

TC-228

*General Export Model
USA Model*



Set using ISO screws

SPECIFICATIONS

Power Requirements: AC 120 V 60 Hz, 40 W (USA Model)
AC 100 V/110 V/120 V/220 V/240 V
50/60 Hz, 40 W (General Export Model)

Track System: Eight-track two-channel stereo

Tape: Eight-track tape cartridge

Tape Speed: 3 3/4" ips (9.5 cm/s)

Recording Time: 40 min with G-40 tape cartridge

Distorsion: Less than 3 %

Signal-to-Noise Ratio: 45 dB or better

Flutter and Wow: 0.17 % (WRMS)

Recording Bias

Frequency: Approx. 85 kHz

Inputs: Two MIC inputs
Impedance: 600 Ω
Maximum sensitivity: 0.25 mV (-70 dB)

LINE INPUTs
Impedance: 100 k Ω
Maximum sensitivity: 70 mV (-21 dB)

REC/PB connector (General Export Model)
Impedance: 10 k Ω
Maximum sensitivity: 17 mV (-33 dB)

Outputs: Two LINE OUTPUTs
Load impedance: 100 k Ω
Output level: 0.5 V (-4 dB) with 100 k Ω load

HEADPHONE output
Impedance: 8 Ω load
Output level: 30 mV (-28 dB)

REC/PB connector (General Export Model)
Impedance: 10 k Ω
Output level: 0.62 ~ 0.38 V (-2 ~ -6 dB)

Semiconductors: 11 transistors and 12 diodes

Dimensions: 14 5/16 (W) x 4 3/4 (H) x 8 3/4" (D)
(363 x 120 x 222 mm)

Weight: 11 lb (4.8 kg)

SONY®
SERVICE MANUAL

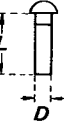
TABLE OF CONTENTS

<u>Section</u>	<u>Title</u>	<u>Page</u>
	Specifications	1
	Hardware Nomenclature	2
1.	OUTLINE	3 ~ 4
	1-1. Block Diagram	3
	1-2. Major Parts Location	3 ~ 4
2.	DISASSEMBLY AND REPLACEMENT	5
3.	ADJUSTMENT PROCEDURES	6 ~ 12
	3-1. Mechanical Adjustments	6
	3-2. Electrical Adjustments/Measurements	7 ~ 12
4.	DIAGRAMS	13 ~ 23
	4-1. Schematic Diagram (USA Model)	13 ~ 14
	4-2. Mounting Diagram - Amplifier Circuit Board - (USA Model)	15 ~ 16
	4-3. Schematic Diagram (General Export Model)	17 ~ 18
	4-4. Mounting Diagram - Amplifier Circuit Board - (General Export Model)	19 ~ 20
	4-5. Mounting Diagram - Eject & Power Supply Circuit Board - (USA Model)	21
	4-6. Mounting Diagram - Eject & Power Supply Circuit Board - (General Export Model)	22
	4-7. Level Diagrams	23
5.	EXPLODED VIEWS	24 ~ 30
	5-1. Packing	24
	5-2. Cabinet - Top View -	25 ~ 26
	5-3. Chassis - Top View -	27 ~ 28
	5-4. Chassis - Bottom View -	29 ~ 30
6.	ELECTRICAL PARTS LIST	31 ~ 32
7.	HARDWARE	32

*When ordering replacement parts, you should use PART NUMBER listed on the Parts Lists or shown in the EXPLODED VIEW.
The reference number should not be used for ordering purposes.*

Hardware Nomenclature

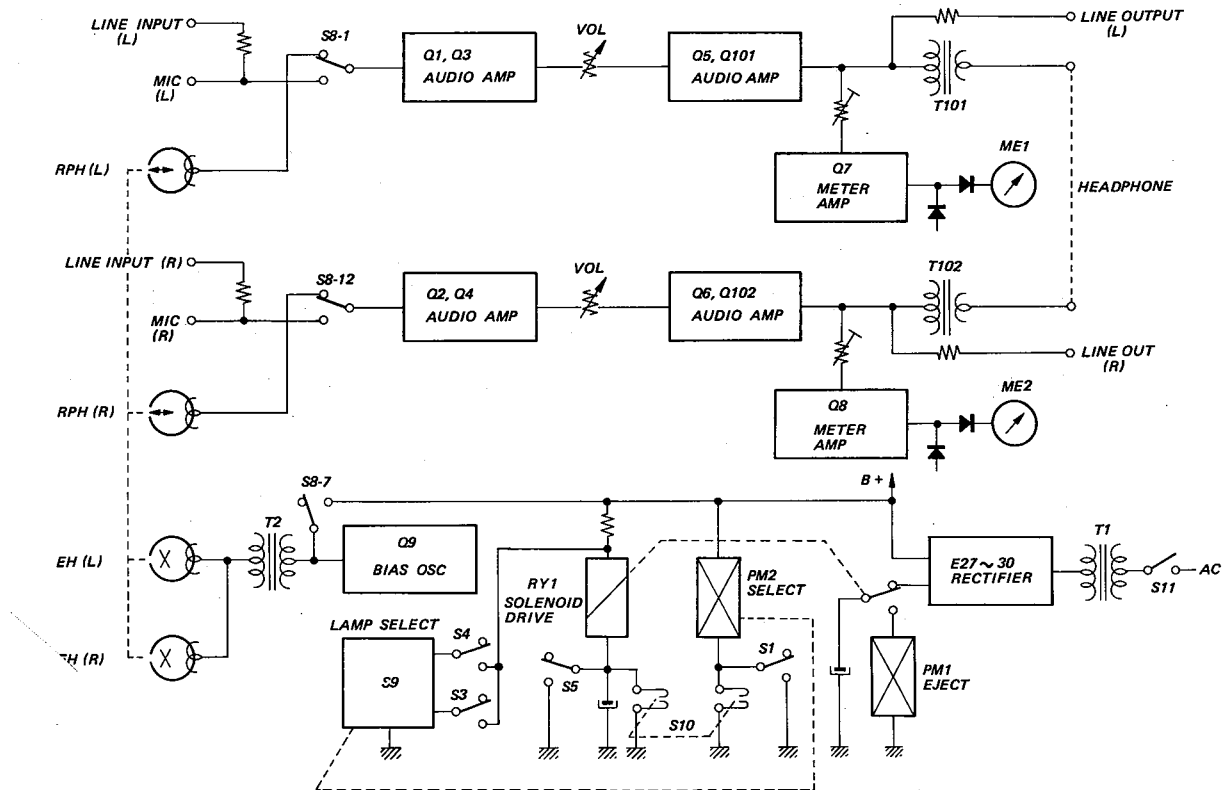
P — Pan Head Screw		E — Retaining Ring (E Washer)	
K — Flat Countersunk Head Screw		W — Washer	
B — Binding Head Screw		SW — Spring Washer	
RK — Oval Countersunk Head Screw		LW — Lock Washer	
T — Truss Head Screw		N — Nut	
R — Round Head Screw			
F — Flat Fillister Head Screw			
SC — Set Screw			

Example	
⊕ P 3 x 10	
— Type of Slot	
— Length in mm (L)	
— Diameter in mm (D)	
— Type of Head	

