Service
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For Service Manuals Contact
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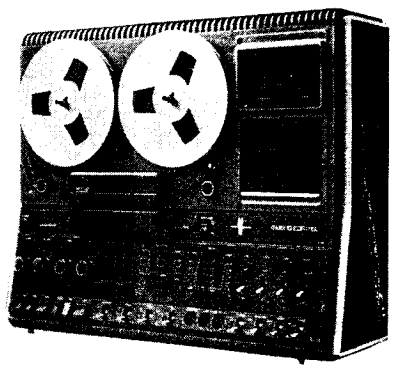

Service Manual

CONTENTS

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 Huolte-Ohje Manual de Servicio Manual de Serviço

Subject to modification

GB 4822 726 11712

Printed in The Netherlands

PHILIPS CS56784

TECHNICAL SPECIFICATION

Mains voltages	: 110-127-220-240 V
Mains frequency	: 50-60 Hz (Switch-over not necessary)
Power consumption	: ca. 35 W
Number of tracks	: 4
Max. reel diameter	: 18 cm
Number of heads	: 3 (1 recording, 1 playback and 1 erase head)
Number of motors	: 3 (1 for capstandrive, 2 for driving the reel discs)
Winding time for an 18 cm reel with LP tape (540 m)	: $\leq$ 180 sek.
Tape speeds	: 4.75 cm/sek. $\pm$ 1% 9.5 cm/sek. $\pm$ 1% 19 cm/sek. $\pm$ 1%
Wow and flutter at:	
4.75 cm/sek.	: $\leq$ 0.3%
9.5 cm/sek.	: $\leq$ 0.2%
19 cm/sek.	: $\leq$ 0.15%
Input sensitivities	
MICRO (Micro sens. switch in position 0dB)	: 0.2 mV/2 kΩ (1,4) 100 mV/1 MΩ (3,5)
LINE	: 2 mV/15 kΩ (1,4) 100 mV/1 MΩ (3,5)
PHONO (X-tal)	: $\geq$ 0.6 mV/1.5 kΩ (3,5)
(MD)	: $\leq$ 0.6 mV/40 kΩ (3,5)
AUX	: 2 mV/15 kΩ (1,4) $\leq$ 100 mV/1 MΩ (3,5)
TUNER	: 2 mV/$\geq$ 100 kΩ (1,4) $\leq$ 100 mV/$\geq$ 100 kΩ (3,5)
Output voltages	
LINE	: 1 V/20 kΩ (3,5)
MONITOR	: 1 V/10 kΩ (3,5)
MFB	: 1 V/750 Ω
Output impedance	
HEADPHONE	: 400 Ω
Frequency range (within 7 dB)	
4.75 cm/sek	: 35 - 11,000 Hz
9.5 cm/sek	: 35 - 18,000 Hz
19 cm/sek	: 35 - 25,000 Hz
Signal-to-noise ratio according to DIN 45,500	: $\geq$ 56 dB
Erase frequency	: 100 kHz $\pm$ 10%
Dimensions	: 535x425x205 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
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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
65 Type plate
66 Phono input socket for HiFi or non HiFi record player
67 'Aux' input - auxilary input socket for radio amplifier or non HiFi record player
68 Tuner input socket
69 Line in/out - combined input/output socket for radio amplifier or recorder
70 MFB output-socket for MFB-loudspeaker enclosures
71 Monitor output socket for radio, amplifier or recorder
72 Remote control socket - for start/stop remote control unit

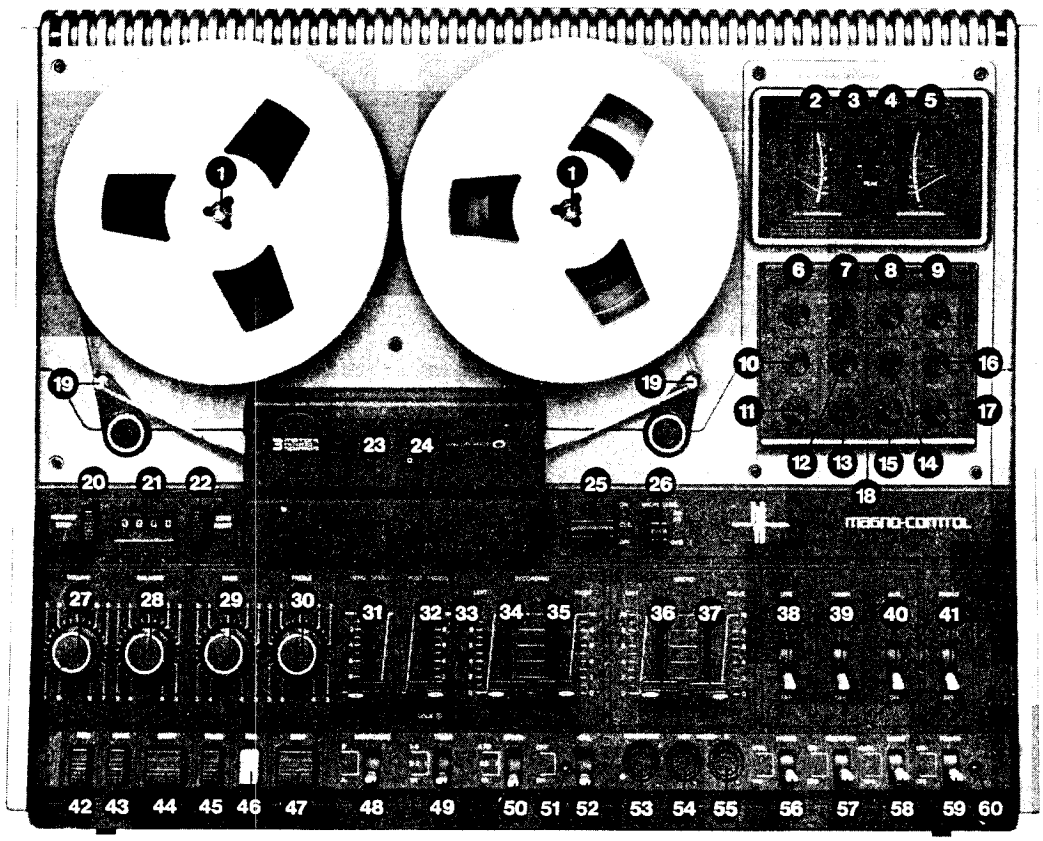

Fig. 1

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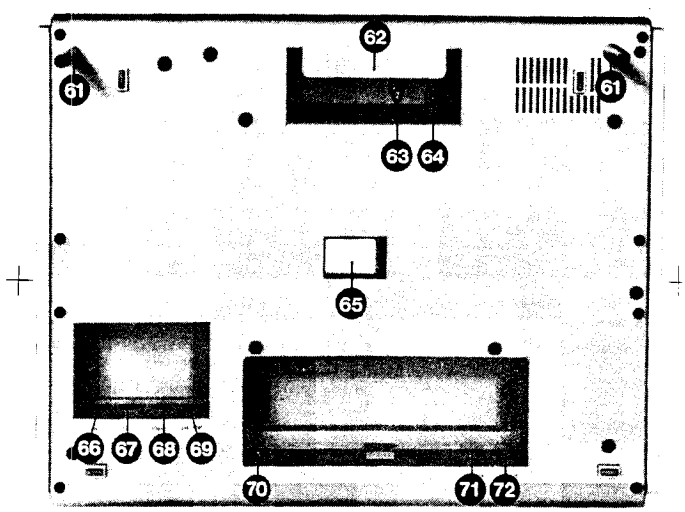
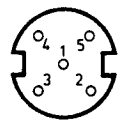
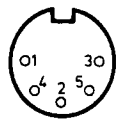
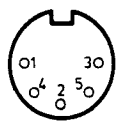
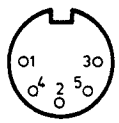
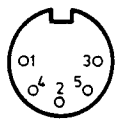
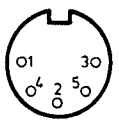
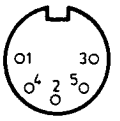
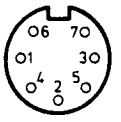
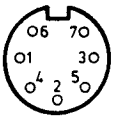
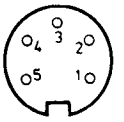


Fig. 2

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 kΩ 1 MΩ	5p,180°,DIN 	1 - left 4 - right 2 - ⊥ 5 - right 3 - left
MICRO R BU101		(1,4)	0.2 mV	2 kΩ	5p,180°,DIN 	1 - left 4 - right 2 - ⊥ 5 - 3 -
PHONO BU604		X-tal MD	≤ 0.6 mV ≤ 0.6 mV	1.5 kΩ 40 kΩ	5p,180°,DIN 	1 - 4 - 2 - ⊥ 5 - right 3 - left
AUX BU603	aux	(1,4) (3,5)	2 mV ≤ 100 mV	15 kΩ 1 MΩ	5p,180°,DIN 	1 - left 4 - right 2 - ⊥ 5 - right 3 - left
TUNER BU602		(3,5)	≤ 100 mV	≥ 100 kΩ	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 kΩ 1 MΩ 20 kΩ	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 kΩ	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

OPERATION OF THE CONTROL SECTION

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 conductivily 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").

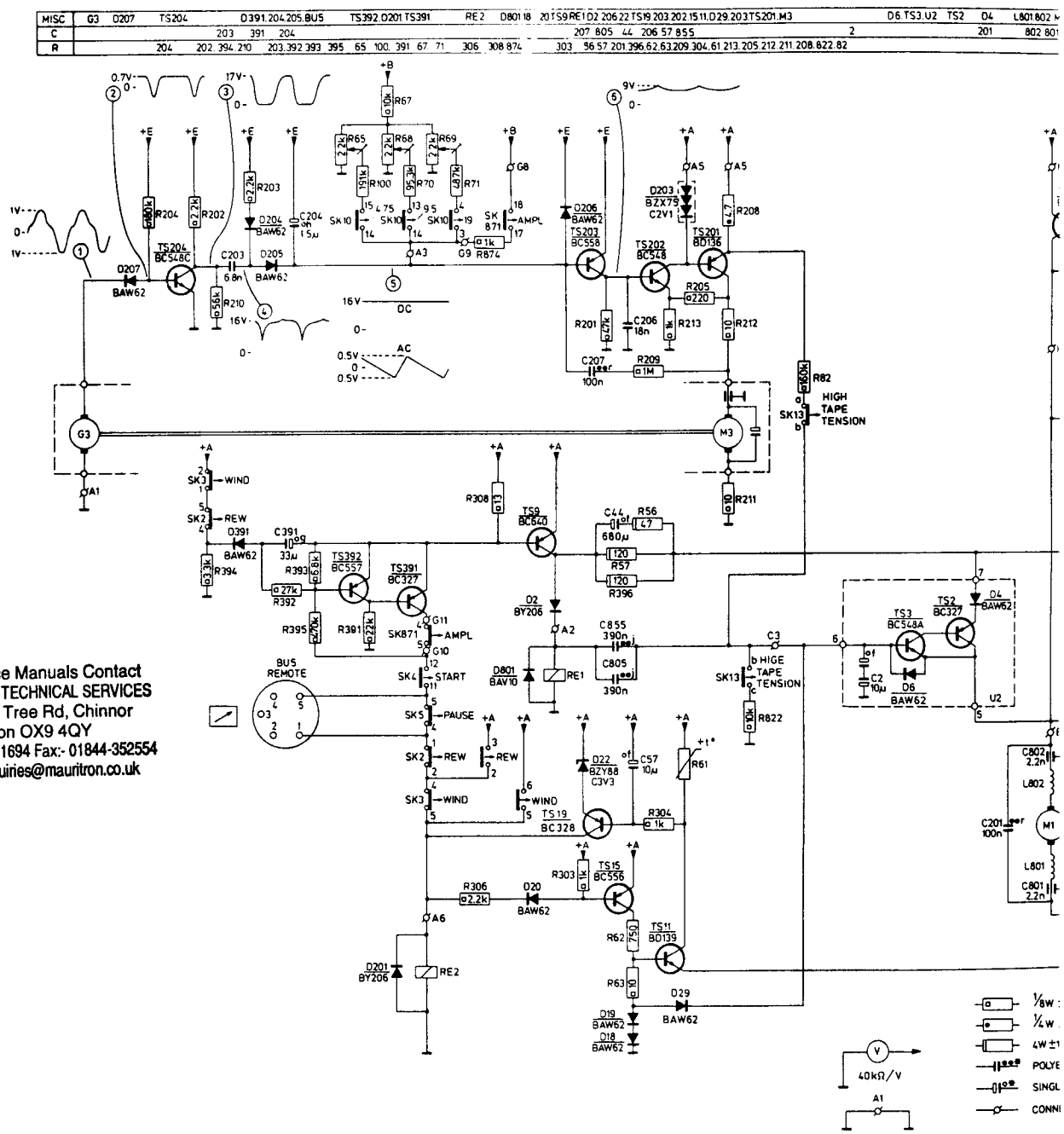
In the event of tape breakage
In the event of tape breakage or at the end of a tape without switching foil the circuit of unit U3 becomes operative. During tape transport one reel-disc motor drives the tape and the other reel disc motor is driven by the tape.
The positive supply voltage of the driving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



ge of TS202. The base
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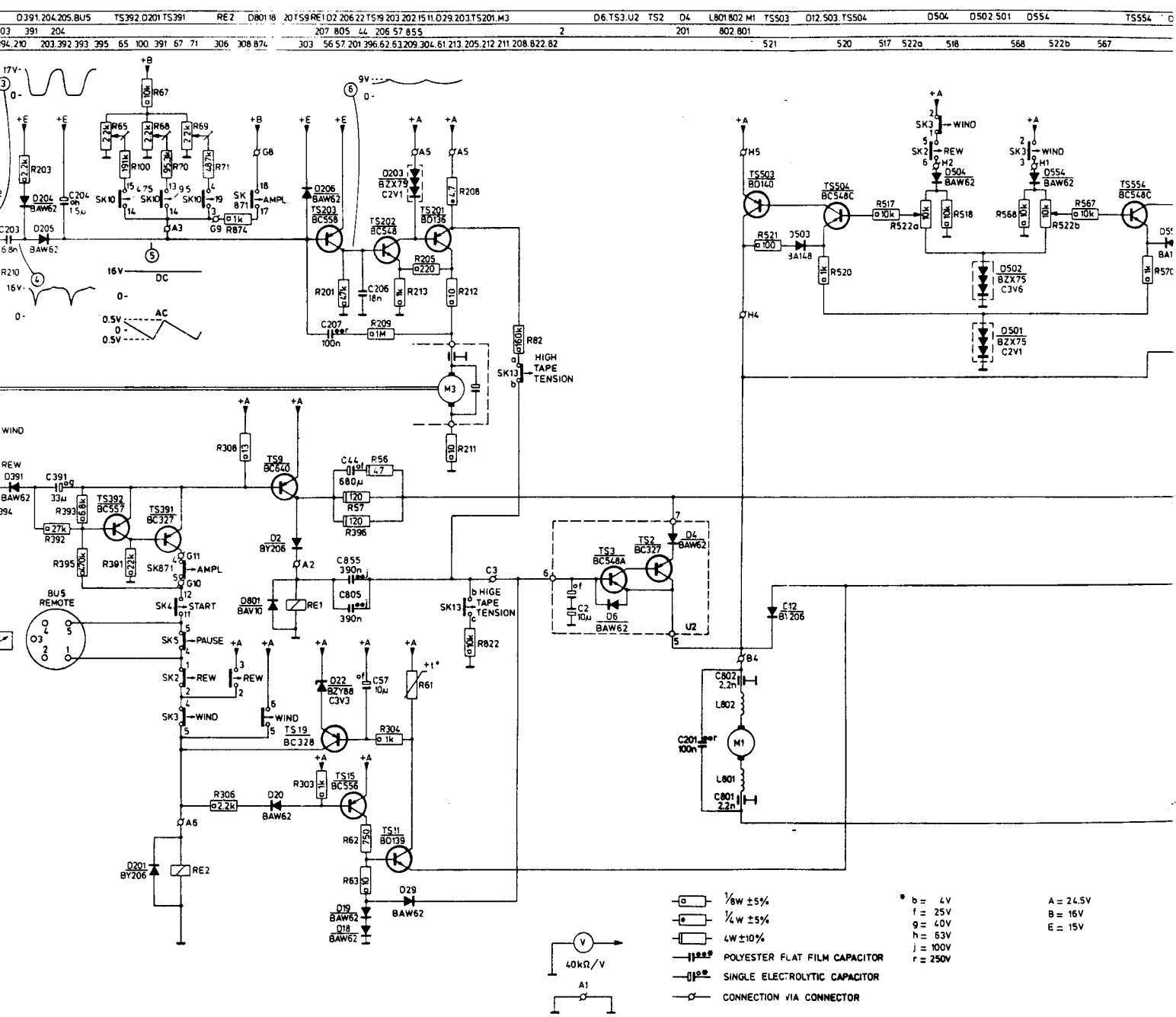
TS201.
stor TS203 and the
h a positive voltage.
r smoothing by C204,
are discharged by C206. C207 and R209 form a filter effecting the stability of the control circuit.
When the recorder is set to position AMPL. a positive voltage is applied to the base of TS203 via SK871 and TS203 is turned off.
As a result motor M3 will stop.



