

SERVICE MANUAL

STEREO AMPLIFIER **SA-7100** KUW, FVW

NOTE:

MODEL SA-7100 COMES IN TWO VERSIONS DISTINGUISHED AS FOLLOWS:

Round label on rear panel	Voltage	Type
KUW FVW	120V only 5-position selector	UL approved (U.S.A.) General export model

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1. SPECIFICATIONS

Semiconductors

FETs	2
Transistors	33
Diodes	24

Power Amplifier Section

Circuitry 1st Stage Differential Amplifier, Direct Coupled Pure Complementary OCL

Continuous Power Output

20Hz ~ 20kHz (Both channels driven)	20W+20W (8Ω), 24W+24W (4Ω)
1kHz (Both channels driven)	22W+22W (8Ω), 30W+30W (4Ω)
1kHz (Each channel driven)	25W/25W (8Ω), 36W/36W (4Ω)

Harmonic Distortion

(Continuous Power Output)	Less than 0.5%
(1W+1W Power Output)	Less than 0.05%

Intermodulation Distortion

(Continuous Power Output)	Less than 0.5%
(1W+1W Power Output)	Less than 0.1%

Power Bandwidth

(IHF, Both channels driven) 5Hz ~ 70kHz (H.D. 0.5%)

Frequency Response

7Hz ~ 80kHz ± 1 dB

Input Sensitivity/Impedance

POWER AMP IN 500mV/50kΩ

Output, Speaker A, B, A+B (4 ~ 16Ω)

Headphone 4 ~ 16Ω

Damping Factor (1kHz, 8Ω) More than 40

Hum & Noise

(IHF, Short-circuited, A Network) More than 90dB

Residual Hum & Noise

(8Ω, Pre & Power-amplifier) Less than 1mV (0.13μW)

Subsonic Filter 5Hz (12dB/oct)

Preamplifier Section

Circuitry

Equalizer-amplifier 3-stage Direct Coupled NFB type

Control-amplifier 1st Stage FET, NFB type

Input Sensitivity/Impedance

PHONO 1	2.5mV/50kΩ
PHONO 2	2.5mV/50kΩ
PHONO Overload Level (rms/p-p)	190mV/530mV
MIC	2.0mV/50kΩ
TUNER	150mV/100kΩ
AUX 1	150mV/100kΩ
AUX 2	150mV/100kΩ
TAPE MONITOR 1, 2	150mV/100kΩ
TAPE MONITOR 2 (DIN connector)	150mV/100kΩ

Output Level/Impedance

TAPE REC 1, 2	150mV
TAPE REC 2 (DIN connector)	30mV/80kΩ
PRE AMP OUT	500mV/1.5kΩ

Harmonic Distortion (20Hz ~ 20kHz)	Less than 0.1%
Frequency Response	
PHONO (RIAA equalization)	30Hz ~ 15kHz ±0.2dB
MIC	15Hz ~ 10kHz $_{-1}^{+0}$ dB
TUNER, AUX, TAPE MON	15Hz ~ 30kHz $_{-1}^{+0}$ dB
Tone Control	
BASS	Turnover Frequency 200Hz ±6.5dB (100Hz)
TREBLE	Turnover Frequency 400Hz ±10dB (100Hz)
	Turnover Frequency 2.5kHz ±10.5dB (10kHz)
	Turnover Frequency 5kHz ±7.5dB (10kHz)
Loudness Contour (Volume control set at -40dB position)	+10dB (100Hz), +6dB (10kHz)
Hum & Noise (IHF, Short-circuited, A Network)	
PHONO	More than 80dB
MIC	More than 70dB
TUNER, AUX, TAPE MON	More than 90dB
Muting	-20dB
Miscellaneous	
Power Requirements	AC 120V/60Hz or AC 110V, 120V, 130V, 220V, and 240V 50/60Hz. (Switchable)
Power Consumption (Max.)	180W
AC Outlets	Switched 1, Unswitched 2
Dimensions (Overall)	430(W) x 138(H) x 341(D)mm 16-15/16(W) x 5-7/16(H) x 13-7/16(D) in.
Weight	Without Package 10.1kg (22 lb 4.2 oz) With Package 12.1kg (26 lb 6.7 oz)
Furnished Parts	
Connection Cord with Pin Plug	1
Polishing Cloth	1
Factory Tested Data	1
Operating Instructions	1
5-line voltage model; Fuse 1A	1
Fuses 2A	2

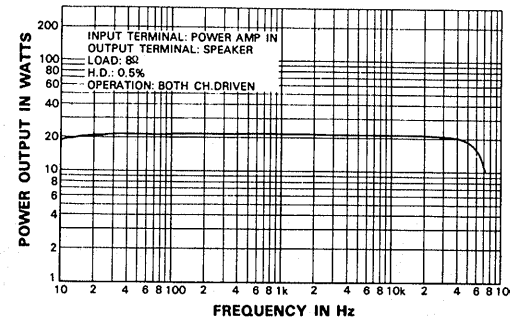
NOTE:

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

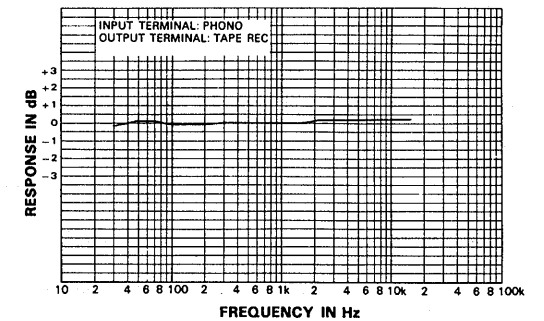


AMPLIFIER CHARACTERISTICS

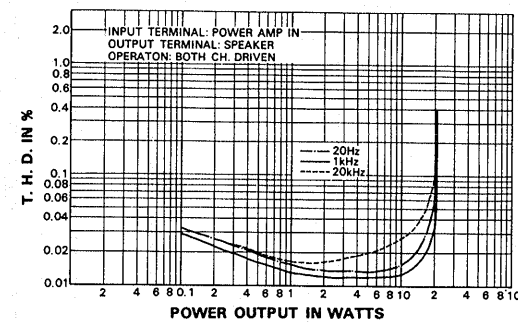
POWER BANDWIDTH



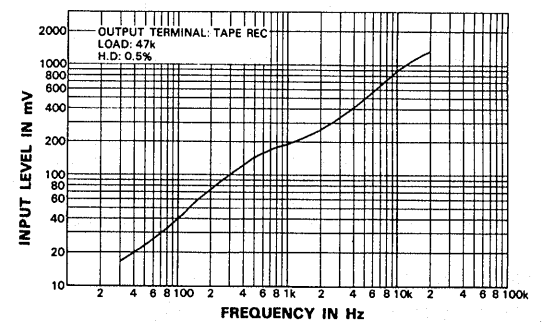
PHONO EQUALIZATION ACCURACY



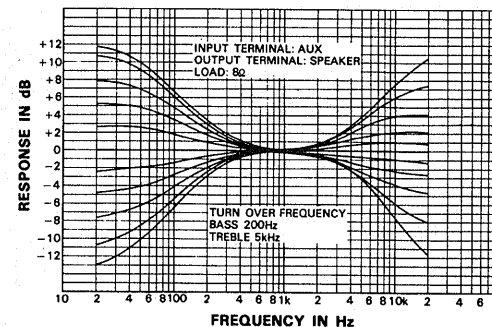
OUTPUT POWER VS. HARMONIC DISTORTION



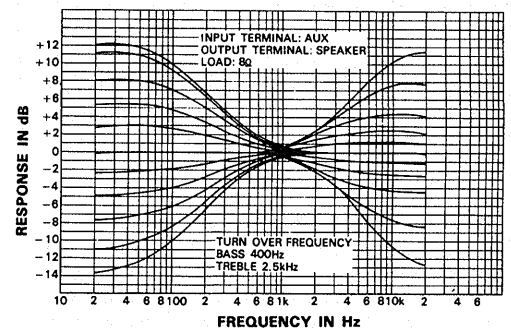
MAX. PHONO INPUT LEVEL



TONE CONTROLS



TONE CONTROLS



2. FRONT PANEL FACILITIES

POWER SWITCH, PILOT LAMP

Turns the power to the unit ON and OFF. Also controls the AC outlet marked SWITCHED on the rear panel. The pilot lamp lights when the power is on.

SPEAKERS SWITCH

Selects the speaker system(s) to be driven.

A Speaker systems connected to speaker outputs A operate.

B Speaker systems connected to speaker outputs B operate.

A+B Both speaker systems A and B operate.

OFF All speakers off. Use this position when listening through headphones.

PROTECTION PILOT LAMP

When the built-in protector circuit operates to shut off the power to the speakers, this lamp will light. This happens when there's a short-circuit in the speaker leads, or when combined speaker impedance is below 2-ohm, causing overload.

NOTE:

The lamp will also light for 3 to 6 seconds after you turn on the power, and the speakers will remain silent. This is no indication of trouble. The protector circuit is so designed that it will keep the speakers muted for the first few seconds, because they might produce unpleasant noise while the amplifier is still warming up.

HEADPHONE JACK

Stereo headphones can be plugged into this jack.

BASS CONTROL

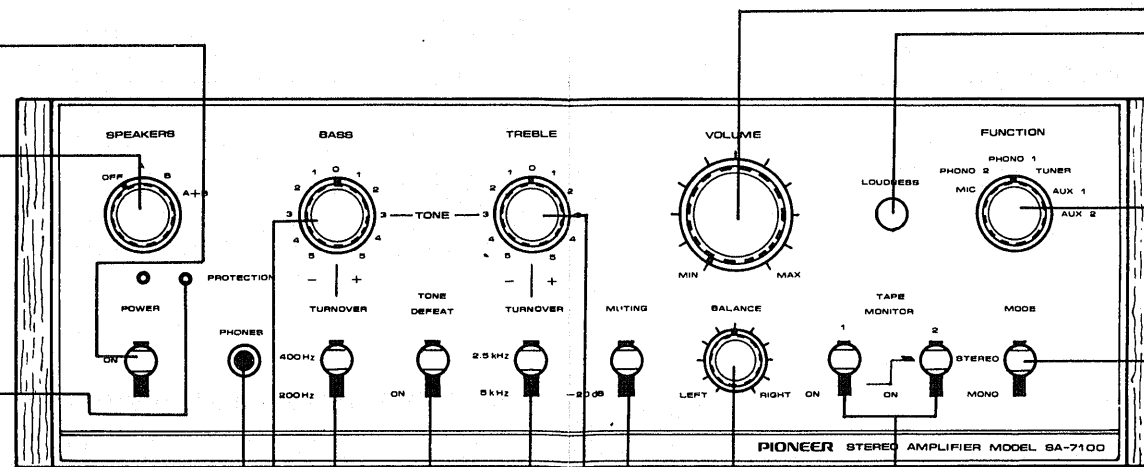
Clockwise rotation gives stronger emphasis of the bass range below the turnover frequency (which is selected by the BASS TURNOVER switch). Counterclockwise rotation reduces bass response. This control knob has click-stops.

BASS TURNOVER SWITCH

This switch selects the frequency below which the bass tone control will begin to act. This "turnover" frequency can be set at 400Hz or 200Hz, to match the characteristics of the room, the program material, or your personal listening preferences.

TONE DEFEAT SWITCH

In position ON, the four bass and treble controls do not function — the amplifier produces flat frequency response. This is useful for frequency response measurements of phono cartridges, loudspeakers and the acoustic characteristics of the room.



VOLUME CONTROL

Controls the listening volume. Clockwise rotation increases the volume.

LOUDNESS SWITCH

Push this switch to obtain a more natural sound contour at low volume levels. Human hearing fails to register very low and very high notes when the overall listening volume is low. The loudness circuit compensates for this handicap by boosting the very low and very high parts of the sound spectrum.

FUNCTION SWITCH

This switch is used for choosing the program source.

PHONO 1 ... For playing records on a turntable connected to the PHONO 1 jacks.

PHONO 2 ... Same as above, for PHONO 2 jacks.

TUNER For listening to broadcasts through the tuner.

AUX 1 For playing signals fed to the AUX 1 jacks.

AUX 2 Same as above, for AUX 2 jacks.

MIC For reproduction through a microphone connected to the MIC jack for rear panel.

MODE SWITCH

STEREO... When set to STEREO, stereo sound is present.

MONO When set to MONO, the left and right channel signals are blended most to reproduce a monophonic sound.

TAPE MONITOR SWITCHES 1, 2

Position ON of these switches is used only for tape playback and tape monitoring of a recording in progress. For all other listening modes (records, radio, etc.) these switches must remain OFF.

TAPE MONITOR 1 ... Playback and monitoring with tape deck connected to TAPE 1 REC and TAPE 1 MON jacks

TAPE MONITOR 2 ... Playback and monitoring with tape deck connected to TAPE 2 REC and TAPE 2 MON jacks, or to the DIN-type REC/PB connector.

BALANCE CONTROL

This control balances the volume of the left and right speaker systems. Where the volume from the right-hand speakers is too low, turn it to the right (clockwise). Where the volume from the left-hand speakers is too low, turn it to the left (counterclockwise).

MUTING SWITCH

Pressing this switch down to the -20dB position decreases the volume by 20dB instantly. Setting it to position OFF restores the volume to normal.

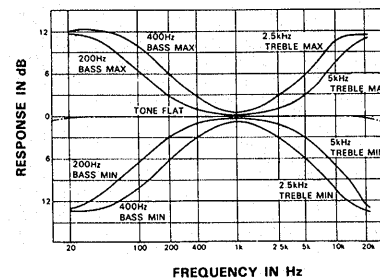
TREBLE CONTROL

Clockwise rotation gives stronger emphasis of the high range above the turnover frequency (selected by the TREBLE TURNOVER switch). Counterclockwise rotation reduces high-range response. This control knob has click-stops.

