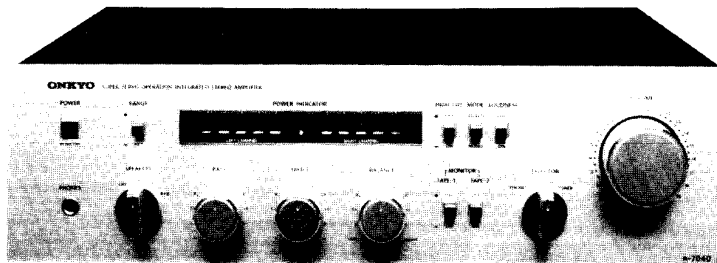


# ONKYO® SERVICE MANUAL

## SUPER SERVO OPERATION INTEGRATED STEREO AMPLIFIER MODEL A-7040



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**ONKYO®**  
**AUDIO COMPONENTS**

## SPECIFICATIONS

Power Output:	50 watts per channel, min. RMS, at 8 ohms both channels driven, from 20 Hz to 20 kHz, with no more than 0.026% total harmonic distortion.	Signal to noise ratio:	PHONO: 80 dB (IHF A Network) TUNER: 90 dB (IHF A Network)
Total Harmonic Distortion:	0.026% at rated power 0.02% at 1 watt output	Loudness: (-40 dB)	+5 dB at 100 Hz +5 dB at 10 kHz
IM Distortion:	0.026% at rated power (60Hz: 7 kHz=4:1) 0.02% at 1 watt output	Range (Ind. switch)	x 1, x 0.1
Frequency Response:	15 ~ 50,000 Hz ( $\pm 1$ dB)	<b>GENERAL</b>	
RIAA Deviation:	20 ~ 20,000 Hz ( $\pm 0.5$ dB)	Power Supply Rating:	AC 120 volts, 60 Hz (120V model) AC 110, 120, 220 or 240V 50/60Hz (Universal model)
Damping Factor:	45 at 8 ohms	Outputs:	SPEAKER A & B, PHONES TAPE REC 1 & 2
Input Sensitivity and Impedance:	PHONE 1 & 2: 2.5mV, 50 kohms TUNER: 150mV, 50 kohms TAPE PLAY 1 & 2: 150mV, 50 kohms	Inputs:	PHONO 1 & 2 TUNER TAPE PLAY 1 & 2
Phono Overload:	170mV RMS. at 1kHz, 0.026% THD	Semiconductors:	22 Transistors, 10 ICs, 19 Diodes
Tone Control		Dimensions:	418(W) x 124(H) x 396(D) mm 16-1/2" x 4-15/16" x 15-5/8"
BASS:	$\pm 10$ dB at 100 Hz	Weight:	9.4 kg (20.7 lbs)
TREBLE:	$\pm 10$ dB at 10 kHz		
High Cut Filter	6 kHz (6 dB/oct.)		

Specifications and features are subject to change without notice for improvement.

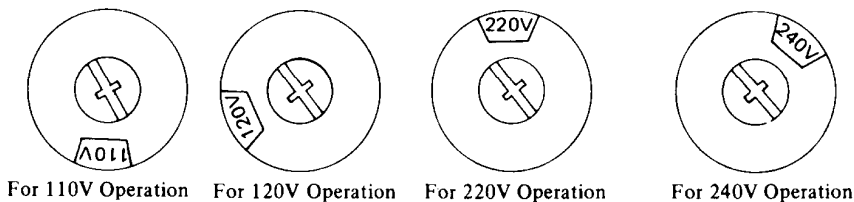
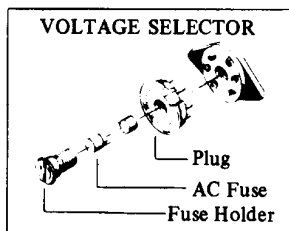
## SERVICE PROCEDURES

### 1. VOLTAGE CONVERSION (Universal model)

This model is equipped with a universal power transformer to permit operation at either power source of 110, 120, 220 or 240V AC 50/60Hz.

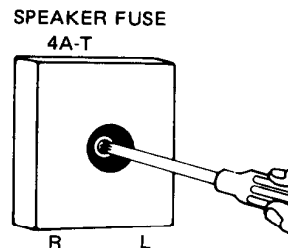
To convert the unit to a different power source voltage, change the plug as illustrated in the drawing below.

**CAUTION: DISCONNECT POWER SUPPLY CORD FROM AC OUTLET BEFORE CONVERTING VOLTAGE.**



### 2. REPLACING THE SPEAKER PROTECTION FUSE

- 1) Remove a screw holding the cover and back panel.
- 2) Replace the fuse with same type and same rating fuse.



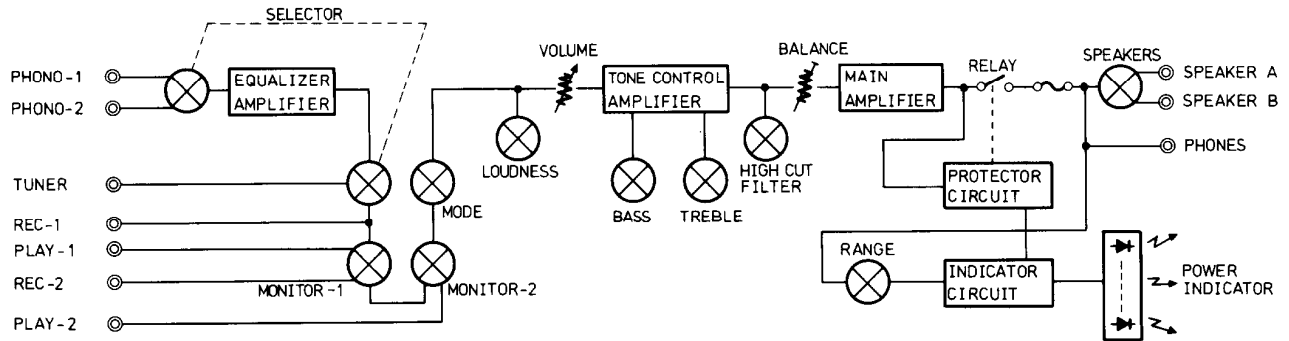
## PRECAUTIONS

1. For continued protection against fire hazard, replace only with same type and same rating fuse.

		PARTS NO.
AC fuse	4A (ST-6)	252053 (110/120V model)
	3A-T	252020 (220/240V model)
Speaker protection fuse	4A-T	252014

