



Service Manual

STEREO AMPLIFIER

SA-610

 **PIONEER®**

- This service manual is applicable to the KU type.

CONTENTS

1. SPECIFICATIONS	3	10. SCHEMATIC DIAGRAM, P.C. BOARD	
2. FRONT PANEL FACILITIES	4	PATTERNS AND PARTS LIST	
3. DISASSEMBLY	6	10.1 Miscellanea	14
4. PARTS LOCATION	6	10.2 Schematic Diagram	15
5. BLOCK DIAGRAM	8	10.3 P.C. Board Connection Diagram	18
6. LEVEL DIAGRAM	8	10.4 Parts List of P.C. Board Assembly	21
7. CIRCUIT DESCRIPTIONS	9	11. PACKING	22
8. ADJUSTMENTS	10		
9. EXPLODED VIEWS AND PARTS LIST	11		

1. SPECIFICATIONS

Semiconductors

ICs	3
Transistors	27
Diodes	18

Amplifier Section

Continuous power output of 45watts* per channel, min., at 8ohms from 20Hertz to 20,000 Hertz with no more than 0.03% total harmonic distortion.

Total Harmonic Distortion (20 Hertz to 20,000 Hertz, 8 ohms, from AUX)
22.5 watts per channel power output
. No more than 0.02%

Intermodulation Distortion (50 Hertz : 7,000 Hertz = 4 : 1
8 ohms, from AUX)
continuous rated power output . . No more than 0.03%
22.5 watts per channel power output
. No more than 0.02%

Damping Factor (20 Hertz to 20,000 Hertz, 8 ohms) . . 50
Input (Sensitivity/Impedance)

PHONO	2.5mV/50 kilohms
TUNER	150mV/50 kilohms
AUX	150mV/50 kilohms
TAPE PLAY 1, 2	150mV/50 kilohms

Phono Overload Level (T.H.D. 0.05%, 1,000Hz)

PHONO	130mV
-----------------	-------

Output (Level)

TAPE REC 1, 2	150mV
Speaker	A, B, OFF

Frequency Response

PHONO (RIAA Equalization)

. 20Hz to 20,000Hz \pm 0.3dB

TUNER, AUX, TAPE PLAY 1, 2

. 10Hz to 60,000Hz \pm 3dB

Tone Control

BASS \pm 10dB (100Hz)

TREBLE \pm 10dB (10,000Hz)

Subsonic Filter 15Hz (-6dB/oct)

Loudness Contour (Volume control set at -40dB position)

. +6dB (100Hz), +3dB (10,000Hz)

Hum and Noise (IHF, short-circuited, A network)

PHONO 82dB

TUNER, AUX, TAPE PLAY 1, 2 100dB

Miscellaneous

Power Requirements AC 120V, 60Hz

Power Consumption 100W (UL)

Dimensions 420(W) x 94(H) x 347(D) mm

16-9/16(W) x 3-11/16(H) x 13-11/16(D) in

Weight (without package) 6.9kg (15 lb 3oz)

Furnished Parts

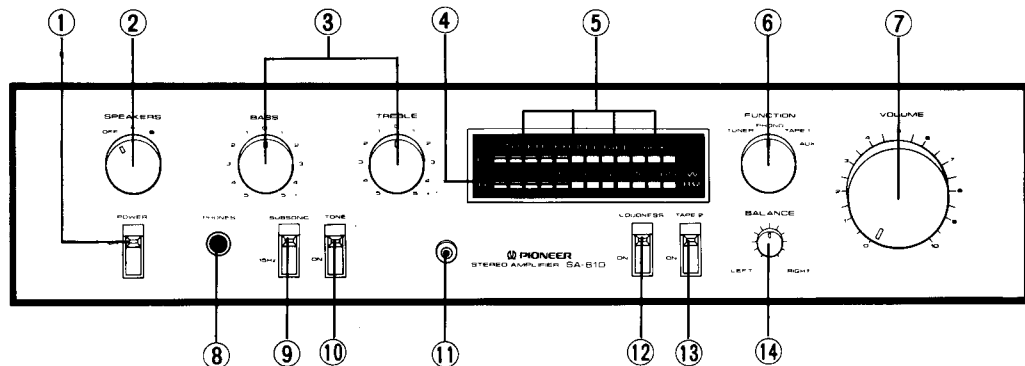
Operating Instructions 1

NOTE:

Specifications and the design subject to possible modifications without notice due to improvements.

* *Measured pursuant to the Federal Trade Commission's Trade Regulation rule on Power Output Claims for Amplifiers.*

2. FRONT PANEL FACILITIES



① POWER SWITCH

Set this switch to ON to supply power to the amplifier. There will be a short delay when it is set to ON, because the muting circuit has been actuated to suppress the unpleasant noise that is sometimes generated when the power is on and off.

② SPEAKER SELECTOR

Use this selector to select the speaker system.

OFF: Sound not obtained from speakers.

A: Sound obtained from speakers connected to the A speaker terminals.

B: Sound obtained from speakers connected to the B speaker terminals.

③ BASS AND TREBLE CONTROLS

Use these controls to adjust the bass and the treble. If you set the tone switch to ON and turn the bass control to right from its center position, you will be able to emphasize the sound in the low-frequency range. Conversely, turning the bass control to the left from the center position, you will attenuate the sound.

You can use the treble control to adjust the sound in the high-frequency range.

④ POWER METER

This meter allows you to read out the rated power level on the fluorescent display tube when speakers with a nominal impedance of 8 ohms are connected to the amplifier's speaker terminals.

⑤ FUNCTION INDICATORS

The TUNER, PHONO, TAPE, AUX function indicators light up in accordance with the position of the function selector.

⑥ FUNCTION SELECTOR

Use this selector to select the program source. When set, the function indicator above the meter panel corresponding to the position of the function selector will light up.

TUNER: Set here when listening to broadcasts on a tuner connected to the TUNER jacks.

(The TUNER function indicator lights up.)

PHONO: Set here when playing records on a turntable connected to the PHONO jacks.

(The PHONO function indicator lights up.)

TAPE 1: Set here when playing tapes on the tape deck connected to the TAPE 1 jacks.

(The TAPE function indicator lights up.)

AUX: Set here when listening to a program source which is connected to the AUX jacks.

(The AUX function indicator lights up.)

⑦ VOLUME CONTROL

Use this control to adjust the output level to the speakers and headphones. Turn it clockwise to increase the output level. No sound will be heard if you set it to "0."

⑧ HEADPHONE JACK

Plug the headphones into this jack when you want to listen through your stereo headphones.

NOTE:

Set the speaker selector to OFF when listening only with headphones.

⑨ SUBSONIC FILTER SWITCH

When this switch is set to the 15Hz position, the subsonic filter with a cut-off frequency of 15Hz is actuated. The subsonic filter serves to attenuate frequencies lower than 15Hz in a 6dB/oct slope. It is therefore effective in suppressing ultra-low-frequency noise which is generated by record warp and other causes. You cannot actually hear this noise but it is a factor in the generation of intermodulation distortion and it may damage your speaker system. Set this switch to the 15Hz position during record play for the best effect.

⑩ TONE SWITCH

Set this switch to ON when adjusting the bass and treble controls. When set to the upper (OFF) position, the tone control circuits are disengaged and frequency response is flat. This function is convenient for checking phono cartridge and speaker tone quality and listening room acoustics.

⑪ POWER INDICATOR

When the power switch is set to ON this lamp lights up, indicating the amplifier is turned on.

⑫ LOUDNESS SWITCH

When listening to a performance with the volume control turned down, set this switch to ON and the bass and treble will be accentuated.

When the volume is low, the human ear finds it harder to hear the bass and treble than when the volume is high. The loudness switch is thus designed to compensate for this deficiency. By setting it to ON, the bass and treble come through much more strongly and the sound takes on a punch even when the volume control is turned down.

⑬ TAPE 2 SWITCH

Set this switch to the ON position when monitoring a tape performance on a tape deck which you have connected to the TAPE 2 jacks or when monitoring a recording.

NOTE:

Set the switch to the upper (OFF) position when listening to records or broadcasts, etc. selected by the function selector.

⑭ BALANCE CONTROL

Use this control to balance the volume of the left and right channels. If the sound appears to be louder on the right, it means that the volume of the right channel is higher. Turn the balance control to the left and adjust. Conversely, if the sound appears to be louder on the left, it means that the volume of the left channel is higher. Therefore, turn the balance control to the right and adjust.

