

STEREO AMPLIFIER

# SA-6500

KCU

<ART-151-0>

# *Service Manual*



 **PIONEER®**

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# 1. SPECIFICATIONS

## Semiconductors

ICs	2
Transistors	25
Diodes	15

## Power Amplifier Section

Circuitry: 1-stage differential amplifier direct-coupled OCL

Continuous Power Output  
from 20 Hertz to 20,000 Hertz

(Both channels driven) . . . . 25 watts per channel (8 ohms)  
27 watts per channel (4 ohms)

Total Harmonic Distortion (20 Hertz to 20,000 Hertz)

Continuous rated power  
output: No more than 0.1%

13 watts per channel  
power output, 8 ohms: No more than 0.05%

1 watt per channel power  
output, 8 ohms: No more than 0.05%

Intermodulation Distortion

Continuous rated power  
output: No more than 0.1%

13 watts per channel  
power output, 8 ohms: No more than 0.05%

1 watt per channel power  
output, 8 ohms: No more than 0.05%

Output: Speaker

A,B,A+B

Headphone

Low impedance

Damping Factor (20 Hertz to

20,000 Hertz, 8 ohms): 30

Input Sensitivity/Impedance

PHONO: 2.5mV/50k ohms

MIC: 8mV/85k ohms

TUNER: 150mV/50k ohms

AUX: 150mV/50k ohms

TAPE PLAY: 150mV/50k ohms

TAPE PLAY (DIN

connector): 150mV/50k ohms

PHONO Overload Level (THD. 0.1%)

PHONO: 200mV (1kHz)

Output Level/Impedance

TAPE REC: 150mV

TAPE REC (DIN

Connector): 30mV/80k ohms

Frequency Response

PHONO (RIAA

Equalization): 30Hz to 15,000Hz,  $\pm 0.3$ dB

TUNER, AUX,

TAPE PLAY: 10Hz to 40,000Hz  $\pm 1$ dB

Tone Control

BASS: +9dB, -8dB (100Hz)

TREBLE: +8dB, -7dB (10kHz)

Loudness Contour (Volume

control set at -40dB

position): +8dB (100Hz), +5dB (10kHz)

Hum and Noise (IHF, short circuited A Network)

PHONO: 70dB

TUNER, AUX,

TAPE PLAY: 90dB

## Miscellaneous

Power Requirements: 120V, 60Hz

Power Consumption: 150 watts

Dimensions: 380(W)x139(H)x306(D)mm  
15(W)x5-1/2(H)x12-1/16(D) in.

Weight: Without package: 7.6kg (16 lb 12 oz)

With package: 8.8kg (19 lb 6 oz)

## Furnished Parts

Connection Cord with Pin Plugs . . . . . 1

Operating Instructions . . . . . 1

## NOTE:

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



## 2. FRONT PANEL FACILITIES

### POWER SWITCH

Set to ON position to activate the SA-6500 power supply.

### SPEAKERS SWITCH

Switch for selecting speaker systems.

OFF: Speakers cut off (headphones can be used).

A: To listen to speakers connected to the A speakers terminals.

B: To listen to speakers connected to the B speakers terminals.

A + B: To listen simultaneously to speaker systems connected to A and B speakers terminals.

### BASS AND TREBLE CONTROLS

Controls for adjusting the tone. Adjust low frequencies with the BASS control and high frequencies with the TREBLE control. Turn controls toward the right (+) to enhance and toward the left (-) to reduce their respective frequency ranges. The tone control circuit does not function unless the TONE switch is set to the ON position.

### PILOT LAMP

Lights when power is supplied to the SA-6500.

### VOLUME CONTROL

Adjusts volume from speakers and headphones. Volume increases with clockwise rotation.

### FUNCTION SWITCH

Switch for selecting desired program source.

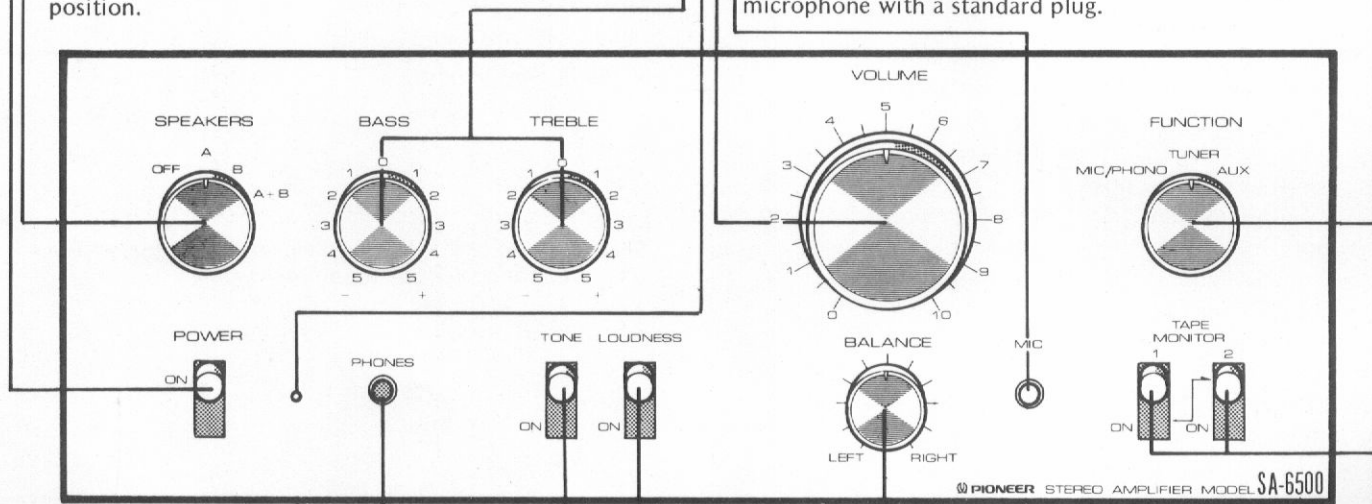
MIC/PHONO: To play records with turntable connected to the PHONO jacks. Also set to this position when using microphone.

TUNER: To listen to broadcasts with tuner connected to the TUNER jacks.

AUX: To play component connected to the AUX jacks.

### MIC JACK

When using a microphone, connect it to this jack. Employ a high impedance (approx. 50k-ohms) dynamic type microphone with a standard plug.



### PHONES JACK

To listen with stereo headphones, plug them firmly into this jack.

### TONE SWITCH

Normally set this switch to the lower ON position and adjust tone with the BASS and TREBLE controls. When set to the upper OFF position, the tone circuit is bypassed and a flat frequency response obtained. This is convenient for checking the tone of the phono cartridge and speakers, etc. and determining listening room acoustics.

### LOUDNESS SWITCH

Set to ON when listening at low volume to enhance low and high frequencies. The human ear possesses different response when listening at high and low volumes so this switch compensates for the difference to provide more pleasant low volume sound.

### BALANCE CONTROL

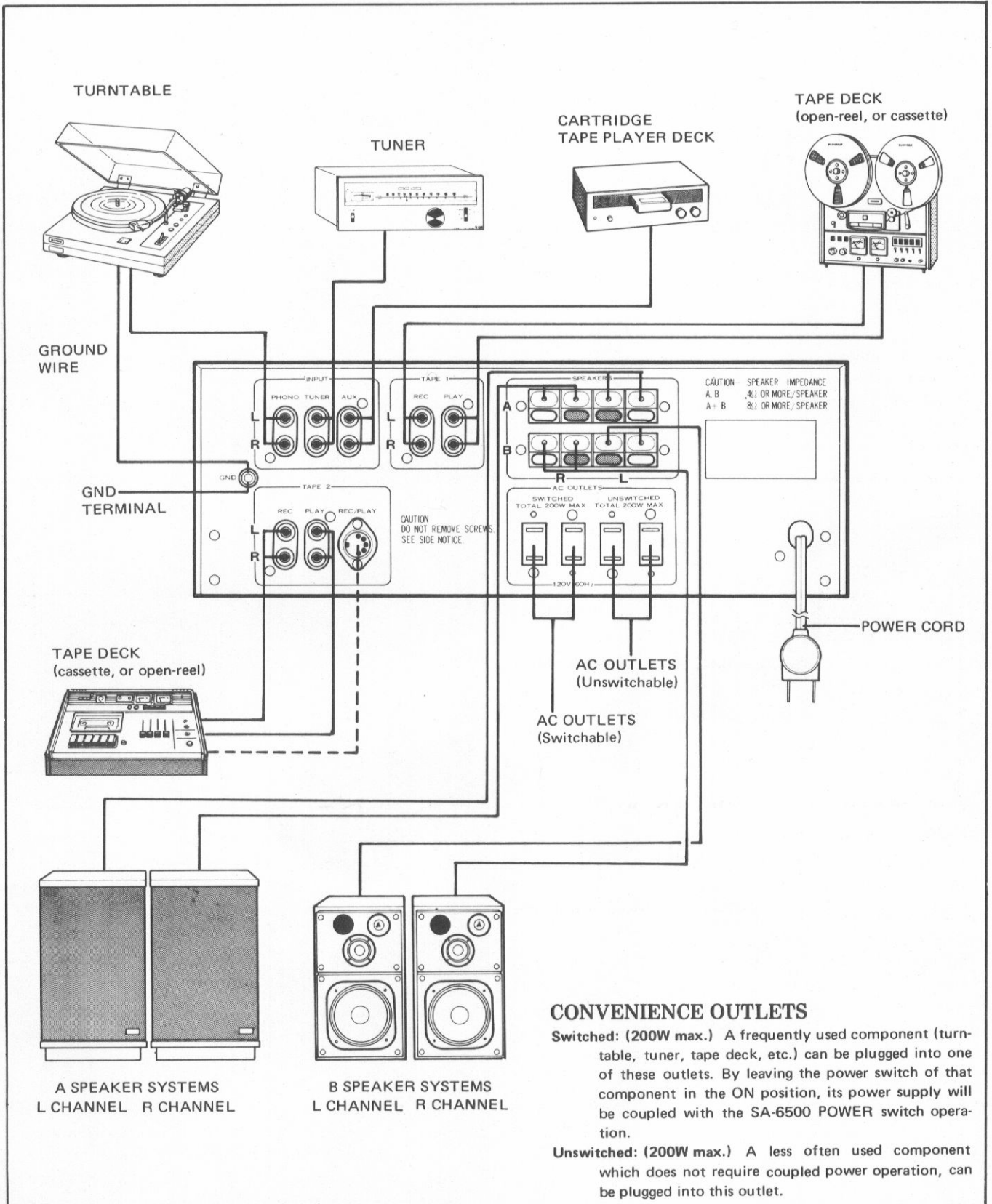
Adjusts volume balance between left and right speaker systems and headphones. Turning the control toward the right reduces the left channel output, while turning it toward the left reduces the right channel output.

### TAPE MONITOR SWITCHES

- 1: Set to ON to play a tape or monitor a recording with a tape deck connected to the TAPE 1 jacks.
  - 2: Set to ON to play a tape or monitor a recording with a tape deck connected to the TAPE 2 jacks or the DIN REC/PLAY jack.
- Set both switches to the upper (OFF) position when playing another program source. If set to ON, sound will not be obtained from speakers or headphones.
  - Do not operate the TAPE 1 switch when recording simultaneously with two tape decks.



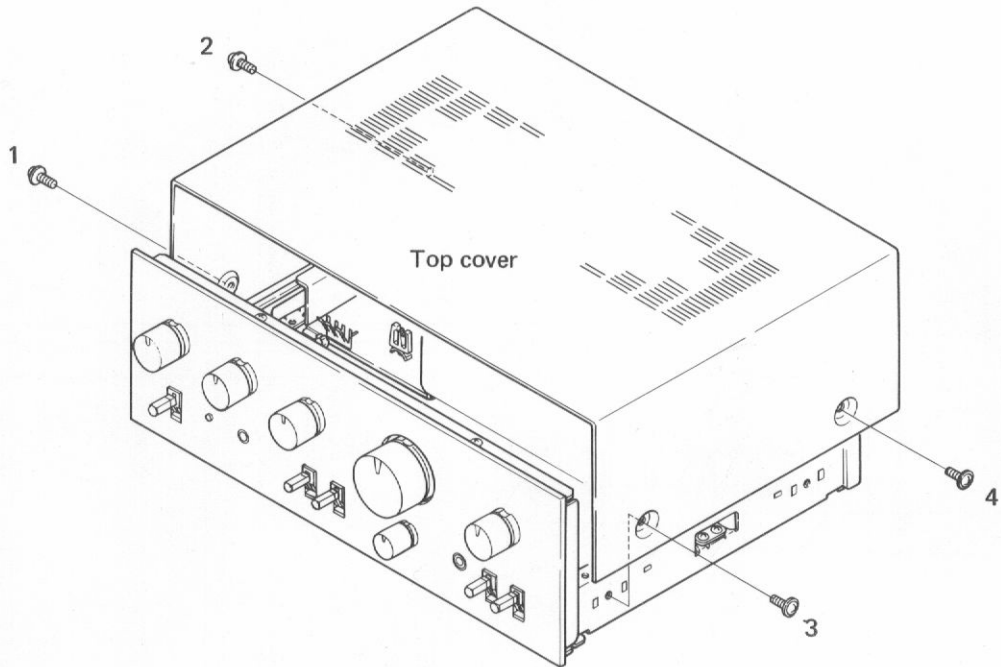
### 3. CONNECTION DIAGRAM



## 4. DISASSEMBLY

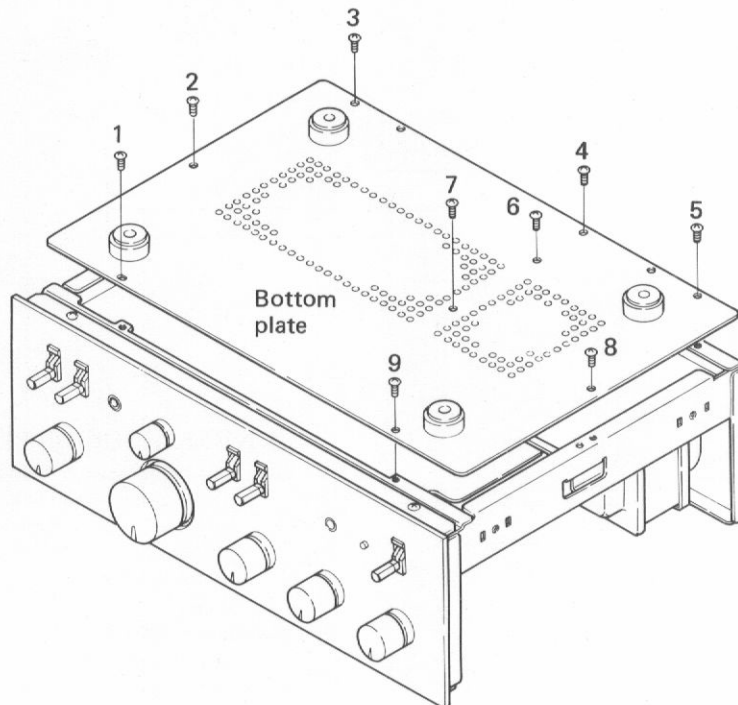
### 1. Removing the Top Cover

Remove the 2 screws on each side of the top cover.