2. Replacement for power, complementary and driver transistors, if necessary, must be made from the same beta ( $h_{FE}$ ) group as the original type.
3. Always disconnect the chassis from power line when soldering.  
Turning the power switch OFF is not enough.  
Power line leakage passing through the heating element may destroy the transistors.

## BLOCK DIAGRAM



## CIRCUIT DESCRIPTION

### Servo Operational Amplifier

In order to achieve a greater degree of fidelity in waveform transmission, and to remove the large capacitance capacitors (which have questionable effect on the quality of sound) from the NFB, DC amplifier designs are being more and more widely used in amplifiers today. The A-7040, however, has advanced even further by adopting the recently developed Servo Operational Amplifier which features a truly superb quality of sound, and performs considerably better than the now conventional DC amplifiers.

The major circuit feature of the Servo Operational Amplifier (see outline in Fig. 1-1) is the servo feedback loop which has no effect whatsoever on the main signal. In other words, if the signal feedback factor is  $\beta_1$ , and the servo feedback factor  $\beta_2$ , the  $0 \approx \beta_2 \ll \beta_1 \ll 1$  relation holds true within the signal bandwidth, while  $\beta_2 \gg 1$  holds true in the subsonic region down to DC. For this purpose, a servo feedback amplifier was necessary. And since it was also necessary to include a high-cut filter, and suppress signal amplifier drift at higher DC gain plus  $1/f$  noise and other subsonic region components, a  $-6\text{dB/oct}$  high-cut mirror integrating circuit (see Fig. 1-2) has been employed. The  $V_{\text{ref}}$  in Fig. 1-1 serves as the input voltage required to keep the system output DC voltage at  $0\text{V}$ .

In the block diagram for the actual Servo Operational Amplifier (see Fig. 1-3),  $R_f$  and  $R_B$  constitute the signal feedback loop, while A2 and A3 form the servo feedback loop.

Assuming that  $A_1, A_2, A_3 \gg 1$ , the input/output characteristics  $T(\omega)$  may be expressed as,

$$T(\omega) = \frac{R_N (R_f + R_B)}{A_2 \cdot R_f \cdot R_B} \left[ \frac{1 + \frac{j\omega}{\omega_1}}{1 + \frac{j\omega}{\omega_2}} \right]$$

$$\text{where } \omega_0 = \frac{1}{CR}, \quad \omega_1 = \frac{\omega_0}{A_2}, \quad \omega_2 = \frac{R_f}{R_N} \omega_0.$$

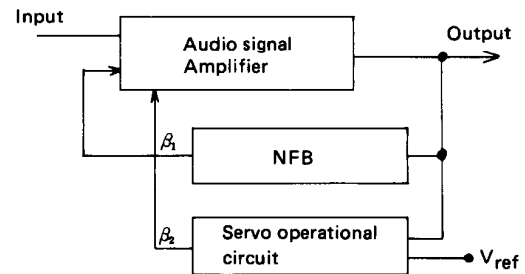


Fig. 1.1

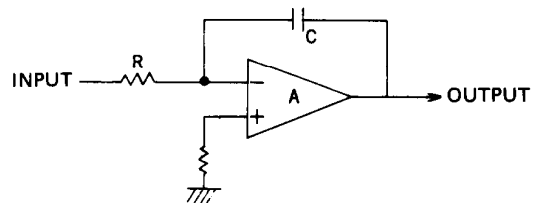


Fig. 1.2

The frequency response is as shown in Fig. 1-4,  $\omega_2$  being about 0.3Hz ~ 2Hz. A3 is phase inverted in order to prevent positive feedback in the DC region.

Hence, the subsonic frequencies are effectively cut just as if by coupling capacitor. But unlike capacitors, the output impedance of the servo operational amplifier decreases at lower frequencies (coupling capacitor impedance increases at corresponding frequencies) due to a greater amount of feedback. Since, however, in actual circuits the second stage is driven at a suitable impedance level, and the output impedance of the amplifier itself is made sufficiently large enough (to improve stability) by connecting a resistance  $\gamma_0$  in series, the output impedance is kept constant at  $\gamma_0$ . With coupling capacitors, on the other hand, the increased impedance at lower frequencies naturally results in an increase in thermal noise (directly related to effective impedance) in the low frequency region.

Although servo feedback circuit integrating capacitors of large leakage current, or high DC resistance and inductance are undesirable, the effects are nowhere near as serious as the insertion of a capacitor in the signal path.

