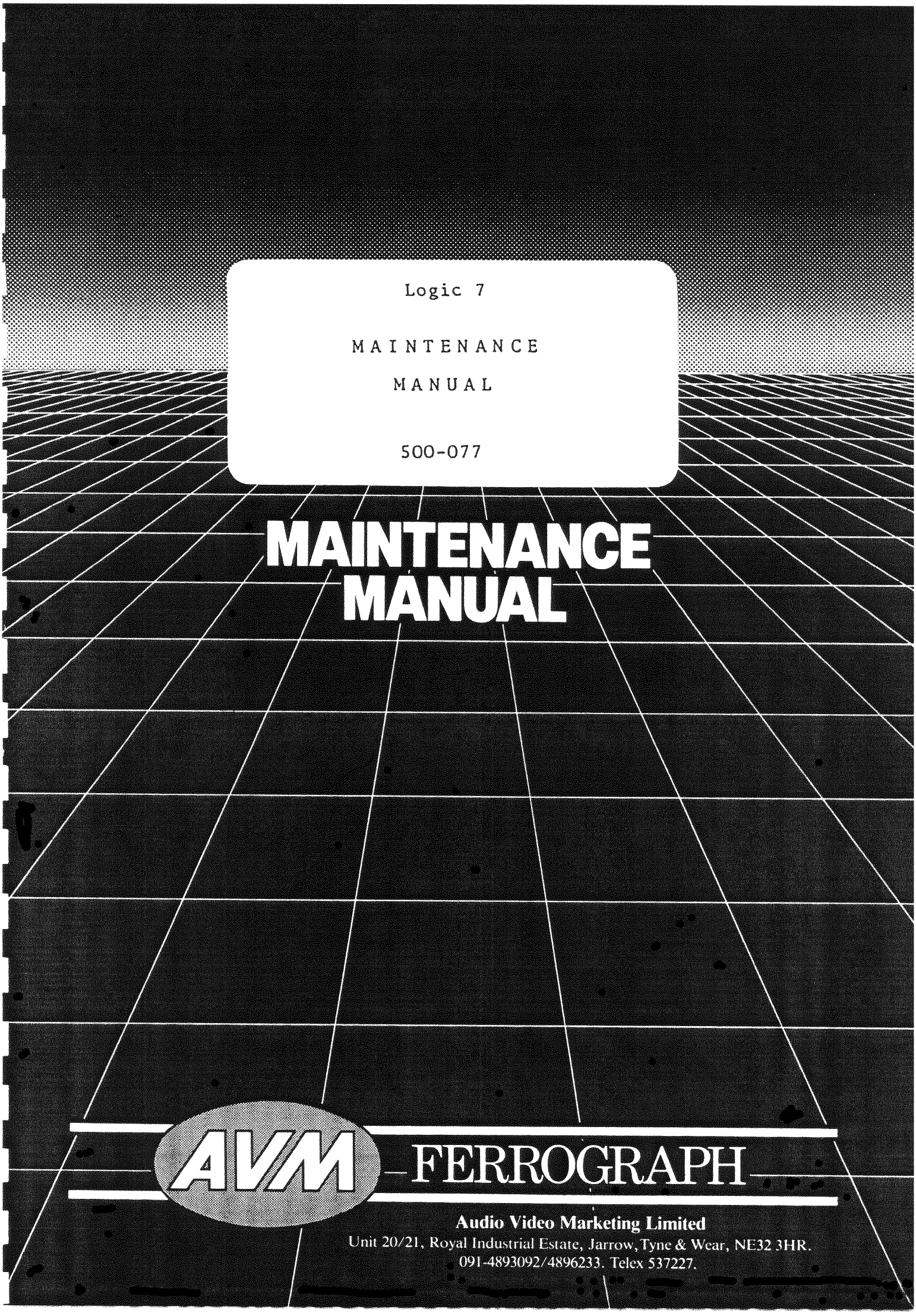

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Errata & Amendments

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31	Fig. 4	Head Alignment (Track Dispositions)	
	Fig. 5	Head Wiring	
56	Item 15	Loading Arm Leaf Spring	714-022
	30A	Pinch Roller	025-112
	30B	Bracket Assy.	022-534
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GENERAL SPECIFICATION

Recording Medium

Magnetic tape ¼in (6.3mm) wide, on reels of up to 10½in (270mm) diameter.

Track Width

½ track - .090in (2.3mm); ¼ track - .043in (1.1mm).

Head Gap Width

Record head - 250µin (6.3µ); Replay head - 80µin (2µ).

Operating Tape Speeds

Three (3): 15, 7½, 3¾in/s (38, 19, 9.5cm/s)

Tape Speed Accuracy

Better than ± 1% (at specified frequency).

Playing Time per Track

3,600 ft (1,080m) of tape - 1hr 36min at 7½in/s (19cm/s)
3hr 12min at 3¾in/s (9.5cm/s)

Fast Wind Time

Continuously variable in either direction;
at fast speed approx. 2min for 1,800ft (540m) of tape,
approx. 3min for 3,600ft (1,080m) of tape.

"Wow" and "Flutter"

Less than 0.08% at 15in/s (38cm/s)
0.10% at 7½in/s (19cm/s)
0.17% at 3¾in/s (9.5cm/s)

Frequency Response

Record-Replay

15in/s	(38cm/s)	: 30-20,000Hz ± 2dB
7½in/s	(19cm/s)	: 30-17,000Hz ± 2dB
3¾in/s	(9.5cm/s)	: 40-14,000Hz ± 3dB

Replay Characteristic - D.I.N.

15in/s	(38cm/s)	: 35µ sec
7½in/s	(19cm/s)	: 50/3180µ sec
3¾in/s	(9.5cm/s)	: 90/3180µ sec

Maximum Output (per channel)*

10 Watts R.M.S. into 8-16Ω loudspeaker

Amplifier Distortion

Less than 0.25% R.M.S. at all levels up to 10 Watts.

GENERAL SPECIFICATION - continued

Signal to Noise Ratio (½ track, Dolby out)

Unweighted, including hum, better than 60dB - ref. 2% distortion.

Channel Separation

Stereo operation - approx. 50dB;
Mono operation - better than 65dB at 1,000Hz.

Bass Control

Continuously variable; typically up to ± 15dB at 50Hz,
± 20dB at 20Hz

Treble Control

Continuously variable; typically up to ± 10dB at 10kHz
± 15dB at 20kHz

Internal Loudspeakers*

Two (2) - elliptical 7in x 4in (18cm x 10cm).

Input Level (for full depth recording)

Microphone : 200µV-50mV, Recommended Source ; 200-1000Ω
Line : 50mV-7V at 2MΩ, Recommended Source; any impedance.

Outputs (from full depth recording)

600Ω : 2V at 600Ω
Low Level : 300mV into 10KΩ or greater.
Loudspeaker : up to 10 Watts R.M.S. into 8-16Ω *
Phones : suitable for headphones of approx. 8-600Ω

Meters

Two, 65 x 40mm (2½ x 1½in): approximately VU characteristic.
full depth recording (320nWb/m) : +4 VU continuous tone, 0 VU music.

Power Supply

200-250V, 50Hz; Suffix A : 117V, 60Hz

Power Consumption

100 Watts approximately.

Overall Dimensions (with lid)

(20¼in wide x 17½in x 10in)
515mm wide x 445mm x 255mm

Weight

26kgm (58lbs).

* Not applicable to Models 7602/7604

1. TECHNICAL DESCRIPTION

Similar to earlier Ferrographs, the Logic 7 recorder is designed in three main sections - deck, amplifier and power unit - interconnected by plugs and sockets for ease of servicing. The deck comprises the mechanics for the tape transport together with the logic switching, tape heads, etc., the component parts being mounted on an aluminium plate which is resiliently mounted on the main frame to form the body of the recorder. The other two sections are also mounted onto the main frame; the amplifier including all the pre-amplifiers and amplifiers, record oscillator, gain controls, etc., and the power unit including the mains supply transformer, smoothed power supplies, rear panel with input and output sockets, and (when fitted) the two 10 Watt loudspeaker power amplifiers.

1.1 Mechanical Section

The basic and most important feature of the tape deck is that the functions of the tape transport mechanism are logic controlled via electro-magnetic actuators which operate with the deck horizontal or vertical. The push button controls are connected to the Remote socket at the rear so that all these main functions can be controlled remotely.

1.1.1. Tape Transport

The tape transport system utilises three motors; a capstan motor and two reel motors. The capstan motor, X100, is resiliently mounted below the deck plate on neoprene shock mounts to minimise mechanical noise and uses grease packed ballraces seated in neoprene mounts for greater reliability and long life. It is a split phase capacity type induction motor which after reaching its synchronous speed is insensitive to small changes of applied voltage or load and hence its speed is controlled only by the frequency of the mains power supply. It runs anticlockwise viewed from the top of its spindle on which is mounted a stepped pulley with sand-blasted finish for reliable traction.

The two reel motors, Supply X101 and Take-up X102, are identical capacitor start motors with a tagboard on top of the motor, the pins being linked as shown in Fig. 3 to give the appropriate rotation (clockwise-Supply, anticlockwise - Take-up) and voltage (240V or 117V models). The top of each reel motor frame carries the wrap type brakes which operate on the drum of the reel carrier mounted on the end of each motor spindle. The LH reel carrier also drives the motion sensor disc via a neoprene belt, the RH reel carrier driving the turns counter, again by a belt.

1.1.2. Operation

The Speed Change switch S104, linked by cable to the Equalisation switch S700 on the amplifier, carries a three position cam which moves the start lever to engage with one of three slider bars, each carrying an idler wheel. When the Start solenoid L100 is energised, the start armature actuates microswitch S102 which energises all three motors. Simultaneously the idler lever, spring loaded to maintain constant pressure, moves the selected idler wheel into engagement with the capstan motor pulley and flywheel, thus driving the flywheel/capstan assembly.

The heavy stepped flywheel is fixed to a stainless steel spindle, the top of which is precision ground and sandblasted to function as the capstan. Its lower bearing is a grease packed ballrace held in a special neoprene lined mount which is factory adjusted so that the capstan is precisely parallel (in all vertical planes) with the pinch roller spindle, and the sintered bronze self-lubricating upper bearing is supported by a special gimbal mounting.

On Pause the tape is maintained stationary by the brakes, although the two reel motors are energised (in series with R161/R162) across the mains power supply in opposite directions.

On Run the brake solenoid is energised releasing the brakes and simultaneously the Run solenoid is energised, moving the resilient pinch roller against the tape and thus gripping it against the capstan. As this is already rotating, the tape is driven immediately and reaches its correct speed virtually instantaneously. The tape is taken up by the RH reel motor and slight back tension is maintained on the tape by the LH reel motor on reduced power. On the 15 in/s tape speed only, as selected by the Speed Change switch S104, the relay RL160 shorts out the LH reel motor momentarily to give the take-up reel motor extra power to cope with the very fast tape start.

On Wind the capacitor start reel motors X101 and X102 are in series across the mains power supply and the Wind relay RL120 is energised connecting the Wind Control RV103 also across the supply. This wire-wound potentiometer (25W rating) has its slider connected to the junction of the two reel motors and by varying the position of the slider from one side to the other the power is divided unequally between the reels so that tape wind is achieved in either direction at fast or slow speeds.

On Rev the Rev relay RL125 reverses the Wind potentiometer connections and hence reverses the direction of wind (but not the speed). On releasing the Rev button the deck is left in the Wind condition with the original direction of wind.

On returning to Pause the Run and/or Brake solenoids are de-energised, when the brakes are re-applied to the drums on the underside of the reel carriers. They are arranged to be self-wrapping in order to have maximum effect on the reel from which the tape is issuing and very little on the reel onto which it is being wound. Thus, on being applied after fast winding, the brakes act equally well whatever the direction of tape travel, the amount of braking torque applied to each reel being adjusted by sliding a locking screw in a slot and thus braking balanced for optimum performance. The brakes are adjusted so that each brake band is clear of the drum when the brake solenoid is energised by moving a nut on the actuating rod and fixing it in position by the locking nut. Because the speed of wind is adjustable, sharp braking is unnecessary and the brakes are normally set to avoid over-spill in both directions without applying too great a strain on the tape, particularly the thinner types, and once set correctly no further adjustments should be needed.

On stopping and starting the tape, any snatch due to the inertia of the reels is minimised by two damped tape tensioning arms. The RH Auto stop arm automatically compensates for any slight delay in taking up the tape when the reel is full and the tape is kept in good contact with the heads by tape tension maintained by the LH damping arm which has a wide swing to cope with starting and stopping. Compensation for the different reel sizes (NAB or cine centred) is provided by S105 which shorts out R162 to increase the torque for larger spools.

The RH damping arm also acts as an automatic stop; should the tape tension fail between the capstan and take-up spool, the arm swings over and contacts the fixed pillar, energising the delay circuit TR124/TR123. After approximately 1 sec. the Stop relay RL124 is energised, completely shutting down the deck.

The turns counter, belt driven from the underside of the reel carrier, indicates the revolutions of the take-up reel. However, as the length of tape per revolution varies throughout the tape depending upon the amount of tape on the reel, the counter reading is not related linearly to time. The turns counter reading is returned to zero (usually at the beginning of a reel) by pressing the zero button adjacent to it.

The Motion Sensor is belt driven from the underside of the LH reel carrier and consists of a transparent disc radially marked with black lines which move between a photo sensor and light source. This produces a series of pulses while the tape is moving, which is used to charge C181 negatively. Transistors TR182 and TR181 are turned off and inhibit Run until the tape stops and the pulses cease, when TR182 and TR181 conduct and trigger TR120. Once the Run condition is reached, R183 prevents the Motion Sensor inhibiting action.

The three heads are mounted on a die-cast block which is held by four screws and which can be removed as a complete unit together with the LH damping arm and mumetal hum wing. The heads, from left to right Erase X103, Record X104, Replay X105, are each fitted rigidly on its own plate, the mountings being spring loaded on a central pivot (adjustable front and rear for head height) to give correct azimuth setting of the headgap by a single adjusting screw. Again for reliable performance the tape guides are individually adjusted to the correct height to maintain a straight tape path and ensure intimate contact of the tape with the head face. The record and erase head connections are via colour coded phono plugs at the rear of the amplifier, the replay head connections being directly to pins on the Replay Board.

1.1.3. Logic Section

The Logic Section is mounted on printed circuit boards on the tape deck and the operating relays are controlled by diode logic activated by the push button switches at the left of the control panel. These switches are single pole connected to zero volts and are momentary action, the relays having latching contacts to retain the function. The diode logic is arranged so that these push buttons operate and/or inhibit the various relays as explained below.

Deck Functions

Table 1 - showing energising path on pressing the designated button(s); relay latching path shown in (brackets).

PUSH BUTTON	WIND RELAY RL120	PAUSE RELAY RL121	RUN RELAY RL122	RECORD RELAY RL123	STOP RELAY RL124	REV RELAY RL125	START SOLENOID L100	RUN SOLENOID L101	BRAKE SOLENOID L102
STOP					R144 (does not latch)				
PAUSE		D126/D128 + R121/RL124b (D129/RL121b/ RL120a)					D148/ RL121b/ RL120a		
RUN		D127/D128 + R121/RL124b (D129/RL121b/ RL120a)	D138/D133/TR120 + R122/RL121c/ RL124b (D134/RL122c)				D148/ RL121b/ RL120a	D141/ RL122c	D151/ RL122c
WIND	D139/R120 (D120/RL124a/ RL120a/RL121b)						D149/ RL120a/ RL121b		D124/ RL120a/ RL121b
REV	D152/D130/R120 (D120/RL124a/ RL120a/RL121b)					Direct (does not latch)	D149/ RL120a/ RL121b		D124/ RL120a/ RL121b
PAUSE + RECORD		D126/D128 + R121/RL124b (D129/RL121b/ RL120a)		D126/TR122/D147/ D142/TR121+R123/ RL121c/RL124b (D143/RL123d)			D148/ RL121b/ RL120a		
RUN + RECORD		D127/D128/ + R121/RL124b/ (D129/RL121b/ RL120a)	D138/D133/ TR120+R122/ RL121c/RL124b (D134/RL122c)	D126/TR122/D147/ D142/TR121+R123/ RL121c/RL124b (D143/RL123d)			D148/ RL121b/ RL120a	D141/ RL122c	D151/ RL122c

Table 2 - Logic Mis-operation Consequences.

Pressing		*Gives*
Run	+ Pause	Pause
	+ Wind	Pause
	+ Rev	Pause
Pause	+ Run	Pause
	+ Wind	Pause
	+ Rev	Pause
Stop	+ any	Stop
Auto stop	+ Wind	Wind
	+ Rev	Rev
	+ any other	Stop
Run + Rec.	+ Wind	Pause + Rec.

1.1.4. Relay Functions

RL120 Wind relay	- switches power to the Wind control RV103 and energises the Brake and Start solenoids L102 and L100, the latter operating microswitch S102 which feeds power to all three motors.
RL121 Pause relay	- unshorts the torque resistors R161 and R162 and energises the Start solenoid L100 which operates micro-switch S102 feeding power to all three motors; it also connects dc to the Run and Record relays RL122 and RL123 and to the Run solenoid L101.
RL122 Run relay	- energises the Run and Brake solenoids L101 and L102 and removes the Wind muting from the replay signals (C125/ C126).
RL123 Record relay	- connects dc to the oscillator and disconnects the short-circuit from the record amplifier feed to each track of the record head.
RL124 Stop relay	- unlatches the Wind relay and dis-connects the dc supply to the Pause relay RL121 and hence to the Run and Record relays RL122 and RL123; it does not self-latch but is de-energised on releasing the Stop button or de-activating the auto stop.
RL125 Rev relay	- reverses the power supply connections to the Wind control RV103; it does not self-latch, but on releasing the Rev button the Wind relay RL120 remains latched while the Rev relay RL125 is released.
RL160 High Speed Start relay	- is momentarily energised by the charging current of C123 on pressing Run at 15 in/s.

1.1.5. Switch Functions

S101 On/off switch	- switches on the recorder.
S102 microswitch	- operated by the Start solenoid L100, feeding power to all three motors.
S103 microswitch	- also operated by the Start solenoid (after S102) to reduce the hold-on current through R100.

S104 Speed Change switch (wafer)	- selects the High Speed start at 15 in/s.
S105 Reel switch	- increases the reel motor torque for large diameter reels (NAB, 10½ in) by shorting resistor R162.
S106 microswitch	- operated by the Run solenoid L101 to reduce its hold-on current through R101 and energises the Run lamp; when the Aux. Skt. stop/start function is used, S106 energises the Brake solenoid L102 and the High Speed Start relay RL160.
S170-S176 push buttons	- comprise the seven deck controls for Stop, Rev, Wind, Pause, Run, Record, and Cancel respectively.
S177 Mute switch	- selects either normal muting or silencing completely of the Tape signal when not in Run.

1.1.6. Logic Functions

On pressing Pause, the Pause relay RL121 is energised via D126/D128 and self-latches via D129 and contacts of RL121/RL120, which also energise the Pause LED D2 and the Start solenoid L100 via D148. There is no inhibit circuit as Pause is the 'fail safe' condition for most improper commands but the Stop relay RL124 interrupts its power supply and the Wind relay RL120 breaks the latch path. Pause inhibits Wind via D123 and Run via D131. The Pause relay RL121 switches the power supply to the Record and Run relays RL123 & RL122 and to the Run solenoid L101.

On pressing Run, the Pause condition above is activated via D127 (if not already energised) and the memory circuit is energised via D138, charging C121 through R145. When the supply reel stops moving, the motion sensor circuit switches on TR120 producing a short-circuit and energising the Run relay RL122. This latches via D134 and energises the Run solenoid L101 via D141 and the Brake solenoid L102 via D151.

If Run is initiated by shorting pins 1 & 2 of the Aux. Skt., the Run solenoid is energised directly and the Brake solenoid via D140. On removing the short-circuit from the Aux. Skt. the Run solenoid is released, thus de-energising the Brake solenoid.

Run is inhibited by Wind via D130 or Pause via D131.

On pressing Record, the collector of TR122 is grounded and if the base is grounded simultaneously via D126 (Pause pressed) or via D127 (Run pressed), the emitter energises the Record relay RL123 through TR121 which is conducting on Pause and Run. The Record relay RL123 self-latches via D143 and the latching contacts also energise the Record LED D4 via R126 (Remote LED via R129).

Record is inhibited by the Motion Sensor via TR121 except on Run, and it is de-energised on pressing Cancel or when the Pause relay RL121 is released, thus disconnecting the supply via RL121c.

On pressing Wind, the Wind relay RL120 is energised via D139 and self-latches via D120, provided that the Stop relay RL124 is not energised (contacts RL124a) and the Pause relay is released (contacts RL121b). The self-latch contacts RL120a energise the Wind LED D1 via R127 (Remote LED via R124) and also the Start solenoid L100 via D149 and the Brake solenoid L102 via D124.

Wind is inhibited by Stop via D122, Pause via D123/D126 or Run via D123/D127.

If Wind is pressed while the memory circuit is active, memory capacitor C121 is discharged via D130.

On pressing Rev, the Wind relay RL120 is energised via D152 and also the Rev relay RL125, which reverses the connections to the ends of the Wind potentiometer RV103. The Rev relay RL125 does not latch (unlike the Wind relay RL120), the deck reverting to Wind when Rev is released.

1.2 Electronic Section

The electronics of the Ferrograph recorder is completely transistorised and accordingly it is constructed on printed circuit boards, the interconnecting wires being soldered to pins rigidly fitted to the boards. In the analysis of the circuitry which follows, each board is described separately although being two-channel models most boards are duplicated, one for each channel, and where alternative circuit references are quoted in brackets () these refer to the Lower Track.

The record and replay tape heads have been designed specifically to match their respective amplifiers both in impedance and gap dimension, and low noise transistors (pnp) are used in the critical replay pre-amplifier stages to give a noise level well below that produced by the tape itself.

1.2.1 Replay Board

The lead from the replay head X105 is pin connected directly to the board to avoid hum loops and the signal is passed via rf interference suppression components R300/C302/ C319 to the base of TR300. The output of this stage is further amplified by TR301 with negative feed back equalisation applied by R315-319 and C313-317 to provide the correct characteristic at each tape speed. The treble response is adjusted by C313, 315 or 316, while the extreme bass is set by R315 or R317 as selected by the equalisation switch S700. The signal is further amplified by TR302, and a phase-shift arrangement of C311 with C305, 306 or 307 (again depending upon the tape speed) produces a small treble lift followed by a sharp fall in the response at the extreme frequency range. This removes any rf bias frequency pick-up and ensures that the response extends only slightly beyond a chosen limit for each tape speed, thus reducing hiss to a minimum. The muting of the high frequencies during wind is provided by switching into circuit R313 & C126 (C125)

The output signal from the Replay Board passed to the 'replay level' control marked 'A' on the control panel.

1.2.2. Tone Control Board

The signal comes from the Source/Tape switch S702 (S703), either from the 'replay level' control 'A' (Tape pressed) or from the Record level control RV220 (Source pressed). The signal is amplified by TR400, which has a small voltage gain, and fed to the emitter follower TR401 which gives an output of 2V at approximately 30Ω. The impedance is made up to 600Ω to feed the 600Ω output JK704 (JK705) by the series resistor R406, but it drives the VU meter directly, thus avoiding the slight distortion of the signal which would occur due to the meter rectifier if this were driven from the higher impedance point. The VU meters are calibrated to the standard 'American operating' level corresponding to 4dB below the European standard peak level of 320nWb/m. However, the amplifier overload level is approximately 14dB above this and the recorder is therefore capable of dealing without excessive distortion with the short duration transients which are inherent in most music signals but not normally indicated on the meter.

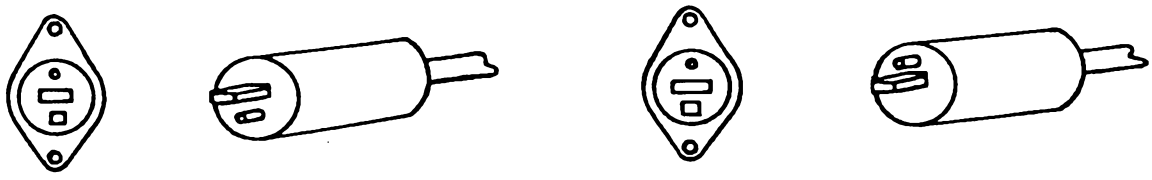
The signal then passes to the tone control stage TR402 which has no mid-frequency gain but provides boost or cut at both ends of the audio band with a clearly defined level position at the centre for the Bass and Treble controls. The signal is fed to the Low Level JK702 (JK703) and the Output control RV705 (RV706) via R417, which allows the possibility of connecting both channels together without any increase in distortion. The Output control varies the signal fed to the Power Amplifier Board (models 7622/7624) or to the Low Level Adjustable output (models 7602/7604). The Output control is a linear potentiometer feeding into a relatively low impedance in order to give an effective logarithmic characteristic. This arrangement has been found to be more consistent than a logarithmic potentiometer and gives good channel balance on all settings.

1.2.3. Power Amplifier Board

This is located on the Power Unit attached to a heatsink on which are mounted the output transistors. It consists of a transformerless arrangement with heavy negative feedback from both sides of the loudspeaker coupling capacitor C500. Resistor R511 provides feedback down to dc, ensuring high stability even on reactive loads, while feedback via R512 reduces the effective reactance of C500 to an insignificant value. Control of the quiescent current in the output stage is effected by R506, which is adjusted by its parallel resistor for approximately 25mA total current for the board. Correction of the quiescent current for ambient temperature variations is obtained from the forward resistances of D500/501.

The Loudspeaker output provides up to 10Watts undistorted output into a 15 or 8Ω external loudspeaker for high fidelity listening. Normally plugging into this socket (Fig. 1a) automatically disconnects the internal loudspeakers and the external loudspeaker signal is then governed by the Volume, Bass and Treble controls. Alternatively, plugging into the Speaker socket with the plug inverted (Fig. 1b), the internal loudspeaker remains 'on' and the internal and external speakers are in parallel.

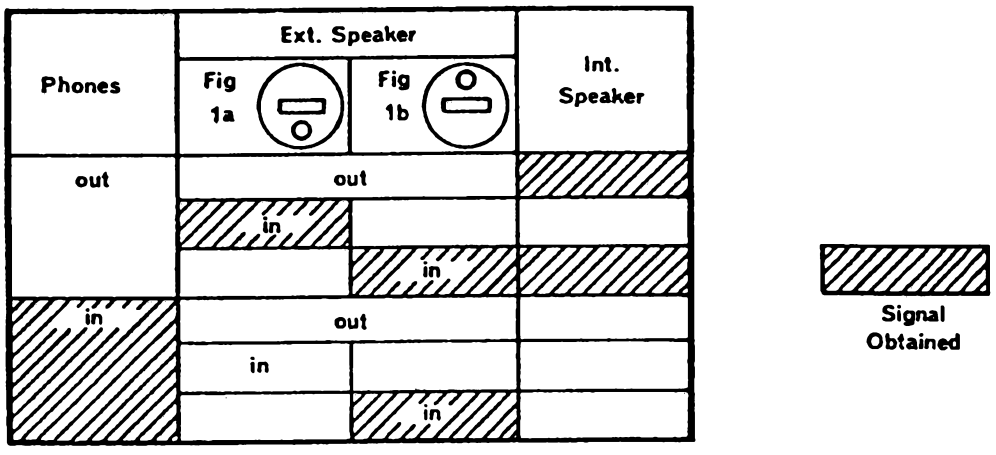
Note. As with other transformerless power output stages, take care not to short the speaker leads to each other, as this will probably overload the amplifier and blow the DC fuse. The faulty connection must be corrected and the fuse replaced before the amplifier will function again on that channel. However, the oscillator is powered through the Upper fuse and should this blow, it is not possible to record (even on the Lower track) until the Upper DC fuse is replaced. On no account should anti-surge or time-delay fuses be used.



(a) Internal speaker off (b) Internal speaker on

FIG. 1. LOUDSPEAKER CONNECTIONS

If it is required to use headphones, these should be plugged into the 'Phones' output. Although their impedance is not critical, it is recommended that this be approx. 8-600Ω. A stereo phones jack plug (3 contact, gauge A) should be used. On models 7622 & 7624, plugging in the phones disconnects the internal loudspeakers, and also the external loudspeakers if these are inserted as in Fig. 1a. Details of the possible arrangements for one channel are given in Table 3.



1.2.4. Record Board

The signal from the Line input JK708(JK709) is fed via protection components R227, C205 & D200 to the gate of FET TR202, which is used in a 'follower' circuit to give unity gain with an impedance transfer from 2MΩ to a few hundred ohms. The signal passes through R216 to the Line gain control RV709 (RV710) which may also receive a signal from the transfer switching if either button is pressed.

The Microphone input signal passes from JK706(JK707) through RF filter components C202 & C203 to the microphone pre-amplifier, which has two stages TR200 & TR201 with the Mic control RV727 (RV728) giving variable negative feedback to control the gain. After amplification the signal mixes with that from the Line input, the mixing being at low impedance to minimise noise level. The combined signal is fed via the Master Record control RV745(RV746) to TR203 which applies bass boost to the recording characteristic from C210/R217, and thence to TR204. The variable tapping on RV220 provides the 'Source' signal for the Source/Tape switch S702 (S703), the bass boost being removed by C212 & R222.

The final record stage TR204 operates with heavy negative feedback which is reduced at high frequencies by S700 which connects different by-pass capacitors for each tape speed, thus applying record pre-emphasis. The signal is then passed from the collector of TR204 via filter C214/R225 which, together with the filter L601/C608 (L602/C611) on the Oscillator Board, prevents the hf bias from appearing on the collector of TR204. The audio output from the board is prevented from reaching the record head by contacts RL123a & c on the deck unless the Record relay RL123 is energised. This ensures that no accidental recording (even without bias) can occur during replay from signals still present in the recording amplifier.

1.2.5. Pre-emphasis Board

This carries the pre-emphasis components selected by S700 to provide high frequency boost to the record signal, the lower octave being controlled by C702-704 (C708-710) depending upon the tape speed in use, and the extreme limit of the response by RV711-712 (RV715-716) at 9.5 & 19cm/s (3¾ & 7½in/s) respectively. At 38cm/s (15in/s) C213/R713 (C213/R717) remove the bass boost.

1.2.6. Oscillator Board

This is located on the cross strap at the rear of the amplifier and consists of a push-pull circuit with TR600 & TR601 operating at approximately 100kHz. The coil L600 has a tuned secondary which feeds the rf output to the record and erase heads via the Record Mode selector switch S600. This switch also selects the dummy load RV606 in the Upper and Lower modes or C607 in the Stereo mode to maintain the bias output and frequency sensibly constant.

The erase/bias supply is fed to the erase head X103 via SK602 (SK603) and to the record head X104 via SK600 (SK601) and the bias

control 'B' RV723 (RV724) mounted on the front panel. The earth return for the record head passes back to the oscillator coil earth via RV721 (RV722) which gives a measurement point for the bias current when the meter is set to read 'Bias'.

The dc supply for the oscillator is present only on Record and the voltage is increased slightly at the faster tape speeds by omitting R702. This increases the bias proportionally so that the value is optimum at each tape speed, giving the best possible balance between distortion, dynamic range and frequency response.

1.3. Dolby Section

The Dolby B-type Noise Reduction system is designed to minimise hiss in domestic tape recorders by employing techniques similar to those used in the wideband Dolby 301 professional noise reduction system and thus retaining the advantages of inaudible action, good matching and low distortion.