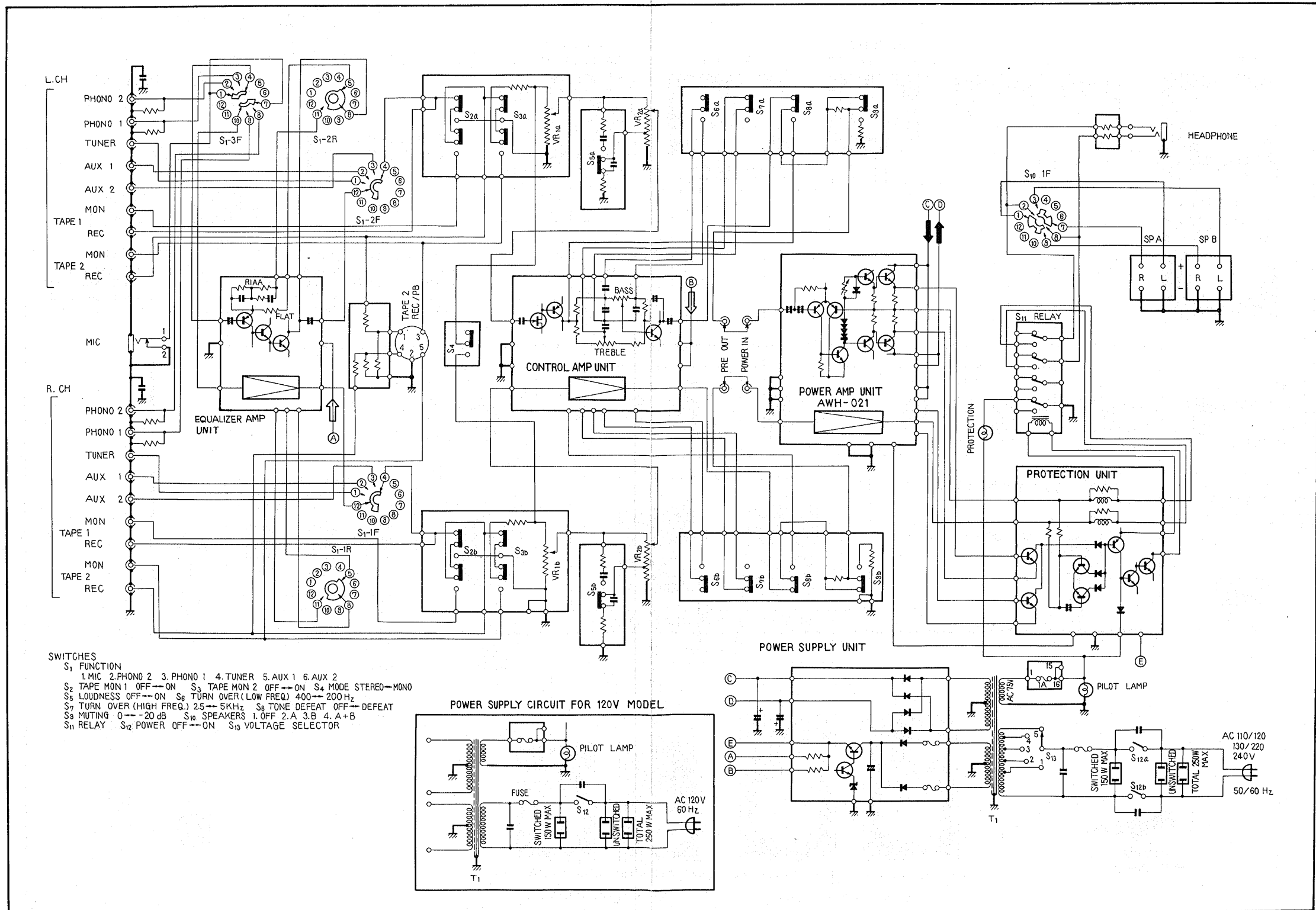
TREBLE TURNOVER SWITCH

This switch selects the frequency above which the treble tone control will begin to act. This "turnover" frequency can be set at 2.5kHz or 5kHz, to match the characteristics of the room, the program material, or your personal listening preferences.

The effect of the tone controls and turnover switches is illustrated in the graph, at the left.



4. BLOCK DIAGRAM



5. CIRCUIT DESCRIPTION

5.1 EQUALIZER AMP

A three-stage direct coupled amplifier circuit is used. In the first stage collector current is extremely small for reduced noise.

Input impedance (Z_{in}) has been designed quite high in this stage by making the second stage an emitter-follower. This assures large gain, low noise and sufficient negative feedback, as well as improved S/N and distortion ratio characteristics.

The Function switch can be used to switch the EQ element for either RIAA characteristics or flat response. Metal film resistors (tolerance 1%) and styrol capacitors impervious to heat and humidity are used in this EQ element for extremely accurate RIAA characteristics (within $\pm 0.2\text{dB}$).

D_1 acts as a speed-up circuit to quickly stabilize the bias when power is supplied. Output from the equalizer amp unit is fed to the Volume control through the Function switch and lever switch unit.

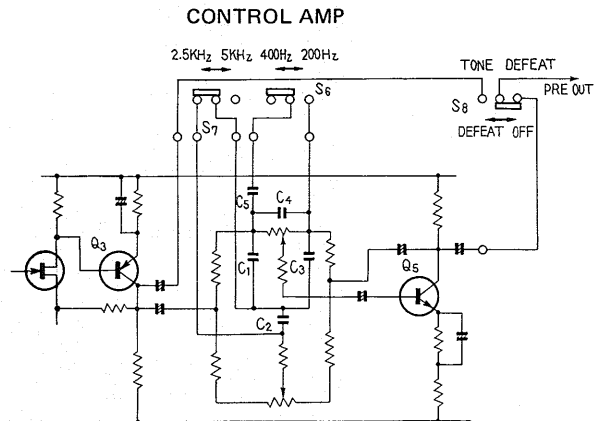
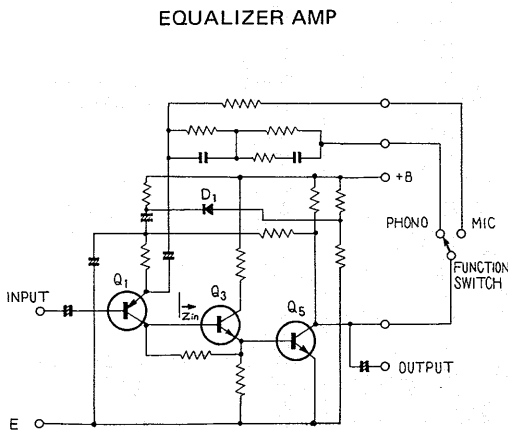
5.2 CONTROL AMP

The signal from the Volume control is fed to the control unit, which consists of a two-stage direct coupled amplifying circuit composed of FET and PNP transistors and an NFB type tone control composed of NPN transistors. Although the signals are amplified in the two-stage direct coupled circuit they can still be fed to the next tone control with low impedance because the NFB works with both direct and alternating current in this section. Since the impedance changes, the next tone control must supply signal source impedance at an extremely low level. Although bass and treble tone controls are click-stop volume control types, a tone defeat switch is included for instant flat (i.e., tone control middle point) response.

When the Defeat switch (S_8) is set to Defeat the signals are fed to the Pre Out terminals via the flat amplifier only.

The tone control also permits selection of the bass/treble crossover frequency, permitting an ideal setting for any location.

Bass crossover is switched between 200Hz and 400Hz by connecting C_5 to S_6 in parallel with C_4 . By shorting or separating C_2 and S_7 the treble crossover can be changed between 2.5kHz and 5kHz.



5.3 POWER AMP

(Ref: Unit Circuit Diagram, p. 42)

The control unit output is fed to the power amp unit through the Pre Out and Power In terminals.

The power amp unit is a first-stage differential amplifier type featuring plus and minus current and a direct coupled pure complementary OCL circuit.

This plus and minus power works with the differential amplifier DC feedback to keep the output terminals at 0V direct current. This assures stable performance and reduced noise when the power is turned on and off. Parallel circuitry (in the protector circuits) for Coils and Resistors are installed in series to the power amp unit output terminal for extra high-range phase supplement.

An active subsonic filter is included in the input side of the power amp unit to avoid mixed modulation distortion caused by noise such as that resulting from motor rumble, etc., in the bass range.

The output transistor emitter is connected to the current overload detector transistor in the protection circuit. The output mid point is connected to the differential amplifier base for direct electric potential sensing.

5.4 PROTECTION CIRCUITRY

(Ref: Unit Circuit Diagram, p. 38)

The protection circuit is composed of overload detector transistors for each channel, plus a relay driving section to feed the output from each detection circuit.

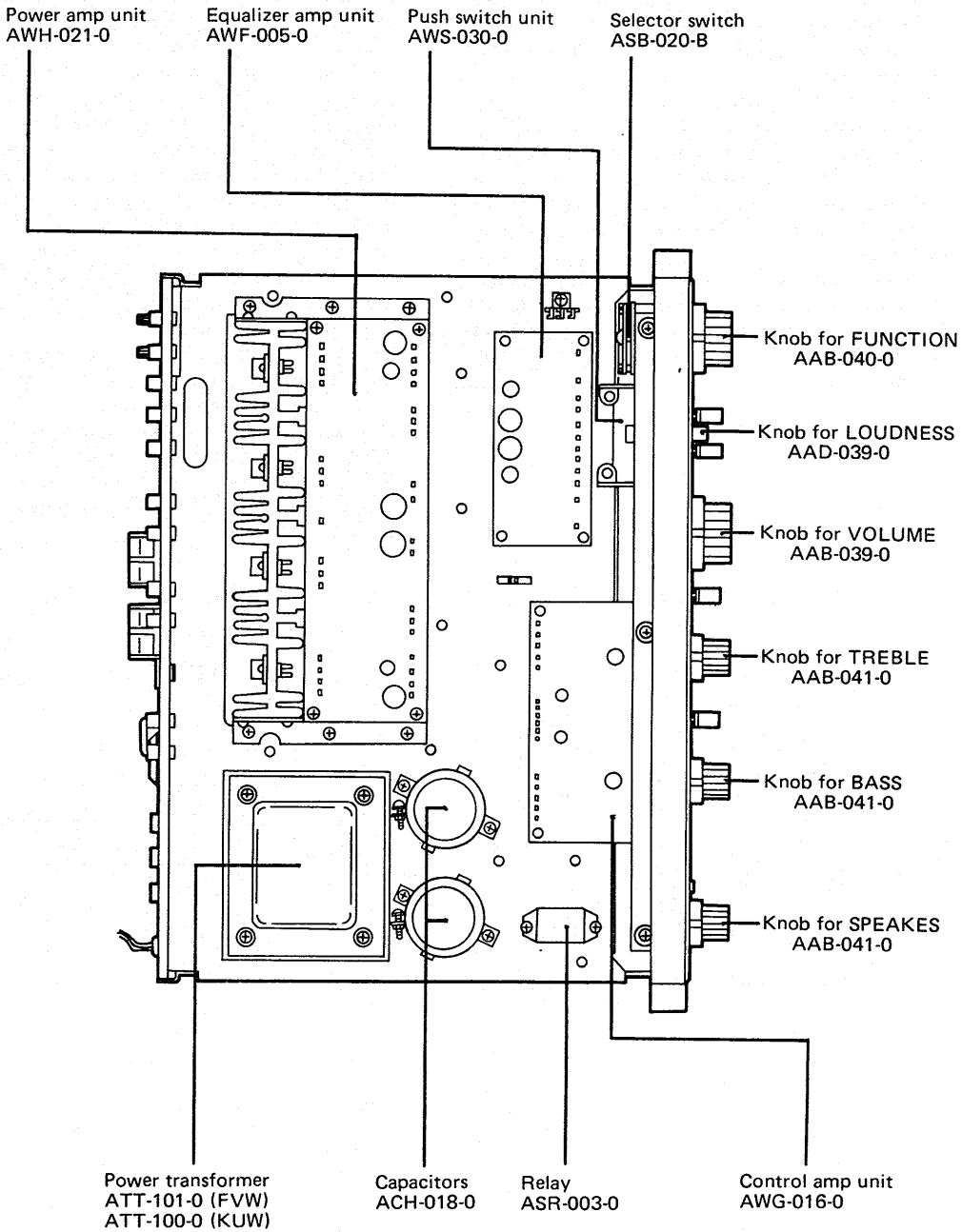
If excessive signal from the power amp unit is detected at Q₁ and Q₂ or Q₃ and Q₄ the base potential of Q₅ drops, and it turns on. Q₆ goes on automatically with Q₅, causing the base potential of Q₇ to drop, and thus turn off. This cuts off the relay current entering the Q₇ collector, thus causing the protection lamp to light.

When the excessive signal returns to within the normal range Q₅ and Q₆ go off and C₆ is charged through R₂₆, raising the base potential of Q₇. After 3~6 seconds Q₇ then goes back on and the current flows through the relay which then passes the signal load.

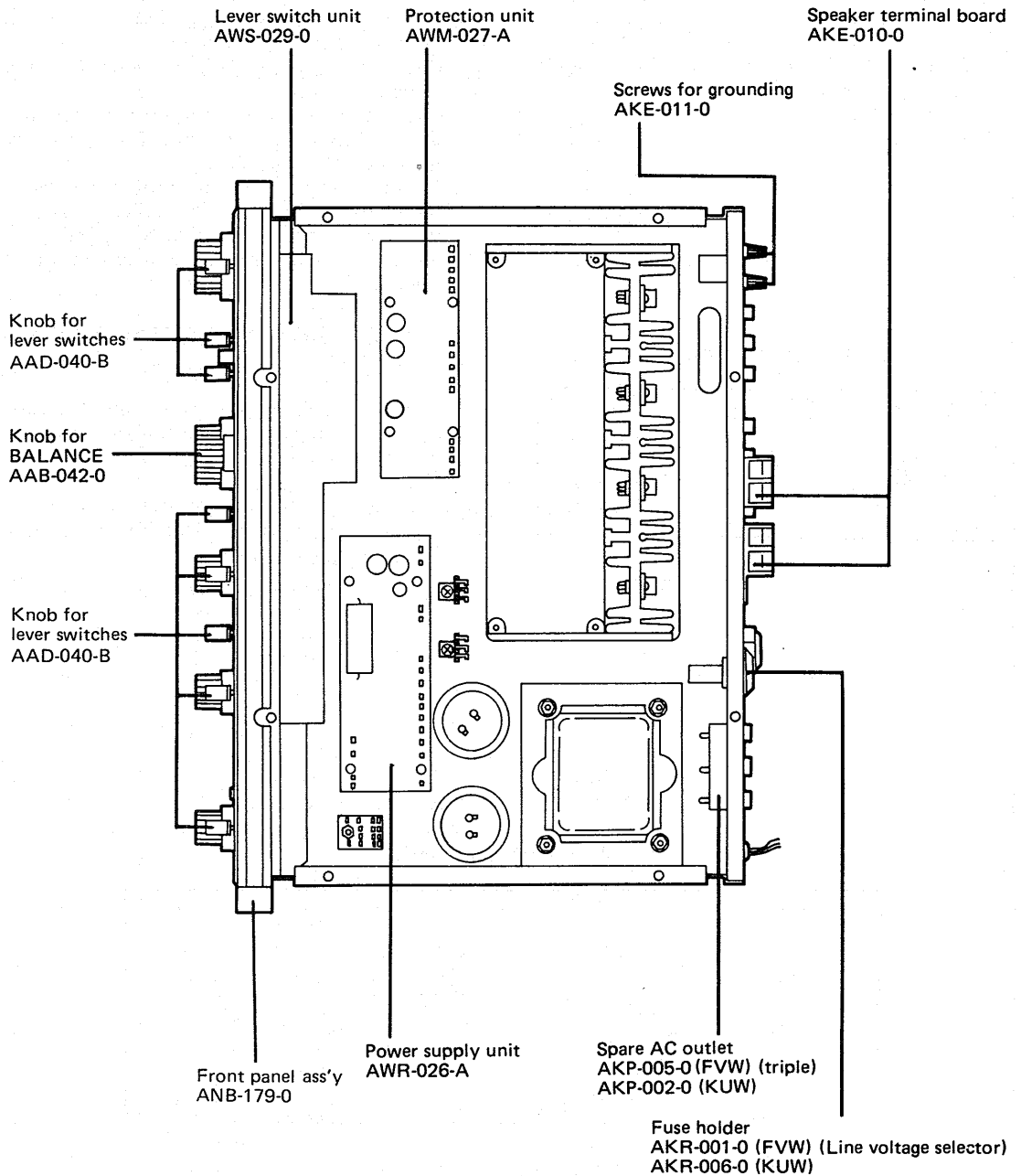
This system works as a muting circuit when the power is turned on.

