME" control to 5 ; adjust input control as desired.
Collaro Studio 'P' and Transcription, and all similar types		

5. **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 room 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 5b below) to see if you prefer the results.

EUROPEAN (1955 onwards). Switch to "LP" (which is the same as British Standard 1928/55 for Coarse Groove records) and proceed as above.

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

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

33½ and 45 r.p.m. Records.

Prior to 1955. Switch to either "NARTB" or "LP" and proceed as above.

(You will notice that "NARTB" gives more bass than "LP"). 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" and proceed as above. (This is now an internationally agreed standard, but remembering the factors not taken into account, (see 5a 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 9kc/s (i.e., the frequency at which the response falls 3db). Other turnover frequencies of 6kc/s and 4kc/s are also obtainable. The "SLOPE" control varies the rate of attenuation above the turnover frequency from 5db per octave (fully clockwise) to 35db 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 also 4d, page 1, and 7, page 5).

6. NOTES ON THE CHOICE AND PERFORMANCE OF 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. We do not recommend viscous damping of an arm. Ideally, an arm and cartridge should be designed conjunctively, as in the Leak "Dynamic" pickup: 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.

Generalising, one can place the three types of pickup generators in order of merit (this being also the order of cost):

- (1) **Moving-coil or Dynamic.** The best pickups in the world are of this type. Ideally the moving-coil should be wound on a non-magnetic former. A shielded transformer will be essential for the best signal/hiss ratio. (See 4h and 4i, page 2).

(2) 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. To reduce this distortion the designer **must** employ a large air gap and/or a weak flux; this perforce makes an insensitive pickup, and in an attempt to rectify this weakness many turns of wire must be used on the coil. This, in turn, leads to two troubles: (1) a relatively high ratio of induced hum (as compared with moving-coil types) and (2) a high-frequency electrical resonance between the relatively high-inductance coil and the capacitance of the shielded cable joining it to the pre-amplifier. This is the resonance which the makers hope to flatten out when telling you to place a certain value of resistor across their pickup. Unfortunately, the magnitude and peak frequency of the resonance will vary according to the capacitance and length of the input cable, which you must keep as small as possible. Also, unfortunately, the added resistor will lower the overall output from the pickup, and the signal will require more amplification, giving a greater proportion of valve (tube) hiss as a background. Summing up, the best variable-reluctance pickups will give more distortion, more hum and more hiss in the output than the best moving-coil.

(3) Crystal types.

These are the cheapest. Some European types can give very pleasing results, and because the output is high the hum and hiss levels can be extremely low.

7. GRAMOPHONE (PHONOGRAPH) MOTORS OR TURNTABLES

The main trouble with the cheaper turntables and with record changers is vibration, which is transmitted to the pickup stylus and appears in the sound output as a low-pitched "rumble". Expensive transcription turntables are relatively free from "rumble" because they are more precisely engineered than mass-produced units. Broadly speaking, you will get what you pay for.

8. THE CONNECTION OF RADIO TUNERS

The output of the tuner must be connected to the co-axial socket marked "TUNER" on the rear of the Varislope III. A separate earth (ground) connection should **NOT** be made to the tuner. Most British tuner units require an external source for heater and anode currents; these can be drawn from the associated Leak TL/12 Plus amplifier. Details are given on the TL/12 Plus installation leaflet.

9. THE CHOICE OF RADIO TUNERS

It is not possible to obtain very high quality from the signals broadcast by medium-wave and long-wave amplitude-modulated (A.M.) transmitters. At their very best, the signals from such stations will not approach the quality obtainable from a good L.P. record with a first-class pickup.

On the other hand, the quality from short-wave frequency-modulated (F.M.) transmitters is better than the best record, provided that the programme is "live" and that good land-lines are used between studio and transmitter, and provided that a first-class F.M. tuner is used.

10. CONNECTING TAPE RECORDERS AND/OR REPRODUCERS

Special Note.—It is **NOT** possible to operate directly from so-called tape "decks". It is essential that the tape system is complete, i.e., with built-in low level amplifiers.