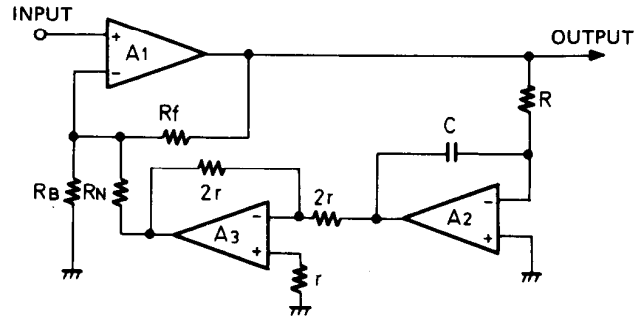


Fig 1.3

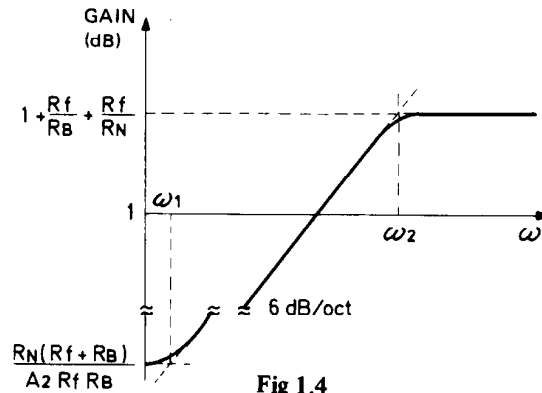
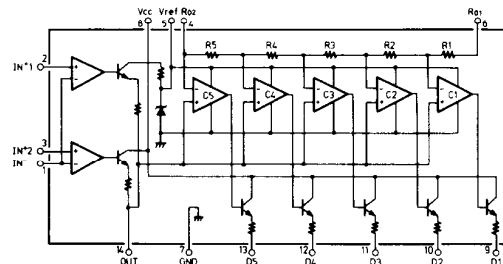


Fig 1.4

### Output Indicator Driver Circuit

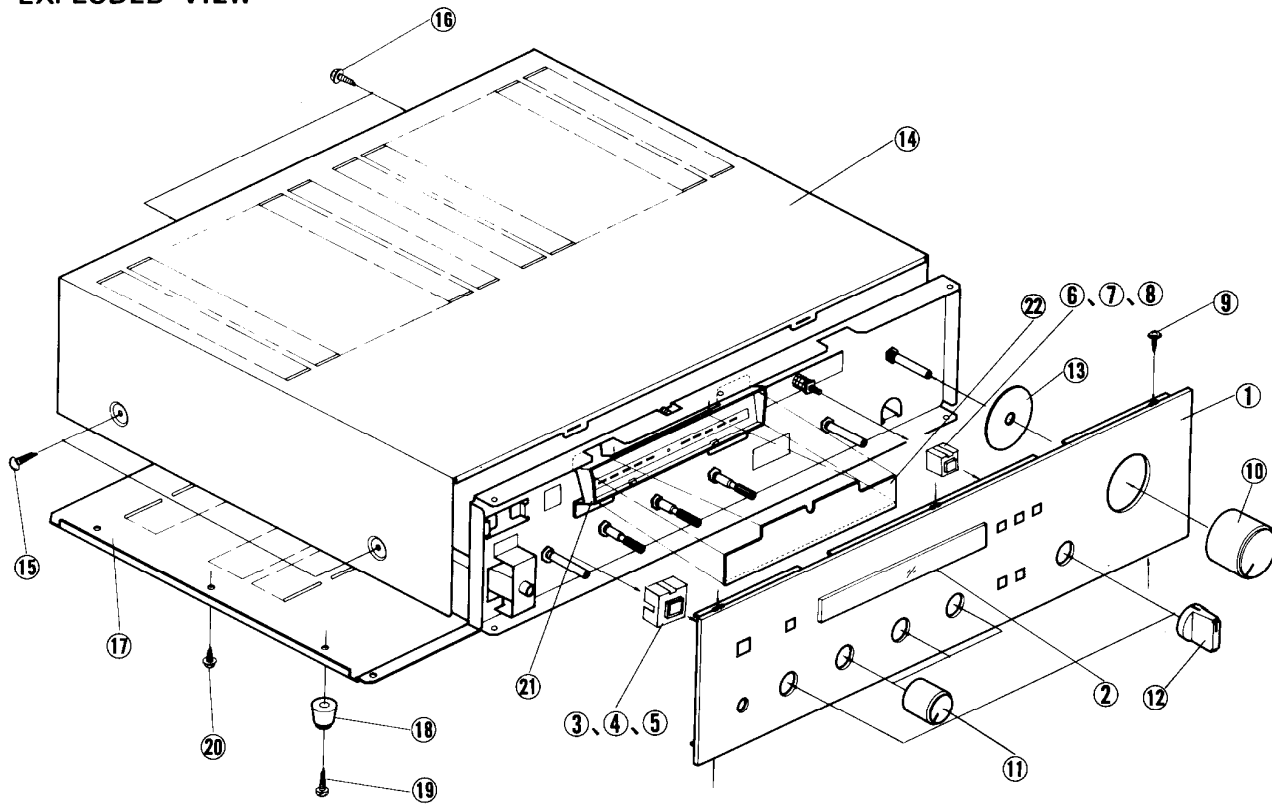
Q701 and Q702 are the power indicator drive ICs. The audio signal applied to pin no. 3 of Q701 is first amplified and then applied to the comparator. The LEDs connected to the IC output terminals pin nos. 9 ~ 13 are lit up in succession depending on the comparator level.

The connection from pin no. 14 to pin no. 1 in Q701 is part of a feedback loop where the feedback resistor R721 (82k $\Omega$ ) determines the gain of the amplifier, and is consequently used in the adjustment of indicator level.