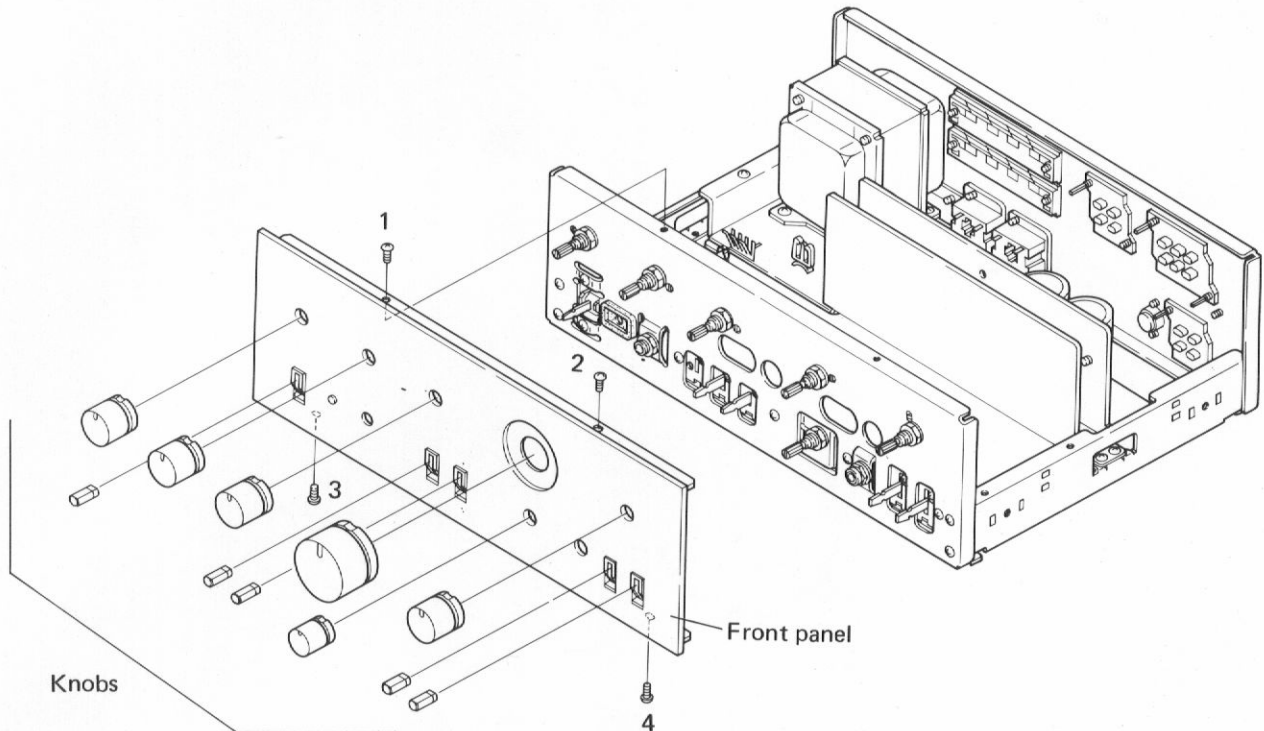
### 2. Removing the Bottom Plate

Remove the 9 screws to detach the bottom plate.



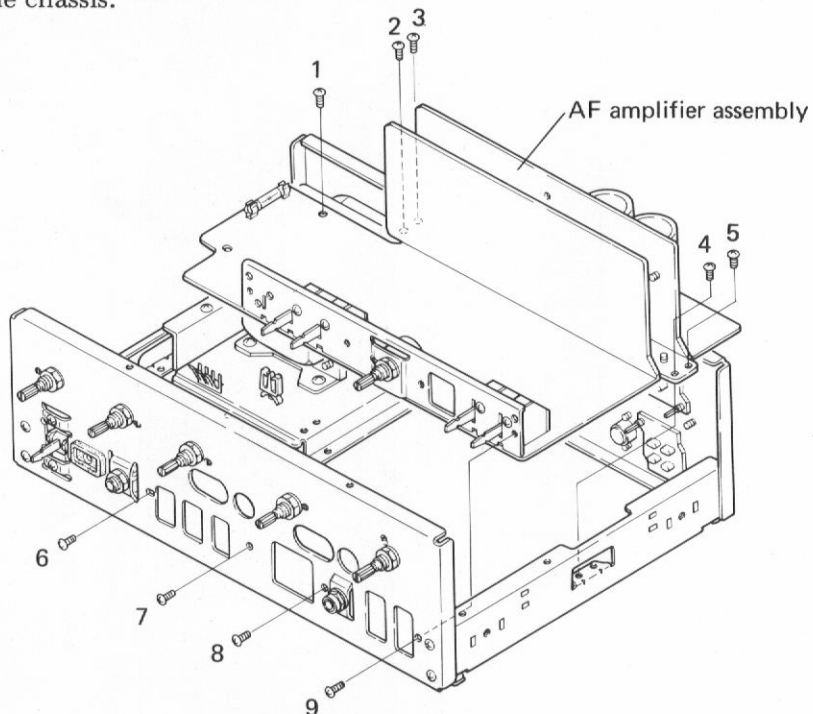
### 3. Removing the Front Panel

1. Remove all control knobs by pulling.
2. Remove the 4 screws to detach the front panel.



### 4. Removing the AF Amplifier Assembly

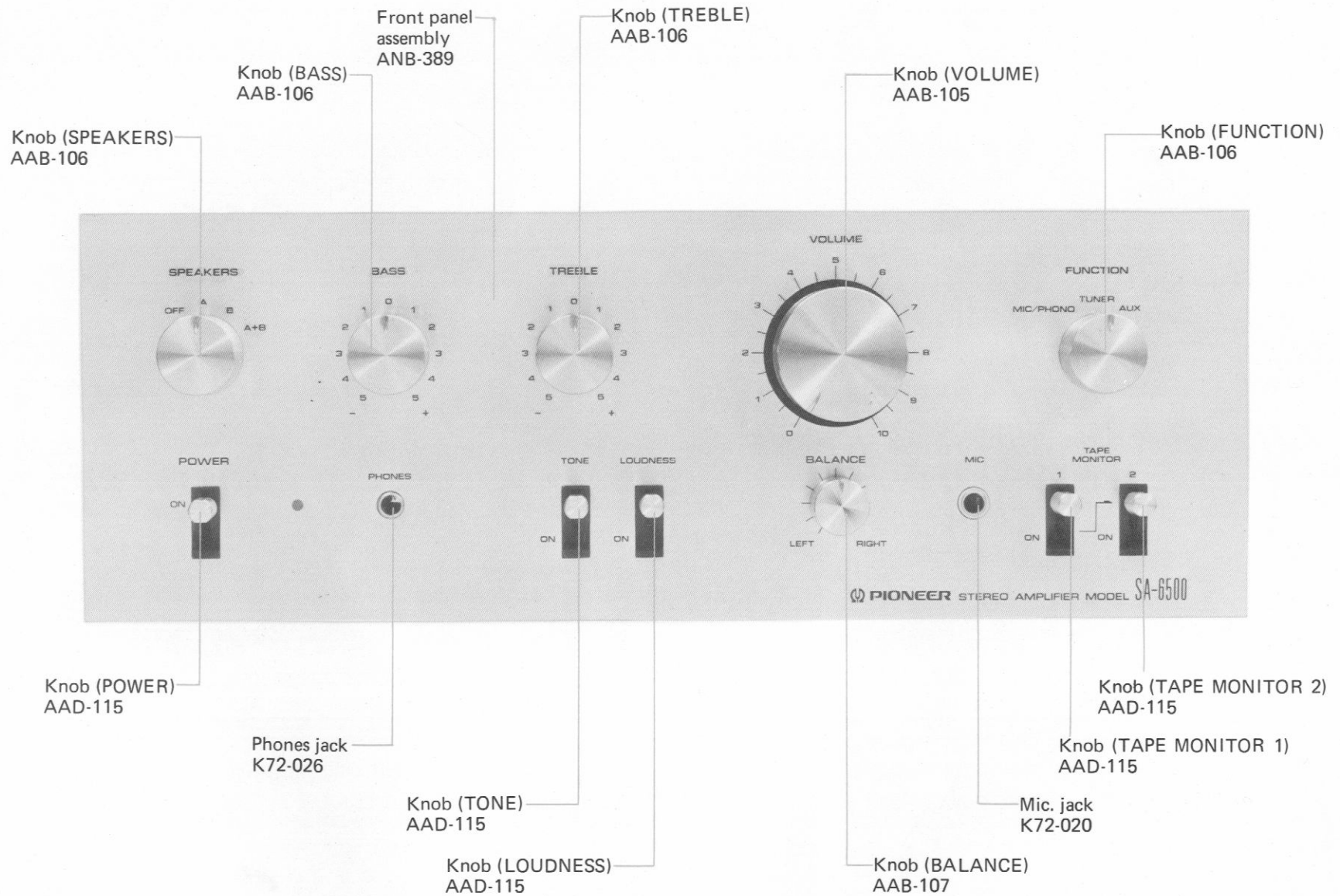
1. Remove the top cover, bottom plate and front panel.
2. Remove the 9 screws which mount the printed circuit board on the chassis.