The system operates by boosting low-level, high-frequency signals in the record mode and attenuating them in a complementary way in the replay mode, while at the same time any noise in the treated frequency range is also attenuated.

It should be appreciated that the full subjective improvement offered by a 10dB reduction in hiss can only be obtained where the other performance parameters of the system, in particular the hum level, are of a comparable standard. This and other important performance features, including wow & flutter, frequency response and distortion, must be given particular attention in the servicing of the Ferrograph Dolby NR recorders.

1.3.1. Dolby NR Record Processor

The signal is taken from the collector of transistor TR203 and is fed via the low-pass filter L1/C2 which attenuates all unwanted high frequencies, such as tape recorder bias or FM multiplex subcarrier signal, to a level of less than -45VU. A 'notch' filter L2/C4 can be switched in by the MPX switch S2 to eliminate the stereo FM pilot carrier tone; if such a spurious signal were above the threshold level of the compressor, the full 10dB of low level pre-emphasis would not be obtained.

The signal at the output of emitter follower TR1 is split along two paths; one path provides an unaltered signal component directly to the output via R8 while the other includes a high-pass dynamic filter comprising C7/R16/C9 and the drain-source resistance of the FET TR2. At low signal levels the FET is biased off (high R_{ds}) and thus C7 & R16 control the response of the side chain. The output from the filter is amplified by TR3 & TR4 and the resultant differential signal is added to the main signal via R9.

The low-level gain of the side chain is such that the overall output is increased by 10dB at 5kHz when the differential signal is added. Under steady-state signal conditions, silicon diodes D3 & D4 are non-conducting. The side chain output is amplified further by TR5, rectified and then smoothed by a non-linear integrator, the resulting dc control signal being fed back to the gate of FET TR2.

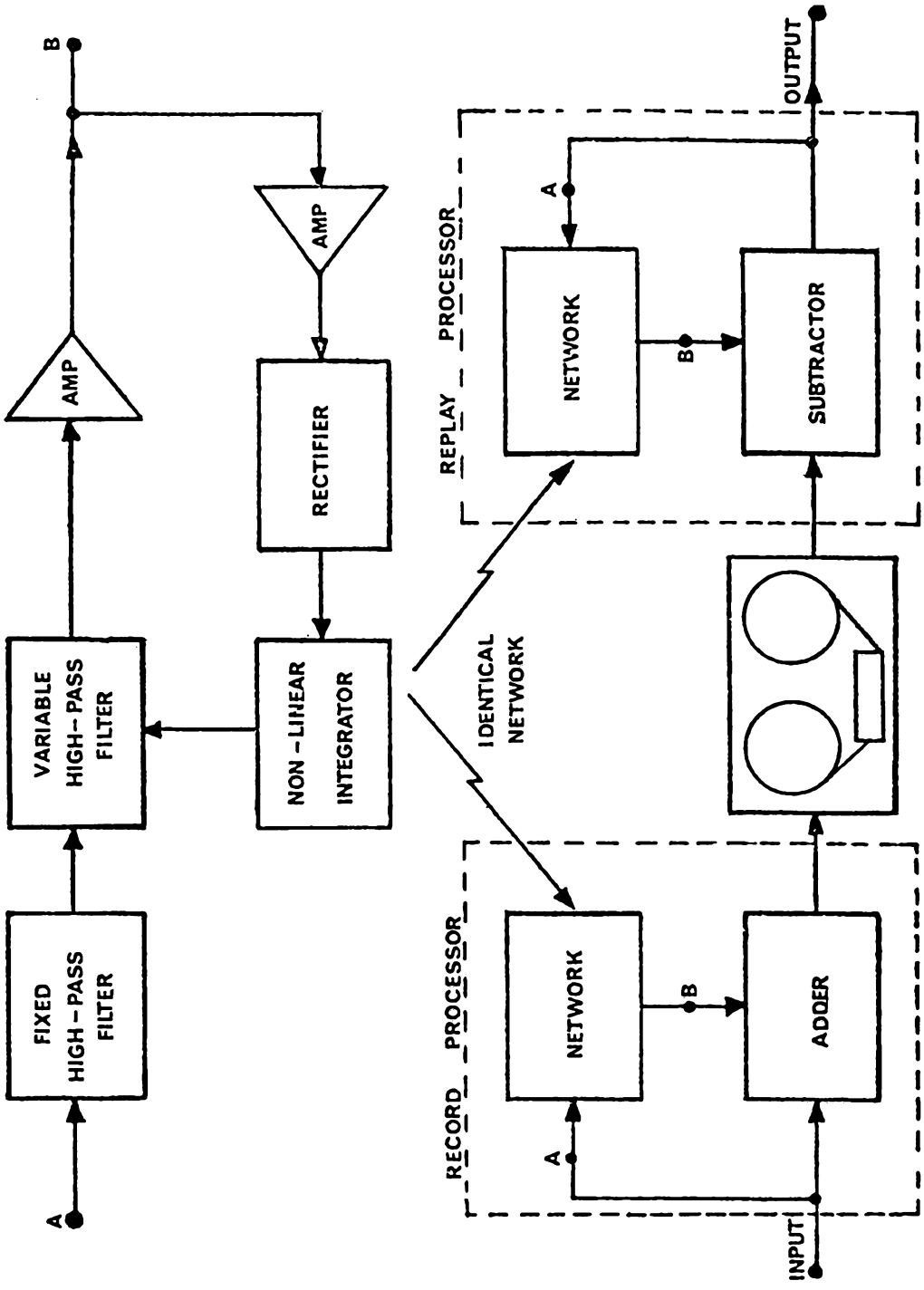


FIG. 2 BLOCK DIAGRAM - DOLBY NR SYSTEM

When the dc control voltage applied to the gate overcomes the bias set by the Law control RV20, it causes the turnover frequency of the second half of the filter to increase, eventually passing beyond the turnover frequency of C7 &R16 and thereby attenuating low and medium frequency signals in the side chain. With increasing input levels, the side chain signal becomes a decreasing proportion of the main signal, producing the standard transfer characteristics.

At 0 VU input level the side chain signal is very small compared with the main signal so that the signal passed to the recording amplifier is substantially unchanged by the added component.

Low frequency high level signals pass straight through the main path but are blocked in the side chain, preventing operation of the noise reduction function in that part of the audio spectrum. However, the presence of such high level signals causes the turnover frequency of the dynamic filter (and thus the frequency at which noise reduction is initiated) to slide upwards, ensuring that at higher frequencies noise reduction is still effective. The psycho-acoustic 'masking' effect caused by the high level signal prevents the ear from detecting noise present at nearby frequencies.

The control circuitry utilizes a two-stage, non-linear smoothing circuit to avoid the generation of modulation products while providing fast response under transient conditions. For small changes in signal level the diode D6 is non-conducting and the time constant R36C22 provides a high degree of smoothing. However, for sudden increases in signal level D6 conducts and quickly reduces the gain of the circuit. With increasing transient inputs, the attack time is reduced to about 2ms. To avoid overshoots in the output during this interval, the side chain includes clipper diodes D3 & D4. These diodes operate only under extreme transient conditions, during which the side chain is re-establishing its steady-state operating point. Thus for a very short period the record output consists of a large pure signal (via the direct path) and a small clipped component (via the side chain).

1.3.2.Dolby NR Replay Processor

On replay, essentially the same circuitry is used but in this case the side chain forms part of a negative feedback loop. The replay processor characteristics are therefore a mirror image of those of the record processor.

The signal is fed via the input control RV51 to the amplifier TR5 & TR6, which inverts the phase of the side chain relative to that in the record processor, the feedback loop being closed by R53. The ratio of R52 to R53 controls the amount of gain reduction which is set at 10dB for low level signals. The resistor values used maintain the same gain and operating conditions in the side channel in both record and replay processors, which is the fundamental principle for correct operation of the NR system.

1.3.3. Dolby NR Switching

The conventional method of switching the Dolby B processors 'out' is by shorting each side chain output to ground with a switch. However, to simplify the switching, the Ferrograph recorders use a dc control system.

With the Dolby switch set to 'on', a resistor (R7-record processor; R62-replay processor) is connected in parallel with the diodes in the side chain output and the circuit operates as described above. With the Dolby switch set to 'out', a positive voltage is fed through R7 or R62 to the signal end of the diodes. This effectively turns on one of the diodes, thereby shorting the side chain output signal to ground and cancelling the effect of the NR circuitry.

1.4. General Overhaul

Before proceeding with the general overhaul, remove the recorder from its case as in 3.1.1 and remove the deck cover plate and the deck control panel as in 3.4.1 & 3.4.2.

Thoroughly clean any dust, dirt or tape oxide from the tape transport system, paying attention to the following:

- Head assembly (the record and replay head faces should have a polished finish.
- Tape guides.
- Capstan spindle & pinch roller.
- Tape tensioning arms.

Warning: Do not use abrasives; if the accumulation of tape coating is excessive, use methylated spirit or an isopropyl alcohol-based cleaner.

Clean any dust, dirt, tape oxide or solidified grease from the deck chassis and mechanisms, paying particular attention to the following:

- Capstan motor pulley.
- Idler wheels.
- Flywheel.
- Speed change cam mechanism.
- Brakes.
- Solenoid pole pieces; these should be free from obstruction.
- Foam pads; these should be firmly attached to the solenoid armatures to minimise mechanical noise; check that adhesive has not encroached onto the face, causing the armature to stick when the recorder warms up.
- Pivots of the Start, Brake and Run levers.
- Turns counter.

Lightly oil the following points using a highly refined straight mineral oil (light machine oil) such as Shell Tellus 27, Aeroshell No. 3, etc.

- Idler wheel bushes (see 3.4.6 for access).
- Pinch roller bush.
- Upper capstan bearing.
- Pivots of the Start, Brake and Run levers.

Warning: Do not over-oil as this will cause more trouble than too little (this applies particularly to the idler wheels and pinch roller).

Check the condition and action of all return springs and replace if damaged.

Check the operation of the tape deck, ensuring that the tape runs smoothly and does not twist or curl in the guides. Check that the tape height is correct across the head faces (Fig.4) and that the tape runs reasonably centrally on the pinch roller. Check that the reels do not scrape on the side frames and if necessary adjust the height as in 3.4.3.

Check the recorder controls as follows:

Examine all switch and control knobs and ensure that they are tight on their spindles.

Operate each switch in turn and ensure that the action is positive.

Rotate each potentiometer in turn and ensure that the action is smooth.

Check that all gain control knobs indicate zero when turned fully off and also that the Bass & Treble knobs indicate equally plus or minus when rotated to their extreme settings.

Visually inspect the wiring for signs of everheating and ensure that all internal plugs and sockets are properly mated.

Warning: Visual inspection should be carried out with the power disconnected.

For more detailed examination of the tape deck operation and setting up procedure see Section 4.1.

2. FAULTS ANALYSIS

2.1. Electro/mechanical Faults

Tape transport sluggish-signal sounds low in pitch.	Tape scraping on reels; check reel carrier height. Incorrect tape being used. Pressure on pinch roller incorrect; check setting as detailed in 4.1.5. Tape speed incorrect; check tape speed as detailed in 4.1.7.
Tape slips or 'wows'.	Excessive oil or grease on idler wheel; clean oil and grease as detailed in 1.4. Accumulation of dirt or tape oxide on tape heads and pinch roller; clean heads and roller as detailed in 1.4. Pressure of pinch roller incorrect; check setting as detailed in 4.1.5.
Tape winds unevenly.	Faulty tape; check tape for stretching, indicated by tape being concave or wavy. Reel carrier loose on supply or take-up motor spindle; check tightness of reel carriers on spindles.
Take-up reel carrier appears to run hot.	It is normal for the take-up reel carrier to feel hot compared to the supply reel carrier, as the latter has its power reduced on Run.
Turns counter does not register.	'Zero' button incorrectly pressed. Belt stretched or broken; replace drive belt.
Motors do not start-capstan does not rotate.	Start solenoid faulty; check circuit and replace solenoid if necessary. Pause relay faulty; clean contacts and check connections, and replace if necessary.
Start solenoid energised but motors do not run.	Microswitch S102 not operated; check as detailed in 4.1.3. Faulty microswitch S102; check and replace if necessary.
Tape not driven on run.	Faulty Run solenoid; check Run solenoid and replace if necessary. No supply to solenoid; check Run solenoid circuit and Run relay and replace as necessary.
Tape not driven on Run, Pause & Run LEDs lit.	Loading arm only partly retracted; check operation and reset to normal position.

2.2. Electronic Faults

Tape transport operates but no output heard or indicated on the meter.	Faulty DC fuse; check appropriate fuse and replace if necessary.
Low output.	Excessive dirt or tape oxide on heads; clean as detailed in 1.4. Fault in power amplifier; check quiescent current as detailed in 4.2.6©. Incorrect bias setting; check bias as detailed in 4.2.4.
Distorted output on Source.	Input level too high; set Master Record control above 8 and adjust Mic and/or Line control for suitable recording level. Faulty power amplifier; check and replace components as necessary, check quiescent current as detailed in 4.2.6©.
Distorted output on Tape.	Recording level too high; check source signal level on VU meter. Incorrect bias setting; check bias as detailed in 4.2.4. Faulty amplifier; check replay section using test tape, then check individual boards.
Low output with severe distortion.	No bias; check HT supply to record oscillator, and also to relay RL123. If HT supply in order, check oscillator circuit. Faulty record or replay head; check heads for cleanliness and wear; if a head has to be replaced, re-align as detailed in 3.4.9 and check equalisation as detailed in 4.2.
Excessive hum.	Check that the voltage links on the power supply transformer T700 are set to the same positions. Check for double earths on recorder and ancillary equipment giving earth loops. Reverse power supply connections to the motors. Check input lead. Check input lead screen is properly earthed.
Excessive hiss when recorded tape is replayed.	Head permanently magnetised; demagnetise all heads using a defluxer. Incorrect bias - too low; check bias setting as detailed in 4.2.4. Record head misaligned; check head alignment and frequency response as in 4.2.4.

No erasure.	Faulty erase head; check head and alignment as in 4.2.4. No feed to erase head; check record oscillator and HT supply via RL123.
Poor top response.	Heads dirty; clean heads as detailed in 1.4. Incorrect bias; check bias setting as detailed in 4.2.4. Incorrect head alignment; check head height as in 3.4.9 and reset azimuth.
Poor bass response.	Faulty capacitor; check coupling capacitors in amplifying stages; check response of replay section by playing a test tape, then check Source response.
Excessive crosstalk.	Incorrect head height; check alignment as detailed in 3.4.9. RV700 faulty or incorrectly set; check RV700 & C714 and check setting as detailed in 4.2.5. Transfer switching faulty; check operation of switches S704 & S705 and replace if necessary. Faulty connection; check wiring of RV700 and also the white & violet leads to the Equalisation switch.

3. REMOVAL/REPLACEMENT

Unless specified otherwise, replacement is the exact reverse of the removal procedure given; where other parts/assemblies need to be removed these items are listed with the individual part.

3.1 Recorder

3.1.1. Recorder Chassis from Case

Stand the recorder vertical with the handle at the top and the amplifier at the bottom.
Remove all connections and fuses from the rear panel.
Lift the carrying handle and push down first one end then the other into the recess to take it clear of the case.
Remove the four bolts on the bottom of the case.
Ease the recorder just clear and unplug both loudspeaker leads (if fitted)
The case can now be removed completely and the fuses replaced.

Prior to replacing the recorder, remove the fuses. Insert a length of tape or string between the handle and its recess then feed the ends through the aperture in the case so that the handle can be pulled out of the recess after the recorder is replaced.

3.2 Power Unit

3.2.1 Power Unit Assembly

Remove the recorder from its case as in 3.1.1.
Remove the 14 pin plug P700 from the rear of the amplifier.
Remove the rectangular 12 pin socket from plug P101 on the top of the deck chassis.
Remove the four countersunk screws from the underside of the main cross frames (Fig.24) and also the two screws holding the rear panel to the support brackets, one at each end.
Lay the main chassis on its back (deck horizontal).
Disconnect the Line input jack sockets by removing the bezel, taking care to retain the spacing washers (refit the bezel, with washers, back into the socket).
Ease the power unit partially clear of the main chassis, taking care not to damage the electrical switch at the bottom of the speed control.
Lift the handle cables out of the side slots and slide the power unit clear.

For certain adjustments/replacements it may be possible to partially remove the power unit sufficiently for these to be carried out without disconnecting the Line input jack sockets as described.

When replacing the jack sockets, ensure that the spacing washers are refitted between the socket and the panel such that the appropriate jack plug mates correctly with the spring contacts.

3.3 Amplifier

3.3.1 Amplifier Assembly

Remove the recorder from its case as in 3.1.1.
Remove the plugs from the rear of the amplifier viz. 9 pin, 14 pin and four phono plugs.
Lay the main chassis on its back (deck horizontal).
Disconnect the replay head leads from each Replay board;
Upper - red sleeve, Lower - white sleeve.
Disconnect the Line input leads to each Record board;
Upper - red sleeve, Lower - black sleeve.
Disconnect the operating cable of the Equalisation switch by removing the circlip and disengaging the pivot.
Remove the three screws each side holding the amplifier to the frame.
Lift the amplifier clear of the chassis.

3.3.2 Amplifier Panel Controls

Remove the amplifier assembly as in 3.3.1.
Set the Record Mode switch to Stereo, slacken the upper locking screw on the switch spindle extension and withdraw the knob and spindle upwards.
Remove the control knobs, loosening the grubscrews using 4BA and 6BA Allen keys (Mic, Line, Master Record & Volume; Bass & Treble).
Remove the four screws holding the panel which can then be lifted over the control spindles and push button knobs.
Access is now available to the components on the main amplifier panel, which can be hinged upwards as required.

When replacing the control knobs, turn each spindle to zero (fully anticlockwise) and locate the knob accordingly.
Check that the Bass & Treble controls are symmetrical about the centre mark and that the Record Mode knob is correctly positioned.

3.3.3 Record, Replay & Dolby Processor Boards

Locate the individual boards(s) shown in Fig.22.
Remove the top board by undoing the three fixing screws; the Dolby Processor board, if fitted, can be hinged up giving access without unsoldering the leads.
Remove the second and third boards as required by undoing the three hexagonal spacers and lift partially clear.
If it is required to remove an individual board completely, check that the lead colours correspond to the appropriate diagram (Fig. 20,21,26,27, or 30) before unsoldering.

Note. Each Dolby processor is set up individually and changing a component may significantly alter the performance even when an 'identical' component is substituted. After any servicing, check the processors for correct operation and carry out recalibration if necessary.

3.3.4 Pre-emphasis Board

Remove the four screws holding the board and lift partially clear; to obtain easier access to the rear of the board, unsolder the two leads at the bottom of the board and hinge upwards.
Before removing the board, check that the lead colours correspond to Fig. 29.

3.3.5 Oscillator Board

Hinge up the Pre-emphasis board as in 3.3.4 to expose the Oscillator board components.
To remove the Oscillator board completely, slacken the lower locking screw on the spindle extension and remove the two nuts holding the Record Mode switch to the cross bracket.
The switch/board assembly can now be moved downwards and clear of the chassis.
Check that the lead colours correspond to Fig. 28 before unsoldering.
When re-assembling, ensure that the two leads are resoldered to the Pre-emphasis board as in 3.3.4.

3.4 Deck

3.4.1 Deck Cover Plate

Remove the On/Off and Speed knobs, loosening the grubscrew using a 4BA or 6BA Allen key.
Remove the four screws holding the plate to the side frames and the two screws holding the rear strap, one at each end.
Ease the plate clear, lifting the rear first.

3.4.2 Deck Control Panel

Remove the Wind, Reel and Load knobs, loosening the grubscrews using a 4BA or 6BA Allen key.
Remove the screw holding the pinch roller top plate and lift off the pinch roller with its washer and plate.
Remove the four screws holding the panel to the side frames.
If tests or alignment procedures are to be carried out, replace the Wind and Reel knobs and refit the pinch roller, the panel being left loosely in position to enable the logic push buttons to be operated.

3.4.3 Reel Motors

Remove the recorder from the case as in 3.1.1.
Remove the deck cover plate as in 3.4.1 and the Power Unit as in 3.2.1.
Unhook the start lever return spring from the Supply reel motor.
Remove the reel carrier by loosening the two grubscrews using a 6BA Allen key on the underside near the brake drum and unhook the drive belt from the reel carrier and turns counter or motion sensor pulley.
Unscrew the locknut and brake adjusting bush from the brake operating stud and dis-engage the stud from the brake arm.

On the underside of the deck plate unplug the motor supply and unsolder the start capacitor leads, noting the tags to which the leads are attached.
Undo the two 2BA nuts holding the motor to the deck plate, when the motor comes free (take care not to damage the motion sensor disc when removing the Supply reel motor).
If necessary, remove the brake arm and tension arm (with spring) and mount on the replacement motor.

When replacing the reel motor, fasten it onto the deck plate using the two 2BA screws (not too tightly), locating the three side screws on the pads on the top of the deck plate.
Re-assemble the motor in the reverse of the removal procedure, using these three set screws to adjust the motor so that the reel carrier is horizontal.
Tighten the locking nuts on the three screws then tighten firmly the two 2BA screws on the underside.
Adjust the height of the reel carrier so that the reel sits approximately 1.5mm(1/16 in) above the level of the side frames.
Load the deck with tape and wind backwards and forwards using the Wind control to check that the tape is wound centrally between the cheeks of each reel.
If necessary reset the brake adjusting bush on the brake operating stud so that with the brake lever held in its operated position, the brake band is clear of the drum then retighten the locknut.
The Supply and Take-up reel motors are identical but their tag-boards are linked differently as shown in Fig. 3.

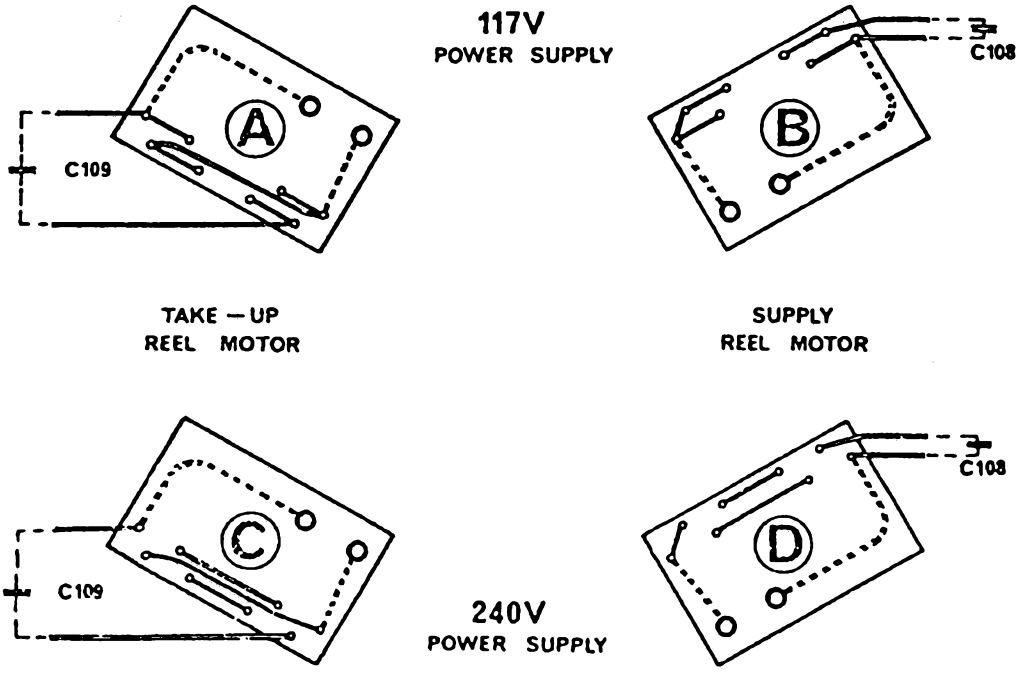


FIG. 3 REEL MOTOR WIRING

3.4.4 Capstan Motor

Remove the recorder from the case as in 3.1.1.
At the rear remove the cable clip from C101 securing clamp and unplug the connection to the capstan motor.
Remove the four bolts holding the capstan motor bracket to the tape deck and ease the assembly clear of the deck.
Remove the four nuts securing the capstan motor to the anti-vibration mountings, unsolder the capacitor connections and lift the capstan motor clear.
Remove the stepped pulley and fan from either end of the capstan motor spindle.
Before replacing the capstan motor, ensure that the anti-vibration mountings are in good condition. When refitting, check that the motor pulley is located centrally through the hole in the deck in order to engage properly with the idler wheels.

3.4.5 Turns Counter Assembly

Remove the deck cover plate as in 3.4.1.
Remove the drive belt from the pulley, taking care to keep it clear of oil or grease.
Unclip the Check lamp.
Remove the hexagonal spacer holding the speed change cable clip.
Pull the turns counter assembly backwards and clear of the retaining slots and lift clear.
To remove the belt, remove the reel carrier by slackening the grubscrews using a 6BA Allen key.
On refitting the turns counter assembly, before tightening the clamping spacer, temporarily refit the deck cover plate and check that the numbers are centrally positioned in the aperture.
When refitting the drive belt, ensure that this is correctly located on the pulley part of the reel carrier before fitting onto the counter pulley.

3.4.6 Idler Wheels

Remove the turns counter assembly as in 3.4.5.
Turn the speed control to the highest tape speed.
Slide the top idler wheel arm clear of the brackets, being careful not to damage or stretch the spring.
Slide out the middle idler arm similarly.
Turn the Speed selector to the middle or lowest tape speed.
Slide out the high speed idler arm similarly.
Remove the individual idler wheel(s) by carefully easing the spring clip off the spindle and sliding off the washer and idler wheel.
When refitting the idler wheel(s), ensure that the larger boss is away from the idler arm except on the high speed arm where the large boss should be next to the arm. Also, ensure that each idler wheel spins freely on its spindle.

3.4.7 Pinch Roller Arm

Remove the recorder from its case as in 3.1.1.
Remove the deck cover plate, deck control panel and amplifier assembly as in 3.4.1, 3.4.2 & 3.3.1.
Move the loading bar to the 'load' position and push on the pinch roller arm by hand.
Remove the two screws and locking plate holding the pinch roller bracket to the arm and remove the pinch roller and bracket.
Unhook the return spring from the pinch roller arm and remove the microswitch actuating arm.
Remove the bottom screw and top circlip of the pivot spindle and withdraw it downwards.
Ease the pinch roller arm forwards and clear of the assembly.
After the pinch roller arm has been replaced, the armature pressure and pinch roller gap must be set correctly as in 4.1.5.

3.4.8 Capstan Spindle/Flywheel

Remove the recorder from its case as in 3.1.1.
Remover the deck cover plate, deck control panel and amplifier assembly as in 3.4.1, 3.4.2 & 3.3.1.
Remove the pin underneath the flywheel locating it on the capstan spindle.
Remove the screw from the lower end of the spindle and withdraw the spindle upwards.
Lift the flywheel clear of the lower bearing and remove.

When replacing the flywheel/spindle, refit the spindle through the flywheel and insert the screw at the bottom.
Locate and insert the pin into the flywheel and spindle, then tighten fully the bottom screw.
Carry out checks on the gimbal bearing and pinch roller setting as in 4.1.5 & 4.1.6.

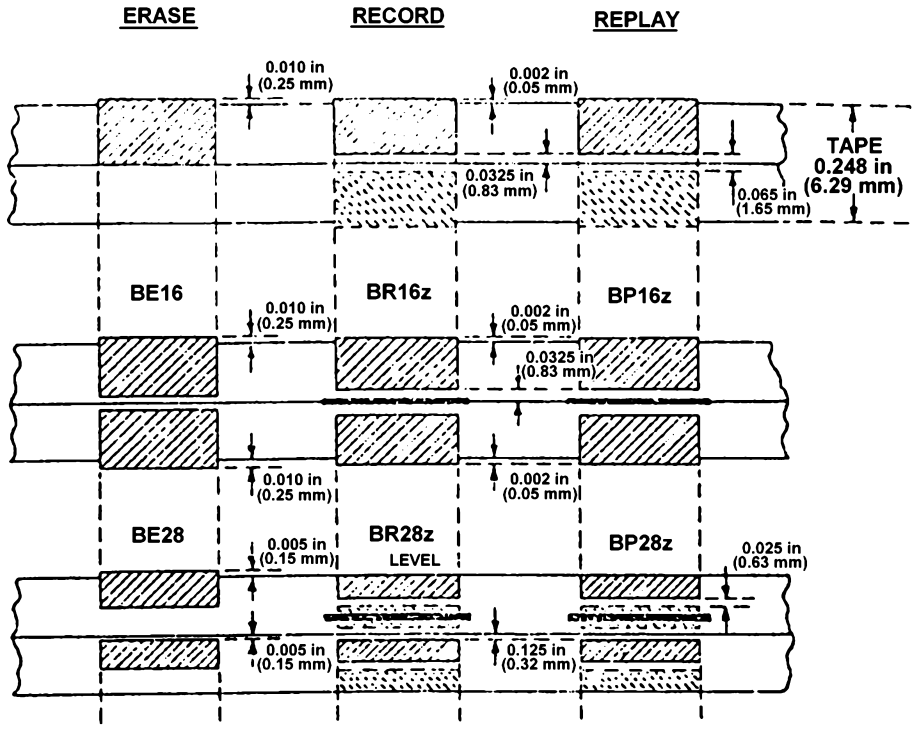
3.4.9 Heads

(a) Head Assembly

Remove the recorder from its case as in 3.1.1.
Remove the deck cover plate & deck control panel as in 3.4.1 & 3.4.2.
Unplug the erase and record head leads from the phono sockets at the rear of the amplifier and remove the replay head lead connectors from the Replay boards (Upper-red sleeve, Lower-white sleeve).
Remove the cable clip from the capstan motor capacitor clamp.
Remove the screw holding the LH arm cable bracket on the end of the loading arm.
Remove the four bolts holding the head assembly (one also holding the LH arm assembly).
Lift the head assembly clear of the deck, threading the cables through the hole in the chassis.

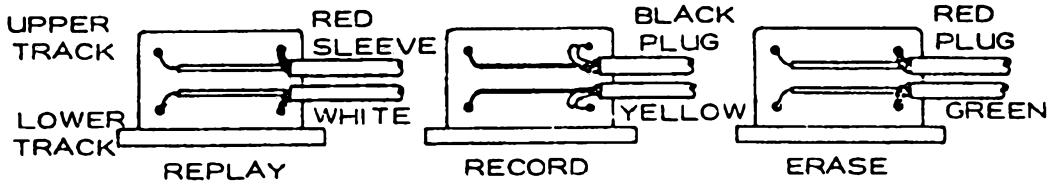
When refitting the head assembly, check that the leads do not foul the fan blades on the capstan motor. The bracket on the end of the loading arm should be set such that the LH arm moves back for easy tape loading, with the edge of the end roller approximately level with the front edge of the sub-plate.

