

NIKKO

AMPLIFIER

NA-590II

INTEGRATED AMPLIFIER



TYPE AND VOLTAGE

W-TYPE: UL and CSA type	120V AC
E -TYPE: NK-STD type	220/240V AC
N -TYPE: DEMKO and SEMKO type	
D -TYPE: DIN type	

SERVICE MANUAL

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SPECIFICATIONS

〈W, E & N-TYPE〉

Continuous Power Output per channel, 8 ohms:

20 ~ 20000 Hz: more than 35 Watts

1000 Hz: more than 38 Watts

T. H. Distortion, 8 ohms:

Continuous Power Output no more than 0.05 %

1 Watt Power Output no more than 0.05 %

I. M. Distortion, 8 ohms:

Continuous Power Output no more than 0.04 %

1 Watt Power Output no more than 0.05 %

IHF Power Bandwidth, 8 ohms: 10 ~ 35000 Hz

Damping Factor, 8 ohms (1 kHz): 30

Frequency Response:

PHONO → TAPE OUT (RIAA Equalization)

..... 30 ~ 15000 Hz ± 1 dB

TUNER, AUX, TAPE IN → Speaker terminals

..... 20 ~ 20000 Hz ± 2 dB

Input Sensitivity for 35 Watts Power Output:

PHONO 2.2 mV ± 2 dB

TUNER, AUX, TAPE IN 150 mV ± 2 dB

〈D-TYPE〉 They were measured according to DIN standard.

Continuous Power Output per channel, 4 ohms:

20 ~ 20000 Hz more than 33 Watts

1000 Hz more than 48 Watts

T. H. Distortion, 4 ohms:

Continuous Power Output no more than 0.1 %

1 Watt Power Output no more than 0.06 %

I. M. Distortion, 4 ohms:

Continuous Power Output no more than 0.1 %

1 Watt Power Output no more than 0.06 %

IHF Power Bandwidth, 4 ohms: 10 ~ 35000 Hz

Damping Factor, 4 ohms (1 kHz): 15

Frequency Response:

PHONO → TAPE OUT (RIAA Equalization)

..... 30 ~ 15000 Hz ± 1 dB

TUNER, AUX, TAPE IN → Speaker terminals

..... 20 ~ 20000 Hz ± 2 dB

Input Sensitivity for 53 Watts Power Output:

PHONO 2.0 mV ± 2 dB

TUNER, AUX, TAPE IN 130 mV ± 2 dB

GENERAL

Power Requirement

W-TYPE: AC120V 60 Hz

E, N & D-TYPE: AC220/240V 50 Hz

Power Consumption: 250 Watts

Phono Maximum Input Capability at 1 kHz:

..... more than 127 mV

Output Level at 35 Watts Power Output, (Input: PHONO)

TAPE OUT: 150 mV ± 2 dB

Tone Control:

BASS (70 Hz) Boost +10 dB ± 2 dB

Cut -11 dB ± 2 dB

TREBLE (10 kHz)

Boost +10 dB ± 2 dB

Cut -11 dB ± 2 dB

Loudness Control (Volume control set at -30 dB Position):

70 Hz +11 dB ± 2 dB

10 kHz +6 dB ± 2 dB

Signal to Noise Ratio: IHF "A" Network;

PHONO better than 75 dB

TUNER, AUX, TAPE IN better than 90 dB

Idling Current: 7 ~ 60 mA

Midpoint Voltage: 0V ± 50 mV

Phono Maximum Input Capability at 1 kHz:

..... more than 127 mV

Output Level at 53 Watts Power Output, (Input: PHONO)

TAPE OUT (DIN): 11 mV ± 2 dB

Tone Control:

BASS (70 Hz) Boost +10 dB ± 2 dB

Cut -11 dB ± 2 dB

TREBLE (10 kHz)

Boost +10 dB ± 2 dB

Cut -11 dB ± 2 dB

Loudness Control (Volume control set at -30 dB Position):

70 Hz +11 dB ± 2 dB

10 kHz +6 dB ± 2 dB

Signal to Noise Ratio: DIN Filter;

PHONO better than 48 dB

TUNER, AUX, TAPE IN better than 48 dB

Idling Current: 7 ~ 60 mA

Midpoint Voltage: 0V ± 50 mV

Dimensions (Width): 420 mm (16 1/2 inches)

(Height): 96 mm (3 5/8 inches)

(Depth): 335 mm (13 1/4 inches)

Weight: 8.5 Kg (18.7 lbs)

Specifications are subject to change without notice.

BLOCK DIAGRAM

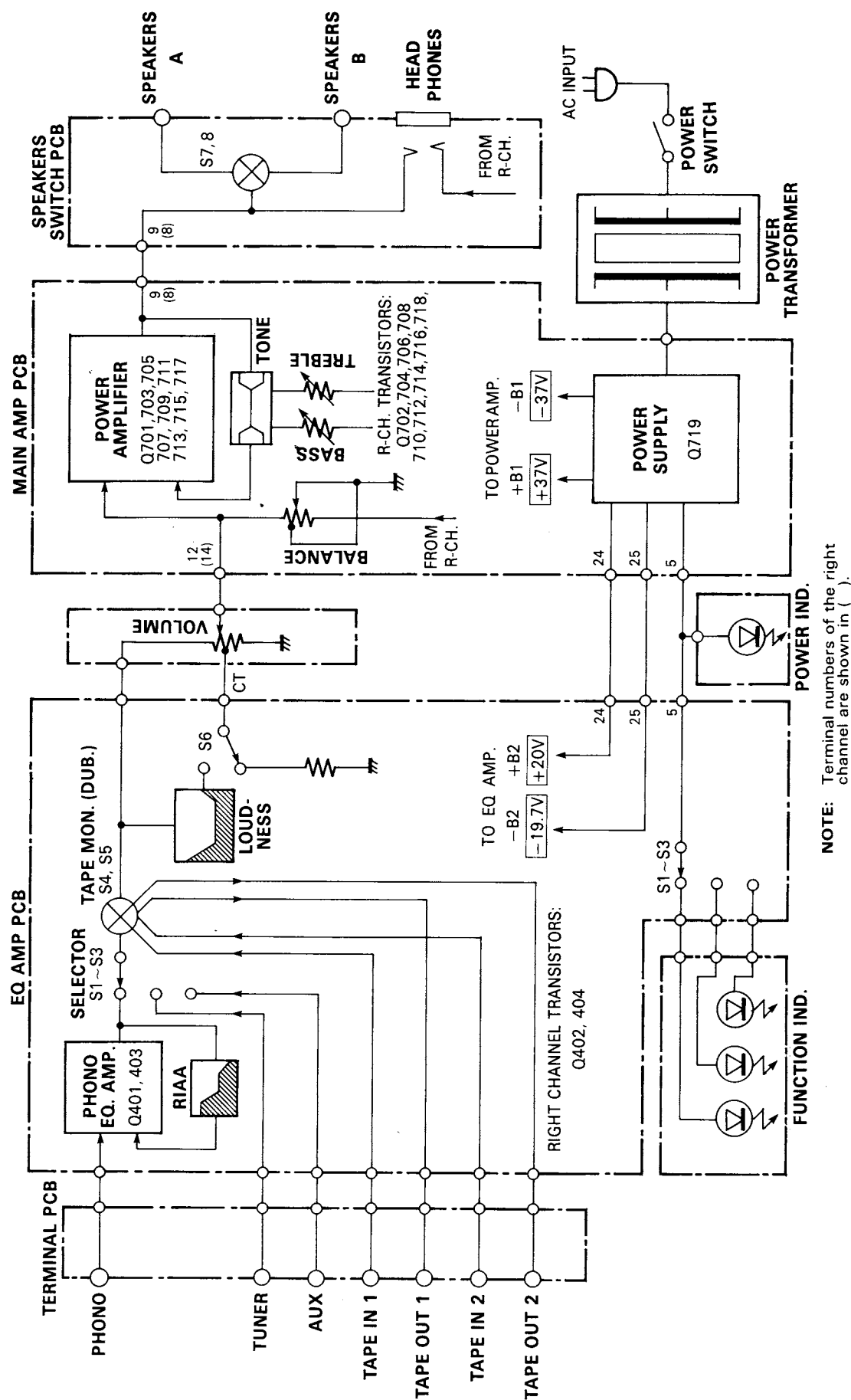


Figure 1

DISASSEMBLY

CABINET COVER REMOVAL

- Remove three tapping screws from the top of the metal cover.
- Remove six screws from both sides of the metal cover.

