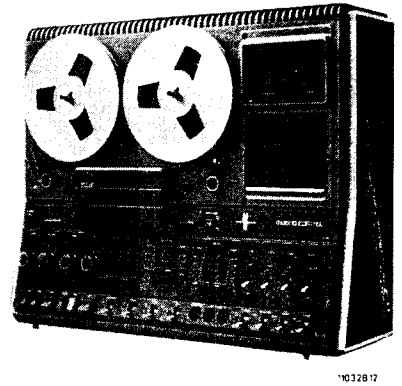


Service
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1032812

Service Manual

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Safety regulations require that the set be restored to its original condition and that parts which are identical with those specified, be used.

Documentation Technique Service Dokumentation Documentazione di Servizio Huolto-Ohje Manual de Servicio Manual de Serviço



Subject to modification

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PHILIPS

CS56784

TECHNICAL SPECIFICATION

Mains voltages	: 110-127-220-240 V	PHONO (X-tal)	: $\leq 0.6 \text{ mV}/1.5 \text{ k}\Omega$ (3,5)
Mains frequency	: 50-60 Hz (Switch-over not necessary)	(MD)	: $\leq 0.6 \text{ mV}/40 \text{ k}\Omega$ (3,5)
Power consumption	: ca. 35 W	AUX	: $2 \text{ mV}/15 \text{ k}\Omega$ (1,4) $\leq 100 \text{ mV}/1 \text{ M}\Omega$ (3,5)
Number of tracks	: 4	TUNER	: $2 \text{ mV}/\geq 100 \text{ k}\Omega$ (1,4) $\leq 100 \text{ mV}/\geq 100 \text{ k}\Omega$ (3,5)
Max. reel diameter	: 18 cm	Output voltages	
Number of heads	: 3 (1 recording, 1 play-back and 1 erase head)	LINE	: $1 \text{ V}/20 \text{ k}\Omega$ (3,5)
Number of motors	: 3 (1 for capstandrive, 2 for driving the reel discs)	MONITOR	: $1 \text{ V}/10 \text{ k}\Omega$ (3,5)
		MFB	: $1 \text{ V}/750 \Omega$
Winding time for an 18 cm reel with LP tape (540 m)	: $\leq 180 \text{ sek.}$	Output impedance	
Tape speeds	: $4.75 \text{ cm/sek.} \pm 1\%$ $9.5 \text{ cm/sek.} \pm 1\%$ $19 \text{ cm/sek.} \pm 1\%$	HEADPHONE	: 400Ω
Wow and flutter at:		Frequency range (within 7 dB)	
4.75 cm/sek.	: $\leq 0.3\%$	4.75 cm/sek	: 35 - 11,000 Hz
9.5 cm/sek.	: $\leq 0.2\%$	9.5 cm/sek	: 35 - 18,000 Hz
19 cm/sek.	: $\leq 0.15\%$	19 cm/sek	: 35 - 25,000 Hz
Input sensitivities		Signal-to-noise ratio according to DIN 45,500	: $\geq 56 \text{ dB}$
MICRO (Micro sens. switch in position 0dB)	: $0.2 \text{ mV}/2 \text{ k}\Omega$ (1,4) $100 \text{ mV}/1 \text{ M}\Omega$ (3,5)	Erase frequency	: $100 \text{ kHz} \pm 10\%$
LINE	: $2 \text{ mV}/15 \text{ k}\Omega$ (1,4) $100 \text{ mV}/1 \text{ M}\Omega$ (3,5)	Dimensions	: $535 \times 425 \times 205 \text{ mm}$
		Weight	: approx 10.3 kg

CONNECTIONS AND CONTROLS

Figures 1 and 2

- 1 Reel spindles with locking clips
- 2 Recording level meter - left channel
- 3 Overload indicator - left channel
- 4 Overload indicator - right channel
- 5 Recording level meter - right channel
- 6 Monitor output level control - left channel
- 7 Monitor output level control - right channel
- 8 Line output level control - left channel
- 9 Line output level control - right channel
- 10 Line input sensitivity control - left channel
- 11 Line input sensitivity control - right channel
- 12 Tuner input sensitivity control - left channel
- 13 Tuner input sensitivity control - right channel
- 14 'Aux' input sensitivity control - left channel
- 15 'Aux' input sensitivity control - right channel
- 16 Phono input sensitivity control - left channel
- 17 Phono input sensitivity control - right channel
- 18 Hinged transparent cover
- 19 Tape-tension stabilisers
- 20 Memory switch for counter
- 21 Counter
- 22 Zero-reset button for counter
- 23 Tape threading slot
- 24 Detachable head-cover
- 25 Cueing knob
- 26 Microphone sensitivity switch
- 27 Volume control
- 28 Balance control
- 29 Bass control
- 30 Treble control
- 31 Wind speed control
- 32 Post fading control
- 33 Lock button for post-fading control
- 34 Recording level control - left channel
- 35 Recording level control - right channel
- 36 Microphone recording level control - left channel
- 37 Microphone recording level control - right channel
- 38 Line input selector
- 39 Tuner input selector
- 40 'Aux' input selector
- 41 Phono input selector
- 42 Fast rewind key
- 43 Fast wind key
- 44 Start key
- 45 Pause key (to disengage, press again)
- 46 Record key
- 47 (Record, playback and fast wind) stop key
- 48 Monitor selector
- 49 Track selector
- 50 Speed selector
- 51 DNL indicator
- 52 DNL switch
- 53 Socket for stereo headset
- 54 Socket for mono microphone (left channel) or stereo microphone can also be used as an extra input for radio, amplifier or recorder
- 55 Socket for mono microphone (right channel)
- 56 Phono equalisation selector
- 57 Multiplay switch
- 58 Function selector
- 59 Mains switch
- 60 Mains on/off-indicator
- 61 Holes for the support-pins for horizontal use
- 62 Carrying handle
- 63 Mains-voltage selector

- | | | | |
|----|--|----|---|
| 64 | Socket for mains lead | 70 | MFB output-socket for MFB-loudspeaker en- |
| 65 | Type plate | 71 | Monitor output socket for radio, amplifier or |
| 66 | Phono input socket for HiFi or non HiFi record | 72 | Remote control socket - for start/stop remote |
| 67 | 'Aux' input - auxiliary input socket for radio | | control unit |
| 68 | Tuner input socket | | |
| 69 | Line in/out - combined input/output socket for | | |
| | radio amplifier or recorder | | |

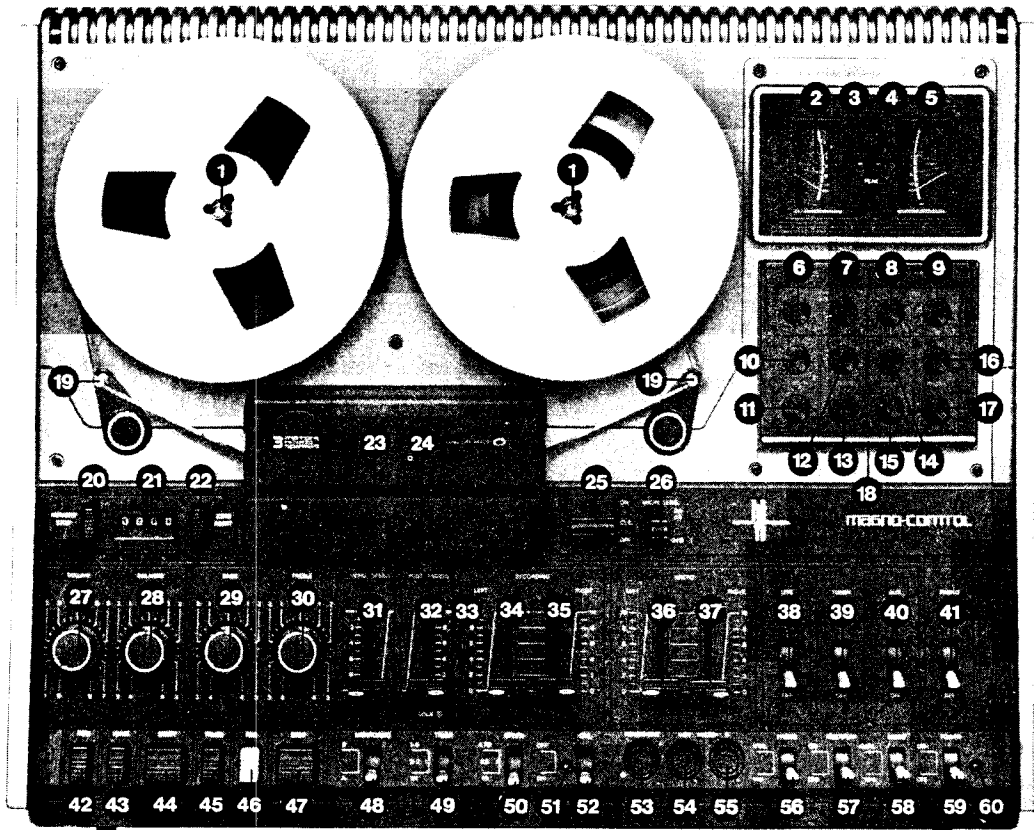


Fig. 1

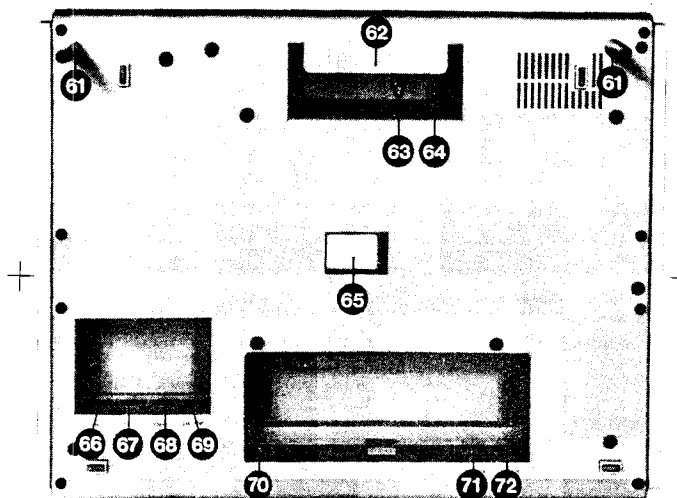
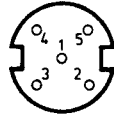
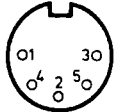
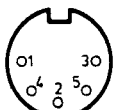
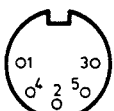
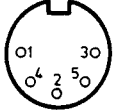
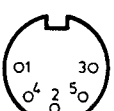
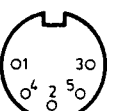
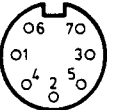
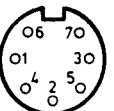
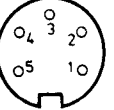


Fig. 2

INPUTS AND OUTPUTS

HEADPHONE BU2				400 Ω	5p,sym,DIN 	1 - 2 -  3 -  4 - left 5 - right
MICRO L+ST BU1		(1,4) (3,5)	0.2 mV 100 mV	2 k Ω 1 M Ω	5p,180°,DIN 	1 - left 4 - right 2 -  5 - right 3 - left
MICRO R BU101		(1,4)	0.2 mV	2 k Ω	5p,180°,DIN 	1 - left 4 - right 2 -  5 - 3 -
PHONO BU604		X-tal MD	≤ 0.6 mV ≤ 0.6 mV	1.5 k Ω 40 k Ω	5p,180°,DIN 	1 - 4 - 2 -  5 - right 3 - left
AUX BU603	aux	(1,4) (3,5)	2 mV ≤ 100 mV	15 k Ω 1 M Ω	5p,180°,DIN 	1 - left 4 - right 2 -  5 - right 3 - left
TUNER BU602		(3,5)	≤ 100 mV	≥ 100 k Ω	5p,180°,DIN 	1 - 4 - 2 -  5 - right 3 - left
LINE IN/OUT BU601	 	(1,4) (3,5) (3,5)	2 mV 100 mV 1 V	15 k Ω 1 M Ω 20 k Ω	5p, 180°, DIN 	1 - left 4 - right 2 -  5 - right 3 - left
MFB BU3			1 V	750 Ω	7p, 270°, DIN 	1 - 4 - 2 -  5 - right 3 - left 6 - M.P. 7 - M.P.
MONITOR BU4		(3,5)	1 V	10 k Ω	7p,270°,DIN 	1 - 4 - 2 -  5 - right 3 - left 6 - M.P. 7 - M.P.
REMOTE BU5					5p,240°,DIN 	1 - SK5-4 2 - 3 - 4 - 5 - SK5-5

Drive system**Position START**

In order to prevent the START switch from burning in upon switching on, the switching function is taken over by transistor TS9.

The impedance of brake solenoid RE2 also determines the setting of TS9.

The base of TS392 is not sufficiently negative with respect to the emitter to make the latter conductive. Thus the base of TS391 is negative with respect to the emitter: TS391 will conduct.

Via the base emitter diode of TS9 parallel to R308 and via TS391 the braking solenoid RE2 is excited (brake is released). TS9 becomes conductive: the pressure roller magnet is excited and the mains voltage applied to the two reel disc motors M1, M2. C44 is a short circuit for the switch-on pulse: via R56 an extra starting current is applied to the right-hand reel disc motor M2, so that the speed required is quickly reached, preventing tape loops to occur.

By means of the capstan the tape gains full speed immediately.

After the switch-on pulse, the voltage for the right hand motor M2 will be supplied via R57.

The left-hand reel disc motor M1 receives its supply voltage via unit U2 (see Tape tension control).

Position REW

The brake solenoid is energized.

The base of TS504 is positive with respect to the emitter, so that TS504 will conduct. The degree of conduction of TS504 depends on the position of R522 ("WIND SPEED" control).

When TS504 is conductive, the base of TS503 becomes negative with respect to the emitter, so that TS503 will also conduct. As a result of this the left hand reel-disc motor M1 is energized.

The right-hand reel-disc motor M2 is driven by the tape and consequently acts as a generator. The generated voltage is negative in comparison with the terminal voltage of the right-hand reel-disc motor M1.

Via D11 the voltage generated by M2 provides the supply voltage for the tape tension control circuit. Diode D2 prevents the pressure roller solenoid RE1 from being energized by this voltage.

The winding speed is controlled with the aid of R522a, b ("WIND SPEED" control).

R522a and b are mechanically coupled to each other. R522a controls the supply voltage for the left-hand reel-disc motor and R522b controls the supply voltage for the right-hand reel disc motor.

When the speed is varied from fast winding to slow winding the motor which is driven by the tape should be braked.

Owing to the mechanical coupling of R522a to b a positive voltage is applied to the base of TS554 via R522a and the wiper of R522b in this position. TS554 is then turned on so that TS553 is also turned on.

The right-hand reel disc motor M2 receives a positive supply voltage and is consequently braked. D553 prevents the negative voltage produced by the right-hand reel-disc motor from affecting the control behaviour.

Position WIND

The operation is the same as in position REW.

However, the left-hand reel-disc motor M1 now functions as a generator and supplies supply voltage for the tape-tension control circuit via D12.

Tape tension control

The recorder has tape-tension control systems:

- for position START
- for position WIND and REW.

Position START

In this position the tape tension is controlled with the aid of the left-hand tape tension sensor SK-13. If the tape tension is too low, SK-13 is closed. C2 on unit U2 is then charged, so that TS3 on U2 is turned on.

TS3 receives its base current from TS2 on U2, so that TS2 is also conductive. The left-hand reel-disc motor M1 consequently receives a positive supply voltage and thus provides a counterfriction.

In case of excessive tape tension SK - 13 is open and the left-hand reel-disc motor M1 is not energized. The counter-friction is minimal.

When the recorder is set to position START capacitor C2 on U2 is charged briefly to an average voltage via C805.

This ensures that tape tension circuit functions more rapidly in position START.

In position WIND the left-hand reel disc motor M1 produces a negative voltage which charges capacitor C2 on U2 negatively via the base-emitter diode of TS3.

When the recorder is set from position WIND to position START the brake will be activated. As a result of this TS15 is turned on (see Electric brake). Via diode D29 capacitor C2 on U2 is held at a low positive voltage. Consequently, the positive pulse from C805 can charge capacitor C2 on U2 to the average voltage.

Position WIND and REW

When the tape runs, one motor pulls and the other is driven by the tape. To ensure constant drive, the braking torque of the driven motor should vary. The extent of the braking torque the motor driven should supply, depends on the diameter of the reel (Braking torque = radius of the reel on the motor pulled x force on the tape).

Maximum diameter of the reel means maximum braking torque of the motor driven.

Minimum diameter of the reel means minimum braking torque of the motor driven.

Maximum diameter of the reel on the motor driven

The reel to be wound has the minimum diameter.

The pulling motor runs at maximum speed.

The voltage flowing through motor and R59 is minimal.

The voltage on the emitter of TS16 is positive, but not sufficient to make TS16 conductive.

Maximum conductivity of TS17, short circuit of the motor driven: the motor driven brakes maximal.

Minimum diameter of the reel on the motor driven

The reel to be rewound has the maximum diameter.

The pulling motor runs at minimum speed.

The voltage flowing through motor and R59 is maximal.

The voltage on the emitter of TS16 is positive, consequently, maximum conductivity of TS16.

Minimum conduction of TS17: the motor pulled brakes with a minimum force.

R60 limits the variations in winding time when the mains voltage varies. When the mains voltage is high, the base of TS16 becomes more positive and, thus, TS16 less conductive. To control TS17, the voltage through R59 should be greater.

The interference pulses from the motor pulled are short circuited by C58.

Electrical brake

When the STOP or PAUSE position is reached, (all keys are released mechanically), the braking solenoid RE2 will be dead and tend to drop off.

The base TS15 becomes negative with respect to the emitter: TS15 conducts. A positive voltage is applied to the base of TS11. The motor driven by the tape, generates a negative voltage, so that the base of TS11 is positive with respect to the emitter: TS11 conducts. A voltage begins to flow through the motors, for the greater part through the motor driven, because it works as a generator. The load current through the generator will strongly brake the tape transport. As long as the motor driven generates a voltage sufficiently negative to keep TS11 conductive, the current through R61 will cause a voltage drop. Via R304 this voltage is applied to the base of TS19. As long as the voltage across R61 is higher than the voltage across D22 (3.3 V) TS19 will conduct. Thus a voltage is applied to the braking solenoid which is smaller than the mains voltage A (through D22), but sufficient to prevent the braking solenoid from being de-energized. Moreover, also TS15 remains conductive because the base remains negative with respect to the emitter.

From the above, it follows that the brake operation is mainly effected by the electrical brake.

The mechanical brake is an auxiliary brake:

- When the mains voltage drops off and
- When the tape is inserted.

Delay circuit

The delay circuit prevents brakage of the tape or tape loops to occur when the recorder is switched over from REW or WIND to the START position. When the set is in the REW or WIND position, C391 is charged (+ via R308, - via R394 and D391). When it is switched to the START position, C391 via R392 and the base emitter diode of TS392 parallel to R393, are discharged. Now TS392 will become conductive. When TS392 conducts, TS391 and TS9 will block. When after some time C391 is sufficiently discharged, TS392 will block and, consequently, TS391 will become conductive. The base of TS9 now becomes negative with respect to the emitter, so that TS9 conducts and the pressure roller is attracted.

