

Dual

C 919

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Service - Manual

Dual Gebrüder Steidinger · 7742 St. Georgen/Schwarzwald

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Technical Data	
The Dual C 919 meets or surpasses the requirements of DIN (German Industry Standard) 45 500 for HiFi home studio equipment. The values stated below are based on the latest DIN reference tapes.	
Tapes Speed	4.75 cm/s
Deviation from correct speed	$< \pm 1 \%$
Wow	
W.R.M.S.	$< \pm 0.07 \%$
According to DIN only playback	$< \pm 0.10 \%$
According to DIN record/ playback	$< \pm 0.14 \%$
Frequency response	(as referred to DIN tolerances)
Fe tape	20 - 15.000 Hz
CrO ₂ tape	20 - 16.000 Hz
FeCr tape	20 - 17.000 Hz
Harmonic distortion	
K3 at 333 Hz (related to 0 dB VU)	
Fe tape	$< 1.7 \%$
CrO ₂ tape	$< 2.8 \%$
FeCr tape	$< 1.2 \%$
Rumble weighted signal-to-noise rate	
	with Dolby without Dolby
Fe	> 60 dB > 53 dB
CrO ₂	> 61 dB > 56 dB
FeCr	> 63 dB > 58 dB
Channel separation at 1.000 Hz	
between stereo channels	> 36 dB
in opposite direction	> 70 dB
Erase at 1.000 Hz	
Fe	> 70 dB
CrO ₂	> 65 dB
Oscillator frequency (push-pull oscillator)	100 kHz
Inputs	
Microphone (1/4 inch coax. jack)	(sensitivity for 0 dB VU)
Receiver/Amplifier (DIN jack)	0.22 mV/3.3 kOhm
Receiver/Amplifier (RCA jack)	1.4 mV/20 kOhm 45 mV/680 kOhm
Outputs	
Receiver/Amplifier (DIN jack)	750 mV/3.3 kOhm
Receiver/Amplifier (RCA jack)	0 - 750 mV/4.7 kOhm
controllable	
Headphones (1/4 in. coax. jack)	4 - 2000 Ohm
volume controlled	
Fast-wind time for C 60 cassette	< 60 sec.
Complement	
2 ICs	
33 transistors	
19 diodes	
Line voltages	110 - 125 V/220 - 240 V
Line frequency	adaptable to 50 or 60 Hz
Power consumption	approx 35 W

Mechanical Part

General

When repairing mechanical parts of the Dual C 919 HiFi cassette deck it is recommended to unhinge the basic printed circuit board (330) and to turn it to the electronic section. This operation is not mentioned in the subsequent chapters of the service instructions since it is required for any manipulation inside the unit. This also applies to the removal or mounting the screening plates. When completing or swivelling the basic printed circuit board make sure that the fork (211) is located in the center of the recesses for the key plungers (keys in neutral position). The number mentioned in the subsequent chapters are identical with the position numbers in the spare parts list and the exploded views.

1. Removal of cover plate

First remove the following parts

- 1.1 Four slide knobs (21)
 - 1.2 Two pins (18)
 - 1.3 Cassette window (17) - First open cassette compartment. Then remove window (17) by lifting it to the rear and pushing it forward.
 - 1.4 Two hexagon self-tapping screws (10).
- Flip up VU meter (300). Push cover (11) backwards, lift it and remove it (Fig. 1). Reassemble in reverse order and mount pins (16) finally.

2. Dismounting and mounting

Pull out power plug. Remove mounting plate (13) from the bottom of the cabinet. Release strainrelief of power cable by removing the securing wedge (Fig. 2). After detaching the cover (11) undo the four machine screws (12). Remove unit from the cabinet. When mounting proceed in reverse order.

3. Motor

When the motor (252) is changed first of all disconnect the stranded connecting wires from the connection plate (214). As an aid screw a M 3-screw (S) - e.g. M 3 x 15 - into the hole provided in the plate. Using tweezers and a small wire hook carefully detach the two belts from the drive pulley (240):

- a) Place round belt (262) on the bearing bolt (L) Fig. 3)
 - b) Place flat belt (232) on the screw (S)
- Undo hex nuts (241) and remove motor (252). Do not loose the two washers (242).

Fig. 1

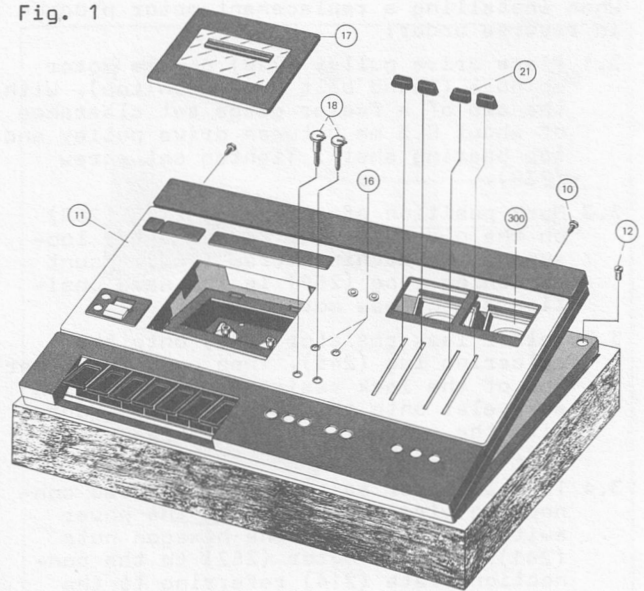


Fig. 2

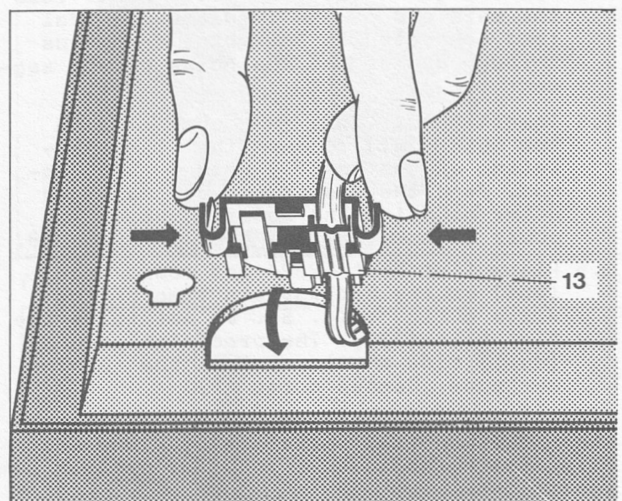
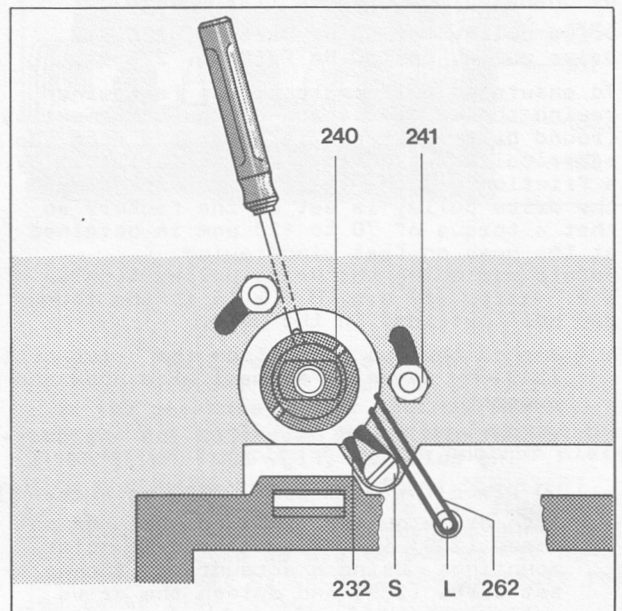


Fig. 3



When installing a replacement motor proceed in reverse order:

- 3.1 Place drive pulley (240) on the motor spindle (Round belt recess on top). With the aid of a feeler gauge set clearance of about 0.3 mm between drive pulley and top bearing shell. Tighten set screw (239).
- 3.2 Mark position of screening ring (268) on the old motor and remove after loosening the machine screw (267). Mount screening ring (268) in the same position of the new motor.
- 3.3 Solder leak resistor (243) onto the soldering lug (246). Then push the other end of the leak resistor provided with an eyelet onto the motor mounting opposite the soldering lug. Put washers (242) onto the free motor mountings.
- 3.4 Install motor so that the stranded connecting wires are opposite the power switch. Then secure the hexagon nuts (241). Connect motor (252) to the connection plate (214) referring to the connection diagram (Fig. 18).

No. 129 001 and subsequent Nos.

- 3.3 Place segment (242) on motor post. Lead the bare end of the insulated control lead connected to the motor downwards through one of the two holes of the segment (242).
- 3.4 Insert motor (252) and mount it with hex nuts (241). Ensure that the insulation of the control head is not jammed. Bend the end of the control lead after mounting the motor. Connect to power switch (200) as shown in Fig. 18.
- 3.5 Place flat belt (232) and round belt (262) on the appropriate step of the drive pulley (Fig. 5). Do not twist the flat belt (232). The precision ground (dull) side should contact the running surfaces. Remove screw (S).

Attention: To counteract hum noises along a tapered motor mounting holes are provided which allow the motor to be turned for optimum hum conditions.

4. Adaptation for line frequency

Adaptation to another line frequency is done by changing the drive pulley (240).

Drive pulley for 50 Hz Part No. 226 812
Drive pulley for 60 Hz Part No. 226 813

To ensure an uniform torque on fast wind/rewind the upper section of the drive pulley (round belt recesses) is separated from the spherical drive pulley for the flat belt by a friction clutch. The clutch friction of the drive pulley is set by the factory so that a torque of 70 to 120 pcm is obtained at the nose on fast wind/rewind.

Before replacing the drive pulley tighten a M 3-screw (S) e.g. M 3 x 15 in the threaded hole provided in the hole.

- 4.1 Remove the two belts from the drive pulley (240) by means of a small wire hook and tweezers:
 - a) Put the round belt (262) on the bearing bolt (L) (Fig. 3).
 - b) Place the flat belt (232) on screw (S).
- 4.2 Turn drive pulley (240) so that the set screw (239) is between the rear motor mountings. Using a screwdriver loosen set screw (239) and detach the drive pulley upwards.

- 4.3 Place new drive pulley (round belt recess on top) on the motor spindle. With a feeler gauge set a clearance of approx. 0.3 mm between drive pulley and top bearing shell (247) (unit in normal position). Tighten set screw (239).

- 4.4 Fit flat belt (232) and round belt (262) on the appropriate step of the drive pulley (Fig. 5). Note - Do not twist the flat belt. The dull finish side should contact the running surfaces. Remove screw (S).

5. Drive belts

It is very easy to replace the counter belts. To change defective counter belts proceed as follows:

Stand unit up. Remove the three machine screws (238) and the soldering lug (237). Remove bottom plate (236). Withdraw flywheel (235) from the bearing bush. Slightly push angle (271) outwards, if necessary.

Attention! The polythene washer (175) on the top of the unit will drop out. Detach main belt (flat belt 232) and counter belt (round belt 262). Install new belts in the following sequence:

Insert flat belt (232) with the dull finish

Fig. 4

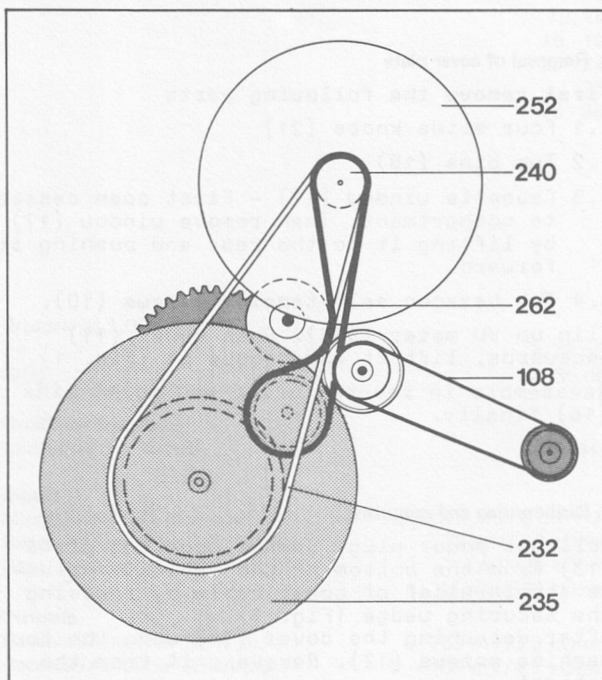
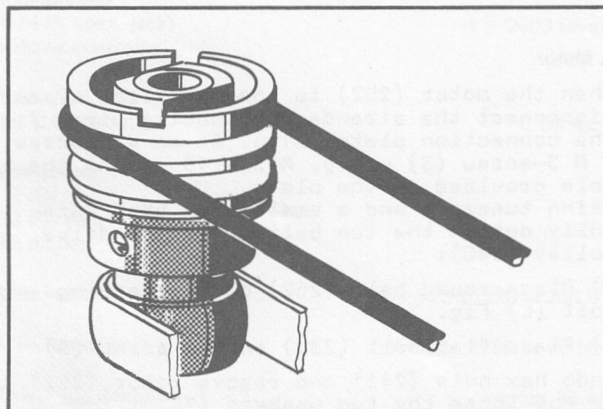


Fig. 5



inside, then fit the round belt (262) on the corresponding steps (Fig. 5) of the drive pulley (240). Route round belt (262) in accordance with the routing plan (Fig. 4) and fit it on the coupling (256). Pass flat belt (232) over the axle of the flywheel (235). Ensure that the flat belt is not twisted. Insert flywheel (235) into the bearing bush. Using a small wire hook place the flat belt on the running surface of the flywheel, then fully insert flywheel (235). Install lower mounting plate (236) with the three machine screws (238). Do not forget soldering lug (237). Bring unit into its normal position and fit polythene washer (175) on the flywheel axle.

6. Wow

Measure with a wow meter (e. g. Woelke ME 101 or ME 104 or Franz EMT 420 A) and wow test cassette 3150 Hz.

Setting of test instrument:

3 % measuring range, weighted.

Attention! To avoid incorrect measurements cause by jamming tape travel, it is recommended to operate forward and reverse wind with the test cassette inserted.

Typical values for reproduction with C 919 Dual Cassette Deck:

$\pm 0.08 - 0.12 \%$

Individual higher deflections should not be weighted because they are the result of bad tape/head contact caused by tape deterioration, dust or felt particles.

If necessary, check the following points or replace parts:

- Clean pressure roller and capstan
- Check pressure roller for free movement
- The take-up moment, adjusted on the coupling, should be 55 ± 10 pcm. A slightly fluctuating value does not have any effect on wow. Simultaneously, the supply moment should be 2 - 6 pcm. Higher values and fluctuations are the result of a defective bearing of the L/H winding gear (234) or memory counter (106).
- Replace flat belt
- Replace flywheel

7. Pressure Roller Lever

Remove pressure roller lever after detaching cover (11) as follows:

Open cassette compartment and remove blind (136). Then detach V-spring (162) (mark its mounting position). Remove machine screw (156) and bracket joint (157). After loosening safety washer (161) remove pressure roller lever (163) and V-spring (162). For reinstallation proceed in reverse order. Ensure that the V-spring (162) is mounted in its correct position.

Fig. 6

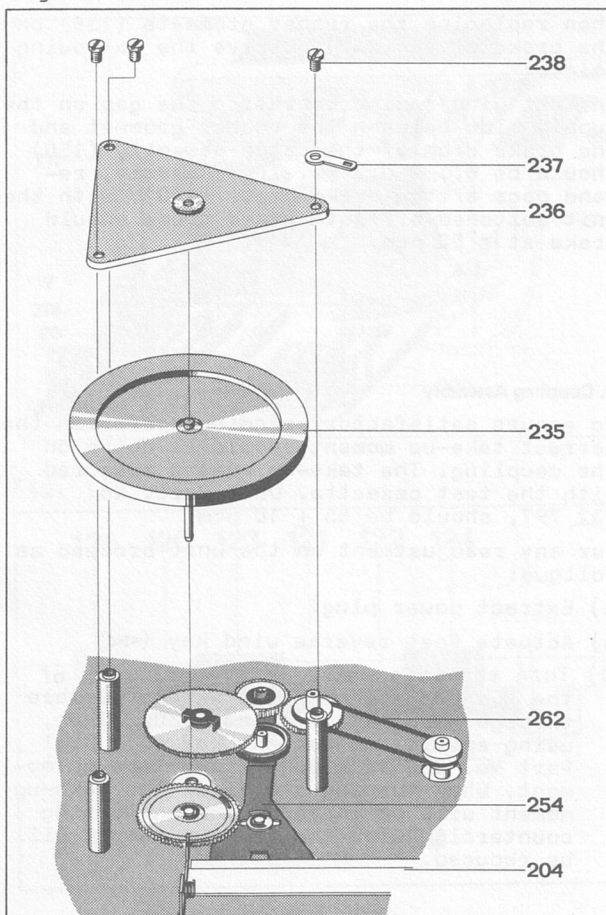
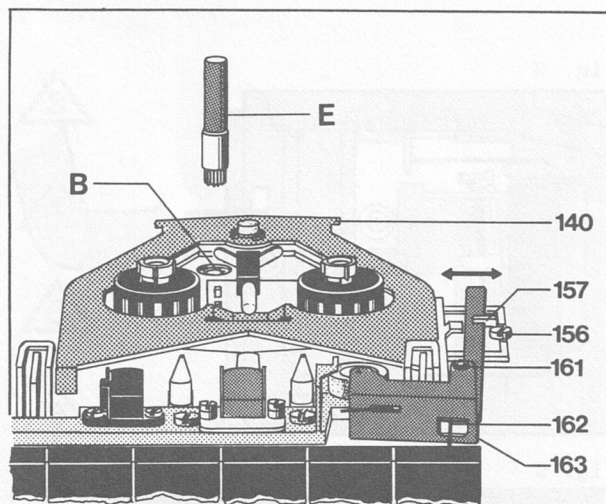


Fig. 7



With the PAUSE key released (unit in operating position) the V-spring (162) should push the pressure roller against the capstan (350 ± 50 p). If necessary, adjust by hanging the V-spring (162) in another place.

With the PAUSE key engaged and the START key (172) fully depressed to the stop the distance between the capstan and the pressure roller should be 0.3 to 0.8 mm. If necessary, adjust by bending the pressure roller lever (163) (Fig. 7).

8. Brake Plate

When replacing the rubber grommets (138) on the brake plate (140) observe the following points:

On fast wind/rewind operation the gap on the supply side between the rubber grommet and the brake drum of the catch assembly (150) should be 0.1 - 0.2 mm. If necessary, re-bend dogs of the brake plate (140). With the unit switched off both brake drums should brake at ≥ 50 pcm.

9. Coupling Assembly

To ensure satisfactory winding operation the correct take-up moment should be noted on the coupling. The take-up moment measured with the test cassette, Dual Part. No. 232 797, should be 55 ± 10 pcm.

For any readjustment on the unit proceed as follows:

- Extract power plug!
- Actuate fast reverse wind key ($\leftarrow$)
- Turn the left catch (150) until one of the two adjustment holes become visible through hole (B) of blind (136). Then, using special adjustment key (E), Dual Part No. 230 933, adjust the take-up moment. When turning clockwise the take-up moment will be increased, when turning counterclockwise the take-up moment will be reduced.

