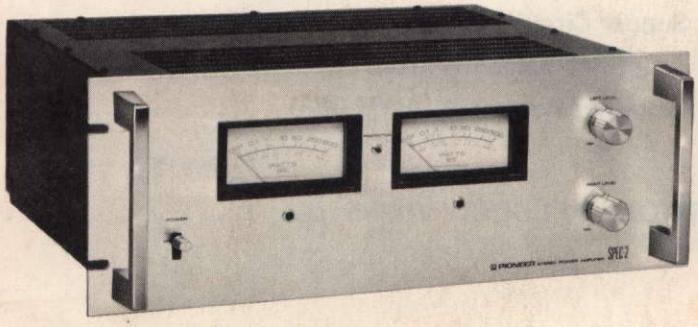
STEREO POWER AMPLIFIER

SPEC-2

KCU

Service Manual



PIONEER®

CONTENTS

1. SPECIFICATIONS

Semiconductors

Transistors 55
Diodes 75

Power Amplifier

Circuitry . . . . . Cascaded differential Amplifier, Push-pull drive, Triple push-pull, direct coupled OCL.
Continuous Power Output
from 20 Hertz to 20,000 Hertz
(Both channels driven) . . . . . 250 watts per channel (8 ohms)
Total Harmonic Distortion at 20 Hertz to 20,000 Hertz
(Continuous rated power output) 0.1%
(125 watts per channel power output, 8 ohms) 0.05%
(1 watt per channel power output, 8 ohms) 0.05%
Intermodulation Distortion
(Continuous rated power output) 0.1%
(125 watts per channel power output, 8 ohms) 0.05%
(1 watt per channel power output, 8 ohms) 0.05%
Frequency Response . . . . . 5 Hertz to 80,000 Hertz $^{+0}_{-1}$dB
Input (Sensitivity/Impedance) . . . . . 2V/50k ohms
Output
Speaker . . . . . 4 ohms to 8 ohms
Damping Factor (20 Hertz to 20,000 Hertz, 8 ohms) 50
Hum and Noise (IHF, short-circuited, A network) 110dB

Miscellaneous

Power Requirements . . . . . AC 120V 60 Hertz
Power Consumption . . . . . 500 watts
Dimensions . . . . . 480(W) x 186.5(H) x 445(D) mm
19-5/16 x 7 x 13-3/16 in
Weight: Without Package . . . . . 24.3kg; 54 lb

Furnished Parts

Connection Cord with Pin Plugs 1
Operating Instructions 1

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

2. FRONT PANEL FACILITIES

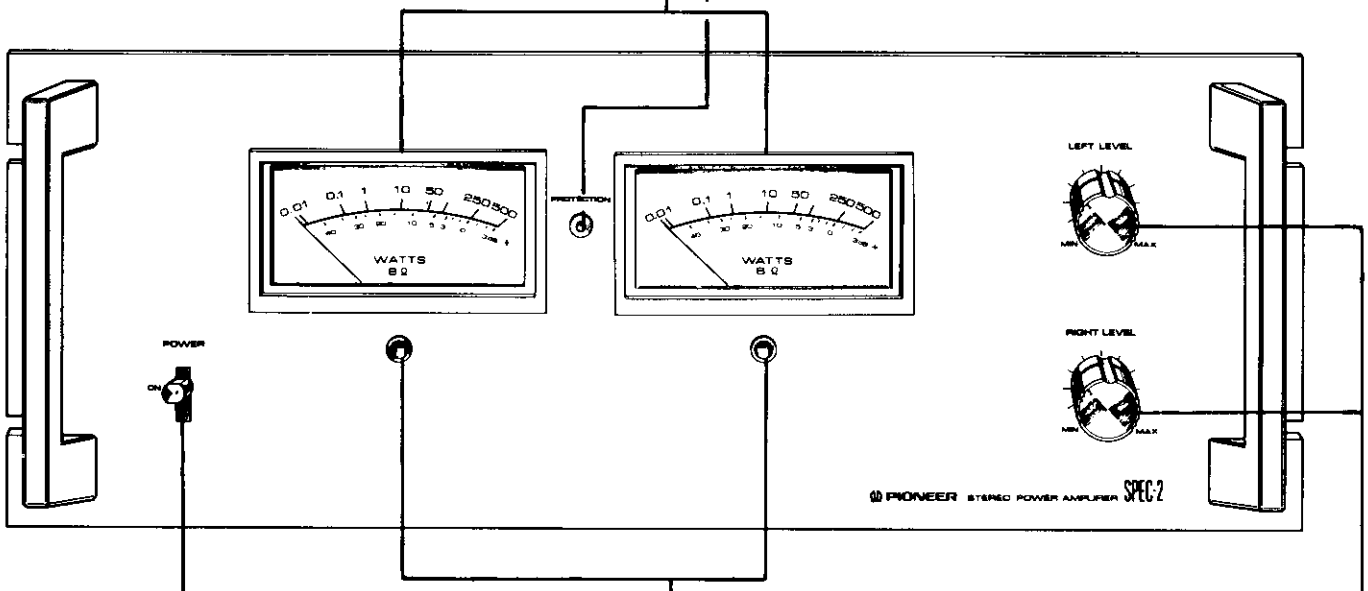
PEAK LEVEL METERS

When speaker systems of 8Ω nominal impedance are connected, these provide direct readout of the output power in Watts.

NOTE:
Speaker system impedance varies according to frequency. To obtain a precise measurement of the output power, remove speaker connections and connect 8Ω dummy loads across the SPEAKERS terminals.

PROTECTION INDICATOR

The lamp lights when the protection circuit functions. If the lamp stays on during operation, turn off the POWER switch and check as described in the section "Protection Circuit Operation". After identifying and correcting the source of difficulty, if the lamp still fails to extinguish, contact a Pioneer Authorized Service Center.



POWER SWITCH

Set to ON to energize the SPEC-2. Output will not be obtained until the PROTECTION indicator lamp goes out. This effect is due to the internal muting circuit and does not indicate malfunction.

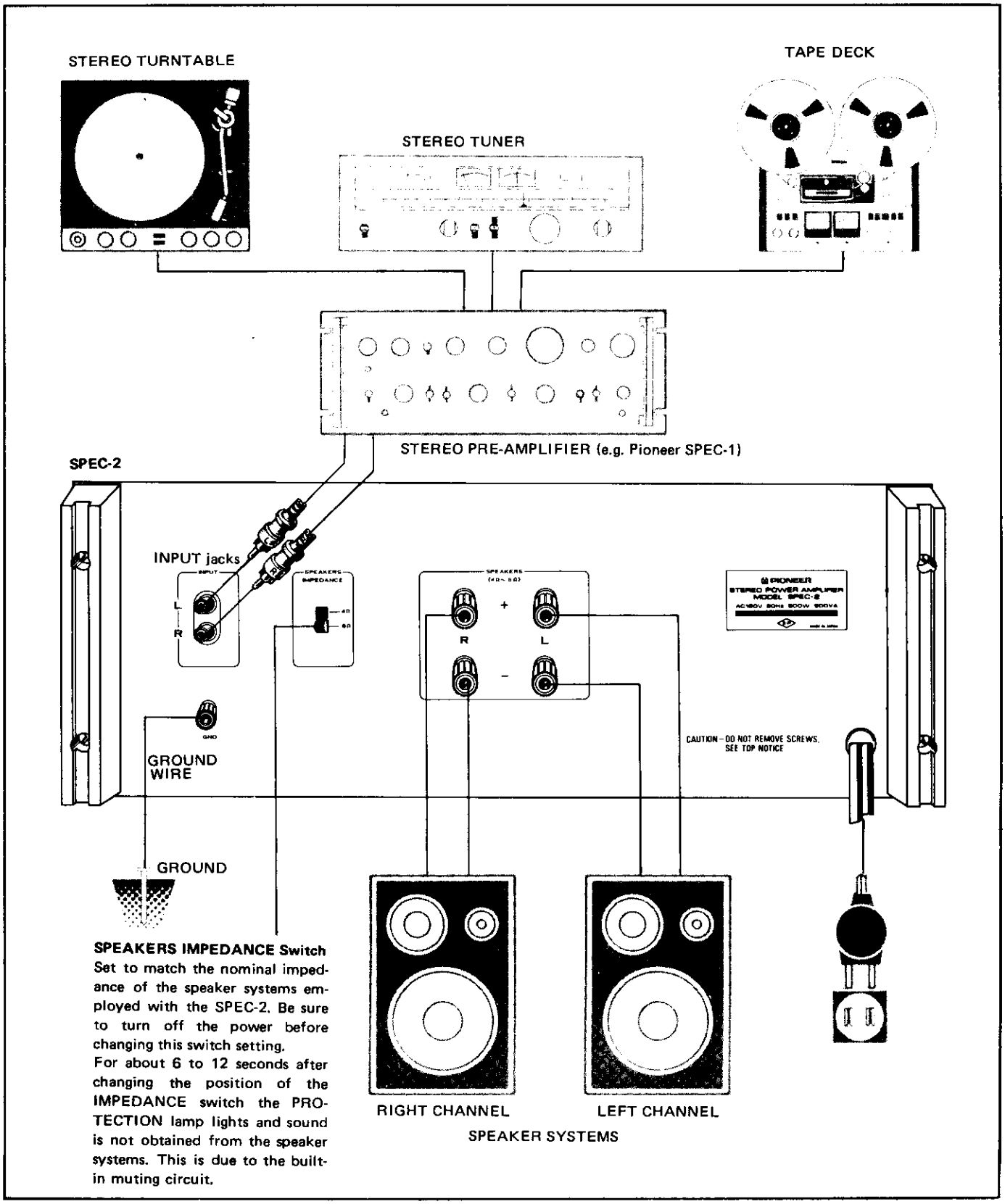
METER ZERO POINT ADJUSTMENT

INPUT LEVEL CONTROLS (LEFT & RIGHT)

Adjust LEFT and RIGHT controls according to the output level (voltage) of the pre-amplifier connected to the SPEC-2 INPUT (L & R) jacks. Control positions correspond to 2V at MAX (fully clockwise), 4V at center of rotation, and ∞ at MIN (fully counter-clockwise) Normally set these controls to MAX (2V).

- If the minimum output voltage of the employed pre-amplifier does not reach 2V, set the controls to MAX (2V). In this case the effective output indicated in the specifications will not be obtained (for example 1/4 of the specified output can be attained with a pre-amplifier output voltage of 1V).

3. CONNECTION DIAGRAM



SPEAKERS IMPEDANCE Switch
Set to match the nominal impedance of the speaker systems employed with the SPEC-2. Be sure to turn off the power before changing this switch setting.
For about 6 to 12 seconds after changing the position of the IMPEDANCE switch the PROTECTION lamp lights and sound is not obtained from the speaker systems. This is due to the built-in muting circuit.

4. CIRCUIT DESCRIPTION

4.1 POWER AMPLIFIER

The SPEC-2 is a high power design, employing a cascoded differential amplifier first stage, push-pull drive, and darlington triple push-pull circuit with all stages direct coupled (OCL).

The circuit diagram is shown in Fig. 2. Q1 and Q2 form the differntial amplifier. The input signal is applied to Q1 and NFB from the output stage applied to Q2 base. These two transistors are connected in common base circuits with Q3 and Q4, forming a cascode amplifier. Since the common emitter circuit (Q1 & Q2) load becomes the input of the following common base circuit stage, load impedance is low and stable amplification can be achieved.

Q3 and Q4 outputs drive Q5 and Q6 in opposite phase. The Q5 output via Q7 is applied to the current mirror circuit formed by D2 and Q8, where the phase is again inverted. Q6 and Q8 outputs thus become signals of the same phase and perform a pre-driver function.

The current mirror circuit is depicted in Fig. 1. Current flowing through R2 and Q8 becomes equal to that flowing through R1 and D2. In other words, since R1 and R2 are equal, and the characteristics of D2 and Q8 base-emitter are also equal, the current +B1 reaching point A (in Fig. 1) through R1 and D2 is equal to that reaching the same point through R2 and Q8 base-emitter. This becomes equivalent to having Q5 output directly driving Q8.

By adopting this current mirror circuit, when muting relay RL5 is OFF Q8 is cut off, Q10 — Q20 are switched OFF in succession, and operation stops. The reversed phases of Q8 and Q6 outputs cause them to cancel each other, reducing pop noise and muting relay switching noise.

Q13 and Q14 in the following driver stage drive the power transistors by direct coupling. The final stage is a high output design with three power transistors for each channel coupled in parallel. This parallel coupling permits comparatively large current (Ic) to be employed through each transistor, plus selection of an operating point with good linearity and high amplification (hfe).

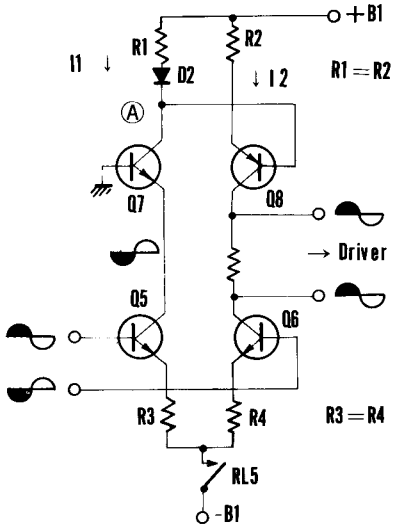


Fig. 1 Current Mirror Circuit

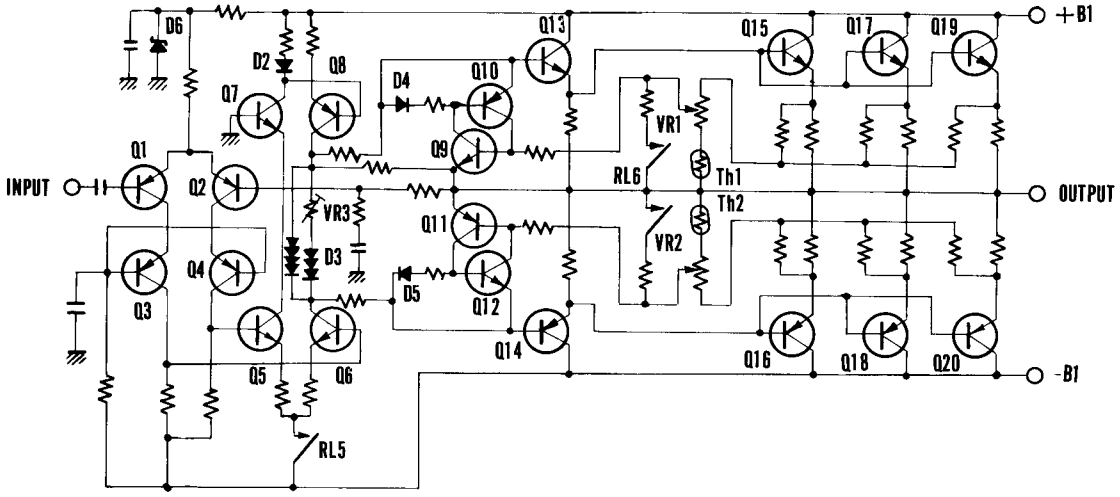


Fig. 2 Power Amplifier Circuit

Current Limiter Circuit

The current limiter circuit, shown in Fig. 2, consists of Q9 — Q12. If an overcurrent flows in the power transistors, due to low load (less than 4Ω) or load shorting, this circuit utilizes the voltage drop produced in the power transistor emitter resistance to limit the input voltage. Q9 — Q12 are normally OFF, but if for some reason an overcurrent occurs in the power transistors, the voltage drop component of the power transistor emitter resistance increases. This voltage is divided and used to bias the bases of Q9 and Q11, switching them ON. Q9 and Q11 make Q10 and Q12 conductive, limiting the signal voltages applied to the basis of Q13 and Q14.

VR2 and VR3 in this circuit set the current limiting value, while TH1 and TH2 are for temperature compensation. RL6 is a selector switch for changing the current limiting value at 4Ω load.

4.2 PEAK LEVEL METER CIRCUIT

Logarithmic indication is required in order to provide a broad indicating range in a single meter, without the need for range selection by the user. With respect to an 8Ω load, approximately 50dB logarithmic compression is performed to allow meter indication in the range of 0.01 — 500W.

As shown in Fig. 3, the circuit is divided into positive and negative sides. Each side consists of logarithmic compression, peak value holding and voltage to current converter circuits. In addition there is a current resultant circuits, common to both sides. The positive side circuit operation is described here.

A portion of the power amplifier output signal is compressed by the logarithmic compression circuit, which utilizes the exponential function properties of diodes. Figs. 4 and 5 illustrate the operating principle and input-output response. The compressed signal is then rectified and retained for a suitable length of time by the peak holding circuit, which employs a simple diode and capacitor construction. Holding time is determined by the time constant of C1 and R1.

The holding circuit voltage is then applied to the voltage-current converter, where it is converted into a current value and amplified. The current afterwards passes through the current resultant circuit and drives the meter.

The current resultant circuit applies the larger current of the positive and negative sides to the meter for operation.

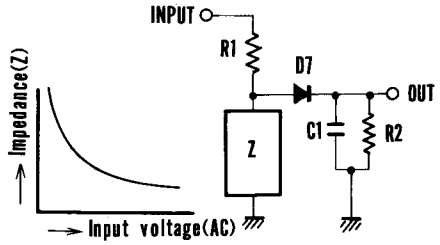


Fig. 4 Equivalent Circuit of the Logarithmic Compression

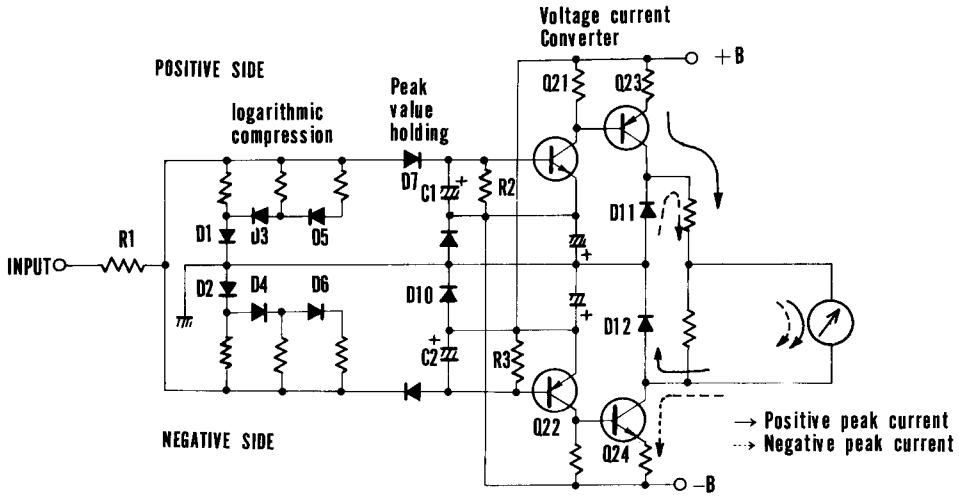


Fig. 3 Peak Level Meter Circuit

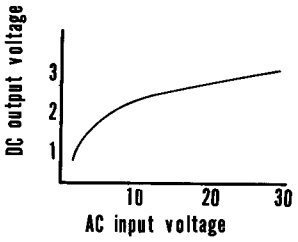


Fig. 5 Input-output Response

4.3 PROTECTION CIRCUIT

The main purpose of the protection circuit is to protect the equipment and give an indication in the event of malfunction, incorrect operation, faulty connections, or other causes.

The block diagram of the protection circuit functions is shown in Fig. 6. The following description is in reference to the diagram.

Relay and Lamp Drivers

Q27 — Q30 form the relay drive circuit (see Fig. 7). while Q31 drives the lamp. In normal operation, reverse bias is applied to Q27, maintaining it in the cut off state. When an abnormality is detected by the DC balance or temperature detector, current flows through R1. Q27 base potential falls rapidly and it switches ON. This causes forward bias voltage to be applied to Q28, turning Q28 ON. Potential at point B drops, turning off Q29 and Q30. With Q29 OFF, current to relay RL5 is cut off, turning Q31 (lamp drive) ON and lighting the protection lamp. Q30 cuts off the current to RL4 and RL2 (when impedance switch is at 8Ω; when at 4Ω, RL4, RL6 and RL3).

Because of RL4 off, output circuit of the power amplifier becomes open, and the stages beyond the predriver are stopped operation completely by RL5.

RL2, RL3 and RL6 are for changing the transformer secondary taps when the impedance switch is selected and determining the value of the current control circuit in the power amplifier. They are thus not directly related to the protection function.

Zener diodes D2 and D3 fix the operating potentials of Q29 and Q30, and the difference in their starting points prevent misoperation.

Power Switch ON Muting

This circuit also includes a delaying function when the power switch is set to ON. The delay time is determined by R8 and C1 in the Q29 and Q30 base circuits.

Immediately after the power switch is turned ON, Q27 and Q28 are reverse biased by −B1 and −B2, and switched OFF. Point B potential from +B3 passes through R8 and rises as C1 charges. The rise time is determined by the time constant of C1 and R8. When the potential exceeds D3 (zener diode) zener voltage, Q30 is switched ON and current flows in the relay circuit connected to Q30.

In the same manner, when the potential at point B exceeds D2 zener voltage, Q29 is switched ON and current flows in RL5. Correct voltage is thus applied to the power amplifier.

