



# *Service Manual*

STEREO AMPLIFIER

## **SA-8800**

ART-342  
S/M SA-8800

1005

LIBR

INV: 31336264  
1 MP: 3362-64

 **PIONEER®**

## MODEL SA-8800 COMES IN FIVE VERSIONS DISTINGUISHED AS FOLLOWS:

Type	Voltage	Remarks
KU	120V only	U.S.A. model
KC	120V only	Canada model
HG	220V and 240V (Switchable)	Europe or Oceania model
S/G	110V, 120V, 220V and 240V (Switchable)	U.S. Military model
S	110V, 120V, 220V and 240V (Switchable)	General export model

The variation in safety standards in different countries has also necessitated variations in power supply and circuit component specifications.

This service manual is applicable to the KU type. For servicing of the other types please refer to the additional service manuals.

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# 1. SPECIFICATIONS

## Semiconductors

ICs .....	3
FETs .....	6
Transistors .....	73
Diodes .....	49
Others .....	2

## Power Amplifier Section

Continuous Power Output is 80watts\* per channel, min., at 8 ohms from 10 Hertz to 20,000 Hertz with no more than 0.005% total harmonic distortion, or 80 watts\* per channel at 4 ohms from 10 Hertz to 20,000 Hertz with no more than 0.005% total harmonic distortion.

### Continuous Power Output

10Hz to 50,000Hz: 80W + 80W (T.H.D. 0.01%, 8 ohms)
100W + 100W (T.H.D. 0.02%, 4 ohms)

### Total Harmonic Distortion (10 Hertz to 20,000 Hertz)

continuous rated power output	..... No more than 0.005%
-------------------------------	---------------------------

40 watts per channel power output,	
8 ohms .....	No more than 0.004%

1 watt per channel power output,	
8 ohms .....	No more than 0.004%

### Intermodulation Distortion (50 Hertz : 7,000 Hertz = 4 : 1)

continuous rated power output	..... No more than 0.002%
-------------------------------	---------------------------

40 watts per channel power output,	
8 ohms .....	No more than 0.002%

1 watt per channel power output,	
8 ohms .....	No more than 0.002%

### Frequency Response .....

5 to 200,000 Hertz $\pm \frac{0}{2}$ dB (POWER AMP IN)
--

### Input (Sensitivity/Impedance) .....

1V/50 kilohms (POWER AMP IN)
------------------------------

### Output

Speaker .....	A, B, A+B
Headphones .....	Low impedance

### Damping Factor

(20 Hertz to 20,000 Hertz, 8 ohms) .....	55
--	----

### Hum and Noise

(IHF, short-circuited, A network) .....	118dB
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## Preamplifier Section

### Input Sensitivity/Impedance

PHONO 1 .....	2.5 mV/50
PHONO 2 .....	2.5 mV/50

CARTRIDGE LOAD .....	Both Phono 1 and 2
	100, 10k, 25k, 50k, 100k ohms
	100, 200, 300, 400, 500pF

TUNER .....	150mV/50 kilohms
-------------	------------------

AUX .....	150mV/50 kilohms
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TAPE PLAY 1 .....	150mV/50 kilohms
-------------------	------------------

TAPE PLAY 2 .....	150mV/50 kilohms
-------------------	------------------

### Phono Overload Level (T.H.D. 0.002%, 1 kHz)

PHONO 1, 2 .....	250mV
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### Output (Level/Impedance)

TAPE REC 1 .....	150mV
------------------	-------

TAPE REC 2 .....	150mV
------------------	-------

PRE OUT .....	1V/600 ohms, 3V/600 ohms (max.)
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### Total Harmonic Distortion

(10 to 50,000 Hertz, 1V output) : No more than 0.006%
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### Frequency Response

PHONO (RIAA Equalization) .....	20Hz to 20,000Hz $\pm 0.2$ dB
---------------------------------	-------------------------------

TUNER, AUX, TAPE PLAY : 5Hz to 100,000Hz $\pm \frac{0}{1}$ dB
---

### Tone Control

BASS .....	+10dB, -10dB (100Hz)
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TREBLE .....	+10dB, -10dB (10kHz)
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### Filter SUBSONIC .....

15Hz (6dB/oct)
----------------

HIGH .....	8kHz (6dB/oct)
------------	----------------

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

PHONO .....	90dB
-------------	------

TUNER, AUX, TAPE PLAY .....	110dB
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### Muting .....

-20dB
-------

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

..... +6dB (100Hz), +3dB (10kHz)
----------------------------------

## Miscellaneous

### Power Requirements .....

120V, 60Hz
------------

### Power Consumption .....

.260W (UL), 500VA (CSA)
-------------------------

### Dimensions .....

453(W) x 155(H) x 425(D) mm
-----------------------------

17-11/16(W) x 6-1/8(H) x 16-3/4(D) in
---------------------------------------

### Weight Without package .....

15.6kg (34 lb 6 oz)
---------------------

## Furnished Parts

### Operating instructions .....

1
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### \* Measured pursuant to Federal Trade Commission's Trade

Regulation rule on Power Output Claims for Amplifier.

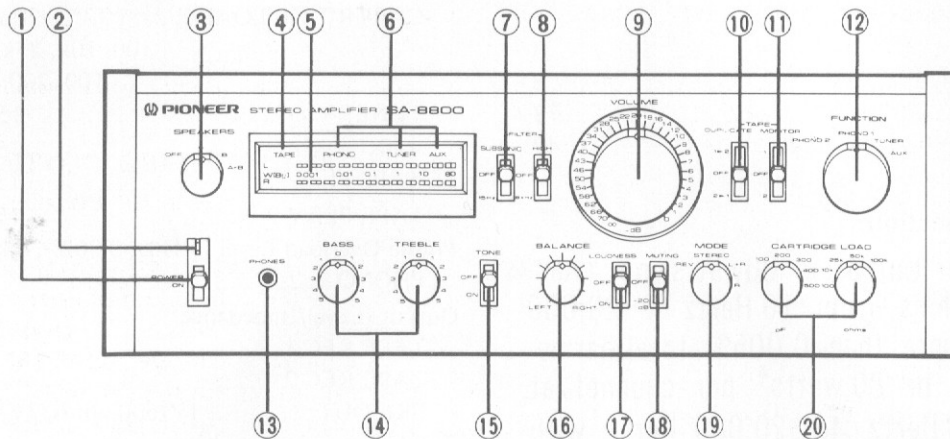
## NOTE:

Specifications and the design subject to possible modifica-

tion without notice due to improvements.



## 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 POWER INDICATOR

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

### ③ 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.

A+B: Sound obtained from speakers connected to both A and B speaker terminals.

### ④ TAPE MONITOR INDICATOR

The TAPE lamp lights up when the tape monitor switch is set to either position "1" or "2".

### ⑤ 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.

### ⑥ FUNCTION INDICATORS

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

### NOTE:

The function indicator will not go off when the tape monitor switch is set to position "1" or "2". This indicates a program at the recording source end during the monitoring of a recording.

### ⑦ 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.

### ⑧ HIGH FILTER SWITCH

The high filter with a cut-off frequency of 8kHz is actuated when this switch is set to the 8kHz position.

The high filter serves to attenuate frequencies higher than 8kHz in a 6dB/oct slope. This is why it is effective in suppressing high-frequency noise or noise from scratches on records being played.

### ⑨ 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  $\infty$ . The scale is graduated in dB which indicate the attenuation when the maximum output level is 0dB.



**⑩ TAPE DUPLICATE SWITCH**

Use this switch when employing two tape decks to duplicate recorded tapes or edit tapes. This switch is otherwise kept at the OFF position.

**1►2:** When playing back the tape on a deck connected to the TAPE 1 jacks and recording (duplicating) on a deck connected to the TAPE 2 jacks.

**OFF:** Set to this position when not duplicating.

**2►1:** When playing back the tape on a deck connected to the TAPE 2 jacks and recording (duplicating) on a deck connected to the TAPE 1 jacks.

**⑪ TAPE MONITOR SWITCH**

Use this switch to select the program source which is being reproduced.

**1:** Set here to monitor a recording or a tape being played back on a tape deck which is connected to the TAPE 1 jacks.

**OFF:** Set here whenever you are not playing back a tape or monitoring a recording (i.e. when you have set the function selector to PHONO 1, PHONO 2 or TUNER, or AUX for an alternative program source).

**2:** Set here to monitor a recording or a tape being played back on a tape deck which is connected to the TAPE 2 jacks.

**⑫ 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.

**PHONO 2:** Set here when playing records on a turntable connected to the PHONO 2 jacks. (The PHONO function indicator lights up.)

**PHONO 1:** Set here when playing records on a turntable connected to the PHONO 1 jacks. (The PHONO function indicator lights up.)

**TUNER:** Set here when listening to broadcasts on a tuner connected to the TUNER jacks. (The TUNER 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.)

**⑬ 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.*

**⑭ 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.

**⑮ TONE SWITCH**

Set this switch to ON when adjusting the bass and treble controls. When set to OFF, 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.

**⑯ BALANCE CONTROL**

Use this control to balance the volume of the left and right channels. First, however, set the mode selector to mono (L+R, L, or R), and adjust so that the sound appears to come from somewhere exactly between the two speakers. 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. After adjusting, return the mode selector to STEREO.

**⑰ 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.

## ⑮ MUTING SWITCH

Set this switch to  $-20\text{dB}$  to attenuate the audio output indicated by the volume control by  $20\text{dB}$ . There is no need to adjust the volume control if you use this switch when turning down the audio output temporarily and when changing over records or tapes.

## ⑯ MODE SELECTOR

Use this selector for selecting the performances.

**REV:** Reverses left and right channel stereo signals and reproduces them stereophonically.

**STEREO:** Set to this position for normal stereo reproduction.

**L+R:** Mixes left and right channel signals and reproduces them monophonically.

**L:** Left channels signal is reproduced monophonically from both speakers.

**R:** Right channel signal is reproduced monophonically from both speakers.

## ⑰ CARTRIDGE LOAD SELECTORS (ohms and pF)

These selectors allow you to select the input resistance and input capacitance in line with the rated load impedance and load capacitance of a moving magnet (MM) cartridge for record play.

Use these two switches to produce the sound quality of your preference or the ideal conditions for your cartridge.

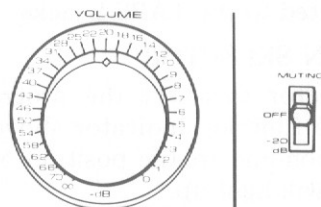
## VOLUME CONTROL AND MUTING SWITCH

The volume control scale is directly calibrated in dB. By adjusting it in combination with the muting switch, it is possible to adjust the attenuation more finely across a very wide range. The attenuation (volume) is equal to the volume control indication plus  $20\text{dB}$ .

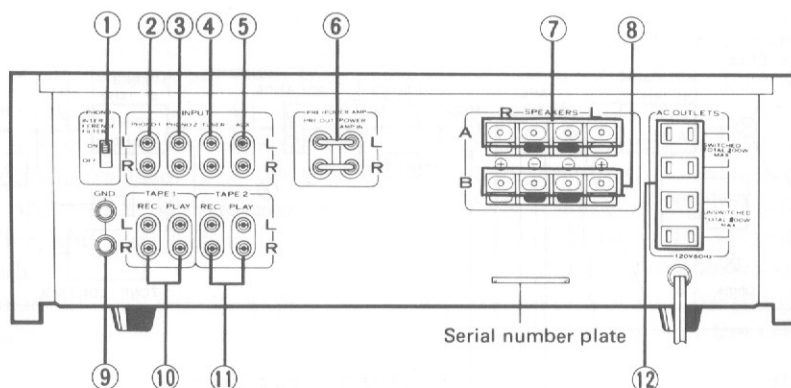
- There will be no need to adjust the volume control every time you change over a tape or record if you set the switch to  $-20\text{dB}$  position for reducing the volume temporarily during play.
- You will not be able to finely adjust the volume if the volume control is near the  $\infty$  position when listening to a program at a low sound level at night, for example. In such cases, set the muting switch to  $-20\text{dB}$  and you will then be able to adjust the sound with the volume control to more fine steps.

### NOTE:

Always turn the volume control right down when returning the muting switch to OFF during a performance when the sound is set to a high level with the volume control.



### 3. REAR PANEL FACILITIES



#### ① PHONO INTERFERENCE FILTER SWITCH

This is used to attenuate radio-frequency interference from external electronic or electrical appliances or products during record play.

When this switch is set to ON during record play with the cartridge load resistance switch is at 100Ω position, the sound volume will be reduced.

#### ② PHONO 1 JACKS

Connect the turntable output cords to these jacks.

#### ③ PHONO 2 JACKS

Connect your second turntable output cords to these jacks.

#### ④ TUNER JACKS

Connect the tuner cords to these jacks.

#### ⑤ AUX JACKS

These are auxiliary input jacks. Connect a TV tuner or cartridge tape player to them.

#### ⑥ PREAMPLIFIER/POWER AMPLIFIER CONNECTOR BAR

When this connector bar is disconnected from the jacks, you can separate the SA-8800's preamplifier and power amplifier. For normal use, however, it is connected.

#### NOTE:

*If this bar is not connected properly, you will not hear any sound from the speakers connected to the SPEAKERS terminals.*

#### ⑦ SPEAKERS TERMINALS A

Connect your first pair of speakers to these terminals.

#### ⑧ SPEAKERS TERMINALS B

Connect your second pair of speakers to these terminals.

#### ⑨ GND TERMINALS

These are the ground terminals. Connect the ground wire of the turntable, etc. to these terminals.

#### ⑩ TAPE 1 JACKS

Connect the tape deck cords to these jacks. Connect the REC (recording) jacks to the INPUT jacks on the tape deck, and the PLAY (playback) jacks to the OUTPUT jacks.

#### ⑪ TAPE 2 JACKS

Connect your second tape deck cords to these jacks. Connect the REC (recording) jacks to the INPUT jacks on the tape deck, and the PLAY (playback) jacks to the OUTPUT jacks.

#### ⑫ AC OUTLETS

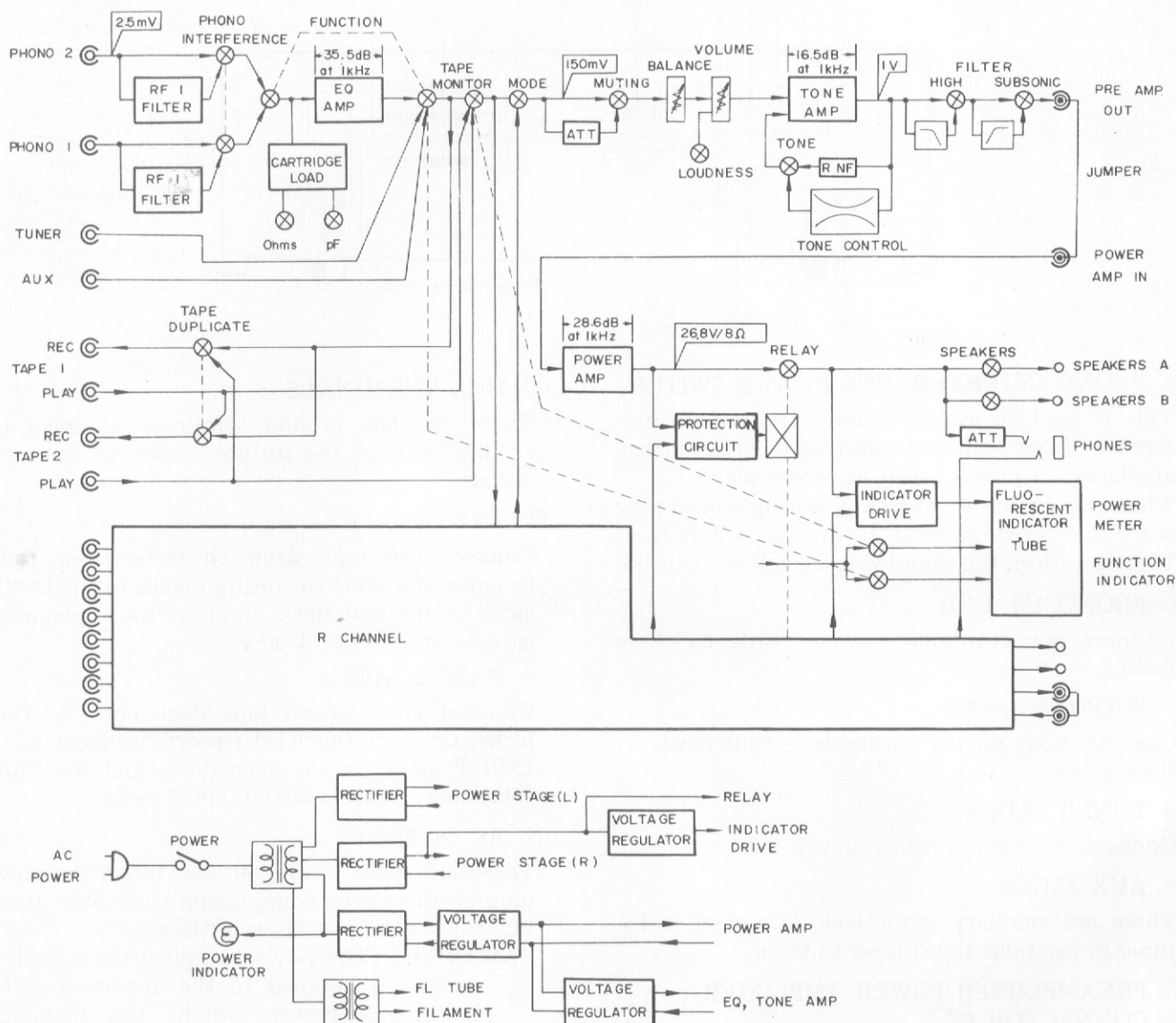
These are spare power outlets. Insert the power plug on the stereo components (turntable, tuner, tape deck, etc.) into these outlets.