Fig. 8

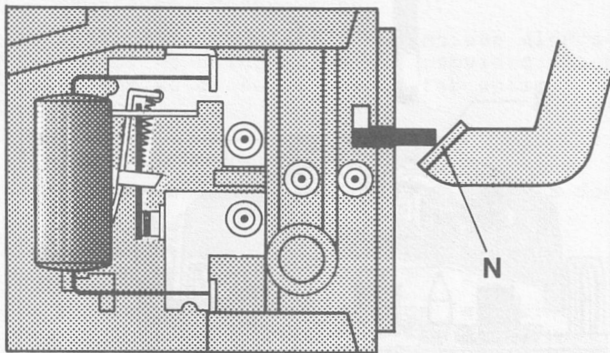
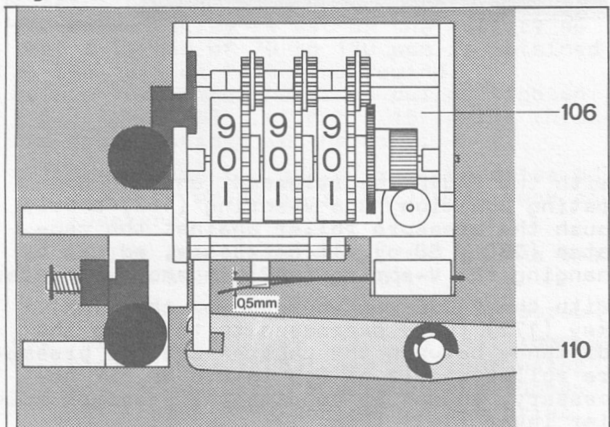


Fig. 9



10. Muting Switch

The muting switch (279) is already adjusted for the correct gap between its contacts. It is used to prevent interference noise and performs the following functions:

- With open flap (204) or rotating muting switch wheel (260) the muting switch contacts (K) short both channels of the output amplifier.
- On fast wind/reverse operation both channels are also shorted against ground via contact (K 1) and main lever (254).
- With PAUSE key engaged or head mounting plate set back (in neutral position or record position) the parallel contacts (P) short point XII-3 against ground thus avoiding reaction of the limit switch.

Use "Kontakt 60" or similar cleaning agent if contact is poor.

11. Power Switch

The power switch must safely switch in all positions.

Check as follows:

When pressing the record key the power switch should operate about 1 mm before the key lever engages the flap (204). If necessary, readjust by bending dog (N) of the head mounting plate (Fig. 8).

12. Memory Switch

With the memory switch in neutral position (unit switched off or fast forward wind/reverse operation) the gap between contacts should be 0.5 mm (Fig. 9) minimum. Contact should be made if the memory switch is operated with the counter in "000" position. Adjust by bending the contact. When the START key (172) is pressed, the memory switch is out of operation. The contact should be lifted by the switch lever (110) by 1 mm minimum.

13. Bowden Cable

For repair of the Bowden cable (372) or its replacement the basic plate (330) shall be pulled up by 90°. When installing the Bowden cable, first the steel core should be fitted on S 4 (Fe-Switch). Then mount adjustable angle piece (SW) on the key board (365). Now fit clamp (374) on the other end of the Bowden cable and attach it on the S 3 switch. Mount angle piece (W) on the frame of the basic plate (330) (Fig. 10).

Adjust as follows:

Tighten angle piece (SW) so that, with the FE key in neutral position, the slide switch (S 3) is pushed against its outer detent by the compression spring. When actuating FE key the slide control S 3 must be pushed against its inner detent by its compression spring.

After assembling or fitting the screening plate mount the Bowden cable in such a manner that it does not touch the motor. The minimum distance should be 2 mm.

14. Record / Playback Head / Erase Head

The Record/playback head (123) is already adjusted in the factory. Both machine screws (120) are secured by enamel. The replacement heads - head unit (119), is preadjusted and should only be adjusted as described in the "Electrical Section".

However, should it be necessary to detach the record/playback head from the head mounting plate observe the following adjustment instructions when reinstalling: Place record/playback head (123) together with leaf spring (125) on the head mounting plate (121) then mount using bushes (121) and machine screws (120) so that the tape guides (B) are in alignment with the tape guides (B₁) of the head mounting plate and of the erase head (B₂) (Fig. 11). The final adjustment is described in the "Electrical Section".

15. Cleaning

Always clean unit when servicing or repairing it.

For proper function of the unit the record/playback head (123), the erase head (124), the pressure roller (163), and the capstan must always be perfectly clean.

The parts are best cleaned with a linen cloth or cotton wool tip soaked in methylated spirit. Cleaning cassettes available from dealers as special accessory are also recommended.

Never use metal objects. The surface of the head should never be touched with the bare hands.

16. Lubrication

All bearings and sliding points of the unit are adequately lubricated at the works. Relubrication is normally not necessary for several years since the most important bearing points are provided with oil retainers.

Bearings and sliding points should be lubricated sparingly rather than generously. It is important that no form of oil or grease reaches the rubber surfaces and rubber belts as otherwise they will be destroyed. For the same reason these parts should not be touched unnecessarily.

Chemical decomposition frequently takes place when lubricants of different types are used.

To prevent lubrication failure we recommend the following original lubricants for lubrication purposes:

Fig. 10

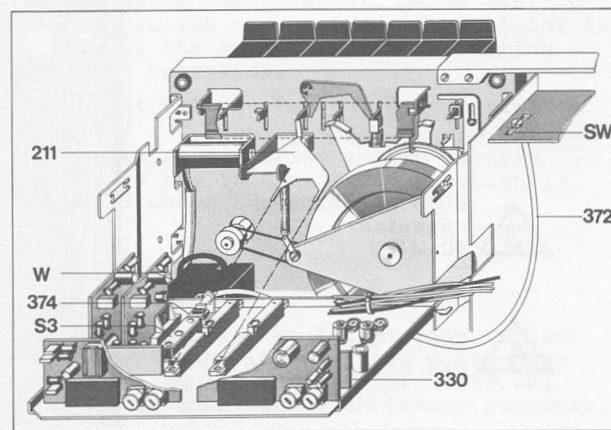
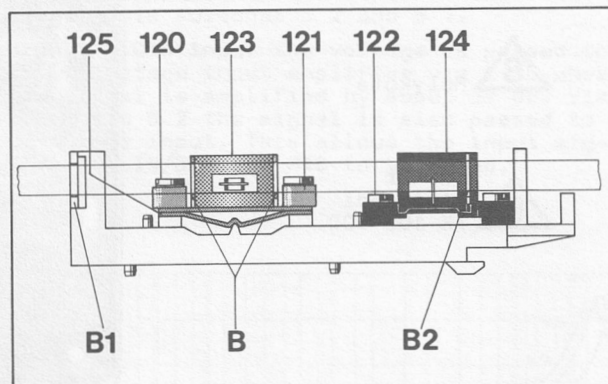


Fig. 11



BP Super Viscostatik 10 W/30



Shell Alvania No. 2



Isoflex PDP 40



Molykote



Wacker Silicon oil AK 100 000

Fig. 12

3 BP Super Vis-
costatik
10 W/30

4 Shell Alva-
nia Nr. 2

5 Isoflex
PDP 40

8 Molykote

9. Wacker
Siliconöl
AK 100 000

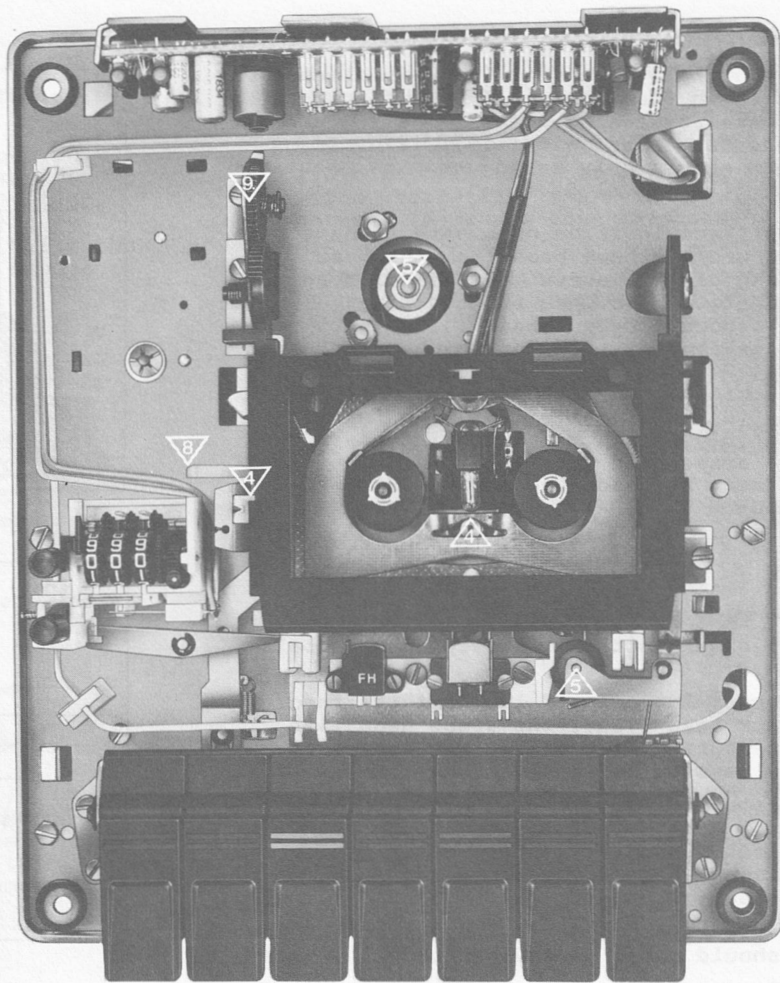
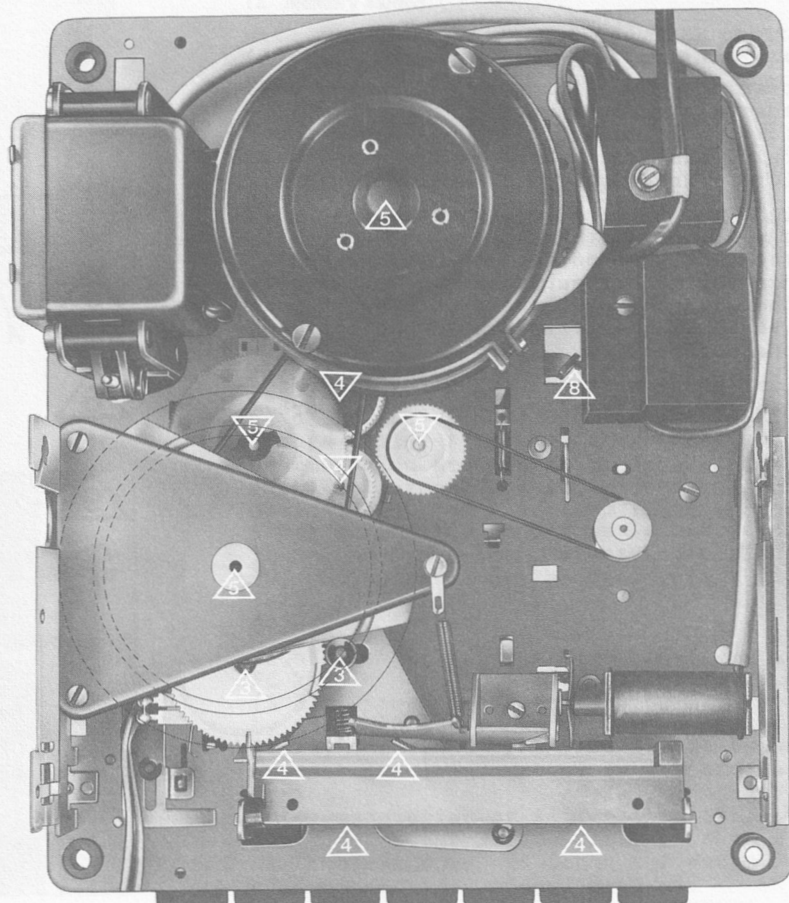


Fig. 13



Electrical Part

Functions

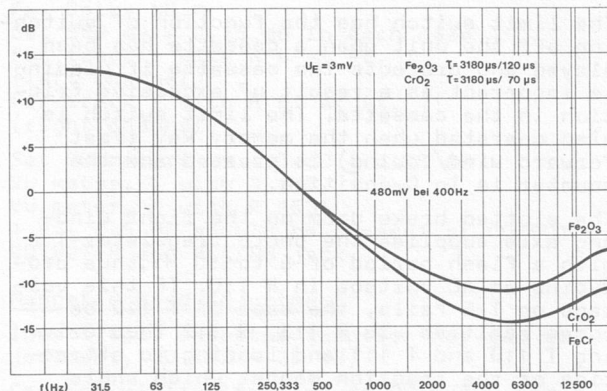
Functions are described for one channel only with the exception of assemblies with common functions for both channels.

Reproduction

The combined 2/4 track recording/reproduction head has 2 active systems having an effective track width of 0.6 mm. This requires maximum care in the design of mechanical tape guide, azimuth and electrical alignment. With a tape reference level of 250 nWb/m at 333 Hz the head supplies a voltage of approx. 300 μ V. For the two-stage discrete design amplifier high standards are set with respect to the signal-to-noise ratio. Particularly, transistor T 40 and resistor R 42 should have minimum noise values.

The frequency response for the appropriate type of tape is determined by a feedback network between collector T 41 and emitter T 40. During playback the frequency response is as shown in Fig. 14.

Fig. 14



Tape changeover switch S 3 carries out correction for CrO₂ tapes in the treble range, this corresponding to the increased high frequency response of these tapes. Amplification of the reproduction amplifier is approximately 44 dB at 400 Hz during playback. The amplified signal is passed to the playback level controls R 6, R 6' where the exact level is set, this being particularly important for satisfactory Dolby function. The signal is passed to the integrated Dolby unit via the record/playback switch S 2 - S 1.

The voltage is amplified by 580 mV (Dolby level, 200 nWb/m) by the integrated circuit. The 400 Hz signal is decoupled via C 80 and passed via capacitor C 100 to the output amplifier which amplifies the voltage by about 2.7 V. R 150 is used to control the voltage of cynch outputs. As during recording the output amplifier is also in operation, the output signal is passed to the DIN-output jacks via switch S 2 only during playback.

This is intended to prevent cross coupling through cable capacitances, jacks etc. To suppress switch noises the output signal is shorted by the muting switch (K) during switching operation.

The output voltage for the Dolby level is approx. / 1 V. During playback and recording the meter amplifier and the record level meters are in operation. Function is described under "Recording".

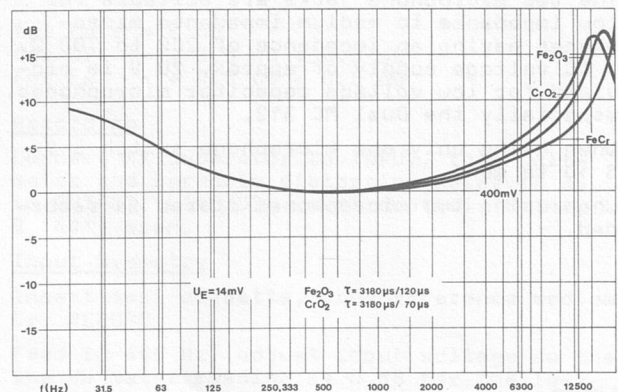
Recording

The signal applied at the microphone jack is passed to the input of the microphone amplifier (amplification approx. 56 dB) where it is amplified with linear response.

Decoupling is accomplished via C 22. R 140 is used to control the recording signal which is applied to the input of the Dolby circuit via switches S 2 and S 1.

From the DIN input the voltage is passed to the two-stage input amplifier via C 30 where the signal is amplified by about 37 dB. Via R 144 and S 2 the signal is also passed to the Dolby input. This allows the input signals of LIN/DIN and MIC to be mixed.

Fig. 15



Now the signal is passed through the Dolby IC and is decoupled at C 80 and then applied to the recording amplifier via the tape selector switches S 3 and S 6. The signal, which has a value of 580 mV at C 80 to produce the Dolby level (400 Hz) is a function of the frequency as shown in the following diagram.

The signal is passed to the combined recording/playback head via T 60, C 63, AF current controls R 5, R 5' and RF wave trap L 1, C 8. Here the RF recording current can be adjusted separately for each track. This current induces a certain magnetic field strength in the head gap which modulates the magnetic tape accordingly.

To determine the optimum high frequency operating point the RF generator supplied supplies a sinusoidal frequency with low distortion via capacitor C 117. The RF voltage is adjusted for linear overall frequency response (CrO₂ tape) with controls R 119 and R 119'. The RF generator supplies on the one hand the voltage for the recording head (biasing) which can be switched over with switches S 3, S 6. On the other hand the erase head are supplied with an erase voltage of about 26 V when using a CrO₂ tape.

The RF generator operates on the push-pull principle whereby the feedback energy is passed back in each case from the collector to the adjacent base. The capacitor C 115 forms a parallel resonance circuit with the tunable inductance of the capcore transformer. The inductance detuning permits a frequency change of 85 - 120 kHz. A change in the RF by a maximum of 10 kHz might be possible in individual cases if recordings are being made from AM stations whose transmission frequency with the RF voltage cases beat-note whistling in the audible range.

When the RF is changed the RF wave trap L 1, C 8 must, however, be readjusted for maximum blocking effect. The supply voltage is passed to the RF generator via AW switch S 2. Simultaneously, on recording the signal which is also applied to the output amplifier is rectified via R 151 and diode 140 and indicated on the VU meter. Calibration is made by R 153. The recording functions described above represent the simplest recording mode:
Input DIN jack or MIC jack, manual recording level control without Dolby circuit.

Microphone Recording

The two microphone jacks are switcheable for low impedance to medium impedance microphones having an impedance of 200 to 700 Ω . A DC voltage supply of approx. 20 V is provided for low voltage capacitor microphones, especially the Dual MC 312.

When using only one microphone switch S 9, S 10 to mono.

When using two microphones stereo is recorded.

Limiter

The control signal for the limiter is supplied by R 151 (output amplifier) and rectified by D 91/D 92. R 90 determines the operating point of the limiter. Depending on the quantity of the DC voltage on D 91 the differential resistance of T 91 (Collector - Emitter) changes which is parallel to R 143 and together with R 141/R 142 forms a voltage divider. This limits the signal at the Dolby input with low distortion. The time of decay is a function of C 90 and C 91 and is 3 - 5 seconds. The limiter can be switched off with S 8.

Dolby Noise Suppression

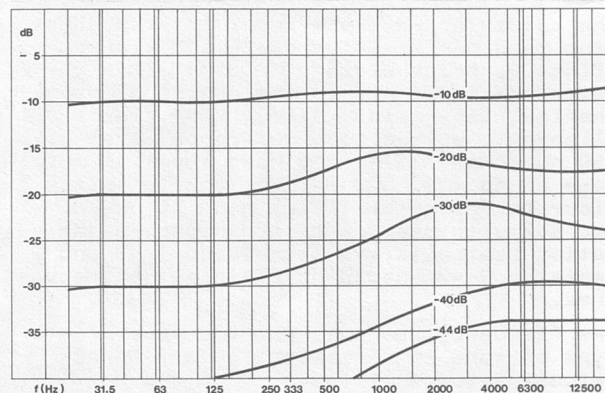
The circuitry incorporates an IC. The signal amplified in the input amplifier or microphone amplifier is passed to the IC via C 72.

A multiplex filter is provided between connections 2 and 6 which is used for pilot frequency suppression (19 kHz L 71/C 77) with 30 dB min. 38 kHz and 100 kHz (RF generator) are also suppressed to prevent faulty control of the Dolby unit.

The Dolby circuit produces treble emphasis during recording differentiated as to amplitude and frequency and exactly reciprocal suppression during playback. As a result the natural tape noise can be improved by approx. 9 dB, but not natural source noise components.

Dolby function for recording and playback can be switched off by push-button S 7.

