

Dual

Edition November 1977

C 939

Download from www.dual.de
Not for commercial use



Service - Manual

Dual Gebrüder Steidinger · 7742 St. Georgen/Schwarzwald

Contents

Page	
2	Technical data
3	Mechanical part
3	1. Removal of cover plate
3	2. Dismounting and mounting
3	3. Motor
4	4. Drive roll
4	5. Drive belts
5	6. Wow
5	7. Coupling
6	8. Pressure roller lever
6	9. Ground contact
6	10. Power switch
6	11. Memory switch / counter
7	12. Record / Playback head
7	13. Erase head
7	14. Cleaning
7,8	15. Lubrication
9	Electrical part
9, 10	Functions
10 - 12	Test and adjustment data
12	Alignment positions
13	Connector positions the moduls and coupler
14 - 16	Circuit diagram
17 - 21	Printed circuit bords
22 - 30	Replacement with exploded views

Technical Data

The Dual C 939 meets or surpasses the requirements of DIN (German Industry Standard) 45 500 for HiFi home studio equipment.

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 - 14.000 Hz
CrO₂ tape 20 - 16.000 Hz
FeCr tape 20 - 17.000 Hz

Harmonic distortion
K3 at 333 Hz (related to 0 dB VU)
Fe tape $< 1.2 \%$
CrO₂ tape $< 1.8 \%$
FeCr tape $< 1.0 \%$

Rumble weighted signal-to-noise rate
with Dolby without Dolby
Fe > 63 dB > 56 dB
CrO₂ > 63 dB > 56 dB
FeCr > 65 dB > 58 dB

Channel separation at 1.000 Hz
between stereo channels 30 dB
in opposite direction > 60 dB

Erase at 1.000 Hz
Fe > 70 dB
CrO₂ > 65 dB
FeCr > 70 dB

Oscillator frequency
(push-pull oscillator) 80 kHz

Inputs
Microphone (1/4 inch coax. jack) (sensitivity for 0 dB VU)
Receiver / Amplifier (DIN jack) 0.30 mV / 10 kOhm
Receiver / Amplifier (RCA jack) 0.45 mV / 4.7 kOhm
70 mV / 82 kOhm

Outputs
Receiver / Amplifier (DIN jack) 0 - 700 mV / 1.8 kOhm
Receiver / Amplifier (RCA jack) 0 - 700 mV / 1.8 kOhm
controllable

Headphones
(1/4 inch. coax. jack) 4 - 2000 Ohm
volume controlled

Fast-wind time
for C 60 cassette < 60 sec.

Complement
4 IC's
49 Transistors
30 Diodes
1 Darlington
28 LED's

Line voltages 110 - 125 V / 220 - 240 V

Line frequency adaptable to 50 or 60 Hz

Power consumption approx 35 W

Mechanical part

1. Removal of cover plate

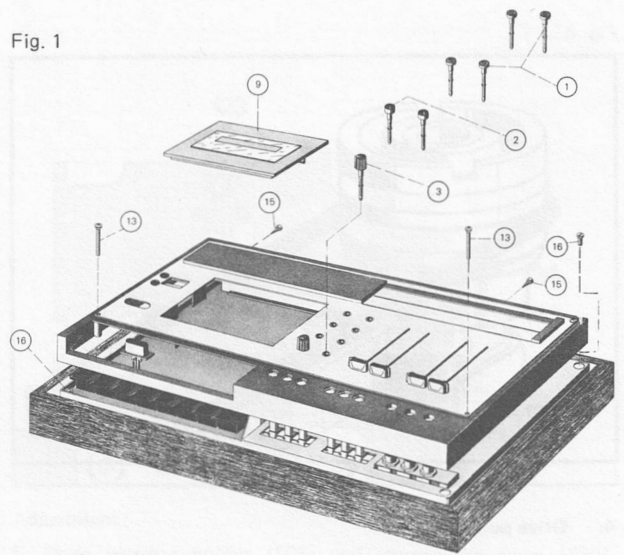
First remove the following parts:

1. 1 the four adjustment knobs (1), the two rotary knobs (2) and the control knob (3),
1. 2 the cassette holder (9), by opening and freeing it by lifting it to the rear and pulling it forward,
1. 3 the two countersunk lenticular head screws (13),
1. 4 the two hexagon head self-tapping screws (15).

The direction indicator of the LED display (350) should be protected against scratches with masking tape. The LED display (350) should be raised, the cover (14) pushed to the rear and lifted, before removing it toward the front.

The reassembly takes place in the reverse order, whereby care must be taken that the slider (24) of the potentiometer engages correctly with the control plate (400). Remove the masking tape.

Fig. 1

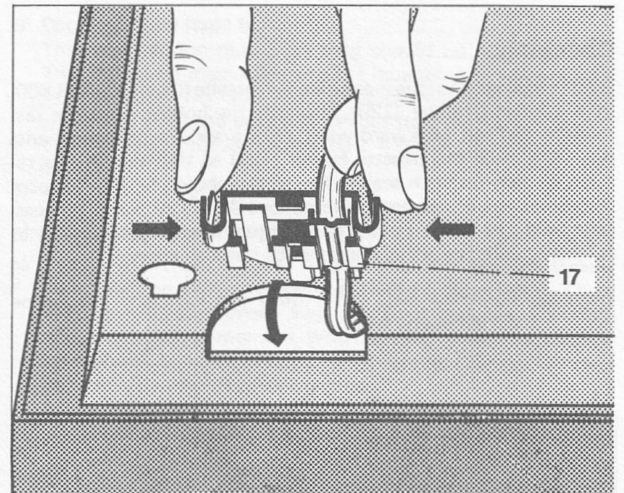


2. Dismounting and mounting

Pull out power plug. Remove mounting plate (17) from the bottom of the cabinet. Release strainrelief of power cable by removing the securing wedge (Fig. 2).

When mounting proceed in reverse order.

Fig. 2



3. Motor

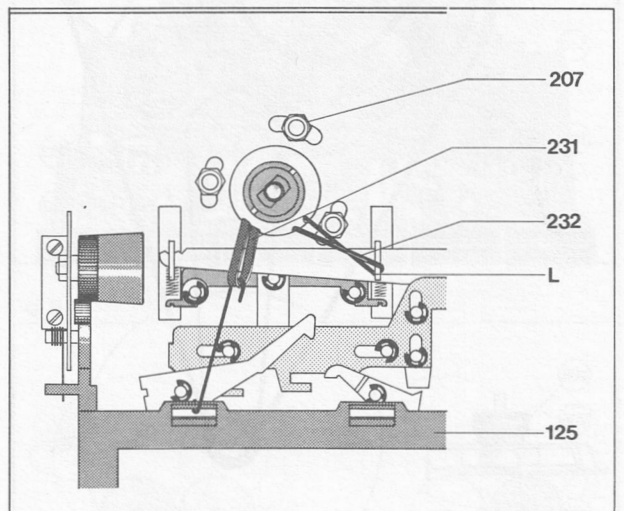
When exchanging the motor, the connecting leads must first be removed from the power supply (390).

- a) The round belt (232) should be engaged over the lug (L) of the forward/reverse plunger (266).
- b) The flat belt (231) should be held aside by means of a suitably sized wire hook (see Fig. 3).

Remove the hexagonal nut (207) and take out the motor (219).

When reassembling, we recommend the following procedure.

Fig. 3



3. 1 The drive pulley (205) should be fitted to the motor axle (round belt notch uppermost). Using a feeler gauge between the drive pulley and the upper shell of the bearing, (209) adjust for a clearance of 0.3 mm. Tighten the set screw (206) (see Fig. 4).

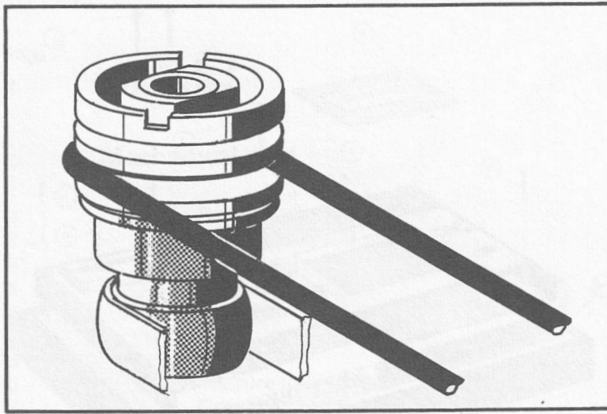
3. 2 Fit the collector (208) on the motor part. The insulated end of the lead connected to the motor should be fed through the holes in the collector (208).

3. 3 Install the motor (219) and fasten in place with the hexagonal nuts (207). Take care that the insulation of the leads does not get damaged or caught. The end of the connecting lead should be bent over when the motor has been installed. See circuit diagram (Fig. 26) for details of the connection to the power unit (Points 'XXII' and 'XIX').

3. 4 Fit the flat belt (231) and the round belt (232) to their respective sections of the drive pulley (Fig. 4) taking care that the flat belt (231) does not get twisted.

Note: The reference numbers in the instructions refer to the spare parts lists and exploded views.

Fig. 4



4. Drive pulley

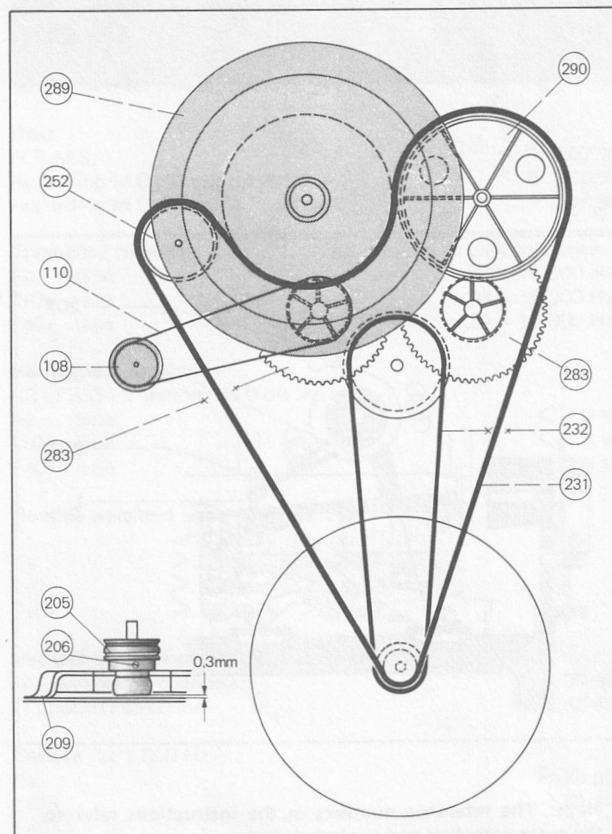
- a) To ensure an even torque for forward and reverse drive, the upper portion of the drive pulley (205) (the recess for the round belt) is separated from the convex drive portion (for the flat belt) by a friction coupling.

Checking

Insert the special torque measurement cassette (Dual No—238.600) in the cassette holder (125), and shut the holder. Press the fast forward and fast backward wind. Over a series of measurements open and close the cassette holder (125) so that the pointer returns to zero on both scales. The torque should be 70—140pcm (reference values for new drive pulleys 90—120 pcm). If necessary hold the drive pulley still. Adjust the friction clutch as necessary with the aid of a spanner or flatnose pliers.

Warning: The main belt (231) must not have any slip, or be dirtied in any way.

Fig. 5



4. Adaptation for line frequency

Adaptation to another line frequency is done by changing the drive pulley (205).

Drive pulley for 50 Hz Part No. 226 812

Drive pulley for 60 Hz Part No. 226 813

- 4.1 Remove the two belts from the drive pulley (205) by means of a small wire hook and tweezers:
 - a) The round belt (232) should be engaged over the lug (L) of the forward/reverse plunger (266).
 - b) The flat belt (231) should be held aside by means of a suitably sized wire hook (see Fig. 3).
- 4.2 Loosen the set screw (206) and remove the drive pulley (205) upward.
- 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 (209) (unit in normal position). Tighten set screw (206).
- 4.4 Fit flat belt (231) and round belt (232) on the appropriate step of the drive pulley (Fig. 4). Note — Do not twist the flat belt.

5. Drive belts

To change defective belts proceed as follows:

Stand unit upright

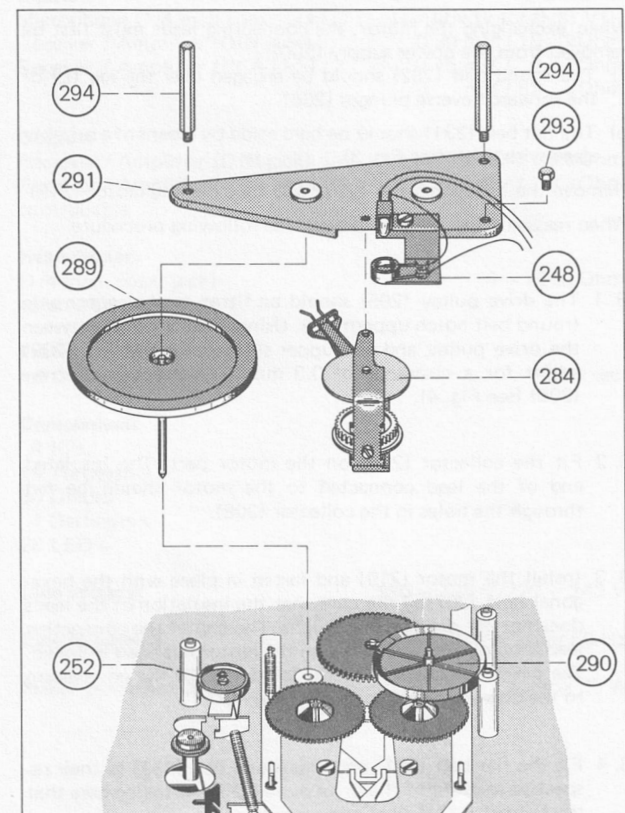
Remove the hexagon head screw (293) and two studs (294). Detach bottom board (291). Raise coupling unit (284) slightly, then withdraw towards motor. Now the round belt (232) for take-up can be changed. To change the main belt (231) or the counter belt (110) the large flywheel (289) should be withdrawn from the bearing bush.

Important: The polythene washer (153) on the top of the unit will drop out. Detach main belt (231) and counter belt (110).

The new belts are best fitted in the following sequence:

Insert counter belt (110) between the two winding gears, then fit on the drive pulley of the counter (108).

Fig. 6



Fit main belt (231) first and then the round belt (232) for take-up on drive pulley (205). Fit main belt on the guide pulley (252) and on the small flywheel (290). When doing so, pass the main belt (231) between the guide pulley (252) and the small flywheel (290) towards the motor so that it is possible to insert the large flywheel (289). Ensure that the main belt is not twisted and that the belts are fitted on the correct drive steps. Further assembly should be carried out in reverse order to removal. Be careful to refit the plythene washer (153) on the spindle of the large flywheel (289). After assembly, it is advisable to press the fast forward or reverse wind key and clean the capstan and the drive belt with a cloth soaked in methylated spirit. Check that the main belt (231) runs in the centre of the guide pulley (252). If necessary adjust the axle of the guide pulley.

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. (Dual Part No. 226 740).

Setting of test instrument:

0.3 % measuring range, weighted.

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

Typical values for reproduction with C 939 Dual Cassette Deck:

$\pm 0.08 - 0.14 \%$

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
- check coupling force
- Replace flat belt
- Replace flywheel

7. Coupling assembly

To ensure satisfactory winding the following adjustments should be noted:

a) Tooth backlash:

Slight tooth backlash should be perceptible between coupling assembly (285) and winding gears (183) in clockwise or anti-clockwise playing position.

Adjust as follows:

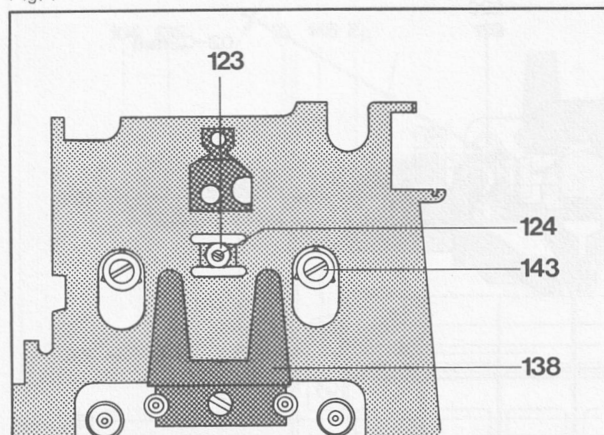
- Depress playback key marked (▷), then pull out power plug.
- Hold the intermediate gear of the coupling assembly in position and determine backlash in conjunction with the right-hand winding gear (183).
- Carry out adjustment by turning the right-hand eccentric screw (E_R) (Fig. 9).
- Repeat the operation after depressing the playback key marked (◁). In this case hold the perforated pulley of the coupling assembly in position and adjust in conjunction with the winding gear by turning the left-hand eccentric screw (E_L), (Fig. 9).

