

ONKYO SERVICE MANUAL

QUARTZ SYNTHESIZED TUNER AMPLIFIER MODEL R-21/R-31



Black model

BHMD, BHMDN	120V AC, 60Hz
BHMP, BHMPV, BHMPF	230V AC, 50Hz
BHMW	120 or 220V AC, 50/60Hz
BHMQA	240V AC, 50Hz

SAFETY-RELATED COMPONENT WARNING!!

COMPONENTS IDENTIFIED BY MARK Δ ON THE SCHEMATIC DIAGRAM AND IN THE PARTS LIST ARE CRITICAL FOR RISK OF FIRE AND ELECTRIC SHOCK. REPLACE THESE COMPONENTS WITH ONKYO PARTS WHOSE PARTS NUMBERS APPEAR AS SHOWN IN THIS MANUAL.

MAKE LEAKAGE-CURRENT OR RESISTANCE MEASUREMENTS TO DETERMINE THAT EXPOSED PARTS ARE ACCEPTABLY INSULATED FROM THE SUPPLY CIRCUIT BEFORE RETURNING THE APPLIANCE TO THE CUSTOMER.

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ONKYO
AUDIO COMPONENTS

SPECIFICATIONS

Tuner Amplifier R-31/21

Amplifier section

Power Output:	R-31: 30 watts per channel, min. RMS, at 6 ohms, both channels driven, from 40 Hz to 20 kHz, with no more than 0.5% THD. R-21: 25 watts per channel, min. RMS, at 6 ohms, both channels driven, from 40 Hz to 20 kHz, with no more than 0.5% THD.
Continuous Power Output:	R-31: 2 × 35 watts at 6 ohms, 1 kHz (DIN) R-21: 2 × 30 watts at 6 ohms, 1 kHz (DIN)
Total Harmonic Distortion:	0.5% at rated power
IM Distortion:	0.5% at rated power
Damping Factor:	40 at 6 ohms
Frequency Response:	40 – 20,000 Hz ±3 dB (DIRECT)
Sensitivity and Impedance:	
CD/Tape Play:	150mV/50 kohms
Tape Rec:	150 mV/3.5 kohms
Signal-to-Noise Ratio:	
CD/Tape:	100dB (IHF-A)
Tone Controls:	
Super Bass:	+15dB at 45Hz
Bass:	±10dB at 100Hz
Treble:	±10dB at 10kHz
Muting:	–45dB

Tuner section

FM:

Tuning Range:	European models: 87.5 – 108.0MHz (50kHz steps) U.S.A. and Canadian models: 87.9 – 107.9MHz (200kHz steps)
Usable Sensitivity:	
Mono:	11.2dBf, 1.0µV, 75 ohms 0.9µV (S/N 26dB, 40kHz Devi.) 75 ohms DIN
Stereo:	18.0dBf, 2.2µV, 75 ohms 23µV (S/N 46dB, 40kHz Devi.) 75 ohms DIN
50dB Quieting Sensitivity:	
Mono:	18.2dBf, 2.2µV, 75 ohms
Stereo:	37.2dBf, 20µV, 75 ohms
Capture Ratio:	1.5dB
Image Rejection Ratio:	85dB (European, Australian and worldwide models) 40dB (USA and Canadian models)
IF Rejection Ratio:	90dB
Signal-to-Noise Ratio:	
Mono:	73dB
Stereo:	66dB
Selectivity:	50dB DIN (±300kHz, 40kHz dev.)
AM Suppression Ratio:	50dB
Harmonic Distortion:	
Mono:	0.15%
Stereo:	0.30%
Frequency Response:	30 – 15,000Hz ±1.5dB
Stereo Separation:	40dB at 1kHz

AM:

Tuning Range:	European and Australian models: 522 – 1611kHz (9kHz steps) U.S.A. and Canadian models: 530 – 1710kHz (10kHz steps) Worldwide models: 531 – 1602kHz (9kHz steps)
Usable Sensitivity:	30µV
Image Rejection Ratio:	40dB
IF Rejection Ratio:	40dB
Signal-to-Noise Ratio:	40dB
Harmonic Distortion:	0.8%

General

Power Supply:	European models: AC 230V, 50Hz U.S.A. and Canadian models: AC 120V, 60Hz Australian models: AC 240V, 50Hz Worldwide models: AC 120 and 220V switchable, 50/60Hz
Dimensions:	275 (W) × 115 (H) × 321 (D) mm 10-7/8" × 4-1/2" × 12-5/8"
Weight:	5.5kg (12.3lbs.)

Remote control RC-257C

Transmitter:	Infrared
Signal range:	Approx. 5 meters (16ft. 4")
Power supply:	Two "AA" batteries (1.5V × 2)

SERVICE PROCEDURES

1. Replacing the fuses

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

CircuitNo.	PartNo.	Description
F901	252160Y	Δ 2.5A-UL/T-237,Primary fuse <W> R-31
	252159Y	Δ 2.0A-UL/T-237,Primary fuse <D/W> R-21
F902	252071	Δ 1.25A-SE-EAK,Primary fuse <P/W/Q> R-31
	252070	Δ 1.00A-SE-EAK,Primary fuse <P/W/Q> R-21
F903	252071	Δ 1.25A-SE-EAK,Primary fuse <P> R-31

NOTE: <D> :Only 120V model
 <P> :Only 230V model
 <W> :Only Worldwide model
 <Q> :Only 240V model

2. Change of FM/AM band step

With the exception of the Worldwide model,a BAND STEP selector switch is not provided.
 (FM)

BAND STEP	R799	J703
200kHz→50kHz	Add	Open
50kHz→200kHz	Open	Short

(AM)

BAND STEP	R798	J702
10kHz→ 9kHz	Add	Open
9kHz→10kHz	Open	Short

R798/R799 1k Ω carbon resistor

—Worldwide model—

Worldwide models are equipped with a step band selector switch. This switch is located on the back panel. This switch is set to 50kHz(FM)and 9kHz(AM)at the factory, but may have to be reset to 200 kHz and 10kHz depending on the area where the unit is used.

	FM step	AM step
Europe:	50kHz	9kHz
U.S.A.:	200kHz	10kHz

3. Memory preservation

This unit does not require memory preservation batteries. A built-in memory power back-up system preserves contents of the memory during power failures and even when the unit is unplugged. The unit must be plugged in and the power switch turned on and off once in order to charge the back-up system. Note that since this is not a permanent memory the power switch must be turned on and off a few times each month to keep the back-up system operative. The period of time during which memory contents are preserved after power has last been turned off varies depending on climate and placement of the unit. On the average, memory contents are protected over a period of 3 to 4 weeks (a minimum of 2 weeks) after the last time power has been turned off. This period is shorter when the unit is exposed to very high humidity or used in an area with an extremely humid climate.

4. Safety-check out

(Only U.S.A. model)

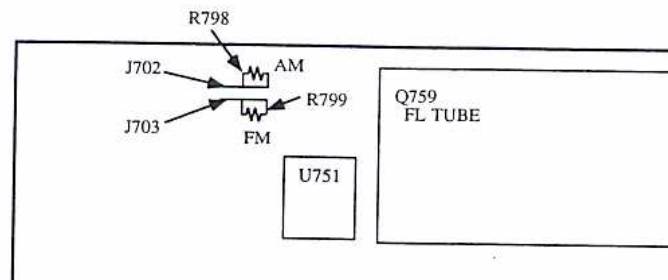
After correcting the original service problem perform the following safety check before releasing the set to the customer.