		TRACK WIDTH	
		Head	Tape
MONO (Half - track)	Erase	0.120	0.110
	Record	0.093	0.091
	Replay	0.093	0.091
STEREO (Half - track)	Erase	0.120	0.110
	Record	0.093	0.091
	Replay	0.093	0.091
MONO & STEREO (Quarter - track)	Erase	0.055	0.049
	Record	0.043	0.043
	Replay	0.043	0.043



(b) Individual Heads

Unclip the head cover and unsolder the heads from the pins at the rear of the head, carefully noting the connections.
Remove the two screws fastening the head mounting plate to the block, taking care not to lose the spring on the rear right screw.
When replacing the head, set the rear right screw (holding the spring) so that its top is approximately 3 mm (½ in) above the head block face.
Adjust the front left screw so that the head plate appears level.
Adjust the two centre set screws (front & rear) so that the head height is correct as in Fig.4 and also that the head face is vertical.
Check the head alignment & equalisation as in 4.2.



4. TESTS & ADJUSTMENTS

4.1 Mechanical

4.1.1 Equipment Required

1. Steel Bar: 2.5 mm (3/32 in) thick approx 1 5 to 2 5 mm (½ to 1 in) wide. approx 50mm (2 in) or longer.

2. Tension Gauges : (a) 1200-1400 grm
   (b) 200 grm

3. Speed Check : (a) Stroboscopic tape - 100 lines per 7½in (19.05 cm) - to be used with mains power supply lighting or with a stroboscopic lamp at 50 Hz. (Suffix A models - 120 lines at 60 Hz).
   or (b) Stop watch.
   Measured length of tape - 31ft 3in (9.525 m) as part of a full reel of tape (preferably measured at a tension of 70 grm (2½ oz) to simulate the tape tension of Run).

4. Wow & Flutter : W & F Meter (DIN weighted) - such as the Ferrograph RTS.

4.1.2 Preliminary

Before proceeding with mechanical adjustments, it is good paractice to carry out the general overhaul detailed in 1.4.
Remove the recorder from its case as in 3.1.1.
Remove the deck cover plate & deck control panel as in 3.4.1. & 3.4.2.
Check that the recorder voltage corresponds to the power supply available, connect to the supply and switch on.
Except where specified otherwise, the deck should be loaded with a full 10½ in. reel of Long Play tape and the Reel switch set appropriately; the screwdriver adjust control should be set to h (or v) as appropriate.

4.1.3 Start Solenoid

With the deck at Stop, press Pause and check that there is no chatter when the Start solenoid is energised; if it does occur, this is usually due to incorrect setting of the operating stud of the economy switch S103. To reset S103 operation, disconnect the power supply and operate the start lever mechanism by hand until it is fully engaged with the Start solenoid. Slacken the locknut and adjust the operating stud until it is 0.4 - 0.5 mm (.015 - .020 in) from the body of the microswitch.
Reconnect the power supply and repeat the above check; if satisfactory, retighten the locknut. If chatter occurs, increase slightly the distance between the operating stud and the microswitch until the chatter ceases - the distance must not be so great that the microswitch is not operated - then retighten the locknut.
Ensure that microswitch S102 is operated immediately before S103; if not, adjust the operating stud of S102 then retighten the locknut.
Press Stop, and check that there is clearance between the leaf spring and the appropriate idler arm at each setting of the Speed control; this is adjusted by the set screw on the start lever arm.
Press Pause, and check that at each setting of the Speed control the appropriate idler wheel is moved into contact with the flywheel and capstan motor pulley, and that a slight movement of its arm is possible.
Check that the height of each idler wheel is aligned with the capstan motor pulley and flywheel such that no idler wheel runs on the edge of a step.
Check that the start lever leaf spring is held clear of the start lever adjusting screw and that the pressure applied to the idler arm is 200 grm (7 oz) as in Fig. 6.

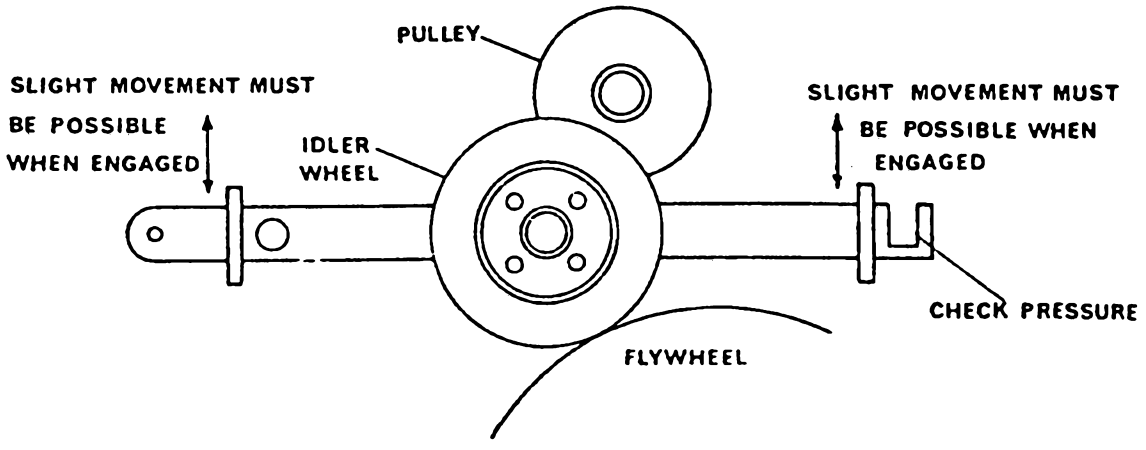


FIG. 6 IDLER AND IDLER ARM ASSEMBLY

4.1.4 Brake Solenoid

With the recorder disconnected from the power supply and the tape reels removed, push on the brake solenoid armature by hand and check that each brake adjusting nut moves the brake operating arm by approx. 3 mm ($\frac{1}{8}$ in) before reaching the fully operated position; if not, slacken the locknut, reset the brake adjusting nut accordingly and retighten the locknut.
Check that in the fully operated position each brake band is clear of the drum on the underside of the reel carrier.
Still holding the arm in the fully operated position, check that the brake release nut is approx. 3 mm ($\frac{1}{8}$ in) clear of the brake arm; if not, slacken the locknut, reset the brake release nut accordingly and retighten the locknut.
Reconnect the power supply and reload with tape.
Press Fast, and check the action of the Wind control, ensuring that the tape winds freely in either direction.
With the tape travelling at maximum speed on Wind, press Pause and check that the tape comes to rest smoothly and without snatch or tape spillage (for this test/adjustment the two reels must be of equal size and weight, e.g. 10½ in metal); repeat with the tape travelling in the opposite direction.
If necessary, adjust the brake tension by releasing the clamping screw and reclamping the adjuster in the correct position - moving the adjuster away from the reel carrier increases the brake tension and vice versa.

> With tape snatch, slacken the brake tension on the reel from which the tape is issuing.
> With tape spillage, slacken the brake tension on the reel onto which the tape is being wound.
> If the braking is then too slow, increase the tension on both equally, then recheck for balance as above.

4.1.5 Run Solenoid

Press Run, and check that the Run solenoid is energised, ensuring that the armature moves the pinch roller arm assembly and that the solenoid is reasonably quiet in operation.
Press Pause, and place a bar (item 1) between the armature and the pinch roller arm.
Press Run, and check that the pinch roller is just touching the capstan spindle; if not, slacken the two screws holding the pinch roller bracket and adjust, retightening the screws when in the correct position.
Press Pause, and remove the bar.
Press Run, and check that there is a gap between the armature and the pinch roller arm (this ensures that the spring has full control of the pinch roller pressure independent of the magnetic force).
Still on Run, check that there is approx. 0.8 - 1.6 mm (1/32 - 1/16in) clearance between the pinch roller bracket and the plastic stop plate; if not, reset the stop plate.

Using a tension gauge, check the pressure of the pinch roller (which should be between 1200 - 1400 grm (42-49 oz) adjustable by the armature spring adjusting nut on the pinch roller arm.
Press Pause, and check that the pinch roller moves clear of the capstan by approx. 0.4 mm (1/64 in).
Check the action of the pinch roller which should be free in movement, slight vertical play being desirable.
Press Run, and check that the pinch roller runs parallel to the capstan; there should be no obvious run up or down of the tape caused by the pinch roller (this can be determined by observing the tape at the adjacent tape guide).
Check that the tape runs reasonably central on the pinch roller.
Check that when the Run solenoid is energised, the microswitch S106 is operated centrally by the pin on the armature; if not, disconnect the power supply, reposition the microswitch on the solenoid, then reconnect the supply.
Check that when operated, microswitch S106 removes the short-circuit from R100 on Run and also shorts out the Pause LED (via D141 & RL122c).
Press Run, and check that the armature does not bind on the sides of the pinch roller arm by moving the assembly gently back towards the 'off' position to see if any stiffness is present.

4.1.6 Tape Transport

With the tape moving on Run, check that there is no indication of tape buckling at one edge due to a tape guide being incorrectly set in the head assembly.
Check that the reel carrier heights are such that with normal spools the tape does not scrape on the reel cheeks; if necessary reset the reel carrier(s) as in 3.4.3.
Check that on Stop, when the loading bar is pulled back it latches in the loading position giving easy tape loading; if necessary reset the bracket on the end of the loading arm so that in the loading position the edge of the small roller on the LH arm is approximately in line with the centre line of the head assembly.
On the replay head, check that the mumetal hum wing contacts the head can without fouling the tape.
Check that when the hum wing is hinged back to approximately right angles to the tape path, it locks in this position; also check that when allowed to move back, the action is damped to avoid too sharp a contact with the head can.
Wind on towards the end of the tape so that most is on the take-up reel (this is the most critical condition).
While on Pause, press Run and observe the tape transport.
Check that the spring of the auto stop arm is not so strong that the arm is pulled over continuously, thus stopping the tape drive; however, it is normal for the arm to move over on first changing to Run, while the take-up reel is reaching speed.
Still on Run, stop the take-up reel by hand and check that the auto stop operates and returns the deck to the Stop condition.
While playing a constant tone recording (such as in the W & F test 4.1.8) press gently on the side of the gimbal bearing, when a change in the pitch of the note will be observed; check that on

removing the pressure there is a complete return to normal.
With the Speed control at 19 cm/s (7½ in/s), press Run then after a few seconds press Stop; check that the capstan/flywheel runs for approx. 30-45 seconds after switch off.

4.1.7 Tape Speed

Replay a stroboscopic tape (100 stripes per 7½ in or 19.05 cm) as part of a full reel of tape and view it under 50 Hz fluorescent tube or stroboscopic lighting - 120 stripes per 7½ in or 19.05 cm at 60 Hz.
With the tape running at exactly the nominal tape speed the stripes appear to remain stationary; if the tape appears to move, count the number of dark stripes progressing (tape speed too fast) or regressing (tape speed too slow) past a fixed point on the deck in a certain number of seconds.

Check that the rate is not more than the following:-

38 cm/s (15 in/s)	-	2 stripes/sec.
19 cm/s (7½ in/s)	-	1 stripe /sec.
9.5 cm/s (3¾ in/s)	-	1 stripe /2 sec.

If stroboscopic tape is not available, the speed can be checked using a measured length of tape and a stop watch.
Make two clearly visible marks on a reel of tape at a distance of 31 ft. 3 in. (9.525 m) apart, preferably measuring the tape while under a tension of 70 grm (2½ oz) to simulate the tape tension on Run. Play this tape and using a stopwatch, measure the time taken for the measured length of tape to pass a given point.

Check that this is within:

38 cm/s (15 in/s) ± 1%	=	25 ± 0.25 seconds
19 cm/s (7½ in/s) ± 1%	=	50 ± 0.5 seconds
9.5 cm/s (3¾ in/s) ± 1%	=	100 ± 1.0 seconds

The accuracy of the reading could be improved by increasing the measured length of tape to 62 ft.6 in. (19.05 m) and doubling the above times.
If an accurate digital frequency meter is available, this could be used to measure the replay frequency of the peak level section of a test tape.
This is usually specified to be within a few cycles of 1000 Hz and the percentage deviation from the nominal gives a reading of the speed deviation, e.g. a meter reading of 100 Hz represents a tape speed 0.5% fast, making due allowance for the possible test tape error of say ± 0.3%.

NOTE : The speed of the capstan motor is synchronous with the power supply frequency, which is nominally 50 Hz (or 60 Hz), and any deviation from this frequency is reproduced in the speed of the recorder. With the stroboscopic technique, where the lighting is powered from the same supply as the recorder, this method is self-compensating, but with the other two methods any power supply frequency errors must be allowed for proportionally, e.g. a frequency error of 0.1 Hz in the 50 Hz supply produces a change in tape speed of 0.2%

4.1.8 Wow & Flutter

Speed variations known as Wow & Flutter should be measured using a meter with DIN weighting, such as the Ferrograph Recorder Test Set.
Connect the oscillator of the W & F meter to the recorder Line input and the meter input to the Low Level output of the recorder.
Record the fixed frequency 3.15 kHz (or 3 kHz) for approximately 5 minutes at a level of about -4 to +2 VU on the recorder signal level meter.
Replay this recording and measure the percentage W & F, which should be better than the following:

Less than 0.08% at 38 cm/s (15 in/s)
0.10% at 19 cm/s (7½ in/s)
0.17% at 9.5 cm/s (3¾ in/s)

If the W & F reading is out of tolerance, check thoroughly that the General Overhaul 1.4 has been carried out; if necessary, carry out the checks and adjustments in 4.1.

4.2 Electronic

The following section outlines the everall alignment procedure, but it must be emphasised that existing settings should not be disturbed unless accurate test equipment is available.

The tape heads should be thoroughly demagnetised using a Ferrograph Defluxer before any alignment procedure is carried out and especially before a standard test tape is played on the recorder. The calibration of a test tape, particularly the higher frequencies, will be permanently damaged if it is played on a recorder with magnetised heads. The defluxer must be held firmly when in contact with the head and must not be allowed to strike or vibrate against the head face.

An earthed soldering iron must not be used to make connections to any part of the electronics while the recorder is switched on, since this can cause current surges which may damage transistors or magnetise the head(s). For the same reason the replay head must not be reconnected to the amplifier when the recorder is switched on.

4.2.1 Equipment Required

1. Magnetic tape viewer (Scotch) - desirable for ¼ track (see 4.2.4 c&d)
2. Ferrograph Recorder Test Set *
3. Ferrograph Auxiliary Test Unit *
   3(a) 40dB Attenuator
4. Ferrograph Defluxer

5. Test Tapes - 5(a) 0 VU level (or peak level) 781-028
(b) 35μsec response (38 cm/s :15 in/s) 781-035
(c) 50/3180μsec „ (19 cm/s :7½ in/s) 781-033
(d) 90/3180μsec „ (9.5 cm/s :3¾ in/s) 781-036
(e) Quarter Track Alignment Tape (see 4.2.3d) 781-029
(f) Unused or Bulk-erased BASF tape LP35LH**

6. Oscilloscope (double beam) or Phasemeter

7. Milliameter (0-50 mA)

* As an alternative the following could be used:-

10. (a) AF Signal Generator (20-20,000 Hz, sine wave)
(b) Millivoltmeter (3mV -3V)
(c) Distortion Meter (1 kHz)
(d) Wave Analyser of 1 kHz Pass Filter
(e) 8Ω Load Resistor (rated at 10W minimum)

** It is not necessary to bulk erase this tape each time it is used provided that it is wound on to a fresh part of the tape for each new test. Good quality tapes other than LP35LH could be used (such as TDK Audua, etc.) with good results, but the bias must be set to the appropriate meter reading as shown in Table 4.

4.2.2 Preliminary

Before starting this Test and Alignment procedure, carry out the General Overhaul Section preceding and also the mechanical checks in Part 4.1, in order to ensure good tape transport. In particular, excessive tape deposit on the head faces can seriously impair the frequency response at the higher frequencies thus leading to maladjustment.

(a) Connections

Connect the test equipment to the recorder Line inputs and 600Ω outputs (unloaded), Upper and Lower, and set the Record Mode switch to Stereo.

4.2.3 Replay

(a) Replay Head

Check that the head face is vertical and correctly set for height as in 3.4.9.
Replay the head azimuth alignment section of the 9.5 cm/s (3¾ in/s) test tape (item 5d) and adjust the head azimuth screw for maximum output as indicated on the millivoltmeter. Note that when adjusting the head after refitting, successive maxima may occur and the head should be set to the highest of these.
Repeat for the other track; if the two positions do not coincide, a compromise may need to be used.

(b) Replay Level

Replay the 0 VU level tape (item 5a) at 19 cm/s(7½ in/s) and adjust each 'A' control to give 0 VU indication on the VU meters, which should give a reading of 1.27V on the millivoltmeter at the 600Ω output.

(c) Replay Response (9.5 cm/s; 3¾ in/s)

Replay the 90/3180μsec test tape (item 5d) at 9.5 cm/s(3¾ in/s) and check that the response is within the specified limits.

9.5 cm/s(3¾in/s) : 40-14,000Hz ± 3dB

If necessary make adjustments to the equalisation components. R319 & C317 are fixed values and select the time constant of 90μ sec (9.1KΩ x .01μF); R315 gives a level bass response; C316 affects the mid-frequency response (5-10,000Hz approx.). The response of the two tracks should match as closely as possible and ideally within 2dB at all frequencies.

NOTE: When replaying a full width recording on a quarter track recorder, due to fringing flux, frequencies below 63Hz give spuriously high readings which should be ignored.

(d) Replay Head Height (Quarter Track)

On quarter track recorders only, at 9.5 cm/s (3¾ in/s) replay the alignment tape (item 5e), which has a 30Hz tone recorded on track 2, and measure the cross talk on each channel. Check that it is the same on each channel and if not, the head height should be adjusted to give this, as in 3.4.9. Note that this test relies on the bass response of both tracks being equal and therefore cannot be carried out until after the responses have been checked. If this tape is not available an alternative can be made after 4.3.4d has been completed by recording 30Hz at 9.5 cm/s(3¾ in/s) on Lower (track 3) and reversing the tape to bring it to track 2.

(e) Replay Response (19 cm/s; 7½ in/s)

Replay the 50/3180μsec test tape (item 5c) at 19 cm/s(7½ in/s) and check that the response is within the specified limits.

19cm/s(7½ in/s) : 30-18,000Hz ± 2dB

If necessary make adjustments to the equalisation components. R318 & C318 are fixed values and select the time constant of 50μsec (5.1KΩ x .01μF); R317 gives a level bass response; C315 affects the mid-frequency response (6-12,000Hz approx.). The frequency response of the two tracks should match as closely as possible and ideally within 2dB at all frequencies.

NOTE: When replaying a full width recording on a quarter track recorder, due to fringing flux, frequencies below 125Hz give spuriously high readings which should be ignored.

(f) Replay Head Alignment

Connect an oscilloscope or phase meter (item 6) to the Upper and Lower 600Ω outputs and replay test tape (item 5c) again. Check that the two tracks are in phase within 90°(viz. a quarter cycle) and if not, adjust the replay head azimuth slightly to achieve this, provided that the HF response (at 16Hz) does not fall by more than 1.5dB on either track. Replay the test tape and recheck the response. If necessary, make slight adjustments, again ensuring that the Upper and Lower responses are within 2dB of each other within the specified ± 2dB limits.

(g) Replay Response (38 cm/s; 15 in/s)

Replay the 35μsec test tape (item 5b) at 38 cm/sec(15 in/s) and check that the response is within the specified limits.

38 cm/s (15 in/s) : 30-20,000Hz ± 2dB

If necessary make adjustments to the equalisation components. R316 & C314 are fixed values and select the time constant of 35μsec (3.3KΩ x .01μF); R320 gives a level bass response; C313 affects the mid-frequency response (8-14,000Hz approx.). The frequency response of the two tracks should match as closely as possible and ideally within 2dB at all frequencies.

NOTE: When replaying a full width recording on a quarter track recorder, due to fringing flux, frequencies below 250Hz give spuriously high readings which should be ignored.

4.2.4 Record

(a) Record Bias

Select the 19 cm/s (7½ in/s) tape speed and press Pause/Record. Set both 'B' controls to maximum (fully clockwise) and check that the voltage (measured on the millivoltmeter) at the collector of TR204 is less than 0.3V on each channel. If necessary adjust the core of L601 and/or L602 (using a non-magnetic screwdriver). Load the recorder with a reel of bulk erased BASF tape LP35LH (item 5f) and with the Record Mode switch at Stereo set the controls to record a 10kHz tone at 19 cm/s (7½ in/s) at a level of 20dB below peak level (-16 VU) viz. approx. 200mV at the 600Ω output. While recording adjust the 'B' control on each track in turn to give maximum output to the millivoltmeter with the Tape button pressed. Turn the 'B' control further clockwise (increased bias) until the output to the millivoltmeter falls by 5dB (56% of maximum reading). Press the Bias button and check that each meter reading is 0 VU. If necessary adjust controls RV721 (Upper) and/or RV722 (Lower) at the rear of the amplifier to give this reading.

NOTE: If tape other than BASF LP35LH is used, then the bias should be set similarly then calibrated to the appropriate meter reading as shown in Table 4.

Cancel Record and set the Record Mode switch to Upper.
Press Pause/Record and check that the bias reading does not change.
If necessary adjust the bias balance control RV606 on the Oscillator Board to return the bias to the correct reading.
Repeat for the Record Mode switch at Lower.

Table 4. Recommended Bias Settings (19 cm/s; 7½ in/s)

Brand	Type	Bias
Agfa	PE 36	-2
	*PER 525	+2
Ampex	407	-1
Audiotape	907	-1
B.A.S.F.	*LGR 30P	+2
	LP35LH	0
	LPR35LH	-1
	LP35LH Super	-2
E.M.I.	825	-1
	Hidynamic	-2
Ferrotape	B	-2
Maxell	UD35	-1
Memorex		-1
Scotch	Classic	0
	207	-2
	223	-2
	*262	+2
T.D.K	Audua	+1
	SD	0

*These tapes are high output types intended for use at 15 in/s and with these the recording level should be allowed to rise to +3VU.

(b) Tape/Source Level

Replay the 0 VU Level tape (item 5a) and with the Tape buttons pressed, check that both meters give a reading of 0 VU.
If necessary, reset the 'A' controls.
Load the recorder with a reel of bulk erased BASF tape LP35LH (item 5f) and press Record/Run.
Adjust the record level of a 500Hz input signal to give 0 VU reading on the VU meters (Tape buttons still pressed).
Press the Source buttons and check that the meters still read 0 VU.
If necessary, reset the record control RV220 on the Record Board.

(c) Erase Head Height (Quarter Track)

Load the recorder with a tape pre-recorded with a peak level signal at 1kHz across the full width of the tape.
Turn all record gains to zero (fully anticlockwise) and the Record Mode switch to Stereo.
Press Record/Run and erase a few seconds of tape.
Reverse the tape and erase for a few seconds over the same length of tape.
Now observe the tape using a scotch Magnetic tape viewer (item 1) and note any residual signal - the tape should be blank over the whole of the erased section. One band not erased down the centre of the tape indicates that the erase head is too low; two hands not erased indicate that the head is too high.

(d) Record Head Height (Quarter Track)

Load the recorder with a reel of bulk erased BASF tape LP35LH (item 5f).
Still on Stereo, record a 250Hz tone at peak level for a few seconds.
Reverse the tape and repeat this recording over the same length of tape.
Now observe the tape using a Scotch magnetic tape viewer (item 1).
The four tracks should be spaced evenly over the tape as in Fig. 4.

(e) Record Head Alignment

Check that the head face is vertical and set correctly for height as in 3.4.9.
Load the recorder with a reel of bulk erased BASF tape LP35LH (item 5f) and set the tape speed to 9.5 cm/s(3¾in/s).
Record a 15kHz tone at 20dB below peak level (-16 VU) viz. approx. 200mV at the 600Ω output.
With both Tape buttons pressed, adjust the head azimuth screw for maximum output read on the millivoltmeter. Each track should be adjusted in turn and if the positions for the two tracks do not coincide, a compromise may have to be used.

(f) Record/Replay Response (9.5 cm/s; 3¾ in/s)

Again using a recording level of 20dB below peak level, measure the overall record/replay response at 9.5 cm/s (3¾ in/s) and check that it is within the specified limits.

9.5 cm/s (3¾ in/s) : 40-14,000 ± 3dB

If necessary make adjustments to the equalisation components. on the Equalisation Board.
C702(C708) affects the mid-frequency response (3-10kHz approx.) and RV711(RV715) the extreme high frequencies (10-15kHz approx.)
The frequency response of the two tracks should match as closely as possible and ideally within 2dB at all frequencies.

(g) Record Head Azimuth

Connect an oscilloscope or phase meter (item 6) to the Upper and Lower 600Ω outputs and check that the tracks are in phase within 90° (viz. a quarter cycle) over the response range up to 8kHz.
If not, adjust the record head azimuth screw slightly to achieve this, at the same time ensuring that the response is maintained within the full specified limits and that the high frequency signal is not degraded by excessive amplitude variations, etc.

(h) Record/Replay Response (19 cm/s; 7½ in/s)

Again using a recording level of 20dB below peak level, measure the overall record/replay response at 19 cm/s (7½ in/s) and check that it is within the specified limits.

19 cm/s (7½ in/s) : 30-18,000Hz ± 2dB.

If necessary make adjustments to the record equalisation components on the Equalisation Board.
C703(C709) affects the mid-frequency response (5-15kHz approx.) and RV712(RV716) the high frequencies (15-18kHz approx.)
The frequency response of the two tracks should match as closely as possible and ideally within 2dB at all frequencies.

(i) Record/Replay Response (38 cm/s; 15 in/s)

Again using a recording level of 20dB below peak level, measure the overall record/replay response at 38 cm/s (15 in/s) and check that it is within the specified limits.

38 cm/s (15 in/s) : 30-20,000Hz ± 2dB

If necessary make adjustments to the record equalisation components on the Equalisation Board.
C704(C710) affects the mid/high frequency response (8-20kHz approx.).
The frequency response of the two tracks should match as closely as possible and ideally within 2dB at all frequencies.

4.2.5 General

(a) Distortion

Set the input signal to 1kHz and set the controls to give a peak level signal (2V at the 600Ω output) with the Source button pressed.
Measure the distortion and check that it is less than 0.2%.
Still at 38 cm/s (15 in/s), press Record/Run and make a short recording.
Replay this tape and measure the distortion (Tape button pressed) and check that it is less than 1.5%.

(b) Erasure

Wind back to the start of the previous recording and erase the recording on Record/Run at 38 cm/s (15 in/s) with all inputs removed and all record gain controls at zero (fully anticlockwise).
Using the 1kHz filter, measure the residual signal, which should be less than 1.2mV (-65dB ref. peak level).

(c) Signal-to-Noise Ratio

Using bulk erased tape and with all record gain controls at zero (fully anticlockwise), run the tape through on Record/Run at 38 cm/s (15 in/s).
Replay this section of tape and measure the hum and noise at the 600Ω output on the millivoltmeter.
Check that this is better than -60dB ref. 2% distortion (normally +4dB ref. peak level viz 3.2mV).
Replay this section of tape again and measure the hum and noise at the 600Ω output using the CCIR noise weighted filter.
Check that this is better than -60dB (half track models) or -56dB (quarter track models); less than 3.2mV or 5mV respectively.
Stop the tape and press the Source button.
Check that the hum and noise measured using the CCIR weighted filter is better than -70dB (viz.less than 1mV).

(d) Crosstalk (Interchannel)

Using a reel of bulk erased BASF tape LP35LH (item 5f), select 19 cm/s (7½ in/s) and set the Record Mode switch to Lower.
Record a peak level signal at 1kHz (2V at 600Ω output) for a short time.
Replay this recording and using the 1kHz filter, measure the crosstalk on Upper.
Check that this is less than 1.2mV (-65dB ref. peak level).
If necessary, adjust the crosstalk potentiometer RV700 for minimum.

(e) Low Frequency Breakthrough (Quarter Track)

Using a reel of bulk erased BASF tape LP35LH (item 5f), select 38 cm/s (15 in/s) and set the Record Mode switch to Lower.
Record a peak level signal at 30Hz (2V at 600Ω output) for a short time.

Invert the tape and replay this recording.
Check that the outputs from each track are within 2dB of each other.
If not, recheck the Replay and Record head heights as in 4.2.3(d) & 4.2.4.(d).

4.2.6. Amplifier Performance

Select Source on both channels and remove all input plugs.

(a) Inputs

Mic

Insert an open-circuit jack plug (on lead attached) into the Mic input and turn the Mic and Master Record controls to maximum (fully clockwise).
Measure the noise at the 600Ω output with the LF Cut button pressed (when using a millivoltmeter without such a filter, a separate LF Cut must be inserted into the lead, otherwise this test should be omitted).
Check that this is less than 10mV.
Connect the oscillator leads to each Mic input via a 40dB attenuator and with the controls still at maximum (fully clockwise), adjust the oscillator output to give peak recording level (2V from 600Ω output).
Check that the Mic input signal is less than 250μV (25mV into 40dB attenuator).
Reduce the oscillator output to give 0 VU meter reading on each channel (if the gain is different for the two channels, set the lesser reading to 0 VU and reduce the higher to 0 VU by turning down the appropriate Master Record control).
Set the Upper Mic control to 4 on its scale and increase the oscillator output to return the meter reading to 0 VU.
With this same oscillator output fed to the Lower channel, adjust the Lower Mic control to give a meter reading of 0 VU.
Check that the new Lower Mic control setting is within 2½ to 5½ on the scale.
Set the oscillator to give 15mV into the Mic input (1.5V from oscillator into 40dB attenuator).
With both Master Record controls at maximum (fully clockwise), set each Mic control to give peak level (2V at 600Ω output) and measure the distortion.
Check that this is less than 0.25% (LF cut still in circuit).

Line

Connect the oscillator leads to each Line input and set the Line and Master Record controls to maximum (fully clockwise).
Adjust the oscillator output to give peak level (2V at the 600Ω output) at 1 kHz.
Check that the input signal to the recorder is less than 50mV.
Reduce the oscillator output to give 0 VU meter reading on each channel (if the gain is different for the two channels, set the lesser reading to 0 VU and reduce the higher to 0 VU by turning down the appropriate Master Control).

Set the Upper Line control to 6 on its scale and increase the oscillator output to return the meter reading to 0 VU.
With this same oscillator output fed to the Lower channel, adjust the Lower Line control to give a meter reading of 0 VU.
Check that the new Lower Line control setting is within 5 to 7 on the scale.

Master Record

Set the Line and Master Record controls to maximum (fully clockwise) and adjust the oscillator output to give 0 VU meter reading on each channel (if the gain is different for the two channels, set the lesser reading to 0 VU and reduce the higher to 0 VU by turning down the appropriate Line Control).
Set the Upper Master Record control to 6 on its scale and increase the oscillator output to return the meter reading to 0 VU.
With this same oscillator output fed to the Lower channel, adjust the Lower Master Record control to give a meter reading of 0 VU.
Check that the new Lower Master Record control setting is within 5 to 7 on the scale.

(b) Low Level Outputs/Tone Controls

Transfer the meter leads to the Low Level outputs and select Source.
With the Bass & Treble controls at their central 'flat' positions, adjust the 1kHz oscillator signal to give 400mV at the Lower Level outputs.
Measure the distortion and check that it is less than 0.25%
Set the oscillator to 100Hz and measure the cut and lift with the Bass control set to minimum (fully anticlockwise) then to maximum (fully clockwise).
Check that each is more than 9dB (less than 143mV and more than 1.13V).
Set the oscillator to 10kHz and measure the cut and lift with the Treble control set to minimum (fully anticlockwise) then to maximum (fully clockwise).
Check that each is more than 9dB (less than 143mV and more than 1.13V).