It is advisable to check tooth backlash in four positions (intervals of 90°).

b) Coupling travel:

With the unit in neutral position, the coupling should have vertical play of 0.2 – 0.5 mm between set screw (124) and the stop.

Fig. 7



Adjustment:

- Open cassette holder (125) and remove the cover (129). Loosen the hexagon nut (123) with a ring spanner (5 mm A/F). (Fig. 7).
- Adjust the backlash by turning set screw (124), then tighten hexagon nut (123).

c) Coupling force (tape tension)

The tape tension during winding should be 40 – 70 pcm. This should be measured using the tape tension measurement cassette (Dual No. 232 797). (Typical values on newly adjusted and with the device in its cold state are 50 – 60 pcm). The unwinding torque should be 2 – 6 pcm under these conditions.

- Extract power plug!
- Actuate fast reverse wind key (◁◁)
- Turn the left catch (143) until one of the two adjustment holes become visible through hole (B) of blind (129). 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

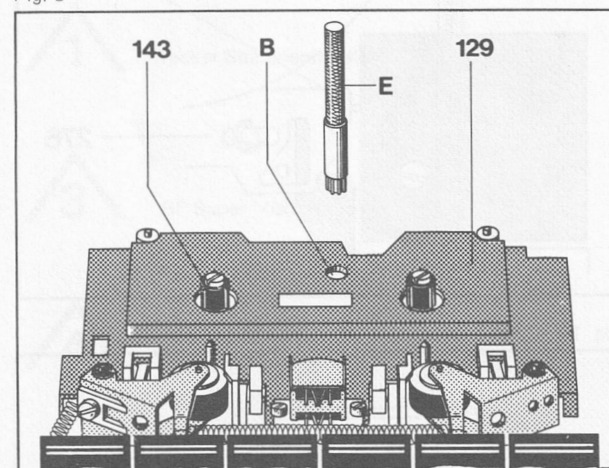


Fig. 9

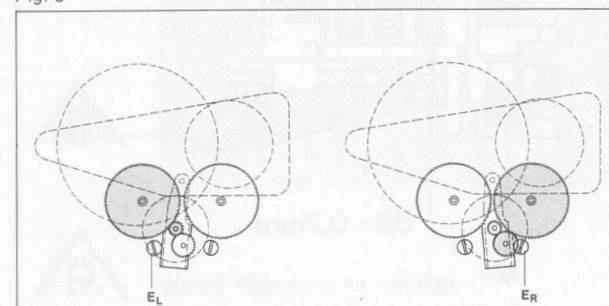


Fig. 10

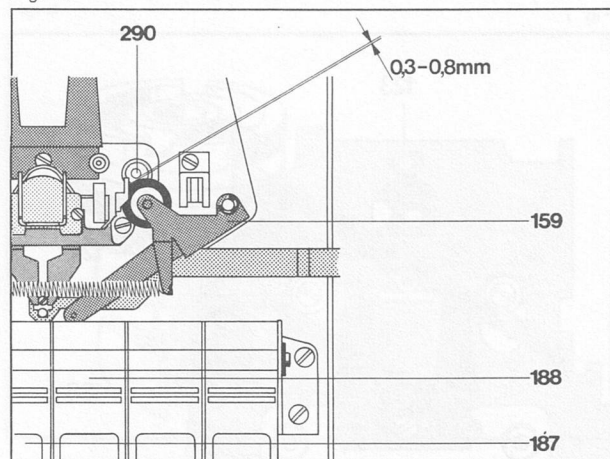


Fig. 11

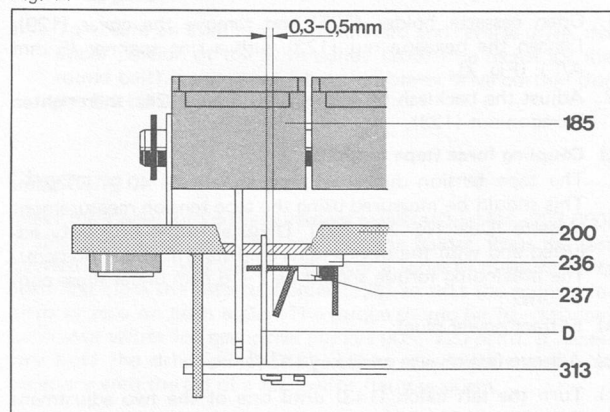


Fig. 12

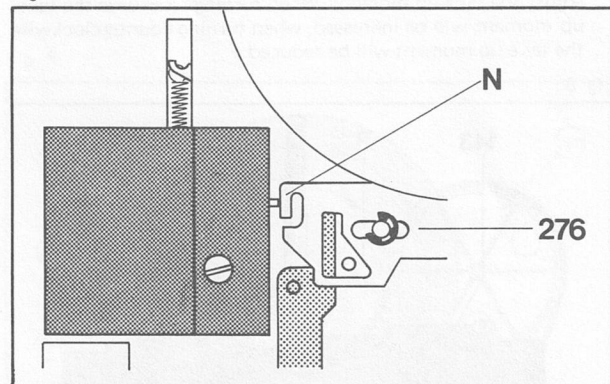
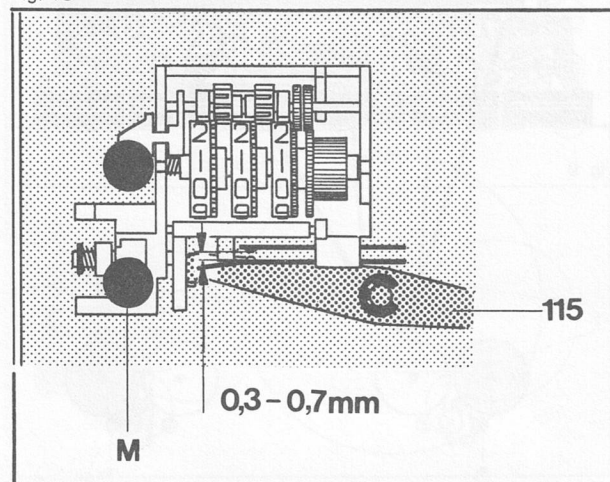


Fig. 13



8. Pressure lever

a) The large and small flywheels (289/290) of the capstan, and the pressure rollers on the pressure lever (104/159) must transport the tape with the greatest possible force. Check as follows:

8. 1 Insert the tape tension measurement tape (Dual No. 232 797) and ensure that the tape is evenly distributed.
8. 2 Press the playback right (▷) button.
8. 3 Using a screwdriver in the screw of the respective non-driven spool, apply increasing braking pressure to the spool. The scale of the non-driven spool should indicate a torque value 70 pcm before the tape is brought to a standstill.
8. 4 Repeat the above measurement for playback left (◁).

Warning: If the above value is not achieved then possible causes are dirt or a damaged pressure roll. Clean or replace as necessary.

b) Pressure

The pressure of the pressure rollers (104/159) on the capstan, measured with a contactor, should be 400 ± 50 p.

c) Lift off height

With the "pause" and "start" buttons pressed, (187 and 188) the clearance between the capstan and the pressure roller should be 0.3 – 0.8 mm. The pressure may be adjusted by lightly bending the pressure lever (Fig. 10). The take-up transport must run until the pressure roller has been safely lifted away from the capstan.

9. Ground contact

- a) When the flap (313) or the stop-bar (192) are deflected, the ground contact wire should make contact with the post (236). In the neutral position of the machine, the contacts should be 0.3 – 0.5 mm apart. Adjust if necessary.
- b) The ground wire of the left-hand pressure level (104) should make firm contact with the casing of the keyboard (190). Adjust if necessary.

10. 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 switch level (276) (Fig. 12).

11. Memory switch (counter)

With the memory switch (M) pressed and the counter setting of "000", the contact must be closed.

With the memory switch (M) not pressed (device switched off or fast forward/backward rewind), the clearance of these contacts should be 0.3 – 0.7 mm. In playback mode, the switch lever (115) must ensure a clearance between the contacts.

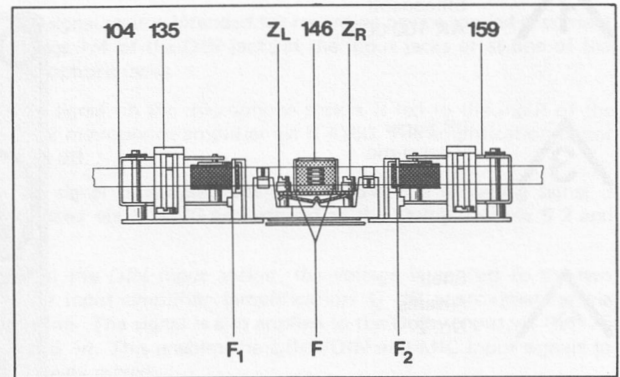
12. Record playback heads

When exchanging or repairing the head unit (145) or the record/playback head (146) the following preadjustments must be made.

The record/playback head (146) should be fitted to the head unit with the retaining spring, and fastened by means of the sleeves and cheesehead screws (Z_L and Z_R). The cheesehead screws (Z_L and Z_R) should be tightened until the tape guides (F) are lined up with head unit tape guides (F1/F2).

The precise adjustment (azimuth adjustment) should be made as described in the section "Electrical Part" on page 11.

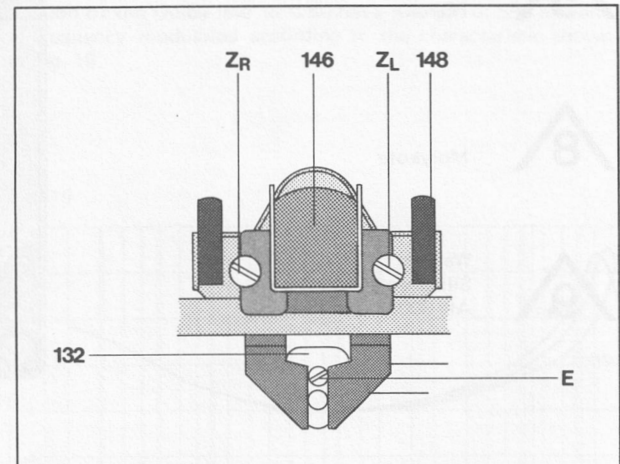
Fig. 14



13. Erase head

- The erase heads should pivot in to the same depth for both directions of travel. Adjustment is made via the eccentric bolt on the pivot arm (132).
- The head unit base (134) should have a clearance of 0.3-0.5 mm to the stop when the playback ($\triangleright$ or $\triangleleft$) button is pressed. If necessary adjust the lugs of the head unit plate (134) which come into contact with the control levers.

Fig. 15



14. Cleaning

Always clean unit when servicing or repairing it.

For proper function of the unit the record playback head (146), the erase head (148), the pressure rollers (104/159) must always be perfectly clean.

The parts are best cleaned with a linen cloth or cotton wool tip soaked in methylated spirit.

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

15. 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:



Wacker Siliconeoil AK 300 000



BP Super Viscostatic 10 W/40



Shell Alvania No. 2



Isoflex PDP 40



Molykote



Wacker Siliconeoil AK 100 000



Wacker
Siliconeoil
AK 100 000



BP Super
Viscostatic
10 W/40



Shell
Alvania
No. 2



Isoflex
PDP 40



Molykote



Wacker
Siliconeoil
AK 300 000

Fig. 16

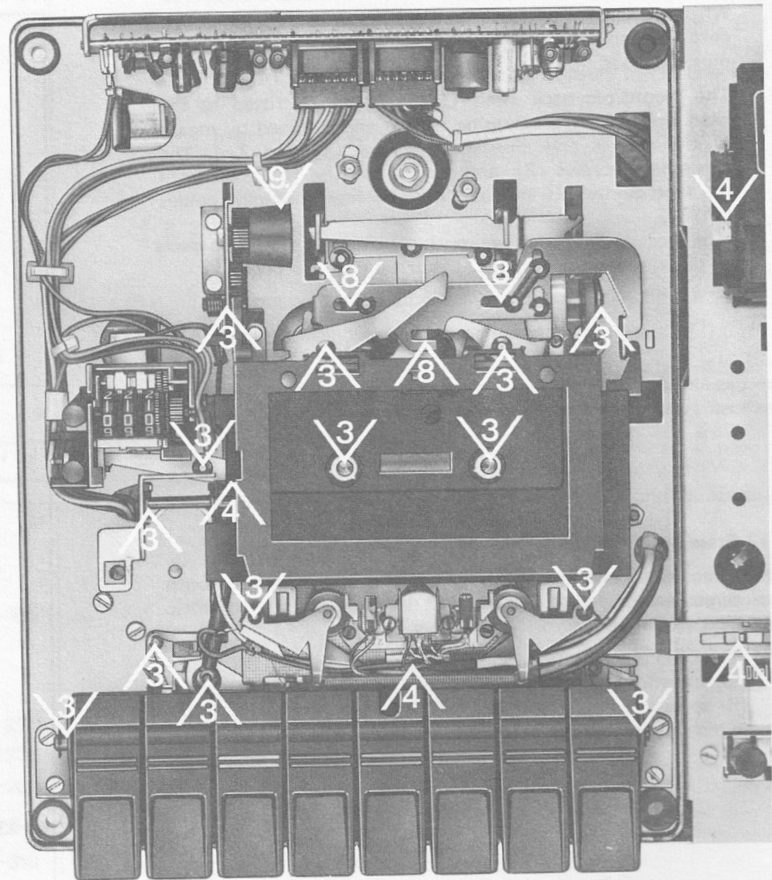
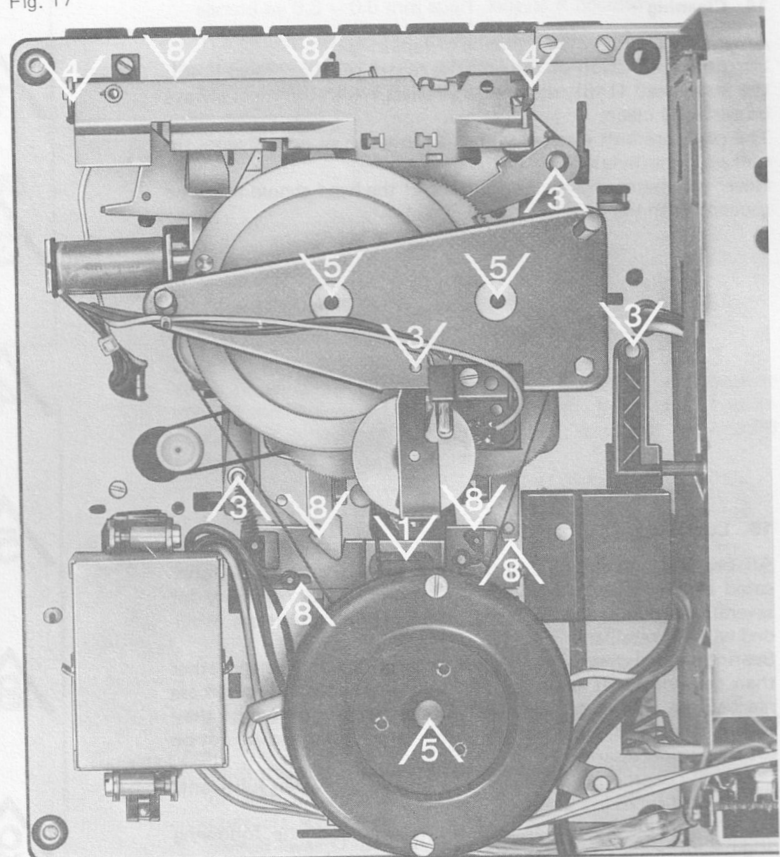


Fig. 17



Electrical Part

Functions

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

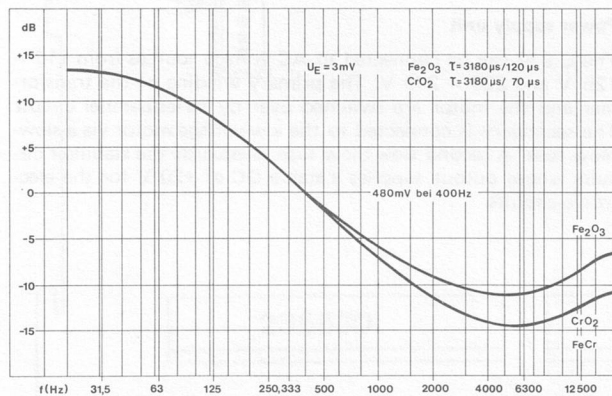
A. Playback

For playback operating mode switches S 1, S 2, S 3, S 4, S 12, S 14 and S 15 are in operation.

