store 4 DS

store 7 DS

TECHNICAL MANUAL

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Technical Manual

Store 4DS Store 7DS

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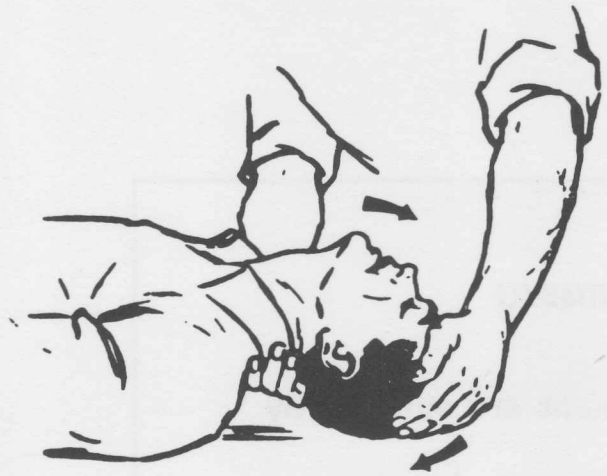
LETHAL WARNING

Voltages within this equipment are sufficiently high to endanger life.

Covers are NOT to be removed except by persons qualified and authorised to do so and these persons should always take extreme care once the covers have been removed.

Resuscitation instructions are given overleaf.

FIRST AID in case of Electric Shock



1. Lay victim on his back.
2. Clear victim's mouth and throat.
3. Tilt victim's head back as far as possible and raise his head.
4. Place a mound of material, i.e. coat, books etc. to support shoulders and open air way.
5. Pinch victim's nostrils.
6. Take a deep breath.
7. Cover the victim's mouth with yours and blow, watching his chest rise.

   Note: Blow forcefully into adults, but gently into children.
8. Move your face away to allow victim to breath out, watching his chest fall.
9. Repeat first five to ten breaths at a rapid rate; thereafter, take one breath every three to five seconds.
10. Keep victim's head back as far as possible all the time.

Have someone else send for a Doctor

Keep patient warm and loosen his clothing

DO NOT Give liquids until patient is conscious

CAUTION

HANDLING PRECAUTIONS FOR MOS DEVICES

The circuits in this equipment contain MOS devices. To eliminate the possibility of damage by static electricity, the handling of electronic components or tracks on the printed circuit boards must be avoided.

Test equipment, soldering irons etc. must be earthed before being used with this equipment.

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store 4 DS

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STORE 4DS and STORE 7DS

INSTRUMENTATION RECORDERS

CHAPTER 1

GENERAL DESCRIPTION

1. Store 4DS and Store 7DS equipments are Dual Standard F.M. (Wideband 1 or Intermediate Band), and Intermediate Band D.R. Instrumentation Recorders.

2. The Store 4DS provides 4 data channels on 6.25 mm ($\frac{1}{4}$ in) magnetic tape, while the Store 7DS accommodates 7 data channels on 12.7 mm ($\frac{1}{2}$ in) tape.

3. Two F.M. recording bandwidths are available on dual standard equipments; that is:-

at 60 in/s	Intermediate Band	DC to 20000 Hz
	Wideband 1	DC to 40000 Hz
at 30 in/s	Intermediate Band	DC to 10000 Hz
	Wideband 1	DC to 20000 Hz

and pro rata for other speeds. The D.R. mode provides a signal bandwidth between 100 Hz and 300 kHz. Signal Bandwidth is directly proportional to tape speed for both modes and is selected automatically.

4. Any combination of F.M. and D.R. channels may be employed, merely by the selection of the appropriate plug-in cards.

5. In addition to data recording a voice channel allows verbal comments, notes etc. to be recorded on tape. On Store 7DS voice announcements are recorded on an eighth track, while on Store 4DS the announcements interrupt data channel 4.

6. Instrumentation tape of thickness 18 μm to 35 μm may be used (corresponding to long, double or triple play audio tapes). The Store 4DS accepts standard ciné hub spools up to a maximum diameter of 210 mm ($8\frac{1}{4}$ in). The Store 7DS uses 203 mm (8 in) semi-precision metal spools, commonly referred to as NAB or NARTB spools. With the thinnest recommended tapes the Store 7DS allows continuous recording on all channels for over 12 hours (nearly 17 hours for Store 4DS $8\frac{1}{4}$ in spools), and this time can be extended by employing bi-directional recording on less channels.

7. Seven tape speeds are available, from $\frac{15}{16}$ in/s to 60 in/s (2.38 cm/s to 152.4 cm/s) selectable by means of a rotary switch. The tape speed is servo controlled; the need for a heavy flywheel is eliminated, and thus accurate speed control may be maintained while recording under extreme mobile conditions.

8. Flutter compensation circuits are included which can be switched in to reduce noise due to recorded tape flutter on F.M. channels. This can improve the signal to noise ratio at low tape speeds.

9. The spool motors are servo controlled and ensure equal tape tension on either side of the steel capstan. Mechanical braking is applied, and tape tension removed during LOAD, when the tape runs off the spool, and when the power is OFF.

10. The tape movement controls may be selected in any order without going through the STOP function, with no danger of damaging the tape.

11. An integral meter allows monitoring of input and output signals and can be used as an aid to check the alignment of the signal electronics. The E to E mode (Electronics to Electronics) allows input signals to by-pass the record/replay heads and appear at the output when the tape is stopped. This allows alignment (of the F.M. signal electronics in particular) without the tape running.

12. The Store 4DS/Store 7DS may be operated from a.c. supplies of 115 V ± 10% or 230 V ± 10% within a supply frequency range 48 to 400 Hz. Alternatively power may be derived from a d.c. supply within the range 11 to 32 volts. In this mode typical maximum continuous consumption is 60 W (Store 4DS) and 80 W (Store 7DS) for a 24 volt supply.

13. Connections to the rear panel provide for remote control of all recording and tape motion functions.

14. A sensor is fitted which will detect reflective markers attached to the back of the tape. When a marker is sensed a STOP command is issued to the recorder and a pulse is transmitted for remote sensing. This provides a means of stopping tapes before they run off the spool, and by the addition of external control logic tape direction change, track switching etc., can be performed automatically at selected points on the tape. The Store 7DS will differentiate between beginning-of-tape (BOT) and end-of-tape (EOT) markers.

15. A D.R. Calibration Board can be supplied if required. It can be used to define levels on tape or to give an indication of frequency response. Signals are available at band-edge frequency and $\frac{1}{10}$ band-edge frequency for all standard D.R. speeds.

CHAPTER 2

INSTALLATION AND OPERATING INSTRUCTIONS

INSTALLATION

1. It is strongly recommended that before operating the equipment, these Installation and Operating Instructions are carefully read, and that the operator becomes familiarised with the controls.

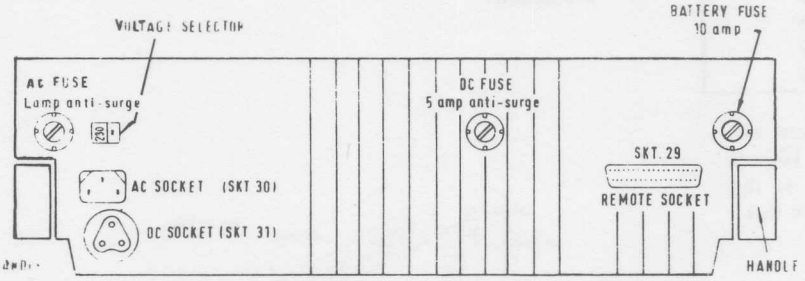
Power Supply Connections

2. Operation from either a.c. or d.c. supplies is possible. Connections are made via separate cables to the a.c. and d.c. power input sockets. Both inputs are fused. When the POWER switch (located alongside meter) is OFF, the negative d.c. input and both line and neutral a.c. input connections are isolated from the equipment.

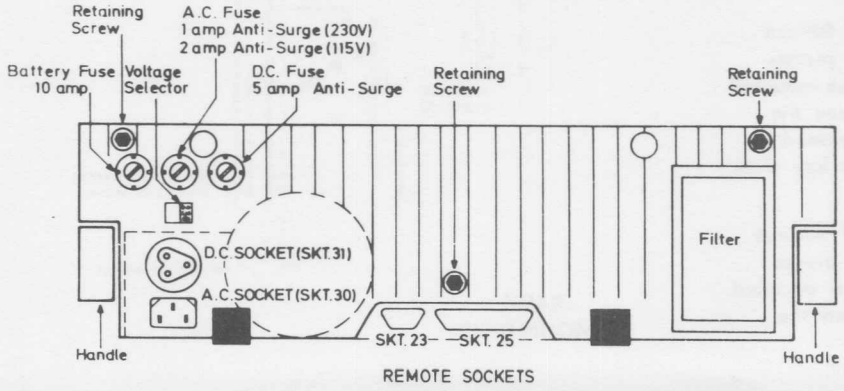
3. A.C. Supply The equipment can be operated from 115V ± 10% and 230V ± 10% nominal a.c. line inputs at a supply frequency within the range 48 to 400 Hz. The voltage selector switch on the rear panel must be set to the appropriate voltage range before the recorder is connected to the supply. The a.c. input connector (SKT30) design is to the IEC320 standard and the power cable is colour coded to British Standards, i.e. Brown - line, Blue - neutral, Green/Yellow - earth.

4. D.C. Supply. The equipment can be powered from a d.c. input within the range 11 to 32 volts. The d.c. input connector (SKT31) employs a 3 pin plug and socket. When a d.c. input is used, both the chassis and the signal earths are electrically isolated from the battery supply. Do not use a d.c. supply which has a current limit, since this may cause serious damage in the event of the recorder's protection circuits operating. The d.c. cable should be of heavy gauge wire (at least 24/0.2mm conductors) to avoid excessive voltage drops. The voltage at the input terminals must be at least 11 volts under all operating conditions. At low battery voltages (i.e. below about 15 volts) the recorder makes a high pitched whistling noise. This should be borne in mind when considering battery operation in an otherwise quiet environment.

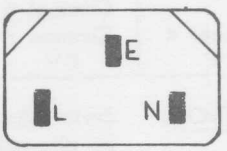
5. Standby Power during a.c. operation. A battery may be connected to the d.c. input to provide power in the event of a supply failure, however to prevent high currents flowing from the rectified a.c. supply a diode must be connected in series with the battery cable. The diode should have a 12 amp (minimum) rating and be mounted on a heat sink. A 24 volt battery is recommended for standby use.



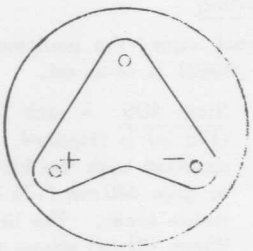
STORE 4DS REAR PANEL



STORE 7DS REAR PANEL



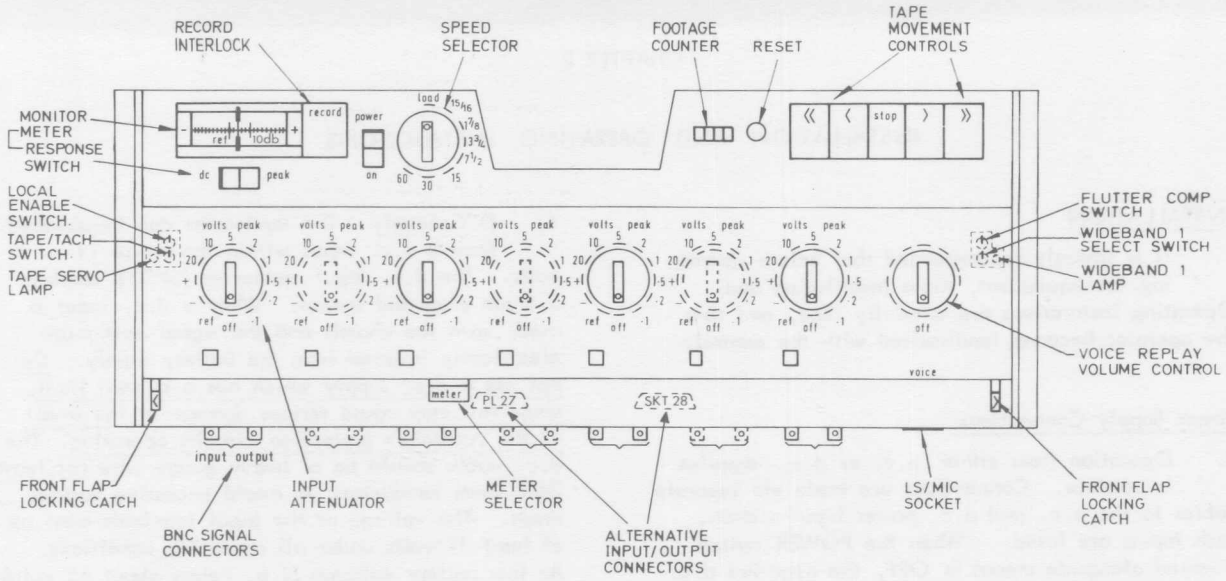
AC SOCKET (SKT 30)



DC SOCKET (SKT 31)

SUPPLY PIN CONNECTIONS
- as viewed on rear panel
(SKT 31 on Store 7DS is rotated through 90°)

CHAPTER 2



Signal Connections

6. Data input/output connections are via the pairs of B.N.C. sockets mounted along the front edge of the equipment (see diagram above). When the equipment is rack mounted the connections can be made via the D-type connectors beneath the front edge. Connections are as follows:-

Store 4DS	Store 7DS	INPUT PL27 OUTPUT SKT28
Channel 1	Channel 1	pin 1
	Channel 2	pin 2
Channel 2	Channel 3	pin 3
	Channel 4	pin 4
Channel 3	Channel 5	pin 5
	Channel 6	pin 6
Channel 4	Channel 7	pin 7
0 V	0 V	pin 9

CAUTION: Earth return currents must not be allowed to exceed 100 mA per channel. Damage to the equipment may result if this figure is exceeded.

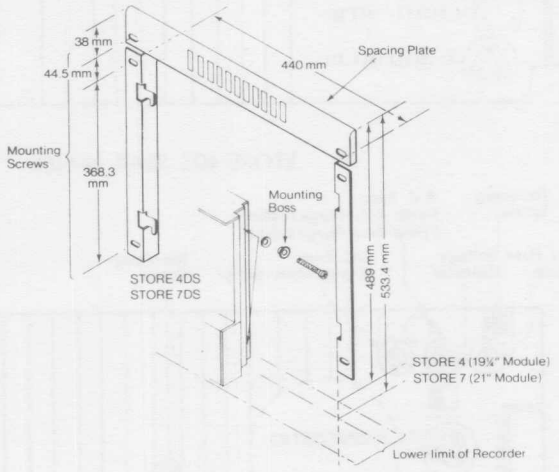
Rack Mounting

7. To rack mount the equipment a Rack Mounting Kit (D5831 is required.

(a) Store 4DS A rack height of 489 mm (19¼ in) is required. The side pieces supplied with the kit should be mounted to give 440 mm (17⅓ in) between the inside faces. The unit will extend 95 mm (3¼ in) above the upper key slots of the side pieces.

(b) Store 7DS A rack height of 533 mm (21 in) is required. The side pieces supplied with the kit should be mounted to give 440 mm (17⅓ in) between the inside faces. The unit will extend 133 mm (5¼ in) above the upper key slots on the side pieces.

8. Draw the handle out of the recorder until it stops, press the catch release tabs at the rear of the handle and slide the handle clear. Remove the handle guides and catches and replace with the screw-in retainers supplied. The recorder can now be slotted into the side pieces, and the trim plate fitted above the equipment with the screws provided. Use the D-type connectors for signal connections (see para 6). Removal is the reverse of the above procedure.



RACK MOUNTING

OPERATION

9. Switch On. Connect power cable to equipment (see para 2 above). The POWER ON switch is located on the front panel adjacent to the monitor meter. The STOP lamp will light when power is switched on.

10. Tape loading. Before loading the following points should be noted:-

(a) Store 4DS equipments are supplied with 210 mm (8¼ in) spools. If other spool sizes are used see para 50.

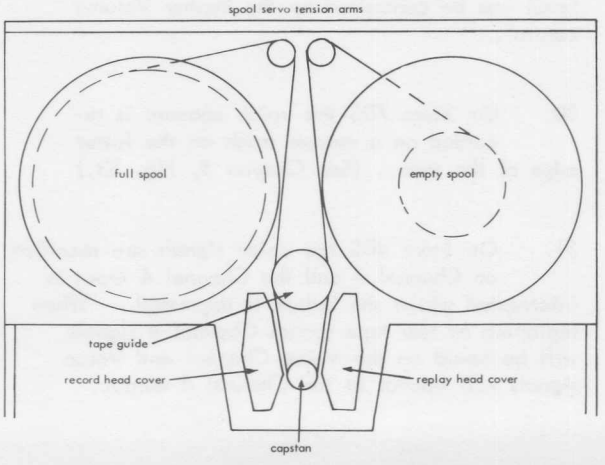
(b) If, with Store 7DS equipments tape thinner than 26 µm is to be used the tape tension must be re-adjusted, refer to Chapter 4 para 45 before loading.

(c) Ensure Remote/Enable switch (see Diag. page 4) is in the "Enable" position.

11. Set the speed selector switch (see facing page) to LOAD. Normally (i.e. for forward tape travel) the full tape spool should be placed on the left hand hub. Thread the tape as illustrated below. The right hand spool should be rotated by hand until successive convolutions of tape trap and secure the beginning of the tape. It is not recommended that the leader on ¼ in tapes is pulled up through the slit on cine spools in order to secure it.

12. Ensure that the tape sits squarely in the groove on the tension arm rollers and that the tape is tensioned. Failure to tension the tape may result in tape damage. To tension the tape, manually wind the R. H. spool until the tape is taut and the tension arms are pulled apart slightly.

13. Turn the Speed Selector to the required speed; this will energise the spool servo and correct tape tension will be assumed. The speed selected determines the signal bandwidth available (see paras 39, 44)



TAPE THREADING DIAGRAM

14. The equipment is now loaded with tape and will respond to commands from the Tape Movement Pushbuttons.

15. Tape Movement Pushbuttons There are five momentary action, illuminated, push buttons controlling tape movement as set out below:-

<<	-	fast reverse
<	-	reverse
STOP	-	stop
>	-	forward
>>	-	fast forward

Tape movement controls can be operated in any order without first going through the STOP condition. No interlocking (mechanical or electrical) is therefore required for the push buttons. The tape servo system provides safe tape handling under all conditions.

16. Tension Arms The tension arms measure tape tension and provide feedback signals to the spool servo motors to maintain a preset tension on both sides of the capstan. This tension is maintained under all operating conditions.

17. When the end of tape is reached or for any reason tape tension is lost, the tension arms sense this and lock the system into the STOP mode. In this condition all tape motion controls are inhibited. After reloading tape the system cannot be restarted unless LOAD has been selected.

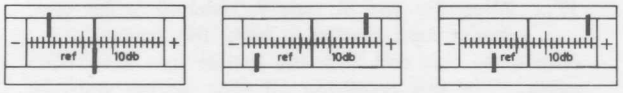
18. Before attempting to remove or adjust the tape, disable the spool servo by either switching to LOAD, or winding the tape fully onto one spool.

19. Recording. To make a recording, depress and hold the Record pushbutton, then depress the > or < button, depending on the direction in which the recording is to be made. Ensure that the Record button is released last. When recording the Record button will be illuminated.

20. Input Level Controls. Input attenuators are mounted on the front panel, one for each channel. Each attenuator is located adjacent to its respective input/output B.N.C. connectors and is labelled "OFF, REF, -, +, 20, 10, 5, 2, 1, 0.5, 0.2, and 0.1". The OFF position disables the record amplifier of the respective channel. "REF, -, and +" are used to check and calibrate the signal circuits (see para 85) and the remaining positions provide a precision attenuator scaled in volts peak.

21. Setting the Record Level. To set the input record level connect the signal to the required channel input socket. Set meter response switch to "PEAK" for a.c. signals above 4Hz. Set Meter Selector to "REC" on required channel, and choose an input attenuator setting which does not overload the meter; i.e. cause the meter to register in the orange region on either the positive or negative peaks. (See meter diagram on this page). The d.c. offset of an input signal may be corrected by means of the OFFSET control on the Record Board (see Chapter 4 para 57). (F.M. Channels only)

22. Monitor Meter. The dual movement meter is mounted on the front panel together with a PEAK - DC meter switch. The PEAK position is used for monitoring frequencies above approximately 4Hz. In this mode, the two needles separate to display, simultaneously, positive and negative peaks. The meter will respond to any pulse wider than 50μs. The DC mode is used for frequencies below 4Hz and for calibration (see para 85-87 below). In this mode, only the upper pointer is used. The movement is centre-zero i.e. negative signals deflect to the left, positive to the right.



D.C. INPUT (D.C. Mode)
Top pointer indicates the d.c. input. Bottom pointer inoperative.

A.C. INPUT (PEAK Mode)
pointers show an a.c. signal about zero

A.C. INPUT WITH OFFSET
pointers have separated, showing the amplitude of the a.c. input and a positive offset

23. Meter Selector. This is a slide switch located on the front edge of the control panel. Operation of the slide switch provides a connection to the monitoring circuit of the selected channel for either record or replay.

NOTE: In Wideband 1 only, when the meter slider is set to rep., and the input attenuator is set to ref., the meter will indicate full scale deflection to the left. This is not a fault condition.

24. Signal Monitoring. During recording the input signal may be monitored by the meter if the selector switch is set to REC. When recording in the forward direction, the meter will monitor signals off tape if the selector switch is set to REP. Similarly signals off tape will appear at the output B.N.C. socket during forward recording. When either "<<, STOP, or >>", is selected, the input signal is electronically switched to by-pass the tape heads and re-appear at the output socket, (see E to E mode, para 64).

25. Replay. For standard replay the TAPE/TACH switch should be in the TACH position and the FLUTTER COMPENSATION switch in the OFF position (these switches are mounted beneath the front flap). To replay depress the forward or reverse button as required. If the equipment is in the RECORD mode the REPLAY mode can be assumed merely by pressing the button for the required direction.

26. Setting the Replay Level. During replay the off-tape signals may be monitored on the monitor meter by setting the Meter Selector to "REP". If the recording has been made at the correct level the meter should not register in the overload (orange) region. The output signal level is normally set to provide a 1 volt peak (2V peak to peak) signal at the output socket when the meter pointers are on the + and - lines. The output level can be adjusted to other values within the range 0V to 3V peak, (see Chapter 4 para 72). Adjustment of this level does not affect the meter reading, hence final output level can be checked only by using an external meter. Replay levels can be checked with the tape stopped (see para 24).

27. Voice Channel. The voice channel is located at the right end of the control panel. The combined speaker/microphone unit plugs in to the DIN socket in front of the Replay Volume control.

28. The button on the microphone/loudspeaker must be held depressed to record spoken notes on tape. When the button is released recorded information will be replayed through the unit. The RECORD button need not be depressed to make voice recordings.

29. Automatic gain control eliminates the need for setting the record level. The replay level can be controlled by the Replay Volume control.

30. On Store 7DS the voice channel is recorded on a narrow track on the lower edge of the tape. (See Chapter 5, Fig. 53.)

31. On Store 4DS the voice signals are recorded on Channel 4 and the Channel 4 input is interrupted whilst the button is depressed. When replaying at low tape speeds Channel 4 signals will be heard on the Voice Channel and Voice signals will appear at the Channel 4 output.

32. Tape Position Indicator. The tape position indicator, reading in feet, provided on the front panel, is driven directly by the capstan via a rubber "O" ring. The reset button resets the counter to zero.

33. EOT Sensor. The Store 4DS has a lamp and photocell sensor which will detect reflective markers attached to the non-oxide side of the tape. If markers are attached near the end of tape this End-of-Tape sensor will stop the recorder before the tape winds completely off the spool. Suitable marker strips are 3M type 650.

34. EOT/BOT Sensor. The Store 7DS has two sensor assemblies. The End-of-Tape (EOT) sensor will detect a reflective marker strip (see para 33) placed on the top half of the tape, while the Beginning-of-Tape sensor (BOT) will sense markers on the lower half of the tape. In the normal mode either of these signals will stop the tape, but by making suitable connections to the remote socket the stop signal can be inhibited and the EOT and BOT signals used for more sophisticated control functions. (See para 82).

35. Erasure. Store 4DS equipments possess a full-width erase head which is energised when recording on all channels in the forward direction. Erasure is inhibited if one or more channel attenuator is switched to the "OFF" position. Reverse erase is possible when optional reverse erase head is fitted. Store 7DS tapes must be erased on a bulk erase unit before new recordings are made.

F.M. AND D.R. RECORDING.

36. Recordings may be made using either F.M. (Frequency Modulation) or D.R. (Direct Recording) techniques, the choice depending on signal requirement . Each signal channel has a set of three plug-in signal cards housed under the front flap, and can be identified by the coloured letters on the attenuator knob. (Red - D.R., White - F.M.)

37. Any channel may be converted from F.M. to D.R. or vice versa by removing the three cards and replacing them with a set of the other type. It should be noted however that D.R. cards are normally aligned for use in a particular channel, and if they are used in a different channel the performance may be affected.

38. Any combination of D.R. and F.M. channels can be used in the recorder. However, certain limitations apply when using Flutter Compensation facilities - see paras 57 to 59.

39. F.M. Electronics. Signal bandwidths are as follows:-

Tape Speed in/s	I.B. Bandwidth (Hz)	WB.1 Bandwidth (Hz)
$\frac{15}{16}$	0 - 313	0 - 625
$1\frac{7}{8}$	0 - 625	0 - 1250
$3\frac{3}{4}$	0 - 1250	0 - 2500
$7\frac{1}{2}$	0 - 2500	0 - 5000
15	0 - 5000	0 - 10000
30	0 - 10000	0 - 20000
60	0 - 20000	0 - 40000

The required bandwidth is selected by means of a switch mounted on the Flutter Compensation Switch Assembly, under the front flap. A lamp will be illuminated whenever "Wideband 1" is selected. (The switch is labelled w.b.1). For full specification see Chapter 3.

Compatibility Between Types of F.M. Boards

40. Original Intermediate Band F.M. signal boards, (D7709, D5823 and D6966) may be used in any recorder modified for dual standard operation. They may be mixed with dual standard boards in channels; they will operate at the intermediate Band only and may require re-alignment when so incorporated.

41. Dual Standard F.M. signal boards may be fitted in an unmodified equipment (see paragraph 42); they may also be mixed with original Intermediate Band boards in this equipment which will operate at Intermediate Band in both cases.

42. In unmodified equipments (those not carrying modification strike 9) Dual Standard boards can not be used in the following channels:-

i Store 4D Channel 4
ii Store 7D Channel 7

Modification Instruction 497 (M.I. 497) is available giving details on how to rewire the recorder so that Dual Standard boards will operate in any channel. M.I.497 also contains all details necessary to convert an equipment to full Dual Standard capability.

43. A switch mounted on each filter board allows selection between two filter characteristics for each channel. The switch position marked G indicates a flat gain response (Tchebychef filter) and position Ø selects a linear phase response (Bessel filter). Position G is used to obtain maximum flat bandwidth and minimum carrier breakthrough (i.e. best signal to noise ratio). Position Ø is used when minimum overshoot on pulse or transient signals is required. See Appendix A at the end of this handbook.

44. D.R. Electronics. Signal bandwidths are as follows:-

Tape Speed (in/s)	Bandwidth
$\frac{15}{16}$	100 Hz - 4.75 kHz
$1\frac{7}{8}$	100 Hz - 9.5 kHz
$3\frac{3}{4}$	100 Hz - 19 kHz
$7\frac{1}{2}$	100 Hz - 37 kHz
15	100 Hz - 75 kHz
30	200 Hz - 150 kHz
60	300 Hz - 300 kHz

for full specification see Chapter 3.

TAPE PERFORMANCE

45. Tape Types. The Store 4DS/Store 7DS are designed to operate with magnetic tape of thickness 18 μm (0.0007 in) up to 35 μm (0.0014 in). The overall performance of the equipment will largely depend on the quality of tape used.

46. On Store 4DS equipments in particular where the tape size is nominally the same as that in domestic audio recorders, it is possible to obtain tapes which are not of instrumentation quality. Prior to dispatch this equipment will have been aligned using the tape type specified on the facia. Use of any other type of tape may result in a slightly degraded performance and in extreme cases necessitate re-alignment. When selecting an alternative tape the following guide-lines should be considered:-

(a) Use only tape from a reputable manufacturer.

(b) Use double play tape (25 μm thick). Do not use standard play tape (50 μm thick) as the tape tension is too low for such tape.

(c) Some tapes have a very low conductivity; this can cause static electrical discharges which affect the recorder logic. "Matt back" tapes do not suffer from this defect and also tend to provide better spool stacking.

(d) Generally the more modern tapes give better performance. Do not use chromium dioxide (CrO_2) tapes as the recording current set up in the Store 4DS is incorrect for this type of tape. It should be noted that the tapes used in alignment are equivalent to "double play". A thinner tape (BASF TP18) is available for Store 4DS. It is supplied on 210 mm ($8\frac{1}{4}$ in) spools in lengths of 1463 m (4,800 ft) under part no D6772.

47. Tape Noise. The signal to noise ratio on D.R. channels is entirely due to tape noise. For F.M. channels at slow tape speeds the signal to noise ratio depends mainly on the flutter of the machine but this can deteriorate seriously when a noisy tape is used. With most instrumentation recorders this is also true at the higher speeds but the flutter at these speeds in the Store 4DS and Store 7DS equipments is so low that the tape noise becomes the predominant factor. This underlines the need to use a good quality tape for best results.

48. Drop-out Performance. If a drop-out should occur on the tape, the signal to the replay electronics is momentarily lost. If this occurs the signal output will fall to zero. While drop-outs are inevitable with even the best quality tapes unless the strictest clean room conditions are observed, the precautions listed below, are in the experience of Racal Recorders, sufficient for normal purposes.

(a) Clean the recorder regularly, paying particular attention to the tape path.

(b) Spools should only be handled by the hub to avoid damage to the edges of the tape.

(c) Distorted spools damage the edges of the tape and therefore should not be used.

(d) Ideally the tape should never be handled. When this is not possible (e.g. when loading the tape onto the recorder) tape handling should be kept to a minimum.

(e) Tapes not in immediate use should be boxed to avoid contamination by dust and grit.

(f) Spools should be stored in boxes, and stacked on edge, preferably in a "comfortable" temperature.

(g) Magnetic fields may erase recordings, and these should therefore be avoided.

(h) Best results are obtained by bulk erasing a used tape before fresh recordings are made.

(j) Demagnetise the heads regularly.

49. Tape Tension Adjustment. (Store 7DS) The Store 7DS as supplied will provide correct tape tension for tapes of thickness 26μm - 35μm. If the Store 7DS is to be used with thinner tapes, then the tape tension must be altered as indicated in Chapter 4 para 45,46.

50. Use of different spool sizes. The Store 4DS is supplied with 210mm (8$\frac{1}{4}$in) spools. Other sizes of spools can be used with the following limitations:-

(a) Do not use 127mm (5in) diameter spools in both the supply and take-up positions, or instability of the spool servo may occur.

(b) If a 127mm spool of tape is to be used, put a 210mm spool in the take up position.

(c) The spool hubs are set for correct operation with the spools supplied. Many 127mm and 178mm (7in) spools are not as thick as those provided. The spool height adjusting discs can be placed under these spools so that the tape runs centrally between the flanges.

ADDITIONAL OPERATIONAL MODES.

51. TAPE/TACH Speed Control. There are two modes of speed control. In the TACH mode the capstan speed is synchronized to the internal crystal oscillator. This has a stability better than 50×10^{-6} over the operating temperature range. However, if the tape stretches (or contracts) due to changes in temperature, humidity or tape tension the overall tape speed constancy between recording and subsequent replay may be worse than this. Errors of $20 \times 10^{-6}/°C$ and $15 \times 10^{-6}/\%$ RH are possible.

52. Where high time base (i.e. tape speed) accuracy is important (e.g. video recordings for facisimile equipment) the TAPE mode may be used during replay. In this mode a constant frequency signal is recorded on one track during recording, and during replay it is this signal which is used to control the capstan speed, and any dimensional changes are compensated for automatically. The TAPE mode is also recommended for mobile applications where high accelerations may be encountered.

53. To use the TAPE mode proceed as follows:- Set the input attenuator of the reference channel (see para 55) to REF. Make the recording using the remaining channels for data. When replaying, set the TAPE/TACH switch (located under the front flap beneath the TAPE lamp window) to TAPE. The TAPE lamp will light, indicating that replay speed control is in the TAPE mode. When recording internal logic selects the TACH mode irrespective of the setting of the TAPE/TACH switch.

54. In the absence of a reference signal during replay, the lamp will be extinguished and speed control automatically revert to the TACH mode. If no reference track has been recorded the switch should be set to TACH, otherwise noise from the tape may cause occasional momentary switching to the TAPE mode.

55. TAPE Reference Channel. Channel 2 (Store 4DS or Channel 3 (Store 7DS) are normally factory selected. If required other channels may be used as follows:-

(a) On Store 4DS any other channel may be selected as reference channel.

(b) On Store 7DS any odd numbered channel may be used.

56. The reference channel is determined by the position of link F on the Motherboard (see Fig.28 Chapter 5). To change this link the base cover of the equipment must be removed.

57. Flutter Compensation. Flutter compensation affords a significant improvement in signal to noise ratio at low tape speeds. It is applicable to F.M. channel recordings only.

58. Flutter Compensation is achieved by recording zero input on a selected channel at the same time as data is being recorded on the other channel. Any unwanted signals caused by tape flutter will appear on this reference channel during replay and can be used to cancel out the similar signals occurring on the data channels.

59. To make a Flutter Compensated recording proceed as follows:-

(a) Ensure that the reference channel(s) (see paras 60, 61 below) contain a set of F.M. signal cards. (A flutter compensated recording cannot be made with D.R. cards in the reference channel(s).

(b) Set the input attenuator of the reference channel(s) to 20 V and ensure that no input is applied to the reference channel(s).

(c) Record data on the remaining channels.

(d) When replaying switch the Flutter Compensation switch (located under the front flap) on. (It can be left on during recording but downstream signals will be cancelled).

60. Flutter Compensation Reference Channel. Store 4DS has a single reference channel. This is normally factory set to channel 2, but if required a different channel can be selected. See para 62 below.

61. Store 7DS has two flutter compensation channels. Normally channel 2 is wired to provide flutter compensation for the even channels, and channel 3 covers the odd channels.

62. The reference channel(s) for flutter compensation are selected by link D on the Motherboard. A position exists for the insertion of link D in any channel (Two such links are required for Store 7DS).

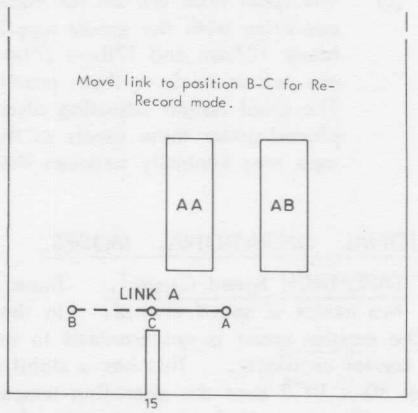
NOTE: It is possible to use the same reference channel for both Flutter Compensation and TAPE mode simultaneously (para 51). In this instance set the reference channel to REF (not 20 V). If older Intermediate Band boards are used in this channel they will undergo a positive d.c. level shift of 18.5% of full scale deflection.

63. On Store 7DS for flutter compensation on odd channels only, short pin 2 and pin 1 on on PL59 (0 volt) and remove even link "D". For even channel flutter compensation only, short pin 5 to pin 1 and remove odd link "D". (See also Fig. 51, Chapter 5).

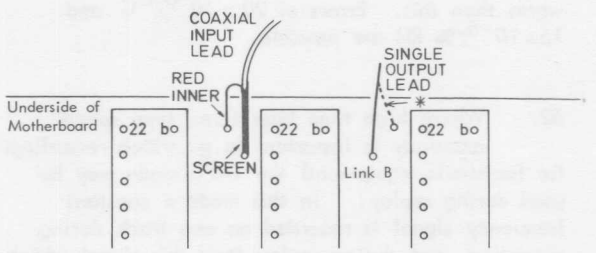
64. E to E Mode. Normally when the equipment is in STOP, or is spooling the channel input signals by-pass the heads and will appear at the channel outputs. This allows setting-up and certain alignment procedures to be performed without the tape running. If however the appearance of signals at the output during STOP or spooling is inconvenient, or line output signals are required whilst spooling (high speed search), the E to E signal may be shorted out by inserting link C in each channel. The link is located on the D.R. Replay 2 Board (D.R. channels). This option is available only on D.R. channels. Bandwidths in high speed search will be modified by the replay equalization.

65. Re-Record Mode (F.M. channels only). To transfer recordings from one machine to another similar recorder, or from one track to another, the demodulator/filter circuits on the playback channel(s) and the modulator circuits on the recording channel(s) can be bypassed. In this mode the recordings are not demodulated and then subsequently re-modulated as would normally be the case, thus the minimum degradation of signal quality takes place. To by-pass the demodulator circuits link B on the Motherboard must be changed. This involves removing the base cover to gain access to the underside of the Motherboard, and then re-soldering the lead on the appropriate channel(s) as shown below. If ringing occurs on the output lines a termination resistor in the range 50 to 100 ohms should be inserted in series with the link B position. (F.M. Replay board must be fitted).

66. To by-pass the modulator circuits, link A on the appropriate Record Board(s) must be changed over as shown below. TTL signals may also be recorded in this mode.



DUAL STANDARD F.M. RECORD BOARD



RE-RECORD MODE. Disconnect output lead (colour coded:- brown - Channel 1, red - Channel 2, etc.) and solder to adjacent pin as indicated by the dotted line.

* anti-ringing resistor as in paragraph 65

67. Unipolar Negative and Positive. The Unipolar Negative switch (SW1) has the effect of shifting the zero point of the record board up to maximum positive (+40%) deviation. It is then possible to apply "negative going" signals and have a working range from +40% to -40% deviation in a negative direction. Switch 1 on the F.M. Filter Board should also be selected. This will reconstitute the signal to that at the input to the equipment.

68. Unipolar Positive can be selected by switch 2 on the F.M. Record Board and F.M. Filter Board, and functions opposite to that described above (para 67).

69. Offset Controls. Offset control RV1, selected by switch 3 on F.M. Record Board, may be used to back off a d.c. component of an a.c. signal and thus move the signal to be "about zero". RV1 has a range of 20 volts.

NOTE: Switches 1 to 4 on the Record Board and 1 and 2 on the Replay Board are "made" when pushed in the direction of the arrow and "open circuit" when pushed in the reverse direction.

70. External Speed Control. Speed control is derived from an internally generated reference frequency. If it is desired to use External Speed control the following should be noted:-

(a) D.R. Recordings may be made at any speed.

(b) D.R. Recordings not replayed at one of the standard speeds will have incorrect equalization which must be allowed for.

(c) F.M. Recordings will contain d.c. offsets if a non standard speed is used for either Record or Replay.

71. External Speed Control is achieved by connecting an external signal to pin 37 of the remote control socket (SKT29 Store 4DS or SKT25 Store 7DS).

72. External Speed Control Reference should be within the following parameters:-

(a) Input Frequency 200 kHz ± 30%.

(b) Input Amplitude TTL (square wave) or sinusoidal, from 600Ω source coupled through 0.22 μF capacitor, in the range 5 V to 10 V peak to peak.

(c) Speed Variation ±30% from nominal as set on speed selector.

73. A signal on this line (pin 37) will override the internal crystal reference; speed of the equipment will be variable simply by changing its frequency. A specific speed can be set using the following formula:-

$$\text{Speed} = S \times \frac{f}{200}$$

where S = speed (in/s) selected by speed selector.
f = external speed reference in kHz.

REMOTE CONTROL

74. The Store 4DS and Store 7DS recorders can be operated remotely if required, via SKT29 (Store 4DS) and SKT23, SKT25 (Store 7DS) mounted on the rear casting of the equipment. Tables A, B and C list the pin number connections. For remote control, certain local controls must be disabled as indicated below.

75. Tape Movement Pushbuttons. The equipment may be run with both local and remote tape movement controls connected. However, if it is essential that conflicting commands are not given, local control can be made non-operative by removing link H on the Deck Control Board (Fig.30, Chapter 5).

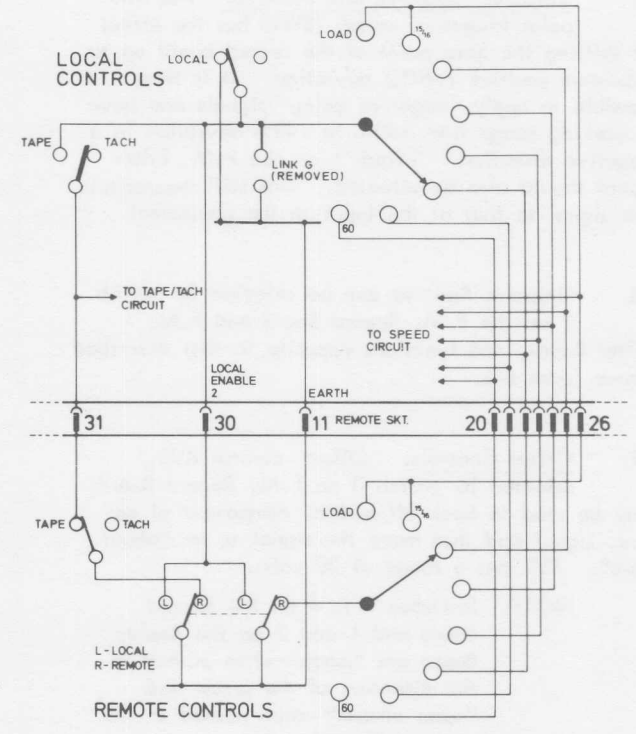
76. It should be noted that the local control can be regained without replacing link H. This is achieved by connecting pin 12 (Local Enable 1) to pin 11 (0 V) on SKT29 (Store 4DS) or SKT25 (Store 7DS). If connections to these pins are run to a remote switch, then when this switch is closed control will return to the local pushbuttons.

77. Speed Selector and Record Button. These functions are "enabled" by the "local" switch situated under the front flap. If remote operation is desired these functions should be disabled by pushing this switch away from the "local" position.

78. Local control can be regained by connecting pin 30 (Local Enable 2) to pin 11 (0 V) in a way similar to that described in para 76 above.

79. TAPE/TACH switch. To allow remote operation of this function the "local" switch must be pushed away from the "local" position and TAPE/TACH switch left in the TACH position.

REMOTE CONTROL OF SPEED AND TAPE/TACH SELECTOR - Suggested wiring arrangement (see para 79,80).



80. When using remote control of both speed selector and TAPE/TACH, conflicting commands may occur via the common return. The diagram at the top of this page indicates how this may be avoided.

81. Remote Recording. Remote operation of the RECORD button is detailed in para 77 above. In addition, individual channels may be switched remotely. Table A lists the connections for Store 7DS - via SKT23 Table C includes the connections for Store 4DS which is via SKT29.

82. Sequential Recording. By the addition of external logic circuits the Store 4DS and Store 7DS equipments can use the EOT/BOT sensor signals appearing at the remote socket to initiate a recording track change and direction change at the end of the tape run. Thus for example the recorder could be arranged to record forward on Channel 1 only, until at the end of tape the equipment would automatically switch to record in the reverse direction on Channel 2 only. By repeated track switching and direction change, prolonged recording times may be achieved. (EOT/BOT sensors are described in paras 33, 34).

83. Remote Switch-on and LOAD. The equipment may be "switched on", and loaded by external control circuits to connect either a.c. or d.c. (battery) supplies. Provision must be made to tension the tape by activating the spool servo. A circuit to do this is shown in the diagram below; if this circuit is used the equipment requires only the application of power to become loaded and ready to run. Carry out the following procedure:-

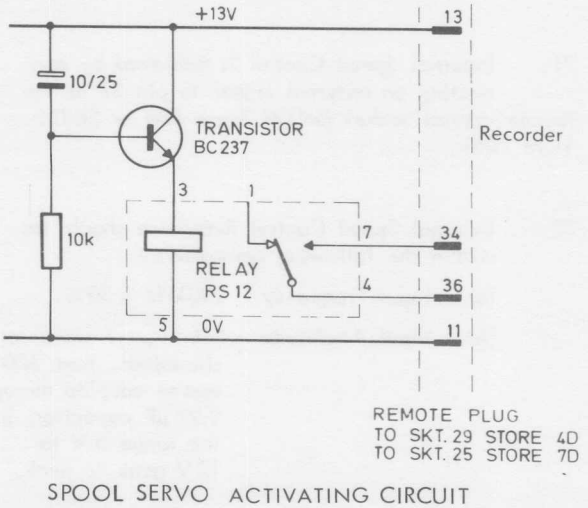
(a) With "power off", connect the circuit shown to the remote socket.

(b) Thread tape on the equipment and ensure that all slack is taken up by hand.

(c) Select the required speed and leave the local power switch in the "ON" position.

(d) When required, apply power to the equipment (a.c. or d.c.). The spool servo will activate by the momentary contact of pins 34 and 36 on the remote socket.

(e) To "switch off", allow the tape to come to rest, and then remove power.



SPOOL SERVO ACTIVATING CIRCUIT

84. Remote d.c. operation. It should be noted that during operation from d.c. sources, Store 7DS equipments draw high currents. It is vital that the supply voltage at the equipment never falls below 11 volts. To achieve this a 24 volt supply is recommended. It may also be necessary to apply this through a relay operated system having the battery local to the equipment. The rating of the relay contacts should be at least 10 amps.

ALIGNMENT OF SIGNAL CIRCUITS.

85. Certain checks on the functioning of the signal circuits can be carried out using the "REF, +, -" positions of the input attenuator. If as a result of these or for any other reason it is felt that the signal circuits should be re-aligned then refer to Chapter 4 para 50 to 72, for the alignment procedure.

86. F.M. Check. With the monitor meter in the d.c. mode, and meter selector in REP position for the required channel, switch input attenuator to "REF, +, -". The meter should also read "REF, +, -" in turn.

87. D.R. Check. The D.R. Calibration Board (where fitted) produces a set of reference frequencies for the D.R. channels on Store 4DS and Store 7DS equipments. It has two main uses:-

(a) In conjunction with the Monitor Meter it enables a check on the frequency response of D.R. channels without the need for external test equipment.

(b) The Calibration Board can be used to put reference levels on tape (the amplitude is specified to within 2%). This reference can be used to define the system sensitivity when tapes are subsequently replayed.

88. The table below indicates the frequencies provided by the Calibration Board. The signal level is equivalent to full rated input (i.e. equivalent for example to injecting a 1 volt peak (-0.8 dB) signal with the input attenuator set to 1 volt).

TAPE SPEED in/s	MID-BAND REFERENCE Select "-" on channel attenuator	BAND EDGE REFERENCE Select "+" on channel attenuator
$\frac{15}{16}$	470 Hz	4.7 kHz
$1\frac{7}{8}$	950 Hz	9.5 kHz
$3\frac{3}{4}$	1.9 kHz	19 kHz
$7\frac{1}{2}$	3.75 kHz	37.5 kHz
15	7.5 kHz	75 kHz
30	15 kHz	150 kHz
60	30 kHz	300 kHz

89. Frequency Response (D.R.) To check frequency response as suggested in paragraph 87 (a) proceed as follows:-

(a) Set meter switch to PEAK

(b) Load equipment with tape. Set desired speed.

(c) With equipment in E to E (tape stopped) set meter selector to Rec.

(d) On the channel to be checked set input control attenuator to "-" (mid-band) and "+" (band-edge) in turn. Both meters should indicate full scale deflection ± 1 division (top to the right, bottom to the left) for both "-" and "+" setting.

(e) Set meter selector to Rep. Meters should still indicate full scale deflection as in (d) above.

(f) Select forward record. The meter should now indicate the equivalent of ± 3 divisions of full scale deflection as in (d) above.

(g) If this result is not achieved the following should be checked:-

(i) All heads are clean.
(ii) Correct tape type in use.
(iii) Equipment may be in need of re-alignment.

(h) Recheck other D.R. channels as required.

90. System Sensitivity can be defined on tape (as suggested in para 87 (b)).

(a) During system setting up and just prior to making the recording the "-" and "+" calibration signals can be recorded on tape.

(b) On replay the amplitude of recorded data can be referenced to the calibration signals.

91. Re-Alignment. It is essential that the Calibration Board is re-aligned at intervals of not more than one year. This will maintain accuracy of calibration for which a procedure of alignment is given in Chapter 4 para 76.

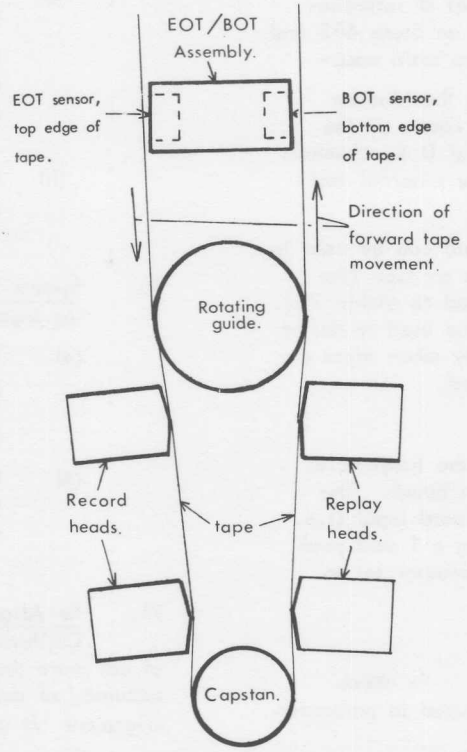
COOLING FAN (Store 7DS)

92. The cooling fan is temperature controlled. Its speed varies with temperature, and it will stop altogether when the equipment is cool.

SKT23 Pin No.	Function	Action
1	Ch 1 Record	Connect pins to 0 V to prevent recording on the selected channels.
2	Ch 2 Record	
3	Ch 3 Record	
4	Ch 4 Record	
5	Ch 5 Record	
6	Ch 6 Record	
7	Ch 7 Record	
9	0 V	

TABLE A

STORE 7DS REMOTE RECORD CONNECTIONS



LAYOUT OF STORE 7DS HEADS-EOT/BOT ASSEMBLY

TAPE PATH

TABLE B

STORE 14DS REMOTE FUNCTIONS - SKT25

SKT25 PIN NO.	FUNCTION	ENABLE	NOTES
1	Fast Reverse Command	Momentary Contact to Earth (pin 11) (4TTL Gate I/Ps)	
2	Fast Reverse Indicator		
3	Reverse Command	Momentary Contact to Earth (pin 11) (4TTL Gate I/Ps)	
4	Reverse Indicator		Responds to 1ms minimum TTL '0' level
5	Stop Command	Momentary Contact to Earth (pin 11) (4TTL Gate I/Ps)	sinking 6mA
6	Stop Indicator		For lamp indications connect between pin 13
7	Forward Command	Momentary Contact to Earth (pin 11) (4TTL Gate I/Ps)	(+13V) and appropriate line. Lamp 14V
8	Forward Indicator		0.04A.
9	Fast Forward Command	Momentary Contact to Earth (pin 11) (4TTL Gate I/Ps)	
10	Fast Forward Indicator		
11	Earth		
12	Local Enable 1	Earth continuously to re-enable local controls (Tape Movement Pins 1,3,5,7,9 above)	Remove link H on Store 14DS to disable local tape movement controls.
13	+13V		Total of 100mA available from pins 13 and 29
14	End of Tape		TTL '1' level while reflective strip is being sensed (duration depends on tape speed).
15	Beginning of Tape		TTL '1' level while reflective strip is being sensed (duration depends on tape speed).
16	EOT/BOT Disable	Earth continuously to prevent EOT/BOT signals automatically commanding stop.	
17	Spare		
18			
19			
20	60in/s Select	Connect any one line continuously to Earth (pin 11) for speed selection.	Local enable switch must be off when using remote speed selection. Continuous TTL '0' level on selected line. All other speed lines '1' level or open circuit
21	30 in/s Select		
22	15 in/s Select		
23	$7\frac{1}{2}$ in/s Select		
24	$3\frac{3}{4}$ in/s Select		
25	$1\frac{7}{8}$ in/s Select		
26	$\frac{15}{16}$ in/s Select		
27	Record Command	Momentary contact to Earth (pin 11) (4TTL Gate I/Ps) Forward or Reverse (pin 7 or 3) command must be given during this contact.	Responds to 3 ms minimum TTL '0' Level sinking 6mA
28	Record Indicator		Lamp (14V, 0.04A) to +13V (pin 29)
29	+13V		Total of 100mA available from pins 13 and 29
30	Local Enable 2	Earth continuously to re-enable local controls (pins 20-27) (See figure, page 12)	Assumes local enable switch pushed away from direction of arrow to disable all local controls except tape movement.
31	Tape/Tach Command	Connect continuously to earth for 'TAPE' Servo Control. Disconnect from earth for 'TACH' Servo Control.	Assumes local TAPE/TACH switch in TACH position.
32	Servo Status		Lamp (14V,0.04A) to +13V (pin 29) Lit in Off Tape Servo mode.
33	Tachometer O/P		0 to +5V p-p square wave. 10,000 cycles/ft of tape.
34	Load	Momentary contact of pin 34 to pin 36.	See page 12
35	200kHz Crystal Reference	Output	TTL 5V square wave
36			
37	External Speed Control Reference	Input	TTL 5V square wave.

TABLE C

STORE 4DS REMOTE FUNCTIONS

SKT29 PIN NO.	FUNCTION	ENABLE	NOTES
1	Fast Reverse Command	Momentary Contact to Earth (pin 11) (4TTL Gate I/Ps)	
2	Fast Reverse Indicator		
3	Reverse Command	Momentary Contact to Earth (pin 11) (4TTL Gate I/Ps)	Responds to 1ms minimum TTL '0' level sinking 6mA
4	Reverse Indicator		
5	Stop Command	Momentary Contact to Earth (pin 11) (4TTL Gate I/Ps)	For lamp indications connect between pin 13 (+13V) and appropriate line. Lamp 14V 0.04A.
6	Stop Indicator		
7	Forward Command	Momentary Contact to Earth (pin 11) (4TTL Gate I/Ps)	
8	Forward Indicator		
9	Fast Forward Command	Momentary Contact to Earth (pin 11) (4TTL Gate I/Ps)	
10	Fast Forward Indicator		
11	Earth		
12	Local Enable 1	Earth continuously to re-enable local controls (Tape Movement pins 1,3,5,7,9 above)	Remove link H on Store 4DS to disable local tape movement controls.
13	+13V		Total of 100mA available from pins 13 and 29
14	End of Tape		+5V while reflective strip is being sensed (length of strip duration depends on tape speed).
16	0V		
15	Ch 1 Record	Connect to pin 16 to inhibit individual channel recording.	
17	Ch 2 Record		
19	Ch 3 Record		
18	Ch 4 Record		
20	60 in/s Select	Connect any one line continuously to Earth (pin 11) for speed selection.	Local enable switch must be off when using remote speed selection. Continuous TTL'0' level on selected line. All other speed lines '1' level or open circuit.
21	30 in/s Select		
22	15 in/s Select		
23	7½ in/s Select		
24	3¾ in/s Select		
25	1⅞ in/s Select		
26	15/16 in/s Select		
27	Record Command	Momentary contact to Earth (pin 11) (4TTL Gate I/Ps) Forward or Reverse (pin 7 or 3) command must be given during this contact.	Responds to 3ms minimum TTL '0' Level sinking 6mA.
28	Record Indicator		Lamp (14V,0.04A) to +13V (pin 29)
29	+13V		Total of 100mA available from pins 13 and 29
30	Local Enable 2	Earth continuously to re-enable local controls (pins 20-27) (see figure, page 12)	Assumes local enable switch pushed away from direction of arrow to disable all local controls except tape movement.
31	Tape/Tach Command	Connect continuously to earth for 'TAPE' Servo Control. Disconnect from earth for 'TACH' Servo Control.	Assumes local TAPE/TACH switch in TACH position.
32	Servo Status		Lamp (14V,0.04A) to +13V (pin 29) Lit in Off Tape Servo mode.
33	Tone O/P		0 to +5V p-p square wave. 10,000 cycles/ft of tape.
34	Load	Momentary contact of pin 34 to 36	A speed should be selected at local control (See page 12)
35	200kHz crystal reference	Output	TTL 5 volt square wave.
36			
37	External Speed control reference	Input	TTL 5 volt square wave

CHAPTER 3

SPECIFICATION

1. The policy of Racal Recorders Limited is one of continuous development, and consequently the equipment may vary in detail from the description and specification in this publication.

2. TAPE/HEAD PARAMETERS (Store 4DS)

Tape: Width: 6.25 mm ($\frac{1}{4}$ in) Thickness: 18 to 35 μm (.0007 to .0014 in). Triple Play to Long Play.

Spools: Max 210 mm ($8\frac{1}{4}$ in) diameter with standard ciné-centre hub. Maximum capacity 1460 m (4800 ft) of 18 μm (Triple Play) tape.

Heads: 4 track in line: Track width 0.89 mm Track pitch 1.78 mm Record/Replay distance 50.8 mm (2.0 in) Erase head automatically energised in Forward Record mode only while all four channels are recording. (Optional facility for reverse erase)

Time Base Error: (TBE) Peak time displacement between reference track and crystal reference frequency Measured in TAPE mode according to I.R.I.G. 118-73

Tape Speed in/s	TBE μs zero to peak
60	± 1.5
30	± 1.5
15	± 2
$7\frac{1}{2}$	± 4
$3\frac{3}{4}$	± 8
$1\frac{7}{8}$	± 12
$\frac{15}{16}$	± 20

Interchannel Time Displacement Error (I.T.D.E.) Observed error after record/replay between adjacent tracks. Measured according to I.R.I.G. 118-73

Tape Speed in/s	I.T.D.E. μs zero to peak
60	±0.5
30	±1
15	±2
$7\frac{1}{2}$	±4
$3\frac{3}{4}$	±8
$1\frac{7}{8}$	±16
$\frac{15}{16}$	±32

3. TAPE/HEAD PARAMETERS (Store 7DS)

Tape: Width: 12.7 mm ($\frac{1}{2}$ in) Thickness: 26 to 35 μm or 18 to 26 μm if alternative tension spring (supplied) is fitted.

Spools: Type: 203 mm (8 in) diameter precision metal spools with NAB (or NARTB) hubs.

Spool Capacity: 3,600 ft (1100 m) of .0008 in (20 μm) tape. 2,400 ft (740 m) of .0012 in (30 μm) tape. 1,800 ft (550 m) of .0015 in (38 μm) tape.

Heads: Interlaced 3 + 4 record and reproduce head stacks in accordance with I.R.I.G. 106-73. Cue track (for voice) on edge of tape adjacent to track 7. Azimuth ± 1 minute of arc. Gap Scatter - 100 μin. Interstack spacing: 1.5 in ±0.0005 in.

Time Base Error (TBE) Peak time displacement between reference track and crystal reference frequency. Measured in TAPE mode according to I.R.I.G. 118-73

Tape Speed in/s	TBE (Channel 3) μs zero to peak
60	±1.5
30	±1.5
15	±2.0
$7\frac{1}{2}$	±4
$3\frac{3}{4}$	±8
$1\frac{7}{8}$	±12
$\frac{15}{16}$	±20

Interchannel Time Displacement Error (I.T.D.E.): Observed error after record/replay between adjacent tracks on the same head. Measured according to I.R.I.G. 118-73.

Tape Speed in/s	I.T.D.E. μs zero to peak
60	± 0.7
30	± 1.5
15	± 3
$7\frac{1}{2}$	± 6
$3\frac{3}{4}$	± 12
$1\frac{7}{8}$	± 25
$\frac{15}{16}$	± 50

4. TAPE TRANSPORT

Tape Speeds: 60, 30, 15, $7\frac{1}{2}$, $3\frac{3}{4}$, $1\frac{7}{8}$ and $\frac{15}{16}$ in/s (152.4, 76.2, 38.1, 19.05, 9.52, 4.76, 2.38, cm/s). Electrically selected by front panel rotary switch, or via remote socket.

Tape speed may also be controlled by an external oscillator giving any speed in the range 0.45 in/s to 90 in/s.

Tape Speed Accuracy: ± 0.2% (TACH mode).

Flutter: Measured per I.R.I.G. 106-73 (2 sigma) (TACH mode).

Tape Speed in/s	Bandwidth Hz	%Flutter (peak to peak)
60	0.2 to 10,000	0.35
30	0.2 to 5,000	0.35
15	0.2 to 2,500	0.35
$7\frac{1}{2}$	0.2 to 1,250	0.35
$3\frac{3}{4}$	0.2 to 625	0.35
$1\frac{7}{8}$	0.2 to 313	0.45
$\frac{15}{16}$	0.2 to 156	0.55

Tape Position Indicator: 4 digit resettable counter reading in feet to an accuracy of ±2%.

Capstan Servo Control: Internal crystal reference 100 kHz at 60 in/s, 50 kHz at 30 in/s and pro rata. Reference Oscillator stability, better than ± 50 x 10^{-6} over the operating temperature range.

Servo Control Mode: TAPE or TACH modes selectable by internal switch.

Capstan Servo Performance: Synchronisation of capstan motor to the oscillator maintained to accelerations of 100 rad/s/s.

Start Time: From Command to meeting flutter specification:-

Speed in/s	Time (seconds)
60	1.5
$\frac{15}{16}$	0.075

Stop Time: 1.5s at 60 in/s

Fast Wind Time: (Store 4DS): Less than 7 minutes for 1,000 m (3280 feet) of tape.

Fast Wind Time: (Store 7DS): 4.8 minutes for 700 m (2300 feet) of tape.

Tape Movement Controls: Momentary action push buttons for, Stop; Forward; Reverse; Fast Forward; Fast Reverse; Record. (Record electronically interlocked).

5. F.M. SIGNAL ELECTRONICS (Dual Standard).

Measurements are taken as laid down in the I.R.I.G. specification 118-73.

(a) Bandwidth and Signal-to-Noise Ratio (Wideband 1).

Tape Speed in/s	Bandwidth* ±0.5 dB	Signal-to-Noise Ratio dB	
		Store 4DS	Store 7DS
60	DC to 40,000 Hz	48	50
30	DC to 20,000 Hz	48	50
15	DC to 10,000 Hz	48	50
$7\frac{1}{2}$	DC to 5,000 Hz	48	48
$3\frac{3}{4}$	DC to 2,500 Hz	48	48
$1\frac{7}{8}$	DC to 1,250 Hz	46	46
$\frac{15}{16}$	DC to 625 Hz	45	44

* Tchebychef Filter

(b) Bandwidth and Signal-to-Noise Ratio (Intermediate Band).

Tape Speed in/s	Bandwidth * ±0.5 dB	Signal-to-Noise Ratio dB	
		Store 4DS	Store 7DS
60	DC to 20,000 Hz	48	52
30	DC to 10,000 Hz	48	52
15	DC to 5,000 Hz	48	52
7½	DC to 2,500 Hz	48	50
3¾	DC to 1,250 Hz	48	50
1⅞	DC to 625 Hz	46	46
15/16	DC to 312 Hz	45	45

* Tchebychef Filter.

(c) Bandwidths for Bessel mode of operation are contained in the following table:-

Tape Speed in/s	Bessel Bandwidths Wideband 1 +0 dB to -3 dB	Intermediate Band +0 dB to -3 dB
60	DC to 32,000 Hz	DC to 16,000 Hz
30	DC to 16,000 Hz	DC to 8,000 Hz
15	DC to 8,000 Hz	DC to 4,000 Hz
7½	DC to 4,000 Hz	DC to 2,000 Hz
3¾	DC to 2,000 Hz	DC to 1,000 Hz
1⅞	DC to 1,000 Hz	DC to 500 Hz
15/16	DC to 500 Hz	DC to 250 Hz

Filter Response: Tchebychef (Flat response) Bessel (Linear phase response)

Flutter Compensation: Selected by means of an internal switch; can improve basic signal-to-noise ratio by up to 10 dB at low tape speeds.

Carrier Frequency: Wideband 1; 3600 Hz per inch per second of tape speed. Intermediate band; 1800 Hz per inch per second of tape speed.

Carrier Deviation: ±40%

System Drift: After 15 minutes setting period, ± 0.5 % of full scale output in 8 hours with 10°C change in ambient temperature.

Input Sensitivity: A twelve position switch on each Record Board is calibrated in volts peak for full carrier deviation; Range 0.1 volt to 20 volt.

Input Sensitivity: (Contd) Additional positions are:- OFF record disable. REF reference frequency. "-" full negative deviation. "+" full positive deviation.

Input Impedance: 100 k ohms ±2% in parallel with 50 pF unbalanced.

Input Overload: Input circuits are protected to a maximum continuous input of ± 100 volt.

Output: Continuously variable from 0 to 6 volts peak to peak for full deviation.

Output Impedance: Less than 1 ohm.

Output Current: Output short circuit protected. Minimum load impedance 600 Ω in parallel with 1000 pF.

Overall System Linearity: ±0.3% deviation from best straight line through zero.

Harmonic Distortion: Less than 1.2% at maximum modulation level.

Intermodulation Distortion: Less than 1%

Variable Offset: Up to ±20 volts referred to input.

Fixed Offset: Switch selectable for recording unipolar signals using full dynamic range.

6. D.R. SIGNAL ELECTRONICS

Frequency Response and Signal/Noise Ratio:

Tape Speed (in/s)	Bandwidth (± 3 dB)	S.N.R. (dB)
60	300 Hz to 300 kHz	40
30	200 Hz to 150 kHz	40
15	100 Hz to 75 kHz	40
7½	100 Hz to 37.5 kHz	38
3¾	100 Hz to 19 kHz	38
1⅞	100 Hz to 9.5 kHz	38
15/16	100 Hz to 4.75 kHz	36

Input Sensitivity: A twelve position switch on each channel is calibrated in volts peak for normal record level. Range 0.1 to 20 V in 8 steps. Additional positions are:-

Input Sensitivity: (Contd).	OFF	Record Disable
	REF	Reference Frequency
	-	Mid-band reference signal *
	+	Band-edge reference signal *

* When calibration board is fitted.

Input Impedance:	10k ohms unbalanced shunted by less than 100pF.
Input Overload:	Input circuits are protected to a maximum continuous input of ± 100V.
Output:	Continuously variable from 0 to ± 3V for normal record level.
Output Impedance:	< 10 ohms.
Output Current:	15mA max. short circuit protected.
Harmonic Distortion:	1% 3rd harmonic at normal record level.

7. SIGNAL MONITORING

Meter:	Simultaneous positive and negative peak indicating meter.
Meter Modes:	Peak or D.C. (selected by front panel switch).
Meter Accuracy:	±2%
Selector:	Front panel slide control selects metered track.
Reponse:	Meter will read the peak amplitude of any pulse greater than 50μs duration.

8. VOICE CHANNEL

Microphone/ Loudspeaker:	Dynamic, hand held, with "press to talk" switch.
Record Level:	Determined by A.G.C.
Reproduce Level:	Adjustable by front panel control.
Power output:	0.2W maximum
Channel:	Interrupts Channel 4 on Store 4DS. Separate channel on Store 7DS.

9. POWER REQUIREMENTS

A.C.	115V ± 10% or 230V ± 10% 48 - 400Hz 80VA (Store 4DS) 100VA (Store 7DS)
D.C.	11 - 32V 65W at 24V (Store 4DS) 80W at 24V (Store 7DS)

10. ENVIRONMENT

Operating Temperature:	0°C to +50°C
Storage Temperature	-10°C to +70°C
Altitude:	4,500m (15,000 ft)
Humidity:	10-95% relative humidity non-condensing.
Shock:	150m/s/s maximum (10ms) non-operating.

11. PHYSICAL

Dimensions (Store 4DS)	Width	483mm (19in)
	Height	140mm (5½in)
	Depth	432mm (17in)
Dimensions (Store 7DS)	Width	483mm (19in)
	Height	156mm (6⅛in)
	Depth	485mm (19⅛in)

Weight:	17.5kg (38.5lb) - Store 4DS 22kg (48lb) - Store 7DS (with full reel of tape).
Rack Mounting:	May be fitted into standard 19in racking with removing covers. (See Chapter 2 para 7).
Operational Attitude:	Any plane.

CHAPTER 4

MAINTENANCE

1. All components are generously rate to give maximum useful life with the minimum of maintenance. Nevertheless it is recommended that routine cleaning as indicated in paras 2,3 and 4 below should be carried out. Should a fault develop which requires removal or adjustment of assemblies within the equipment, consult the appropriate paragraphs in this chapter. The Manufacturers reference number should be quoted in any correspondence relating to spares. The suggested maintenance periods may be extended if the equipment is subject to light usage in a clean environment and good quality recording tape is used.

DAILY MAINTENANCE

2. Clean the heads, tension arm rollers, and tape guide with tape cleaning fluid only, e.g. Freon TF. This is obtainable from Racal Recorders under part number, Cat 13021. Clean by rubbing gently using either a cotton bud or paper tissue lightly moistened with the liquid.

NOTES:
1. Despite the instructions on the outside of cans of cleaning fluid, NEVER spray the cleaning fluid directly onto the heads. Moisten the cotton bud or tissue with the liquid.
2. Use Freon TF sparingly. Do not flood the bearings with it.
3. Do not attempt to remove oxide build-up by scraping.
4. If the equipment has been out of use for a period, it is essential that the above cleaning instructions are carried out before switching on the unit.

PERIODIC MAINTENANCE

3. Most of the functions of the equipment are performed electrically, and the remaining moving parts are lubricated for life, consequently no routine maintenance is required. The lid hinges and catches may be lightly oiled when necessary. Weekly or as required clean the capstan shaft with a cotton bud or lint free cloth which may be lightly moistened with Freon TF if required.

Cooling Fan Filter (Store 7DS only)

4. At approximately six monthly intervals the air filter should be pulled out of the rear panel and washed in warm soapy water. The filter may be removed and replaced without dismantling the equipment. In dusty conditions the filter must be cleaned more often as required.

FAULT FINDING

5. If a fault occurs, perform the appropriate checks listed below. The functioning of the equipment is described comprehensively in Chapter 5. (Consult first the block diagrams at the beginning of the chapter). Connections within the equipment are numbered and wires are colour coded accordingly (see para 78, 79).

System Failure.

6. (a) Ensure that the equipment has been connected correctly and switched on (see Chapter 2, paras 2-5, 9).
   (b) If d.c. power is being used, check the polarity and voltage of the battery. Check the power lead to the d.c. input socket (Chapter 2 para 4).
   (c) If a.c. power is being used, check the supply voltage against setting (Chapter 2 para 3). Check also the power lead to the a.c. input socket.
   (d) Check that all fuses are correct and have not blown.

Tape Transport Malfunction

7. (a) Ensure that the TAPE/TACH switch is in the TACH position and that the local enable switch is set to local.
   (b) On Store 4DS the use of small diameter spools (127mm (5in) or less), in both supply and take-up positions may cause instability of the spool servo control. See Chapter 2 para 50.
   (c) Ensure that the tape has been loaded correctly. See Chapter 2 paras 10-14.

(d) On Store 7DS equipments the tape tension must be altered when tapes thinner than 25 µm are used. Check tape thickness and tension setting (see para 46).

(e) Instability of tension arms. If the tension arms move erratically while the tape is running, the tape path i.e. heads, guides and capstan should be checked and cleaned. If the fault prevails, check that the brakes are not binding.

(f) Tapes that have been slit incorrectly (i.e. oversize) may jam in the guides. These should be returned to the tape supplier.

(g) If when a tape motion pushbutton is depressed the capstan only turns, but stops on release of the button, then the tape has not been loaded correctly (see para 7 (c) above). If the tape also moves, but similarly stops on release of the button, then the tape backing may be too reflective causing the EOT or EOT/BOT sensor to be activated. A less reflective tape should be substituted.

(h) On equipment which has been used before, check that links have not been altered within the unit - see under "additional Operational Modes" and "Remote Control" in Chapter 2, para 52-84.

Signal Malfunction

8. (a) Throughly clean the heads.

(b) Check that the oxide side of the tape faces the heads.

(c) Check signal leads and attached equipments.

(d) Ensure that the Flutter Compensation switch is in the OFF position.

(e) Ensure that the frequency and amplitude of the input signal is within the specified range - the suitability of the input signal and the functioning of the record and replay electronics can be checked using the internal meter. See Chapter 2 paras 22 - 26.

(f) When recording, ensure that the Record button is released after the motion pushbutton, also ensure that recordings are not being made on top of previous recording.

(g) Check individual channels by substituting signal boards from known working channels, (see paras 61, 62 below).

(h) Check malfunction with tape stationary as well as running (signal by-passes heads when tape is stopped).

MAINTENANCE OF SUB-ASSEMBLIES

Removal and Replacement of Sub-assemblies

9. Access to and removal of individual sub-assemblies is described in the paragraphs below. When dismantling the equipment the following points should be borne in mind.

(a) In order to facilitate reassembly it is advisable that a note of appropriate connections should be made before dismantling any part of the machine. All connections are numbered (see circuit diagrams, Chapter 5) and the connecting wires colour coded accordingly (see paras 78, 79 below).

(b) For the majority of maintenance work involving access to the P.C. Boards etc., it is convenient to stand the machine on its rear casting. The Store 7DS must not be stood on end when the rear casting has been removed (see para 19 below).

(c) The Power Supply, Switching Regulator, Deck Control, Capstan Servo and Spool Servo Boards all have heatsinks which are screwed onto a main assembly member, and use heat conducting compound for efficient heat transfer. When reassembling any of the above boards, it is essential to ensure that an adequate quantity of the compound is present, and evenly spread over the heat transfer area. The recommended compound is Dow Corning 340, obtainable from Hopkins and Williams, High Wycombe.

(d) No board bearing a heatsink should be operated for a long period unless securely connected to a larger heatsink.

(e) When remounting the Meter Assembly, Speed Selector Assembly, Footage Counter Assembly or Pushbutton Assembly onto the deck casting, the assembly mounting screws should not be tightened until the top cover has been replaced and the assembly position adjusted for correct alignment with the top cover.

To gain access to sub-assemblies, the handle and various covers may have to be removed as described in paras 10 - 14 below.

Removal of Base Cover

10. Remove by extracting the four retaining screws.

Removal of Handle

11. Pull the handle out until it stops in the normal carrying position, then press the two nylon catches now exposed behind the handle and withdraw handle completely. When replacing the handle ensure that its inner flange runs in the grooves of the nylon rollers, and that the catches engage correctly.