3. DISASSEMBLY

Bonnet Case

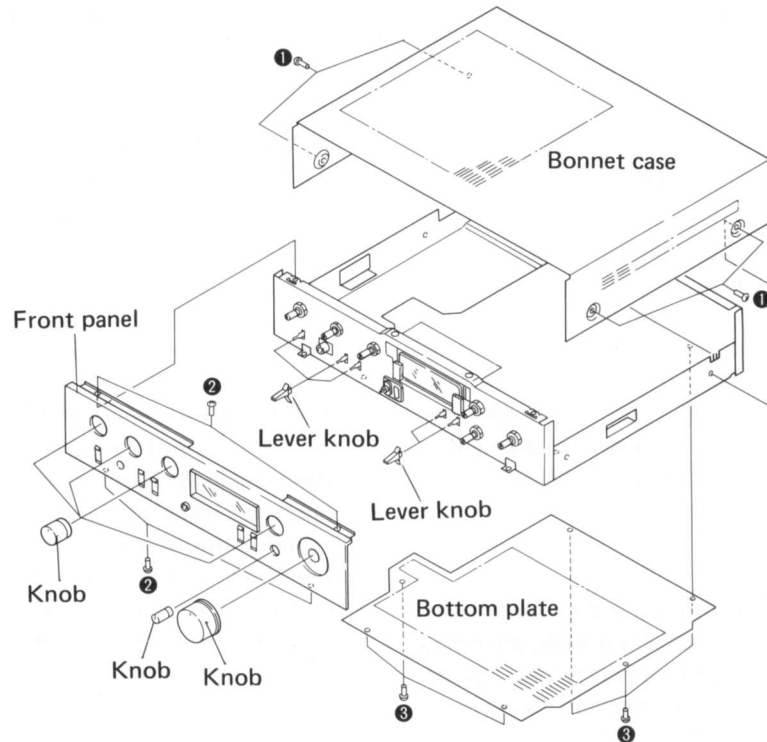
Remove the four screws ①.

Bottom Plate


Remove the six screws ③.

Front Panel

Remove the four screws ②.



4. PARTS LOCATION

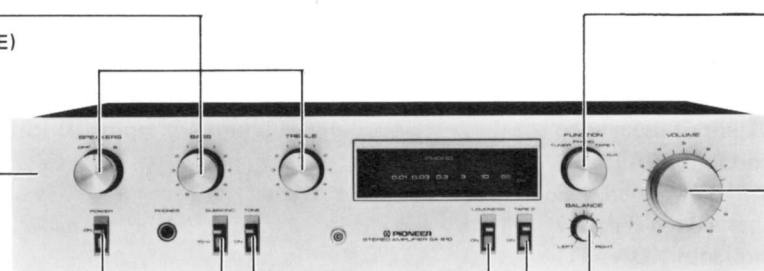
• The  mark found on some component parts indicates the importance of the safety factor of the part. Therefore, when replacing, be sure to use parts of identical designation.