SECTION 1

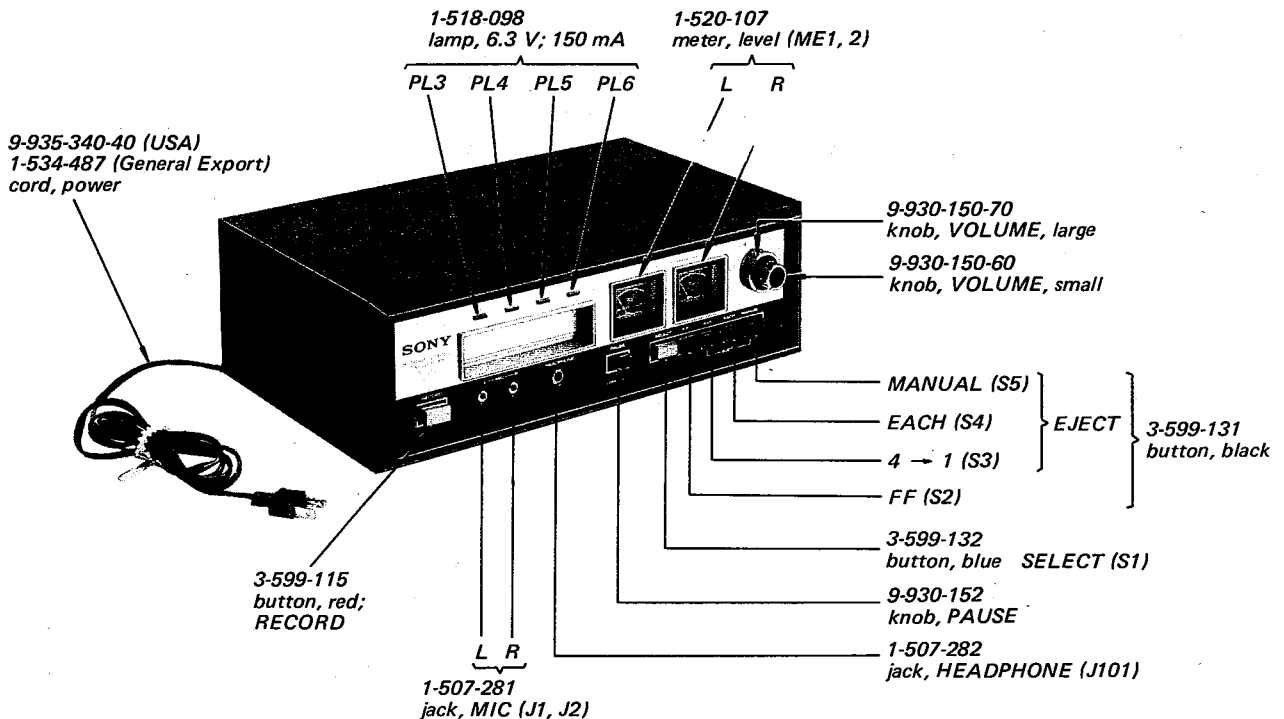
OUTLINE

1-1. BLOCK DIAGRAM

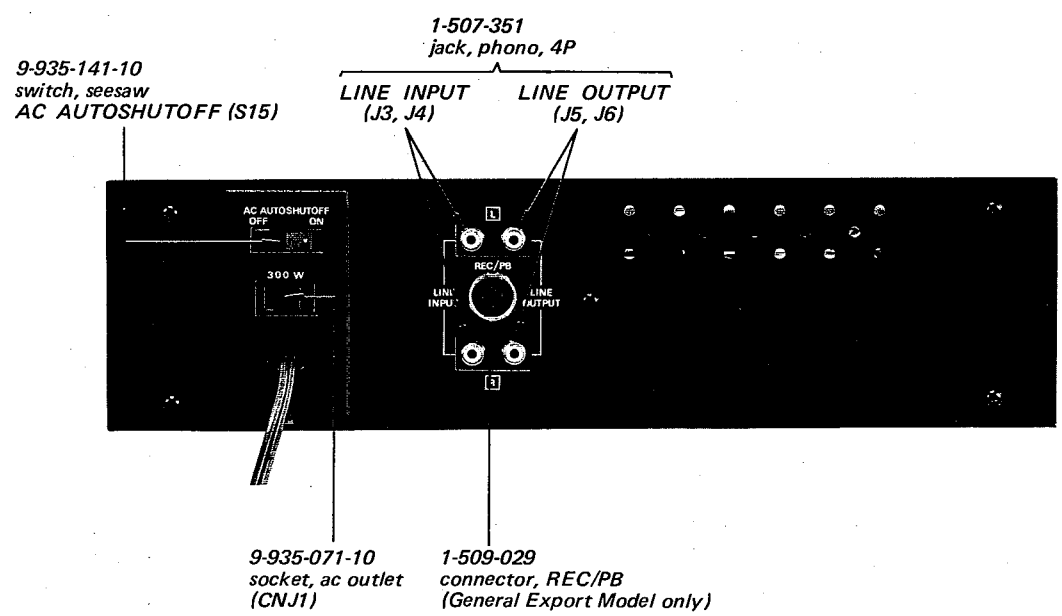


1-2. MAJOR PARTS LOCATION

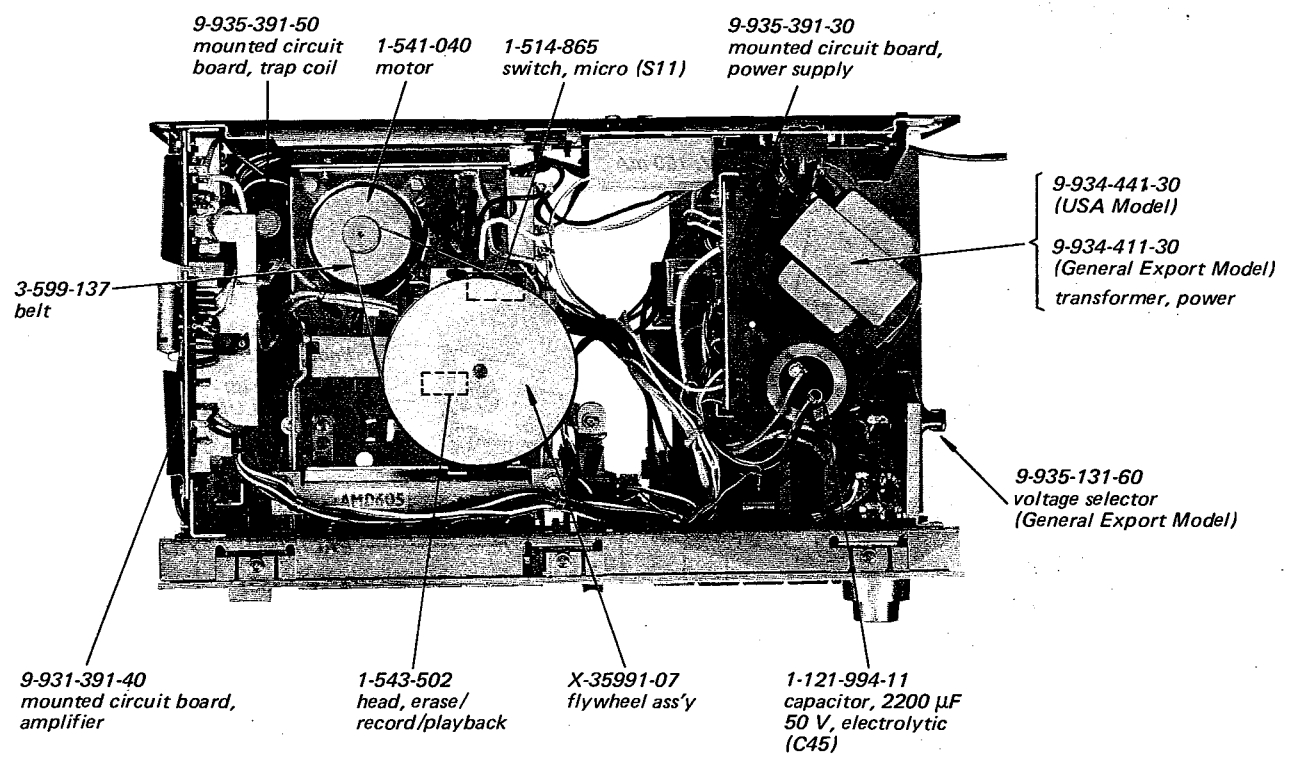
Cabinet Front View



Back Panel

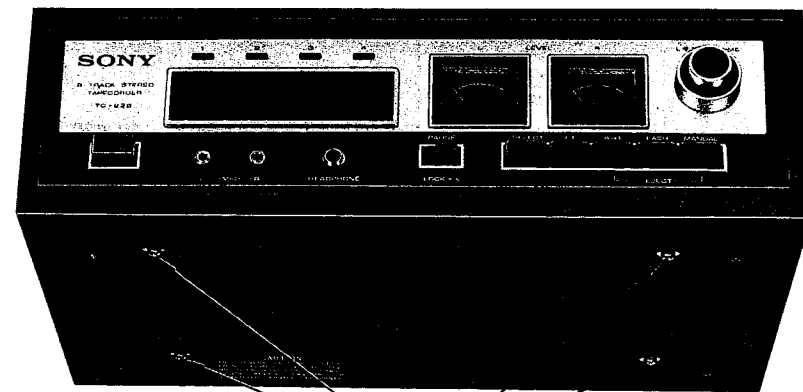


Chassis — Top View —



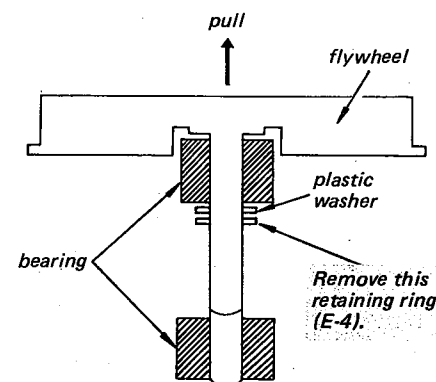
DISASSEMBLY AND REPLACEMENT

2-1. CABINET REMOVAL

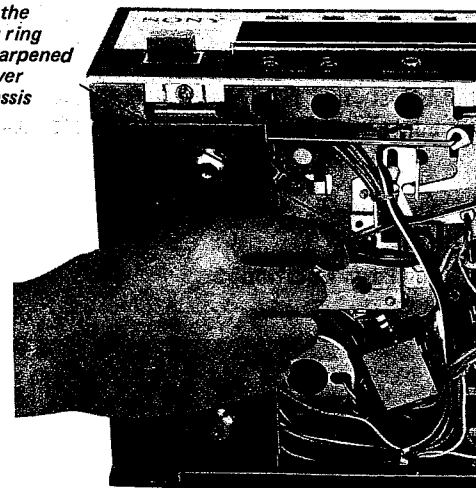


Remove these screws (+ P 4 x 12).

2-2. FLYWHEEL REMOVAL

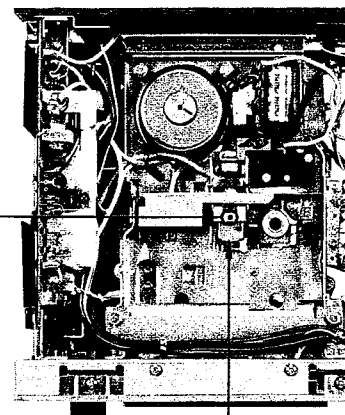


Remove the retaining ring with a sharpened screwdriver from chassis bottom.



2-3. HEAD REPLACEMENT

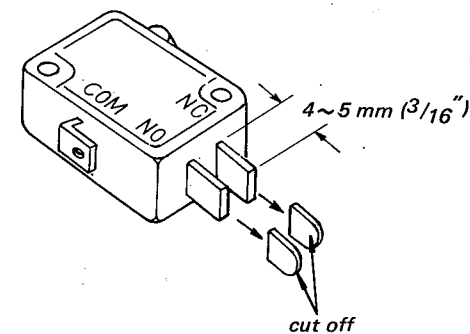
After removing flywheel, loosen this hex socket set-screw. Install the head marking-side up.



head

2-4. MICROSWITCH REPLACEMENT

When replacing microswitch, cut off the terminals as shown.



cut off

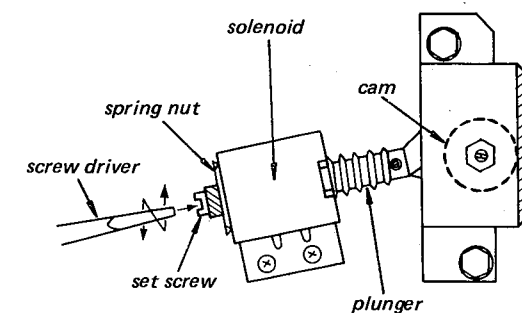
ADJUSTMENT PROCEDURES

3-1. MECHANICAL ADJUSTMENTS

Channel Selecting Solenoid Adjustment

Reduce the power voltage to 90 % rated voltage and load a tape cartridge. While turning the cam by pushing SELECT button, adjust as follows:

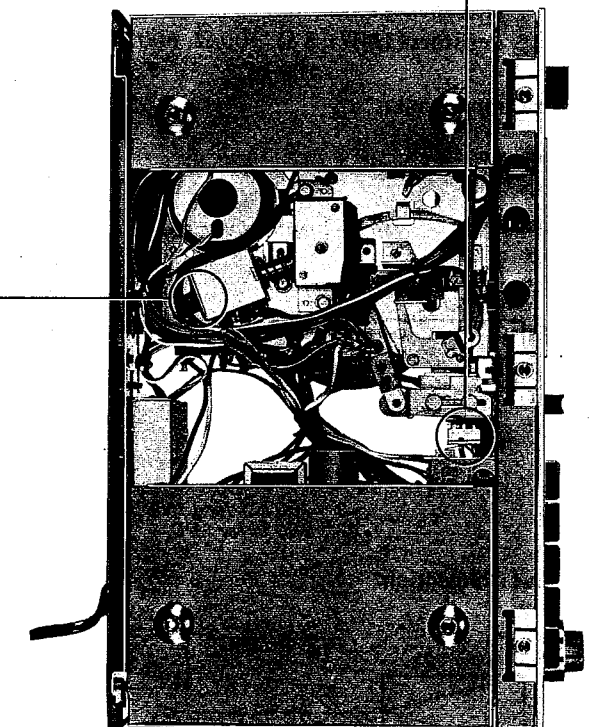
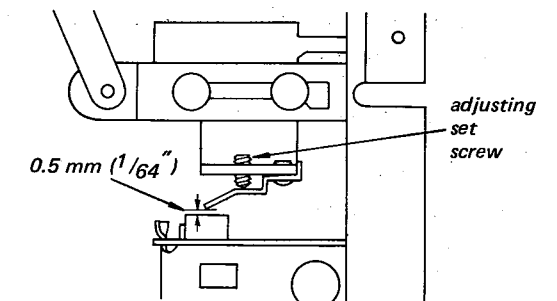
1. Loosen the spring nut.
2. Turn the set screw clockwise until the plunger is unable to turn the cam.
3. Turn the set screw counterclockwise until the plunger starts to turn the cam.
4. Turn the set screw $\frac{1}{4}$ turn counterclockwise.
5. Fix the set screw by the spring nut.



FF Button Release Adjustment

Use a L-shaped wrench for adjustment.

1. Load a tape cartridge.
2. Adjust the set screw for 0.5 mm (1/64") clearance as shown.
3. Push FF button.
4. Make sure that FF button is released by taking out the tape cartridge.
5. Apply locking compound to the screw.



- bottom view -

3-2. ELECTRICAL ADJUSTMENTS/ MEASUREMENTS

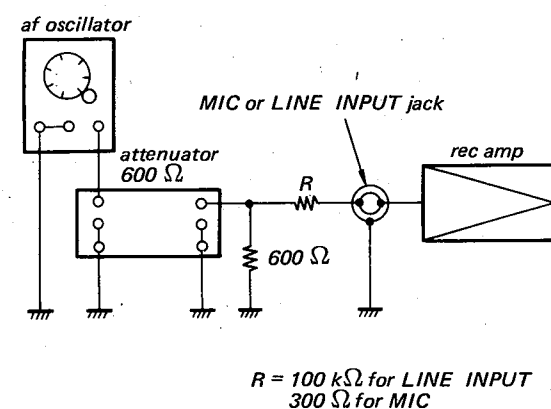
Precautions:

1. Clean the heads with an alcohol moistened swab and demagnetize the record/playback head with a head demagnetizer.
2. Do not use a magnetized screw driver for adjustments.
3. Adjustment should be performed in numerical order.
4. After adjustment, apply locking compound to the parts adjusted.