When the recording is in position AMPL transistors TS391 and TS9 will not conduct and the pressure roller will not be energized.

Automatic stop

The tape transport is automatically stopped.

- at the end of the tape,
- in the event of tape breakage, and
- in position zero of the counter.

In all cases the recorder is switched off by mechanically unlocking the buttons.

The buttons are unlocked by energizing RE3.

At the end of the tape.

Now there are two possibilities:

- The tape has a switching foil
- The tape has no switching foil.

The tape has a switching foil

At the end of the tape the switching foil closes the tape contact TC. As a result of this R79 will be at earth potential. Via C53 a negative pulse is produced at the base of TS6, so that TS6 is turned on and RE3 is momentarily energized.

C53 prevents TS6 from remaining conductive. When the tape contact TC opens C53 is discharged via R78.

The tape has no switching foil

In this case automatic stopping is obtained in the same way as in the event of tape breakage (see "In the event of Tape Breakage").

In the event of tape breakage

In the event of tape breakage or at the end of a tape without switching foil the circuit of unit U3 becomes operative. During tape transport one reel-disc motor drives the tape and the other reel disc motor is driven by the tape.

The positive supply voltage of the driving motor is compared with the negative voltage which is produced by the driven reel-disc motor.

This comparison is effected in the voltage comparator circuit which comprises R4, R5, R6, D2 and D3 on unit U2. Via a 22 kohm resistor (R5 or R6) the positive voltage is applied to the base of TS1, whilst the negative voltage is applied to the base of TS1 via a 3.3 kohm resistor (R4). When a negative voltage appears the base of TS1 is negative with respect to the emitter and TS1 cuts off.

In the event of tape breakage or at the end of the tape there is only a driving motor. As a result of this the base of TS1 becomes positive with respect to the emitter so that TS1 is turned on.

When TS1 is conductive the base of TS6 receives a negative pulse, so that TS6 is turned on and relay RE3 is energized.

Counter zero-position

In order to stop the recorder in the zero position of the counter the following requirements must be met:

The recorder must be in position START (REC not depressed), REW or WIND. SK6 is then closed. Switch MEMORY STOP must be depressed. SK16 is then closed.

In the zero position of the counter SK17 is closed. The base of TS18 is positive with respect to the emitter, so that TS18 conducts.

As TS18 conducts the base of TS6 receives a negative pulse, so that TS6 is momentarily turned on and relay RE3 is briefly energized.

R178 prevents TS18 from being turned on in the recording mode.

When SK16 is in the closed position and SK17 is closed (the counter reaches the zero position) a positive voltage pulse is produced on the collector of TS18 (via the base-emitter diode of TS6, R79 and R78). Via the collector-base capacitance of TS18 this positive voltage pulse can reach the base of TS18 so that this transistor may be turned on. However, R178 ensures that the collector of TS18 is at a positive voltage, so that the voltage pulse has no effect.

Speed control of the capstan motor

A generator G3 is mechanically coupled to the motor M3. The AC generated is supplied to the cathode of the diode D207 (The frequency of this AC depends on the speed of the motor).

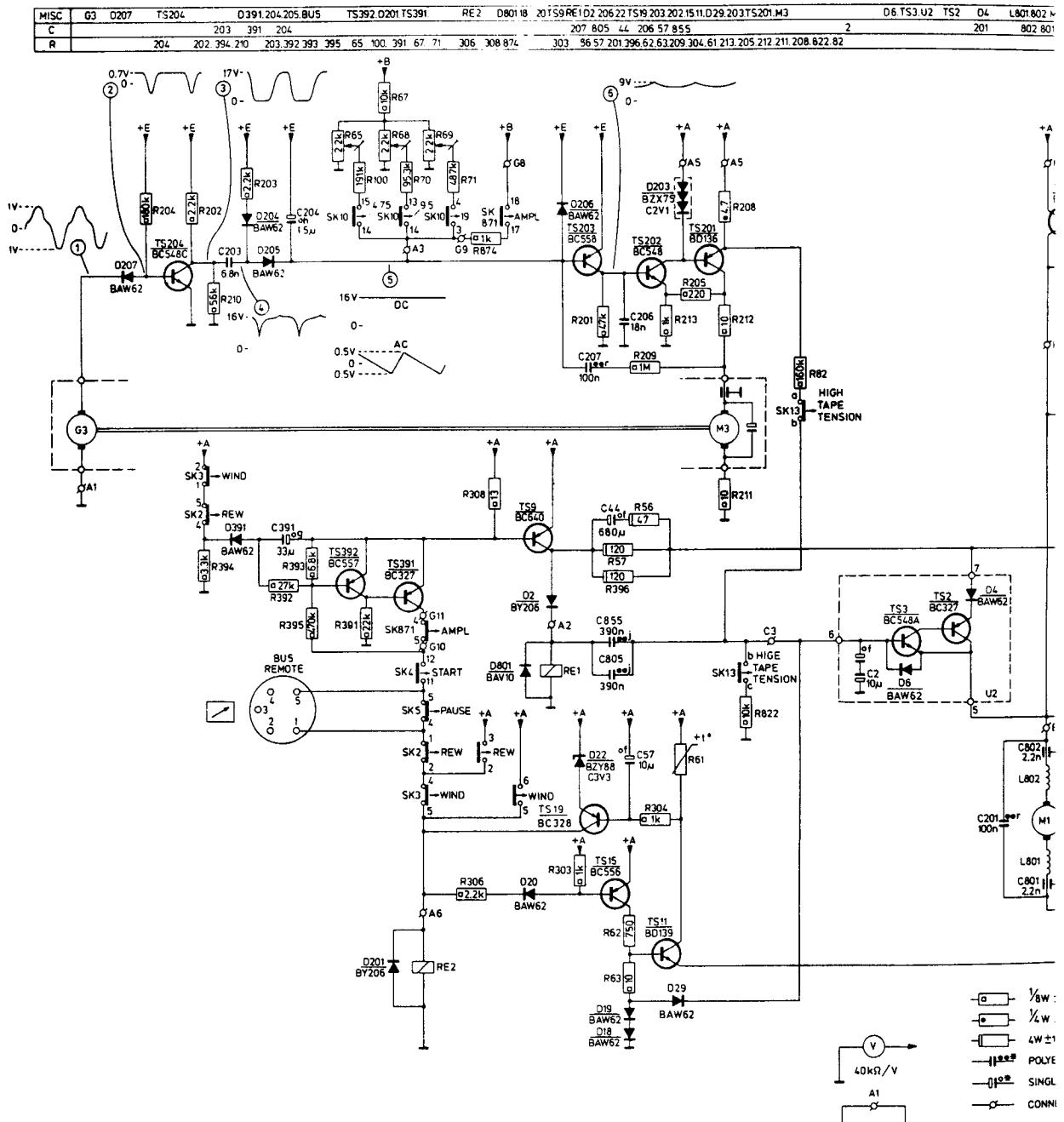
D207 allows only the negative half of the AC voltage to flow through. The AC voltage of the generator is converted to a square-wave voltage by TS204.

This square-wave voltage is differentiated by the capacitor C203 (voltage through C203).

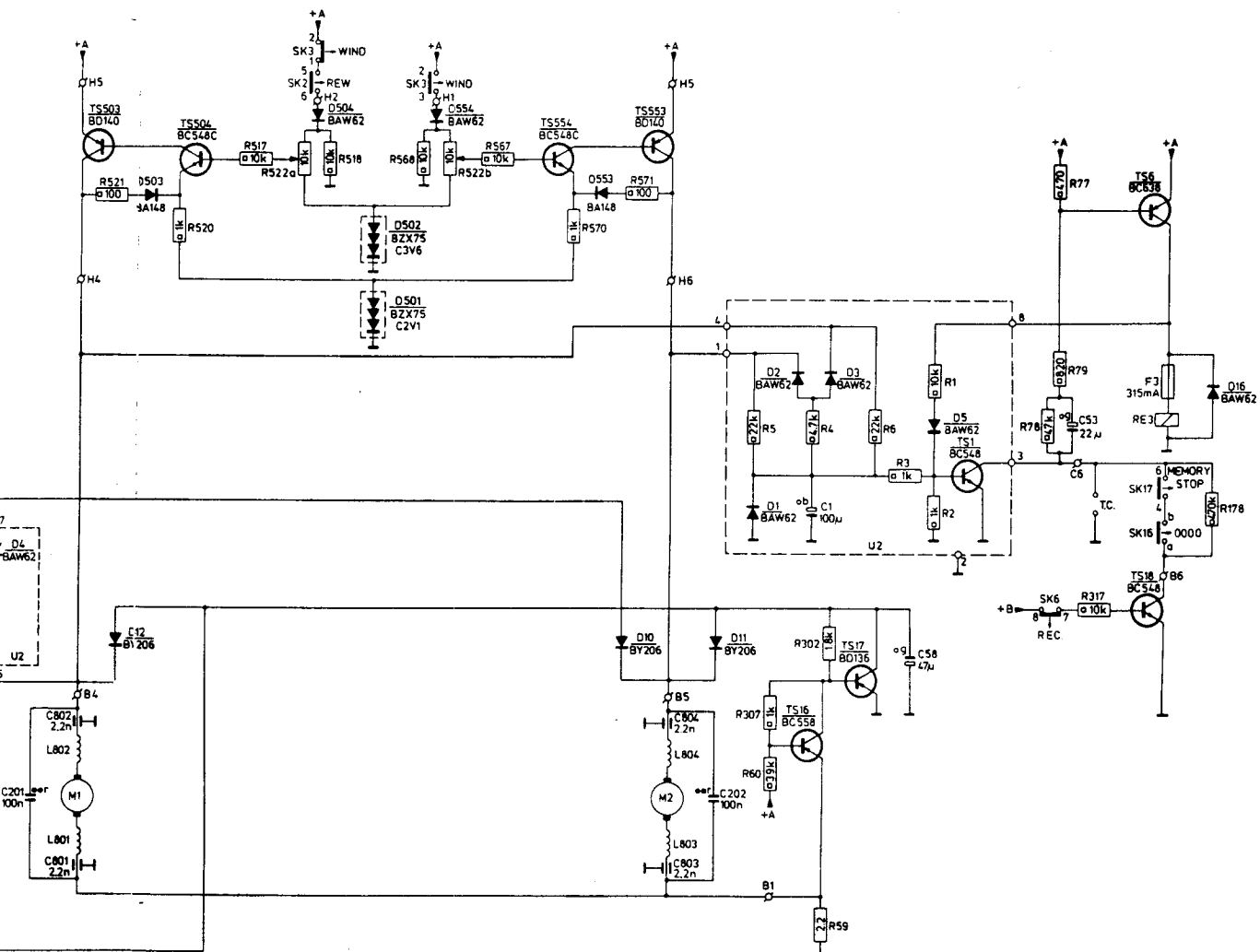
The voltage is rectified by the diodes D204 and D205 and smoothed by the capacitor C204. The smoothed positive voltage is applied to the base of TS203. Also, via one of the speed adjustment resistors, a DC voltage is applied to the base of TS203. The resultant of these two voltages determines the measure of conductivity of TS203. When the generator supplies less pulses, the resultant of these voltages will be lower so that the conductivity of TS203 increases.

TS203 controls the base voltage of TS202. The base current through TS201 is controlled by TS202. The motor voltage is controlled by TS201. Diode D206 protects the transistor TS203 and the capacitor C204 against too high a positive voltage. The pulses, which remain after smoothing by C204,

are discharged by C206. C207 and R209 form a filter effecting the stability of the control circuit. When the recorder is set to position AMPL. a positive voltage is applied to the base of TS203 via SK871 and TS203 is turned off. As a result motor M3 will stop.



D4	L801.802 M1	TS503	D12 503 TS504	D504	D502 501	D554	TS554	D553 10 TS553 M2	L803 804 D11 12	TS16 D3	TS17 U2	D5	TS1	RE3 TS6 18 F3	D16			
201	802.801								804 803 202	1		58		53				
		521	520	517 522a	518	568	522b	567	570	571	5.307.60	4.302.59	6	3	1.2	78 77.79	317	178



□ 1/8W ±5%
 □ 1/4W ±5%
 □ 1/2W ±5%
 □ 1W ±5%
 □ 4W ±10%
 ——— POLYESTER FLAT FILM CAPACITOR
 ——— SINGLE ELECTROLYTIC CAPACITOR
 ——— CONNECTION VIA CONNECTOR

b = 4V
 f = 25V
 g = 40V
 h = 63V
 j = 100V
 r = 250V

A = 24.5V
 B = 16V
 E = 15V

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Upper half of the cover plate

- Remove the 8 screws A,B,C and E on the front.
- Remove the two indicators (which form one unit)
- Lift the tape tension controls 2, turn them outside to the stop and let them go again. They will remain in this position.
- To take off the cover plate of the set, slightly lift it at the top and slide out under the tape tension controls.

Lower half of the cover plate

- Pull off the four turning knobs 10,11,12 and 13.
- Remove the two screws B on the front and the three screws C on the back.
- Lift the tape tension controls 2, turn them outside to the stop and let them go again. They will remain in this position.
- To take off the cover plate, lift it at the bottom and slide it out under the tape tension controls.

N.B.:

When mounting the cover plate all switch levers must be set to the lower positions and the memory stop switch must be pressed in.

Frame

- Take off the upper and lower halves of the cover plate.
- Remove the seven screws D.
- The frame can be lifted from the cabinet.

REPAIR HINTS, Figs 4,5

Fuses

- The fuses, incl. that for the transformer, are located in the upper part of the set. To replace them, the upper part of the cover plate should be removed.
- The fuse in the automatic stop circuit can be replaced after the chassis has been completely removed from the cabinet.

Indicator lamps

- Remove screw E.
- Remove the two indicators (which form one unit).
- The lamps can now be replaced.

LED for DNL and mains voltage indication

- Remove the lower part of the cover plate.
- The LEDs are fixed in the brackets by means of plastic rings. These rings should be re-inserted after replacement of the LEDs.
- The electrode with the larger surface is the cathode (- pole).

LED for DNL indication

- Push the LED forward, out of bracket F.

N.B.: When re-mounting, take care that the connecting wires of the LED lie behind tag E of the mounting bracket F.

LED for mains voltage indication

- Remove the frame from the cabinet
- Pull up the LED and remove it in right hand direction.

LEDs for overmodulation indication

- Proceed in the same way as for the indicator lights.
- Remove the two fixing screws from the indicator board.
- The LEDs can now be replaced.

Sockets 53,54 and 55

- Remove the lower part of the cover plate.
- Carefully unbend the tags J from the sockets.
- Remove bracket with sockets by lifting it on the side of the opened tags.

N.B.: For service the sockets are supplied separately.

Switch levers 48,49,50 and 52

- Remove the bracket with mounted-on sockets 53,54 and 55.
- Pull spindle K to the right far enough for the switch lever to be replaced to come free.

N.B.: For the levers 50 and 52, the levers 56,57,58 and 59 have to be lefted up (see "Switch levers 56,57,58 and 59").

Switches microphone sensitivity and cueing

- Remove the lower half of the cover plate.
- The switch levers can be replaced after moving them completely upwards and removing them from the recorder.

Switch levers 56,57,58 and 59

- Remove the lower half of the cover plate.
- Remove screws L.
- Detach the spindle from the mains switch by pulling the spindle out of the lever (snap connection)
- The complete lever unit can now be lifted up.
- Pull spindle M so far to the left that the switch lever to be replaced is released.

Switch levers 38,39,40 and 41

- Remove screws N.
- The complete lever unit can now be removed.
- Pull spindle O so far to the right that the switch lever to be replaced is released.

Switch slides and control keys

- Remove the frame from the cabinet.
- Unfasten the spindles of all the slides: at the levers by pulling the spindles from the lever at the keys by spanning out the key spindle.
- Take out the print.
- The slides can be replaced.
- Remove the knobs by pulling them from the keys.

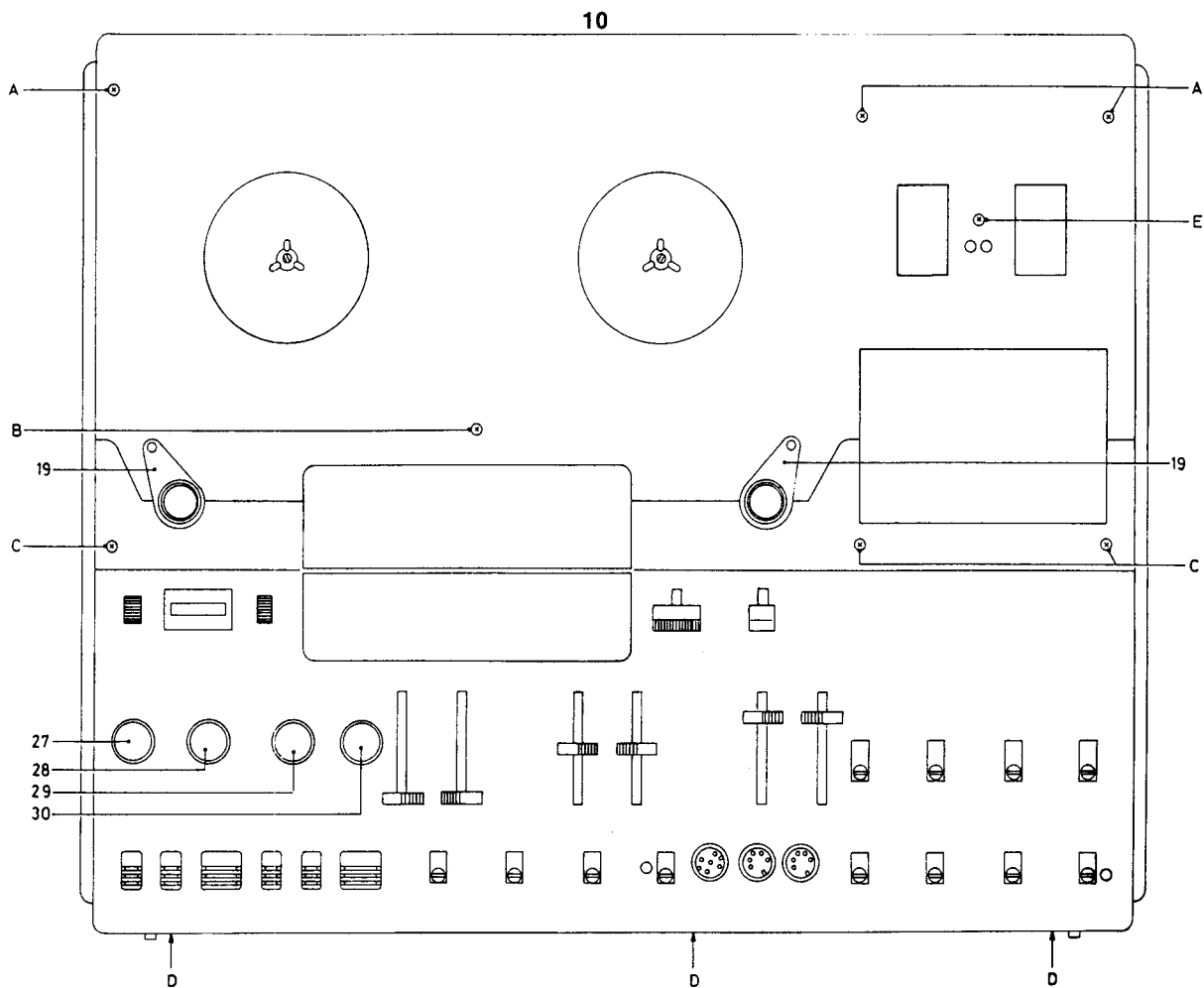
Tape tension controls

- Remove the frame from the cabinet.
- Release the tension spring.
- Remove the circlip, the rings, the tension spring and the plastic discs at the bottom.
- The plastic discs should not be separated.
- The tape tension control can now be removed.