Front Panel View

Knob
(SPEAKER, BASS, TREBLE)
AAB-222

Front panel assembly
ANB-847

Lever knob (POWER, SUBSONIC, TONE)
AAD-200



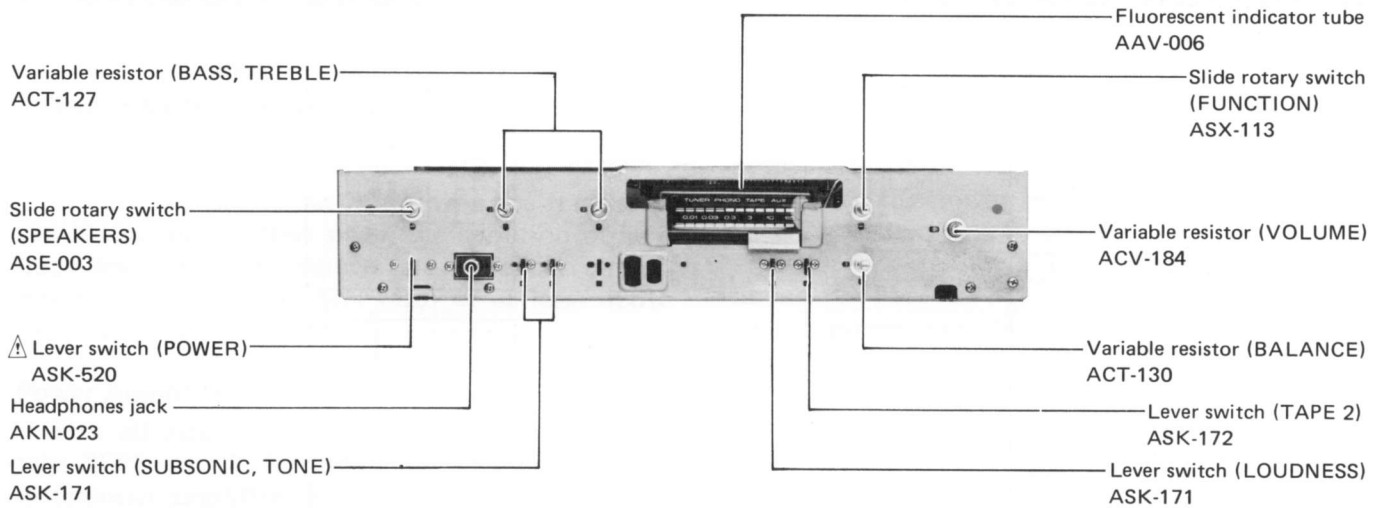
Knob (FUNCTION)
AAB-222

Knob (VOLUME)
AAB-221

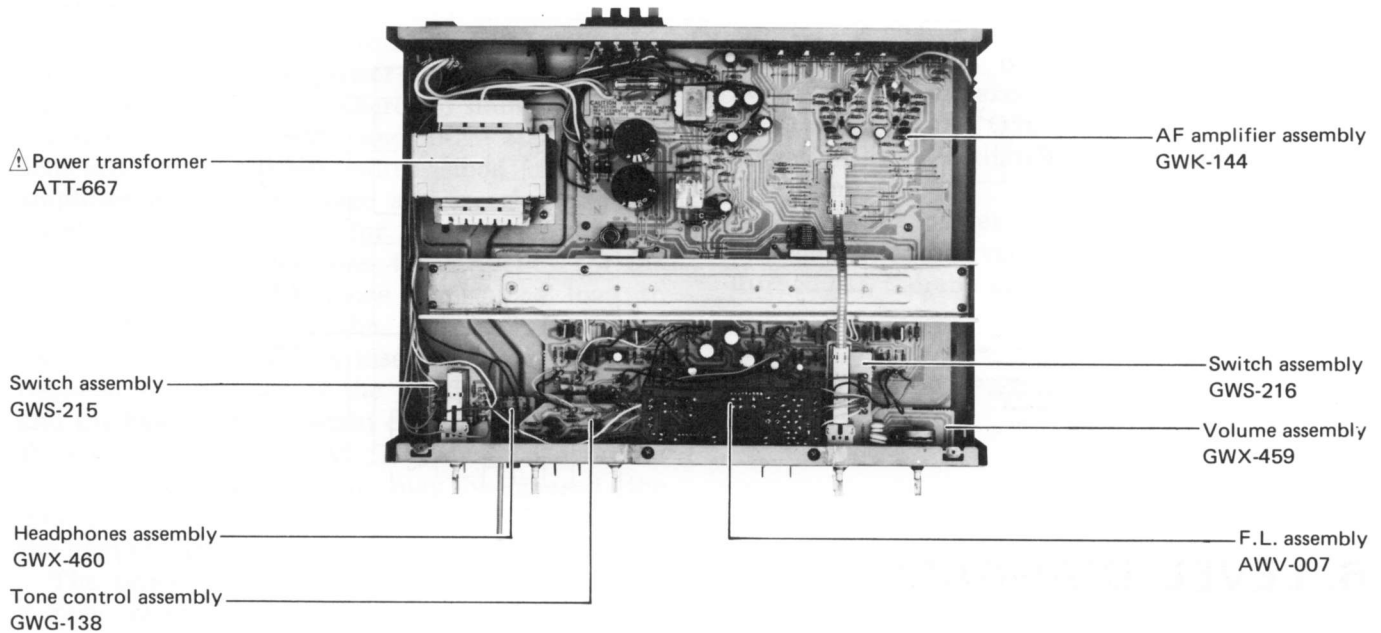
Knob (BALANCE)
AAB-223

Lever knob
(LOUDNESS, TAPE 2)
AAD-200

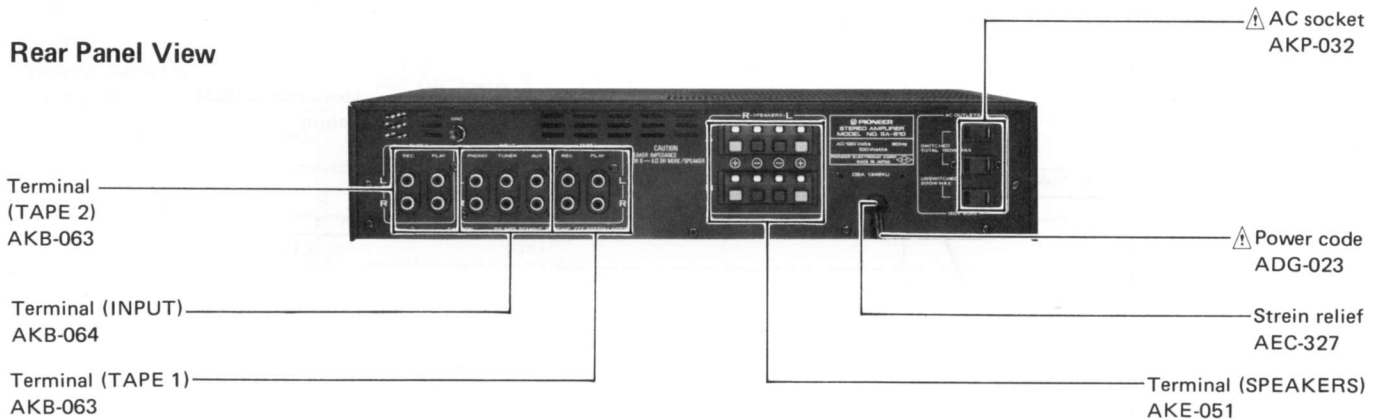
Front View with Front Panel Removed



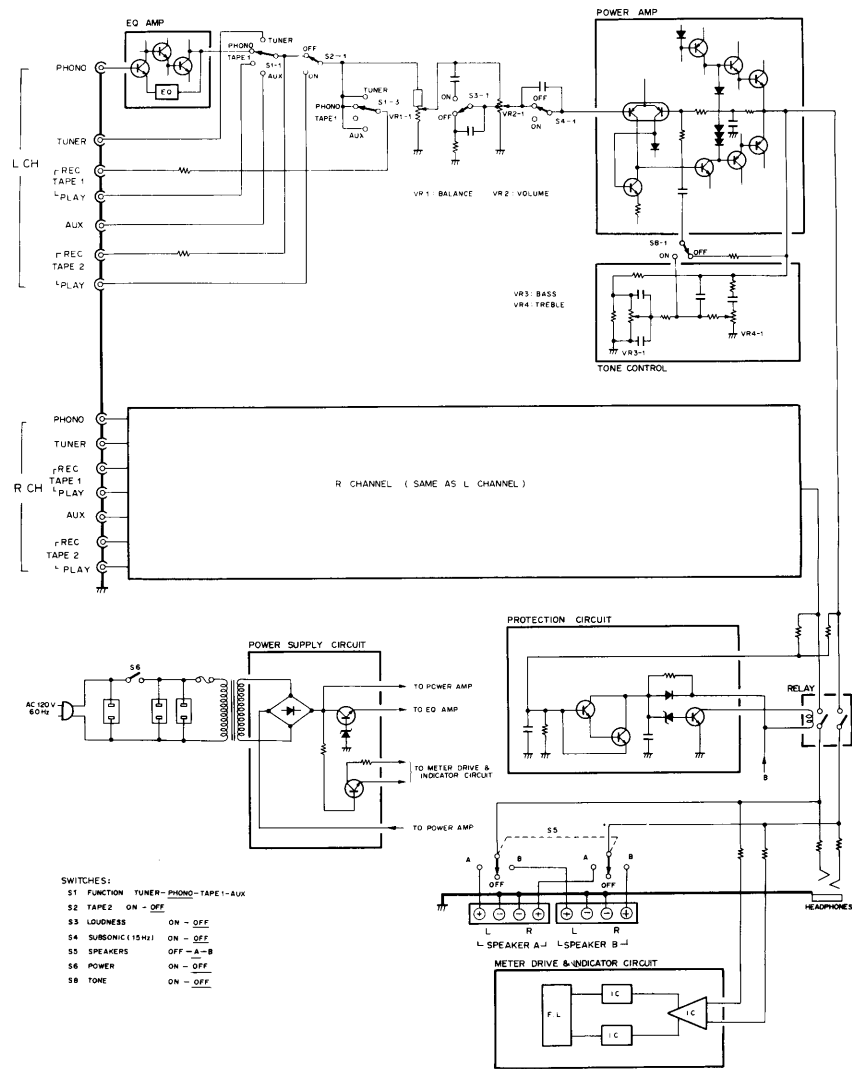
Top View with Bonnet Removed



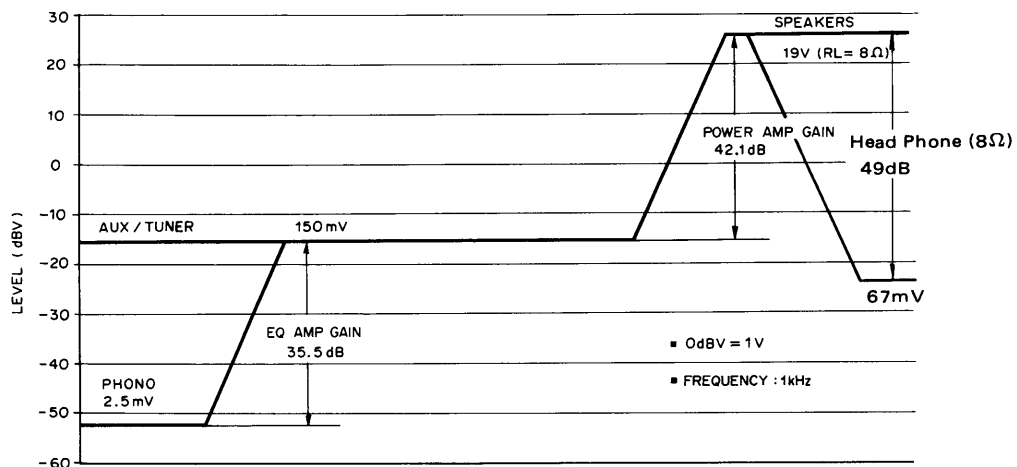
Rear Panel View



5. BLOCK DIAGRAM



6. LEVEL DIAGRAM



7. CIRCUIT DESCRIPTIONS

Equalizer Amplifier

The SA-610 features a 3-stage direct-coupled equalizer amplifier for greater reduction of noise and distortion.

Besides the use of an ultra low-noise transistor (2SC2602) in the first stage, the adoption of low impedance input resistance and equalizer circuit has contributed to an S/N ratio of at least 82dB (at 2.5mV input, IHF-A).

Power Amplifier

This all stage direct-coupled pure complementary SEPP circuit features a current mirror load differential amplifier in the first stage, and incorporates the tone control circuit in the NFB loop.

Although the incorporation of the tone control circuits in the power amplifier stage reduces the number of elements that the signal has to pass through, and thereby further reduces noise, distortion, and cost, the power stage does require a higher gain and a higher degree of stability. In the SA-610, this high gain and high stability are achieved by a current mirror load differential amplifier in the first stage and by the use of a constant current circuit for the load of the pre-driver stage. Furthermore, the tendency for the pre-driver stage capacitance impedance load to cause deterioration in the high end frequency response is suppressed by inserting a capacitor (C) between the emitter of the pre-driver stage (Q2) and the base of the constant current circuit (Q1) as shown in Fig. 7-1. At frequencies where the reactance of this capacitor may be ignored, the push-pull action of Q1 and Q2 serves to counteract the high end frequency response deterioration.

The power amplifier stage is a complementary 2-stage Darlington connection, resulting in an output power rating of 45W + 45W (8 Ω , 20Hz–20kHz), harmonic distortion of less than 0.03% (20Hz – 20kHz at rated output), and output power bandwidth of 5Hz – 50kHz (0.03% THD). Certainly a superb performance for an amplifier of this class is obtained.

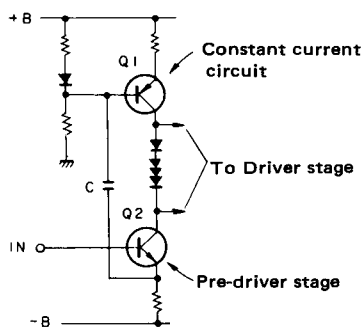


Fig. 7-1 Pre-driver stage

Protection Circuit

Besides protecting the speakers if a DC voltage should happen to appear at the power amplifier stage outputs, this circuit also mutes the signal path when the power switch is turned on and off (See Fig. 7-2).

If for any reason a DC voltage (in excess of about $\pm 5V$) should happen to appear in the output of the power amplifier stage, it is detected immediately by either Q23 or Q24. Q23 is turned on by a positive voltage, and Q24 by a negative voltage. In either case, Q25 is also turned off, thereby opening the relay contact to disconnect the power amplifier stage from the speakers.

The muting action when the power switch is turned on is achieved by delaying the rise of the Q25 base potential by means of the R95/C77 time constant circuit. When the power switch is turned on, C77 is charged up via R95, thereby increasing the voltage across both ends of this capacitor. When this voltage exceeds the zener voltage of the D15 zener diode, Q25 is biased in the forward direction, and is thereby turned on to close the relay contact.

When the power switch is turned off, C77 discharges rapidly via D18, resulting in Q25 being turned off, thereby opening the relay contact.

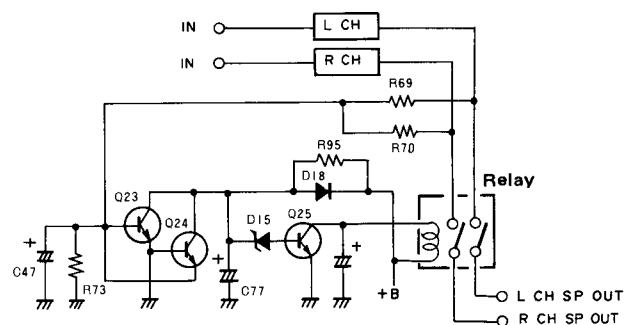


Fig. 7-2 Protection circuit

8. ADJUSTMENTS

8.1 IDLE CURRENT ADJUSTMENT

1. Set the SPEAKERS selector to the A position, and connect an 8Ω resistor to the speaker output terminals.
2. Turn the VOLUME control down to minimum level, turn the power on, and wait about 10 minutes.
3. Connect a DC voltmeter to the TP terminals (Lch; TP4 and TP3, Rch; TP2 and TP1) of the AF Amplifier Assembly (GWK-144).
4. Check that the voltage between TP4 and TP3 (Lch) lies within the DC 4mV-50mV range then make a similar check for the Rch (between TP2 and TP1). If the voltage is less than 4mV, cut jumper wire A (Lch), and jumper wire B (Rch). If the voltage exceeds 70mV, check for circuit failure.