The combined 4/4 track recording/reproducing head has four active systems whose effective track width is only 0.6 mm. This requires maximum care in the design of mechanical tape location, azimuth and electrical adjustment. With a tape reference level of 250 nWb/m at 333 Hz the head supplies a voltage of approx. 300 μ V. This signal is track-allocated by the head changeover switch S 3, function-allocated by record/playback switch S 2 and passed to the input amplifier through double capacitor C 40. At 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 transistors operate in emitter circuit.

The inverse feedback network between the collector of T 41 and the emitter of T 40 determines the frequency characteristic for the corresponding tape type. For playback, the frequency characteristic is as shown in Fig. 18.

Fig. 18



Tape changeover switch S 12, S 13 carries out correction for CrO₂ tapes in the treble range, this corresponding to the increased high frequency response of these tapes. Amplification of the input amplifier is approximately 48 dB at 400 Hz during playback. The amplified signal is passed to the playback level controls R 4224 and R 4225 where the exact level is set, this being particularly important for satisfactory Dolby function. The signal is passed to the input, of the Dolby unit via a further section of the Dolby unit via a further section of the record/playback switch S 2.

In the Dolby unit the 400 Hz signal is brought to 580 V (Dolby level 200 nWb/m) coupled out via C 80 and passed to the output amplifier via S 2 and C 4260, which amplifies the voltage to 2.7 V.

Via R 4185 (preset) the voltage is passed to the headphones socket. In addition it is also applied to the potential divider R 4156, R 4157 via R 4190 (preset) and thence to the OUT socket. At the same time it is passed to the DIN socket via T 4147 (S 1 switched).

Since the output amplifier is also in operation during recording, the output signal is only switched to the DIN socket via S 1 during playback. This is done to prevent feedback occurring via cable capacitance, sockets etc. The muting switch ensures that switching interference is suppressed. On pins 3/5 of the DIN socket and also on the OUT socket an output voltage of approximately 1 V Dolby is available.

For playback and record, the LED modulation display is in operation. This function is described in the section on recording.

B. Recording

The signal source intended for recording can be applied at contact springs 1/4 of the DIN jack, at the input jacks or at one of the microphone jacks.

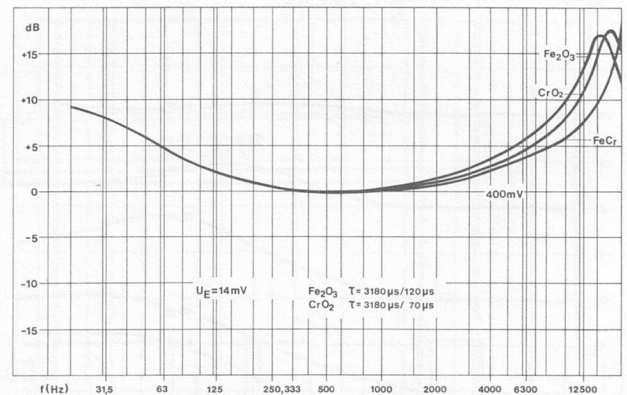
The signal on the microphone socket is fed to the input of the linear microphone amplifier via R 4160. The amplification factor is 56 dB.

The signal is coupled out via C 4164. The recording signal is adjusted via R 4170 and applied to the Dolby unit via S 2 and S 14.

From the DIN input socket, the voltage is applied to the two stage input amplifier (amplification 37 dB approximately) via C 4145. The signal is also applied to the Dolby input via R 4175 and S 14. This enables the LINE/DIN and MIC input signals to be freely mixed.

The signal passes through the Dolby unit, is coupled out via C 80 and fed to tape type switch via S 11, S 12 and S 13, and thence to the recording amplifier. The 400 Hz signal for the production of the Dolby level at C 80 has a strength of 580 mV and is frequency modulated according to the characteristic shown in Fig. 19.

Fig. 19



The signal is passed to the talk-listen head via T 60, C 63, the HF wave trap circuit L 4220, C 4224 and the AF current controls R 4221, R 4220. The AF threshold may be adjusted separately for each channel on these controls.

The HF generator produces a sinusoidal frequency with a low distortion factor. This HF is fed to the erase head on the one hand (erase voltage approx. 20 V for CrO₂ tapes) and on the other hand, is used for premagnetizing via S 1 and S 4. The HF voltage for the premagnetization is controlled via R 4222 and R 4223 for a linear overall frequency range (CrO₂).

The HF generator works on a push-pull principle whereby the feedback potential is fed from the collector to the base of the other transistor. C 4296 forms a parallel resonance circuit with the adjustable inductance of the transformer. The available inductance variation allows a frequency range of 85 to 120 kHz. A variation of maximum 10 kHz in the HF may be necessary in individual cases when recordings are being made from AM transmissions, whose transmission frequency cause audible beat signals with the HF voltage.

When altering the HF frequency, the HF wave trap circuit L 4220, C 4224, L 4220' and C 4224' has to be readjusted for maximum wave trap capability. The supply voltage is applied to the HF generator via the switch S 1. For recording, the signal on the output amplifier is also applied to T 4221 via the bass and treble filters, rectified by diodes D 4223, D 4224 and displayed via the LED display unit. The calibration control is R 4236.

The recording functions described to this point represent the simplest type of recording: Input from DIN or MIC socket, with manual modulation control and without Dolby function.

Microphone recording

The two microphone jacks are suitable for low impedance to medium impedance microphones having an impedance of 200 to 700 Ω . A DC voltage supply of approx. 20 V is designed for low voltage capacitor microphones, especially the Dual MC 312. When using only one microphone, the switch S 9, S 10 is switched to Mono. When using two microphones, the recording is made in stereo.

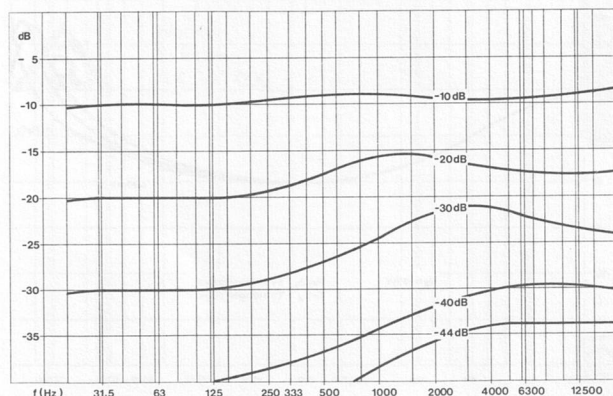
Limiter

The control signal for the limiter is taken from R 4235 (output amplifier) and rectified via D 4222. R 4235 controls the threshold of the limiter. The differential resistance of T 4200 (collector – emitter) in parallel with R 4177 varies with the amplitude of DC on D 4222. This provides low distortion limiting of the signal at the Dolby unit input. The response time is dependent on C 4201 and C 4200 and is 3 – 5 seconds. The limiter can be switched off by switch S 16.

Dolby noise suppression

The circuit used is constructed in IC technology. The input signal from the microphone amplifier or input amplifier is fed to the IC input via C 72.

Fig. 20 Dolby frequency response



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 4190 and 4190' which should be in their extremest right position.

Warning: The adjustment controls for the LED display R 4312, R 4312', R 4313 and R 4313' should not be altered.

Between the connectors 2 and 6 a multiples filter is fitted, which is used for carrier suppression (19 kHz L 71 / C 77) with a minimum suppression of 30 dB. The 38 kHz (HF generator) are also suppressed to prevent erroneous regulation of the Dolby circuits. The Dolby function can be switched off for recording or playback by means of the Dolby button S 14.

Limit switch

The limit switch has the function of reversing direction of tape travel and protecting the cassette from damage e.g. if winding is incorrect as a result of excessive friction in the cassette. The limit switch is also activated when the memory counter reaches "000" when ▷ or ◁ are pressed.

An aperture disc permanently coupled to the winding spindle supplies the photo-resistor ZM X 140 with a flash period in the frequency range from 9 to 30 Hz. The photo-resistor supplies an AC voltage via C 4290, whose negative half wave generates a DC voltage, via diode D 4281, at the base of transistor T 4290 which opposes the static base emitter voltage through voltage divider R 4393, R 4294 and R 4395. When the aperture disc is stationary this voltage falls to zero. If this voltage fails, the resultant base emitter voltage becomes more positive by a slight amount which is sufficient to drive T 4290 and T 4291. This operates the traction magnet which reverses direction of tape travel or shuts off the drive. The feedback circuit R 4297 and C 4292 forms an unstable flip-flop with T 4290 and T 4291. This feed current impulses to the traction magnet and guarantees a positive switching.

Power supply unit

The C 939 can be connected to AC voltage sources from 110 – 125 V and 220 – 240 V. The primary winding of the transformer and the motor are switched over by series-parallel circuit. The secondary is connected to the low-voltage motor via a slow-blow fuse. A second slow-blow fuse safeguards the stabiliser circuits whose output supplies a stable DC of +20 V for the electronic circuits.

All measurements should be made with damped LED display (VU-PEAK switch in the VU position). When testing and calibrating, no headphones with an impedance less than 16 Ohms should be used since these would influence the levels.

Playback

Level and LED displays

Turn the LINE OUTPUT control L and R as far as possible to the right. Insert the test cassette, for 400 Hz Dolby reference level.

Set to Fe, Dolby NR ▷ or ◁
adjust for 580 mV $\pm$ 0.25 dB in each case.

For track 1 use R 4225 on MP 1 (left-hand channel)
For track 2 use R 4225' on MP 1 (right-hand channel)
For track 3 use R 4224' on MP 1 (right-hand channel)
For track 4 use R 4224 on MP 1 (left-hand channel).

1 V $\pm$ 1.5 dB must be present at pins 3 and 5 of the OUTPUT-L, OUTPUT-R and LINE-DIN sockets.

The LED displays should be adjusted for +3 dB while the Dolby reference signal tape is running, using R 4236 (left-hand channel) and R 4236' (right-hand channel).

Magnetic head adjustment

Insert test cassette (section determined for gap adjustment, 10 kHz – 20 dB).

Connect the millivoltmeter to OUTPUT L and R.

Fe ▷ or ◁,

With the set screw Z_L on the left-hand side of the magnetic head align for maximum voltage, (see Fig. 14 page 7). Care must be taken that the true maximum is set, since a secondary peak 12 dB below the main peak occurs when the adjustment is too far off true. Fine adjustment should be made by switching both channels in parallel and calibrating for maximum. The test cassette should be of high quality to prevent incorrect adjustment. Cross check setting by using 2 cassettes.

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 + 1 dB.

Background noise

Screen amplifier. Make sure that the magnetic head is free of num.

Fe, Pause, ▷

Background noise at OUTPUT L and R 4 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, ▷ or ◁

Controls R 4222, R 4222', R 4223 and R 4223' (RF biasing) in center position.

Using L 4290 set 80 kHz $\pm$ 2 kHz generator frequency measured with an absorption frequency meter near the erase head or with an oscilloscope at the erase head via a 1 Mohm series resistor. Frequency deviation occurring when switching over to Fe or FeCr tape should not exceed 2 kHz.

Erase Head Voltage

Measured at the erase head (Cr)

▷ 20 V

RF Wave Traps

Connect tube voltmeter to test point 2 or 2' and align with L 4220 or L 4220' for minimum.

Bias Switching

For FeCr = 0 dB

For CrO₂ = + 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 4175, R 4175') open.

RF Biasing

Insert test cassette, CrO₂ — reference medium section
Cr, RECORD and ▷ respectively ◁

400 Hz and 10 kHz with — 20 dB (LED — indication).
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).

For alignment of track 1 with R 4223

For alignment of track 2 with R 4223'

For alignment of track 3 with R 4222

For alignment of track 4 with R 4222'

less RF = treble emphasis!

more RF = treble deemphasis!

Level

Insert test cassette, CrO₂ reference medium section

Cr, RECORD, ▷ or ◁

LINE/DIN level control R 4175, R 4175' open. Record 400 Hz with 0 dB (LED indicator). Then check playback level (LED indicator).

Adjust recording current so that playback level = recording level

Using R 4221 for track 1

Using R 4221' for track 2

Using R 4220' for track 3

Using R 4220 for track 4

Insert FeCr cassette of the type used by the customer.

FeCr, RECORD, ▷

Record 400 Hz 0 dB (LED indicator).

Compare recording and playback levels and, using R 4205 or R 4205', adjust for same level.

Insert an unrecorded FeCr tape cassette,
(use the same make as the customer).

Set to FeCr, RECORD ▷

Record 400 Hz at 0 dB (LED display).

Compare recording and playback levels and correct as necessary with R 4205 or R 4205'.

Harmonic distortion

For 333 Hz, 0 dB recordings (as indicated by LEDs)

the harmonic distortion of playback should not exceed the following values

For Fe₂O₃ tape K 3 = 3 %

For CrO₂ tape K 3 = 3 %

Erasure

Insert test cassette, CrO₂ reference medium

Cr, RECORD, ▷

Feed in 1 kHz, 0 dB (LED indicator)

Erasure (measured selectively)

> 62 dB

Limiter

Set R 4235 and R 4235' fully clockwise

LIMITER, RECORD, ▷

Feed in 400 Hz, adjust both channels for + 1 dB (LED indication).

Slowly turn R 4235 counterclockwise until LEDs (L/H channel) indicate 0 dB. Using R 4235' repeat adjustment for the right channel.

Momentary voltage increase of 20 dB (10 fold) at the input will cause the limiter to open and then to close slowly. The time until the LEDs exceed — 10 dB should be 1.5 — 4 seconds.

Dolby FM

Adjust R 4190 and R 4190' fully clockwise DOLBY FM,
RECORD

Apply 5 kHz 10 mV to LINE jack.

Using R 4180 or 4181' adjust 100 mV as measured at the LINE output.

Switch frequency to 400 Hz; same input level.

