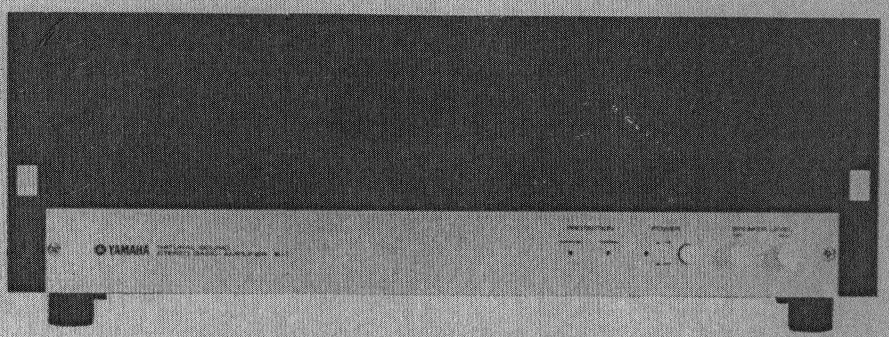
SERVICE MANUAL

B-1

STEREO BASIC AMPLIFIER



SINCE 1887

YAMAHA

NIPPON GAKKI CO., LTD. HAMAMATSU, JAPAN

ASM-35 ② 10 ℘ Printed in Japan 1·76

CONTENTS

SPECIFICATIONS

Dynamic Power (IHF)	360W (8Ω)
Continuous RMS Power (both channels driven, 4Ω or 8Ω)	1KHz: 160 + 160W
Power Bandwidth (8Ω, 0.5% THD)	5—50,000Hz
Input Sensitivity & Impedance	775mV/100KΩ
Total Harmonic Distortion (8Ω)	
At 100W Output	1KHz: 0.02%
	20KHz: 0.06%
At 1W Output	1KHz: 0.02%
	20KHz: 0.03%
Intermodulation Distortion (70Hz: 7KHz=4 : 1 8Ω, 100W Output)	0.04%
Frequency Response (at 1 watt 8Ω)	5—100,000Hz, +0dB, —1dB
Damping Factor	80 at 1KHz/8Ω
Level Control Range	18dB (775mV—6V)
Residual Noise	0.3mV
Signal-to-Noise Ratio	100dB
Rumble Filter	10Hz (—12dB/oct.)
Output Terminal Sets	1 (B-I only)
	5 (with UC-I)
Semiconductors	
39 FETs, 113 Transistors, 3 LEDs, 64 Diodes, 7 Zener Diodes	
Power Source	
U.S.A. & Canada	AC 117V, 60Hz
Other Areas	AC 220/240V, 50/60Hz
Power Consumption	440W
Dimensions (W x H x D)	460 x 150 x 390 mm
	18" x 6" x 15-1/2"
Weight	37Kg (81.57 lbs.)

COMPONENTS LOCATION

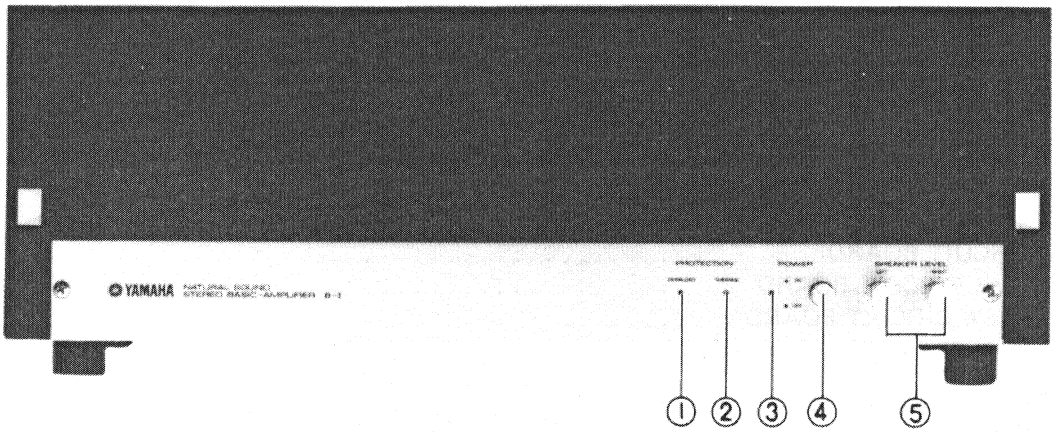


Fig. 1. Front View

❶ OVERLOAD INDICATOR
❷ THERMAL INDICATOR
❸ POWER INDICATOR
❹ POWER SWITCH
❺ SPEAKER LEVEL CONTROLS

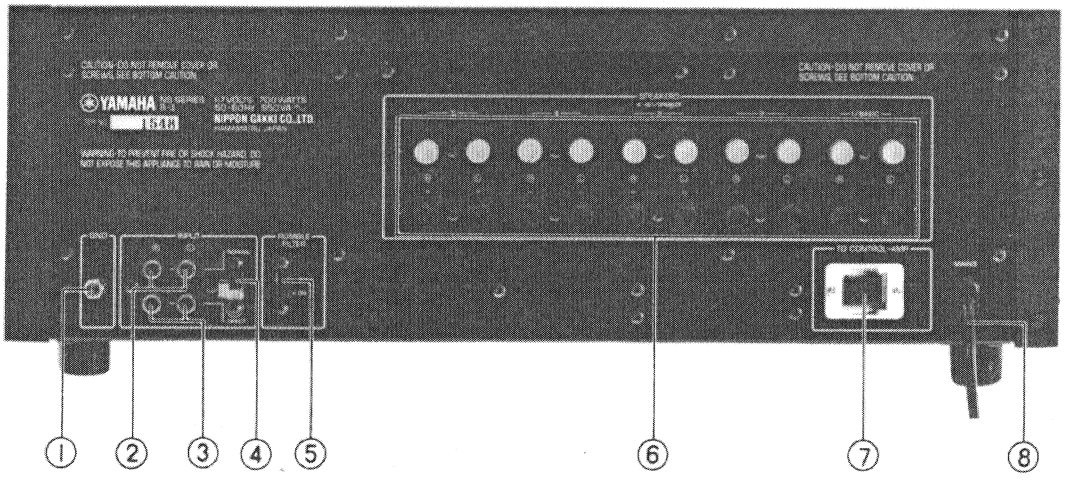


Fig. 2. Rear View

❶ GROUND TERMINAL
❷ NORMAL INPUT JACKS
❸ DIRECT INPUT JACKS
❹ INPUT SELECTOR SWITCH
❺ RUMBLE FILTER SWITCH
❻ SPEAKER TERMINALS
❼ REMOTE CONTROL POWER TERMINAL
❽ AC POWER CORD

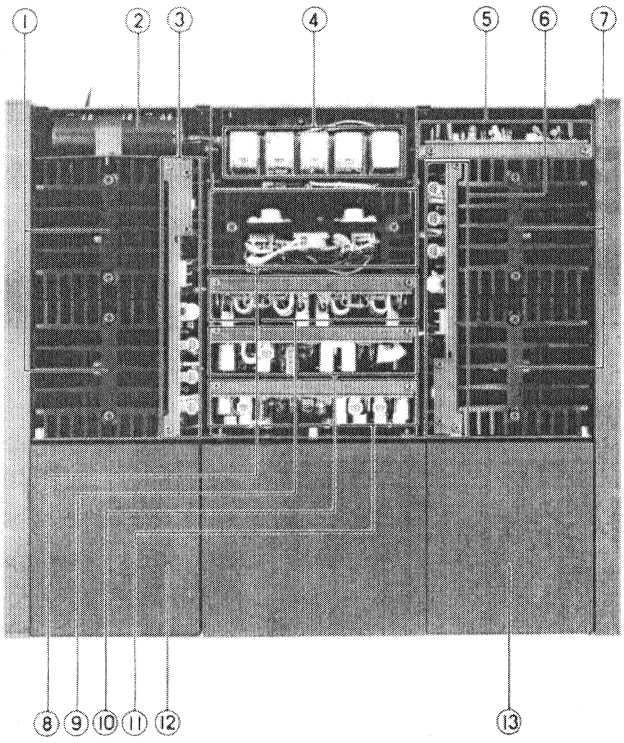


Fig. 3. Top View

1. POWER FET UNIT (L CH)
2. ELECTROLYTIC CAPACITOR
3. DRIVER CIRCUIT BOARD (L CH)
4. SPEAKER RELAYS
5. FILTER CIRCUIT BOARD
6. DRIVER CIRCUIT BOARD (R CH)
7. POWER FET UNIT (R CH)
8. POWER SUPPLY UNIT
9. PROTECTOR & POWER SUPPLY CIRCUIT BOARD #3
10. PROTECTOR & POWER SUPPLY CIRCUIT BOARD #2
11. PROTECTOR & POWER SUPPLY CIRCUIT BOARD #1
12. POWER TRANSFORMER (L CH)
13. POWER TRANSFORMER (R CH)

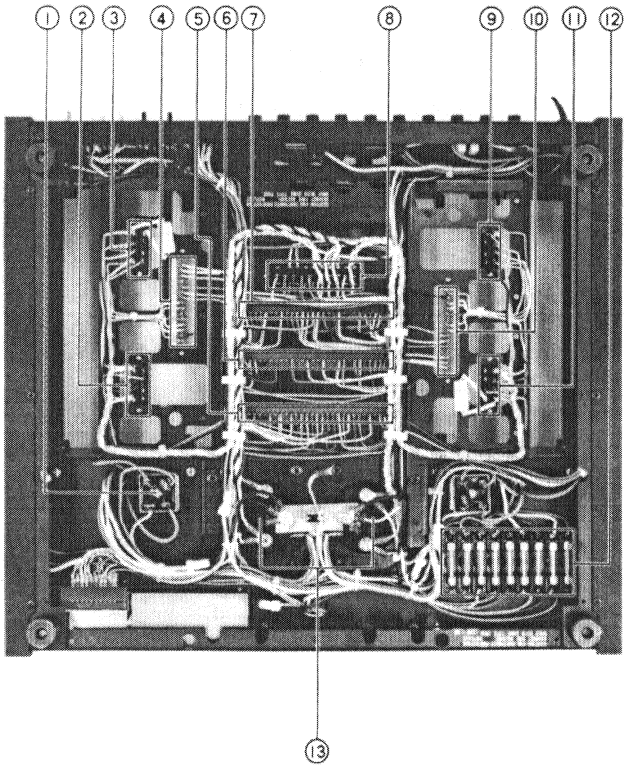


Fig. 4. Bottom View

1. RECTIFIER
2. CONNECTOR (POWER FET UNIT - R CH ⊖)
3. CONNECTOR (POWER FET UNIT - R CH ⊕)
4. CONNECTOR (DRIVER CIRCUIT BOARD - R CH)
5. CONNECTOR (PROTECTOR & POWER SUPPLY CIRCUIT BOARD #1)
6. CONNECTOR (PROTECTOR & POWER SUPPLY CIRCUIT BOARD #2)
7. CONNECTOR (PROTECTOR & POWER SUPPLY CIRCUIT BOARD #3)
8. CONNECTOR (POWER SUPPLY UNIT)
9. CONNECTOR (POWER FET UNIT - L CH ⊕)
10. CONNECTOR (DRIVER CIRCUIT BOARD - L CH)
11. CONNECTOR (POWER FET UNIT - L CH ⊖)
12. FUSES
13. POWER STAGE ELECTROLYTIC CAPACITOR

CIRCUIT DESCRIPTION

FILTER AMPLIFIER

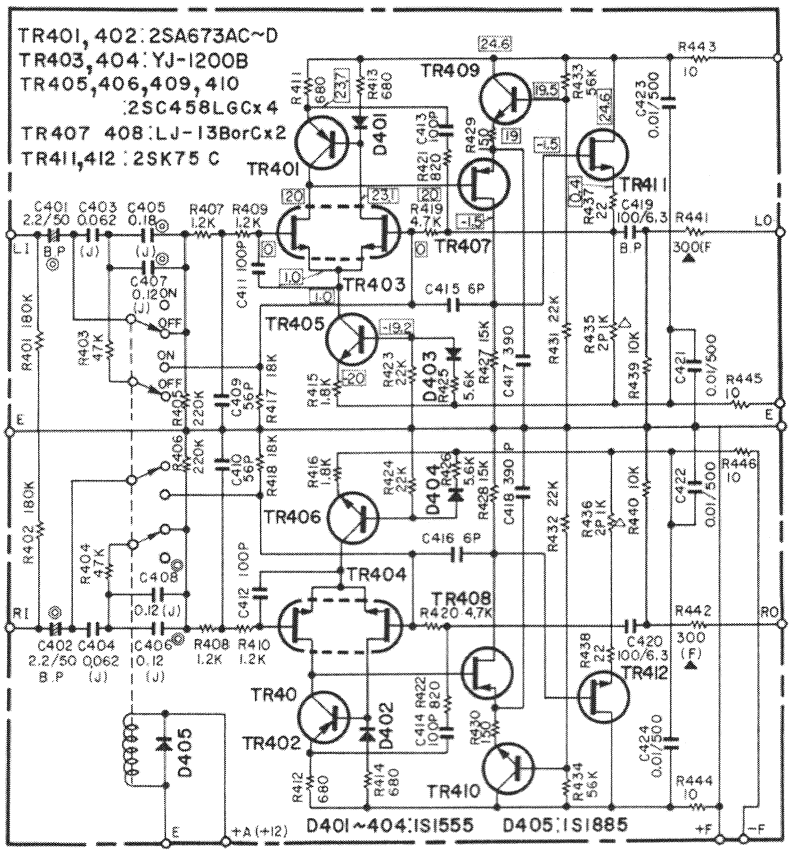


Fig. 5. Filter Amplifier

This 0dB voltage gain filter amplifier is built into the B-I primary stage. This circuit works not only as a rumble filter, but also as an impedance converter to permit level control when the UC-I is connected directly or via the RU-I.

CONSTRUCTION

Primary Stage: A differential amplifier composed of dual Yamaha FETs.

Second Stage: A source ground composed of Yamaha FETs.

Third Stage: A source follower composed of Yamaha vertical FETs (drain loss: 20W).

CHARACTERISTICS

Input Impedance: 100KΩ
Output Impedance: 300Ω
Voltage Gain: 0dB=1 (at 1KΩ load)
Max. Output Level: +19dBm (app. 6Vrms) at 0.01% THD

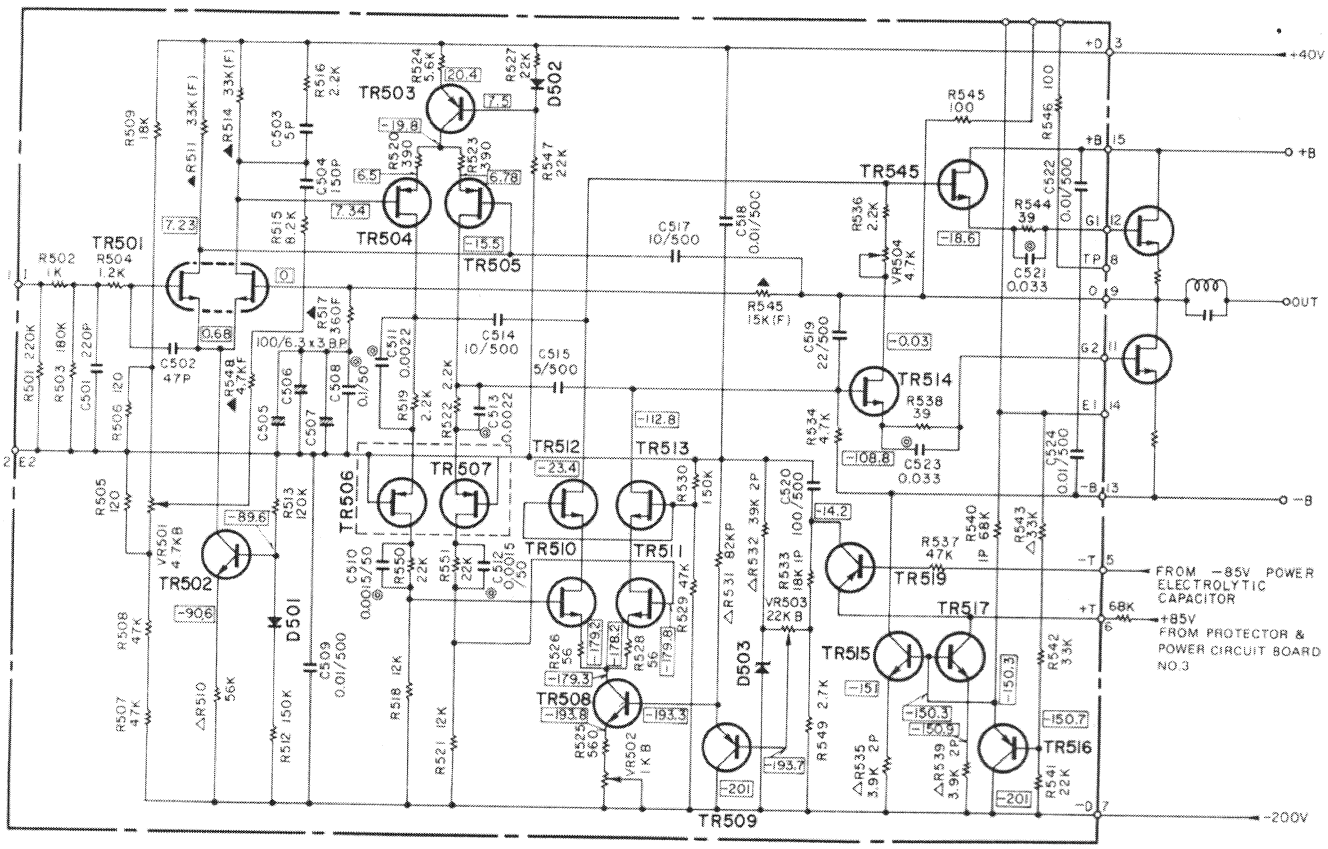
RUMBLE FILTER

This filter is operated either by the switch on the B-I rear panel or by remote control using the UC-I.
The rumble filter's steep cutoff of −12dB octave beginning at 10Hz assures complete removal of ultra-low frequency sound distortions without affecting the audible frequency spectrum.

IMPEDANCE CONVERTER

This circuit is a source follower composed of Yamaha vertical FETs (drain loss: 20W).
The 300Ω output impedance is ideal (not too high or too low), assuring virtually no signal deterioration, even when the UC-I and RU-I are used for remote level control.
As the block diagram shows, this amplifier works only during Normal operation. When the switch is set for Direct input, this circuit is bypassed.

DRIVE AND POWER STAGE



The signal line semiconductors for this all-FET amplifier circuit are Yamaha-produced field effect transistors.

Fig. 6

CONSTRUCTION

Primary Stage: A differential amplifier employing Yamaha dual FETs.