Fig. 16
Dolby-frequency characteristic



Limit switch

The limit switch has the function of switching off the unit when a cassette has been played and protects the cassette if winding is incorrect as a result of excessive friction in the cassette. The limit switch is also operated when the memory key (fast forward wind/rewind) is pressed and the counter is in 0-position.

The slotted brake drum on the right winding axle supplies the photo transistor T 6 with a flash period of 6 to 550 Hz, thus producing an AC voltage in R 110. If this voltage on T 6 fails, the base of T 110 becomes positive via R 113, R 112 thus driving T 110 and T 111 and leading to attraction of the traction magnet which shuts off the unit.

The circuit consisting of the resistor R 120 and capacitor C 118 caused feedback. If an AC voltage signal is present, the negative half wave is applied (via D 111) to the base of T 110 and blocking it.

Power Supply Unit

The C 919 can be connected to AC voltage sources from 110 to 125 V and 220 to 240 V. The primary winding of the C-core transformer and the motor are switched over by series parallel circuit. The secondary voltage is rectified in the bridge circuit of diodes D 130 to D 133 and effectively filtered. Transistor T 130 acting as a variable resistor automatically corrects voltage and load fluctuations. The secondary circuit is protected by the T 0.63 A slow-blow fuse.

The indicator lights are connected to the stabilized DC voltage of 20 V.

Adjustment-and test data

Test instruments and test cassettes required:

- 2 millivoltmeters
- 1 AF oscillator
- 1 oscilloscope
- 1 frequency counter
- 1 1000 Hz filter
- 1 capacitive voltage divider 1 : 1000
(Coupling capacitance 1 pF)
- 1 test cassette 400 Hz - 20 dB,
10 kHz - 20 dB
- 1 test cassette Fe₂O₃ - reference medium
section, CrO₂ reference medium section
- 1 test cassette 400 Hz Dolby level 200 nWb/m

General notes

Before adjustment the magnetic head and all ferrous components contacting the tape shall be demagnetized. When adjusting the coils two core positions are possible. However, the outer core position should always be chosen.

Re-adjustment must be carried out in the sequence stated. All controls should be in their midposition except R 171 and 171' which should be in their extremest right position.

Playback

Level and VU meter

Fully turn LINE OUTPUT control L and R to the right hand stop. Insert test cassette, 400 Hz Dolby level.

Fe, Dolby NR,▷

Set 580 mV $\pm$ 0.25 dB in each case for track 1 with R 6 at Pt. 1

(left channel)

for track 2 with R 6' at Pt. 1'

(right channel)

Set VU meters to + 3 dB $\pm$ 0.25 dB

VU meter, L with R 153

VU meter, R with R 153'

1 V $\pm$ 1.5 dB should be present at OUTPUT L, OUTPUT R and REC/PB jack

Magnetic Head Adjustment

Insert test cassette (Section for gap adjustment, 10 kHz - 20 dB)

Connect millivoltmeters to OUTPUT L and R. If only one millivoltmeter is available OUTPUT L and R should be connected in parallel.

Fe,▷

With the set screw on the left-hand side of the magnetic head align for maximum voltage. Maximum permissible distance between tracks 4 dB.

Playback frequency response

Insert test cassette, 400 Hz - 20 dB, 10 kHz - 20 dB

Fe,▷

the output voltage at OUTPUT L and R should be referring to the 400 Hz - 20 dB = 0 dB
10 kHz = + 4 dB - 3 dB.

When switching over Cr or FeCr the 10 kHz level should indicate a voltage step of - 4 dB $\pm$ 1 dB.

Background noise

Screen amplifier. Make sure that the magnetic head is free of hum. Loosen screening ring from motor and motor mounting.

Fe, PAUSE,▷

Set background noise at OUTPUT L and R to minimum by turning motor and screening ring. Retighten screening ring and motor.

Background noise at OUTPUT L and R 5 mV max. Measured with 20 Hz filter (e.g. Sennheiser FO 55, curve 2, 20 Hz - 3 dB) and RMS rectification of meter. Observe polarity of power plug.

RF generator

Cr, RECORD, with L 110 set 100 kHz.

Measure the generator frequency with absorption frequency meter in the vicinity of the erase head, or with oscilloscope or frequency counter through 1 Mohm series resistor on the erase head. Frequency deviation on changeover to FeCr 2 kHz max.

Erase Head Voltage

Measured at the erase head (Cr) 24 - 29 V

RF Wave Traps

Connect tube voltmeter to test point 2 or 2' and align with L 1 or L 1' for minimum.

Bias Switching

Cr, RECORD,▷

The following voltage change should be measured at test points 2 or 2' as referred to URF

for FeCr = 0 dB

for Cr = + 3.5 dB $\pm$ 0.5 dB

for Fe = + 0.5 dB $\pm$ 0.5 dB

Recording

Connect AF generator to INPUT, tube voltmeter and harmonic distortion meter (K 3) to OUTPUT, LINE/DIN level control (R 144, R 144') open.

Input Symmetry

Insert test cassette, CrO₂ reference medium Cr, RECORD,

Feed in 400 Hz, adjust input voltage so that the VU meter reading is 0 dB for the less sensitive channel.

Using R 171 or R 171' also set the most sensitive channel for 0 dB (VU meter).

RF Biasing

Insert test cassette, CrO₂ - reference medium section

Cr, RECORD,▷

LINE/DIN level control (R 144, R 144') open.

Record 400 Hz and 10 kHz with - 20 dB (VU-meter). Compare levels on reproduction. If there is no uniform level correct RF biasing.

Any changes of the RF level can be measured directly on the head via a capacitive voltage divider (1 pF coupling capacity) or at measuring point 3 or 3'.

For alignment of track 1 use R 119, for track 2 use R 119'.

less RF = treble emphasis!

more RF = treble deemphasis!

Level

Insert test cassette, CrO₂-reference medium section

Cr, RECORD,▷

LINE/DIN level control (R 144, R 144') open.

Record 400 Hz with 0 dB (VU meter). Then check playback level using the VU meter.

Using R 5 (left VU meter) and R 5' (right

VU meter) vary recording current so that playback level is the same as the recording level. To check the NF recording current the AF voltage can be measured at test point 3 or 3' via filter.

Distortion

For 333 Hz, 0 dB (VU meter) recordings the harmonic distortion on playback should not exceed the following values.

for Fe₂O₃ tape K 3 = 3 %
for CrO₂ tape K 3 = 3 %

Erase

Insert test cassette, CrO₂ - reference medium section
Cr, RECORD,
Feed in 1 kHz 0 dB (VU meter)
Erase (selective measurement) ≥ 62 dB

Limiter

Set R 90 and R 90' fully clockwise.
RECORD, LIMITER,
LINE/DIN level control (R 144, R 144') open.
Apply 400 Hz + 1 dB (VU meter) to INPUT,
slowly turn R 90 counterclockwise until the left VU meter indicates 0 dB. Adjust the other channel in the same manner using R 90'.

If the voltage at the input increases by 20 dB (10 times), the limiter first closes instantaneously and opens again slowly. The control time until the VU meters indicate -10 dB should be 2.5 to 4 seconds.

Dolby FM

DOLBY FM, RECORD,
Turn R 150 and R 150' fully clockwise, set R 140, R 140', R 144, R 144' to zero.

Feed LINE-DIN input with 5 kHz, 10 mV.
Using R 166 or R 166' set 100 mV across LINE-DIN output.

Depress DOLBY NR-key
attenuation 4 - 6 dB

Release DOLBY NR-key
Feed in 400 Hz
attenuation 5.5 - 7.5 dB

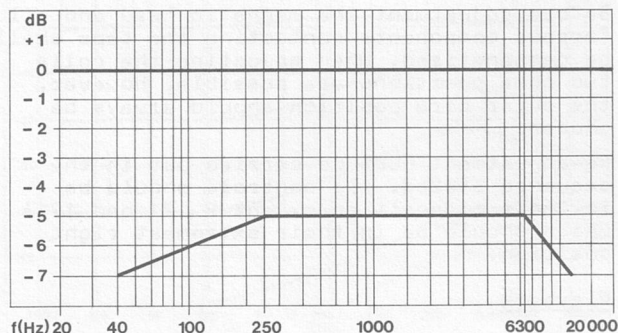
Microphone connection

Check power supply for capacitor microphones in the microphone jacks. U = 19 - 21 V

Overall frequency responses

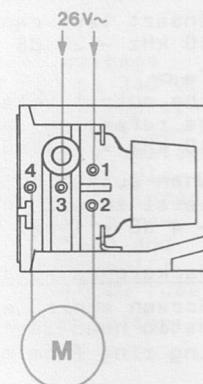
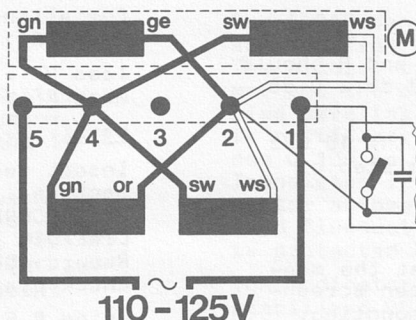
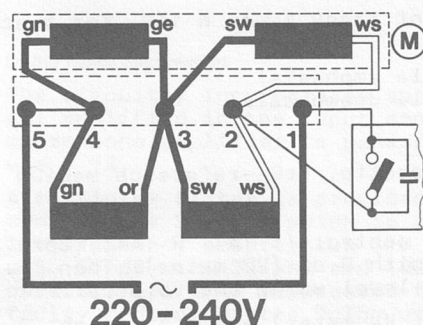
The overall frequency responses for Fe₂O₃ and CrO₂ tapes must be within the specified tolerances, in accordance with DIN 45500, recorded with -20 dB (VU meter).

Fig. 17



In accordance with the directives of the "Rules for the application of units of measure", dated 5 July 1970 the unit of measure for the magnetic flux is now Wb (Weber) instead of Maxwell (M).
1 Wb (Weber) = 10^8 M (Maxwell) = 1 VS (volt/second)
250 nWb/m = 25 mM/mm

Fig. 18 Motor connection schematic



The drawing shows the rear view of the 235 500 module. It includes a detailed view of the internal layout with components labeled 235 520, 235 510, 235 530, 235 540, 235 560, 235 580, 235 590, 235 600, 235 610, 235 620, 235 630, 235 640, 235 650, 235 660, 235 670, 235 680, 235 690, 235 700, 235 710, 235 720, 235 730, 235 740, 235 750, 235 760, 235 770, 235 780, 235 790, 235 800, 235 810, 235 820, 235 830, 235 840, 235 850, 235 860, 235 870, 235 880, 235 890, 235 900, 235 910, 235 920, 235 930, 235 940, 235 950, 235 960, 235 970, 235 980, 235 990. It also shows the external shielding ring (Abschirmring / Anneau de blindage) and the mounting holes.

When ordering spare parts please take the article numbers from the spare parts list pages 22 to 33.

Fig. 21 Alignment positions, unit top side (FM)

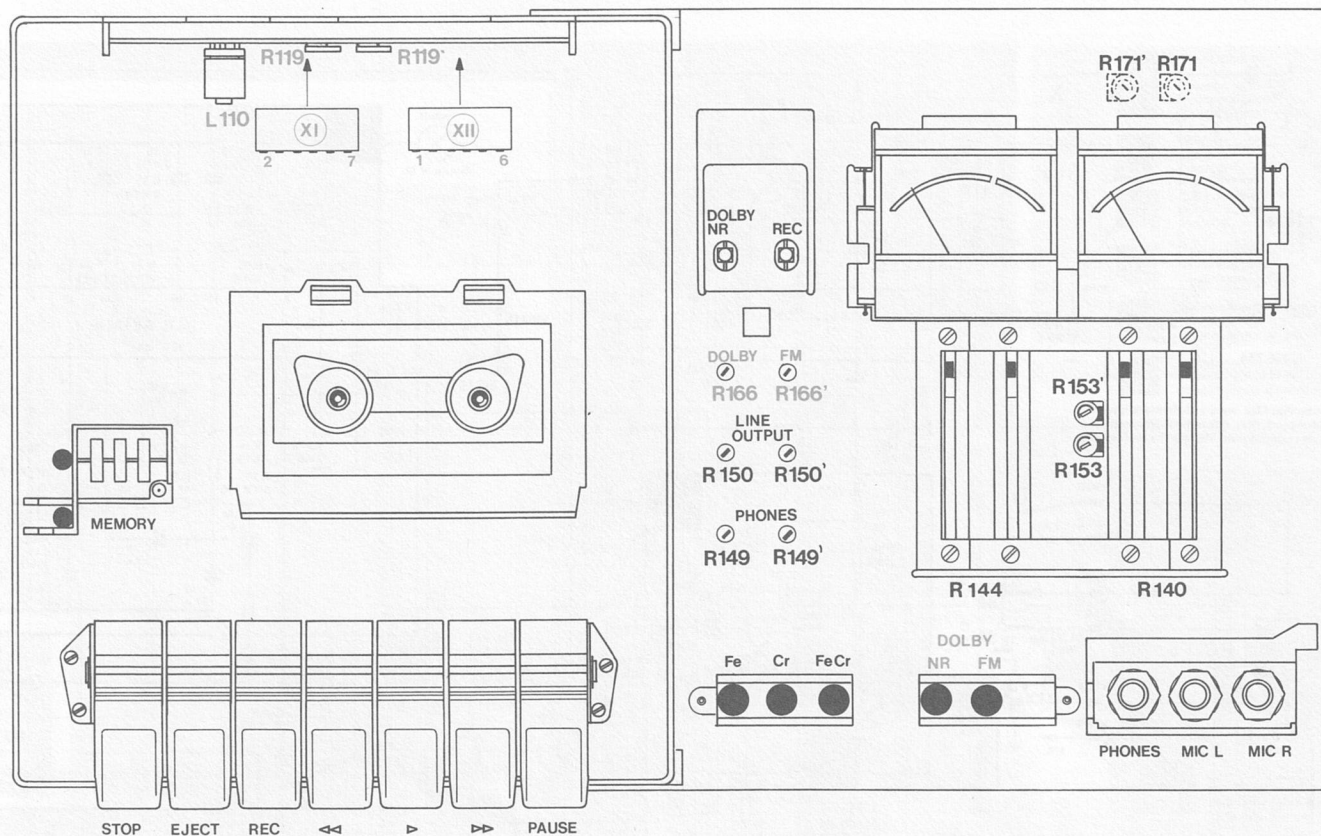


Fig. 22 Alignment positions, unit bottom side (FM)