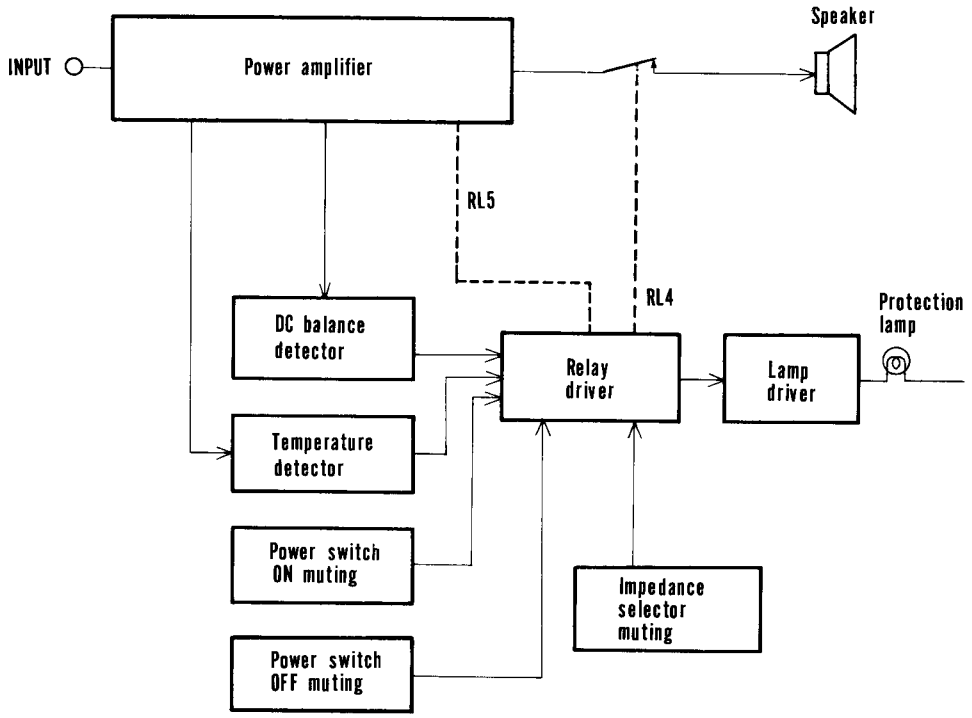


Fig. 6 Block Diagram of the Protection Circuit

Power Switch OFF Muting

Since +B3 normally passes from R7 to R6 and flows to −B2, Q28 base is maintained at cut off potential. When the power switch is turned OFF, −B2 immediately ceases, since its time constant is smaller than +B3. Consequently, +B3 passes through D1 and is applied to Q28 base, turning Q28 ON. Point B potential then falls rapidly, turning Q27 and Q30 OFF.

Impedance Selector Muting

When the impedance selector switch (S1) is changed from 8Ω to 4Ω, uncharged capacitor C2 is introduced into the −B2 circuit, temporarily reducing −B2 voltage. This causes Q28 to switch ON, C1 to be discharged, and Q29 & Q30 to be switched OFF.

Although Q28 switches OFF again, Q29 and Q30 continue in the OFF condition for several seconds while C1 is charging.

Temperature Detector

The temperature detector employs positive coefficient thermistors (posistors). These are temperature sensitive elements possessing a positive temperature response, rapidly increasing in resistance when a certain temperature is exceeded (see Figs. 8 & 9). The posistors (TH3 & TH4) are mounted on the power transistor. If some abnormality increases the temperature to the posistor operating point, their resistance rapidly increases, reducing the potential at point C. This allows D3 to conduct, so that the potential at point D drops and Q27 switches ON.

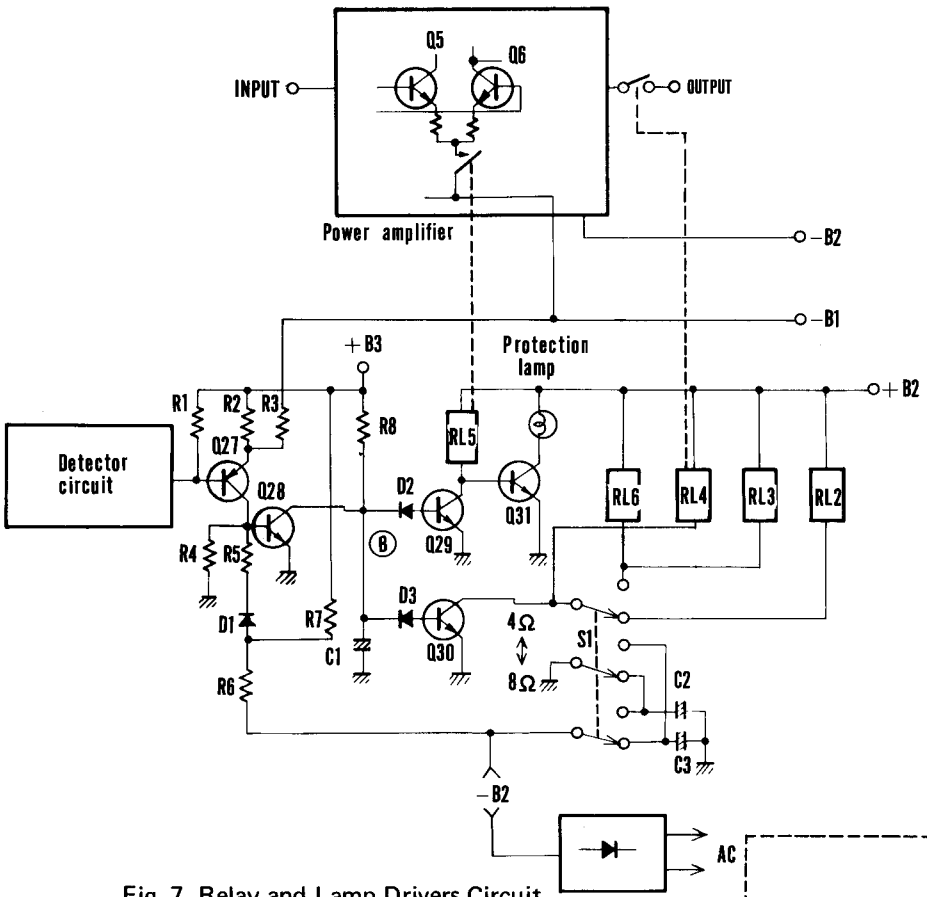


Fig. 7 Relay and Lamp Drivers Circuit

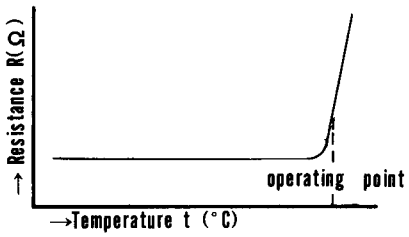


Fig. 8 Posistor-temperature Response

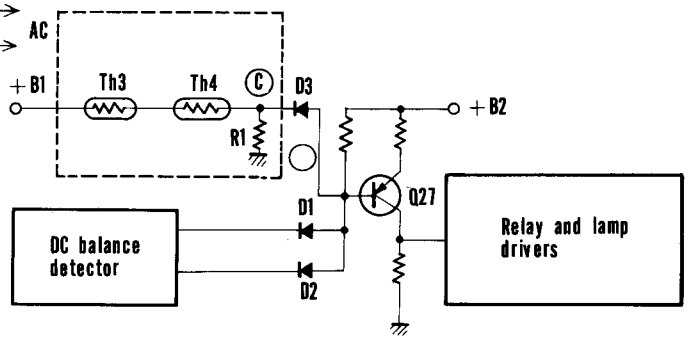


Fig. 9 Temperature Detector Circuit

DC Balance Detector

Q25 and Q26 make up a differential amplifier, as shown in Fig. 10. The inputs (bases) of these transistors are connected to the left and right power amplifier. If for some reason the DC balance of the power stage is upset, a potential difference arises in the differential amplifier input signal, unbalancing Q25 and Q26 collector currents. When one of the collector potentials becomes lower than Q27 base potential, this base potential is dissipated through D1 or D2, Q27 switches ON, and relay and lamp drives operate.

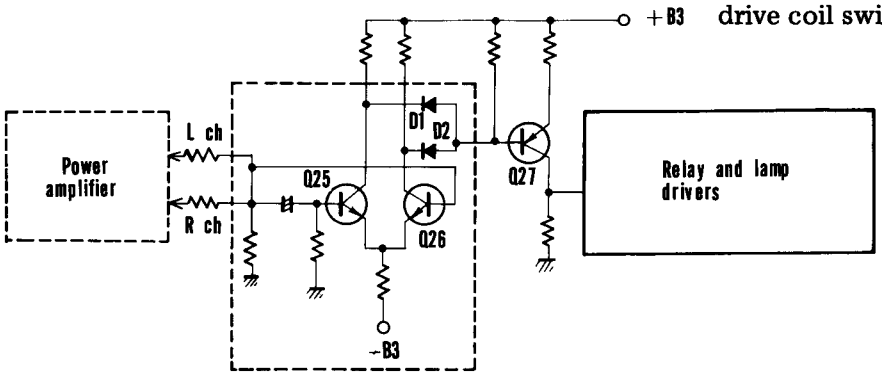


Fig. 10 DC Balance Detector Circuit

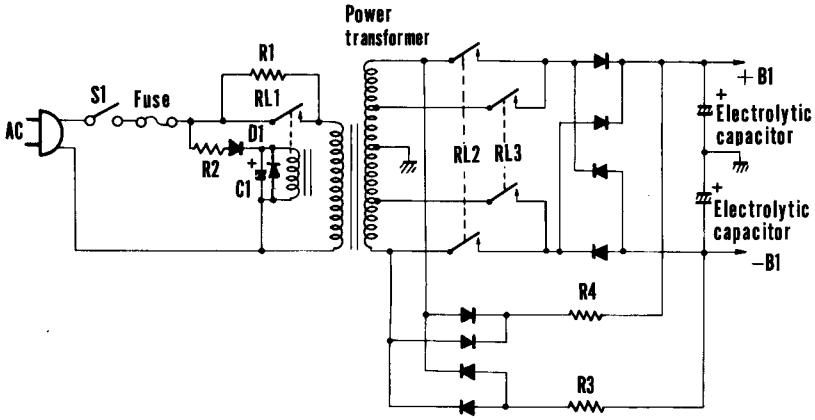


Fig. 11 Surge Current Suppressor Circuit

4.4 SURGE CURRENT SUPPRESSOR CIRCUITS

A toroidal core power transformer is used in the SPEC-2, which while possessing compactness and a large handling capacity, also exhibits extremely low internal resistance. In combination with the four 15,000μF electrolytic capacitors forming the power supply, surge current accompanying power switch operation can reach a maximum of 300A. The power supply can therefore be damaged unless protective measures are taken.

The main sources of surge current generation are power transformer excitation current and power supply electrolytic capacitor charging current.

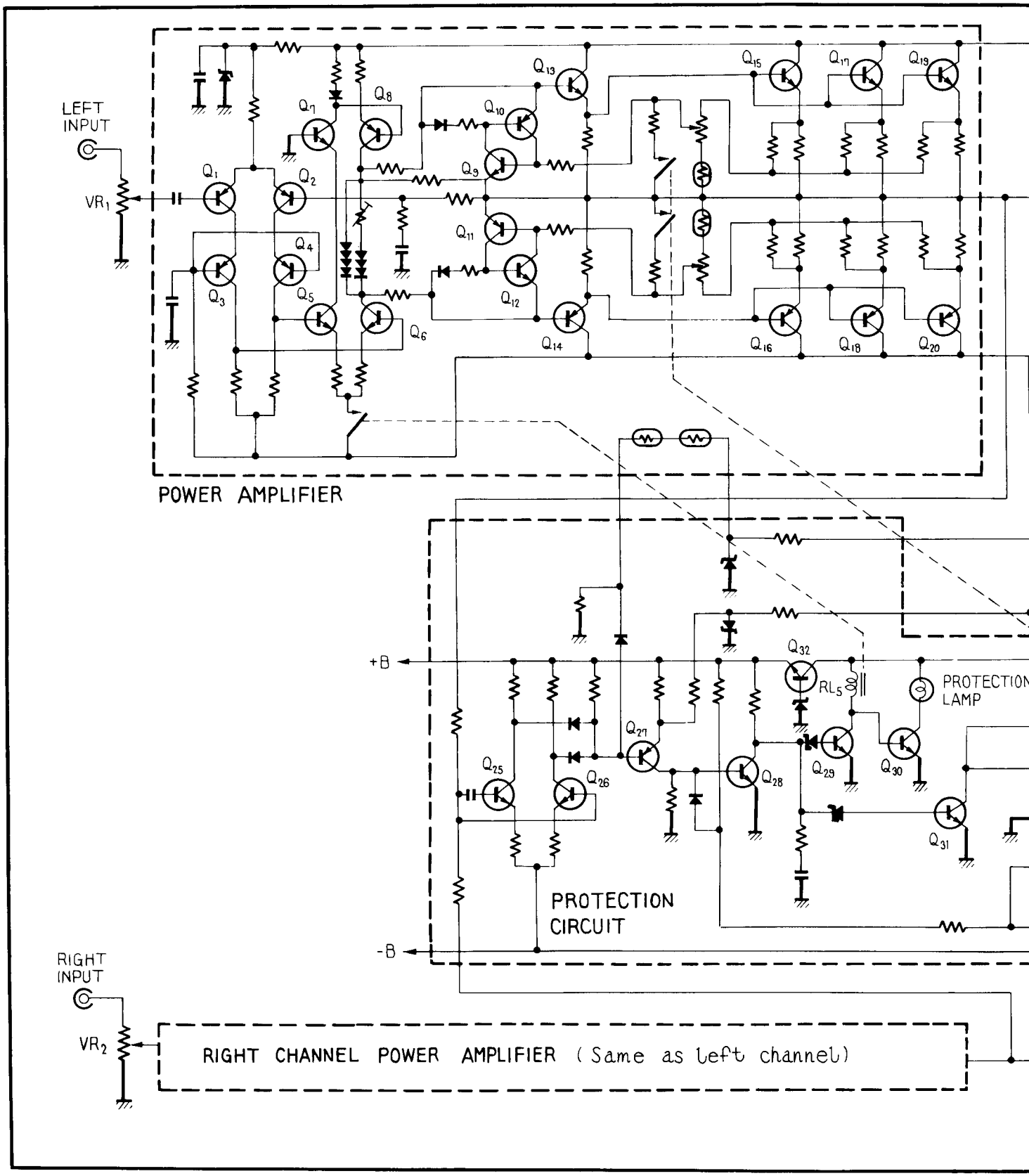
Two surge suppressor circuits are employed in the SPEC-2, one each in the primary and secondary power transformer circuits. These circuits are shown in Fig. 11.

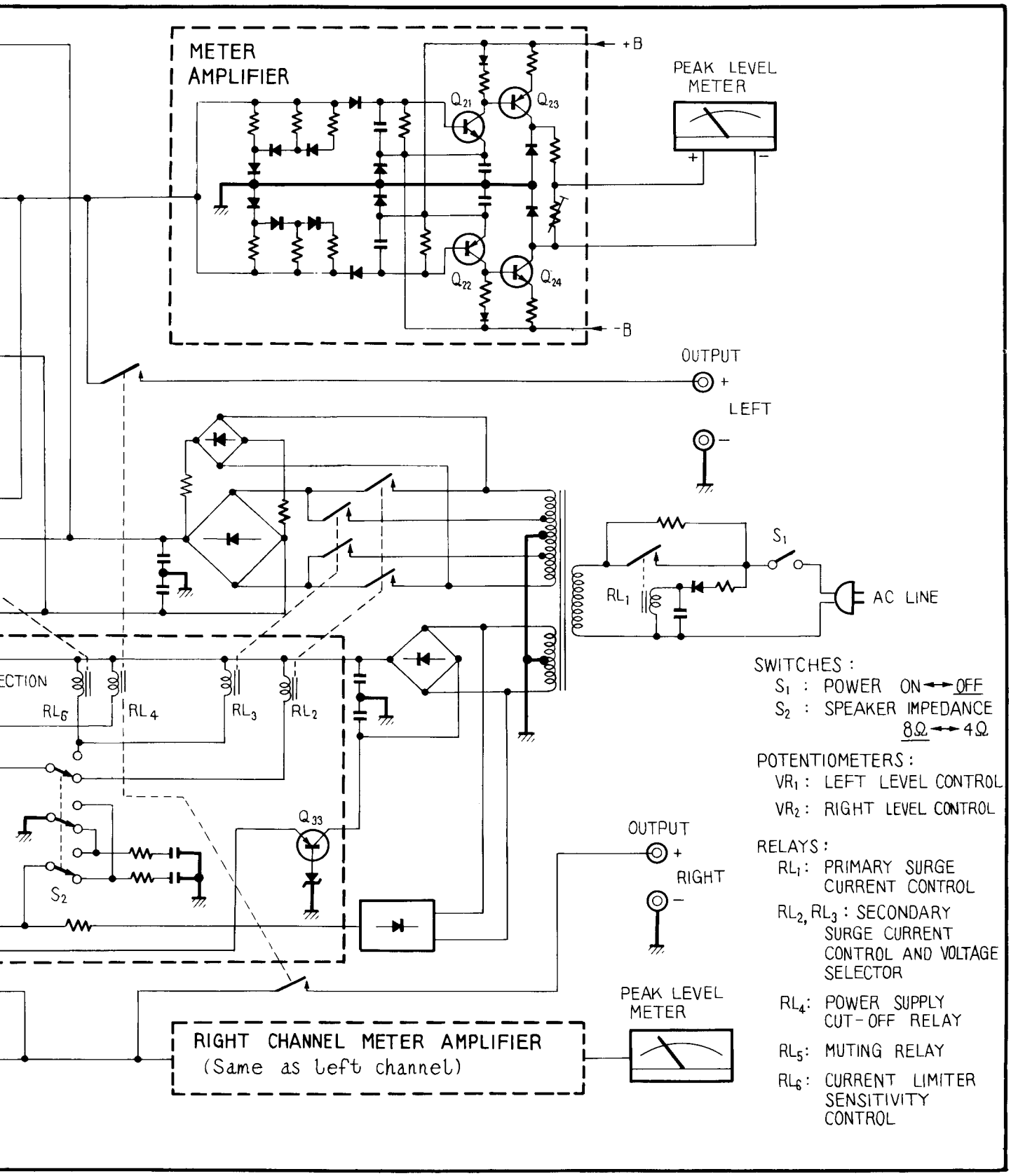
Power transformer excitation current is handled by the relay surge suppressor circuit at the primary side. When the power switch is turned ON, the current passes through R2 & D1 and charges C1, therefore it does not flow through the relay drive coil immediately, and RL1 remains OFF. The transformer excitation current flows through R1 during this interval. After C1 is completely charged, current flows in the RL1 drive coil switching it ON, and R1 is shorted.

The surge suppressor circuit in the secondary side of the power transformer is designed to handle the electrolytic capacitor charging current. When the power switch is turned ON, RL2 and RL3 remain OFF due to protection circuit operation. Consequently, the current passes through R3 and R4, gradually charging the electrolytic capacitors through a bridge type rectifier circuit. RL2 or RL3 is switched ON when charging has been completed, giving the normal operating mode.

By employing these circuits, surge current is limited to approximately 40 A.

5. BLOCK DIAGRAM





SWITCHES :

S_1 : POWER ON ↔ OFF

S_2 : SPEAKER IMPEDANCE 8Ω ↔ 4Ω

POTENTIOMETERS :

VR_1 : LEFT LEVEL CONTROL

VR_2 : RIGHT LEVEL CONTROL

RELAYS :

RL_1 : PRIMARY SURGE CURRENT CONTROL

RL_2, RL_3 : SECONDARY SURGE CURRENT CONTROL AND VOLTAGE SELECTOR

RL_4 : POWER SUPPLY CUT-OFF RELAY

RL_5 : MUTING RELAY

RL_6 : CURRENT LIMITER SENSITIVITY CONTROL

6. ADJUSTING PROCEDURES

Since the same configuration is used for both left and right channels of the SPEC-2 power amplifier assembly, the following adjustments apply to both channels.

6.1 IDLE CURRENT ADJUSTMENT

1) Connect as shown in Fig. 12.
2) Set LEFT LEVEL and RIGHT LEVEL controls on the front panel to minimum (fully counter-clockwise).
3) Set POWER switch to ON. After 1 or 2 minutes adjust VR1 to give an indication of 30mV on the voltmeter.
4) After the power has been ON for 30 minutes, readjust VR1 for 30mV indication on the voltmeter.

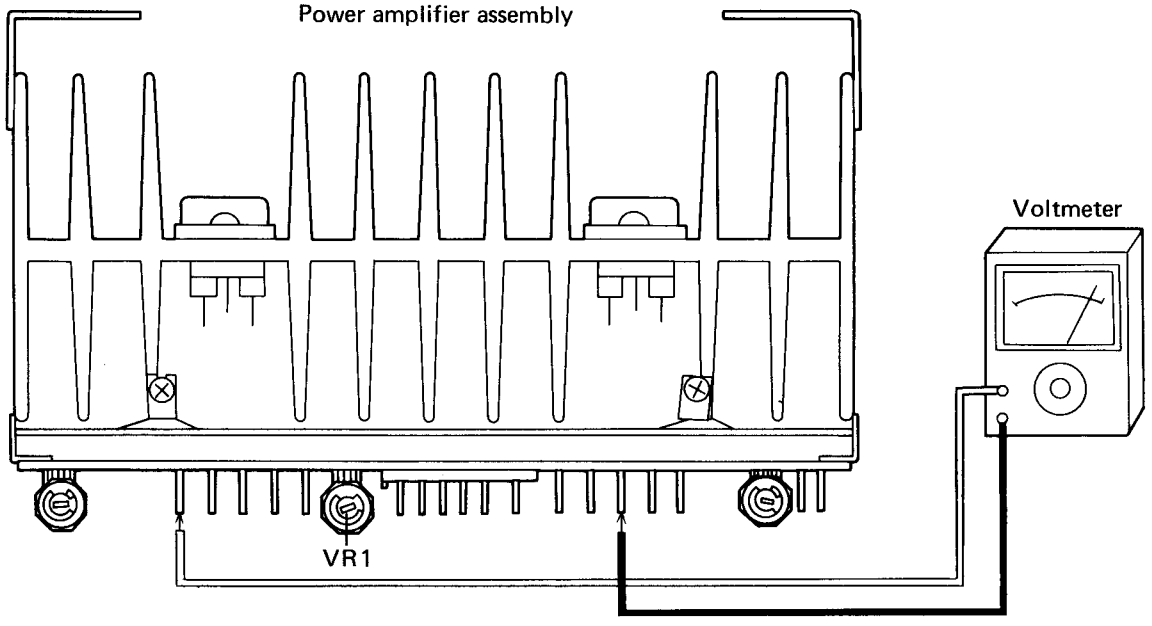


Fig. 12 Connection Diagram for Idle Current Adjustment

6.2 CURRENT LIMITER SENSITIVITY ADJUSTMENT

Note:
The high output power of the SPEC-2 requires a dummy load of 4Ω and more than 200W. If a 200W dummy load is not available, connect two 8Ω, 100W loads in parallel.