BOTTOM PLATE REMOVAL

- Remove eight tapping screws (#1 ~ #8) shown in Photo 1.

FRONT PANEL REMOVAL

- Remove two tapping screws (#9, 10) (Photo 1).
- Remove two tapping screws (#1, 2) shown in Photo 2.
- Lift the front panel away from the unit.

POWER TRANSFORMER REMOVAL

- Disconnect all the power transformer cables.
- Remove four screws (#3 ~ #6) shown in Photo 2.
- Lift the power transformer away from the unit.

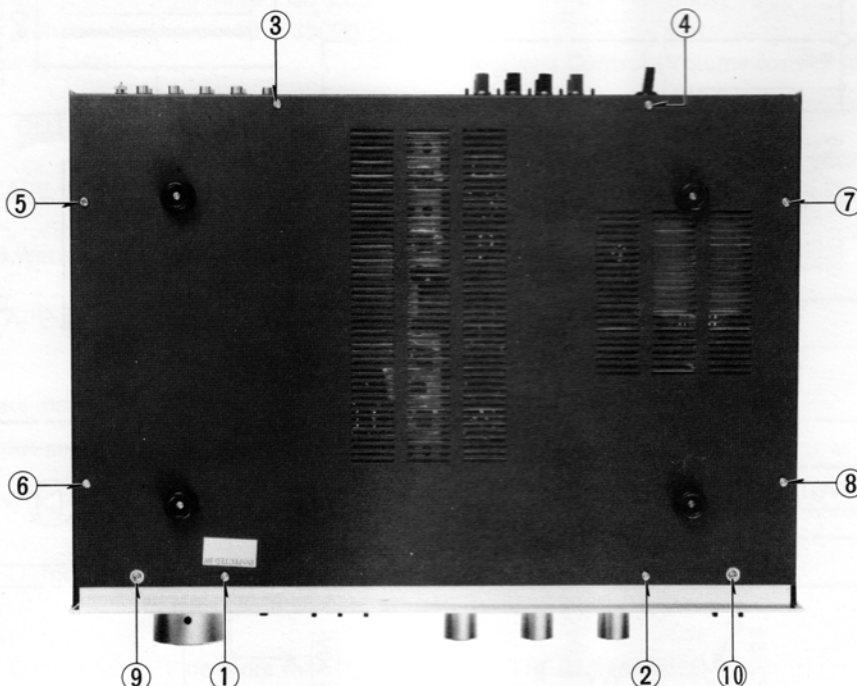


Photo 1

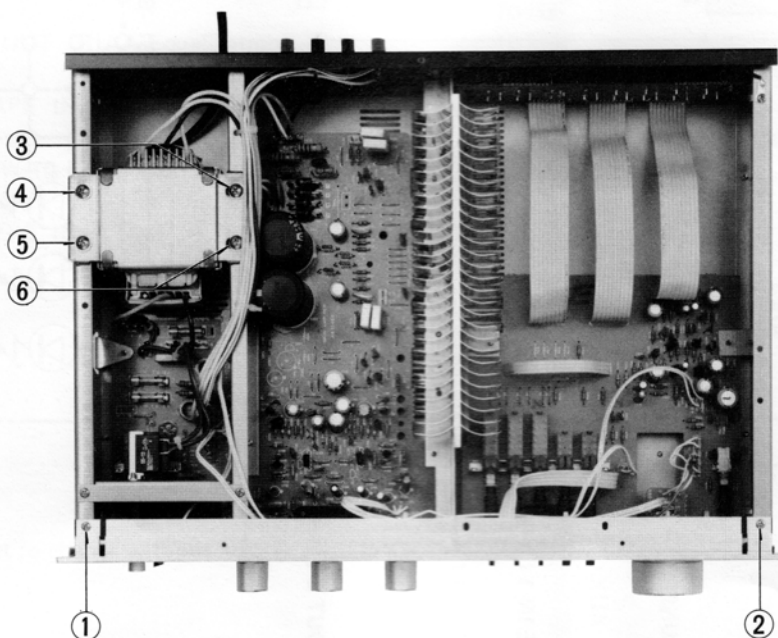


Photo 2

POWER TRANSISTORS MOUNTING ASSEMBLY

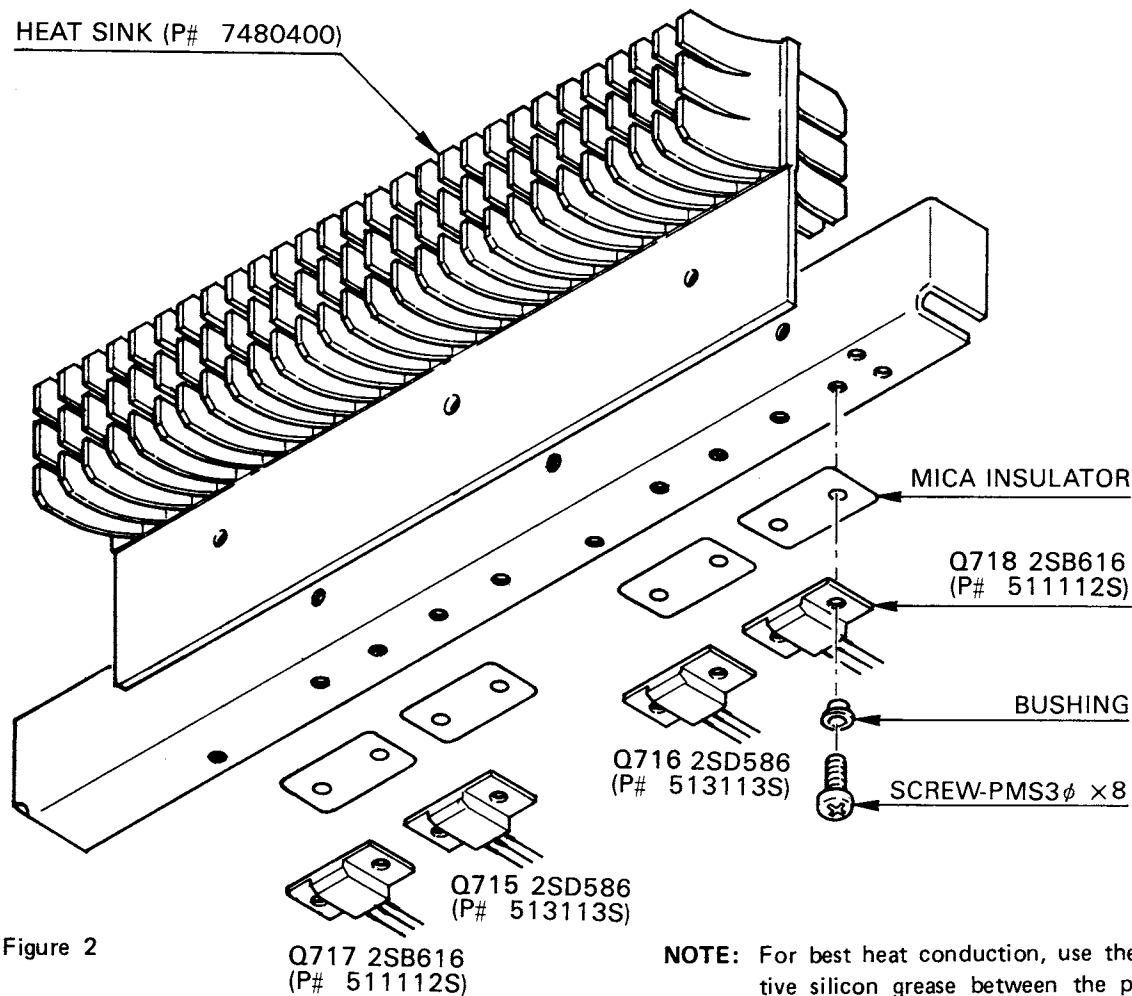


Figure 2

NOTE: For best heat conduction, use thermally conductive silicon grease between the power transistor and the mica insulator and between the insulator and the heat sink.