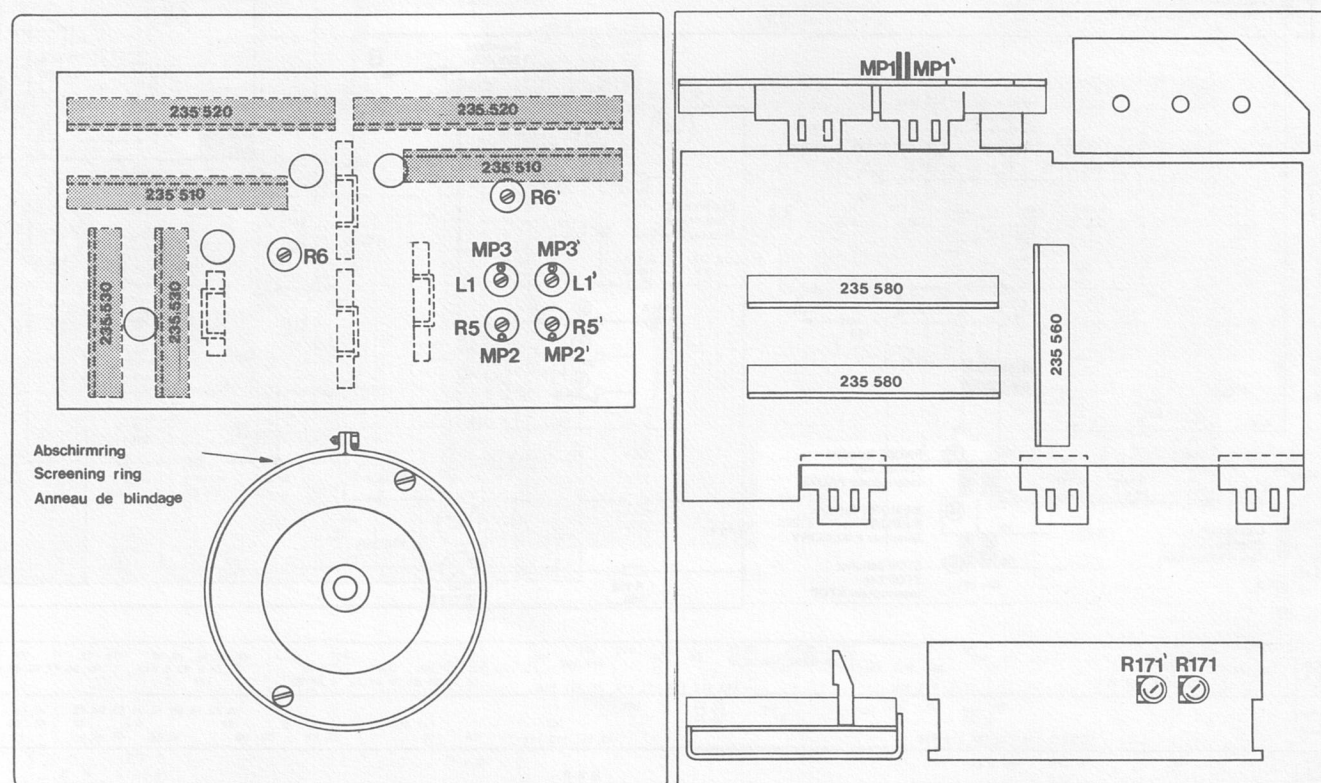
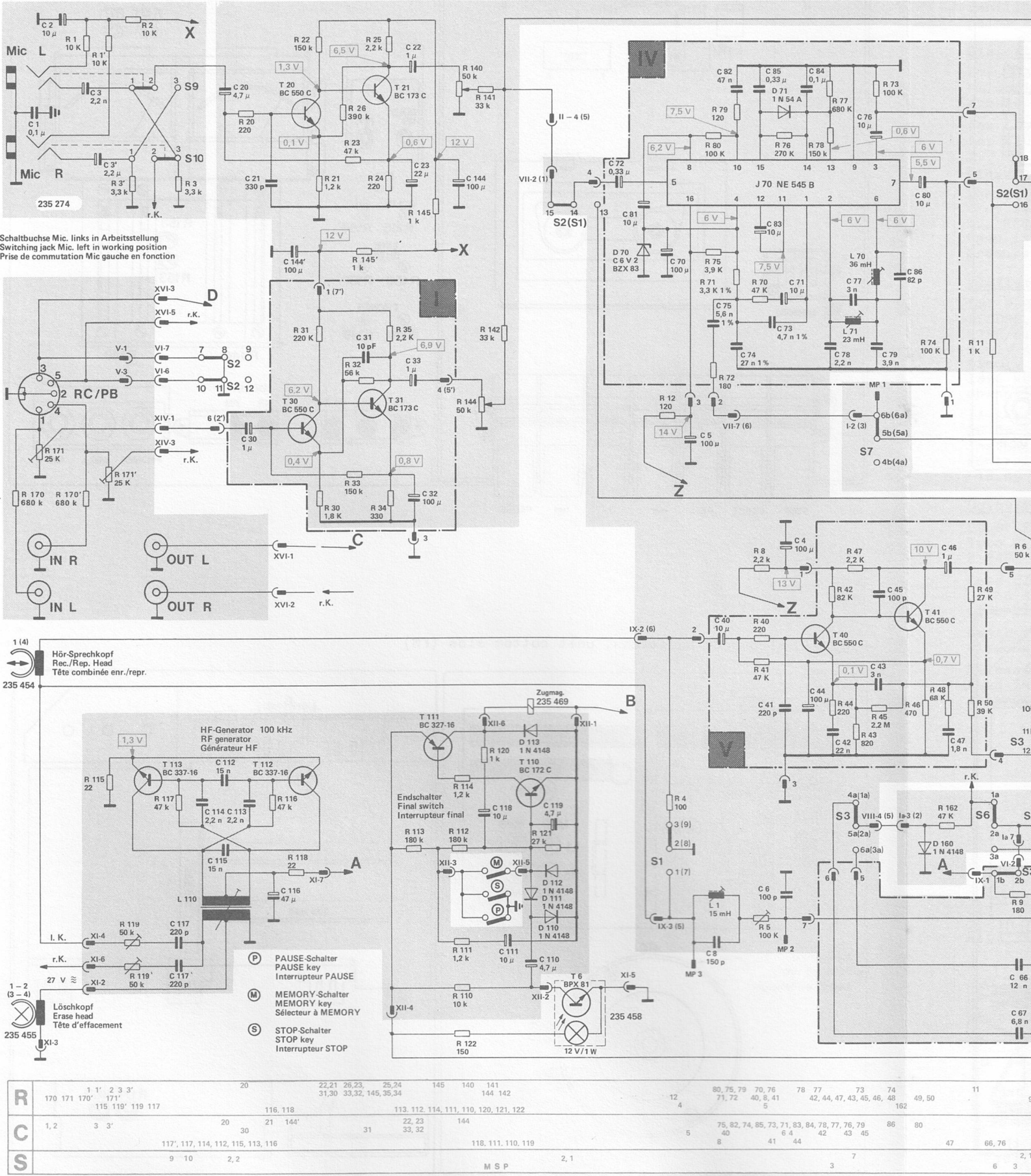
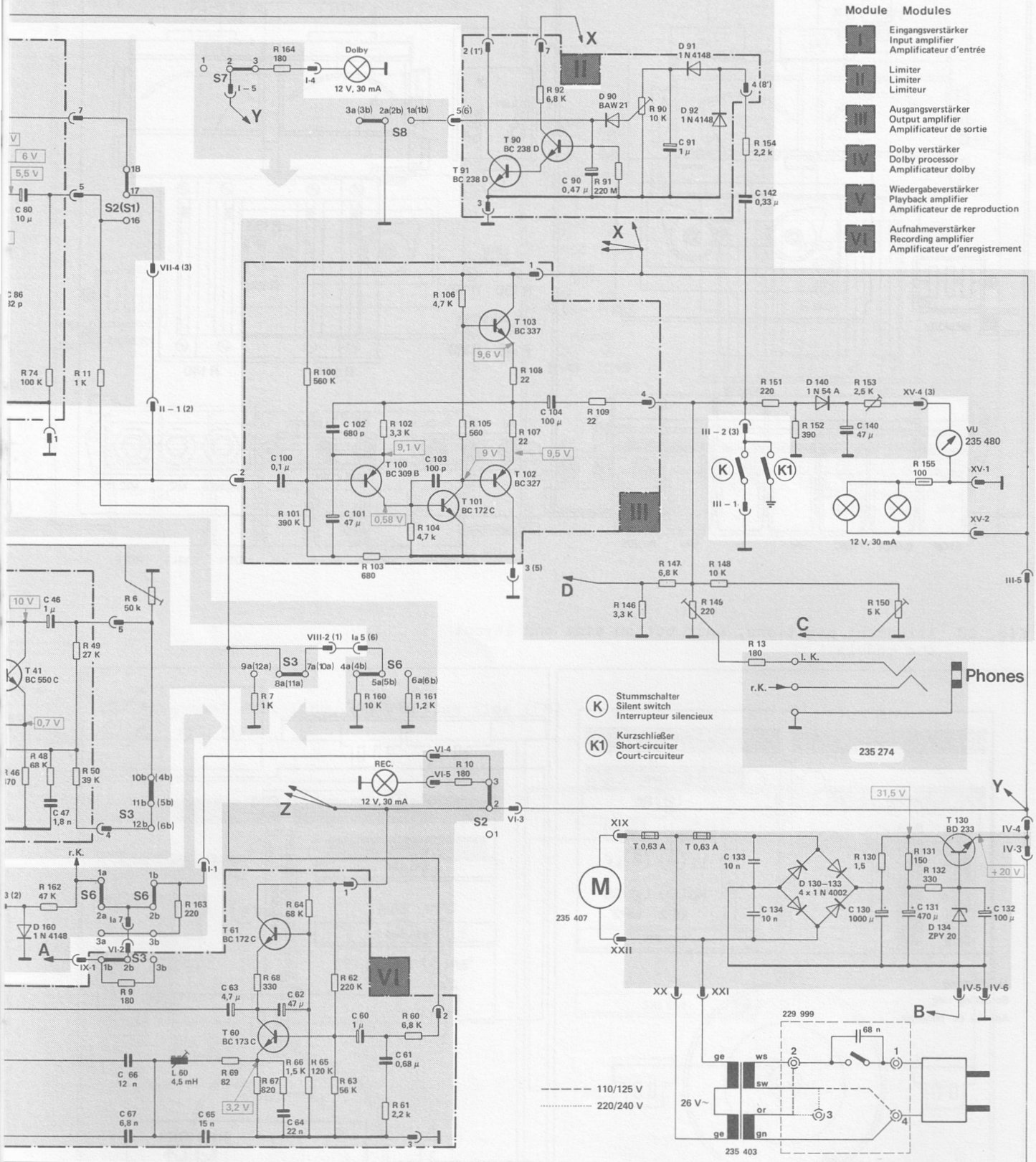


Fig. 23 Wiring diagram



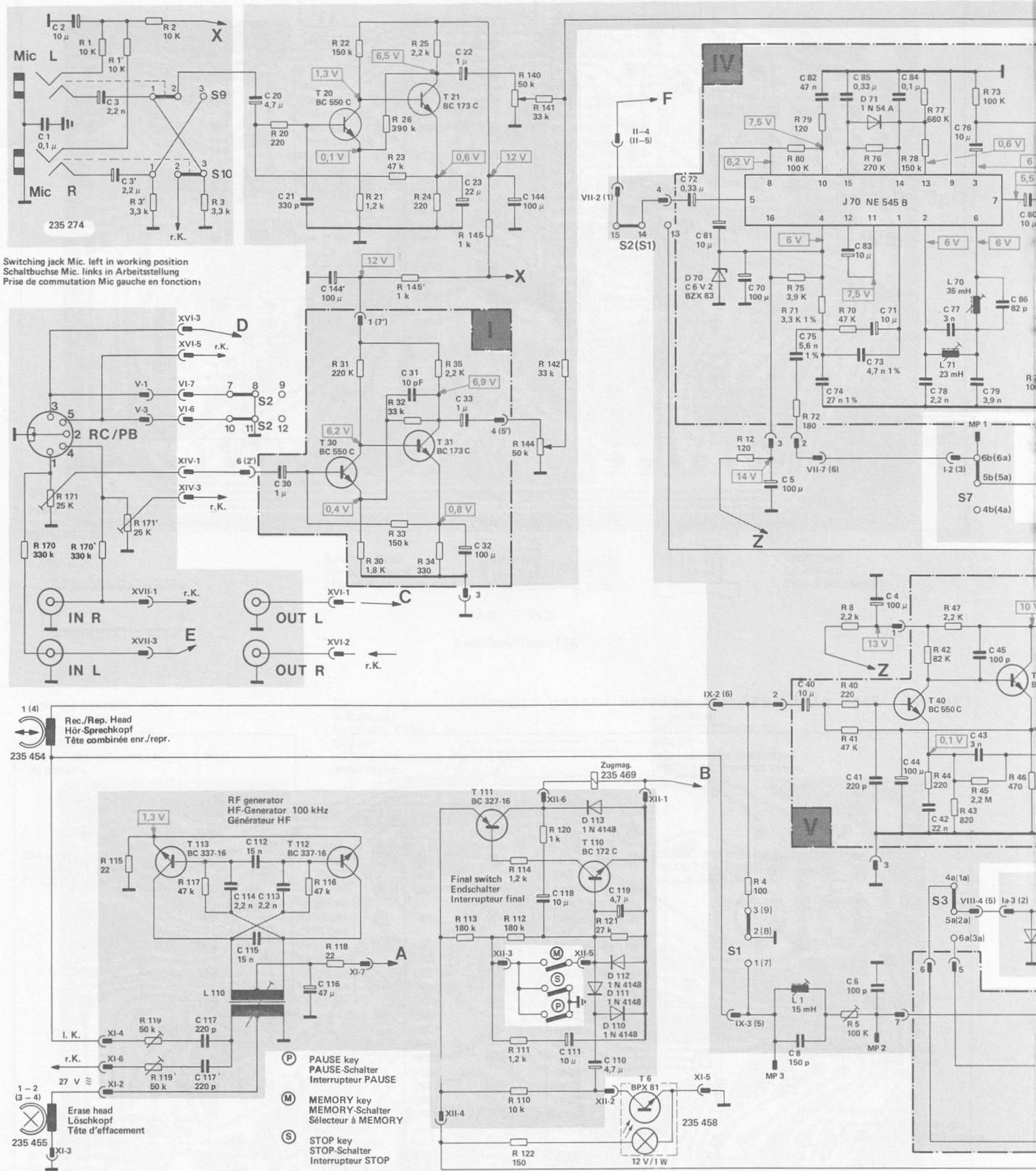
Module Modules

- I** Eingangsverstärker
Input amplifier
Amplificateur d'entrée
- II** Limiter
Limiter
Limiteur
- III** Ausgangsverstärker
Output amplifier
Amplificateur de sortie
- IV** Dolby verstärker
Dolby processor
Amplificateur dolby
- V** Wiedergabeverstärker
Playback amplifier
Amplificateur de reproduction
- VI** Aufnahmeverstärker
Recording amplifier
Amplificateur d'enregistrement

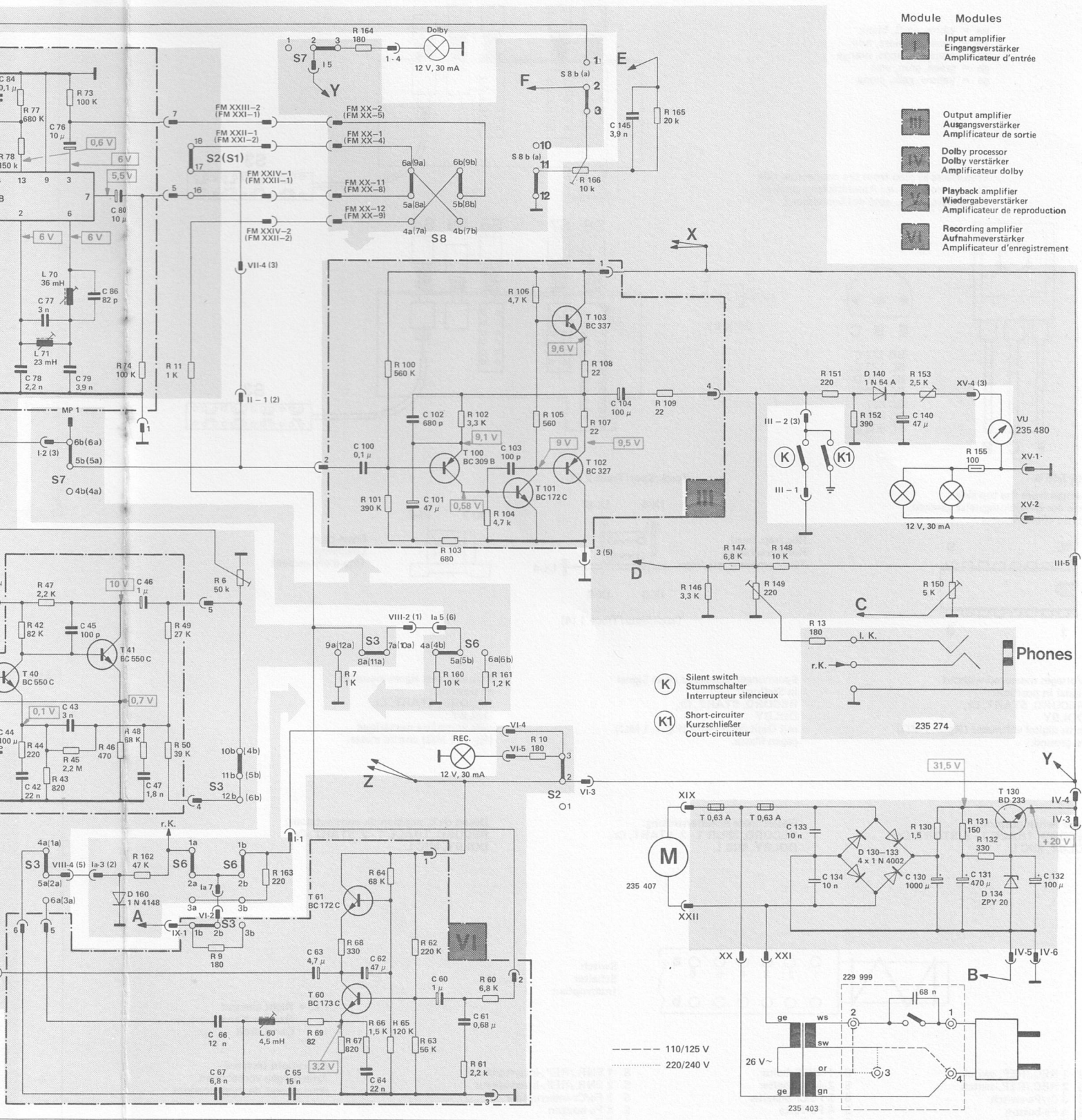


49, 50	11	9	6	163	164	100	160, 103, 102, 104, 161, 105, 10	106	108	92	91	90	146	147	149	148	154	151	152	153	150	155	130	131, 132
80	47	66, 76	66, 67	65	63	100	64, 62	102, 101	60	61	103	104	90	91	142	133	134	140	130	131	132			
	6	3	6	7	3	8	6	2																

Fig. 24 Wiring diagram (FM)

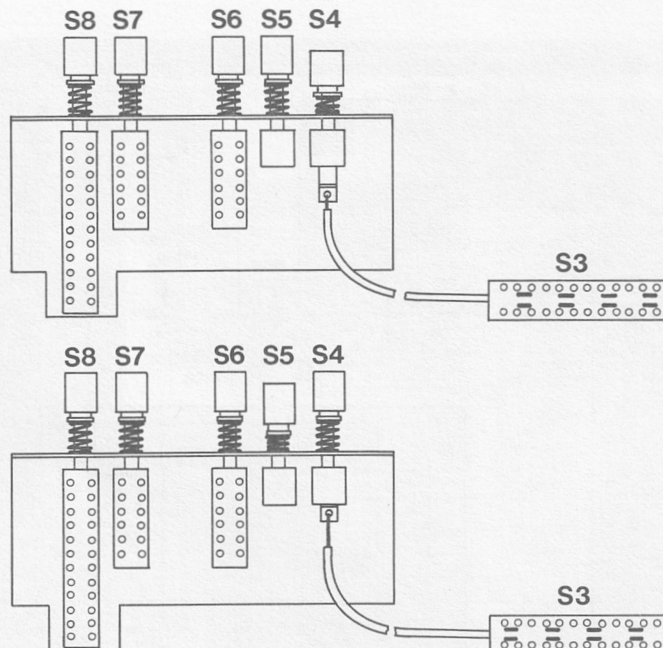
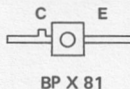
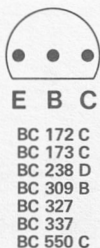
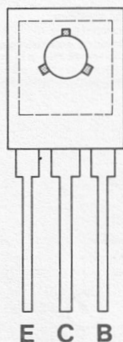


R	170	171	170'	171'	115	119'	119	117																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																</
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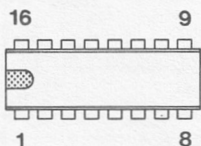
ws = white, weiß, blanc
 sw = black, schwarz, noir
 or = orange, orange, orange
 gn = green, grün, vert
 ge = yellow, gelb, jaune

Transistors as seen from the connecting side
 Transistoren von der Anschlußseite gesehen
 Transistors vus du côté des connexions

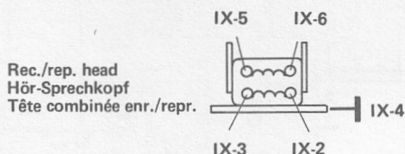


NE 545 B

as seen from the top side
 von der Bestückungsseite gesehen
 vu du côté éléments



Track/Spur/Trace 2 (3)



Erase head
 Löschkopf
 Tête d'effacement

Track/Spur/Trace 1 (4)

Voltages measured without
 signal in position:
 RECORD, START, Cr,
 DOLBY
 with digital voltmeter ($R_E > 1 \text{ M}\Omega$)
 to ground.

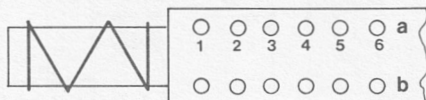
Spannungen gemessen ohne Signal
 in Stellung:
 RECORD, START, Cr,
 DOLBY
 mit Digitalvoltmeter ($R_E > 1 \text{ M}\Omega$)
 gegen Masse.

Tensions sans signal mesurées
 en position:
 RECORD, START, Cr,
 DOLBY
 avec voltmètre numérique
 ($R_E > 1 \text{ M}\Omega$) contre masse.