8.2 OUTPUT INDICATOR ADJUSTMENT

1. Set the TONE CONTROL to the center position.
2. Set the SPEAKERS selector to the A position, and connect an 8Ω resistor and AC voltmeter to the speaker output terminals.
3. Set the FUNCTION switch to the AUX position, and apply a 1kHz, 150mV signal to the AUX terminals.
4. Adjust the VOLUME control so that the voltage on the output terminals (SPEAKERS) read 9V (AC).
5. Adjust VR1 (Lch) and VR2 (Rch) of the indicator assembly so that the output power indicator read 10 watts.

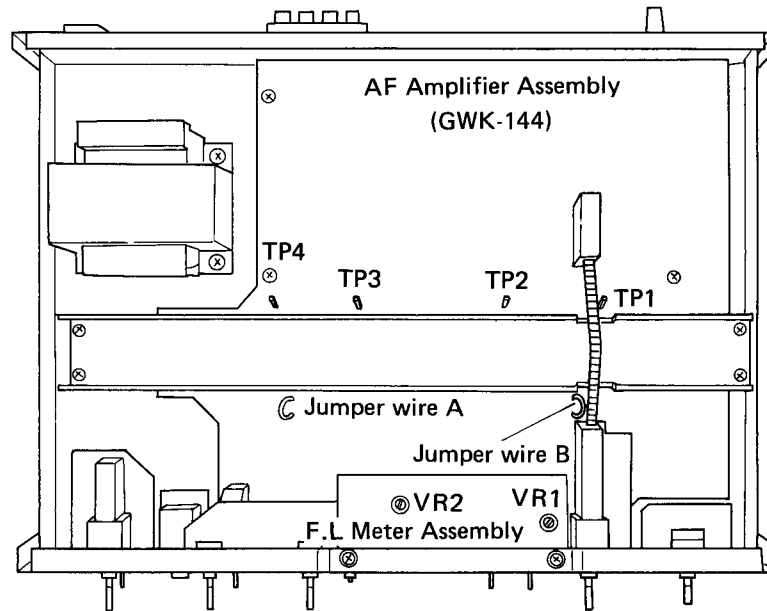
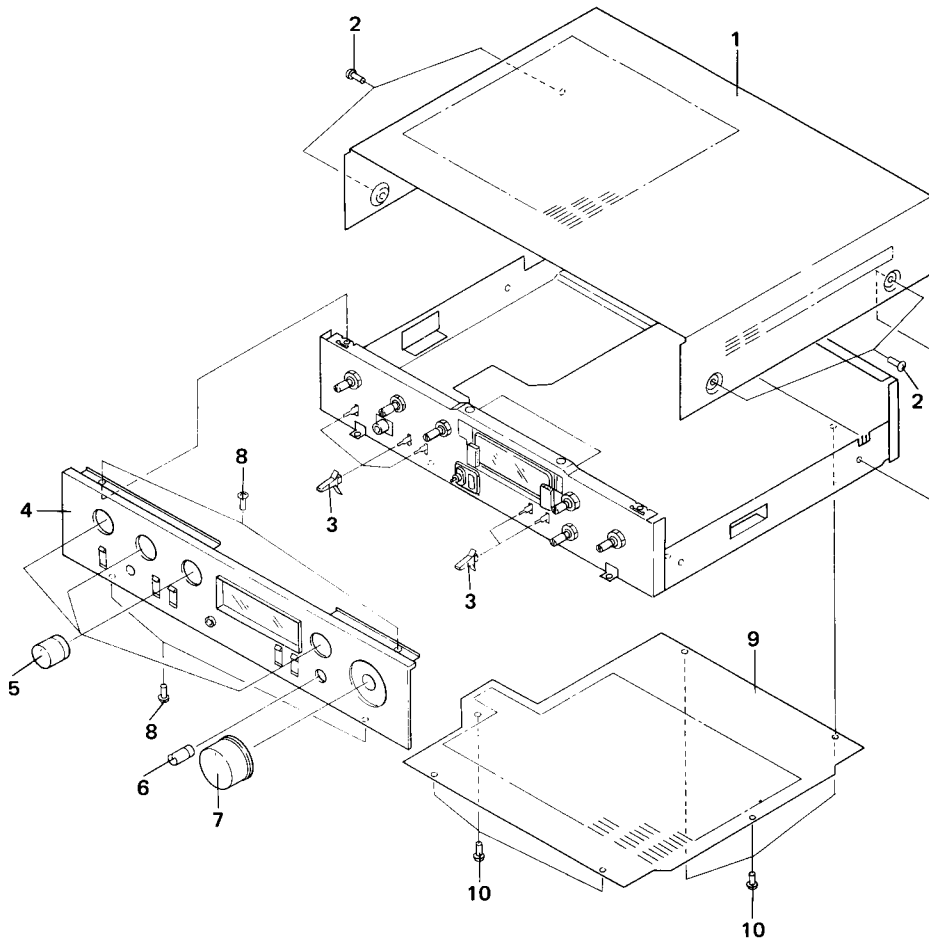


Fig. 8-1 Adjustment point

9. EXPLODED VIEWS AND PARTS LIST

Exterior Component



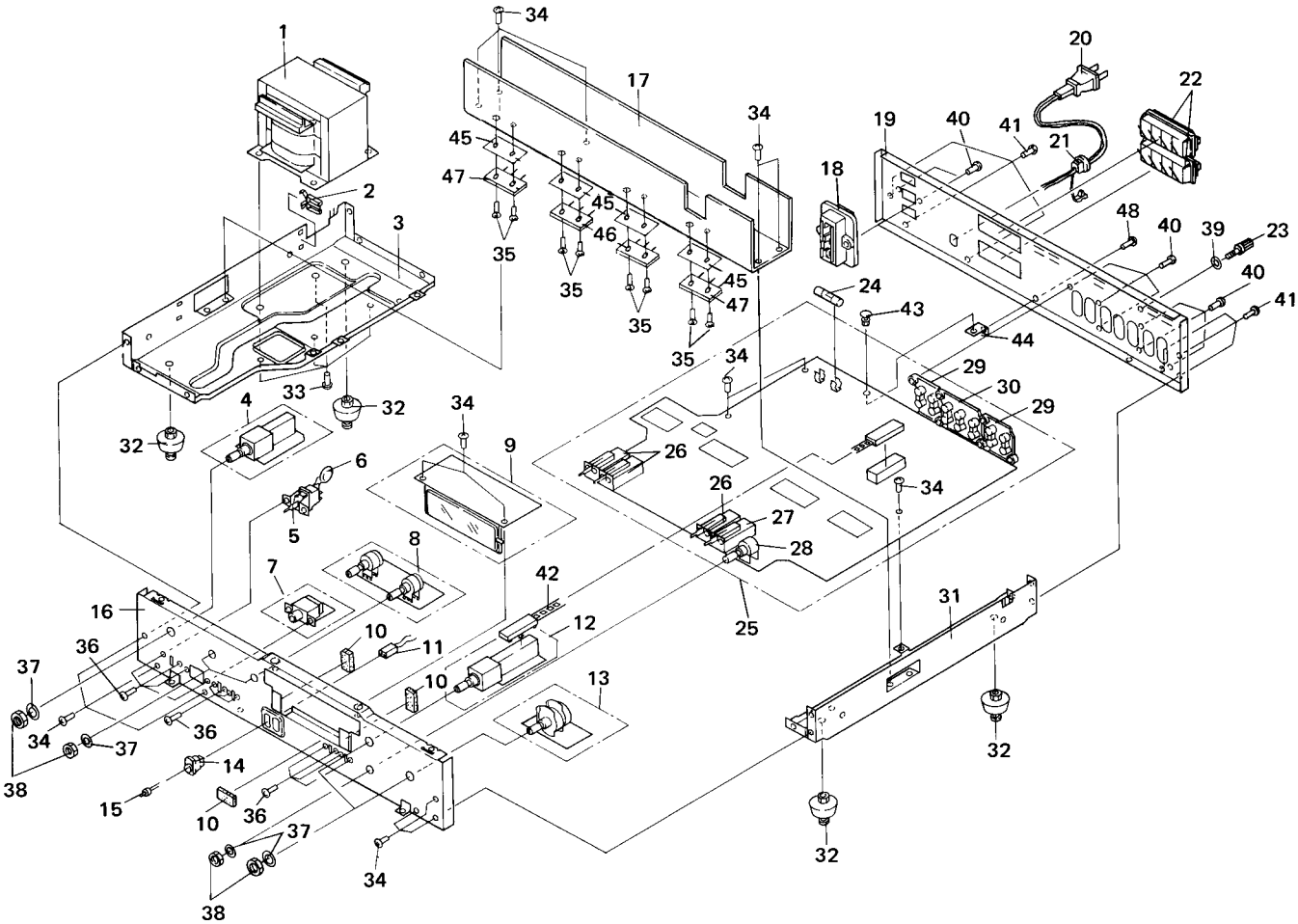
Parts List

NOTE:

- Parts without part number cannot be supplied.
- The \triangle mark found on some component parts indicates the importance of the safety factor of the part. Therefore, when replacing, be sure to use parts of identical designation.