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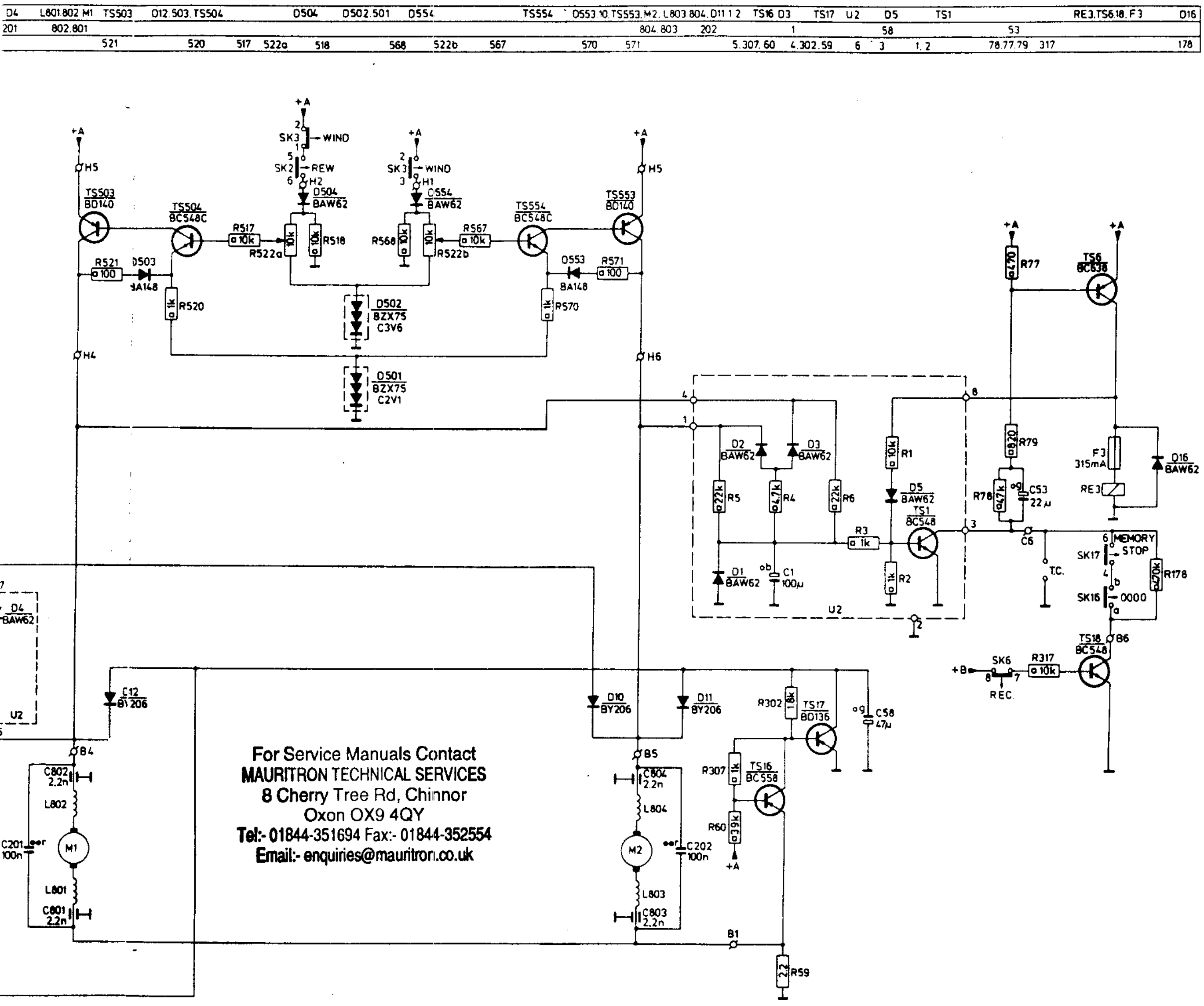

1/8 W ±5%
1/4 W ±5%
4 W ±10%
POLYESTER FLAT FILM CAPACITOR
SINGLE ELECTROLYTIC CAPACITOR
CONNECTION VIA CONNECTOR

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

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

DECASING THE SET. Figs 4,5

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 controle 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 surfice 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 sic 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 connectior
- The complete lever unit can now be lifted up.
- Pull spindle M so far to the left that the switch leve 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.

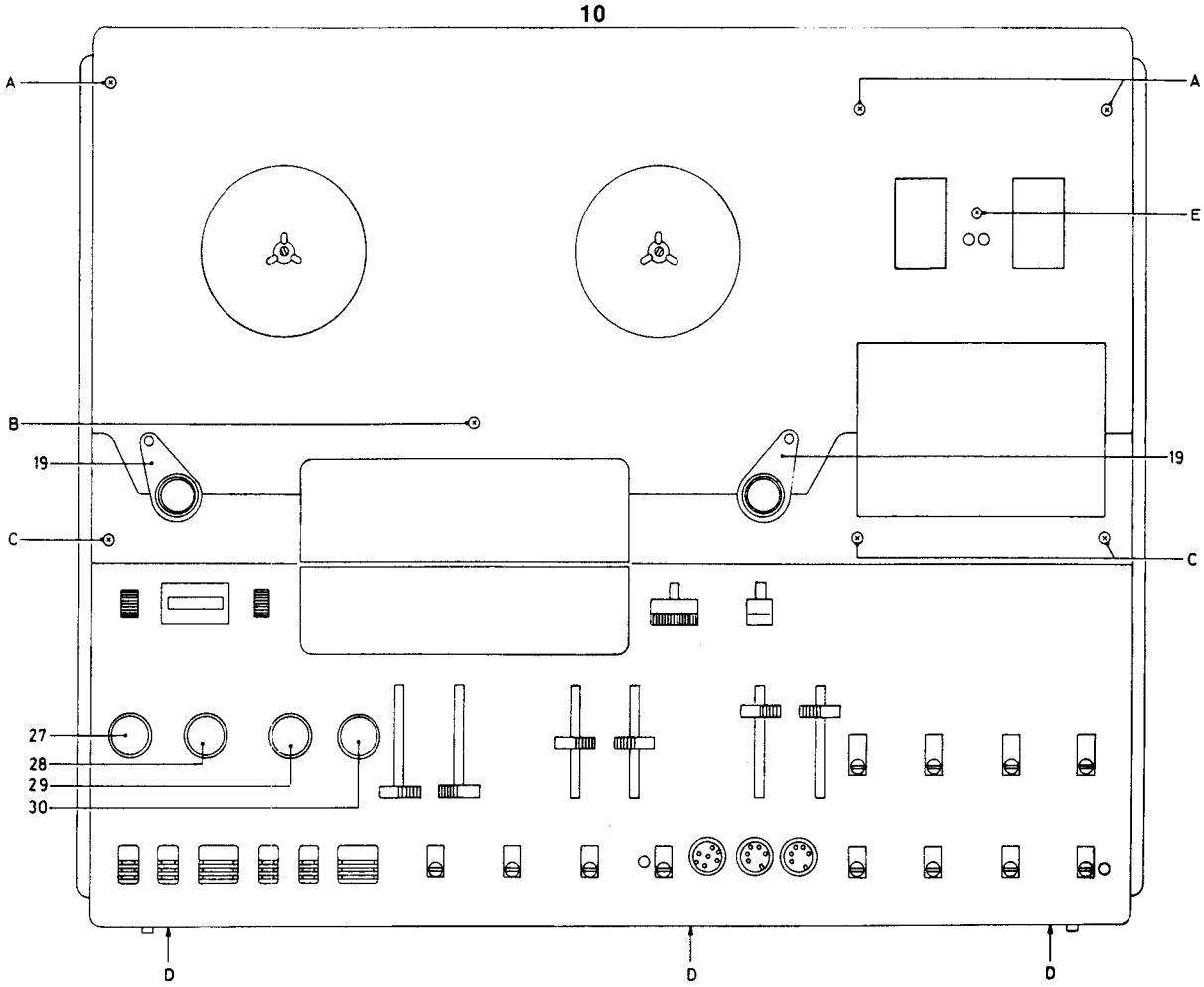
A
A
E
B
19
19
C
C
27
28
29
30
D
D
D
11043D2

Fig. 4

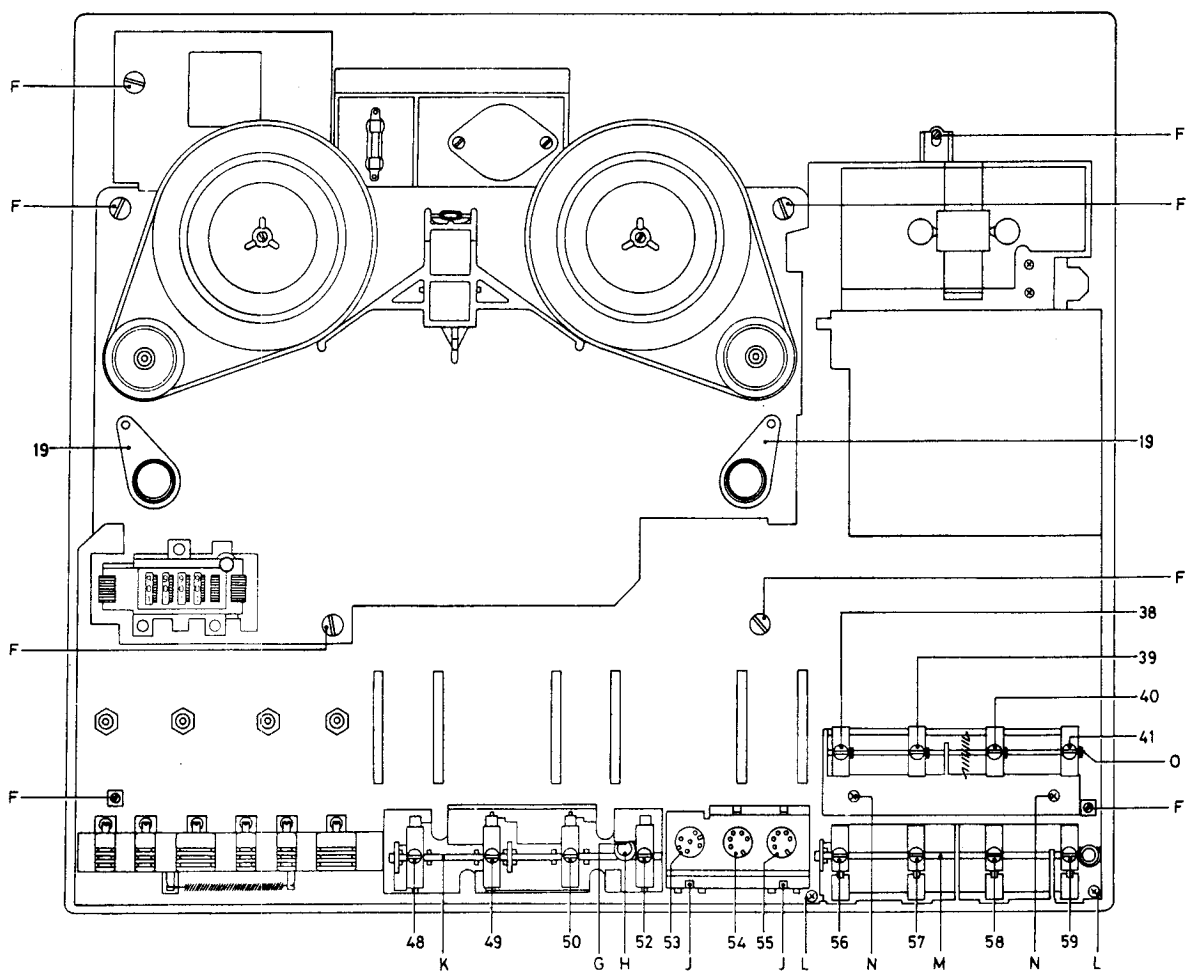
F
F
F
F
19
19
F
F
38
39
40
41
O
F
F
48
K
49
50
G
H
52
53
J
54
55
J
L
56
N
57
M
58
N
59
L
11042D2

Fig. 5

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.

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.

Lefthand 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 guldes A should be such that the tape runs free from the guldes.
  The height can be adjusted with nut B.

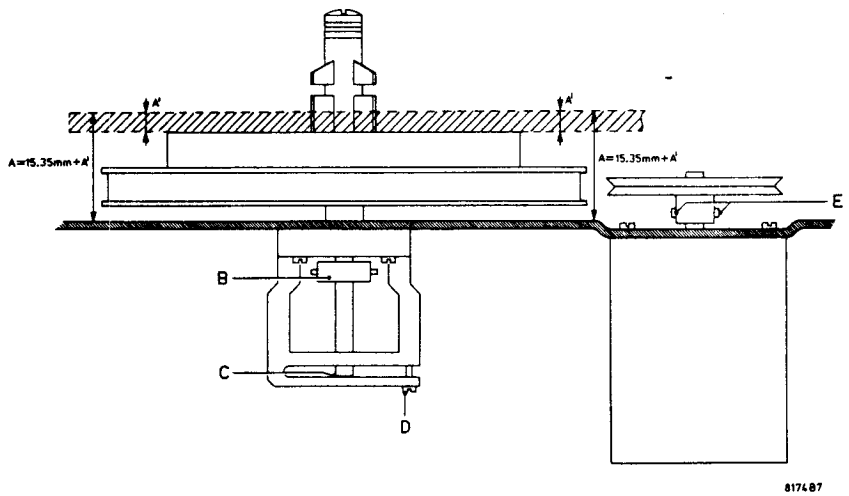

Fig. 6

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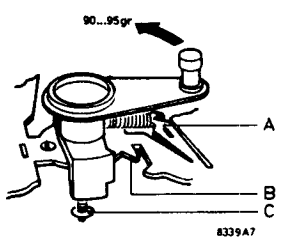

Fig. 7

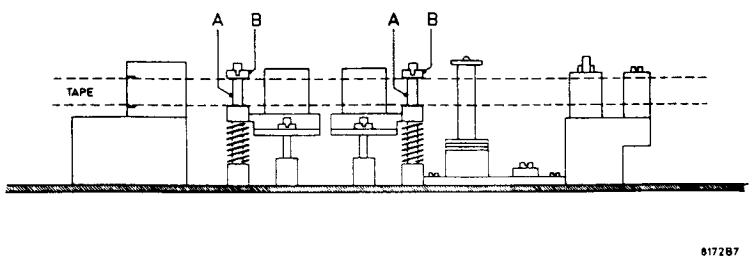

Fig. 8

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 g $\pm$ 50 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.
  . Trighten 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 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 aiso heads are manufactured with certain tolerances. This necessitates readjustment of the heads on replacement.
The mechanical adjustment comprises four important points (see Fig. 11).

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

Adjustment playback head K2/K102 (Fig. 12)

a. 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 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.

b. 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.

c. 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.

d. 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

a. 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°.
- 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 lagquer.

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 guldes 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/sek	R65	0.3 %
9.5 cm/sek	R68	0.2 %
19 cm/sek	R69	0.15 %