Secondary Stage: Cascade-connected differential amplifiers employing Yamaha conventional and vertical FETs.

Third Stage: Cascade-connected differential amplifiers employing Yamaha conventional and vertical FETs.

Final Stage: A Darlington-connected single-ended push-pull circuit incorporating Yamaha vertical FETs and vertical power FETs.

TR-502, D-501: Form a constant-current power supply circuit for the primary stage.

TR-503, D-502: Form a constant-current power supply circuit for the secondary stage.

TR-508, TR-509, D-503: Form a constant-current power supply circuit for the third stage.

TR-519: A voltage detector circuit for ±B (±85V) voltage.
This circuit is designed to provide stable idling current to the final stage in spite of power supply voltage fluctuations which cause changes in the ±B voltage. It is connected to the constant-current power supply for the third stage.

TR-515, TR-517, TR-516: These form a constant-current power supply circuit for the final stage.

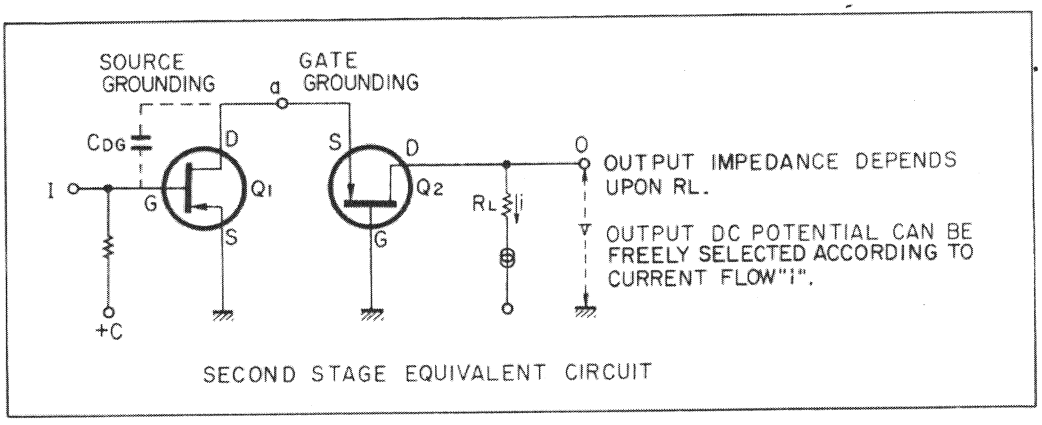


Fig. 7

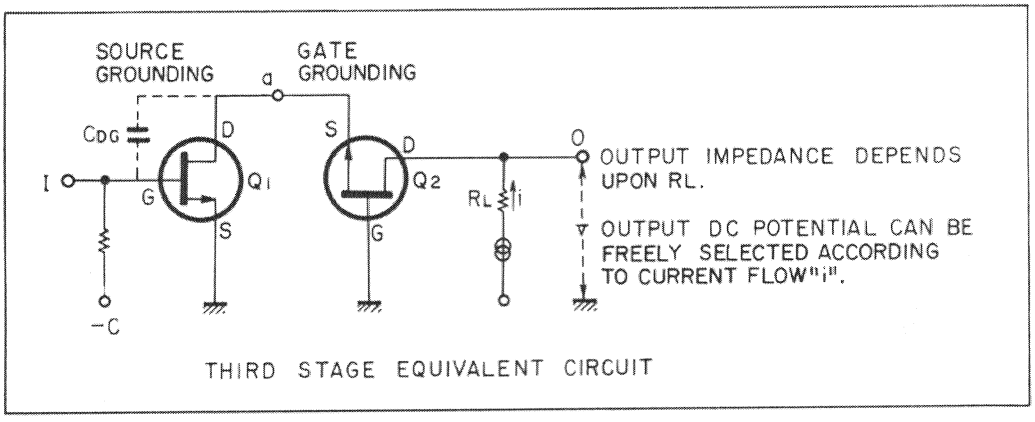


Fig. 8

OPERATION

The signal which enters from input terminal I passes to the differential amplifier formed by TR-501 (dual FET YJ-1200B), and two outputs with a 180° difference in phase appear at various drains. This dual FET construction assures minimum variation in I_{DSS} characteristics; when used as a differential amplifier this provides a large CMRR (common mode rejection ratio). Thus outstanding operational stability can be provided by the construction which features parallel thermal conditions. The two signals created by this differential amplifier are fed to the second and third stage differential amplifiers, and, maintaining this 180° phase difference, pass to the final stage. The second and third stage differential amplifiers, which are composed of conventional and vertical FETs connected in cascade, have the following features:

a. Conventional FETs have not been able to provide high voltage handling capacity, but using this circuit higher voltage handling is possible.

b. The initial stage of this circuit is connected to the source, the final stage to the gate, so the high output impedance of the initial is reduced by the final stage. Thanks to the capacitor C_{DG} between the drain and source of the initial stage FET, mirror effect and high-range signal deterioration are canceled.

c. DC potential rise is sufficient for an all-stage direct coupled circuit.

In a power FET a high voltage is required between the gate and source. Since this requires a special design directly connected to the previous stage, Yamaha developed a Darlington-connected circuit which assures no AC signal loss, thanks to the stable current circuit connected to the FET source of the previous stage. In this way a continuous output power of 150W (both channels driven 20 – 20,000Hz, 8 ohms load, total harmonic distortion 0.1%) is assured by a single pair of Yamaha Vertical Power FETs.

POWER SUPPLY AND PROTECTOR CIRCUITS

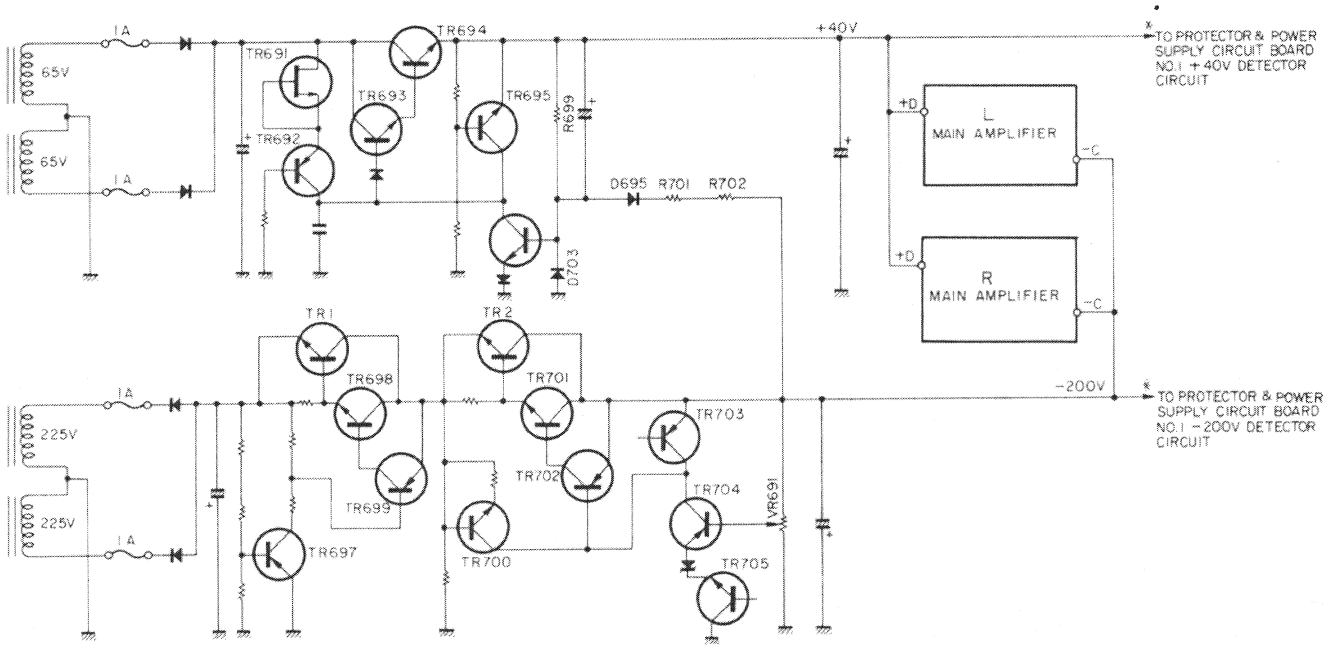


Fig. 9

The power FET amplifier differs from conventional bipolar transistor amplifiers in that a special type of bias circuit is required. In the case of conventional FETs, however, when gate bias voltage is 0V (i.e., no bias), the source-drain interval is on.

The power FET has extremely low internal impedance, and if the ±B source is applied before the gate bias excessive drain current flows, causing device damage.

In the B-I main amplifier, however, the following relations between the various sources are necessary.

1. −200V source must be applied before ±B source.
2. +40V source for the pre-drive stages (primary and second) must be applied at the same time as the −200V source to stabilize the mid-point potential.

−200V AND +40V SUPPLY CIRCUIT OPERATION

1. −200V Supply Circuit

This circuit is composed of a constant-voltage circuit mounted on the power supply No. 2 circuit board, which provides excellent voltage stability by cancelling ripples and providing excellent temperature characteristic. When AC line voltage drifts, transistors TR1 and TR2 as shown in Fig. 9 operate to stabilize the voltage. If the line voltage drops below the rated value, TR2 works alone. If it rises more than 20% above the rated value, TR1 and TR2 both work to drain via the various VCE. Furthermore, if excessive current suddenly begins to flow in this circuit, TR703 switches on and TR701, TR702 are switched off.

2. +40V Supply Circuit

This is composed of the constant-voltage circuit mounted on the power supply No. 2 circuit board. The circuit consisting of R701, R702, R699, D703 and D695 operates to obtain the basic voltage for the +40V source by using the highly stable −200V source.

For this reason, the circuit is non-adjustable. If excessive current flows in this circuit, TR695 switches on, cutting TR693 and TR694.

±25V SUPPLY CIRCUIT OPERATION

This circuit is composed of a constant-voltage circuit mounted on the power supply No. 1 circuit board. Its output is used for the filter circuit and UC-I meter circuit ±B. TR601 and TR602 in this circuit operate at constant-current to provide stable constant-voltage output. In case of excessive current flow in this circuit, TR609 and TR610 switch on, shutting off TR603, TR605, TR607, TR604, TR606 and TR608. In other words, it incorporates an excessive current protector circuit.

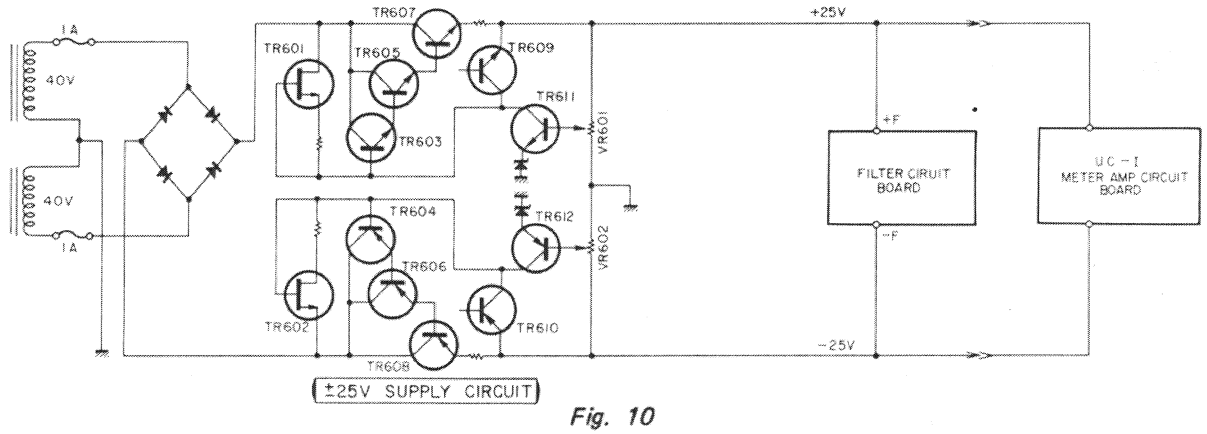


Fig. 10

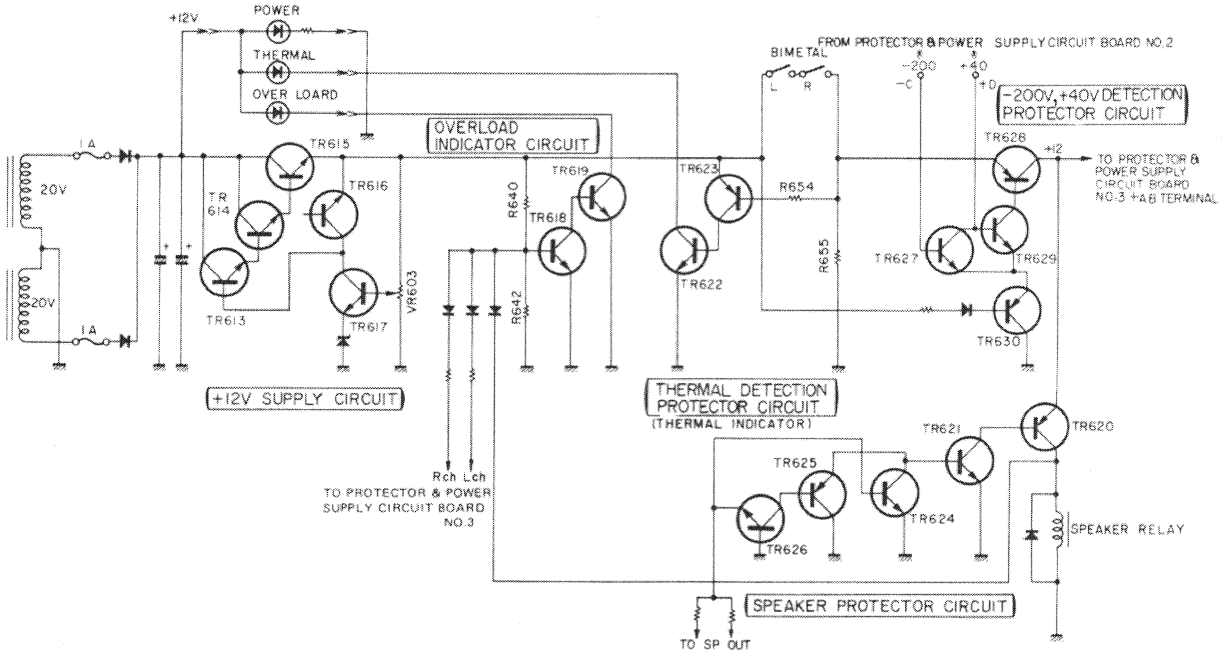


Fig. 11

+12V SUPPLY CIRCUIT OPERATION

This circuit is composed of a constant-voltage circuit mounted on the power supply No. 2 circuit board. Its output is used for the various detector and protector circuits. In case of excessive current flow in this circuit, TR616 switches on, shutting off TR613, TR614 and TR615, thus providing a protector circuit.

OVERLOAD INDICATOR CIRCUIT OPERATION

1. **+B Power Supply Detector Circuit** (located on the power supply No. 1 circuit board)

   This circuit detects and indicates (Overload) an excessive voltage drop in the +B side only of the ±B (±85V) for the main amplifier final stage.

   The left and right channel +B source is added to diodes D610 and D611 after being divided by the 47KΩ and 1KΩ resistors. At this time the forward bias is applied to the base of TR618, which can turn on this transistor. For normal operation, in order to create reverse bias in D610 and D611, TR618 is on and TR619 is off; the Overload indicator is also off.

   If the +B voltage drops suddenly in either left or right channel, or both, D610 and D611 become forward bias and ground the base of TR618; TR618 is switched off and TR619 on, and the Overload indicator lights.

2. **Speaker Protection Detector Circuit**

   When the speaker protector circuit speaker relay drive voltage is detected, the speaker relay cuts off signals to the speakers. At this time the operation of the Overload indicator circuit is exactly the same as that of the +B power supply detector circuit. Detection is carried out by R641 (4.7KΩ), R642 (1KΩ) and D612.

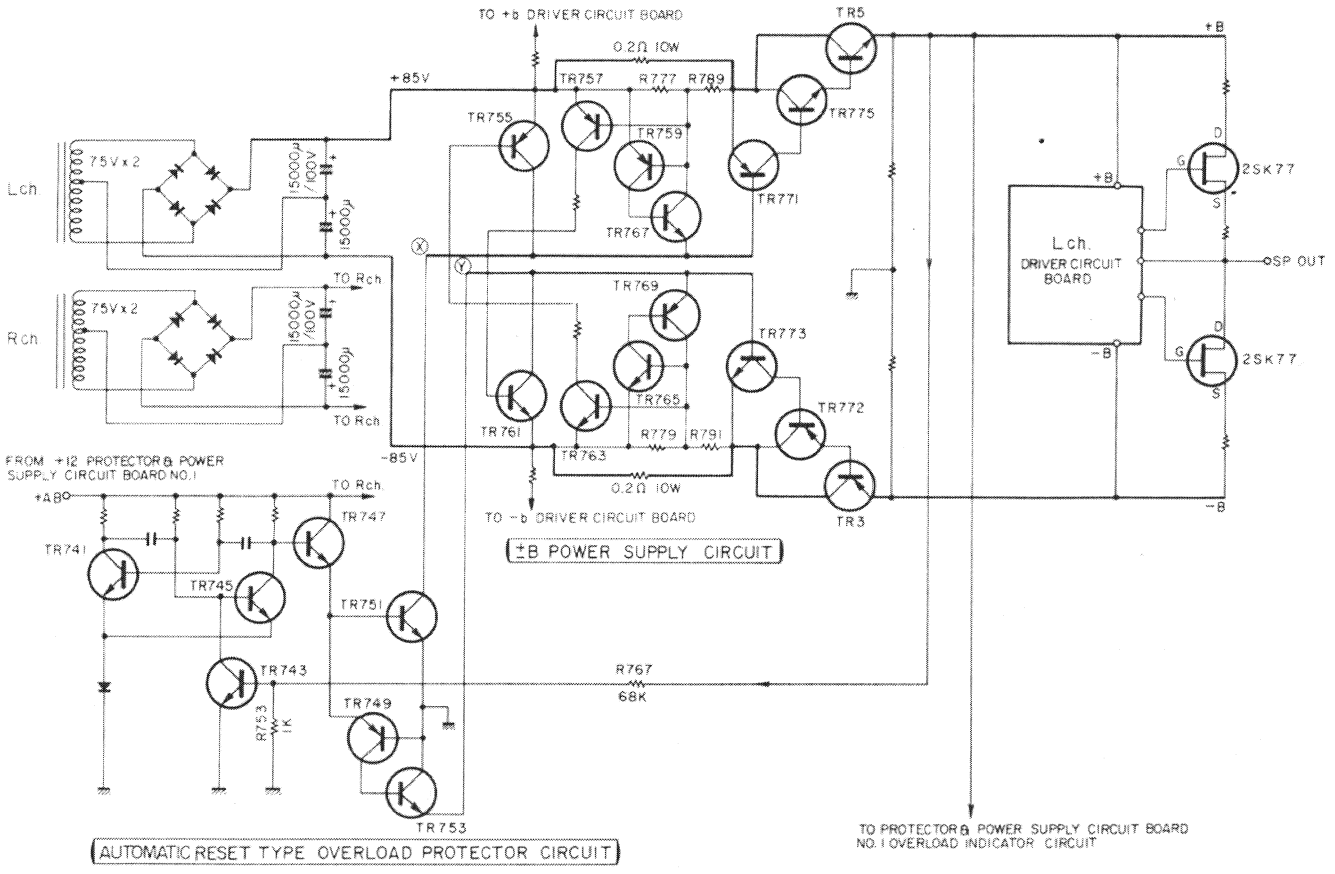


Fig. 12

THERMAL INDICATOR AND THERMAL DETECTION PROTECTOR CIRCUIT OPERATION

This circuit is composed of a bimetal which detects the power FET unit temperature and a circuit which activates the Thermal indicator in case of excessive heat rise; both are mounted on the power supply No. 1 circuit board.