Show switch position:
 RECORD, TRACK 1 - 2, START, Cr,
 DOLBY, MIC L

Gezeichnete Schalterstellung:
 RECORD, SPUR 1 - 2, START, Cr,
 DOLBY, MIC L

Dessin de la position du commutateur:
 RECORD, TRACE 1 - 2, START, Cr,
 DOLBY, MIC L



Switch
 Schalter
 Interrupteur

r.k. = Right channel
 Rechter Kanal
 Canal droit

S 1 REC./REP.-switch
 S 2 REC./REP.-switch
 S 3 Cr/Fe-switch
 S 4 Fe-button
 S 5 Cr-button
 S 6 Fe/Cr-switch
 S 7 Dolby NR-switch
 S 8 FM-switch
 S 9 Mic-switch left
 S 10 Mic-switch right

S 1 AW-Schalter
 S 2 AW-Schalter
 S 3 Fe-Cr-Schalter
 S 4 Fe-Taste
 S 5 Cr-Taste
 S 6 Fe/Cr-Schalter
 S 7 Dolby NR-Schalter
 S 8 FM-Schalter
 S 9 Mic-Schalter L
 S 10 Mic-Schalter R

S 1 ENR./REP.-interrupteur
 S 2 ENR./REP.-interrupteur
 S 3 Fe/Cr-interrupteur
 S 4 Fe-bouton
 S 5 Cr-bouton
 S 6 Fe/Cr-interrupteur
 S 7 Dolby NR-interrupteur
 S 8 FM-interrupteur
 S 9 Mic-interrupteur L
 S 10 Mic-interrupteur R

Alterations reserved
 Änderungen vorbehalten
 Sous réserve de modifications

Edition 3/March 1977



Fig. 27 Control plate 235 492 printed wiring side

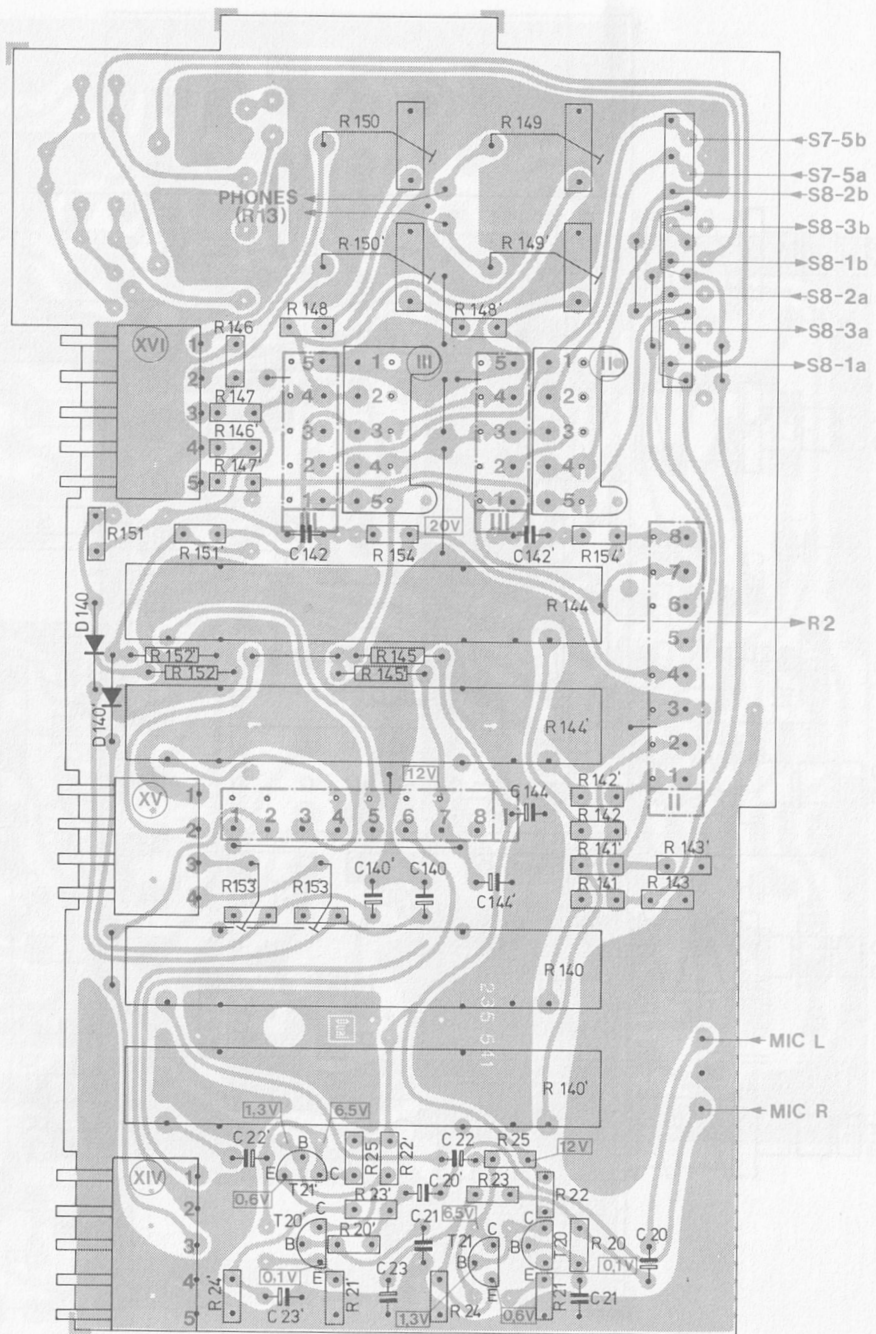


Fig. 28 Control plate 235 493 printed wiring side (FW)

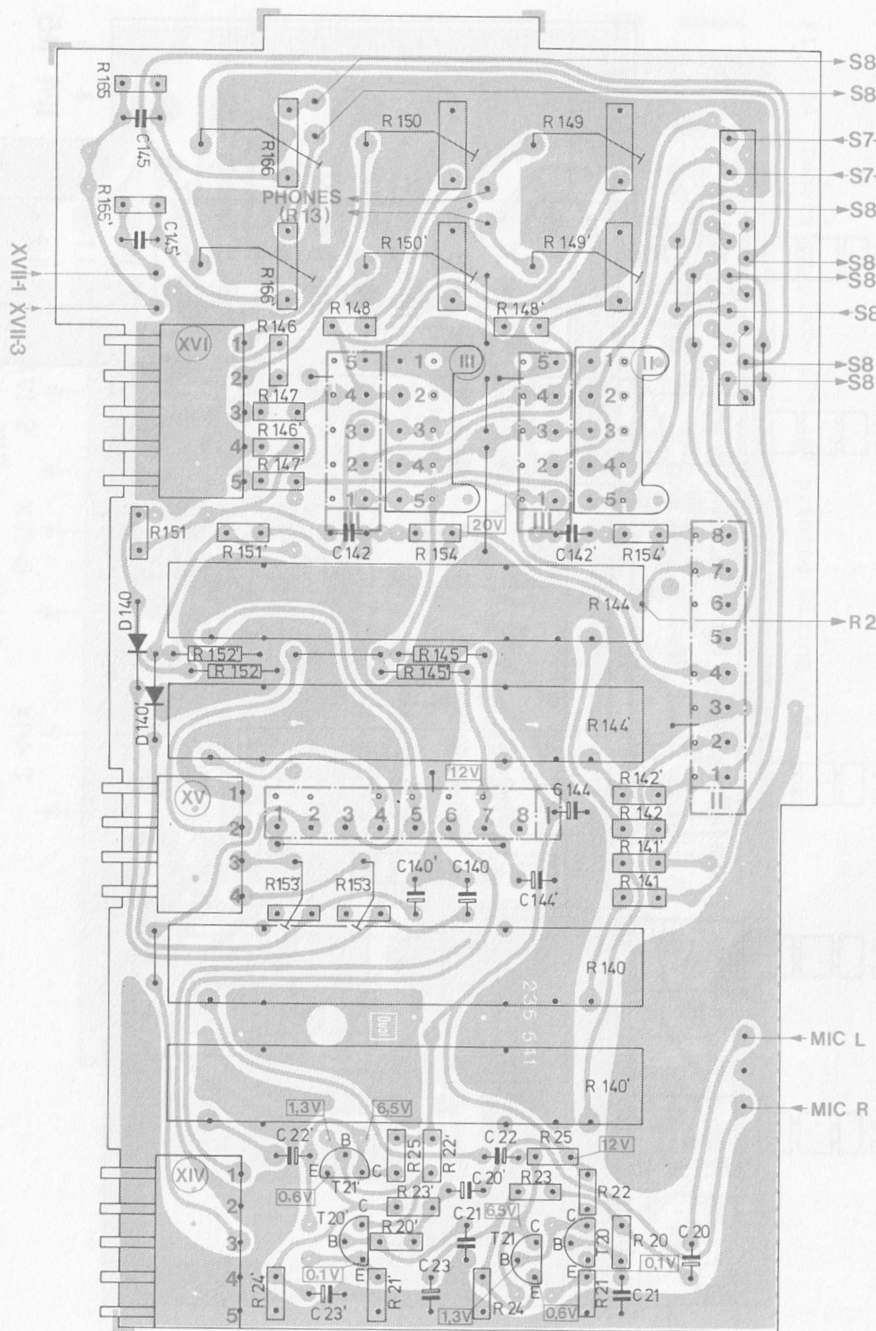


Fig. 29 Key plate 235 489 printed wiring side

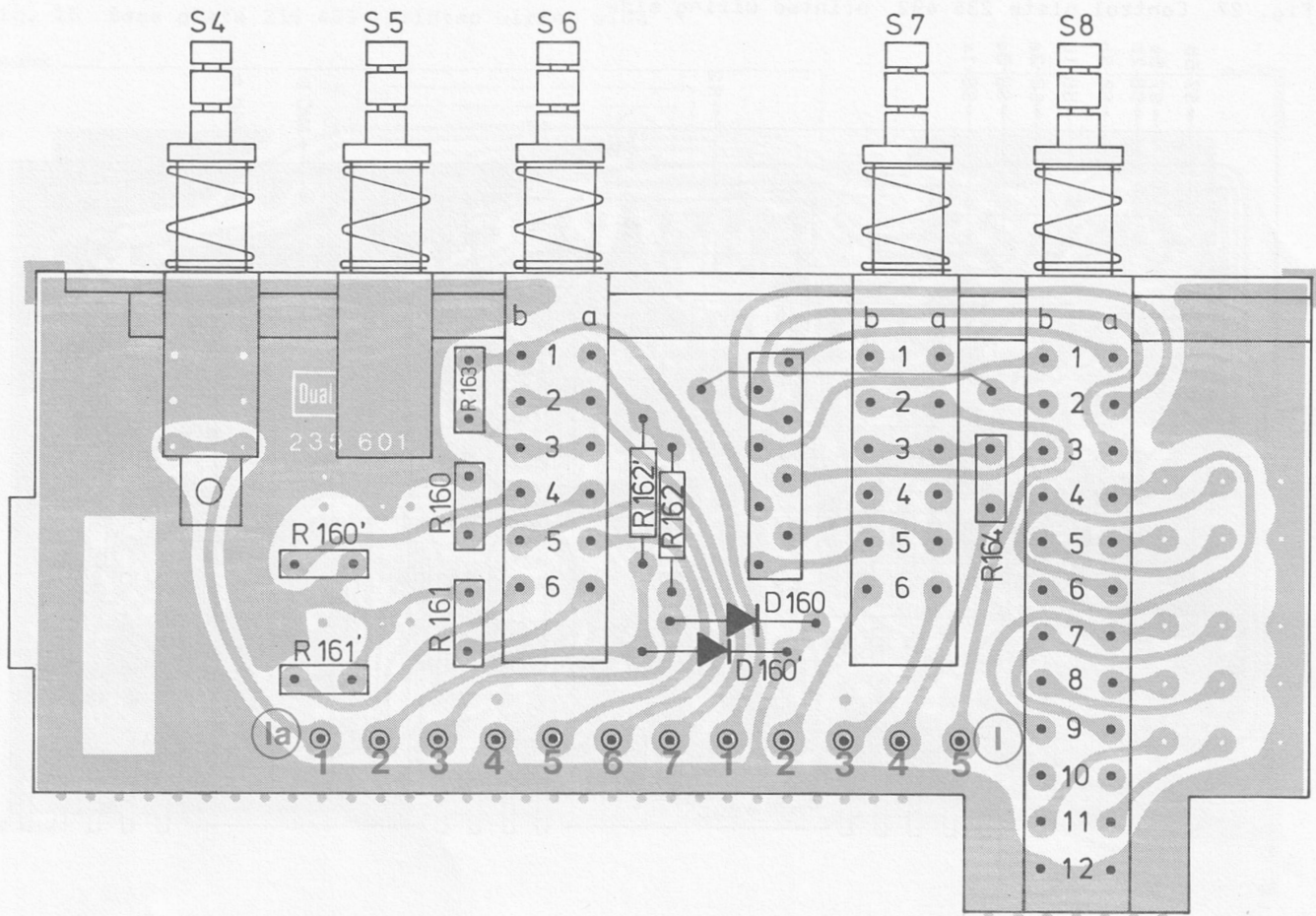


Fig. 30 Key plate 235 489 printed wiring side (FM)

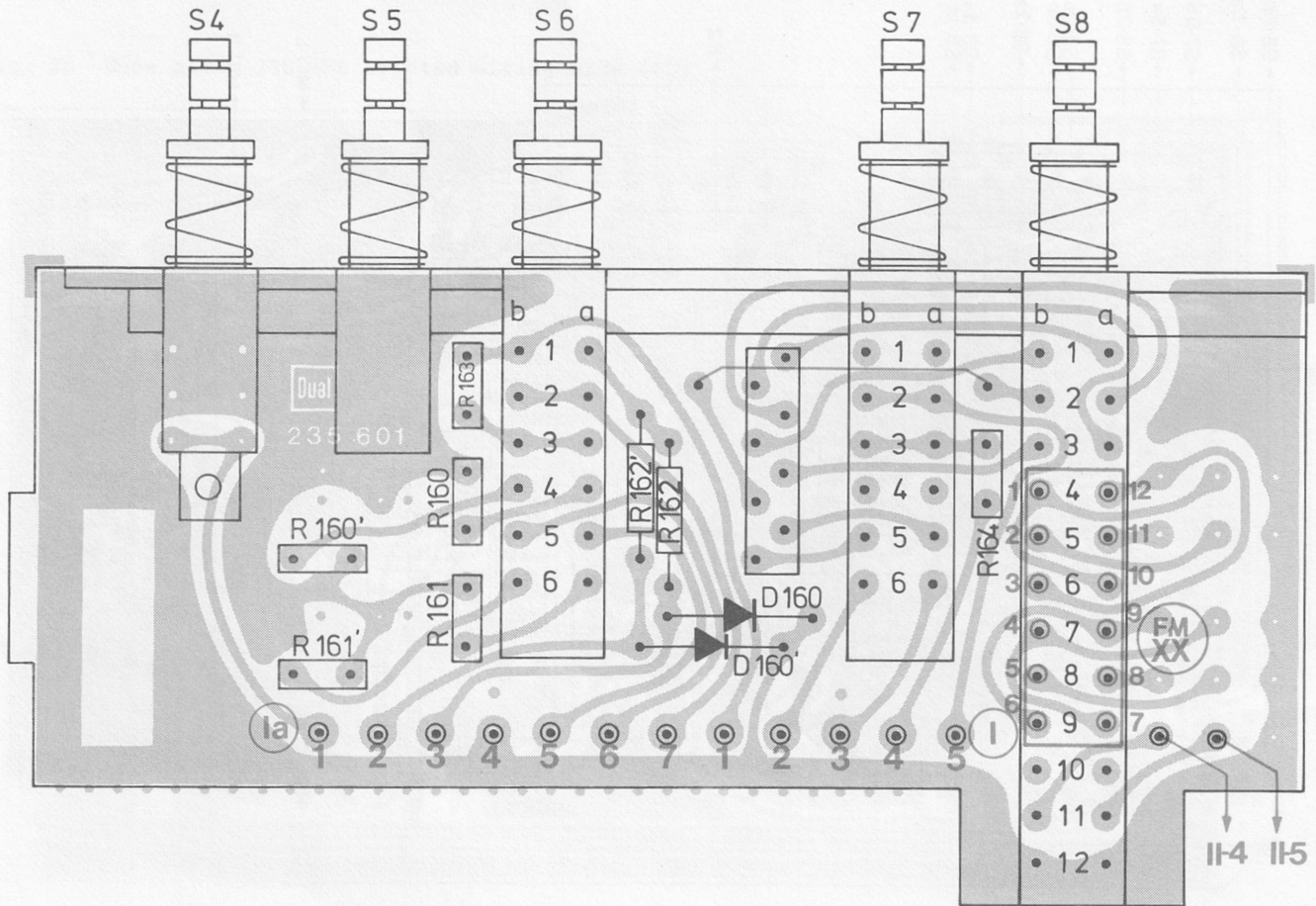


Fig. 31 Dolby amplifier 235 484 printed wiring side

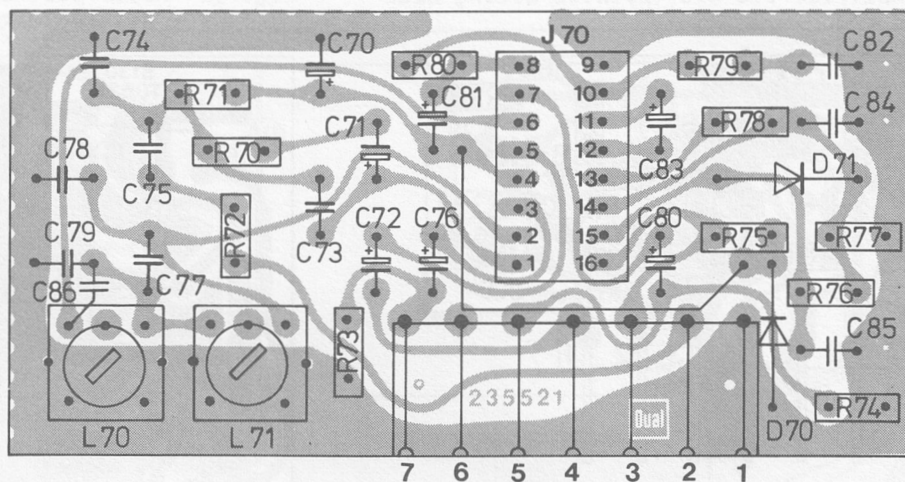


Fig. 32 Recording amplifier 235 482 printed wiring side

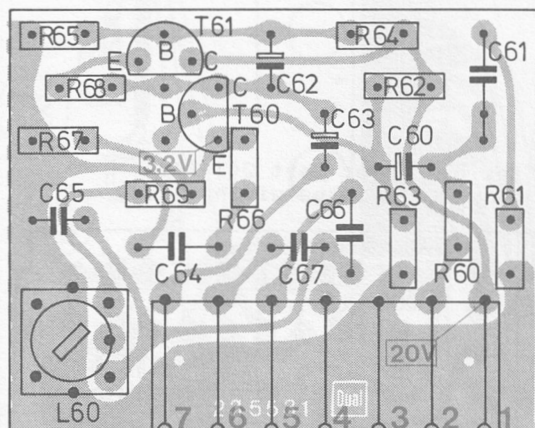


Fig. 33 Reproduction amplifier 235 483 printed wiring side

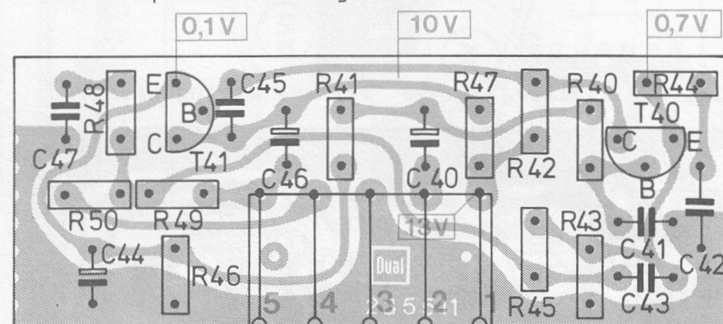


Fig. 34 Generator plate 235 481 printed wiring side

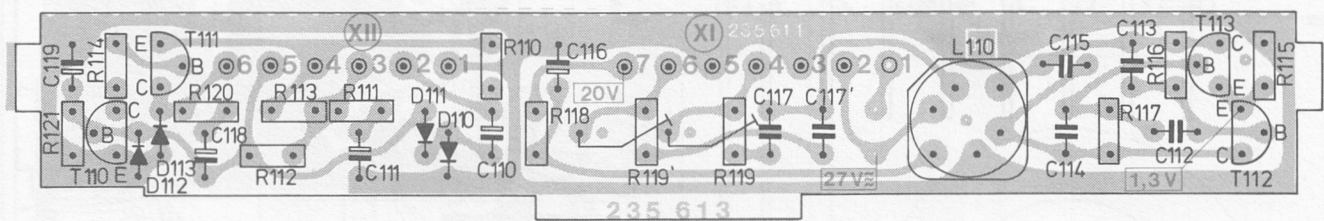


Fig. 35 Socket plate 235 491 printed wiring side

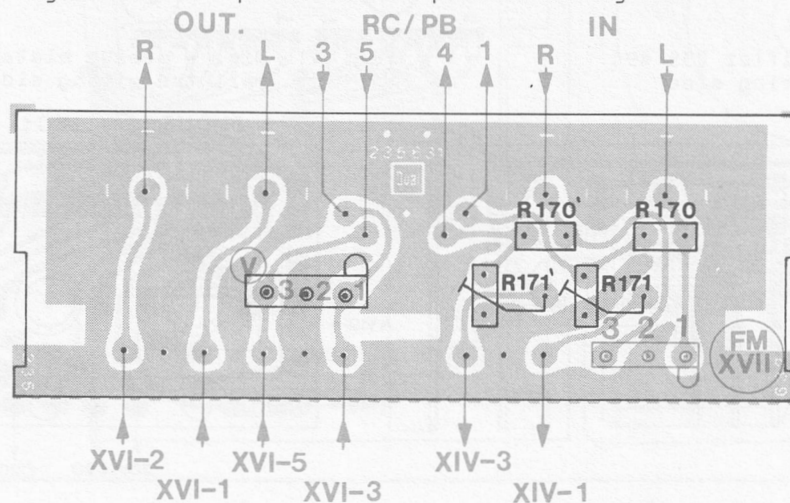


Fig. 36 Input amplifier 235 495 printed wiring side
(235 402 FM)