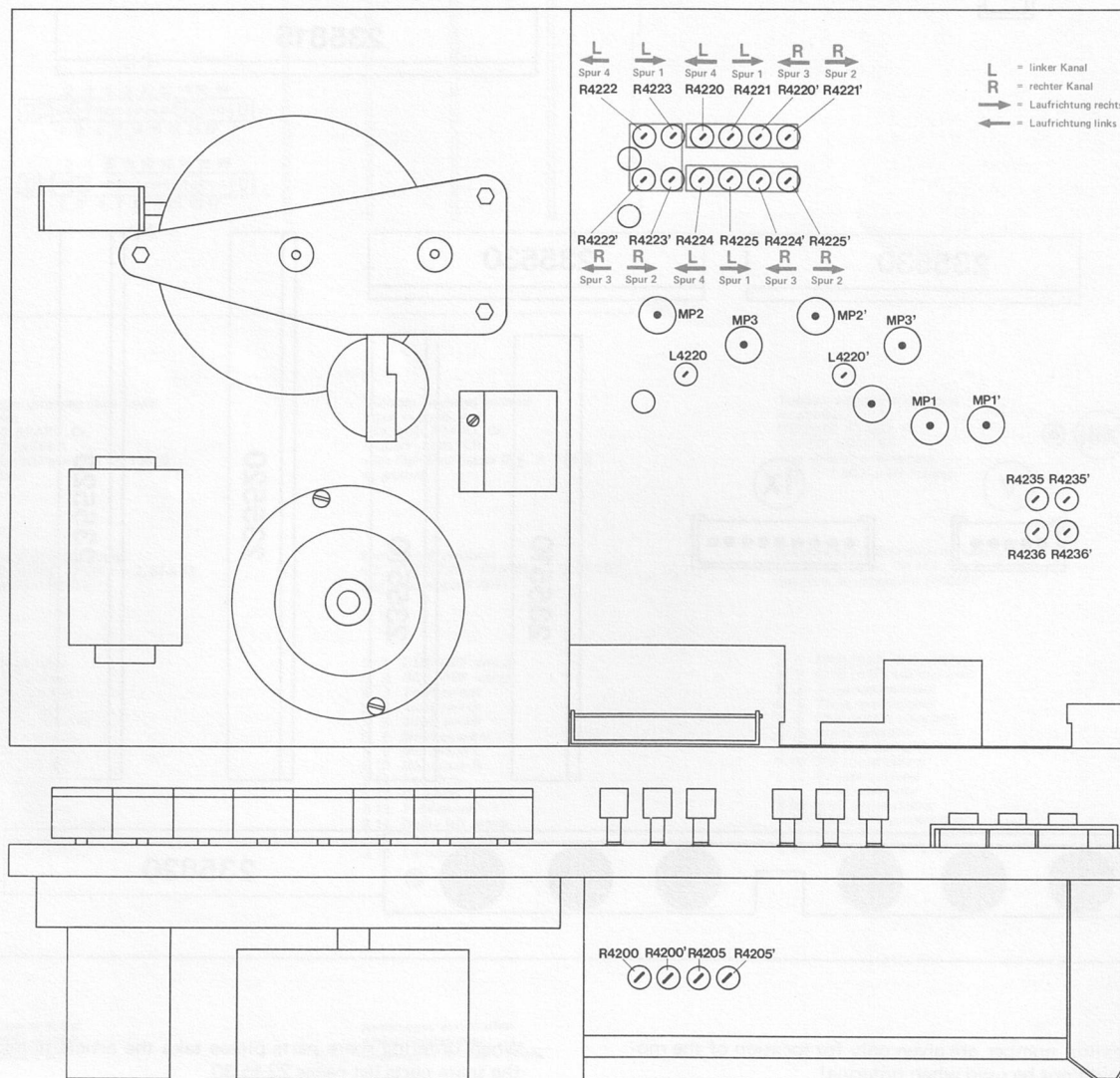
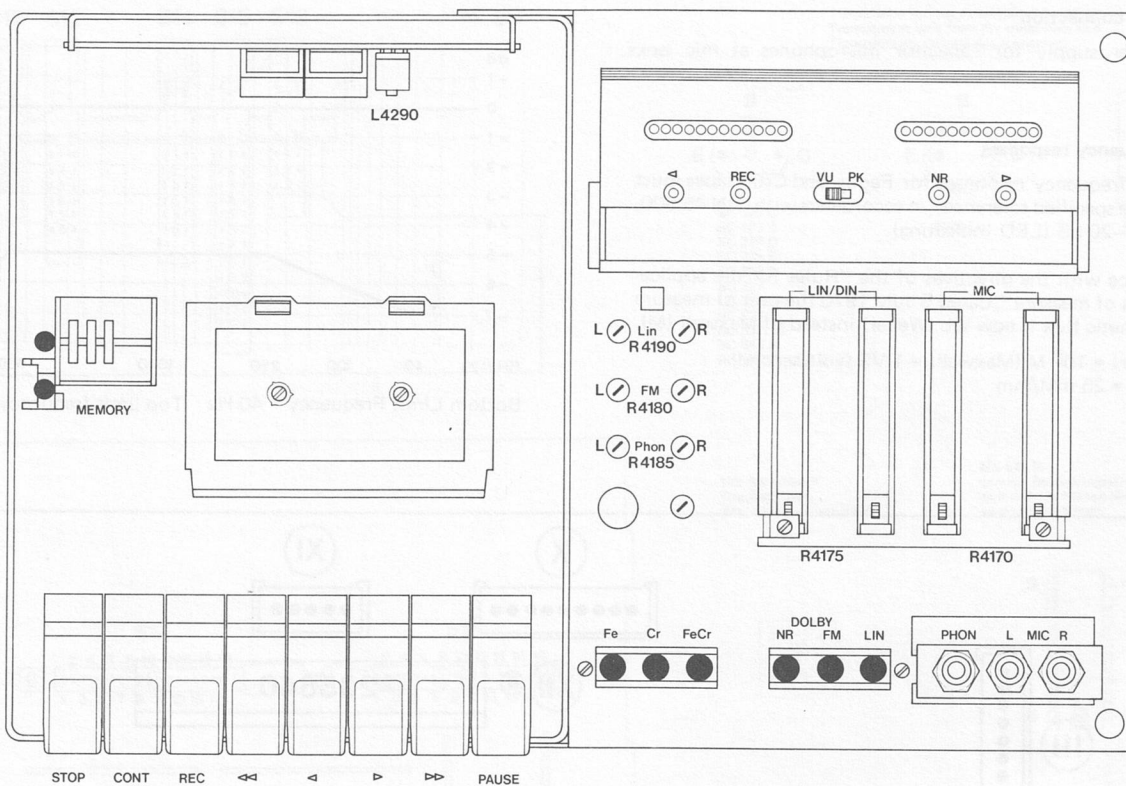
Output voltage — 6.5 dB $\pm$ 1 dB

Switch back frequency to 5 kHz

DOLBY NR

Output voltage — 5 dB $\pm$ 1 dB

Fig. 21— 23 Alignment positions



Microphone connection

Check power supply for capacitor microphones at mic jacks:
U = 19-21 V

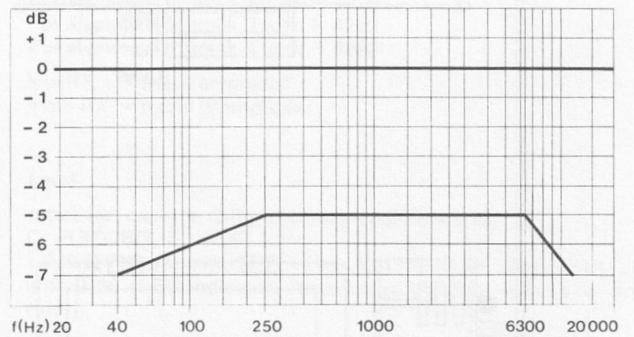
Overall frequency responses

The overall frequency responses for Fe₂O₃ and CrO₂ tapes must be within the specified tolerances, in accordance with DIN 45 500, recorded at -20 dB (LED Indicating).

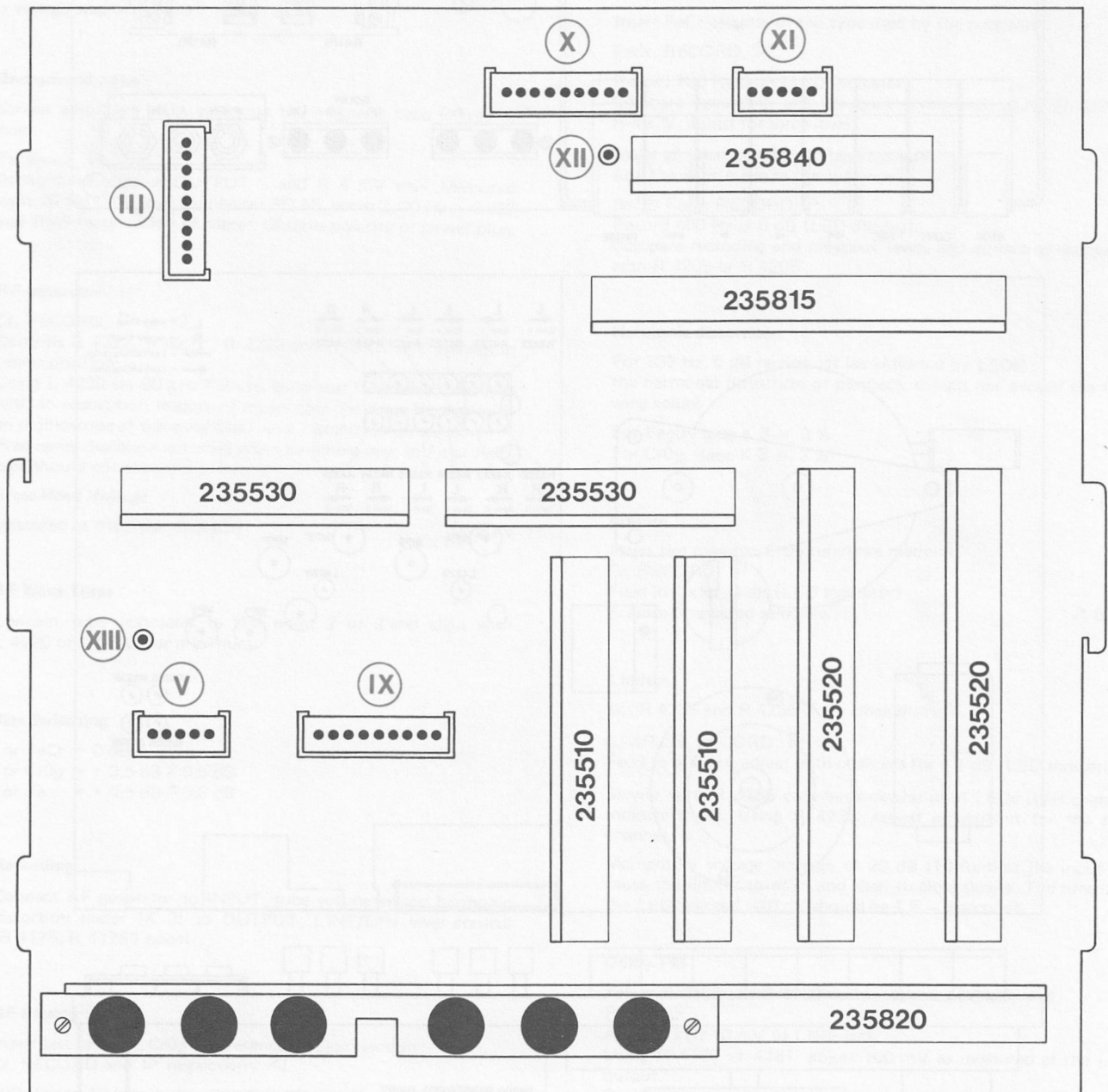
In accordance with the directives of the "Rules for the application of units of measure", dated 5 July 1970 the unit of measure for the magnetic flux is now Wb (Weber) instead of Maxwell (M).

1 Wb (Weber) = 10⁸ M (Maxwell) = 1 VS (volt/second)
250 nWb/m = 25 mM/mm

Fig. 24



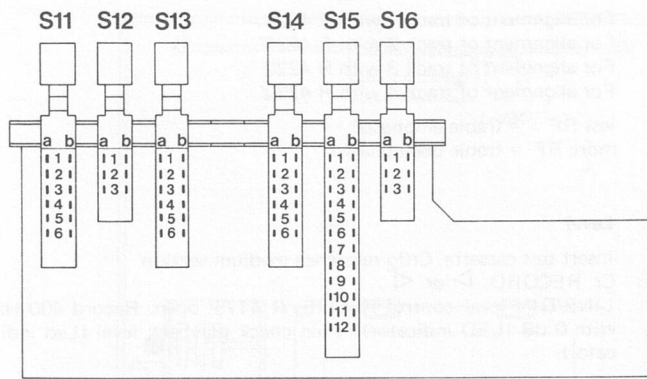
Bottom Limit Frequency = 40 Hz Top limit frequency = 12,5 kHz



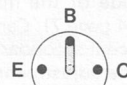
The identification number are given only for location of the modules and should not be used when ordering!

When ordering spare parts please take the article numbers from the spare parts list pages 22 to 30.

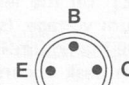
Fig. 25 Location of moduls and plug-in connections



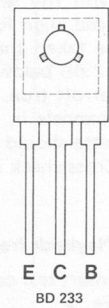
Transistoren von der Anschlußseite gesehen
Transistors as seen from the connecting side
Transistors vus du côté des connexions



BC 172 C
BC 173 C
BC 238 D
BC 239 C
BC 253 B
BC 327
BC 327/16
BC 337
BC 337/16
BC 548 A
BC 550 C



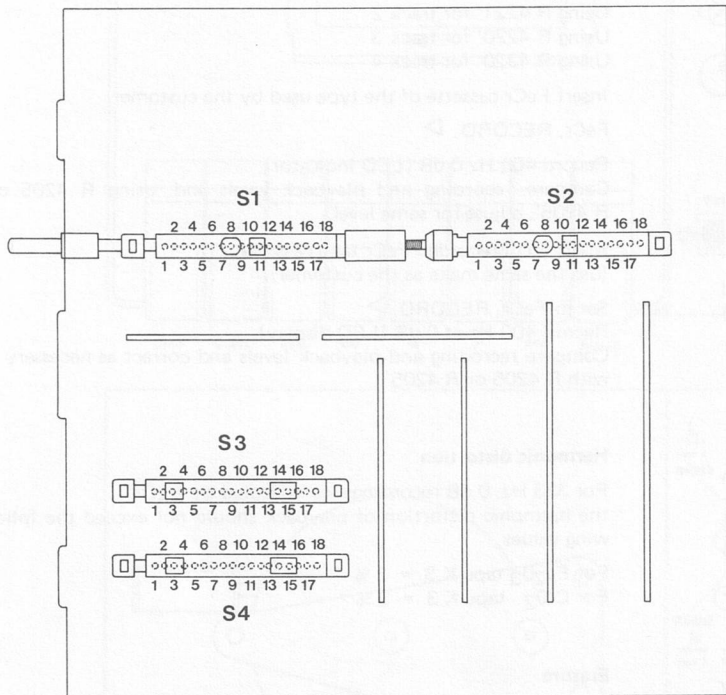
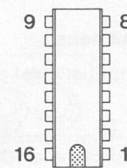
ZMX 140



BD 233

Hör-Sprechkopf
Rec./rep. head
Tête combinée enr./repr.

NE 545 B
von der Bestückungsseite gesehen
as seen from the top side
vu du côté éléments



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

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

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

Gezeichnete Schalterstellung:
MIC R, RECORD, SPUR 1 – 2, START,
Laufrichtung RECHTS

Show switch position:
MIC R, RECORD, TRACE 1 – 2, START,
runing direction RIGHT

Dessin de la position du commutateur:
MIC R, RECORD, TRACE 1 – 2, START,
direction du défilement DROITE

S 1 AW-Schalter
S 2 AW-Schalter
S 3 Spur-Schalter
S 4 Spur-Schalter
S 5 Stumm-Schalter
S 6 Kurzschließer
S 9 Mic-Schalter L
S 10 Mic-Schalter R
S 11 Fe-Schalter
S 12 Cr-Schalter
S 13 FeCr-Schalter
S 14 Dolby NR-Schalter
S 15 Dolby FM-Schalter
S 16 Limiter-Schalter

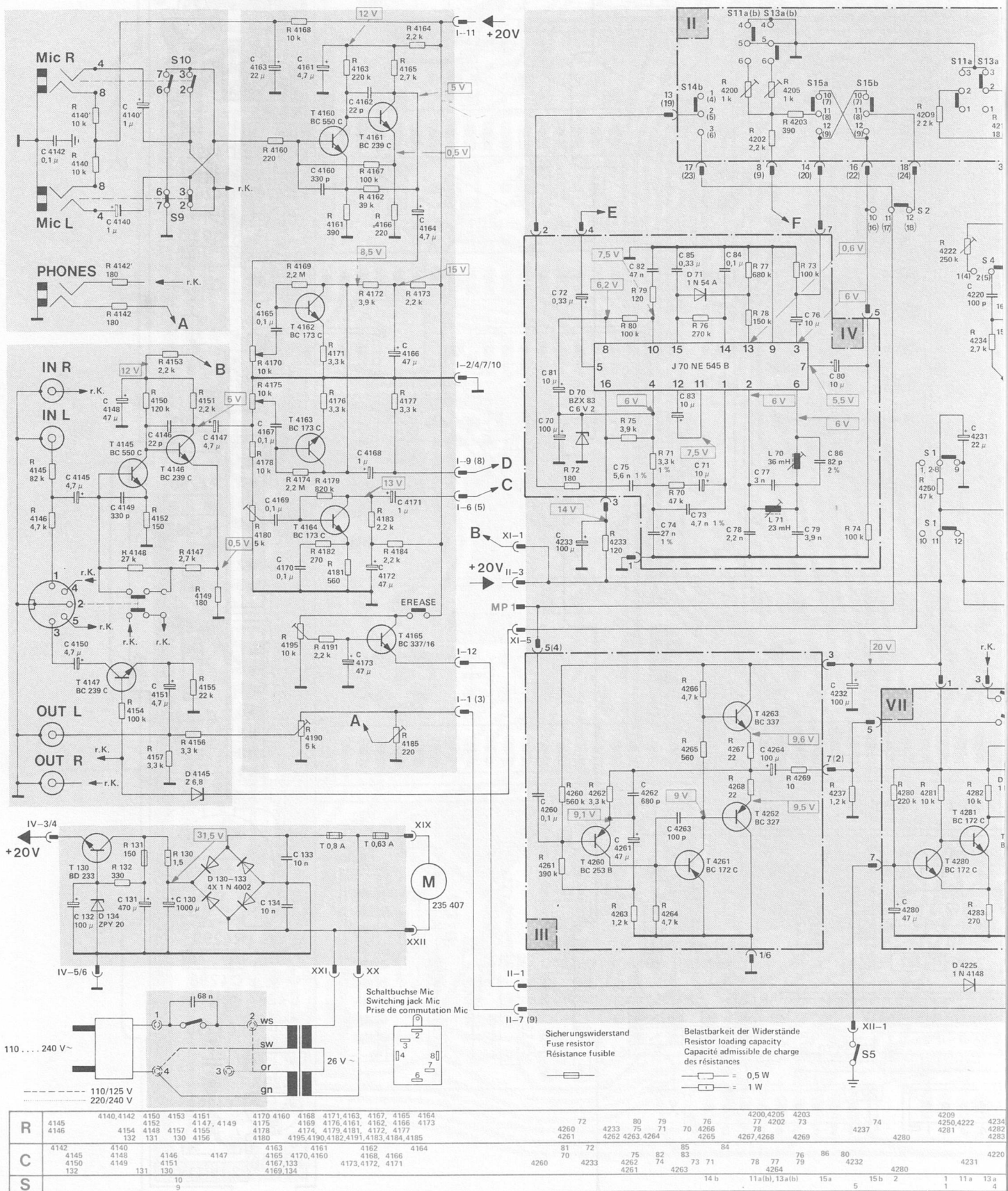
S 1 REC./REP. switch
S 2 REC./REP. switch
S 3 Track switch
S 4 Track switch
S 5 Silent switch
S 6 Short-circuiter
S 9 Mic switch L
S 10 Mic switch R
S 11 Fe switch
S 12 Cr switch
S 13 FeCr switch
S 14 Dolby NR switch
S 15 Dolby FM switch
S 16 Limiter switch