**SWITCHED:** The power supplied through these outlets is coupled to the operation of the amplifier's power switch. The maximum power capacity which may be connected to the two SWITCHED outlets is 200W (For the Canadian model, the maximum power capacity is 100VA).

**UNSWITCHED:** The power is always supplied through these two outlets regardless of the position of the power switch. The maximum power capacity which may be connected to these two outlets is 200W (For the Canadian model, the maximum power capacity is 100 VA).



## 4. BLOCK DIAGRAM



## 5. CIRCUIT DESCRIPTIONS

### 5.1 PRE-AMPLIFIER SECTION

#### Cartridge Load Selectors

The input resistance and input capacitance of the PHONO input may be varied. The EQ amplifier input resistance is set to 100k $\Omega$ , and the input capacitance to 100pF. By operation of the CARTRIDGE LOAD selectors, different resistors and capacitors will be in parallel with the PHONO input circuit. Five different input resistance levels (100 $\Omega$ , 10k $\Omega$ , 30k $\Omega$ , 50k $\Omega$  and 100k $\Omega$ ) and five different input capacitance levels (100pF, 200pF,

300pF, 400pF and 500pF) are available, permitting the user to select optimum load conditions for the phono cartridge being employed in the turntable connected to the PHONO terminals.

#### Phono Interference Filter

Because of the high sensitivity of the phono input circuits, a certain amount of radio frequency interference may occur. This may be reduced by simply turning the rear panel PHONO INTERFERENCE FILTER on (thereby connecting a resistor in series with the phono input circuits).

## EQ Amplifier

Fig. 5-1 shows the basic configuration of the circuit. The EQ amplifier is a completely symmetrical DC-coupled 3-stage amplifier, the first stage of which employs newly developed ultra-low-noise NPN and PNP transistors.

The output stage is a symmetrical complementary SEPP Class A configuration. The output current is of the same order of magnitude as that of a small power amplifier, and is sufficient to cope with low-impedance loads.

The resultant S-N ratio of the EQ amplifier is 90dB, while the equalizer deviation is  $\pm 0.2\text{dB}$  (20Hz to 20,000Hz).

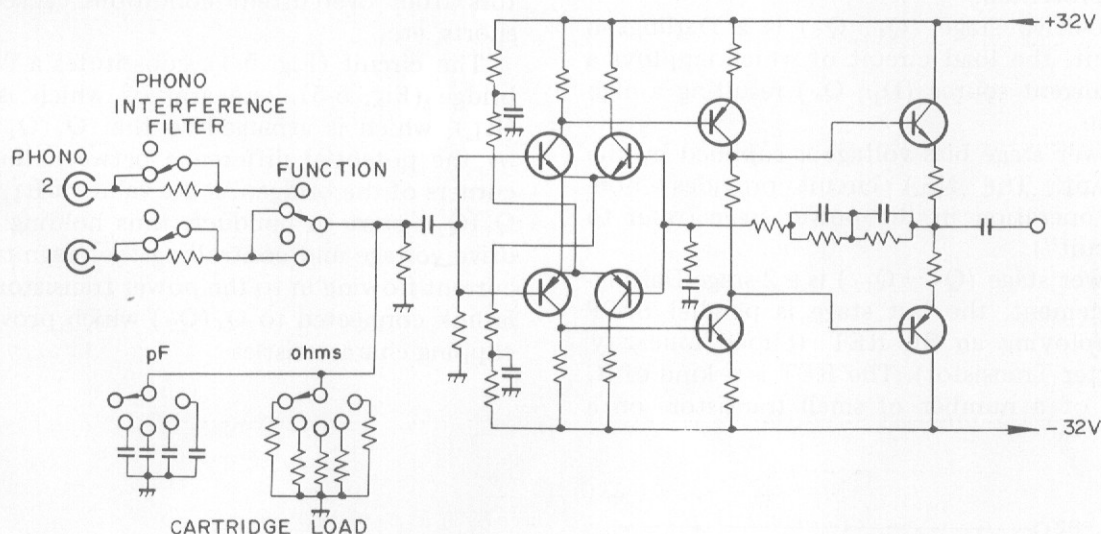


Fig. 5-1 EQ Amplifier

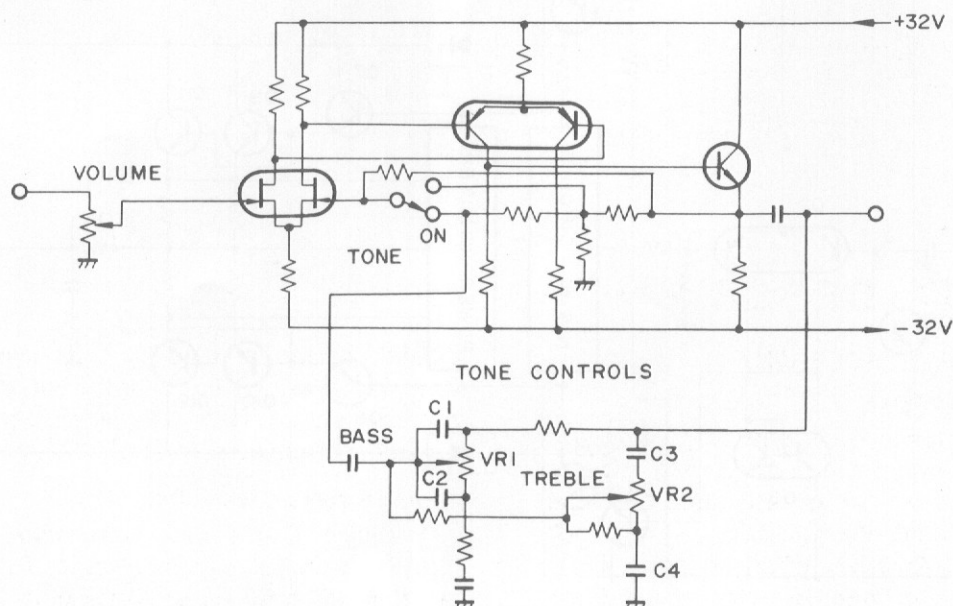


Fig. 5-2 Tone Control Circuit

## Tone Controls

Fig. 5-2 shows the basic tone control circuit. The tone amplifier is a 3-stage DC-coupled amplifier, the first stage is a differential amplifier consisting of a ultra-low-noise twin FET. The second stage is a differential amplifier consisting of a PNP twin transistor, and the output impedance lowered by using an emitter follower at the output stage.

Tone control (BASS, TREBLE) is accomplished by providing the tone amplifier NFB circuit with a frequency selective characteristic. The NFB circuit is changed to a flat frequency characteristic when the TONE switch is in the OFF position.

## 5.2 POWER AMPLIFIER SECTION

### Amplifier Circuit

The basic circuit arrangement of the power amplifier is shown in Fig. 5-3. The first stage is a differential amplifier comprising PNP twin transistor ( $Q_2$ ), the load circuit of which is a current mirror employing an NPN twin transistor ( $Q_3$ ). The current mirror provides push-pull operation in this stage, which serves to cancel even harmonics and further increase gain.

$Q_1$  in the input circuit absorbs outflow of base current from  $Q_2$ , and prevents the generation of a DC voltage. Because  $Q_1$  follows any temperature drift in  $Q_2$ , temperature drift of the center point voltage is prevented.

The pre-drive stage ( $Q_4, Q_5$ ) is a Darlington arrangement, the load circuit of which employs a constant-current source ( $D_1, Q_6$ ) resulting a high voltage gain.

The power stage bias voltage is supplied by the NSA circuit. The NSA circuit provides non-switching operation in the power stage (refer to "NSA Circuit").

The power stage ( $Q_7 - Q_{12}$ ) is a 2-stage Darlington arrangement, the last stage is parallel SEPP circuit employing an SL RET (Super Linearity Ring Emitter Transistor). The RET is a kind of IC consisting of a number of small transistors on a

single chip, with each transistor being connected in parallel via an emitter resistor. This provides excellent high frequency characteristics comparable to those of a small-signal transistor. Furthermore, because there is no time constant in the NFB circuit in the low-frequency region, amplification is possible down to DC (DC inputs will be cut off, however, by the input coupling capacitor).

The circuit features described above provide an extremely wide power frequency range (80W + 80W, 10Hz to 20kHz, THD 0.005%,  $8\Omega$ ).

### Power Limiter

The power limiter is a high-speed protection circuit which operates to protect the power transistors from overcurrent conditions caused by load shorts, etc.

The circuit (Fig. 5-4), constitutes a Wheatstone bridge (Fig. 5-5), one arm of which is the load ( $R_L$ ), which is arranged so that  $Q_1(Q_2)$  is biased by the potential difference between the opposite corners of the bridge. As the value of  $R_L$  decreases,  $Q_1(Q_2)$  start to conduct, thus holding down the drive voltage and controlling the magnitude of the current flowing in to the power transistors.  $Q_3(Q_4)$  is link connected to  $Q_1(Q_2)$  which provides sharp clipping characteristics.

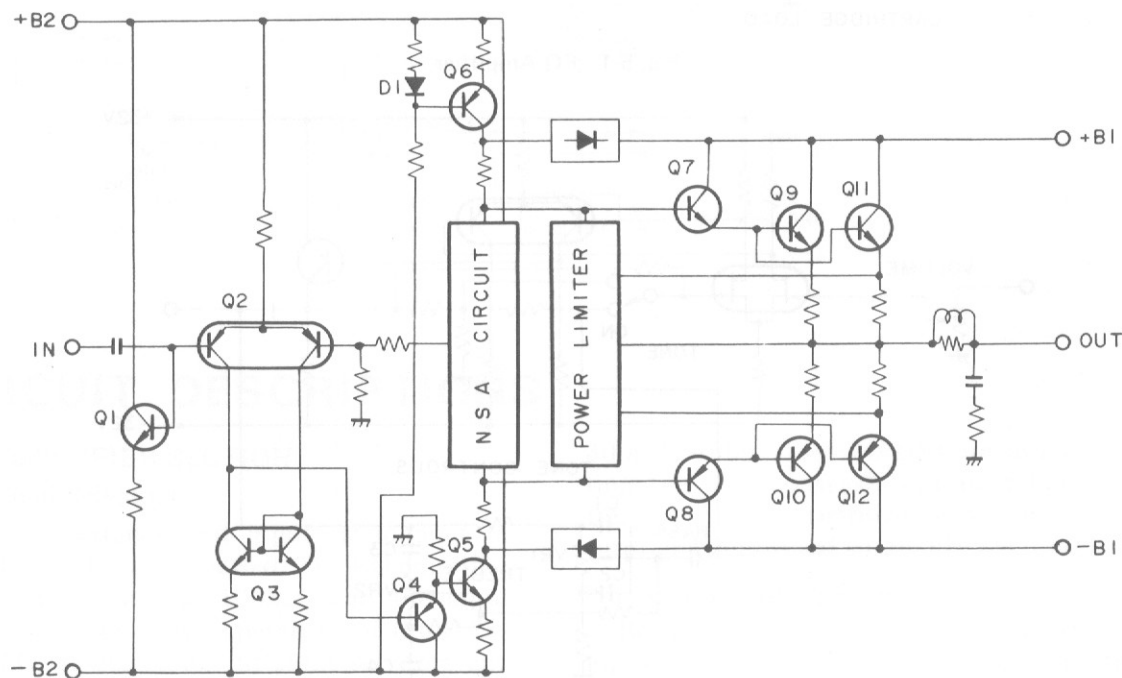


Fig. 5-3 Power amplifier circuit



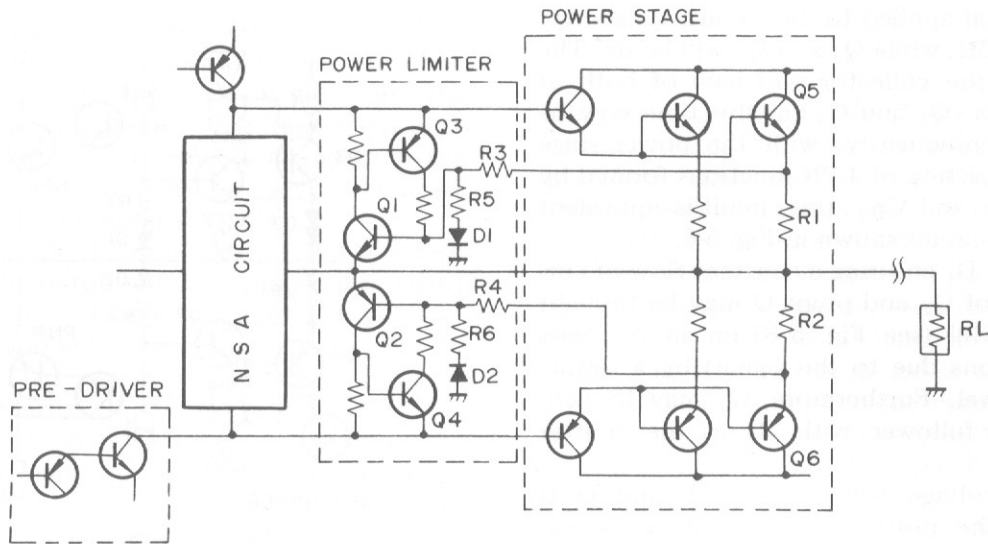


Fig. 5-4 Power Limiter Circuit

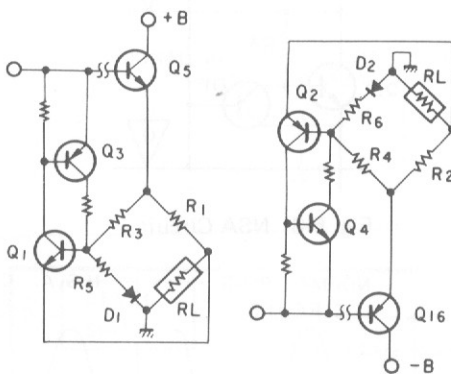


Fig. 5-5 Bridge Circuit

### NSA (Non-Switching Amplifier) Circuit

By operating the power stage only within the active region (no possible cut-off) and with minimum idle current, the NSA circuit prevents the generation of switching distortion and reduces heat loss.

### Operating Principle

Since idle current flows through normal class B SEPP power stages (see Fig. 5-6) when no signal is applied, the DC level is shifted by D and VR by a fixed amount (with the voltage across points P and R serving as a bias). The voltages across points P and Q, and Q and R at this time will be equal. When the positive portion of a signal is applied to this circuit, the power stage current on the NPN

side is increased resulting in the voltage across points P and Q also being increased. However, since the voltage across points P and R is practically constant (see note), the voltage across points P and R (PNP power stage bias) will be decreased, resulting in the PNP power stage being cut off.

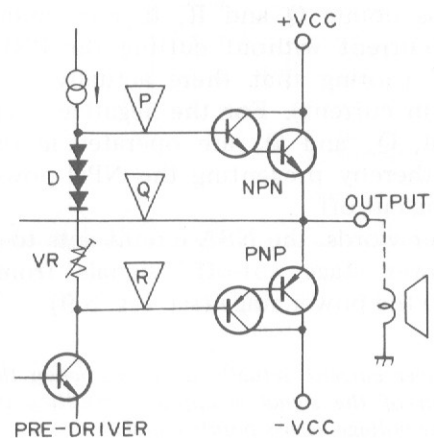


Fig. 5-6 Normal Power Stage

The NSA circuit increases the voltage across points P and R by the same amount as the voltage increase across points P and Q, thereby cancelling the voltage decrease across points Q and R, and preventing the PNP power stage from being cut off.