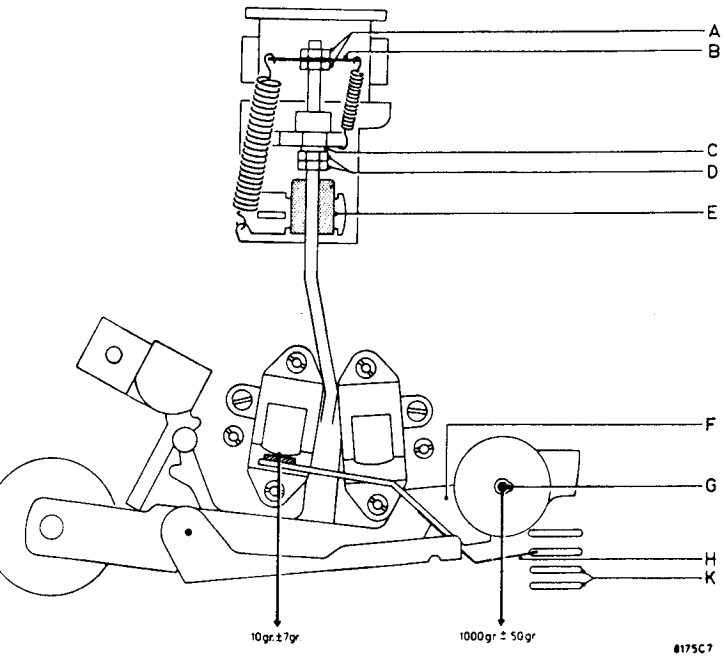

Fig. 9

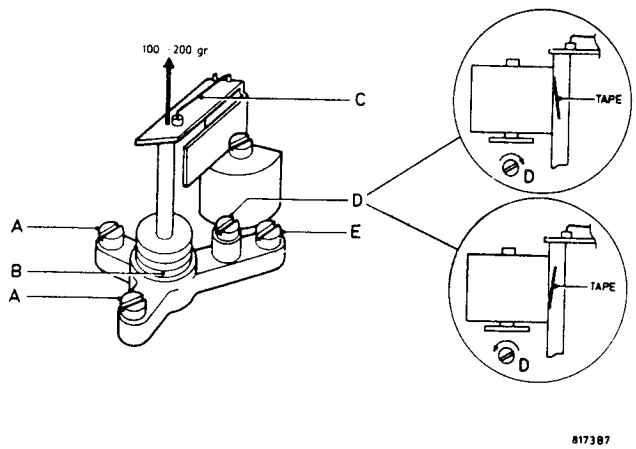

Fig. 10

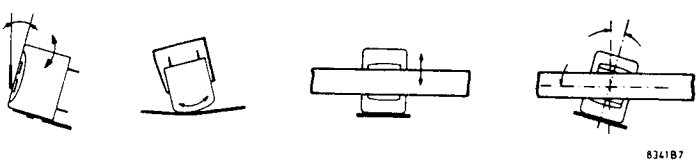

Fig. 11

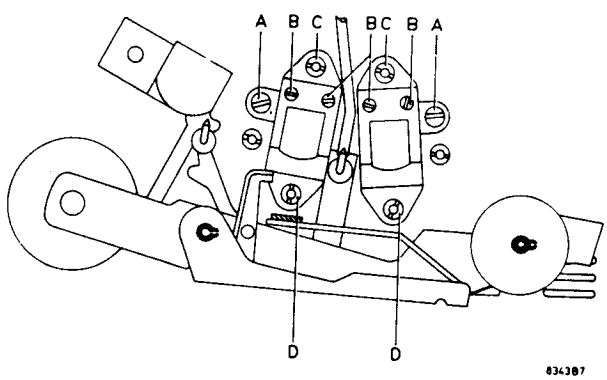

Fig. 12

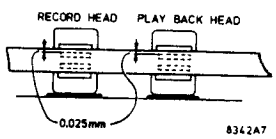

Fig. 13

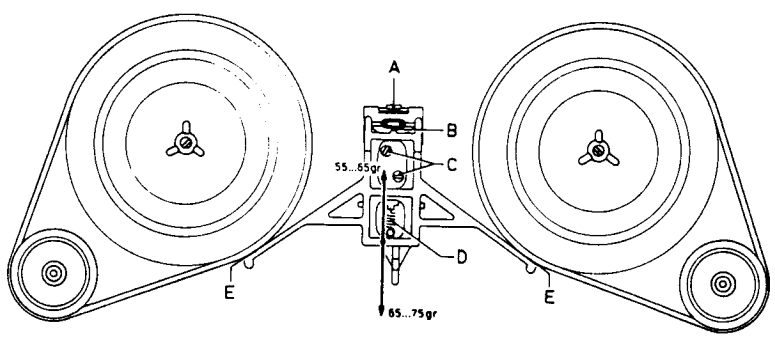

Fig. 14

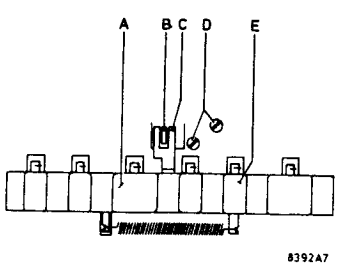

Fig. 15

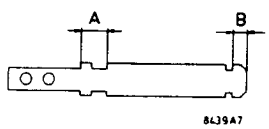

Fig. 16

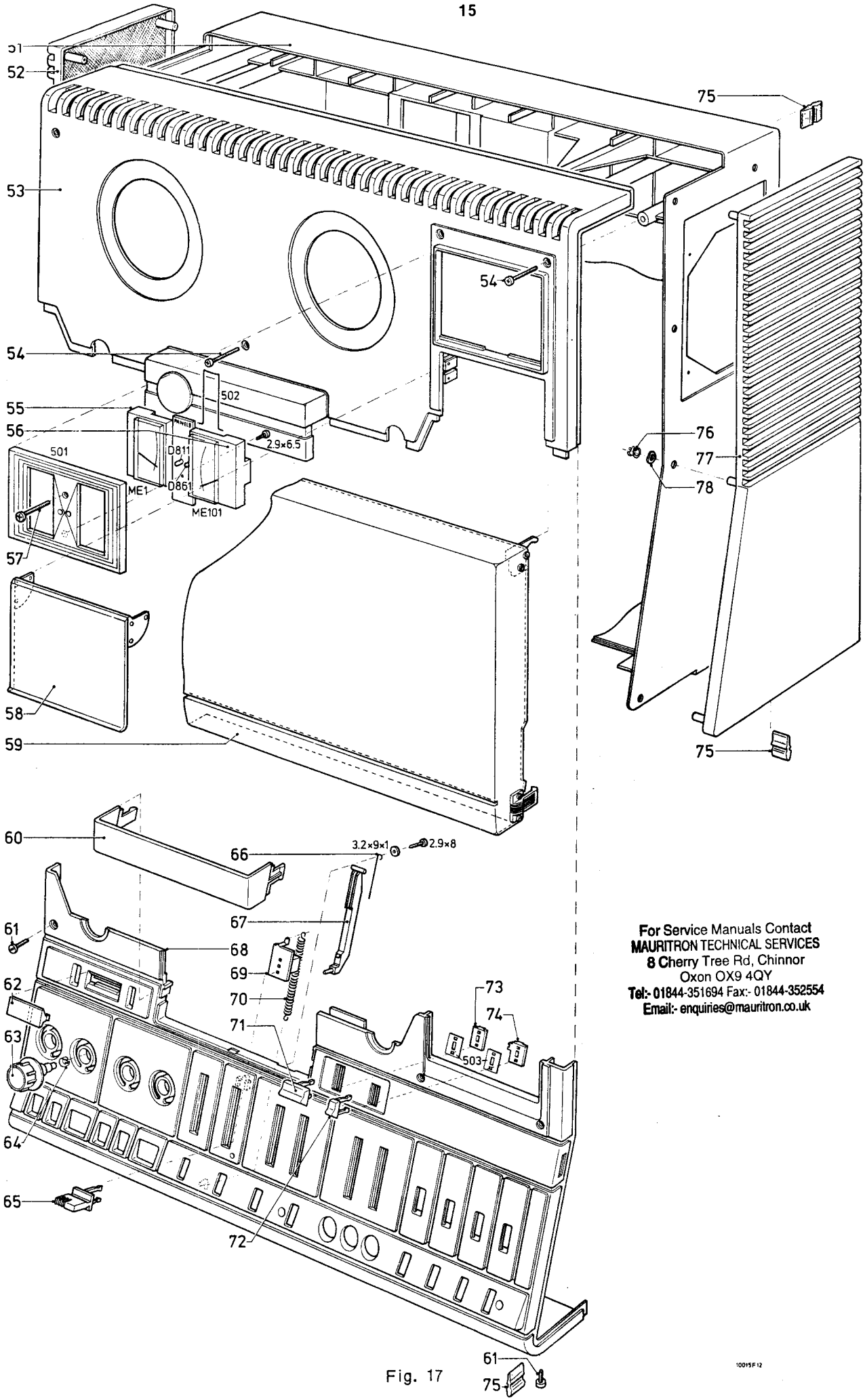

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Fig. 17

10015F12

LIST OF MECHANICAL PARTS

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

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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.

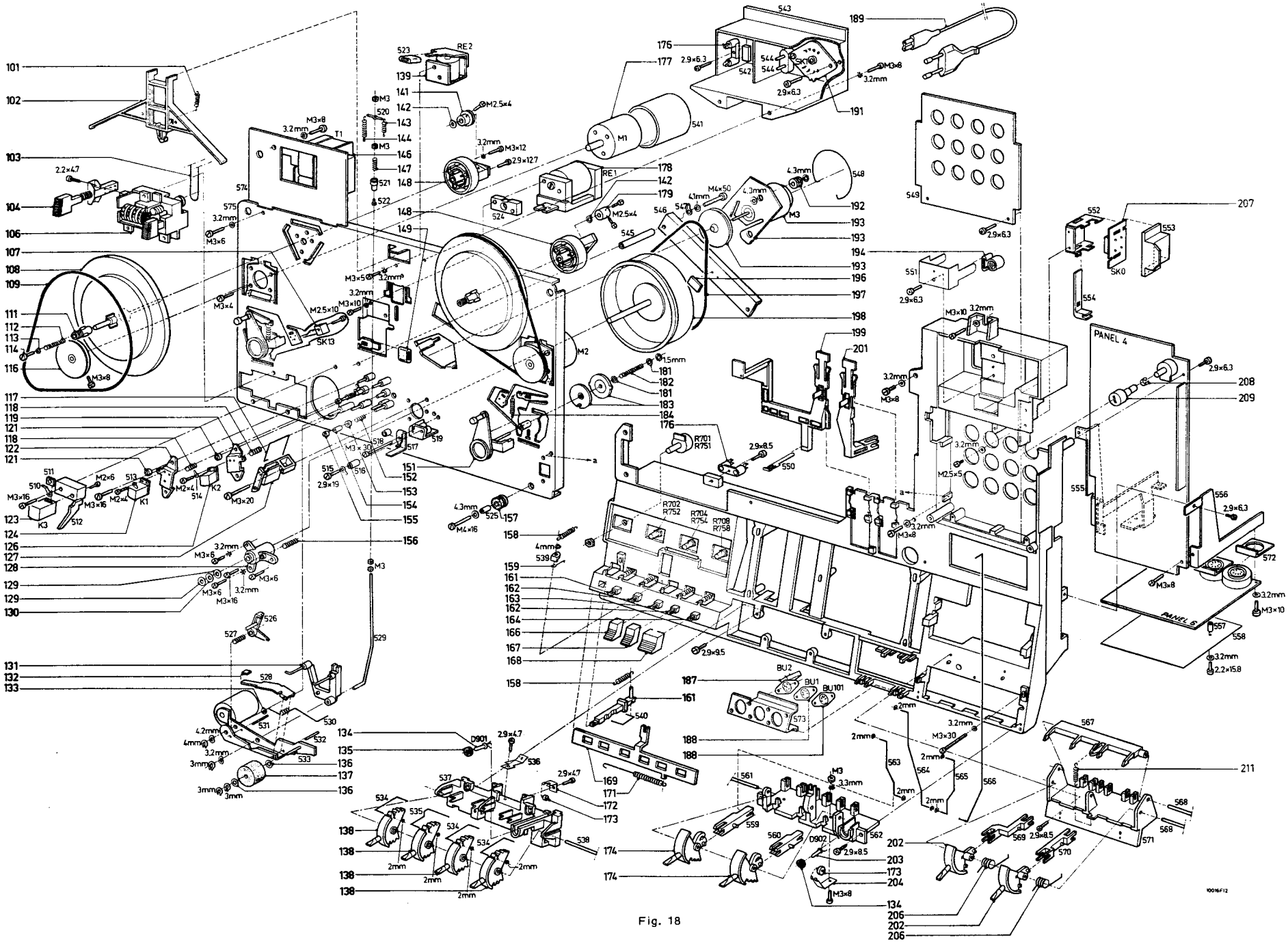

PANEL 4
PANEL 5
SK0
SK13
T1
M1
M2
RE1
RE2
D901
D902
BU1
BU2
BU101
K1
K2
K3
R701
R751
R702
R752
R704
R754
R708
R758
100156F12

Fig. 18

ELECTRICAL MEASUREMENTS AND ADJUSTMENTS

The following meassurements 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 kΩ 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 deffection

- 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 mV ± 0.5 dB.
- Adjust R96 (R196) in such a way that the voltage on BU4 MONITOR point 6/2 (7/2) is 1.4 mV ± 0.5 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 compromize 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 kHz ± 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 ≤ 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 mV ± 0.5 dB (The indicator deffection should be 100%).
- Reduce the output voltage to 90 mV (≙ - 20 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 mV $\pm$ 0.5 dB.
- Press the keys START and REC.
- The cross-talk rejection measured on BU4 MONITOR point 5/2 (3/2) should be $\geq$ 20 dB ($\hat{=} \leq$ 90 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 mV $\pm$ 0.5 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 dB ($\hat{=} \leq$ 0.9 mV).
  If this value is not reached, it is advisable to check the tape transport and the height of the head.

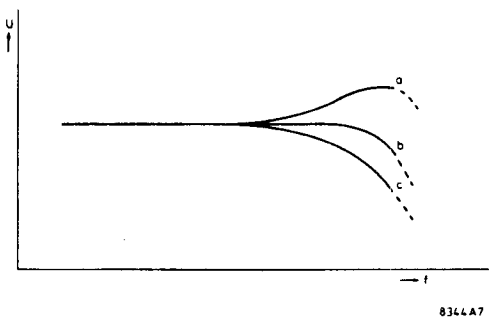


Fig. 19

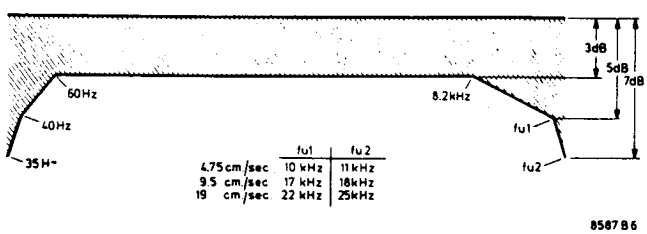


Fig. 20

LIST OF ELECTRICAL PARTS

-TS-

2,102	BC559B	5322 130 44358
4	BC337	4822 130 40855
5,105,204, 504,554	BC548C	5322 130 44196
6	BC638	4822 130 41087
7	BC548B	4822 130 40937
8,17,201	BC136	5322 130 40712
9	BC640	4822 130 41078
10,391	BC327	4822 130 40854
11	BD139	5322 130 40823
12,16,112, 203	BC558	4822 130 40941
15	BC556	4822 130 40989
18,202	BC548	4822 130 40938
19	BC328	5322 130 44104
392	BC557	5322 130 44256
401,402,451, 452,501,502, 551,552	BC549B	4822 130 40936
503,553	BD140	5322 130 40824
507	BC337/25	4822 130 40981
701,751,801, 851	BC549C	5322 130 44246
702,752	BC549	4822 130 40964
703,753	BC559	4822 130 40963

-D-

2,10,11,12, 30,201	BY206	4822 130 30839
14	BY225-10	4822 130 30917
15,17	BZX79-B8V2	5322 130 34382
16,18,19,20, 24,28,29,124, 128,204,205, 206,207,251, 252,253,391, 504,507,554	BAW62	5322 130 30613
22,23	BZY88-C3V3	5322 130 30392
203,501,812, 862	BZX75-C2V1	5322 130 34049
401	BZX79-C12	5322 130 34069
502	BZX75-C3V6	5322 130 30765
503,553	BA148	4822 130 30839
801	BAV10	5322 130 30594
811,861,902	LED CQY24	4822 130 30922
901	LED OF048	4822 130 30904

-C-

12,112,602, 652	120 pF, 63 V	4822 122 30093
15,16,23,115, 116,123	2.2 μF, 63 V	4822 124 20482
17,117,203	6.8 nF, 63 V	4822 121 50538
26	15 nF, 63 V	5322 121 45119
27	36 nF, 63 V	4822 121 50605
29	9.1 nF, 63 V	5322 121 54165
31,131	100 pF, 63 V	4822 122 31081
45,145	33 nF, 250 V	4822 121 41147
53	22 μF, 40 V	4822 124 20499
56,156	22 nF, 63 V	4822 122 30103
204	1.5 μF, 63 V	4822 124 20605
206	18 nF, 250 V	4822 121 41141
502,552	10 nF, 63 V	5322 121 54154
601,651	56 pF, 40 V	4822 122 31074
701,751	22 nF, 250 V	4822 121 40407
704,754	10 nF, 250 V	4822 121 41134
705,755	100 nF, 100 V	4822 121 41161
901	3.3 μF, 40 V	4822 124 70312

-L-

2,102	Coil	4822 157 50735
601,602,651, 652	Coil	4822 157 50869

-R-

22,122,804, 854	22 kΩ, trim	4822 100 10051
40,140	220 kΩ, trim	4822 100 10088
48,148	510 Ω,1/4 Watt	5322 116 54525
49	62 Ω, 1 Watt	4822 111 50389
59	2.2 Ω, wire wound	4822 113 60028
61	PTC 25 Ω - 50 Ω	4822 116 40001
62	750 Ω,wire wound	4822 112 20104
65,68,69, 96,196	2.2 kΩ, trim	4822 100 10029
70	95.3 kΩ,metal film	5322 116 50567
71	48.7 kΩ,metal film	5322 116 50442
74	4.64 kΩ,metal film	4822 116 51163
75	5.11 kΩ,metal film	4822 116 51164
100	191 kΩ,metal film	5322 116 54724
420,421,422, 423,470,471, 472,473	470 kΩ, log	4822 101 30327
424,474, 426,476	10 kΩ, log	4822 101 30307
511,513,561, 563	22 kΩ, log	4822 105 10071
522,523	10 kΩ, lin	4822 105 10262
701/751	47 kΩ, log	4822 102 30207
702/752	47 kΩ, bal	4822 102 30215
704/754	100 kΩ, log	4822 102 30219
708/758	220 kΩ, log.	4822 102 30214
714,764	360 Ω,1/4 Watt	5322 116 50603
802,852	750 Ω,1/4 Watt	5322 116 54536

-Miscellaneous-

BU1,101	Socket 5-pol	4822 267 40039
BU2	Socket 5-pol + switch	4822 267 40155
BU3,4,601, 602,603,604	Socket 7 pol	4822 267 50218
BU5	Socket 5 pol	4822 267 40233
Multiway connector for U1,101		4822 267 40127
Multiway connector for U2		4822 267 50156
Socket A,B,C		4822 265 30117
Plug A,B,C		4822 266 30073
Socket D,F		4822 265 30119
Plug D,F		4822 266 30072
Socket E		4822 265 30121
Plug E		4822 266 30071
Core for L2,102		4822 526 10111
Core for L601,651		4822 526 10099
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

MISC	M2 D901 F1 K103 K3 BU2 BU6 K101 BU1 K102 D801 BU101 SK1 T.C. D902 ME701 TS203 D206 D201 D203 D861 TS801 D812 D811 L801 LA901 ME751 M1 T1 L804 L803 SK15 K1 M3 RE1 G3 K2 RE2 D205 D207 D204 LA951 TS204 TS202 TS201 TS851 D862 SK16 L802 SK13 F2 SK17 SK0
C	804 805 204 207 206 203 801 803 855 201 205 202 802
R	820 951 901 207 203 209 201 205 208 801···805 822 178 82 202 204 211 212 213 210 851···855