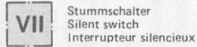
S 1 ENR./REP. commutateur
S 2 ENR./REP. commutateur
S 3 Trace commutateur
S 4 Trace commutateur
S 5 Interrupteur silencieux
S 6 Court circuitier
S 9 Mic commutateur
S 10 Mic commutateur
S 11 Fe commutateur
S 12 Cr commutateur
S 13 FeCr commutateur
S 14 Dolby NR commutateur
S 15 Dolby FM commutateur
S 16 Limiter commutateur

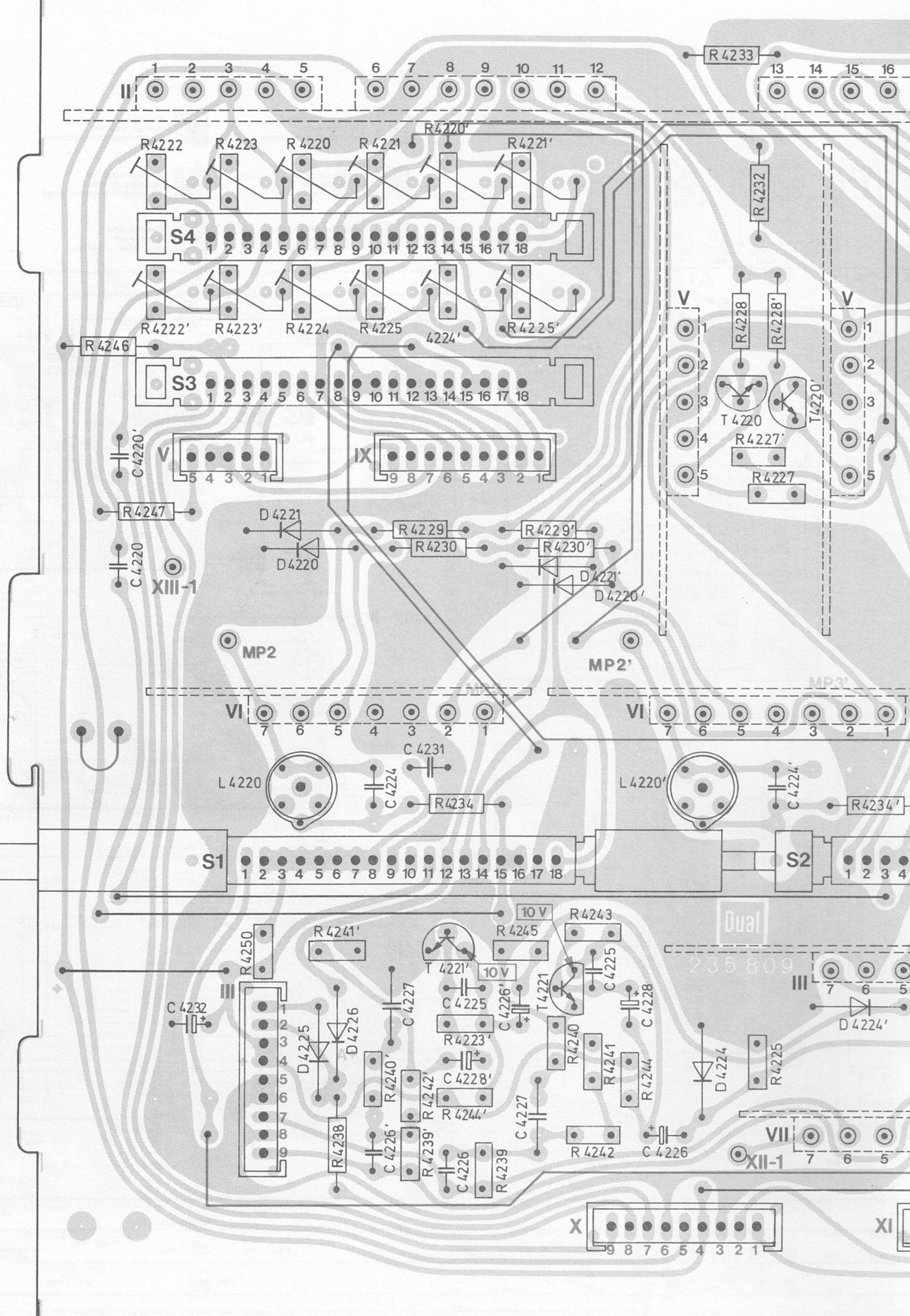
r.K. = Rechter Kanal
Right channel
Canal droit

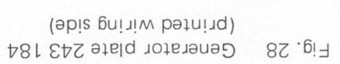
Änderungen vorbehalten
Alterations reserved
Sous réserve de modifications

Fig. 26









Mic L/R Mic L Mic R

↑ ↑ ↓



Fig. 31 Bush plate 243 187 (printed wiring side)

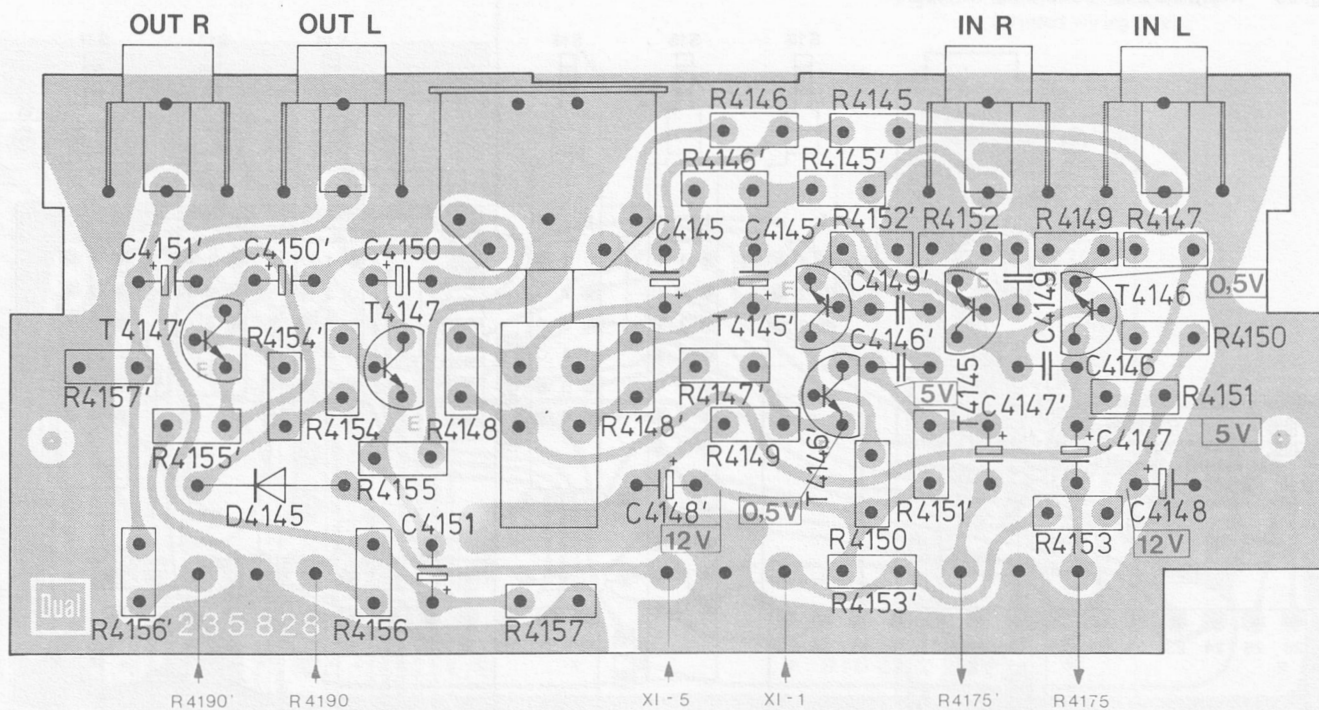


Fig. 33 Power part 241 732 (printed wiring side)

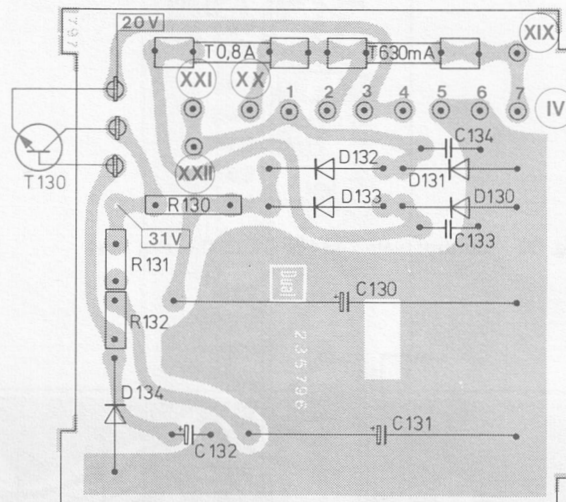


Fig. 32 Mic-bush plate 243 186 (printed wiring side)

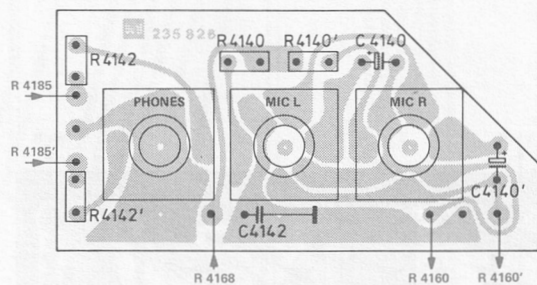


Fig. 34 LED-indicating 243 179 (printed wiring side)

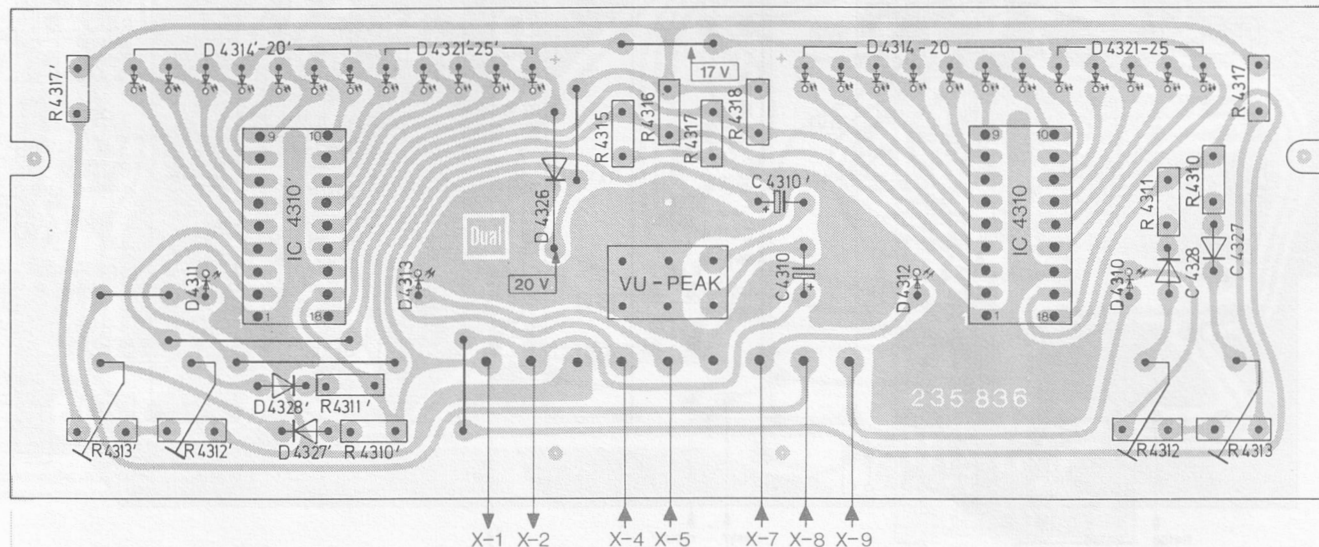
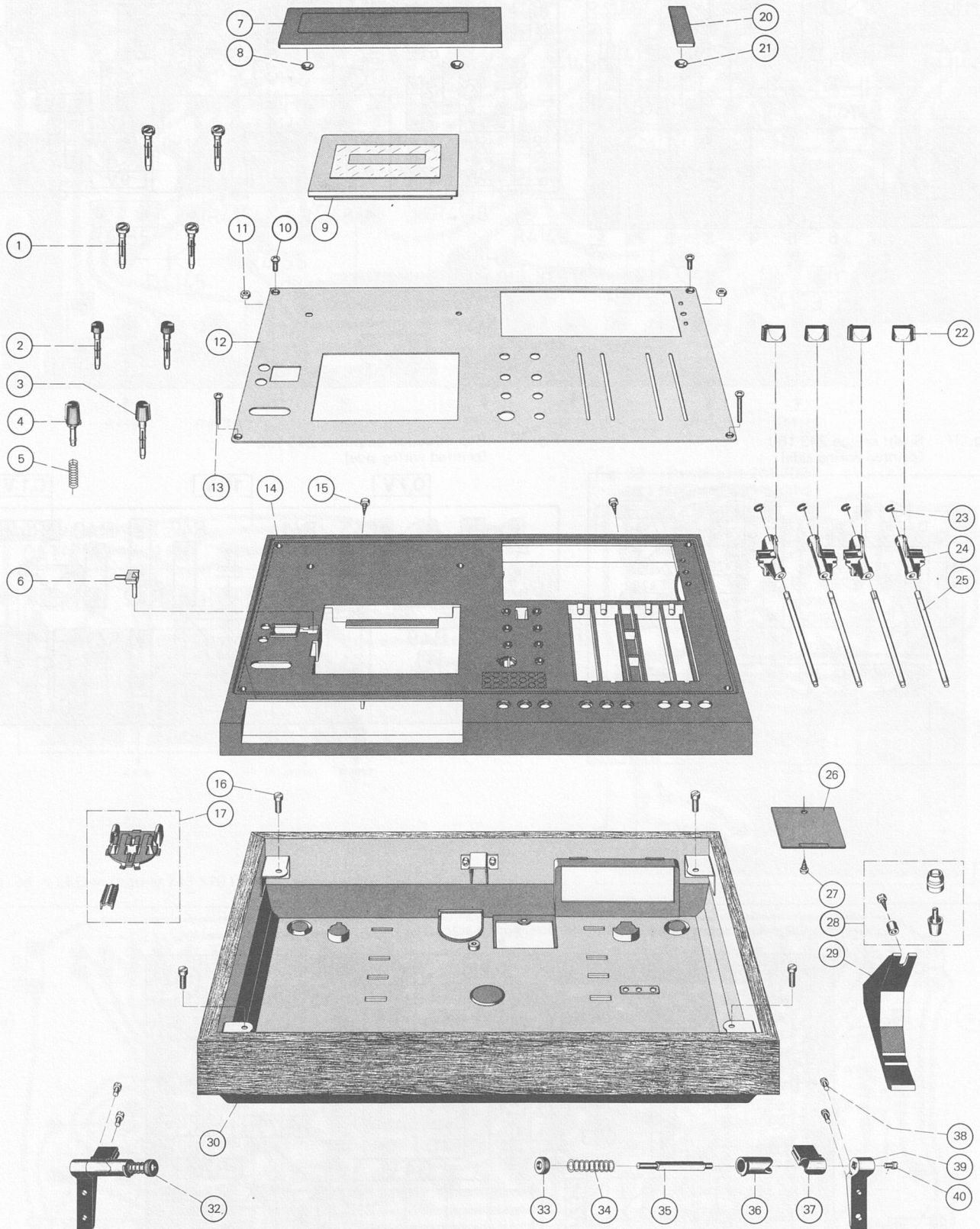