(c) Output Stages

Transfer the meter leads to the Speaker outputs and with the oscillator set at 1kHz, adjust the controls on the recorder to give 8.9V output into the 8Ω load of the ATU (or item 10e), thus giving 10 W output.
Check that the distortion is less than 0.25%.
Connect the output leads to the Phones output using a 3 contact gauge A jack plug and adjust the output to be 100mV into the 8Ω load.
Check that the distortion is less than 0.25%.
If the output transistor (TR500 or TR502) becomes faulty, check the other output transistor and both driver transistors (TR501 & TR503), and replace if necessary.

Check the quiescent current by connecting the milliameter (item 7) in the dc supply to the board; after allowing 5 min under 'no signal' conditions, check that the current is 20-25 mA; if not, adjust the value of the trimmer resistor soldered across R506.

Transfer Switching

Set the Line & Master Record controls on both channels at maximum (fully clockwise) and press the U→ L button.
Feed a 1kHz signal into the Upper Line input only and adjust the input level to give a reading of 0 VU on the Lower VU meter.
Check that the Upper VU meter reads -5(± 2VU).
Press the L→ U button and feed a 1kHz signal into the Lower Line input only.
Adjust the input level to give a reading of 0 VU on the Upper VU meter.
Check that the Lower VU meter reads -5(± 2VU).

4.3 Dolby

While moderate mismatching is difficult to detect by ear, for optimum performance of the Dolby B-type Noise Reduction circuitry there should be no overall amplification or attenuation of the signal between processors and it is therefore essential that the normal record/replay characteristics of the recorder be set up with great care. In particular the frequency response of the instrument should be as 'flat' as possible for each tape speed. The operation of the Dolby B processors should never be regarded as suspect without first ensuring that the recorder is working correctly with the Dolby NR system switched out. Where necessary, bias, record & replay levels and equalisation should be re-adjusted and the performance optimised before any attempt to check and adjust the Dolby B processors.
Each Dolby processor is set up individually and the changing of a component may significantly alter the performance even when an 'identical' component is substituted. After any servicing it is important to check the processors for correct operation and recalibration carried out if necessary.

4.3.1 Equipment Required

1. *Ferrograph Recorder Test Set

   (could be used in conjunction with a Ferrograph ATU as in previous section)

8. Resistor 390Ω (½ or ¼W)
9. Digital Frequency Meter (for 19kHz MPX filter)

   *As an alternative the following could be used:-

10. (a) AF Signal Generator (20-20,000Hz, sine wave)
    (b) Millivoltmeter (3mV - 3V)

4.3.2 Preliminary

During the alignment procedure many measurements are made at low levels, and it is therefore vital to ensure that the accuracy of the instrument readings is not affected by any bias pick-up or hum. Bias pick-up can be reduced to a minimum by keeping the unscreened parts of the test leads to shorter than 25 mm (1 inch), and both bias and hum pick-up can be reduced by connecting the test leads directly to the board earth pins rather than to random points on the chassis. It is essential to recognise that although the record and replay processors have complementary curves, the replay processor cannot be checked against the reciprocal of the record processor curves from a constant level input signal. This is because a constant voltage input to the replay processor does not represent the plotted outputs from the record processor. The correct operation of the replay processor can only be determined by feeding to it the processed output from a known-to-be-correct record processor and checking for a level overall frequency response.

4.3.3 Record Processor

The location of the preset controls, test points and pin positions is given in Fig. 8; component location and connections are given in Fig.20 and the circuit diagram is Fig. 40.

Set the Dolby and MPX switches to 'out', and on the Record Processor Board set the Law and Output controls fully clockwise.
Switch off the recorder and disconnect the input lead from pin 3 and the output lead from pin 7, then short the 'FET gate' pin to earth (pin 6) and switch on the recorder.
Connect the RTS meter input to pin 4 (test point-cal) and the oscillator output to pin 3.
Set the oscillator to 5kHz and adjust the output to give a reading of 3mV at pin 4.
Transfer the meter connection to pin 7 (output) and note the reading obtained.
Set the Dolby switch to 'in' and check that the reading increases by 10dB (x 3.16).
Remove the short to earth from the 'FET gate' pin and adjust the Law control to reduce the reading by 2dB (x 0.794 or ÷ 1.26).

Note: Adjustment of the Law control causes the output to fluctuate greatly; turn the control slowly and allow the meter to settle before taking the reading.

Reconnect the meter lead to pin 4 (test point-cal), set the oscillator to 1kHz and adjust the output to give a reading of 0 dB on the 100mV range of the millivoltmeter (if instead of the RTS another meter is used which does not have a dB scale, adjust to read 80mV).
Set the oscillator to 20kHz and adjust L1 (with a non-magnetic screwdriver or trimming tool) for a drop in output of 2dB (or to 63.5mV compared to 80mV).

(a) MPX Filter

Using the digital frequency meter, adjust the oscillator to exactly 19kHz. Set the MPX switch to 'in' and adjust L2 for minimum reading on the millivoltmeter; this should be about 35dB below the previous 0dB reading at 1kHz (less than 0.9mV compared to 80mV).

Important Note: The MPX filter rejects the 19kHz tone which is present in the output from some stereo tuners and which would otherwise make the noise reduction circuitry inoperative. As the notch of this filter is sharp, the frequency must be set very accurately to ensure correct attenuation of the pilot tone. The scale calibration of most signal generators is not precise enough for this purpose and unless an accurate frequency meter is available, the retuning of the 19kHz filter coil L2 should not be undertaken.

(b) Checking

Connect the RTS meter input to pin 7 (output) and the oscillator output to pin 3 (input).
Measure a series of frequency response curves at various signal levels and compare these with those shown in Fig. 16, when ideally they should be within ± 1dB except at 20kHz where the response should fall as set by the low-pass filter L1 adjusted above.

Unless it is required to also check the Replay processor after testing the Record processor, switch off the recorder and re-solder the leads to their correct pins.

4.3.4 Replay Processor

The location of the pre-set controls, test points and pin positions is given in Fig.9; component location and connections are given in Fig. 21 and the circuit diagram is Fig. 40.

Set the Dolby and MPX switches to 'out', and on the Replay Processor Board set the Law control fully clockwise and the input control to its maximum position.
Switch off the recorder and disconnect the input lead from pin 2, short the 'FET gate' pin to earth (pin 3) and switch on the recorder.
Connect the RTS meter input to pin 1 (test point-cal) and the oscillator output to pin 2.
Set the oscillator to 5kHz and adjust the output to give a reading of 7.6mV at pin 1.
Set the Dolby switch to 'in' and check that the reading falls by 10dB to 2.4mV.
Remove the short to earth from the 'FET gate' pin and adjust the Law control to increase this reading by 2dB to 3mV.

Note: Adjustment of the Law control causes the output to fluctuate greatly; turn the control slowly and allow the meter to settle before taking the reading.

(a) Checking

As explained previously, checking the response curves of the Replay processor cannot be done directly; it can only be carried out by connecting it 'back-to-back' with a tested Record processor and measuring the overall frequency response, when ideally the frequency response at each signal level should be flat within ± 1dB over the relevant frequency range.

Switch off the recorder and, if not already removed, disconnect the leads from pins 3 & 7 of the Record Processor Board and from pin 2 of the Replay Processor Board.
Connect a 390KΩ resistor between pin 7 on the Record processor (output) and pin 2 on the Replay processor (input) and switch on the recorder.
Connect the RTS meter input to pin 4 on the Record processor (test point-cal) and the oscillator output to pin 3 on the Record processor (input).
Set the oscillator to 100Hz and adjust the output to give a reading of 100mV at pin 4.
Transfer the meter connection to pin 1 on the Replay processor (test point-cal) and adjust the Input control to give a reading of 100mV.

Having matched the two processor boards for unity gain, measure the frequency response at various signal levels to check the alignment, which should be within ± 1dB over the frequency range; since a level of about 25dB below 100mV is the input most likely to show up any deficiencies in matching, it is recommended that this level (5.6mV) be checked first.

After the processors have tested satisfactorily, switch off the recorder, disconnect the 390KΩ resistor, resolder the leads to their correct pins and switch on the recorder.

4.3.5 Processor Levels

The complete procedure given below outlines the correct adjustment of the processor levels and also the setting up for the brand of tape in use. Once this procedure has been carried out, should a different brand of tape be used, it is only necessary to carry out the abridged procedure for Tape Level Adjustment.

(a) Complete Procedure

Connect the RTS meter input to pin 1 on the Replay Processor (test point-cal).
With the Dolby switch at 'in', replay an 0 VU test tape (flux density 18.5 mMx/mm) and adjust the Input control on the Replay Processor Board to give a reading of 100mV at pin 1.
With the Tape button pressed, continue playing this 0 VU test tape and adjust the preset control 'A' to give a reading of 0 VU on the signal meter in the recorder.
Transfer the meter connection to pin 4 on the Record processor (test point-cal).
Connect the RTS oscillator output to the Line input on the recorder and set the oscillator frequency to 500Hz.
Adjust the oscillator output controls and the Line/Master Record controls to give a reading of 100mV at pin 4.

Load the recorder with tape to which it is required to set up the recorder and check that the bias is optimum for this tape, as in 4.2.4(a).
With the Bias button released and with the Tape button still pressed, adjust the Output control on the Record Processor Board to give a reading of 0 on the VU meter of the recorder.

Note: This Output control has a range of approx. 6dB, which is sufficient for most head/tape combinations. However, if more output is needed, resistor R13 in series with it on the Record Processor Board may be increased from 180kΩ to 220kΩ. Similarly, should less output be required, the value of R13 could be decreased to 150kΩ or 120kΩ.

Press the Source button and adjust the potentiometer RV220 on the Record Board (accessible through a hole in the Record Processor Board - see Fig.8) to give a reading of 0 on the VU meter.
Disconnect the RTS connections from the recorder.

(b) Tape Level Adjustment

Provided that initially the recorder has been set up with the full procedure above, this shortened version is entirely adequate for adjustment to suit the sensitivity of a particular brand of tape.

Feed a 500Hz signal into the Line input and adjust the controls to give a reading of 0 on the VU meter of the recorder with the Source button pressed.
Load the recorder with the required tape and set the bias to optimum as in 4.2.4a.
Release the Bias button and with the Tape button pressed, press Run/Record and adjust the Output control on the Record Processor Board to give a reading of 0 on the VU meter of the recorder.

Note: Although the above abridged procedure enables the gain to be set to unity at one specific frequency, this is not necessarily so over the complete frequency range as this depends upon the characteristics of the 'old' and 'new' tapes. While it is essential to re-adjust the gain settings for tapes of different sensitivities, this adjustment by itself is only entirely satisfactory if the frequency response of the 'new' tape is the same as the 'old'.
If a small difference occurs at high frequencies, some compensation may be possible by slight adjustment of the bias to reduce the top response and vice versa). The optimum bias for different types of tape can then be observed on the VU meter (Bias button pressed) and noted in the manual.
In general it is essential to remember that for perfect Dolby B-Type NR system matching the gain between the processors must be unity over the relevant frequency spectrum. If a change of tape causes deviation from this optimum, not only should the levels be reset but also the overall frequency response (including record pre-emphasis) should be re-adjusted as necessary.

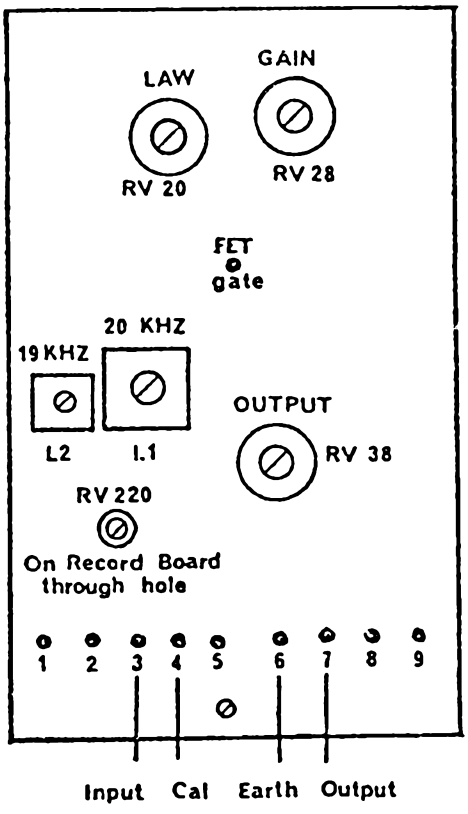


Fig. 7 Record Processor Board

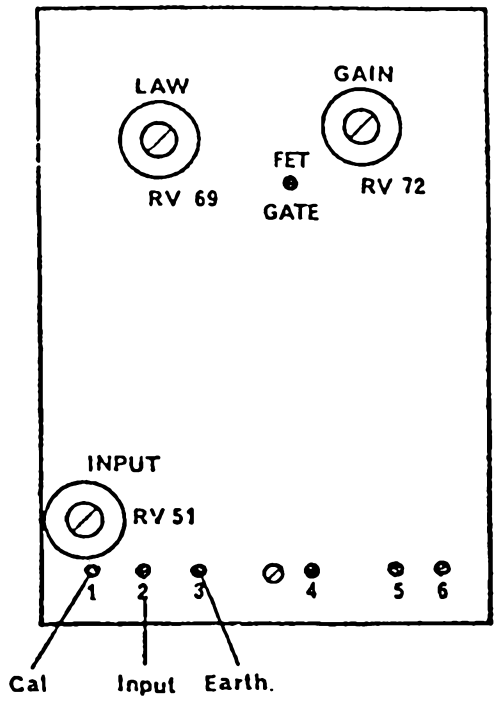


Fig. 8 Replay Processor Board

4.4 General

4.4.1 Remote Control

(a) Remote Socket

The Remote Socket is situated at the rear of the recorder (under the carrying handle) and consists of a 14 way socket carrying all the information and connections to facilitate remote control of all the main functions of the recorder push buttons. It accepts the Remote Control Unit accessory.

The commands on pins 7, 8, 9, 10, 11, 12 & 14 are initiated by temporarily connecting the appropriate pin to pin 1 (earth); the current varies according to the previous condition but that shown in the list gives the maximum in each case. The corresponding lamps (LEDs) are connected between pins 3, 4 and pin 2 (+24V), and are limited to 20mA. For pins 5 & 6 (LED Pause/Run), the circuit incorporating R170 & R171 must be duplicated as in the circuit diagram.

1	Earth	6	LED Pause	11	Wind (200mA)
2	+24V	7	Cancel (140mA)	12	Rev (240mA)
3	LED Record	8	Record (70mA)	13	LED Check
4	LED Wind	9	Run (270mA)	14	Stop (170mA)
5	LED Pause/Run	10	Pause (250mA)		

A Remote Control Unit is available as an accessory.

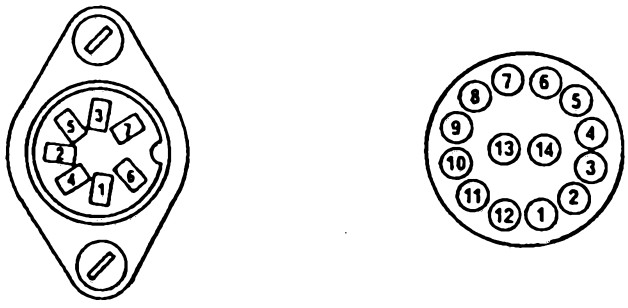


FIG. 9. REMOTE AND AUXILIARY SOCKET CONNECTIONS

(b) Auxiliary Socket

The Auxiliary Socket is situated at the rear of the recorder and is intended to augment the facilities of the Remote Socket. It is a 7 pin DIN socket and into it can be inserted the standard 3 pin, 5 pin & 7 pin DIN plugs, connecting to pins 1-3, 1-5, & 1-7 respectively.

WARNING: Standard DIN connecting leads must not be used.

1 Start (connect to pin 2 to go from Pause to Run)
2 Earth
3 +50V (provides up to 200mA DC)
4 Low Level Output (Upper)
5 Low Level Output (Lower)
6 600 ohm Output (Upper)
7 600 ohm Output (Lower)

4.4.2 Power Supply Conversion

240V, 50Hz to 200V, 50Hz

The standard recorder can be operated from a power supply of 240V, 220V or 200V, 50Hz; it is normally supplied wired for 240V, 50Hz but can be converted to 220V or 200V operation.

Remove the Power Unit as in 3.1, although it may not be necessary to remove it completely to gain access to the transformer, and the Line socket could then be left connected. Remove the Brown & Grey leads and resolder to the appropriate tags as shown in Fig. 10.
Re - assemble the recorder in the reverse procedure.

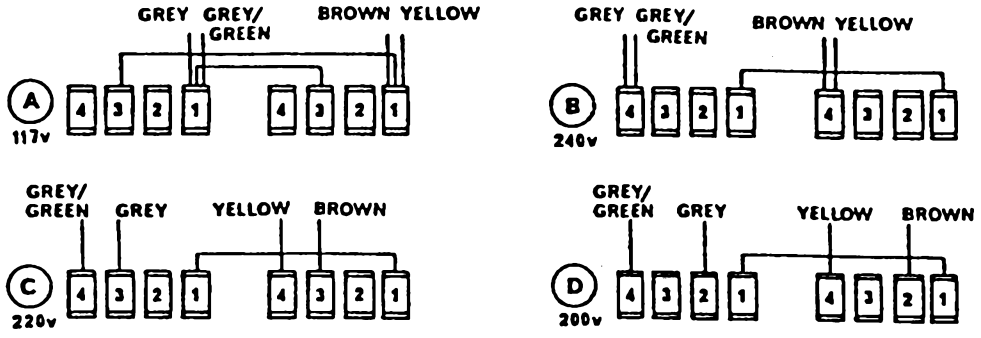


Fig. 10 Mains Supply Transformer Wiring.

240V, 50Hz to 117V, 50Hz or 117V, 60Hz

To convert from 240V, 50Hz to 117V, 50Hz or 117V,60Hz operation change the components listed in the table and rewire the Reel motors and mains supply transformer as indicated.

Table 5. Power Supply Conversion.

		240V, 50Hz	117V, 50Hz	117V, 60Hz
Capstan Motor	X100	022-003	022-039	022-039
Capacitor	C101	0.75µF(132-001)	3µF (132-005)	2.5µF(132-002)
	C108	1µF (132-007)	4µF (132-013)	3.5µF(132-012)
	C109	1µF (132-007)	4µF (132-013)	3.5µF(132-012)
Wind Potentiometer	RV103	5kΩ (582-082)	800Ω(582-097)	800Ω (582-097)
Capstan/Flywheel Spindle		705-013	705-013	705-016
Power Board Assembly		025-601	025-628	025-628
(including R160, R162)		2.2kΩ (626-063), 330Ω (626-064)	470Ω(626-069), 33Ω (626-068)	470Ω (626-069), 33Ω (626-068)
Power Supply Fuse	FS702	1 Amp (380-000)	2 Amp(380-009)	2 Amp(380-009)
Wiring of Reel Motor				
Take-up	X101	Fig.3 C	Fig.3 A	Fig.3 A
Supply	X102	Fig.3 D	Fig.3 B	Fig.3 B
Wiring of mains supply Transformer	T700	Fig.10 B,C or D	Fig.10 A	Fig.10 A

5.1 Mechanical

Deck Unit (Fig. 12)

Reference Number	Item	Qty.	Part Number
1	Wind Knob	1	022-452
2A	Auto Stop Arm	1	022-460
2B	Return Spring	1	712-006
2C	Guide	1	409-015
3	Contact Pin	1	570-031
4	Auto Stop Arm Damping Assy	1	022-065
5A	Auto Stop Arm Tension Bracket	1	095-060
5B	Screw 4BA	1	666-065
5C	Washer 4BA SP	1	922-045
5D	Locknut 4BA	1	554-012
5E	Washer 4BA ⅛ in	3	922-057
5F	Washer Spring	1	922-016
5G	Nut 4BA Nyloc	1	554-017
5H	Screw 6BA x ½ in Rd Hd	1	666-179
5J	Spacer	1	698-108
5K	Washer 6BA SP	1	922-041
5L	Locknut 6BA	1	554-019
6A	Loading Arm	1	025-610
6B	Knob	1	022-453
6C	Spring	1	712-012
7A	Stop Plate	1	573-412
7B	Screw 6BA x 5/16 in Hex Hd Brass	2	668-000
7C	Washer 6BA x 5/16 in x 22g Brass	2	922-043
8A	Pivot Screw 2BA x 1 in Hex Hd BMS	1	666-091
8B	Sleeve	1	687-011
8C	Washer 2BA x ½ in	2	922-114
8D	Washer 2BA x ⅜ in x 18g BMS	1	922-088
9A	Auto Stop Arm Stop Screw 4BA x ½ in Hex hd	1	666-263
9B	Locknut 4BA	1	554-012
9C	Washer 4BA SP	1	922-045
9C	Spring	1	712-013
9E	Sleeve	1	687-511
10A	Hum Wing	1	215-026
10B	Domed Nut	1	556-027
10C	Pillar	1	568-016
10D	Spindle	1	705-062
10E	Spring	1	712-047
10F	Lever	1	457-003
10G	Washer	1	922-123

11A	Head Block Assy - Stereo ½ Track	1	020-366
	Stereo ¼ Track		020-365
11B	Screw 4BA x ⅜ Skt hd Cap hd	3	666-266
12	Head Block Screen Plate	1	573-374
13A	Loading Arm Stop	1	560-008
13B	Washer 2BA	2	922-087
13C	Washer 2BA SP	1	922-050
13D	Locknut 2BA	1	554-008
14	Loading Arm Retaining Bracket	1	095-036
15	Loading Arm Leaf Spring	1	714-003
16	Upper Support Plate	1	025-609
17A	LH Damping Arm Assy	1	022-442
17B	Plate	1	573-376
17C	Screw 8BA x 3/16 in Ch Hd	1	666-221
18A	Motion Sensor Pulley Assy	1	025-626
18B	Bracket	1	025-606
18C	Pillar	1	568-017
18D	Screw 6BA x ¼ in Ch Hd	1	668-056
18E	Washer 6BA Flat	2	922-061
18F	Retainer	1	630-022
19	Motion Sensor Drive Belt.	1	060-004
20	Brake Solenoid Armature	1	013-002
21	Speed Change Cable	1	108-020
22	Speed Change Cable Clamp	1	190-066
23A	Reel Retainer Assy	2	022-283
23B	Screw No.2 x 3/16 in Pan Hd	3	666-111
24A	Reel Carrier	2	025-576
24B	Screw 6BA x 3/16 in Skt Hd Cup Pt	4	666-182
25	Retainer 'C' Clip	1	630-002
26A	Lamp Holder LES 'Fault'	1	455-000
26B	Lamp Holder LES 'Power On'	1	455-003
27A	Deck Cover Support Pillar	1	586-002
27B	Screw 4BA x ⅜ in Ch Hd	1	666-250
27C	Washer 4BA SP	2	922-045
27D	Pillar	1	568-010
27E	Rubber Insert	1	440-012
28	Counter Assy	1	022-343
29	Counter Drive Belt	1	060-002
30A	Pinch Roller	1	022-459
30B	Bracket Assy	1	025-629
30C	Disc	1	295-008
30D	Screw 6BA x 3/16 in Mush Hd	1	668-065
31A	Pinch Roller Arm Assy	1	012-000
31B	Extension Spring	1	712-007
31C	Spindle	1	705-005

32A	Capstan Spindle H 50Hz	1	705-013
	H 60Hz		705-016
33	Gimbal Bearing Assy	1	022-445
34	Flywheel	1	940-001
35A	Idler Wheel	3	025-113
35B	Washer	3	922-034
35C	Retainer	3	630-019
35D	Grommet	3	398-004
35E	Idler Arm Low Speed	1	022-431A
35F	Med Speed	1	022-431B
35G	High Speed	1	022-431C
36	Idler Arm Spring	3	712-015
37A	Idler Arm Bracket	1	095-229
37B	" " "	1	095-230
37C	" " Interlock	1	095-231
38	Spring Retaining Bracket	1	095-003
39	Run Solenoid Armature Assy	1	022-024
40A	Compression Spring	1	712-010
40B	Nut 4BA Nyloc	1	554-017
40C	Washer	2	922-055
41	Brake Tension Spring	2	712-043
42	Brake Arm	2	025-439
43	Brake Band	2	097-003
44	Circlip	4	630-013
45A	Brake Arm Pivot Screw	2	688-048
45B	Pillar	2	568-011
45C	Shim	As reqd.	677-009
46A	Brake Tension Spring Arm	2	722-038
46B	Screw 6BA x 3/16 in Csk Hd BMS	4	666-191
47A	Brake Tension Bracket	2	095-115
47B	Screw 6BA x 3/16 in Ch Hd BMS	2	666-183
47C	Washer 6BA x 15/64 in x .024 in	2	922-061
48A	Brake Arm Actuator - Supply	1	025-594
48B	- Take-up	1	025-595
48C	Brake Adjusting Bush	2	100-051
48D	Locknut 4BA Nyloc	2	554-022
49	Brake Rod Pivot Screw 6BA x ¼ in Mush Hd	1	666-196
50	Sleeve	1	687-039
51A	Spindle Support Link	1	470-011
51B	Brake Return Spring	1	712-007
52	Power Supply Switch Board	1	087-034
53A	Bracket (P101 fixing)	2	095-115
53B	Screw 8BA x ⅜ in Csk Hd	2	666-218
53C	Washer 8BA SP	2	922-043
53D	Locknut 8BA	2	554-027

54A	Pillar	2	568-013
54B	Screw 2BA x ½ in Hex Hd BMS	4	666-017
54C	Washer 2BA SP	4	922-050
55	Tape Speed Indicator	1	025-583
56	Tape Speed Indicator Knob	1	022-451
57	Take-up Reel Motor	1	025-250
58A	Start Lever Assy	1	025-018
58B	Spring Assy	1	025-003
58C	Screw 6BA x 5/16 in Hex Hd	1	666-019
58D	Locknut 6BA	1	554-019
58E	Spring	1	712-004
59A	Side Frame - RH	1	022-447
59B	- LH	1	022-448
60	Start Solenoid Armature	1	013-003
61	Tape Deck Plate	1	025-597
62A	Handle - Main Rib	1	412-004
62B	- Cover	1	215-019
63A	Speed Change Spindle	1	705-003
63B	Cam	1	126-000
64A	Remote Socket Bracket	1	095-236
64B	Screw 6BA x ⅜ in Ch Hd	3	666-192
64C	Locknut 6BA	6	554-019
64D	Washer 6BA SP	3	922-041
65	Cam Follower Bracket Spring	1	712-011
66A	Cam Follower Roller	1	642-002
66B	Screw 4BA x ¼ in Hex Hd BMS	1	666-271
66C	Washer 4BA x ⅜ in	1	922-056
66D	Washer 4BA SP	2	922-045
66E	Locknut 4BA	1	554-012
67	Switch Operating Bracket Assy	1	025-437A
68	Screw 6BA x ⅜ in Hex Hd BMS	2	666-175
69A	Cam Follower Support Bracket Assy	1	022-001
69B	Cam Bracket	1	025-001
69C	Screw	1	666-137
69D	Washer 4BA SP	1	922-045
69E	Locknut 4BA	1	554-012
70A	Screw 4BA x ⅜ in Ch Hd BMS	2	666-250
70B	Washer 4BA SP	2	922-045
70C	Locknut 4BA	2	554-012
71	Reel Size Knob	1	022-452
72	Control Switch Assy	1	025-605
74A	Grommet	4	398-005
74B	Screw 1¼ x ¼ in BSW Hex Hd BMS	4	666-100
74C	Washer ¼ in	4	922-002
74D	Spacer	4	698-039

75A	Amplifier Support Strap	1	025-577
75B	Screw 4BA x ⅜ in Hex Hd BMS	4	555-256
75C	Washer 4BA SP	4	922-045
75D	Locknut 4BA	4	554-012
76A	Deck Support Frame (Front)	1	025-435
76B	Screw 4BA x ⅜ in Hex Hd BMS	4	555-256
76C	Washer 4BA SP	4	922-045
76D	Locknut 4BA	4	554-012
77A	Deck Support Frame (Rear)	1	025-435
77B	Screw 4BA x ⅜ in Hex Hd BMS	4	555-256
77C	Washer 4BA SP	4	922-045
77D	Locknut 4BA	4	554-012
78	Supply Reel Motor	1	022-250
79A	Capstan Motor	1	022-003
79B	Pulley	1	596-000
79C	Mounting Bracket	1	095-095
79D	Shockmounts	4	541-022
79E	Locknuts 2BA	8	554-008
80	Foil Stop Guide Assy:-		
80A	Spacer, tapped, Hex	1	698-149
80B	Tape Guide Cheek	2	409-018
80C	Tape Guide Shell	1	409-019
80D	Spring	1	712-051
80E	Pin	1	568-015
80F	Washer 6BA Wavy	1	922-122
80G	Locknut 6BA	1	554-019
81	Tape Guide Assy:-		
81A	Spacer, tapped	3	698-149
81B	Tape Guide Cheek	6	409-013
81C	Tape Guide Shell	3	409-014
81D	Spring	3	712-050
81E	Platform	2	409-017
81F	Pin	3	568-015
81G	Washer 6BA Wavy	3	922-122
81H	Locknut 6BA	3	554-019

5.2 Miscellaneous

Knobs

Amplifier Controls Knob - Upper	4	022-439
Lower	4	022-438
Bass & Treble Controls Knob	4	022-435
Record Track Knob	1	022-440
Transfer, Bias, Tape & Source Knob	7	022-436
On/Off Knob	1	022-450
Speed Knob	1	022-451
Wind & Reel Knob	2	022-452
Loading Arm Knob	1	022-453
Turns Counter Zero Knob	1	448-045
Dolby Switches Knob	2	022-437

Amplifier Panel - 'Non-Dolby'	1	573-401
'Dolby'		573-400
Deck Control Panel	1	573-386
Deck Cover Plate	1	022-425
Rear Trim	1	573-398
Head Cover	1	215-029
Cabinet Feet - Front Insert	4	332-008
Back	4	332-001
Power Supply Socket & Lead	1	578-018

PARTS LISTS

Unless stated otherwise, all resistors are ± 5% tolerance and rated at $\frac{1}{2}$W.

Note: When ordering any replacement parts, it is advisable to quote the serial number of the recorder. When ordering replacement transistors, it is essential to quote both the serial number and the circuit reference of the position for which it is intended, as in certain circumstances it may be necessary to supply an alternative with a different part number.