Connect the Insulating-resistance tester between the plug of power supply cord and terminal GND on the back panel. Specifications: 3.3 Mohm \pm 10% at 500V.

5. Change of voltage

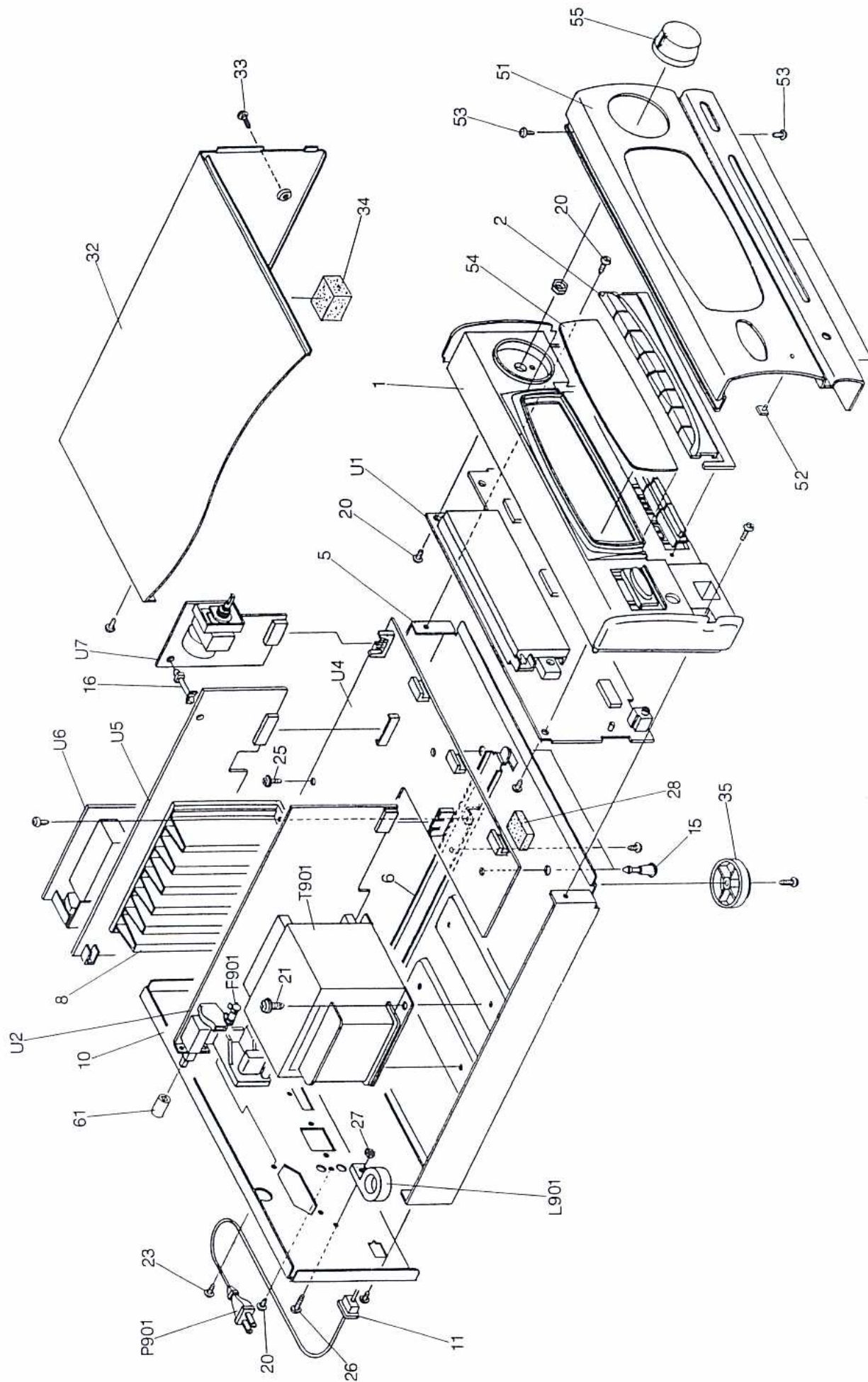
Worldwide models are equipped with a voltage selector to conform with local power supplies. This switch is located on the back panel. Be sure to set this switch to match the voltage of the power supply in your area before turning the power switch on.

This switch is set to 220V at the factory. Voltage is changed by sliding the groove in the switch with the screwdriver to the right or left. Confirm that the switch has been moved all the way to the right or left before turning the power switch on.



MICROPROCESSOR CIRCUIT PC BOARD

EXPLODED VIEW



PARTS LIST

CAUTION: Replacement for transistor of mark \star ; if necessary, must be made from the same beta group (H \neq) as the original type.