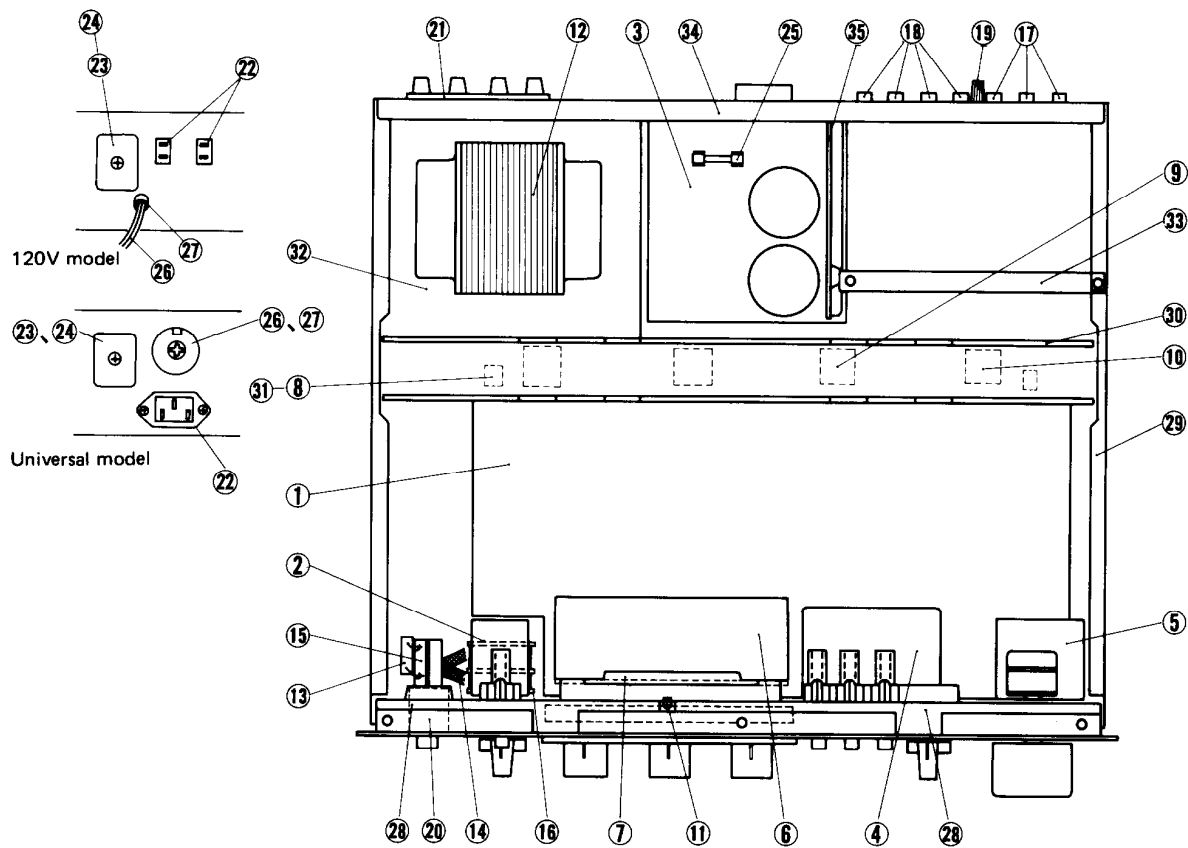


LB1416 EQUIVALENT DIAGRAM

# EXPLODED VIEW



# COMPONENT LOCATION



## EXPLODED VIEW — PARTS LIST

REF. NO.	PARTS NO.	DESCRIPTION	REF. NO.	PARTS NO.	DESCRIPTION
	12669121	Front panel ass'y (1, 2)	11	28320312	Tone control knob
1	27210122	Front panel	12	28320314	Selector knob
2	28191037	Glass for indicator	13	28140126	Cushion
	13639126	Power switch knob ass'y (3-5)	14	28184051	Top cover
3	27267048A	Power switch guide		28140020	Cushion
4	27180038	Spring	15	838440109	4TTB+10C(BC), Tap screw
5	28320319	Power switch knob	16	834430062	3STS+6BQ(BC), Tapping screw
	13639125	Push switch knob ass'y (6-8)	17	27170054	Bottom board
6	27267049A	Push switch guide	18	27175009	Leg
7	27180037	Spring	19	831130162	3STW+16BQ, Tapping screw
8	28320318	Push switch knob	20	831130082	3STW+8BQ, Tapping screw
9	834130062	3STS+6BQ, Tapping screw	21	27190044A	Holder
10	28320308	Volume control knob	22	28130073	Plate, indicator