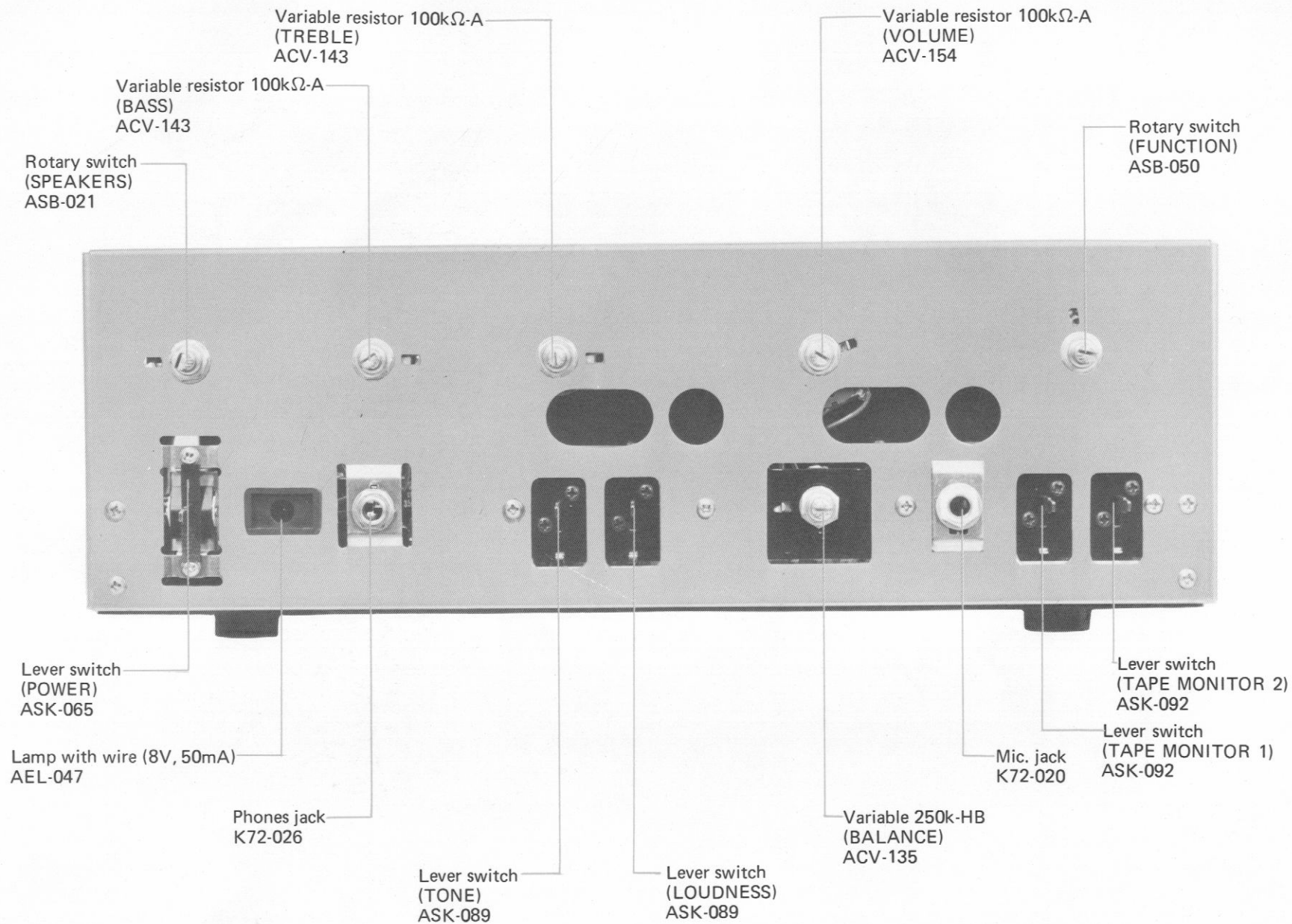


# 5. PARTS LOCATION

## 1. Front Panel View



## 2. Front View with Panel Removed



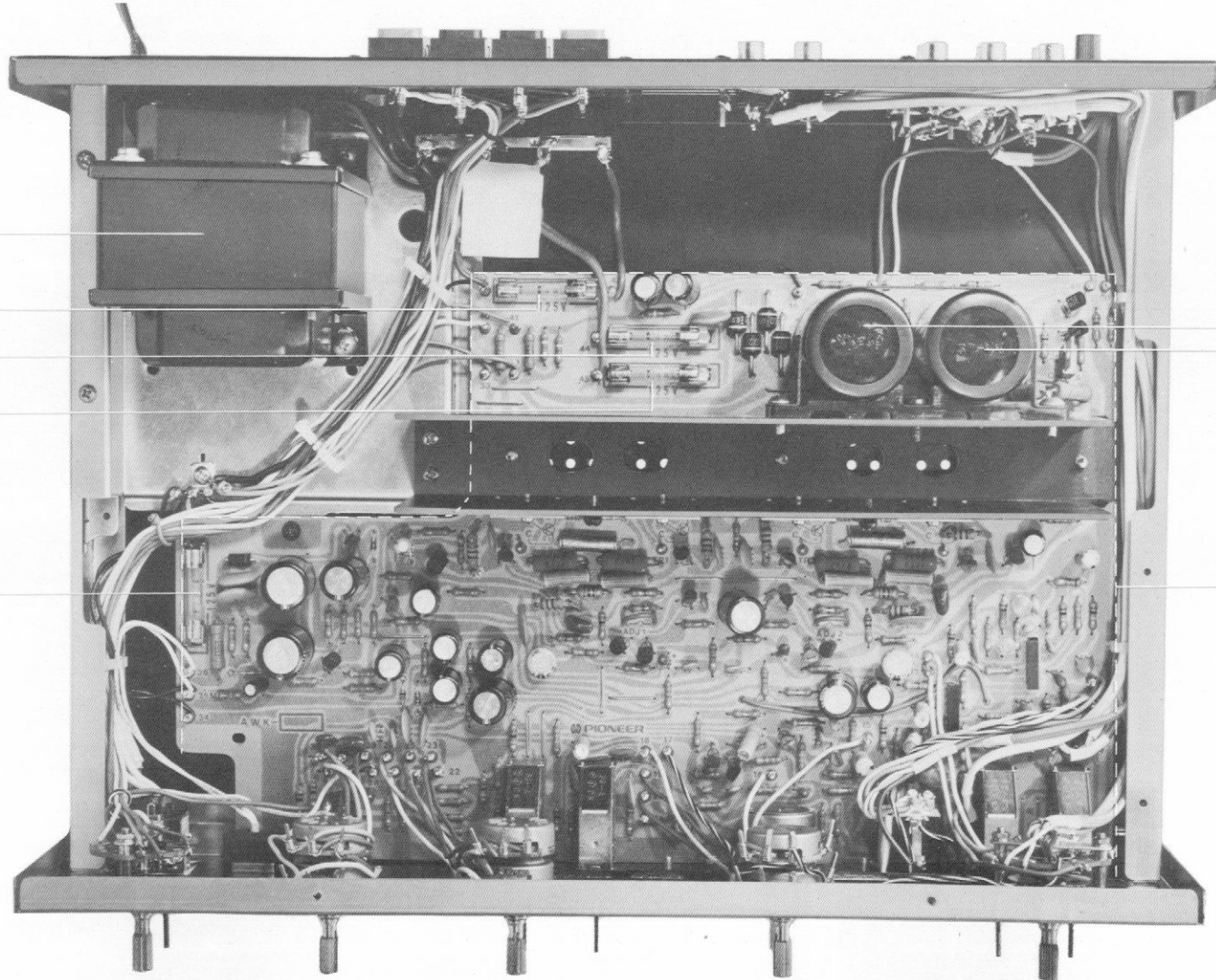
### 3. Top View

Power transformer  
ATT-285  
Fuse 4A  
AEK-100  
Fuse 5A  
AEK-108  
Fuse 5A  
AEK-108

Electrolytic capacitor  
8,200 $\mu$ F 35V  
ACH-058

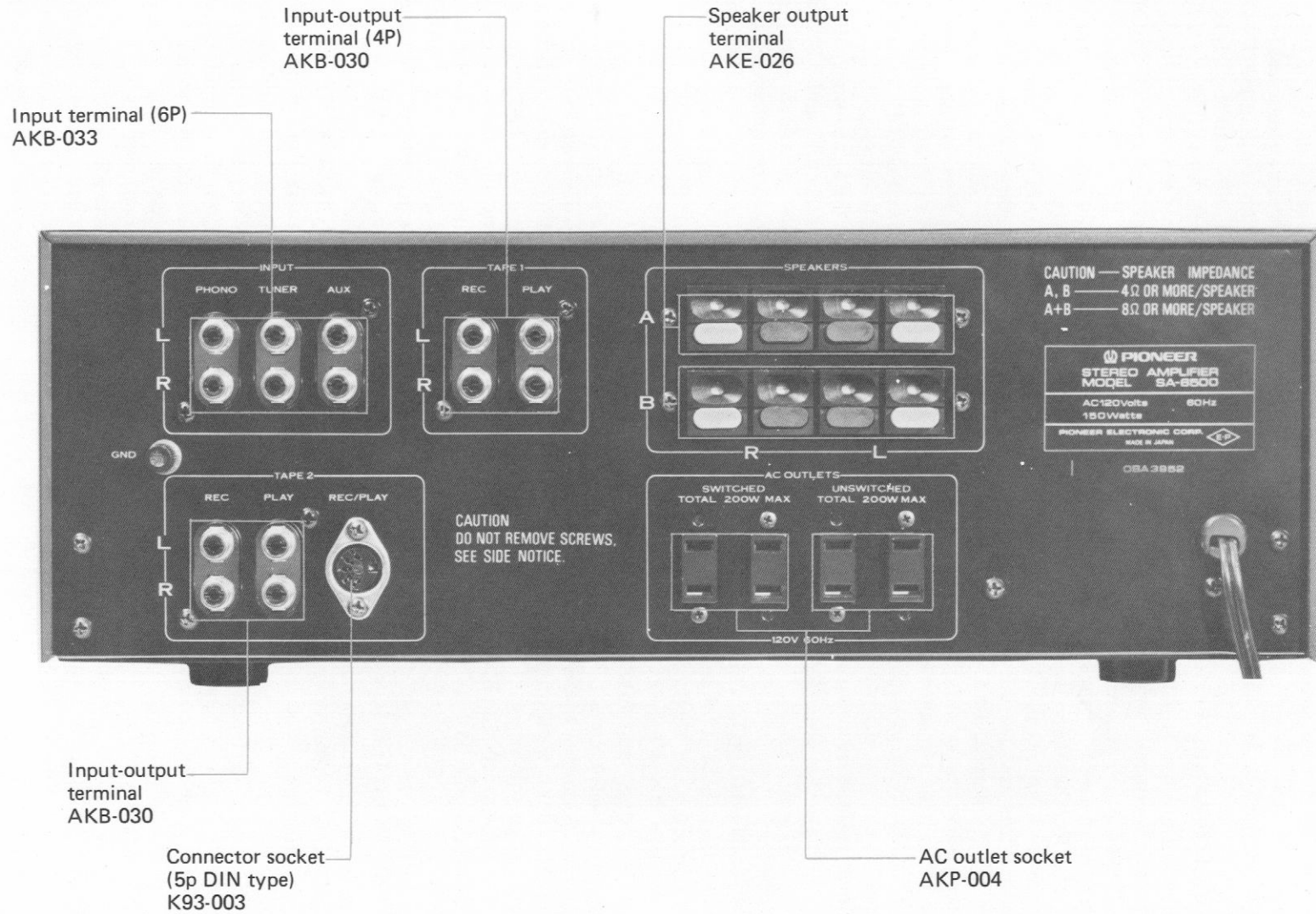
Fuse 1A  
AEK-106

AF assembly  
assembly  
AWK-052





#### 4. Rear View



## 6. CIRCUIT DESCRIPTION

The SA-6500 is a 2-channel integrated stereo amplifier. The descriptions given here mainly refer to the left channel. Please refer to the block diagram on pages 15 to 16.

### 6.1 EQUALIZER AMPLIFIER (Q1)

The equalizer amplifier is a high gain IC with a first stage differential amplifier, final stage emitter-follower and 3 stages direct coupled. The RIAA curve is derived from sufficient negative feedback, and for the elements which govern the RIAA response is obtained, 1% tolerance metalized film resistors and 2% tolerance polystyrene capacitors are employed. RIAA deviation in the range from 30Hz to 15,000Hz is guaranteed within  $\pm 0.3$ dB of the standard value. At the same time, high reliability is obtained with respect to thermal variations and aging. Since this IC also possesses high voltage endurance (43V), maximum nominal input at 1kHz is 200mVrms (at 0.1% H.D.).

### 6.2 TONE CONTROL (Q2, Q3)

A CR network tone control system is used. The attenuator circuits used each consist of a capacitor and a resistor. They increase and decrease the relative levels of high and low frequency sound. Because the attenuator gives relative control over the frequency response, there is constant loss. To compensate for this, an amplifier (Q2, Q3) is employed prior to this stage.

The control ranges are +8dB to -7dB for the highs (at 10kHz) and +9dB to -8dB for the lows (at 100Hz).

### 6.3 POWER AMPLIFIER (Q4 - Q11)

This is a basic direct-coupled pure complementary OCL amplifier. Its operation is stabilized by the differential amplifier which is driven by a balanced power supply.

Q4 and Q5 form a differential amplifier: 100% d.c. feedback is applied from the junction point of the power stage to the base of Q5 so the potential of the junction point is always maintained at the same level.

The driver and output stages are Darlington connected and a perfectly complementary symmetrical circuit is formed using PNP and NPN transistors; this ensures dynamic balance at different inputs.

### 6.4 MUTING CIRCUIT (Fig. 1)

This muting circuit, shown in Fig. 1, functions to reduce shock noise and residual sound when the POWER switch is operated ON-OFF.

POWER switch ON muting: Q15 base is immediately reverse biased by -B1 and becomes OFF. Q14 emitter voltage gradually increases due to the gradual charging of C3 in the base circuit by +B1 through R4 - R6. Since the power amplifier first stage and predriver obtain voltage supply from Q14 emitter, operation begins 2 to 3 seconds after the POWER switch has been set to ON. This delay time is determined by the time constant of R4 - R6 and C3. Since the equalizer and tone amplifiers attain normal operation during this interval, shock noise produced in these circuits when the POWER switch is set to ON does not reach the output.

POWER switch OFF muting: -B1 immediately reaches ground potential and +B2 forward biases Q15 base through R8. Q15 becomes ON, C3 is discharged, and Q14 becomes OFF. Consequently, the power amplifier first stage and predriver stage also become OFF and residual sound does not reach the output. Since Q16 becomes ON at the same time of Q15 operation, C4 is immediately discharged. This circuit is designed to prevent disturbance to the power amplifier DC balance when the POWER switch is set to ON immediately after setting to OFF. If the power switch set to ON while C4 has not discharged, Q7 (Constant current circuit) becomes ON and the predriver stage begin to operate before the first stage operation. The result in, the DC balance is disturbed. C4 is therefore discharged when the POWER switch is set to OFF.

### 6.5 PROTECTION CIRCUIT (Fig. 2)

This circuit protects the speakers from any possible damage. Then a potential of more than +4V or less than -4V occurs at the junction point in the power amplifier, this circuit causes the fuse in the secondary side of the power transformer to blow within 2 seconds. This cuts off the power amplifier's power supply.

D1 is a tri-electrode AC switch (a type of thyristor) which can control switching in either direction by means of its gate signal. Both positive and negative gate signals turn it ON.