1) Connect as shown in Fig. 14.
2) Set SPEC-2 impedance selector switch to 8Ω (even though a 4Ω dummy load is used).
3) While the voltmeter indicated 30V/(4Ω), adjust VR2 to just distorted point the upper half of the waveform.
   In the same manner, adjust VR3 to just distorted point the lower half with 28.3V/(4Ω).

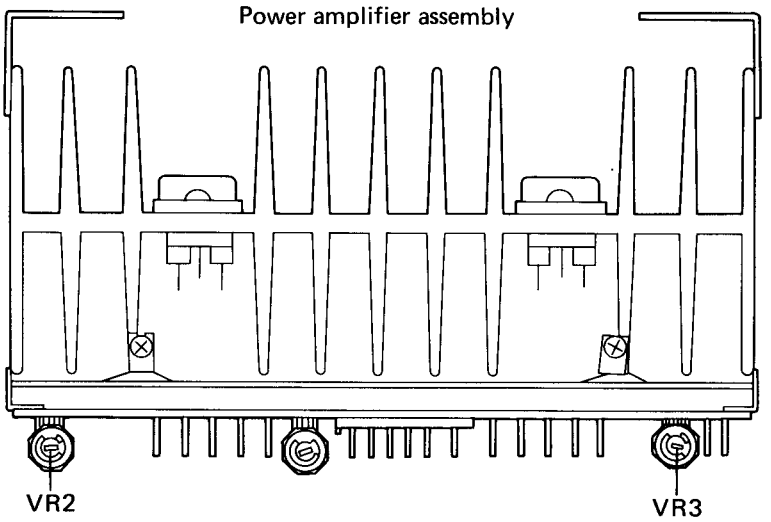


Fig. 13 The Position of VR2 and VR3

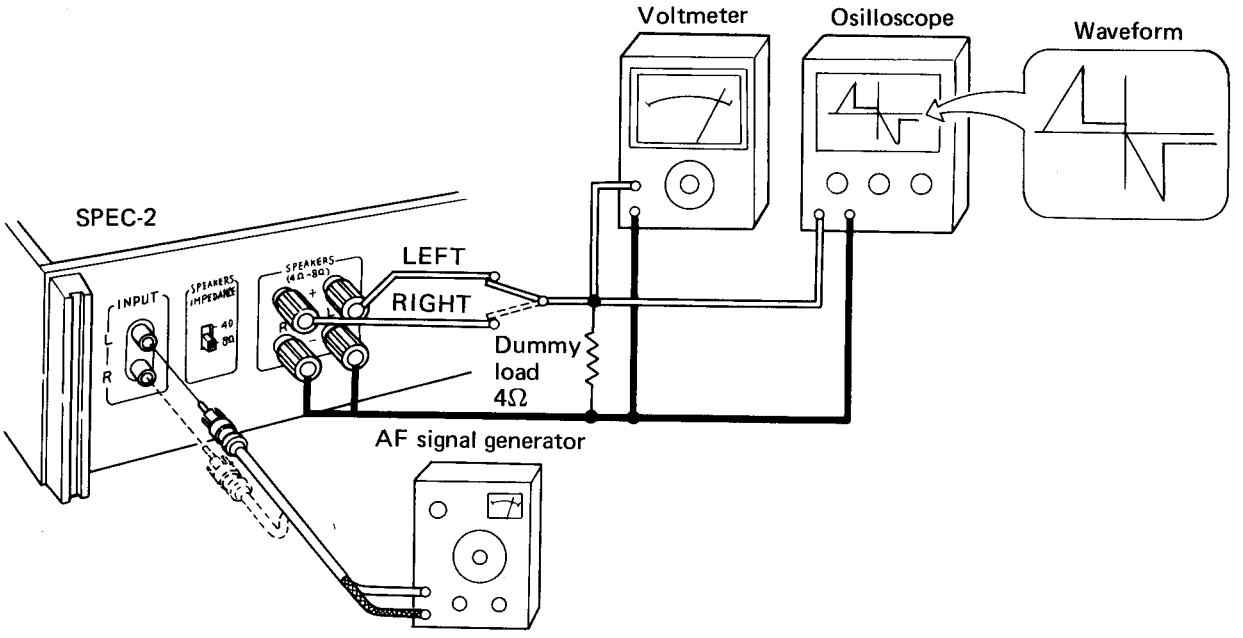


Fig. 14 Connection Diagram for Current Limiter Sensitivity Adjustment

6.3 METER AMPLIFIER ADJUSTMENT

1) Connect as shown in Fig. 16.
2) Adjust input level to give an indication of 44.7V on the voltmeter.
3) At this time, adjust VR1 (left channel; VR2 is for right channel) for 0dB (250W) indication on the LEVEL meter.

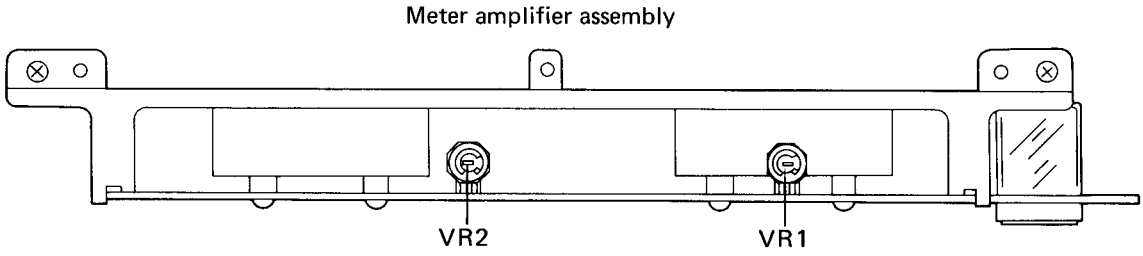


Fig. 15 The Position of VR1 and VR2

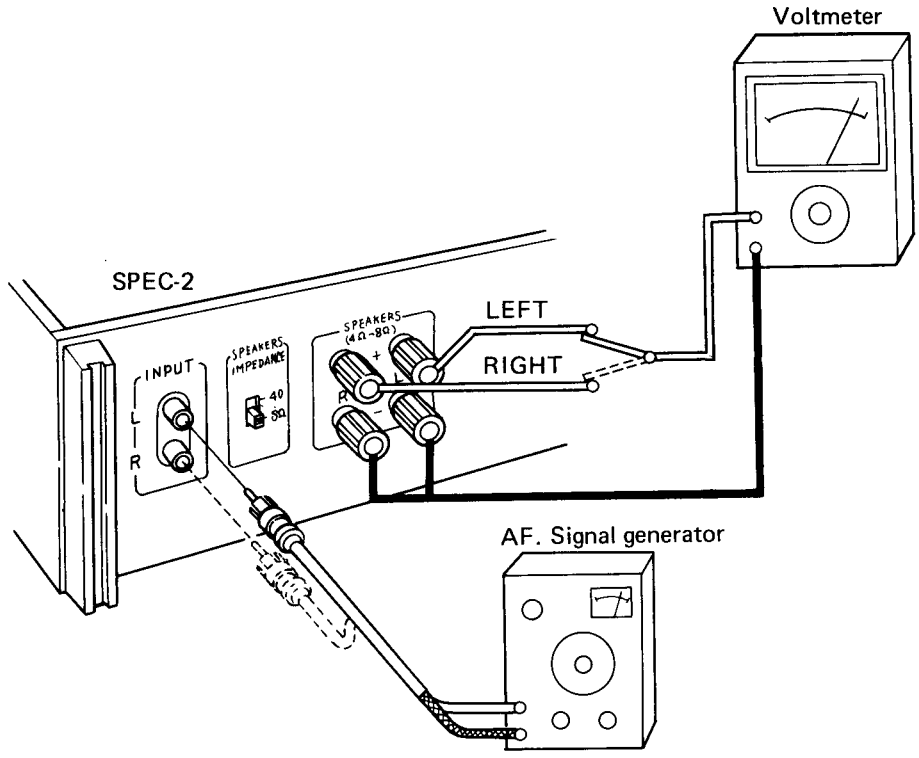
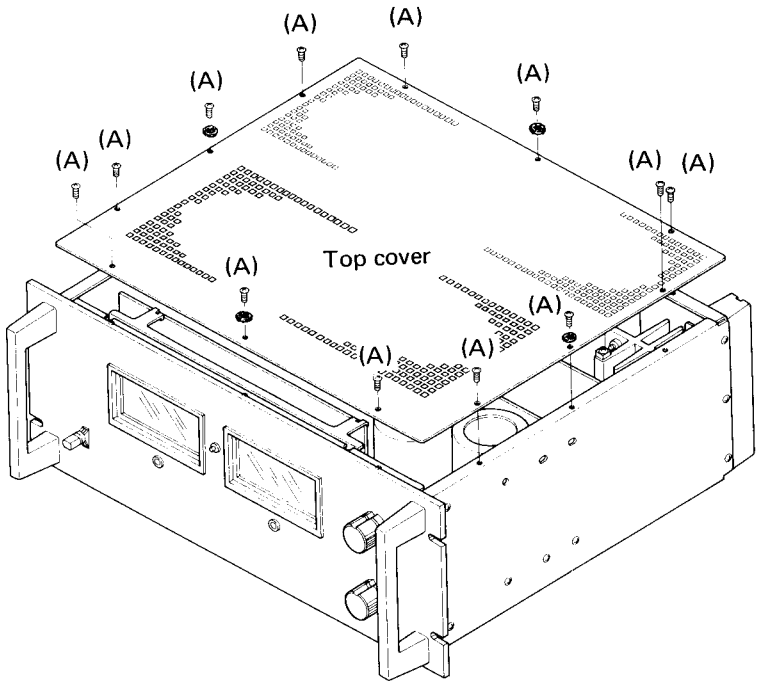


Fig. 16 Connection Diagram for Meter Amplifier Adjustment

7. DISASSEMBLY

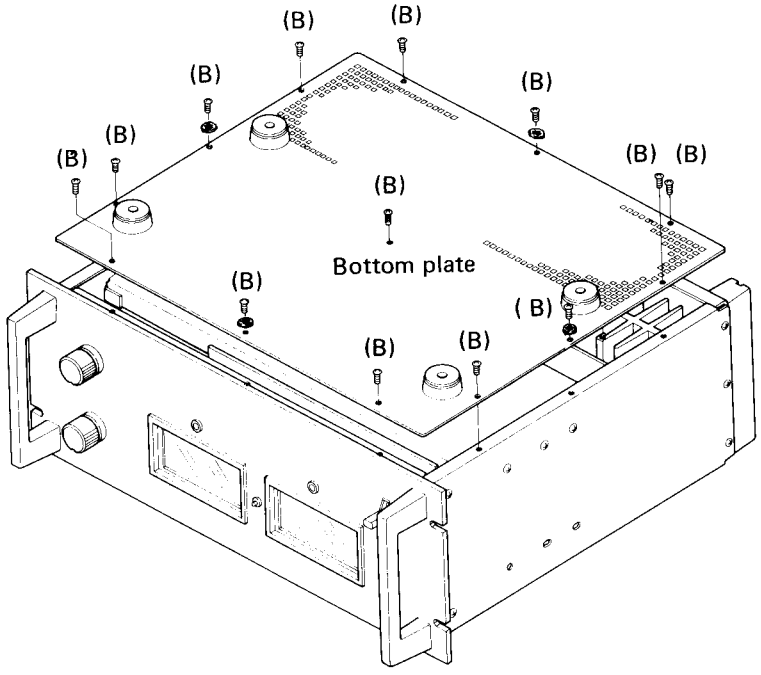
1. Removing the Top Cover

Remove the 12 screws (A) to detach the top cover.



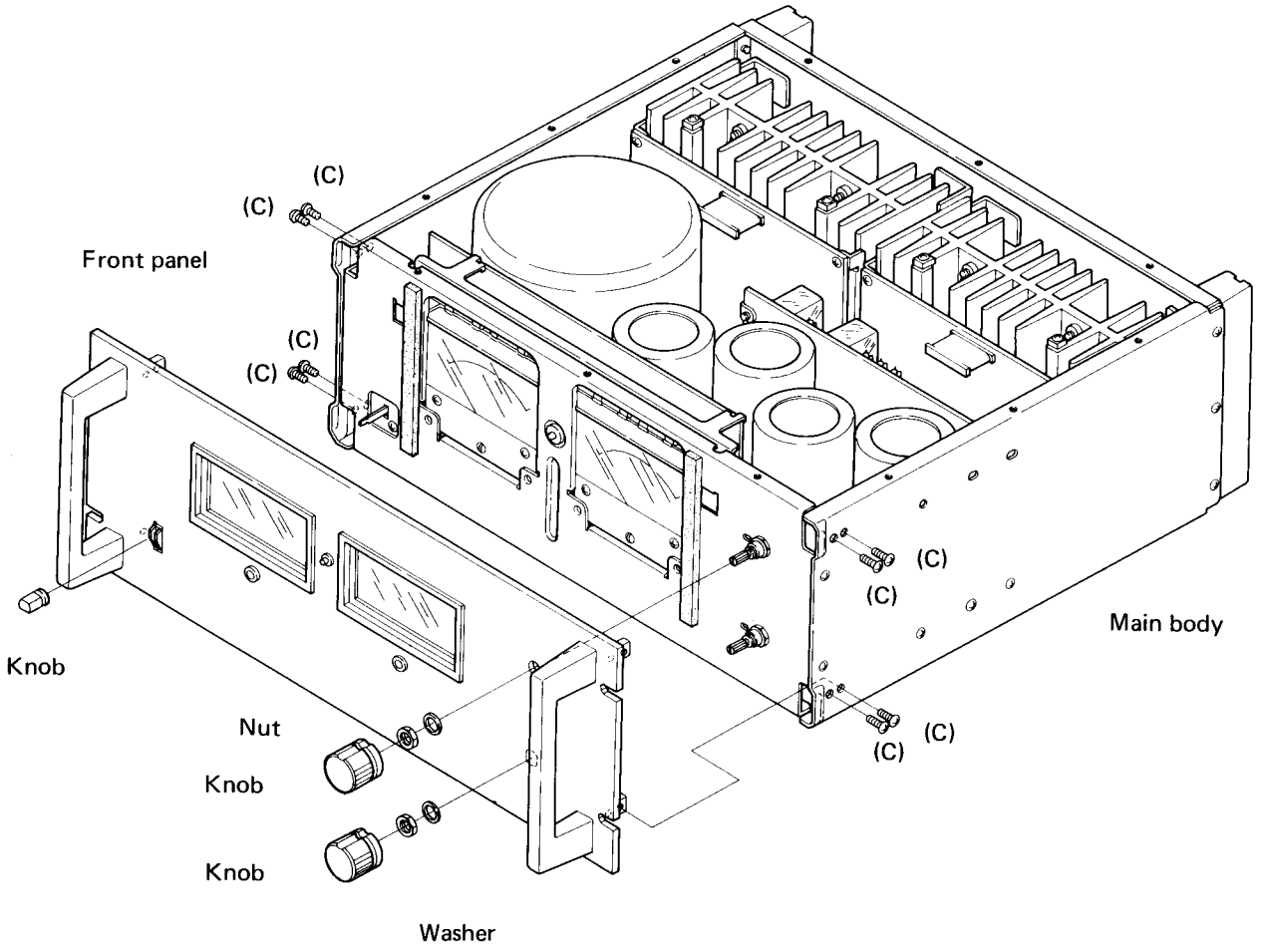
2. Removing the Bottom Plate

Remove the 13 screws (B) to detach the bottom plate.



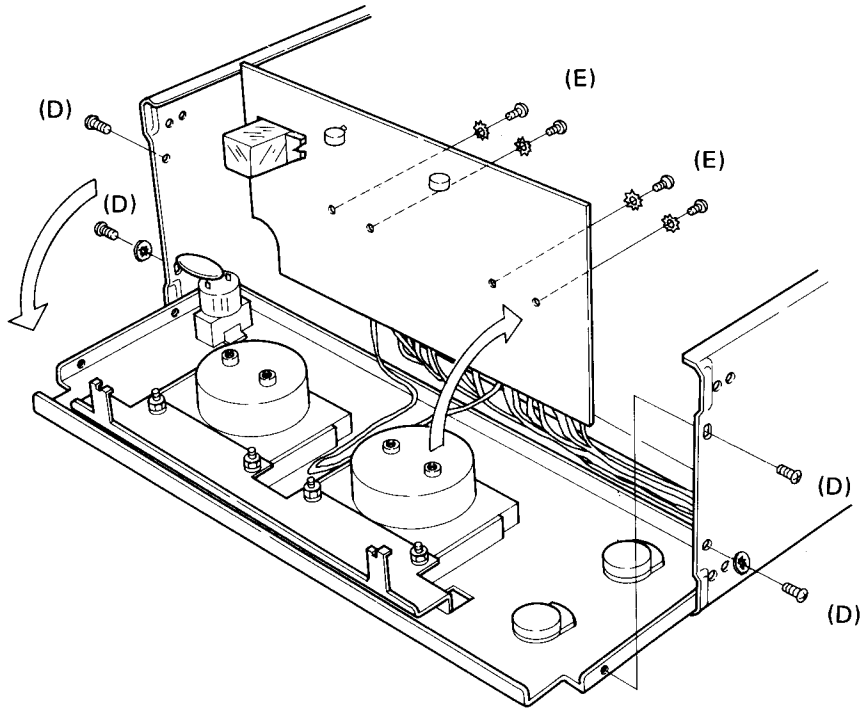
3. Removing the Front Panel

(1) Remove all control knobs by pulling them out.
(2) Remove the LEFT LEVEL and RIGHT LEVEL shaft nuts and washers.
(3) Remove the 4 screws (C) on each side of the main body. The front panel is ready for removal.



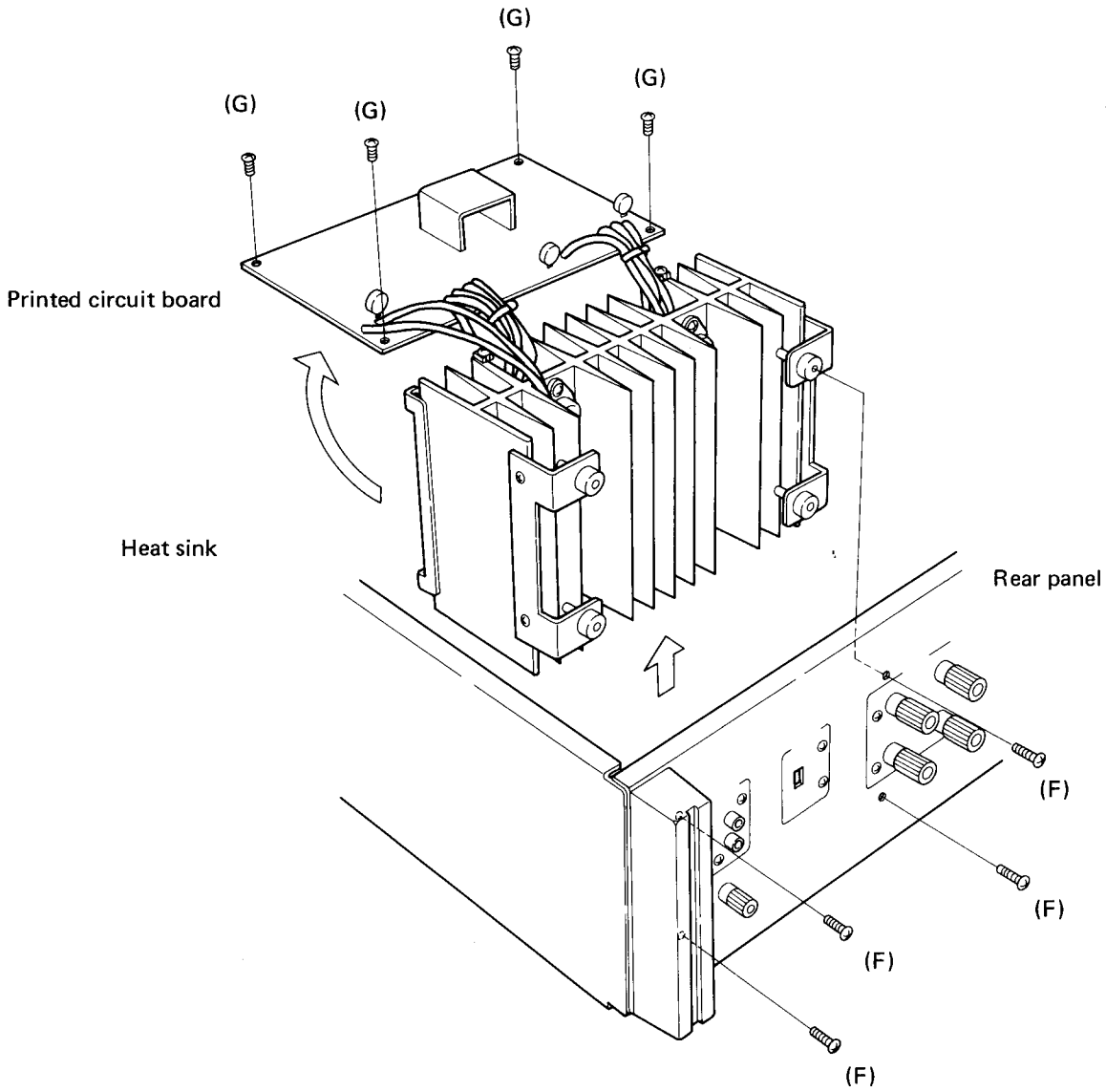
4. Removing the Meter Amplifier Assembly

(1) Remove the top cover, bottom plate and front panel.
(2) Unscrew the 4 screws (D). Remove the panel stay.
(3) Unscrew the 4 screws (E) which mount the printed circuit board on peak level meter.
This allows the printed circuit board to be moved, though the distance is limited by the length of its lead wire.