## COMPONENT LOCATION — PARTS LIST

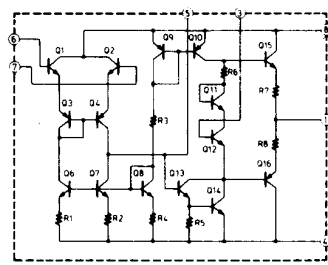
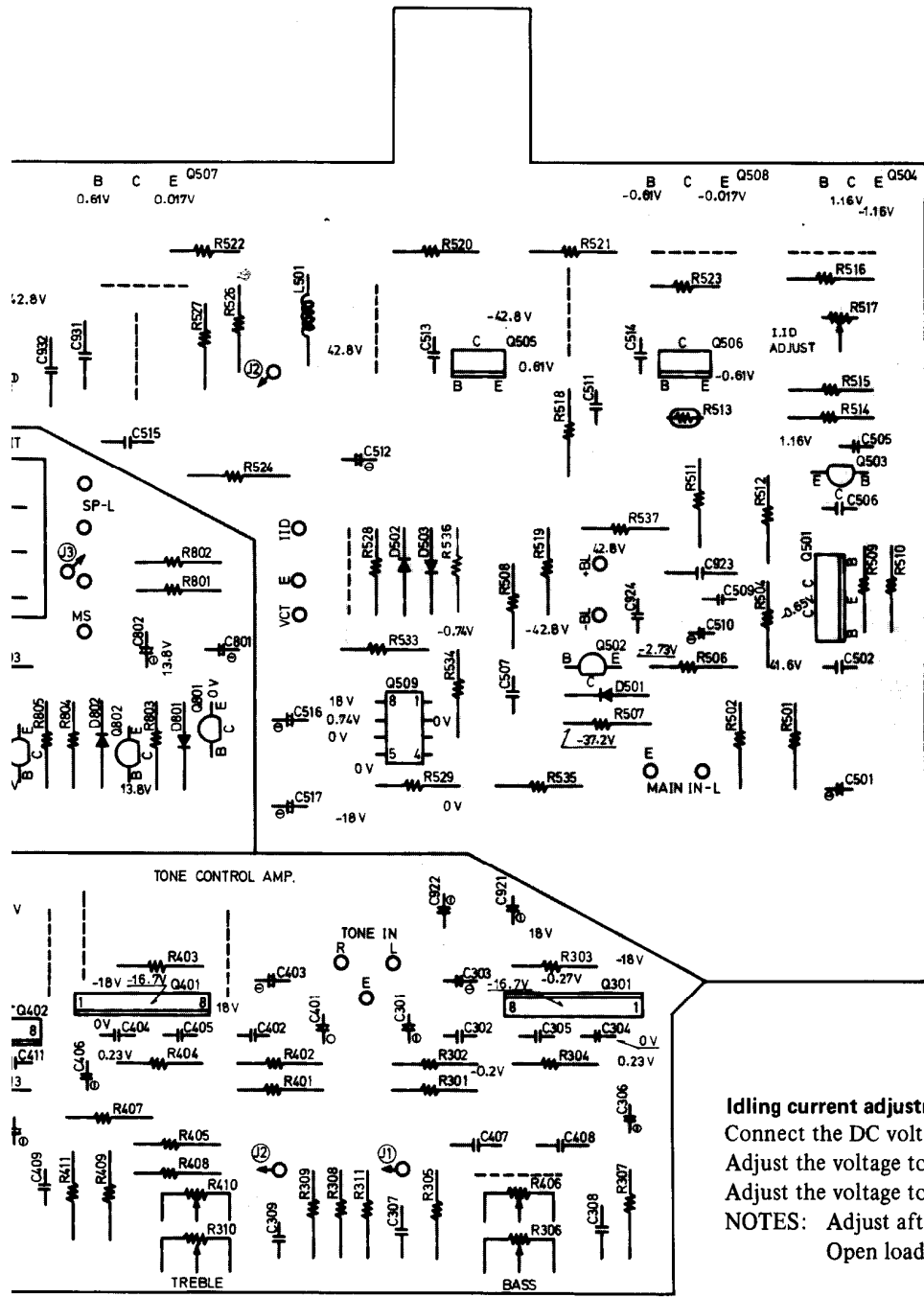
### 120V model

REF. NO.	CIRCUIT NO.	PARTS NO.	DESCRIPTION
1		12669540	NAAF-640, Pre., and main ampli. p.c.b.
2		12669541	NASW-641, Switch p.c.b.
3		12669542	NAPS-642, Power supply p.c.b.
4		12669543	NASW-643, Switch p.c.b.
5		12669544	NAVR-644, Volume control p.c.b.
6		12669545	NAME-645, Output indicator driver p.c.b.
7		12669546	NADIS-646, Output indicator p.c.b.
8	Q504, Q604	2211255 or 2211256	2SC1815(GR) or Thermo ampli. transistor
9	Q507, Q607	2200993 or 2200994	2SC2580(O) or Power ampli. transistor
10	Q508, Q608	2201003 or 2201004	2SA1105(O) or Power ampli. transistor
11	PL001	210057	PL6.3V 0.15AW1.5, Power indicator lamp
12	T001	230286	NPT-668D, Power transformer
13	C001	3504012	UL125V103M, UL capacitor
14	R001, R002	441723314	330Ω, 2W, Metal oxide film resistor
15	S001	25035135 or 24035138	NPS-111-L100P or Power switch
16	S002	25030124	NRSM-244-35Y, Speaker selector switch
17	P001	25045056	NPJ-6PRBL29, Tuner, Phono 1 and Phono 2 input terminal
18	P002, P003	25045025	NPJ-4PRBL03, Tape input/output terminal
19	P004	25060008	Ground terminal
20	P005	25045018	LT-100H, Headphone jack
21	P006, P007	25060029	NTM-4PRMN05, Speaker terminal
22	P008, P009	25050032	S-I6444-01, AC outlet
23	P010, P011	25050004	Fuseholder
24	P010a, P011a	252014	4A-T, Speaker fuse
25	F901b	252049	4A (ST-6), AC fuse
26	W001	253099	AS-VC-3, Power supply cord
27	W001a	270025	SR-3P-4, Strainrelief
28	A001	27110079	Front bracket
29	A014	27115043A	Side bracket
30	A015	27160052	Radiator
31	A016	223012	RH-14, Bracket
32	A017	27130148	Bracket for power transformer
33	A027	27140285	Bracket
34	A032	27120157	Back panel
35	A033	27150096B	Shielded plate for equalizer