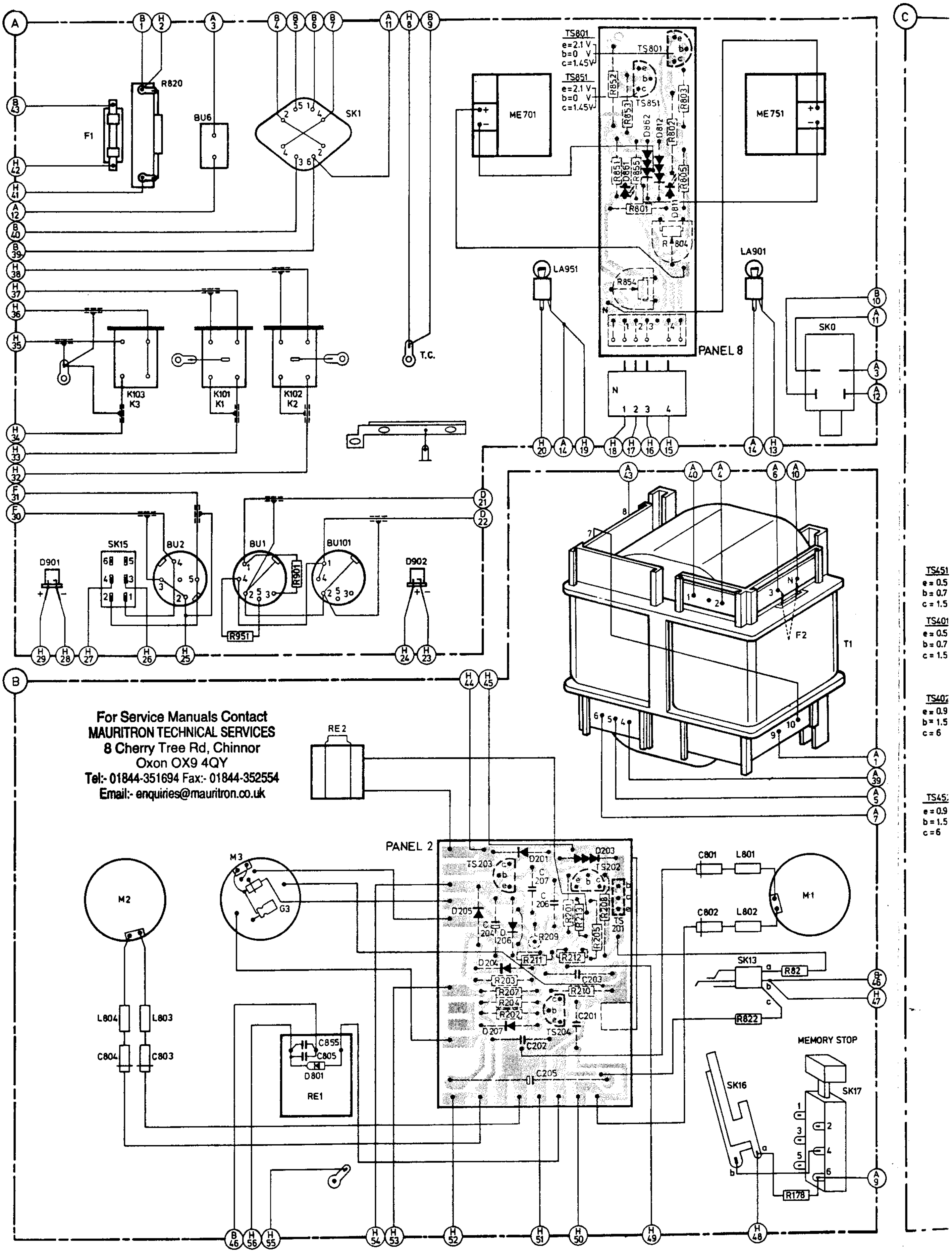


Fig. 21

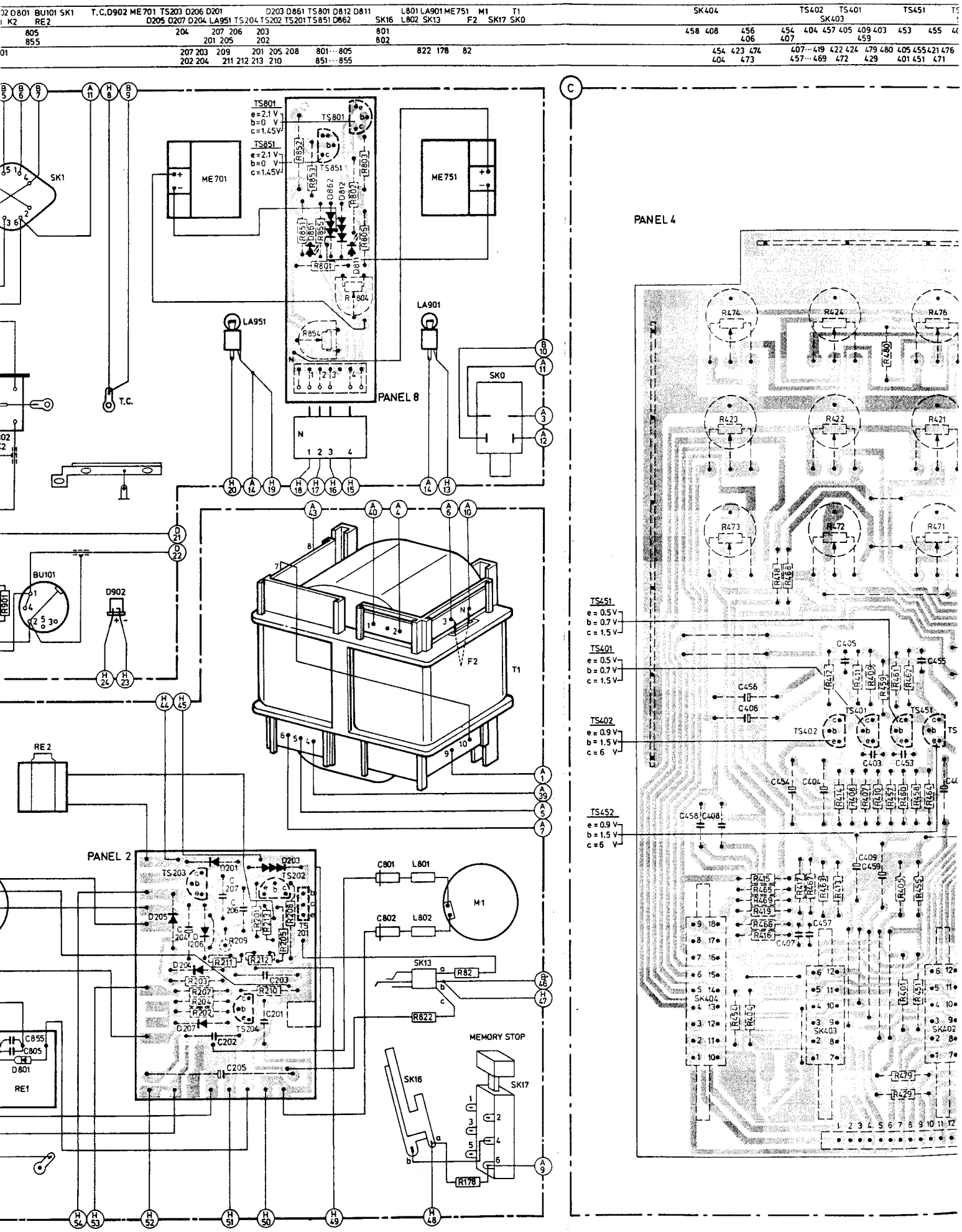
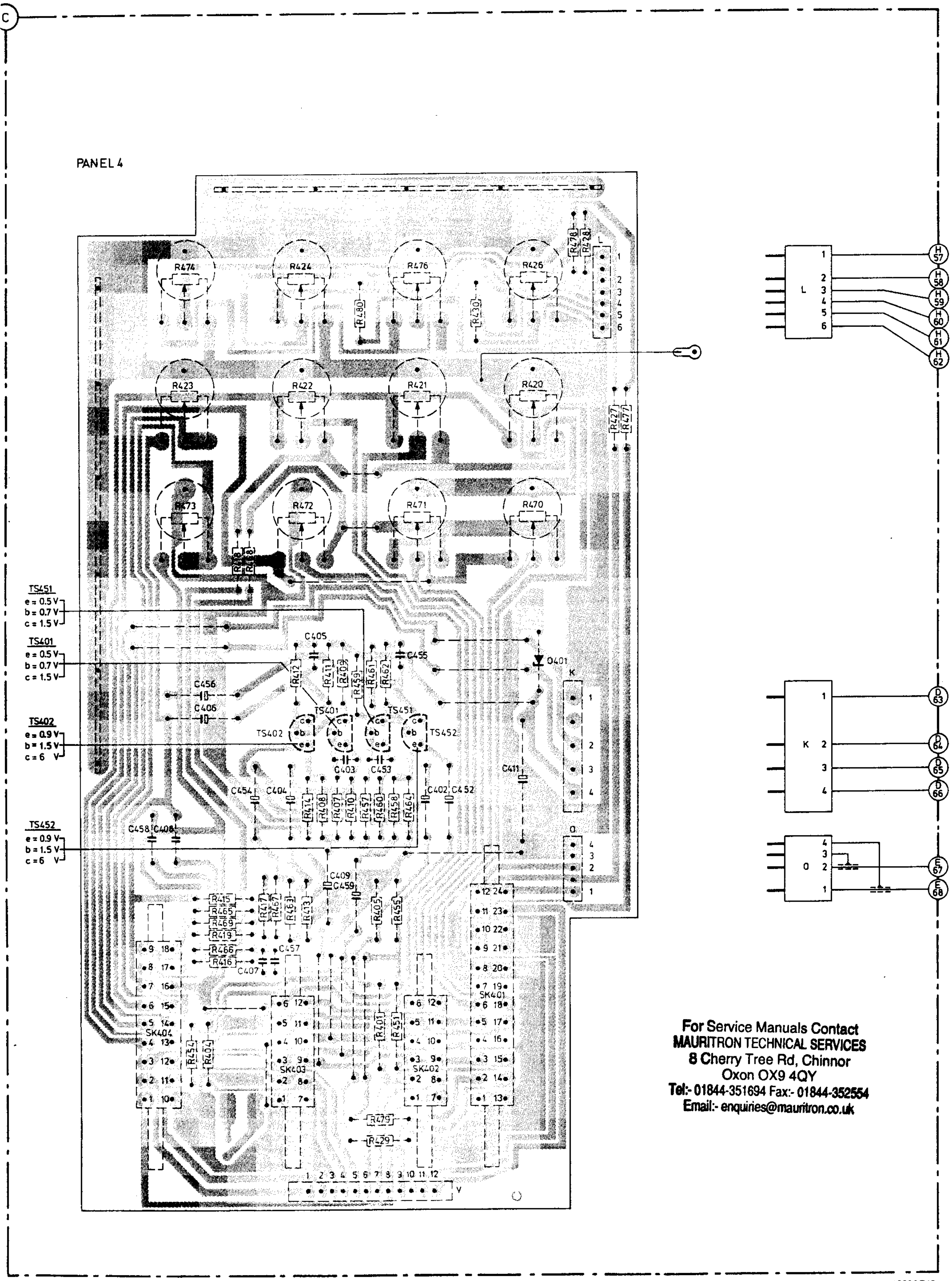

PANEL 8
PANEL 2
PANEL 4
T.C.
SK1
ME701
ME751
LA951
LA901
SK0
BU101
D902
RE2
RE1
T1
F2
M1
SK13
SK16
SK17
SK404
SK403
SK402
MEMORY STOP
TS801
TS851
TS451
TS401
TS402
TS452
TS203
TS204
C801
L801
C802
L802
C855
C805
D801
R82
R822
R178
IC201
C205
C202
C203
C207
C206
C204
R209
R211
R212
R201
R207
R204
R202
R213
R208
R205
D201
D203
D205
D204
D207
S202
C405
C455
C456
C406
C403
C453
C454
C404
C458
C408
C409
C459
C457
C407
R474
R424
R476
R480
R423
R422
R421
R473
R472
R471
R478
R468

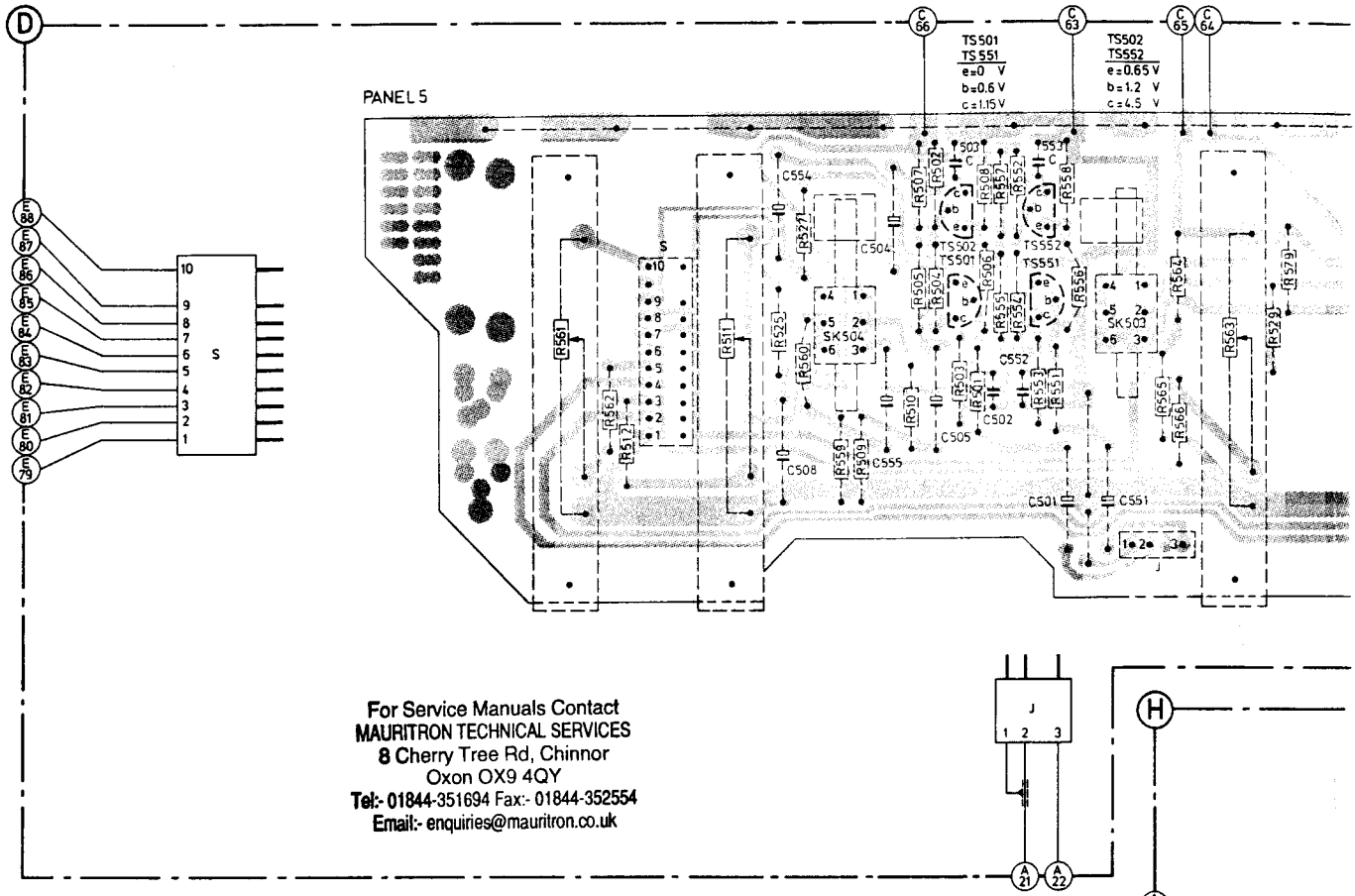
Fig. 21

SK404	TS402 TS401 SK403	TS451	TS452 SK402	SK401	D401		MISC.
458 408 456 406	454 407 404 457 405 409 403 459	453 455	402 452	411			C
454 404 423 474 473	407···419 457···469 422 424 472 479 480 429	405 455 401 451	421 476 471	430	420 426 470	428 478 477 427	R

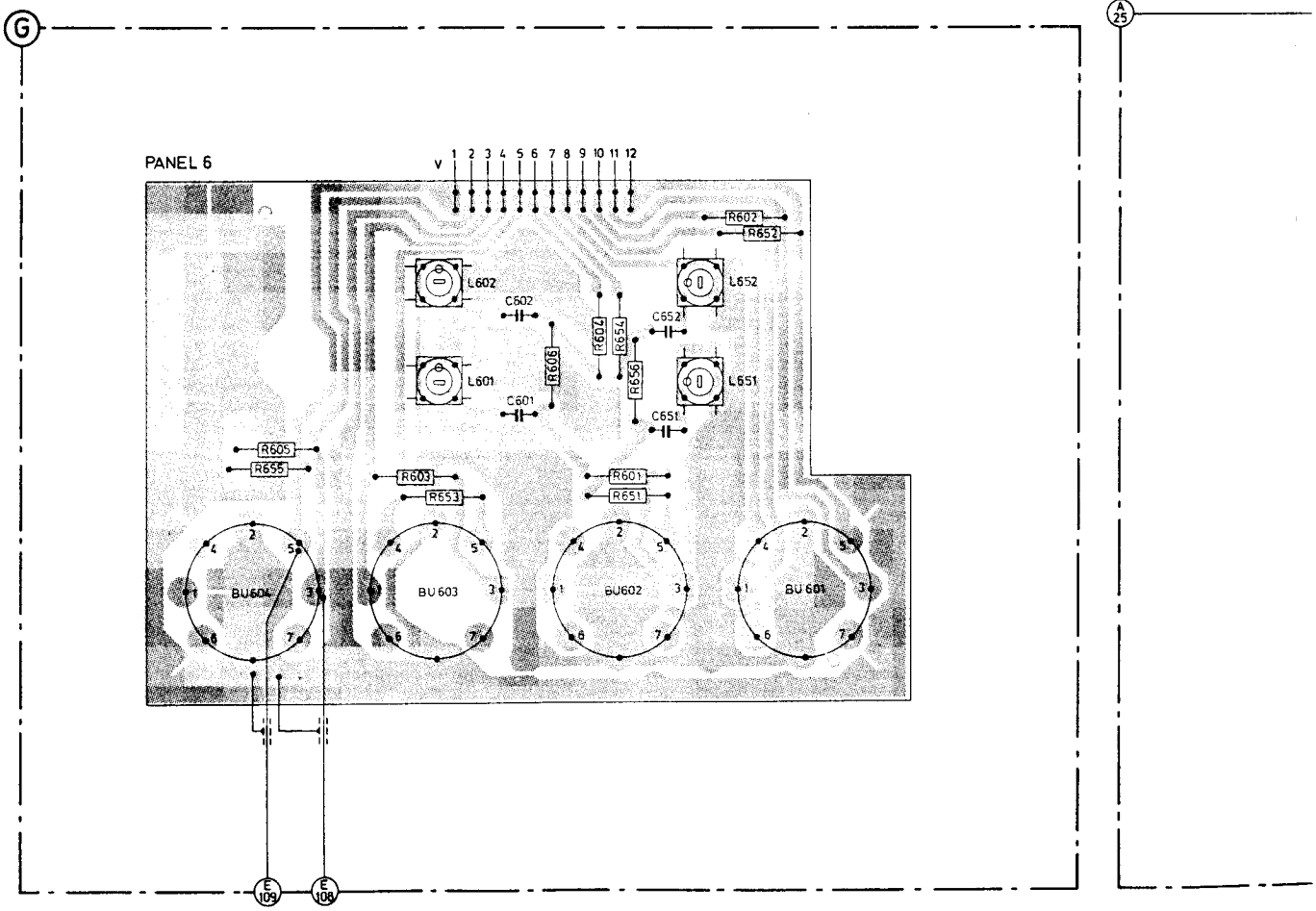


10969E13

MISC.	BU604	BU603 L602 L601	BU602	L652 L651	BU601 SK504	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



For Service Manuals Contact
MAURITRON TECHNICAL SERVICES
8 Cherry Tree Rd, Chinnor
Oxon OX9 4QY
Tel:- 01844-351694 Fax:- 01844-352554
Email:- enquiries@mauritron.co.uk



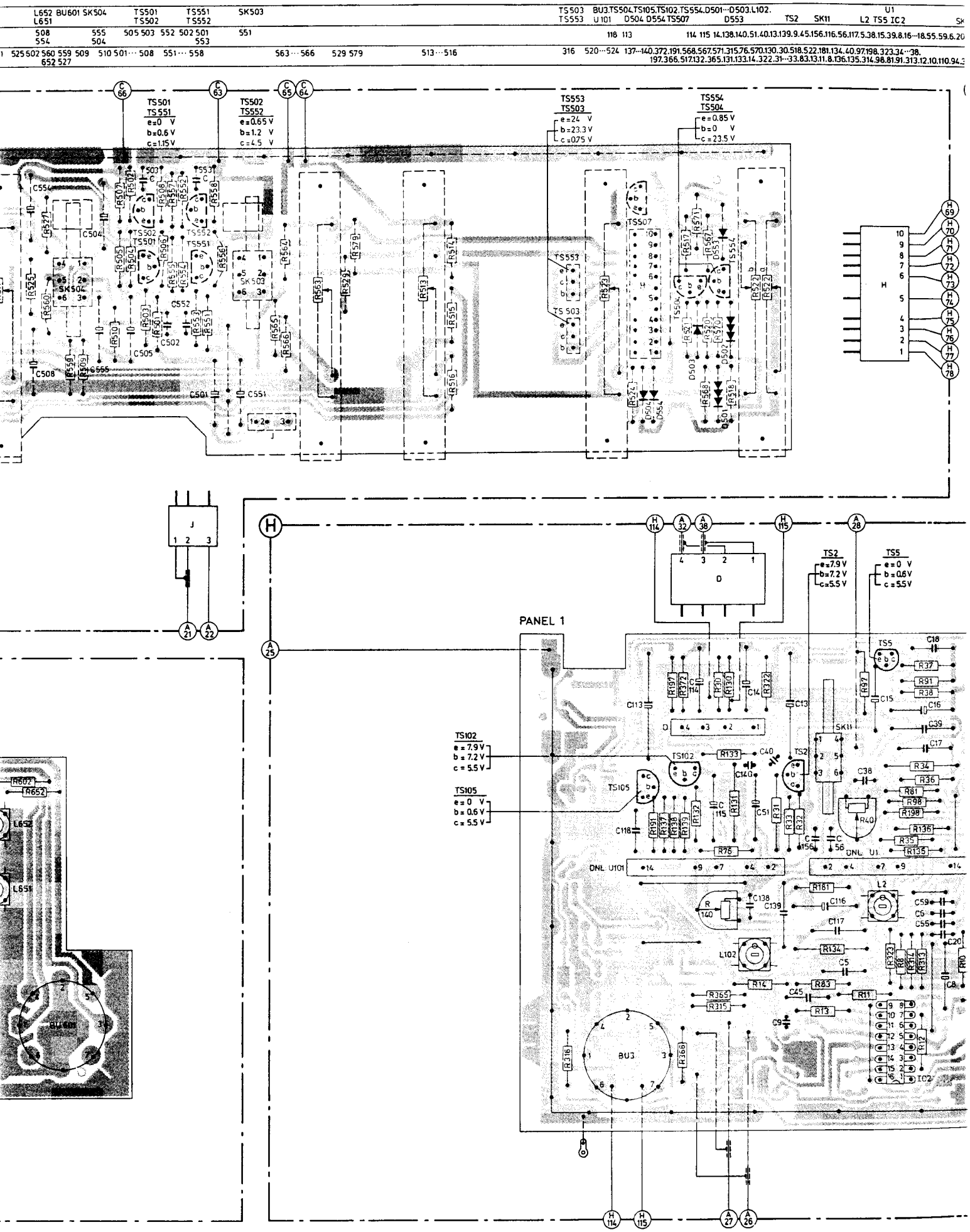

TS501
TS551
e=0 V
b=0.6 V
c=1.15 V
TS502
TS552
e=0.65 V
b=1.2 V
c=4.5 V
TS553
TS503
e=24 V
b=23.3 V
c=0.75 V
TS554
TS504
e=0.85 V
b=0 V
c=23.5 V
TS102
e=7.9 V
b=7.2 V
c=5.5 V
TS105
e=0 V
b=0.6 V
c=5.5 V
TS2
e=7.9 V
b=7.2 V
c=5.5 V
TS5
e=0 V
b=0.6 V
c=5.5 V
PANEL 1
BU3
DNL U101
DNL U1
IC2
L2
L102