PRECAUTIONS FOR REPAIR SERVICE

Many of these items are included just as a reminder — they are normal procedures for experienced technicians. Short-cuts can be taken: but, often they cause additional damage to transistors, circuit components or the printed circuit board.

1. **Do not** bridge electrolytic capacitors with AC power. The resultant surges may damage solid state devices.
2. **Do not** bias the base of any transistor while voltage is being applied to its collector.
3. Replacements for output and driver transistors, if necessary, must be made from the same **hfe** group as the original type. Be sure to include this information when ordering replacement transistors.
4. If one output transistor burns out (open or shorts), always remove **all** output transistors in that channel and check the bias adjustment, the control and other parts in the network with an ohmmeter before inserting a new transistor. All output transistors in one channel will be destroyed if the base biasing circuit is open in the emitter end.

ALIGNMENT

IDLING CURRENT ADJUSTMENT

The adjustment done for this model is only for that of the idling current. But since this model does not have any semi-fixed resistors for this adjustment, the adjustment is done by choosing whether the fixed resistor are to short or not.

In the case of exchanging power transistors etc. during service, as the idling current gets too large or too small, the distortion gets large, must thoroughly make certain of the effects after exchange has been made.

1. The high-sensitivity DC voltmeter is connected to the test point on the printed circuit board. (The left channel is connected to the terminals #15 and #16. The positive side is the terminal #15. The right channel is connected to the terminals #17 and #18. The positive side is the terminal #18.)
2. The input signal is not added at all. Simply, the volume is turned counter-clockwise to minimum.
3. The voltage drop occurring in the resistor (R735, R738) connected to the emitter of the power transistor measured by the DC voltmeter is shown. Adjustment is not necessary if this voltage variation remains between 2.4 mV and 9.9 mV.
4. In the case when the voltage variation is greater than this range, the jumper wire which shorts the resistors R729 and R730 must be cut. (Refer to PC BOARD on page 8 and 9.)

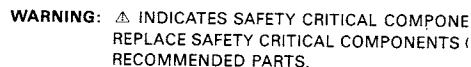
In the case when the jumper wire has already been cut or the voltage does not come in range even though the jumper wire has been cut, there might be some other influences which need to be taken account of. But if the variation is less than 19.8 mV and no other defects are found, no further modifications are necessary.

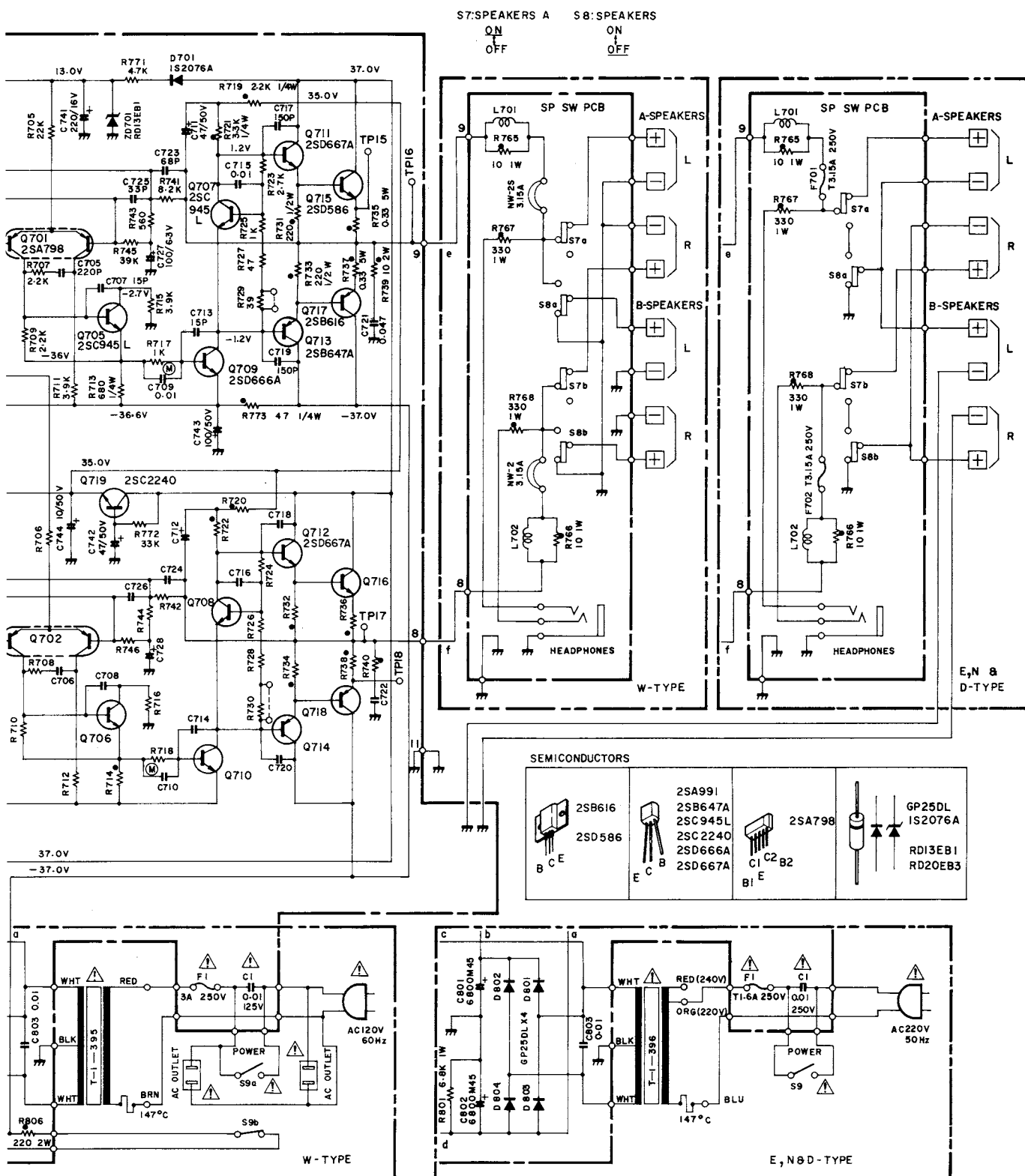
5. In the case when the voltage variation is lower than the applicable range, for most cases it can be said that the jumper wire, which shorts the resistors R729 and R730, must have already been cut.

So again, a short jumper wire is connected to the printed circuit board to short the resistors. In the case when the jumper wire has not already been cut from the beginning or the variation is not in the range even though the jumper wire is connected, it must be though that some other defects exist.

NOTE: Until the power transistor and the neighboring radiators reach a certain temperature, the idling current changes little by little and takes at least 5 minutes to settle. Therefore, when adjusting the idling current, have to wait for a while after turning on the power switch of the amplifier till everything gets stable before start to make adjustments.