Removal of Facia

12. The facia is sited beneath the tape spools and covers most of the fixed sub-assemblies. To remove, first take off the handle (para 11) and tape spools. Remove the four screws adjacent to the spool hubs and tension arms using a 2.5mm socket key. The facia is a spring fit onto the side members and is removed by tapping the facia to the left with the palm of one hand and then prising the left-hand edge of the lip off the side member.

Removal of Top Cover and Front Flap

13. To remove this complete assembly first remove handle (para 11), then remove the two screws on each side which secure the top cover to the side members.

Removal of Tinted Transparent Lid

14. To remove, extract the two screws which secure the hinges to the rear casting.

Signal Boards

15. The F.M. and D.R. signal boards plug into the motherboard and may be removed by raising the front flap, removing the board locating bar, and extracting the boards required. (For motherboard see Chapter 5 Fig.28). Note that the Record Boards will have to be removed before adjacent boards can be extracted. Care must be taken to ensure that D.R. cards are replaced in the channel from which they were extracted.

16. To re-align the signal boards refer to paras 50 to 72 in this chapter. To facilitate circuit checking during operation these boards may be mounted on extender cards- see Optional Accessories, Chapter 5, Figs 48 and 49.

Meter Assembly

17. To remove, first remove top cover and Channel 1 signal boards (see above). Disconnect the meter leads from the motherboard (PL57), extract the two mounting screws, and lift the complete assembly out. To replace, reverse the procedure (but see para 9 (e) above).

Power Supply Board (Store 4DS)

18. The Power Supply Board is mounted inside a metal screening box. To examine the board it is necessary to remove the screws which hold the cover in place. To remove the complete assembly the three screws securing the box to the rear casting must be removed. Later equipments have an additional bracket screwed to the side extrusion.

Power Supply Board (Store 7DS)

19. The Power Supply Board is mounted inside the rear casting. To gain access to this board, disconnect the equipment from the power source, remove the three rear casting retaining screws (see diagram on page 3) and detach the rear casting. The rear casting is still attached to the main frame by the wire loom to SKT22 and if desired the equipment can still be operated, however care must be taken to avoid contact with high a.c. supply voltages appearing on SKT22 and the a.c. input socket, fuses etc..

Switching Regulator

20. (a) (Store 7DS) To gain access to this unit, remove the base cover (para 10), the regulator cover by undoing the two pozidriv screws. To remove the unit, first prize off the black caps, which cover the retaining screws (the rear casting must be removed - see para 19). Next release these screws, detach the push on wire connectors and remove the regulator. When reassembling ensure that the bushes which insulate the regulator from the main frame are in place.

(b) (Store 4DS) To gain access to this unit first remove the facia (para 12). Remove by undoing the two pozidriv insulated screws in the rear casting. Connections are by push on connectors. When re-assembling ensure that electrical isolation to chassis is maintained.

Capstan Servo, Deck Control, and Spool Servo Boards

21. To gain access to these, remove the base cover. Each board is secured by two bolts through the side of the main frame into the heat-sink and two bolts through the p.c. board. Access to heat sink bolts is easier if the handle is first removed (see paras 10 and 11).

Bias Oscillator and Replay Preamplifier

22. The facia must be removed (para 12) to reach these boards. The preamplifier is enclosed in a screening can, the lid of which can be removed by undoing the three retaining screws.

D.R. Calibration Board (where fitted)

23. To remove the unit, proceed as follows:-

(a) Remove base cover, handle, top cover and front flap (para 10,11,12,13).

(b) Remove Voice Channel Board.

(c) From the underside, remove the two M3 screws which attach the Calibration Board to the Motherboard.

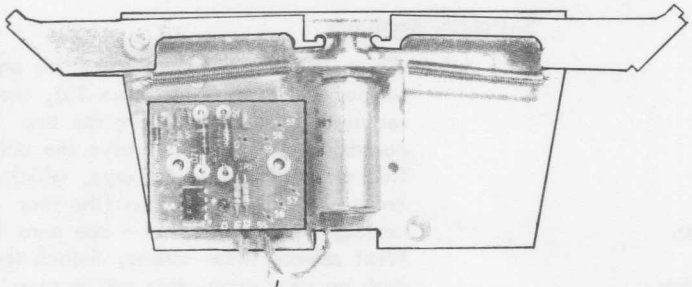
(d) Unplug the flat strip cable from SKT58 (extreme right of Motherboard, when viewed from above) and remove the unit.

(e) Replacement is the reverse procedure.

Brake Assembly

24. The brake assemblies on Store 4DS and Store 7DS are mechanically similar. On the Store 4DS the Solenoid Driver Board is mounted above the brake assembly and on the Store 7DS it is mounted underneath the brake assembly. The EOT/BOT assembly is mounted on top of the Store 7DS Brake Assembly.

25. Brake Assembly Adjustment Remove facia (see para 12 above), and loosen the two brake assembly screws. Press in the solenoid as far as it will go, this brings the brakes to the released position. Take care not to exert undue bias on the spring or linkage mechanism. Adjust the entire assembly until the gaps between pads and drums are equal, and set at about 0.5 mm (0.02 in), whilst maintaining the solenoid fully pressed in. Tighten the assembly securing screws. Check that the solenoid operates and releases the brakes correctly, by switching from LOAD to $\frac{15}{16}$ in/s and back, with the machine switched on. Test as follows:- The final dynamic test with tape loaded is to set the machine into the spool mode, and when it has reached full speed, move the Selector Switch to LOAD. This will cause the brakes to be applied. The tape should come to a halt without snatching, or throwing loops of tape. It should be possible to perform this test under all conditions of tape movement in both directions.

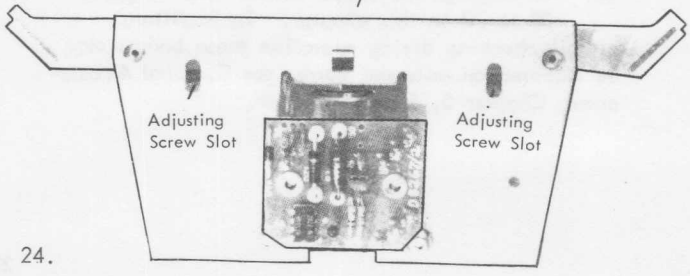


STORE 4DS BRAKE ASSEMBLY

The two fixing screws are located partly under the return springs. The solenoid driver board is located to one side of the solenoid and is connected to the Spool Servo Board.

STORE 7DS BRAKE ASSEMBLY

The two fixing screws are located partly under the return springs. The EOT/BOT assembly is mounted on top of the Brake Assembly. The Solenoid Drive Board is mounted under the solenoid and carries through connections between EOT/BOT and Deck Control. The brake supply comes from the Spool Servo Board.



26. Brake Assembly Removal (Store 4DS). Remove facia and base cover (see paras 10 and 12 above), pull the supply connectors (wire numbers 50 and 58) off their tags on the spool servo board. Remove the two screws securing the Brake Assembly to the deck casting. Feed wires 50 and 58 through the chassis and remove the brake assembly.

27. Brake Assembly Removal (Store 7DS). Remove facia and base cover (see paras 10 and 12) and pull off connector wires number 50 to 58 at the Solenoid Driver Board. At the Deck Control Board remove Scotchflex wires 0, 21, 23 and 26, (from EOT/BOT). Remove the two screws securing the Brake Assembly. Lift the Brake Assembly with care, feeding wires through the chassis.

28. Brake Pad Renewal. The brake pads are bonded onto their respective arms with Evostick 528 adhesive. To replace a brake pad, remove the assembly from the machine, firmly grip the brake arm and finally lever off the pad. Brake Pads are supplied under part number D8178 and are the only part of the Brake Assembly supplied separately.

Lamp Replacement.

29. The indicator lamps in the record and tape movement pushbuttons are replaced by pulling the appropriate button out of the equipment, and extracting the lamp from the base of the button.

NOTE: It may be found necessary to remove the top cover in order to obtain sufficient grip on the button (para 13 above).

Capstan Assembly

30. The Capstan Assembly is a precision assembly and should not be dismantled. Should it be necessary to remove the assembly, proceed as follows:-

(a) Remove Head Plate (paras 36 - 37 below).

(b) Remove footage counter drive ring (para 31, below).

(c) Remove Tone Head Preamplifier connections and Capstan Motor connections to the Capstan Servo Board (PL55, PL56).

(d) Do not apply any voltage (a.c. or d.c.) to the Tone Wheel Head, since this will destroy the tone wheel recording, and necessitate replacement of the Capstan Assembly. Continuity testing of the tone wheel head will cause the above condition and therefore must NOT be carried out.

(e) Remove all screws securing the Capstan Servo and Deck Control Boards and swing these boards aside (without removing the electrical connections).

(f) Unscrew the four capstan retaining screws (accessible from the top of the equipment) let the assembly drop slightly towards the Motherboard, and then ease out.

(g) To replace the Capstan Assembly, reverse the above instructions. When replacing the Capstan Servo and Deck Control Boards, ensure all plug-in leads are secure, particularly those to the Mother Board, and that no wires are trapped.

Tape Position Indicator (Counter Assembly)

31. Renewal of Drive Ring

(a) Remove Head Plate (paras 36, 37 below).

(b) Ease drive ring over counter pulley and remove from capstan.

(c) Place new drive ring over capstan and ease onto counter pulley.

(d) Ensure drive ring runs in the groove in the capstan.

(e) Replace Head Plate.

32. Removal of Counter

(a) Remove top cover and facia.

(b) Ease drive ring off counter pulley.

(c) Extract the two screws securing the counter bracket to the deck casting and remove the assembly.

(d) When re-assembling ensure that the drive ring runs in the groove in the capstan shaft.

(e) Before finally tightening screws see para 9 (e).

EOT Assembly (Store 4DS)

33. This assembly is mounted in the fixed tape guide. When correctly adjusted the photocell/lamp face will be parallel with the tape path. If adjustment is necessary (due for example to the addition of a reverse erase head) proceed as follows:-

(a) Remove the Head Plate (see para 36 below).

(b) Loosen the single screw attaching the guide to the Head Plate (located below Head Plate).

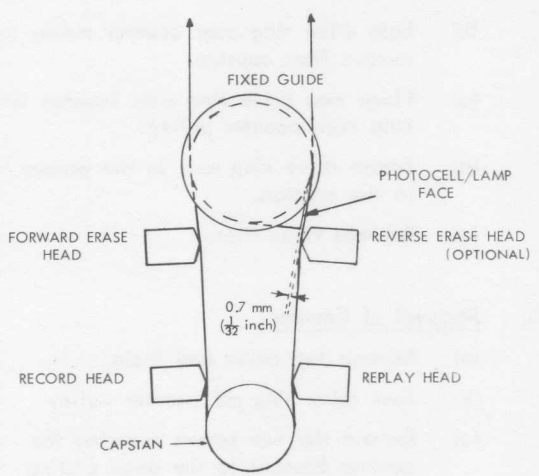
(c) Thread a piece of tape round the guide and pull the ends taut over the heads.

(d) Rotate sensor until the photocell/lamp face is parallel to the tape. (The separation should then be approximately 0.7 mm).

(e) Tighten screw, replace Head Plate.

If complete removal of the sensor is necessary, the flat cableform connecting the assembly to the Deck Control Board must be disconnected. Connections are as follows:-

Wire No.	Connect to (Deck Control Board)
23	-13 V
0	0 V
21	+5 V
26	EOT



EOT/BOT Assembly (Store 7DS)

34. The assembly is attached to the brake assembly. Removal is achieved by disconnecting the leads from the Deck Control Board and the terminal block on the underside of the brake assembly, and removing the two retaining screws. Adjustment can be carried out by loosening the same two retaining screws. Correct adjustment is obtained when the EOT and BOT sensors are equidistant from the tape.

35. The operation of the sensors can be checked as follows:-

(a) Attach a reflective strip approximately 25 mm (1 in) long to the back of the tape in the required position. (See Chapter 2 para 34).

(b) Spool towards the marker strip. The recorder will select the STOP mode when the marker is sensed.

(c) Check correct operation for both directions of tape movement and verify that both EOT and BOT sensors are sensing their appropriate markers.

(d) Suitable reflective marker strips are available from 3 M's Company (Sensing Markers No. 650).

Head Plate Assembly

36. Removal of Headplate (Store 4DS)

(a) Remove base cover, top cover, and facia (see paras 10-13 above).

(b) Remove head cover (one screw).

(c) Unplug End of Tape leads from the Deck Control Board, Record head cable and erase leads from the Bias Oscillator, Replay head cable from the Replay Preamplifier Board.

(d) Remove the three headplate securing screws.

(e) The record and replay heads are critically positioned and must not be removed from the headplate.

(f) Refitting is the opposite of the above, the following points being noted:-

(i) Headplate to main assembly mating surfaces must be scrupulously clean.

(ii) After replacing the head cover, check that it does not foul the tape.

(g) The surface finish on the heads is critical and the heads must not be allowed to touch anything which will impair this finish. (A recorder with damaged heads is useless).

(h) Clean the heads thoroughly before use (para 2 above).

37. Removal of Headplate (Store 7DS)

(a) Remove base cover, top cover, and facia (see paras 10 -13 above).

(b) Remove head cover (one screw).

(c) Unplug the Replay head cables from the Replay Preamplifier and the Record head cables from the Bias Oscillator.

(d) The headplate can now be removed by loosening the three retaining screws.

(e) The record and replay heads are critically positioned and must not be removed from the headplate.

(f) To refit the headplate, carry out sub-paragraphs (a) to (d) in reverse order. The following points should be noted.

(i) Ensure that mating surfaces are scrupulously clean.

(ii) After replacing the head cover, check that it does not foul the tape.

(g) The surface finish on the heads is critical and the heads must not be allowed to touch anything which will impair this finish. (A recorder with damaged heads is useless).

(h) Clean the heads thoroughly before use (para 2 above).

Pushbutton Assembly

38. To replace the indicator lamps see para 29 above. To remove the Assembly proceed as follows:-

(a) Remove facia and top cover.

(b) Unplug the cable from the Deck Control Board.

(c) Extract the two screws securing the Pushbutton Assembly bracket to the deck casting and remove assembly.

(d) The assembly is connected to the remote control socket, and therefore cannot be removed completely without unsoldering the connections.

(e) When replacing reverse the procedure, adjusting for alignment as described in paragraphs 9 (e) above.

Speed Selector Assembly.

39. To replace the Record indicator lamp see para 29 above. To remove the assembly proceed as follows:-

(a) Remove facia and top cover.

(b) Unplug the selector cable from the Capstan Board.

(c) Extract the two screws securing the Speed Selector bracket to the deck casting and remove assembly.

(d) The assembly is connected to the remote control socket and therefore cannot be removed completely without unsoldering the connections.

(e) When replacing, reverse the procedure, (but see also para 9 (e)).

Spool Motor Assembly.

40. The spool motors are precision assemblies, and should not be dismantled. If a fault develops the complete unit must be replaced.

41. Spool Assembly Replacement

(a) Remove facia (para 12 above).

(b) Disconnect Spool Motor. The motor wires (red and black on Store 4DS, pink and black on Store 7DS) plug in to a terminal block near the tension arms.

(c) To gain access to the motor securing screws the Replay Preamplifier or Bias Oscillator (depending on which motor is being removed) must be moved aside - see para 22 above.

(d) On Store 7DS the brake assembly must also be moved aside. Remove the two brake assembly retaining screws.

(e) Remove the three motor securing screws and the facia support pillar.

(f) Withdraw the assembly while feeding wires behind the deck casting (it is not necessary to remove the hub).

(g) A socket screw secures the spool hub collar to the motor (3 mm key).

(h) Reassembly is the reverse of the above. If the spool hub collar has been removed from the motor, adjustment will be required as in para 43.

42. Spool Hub Height Adjustment. (Store 4DS) The hub height is factory preset by means of shims under the hub. Spool assemblies are dispatched as complete units and should not need further adjustment. If however, spools of different thickness are in use, adjustment is as follows:-

(a) Remove the black Spool Hub. (The hub is held by 3 screws under plastic buttons; the buttons are removed by laying a piece of adhesive tape over the button and pulling away).

(b) When the Spool Hub is removed this will expose 2 plastic shims each of .010 in.

(c) The shims should be removed one at a time until the tape runs centrally between the spool flanges.

(d) This amount of adjustment is sufficient to cater for most spool widths. If the tape still does not run centrally in the spools it is possible that there is a further fault with the tape path, in which case a service agent of Racal Recorders should be consulted.

(e) Reassembly is the reverse of the above procedure.

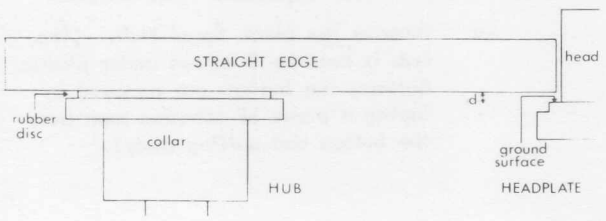
43. Spool Hub Height Adjustment (Store 7DS)
Adjustment will normally be necessary only after a spool assembly has been replaced. Proceed as follows:-

(a) Remove facia and head cover (para 12 above).

(b) Remove spool hubs. This is done by first removing the central screw (use special tool, P15358) and removing the top portion of the hub. (Note that there are usually 2 or 3 waved washers in the central screw recess which must be preserved for replacement on reassembly). Three pan head pozidriv screws are now accessible and must be removed to allow the lower half of the hub assembly to be detached.

(c) Lay a substantial straight edge across the rubber disc as shown in the diagram below. One end of the straight edge should be over part of the ground surface of the headplate, near the head nearest the rotating guides. Take care not to touch the head faces.

(d) Measure (with slip gauges or depth gauge), the distance 'd' as illustrated below. Rotate the hub and take the average value of 'd' (it will vary slightly).



(e) If necessary adjust the height of the collar by slackening the socket screw (3 mm key).

(f) Factory adjustment of 'd' is to 4.71 mm ±0.1 mm (0.186 ± .003 in) for the spools supplied. (T = 18.08 mm).

(g) If the tape touches the edge of the spool when the recorder is in normal operation, and the hub height is correct, check that the tension arm rollers are vertical. If this is not so, replacement of the Tension Arm Assembly is necessary.

Tension Arm Assembly

44. The assembly may be checked and adjusted as described in this paragraph and paras 45 - 47 below:-

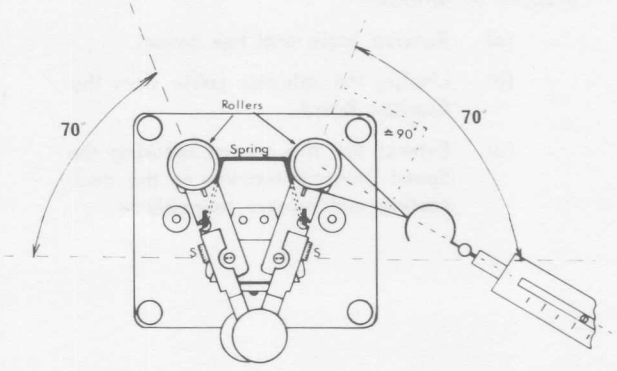
(a) Remove facia (para 12 above).

(b) Check rollers spin freely.

(c) Pull the L.H. roller until the arm touches the outer end stop, then release. The bearings are oil filled. The arm should return to the inner stop quickly and smoothly with a damped action. Repeat for R.H. arm.

(d) The oil filled assembly must not be disturbed. If faulty, the complete assembly must be replaced.

45. Tension Adjustment Attach a spring balance to one tension arm (see diagram). Hold the other arm at an angle of 70° as shown in the diagram and pull the spring balance until the other arm is also at an angle of 70°. The balance should read between 80 and 90 gf (2.8 to 3.2 ozf) for Store 4DS and between 125 and 135 gf (4.4 to 4.7 ozf) for Store 7DS (see para 46). If the reading is outside the above range, reset by carefully adjusting the two innermost bends in the spring until a reading in the centre of the range is obtained.



46. Tension Change for thin tapes (Store 7DS)
The spring tension must be altered for tapes which are thinner than 25μm. To do this remove the red spring and replace it with the black spring which is clipped on the side of the tension arm assembly. The spring tension as measured in para 45 above should then read between 80 and 90 gf (2.8 - 3.2 ozf).

47. Photocell Checks. The tension arms move shutters in front of a lamp to alter the light intensity falling on the photocells housed in the assembly. The operation can be checked as follows:-

(a) Remove base cover.

(b) Measure the voltage between TP1 and TP15 (TP1 at approximately +5V) on the Spool Servo Board.

(c) Measure the voltage between TP2 and TP15 while swinging the R.H. tension arm between the end stops. The voltage swing should be between 20% and 80% of the voltage measured in (b) and at 50% when the arm is midway.

(d) Repeat (c) for the L.H. arm and the voltage between TP3 and TP15.

48. If no voltage swing is apparent, check that the lamp is illuminated by removing the assembly (para 49 below). If the lamp is functioning the entire photocell assembly must be replaced. (Individual photocells must not be removed from the boards since damage will result from overheating the photocell).

49. If the swings measured are incorrect, the shutter (at rear of Tension Arm Assembly) requires adjustment as detailed below, however as these adjustments are critical to the correct operation of the equipment, it is strongly recommended that they are performed by the Manufacturer or Agent.

(a) Slacken the socket screw S (use 2.5mm socket key).

(b) Hold the arm in mid position and turn the shaft, using tool - Cat.2692 inserted in the two drive holes until the voltage reads 50% of the value measured in para 47. DO NOT turn the shaft beyond the point where the shutter hits the photocell board.

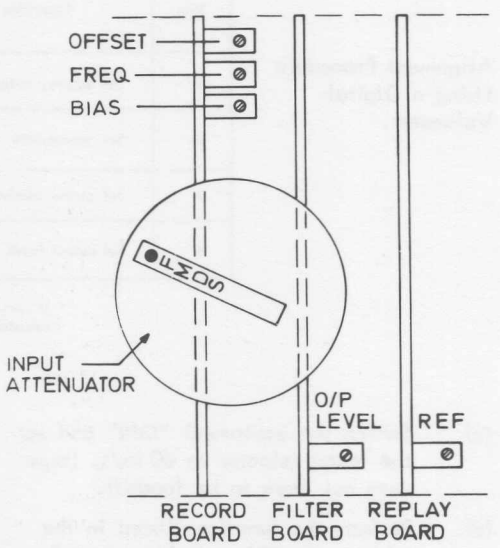
(c) Tighten the socket screw ensuring that the arm is pushed down against the circlip on the shaft.

ALIGNMENT OF SIGNAL CIRCUITS

50. Certain checks on the functioning of the signal circuits can be carried out using the monitor meter as described in Chapter 2 para 85. The full re-alignment procedure is outlined in the paragraphs below:-

Alignment of Dual Standard F.M. Channels.

51. The Dual Standard F.M. Electronics can be set up without recourse to test instruments. Greater accuracy can be achieved with the aid of a digital voltmeter.



NOTE: Alignment cannot be performed when using external speed control. See para 73 below.

52. Alignment Procedure without external instruments.

(a) Ensure that switches 1,2,3 and 4 on the Record Board and switches 1 and 2 on the Filter Board are open circuit, i.e. pushed away from the direction of the arrow head.

(b) Select Intermediate Band operation with the switch labelled w.b.1. under the front flap. Push the switch away from the w.b.1. position.

Normal Alignment Procedure

Step	Meter Selector position on required channel	Input Attenuator position (no input)	Potentiometer to be adjusted See diagram above		Result on Meter (d.c. mode)
			Identification	P.C. Board	
1	'REC'	'+'	no adjustment		check for +fsd
2	'REC'	'-'	no adjustment		check for -fsd
3	'REP'	'REF'	'REF'	replay	adjust to ref mark
4	'REP'	'20 V'	'FREQ'	record	adjust for zero

If the results set out in this table are not achieved it is possible that there is a Signal Board fault. Reference to the trouble shooting tables in Appendix B should help eliminate this.

Alignment Procedure Using a Digital Voltmeter.

Step	Operation	Input Attenuator position (no input)	Potentiometer to be adjusted		Reading on Digital Voltmeter
			Identification	P.C. Board	
1	Set approx. output level	'+'	OUTPUT LEVEL	filter	+V out*(e.g. 1V)
2	Set demodulator	'REF'	'REF'	replay	-18.5% V out (e.g. -185 mV)
3	Set centre carrier	'20 V'	'FREQ'	record	0V
4	Set output level	'+'	OUTPUT LEVEL	filter	+V out (e.g. 1V)

* V out is the output voltage required for a full scale positive input, and can be adjusted within the range 0V to 3V.

(c) Switch the equipment "ON" and set the speed selector to 60 in/s, (tape does not have to be loaded).

(d) Perform the functions listed in the table under "Normal Alignment Procedure".

53. Alignment Procedure using a digital voltmeter. Greater accuracy can be achieved if a digital voltmeter is used. Initially carry out the procedure in para 52 above.

54. On completion of para 52 above connect a digital voltmeter to the output of the channel concerned. The equipment should be set as in para 52. Carry out the functions listed in the Procedure Using a Digital Voltmeter.

NOTE: Alignment cannot be performed when using external speed control.

55. Bias Adjustment. Re-adjustment of the bias control will be necessary on the following occasions:-

(a) Change of headplate.

(b) Change of bias board.

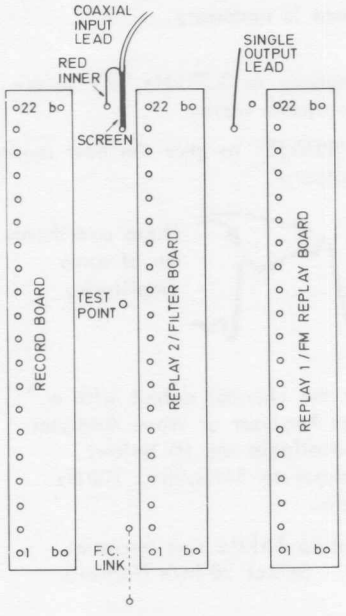
(c) Change of "tape type"

(d) On acquiring signal boards not previously used in an equipment.

56. The bias level may be adjusted as follows:-

(a) Disconnect power to equipment, remove base cover, and connect monitor probe to pin 1 of the Replay Board socket, (see illustration below).

(b) Connect monitor probe to an oscilloscope, load equipment with tape of the type to be used. Preferably tape should be bulk erased.



VIEW OF UNDERSIDE OF MOTHERBOARD SHOWING PRINTED CIRCUIT BOARD SOCKETS.

(c) Switch on equipment, set speed selector switch to $7\frac{1}{2}$ in/s, set bandwidth switch to wideband 1 (w.b.1), under the front flap.

(d) Set attenuator control of channel concerned to "+" position.

(e) Set equipment in motion by selecting forward record.

(f) Adjust BIAS control (see illustration on page 29) for maximum output.

57. Offset Adjustment. The OFFSET control, selected by switch 3 on the Dual Standard Record Board can be used to reduce to zero any d.c. input level within the range ±20 volt.

58. Output Level. This control is normally set to give unity gain when the equipment is used with the input attenuator control set to the 1 volt range. After alignment has been carried out, however, customers may wish to reset this control to their own particular need. Proceed as follows:-

(a) Connect a digital voltmeter to the output BNC socket of the channel in question.

(b) Select "+" with the input attenuator control of that channel.

(c) Adjust "Output Level" control, (see illustrations on page 29) to the peak output required in the range 0 to 3 volts.

59. Maximum output levels are:-

(a) Bipolar 0 to 6 volt peak to peak.

(b) Unipolar 0 to 6 volt peak.

Alignment of D.R. Channels

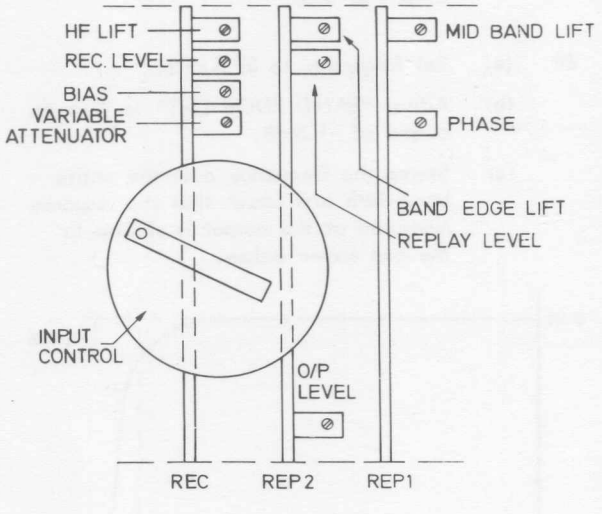
60. D.R. signal boards are aligned as a set of three, for a particular signal channel. If the boards are mixed with other sets, or put in a different channel slight changes in the phase/amplitude frequency responses may occur.

61. If due to mixing of boards, or on acquisition of a new set of boards it is felt that the channel response is not satisfactory, then a set can be adjusted as set out in the paragraphs below. Re-alignment may be necessary also if the equipment is used with a different tape type from that supplied.

62. Alignment Procedure. Test equipment required:- Signal Generator (sine and square wave outputs up to 300 kHz), A.C. Voltmeter, Oscilloscope, Spectrum Analyser or Wave Analyser (if this item of equipment is not available alignment is still possible but the record level necessary for the specified -40 dB third harmonic distortion can only be approximated (see para 70) (f)).

63. For the channel under test, set the controls as follows:-

(a) On the Record Board set "RECORD LEVEL" and "BIAS" fully anticlockwise.



(b) On the Replay 1 Board set "MID BAND LIFT" fully anticlockwise, then rotate 12 turns clockwise.

(c) On the Replay 2 Board turn "BAND EDGE LIFT" fully anticlockwise, then 12 turns clockwise, turn "REPLAY LEVEL" fully clockwise.

NOTE: All voltage levels quoted below in dB are relative to 775 mV (0 dBm on most valve voltmeters) except where otherwise stated.

64. (a) Set input attenuator to 1 V position.

(b) Connect signal generator to the channel input, and set to 707 mV (-0.8 dB) at 1 kHz sine wave.

(c) Set "O/P LEVEL" to give an output of 0 dB. The tape should be stopped - i.e. in the "E-E" mode.

65. (a) Set input frequency to 37.5 kHz.

(b) Record forward at $7\frac{1}{2}$ in/s and monitor the signal output. (The rest of the calibration procedure is performed in the "Forward Record" mode).

(c) Turn "BIAS" clockwise until the output rises to a peak and falls 3 dB below this peak.

66. (a) Set input frequency back to 1 kHz.

(b) Turn "REC LEVEL" clockwise to give 0 dB output.

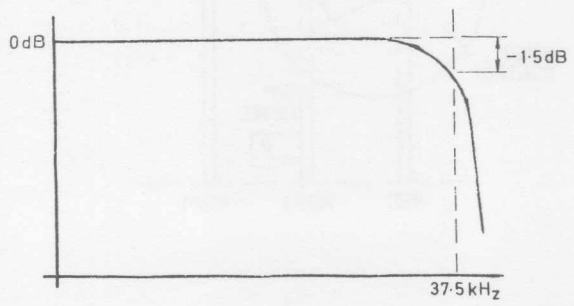
67. (a) Set input frequency to 10 kHz.

(b) Adjust "MID-BAND LIFT" to give an output of 0 dB.

68. (a) Set frequency to 37.5 kHz.

(b) Adjust "BAND EDGE LIFT" to give an output of -1.5 dB.

(c) Sweep the frequency over the entire bandwidth and check that the response measured at the output is similar to the one shown below.



(d) Repeat paras 65 to 67 until no further adjustment is necessary.

69. (a) Set frequency to 3.75 kHz, 2 V peak-to-peak square wave.

(b) Adjust "PHASE" to give the best square wave output:-

70. (a) Monitor the channel output with a Spectrum Analyser or Wave Analyser (if not available see (f) below). Set Analyser to 5 kHz/div, 100 Hz bandwidth.

(b) Set input to 15 kHz sine wave at -0.8 dB. Select 30 in/s (forward record).

(c) Adjust "REC LEVEL" so that the third harmonic distortion is -40 dB with respect to the fundamental (15 kHz).

(d) Select $7\frac{1}{2}$ in/s. Set frequency to 1 kHz. Adjust "REPLAY LEVEL" for 0 dB output.

(e) Repeat (b) to (d) until no further adjustment is necessary.

(f) If an analyser is not available omit steps (a) to (e); select $7\frac{1}{2}$ in/s and set frequency to 1 kHz sinewave at -0.8 dB. Adjust "REC LEVEL" to give an output of +2 dB. Adjust "REPLAY LEVEL" for 0 dB output. This will give approximately -40 dB third harmonic distortion with the tape supplied (Ampex 797).

71. (a) Set frequency to 37.5 kHz, sine wave, -0.8 dB. Record at $7\frac{1}{2}$ in/s for approximately 60 feet (the counter measures in feet).

(b) Rewind and replay in the same direction at 60 in/s. Note the signal output level.

(c) Record a 300 kHz -0.8 dB sine wave at 60 in/s and adjust "H.F. LIFT" while recording until the output level is the same as in (b)

72. When the above alignment procedure is complete, the "OUTPUT LEVEL" can be set to 1 volt peak (-0.8 dB) which is the normal setting. Alternatively the output may be set to any value within the range 0 to 3 V peak for the full rated input.

Variation of Alignment with Tape Speed

73. The F.M. and D.R. circuits incorporate switches which select equalization circuits to ensure that, once aligned at a particular speed, the alignment is correct for all other standard speeds. If non-standard speeds are used (e.g. external speed control) then the alignment is likely to be incorrect.

74. External Speed Control (See Chapter 2 para 72). Although the tape speed can be varied anywhere in the range 0.45 in/s to 90 in/s the signal channels are aligned for the seven discrete speeds from $\frac{15}{16}$ to 60 in/s. Operation of an F.M. channel at other speeds will cause D.C. offsets and gain changes which are proportional to the ratio of the record and replay speeds.

75. Operation of D.R. channels at different speeds will affect the frequency response equalization although the mid band gain will be unaffected.

Alignment of D.R. Calibration Board. (If fitted)

76. The accuracy of the amplitude of Calibration Board signals is specified as ±2%. To ensure that this accuracy is maintained the board should be re-aligned at intervals of not more than one year.

77. Procedure. Stand the equipment on its rear casting. Remove base cover and proceed as follows:-

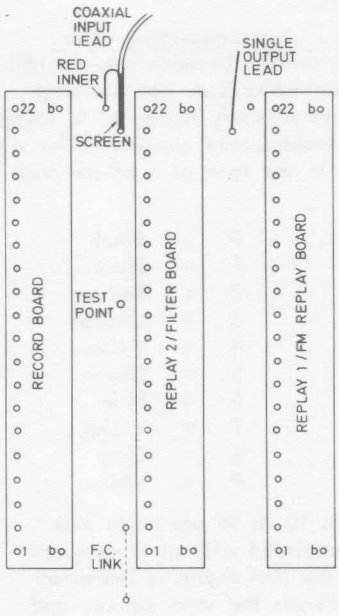
(a) Monitor +9 volt and -9 volt on the Motherboard with respect to the 0 V test point. Both 9 volt rails should be set to 9.00 volt by means of RV1 and RV2 respectively, on the Deck Control Board.

(b) Select $\frac{15}{16}$ in/s (tape does not have to be loaded); set Channel 1 attenuator to "+" (band-edge calibration signal) and all other attenuators to OFF.

(c) Monitor output BNC socket of Channel 1 with counter and oscilloscope. Signal should be sine wave with no visible distortion. Adjust RV1 on Calibration Board to give a frequency of 4,750 Hz ± 5 Hz. Check that the output frequency at other speeds lies between the following limits.

Speed in/s	Frequency (kHz)
60	285 - 315
30	142.5 - 157.5
15	71.2 - 78.75
$7\frac{1}{2}$	35.5 - 39.2
$3\frac{3}{4}$	18.1 - 19.9
$1\frac{7}{8}$	9.1 - 9.9

(d) Monitor pin 22b on any Record Board socket with respect to 0 V on the Motherboard (see illustration below). If using a Hewlett Packard 400 E set range switch to 100 mV, and connect digital voltmeter to the d.c. output of the a.c. voltmeter. Adjust RV2 on the Calibration Board for a reading of 707 mV on the digital voltmeter . On completion disconnect the a.c. voltmeter.



VIEW OF UNDERSIDE OF MOTHERBOARD SHOWING PRINTED CIRCUIT BOARD SOCKETS.

(e) Select $\frac{15}{16}$ in/s and set Channel 1 attenuator "-" ($\frac{1}{10}$ band-edge calibration signal) and with the counter and oscilloscope still connected to Channel 1 output BNC socket, adjust RV3 on the Calibration Board to give a frequency of 475 Hz ± 0.5 Hz. Check that the output frequency at other speeds lies between the following limits.

Speed (in/s)	Frequency (kHz)
60	28.5 - 31.5
30	14.25 - 15.75
15	7.12 - 7.87
$7\frac{1}{2}$	3.55 - 3.95
$3\frac{3}{4}$	1.81 - 1.9
$1\frac{7}{8}$	0.91 - 0.99

(f) Monitor pin 1b on any Record Board socket with respect to 0V on the Mother Board with a.c. voltmeter and digital voltmeter as in para 77 (d). Adjust RV4 on the Calibration Board for a reading of 707mV on the digital voltmeter.

(g) Switch off and remove test equipment, replace any signal boards that have been removed, signal board retaining bar, top cover and flap. (The top of the Calibration Board locates on the lower front edge of the top cover). Replace the base cover.

Wiring Configuration

78. Colour coding of Interconnecting wires. When interconnections between sub-assemblies are made via discrete wires (i.e. not flat-strip cables), the wires are normally numbered to correspond with the pin numbers they connect. The wire number is expressed in the form of a colour code as follows:-

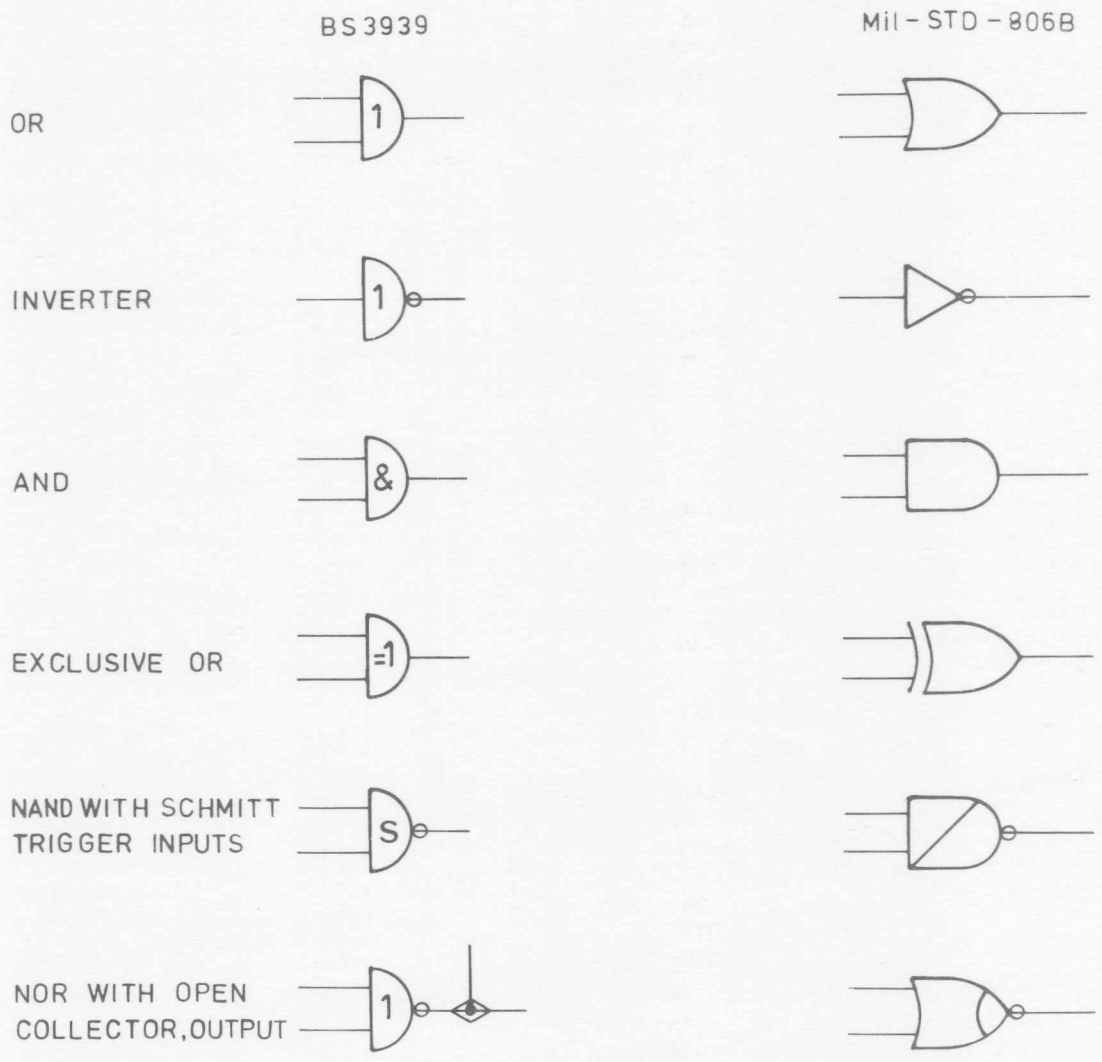
(a) Wire No.

0	=	Black
1	=	Brown
2	=	Red
3	=	Orange
4	=	Yellow
5	=	Green
6	=	Blue
7	=	Violet
8	=	Grey
9	=	White

(b) Wire Nos 10 to 99 are basic pink wire overprinted with spiral coloured stripes, the first figure is indicated by two stripes the same colour, and the second figure by a single stripe e.g. Wire No.21 is a pink wire overprinted with two Red stripes and one Brown stripe; wire No.55 is a pink wire overprinted with all Green stripes.

The wires which are numbered in Figs. 46, 50 of Chapter 5 follow the above code.

79. Numbering of Flat-Strip Cableforms. Many of the interconnections between sub-assemblies are in the form of Scotchflex strip cableforms. The wires are numbered according to the plug/socket pin number to which they connect. Counting across the strip from the red edge the wires are numbered as follows:- 14, 1, 13, 2, 12, 3, 11, 4, 10, 5, 9, 6, 8, 7.



LOGIC SYMBOLS - CHART OF EQUIVALENTS

CHAPTER 5

TECHNICAL INFORMATION

PRESENTATION

1. To provide technical information relating to the equipment as concisely as possible, this Manual employs an illustrative format. A written description of the operation of each sub system will be found in the block diagrams, while the comprehension of individual circuit operation is aided by splitting the circuit diagram into coloured functional areas supplemented by captions.

2. Figure 1 shows the relationship between the basic controls and the systems within the equipment. Figs 2 - 5 describe the operation of the three main sub systems, namely record/replay, tape transport and power supply circuits. The Block Diagrams also act as an index for the individual circuit boards they describe.

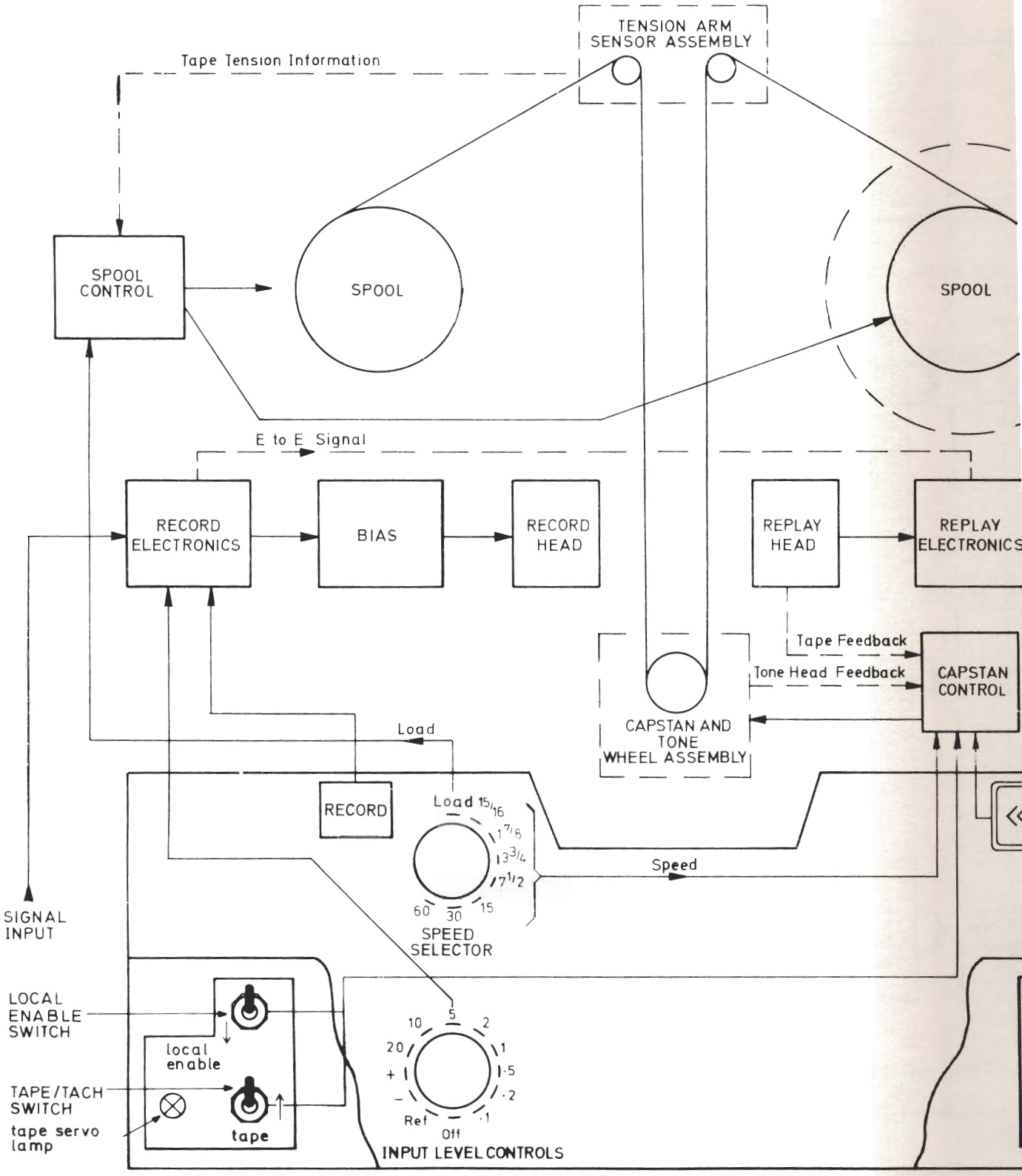
3. The signal circuits are arranged where possible in an order which follows the signal path from input to output. Later circuits cover transport and power circuits respectively.

4. In most cases the board layout and parts list are presented on the page facing the appropriate circuit diagram, providing complete information about the board at one opening of the Handbook.

5. The equipment interconnection diagrams and main parts lists are included at the end of the Chapter.

6. The logic symbols in this Handbook comply with BS3939. The chart opposite gives the equivalent symbols to Mil -STD - 806B for users who are accustomed to the latter standard.

INDEX TO FIGURES



Store 4DS/Store 7DS
August 1979

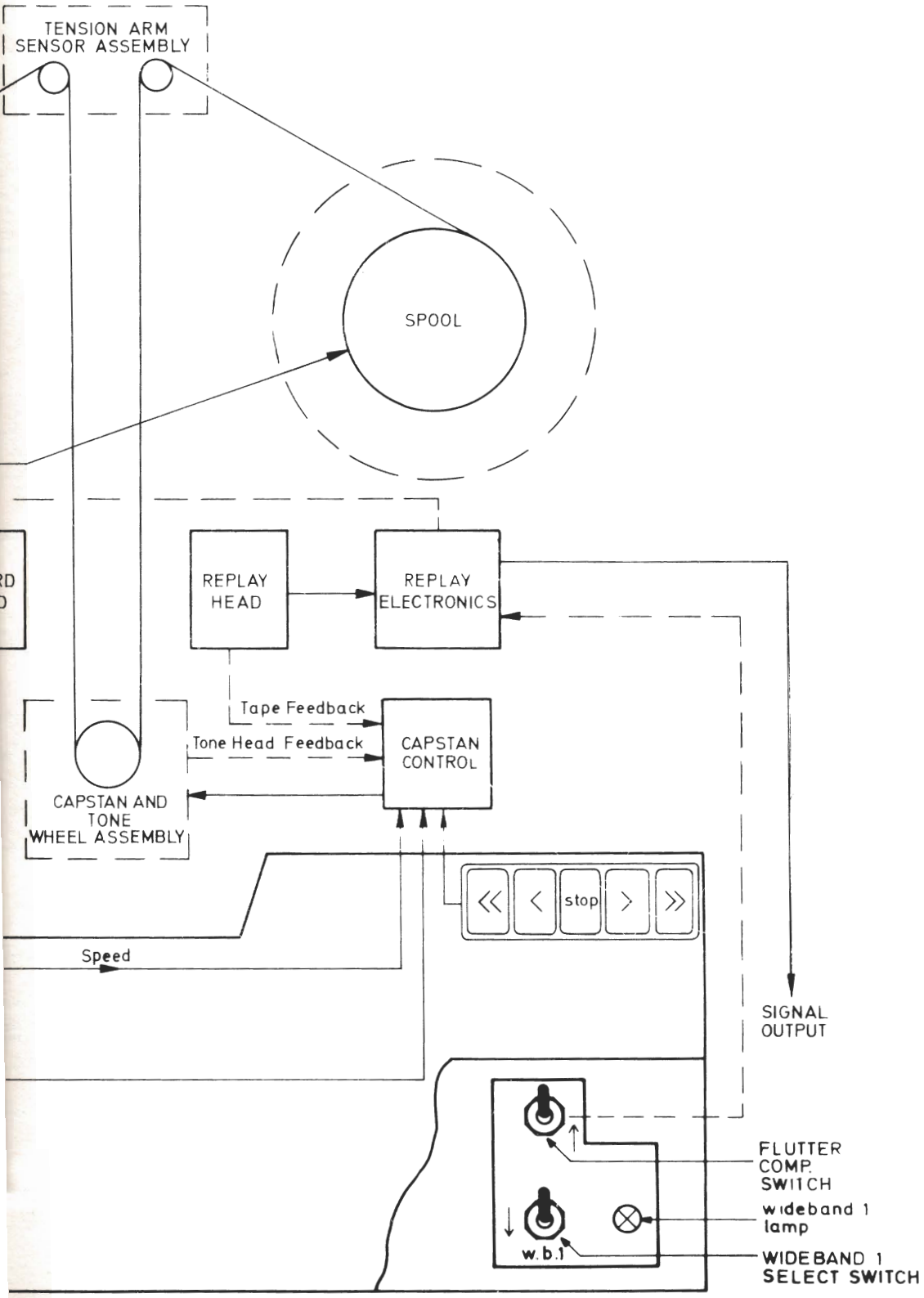
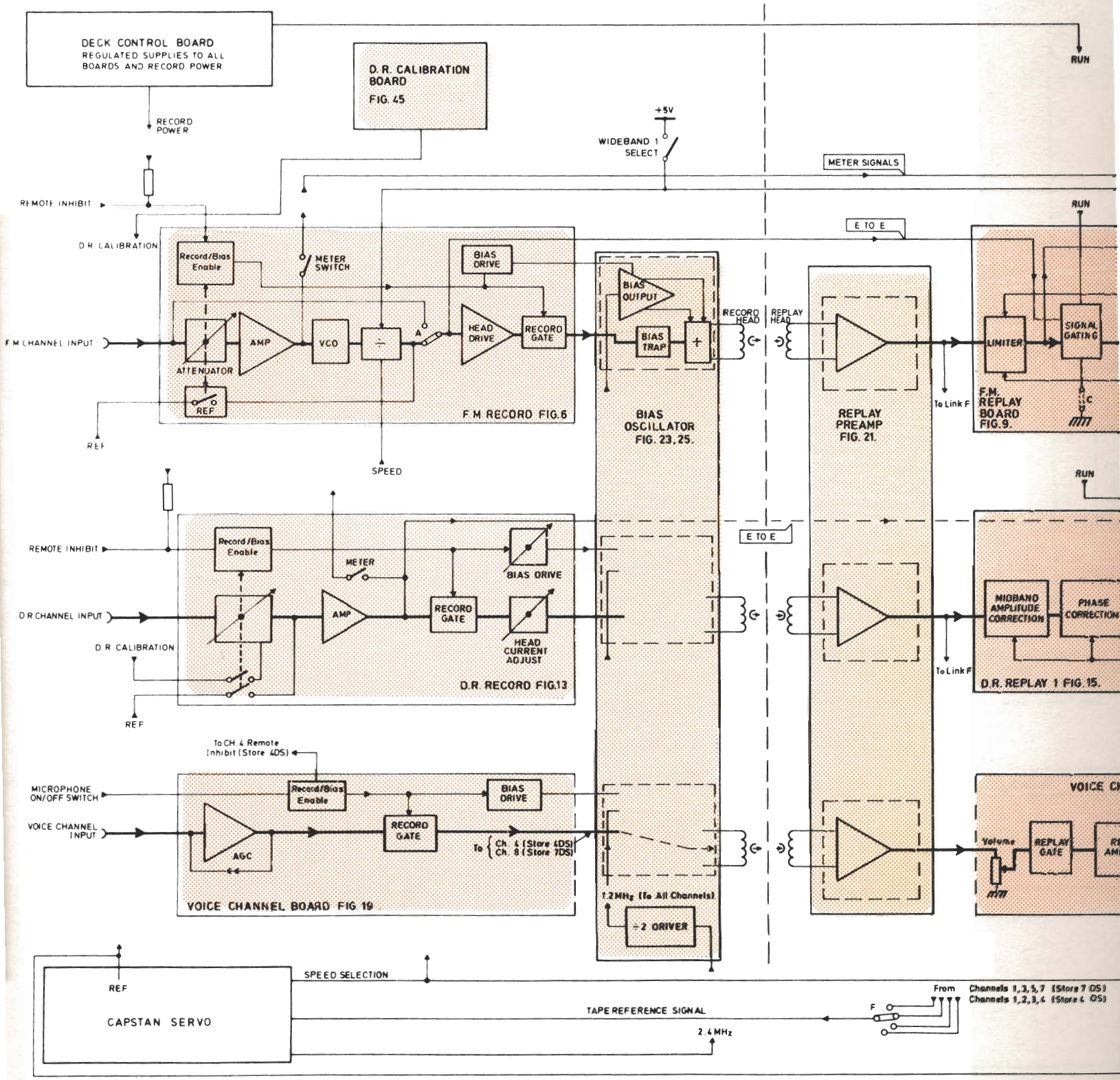


FIG. 1
GENERAL
BLOCK DIAGRAM



Store 4DS/7DS
August 1980

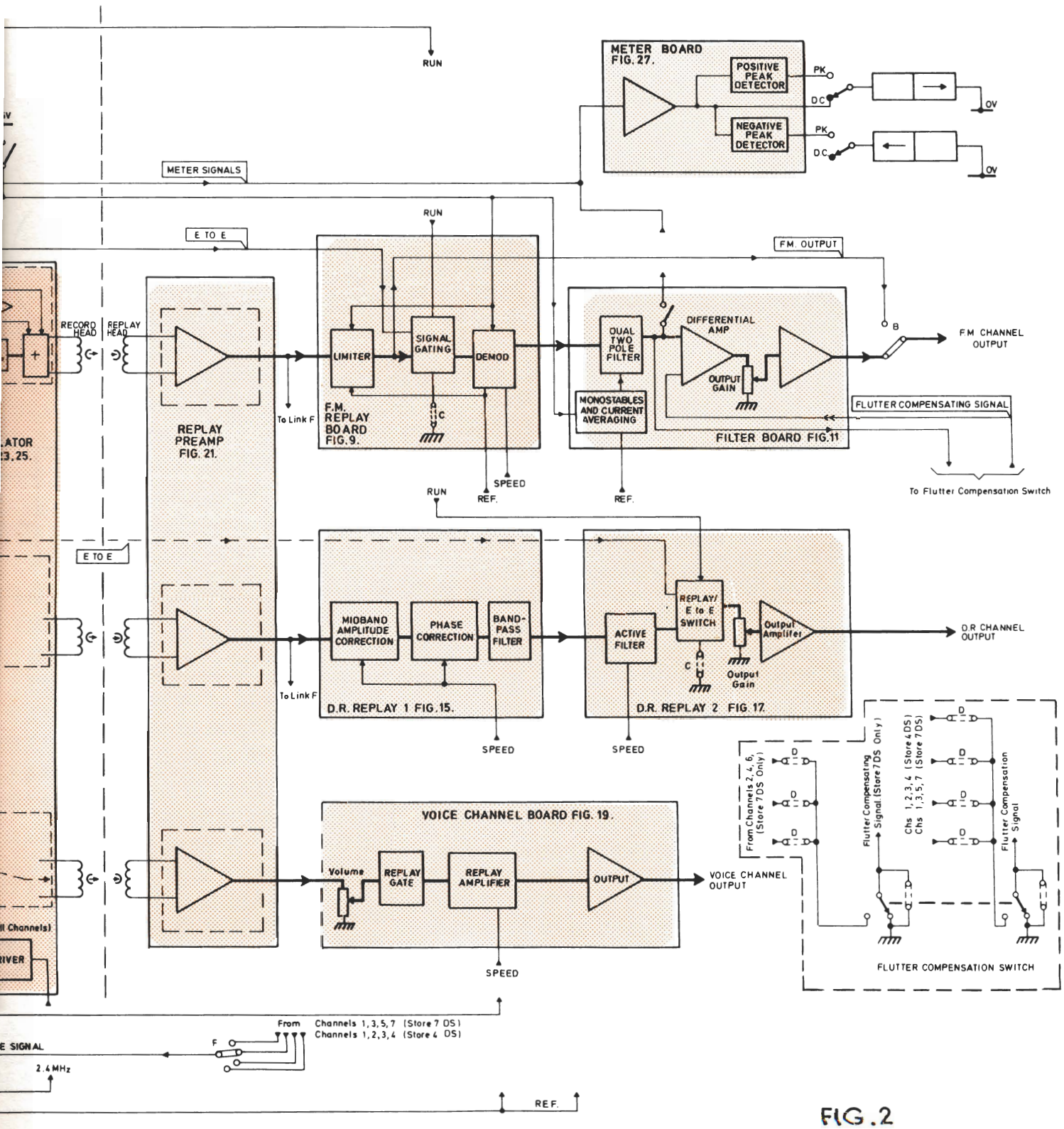


FIG. 2
RECORD/REPLAY ELECTRONICS
BLOCK DIAGRAM

D.R. CALIBRATION BOARD
(Fig.55)

Generates signals at XI and X0.1 bandedge frequency controlled by speeds lines. Signals are fed to D.R. Record board and selected by + and - on the attenuator switch.

DUAL STANDARD F.M. RECORD BOARD (FIG.7)

The input signal is fed to a virtual earth input amplifier. The input attenuator control adjusts the feed back of this amplifier to give maximum inputs as given in Chapter 2. The input amplifiers feed into a current controlled oscillator the output of which is conditioned by speed lines and whether or not wideband i is required. The output from the head drive amplifier passes through 'transmission gates', and then to the bias board.

The attenuator control can be switched to "+" or "-" This will provide calibration signals at -40% and +40% deviation. If the attenuator control is switched to REF a reference tone is recorded on tape for use in tape servo mode. When the control is set to "off" all Record Drive and Bias Drive outputs are inhibited.

Link A can be changed to allow direct recording of F.M. or TTL input signals.

D.R. RECORD BOARD (Fig. 13)

The input signal is fed via an input attenuator to the Record amplifier. Record Drive and Bias Drive outputs are inhibited if the Record Power line is LO. (i.e. the Record button has not been depressed), if the Remote Inhibit line is LO, or for OFF.

The REF attenuator position allows recording of a reference signal for subsequent speed control during replay in the Tape mode. The + and - positions select calibration signals from the Calibration board. Frequencies are upper band edge (+) and $\frac{1}{10}$ of band edge (-).

The Bias Drive controls and provides adjustment of bias level on the Bias board.

Signals are taken from pin 3 and fed to an overload detector to check the amplitude of the applied signal.

VOICE CHANNEL BOARD (Fig. 19)

The output from the microphone unit is fed to the Record amplifier. An A.G.C. circuit ensures correct recording level The output is fed to the Bias board via the Record Gate which is enabled by the microphone Talk switch. Depressing the Talk switch also enables the Bias Drive.

Voice recordings can be made during replay.

BIAS OSCILLATOR
Fig. 22-25

The 2.4MHz signal from the Capstan servo is divided by two and a 1.2MHz signal fed to each channel's push-pull output. Bias output level for each channel is controlled by the Bias Drive on the corresponding Record board. The record signals are added to the bias signal via bias trap, the combined signal being fed to the Record Heads.

An additional push-pull output drives the erase head.

REPLAY PREAMPLIFIER BOARD
(Fig.21)

Each replay head output feeds into identical preamplifiers. Each has a balanced low impedance input and a gain of approximately 100dB at 50Hz, falling at 6dB/octave for higher frequencies to compensate for the replay head characteristic

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METER BOARD (Fig.27)

An input buffer amplifier drives a pair of peak detector circuits, one connected in the inverting mode for negative peaks and the other connected in the non-inverting mode for positive peaks. Diodes are used to prevent excessive input voltages causing damage to the meter.

BIAS OSCILLATOR
Fig. 22-25

2.4MHz signal from the
tan servo is divided by two
a 1.2MHz signal fed to
channel's push-pull output.
output level for each chan-
is controlled by the Bias
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trap, the combined signal
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additional push-pull output
es the erase head.

REPLAY PREAMPLIFIER BOARD
(Fig.21)

Each replay head output feeds into identical preamplifiers. Each has a balanced low impedance input and a gain of approximately 100dB at 50Hz, falling at 6dB/octave for higher frequencies to compensate for the replay head characteristic.

DUAL STANDARD F.M. REPLAY BOARD (FIG.9)

The Replay Pre-amplifier output is passed into a high pass amplifier. This amplifier is fed with a variable current proportional to reference frequency The signal then splits two ways, one to a threshold detector and the other to a crossover detector. After E to E switching (operated by run line) the signal passes to a squelch detection circuit where a lack of signal will operate the squelch switch.

Speed and Wideband 1 or Intermediate Band information is fed into the pulse counter which is used to gate the Gated Oscillator. Output from the replay boards consists, at 60 in/s wideband 1 of a monostable waveform containing one oscillator waveform, at 60 in/s intermediate band or 30 in/s wideband 1 two oscillator waveforms will be enclosed and pro-rata for all ranges. An output impedance of 1k5 is presented to the F.M. Filter Board.

DUAL STANDARD F.M. FILTER BOARD
(FIG.11)

The signal from the Dual Standard Replay Board is averaged by a 24dB/octave low pass filter. The bandwidth is determined by reference frequency and whether or not wideband 1 is selected. Flutter compensation is achieved by subtracting the flutter compensation signal from the channel signal. Unipolar restoration is selected by means of S1 or S2. The output stage incorporates a low pass filter to eliminate high frequency elements still remaining.

D.R. REPLAY 1 (Fig. 15)

The signal from the Replay Preamplifier pass through two amplifiers which provide midband amplitude correction and phase correction respectively. The circuits are switched by the speed lines as the correction required depends on the tape speed selected. Fine adjustment controls are included which once set for one speed are correct for all other speeds.

The signals pass to the D.R. Replay 2 card via a band pass filter of:-

(i) 100Hz to 300kHz
(ii) 50Hz to 300kHz.

according to option requirements.

D.R. REPLAY 2 (Fig.17)

Signals from Replay 1 go via a preset level control to an active filter. Feedback provides high gain at the upper band edge to compensate for head/tape losses. The feedback is switched by the speed lines, and once adjusted for a given speed is automatically correct at all other speeds.

The Replay E to E Switch selects either the above signal, or the E to E signal direct from the D.R. Record board, and depends on the status of the Run line. Link C inhibits the E to E mode.

The selected signal passes to the Output amplifier and thence to the Signal Output socket.

VOICE CHANNEL BOARD (Fig. 19)

The output from the Replay Preamplifier passes via the Gain (Volume) control to the Replay Gate. Signals are allowed through when the "TALK" switch is not depressed, and pass to the Replay Amplifier which drives the push-pull output to the microphone/loudspeaker unit.

A Frequency Response Equaliser gives H.F. lift at $\frac{1}{16}$ in/s.

FIG.2a RECORD REPLAY ELECTRONICS

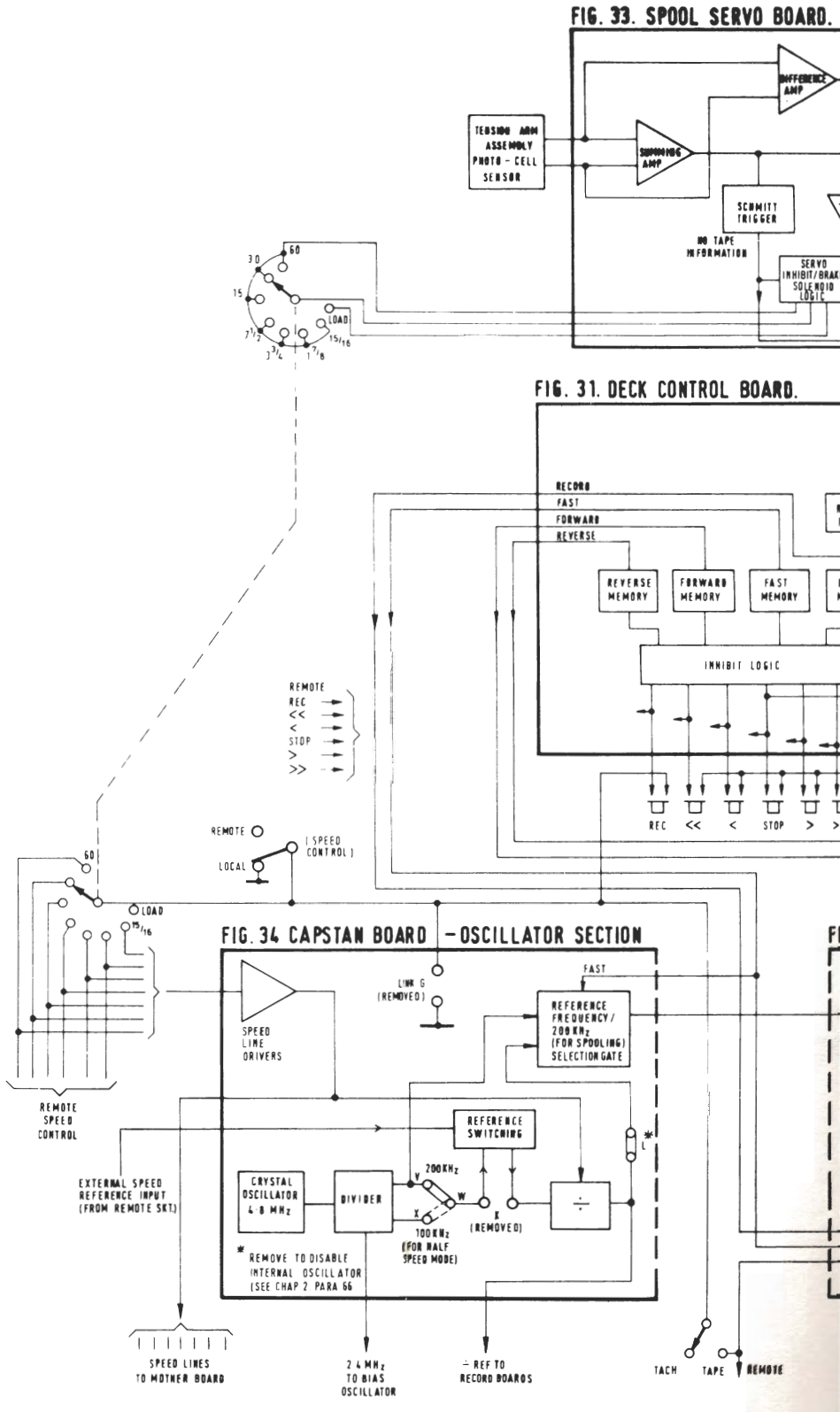


FIG.
TAPE TRANSPORT -

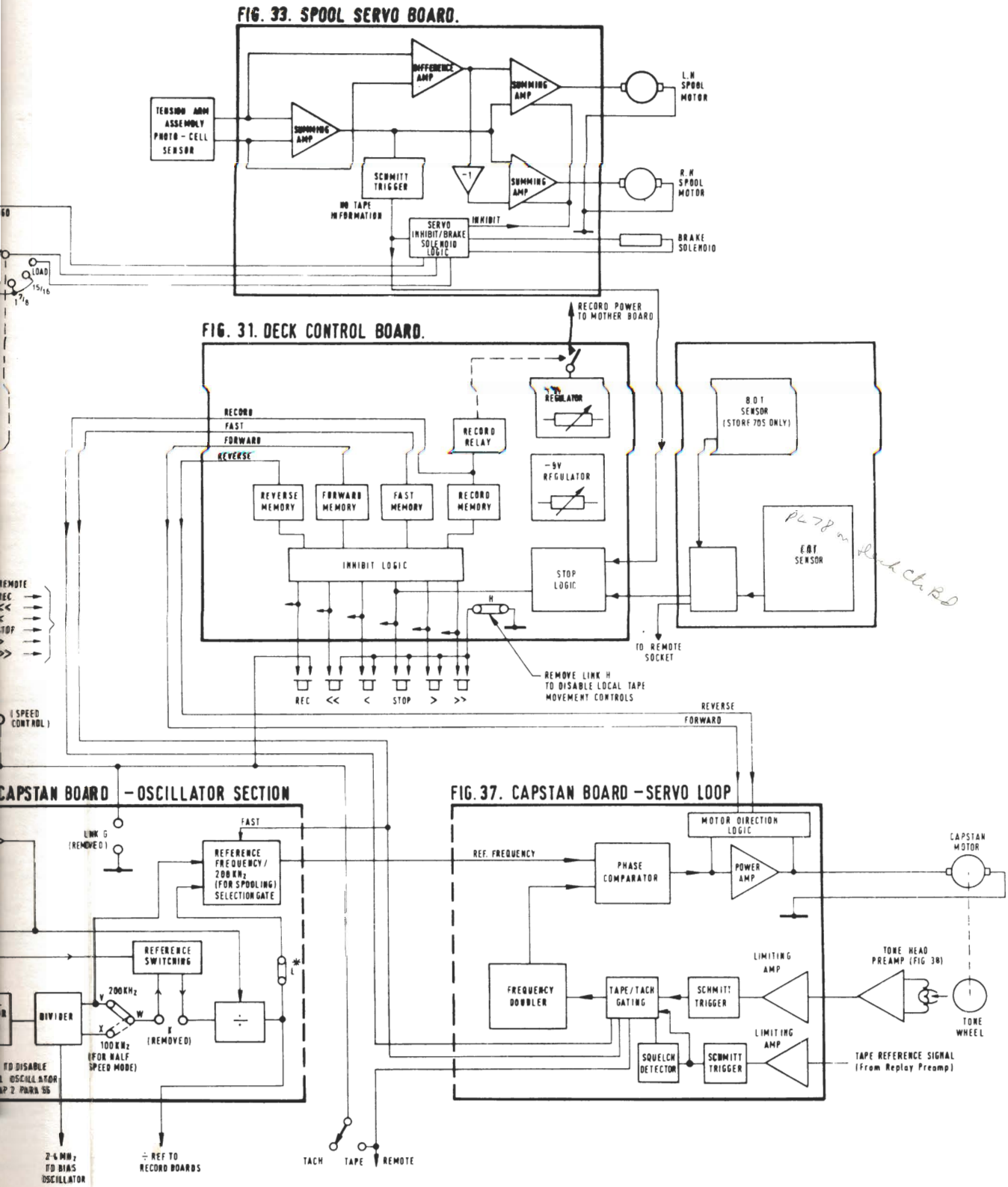


FIG.3
TAPE TRANSPORT - BLOCK DIAGRAM

SPOOL SERVO BOARD (Fig.33)

The tension arm assembly output voltages are proportional to their respective arm positions. The Spool Servo board processes these voltages to provide total and differential tension parameters, which are then combined in the Spool Power amplifiers to provide the motor drive currents. The above process is carried out in summing and differential amplifiers.

The total tension parameter is monitored, and if it falls below a defined level, Stop is commanded, the brake solenoid released (i.e. brakes on) and the Spool Motor Power amplifiers disabled. Resetting is accomplished by turning the speed switch to LOAD.

DECK CONTROL BOARD (Fig.31)

Provides logic and memory circuits for encoding control signals, also decoding logic and drivers for the push-button lamps.

Circuits select the Stop mode when the equipment is switched on, also on receipt of an EOT or BOT signal.

Link H is removed when remote control of the command push-button functions is required.

The +9V and -9V regulators share the board.

CAPSTAN SERVO BOARD

OSCILLATOR SECTION (Fig. 34).

The 4.8MHz crystal oscillator frequency is divided to give an output of 2.4MHz for the Bias Oscillator and outputs of 200kHz and 100kHz for capstan speed control. When in the Run mode the 200kHz signal is divided according to tape speed selected (100kHz for 60in/s, 50kHz for 30in/s and pro rata). This divided reference is fed to the Record boards and also to the Servo section via the selection gate. In the Fast mode a 200kHz signal is fed to the Servo section. An External Speed Reference input will override the internal crystal reference; speed of equipment will be variable simply by changing its frequency. The Local/Remote switch in place of Link 'G' will facilitate disabling the local Record Button and Speed Selector when remote operation is required.

CAPSTAN SERVO BOARD

SERVO LOOP SECTION (Fig. 37)

During recording, the reference frequency from section is compared with the signal coming from This Tach signal is amplified, squared up, and f doubled before comparison with the reference fre phase comparator. This detects differences in the two signals and drives the capstan motor acc correct any error.

During replay the reference frequency can eithe with the Tach signal (capstan speed) or Tape sig speed) depending on the state of the control log

In the Fast mode the servo will attempt to achie (for spooling) due to the 200kHz signal from the section.

VO BOARD (Fig.33)

utput voltages are proportional to
ns. The Spool Servo board
provide total and differential
are then combined in the Spool
the motor drive currents. The
it in summing and differential

is monitored, and if it falls below
and the Spool Motor Power amplifiers
ccomplished by turning the speed

NTROL BOARD (Fig.31)

circuits for encoding control signals,
rivers for the push-button lamps.

ode when the equipment is switched
EOT or BOT signal.

remote control of the command push-
ed.

tors share the board.