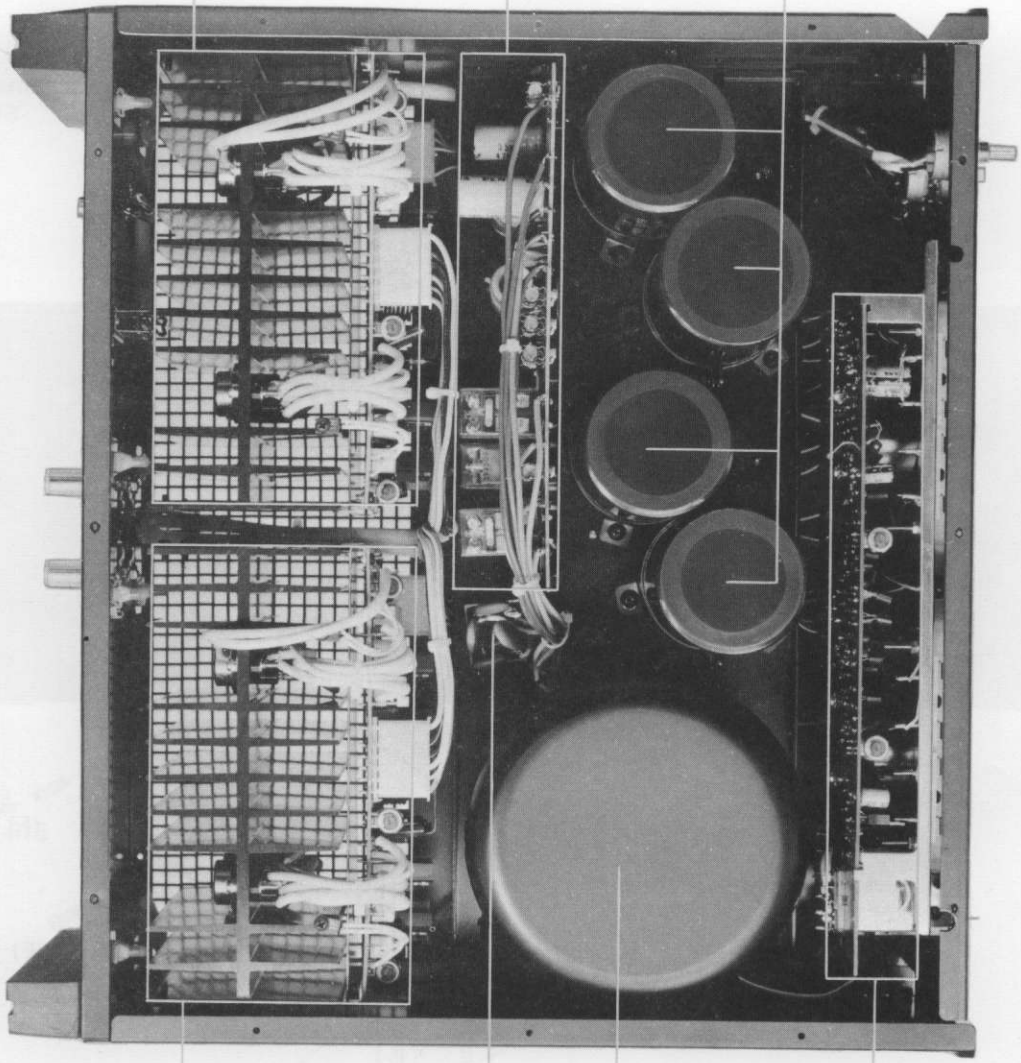
5. Removing the Power Amplifier Assembly

(1) Remove the top cover and bottom plate.
(2) Unscrew the 4 screws (F) which mount the power amplifier assembly on the rear panel.
(3) Unscrew the 4 screws (G) which mount the printed circuit board on the heat sink.

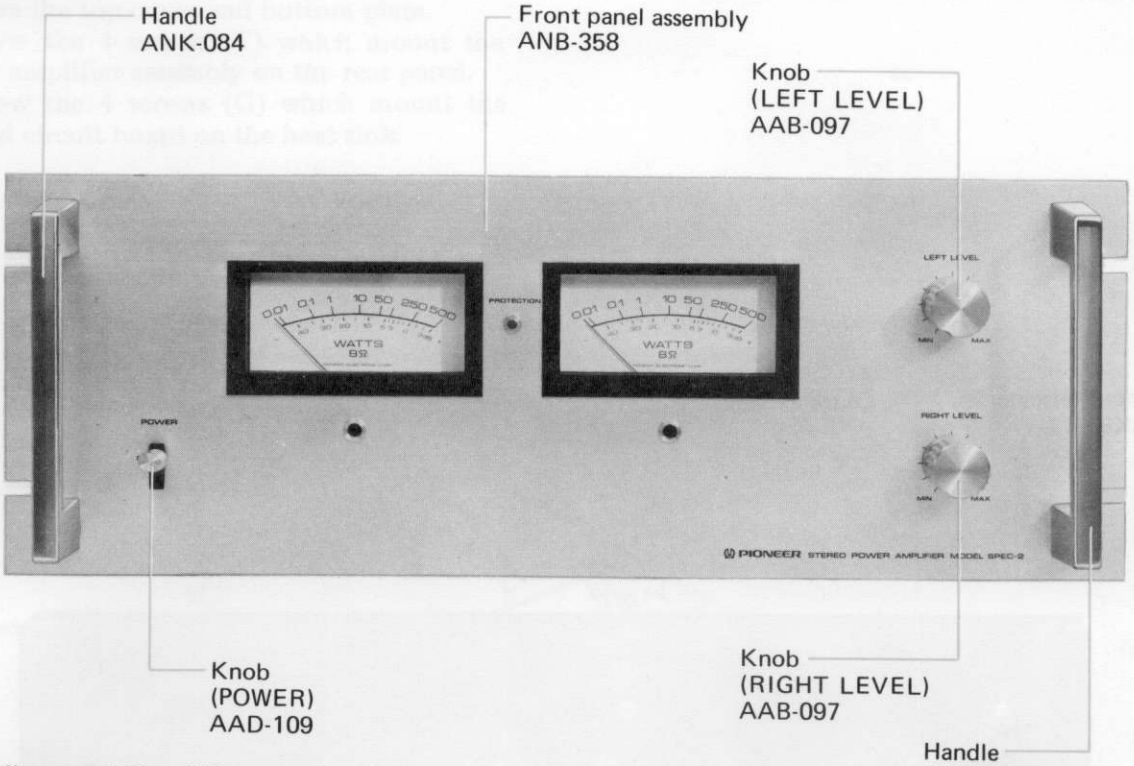


8. PARTS LOCATIONS

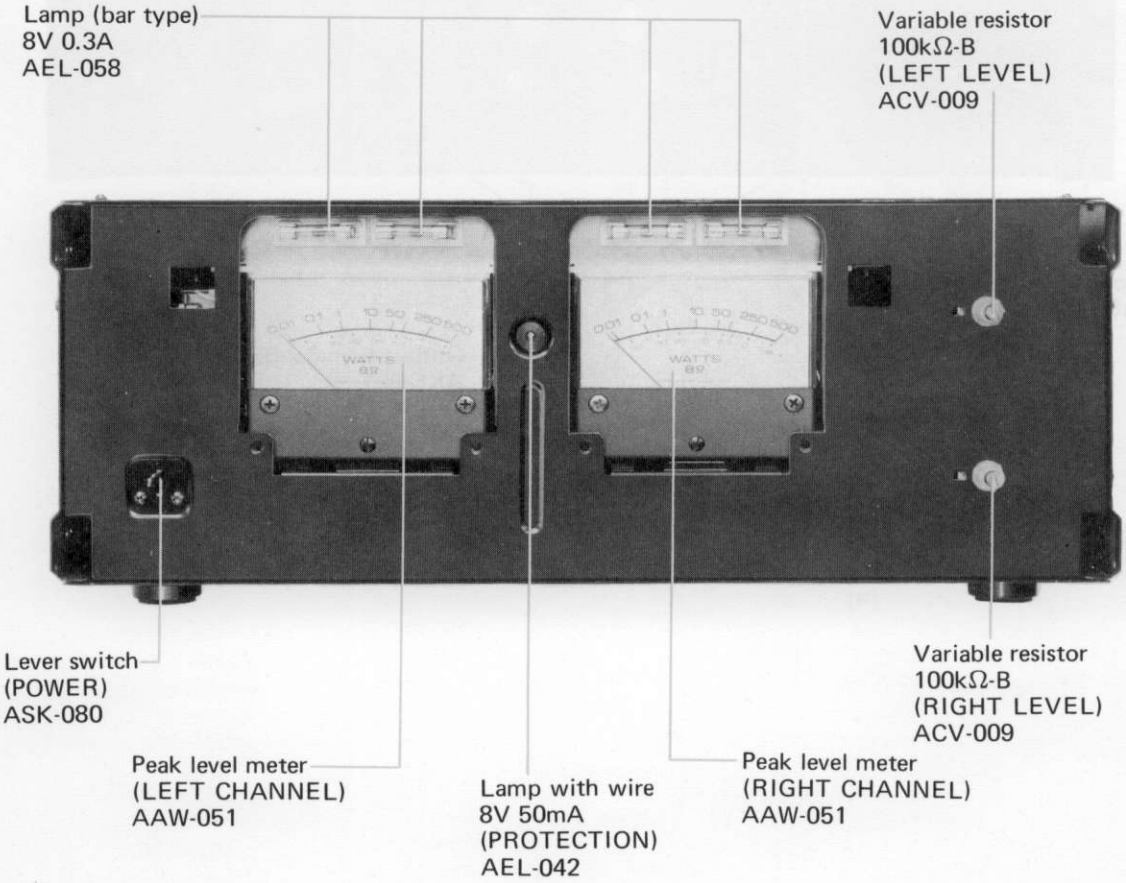
1. Top View



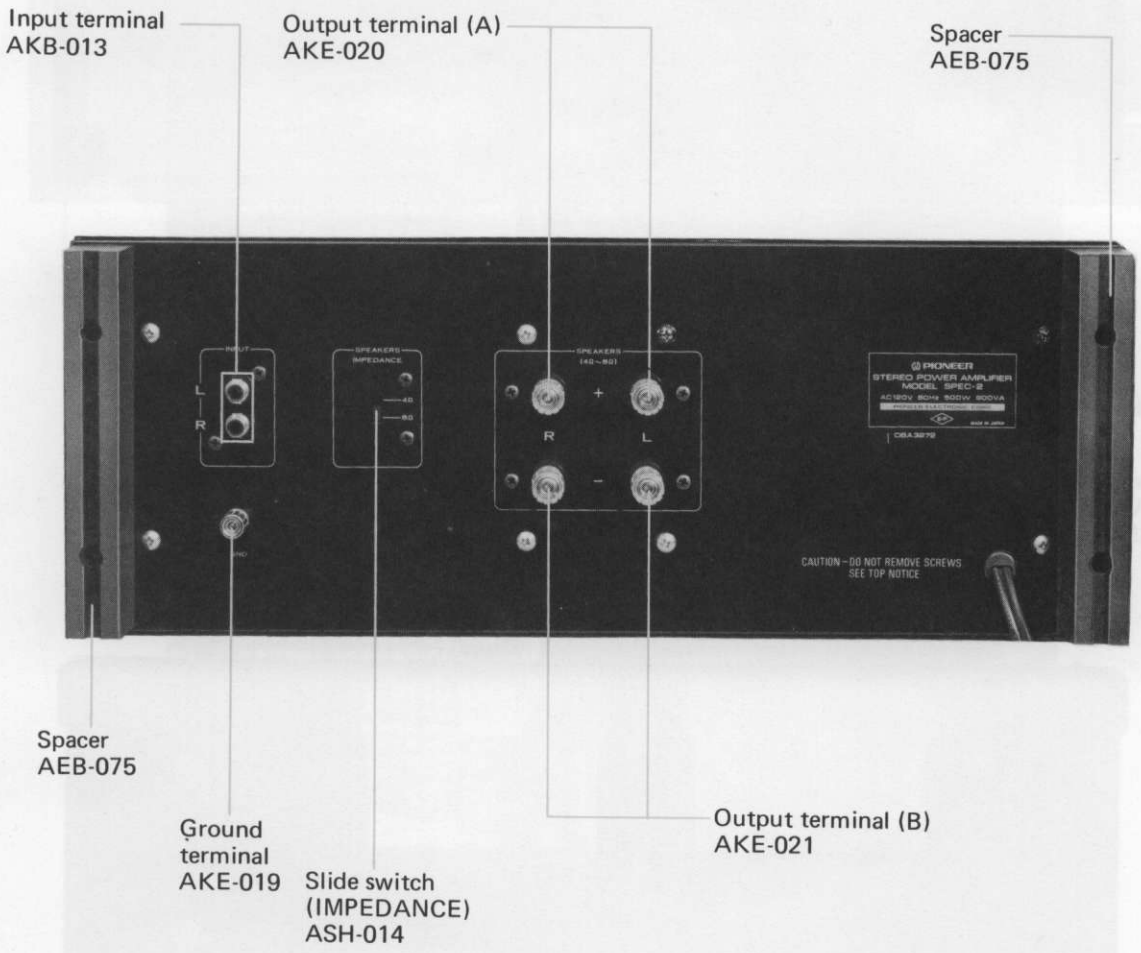
2. Front Panel View



3. Front View with Panel Removed

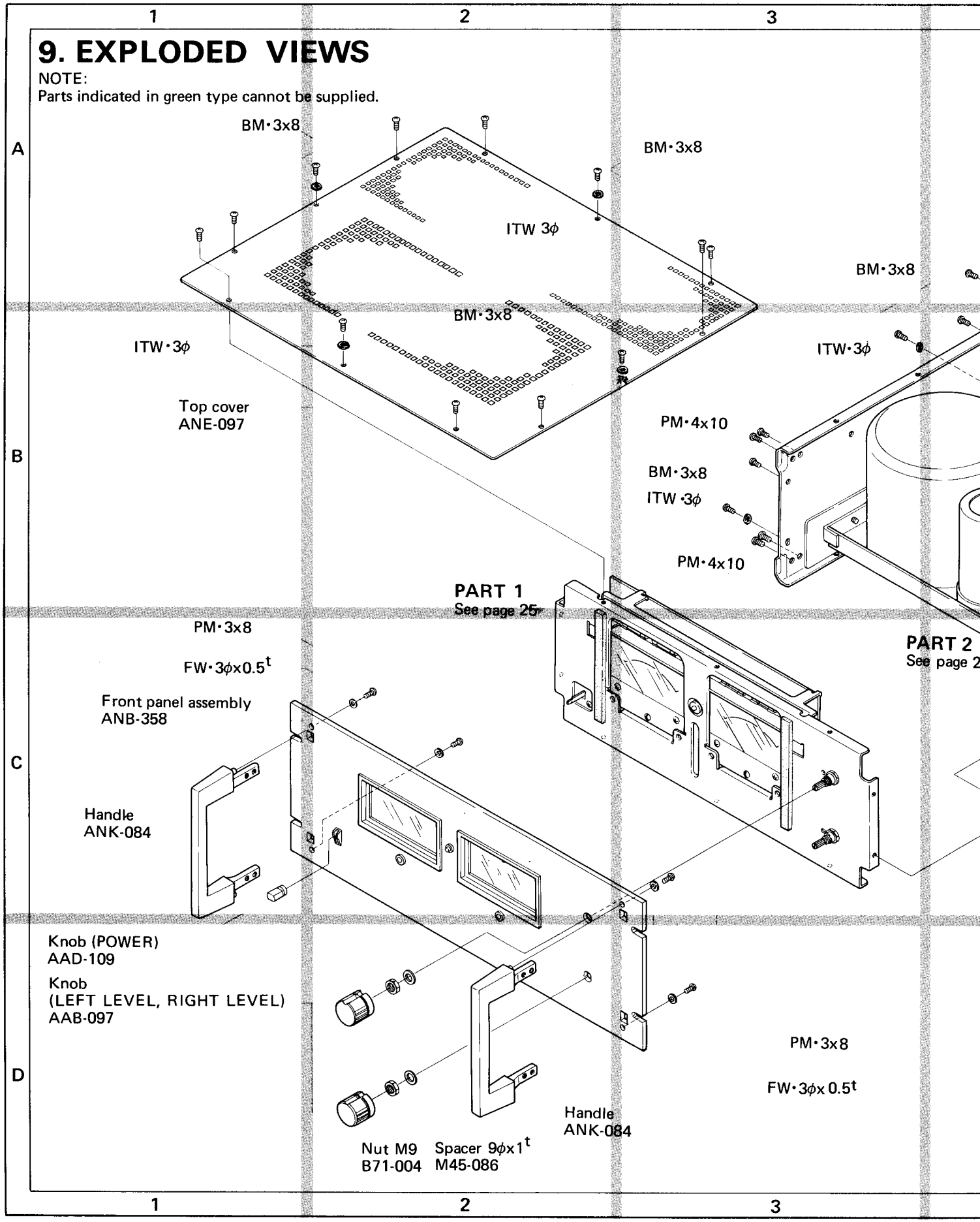


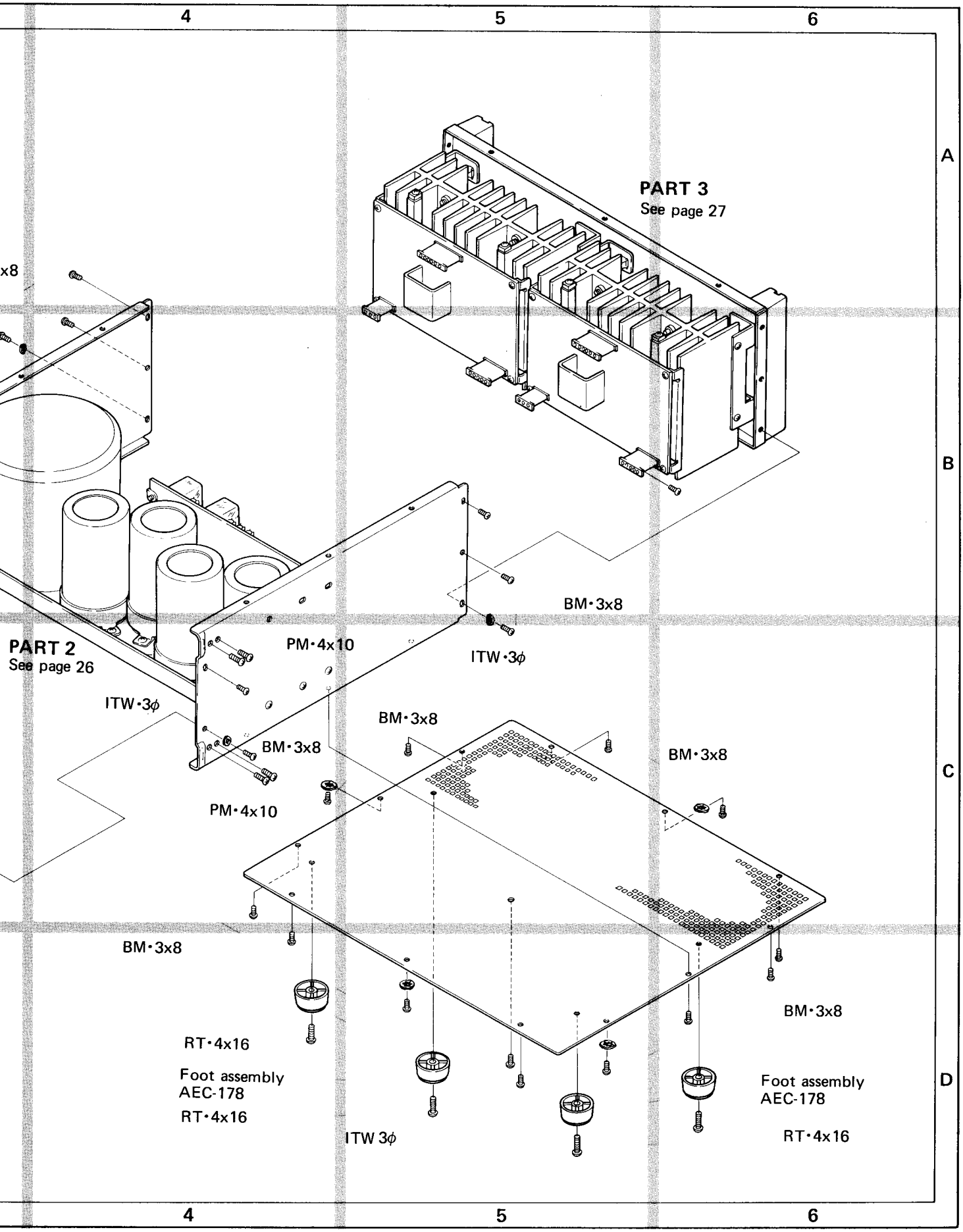
4. Rear View


Input terminal
AKB-013
Output terminal (A)
AKE-020
Spacer
AEB-075
Spacer
AEB-075
Ground
terminal
AKE-019
Slide switch
(IMPEDANCE)
ASH-014
Output terminal (B)
AKE-021
PIONEER
STEREO POWER AMPLIFIER
MODEL SPEC-2
CAUTION – DO NOT REMOVE SCREWS
SEE TOP NOTICE

9. EXPLODED VIEWS

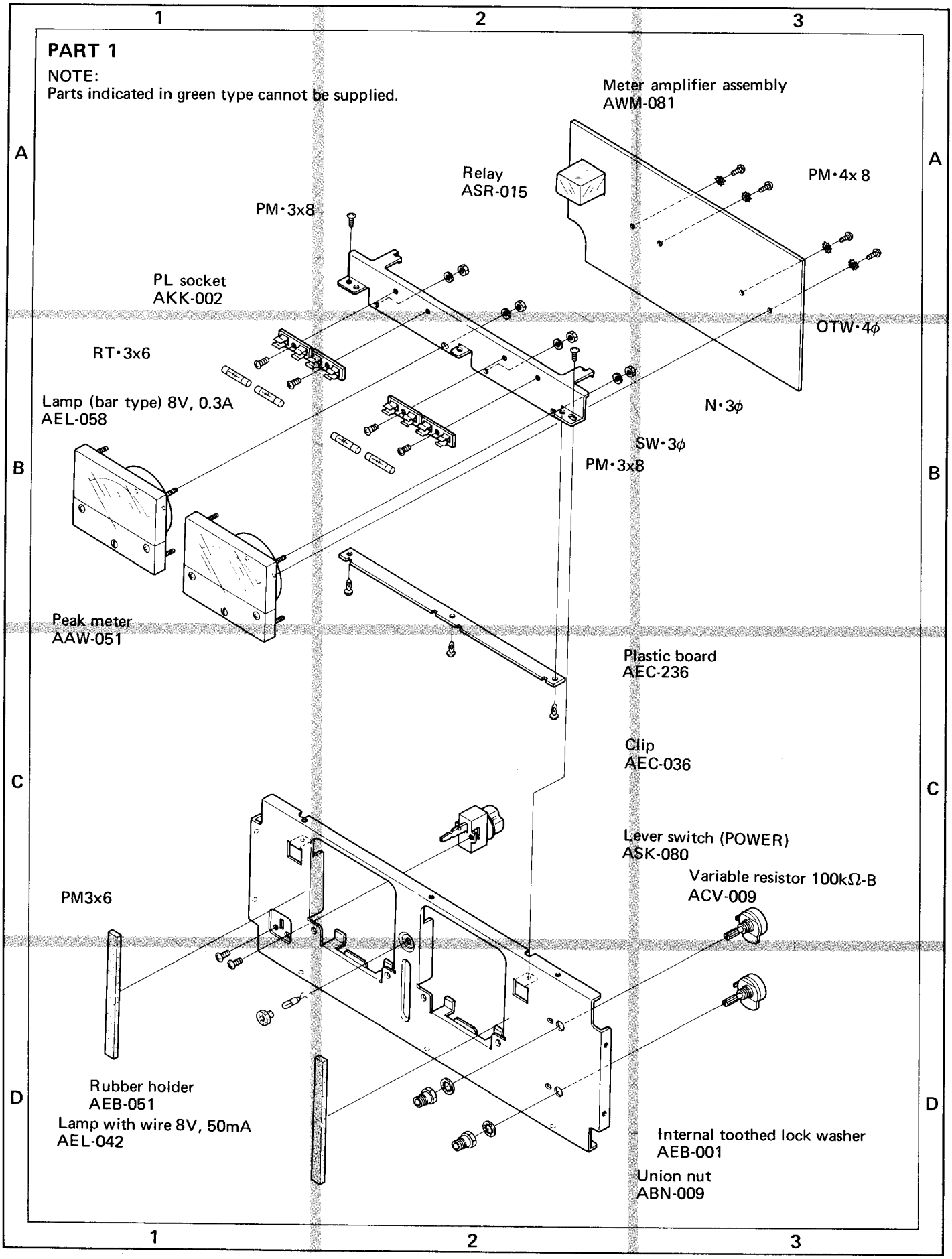
NOTE:
Parts indicated in green type cannot be supplied.