The bases of Q12 and Q13 are connected to the junction point of the power amplifier. The emitters of Q12 and Q13 are connected to the gate of D1 and the emitter resistor  $R_E$  is common to both (Fig. 2).

When a positive potential occurs at the junction point of the power amplifier, current flows through the NPN transistor Q12 but not through PNP transistor Q13. Current flowing through Q12 to  $R_E$  causes the voltage across  $R_E$  to drop. Because of this, positive voltage is supplied to the gate of D1.

When a negative potential occurs at the junction point of the power amplifier, current flows through Q13 and not through Q12.

Due to this the voltage drop across  $R_E$  causes a negative voltage at the gate of D1.

When the potential at the junction point of the power amplifier exceeds  $\pm 4V$ , the voltage drop across  $R_E$  exceeds the gate trigger voltage of D1, which turns D1 ON. With D1 turned ON, a large current flows through the power circuit which blows the fuse on the secondary side of the power transformer.

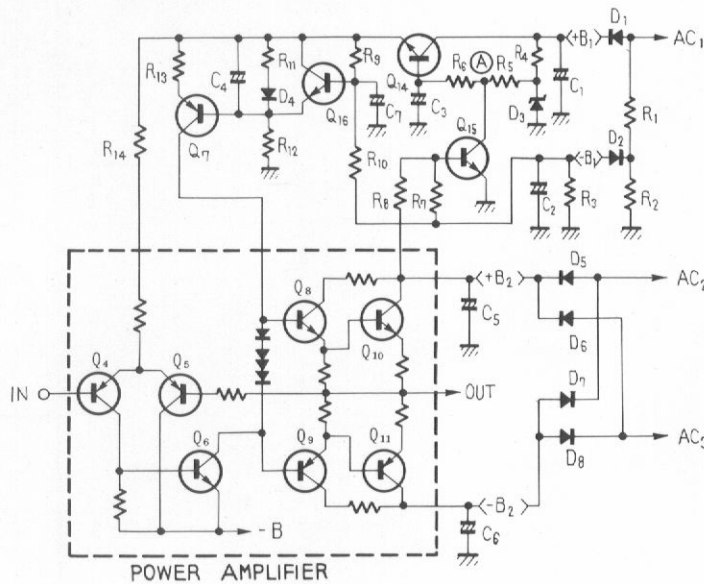


Fig. 1 Muting Circuit

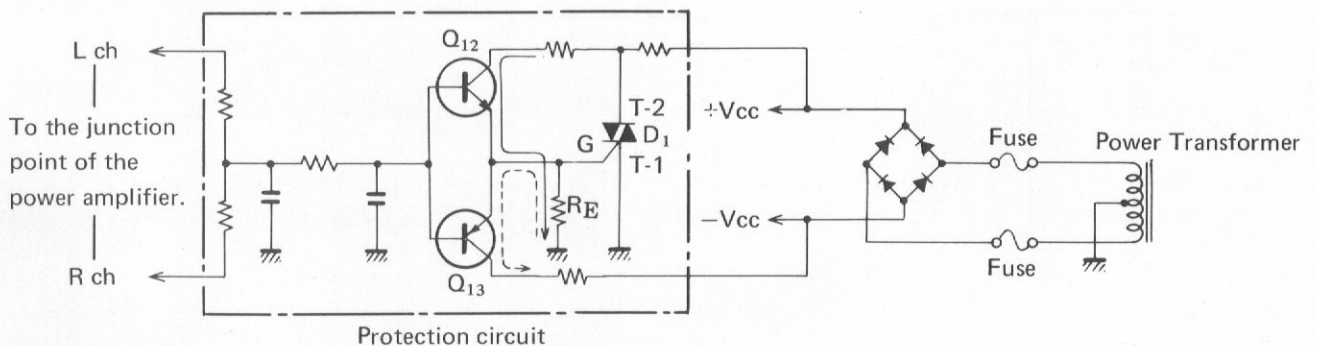
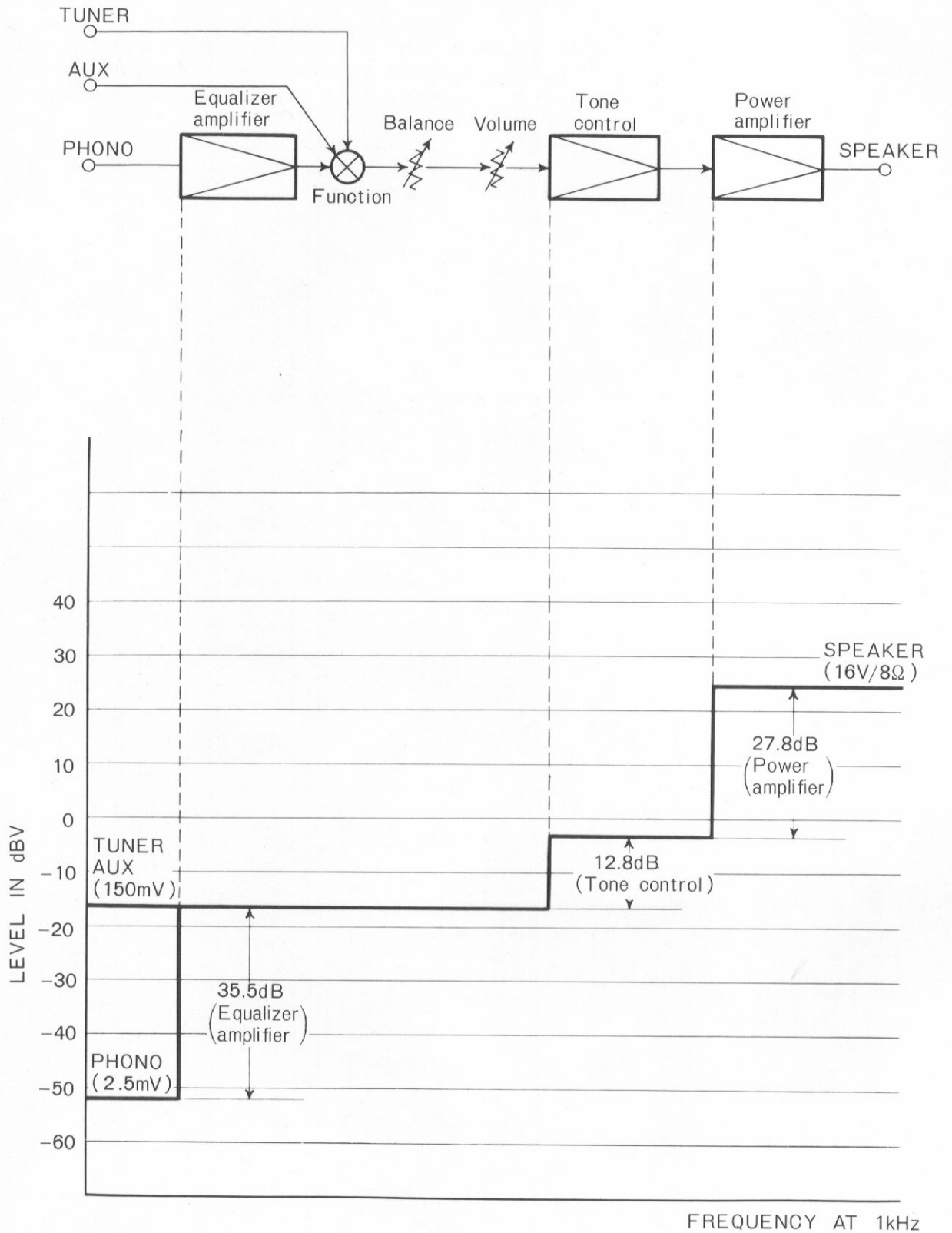


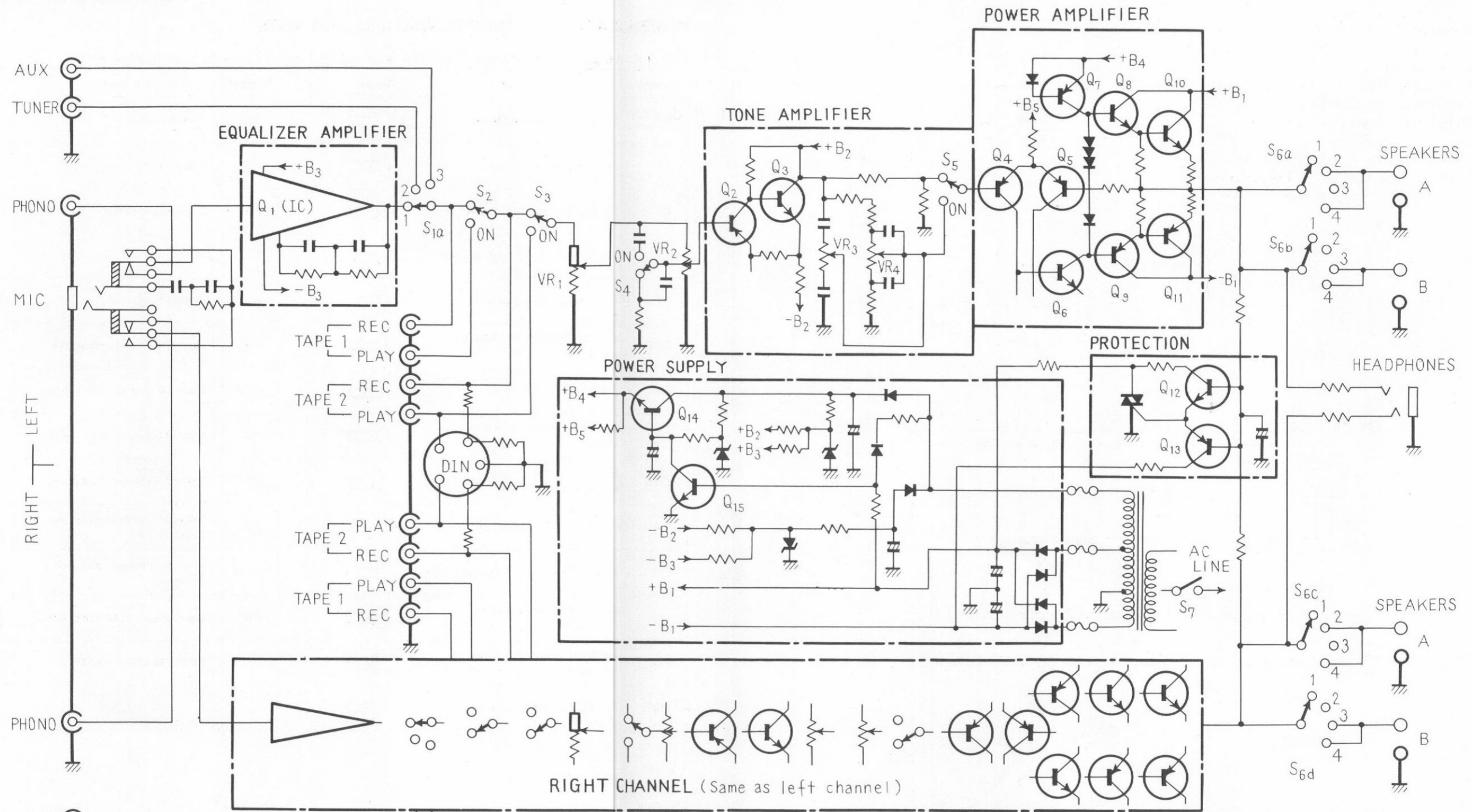
Fig. 2 Protection circuit



# 7. LEVEL DIAGRAM



# 8. BLOCK DIAGRAM



NOTES :

- S<sub>1</sub> : FUNCTION  
1. PHONO 2. TUNER 3. AUX
- S<sub>2</sub> : TAPE MONITOR 1  
OFF ↔ ON
- S<sub>3</sub> : TAPE MONITOR 2  
OFF ↔ ON

- S<sub>4</sub> : LOUDNESS  
OFF ↔ ON
- S<sub>5</sub> : TONE  
OFF ↔ ON
- S<sub>6a~d</sub> : SPEAKERS  
1. SP OFF 2. A 3. B 4. A+B

- S<sub>7</sub> : POWER  
OFF ↔ ON

- VR<sub>1</sub> : BALANCE
- VR<sub>2</sub> : VOLUME
- VR<sub>3</sub> : TREBLE
- VR<sub>4</sub> : BASS

## 9. ADJUSTMENT

- This adjustment should be performed only when any of the transistors in the power amplifier have been replaced.
  - For adjustment, wait 10 minutes after the POWER switch is turned ON.
1. Set the VOLUME control to minimum.
  2. Connect as shown in Fig. 3.
  3. Cut the jumper lead A (right channel, B: for left channel), if the voltage is less than 10mV reading on the DC millivolt meter.