CAPSTAN SERVO BOARD

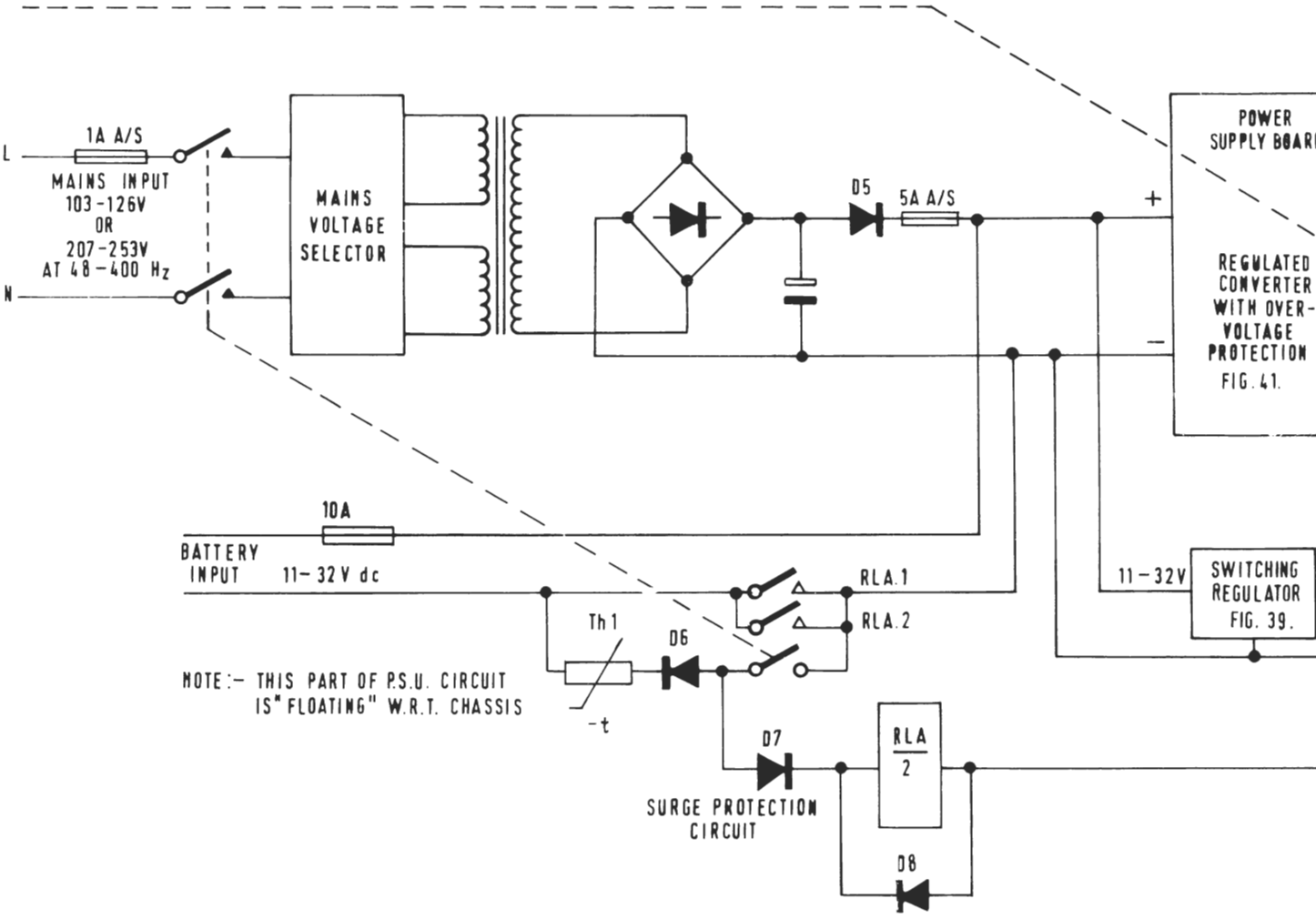
SERVO LOOP SECTION (Fig. 37)

During recording, the reference frequency from the Oscillator section is compared with the signal coming from the Tone Head. This Tach signal is amplified, squared up, and frequency doubled before comparison with the reference frequency in the phase comparator. This detects differences in phase between the two signals and drives the capstan motor accordingly to correct any error.

During replay the reference frequency can either be compared with the Tach signal (capstan speed) or Tape signal (tape speed) depending on the state of the control logic.

In the Fast mode the servo will attempt to achieve 120 in/s (for spooling) due to the 200 kHz signal from the Oscillator section.

Fig.3a
TAPE TRANSPORT



WHEN d.c. POWER IS CONNECTED AND MACHINE SWITCHED ON, P.S.U POWER IS SUPPLIED VIA D6 UNTIL −12V(B) IS SUFFICIENTLY HIGH TO ENERGISE RLA. D6 ALLOWS RLA TO DE-ENERGISE WHEN MACHINE IS SWITCHED OFF.

FIG. 4. POW

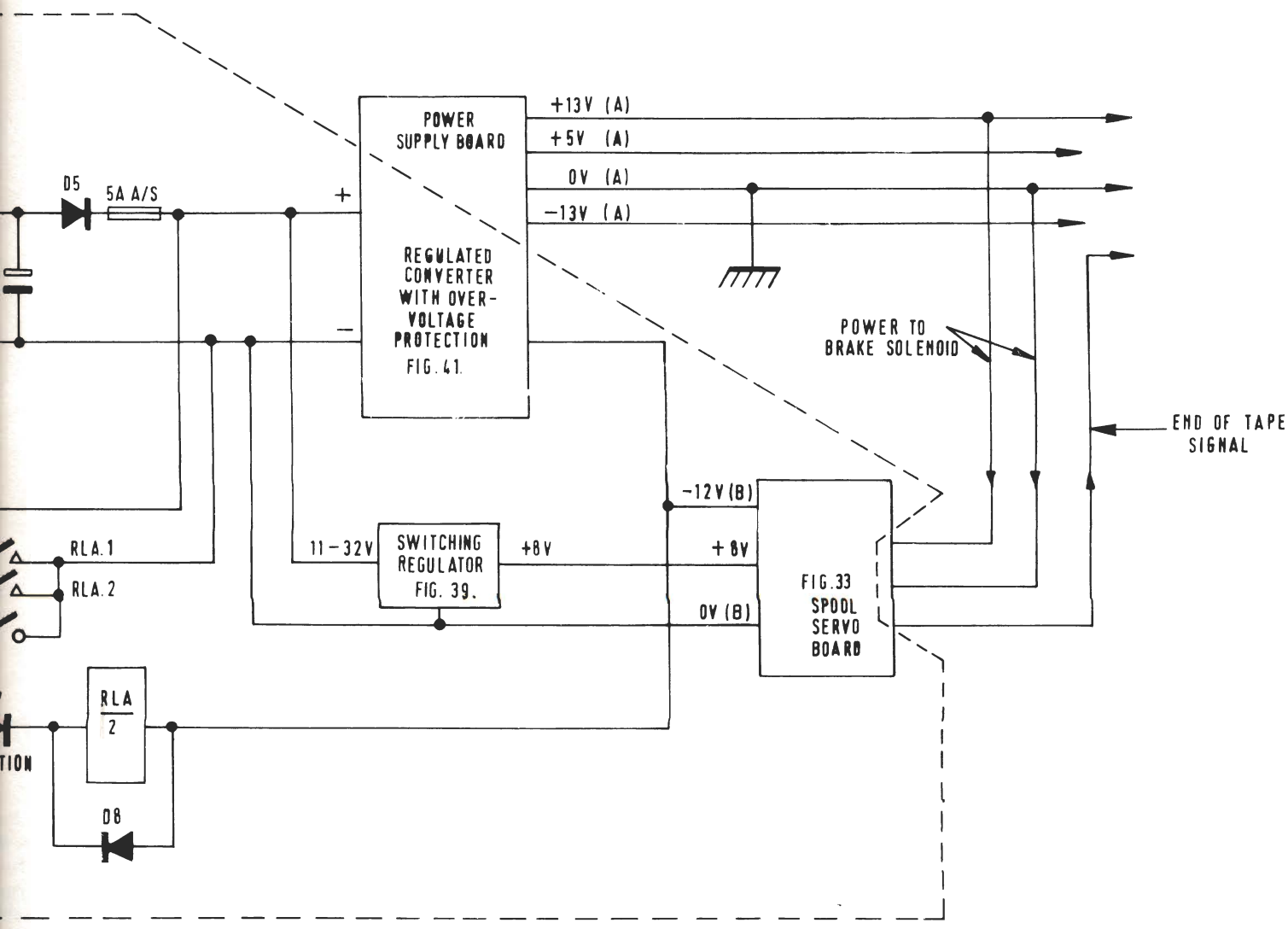
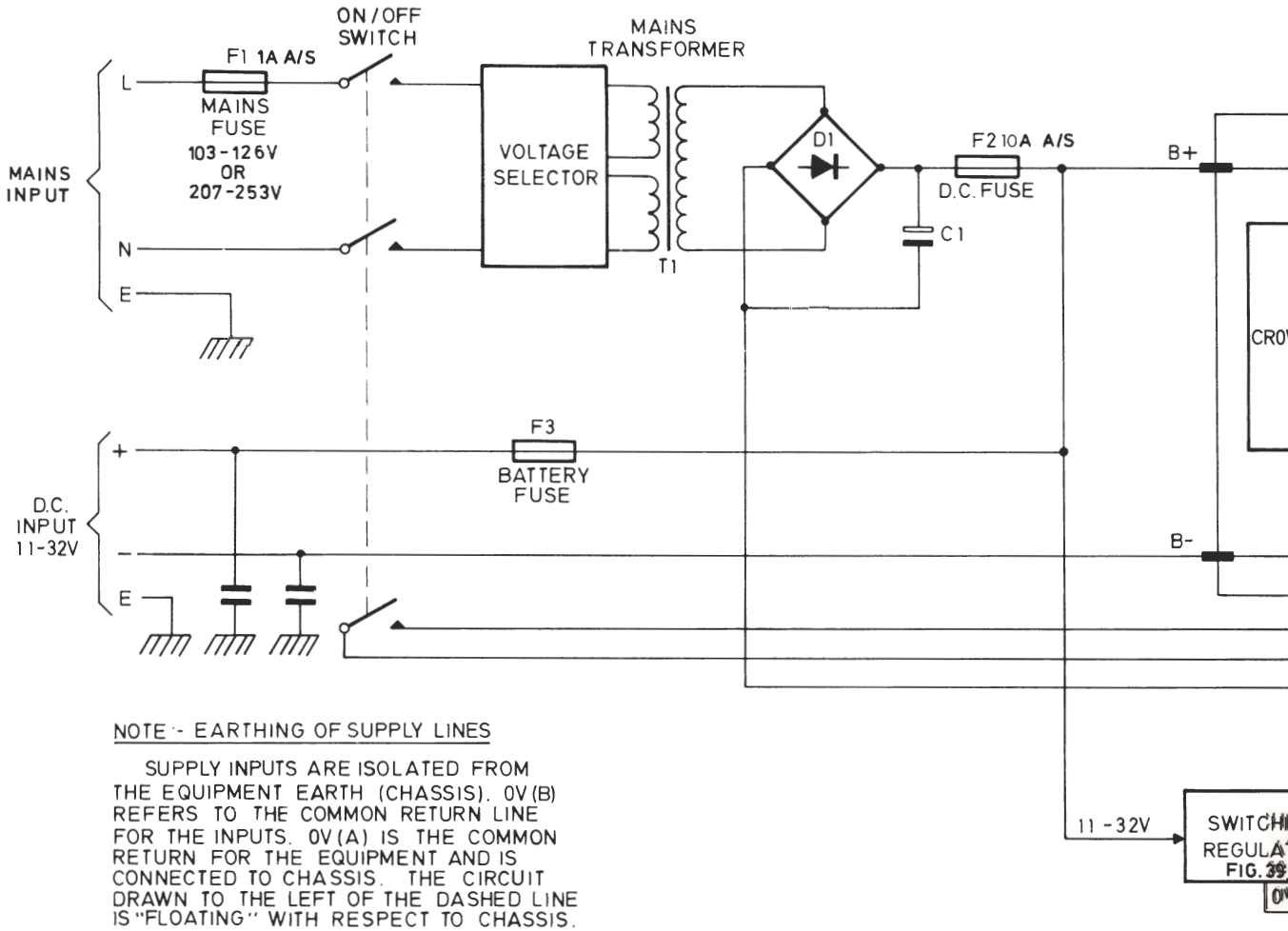
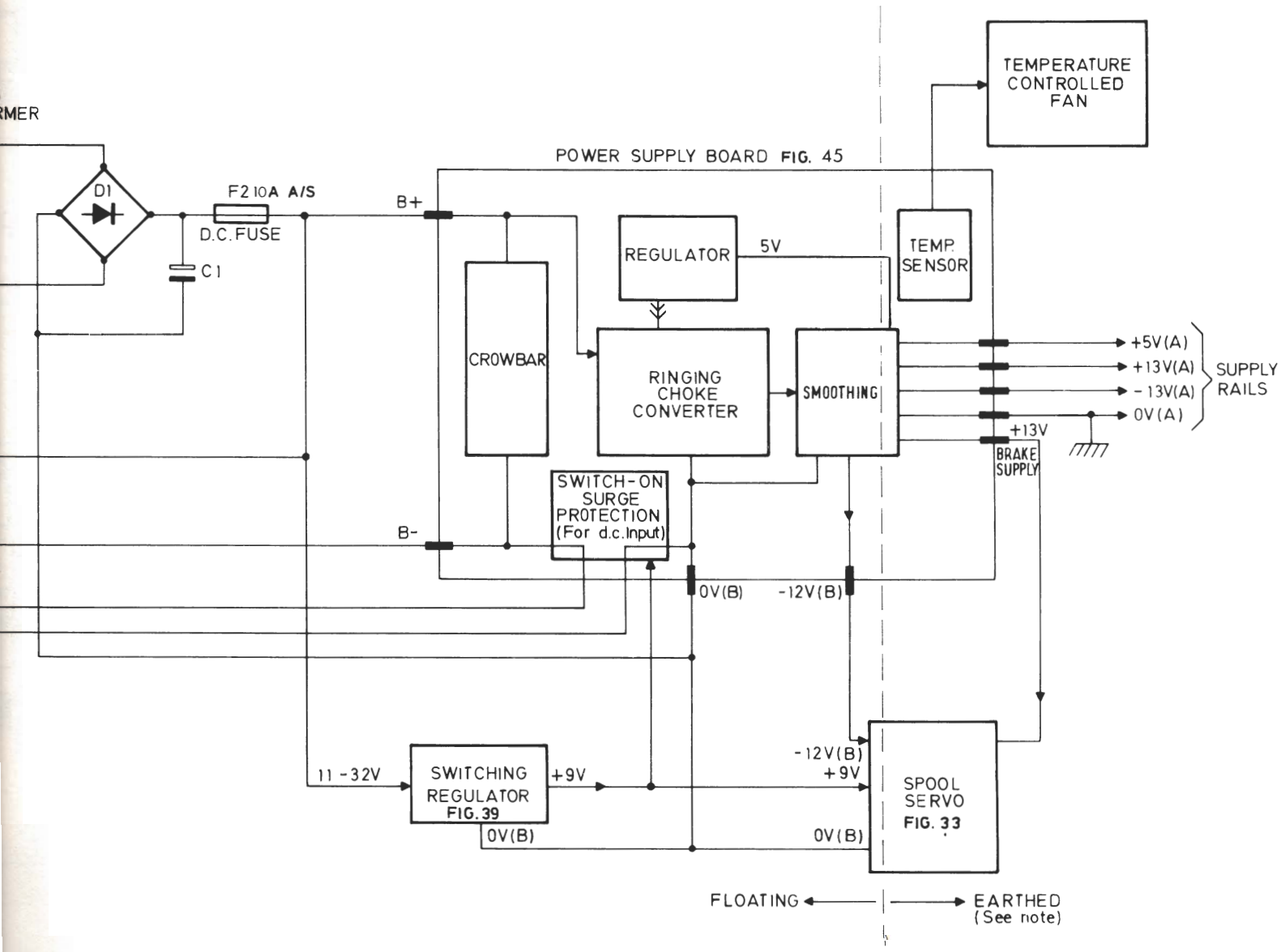


FIG. 4. POWER SUPPLY: BLOCK DIAGRAM.



NOTE :- EARTHING OF SUPPLY LINES

SUPPLY INPUTS ARE ISOLATED FROM THE EQUIPMENT EARTH (CHASSIS). 0V(B) REFERS TO THE COMMON RETURN LINE FOR THE INPUTS. 0V(A) IS THE COMMON RETURN FOR THE EQUIPMENT AND IS CONNECTED TO CHASSIS. THE CIRCUIT DRAWN TO THE LEFT OF THE DASHED LINE IS "FLOATING" WITH RESPECT TO CHASSIS.



POWER SUPPLY - BLOCK DIAGRAM - FIG. 5.

CIRCUIT REF	VALUE	TOL	RATING	MFRS. REF. NO.
	F.M. RECORD BOARD (Dual Standard)			D8920
Capacitors				
C1	220 pF	1%	400 V	Cat 15368
C2,14	22 pF	2%	63 V	Cat 10191
C3	0.01 µF	-20% +80%	100 V	Cat 13427
C4,15	1 µF	20%	35 V	C166109
C5,6,13	47 pF	2%	63 V	Cat 11615
C8	1000 pF	10%	100 V	Cat 12033
C9,10	33 µF	20%	16 V	Cat 163330
C11	47 µF	20%	10 V	C162470
C12 *	10 pF	2%	63 V	Cat 12030
C16	0.1 µF	20%	100 V	Cat 14546
C17	3300 pF	10%	100 V	Cat 13130
* Not required if AC is TLO 81CP				
Diodes				
D1-D16, D18-D20	BAX 13			Cat 8406
D17	Light Emitting Diode			Cat 14060
Knob				
1 off	F.M.D.S.			D7601/5
Integrated Circuits				
AA	CD4053B			S64 4053
AB	CD40103B			S64 0103
AC	TLO 81CP or RCA 3100S			Cat 14374 / Cat 11405
AD	CD4011B			S644011
AE	CD4013B			S644013
AF	CD4066B			S644066
AG	LF356N			Cat 14372
AH	RC4558			Cat 14373
Potentiometers				
RV1	50k' Spectrol 43p			Cat 12420
RV2	500Ω Spectrol 43p			Cat 12409
RV3	1k Spectrol 43 p			Cat 11930
RV4	10k Spectrol 64W			Cat 14329

CIRCUIT REF	VALUE	TOL	RATING	MFRS. REF. NO.
	F.M. RECORD BOARD (Contd) (Dual Standard)			D8920
Resistors				
R1	2k2	5%	¼W	R10222
R4	3k3	5%	¼W	R10332
R5	100Ω	5%	¼W	R10101
R6	1k8	5%	¼W	R10182
R7,13	220Ω	5%	¼W	R10221
R8	2k2	2%	¼W	R30222
R9	10k	5%	¼W	R10103
R11	1k8	5%	¼W	R10182
R12	820	5%	¼W	R10820
R14,17	100k	5%	¼W	R10104
R15	22k	5%	¼W	R10223
R16	390	5%	¼W	R10391
R18	47k	5%	¼W	R10473
R19	4k7	5%	¼W	R10472
Resistor Arrays				
RU1				Cat 15230
RU2				Cat 15234
RU3				Cat 15232
RU4				Cat 15231
Screen				
	Switch Screen Screening Board			P16745 P16737
Switches				
S1-S4	D.I.L. Erg			Cat 15181
S5	Reed, Hamlin MSRR-220-30AT			Cat 11539
S6	Rotary, Attenuator			P15831
Terminal Assembly	Vero			Cat 13747
Test Probe Socket				Cat 2683
Transistors				
TR1,5	BC109B			Cat 15104
TR2	2N2369A			Cat 15105
TR3	MPS 3640			Cat 13209
TR4	BC308			Cat 11977
TR6	ZTX 550			Cat 13629

FIG.

Store 4DS/7DS
January 1982

RS. REF. NO.

920

0222
0332
0101
0182
0221

0222
0103
0182
0820
0104

0223
0391
0473
0472

at 15230
at 15234
at 15232
at 15231

16745
16737

Cat 15181

Cat 11539
15831

Cat 13747

Cat 2683

Cat 15104
Cat 15105
Cat 13209
Cat 11977
Cat 13629

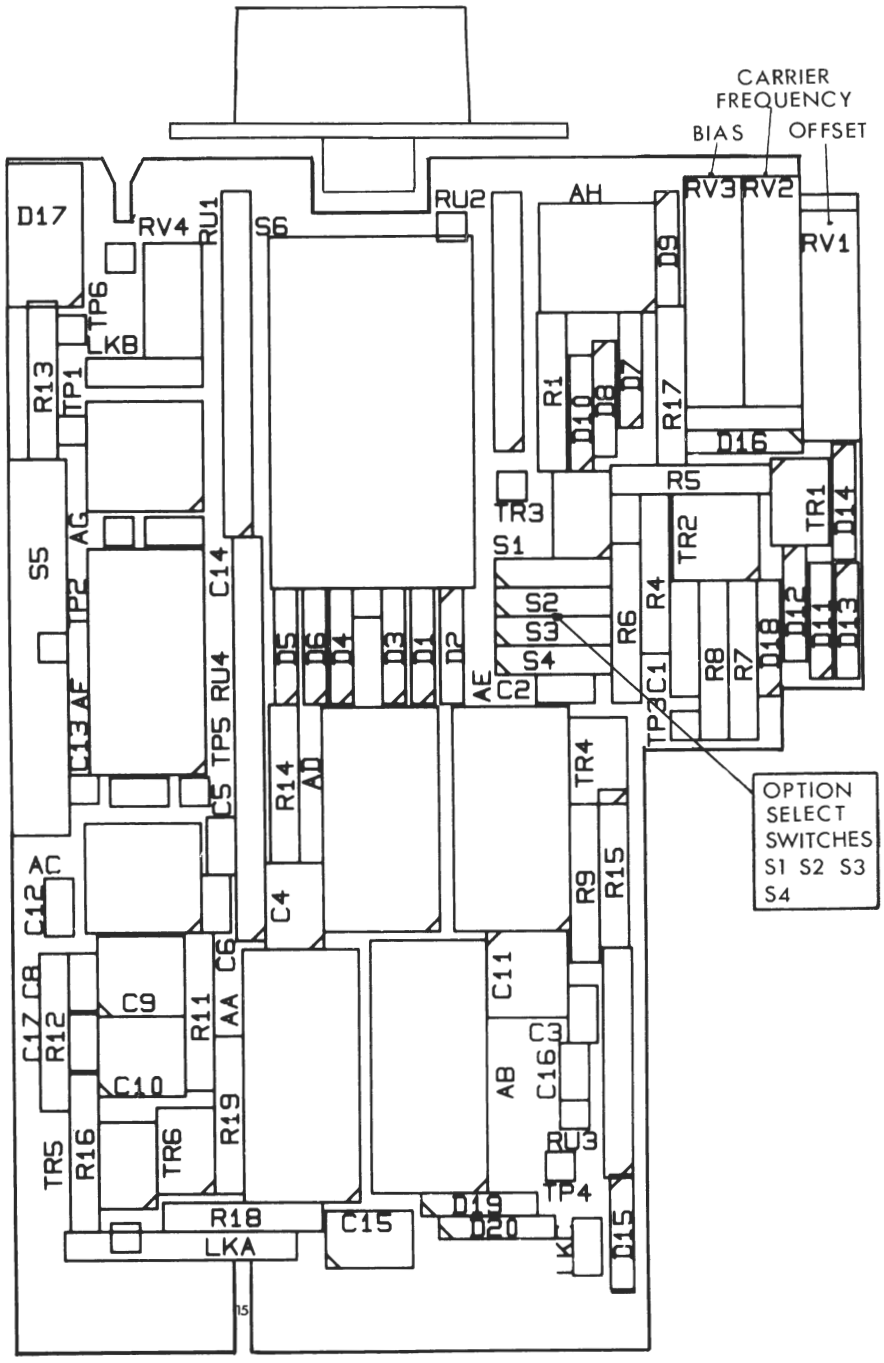
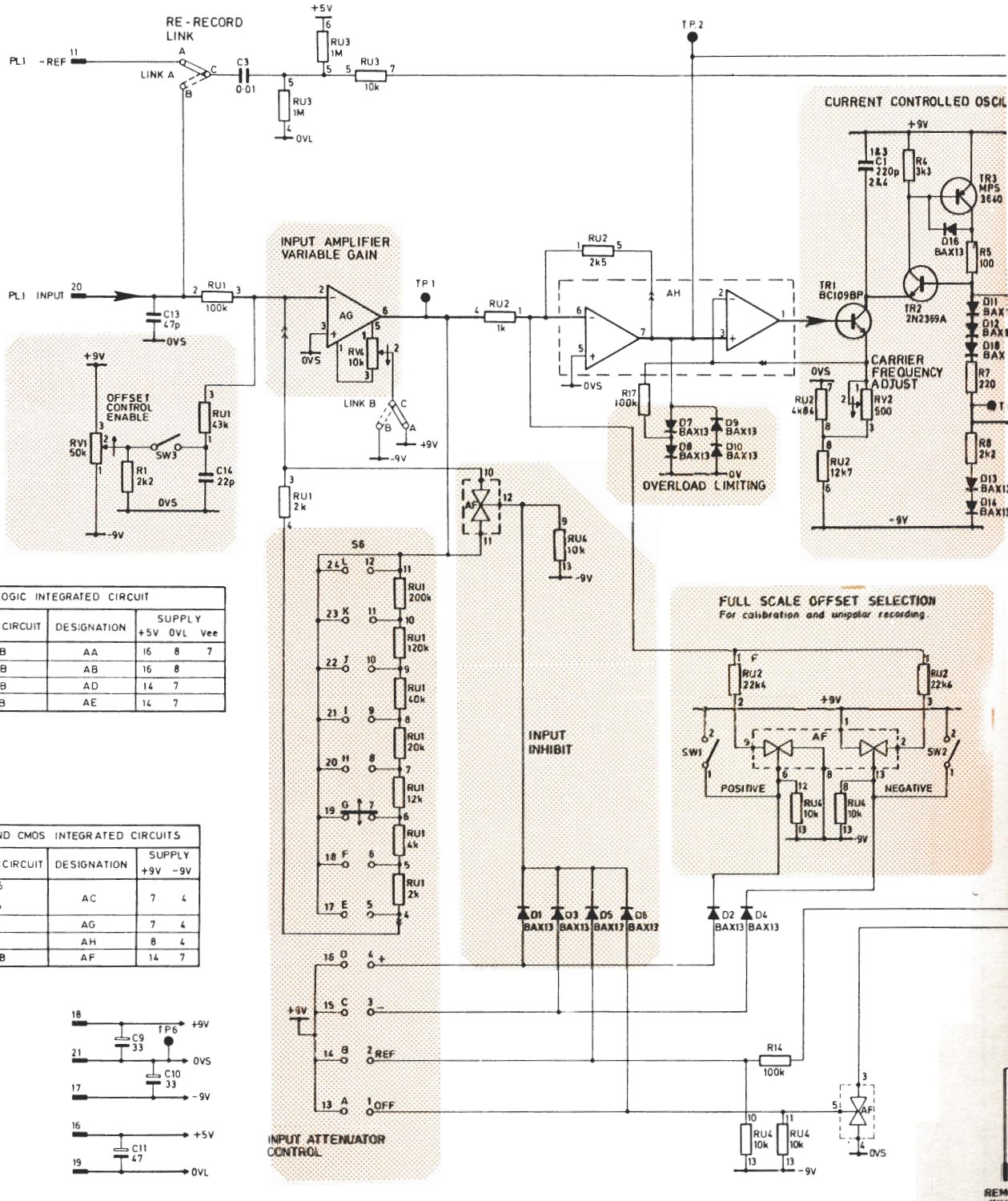


FIG.6 F.M. RECORD BOARD - LAYOUT (DUAL STANDARD) D8920

DS/7DS
1982

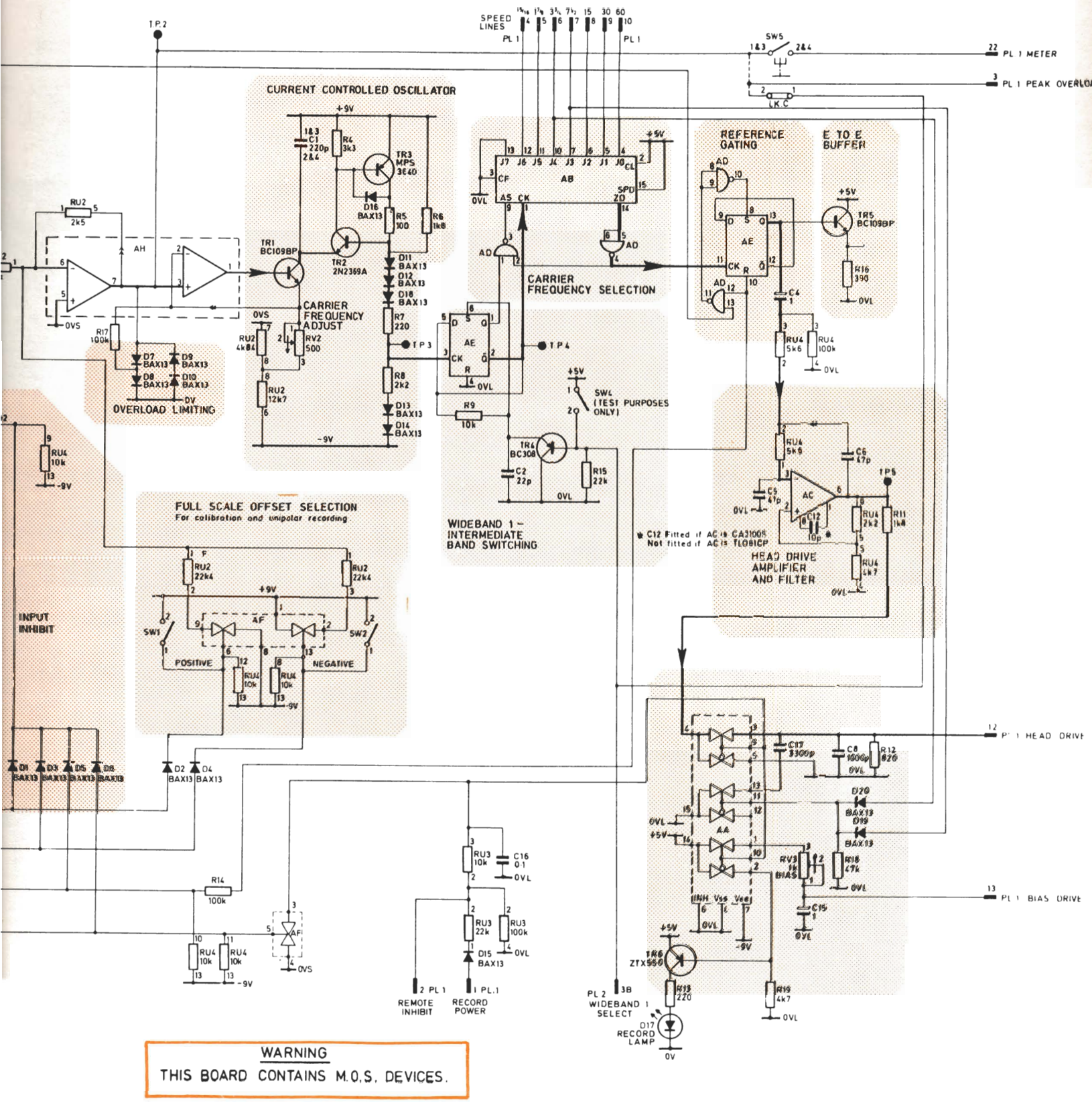


LOGIC INTEGRATED CIRCUIT				
INTEGRATED CIRCUIT	DESIGNATION	SUPPLY +5V	0VL	Vee
CD4053B	AA	16	8	7
CD40103B	AB	16	8	
CD4011 B	AD	14	7	
CD4013B	AE	14	7	

LINEAR AND CMOS INTEGRATED CIRCUITS			
INTEGRATED CIRCUIT	DESIGNATION	SUPPLY +9V	-9V
CA31005 OR TL081CP	AC	7	4
LF356N	AG	7	4
RC4558	AH	8	4
CD4066B	AF	14	7

WARNING

THIS BOARD CONTAINS M.O.S. DEVI



WARNING

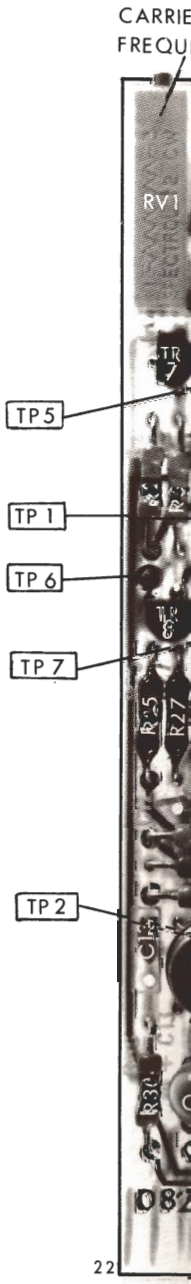
THIS BOARD CONTAINS M.O.S. DEVICES.

FIG.7

F.M. RECORD BOARD - CIRCUIT (DUAL STANDARD)

CIRCUIT REF.	VALUE	TOL	RATING	MFRS. REF. NO.
	F.M. REPLAY BOARD (Dual Standard)			D8283
Capacitors				
C1,4	330 pF	2½%	30 V	Cat 12731
C2	2200 pF	2½%	30 V	Cat 12328
C3	220 µF	20%	3 V	Cat 13398
C6	47 µF	20%	10 V	C162470
C7	220 pF	2%	63 V	Cat 10357
C8,20	470 pF	10 %	100 V	Cat 12032
C9	100 pF	1%	400 V	Cat 15367
C10	100 pF	2%	100 V	Cat 16003
C11	10 µF	20%	10 V	C162100
C12	2200 pF	10%	100 V	Cat 18175
C13,18	47 pF	2%	63 V	Cat 11615
C14,15,16	33 µF	20%	16 V	C163330
Diodes				
D1-7	BAX 13			Cat 8406
Integrated Circuits				
AA	CA3100S			Cat 11405
AB	LF357N			Cat 15387
AC	LM319K			Cat 14379
AD	SN74LS86N			Cat 11408
AE	SN74LS132N			Cat 14041
AF,AG	SN74LS193N			Cat 11409
AH	SN74221N			Cat 14386
AJ	SN74LS73N			Cat 14048
AK	SN74LS74N			Cat 15073
Potentiometer				
RV1	2k			Cat 11936
Resistors				
R1	2k7	5%	¼ W	R10272
R2	3k3	5%	¼ W	R10332
R3,14	560	5%	¼ W	R10561
R4	15k	5%	¼ W	R10153
R5,6,12,15, 18,22	470	5%	¼ W	R10471
R7,8	8k2	5%	¼ W	R10822
R9,16	10	5%	¼ W	R10100
R10	56k	5%	¼ W	R10563
R11	1k	5%	¼ W	R10102

CIRCUIT REF.	VALUE	TOL	RATING	MFRS. REF. NO.
	F.M. REPLAY BOARD (Contd) (Dual Standard)			D8283
Resistors (Contd)				
R13,38,41	4k7	5%	¼ W	R10472
R17	12k	5%	¼ W	R10123
R19,24,31, 32,33,40,42	10k	5%	¼ W	R10103
R21	100k	5%	¼ W	R10104
R23	47k	5%	¼ W	R10473
R25	46k4	0.5%	⅛ W	Cat 15343
R26	18k	2%	¼ W	R30183
R27	28k	1%	⅛ W	R202802
R28	4R7	5%	¼ W	R10479
R29	14k	0.5%	⅛ W	Cat 15342
R30	1k5	2%	¼ W	R30152
R34	1k5	5%	¼ W	R10152
R21	5k1	2%	¼ W	R30512
R36	5k6	2%	¼ W	R30562
R37	100	5%	¼ W	R10101
R39	2k7	2%	¼ W	R30272
R43	1M	5%	¼ W	R10105
Terminal Assembly				
TP1-7	Vero			Cat 13747
Transistors				
TR1,11	VN10KM (FET)			Cat 15101
TR2,3,4,9, 10	BC 237			Cat 11978
TR5	J112 (FET)			Cat 10540
TR6,7,8	J177 (FET)			Cat 13967



FIG

TOL	RATING	MFRS. REF. NO.
AY BOARD (Contd) dard)		D8283
5%	¼W	R10472
5%	¼W	R10123
5%	¼W	R10103
5%	¼W	R10104
5%	¼W	R10473
0.5%	⅛W	Cat 15343
2%	¼W	R30183
1%	⅛W	R202802
5%	¼W	R10479
0.5%	⅛W	Cat 15342
2%	¼W	R30152
5%	¼W	R10152
2%	¼W	R30512
2%	¼W	R30562
5%	¼W	R10101
2%	¼W	R30272
5%	¼W	R10105
		Cat 13747
FET)		Cat 15101
		Cat 11978
		Cat 10540
		Cat 13967

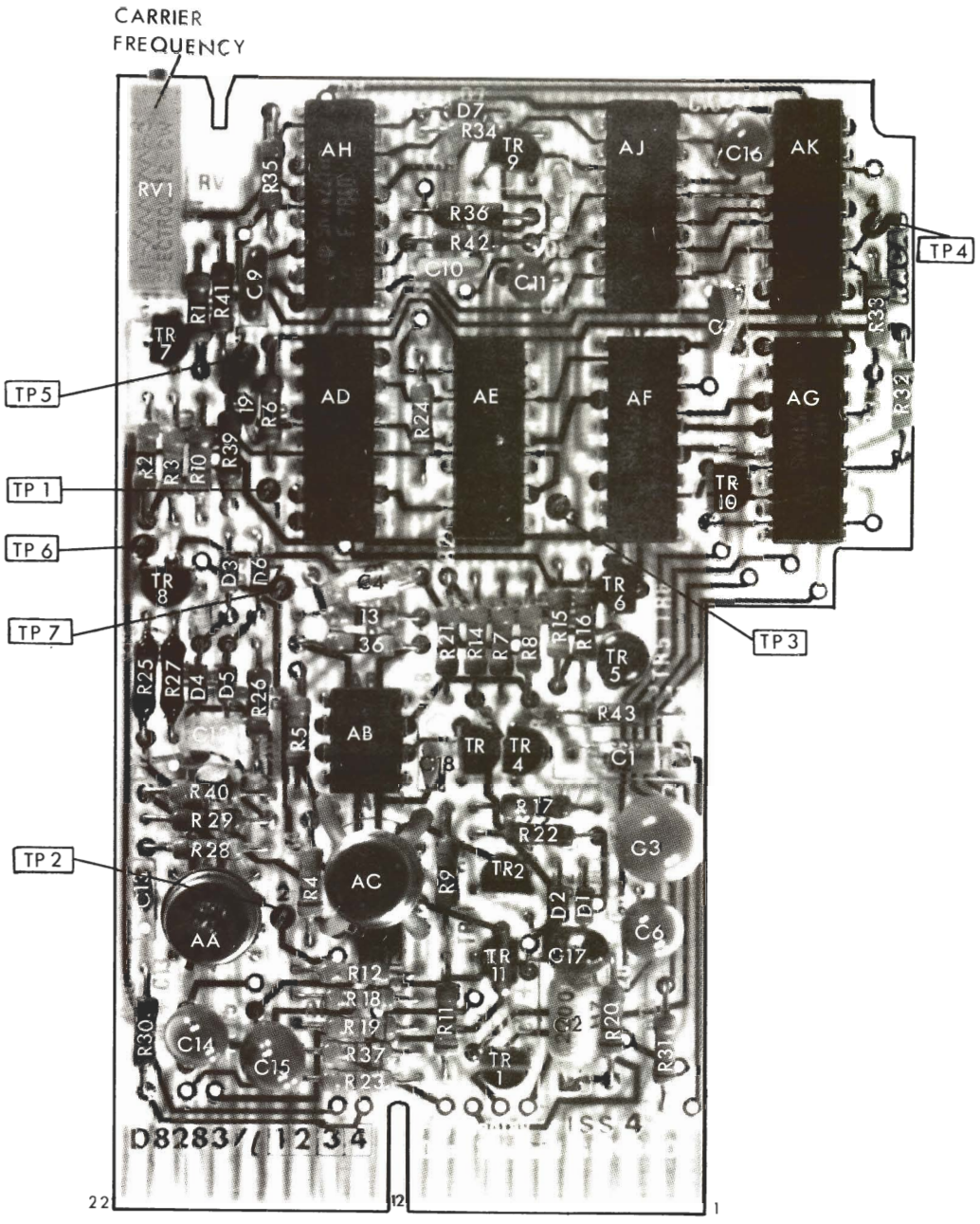
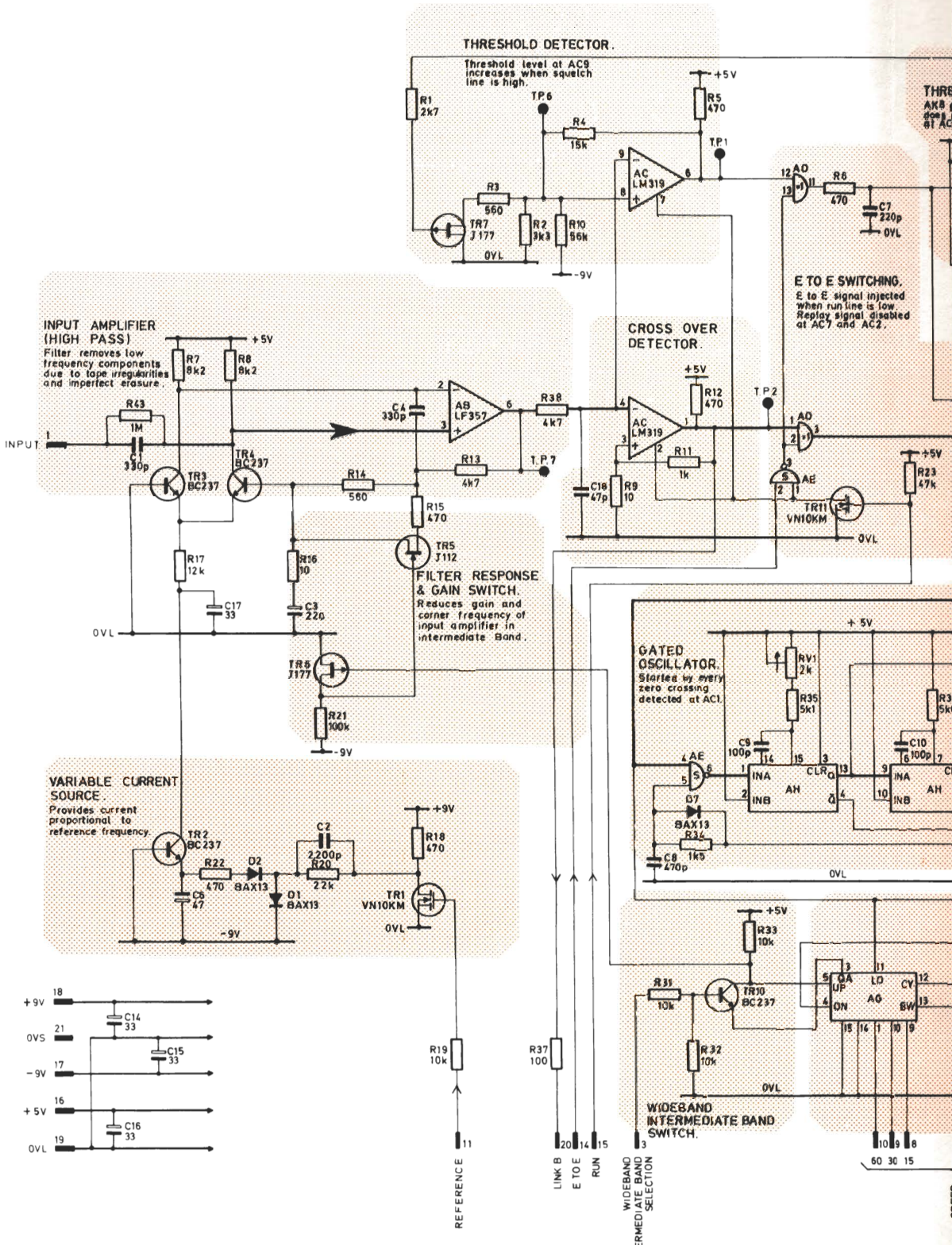
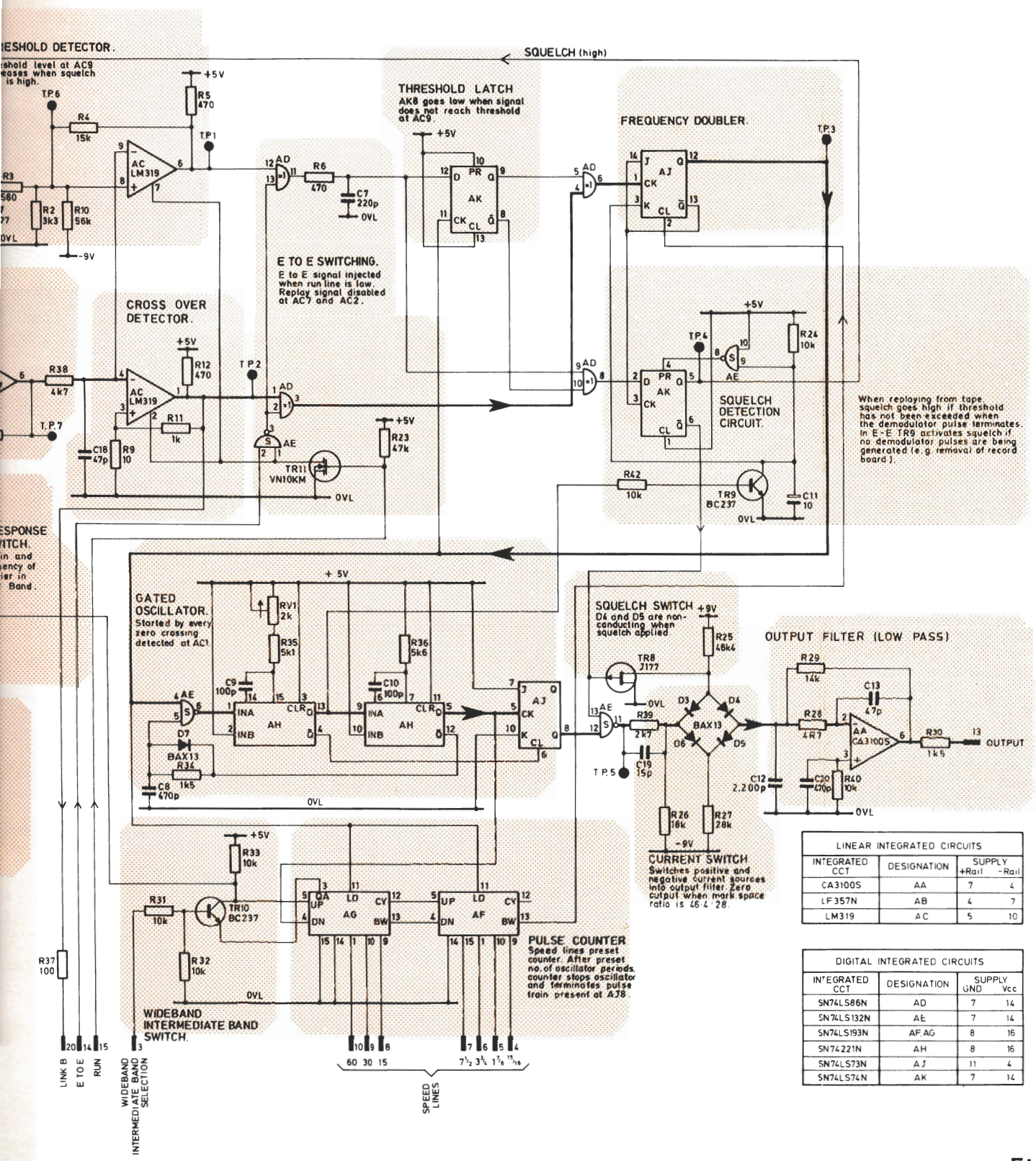


FIG.8 F.M. REPLAY BOARD - LAYOUT (DUAL STANDARD) D8283



Store 4DS/7DS
August 1980



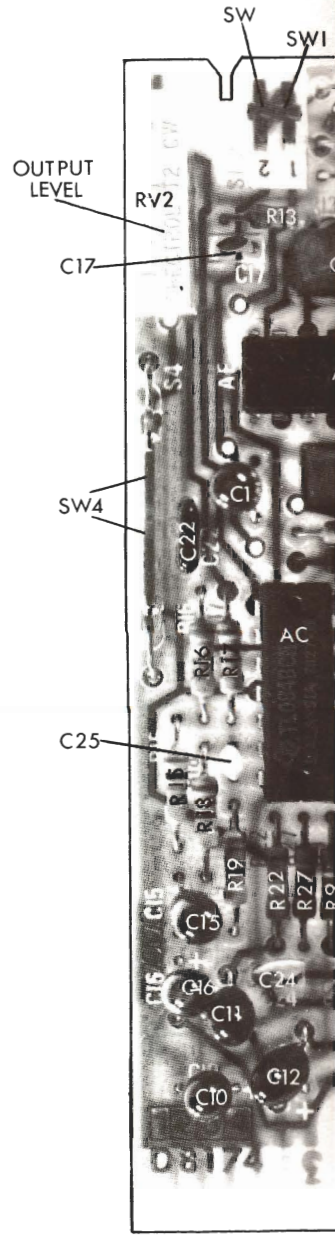
LINEAR INTEGRATED CIRCUITS			
INTEGRATED CCT	DESIGNATION	SUPPLY +Rail	SUPPLY -Rail
CA3100S	AA	7	4
LF357N	AB	4	7
LM319	AC	5	10

DIGITAL INTEGRATED CIRCUITS			
INTEGRATED CCT	DESIGNATION	SUPPLY GND	SUPPLY Vcc
SN74LS86N	AD	7	14
SN74LS132N	AE	7	14
SN74LS193N	AF.AG	8	16
SN74221N	AH	8	16
SN74LS73N	AJ	11	4
SN74LS74N	AK	7	14

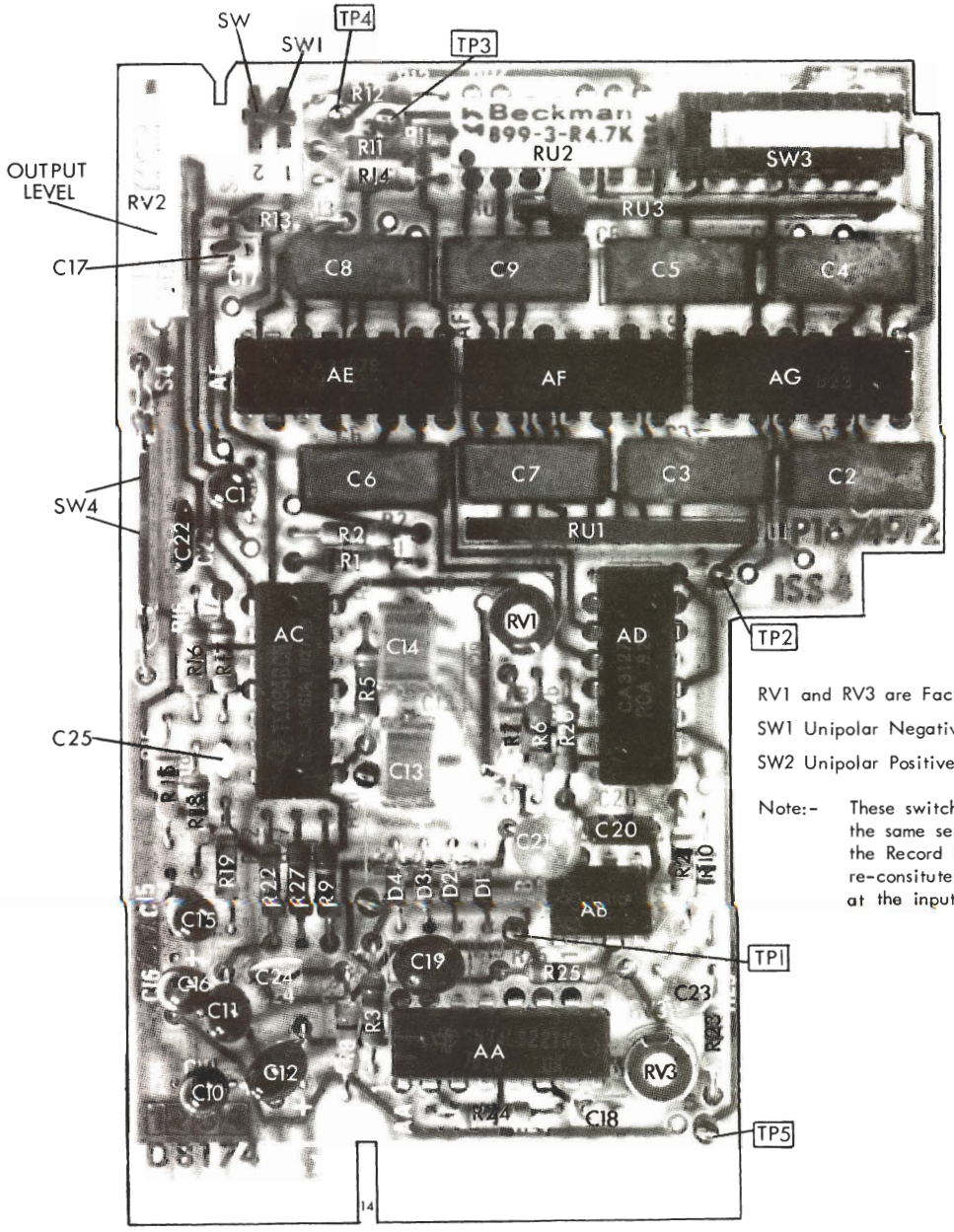
FIG.9
F.M. REPLAY BOARD - CIRCUIT (DUAL STANDARD)

CIRCUIT REF.	VALUE	TOL	RATING	MFRS. REF. NO.
	F.M. FILTER BOARD (Dual Standard)			D8174
Capacitors				
C1,15,16	22 µF	20%	10 V	C162220
C2,3	1150 pF	1%	30 V	Cat 14649
C4,5	1611 pF	1%	30 V	Cat 15865
C6	290 pF	1%	30 V	Cat 15864
C7	308 pF	1%	30 V	Cat 14648
C8,9	3891 pF	1%	30 V	Cat 15866
C10,11,12	10 µF	20%	16 V	C163100
C13,14	.47 µF	5%	100 V	Cat 12729
C17	4.7 pF	± .25 pF	63 V	Cat 13713
C18	.001 µF	10%	100 V	Cat 12033
C19	100 pF	1%	400 V	Cat 15367
C20	.1 µF	-20% +80%	100 V	Cat 12321
C21,23	47 µF	20%	10 V	C162470
C24	.022 µF	10%	100 V	Cat 13646
C25	390 pF	10%	100 V	Cat 13396
C26	220 pF	2%	63 V	Cat 10357
Cover Dust	Erg Switch Cover DS16A			Cat 13060
Diodes				
D1-D4	Mullard BAX 13			Cat 8406
Integrated Circuits				
AA	Texas 74LS221			Cat 14047
AB	Texas TL081CP			Cat 14374
AC	Texas TL074CN green spot			Cat 15384
AD	RCA CA3127E blue spot			Cat 14377
AE,AG	RCA CA3127E blue or yellow spot			Cat 14377
AF	Texas TLO74CN red spot			Cat 15385
Potentiometers				
RV1	1k Spectrol			Cat 15350
RV2	5k Spectrol			Cat 12402
RV3	10k Spectrol			Cat 15351

CIRCUIT REF.	VALUE	TOL	RATING	MFRS. REF. NO.
	F.M. FILTER BOARD (Contd) (Dual Standard)			D8174
Resistors				
R1	220Ω	5%	¼W	R10221
R2	560Ω	5%	¼W	R10561
R3	150k	5%	¼W	R10154
R5	470Ω	2%	¼W	R30471
R6	3k3	2%	¼W	R30332
R7	1M	5%	¼W	R10105
R8	820k	5%	¼W	R10824
R9	6k19	1%	⅛W	R206191
R10,17,18	1k	5%	¼W	R10102
R11,12	102k	1%	⅛W	R201023
R13	11k3	1%	⅛W	R201132
R14,16	39k	5%	¼W	R10393
R15,21	10k	5%	¼W	R10103
R19	68Ω	5%	¼W	R10680
R20	Select on Test			
R22	100k	5%	¼W	R10104
R23	4k7	5%	¼W	R10472
R24	6k8	5%	¼W	R10682
R25	30k	5%	¼W	R10303
R26	1k8	5%	¼W	R10182
R27	3k48	1%	⅛W	R203481
R30	10k	2%	¼W	R30103
Resistor Arrays				
RU1	Bourns			Cat 15330
RU2	Beckman			Cat 15332
RU3				Cat 15331
Socket, Integrated Circuit 4 off				Cat 12795
Switches				
S1,S2	DIL Erg			Cat 14210
S3	DIL Erg DS16A4-2			Cat 13104
S4	Reed, Hamlin, MSRR-220-30AT			Cat 11539
Terminal Assemblies				
TP1,5	Vero			Cat 13747



RATING	MFRS. REF. NO.
(Contd)	D8174
¼W	R10221
¼W	R10561
¼W	R10154
¼W	R30471
¼W	R30332
¼W	R10105
¼W	R10824
⅛W	R206191
¼W	R10102
⅛W	R201023
⅛W	R201132
¼W	R10393
¼W	R10103
¼W	R10680
¼W	R10104
¼W	R10472
¼W	R10682
¼W	R10303
¼W	R10182
⅛W	R203481
¼W	R30103
	Cat 15330
	Cat 15332
	Cat 15331
	Cct 12795
	Cat 14210
-2	Cat 13104
RR-220-30AT	Cat 11539
	Cat 13747



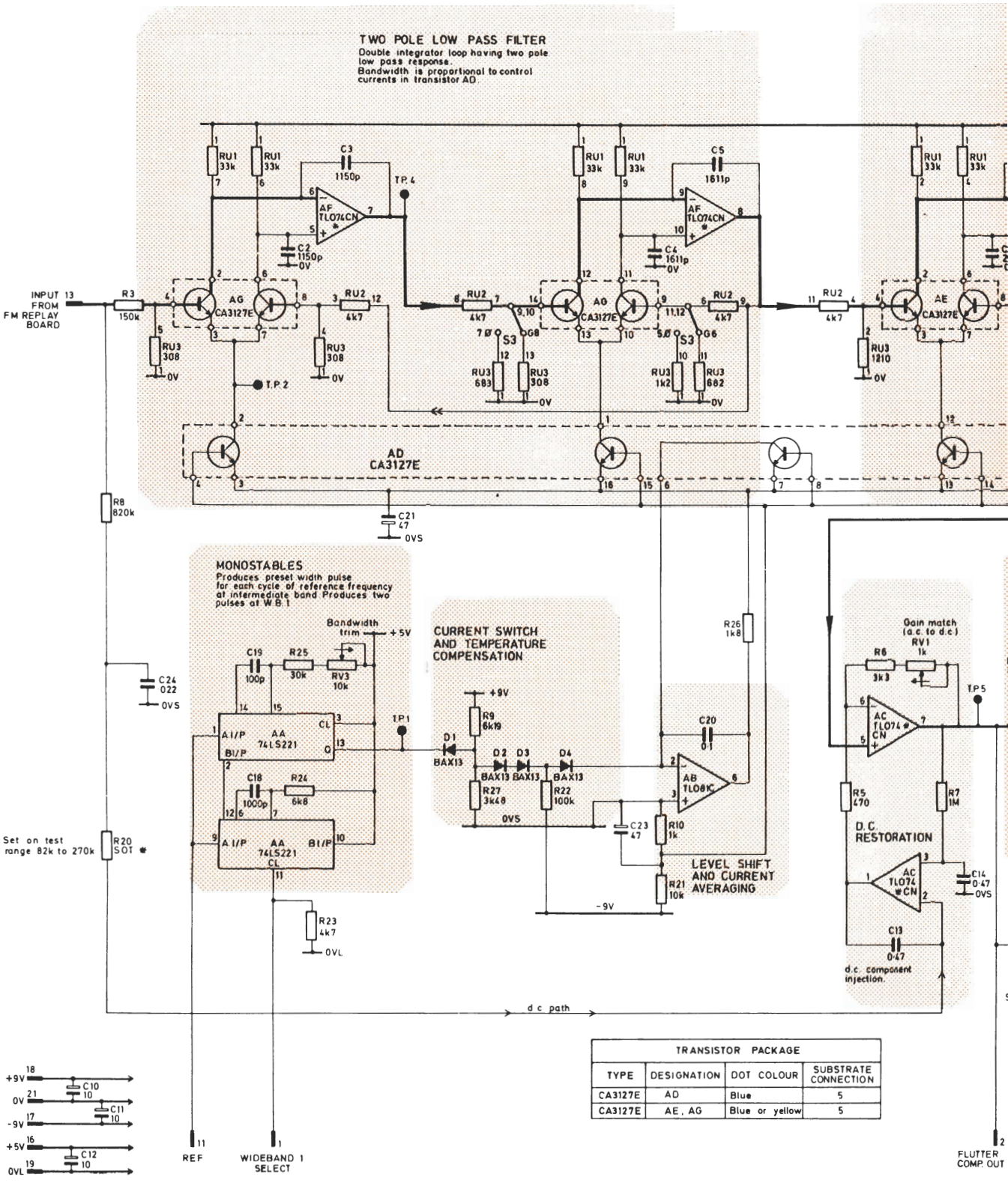
RV1 and RV3 are Factory Preset

SW1 Unipolar Negative

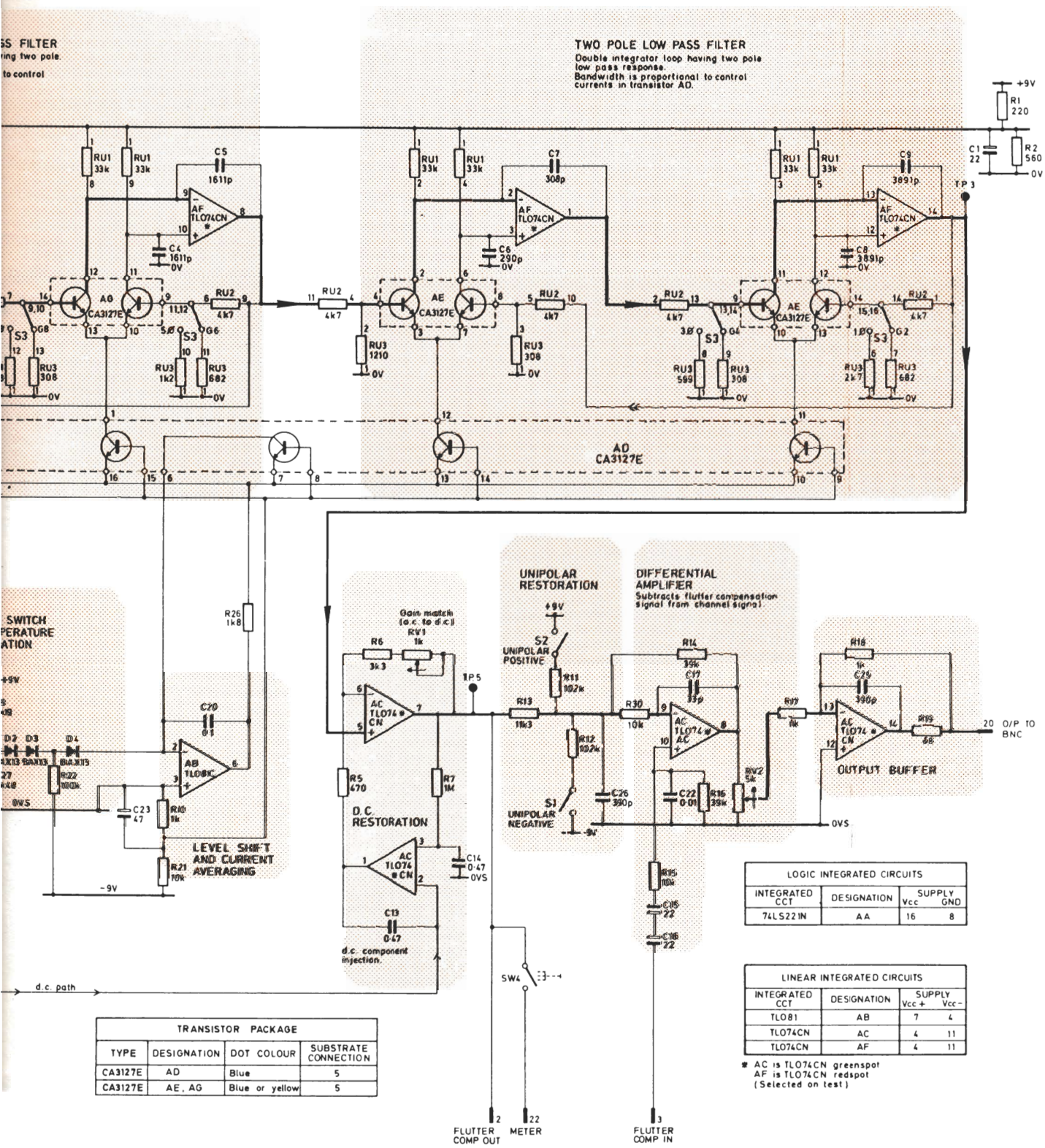
SW2 Unipolar Positive

Note:- These switches should be to the same setting as those on the Record Board. This will re-consitute the signal to that at the input to the equipment.

FIG.10 F.M. FILTER BOARD - LAYOUT (DUAL STANDARD) D8174



TRANSISTOR PACKAGE			
TYPE	DESIGNATION	DOT COLOUR	SUBSTRATE CONNECTION
CA3127E	AD	Blue	5
CA3127E	AE, AG	Blue or yellow	5



TRANSISTOR PACKAGE			
TYPE	DESIGNATION	DOT COLOUR	SUBSTRATE CONNECTION
CA3127E	AD	Blue	5
CA3127E	AE, AG	Blue or yellow	5

LOGIC INTEGRATED CIRCUITS			
INTEGRATED CCT	DESIGNATION	SUPPLY Vcc	GND
74LS221N	AA	16	8

LINEAR INTEGRATED CIRCUITS			
INTEGRATED CCT	DESIGNATION	SUPPLY Vcc +	Vcc -
TL081	AB	7	4
TL074CN	AC	4	11
TL074CN	AF	4	11

* AC is TL074CN greenspot
AF is TL074CN redspot
(Selected on test)

FIG. 11
F.M. FILTER BOARD - CIRCUI
(DUAL STANDARD)

CIRCUIT REF.	VALUE	TOL	RATING	MFRS. REF. NO.
	D.R. RECORD			D7737
Capacitors				
C1, 3	1.0 µF	5%	100 V	Cat 13708
C2	220 pF	2%	63 V	Cat 10357
C4, 5	33 µF	20%	16 V	C 163330
C6	470 µF	-10 +50%	6.3 V	Cat 13655
C7, 8	6.8 µF	20%	16 V	Cat 14212
C10, 12	0.1 µF	5%	250 V	Cat 14252
C11	2200 pF	10%	100 V	Cat 13646
C13	10 pF	2%	63 V	Cat 12030
C9	47 µF	20%	16 V	Cat 13433
Diodes				
D1 - 4, 6, 7	BAX13			Cat 8406
D5	L.E.D. (light emitting diode)			Cat 15103
Potentiometers				
RV1	100 Ω			Cat 12408
RV2, 4	1 k			Cat 11930
RV3	5 k			Cat 12402
RV5	50 k			Cat 12420
Resistors				
R1 *	8474 Ω	0.5%	¼ W	Cat 12343
R2 *	7095 Ω	0.5%	¼ W	Cat 12344
R3 *	2313 Ω	0.5%	⅛ W	Cat 12345
R4 *	1088 Ω	0.5%	⅛ W	Cat 12346
R5 *	625.6 Ω	0.5%	⅛ W	Cat 12347
R6 *	203.7 Ω	0.5%	⅛ W	Cat 12348
R7 *	100.9 Ω	0.5%	⅛ W	Cat 12349
R8 *	100.3 Ω	0.5%	⅛ W	Cat 12354
R9, R34	100 k	5%	¼ W	R10104
R10	8 k 2	5%	¼ W	R10822
R11	33 k	5%	¼ W	R10333
R12, 23, 25, 26, 29	4 k 7	5%	¼ W	R10472
R13	2 k 4	5%	¼ W	R10242
R14, 30, 33, 36	270 Ω	5%	¼ W	R10271
R15, 21, 27, 31	220 Ω	5%	¼ W	R10221
R16	100 Ω	5%	¼ W	R10101
R17	10 Ω	5%	¼ W	R10100
R18	5 k 6	5%	¼ W	R10562
R19	1 k 5	5%	¼ W	R10152

CIRCUIT REF.	VALUE	TOL	RATING	MFRS. REF. NO.
	D.R. RECORD (Contd)			D7737
Resistors (Contd)				
R20	1 k 8	5%	¼ W	R10182
R22, 28, 37	15 k	5%	¼ W	R10153
R24	10 k	5%	¼ W	R10103
R32	1 M	5%	¼ W	R10271
R35	47 Ω	5%	¼ W	R10470
*Resistor Array	R1 to R8 are replaced by RU1 on later boards.			
RU1				Cat 15336
Sockets				
2 off	Testprobe socket			Cat 2683
Switches				
S1	Switch			P15831
	Knob			D7601/3
S2	Switch, reed			Cat 11539
S3	Switch, slide, Siemens			Cat 14653
Terminal Assembly				
3 off	Vero 22436			Cat 13747
Transistors				
TR1, 5, 6	BC308			Cat 11977
TR2, 3, 4	BC237			Cat 11978
TR7	E112 F.E.T.			Cat 10540
TR8	E177			Cat 13967
	Switch 3 and RV5 Customer Option			

TP2

FIG.