Under normal conditions the bimetal is on and Tr623 is off. By the same token, TR622 is off. In such a case the +12V line is not open and the Thermal indicator does not light.

In case of excessive heat rise in the power FET unit, the bimetal opens and the +12V line is cut. At the same time the TR623 base is grounded and this element switches on. TR622 also goes on and the Thermal indicator lights.

Because the +12V line is shut off, the ±B source for the main amplifier final stage is also cut (see the automatic reset circuit explanation).

±B POWER SUPPLY CIRCUIT OPERATION

This is the ±B supply circuit for the main amplifier final stage; it is mounted on the power supply No. 3 circuit board. Equipped with detector/protector circuits to guard against excessive current flow in both plus and minus sides, such excessive current in either side (plus or minus) will cause the ±B source to be cut for both sides.

Below is an explanation of the detection and protection operations of these circuits (note that automatic reset of these circuits involves TR751 and TR753 coming on).

1. When excessive current flows on the +B side

In case of a large drop in voltage from the 0.2Ω/10W resistor, at that time this voltage is divided by R777 and R789, so that the voltage on both ends of R777 increases. Therefore TR759 switches on and at the same time TR767 comes on. This creates a 0V bias in TR771 and it switches off. In this way TR775 and TR5 go off, cutting the +B line. In addition, bias voltage is created by the voltage at both ends of this same R777, in TR757 switching it on at this time. This switches TR761 on. The result is that TR773, TR777 and TR3 all go off, switching off the −B line. Then, when current flow returns to normal, TR759 and TR767 go off, and the ±B source automatically heals.

2. **When excessive current flows on the −B side**
   The same operation takes place on this side as described above for the +B side.
3. **When excessive current flows on both ±B sides**
   The same operations as described in both 1 and 2 above take place.

AUTOMATIC RESET TYPE OVERLOAD PROTECTOR CIRCUIT OPERATION

This circuit is located on the power supply No. 3 circuit board. It has the following two functions.

1. This circuit cuts the ± B source in case of a speaker terminal short or any other cause which results in an excessive ±B voltage drop in the main amplifier final stage.
   a. If the +B voltage detected by R767 and R753, and fed to the base of TR743, is normal, TR743 is on. Therefore the free-running multivibrator circuit consisting of TR741 and TR745 is locked because the base of TR745 is grounded, resulting in a condition whereby TR741 is on and TR745 is off. On the other hand, TR747, TR751, TR749 and TR753 are all on, grounding (X) and (Y) lines of the ±B power supply circuit and connecting the ± B line as usual.
   b. If the +B voltage drops below +40V, TR743 goes off and the free-running multivibrator begins to operate, sending a 40Hz pulse signal to the TR747 base. Following this signal, TR747, TR751, TR749 and TR753 switch on and off. At this time the ± B supply circuit (X) and (Y) lines naturally open and ground. ± B source repeats on and off at intervals of 12.5 ms.
   When the cause of the sudden drop in +B voltage is corrected, the circuit soon returns to condition a.
2. The ±B source is shut off by the protective action of the various protector circuits on the power supply No. 1 circuit board +12V line.
   a. When +12V is fed to the +AB terminal the free-running multivibrator promptly begins to operate, +B voltage rises above 40V and the condition described in 1a above occurs.
   b. When +12V is not fed to the +AB terminal, the bases of TR751 and TR749 are grounded by R759, R761 and R757. TR751, TR749 and TR753 go off, the (X) and (Y) lines are opened and the ± B source is cut. +12V is not created in case of the following condition.
      1. When the +12V supply excessive current protector circuit is operating.
      2. When the thermal detection protector circuit is operating.
      3. When the −200V, +40V detection protector circuit is operating.

−200V, +40V DETECTION PROTECTOR CIRCUIT (LOCATED ON THE POWER SUPPLY NO. 1 CIRCUIT BOARD)

As mentioned above in the section on various power supplies, the ±B source for the main amplifier must be applied after the +40V and −200V sources. This circuit is designed for that reason, but it also serves as a protector circuit in case of a noticeable drop in the +40V or −200V source.

When −200V is not supplied to the −C terminal, TR267 is in a forward bias condition and switched on; it switches off only when −200V is supplied to the −C terminal.

If +40V is not supplied to the +D terminal, and of course if it is supplied, TR629 is off whenever TR627 is on (i.e., whenever −200V is not supplied to the −C terminal).

In order for TR629 to switch on, −200V must be supplied to the −C terminal and +40V to the +D terminal. TR628 operates according to the on/off condition of TR629. When TR629 is on, TR628 is also on, When TR629 goes off, so does TR628. Since it opens and closes +12V line, it controls the ±B source. Therefore, if for any reason either the −200V or +40V supply is interrupted, the ±B source is not supplied to the main amplifier. In this way the circuit works as a protector circuit.

In order for the above circuits to assure operating stability they incorporate bias transistor TR630, which employs standard voltage from R658, R661 and D616.

SPEAKER PROTECTOR CIRCUIT

This circuit is located on the power supply No. 1 circuit board. It detects direct current present at the main amplifier output terminals and operates to protect the speakers in case abnormal DC appears at any such terminal when the main amplifier is in operation. It also protects the speakers from abnormal signals when the power switch is turned on (at the same time cutting transient noise). Finally, it cuts transient noise when the power switch is turned off.

1. **Operation when power switch turned on (transient noise cancellation)**
   When the power switch is turned on +12V is fed to the emitter of TR620. TR621 base potential depends on the time constant when it is set by R648 and C623. At this time TR621 is off until the potential rises to 0.6V; TR620 is also off, and thus the speaker relay works to cut all signals to the speakers.

Then, when the potential rises above 0.6V, TR621 switches on, and so does TR620, so the speaker relay works to pass signals to the speakers.

2. **Transient noise cancellation when power switch is turned off.**
   When the power switch is turned off, C623 discharges and passes via D613 and R649. Thus TR621 goes off, and so does TR620, causing the speaker relay to interrupt signals to the speakers.

3. **Output terminal DC detection and speaker protection**
   The RI and LI terminals, connected to the various left and right channel output terminals, detect DC potential using R667, R666, R664 and C625, feeding it to the speaker protector circuit.
   a. If the DC potential detected at terminals RI or LI is less than ±0.5V, TR626, TR625 and TR624 shut off, and so TR621 and TR620 go on. The speakers are connected as normal.
   b. If the potential detected at RI and/or LI is more than −0.5V, TR626 goes on and so does TR625, Therefore TR621 and TR620 go off, cutting the connection between speakers and amplifier.
   c. If the potential detected at RI and/or LI is more than +0.5V, TR624 goes on and therefore TR621 and TR620 shut off, cutting all amplifier signals to the speakers.

4. In addition, the power supply for this circuit produces +12V at point (a), and in the following cases the speaker relay is shut off, cutting signals to the speakers:
   (a) When the +12V supply protector circuit operates.
   (b) When the thermal detection protector circuit operates. (c) When the −200V, +40V detection protector circuit operates.

DISASSEMBLY PROCEDURES

TOP COVER REMOVAL

a. Remove screws (1) to (4) from the rear panel as shown in Fig. 13.
b. Remove the top cover in the direction shown by the arrow in Fig. 14.

POWER FET UNIT REMOVAL

Remove screws (1) to (8) shown in Fig. 15 and pull out each unit.

Be careful not to reverse the (+) and (–) connections of the power FET units when reconnecting. A reversed connection will damage or destroy the unit.

POWER SUPPLY CIRCUIT BOARD REMOVAL

Remove screws (9) to (14) shown in Fig. 15 and pull out power supply circuit boards 1 to 3.

DRIVER CIRCUIT BOARD REMOVAL

Remove screws (15) to (18) as shown in Fig. 15, then pull out the driver circuit board.

POWER SUPPLY UNIT REMOVAL

Remove screws (19) and (20) as shown in Fig. 15, then pull out the power supply unit.

FILTER CIRCUIT BOARD REMOVAL

Remove screws (21) and (22) as shown in Fig. 15, then pull out the filter circuit board.

BOTTOM COVER REMOVAL

Remove screws (1) to (9) as shown in Fig. 16, then take off the bottom cover.

REAR PANEL REMOVAL

Remove screws (5) to (12) as shown in Fig. 13, and screws (10) and (11) as shown in Fig. 16.

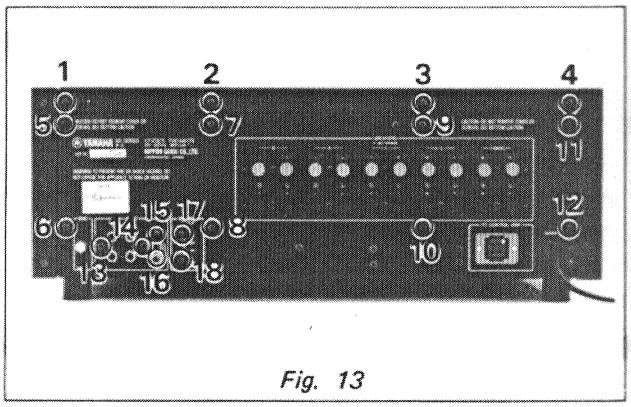


Fig. 13

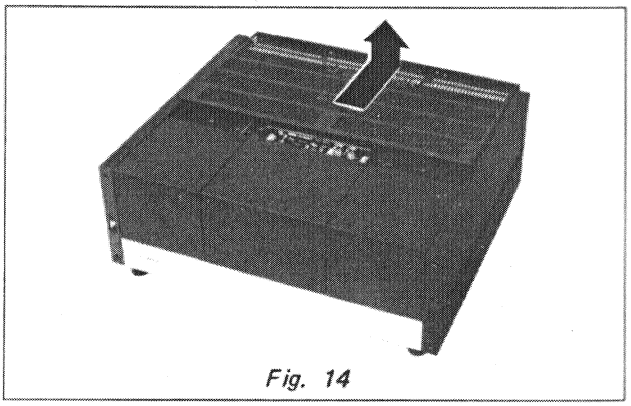


Fig. 14

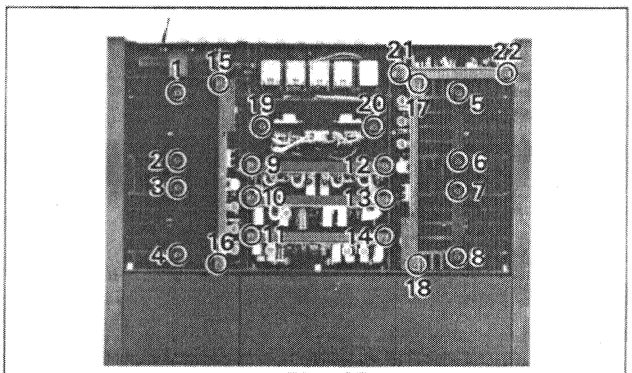


Fig. 15

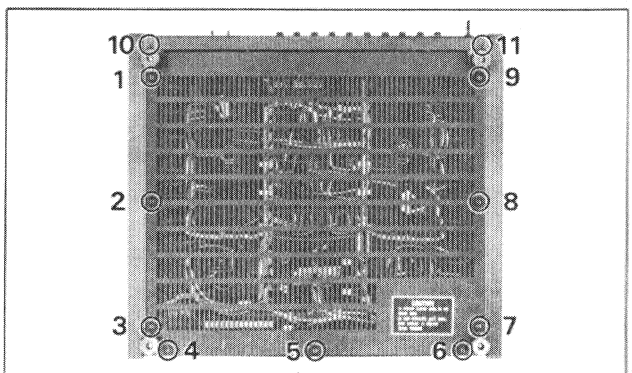


Fig. 16

FRONT PANEL REMOVAL

a. Remove the B-I front panel screws (1) and (2) as shown in Fig. 17.
b. Pull off the front panel as shown in Fig. 18. At this time be careful not to tilt the panel.

POWER ELECTROLYTIC CAPACITOR REMOVAL

a. First remove the bottom cover and front panel, then take off screws (1) to (4) as shown in Fig. 19. Then remove the power electrolytic capacitor.
b. Next remove terminal screws (5) to (10) as shown in Fig. 19, followed by the mounting screws (11) to (14). Now remove the capacitor.

ELECTROLYTIC CAPACITOR FOR −200V SUPPLY REMOVAL

First remove the rear panel, and then screws (1) and (2) as shown in Fig. 20. Then take out the capacitor.

There is a danger of electric shock if you touch the ± B, −200V side, due to the large-capacity electrolytic capacitors used in the B-I.
For this reason, be sure to check that the capacitor is discharged by testing the voltage, even after the power supply is turned off. See page 16 for discharge procedures.

POWER SUPPLY (RELAY) CIRCUIT BOARD REMOVAL

Remove the bottom cover and then screws (1) to (4) as shown in Fig. 21. Then take out the circuit board.

RECTIFIER REMOVAL

Remove screws (5) and (6) as shown in Fig. 21, then take out the rectifier.
Note: Be careful not to remove the heat transfer material.

POWER TRANSFORMER REMOVAL

Remove the rubber foot screws (7) to (11) as shown in Fig. 21, then take the transformer out.

OUTPUT CIRCUIT BOARD REMOVAL

Take off the rear panel and then remove screws (3) to (6) as shown in Fig. 20, then pull off the circuit board.

SPEAKER RELAY REMOVAL

Take off the rear panel and then remove the speaker relay by pulling in the direction shown by the arrow in Fig. 22.

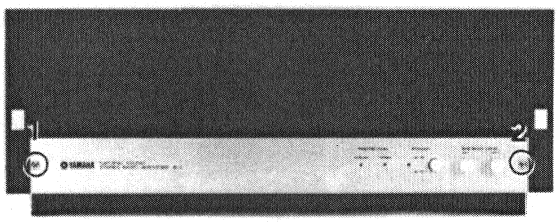


Fig. 17

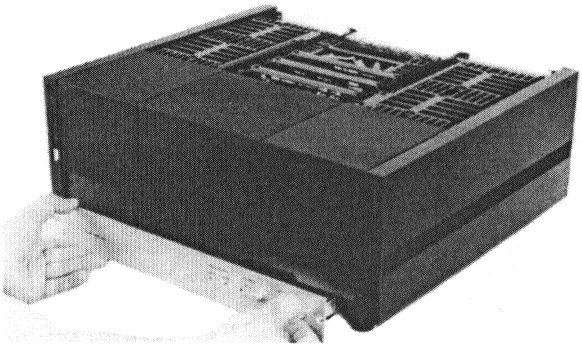


Fig. 18

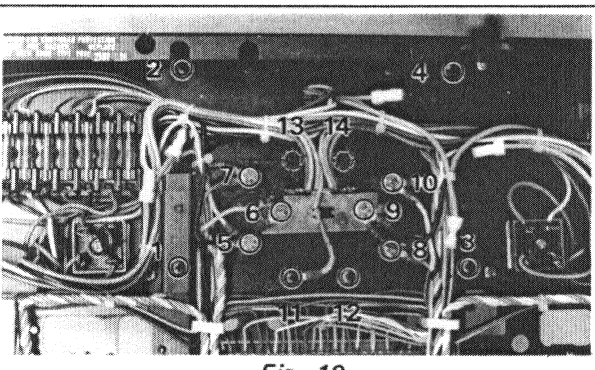


Fig. 19

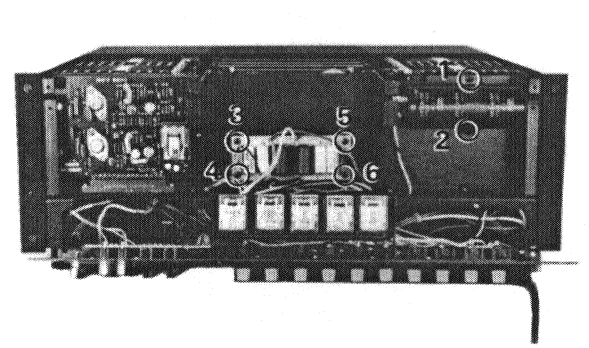


Fig. 20

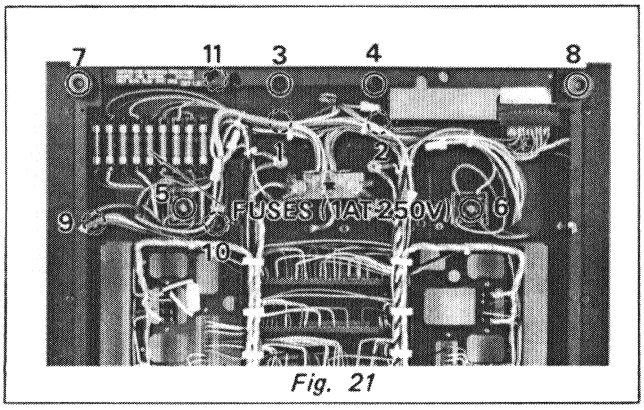


Fig. 21

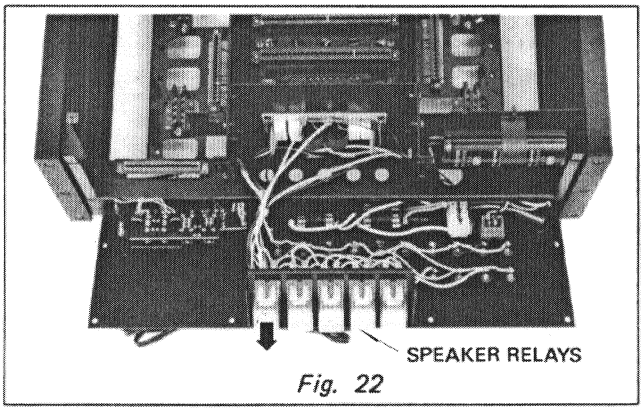


Fig. 22

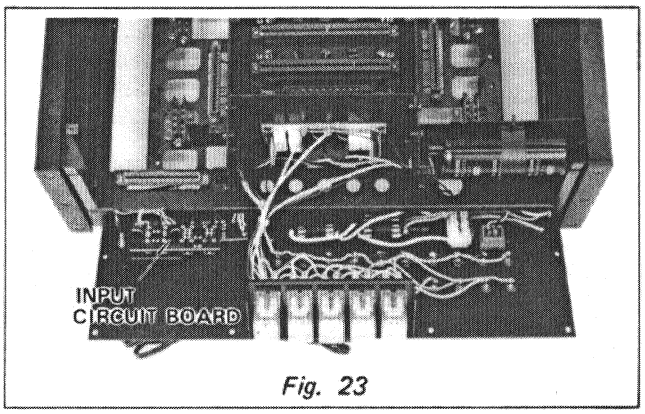


Fig. 23

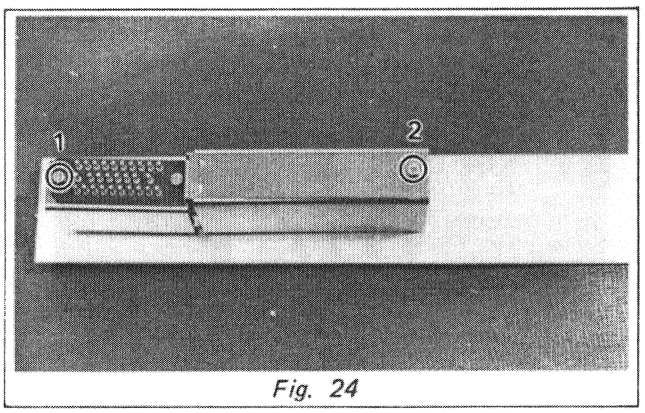


Fig. 24

INPUT CIRCUIT BOARD REMOVAL

Take off the rear panel and remove screws (13) to (18) as shown in Fig. 13. Then remove the input circuit board.