Key No.	Part No.	Description
1.	ANE-269	Bonnet case
2.	ABA-079	Screw
3.	AAD-200	Lever knob
4.	ANB-847	Front panel assembly
5.	AAB-222	Knob
6.	AAB-223	Knob
7.	AAB-221	Knob
8.	ABA-186	Screw
9.		Bottom plate
10.	ABA-066	Screw

Interior Component



Parts List

Key No.	Part No.	Description	Key No.	Part No.	Description
⚠ 1.	ATT-667	Power transformer	26.	ASK-171	Lever switch
2.		Wire clip	27.	ASK-172	Lever switch
3.		Frame	28.	ACT-130	Variable resistor
4.	GWS-215	Switch assembly	29.	AKB-063	Terminal
⚠ 5.	ASK-520	Lever switch	30.	AKB-064	Terminal
⚠ 6.	ACG-001	Capacitor	31.		Frame
7.	GWX-460	Headphones assembly	32.	AEC-672	Foot assembly
8.	GWG-138	Tone control assembly	33.	ABA-107	Screw
9.	AWV-007	F.L. assembly	34.	ABA-066	Screw
10.		Cushion	35.	ABA-234	Screw
11.		LED socket	36.	ABA-026	Screw
12.	GWS-216	Switch assembly	37.	M45-086	1t spacer
13.	GWX-459	Volume assembly	38.	B71-004	Nut 9φ
14.		Cushion rubber	39.	ABE-005	Washer
15.	AEL-320	LED	40.	ABA-240	Screw
16.		Panel stay	41.	ABA-198	Screw
17.		Heat sink	42.		Remote wire
⚠ 18.	AKP-032	AC socket	43.	AEC-352	Nylon rivet
19.		Rear panel	44.		P.C.B. holder
⚠ 20.	ADG-023	Power code	45.	AEC-488	Insulator spacer
21.	AEC-327	Strain relief	46.	2SA1108/A/Q or R	Transistor } hfe should have the same rank
22.	AKE-051	Terminal	47.	2SC2588/A/Q or R	
23.		Terminal (GND)	48.	ABA-145	Screw
⚠ 24.	AEK-100	Fuse			
25.	GWK-144	AF amplifier assembly			

10. SCHEMATIC DIAGRAM, P.C. BOARD PATTERNS AND PARTS LIST

10.1 MISCELLANEA

NOTE:

- When ordering resistors, first convert resistance values into code form as shown in the following examples.

Ex. 1 When there are 2 effective digits (any digit apart from 0), such as 560 ohm and 47k ohm (tolerance is shown by J = 5%, and K = 10%).

560Ω — 56 × 10¹ — 561 RD¼PS 561 J
 47kΩ — 47 × 10³ — 473 RD¼PS 473 J
 0.5Ω — 0R5 RN2H 0R5 K
 1Ω — 010 RS1P 010 K

Ex. 2 When there are 3 effective digits (such as in high precision metal film resistors).

5.62kΩ 562 × 10¹ 5621 RN¼SR 562 F

- The Δ mark found on some component parts indicates the importance of the safety factor of the part. Therefore, when replacing, be sure to use parts of identical designation.

Miscellaneous Parts

ASSEMBLIES

Part No.	Symbol & Description
GWK-144	AF amplifier assembly
GWG-138	Tone control assembly
GWS-215	Switch assembly
GWS-216	Switch assembly
GWX-459	Volume assembly
GWX-460	Headphones assembly
AWV-007	F.L. assembly

OTHERS

Part No.	Symbol & Description
Δ ATT-667	T1 Power transformer
Δ AEK-100	F1 Fuse
ASK-520	S8 Lever switch (POWER)
Δ AKP-032	AC socket
Δ ADG-023	Power code
ANB-847	Front panel assembly
AKE-051	Terminal (SPEAKERS)

SEMICONDUCTORS

Part No.	Symbol & Description
2SA1108/A/Q or R	Q21, Q22 } hfe should have the same rank
2SC2588/A/Q or R	
AEL-320	D1 LED

CAPACITOR

Part No.	Symbol & Description
Δ ACG-001	C1 Capacitor 0.01/250V

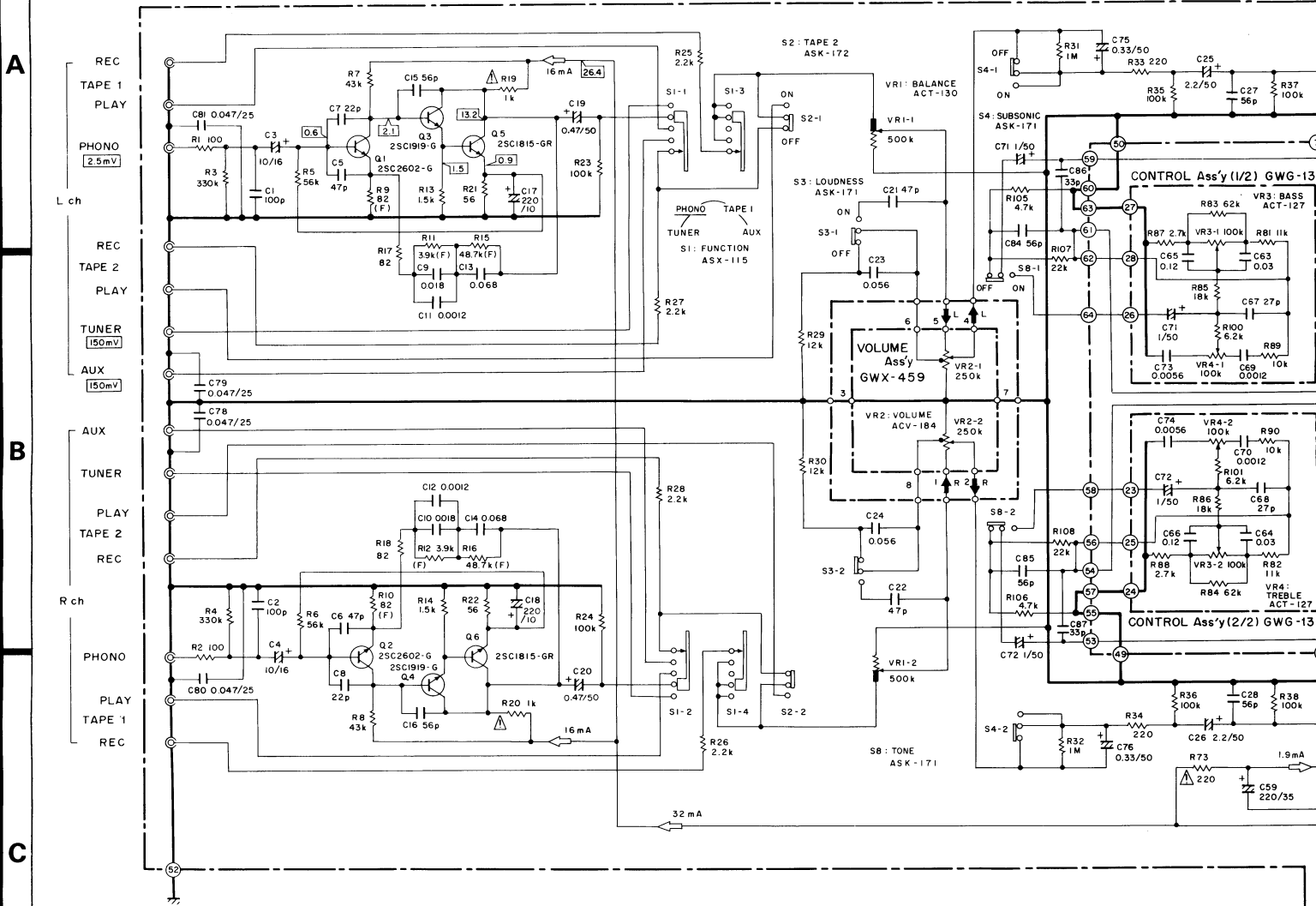
List of Changed Parts for Factory Modification

List of changed parts information will be furnished whenever necessary and you are requested to amend parts number in this parts list.

Symbol	Part No.	Description

10.2 SCHEMATIC DIAGRAM

AF AMP Ass'y (1/2) GWK-144



1. RESISTORS:

Indicated in Ω , $\frac{1}{2}W$, $\pm 5\%$ tolerance unless otherwise noted k : k Ω , M : M Ω , (F) : $\pm 1\%$, (G) : $\pm 2\%$, (K) : $\pm 10\%$ tolerance

2. CAPACITORS:

Indicated in μF /voltage (V) unless otherwise noted p : pF Indication without voltage is 50V except electrolytic capacitor.