This NSA circuit is outlined in Fig. 5-7. When there is no signal applied to the circuit,  $Q_1$  and  $Q_2$  are almost cut off, while  $Q_3$  and  $Q_4$  will be on. The voltage across the collector and base of both of these transistors ( $Q_3$  and  $Q_4$ ) at this time may be disregarded. Consequently, with the power stage bias circuit consisting of 4 PN junctions formed by  $Q_3$ ,  $D_3$ , and  $Q_4$ , and  $VR_1$ , this circuit is equivalent to the previous circuit shown in Fig. 5-6.

With  $R_1$  and  $D_1$  ensuring a constant flow of current, the base of  $Q_1$  and point Q may be brought to the same level (see Fig. 5-8) on an AC basis (level fluctuations due to the signal) by a simple shift in DC level. Furthermore,  $Q_1$  may be considered emitter-follower with  $R_3$  as the emitter resistance.

When the voltage across points P and Q is increased by the positive portion of the signal applied to this circuit, it becomes the input signal of this emitter-follower ( $Q_1$ ). Since the emitter-follower voltage gain is practically 1, a voltage more or less equal to that of the input signal (that is, the voltage increase across points P and Q) is produced at  $R_3$ . And the  $R_3$  voltage is the voltage applied across the base and collector of  $Q_3$  which forms part of the power stage bias circuit. So the bias voltage applied to  $Q_3$  will be in excess by the same amount that the voltage across points P and Q is increased (by positive portion of the signal) above the voltage level when no signal is being applied. Consequently, the increase in voltage across points P and Q cancels the decrease in voltage across points Q and R, thereby maintaining the idle current without cutting the PNP power stage off (noting that there actually is a slight decrease in current). For the negative portions of the signal,  $Q_3$  and  $Q_4$  are operated in the same manner, thereby preventing the NPN power stage from being cut off.

In other words, the NSA circuit acts to prevent any "power stage cut-off" signals from being applied to the power stage (see Fig. 5-9).

Note:

*The pre-driver current actually decreases when the positive portion of the signal is applied, resulting in a decrease in the voltage across points P and R.*

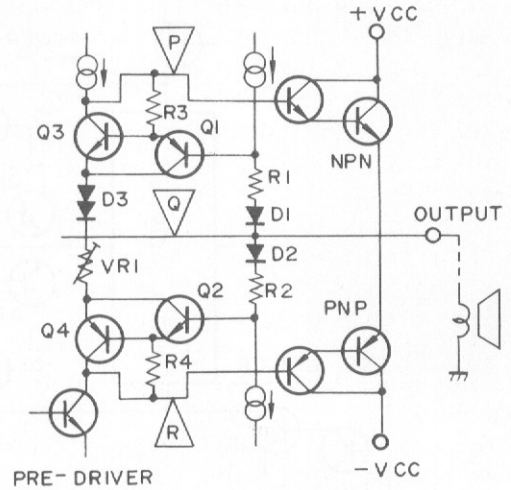


Fig. 5-7 NSA Circuit

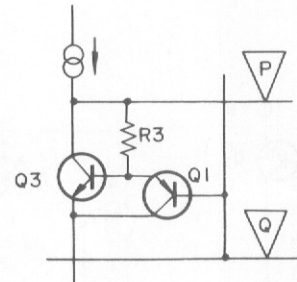


Fig. 5-8 NSA Circuit

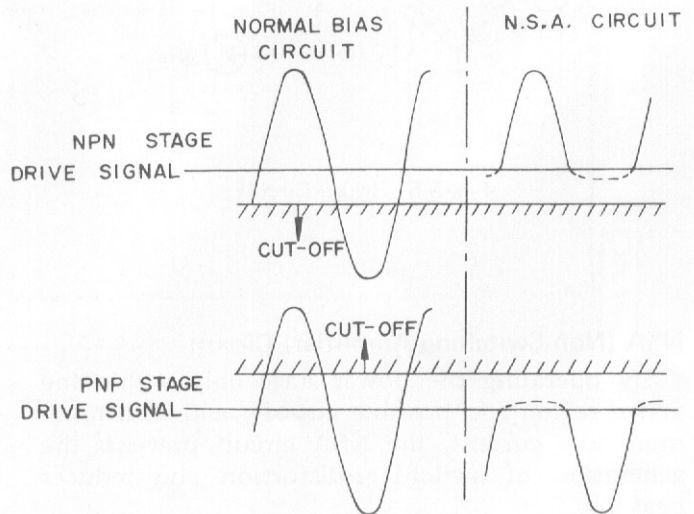


Fig. 5-9 Driving Signal of Power Stage

### 5.3 INDICATOR CIRCUIT

The SA-8800 output power and function indicators feature fluorescent indicator tube (FL tube). In this tube, thermionic emissions from the cathode are accelerated into the fluorescent substance of the segmental anodes, resulting in the emission of light. This tube is used to indicate numerals, letters, and other symbols.

An outline of the FL tube drive circuit is shown in Fig. 5-10. The output circuit signal is first passed through a low-pass filter and a compressor circuit before being applied to pin no.6 (4) of the IC (TA7318P-A). The compressor circuit makes use of the non-linearity of the rising portion of the diode's  $V_d - I_d$  characteristics to contract the signal dynamic range by 20dB. The IC contains a detector circuit, compressor (40dB), and peak

hold circuit for both left and right channels. The dynamic range of the signal is thus contracted by 60dB to obtain a "peak held" DC voltage.

The output power indicator segments of the FL tube are driven by the HA12010 ICs (one for each channel) equipped with 12 pairs of differential amplifiers. These amplifiers are biased at increasing levels, so each amplifier will commence to operate separately as the input level increases. And since these amplifiers apply the voltages to the output power indicator segments, each successive segment will light up in turn as the input level rises.

The function indicators are lit up as a result of a voltage being applied to the corresponding function indicator segment according to the selected positions of the FUNCTION and TAPE MONITOR switches.

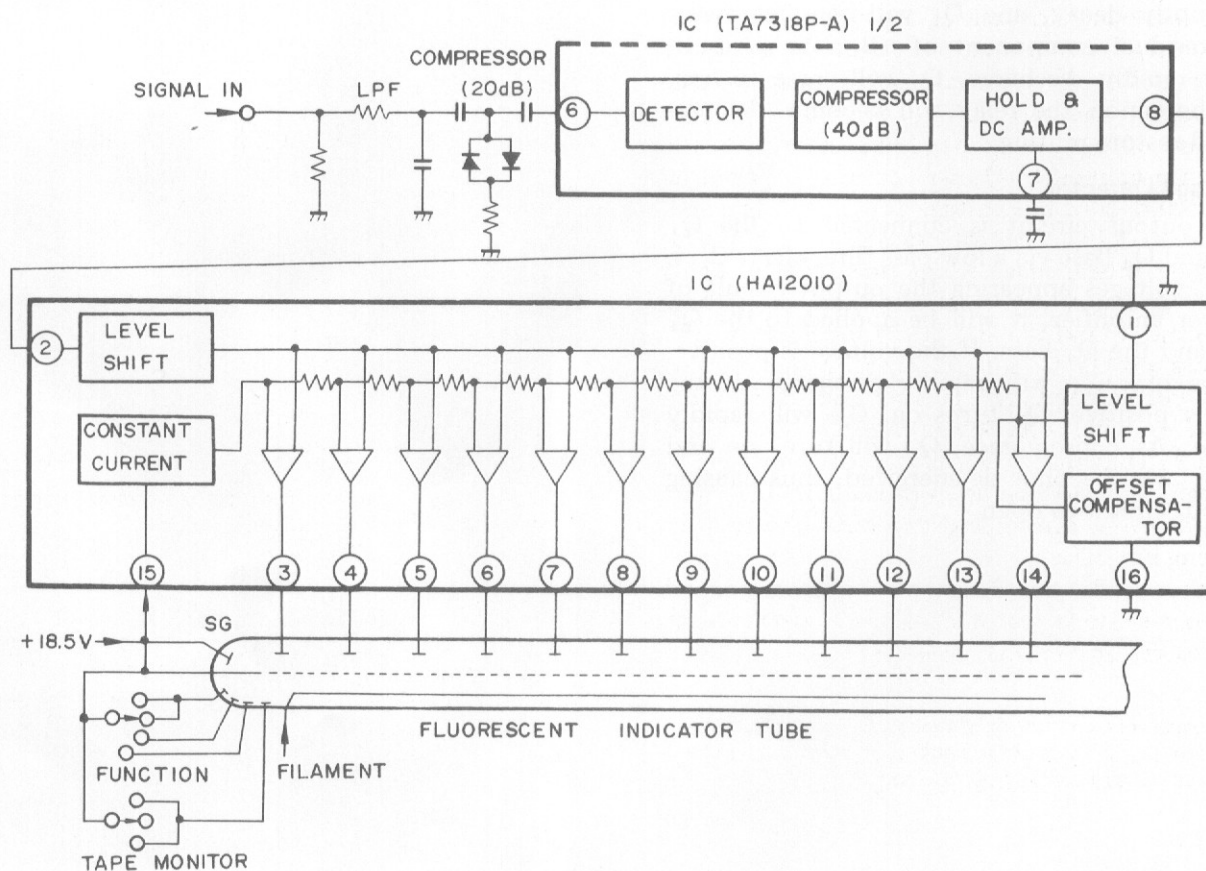


Fig. 5-10 Indicator Circuit



## 5.4 PROTECTION CIRCUIT

The purpose of this circuit is to protect the speakers. The relay in the output circuit is automatically opened in any of the following cases:

1. During the "transient operations" when the power supply is turned on and off.
2. Upon detection of a DC voltage in the output circuit, caused by component failure or accident.

### Muting Operation when Power Supply is Turned On and Off

With reference to Fig. 5-11 when the power supply is turned on,  $Q_1$  turns off due to  $-B_1$  (The time constant of the  $-B_1$  circuit is very small.). If there is no input (DC) on  $Q_3$  and  $Q_4$ , they will be off, and the timing capacitor  $C_{24}$  charges up through  $R_7$  and  $R_{12}$ , and thus  $Q_2$  turns on. When  $Q_2$  conducts, the relay operates, and the output muting on the power amplifier will be removed.

When the power supply is turned off,  $-B_1$  will abruptly decay, and  $Q_1$  will conduct owing to the residual component of  $+B_1$ . As a result,  $C_{24}$  will rapidly discharge,  $Q_2$  will cease to conduct, whereupon the relay will become de-energized and restore muting.

### DC Voltage Detector

The output circuit is connected to the  $Q_3$  emitter and  $Q_4$  base via a low-pass filter ( $R_{13}$ ,  $C_{25}$ ). Any DC voltages appearing the output circuit of the power amplifier, it will be applied to the  $Q_3$  emitter and the  $Q_4$  base. If the voltage is positive,  $Q_4$  turns on.  $C_{24}$  will rapidly discharge. If the voltage is positive,  $Q_4$  turns on.  $C_{24}$  will rapidly discharge. As consequence,  $Q_2$  will turn on and the relay will become de-energized, thus causing the output circuit to open.

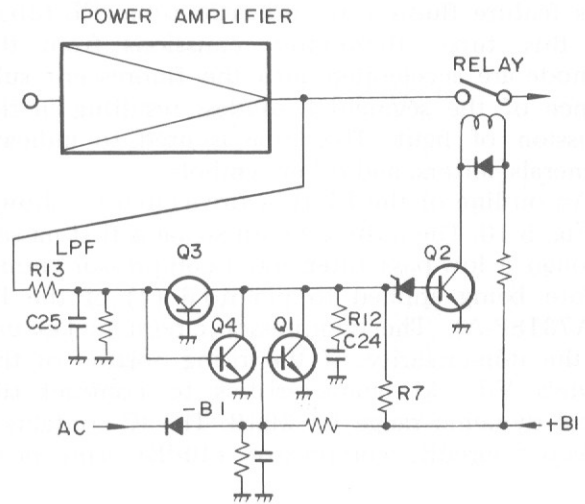


Fig. 5-11 Protection Circuit

## 6. DISASSEMBLY

### Wooden Cover

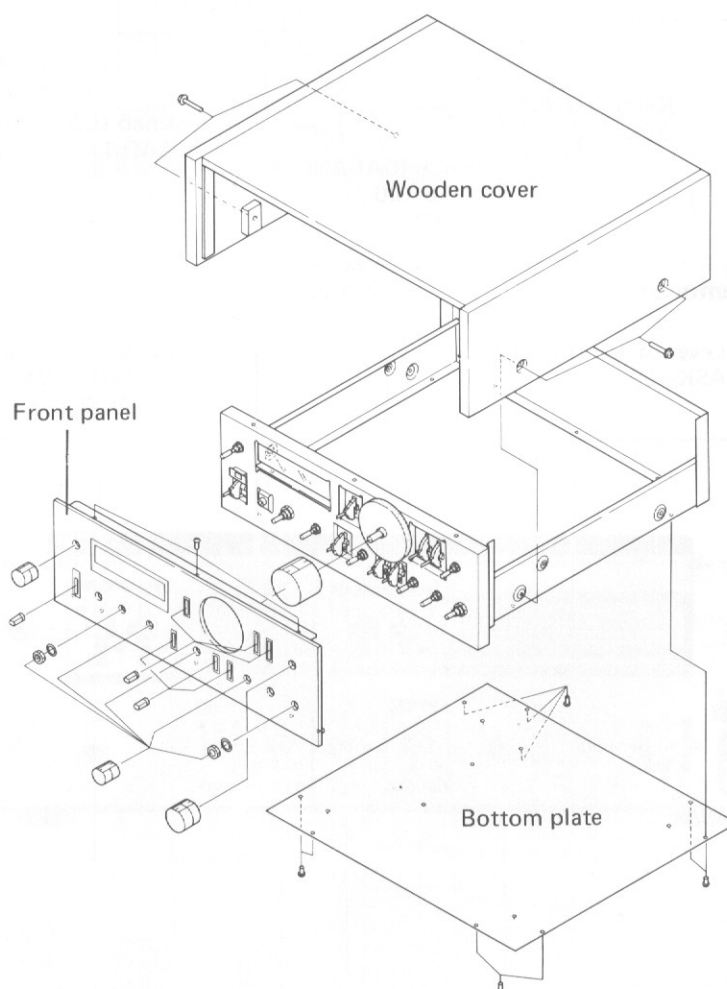
Remove the two screws on each side of the wooden cover.

### Bottom Plate

Remove the nine screws to detach the bottom plate.

### Front Panel

Loosen the set screws of VOLUME knob with a hexagonal wrench. Remove all the knobs by pulling. Remove the three screws from the top edge of the front panel. Remove the two nuts from the control shafts.