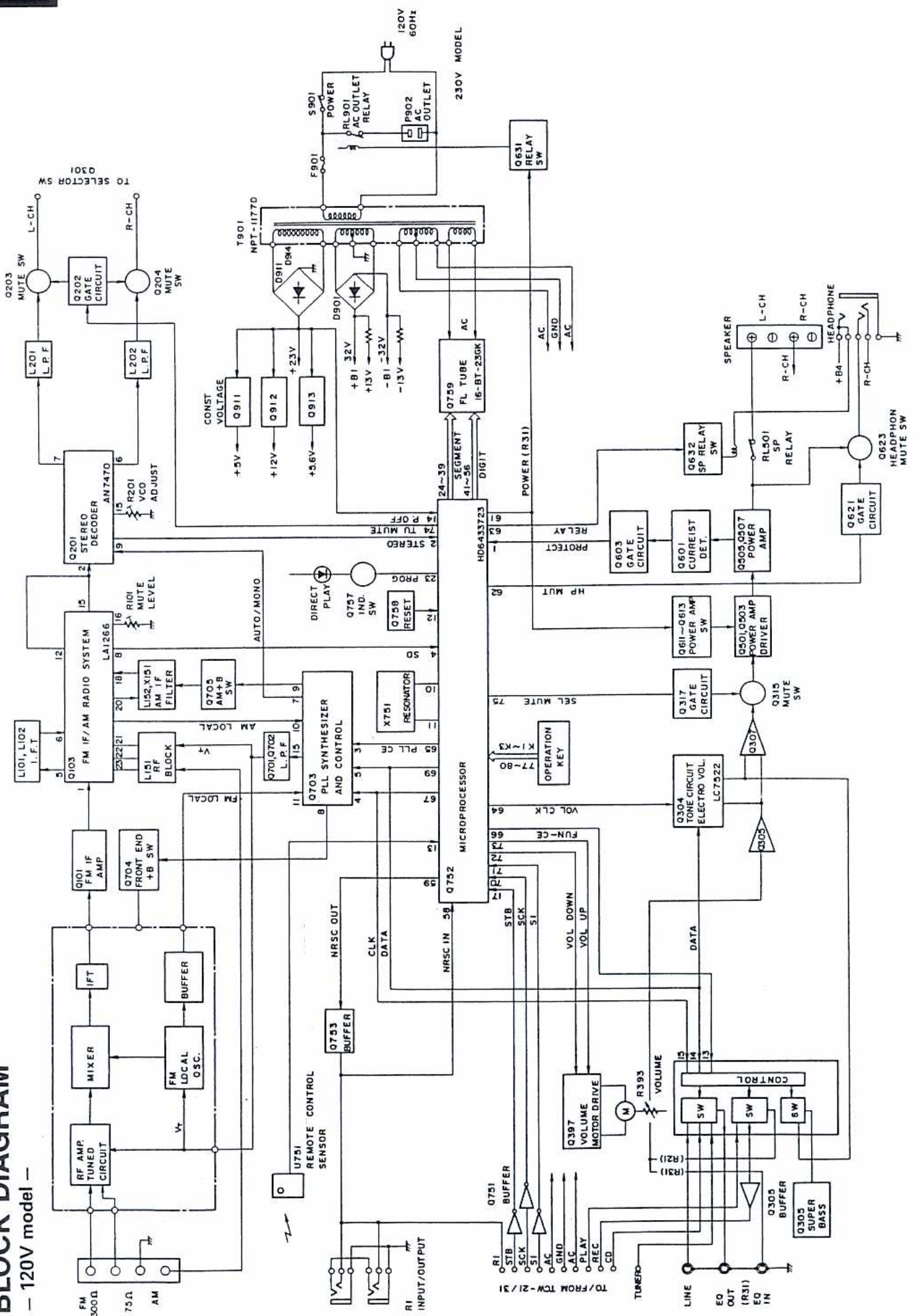
REF. NO.	PART NO.	DESCRIPTION	REF. NO.	PART NO.	DESCRIPTION
1	27110770Y	Front bracket	Q505, Q506	2202303, 2202304 or 2202305	2SC4512-O, 2SC4512-Y or 2SC4512-P, Power amplifier transistors
2	28324837AY	Knob, selector	Q507, Q508	2202313, 2202314 or 2202315	2SA1726-O, 2SA1726-Y or 2SA1726-P, Power amplifier transistors
5	27100268AY	Chassis	T901	2300928Y, 2300929Y, 2300930Y, 2300919Y, 2300920Y, 2300921Y, 2300922Y	NPT-1179P, Power transformer <P> NPT-1179DG, Power transformer <W> NPT-1179Q, Power transformer <Q> NPT-1177D, Power transformer <D> NPT-1177P, Power transformer <P> NPT-1177DG, Power transformer <W> NPT-1177Q, Power transformer <Q>
6	27130720AY	Bracket H	U1	1A439555-2A, 1A439555-2B, 1A438555-1, 1A438555-1A, 1A438555-1B, 1A439556-2A, 1A439556-2B, 1A439556-2C, 1A438556-1, 1A438556-1A, 1A438556-1B, 1A438556-1C, 1A439569-2, 1A438569-1, 1A439557-2A, 1A439557-2B, 1A438557-1, 1A438557-1A, 1A438557-1B, 1A439558-2A, 1A438558-1, 1A438558-1A, 1A439559-2A, 1A438559-1, 1A438559-1A, 1A439560-2, 1A438560-1	ADG-4755-2A, Microprocessor circuit pc board ass'y <P/Q> ADG-4755-2B, Microprocessor circuit pc board ass'y <W> ADG-4755-1, Microprocessor circuit pc board ass'y <D> ADG-4755-1A, Microprocessor circuit pc board ass'y <P/Q> ADG-4755-1B, Microprocessor circuit pc board ass'y <W> APS-4756-2B, Power supply circuit pc board ass'y <P> APS-4756-2B, Power supply circuit pc board ass'y <W> APS-4756-2C, Power supply circuit pc board ass'y <Q> APS-4756-1, Power supply circuit pc board ass'y <P> APS-4756-1A, Power supply circuit pc board ass'y <P> APS-4756-1B, Power supply circuit pc board ass'y <W> APS-4756-1C, Power supply circuit pc board ass'y <Q> ASW-4769-2, Voltage selector switch pc board ass'y <W> ASW-4769-1, Voltage selector switch pc board ass'y <P/Q> AAR-4757-2A, Main circuit pc board ass'y <W> AAR-4757-2B, Main circuit pc board ass'y <D> AAR-4757-1, Main circuit pc board ass'y <P/Q> AAR-4757-1A, Main circuit pc board ass'y <P/Q> AAR-4757-1B, Main circuit pc board ass'y <W> AAF-4758-2A, Tone control circuit pc board ass'y <D> AAF-4758-1, Tone control circuit pc board ass'y <P/W/Q> AAF-4758-1A, Tone control circuit pc board ass'y <D> ARF-4759-2A, Front end pc board ass'y <P/W/Q> ARF-4759-1, Front end pc board ass'y <D> ARF-4759-1A, Front end pc board ass'y <P/W/Q> AETC-4760-2, Volume circuit pc board ass'y AETC-4760-1, Volume circuit pc board ass'y
8	27160326Y	Radiator	U2	3TTS+8B(BC), Self-tapping screw 4TTC+8C(BC), Self-tapping screw 3SMS8W, SW+14B(BC), Self-tapping screw 3TTP+8P(BC), Self-tapping screw 3P+6FN(BC), Pan head screw 3TTW+8B, Self-tapping screw 4TTB+10C(BC), Self-tapping screw FWN4 x 10FN, Nut 15 x 60 x 40, Cushion Top cover	
10	27121761AY	Rear panel <P>	U3	3TTB+8B(BC), Self-tapping screw	
	27121762AY	Rear panel <W>	U4	27 x 40 x 27, Cushion	
	27121763AY	Rear panel <Q>	U5	Leg	
	27121763AY	Rear panel <Q>	U6	2.5A-UL/T-237, Primary fuse <W> 2.0A-UL/T-237, Primary fuse <D/W> 1.25A-SE-EAK, Primary fuse <P/W/Q> 1.00A-SE-EAK, Primary fuse <P/W/Q> 1.25A-SE-EAK, Primary fuse <P>	
	27121756AY	Rear panel <D>	U7	ESD-R25DB, Core AS-UC-6#18, Power supply cord <D> AS-CEE, Power supply cord <P/W> AS-SAA, Power supply cord <Q> NSCT-2P697, AC outlet <Q>	
	27121757AY	Rear panel <P>			
	27121758AY	Rear panel <W>			
	27121759AY	Rear panel <Q>			
11	27300750	Pushing, cord			
15	27190524	KGLS-14RT, Holder			
16	27190513	KGLS-18S, Holder			
20	834430088	3TTS+8B(BC), Self-tapping screw			
21	830440089	4TTC+8C(BC), Self-tapping screw			
22	801433	3SMS8W, SW+14B(BC), Self-tapping screw			
23	833430080	3TTP+8P(BC), Self-tapping screw			
24	82143006	3P+6FN(BC), Pan head screw			
25	831130088	3TTW+8B, Self-tapping screw			
26	838440109	4TTB+10C(BC), Self-tapping screw			
27	86414010	FWN4 x 10FN, Nut			
28	28141278	15 x 60 x 40, Cushion			
32	28184541Y	Top cover			
33	838430088	3TTB+8B(BC), Self-tapping screw			
34	28141277Y	27 x 40 x 27, Cushion			
35	27175252-1AY	Leg			
51	1A439701K	Front panel ass'y			
	1A438701K	Front panel ass'y			
52	28198794Y	Facet			
53	801230	3TTS+8BQ(BC), Self-tapping screw			
54	28191657AY	Clear plate			
55	28324842Y	Knob, volume			
61	28324843	Knob, push <P/W/Q>			
F901	252160Y	2.5A-UL/T-237, Primary fuse <W>			
	252159Y	2.0A-UL/T-237, Primary fuse <D/W>			
F902	252071	1.25A-SE-EAK, Primary fuse <P/W/Q>			
	252070	1.00A-SE-EAK, Primary fuse <P/W/Q>			
F903	252071	1.25A-SE-EAK, Primary fuse <P>			
L901	230910	ESD-R25DB, Core			
P901	253163Y or 253174Y	AS-UC-6#18, Power supply cord <D>			
	253164Y or 253175Y	AS-CEE, Power supply cord <P/W>			
	253170	AS-SAA, Power supply cord <Q>			
P902	25050904	NSCT-2P697, AC outlet <Q>			

NOTE: THE COMPONENTS IDENTIFIED BY MARK Δ ARE CRITICAL FOR RISK OF FIRE AND ELECTRIC SHOCK. REPLACE ONLY WITH PARTS NUMBER SPECIFIED.