3. VOLTAGE, CURRENT:

\square V : Signal voltage at 45 W + 45 W 8 Ω output (1kHz)
 \square V : DC voltage (V) at no input signal
 Value in () is DC voltage at rated power.
 \leftarrow mA : DC current at no input signal

4. OTHERS:

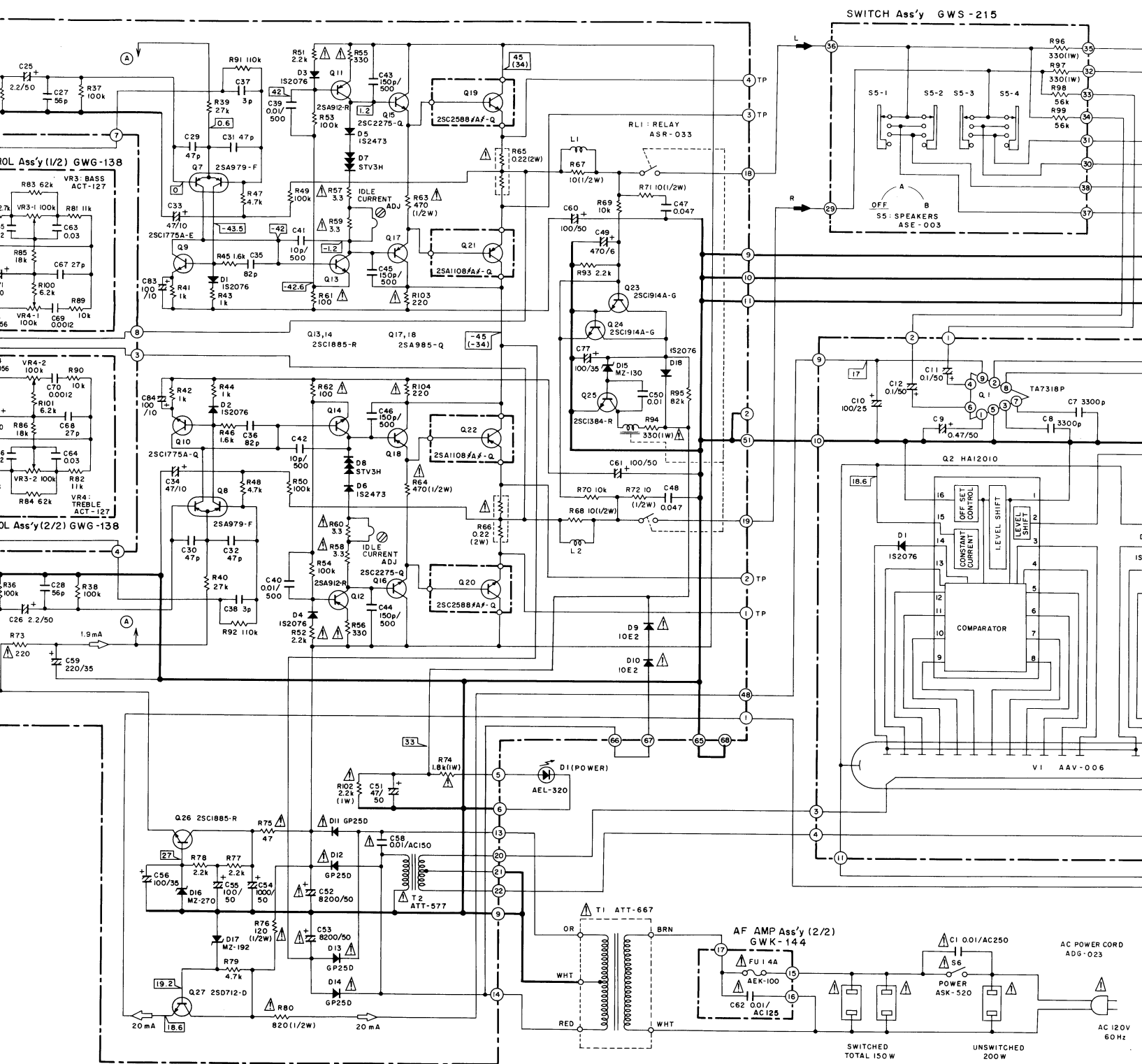
\rightarrow : Signal route.
 \odot : Adjusting point.
 The Δ mark found on some component parts indicates the importance of the safety factor of the part. Therefore, when replacing, be sure to use parts of identical designation.

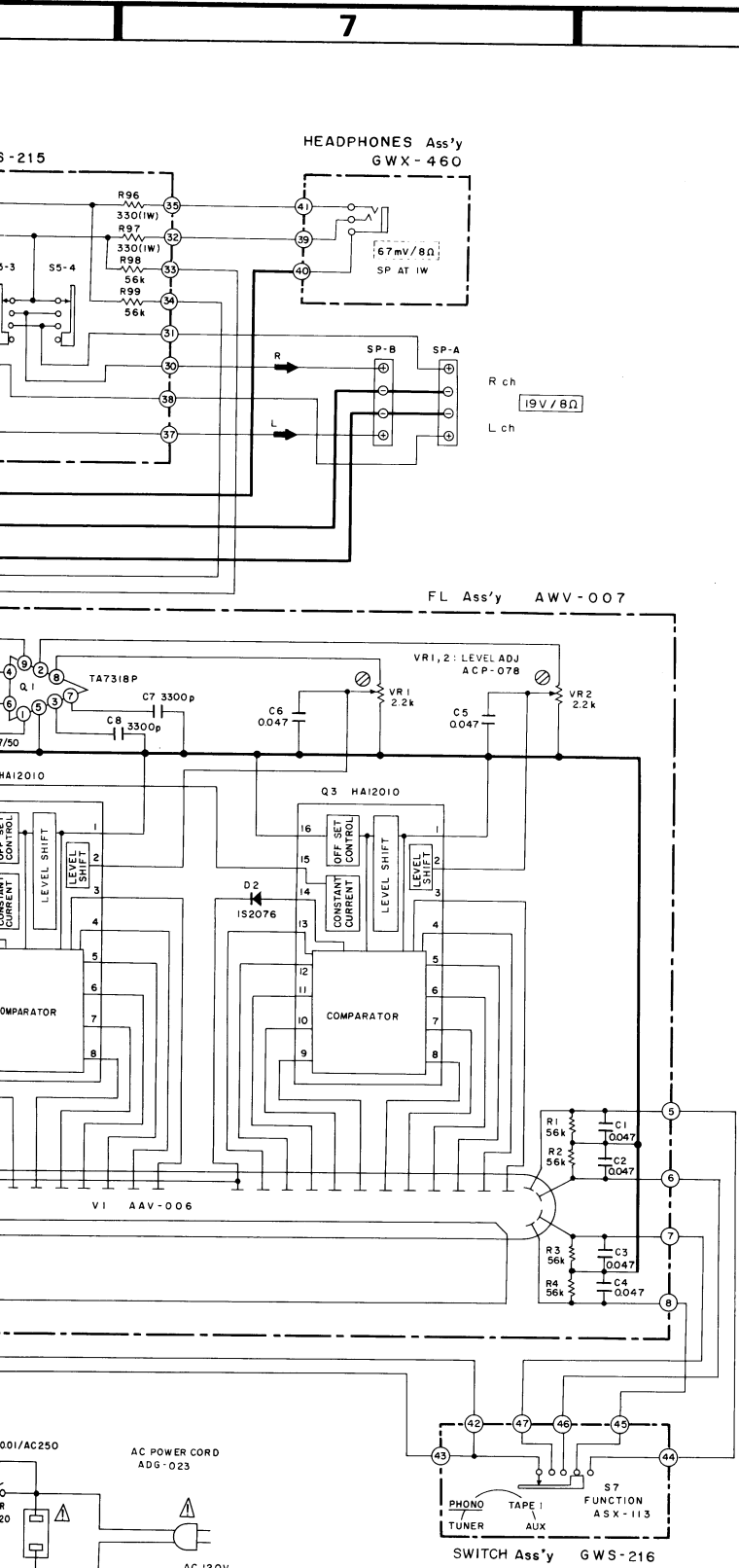
This is the basic schematic diagram, but the actual circuit may vary due to improvements in design.

SWITCHES:

- | | |
|------------------------|------------------------------|
| S 1,7 : FUNCTION | TUNER — PHONO — TAPE 1 — AUX |
| S 2 : TAPE 2 | ON — OFF |
| S 3 : LOUDNESS | ON — OFF |
| S 4 : SUBSONIC (15 Hz) | ON — OFF |
| S 5 : SPEAKERS | OFF — A — B |
| S 6 : POWER | ON — OFF |
| S 8 : TONE | ON — OFF |

The underlined indicates the switch position.