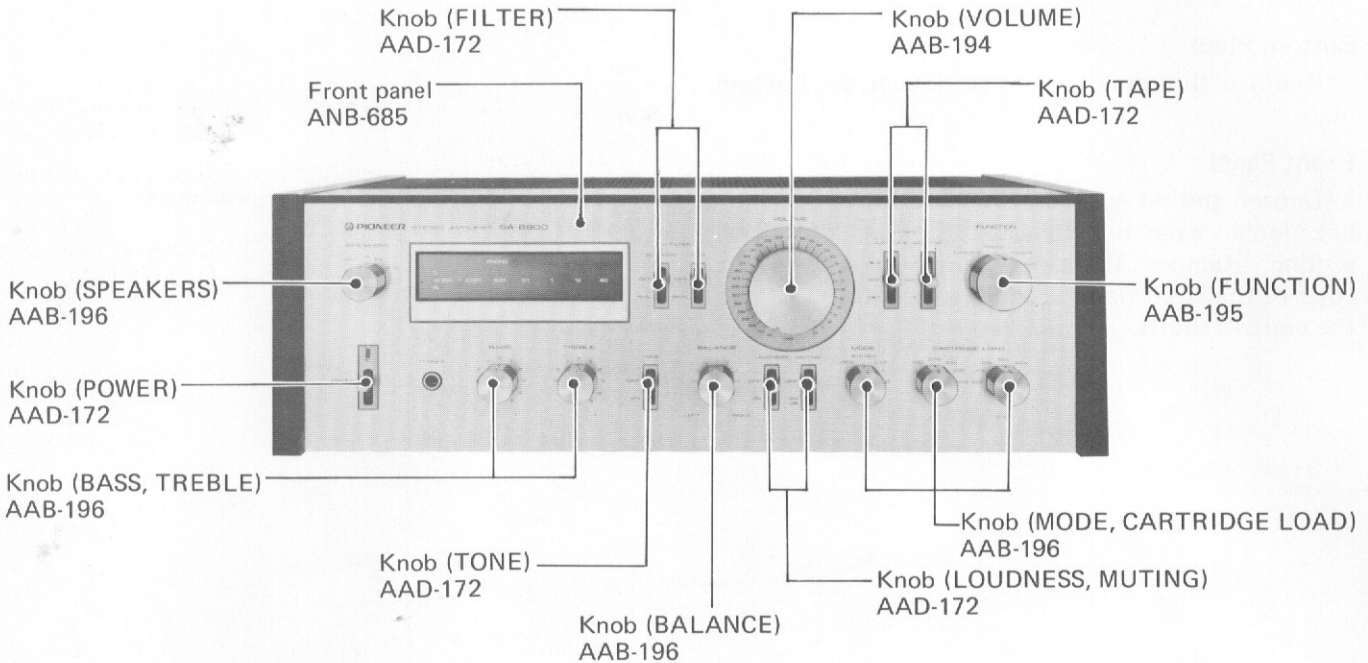


# 7. PARTS LOCATION

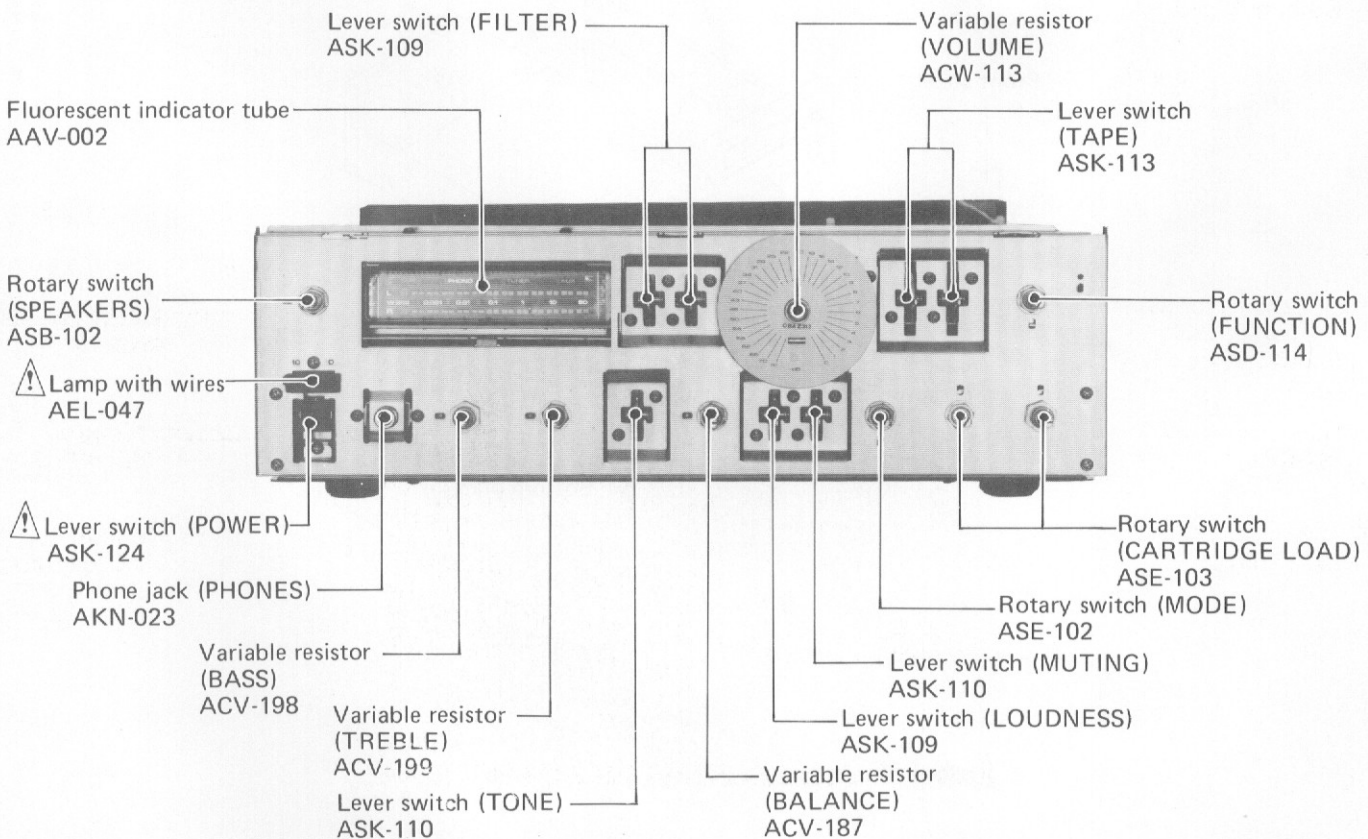
## Front Panel View

### NOTE:

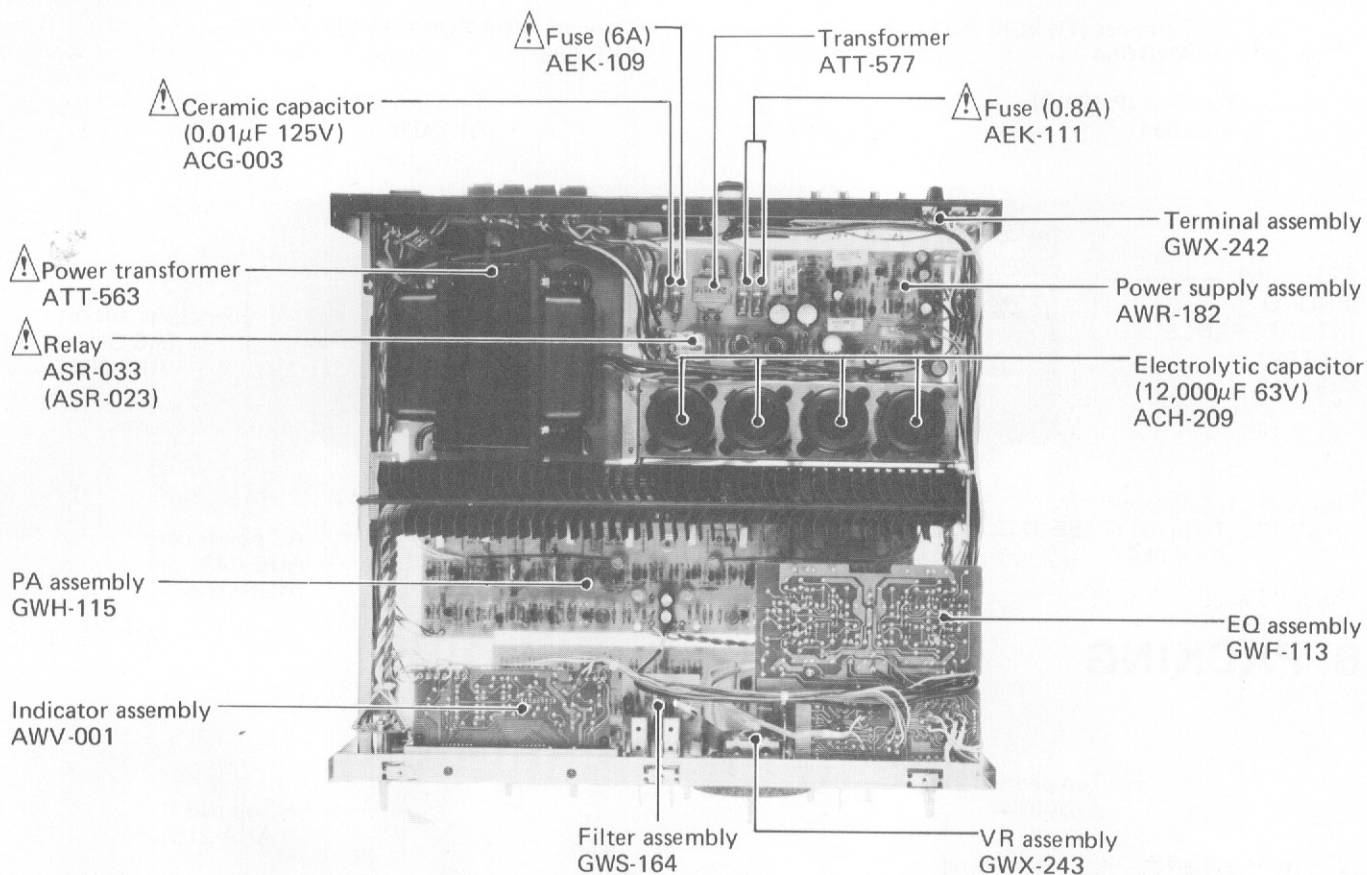
- The  $\triangle$  mark found on some component parts indicates the importance of the safety factor of the part. Therefore, when replacing, be sure to use parts of identical designation.



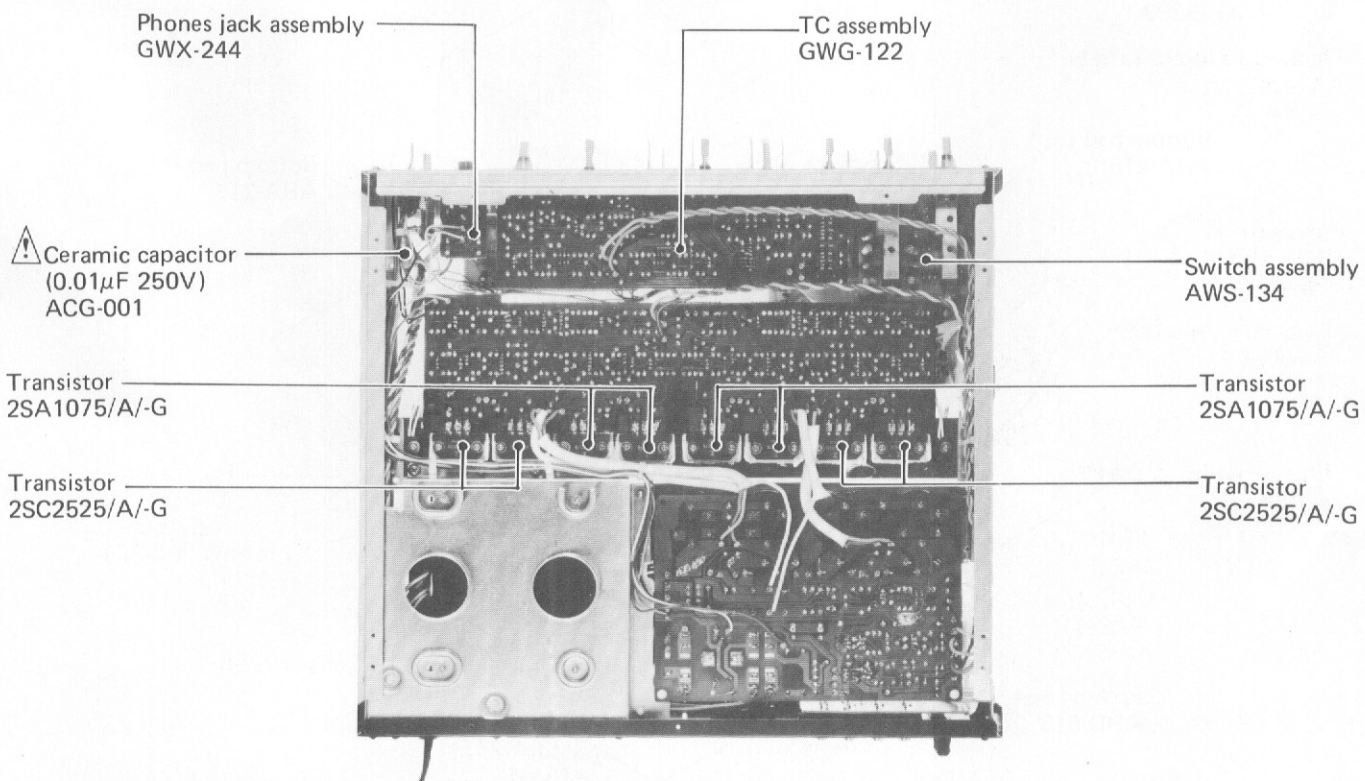
## Front View with Panel Removed



## Top View

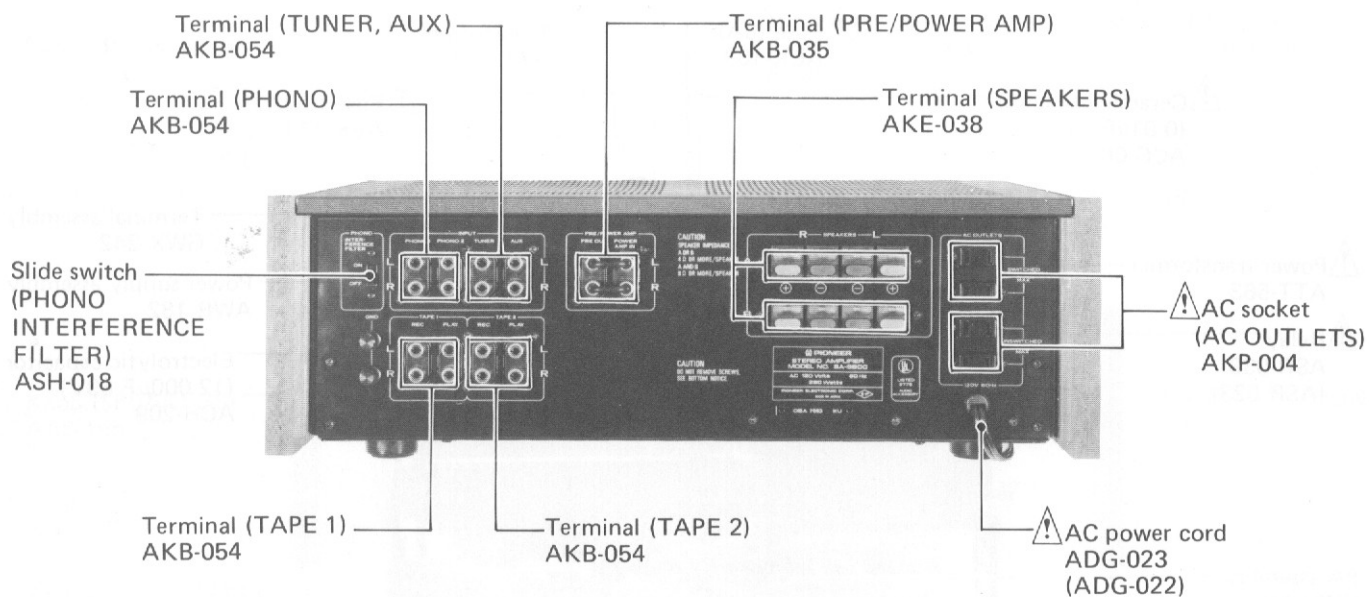


## Bottom View

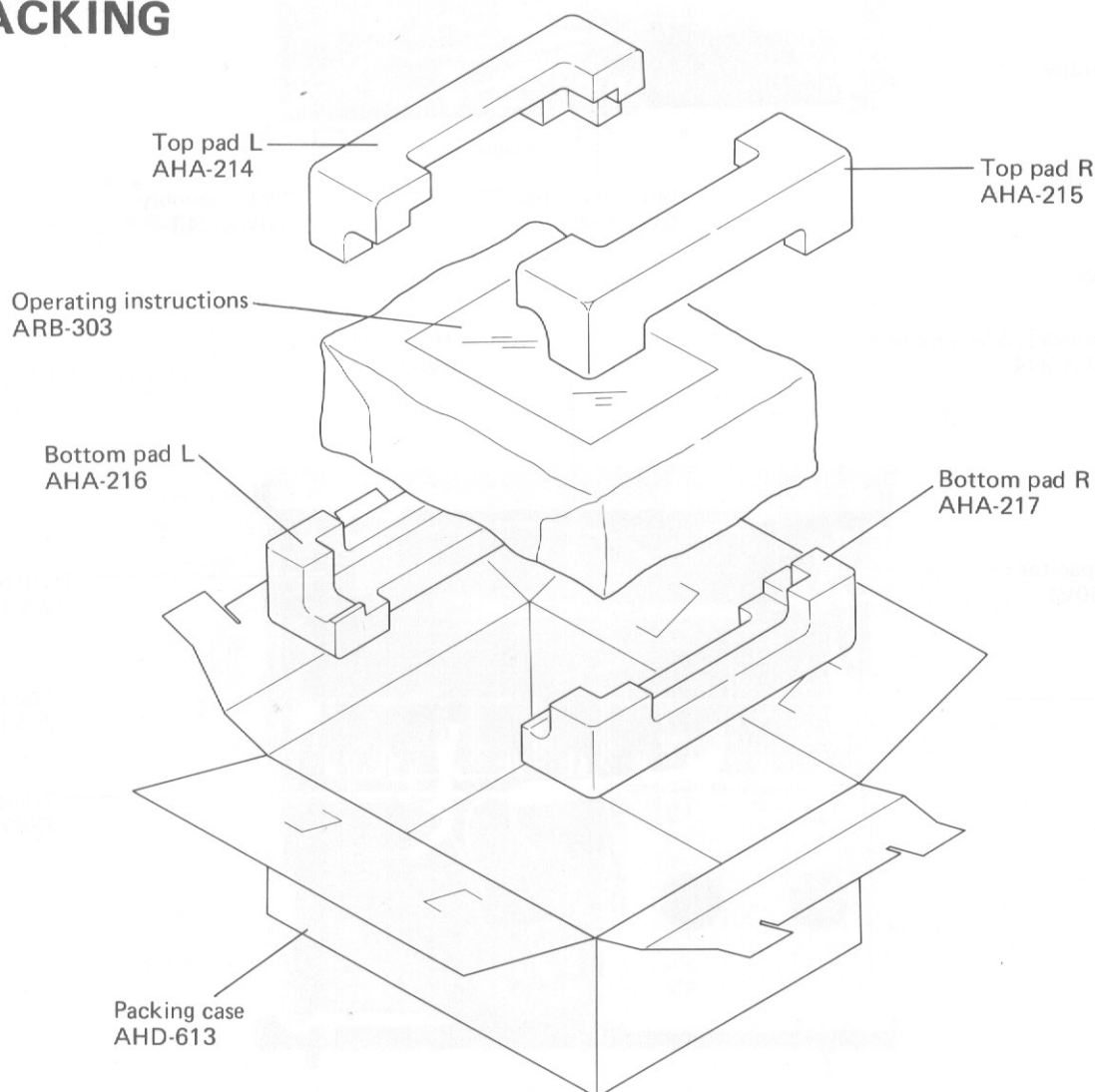




## Rear Panel View



## 8. PACKING



## 9. ADJUSTMENTS

### Power Amplifier

Turn  $VR_7$ ,  $VR_9$  (L) and  $VR_8$ ,  $VR_{10}$  (R) fully around in the counter-clockwise direction, but set  $VR_5$  (L) and  $VR_6$  (R) to the center positions. Without any load or input signal, turn the POWER switch ON.