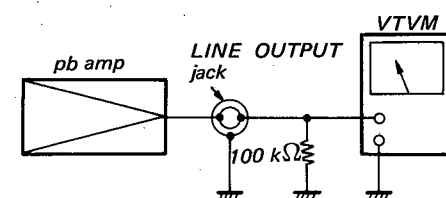
Test Equipment/Tools Required:

- * af oscillator
- * attenuator (600 Ω)
- * 1-kHz bandpass filter
- * VTVM
- * blank tape cartridge
- * SONY alignment tape
 - R-9-A1, 5 kHz
 - R-9-T1, blank track of channel 3-R
 - R-9-L1, 400 Hz
- * hex socket screw wrench (1.58 mm, 1/16")
- * resistors (1/4W); 8 Ω , 300 Ω , 600 Ω , 10 k Ω , 100 k Ω

Input Connection:

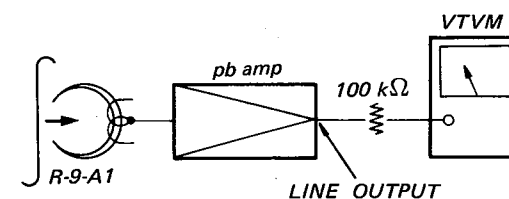


Output Connection:



3-2-1. Head Azimuth Adjustment

Setup:



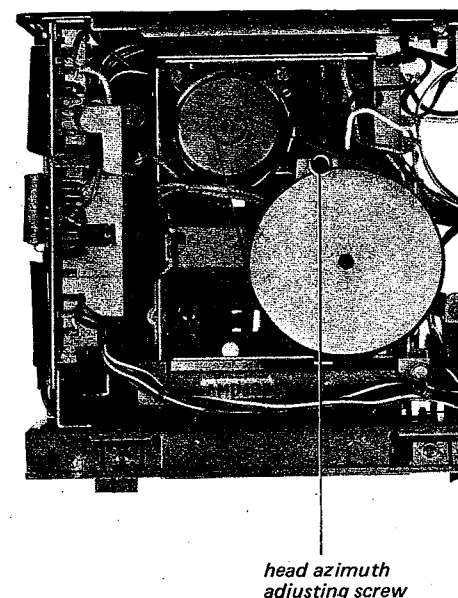
Control/Switch Setting:

VOLUME : mechanical mid
channel : 2

Procedure:

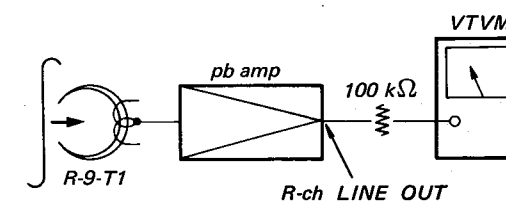
1. Play SONY alignment tape R-9-A1 (5 kHz).
2. Adjust the head azimuth adjusting screw with a hex socket screw wrench (1.58 mm, 1/16") for maximum VTVM reading.

Adjusting Parts Location:



3-2-2. Head Height Adjustment

Setup:



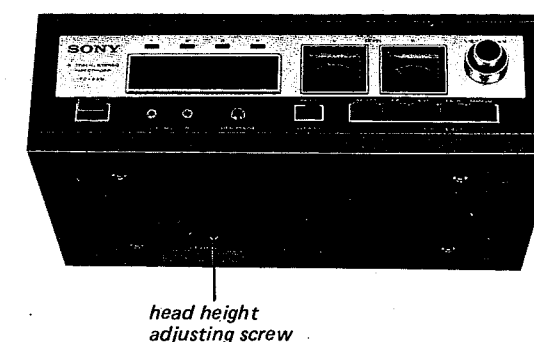
Control/Switch Setting

VOLUME : mechanical mid
channel : 3

Procedure:

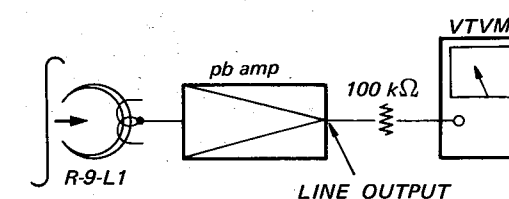
1. Remove locking compound and loosen the nut securing the adjusting screw.
2. Play SONY alignment tape R-9-T1.
3. Adjust the head height adjusting screw for minimum R-channel LINE OUTPUT level.

Adjusting Parts Location:



3-2-3. Playback Level Adjustment

Setup:



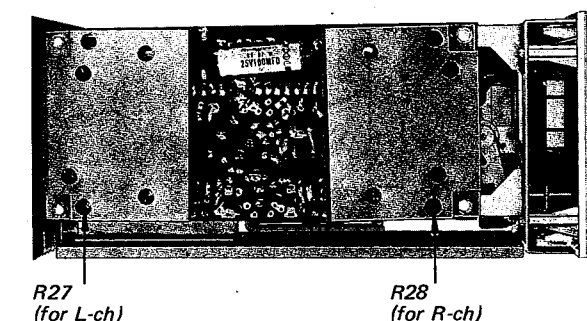
Control/Switch Setting:

VOLUME : mechanical mid
channel : 2

Procedure:

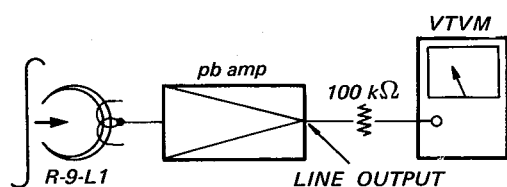
1. Play SONY alignment tape R-9-L1 (400 Hz).
2. Adjust R27 (R28) for -4 dB (0.49 V) VTVM reading.

Adjusting Parts Location:



3-2-4. LEVEL Meter Calibration

Setup:



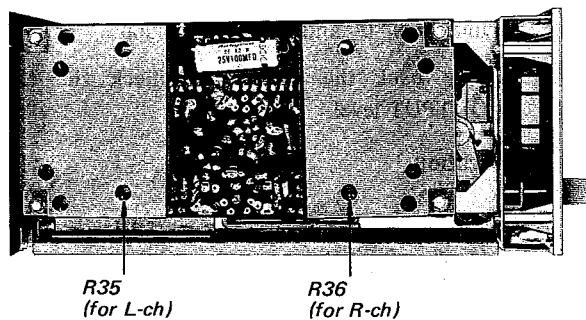
Control/Switch Setting:

channel : 2

Procedure:

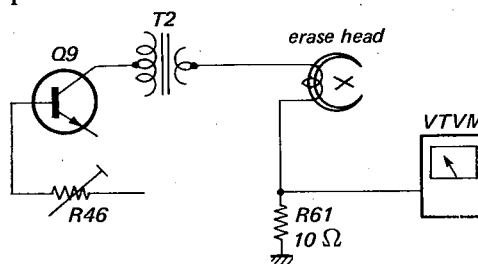
1. Play SONY alignment tape R-9-L1 and set the VOLUME control for -4 dB (0.49 V) LINE OUTPUT level.
2. Adjust R35 (R36) so that the LEVEL meter indicates "0".

Adjusting Parts Location:



3-2-5. Recording Bias Adjustment

Setup:



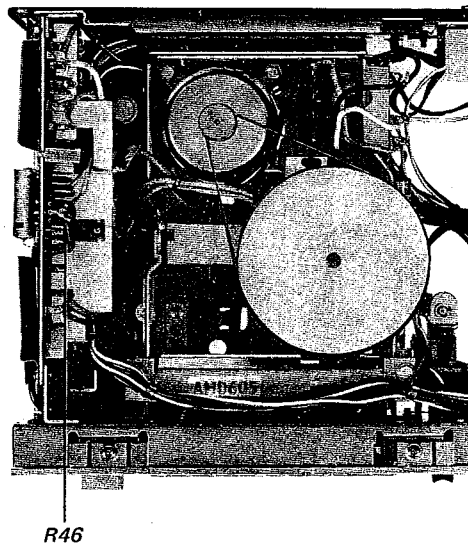
Control/Switch Setting:

channel : 2

Procedure:

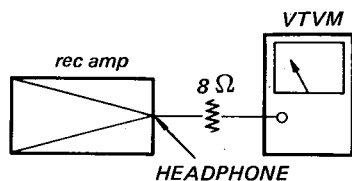
1. Place the set in record mode with a blank tape cartridge.
2. Adjust R46 for 240 ~ 280 mV VTVM reading.

Adjusting Parts Location:



3-2-6. Trap Coil Adjustment

Setup:



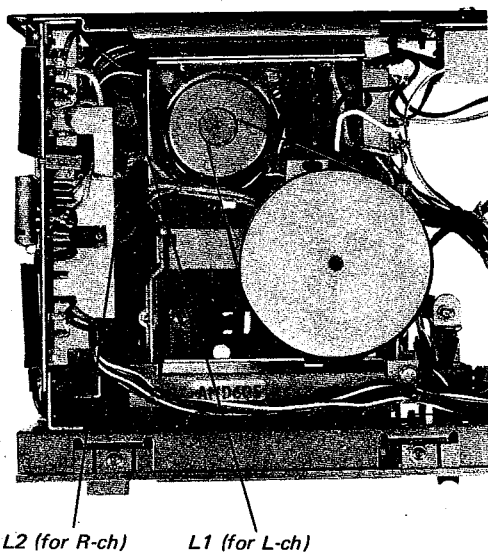
Control/Switch Setting:

VOLUME : mechanical mid
channel : 2

Procedure:

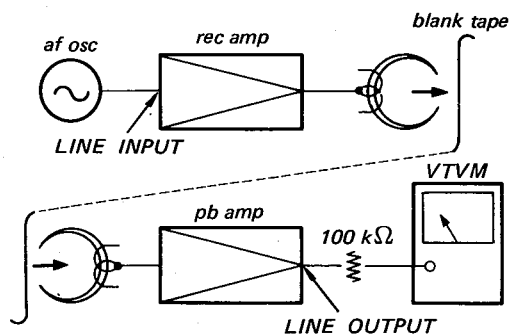
1. Place the set in record mode with a blank tape cartridge.
2. Adjust L1 (L2) for minimum VTVM reading.

Adjusting Parts Location:



3-2-7. Record Level Adjustment

Setup:



Control/Switch Setting:

VOLUME : mechanical mid
channel : 2

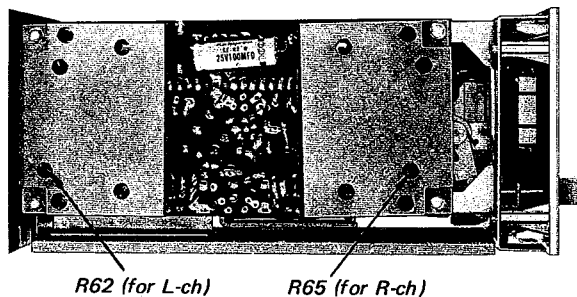
Procedure:

1. Place the set in record mode with a blank tape cartridge and deliver a 400 Hz (-10 dB, 0.24 V) signal to the LINE INPUT jack.
2. Adjust R62 (R65) so that the LEVEL meter indicates "0" and record the signal.
3. Play back the signal and check the LINE OUTPUT level.

Specification:

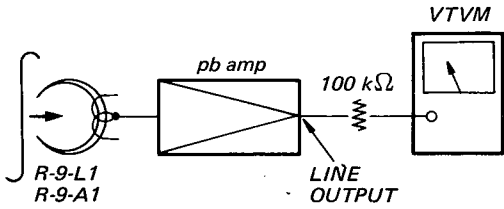
LINE OUTPUT level, -6 dB ~ 0 dB
(0.38 ~ 0.77 V)

Adjusting Parts Location:



3-2-8. Play back Frequency Response Measurement

Setup:



Control/Switch Setting:

VOLUME : mechanical mid
channel : 2

Procedure:

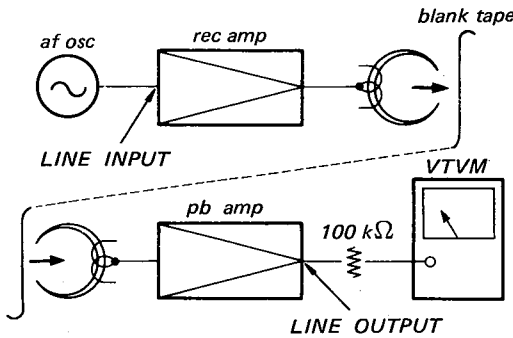
1. Play SONY alignment tape R-9-L1 (400 Hz).
2. Read LINE OUTPUT level.
3. Play SONY alignment tape R-9-A1 (5 kHz).
4. Read LINE OUTPUT level difference from step 2.

Specification:

Approx. 10 dB lower than step 2.

3-2-9. Overall Frequency Response Measurement

Setup:



Control/Switch Setting:

VOLUME : mechanical mid
channel : 2

Procedure:

1. Place the set in record mode with a blank tape cartridge.
2. Record the following signals (-20 dB, 77.5 mV) through LINE INPUT jack:
50 Hz, 400 Hz, 1 kHz, 5 kHz, 10 kHz
3. Play back the signals and read the each signal level deviation from 1 kHz.