Fig. 22

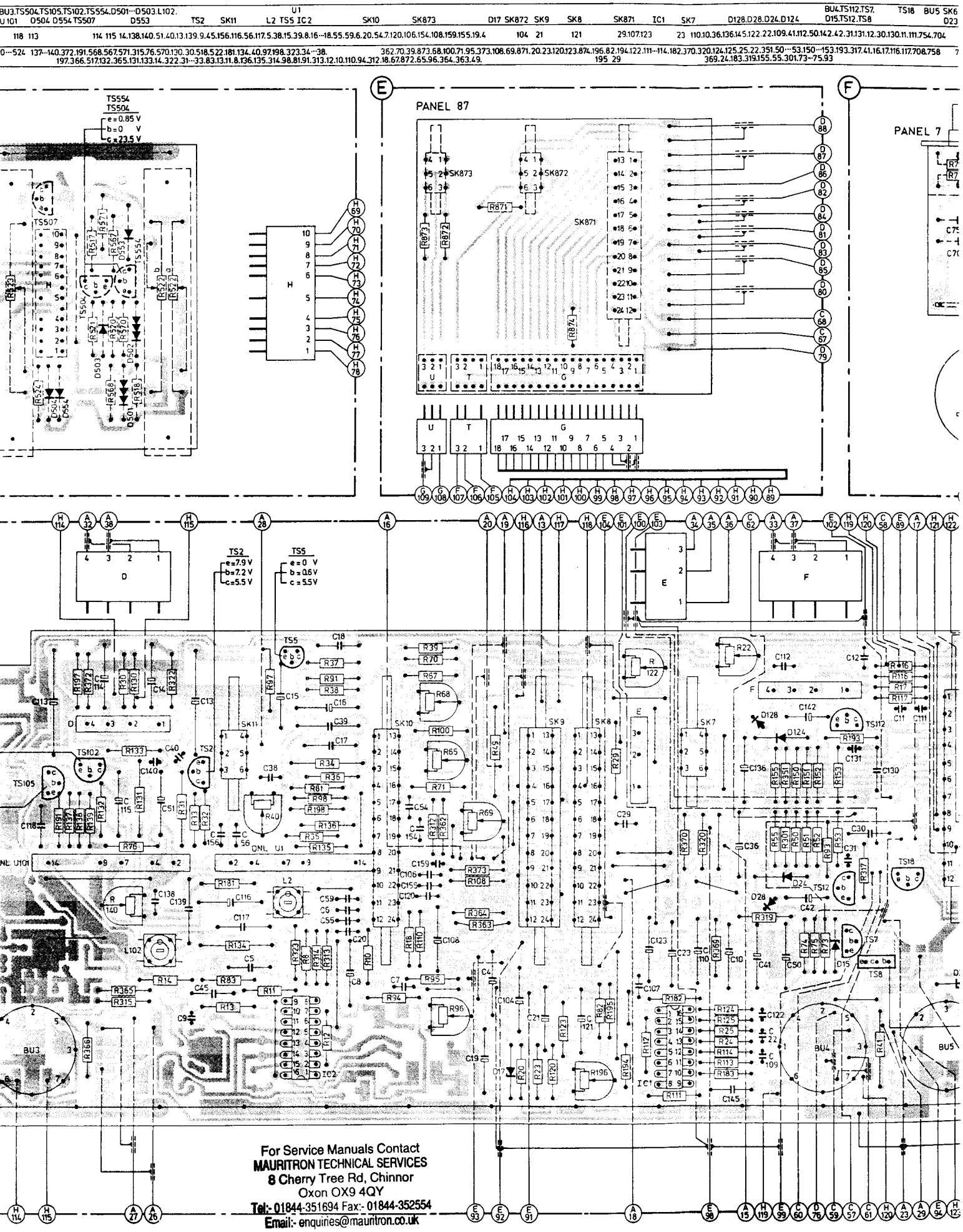
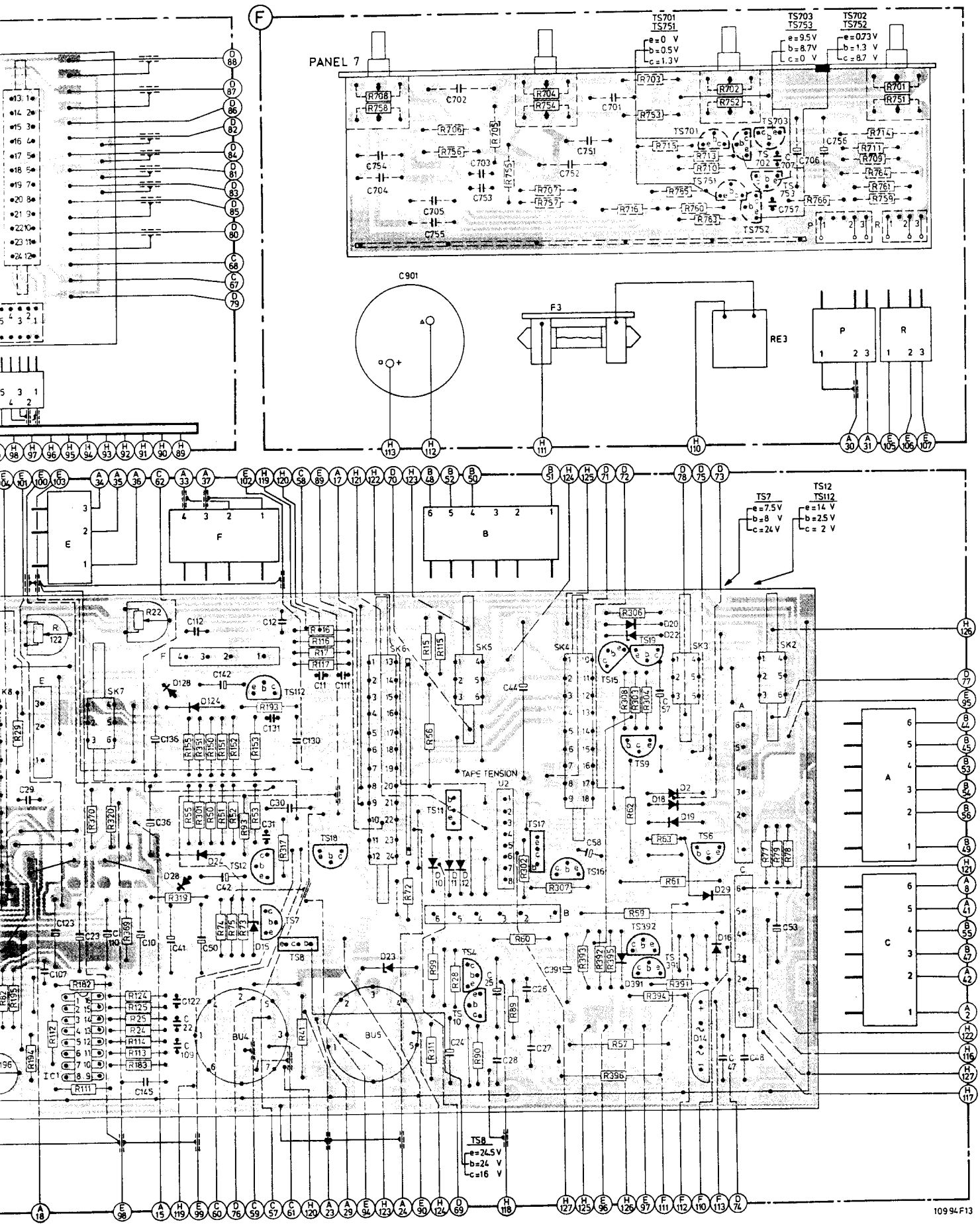

PANEL 87
PANEL 7
TS554
TS504
e = 0.85 V
b = 0 V
c = 23.5 V
TS507
SK873
SK872
SK871
TS2
e = 7.9 V
b = 7.2 V
c = 5.5 V
TS5
e = 0 V
b = 0.6 V
c = 5.5 V
For Service Manuals Contact
MAURITRON TECHNICAL SERVICES
8 Cherry Tree Rd, Chinnor
Oxon OX9 4QY
Tel:- 01844-351694 Fax:- 01844-352554
Email:- enquiries@mauritron.co.uk

Fig. 22

SK871 IC1 SK7 D128.D28.D24.D124 BU4.TS112.TS7. D15.TS12.TS8 TS18 BU5 SK6 D23 D10–D12. U2 SK5.TS11. TS4.TS10.TS17.F3.TS16.SK4.TS15.D391.D18···D20.SK3.TS6.D14.D29.TS701.TS751.D16.RE3.TS752.TS753 D22.TS9.TS19.D2.TS391.TS392.TS702.TS703.SK2

29.107.123 23 110.10.36.136.145.122.22.109.41.112.50.142.42.31.131.12.30.130.11.111.754.704 901.705.755.702.24···28.703.753.44.391.752 58.751. 701 57 47.48 757.707.53.706.756

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 72.15.56.311.115.99.706.756.28.90.705.755.302.89.60.707.704.303.306.308.304.715.716.703.753.63.61.765. 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
6 29 369.24.183.319.155.55.301.73···75.93



CS56732

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	402.409 407 403 404 405 406.408	114
C451···757	501.651 602.652.501.551 502 552.459.452 457.453 454 504.503.505.458.456.455.553...555	
R8 ··· 100		30
R101···458	451.404.401.429.454.455. 405 458 408 407 457.410.417 409 419 416 413 411 412 414 415 418 420···423	130 123
R459···550	501 479 502···506.461.459...460. 507 508 463 469 509···512. 527 464...468 473 470 471 472 513···516	
R551···951	951 652 653.872.873. 901 50... ...1.656 606 655 605 604 654 551 552...558 560 559 561 562.871 563···566	

TS502,401 TS402
TS552,451 TS452
.03 404 405 406,408
454 504,503,505,458,456,455,553...555
.417 409 419 416 413 411 412 414 415 418 420···423
.60, 507 508 463 469 509···512,527 464...468 473 470 471 472 513···516
552...558 560 559 561 562,871 563···566

K2 TS2 IC1 L2 TS5 U1 IC2
K102 TS102 L102,TS105 U101
14 4,21 19 40 22 15 13 18 39 54 55 17 16,23,55,20 7,38,6 59 8 9 5 45 56 10
114 104 121 140 122 115,113 118 139 154 155 117,116,123 ,120,107,138,106 159 108 109 145 156 110
30 20 23 31 82 24 32 33 35 98 97 25 91 36···39 34 81 95 8 40 94 96 10 11 12 13 83 14
130 123 120 322 372 131 182 132 124 133 197 191 125 198,135...139, 312, 362,134,314,364,181,320,370, 313 195 363 108,140,323,373,196 194 110 111 112 113 183 114