### DC Balance

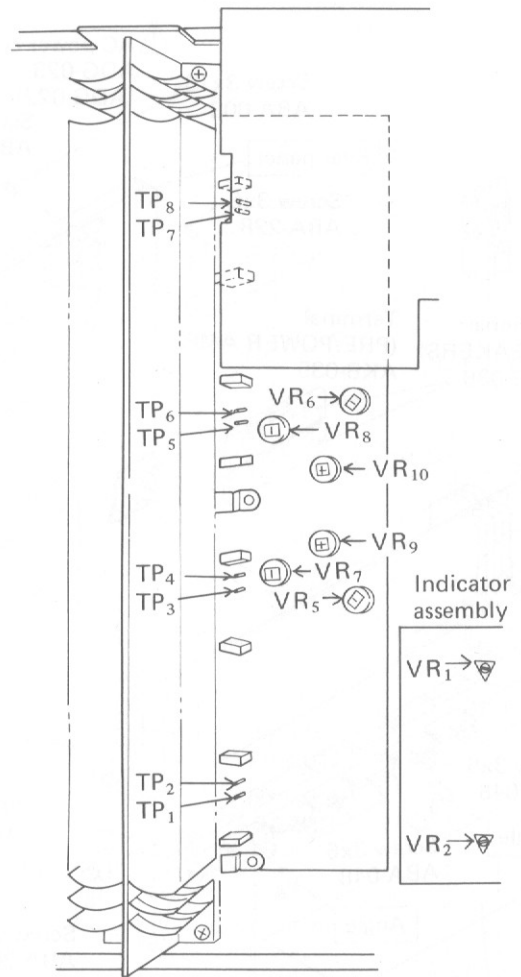
1. Adjust  $VR_5$  (L) for 0V (to within  $\pm 30\text{mV}$ ) between terminal No.15 and ground.
2. Adjust  $VR_6$  (R) for 0V (to within  $\pm 30\text{mV}$ ) between terminal No.20 and ground.

### Idle Current

1. Adjust  $VR_7$  (L) for 56mV between terminals  $TP_1$  (+) and  $TP_3$  (-). The potential difference between terminals  $TP_2$  (+) and  $TP_4$  (-) should register about 56mV at this time.
2. Adjust  $VR_8$  (R) for 56mV between terminals  $TP_7$  (+) and  $TP_5$  (-). The potential difference between terminals  $TP_8$  (+) and  $TP_6$  (-) should register about 56mV at this time.
3. Adjust  $VR_9$  (L) for 70mV between terminals  $TP_1$  (+) and  $TP_3$  (-). The potential difference between terminals  $TP_2$  (+) and  $TP_4$  (-) should register about 70mV at this time.
4. Adjust  $VR_{10}$  (R) for 70mV between terminals  $TP_7$  (+) and  $TP_5$  (-). The potential difference between terminals  $TP_8$  (+) and  $TP_6$  (-) should register about 70mV at this time.



### Output Power Indicator Calibration

1. Apply a 1kHz signal to the POWER AMP IN terminals (or any other input power amplifier input terminals).
2. Adjust the level of this input signal so that the voltage on the output terminals (SPEAKERS) read 8.9V (AC).
3. Adjust  $VR_1$  (L) and  $VR_2$  (R) so that the output power indicator read 10 watts.



## 10. EXPLODED VIEW

## NOTES:

-  marked parts cannot be supplied.
- 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.

Washer faced screw  
ABA-206

Wooden cover  
AMM-077

Front panel  
ANB-685

Screw 3x8  
ABA-186

Knob (SPEAKERS)  
AAB-196

Knob (POWER)  
AAD-172

Washer M9  
M45-086

Nut M9  
B71-004

Knob  
AAD-172

Knob  
AAB-196

Nut M9  
B71-004

Washer M9  
M45-086

Knob (FUNCTION)  
AAB-195

Screw 3x6  
ABA-228

Foot  
AEC-178

Screw 4x12  
ABA-196

Screw 3x6  
ABA-228

Screw 4x12  
ABA-196

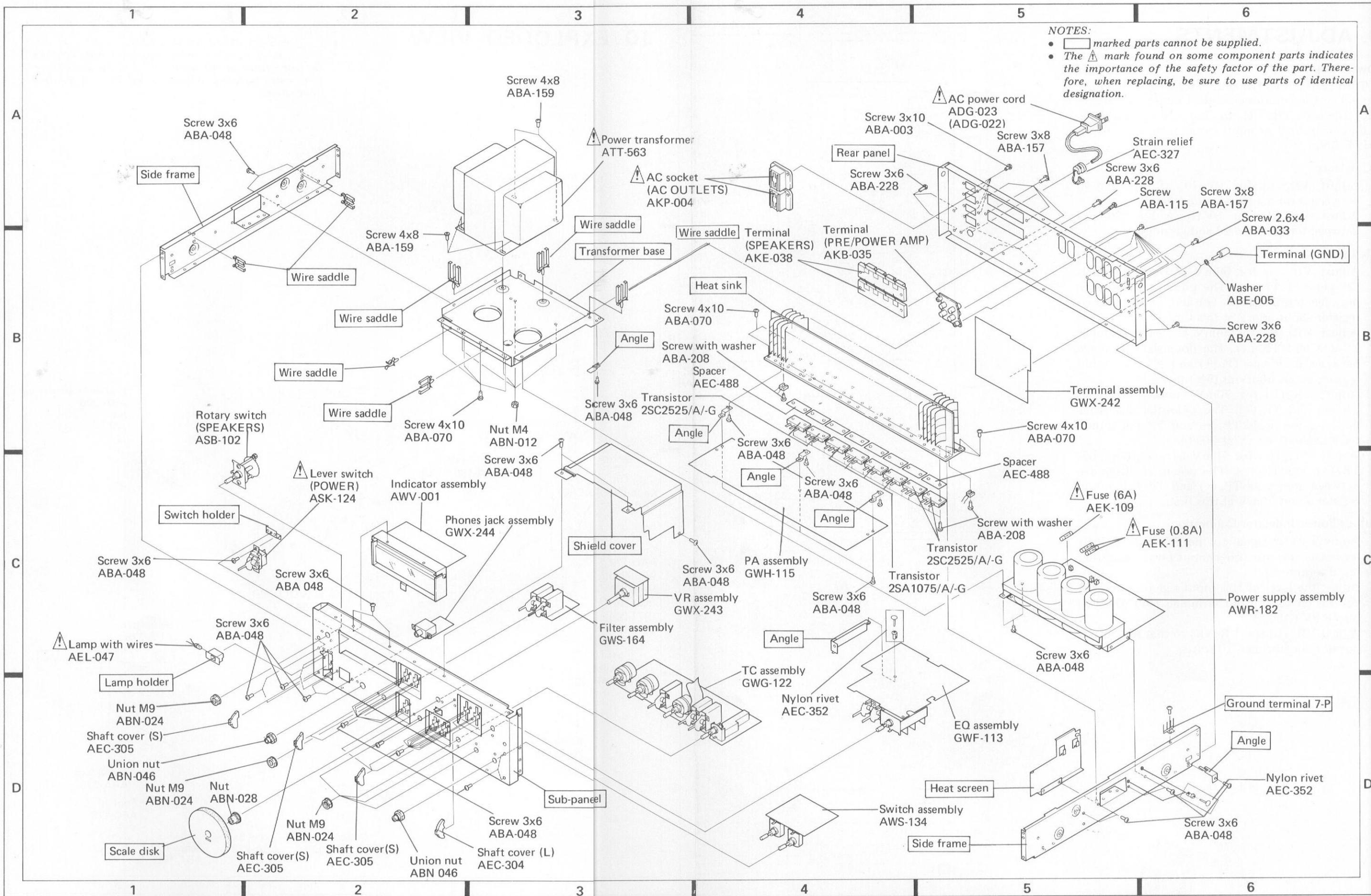
Screw 3x6  
ABA-228

Foot  
AEC-178

Screw 3x6  
ABA-228

Bottom plate

Washer faced screw  
ABA-206





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

## NOTES:


- 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 × 10<sup>1</sup>      561 . . . . . RD½PS 561J  
 47kΩ      47 × 10<sup>3</sup>      473 . . . . . RD½PS 473J  
 0.5Ω      0R5 . . . . . RN2H 0R5K  
 1Ω      010 . . . . . RSIP 010K

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

5.62kΩ      562 × 10<sup>1</sup>      5621 . . . . . RN½SR 5621F

- 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.




## 11.1 MISCELLANEA

### Miscellaneous Parts

#### P. C. BOARD ASSEMBLIES

Part No.	Description
AWV-001	Indicator assembly
AWS-134	Switch assembly
AWR-182	Power supply assembly
GWH-115	PA assembly
GWG-122	TC assembly
GWS-164	Filter assembly
GWX-243	VR assembly
GWX-244	Phones jack assembly
GWF-113	EQ assembly
GWX-242	Terminal assembly


#### LAMP AND FUSES

Part No.	Symbol & Description
 AEL-047	PL1      Lamp with wires
 AEK-109	FU1      Fuse (6A)
 AEK-111	FU2, FU3      Fuse (0.8A)


#### SEMICONDUCTORS

Part No.	Symbol & Description
2SC2525/A/-G	Q1-Q4
2SA1075/A/-G	Q5-Q8





#### SWITCHES

Part No.	Symbol & Description
ASB-102	S13      Rotary (SPEAKERS)
 ASK-124	S14      Lever (POWER)

#### CAPACITORS

Part No.	Symbol & Description
 ACG-001	C1      Ceramic      0.01/250V
CKDYF 473Z 50	C2, C4
CCDSL 221K 50	C5, C6

#### OTHERS

Part No.	Symbol & Description
 ATT-563	T1      Power transformer
 ADG-023	AC power cord
 (ADG-022)	
 AKP-004	AC socket (AC OUTLETS)
AKE-038	Terminal (SPEAKERS)
AKB-035	Terminal (PRE/POWER AMP)

#### 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.

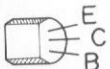
Symbol	Part No.	Description



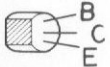
## 11.2 SCHEMATIC DIAGRAM

## External Appearance of Transistors and ICs

2SA904A 2SC1919  
2SA1114 2SC2602  
2SC1914A



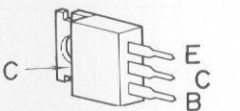
2SA733A 2SC1400  
2SA750 2SC1775A  
2SC945A



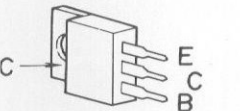
2SA850 2SC1735  
2SA905 2SC1915



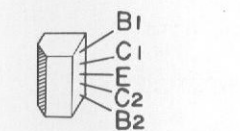
2SA913 2SC1913



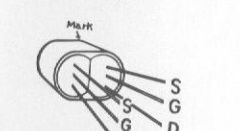
2SB682 2SD712



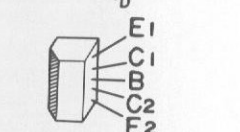
2SA798 2SA979



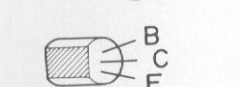
2SK129A



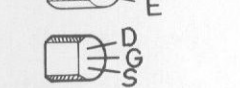
2SC2291



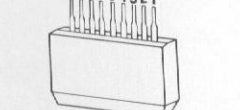
2SC1384



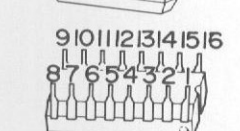
2SK34



TA7318P

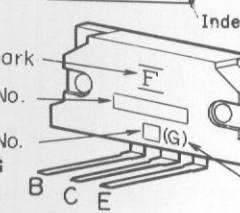


HA12010



Trade mark  
Type No.