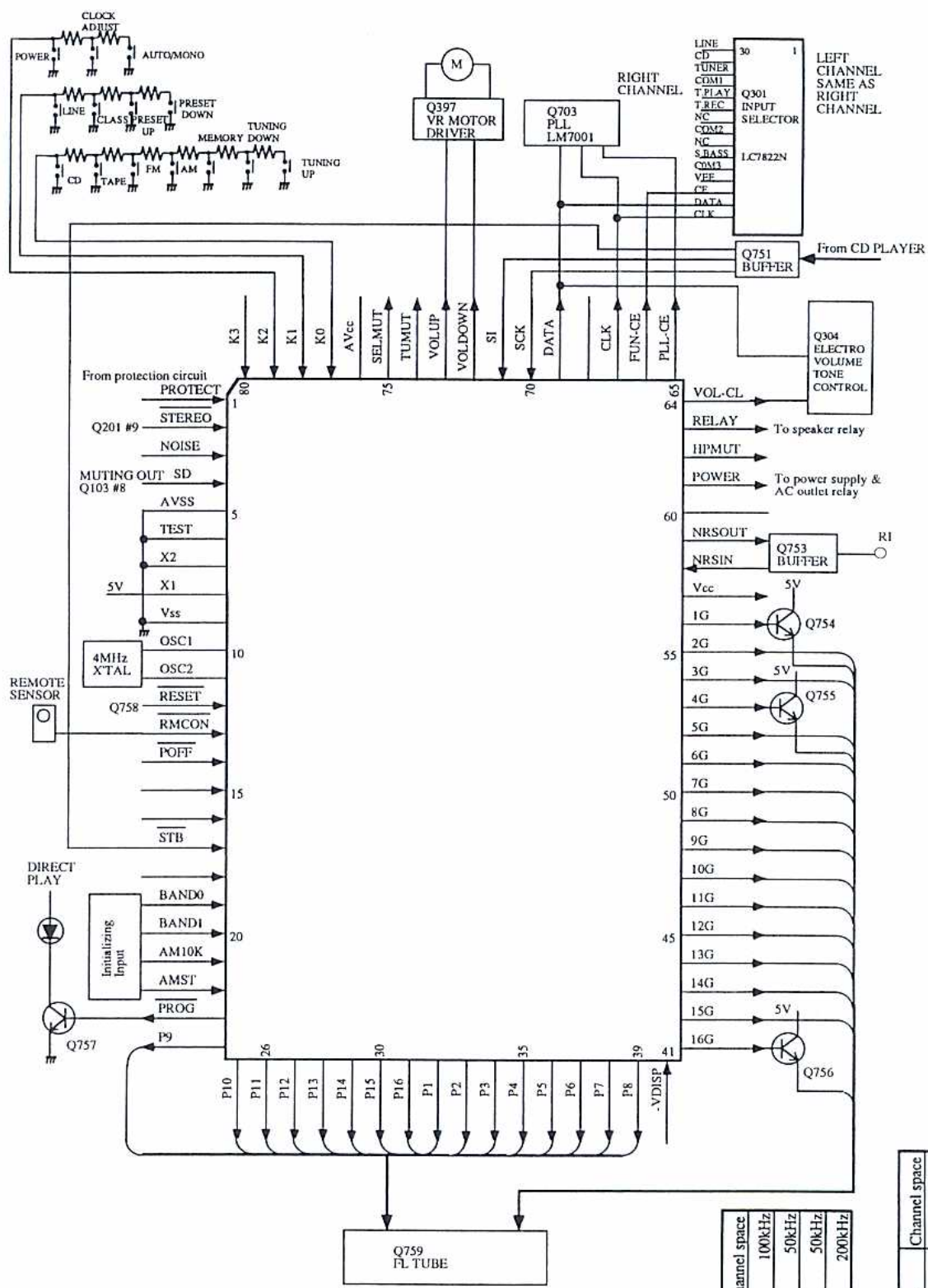
NOTE:
 <D>: 120V model only
 <P>: 230V model only
 <W>: Worldwide model only
 <Q>: 240V model only

BLOCK DIAGRAM

— 120V model —



MICROPROCESSOR CONNECTION DIAGRAM



#72	#73	VOLUME
H	H	STOP
L	H	UP
H	L	DOWN
L	L	Power Off

FM band setting			
BAND1	BAND0	Region	Channel space
0	0	Japan	100kHz
0	1	Europe	50kHz
1	0	Worldwide	50kHz
1	1	U.S.A.	200kHz

AM band setting					
BAND1	BAND0	AM10K	Region	Frequency range	Channel space
0	1	0	Europe	522 ~ 1611kHz	9kHz
1	0	0	Worldwide	531 ~ 1602kHz	9kHz
1	1	1	U.S.A.	530 ~ 1710kHz	10kHz

TERMINAL DESCRIPTION

Pin No.	Symbol	I/O	Description
1	PROTECT	I	Detection input terminal of protection circuit operation.
2	STEREO	I	Detection input terminal of stereo broadcast.
3	NOISE	I	Noise detection input terminal of broadcast. Not used.
4	SD	I	Detection input terminal of broadcast more than muting level.
5	AVss		Reference ground terminal for AD converter.
6	TEST	I	Test terminal. Connect to the ground terminal.
7	X2	O	Resonator output terminal of sub clock.
8	X1	I	Resonator input terminal of sub clock.
9	Vss		Ground terminal
10	OSC1	I	Main clock resonator input. Connect the 4MHz crystal resonator.
11	OSC2	O	Main clock resonator output.
12	RESET	I	Reset input terminal.
13	RMCN	I	Remote control signal input terminal.
14	POFF	I	Detection input terminal of stoppage of electric current.
15	SELC0	I	Initializing input terminal for operation mode
16	SELC1	I	of input selector.
17	STB	I	Transfer strobe input terminal from CD player.
18	TIMER	I	Timer function takeover input.
19	BAND0	I	FM band initializing input terminals.
20	BAND1	I	
21	AM10K	I	AM band initializing input terminal.
22	AMST	I	AM stereo operation setting initializing input.
23	PROG	O	DIRECT PLAY indication output terminal.
24~31	P9~P16	O	Segment output terminals for FL tube.
32~39	P1~P8	O	Segment output terminals for FL tube.
40	-Vdisp		Negative power supply terminal for grid of FL tube.