Circuit Reference	RECORD N.R. PROCESSOR ASSEMBLY 025-591				Part Number
	Resistors (R) and Potentiometers (RV)				
R1	18k Ω				625-26-18K
R2	5·6k Ω				625-28-5K6
R3	5·6k Ω				625-28-5K6
R4	18k Ω				625-26-18K
R5	100 Ω				625-26-100
R6	18k Ω				625-28-18K
R7	33k Ω				625-28-33K
R8	27k Ω				625-26-27K
R9	180k Ω	¼W	2%		625-25-180K
R10	12k Ω				625-28-12K
R11	18k Ω				625-28-18K
R12	4·7M Ω				625-26-4M7
R13	180k Ω				625-28-180K
R14	2·7k Ω				625-28-2K7
R15	47k Ω				625-28-47K
R16	3·3k Ω	¼W	1%		625-24-3K3
R17	39k Ω				625-28-39K
R18	2·2k Ω				625-26-2K2
R19	10k Ω				625-28-10K
RV20	5k Ω	Linear Pre-set			582-049
R21	1·8k Ω				625-28-1K8
R22	1M Ω				625-28-1M
R23	1·5M Ω				625-28-1M5
R24	15k Ω				625-28-15K
R25	8·2k Ω				625-28-8K2
R26	8·2k Ω				625-28-8K2
R27	10k Ω				625-28-10K
R28	432 Ω		¼%		624-014
R29	47k Ω				625-28-47K
R30	120k Ω				625-26-120K
R31	2·7k Ω				625-28-2K7
R32	1k Ω				625-26-1K
R33	15k Ω				625-28-15K
R34	270k Ω				625-28-270K
R35	47 Ω				625-28-47
R36	270k Ω				625-26-270K
R37	220k Ω				625-28-220K
RV38	200k Ω	Linear Pre-set			582-048
R38	8·2k Ω				625-28-8K2
R39	33 Ω				625-28-33
	Capacitors				
C1	10μF	16V	Electrolytic		130-027
C2	2,200pF	63V			131-781
C3	2,200pF	63V			131-781
C4	3,000pF	63V			131-782
C5	10μF	16V	Electrolytic		130-027
C6	10μF	16V	Electrolytic		130-027
C7	33,000pF	30V			131-786
C8	150μF	16V	Electrolytic		130-002
C9	4,700pF	63V			131-783
C10	10μF	16V	Electrolytic		130-027
C11	0·022μF	250V			131-517
C12	10μF	16V	Electrolytic		130-027
C13	10μF	16V	Electrolytic		130-027
C14	220μF	40V	Electrolytic		130-003
C15	0·1μF	100V			131-250
C16	150μF	16V	Electrolytic		130-002

Circuit Reference	RECORD PROCESSOR (continued)			Part Number
C17	0·1μF	100V		131-250
C18	10μF	16V	Electrolytic	130-027
C19	10μF	16V	Electrolytic	130-027
C20	0·1μF	250V		131-261
C21	0·1μF	100V		131-250
C22	0·33μF	100V		131-257
C23	2,700pF	30V		131-785
	Miscellaneous			
TR1	Transistor BC184LC			825-005
TR2	F.E. Transistor 2SK30GR— selected			825-027
TR3	Transistor BC184LC			825-005
TR4	Transistor BC214			825-016
TR5	Transistor BC184LC			825-005
TR6	Transistor BC184LC			825-005
D1	Zener Diode BZY 88-C8V2			290-018
D2	Diode		OA91	290-003
D3	Diode		BAX16	290-001
D4	Diode		BAX16	290-001
D5	Diode		OA91	290-003
D6	Diode		BAX16	290-001
L1	Filter Coil 36mH (type 15F)			200-002
L2	Filter Coil 23mH (type 10ME)			200-003

Circuit Reference	REPLAY N.R. PROCESSOR ASSEMBLY 025-590				Part Number
	Resistors (R) and Potentiometers (RV)				
RV51	100k Ω	Linear Pre-set			582-045
R52	27k Ω				625-28-27K
R53	430k Ω	¼W	2%		625-25-430K
R54	6·8k Ω				625-28-6K8
R55	68k Ω	¼W	2%		625-25-68K
R56	2·7k Ω				625-26-2K7
R57	10k Ω				625-28-10K
R58	39k Ω				625-26-39K
R59	4·7k Ω				625-28-4K7
R60	2·2M Ω				625-28-2M2
R61	12k Ω				625-28-12K
R62	33k Ω				625-28-33K
R63	2·2k Ω				625-28-2K2
R64	39K Ω				625-28-39K
R65	2·7k Ω				625-28-2K7
R66	3·3k Ω	¼W	1%		625-24-3K3
R67	2·2k Ω				625-28-2K2
R68	10k Ω				625-28-10K
RV69	5k Ω	Linear Pre-set			582-049
R70	1·8k Ω				625-28-1K8
R71	1M Ω				625-28-1M
R72	432 Ω		¼%		624-014
R73	10k Ω				625-28-10K
R74	8·2k Ω				625-28-8K2
R75	8·2k Ω				625-28-8K2
R76	1·5M Ω				625-28-1M5
R77	15k Ω				625-28-15K
R78	120k Ω				625-28-120K
R79	2·7k Ω				625-28-2K7
R80	47k Ω				625-28-47K
R81	47 Ω				625-28-47

Circuit Reference	REPLAY PROCESSOR (continued)			Part Number
R82	1k Ω			625-28-1K
R83	15k Ω			625-28-15K
R84	270k Ω			625-28-270K
R85	220k Ω			625-28-220K
R86	270k Ω			625-26-270K
R87	8·2k Ω			625-28-8K2
R88	33 Ω			625-28-33
	Capacitors			
C51	100μF	40V	Electrolytic	130-001
C52	10μF	16V	Electrolytic	130-027
C53	10μF	16V	Electrolytic	130-027
C54	0·1μF	100V		131-250
C55	10μF	16V	Electrolytic	130-027
C56	·033μF	30V		131-786
C57	4,700pF	63V		131-783
C58	150μF	16V	Electrolytic	130-002
C59	10μF	16V	Electrolytic	130-027
C60	0·1μF	100V		131-250
C61	150μF	16V	Electrolytic	130-002
C62	0·1μF	100V		131-250
C63	10μF	16V	Electrolytic	130-027
C64	0·1μF	250V		131-261
C65	10μF	16V	Electrolytic	130-027
C66	0·1μF	100V		130-250
C67	0·33μF	100V		131-257
C68	2,700pF	30V		131-785
	Miscellaneous			
TR51	Transistor BC184LC			825-005
TR52	Transistor BC184LC			825-005
TR53	F.E. Transistor 2SK30GR— selected			825-027
TR54	Transistor BC184LC			825-005
TR55	Transistor BC214			825-016
TR56	Transistor BC184LC			825-005
TR57	Transistor BC184LC			825-005
D51	Zener Diode BZY88-C8V2			290-018
D52	Diode OA91			290-003
D53	Diode BAX16			290-001
D54	Diode BAX16			290-001
D55	Diode OA91			290-003
D56	Diode BAX16			290-001

Circuit Reference	SUPPLY BOARD ASSEMBLY 025-287			Part Number
	Resistors			
R90	4·7k Ω			625-28-4K7
R91	4·7k Ω			625-28-4K7
	Capacitors			
C90	4·7μF	63V	Electrolytic	130-007
C91	4·7μF	63V	Electrolytic	130-007

Circuit Reference	GENERAL	Part Number
S1	Dolby Switch (3 position)	747-001
S2	M.P.X. Switch (2 position)	747-002

Circuit Reference	100 DECK UNIT			Part Number
	Resistors (R) and Potentiometers (RV)			
R100	68 Ω	2W		626-002
R101	33 Ω			626-009
RV103	2K Ω	25W	Wind	582-082
R110	100 Ω	¼W		625-08-100
	Capacitors			
C100	0·1μF	300V	ac	132-000
C101	0·75μF	450V	ac	132-001
C108	1μF	450V	ac	132-007
C109	1μF	450V	ac	132-007
	Miscellaneous			
D101	Diode BAX16 (or 1N4148)			290-001
D102	Diode BAX16 (or 1N4148)			290-001
D103	Diode BAX16 (or 1N4148)			290-001
S101	Switch, On/Off			750-004
S102	Start Switch (motors)			748-001
S103	Start Switch (economy)			748-001
S104	Speed Switch (wafer)			750-002
S105	Reel Switch			750-025
S106	Run microswitch			748-001
L100	Solenoid Start			025-625
L101	Solenoid Run			025-083
L102	Solenoid Brake			025-625
LP100	Lamp LES 14V (Lampholder 455-000)			455-018
X100	Capstan Motor (240V)			022-003
X101	Supply Reel Motor			022-250
X102	Take-up Reel Motor			022-250
		7622/7602		7624/7604
	Head Assembly	020-366		020-365
X103	Erase Head	BE16		BE28
X104	Record Head	BR16z		BR28z
X105	Replay Head	BP16z		BP28z
SK1	Connector, 15 way			692-085
SK2	Connector, 25 way			692-086
SK3	Connector, 15 way			692-084
SK4	Connector, 15 way			692-084
SK5	Connector, 16 way			692-088
SK6	Connector, 28 way			692-087
SK7	Connector, 5 way			692-083
P100	Plug, 9 way (cover 577-045)			577-007
P101	Plug, 12 way (with 12 x pin 577-033)			577-019
SK102	Socket, 14 way Remote			692-013

Circuit Reference 120 LOGIC BOARD ASSEMBLY 025-600 — Part Number

	Resistors	
R120	180 Ω 4W	626-062
R121	180 Ω 4W	626-062
R122	180 Ω 4W	626-062
R123	180 Ω 4W	626-062
R124	1·2K Ω 1W	625-16-1K2
R125	1·2K Ω 1W	625-16-1K2
R126	1·2K Ω 1W	625-16-1K2
R127	1·2K Ω 1W	625-16-1K2
R128	1·2K Ω 1W	625-16-1K2
R129	1·2K Ω 1W	625-16-1K2
R130	10K Ω 1W	625-16-1K
R131	180 Ω 1W	625-16-180
R132	180 Ω 1W	625-16-180
R133	2·2K Ω	625-28-2K2
R134	1M Ω	625-28-1M
R135	150K Ω	625-28-150K
R136	22K Ω	625-28-22K
R137	10K Ω	625-28-10K
R138	10K Ω	625-28-10K
R139	10K Ω	625-28-10K
R140	10K Ω	625-28-10K
R141	10K Ω	625-28-10K
R142	4·7K Ω	625-28-4K7
R143	1·2K Ω	625-28-1K2
R144	22 Ω	625-28-22
R145	22 Ω	625-28-22
R147	3·3K Ω	625-28-3K3
	Capacitors	
C120	100µF 40V Electrolytic	130-001
C121	100µF 40V Electrolytic	130-001
*C123	68µF 40V Electrolytic	130-077
C124	1µF 100V	131-521
C125	·047µF 250V	131-506
C126	·047µF 250V	131-506
	Miscellaneous	
TR120	Transistor BC182LB	825-012
TR121	Transistor BC182LB	825-012
TR122	Transistor BC212LB	825-049
TR123	Transistor BC300	825-033
TR124	Transistor BC212LB	825-049
D120 to D152 inclusive	Diode 1N4002	290-022
RL120	Relay Wind	622-008
RL121	Relay Pause	622-008
RL122	Relay Run	622-010
RL123	Relay Rec.	622-010
RL124	Relay Stop	622-011
RL125	Relay Rev	622-009
P1	Connector, 20 way	577-076
P2	Connector, 25 way	577-077
P3	Connector, 15 way	577-075
P4	Connector, 15 way	577-075

*Selected to suit relay RL160 (HS start at 15 in/s)

Circuit Reference 160 POWER BOARD ASSEMBLY 025-601 — Part Number

	Resistors	
R160	2·2K Ω 7W	626-063
R161	0 Ω (short circuit)	
R162	330 Ω 7W	626-064
R163	10 Ω 2½W	626-035
R164	10 Ω 2½W	626-035
	Capacitors	
C160	0·1µF 250V ac	132-000
C161	0·1µF 250V ac	132-000
	Miscellaneous	
RL160	Relay (700 Ω) 24V	622-011
P6	Connector, 28 way	577-078

Circuit Reference 170 SWITCH BOARD ASSEMBLY 025-605 — Part Number

	Resistors	
R170	1K Ω 1W	625-16-1K
R171	560 Ω	625-28-560
	Miscellaneous	
S170	Switch Wind	749-035
S171	Switch Pause	749-035
S172	Switch Run	749-035
S173	Switch Rec.	749-035
S174	Switch Can	749-035
S175	Switch Stop	749-035
S176	Switch Rev.	749-035
S177	Switch Mute	747-073
P5	Connector, 16 way	577-073
	LED Board 025-604	
D1	L E Diode Wind	290-031
D2	L E Diode Pause	290-031
D3	L E Diode Run	290-031
D4	L E Diode Rec.	290-031

Circuit Reference 180 MOTION SENSOR BD. ASSEMBLY 025-602 — Part Number

	Resistors	
R180	1M Ω	625-28-1M
R181	270K Ω	625-28-270K
R182	82K Ω	625-28-82K
R183	82K Ω	625-28-82K
R184	27K Ω	625-28-27K
R185	10K Ω	625-28-10K
R186	10K Ω	625-28-10K
R187	180K Ω	625-28-180K
R188	1K Ω	625-28-1K
R189	1K Ω 1W	625-16-1K
	Capacitors	
C180	0·33µF 100V	131-257
C181	0·22µF 100V	131-253

Circuit Reference	MOTION SENSOR BOARD (continued)	Part Number
	Miscellaneous	
TR180	Transistor BC182LB	825-012
TR181	Transistor BC212LB	825-049
TR182	Transistor BC182LB	825-012
D180	Diode BAX16 (or 1N4148)	290-001
D181	Diode BAX16 (or 1N4148)	290-001
S180	Optical Switch	290-035
P7	Plug (5 way)	577-074

Circuit Reference	200 RECORD BOARD ASSEMBLY 025-589	Part Number
	Resistors (R) and Potentiometers (RV)	
R200	15 Ω	625-27-15
R201	1k Ω	625-27-1K
R202	3·9K Ω	625-28-3K9
R203	100K Ω	625-28-100K
R204	220K Ω	625-27-220K
R205	220 Ω	625-28-220
R206	180K Ω	625-28-180K
R207	180K Ω	625-28-180K
R208	2·2M Ω	625-28-2M2
R209	22K Ω	625-28-22K
R210	10K Ω	625-28-10K
R211	22K Ω	625-28-22K
R212	100K Ω	625-28-100K
R213	1K Ω	625-28-1K
R214	33K Ω	625-28-33K
R215	3·3K Ω	625-28-3K3
R216	1·8K Ω	625-28-1K8
R217	180K Ω	625-28-180K
R218	1M Ω	625-28-1M
R219	470k Ω	625-28-470K
RV220	10K Ω Linear Pre-Set	582-099
R221	470 Ω	625-28-470
R222	12K Ω	625-28-12K
R223	1·5M Ω	625-28-1M5
R224	10K Ω	625-28-10K
R225	1K Ω	625-28-1K
R226	3·3K Ω	625-28-3K3
	Capacitors	
C200	10µF 25V Electrolytic	130-027
C201	150µF 16V Electrolytic	130-002
C202	1,000pF 63V	131-768
C203	1,000pF 63V	130-768
C204	100µF 4V Electrolytic	130-068
C205	·047µF 250V	131-506
C206	10µF 25V Electrolytic	130-027
C207	10µF 25V Electrolytic	130-027
C208	10µF 25V Electrolytic	130-027
C209	100µF 40V Electrolytic	130-001
C210	·015µF 250V	131-509
C211	·047µF 250V	131-506
C212	0·22µF 100V	131-253
C213	·022µF 250V	131-505
C214	1,000pF 125V	131-768
C215	220µF 40V Electrolytic	130-003
C216	2·2µF 35V Tantalum	130-006

Circuit Reference	RECORD BOARD (continued)	Part Number
	Miscellaneous	
TR200	Transistor BC184LC	825-005
TR201	Transistor BC183LB	825-015
TR202	F.E. Transistor 2SK30GR	825-006
TR203	Transistor BC184LC	825-005
TR204	Transistor BC183LB	825-015
D200	Diode BAX16 (or 1N4148)	290-001

Circuit Reference	300 REPLAY BOARD ASSEMBLY 025-587	Part Number
	Resistors	
R300	100 Ω	625-28-100
R301	2·2M Ω	625-28-2M2
R302	68 Ω	625-28-68
R303	47K Ω	625-28-47K
R304	100K Ω	625-28-100K
R305	2·2M Ω	625-28-2M2
R306	27K Ω	625-28-27K
R307	6·8K Ω	625-28-6K8
R308	10K Ω	625-28-10K
R309	150K Ω	625-28-150K
R310	22K Ω	625-28-22K
R311	6·8K Ω	625-28-6K8
R312	3·3K Ω	625-28-3K3
R313	10K Ω	625-28-10K
R314	22K Ω	625-28-22K
R315	120K Ω Average Value	
R316	3·3K Ω	625-28-3K3
R317	120K Ω Average Value	
R318	5·1K Ω	625-28-5K1
R319	9·1K Ω	625-28-9K1
R320	120K Ω Average Value	
	Capacitors	
C300	150µF 16V Electrolytic	130-002
C301	4·7µF 20V Tantalum	130-039
C302	150pF 350V	131-757
C303	0·22µF 250V	131-508
C304	1µF 63V Electrolytic	130-045
C305	·068µF 250V	131-552
C306	·068µF 250V	131-552
C307	·033µF 250V	131-548
C308	0·1µF 100V	131-250
C309	220µF 40V Electrolytic	130-003
C310	0·22µF 250V	131-508
C311	4,700pF 30V	131-778
C312	·047µF 250V	131-506
C313	1,500pF Average Value	
C314	·01µF 30V	131-774
C315	4,000pF Average Value	
C316	2,000pF Average Value	
C317	·01µF 30V	131-774
C318	·01µF 30V	131-774
C319	1,000pF 30V	131-768
	Miscellaneous	
TR300	Transistor BC214LB	825-016
TR301	Transistor BC214LB	825-016
TR302	Transistor BC183LB	825-015

400 TONE CONTROL BD. ASSEMBLY 025-588

Circuit Reference					Part Number
	Resistors				
R400	4·7M Ω				625-13-4M7
R401	10K Ω				625-28-10K
R402	180K Ω				625-28-180K
R403	68K Ω				625-28-68K
R404	1K Ω				625-28-1K
R405	1K Ω	2½W			624-034
R406	560 Ω				625-28-560
R407	620 Ω				625-28-620
R408	27K Ω				625-28-27K
R409	180 Ω				625-28-180
R410	22K Ω				625-28-22K
R411	10K Ω				625-28-10K
R412	27K Ω				625-28-27K
R413	2·2M Ω				625-28-2M2
R414	2·2M Ω				625-28-2M2
R415	10K Ω				625-28-10K
R416	1·5K Ω				625-28-1K5
R417	1K Ω				625-28-1K
R418	1·5K Ω				625-28-1K5
R419	470 Ω	¼W			625-13-470
	Capacitors				
C400	1μF	63V	Electrolytic		130-045
C401	100μF	63V	Electrolytic		130-020
C402	1μF	63V	Electrolytic		130-045
C403	4·7μF	63V	Electrolytic		130-007
C404	220μF	40V	Electrolytic		130-003
C405	100μF	40V	Electrolytic		130-001
C406	33μF	40V	Electrolytic		130-048
C407	·022μF	250V			131-505
C408	·022μF	250V			131-505
C409	0·1μF	250V			131-250
C410	4·7μF	63V	Electrolytic		130-007
C411	800pF	125V			131-759
C412	1μF	63V	Electrolytic		130-045
	Miscellaneous				
VT400	Transistor BC184LC				825-005
VT401	Transistor BC377				825-029
VT402	Transistor BC184LC				825-005

500 POWER AMPLIFIER BOARD ASSEMBLY 025-100

Circuit Reference					Part Number
	Resistors				
R500	0·35 Ω	1W	Wire-wound		626-005
R501	0·35 Ω	1W	Wire-wound		626-005
R502	220 Ω				625-28-220
R503	220 Ω				625-28-220
R504	2·2 Ω				625-28-2D2
R505	4·7K Ω				625-28-4K7
R506	160 Ω	¼W	Average Value		624-003
R507	470 Ω				625-28-470
R508	1K Ω				625-28-1K
R509	39K Ω				625-28-39K
R510	4·7 Ω				625-28-4K7
R511	10K Ω				625-28-10K
R512	10K Ω				625-28-10K
R513	3·9K Ω				625-28-3K9
R514	8·2K Ω				625-28-8K2

Circuit Reference	POWER AMPLIFIER BOARD (continued)				Part Number
R515	82K Ω				625-28-82K
R516	68 Ω				625-28-68
R517	100K Ω				625-28-100K
R518	6·8K Ω				625-28-6K8
R519	3·3K Ω				625-28-3K3
R520	22 Ω				625-07-22
	Capacitors				
C500	680μF	25V	Electrolytic		130-004
C501	150μF	16V	Electrolytic		130-002
C502	22μF	25V	Electrolytic		130-016
C503	100μF	40V	Electrolytic		130-001
C504	350pF	160V	10%		131-763
C505	150μF	16V	Electrolytic		130-002
C506	1μF	63V	Electrolytic		130-015
C507	1,800pF	125V	10%		131-764
	Miscellaneous				
TR500	Transistor 40312				825-002
TR501	Transistor BC300				825-033
TR502	Transistor 40312				825-002
TR503	Transistor BC461				825-032
TR504	Transistor BC300				825-033
TR505	Transistor BC183LB				825-015
D500	Diode BAX16				290-001
D501	Diode BAX16				290-001

600 OSCILLATOR BOARD ASSEMBLY 025-103

Circuit Reference					Part Number
	Resistors (R) and Potentiometers (RV)				
R600	100 Ω	¼W	10%		625-13-100
R601	100K Ω				625-28-100K
R602	270 Ω	¼W	5%		625-12-270
R603	10K Ω				625-28-10K
R604	10K Ω				625-28-10K
R605	100K Ω				625-28-100K
RV606	22K Ω	Linear Pre-Set			582-012
R607	270 Ω	¼W	5%		625-12-270
	Capacitors				
C600	68μF	63V	Electrolytic		130-008
C601	·01μF	250V			131-500
C602	12,000pF	125V			131-750
C603	250pF	350V			131-758
C604	250pF	350V			131-758
C605	·01μF	250V			131-500
C606	0·22μF	250V			131-508
C607	3,300pF	160V			131-751
C608	150pF	350V			131-757
C609	390pF	160V			131-784
C610	390pF	160V			131-784
C611	150pF	350V			131-757
C612	500pF	160V			131-765
	Miscellaneous				
TR600	Transistor BC300				825-033
TR601	Transistor BC300				825-033
S600	Record Mode Switch				750-003
L600	Oscillator Coil (Type 799)				025-085
L601	Filter Coil (Type 800)				200-019
L602	Filter Coil (Type 800)				200-019

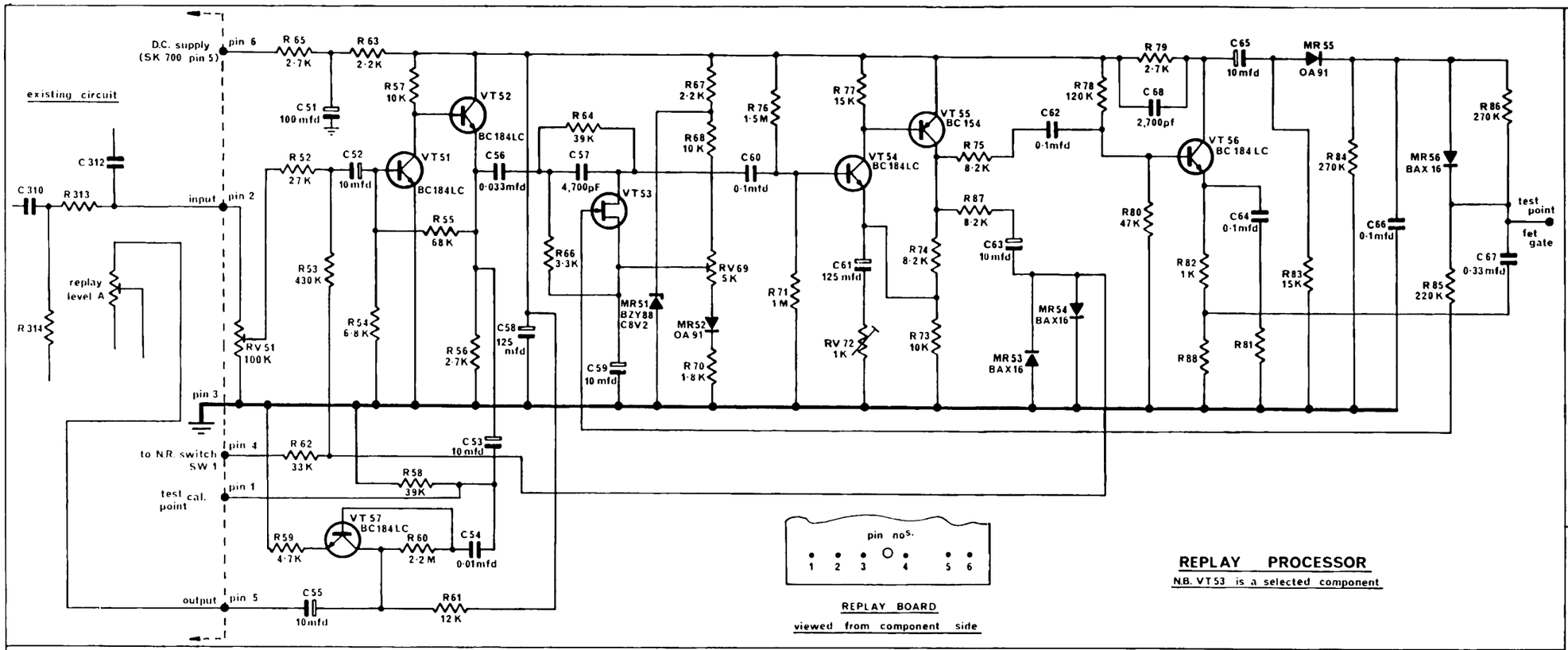
Circuit Reference	OSCILLATOR BOARD (continued)	Part Number
P600	Coaxial Plug (Black) · lead	578-000D
P601	Coaxial Plug (Yellow) · lead	578-000A
P602	Coaxial Plug (Red) · lead	578-000C
P603	Coaxial Plug (Green) · lead	578-000B
SK600	Coaxial Socket (Black) with SK602	692-001
SK601	Coaxial Socket (Yellow) with SK603	692-002
SK602	Coaxial Socket (Red) with SK600	692-001
SK603	Coaxial Socket (Green) with SK601	692-002

Circuit Reference	700 POWER UNIT & GENERAL	Part Number
	Resistors (R) and Potentiometers (RV)	
RV700	100KΩ Linear Pre-Set	582-053
R702	220Ω	625-07-220
RV703	500KΩ Linear 'Bass'	582-081
RV704	500KΩ Linear 'Bass'	582-081
RV705	100KΩ Linear } Volume	582-103
RV706	100KΩ Linear } Volume	
R707	12KΩ (see SW701/4/5)	625-28-12K
R708	12KΩ	625-28-12K
RV709	50KΩ Log. } Line	582-101
RV710	50KΩ Log. } Line	
RV711	10KΩ Log. Pre-Set	582-011
RV712	10KΩ Log. Pre-Set	582-011
R713	270KΩ	625-27-270K
R714	820Ω	625-28-820
RV715	10KΩ Log. Pre-Set	582-011
RV716	10KΩ Log. Pre-Set	582-011
R717	270KΩ	625-27-270K
R718	820Ω	625-28-820
RV719	500KΩ Linear Treble	582-081
RV720	500KΩ Linear Treble	582-081
RV721	1KΩ Linear	582-051
RV722	1KΩ Linear	582-051
RV723	100KΩ Linear 'B'	582-080
RV724	100KΩ Linear 'B'	582-080
RV725	100KΩ Linear 'A'	582-080
RV726	100KΩ Linear 'A'	582-080
RV727	25KΩ Inv. Log. } Mic.	582-102
RV728	25KΩ Inv. Log. } Mic.	
R729	400Ω 2W	626-014
R730	400Ω 2W	626-014
R731	4·7KΩ 1%	625-24-4K7
R732	4·7KΩ 1%	625-24-4K7
R741	68KΩ	625-27-68K
R742	68KΩ	625-27-68K
R743	330Ω	625-27-330
R744	330Ω	625-27-330
RV745	25KΩ Log. } Master Rec.	582-104
RV746	25KΩ Log. } Master Rec.	

Circuit Reference	POWER UNIT AND GENERAL (continued)	Part Number
	Capacitors	
C700	3,300μF 63V Electrolytic	130-067
C701	2,000μF 30V Electrolytic	130-017
C702	8,200pF Average Value	
C703	5,600pF Average Value	
C704	2,700pF Average Value	
C705	2,000pF	131-767
C706	1,200pF	131-760
C707	·047μF	131-506
C708	8,200pF Average Value	
C709	5,600pF Average Value	
C710	2,700pF Average Value	
C711	2,000pF Average Value	131-767
C712	1,200pF Average Value	131-760
C713	·047μF Average Value	131-506
C714	600pF 125V	131-756
C716	·022μF 250V	131-505
C717	·022μF 250V	131-505
	Miscellaneous	
S700	Equalisation Switch	750-001
S702	P B Switch 'Source/Tape'	749-027
S703	P B Switch 'Source/Tape'	749-027
S704	P B Switch 'U→L' } Assembly 025-624 (incl. R707/8)	
S705	P B Switch 'L→U' } Assembly 025-624 (incl. R707/8)	
S701	P B Switch 'Bias' } Assembly 025-624 (incl. R707/8)	
L700	Treble Boost Inductor (727)	022-073
L701	Treble Boost Inductor (727)	022-073
TR700	Mains Supply Transformer (240V)	022-056
D700	Bridge Rectifier WO2	600-002
D701	Bridge Rectifier WO2	600-002
D702	Diode OA91	290-003
D703	Diode OA91	290-003
D704	Diode OA91	290-003
D705	Diode OA91	290-003
D706	Diode OA91	290-003
D707	Diode OA91	290-003
D708	Diode OA91	290-003
D709	Diode OA91	290-003
JK702	Jack Socket, 2 way	692-011
JK703	Jack Socket, 2 way	692-011
JK704	Jack Socket, 2 way	692-011
JK705	Jack Socket, 2 way	692-011
JK706	Jack Socket, 2 way	692-011
JK707	Jack Socket, 2 way	692-011
JK708	Jack Socket, 2 way	692-011
JK709	Jack Socket, 2 way	692-011
JK710	Jack Socket, 3 way (switched)	692-060
P700	Plug, 14 way	577-008
P701	Plug, 3 way 'Power Supply'	577-018
P702	Plug, 2 way (loudspeaker)	577-006
P703	Plug, 2 way (loudspeaker)	577-006
SK100	Socket, 9 way	692-012
SK101	Socket, 12 way (with 12x pin 570-034)	692-027

Circuit Reference	POWER UNIT AND GENERAL (continued)	*Part Number*
SK700	Socket, 14 way	692-013
SK701	Socket, 7 way 'Aux. Skt.'	692-004
SK702	Socket 2 way (loudspeaker)	692-014
SK703	Socket, 2 way (loudspeaker)	692-014
SK704	Socket, 2 way DIN 'Speaker'	692-061
SK705	Socket, 2 way DIN 'Speaker'	692-061
LP700	Lamp LES 14V	455-018
LP701	Lamp LES 14V	455-018
LP702	Lamp LES 14V	455-018
LP703	Lamp LES 14V (Lampholder 455-001)	455-018
FS700	D.C. Fuse (1 Amp-20 x 5 mm)	380-000
FS701	D.C. Fuse (1 Amp-20 x 5 mm) (Fuseholder 380-001)	380-000

Circuit Reference	POWER UNIT AND GENERAL (continued)	*Part Number*
FS702	Power Supply Fuse (1 Amp-) (Fuseholder 380-017)	380-000
FS703	24V D.C. Fuse (1 Amp-20x 5 mm dia)	380-000
FS704	Fuse 3·15 Amp (Fuseholder 380-010)	380-019
FS705	Fuse 1 Amp (Fuseholder 380-010)	380-000
M700	Meter	512-011
M701	Meter	512-011
LS700	Loudspeaker (30 Ω) 7x4 in	700-000
LS701	Loudspeaker (30 Ω) 7x4 in	700-000



FERROGRAPH SERIES 7D

Dolby Noise Reduction (System B) Recorders

Circuit Diagram 250-034 issue 1

To be used in conjunction with the normal circuit diagram and parts list.