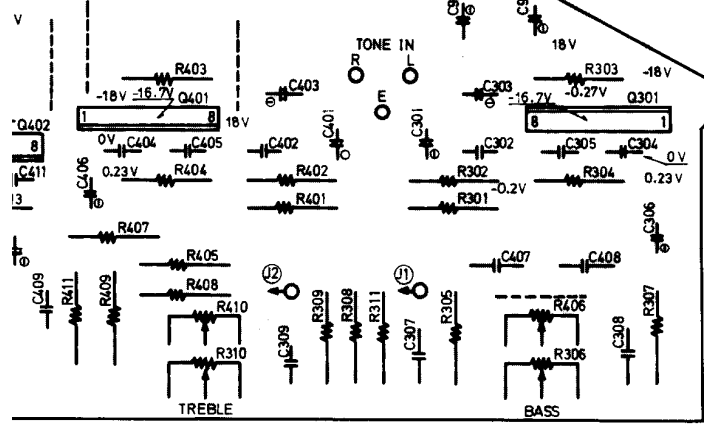
### Universal model

REF. NO.	CIRCUIT NO.	PARTS NO.	DESCRIPTION
1		12669540	NAAF-640, Pre., and main ampli. p.c.b.
2		12669541	NASW-641, Switch p.c.b.
3		12670542A	NAPS-642a, Power supply p.c.b.
4		12669543	NASW-643, Switch p.c.b.
5		12669544	NAVR-644, Volume control p.c.b.
6		12669545	NAME-645, Output indicator driver p.c.b.
7		12669546	NADIS-646, Output indicator p.c.b.
8	Q504, Q604	2211255 or 2211256	2SC1815(GR) or Thermo ampli. transistor
9	Q507, Q607	2200993 or 2200994	2SC2580(O) or Power ampli. transistor
10	Q508, Q608	2201003 or 2201004	2SA1105(O) or Power ampli. transistor
11	PL001	210057	PL6.3V 0.15AW1.5, Power indicator lamp
12	T001	230287	NPT-668ADGQ, Power transformer
13	C001, C002	3500052	PME271Y510CEE, IS capacitor
14	R001, R002	441723314	330Ω, 2W, Metal oxide film resistor
15	S001	25035051	NPS-121-L26P Power switch
16	S002	25030124	NRSM-244-35Y, Speaker selector switch
17	P001	25045056	NPJ-6PRBL29, Tuner, Phono 1 and Phono 2 input terminal
18	P002, P003	25045025	NPJ-4PRBL03, Tape input/output terminal
19	P004	25060008	Ground terminal
20	P005	25045018	LT-100H, Headphone jack
21	P006, P007	25060029	NTM-4PRMN05, Speaker terminal
22		25050018	PA-125, 3P inlet
23	P010a, P011a	25050004	Fuseholder
24	P010, P011	252014	4A-T, Speaker fuse
25	F901b	252049	4A (ST-6), AC fuse
26	F001a	252003	3A-T, AC fuse
27	F001b	25050021	X-I7240, VS socket
28	A001	27110079	Front bracket
29	A014	27115043A	Side bracket
30	A015	27160052	Radiator
31	A016	223012	RH-14, Bracket
32	A017	27130148	Bracket for power transformer
33	A027	27140285	Bracket
34	A032	27120158	Back panel
35	A033	27150096B	Shielded plate for equalizer

HA-1457

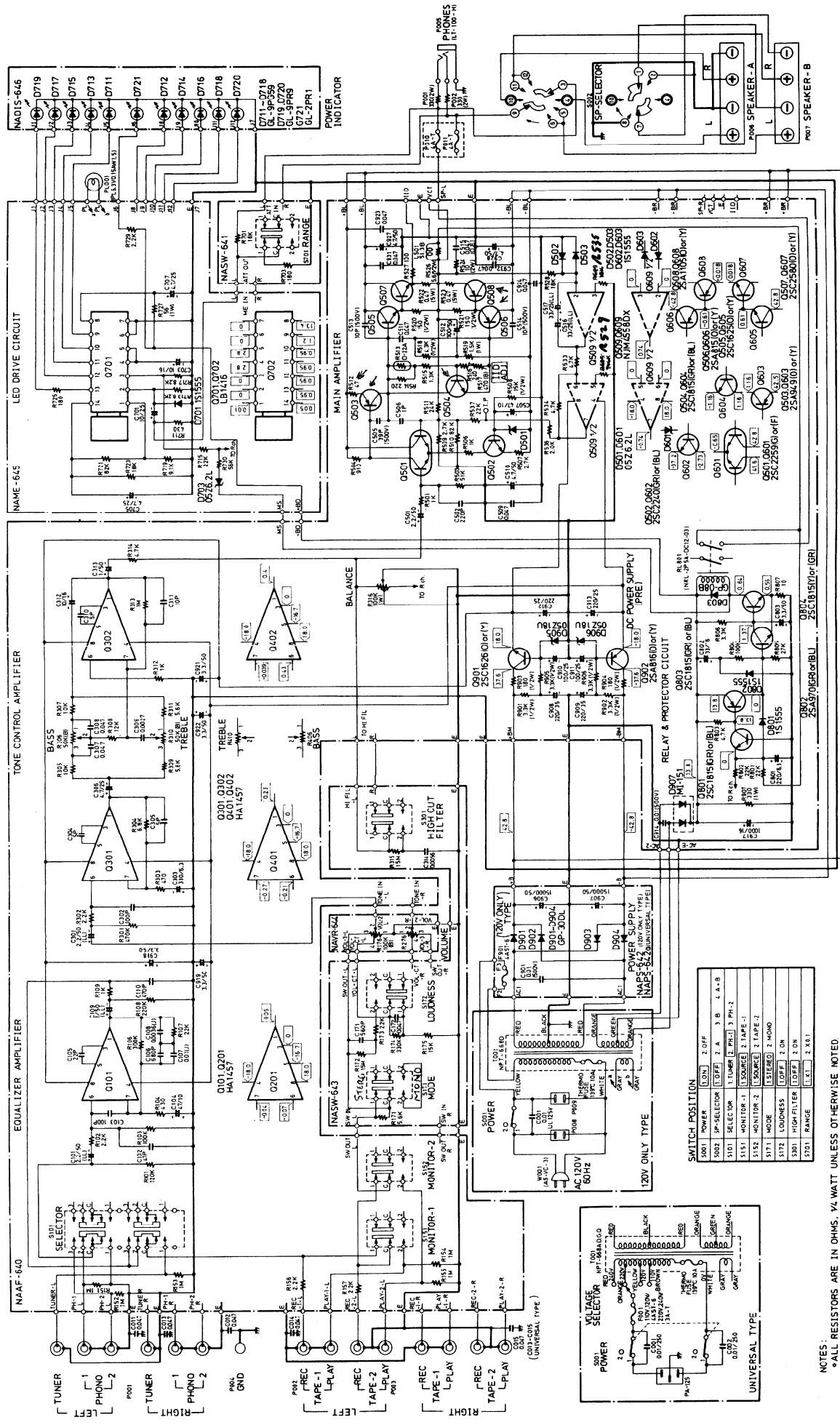


TONE CONTROL AMP.