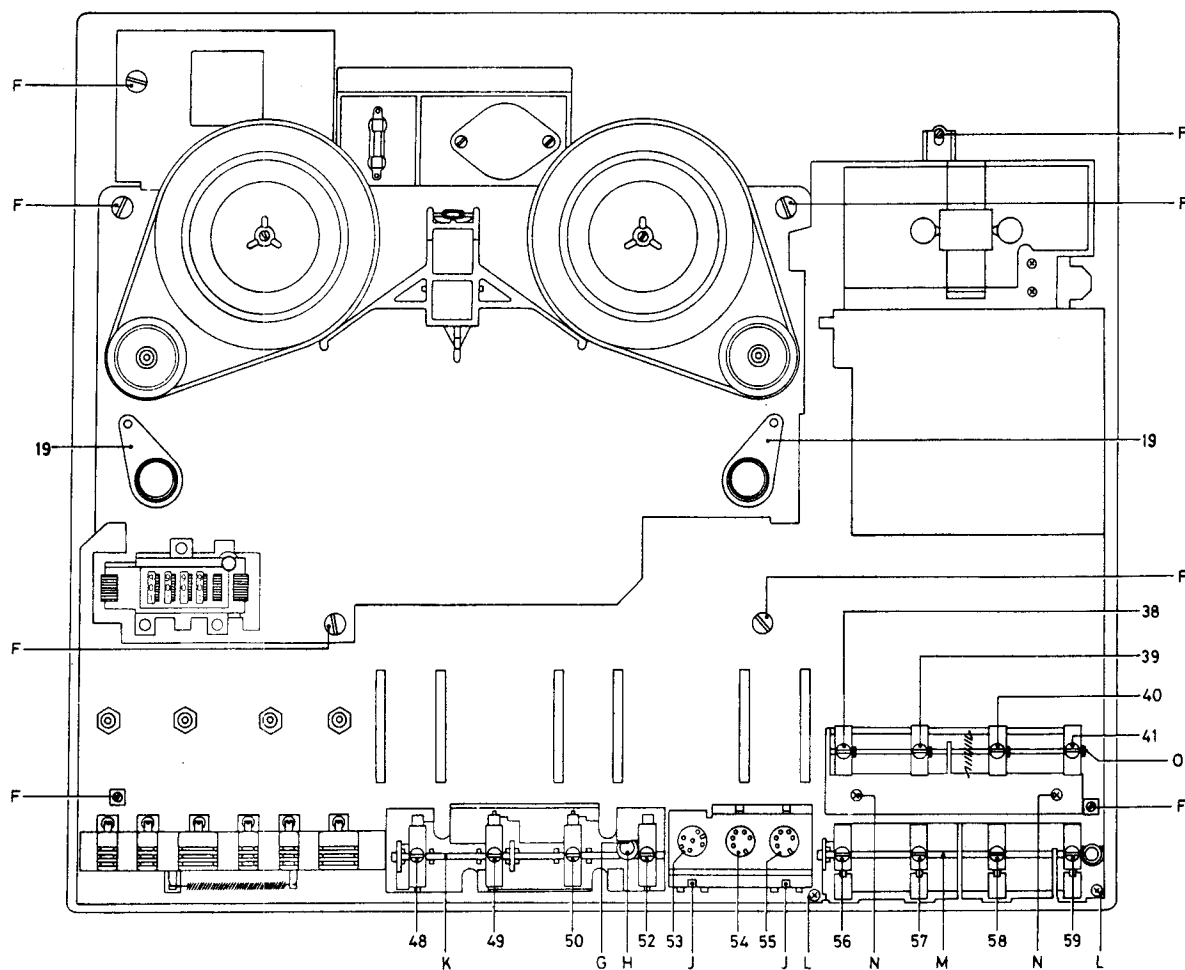
N.B.: The plastic discs are supplied assembled.

Static load

When metal reels are used, static load may occur. This static load can be discharged by means of metal discs on the reels.
Code number of the disc: 4822 466 80664.



11043D2



11042D2

MECHANICAL ADJUSTMENTS AND CHECKS

N.B.:

Do not use magnetized screw drivers. Secure screws and nuts adjusted with laquer.

Tools and measuring instruments required:

- Caliper gauge
- Set feeler gauge
- Spring pressure meter 3-30 g 4822 395 80029
- Spring pressure meter 50-500 g 4822 395 80028
- Spring pressure meter 300-3000 g 4822 395 84009
- Test tape 1 kHz - 13 kHz 4822 397 30014
 - 3150 Hz, 4.75 cm/s
 - 3150 Hz, 9.5 cm/s
 - 3150 Hz, 19 cm/s
- Multimeter
- mV-meter
- Double beam oscilloscope
- LF-generator
- Wow and Flutter meter

TAPE THREADING ADJUSTMENTS

Reel disc (Fig. 6)

- The height of the reel disc should be such that the distance between the top of the reel disc and the mounting plate is 15.35 mm. To measure this, you may lay a ruler with thickness A' flat on the reel disc. (When measuring, the reel disc spindle should be pressed against the thrust bearing). Adjustments to be made with screw D.
- The axial play of the reel disc (stretch C) should lie between 0.1 and 0.2 mm. It can be adjusted with ring B.

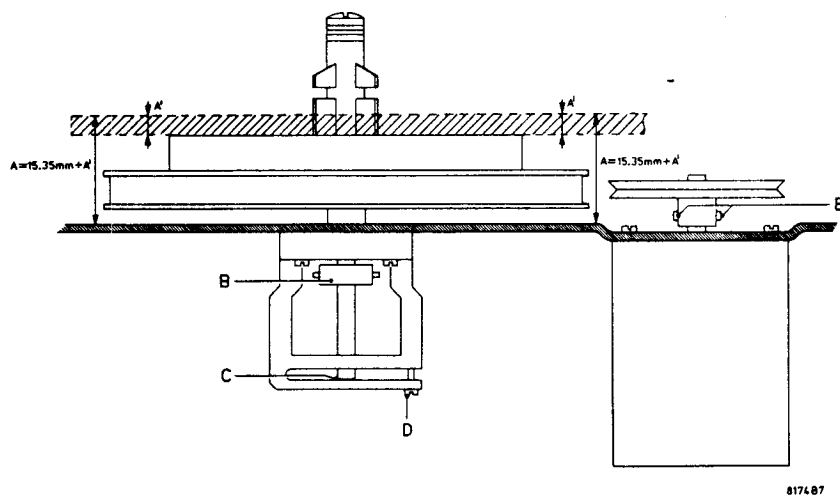


Fig. 6

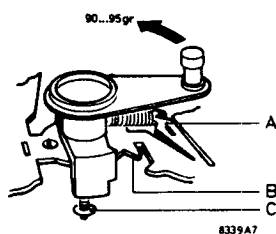


Fig. 7

Pulley of the reel disc motor (Fig. 6)

- The height of the pulley should be such that it is on the same level as the middle of the running surface of the belt of the reel disc. Adjustments can be made by moving the pulley on the motor spindle after loosening the screws E.

Tape tension controls (Fig. 7)

The time to come back to the rest position should be 1-1.5 s. This time should be the same for both tape tension feelers and can be adjusted by moving ring C.

Left hand tape tension sensor

The force which is necessary to open tape tension switch SK13 should be 65-70 grammes and is measured at the pin of the tape tension sensor. To be adjusted by bending tag A.

Right hand tape tension sensor

The force on the pin of the tape tension feeler should be 90-95 g just before the tape tension feeler touches stop B. Adjustments can be made by bending tag A.

Tape gulde (Fig. 8)

- Check the height of the reel discs.
- The erase head and the contacts for the automatic switch-off should be fixed on the mounting plate in the right way.
- Insert a tape and play it back.
- The height of the tape guides A should be such that the tape runs free from the guides.
- The height can be adjusted with nut B.

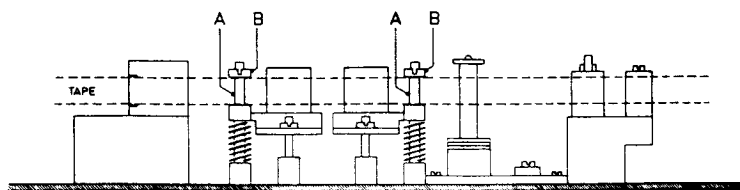


Fig. 8

817287

Pressure roller (Fig. 9)

- The pressure roller should be parallel with the capstan. Adjustments can be made by bending the pressure roller bracket at point F.
- The axial play of the pressure roller should be 0.1-0.2 mm, to be adjusted by moving the circlip B.
- With pressure roller magnet off, the distance between capstan and pressure roller should be 12 mm, to be adjusted by bending tag E.
- With pressure roller magnet off, the pressure roller should be kept from the capstan with a force of 25-30 g, to be adjusted by bending tag B.
- With pressure roller magnet pulled-on, the distance between ring C and upper nut D should be 0.1-0.2 mm, to be adjusted by turning the nuts D.
- With pressure roller magnet pulled-on, the pressure roller force on the capstan should be $1.000 \text{ g} \pm 50 \text{ g}$, to be adjusted by turning the nuts A.

Capstan (Fig. 10)

- The force of the stop on the capstan should be 100-200 g, to be adjusted by bending spring C.
- The distance between oil-retaining ring B and bearing should be 0.5-1 mm, to be adjusted by moving the oil-retaining rings.
- The capstan bearing should be so adjusted that the tape runs flat between capstan and pressure roller (The tape guides should be well adjusted).
To adjust:
 - . Tighten screws A
 - . Insert a DP-tape
 - . Turn screw D until the tape runs through flat between capstan and pressure roller.
 - . Tighten screw E to secure the adjustment.

Pressure felt (Fig. 9)

- Check the quality of the pressure felt. If it is hard, it should be replaced. The felt is supplied separately and should be glued on the bracket in such a way that the gap is in the centre of the felt.
Warning:
Take care that no glue remains on top of the felt.
- The force of the felt against the recording head should be $10 \pm 7 \text{ g}$ measured at the felt. Adjustments are made by moving spring H in one of the grooves K.
- With pressure roller magnet off, the bracket of the felt should be so far backward that the tape groove is free.

HEADS

For optimal playback results and minimal wear of the heads it is essential that recording and playback heads are correctly adjusted. The tape running may vary per recorder and also heads are manufactured with certain tolerances. This necessitates readjustment of the heads on replacement.

The mechanical adjustment comprises four important points (see Fig. 11).

- Adjustment of the head inclination. Wrong adjustment means that the head will wear on one side and will also result in a poor tape-head contact.
- Tangential adjustment. When adjusted wrongly, the tape-head contact will be poor.
- Adjustment of the height of the head. Wrong adjustment results in signal losses and possible overlapping of two tracks.
- Azimuth adjustment (groove adjustment). Wrong Azimuth adjustment means losses in the higher frequencies.

Adjustment playback head K2/K102 (Fig. 12)

- Adjustment of the head inclination
Adjust the playback head with nut C in such a way that the front of the head is exactly parallel to the tape or at right angles to the mounting plate.

Check:

- . Place a full-modulated 18 cm test tape with a frequency $> 10 \text{ kHz}$ on the recorder, or use a full 18 cm tape with on top a test tape 1 kHz - 13 kHz (code number 4822 397 30014).
- . Connect an mV-meter to BU4 MONITOR point 3/2.
- . Recorder in position "START" - "A" - "STEREO" "9.5".
- . Note the meter reading.
- . Slightly brake the full reel with the hand.
- . Note the meter reading.
- . Connect the mV-meter to BU4 MONITOR point 5/2 and repeat the above actions.
When braked, the output signal should not increase over 2 dB. If both output signals increase by more than 2 dB, the tape transport should be checked (see tape adjustments).
If only track 1 should increase by more than 2 dB when braked, the head inclines backward, if track 3 increases more than 2 dB, the head inclines forward.

- Tangential adjustment
Check carefully if the head groove is in the centre of the contact surface of the tape. If necessary, loosen the screws B and move the head.
- Adjusting the height of the head (Fig. 13)
 - Coarse adjustment.
 - . Place a tape on the set.
 - . With nuts C/D and screw A, adjust the height of the head in such a way that the top of the upper core lies just under the top of the tape
 - N.B. Nuts C and D and screw A should be turned to exactly the same extent in order not to change the adjustment of the head inclination.
 - Fine adjustment with test tape 1 kHz-13 kHz.
 - . Connect an amplifier to BU4 MONITOR
 - . Recorder in position "START" - "A" - "1-4" - "9.5".
 - . With nuts C and D, and screw A, adjust the height of the head such that the 1 kHz signal is just audible above the noise.
- Azimuth adjustment with test tape 1 kHz-13 kHz
 - Connect an mV-meter to BU4 MONITOR point 5/2
 - Recorder in position: "START" - "A" - "1-4" - "9.5".
 - With screw A, adjust the azimuth of the head in such a way that the playback of the 13 kHz signal is maximal. When the playback of the 1 kHz signal gets stronger again, the height of the head should be re-adjusted.

Adjustment recording head K1/K101

- Head inclination - tangential - height of head - and azimuth adjustment.
 - Detach the wiring of the recording head K1/K101 with a soldering iron.
 - Ditto, that of the playback head K2/K102 to the recording head K2/K102.
 - Adjust the head inclination, head slit, height of the head and azimuth of K2 according to the procedure for the playback head K2.
 - Readjust the wiring after these adjustments

b. Phase difference recording/playback head.

For the line-adjustment of the azimuth of the recording head K2/K102 according to the phase adjustment method, it is absolutely necessary to perform the aforementioned adjustments, in order to prevent phase difference $> 90^\circ$.

- Feed a signal of 1 kHz to BU3 LINE IN/OUT points 3/2 and 5/2.
- Connect a double beam oscilloscope to BU4 MONITOR (e.g. point 5 of BU4 to Ya input and point 3 of BU4 to Yb input).
- Recorder in position "RECORDING" - "A" - "STEREO" - "19".
- With screw A, adjust the recording head is such a way that the two signals are in phase.
- Check the phase difference likewise on higher frequencies and, if necessary, correct the azimuth adjustment with screw A of the recording head K2/K102.

Remarks:

1. After the mechanical adjustment of the heads, the following electrical measurements and adjustments should be performed.
 - a. Recording/playback sensitivity
 - b. Premagnetisation current
 - c. Frequency characteristic
2. After completion of the adjustments, nuts C and D and screw A should be secured with laguer.

When replacing the recording head K2/K102 it is advisable to likewise replace the pressure felt (see "Mechanical checks and adjustments").

Erase head K3/K103

Check if the core surface near the core groove is smooth. If it has become coarse, it is necessary to replace the erase head, as otherwise the tape may be damaged.

A new erase head needs no adjustment. The tape guides of the erase head are fixed points for the tape transport. It is therefore advisable to check the tape transport after replacement of the erase head.

BRAKES

The recorder is braked both mechanically and electrically (see "Operation of the control section").

Mechanical brake (Fig. 14)

- The force to move the brake bracket from rest position to such an extent that the distances E are 1.5 mm, should be 65-75 g.
- From this position, a force of 55-65 g is required to bring the braking magnet back to the rest position. Adjustments can be made by bending the bracket with spring D attached.
- In pulled-on position of the braking magnet the distance E should be 1.3-1.5 mm, to be adjusted by moving the braking magnet after loosening the screws C.
- With braking magnet off, the distance B should be 0.3-0.5 mm, to be adjusted by bending tag A.

Electrical brake

No adjustments are necessary for the electrical brake

Automatic switch-off (Fig. 15)

- With magnet B pulled-on and keys START (A) and REC (E) pressed, the magnet should be moved so far that the keys are mechanically released (screws D loosened).
- Anchor B should be parallel to fork B of the stop bracket.

Slide switches (Fig. 16)

- With keys depressed, lever switches TRACK and SPEED in mid position and the other lever switches in the upper position, the front of the switch housing should be in area A of the slider. Adjustments can be made by bending the intermediale bracket.
 - With keys in off-position, lever switches in lowest position and slide switches in upper position, the back of the switch housing should be in area B of the slider. Adjustments can be made by bending the intermediale bracket.
- Lever switch POWER can be adjusted after loosening 2 screws and by moving the switch.

FAST WINDING

- Insert a tape
With pressure roller magnet off, the distance between tape and heads should be 1-1.5 mm.
To make adjustments: bend the tape take-off pins.
- The current through the pulling motor should be abt. 150 mA at the beginning and 500 mA at the end of the tape.
- With transport blocked, the current through the pulling motor should be abt. 760 mA.
- The current through the motor pulled should be abt. 80 mA at the beginning and P mA at the end of the tape.

PLAYBACK

Insert a tape.

The current through the pulling motor should be abt. 230 mA. The current through the motor pulled should be 25-30 mA.

SPEED ADJUSTMENT

- Connect a wow and flutter meter to BU601 LINE IN/OUT. Insert a test tape with a frequency of 3,150 Hz, recorded at 4.75 cm/sec. 9.5 cm/sec. or 19 cm/sec, depending on the speed to be adjusted, and play it back.
Adjust the right speed with one of the trimming potentiometers (see table below).
After the speed adjustment, the wow and flutter may be as indicated in the table below.