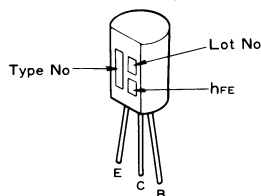




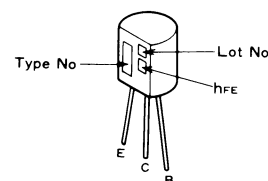
Appearance of Transistors and ICs

2SA912

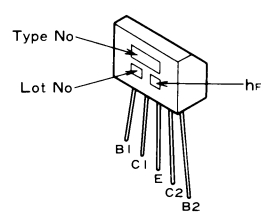
2SC1885



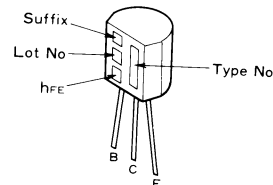
2SC1815



2SA979

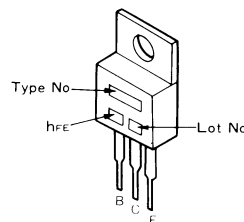


2SC1914A



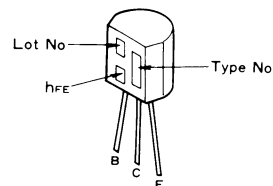
2SA985

2SC2275



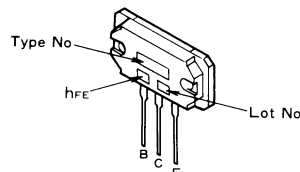
2SC1919

2SC2602

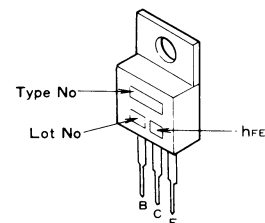


2SA1108A

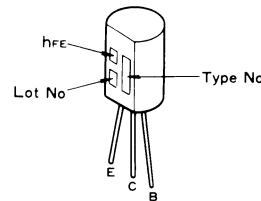
2SC2588A



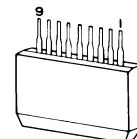
2SD712



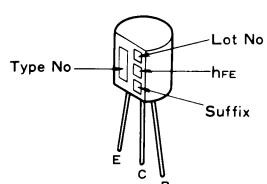
2SC1384



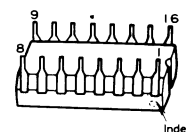
TA7318P



2SC1775A



HA12010



A

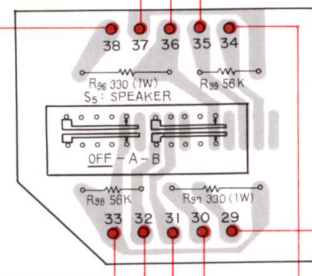
B

C

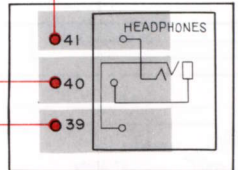
D

10.3 P.C. BOARD CONNECTION DIAGRAM

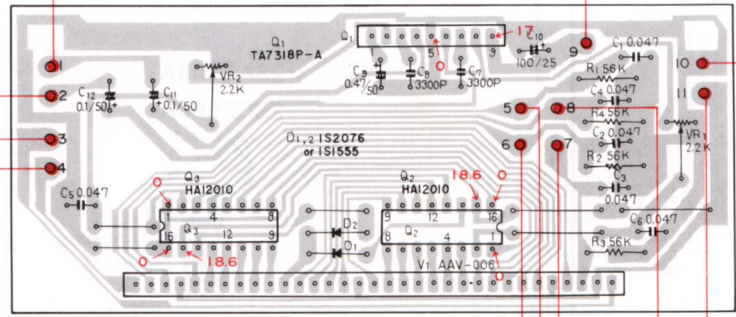
A
B
C
D



SWITCH Ass'y (GWS-215)

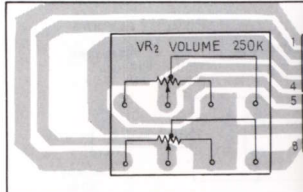
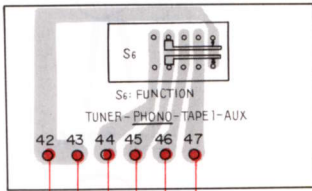


HEADPHONE Ass'y (GWX-460)



FL Ass'y (AWV-007)

SWITCH Ass'y (GWS-216)

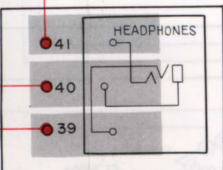


VOLUME Ass'y (GWX-459)

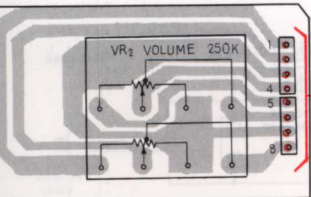
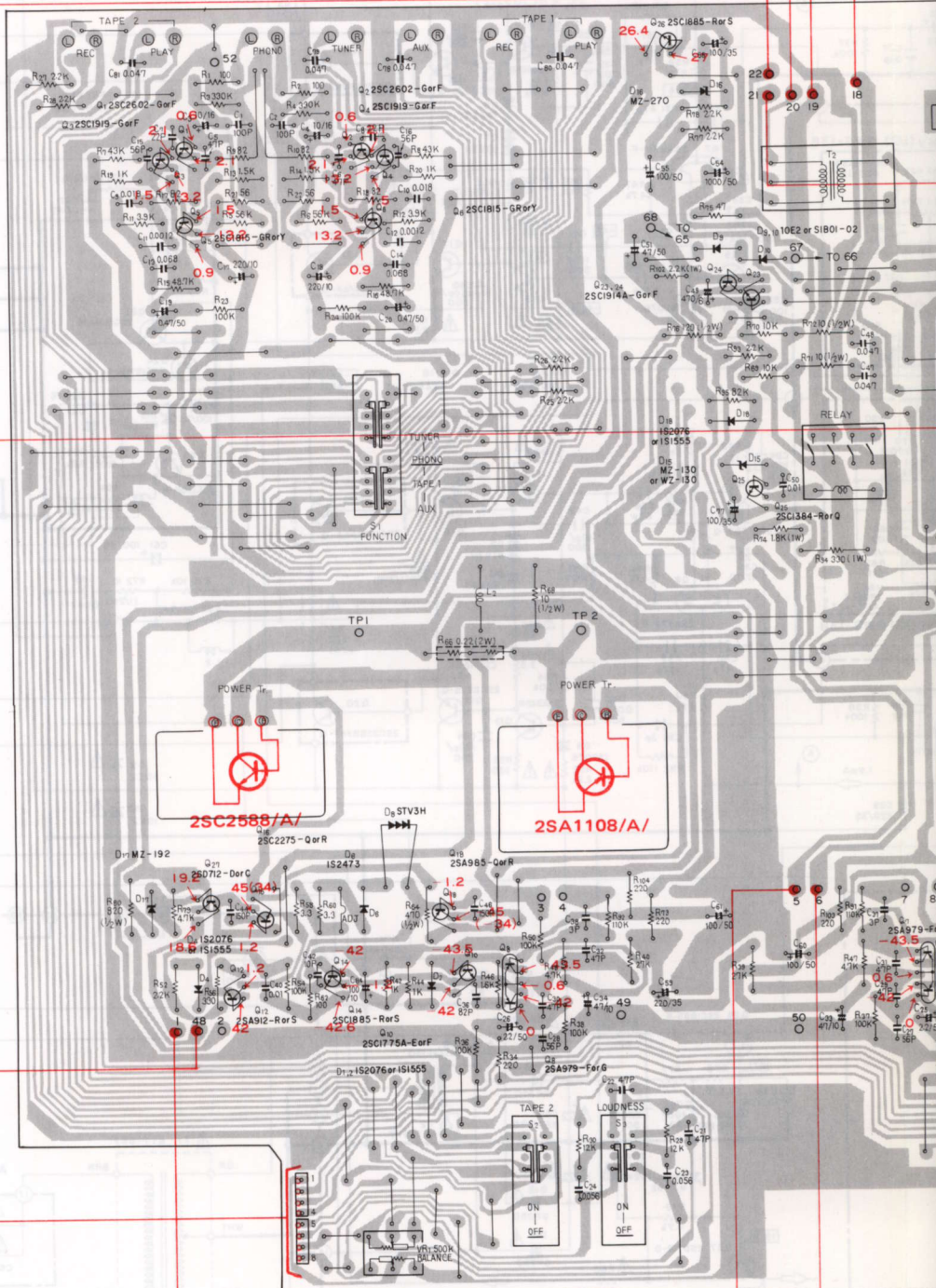
1