4
5
6
A
B
C
D
PART 3
See page 27
PART 2
See page 26
BM•3x8
PM•4x10
ITW•3ϕ
ITW•3ϕ
BM•3x8
BM•3x8
BM•3x8
PM•4x10
BM•3x8
BM•3x8
RT•4x16
Foot assembly
AEC-178
RT•4x16
ITW 3ϕ
Foot assembly
AEC-178
RT•4x16

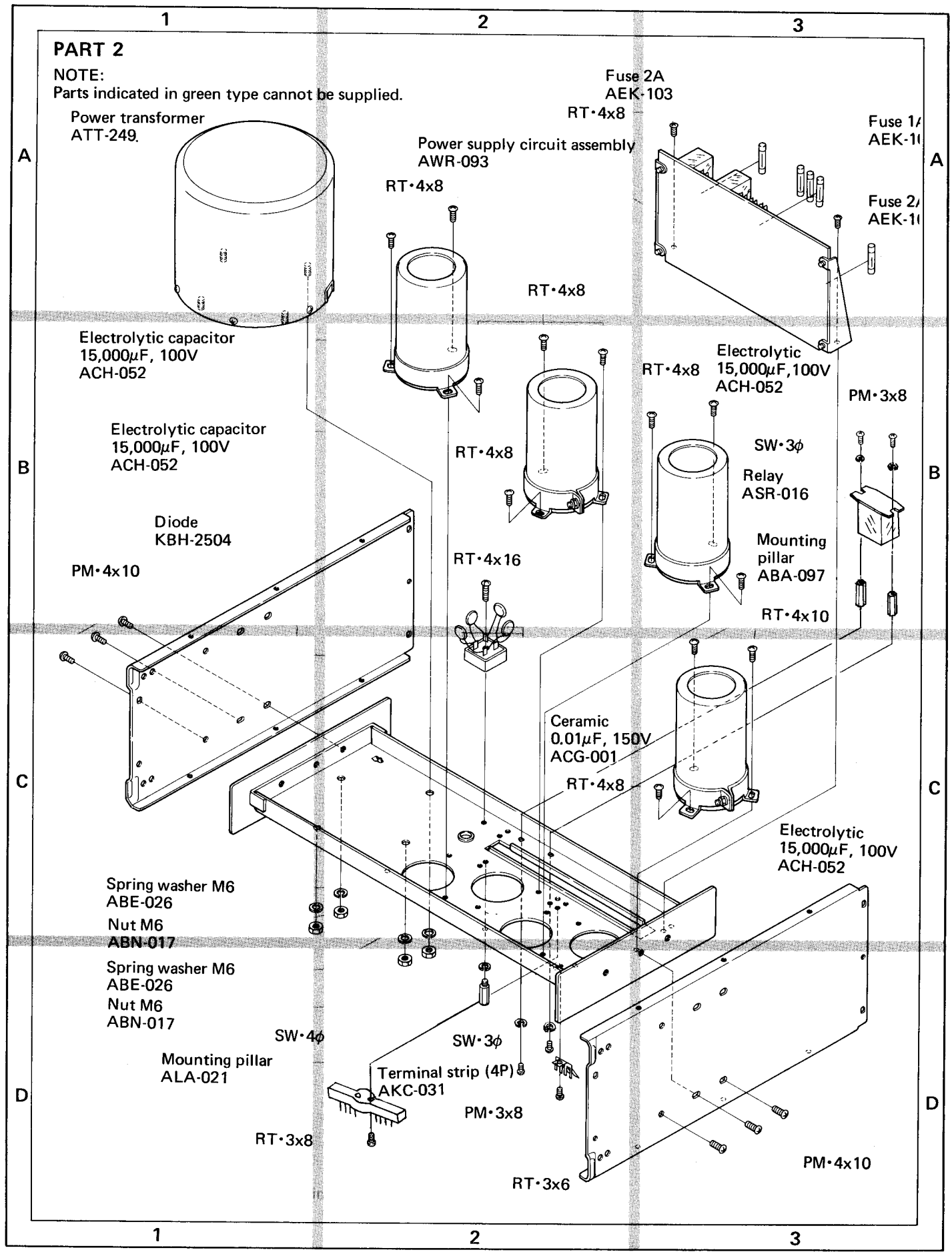
PART 1

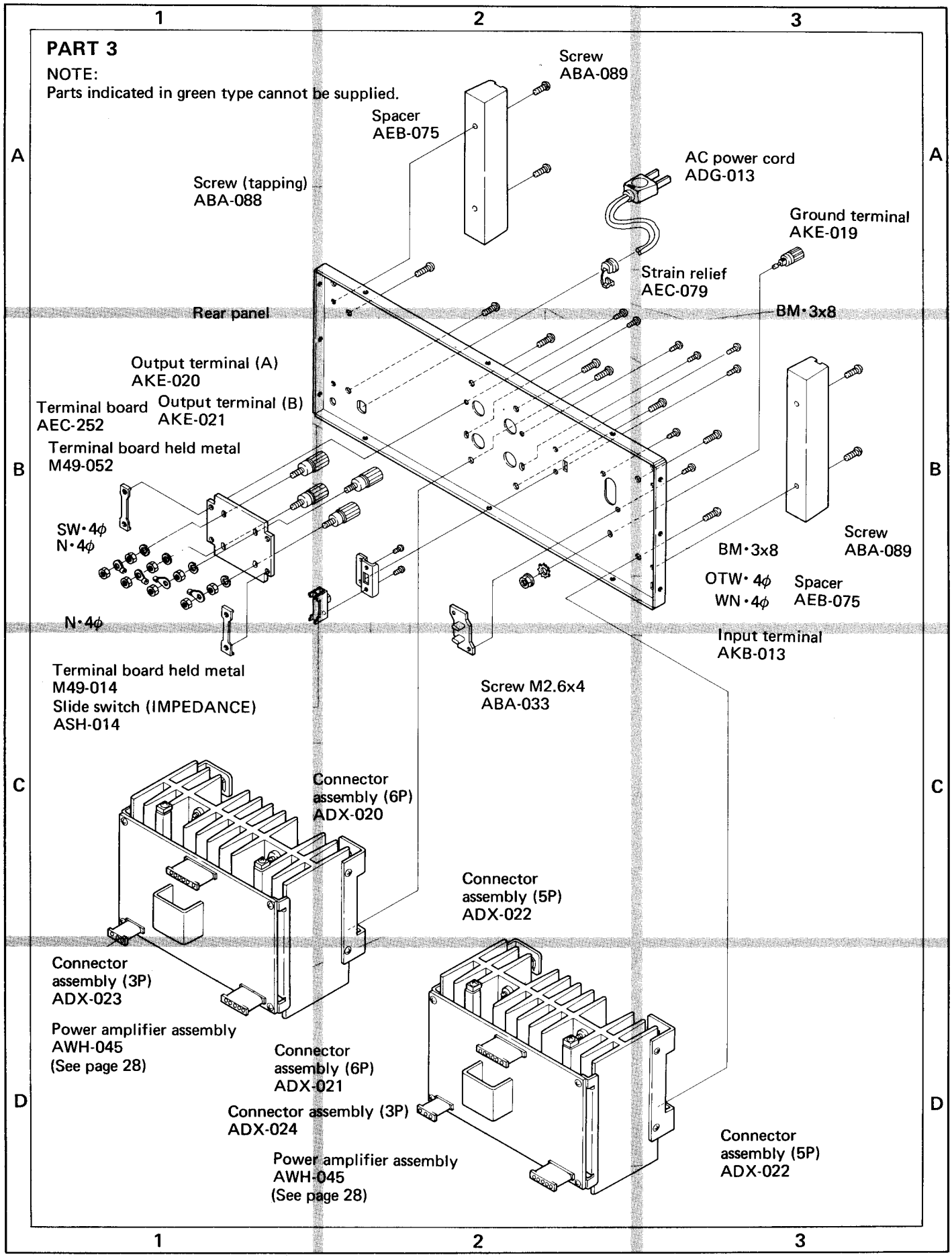
NOTE:
Parts indicated in green type cannot be supplied.



PART 2

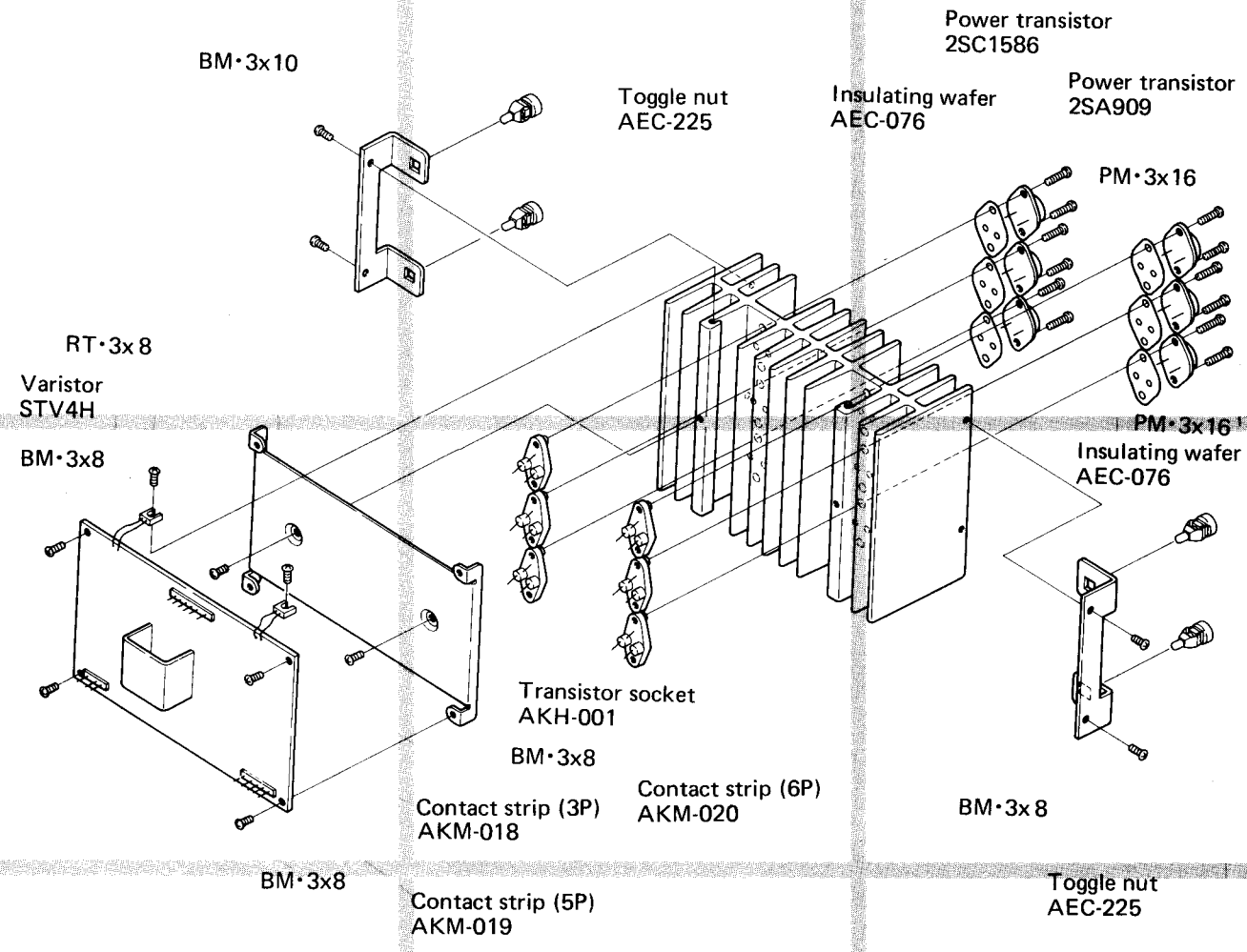
NOTE:
Parts indicated in green type cannot be supplied.




1
2
3
PART 3
NOTE:
Parts indicated in green type cannot be supplied.
Screw
ABA-089
Spacer
AEB-075
AC power cord
ADG-013
Screw (tapping)
ABA-088
Ground terminal
AKE-019
Strain relief
AEC-079
Rear panel
BM•3x8
Output terminal (A)
AKE-020
Terminal board
AEC-252
Output terminal (B)
AKE-021
Terminal board held metal
M49-052
SW•4φ
N•4φ
BM•3x8
Screw
ABA-089
OTW•4φ
WN•4φ
Spacer
AEB-075
N•4φ
Input terminal
AKB-013
Terminal board held metal
M49-014
Slide switch (IMPEDANCE)
ASH-014
Screw M2.6x4
ABA-033
Connector
assembly (6P)
ADX-020
Connector
assembly (5P)
ADX-022
Connector
assembly (3P)
ADX-023
Power amplifier assembly
AWH-045
(See page 28)
Connector
assembly (6P)
ADX-021
Connector assembly (3P)
ADX-024
Power amplifier assembly
AWH-045
(See page 28)
Connector
assembly (5P)
ADX-022
A
B
C
D

POWER AMPLIFIER ASSEMBLY

NOTE:
Parts indicated in green type cannot be supplied.



NOMENCLATURE OF SCREWS, WASHERS AND NUTS

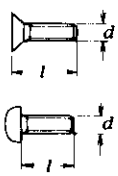
The following symbols stand for screws, washers and nuts as shown in exploded view.

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

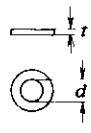
Symbol	Description	Shape
EW	E type washer	
FW	Flat washer	
SW	Spring lock washer	
N	Nut	
WN	Washer faced nut	
ITW	Internal toothed lock washer	
OTW	Outernal toothed lock washer	
SC	Slotted set screw (Cone point)	
SF	Slotted set screw (Flat point)	
HS	Hexagon socket headless set screw	
OCW	Oval countersunk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

EXAMPLE

PM・3x8
- 3: diameter in mm (d)
- 8: length in mm (l)
- PM: Symbol



FW・9φx1^{t}
- 9φ: diameter in mm (d)
- 1^{t}: thickness in mm (t)
- FW: Symbol



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

10.1 SCHEMATIC DIAGRAM AND MISCELLANEOUS PARTS

Miscellaneous Parts List

NOTE:
- *Capacitors: in μF unless otherwise noted p:pF*
- *Resistors: in Ω, ¼W unless otherwise noted k:kΩ, M:MΩ*

CAPACITORS

Symbol	Description			Part No.
C1	Ceramic	0.01	150V	ACG-003
C2	Electrolytic	15,000	100V	ACH-052
C3	Electrolytic	15,000	100V	ACH-052
C4	Electrolytic	15,000	100V	ACH-052
C5	Electrolytic	15,000	100V	ACH-052
C6	Ceramic	0.01	150V	ACG-001
C7	Ceramic	0.01	150V	ACG-001
C8	Ceramic	0.01	150V	ACG-001
C9	Ceramic	0.01	150V	ACG-001
C10	Ceramic	0.01	150V	ACG-003

RESISTORS AND POTENTIOMETERS

Symbol	Description			Part No.
R1	Metal oxide	4.7k	3W	RS3P 472K
R2	Metal oxide	4.7k	3W	RS3P 472K
VR1	Variable resistor (LEFT LEVEL)	100k-B		ACV-009
VR2	Variable resistor (RIGHT LEVEL)	100k-B		ACV-009

SWITCHES

Symbol	Description	Part No.
S1	Lever switch (POWER)	ASK-080
S2	Slide switch (IMPEDANCE)	ASH-014

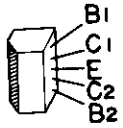
FUSES

Symbol	Description	Part No.
FU1	.....	.....
FU2	.....	.....
FU3	Fuse 2A (Secondary)	AEK-103
FU4	Fuse 2A (Secondary)	AEK-103
FU5	Fuse 1A (Secondary)	AEK-106
FU6	Fuse 1A (Secondary)	AEK-106
FU7	Fuse 2A (Secondary)	AEK-103
FU8	Fuse 12A (Primary)	AEK-301

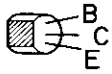
OTHERS

Symbol	Description	Part No.
T1	Power transformer	ATT-249
PL1	Lamp with wire 8V, 50mA	AEL-042
PL2	Lamp (bar type) 8V, 0.3A	AEL-058
PL3	Lamp (bar type) 8V, 0.3A	AEL-058
PL4	Lamp (bar type) 8V, 0.3A	AEL-058
PL5	Lamp (bar type) 8V, 0.3A	AEL-058
RL1	Relay	ASR-015
RL4	Relay	ASR-016
D1	Diode	KBH-2504
D2	Diode	SIB01-02

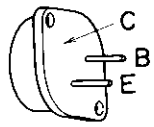
2SA798



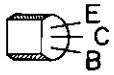
2SA733
2SA872A
2SC945



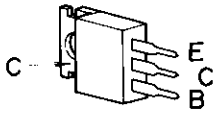
2SA909
(2SB600A)
2SC1586
(2SD555A)