7. PARTS AND P.C. BOARD LOCATION

7.1 TOP VIEW



7.2 BOTTOM VIEW

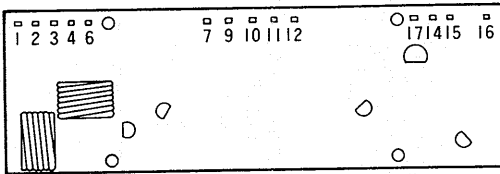


8. ALIGNMENT PROCEDURE

8.1 PROTECTION CIRCUIT CHECK

1. Remove the leads from protection circuit terminals 1 through 4 and 9 through 12.
2. Feed approx. 4V DC, both plus and minus, to terminal 2 and check that the relay works.
3. Perform the same check with terminal 4.
4. Feed +20V DC to terminal 9 and check that the relay works.
5. Perform the same check with terminal 12.
6. Feed -20V DC to terminal 10 and check that the relay works. Do the same for terminal 11.
7. Reconnect all leads.

PROTECTION P.C. BOARD



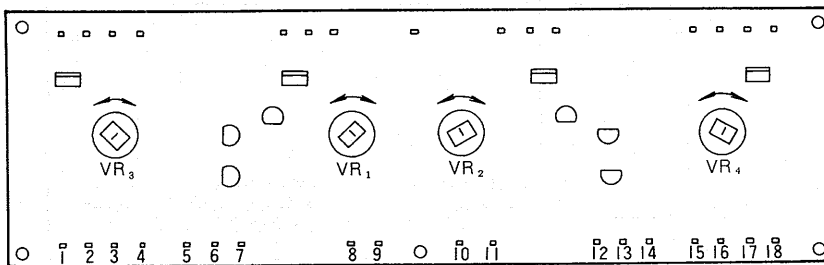
8.2 IDLE CURRENT ADJUSTMENT

1. Remove the wooden cabinet and bottom panel as explained in item 6.1.
2. Remove the lead wires from power amp unit terminals 1 through 3 and 16 through 18.
3. Turn on the power and check that the proper voltage is being fed to the +B terminal of the power amp unit.
4. Connect a high-sensitivity voltmeter between terminals 1 and 3.
5. Leave the power on for twenty minutes, then adjust VR_3 so that the voltmeter reads 30mV ($\pm 10\text{mV}$).
6. Connect a high-sensitivity voltmeter between terminals 16 and 18 and adjust VR_4 so that the voltmeter reads 30mV ($\pm 10\text{mV}$).
7. Disconnect the voltmeter and reconnect all leads.

8.3 MID-POINT POTENTIAL ADJUSTMENT

1. Connect a high-sensitivity voltmeter between power amp terminal 2 and the ground.
2. Adjust VR_1 for lowest meter reading (under 10mV).
3. Connect the voltmeter between terminal 17 and the ground, then adjust VR_2 for lowest meter reading (under 10mV).

POWER AMP P.C. BOARD



9. EXPLODED VIEW AND PARTS LIST

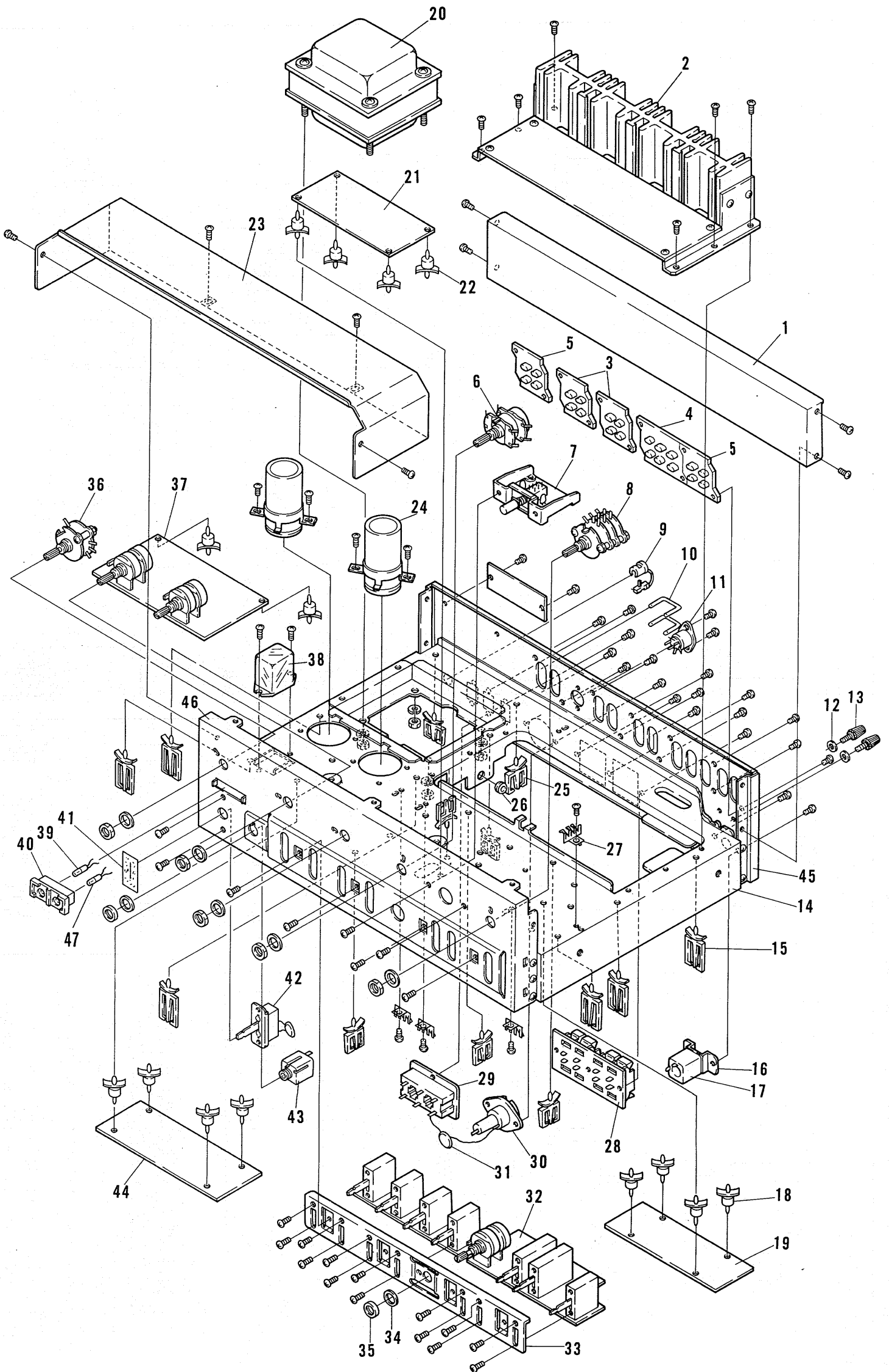
Parts List of Exploded View

NOTE:

Parts without part numbers are not supplied as service parts.

Key No.	Description	Part No.
1	Rear shield cover	
2	Power amp unit	AWH-021-0
3	Four-fold phono jack A (RCA type)	AKB-014-0
4	Six-fold phono jack A (RCA type)	AKB-015-0
5	Four-fold phono jack B (RCA type)	AKB-018-0
6	VOLUME control, 250k-B1	ACV-112-0
7	Push switch unit	AWS-030-0
8	FUNCTION switch	ASB-020-B
9	AC cord stopper	E32-056-0
10	Jumper plug	AKM-004-A
11	5P Connector (DIN type)	K93-003-B
12	Washer	ABE-005-0
13	Screw for grounding	AKE-011-0
14	Chassis	
15	Wire clip A	
16	Jack mount	
17	Microphone jack	K72-024-0
18	Boss	
19	Protection unit	AWM-027-A
20	Power transformer for KUW model	ATT-100-0
	Power transformer for FVW model	ATT-101-0
21	Equalizer amp unit	AWF-005-0
22	Boss	
23	Front shield cover	
24	Electrolytic capacitor 6800 μ F 35V	ACH-018-0
25	Wire clip B	
26	Rubber bush	
27	4P ground terminal	
28	Speaker terminal board (dual)	AKE-010-0
29	Spare AC outlet for KUW model	AKP-002-0
	Spare AC outlet for FVW model (Triple type)	AKP-005-0
30	Fuse holder for KUW model	AKR-006-0
	Fuse holder for FVW model (Line voltage selector)	AKR-001-0
31	Capacitor 0.01 μ F Metallized mylar (800V) for KUW model	ACE-002-0
	Ceramic (1.4kV) for FVW model	C43-003-0
32	Lever switch unit	AWS-029-0
33	Lever switch sub-pannel	
34	Spacer (1t)	
35	Nut (M9)	B71-004-0
36	SPEAKERS switch	ASB-021-0

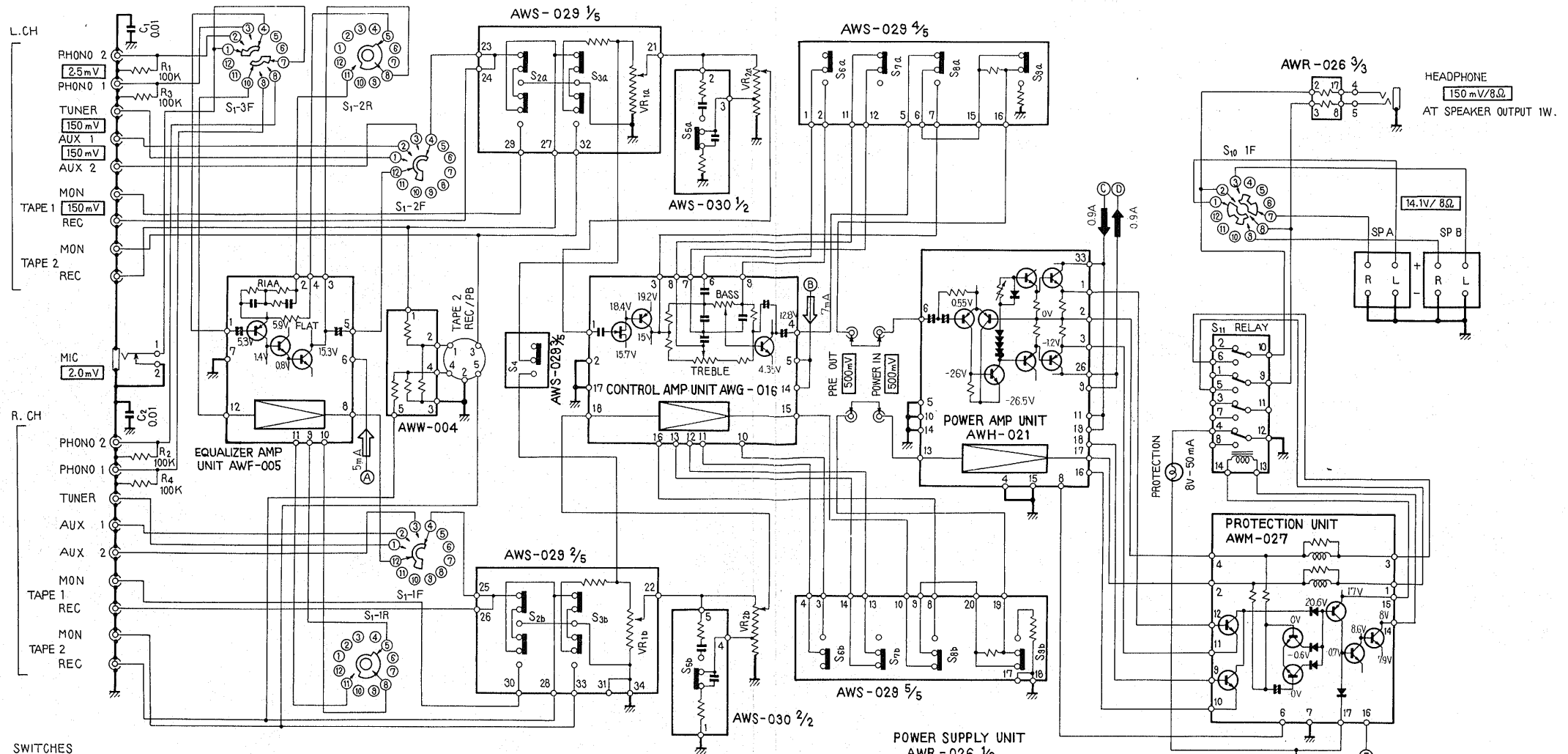
Key No.	Description	Part No.	
37	Control amp unit	AWG-016-0	
38	Relay	ASR-003-0	
39	Pilot lamp	AEL-007-0	
40	Cushion		
41	Light shade		
42	POWER switch for KUW model	ASK-025-0	
	POWER switch for FVW model	ASK-024-0	
43	Headphone jack	K72-026-0	
44	Power supply unit	AWR-026-A	
45	Rear panel		
46	Sub-panel		
47	Pilot lamp (Protection)	AEL-014-0	



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

10.1 UNIT CONNECTION DIAGRAM AND MISCELLANEOUS PARTS

SA-7100



- SWITCHES**
S₁ FUNCTION
 1. MIC 2. PHONO 2 3. PHONO 1 4. TUNER 5. AUX 1 6. AUX 2
 7. TAPE MON 1 OFF → ON 8. TAPE MON 2 OFF → ON 9. MODE STEREO → MONO
 10. LOUDNESS OFF → ON 11. TURN OVER (LOW FREQ) 400 → 200 Hz
 12. TURN OVER (HIGH FREQ) 25 → 5 kHz 13. TONE DEFEAT OFF → DEFEAT
 14. MUTING 0 → -20 dB 15. SPEAKERS 1. OFF 2. A 3. B 4. A+B
 16. RELAY 17. POWER OFF → ON 18. VOLTAGE SELECTOR

POTENTIOMETERS
 VR₁ BALANCE CONTROL (250KΩ) VR₂ VOLUME CONTROL

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

CAPACITORS
 IN μF UNLESS OTHERWISE NOTED. P=PF.