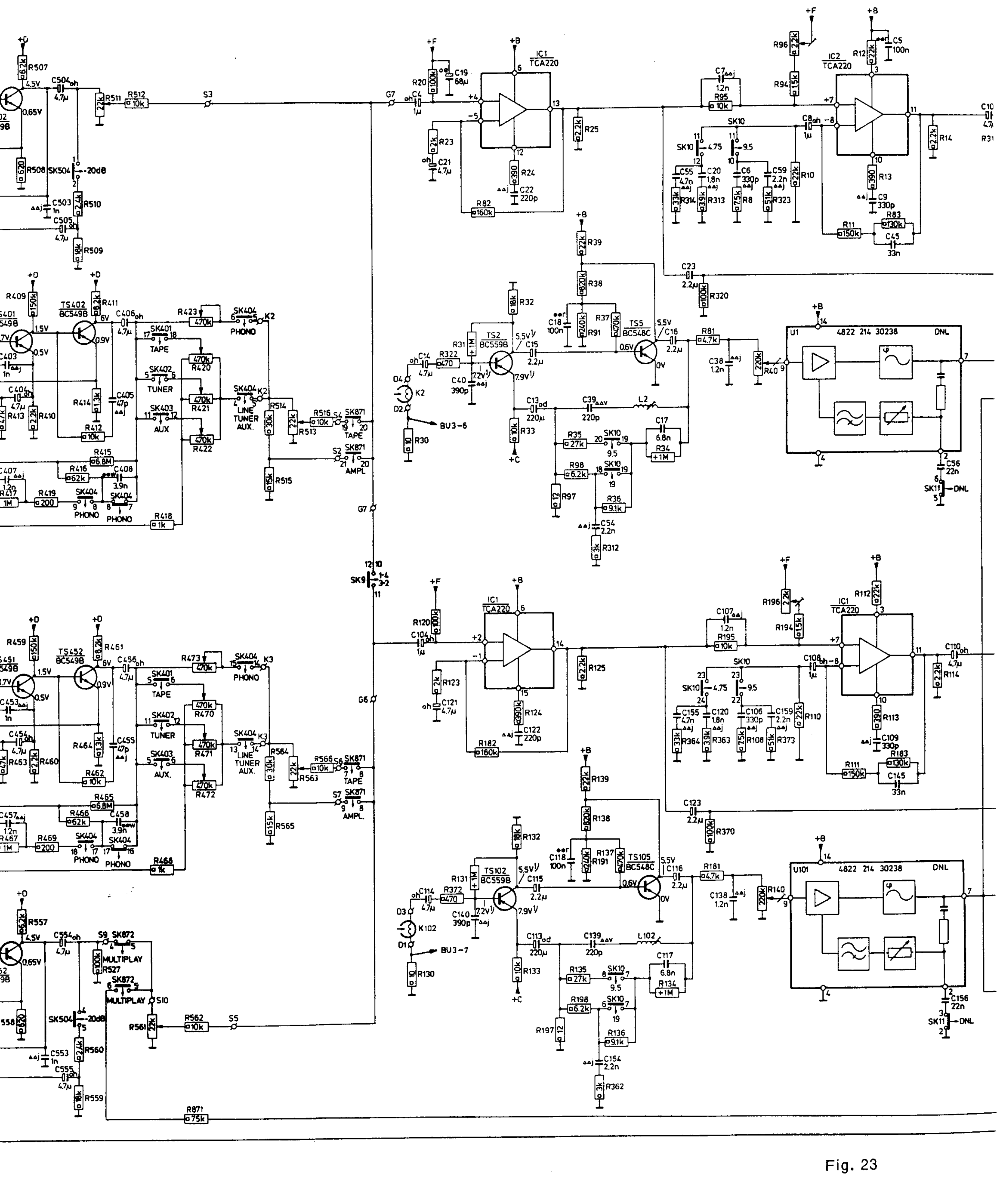


Fig. 23

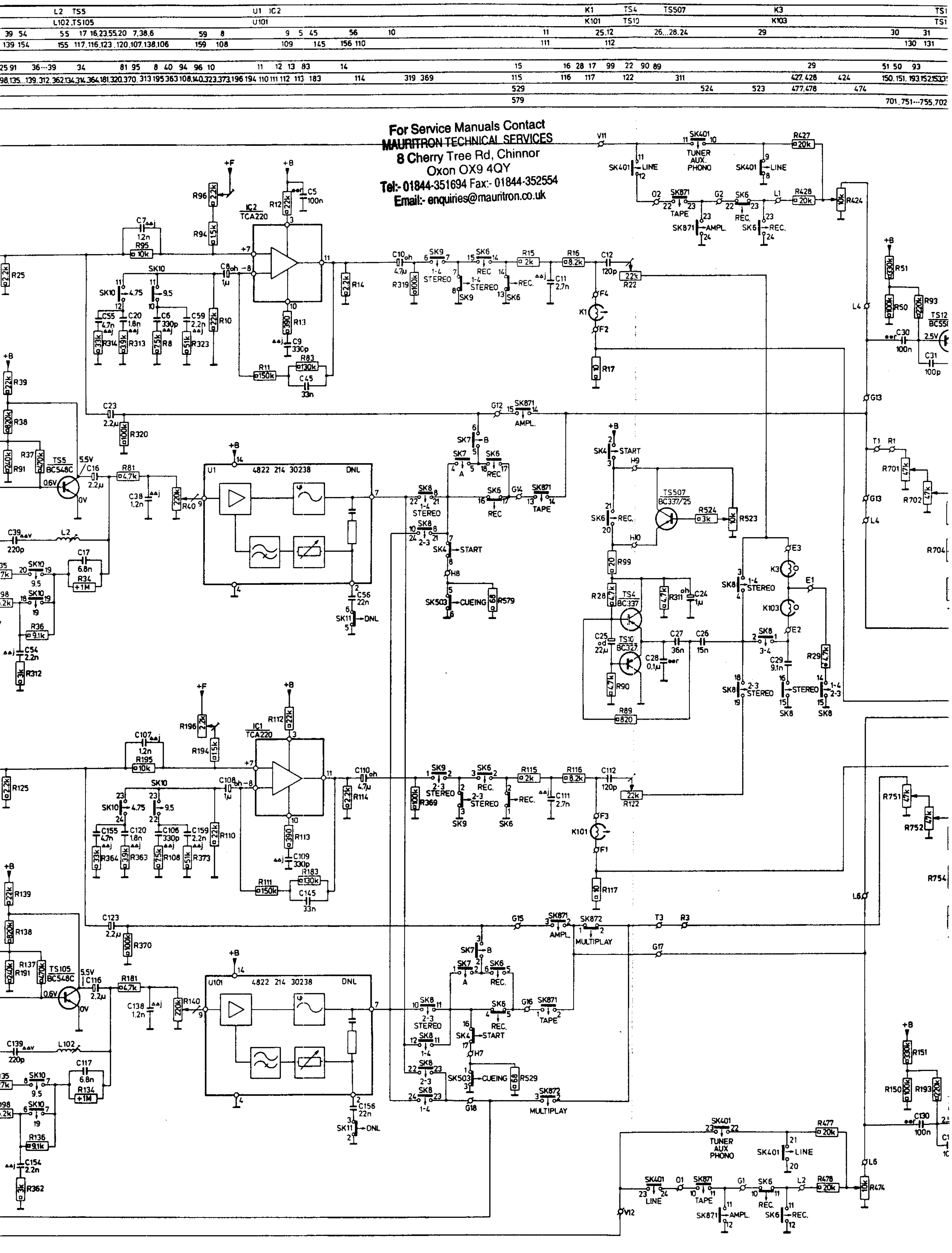
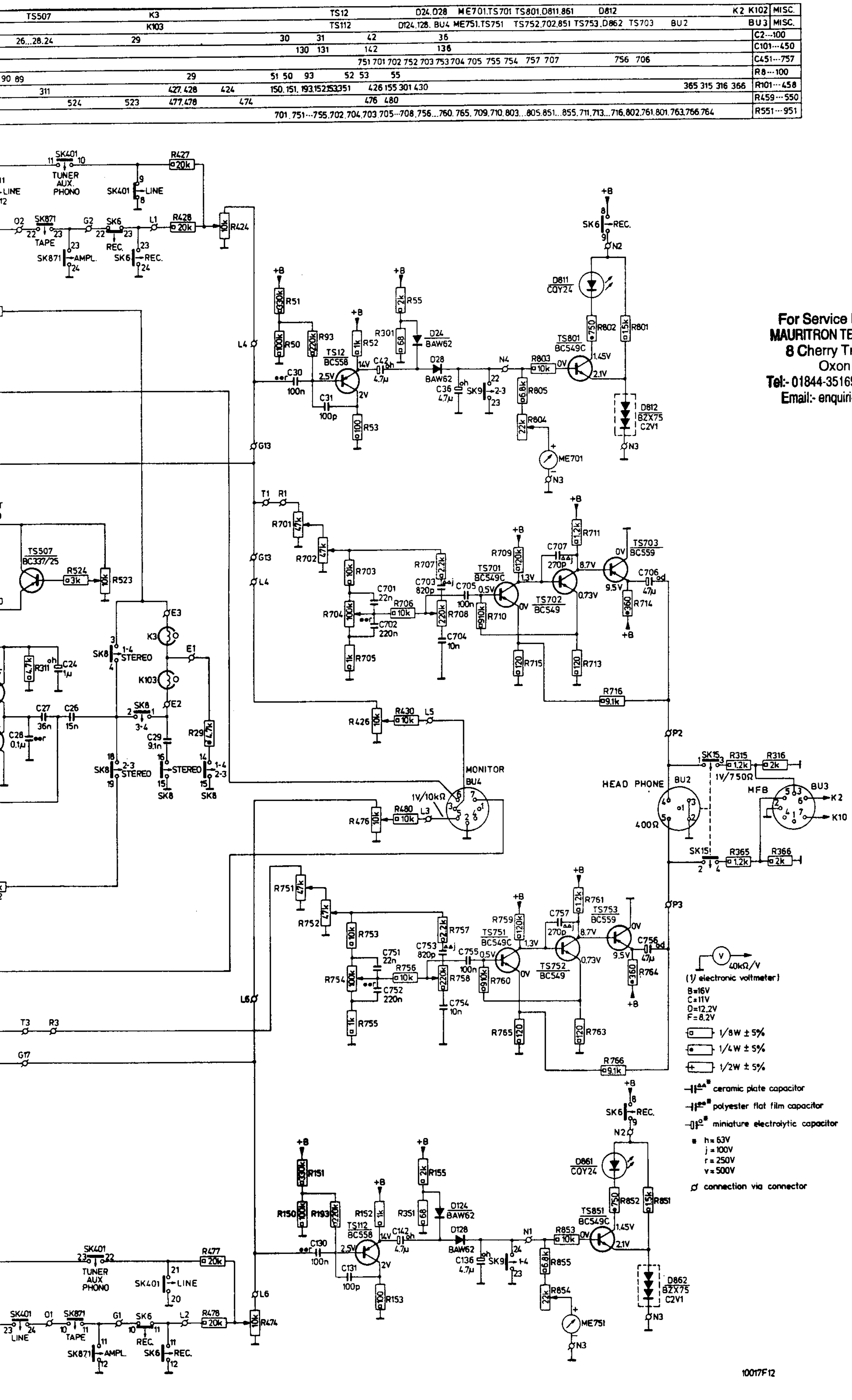
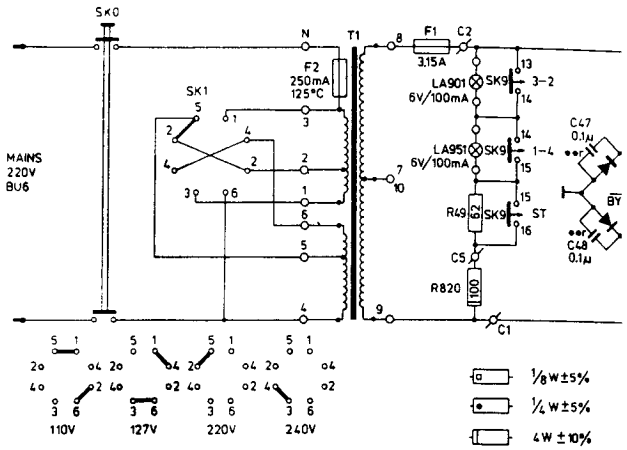


Fig. 23

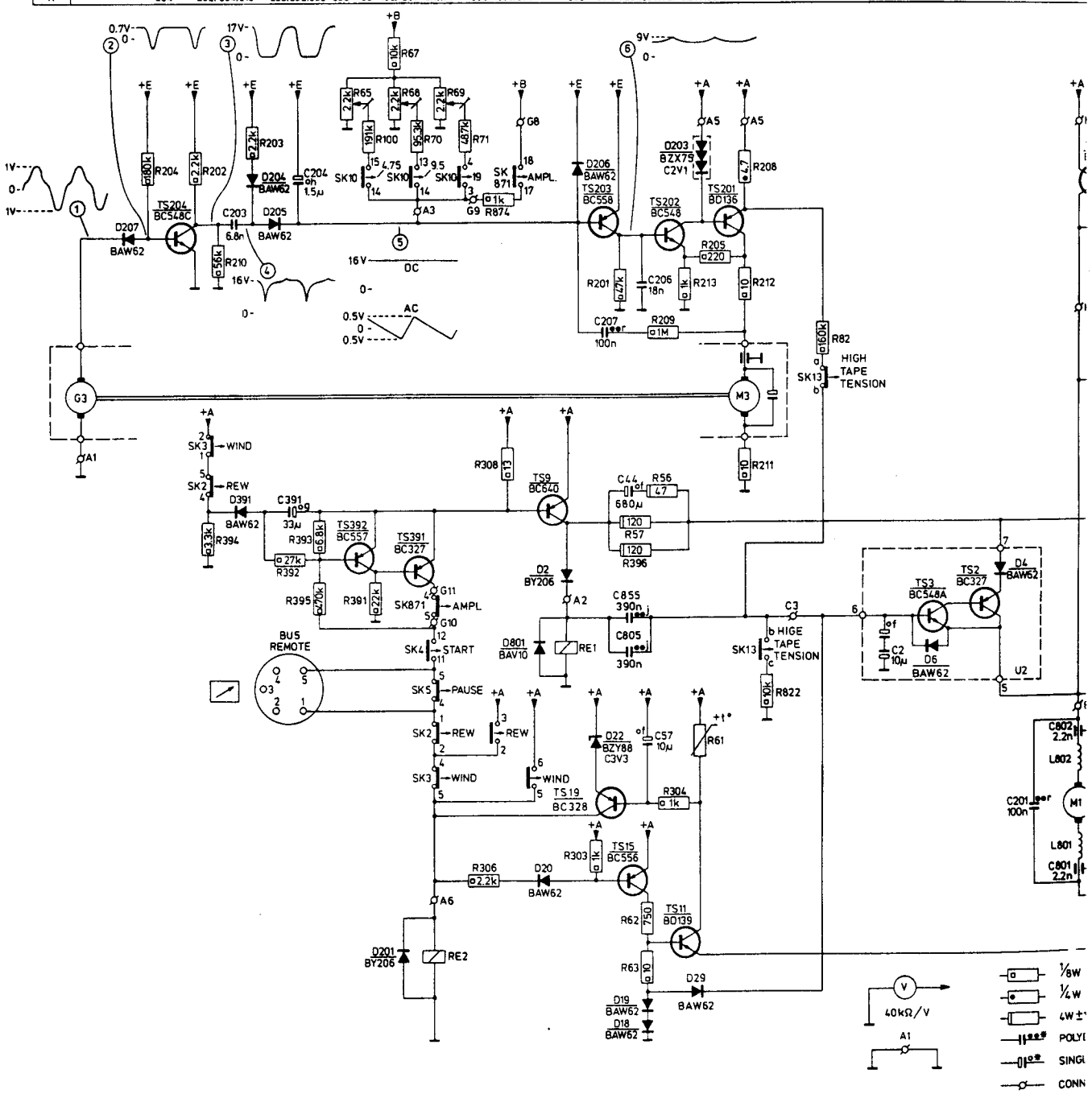


MISC	BU5	SK0	SK1	F2	T1	F1 LA901 LA951	C
C						47 48	
R						49 820	



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
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. 201.396.62.63.209.304.61.213. 205.212.211.208.822.82				



Fig

MISC	BUS	SK0	SK1	F2	T1	F1 LA901 LA951	D14	D902 D23 D901	TS8	D15 TS7	D17 D
C						47 48		901		50 41	51 508 2
R						49 820		41	72 73	74 75	76 525 207 18

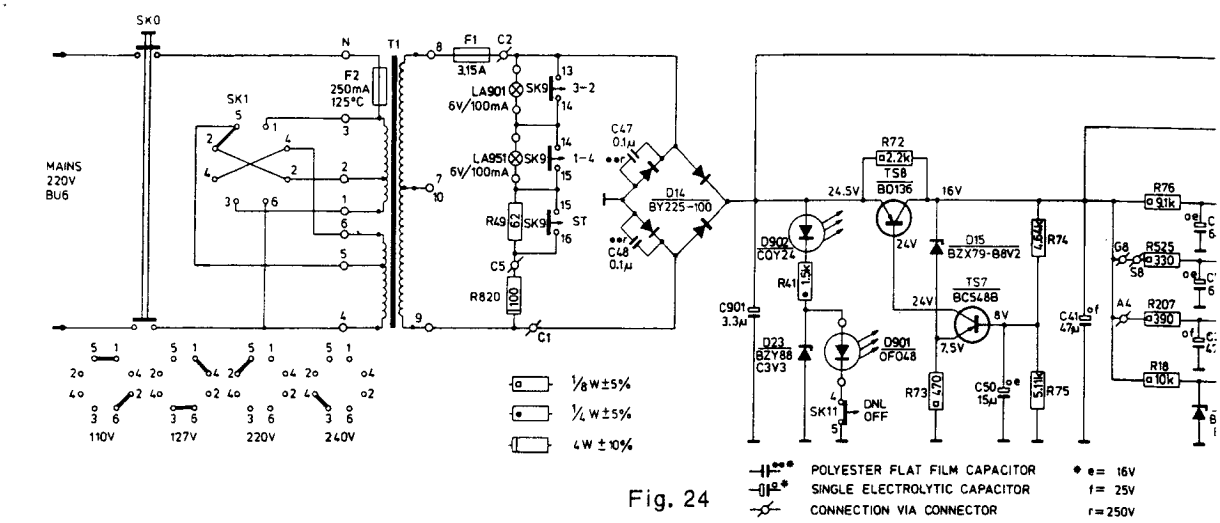


Fig. 24

05.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.M1	TS503	D12.503.TS504	D504	D502.501	D554	TS
4			207 805 44 206 57 855	2		201	802.801						
92.393	395 65 100 391 67...71	306	308.874 303 56.57 201.396.62.63.209.304.61.213.205.212.211.208.822.82					521	520 517	522a	518	568	522b 567

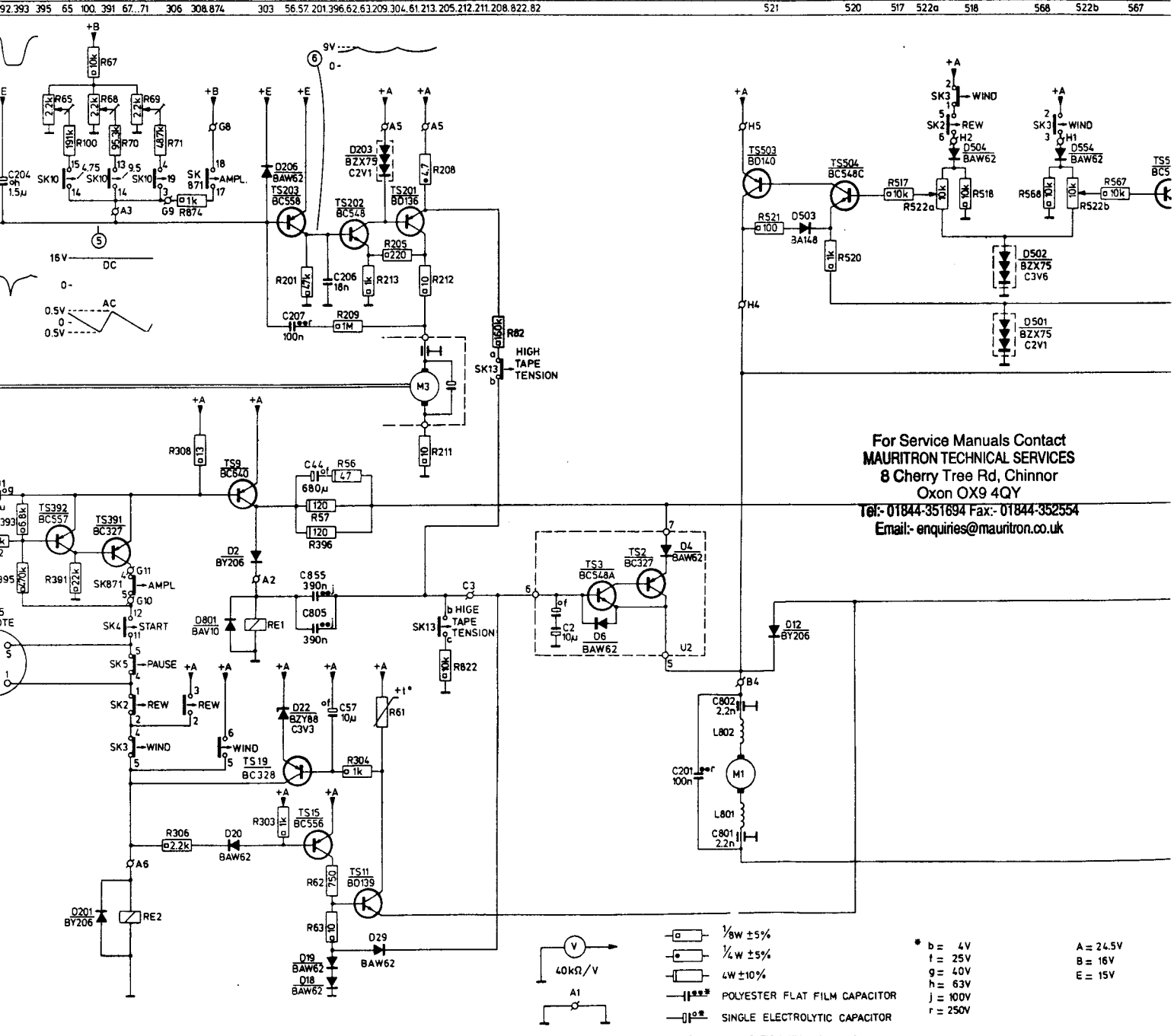
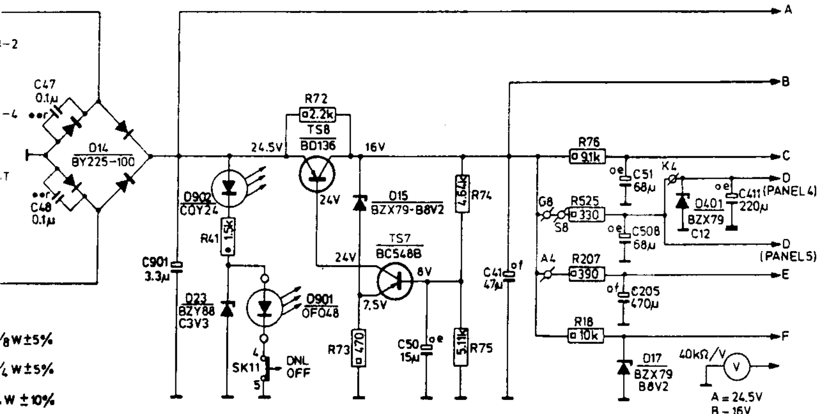


Fig. 25

D14 · D902 D23 D901 TS8 · D15 TS7 · D17 D401	MISC
47 48 · 901 · 50 · 41 · 51 508 205 411	C
41 · 72 · 73 · 74 75 · 76 525 207 18	R