CIRCUIT DIAGRAM OF DOLBY N. R. PROCESSORS

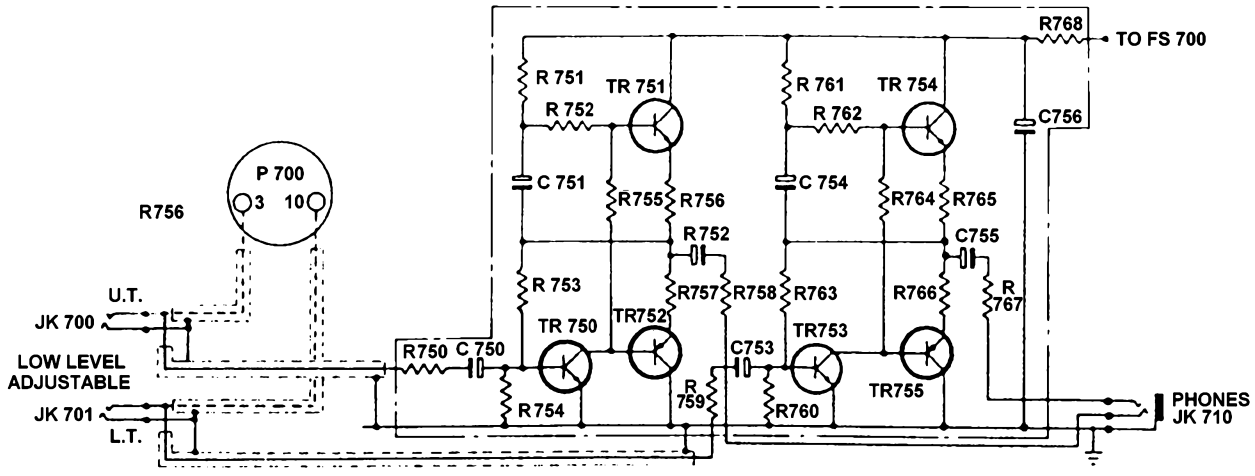


FIG. 29b PHONES AMPLIFIER—MODELS 7602 & 7604

Circuit Reference	750 PHONES AMPLIFIER BOARD ASSEMBLY 025-548		*Part Number*
	Resistors		
R750	8·2K Ω		625-28-8K2
R751	3·3K Ω		625-28-3K3
R752	3·3K Ω		625-28-3K3
R753	68K Ω		625-28-68K
R754	6·8K Ω		625-28-6K8
R755	1·2K Ω		625-28-1K2
R756	22 Ω		625-28-22
R757	22 Ω		625-28-22
R758	100 Ω		625-28-100
R759	8·2K Ω		625-28-8K2
R760	6·8K Ω		625-28-6K8
R761	3·3K Ω		625-28-3K3
R762	3·3K Ω		625-28-3K3
R763	68K		625-28-68K
R764	1·2K Ω		625-28-1K2
R765	22 Ω		625-28-22
R766	22 Ω		625-28-22
R767	100 Ω		625-28-100
R768	1K Ω	2·5W	624-034

Circuit Reference				*Part Number*
	Capacitors			
C750	5μF	63V	Electrolytic	130-007
C751	5μF	63V	Electrolytic	130-007
C752	150μF	25V	Electrolytic	130-011
C753	5μF	63V	Electrolytic	130-007
C754	5μF	63V	Electrolytic	130-007
C755	150μF	25V	Electrolytic	130-011
C756	100μF	40V	Electrolytic	130-001
	Miscellaneous			
TR750	Transistor BC183			825-015
TR751	Transistor BC183			825-015
TR752	Transistor BC214			825-016
TR753	Transistor BC183			825-015
TR754	Transistor BC183			825-015
TR755	Transistor BC214			825-016

FERROGRAPH LOGIC SEVEN

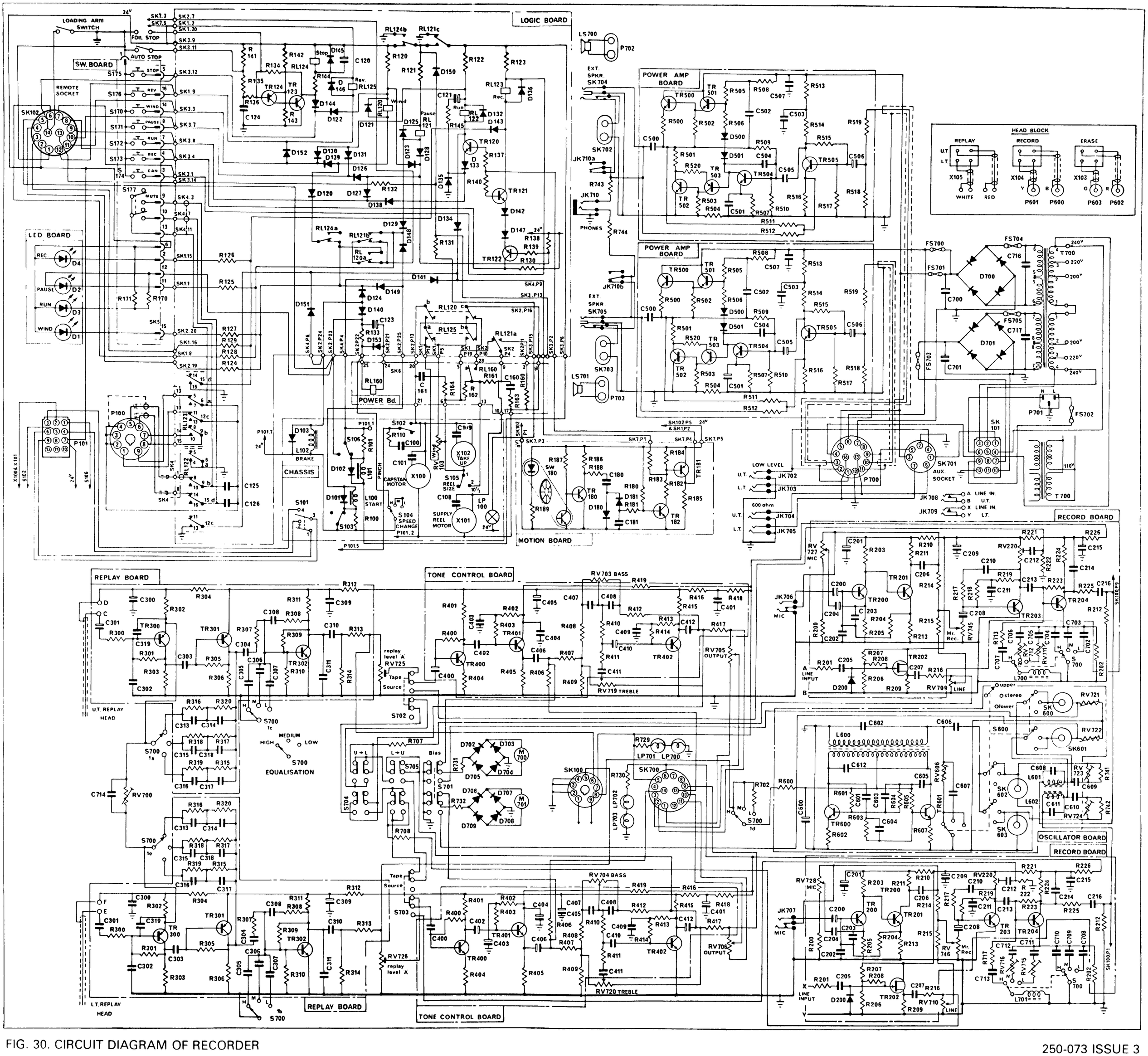


FIG. 30. CIRCUIT DIAGRAM OF RECORDER

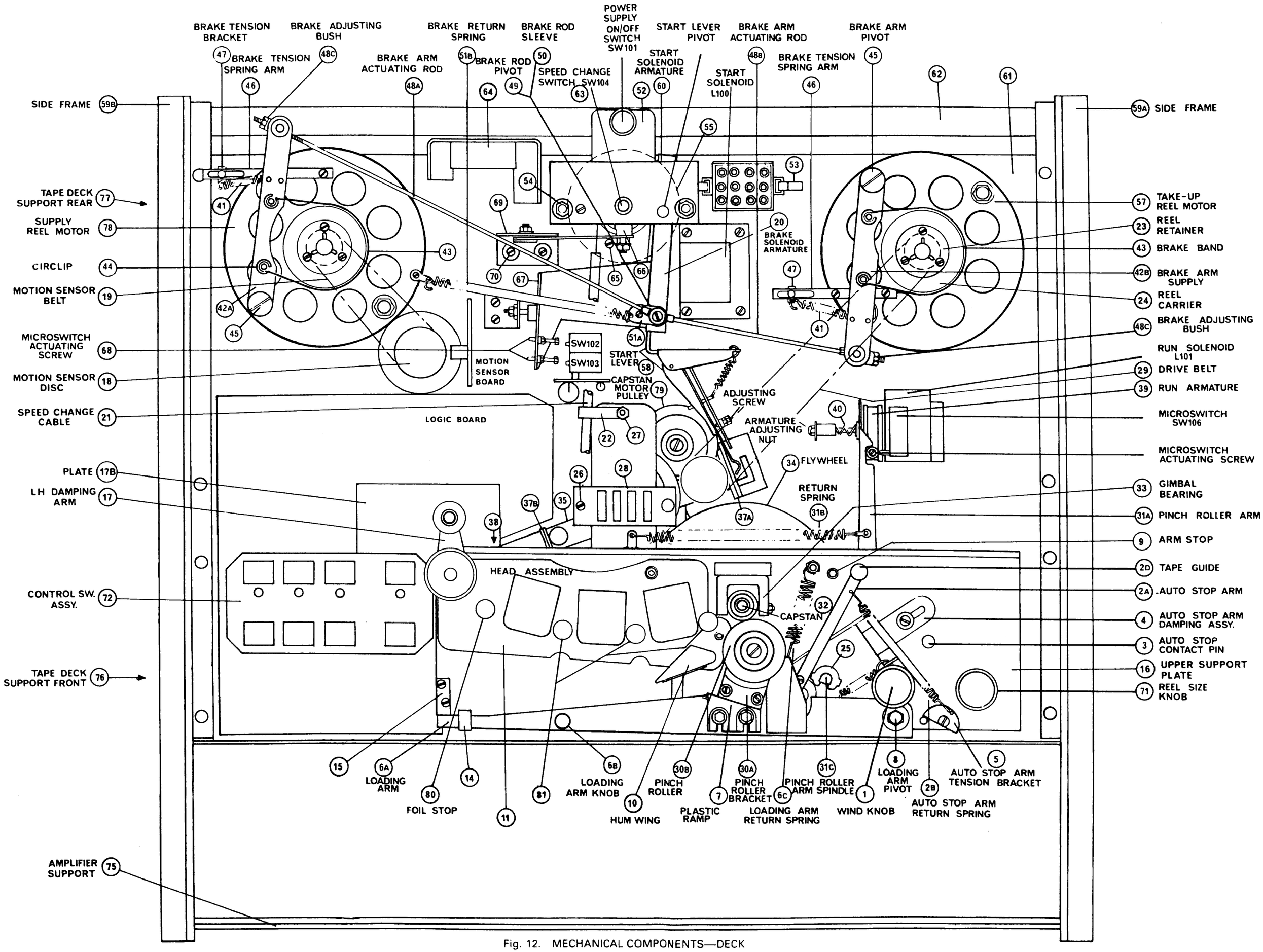
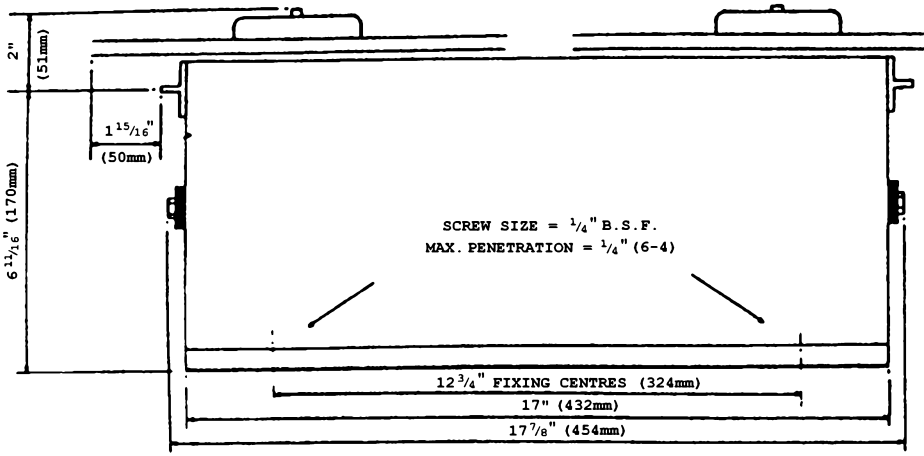
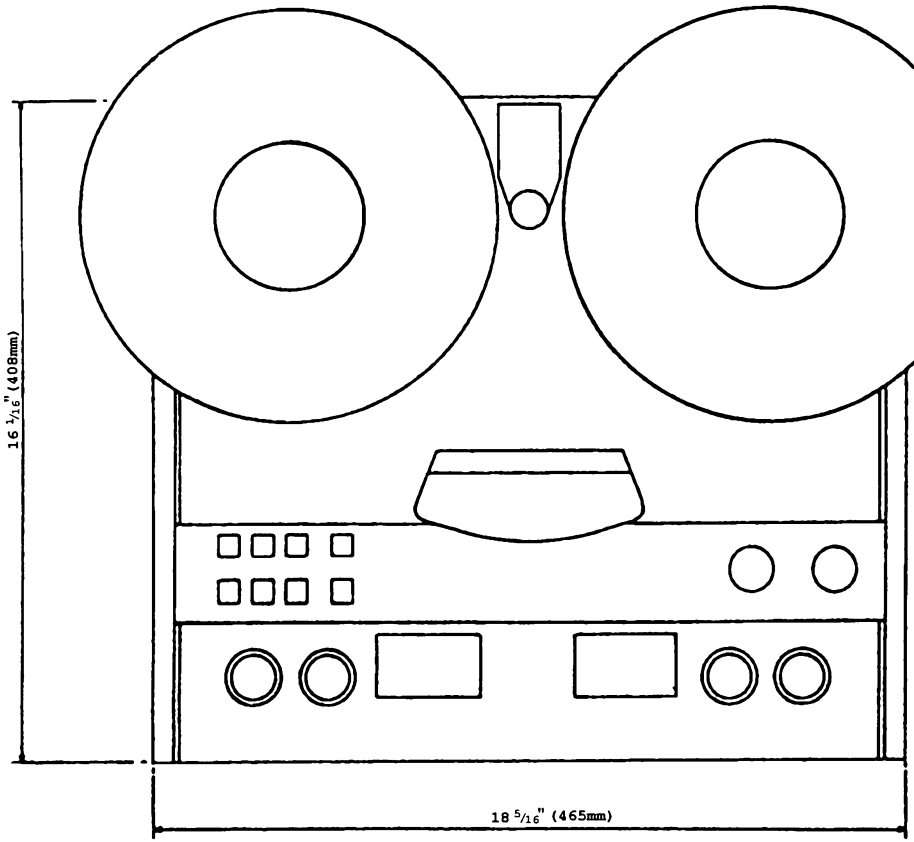
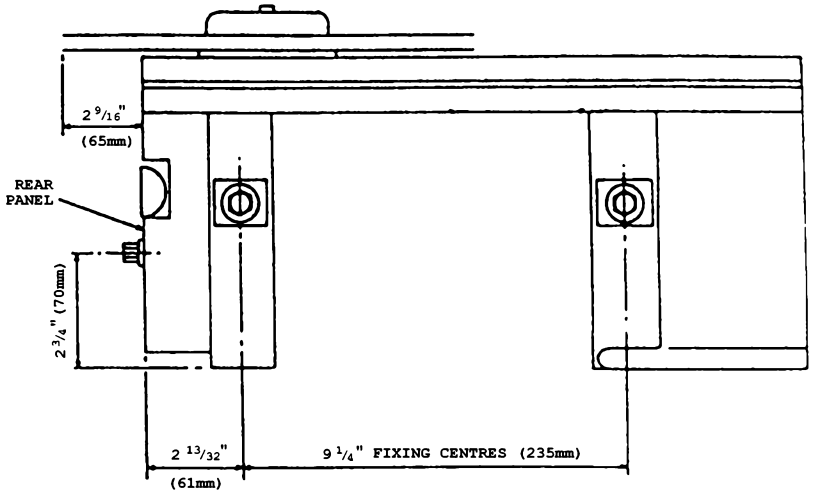
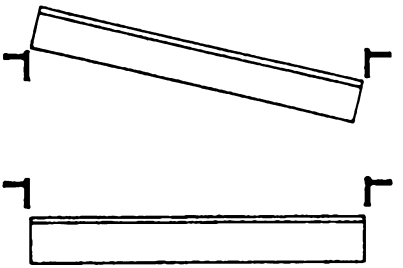


Fig. 12. MECHANICAL COMPONENTS—DECK


2" (51mm)
1 15/16" (50mm)
6 11/16" (170mm)
SCREW SIZE = 1/4" B.S.F.
MAX. PENETRATION = 1/4" (6-4)
12 3/4" FIXING CENTRES (324mm)
17" (432mm)
17 7/8" (454mm)


16 1/16" (408mm)
18 5/16" (465mm)





PROCEDURE FOR STOWAGE OF HANDLE
PRIOR TO REMOVAL FROM CASE

Fig. 13. CHASSIS DIMENSIONS

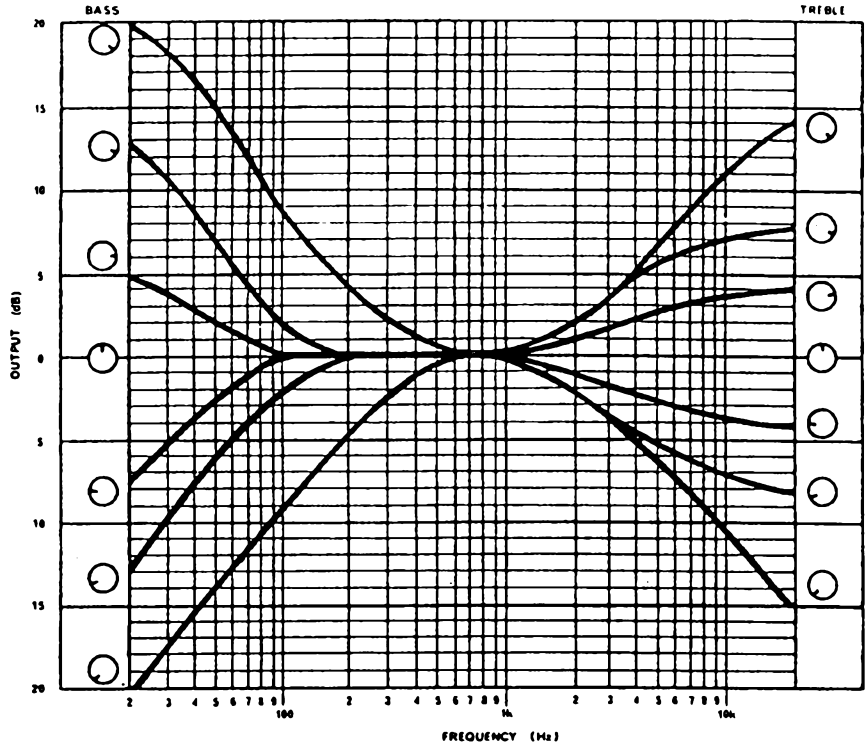


Fig. 14. EFFECT OF BASS AND TREBLE CONTROLS

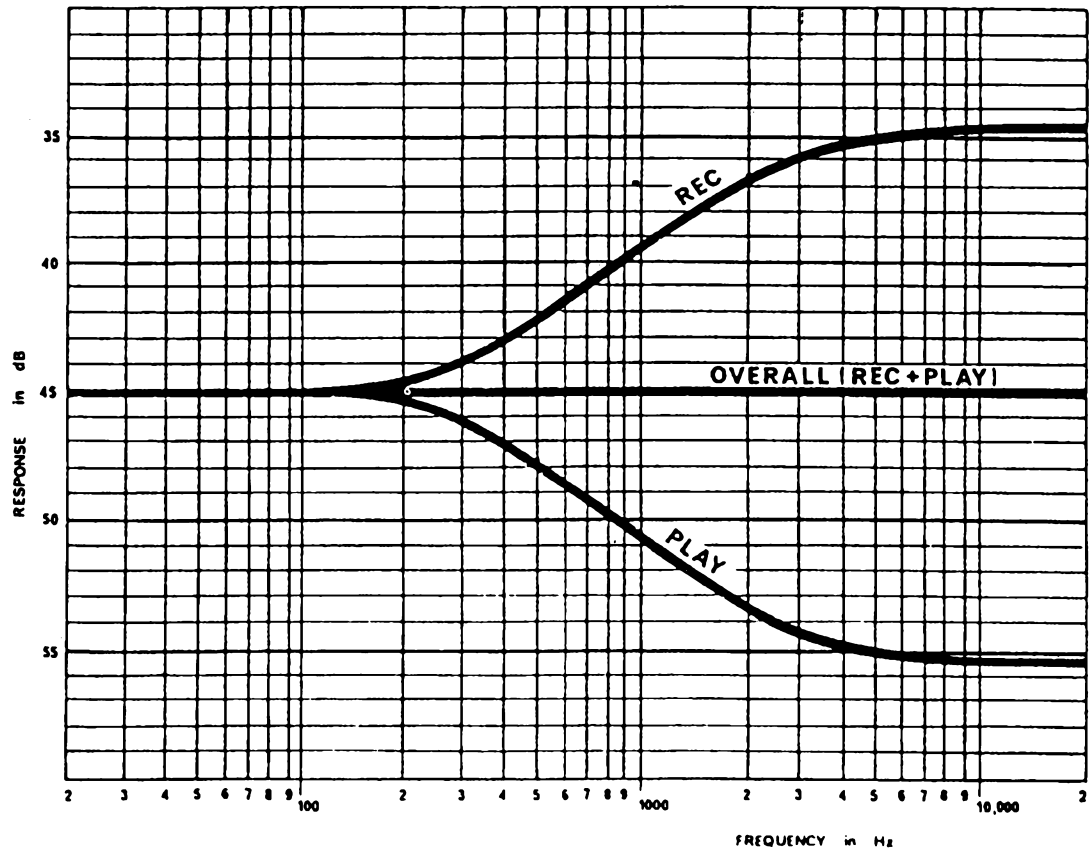


Fig. 15. LOW-LEVEL CHARACTERISTICS OF RECORD AND REPLAY DOLBY PROCESSORS

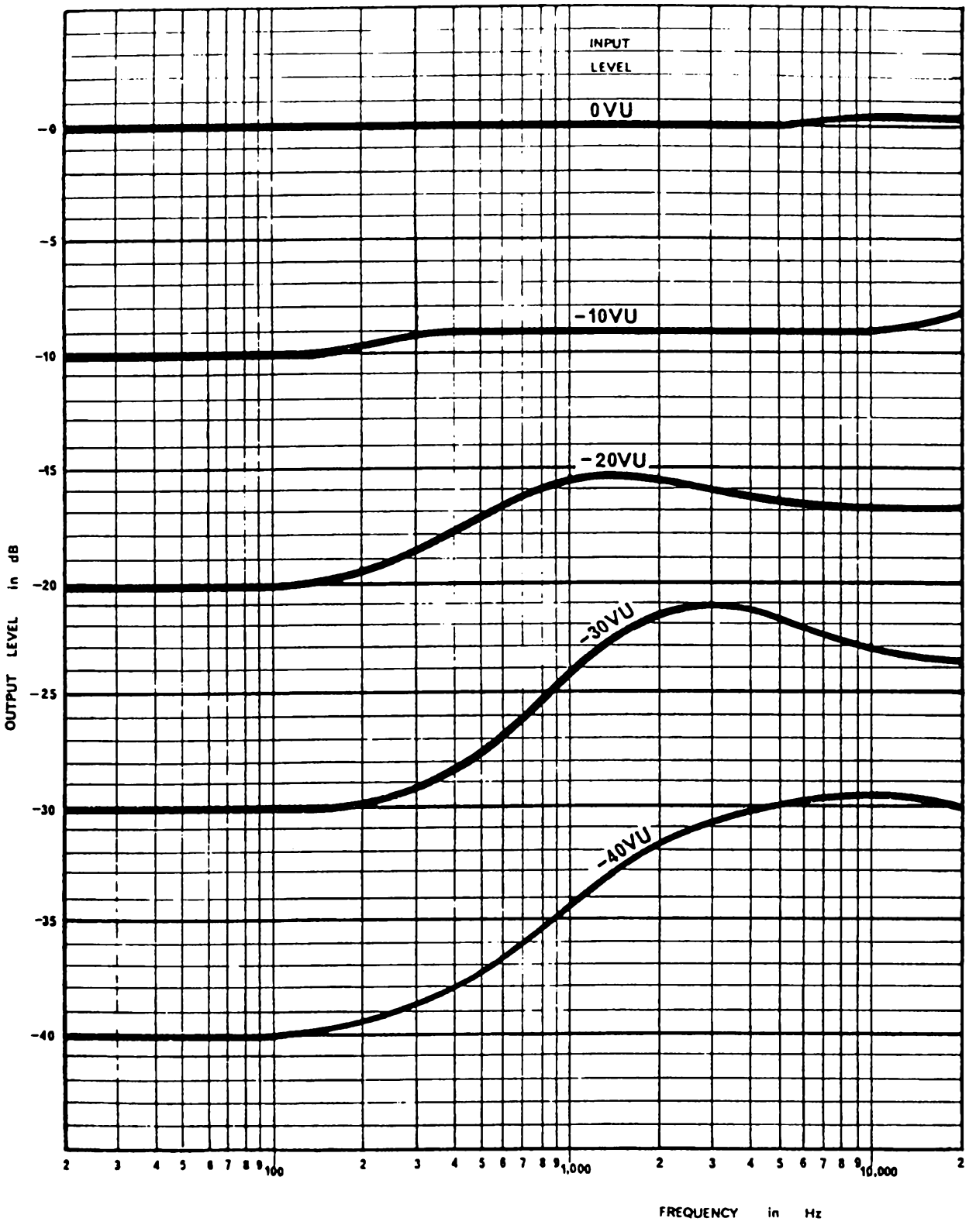


Fig. 16. RECORD PROCESSOR CHARACTERISTICS

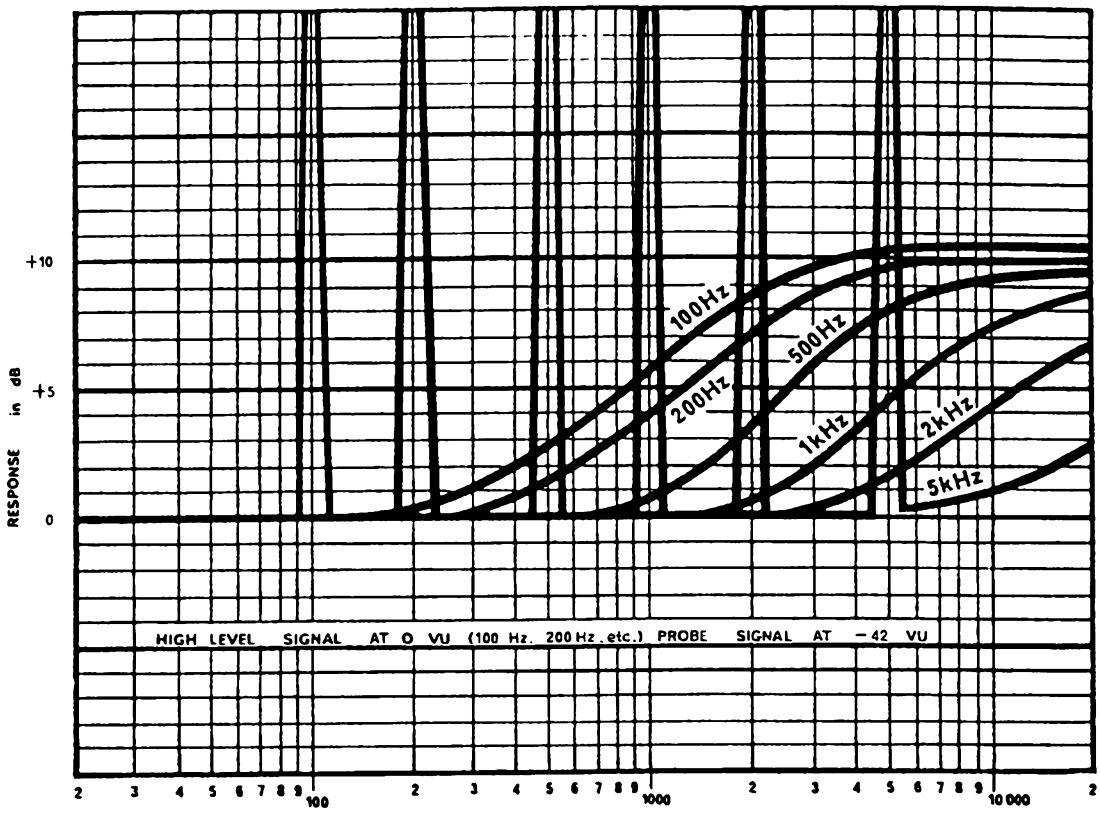


Fig. 17. LOW-LEVEL FREQUENCY RESPONSE OF RECORD PROCESSOR UNDER HIGH LEVEL SIGNAL CONDITIONS

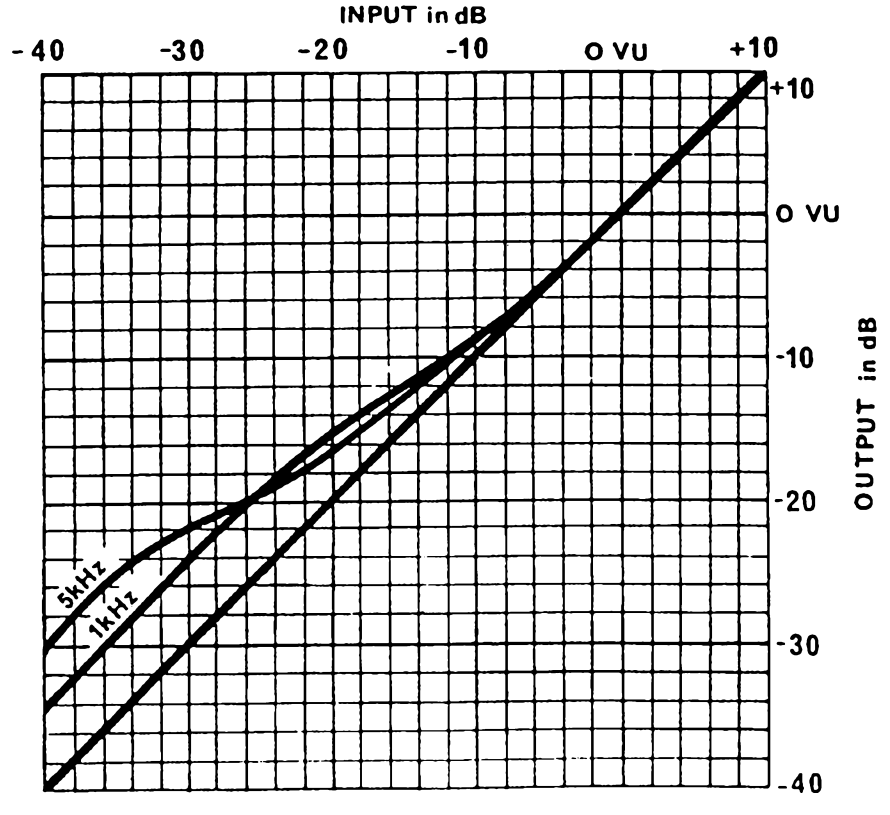


Fig. 18. RECORD TRANSFER CHARACTERISTICS—1kHz AND 5kHz

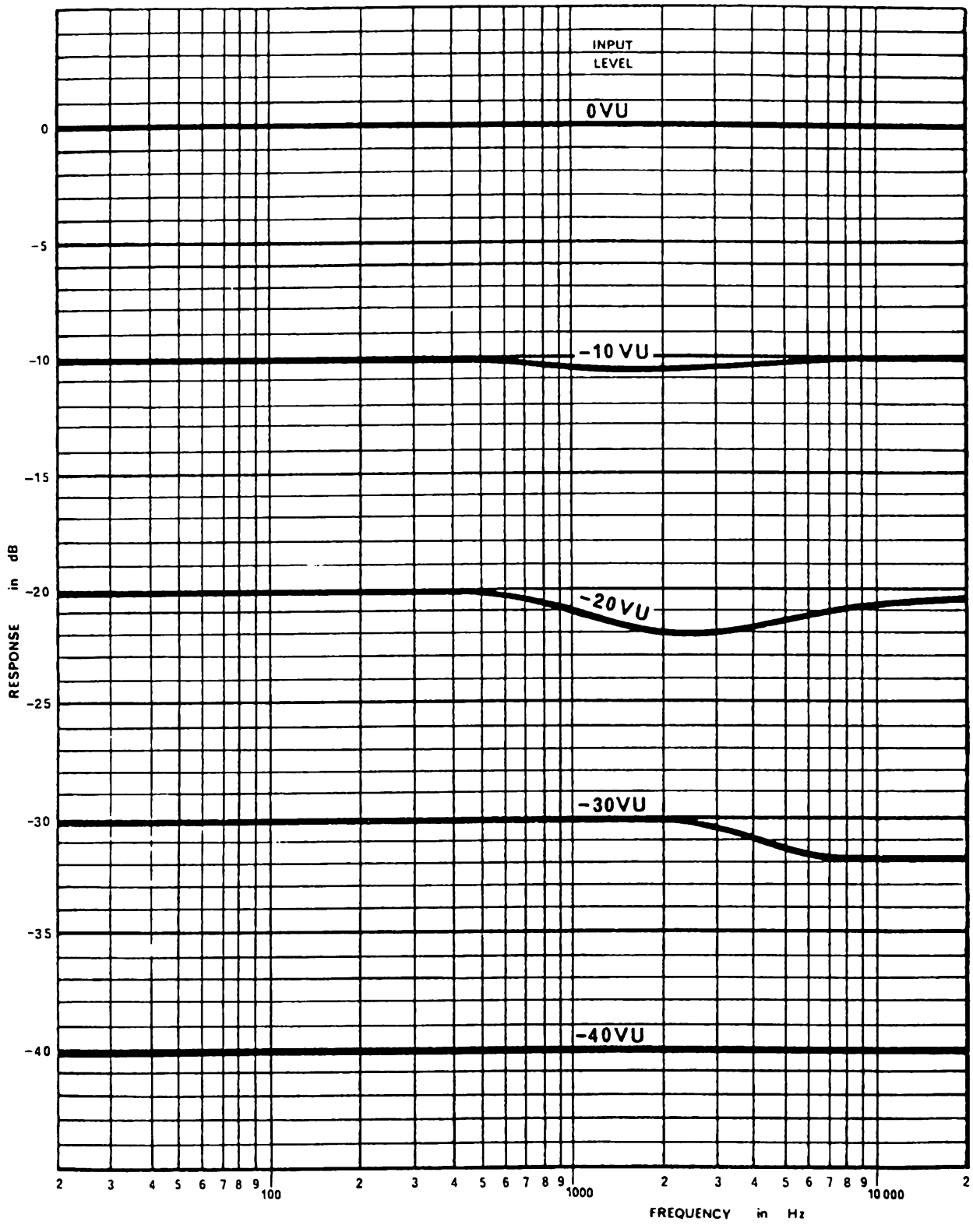


Fig 19. RECORD/REPLAY RESPONSE—LEVEL MISMATCH (2dB loss between Record and Replay Processors)