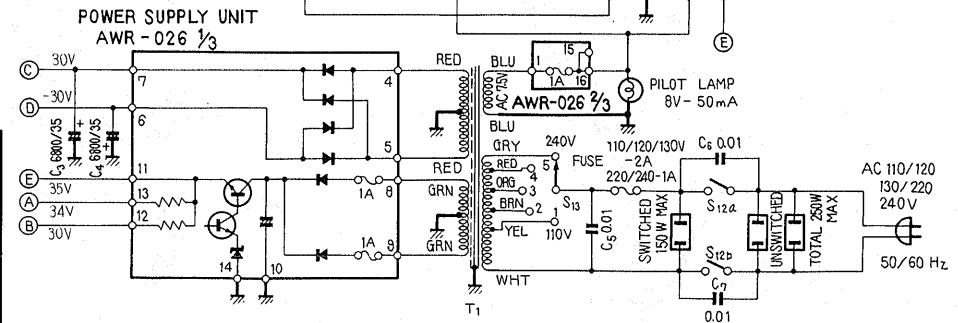
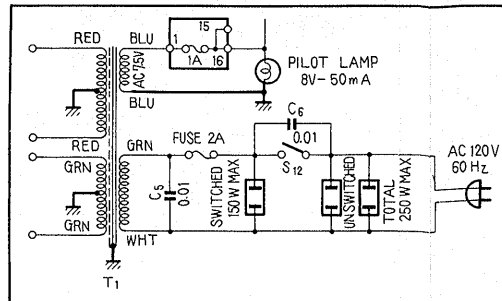
V: SIGNAL VOLTAGE NECESSARY FOR OBTAINING 25W/8Ω (1KHz)

V: DC VOLTAGE AT NO INPUT SIGNAL.

↑: DC CURRENT AT NO INPUT SIGNAL.

↔: DC CURRENT AT MAX INPUT SIGNAL.

POWER SUPPLY CIRCUIT FOR 120V MODEL



- CAPACITORS: IN μ F UNLESS OTHERWISE NOTED. p: pF.
- RESISTORS: IN Ω , $\frac{1}{4}$ W UNLESS OTHERWISE NOTED. k: k Ω , M: M Ω .

Miscellaneous Parts List

CAPACITORS

Symbol	Description	Part No.	
C1	Ceramic 0.01 50V	CKDYF 103Z 50	
C2	Ceramic 0.01 50V	CKDYF 103Z 50	
C3	Electrolytic 6,800 35V	ACH-018-0	
C4	Electrolytic 6,800 35V	ACH-018-0	
C5	Ceramic 0.01 1.4kV	C43-003-0	FVW model
	Metallized mylar 0.01 800V	ACE-002-0	KUW model
C6	Ceramic 0.01 1.4kV	C43-003-0	FVW model
	Ceramic 0.01 150V	ACG-002-0	KUW model
C7	Ceramic 0.01 1.4kV	C43-003-0	FVW model only

RESISTORS AND POTENTIOMETER

Symbol	Description	Part No.	
R1	Carbon film 100k	RD $\frac{1}{4}$ PS 104J	
R2	Carbon film 100k	RD $\frac{1}{4}$ PS 104J	
R3	Carbon film 100k	RD $\frac{1}{4}$ PS 104J	
R4	Carbon film 100k	RD $\frac{1}{4}$ PS 104J	
VR2	VOLUME control, 250k-B1 Compound part for REC terminal	ACV-112-0 AWW-004-0	

SWITCHES

Symbol	Description	Part No.	
S1	FUNCTION switch	ASB-020-B	
S10	SPEAKERS switch	ASB-021-0	
S11	Relay	ASR-003-0	
S12	POWER switch for FVW model	ASK-024-0	
	POWER switch for KUW model	ASK-025-0	
S13	Line voltage selector (Fuse holder)	AKR-001-0	FVW model only

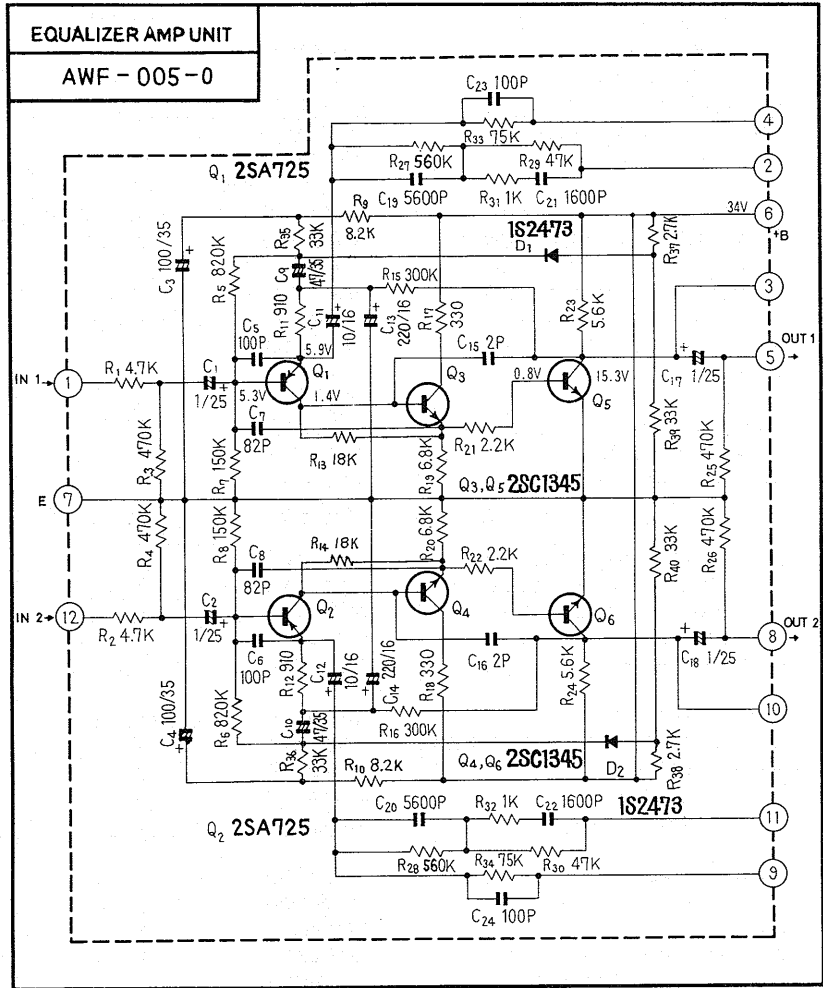
OTHERS

Symbol	Description	Part No.	
	Equalizer amp unit	AWF-005-0	
	Control amp unit	AWG-016-0	
	Power amp unit	AWH-021-0	
	Protection unit	AWM-027-A	
	Power supply unit	AWR-026-A	
	Push switch unit	AWS-030-0	
	Lever switch unit	AWS-029-0	
	Power transformer for FVW model	ATT-101-0	
	Power transformer for KUW model	ATT-100-0	
	Pilot lamp	AEL-007-0	

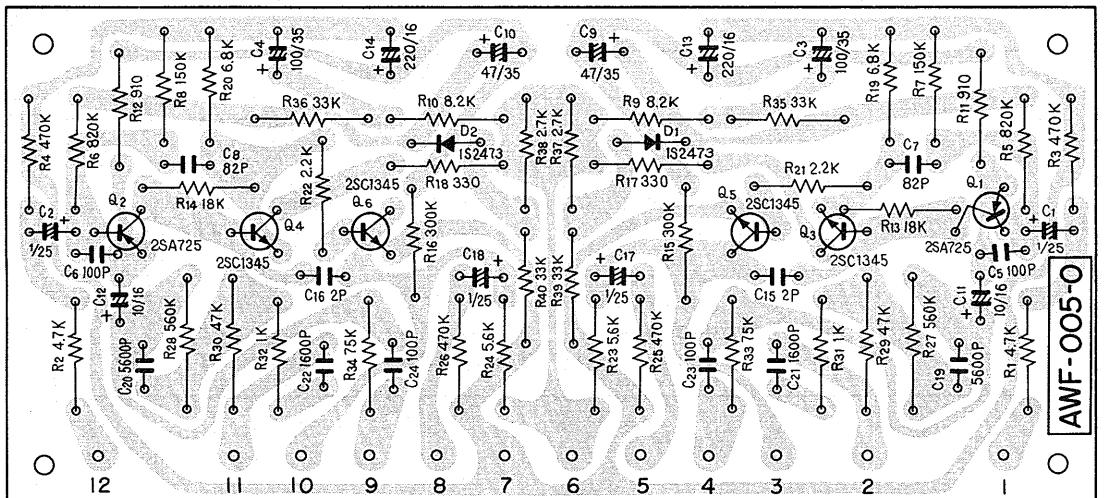
Symbol	Description	Part No.	
	Pilot lamp (Protection)	AEL-014-0	
	Fuse 1A for protection for FVW model	E21-034-A	
	Fuse 1A for KUW model	E21-033-0	
	Fuse 2A for KUW model	E21-027-0	
	AC power cord for FVW model	ADG-004-0	
	AC power cord for KUW model	ADG-003-0	
	Fuse holder	AKR-006-0	
	Stereo cable (Phono plug to phono plug)	ADE-005-0	
	Spare AC outlet (triple) for FVW model	AKP-005-0	
	Spare AC outlet for KUW model	AKP-002-0	
	Microphone jack	K72-024-0	
	Headphone jack	K72-026-0	
	5P Connector (DIN type)	K93-003-B	
	Speaker terminal board (dual)	AKE-010-0	
	Jumper plug	AKM-004-A	
	Four-fold phono jack A (RCA type)	AKB-014-0	
	Four-fold phono jack B (RCA type)	AKB-015-0	
	Six-fold phono jack A (RCA type)	AKB-018-0	
	AC cord stopper	E32-056-0	
	Knob for VOLUME	AAB-039-0	
	Knob for FUNCTION	AAB-040-0	
	Knob for BASS, TREBLE, SPEAKES	AAB-041-0	
	Knob for BALANCE	AAB-042-0	
	Knob for LOUDNESS	AAD-039-0	
	Knob for lever switches	AAD-040-0	
	Front panel ass'y	ANB-179-0	
	Wooden case	AMM-022-A	
	Foot	AEC-083-A	
	Operating instructions	ARB-068-0	
	Packing case for FVW model	AHD-127-0	
	Packing case for KUW model	AHD-128-A	
	Styrotector	H11-070-D	

KUW model only

10.2 EQUALIZER AMP UNIT (AWF-005)



Foil Side



Parts List of Equalizer Amp Unit

CAPACITORS

Symbol	Description	Part No.
C1	Electrolytic 1 25V	CSSA 010M 25
C2	Electrolytic 1 25V	CSSA 010M 25
C3	Electrolytic 100 35V	CEA 101P 35
C4	Electrolytic 100 35V	CEA 101P 35
C5	Ceramic 100p 50V	CCDSL 101K 50
C6	Ceramic 100p 50V	CCDSL 101K 50
C7	Ceramic 82p 50V	CCDSL 820K 50
C8	Ceramic 82p 50V	CCDSL 820K 50
C9	Electrolytic 47 35V	CEA 470P 35
C10	Electrolytic 47 35V	CEA 470P 35
C11	Electrolytic 10 16V	CEA 100P 16
C12	Electrolytic 10 16V	CEA 100P 16
C13	Electrolytic 220 16V	CEA 221P 16
C14	Electrolytic 220 16V	CEA 221P 16
C15	Ceramic 2p 50V	CCDSL 020C 50
C16	Ceramic 2p 50V	CCDSL 020C 50
C17	Electrolytic 1 25V	CSSA 010M 25
C18	Electrolytic 1 25V	CSSA 010M 25
C19	Styrol 5600p 50V	CQSA 562G 50
C20	Styrol 5600p 50V	CQSA 562G 50
C21	Styrol 1600p 50V	CQSA 162G 50
C22	Styrol 1600p 50V	CQSA 162G 50
C23	Ceramic 100p 50V	CCDSL 101K 50
C24	Ceramic 100p 50V	CCDSL 101K 50

RESISTORS

Symbol	Description	Part No.
R1	Carbon film 4.7k	RD $\frac{1}{4}$ PS 472J
R2	Carbon film 4.7k	RD $\frac{1}{4}$ PS 472J
R3	Carbon film 470k	RD $\frac{1}{4}$ PS 474J
R4	Carbon film 470k	RD $\frac{1}{4}$ PS 474J
R5	Carbon film 820k	RD $\frac{1}{4}$ PS 824J
R6	Carbon film 820k	RD $\frac{1}{4}$ PS 824J
R7	Carbon film 150k	RD $\frac{1}{4}$ PS 154J
R8	Carbon film 150k	RD $\frac{1}{4}$ PS 154J
R9	Carbon film 8.2k	RD $\frac{1}{4}$ PS 822J
R10	Carbon film 8.2k	RD $\frac{1}{4}$ PS 822J
R11	Carbon film 910	RD $\frac{1}{4}$ PS 911J
R12	Carbon film 910	RD $\frac{1}{4}$ PS 911J
R13	Carbon film 18k	RD $\frac{1}{4}$ PS 183J
R14	Carbon film 18k	RD $\frac{1}{4}$ PS 183J
R15	Carbon film 300k	RD $\frac{1}{4}$ PS 304J