Lot No.  
2SA1075/A/G  
2SC2525/A/G



A

B

C

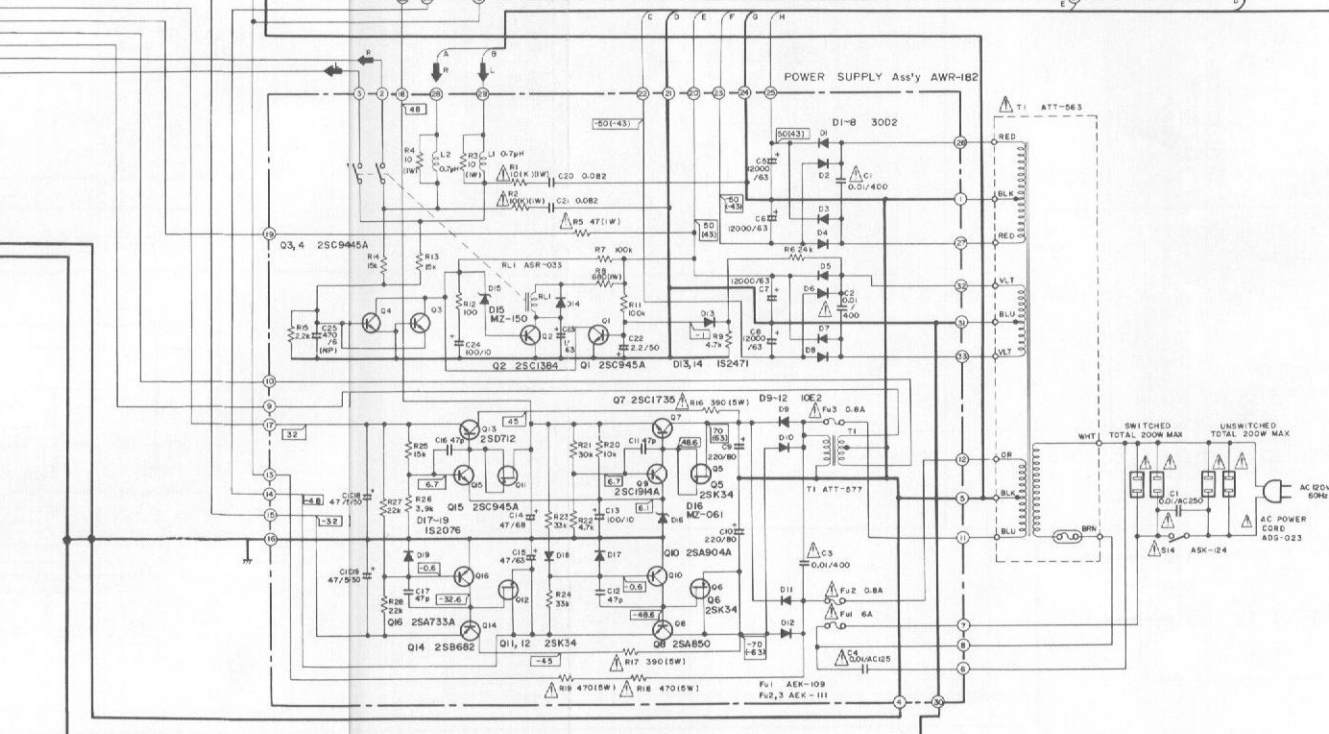
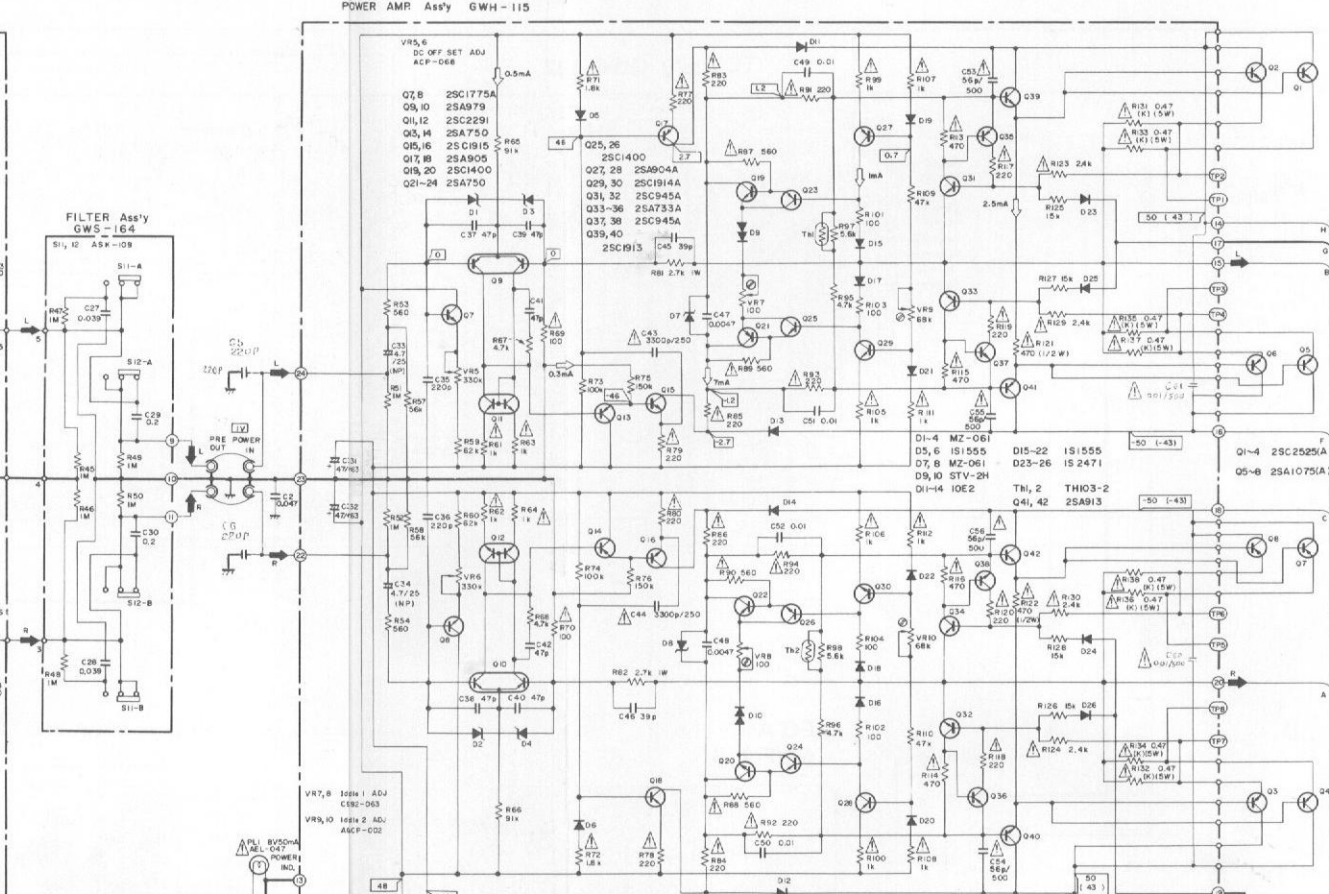
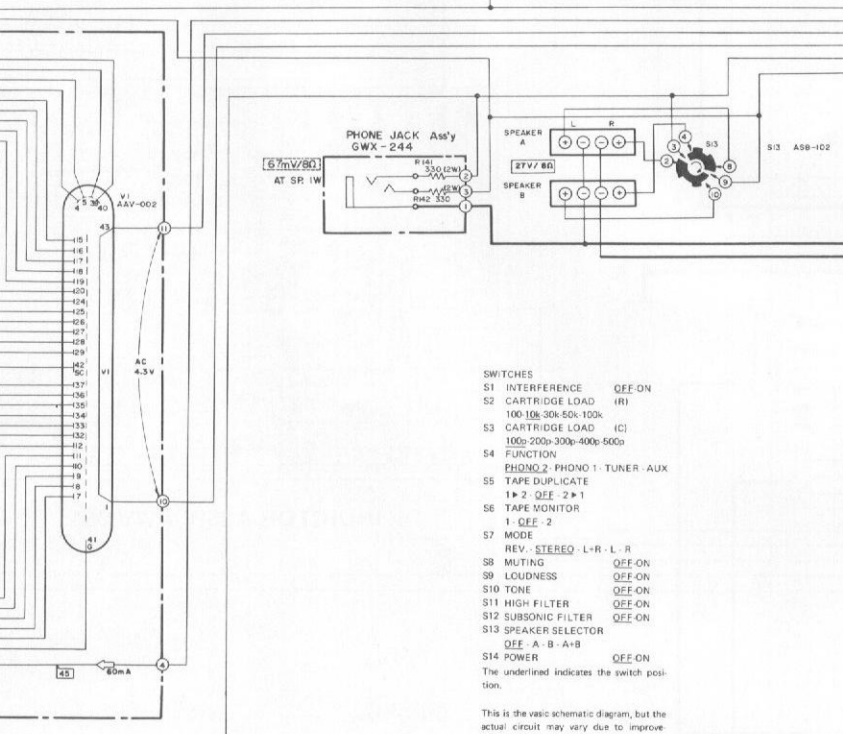
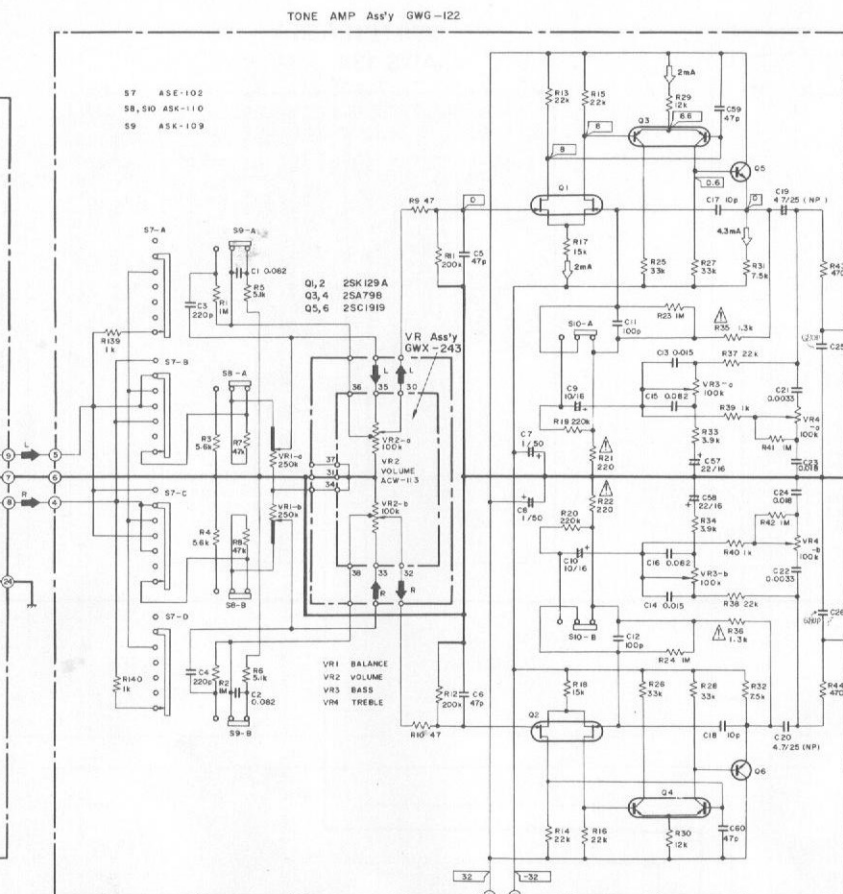
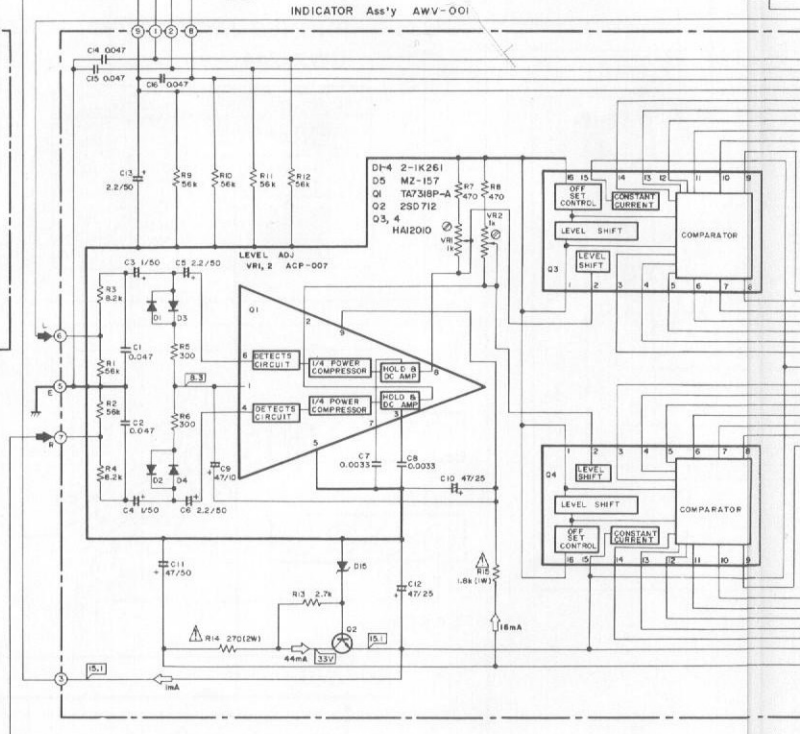
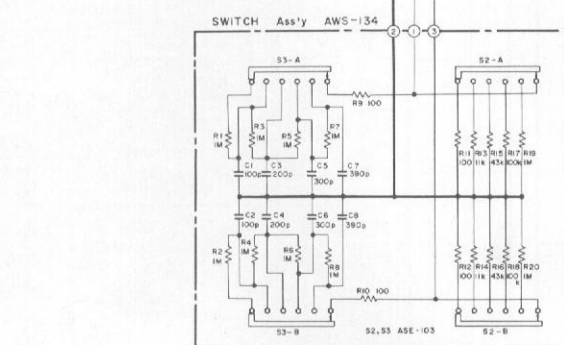
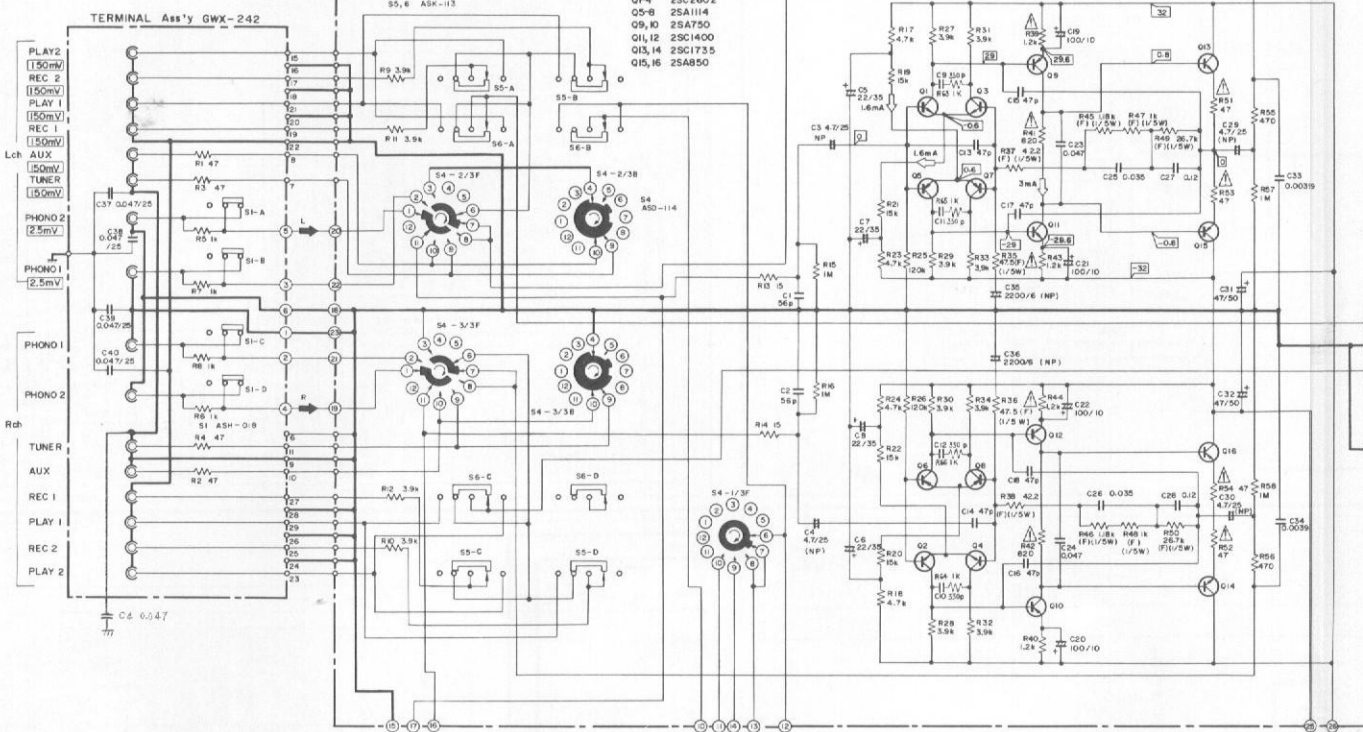
D

A

B

C

D



- SWITCHES  
S1 INTERFERENCE OFF-ON  
S2 CARTRIDGE LOAD 1R1  
S3 CARTRIDGE LOAD 1R2  
S4 FUNCTION  
S5 TAPE DUPLICATE  
S6 TAPE MONITOR  
S7 MODE  
S8 REV. STEREO L-R L-R  
S9 MUTE OFF-ON  
S10 LOUDNESS OFF-ON  
S11 TONE OFF-ON  
S12 HIGH FILTER OFF-ON  
S13 SUBSONIC FILTER OFF-ON  
S14 SPEAKER SELECTOR OFF-ON  
S15 POWER OFF-ON

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

1

2

3

4

5

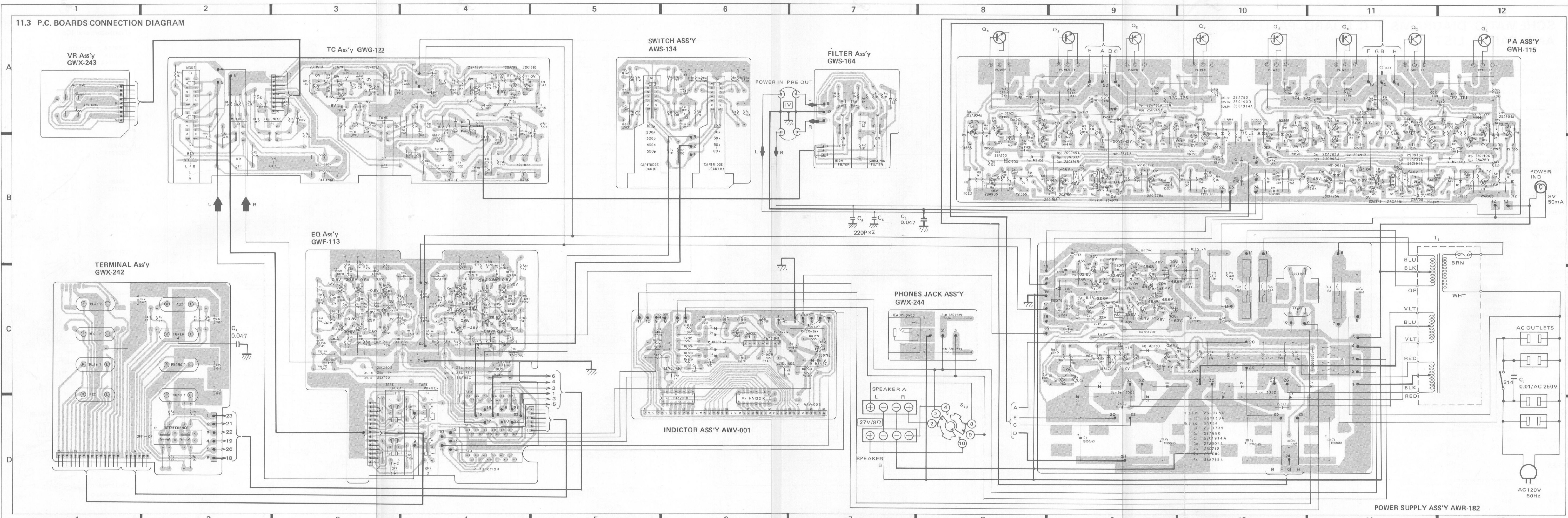
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7