2

3

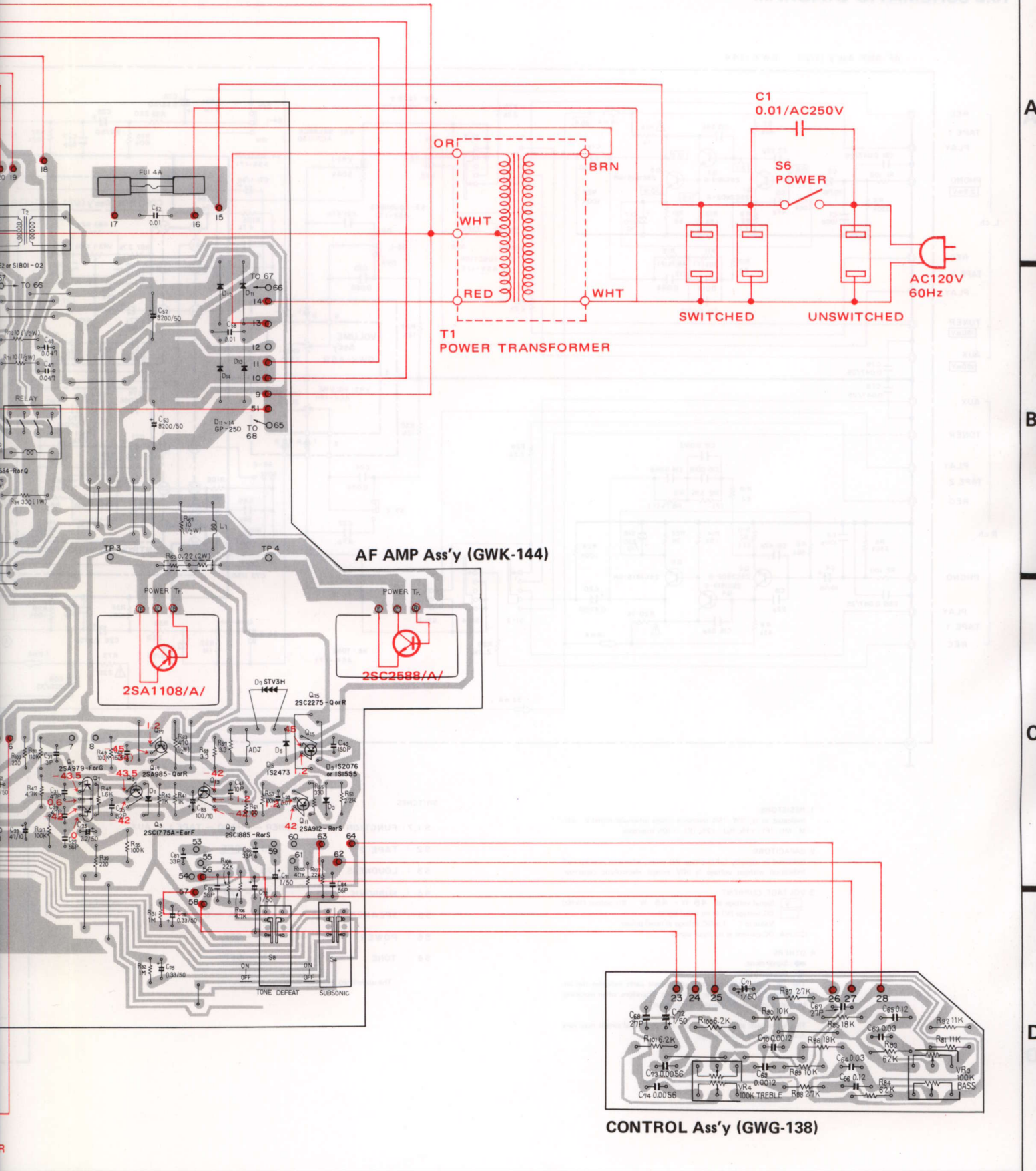


HEADPHONE Ass'y (GWX-460)



VOLUME Ass'y (GWX-459)





A

B

C

D

AF AMP Ass'y (GWK-144)

CONTROL Ass'y (GWG-138)

10.4 PARTS LIST OF P.C. BOARD ASSEMBLY

Parts List of Amplifier Assembly (GWK-144)

CAPACITORS

Part No.	Symbol & Description
CCDSL 101J 50	C1, C2
CEA 102M 50L	C54
CEA 221M 35L	C59
CEA 101M 50L	C60, C61, C55
CEA 101M 35L	C56, C77
CEA 101M 10L	C83, C84
CEA 471M 6L	C49
CEA 470M 50L	C51
CEA 221M 10L	C18, C17
CEA 470M 10L	C33, C34
CEANL 010M 50	C71, C72
CEANL 2R2M 50	C25, C26
CEANL 100M 16	C3, C4
CEANL R33M 50	C75, C76
CEANL R74M 50	C19, C20
CCDSL 030C 50	C37, C38
CCDSL 100K 500	C41, C42
CCDSL 220J 50	C7, C8
CCDSL 330J 50	C86, C87
CCDSL 470J 50	C5, C6, C21-22, C29-C32
CCDSL 560J 50	C15, C16, C27, C28, C88, C85
CCDSL 820J 50	C35, C36
CCDSL 151K 500	C43-C46
CKDYF 103Z 50	C50
CKDYF 103Z 500	C39, C40
CQMA 473K 50	C47, C48
CKDYX 473M 25	C78-C81
CQMA 122J 50	C11, C12
CQMA 183J 50	C9, C10
CQMA 563J 50	C23, C24
CQMA 683J 50	C13, C14
ACG-017	C62
ACG-004	C58
ACH-215	C52, C53

Note: When ordering resistors, convert the resistance value into code form, and then rewrite the part no. as before.

RESISTORS

Part No.	Symbol & Description
RD½ PM000J	R1-R8, R13, R14, R17, R18, R21-R50, R53, R54, R69, R70, R77-R79, R91-R93, R95, R105-R108
△ RD½ PMF000J	R19, R20, R51, R52, R55-R62, R73, R75, R103, R104
RN½ PQ000J	R9-R12, R15, R16
△ RD½ PSF000J	R63, R64, R76, R80
RD½ PS000J	R67, R68, R71, R72
△ RS 1P000J	R74, R94, R102
△ ACN-070	R65, R66

SEMICONDUCTORS

Part No.	Symbol & Description
2SC2602	Q1, Q2
2SC1919	Q3, Q4
2SC1815	Q5, Q6
2SA979	Q7, Q8
2SC1775A	Q9, Q10
2SA912	Q11, Q12
2SC1885	Q13, Q14, Q26
2SC 2275-Q	Q15, Q16
2SA 985-Q	Q17, Q18
2SC1914A	Q23, Q24
2SC1384	Q25
2SD712	Q27
1S2076	D1-D4, D18
(1S1555)	
1S2473	D5, D6
STV3H	D7, D8
10E2	D9, D10
(SIB01-02)	
GP-25D	D11-D14
MZ-130	D15
(WZ-130)	
MZ-270	D16
MZ-192	D17
(WZ-192)	

hfe should have the same rank

OTHERS

Part No.	Symbol & Description
ACT-130	VR1 Variable resistor
ASK-171	S3, S4, S7 Lever switch
ASK-172	S2 Lever switch
ASX-115	S1 Remote slide switch
△ ATT-577	T2 Heater transformer
AKB-063	Terminal
AKB-064	Terminal
ASR-033	Relay

Parts List of Tone Control Assembly (GWG-135)

CAPACITORS

Part No.	Symbol & Description
CQMA 303J 50	C63, C64
CQMA 124K 50	C65, C66
CQSA 270K 50	C67, C68
CQMA 122K 50	C69, C70
CQMA 562K 50	C73, C74

Note: When ordering resistors, convert the resistance value into code form, and then rewrite the part no. as before.

RESISTORS

Part No.	Symbol & Description
ACT-127 RD¼PM□□□	VR3, VR4 Variable resistor R81-R90, R101, R100

Parts List of Switch Assembly (GWS-215)

Part No.	Symbol & Description
ASE-003	S5 Slide rotary switch (SPEAKERS)
RS1P 331J	R96, R97
RD¼PM 563J	R98, R99

Parts List of Switch Assembly (GWS-216)

Part No.	Symbol & Description
ASX-113	S6 Slide rotary switch (FUNCTION)

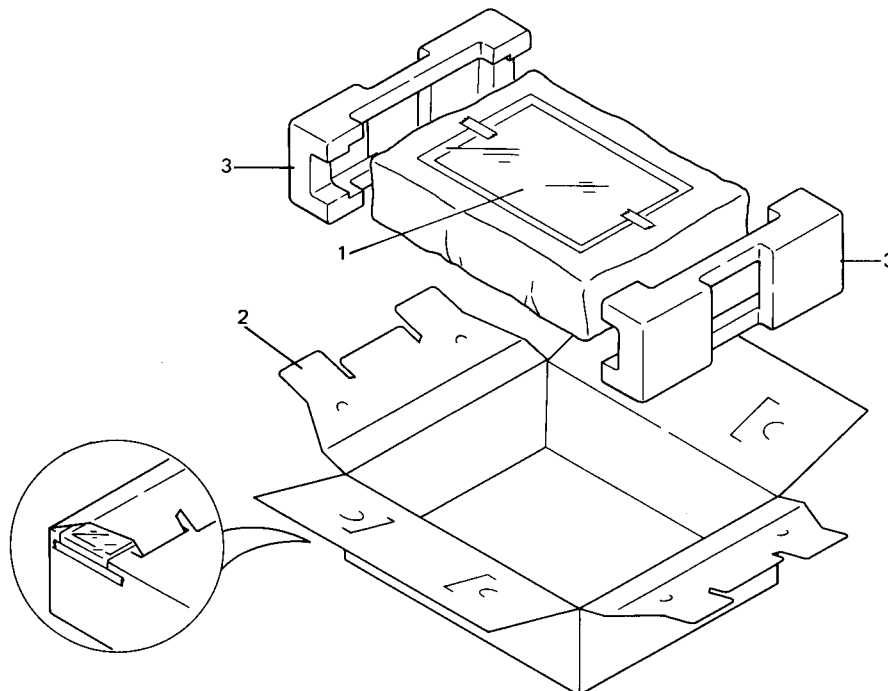
Parts List of Volume Assembly (GWX-459)

Part No.	Symbol & Description
ACV-184	VR2 Variable resistor (VOLUME)

Parts List of Headphones Assembly (GWX-460)

Part No.	Symbol & Description
AKN-023	Headphones jack

11. PACKING



Parts List

Key No.	Part No.	Description
1.	ARB-351	Operating instructions
2.	AHD-754	Packing case
3.	AHA-239	Side pad

PIONEER ELECTRONIC CORPORATION 4-1, Meguro 1-Chome, Meguro-ku, Tokyo 153, Japan
U.S. PIONEER ELECTRONICS CORPORATION 85 Oxford Drive, Moonachie, New Jersey 07074, U.S.A.
PIONEER ELECTRONIC (EUROPE) N.V. Luithagen-Haven 9, 2030 Antwerp, Belgium
PIONEER ELECTRONICS AUSTRALIA PTY. LTD. 178-184 Boundary Road, Braeside, Victoria 3195, Australia