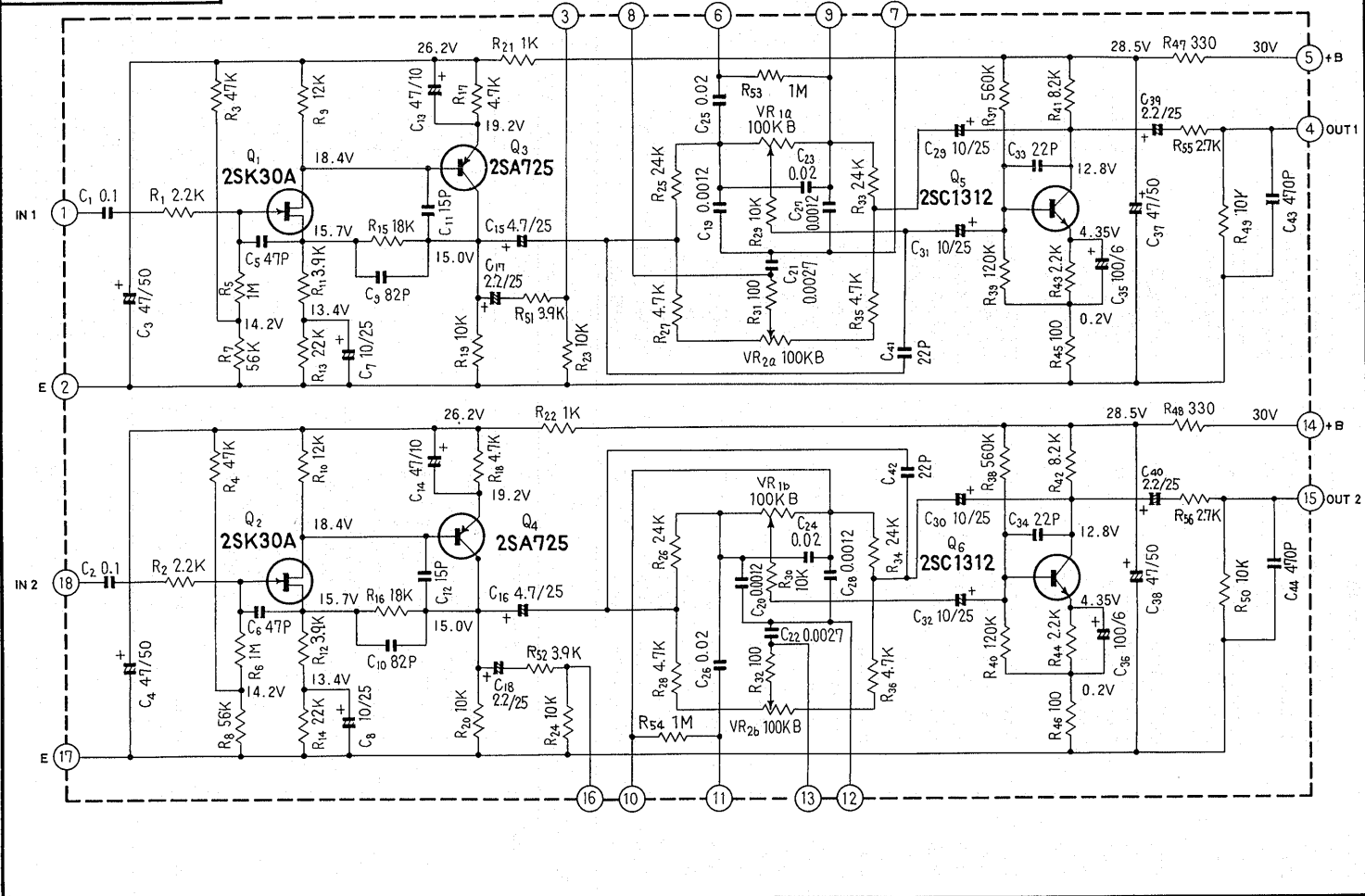
Symbol	Description	Part No.
R16	Carbon film 300k	RD¼PS 304J
R17	Carbon film 330	RD¼PS 331J
R18	Carbon film 330	RD¼PS 331J
R19	Carbon film 6.8k	RD¼PS 682J
R20	Carbon film 6.8k	RD¼PS 682J
R21	Carbon film 2.2k	RD¼PS 222J
R22	Carbon film 2.2k	RD¼PS 222J
R23	Carbon film 5.6k	RD¼PS 562J
R24	Carbon film 5.6k	RD¼PS 562J
R25	Carbon film 470k	RD¼PS 474J
R26	Carbon film 470k	RD¼PS 474J
R27	Metal film 560k ½W	RN¼SR 5603F
R28	Metal film 560k ½W	RN¼SR 5603F
R29	Metal film 47k ½W	RN¼SR 4702F
R30	Metal film 47k ½W	RN¼SR 4702F
R31	Carbon film 1k	RD¼PS 102J
R32	Carbon film 1k	RD¼PS 102J
R33	Carbon film 75k	RD¼PS 753J
R34	Carbon film 75k	RD¼PS 753J
R35	Carbon film 33k	RD¼PS 333J
R36	Carbon film 33k	RD¼PS 333J
R37	Carbon film 2.7k	RD¼PS 272J
R38	Carbon film 2.7k	RD¼PS 272J
R39	Carbon film 33k	RD¼PS 333J
R40	Carbon film 33k	RD¼PS 333J

SEMICONDUCTORS

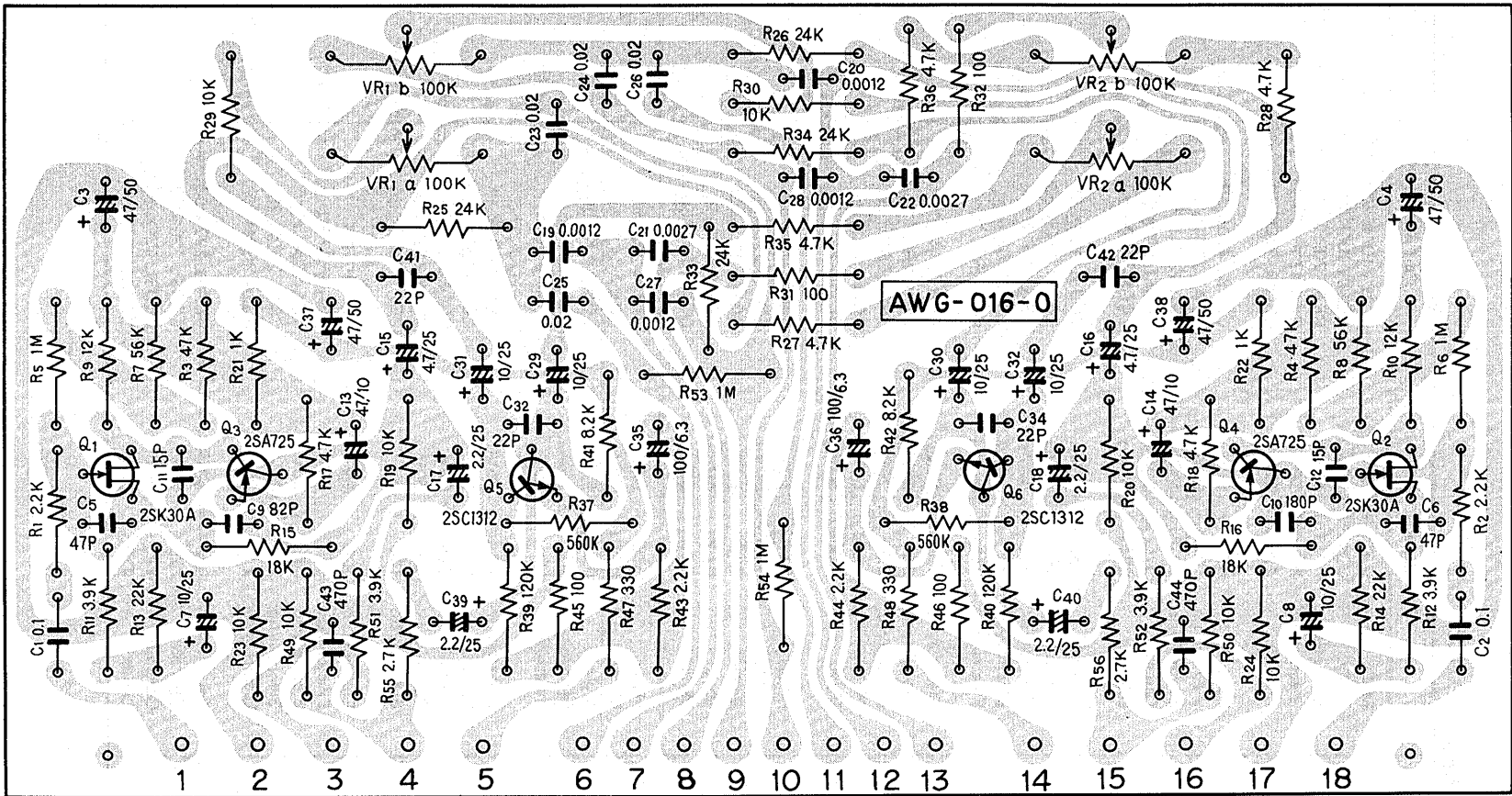
Symbol	Description	Part No.
Q1	Transistor 2SA725-G or F	
Q2	Transistor 2SA725-G or F	
Q3	Transistor 2SC1345-E or D 2SC1313-G or F	
Q4	Transistor 2SC1345-E or D 2SC1313-G or F	
Q5	Transistor 2SC1345-E or D 2SC1313-G or F	
Q6	Transistor 2SC1345-E or D 2SC1313-G or F	
D1	Diode 1S2473	
D2	Diode 1S2473	

CONTROL AMP UNIT

AWG - 016-0



Foil side



Parts List of Control Amp Unit

CAPACITORS

Symbol	Description			Part No.
C1	Mylar	0.1	50V	CQMA 104K 50
C2	Mylar	0.1	50V	CQMA 104K 50
C3	Electrolytic	47	50V	CEA 470P 50
C4	Electrolytic	47	50V	CEA 470P 50
C5	Ceramic	47p	50V	CCDSL 470K 50
C6	Ceramic	47p	50V	CCDSL 470K 50
C7	Electrolytic	10	25V	CEA 100P 25
C8	Electrolytic	10	25V	CEA 100P 25
C9	Ceramic	82p	50V	CCDSL 820K 50
C10	Ceramic	82p	50V	CCDSL 820K 50
C11	Ceramic	15p	50V	CCDSL 150K 50
C12	Ceramic	15p	50V	CCDSL 150K 50
C13	Electrolytic	47	10V	CEA 470P 10
C14	Electrolytic	47	10V	CEA 470P 10
C15	Electrolytic	4.7	25V	CEA 4R7P 25
C16	Electrolytic	4.7	25V	CEA 4R7P 25
C17	Electrolytic	2.2	25V	CSSA 2R2M 25
C18	Electrolytic	2.2	25V	CSSA 2R2M 25
C19	Mylar	0.0012	50V	CQMA 122J 50
C20	Mylar	0.0012	50V	CQMA 122J 50
C21	Mylar	0.0027	50V	CQMA 272J 50
C22	Mylar	0.0027	50V	CQMA 272J 50
C23	Mylar	0.02	50V	CQMA 203J 50
C24	Mylar	0.02	50V	CQMA 203J 50
C25	Mylar	0.02	50V	CQMA 203J 50
C26	Mylar	0.02	50V	CQMA 203J 50
C27	Mylar	0.0012	50V	CQMA 122J 50
C28	Mylar	0.0012	50V	CQMA 122J 50
C29	Electrolytic	10	25V	CEA 100P 25
C30	Electrolytic	10	25V	CEA 100P 25
C31	Electrolytic	10	25V	CEA 100P 25
C32	Electrolytic	10	25V	CEA 100P 25
C33	Ceramic	22p	50V	CCDSL 220K 50
C34	Ceramic	22p	50V	CCDSL 220K 50
C35	Electrolytic	100	6V	CEA 101P 6
C36	Electrolytic	100	6V	CEA 101P 6
C37	Electrolytic	47	50V	CEA 470P 50
C38	Electrolytic	47	50V	CEA 470P 50
C39	Electrolytic	2.2	25V	CSSA 2R2M 25
C40	Electrolytic	2.2	25V	CSSA 2R2M 25
C41	Ceramic	22p	50V	CCDSL 220K 50
C42	Ceramic	22p	50V	CCDSL 220K 50
C43	Ceramic	470p	50V	CCDSL 471K 50
C44	Ceramic	470p	50V	CCDSL 471K 50

RESISTORS AND POTENTIOMETERS

Symbol	Description	Part No.
R1	Carbon film 2.2k	RD¼PS 222J
R2	Carbon film 2.2k	RD¼PS 222J
R3	Carbon film 47k	RD¼PS 473J
R4	Carbon film 47k	RD¼PS 473J
R5	Carbon film 1M	RD¼PS 105J
R6	Carbon film 1M	RD¼PS 105J
R7	Carbon film 56k	RD¼PS 563J
R8	Carbon film 56k	RD¼PS 563J
R9	Carbon film 12k	RD¼PS 123J
R10	Carbon film 12k	RD¼PS 123J
R11	Carbon film 3.9k	RD¼PS 392J
R12	Carbon film 3.9k	RD¼PS 392J
R13	Carbon film 22k	RD¼PS 223J
R14	Carbon film 22k	RD¼PS 223J
R15	Carbon film 18k	RD¼PS 183J
R16	Carbon film 18k	RD¼PS 183J
R17	Carbon film 4.7k	RD¼PS 472J
R18	Carbon film 4.7k	RD¼PS 472J
R19	Carbon film 10k	RD¼PS 103J
R20	Carbon film 10k	RD¼PS 103J
R21	Carbon film 1k	RD¼PS 102J
R22	Carbon film 1k	RD¼PS 102J
R23	Carbon film 10k	RD¼PS 103J
R24	Carbon film 10k	RD¼PS 103J
R25	Carbon film 24k	RD¼PS 243J
R26	Carbon film 24k	RD¼PS 243J
R27	Carbon film 4.7k	RD¼PS 472J
R28	Carbon film 4.7k	RD¼PS 472J
R29	Carbon film 10k	RD¼PS 103J
R30	Carbon film 10k	RD¼PS 103J
R31	Carbon film 100	RD¼PS 101J
R32	Carbon film 100	RD¼PS 101J
R33	Carbon film 24k	RD¼PS 243J
R34	Carbon film 24k	RD¼PS 243J
R35	Carbon film 4.7k	RD¼PS 472J
R36	Carbon film 4.7k	RD¼PS 472J
R37	Carbon film 560k	RD¼PS 564J
R38	Carbon film 560k	RD¼PS 564J
R39	Carbon film 120k	RD¼PS 124J
R40	Carbon film 120k	RD¼PS 124J
R41	Carbon film 8.2k	RD¼PS 822J
R42	Carbon film 8.2k	RD¼PS 822J
R43	Carbon film 2.2k	RD¼PS 222J
R44	Carbon film 2.2k	RD¼PS 222J
R45	Carbon film 100	RD¼PS 101J
R46	Carbon film 100	RD¼PS 101J
R47	Carbon film 330	RD¼PS 331J
R48	Carbon film 330	RD¼PS 331J
R49	Carbon film 10k	RD¼PS 103J
R50	Carbon film 10k	RD¼PS 103J