Speed	Trimming potentiometer	Wow and flutter
4.75 cm/sec	R65	0.3 %
9.5 cm/sec	R68	0.2 %
19 cm/sec	R69	0.15 %

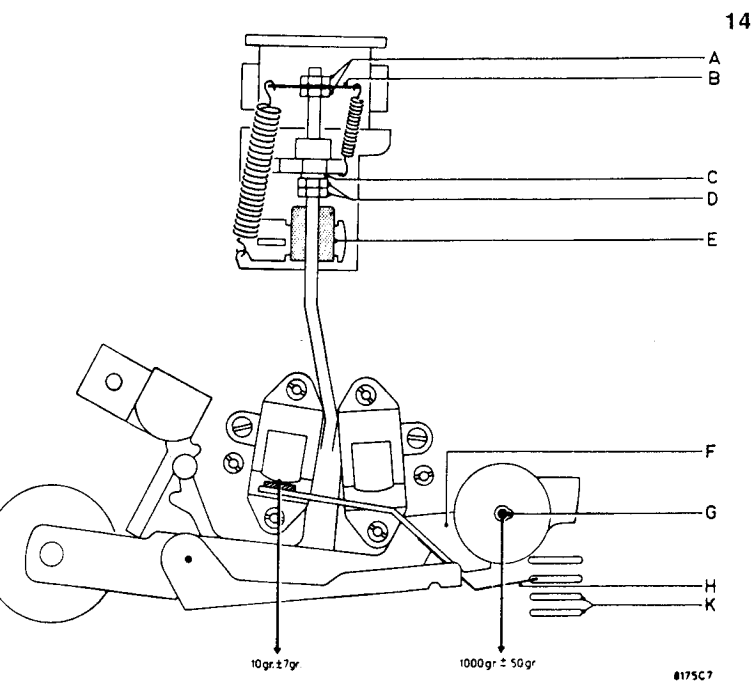


Fig. 9

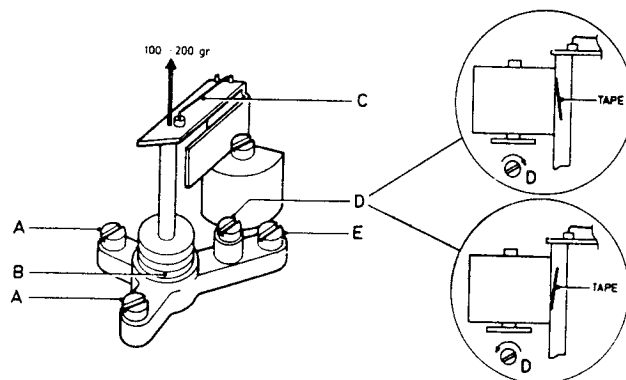


Fig. 10

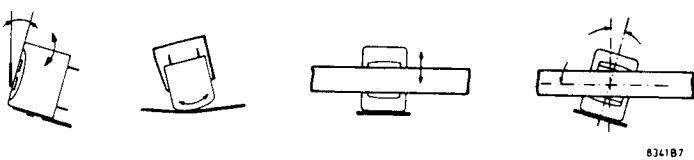


Fig. 11

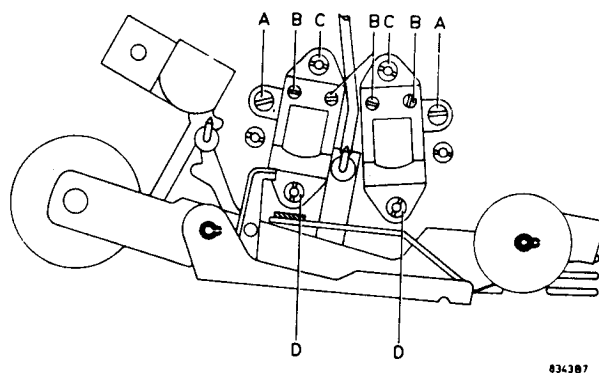


Fig. 12

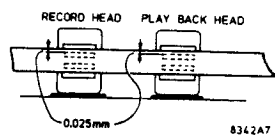


Fig. 13

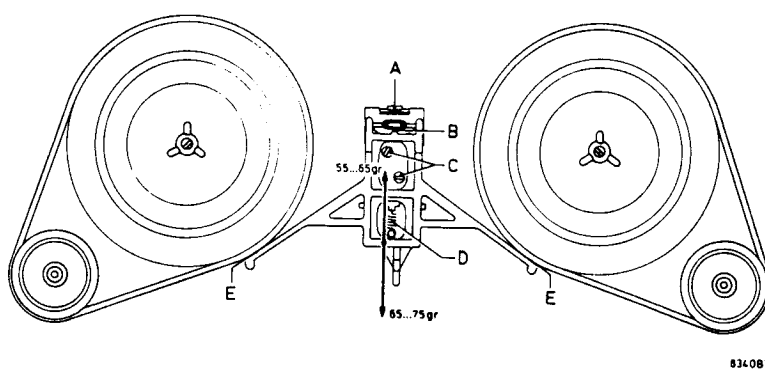


Fig. 14

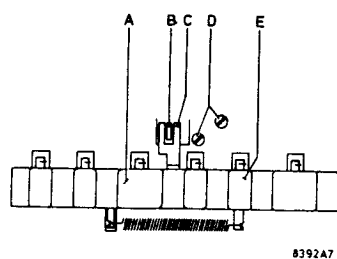


Fig. 15

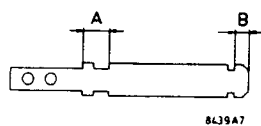


Fig. 16

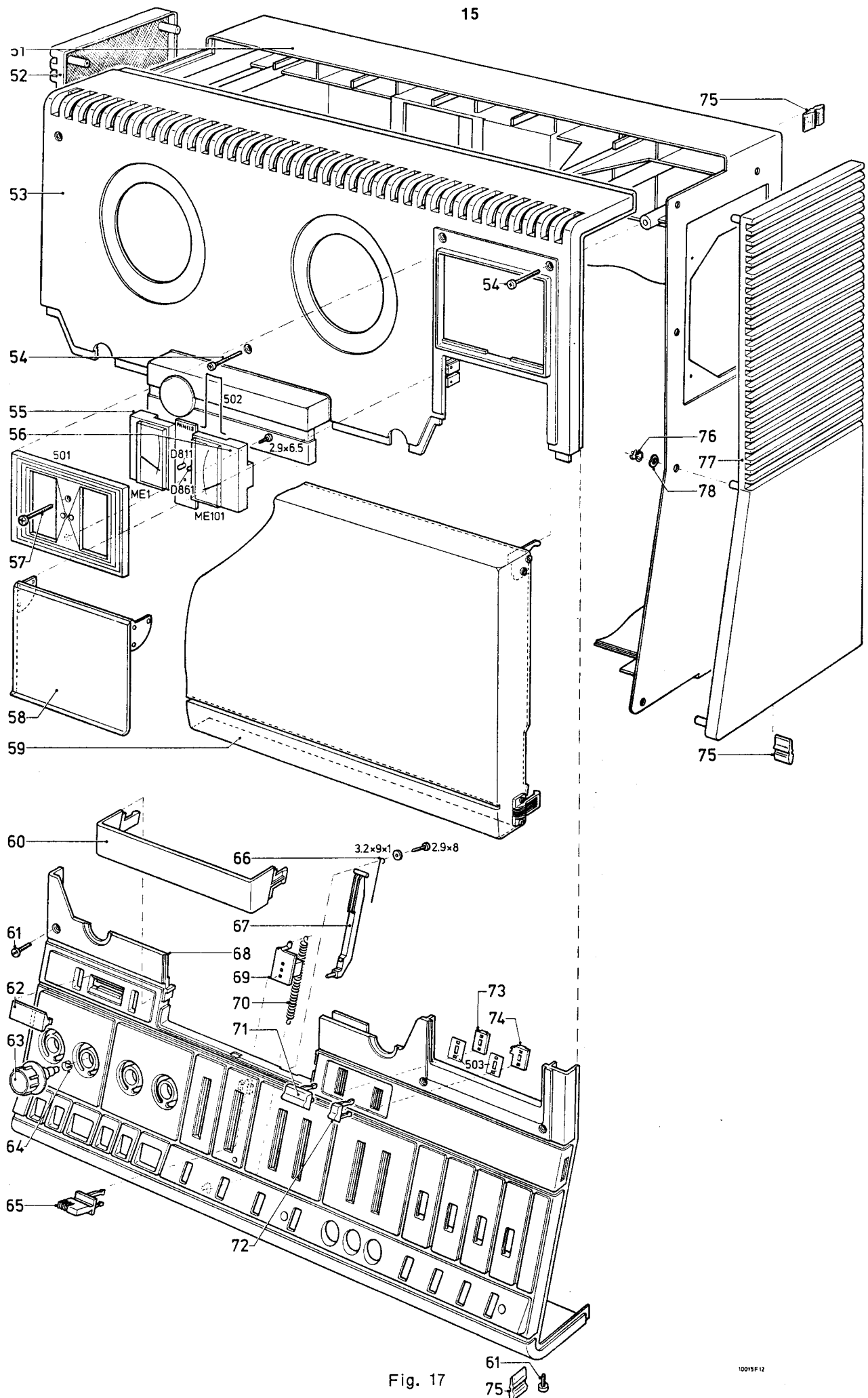


Fig. 17

LIST OF MECHANICAL PARTS

16

51	4822 691 20082	118	4822 492 50312	171	4822 492 31274
52	4822 443 40099	119	4822 402 60284	172	4822 492 40593
53+58+501+		121	4822 505 10199	173	4822 528 90247
502+55+56+	4822 443 30138	122	4822 402 60285	174	4822 411 50414
panel 8		123	4822 249 40064	176	4822 256 30128
54	4822 502 11341	124	4822 249 20037	177	4822 361 20091
55	4822 347 10135	126	4822 249 10085	178	4822 280 70152
56	4822 347 10136	127	4822 403 10125	179	4822 532 30271
57	4822 502 11347	128	4822 520 10359	181	4822 532 50692
58	4822 443 60525	129	4822 532 50904	182	4822 492 51122
59	4822 443 20086	130	4822 532 50964	183	4822 532 50987
60	4822 443 60524	131	4822 403 50661	184	4822 492 31272
61	4822 502 11339	132	4822 462 71054	187	4822 267 40155
62	4822 381 10437	133	5322 532 14416	188	4822 267 40039
63	4822 413 40713	134	4822 130 30904	189	4822 321 10105
64	4822 532 10284	135	4822 532 50906	191	4822 272 10118
65	4822 411 20227	136	4822 310 40003	192	4822 325 60038
66	4822 492 40648	137	4822 528 70018	193	4822 361 20126
67	4822 410 30127	138	4822 403 50876	194	4822 255 10007
68+62+65+69+		139	4822 280 70156	196	4822 520 30281
71+72+73+74+	4822 443 30319	141	4822 528 80619	197	4822 358 30135
75+503		142	4822 532 50725	198	4822 528 60075
69	4822 403 30264	143	4822 492 31271	199	4822 403 50932
70	4822 492 31314	144	4822 492 31017	201	4822 403 10139
71	4822 410 40123	146	4822 146 20509	202	4822 411 50413
72	4822 410 30131	147	4822 492 50923	203	4822 130 30922
73	4822 532 20661	148	4822 520 10374	204	4822 492 62064
74	4822 532 20664	149	4822 466 60611	206	4822 492 40647
75	4822 462 40245	151	4822 403 20123	207	4822 277 60112
76	4822 492 62039	152	4822 492 50314	208	4822 532 10284
77	4822 460 20157	153	4822 532 10528	209	4822 413 30641
78	4822 530 80078	154	4822 532 20103	211	4822 492 31315
101	4822 492 31269	155	4822 505 10446		
102	4822 403 50874	156	4822 492 50152		
103	4822 358 30186	157	4822 325 80066		
104	4822 276 10605	158	4822 492 31273		
106	4822 349 50078	159	4822 492 40592		
107	4822 278 90035	161	4822 403 30254		
108+111+112+		162	4822 403 30256		
113+114	4822 528 10304	163	4822 403 30257		
109	4822 358 30195	164	4822 403 30255		
111	4822 532 20578	166	4822 410 21712		
112	4822 492 51002	167	4822 410 21713		
113	4822 532 20619	168	4822 410 21711		
114	4822 502 11218	169	4822 417 10639		
116	4822 528 80521				
117	4822 492 40591				

MAINTENANCE

We advise regular cleaning with e.g. alcohol of the following parts:

- erase, recording and playback heads
- capstan
- tape guides
- pressure roller
- grooves in pulleys, reel discs and flywheel
- brake bracket

The pressure felt for the recording head can be cleaned with a brush.

N.B.: Rub dry the heads after cleaning with a cloth.

Lubrication directions

- Shell Alvania 2 - code 4822 389 10001
Thrust bearing of the flywheel.
- Mobil oil DTE - code 4822 390 10065
Flywheel bearing

N.B.: After lubrication, carefully clean the part of the capstan above the retaining rings.

- Silicone liquid - code 4822 390 20023
Bearings of reel discs and tape tension feelers.
- Shell Clavus 17 - code 4822 390 10048.
Pressure roller bearing.

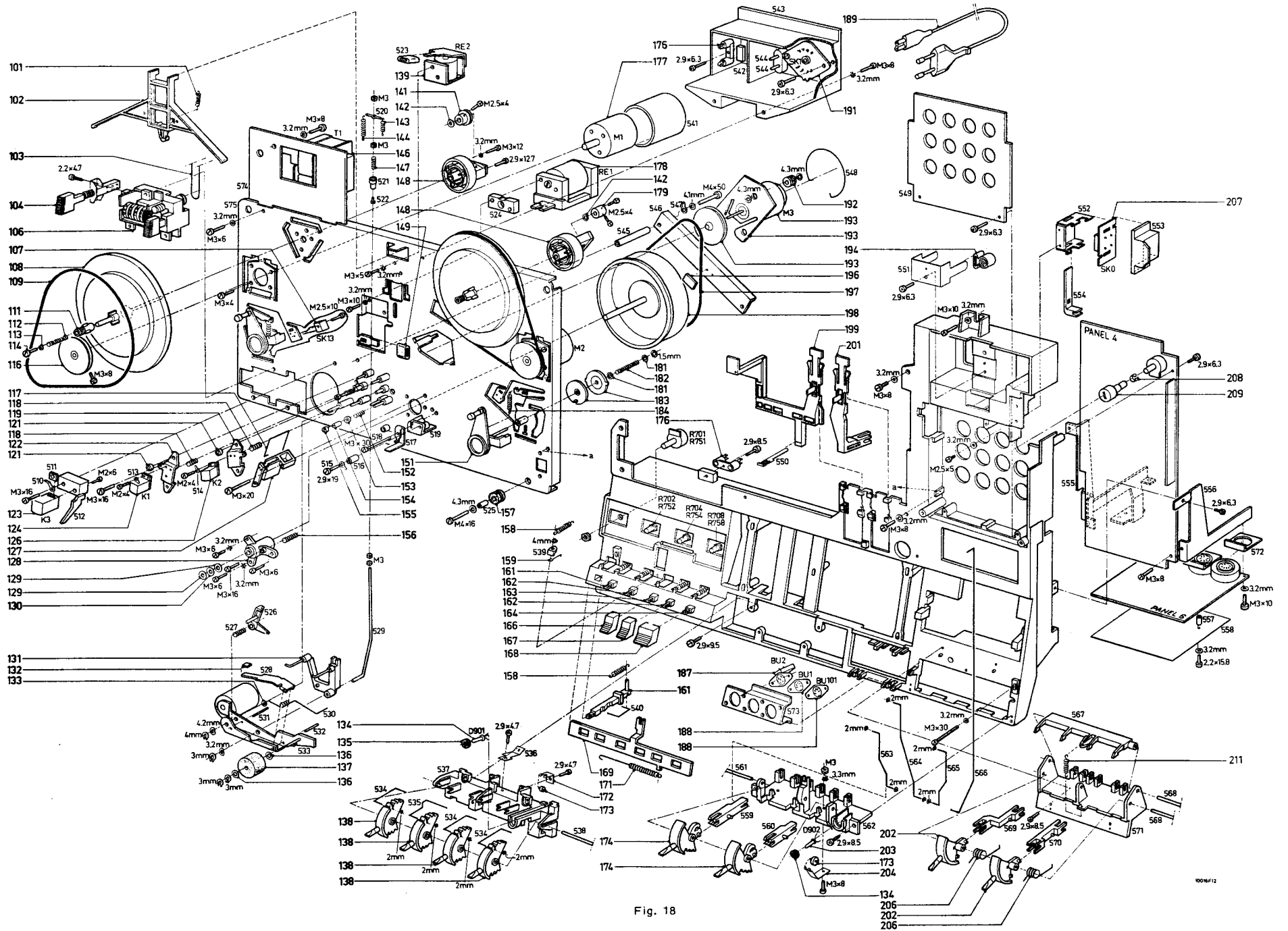


Fig. 18

ELECTRICAL MEASUREMENTS AND ADJUSTMENTS

The following measurements and adjustments were performed on the left channel. The connecting points and adjustment devices for the right channel are bracketed.

The output measured should be cut-off with a 100 k Ω resistor.

Secure the cores adjusted with wax, code 4822 390 40013.

Measuring instruments required

Multimeter
mV-meter
LF-generator

Positions and controls

VOLUME, RECORDING LEFT and RIGHT, MICRO LEFT and RIGHT and the pre adjusting potentiometers to maximum. BALANCE to "0".
BASS, TREBLE, WIND SPEED and POST FADING to minimum.

19 kHz and 38 kHz suppression

- No tape in the recorder
- Positions of the switches

MICRO SENS	: odB
TRACK	: ST
SPEED	: 4.75
MULTIPLAY	: OFF
MODE	: AMPL
TUNER	: ON
- Feed a signal of 19 kHz, 100 mV to BU602 TUNER point 3/2 (5/2).
Adjust L602 (L652) in such a way that the voltage on BU4 MONITOR point 3/2 (5/2) is minimum (≤ 158 mV).
- Feed a signal of 38 kHz, 100 mV to BU602 Tuner point 3/2 (5/2).
Adjust L601 (L651) in such a way that the voltage on BU4 MONITOR point 3/2 (5/2) is minimum (≤ 63 mV).

Suppression of the radiation of the erase oscillator signal

- No tape in the recorder
- Positions of the switches

MONITORING	: A
TRACK	: ST
SPEED	: 9.5
MULTIPLAY	: OFF
MODE	: TAPE
- Press the keys "START" and "REC" until the reel discs turn adjust L2 (L102) in such a way that the voltage on BU4 MONITOR point 3/2 (5/2) is minimum (≤ 1.5 mV).

Adjustment of the recording/playback sensitivity and the indicator deflection

- Insert an unmodulated tape of good quality.
- Positions of the switches.

MONITORING	: B
TRACK	: ST
SPEED	: 19
MULTIPLAY	: OFF
MODE	: TAPE
LINE	: ON

- Press the REC key
- Feed a signal of 330 Hz to BU601 LINE IN/OUT point 3/2 (5/2).
- Select the input signal in such a way that the output voltage on BU4 MONITOR point 3/2 (5/2) is $900 \text{ mV} \pm 0.5 \text{ dB}$.
- Adjust R96 (R196) in such a way that the voltage on BU4 MONITOR point 6/2 (7/2) is $1.4 \text{ mV} \pm 0.5 \text{ dB}$.
- Adjust R54 (R154) in such a way that the left (right) hand indicator indicates 100%.
- Press the keys START and REC.
- MONITORING switch in position "A".
- R40 (R140) should be adjusted so that the left (right) hand indicator indicates 100%.

Adjustment of the premagnetization current

For a correct adjustment of the premagnetization current it is necessary to compromise between the frequency characteristic and the distortion. The premagnetization current is determined by measuring the voltage on BU4 MONITOR point 6/2 (7/2) in the recording position. The orientation value is 4 mV and should be adjusted with R22 (R122). The frequency should be $100 \text{ kHz} \pm 10\%$.