Store 4DS/7DS
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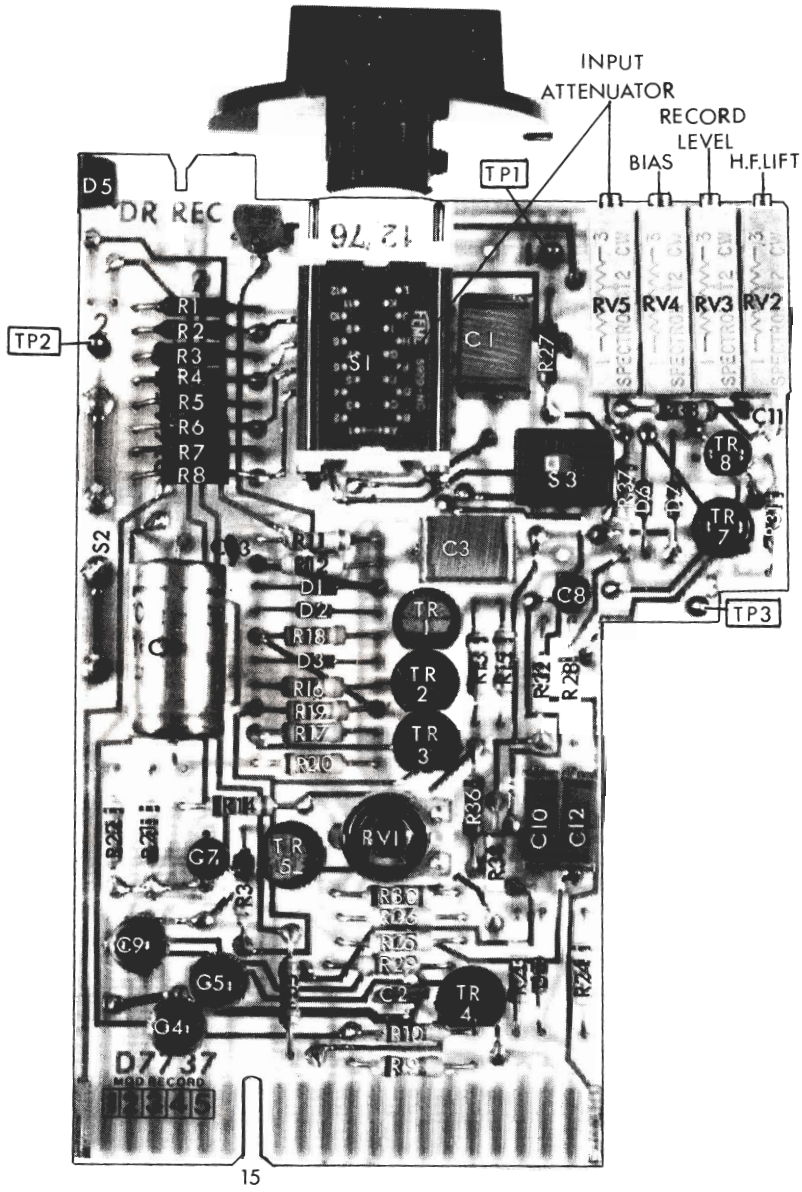
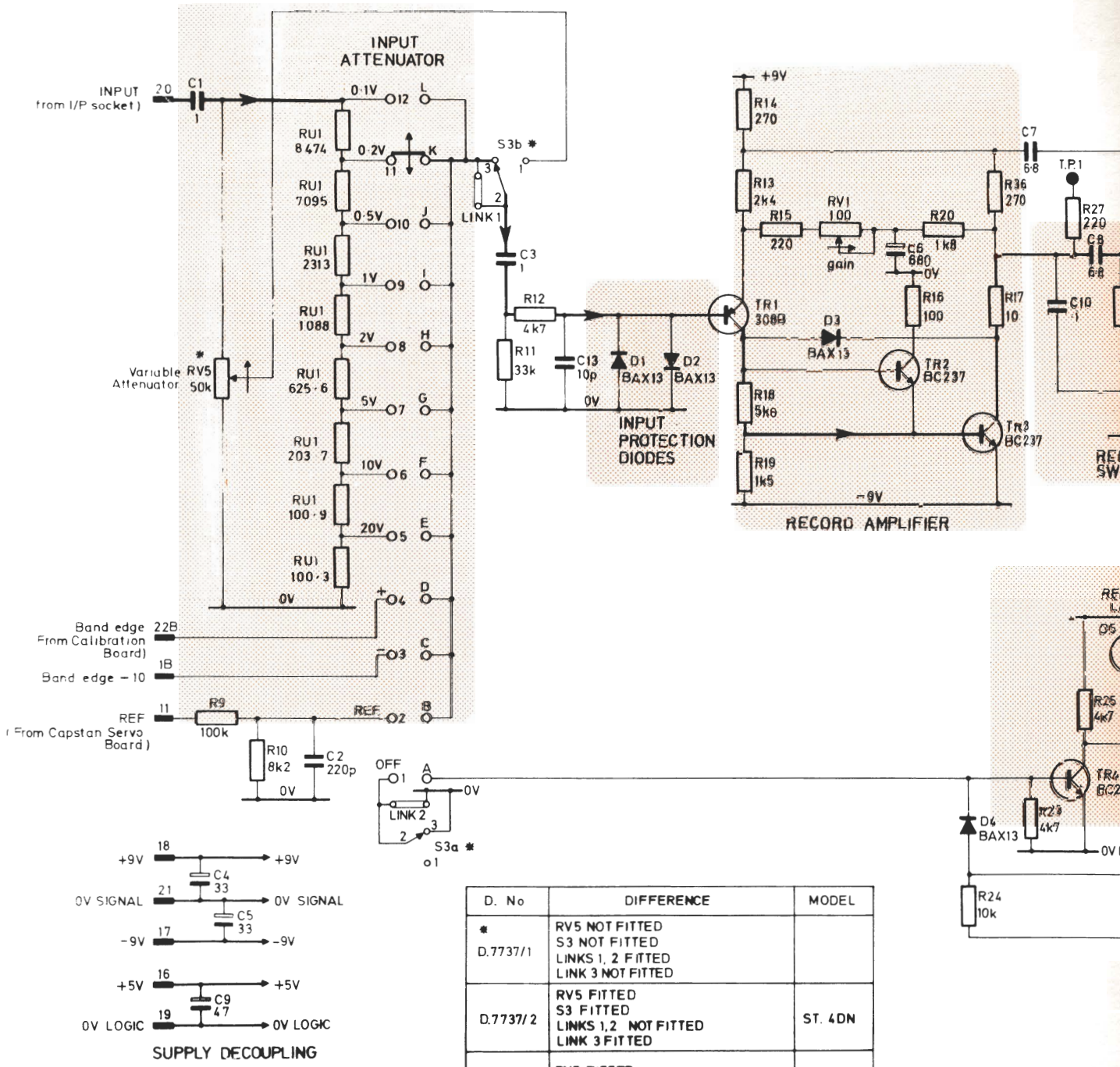
	VALUE	TOL	RATING	MFRS. REF. NO.
	D.R. RECORD (Contd)			D7737
ntd)				
	1k8	5%	¼W	R10182
	15k	5%	¼W	R10153
	10k	5%	¼W	R10103
	1M	5%	¼W	R10271
	47Ω	5%	¼W	R10470
	R1 to R8 are replaced by RU1 on later boards.			
				Cat 15336
	Testprobe socket			Cat 2683
	Switch			P15831
	Knob			D7601/3
	Switch, reed			Cat 11539
	Switch, slide, Siemens			Cat 14653
	Vero 22436			Cat 13747
	BC308			Cat 11977
	BC237			Cat 11978
	E112 F.E.T.			Cat 10540
	E177			Cat 13967

Switch 3 and RV5 Customer Option



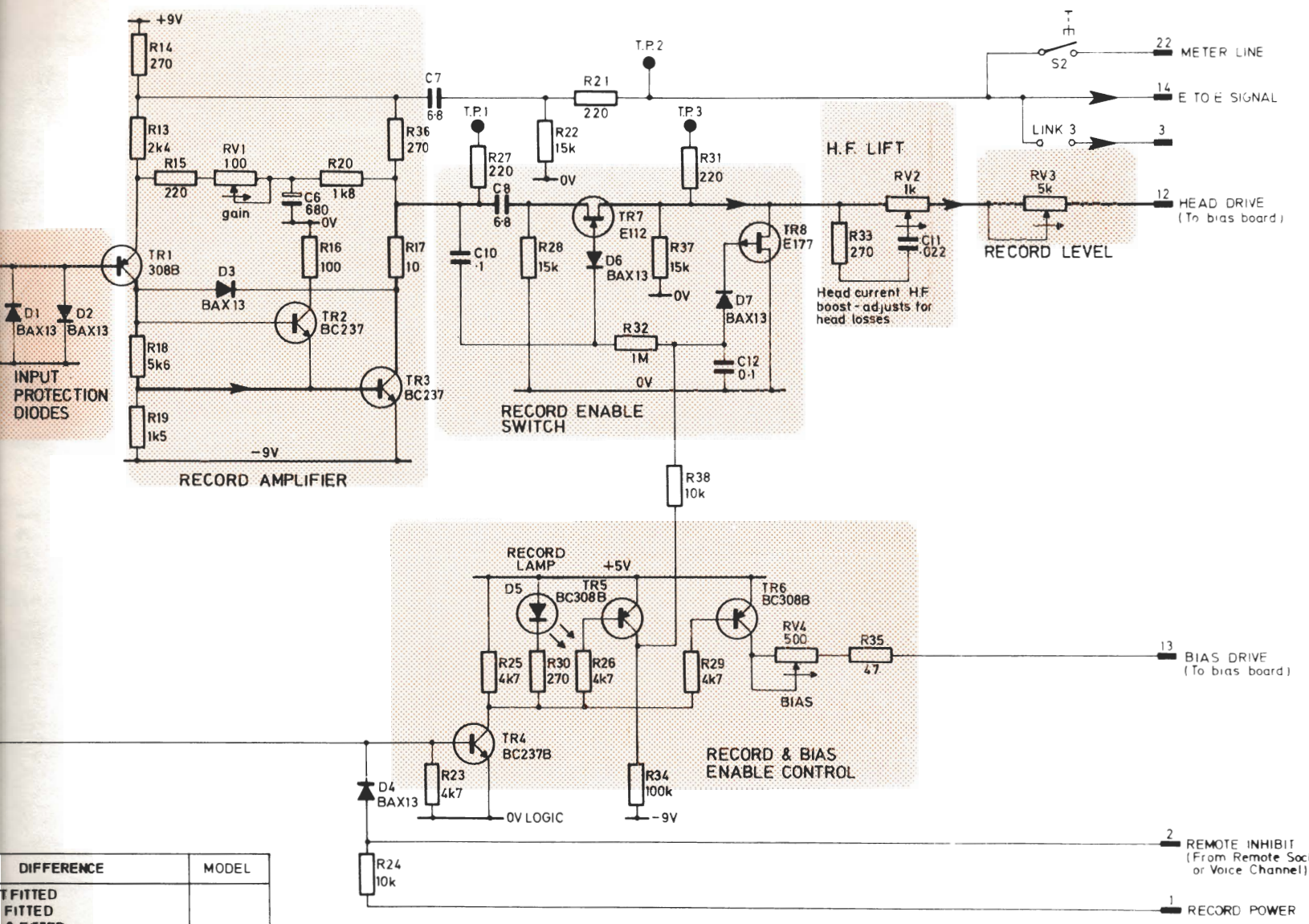
NOTE:- Switch 3 Positions.
Position 1, Left Position, Switched Attenuator.
Position 2, Right Position, Variable Attenuator.

FIG. 12 D.R. RECORD BOARD - LAYOUT D7737



D. No	DIFFERENCE	MODEL
* D.7737/1	RV5 NOT FITTED S3 NOT FITTED LINKS 1, 2 FITTED LINK 3 NOT FITTED	
D.7737/2	RV5 FITTED S3 FITTED LINKS 1,2 NOT FITTED LINK 3 FITTED	ST. 4DN
D.7737/3	RV5 FITTED S3 FITTED LINKS 1,2 &3 NOT FITTED	

Store 4DS/7DS
August 1980



DIFFERENCE	MODEL
T FITTED FITTED 2 FITTED NOT FITTED	
TED IED .2 NOT FITTED FITTED	ST. 4DN
TED ED .2 &3 NOT FITTED	

FIG. 13
D.R. RECORD BOARD - CIRCUIT

CIRCUIT REF.	VALUE	TOL	RATING	MFRS. REF. NO.
	D.R. REPLAY 1			D7734
Capacitors				
C1,3	33 µF	20%	16V	C16330
C2	0.1 µF	10%	35V	Cat 13782
C4,10,11	47 µF	20%	10V	Cat 13433
C5,6	0.1 µF	10%	250V	Cat 14256
C7	220 pF	2%	63V	Cat 10357
C8,9	330 pF	2%	63V	Cat 13714
C12,13,19,20	592 pF	2½%	30V	Cat 14213
C14,21	1850 pF	2½%	30V	Cat 14214
C15,22	4350 pF	2½%	30V	Cat 14215
C16,23	9350 pF	2½%	30V	Cat 14216
C17,24	19350 pF	2½%	30V	Cat 14217
C18,25	39400 pF	2½%	30V	Cat 14219
Integrated Circuits				
AA,AB	SN7416 N			Cat 12098
Potentiometers				
RV1	10k			Cat 11931
RV2	5k			Cat 12402
Resistors				
R1	150k	5%	¼W	R10154
R2	2k2	5%	¼W	R10222
R3,20	6k8	5%	¼W	R10682
R4,6,11	1k5	5%	¼W	R10152
R5,7,13,21	220Ω	5%	¼W	R10221
R8	1k2	5%	¼W	R10122
R9,10,15,35,36,37	10k	5%	¼W	R10103
R12	680Ω	5%	¼W	R10681
R14,16,19	1k	5%	¼W	R10102
R17	33k	5%	¼W	R10333
R18,34	4k7	5%	¼W	R10472
R22 - 33	2M2	5%	¼W	R10225
R38,39	47k	5%	¼W	R10473
Terminal Assemblies				
TP1 - 3	Vero 22436			Cat 13747
Transistors				
TR1,3,6,	BC 308B			Cat 11977
TR2,4,5,8,10	BC237B			Cat 11978
TR7,9	E177			Cat 13967

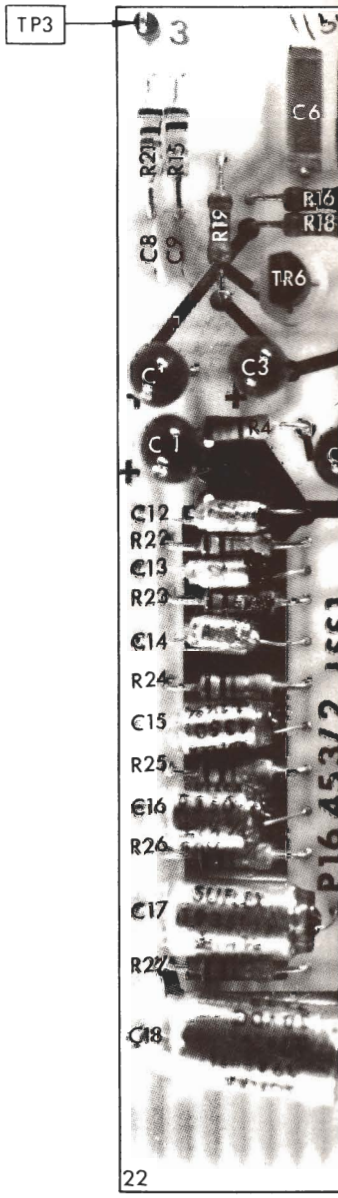


FIG. 14

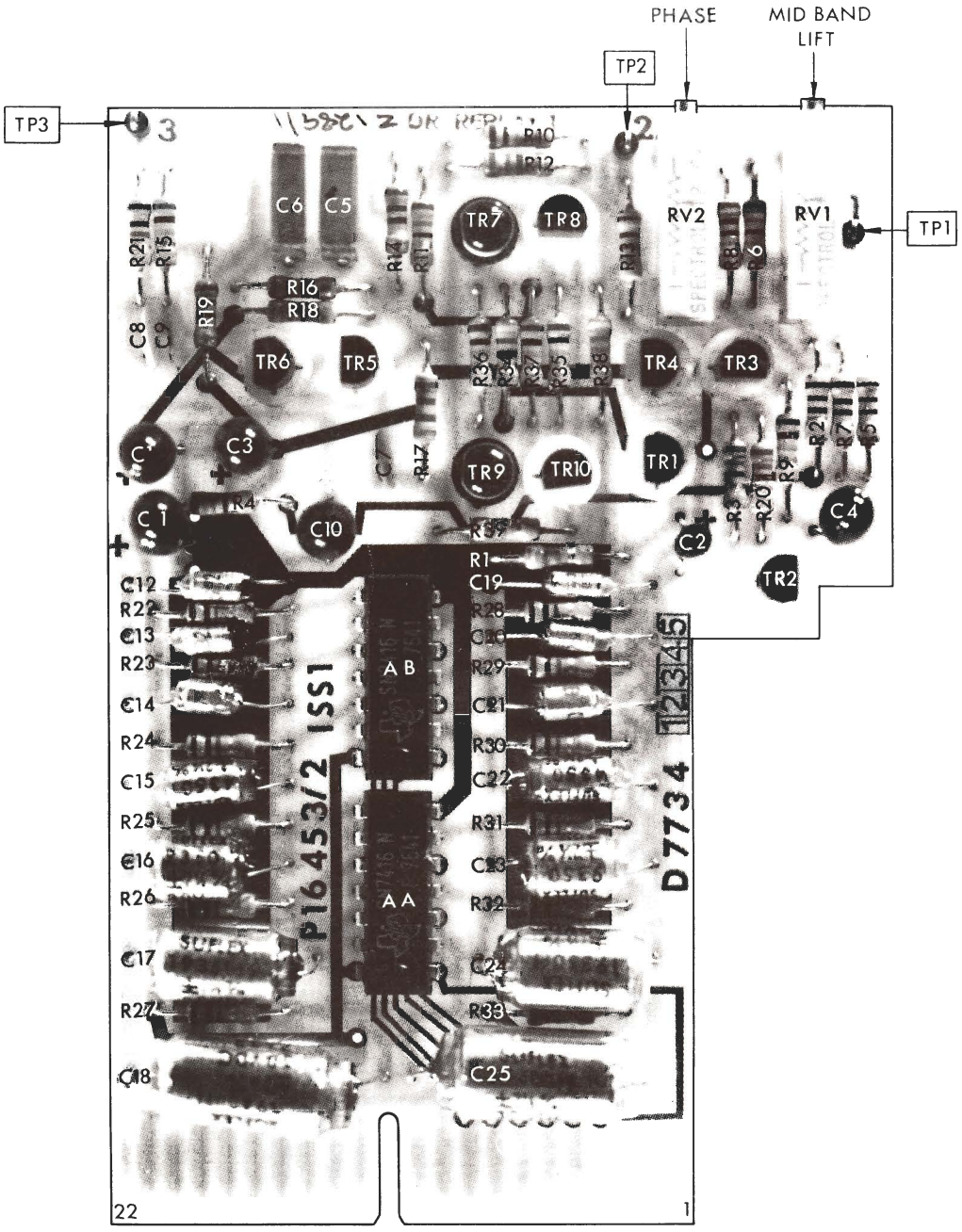
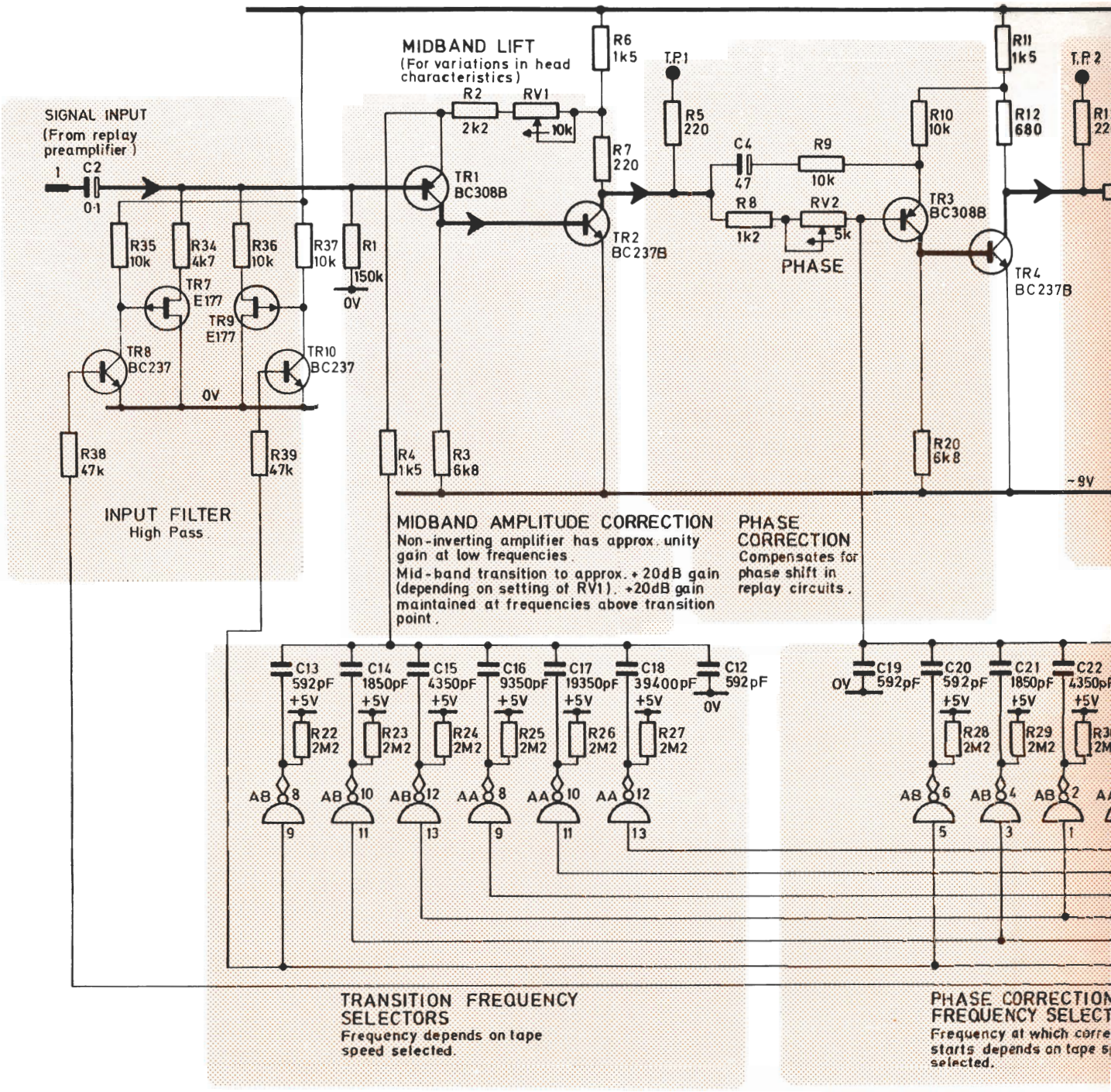


FIG. 14 D.R. REPLAY 1 BOARD - LAYOUT D7734



REF. No.	DIFFERENCE	USED ON
D7734/1	C5, C6 = 0·1μF AA, AB = SN7416N	STORE 4DS/7DS
D7734/2	C5, C6, = 0·22μF AA, AB= SN7416N	STORE 4DN STORE 4DS/7DS (OPTION)
D7734/3	C5, C6 = 0·1μF AA AB= 8T94A	STORE 14DS

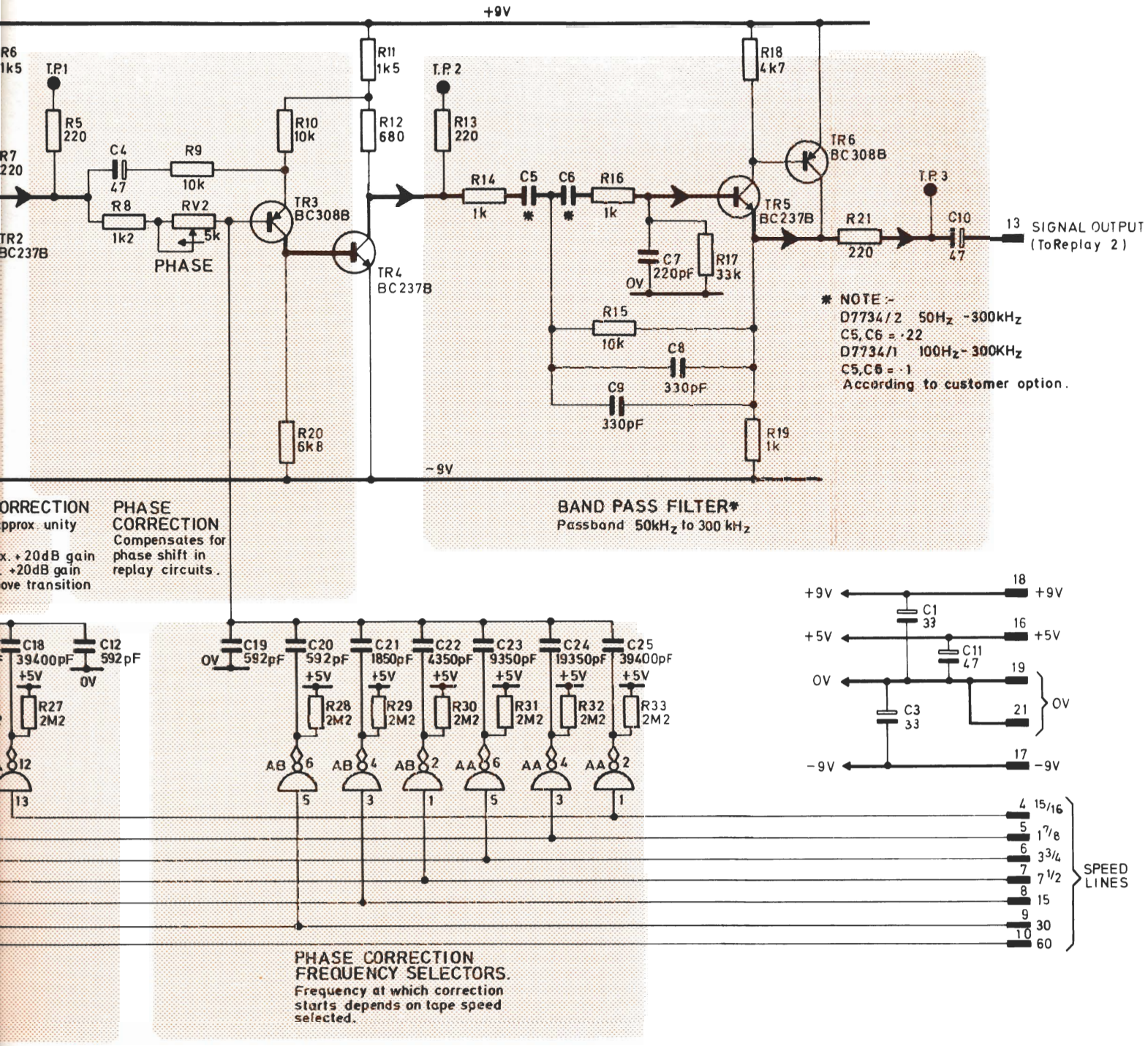


FIG.15
D.R. REPLAY 1 BOARD - CIRCUIT

CIRCUIT REF.	VALUE	TOL	RATING	MFRS. REF. NO.
	D.R. REPLAY 2			D7689
Capacitors				
C1	592 pF	2½%	30 V	Cat 14213
C2, 6	1850 pF	2½%	30 V	Cat 14214
C3, 7	9350 pF	2½%	30 V	Cat 14216
C4, 8	39400 pF	2½%	30 V	Cat 14219
C5	470 pF	2½%	30 V	Cat 14632
C9, 12, 15	47 µF	20%	10 V	Cat 13433
C10	47 pF	2%	63 V	Cat 11615
C13, 14	33 µF	20%	16 V	C163330
Diodes				
D1-D3	BAX13			Cat 8406
Integrated Circuits				
AA, AB	SN7416N			Cat 12098
AC	LM318H			Cat 9982
Potentiometers				
RV1, 3	10k Spectrol 43p			Cat 11931
RV2	20k			Cat 14327
Resistors				
R1, 5	12Ω	5%	⅓ W	Cat 14168
R2, 3, 4, 6, 7, 8	2M2	5%	⅓ W	Cat 9725
R9, 27, 34	2k2	5%	⅓ W	Cat 8903
R10	4k7	5%	⅓ W	Cat 8886
R11, 12, 21, 25	6k8	5%	⅓ W	Cat 8989
R13, 32	5k6	5%	⅓ W	Cat 8898
R14, 28	220Ω	5%	⅓ W	Cat 8889
R15, 16, 20 24, 26	1k	5%	⅓ W	Cat 8888
R17	1k2	5%	⅓ W	Cat 8909
R18	18k	5%	⅓ W	Cat 8897
R19	820Ω	5%	⅓ W	Cat 8917
R22	680Ω	5%	⅓ W	Cat 8892
R23	3k3	5%	⅓ W	Cat 8981
R33	68Ω	5%	⅓ W	Cat 9972
R36	10Ω	5%	⅓ W	Cat 8899
R37	100k	5%	⅓ W	Cat 8884
Switch				
S1	Switch - reed			Cat 11539
Terminal Assembly				
4 off	Vero 22436			Cat 13747
Transistors				
TR1, TR8	J177			Cat 13967
TR2, 5, 6	BC237B			Cat 11978
TR3, 4, 7, 10	BC308B			Cat 11977
TR9	E112			Cat 10540

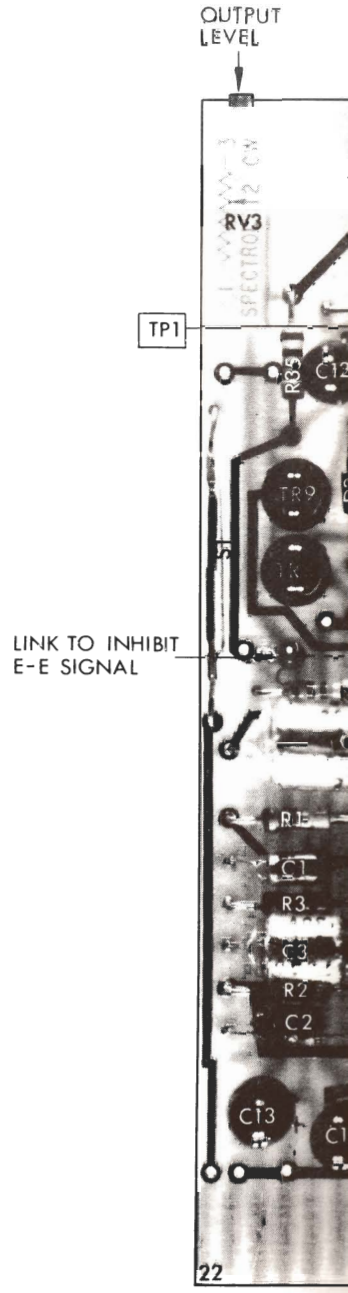


FIG. 16

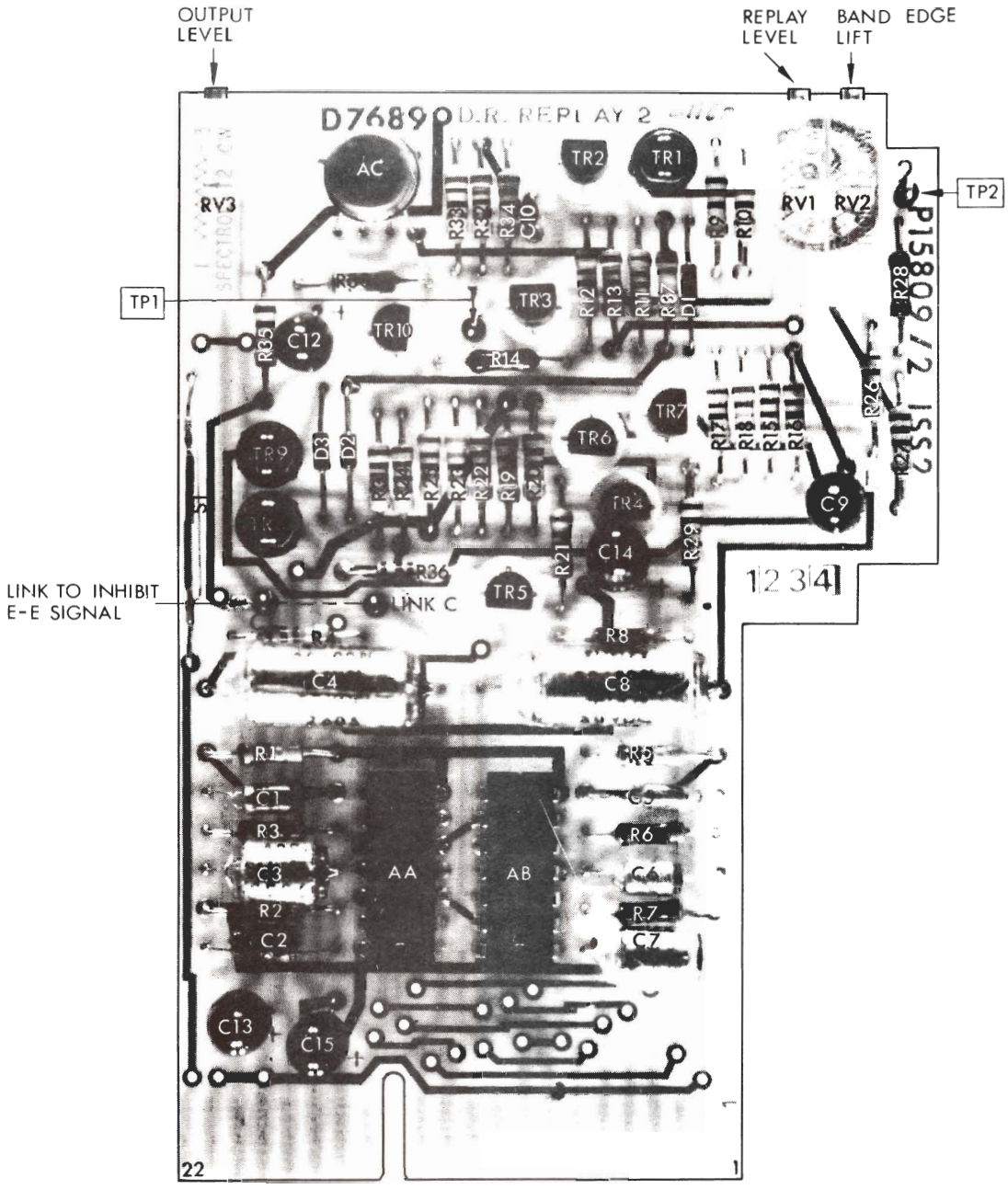
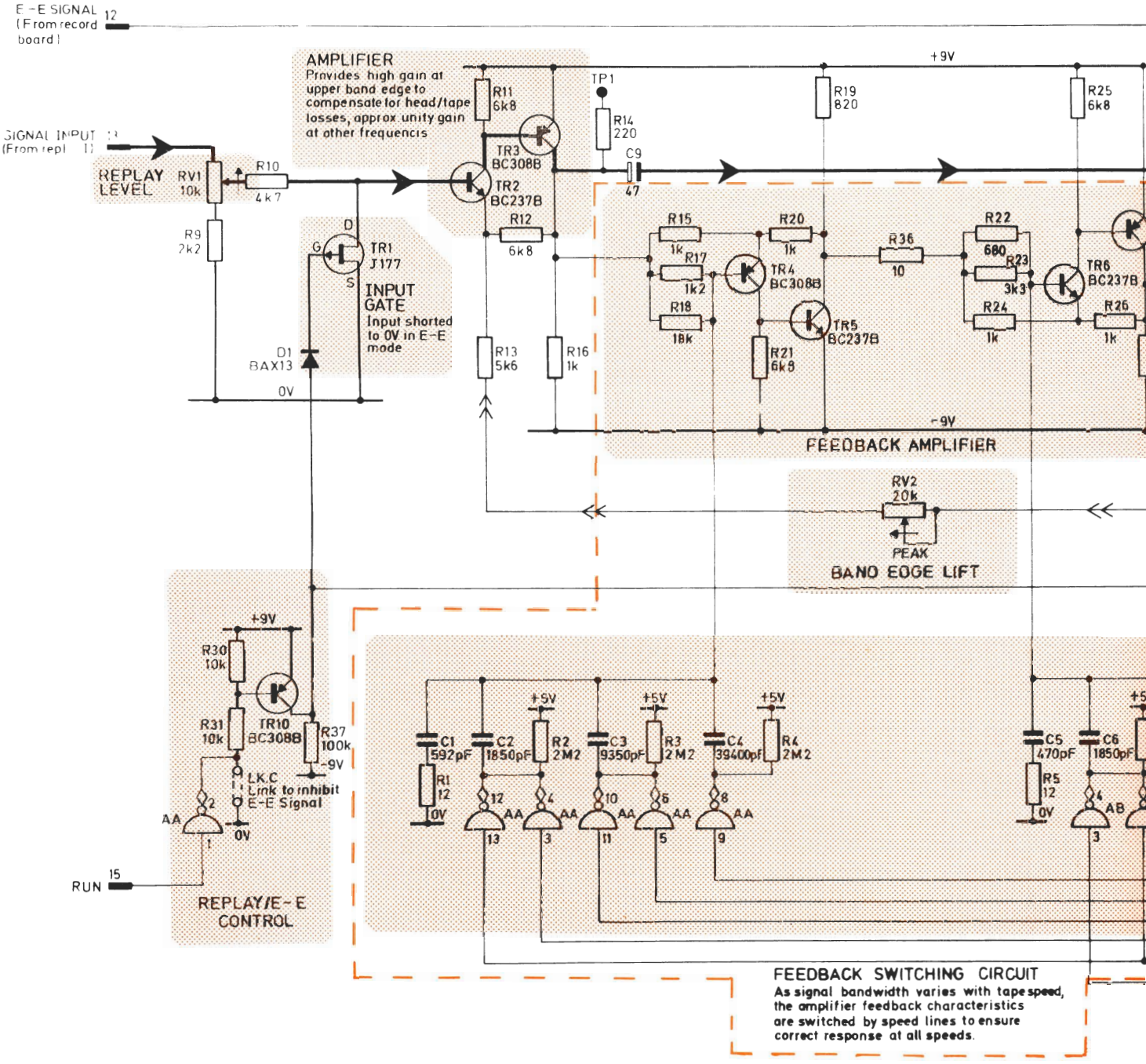


FIG. 16 D.R. REPLAY 2 BOARD - LAYOUT D7689



Store 4DS/7DS
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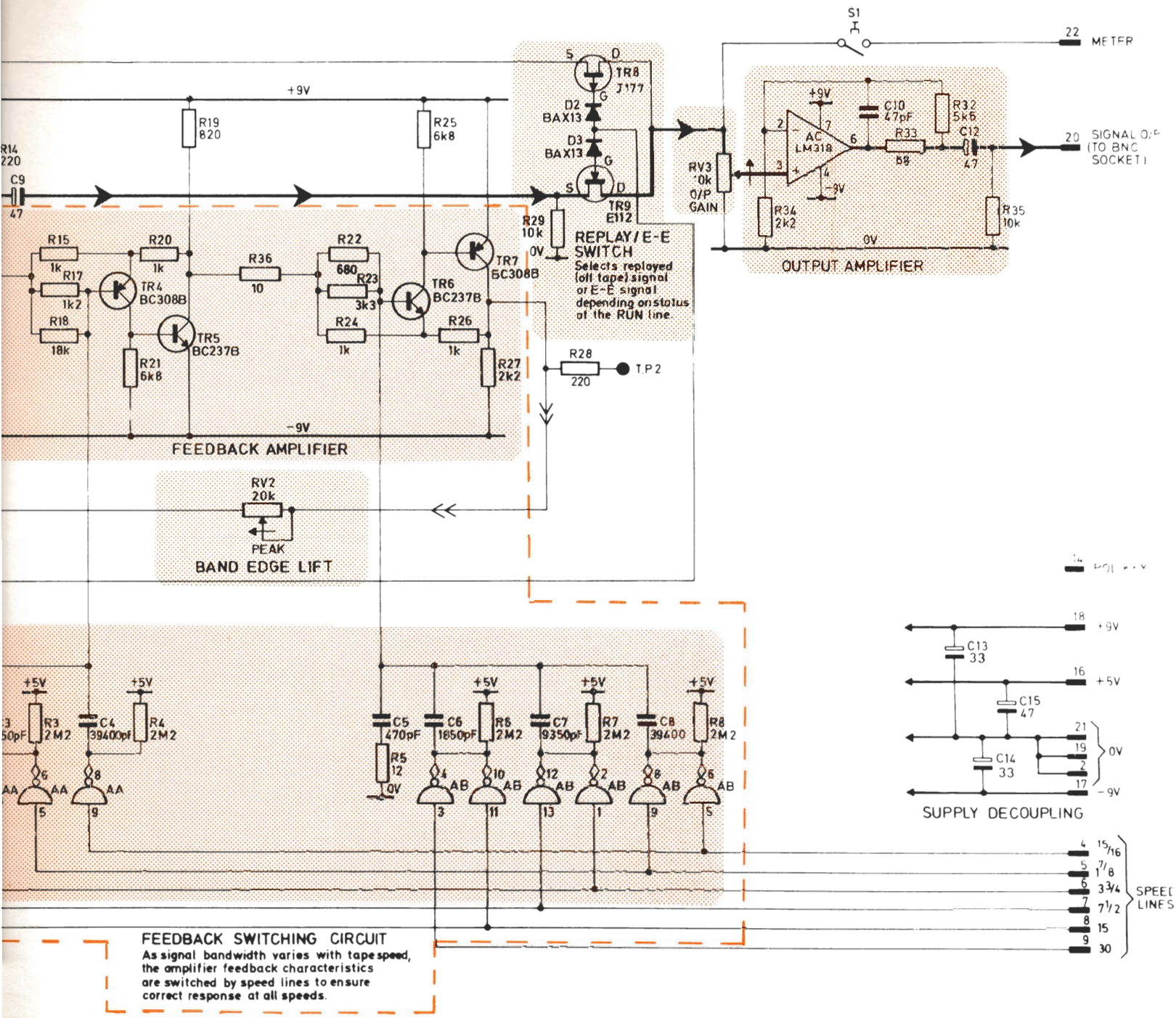


FIG.17
D.R. REPLAY 2 BOARD - CIRCUIT

CIRCUIT REF	VALUE	TOL.	RATING	MFRS. REF. NO.
	VOICE CHANNEL BOARD			D8923/3
Capacitors				
C1	10 µF	20%	16V	CI63100
C2,9	47 µF	20%	16V	CI63470
C3	0.01 µF	+80%-20%	63V	28738-188-09
C4	2.2 µF	20%	16V	CI63229
C5	4700 pF	+80%-20%	63V	28738-184-09
C6	22 µF	20%	16V	CI63220
C7	0.015 µF	5%	160V	Cat 4169
C8	0.1 µF	10%	100V	Cat 13431
C12	220 pF	+80%-20%	63V	28738-129-02
CI3	1 µF	20%	35V	CI66109
CI4	10 µF	20%	35V	CI66100
Diodes				
D1,2	BAX 13			Cat 8406
Heatsink				
1 off	Redpoint			Cat 14012
Heatsink Insulator				
1 off				Cat 12279
Integrated Circuits				
AA	RC4558			Cat 14373
AB	CD4053			S644053
AC	TDA2030H			Cat 14972
Potentiometers				
RV1	see Potentiometer Assemblies below			
RV2	1K	10%		Cat 11930
Potentiometer Assemblies				
Type 1				
Bracket				P 14290
Potentiometer RV1	50K log	20%		Cat 16517
Knob				D 7602/2
Type 2				
Bracket				P 17736
Potentiometer RV1	47K log	20%		Cat 16516
Knob				D7601/4

CIRCUIT REF.	VALUE	TOL.	RATING	MFRS. REF. NO.
Resistors				
R1,11	47	5%	¼ W	R10470
R2	1k2	5%	¼ W	R10122
R3,4,7	100k	5%	¼ W	R10104
R5,6,15,16	2k2	5%	¼ W	R10222
R8	1k5	5%	¼ W	R10152
R9	6k8	5%	¼ W	R10682
R10	820	5%	¼ W	R10820
R12	4k7	5%	¼ W	R10472
R13,19	10k	5%	¼ W	R10103
R14,	47k	5%	¼ W	R10473
R17	33k	5%	¼ W	R10333
R18	22k	5%	¼ W	R10223
R20	3k9	5%	¼ W	R10392
R21	100	5%	¼ W	R10101
R22	4R7	5%	¼ W	R10479
R23	22	5%	¼ W	R10220
R24	1M	5%	¼W	R10105
Switch				
S1	Siemans (C42315-A68-A1)			Cat 14653
Transistors				
TR1	BC237B			Cat 11978
TR2	BC308B			Cat 11977

FIG

LUE	TOL.	RATING	MFRS. REF. NO.
	5%	¼ W	R10470
:2	5%	¼ W	R10122
0k	5%	¼ W	R10104
:2	5%	¼ W	R10222
:5	5%	¼ W	R10152
:8	5%	¼ W	R10682
0	5%	¼ W	R10820
:7	5%	¼ W	R10472
k	5%	¼ W	R10103
k	5%	¼ W	R10473
k	5%	¼ W	R10333
k	5%	¼ W	R10223
:9	5%	¼ W	R10392
0	5%	¼ W	R10101
7	5%	¼ W	R10479
	5%	¼ W	R10220
	5%	¼W	R10105
mans			
15-A68-A1)			Cat 14653
378			Cat 11978
08B			Cat 11977

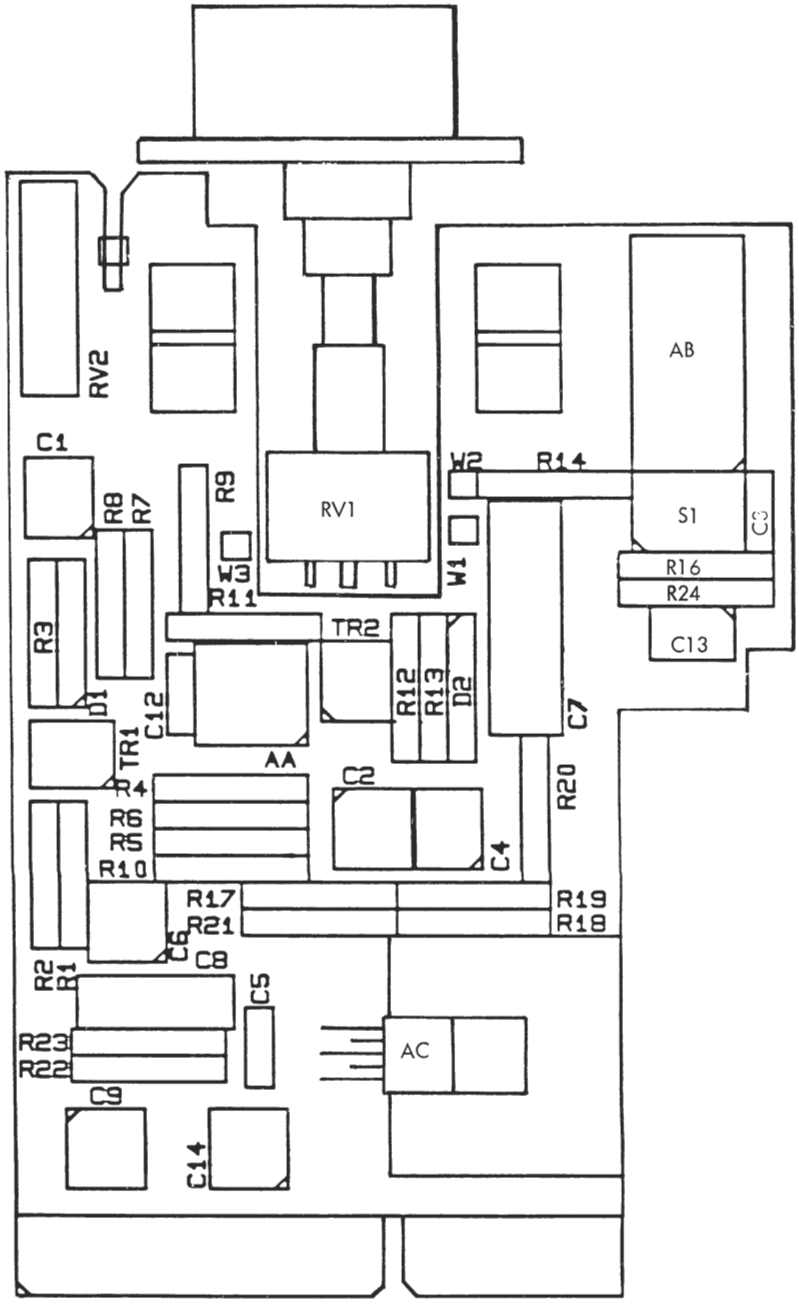
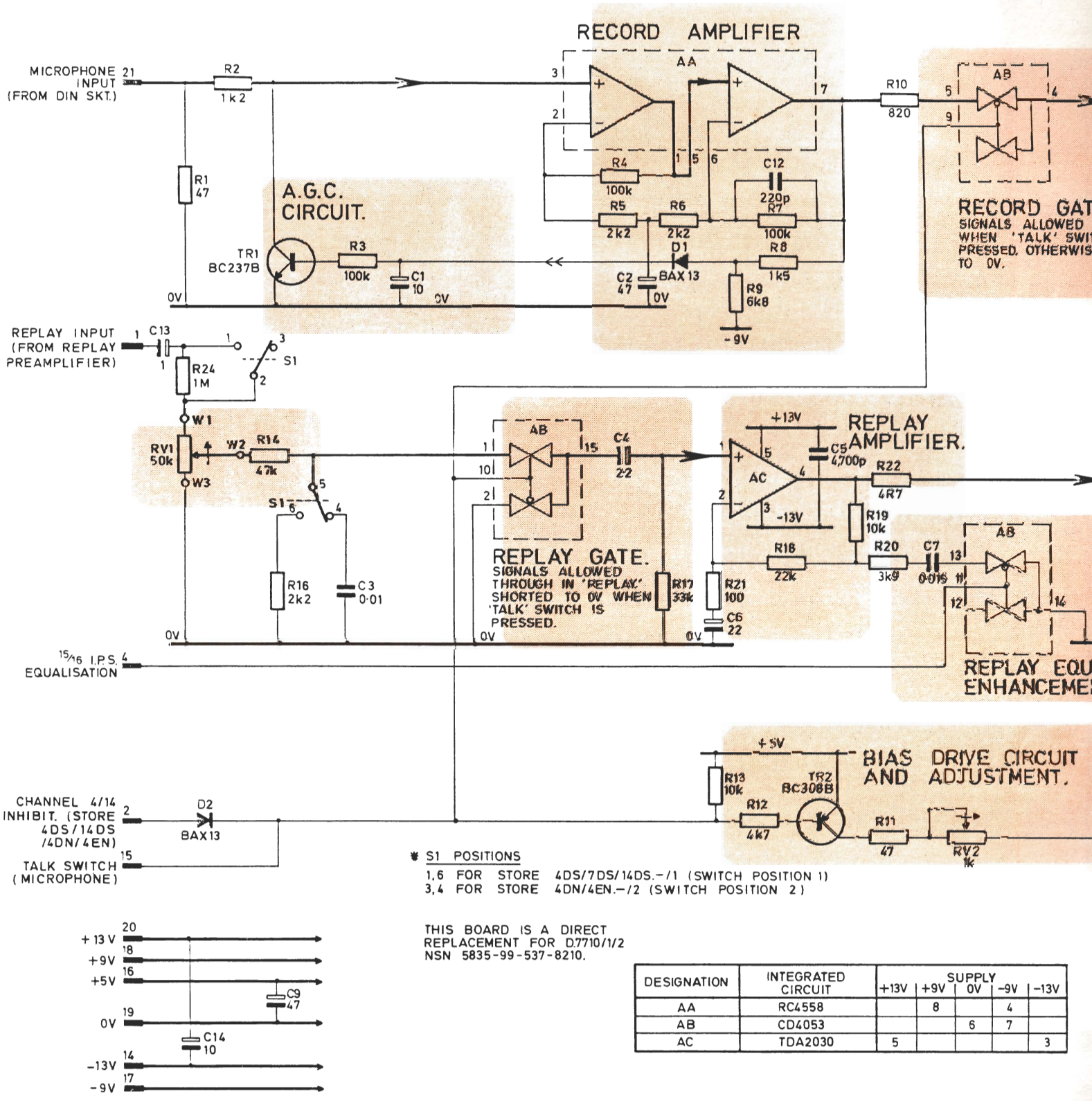


FIG.18 VOICE CHANNEL BOARD - LAYOUT D8923/3

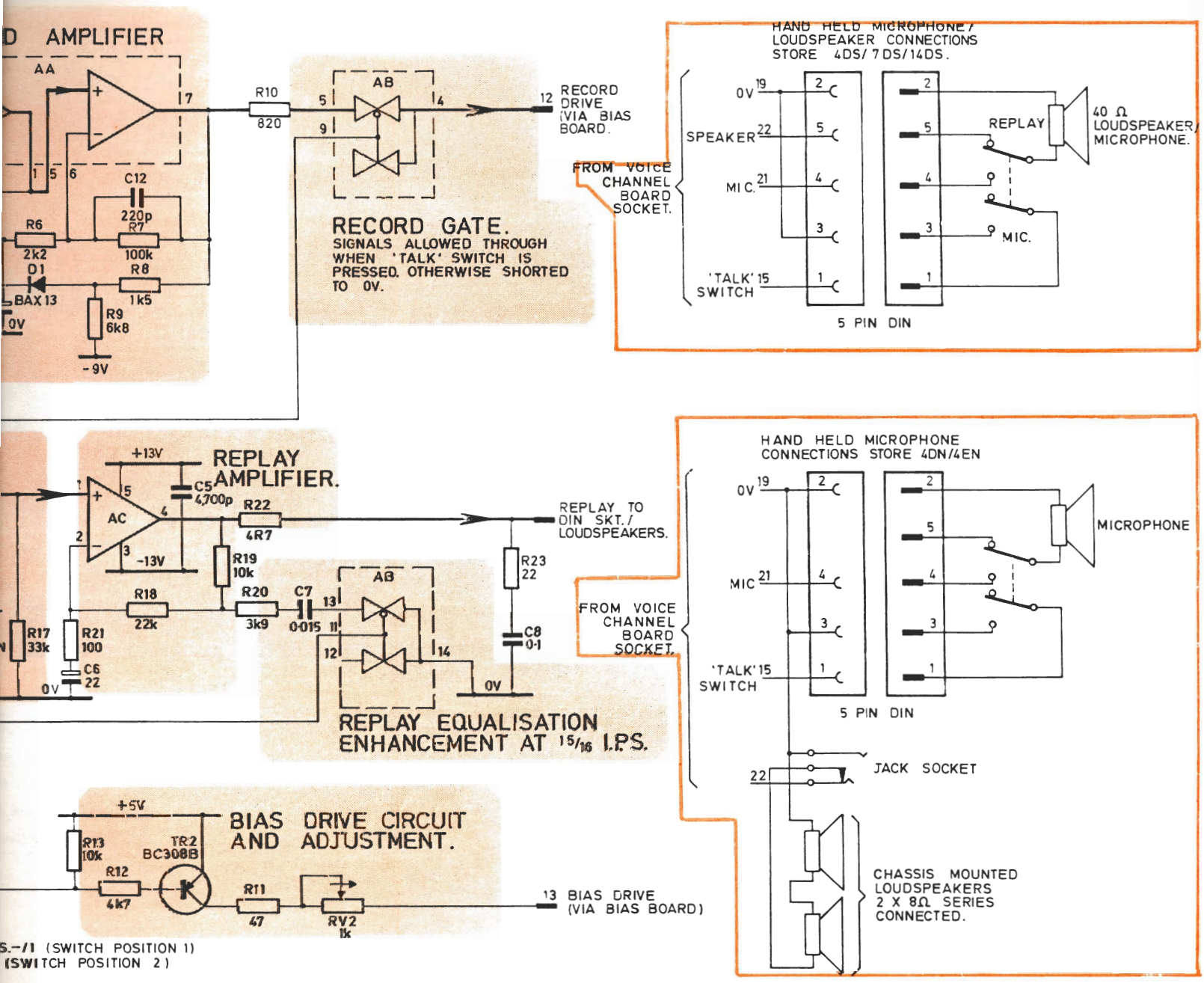


* S1 POSITIONS

1,6 FOR STORE 4DS/7DS/14DS.-/1 (SWITCH POSITION 1)
3,4 FOR STORE 4DN/4EN.-/2 (SWITCH POSITION 2)

THIS BOARD IS A DIRECT REPLACEMENT FOR D.7710/1/2
NSN 5835-99-537-8210.

DESIGNATION	INTEGRATED CIRCUIT	SUPPLY +13V	+9V	0V	-9V	-13V
AA	RC4558		8		4	
AB	CD4053			6	7	
AC	TDA2030	5				3



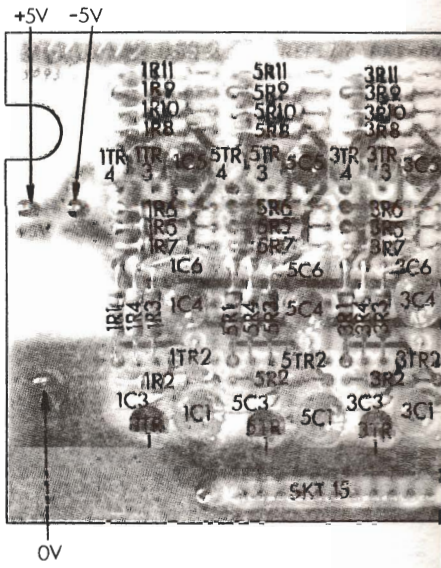
DESIGNATION	INTEGRATED CIRCUIT	SUPPLY +13V	+9V	0V	-9V	-13V
AA	RC4558		8		4	
AB	CD4053			6	7	
AC	TDA2030	5				3

FIG. 19

VOICE CHANNEL BOARD D8923/3

CIRCUIT REF.	VALUE	TOL	RATING	MFRS. REF. NO.
	STORE 4DS REPLAY PREAMPLIFIER			D8421/1
Capacitors				
1C1-4C1 1C4-4C4	220 µF	20%	3V	C160221
1C3-4C3	.0047µF	10%	100V	Cat 13647
1C5-4C5	100 µF	20%	10V	C162101
1C6-4C6	220 pF	2%	63V	Cat 10357
C7,8	33 µF	20%	16V	C163330
C9,10	47 µF	20%	10V	C162470
Resistors				
1R1-4R1	12k	5%	¼ W	R10123
1R2-4R2	22Ω	5%	¼ W	R10220
1R3-4R3	10k	2%	¼ W	Cat 11511
1R4-4R4	1M5	5%	¼ W	R10155
1R5-4R5	270Ω	5%	¼ W	R10271
1R6-4R6 1R9-4R9	2k2	5%	¼ W	R10222
1R7-4R7 1R8-4R8	1k5	5%	¼ W	R10152
1R10-4R10	1k8	5%	¼ W	R10182
1R11-4R11	100Ω	5%	¼ W	R10101
Sockets				
SKT7 SKT15 2 off	14 pin D.I.L. Connector contact strip Guide pins			Cat 12782 Cat 13087 Cat 11652
Terminal Assembly				
3 off				Cat 13747
Transistors				
1TR1-4TR1	2N4403			Cat 13970
1TR2-2TR2	ZTX384C			Cat 13630
1TR3-4TR3	ZTX213BK			Cat 13972
1TR4-4TR4	ZTX238BK			Cat 13973
Voltage Regulators				
AA	LM309H		(+5V)	Cat 13223
AB	LM320H		(-5V)	Cat 12649

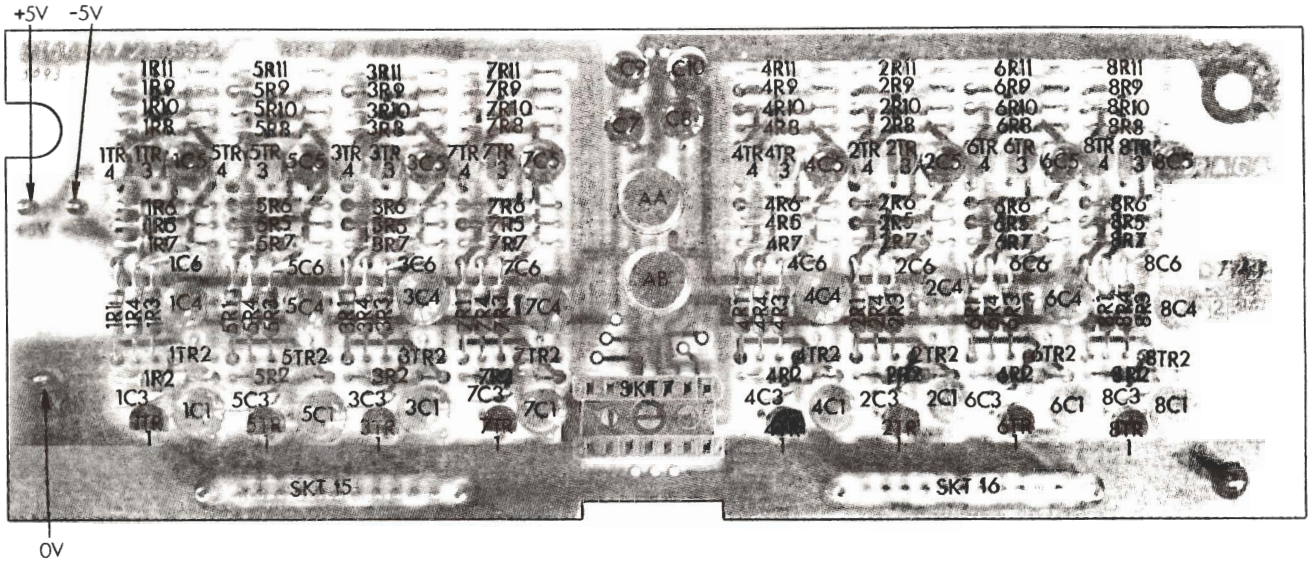
CIRCUIT REF.	VALUE	TOL	RATING	MFRS. REF. NO.
	STORE 7DS REPLAY PREAMPLIFIER			D8421/2
Capacitors				
1C1-8C1 1C4-8C4	220 µF	20%	3V	C160221
1C3-8C3	.01 µF	10%	100V	Cat 13787
1C5-8C5	100 µF	20%	10V	C162101
1C6-8C6	220 pF	2%	63V	Cat 10357
C7,8	33 µF	20%	16V	C163330
C9,10	47 µF	20%	10V	C162470
Resistors				
1R1-8R1	12k	5%	¼ W	R10123
1R2-8R2	22Ω	5%	¼ W	R10220
1R3-8R3	10k	2%	¼ W	Cat 11511
1R4-8R4	470k	5%	¼ W	R10474
1R5-8R5	270Ω	5%	¼ W	R10271
1R6-8R6 1R9-8R9	2k2	5%	¼ W	R10222
1R7-8R7 1R8-8R8	1k5	5%	¼ W	R10152
1R10 - 8R10	1k8	5%	¼ W	R10182
1R11-8R11	100Ω	5%	¼ W	R10101
Sockets				
SKT7 SKT15, 16 4 off	14 pin D.I.L. Connector contact strip Guide pins			Cat 12782 Cat 13087 Cat 11652
Terminal Assembly				
4 off				Cat 13747
Transistors				
1TR1-8TR1	2N4403			Cat 13970
1TR2-8TR2	ZTX384C			Cat 13630
1TR3-8TR3	ZTX213BK			Cat 13972
1TR4-8TR4	ZTX238BK			Cat 13973
Voltage Regulators				
AA	LM309H		(+5V)	Cat 13223
AB	LM320H		(-5V)	Cat 12649



The Store 7
Store 4DSee
above, but
of the board
1,2,3,4 res

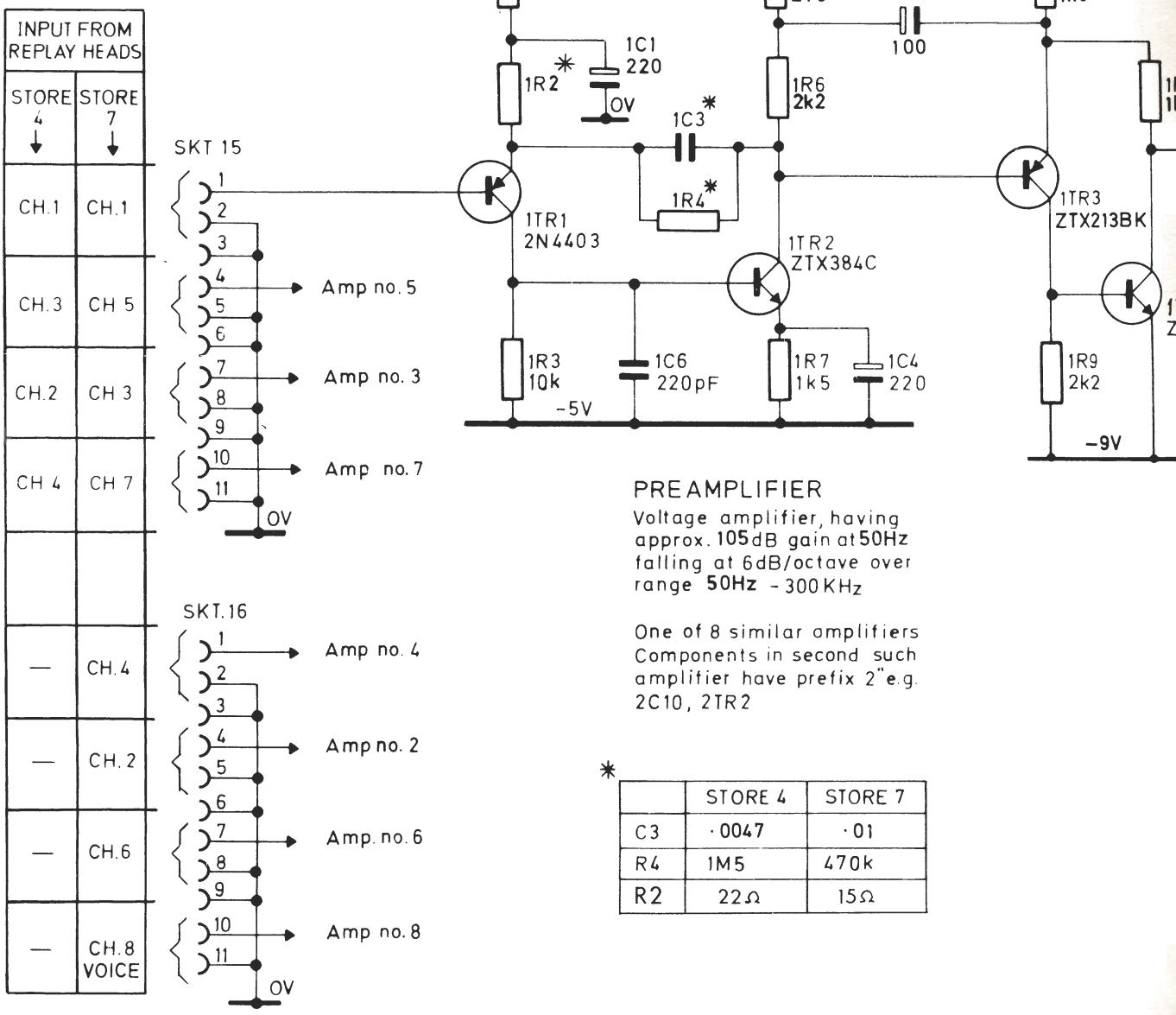
FIG. 20 RE
D8

NG	MFRS. REF. NO.
	D8421/2
	C160221
V	Cat 13787
	C162101
	Cat 10357
	C163330
	C162470
	R10123
	R10220
	Cat 11511
	R10474
	R10271
	R10222
	R10152
	R10182
	R10101
	Cat 12782
	Cat 13087
	Cat 11652
	Cat 13747
	Cat 13970
	Cat 13630
	Cat 13972
	Cat 13973
5V)	Cat 13223
-5V)	Cat 12649



The Store 7DSpreamplifier (D8421/2) is illustrated above. On Store 4DSequipments D8421/1 is used. This is the same as above, but channels 2, 4, 6, 8 (components on the right hand side of the board) are omitted. Channels 1, 3, 5, 7 are re-numbered 1, 2, 3, 4 respectively.

FIG. 20 REPLAY PREAMPLIFIER BOARD - LAYOUT D8421/1 D8421/2



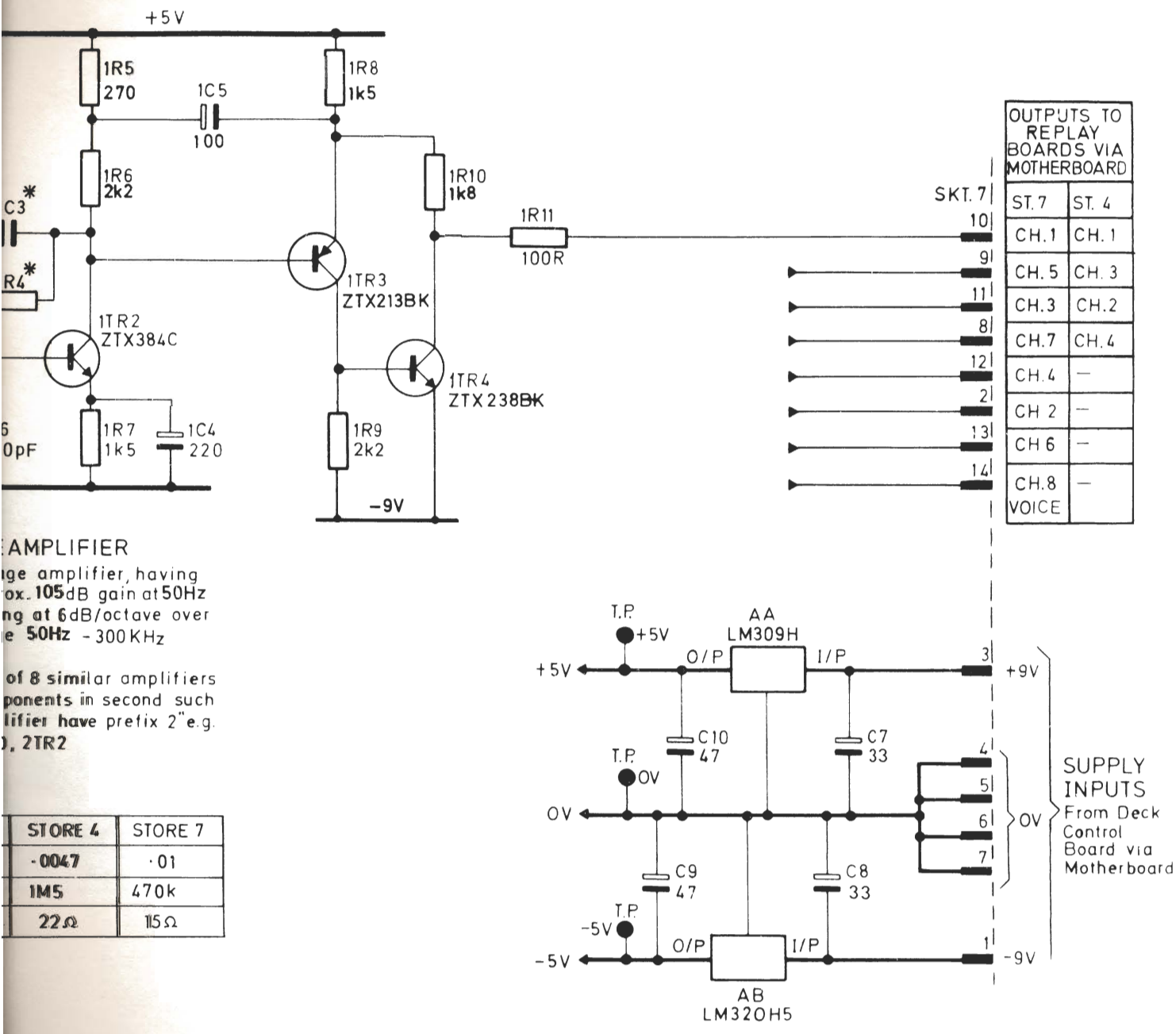
PREAMPLIFIER

Voltage amplifier, having approx. 105dB gain at 50Hz falling at 6dB/octave over range 50Hz - 300KHz

One of 8 similar amplifiers Components in second such amplifier have prefix 2" e.g. 2C10, 2TR2

*

	STORE 4	STORE 7
C3	·0047	·01
R4	1M5	470k
R2	22Ω	15Ω



AMPLIFIER

ige amplifier, having
ox. 105dB gain at 50Hz
ng at 6dB/octave over
e 50Hz - 300KHz

of 8 similar amplifiers
ponents in second such
lifier have prefix 2" e.g.
), 2TR2

	STORE 4	STORE 7
	·0047	·01
	1M5	470k
	22Ω	115Ω

STORE 4 D8421-1 (4 CHANNELS)
STORE 7 D8421-2 (8 CHANNELS)

FIG. 21
REPLAY PREAMPLIFIER BOARD - CIRCUIT

CIRCUIT REF.	VALUE	TOL	RATING	MFRS. REF. NO.
	STORE 4DS			
	BIAS OSCILLATOR			D7732/1 D7732/2
Capacitors				
1C1 - 4C1	10µF	20%	10V	Cat 13435
1C2 - 4C2, 1C4 - 4C4	100pF	2%	63V	Cat 10476
1C3 - 4C3	150pF	2%	63V	Cat 13645
1C5 - 4C5	10pF	2%	63V	Cat 12030
C7,8	33µF	20%	16V	C163330
Choke				
1L1 - 4L1	100µH	Toko		Cat 426
Connector				
SKT63	Contact strip - 8 way			Cat 13883
	Guide pins (2 off)			Cat 11652
Diodes *				
1D1 - 4D1, D5 - D8	BAX 13			Cat 8406
DZ1,DZ2	Zener Diode ZF33B			Cat 13979
Integrated Circuits				
AA,AC	SN7437N			Cat 13526
AB	SN7474N			Cat 9789
Relay *				
RLA	RS5		5V	Cat 13363
Resistors				
1R1 - 4R1, 1R3 - 4R3	100Ω	5%	⅓W	Cat 8901
1R2 - 4R2	220Ω	5%	⅓W	Cat 8889
1R4 - 4R4, R7,8,9	1k	5%	¼W	Cat 8888
1R5 - 4R5	10Ω	5%	⅓W	Cat 8899
R10	47k	5%	⅓W	Cat 8891
R11,21	3k9	5%	⅓W	Cat 8908
R12	22k	5%	⅓W	Cat 8881
R13,17	47Ω	5%	⅓W	Cat 8914
R14,18	68Ω	5%	⅓W	Cat 9972
R15,16	120Ω	5%	⅓W	Cat 9546
R19	22Ω	5%	3W	Cat 12374
R20	1Ω	5%	⅓W	Cat 14170
Sockets				
SKT17,18	14pin	D.I.L.		Cat 12782
Terminals				
10 off	Vero 22436			Cat 13747

CIRCUIT REF.	VALUE	TOL	RATING	MFRS. REF. NO.
	STORE 4DS			
	BIAS OSCILLATOR			D7732/1 D7732/2
Transformers				
1T1 - 4T1	Toko			Cat 13839
T2				D7705
Transistors				
1TR1 - 4TR1, 1TR2 - 4TR2	2N3906			Cat 13625
TR4	BC237B			Cat 11978
TR5,6	ZTX 550			Cat 13629

* D8 and RLA are fitted on D7732/2 boards only.

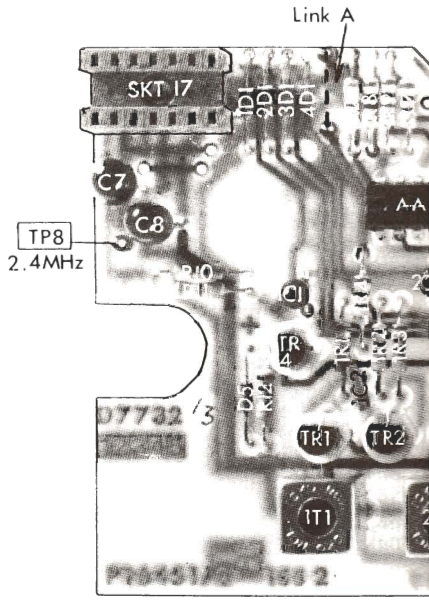


FIG. 22

Store 4DS
January 1982

TOL	RATING	MFRS. REF. NO.
4DS		
OSCILLATOR		D7732/1 D7732/2
		Cat 13839 D7705
		Cat 13625
		Cat 11978 Cat 13629
on D7732/2 boards only.		