**Idling current adjustment**  
 Connect the DC voltmeter between I<sub>1D</sub> and V<sub>CT</sub> terminal.  
 Adjust the voltage to 18mV with R517. (Lch)  
 Adjust the voltage to 18mV with R617. (Rch)  
 NOTES: Adjust after switching on for 5 minutes.  
 Open load, Volume . . . . Minimum.

**SCHEMATIC DIAGRAM**  
Model A-7040



- HA1457
- BA6E8
- 25C2259
- 25C2240
- 25C1815
- 25A949
- 25A970
- 25C1625
- 25A815
- 25C1626
- 25A105
- 25C2580
- 25A1105
- 25C1815
- 25A1105
- 25C1626
- 25A970
- LB1416
- 25C1625
- 25A815
- 25C1626
- 25A105
- 25C2580
- 25A1105
- 25C1815
- 25A1105
- 25C1626
- 25A970
- GL-9P69
- GL-2PR1
- GL-9P69
- GL-2PR1

NOTES:  
 \* ALL RESISTORS ARE IN OHMS, 1/4 WATT UNLESS OTHERWISE NOTED  
 \* ALL CAPACITORS ARE IN  $\mu$ F 50VW UNLESS OTHERWISE NOTED  
 \* ELECTROLYTIC CAPACITORS (—E—) ARE IN  $\mu$ F/WV  
 \* VOLTAGE (MEASURED WITH V.T.M.) IN INPUT SIGNAL.  
 \* CIRCUIT IS SUBJECT TO CHANGE FOR IMPROVEMENT.



**PRINTED CIRCUIT BOARD – PARTS LIST**  
**PRE., AND POWER AMPLI. PC BOARD**  
**(NAAF-640) – PARTS LIST**

CIRCUIT NO.	PARTS NO.	DESCRIPTION
Q101,Q201,Q301, Q302,Q401,Q402 Q509,Q609	222471	HA-1457
	222502	NJM-4558DX
Q501,Q601	2211372	2SC2259(G) or
	2211371	2SC2259(F) or
Q502,Q602	2211405	2SC2240(GR) or
	2211406	2SC2240(BL) or
Q503,Q603	2211353	2SA949(O) or
	2211354	2SA949(Y) or
Q504,Q604	2211255	2SC1815(GR) or
	2211256	2SC1815(BL) or
Q505,Q605	2200393	2SC1625(O) or
	2200394	2SC1625(Y) or
Q506,Q606	2200403	2SA815(O) or
	2200404	2SA815(Y) or
Q507,Q607	2200993	2SC2580(O) or
	2200994	2SC2580(Y) or
Q508,Q608	2201003	2SA1105(O) or
	2201004	2SA1105(Y) or
Q801,Q803	2211255	2SC1815(GR) or
	2211256	2SC1815(BL) or
Q802	2211395	2SA970(GR) or
	2211396	2SA970(BL) or
Q804	2211254	2SC1815(Y) or
	2211255	2SC1815(GR) or
Q901	2200663	2SC1626(O) or
	2200664	2SC1626(Y) or
Q902	2200673	2SA816(O) or
	2200674	2SA816(Y) or
D501,D601 D502,D503,D602 D603,D801,D802 D803 D905,D906 D907	224042	05Z6.2L
	223105	1S1555
	223848	GP-08B
	224065	05Z18U
	223853	MI-151
L501,L601	231001	S-1.3B
	<b>Capacitors</b>	
C101,C201	392880227	2.2 $\mu$ F, 50V, LL
C104,C204	352734701	47 $\mu$ F, 10V, Elect.
C109,C209	392880107	1 $\mu$ F, 50V, LL
C301,C401	392880227	2.2 $\mu$ F, 50V, LL
C303,C403	352723311	330 $\mu$ F, 6.3V, Elect.
C306,C406	352750471	4.7 $\mu$ F, 25V, Elect.
C312,C412	352741001	10 $\mu$ F, 16V, Elect.
C313,C413	352780101	1 $\mu$ F, 50V, Elect.
C501,C601	352780221	2.2 $\mu$ F, 50V, Elect.
C507,C607	352734701	47 $\mu$ F, 10V, Elect.
C510,C610	352780471	4.7 $\mu$ F, 50V, Elect.
C512,C612	352781011	100 $\mu$ F, 50V, Elect.
C513,C514 C613,C614	345071002	10pF $\pm$ 2%, 500V, Ceramic
C515,C615	374124735	0.047 $\mu$ F $\pm$ 10%, 50V, DE
C516,C517 C616,C617	392853307	33 $\mu$ F, 25V, LL
C801	352722211	220 $\mu$ F, 6.3V, Elect.
C802	322743301	33 $\mu$ F, 16V, Elect.
C803	352780331	3.3 $\mu$ F, 50V, Elect.
C908,C909	352762211	220 $\mu$ F, 35V, Elect.
C910,C911	352751011	100 $\mu$ F, 25V, Elect.
C912,C913	352752211	220 $\mu$ F, 25V, Elect.
C917	352741021	1,000 $\mu$ F, 16V, Elect.
C918–C922	352780331	3.3 $\mu$ F, 50V, Elect.
C927–C930	352780471	4.7 $\mu$ F, 50V, Elect.