⅛W±5%
¼W±5%
W±10%

POLYESTER FLAT FILM CAPACITOR
SINGLE ELECTROLYTIC CAPACITOR
CONNECTION VIA CONNECTOR

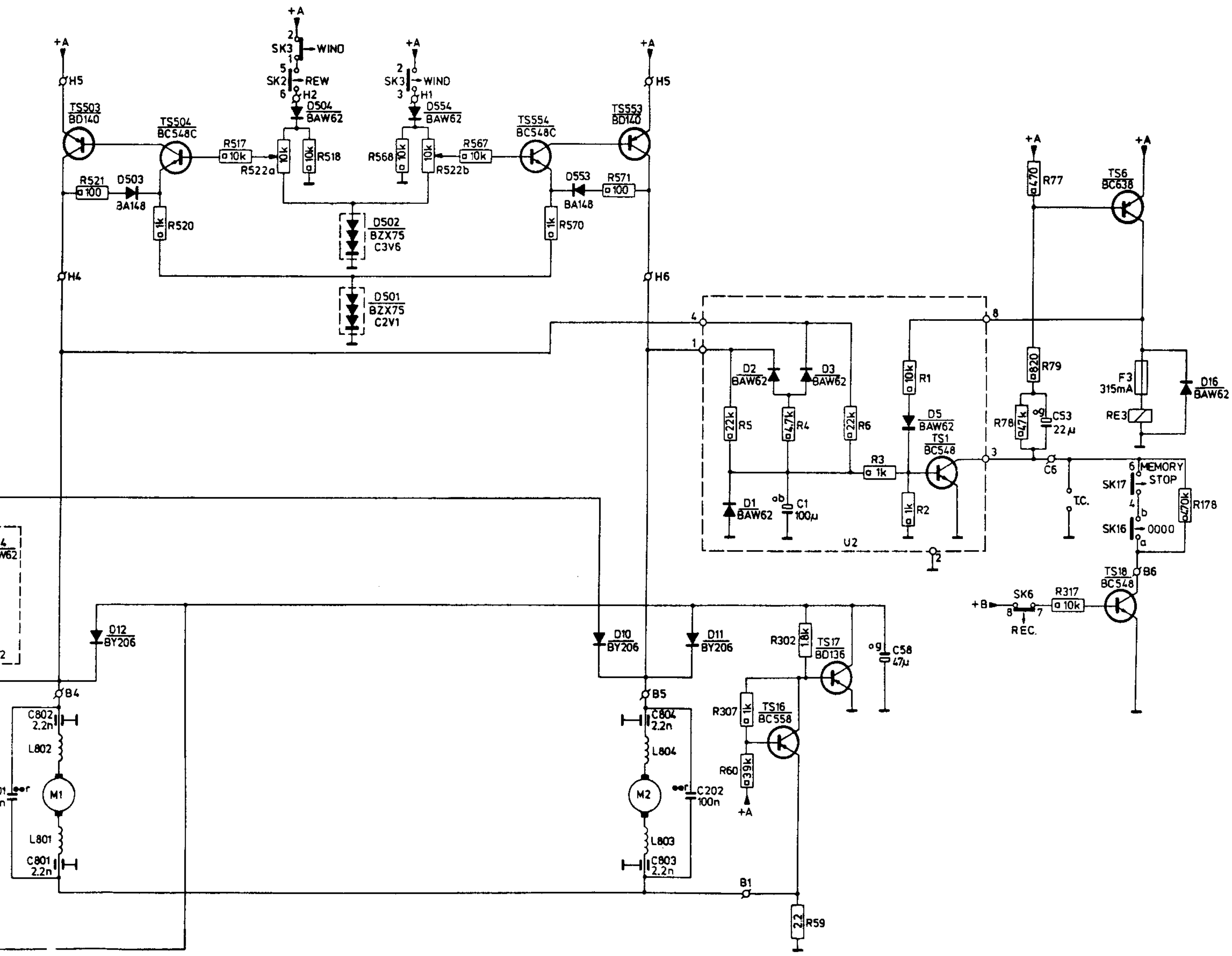
* e = 16V
f = 25V
r = 250V

A = 24.5V
B = 16V
C = 11V
D = 12.2V
E = 15V
F = 8.2V

10953C2

Fig. 24

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

⅛W ±5%
¼W ±5%
4W ±10%
POLYESTER FLAT FILM CAPACITOR
SINGLE ELECTROLYTIC CAPACITOR
CONNECTION VIA CONNECTOR

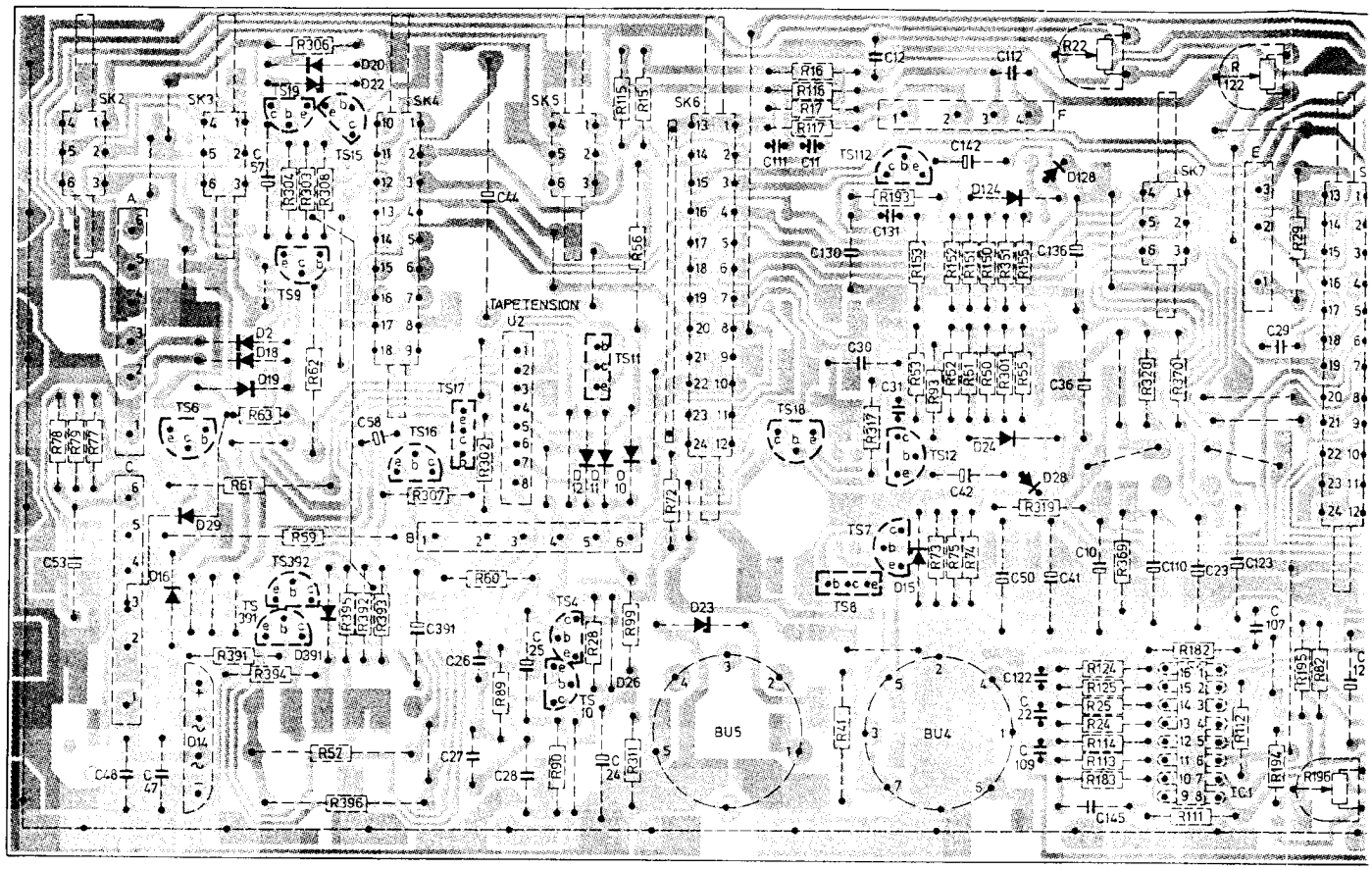
* b = 4V
f = 25V
g = 40V
h = 63V
j = 100V
r = 250V

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

Fig. 25

MISC.	SK2.D29.D16.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.TS112.D15.BU4.D124,24.D28.D128.SK7.IC1	SK8
C	53 48 47 57 58 391 44 24···28	111 11 130.30.12.131.31.42.142.112.50.122.22.109.41.10.136.36.145.110.23	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



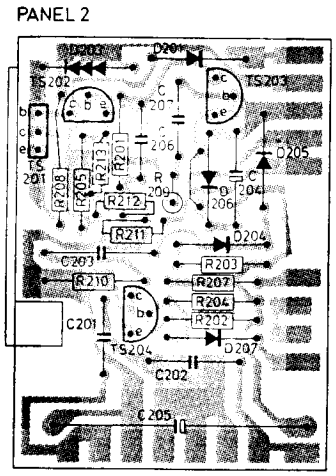
For Service Manuals Contact
MAURITRON TECHNICAL SERVICES
8 Cherry Tree Rd, Chinnor
Oxon OX9 4QY
Tel:- 01844-351694 Fax:- 01844-352554
Email:- enquiries@mauritron.co.uk

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	TS204	D201 D206 TS203 D204 D207 D205
C	203 201	206 207 205 202	204
R	208 205 201 210···213	209	203 207 204 202

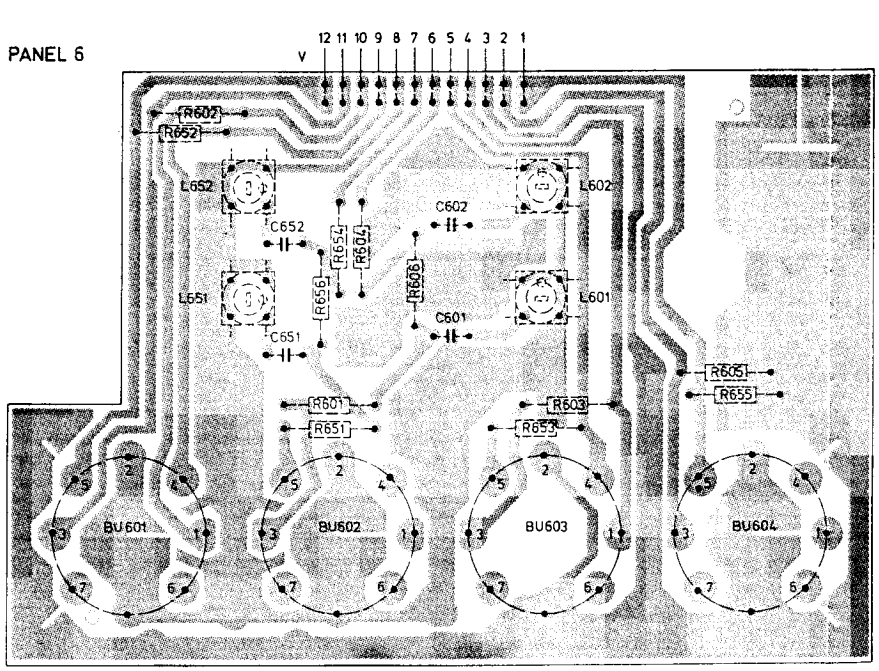
PANEL 2



10962B13

Fig. 27

PANEL 6



10965C13

Fig. 28

		SK8	SK9	D17	SK10
.TS9.TS19.D22.TS392.TS391.D391.SK4.TS15···TS17.SK5.TS10.TS11.TS4.	D10–D12.SK6.D23.BU5.TS18.TS7.TS8.TS12.TS112.D15.BU4.D124,24.D28.D128.SK7.IC1				
58 391 44 24···28	111 11 130.30.12.131.31.42.142.112.50.122.22.109.41.10.136.36.145.110.23 123.107.29	121	21 104	4	19.159.106.155.154.120.108.54.7.16–18.20.6.8.5
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···53.351.155.301.55.319.22.113.114.125.124.25.24.369.183.320.370.111.182.122.112.194.29.195.82.196.123.120.23.20.49.373.108.364.363.67···7				

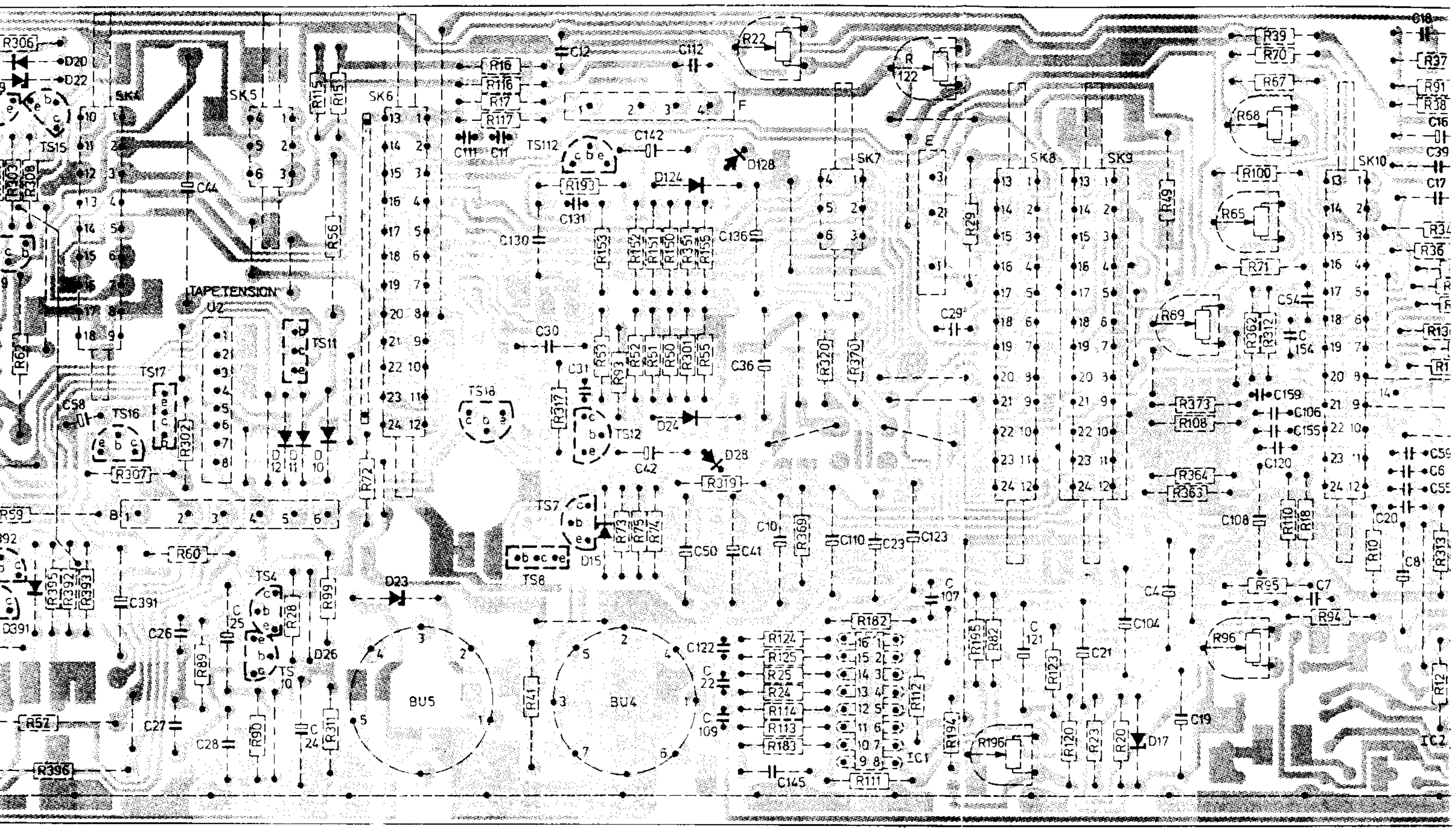
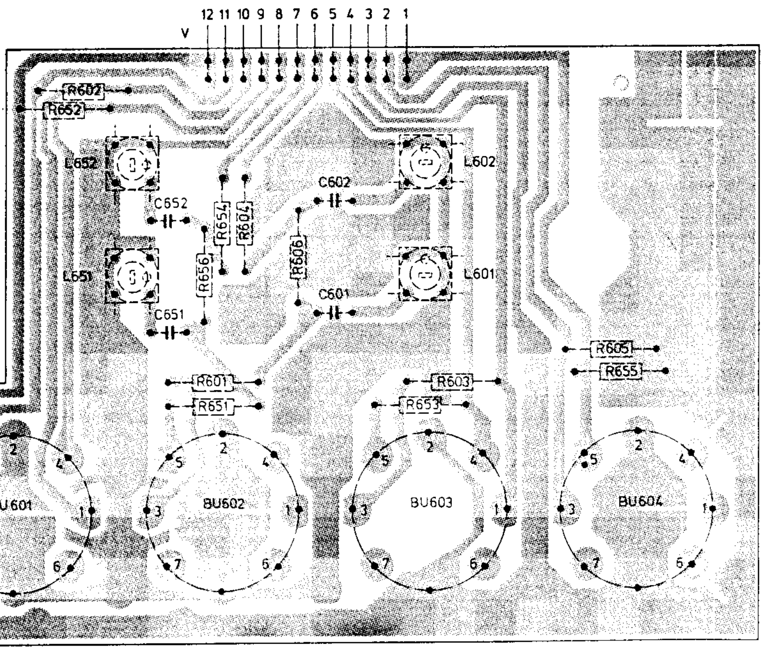


Fig. 26

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

PANEL 6

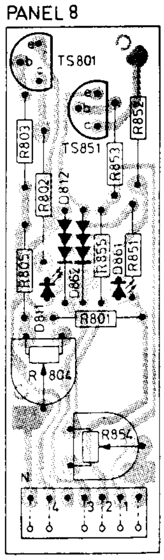


10955C13

Fig. 28

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

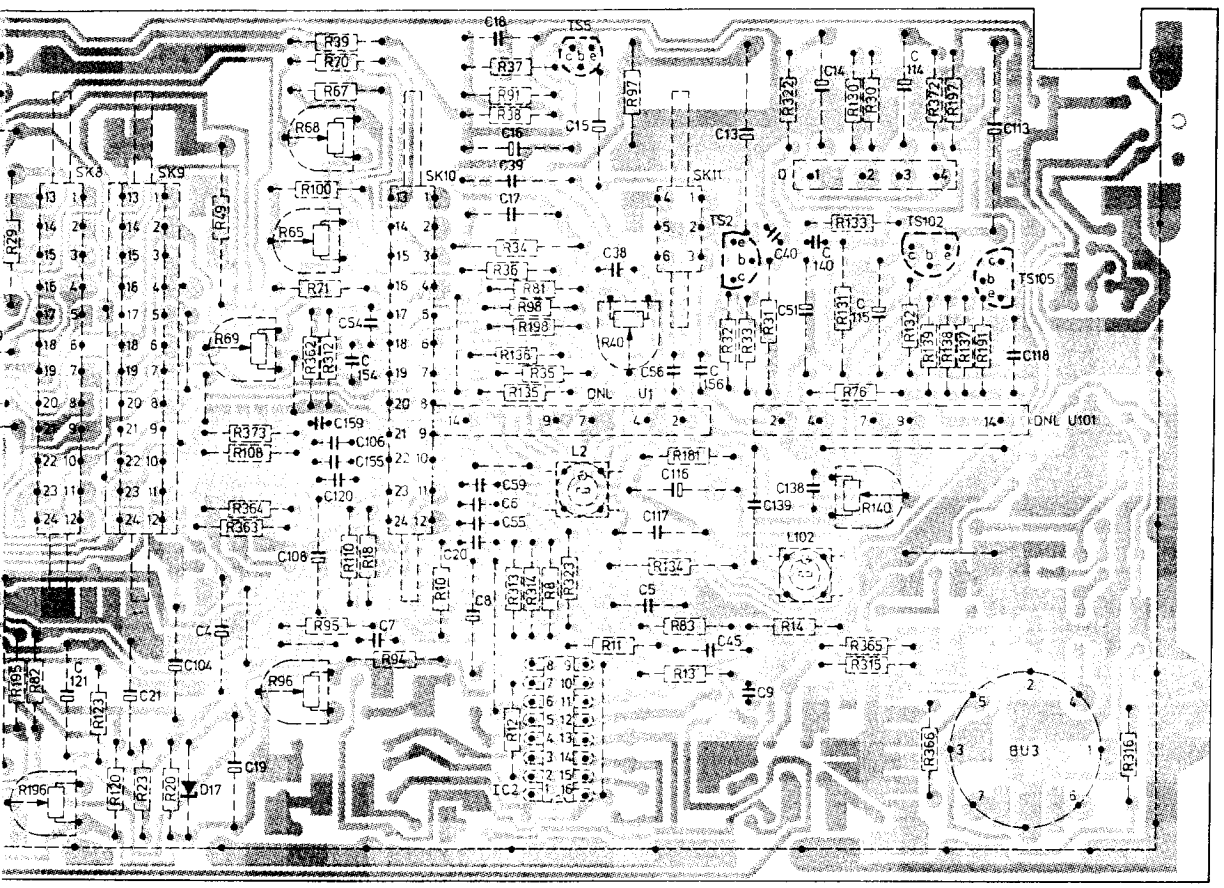
PANEL 8



10963B13

Fig. 29

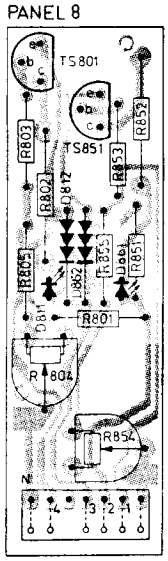
SK8	SK9	D17	SK10	IC2.TS5.L2	U1	SK11	TS2	L102	TS102	TS105	BU3 U101
121	21	104	4	19.159.106.155.154.120.108.54.7.16–18.20.6.8.55.59.39.15.38.5.117.56.116.156.9.45.13.139.40.138.14.140.51					113–115.	118	
4.369.183.320.370.111.182.122.112.194.29.195.82.196.123.120.23.20.49.373.108.364.363.67–71.94–96.100.65.39.362.312.110.18.10–14.91.81.98.198.30–38.8.323.313–316.97.40.181.83.322.130–140.											76.365.372.366.197.191