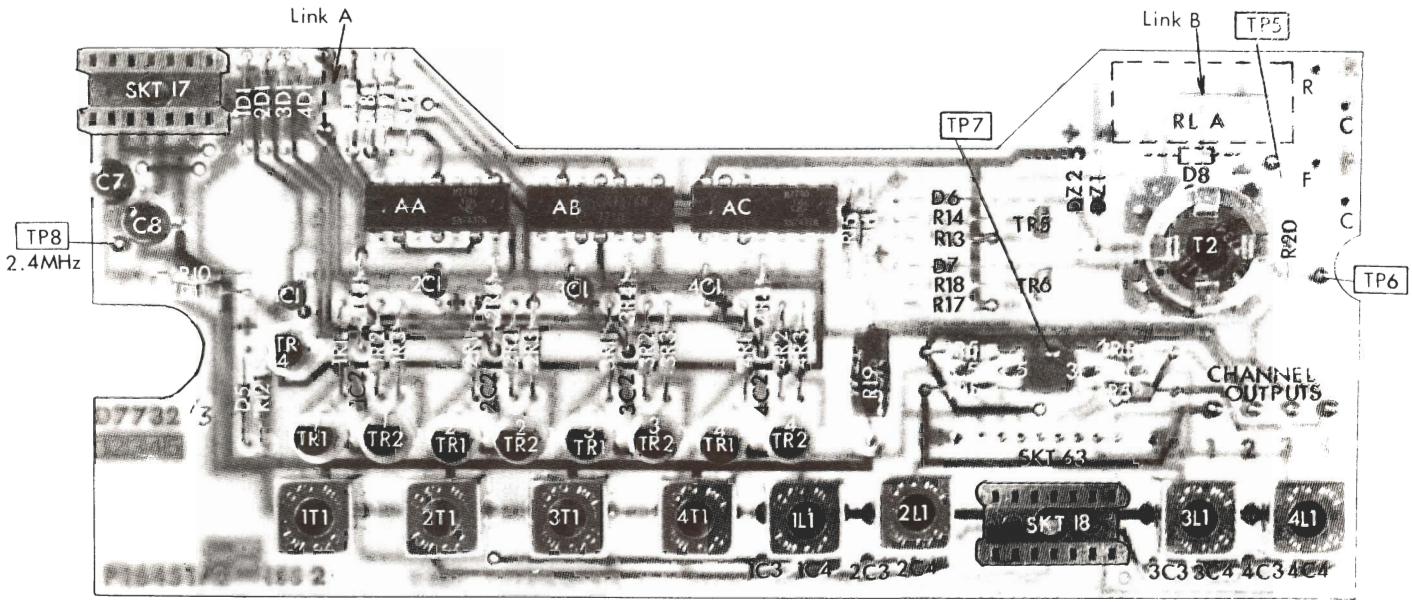
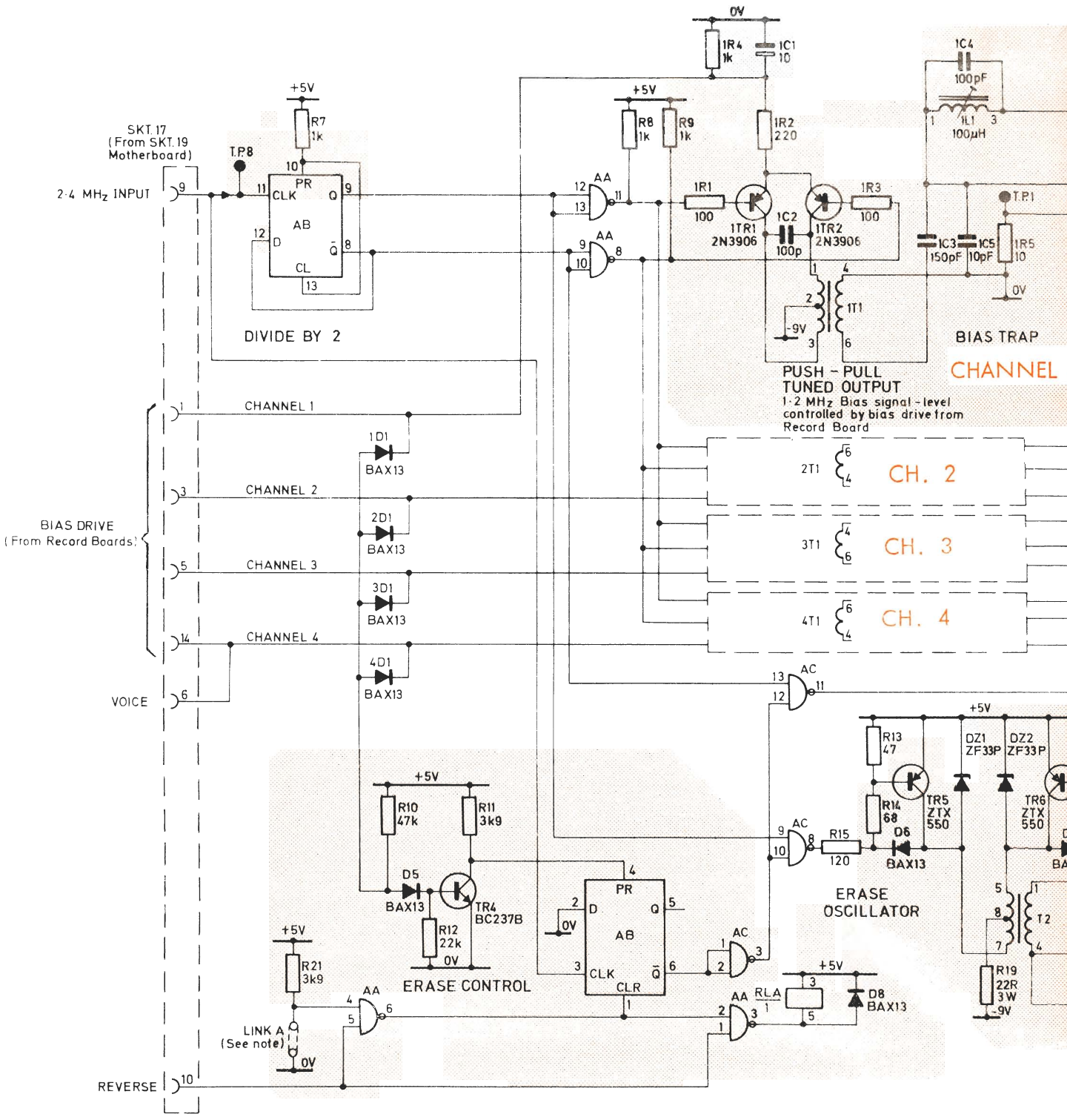


FIG. 22 BIAS OSCILLATOR BOARD - LAYOUT D7732


SKT.17
(From SKT.19
Motherboard)
2·4 MHz INPUT
T.P.8
+5V
R7
1k
PR
CLK
AB
D
CL
Q
DIVIDE BY 2
0V
1R4
1k
1C1
10
R8
1k
R9
1k
1R2
220
1C4
100pF
1L1
100µH
AA
1R1
100
1TR1
2N3906
1C2
100p
1TR2
2N3906
1R3
100
1C3
150pF
1C5
10pF
1R5
10
T.P.1
1T1
-9V
BIAS TRAP
PUSH - PULL
TUNED OUTPUT
1·2 MHz Bias signal - level
controlled by bias drive from
Record Board
CHANNEL
BIAS DRIVE
(From Record Boards)
CHANNEL 1
CHANNEL 2
CHANNEL 3
CHANNEL 4
VOICE
REVERSE
1D1
2D1
3D1
4D1
BAX13
2T1
3T1
4T1
CH. 2
CH. 3
CH. 4
AC
R13
47
DZ1
ZF33P
DZ2
ZF33P
TR5
ZTX
550
TR6
ZTX
550
R14
68
D6
R15
120
ERASE
OSCILLATOR
T2
R19
22R
3W
R10
47k
R11
3k9
D5
TR4
BC237B
R12
22k
ERASE CONTROL
R21
3k9
LINK A
(See note)
RLA
D8
Store 4DS
January 1982

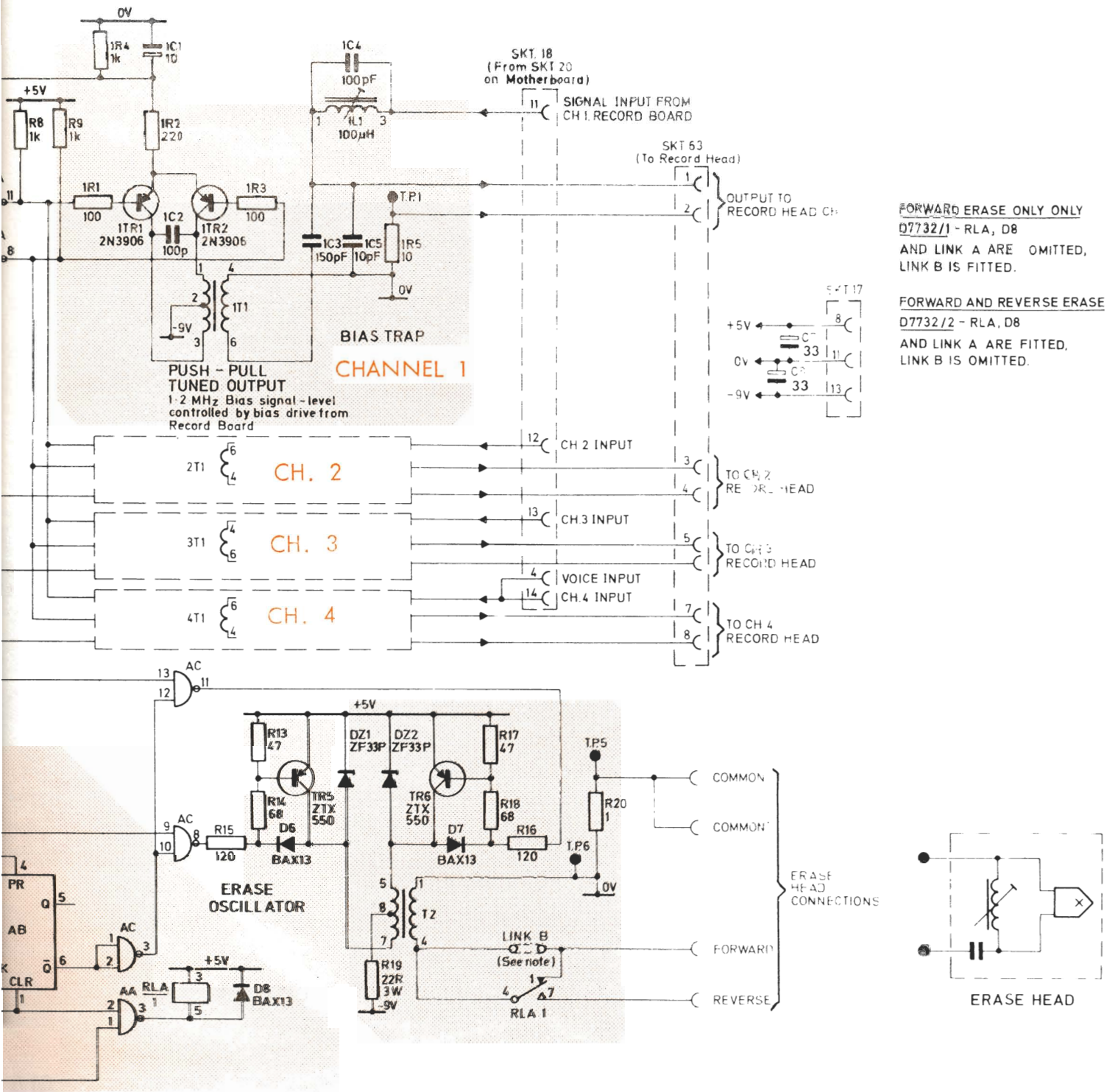


FIG. 23
BIAS OSCILLATOR BOARD - CIRCUIT

Store 4DS
January 1982

CIRCUIT REF.	VALUE	TOL	RATING	MFRS. REF. NO.
	STORE 7 D.S. BIAS OSCILLATOR			D7733
Capacitors				
C6,7	33μF	20%	16 V	C163330
1C1 - 8C1, 1C3 - 8C3	100pF	2%	63 V	Cat 10476
1C2 - 8C2	150pF	2%	63 V	Cat 13645
1C4 - 8C4	10pF	2%	63 V	Cat 12030
1C5 - 8C5	10μF	20%	10 V	Cat 13435
Chokes				
1L1 - 8L1	100μH	TOKO		Cat 426
Diodes				
1D1 - 7D1, D2	BAX 13			Cat 8406
Holders				
45 off	Holders - component			Cat 14111
Integrated Circuits				
AA	SN7474N			Cat 9789
AB	SN7437N			Cat 13526
Resistors				
1R1 - 8R1, R6,7,8	1k	5%	⅓W	Cat 8888
1R2 - 8R2, 1R4 - 8R4	100Ω	5%	⅓W	Cat 8901
1R3 - 8R3	220Ω	5%	⅓W	Cat 8889
1R5 - 8R5	10Ω	5%	⅓W	Cat 8899
R9	3k9	5%	⅓W	Cat 8908
R10	47k	5%	⅓W	Cat 8891
R11	22k	5%	⅓W	Cat 8881
Sockets				
SKT17,18	14 pin D.I.L.			Cat 12782
SKT63,64	Connector contact strip (8 way)			Cat 13883
	Guide pins			Cat 11652
Terminal Assemblies				
10 off	Vero 22436			Cat 13747

CIRCUIT REF.	VALUE	TOL	RATING	MFRS. REF. NO.
	STORE 7 D.S. BIAS OSCILLATOR (Contd)			D7733
Transformers				
1T1 - 8T1	TOKO			Cat 13839
Transistors				
1TR1 - 8TR1, 1TR2 - 8TR2	2N3906			Cat 13625
TR3	BC237B			Cat 11978

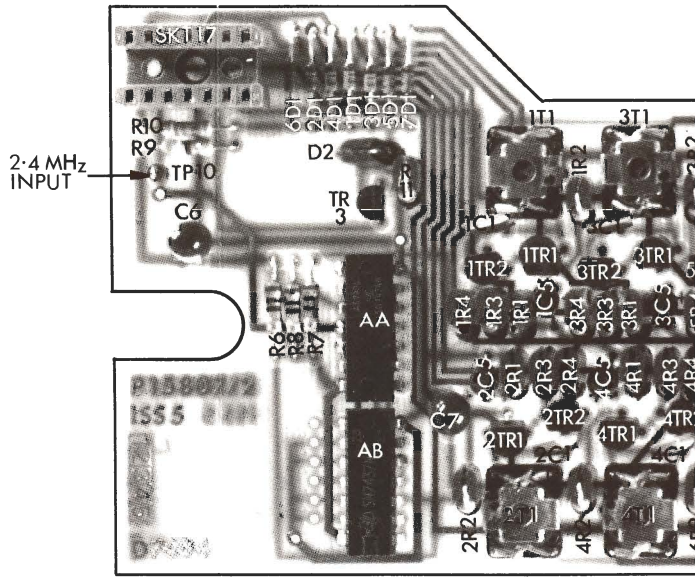


FIG. 24

Store 7DS
Fourteenth Edition

	RATING	MFRS. REF. NO.
S.		
ATOR (Contd)		D7733
		Cat 13839
		Cat 13625
		Cat 11978

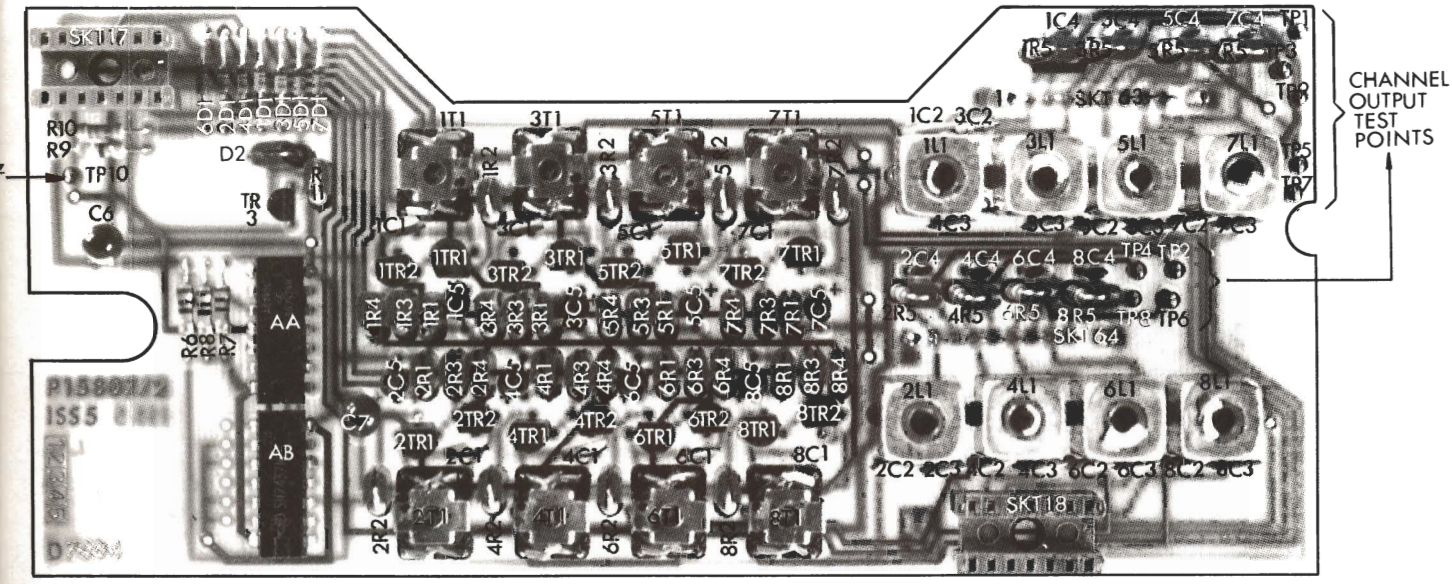
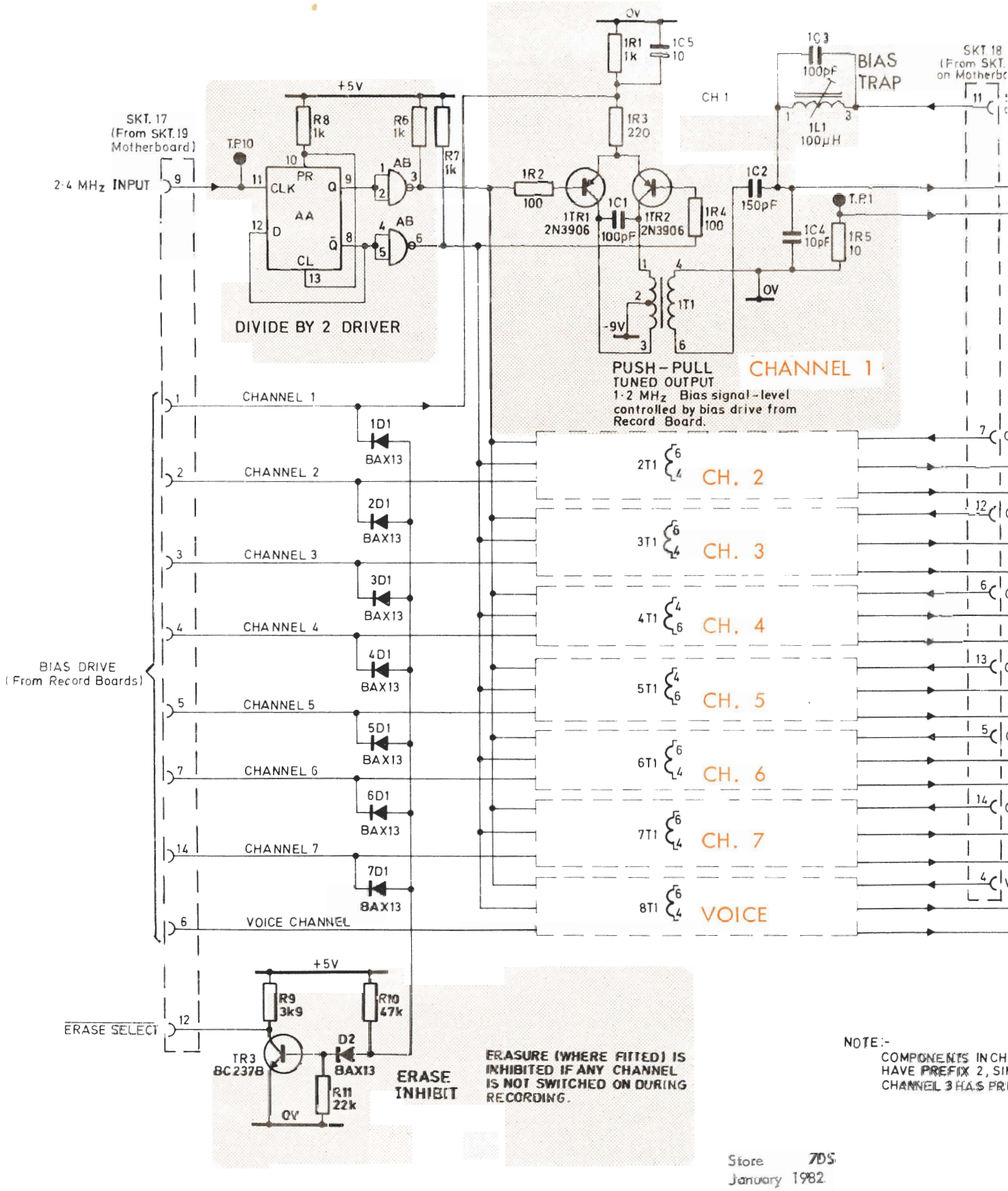
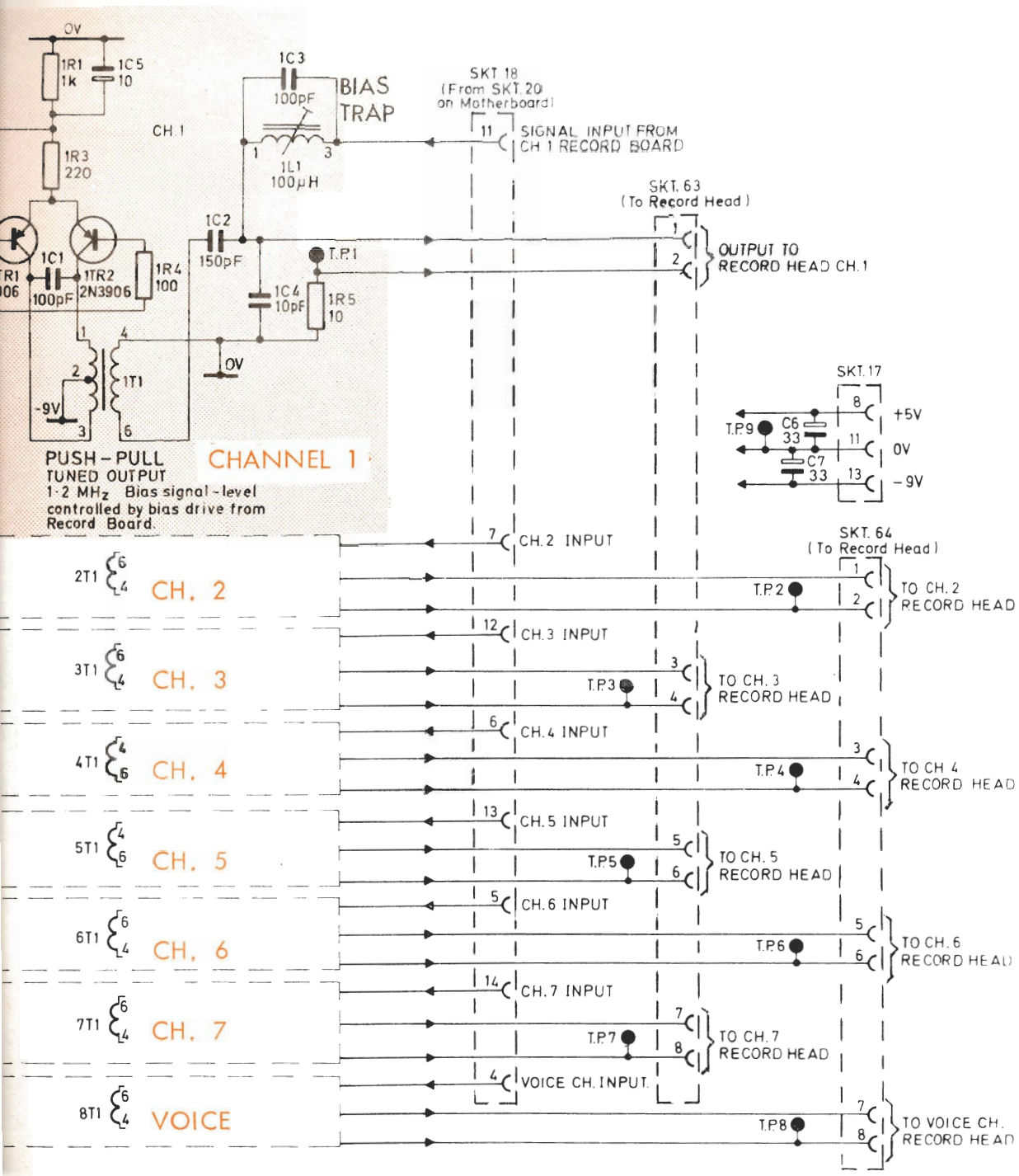


FIG. 24 BIAS OSCILLATOR BOARD - LAYOUT D7733



Store 7DS
January 1982.



NOTE:-
COMPONENTS IN CHANNEL 2 HAVE PREFIX 2, SIMILARLY CHANNEL 3 HAS PREFIX 3 etc.

FIG.25
BIAS OSCILLATOR BOARD - CIRCUIT

HERE FITTED) IS ANY CHANNEL CHED ON DURING

Store 7DS
January 1982

CIRCUIT REF.	VALUE	TOL	RATING	MFRS. REF. NO.
	METER ASSEMBLY			D7679
1 off	Meter			P14281
S1	Switch, 2 pole c/o Plessey 82121			Cat 12122
1 off	Meter Amplifier Assembly			D7676
	METER AMPLIFIER ASSEMBLY			D7676
Capacitors				
C1, 2	33µF	20%	16V	C 163330
C3	100pF	2%	63V	Cat 10476
C4, 5	0.1µF	5%	100V	Cat 13719
Diodes				
D1 - 4	Mullard BAX 13			Cat 8406
Integrated Circuits				
AA	National LM310H			Cat 11401
AB	Transistor array - CA3046			Cat 9650
Potentiometers				
RV1, 3	2k2 Bourns VA05H			Cat 13844
RV2, 4	1k Bourns VA05V			Cat 11938

CIRCUIT REF.	VALUE	TOL	RATING	MFRS. REF. NO.
	METER AMPLIFIER ASSEMBLY (Contd)			D7676
Resistors				
R1, 8	10k	5%	¼ W	R10103
R2 (4D/7D)	1M	5%	¼ W	R10105
R2 (4DN)	3M3	5%	¼ W	R10335
R3, 4	10Ω	5%	¼ W	R10100
R5, 11, 19, 21, 25	1k	5%	¼ W	R10102
R6, 16, 18	4k7	5%	¼ W	R10472
R9	510Ω	5%	¼ W	R10511
R10	270Ω	5%	¼ W	R10271
R12, 22	10M	5%	¼ W	R10106
R13, 23	6k8	5%	¼ W	R10682
R14, 24	1k8	5%	¼ W	R10182
R17	47k	5%	¼ W	R10473
R20	2k2	5%	¼ W	R10222
Socket				
SKT57	Contacts, Molex 2759, 4 off			Cat 14191
	Socket Housing Molex			Cat 12794
Transistors				
TR1, 3, 4, 6	Telefunken BC308B			Cat 11977
TR2, 5	Siliconix E112			Cat 10540
Terminal Assembly				
TP1, 2, 3	Vero 22436			Cat 13747

FIG

TOL.	RATING	MFRS. REF. NO.
PLIFIER ASSEMBLY (Contd)		D7676
5%	¼ W	R10103
5%	¼ W	R10105
5%	¼ W	R10335
5%	¼ W	R10100
5%	¼ W	R10102
5%	¼ W	R10472
5%	¼ W	R10511
5%	¼ W	R10271
5%	¼ W	R10106
5%	¼ W	R10682
5%	¼ W	R10182
5%	¼ W	R10473
5%	¼ W	R10222
Molex	2759, 4 off	Cat 14191
sing	Molex	Cat 12794
BC3088		Cat 11977
112		Cat 10540
		Cat 13747

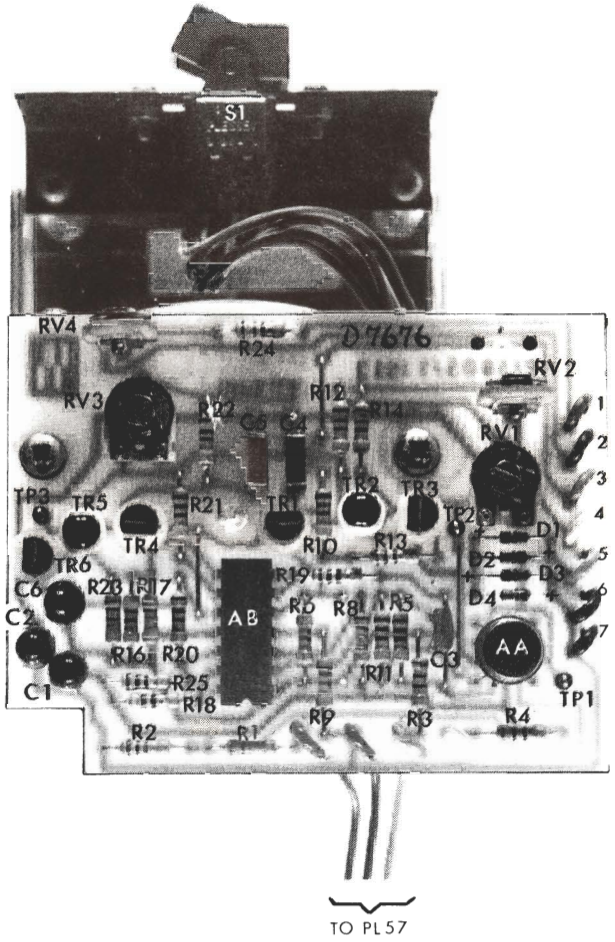
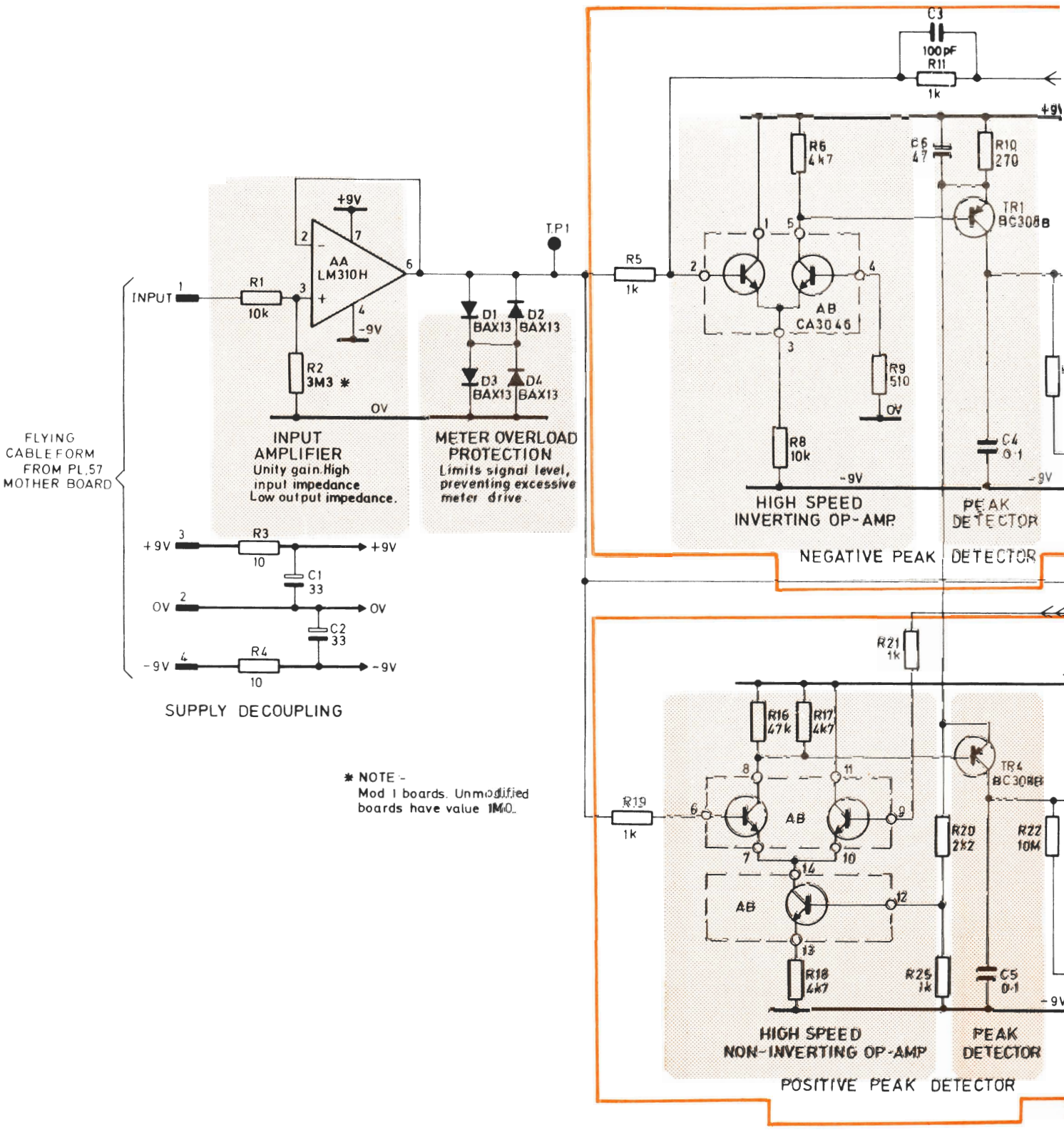


FIG. 26 METER ASSEMBLY D7679



* NOTE -
Mod 1 boards. Unmodified boards have value 1M0.

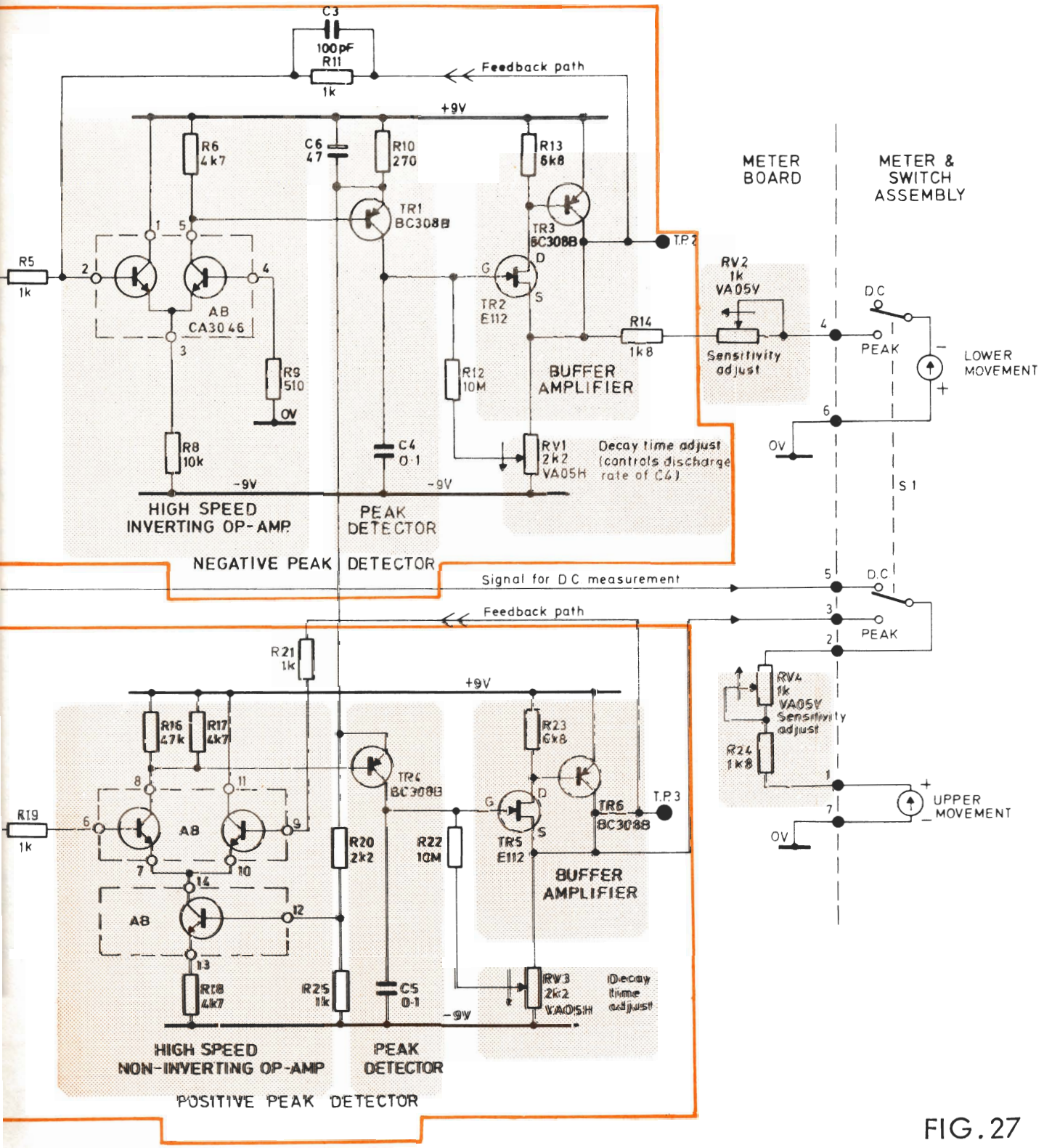
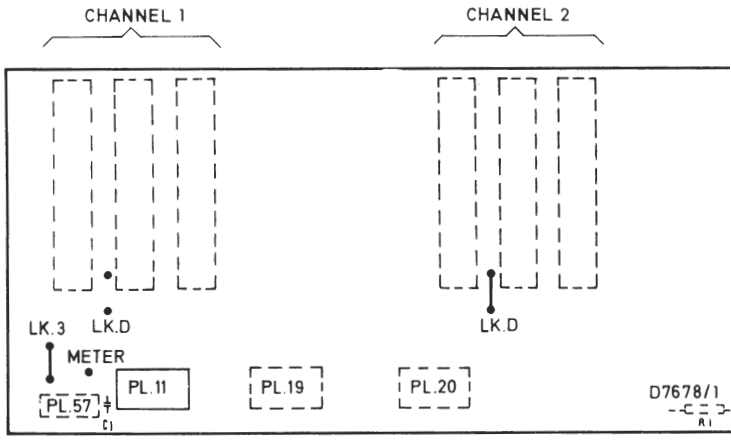


FIG. 27
METER ASSEMBLY - CIRCUIT

CIRCUIT REF.	VALUE	TOL	RATING	MFRS. REF. NO.
	MOTHERBOARD ASSEMBLY			
	STORE 4DS			D7678/1
	STORE 7DS			D7678/2
Cableform Connectors				
1 off	Cableform to PL11			D7755
1 off	Cableform to PL10			D7750
1 off	Cableform to PL9			D7747
1 off	Cableform to PL19			D7748
1 off	Cableform to PL20			D7749
Capacitor				
C1	1000pF	10%	100 V	Cat 12033
Connectors				
13 off (Store 4) 22 off (Store 7)	Connector, edge 23 +2 way Polarizing Key Spacer			Cat 14586 Cat 10028 P15620
Plugs				
PL57,59	Plug - 5 way Molex			Cat 14181
Resistor				
R1	820	5%	⅛ W	Cat 12308
Sockets				
SKT12,58	12 pin D.I.L.			Cat 12782
Terminals				
13 off 57 off	Vero 22436 Terminal pin TP11034			Cat 13747 Cat 14024

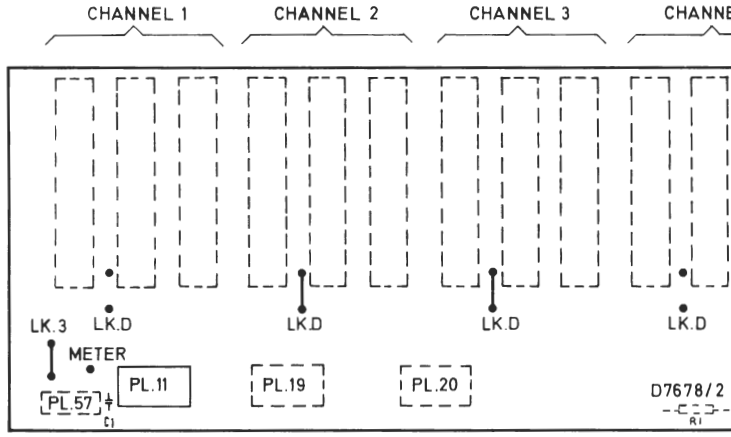
NOTE:

1. Link D selects the reference channel for flutter compensation. This is normally Channel 2 on Store 4DS, and channels 2 and 3 on Store 7DS.
2. Link F selects the reference channel for TAPE mode replay speed control. (Normally channel 2 on Store 4DS and channel 3 on Store 7DS).
3. Links 1,2 and 3 are correct for the equipment supplied and should not be altered.



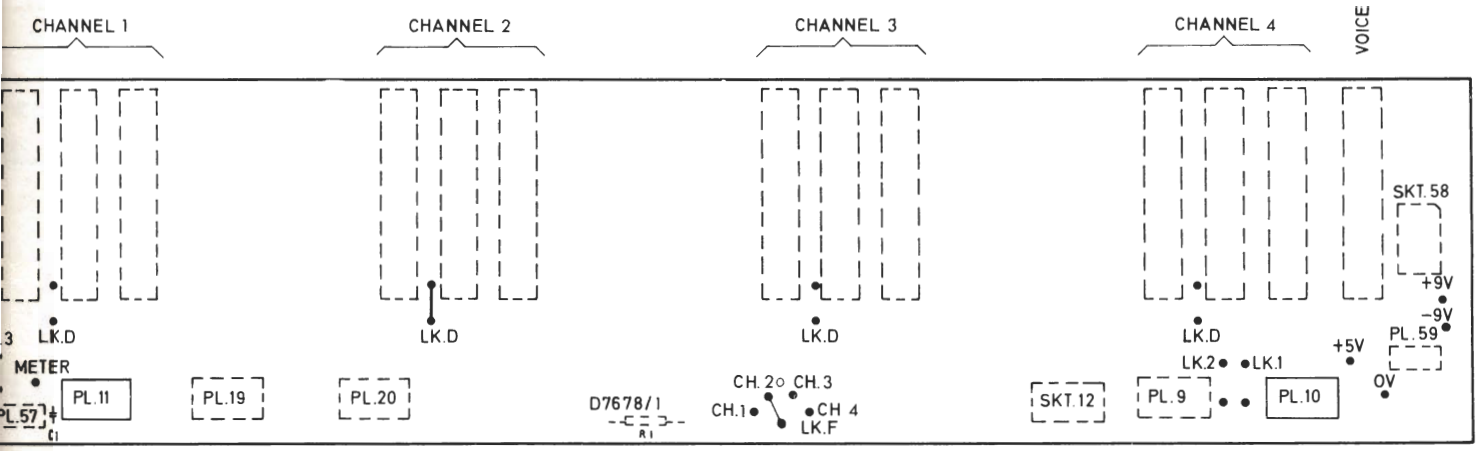
STORE 4

VIEW OF UNDERSIDE OF MOTHERBO
standing on its rear casting,



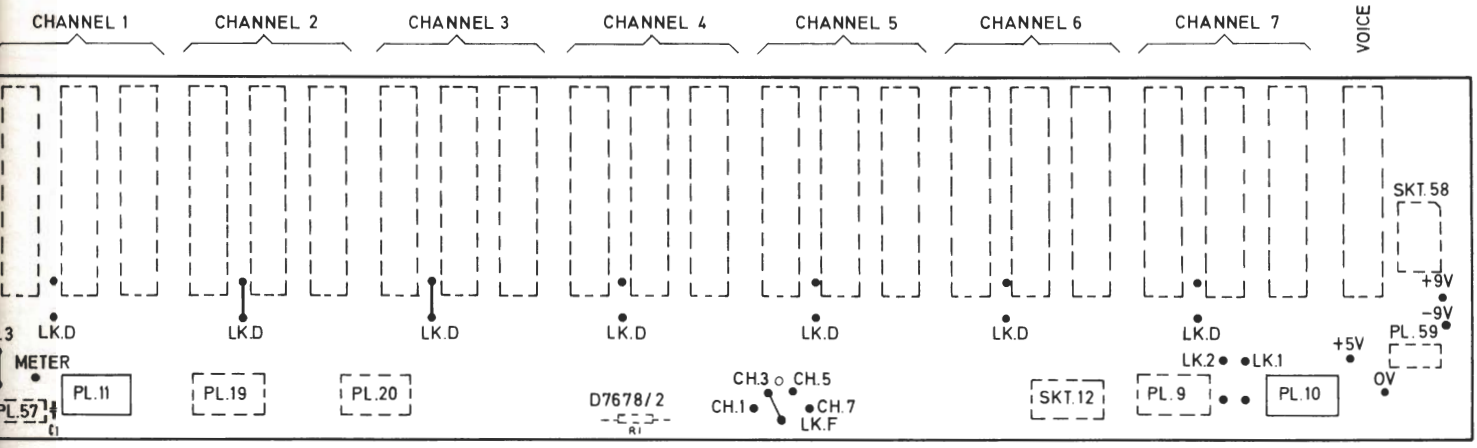
STORE 7

FIG.28



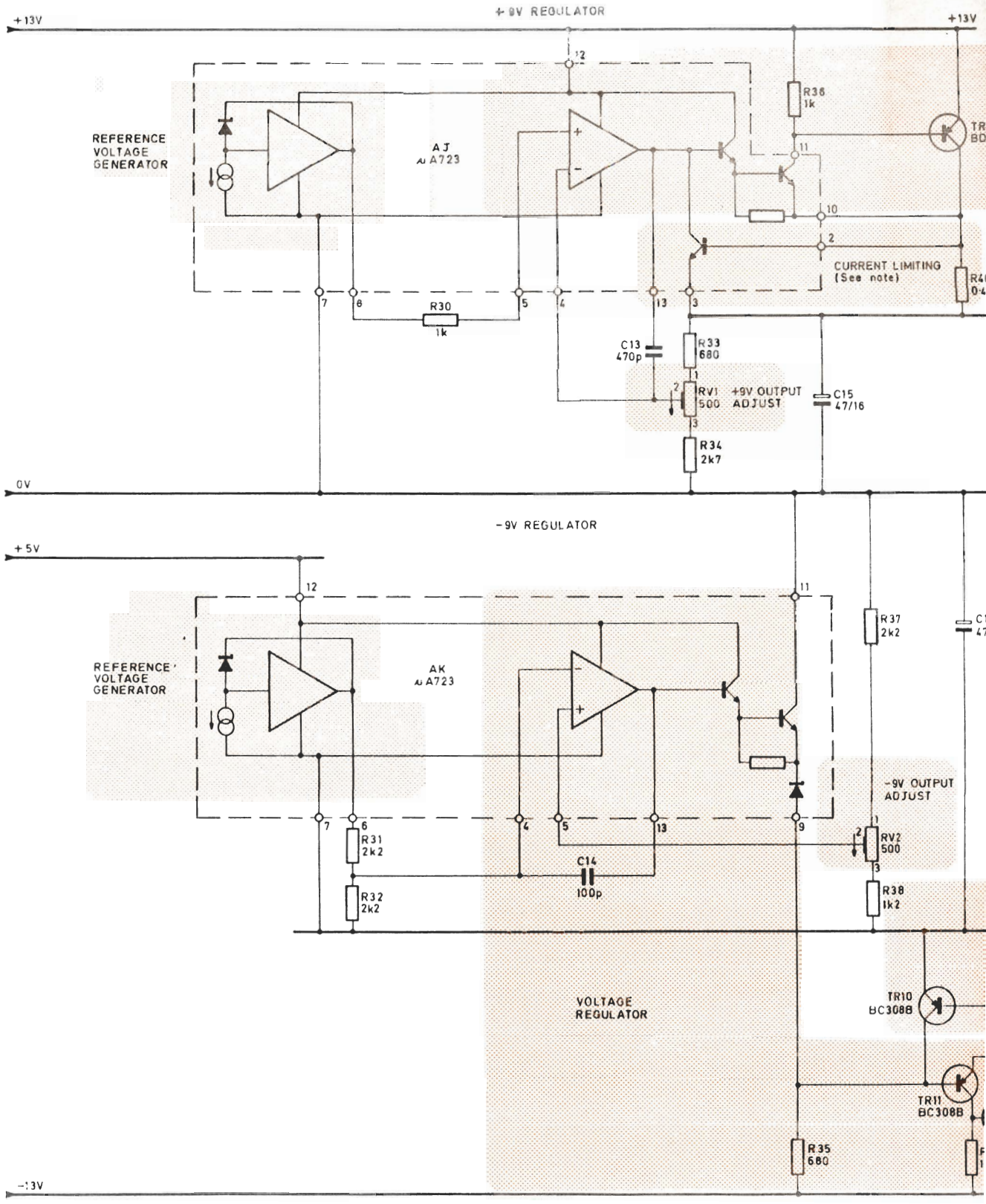
STORE 4DS MOTHERBOARD

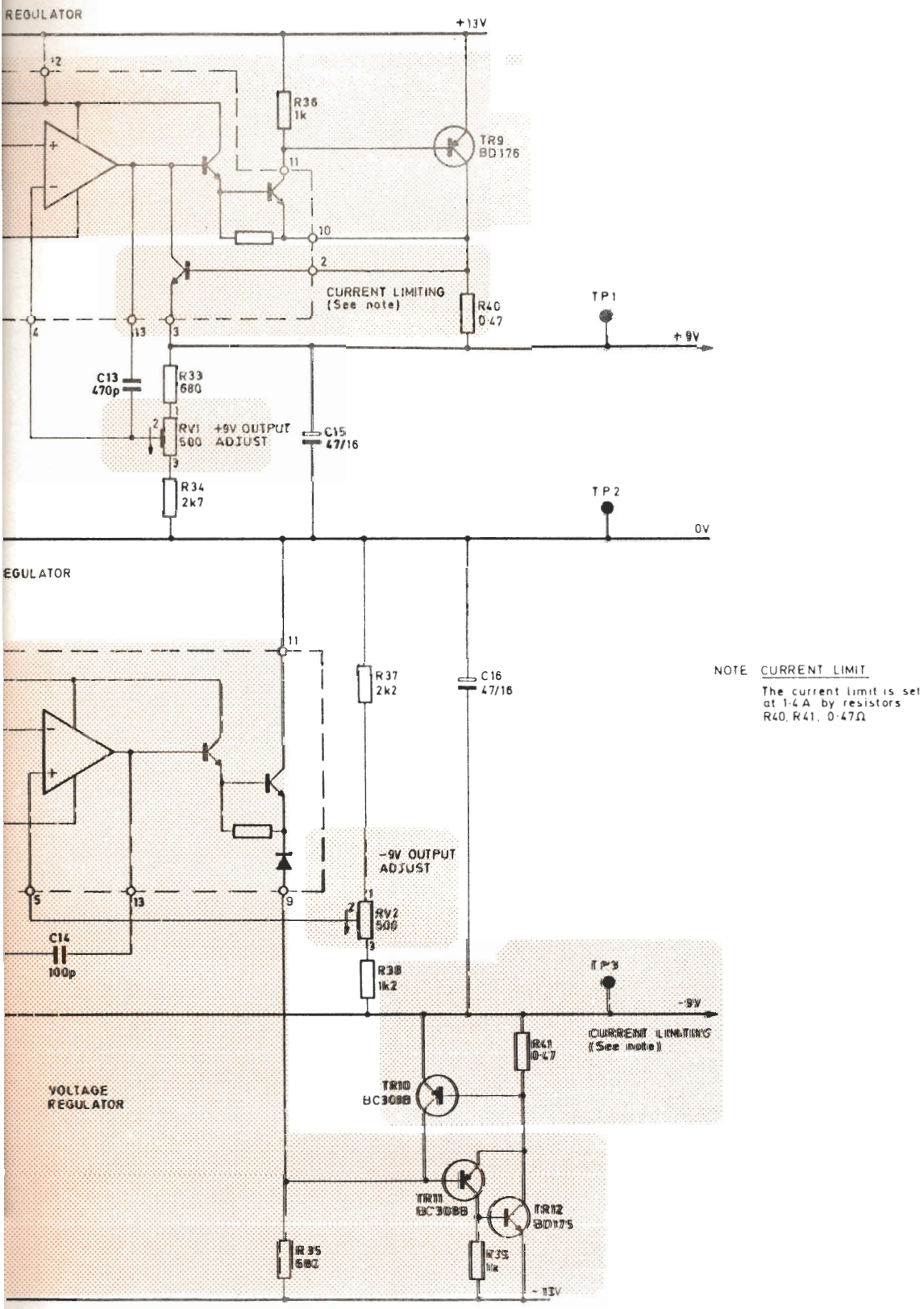
VIEW OF UNDERSIDE OF MOTHERBOARD — as seen when the equipment is standing on its rear casting, with the base cover removed.



STORE 7DS MOTHERBOARD

FIG.28 MOTHERBOARD - LAYOUT (For circuits, see Fig. 47 and 51)


+9V REGULATOR
+13V
+13V
REFERENCE VOLTAGE GENERATOR
AJ
≈ A723
R36
1k
CURRENT LIMITING
(See note)
R30
1k
C13
470p
R33
680
RV1
500
+9V OUTPUT ADJUST
C15
47/16
R34
2k7
0V
-9V REGULATOR
+5V
REFERENCE VOLTAGE GENERATOR
AK
≈ A723
R37
2k2
-9V OUTPUT ADJUST
RV2
500
R31
2k2
C14
100p
R32
2k2
R38
1k2
VOLTAGE REGULATOR
TR10
BC308B
TR11
BC308B
R35
680
-13V



NOTE CURRENT LIMIT

The current limit is set at 1·4 A by resistors R40, R41, 0·47Ω

FIG. 29

9 VOLT REGULATORS - CIRCUIT

(Part of Deck Control Board)

(See Fig. 30 for Layout)

CIRCUIT REF.	VALUE	TOL	RATING	MFRS. REF. NO.
	DECK CONTROL BOARD (including 9V Regulators)			D8901
Capacitors				
C1,6,15,16	47µF	20%	10V	C162470
C2,3	0.1µF	10%	100V	Cat 13431
C4,5	100µF	20%	25V	Cat 14431
C7,8,9,10, 11,12	0.47µF	20%	35V	C166478
C13	470pF	10%	100V	28738-159-00
C14	100pF	2%	63V	28738-125-02
Diodes				
D1	BAX13			Cat 8406
DZ1	BZY88	C4V7		Cat 10122
Integrated Circuits				
AA	SN74LS00N			Cat 15077
AB,AC	SN74LS20N			Cat 16914
AD	SN74LS10N			Cat 15818
AE	SN74LS08N			Cat 15071
AF	SN74LS02N			Cat 15070
AG,AH	SN7416N			Cat 12098
AJ,AK	µA723			Cat 12099
Plugs				
PL78	14 way Molex			Cat 14951
PL79	3 way Molex			Cat 14498
Potentiometers				
RV1,2	500Ω Spectrol 43p			Cat 12409
Relay				
RLA	ITT, RS12			Cat 11841
Resistors				
R1	6k8	5%	¼W	R10682
R2	10k	5%	¼W	R10103
R3,24,25,26, 27,28,29	100	5%	¼W	R10101
R4,6,11	4k7	5%	¼W	R10472
R5,10,19,20, 21,22,23,30, 36,39	1k	5%	¼W	R10102

CIRCUIT REF.	VALUE	TOL	RATING	MFRS. REF. NO.
	DECK CONTROL BOARD (Contd) (including 9V Regulator)			D8901
R7	470 or 680 (To suit d.c. erase head)	5% 5%	¼W ¼W	R10471 R10681
R8,34,35	680	5%	¼W	R10681
R9	560	5%	¼W	R10561
R12,14,15, 16,17,18,31, 32,37	2k2	5%	¼W	R10222
R13,34	2k7	5%	¼W	R10272
R38	1k2	5%	¼W	R10122
R40	0.42Ω	10%	2½W	Cat 11501
Sockets				
SK1,2,3,80	14 pin	DIL		Cat 12782
Switches				
S1	Switch SDS2			Cat 15669
S2	Switch SDC1			Cat 15666
Terminals				
5 off	Terminal Assembly			Cat 13746
TS1	Terminal Faston			Cat 2678
Transistors				
TR1,13	ZTX 450			Cat 13628
TR2	ZTX 550			Cat 13629
TR3,4,5,6, 7,8	BC237 B			Cat 11978
TR9	BD176			Cat 12381
TR10,11	BC308B			Cat 11977
TR12	BD175			Cat 11980
	Transistor Heatsink			P14865
8 off	Transistor Mounting Pad			Cat 1179
3 off	Transistor Mounting Pad			Cat 11543

FIG. 30

TOL	RATING	MFRS. REF. NO.
TROL BOARD (Contd)		
9V Regulator)		D8901
%	¼ W	R10471
%	½ W	R10681
erase head)		
%	¼ W	R10681
%	½ W	R10561
%	½ W	R10222
%	¼ W	R10272
%	¼ W	R10122
0%	2½ W	Cat 11501
		Cat 12782
2		Cat 15669
1		Cat 15666
sembly		Cat 13746
ston		Cat 2678
		Cat 13628
		Cat 13629
		Cat 11978
		Cat 12381
		Cat 11977
		Cat 11980
leatsink		P14865
Mounting Pad		Cat 1179
Mounting Pad		Cat 11543

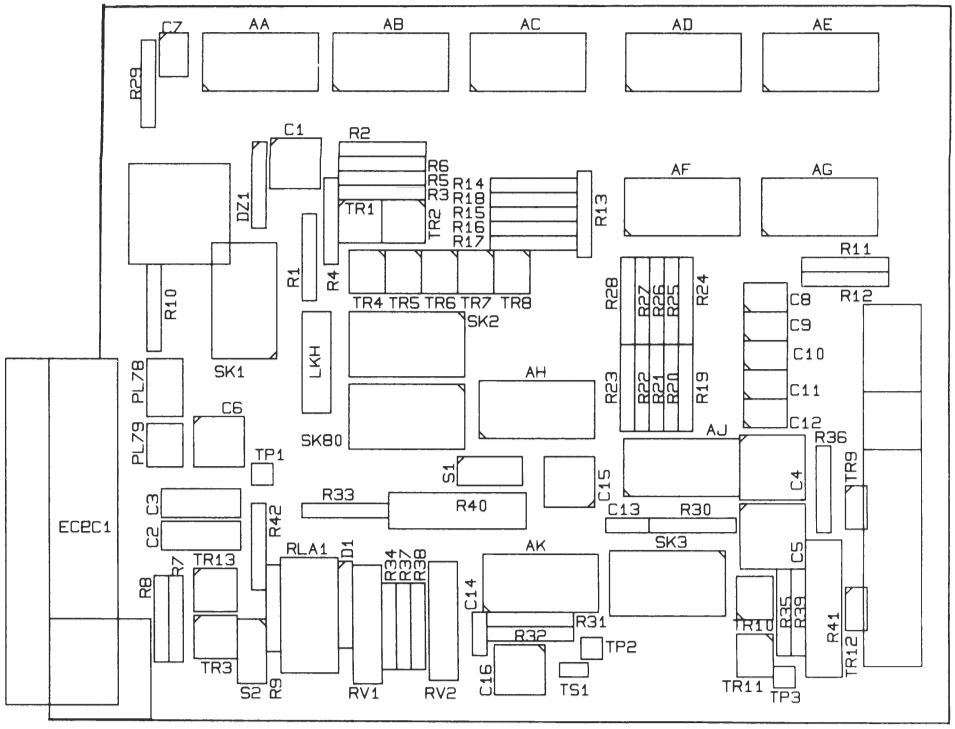
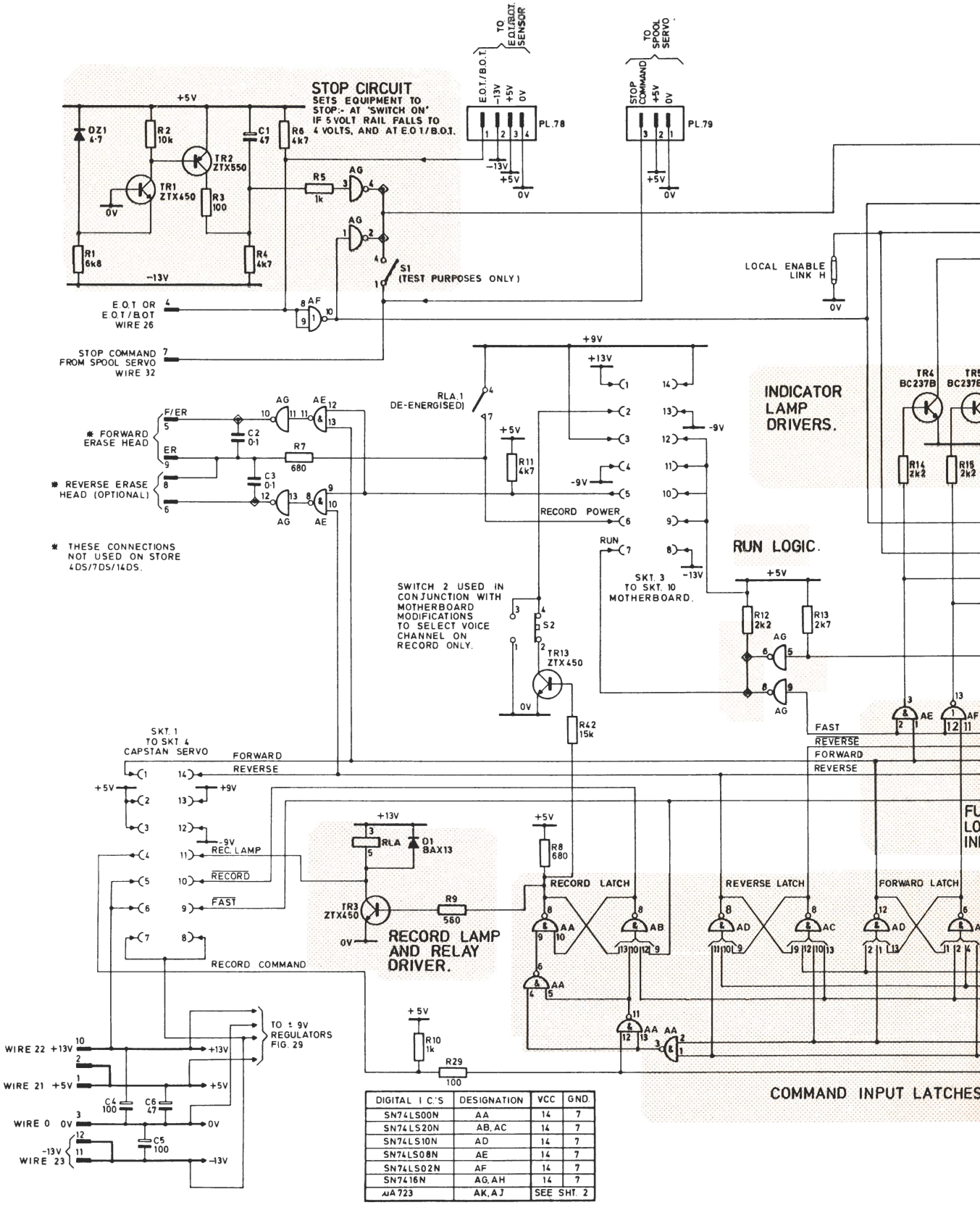


FIG. 30 DECK CONTROL BOARD - LAYOUT (Including 9 Volt Regulators) D8901

Store 4DS/7DS
January 1982



DIGITAL I C'S	DESIGNATION	VCC	GND.
SN74LS00N	AA	14	7
SN74LS20N	AB, AC	14	7
SN74LS10N	AD	14	7
SN74LS08N	AE	14	7
SN74LS02N	AF	14	7
SN7416N	AG, AH	14	7
μA723	AK, AJ	SEE SHT. 2	

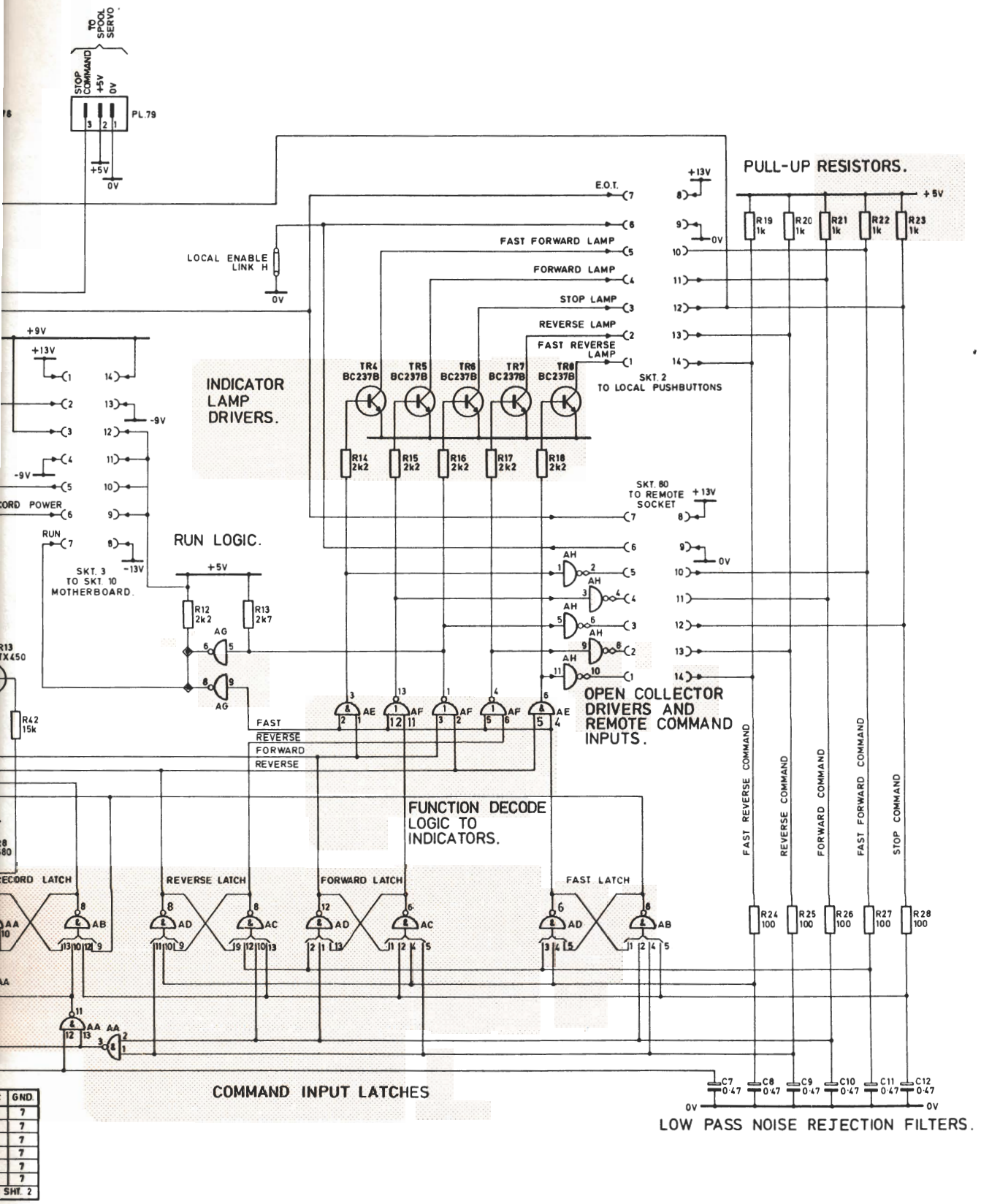


FIG.31
DECK CONTROL BOARD - CIRCUIT
(See Fig.29 for 9V Regulators)

CIRCUIT REF.	VALUE	TOL	RATING	MFRS. REF. NO.
	SPOOL SERVO P.C. BOARD			D6522
Capacitors				
C1	10μF	20%	10V	C162100
C2, 3, 6, 9, 11	1μF	10%	160V	Cat 13423
C4, 5	2.2μF	20%	35V	C166229
C8, 10	1000pF	10%	100V	Cat 12033
C12, 13, 18	47μF	20%	16V	C163470
C14, 15	0.1μF	10%	100V	Cat 13431
C16	33μF	20%	16V	C163330
C17	47μF	20%	10V	C162470
Chokes				
L1, 2	100μH	Plessey (ITT ref 58/10/0017/10)		Cat 11679
Diodes				
D1-5	Mullard BAX13			Cat 8406
D6-9	Telefunken BZ102 C1V4 or 2 off Mullard BAX 13			Cat 12648 Cat 8406
Diode Zener				
DZ1	Mullard BZY88 C5V6			Cat 2851
Integrated Circuits				
AA, AB, AC, AD, AE, AF, AG	Signetics μA741 (8 pin D.I.P.)			Cat 9796
Relay				
RLA	Thorn Bendix RS12			Cat 11841
Resistors				
R1	15Ω	5%	¼ W	R10150
R2	220Ω	5%	¼ W	R10221
R3, 4, 7	47k	2%	⅓ W	Cat 12633
R5	100k	2%	⅓ W	Cat 12379
R6	56k	2%	⅓ W	Cat 12634
R8, 31	15k	5%	¼ W	R10153
R9, 10, 25, 26	47k	5%	¼ W	R10473
R11	150Ω	5%	¼ W	R10151
R12	270Ω	5%	¼ W	R10271
R13, 14, 28, 29 36, 38, 39, 42, 51, 54	10k	5%	¼ W	R10103
R15, 22	2k2	5%	¼ W	R10222
R16, 43, 55	100k	5%	¼ W	R10104
R17	560Ω	5%	¼ W	R10561
R18, 33	6k8	5%	¼ W	R10682
R19	27k	5%	¼ W	R10273
R20, 24, 27	12k	5%	¼ W	R10123
R21, 23, 37, 44, 45, 48, 52, 56, 57, 60	4k7	5%	¼ W	Cat 10472

CIRCUIT REF.	VALUE	TOL	RATING	MFRS. REF. NO.
	SPOOL SERVO P.C. BOARD (Contd)			D6522
Resistors (Cont)				
R30	3k9	5%	¼ W	R10392
R32	2k7	5%	¼ W	R10272
R41, 53	1k5	5%	¼ W	R10152
R46, 47, 58, 59	330Ω	5%	¼ W	R10331
R49, 61	3.3Ω	5%	¼ W	R10339
R50, R62	0.1Ω	5%	3W	Cat 12623
R63, 64	1k	5%	¼ W	R10102
Socket				
SKT32	Cinch 133-51-92-005			Cat 12782
Transistors				
TR1	Telefunken BD175			Cat 11980
TR2, 6, 11	Telefunken BC237B			Cat 11978
TR3, 4, 12	Telefunken BC308B			Cat 11977
TR5, 10	Siliconix E112			Cat 10540
TR8, TR13	RCA TA8204			Cat 13640
TR9, 14	RCA TA8202			Cat 13639
Heatsink				P14864
Spacer, (Captive)				P14868
Terminal	AMP 61134-1 110 Series			Cat 2678
Transistor Pads				
7 off	Milton Ross 10171			Cat 1179
2 off	Jermyn TO-18-002			Cat 11541
Turret Lugs	Harwin H2121			Cat 1067
Washer (nylon)				P14885
	SPOOL SERVO BOARD			D6935
	This board is similar to D6522 (see above) with the following exceptions:-			
Capacitors				
C3	omitted			
Resistors				
R18, 24, 27, 39, 51	4k7	5%	¼ W	R10472
R19	47k	5%	¼ W	R10473
R21	12k	5%	¼ W	R10123
R22	omitted			
R23	replaced by wire link			
R30	1k	5%	¼ W	R10102
R31	10k	5%	¼ W	R10103
R33	5k6	5%	¼ W	R10562

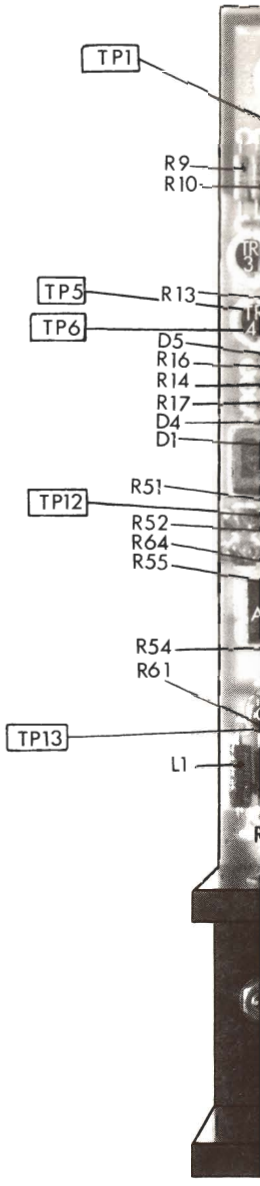


FIG. 3

	RATING	MFRS. REF. NO.
. BOARD		D6522
ontd)		
	¼ W	R10392
	¼ W	R10272
	¼ W	R10152
	¼ W	R10331
	¼ W	R10339
	3W	Cat 12623
	¼ W	R10102
005		Cat 12782
		Cat 11980
B		Cat 11978
B		Cat 11977
		Cat 10540
		Cat 13640
		Cat 13639
		P14864
		P14868
Series		Cat 2678
		Cat 1179
2		Cat 11541
		Cat 1067
		P14885
ARD		D6935
r to D6522		
e following		
	¼ W	R10472
	¼ W	R10473
	¼ W	R10123
link		
	¼ W	R10102
	¼ W	R10103
	¼ W	R10562

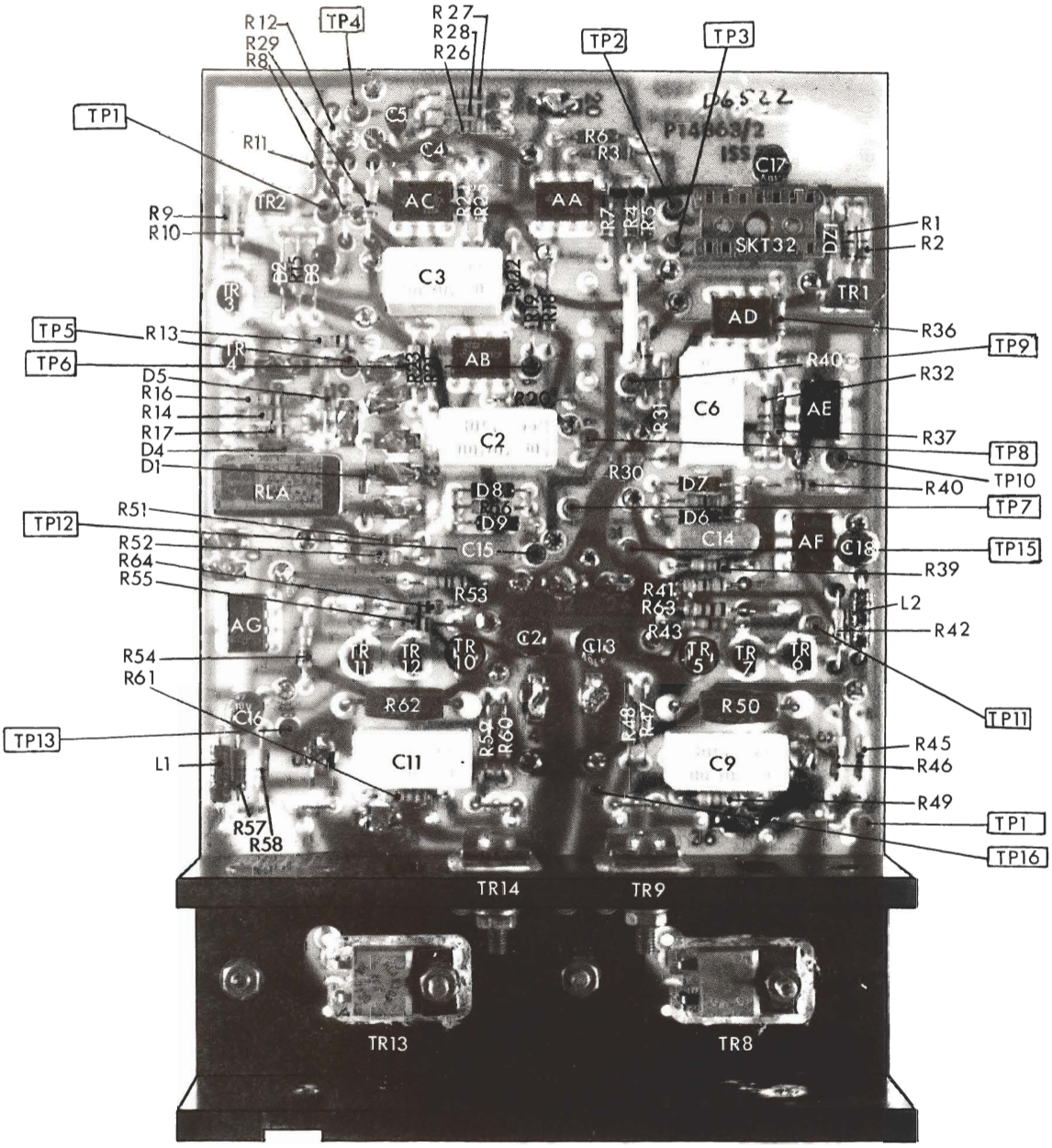
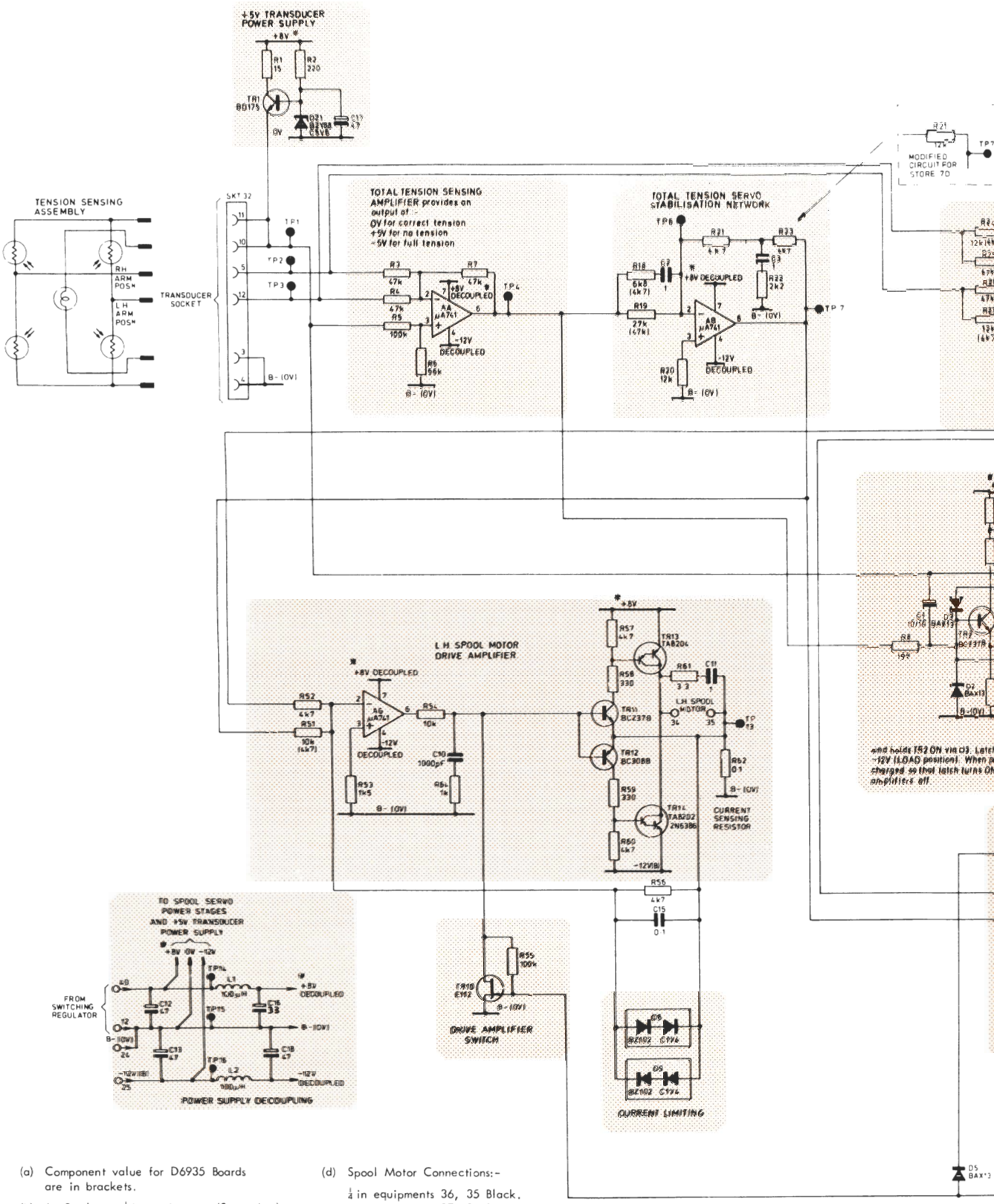


FIG. 32 SPOOL SERVO BOARD - LAYOUT



NOTES:

(a) Component value for D6935 Boards are in brackets.