PANEL CONNECTOR REMOVAL

a. Remove screws (1) and (2) as shown in Fig. 24, then take off the connector cover.
b. Use the hexagonal wrench to remove the two speaker level control knobs from the panel. Remove screws (1) and (2) as shown in Fig. 25, then take off the LED circuit board.
c. Pull off the power switch as shown in Fig. 25. Remove fixing nuts (1) and (2) as shown in Fig. 26, then take off the level controls.

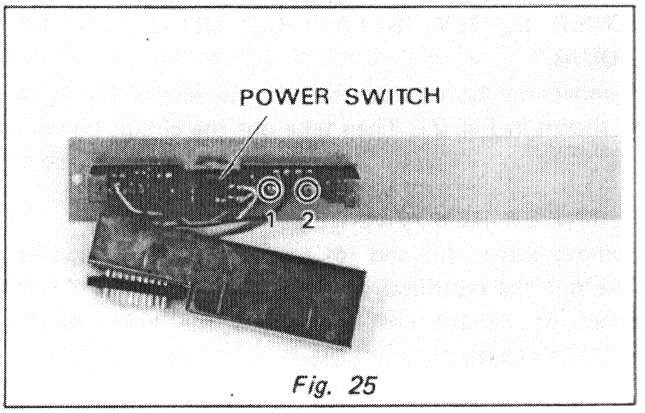


Fig. 25

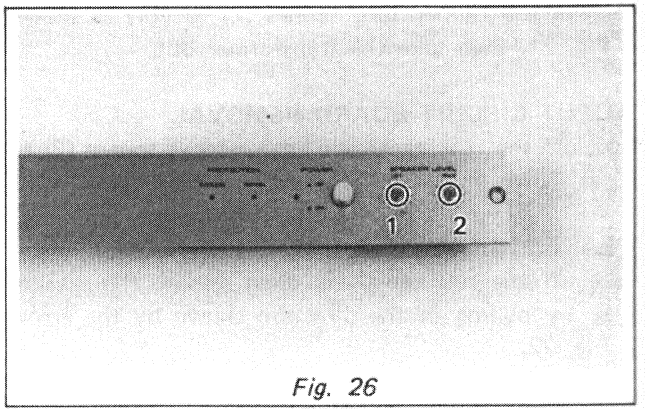


Fig. 26

PRIMARY FUSE REPLACEMENT

a. **For U.S. and Canadian Models**
Fuse location is inside the rear panel as shown in Fig. 27. Use a 2.5AT/250V fuse.

b. **For European Models**
Remove the rear panel fuse holder and replace with a 2.5AT/250V fuse.

SECONDARY FUSE REPLACEMENT

Remove the bottom cover and the 1AT/250V fuses can be found in the location indicated in Fig. 28.

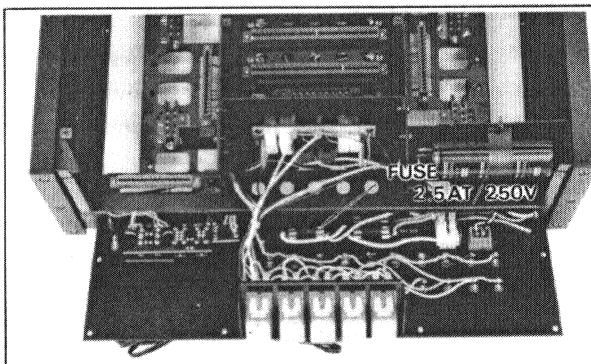


Fig. 27

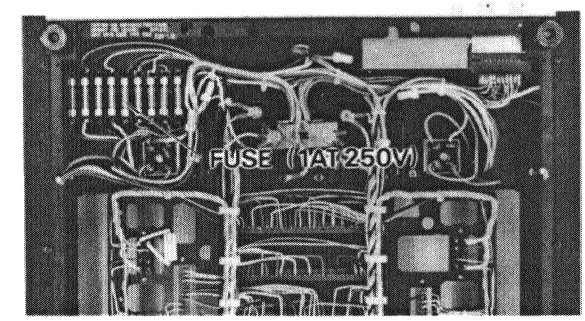


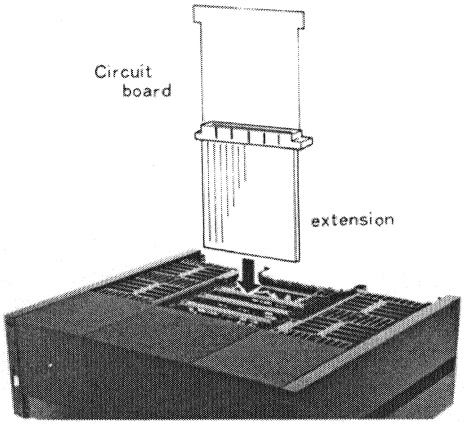
Fig. 28

MEASUREMENTS AND ADJUSTMENTS

GENERAL NOTICE

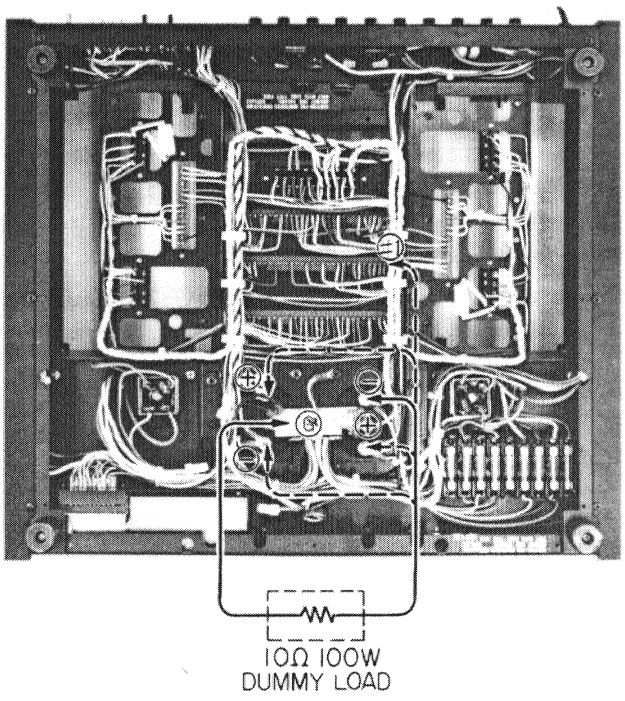
a. Before any repair or adjustment procedures are carried out, be sure to discharge the power circuit. This is to prevent electric shock and damage to the power FETs.

b. When measuring the voltage or repairing the filter, driver, or power supply 1, 2 or 3 circuit boards, be sure to use the circuit board extension adaptor.



c. Be sure to replace power FETs or FETs used in the differential amplifier in pairs of the same type.

d. When replacing the power supply 1, 2 or 3 circuit boards, the driver circuit boards, or either the semiconductors or variable resistor on the power FET unit, be sure to carry out all adjustments called for in the unit replacement adjustment chart below.



Connect a 10Ω, 100W dummy load between ground bus and each of the following: + and – terminals on both channel power stage electrolytic capacitors and the terminal #1 (gray lead) on the protector & power supply circuit board No. 2.

Fig. 30. Discharge Procedures

UNIT NAME	ADJUSTMENT ITEM	REQUIRED EQUIPMENT
Protector & Power Supply Circuit Board No. 1	Steps 1–1 to 1–2	(1) DC Voltmeter or Multimeter (2) 4Ω/100W Dummy Load
Protector & Power Supply Circuit Board No. 2	Steps 1–1 to 1–2	(1) DC Voltmeter or Multimeter (2) 4Ω/100W Dummy Load
Protector & Power Supply Circuit Board No. 3	Steps 1–3 to 1–5	(1) DC Voltmeter or Multimeter (2) 4Ω/100W Dummy Load
Driver Circuit Board	Steps 2–1 to 3–10	(1) DC Voltmeter or Multimeter (2) 4Ω/100W Dummy Load (3) Audio Signal Generator (Low distortion type) (4) Distortion Meter (5) 8Ω/200W Dummy Load
Filter Circuit Board	Distortion Check Signal-to-Noise Ratio Check Frequency Response Check Filter Characteristics Check	(1) DC Voltmeter or Multimeter (2) 4Ω/100W Dummy Load (3) Audio Signal Generator (Low distortion type) (4) Distortion Meter (5) 8Ω/200W Dummy Load

SUPPLY VOLTAGE

STEP	ADJUSTMENT ITEM	TERMINALS TO BE CONNECTED & INSTRUMENTS REQUIRED	ADJUST	HOW TO ADJUST	RATING OR STANDARD	REMARKS
1-1	Install only Protector & Power Supply Circuit Boards 1 & 2			Provide power to the unit		
1-1-1	−200V Adjustment	Connect a DC voltmeter between E and −200V terminals on the protector & power supply circuit board No. 2.	VR691	Adjust VR691 to obtain a −200 (±0.5) V reading on the DC voltmeter.	−200±0.5V	Refer to Fig. 31.
1-1-2	+40V Check	Connect a DC voltmeter between E and +40V terminals on the protector & power supply circuit board No. 2.		When the procedure in 1-1-1 is completed, check the voltage on the DC voltmeter.	+40.5±1V	Refer to Fig. 31.
1-1-3	+12V Adjustment	Connect a DC voltmeter between TP3 and E terminals on the protector & power supply circuit board No. 1.	VR603	Adjust VR603 to obtain a +12(±0.2)V reading on the DC voltmeter.	+12± 0.2V	Refer to Fig. 32
1-1-4	+25V Adjustment	Connect a DC voltmeter between TP1 and E terminals on the protector & power supply circuit board No. 1.	VR601	Adjust VR601 to obtain a +25(±0.2)V reading on the DC voltmeter.	+25±0.2V	Refer to Fig. 32.
1-1-5	−25V Adjustment	Connect a DC voltmeter between TP2 and E terminals on the protector & power supply circuit board No. 1.	VR602	Adjust VR602 to obtain a −25(±0.2)V reading on the DC voltmeter.	−25±0.2V	Refer to Fig. 32.
1-2	Discharge		L: ±B, R: ±B, −200V	Turn off the power switch and discharge the power circuit. Refer to page 16.		
1-3	Install Protector & Power Supply Circuit Board 3.			Supply power.		

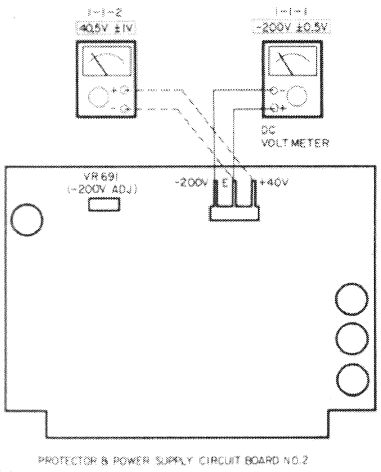


Fig. 31

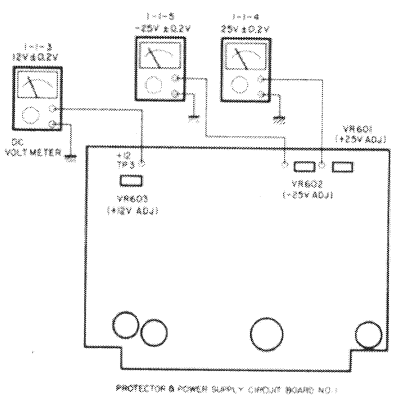


Fig. 32

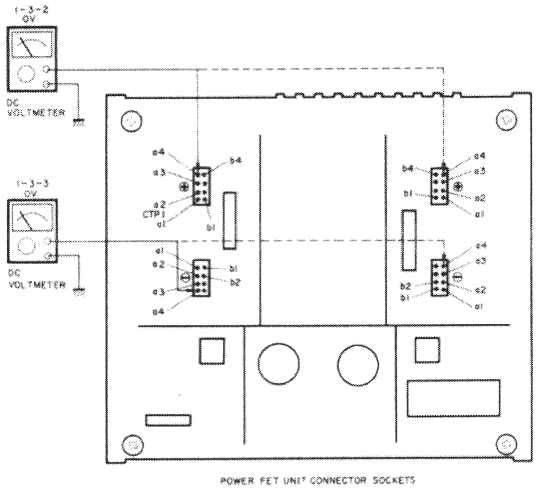


Fig. 33

STEP	ADJUSTMENT ITEM	TERMINALS TO BE CONNECTED & INSTRUMENTS REQUIRED	ADJUST	HOW TO ADJUST	RATING OR STANDARD	REMARKS
1-3-1	LED Indicator Lighting Check			Thermal and Overload LED indicators should stay on.		
1-3-2	+B Source Check #1	Connect a DC voltmeter between a4 and E terminals on the plus side power FET unit connector socket.		The reading should be 0V.	0V	Check both left and right channels. Refer to Fig. 33.
1-3-3	−B Source Check #1	Connect a DC voltmeter between a4 and E terminals on the minus side power FET unit connector socket.		The reading should be 0V.	0V	Check both left and right channels. Refer to Fig. 33.
1-3-4	+B Source Check #2	Connect a DC voltmeter between a4 and E terminals on the plus side power FET unit connector socket.		Short between terminals a2 and b2 on the minus side power FET unit connector socket. Then check for the following conditions: 1. In this shorted condition, +B voltage between a4 and E should be +85 ± 10V. 2. When +B voltage appears check that the Thermal LED indicator goes off, followed a short time later by the Overload LED going off.	+B voltage: +85 ± 10V	Check both left and right channels.
1-3-5	−B Source Check #2	Connect a DC voltmeter between a4 and E terminals on the minus side power FET unit connector socket.		Short between terminals a2 and b2 on the minus side power FET unit connector socket. Then check for the following conditions: 1. In this shorted condition, −B voltage between a4 and E should be −85±10V. 2. Same as Step 1-3-4.	−B voltage: −85±10V	Check both left and right channels.
1-4	Protector Circuit Operation Check (+B Voltage Variation Check)	Connect a DC voltmeter between a4 and E terminals on the plus side power FET unit connector socket.		1. Short between terminals a2 and b2 on the minus side power FET unit connector socket. 2. Short the a4 and E terminals on the plus side power FET unit connector socket with a 4Ω, 100W dummy load. At the same time check that the +B voltage becomes 0V. Remove the load and check that the +B voltage returns to its previous value.	+B voltage: 0V→+85 ± 10V	Check both left and right channels.

STEP	ADJUSTMENT ITEM	TERMINALS TO BE CONNECTED & INSTRUMENTS REQUIRED	ADJUST	HOW TO ADJUST	RATING OR STANDARD	REMARKS
	(−B Voltage Variation Check)	Connect a DC voltmeter between a4 and E terminals on the minus side power FET unit connector socket.		1. Short between terminals a2 and b2 on the minus side power FET unit connector socket. 2. Short the a4 and E terminals on the minus side power FET unit connector socket with a 4Ω, 100W dummy load. At the same time check that the −B voltage becomes 0V. Remove the load and check that the −B voltage returns to its previous value.	−B voltage: 0V → −85±10V	Check both left and right channels.
1-5	Discharge		L: ±B, R: ±B, −200V terminals	Turn off the power switch and discharge the power circuit. Refer to page 16.		

DRIVER CIRCUIT OPERATION

STEP	ADJUSTMENT ITEM	TERMINALS TO BE CONNECTED & INSTRUMENTS REQUIRED	ADJUST	HOW TO ADJUST	RATING OR STANDARD	REMARKS
2-1	Discharge		L: ±B R: ±B −200V terminals	Turn off the power switch and discharge the power circuit.		
2-2	Variable Resistor Fixed Position Check (On Drive Circuit Board)		VR501 VR502 VR503 VR504	VR501 (DC Balance): Center VR502 (Bias Adjustment): Turn all the way to the left. VR503 (Bias Balance): Turn all the way to the left. VR504 (P-P Balance): Center Position an indicated above.		Refer to Fig. 34.

STEP	ADJUSTMENT ITEM	TERMINALS TO BE CONNECTED & INSTRUMENTS REQUIRED	ADJUST	HOW TO ADJUST	RATING OR STANDARD	REMARKS
2-3	Dummy Load Connection	Connect a 4.7KΩ, 5W resistor between terminals a1 and b4 on the plus side power FET unit connector socket.				
2-4	Driver Circuit Board Connection			Install the driver circuit board and switch on the power.		
2-5	DC Balance Adjustment	Connect a DC voltmeter between E and O terminals on the driver circuit board.	VR501	Adjust VR501 to obtain a 0(±0.1)V reading on the DC voltmeter.	0±0.1V	Refer to Fig. 34
2-6	Power FET Bias Voltage Adjustment (Minus Side Power FET Unit)	Connect a DC voltmeter between terminals a4 and a3 on the minus side power FET unit connector socket.	VR502	Adjust VR502 to obtain a −15(±1)V reading on the DC voltmeter.	−15±1V	
2-7	Power FET Bias Voltage Adjustment (Plus Side Power FET Unit)	Connect a DC voltmeter between terminals a1 and a3 on the plus side power FET unit connector socket.		After step 2-6 is completed, check that the voltage between a1 and a3 is −15±5V.	−15±5V	
2-8	DC Balance Check	Connect a DC voltmeter between terminals E and O on the driver circuit board.		After 2-6 and 2-7 are completed, check that the voltage between E and O is 0±0.1V.	0±0.1V	
2-9	Discharge		L: ±B R: ±B −200V terminals	1. Return VR502 on the drive circuit board all the way to the left. 2. Switch on the power. 3. Discharge the power circuit.		