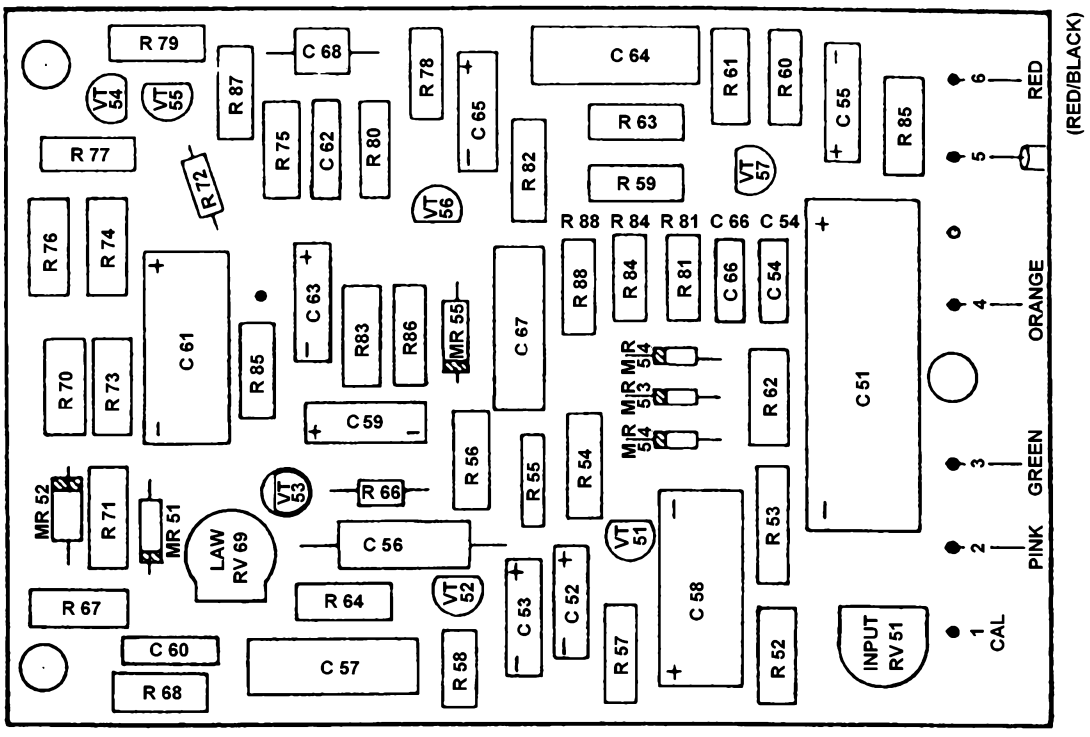


Fig. 21. DOLBY REPLAY PROCESSOR BOARD

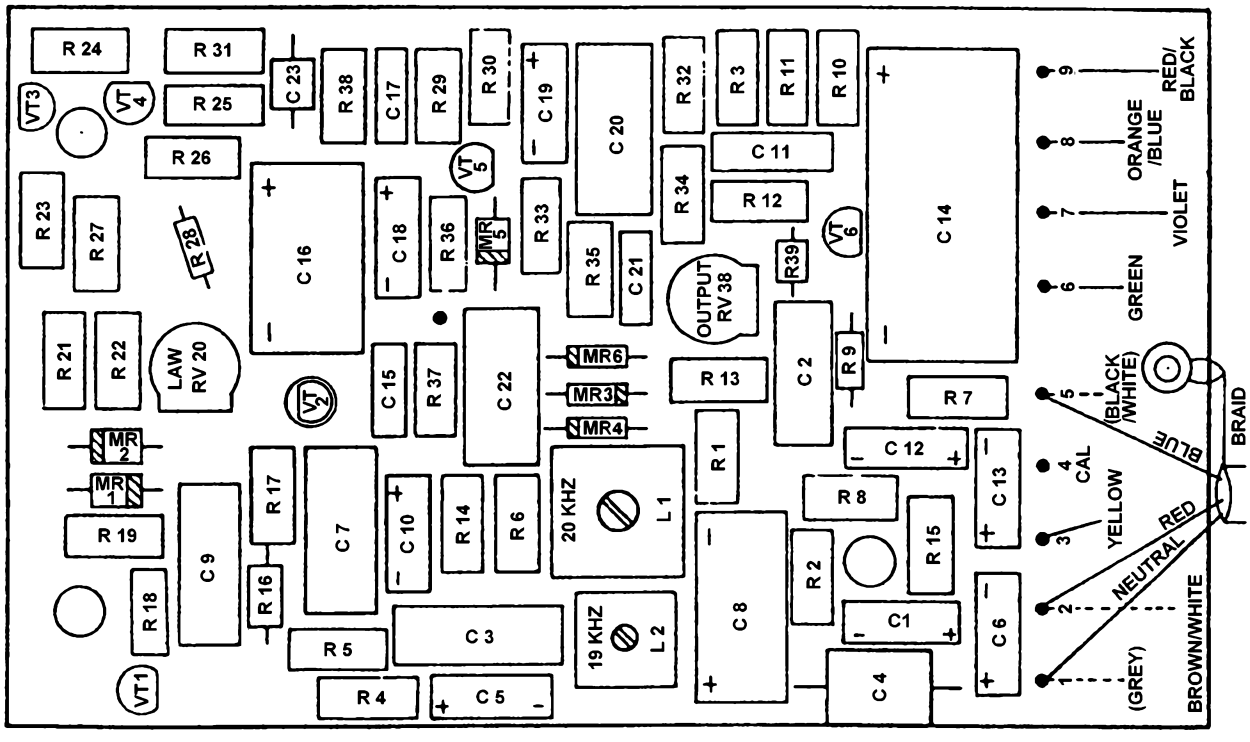


Fig. 20. DOLBY RECORD PROCESSOR BOARD

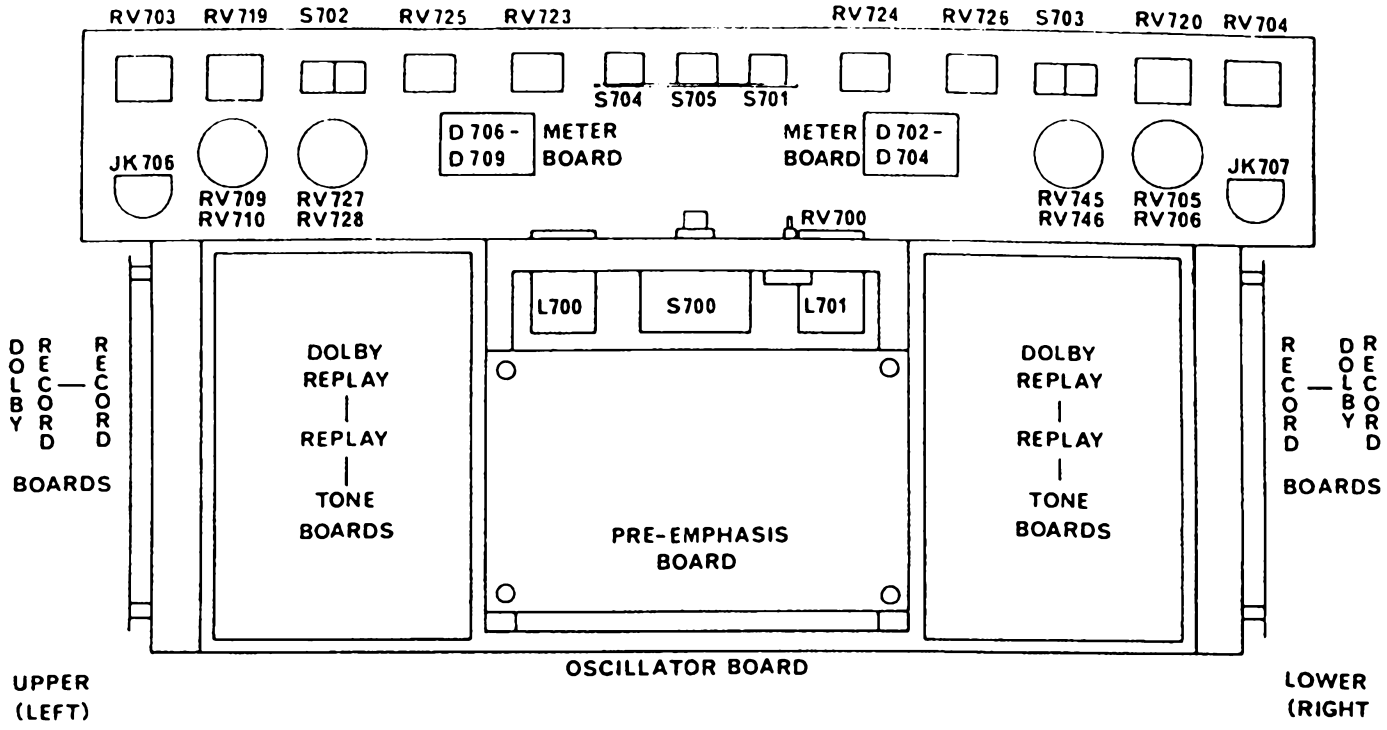


Fig. 22. AMPLIFIER—FRONT VIEW

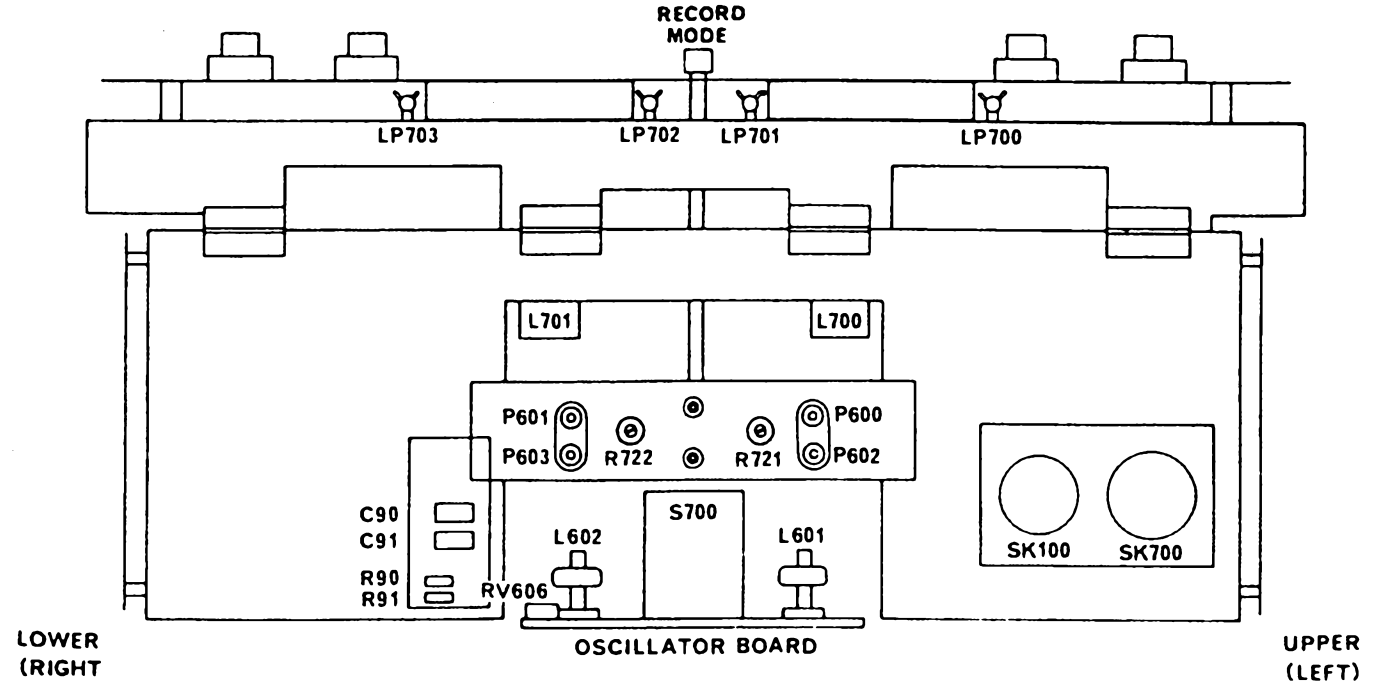


Fig. 23. AMPLIFIER—REAR VIEW

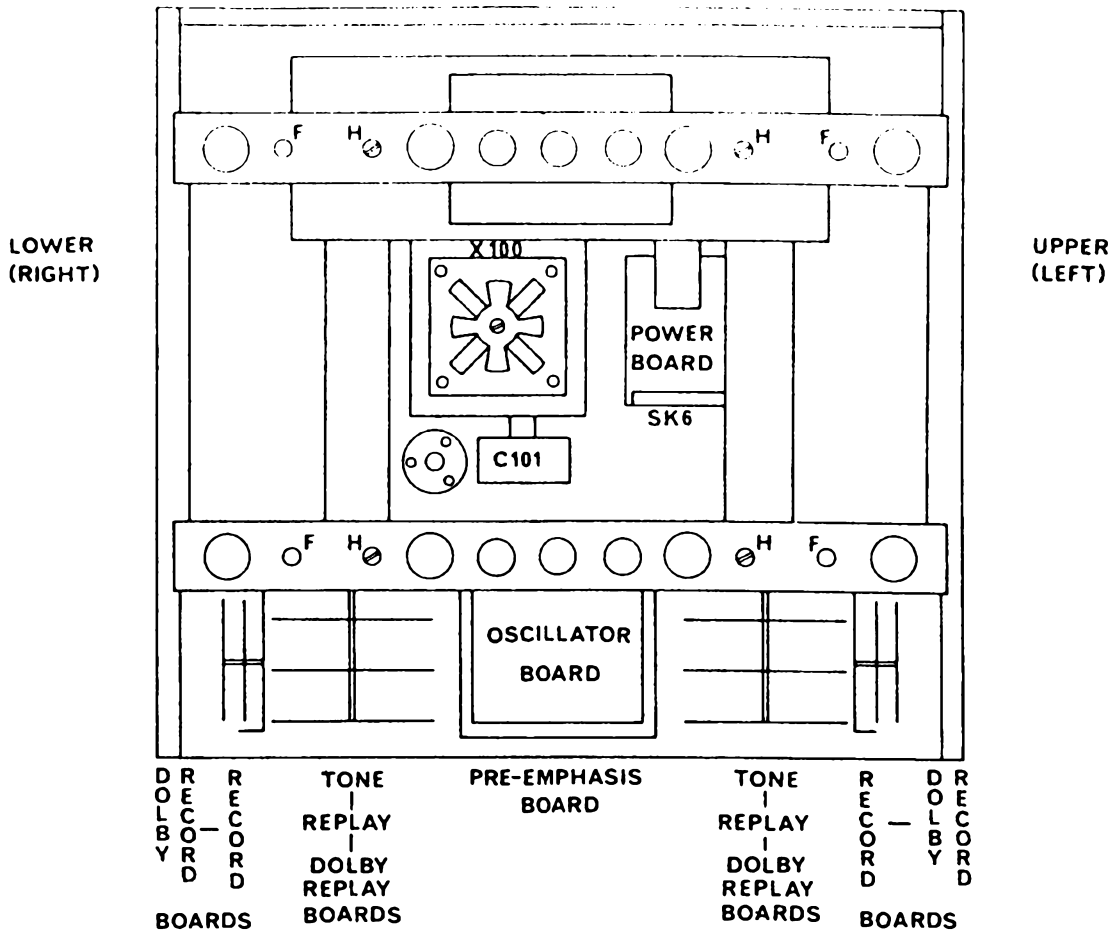


Fig. 24. RECORDER—REAR VIEW

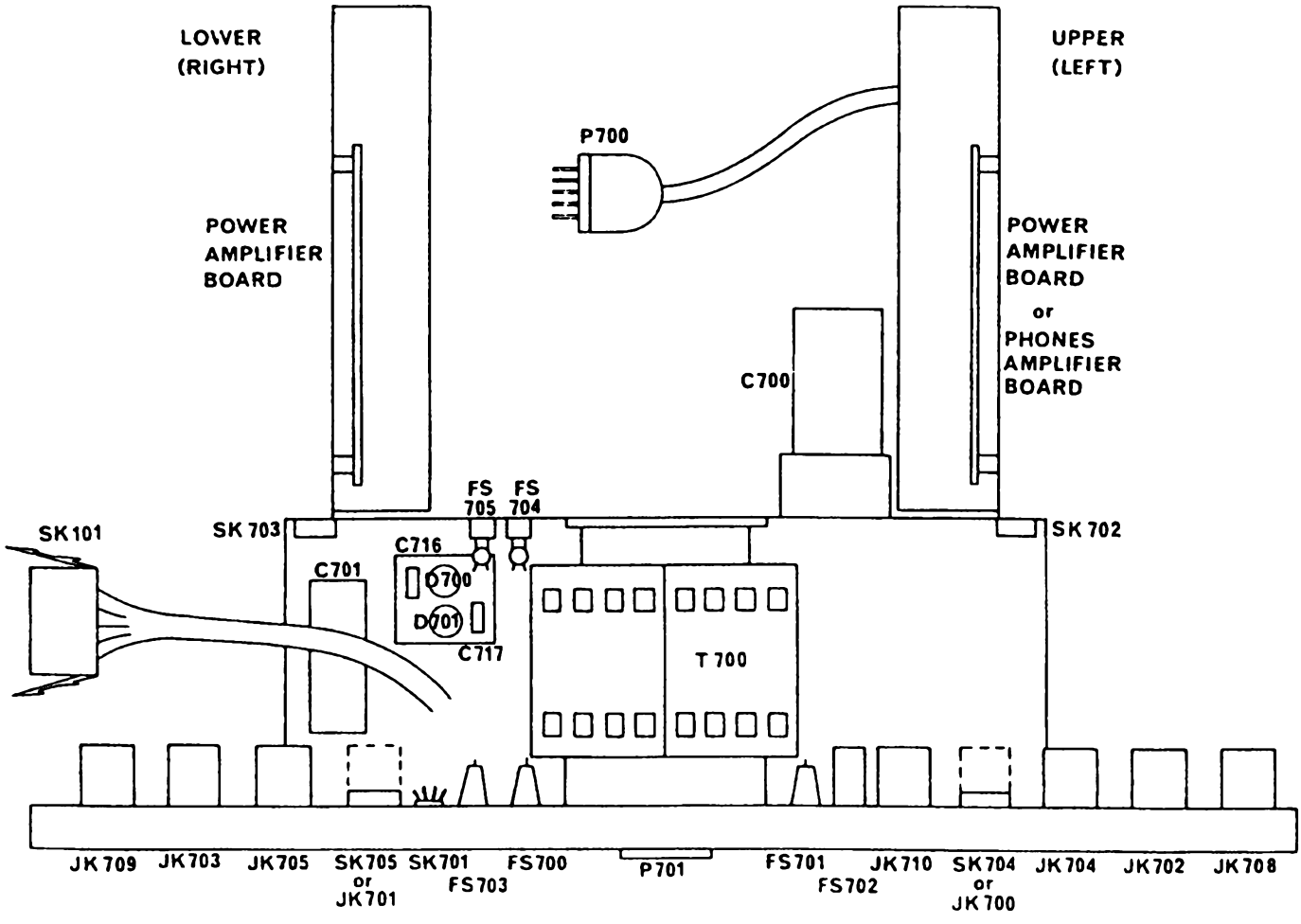


Fig. 25. POWER UNIT—REAR VIEW

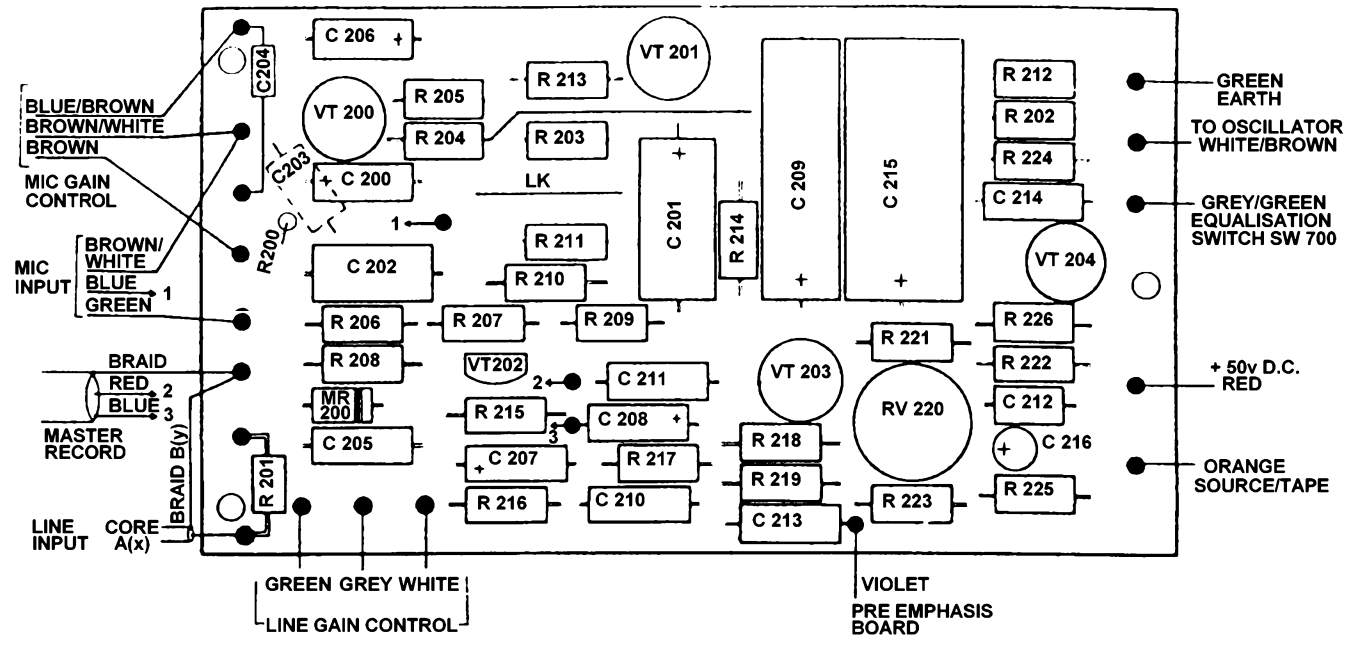


Fig. 26. RECORD AMPLIFIER BOARD (Upper Track)

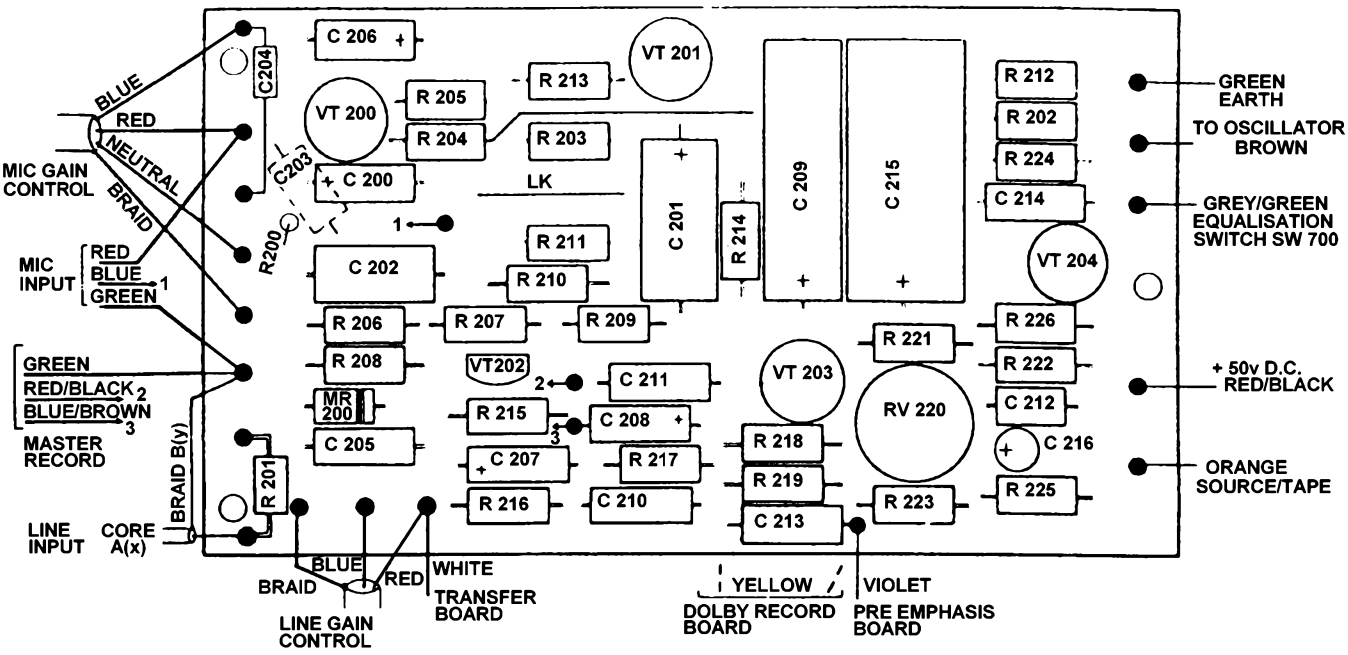


Fig. 27. RECORD AMPLIFIER BOARD (Lower Track)