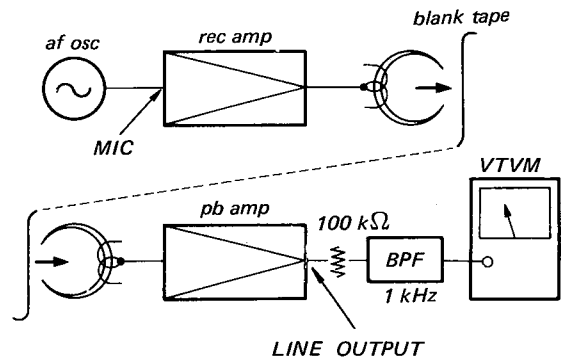
Specification:

The deviation should be within the following range:

Frequency	50 Hz	400 Hz	1 kHz	5 kHz	10-kHz
Deviation	+2 dB -8 dB	±3 dB	0	±3 dB	+4 dB -8 dB

3-2-10. Erase Ratio Measurement

Setup:



Control/Switch Setting:

VOLUME : mechanical mid
channel : 2

Procedure:

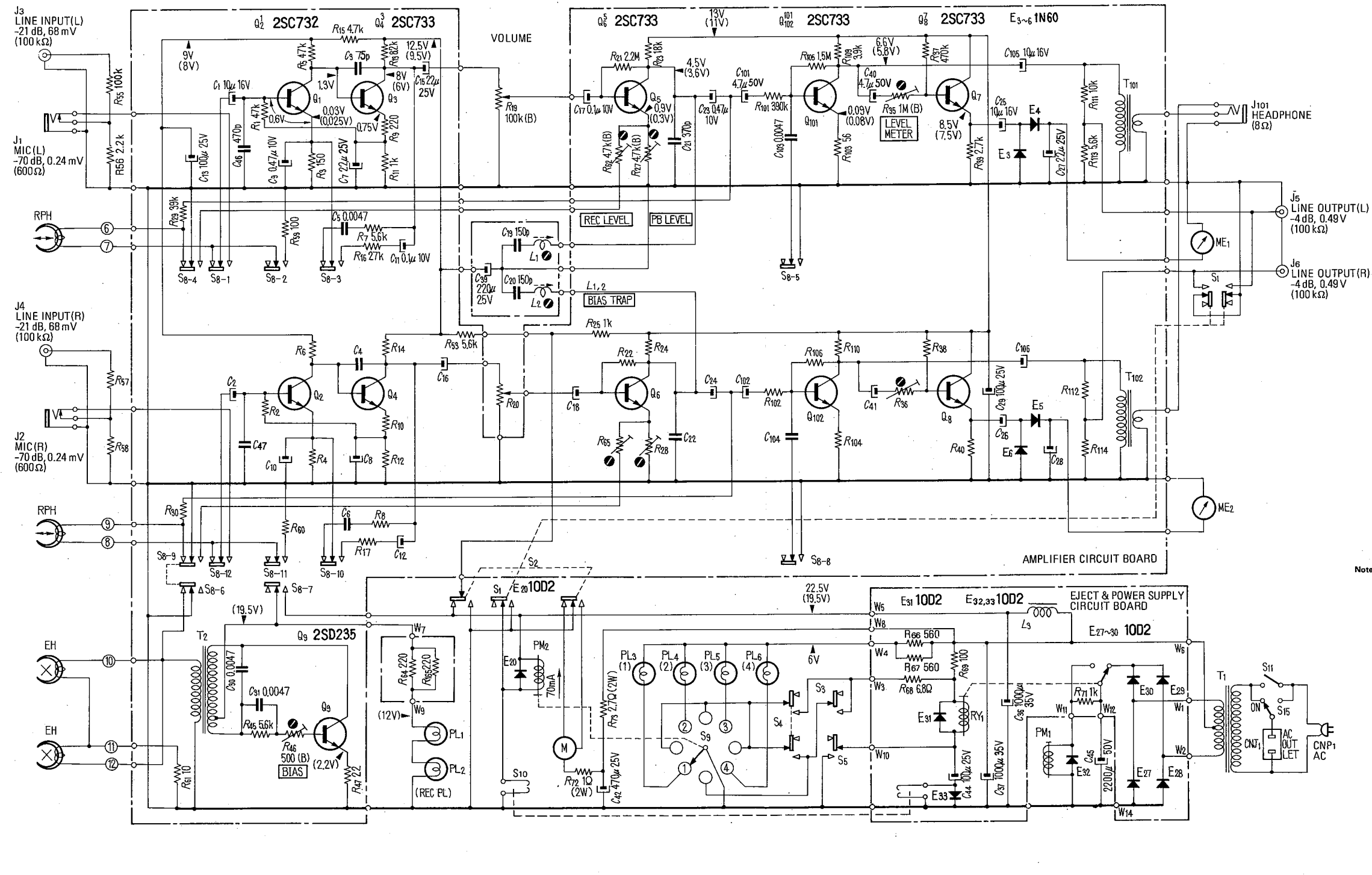
1. Place the set in record mode with a blank tape cartridge.
2. Deliver a 1 kHz signal (-46 dB, 3.8 mV) to MIC jack and record the signal.
3. Take up the tape until the mid of the signal recorded part with FF button.
4. Terminate MIC jack with a 600 Ω resistor and erase a latter half of the signal recorded part (record mode without signal).
5. Play back the signal recorded part and the erased part.
6. Read the difference between the two parts.

Specification:

greater than 40 dB

SECTION 4 DIAGRAMS

4-1. SCHEMATIC DIAGRAM (USA Model)

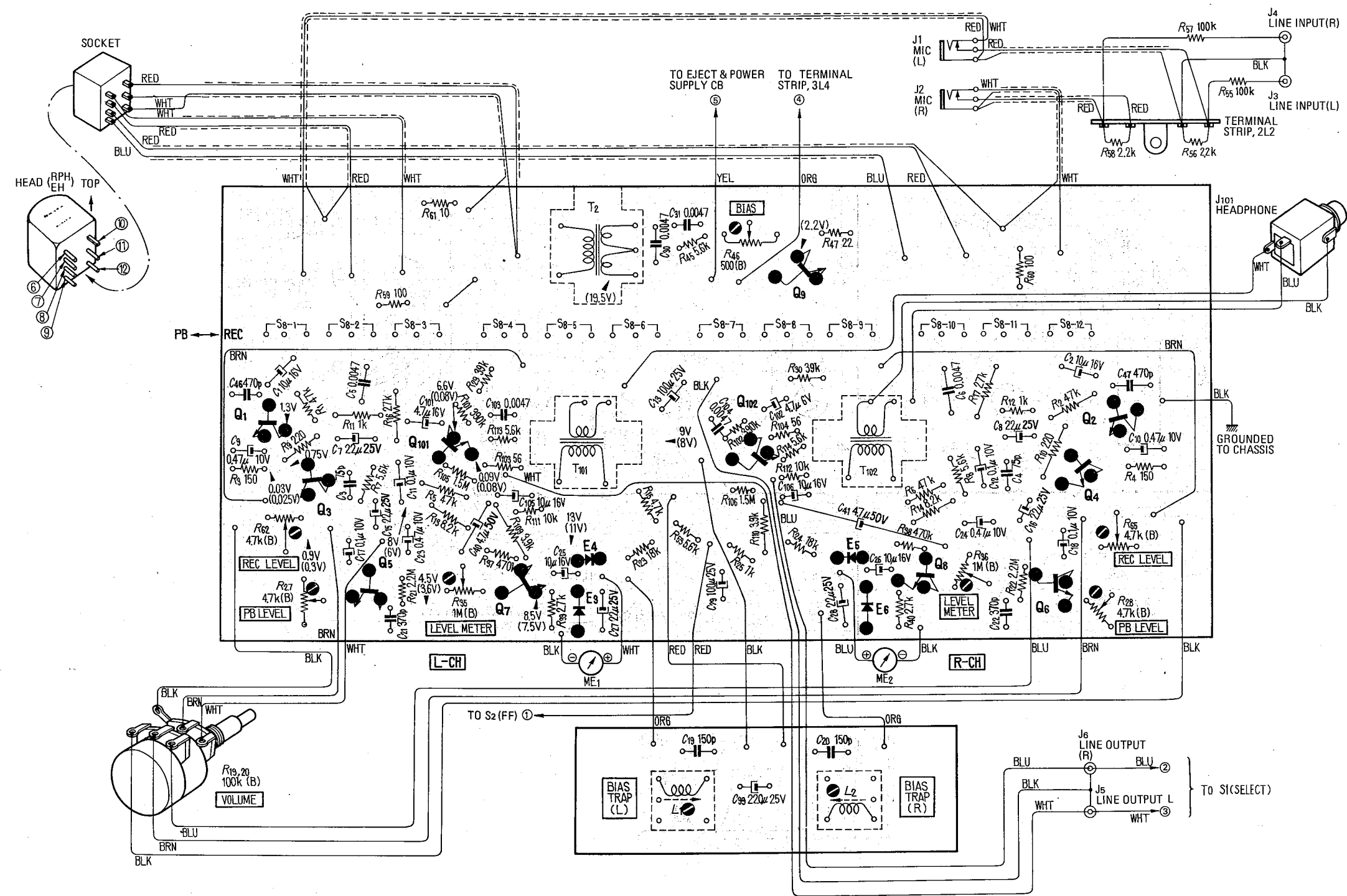


- Note: 1. All resistors and capacitors are rated in Ω and μF unless otherwise specified.
2. The letter (B) suffixed to rating value of resistor or semi-fixed resistor indicates its characteristic.
3. Voltage values shown are measured with a dc voltmeter of 20 k Ω /V in playback mode. Values in () are in record mode.
4. $\bullet$: adjustable
5. Switch positions are as the following table:

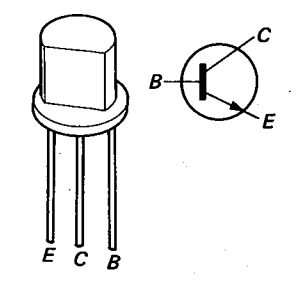
Ref. No.	Description	Position
S1	SELECT	off
S2	FF	off
S3	EJECT (4 $\rightarrow$ 1)	off
S4	EJECT (EACH)	off
S5	EJECT (MANUAL)	off
S8	record/playback	playback
S9	lamp, select	CH-1
S10	channel change	off
S11	power	off
S15	AUTO SHUTOFF	ON

6. Recording bias is supplied from erase head through electromagnetic coupling.

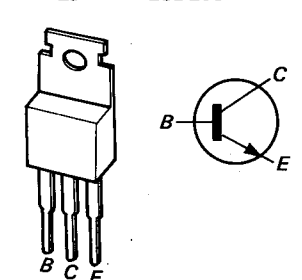
4.2. MOUNTING DIAGRAM — Amplifier Circuit Board — (USA Model)
— Conductor side —