(b) * +8 volts on ¼ in equipments (Store 4)

+9 volts on ½ in equipments (Store 7DS/14DS)

(c) On ½ in equipments +13V (A) is connected to +13V (brake), wire No. 48.

(d) Spool Motor Connections:-

¼ in equipments 36, 35 Black.
37, 34 Red.

½ in equipments 34, 37 Black.
35, 36 [illegible]

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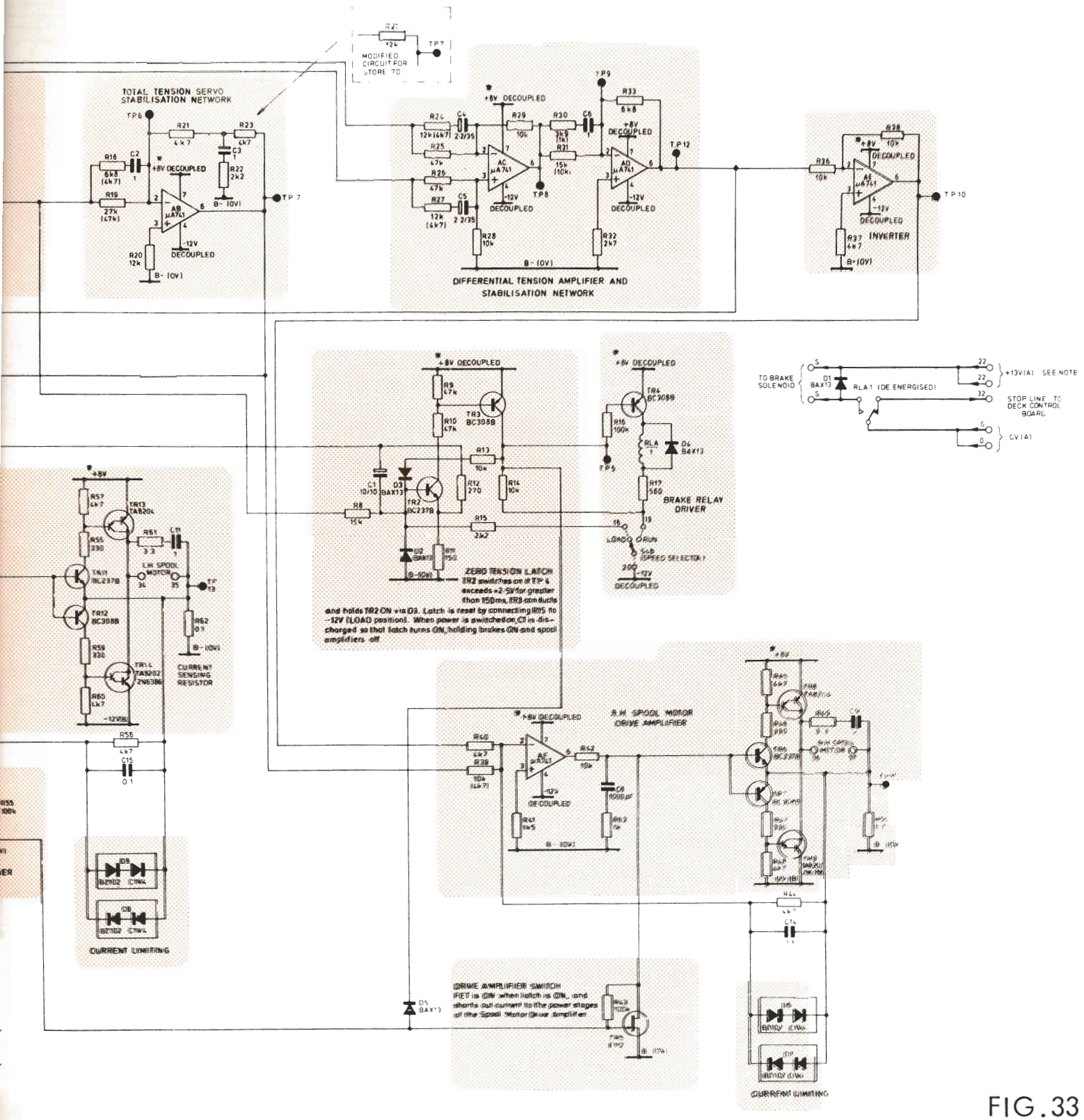
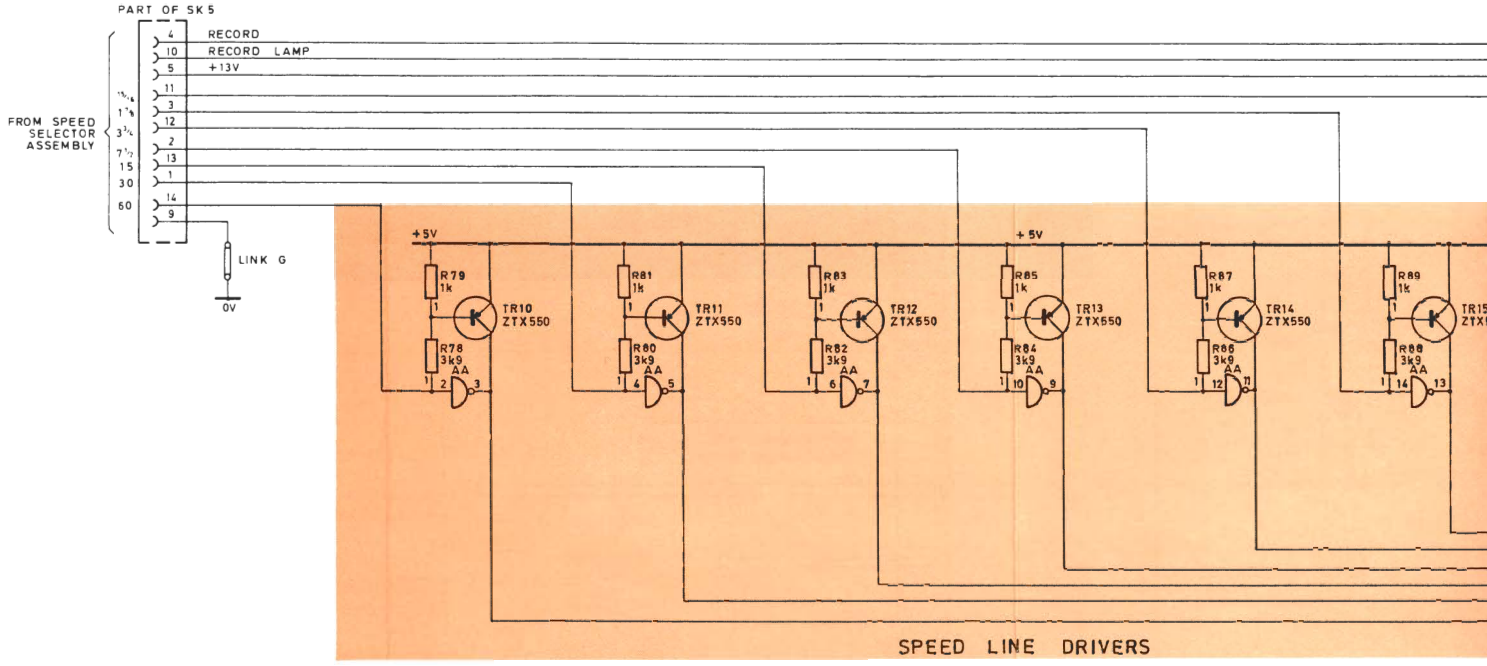
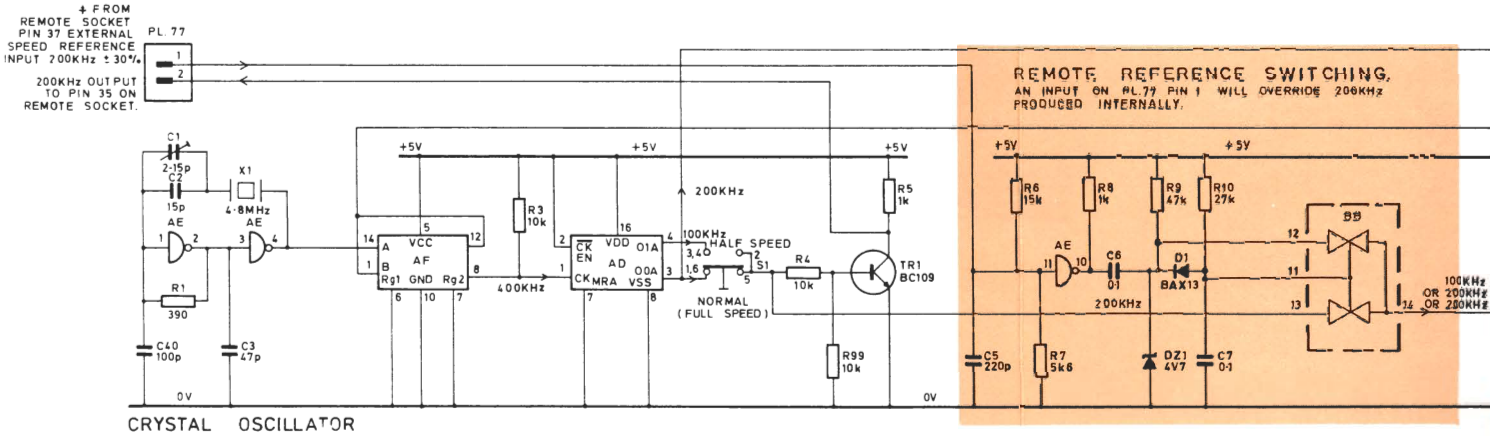


FIG.33
SPOOL SERVO BOARD - CIRCUIT

Store 4DS/7DS
January 1982

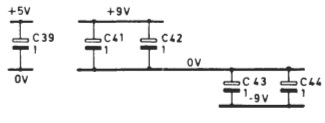




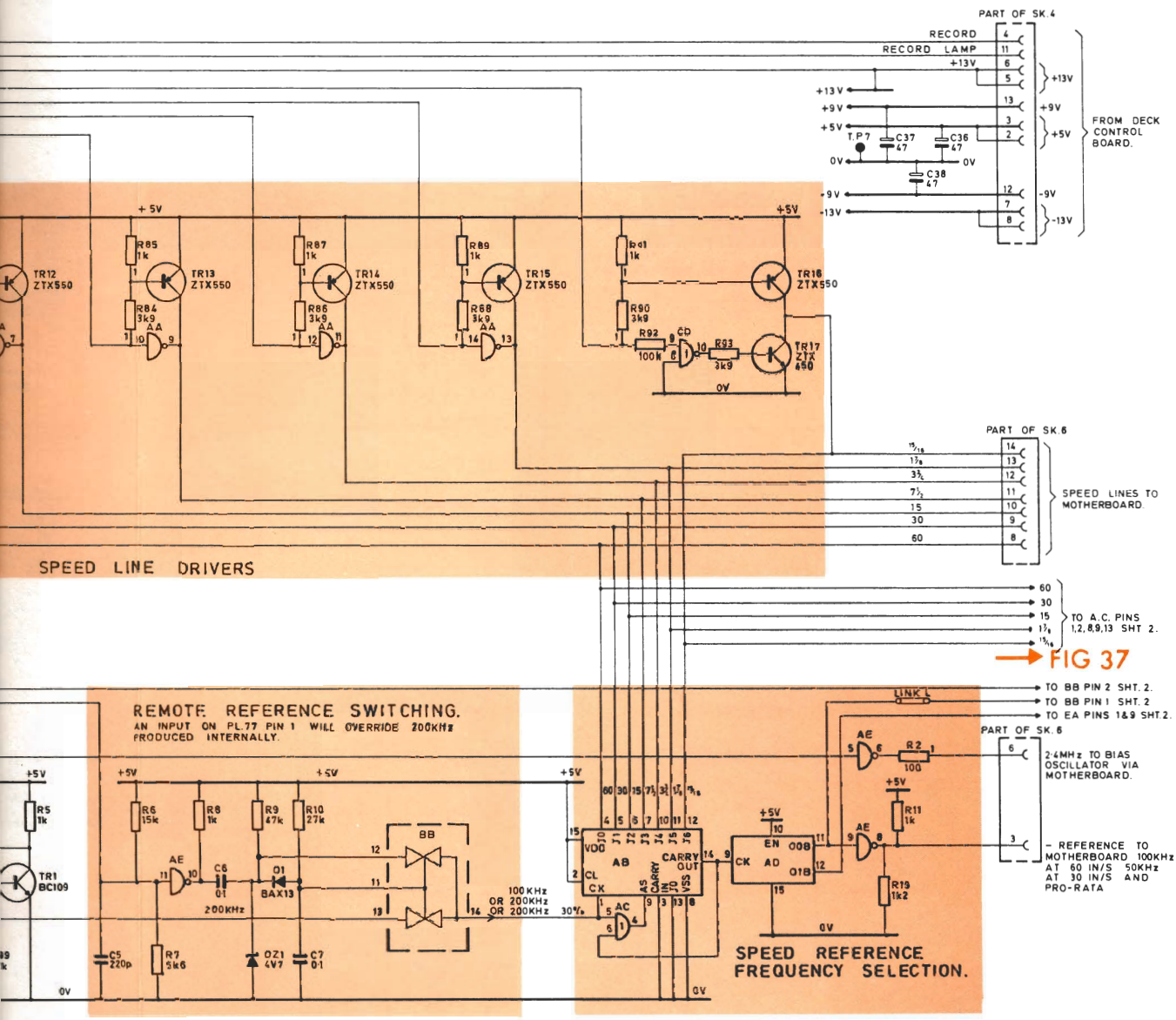
INTEGRATED CIRCUIT	DESIGNATION	SUPPLY -9V	0V	+5V	+9V
8T98	AA		1,8,15	16	
CD40103	AB		8	16	
CD4071	AC		7	14	
CD4520	AD		8	16	
* SN74LS04	AE		7	14	
* SN74LS92	AF		10	5	
CD4053	BA,BB,CC	7	6,8	16	
CD4082	CA		7	14	
CD4046	CB		8,9	16,5	

INTEGRATED CIRCUIT	DESIGNATION	SUPPLY -9V	0V	+5V	+9V
CD4030	CD		7	14	
TL082	DA,DD	4			8 *
CD4011	DB		7	14	
LM13600	DC	6			11
CD4015	EA		8	16	
CD4013	EB		7	14	
LM319	EC	5	2,7		10

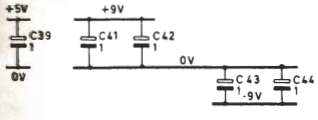
* INTEGRATED CIRCUITS MARKED WITH ASTERISK ARE DECOUPLED TO 0V AS FOLLOWS :-



† EXTERNAL SPEED CONTR
REMOTE SOCKET PIN 37
200KHz. THIS WILL GIVE
SPEED AS SET ON THE
THIS MAY BE VARIED BY



* INTEGRATED CIRCUITS MARKED WITH ASTERISK ARE DECOUPLED TO 0V AS FOLLOWS :-



† EXTERNAL SPEED CONTROL FED IN AT REMOTE SOCKET PIN 37 SHOULD BE AT 200KHz. THIS WILL GIVE STANDARD SPEED AS SET ON THE SPEED SELECTOR. THIS MAY BE VARIED BY UP TO ± 30%

FIG. 34
CAPSTAN SERVO BOARD - CIRCUIT
(Oscillator Section)

CIRCUIT REF	VALUE	TOL.	RATING	MFRS. REF. NO.
	CAPSTAN SERVO BOARD			D8286/2
Capacitors				
C1	2pF to 15pF	Trimmer		Cat 14171
C2	15pF	2%	100V	C396150
C3	47pF	2%	100V	C396470
C5, 18	220pF	2%	100V	C396221
C6, 7	0.1µF	20%	100V	Cat 16589
C8,46	10µF	20%	16V	C173100
C9	2200pF	10%	100V	C394222
C10,21,36,37,38	47µF	20%	16V	C173470
C11,23	1500pF	10%	100V	C394152
C12	330pF	2%	100V	C396331
C13, 39,41, 42,43,44	1µF	20%	50V	C177109
C14,31	0.01µF	20%	100V	Cat 13787
C15	0.47µF	20%	50V	C177478
C16,40	100pF	2%	100V	C396101
C17	33pF	2%	100V	C396330
C19	0.33µF	20%	50V	C177338
C22	3300pF	10%	100V	C394332
C24	0.22µF	20%	100V	Cat 16590
C25	0.068µF	10%	100V	28751-273-00
C26A,26B,32A, 32B	2.2µF	20%	50V	C177229
C27	68pF	2%	100V	C396680
C28	0.33µF	20%	100V	Cat 18171
C29,35	22µF	20%	16V	C183220
C30	0.068µF	20%	100V	Cat 16588
C33,34	100µF	20%	25V	C175101
Crystal				
X1	4.8 MHz			Cat 13924
Diodes				
D1-D12	BAX13			Cat 8406
Diode, Zener				
DZ1	BZY88	4V7		Cat 10122
DZ2,3	BZY88	3V9		Cat 8419
Integrated Circuits				
AA	8T98			Cat 14302
AB	CD40103			S640103
AC	CD4071			S644071
AD	CD4520			S644520
AE	SN74LS04			Cat 15811
AF	SN74LS92			Cat 15075
BA,BB,CC	CD4053			S644053
CA	CD4082			S644082
CB	CD4046			S644046
CD	CD4030			S644030
DA,DD	TL082			Cat 14378
DB	CD4011			S644011
DC	LM13600			Cat 15838
EA	CD4015			S644015
EB	CD4013			S644013
EC	LM319H			Cat 14379
Plugs				
PL55,56	S.I.L.	5 way		Cat 14181
PL77	S.I.L.	2 way		Cat 14952

CIRCUIT REF	VALUE	TOL.	RATING	MFRS. REF. NO.
	CAPSTAN SERVO BOARD (Contd.)			D8286/2
Resistors				
R1,96	390Ω	5%	¼W	R10391
R2,14,15,33,34, 41,42,44, 77, 95	100Ω	5%	¼W	R10101
R3,4,29,37,43, 46,47,67,99,102	10k	5%	¼W	R10103
R5,8,11,17,18,22 63,70,73,79,81, 83,85,87,89,91,97	1k	5%	¼W	R10102
R6,26	15k	5%	¼W	R10153
R7	5k6	5%	¼W	R10562
R9, 104	47k	5%	¼W	R10473
R10,R98	27k	5%	¼W	R10273
R12,25	3k3	5%	¼W	R10332
R13,31,32,38,39, 40,48,49,57,66, 92,94	100k	5%	¼W	R10104
R16,58,	6k8	5%	¼W	R10682
R19,68	1k2	5%	¼W	R10122
R20	1k5	5%	¼W	R10152 (Select on test)
	1k8	5%	¼W	R10182 (Select on test)
	2k2	5%	¼W	R10222 (Select on test)
R21,45,54,55, 56,62,74	4k7	5%	¼W	R10472
R23,60	56k	5%	¼W	R10563
R24	560Ω	5%	¼W	R10561
R27,30	470Ω	5%	¼W	R10471
R28	150Ω	5%	¼W	R10151
R35	1k5	5%	¼W	R10152
R36,	2k7	5%	¼W	R10272
R50,65	150K	5%	¼W	R10154
R51,100	220K	5%	¼W	R10224
R52	39K	5%	¼W	R10393
R53	33k	5%	¼W	R10333
R59	680Ω	5%	¼W	R10681
R61	180k	5%	¼W	R10184
R64	1M	5%	¼W	R10105
R69,74,	2k2	5%	¼W	R10222
R71,72	220Ω	5%	¼W	R10221
R75	1Ω	5%	¼W	R10109
R76	1Ω	5%	2½W	Cat 7913
R78,80,82,84, 86,88,90,93	3k9	5%	¼W	R10392
R103	22K	5%	¼W	R10223
R106	10	5%	¼W	R10100
R107,108	22K to 470K	5%	¼W	Select on test.
Sockets				
SK4,5,6.	D.I.L.	14 way		Cat 12782
Switch				
S1				Cat 14653
Transistors				
TR1	BC109BP			Cat 15104
TR2	BC237			Cat 11978
TR3,20	BC308			Cat 11977
TR4,18,19	J177			Cat 13967
TR5,7,17	ZTX450			Cat 13628
TR6	BD176			Cat 12381
TR8,10,11,12,13, 14,15,16	ZTX5500			Cat 13629
TR9	BD175			Cat 11980
Test Points				
TP1-TP7,W1				Cat 13746

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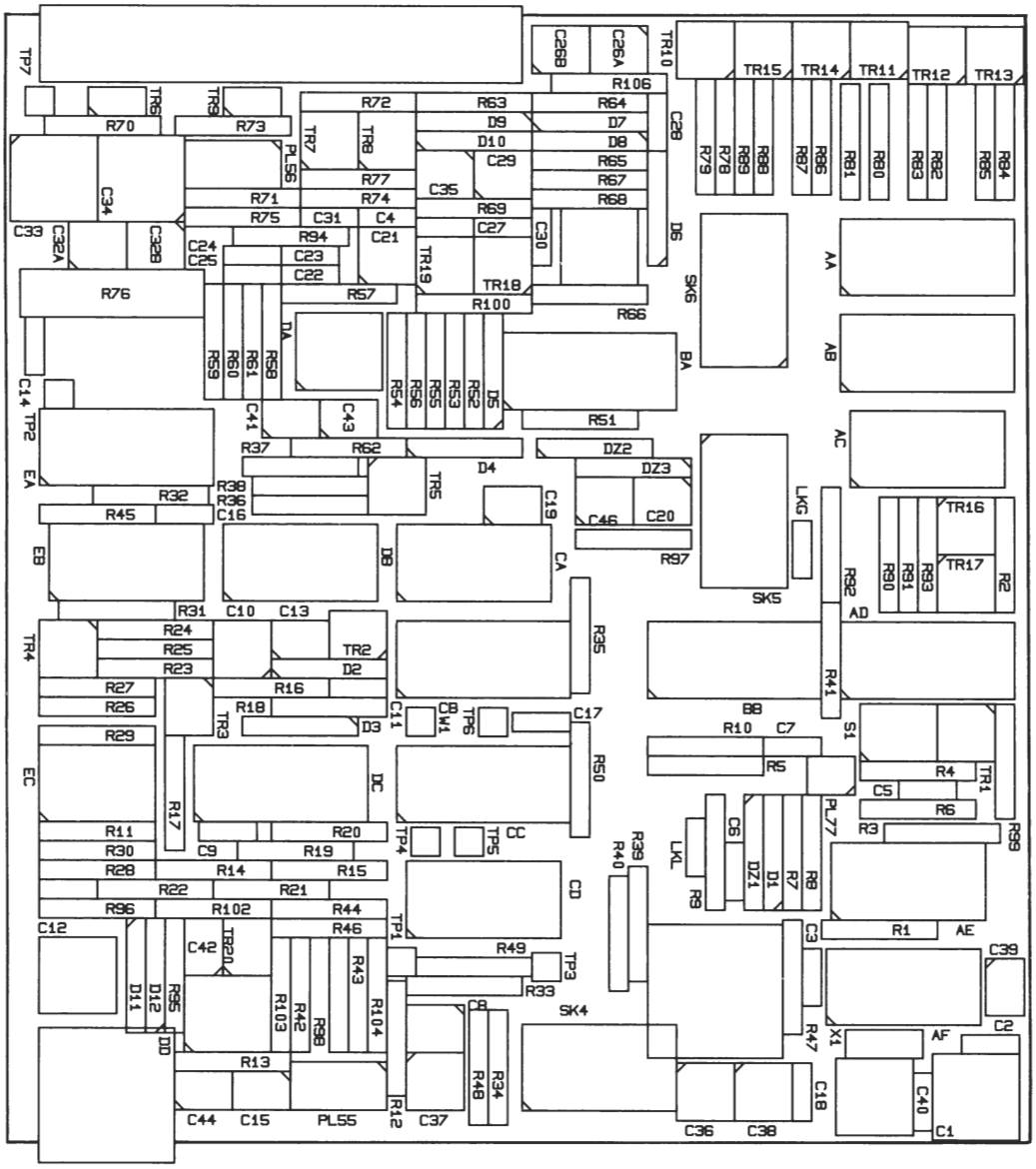
FIG. 35
CAPSTAN SERVO BOARD D8286/2
PARTS LIST



SELECT ON TEST RESISTOR.

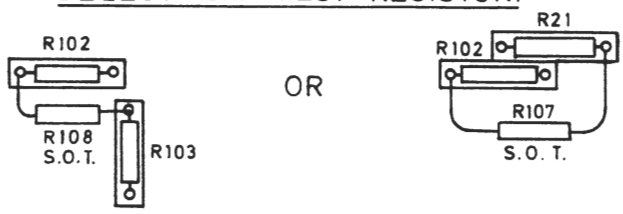
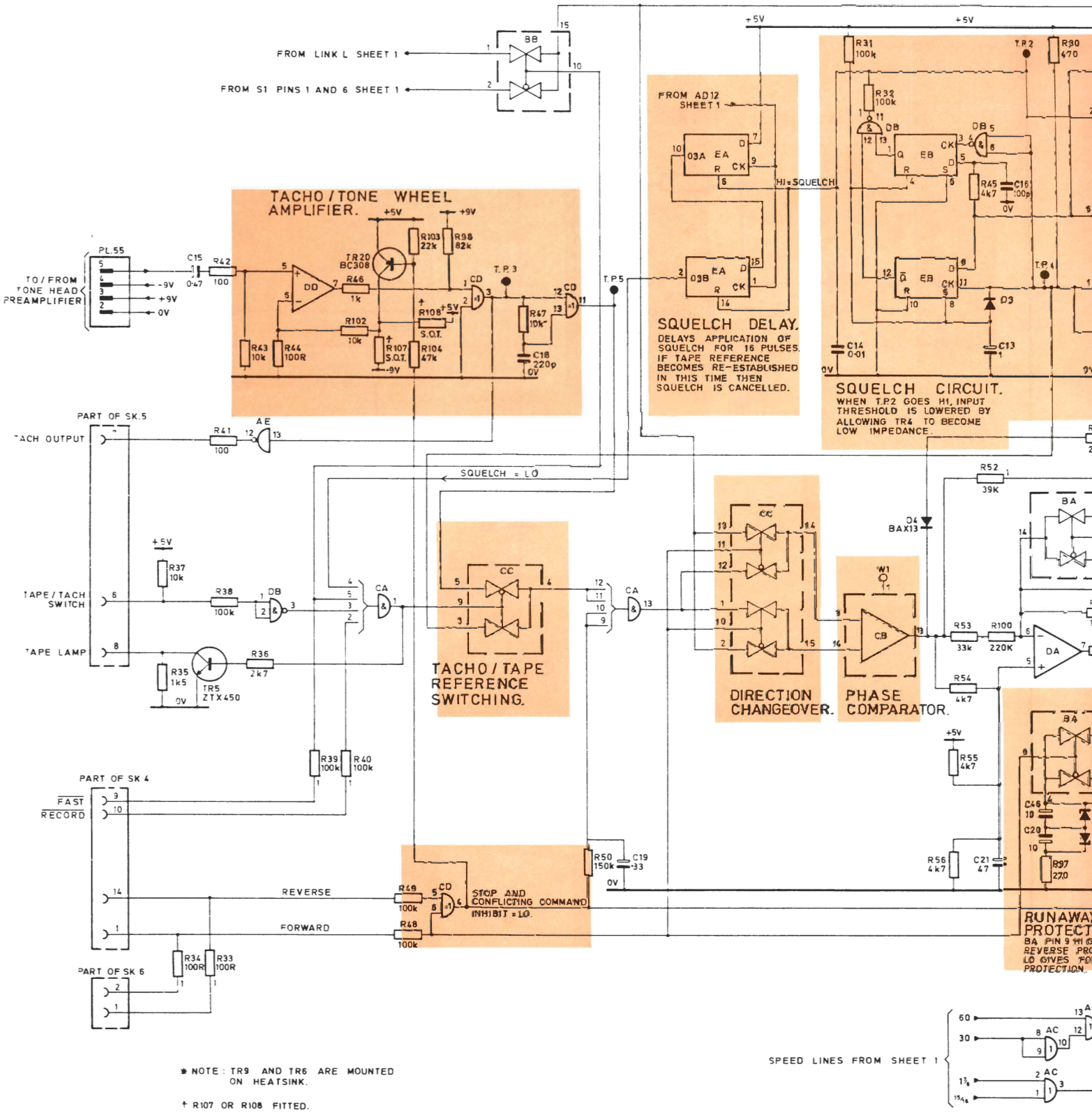


FIG.36 CAPSTAN SERVO BOARD - LAYOUT
D8286/2



* NOTE : TR9 AND TR6 ARE MOUNTED ON HEATSINK.

† R107 OR R108 FITTED.

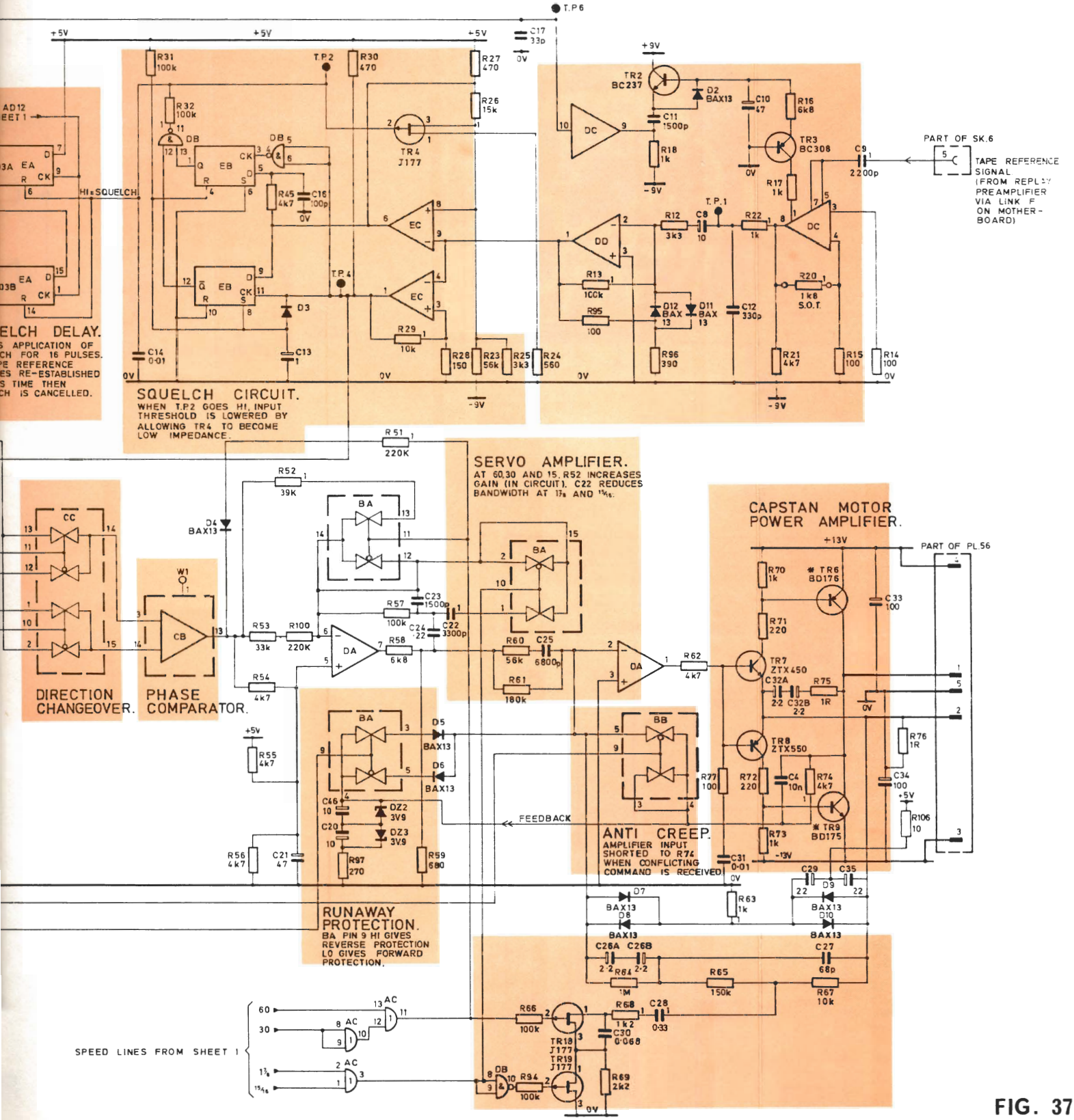
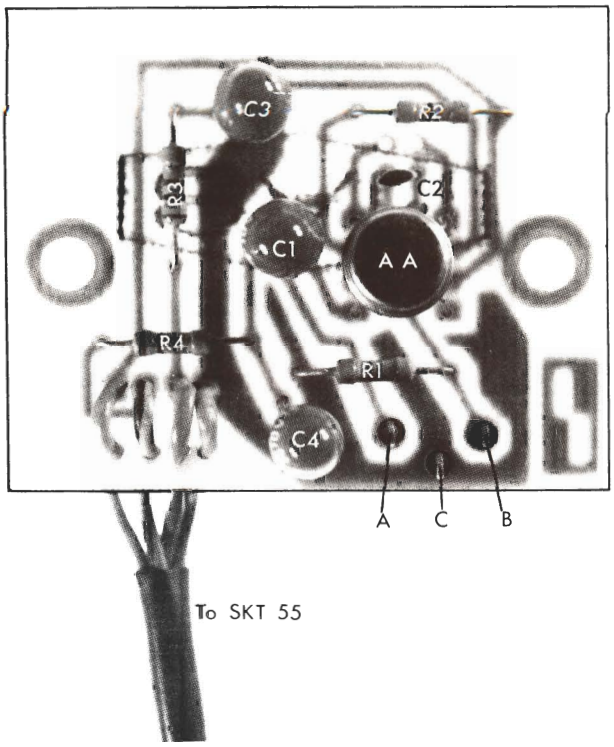
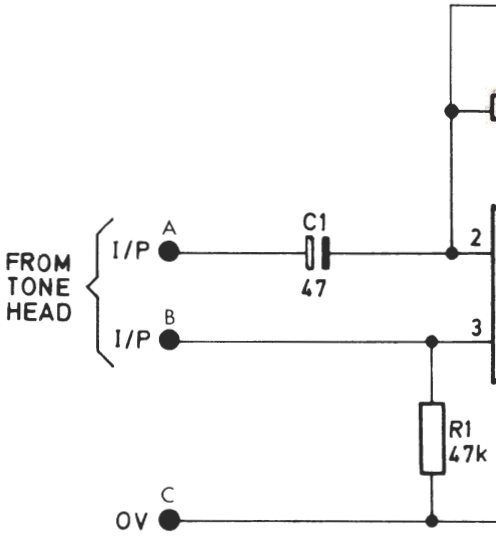


FIG. 37

CAPSTAN SERVO BOARD D8286/2

SERVO LOOP SECTION





CIRCUIT REF.	VALUE	TOL	RATING	MFRS. REF. NO.
	TONE HEAD PREAMPLIFIER			D7697
Capacitors				
C1	47µF	20%	10V	Cat 13433
C3,4	33µF	20%	16V	C163330
C5	4.7pF	5%	63V	Cat 13713
Integrated Circuit				
AA	LM318H			Cat 9982
Resistors				
R1, 2	47k	5%	¼W	R10473
R3, 4	100	5%	¼W	R10101
Socket				
SKT55	Housing			Cat 12794
	Contact	(4 off)		Cat 14191
Terminal Assembly				
3 off	Vero 22436			Cat 13747

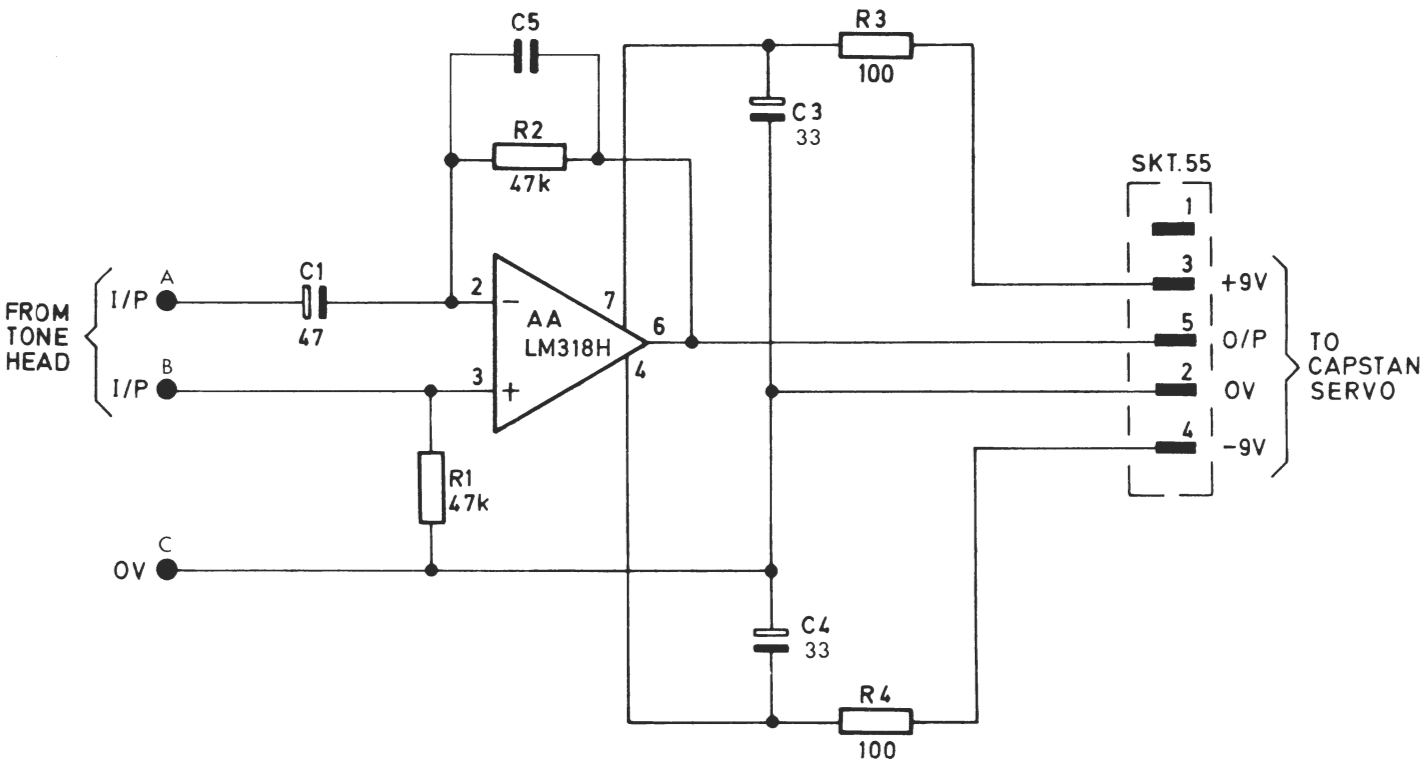
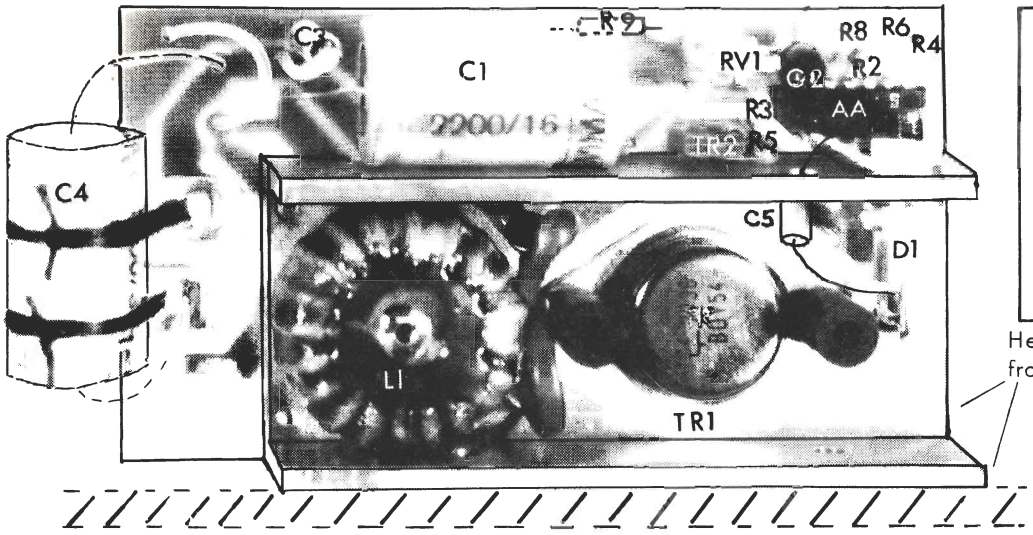


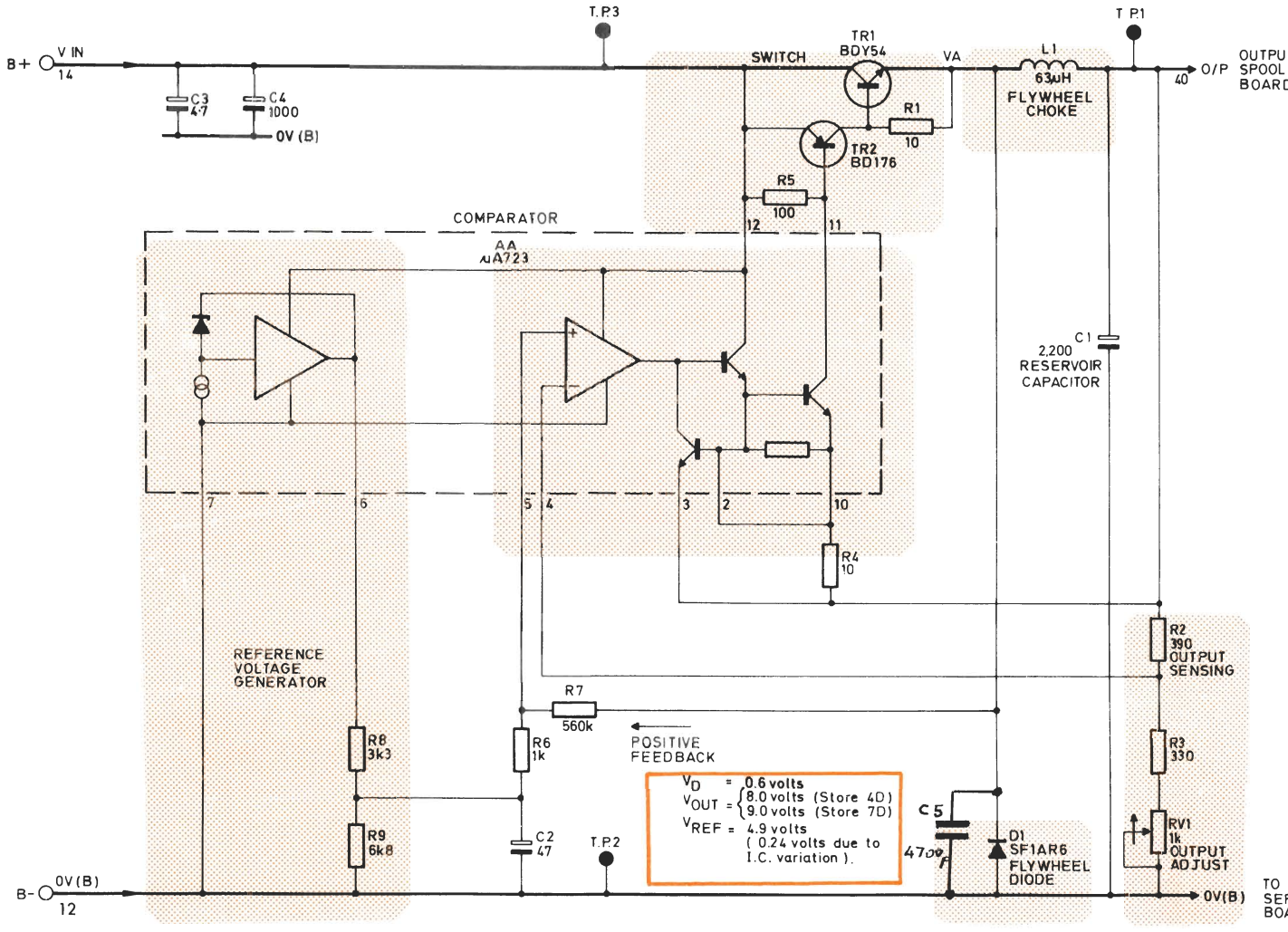
FIG.38 TONE HEAD PREAMPLIFIER LAYOUT AND CIRCUIT D7697

Store 4DS/7DS
January 1981



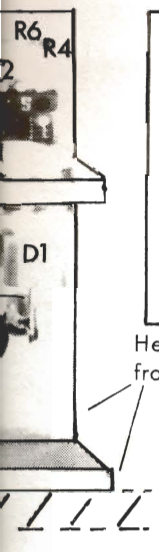
Heatsink electrically insulated from main chassis.

When the transistor switch is ON, V_A = (V_{IN} across switch). V+ will be V_{REF} + a fraction V_{IN} = 20V, V_A = 19V, V+ = (V_{REF} + 0.025 until V- exceeds V+ when the switch turns OF and D1 conducts with a voltage drop V_D = 0. and V+ = (V_{REF} -0.01) volts. The output de when the switch turns ON again. Operating

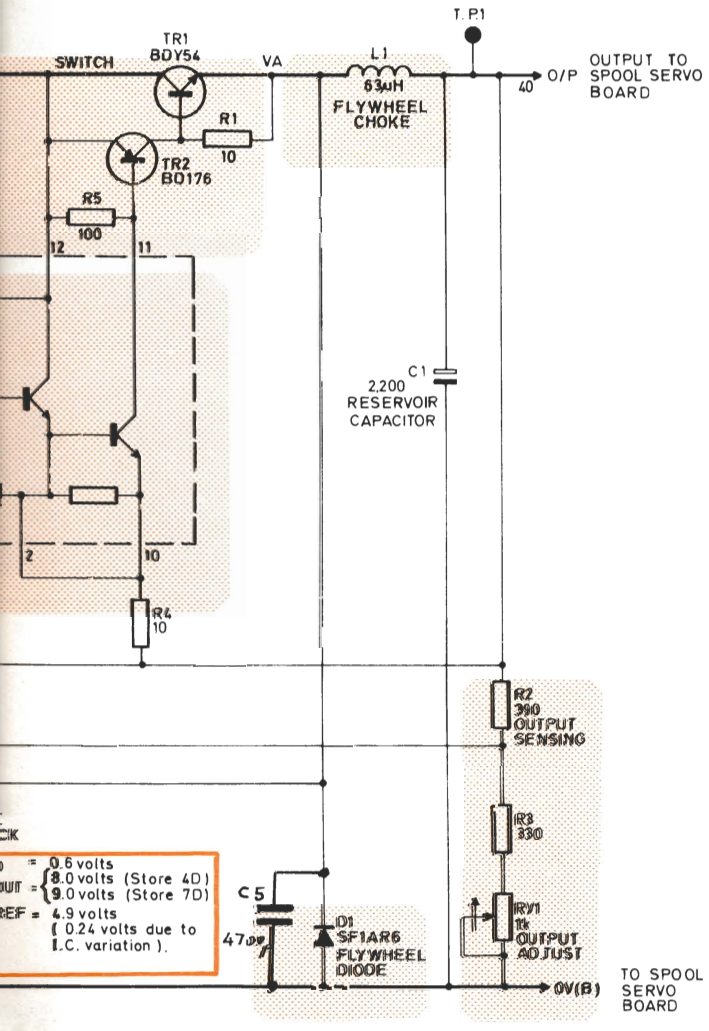


April, 1982

When the transistor switch is ON, $^{V}A = (^{V}IN - 1)$ volts (due to drop across switch). V+ will be ^{V}REF + a fraction of ^{V}A due to R7. For $^{V}IN = 20V$, $^{V}A = 19V$, V+ = ($^{V}REF + 0.025$) volts. The output rises until V- exceeds V+ when the switch turns OFF. The choke "flywheels" and D1 conducts with a voltage drop $^{V}D = 0.6V$. $^{V}A = -0.6V$ therefore, and V+ = ($^{V}REF - 0.01$) volts. The output decays until V+ exceeds V- when the switch turns ON again. Operating frequency 20kHz - 40kHz.



Heatsink electrically insulated from main chassis.



CIRCUIT REF.	VALUE	TOL	RATING	MFRS. REF. NO.
	SWITCHING REGULATOR			D7725/2
Capacitors				
C1	2200μF	-20% +50%	16V	Cat 13425
C2	47μF	20%	10V	Cat 13433
C3	4.7μF	20%	50V	Cat 13795
C4	1000μF	-10%+50%	35V	Cat 13470
C5	4700pF	25%	100V	Cat 11610
Choke				
L1	63μH			D7615
Diode				
D1	Westinghouse SF1AR6			Cat 12643
Integrated Circuit				
AA	Signetics N5723A			Cat 12099
Potentiometer				
RV1	1k Bourns VA05V			Cat 11938
Resistors				
R1, 4	10Ω	5%	¼W	R10100
R2	390Ω	5%	¼W	R10391
R3	330Ω	5%	¼W	R10331
R5	100Ω	5%	¼W	R10101
R6	1k	5%	¼W	R10102
R7	560k	5%	¼W	R10564
R8	3k3	5%	¼W	R10332
R9	6k8	5%	¼W	R10682
Transistors				
TR1	Sesco BDY54			Cat 12384
TR2	Telefunken BD176			Cat 12381
Heatsink				P14852
Diode Mounting Kit	Mullard 56295			Cat 7097
Transistor Insulating Kit	Mica Washer Mullard 56201B			Cat 7073
	Sleeving, Hellerman			Cat 2052
Terminal				Cat 13745

FIG. 39
SWITCHING REGULATOR BOARD LAYOUT AND CIRCUIT D7725/2

April, 1982

CIRCUIT REF.	VALUE	TOL	RATING	MFRS. REF. NO.
	POWER SUPPLY BOARD			D6535
Capacitors				
C1	1000 µF	-10% +50%	35 V	Cat 13470
C3	0.1 µF	20%	35 V	Cat 13782
C4	0.01 µF	-20% +80%	100 V	Cat 13427
C5	4.7 µF	10%	160 V	Cat 13429
C6, C7, C8	2200 µF	-20% +50%	16 V	Cat 13425
C9	4700 µF	-20% +50%	10 V	Cat 13426
C10, C11, C12, C13	10 µF	20%	16 V	Cat 12037
C14, C17	47 µF	20%	10 V	Cat 13433
C15	2.2 µF	20%	35 V	Cat 13466
C16	2.2 µF	20%	63 V	C10225
C18, C19	.47 µF	20%	100 V	Cat 10346
Diodes				
D2, D3	Motorola 1N4002			Cat 9660
D4	I.R. 30S1			Cat 12385
D5, D6, D7, D8, D9	Westinghouse SF1AN6			Cat 12386
Diodes Zener				
DZ1	Mullard BZY88 C33V			Cat 13979
DZ2	Mullard BZY85 C6V2			Cat 2844
DZ3	I.R. 5ZS 12B			Cat 12660
DZ4, DZ5	I.R. 5ZS 17B			Cat 13201
DZ6	Mullard BZY88 C5V6			Cat 2851
Inductors				
L1	200-230 mH			D7088
L2, L3, L4	35-50 mH			D7087
L5	22-35 mH			D7089
Integrated Circuit				
AA	Signetics N57 23A			Cat 12099
Potentiometer				
RV1	2k2	Bourns VA 05H		Cat 13844

CIRCUIT REF.	VALUE	TOL	RATING	MFRS. REF. NO.
Resistors				
R2, R10	220 Ω	5%	¼ W	R10221
R3	15k	5%	¼ W	R10153
R4	2k2	5%	¼ W	R10222
R5, R19, R20	100 Ω	5%	¼ W	R10101
R6	100 Ω	5%	3 W	Cat 8167
R7, R9	10 Ω	5%	¼ W	R10100
R8	390 Ω	5%	¼ W	R10391
R11	3k9	5%	¼ W	R10392
R12, R13	1k	5%	¼ W	R10102
R14	4k7	5%	¼ W	R10472
R15, R16	1k5	5%	¼ W	R10152
R17	33k	5%	¼ W	R10333
R21	330 Ω	5%	¼ W	R10331
Thyristors				
CSR1	1R 12RCM5			Cat 12391
CSR2	ITT BTX 30-400			Cat 12388
Transformers				
T1	Convertor			D7091
T2	Timing			D7090
T3	Trigger I.T.T.			Cat 11377
Transistors				
TR1	GEC 2N2646			Cat 10127
TR2, TR3	SESCO BDY 54			Cat 12384
TR4	Telefunken BD175			Cat 11980
TR5	Telefunken BC308B			Cat 11977
Heatsink				P15289
Insulating Bead	Steatite			Cat 4020
Insulating Kits for :-				
Diode	Mullard 56295			Cat 7097
Transistor Bush	Mullard 56201B			Cat 7073
Transistor Washer	Mullard 56239A			Cat 11903
Terminal (Spade)	AMP 61134-1			Cat 2678
Transistor Pads				
1 off	Jermyn	TO18-002		Cat 11541
1 off	Jermyn	TO5-001		Cat 1162
Turret Lugs	Vero No. 22435			Cat 13746

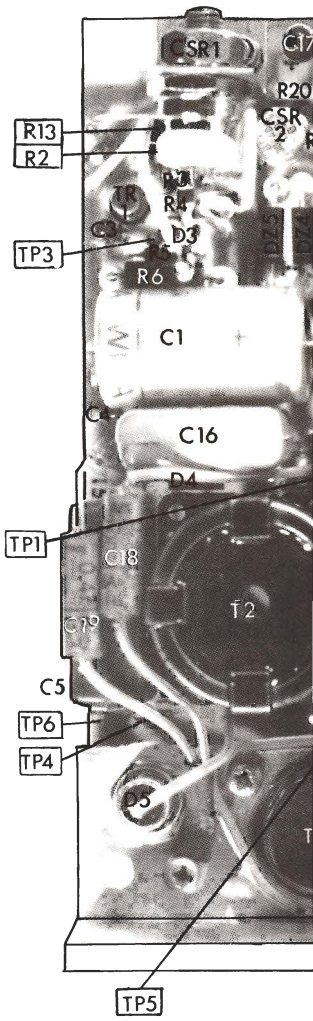


FIG. 40 P

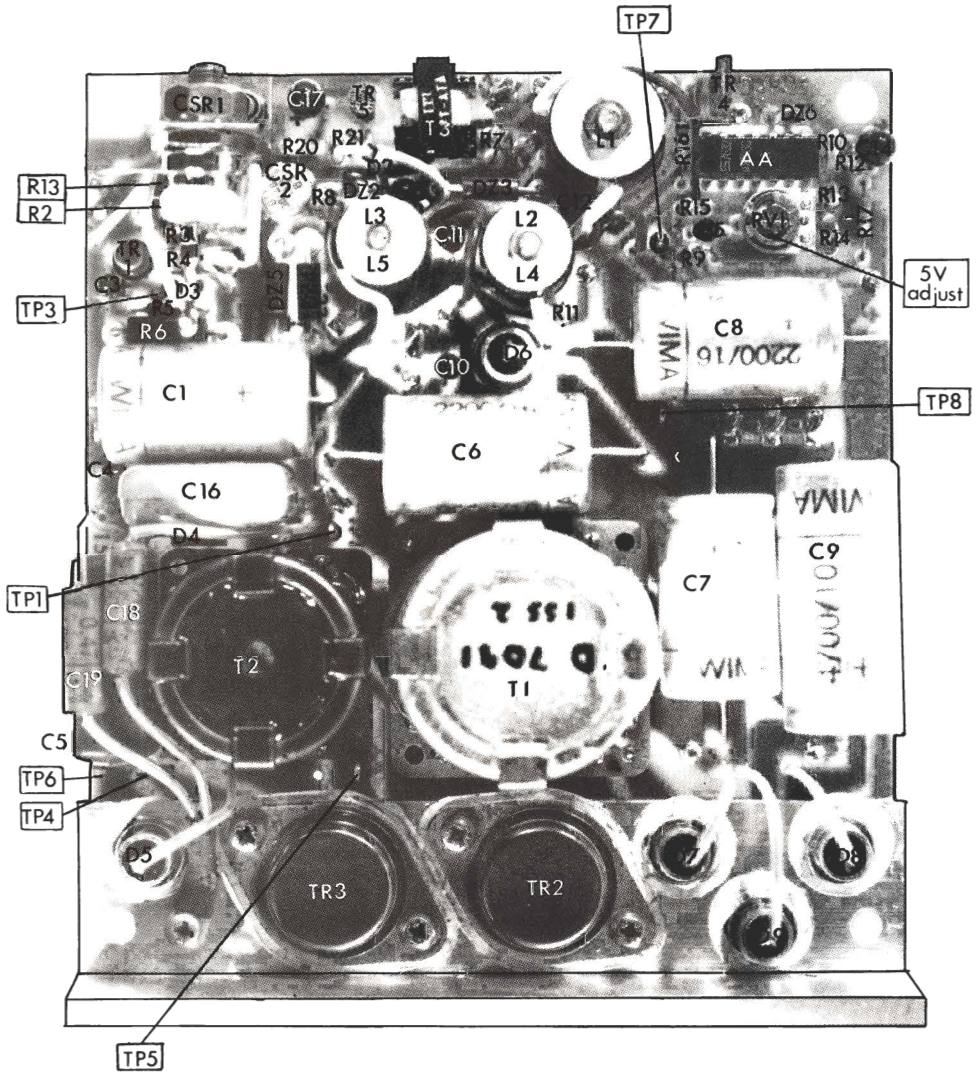


FIG. 40 POWER SUPPLY BOARD - LAYOUT
D6535

OPERATION OF RINGING CHOKE CONVERTER

(1) TR1 provides a pulse which turns on TR2 and TR3. The collector current rises linearly, at a rate determined by the input voltage (B+) and the inductance of T1 primary. The polarity of the secondaries is such that the diodes D6–9 are reverse biased.

Current in T2 primary (N1) induces base current in T2 secondary (N3). Eventually T2 saturates. Base drive reduces and TR2 and TR3 turn OFF.

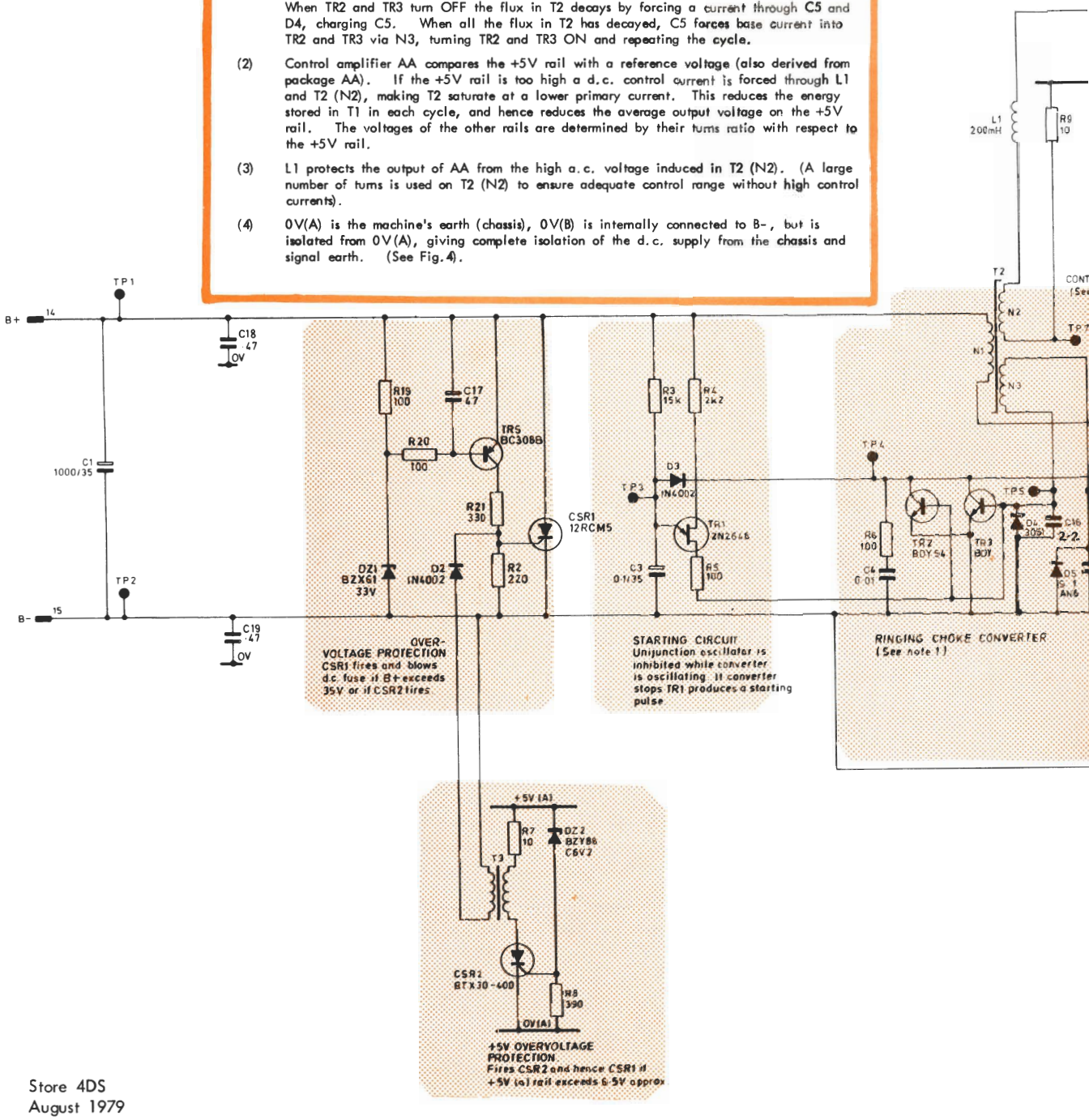
Current in T1 primary stops instantaneously, and flux in T1 decays by forcing currents through D6 to D9 into C6 to C9. Energy from T1 core is all dumped into C6 to C9 before TR3 turns ON again.

When TR2 and TR3 turn OFF the flux in T2 decays by forcing a current through C5 and D4, charging C5. When all the flux in T2 has decayed, C5 forces base current into TR2 and TR3 via N3, turning TR2 and TR3 ON and repeating the cycle.

(2) Control amplifier AA compares the +5V rail with a reference voltage (also derived from package AA). If the +5V rail is too high a d.c. control current is forced through L1 and T2 (N2), making T2 saturate at a lower primary current. This reduces the energy stored in T1 in each cycle, and hence reduces the average output voltage on the +5V rail. The voltages of the other rails are determined by their turns ratio with respect to the +5V rail.

(3) L1 protects the output of AA from the high a.c. voltage induced in T2 (N2). (A large number of turns is used on T2 (N2) to ensure adequate control range without high control currents).

(4) 0V(A) is the machine's earth (chassis), 0V(B) is internally connected to B–, but is isolated from 0V(A), giving complete isolation of the d.c. supply from the chassis and signal earth. (See Fig.4).