Fig. 35 Playback amplifier 235 482
(printed wiring side)

Fig. 40 Exploded view 1



Replacement parts

Pos.	Part. No.	Qty.	Description	Pos.	Part. No.	Qty.	Description
1	240 298	4	Adjusting knob	138	226 247	1	Retaining spring
2	240 297	2	Turning knob	139	226 227	1	Lamp socket
3	240 296	1	(Regulating knob)	140	209 443	1	Lamp with glass pedestal 12 V/1 W
4	240 286	1	Trick button	141	210 145	2	Lock washer 2,3
5	240 287	1	Spring washer	142	216 864	1	Spindle
6	240 288	1	Illumination sleeve	143	235 457	2	Driver assembly
7	242 942	1	Plaque LH	144	209 353	2	Ball 2
8	200 444	2	Spring washer	145	226 775	1	Head unit
9	232 946	1	Window compl.	146	226 776	1	Record / playback
10	240 349	2	Fillister head sheet metal screw M x 8	147	226 882	2	Machine screw
11	210 362	2	Hex nut BM 3	148	226 777	1	Erase head support
12	242 944	1	Panel	151	226 260	4	Sleeve
13	240 350	2	Fillister head screw M 3 x 30	152	211 306	1	Ball 3,50
14	242 945	1	Cover plate	153	210 556	2	Washer 2,4/0,50 Poleth.
15	218 055	2	Fillister head sheet metal screw B 2,9 x 9,5	154	210 145	1	Lock washer 2,3
16	210 518	2	Machine screw M 4 x 12	155	240 234	1	Key LH assembly
17	226 815	1	Fixing plate compl.	156	226 367	1	V-spring
20	242 943	1	Plaque RH	158	210 144	1	Lock washer 1,9
21	200 444	1	Spring washer	159	243 177	1	Pressure lever RH assembly
22	240 299	4	Slide head	160	200 463	1	Tension spring
23	210 146	4	Lock washer 3,2	161	210 145	3	Lock washer 2,3
24	240 284	4	Slide	162	226 243	2	Swivel lever VR
25	240 285	4	Spindle	163	226 895	1	Washer 5,1/10/0,75
26	235 365	1	Fuse cover	164	240 218	1	Record bar assembly
27	210 283	1	Fillister head screw B 2,9 x 6,5	165	210 145	1	Lock washer 2,3
28	240 374	1	Accessory console	166	240 236	1	Keys RH assembly
29	240 334	2	(Konsole base)	167	226 367	1	V-spring
30	242 823	1	CK 92 base walnut, complete	168	210 145	2	Lock washer 2,3
30	242 824	1	CK 92 base black, complete	169	240 229	1	Feeler bar
31	235 308	1	CH 82 cover	170	226 352	2	Tension spring
32	242 584	1	Hinge compl.	171	240 231	1	Blacking part
33	226 836	1	Knurled nut	172	210 144	2	Lock washer 1,9
34	226 835	1	Compression spring	173	226 324	2	Washer 2,6/5/0,75
35	226 832	1	Hinge pin	174	226 363	2	V-spring
36	226 834	1	Hinge cam	175	226 240	2	Switch lever
37	226 833	1	Hinge plate	176	226 119	1	Lift assembly
38	226 856	4	Machine screw AM 4 x 8	178	226 148	1	Disengagement arm assembly
39	235 336	1	Hinge pivot	179	226 352	1	Tension spring
40	235 375	1	Machine screw AM 3 x 5	180	242 957	1	Changeover arm compl. with slide spring
***	243 195	1	Packing carton compl.	181	210 472	4	Machine screw AM 3 x 4
***	240 318	1	Operating Instructions	182	226 305	1	Rubber stop
***	241 466	1	Operating Instructions UAP	183	210 147	2	Lock washer
100	210 472	2	Machine screw AM 3 x 4	184	226 891	8	V-spring
101	240 358	1	Angle with cone	185	242 949	5	Key compl. packed
102	240 357	1	V-spring	186	242 955	1	Record key compl. packet
103	210 144	1	Lock washer 1,9	187	242 951	1	Playing key LH compl.
104	243 176	1	Pressure lever	188	242 953	1	Playing key RH compl.
108	242 958	1	Memory counter	189	226 173	1	Spindle
109	210 478	1	Machine screw AM 3 x 5,5	190	242 956	1	Key panel assembly
110	226 259	1	Counter belt	191	210 145	2	Lock washer
111	240 277	1	Ejector key	192	240 246	1	Stop bar
112	240 278	1	Lock washer	200	242 947	1	(Desc)
113	240 268	1	Ejector lever assembly	201	210 357	1	Hex nut M 4
114	210 145	1	Lock washer 2,3	202	240 244	1	Recording angle
115	240 266	1	Switch lever	203	240 245	1	(Screw bolt)
116	210 144	2	Lock washer 1,9	204	210 147	1	Lock washer 4
117	226 324	2	Washer 2,6 x 5 x 0,75	205	226 812	1	Drive pulley 50 Hz
118	226 235	1	Release	205	226 813	1	Drive pulley 60 Hz
119	226 363	2	V-spring	206	230 559	1	Set screw M 2,5 x 3,5
120	226 240	2	Switch catch	207	210 366	3	Hex nut BM 4
121	235 665	2	Cable holder	208	235 391	1	Segment
122	226 769	4	Fixing rubber assembly	209	235 395	1	Top housing panel assembly
123	234 010	1	Hex nut B 2,5	211	226 811	1	Armature
124	240 222	1	Set screw	212	210 366	2	Hex nut M 4
125	235 456	1	Holder compl.	213	210 161	2	Serrated lock washer
126	235 065	1	Leaf spring LH	214	209 977	1	Solder lug
127	235 067	1	Leaf spring	216	241 684	1	Stator
128	235 066	1	Leaf spring RH	217	211 553	2	Machine screw AM 4 x 48
129	240 280	1	Trimplate to put in	218	216 276	1	Bottom housing panel assembly
130	230 281	1	Light line	219	241 683	1	Motor assembly 940-2
131	241 667	1	Machine screw M 2 x 4	220	235 385	2	Clamping plate compl.
132	226 179	1	Switch unit assembly	221	226 296	2	Rubber sleeve
133	210 471	2	Machine screw M 3 x 3,5	222	242 032	1	Power transformer compl.
134	240 220	1	Head black plate assembly	223	235 386	2	Clamping plate
135	235 017	2	Support	224	210 515	4	Machine screw M 4 x 6
136	226 355	2	Tension spring	228	226 930	1	Slide control
137	210 472	1	Machine screw AM 3 x 4	229	226 246	1	Retainer plate

Fig. 41 Exploded view 2

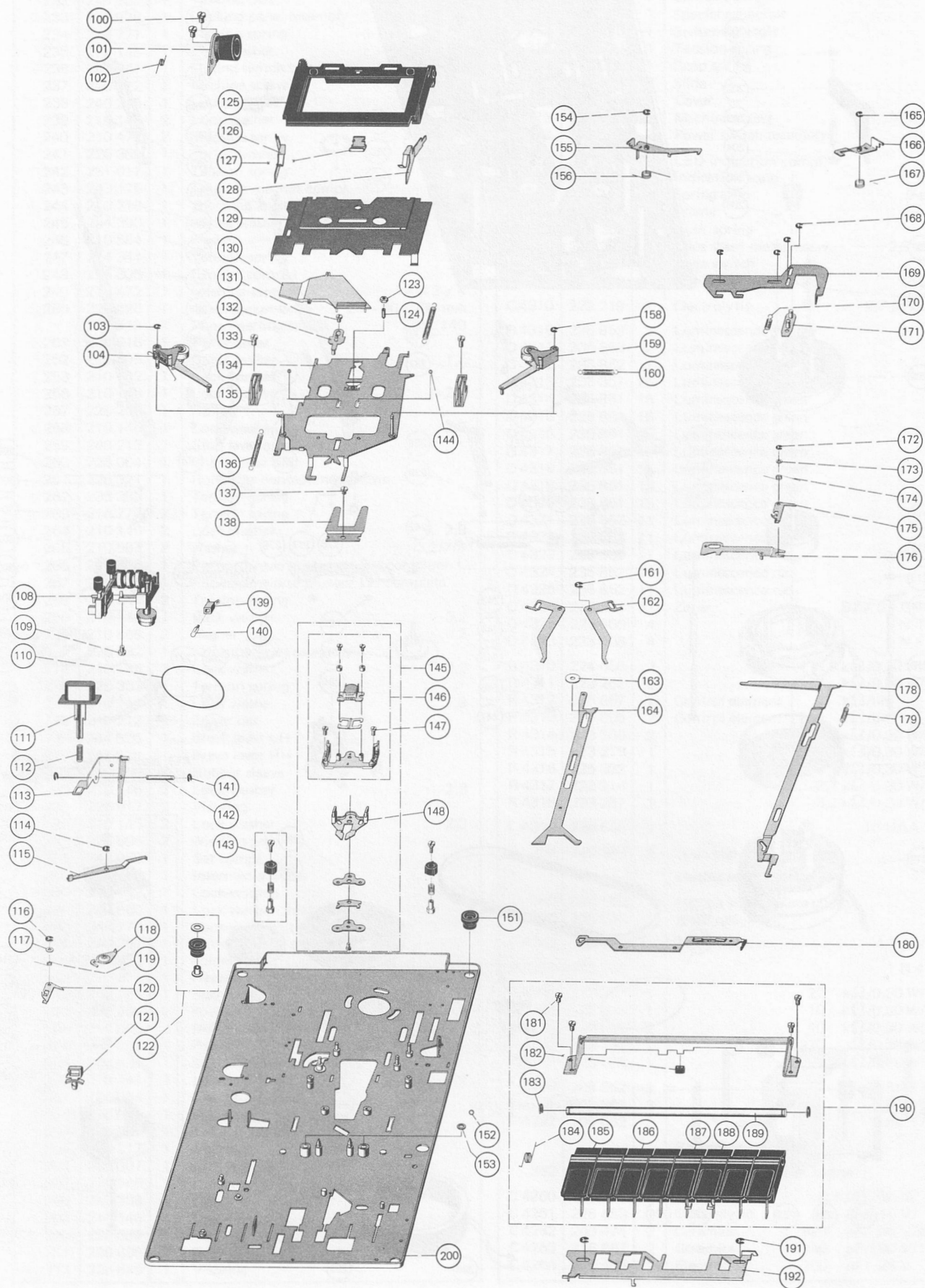
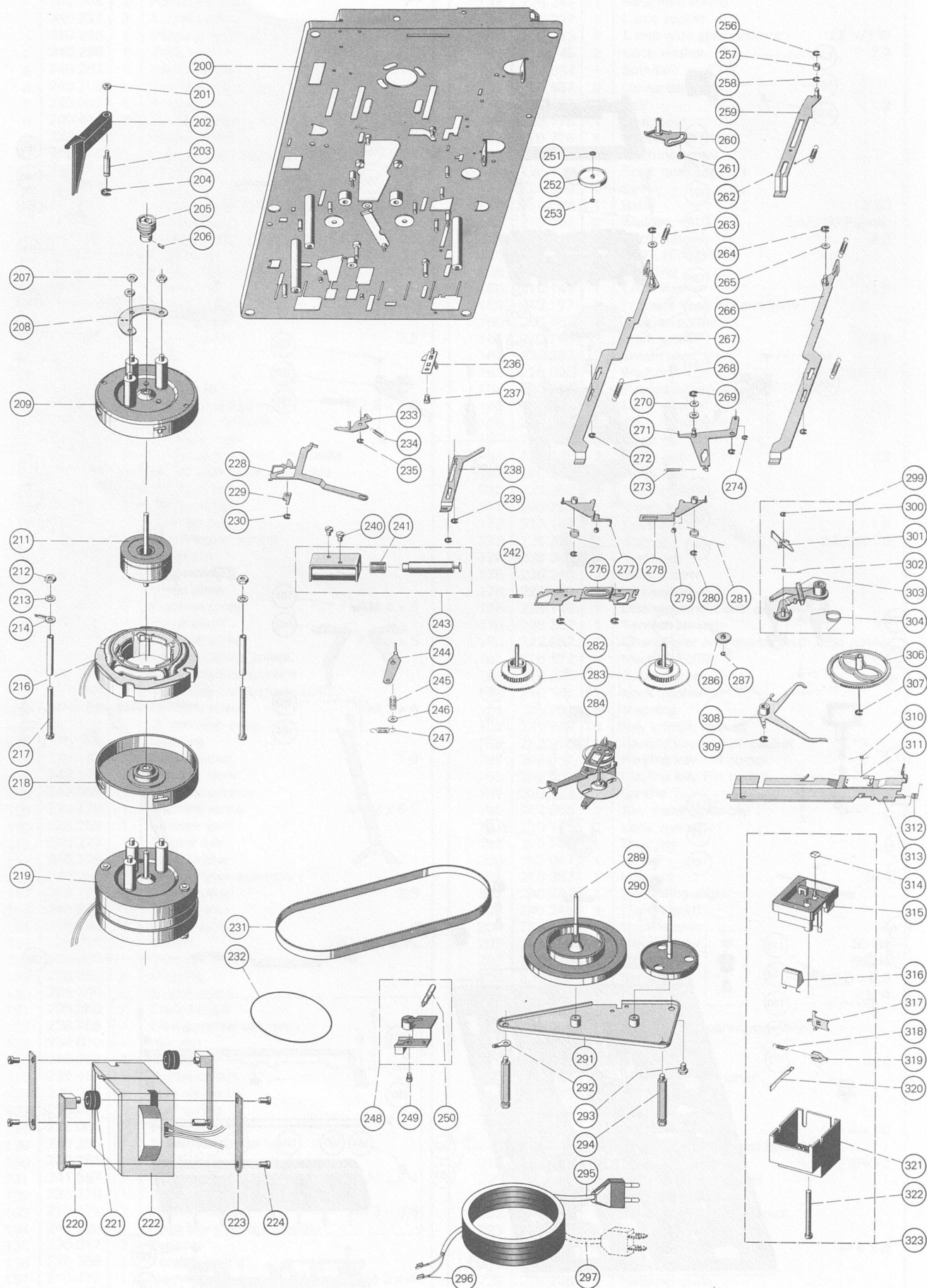