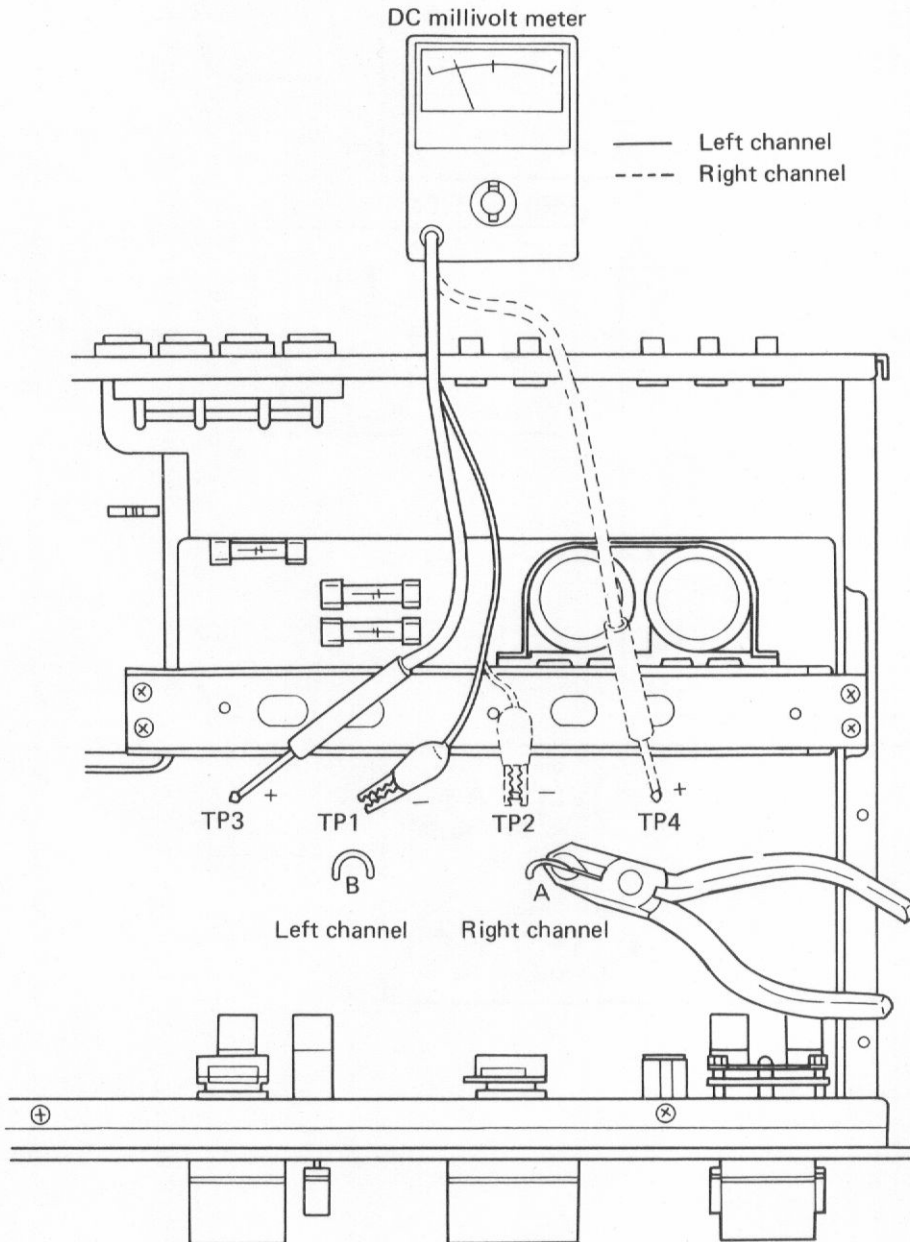







































Fig. 3 Connection Diagram of Idle Current Adjustment

# 10. EXPLODED VIEWS

## NOMENCLATURE OF SCREWS, WASHERS AND NUTS

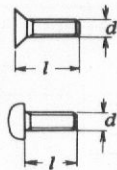
The following symbols stand for screws, washers and nuts as shown in exploded view.

Symbol	Description	Shape
RT	Brazier head tapping screw	
PT	Pan head tapping screw	
BT	Binding head tapping screw	
CT	Countersunk head tapping screw	
TT	Truss head tapping screw	
OCT	Oval countersunk head tapping screw	
PM	Pan head machine screw	
CM	Countersunk head machine screw	
OCM	Oval countersunk head machine screw	
TM	Truss head machine screw	
BM	Binding head machine screw	
PSA	Pan head screw with spring lock washer	
PSB	Pan head screw with spring lock washer and flat washer	
PSF	Pan head screw with flat washer	

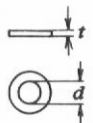
Symbol	Description	Shape
EW	E type washer	 
FW	Flat washer	 
SW	Spring lock washer	 
N	Nut	 
WN	Washer faced nut	 
ITW	Internal toothed lock washer	 
OTW	Outernal toothed lock washer	 
SC	Slotted set screw (Cone point)	 
SF	Slotted set screw (Flat point)	 
HS	Hexagon socket headless set screw	 
OCW	Oval countersunk head wood screw	
CW	Countersunk head wood screw	
RW	Round head wood screw	

### EXAMPLE

PM 3x8  
 length in mm ( $l$ )  
 diameter in mm ( $d$ )  
 Symbol

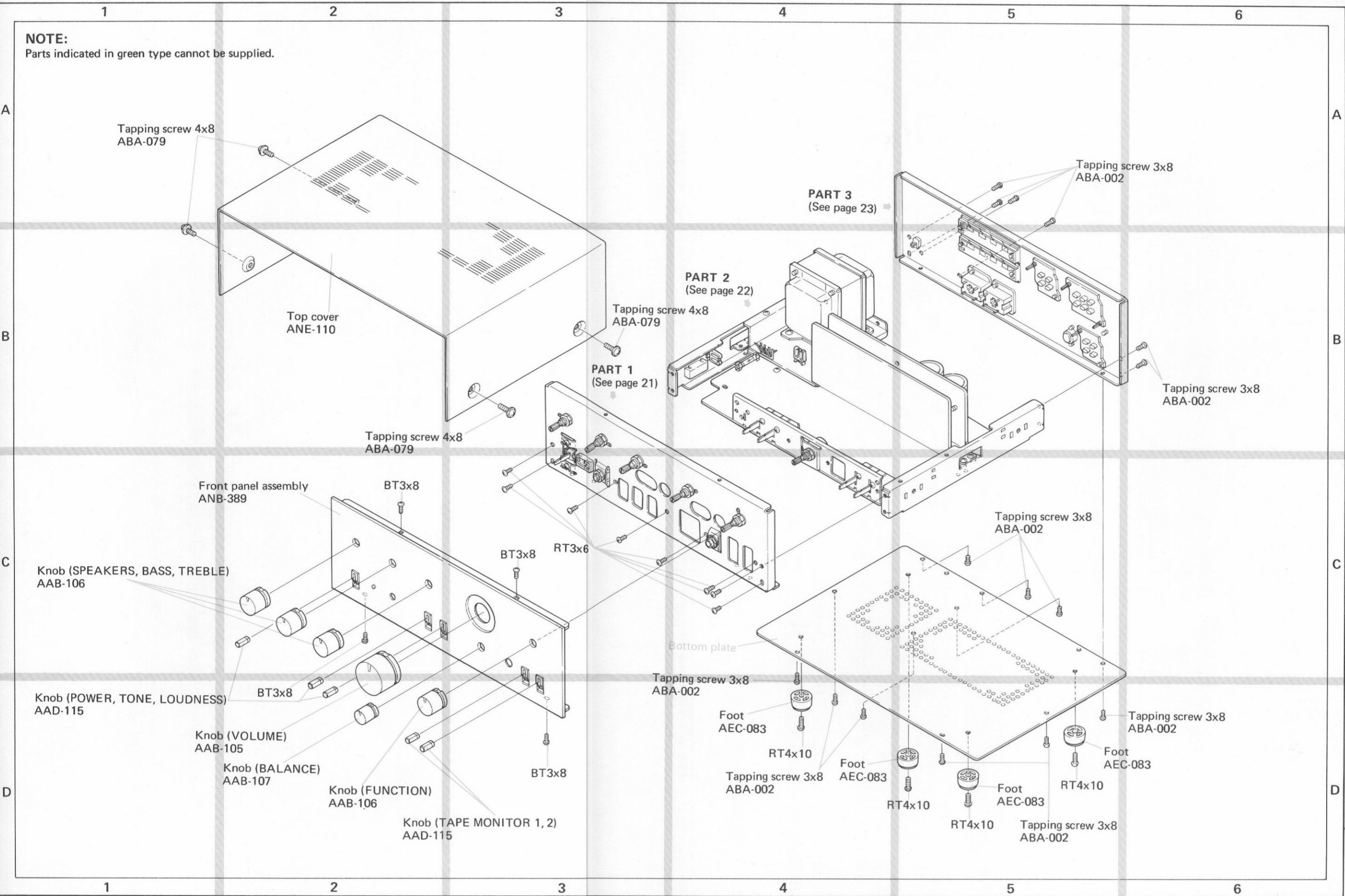


FW 9 $\phi$ x1<sup>t</sup>  
 thickness in mm ( $t$ )  
 diameter in mm ( $d$ )  
 Symbol





**NOTE:**  
Parts indicated in green type cannot be supplied.



**PART 1**

**NOTE:**

Part indicated in green type cannot be supplied.