2SA725
2SC1312

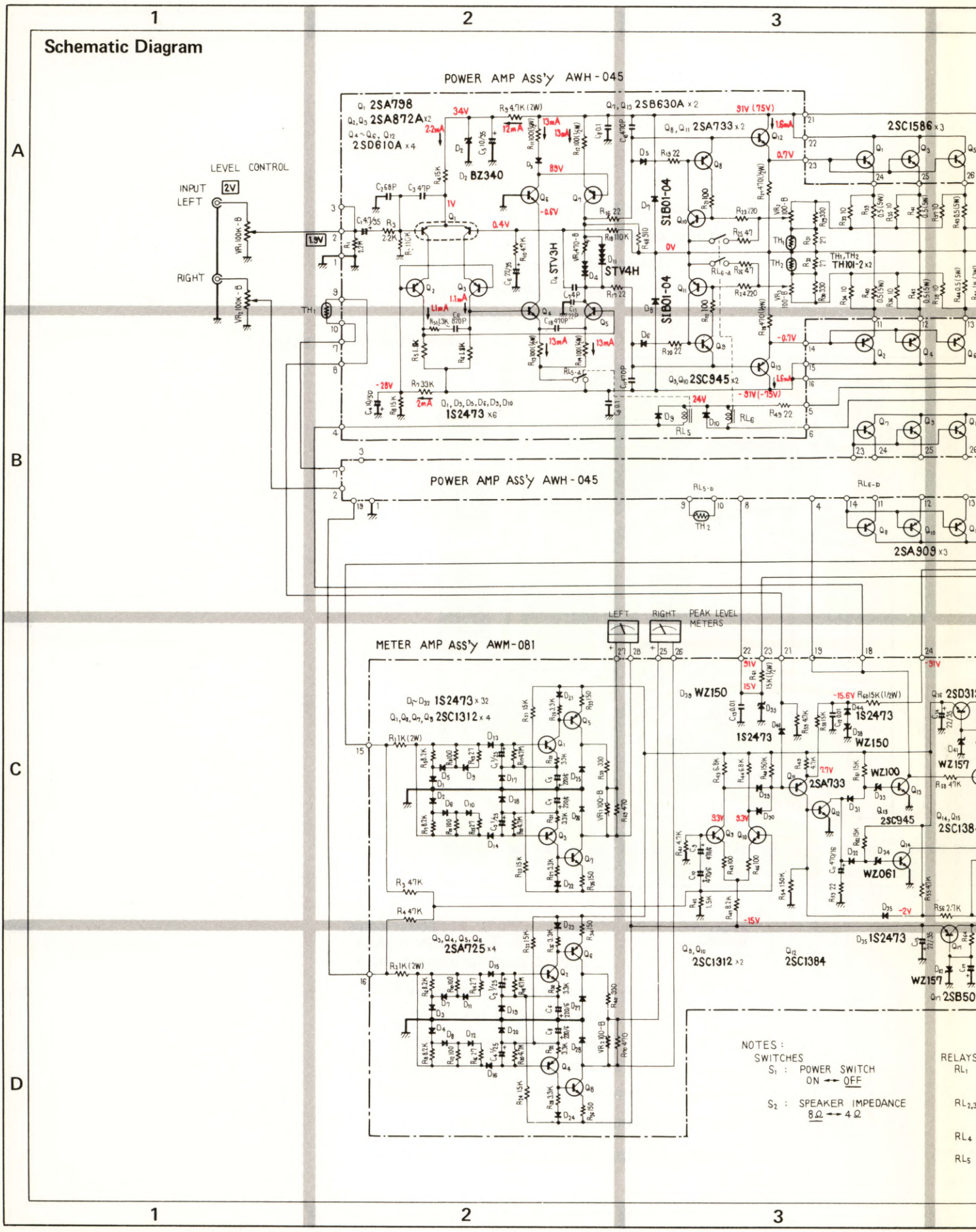


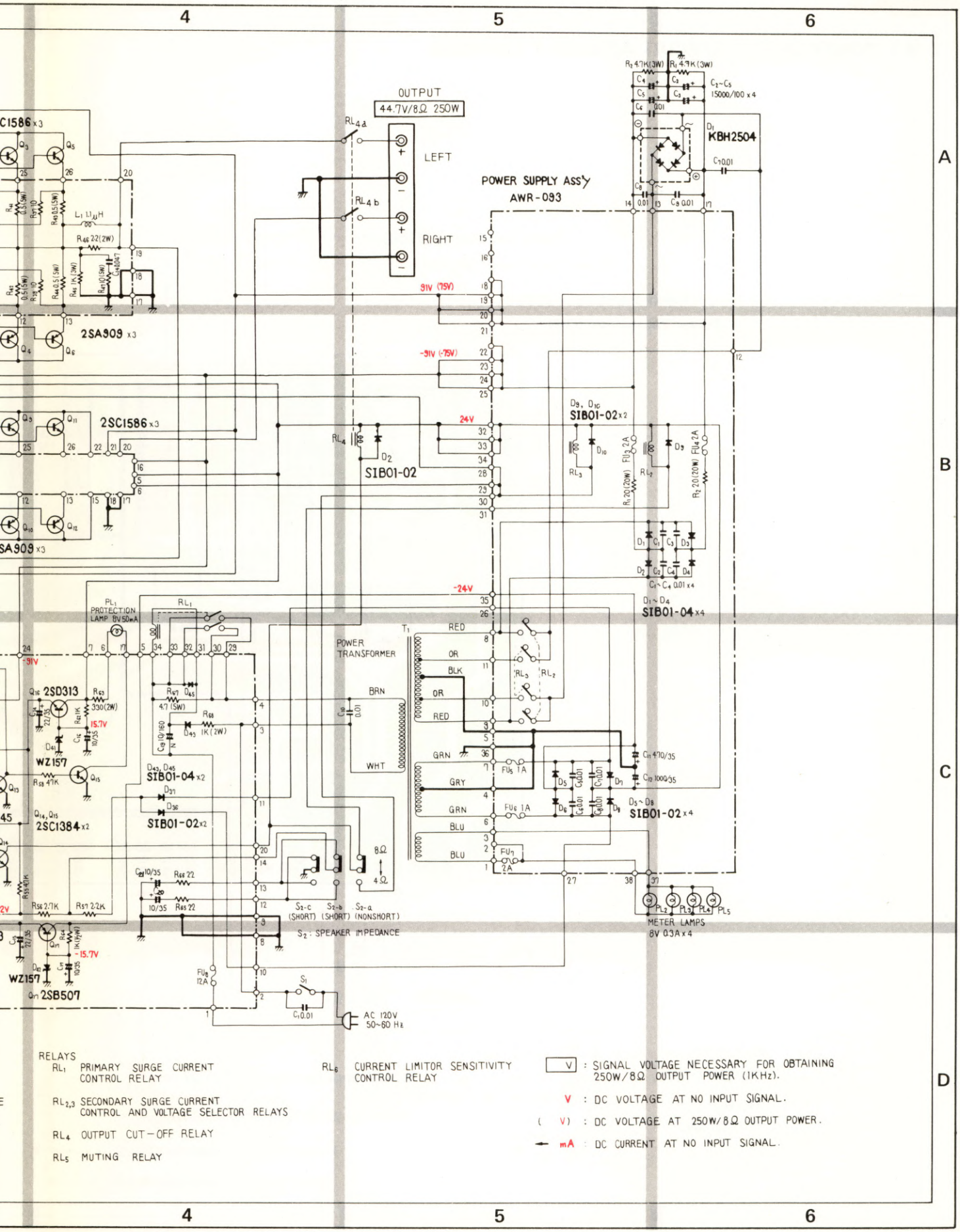
2SB507
2SB630A
2SD313
2SD610A



2SC1384

Schematic Diagram





RELAYS

RL1 PRIMARY SURGE CURRENT CONTROL RELAY

RL2,3 SECONDARY SURGE CURRENT CONTROL AND VOLTAGE SELECTOR RELAYS

RL4 OUTPUT CUT-OFF RELAY

RL5 MUTING RELAY

RL6 CURRENT LIMITOR SENSITIVITY CONTROL RELAY

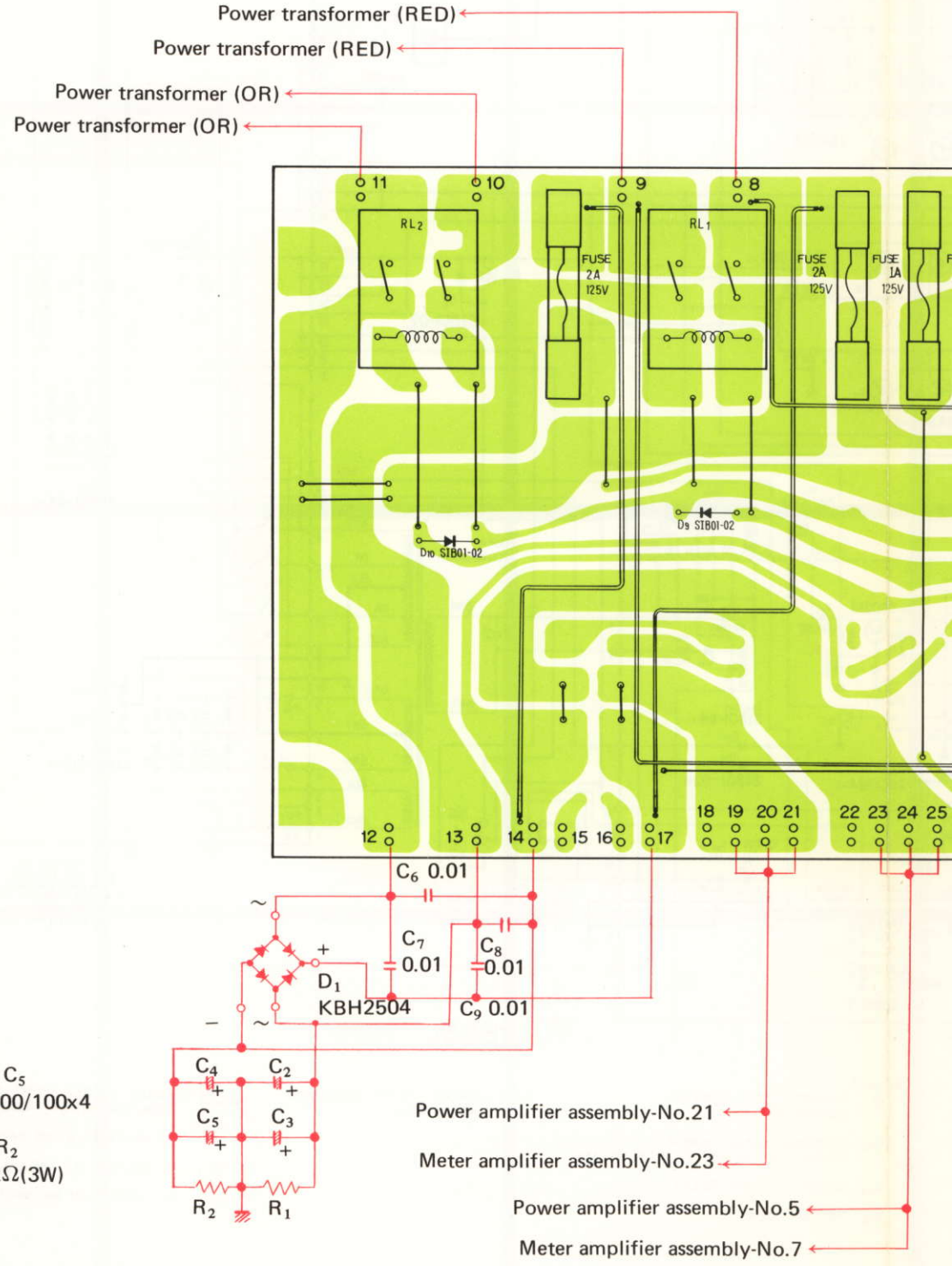
[V] : SIGNAL VOLTAGE NECESSARY FOR OBTAINING 250W/8Ω OUTPUT POWER (1KHz).

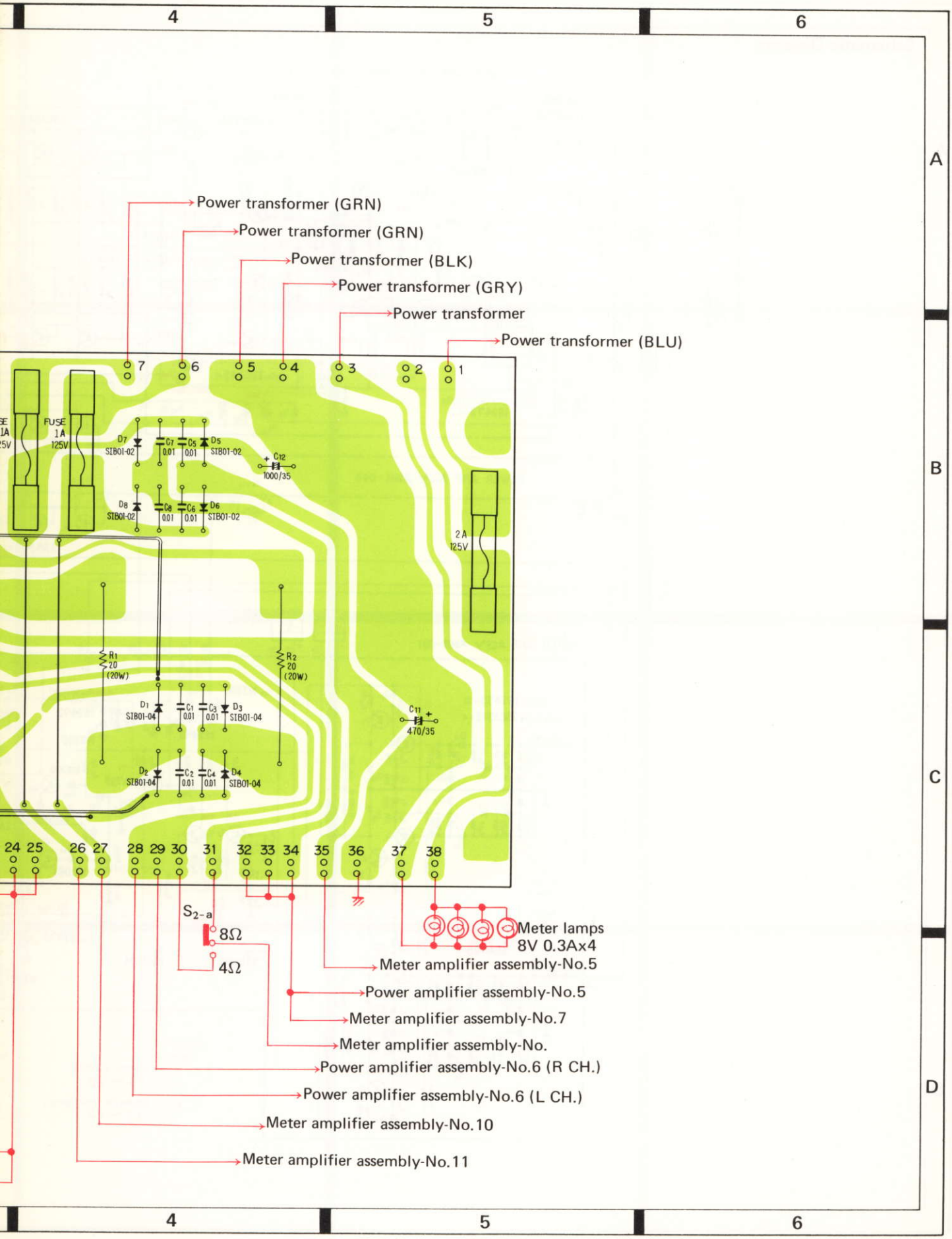
V : DC VOLTAGE AT NO INPUT SIGNAL.

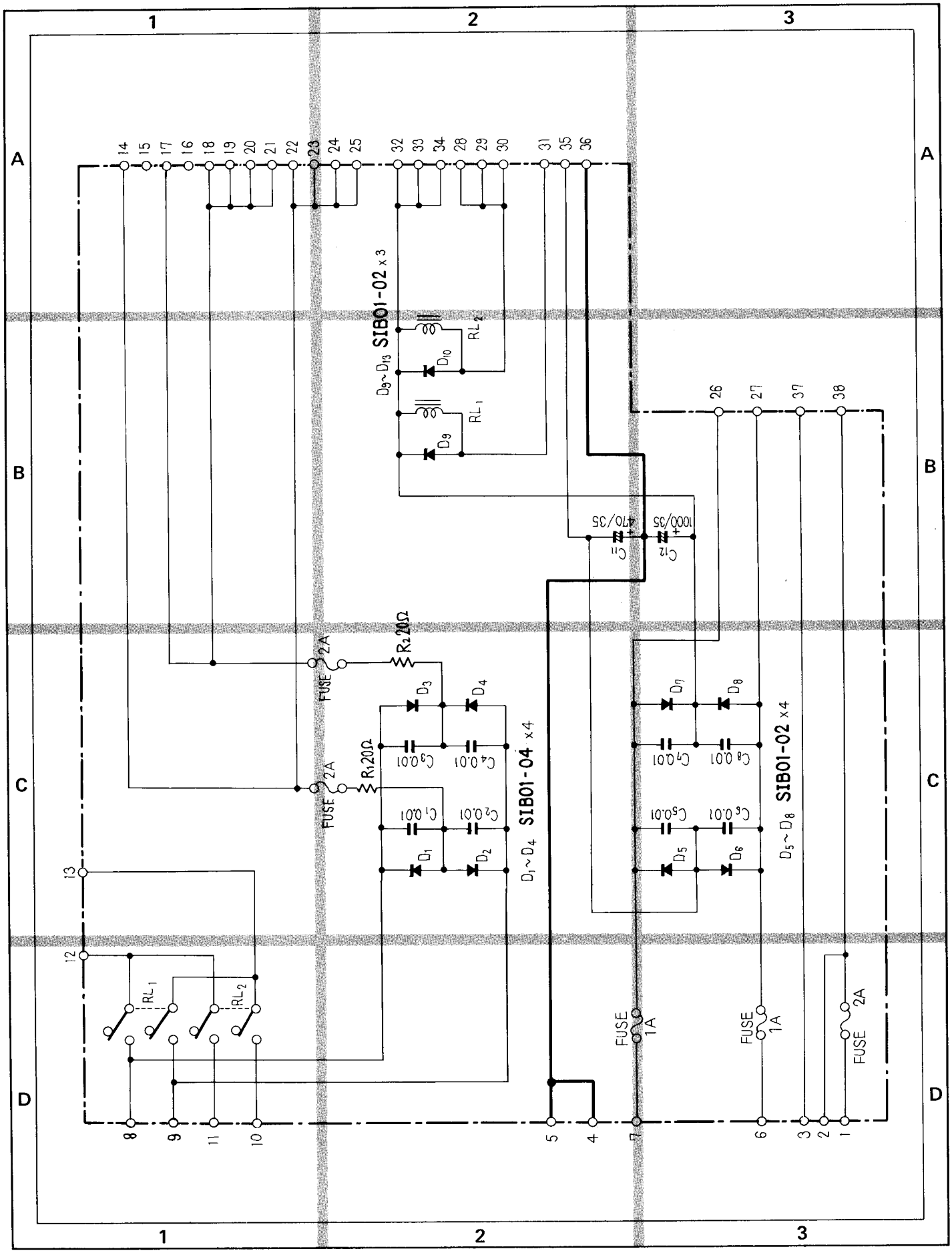
(V) : DC VOLTAGE AT 250W/8Ω OUTPUT POWER.

mA : DC CURRENT AT NO INPUT SIGNAL.

10.2 POWER SUPPLY CIRCUIT ASSEMBLY (AWR-093)




4
5
6
A
B
C
D
Power transformer (GRN)
Power transformer (GRN)
Power transformer (BLK)
Power transformer (GRY)
Power transformer
Power transformer (BLU)
7
6
5
4
3
2
1
FUSE
1A
125V
D7
SIB01-02
C7
0.01
C5
0.01
D5
SIB01-02
C12
1000/35
D8
SIB01-02
C8
0.01
C6
0.01
D6
SIB01-02
2A
125V
R1
20
(20W)
R2
20
(20W)
D1
SIB01-04
C1
0.01
C3
0.01
D3
SIB01-04
C11
470/35
D2
SIB01-04
C2
0.01
C4
0.01
D4
SIB01-04
24 25
26 27
28 29 30
31
32 33 34
35
36
37
38
S2-a
8Ω
4Ω
Meter lamps
8V 0.3Ax4
Meter amplifier assembly-No.5
Power amplifier assembly-No.5
Meter amplifier assembly-No.7
Meter amplifier assembly-No.
Power amplifier assembly-No.6 (R CH.)
Power amplifier assembly-No.6 (L CH.)
Meter amplifier assembly-No.10
Meter amplifier assembly-No.11


1
2
3
A
B
C
D
14 15 17 16 18 19 20 21 22 23 24 25
32 33 34 28 29 30
31 35 36
26 27 37 38
$D_9 \sim D_{13}$ SIB01-02 x3
D_{10}
RL_2
RL_1
D_9
1000/35
470/35
C_{11}
C_{12}
FUSE 2A
R_1 20Ω
R_2 20Ω
D_3
D_4
C_3 0.01
C_4 0.01
C_1 0.01
C_2 0.01
D_1
D_2
$D_1 \sim D_4$ SIB01-04 x4
D_7
D_8
C_7 0.01
C_8 0.01
C_5 0.01
C_6 0.01
D_5
D_6
$D_5 \sim D_8$ SIB01-02 x4
13
12
RL_1
RL_2
FUSE 1A
FUSE 1A
FUSE 2A
8 9 11 10
5 4 7 6 3 2 1

Parts List of Power Supply Circuit Assembly (AWR-093)

CAPACITORS

Symbol	Description			Part No.
C1	Ceramic	0.01	150V	ACG-004-0
C2	Ceramic	0.01	150V	ACG-004-0
C3	Ceramic	0.01	150V	ACG-004-0
C4	Ceramic	0.01	150V	ACG-004-0
C5	Ceramic	0.01	150V	ACG-004-0
C6	Ceramic	0.01	150V	ACG-004-0
C7	Ceramic	0.01	150V	ACG-004-0
C8	Ceramic	0.01	150V	ACG-004-0
C9	.....			.....
C10	.....			.....
C11	Electrolytic	470	35V	CEA 471P35-85C
C12	Electrolytic	1000	35V	CEA 102P35-85C

RESISTORS

Symbol	Description			Part No.
R1	Wire wound	20	20W	ACN-005-0
R2	Wire wound	20	20W	ACN-005-0