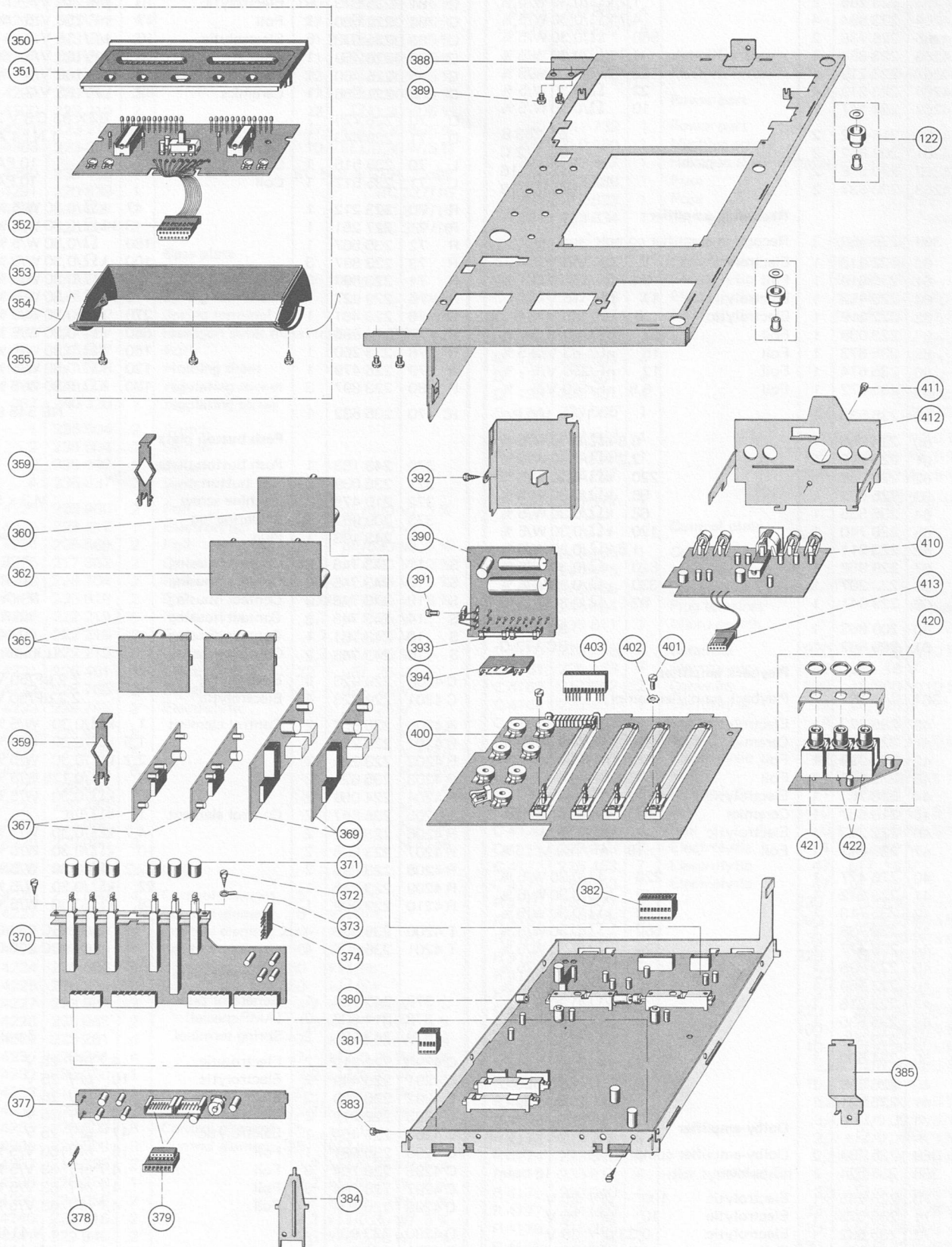
Fig. 42 Exploded view 3



Pos.	Part. No.	Qty.	Description
230	210 145	1	Lock washer 2,3
231	243 196	1	Main belt
232	240 253	1	Take-up belt
233	226 928	1	Locking panel assembly
234	216 777	1	Tension spring
235	210 145	1	Lock washer 2,3
236	240 241	1	Muting switch compl.
237	210 472	1	Machine screw AM 3 x 4
238	240 215	1	Locking slide
239	210 145	2	Lock washer 2,3
240	210 472	2	Machine screw AM 3 x 4
241	226 359	1	Spring washer
242	231 017	1	Tension spring
243	243 175	1	Traction magnet compl.
244	240 216	1	Blocking angle
245	234 303	1	Spring washer
246	210 584	1	Washer 3,2
247	214 344	1	Tension spring
248	226 805	1	(Holder compl.)
249	210 472	1	Machine screw AM 3 x 4
250	220 625	1	Glass socket lamp 24 - 30 V/30 mA
	226 919	1	Photo darlington ZMX 140
251	226 618	1	Felt washer
252	226 595	1	Guide pulley 1,2
253	210 142	1	Lock washer
256	210 145	1	Lock washer 2,3
257	226 255	1	Roller
258	210 145	1	Lock washer 2,3
259	240 213	1	Stop lever assembly
260	226 064	1	Changeover unit
261	226 321	1	Roller for contact mechanism
262	235 382	1	Tension spring
263	216 777	2	Tension spring
264	210 145	2	Lock washer 2,3
265	210 587	2	Washer 3,2/7/1
266	240 208	1	Forward/reverse plunger RH complete
267	240 210	1	Forward/reverse plunger LH complete
268	214 344	2	Tension spring
269	210 146	1	Lock washer 3,2
270	210 586	2	Washer 3,2
271	226 932	1	Non-stop lever assembly
272	210 145	1	Lock washer 2,3
273	226 353	1	Tension spring
274	210 144	1	Lock washer 1,9
276	240 212	1	Power bar
277	244 525	1	Brave lever LH
278	244 526	1	Brave lever RH
279	200 650	2	Rubber sleeve
280	210 145	2	Lock washer 2,3
281	226 617	2	V-spring
282	210 145	2	Lock washer 2,3
283	226 806	2	Winding gear
284	242 959	1	Set compl.
286	226 018	1	Intermediate gear
287	210 142	1	Lock washer 1,2
289	242 960	1	Lock washer great compl.
290	243 174	1	Lock washer little compl.
291	240 262	1	Bottom board compl.
292	209 962	1	Solder lug
293	210 811	1	Hexagon metal screw M 3 x 5
294	240 264	1	Stay bolt
295	232 996	1	Power card Europe compl.
296	214 602	2	(AMP plug sleeve)
297	232 995	1	Power cord America compl.
299	226 934	1	Swivel unit assembly
300	210 144	1	Lock washer 3,2
301	226 064	1	Changeover unit
302	226 931	1	Resetting spring
303	226 350	1	Tension spring
304	240 217	1	V-spring
306	226 807	1	Cam wheel
307	210 145	1	Lock washer 2,3
308	240 238	1	Locking lever compl.
309	210 146	1	Lock washer 3,2
310	226 639	1	V-spring
311	226 638	1	Slide
312	226 845	1	V-spring

Pos.	Part. No.	Qty.	Description
313	240 265	1	Flap compl.
314	200 444	1	Lock washer
315	236 605	1	Switch board
316	230 294	1	Special capacitor
317	230 148	1	Switching angle
318	239 732	1	Tension spring
319	219 200	1	Snap spring
320	236 335	1	Slide
321	242 102	1	Cover
322	210 498	1	Machine screw M 3 x 28
323	242 582	1	Power switch assembly
350	243 179	1	LED-indication compl.
351	243 178	1	Indication scale
352	243 192	3	Spring strip 9-pole
353	240 315	1	Frame
354	226 369	2	Hock spring
355	210 285	3	Lens sheet metal screw 2,9 x 9,5
356	235 900	1	Slide switch
357	235 849	2	IC-holder 18-pole
C 4310	222 219	2	Electrolytic 4,7 μ F/25 V
D 4310	235 853	2	Luminescence yellow
D 4311	235 853	2	Luminescence yellow
D 4312	235 852	1	Luminescence red
D 4313	235 851	15	Luminescence green
D 4314	235 851	15	Luminescence green
D 4315	235 851	15	Luminescence green
D 4316	235 851	15	Luminescence green
D 4317	235 851	15	Luminescence green
D 4318	235 851	15	Luminescence green
D 4319	235 851	15	Luminescence green
D 4320	235 851	15	Luminescence green
D 4321	235 852	11	Luminescence red
D 4322	235 852	11	Luminescence red
D 4323	235 852	11	Luminescence red
D 4324	235 852	11	Luminescence red
D 4325	235 852	11	Luminescence red
D 4326	235 854	1	Zener BZX 83 C3 VO
D 4327	223 906	4	1 N 4148
D 4328	223 906	4	1 N 4148
R 4310	224 058	2	6,8 k Ω /0,30 W/5 %
R 4311	223 262	2	27 k Ω /0,30 W/5 %
R 4312	235 857	2	Control element 1 k Ω /lin.
R 4313	235 856	2	Control element 500 Ω /lin.
R 4314	223 266	2	5,6 k Ω /0,30 W/5 %
R 4315	223 215	1	22 k Ω /0,30 W/5 %
R 4316	225 592	1	56 k Ω /0,30 W/5 %
R 4317	223 214	1	2,7 k Ω /0,30 W/5 %
R 4318	223 257	1	8,2 k Ω /0,30 W/5 %
I 4310	235 848	2	IC-UAA 180
359	240 333	6	Span clip
360	243 180	1	Muting switch plate
361	235 838	1	Muting switch plate compl.
C 4280	226 452	1	Reed relay
D 4280	223 306	1	Electrolytic 4,7 μ F/6 V
R 4280	223 258	1	1 N 4148
R 4281	223 898	1	22 k Ω /0,30 W/5 %
R 4282	223 898	2	10 k Ω /0,30 W/5 %
R 4283	228 741	1	10 k Ω /0,30 W/5 %
R 4284	223 265	1	270 Ω /0,30 W/5 %
T 4280	209 862	3	1,2 k Ω /0,30 W/5 %
T 4281	209 862	3	BC 172 C
T 4282	209 862	3	BC 172 C
362	242 181	2	Recording amplifier
C 4260	226 459	0	Recording amplifier compl.
C 4261	226 453	2	Foil 0,1 μ F/100 V/ 5 %
C 4262	203 474	2	Electrolytic 47 μ F/ 16 V/ 5 %
C 4263	216 667	2	Ceramics 680 pF/ 50 V/20 %
C 4264	226 455	2	Ceramics 100 pF/100 V/10 %
		2	Electrolytic 100 μ F/ 25 V

Fig. 43 Exploded view 4



Pos.	Part. No.	Qty.	Description
R 4260	227 263	2	560 $k\Omega/0,30 W/5 \%$
R 4261	235 544	2	390 $k\Omega/0,30 W/5 \%$
R 4262	229 940	2	3,3 $k\Omega/0,30 W/5 \%$
R 4263	223 265	2	1,2 $k\Omega/0,30 W/5 \%$
R 4264	223 884	4	4,7 $k\Omega/0,30 W/5 \%$
R 4265	228 738	2	560 $\Omega/0,30 W/5 \%$
R 4266	223 884	4	4,7 $k\Omega/0,30 W/5 \%$
R 4267	223 219	4	22 $\Omega/0,30 W/5 \%$
R 4268	223 219	4	22 $\Omega/0,30 W/5 \%$
R 4269	224 147	2	10 $\Omega/0,30 W/5 \%$
T 4260	216 042	2	BC 253 B
T 4261	209 862	2	BC 172 C
T 4262	220 528	2	BC 327/16
T 4263	220 537	2	BC 337/16
Recording amplifier			
365	235 482	2	Recording amplifier compl.
C 60	222 213	1	Electrolytic 1 $\mu F/50 V$
C 61	235 619	1	Foil 0,68 $\mu F/100 V/5 \%$
C 62	226 452	1	Electrolytic 47 $\mu F/16 V$
C 63	222 219	1	Electrolytic 4,7 $\mu F/25 V$
C 64	223 039	1	Foil 22 $nF/250 V/5 \%$
C 65	235 673	1	Foil 15 $nF/63 V/2,5 \%$
C 66	235 674	1	Foil 12 $nF/250 V/5 \%$
C 67	235 672	1	Foil 6,8 $nF/100 V/5 \%$
L 60	235 533	1	Type 100 PA
R 60	224 058	1	6,8 $k\Omega/0,30 W/5 \%$
R 61	223 216	1	2,2 $k\Omega/0,30 W/5 \%$
R 62	223 258	1	220 $k\Omega/0,30 W/5 \%$
R 63	225 592	1	56 $k\Omega/0,30 W/5 \%$
R 64	235 535	1	68 $k\Omega/0,30 W/5 \%$
R 65	228 740	1	120 $k\Omega/0,30 W/5 \%$
R 66	223 211	1	1,5 $k\Omega/0,30 W/5 \%$
R 67	229 952	1	820 $\Omega/0,30 W/5 \%$
R 68	223 207	1	330 $\Omega/0,30 W/5 \%$
R 69	229 941	1	82 $\Omega/0,30 W/5 \%$
T 60	209 863	1	BC 173 C
T 61	209 862	1	BC 172 C
Playback amplifier			
367	243 182	2	Playback amplifier compl.
C 40	235 573	1	Electrolytic 10 $\mu F/16 V$
C 41	220 591	1	Ceramics 220 $pF/500 V/20 \%$
C 42	223 039	1	Foil 22 $nF/250 V/5 \%$
C 43	235 527	1	Foil 3 $nF/63 V/5 \%$
C 44	228 763	1	Electrolytic 100 $\mu F/63 V$
C 45	216 667	1	Ceramics 100 $pF/100 V/10 \%$
C 46	222 213	1	Electrolytic 1 $\mu F/50 V$
C 47	235 617	1	Foil 18 $nF/160 V/2,5 \%$
R 40	226 477	1	220 $\Omega/0,30 W/5 \%$
R 41	223 212	1	47 $k\Omega/0,30 W/5 \%$
R 42	235 713	1	82 $k\Omega/0,30 W/5 \%$
R 43	228 738	1	560 $\Omega/0,30 W/5 \%$
R 44	226 477	1	220 $\Omega/0,30 W/5 \%$
R 45	223 896	1	2,2 $M\Omega/0,30 W/5 \%$
R 46	223 259	1	470 $\Omega/0,30 W/5 \%$
R 47	223 216	1	2,2 $k\Omega/0,30 W/5 \%$
R 48	235 535	1	68 $k\Omega/0,30 W/5 \%$
R 49	223 262	1	27 $k\Omega/0,30 W/5 \%$
R 50	224 600	1	39 $k\Omega/0,30 W/5 \%$
T 40	226 898	1	BC 550 C
T 41	235 921	1	BC 239 C
Dolby-amplifier			
369	235 484	2	Dolby-amplifier compl.
368	235 574	1	IC-holder 16-pole
C 70	226 455	1	Electrolytic 100 $\mu F/25 V$
C 71	235 573	1	Electrolytic 10 $\mu F/16 V$
C 72	235 662	1	Electrolytic 0,33 $\mu F/35 V$
C 73	235 524	1	Foil 4,7 $nF/63 V/2,5 \%$
C 74	235 523	1	Foil 27 $nF/63 V/2,5 \%$
C 75	235 525	1	Foil 5,6 $nF/63 V/2,5 \%$
C 76	235 573	5	Electrolytic 10 $\mu F/16 V$
C 77	235 572	1	Foil 3 $nF/63 V/5 \%$

Pos.	Part. No.	Qty.	Description
C 78	235 513	1	Foil 2,2 $nF/160 V/5 \%$
C 79	235 528	1	Foil 3,9 $nF/63 V/5 \%$
C 80	235 573	5	Electrolytic 10 $\mu F/16 V$
C 81	235 573	5	Electrolytic 10 $\mu F/16 V$
C 82	222 500	1	Foil 47 $nF/250 V/5 \%$
C 83	235 573	5	Electrolytic 10 $\mu F/16 V$
C 84	226 459	1	Foil 0,1 $\mu F/100 V/5 \%$
C 85	226 460	1	Foil 0,33 $\mu F/100 V/5 \%$
C 86	227 888	1	Ceramics 82 $pF/63 V/2$
D 70	226 725	1	BZX 83 C 6 V 2
D 71	226 443	1	1 N 54 A
L 70	235 516	1	Coil 10 PA
L 71	235 517	1	Coil 10 PA
R 70	223 212	1	47 $k\Omega/0,30 W/5 \%$
R 71	227 251	1	3,3 $k\Omega/0,30 W/5 \%$
R 72	235 507	1	180 $\Omega/0,30 W/5 \%$
R 73	223 897	3	100 $k\Omega/0,30 W/5 \%$
R 74	223 897	3	100 $k\Omega/0,30 W/5 \%$
R 75	229 927	1	3,9 $k\Omega/0,30 W/5 \%$
R 76	226 481	1	270 $k\Omega/0,30 W/5 \%$
R 77	223 895	1	680 $k\Omega/0,30 W/5 \%$
R 78	223 260	1	150 $k\Omega/0,30 W/5 \%$
R 79	226 479	1	120 $\Omega/0,30 W/5 \%$
R 80	223 897	3	100 $k\Omega/0,30 W/5 \%$
IC 70	235 532	1	NE 545 B
Push button plate			
370	243 183	1	Push button plate
371	235 039	6	Key button
372	210 475	2	Machine screw M 3 x 5
373	209 962	1	Soldering lug
374	243 193	1	Plug 6-pole
S 11	243 748	3	Contact housing (FE)
S 12	243 745	2	Contact housing (CR)
S 13	243 748	3	Contact housing (FeCr)
S 14	243 748	3	Contact housing (NR)
S 15	243 751	1	Contact housing (FM)
S 16	243 745	2	Contact housing (Limiter)
C 4200	229 923	4	Electrolytic 2,2 $\mu F/50 V$
C 4201	229 923	4	Electrolytic 2,2 $\mu F/50 V$
R 4200	235 857	2	Control element 1 $k\Omega/0,30 W/5 \%$
R 4201	223 211	1	1,5 $k\Omega/0,30 W/5 \%$
R 4202	223 216	2	2,2 $k\Omega/0,30 W/5 \%$
R 4203	235 624	2	390 $\Omega/0,125 W/5 \%$
R 4204	224 059	2	33 $k\Omega/0,30 W/5 \%$
R 4205	235 857	2	Control element 1 $k\Omega/lin.$
R 4206	223 884	2	4,7 $k\Omega/0,30 W/5 \%$
R 4207	223 898	2	10 $k\Omega/0,30 W/5 \%$
R 4208	223 896	2	2,2 $M\Omega/0,30 W/5 \%$
R 4209	223 215	1	22 $k\Omega/0,30 W/5 \%$
R 4210	229 909	1	18 $k\Omega/0,30 W/5 \%$
T 4200	235 808	4	BC 238 D
T 4201	235 808	4	BC 238 D
Generator plate			
377	243 184	1	Generator plate
378	214 602	2	(AMP-special)
379	243 191	2	Spring terminal 7-pole
C 4290	222 219	2	Electrolytic 4,7 $\mu F/25 V$
C 4291	226 449	2	Electrolytic 10 $\mu F/25 V$
C 4292	226 449	2	Electrolytic 10 $\mu F/25 V$
C 4293	222 219	2	Electrolytic 4,7 $\mu F/25 V$
C 4294	226 454	1	Electrolytic 47 $\mu F/25 V$
C 4295	235 681	1	Foil 15 $nF/160 V/5 \%$
C 4296	228 704	3	Foil 4,7 $nF/63 V/5 \%$
C 4297	228 704	3	Foil 4,7 $nF/63 V/5 \%$
C 4298	228 704	3	Foil 4,7 $nF/63 V/5 \%$
D 4290	223 906	3	1 N 4148
D 4291	223 906	3	1 N 4148
D 4292	223 906	3	1 N 4148
L 4290	235 866	1	Generator coil
R 4290	223 898	2	10 $k\Omega/0,30 W/5 \%$