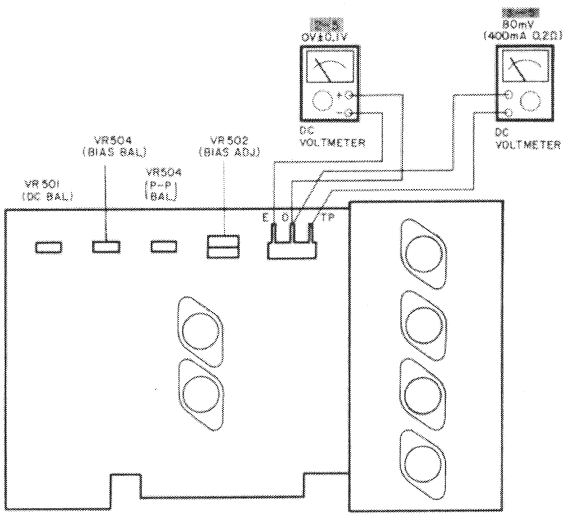


Fig. 34

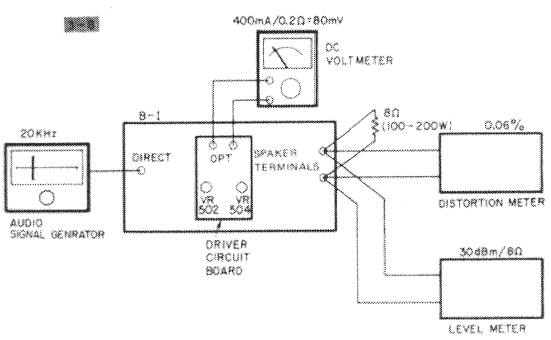


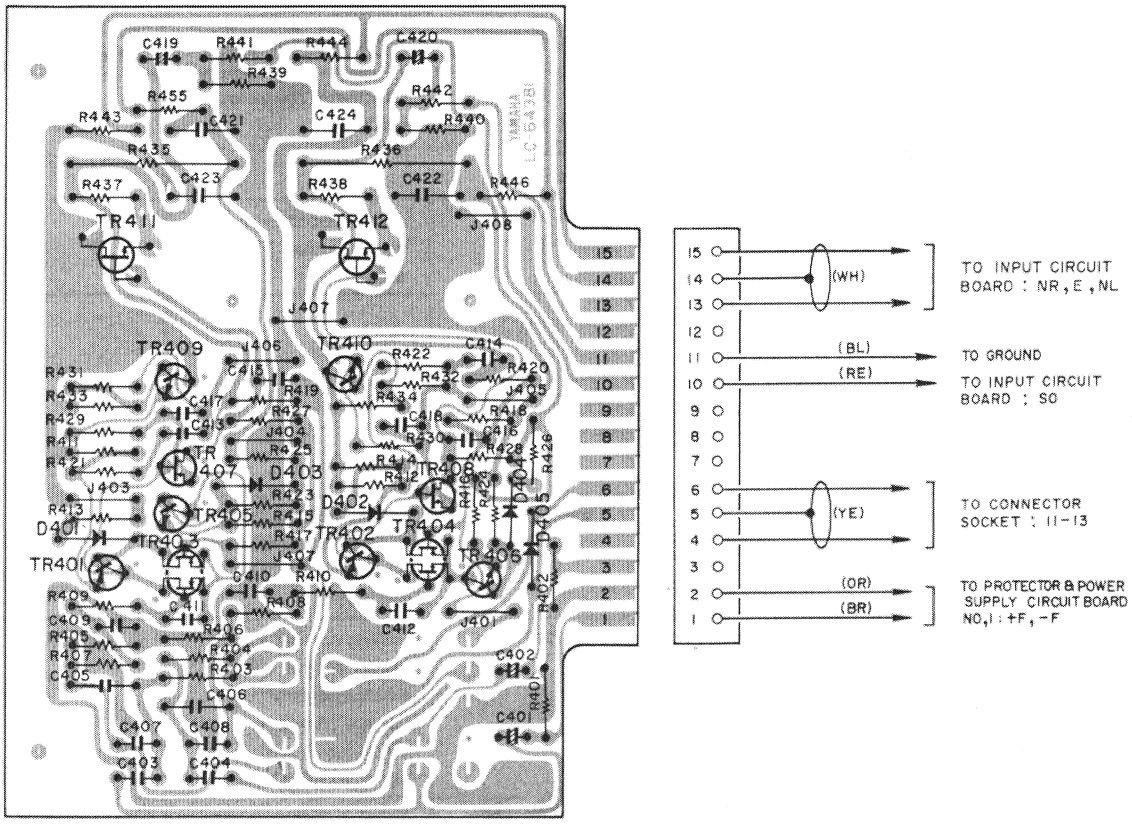
Fig. 35

OVERALL ADJUSTMENTS

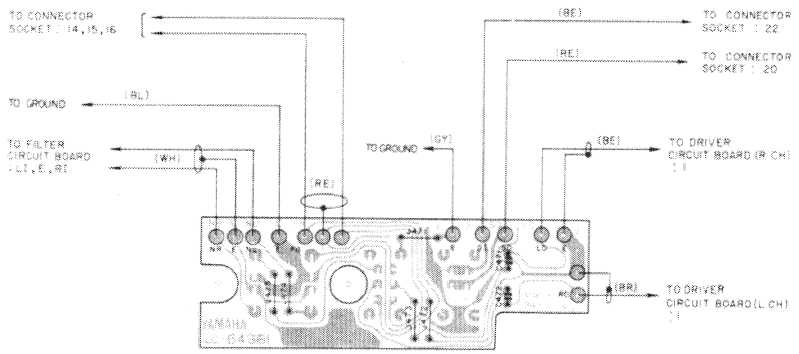
STEP	ADJUSTMENT ITEM	TERMINALS TO BE CONNECTED & INSTRUMENT REQUIRED	ADJUST	HOW TO ADJUST	RATING OR STANDARD	REMARKS
3-1	Discharge		L: ±B R: ±B −200V terminals	Discharge the power circuit.		
3-2	Power FET Unit Attachment			Attach both plus and minus power FET units.		
3-3	DC Voltmeter Connection for Measuring Idling Current	Connect a DC voltmeter between terminals O and TP on the driver circuit board.				Refer to Fig. 34.
3-4	Switch On Power					
3-5	Idling Current Adjustment	Same as 3-3.	VR502	Adjust VR502 to obtain a 80mV (400mA/0.2Ω) reading on the DC voltmeter.	80mV	Refer to Fig. 34.
3-6	Bias Balance Adjustment	1. Same as 3-3. 2. Connect a variable transformer to the power primary stage.	VR503	Adjust so that even at power source voltage fluctuations of ±10%, voltage between O and TP remains within the limits of 80mV±5mV.	80mV±5mV	
3-7	DC Balance Adjustment	Same as 2-5.	VR501	Same as 2-5.	0±0.1V	
3-8	P-P Balance Adjustment	1. Connect an audio signal generator to the Direct input terminal. 2. Connect a DC voltmeter between terminals O and TP on the driver circuit board (for idling current check). 3. Connect an 8Ω, 100−200W dummy load, distortion meter and level meter in parallel to the speaker terminal providing output.	VR502 VR504	1. Set the audio signal generator for a 20KHz output and adjust the level meter so that it indicates 30dBm/8Ω (75W). Input: 20KHz; Output: 30dBm/8Ω (75W). 2. Adjust VR502 and VR504 so that idling current is maintained at 400mA/0.2Ω= 80mV. Also reduce distortion to the lowest possible level; it must be under 0.06%.	Idling Current: 400mA/ 0.2Ω= 80mV Total Harmonic Distortion: Less than 0.06%	Refer to Fig. 35.
3-9	Recheck	Recheck the idling current, bias balance and DC balance.				
3-10	Discharge		Same as 3-1.	Same as 3-1.		