8

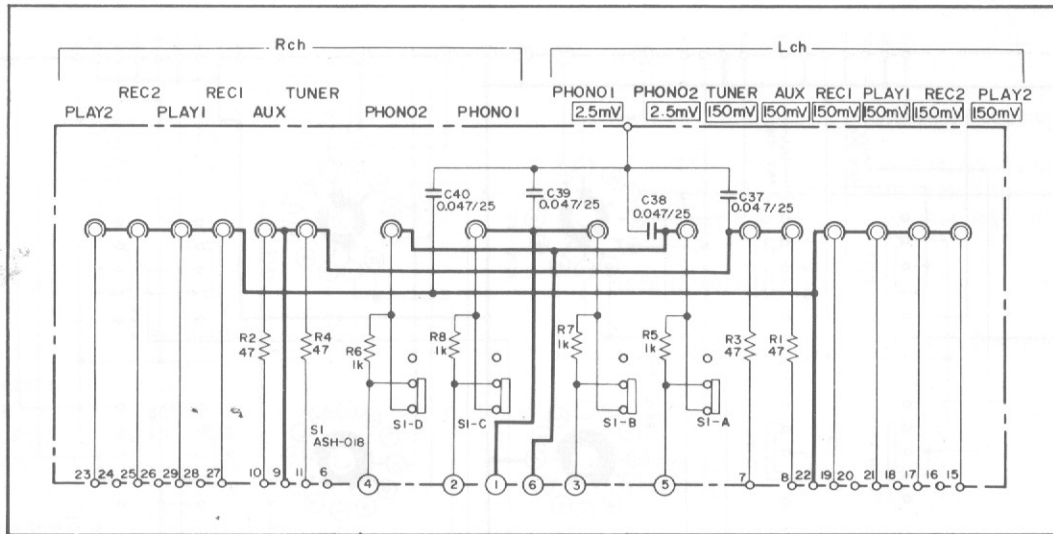
9







## 11.4 TERMINAL ASSEMBLY (GWX-242)



## Parts List

## CAPACITORS

Part No.	Symbol & Description
CKDBC 473Z 25	C37-C40

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

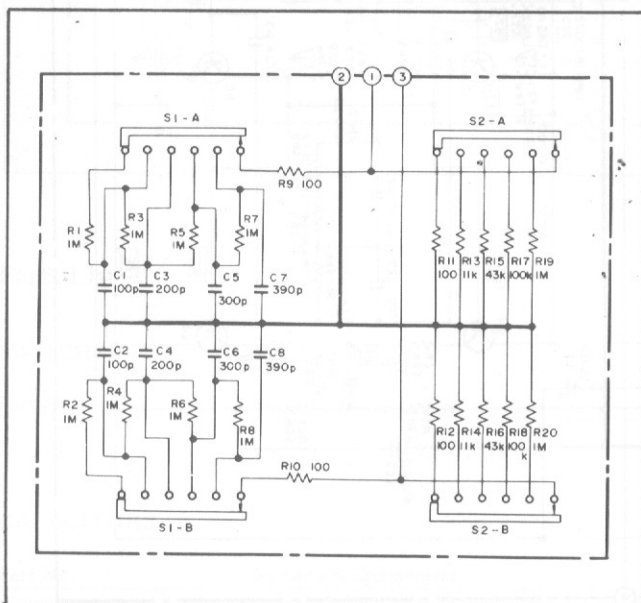
## RESISTORS

Part No.	Symbol & Description
RD4PM 000 J	R1-R8

## OTHERS

Part No.	Symbol & Description
ASH-018	S1 Slide switch (PHONO INTERFERENCE)
AKB-054	Terminal (INPUT, TAPE)

## 11.5 SWITCH ASSEMBLY (AWS-134)



## Parts List

## SWITCHES

Part No.	Symbol & Description
ASE-103	S1, S2 Rotary (CARTRIDGE LOAD)

## CAPACITORS

Part No.	Symbol & Description
CQSH 101K 50	C1, C2
CQSH 201K 50	C3, C4
CQSH 301K 50	C5, C6
CQSH 391K 50	C7, C8

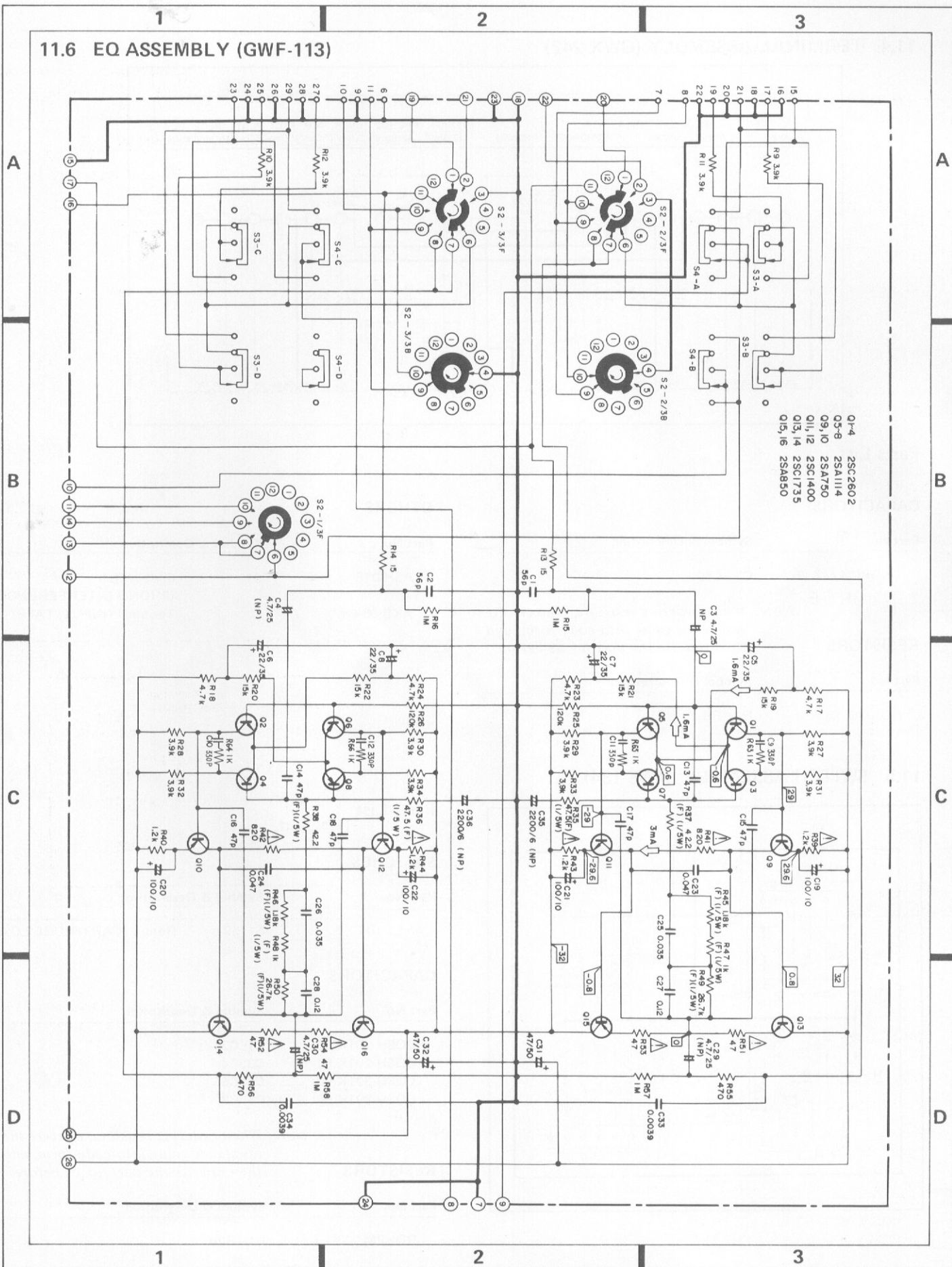
*Note: When ordering resistors, convert the resistance value into code form, and then rewrite the part no. as before.*

## RESISTORS

Part No.	Symbol & Description
RD4PM 000 J	R1-R20



## 11.6 EQ ASSEMBLY (GWF-113)



## Parts List of EQ Assembly (GWF-113)

## SWITCHES

Part No.	Symbol & Description
ASD-114	S2 Rotary (FUNCTION)
ASK-113	S3 Lever (DUPLICATE)
ASK-113	S4 Lever (MONITOR)

## CAPACITORS

Part No.	Symbol & Description
CQSH 560K 50	C1, C2
ACH-318	C3, C4, C29, C30 Electrolytic 4.7/25 (NP)
CEA 220P 35	C5—C8
CCDSL 470K 50	C13—C18
CEA 101P 10	C19—C22
CKDYB 331K 50	C9—C12
CQMA 473K 50	C23, C24
CQPA 353G 50	C25, C26
CQPA 124G 50	C27, C28
CEA 470P 50	C31, C32
CQMA 392J 50	C33, C34
ACH-339	C35, C36 Electrolytic 2200/6V (NP)

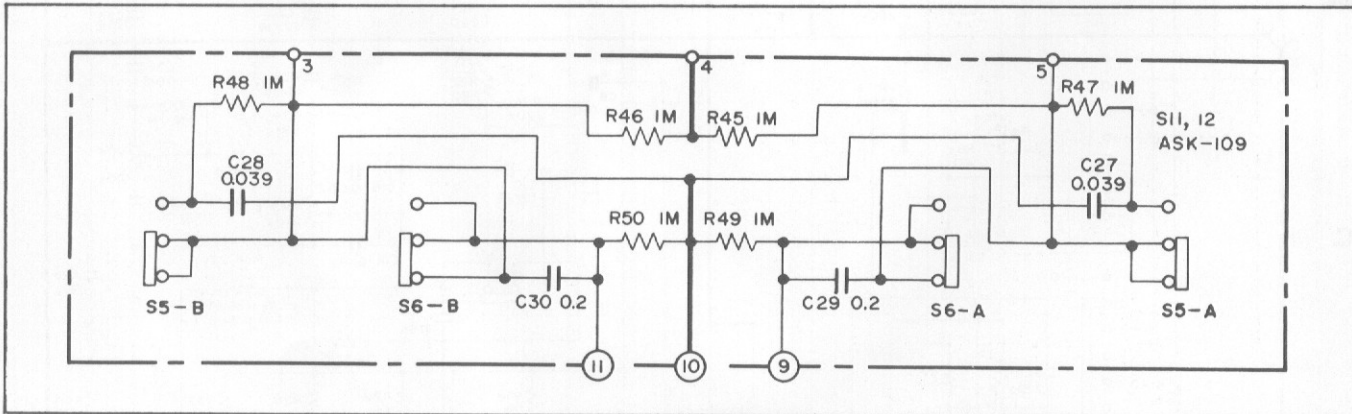
## RESISTORS

Part No.	Symbol & Description
RD $\frac{1}{4}$ PM $\square\square\square$ J	R9—R34, R55—R58, R63—R66
RN $\frac{1}{5}$ SQ $\square\square\square\square$ F	R35—R38, R45—R50
$\Delta$ RD $\frac{1}{4}$ PSF $\square\square\square$ J	R39—R44, R51—R54

## SEMICONDUCTORS

Part No.	Symbol & Description
2SC2602	Q1—Q4
2SA1114	Q5—Q8
2SA750	Q9, Q10
2SC1400	Q11, Q12
2SC1735	Q13, Q14
2SA850	Q15, Q16

## 11.7 FILTER ASSEMBLY (GWS-164)



## Parts List

## SWITCHES

Part No.	Symbol & Description
ASK-109	S5, S6 Lever (FILTER)

## CAPACITORS

Part No.	Symbol & Description
CQMA 393K 50	C27, C28
CQMA 204J 50	C29, C30

## RESISTORS

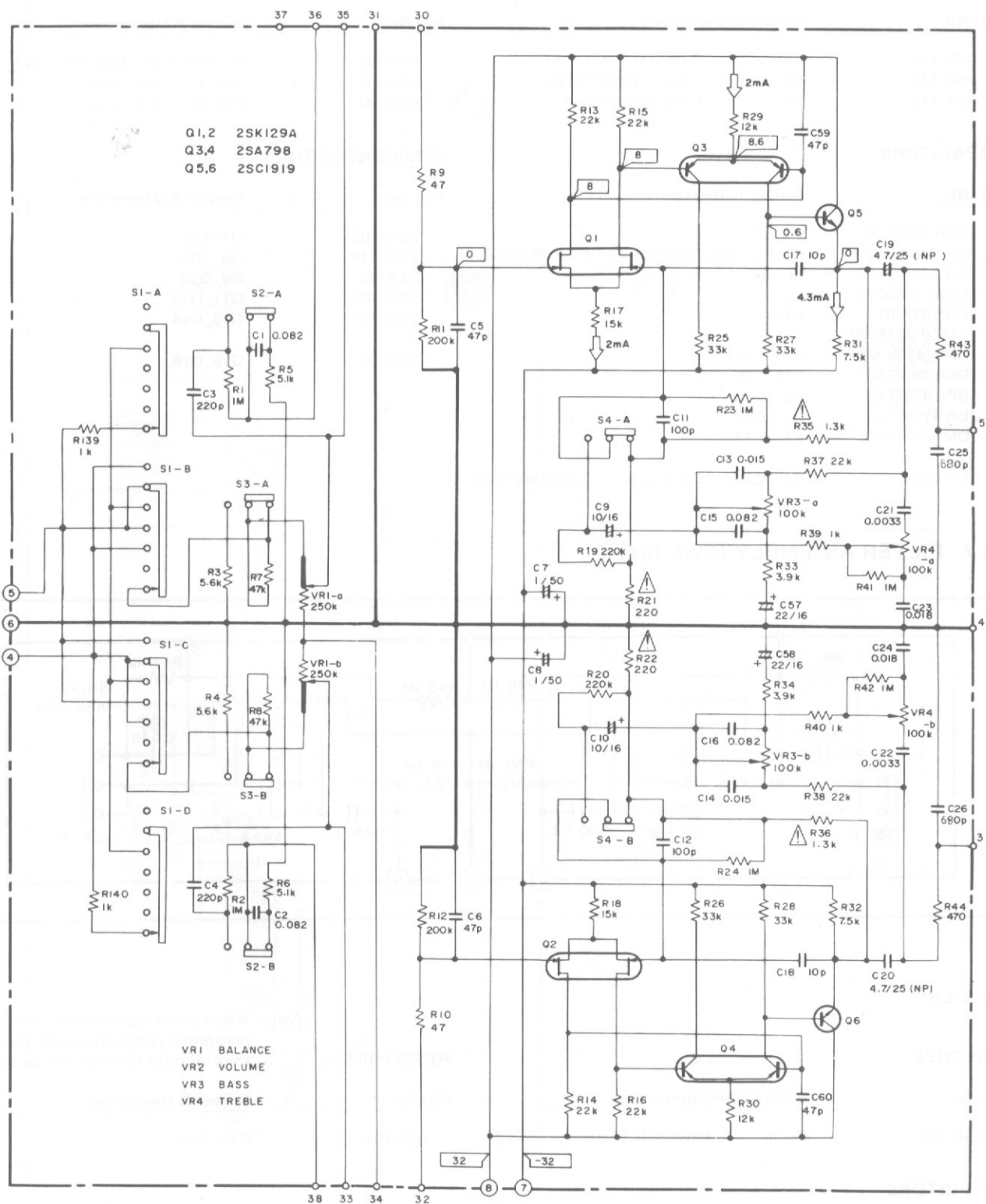
Part No.	Symbol & Description
RD $\frac{1}{4}$ PM $\square\square\square$ J	R45—R50

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

# 11.8 TC ASSEMBLY (GWG-122)

Q1,2 2SK129A  
Q3,4 2SA798  
Q5,6 2SC1919

VR1 BALANCE  
VR2 VOLUME  
VR3 BASS  
VR4 TREBLE



## Parts List of TC Assembly (GWG-122)

## SWITCHES

Part No.	Symbol & Description	
ASE-102	S1	Rotary (MODE)
ASK-109	S2	Lever (LOUDNESS)
ASK-110	S3	Lever (MUTING)
ASK-110	S4	Lever (TONE)