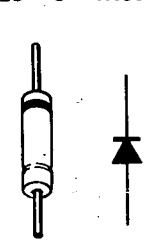
Q1 ~ 2 2SC732
Q3 ~ 8, Q101 ~ 102
2SC733



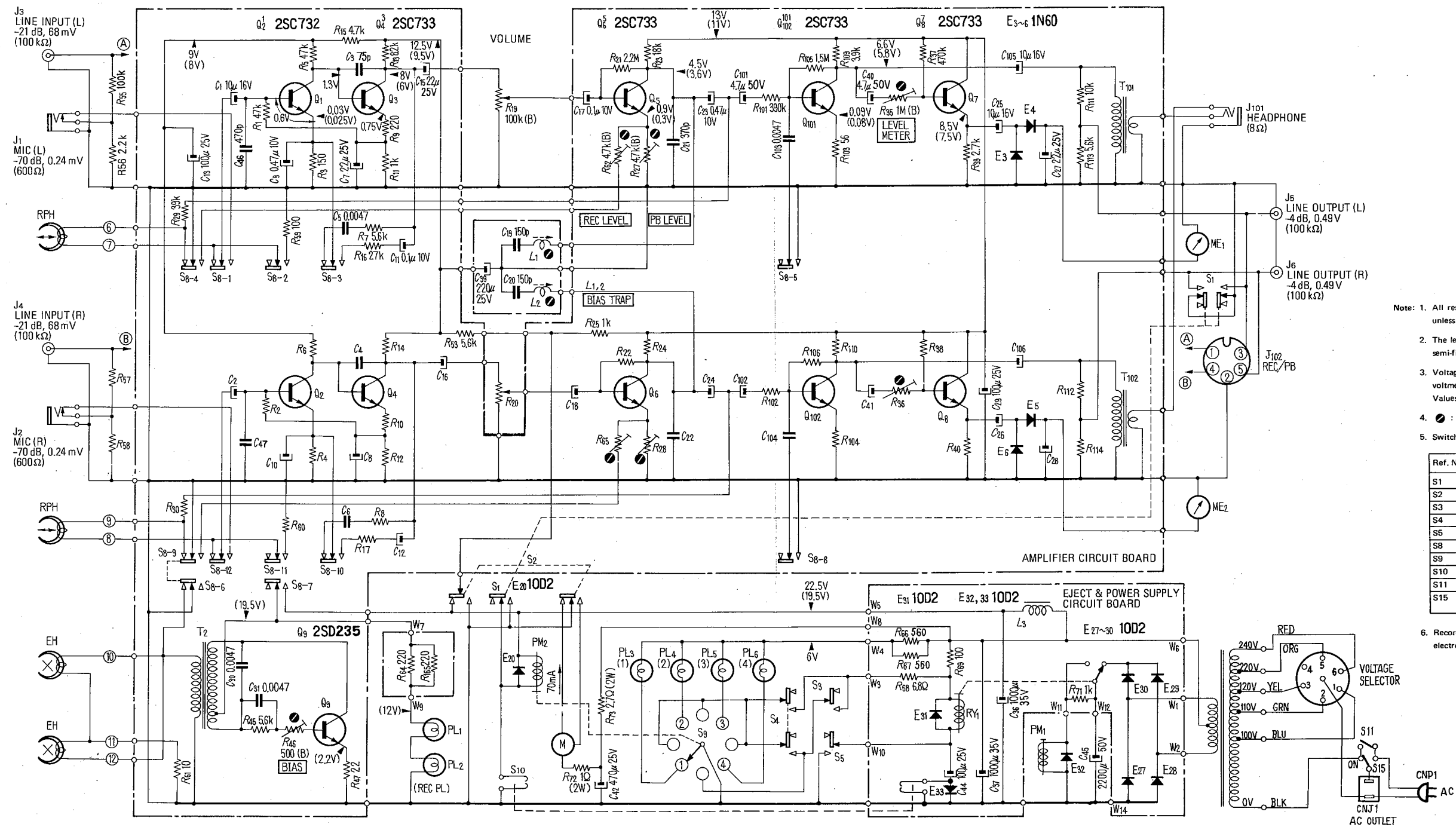
Q9 2SD235



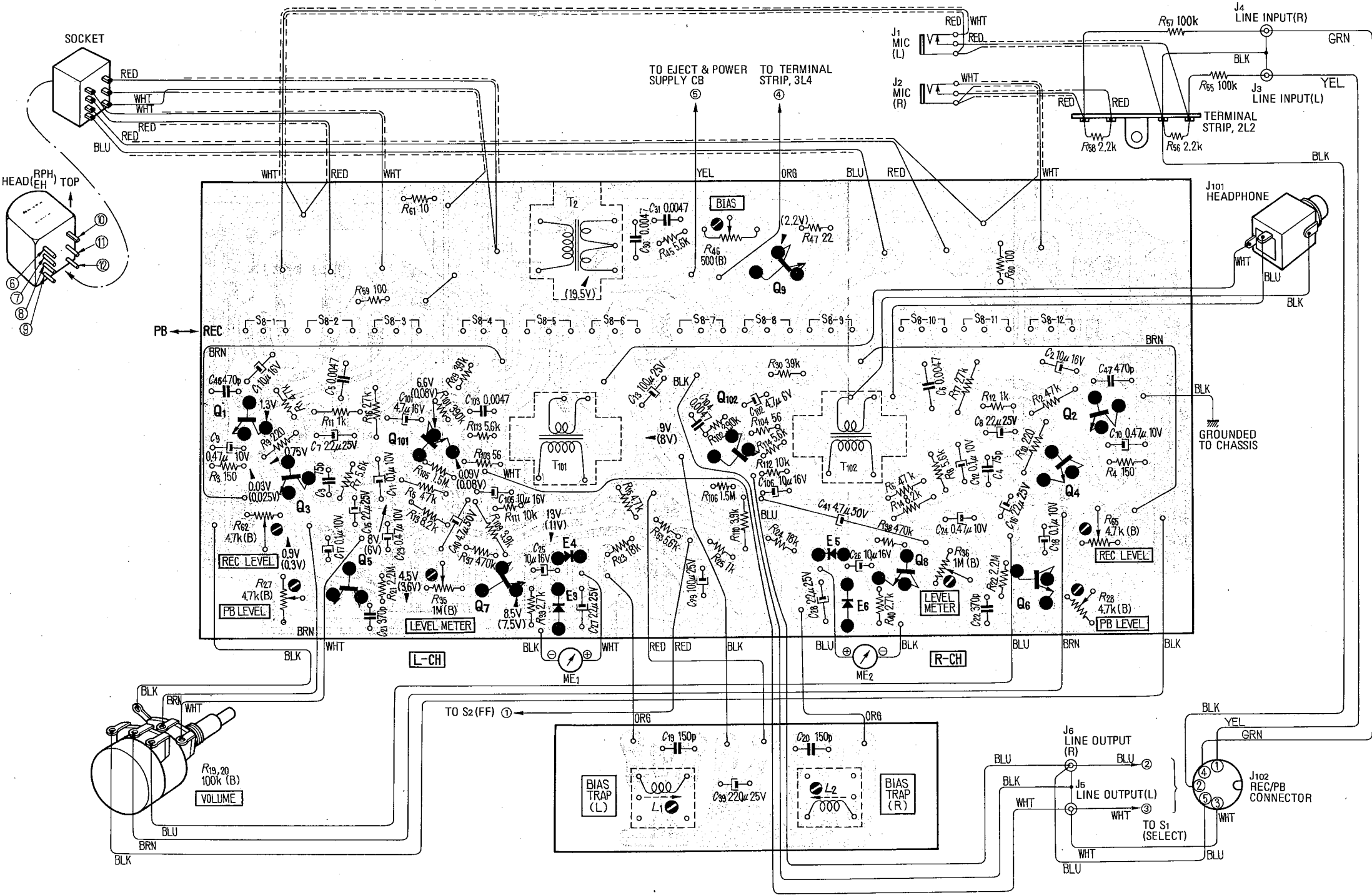
E3 ~ 6 1N60



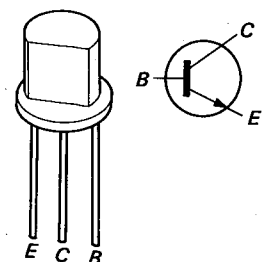
4.3. SCHEMATIC DIAGRAM (General Export Model)



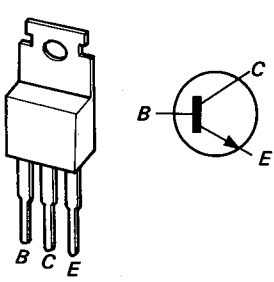
4-4. MOUNTING DIAGRAM – Amplifier Circuit Board – (General Export Model)
– Conductor side –