**CAUTION:** Replacement for power, complementary and driver transistors, if necessary, must be made from the same beta group ( $h_{FE}$ ) as the original type.

**NOTES:** Capacitors: LL: Low leakage current type electrolytic capacitor  
 DE: Non-inductive polyester film capacitor  
 Resistors: MOF: Metal oxide film resistor

CIRCUIT NO.	PARTS NO.	DESCRIPTION
<b>Resistors</b>		
R306,R406	5148035	N16RGM11C50KBS35
R310,R410	5148034	N16RGM11C50KBO35
R316	5104079	N16RLC100KWTP35
R508,R608	441521534	15k $\Omega$ , 1/2W, M.O.F.
R513,R613	4000003	D-22A, Thermistor
R517,R617	5225026	N10HR470BD,
R158,R618	441524324	4.3k $\Omega$ , 1/2W, M.O.F.
R519,R619	441621524	1.5k $\Omega$ , 1W, M.O.F.
R520,R521 R620,R621	441521514	150 $\Omega$ , 1/2W, M.O.F.
R522,R523 R622,R623	4000047	0.47 $\Omega$ , 5W, Metal plate
R524,R624	451731004	10 $\Omega$ , 2W, Metal
R526,R626	451630564	5.6 $\Omega$ , 1W, Metal
R903,R904	441521814	180 $\Omega$ , 1/2W, M.O.F.
R907	441623314	330 $\Omega$ , 1W, M.O.F.
<b>Switches</b>		
S101	25030127	NRSM-143-35ZR
S151,S152	25035115	NPS-222-L80
<b>Relay</b>		
RL801	25065085A	NRL-2P-5A-DC12-03

**SWITCH PC BOARD (NASW-641) – PARTS LIST**

S701 25035109 NPS-122-L74

**POWER SUPPLY PC BOARD (NAPS-642) – PARTS LIST (120V model)**

D901–D904 223863 GP-30DL, Diode  
 C906,C907 3504118 15,000 $\mu$ F, 50V, Elect. capacitor  
 F901a 250113 SN5051, Fuseholder

**POWER SUPPLY PC BOARD (NAPS-642a) – PARTS LIST (Universal model)**

D901–D904 223863 GP-30DL, Silicon diode  
 C906,C907 3504118 15,000 $\mu$ F, 50V, Elect.

**SWITCH PC BOARD (NASW-643) – PARTS LIST**

S171,S172,S301 25035114 NPS-322-L79

**VOLUME CONTROL PC BOARD (NAVR-644) – PARTS LIST**

R176,R276 5172055 N24RGL41C100KBTP35M, Volume control

**METER DRIVER PC BOARD (NAME-645) – PARTS LIST**

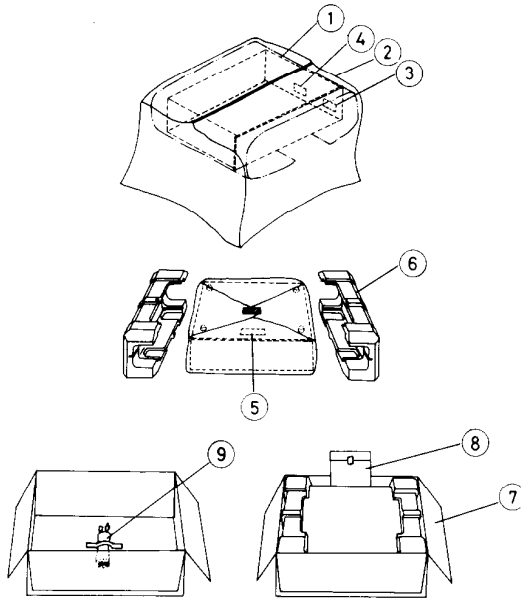
Q701, Q702 222539 LB1416, IC  
 D701,D702 223105 1S1555, Silicon diode  
 D703 224042 05Z6.2L  
 C701,C702 352751001 10 $\mu$ F, 25V, Elect.  
 C703,C704 352741001 10 $\mu$ F, 16V, Elect.  
 C705–C708 352750471 4.7 $\mu$ F, 25V, Elect.

**Resistors**  
 R727,R728 441625604 56 $\Omega$ , 1W, M.O.F.

**DISPLAY PC BOARD (NADIS-646) – PARTS LIST**

D711–D718 225028 GL-9PG59, L.E.D.  
 D719,D720 225029 GL-9PR9, L.E.D.  
 D721 225018 GL-2PR1, L.E.D.

## PACKING PROCEDURES



REF. NO.	PARTS NO.	DESCRIPTION
1	29100036	850 × 550mm, Poly bag
2	29095012	500 × 800mm, Protection sheet
3	29380040	Cabinet composite label (USA)
4	282969	Caution label (A) (USA)
5	293041	Caution label (USA)
6	29090398	Pad
7	29050269	Carton box
8		Accessory bag complete
	U.S.A. model	
	29340315	Instruction manual
	29365006	Warranty card
	29358002	S. S list
	29100006	250 × 350mm, Poly bag
	Universal model	
	29340316	Instruction manual
	25055018	Conversion plug
	252049	4A ST-6, Fuse
	29100002	150 × 80 mm, Poly bag for fuse
	29100006	250 × 350mm, Poly bag
	Germany model	
	29340316	Instruction manual
	29365005-1	Warranty card
	29100006	250 × 350mm, Poly bag
9	13710703	Power supply cord (UU)
	253089	AS-VDE-C, Power supply cord (G)
	29380038	Voltage tag (UU), (G)
NOTE:	(USA):	U.S.A. model
	(UU):	Universal model
	(G):	Germany model

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