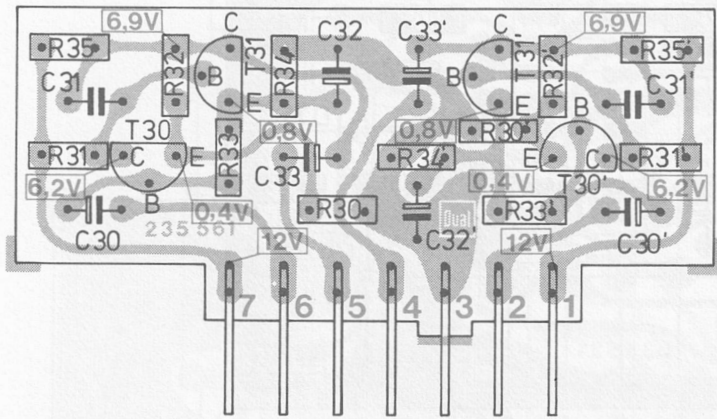


Fig. 37 Power part 235 488
printed wiring side

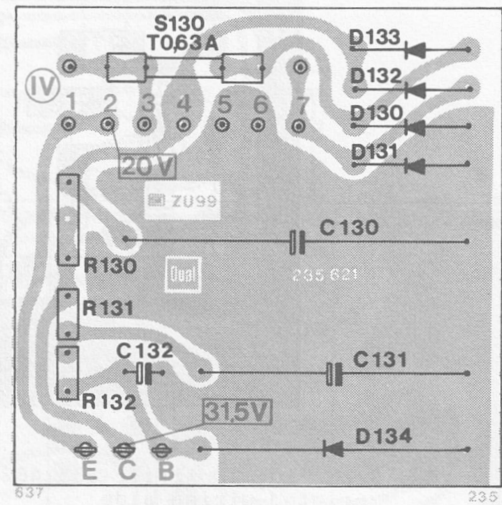


Fig. 38 Limiter 235 496 printed wiring side

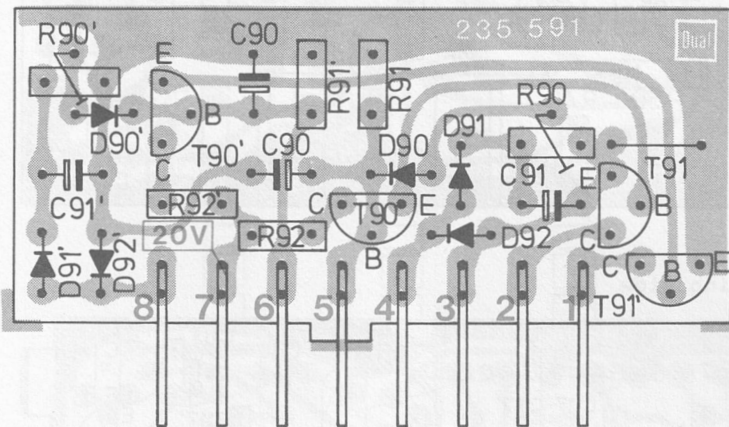


Fig. 39 Power part 241 732
(printed wiring side)

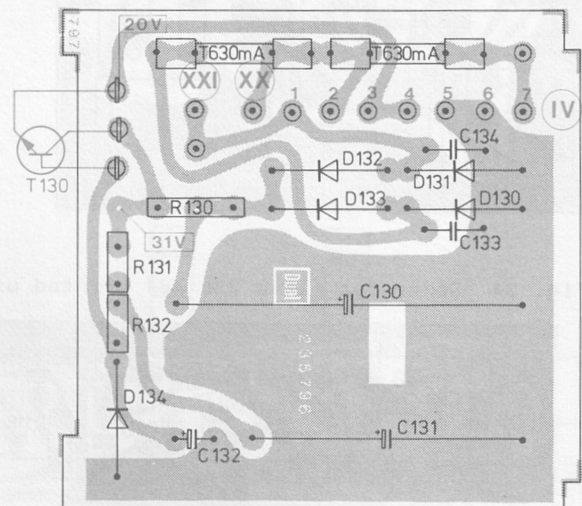


Fig. 40 Output amplifier 235 494
printed wiring side

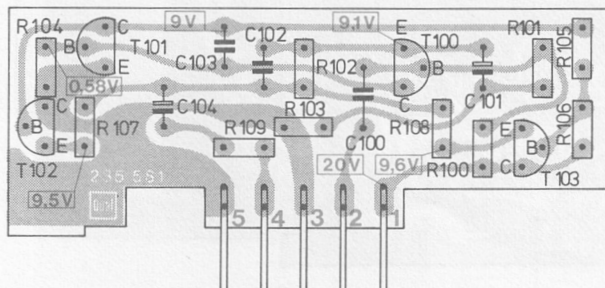
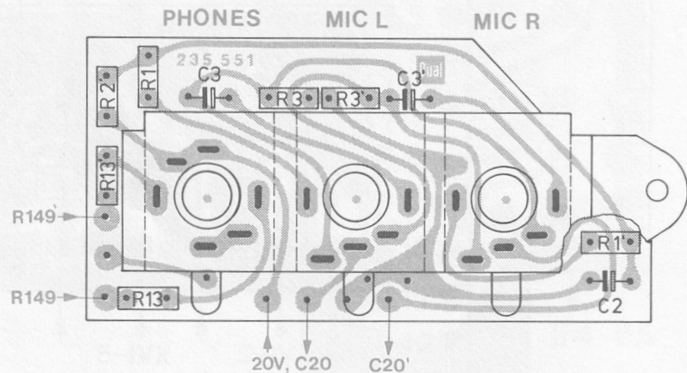
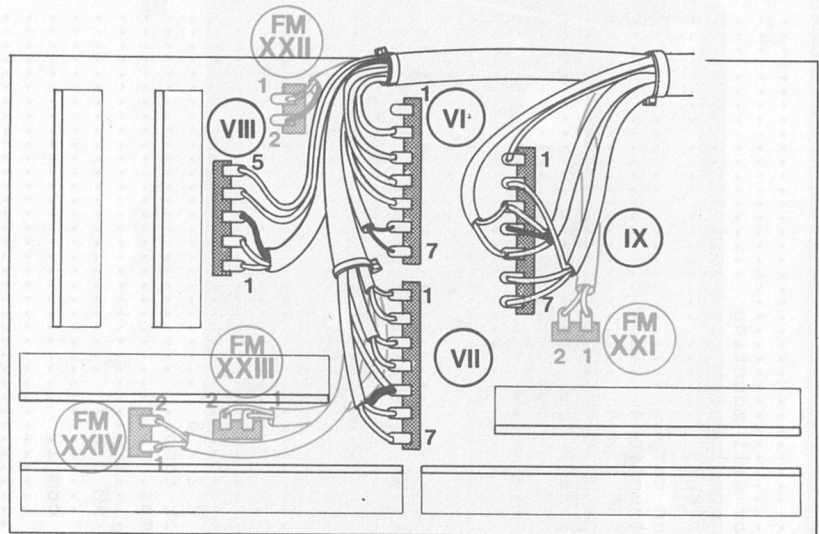


Fig. 41 Mic. - sleeve plate 235 274
printed wiring side





Replacement Parts

Pos.	Part. No.	Description	Qty.
1	235 444	Type plate compl.	1
2	210 155	Serrated lock washer	1
3	200 444	Spring washer	7
4	200 622	Compression spring	1
5	200 444	Spring washer	7
6	235 445	Holder of counter window compl.	1
7	235 005	Counter window	1
8	235 099	Brake lever	2
9	200 444	Spring washer	7
10	218 055	Fillister head sheet metal screw 8 2.9 x 9.5	2
11	235 446	Cover plate assembly compl.	1
12	210 518	Machine screw M 4 x 12	4
13	226 815	Fixing plate compl.	1
14	235 448	Plaque	1
15	200 444	Spring washer	7
16	235 013	Socket shaft 1	4
17	235 449	Window compl.	1
18	235 014	Socket shaft 2	2
19	235 450	Illumination green compl.	1
20	235 451	Illumination red compl.	1
21	235 018	Slide knob	4
22	210 518	Machine screw M 4 x 12	4
23	226 281	Cover plate	1
24	218 044	Cross head self-taping screw 2.7 x 8	2
25	235 422	Cabinet CK 82 compl.	1
	235 423	Cabinet CK 82 black compl.	1
	235 431	Cabinet CK 80 black compl.	1
	235 442	Cabinet CK 80 walnut compl.	1
	235 443	Cabinet CK 80 white compl.	1
27	228 387	Dual emblem	1
28	226 889	Hinge compl.	2
	242 584	Hinge compl. (for CK 82 and CH 82)	2
29	226 836	Knurled nut	2
30	226 835	Compression spring	2
31	226 832	Hinge pin	2
32	226 834	Hinge cam	2
33	226 833	Hinge plate	2
34	226 856	Machine screw AM 4 x 8	4
35	226 831	Hinge pivot	2
	235 336	Hinge pivot (for CK 82 and CH 82)	2
36	235 375	Machine screw AM 3 x 5	2
37	235 308	CH 82 cover	1
38	235 219	CH 80 cover	1
39	226 411	Accessories for wall mounting	1
40	226 814	Vertical base compl. with accessories	1
	235 273	Vertical base (set)	1
***	235 194	Shipping carton compl.	1
***	235 192	Operating instructions	1
100	210 472	Machine screw AM 3 x 4	12
101	240 358	Angle compl. with cone	1
106	235 452	Memory counter assembly	1
107	210 478	Machine screw AM 3 x 5,5	1
108	235 134	Counter belt	1
109	210 144	Lock washer 1.9	4
110	235 162	Switch lever	1
111	210 145	Lock washer 2.3	10
112	235 382	Tension spring	1
113	235 056	Eject lever 1	1
114	210 145	Lock washer 2.3	10
115	235 057	Eject lever 2	1
116	235 269	Tension spring	1
117	235 152	Tension spring	1
118	235 055	Record bar	1
119	235 453	Head unit compl.	1
120	210 433	Machine	2
121	226 881	Bush	2
122	210 434	Machine screw M 2 x 6	2
123	235 454	Record/Playback compl.	1
124	235 455	Erase head compl.	1
125	235 118	Leaf spring	1
126	210 485	Machine screw AM 3 x 7	2
127	235 665	Cable holder	2
128	226 769	Fixing rubber compl.	4
129	235 470	Plate compl.	1
130	235 067	Leaf spring	1

Fig. 43 Exploded view I

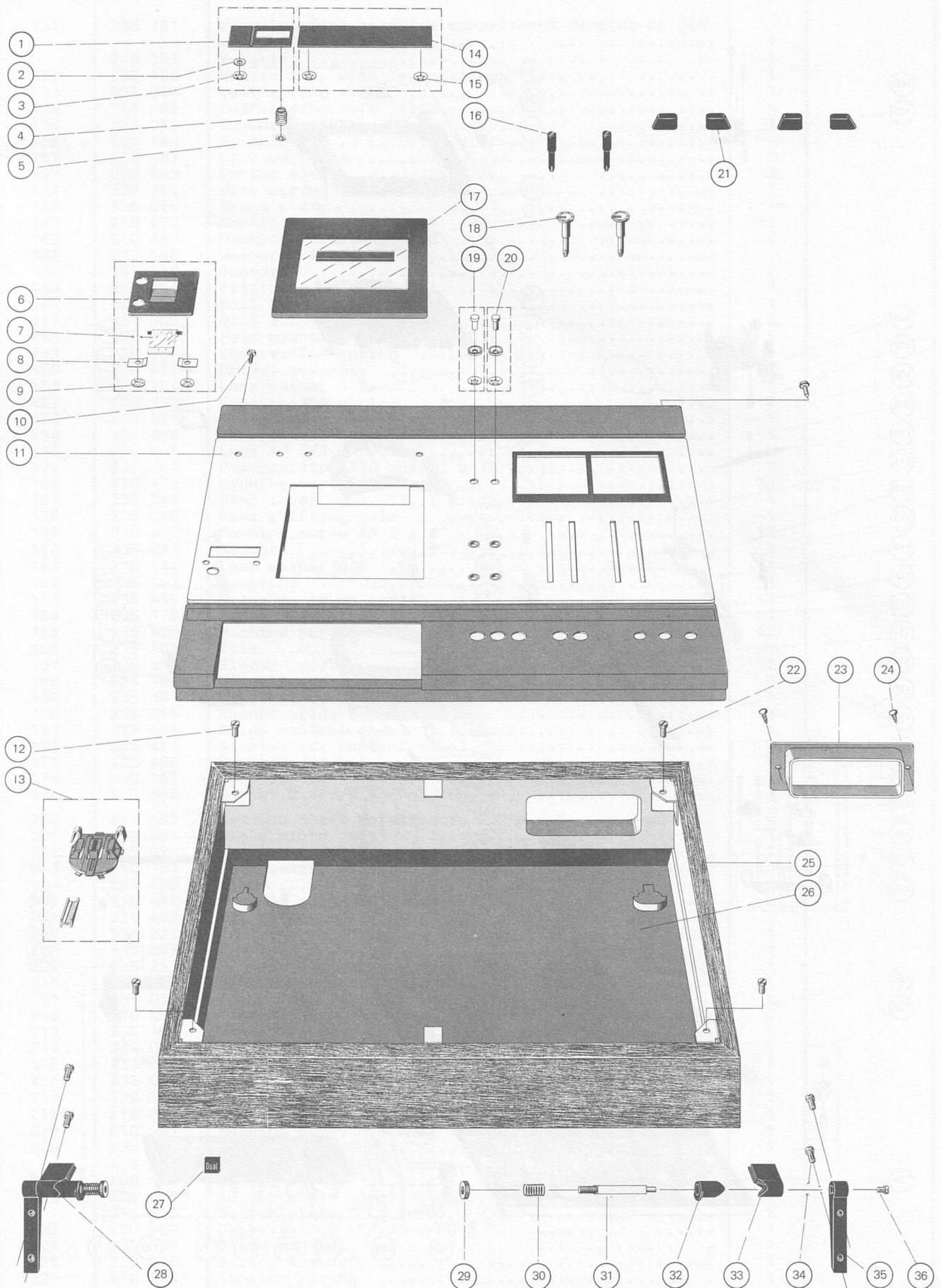
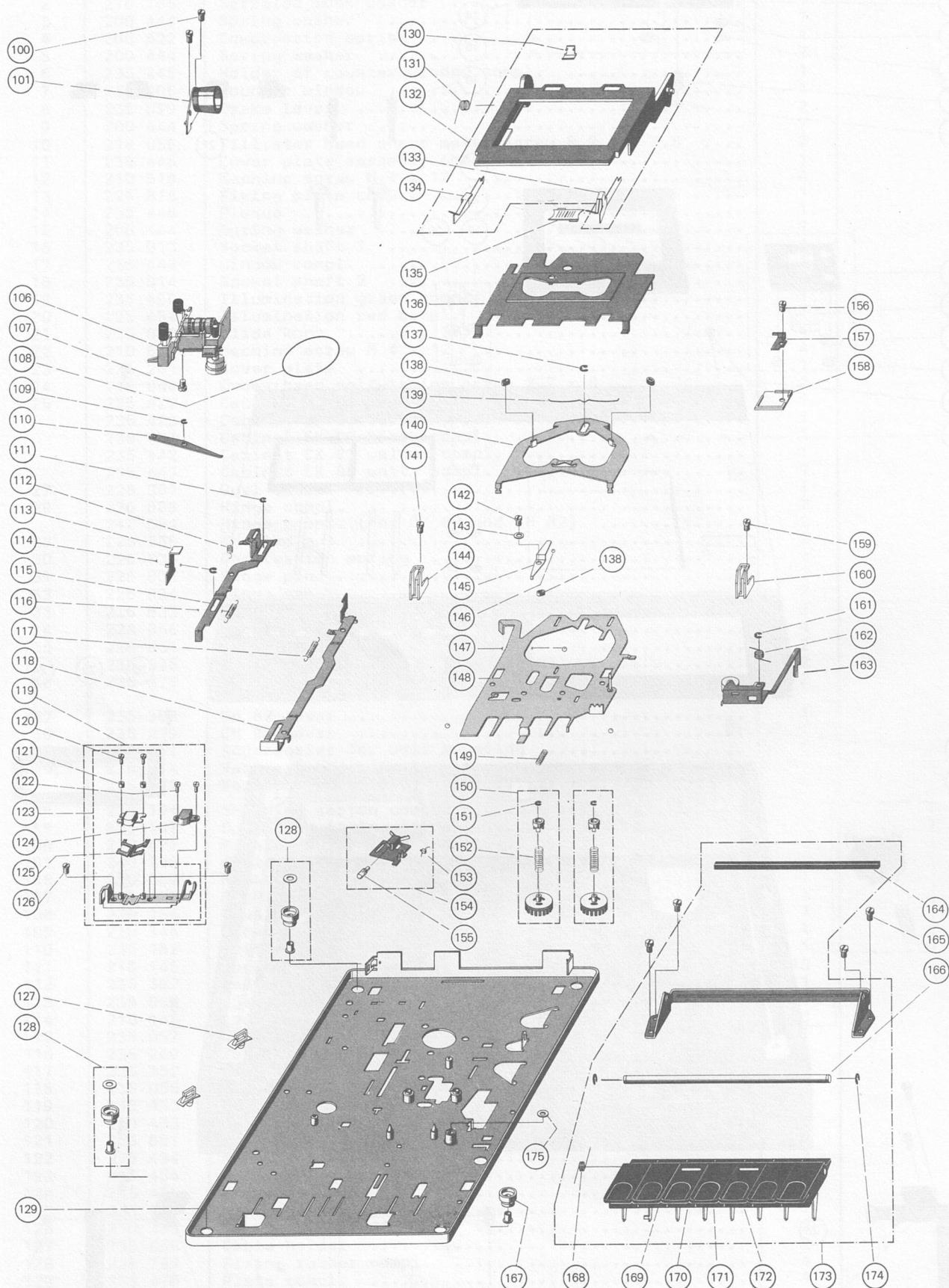