Pin No.	Symbol	I/O	Description
41~56	16G~1G	O	Grid output terminals for FL tube
57	Vcc		Power supply terminal (+5V)
58	NRSCIN	I	System code input terminal.
59	NRSCOUT	O	System code output terminal.
60			Not used.
61	POWER	O	Power source control output terminal.
62	HPMUT	O	Muting output for headphone.
63	RELAY	O	Speaker relay control output terminal.
64	VOLCLK	O	Transfer clock output terminal for electro volume LC7522.
65	PLLCE	O	Chip enable signal output terminal for PLL IC LM7001.
66	FUNCCE	O	Chip enable signal output terminal for function switch LC7822N.
67	CLK	O	Clock signal output terminal for PLL and function switch.
68			Not used.
69	DATA	O	Serial data output terminal for LM7001, LC7822N and LC7522.
70	SCK	I	Data transfer clock input terminal of indicator from CD player.
71	SI	I	Serial data input terminal of indicator from CD player.
72	VOLDOWN	O	Volume control output terminal.
73	VOLUP	O	Volume control output terminal.
74	TUMUT	O	Muting output terminal for tuner section.
75	SELMUT	O	Muting output terminal for amplifier section.
76	AVcc		Reference voltage input terminal for A/D converter.
77~79	K0~K2	I	Operation key connection terminals.
80			Not used.

SCHEMATIC DIAGRAM PART 1

— 120V MODEL —

A

B

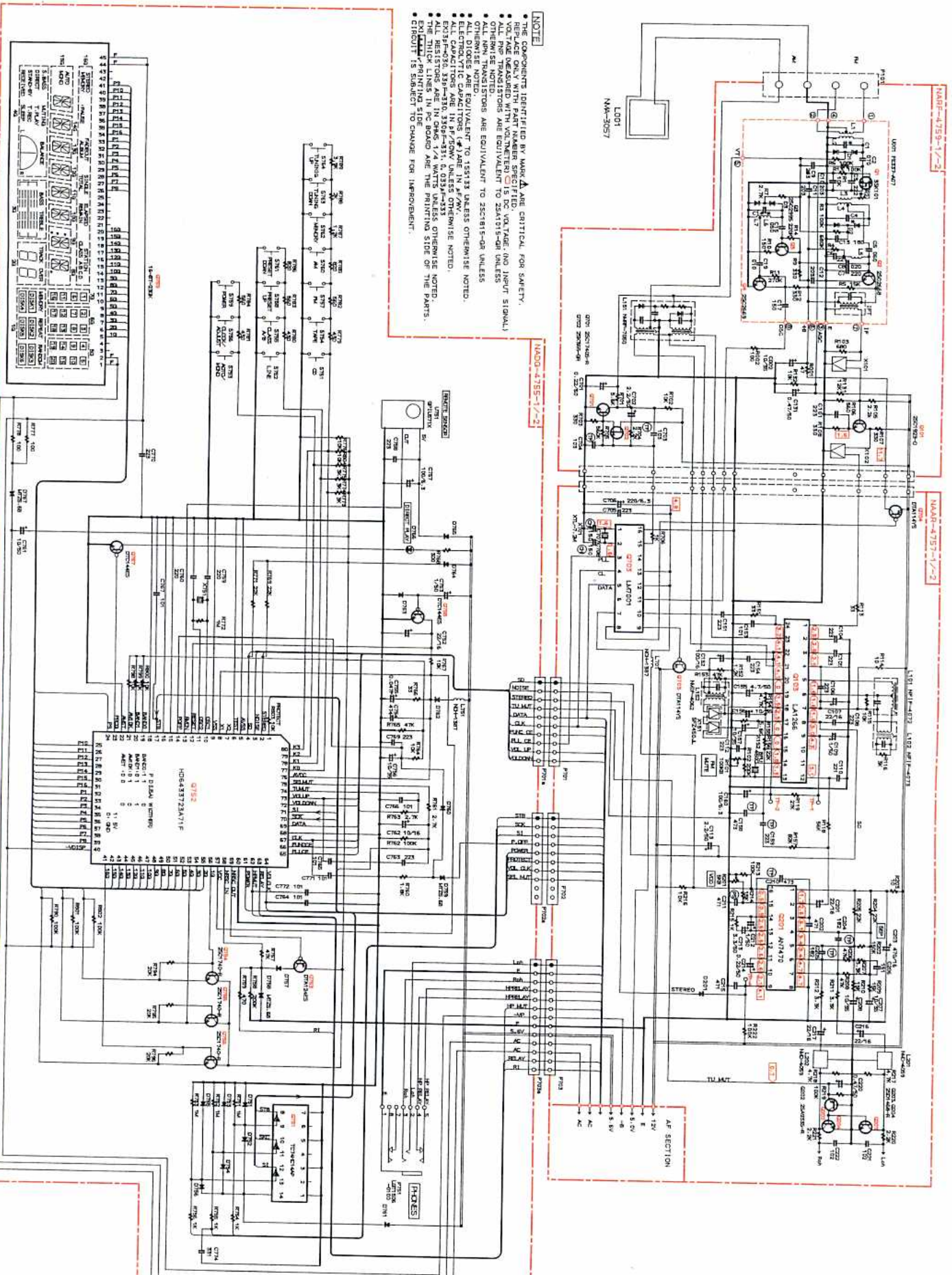
C

D

E

F

G



NOTE

- THE COMPONENTS IDENTIFIED BY MARK Δ ARE CRITICAL FOR SAFETY.
- ALL TRANSISTORS ARE EQUIVALENT TO 2N4113 UNLESS OTHERWISE NOTED.
- ALL DIODES ARE EQUIVALENT TO 1N5113 UNLESS OTHERWISE NOTED.
- ALL CAPACITORS ARE IN MICROFARADS UNLESS OTHERWISE NOTED.
- ALL RESISTORS ARE IN OHMS UNLESS OTHERWISE NOTED.
- THE THICK LINE IS USED TO INDICATE THE PRINTING SIDE OF THE PARTS.
- CIRCUIT IS SUBJECT TO CHANGE FOR IMPROVEMENT.

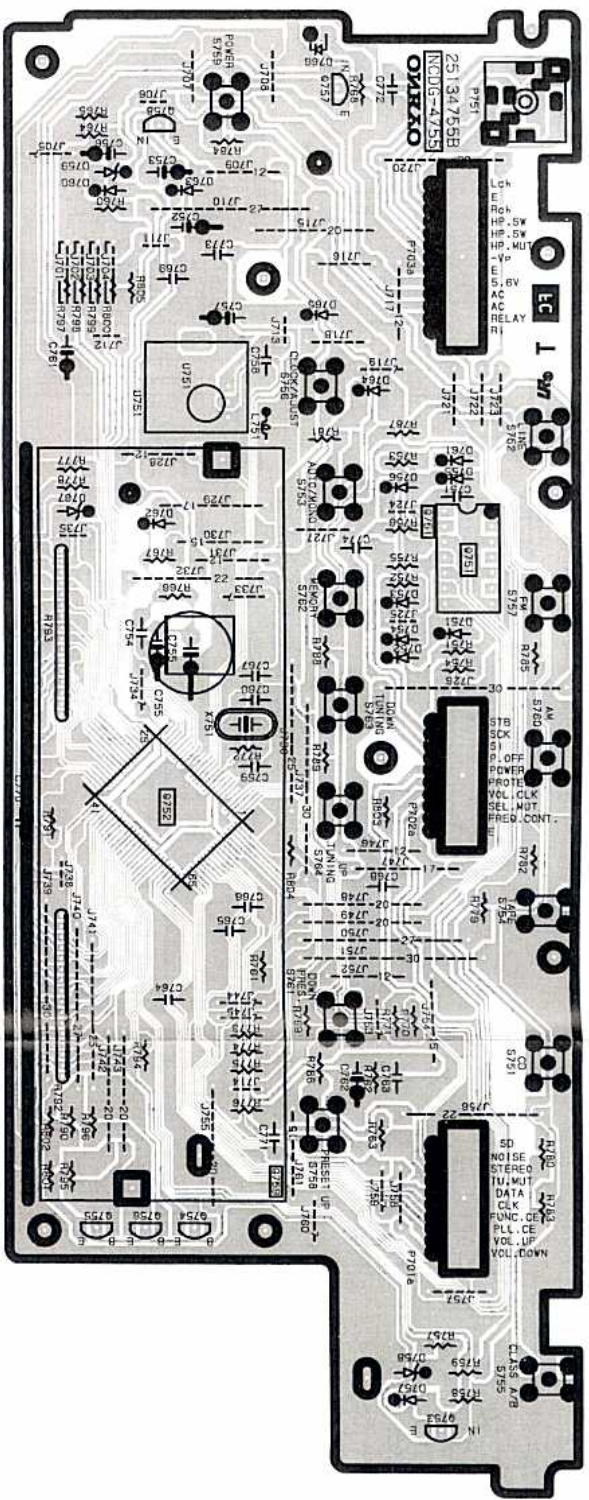
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4