*MARKED RESISTORS AND
A DIN JACK ARE DELETED
FOR W-TYPE



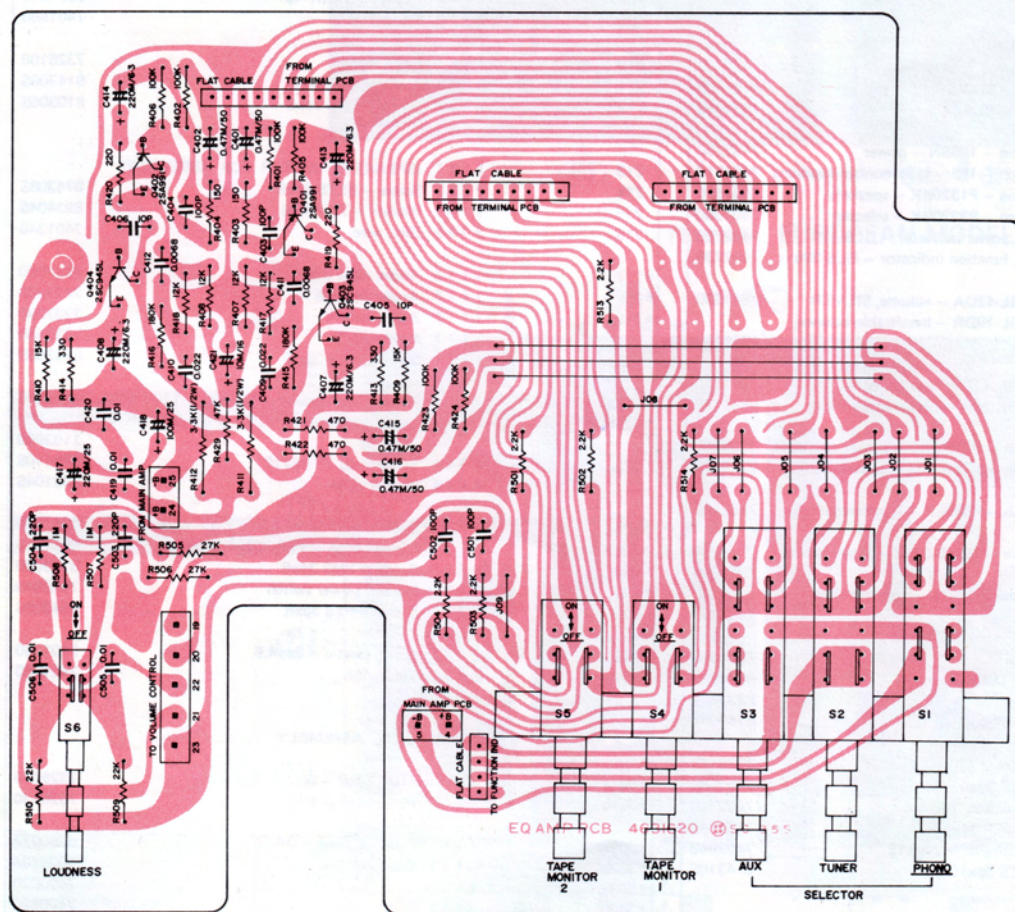


NTS FOR CONTINUED SAFETY.
ONLY WITH MANUFACTURER'S

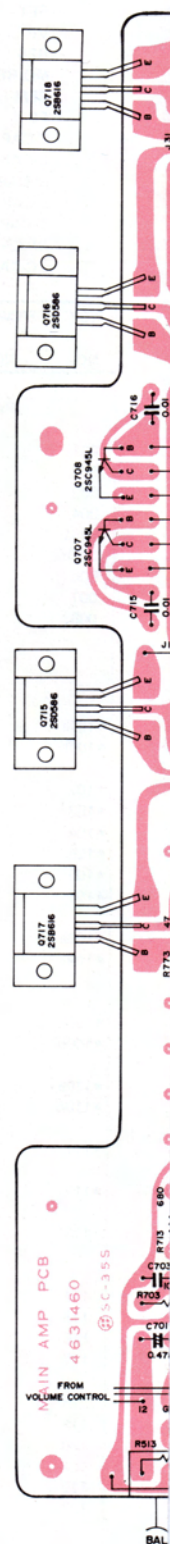
Figure 3

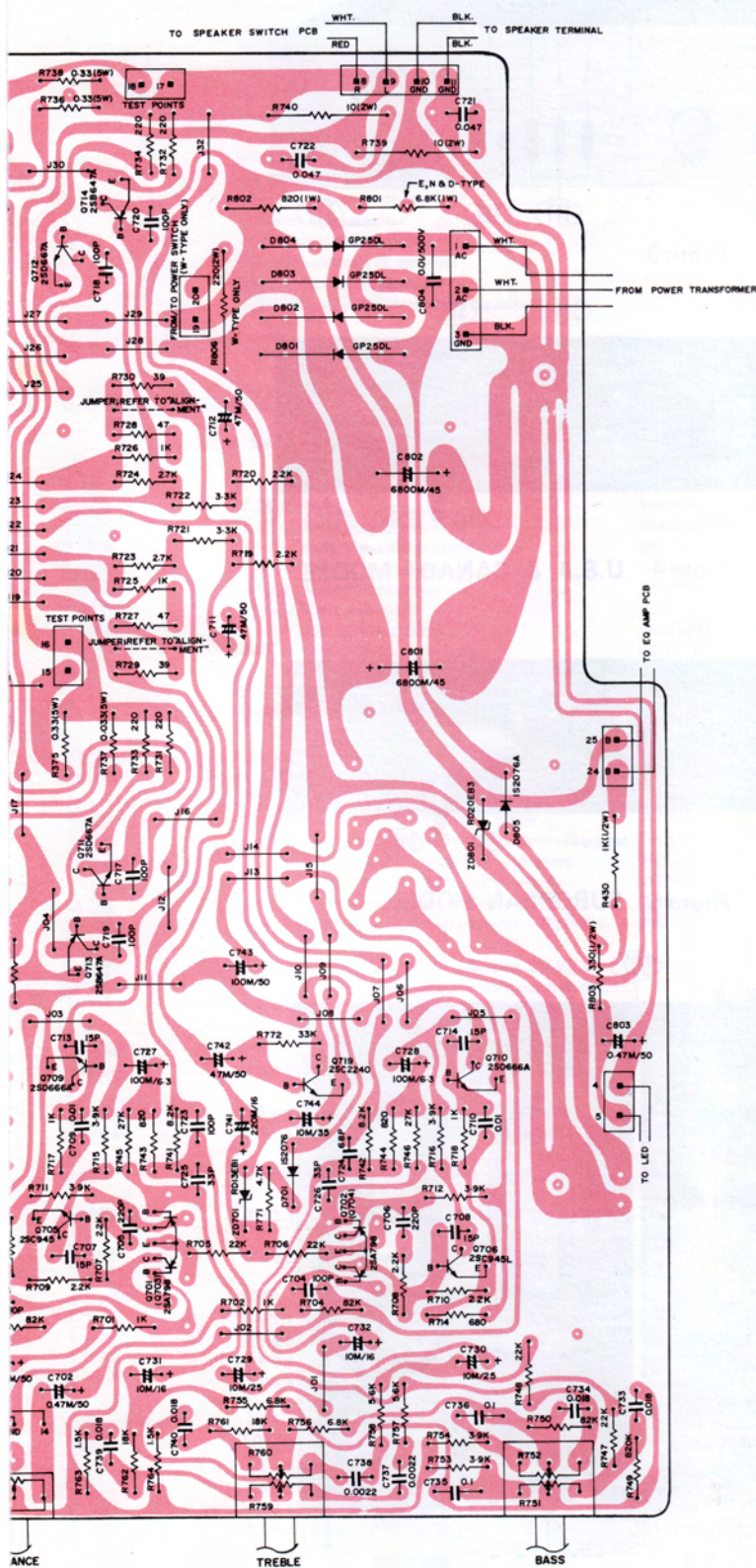


TERMINAL PCB

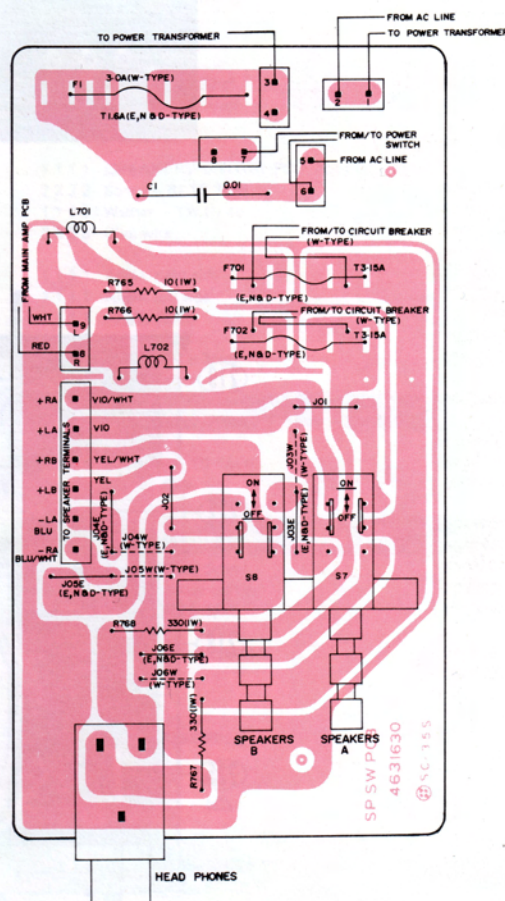


EQ AMP PCB





MAIN AMP PCB



SPEAKERS SWITCH PCB

PARTS LOCATION

NOTE: Numbers of three digits with a  are related to the KEY NUMBERS on parts list.