Fig. 44 Exploded view II



Pos.	Part.-No.	Description	Qty.
131	235 161	V-spring (for cassette compartment damping of old version)	1
	240 357	V-spring	1
132	235 456	Holder cpl. with leaf springs	1
133	235 066	Leaf spring right	1
134	235 065	Leaf spring left	1
135	235 042	Luminous window	1
136	235 160	Trimplate	1
137	210 147	Lock washer 4	1
138	200 650	Rubber sleeve	3
139	235 156	Wire spring	1
140	235 074	Brake plate	1
141	210 472	Machine screw AM 3 x 4	12
142	210 469	Machine screw AM 3 x 3	2
143	210 586	Washer 3.2/7/0.5 St	1
144	235 017	Support	2
145	235 354	Retaining spring compl.	1
146	209 353	Ball 2	1
147	211 306	Ball 3.5	3
148	235 115	Head mounting plate assembly	1
149	235 155	Compression spring	1
150	235 457	Driver assembly	2
151	210 144	Lock washer 1.9	4
152	235 150	Compression spring	2
153	235 625	Photo transistor	1
154	235 458	Tape travel and monitor unit compl.	1
155	209 443	Lamp 12 V/1 W	1
R 122	235 787	Pre-resistor 150 ohms/1 W/10 %	1
156	210 472	Machine screw AM 3 x 4	12
157	235 244	Stop lever	1
158	235 080	Gear shifting gate	1
159	210 472	Machine screw AM 3 x 4	12
160	235 017	Support	2
161	210 144	Lock washer 1.9	4
162	235 157	V-spring	1
163	235 459	Pressure lever compl.	1
164	235 179	Stop	1
165	210 472	Machine screw AM 3 x 4	12
166	235 105	Axle	1
167	226 260	Sleeve	2
168	235 163	V-spring control	7
169	235 461	Eject slide compl.	1
170	235 463	Record slide control compl.	1
171	235 465	Slide control compl.	4
172	235 467	Start-slide control compl.	1
173	235 468	Key board compl.	1
174	210 147	Lock washer 4	2
175	210 556	Washer 2.4/6/0.5 (Poliäthylen)	1
200	227 467	Hexagon sheet metal screw 2.9 x 6.5	4
201	235 035	Angle plate left	1
202	235 098	Locking lever	1
203	210 145	Lock washer 2.3	10
204	235 120	Flap	1
205	210 472	Machine screw AM 3 x 4	2
206	235 469	Traction magnet compl. with armature	1
207	235 223	Compression spring	1
208	235 097	Armature	1
209	235 233	Release control	1
210	235 068	Bearing support	1
211	235 052	Fork	1
212	210 469	Machine screw AM 3 x 3	2
213	235 152	Tension spring	1
214	233 005	Connection plate compl. with cover	1
215	233 007	Connection plate	1
216	233 006	Cover	1
217	220 152	Plastic clip	1
218	210 586	Washer 3.2/7/0.5	1
219	210 501	Machine screw M 3 x 35	1
220	236 606	Power switch compl.	1
	233 008	Power switch "UL", compl.	1
221	200 444	Spring washer	1
222	236 605	Switch plate compl.	1
	233 013	Switch plate "UL" compl.	1
223	230 355	Capacitor 68 nF/250 V/20 %	1
224	236 335	Slide control	1
225	230 148	Switch bracket	1
226	230 296	Tension spring	1

Pos.	Part.-No.	Description	Qty.
227	219 200	Snap spring	1
228	233 011	Cover	1
229	210 498	Machine screw M 3 x 28	1
230	235 470	Basic mounting plate, compl.	1
231	226 845	V-spring	1
232	235 471	Main belt	1
233	210 145	Lock washer 2.3	10
234	235 472	Winding gear left compl.	1
235	235 473	Large flywheel compl.	1
236	235 044	Bottom board	1
237	209 962	Solder lug	1
238	210 480	Machine screw AM 3 x 6	1
239	230 559	Set screw M 2.5 x 3.5	1
240	226 812	Drive pulley 50 Hz compl.	1
	226 813	Drive pulley 60 Hz compl.	1
241	210 366	Hex nut BM 4	4
242	210 626	Washer 4.2/7/0.5 St	2
**	235 391	Segment	1
* 243	226 506	Leakage resistor 2.2 Mohms/0.3 W	1
244	210 366	Hex nut M 4	2
245	201 161	Serrated lock washer 4.3	2
246	209 977	Solder lug	1
* 247	235 206	Top housing panel compl.	1
**	235 395	Top housing panel compl.	1
248	211 553	Machine screw M 4 x 48	2
249	226 811	Armature	1
* 250	218 323	Stator 110/220 V compl.	1
**	241 684	Stator 26 V compl.	1
251	216 276	Bottom housing panel compl.	1
* 252	235 474	Motor 110/220 V compl.	1
**	241 683	Motor SM 840-2 26 V compl.	1
253	226 260	Sleeve	2
254	235 475	Top lever compl.	1
255	210 145	Lock washer 2.3	10
256	235 147	Coupling compl.	1
257	210 142	Lock washer 1.2	2
258	235 106	Intermediate gear	1
259	210 142	Lock washer 1.2	2
260	235 129	Muting switch gear	1
261	210 145	Lock washer 2.3	10
262	235 135	Take-up belt	1
263	235 025	Coupling unit	1
264	235 107	Leaf spring	1
* 265	235 476	Power transformer compl.	1
**	242 032	Power transformer compl.	1
266	210 359	Hex nut M 3	1
267	210 486	Machine screw AM 3 x 8	1
268	235 692	Screening ring (motor)	1
269	214 602	AMP sleeve	2
270	232 996	Power cable europe compl.	1
271	235 034	Bracket, right	1
272	227 467	Hexagonal sheet metal screw	4
273	235 142	Tension spring	1
274	235 110	Pause lever	1
275	210 145	Lock washer 2.3	10
276	235 284	Release lever	1
277	210 619	Washer 3.7/8/1	1
278	210 145	Lock washer 2.3	10
279	235 478	Muting switch assembly	1
280	210 472	Machine screw M 3 x 4	1
281	210 145	Lock washer 2.3	10
282	235 479	Take-up gear right	1
283	235 150	Compression spring	1
284	235 070	Winding axle	1
* 285	235 059	Clamping plate right	1
**	235 385	Clamping plate compl.	2
286	210 515	Machine screw M 4 x 6	4
* 287	235 061	Clamping plate	2
**	235 386	Clamping plate compl.	2
288	235 060	Clamping plate left	1
289	232 995	Power cable america compl.	1
290	235 283	Lift piece	1
300	235 480	Recording level meter assembly, twin-type	1
301	226 369	Hook spring	2
302	226 393	Lamp 12 - 15 V/30 mA	2
303	230 955	Lamp socket	2
R 155	235 729	Carbon resistor 100 ohms/0.50 W/5 %	1

* up to No. 129 000 ** No. 129 001 and subsequent Nos.

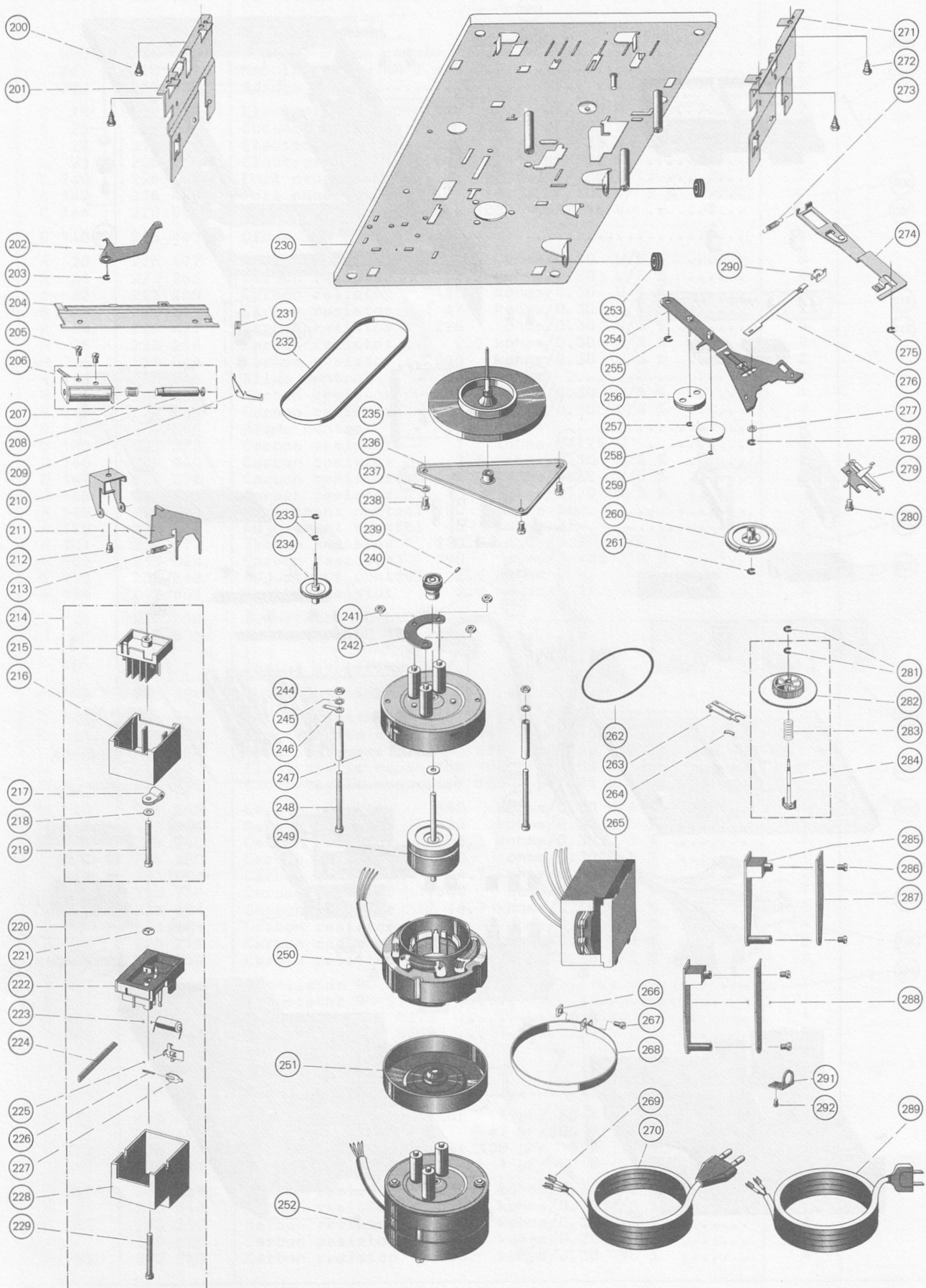
Pos.	Part.-No.	Description	Qty.
310	235 481	Generator plate compl.	1
311	235 667	Spring ledge 6 pole	2
C 110	222 219	Electrolytic capacitor 4.7 μ F/ 25 V	1
C 111	226 449	Electrolytic capacitor 10 μ F/ 25 V	1
C 112	235 568	Foil capacitor 15 nF/ 63 V/5 %	1
C 113	235 513	Foil capacitor 2.2 nF/ 63 V/5 %	2
C 114	235 513	Foil capacitor 2.2 nF/ 63 V/5 %	2
C 115	235 681	Foil capacitor 15 nF/160 V/5 %	1
C 116	226 454	Electrolytic capacitor 47 μ F/ 25 V	1
C 117	235 569	Foil capacitor 220 pF/ 63 V/5 %	2
C 118	226 449	Electrolytic capacitor 10 μ F/ 25 V	1
C 119	222 219	Electrolytic capacitor 4.7 μ F/ 25 V	1
D 110	223 906	Diode 1 N 4148	4
D 111	223 906	Diode 1 N 4148	4
D 112	223 906	Diode 1 N 4148	4
D 113	223 906	Diode 1 N 4148	4
L 110	235 612	Generator coil	1
R 110	223 898	Carbon resistor 10 kohms/0.30 W/5 %	1
R 111	223 265	Carbon resistor 1.2 kohms/0.30 W/5 %	2
R 112	226 476	Carbon resistor 180 kohms/0.30 W/5 %	2
R 113	226 476	Carbon resistor 180 kohms/0.30 W/5 %	2
R 114	223 265	Carbon resistor 1.2 kohms/0.30 W/5 %	2
R 115	223 219	Carbon resistor 22 ohms/0.30 W/5 %	2
R 116	223 212	Carbon resistor 47 kohms/0.30 W/5 %	2
R 117	223 212	Carbon resistor 47 kohms/0.30 W/5 %	2
R 118	223 219	Carbon resistor 22 ohms/0.30 W/5 %	2
R 119	235 676	Adjustment control 50 kohms/lin.	2
R 120	223 264	Carbon resistor 1 kohms/0.30 W/5 %	1
R 121	223 262	Carbon resistor 27 kohms/0.30 W/5 %	1
T 110	209 862	Transistor BC 172 C	1
T 111	220 538	Transistor BC 327/16	1
T 112	220 537	Transistor BC 337/16	2
T 113	220 537	Transistor BC 337/16	2
<u>Recording amplifier</u>			
315	235 482	Recording amplifier compl.	2
316	211 379	Washer 2.1/5.0/0.5	3
317	210 535	Machine screw B 2.2 x 6.5	2
C 60	222 213	Electrolytic capacitor 1 μ F/ 50 V	1
C 61	235 619	Foil capacitor 0.68 μ F/100 V/5 %	1
C 62	226 453	Electrolytic capacitor 47 μ F/ 16 V	1
C 63	222 219	Electrolytic capacitor 4.7 μ F/ 25 V	1
C 64	223 039	Foil capacitor 22 nF/250 V/5 %	1
C 65	235 673	Foil capacitor 15 nF/ 63 V/2.5 %	1
C 66	235 674	Foil capacitor 12 nF/250 V/5 %	1
C 67	235 672	Foil capacitor 6.8 nF/100 V/5 %	1
L 60	235 533	Coil	1
R 60	224 058	Carbon resistor 6.8 kohms/0.30 W/5 %	1
R 61	223 216	Carbon resistor 2.2 kohms/0.30 W/5 %	1
R 62	223 258	Carbon resistor 220 kohms/0.30 W/5 %	1
R 63	225 592	Carbon resistor 56 kohms/0.30 W/5 %	1
R 64	235 535	Carbon resistor 68 kohms/0.30 W/5 %	1
R 65	228 740	Carbon resistor 120 kohms/0.30 W/5 %	1
R 66	223 211	Carbon resistor 1.5 kohms/0.30 W/5 %	1
R 67	229 952	Carbon resistor 820 ohms/0.30 W/5 %	1
R 68	223 207	Carbon resistor 330 ohms/0.30 W/5 %	1
R 69	229 941	Carbon resistor 82 ohms/0.30 W/5 %	1
T 60	209 863	Transistor BC 173 C	1
T 61	209 862	Transistor BC 172 C	1
<u>Playback amplifier</u>			
320	235 483	Playback amplifier compl.	2
C 40	235 573	Electrolytic capacitor 10 μ F/ 16 V	1
C 41	220 591	Ceramic capacitor 220 pF/500 V/20 %	1
C 42	223 039	Foil capacitor 22 nF/250 V/ 5 %	1
C 43	235 527	Foil capacitor 3 nF/ 63 V/ 5 %	1
C 44	228 763	Electrolytic capacitor 100 μ F/ 6 V	1
C 45	216 667	Ceramic capacitor 100 pF/100 V/10 %	1
C 46	222 213	Electrolytic capacitor 1 μ F/ 50 V	1
C 47	235 617	Foil capacitor 1.8 nF/160 V/2.5 %	1

Pos.	Part.-No.	Description	Qty.
R 40	226 477	Carbon resistor 220 ohms/0.30 W/5 %	1
R 41	223 212	Carbon resistor 47 kohms/0.30 W/5 %	1
R 42	235 713	Carbon resistor 82 kohms/0.30 W/5 %	1
R 43	229 952	Carbon resistor 820 ohms/0.30 W/5 %	1
R 44	226 477	Carbon resistor 220 ohms/0.30 W/5 %	1
R 45	223 896	Carbon resistor 2.2 Mohms/0.30 W/5 %	1
R 46	223 259	Carbon resistor 470 ohms/0.30 W/5 %	1
R 47	223 216	Carbon resistor 2.2 kohms/0.30 W/5 %	1
R 48	235 535	Carbon resistor 68 kohms/0.30 W/5 %	1
R 49	223 262	Carbon resistor 27 kohms/0.30 W/5 %	1
R 50	224 600	Carbon resistor 39 kohms/0.30 W/5 %	1
T 40	226 898	Transistor BC 550 C	2
T 41	235 921	Transistor BC 239 C	2
<u>Dolby amplifier</u>			
325	235 484	Dolby amplifier compl.	2
326	235 574	JC-holder 16 pole	1
327	210 535	Machine sheet metal screw B 2.2 x 6.5	2
C 70	226 455	Electrolytic capacitor 100 μ F/ 25 V	1
C 71	235 573	Electrolytic capacitor 10 μ F/ 16 V	5
C 72	235 662	Electrolytic capacitor 0.33 μ F/ 35 V	1
C 73	235 524	Foil capacitor 4.7 nF/ 63 V/2.5 %	1
C 74	235 523	Foil capacitor 27 nF/ 63 V/2.5 %	1
C 75	235 525	Foil capacitor 5.6 nF/ 63 V/2.5 %	1
C 76	235 573	Electrolytic capacitor 10 μ F/ 16 V	5
C 77	235 527	Foil capacitor 3 nF/ 63 V/5 %	1
C 78	235 513	Foil capacitor 2.2 nF/ 63 V/5 %	1
C 79	235 528	Foil capacitor 3.9 nF/ 63 V/5 %	1
C 80	235 573	Electrolytic capacitor 10 μ F/ 16 V	5
C 81	235 573	Electrolytic capacitor 10 μ F/ 16 V	5
C 82	222 500	Foil capacitor 47 nF/250 V/5 %	1
C 83	235 573	Electrolytic capacitor 10 μ F/ 16 V	5
C 84	226 459	Foil capacitor 0.1 μ F/100 V/5 %	1
C 85	226 460	Foil capacitor 0.33 μ F/100 V/5 %	1
C 86	227 888	Ceramic capacitor 82 pF/ 63 V/2 %	1
D 70	226 725	Diode BZX 83	1
D 71	226 443	Diode 1 N 54 A	1
J 70	235 532	Integrated circuit	1
L 70	235 516	Coil	2
L 71	235 517	Coil	2
R 70	223 212	Carbon resistor 47 kohms/0.30 W/5 %	1
R 71	227 251	Carbon resistor 3.3 kohms/0.30 W/2 %	1
R 72	235 507	Carbon resistor 180 ohms/0.30 W/5 %	1
R 73	223 897	Carbon resistor 100 kohms/0.30 W/5 %	3
R 74	223 897	Carbon resistor 100 kohms/0.30 W/5 %	3
R 75	229 927	Carbon resistor 3.9 kohms/0.30 W/5 %	1
R 76	226 481	Carbon resistor 270 kohms/0.30 W/5 %	1
R 77	223 895	Carbon resistor 680 kohms/0.30 W/5 %	1
R 78	223 260	Carbon resistor 150 kohms/0.30 W/5 %	1
R 79	226 479	Carbon resistor 120 ohms/0.30 W/5 %	1
R 80	223 897	Carbon resistor 100 kohms/0.30 W/5 %	3
<u>Base plate</u>			
330	235 485	Base plate compl.	1
C 4	228 765	Electrolytic capacitor 100 μ F/ 25 V	2
C 5	228 765	Electrolytic capacitor 100 μ F/ 25 V	2
C 6	226 741	Foil capacitor 100 pF/160 V/ 5 %	1
C 8	235 577	Foil capacitor 150 pF/630 V/10 %	2
L 1	226 406	Coil 16 mH	2
R 4	226 483	Carbon resistor 100 ohms/0.30 W/5 %	2
R 5	235 578	Adjustment control 100 kohms/lin.	2
R 6	235 676	Adjustment control 50 kohms/lin.	2
R 7	235 675	Carbon resistor 1 kohms/0.30 W/2 %	2
R 8	223 216	Carbon resistor 2.2 kohms/0.30 W/5 %	1
R 9	235 656	Carbon resistor 180 ohms/0.30 W/2 %	2
R 10	235 507	Carbon resistor 180 ohms/0.30 W/5 %	2
R 11	235 675	Carbon resistor 1 kohms/0.30 W/2 %	2
R 12	226 479	Carbon resistor 120 ohms/0.30 W/5 %	1
S 1	235 504	Switch	1
S 2	235 504	Switch	1
S 3	235 506	Switch	1