- Insert an unmodulated tape of good quality
- Note the frequency characteristic (see Measuring of the frequency characteristic). Add extra values in the range over 6,300 Hz.
- The curve over 6,300 Hz should more or less correspond with the characteristic b shown in Fig. 19, whilst the after-tape distortion should be $\leq 3\%$ at 1 kHz (100% modulation).

When the high frequencies are weakened too much (Fig. 19c), the premagnetization current is too high. Are the high frequencies too strong (Fig. 19d) and/or is distortion audible, then the premagnetization current is too low.

Remark:

When adjusting one channel, the other may also be somewhat influenced.

Measuring the frequency characteristic

- Insert an unmodulated tape of good quality .
Control MICRO LEFT and RIGHT to minimum.
- Positions of the switches.

MONITORING	: B
TRACK	: ST
SPEED	: 19
MULTIPLAY	: OFF
MODE	: TAPE
LINE	: ON
- Press the REC key.
- Feed a signal of 330 Hz to BU601 LINE IN/OUT point 3/2 (5/2).
Select the input signal in such a way that the output voltage on BU4 MONITOR point 3/2 (5/2) is $900 \text{ mV} \pm 0.5 \text{ dB}$ (The indicator deflection should be 100%).
- Reduce the output voltage to 90 mV ($\pm 20 \text{ dB}$) by means of the control RECORDING LEFT (RIGHT)
- Press the keys START and REC.
- MONITORING switch in position "A".
- Make a recording of the following frequencies and read the output voltages: 35 Hz - 40 Hz - 60 Hz - 330 Hz - 1 kHz - 8.2 kHz - 22 kHz - 25 kHz.

The frequency characteristic which is now measured against the 330 Hz level, should lie within the curve drawn in Fig. 20.

Likewise, the frequency characteristic at 9.5 cm/sec can be measured.

The highest frequencies should now be 17 and 18 kHz (see Fig. 20). At 4.75 cm/sec. the output voltage should be reduced to 45 mV (-26 dB). The frequency characteristic should be within 7 dB in the range 35 Hz - 11 kHz.

Check on cross-talk

a. Channels mutually

- Insert an unmodulated tape of good quality.

Controls MICRO LEFT and RIGHT to maximum.

- Positions of the switches.

MONITORING : B
TRACK : ST
SPEED : 19
MULTIPLAY : OFF
MODE : TAPE
LINE : ON

- Press the REC key.

- Feed a signal of 6.3 kHz to BU601 LINE IN/OUT point 3/2 (5/2).

Select the input signal in such a way that the output voltage on BU4 MONITOR point 3/2 (5/2) is $900 \text{ mV} \pm 0.5 \text{ dB}$.

- Press the keys START and REC.
- The cross-talk rejection measured on BU4 MONITOR point 5/2 (3/2) should be $\geq 20 \text{ dB}$ ($= \leq 90 \text{ mV}$) in position "A" and "B".

b. Tracks mutually

- Insert an unmodulated tape.

Controls MICRO LEFT and RIGHT to minimum.

- Positions of the switches.

MONITORING : B
TRACK : ST
SPEED : 19
MULTIPLAY : OFF
MODE : TAPE
LINE : ON

- Press the REC key.

- Feed a signal of 6.3 kHz to BU601 LINE IN/OUT point 3/2 (5/2).

Select the input signal in such a way that the output voltage on BU4 MONITOR point 3/2 (5/2) is $900 \text{ mV} \pm 0.5 \text{ dB}$.

- Make a recording of about 30 sec.

- Reverse the tape.

- Press the START key.

- The cross-talk rejection measured on BU4 MONITOR point 3/2 (5/2) should be $\geq 60 \text{ dB}$ ($= \leq 0.9 \text{ mV}$).

If this value is not reached, it is advisable to check the tape transport and the height of the head.

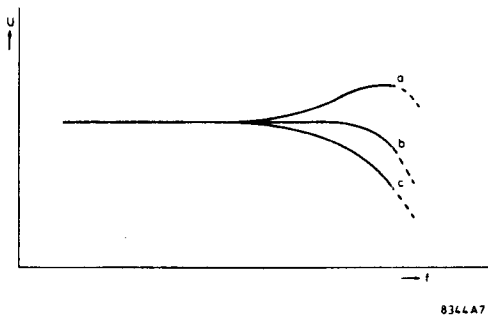


Fig. 19

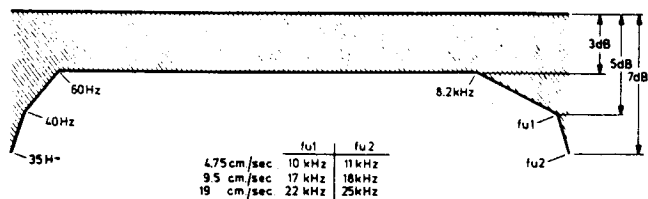
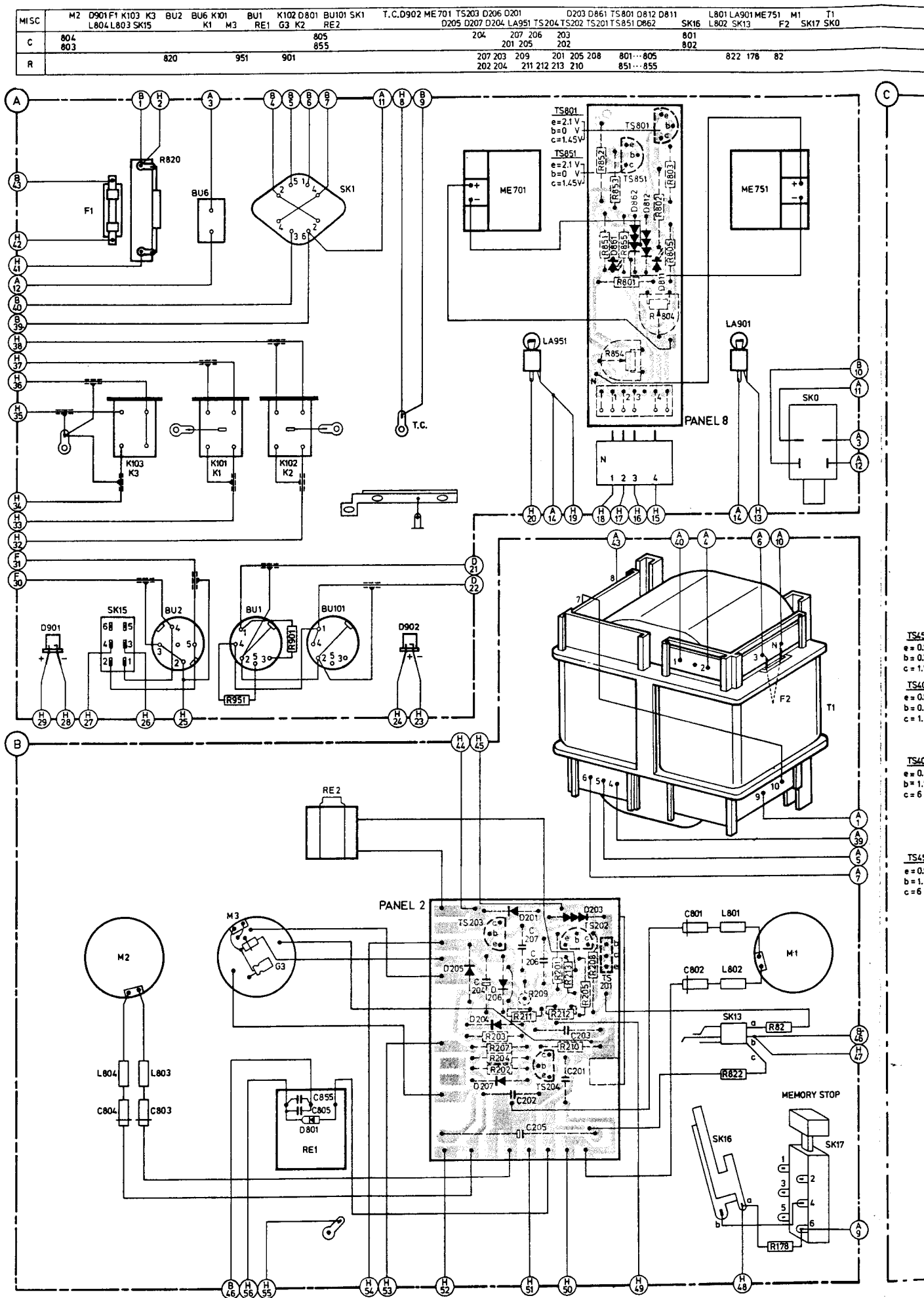


Fig. 20

-TS-			601,651	56 pF, 40 V	4822 122 31074
2,102			701,751	22 nF, 250 V	4822 121 40407
4			704,754	10 nF, 250 V	4822 121 41134
5,105,204, } 504,554			705,755	100 nF, 100 V	4822 121 41161
6			901	3.3 μ F, 40 V	4822 124 70312
7			-L-		
8,17,201			2,102	Coil	4822 157 50735
9			601,602,651, } 652	Coil	4822 157 50869
10,391			-R-		
11			22,122,804, } 854	22 k Ω , trim	4822 100 10051
12,16,112, } 203			40,140	220 k Ω , trim	4822 100 10088
15			48,148	510 Ω , 1/4 Watt	5322 116 54525
18,202			49	62 Ω , 1 Watt	4822 111 50389
19			59	2.2 Ω , wire wound	4822 113 60028
392			61	PTC 25 Ω - 50 Ω	4822 116 40001
401,402,451, } 452,501,502, } 551,552			62	750 Ω , wire wound	4822 112 20104
503,553			65,68,69, } 96,196	2.2 k Ω , trim	4822 100 10029
507			70	95.3 k Ω , metal film	5322 116 50567
701,751,801, } 851			71	48.7 k Ω , metal film	5322 116 50442
702,752			74	4.64 k Ω , metal film	4822 116 51163
703,753			75	5.11 k Ω , metal film	4822 116 51164
-D-			100	191 k Ω , metal film	5322 116 54724
2,10,11,12, } 30,201			420,421,422, } 423,470,471, } 472,473	470 k Ω , log	4822 101 30327
14			424,474, } 426,476	10 k Ω , log	4822 101 30307
15,17			511,513,561, } 563	22 k Ω , log	4822 105 10071
16,18,19,20, } 24,28,29,124, } 128,204,205, } 206,207,251, } 252,253,391, } 504,507,554			522,523	10 k Ω , lin	4822 105 10262
22,23			701/751	47 k Ω , log	4822 102 30207
203,501,812, } 862			702/752	47 k Ω , bal	4822 102 30215
401			704/754	100 k Ω , log	4822 102 30219
502			708/758	220 k Ω , log.	4822 102 30214
503,553			714,764	360 Ω , 1/4 Watt	5322 116 50603
801			802,852	750 Ω , 1/4 Watt	5322 116 54536
811,861,902			-Miscellaneous-		
901			BU1,101	Socket 5-pol	4822 267 40039
-C-			BU2	Socket 5-pol + switch	4822 267 40155
12,112,602, } 652			BU3,4,601, } 602,603,604	Socket 7 pol	4822 267 50218
15,16,23,115, } 116,123			BU5	Socket 5 pol	4822 267 40233
17,117,203			Multiway connector for U1,101		4822 267 40127
26			Multiway connector for U2		4822 267 50156
27			Socket A,B,C		4822 265 30117
29			Plug A,B,C		4822 266 30073
31,131			Socket D,F		4822 265 30119
45,145			Plug D,F		4822 266 30072
53			Socket E		4822 265 30121
56,156			Plug E		4822 266 30071
204			Core for L2,102		4822 526 10111
206			Core for L601,651		4822 526 10099
502,552			Core for L602,652		4822 526 10014
			F1	Fuse 3.15 A	4822 253 30027
			F2	250 mA/125°C	4822 252 20007

F3	Fuse 315 mA	4822 253 30014
IC1,2	TCA220	5322 209 84386
K1/101	Rec.head	4822 249 20037
K2/102	Sound head	4822 249 10085
K3/103	Erase head	4822 249 40064
LA901,951	Lamp 6V/100 mA	4822 134 40326
M1,2	Motor	4822 361 20091
M3	Motor	4822 361 20126
ME1	Indicator left	4822 347 10135
ME101	Indicator right	4822 347 10136
RE1	Magnet assy	4822 280 70152
RE2	Magnet assy	4822 280 70156
RE3	Magnet assy	4822 280 70155
SK0	Mains switch	4822 277 60112
SK1	Voltage adaptor	4822 272 10118
SK2,3,5,7,11, 503,504,872, 873	}	4822 277 30591
SK4,404		4822 277 30592
SK6,8,9,10, 401,871	}	4822 277 30586
SK13		4822 278 90035
SK402,403		4822 278 20327
Pin for slide switch		4822 535 90892
Pin for slide switch (SK503)		4822 532 20662
T1	Transformer	4822 146 20509
Mains cord		4822 321 10074
Mains cord /15		4822 321 10235
U1,101	DNL unit	4822 214 30238
U2	Tape tension unit	4822 214 30399
Fuse holder		4822 256 30128



D2 0801	BU101 SK1	T.C.D902 ME701	TS203 D206 D201	D203 D861 TS801 D812 D811	L801 LA901 ME751 M1	T1	SK404	TS402	TS401	TS451	TS452
K2	RE2		D205 D207 D204 LA951 TS204 TS202 TS201 TS851 D862	SK16	L802 SK13	F2 SK17 SK0		SK403			
805			204	207 206	203		458 408	456	454	404 457 405	409 403
855			201 205	202			406	407	459	453	455
			207 203	209	201 205 208	801...805	454 423 474	407...419	422 424	479 480	405 455 421 476
			202 204	211 212 213	210	851...855	404 473	457...469	472	429	401 451 471