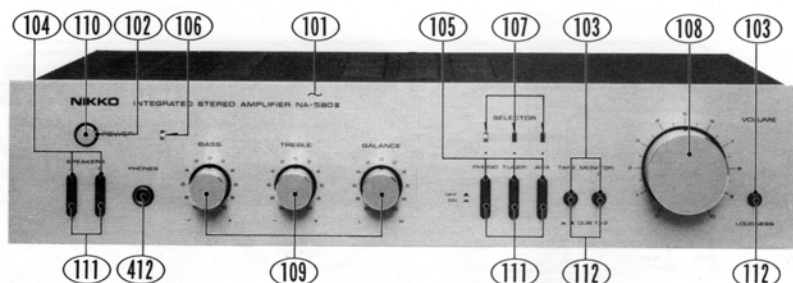


Photo 3

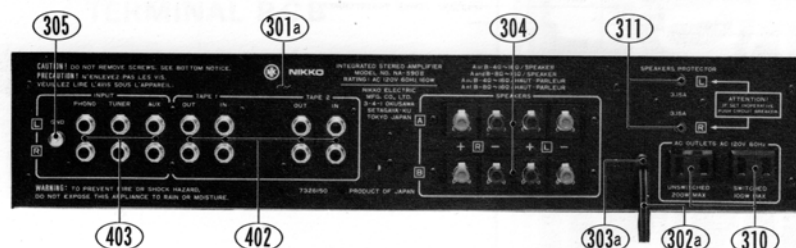


Photo 4 U.S.A. & CANADA MODEL

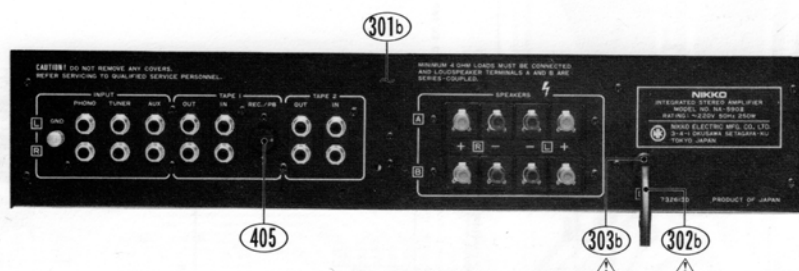


Photo 5 EUROPEAN MODEL

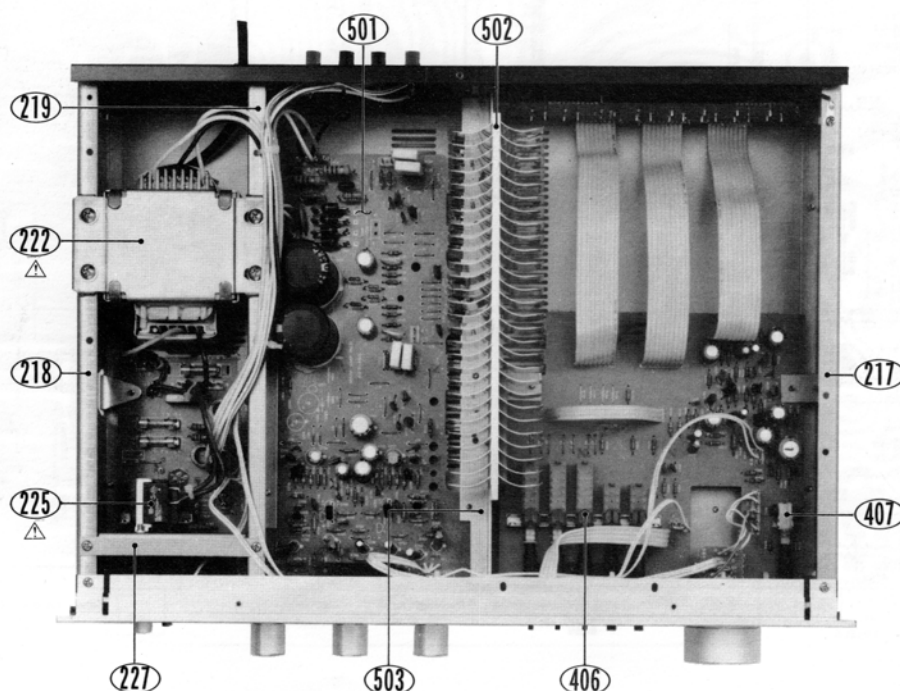


Photo 6

PARTS LIST

NOTES:

1. * The KEY NUMBER (#) marked with a (*) on parts list relate to number of three digits with a (). (Photo 3 - 6)
2. + Numerals in file indicate the quantity of parts used in one type.
3. ++ TR : Transistor
FET : Field effect transistor
VR : Volume control (Variable resistor)
RES : Carbon film fixed resistor
MO-RES : Metal oxide film fixed resistor
CEM-RES : Cemented wirewound fixed resistor
FP : Flame proof
C-CAP : Ceramic capacitor
E-CAP : Aluminum electrolytic capacitor
M-CAP : Polyester film capacitor
S-CAP : Polystyrene film capacitor
T-CAP : Tantalum electrolytic capacitor
BP-CAP : Bipolar electrolytic capacitor
LC-CAP : Low current leakage electrolytic capacitor.

4. Assemblies and parts are subject to change without notice.

5. Parts ordering procedure:

- A. DO NOT USE THE "KEY" NUMBER AND "SYMBOL" NUMBER.
(these are control # for the factory only)

- B. Include in any order

- a. Part number.
- b. Part description.
- c. Model number.

(any of the above lacking from an order may delay shipment of that order.)

CAUTION :

The $\triangle$ mark, the KEY NO. and the SYMBOL NO. circled with rectangle in the schematic diagram and the shaded area in the parts list designate components which have special characteristics important for safety and should be replaced only with types identical to those in the original circuit or specified in the parts list.

KEY NO.	SYMBOL NO.	TYPE ⁺ WEND	DESCRIPTION ⁺⁺	PART NO.
PACKING MATERIALS & ACCESSORIES				
001	1 1 1 1		Carton box	9825740
002	2 2 2 2		Pad	9840830
003	1 1 1 1		Sack, polyethylen cloth	9640550
004	1 1 ---		Sack, polyethylen cloth - #13	9640320
005a	1 ---		Manual, instruction - E	960328E
005b	- 1 1 1		Manual, instruction - K	960329K
006	1 ---		Card, warranty	967010A
007	1 ---		List, service stations	9690180
008	1 ---		Manual, safety instruction	9670410
CABINET ASSEMBLY				
*101a	1 1 1 1		Panel, front - SILVER	7884770
*101b	1 1 1 1		Panel, front - BLACK	7884780
*102	1 1 1 1		Guide, button - 125BN - power	7402250
*103	3 3 3 3		Guide, button - 1P5 - tape monitor/loudness	7401710
*104	2 2 2 2		Guide, button - P1320BK - speakers	7401670
*105	1 1 1 1		Guide, button - P3320BK - selector	7401680
*106	1 1 1 1		Light guide, power indicator - GLB-125	7402720
*107	1 1 1 1		Light guide, function indicator - GLB-325	7402730
*108a	1 1 1 1		Knob - 19SL-42DA - volume, SILVER	7841290
*109a	3 3 3 3		Knob - 19SL-19DR - bass/treble/balance, SILVER	7841250
*108b	1 1 1 1		Knob - 19BK-42D - volume, BLACK	7841160
*109b	3 3 3 3		Knob - 19BK-19D - bass/treble/balance	7841140
*110a	1 1 1 1		Button, push - M10SL-12 - power, SILVER	7852060
*110b	1 1 1 1		Button, push - M10BK-12 - power, BLACK	7852070
*111	5 5 5 5		Button, push - P320BK - speakers/selector	7852100
*112	3 3 3 3		Button, push - P5x15 BK-II - tape monitor/loudness	7852090
113	3 3 3 3		Shaft, extension - 31M - tape monitor/loudness	7401890
114	1 1 1 1		Cover, metal	7821080
115	6 6 6 6		Screw - TFS4x10	887408W
116	6 6 6 6		Washer - 4 ϕ	893104W
117	3 3 3 3		Screw - PTS 3 ϕ x8	814308W
118	1 1 1 1		Plate, bottom	7326170
119	8 8 8 8		Screw - PTS 3 ϕ x8	814308S
120	1 1 1 1		Spacer, insulation	7402740
121	2 2 2 2		Rivet, plastic - 3 ϕ x4.5	7401240
122	4 4 4 4		Foot, polyethylen - 20 ϕ x12	7402640
123	4 4 4 4		Screw - PTS 3 ϕ x10	814310S