PRINTED CIRCUIT BOARD

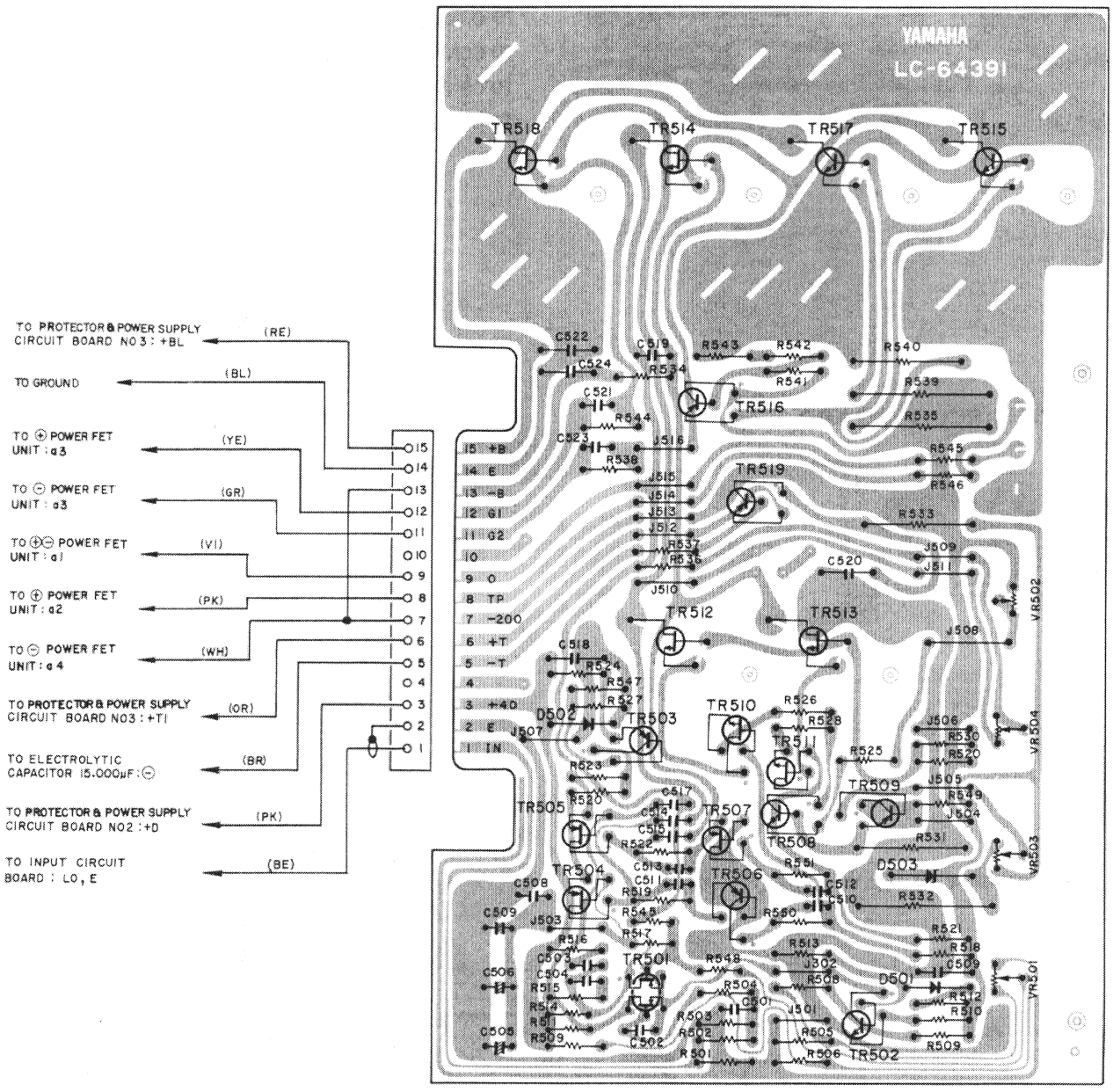
FILTER CIRCUIT BOARD



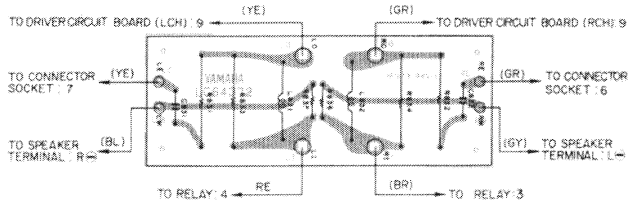
INPUT CIRCUIT BOARD



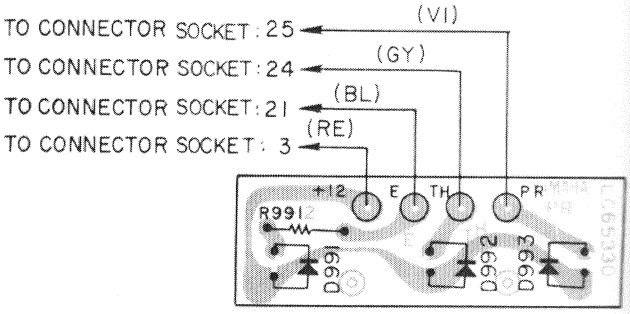
DRIVER CIRCUIT BOARD



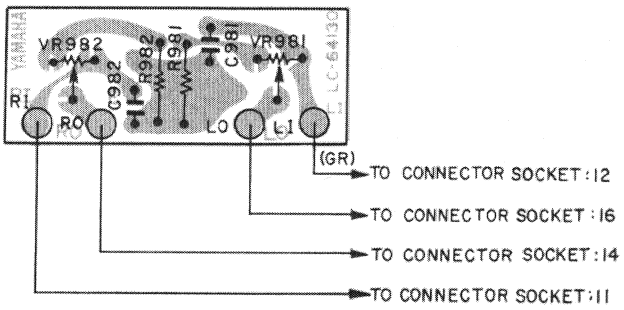
OUTPUT CIRCUIT BOARD



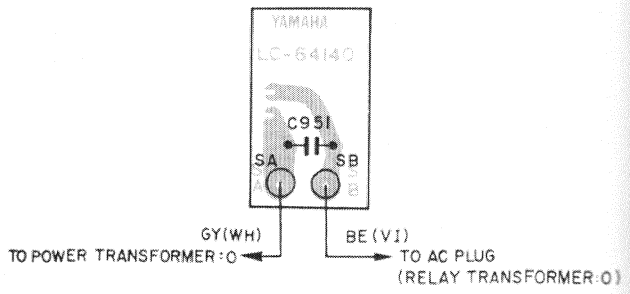
LED CIRCUIT BOARD



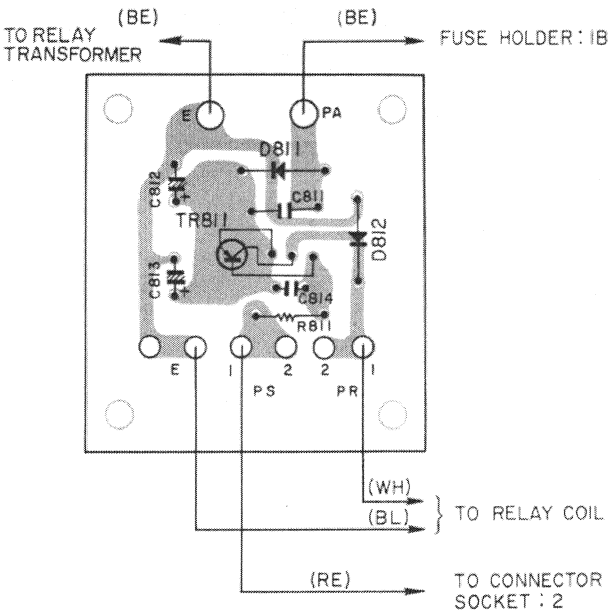
BASIC VR CIRCUIT BOARD



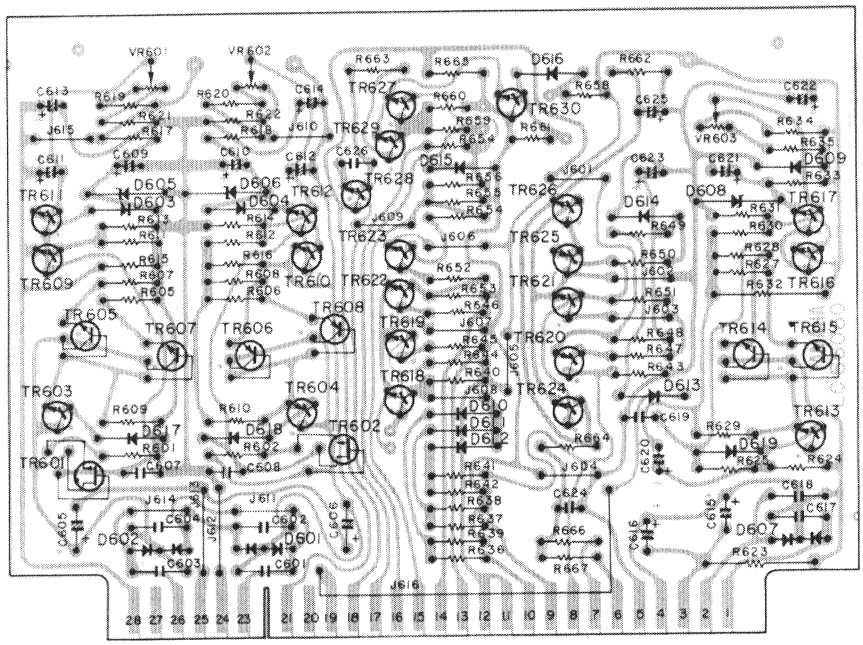
POWER SW CIRCUIT BOARD



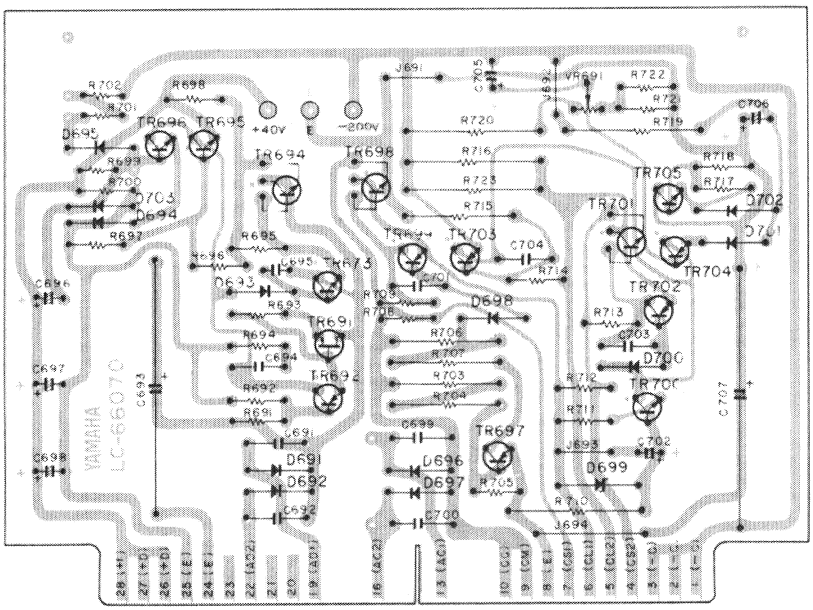
POWER SUPPLY (RELAY) CIRCUIT BOARD

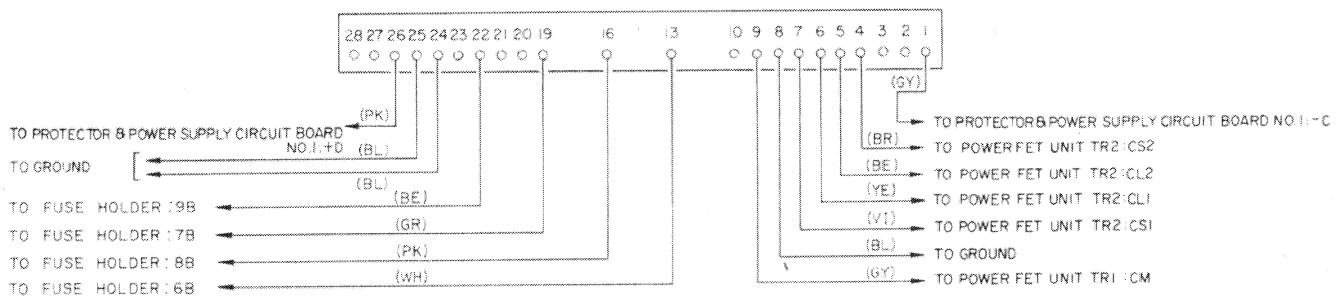


PROTECTOR & POWER SUPPLY CIRCUIT BOARD NO.1

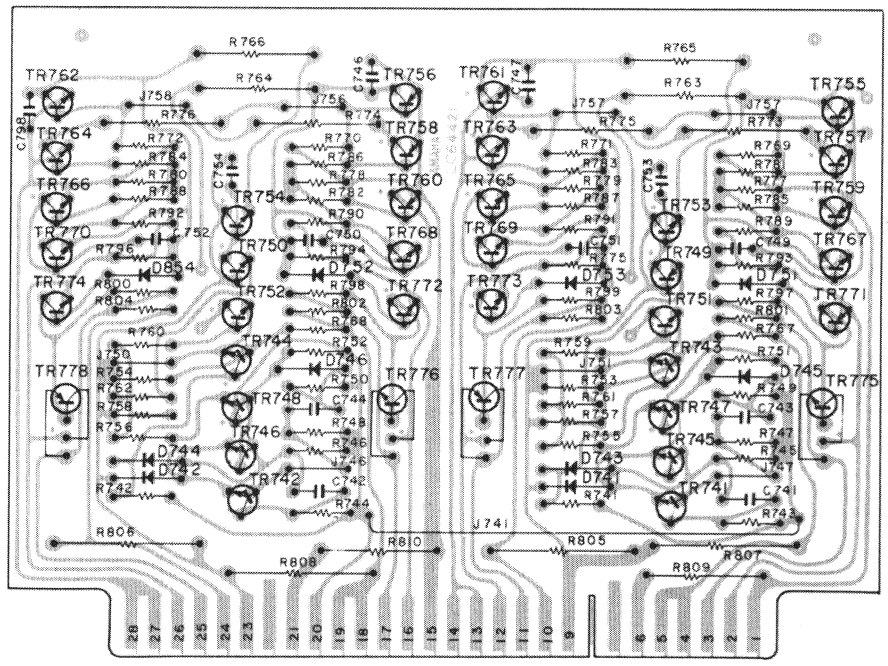


PROTECTOR & POWER SUPPLY CIRCUIT BOARD NO.2



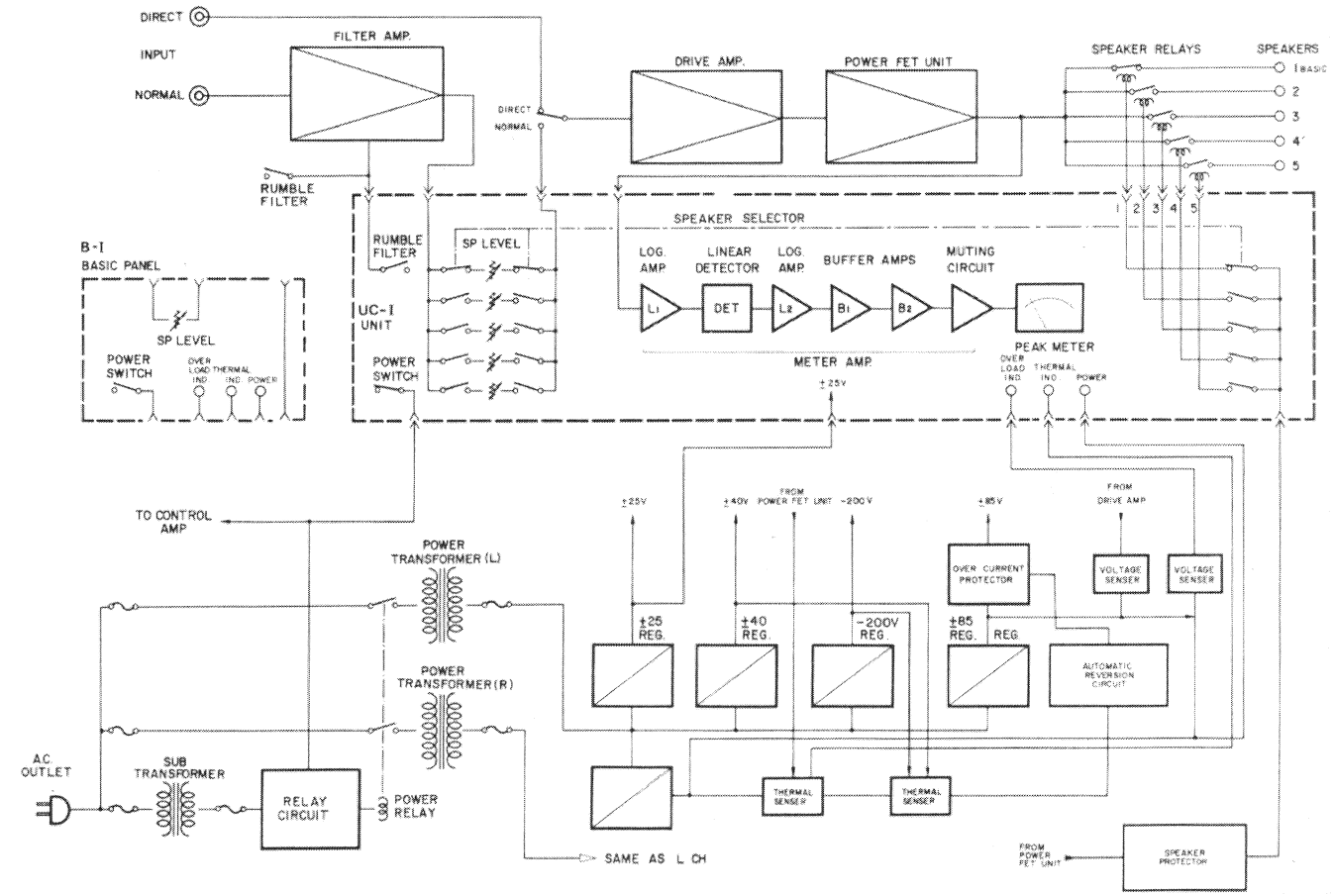


PROTECTOR & POWER SUPPLY CIRCUIT BOARD NO.3



TO POWER FET UNIT TR4 : -B2 (WH)
TO POWER FET UNIT TR4 : -L2 (BE)
TO POWER FET UNIT TR4 : -S2 (GR)
TO POWER FET UNIT TR4 : -BR (WH)
TO GROUND (BL)
TO DRIVER CIRCUIT BOARD (L CH) : +T (OR)
TO PROTECTOR & POWER SUPPLY CIRCUIT BOARD NO.1 : +AB (BE)

(RE) TO POWER FET UNIT TR5 : +BI
(OR) TO POWER FET UNIT TR5 : +LI
(YE) TO POWER FET UNIT TR5 : +SI
(RE) TO POWER FET UNIT TR5 : +BL
(OR) TO DRIVER CIRCUIT BOARD : +T
(BL) TO GROUND
(WH) TO POWER FET UNIT TR3 -BL
(GR) TO POWER FET UNIT TR3 -SI
(BE) TO POWER FET UNIT TR3 -LI
(WH) TO POWER FET UNIT TR3 -BI
(RE) TO POWER FET UNIT TR6 +B2
(OR) TO POWER FET UNIT TR6 +L2
(YE) TO POWER FET UNIT TR6 +S2
(RE) TO POWER FET UNIT TR6 +BR



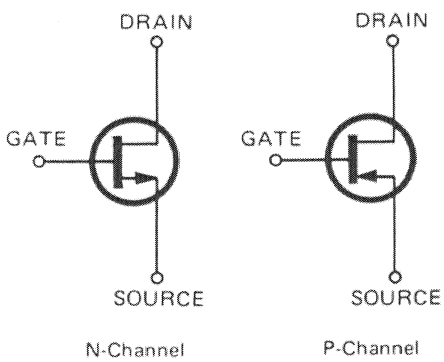


Fig. 36. Schematic Symbols for N- and P-channel FETs

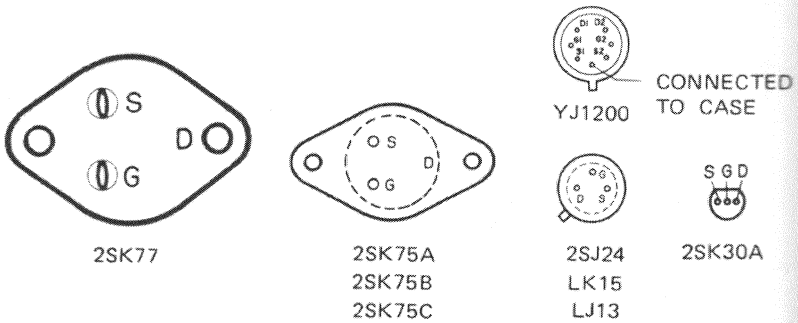


Fig. 37. FET Lead Identification

• RESISTOR

SYMBOL	PART NAME
○—∿∿—○	FUSE RESISTOR
△	METALIZED OXIDATION RESISTOR
□	CEMENT RESISTOR
NO MARK	CARBON RESISTOR
⊠	CEMENT MOLDED RESISTOR
▲	METALIZED FILM RESISTOR

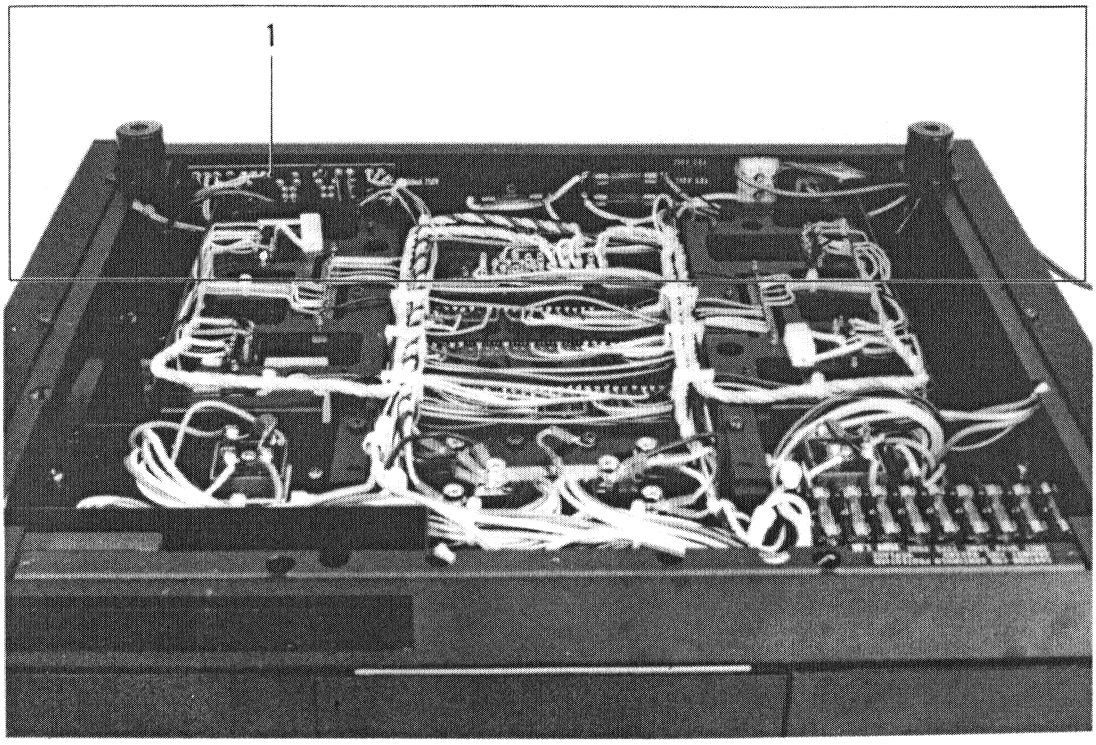
• CAPACITOR

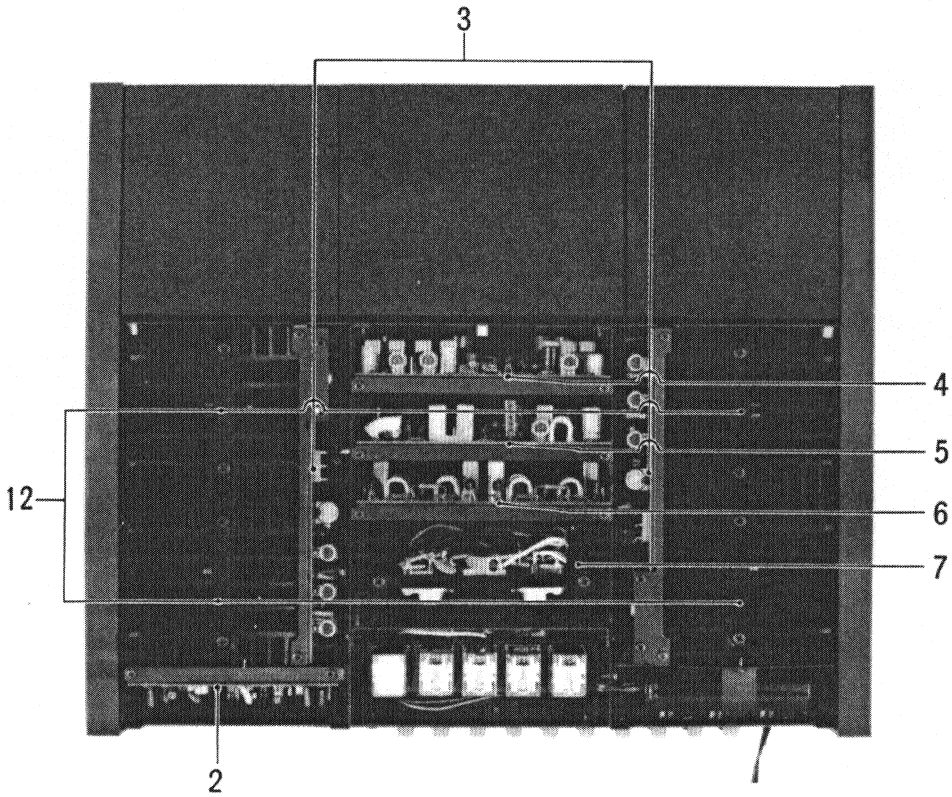
SYMBOL	PART NAME	REMARKS
◎	MYLAR CAPACITOR	⊣⊢
NO MARK	CERAMIC CAPACITOR	
○	POLYSTYRENE CAPACITOR	
NO MARK	(BI-POLAR) ELECTROLYTIC CAPACITOR	⊣⊢
●	LOW-NOISE ELECTROLYTIC CAPACITOR	
⊗	TANTALUM CAPACITOR	