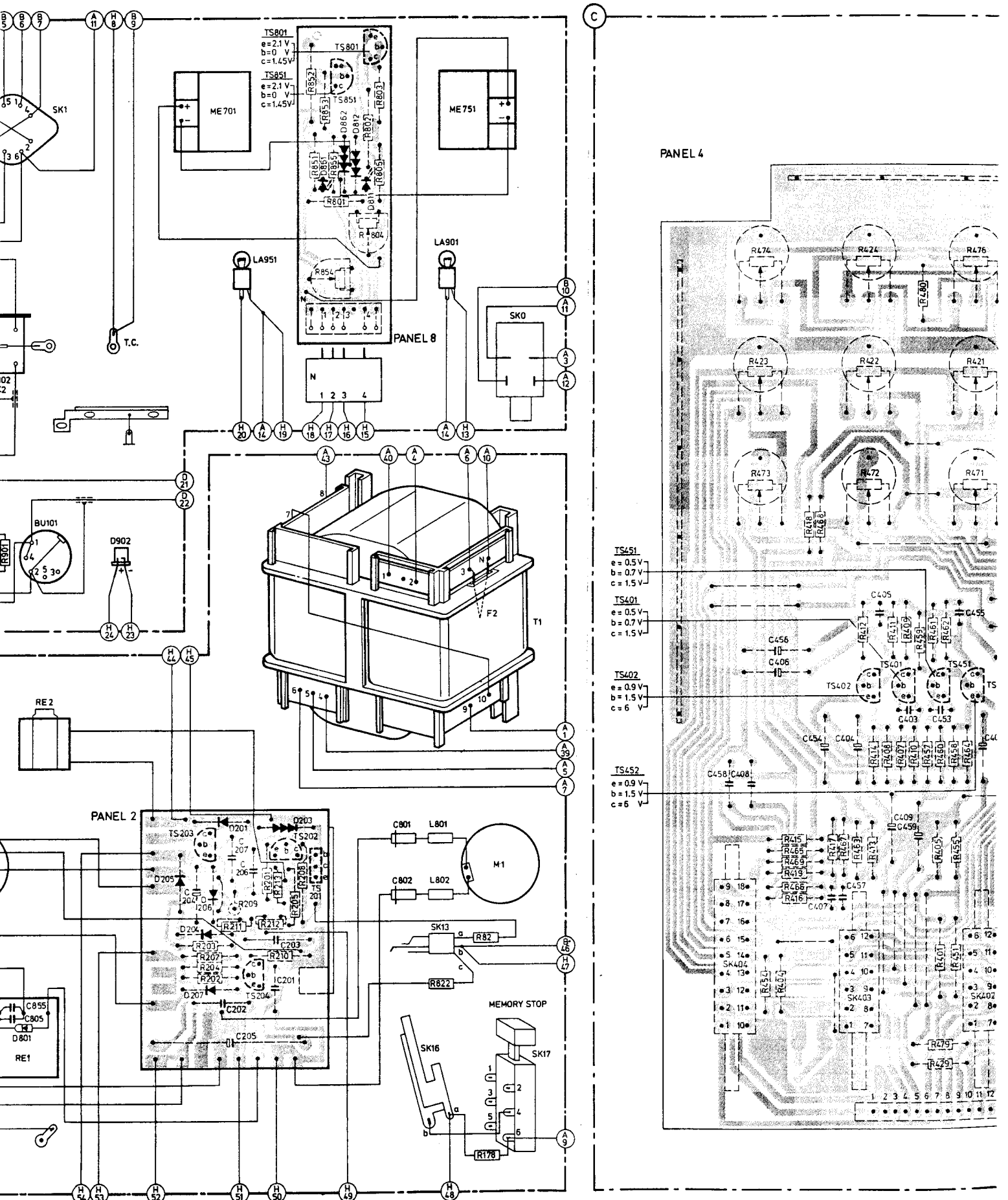
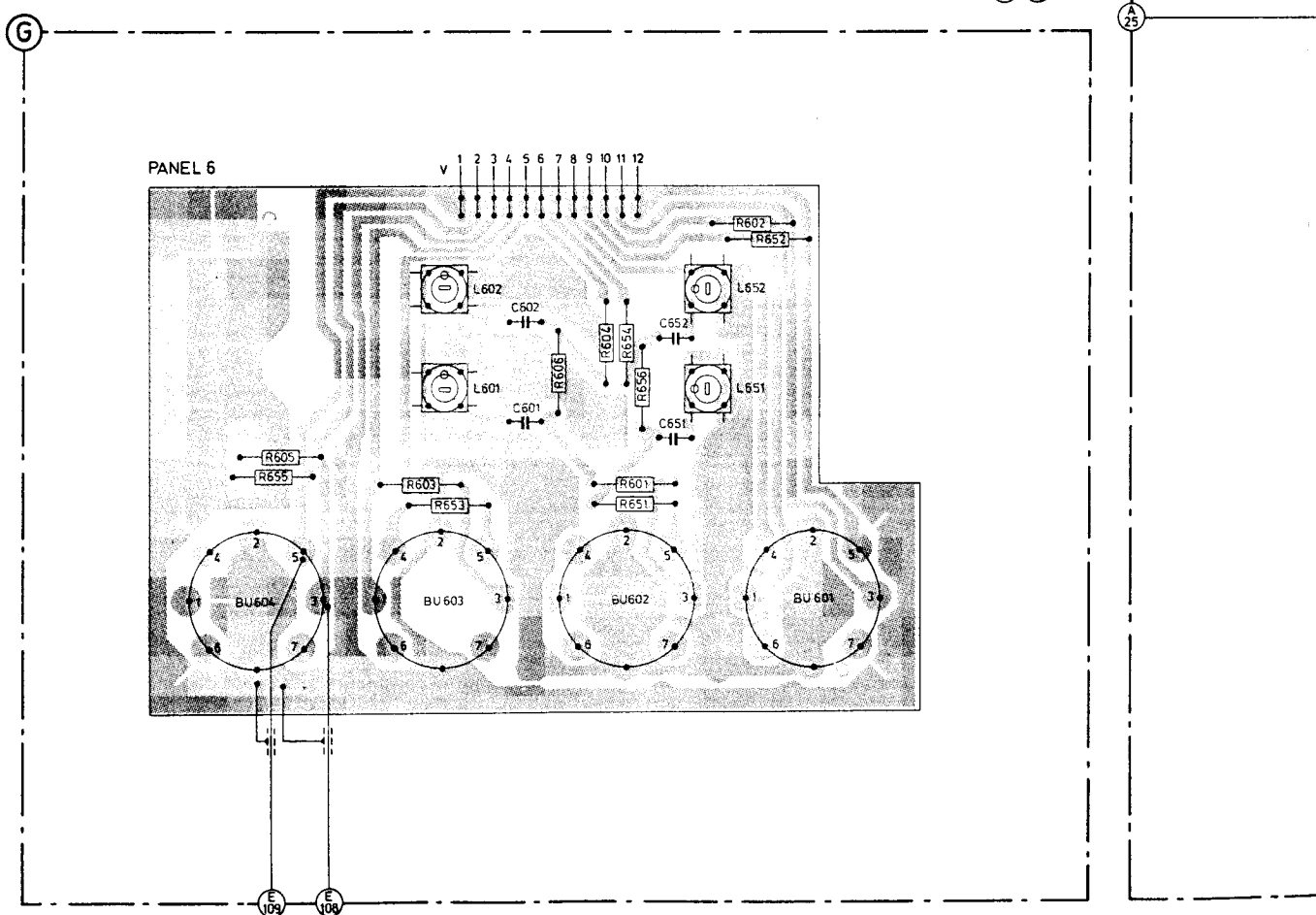
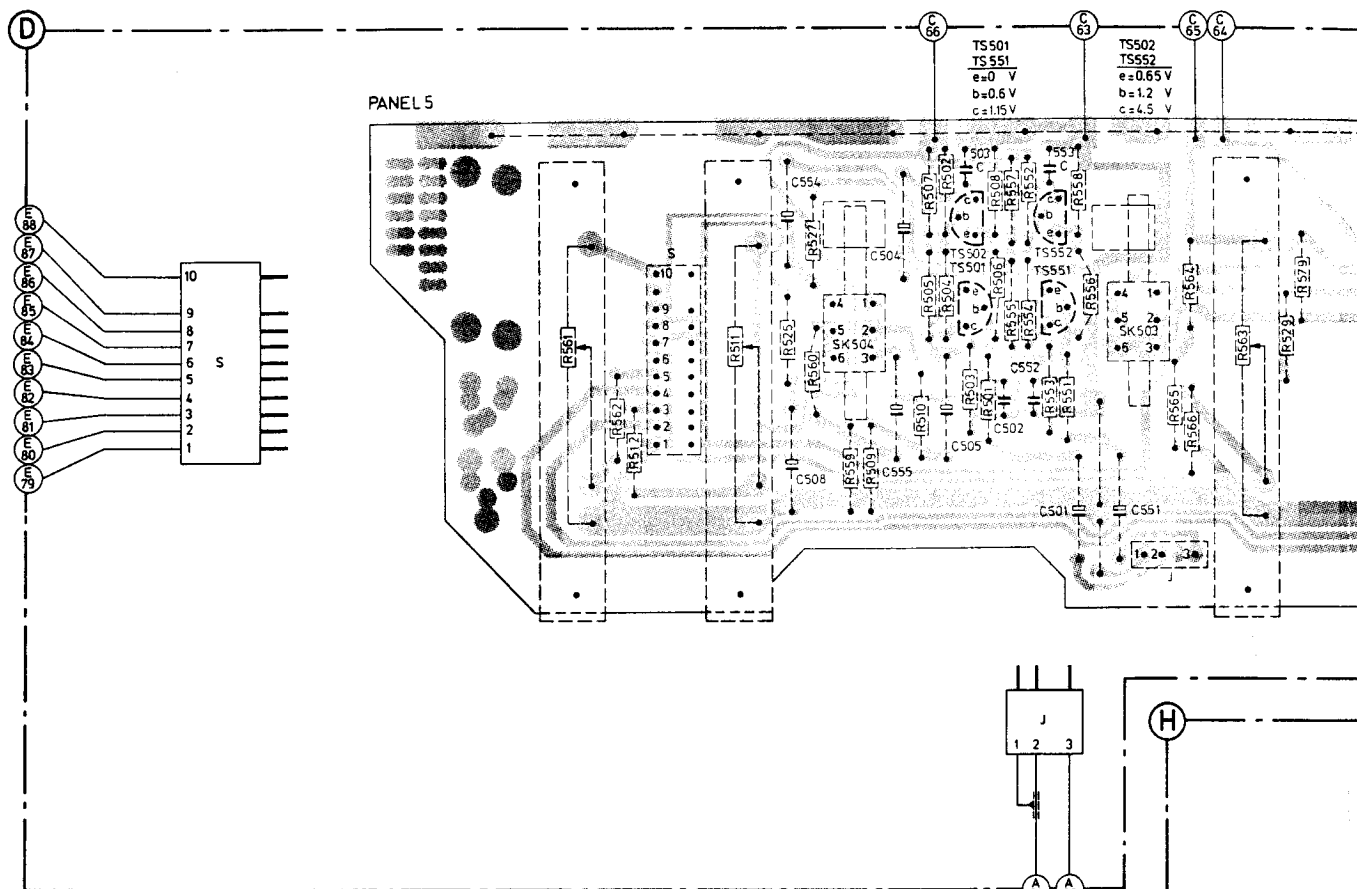


Fig. 21

MISC.	BU604	BU603 L602 L601	BU602	L652 BU601 SK504 L651	TS501 TS502	TS551 TS552	SK503
C		602 601	652 651	508 554	555 504	505 503 552 502 501 553	551
R	605 655	653 603	561 606 562 604 656 512 654 601 651	511 525 502 560 559 509 652 527	510 501... 508	551... 558	563... 566 529 579



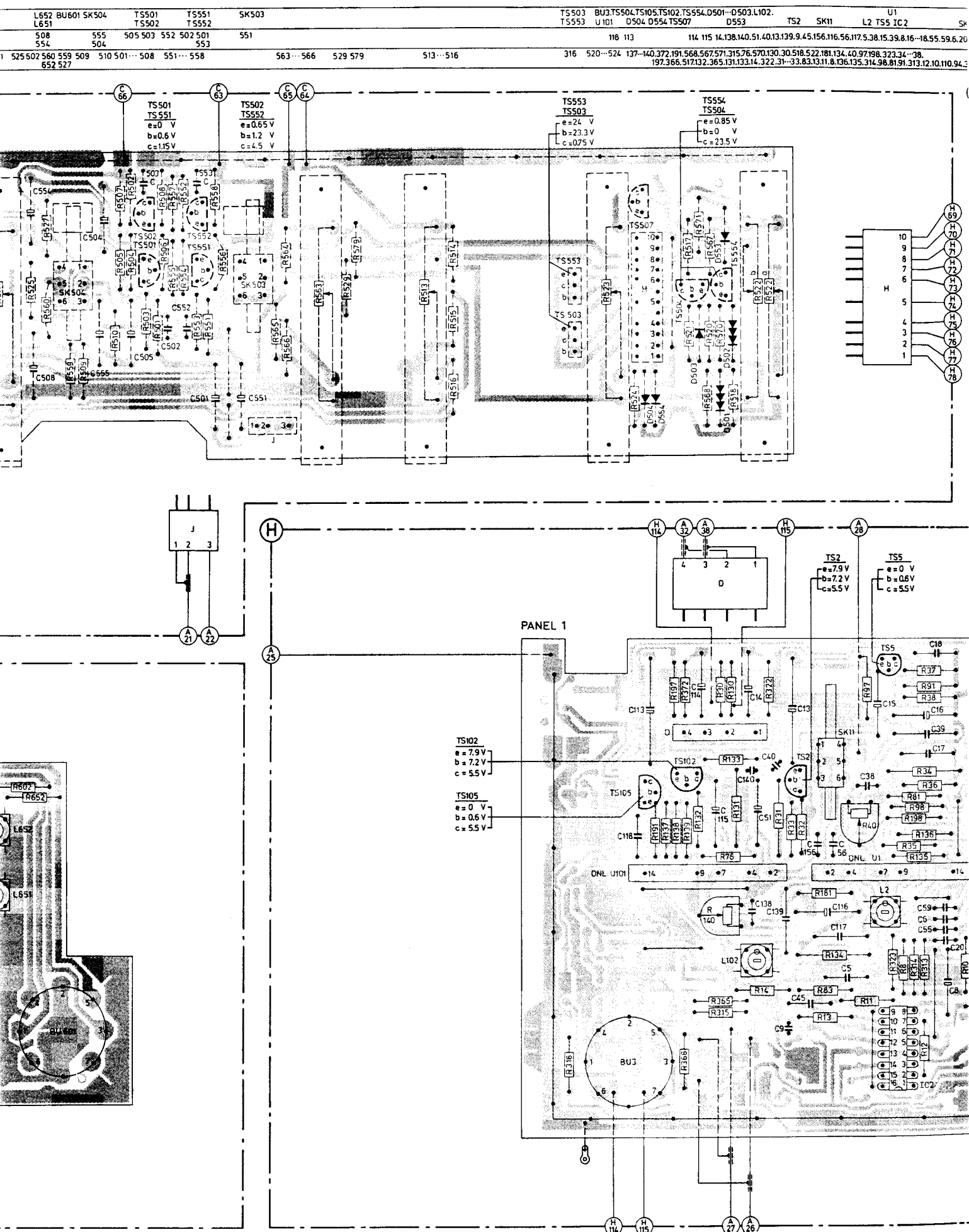
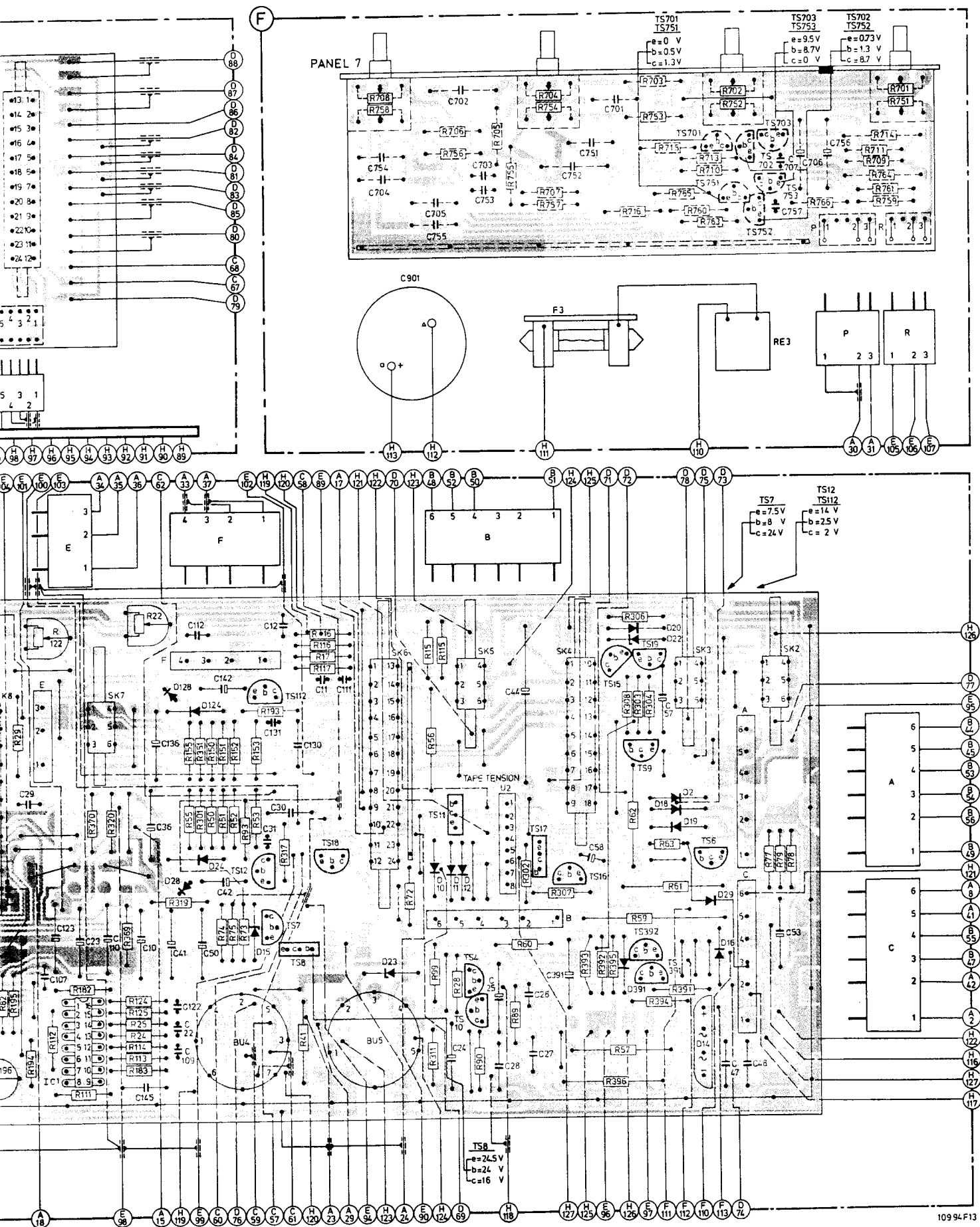


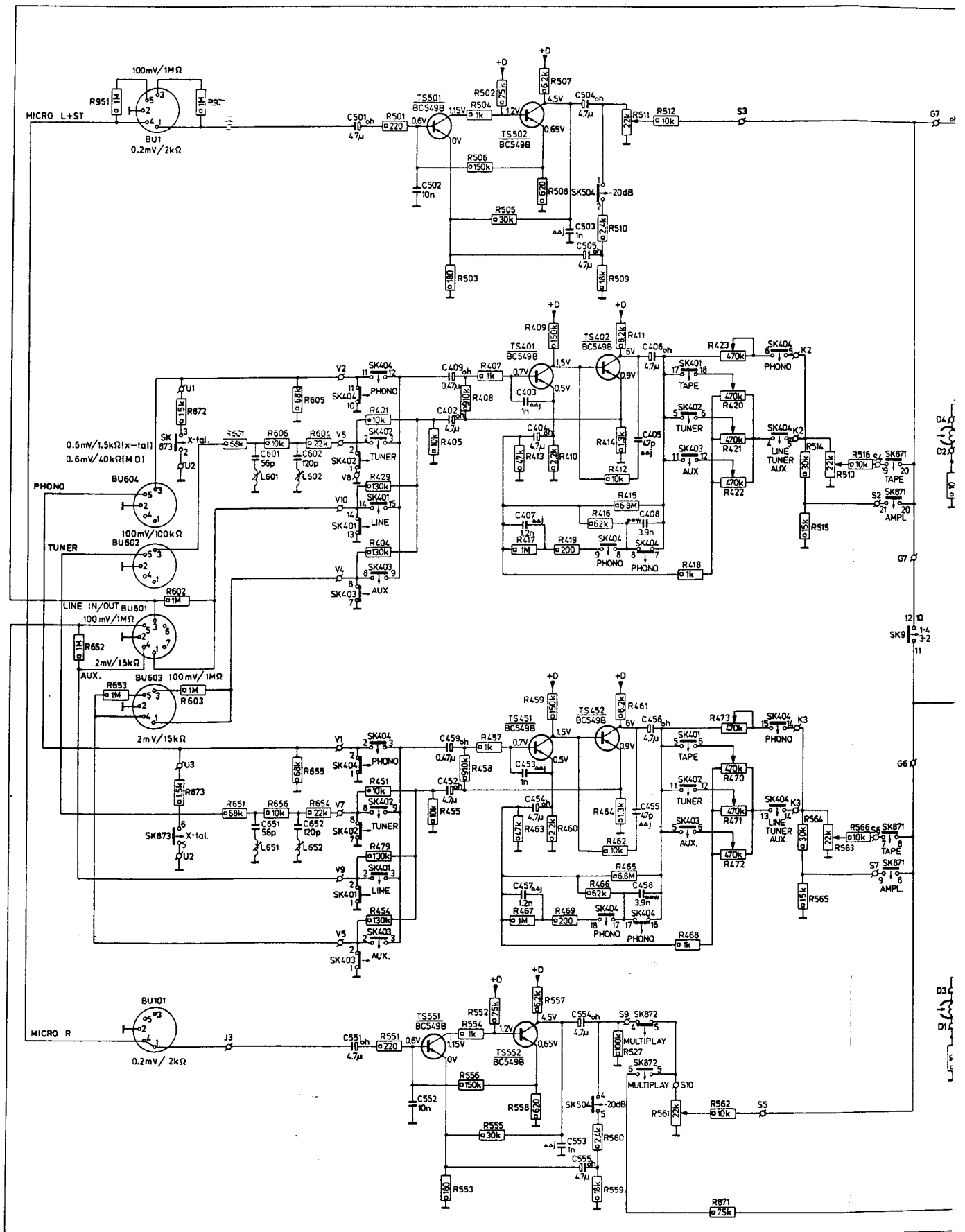
Fig. 22



SK871	IC1	SK7	D128.D28.D24.D124	BU4.TS112.TS7. D15.TS12.TS8	TS18	BU5 SK6 D23	D10-D12.	SK5.TS11.	TS4.TS10.TS17.F3.TS16.SK4.TS15.D391.D18--D20.SK3.TS6.D14.D29.TS701.TS751.D16.RE3.TS752.TS753 D22.TS19.TS19.D2.TS391.TS392.TS702.TS703.SK2	U2					
29.107.123	23	110.10.36.136.145.122.22.109.41.112.50.142.42.31.131.12.30.130.11.11.754.704						901.705.755.702.24--28.703.753.44.391.752	58.751.	701	57	47.48	757707.53.706.756		
82.194.122.111-114.182.370.320.124.125.25.22.351.50--53.150--153.193.317.41.16.17.116.117.708.758								72.15.56.31.115.99.706.756.28.90.705.755.302.89.60.707.704.303.306.308.304.715.716.703.753.63.61.765.							
5 29			369.24.183.319.155.55.301.73--75.93					757.754.393.307.392.62.395.396.57.59.394.710.760.763.391.713.702.752.77--79.766.714.709.711.764.701.761.751.759							