Symbol	Description	Part No.
R51	Carbon film 3.9k	RD¼PS 392J
R52	Carbon film 3.9k	RD¼PS 392J
R53	Carbon film 1M	RD¼PS 105J
R54	Carbon film 1M	RD¼PS 105J
R55	Carbon film 2.7k	RD¼PS 272J
R56	Carbon film 2.7k	RD¼PS 272J
VR1	100k-B, Bass control	ACV-110-0
VR2	100k-B, Trable control	ACV-110-0

SEMICONDUCTORS

Symbol	Description	Part No.
Q1	FET 2SK30A-Y, O or GR	
Q2	FET 2SK30A-Y, O or GR	
Q3	Transistor 2SA725-F or G	
Q4	Transistor 2SA725-F or G	
Q5	Transistor 2SC1312-F or G 2SC1344-D or E	
Q6	Transistor 2SC1312-F or G 2SC1344-D or E	

10.4 LEVER SWITCH UNIT (AWS-029)

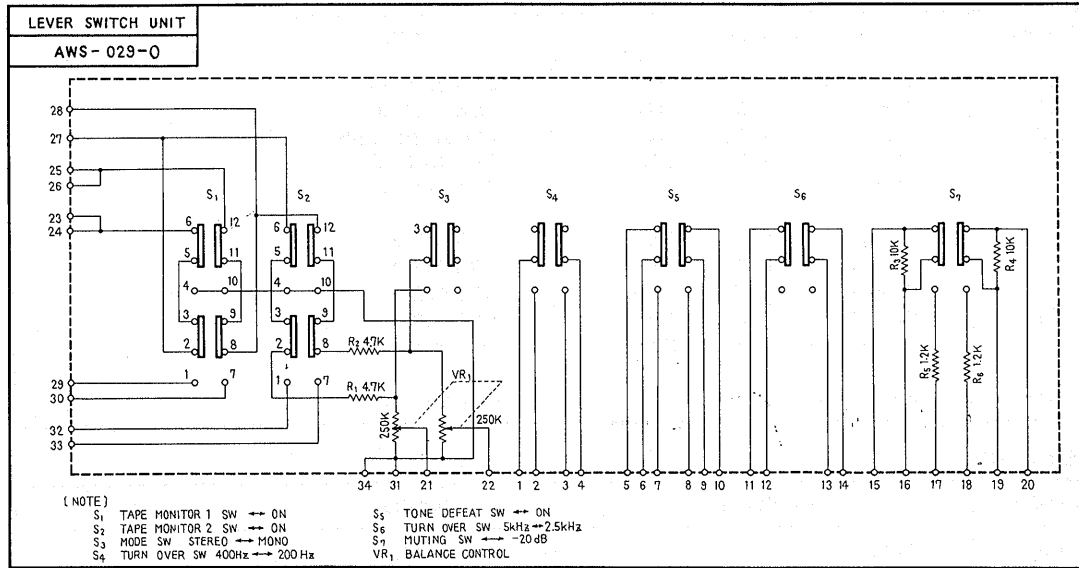
Parts List of Lever Switch Unit

RESISTORS AND POTENTIOMETER

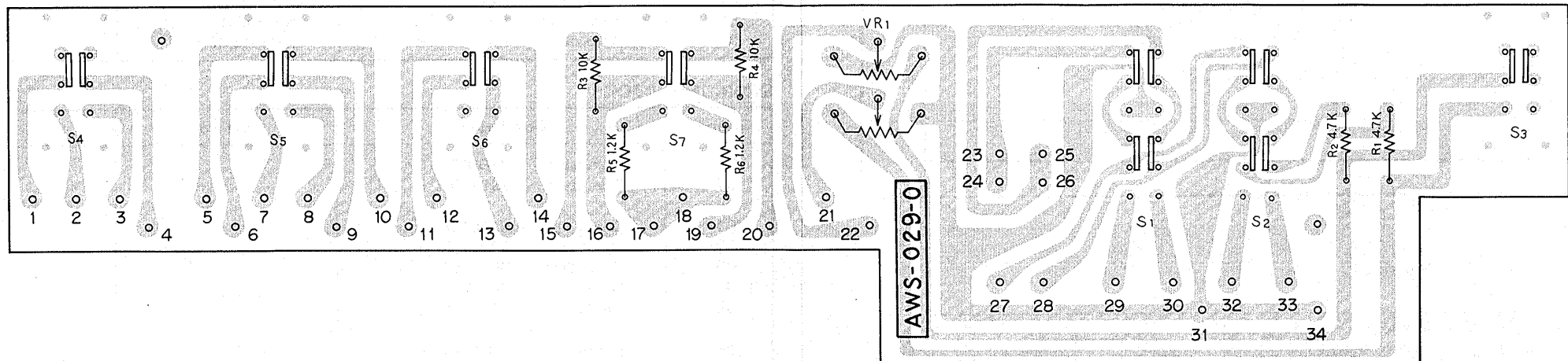
Symbol	Description	Part No.
R1	Carbon film 4.7k	RD¼PS 472J
R2	Carbon film 4.7k	RD¼PS 472J
R3	Carbon film 10k	RD¼PS 103J
R4	Carbon film 10k	RD¼PS 103J
R5	Carbon film 1.2k	RD¼PS 122J
R6	Carbon film 1.2k	RD¼PS 122J
VR1	Balance control, 250k-AC	ACV-111-B

SWITCHES

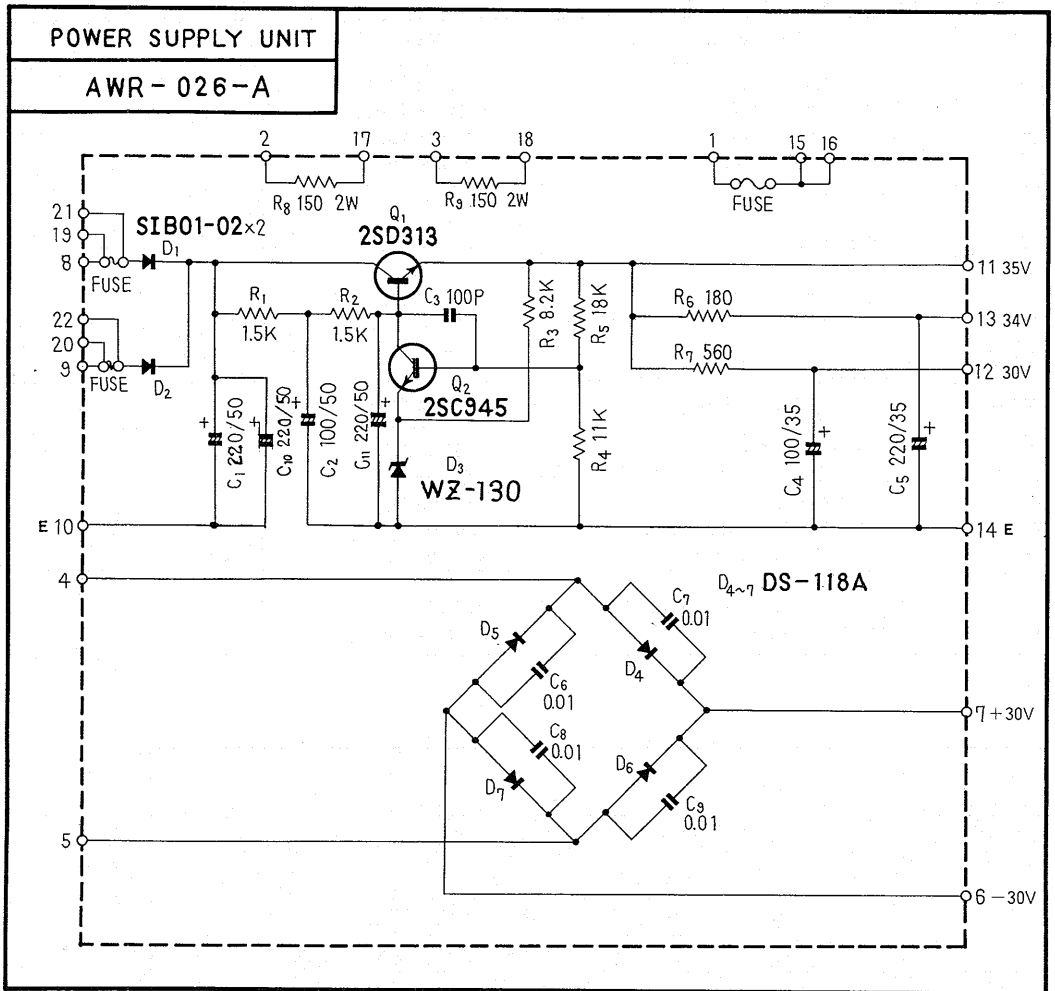
Symbol	Description	Part No.
S1	TAPE MONITOR Switch 1	ASK-028-0
S2	TAPE MONITOR Switch 2	ASK-028-0
S3	MODE Switch	ASK-027-0
S4	TURN OVER Switch (Bass)	ASK-027-0
S5	TONE DEFEAT Switch	ASK-026-0
S6	TURN OVER Switch (Treble)	ASK-027-0
S7	MUTING Switch	ASK-027-0



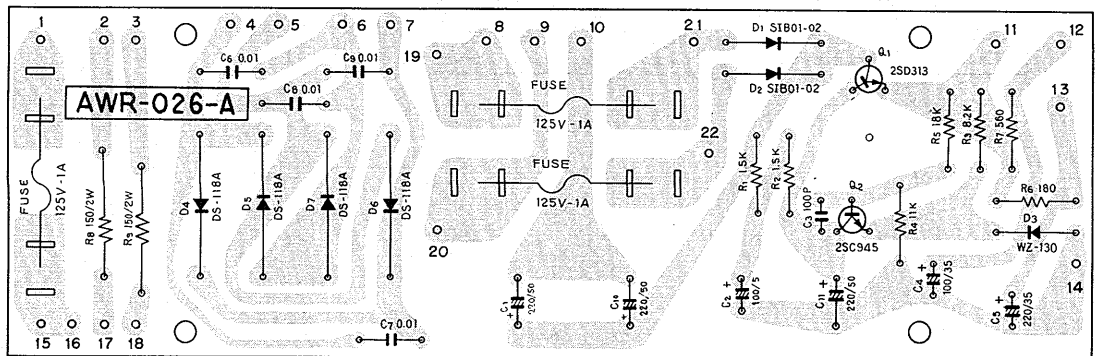
Foil side



10.5 POWER SUPPLY UNIT (AWR-026)



Foil side



Parts List of Power Supply Unit

CAPACITORS

Symbol	Description	Part No.
C1	Electrolytic 220 50V	CEA 221P 50
C2	Electrolytic 100 50V	CEA 101P 50
C3	Ceramic 100p 50V	CCDSL 101K 50
C4	Electrolytic 100 35V	CEA 101P 35
C5	Electrolytic 220 35V	CEA 221P 35
C6	Ceramic 0.01 150V	ACG-002-0
C7	Ceramic 0.01 150V	ACG-002-0
C8	Ceramic 0.01 150V	ACG-002-0
C9	Ceramic 0.01 150V	ACG-002-0
C10	Electrolytic 220 50V	CEA 221P 50
C11	Electrolytic 220 50V	CEA 221P 50

RESISTORS

Symbol	Description	Part No.
R1	Carbon film 1.5k	RD $\frac{1}{2}$ PS 152J
R2	Carbon film 1.5k	RD $\frac{1}{2}$ PS 152J
R3	Carbon film 8.2k	RD $\frac{1}{2}$ PS 822J
R4	Carbon film 11k	RD $\frac{1}{2}$ PS 113J
R5	Carbon film 18k	RD $\frac{1}{2}$ PS 183J
R6	Carbon film 180	RD $\frac{1}{2}$ PS 181J
R7	Carbon film 560	RD $\frac{1}{2}$ PS 561J
R8	Metal oxide 150 2W	RS2P 151K
R9	Metal oxide 150 2W	RS2P 151K

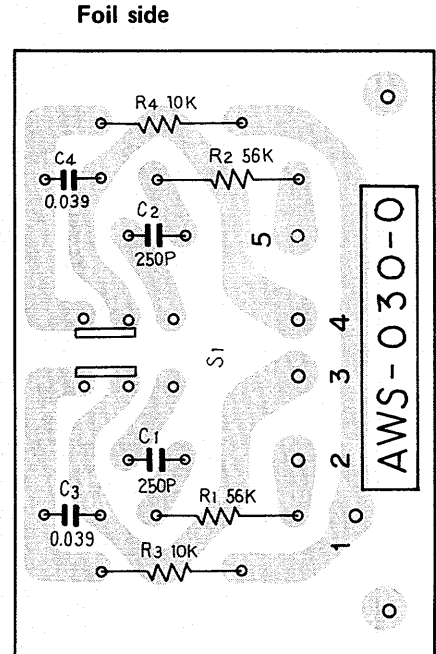
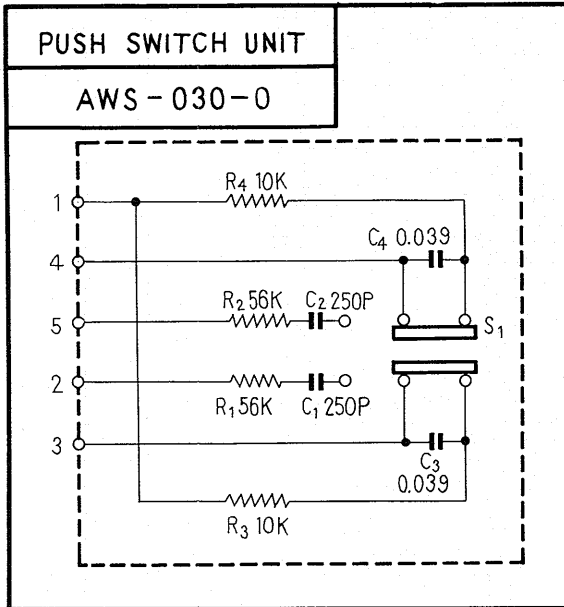
SEMICONDUCTORS