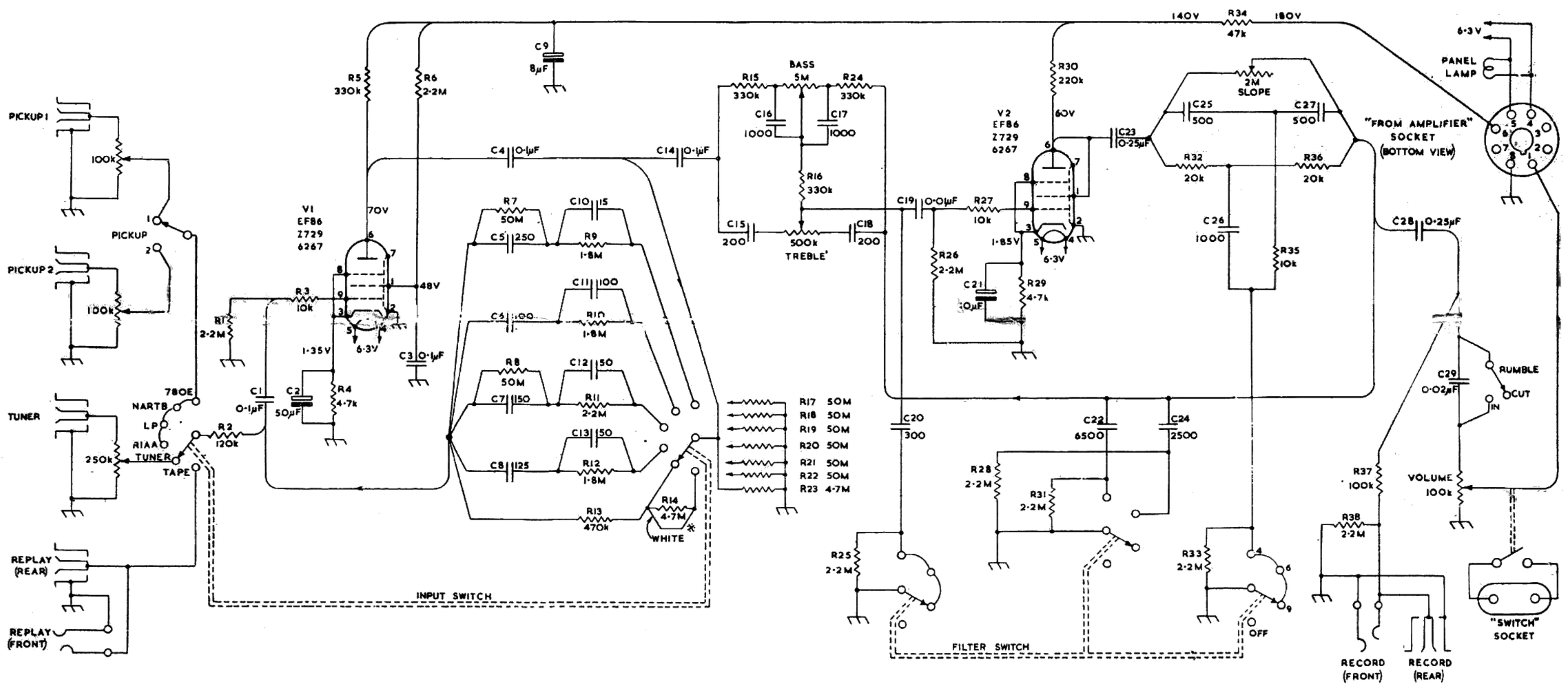
In general, any normally designed tape system may be connected, using the shortest possible lengths of screened wire, either to the jack sockets on the front panel or to the co-axial sockets on the rear of the Varislope III.

The following points should be noted:—

- (a) The output impedance of the tape recorder may be of any value up to 50,000 ohms.
- (b) The input impedance presented by the Varislope III pre-amplifier, in the "TAPE" position, is approximately 200,000 ohms.
- (c) The input impedance of the recorder, when recording, should preferably be at least 100,000 ohms.
- (d) 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.
- (e) When recording it may be desired to monitor the signal going to the recorder using the loudspeaker connected to the Leak power amplifier. The volume control in the pre-amplifier can be used, without affecting the level of recording.

11. CONNECTION OF MICROPHONES

Any dynamic (moving-coil) or ribbon microphone, together with its associated grid-matching transformer, may be plugged into either of the sockets marked "REPLAY" on front and back panels. The gain of the pre-amplifier will need to be raised and this can easily be done by cutting the only white wire used on the input switch (see circuit diagram and chassis lay-out). The input control must, of course, be switched to "TAPE," and any replay connection to a tape mechanism must be withdrawn from the pre-amplifier.