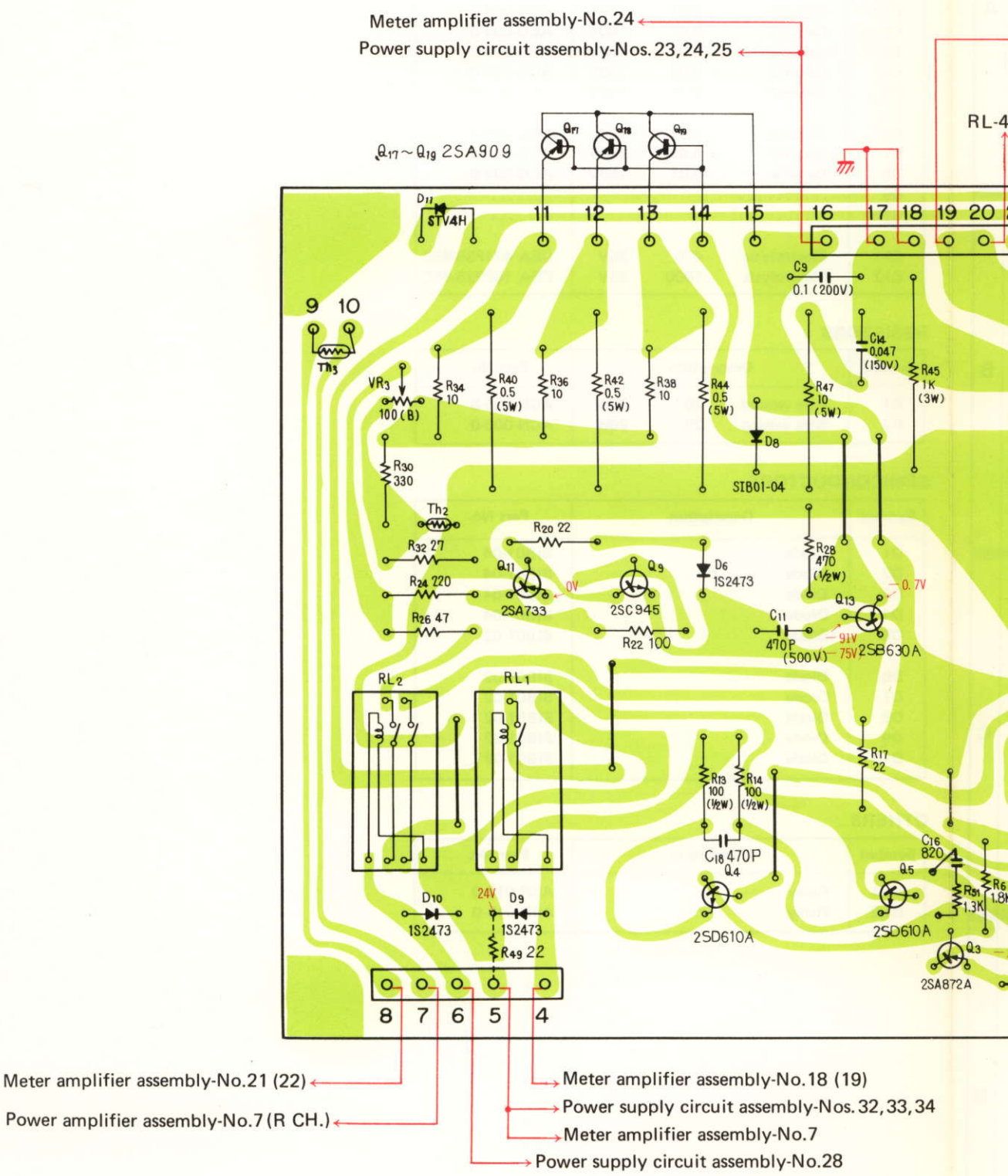
SEMICONDUCTORS

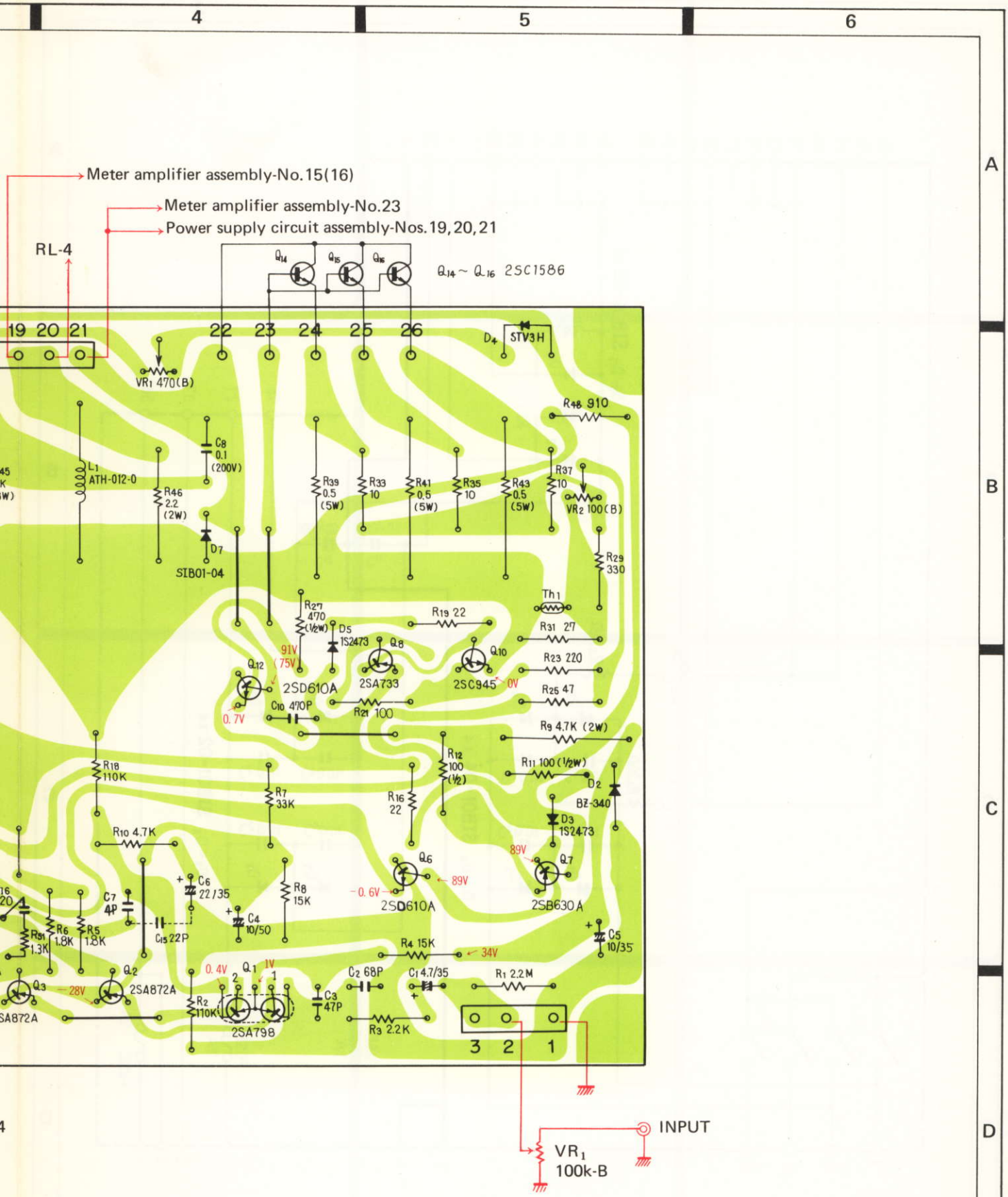
Symbol	Description	Part No.
D1	Diode	SIB01-04
D2	Diode	SIB01-04
D3	Diode	SIB01-04
D4	Diode	SIB01-04
D5	Diode	SIB01-02
D6	Diode	SIB01-02
D7	Diode	SIB01-02
D8	Diode	SIB01-02
D9	Diode	SIB01-02
D10	Diode	SIB01-02

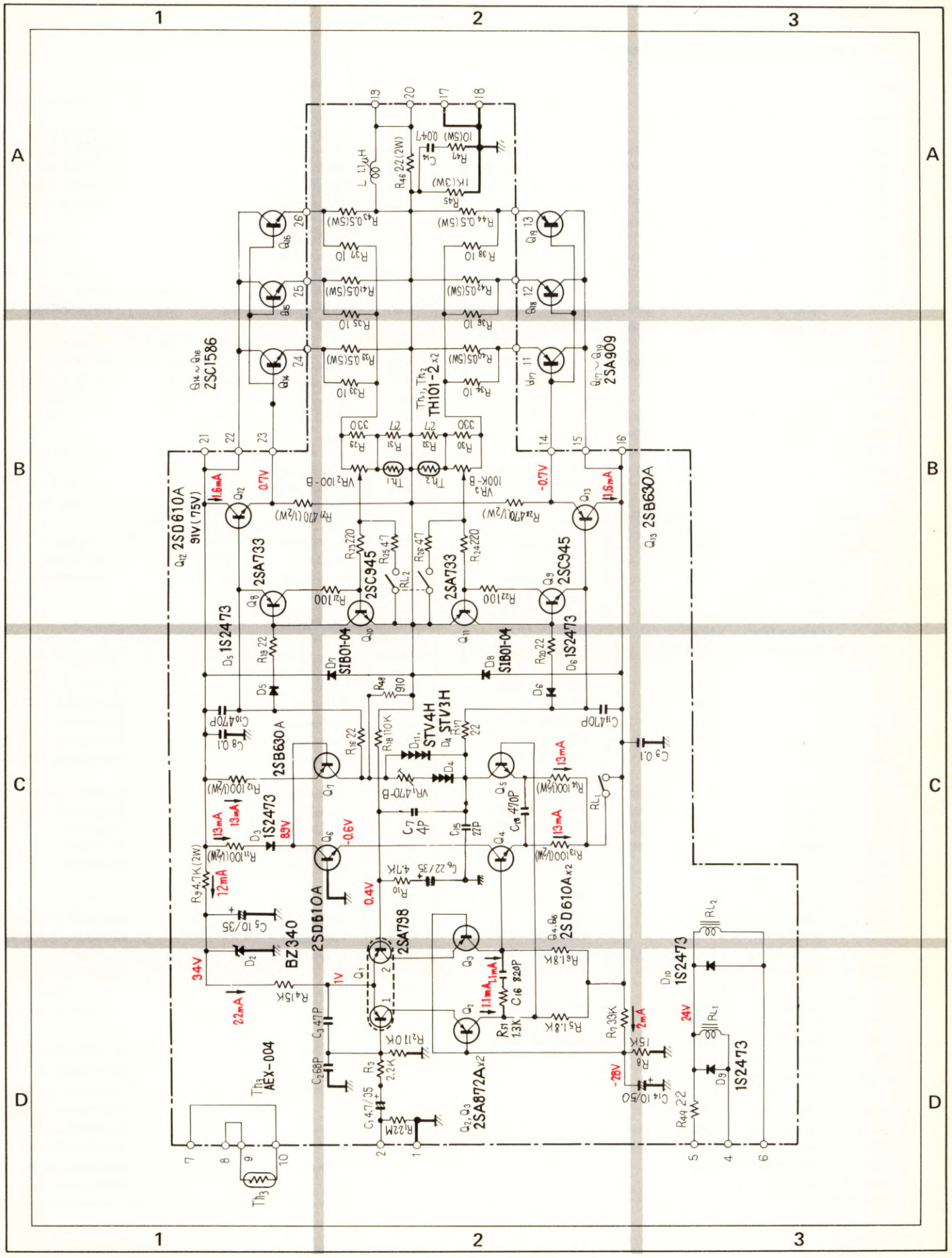
OTHERS

Symbol	Description	Part No.
RL1	Relay	ASR-013-0
RL2	Relay	ASR-013-0

10.3 POWER AMPLIFIER ASSEMBLY (AWH-045)




Meter amplifier assembly-No.15(16)
Meter amplifier assembly-No.23
Power supply circuit assembly-Nos.19,20,21
RL-4
Q14 Q15 Q16
Q14 ~ Q16 2SC1586
19 20 21
22 23 24 25 26
D4 STV3H
VR1 470(B)
R48 910
L1 ATH-012-0
C8 0.1 (200V)
R46 2.2 (2W)
R39 0.5 (5W)
R33 10
R41 0.5 (5W)
R35 10
R43 0.5 (5W)
R37 10
VR2 100(B)
D7 SIB01-04
R29 330
Th1
R27 470 (½W)
D5 1S2473
R19 22
R31 27
R23 220
R25 47
91V (75V)
Q12 2SD610A
0.7V
Q8 2SA733
Q10 2SC945
0V
C10 470P
R21 100
R9 4.7K (2W)
R11 100 (½W)
D2 BZ-340
R18 110K
R7 33K
R16 22
R12 100 (½)
D3 1S2473
89V
Q7 2SB630A
R10 4.7K
Q6
89V
-0.6V
2SD610A
C6 22/35
C7 4P
C4 10/50
R8 15K
C5 10/35
R31 1.3K
R6 1.8K
R5 1.8K
C15 22P
R4 15K
34V
Q3
-28V
Q2 2SA872A
0.4V
Q1
1V
C2 68P
C1 4.7/35
R1 2.2M
R2 110K
2SA798
C3 47P
R3 2.2K
3 2 1
INPUT
VR1 100k-B


1
2
3
A
B
C
D
2SC1586
2SA909
TH101-2
2SD610A
2SB630A
2SA733
2SC945
1S2473
S1B01-04
STV4H
STV3H
BZ340
2SA798
2SA872A
AEX-004
L 1.1μH
R46 22(2W)
10(SW) 0.047
1K(3W)
91V(75V)
11.6mA
0.7V
-0.7V
100K-B
13mA
12mA
22mA
34V
89V
-0.6V
0.4V
1V
1.1mA
2mA
24V
-28V

Parts List of Power Amplifier Assembly (AWH-045)

CAPACITORS

Symbol	Description			Part No.
C1	Electrolytic	4.7	35V	CSZA 4R7M 35
C2	Ceramic	68p	50V	CCDSL 680K 50
C3	Ceramic	47p	50V	CCDSL 470K 50
C4	Electrolytic	10	35V	CEA 100P 50
C5	Electrolytic	10	35V	CEA 100P 35
C6	Electrolytic	22	35V	CEA 220P 35
C7	Ceramic	4p	50V	CCDSL 040K 50
C8	Mylar	0.1	200V	CQMA 104K 200
C9	Mylar	0.1	200V	CQMA 104K 200
C10	Ceramic	470p	500V	CKDYB 471K 500
C11	Ceramic	470p	500V	CKDYB 471K 500
C12	.....			.....
C13	.....			.....
C14	Ceramic	0.047	150V	ACG-009-0
C15	Ceramic	22p	50V	CKDYB 220 50
C16	Ceramic	820p	50V	CKDYB 821K 50
C18	Ceramic	470p	50	CKDYB 471K 50

RESISTORS AND POTENTIOMETERS

Symbol	Description			Part No.
R1	Carbon film	2.2M		RD¼PS 225J
R2	Carbon film	110k		RD¼PS 114J
R3	Carbon film	2.2k		RD¼PS 222J
R4	Carbon film	15k		RD¼PS 153J
R5	Carbon film	1.8k		RD¼PSF 122J
R6	Carbon film	1.8k		RD¼PSF 122J
R7	Carbon film	33k		RD¼PS 333J
R8	Carbon film	15k		RD¼PS 153J
R9	Metal oxide	4.7k	2W	RS2P 472K
R10	Carbon film	4.7k		RD¼PS 472J
R11	Carbon film	100	½W	RD½PMF 101J
R12	Carbon film	100	½W	RD½PMF 101J
R13	Carbon film	100	½W	RD½PMF 101J
R14	Carbon film	100	½W	RD½PMF 101J
R15	.....			.....
R16	Carbon film	22		RD¼PSF 220J
R17	Carbon film	22		RD¼PSF 220J
R18	Carbon film	110k		RD¼PSF 114J
R19	Carbon film	22		RD¼PSF 220J
R20	Carbon film	22		RD¼PSF 220J
R21	Carbon film	100k		RD¼PS 101J
R22	Carbon film	100k		RD¼PS 101J
R23	Carbon film	220k		RD¼PSF 221J
R24	Carbon film	220k		RD¼PSF 221
R25	Carbon film	47		RD¼PS 470J
R26	Carbon film	47		RD¼PS 470J
R27	Carbon film	470	½W	RD½PMF 471J
R28	Carbon film	470	½W	RD½PMF 471J
R29	Carbon film	330		RD¼PS 331J
R30	Carbon film	330		RD¼PS 331J
R31	Carbon film	27		RD¼PS 270J
R32	Carbon film	27		RD¼PS 270J
R33	Carbon film	10		RD¼PS 100J
R34	Carbon film	10		RD¼PS 100J
R35	Carbon film	10		RD¼PS 100J
R36	Carbon film	10		RD¼PS 100J
R37	Carbon film	10		RD¼PS 100J
R38	Carbon film	10		RD¼PS 100J
R39	Wire wound	0.5	5W	RT5B 0R5K
R40	Wire wound	0.5	5W	RT5B 0R5K
R41	Wire wound	0.5	5W	RT5B 0R5K
R42	Wire wound	0.5	5W	RT5B 0R5K
R43	Wire wound	0.5	5W	RT5B 0R5K
R44	Wire wound	0.5	5W	RT5B 0R5K
R45	Metal oxide	1k	3W	RS3P 102K
R46	Wire wound	2.2	2W	RT2B 2R2K
R47	Wire wound	10	5W	RT5B 100K
R48	Carbon film	910		RD¼PS 911J
R51	Carbon film	1.3k		RD¼PS 132J
VR1	Semi-fixed	470-B		ACP-051-0
VR2	Semi-fixed	100-B		ACP-050-0
VR3	Semi-fixed	100-B		ACP-050-0

SEMICONDUCTORS

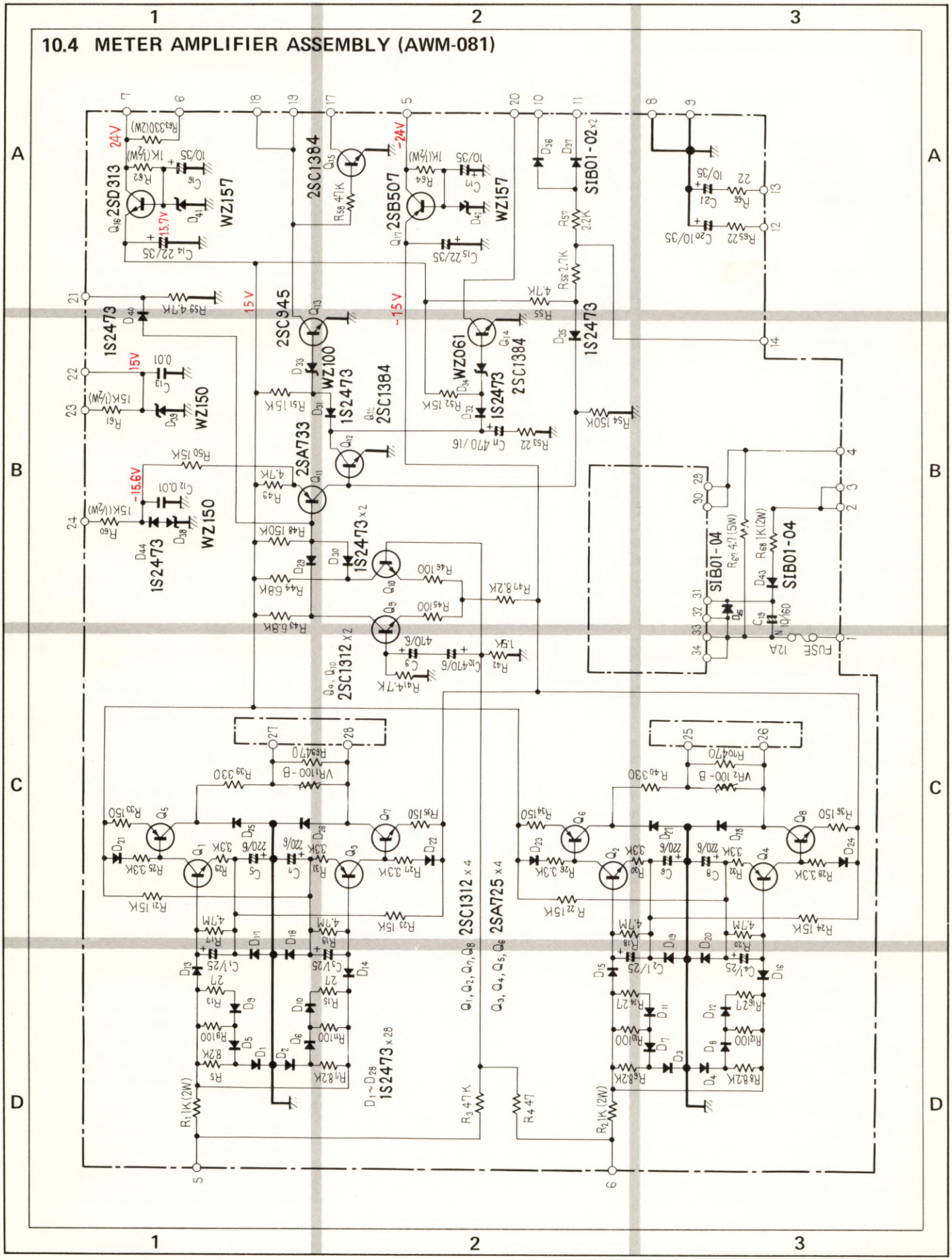
Symbol	Description	Part No.
Q1	Transistor	2SA798-G or F
Q2	Transistor	2SA872A-D or E
Q3	Transistor	2SA872A-D or E
Q4	Transistor	2SD610A-R or S, Q
Q5	Transistor	2SD610A-R or S, Q
Q6	Transistor	2SD610A-R or S, Q
Q7	Transistor	2SB630A-R or S, Q
Q8	Transistor	2SA733-R
Q9	Transistor	2SC945-R
Q10	Transistor	2SC945-R
Q11	Transistor	2SA733-R
Q12	Transistor	2SD610A-R or S, Q
Q13	Transistor	2SB630A-R or S, Q
Q14	Transistor	2SC1586-O or R 2SD555A-R or S
Q15	Transistor	2SC1586-O or R 2SD555A-R or S
Q16	Transistor	2SC1586-O or R 2SD555A-R or S
Q17	Transistor	2SA909-O or R 2SB600A-R or S
Q18	Transistor	2SA909-O or R 2SB600A-R or S
Q19	Transistor	2SA909-O or R 2SB600A-R or S