KEY NO.	SYMBOL NO.	TYPE ⁺ WEND	DESCRIPTION ⁺⁺	PART NO.
CHASSIS ASSEMBLY				
201	1 1 1 1		(BACK PLATE ASSEMBLY)	
202	1 1 1 1		Screw - PTS 3 ϕ x8	814308W
203	1 1 1 1		(MAIN AMP PCB ASSEMBLY)	
204	3 3 3 3		Screw - BLTS 3 ϕ x8	874308S
205	2 2 2 2		Washer - TW(I) 4 ϕ	893404U
206	1 1 1 1		(EQ AMP PCB ASSEMBLY)	
207	4 4 4 4		Screw - BLTS 3 ϕ x8	874308S
208	1 1 1 1		Washer - TW(I) 4 ϕ	893404U
209	2 2 2 2		Tie, nylon	7401880
210	1 1 1 1		Plate, front	7326160
211	8 8 8 8		Screw - PTS 3 ϕ x8	814308S
212	2 2 2 2		Screw - PMS 3 ϕ x6	810306S
213	1 1 1 1		(SPEAKERS SWITCH PCB ASSEMBLY)	
214	2 2 2 2		Screw - BLTS 3 ϕ x8	874308S
215	1 1 1 1		Washer - TW (I) 4 ϕ	893404S
216	3 3 3 3		Clip, wire	7401340
*217	1 1 1 1		Angle, right side	7227060
*218	1 1 1 1		Angle, left side	7227220
*219	1 1 1 1		Angle, center	7227290
220	1 1 1 1		Holder, PCB	7033480
221	1 1 1 1		Screw - PTS 3 ϕ x8	814308S
$\triangle$ *222a	1 ---		Transformer, power - T-1-395 - 120V only	1103950
$\triangle$ *222b	- 1 1 1		Transformer, power - T-1-396 - 220/240V class II	1103960
223	4 4 4 4		Screw - BLTS 4 ϕ x10	874410S
224	4 4 4 4		Washer - 4 ϕ	893104S
$\triangle$ *225a	S8	1 ---	Switch, push - SDV-2P TV-5 - power	4041380
$\triangle$ *225b	S8	- 1 1 1	Switch, push - ESB-70294 - power	4041460
226	2 2 2 2		Screw - PMS 3 ϕ x6	8103060
*227	1 1 1 1		Holder, power switch	7032840
228	2 2 2 2		Screw - PTS 3 ϕ x8	814308S
229	3 3 3 3		Rivet, plastic - 3 ϕ x4.5	7401240
230	8 6 6 6		Tie, nylon	7401880
BACK PLATE ASSEMBLY				
*301a	1 ---		Plate, back - W	7326150
*301b	- 1 1 1		Plate, back - E	7326130
$\triangle$ *302a	1 ---		Cord, AC line - DP-70	606007A
$\triangle$ *302b	- 1 1 1		Cord, AC line - CEE-2T	600510A
*303a	1 ---		Bush, cord - SR-3P-4	7400620
$\triangle$ *303b	- 1 1 1		Bush, cord - SR-4N-4	7400690

PART ORDERING PROCEDURE ----- DO NOT USE THE "KEY" NUMBER AND "SYMBOL" NUMBER. (these are control # for the factory only.) Include in any order: a. Part number, b. Part description, c. Model number. (any of the above lacking from an order may delay shipment of the order.)

KEY	SYMBOL	TYPE ⁺	DESCRIPTION ⁺⁺	PART
NO.	NO.	W END		NO.
*304		2 2 2 2	Terminal, speaker — screw type	4450470
		4 4 4 4	Screw — PTS 3φx8	814308W
*305		1 1 1 1	Nut, GND terminal	4400050
306		1 1 1 1	Screw — PMS 3φx12	810312S
307		1 1 1 1	Washer — IN 3φ	892013S
308		1 1 1 1	Washer — TW(II) 3φ	893403U
309		1 1 1 1	Washer — 3φ	893203S
△ *310		2 — — —	Socket, AC outlet	4500150
311		2 — — —	Circuit breaker — NW-2S(N) 3.15A	4900870
312		1 — — —	Bracket, circuit breaker	7030140
313		2 — — —	Screw — PTS 3φx8	814308W
EQUALIZER AMP PC BOARD ASSEMBLY				
401a		1 — — —	EQ AMP PCB ASSEMBLY	9441680
401b		— 1 1 1	EQ AMP PCB ASSEMBLY	9441670
(TERMINAL SECTION)				
*402		2 2 2 2	Terminal, RCA phono pin jack — 2Px2 — tape in/out	4444040
*403		1 1 1 1	Terminal, RCA phono pin jack — 2Px3 — phono/tuner/aux	4446010
404		1 1 1 1	Lug, ground	4400000
*405		— 1 1 1	Connector, DIN type — 5P	4530560
	R425,426	— 2 2 2	RES 330kohm 5% ¼W	328334J
	R427,428	— 2 2 2	RES 100kohm 5% ¼W	328104J
(EQ AMP SECTION)				
*406	S1~S5	1 1 1 1	Switch, penta push — SUF-52 — selector/tape	4041540
*407	S6	1 1 1 1	Switch, mono push — ESB-62 — loudness	4041580
	Q401,402	2 2 2 2	TR 2SA991 (E or F)	510104S
	Q403,404	2 2 2 2	TR 2SC945L (P or Q)	515077S
	C401,402	2 2 2 2	E-CAP 0.47uf 50V	211505Q
	C403,404	2 2 2 2	C-CAP 100pf 10% 50V SL	232101K
	C405,406	2 2 2 2	C-CAP 20pf 10% 50V SL	232100K
	C407,408	2 2 2 2	E-CAP 220uf 6.3V	211032Q
	C409,410	2 2 2 2	M-CAP 0.022uf 50V	222223J
	C411,412	2 2 2 2	M-CAP 0.0068uf 50V	222682J
	C413,414	2 2 2 2	E-CAP 220uf 6.3V	211032Q
	C415,416	2 2 2 2	E-CAP 0.47uf 50V	211505Q
	C417	1 1 1 1	E-CAP 220uf 25V	211332Q
	C418	1 1 1 1	E-CAP 100uf 25V	211330Q
	C419,420	2 2 2 2	C-CAP 0.01uf +80, -20% 50V YG	231103Z
	C421	1 1 1 1	E-CAP 10uf 16V	211220Q
	C422	1 1 1 1	C-CAP 0.01uf +80, -20% 50V YG	231103Z
	C501,502	2 2 2 2	C-CAP 100pf 10% 50V SL	232101K
	C503,504	2 2 2 2	C-CAP 220pf 10% 50V SL	232221K
	C505,506	2 2 2 2	M-CAP 0.01uf 10% 50V	222103K
	R401,402	2 2 2 2	RES 100kohm 5% ¼W	328104J
	R403,404	2 2 2 2	RES 150kohm 5% ¼W	328151J
	R405,406	2 2 2 2	RES 100kohm 5% ¼W	328104J
	R407,408	2 2 2 2	RES 12kohm 5% ¼W	328123J
	R409,410	2 2 2 2	RES 15kohm 5% ¼W	328153J
	R411,412	2 2 2 2	RES 3.3kohm 5% ¼W	329332J
	R413,414	2 2 2 2	RES 330ohm 5% ¼W	328331J
	R415,416	2 2 2 2	RES 180kohm 5% ¼W	328184J
	R417,418	2 2 2 2	RES 12kohm 5% ¼W	328123J
	R419,420	2 2 2 2	RES 220ohm 5% ¼W	328221J
	R421,422	2 2 2 2	RES 470ohm 5% ¼W	328471J
	R423,424	2 2 2 2	RES 100kohm 5% ¼W	328104J
	R429	1 1 1 1	RES 47kohm 5% ¼W	328473J
	R501,502	2 2 2 2	RES 2.2kohm 5% ¼W	328222J