A

B

C

D

A

B

C

D

1

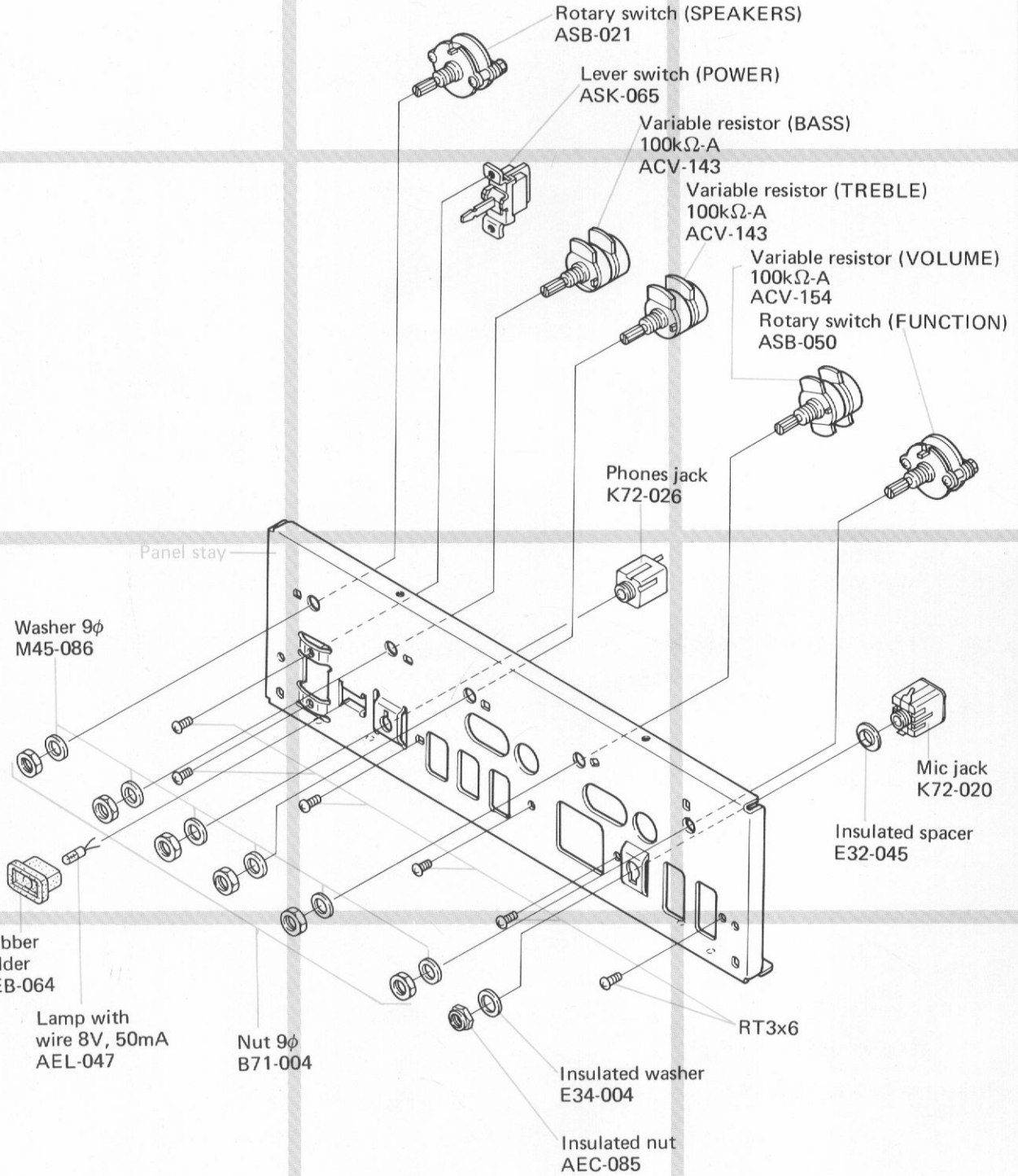
2

3

1

2

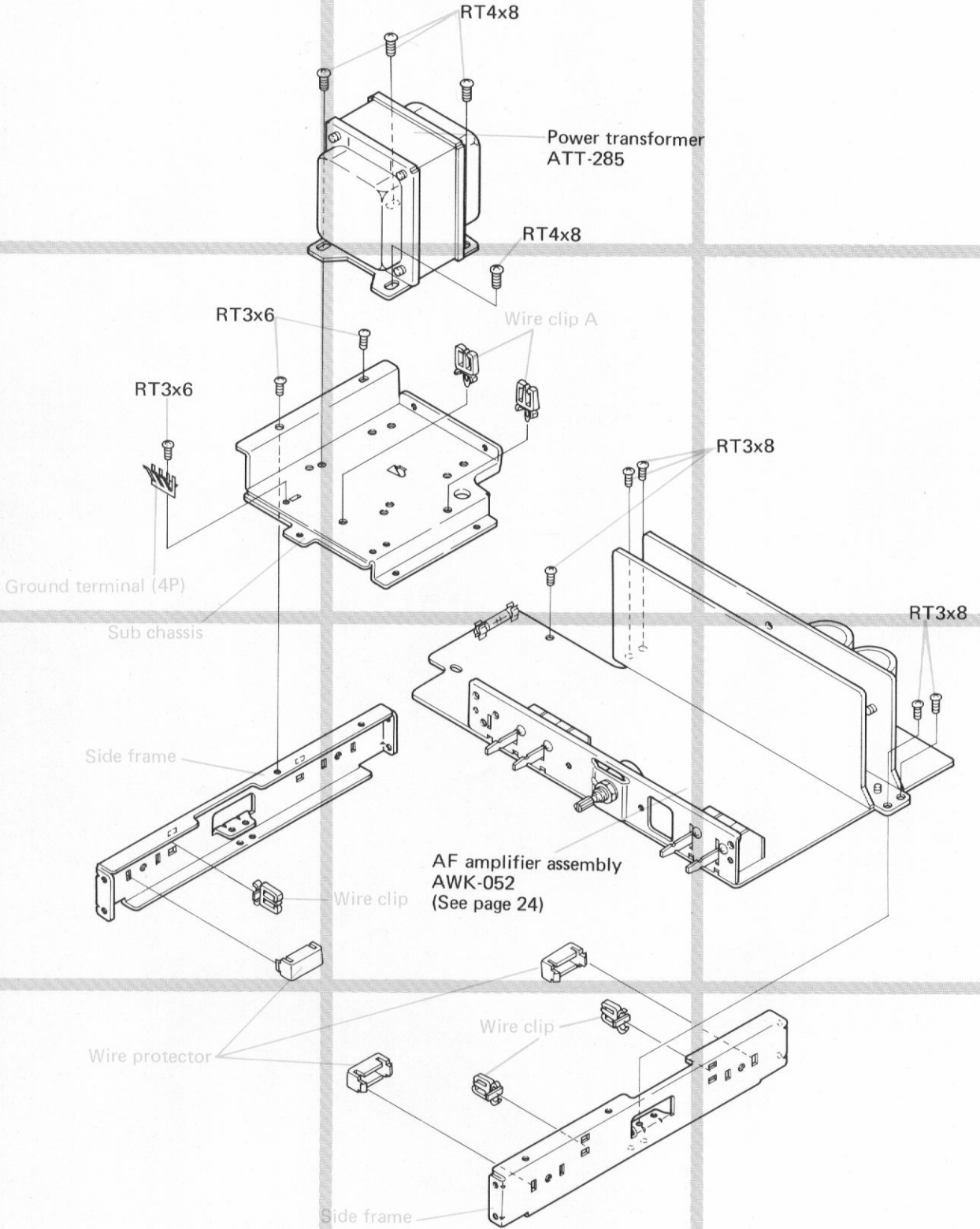
3



**PART 2**

**NOTE:**

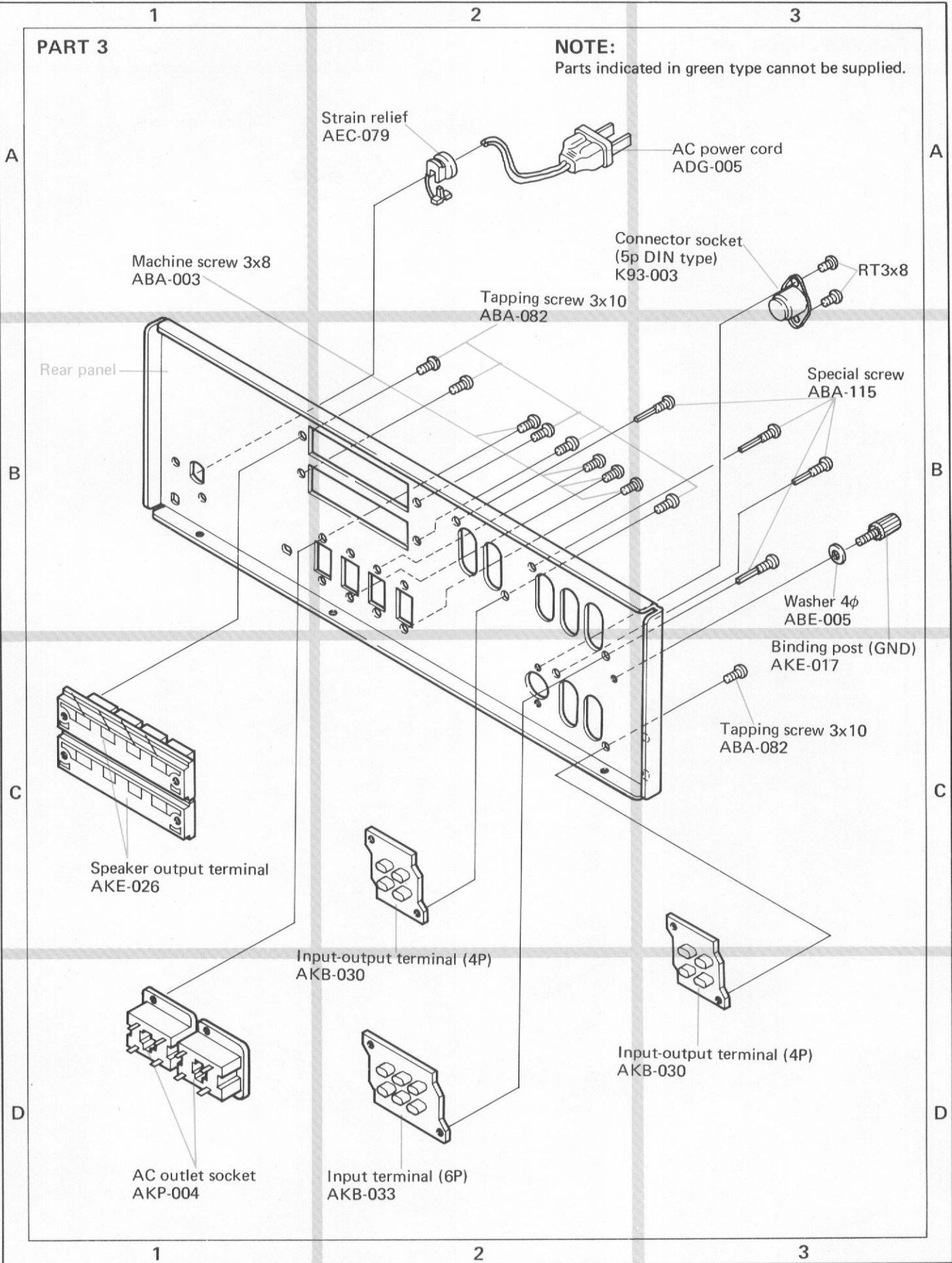
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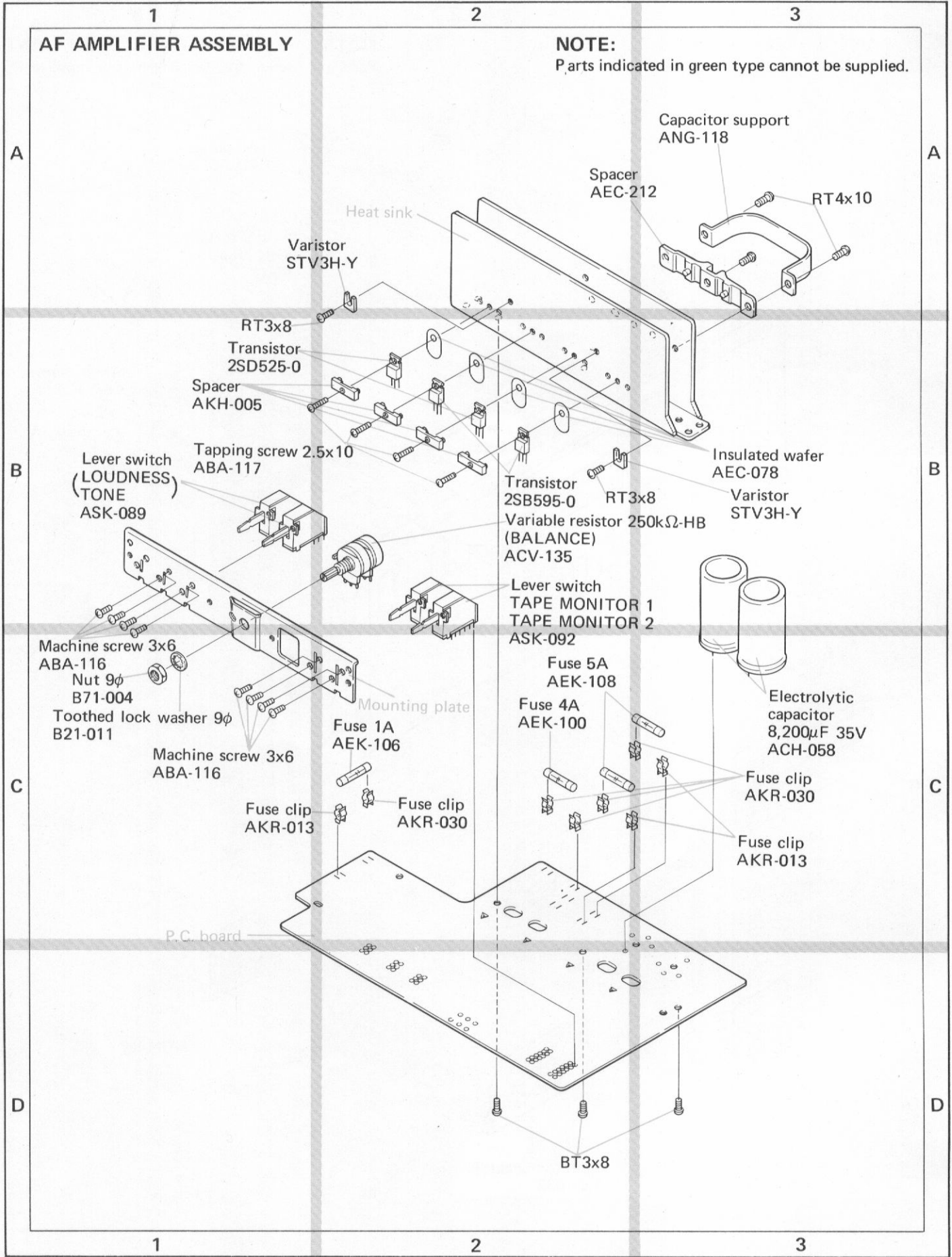
**PART 3**

**NOTE:**

Parts indicated in green type cannot be supplied.







# 11. SCHEMATIC DIAGRAMS, P.C. BOARD PATTERN AND PARTS LIST

## 11.1 SCHEMATIC DIAGRAM AND MISCELLANEOUS PARTS

### Miscellaneous Parts List

NOTE:

- Capacitors: in  $\mu F$  unless otherwise noted p:pF
- Resistors: in  $\Omega$ ,  $\frac{1}{4}W$  unless otherwise noted k:k $\Omega$ , M:M $\Omega$

### SWITCHES

Symbol	Description	Part No.
S1	Rotary switch (FUNCTION)	ASB-050
S6	Rotary switch (SPEAKERS)	ASB-021
S7	Lever switch (POWER)	ASK-065

### TRANSFORMER

Symbol	Description	Part No.
T1	Power transformer	ATT-285

### RESISTOR AND POTENTIOMETERS

Symbol	Description	Part No.
R1	Carbon film 39k	RD $\frac{1}{4}$ PS 393J
VR2	Variable resistor (VOLUME)100k-A	ACV-154
VR3	Variable resistor (TREBLE) 100k-A	ACV-143
VR4	Variable resistor (BASS) 100k-A	ACV-143

### CAPACITORS

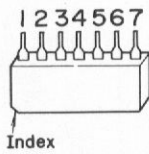
Symbol	Description	Part No.
C1	Ceramic 0.01 150V	ACG-003
C2	Ceramic 0.01 150V	ACG-003
C3	Ceramic 0.047 25V	CKDBC 473Z 25
C4	Ceramic 0.047 25V	CKDBC 473Z 25
C5	Ceramic 0.047 25V	CKDBC 473Z 25
C6	Ceramic 0.047 25V	CKDBC 473Z 25
C7	Ceramic 0.047 25V	CKDBC 473Z 25
C8	Ceramic 2700p 50V	CKDYB 272K 50
C9	Ceramic 4700p 50V	CKDYB 472Z 50

### LAMP AND FUSES

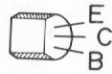
Symbol	Description	Part No.
PL1	Lamp with wire 8V 50mA	AEL-047
FU1	Fuse (Primary) 4A	AEK-100
FU2	Fuse (Secondary) 1A	AEK-106
FU3	Fuse (Secondary) 5A	AEK-108
FU4	Fuse (Secondary) 5A	AEK-108

## External Appearance of Transistors and IC

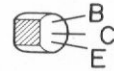
TA7136P



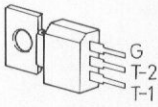
2SC1735  
2SA850



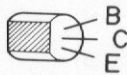
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2SC1222  
2SC945A  
2SA733  
2SC1318  
2SC1438