## CAPACITORS

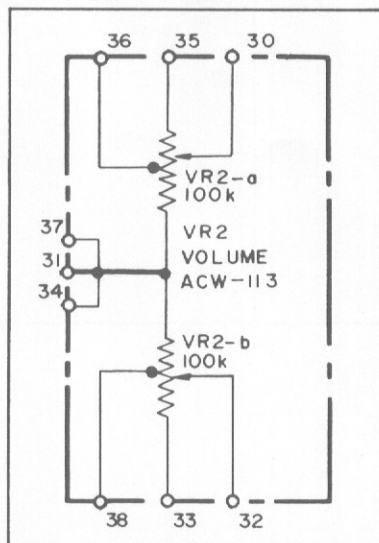
Part No.	Symbol & Description	
CQMA 823J 50	C1, C2, C15, C16	
CCDSL 221K 50	C3, C4,	
CCDSL 470K 50	C5, C6, C59, C60	
CEA 010P 50	C7, C8	
CEANL 100M 16	C9, C10	
CCDSL 101K 50	C11, C12	
CQMA 153J 50	C13, C14	
CCDSL 100F 50	C17, C18	
ACH-318	C19, C20	Electrolytic 4.7/25(NP)
CQMA 332J 50	C21, C22	
CCDSL 681K 50	C25, C26	
CQMA 183J 50	C23, C24	
CEANL 220M 16	C57, C58	

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

## RESISTORS

Part No.	Symbol & Description	
ACV-187	VR1	Variable (BALANCE)
ACV-198	VR3	Variable (BASS)
ACV-199	VR4	Variable (TREBLE)
RD $\frac{1}{4}$ PM $\square\square\square$ J	R1-R20, R23-R34, R37-R44, R139, R140	
$\Delta$ RD $\frac{1}{4}$ PSF $\square\square\square$ J	R21, R22, R35, R36	

## 11.9 VR ASSEMBLY (GWX-243)



## SEMICONDUCTORS

Part No.	Symbol & Description	
2SK129A	Q1, Q2	
2SA798	Q3, Q4	
2SC1919	Q5, Q6	
(2SC1400)		

## 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

## Parts List




Part No.	Symbol & Description	
ACW-113	Variable resistor (VOLUME)	



### 11.10 PA ASSEMBLY (GWH-115)






## Parts List

## CAPACITORS

Part No.	Symbol & Description
CEA 470P 63	C31, C32
ACH-318	C33, C34
CCDSL 221K 50	C35, C36
CCDSL 470K 50	C37—C40
CCDSL 470K 50	C41, C42
 CQMA 332K 250	C43, C44
CCDSL 390K 50	C45, C46
CQMA 472K 50	C47, C48
CQMA 103K 50	C49—C52
 CCDSL 560K 500	C53—C56
 CKDYF 103Z 500	C61, C62

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

## RESISTORS

Part No.	Symbol & Description
ACP-068	VR5, VR6 Semifixed 330k-B
C92-063	VR7, VR8 Semifixed 100-B
ACP-002	VR9, VR10 Semifixed 68k-B
RD%PM □□□ J	R51—R54, R57—R60, R65—R68, R73—R76
RD%PM □□□ J	R95—R98, R101—R104, R109, R110
RD%PM □□□ J	R125—R128
 RD%PSF □□□ J	R61—R64, R69—R72, R77—R80, R83—R90
 RD%PSF □□□ J	R91—R94, R99, R100, R105—R108
 RD%PSF □□□ J	R111—R120, R123, R124, R129, R130
RS1P □□□ J	R81, R82
 RD%PSF □□□ J	R121, R122
 ACN-041	R131—R138 Wire wound 0.47/5W

## SEMICONDUCTORS

Part No.	Symbol & Description
2SC1775A-E *	Q7, Q8
or -F *	
2SA979-F *	Q9, Q10
or -G *	
*hfe of Q7 and Q8 should have the E-rank, if Q9 and Q10 have the F-rank.	
*hfe of Q7 and Q8 should have the F-rank, if Q9 and Q10 have the G-rank.	
2SC2291	Q11, Q12
2SA750	Q13, Q14
(2SA726S)	
2SC1915	Q15, Q16
2SA905	Q17, Q18
2SC1400	Q19, Q20, Q25, Q26
2SA750	Q21—Q24
2SA904A	Q27, Q28
2SC1914A	Q29, Q30
2SC945A	Q31, Q32, Q37, Q38
2SA733A	Q33—Q36

Part No.	Symbol & Description
2SC1913-R** or -Q**	Q39, Q40
2SA913-R** or -Q**	Q41, Q42
**hfe of Q39—Q42 should have the same value.	
1S1555 (1S2473)	D5, D6, D15—D22
10E2	D11—D14
1S2471	D23—D26
MZ-061 (WZ-061)	D1—D4, D7, D8
STV2H	D9, D10
TH103-2	Th1, Th2

### List of Changed Parts for Factory Modification

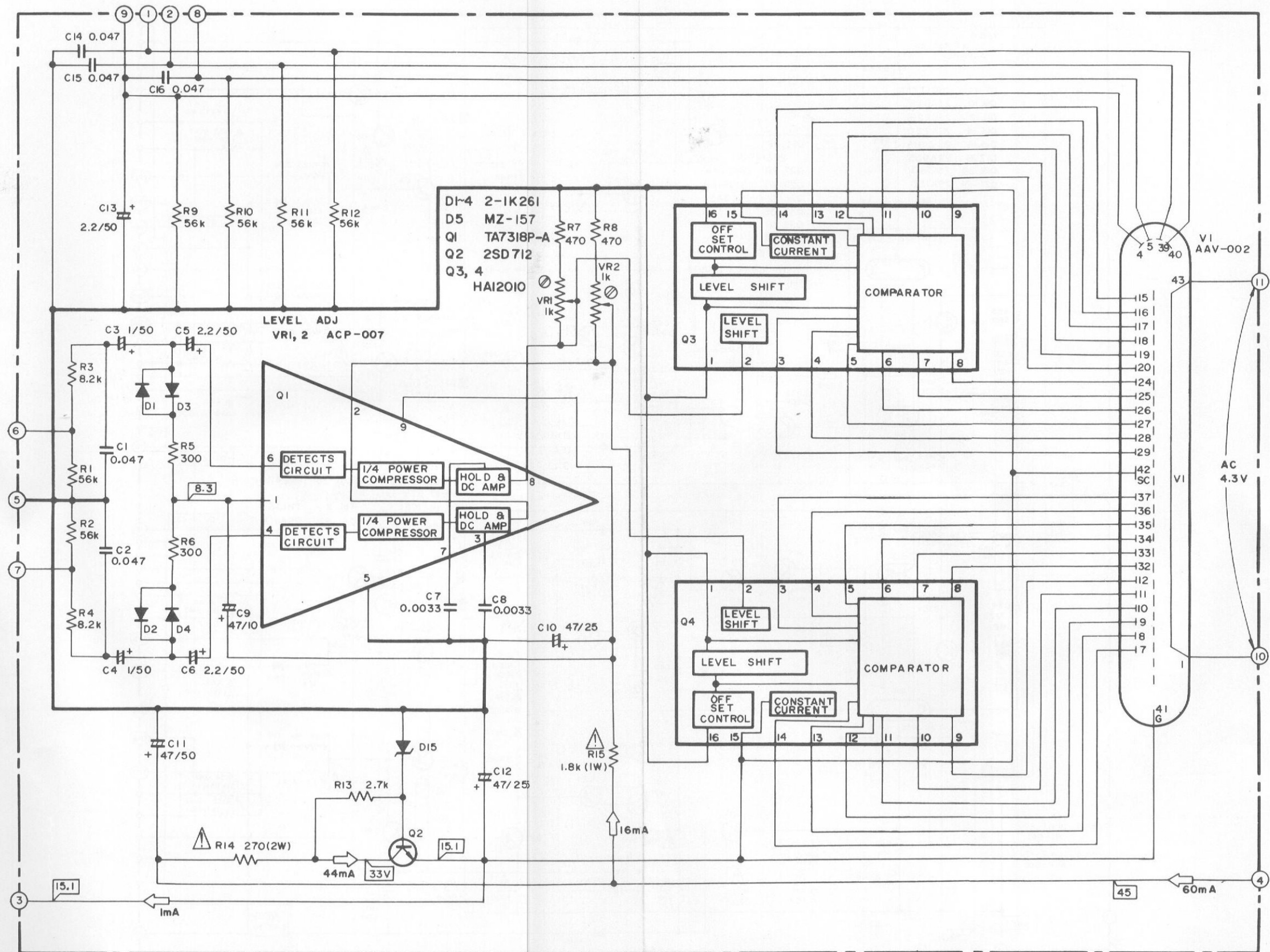
List of changed parts information will be furnished whenever necessary and you are requested to amend parts number in this parts list.

Symbol	Part No.	Description





### 11.11 INDICATOR ASSEMBLY (AWV-001)



## Parts List of Indicator Assembly (AWV-001)

## CAPACITORS

Part No.	Symbol & Description
CQMA 473K 50	C1, C2
CEA 010P 50	C3, C4
CEA 2R2P 50	C5, C6, C13
CQMA 332K 50	C7, C8
CEA 470P 10	C9
CEA 470P 25	C10, C12
CEA 470P 50	C11
CKDYF 473Z 50	C14-C16

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

## RESISTORS

Part No.	Symbol & Description
ACP-007	VR1, VR2 Semifixed 1k-B
⚠ RS2P □□□ J	R14
⚠ RS1P □□□ J	R15
RD¼PM □□□ J	R1-R3

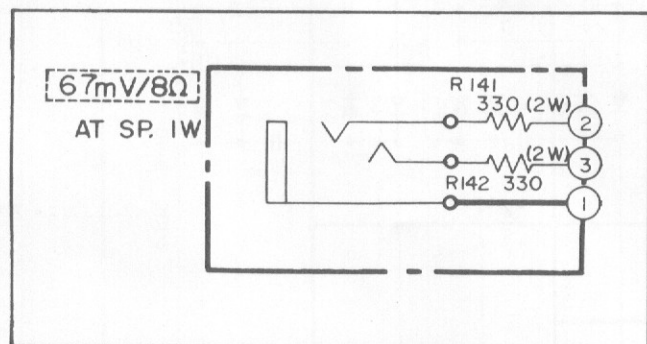
## SEMICONDUCTORS

Part No.	Symbol & Description
TA7318P-A	Q1
2SD712	Q2
HA12010	Q3, Q4
2-1K261	D1-D4
MZ-157 (WZ-157)	D5

## OTHERS

Part No.	Symbol & Description
AAV-002	V1
ABA-048	Fluorescent indicator tube Screw 3x6

## 11.12 PHONES JACK ASSEMBLY (GWX-244)

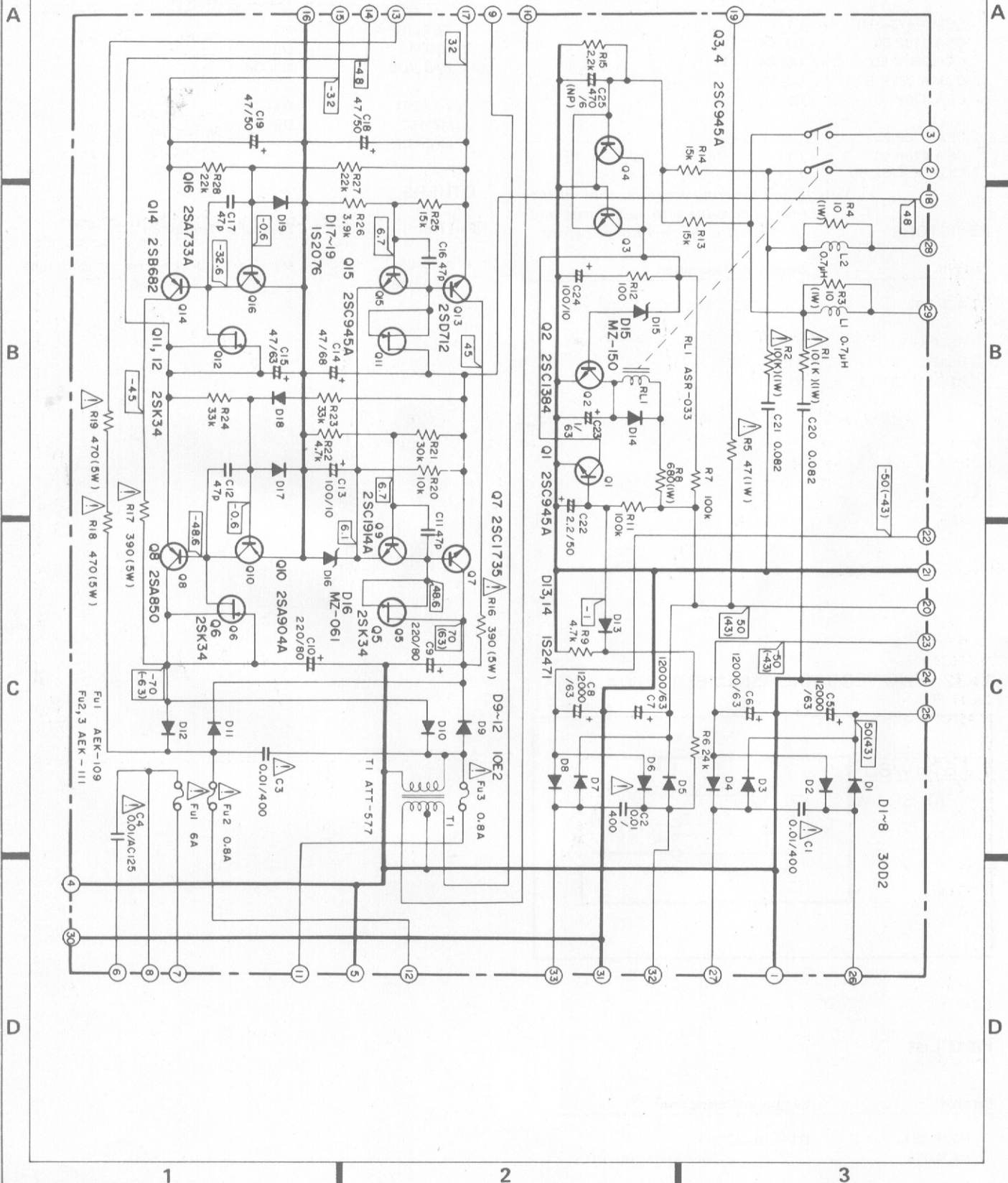


## Parts List

Part No.	Symbol & Description
RS2P 331J AKN-023	R141, R142 Phone jack (PHONES)



# 11.13 POWER SUPPLY ASSEMBLY (AWR-182)






### Parts List of Power Supply Assembly (AWR-182)

## CAPACITORS

Part No.	Symbol & Description	
QOMA 103K 400	C1—C3	
△ ACG-003	C4	Ceramic 0.01/125V
ACH-209	C5—C8	Electrolytic 12000/63V
CEA 221P 80	C9, C10	
CCDSL 470K 50	C11, C12, C16, C17	
CEA 101P 10	C13	
CEA 470P 63	C14, C15	
CEA 470P 50	C18, C19	
QOMA 823K 50	C20, C21	
CEANL 2R2M 50	C22	
CEA 010P 63	C23	
CEA 101P 16	C24	
ACH-340	C25	

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




## RESISTORS

Part No.	Symbol & Description
 RN1H □□□ K	R1, R2
RS1P □□□ J	R3, R4, R8
 RS1P □□□ J	R5
 RT5B □□□ K	R16–R19
RD½PM □□□ J	R6, R7, R9, R11–R15, R20–R28

## SEMICONDUCTORS

Part No.	Symbol & Description
2SC945A	Q1, Q3, Q4, Q15
2SC1384	Q2
2SK34	Q5, Q6, Q11, Q12
2SC1735	Q7
2SA850	Q8
2SC1914A	Q9
2SA904A	Q10
2SD712	Q13
2SB682	Q14
2SA733A	Q16
30D2	D1—D8
(GP-25D)	
10E2	D9—D12
(SIB01-02)	
1S2471	D13, D14
WZ-150	D15
WZ-061	D16
1S2076	D17—D19
(1S1555)	

## OTHERS

Part No.	Symbol & Description
ATT-577	T1 Transformer (for FL)
 ASR-033	RL1 Relay
 (ASR-023)	
 AEC-279	Capacitor cover
ABA-048	Screw 3x6
ABA-051	Screw 3x12
ABE-020	Washer

### List of Changed Parts for Factory Modification

Symbol	Part No.	Description