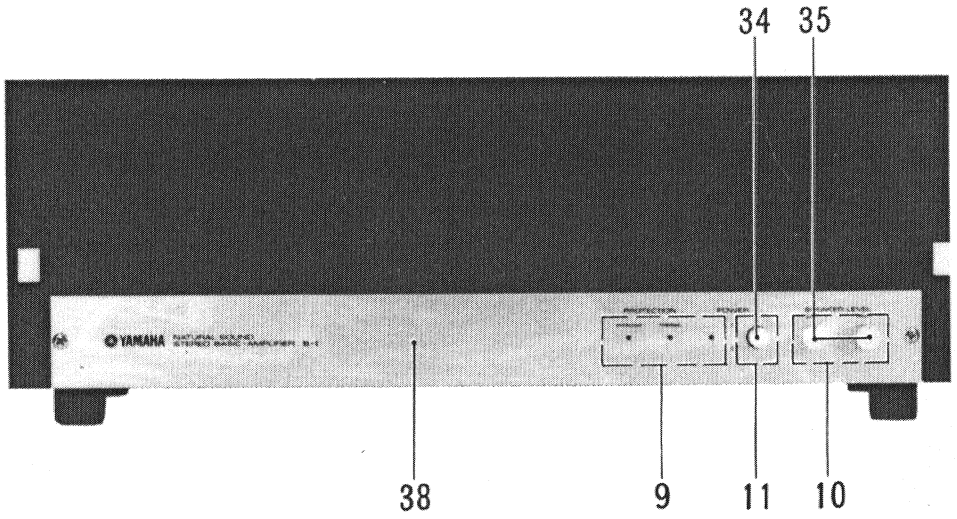
• WIRE COLOR ABBREVIATIONS

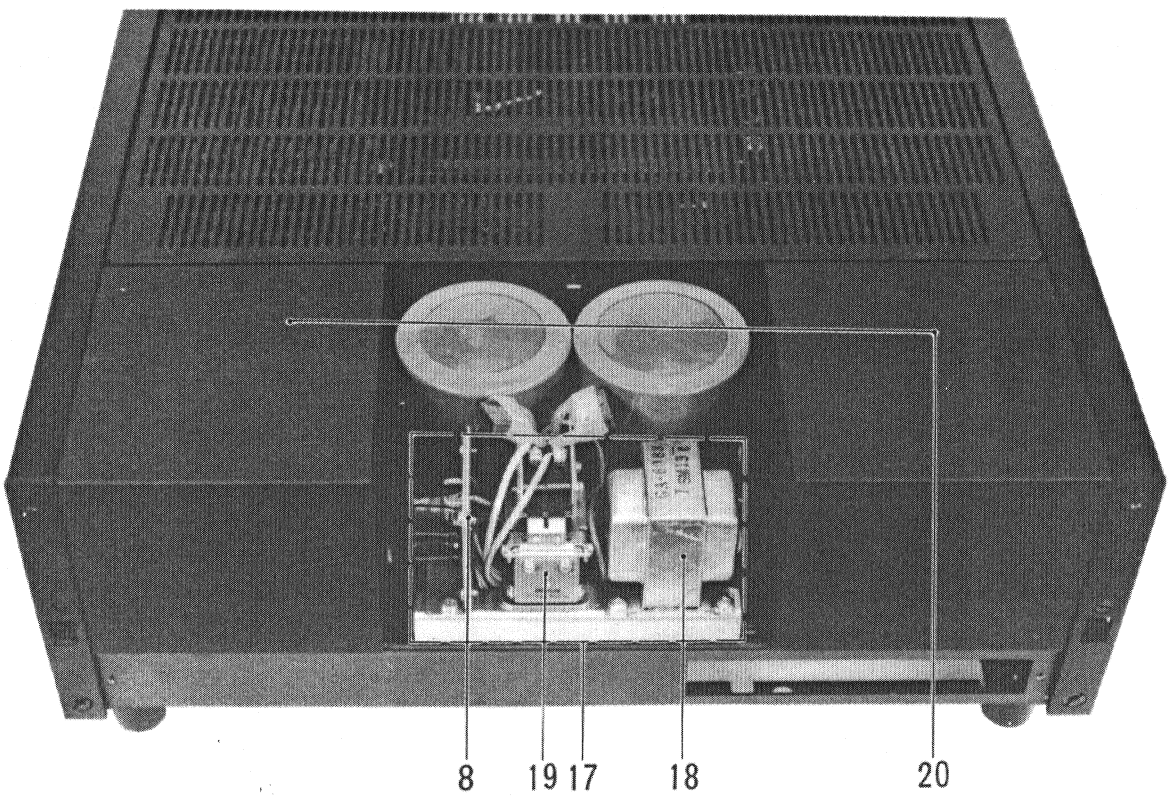
BL ▶	Black	VI ▶	Violet
BR ▶	Brown	GY ▶	Gray
RE ▶	Red	WH ▶	White
OR ▶	Orange	GG ▶	Light Green
YE ▶	Yellow	SB ▶	Light Blue
GR ▶	Green	PK ▶	Pink
BE ▶	Blue		

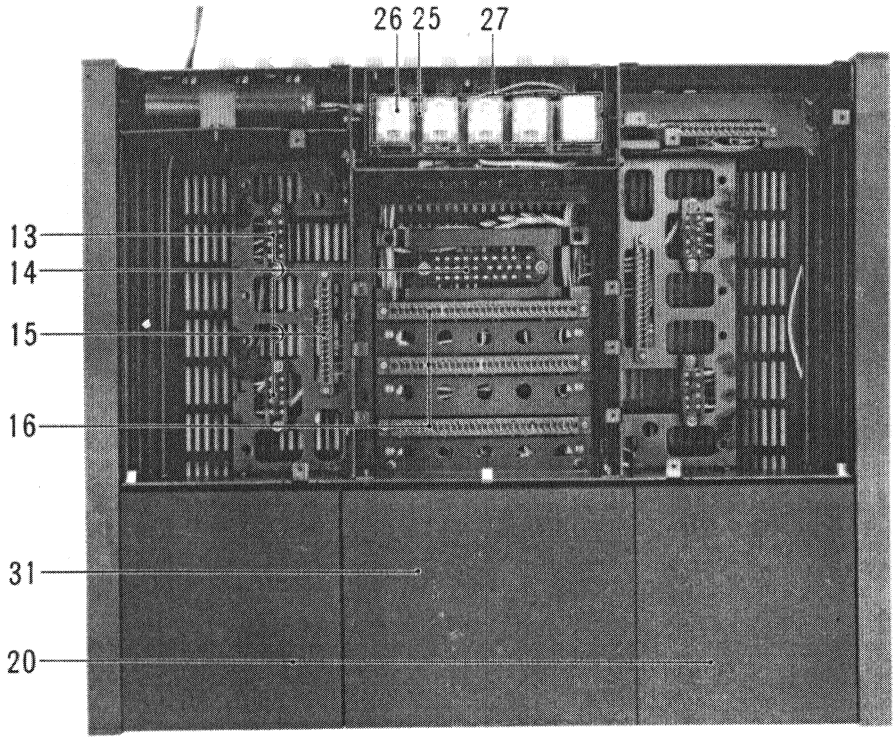
PARTS LIST

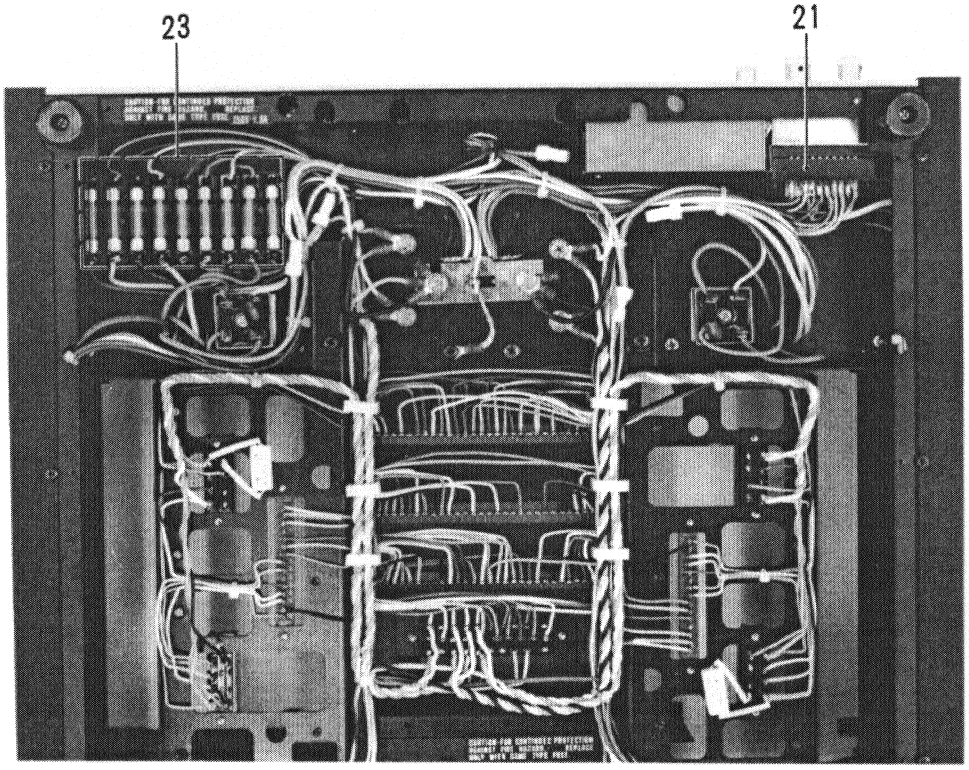


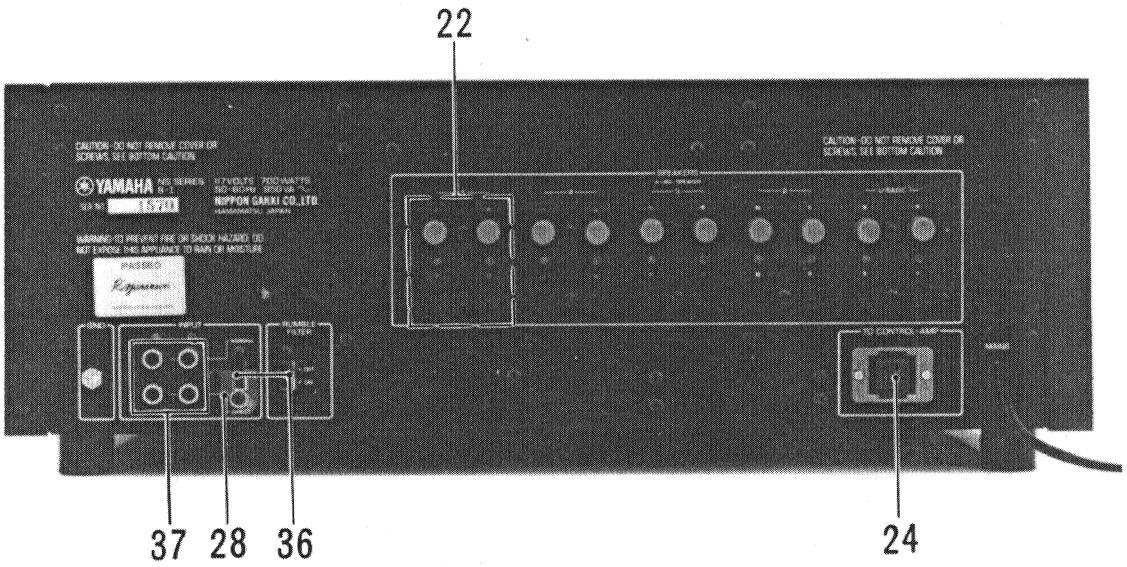


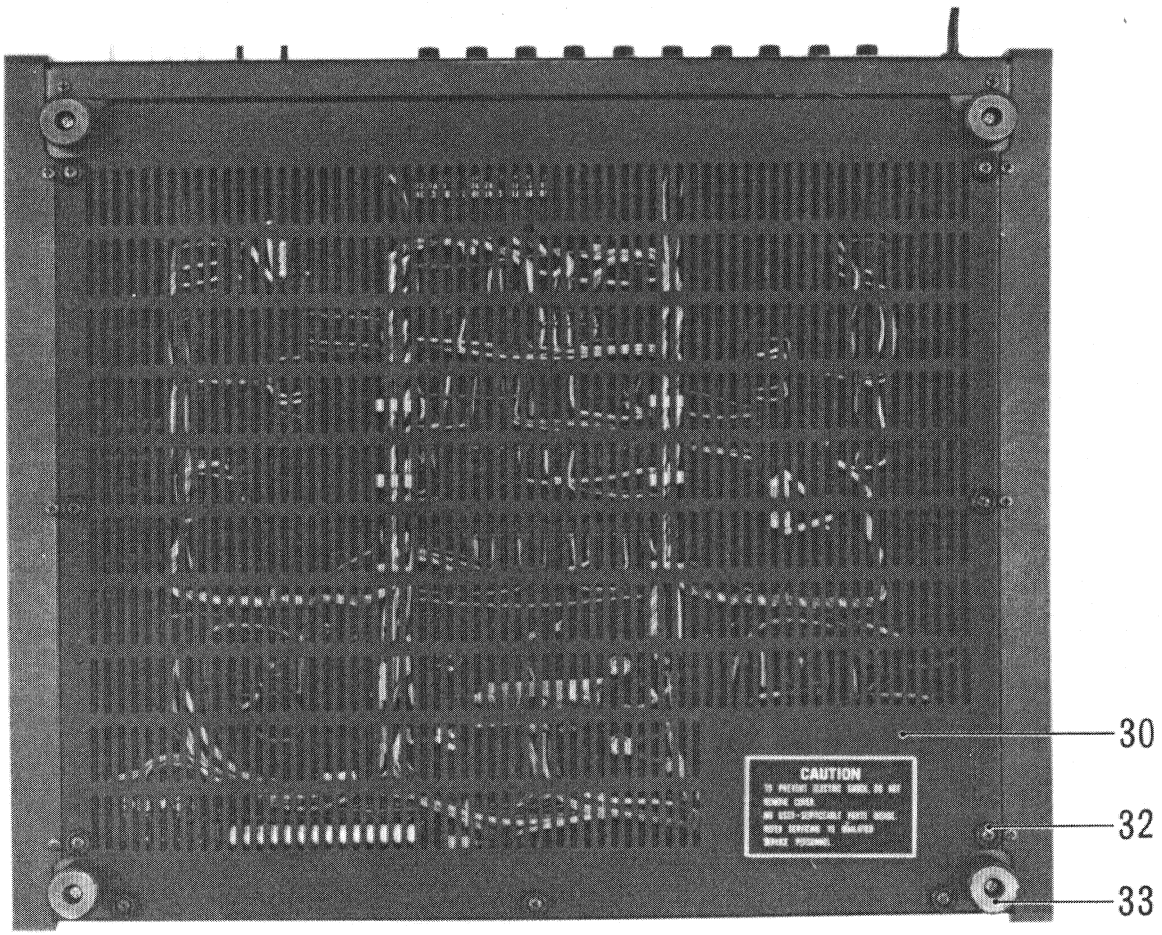









22
37
28
36
24


30
32
33

Ref. No.	Part No.	Description		Remarks	Common Models	
Circuit Boards & Ckt. B. Component-parts						
1	32 00 00 NA 06 66 30	Input Circuit Board #64361	入力シート			
	42 00 00 FM 11 62 20	Bi-polar Electrolytic Capacitor 2.2μF/50V	バイポーラケシコン			
36	42 00 00 KA 40 02 10	Slide Switch SSB-02242	スライドスイッチ	Input & Filter Ckt. B.		
37	42 00 00 LB 40 02 10	4P Pin Jack SMK for P.Ckt.	4Pピンジャック			
2	32 00 00 NA 06 66 50	Filter Circuit Board #64381	フィルターシート			
	42 00 00 HL 32 61 00	Metal Oxide Resistor 1KΩ 2W	酸金抵抗			
	42 00 00 HU 47 53 00	Metal Film Resistor 300Ω ± 1%	金属被膜抵抗(F)			
	42 00 00 TA 07 63 00	Transistor 2SA763	トランジスター			
	42 0 00 TC 04 58 90	—do.— 2SC458	〃			
	32 00 00 TE 20 01 00	FET LJ-13	FET			
	32 00 00 TE 10 02 10	—do.— YJ-1200B	FET選別品			
	32 00 00 TE 30 02 10	—do.— 2SK-75C	〃			
	42 00 00 TF 00 00 40	Diode IS1555	ダイオード			
	42 00 00 TH 00 00 60	—do.— IS1885	〃	Substitution part	10D-4	
	42 00 00 KC 00 01 90	Relay NF-4 DC-12V	リレー	Filter		
	32 00 00 AA 07 84 30	Filter Circuit Board Holder	フィルターシートホルダー			
	42 00 00 FM 10 81 00	Bi-polar Electrolytic Capacitor 100μF/63V	バイポーラケミコン			
	42 00 00 FM 11 62 20	—do.— 2.2μF/50V	〃			
3	32 00 00 NA 06 66 60	Drive Circuit Board #64391	ドライブシート			
	42 00 00 FH 61 05 00	Ceramic Capacitor 5pF 500V	セラコン			
	42 00 00 FH 62 11 00	—do.— 10pF 500V	〃			
	42 00 00 FH 61 21 00	—do.— 100pF 500V	〃			
	42 00 00 HL 41 76 80	Metal Oxide Resistor 68KΩ 1W	酸金抵抗			
	42 00 00 HL 41 71 80	—do.— 18KΩ 1W	〃			
	42 00 00 HL 41 78 20	—do.— 82KΩ 1W	〃			
	42 00 00 HL 42 63 90	—do.— 3.9KΩ 2W	〃			
	42 00 00 HL 42 73 90	—do.— 39KΩ 2W	〃			
	42 00 00 HU 47 53 60	Metal Film Resistor 360Ω ± 1%	金属被膜抵抗(F)			
	42 00 00 HU 47 64 70	—do.— 4.7KΩ ± 1%	〃			
	42 00 00 HU 47 71 50	—do.— 15KΩ ± 1%	〃			
	42 00 00 HU 47 73 30	—do.— 33KΩ ± 1%	〃			
	42 00 00 HY 00 02 60	Variable Resistor λ-13S 1KΩ	ポテンショメーター			
	42 00 00 HY 00 02 20	—do.— CR-31R B-4.7KΩ	メタルグレーズVR			
	42 00 00 HY 00 02 30	—do.— 22KΩ	〃			