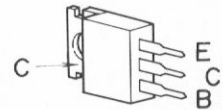
SM2B41



2SA777

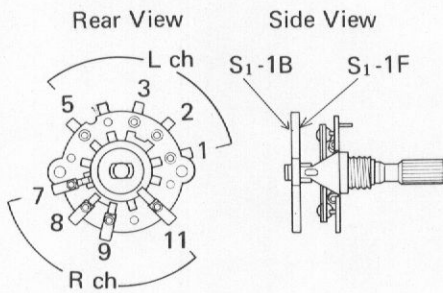


2SB595  
2SD525

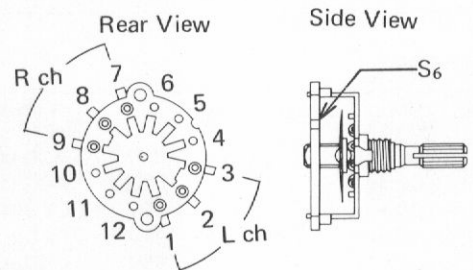


## Diagram of Rotary Switches

S<sub>1</sub>: FUNCTION switch

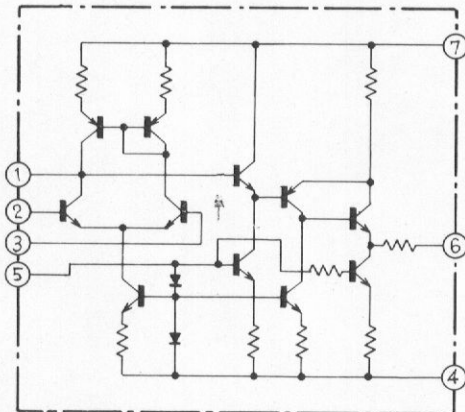


S<sub>6</sub>: SPEAKERS switch



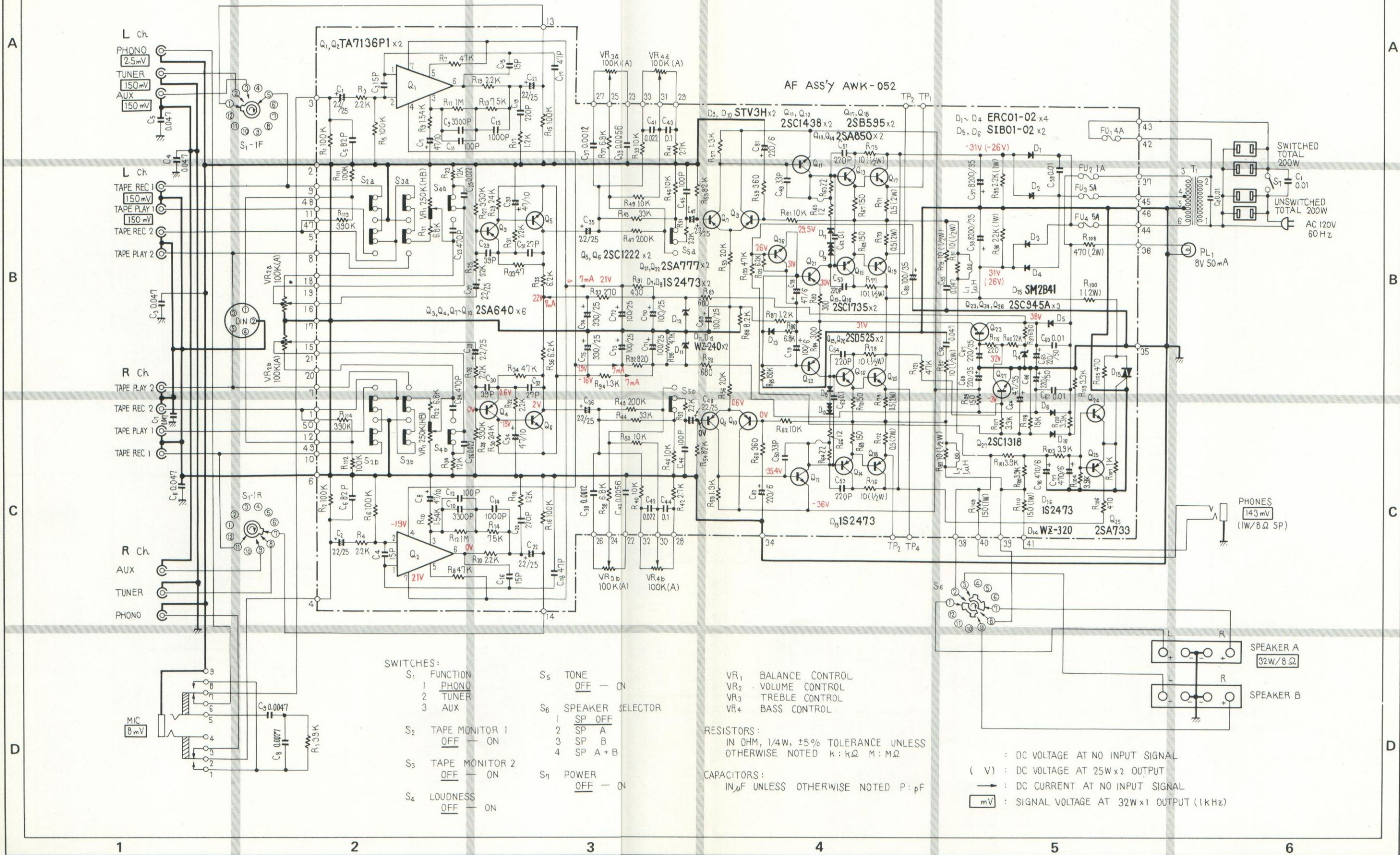
## Circuit Diagram of IC

TA7136P





Schematic Diagram



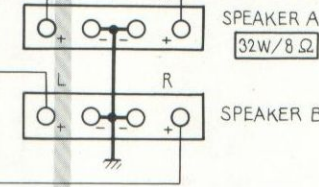
- SWITCHES:**
- S<sub>1</sub> FUNCTION
    - 1 PHONO
    - 2 TUNER
    - 3 AUX
  - S<sub>2</sub> TAPE MONITOR 1
    - OFF — ON
  - S<sub>3</sub> TAPE MONITOR 2
    - OFF — ON
  - S<sub>4</sub> LOUDNESS
    - OFF — ON
  - S<sub>5</sub> TONE
    - OFF — ON
  - S<sub>6</sub> SPEAKER SELECTOR
    - 1 SP OFF
    - 2 SP A
    - 3 SP B
    - 4 SP A + B
  - S<sub>7</sub> POWER
    - OFF — ON

- VR<sub>1</sub> BALANCE CONTROL  
 VR<sub>2</sub> VOLUME CONTROL  
 VR<sub>3</sub> TREBLE CONTROL  
 VR<sub>4</sub> BASS CONTROL

**RESISTORS:**  
 IN OHM, 1/4W, ±5% TOLERANCE UNLESS OTHERWISE NOTED K: KΩ M: MΩ

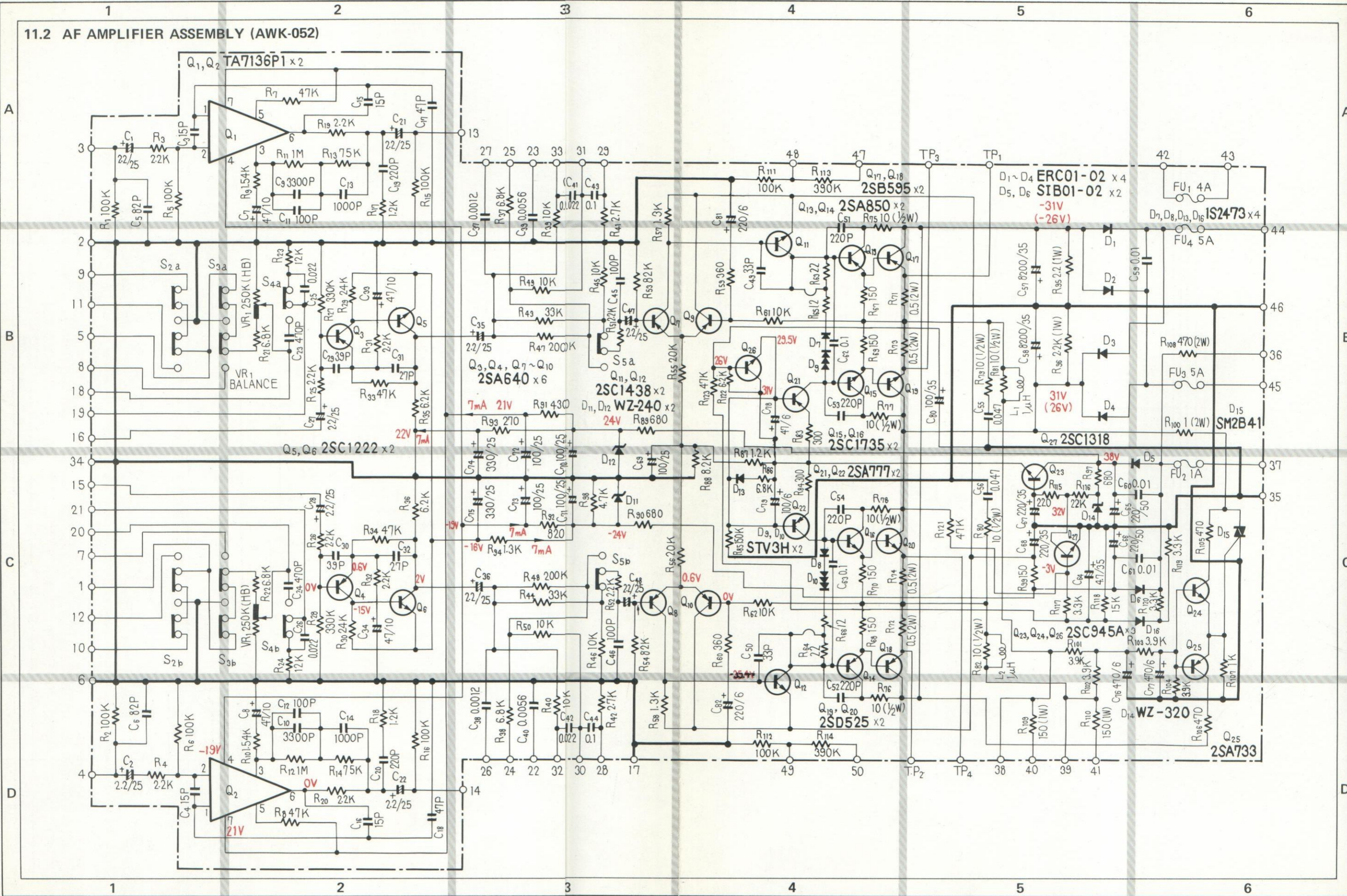
**CAPACITORS:**  
 IN μF UNLESS OTHERWISE NOTED P: pF

- : DC VOLTAGE AT NO INPUT SIGNAL
- ( V ) : DC VOLTAGE AT 25W x 2 OUTPUT
- : DC CURRENT AT NO INPUT SIGNAL
- mV : SIGNAL VOLTAGE AT 32W x 1 OUTPUT (1kHz)





11.2 AF AMPLIFIER ASSEMBLY (AWK-052)









## Parts List of AF Amplifier Assembly (AWK-052)

### SEMICONDUCTORS

Symbol	Description	Part No.
Q1	IC	TA7136P1
Q2	IC	TA7136P1
Q3	Transistor	2SA640-E
Q4	Transistor	2SA640-E
Q5	Transistor	2SC1222-E
Q6	Transistor	2SC1222-E
Q7	Transistor	2SA640-E
Q8	Transistor	2SA640-E
Q9	Transistor	2SA640-E
Q10	Transistor	2SA640-E
Q11	Transistor	2SC1438-V
Q12	Transistor	2SC1438-V
Q13	Transistor	2SA850-C
Q14	Transistor	2SA850-C
Q15	Transistor	2SC1735-C
Q16	Transistor	2SC1735-C
Q17	Transistor	2SB595-0
Q18	Transistor	2SB595-0
Q19	Transistor	2SD525-0
Q20	Transistor	2SD525-0
Q21	Transistor	2SA777-R
Q22	Transistor	2SA777-R
Q23	Transistor	2SC945A-Q
Q24	Transistor	2SC945A-Q
Q25	Transistor	2SA733-Q
Q26	Transistor	2SC945A-Q
Q27	Transistor	2SC1318-R
D1	Diode	ERC01-02
D2	Diode	ERC01-02
D3	Diode	ERC01-02
D4	Diode	ERC01-02
D5	Diode	SIB01-02 (1S1886)
D6	Diode	SIB01-02 (1S1886)
D7	Diode	1S2473
D8	Diode	1S2473
D9	Varistor	STV3H-Y
D10	Varistor	STV3H-Y
D11	Zener diode	WZ-240
D12	Zener diode	WZ-240
D13	Diode	1S2473
D14	Zener diode	WZ-320
D15	Thyristor	SM2B41
D16	Diode	1S2473

### SWITCHES

Symbol	Description	Part No.
S2	Lever switch (TAPE MONITOR 1)	ASK-092
S3	Lever switch (TAPE MONITOR 2)	ASK-092
S4	Lever switch (LOUDNESS)	ASK-089
S5	Lever switch (TONE)	ASK-089