Pos.	Part.-No.	Description	Qty.
* 340	235 487	Cable assembly compl.	1
** 341	242 031	Cable assembly compl.	1
342	223 834	Plug 7 pole	5
343	226 514	Bush terminal 3 pole	2
344	229 869	Spring terminal 3 pole	1
345	235 634	Plug terminal 5 pole	1
346	235 682	AMP-flat plug 2.8 x 0.5	4
350	226 755	Cable band	10
351	235 046	Chassis plate	1
352	210 472	Machine screw AM 3 x 4	4
353	226 393	Lamp 12 - 15 V	2
354	226 944	Lamp housing	2
355	235 255	Cover	2
355	227 467	Hexagon sheet metal screw BZ 2.9 x 6.5	1
<u>Power part</u>			
** 360	241 732	Power part compl.	1
* 361	235 488	Power part compl.	1
362	210 480	Machine screw AM 3 x 6	1
362	235 031	Cooling plate	1
C 130	217 883	Fuse 630 mA (slow blow)	1
C 131	226 586	Electrolytic capacitor 1000 µF/ 40 V	1
C 132	226 457	Electrolytic capacitor 470 µF/ 40 V	2
**C 133	226 455	Electrolytic capacitor 100 µF/ 25 V	1
**C 134	222 495	Foil capacitor 0.1 µF/250 V/5 %	2
D 130	222 495	Foil capacitor 0.1 µF/250 V/5 %	2
D 131	226 501	Diode 1 N 4002	4
D 132	226 501	Diode 1 N 4002	4
D 133	226 501	Diode 1 N 4002	4
D 134	226 501	Diode 1 N 4002	4
R 130	235 565	Diode ZPY 20	1
R 131	235 563	Carbon resistor 1,5 ohms/1.0 W/10 %	1
R 132	235 799	Carbon resistor 150 ohms/0.30 W/ 5 %	1
T 130	223 207	Carbon resistor 330 ohms/0.30 W/ 5 %	1
T 130	226 472	Transistor BD 233/16	1
<u>Push button plate</u>			
365	235 489	Push button plate compl.	1
366	235 069	Key button	5
367	227 467	Hexagon sheet metal screw BU 2.9 x 6.5	2
368	209 974	Soldering lug	1
369	233 652	Compression spring (FE CR)	1
370	233 657	Compression (Limiter)	2
371	235 739	Compression (FE)	1
371	236 653	Compression (Dolby No.)	1
371	238 083	Compression (CR)	1
371	236 659	Form spring	1
371	238 086	Safety plate	1
D 160	223 906	Diode 1 N 4148	2
R 160	223 898	Carbon resistor 10 kohms/0.30 W/5 %	2
R 161	223 265	Carbon resistor 1.2 kohms/0.30 W/5 %	2
R 162	220 539	Carbon resistor 47 kohms/0.25 W/5 %	1
R 163	235 671	Carbon resistor 220 ohms/0.30 W/2 %	1
R 164	235 507	Carbon resistor 180 ohms/0.30 W/5 %	1
S 4	238 091	Contact housing compl. (FE)	1
S 5	238 090	Contact housing compl. (CR)	1
S 6	238 089	Contact housing compl. (FE/CR)	1
S 7	238 088	Contact housing compl. (DOLBY No.)	1
S 8	238 087	Contact housing compl. (Limiter)	1
372	235 490	Bowden wire compl.	1
373	210 472	Machine screw AM 3 x 4	2
374	235 293	Clamp	1
<u>Socket plate</u>			
375	235 491	Socket plate compl.	1
376	235 332	Plate	1
377	235 032	Holding sheet	4
378	235 572	Input socket (Cynch)	2
378	226 514	Bush terminal 5 pole	2
*R 170	226 486	Carbon resistor 330 kohms/0.30 W/5 %	2
** 170	223 895	Carbon resistor 680 kohms/0.30 W/5 %	2

* up to No. 129 000 ** No. 129 001 and subsequent Nos.

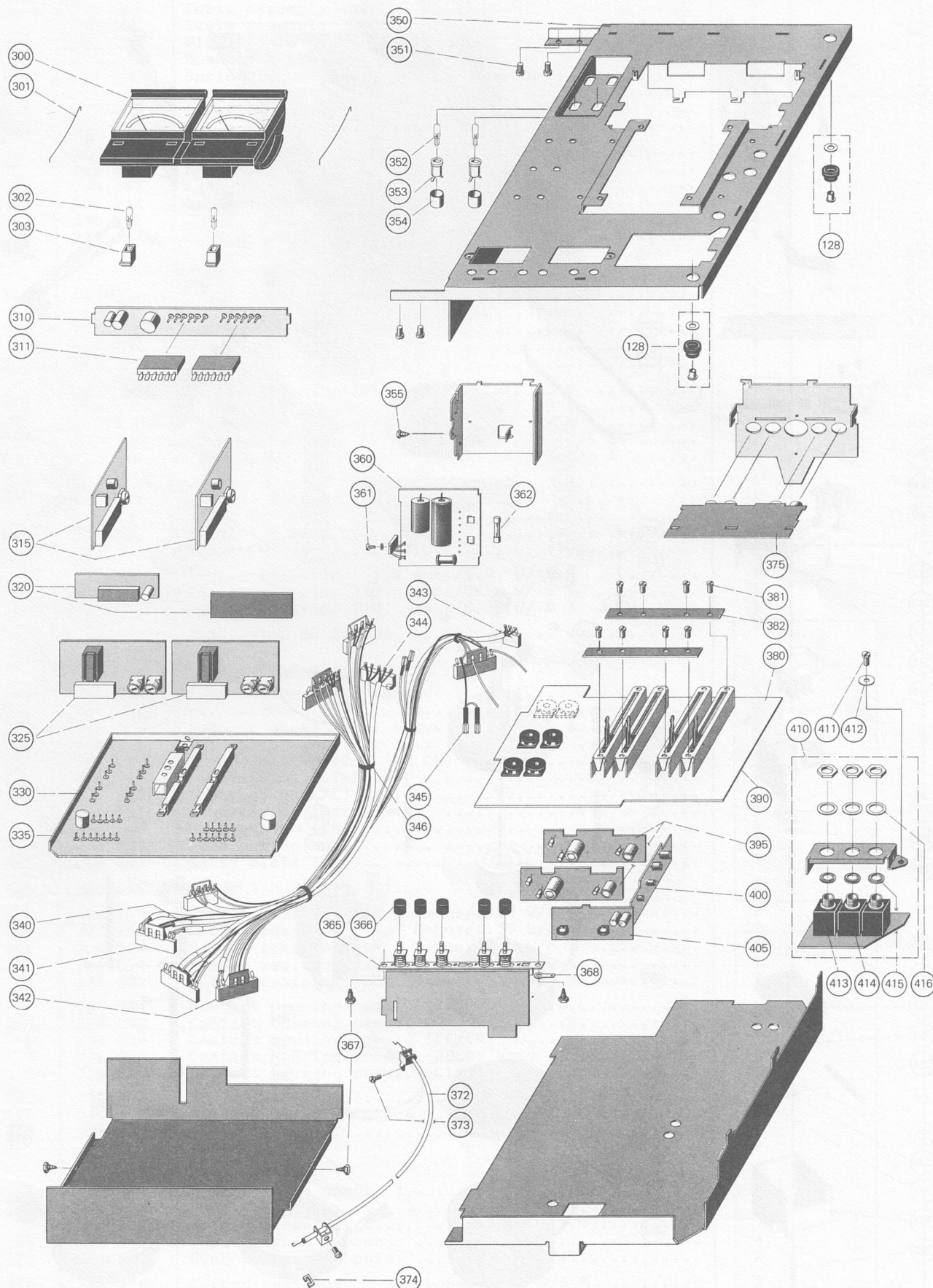
Fig. 45 Exploded view III



Pos.	Part.-No.	Description	Qty.
R 171	226 509	Adjustment control 25 kohms lineary	2
		<u>Control plate</u>	
380	235 492	Control plate compl.	1
381	210 469	Machine screw AM 3 x 3	8
382	235 058	Bridge	2
C 20	222 219	Electrolytic capacitor 4.7 μ F/ 25 V	2
C 21	223 278	Ceramic capacitor 330 pF/500 V/10 %	2
C 22	216 664	Electrolytic capacitor 1 μ F/ 35 V	2
C 23	226 450	Electrolytic capacitor 22 μ F/ 16 V	2
C 140	226 452	Foil capacitor 47 μ F/ 6 V	2
C 142	226 460	Foil capacitor 0.33 μ F/100 V/ 5 %	2
C 144	220 531	Electrolytic capacitor 100 μ F/ 16 V	2
D 140	226 443	Diode 1 N 54 A	2
R 20	226 477	Carbon resistor 220 ohms/0.30 W/5 %	6
R 21	223 265	Carbon resistor 1.2 kohms/0.30 W/5 %	2
R 22	223 260	Carbon resistor 150 kohms/0.30 W/5 %	2
R 23	223 212	Carbon resistor 47 kohms/0.30 W/5 %	2
R 24	226 477	Carbon resistor 220 ohms/0.30 W/5 %	6
R 25	223 216	Carbon resistor 2.2 kohms/0.30 W/5 %	2
**R 26	235 544	Carbon resistor 390 kohms/0.30 W/5 %	2
R 140	235 546	Slide control 50 kohms	4
R 141	224 059	Carbon resistor 33 kohms/0.30 W/5 %	4
R 142	224 059	Carbon resistor 33 kohms/0.30 W/5 %	4
R 144	235 546	Slide control 50 kohms	4
R 145	227 370	Carbon resistor 1 kohms/0.125 W	2
R 146	229 940	Carbon resistor 3.3 kohms/0.30 W/5 %	2
R 147	224 058	Carbon resistor 6.8 kohms/0.30 W/5 %	2
R 148	223 898	Carbon resistor 10 kohms/0.30 W/5 %	2
R 149	235 576	Adjustment control 220 ohms lin.	2
R 150	235 539	Adjustment control 5 kohms lin.	2
R 151	226 477	Carbon resistor 220 ohms/0.30 W/5 %	6
R 152	235 624	Carbon resistor 390 ohms/0.125 W/5 %	2
R 153	235 543	Adjustment control 2.5 kohms lin.	2
R 154	217 861	Carbon resistor 2.2 kohms/0.25 W/5 %	2
T 20	226 898	Transistor BC 550 C	2
T 21	209 863	Transistor BC 173 C	2
		<u>Output amplifier</u>	
395	235 494	Output amplifier compl.	2
C 100	226 459	Foil capacitor 0.1 μ F/100 V/ 5 %	1
C 101	226 453	Electrolytic capacitor 47 μ F/ 16 V	1
C 102	203 474	Ceramic capacitor 680 pF/ 50 V/20 %	1
C 103	216 667	Electrolytic capacitor 100 pF/100 V/10 %	1
C 104	226 455	Electrolytic capacitor 100 μ F/ 25 V	1
R 100	227 263	Carbon resistor 560 kohms/0.30 W/5 %	1
R 101	235 544	Carbon resistor 390 kohms/0.30 W/5 %	1
R 102	229 940	Carbon resistor 3.3 kohms/0.30 W/5 %	1
R 103	226 480	Carbon resistor 680 ohms/0.30 W/5 %	1
R 104	223 884	Carbon resistor 4.7 kohms/0.30 W/5 %	2
R 105	228 738	Carbon resistor 560 ohms/0.30 W/5 %	1
R 106	223 884	Carbon resistor 4.7 kohms/0.30 W/5 %	2
R 107	223 219	Carbon resistor 22 ohms/0.30 W/5 %	1
R 108	223 219	Carbon resistor 22 ohms/0.30 W/5 %	2
R 109	223 219	Carbon resistor 22 ohms/0.30 W/5 %	2
T 100	216 042	Transistor BC 253 B	1
T 101	209 862	Transistor BC 172 C	1
T 102	220 538	Transistor 2 N 5375	1
T 103	220 537	Transistor 2 N 5369	1
		<u>Input amplifier</u>	
400	235 495	Input amplifier compl.	1
C 30	222 213	Electrolytic capacitor 1 μ F/ 50 V	2
C 31	213 498	Ceramic capacitor 47 pF/500 V/10 %	2
C 32	228 763	Electrolytic capacitor 100 μ F/ 6 V	2
C 33	222 213	Electrolytic capacitor 1 μ F/ 50 V	2
R 30	226 631	Carbon resistor 220 kohms/0.30 W/5 %	2
R 31	223 258	Carbon resistor 220 kohms/0.30 W/5 %	2
*R 32	223 260	Carbon resistor 150 kohms/0.30 W/5 %	4
**	235 535	Carbon resistor 68 kohms/0.30 W/5 %	2
R 33	223 260	Carbon resistor 150 kohms/0.30 W/5 %	4

* up to No. 129 000 ** No. 129 001 and subsequent Nos.

Fig. 46 Exploded view IV



Pos.	Part.-No.	Description	Qty.
R 34	223 207	Carbon resistor 350 ohms/0.30 W/5 %	2
R 35	223 216	Carbon resistor 2.2 kohms/0.30 W/5 %	2
T 30	226 898	Transistor BC 550 C	2
T 31	221 942	Transistor BC 239 C	2
<u>Limiter</u>			
405	235 496	Limiter compl.	1
*C 90	222 213	Electrolytic capacitor 1 μ F/50 V	4
**	216 410	Elyt capacitor 470 nF/35 V	2
C 91	222 213	Electrolytic capacitor 1 μ F/50 V	4
D 90	226 629	Diode BAW 21	2
D 91	223 906	Diode 1 N 4148	4
D 92	223 906	Diode 1 N 4148	4
R 90	235 542	Adjustment control 10 kohms lin.	2
R 91	226 548	Carbon resistor 200 Mohms/0.50 W/20 %	2
R 92	224 058	Carbon resistor 6.8 kohms/0.30 W/ 5 %	2
T 90	235 808	Transistor BC 238 D	4
T 91	235 808	Transistor BC 238 D	4
<u>Mic.-socket plate</u>			
410	235 274	Mic.-socket plate compl.	1
411	210 475	Machine screw AM 3 x 5	1
412	235 063	Socket	1
413	235 498	Headphone socket compl.	1
414	235 499	Mic. socket compl.	2
415	235 064	Insulating ring	3
416	235 683	Washer 9.2 x 12 x 1	3
C 1	216 414	Ceramic capacitor	1
C 2	226 449	Electrolytic capacitor 10 μ F/25 V	1
C 3	229 923	Electrolytic capacitor 2.2 μ F/50 V	2
R 1	223 898	Carbon resistor 10 kohms/0.30 W/5 %	3
R 2	223 898	Carbon resistor 10 kohms/0.30 W/5 %	3
R 3	229 940	Carbon resistor 3.3 kohms/0.30 W/5 %	2
R 13	235 507	Carbon resistor 180 ohms/0.30 W/5 %	2
Replacement for model „FM„			
<u>Base plate FM</u>			
335	235 486	Base plate FM compl.	1
C 4	228 765	Elyt capacitor 100 μ F/ 25 V	2
C 5	228 765	Elyt capacitor 100 μ F/ 25 V	2
C 8	235 577	Foil capacitor 150 pF/ 63 V	2
L 1	226 406	Coil 16 mH	2
R 4	226 483	Carbon resistor 100 ohms/0.3 W/3,5 %	2
R 5	235 578	Adjustment control 100 kohms lin.	2
R 6	235 676	Adjustment control 50 kohms lin.	2
R 7	235 675	Carbon resistor 1 kohms/0.3 W	2
R 8	223 216	Carbon resistor 2.2 kohms/0.3 W	1
R 9	235 656	Carbon resistor 180 ohms	2
R 10	235 507	Carbon resistor 180 ohms	2
R 11	235 675	Carbon resistor 1 kohms	2
R 12	226 479	Carbon resistor 120 ohms/0.3 W/5 %	1
S 1	235 504	Switch	2
S 2	235 504	Switch	2
S 3	235 506	Switch	1
<u>Control plate</u>			
380	235 493	Control plate compl.	1
C 20	222 219	Electrolytic capacitor 4.7 μ F/ 25 V	2
C 21	223 278	Ceramic capacitor 330 pF/500 V/10 %	2
C 22	216 664	Electrolytic capacitor 1 μ F/ 35 V	2
C 23	226 450	Electrolytic capacitor 22 μ F/ 16 V	2
C 140	226 452	Foil capacitor 47 μ F/ 6 V	2
C 144	220 531	Electrolytic capacitor 100 μ F/ 16 V	2
C 145	235 528	Foil capacitor 3.9 nF/ 63 V	2
D 140	226 443	Diode 1 N 54 A	2
R 20	226 477	Carbon resistor 220 Ω /0.30 W/5 %	6
R 21	223 265	Carbon resistor 1.2 k Ω /0.30 W/5 %	2
R 22	223 260	Carbon resistor 150 k Ω /0.30 W/5 %	2

* up to No. 129 000

** No. 129 001 and subsequent Nos.

Pos.	Part.-No.	Description	Qty.
R 23	223 212	Carbon resistor 47 kΩ/0.30 W/5 %	2
R 24	226 477	Carbon resistor 220 Ω/0.30 W/5 %	6
R 25	223 216	Carbon resistor 2.2 kΩ/0.30 W/5 %	2
**R 26	235 544	Carbon resistor 390 kΩ/0.30 W/5 %	2
R 140	235 546	Slide control 50 kΩ	4
R 141	224 059	Carbon resistor 33 kΩ/0.30 W/5 %	4
R 142	224 059	Carbon resistor 33 kΩ/0.30 W/5 %	4
R 144	235 546	Slide control 50 kΩ	4
R 145	227 370	Carbon resistor 1.5 kΩ/0.125 W	2
R 146	229 940	Carbon resistor 3.3 kΩ/0.30 W/5 %	2
R 147	224 058	Carbon resistor 6.8 kΩ/0.30 W/5 %	2
R 148	223 898	Carbon resistor 10 kΩ/0.30 W/5 %	2
R 149	235 576	Adjustment control 220 Ω lin.	2
R 150	235 539	Adjustment control 5 kΩ lin.	2
R 151	226 477	Carbon resistor 220 Ω/0.30 W/5 %	6
R 152	235 624	Carbon resistor 390 Ω/0.125 W/5 %	2
R 153	235 543	Adjustment control 2.5 kΩ lin.	2
R 165	235 519	Carbon resistor 20 kΩ/0.30 W/5 %	2
R 166	235 537	Trimmer 10 kΩ lineary	2
T 20	226 898	Transistor BC 550 C	2
T 21	209 863	Transistor BC 173 C	2
<u>Input amplifier</u>			
400	235 402	Input amplifier compl. (for model USA)	1
C 30	222 213	Electrolytic capacitor 1 μF/ 50 V	2
C 31	226 462	Ceramic capacitor 10 μF/250 V/10 %	2
C 32	228 763	Electrolytic capacitor 100 μF/ 6 V	2
C 33	222 213	Electrolytic capacitor 1 μF/ 50 V	2
R 30	226 631	Carbon resistor 220 kΩ/0.30 W/5 %	2
R 31	223 258	Carbon resistor 220 kΩ/0.30 W/5 %	2
R 32	224 059	Carbon resistor 33 kΩ/0.30 W/5 %	2
R 33	223 260	Carbon resistor 150 kΩ/0.30 W/5 %	4
R 34	223 207	Carbon resistor 350 Ω/0.30 W/5 %	2
R 35	223 216	Carbon resistor 2.2 kΩ/0.30 W/5 %	2
T 30	226 898	Transistor BC 550 C	2
T 31	221 942	Transistor BC 239 C	2

We reserve the right to delivery and modifications in the interessents of technical progress.