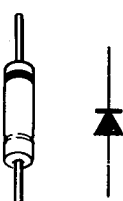
Q1 ~ 2 2SC732
Q3 ~ 8, Q101 ~ 102
2SC733



Q9 2SD235

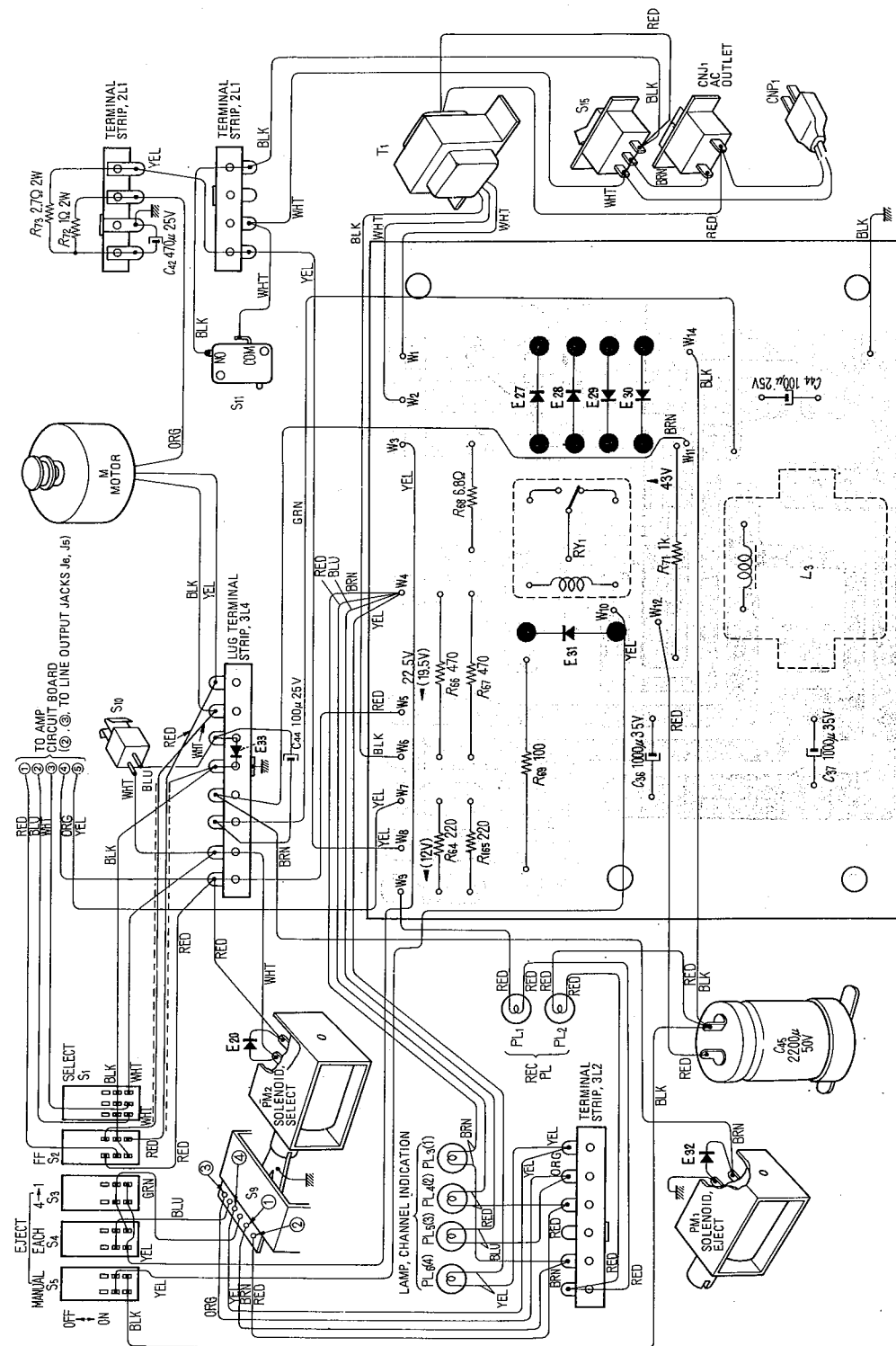


E3 ~ 6 1N60

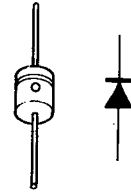


4-5. MOUNTING DIAGRAM

— Eject & Power Supply Circuit Board — (USA Model)
— Conductor side —

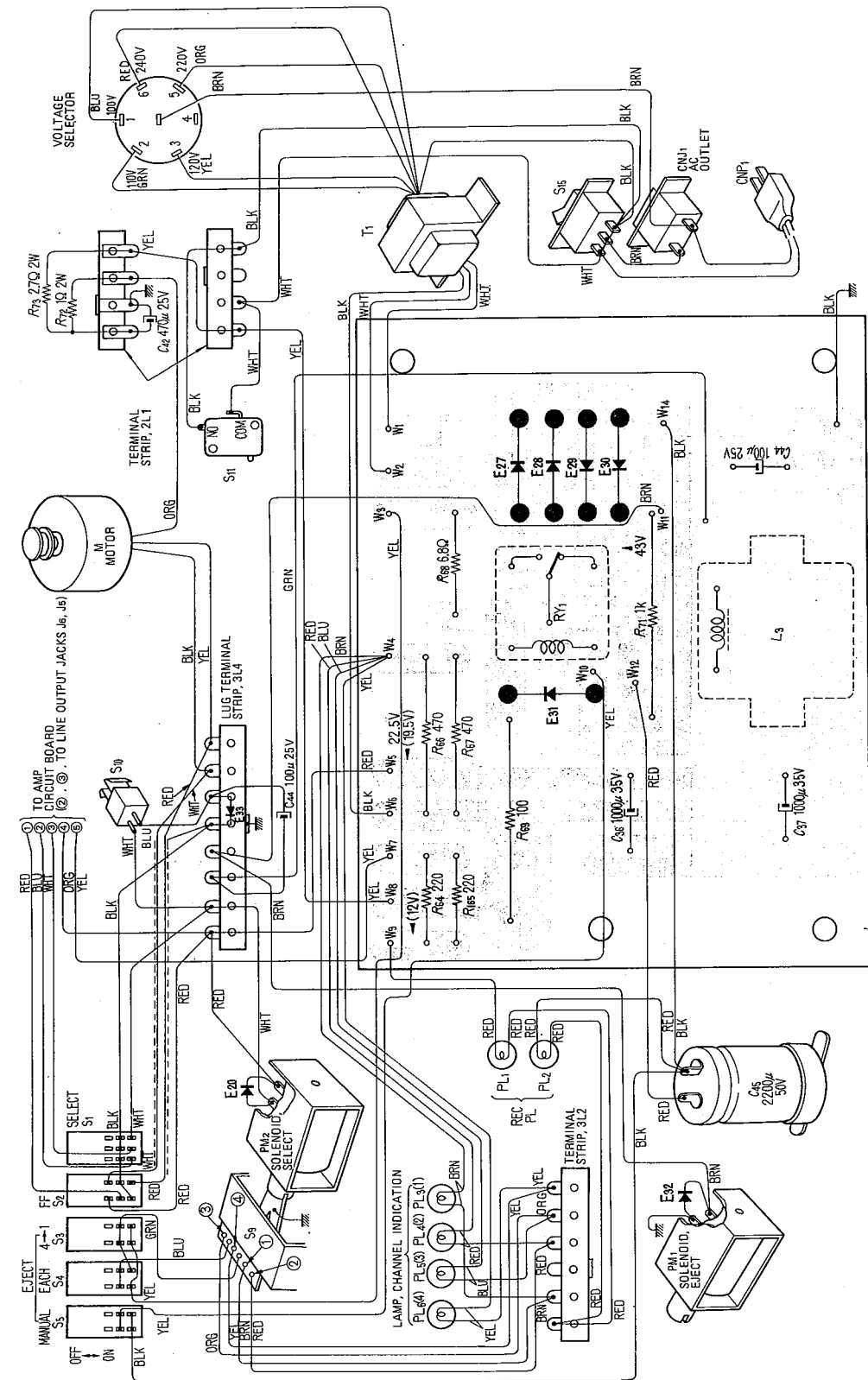


E20, 27 ~ 33
10D-2

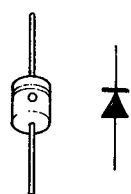


4-6. MOUNTING DIAGRAM

— Eject & Power Supply Circuit Board — (General Export Model)
— Conductor side —

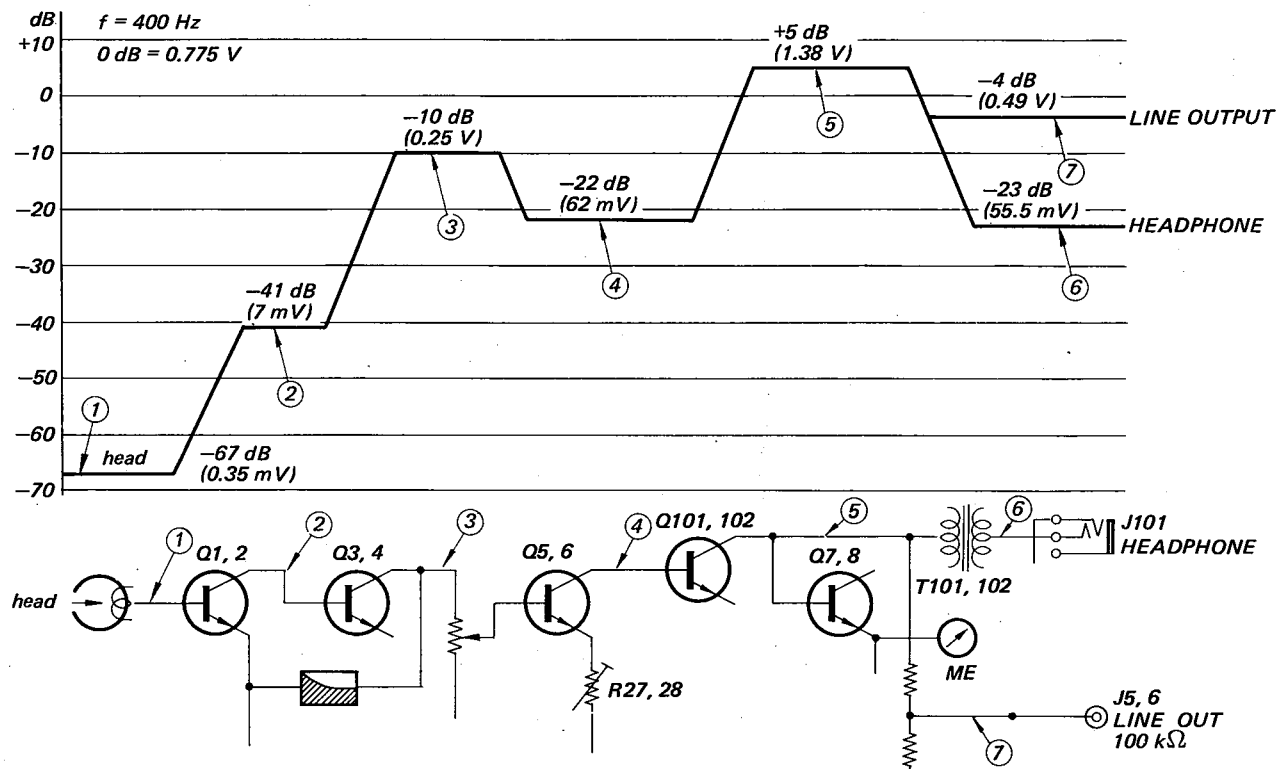


E20, 27 ~ 33
10D-2

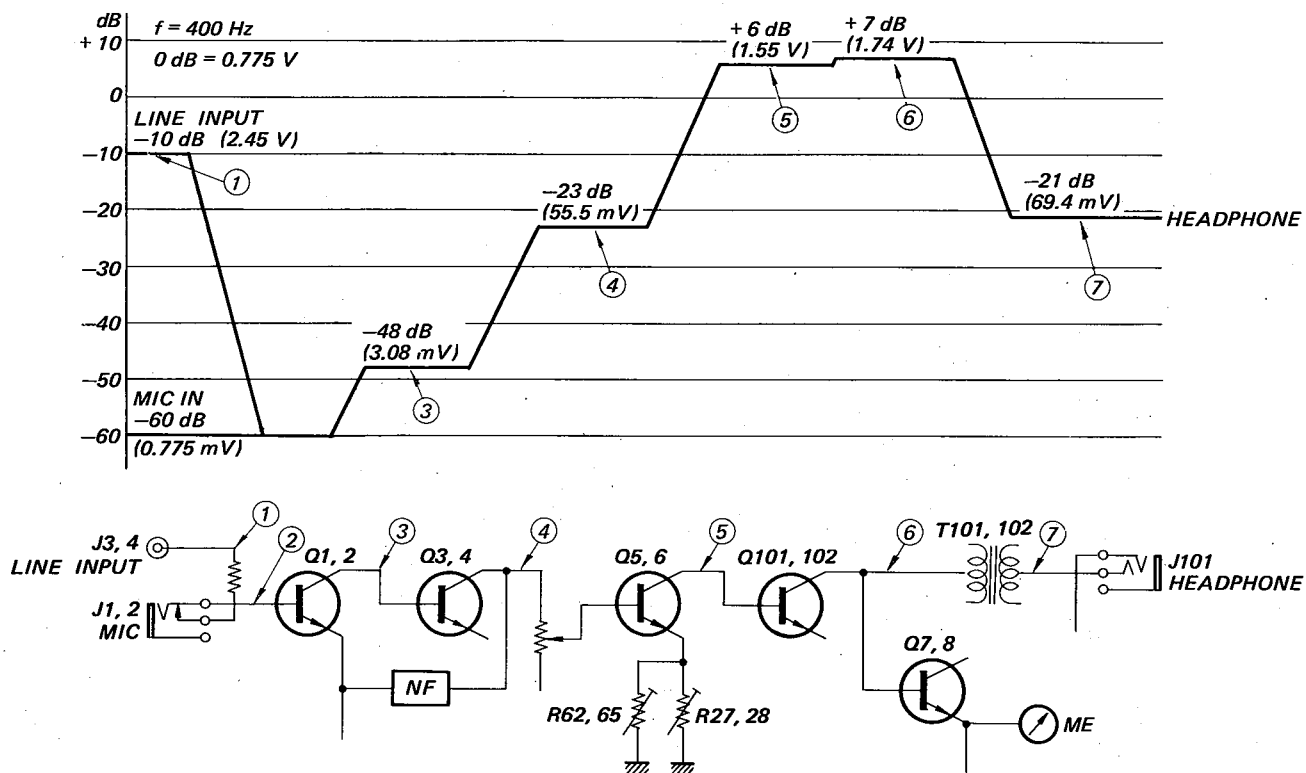


4-7. LEVEL DIAGRAMS

4-7-1. Playback

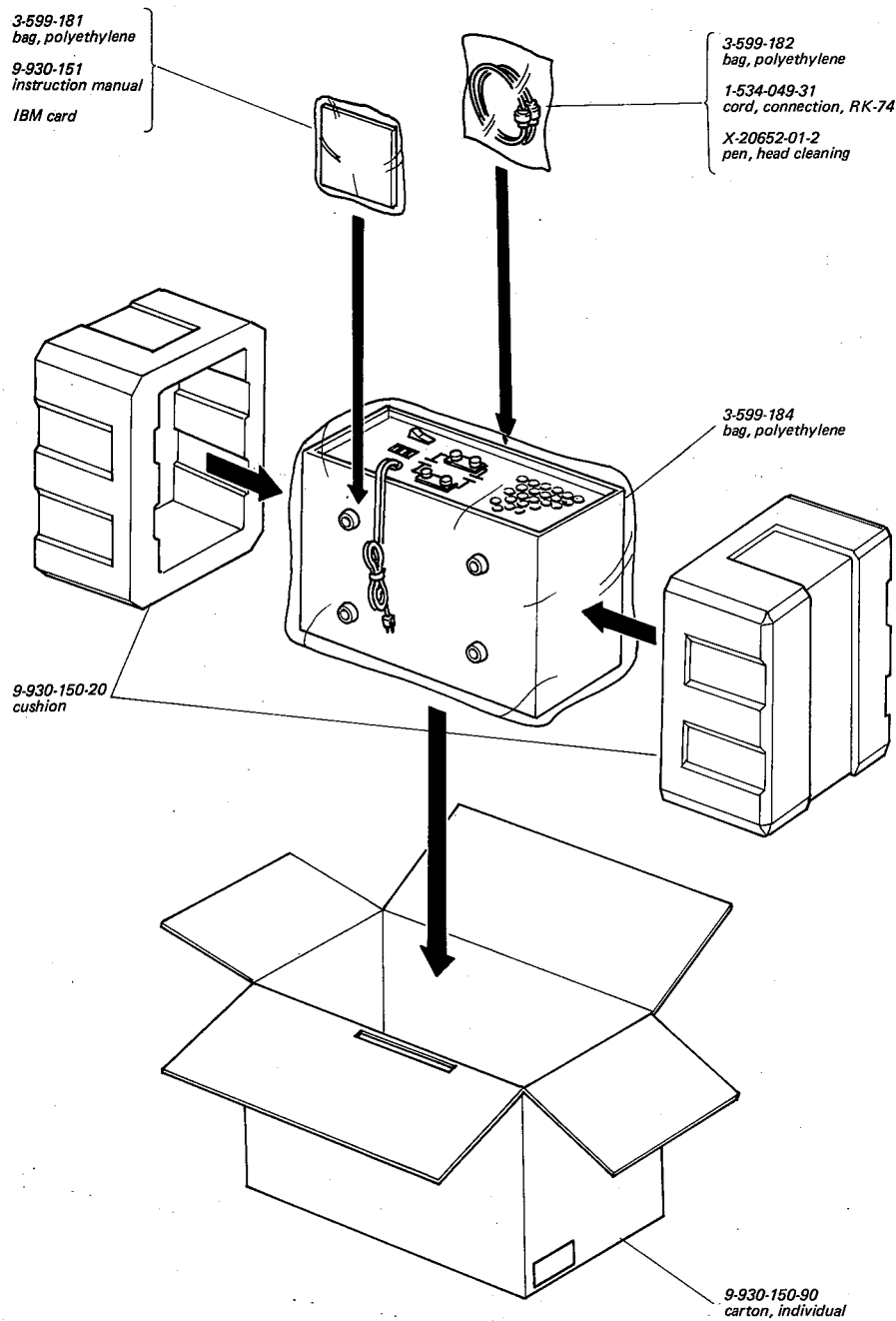


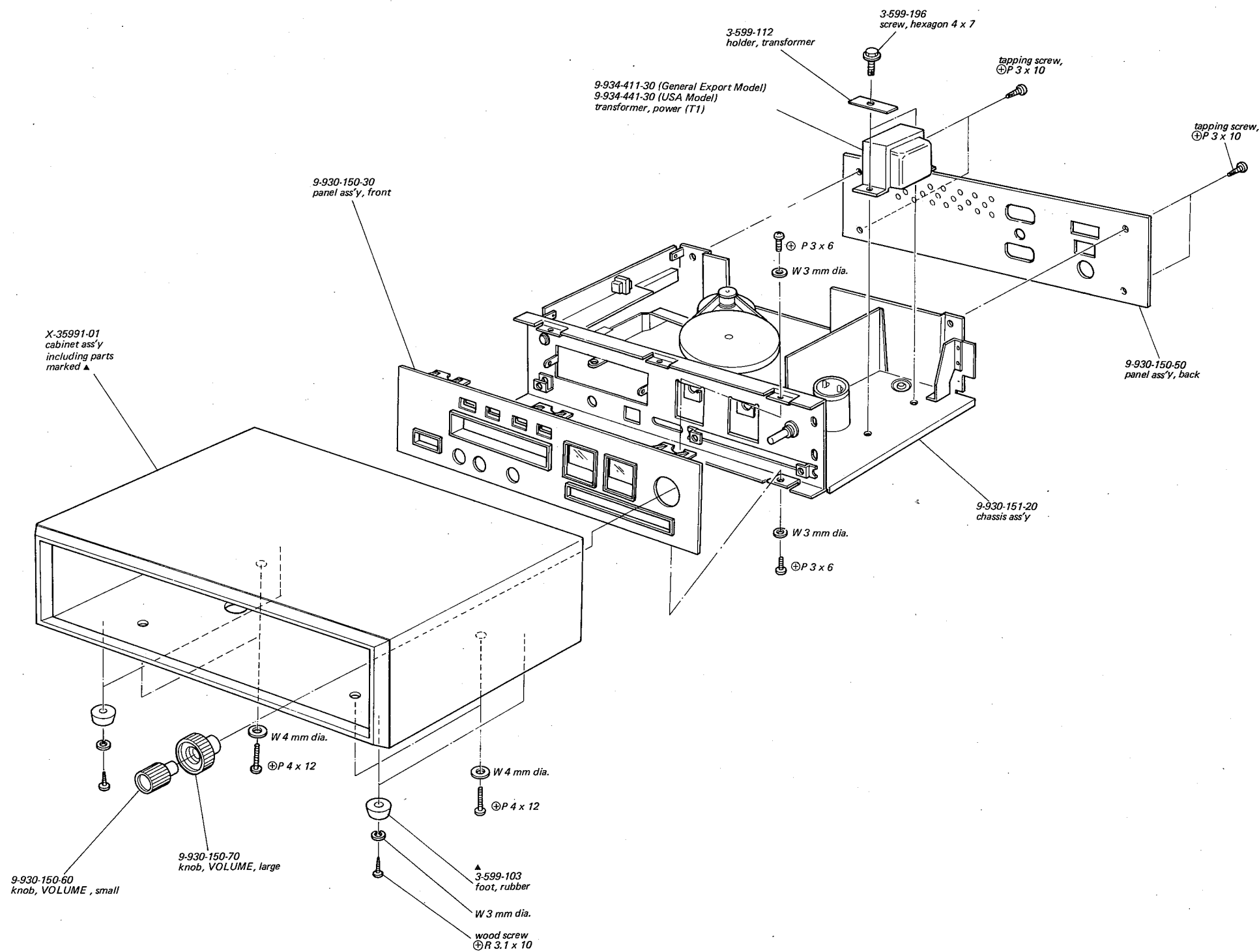
4-7-2. Record