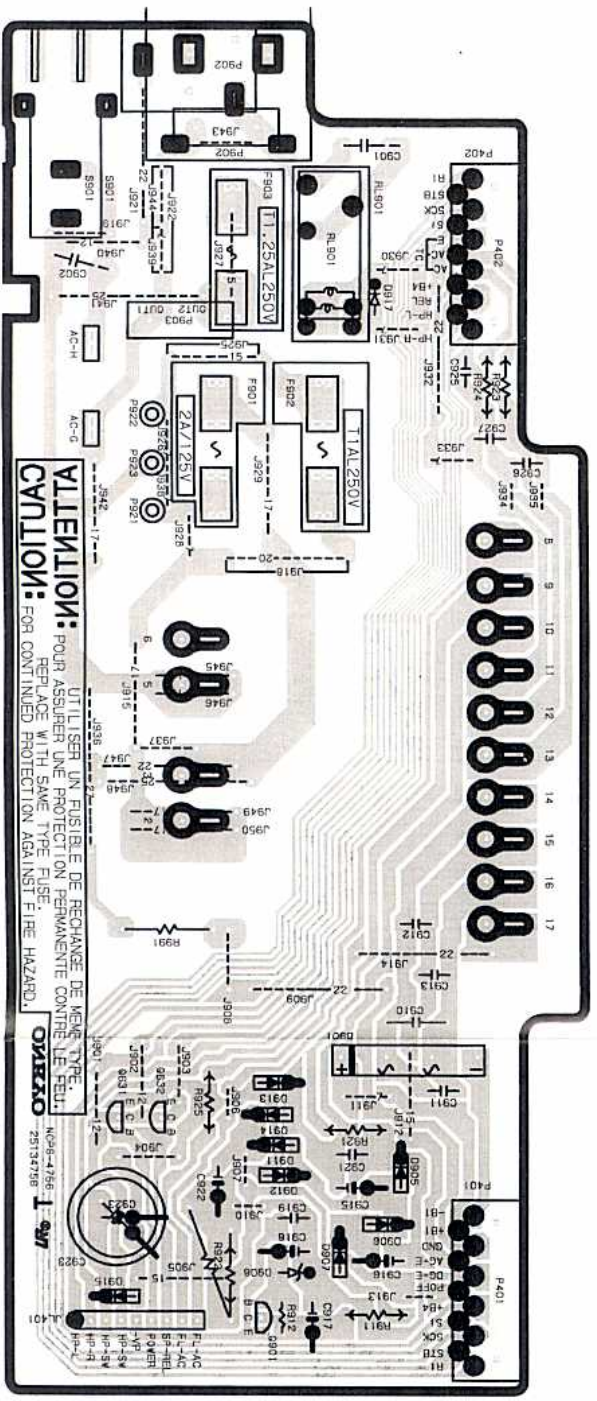
3

2

1

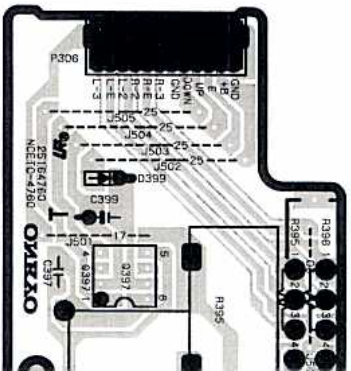


MICROPROCESSOR CIRCUIT PC BOARD

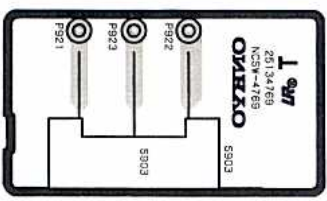


POWER SUPPLY CIRCUIT PC BOARD

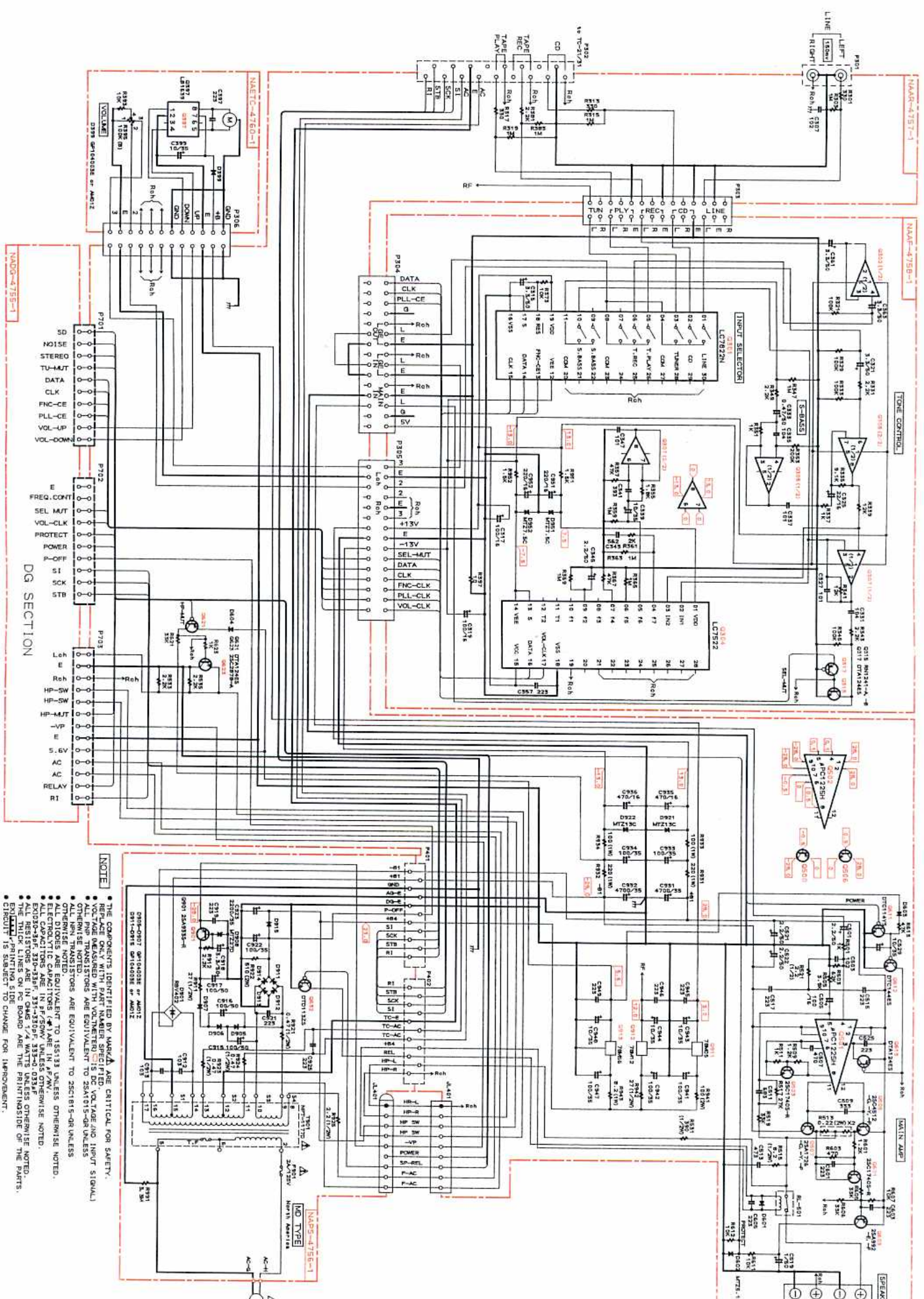
ATTENTION: UTILISER UN FUSIBLE DE RECHARGE DE MÊME TYPE.
REPLACE WITH SAME TYPE FUSE.
CAUTION: FOR CONTINUED PROTECTION AGAINST FIRE HAZARD.