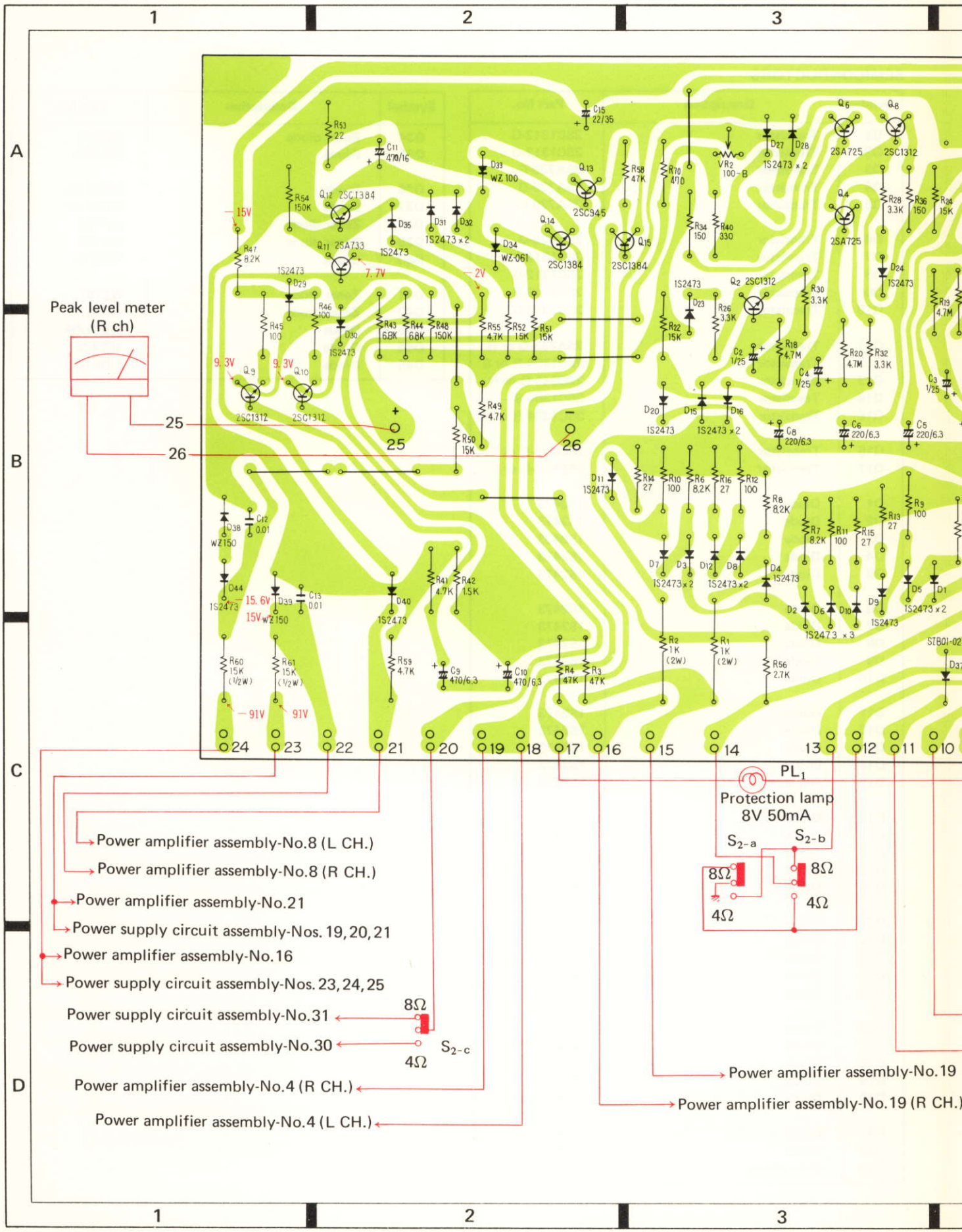
Symbol	Description	Part No.
D1	.....	
D2	Zener diode	BZ 340
D3	Diode	1S2473 (1S1555)
D4	Diode	STV3H-Y
D5	Diode	1S2473 (1S1555)
D6	Diode	1S2473 (1S1555)
D7	Diode	SIB01-04
D8	Diode	SIB01-04
D9	Diode	1S2473 (1S1555)
D10	Diode	1S2473 (1S1555)
D11	Diode	STV4H
Th1	Thermistor	TH101-2
Th2	Thermistor	TH101-2
Th3	P.T.C. thermistor	AEX-044

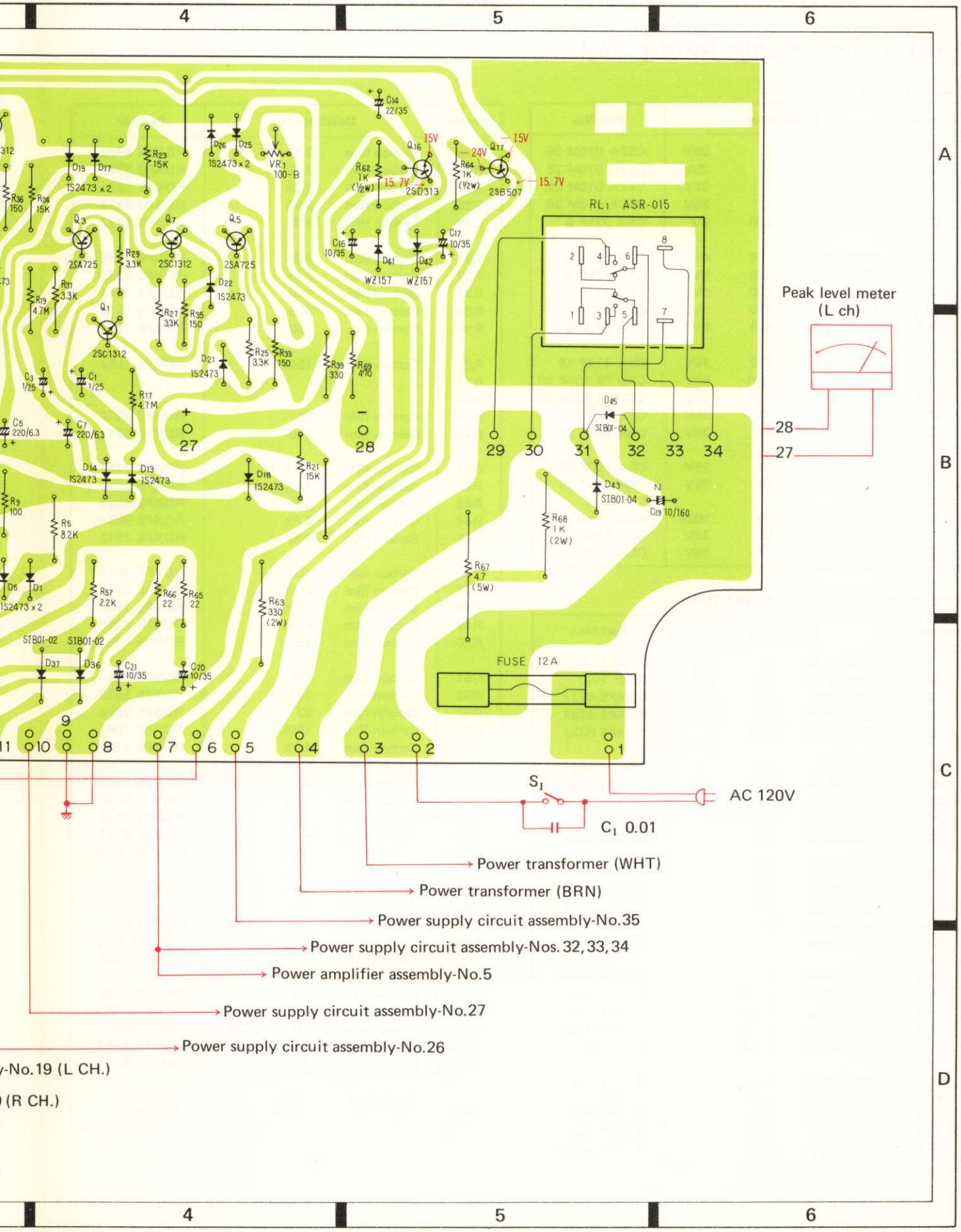
OTHERS

Symbol	Description	Part No.
L1	AF choke coil	ATH-012-0
RL1	Reed relay	ASR-017-0
RL2	Reed relay	ASR-005-C

10.4 METER AMPLIFIER ASSEMBLY (AWM-081)




Peak level meter
(R ch)
25
26
Power amplifier assembly-No.8 (L CH.)
Power amplifier assembly-No.8 (R CH.)
Power amplifier assembly-No.21
Power supply circuit assembly-Nos. 19, 20, 21
Power amplifier assembly-No.16
Power supply circuit assembly-Nos. 23, 24, 25
Power supply circuit assembly-No.31
Power supply circuit assembly-No.30
Power amplifier assembly-No.4 (R CH.)
Power amplifier assembly-No.4 (L CH.)
Power amplifier assembly-No.19
Power amplifier assembly-No.19 (R CH.)
PL1
Protection lamp
8V 50mA
S2-a
S2-b
S2-c
8Ω
4Ω
15V
9.3V
7.7V
2V
15.6V
91V
2SC1312
2SA733
2SC1384
2SC945
2SA725
1S2473
WZ-100
WZ-061
WZ150


4
5
6
A
B
C
D
RL1 ASR-015
Peak level meter
(L ch)
28
27
29
30
31
32
33
34
FUSE 12A
S1
AC 120V
C1 0.01
Power transformer (WHT)
Power transformer (BRN)
Power supply circuit assembly-No.35
Power supply circuit assembly-Nos. 32, 33, 34
Power amplifier assembly-No.5
Power supply circuit assembly-No.27
Power supply circuit assembly-No.26
-No.19 (L CH.)
(R CH.)

Parts List of Meter Amplifier Assembly (AWM-081)

CAPACITORS

Symbol	Description			Part No.
C1	Electrolytic	1	25V	CSZA 010M 25
C2	Electrolytic	1	25V	CSZA 010M 25
C3	Electrolytic	1	25V	CSZA 010M 25
C4	Electrolytic	1	25V	CSZA 010M 25
C5	Electrolytic	220	6V	CEA 221P 6
C6	Electrolytic	220	6V	CEA 221P 6
C7	Electrolytic	220	6V	CEA 221P 6
C8	Electrolytic	220	6V	CEA 221P 6
C9	Electrolytic	470	6V	CEA 471P 6
C10	Electrolytic	470	6V	CEA 471P 6
C11	Electrolytic	470	16V	CEA 471P 16
C12	Ceramic	0.01	50V	CKDYB 103K 50
C13	Ceramic	0.01	50V	CKDYB 103K 50
C14	Electrolytic	22	35V	CEA 220P 35
C15	Electrolytic	22	35V	CEA 220P 35
C16	Electrolytic	10	35V	CEA 100P 35
C17	Electrolytic	10	35V	CEA 100P 35
C18	.....			.....
C19	Electrolytic	10	160V	ACH-313-0
C20	Electrolytic	10	35V	CEA 100P 35
C21	Electrolytic	10	35V	CEA 100P 35

RESISTORS AND POTENTIOMETERS

Symbol	Description			Part No.
R1	Metal oxide	1k	2W	RS2P 102J
R2	Metal oxide	1k	2W	RS2P 102J
R3	Carbon film	47k		RD¼PS 473J
R4	Carbon film	47k		RD¼PS 473J
R5	Carbon film	8.2k		RD¼PS 822J
R6	Carbon film	8.2k		RD¼PS 822J
R7	Carbon film	8.2k		RD¼PS 822J
R8	Carbon film	8.2k		RD¼PS 822J
R9	Carbon film	100		RD¼PS 101J
R10	Carbon film	100		RD¼PS 101J
R11	Carbon film	100		RD¼PS 101J
R12	Carbon film	100		RD¼PS 101J
R13	Carbon film	27		RD¼PS 270J
R14	Carbon film	27		RD¼PS 270J
R15	Carbon film	27		RD¼PS 270J
R16	Carbon film	27		RD¼PS 270J
R17	Carbon film	4.7M		RD¼PS 475J
R18	Carbon film	4.7M		RD¼PS 475J
R19	Carbon film	4.7M		RD¼PS 475J
R20	Carbon film	4.7M		RD¼PS 475J
R21	Carbon film	15k		RD¼PS 153J
R22	Carbon film	15k		RD¼PS 153J
R23	Carbon film	15k		RD¼PS 153J
R24	Carbon film	15k		RD¼PS 153J
R25	Carbon film	3.3k		RD¼PS 332J

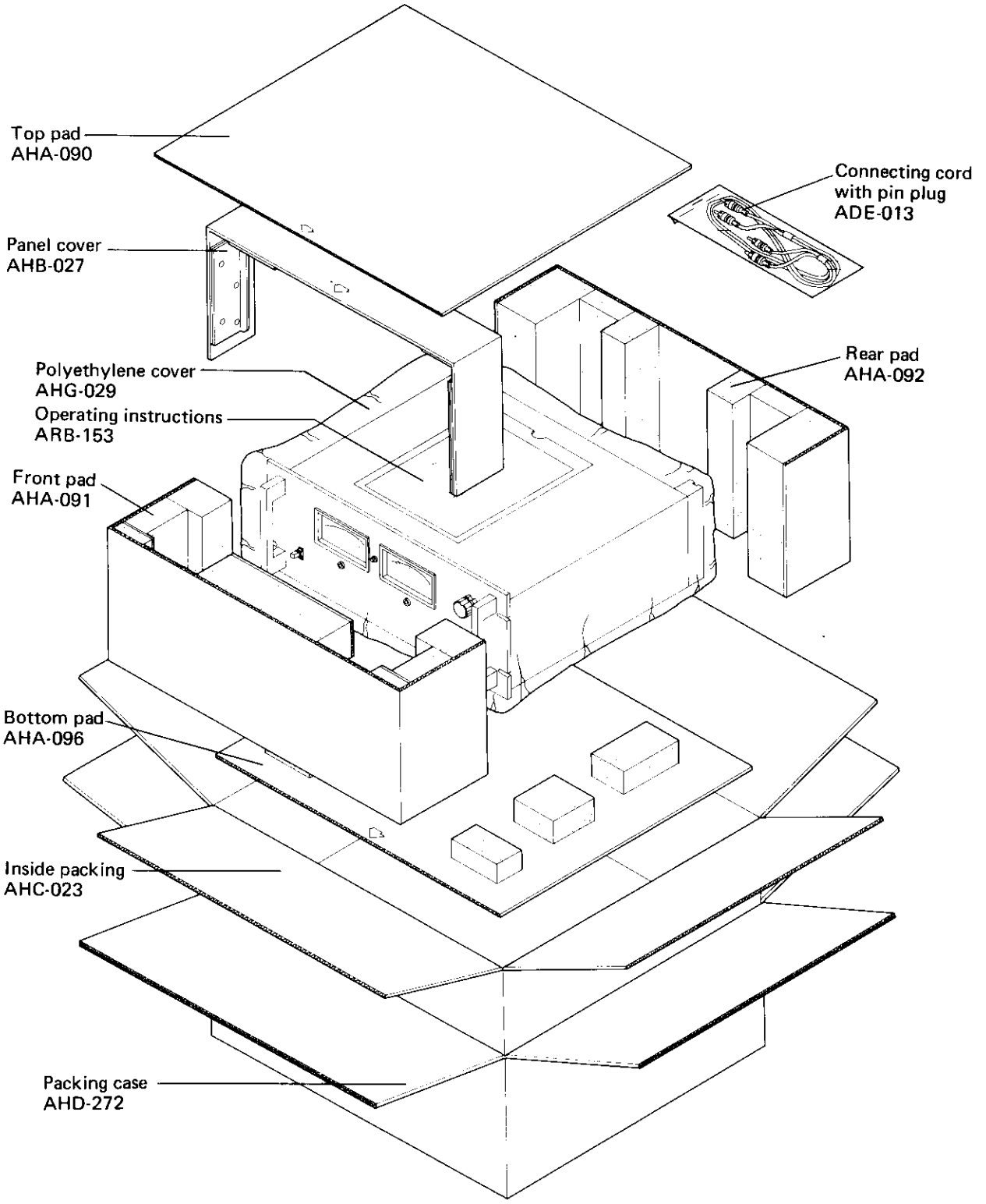
Symbol	Description			Part No.
R26	Carbon film	3.3k		RD¼PS 332J
R27	Carbon film	3.3k		RD¼PS 332J
R28	Carbon film	3.3k		RD¼PS 332J
R29	Carbon film	3.3k		RD¼PS 332J
R30	Carbon film	3.3k		RD¼PS 332J
R31	Carbon film	3.3k		RD¼PS 332J
R32	Carbon film	3.3k		RD¼PS 332J
R33	Carbon film	150		RD¼PS 151J
R34	Carbon film	150		RD¼PS 151J
R35	Carbon film	150		RD¼PS 151J
R36	Carbon film	150		RD¼PS 151J
R37	.....			.....
R38	.....			.....
R39	Carbon film	330		RD¼PS 331J
R40	Carbon film	330		RD¼PS 331J
R41	Carbon film	4.7k		RD¼PS 472J
R42	Carbon film	1.5k		RD¼PS 152J
R43	Carbon film	6.8k		RD¼PS 682J
R44	Carbon film	6.8k		RD¼PS 682J
R45	Carbon film	100		RD¼PS 101J
R46	Carbon film	100		RD¼PS 101J
R47	Carbon film	8.2k		RD¼PS 822J
R48	Carbon film	150k		RD¼PS 154J
R49	Carbon film	4.7k		RD¼PS 472J
R50	Carbon film	15k		RD¼PS 153J
R51	Carbon film	15k		RD¼PS 153J
R52	Carbon film	15k		RD¼PS 153J
R53	Carbon film	22		RD¼PS 220J
R54	Carbon film	150k		RD¼PS 154J
R55	Carbon film	4.7k		RD¼PS 472J
R56	Carbon film	2.7k		RD¼PS 272J
R57	Carbon film	2.2k		RD¼PS 222J
R58	Carbon film	47k		RD¼PS 473J
R59	Carbon film	4.7k		RD¼PS 472J
R60	Carbon film	15k	½W	RD½PM 153J
R61	Carbon film	15k	½W	RD½PM 153J
R62	Carbon film	1k	½W	RD½PM 102J
R63	Metal oxide	330	2W	RS2P 331J
R64	Carbon film	1k	½W	RD½PM 102J
R65	Carbon film	22		RD¼PS 220J
R66	Carbon film	22		RD¼PS 220J
R67	Wire wound	4.7	5W	RT5B 4R7K
R68	Metal oxide	1k	2W	RS2P 102J
R69	Carbon film	470		RD¼PS 471J
R70	Carbon film	470		RD¼PS 471J
VR1	Semi-fixed	100-B		ACP-050-0
VR2	Semi-fixed	100-B		ACP-050-0

SEMICONDUCTORS

Symbol	Description	Part No.
Q1	Transistor	2SC1312-G
Q2	Transistor	2SC1312-G
Q3	Transistor	2SA725-G
Q4	Transistor	2SA725-G
Q5	Transistor	2SA725-G
Q6	Transistor	2SA725-G
Q7	Transistor	2SC1312-G
Q8	Transistor	2SC1312-G
Q9	Transistor	2SC1312-G
Q10	Transistor	2SC1312-G
Q11	Transistor	2SA733-Q or R
Q12	Transistor	2SC1384-R or S
Q13	Transistor	2SC945-Q or R
Q14	Transistor	2SC1384-S
Q15	Transistor	2SC1384-R or S
Q16	Transistor	2SD313-D or E
Q17	Transistor	2SB507-D or E
D1	Diode	1S2473
D2	Diode	1S2473
D3	Diode	1S2473
D4	Diode	1S2473
D5	Diode	1S2473
D6	Diode	1S2473
D7	Diode	1S2473
D8	Diode	1S2473
D9	Diode	1S2473
D10	Diode	1S2473
D11	Diode	1S2473
D12	Diode	1S2473
D13	Diode	1S2473
D14	Diode	1S2473
D15	Diode	1S2473
D16	Diode	1S2473
D17	Diode	1S2473
D18	Diode	1S2473
D19	Diode	1S2473
D20	Diode	1S2473
D21	Diode	1S2473
D22	Diode	1S2473
D23	Diode	1S2473
D24	Diode	1S2473
D25	Diode	1S2473
D26	Diode	1S2473
D27	Diode	1S2473
D28	Diode	1S2473
D29	Diode	1S2473
D30	Diode	1S2473
D31	Diode	1S2473
D32	Diode	1S2473
D33	Zener diode	WZ100

Symbol	Description	Part No.
D34	Zener diode	WZ061
D35	Diode	1S2473
D36	Diode	SIB01-02
D37	Diode	SIB01-02
D38	Zener diode	WZ150
D39	Zener diode	WZ150
D40	Diode	1S2473
D41	Zener diode	WZ157
D42	Zener diode	WZ157
D43	Diode	SIB01-04
D44	Diode	1S2473
D45	Diode	SIB01-04

11. PACKING


Top pad
AHA-090
Connecting cord
with pin plug
ADE-013
Panel cover
AHB-027
Rear pad
AHA-092
Polyethylene cover
AHG-029
Operating instructions
ARB-153
Front pad
AHA-091
Bottom pad
AHA-096
Inside packing
AHC-023
Packing case
AHD-272

12. PARTS LIST OF EXPLODED VIEWS

Parts No.	Parts Name
AAB-097	Knob
AAD-109	Knob
AAW-051	Peak Level Meter
ABA-033	Screw M2.6x4
ABA-088	Screw
ABA-089	Screw
ABA-090	Screw M4x8
ABA-097	Mounting Pillar
ABE-026	Spring Washer M6
ABN-009	Union Nut
ABN-017	Nut M6
ACG-001	Ceramic Capacitor
ACH-052	Ele, Capacitor
ACV-009	Variable Resistor
ADE-013	Connection Cord (with Pin Plug)
ADG-013	AC Power Cord
ADX-020	Connector Ass. (6P)
ADX-021	Connector Ass. (6P)
ADX-022	Connector Ass. (5P)
ADX-023	Connector Ass. (3P)
ADX-024	Connector Ass. (3P)
AEB-001	Washer (Internal Toothed Lock)
AEB-051	Rubber Holder
AEB-075	Spacer
AEC-036	Clip
AEC-076	Insulating Wafer
AEC-079	Strain Relief
AEC-178	Foot Ass.
AEC-222	Terminal Board
AEC-225	Toggle Nut
AEC-236	Plastic Board
AEK-103	Fuse 2A
AEK-106	Fuse 1A
AEL-042	Lamp with Wire (8V 50mA)
AEL-058	Lamp 8V 0.3A
AHA-090	Top Pad
AHA-091	Front Pad
AHA-092	Rear Pad
AHA-096	Bottom Pad
AHB-027	Panel Cover
AHC-023	Inside Packing
AHD-272	Packing Case
AHG-029	Polyethylene Cover
AKB-013	Input Terminal
AKC-031	Terminal strip (4P)
AKE-019	Ground Terminal
AKE-020	Output Terminal A
AKE-021	Output Terminal B
AKH-001	Transistor Socket
AKK-002	PL Socket

Parts No.	Parts Name
AKM-018	Contact Strip (3P)
AKM-019	Contact Strip (5P)
AKM-020	Contact Strip (6P)
ALA-021	Chassis Mounting Pillar
ANB-358	Front Panel Ass.
ANE-097	Top Cover
ANK-084	Handle
ARB-153	Operating Instruction
ASH-014	Slide Switch
ASK-080	Lever Switch
ASR-015	Relay
ASR-016	Relay
ATT-249	Power Transformer
AWH-045	Power Amp Ass.
AWM-081	Meter Amp Ass.
AWR-093	Power Supply Ass.
B71-004	Nut M9
M45-086	Spacer 9mmx1t
M49-014	Terminal Board Held Metal
M49-052	Terminal Board Held Metal
2SA909	Power Transistor
2SB1586	Power Transistor
KBH2504	Diode
STV4H	Varistor

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 Printed in Japan

<75I04Y31>