Symbol	Description	Part No.
Q1	Transistor 2SD313	
Q2	Transistor 2SC945	
D1	Diode S1B01-02	
D2	Diode S1B01-02	
D3	Zener diode WZ-130	
D4	Diode DS-118A	
D5	Diode DS-118A	
D6	Diode DS-118A	
D7	Diode DS-118A	

OTHERS

Symbol	Description	Part No.
	Heat sink	ANH-117-0
	Insulator	E32-102-0
	Fuse holder	K91-006-0
	Insulator screw	B13-001-0

10.6 PUSH SWITCH UNIT (AWS-030)



CAPACITORS

Symbol	Description	Part No.
C1	Ceramic 250p 50V	CCDSL 251K 50
C2	Ceramic 250p 50V	CCDSL 251K 50
C3	Mylar 0.039 50V	CQMA 393K 50
C4	Mylar 0.039 50V	CQMA 393K 50

RESISTORS

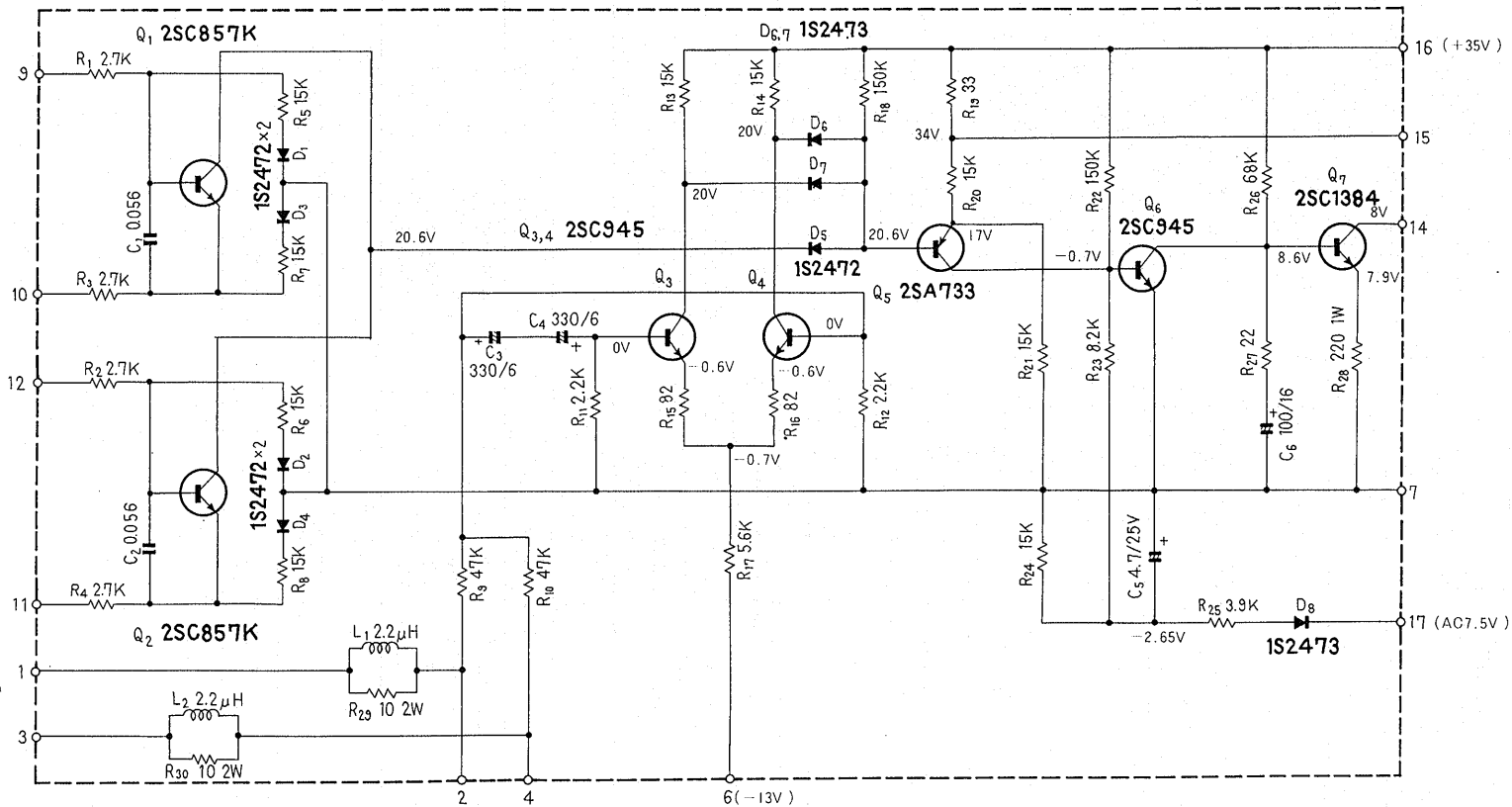
Symbol	Description	Part No.
R1	Carbon film 56k	RD¼PS 563J
R2	Carbon film 56k	RD¼PS 563J
R3	Carbon film 10k	RD¼PS 103J
R4	Carbon film 10k	RD¼PS 103J

SWITCH

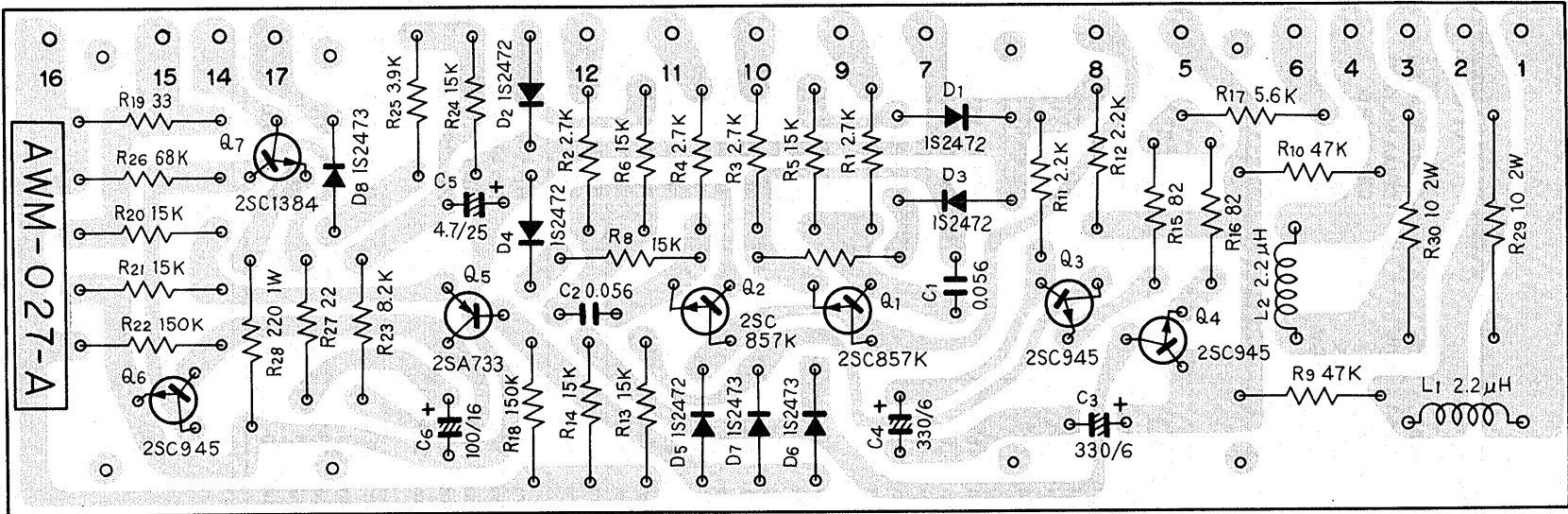
Symbol	Description	Part No.
S1	LOUDNESS Switch	ASG-035-A

PROTECTION UNIT

AWM-027-A



Foil side



Protection Unit

Parts List of Protection Unit

CAPACITORS

Symbol	Description	Part No.
C1	Mylar 0.056 50V	CQMA 563K 50
C2	Mylar 0.056 50V	CQMA 563K 50
C3	Electrolytic 330 6V	CEA 331P 6
C4	Electrolytic 330 6V	CEA 331P 6
C5	Electrolytic 4.7 25V	CEA 4R7P 25
C6	Electrolytic 100 16V	CEA 101P 16

RESISTORS

Symbol	Description	Part No.
R1	Carbon film 2.7k	RD¼PS 272J
R2	Carbon film 2.7k	RD¼PS 272J
R3	Carbon film 2.7k	RD¼PS 272J
R4	Carbon film 2.7k	RD¼PS 272J
R5	Carbon film 15k	RD¼PS 153J
R6	Carbon film 15k	RD¼PS 153J
R7	Carbon film 15k	RD¼PS 153J
R8	Carbon film 15k	RD¼PS 153J
R9	Carbon film 47k	RD¼PS 473J
R10	Carbon film 47k	RD¼PS 473J
R11	Carbon film 2.2k	RD¼PS 222J
R12	Carbon film 2.2k	RD¼PS 222J
R13	Carbon film 15k	RD¼PS 153J
R14	Carbon film 15k	RD¼PS 153J
R15	Carbon film 82	RD¼PS 820J
R16	Carbon film 82	RD¼PS 820J
R17	Carbon film 5.6k	RD¼PS 562J
R18	Carbon film 150k	RD¼PS 154J
R19	Carbon film 33	RD¼PS 330J
R20	Carbon film 15k	RD¼PS 153J
R21	Carbon film 15k	RD¼PS 153J
R22	Carbon film 150k	RD¼PS 154J
R23	Carbon film 8.2k	RD¼PS 822J
R24	Carbon film 15k	RD¼PS 153J
R25	Carbon film 3.9k	RD¼PS 392J
R26	Carbon film 68k	RD¼PS 683J
R27	Carbon film 22	RD¼PS 220J
R28	Metal oxide 220 1W	RS1P 221J
R29	Metal oxide 10 2W	RS2P 100J
R30	Metal oxide 10 2W	RS2P 100J

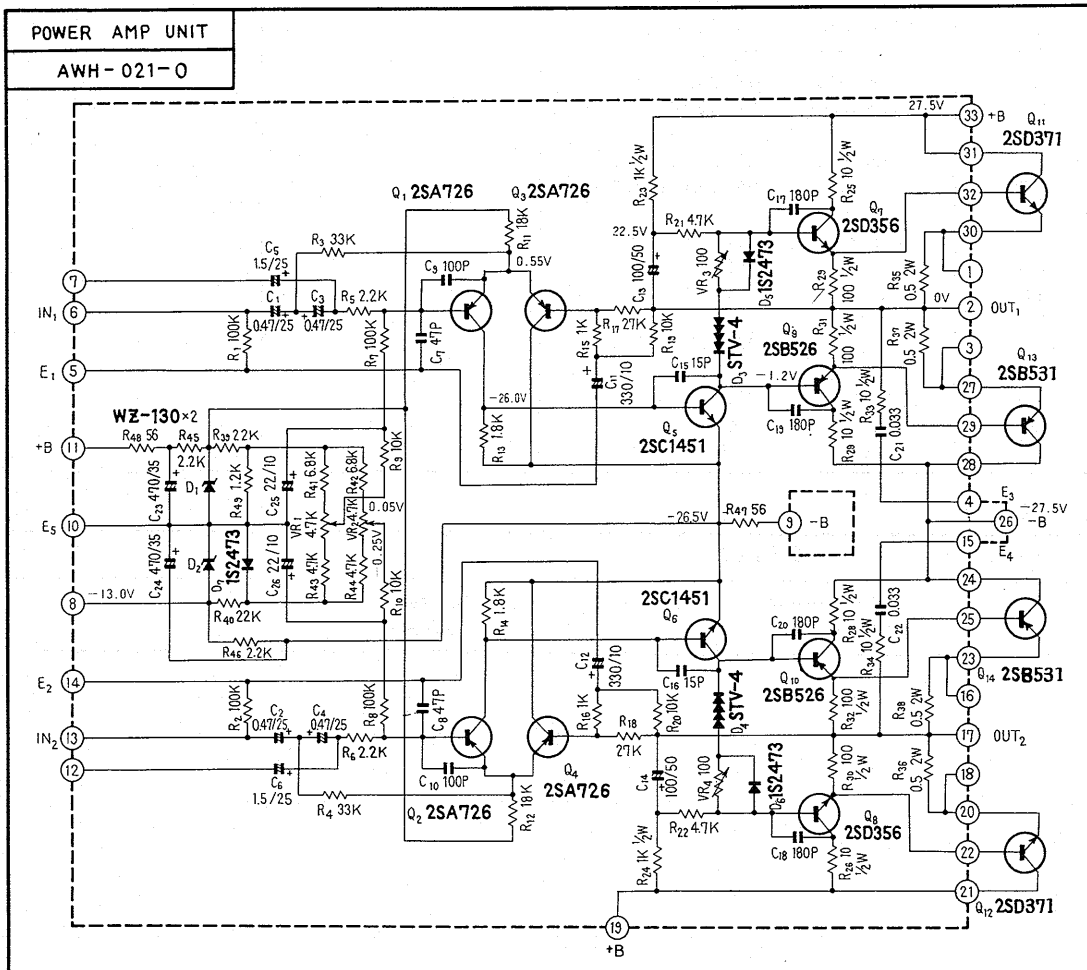
SEMICONDUCTORS

Symbol	Description	Part No.	
Q1	Transistor	2SC857K-A	
Q2	Transistor	2SC857K-A	
Q3	Transistor	2SC945-Q or R	
Q4	Transistor	2SC945-Q or R	
Q5	Transistor	2SA733-Q or R	
Q6	Transistor	2SC945-Q or R	
Q7	Transistor	2SC1384-R or Q	
D1	Diode	1S2472	
D2	Diode	1S2472	
D3	Diode	1S2472	
D4	Diode	1S2472	
D5	Diode	1S2472	
D6	Diode	1S2473	
D7	Diode	1S2473	
D8	Diode	1S2473	