10968E13

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

PANEL 8

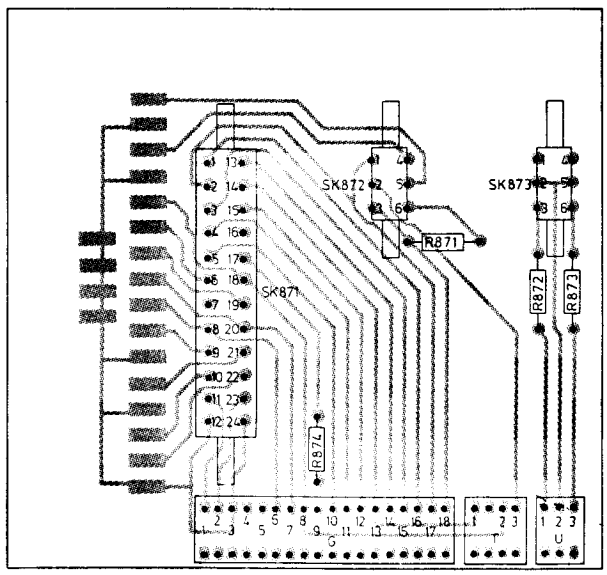


10963B13

Fig. 29

MISC.	SK871	SK872	SK873	
R	874	871	872	873

PANEL 87

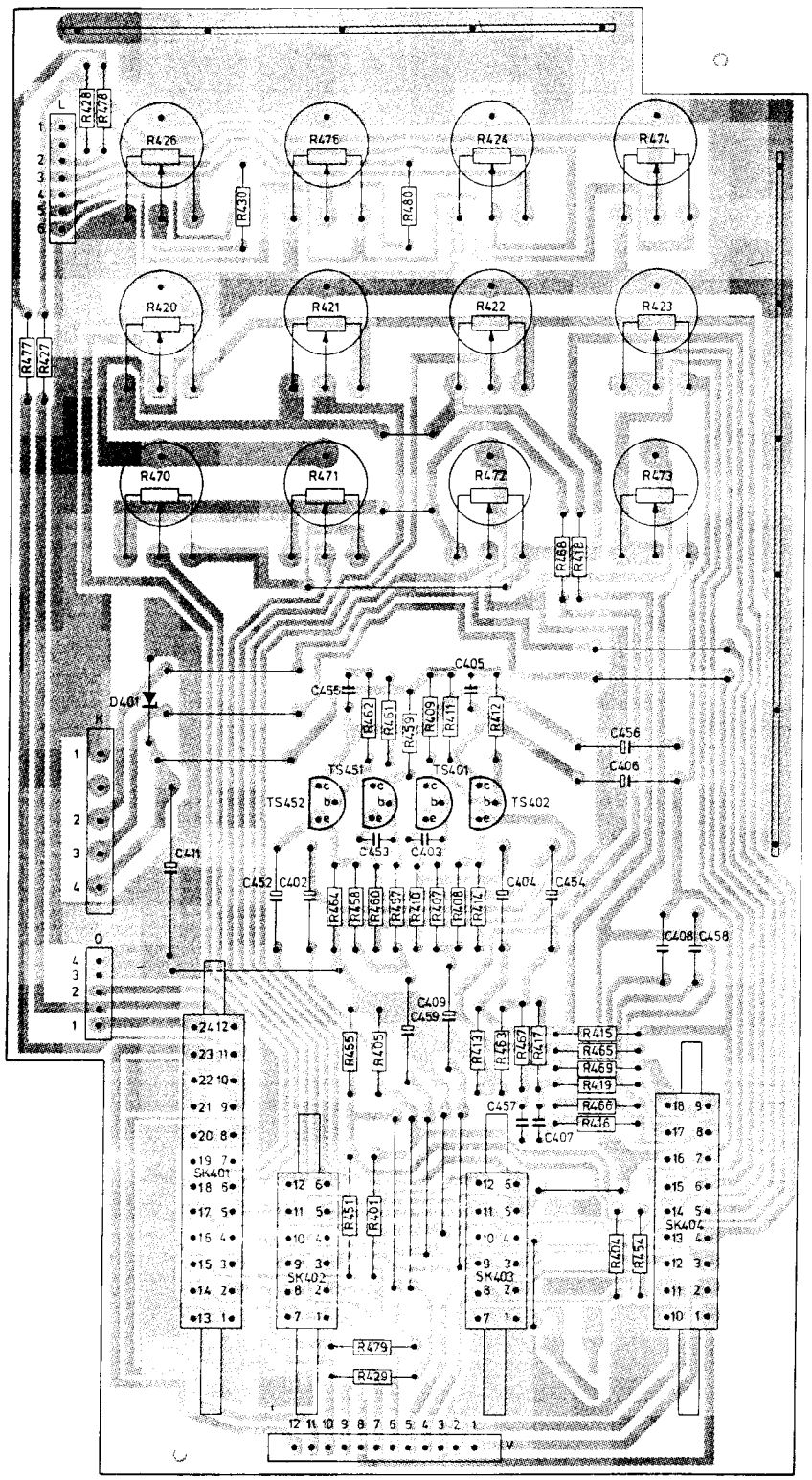


10993D13

Fig. 30

MISC.			D401		SK401	TS452 SK402	TS451			TS401	TS402 SK403		SK404				
C					411	452	402	455	453	403	409 459	405	457	404	454 407	456 406	408 458
R	477 427	428 478	426	420 470	430	476	421 471	455 451	405 401	480	479 429	424	422 472	407···419 457···469		474 473	423 454 404

PANEL 4

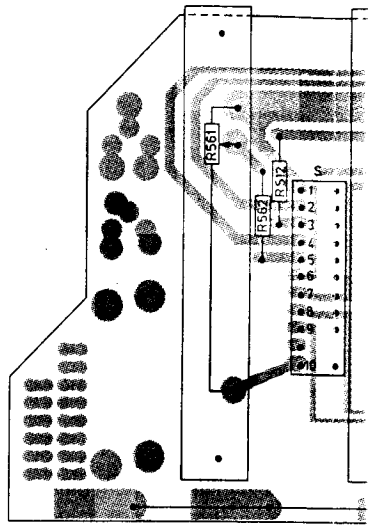


10967D13

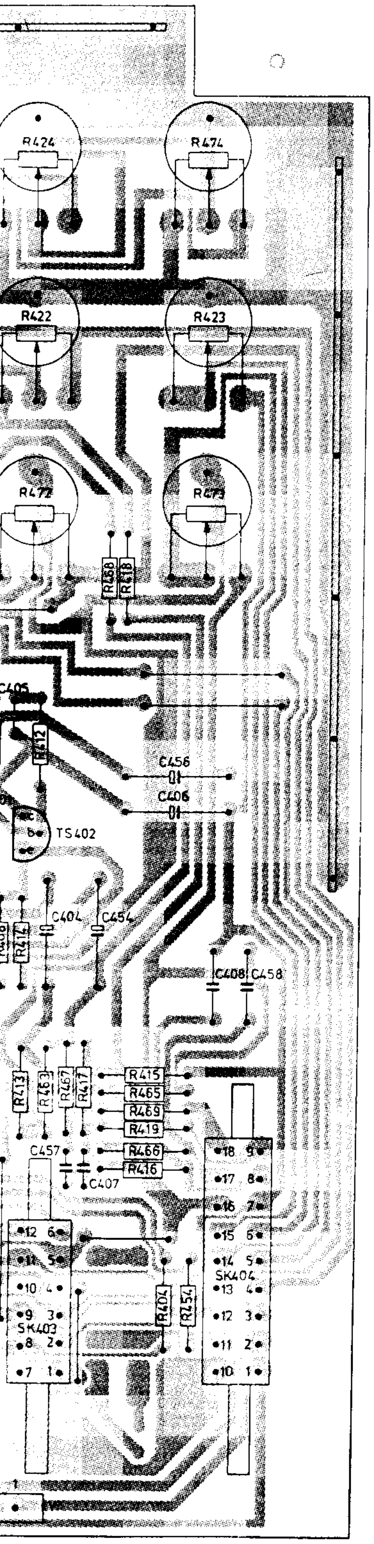
Fig. 31

MISC.	
C	
R	561 562 512

PANEL 5



1	TS402 SK403		SK404				
9 9	405 457 404	454 407		456 406		408 458	
	424 422 472	407···419 457···469		474 473	423	454 404	



10967D13

MISC.					SK504		TS501 TS502	TS551 TS552	SK503		
C				508 554		555 504	505 503 502	552 501 553	551		
R	561	562 512	511	525 560 527	559 509	510	501···508	551···558		563···566	529 579

PANEL 5

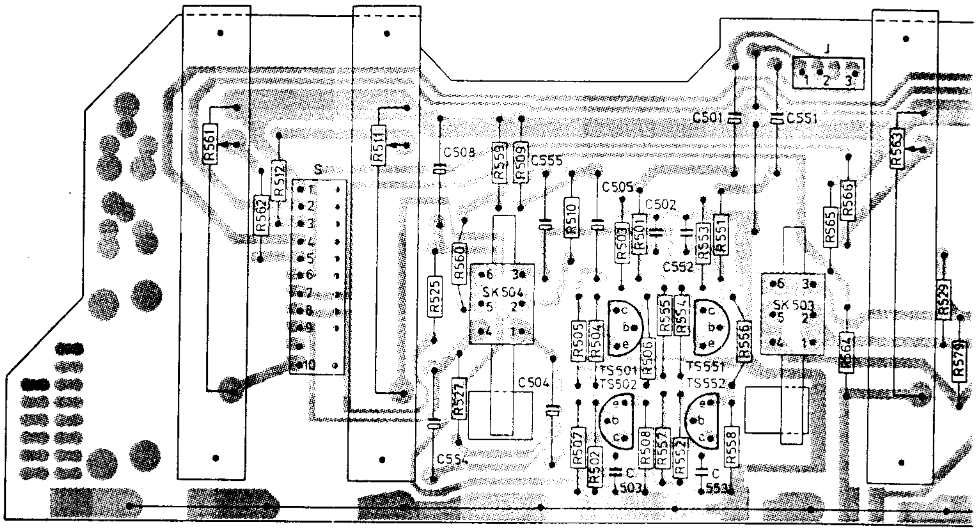
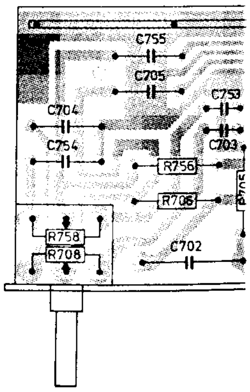


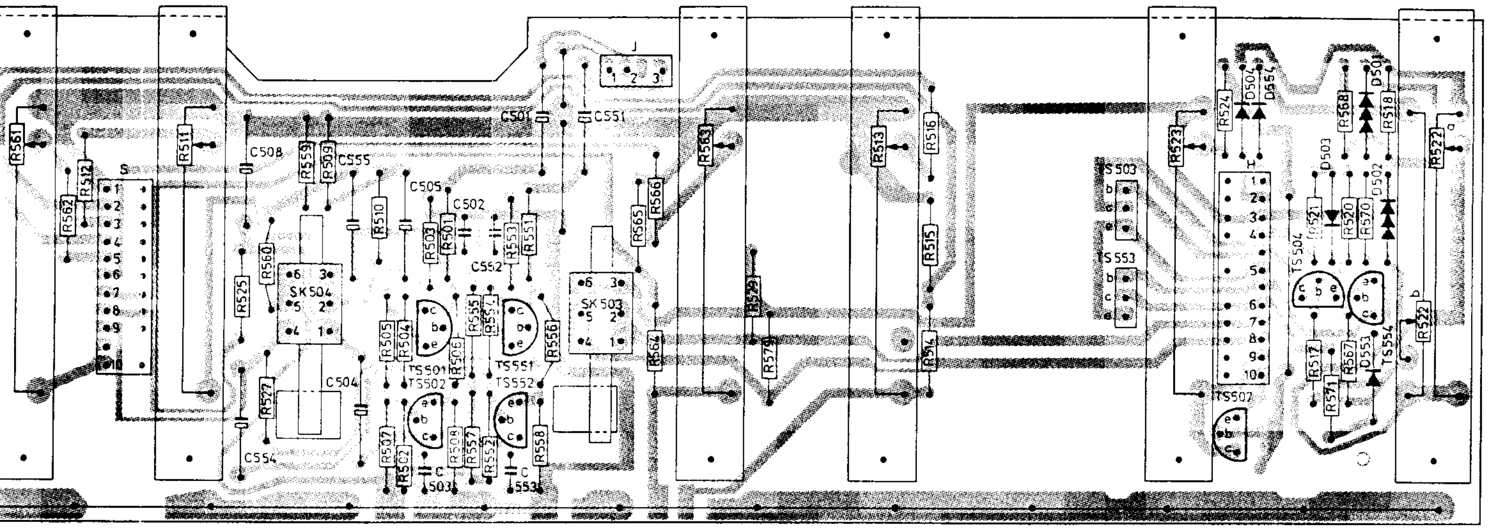
Fig. 32

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

PANEL 7



					SK504		TS501 TS502	TS551 TS552	SK503				TS503 TS553		D504 D554 TS507	D503 D501 D502 TS504 D553 TS554
				508 554		555 504	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

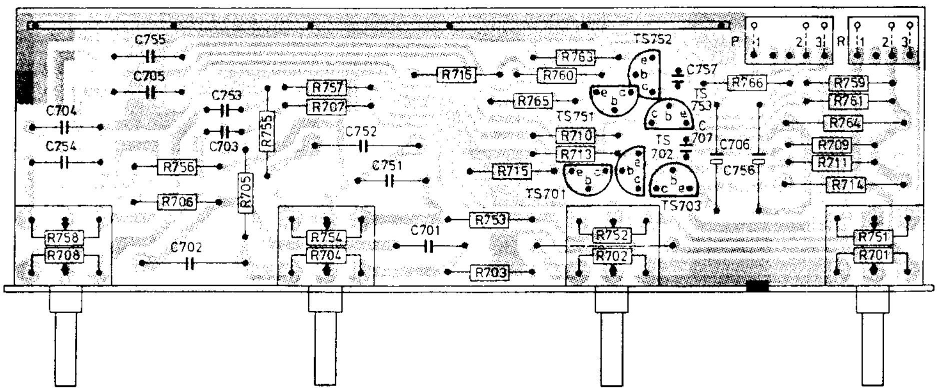


10966D13

Fig. 32

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

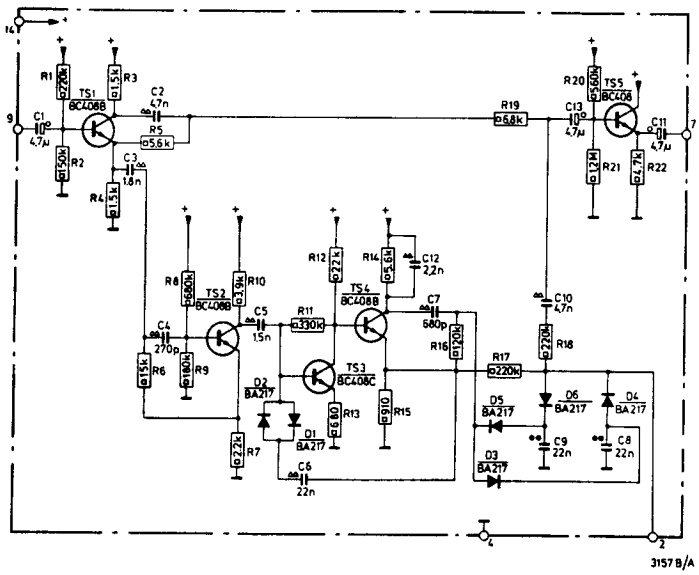


Fig. 34

MISC.	TS1	TS2			D1	TS3	D2		TS5.4			D3···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

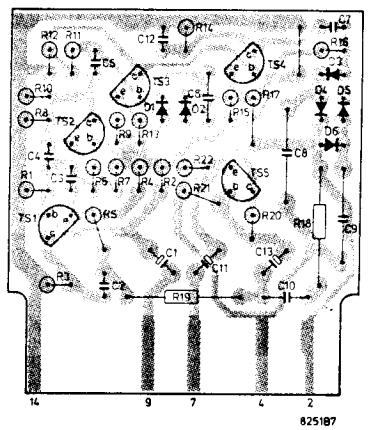


Fig. 35

U2	Tape tension/protection UNIT	4822 214 30399

1 - M2
2 - ⊥
3 - T.C., SK17
4 - M1
5 - M1
6 - SK13
7 - R56, R57, R396
8 - F3, TS6

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

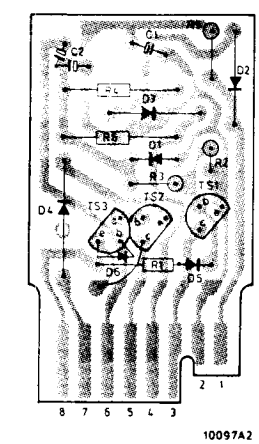


Fig. 36