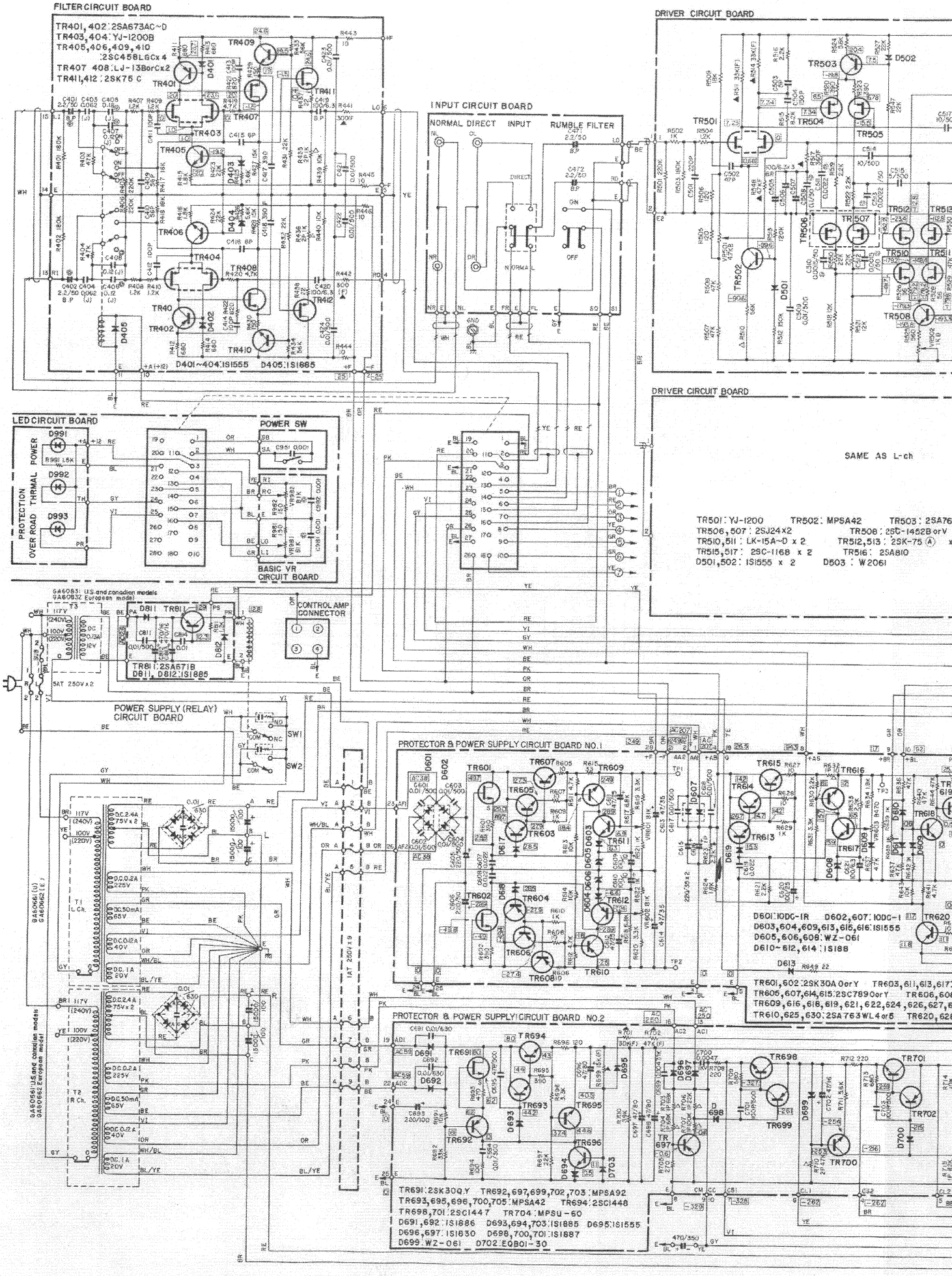
Ref. No.	Part No.	Description			Remarks	Common Models	
	42 00 00 ↓Z 00 00 70	Transistor	MPS A92	トランジスター			
	42 00 00 ↓Z 00 00 80	—do.—	MPS A42	〃			
	42 00 00 ↓Z 00 00 90	—do.—	MPS U60	〃	※ 2SJ-24A (FET)		
	42 00 00 ↓A 07 63 00	—do.—	2SA763	〃			
	42 00 00 ↓A 08 10 00	—do.—	2SA810	〃			
	42 00 00 ↓C 11 68 00	—do.—	2SC1168	〃			
	42 00 00 ↓C 14 52 00	—do.—	2SC1452	〃			
	32 00 00 ↓E 40 01 00	FET	2SJ-24A	FET			
	32 00 00 ↓E 10 02 10	Dual FET	YJ-1200B	デュアルFET			
	32 00 00 ↓E 10 01 00	FET	LK-15	FET			
	32 00 00 ↓E 20 01 10	—do.—	LJ-13	〃			
	32 00 00 ↓E 30 02 00	—do.—	2SK-75B	〃			
	32 00 00 ↓E 30 02 20	—do.—	2SK-75A	〃			
	42 00 00 ↓F 00 03 20	Zener Diode	WZ-061	ツェナーダイオード			
	42 00 00 ↓F 00 00 40	Diode	IS1555	ダイオード			
	32 00 00 BA 06 63 30	Heat Sink on Drive C.B.		ドライブラジエター			
	32 00 00 AA 07 84 20	Drive Circuit Board Holder		ドライブシートホルダー			
	42 00 00 LB 30 03 00	Connector	5036-A6	コネクトコンウェハー			
	42 00 00 ↓L 00 03 40	Insulation Spacer for Transistor	YD-20C	絶縁ブッシュ			
	42 00 00 ↓L 00 00 70	Insulation Base for Transistor	AC203	ベース			
	32 00 00 BA 00 68 60	Head Sink for FET 2SJ-24A		放熱器			
	32 00 00 NA 06 66 40	Output Circuit Board	#64372	出力シート			
	42 00 00 FZ 00 02 20	Ceramic Capacitor	0.22μF/500V	セラコン			
	42 00 00 GD 90 01 20	Air Core Coil	3μH	空芯コイル			
	42 00 00 HM 55 42 20	Cement Resistor	22Ω 5W	セメント抵抗			
4	32 00 00 NA 06 66 70	Power Supply No. 1 Circuit Board	#66060	電源シート No.1			
	42 00 00 EM 10 81 00	Bi-Polar Electrolytic Capacitor	100μF/63V	バイポーラケシコン			
	42 00 00 EM 11 61 00	—do.—	1μF/50V	〃			
	42 00 00 HL 41 41 00	Metal Oxide Resistor	10Ω 1W	酸金抵抗			
	42 00 00 HL 31 62 20	—do.—	2.2KΩ 1W	〃			
	42 00 00 HU 47 64 70	Metal Film Resistor	4.7KΩ ±1%	金属被膜抵抗			
	42 00 00 HU 47 65 60	—do.—	5.6KΩ ±1%	〃			
	42 00 00 HU 47 66 80	—do.—	6.8KΩ ±1%	〃			
	42 00 00 HU 47 73 00	—do.—	30KΩ ±1%	〃			
	42 00 00 HY 00 02 40	Variable Resistor CR-31R	B-470Ω	メタルグレースVR			
	42 00 00 HY 00 02 50	—do.—	B-1KΩ	〃			
	42 00 00 ↓A 05 89 10	Transistor	2SA489	トランジスター			
	42 00 00 ↓A 05 61 20	—do.—	2SA561	〃			
	42 00 00 ↓A 07 63 00	—do.—	2SA763	〃			
	42 00 00 ↓A 07 77 30	—do.—	2SA777	〃			
	42 00 00 ↓C 04 90 90	—do.—	2SC458	〃			

Ref. No.	Part No.	Description			Remarks	Common Models	
	42 00 00 ‡C 07 34 20	Transistor	2SC734	〃			
	42 00 00 ‡C 07 89 10	—do.—	2SC789	〃			
	42 00 00 ‡E 00 00 10	FET	2SK30AY	F E T			
	42 00 00 ‡H 00 00 60	Diode	IS1885	ダイオード	Substitution part	10D-4	
	42 00 00 ‡H 00 00 40	—do.—	IS1555	〃			
	42 00 00 ‡H 00 03 30	—do.—	IS188FM	〃			
	42 00 00 ‡H 00 01 40	—do.—	10DC-1	〃	Substitution part	10DC-4	
	42 00 00 ‡H 00 01 50	—do.—	10DC-1R	〃	—do.—	10DC-4R	
	42 00 00 ‡F 00 03 20	Zener Diode	WZ-061	ツェナーダイオード			
	32 00 00 BA 06 27 60	Heat Sink for Transistor		放熱板			
	32 00 00 AA 07 84 10	Power Supply No. 1 C.B. Holder		電源シートホルダー			
5	32 00 00 NA 06 66 80	Power Supply No. 2 Circuit Board #66070		電源シート No. 2			
	42 00 00 FZ 00 06 50	Metalized Film Capacitor	0.01μF 630V	メタライズドフィルムコンデンサ			
	42 00 00 FZ 00 06 60	—do.—	0.0047μF/1KV	〃			
	42 00 00 FH 61 14 70	Ceramic Capacitor	47pF/500V	セラコン			
	42 00 00 FH 61 21 00	—do.—	100pF/500V	〃			
	42 00 00 FH 23 41 00	—do.—	0.01μF/500V	〃			
	42 00 00 FM 26 71 00	Electrolytic Capacitor	10μF/250V	ケミコンタテ			
	42 00 00 FK 29 82 20	—do.—	220μF/100V	〃 ヨコ			
	42 00 00 FM 21 74 70	—do.—	47μF/350V	〃 〃			
	42 00 00 HL 41 72 20	Metal Oxide Resistor	22KΩ 1W	酸金抵抗			
	42 00 00 HL 41 76 80	—do.—	68KΩ 1W	〃			
	42 00 00 HL 41 78 20	—do.—	82KΩ 1W	〃			
	42 00 00 HL 41 81 00	—do.—	100KΩ 1W	〃			
	42 00 00 HL 42 52 20	—do.—	220Ω 2W	〃			
	42 00 00 HL 42 74 70	—do.—	47KΩ 2W	〃			
	42 00 00 HL 42 73 30	—do.—	33KΩ 2W	〃			
	42 00 00 HU 47 71 50	Metal Film Resistor	15KΩ ± 1%	金属被膜抵抗			
	42 00 00 HU 47 73 00	—do.—	30KΩ ± 1%	〃			
	42 00 00 HU 47 74 70	—do.—	47KM ± 1%	〃			
	42 00 00 HZ 00 06 70	Metal Oxide Resistor	47KΩ (± 100 PPM/°C)	酸金特殊温度抵抗			
	42 00 00 HY 00 02 10	Variable Resistor CR-31R B-2.2KΩ		メタルグレースVR			
	42 00 00 ‡Z 00 00 90	Transistor	MPSU-60	トランジスター			
	42 00 00 ‡Z 00 00 70	—do.—	MPSA-92	〃			
	42 00 00 ‡Z 00 00 80	—do.—	MPSA-42	〃			
	42 00 00 ‡C 14 47 00	—do.—	2SC1447	〃			
	42 00 00 ‡C 14 48 00	—do.—	2SC1448	〃			
	42 00 0 ‡E 00 00 10	FET	2SK30AY	F E T			
	42 00 00 ‡H 00 00 60	Diode	IS1885	ダイオード	Substitution part	10D-4	
	42 00 00 ‡H 00 00 60	—do.—	IS1886	〃	—do.—	—do.—	
	42 00 00 ‡H 00 00 60	—do.—	IS1887	〃	—do.—	—do.—	
	42 00 00 ‡H 00 04 00	—do.—	IS1830	〃	—do.—	10D-10	

Ref. No.	Part No.	Description			Remarks	Common Models	
	42 00 00 iF 00 00 40	Diode	IS1555	ダイオード			
	42 00 00 iF 00 03 20	Zener Diode	WZ-061	ツェナーダイオード			
	42 00 00 iF 00 05 00	—do.—	EQB-01-30	〃			
	32 00 00 BA 06 27 60	Heat Sink for Transistor					
	32 00 00 AA 07 84 10	Power Supply No. 2 C.B. Holder		電源シートNo.2ホルダー			
	42 00 00 LB 30 03 00	Connector	5036-A6	コネクトコンウエハー			
6	32 00 00 NA 06 66 90	Power Supply No. 3 Circuit Board #64421		電源シート No. 3			
	42 00 00 HL 41 72 20	Metal Oxide Resistor	22KΩ 1W	酸金抵抗			
	42 00 00 HL 41 76 80	—do.—	68KΩ 1W	〃			
	42 00 00 HL 41 78 20	—do.—	82KΩ 1W	〃			
	42 00 00 HL 42 71 00	—do.—	10KΩ 2W	〃			
	42 00 00 FH 61 11 00	Ceramic Capacitor	10pF 500V	セラコン			
	42 00 00 FH 11 52 70	Mylar Capacitor	0.27μF 50V				
	42 00 00 iH 00 00 60	Diode	IS1885	ダイオード	Substitution part	10D-4	
	42 00 00 iF 00 03 30	—do.—	IS188FM	ダイオード			
	42 00 00 iF 00 00 40	—do.—	IS1555	〃			
	42 00 00 iC 04 58 90	Transistor	2SC458	トランジスター			
	42 00 00 iC 14 39 00	—do.—	2SC1439	〃			
	42 00 00 iC 14 48 00	—do.—	2SC1448	〃			
	42 00 00 iA 08 58 00	—do.—	2SA858	〃			
	42 00 00 iA 07 40 00	—do.—	2SA740	〃			
7	32 00 00 BA 06 27 60	Heat Sink for Transistor		放熱板			
	32 00 00 AA 07 84 10	Power Supply No. 3 C. B. Holder		電源シートNo. 3ホルダー			
8	32 00 00 NA 06 67 00	A.C. Power Supply (Relay) Circuti Board #64430		リレー用電源シート			
	42 00 00 iA 04 89 10	Transistor	2SA489	トランジスター			
	iH 00 02 40	Diode	IS1885	ダイオード	Servicing 401000iH000060		
9	32 00 00 NA 06 67 10	LED Circuit Board #65330		LED シート			
	42 00 00 iF 00 04 90	Light Emitting Diode SLP-119B		LED			
10	32 00 00 NA 06 65 80	Basic VR Circuit Board # 64130		ベーシックVRシート			
	42 00 00 HT 31 00 60	Variable Resistor EVS-00AS15E13 B-1KΩ		ソリッドVR			

Ref. No.	Part No.	Description		Remarks	Common Models	
11	32 00 00 NA 06 65 90	Power Switch Circuit Board # 64140	パワースイッチシート			
	32 00 00 ıE 30 01 00	V-FET 2SK-77	V－F E T			
	42 00 00 ıL 00 03 00	Insulation Base for FET MD-18/M	マイカベース			
	42 00 00 ıL 00 03 10	Insulation Bushing for FET	絶縁ブッシュ			
	42 00 00 KA 00 00 10	Thermostat kilicon 20702 100°C	サーモスタット			
	42 00 00 HM 55 22 20	Cement Resistor 0.22Ω ± 10% 5W	セメント抵抗			
	42 00 00 LB 60 08 50	Multi-Connector Plug P-8	10型マルチコネクタ・プラグ			
	42 00 00 FZ 00 02 20	Ceramic Capacitor 0.022μF/500V	セラコン			
	42 00 00 HM 55 64 70	Cement Resistor 4.7KΩ ± 10% 5W	セメント抵抗			
12	42 00 00 BA 06 62 40	Main Heat Sink for V-FET	メインラジェター			
	42 00 00 ıC 11 16 10	Transistor 2SC1116A	トランジスター			
	42 00 00 ıA 07 47 10	—do.— 2SA747	〃			
	42 00 00 ıC 15 77 00	—do.— 2SC1577	〃			
	42 00 00 LB 30 02 70	Transistor Socket TO-3	トランジスターソケット			
	42 00 00 ıL 00 03 20	Insulation Base for Transistor 4A01205	マイカーベース			
	42 00 00 HZ 00 06 60	Metal Clad Resistor 0.2Ω ± 10% RE65G	メタルクラッド抵抗			
	42 00 00 LB 60 08 70	Multi-Connector Plug P-30	10型マルチコネクタープラグ			
	42 00 00 FZ 00 02 00	Electrolytic Capacitor 15,000μF/100WV x 2	ラグ型電界コン			
	42 00 00 FZ 00 02 10	—do.— 470μF/350WV	〃			
	42 00 00 ıH 00 03 90	Rectification Diode (Bridge Connection)	ダイオードスタック			
	42 00 00 FZ 00 06 50	Metalized Film Capacitor 0.01μF/630V	メタライズドコンデンサ			
13	42 00 00 LB 60 08 40	Multi-Connector Socket 8P	マルチコネクターソケット			
14	42 00 00 LB 60 08 60	—do.— 30P	〃			
15	42 00 00 LB 60 12 10	P.C.B. Connector 15P	PCBコネクター			
16	42 00 00 LB 60 12 20	—do.— 28P	〃	Attached Prohibition Pin		
	42 00 00 LB 60 11 30	Fuse Holder	フューズホルダー	U.S. and Canadian models		
	42 00 00 LB 60 11 40	—do.—	〃	European model		
	42 00 00 KB 00 10 20	UL Listed Fuse SS-2 1A 250V	UL ヒューズ	U.S. and Canadian models		
	42 00 00 KB 00 07 30	Miniature Fuse 1AT 250V	Ⓢヒューズタイムラブ	European model		
	42 00 00 HM 55 54 70	Cement Resistor 470 5W	セメント抵抗			
17	32 00 00 NB 07 22 55	Sub-Transformer Unit	サブトランスユニット	U.S. and Canadian models		
	32 00 00 NB 07 22 60	—do.—	〃	European model		
18	42 00 00 GA 60 83 10	Power Transformer	電源トランス	U.S. and Canadian models		
	42 00 00 GA 60 83 20	—do.—	〃	European model		

Ref. No.	Part No.	Description		Remarks	Common Model	
19	42 00 00 KC 00 02 10	Micro Switch (2V 2A) and Relay (DC12V 320mA)	マイクロスイッチリレー			
	42 00 00 FZ 00 01 10	Spark Killer 0.033μF + 120Ω	スパークキラー	U.S. and Canadian models		
20	42 00 00 GA 60 66 10	Power Transformer	電源トランス	U.S. and Canadian models		
	42 00 00 GA 60 66 20	—do.—	〃	European model		
21	42 00 00 LB 60 08 30	Connector Socket 28P	コネクターソケット			
22	42 00 00 LA 00 14 10	Speaker Terminal	スピーカー端子			
	42 00 00 CB 06 86 30	Cord Stopper SR-3P-4	コードストッパー	U.S. and Canadian models		
	42 00 00 CB 07 06 90	—do.— EA-5	〃	European model		
	42 00 00 LA 00 10 40	3P Connection Terminal	3P中継端子台			
	42 00 00 LB 20 08 40	Fuse Holder 1P	ヒューズホルダー	U.S. and Canadian models		
23	42 00 00 LB 20 05 90	—do.— H. Shurter FEB031-1401	〃	European model		
	42 00 00 KB 00 11 00	UL Listed Fuse SS-2 5A 250V	ULヒューズ	U.S. and Canadian models		
	42 00 00 KB 00 06 90	Miniature Fuse 2.5AT 250V	タイムラグSヒューズ	European model		
24	42 00 00 LB 40 02 00	4P Connector Socket S1304-DB	4Pコネクターソケット			
	42 00 00 LA 00 07 90	Ground Terminal B	アース端子			
25	42 00 00 LB 60 09 10	Socket for Relay PT-08	リレー用ソケット			
26	42 00 00 KC 00 02 20	Relay LY-2-US DC-12V	リレー			
	42 00 00 HH 00 00 60	Diode IS1885	ダイオード	Substitution part	10D-4	
	42 00 00 KB 00 10 10	UL Listed Fuse SS-2 0.5A 250V	ULヒューズ	U.S. and Canadian models		
	42 00 00 KB 00 06 40	Miniature Fuse 250mA 250V	タイムラグSヒューズ	European model		
27	32 00 00 AA 07 83 30	Relay Holder	リレーホルダー			
28	32 00 00 CB 06 86 80	Coupler Stopper	カプラーストッパー			
29	32 00 00 AA 07 83 80	Top Cover	上面カバー			
30	32 00 00 AA 08 04 20	Bottom Cover	底カバー			
31	32 00 00 AA 07 84 00	Cover for Electrolytic Capacitor	ケミコンカバー			
32	42 00 00 CB 07 21 00	Sub-Leg	副脚（ボルトスペーサー）			
33	42 00 00 CB 07 25 10	Main Leg (A)	脚			
34	32 00 00 BA 06 62 20	Button for Push Switch (Power Switch)	プッシュスイッチボタン			
35	32 00 00 BA 06 62 30	Knob for Variable Resistor	VRツマミ			
	42 00 00 TX 90 09 30	Hexagonal Wrench 1.5 mm	六角レンチ			
	42 00 00 MZ 06 18 90	Connection Cord Pin-Pin	接続コード			
11	42 00 00 KA 90 00 60	Switch	ミニキースイッチ			
38	32 00 00 BA 06 62 10	Basic-Amp. Panel	パネル			



B-I SCHEMATIC DIAGRAM