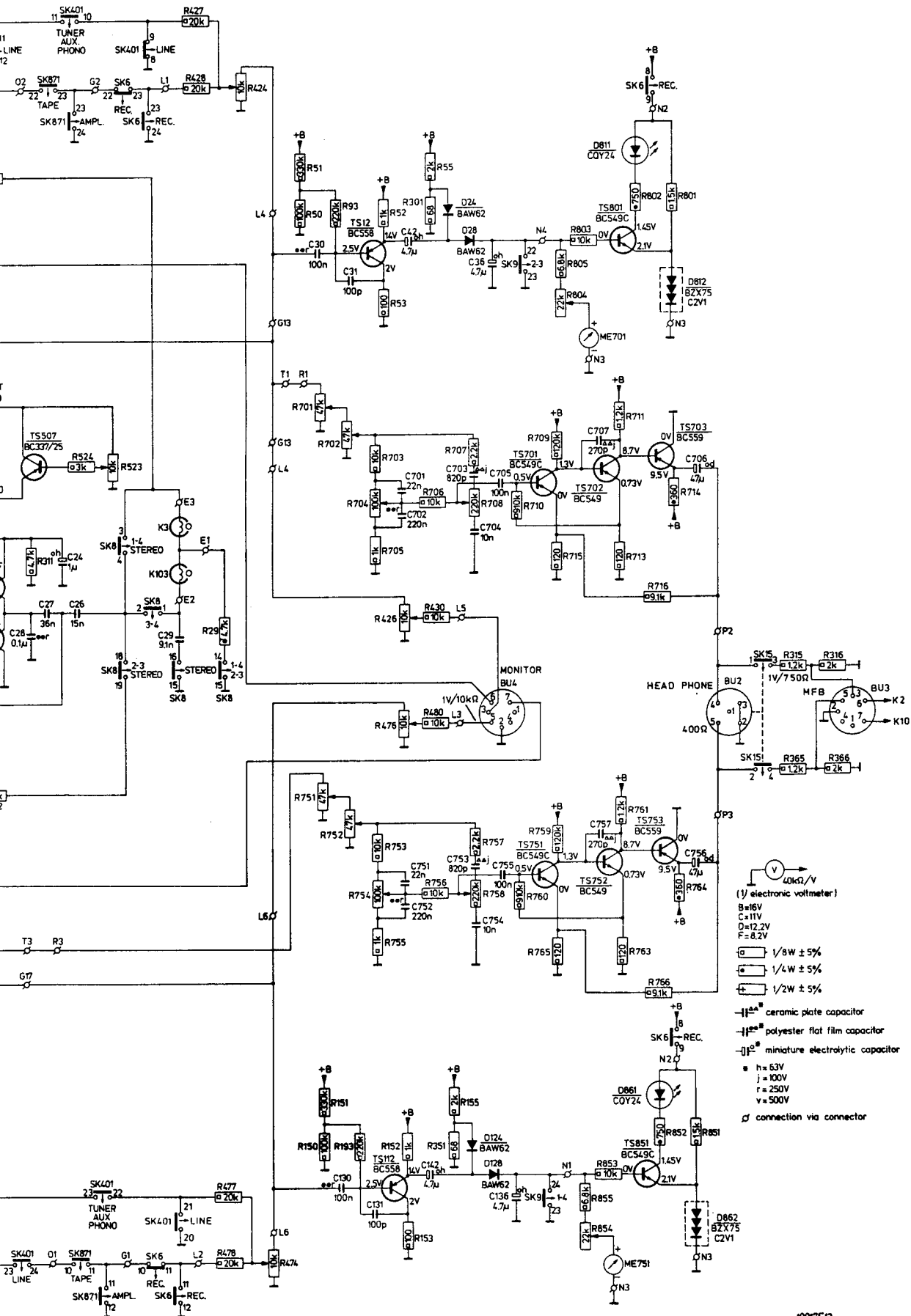
MISC.	BU1	BU604.602	.501	L602	TS501	TS502.401	TS402	K2
MISC.	BU601.603	10	.551	L652	TS551	TS552.451	TS452	K102
C2...100								1
C101...450					402.409	407	403	404
C451...757			301.651	602.652.501.551	502	552.459.452	457.453	454
R8...100						504.503.505.458.456	455.553	555
R101...458					451.404.401.429.454.455.405	458.408.407.457.400.417.409	419	416
R159...550					501.479	502...506.461.459	460.507.508.463.469	509
R551...951	951	652	653.872.873	901.57	556	606.655.605.604.654	551	552...558
							560.559	561
							562.871	563...566



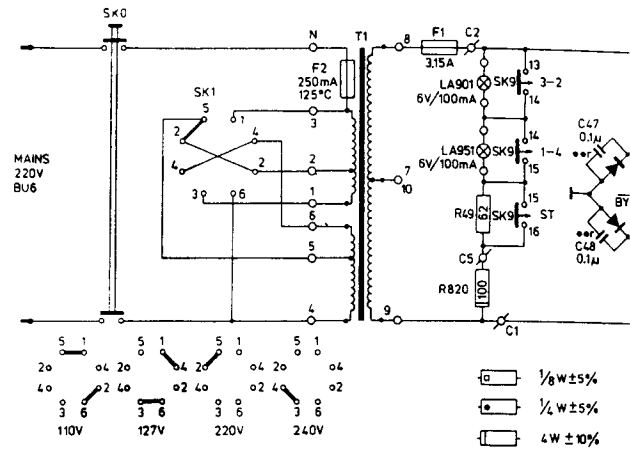




TS507	K3	TS12	D24.028	ME701.TS701	TS801.D811.861	D812	K2	K102	MISC.
	K103	TS112	D124.128.	BU4	ME751.TS751	TS752.702.851	TS753.D862	TS703	BU2
26...28.24	29	30	31	42	36				
		130	131	142	138				
				751 701 702 752 703 753 704 705 755 754 757 707					
						756 706			
90 89	29	51 50 93	52 53	55					
311	427.428	424	150.151.193.152.853.51	426 155 301 430				385 315 316 366	
524	523	477.478	474	476 480					
				701.751...755.702.704.703.705...708.756...760.765.709.710.803...805.851...855.711.713...716.802.761.801.763.766.764					

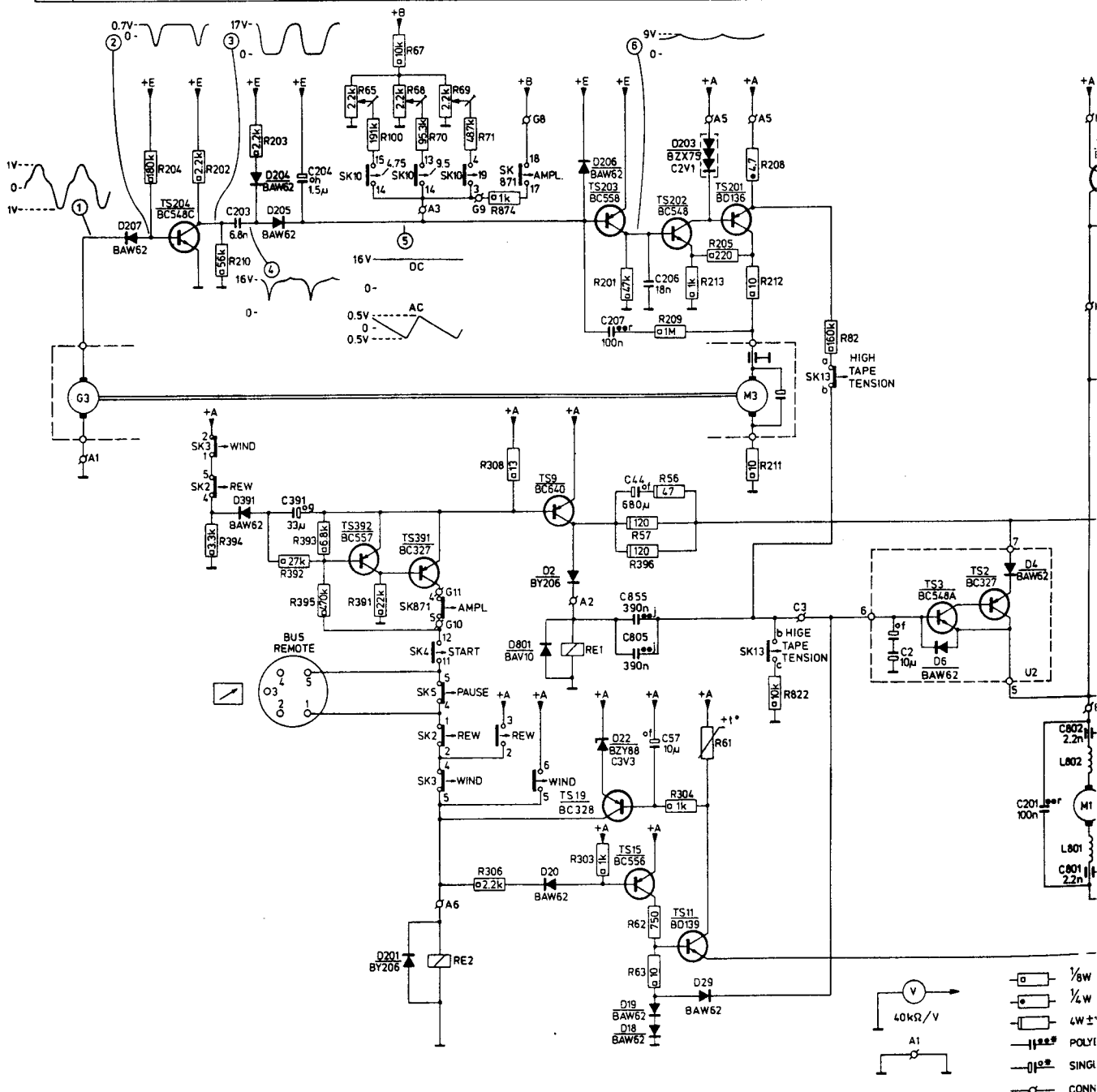


MISC	But	SK	K1	F2	T1	F1	LA901	LA951	C
C									47 48
R									49 820



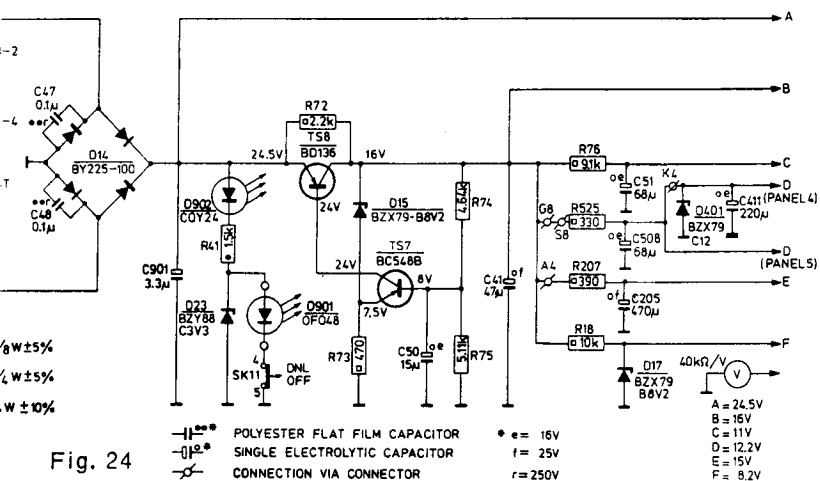
Fig

MISC	G3	D207	TS204	D391.204.205.BU5										TS392.D201.TS391			RE2	D801.18...20.TS9.RE1.D2.206.22.TS19.203.202.15.11.D29.203.TS201.M3										D6.TS3.U2			TS2	D4	L801.802.N										
C				203		391		204														207.805.44.206.57.855													2			201			802.801		
R			204	202		394.210		203.392.393		395		65		100		391.67..71		306		308.874		303		56.57.201.396.62.53.209.304.61.213.205.212.211.208.822.82																			



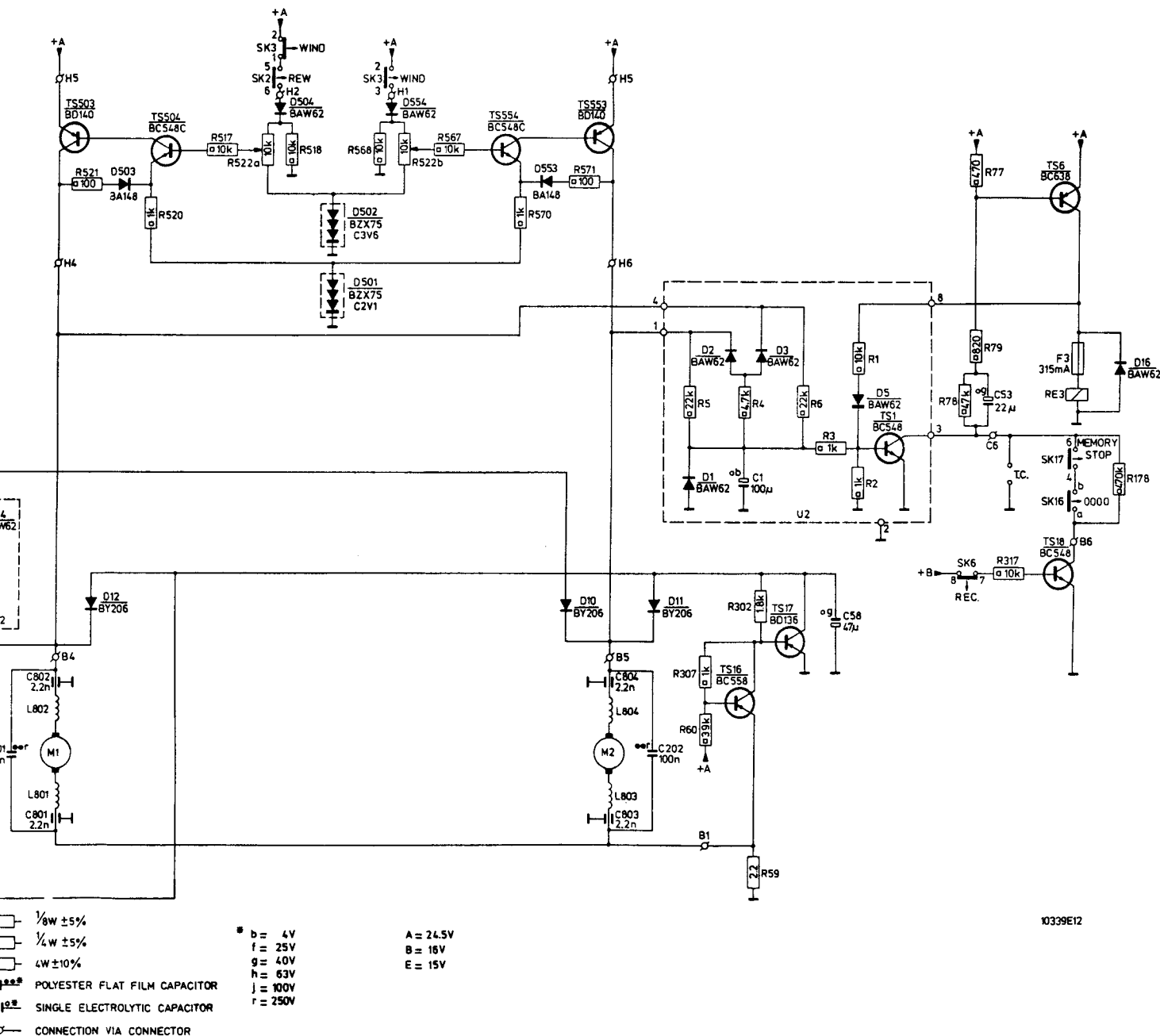


D14	D902	J23	D901	TS8	D15	TS7	D17	D401	MISC
47 48	901	41	72	73	74	75	51	508	205 411
									C
									R



10953C2

L801.802.M1	TS503	D12.503.TS504	D504		D502.501	D554	TS554		D553.10.TS553.M2.L803.804.D11.1.2		TS16.D3	TS17	U2	D5	TS1	RE3.TS6.18.F3	D16
802.801								804.803	202		1			58	53		
521	520	517	522a	518	568	522b	567	570	571	5.307.60	4.302.59	6	3	1.2	78.77.79	317	178



10339E12

CS56734

MISC.	SK2D29D16.TS6.D14.SK3.D2.D18---D20.TS9.TS19.D22.TS392.TS391.D391.SK4.TS15---TS17.SK5.TS10.TS11.TS4.										D10-D12.SK6.D23.BU5.TS18.TS7.TS8.TS12.TS12.D15.BU4.D124,24.D28.D128.SK7.TC1										SK8
C	53	48	47	57	58	391	44	24-28			111	11	130.130.12.131.31.42.142.112.50.122.22.109.41.10.136.36.145.110.23	123.107.29	121						
R	77-79			61-63.303.304.308.306.59.57.391-396.307.302.60.89.90.28.56.115.15.99.311.72							117.16.116.17		41.317.193.93.73-75.150-153.50-53.351.155.301.55.319.22.113.114.125.124.25.24.369.183.320.								