COILS

Symbol	Description	Part No.	
L1	AF choke coil	T63-009-A	
L2	AF choke coil	T63-009-A	

10.8 POWER AMP UNIT (AWH-021)



Parts List of Power Amp Unit

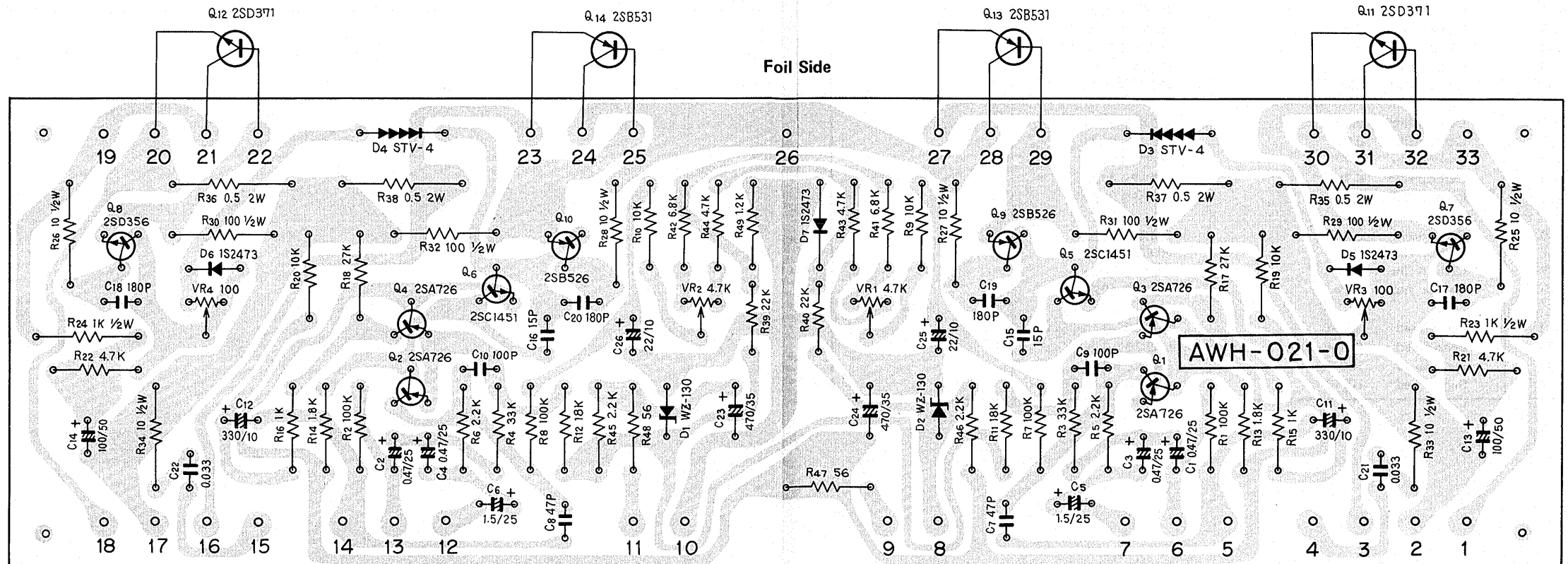
CAPACITORS

Symbol	Description	Part No.
C1	Electrolytic 0.47 25V	CSSA R47M 25
C2	Electrolytic 0.47 25V	CSSA R47M 25
C3	Electrolytic 0.47 25V	CSSA R47M 25
C4	Electrolytic 0.47 25V	CSSA R47M 25
C5	Electrolytic 1.5 25V	CSSA 1R5M 25
C6	Electrolytic 1.5 25V	CSSA 1R5M 25
C7	Ceramic 47p 50V	CCDSL 470K 50
C8	Ceramic 47p 50V	CCDSL 470K 50
C9	Ceramic 100p 50V	CCDSL 101K 50
C10	Ceramic 100p 50V	CCDSL 101K 50
C11	Electrolytic 330 10V	CEA 331P 10
C12	Electrolytic 330 10V	CEA 331P 10
C13	Electrolytic 100 50V	CEA 101P 50
C14	Electrolytic 100 50V	CEA 101P 50
C15	Ceramic 15p 50V	CCDSL 150K 50
C16	Ceramic 15p 50V	CCDSL 150K 50
C17	Ceramic 180p 50V	CCDSL 181K 50
C18	Ceramic 180p 50V	CCDSL 181K 50
C19	Ceramic 180p 50V	CCDSL 181K 50
C20	Ceramic 180p 50V	CCDSL 181K 50

Symbol	Description	Part No.
C21	Mylar 0.033 50V	CQMA 333K 50
C22	Mylar 0.033 50V	CQMA 333K 50
C23	Electrolytic 470 35V	CEA 471P 35
C24	Electrolytic 470 35V	CEA 471P 35
C25	Electrolytic 22 10V	CEA 220P 10
C26	Electrolytic 22 10V	CEA 220P 10

RESISTORS AND POTENTIOMETER

Symbol	Description	Part No.
R1	Carbon film 100k	RD½PS 104J
R2	Carbon film 100k	RD½PS 104J
R3	Carbon film 33k	RD½PS 333J
R4	Carbon film 33k	RD½PS 333J
R5	Carbon film 2.2k	RD½PS 222J
R6	Carbon film 2.2k	RD½PS 222J
R7	Carbon film 100k	RD½PS 104J
R8	Carbon film 100k	RD½PS 104J
R9	Carbon film 10k	RD½PS 103J
R10	Carbon film 10k	RD½PS 103J


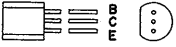
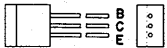
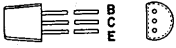
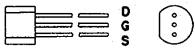
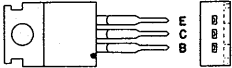


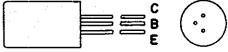
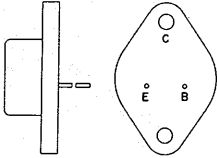
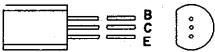


Symbol	Description	Part No.
R11	Carbon film 18k	RD¼PS 183J
R12	Carbon film 18k	RD¼PS 183J
R13	Carbon film 1.8k	RD¼PS 182J
R14	Carbon film 1.8k	RD¼PS 182J
R15	Carbon film 1k	RD¼PS 102J
R16	Carbon film 1k	RD¼PS 102J
R17	Carbon film 27k	RD¼PS 273J
R18	Carbon film 27k	RD¼PS 273J
R19	Carbon film 10k	RD¼PS 103J
R20	Carbon film 10k	RD¼PS 103J
R21	Carbon film 4.7k	RD¼PS 472J
R22	Carbon film 4.7k	RD¼PS 472J
R23	Carbon film 1k ½W	RD½PS 102J
R24	Carbon film 1k ½W	RD½PS 102J
R25	Carbon film 10 ½W	RD½PS 100J
R26	Carbon film 10 ½W	RD½PS 100J
R27	Carbon film 10 ½W	RD½PS 100J
R28	Carbon film 10 ½W	RD½PS 100J
R29	Carbon film 100 ½W	RD½PS 101J
R30	Carbon film 100 ½W	RD½PS 101J
R31	Carbon film 100 ½W	RD½PS 101J
R32	Carbon film 100 ½W	RD½PS 101J
R33	Carbon film 10 ½W	RD½PS 100J
R34	Carbon film 10 ½W	RD½PS 100J
R35	Metal film 0.5 2W	RN2H 0R5K
R36	Metal film 0.5 2W	RN2H 0R5K
R37	Metal film 0.5 2W	RN2H 0R5K
R38	Metal film 0.5 2W	RN2H 0R5K
R39	Carbon film 22k	RD¼PM 223J
R40	Carbon film 22k	RD¼PM 223J
R41	Carbon film 6.8k	RD¼PS 682J
R42	Carbon film 6.8k	RD¼PS 682J
R43	Carbon film 4.7k	RD¼PS 472J
R44	Carbon film 4.7k	RD¼PS 472J
R45	Carbon film 2.2k	RD¼PS 222J
R46	Carbon film 2.2k	RD¼PS 222J
R47	Carbon film 56	RD¼PS 560J
R48	Carbon film 56	RD¼PS 560J
R49	Carbon film 1.2k	RD¼PS 122J
VR1	Semi-fixed 4.7k-B	C92-051-0
VR2	Semi-fixed 4.7k-B	C92-051-0
VR3	Semi-fixed 100-B	C92-063-0
VR4	Semi-fixed 100-B	C92-063-0

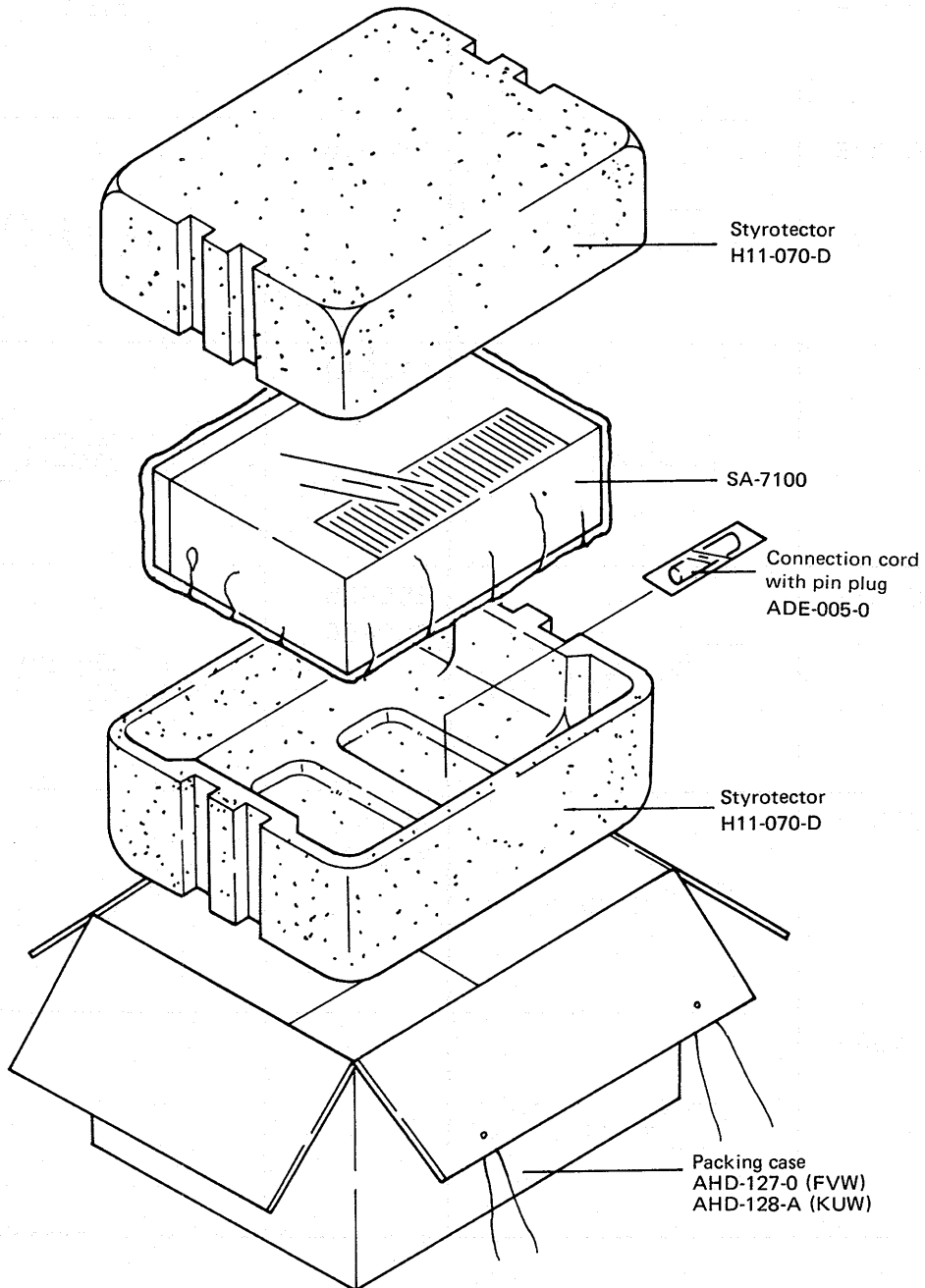
SEMICONDUCTORS

Symbol	Description	Part No.
Q1	Transistor	2SA726-G or F
Q2	Transistor	2SA726-G or F
Q3	Transistor	2SA726-G or F
Q4	Transistor	2SA726-G or F
Q5	Transistor	2SC1451-V or B, S
Q6	Transistor	2SC1451-V or B, S
Q7	Transistor	2SD356-D or C
Q8	Transistor	2SD356-D or C
Q9	Transistor	2SB526-D or C
Q10	Transistor	2SB526-D or C
Q11	Transistor	2SD371-O or R, 2SC1030-C or D
Q12	Transistor	2SD371-O or R, 2SC1030-C or D
Q13	Transistor	2SB531-O or R, 2SA756-C or D
Q14	Transistor	2SB531-O or R, 2SA756-C or D
D1	Zener diode	WZ-130
D2	Zener diode	WZ-130
D3	Varistor	STV-4
D4	Varistor	STV-4
D5	Diode	1S2473
D6	Diode	1S2473
D7	Diode	1S2473

11. SKELETON APPEARANCES OF TRANSISTORS

<p>2SA725 2SA726 2SC1312</p>		<p>2SA733</p>	
<p>2SC1345</p>		<p>2SC945</p>	
<p>2SK30A</p>		<p>2SD313</p>	
<p>2SC1451</p>		<p>2SB526 2SD356</p>	
<p>2SC857K</p>		<p>2SB531 2SD371</p>	
<p>2SC1384</p>			

12. PACKING METHOD AND PART NUMBERS



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