### COILS

Symbol	Description	Part No.
L1	Choke coil	ATH-011
L2	Choke coil	ATH-011

### CAPACITORS

Symbol	Description	Part No.
C1	Electrolytic 2.2 25V	CSZA 2R2M 25
C2	Electrolytic 2.2 25V	CSZA 2R2M 25
C3	Ceramic 15p 50	CCDSL 150K 50
C4	Ceramic 15p 50	CCDSL 150K 50
C5	Ceramic 82p 50	CCDSL 820K 50
C6	Ceramic 82p 50	CCDSL 820K 50
C7	Electrolytic 47 25V	ACH-308
C8	Electrolytic 47 25V	ACH-308
C9	Polystyrene 3300p 50V	CQSA 332G 50
C10	Polystyrene 3300p 50V	CQSA 332G 50
C11	Ceramic 100p 50V	CCDSL 101K 50
C12	Ceramic 100p 50V	CCDSL 101K 50
C13	Polystyrene 1000p 50V	CQSA 102G 50
C14	Polystyrene 1000p 50V	CQSA 102G 50
C15	Ceramic 15p 50V	CCDSL 150K 50
C16	Ceramic 15p 50V	CCDSL 150K 50
C17	Ceramic 47p 50V	CCDSL 470K 50
C18	Ceramic 47p 50V	CCDSL 470K 50
C19	Ceramic 220p 50V	CCDSL 221K 50
C20	Ceramic 220p 50V	CCDSL 221K 50
C21	Electrolytic 2.2 25V	CEANL 2R2M25
C22	Electrolytic 2.2 25V	CEANL 2R2M25
C23	Ceramic 470p 50V	CKDYB 471K 50
C24	Ceramic 470p 50V	CKDYB 471K 50
C25	Ceramic 0.022 50V	CKDYF 223Z 50

Symbol	Description			Part No.
C26	Ceramic	0.022	50V	CKDYF 223Z 50
C27	Electrolytic	.2.2	25V	CSZA 2R2M 25
C28	Electrolytic	2.2	25V	CSZA 2R2M 25
C29	Ceramic	39p	50V	CCDSL 390K 50
C30	Ceramic	39p	50V	CCDSL 390K 50
C31	Ceramic	27p	50	CCDSL 270K 50
C32	Ceramic	27p	50	CCDSL 270K 50
C33	Electrolytic	47	25V	ACH-308-0
C34	Electrolytic	47	25V	ACH-308-0
C35	Electrolytic	2.2	25V	CEANL 2R2M25
C36	Electrolytic	2.2	25V	CEANL 2R2M25
C37	Ceramic	1200p	50V	CKDYB 122K 50
C38	Ceramic	1200p	50V	CKDYB 122K 50
C39	Ceramic	5600p	50V	CKDYB 562K 50
C40	Ceramic	5600p	50V	CKDYB 562K 50
C41	Mylar	0.022	50V	CQMA 223K 50
C42	Mylar	0.022	50V	CQMA 223K 50
C43	Mylar	0.1	50V	CQMA 104K 50
C44	Mylar	0.1	50V	CQMA 104K 50
C45	Ceramic	100p	50V	CCDSL 101K 50
C46	Ceramic	100p	50V	CCDSL 101K 50
C47	Electrolytic	2.2	25V	CSZA 2R2M 25
C48	Electrolytic	2.2	25V	CSZA 2R2M 25
C49	Ceramic	33p	50V	CCDSL 330K 50
C50	Ceramic	33p	50V	CCDSL 330K 50
C51	Ceramic	220p	50V	CCDSL 221K 50
C52	Ceramic	220p	50V	CCDSL 221K 50
C53	Ceramic	220p	50V	CCDSL 221K 50
C54	Ceramic	220p	50V	CCDSL 221K 50
C55	Ceramic	0.047	50V	CKDYF 473Z 50
C56	Ceramic	0.047	50V	CKDYF 473Z 50
C57	Electrolytic	8200 $\mu$ F	35V	ACH-058
C58	Electrolytic	8200 $\mu$ F	35V	ACH-058
C59	Ceramic	0.01	150V	ACG-004
C60	Ceramic	0.01	150V	ACG-004
C61	Ceramic	0.01	150V	ACG-004
C62	Mylar	0.1	50V	CQMA 104K 50
C63	Mylar	0.1	50V	CQMA 104K 50
C64	Electrolytic	4.7	35V	CEA 4R7P 35
C65	Electrolytic	220	50V	CEA 221P 50
C66	Electrolytic	220	50V	CEA 221P 50
C67	Electrolytic	220	35V	ACH-315
C68	Electrolytic	220	35V	CEA 221P 35
C69	Electrolytic	100	25V	CEA 101P 25
C70	Electrolytic	100	25V	CEA 101P 25
C71	Electrolytic	100	25V	CEA 101P 25
C72	Electrolytic	100	25V	CEA 101P 25
C73	Electrolytic	100	25V	CEA 101P 25
C74	Electrolytic	330	25V	CEA 331P 25
C75	Electrolytic	330	25V	CEA 331P 25
C76	Electrolytic	470	6V	CEA 471P 6
C77	Electrolytic	470	6V	CEA 471P 6

Symbol	Description			Part No.
C78	Electrolytic	47	6V	CEA 470P 6
C79	Electrolytic	100	6V	CEA 101P 6
C80	Electrolytic	100	35V	CEA 101P 35
C81	Electrolytic	220	6V	CEA 221P 6
C82	Electrolytic	220	6V	CEA 221P 6

## RESISTORS

Symbol	Description			Part No.
R1	Carbon film	100k		RD $\frac{1}{2}$ PS 104JNL
R2	Carbon film	100k		RD $\frac{1}{2}$ PS 104JNL
R3	Carbon film	2.2k		RD $\frac{1}{2}$ PS 222J
R4	Carbon film	2.2k		RD $\frac{1}{2}$ PS 222J
R5	Carbon film	100k		RD $\frac{1}{2}$ PS 104JNL
R6	Carbon film	100k		RD $\frac{1}{2}$ PS 104JNL
R7	Carbon film	47k		RD $\frac{1}{2}$ PS 473J
R8	Carbon film	47k		RD $\frac{1}{2}$ PS 473J
R9	Metal film	1.54k		RN $\frac{1}{2}$ PT 1541F
R10	Metal film	1.54k		RN $\frac{1}{2}$ PT 1541F
R11	Metal film	1M	$\frac{1}{2}$ W	RN $\frac{1}{2}$ PT 1004F
R12	Metal film	1M	$\frac{1}{2}$ W	RN $\frac{1}{2}$ PT 1004F
R13	Metal film	75k		RN $\frac{1}{2}$ PT 7502F
R14	Metal film	75k		RN $\frac{1}{2}$ PT 7502F
R15	Carbon film	100k		RD $\frac{1}{2}$ PS 104J
R16	Carbon film	100k		RD $\frac{1}{2}$ PS 104J
R17	Carbon film	1.2k		RD $\frac{1}{2}$ PS 122J
R18	Carbon film	1.2k		RD $\frac{1}{2}$ PS 122J
R19	Carbon film	2.2k		RD $\frac{1}{2}$ PS 222J
R20	Carbon film	2.2k		RD $\frac{1}{2}$ PS 222J
R21	Carbon film	6.8k		RD $\frac{1}{2}$ PS 682J
R22	Carbon film	6.8k		RD $\frac{1}{2}$ PS 682J
R23	Carbon film	12k		RD $\frac{1}{2}$ PS 123J
R24	Carbon film	12k		RD $\frac{1}{2}$ PS 123J
R25	Carbon film	2.2k		RD $\frac{1}{2}$ PS 222J
R26	Carbon film	2.2k		RD $\frac{1}{2}$ PS 222J
R27	Carbon film	330k		RD $\frac{1}{2}$ PS 334JNL
R28	Carbon film	330k		RD $\frac{1}{2}$ PS 334JNL
R29	Carbon film	24k		RD $\frac{1}{2}$ PS 243J
R30	Carbon film	24k		RD $\frac{1}{2}$ PS 243J
R31	Carbon film	2.2k		RD $\frac{1}{2}$ PS 222J
R32	Carbon film	2.2k		RD $\frac{1}{2}$ PS 222J
R33	Carbon film	47k		RD $\frac{1}{2}$ PS 473JNL
R34	Carbon film	47k		RD $\frac{1}{2}$ PS 473JNL
R35	Carbon film	6.2k		RD $\frac{1}{2}$ PS 622J
R36	Carbon film	6.2k		RD $\frac{1}{2}$ PS 622J
R37	Carbon film	6.8k		RD $\frac{1}{2}$ PS 682J
R38	Carbon film	6.8k		RD $\frac{1}{2}$ PS 682J
R39	Carbon film	10k		RD $\frac{1}{2}$ PS 103J
R40	Carbon film	10k		RD $\frac{1}{2}$ PS 103J
R41	Carbon film	2.7k		RD $\frac{1}{2}$ PS 272J
R42	Carbon film	2.7k		RD $\frac{1}{2}$ PS 272J
R43	Carbon film	33k		RD $\frac{1}{2}$ PS 333J



Symbol	Description	Part No.
R44	Carbon film 33k	RD½PS 333J
R45	Carbon film 10k	RD½PS 103J
R46	Carbon film 10k	RD½PS 103J
R47	Carbon film 200k	RD½PS 204J
R48	Carbon film 200k	RD½PS 204J
R49	Carbon film 10k	RD½PS 103J
R50	Carbon film 10k	RD½PS 103J
R51	Carbon film 2.2k	RD½PS 222J
R52	Carbon film 2.2k	RD½PS 222J
R53	Carbon film 82k	RD½PS 823JNL
R54	Carbon film 82k	RD½PS 823JNL
R55	Carbon film 20k	RD½PS 203J
R56	Carbon film 20k	RD½PS 203J
R57	Carbon film 1.3k	RD½PS 132J
R58	Carbon film 1.3k	RD½PS 132J
R59	Carbon film 360	RD½PS 361J
R60	Carbon film 360	RD½PS 361J
R61	Carbon film 10k	RD½PS 103J
R62	Carbon film 10k	RD½PS 103J
R63	Carbon film 22	RD½PS 220J
R64	Carbon film 22	RD½PS 220J
R65	Carbon film 12	RD½PS 120J
R66	Carbon film 12	RD½PS 120J
R67	Carbon film 150	RD½PS 151J
R68	Carbon film 150	RD½PS 151J
R69	Carbon film 150	RD½PS 151J
R70	Carbon film 150	RD½PS 151J
R71	Metal film 0.5 2W	RN2H 0R5J
R72	Metal film 0.5 2W	RN2H 0R5J
R73	Metal film 0.5 2W	RN2H 0R5J
R74	Metal film 0.5 2W	RN2H 0R5J
R75	Carbon film 10 ½W	RD½PSF 100J
R76	Carbon film 10 ½W	RD½PSF 100J
R77	Carbon film 10 ½W	RD½PSF 100J
R78	Carbon film 10 ½W	RD½PSF 100J
R79	Carbon film 10 ½W	RD½PSF 100J
R80	Carbon film 10 ½W	RD½PSF 100J
R81	Carbon film 10 ½W	RD½PS 100J
R82	Carbon film 10 ½W	RD½PS 100J
R83	Carbon film 300	RD½PS 301J
R84	Carbon film 300	RD½PS 301J
R85	Carbon film 150k	RD½PS 154J
R86	Carbon film 6.8k	RD½PS 682J
R87	Carbon film 1.2k	RD½PS 122J
R88	Carbon film 8.2k	RD½PS 822J
R89	Carbon film 680	RD½PS 681J
R90	Carbon film 680	RD½PS 681J
R91	Carbon film 430	RD½PS 431J
R92	Carbon film 820	RD½PS 821J
R93	Carbon film 270	RD½PS 271J
R94	Carbon film 1.3k	RD½PS 132J
R95	Metal oxide film 2.2k 1W	RS1P 222J

Symbol	Description	Part No.
R96	Metal oxide film 2.2k 1W	RS1P 222J
R97	Carbon film 680	RD½PS 681J
R98	Carbon film 4.7k	RD½PS 472J
R99	Carbon film 150	RD½PS 151J
R100	Metal film 1 2W	RN2H 010K
R101	Carbon film 3.9k	RD½PS 392J
R102	Carbon film 3.9k	RD½PS 392J
R103	Carbon film 3.9k	RD½PS 392J
R104	Carbon film 3.9k	RD½PS 392J
R105	Carbon film 470	RD½PS 471J
R106	Carbon film 470	RD½PS 471J
R107	Carbon film 1k	RD½PS 102J
R108	Metal oxide film 470 2W	RS2P 471J
R109	Metal oxide film 150 1W	RS1P 151J
R110	Metal oxide film 150 1W	RS1P 151J
R111	Carbon film 100k	RD½PS 104J
R112	Carbon film 100k	RD½PS 104J
R113	Carbon film 390k	RD½PS 394J
R114	Carbon film 390k	RD½PS 394J
R115	Carbon film 220	RD½PS 221J
R116	Carbon film 22k	RD½PS 223J
R117	Carbon film 3.3k	RD½PS 332J
R118	Carbon film 15k	RD½PS 153J
R119	Carbon film 3.3k	RD½PS 332J
R120	Carbon film 3.3k	RD½PS 332J
R121	Carbon film 47k	RD½PS 473J
R122	Carbon film 6.2k	RD½PS 622J
R123	Carbon film 47k	RD½PS 473J
VR1	Variable resistor (BALANCE) 250k-HB	ACV-135

## 12. PACKING