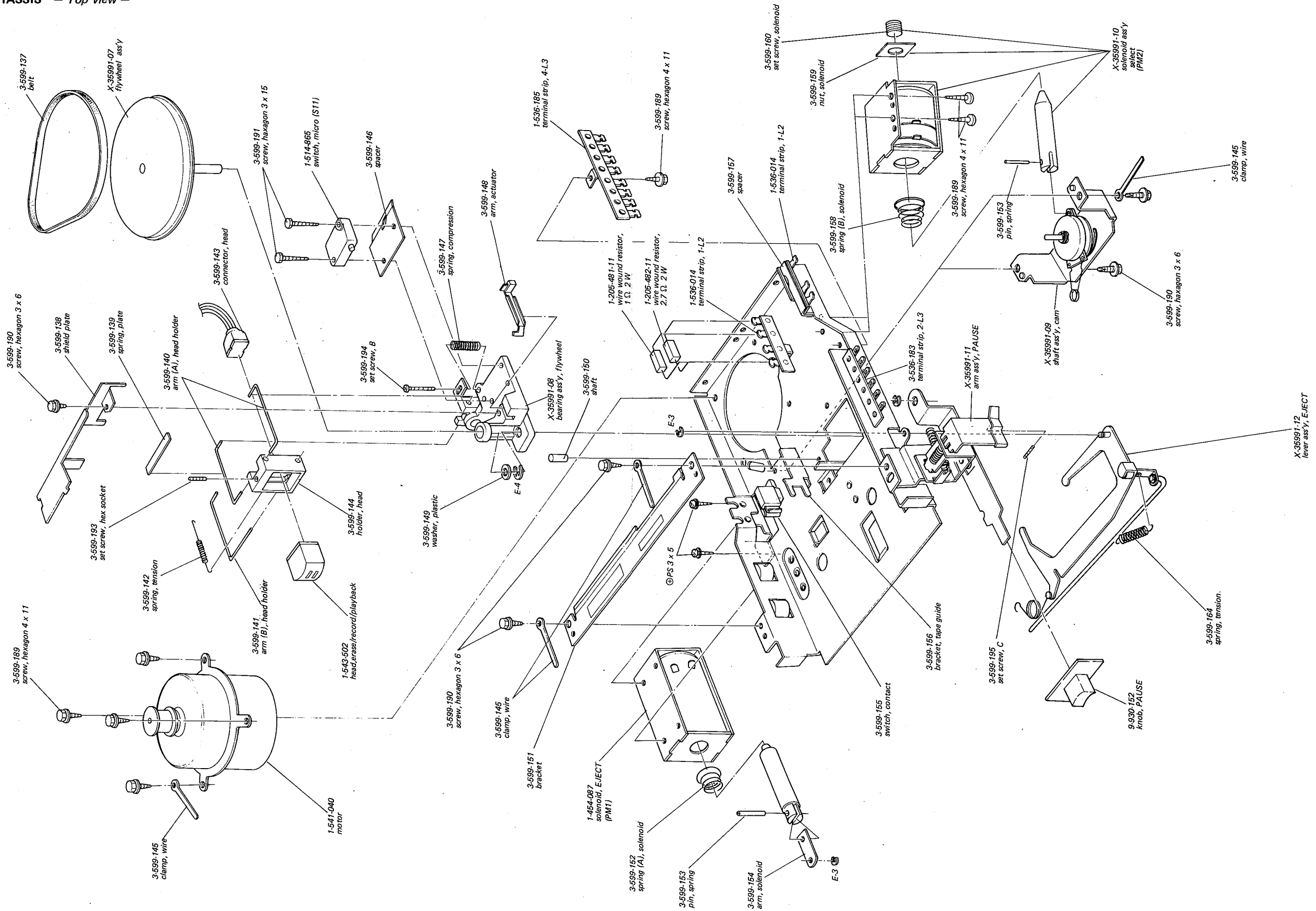
SECTION 5
EXPLODED VIEWS

5-1. PACKING

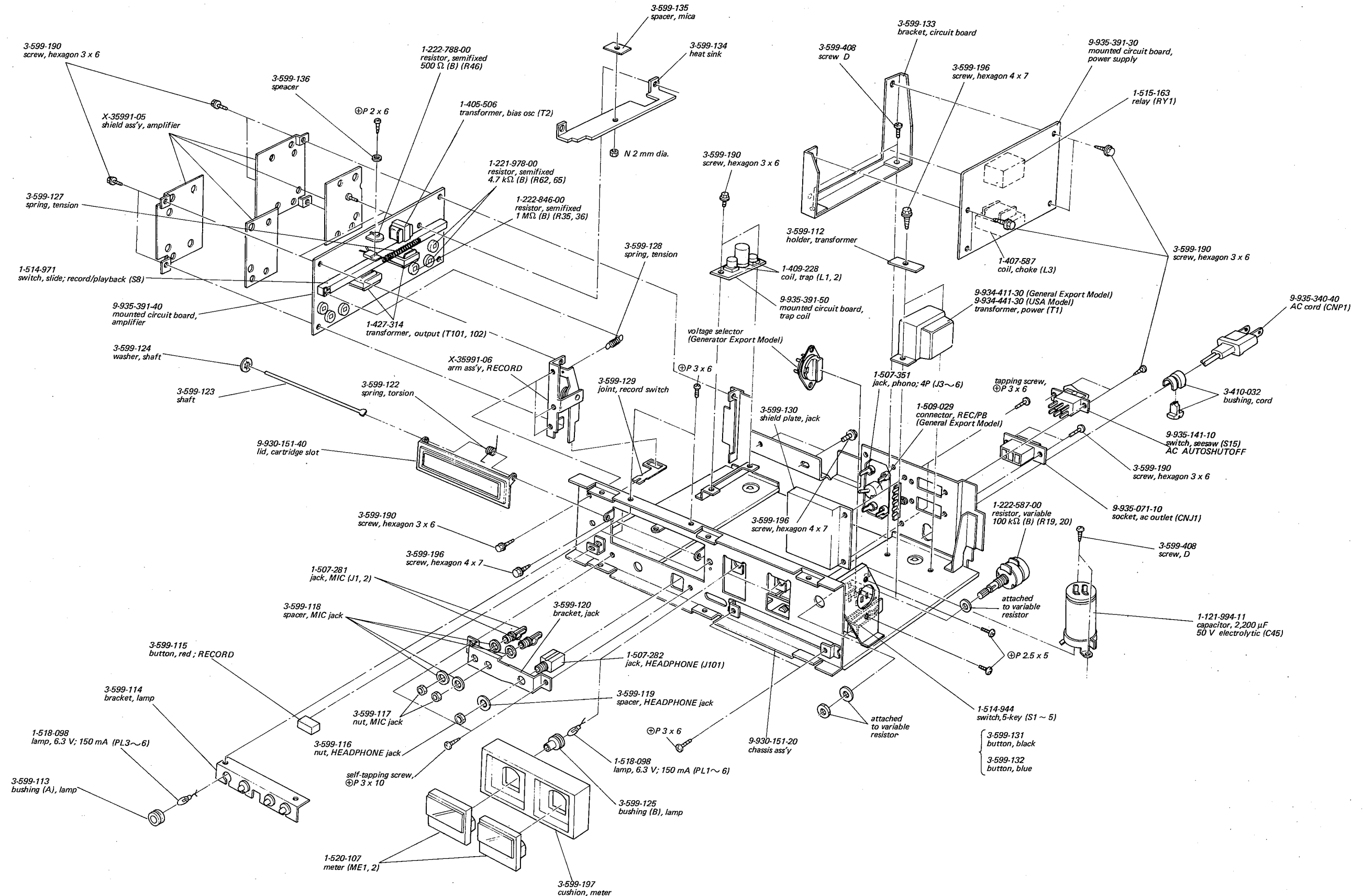




5-3. CHASSIS – Top view –



5-4. CHASSIS — Bottom view —



SECTION 6
ELECTRICAL PARTS LIST

Ref. No. Part No. Description

MOUNTED CIRCUIT BOARDS

9-935-391-30 eject & power supply
9-935-391-40 amplifier
9-935-391-50 trap coil

SEMICONDUCTORS

Q1, 2 transistor, 2SC732 (BL)
Q3, 4 transistor 2SC733 (BL)
Q5, 6 transistor 2SC733 (BL)
Q7, 8 transistor 2SC733 (BL)
Q9 transistor 2SD235-0
Q101, 102 transistor 2SC733 (BL)
E3 diode 1N60
E4 diode 1N60
E5 diode 1N60
E6 diode 1N60
E20 diode 10D-2
E27 diode 10D-2
E28 diode 10D-2
E29 diode 10D-2
E30 diode 10D-2
E31 diode 10D-2
E32 diode 10D-2
E33 diode 10D-2