KEY	SYMBOL	TYPE ⁺	DESCRIPTION ⁺⁺	PART
NO.	NO.	W END		NO.
	R503,504	2 2 2 2	RES 8.2kohm 5% ¼W	328822J
	R505,506	2 2 2 2	RES 27kohm 5% ¼W	328273J
	R507,508	2 2 2 2	RES 1meg.ohm 5% ¼W	328105J
	R509,510	2 2 2 2	RES 22kohm 5% ¼W	328223J
(LED SECTION)				
408	LED1	1 1 1 1	LED PR5527S — red — power indicator	506027S
		1 1 1 1	Holder, LED	7903060
409	LED2~4	3 3 3 3	LED SLP-231B — green — function indicator	5060320
410		3 3 3 3	Spacer, LED	7903140
(SPEAKERS SWITCH SECTION)				
411	S7, 8	1 1 1 1	Switch, twin push — SUF-22	4041250
*412		1 1 1 1	Jack, head phones	4550260
	L701,702	2 2 2 2	Coil, choke	1210960
	R765,766	2 2 2 2	FP-MO-RES 10ohm 5% 1W	361100L
	R767,768	2 2 2 2	FP-MO-RES 330ohm 5% 1W	361331L
△ 413	C1	1 1 1 1	M-CAP 0.01uf 250V	283103M
△ 414a	F1	1 — — —	Fuse 3.0A 250V	4700630
△ 414b	F1	— 1 1 1	Midget fuse T1.6A 250V	4720360
415	F701,702	— 2 2 2	Midget fuse T3.15A 250V	4720390
416a		2 — — —	Clip, fuse	7050560
416b		— 6 6 6	Clip, midget fuse	7050430
MAIN AMP PC BOARD ASSEMBLY				
*501		1 1 1 1	MAIN AMP PCB ASSEMBLY	9431010
(HEAT SINK SECTION)				
*502		1 1 1 1	Heat sink	7480400
*503		1 1 1 1	Holder, heat sink	7080120
	Q715,716	2 2 2 2	TR 2SD586 (R)	513113S
	Q717,718	2 2 2 2	TR 2SB616 (R)	511112S
(VOLUME CONTROL SECTION)				
	R511,512	1 1 1 1	VR GM80E801A — 250kohm (B)x2	4321030
(MAIN AMP SECTION)				
	R513	1 1 1 1	VR VM10E — 250kohm (SW) — balance	4310620
	R751,752			
	R759,760	2 2 2 2	VR GM70R 715C — 100kohm (C)x2 — bass/treble	4320980
	Q701			
	~Q704	2 2 2 2	TR 2SA798 (F or G)	514086S
	Q705			
	~Q708	4 4 4 4	TR 2SC945L (P or Q)	515077S
	Q709,710	2 2 2 2	TR 2SD666A (B or C)	511020S
	Q711,712	2 2 2 2	TR 2SD667A (B or C)	511022S
	Q713,714	2 2 2 2	TR 2SB647A (B or C)	510046S
	Q719	1 1 1 1	TR 2SC2240 (BL)	512116S
	D701,805	2 2 2 2	Diode 1S2076A	501020S
	D801			
	~D804	4 4 4 4	Diode GP25D-L	560062S
	ZD701	1 1 1 1	Zener diode RD13EB1	502049S
	ZD801	1 1 1 1	Zener diode RD20EB3	502069S
	C701,702	2 2 2 2	E-CAP 0.47uf 50V	211505Q

PART ORDERING PROCEDURE ----- DO NOT USE THE "KEY" NUMBER AND "SYMBOL" NUMBER. (these are control # for the factory only.) Include in any order: a. Part number, b. Part description, c. Model number. (any of the above lacking from an order may delay shipment of the order.)

KEY	SYMBOL	TYPE ⁺	DESCRIPTION ⁺⁺				PART
NO.	NO.	W E N D					NO.
	C703,704	2 2 2 2	C-CAP	100pf	10%	50V	SL 232101K
	C705,706	2 2 2 2	C-CAP	220pf	10%	50V	SL 232220K
	C707,708	2 2 2 2	C-CAP	15pf	10%	50V	SL 232150K
	C709,710	2 2 2 2	M-CAP	0.01uf	10%	50V	222103K
	C711,712	2 2 2 2	E-CAP	47uf	50V		211525Q
	C713,714	2 2 2 2	C-CAP	15pf	10%	50V	SL 232150K
	C715,716	2 2 2 2	C-CAP	0.01uf +80, -20%	50V	YG	231103Z
	C717						
	~C720	4 4 4 4	C-CAP	100pf	10%	50V	SL 232101K
	C721,722	2 2 2 2	M-CAP	0.047uf	10%	50V	222473K
	C723,724	2 2 2 2	C-CAP	68pf	10%	50V	SL 232680K
	C725,726	2 2 2 2	C-CAP	33pf	10%	50V	SL 232330K
	C727,728	2 2 2 2	E-CAP	100uf	6.3V		211030Q
	C729,730	2 2 2 2	E-CAP	10uf	25V		211320Q
	C731,732	2 2 2 2	E-CAP	10uf	16V		211220Q
	C733,734	2 2 2 2	M-CAP	0.018uf	10%	50V	222183K
	C735,736	2 2 2 2	M-CAP	0.1uf	10%	50V	222104K
	C737,738	2 2 2 2	M-CAP	0.0022uf	10%	50V	222222K
	C739,740	2 2 2 2	M-CAP	0.018uf	10%	50V	222183K
	C741	1 1 1 1	E-CAP	220uf	16V		211232Q
	C742	1 1 1 1	E-CAP	47uf	50V		211525Q
	C743	1 1 1 1	E-CAP	100uf	50V		211530Q
	C744	1 1 1 1	E-CAP	10uf	50V		211520Q
	C801,802	2 2 2 2	E-CAP	6800uf	45V		2100040
	C803	1 1 1 1	E-CAP	0.47uf	50V		211505Q
	C804	1 1 1 1	C-CAP	0.01uf	500V	YG	238103P
	R430	1 1 1 1	FP-MO-RES	1kohm	5%	1/4W	360102L
	R701,702	2 2 2 2	RES	1kohm	5%	1/4W	328102J
	R703,704	2 2 2 2	RES	82kohm	5%	1/4W	328823J
	R705,706	2 2 2 2	RES	22kohm	5%	1/4W	328223J
	R707						
	~R710	4 4 4 4	RES	2.2kohm	5%	1/4W	328222J