Store 4DS
August 1979

CHOKE CONVERTER

R3. The collector current rises linearly, and the inductance of T1 primary. The des D6-9 are reverse biased.

t in T2 secondary (N3). Eventually T2 3 turn OFF.

flux in T1 decays by forcing currents m T1 core is all dumped into C6 to C9

oays by forcing a current through C5 and as decayed, C5 forces base current into and repeating the cycle.

th a reference voltage (also derived from d.c. control current is forced through L1 imary current. This reduces the energy the average output voltage on the +5V rmined by their turns ratio with respect to

:. voltage induced in T2 (N2). (A large dequate control range without high control

s internally connected to B-, but is of the d.c. supply from the chassis and

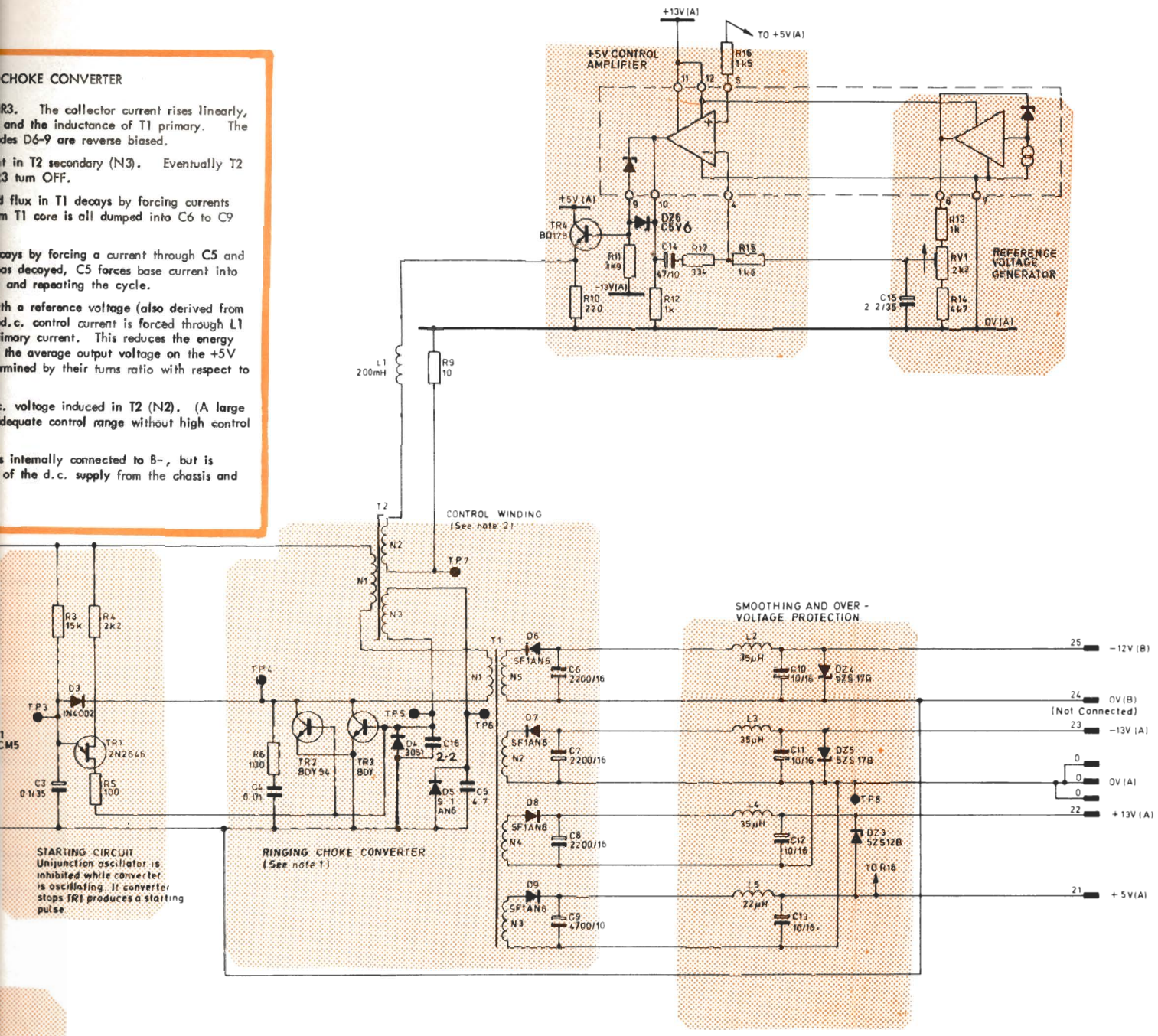
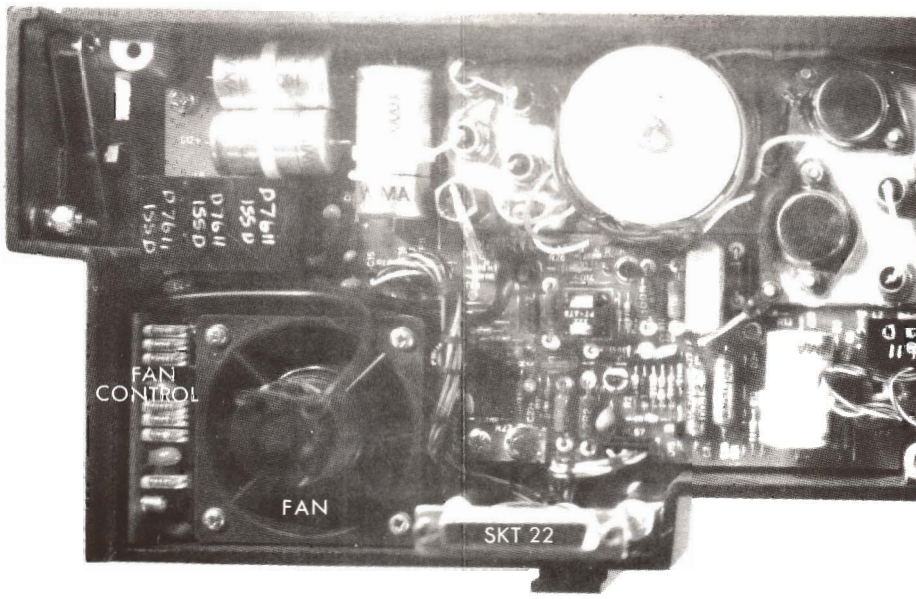
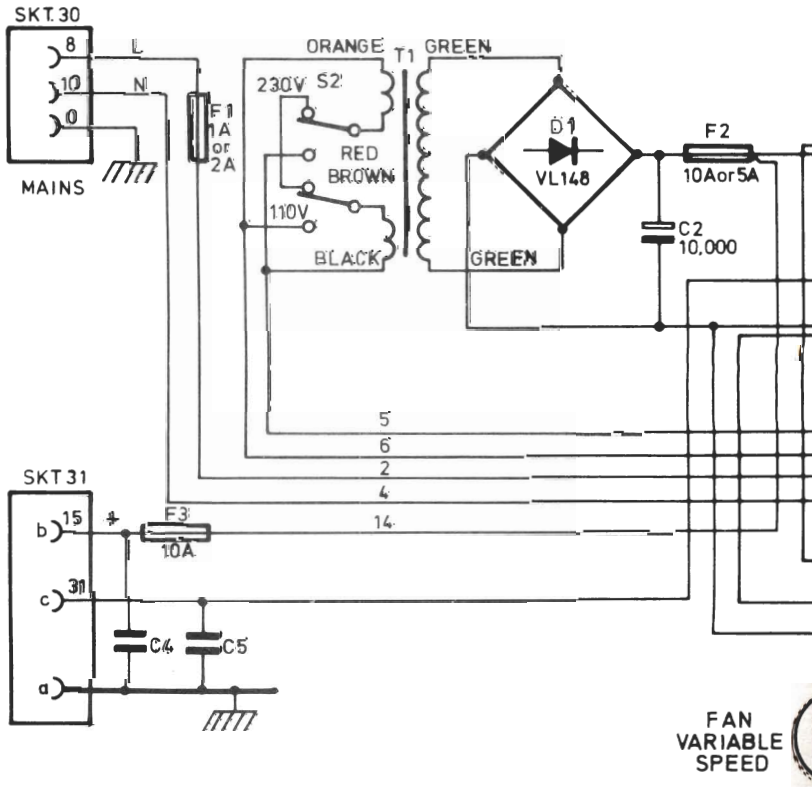
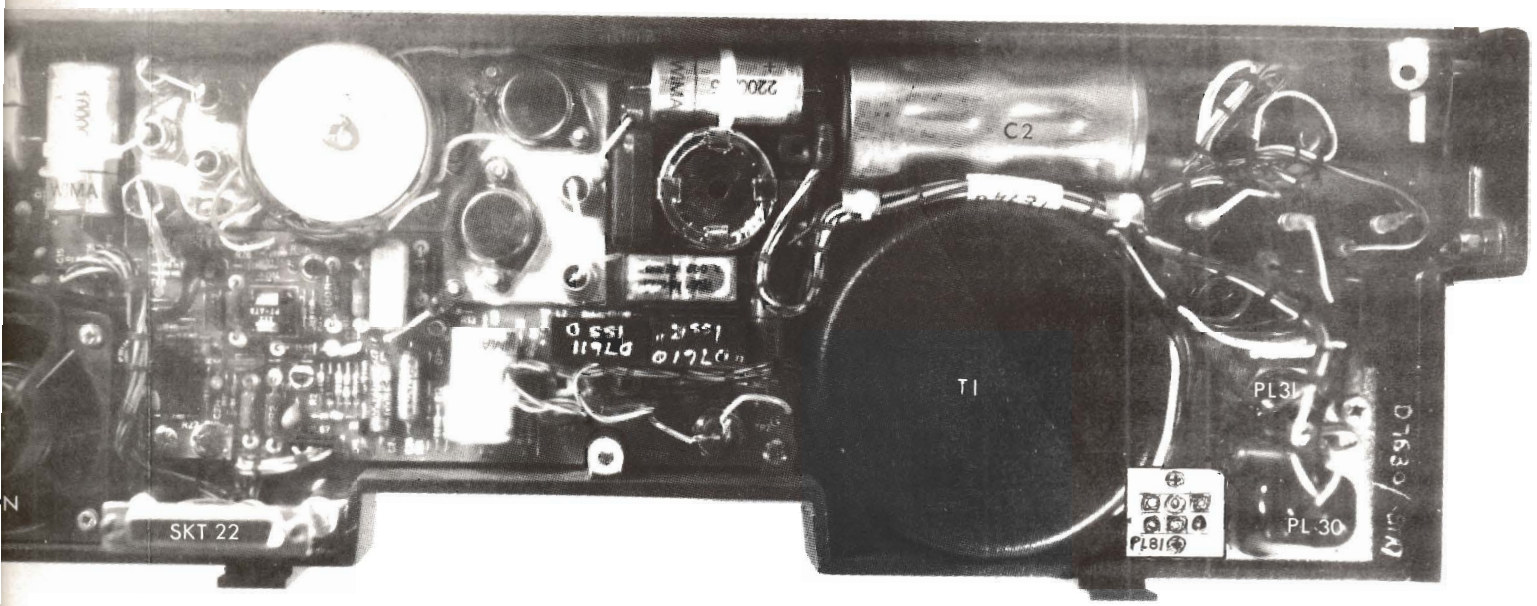


FIG. 41
POWER SUPPLY BOARD - CIRCUIT

CIRCUIT REF.	VALUE	TOL.	RATING	MFRS. REF. NO.
	REAR CASTING ASSEMBLY			
		Store 7DS		D7630/3
		Store 14/14DS		D7630/4
General Items				
	Board, Printed Circuit			
		Store 7DS		D7736/1
		Store 14/14DS		D7736/2
	Board, Insulating			P16461
	Cableform			D7631/2
	Diode, Bridge Rectifier Varo VL148			Cat 14403
	Screwlocks, female			Cat 14297
Capacitors				
C2	10,000 µF			Cat 12034
C4,5	0.47 µF			Cat 10346
Connector				
	Socket Housing			Cat 16756
	Terminals male			Cat 16403
	Plug Housing			Cat 15871
	Terminals female			Cat 16404
Fan, Filter				
	Fan, control board			D7738
	Fan unit, modified			P17733
	Fan filter			P16497
	Fan grill			P16447
Fuses				
F1	1 amp,	antisurge	(230 V)	Cat 4305
or				
F1	2 amp,	antisurge	(115 V)	Cat 4304
F2	5 amp	Store 7DS		Cat 4303
or				
F2	10 amp	Store 14/14DS		Cat 4315
F3	10 amp			Cat 4315
Plugs				
PL30	A.C. mains input			Cat 11713
PL31	D.C. battery input			Cat 1359
PL81	Housing			Cat 16756
	Contacts			Cat 16403
Switch				
1 off	Voltage selector			Cat 15182
Transformer				
T1	A.C. Mains, Toroidal			
	Store 7DS			D7607/2
	Store 14/14DS			D7608/2







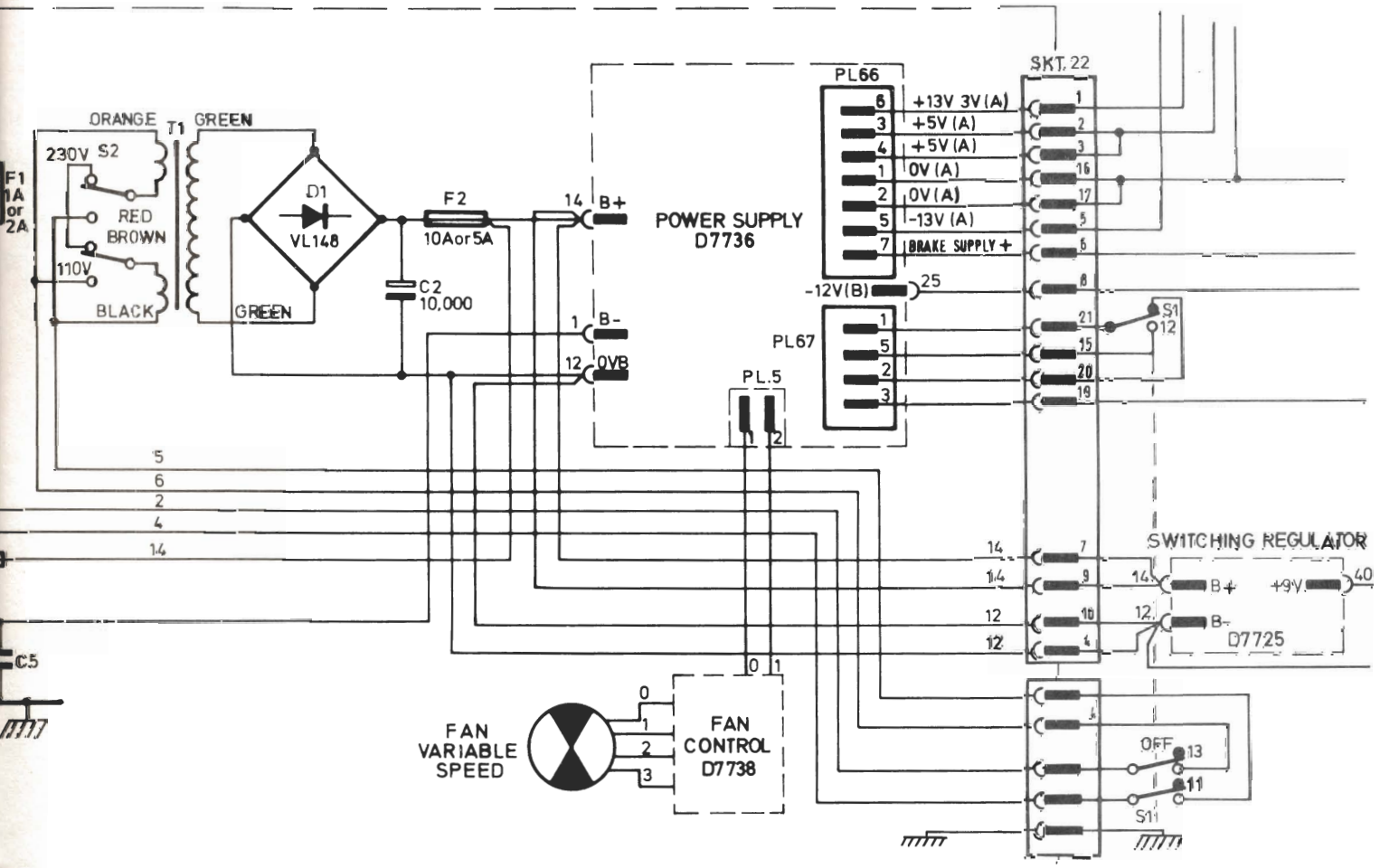
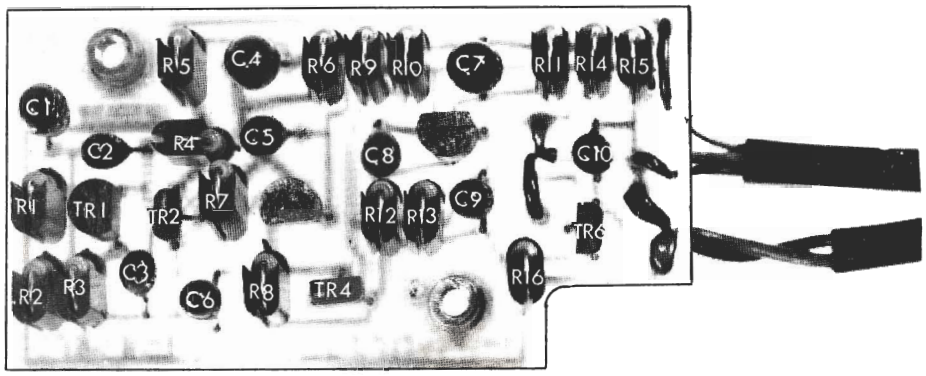
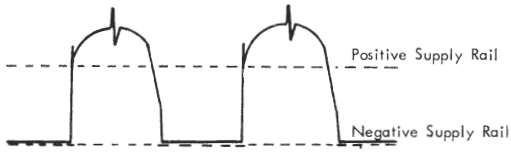


FIG. 42.

REAR CASTING ASSEMBLY - LAYOUT AND CIRCUIT

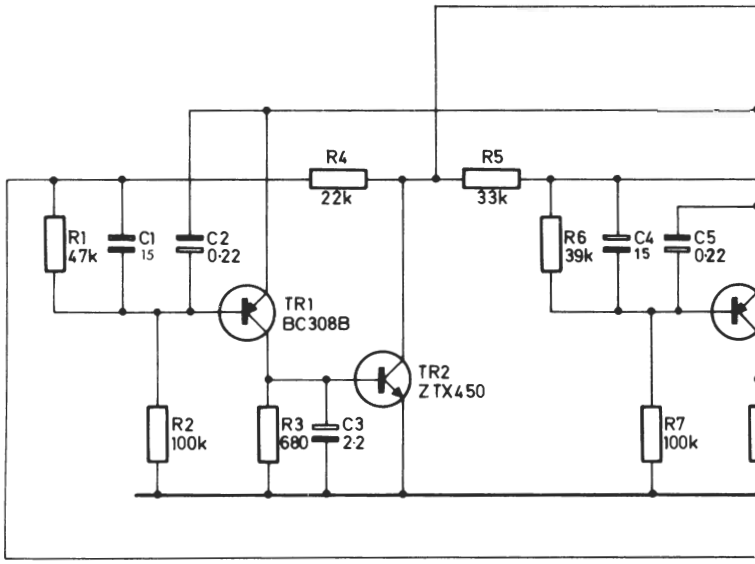
(D7630)





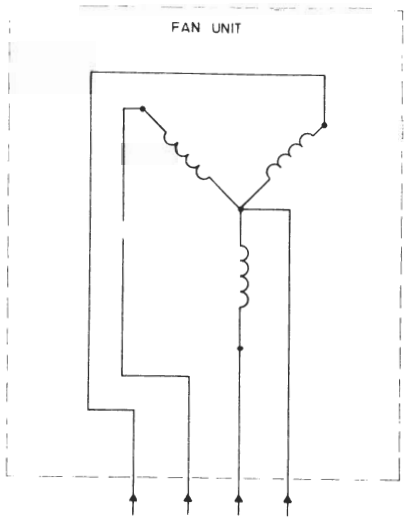
Waveform at collectors of TR2, TR4, and TR6.
Voltage and Frequency are proportional to the applied voltage at SKT65 which should be between 4 volts and 12 volts.
At less than approximately 4 volts applied, i.e. when the equipment is cold, the fan will not rotate.

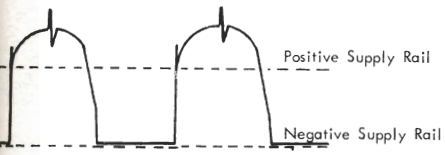
CIRCUIT REF.	VALUE	TOL	RATING	MFRS. REF. NO.
	FAN CONTROL BOARD			D7738
Capacitors				
C1, 4, 7	15µF	20%	25V	Cat 13781
C2, 5, 8	0.22µF	20%	35V	Cat 14333
C3, 6, 9	2.2µF	20%	35V	Cat 13466
C10	0.47µF	20%	35V	Cat 13648
Housing Component for Resistors				Cat 14111
Resistors				
R1	47k	5%	¼ W	R10473
R2, 7, 12	100k	5%	¼ W	R10104
R3, 8, 13	680Ω	5%	¼ W	R10681
R4, 9, 14	22k	5%	¼ W	R10223
R5, 10, 11, 16	33k	5%	¼ W	R10333
R6	39k	5%	¼ W	R10393
R7	150Ω	5%	¼ W	R10151
Socket				
SKT65	Socket Housing 2 Way Contact Crimp, 2 off			Cat 14769 Cat 14191
Transistors				
TR1, 3, 5	BC308B			Cat 11977
TR2, 4, 6	ZTX450			Cat 13628



Store 4DS/Store 7DS
August 1979

FAN CO
D7738





orm at collectors of TR2, TR4, and TR6.
ge and Frequency are proportional to the applied voltage
T65 which should be between 4 volts and 12 volts.
ss than approximately 4 volts applied, i.e. when the
ment is cold, the fan will not rotate.

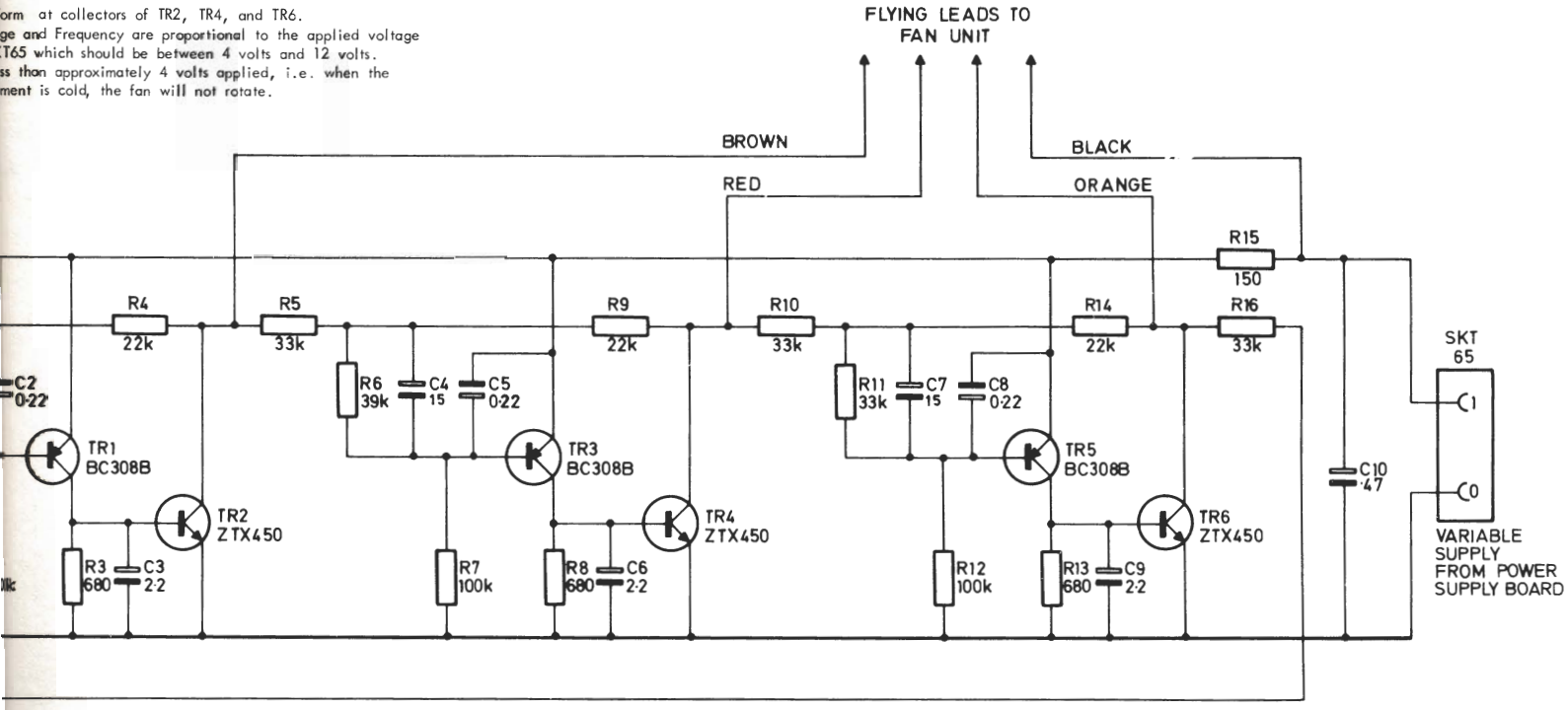
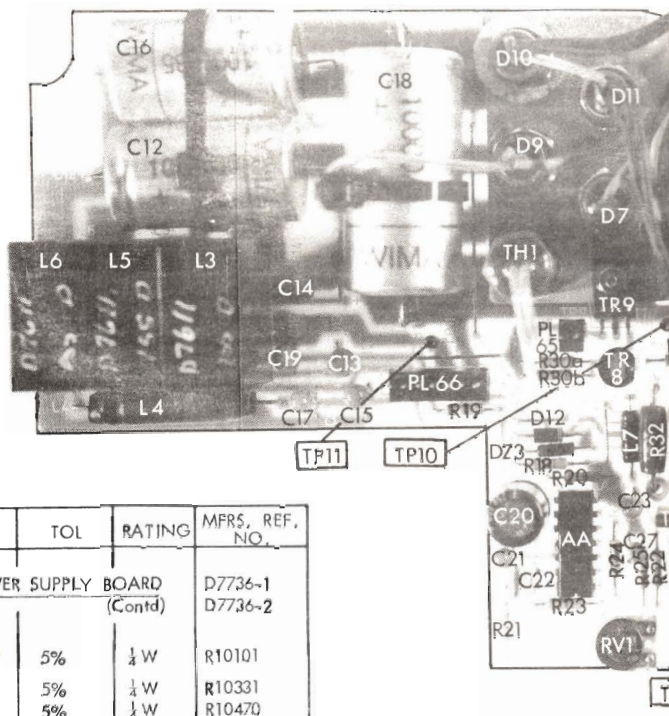


FIG. 43

FAN CONTROL BOARD - LAYOUT AND CIRCUIT D7738

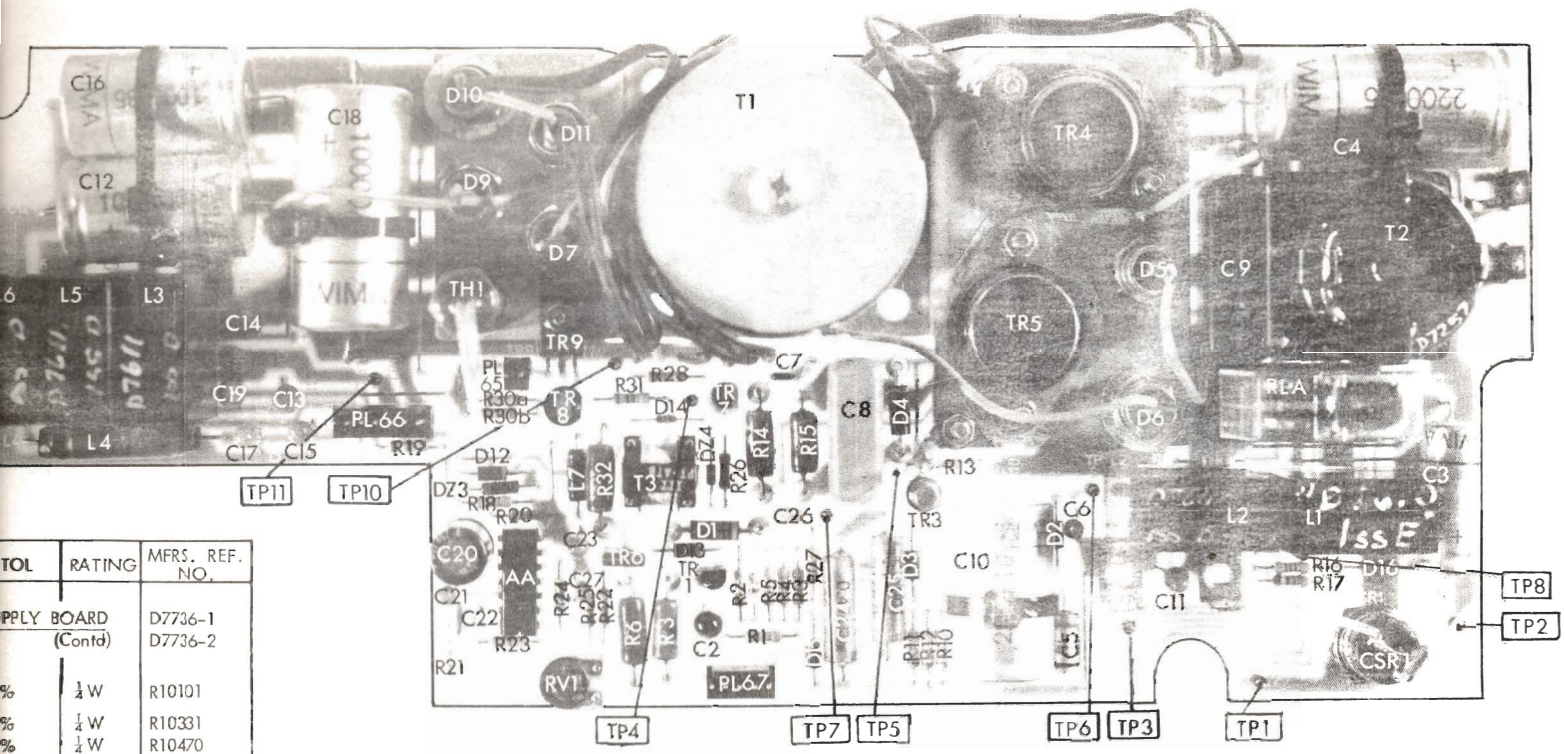
CIRCUIT REF.	VALUE	TOL	RATING	MFRS. REF. NO.
	POWER SUPPLY BOARD			D7736-1 D7736-2
Capacitors				
C2	47 µF	20%	10 V	C162470
C3	1000 µF	-20% +50%	6.3 V	Cat 14435
C4	2200 µF	-10%+50%	35 V	Cat 13137
C5	15 µF	-10%+50%	40 V	Cat 4219
C6,21,27	0.47 µF	20%	35 V	C166478
C7	0.01 µF	-20%+80%	100 V	Cat 13427
C8	2.2 µF	10%	100 V	Cat 9713
C9	4.7 µF	10%	160 V	Cat 13429
C10	2200 µF	-20% +50%	16 V	Cat 13425
C11,19	10 µF	20%	16 V	C163100
C12,16	1000 µF	-10%+50%	35 V	Cat 13470
C18	10,000 µF	-20%+50%	6.3 V	Cat 14432
C20	100 µF	20%	25 V	Cat 14431
C22	100 pF	2%	63 V	Cat 10476
C23	2.2 µF	20%	35 V	C166229
C24,25	0.47 µF	20%	100 V	Cat 10346
C26	4700 pF	10%	100 V	Cat 13647
Chokes				
L1	210 mH			D7610
L2,3,5,6	120 mH			D7611
L4	56 µH			Cat 11670
L7	100 µH			Cat 11679
Diodes				
D1,4	30S1			Cat 12385
D2,3,8,12,13,15,16	1N4002			Cat 9660
D5	S1AN12			Cat 11975
D6,7	SF1AR12			Cat 12643
D9,10,11	SF1AN6			Cat 12386
D14	BAX13			Cat 8406
Diodes Zener				
DZ1	1N5258B			Cat 15066
DZ3	BZY88	C5V1		Cat 8407
DZ4	BZY88	C6V2		Cat 2844
Intergrated Circuit				
AA	N5723A	(Voltage Regulator)		Cat 12099
Plugs				
PL65	Plug Molex 22-04-1021			Cat 14952
PL66	Plug Molex 22-04-1071			Cat 14499
PL67	Plug Molex 22-04-1051			Cat 14181
Potentiometer				
RV1	2k2	Cermit VA05H		Cat 13844
Relay				
RLA				Cat 13366



CIRCUIT REF.	VALUE	TOL	RATING	MFRS. REF. NO.
	POWER SUPPLY BOARD (Contd)			D7736-1 D7736-2
Resistors				
R1,2,9,13,26	100	5%	¼ W	R10101
R3	330	5%	¼ W	R10331
R4	47	5%	¼ W	R10470
R5,20,25,27,30	1 k	5%	¼ W	R10102
R6,32	18	5%	3 W	Cat 11987
R8	2R2	5%	3 W	Cat 12624
R10	22 k	5%	¼ W	R10223
R11	2k7	5%	¼ W	R10272
R12	2k2	5%	¼ W	R10222
R14	100	5%	3 W	Cat 8167
R15	0R2	5%	3 W	Cat 9286
R16	10	5%	¼ W	R10100
R17	220	5%	¼ W	R10221
R18,23	680	5%	¼ W	R10681
R19	3k9	5%	¼ W	R10392
R21(D7736-1)	330 k	5%	¼ W	R10334
R21(D7736-2)	150 k	5%	¼ W	R10154
R22,30a	1k5	5%	¼ W	R10152
R25	4k7	5%	¼ W	R10472
R28	270	5%	¼ W	R10271
R30b	1k8	5%	¼ W	R10182
R31	120	5%	¼ W	R10121
Set on Test Resistor, if fitted	In range 0R1 to 1R3	5%	¼ W	
Terminals				
4 off	Terminal, Faston Tab, Hellerman HC8150T			Cat 13745
11 off	Terminal Assembly Vero 22436			Cat 13747
Thermistor				
TH1	Thermistor Assembly			D7612/2
Thyristor				
CSR1	12RCM10	or BTY 87	100R	Cat 12391

CIRCUIT REF.	VALUE	TOL
	POWER SUPPLY B	
Transformers		
T1	Converter	
T2	Timing	
T3	ITT	
Transistors		
TR1	BC308B	
TR3	Unijunction 2N2	
TR4,5	BDY58	
TR6,9	BD175	
TR7	BC237B	
TR8	ZTX550	
Transistor and Diode Mounting Items		
	Heat sink	
	Heat sink Comps	
	Insulating Bush	
	Mica Washer -	
	Mounting Kit -	
	Pad - Mounting	
	Pad - Mounting	

FIG. 44 P



TOL	RATING	MFRS. REF. NO.
PPLY BOARD (Contd)		D7736-1 D7736-2
%	¼W	R10101
%	¼W	R10331
%	¼W	R10470
%	¼W	R10102
%	3W	Cat 11987
%	3W	Cat 12624
%	¼W	R10223
%	¼W	R10272
%	¼W	R10222
%	3W	Cat 8167
%	3W	Cat 9286
%	¼W	R10100
%	¼W	R10221
%	¼W	R10681
%	¼W	R10392
%	¼W	R10334
%	¼W	R10154
%	¼W	R10152
%	¼W	R10472
%	¼W	R10271
%	¼W	R10182
%	¼W	R10121
%	¼W	
on Tab, Hellermann		Cat 13745
mbly Vero 22436		Cat 13747
sembly		D7612/2
61Y 57	100R	Cat 12391

CIRCUIT REF.	VALUE	TOL	RATING	MFRS. REF. NO.
	POWER SUPPLY BOARD (Contd)			D7736-1 D7736-2
Transformers				
T1	Converter			D7609
T2	Timing			D7257
T3	ITT			Cat 13840
Transistors				
TR1	BC308B			Cat 11977
TR3	Unijunction 2N2646			Cat 10127
TR4,5	BDY58			Cat 13204
TR6,9	BD175			Cat 11980
TR7	BC237B			Cat 11978
TR8	ZTX550			Cat 13629
Transistor and Diode Mounting Items				
	Heat sink			P16036
	Heat sink Compound			Cat 8274
	Insulating Bush - Transistors			Cat 11903
	Mica Washer - Transistor			Cat 7073
	Mounting Kit - Diode			Cat 7097
	Pad - Mounting			Cat 11548
	Pad - Mounting			Cat 11541

Store 4DS/7DS
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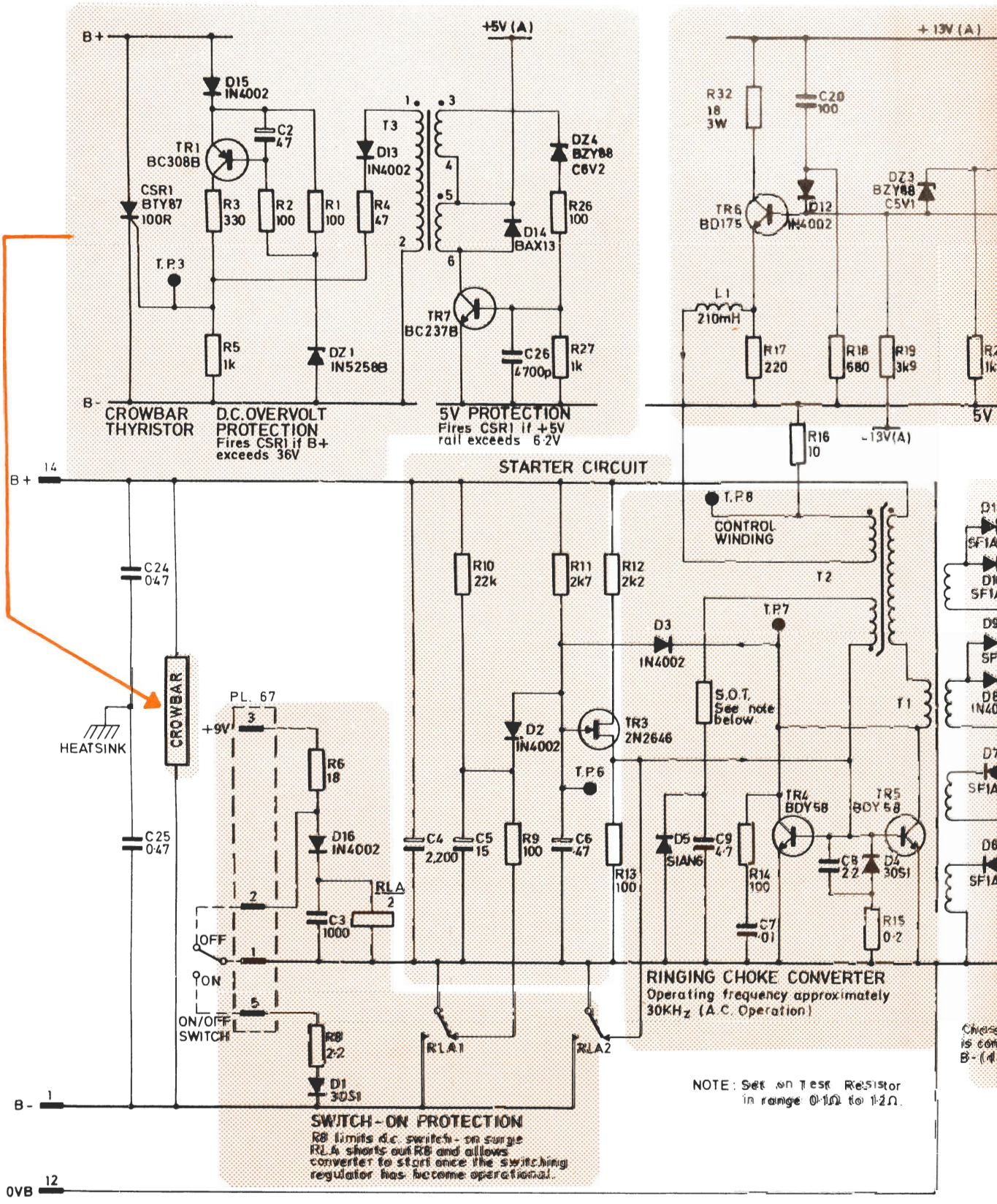
FIG.44 POWER SUPPLY BOARD - LAYOUT D7736/1



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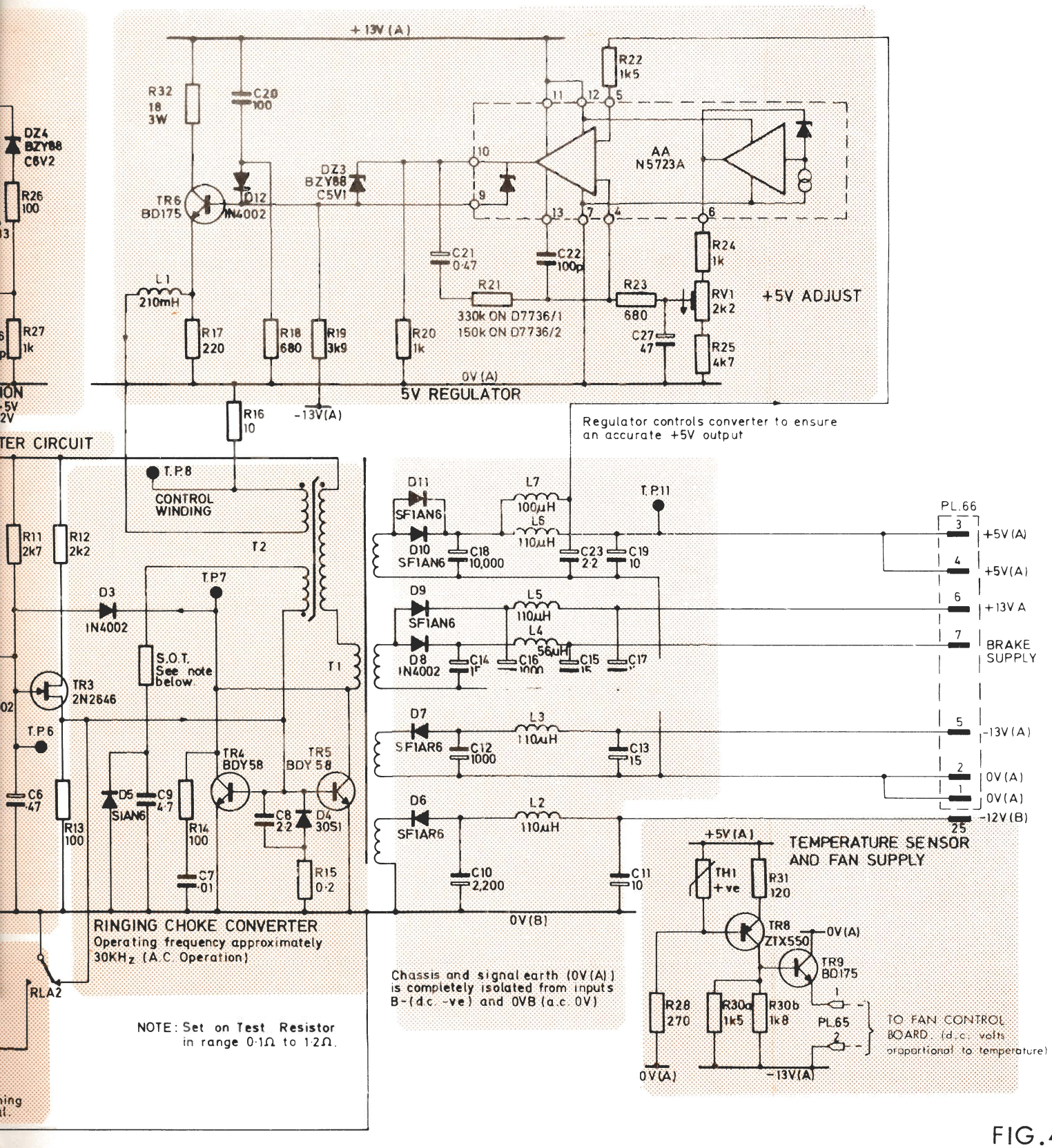


FIG.45
POWER SUPPLY BOARD - CIRCUIT

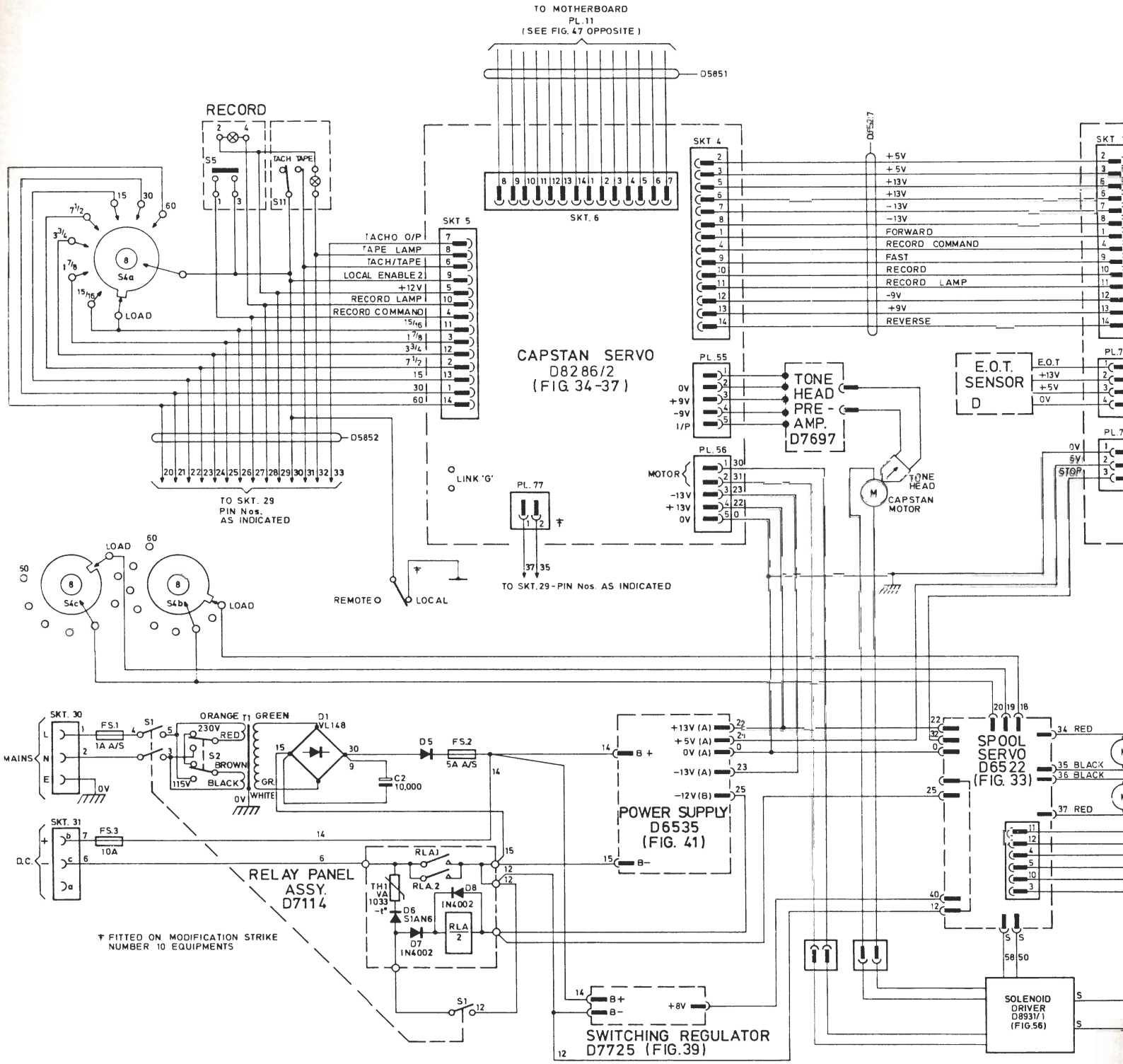
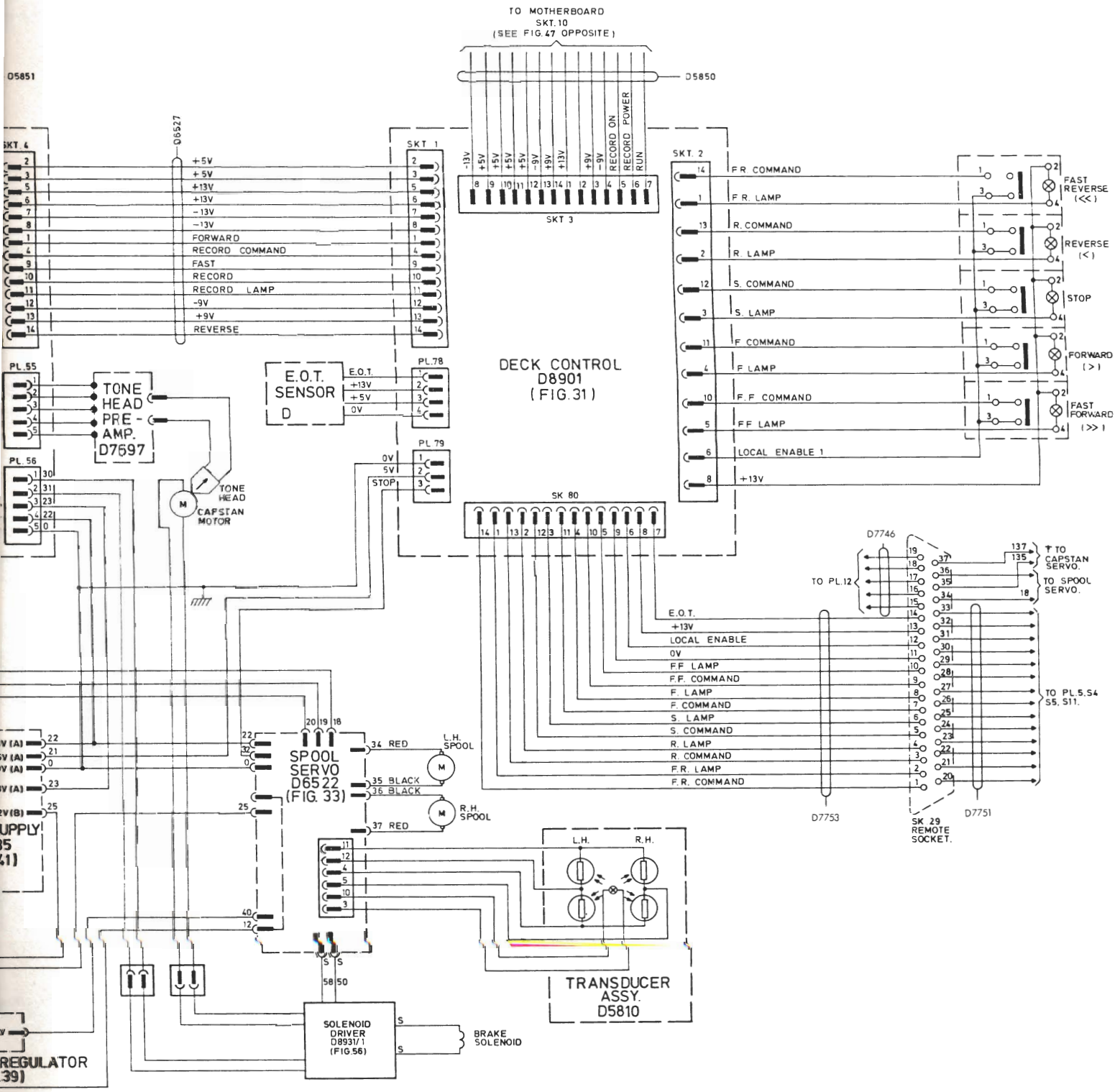
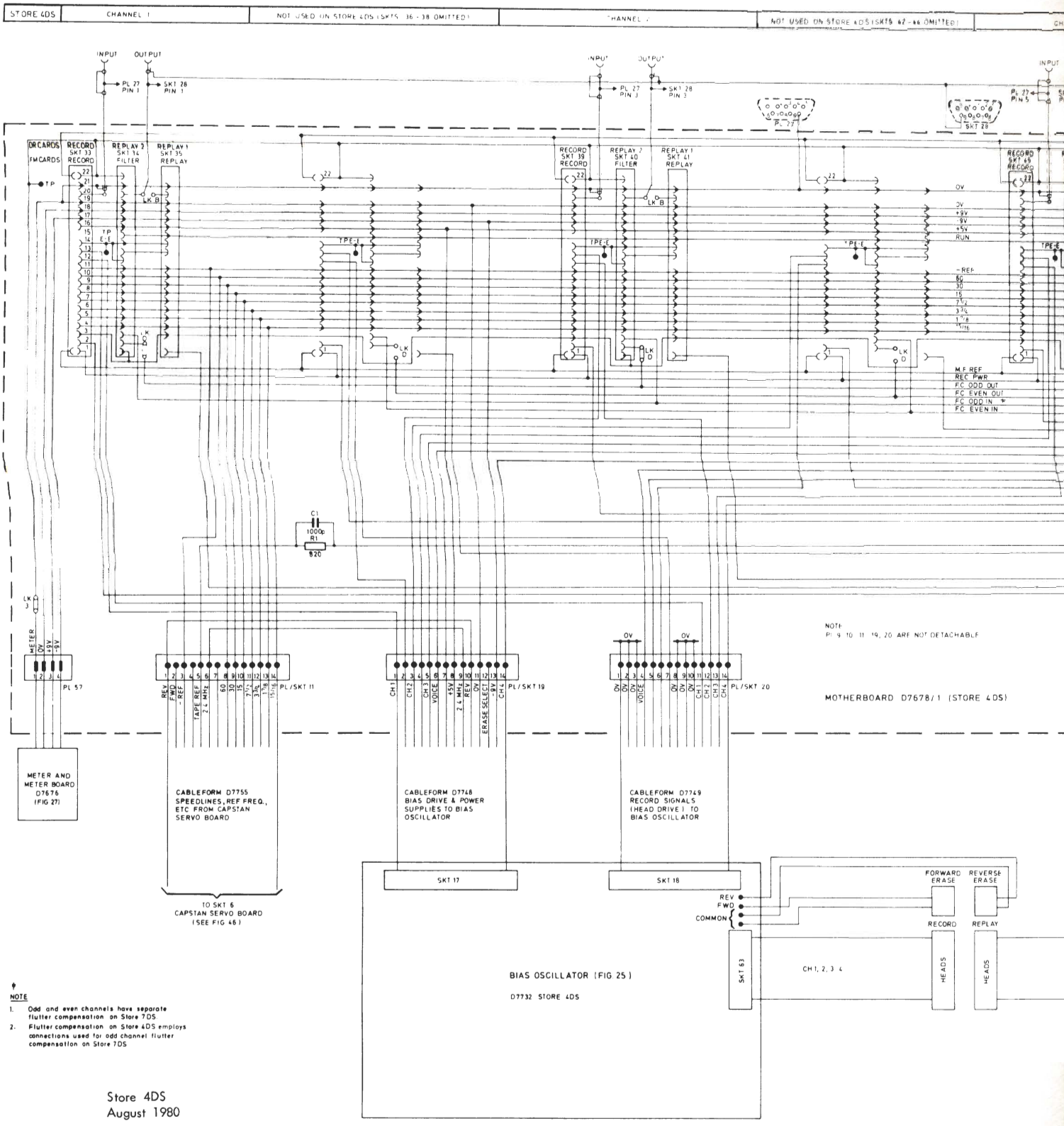


FIG. 46
STORE 4DS INTERCONNECTION OF TRANSPORT AND POWER CIRCUITS


TO MOTHERBOARD
SKT. 10
(SEE FIG. 47 OPPOSITE)
D5850
D5851
SKT 3
SKT 1
SKT 2
SKT 4
D6527
+5V
+5V
+13V
+13V
-13V
-13V
FORWARD
RECORD COMMAND
FAST
RECORD
RECORD LAMP
-9V
+9V
REVERSE
RECORD ON
RECORD POWER
RUN
F.R. COMMAND
F.R. LAMP
R. COMMAND
R. LAMP
S. COMMAND
S. LAMP
F. COMMAND
F. LAMP
F.F. COMMAND
F.F LAMP
LOCAL ENABLE 1
+13V
FAST REVERSE (<<)
REVERSE (<)
STOP
FORWARD (>)
FAST FORWARD (>>)
DECK CONTROL
D8901
(FIG. 31)
SK 80
PL.55
TONE HEAD PRE-AMP. D7597
PL.56
TONE HEAD
CAPSTAN MOTOR
E.O.T. SENSOR D
E.O.T.
+13V
+5V
0V
PL.78
PL.79
0V
5V
STOP
D7746
TO PL.12
TO CAPSTAN SERVO.
TO SPOOL SERVO.
TO PL.5.S4 S5, S11.
E.O.T.
+13V
LOCAL ENABLE
0V
F.F. LAMP
F.F. COMMAND
F. LAMP
F. COMMAND
S. LAMP
S. COMMAND
R. LAMP
R. COMMAND
F.R. LAMP
F.R. COMMAND
D7753
D7751
SK 29 REMOTE SOCKET.
SPOOL SERVO D6522 (FIG. 33)
34 RED
35 BLACK
36 BLACK
37 RED
L.H. SPOOL
R.H. SPOOL
L.H.
R.H.
TRANSDUCER ASSY. D5810
SOLENOID DRIVER D8931/1 (FIG.56)
BRAKE SOLENOID
REGULATOR



NOTE

1. Odd and even channels have separate flutter compensation on Store 7DS.
2. Flutter compensation on Store 4DS employs connections used for odd channel flutter compensation on Store 7DS.

Store 4DS
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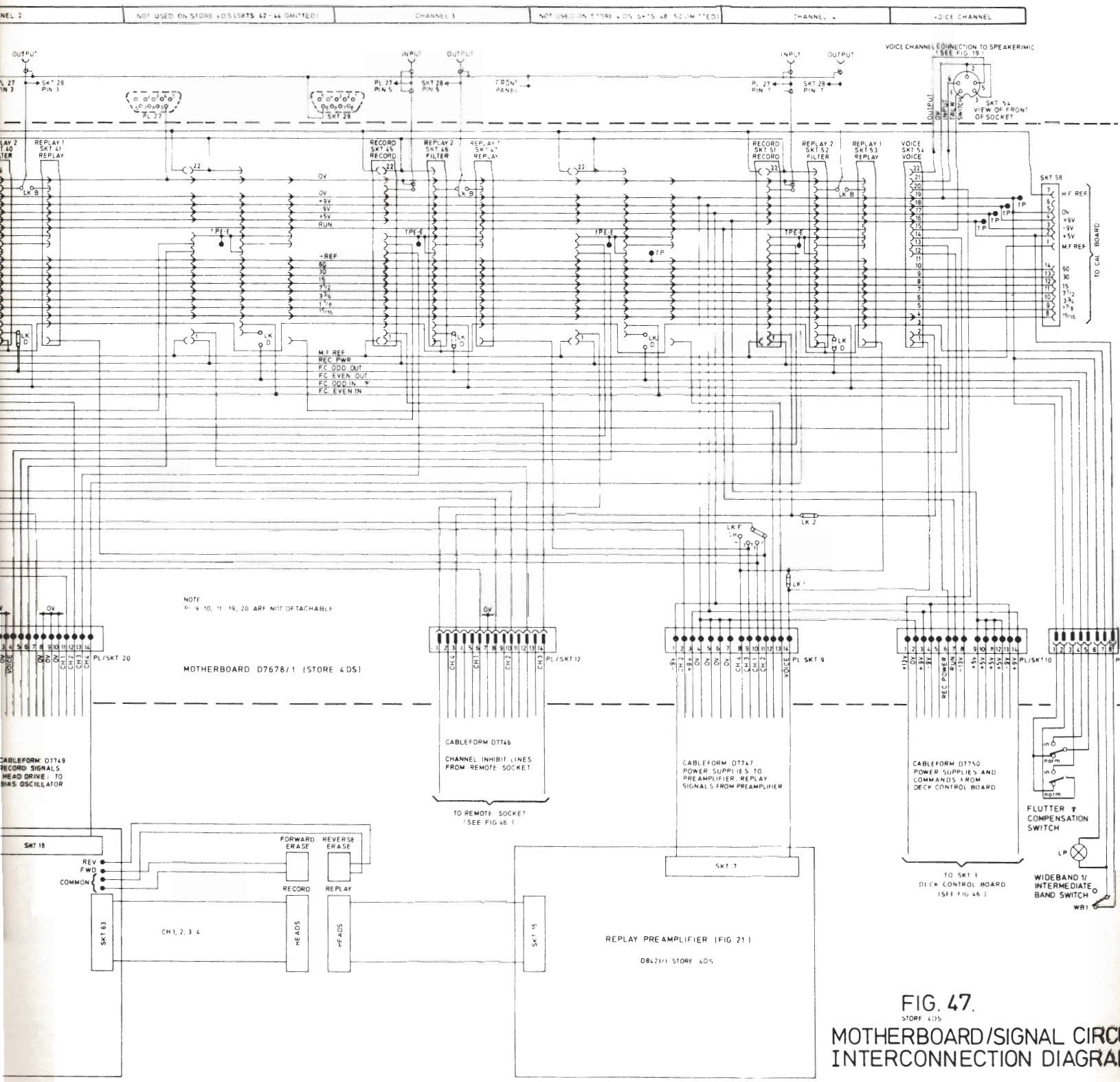


FIG. 47.
STORE 4DS
MOTHERBOARD/SIGNAL CIRC
INTERCONNECTION DIAGRA

CIRCUIT REF.	VALUE	TOL	RATING	MFRS. REF. NO.
	STORE 7DS			D7690
ACCESSORIES				
Connectors				
1 off	Connector, Mains Lead			Cat 11728
1 off	Plug, D.C. Supply			Cat 8429
14 off	Plug, Coaxial BNC			Cat 4858
1 off	Plug, (Remote control) Cannon 37 way DC 37P			Cat 4820
2 off	Plug, 9 pin Cannon DE9P			Cat 1366
1 off	Socket, 9 pin Cannon DE9S			Cat 2202
3 off	Shell - 9 pin Amp 205729-1			Cat 14294
1 off	Shell - 37 pin Amp 205731-5			Cat 14296
General Items				
1 off	Microphone/Loudspeaker Assembly			D5846
1 off	Muff, Protector			Cat 11468
1 roll	Reflective Marker Tape			Cat 10331
1 off	Spool (empty)			Cat 2300
1 off	Tape, on spool			Cat 15290
1 off	Technical Handbook			Cat 13335
MAIN ASSEMBLY				
	Base Cover			D6959
	Deck Cover (Transparent)			D8099
	Fascia Cover			P15237
	Front and Top Cover Assembly			D8652
	Handle			D5840
	Handle Catch			D5839
	Handle Runner			D5838
	Head Cover			P15211
Connectors	(Chassis Mounting)			
SKT22	25 Way, Cannon DB25S			Cat 2208
PL27	9 pin D Type Cannon DE9P			Cat 1366
SKT23,28	9 pin D Type Cannon DE9S			Cat 2202
SKT25	37 pin Cannon DC37S			Cat 8430
SKT26	5 Pin DIN			Cat 10238
14 off	Plug, Coaxial, BNC			Cat 12012

CIRCUIT REF.	VALUE	TOL	RATING	MFRS. REF. NO.
	STORE 7DS (Contd)			D7690
SUB ASSEMBLIES				
(For printed circuit boards, refer to index for appropriate Figure)				
Brake Arm Assembly				D8937
2 off	Brake Pad Assembly			D8178
Capstan Drive Assembly				D8930/1
	Capstan Pulley			30120-614-00
	Pulley Disc, Black			P15346
Counter Assembly				D5816
	Counter			Cat 4223
	Counter Drive Ring			Cat 1863
	Pulley			P13867
EOT/BOT Assembly				D6932
Head Plate Assembly				*
	Standard			D8089/1
	alternative voice track position (see Fig.53)			D8089/2
Meter Assembly	(See Fig.26)			D7679
Push Button Assembly				D5814
	Bracket (mounting)			P13868
	Bulb 14V 0.04A midget flange base			Cat 8600
	Push Button "<<"			P14270
	Push Button "<"			P14272
	Push Button "STOP"			P14268
	Push Button ">"			P14273
	Push Button ">>"			P14271
5 off	Switch TMC dialight 513-0101-604			Cat 12125
Rear Casting Assembly				D7630

CIRCUIT REF.	VALUE	TOL
	STORE 7DS	
Speed Selector Assembly		
	Bracket (mounting	
	Bracket (switch)	
	Knob	
	Push Button "REC	
S5	Switch (push) TM 513-0101-60	
S1	Switch, mains, (	
S4	Switch (rotary)	
Spool Drive Assembly (2 off)		
Switch Assemblies		
	Flutter Compensa Assembly	
	Bracket	
LP2	Lamp 6V, 0.1A	
	Lamp Holder, cl	
S13	Switch, sub mini	
S12	Switch, Toggle	
	Local Enable an Switch Asse	
	Bracket	
LP1	Lamp 14V 0.0	
	Lamp Holder, cl	
S11	Switch, Toggle	
Tension Arm Assembly		
	Bulb 5V 0.06A V6	
	Photocell P.C.B A	
	Spring (Red)	
	Spring (Black)	

TOL	RATING	MFRS. REF. NO.
E 7DS (Contd)		D7690
refer gure)		
		D8937
Assembly		D8178
		D8930/1
ey		30120-614-00
Black		P15346
		D5816
		Cat 4223
ive Ring		Cat 1863
		P13867
		D6932
	*	
		D8089/1
voice track ee Fig. 53)		D8089/2
26)		D7679
		D5814
nounting)		P13868
0.04A midget base		Cat 8600
on "<<"		P14270
on "<"		P14272
on "STOP"		P14268
on ">"		P14273
on ">>"		P14271
MC diolight 513-1-604		Cat 12125
		D7630

CIRCUIT REF.	VALUE	TOL	RATING	MFRS. REF. NO.
	STORE 7DS (Contd)			D7690
Speed Selector Assembly				D5815
	Bracket (mounting)			P13863
	Bracket (switch)			P13864
	Knob			Cat 12163
	Push Button "RECORD"			P14269
S5	Switch (push) TMC dialight 513-0101-604			Cat 12125
S1	Switch, mains, (rocker)			Cat 15189
S4	Switch (rotary)			Cat 12131
Spool Drive Assembly (2 off)			*	D6941
Switch Assemblies				
	Flutter Compensation Switch Assembly			D8338/1
	Bracket			P16740/2
LP2	Lamp 6V, 0.1A			Cat 13731
	Lamp Holder, clear			Cat 4770
S13	Switch, sub miniature			Cat 12745
S12	Switch, Toggle			Cat 12759
	Local Enable and Tape Switch Assembly			D8669
	Bracket			P17276/2
LP1	Lamp 14V 0.04A			Cat 8600
	Lamp Holder, clear			Cat 4770
S11	Switch, Toggle			Cat 12759
Tension Arm Assembly				D6954
	Bulb 5V 0.06A vitality V680			Cat 8599
	Photocell P.C. Boards Assembly			D5811
	Spring (Red)			P15251
	Spring (Black)			P15352

CIRCUIT REF.	VALUE	TOL	RATING	MFRS. REF. NO.
TOOLS, SPARES AND OPTIONAL ITEMS (Not supplied with basic equipment).				
Boards				
	Calibration (Reference) Board			D7720
	Extender Boards for:-			
	F.M. Record/D.R. Record			D6502/2
	F.M. Replay/D.R. Replay 1			D6503
	F.M. Filter/D.R. Replay 2			D6504/2
	Voice Board			D6505
	Set of D.R. Boards for one channel			D7741/2
	Set of F.M. Dual Standard Boards for one channel			D8285
Tools etc.				
	Allen Keys:-			
	1.5 mm			523/00/557
	2.5 mm			523/00/558
	3.0mm			523/00/701
	Pozidriv Screwdrivers:-			
	Point 0			523/00/647
	Point 1			523/00/670
	Point 2			Cat 12683
	Screw fixing (assorted packet)			D5894
	Heat Transfer Compound, Dow Corning 340 (see maintenance chapter)			Cat 8274
Rack Mounting Kit				D5831

* The items which make up this unit come as a complete assembly and cannot be supplied separately.

FIG. 49
GENERAL PARTS LIST

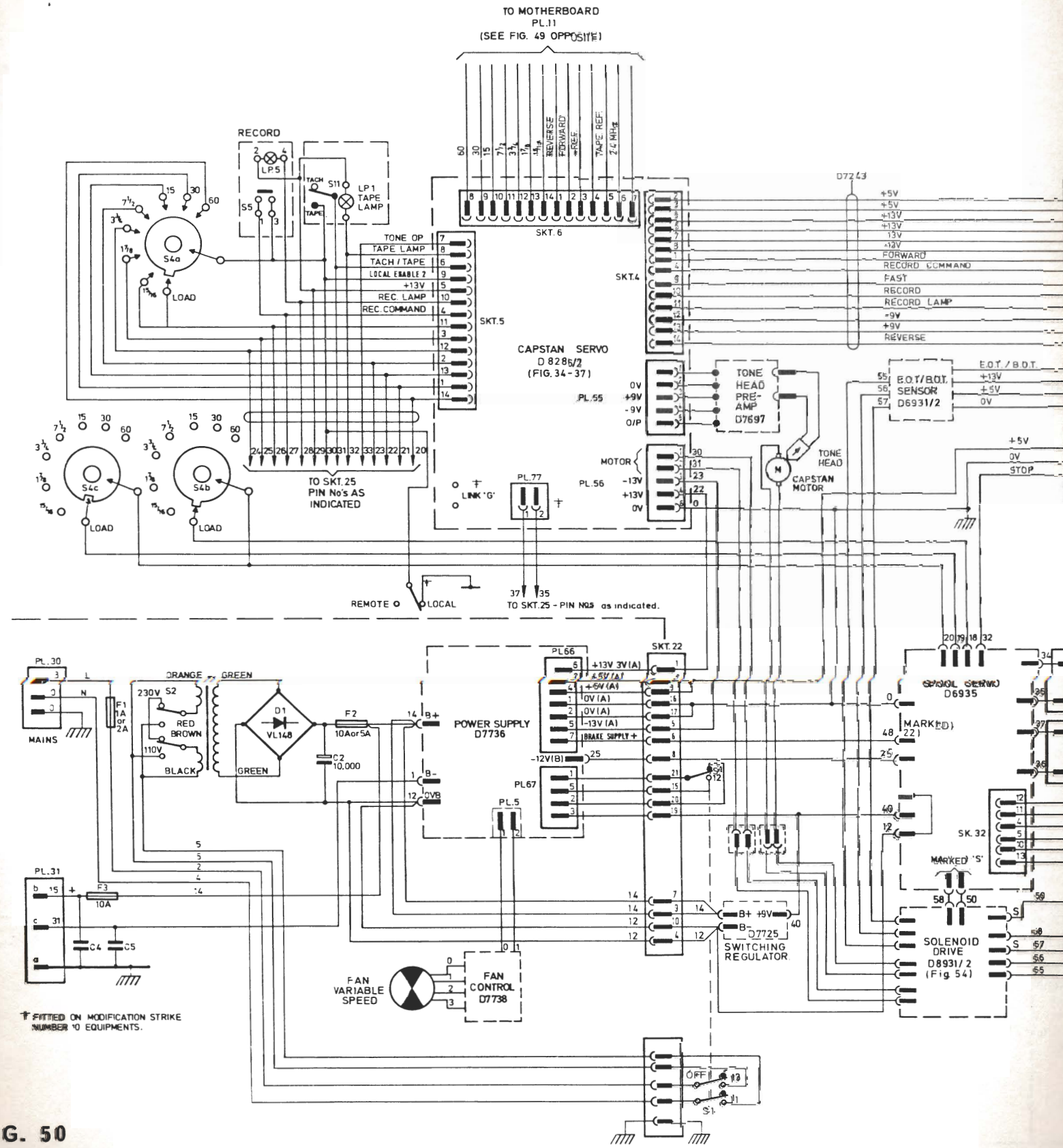
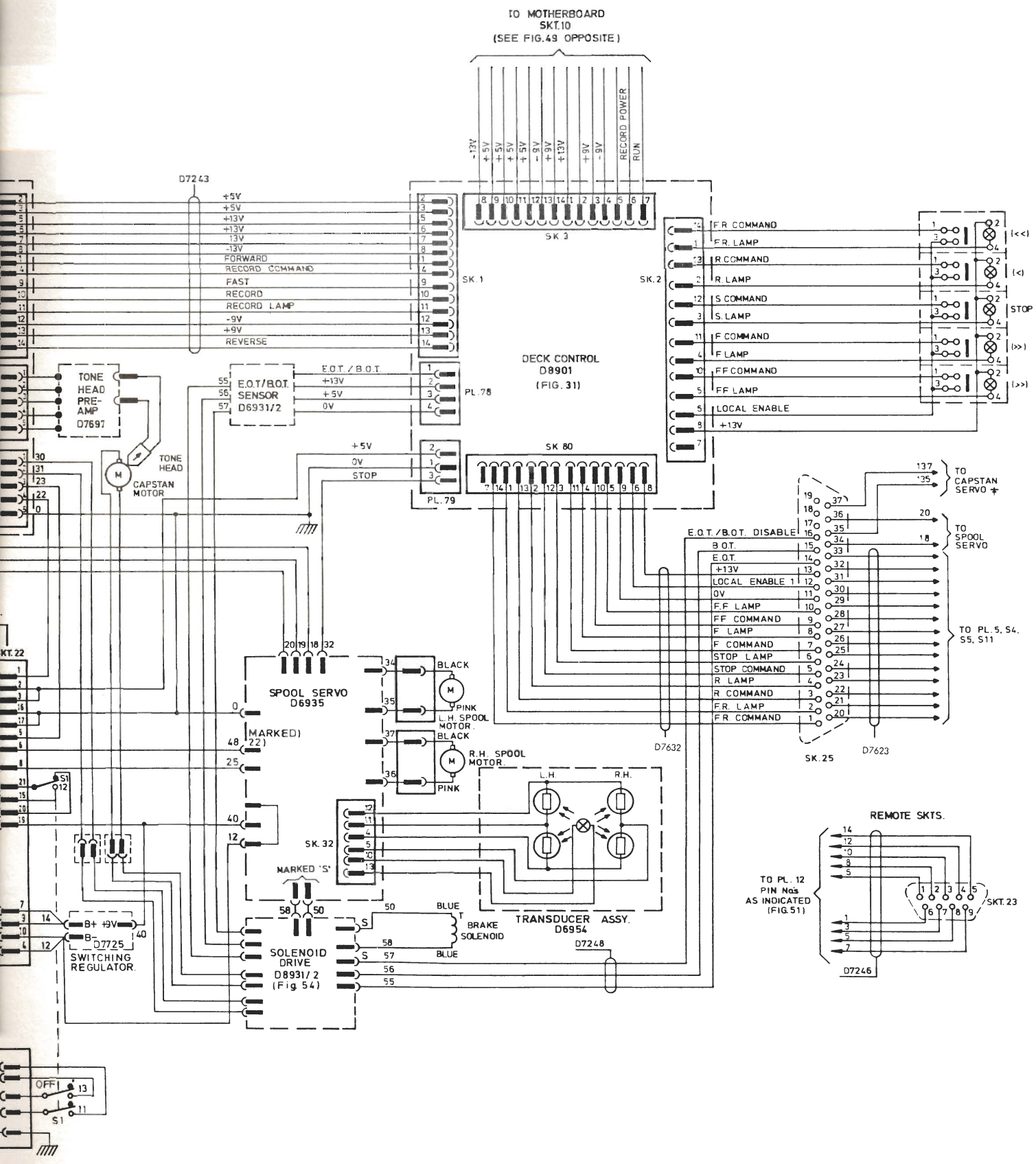
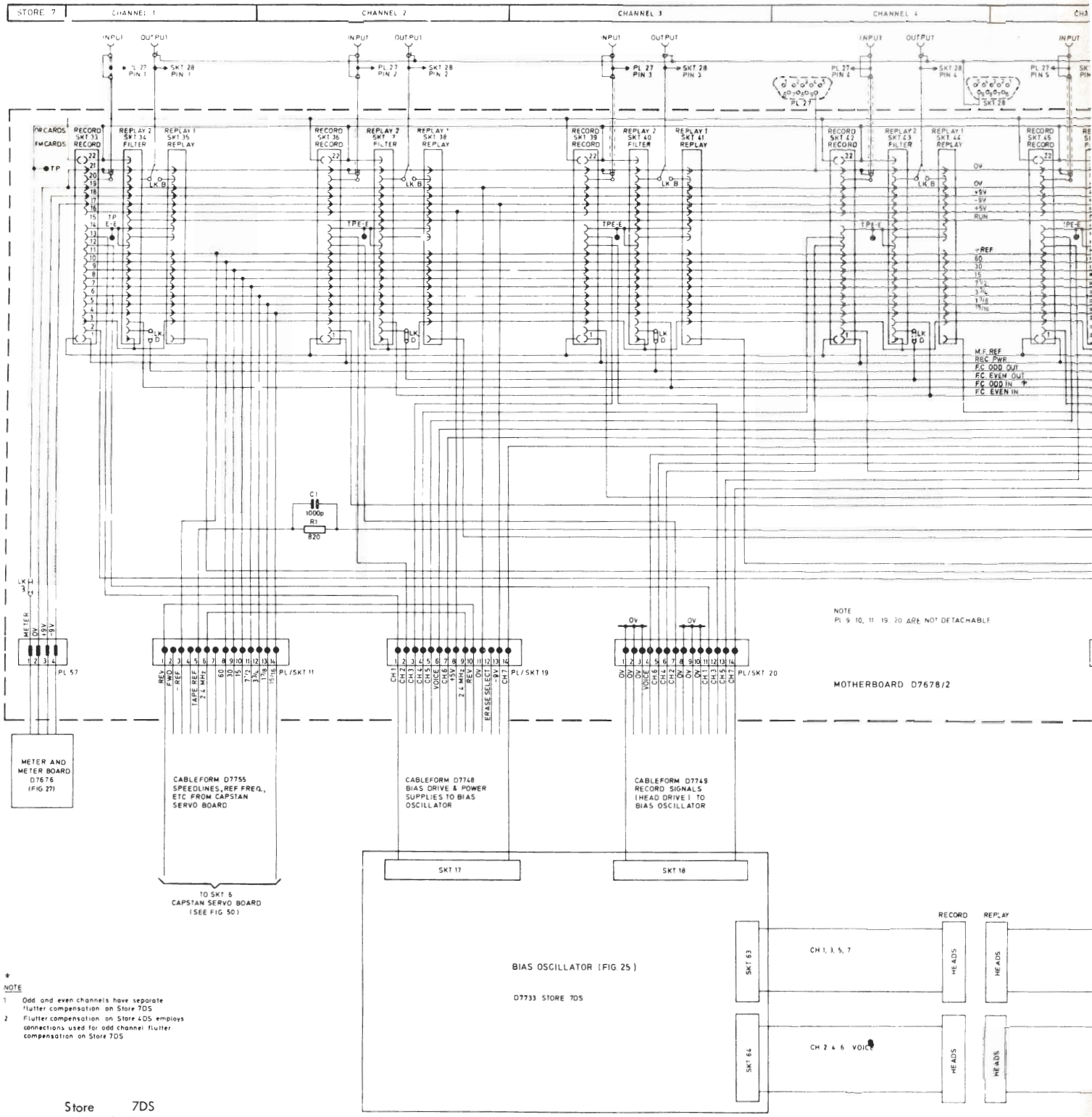


FIG. 50
STORE 7DS INTERCONNECTION OF TRANSPORT AND POWER CIRCUITS


TO MOTHERBOARD
SKT.10
(SEE FIG.49 OPPOSITE)
-13V
+5V
+5V
+5V
+5V
-9V
+9V
+13V
+9V
-9V
RECORD POWER
RUN
D7243
+5V
+5V
+13V
+13V
13V
-13V
FORWARD
RECORD COMMAND
FAST
RECORD
RECORD LAMP
-9V
+9V
REVERSE
SK.1
SK.3
SK.2
DECK CONTROL
D8901
(FIG. 31)
F.R COMMAND
F.R. LAMP
R.COMMAND
R. LAMP
S.COMMAND
S. LAMP
F.COMMAND
F LAMP
FF COMMAND
FF LAMP
LOCAL ENABLE
+13V
(<<)
(<)
STOP
(>>)
(>>)
TONE HEAD PRE-AMP D7697
E.O.T./B.O.T. SENSOR D6931/2
E.O.T./B.O.T.
+13V
+5V
0V
PL.78
PL.79
SK 80
+5V
0V
STOP
TONE HEAD
CAPSTAN MOTOR
E.O.T./B.O.T. DISABLE
B.O.T.
E.O.T.
+13V
LOCAL ENABLE 1
0V
F.F LAMP
FF COMMAND
F LAMP
F COMMAND
STOP LAMP
STOP COMMAND
R LAMP
R COMMAND
F.R. LAMP
F.R. COMMAND
TO CAPSTAN SERVO
TO SPOOL SERVO
TO PL. 5, S4, S5, S11
D7632
D7623
SK.25
SPOOL SERVO D6935
BLACK
PINK
L.H. SPOOL MOTOR.
R.H. SPOOL MOTOR.
MARKED)
22)
SK. 32
MARKED 'S'
L.H.
R.H.
TRANSDUCER ASSY. D6954
REMOTE SKTS.
TO PL. 12 PIN Nos AS INDICATED (FIG. 51)
SKT. 23
D7246
SKT. 22
S1
12
B+ +9V
B-
D7725
SWITCHING REGULATOR.
SOLENOID DRIVE D8931/2 (Fig. 54)
BLUE
BRAKE SOLENOID
D7248
OFF
13
11
S1



*
NOTE

1 Odd and even channels have separate flutter compensation on Store 7DS

2 Flutter compensation on Store 4DS employs connections used for odd channel flutter compensation on Store 7DS

Store 7DS
August 1980

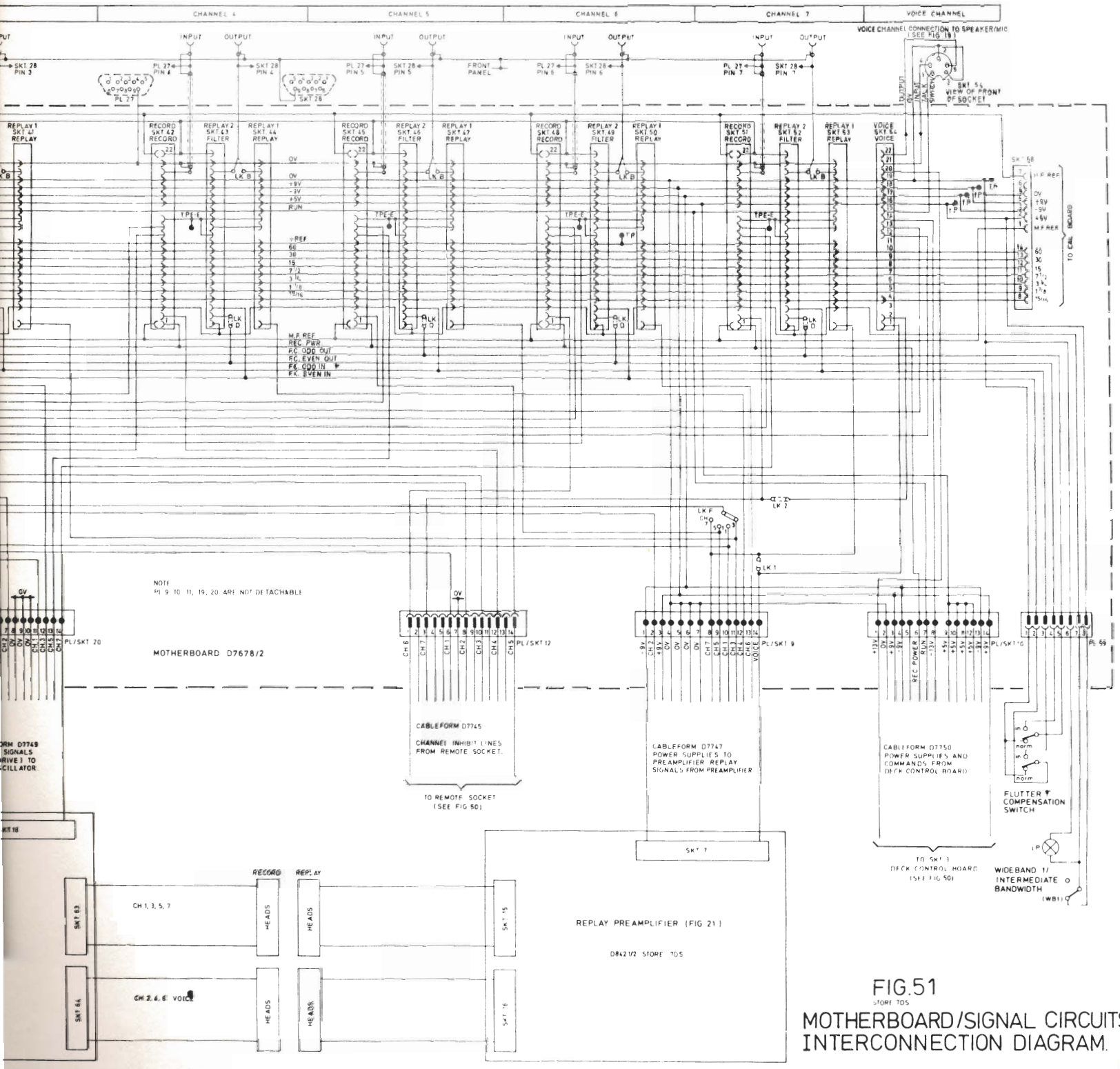
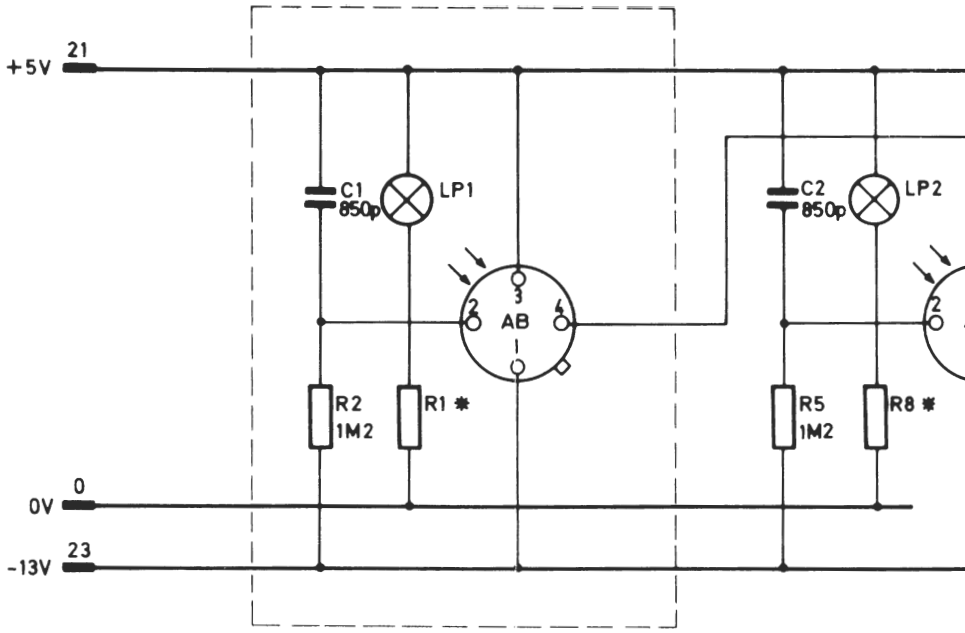


FIG.51
STORE 705
MOTHERBOARD/SIGNAL CIRCUITS INTERCONNECTION DIAGRAM.