COILS AND TRANSFORMERS

L1, 2 1-409-228 coil, trap
L3 1-407-587 coil, choke
T1 9-934-411-30 transformer, power
(General Export Model)
9-934-441-30 transformer, power
(USA Model)
T2 1-405-506 transformer, bias osc
T101, 102 1-427-314 transformer, output

TERMINAL STRIPS

1-536-014 1-L2
1-536-183 2-L3
1-536-185 4-L3

CAPACITORS

C1, 2 1-121-397-11 10 μ F 16 V electrolytic
C3, 4 1-107-082 75 pF 50 V mica
C5, 6 1-105-841-12 0.0047 μ F 50 V mylar
C7, 8 1-121-767-11 22 μ F 25 V electrolytic
C9, 10 1-127-022-11 0.47 μ F 10 V electrolytic (alox)
C11, 12 1-127-045-11 0.1 μ F 10 V electrolytic (alox)

Ref. No. Part No. Description

C13 1-121-416-11 100 μ F 25 V electrolytic
C15, 16 1-121-767-11 22 μ F 25 V electrolytic
C17, 18 1-127-045-11 0.1 μ F 10 V electrolytic (alox)
C19, 20 1-107-089 150 pF 50 V mica
C21, 22 1-103-290 370 pF 35 V styrol
C23, 24 1-127-022-11 0.47 μ F 10 V electrolytic (alox)
C25, 26 1-121-397-11 10 μ F 16 V electrolytic
C27, 28 1-121-767-11 22 μ F 25 V electrolytic
C29 1-121-416-11 100 μ F 25 V electrolytic
C30, 31 1-105-841-12 0.0047 μ F 50 V mylar
C36, 37 1-121-945-11 1000 μ F 35 V electrolytic
C39 1-121-422-11 220 μ F 25 V electrolytic
C40, 41 1-121-750-11 4.7 μ F 50 V electrolytic
C44 1-121-416-11 100 μ F 25 V electrolytic
C45 1-121-994-11 2200 μ F 50 V electrolytic
C46, 47 1-103-617 470 pF 50 V styrol
C101, 102 1-121-750-11 4.7 μ F 50 V electrolytic
C103, 104 1-105-841-12 0.0047 μ F 50 V mylar
C105, 106 1-121-397-11 10 μ F 16 V electrolytic

RESISTORS

All resistors are $\frac{1}{4}$ W and carbon type, unless otherwise indicated.

R1, 2 1-242-713-12 47 k Ω
R3, 4 1-242-453-12 150 Ω
R5, 6 1-242-713-12 47 k Ω
R7, 8 1-242-691-12 5.6 k Ω
R9, 10 1-242-457-12 220 Ω
R11, 12 1-242-473-12 1 k Ω
R13, 14 1-242-495-12 8.2 k Ω
R15 1-242-489-12 4.7 k Ω
R16, 17 1-242-507-12 27 k Ω
R19, 20 1-222-587-00 100 k Ω (B), variable
R21, 22 1-242-753-11 2.2 M Ω
R23, 24 1-242-503-12 18 k Ω
R25 1-242-473-12 1 k Ω
R27, 28 1-221-978-00 4.7 k Ω (B), semifixed
R29, 30 1-242-511-12 39 k Ω
R35, 36 1-222-846-00 1 M Ω (B), semifixed
R37, 38 1-242-737-12 470 k Ω
R39, 40 1-242-683-12 2.7 k Ω
R45 1-242-691-12 5.6 k Ω
R46 1-222-788-00 500 Ω (B), semifixed
R47 1-244-833-11 22 Ω , RD $\frac{1}{2}$ SP
R53 1-242-691-12 5.6 k Ω
R55 1-242-521-12 100 k Ω
R56 1-242-681-12 2.2 k Ω
R57 1-242-521-12 100 k Ω
R58 1-242-681-12 2.2 k Ω
R59, 60 1-242-649-12 100 Ω

Ref. No. Part No. Description

R61 1-242-625-12 10 Ω
R62 1-221-978-00 4.7 k Ω (B), semifixed
R64 1-244-857-11 220 Ω $\frac{1}{2}$ W
R65 1-221-978-00 4.7 k Ω (B), semifixed
R66, 67 1-244-867-11 560 Ω $\frac{1}{2}$ W
R68 1-244-821-11 6.8 Ω $\frac{1}{2}$ W
R69 1-206-147-11 100 Ω 3 W, metal film
R71 1-206-157-11 1 k Ω 3 W, metal film
R72 1-205-481-11 1 Ω 2 W, wire wound
R73 1-205-482-11 2.7 Ω 2 W, wire wound
R101, 102 1-242-735-12 390 k Ω
R103, 104 1-242-643-12 56 Ω
R105, 106 1-242-749-12 1.5 M Ω
R109, 110 1-242-687-12 3.9 k Ω
R111, 112 1-242-697-12 10 k Ω
R113, 114 1-242-691-12 5.6 k Ω
R165 1-244-857-11 220 Ω $\frac{1}{2}$ W

SWITCHES

S1 $\sim$ 5 1-514-944 5-key
S8 1-514-971 slide, record/playback
S10 3-599-155 contact
S11 1-514-865 micro
S15 9-935-141-10 seesaw, AC AUTOSHUTOFF

Ref. No. Part No. Description

JACKS

CNJ1 9-935-071-10 ac socket
J1, 2 1-507-281 MIC
J3 $\sim$ 6 1-507-351 phono, 4P; LINE INPUT/
LINE OUTPUT
J101 1-507-282 HEADPHONE
J102 1-509-029 connector, REC/PB
(General Export Model)

HEAD

EH }
RPH } 1-543-502 erase/record/playback

MISCELLANEOUS

M 1-541-040 motor
ME1, 2 1-520-107 meter, level
PL1, $\sim$ 6 1-518-098 lamp, 6.3 V; 150 mA
PM1 1-454-087 solenoid, EJECT
PM2 X-35991-10 solenoid, select
9-935-131-60 voltage selector
(General Export Model)
RY1 1-515-163 relay
CNP1 1-534-487 ac cord (General Export Model)
CNP1 9-953-340-40 ac cord (USA Model)

SECTION 7
HARDWARE

Part No. Description

SCREWS

7-621-255-45 $\oplus$ P 2 x 6
7-682-147-03 $\oplus$ P 3 x 6
7-682-163-03 $\oplus$ P 4 x 12
7-685-145-01 $\oplus$ P 3 x 6, tapping
7-685-147-21 $\oplus$ P 3 x 10, tapping
7-682-646-02 $\oplus$ PS 3 x 5
7-682-134 $\oplus$ P 2.5 x 5 (General Export Model)
7-621-743-21 $\oplus$ R 3.1 x 10, wood screw

Part No. Description

NUT

7-622-105-02 2 mm dia.

WASHERS

7-623-108-15 3 mm dia.
7-623-110-12 4 mm dia.

RETAINING RINGS

7-624-106-01 E-3
7-624-108-01 E-4

SONY CORPORATION

1J0578-1

© Printed in Japan

General Export Model

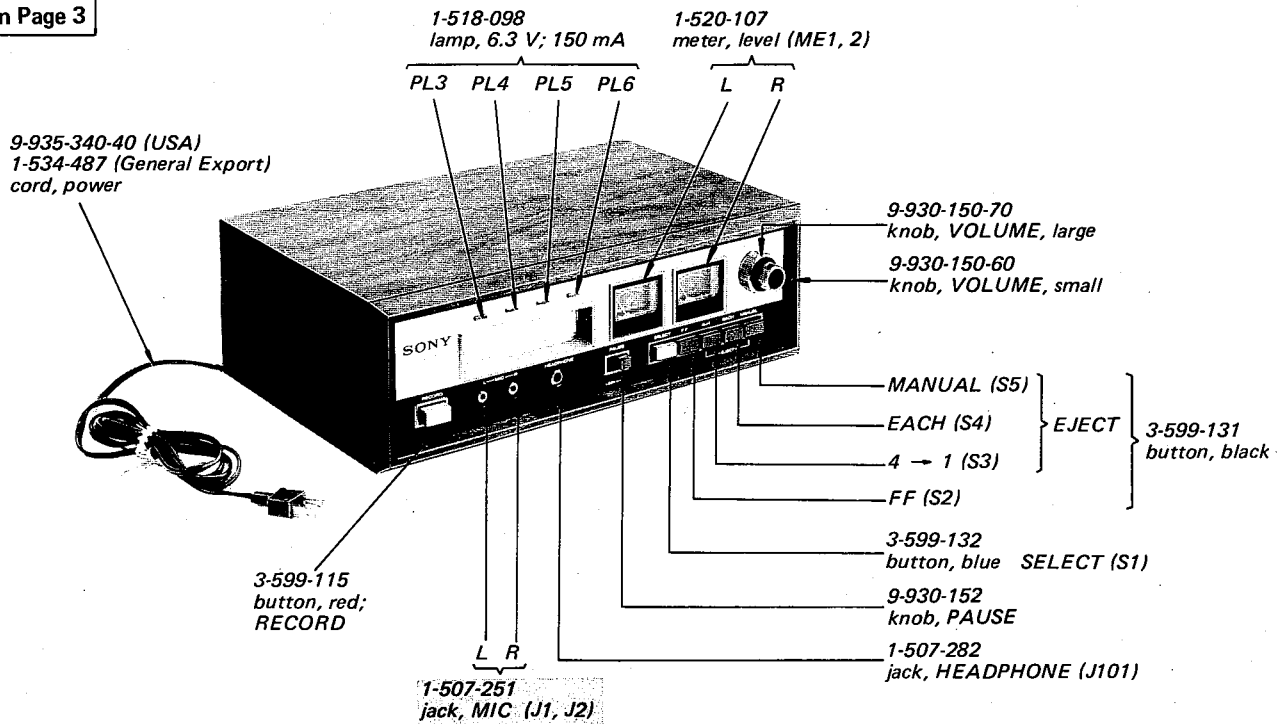
USA Model

CORRECTION

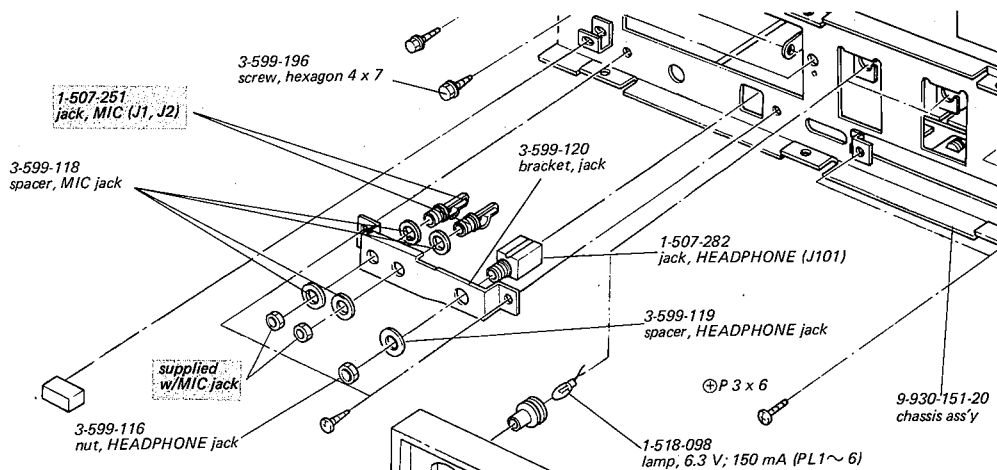
July, 1972

 indicates corrected portions.

On Page 3



On Page 29



On Page 32

	Correct	Incorrect
MIC jack (J1, 2) Part No.	1-507-251-	1-507-281-

SONY CORPORATION