VOLUME CIRCUIT PC BOARD

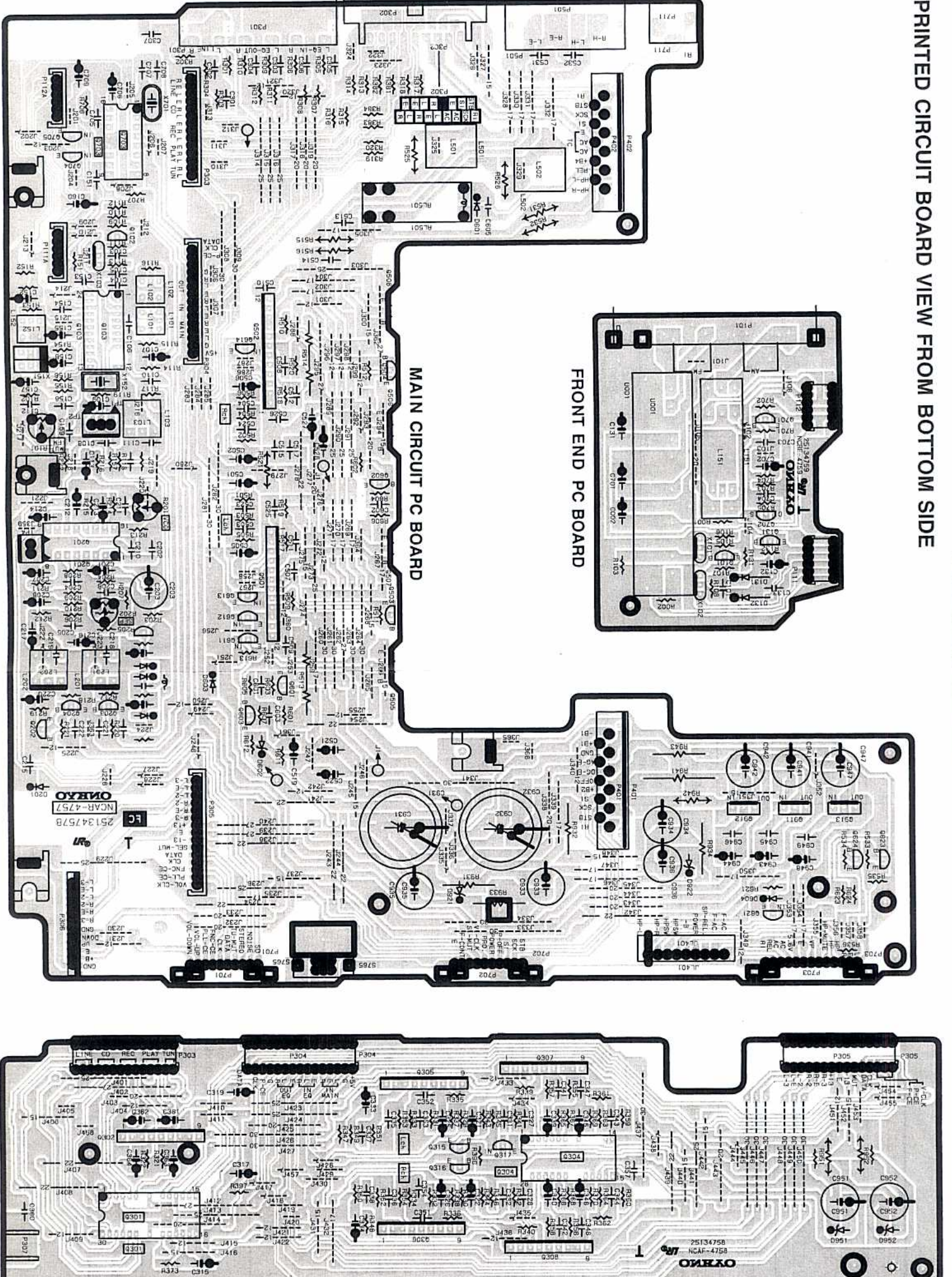


VOLTAGE SELECTO CIRCUIT PC BOARD



NOTE

- THE COMPONENTS IDENTIFIED BY MARK A ARE CRITICAL FOR SAFETY.
- REPLACE ONLY WITH PART NUMBER SPECIFIED (ON TAPE AND INPUT SIGNAL).
- ALL PNP TRANSISTORS ARE EQUIVALENT TO 2SA4015-GR UNLESS OTHERWISE NOTED.
- ALL DIODES ARE EQUIVALENT TO 2C31815-GR UNLESS OTHERWISE NOTED.
- ALL DIODES ARE EQUIVALENT TO 1SS133 UNLESS OTHERWISE NOTED.
- ELECTROLYTIC CAPACITORS (4) ARE IN P.P.W.V.
- EXPOSURE TO HIGH VOLTAGE IS PROHIBITED. CHANGE NOTED.
- ALL RESISTORS ARE IN OHMS 1/4 WATT UNLESS OTHERWISE NOTED.
- ENGLISH PRINTING SIDE OF THE BOARD AND THE PRINTING INSIDE OF THE PARTS.
- CIRCUIT IS SUBJECT TO CHANGE FOR IMPROVEMENT.