CIRCUIT REF.	VALUE	TOL	RATING	MFRS. REF. NO.
	EOT/BOT SENSOR BOARD			
Capacitors				
C1, C2	820 pF	10%	200 V	Cat 13128
Integrated Circuit				
AA	SN74LSOON			Cat 15077
Lamps				
LP1, LP2	Vitality	V680		Cat 8599
Photocell				
AB, AC	IPL1500AO Integrated Photo Matrix Ltd. (WARNING MOS DEVICES)			Cat 11758
Resistors				
R1, R8	S.O.T.	5%	¼ W	
R2, R5	1M2	5%	¼ W	R10125
R3, R6, R7	100Ω	5%	¼ W	R10101
R4	4k7	5%	¼ W	R10472

* SELECT ON TEST
VALUE BETWEEN 15R AND 100R.

CIRCUIT IN ENCLOSED BROKEN LINE
IS FOR STORE 4 EXCEPT THAT IDENTIFICATIONS
R1 AND R2 ARE TRANSPOSED.

STORE 4DS EOT circuit is D6501/2

STORE 7DS EOT/BOT circuit is D6931/2

Store 4DS/7DS
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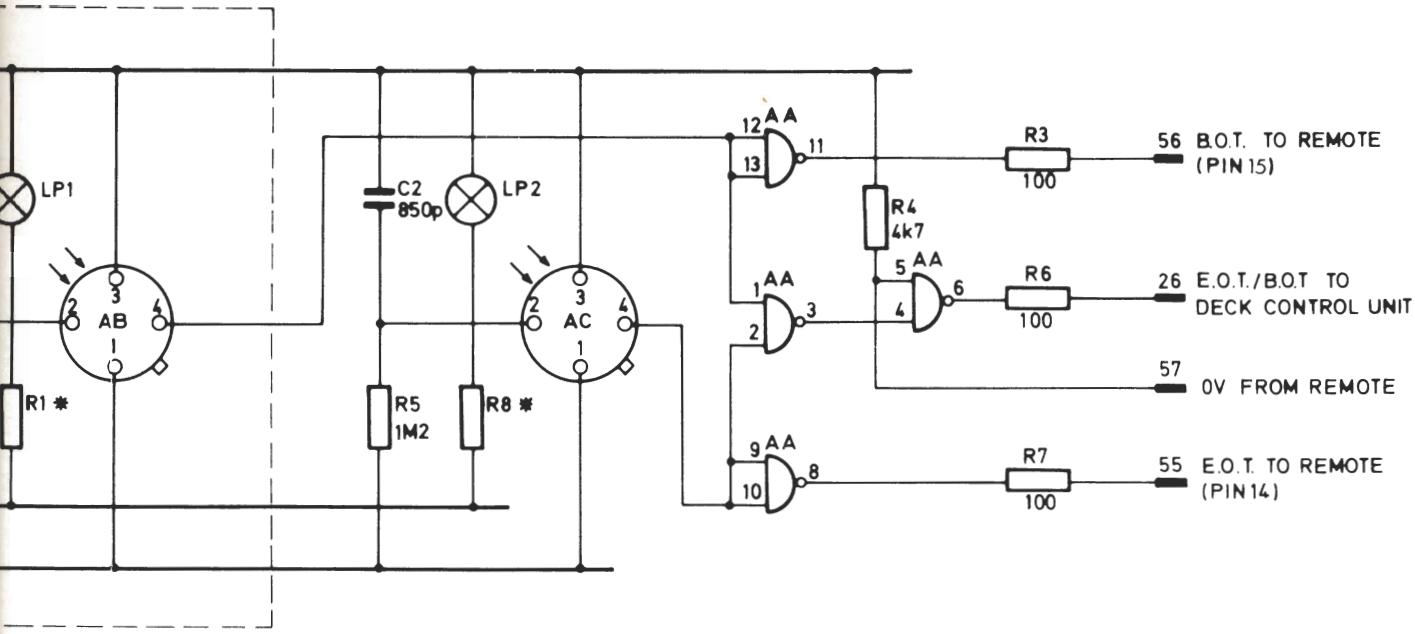


TEST
EN 15R AND 100R.

CLOSED BROKEN LINE
4 EXCEPT THAT IDENTIFICATIONS
RE TRANSPOSED.

OT circuit is D6501/2

OT/BOT circuit is D6931/2

WARNING

MOS DEVICES

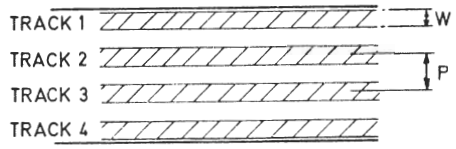
This circuit contains MOS devices. To eliminate the possibility of damage by static electricity the handling of electronic components or tracks on the printed circuit board, must be avoided.

Test equipment, soldering irons etc., must be earthed before being used on this circuit

FIG. 52
EOT/BOT - CIRCUIT AND PARTS LIST
D6501/2 and D6931/2

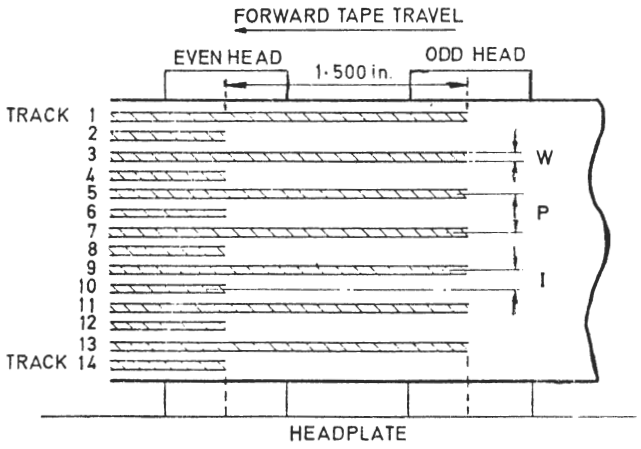
/7DS
30

The diagrams below summarize the magnetic track configuration on $\frac{1}{4}$ in and $\frac{1}{2}$ in "STORE" Range Recorders:-



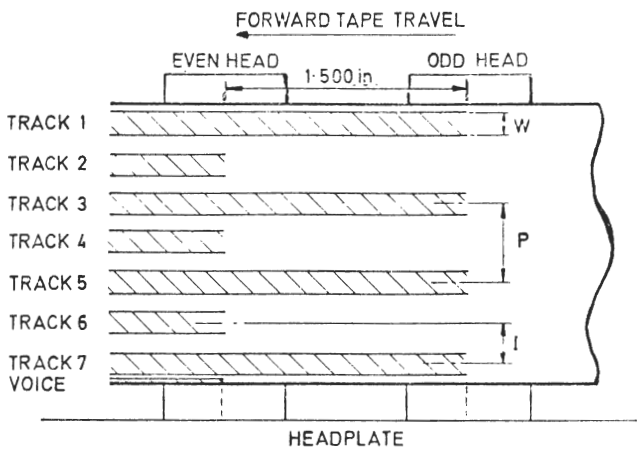
4 TRACK CONFIGURATION

PITCH P = 1·78mm
WIDTH W = 0·76mm on STORE 4, 4M, STOREFAX.
= 0·89mm on STORE 4D.



STORE 14, GEOSTORE TRACK CONFIGURATION

TRACK WIDTH	W = 0·64 mm
PITCH	P = 1·78 mm
TRACK INTERLACE	I = 0·89 mm



STORE 7, STORE 7D, TRACK CONFIGURATION

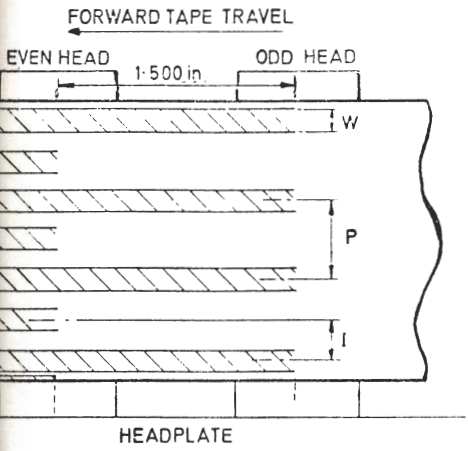
TRACK WIDTH	W = 1·17mm
PITCH	P = 3·56mm
TRACK INTERLACE	I = 1·78mm
VOICE TRACK —	CUE TRACK 0·2mm WIDE (APPROX) ON LOWER EDGE OF TAPE.

STORE 7D VOICE TRACK

On standard equipments the voice track is on the lower edge of the tape, however equipments can be supplied to special order with the voice track on the top edge of the tape.

configuration on $\frac{1}{4}$ in and

FAX.



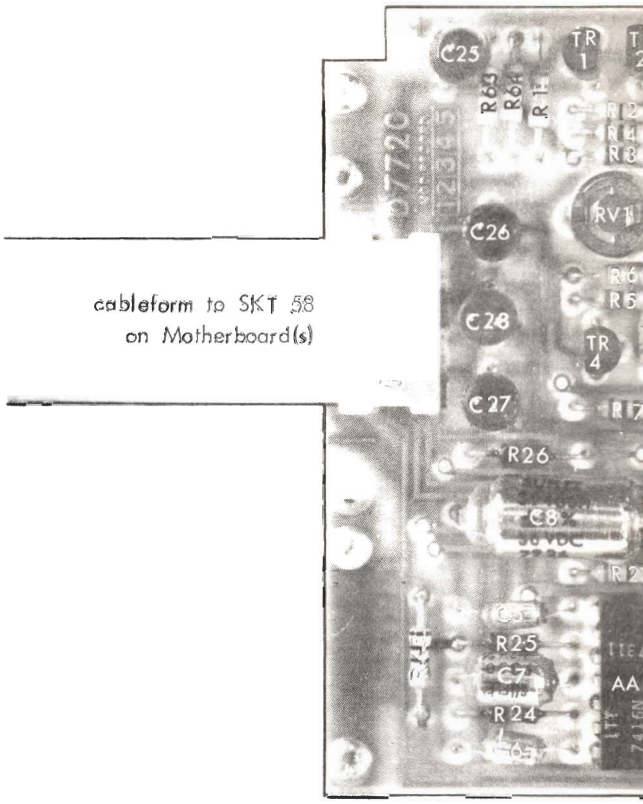
7, STORE 7D, TRACK CONFIGURATION

K WIDTH	W = 1·17mm
H	P = 3·56mm
CK INTERLACE	I = 1·78mm
E TRACK —	CUE TRACK 0·2mm WIDE (APPROX) ON LOWER EDGE OF TAPE.

track
, how-
to special
top edge

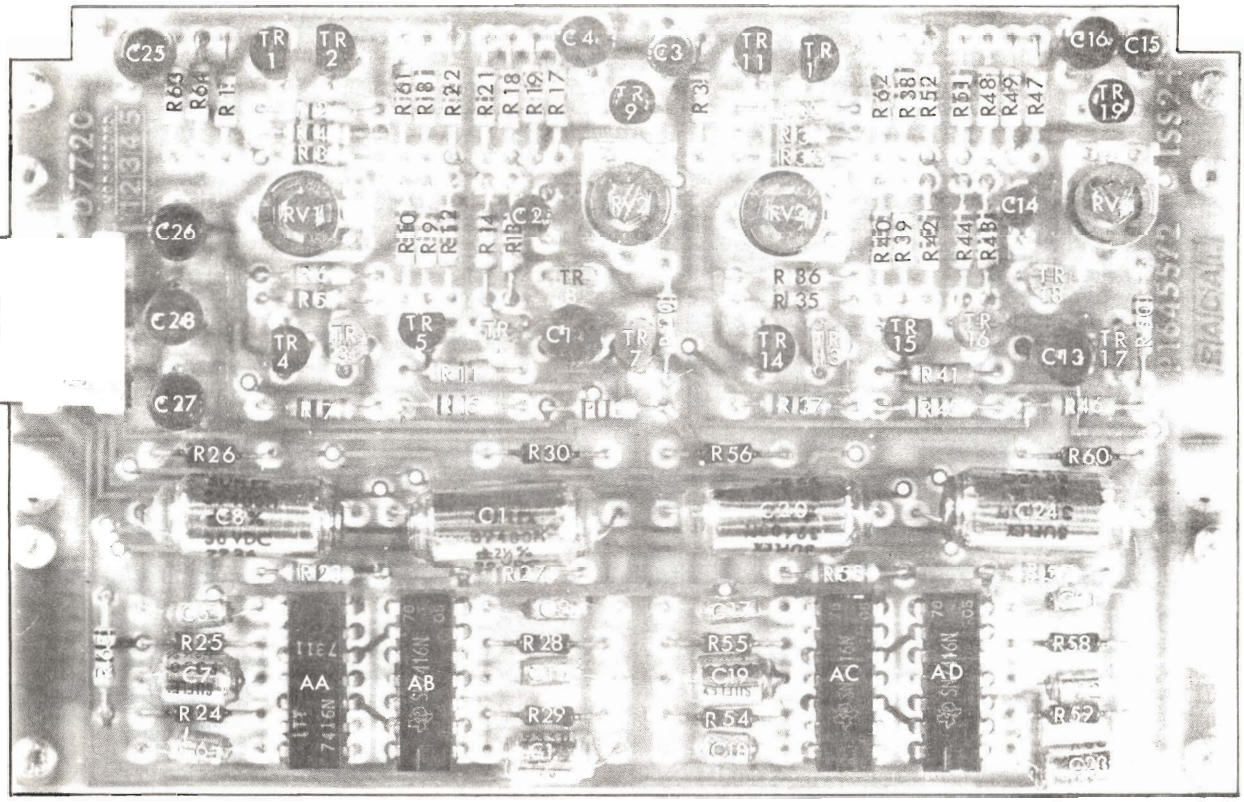
FIG. 53
MAGNETIC RECORDING TRACK FORMAT

CIRCUIT REF.	VALUE	TOL	RATING	MFRS. REF. NO.
	D.R.CALIBRATION BOARD			D7720/1 D7720/2
Capacitors				
C1, 9, 13, 16, 27, 28	47 µF	20%	10V	Cat 13433
C2, 14	6.8 µF	20%	16V	Cat 14212
C3, 15, 25, 26	33 µF	20%	16V	C163330
C5	592 pF	2½%	30V	Cat 14213
C6, 10, 18, 22	1850 pF	2½%	30V	Cat 14214
C7, 11, 19, 23	9350 pF	2½%	30V	Cat 14216
C8, 12, 20, 24	39400 pF	2½%	30V	Cat 14219
C9	470 pF	2½%	30V	Cat 14632
C17, 21	560 pF	2½%	30V	Cat 14909
Integrated Circuit				
AA, AB, AC, AD	SN7416N			Cat 12098
Potentiometers				
RV1	470Ω	Cermet		Cat 11926
RV2, 4	220Ω	Cermet		Cat 13858
RV3	4k7	Cermet		Cat 12411
Resistors				
R1, 14, 31, 35	10k	5%	¼ W	R10103
R2, 19, 49	12k	5%	¼ W	R10123
R3, 4, 5, 7, 10, 12, 33, 34, 37, 40, 42, 51	1k	5%	¼ W	R10102
R6, 11, 36, 41	6k8	5%	¼ W	R10682
R9	560Ω	5%	¼ W	R10561
R15, 45	121Ω	1%	¼ W	R201210
R16, 46	68R1	1%	¼ W	R206819
R17, 47	39k	5%	¼ W	R1039
R18, 48	150k	5%	¼ W	R10154
R19, 49	12k1	1%	¼ W	R201212
R20, 50	221Ω	1%	¼ W	R202210
R21	68Ω	5%	¼ W	R10680
R22, 52, 61, 62	100Ω	5%	¼ W	R10101
R23, 27, 53, 57	15Ω	5%	¼ W	R10150
R24, 25, 26, 28, 29, 30, 54, 55, 56, 58, 59, 60	2M2	5%	¼ W	R10225
R32	68k	5%	¼ W	R10683
R39	5k6	5%	¼ W	R10562
R44	56k	5%	¼ W	R10563
R63, 64	10Ω	5%	¼ W	R10100



CIRCUIT REF.	VALUE	TOL	RATING	MFRS. REF. NO.
	D.R. CALIBRATION BOARD (Cont)			D7720/1 D7720/2
Transistors				
TR1, 2, 4, 5, 11, 12, 14, 15	BC237B			Cat 11978
TR3, 6, 7, 8, 13, 16, 17, 18	BC308B			Cat 11977
TR9, 19	E112 F.E T.			Cat 10540

FIG. 54

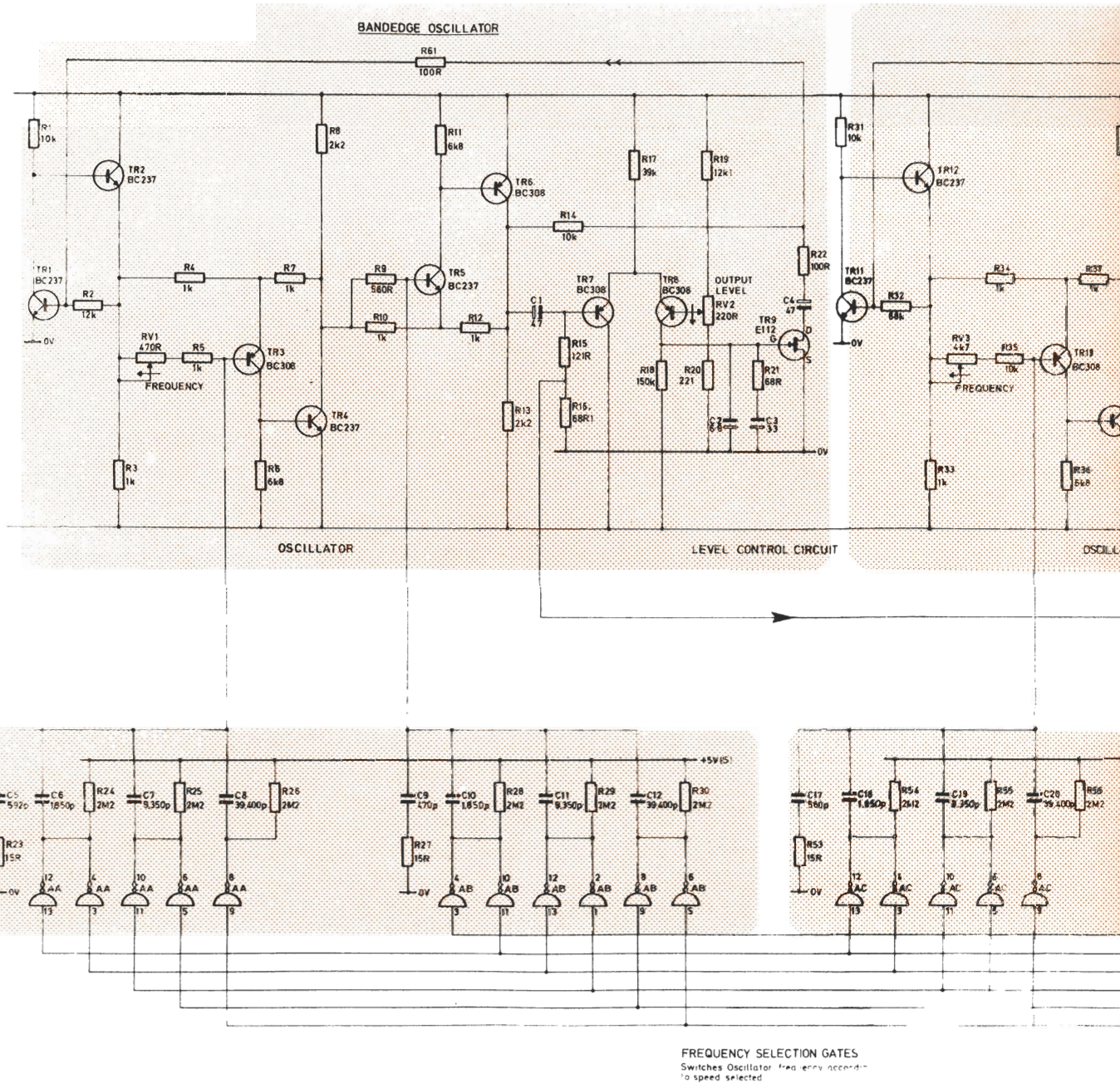


cableform to SKT 58 on Motherboard(s)

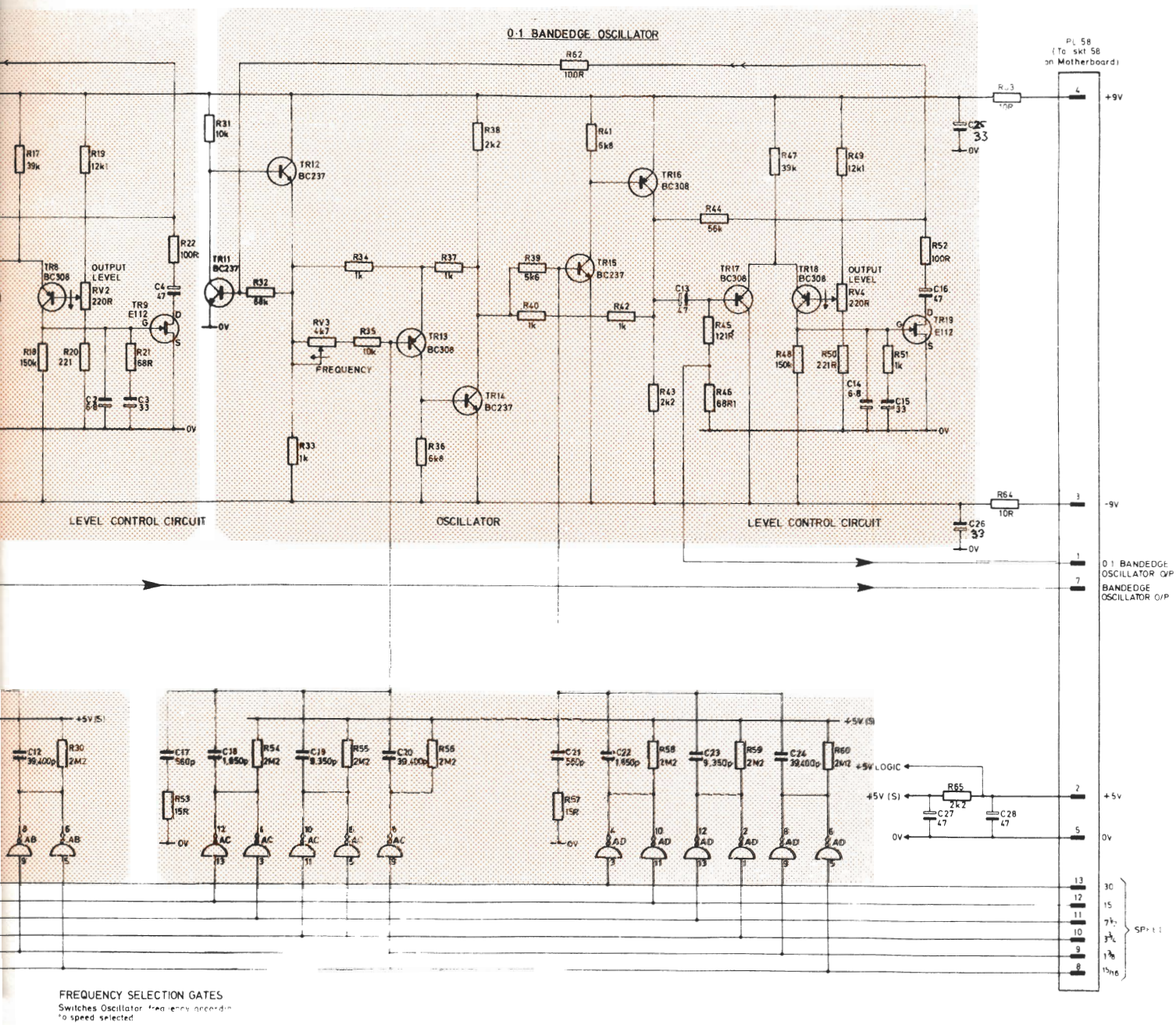
VALUE	TOL	RATING	MFRS. REF. NO.
D.R. CALIBRATION BOARD			D7720/1 D7720/2
		(Cont)	
C237B			Cat 11978
C308B			Cat 11977
112 F.E.T.			Cat 10540

D7720/1 STORE 4DS, STORE 7DS, STORE 4DN.
D7720/2 STORE 14DS.

FIG. 54 D.R. CALIBRATION BOARD - LAYOUT D7720



Store 4DS/7DS
January 1982



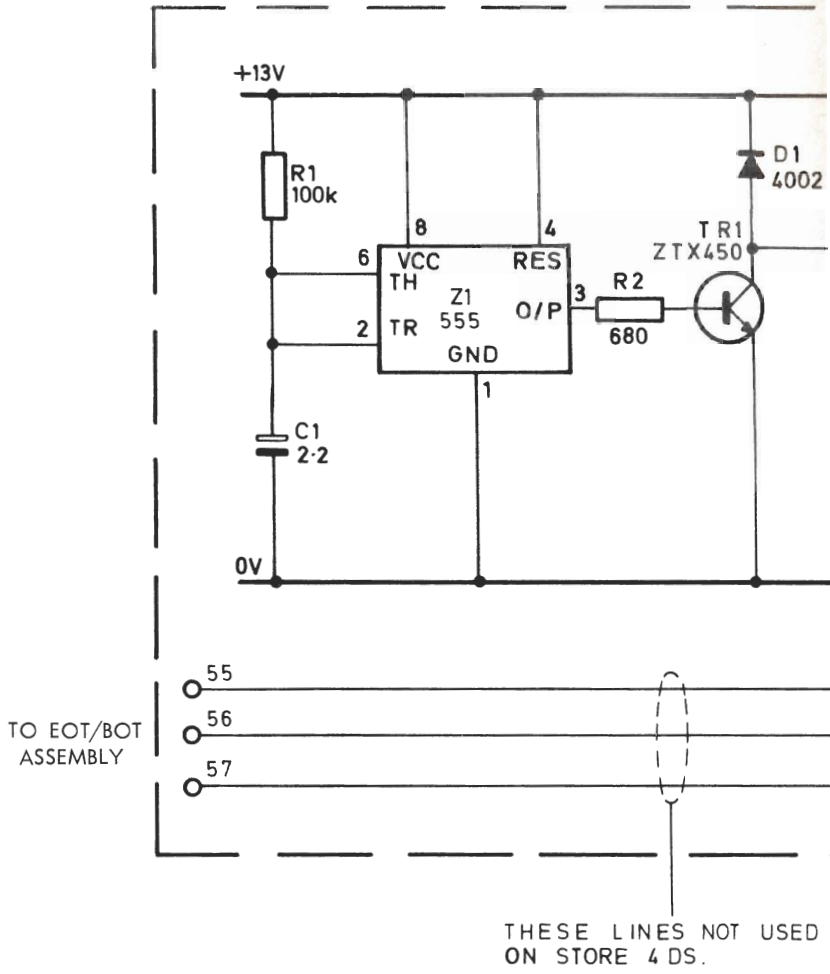
FREQUENCY SELECTION GATES

Switches Oscillator frequency according to speed selected

FIG. 55

D.R. CALIBRATION BOARD - CIRCUIT

CIRCUIT REF	VALUE	TOL.	RATING	MFRS. REF. NO.
		BRAKE ARM ASSEMBLY		
Store 4 DS				D 8935
Store 7DS				D 8937
Store 14DS				D 8937
Pad Assembly (all models)				D 8178
Solenoid (all models)				P 16559
Brake Solenoid Driver PCB				
Store 4DS				D 8931/1
Store 7DS }				D 8931/2
Store 14DS }				
		BRAKE SOLENOID DRIVER PCB		
Capacitor C1	2.2 µF	20%	35V	Cat 13466
Diode D1	IN 4002			Cat 9660
Diode, Zener DZ1	5ZS5.6B			Cat 15068
Integrated Circuit Z1	LM 555CN			Cat 11404
Plug PL 62A	Housing, Molex 03-06-2023			Cat 14490
	Terminals, Molex 02-06-2132			Cat 13752
Relay RL1	Thorn	NF2-12V		Cat 13375
Resistors				
R1	100K	5%	¼W	R 10104
R2	680	5%	¼W	R 10681
R3	39	5%	2.5W	R 400390
Socket SK 62A	Housing. Molex 03-06-1023			Cat 14288
	Terminals, Molex 02-06-1132			Cat 13753
Transistor TR1	ZTX 450			Cat 13628
Terminal, Receptacle (D8931/1 only) 2 off	Amp 140719-2			Cat 4895



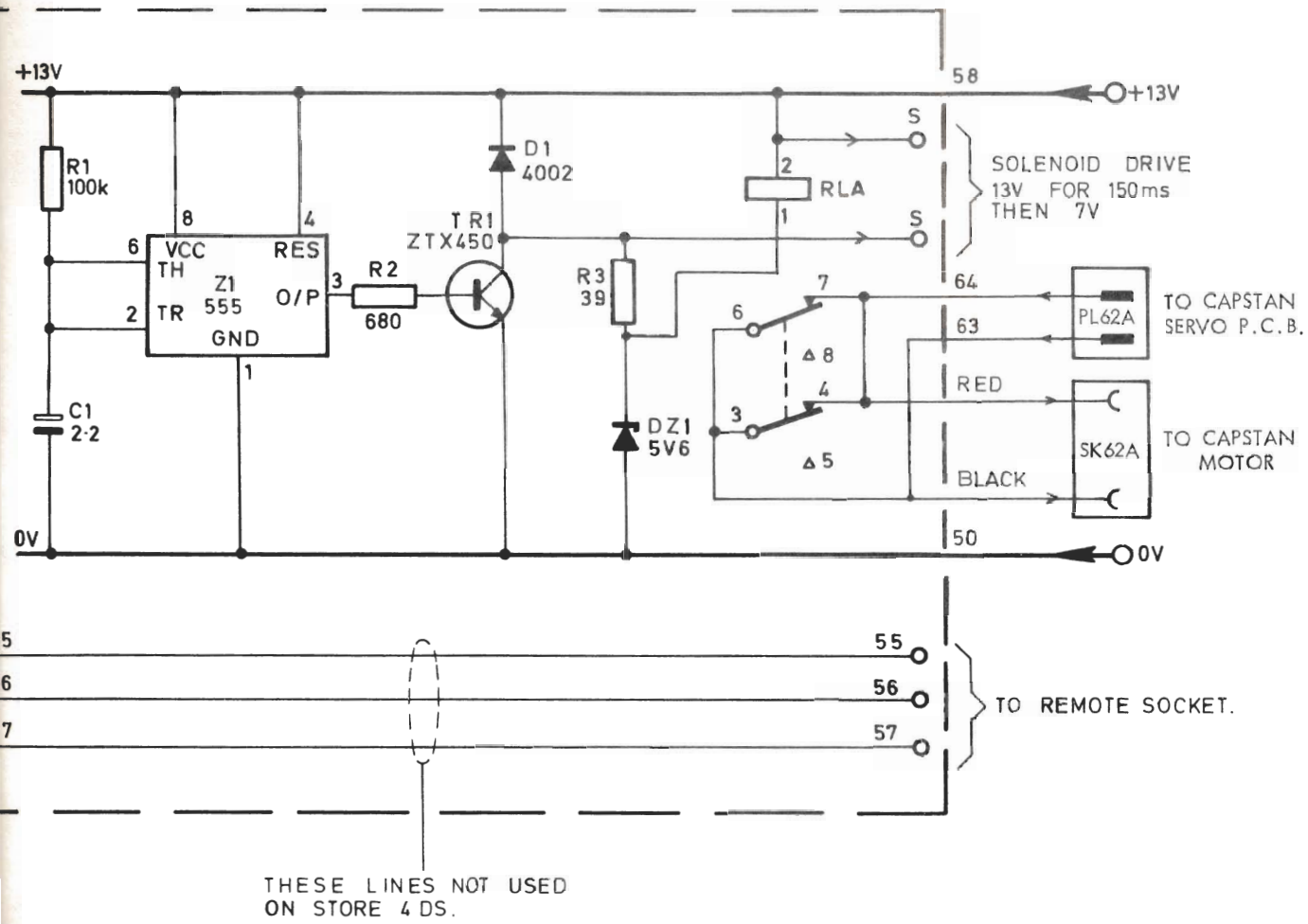


FIG. 56

BRAKE SOLENOID DRIVER

PARTS LIST AND CIRCUIT

APPENDIX A

"STORE" RANGE FILTER TYPES (Dual Standard)

1. The "Store" range Instrumentation Recorders incorporate active low pass filters in the replay circuits. Above the cut-off frequency the amplitude response falls at a rate approaching 24 dB/octave, ensuring that very little of the f.m. carrier is present in the output signal. A switch on each filter board selects either Tchebychef or Bessel response. The Tchebychef provides greater carrier attenuation while Bessel provides linear phase response.

2. The optimum filter type will depend on the application for which the recorder is intended; with this in mind the following factors should be considered:-

(a) Carrier Attenuation. The amount of carrier attenuation limits the signal-to-noise ratio; for example, if after filtering there remains a -50 dBm residual carrier signal, then the best signal-to-noise ratio that can be achieved is 50 dB. Worst case conditions for "Store" range recorders are when a peak negative signal occurs. In this situation the carrier frequency is 40% less than the centre carrier frequency and consequently is attenuated less by the filter.

(b) Amplitude/Frequency Response. Ideally the response of the filter within the passband should be perfectly flat. The degree of departure from the ideal is tabulated below for the two filter types.

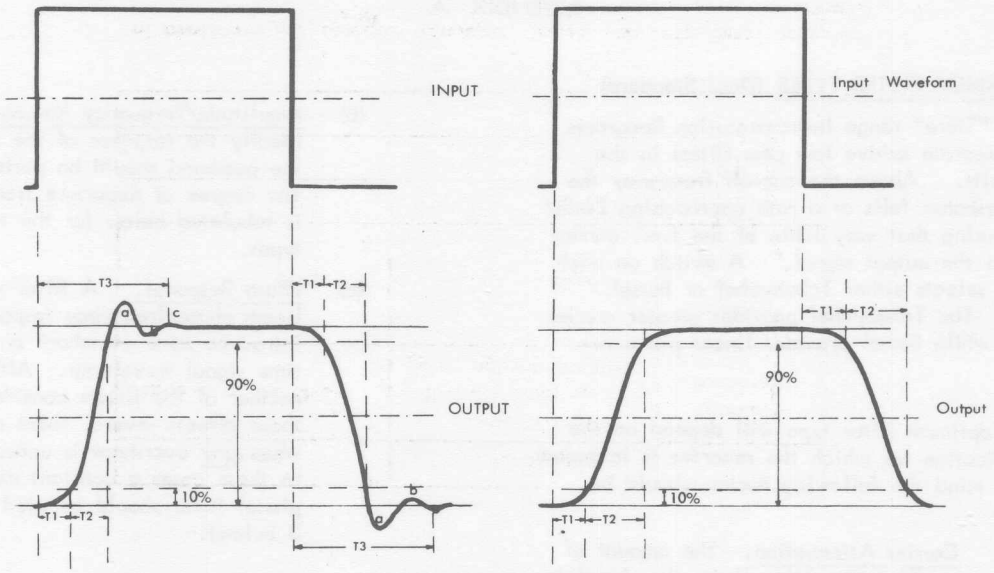
(c) Phase Response. A filter with a non-linear phase/frequency response will introduce some overshoot on fast rise-time signal waveforms. Although in neither of the filters considered are these effects severe, there are occasions when any overshoot is undesirable. In these cases a constant delay (linear phase) filter should be used (see para 3 below).

3. The tables below give an indication of the performance of the two types of filter. It can be seen that the Tchebychef filter gives a flatter passband response and greater carrier attenuation. The Bessel filter provides a linear phase response.

		Tchebychef	Bessel
Passband * Response		Slight Ripple Less than ± 0.5 dB at band edge	Typically -3 dB at band edge
Residual Carrier at -40%		-53 dB	-38 dB
Overshoot (see below)	a	+15%	-
	b	-5%	-
	c	+3%	-

* Tables of Tchebychef and Bessel frequency response are contained in Chapter 3.

APPENDIX A



TCHEBYCHEF

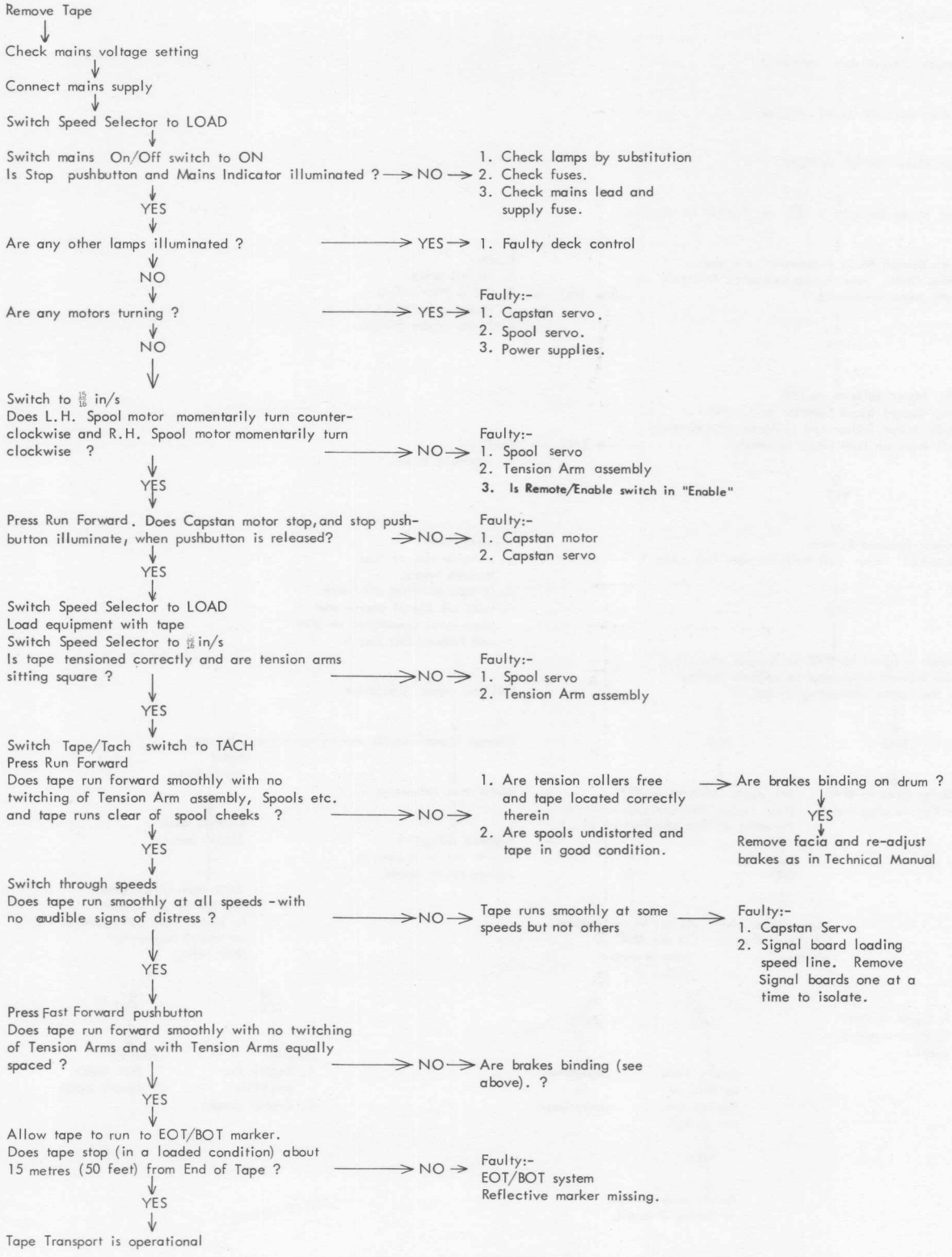
BESSEL

SPEED IN/S		TCHEBYCHEF			BESSEL	
Inter. Band	Wide Band 1	T1	T2	T3	T1	T2
$\frac{15}{16}$	-	800 µs	1040 µs	5040 µs	640 µs	1250 µs
$1\frac{7}{8}$	$\frac{15}{16}$	400 µs	520 µs	2520 µs	320 µs	640 µs
$3\frac{3}{4}$	$1\frac{7}{8}$	200 µs	260 µs	1260 µs	160 µs	320 µs
$7\frac{1}{2}$	$3\frac{3}{4}$	105 µs	130 µs	635 µs	85 µs	160 µs
15	$7\frac{1}{2}$	53 µs	65 µs	317 µs	45 µs	80 µs
30	15	30 µs	32 µs	162 µs	25 µs	40 µs
60	30	17 µs	17 µs	84 µs	15 µs	20 µs
-	60	11 µs	9 µs	47 µs	10 µs	12 µs

Comparison of Delay Time (T1), Rise Time (T2) and Settling Time (T3) for Tchebychef and Bessel filters when measured on Store 4DS/Store 7DS Instrumentation Recorder.

APPENDIX B

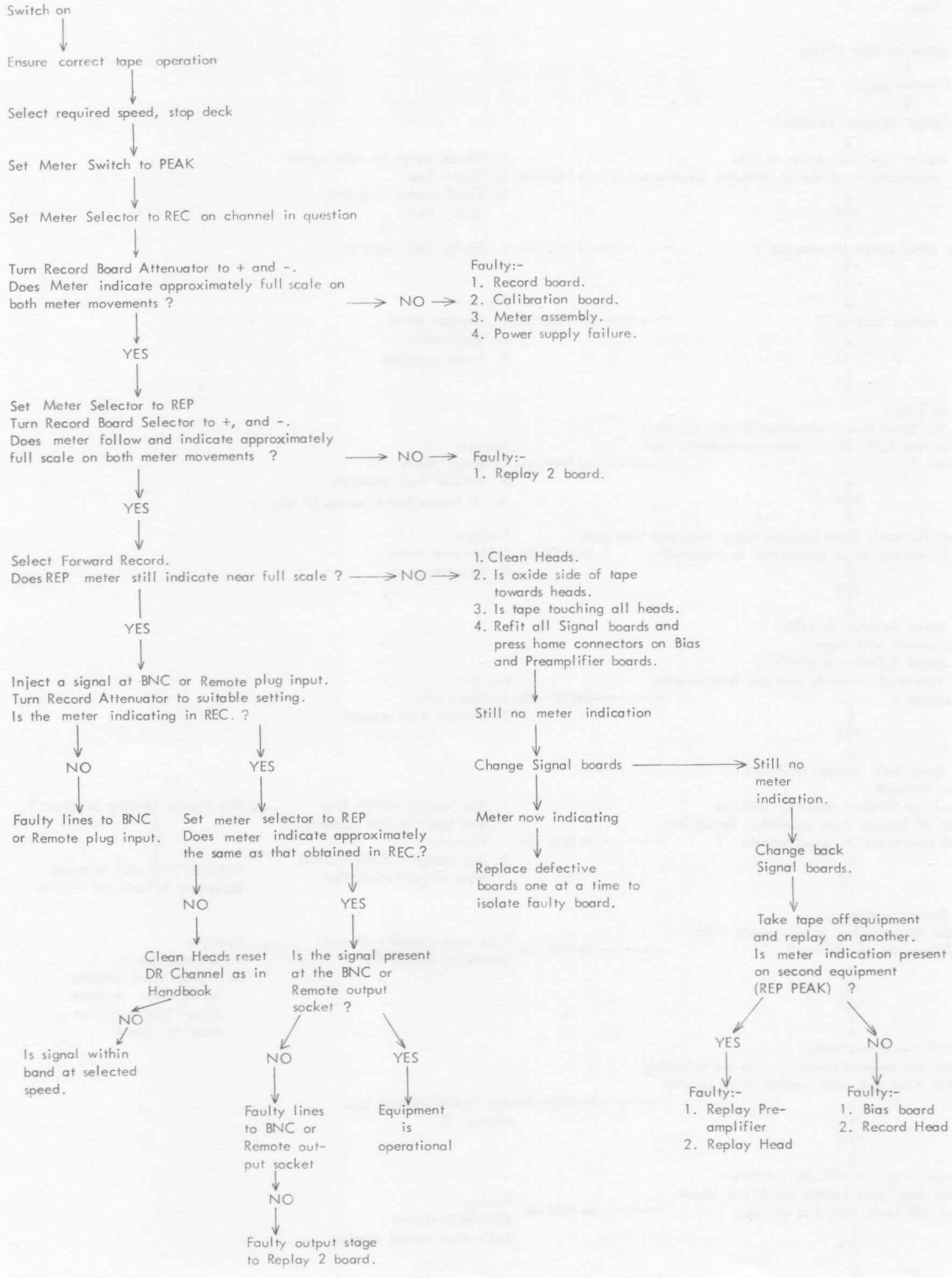
DIAGNOSTIC AID - TAPE TRANSPORT



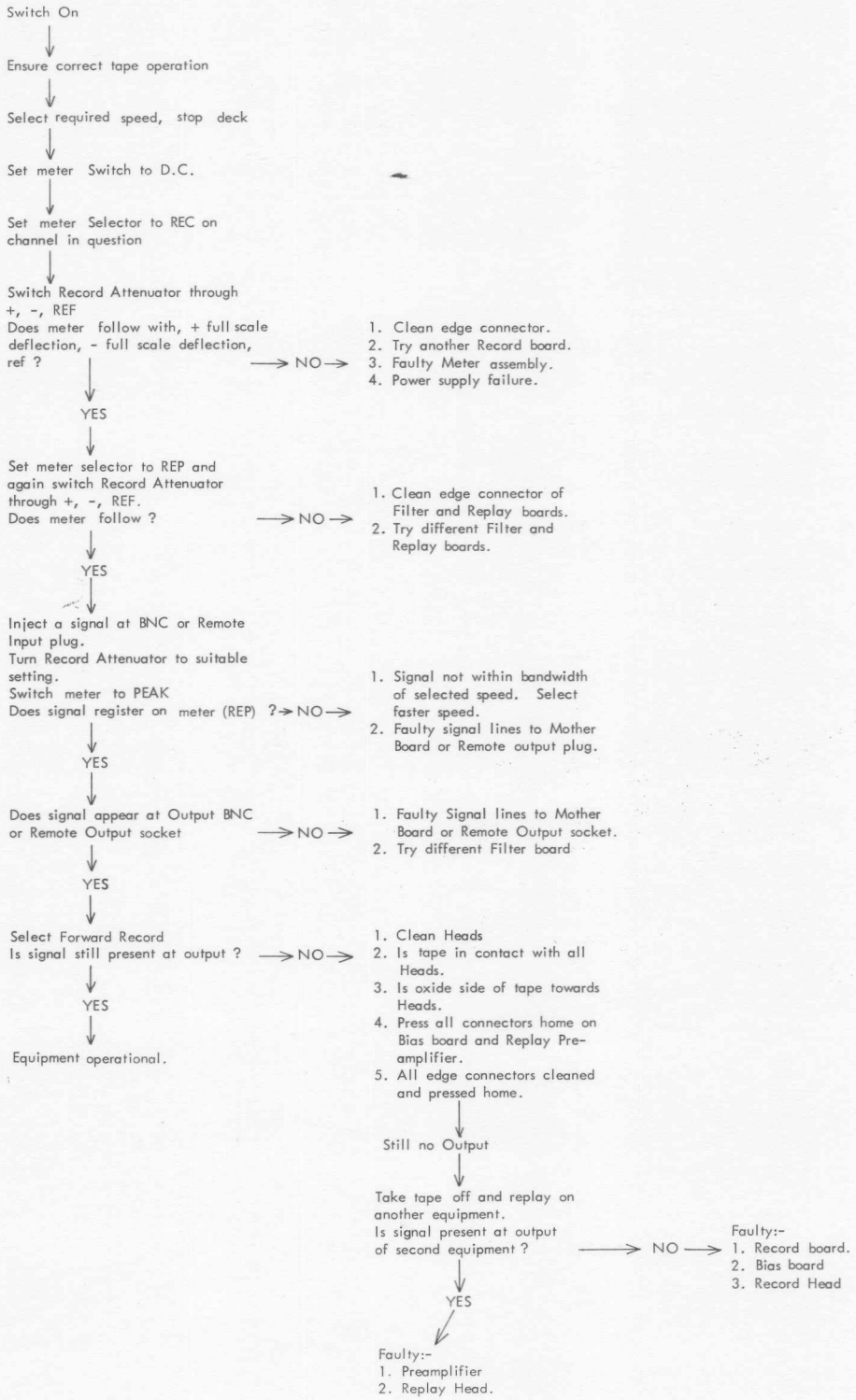
APPENDIX B

DIAGNOSTIC AID - D.R. SIGNAL CIRCUITS

(Using D.R. Calibration Board)



DIAGNOSTIC AID - F.M. SIGNAL CIRCUITS



APPENDIX B

APPENDIX C

STORE 4DS/7DS - METAL COVER OPTION

1. Store 4DS and Store 7DS are available with metal covers. Tape Transport, Signal Boards, and Electrical Specification remains unchanged as quoted in Store 4DS/7DS Technical Manual, Chapter 3.

2. The metal cover option is available for the following equipments:-

Store 4DS	from serial number 10000.
Store 7DS	from serial number 6000.

3. Metal covers may be fitted to the above equipments after they have been delivered to customers, but this will necessitate returning the equipment to the factory.

4. Equipments fitted with metal covers are approximately 1 kg heavier than standard equipments.

5. Changes to the General Parts List (Fig.48 and Fig.49 in the Technical Manual, are listed below.

STORE 4DS		STORE 7DS	
Base Cover	D8454	Base Cover	D8448
Deck Cover	D8408/2	Deck Cover	D8408/3
Facia Cover	P17267	Facia Cover	P17272
Front and Top Cover Assembly	D8453	Front and Top Cover Assembly	D8449
L.H. Wing Assembly	D8424	L.H. Wing Assembly	D8424
R.H. Wing Assembly	D8425	R.H. Wing Assembly	D8425

SUPPLEMENT 1

REMOTE CONTROL UNIT RC4714

GENERAL DESCRIPTION

1. The Remote Control Unit RC4714 is a unit especially designed for the remote control of all Store Range equipments.

2. The unit is housed in a robust case. It has pushbuttons, indicators, and a display showing 'tape footage'. The remote control unit derives its power from the Store Range Equipment to which it is connected.

3. Connection to a Store Range Equipment is via a 37 way plug and flatstrip cable. It plugs into the remote socket of the Recorder.

INSTALLATION AND OPERATION

4. Follow the installation instructions for the Store Range Equipment. These are contained in Chapter 2 of its Technical Manual.

5. To instal the Remote Control Unit RC4714 it is necessary only to connect its 37 way plug to the socket at the rear of the Store Range Recorder.

6. If the screwlocks are to be used (to secure plug to socket) they should be tightened 'two turns at a time'. This will ensure even mating. Similarly at disconnection they must be unscrewed 'two turns at a time'.

7. If the Remote Control Unit is to be used with older Store Range Equipment, not fitted for screwlocks, the screws may need to be removed altogether to ensure that the plug and remote socket mate properly.

Tape Movement Controls.

8. Pushbuttons on the Remote Control Unit allow selection of:-

'<<' fast reverse.
'<' reverse
'stop'
'>' forward
'>>' fast forward

The pushbuttons may be used in any order without fear of damage to tape.

9. Light Emitting Diodes (LEDs), associated with the pushbuttons, indicate which mode is in operation.

10. When the control unit is connected both remote and local tape movement controls are in operation and will give the same indication.

Tape Speed Controls.

11. The selected speed is shown by the illumination of one of seven LEDs and will indicate a speed in the range $\frac{15}{16}$ to 60 in/s.

12. Tape speed is normally selected by the speed switch on the Store Range Recorder. Control of tape speed can be assumed by the Remote Control Unit as follows:-

(a) On the 'DS' range of equipments the local enable switch, (at the L.H. side under the front flap) must be set away from local.

(b) On other Store Range equipments link G, on the Deck Control Board, must be removed, as described in Chapter 2 of the relevant Technical Manual.

13. On completion of para 12 (a) or (b) above, speed selection can take place only at the Remote Control Unit. Pressing the 'speed' button will cause recorder speed to step through the range $\frac{15}{16}$ to 60 in/s, one step at a time. Select the required speed before operating tape movement controls.

14. A further step in the tape speed sequence between 60 and $\frac{15}{16}$ in/s illuminates the 'local' indicator on the Remote Control Unit. In this condition selection of tape speed is returned to the Store Range recorder. It will operate normally in the 'local' condition as long as the Remote Control Unit remains connected. If it is required to operate the Store Range Recorder without the Remote Control Unit, Link 'G' must be replaced, on the

Deck Control Board, or, on DS range of equipment the local enable switch set back to 'local'.

Tape Footage Counter.

15. This counter displays the length of tape 'played'. A reset button is provided and it is recommended that the display is zeroed at the beginning of tape.

SPECIFICATION

16. The policy of Racal Recorders Ltd. is one of continuous development and consequently the equipment may vary in detail from the description and specification in this publication.

17. The Remote Control Unit RC4714 is for use with the following Store Range Equipments:-

Store 4/7/14
Store 4D/7D/14D
Store 4DS/7DS/14DS
Store 4EN
Storefax

18. The Remote Control Unit is supplied with a 5 metre length of cable. It can, however, be operated at distances of up to 30 metres.

General Items.

19.

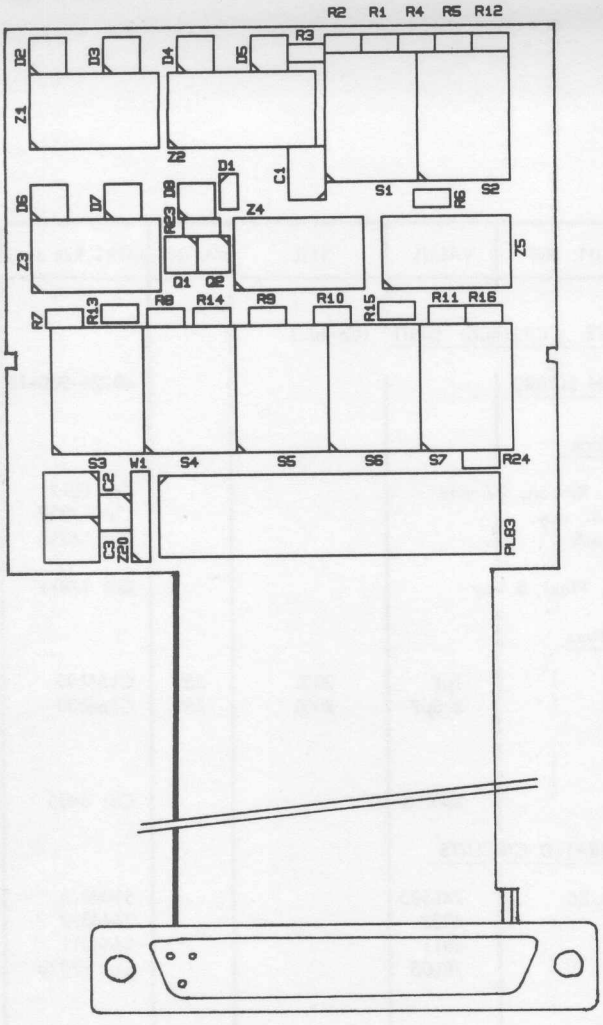
Size	100 mm x 120 mm x 50 mm
Connector	37 way 'D' type
Power Supply	from Store Range Recorder
Racal Part No.	Cat 14197

CIRCUIT REF	VALUE	TOL.	RATING	MFRS.REF.NO.
REMOTE CONTROL UNIT				40126-001-00
DISPLAY BOARD				40126-301-10
Capacitors.				
C4,8,9	10 nF	10%		Cat 14154
C5	1 uF	20%	35V	C166109
C6	100 pF	20%	400V	Cat 4170
C7	100 nF	20%	35V	C166108
Display, LCD 4 digit				Cat 4247
Integrated Circuits				
Z6,7,8,9	4056			S644056
Z10,11,12,13 15,16	4029			S644029
Z14	4518			S644518
Z17	4528			S644528
Z18	4027			S644027
Z19	4093			S644093
Resistors.				
R17	10K	5%	¼W	R10103
R18	1M6	5%	¼W	R10165
R19	820K	5%	¼W	R10824
R20	47K	5%	¼W	R10473
R21	1M0	5%	¼W	R10105
R22	470K	5%	¼W	R10474
R25	2K2	5%	¼W	R10222
Switch				
S8	Digitast ,orange			Cat 17208
Sockets				
	20 way	sil		Cat 16247
	14 way	dil		Cat 11946

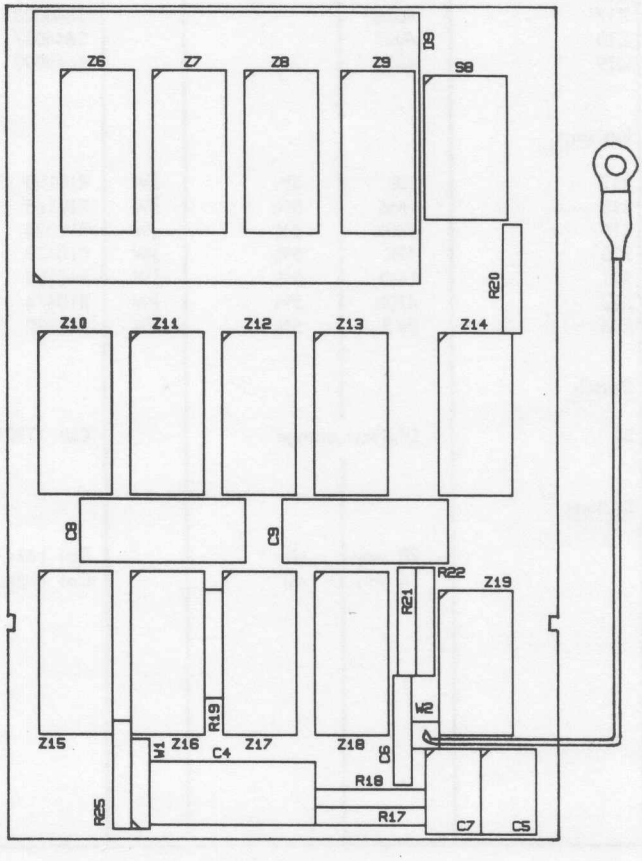
CIRCUIT REF	VALUE	TOL.	RATING	MFRS.REF.NO.
REMOTE CONTROL UNIT (Contd.)				
SWITCH BOARD				40126-300-10
Cableform				
Cable, Ribbon, 37 way				Cat 18131
Plug, 37 way				Cat 17337
Screwlock				Cat 14298
Cable, Flexi, 5 way				Cat 17871
Capacitors				
C1	1µF	20%	35V	C166109
C2,C3	3.3µF	20%	35V	C166339
Diode.				
D1	BAX13			Cat 8406
INTEGRATED CIRCUITS				
Z1,Z3,Z5	74LS05			S100005
Z2	4022			S644022
Z4	4011			S644011
Z20	78L05			Cat 17078
LEDS				
D2,3,4,5,6,7,8	RED			Cat 14054
Plug	34 way			Cat 15618
Transistors				
Q1,Q2	BC237			Cat 11978
Resistors				
R1,2	330R	5%	¼W	R10331
R3	1M0	5%	¼W	R10105
R4,5,6,13,14 15,16,23	47K	5%	¼W	R10473
R7,8,9,10,11,12	1K0	5%	¼W	R10102
R24	39R	5%	¼W	R10390
Switches				
S1 to S7	Digitast, orange + led			Cat 17209

REMOTE CONTROL UNIT

FIG S1



SWITCH BOARD

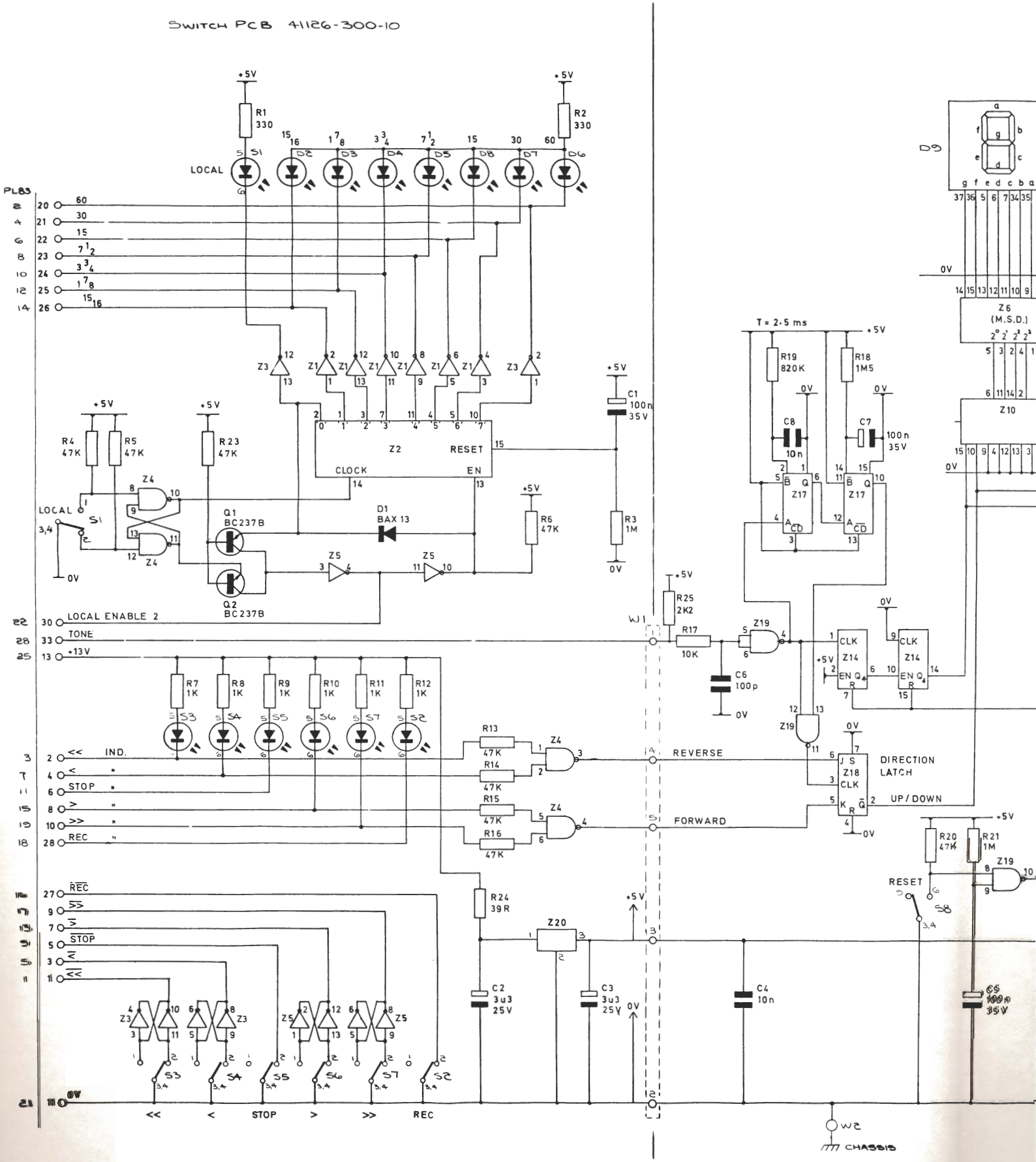


DISPLAY BOARD

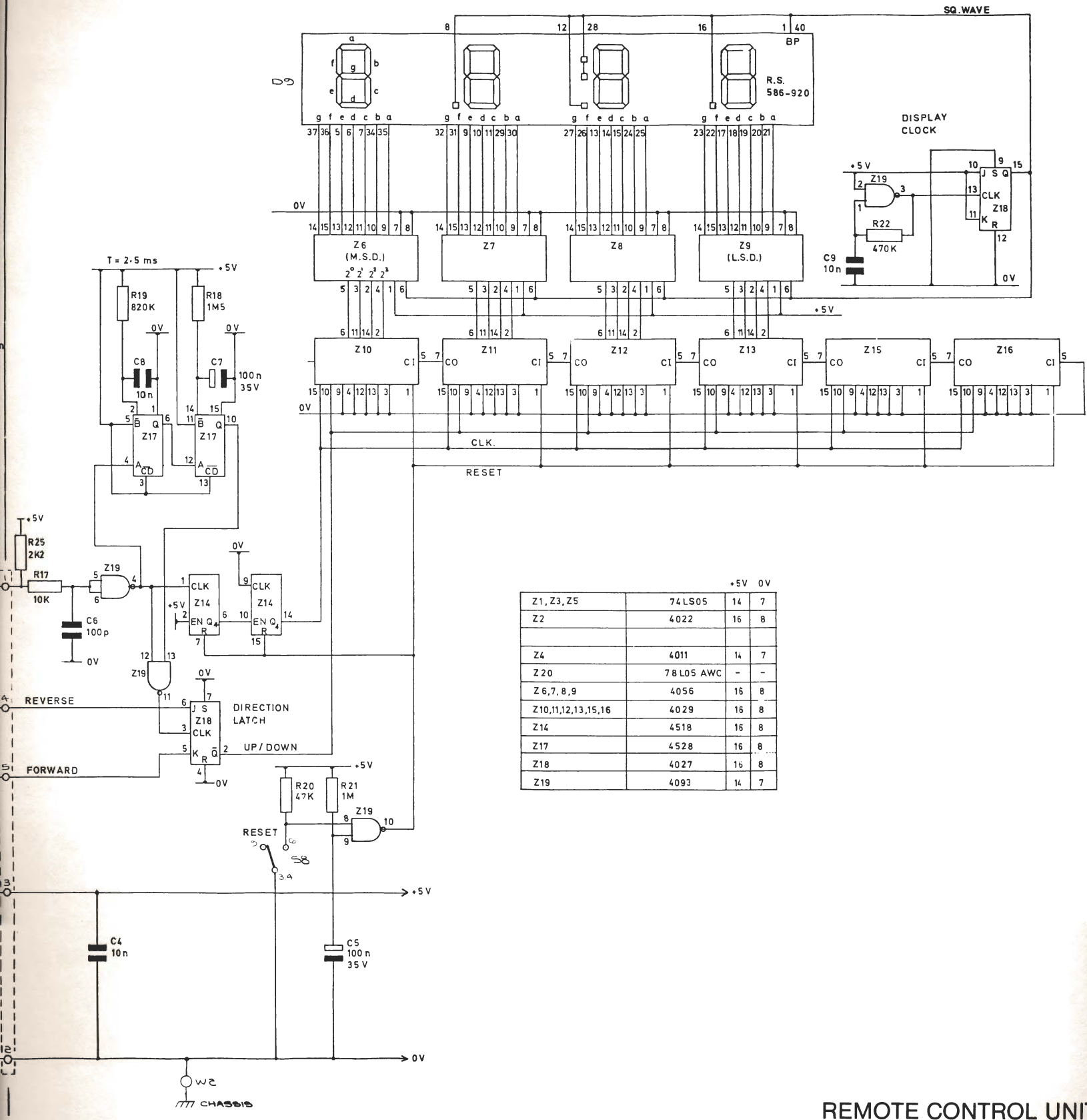
REMOTE CONTROL UNIT

FIG. S2

BLANK


SWITCH PCB 41126-300-10
PL83
LOCAL
LOCAL ENABLE 2
TONE
+13V
<<
IND.
<
STOP
>
>>
REC
REVERSE
FORWARD
DIRECTION LATCH
UP/DOWN
RESET
T = 2·5 ms
Z2
CLOCK
RESET
EN
CHASSIS

DISPLAY PCB 41126-301-10



		+5V	0V
Z1, Z3, Z5	74LS05	14	7
Z2	4022	16	8
Z4	4011	14	7
Z20	78L05 AWC	-	-
Z6,7,8,9	4056	16	8
Z10,11,12,13,15,16	4029	16	8
Z14	4518	16	8
Z17	4528	16	8
Z18	4027	16	8
Z19	4093	14	7

REMOTE CONTROL UNI

FIG. S3