KEY	SYMBOL	TYPE ⁺	DESCRIPTION ⁺⁺				PART
NO.	NO.	W E N D					NO.
	R711,712	2 2 2 2	RES	3.9kohm	5%	1/4W	328392J
	R713,714	2 2 2 2	FP-RES	680ohm	5%	1/4W	328681L
	R715,716	2 2 2 2	RES	3.9kohm	5%	1/4W	328392J
	R717,718	2 2 2 2	RES	1kohm	5%	1/4W	328102J
	R719,720	2 2 2 2	FP-RES	2.2kohm	5%	1/4W	328222L
	R721,722	2 2 2 2	FP-RES	3.3kohm	5%	1/4W	328332L
	R723,724	2 2 2 2	RES	2.7kohm	5%	1/4W	328272J
	R725,726	2 2 2 2	RES	1kohm	5%	1/4W	328102J
	R727,728	2 2 2 2	RES	47ohm	5%	1/4W	328470J
	R729,730	2 2 2 2	RES	39ohm	5%	1/4W	328390J
	R731						
	~R734	4 4 4 4	FP-RES	220ohm	5%	1/4W	328221L
	R735						
	~R738	4 4 4 4	CEM-RES	0.33ohm	10%	5W	384339W
	R739,740	2 2 2 2	FP-MO-RES	10ohm	5%	2W	362100L
	R741,742	2 2 2 2	RES	8.2kohm	5%	1/4W	328822J
	R743,744	2 2 2 2	RES	560ohm	5%	1/4W	328561J
	R745,746	2 2 2 2	RES	39kohm	5%	1/4W	328393J
	R747,748	2 2 2 2	RES	22kohm	5%	1/4W	328223J
	R749,750	2 2 2 2	RES	820kohm	5%	1/4W	328824J
	R751,752		(TONE VR)				
	R753,754	2 2 2 2	RES	3.9kohm	5%	1/4W	328392J
	R755,756	2 2 2 2	RES	6.8kohm	5%	1/4W	328682J
	R757,758	2 2 2 2	RES	5.6kohm	5%	1/4W	328562J
	R759,760		(TONE VR)				
	R761,762	2 2 2 2	RES	18kohm	5%	1/4W	328183J
	R763,764	2 2 2 2	RES	1.5kohm	5%	1/4W	328152J
	R771	1 1 1 1	RES	4.7kohm	5%	1/4W	328472J
	R772	1 1 1 1	RES	33kohm	5%	1/4W	328333J
	R773	1 1 1 1	FP-RES	47ohm	5%	1/4W	328470L
	R801	- 1 1 1	FP-MO-RES	6.8kohm	5%	1W	361682L
	R802	1 1 1 1	FP-MO-RES	820ohm	5%	1W	361821L
	R803	1 1 1 1	FP-MO-RES	330ohm	5%	1/2W	360331L
	R806	1 - - -	FP-MO-RES	220ohm	5%	2W	362221L

SEMICONDUCTOR DATA,

TRANSISTORS

† NOTES

Ge: Germanium
Si: SiliconA: Alloy
B: Base
D: Diffused
Dd: Double-diffusedDf: Drift-field
E: Epitaxial
G: Grown
J: JunctionM: Mesa
P: Planar
Pc: Point-contact
Td: Triple-diffused

DEVICE TYPE	APPLICATIONS	STRUC- TURE†	MAXIMUM RATINGS Absolute-Maximum Values: (T _A = 25 °C unless otherwise specified)					ELECTRICAL CHARACTERISTICS Typical Values: (T _A = 25 °C unless otherwise specified)														MANU- FACTURER
			Collector-to-Base Voltage V _{CB0} (V)	Emitter-to-Base Voltage V _{EB0} (V)	Collector Current I _C (mA)	Collector Dissipa- tion P _C (mW)	Junction Tempera- ture T _J (°C)	Collector Cutoff Current		Static Forward Current Transfer Ratio			Collector-Emitter Saturation Voltage			Gain-Bandwidth Product			Output Capaci- tance C _{ob} (pF)	Others		
								I _{CBO} (μA)	V _{CB} (V)	h _{FE}	V _{CE} (V)	I _C (mA)	V _{CE(sat)} (V)	I _C (mA)	I _B (mA)	f _T f _{db} * (MHz)	V _{CE} V _{CB} * (V)	I _E I _C * (mA)				
2SA798 (F, G)	AF, Low noise Diff. amp.	PNP, Dual Si-EP	-70	-5	-100	200/ unit	125	-0.1 max.	-35	250 ~ 800	-6	-1	-0.6 max.	-10	-1	100	-6	1	3		MITSUBISHI	
2SA991 (E, F)	AF, Low noise	PNP Si-E	-60	-5	-100	500	125	-0.005 max.	-60	300 ~ 800	-6	-1	-0.5 max.	-100	-10	90	-6	1	10 max.		N E C	
2SB616 (R)	AF Power amp.	PNP Si-E	-100	-5	-5A	60W (T _C = 25 °C)	150	-10 max.	-80	60 ~ 120	-5	-1A	-2 max.	-3A	-300	11	-5	100*	140	Complementary to 2SD586	N E C	
2SB647A (B, C)	AF Driver	PNP Si-E	-120	-5	-1A	900	150	-10 max.	-100	60 ~ 200	-5	-150	-1 max.	-600	-50	140	-5	150*	20	Complementary to 2SD667A	HITACHI	
2SC945L (P, Q)	AF	NPN Si-E	60	5	100	250	125	0.01 max.	60	135 ~ 400	6	1	0.3 max.	100	10	450 max.	6	-10	5 max.		N E C	
2SC2240 (BL)	AF, Low noise	NPN Si-E	120	5	100	300	125	0.01 max.	120	350 ~ 700	6	2	0.3 max.	10	1	100	6	1*	3		TOSHIBA	
2SD586 (R)	AF Power amp.	NPN Si-E	100	5	5A	60W (T _C = 25 °C)	150	10 max.	80	60 ~ 120	5	1A	2 max.	3A	300	18	5	100*	90	Complementary to 2SB616	N E C	
2SD666A (B, C)	AF Pre driver	NPN Si-E	120	5	50	900	150	10 max.	100	60 ~ 200	5	10	2 max.	30	3	140	5	10*	3		HITACHI	
2SD667A (B, C)	AF Driver	NPN Si-E	120	5	1A	900	150	10 max.	100	60 ~ 200	5	150	1 max.	500	50	140	5	150	12	Complementary to 2SB647A	HITACHI	

DIODE, LED'S

DEVICE TYPE	APPLICATIONS	STRUCTURE†	MAXIMUM RATINGS Absolute - Maximum Values: (T _A = 25°C unless otherwise specified)									ELECTRICAL CHARACTERISTICS Typical Values: (T _A = 25°C unless otherwise specified)							MANU- FACTURER
			Reverse Surge Voltage V _{RSurge} (V)	Peak Reverse Voltage V _{RM} (V)	Reverse Voltage V _R (V)	Peak Forward Voltage V _{FM} (V)	Peak Forward Current I _{FM} (mA)	Average Rectified Current I _O (mA)	Forward Surge Current I _{F surge} (A)	Junction Temperature T _J (°C)	Total Power Dissipation P _D (mW)	I _{Fmin} (mA)	Test Condition V _F (V)	Forward Voltage V _{Fmax} (V)	Test Condition I _F (mA)	Reverse Current I _{Rmax} (μA)	Test Condition V _R (V)	Others	
GP25D-L	Rectifier	Si		200				2.5A	100	150			1.1	2.5A	5			GENERAL INSTRUMENT	
IS- 2076A	Detector	Si-DJ		70	60		450	150	1	175	250			0.8	10	1	30	HITACHI	
SLP- 231B	Lamp (green)	Gap			3		I _F = 30			80	70			2.8	20	10	3	SANYO	
PR- 5527S	Lamp (red)	Gap			4		I _F = 30			85	75			2.5	10	100	4	I _V = 1.2 mcd (I _F = 10 mA)	STANLEY

ZENER DIODES

DEVICE TYPE	APPLICATIONS	STRUCTURE†	MAXIMUM RATINGS Absolute-Maximum Values: (T _A = 25°C unless otherwise specified)			ELECTRICAL CHARACTERISTICS Typical Values: (T _A = 25°C unless otherwise specified)												MANU- FACTURER	
			Total Power Dissipation P _D (mW)	Zener Current I _Z (A)	Junction Temperature T _J (°C)	Zener Voltage			Differential Resistance		Temperature Coefficient		Reverse Current		Others				
						V _Z	Test Conditions	I _Z	I _Z (mA)	r _Z	MAX (Ω)	I _Z (mA)	MAX (μA)	V _R (V)					
RD13EB1	Regulator	Si-J	400		175	12.11		12.75	10		25	10				2	10		N E C
RD20EB3	Regulator	Si-J	400		175	19.23		20.22	10		25	10				2	15		N E C

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