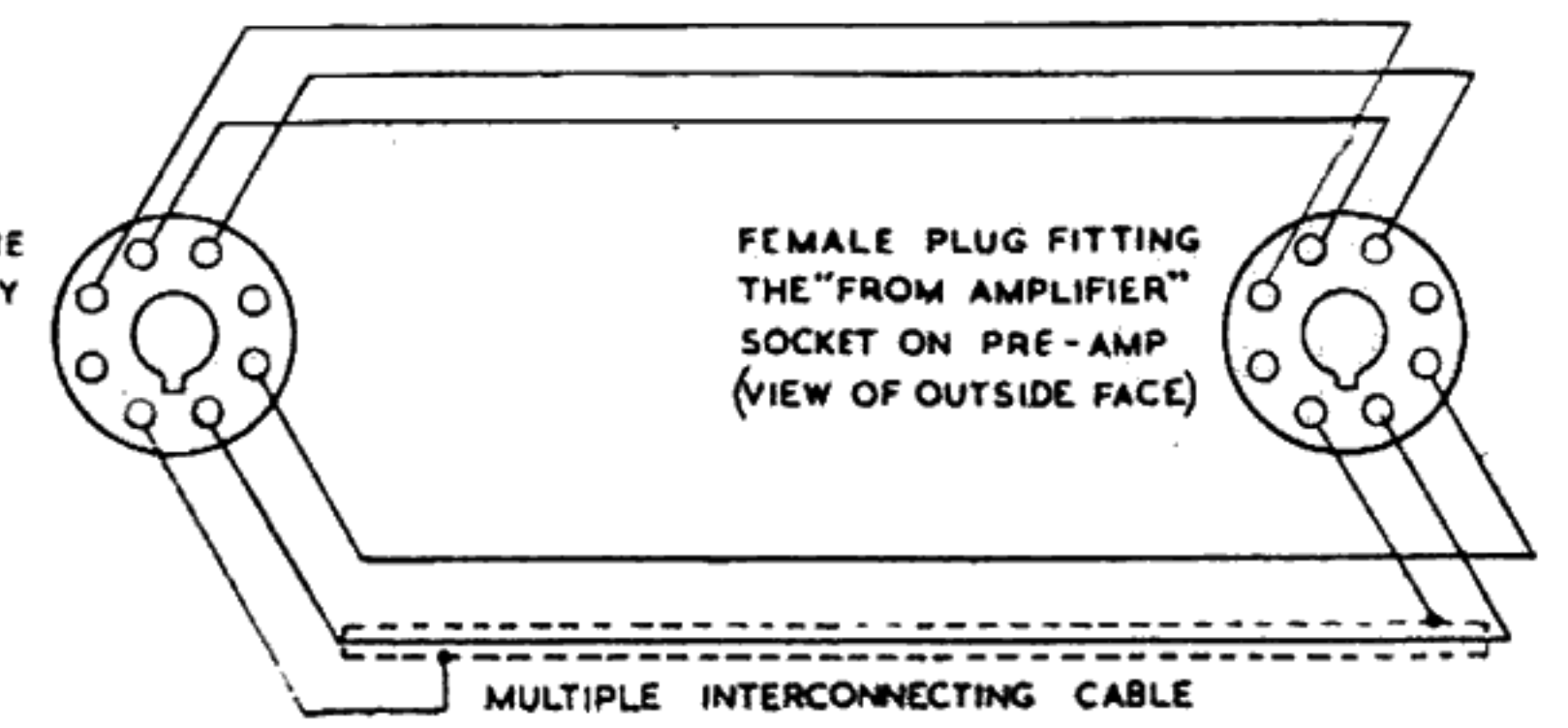
RESISTOR VALUES SHOWN IN OHMS
CAPACITOR VALUES SHOWN IN MICRO-MICROFARADS
EXCEPT WHERE OTHERWISE SHOWN
VOLTAGES MEASURED ON A METER OF 20000 Ω /VOLT

* TO INCREASE THE SENSITIVITY OF THE TAPE REPLAY
INPUT FOR MICROPHONE OPERATION,
CUT THE WHITE LEAD ON THE INPUT SWITCH.

MALE PLUG FITTING THE
"PRE-AMP" SOCKET ON ANY
"LEAK" POWER AMPLIFIER
(VIEW OF OUTSIDE FACE)

FEMALE PLUG FITTING
THE "FROM AMPLIFIER"
SOCKET ON PRE-AMP
(VIEW OF OUTSIDE FACE)