PANEL 1

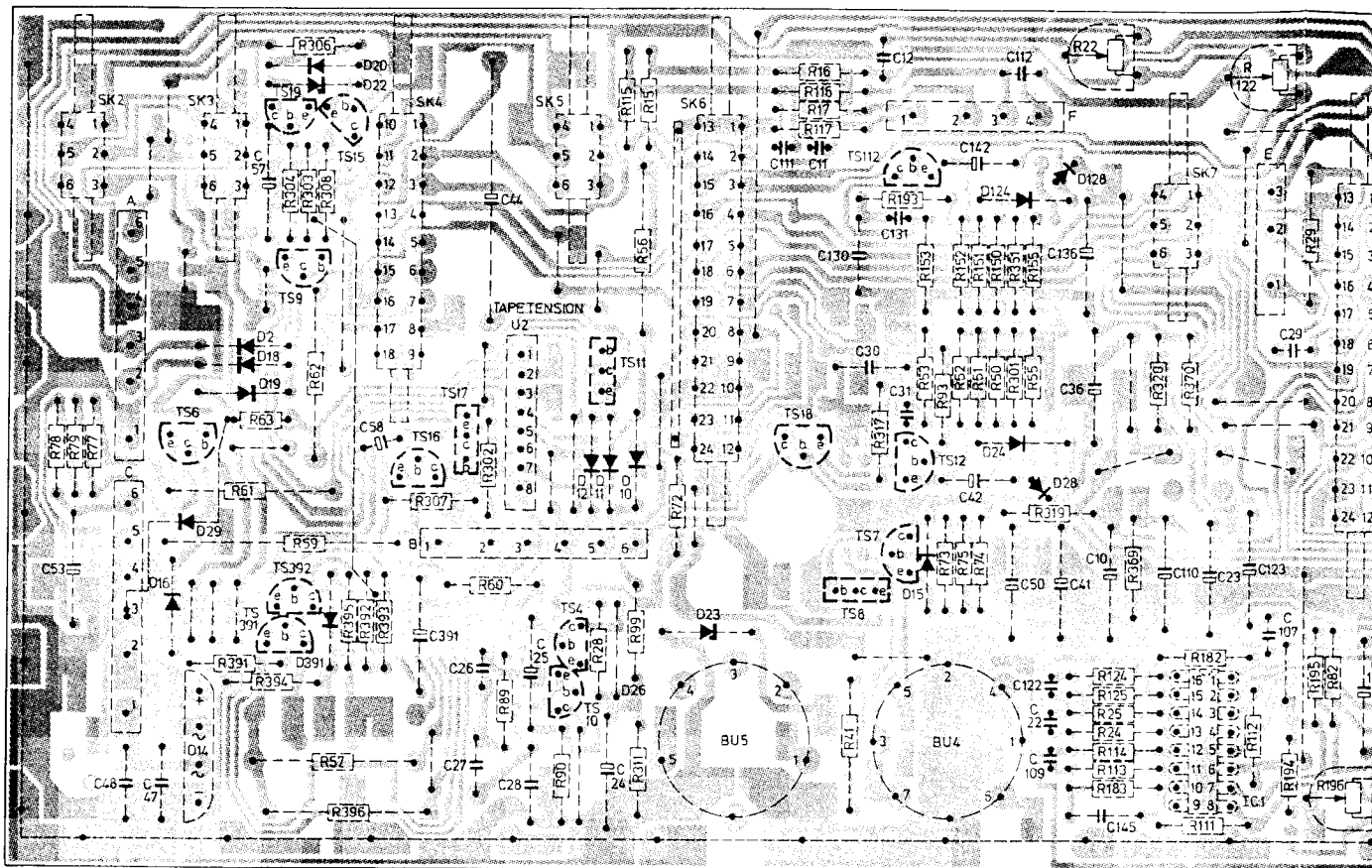
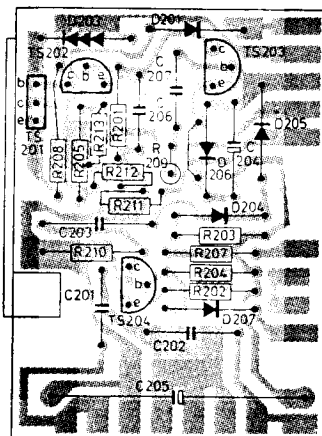


Fig. 26

MISC.	BU601	L652 L651	BU602	BU603	L602 L601	BU604
C		652 651	602 601			
R	602 652	656 604 651 601 654	606	653 603		605 655

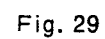
MISC.	TS202 D203 TS201	D201D206 TS203 D204.D207 D205
C	203 201	206 207 205 202
R	208 205 201 210-213	209 203 207 204 202

PANEL 2



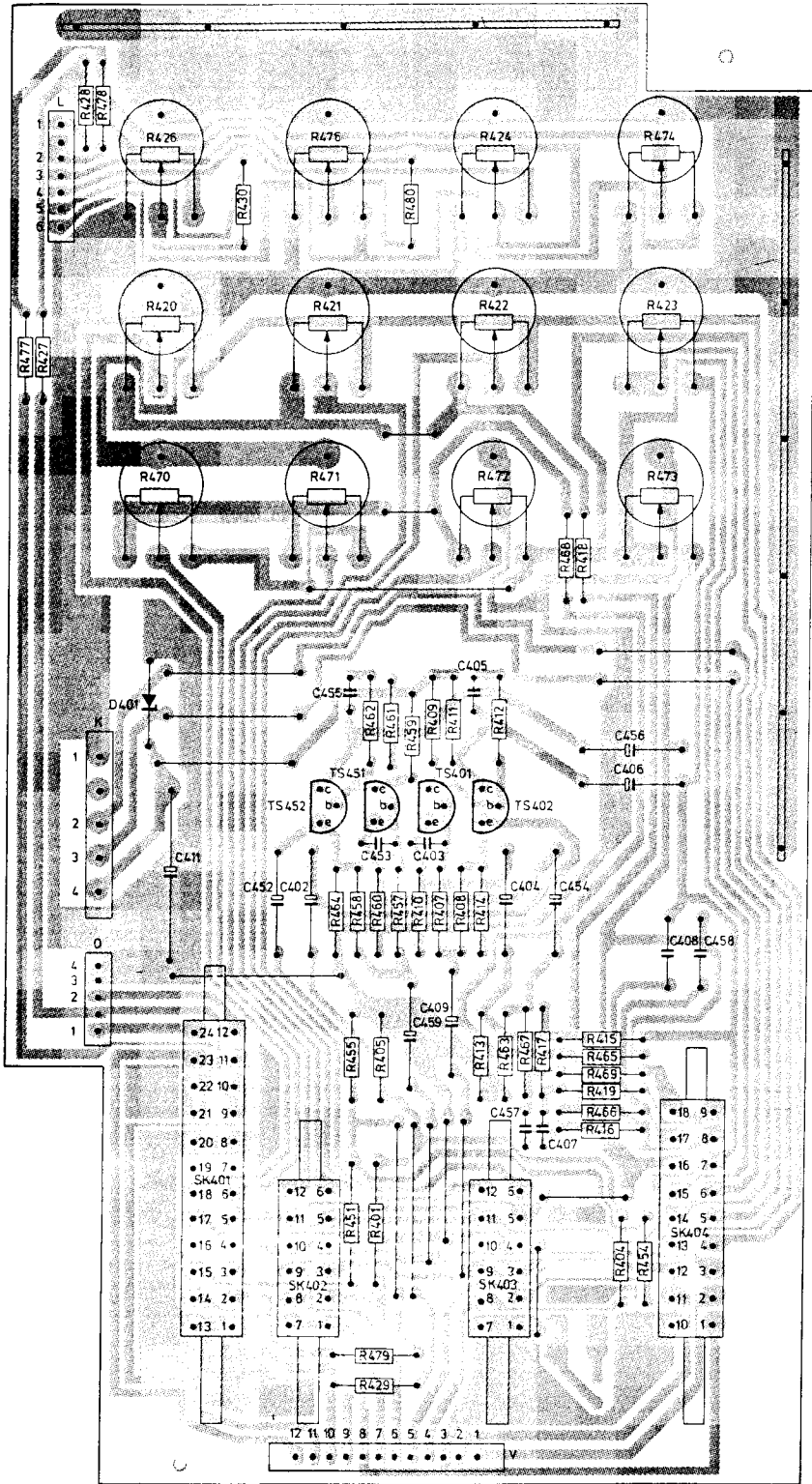


MISC.	D811 D812 TS801 D861 D862 TS851
R	801...805 851...855



MISC.	D401	SK401	TS452	TS451	TS401	TS402	SK404
		SK402	SK403				
C	411	452 402 455 453 403 409 459	405 457 404 454 407	456 408 458			
R	477 427	428 478 426 420 470	430 476 421 455 405 480 479 471 451 401	424 422 407 419 429 472 457 459	474 423 454 473 404		

PANEL 4

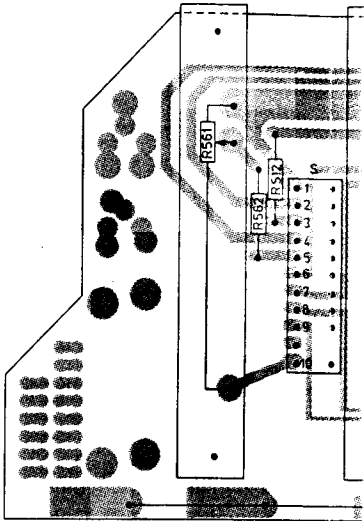


10967013

Fig. 31

MISC.	
C	
R	561 562 512

PANEL 5



1	TS402	SK404					
	SK403						
405	457	404	454	456	408	458	
		407		406			
424	422	407-419		474	423	454	
472	457-469			473	404		

MISC.		SK504	TS501	TS551	SK503	
		TS502	TS552			
C		508	555	505 503	502 552 501	551
		554	504		553	
R		561	562 512	511	525 560	559 509
					510 501-508	551-558
						563-566
						529 579

PANEL 5

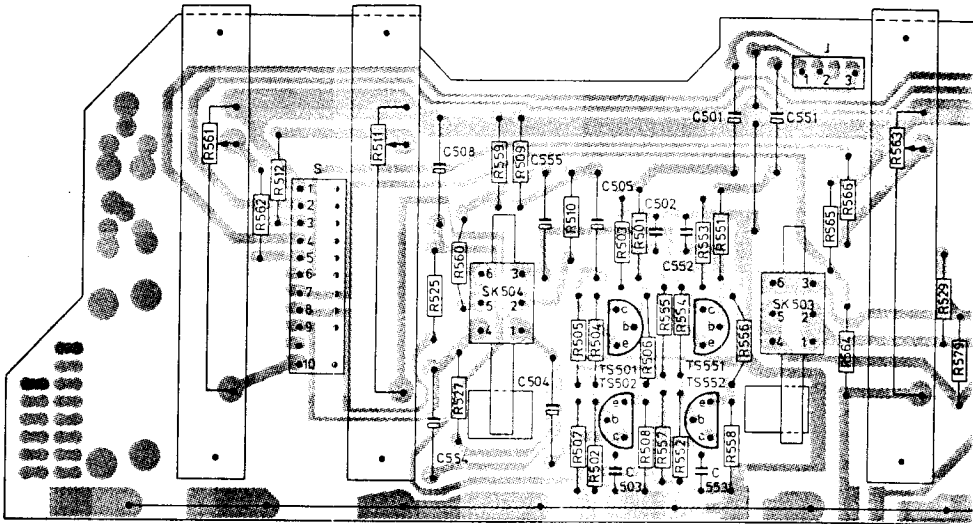
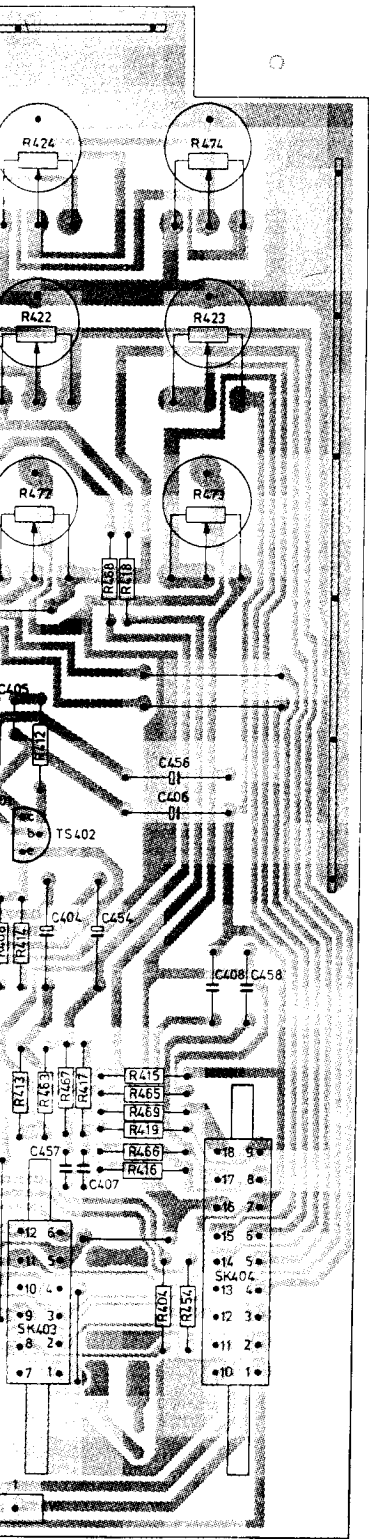


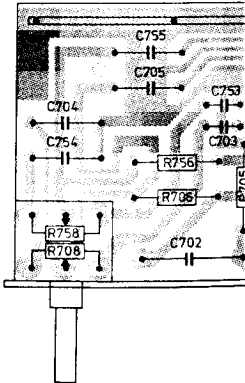
Fig. 32



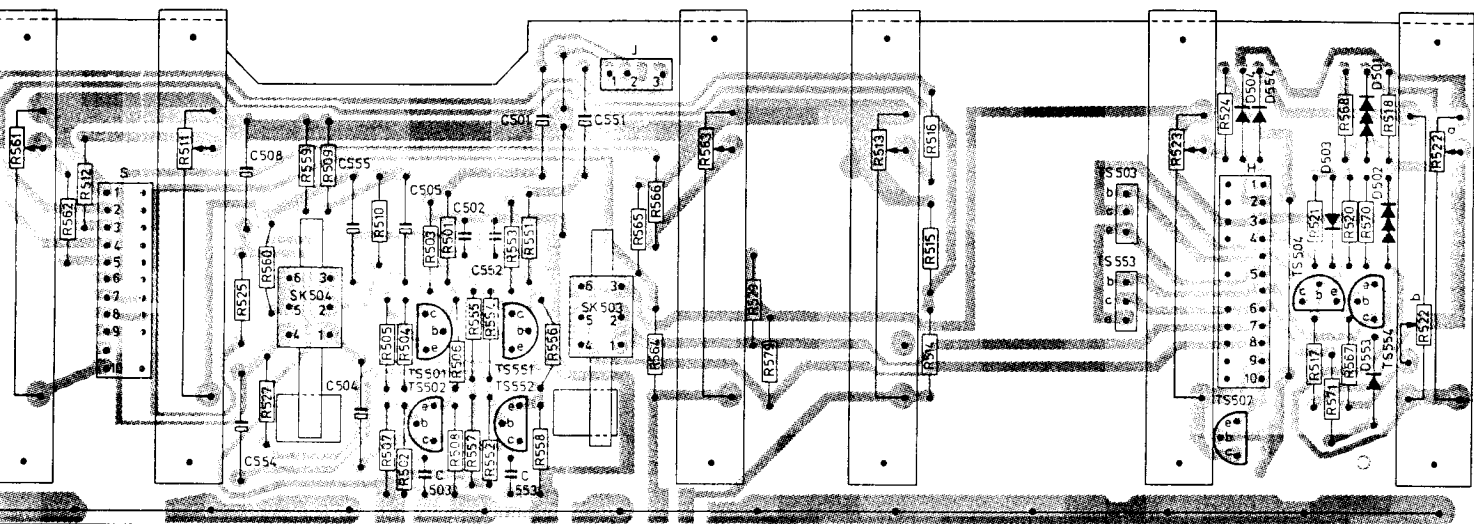
10967013

MISC.				
C	754	705	702	703
	704	755	753	
R	708	706	70	
	758	756		

PANEL 7



SK504			TS501 TS502		TS551 TS552		SK503		TS503 TS553		D504 D554 TS507		D503 TS504		D501 D502 D551 TS554	
508	555	505 503	502 552	501 553	551											
561	562 512	511	525 560 527	559 509	510 501...508	551...558	563...566	529 579	513...516	523	524	521 568 520 570 518 522 517 571 567				

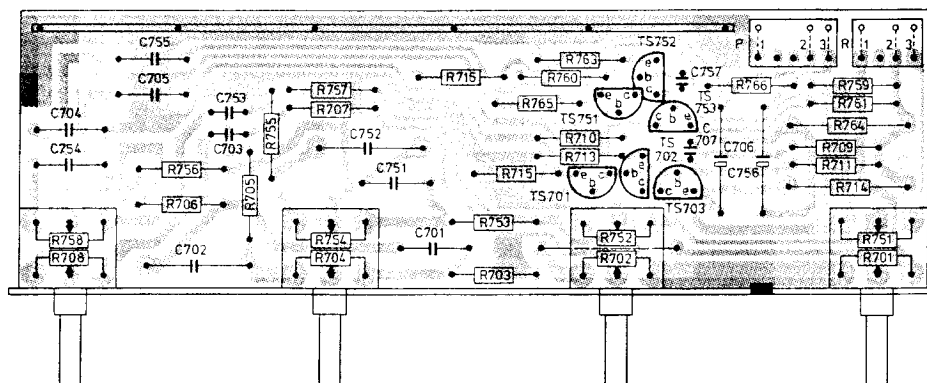


10966D13

Fig. 32

MISC.	TS751 TS701										TS702 TS703 TS752 TS753	
C	754 704	705 755	702 753	703 753	752	751	701				757 706 756 707	
R	708 758	706 756	705 755	707 704 757 754	716 703 715 765 713 753 760 710 763 752	702					766 709 711 714 759 764 701 761 751	

PANEL 7



10964C13

Fig. 33

U1/U101

D.N.L.

4822 214 30238

2 - output

4 - 

7 - output

9 - input

14 - supply

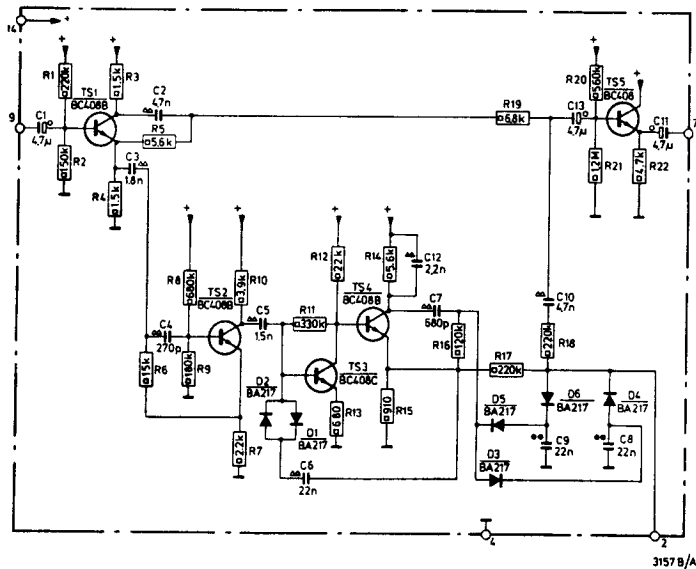


Fig. 34

MISC.	TS1	TS2	O1 TS3 O2				TS5,4				O3...6				MISC.
C	4	3	5	2	12	1	6	11	13	10	8	7	9	C	
R	1.8	10.12.3.11	6.5.9.7	4.13.2	19.21.14.22	15	17.20	18	16					R	

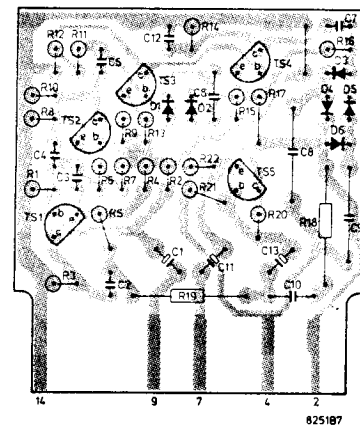


Fig. 35

U2

Tape tension/protection UNIT

4822 214 30399

MISC.	D4	TS3	D6	D3	TS2	D5	TS1	D2
C	2	1						
R	6	4	1	3	5	2		

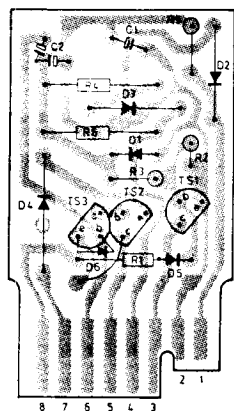


Fig. 36

1 - M2

2 - 

3 - T.C., SK17

4 - M1

5 - M1

6 - SK13

7 - R56, R57, R396

8 - F3, TS6