Pos.	Part. No.	Qty.	Description
R 4291	223 265	2	1,2 k Ω /0,30 W/5 %
R 4292	235 869	1	100 Ω /1 W/5 %
R 4293	226 476	2	180 k Ω /0,30 W/5 %
R 4294	226 476	2	180 k Ω /0,30 W/5 %
R 4295	223 262	1	27 k Ω /0,30 W/5 %
R 4296	223 265	2	1,2 k Ω /0,30 W/5 %
R 4297	223 264	1	1 k Ω /0,30 W/5 %
R 4298	223 219	2	22 Ω /0,30 W/5 %
R 4299	223 212	2	47 k Ω /0,30 W/5 %
R 4300	223 219	2	22 Ω /0,30 W/5 %
R 4301	223 212	2	47 k Ω /0,30 W/5 %
R 4303	223 898	2	10 k Ω /0,30 W/5 %
T 4290	239 465	1	BC 548 A GEH. T o92
T 4291	220 538	1	BC 327/16
T 4292	220 537	2	BC 337/16
T 4293	220 537	2	BC 337/16
Base plate			
380	243 188	1	Base plate compl. with frame
381	243 190	1	Spring terminal 5-pole
382	243 192	3	Spring terminal 9-pole
383	227 467	2	Hexagon sheet metal screw 2,9 x 6,5
384	235 847	1	Fork
385	240 308	1	Holding sheet
386	240 331	1	regulating socket
387	240 330	1	regulating screw
S 1	235 504	2	Switch
S 2	235 504	2	Switch
S 3	235 837	2	Switch
S 4	235 837	2	Switch
C 4220	235 906	2	Foil 100 pF/630 V/ 5 %
C 4223	222 212	1	Electrolytic 100 μ F/ 25 V
C 4224	235 569	2	Foil 220 pF/630 V/ 5 %
C 4225	217 862	2	Ceramics 22 pF/500 V/10 %
C 4226	228 704	2	Foil 4,7 nF/ 63 V/ 5 %
C 4227	235 619	2	Foil 0,68 μ F/100 V/ 5 %
C 4228	222 219	6	Electrolytic 4,7 μ F/ 25 V
C 4229	222 219	6	Electrolytic 4,7 μ F/ 25 V
C 4230	222 219	6	Electrolytic 4,7 μ F/ 25 V
C 4231	226 451	1	Electrolytic 22 μ F/ 25 V
C 4232	228 765	2	Electrolytic 100 μ F/ 25 V
C 4233	229 765	2	Electrolytic 100 μ F/ 25 V
D 4220	223 906	8	1 N 4148
D 4221	223 906	8	1 N 4148
D 4222	223 906	8	1 N 4148
D 4223	226 443	4	1 N 54 A
D 4224	226 443	4	1 N 54 A
D 4225	223 906	8	1 N 4148
D 4226	223 906	8	1 N 4148
L 4220	226 406	2	Coil
R 4220	235 859	4	Control element 5 k Ω /lin.
R 4221	235 859	4	Control element 5 k Ω /lin.
R 4222	235 923	4	Control element 250 k Ω /lin.
R 4223	235 923	4	Control element 250 k Ω /lin.
R 4224	226 509	8	Control element 250 k Ω /lin.
R 4225	226 509	8	Control element 250 k Ω /lin.
R 4227	223 884	2	4,7 k Ω /0,30 W/ 5 %
R 4228	235 868	2	1,5 M Ω /0,25 W/ 5 %
R 4229	228 261	4	47 k Ω /0,25 W/ 5 %
R 4230	228 261	4	47 k Ω /0,25 W/ 5 %
R 4232	228 250	1	2,2 k Ω /0,25 W/ 5 %
R 4233	216 695	1	120 Ω /0,25 W/10 %
R 4234	228 256	2	2,7 k Ω /0,25 W/ 5 %
R 4235	226 509	8	Control element 25 k Ω /lin.
R 4236	226 509	8	Control element 25 k Ω /lin.
R 4237	216 325	2	1,2 k Ω /0,25 W/ 5 %
R 4238	228 250	1	2,2 k Ω /0,25 W/ 5 %
R 4239	224 058	2	6,8 k Ω /0,30 W/ 5 %
R 4240	223 216	2	2,2 k Ω /0,30 W/ 5 %
R 4241	229 940	2	3,3 k Ω /0,30 W/ 5 %
R 4242	223 215	2	22 k Ω /0,30 W/ 5 %
R 4243	227 263	2	560 k Ω /0,30 W/ 5 %
R 4244	223 264	2	1 k Ω /0,30 W/ 5 %
R 4245	223 898	2	10 k Ω /0,30 W/ 5 %

Pos.	Part. No.	Qty.	Description
R 4246	216 838	1	1,5 k Ω /0,25 W/ 5 %
R 4247	216 352	1	6,8 k Ω /0,25 W/ 5 %
R 4250	223 212	1	47 k Ω /0,30 W/ 5 %
T 4220	209 862	4	BC 172 C
T 4221	209 862	4	BC 172 C
388	235 307	1	Amplifier sheet
389	210 475	2	Machine screw AM 3 x 5
Power part			
390	241 732	1	Power part
391	210 480	1	Machine screw AM 3 x 6
392	227 467	1	Hexagon sheet metal screw BZ 2,9 x 6,5
393	213 288	1	Fuse T 0,800
393	217 883	1	Fuse T 0,630
394	223 834	1	Spring terminal 7-pole
C 130	266 286	1	Electrolytic 100 μ F/ 40 V
C 131	226 457	1	Electrolytic 470 μ F/ 40 V
C 132	226 455	1	Electrolytic 100 μ F/ 25 V
C 133	222 495	2	Electrolytic 10 nF/250 V/5 %
C 134	222 495	2	Electrolytic 10 nF/250 V65 %
D 130	226 501	4	1 N 4002
D 131	226 501	4	1 N 4002
D 132	226 501	4	1 N 4002
D 133	226 501	4	1 N 4002
D 134	235 565	1	ZPY 20
R 130	235 563	1	1,5 Ω /1,0 W/10 %
R 131	235 799	1	150 Ω /0,30 W/ 5 %
R 132	223 207	1	330 Ω /0,30 W/ 5 %
T 130	226 472	1	BD 233/16
Control plate			
400	243 185	1	Control plate
401	210 475	2	Machine screw
402	210 155	1	Serrated lock washer
403	243 194	1	Plug terminal 10-pole
404	235 811	1	Micro-switch
C 4160	223 278	2	Ceramics 330 pF/500 V/10 %
C 4161	226 453	7	Electrolytic 47 μ F/ 16 V
C 4162	217 862	2	Ceramics 220 pF/500 V/10 %
C 4163	226 451	1	Electrolytic 22 μ F/ 25 V
C 4164	222 219	2	Electrolytic 4,7 μ F/ 25 V
C 4165	226 459	8	Foil 0,1 μ F/100 V/ 5 %
C 4166	226 453	7	Electrolytic 47 μ F/ 16 V
C 4167	226 459	8	Foil 0,1 μ F/100 V/ 5 %
C 4168	222 213	2	Electrolytic 1 μ F/ 50 V
C 4169	226 459	8	Foil 0,1 μ F/100 V/ 5 %
C 4170	226 459	8	Foil 0,1 μ F/100 V/ 5 %
C 4171	222 213	2	Electrolytic 1 μ F/ 50 V
C 4172	226 453	7	Electrolytic 47 μ F/ 16 V
C 4173	226 453	7	Electrolytic 47 μ F/ 16 V
R 4160	226 477	4	220 Ω /0,30 W/5 %
R 4161	235 876	2	390 Ω /0,30 W/5 %
R 4162	224 600	2	39 k Ω /0,30 W/5 %
R 4163	223 258	2	220 k Ω /0,30 W/5 %
R 4164	223 216	9	2,2 k Ω /0,30 W/5 %
R 4165	223 214	2	2,7 k Ω /0,30 W/5 %
R 4166	226 477	4	220 Ω /0,30 W/5 %
R 4167	223 897	2	100 k Ω /0,30 W/5 %
R 4168	223 898	1	10 k Ω /0,30 W/5 %
R 4169	223 896	4	2,2 M Ω /0,30 W/5 %
R 4170	235 817	4	10 k Ω /log.
R 4171	229 940	4	3,3 k Ω /0,30 W/5 %
R 4172	229 927	2	3,9 k Ω /0,30 W/5 %
R 4173	223 216	9	2,2 k Ω /0,30 W/5 %
R 4174	223 896	4	2,2 M Ω /0,30 W/5 %
R 4175	235 817	4	disk type rheostat 1 k Ω /log.
R 4176	229 940	4	3,3 k Ω /0,30 W/5 %
R 4177	224 059	2	33 k Ω /0,30 W/5 %
R 4178	228 255	2	10 k Ω /0,25 W/5 %
R 4179	235 686	2	820 k Ω /0,30 W/5 %
R 4180	235 539	4	Control element 5 k Ω /lin.
R 4181	228 738	2	560 Ω /0,30 W/5 %
R 4182	228 741	2	270 Ω /0,30 W/5 %
R 4183	223 216	9	2,2 k Ω /0,30 W/5 %

Pos.	Part. No.	Qty.	Description
R 4184	223 216	9	2,2 k Ω /0,30 W/5 %
R 4185	235 576	2	Control element 220 Ω /lin.
R 4190	235 539	4	Control element 5 k Ω /lin.
R 4191	223 216	9	2,2 k Ω /0,30 W/5 %
R 4195	235 537	1	Control element 10 k Ω /lin.
T 4160	226 898	2	BC 550 C
T 4161	235 921	2	BC 239 C
T 4162	209 863	6	BC 173 C
T 4163	209 863	6	BC 173 C
T 4164	209 863	6	BC 173 C
T 4165	220 537	1	BC 337/16
DIN-socket plate			
410	243 187	1	DIN-socket plate
411	227 467	1	Hexagon sheet metal screw BZ 2,9 x 6,5
412	240 309	1	plate-sleeve unit
413	243 190	1	Spring terminal 5-pole
414	233 601	1	Socket 5-pole
415	233 600	1	Changeover 3-pole
416	233 547	1	Connecting slide
417	235 572	4	Flush plate
C 4145	222 219	8	Electrolytic 4,7 μ F/ 25 V
C 4146	217 862	2	Cermics 22 pF/500 V/10 %
C 4147	222 219	8	Electrolytic 4,7 μ F/ 25 V
C 4148	226 453	2	Electrolytic 47 μ F/ 16 V
C 4149	223 278	2	Ceramics 330 pF/500 V/10 %
C 4150	222 219	8	Electrolytic 4,7 μ F/ 25 V
C 4151	222 219	8	Electrolytic 4,7 μ F/ 25 V
D 4145	226 725	1	BZX 83 C6 V 2
R 4145	223 218	2	82 k Ω /0,30 W/5 %
R 4146	223 884	2	4,7 k Ω /0,30 W/5 %
R 4147	223 214	2	2,7 k Ω /0,30 W/5 %
R 4148	223 262	2	27 k Ω /0,30 W/5 %
R 4149	235 507	2	180 Ω /0,30 W/5 %
R 4150	228 740	2	120 k Ω /0,30 W/5 %
R 4151	223 216	4	2,2 k Ω /0,30 W/5 %
R 4152	223 268	2	150 Ω /0,30 W/5 %
R 4153	223 216	4	2,2 k Ω /0,30 W/5 %
R 4154	223 897	2	100 k Ω /0,30 W/5 %
R 4155	223 215	2	22 k Ω /0,30 W/5 %
R 4156	229 940	4	3,3 k Ω /0,30 W/5 %
R 4157	229 940	4	3,3 k Ω /0,30 W/5 %
T 4145	226 898	2	BC 550 C

Pos.	Part. No.	Qty.	Description
T 4146	235 921	4	BC 239 C
T 4147	235 921	4	BC 239 C
Mic-socket plate			
420	243 186	1	Mic-socket plate
421	240 880	1	Phono-socket
422	240 880	2	Mic-socket
C 4140	222 213	2	Electrolytic 10 μ F/50 V
C 4142	216 414	1	Cermics 0,1 μ F/16 V
R 4140	223 898	2	10 k Ω /0,30 W/5 %
R 4142	235 507	2	180 Ω /0,30 W/5 %
R 4175	235 817	4	1 k Ω /log.
R 4176	229 940	4	3,3 k Ω /0,30 W/5 %
R 4177	224 059	2	33 k Ω /0,30 W/5 %
R 4178	228 255	2	10 k Ω /0,25 W/5 %
R 4179	235 686	2	820 k Ω /0,30 W/5 %
R 4180	235 539	4	Potentiometer 5 k Ω /lin.
R 4181	228 738	2	560 Ω /0,30 W/5 %
R 4182	228 741	2	270 Ω /0,30 W/5 %
R 4183	223 216	9	2,2 k Ω /0,30 W/5 %
R 4184	223 216	9	2,2 k Ω /0,30 W/5 %
R 4185	235 576	2	Potentiometer 220 Ω /lin.
R 4190	235 539	4	Potentiometer 5 k Ω /lin.
R 4191	223 216	9	2,2 k Ω /0,30 W/5 %
R 4195	235 537	1	Potentiometer 10 k Ω /lin.
T 4160	226 898	2	BC 550 C
T 4161	235 921	2	BC 239 C
T 4162	209 893	6	BC 173 C
T 4163	209 863	6	BC 173 C
T 4164	209 863	6	BC 173 C
T 4165	220 537	1	BC 337/16
DIN socket plate			
410	243 187	1	DIN socket plate
411	227 467	1	Hexagon screw BZ 2,9 x 6,5
412	240 309	1	Plate socket unit
413	243 190	1	Spring edge 5-pole
414	233 601	1	Socket 5-pole
415	233 600	1	Changeover 3-pole
416	233 547	1	Connecting slide
417	235 572	4	Mounting plate
C 4145	222 219	8	Elyt 4,7 μ F/ 25 V
C 4146	217 862	2	Ceramic 22 pF/500 V/10 %

**not illustrating

Alteration reserved!



Dual Gebrüder Steidinger · 7742 St. Georgen/Schwarzwald

Allgemeine Information
General Information
Information générale



Datum-Date-Date	Zeichen-Ref.-N/réf.	Geräte Nr. Serial number- No. de l'appareil	No
11.10.84	KD 12/Bm		3/C 939

Play-Taste rechts (grün) Art-Nr. 242 953 ist nicht mehr komplett lieferbar.

Bitte, bestellen Sie ab sofort die Record-Taste (rot) Art-Nr. 242 955 und übernehmen Sie die Mechanikteile der Play-Taste.

PS: Vorliegende Bestellungen werden storniert.

Key play right (green) part no. 242 953 is no longer available in complete version.

Please order from now on record key (red) part no. 242 955 and add the mechanical parts of play key.

PS: Backorders will be cancelled.