CIRCUIT DIAGRAM



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

Pickup 1 or Pickup 2
Input impedance 9.5mV
70k-100k ohm

Tuner
Input impedance 50mV
125k-200k ohm

Tape
Input impedance 50mV
200k ohm

Microphone (see 11 p.5)
Input impedance 4mV
250k ohm

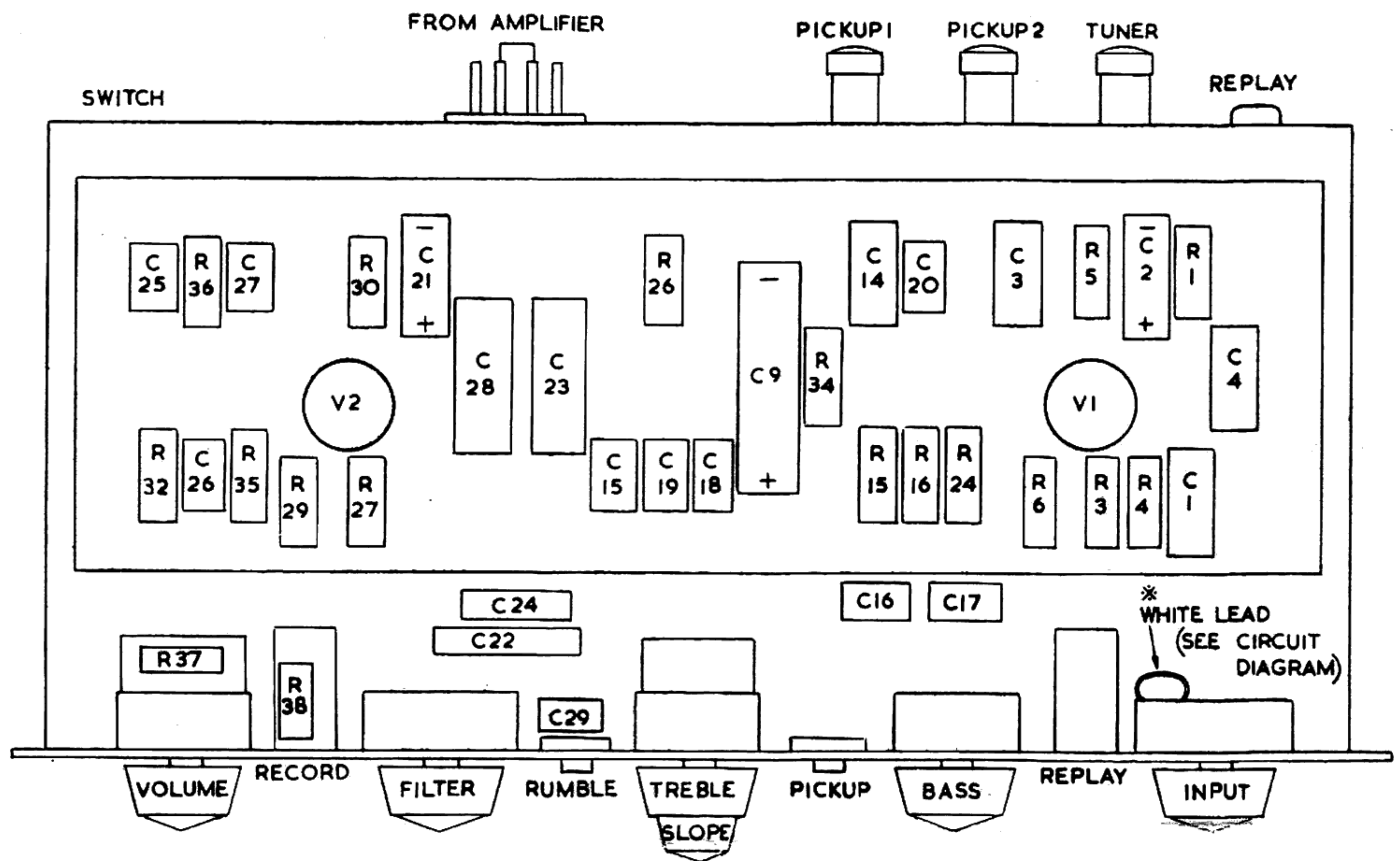
Bass Control : ± 16 db at 30c/s.

Treble Control : ± 18 db at 20kc/s.

Distortion :
Less than 0.01% for 125mV output.

Hum and Noise :

when plugged into any Leak power amplifier approximately 66db below full power output on Radio and Tape, and 60db below on other inputs.



CHASSIS LAYOUT, BOTTOM COVER REMOVED

H. J. LEAK & CO. LTD.
BRUNEL ROAD, WESTWAY FACTORY ESTATE
LONDON, W.3

Telephone:
SHEpherds Bush 1173/4/5

Telegrams:
Inland: Sinusoidal, Ealux, London
Foreign: Sinusoidal, London