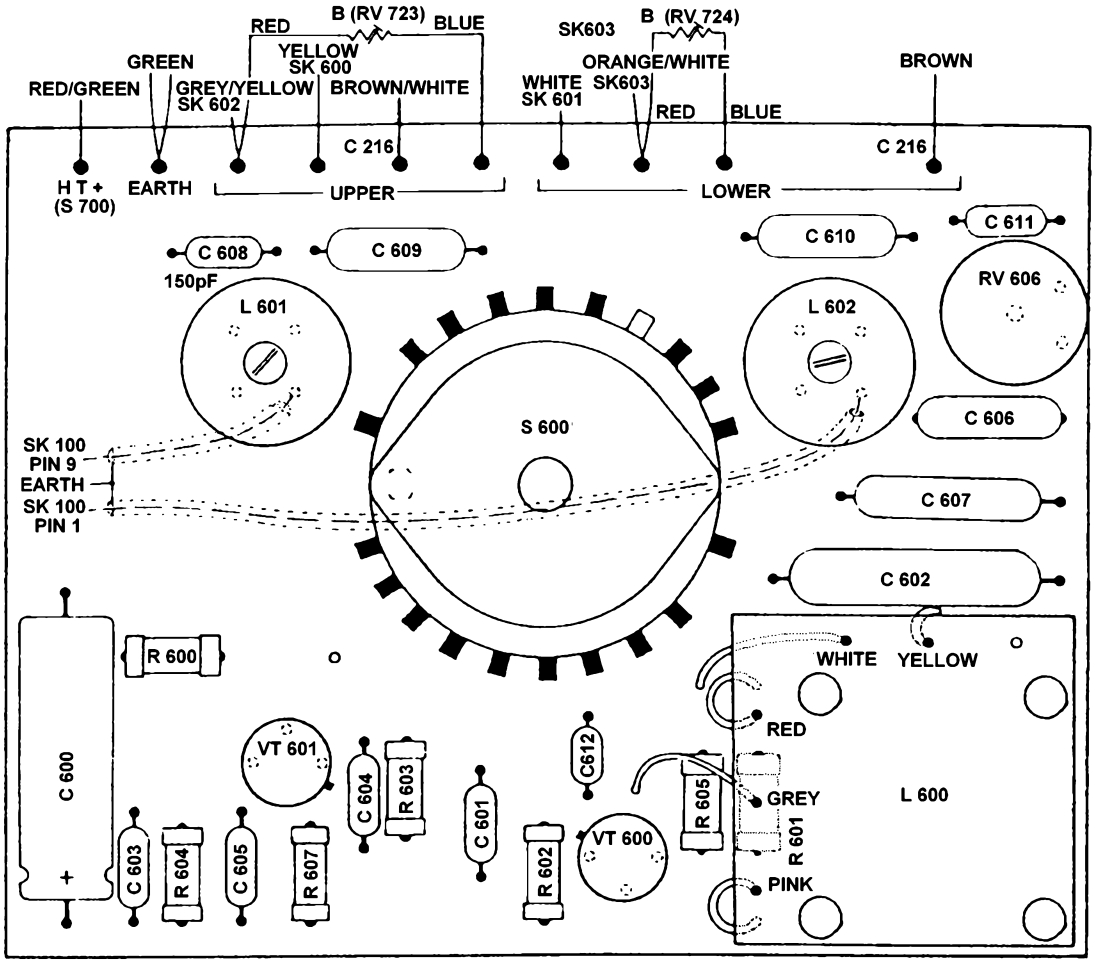


Fig. 28. OSCILLATOR BOARD

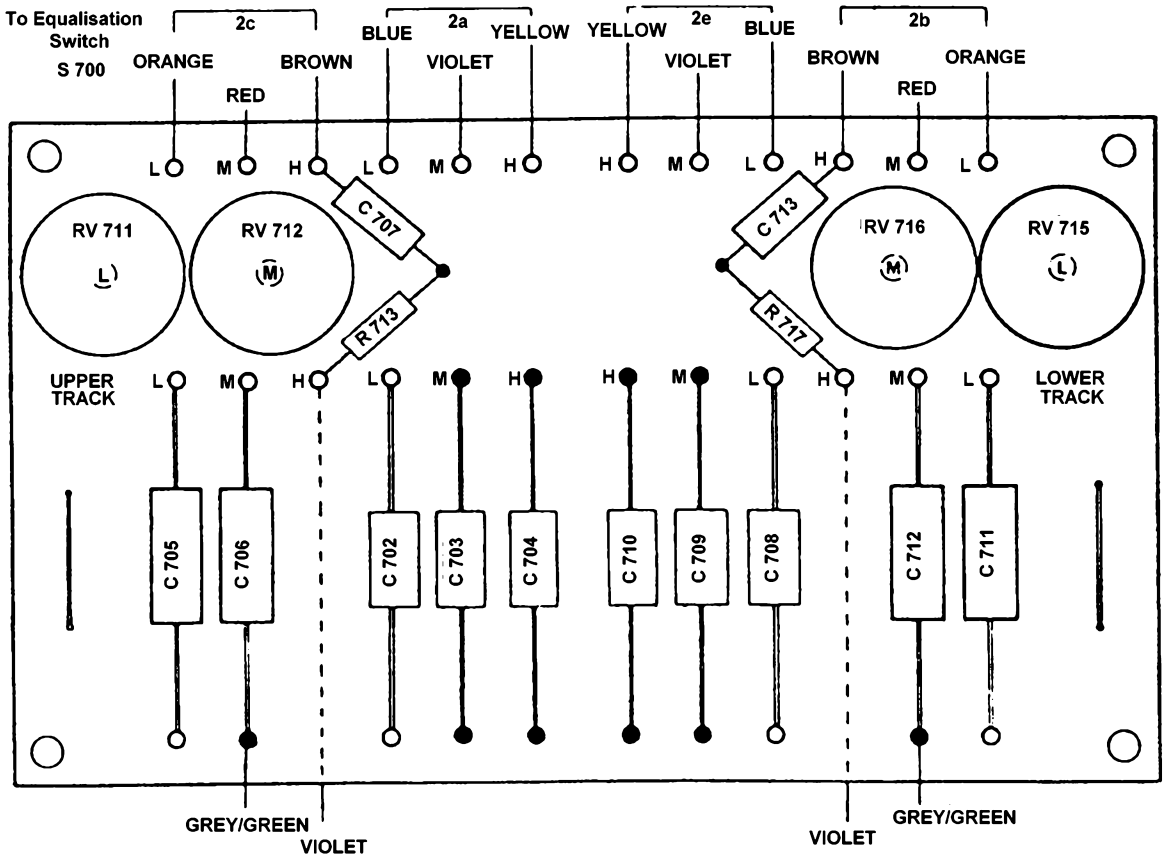


Fig. 31. PRE-EMPHASIS BOARD

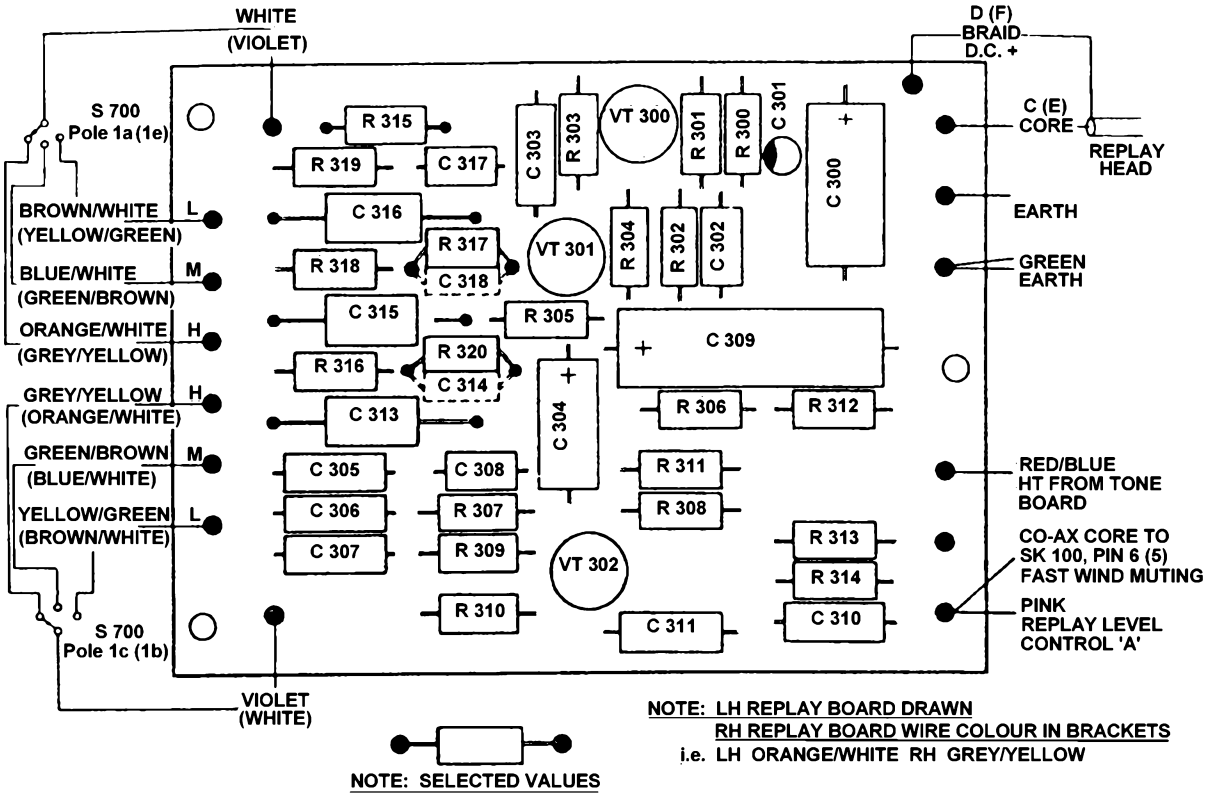


Fig. 32. REPLAY BOARD

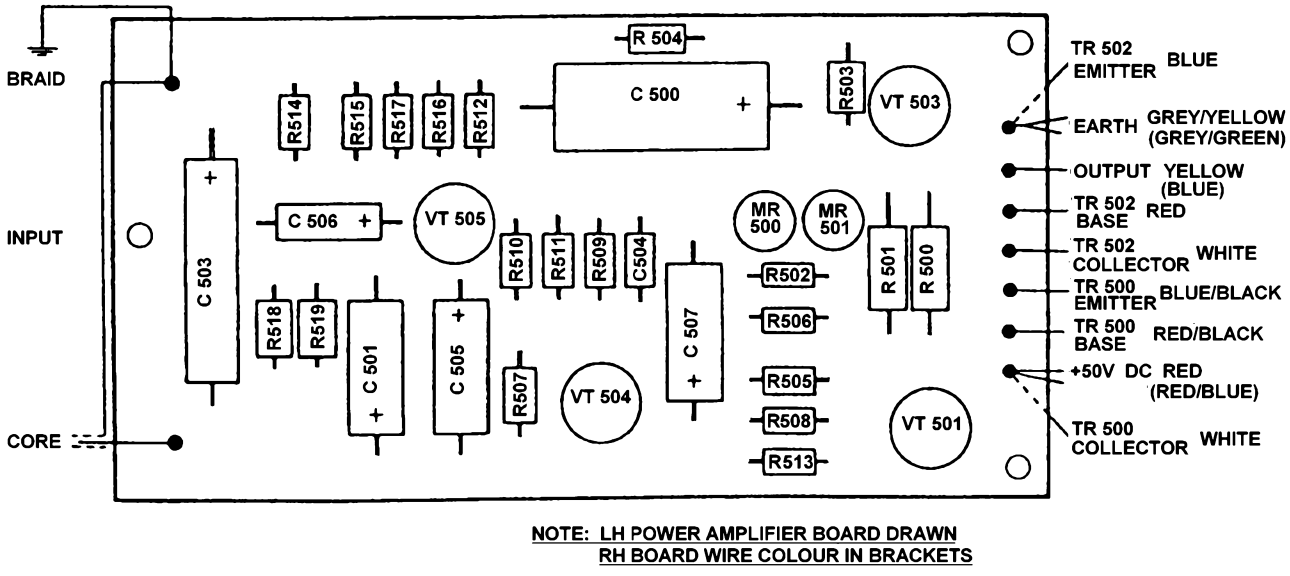


Fig. 33. POWER AMPLIFIER BOARD

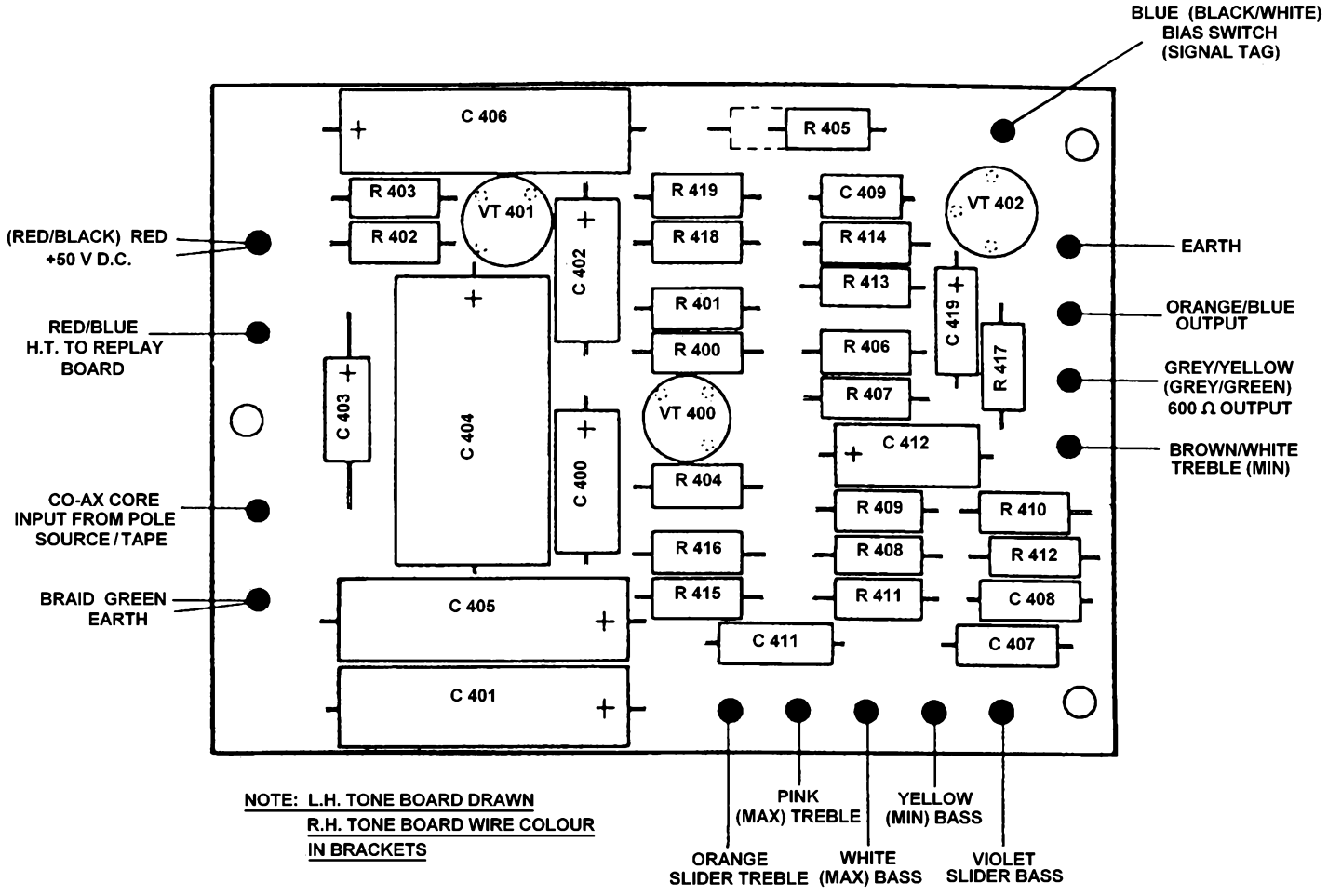


Fig. 34. TONE CONTROL BOARD

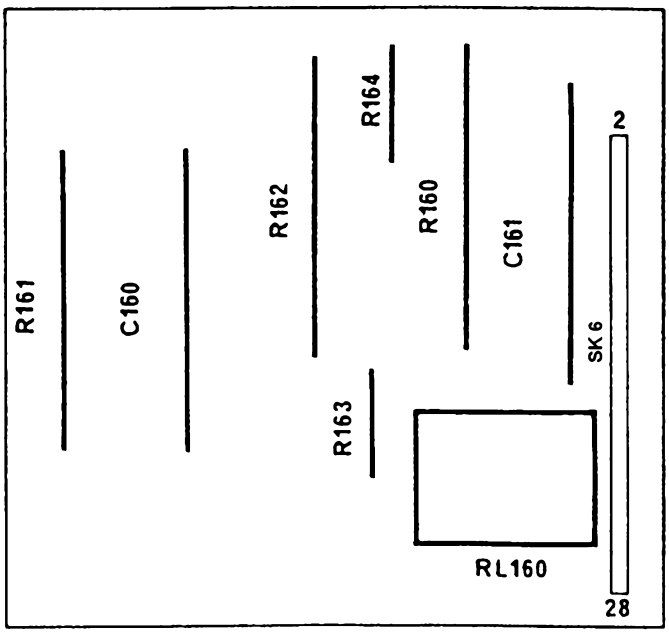


Fig. 35. POWER BOARD

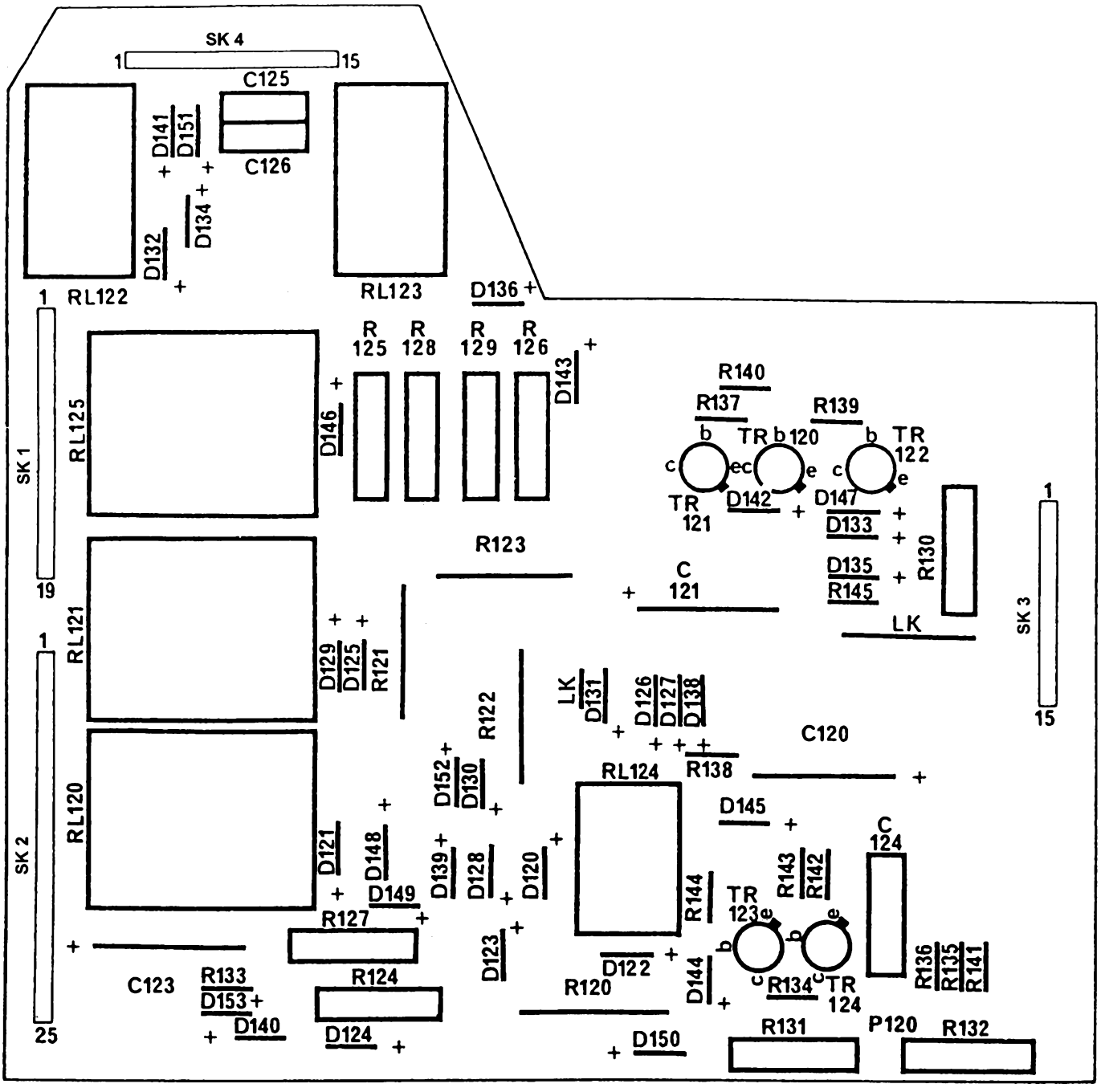


Fig. 36. LOGIC BOARD

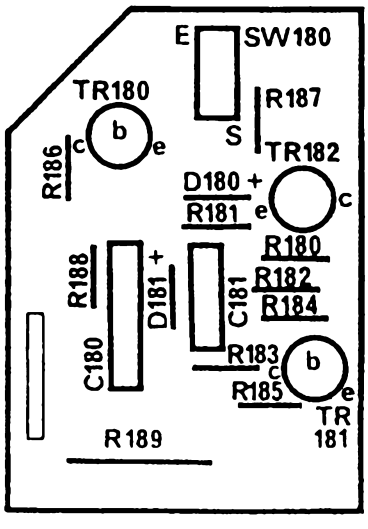


Fig. 37. MOTION SENSOR BOARD

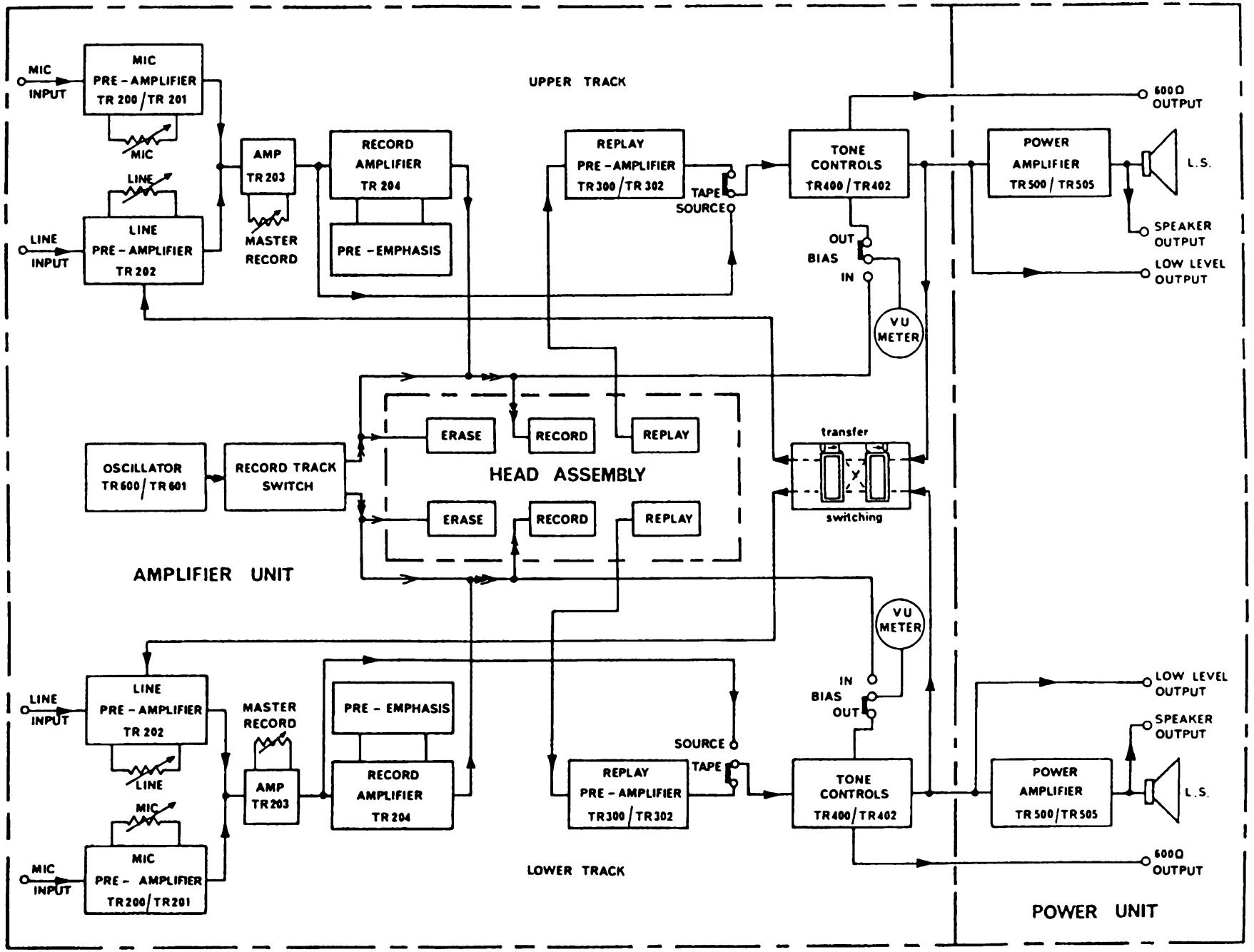


Fig. 38. BLOCK DIAGRAM—STANDARD MODELS

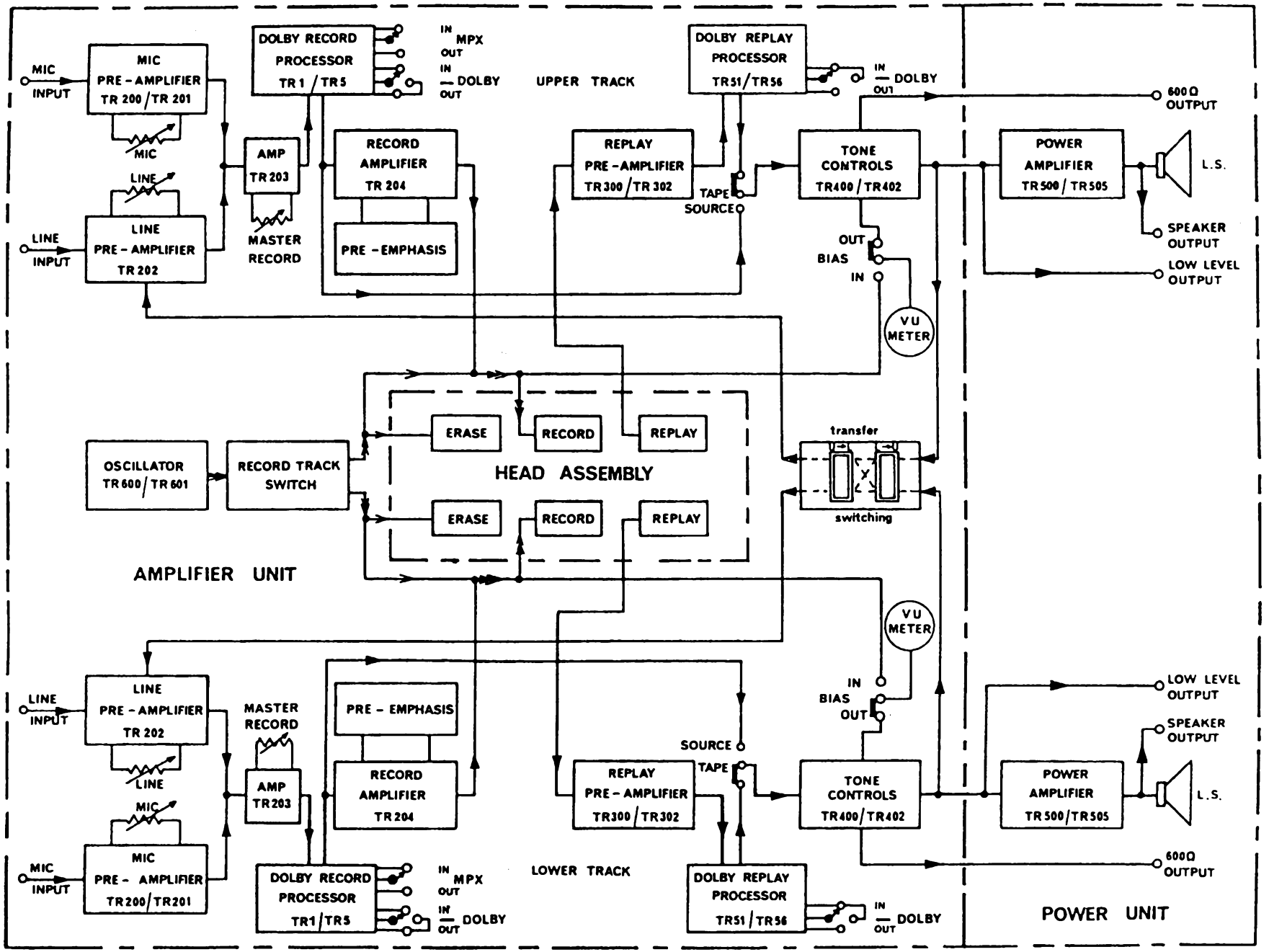


Fig. 39. BLOCK DIAGRAM—DOLBY MODELS (Suffix D)

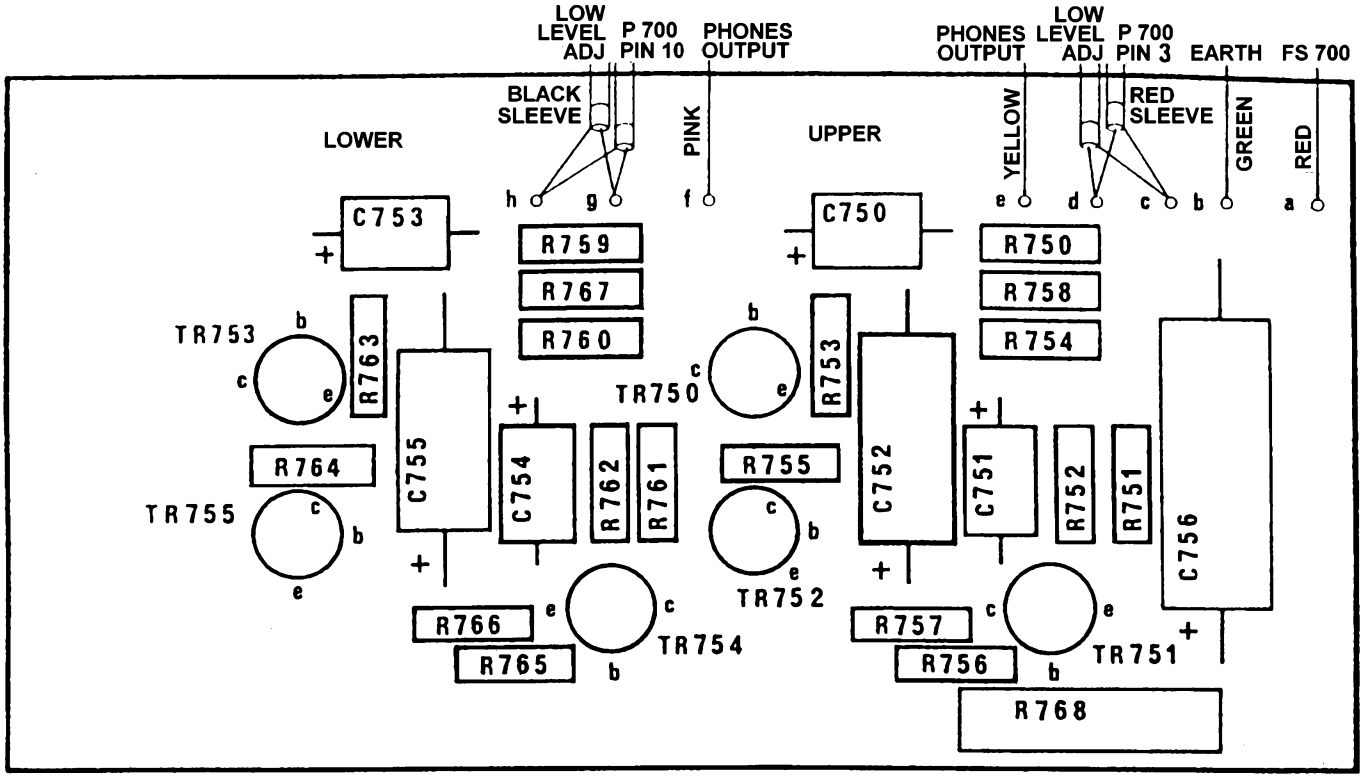


Fig. 40. PHONES BOARD