FRONT END PC BOARD

MAIN CIRCUIT PC BOARD

25134758
NCAF-4758
OMRON

FM section

Item	Step of instrument	Connection of instrument	FM SG output	Stereo modulator output	Tuning frequency	Output indicator	Adjustment point	Adjust for	Remarks
FM IF/RF	1	Fig. 1	99.1MHz 1kHz 75kHz devi. 65dB(60dB)	—	99.1MHz	DC voltmeter	L101	0±20mV	FM MUTE/MODE switch: ON/STEREO Repeat the steps 1 and 3 until no further adjustment is necessary.
	AC voltmeter Distortion analyzer					IFT on the front end	Maximum		
VCO		Fig. 2	99.1MHz 1kHz 75kHz devi. 65dB(60dB)	—	99.1MHz	Frequency counter	R201	19kHz ± 10Hz	
Stereo Distortion		Fig. 3	99.1MHz Ext. mod. 65dB(60dB)	Channel L or R 1kHz	99.1MHz	Distortion analyzer	IFT on the front end	Minimum	Don't turn more than ±180°
Muting Level		Fig. 3	99.1MHz 17.2dB(12dB) <19.2dB(14dB)>	—	99.1MHz	Oscilloscope	R101	Signal output	

NOTE: < >: 230V and Worldwide models

AM section

120V model

Step	AM SG output	Tuning Frequency	Output Indicator	Adjustment point	Adjust for
1		530kHz	Digital DC voltmeter	OSC coil on RF block L151	1.4 ± 0.2V
2	600kHz 400Hz 30% mod. 60dB/m	600kHz	AC voltmeter	RF coil on RF block L151	Maximum
3	990kHz 400Hz 30% mod. 60dB/m	990kHz	AC voltmeter	L152	Maximum

230V and Worldwide models

Step	AM SG output	Tuning Frequency	Output Indicator	Adjustment point	Adjust for
1		522kHz or 531kHz	Digital DC voltmeter	OSC coil on RF block L151	1.3 ± 0.2V
2	603kHz 400Hz 30% mod. 60dB/m	603kHz	AC voltmeter	RF coil on RF block L151	Maximum
3	999kHz 400Hz 30% mod. 60dB/m	999kHz	AC voltmeter	L152	Maximum

Reference Specification

FM tuned voltage: 87.9MHz-107.9MHz
1.6 ± 0.5V ~ 8.0 ± 0.5V

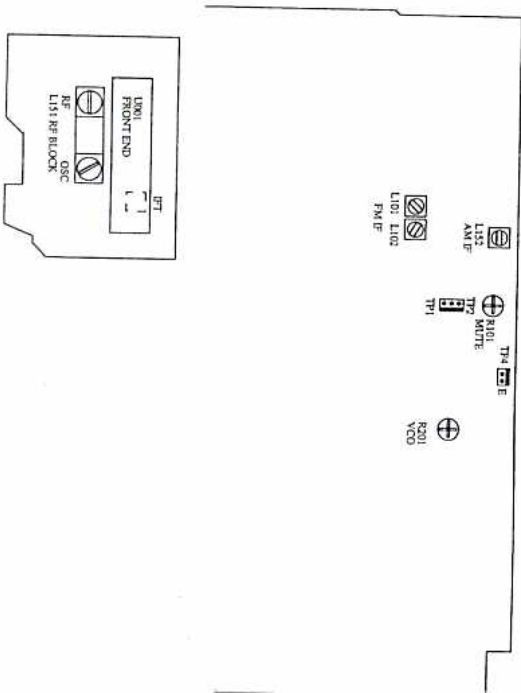
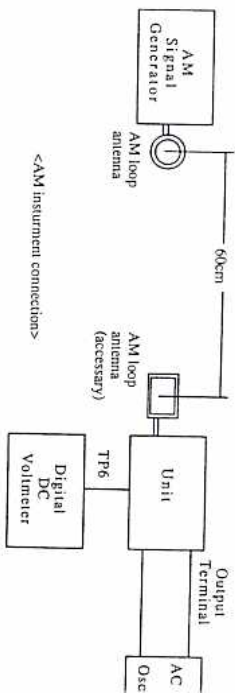
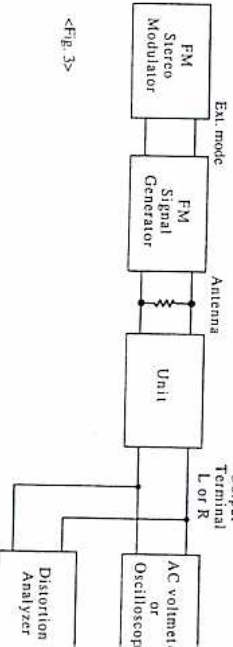
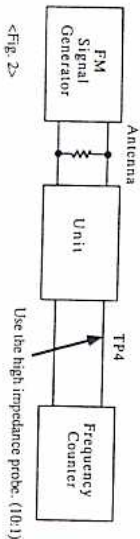
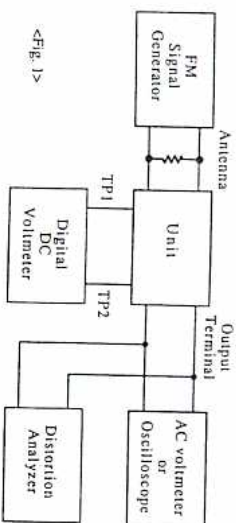
AM tuned voltage: 530kHz-1710kHz
1.3 ± 0.5V ~ 7.6 ± 0.5V

Reference Specification

FM tuned voltage: 87.5MHz-108MHz
1.6 ± 0.5V ~ 8.0 ± 0.5V

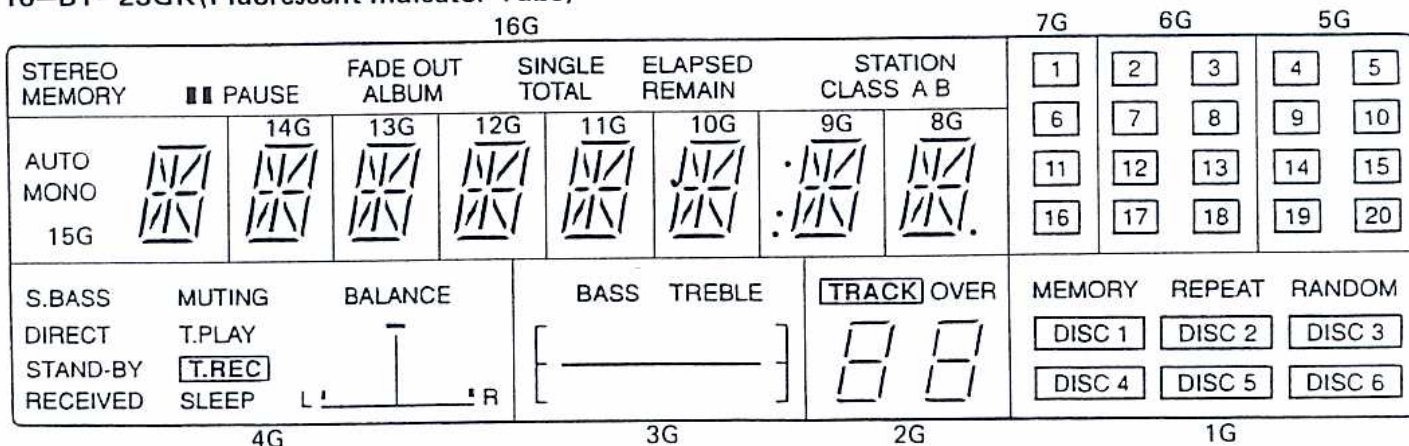
AM tuned voltage: 522kHz-1611kHz
1.3 ± 0.5V ~ 7.2 ± 0.5V
(230V model)

AM tuned voltage: 531kHz-1602kHz
1.3 ± 0.5V ~ 7.2 ± 0.5V
(Worldwide model)



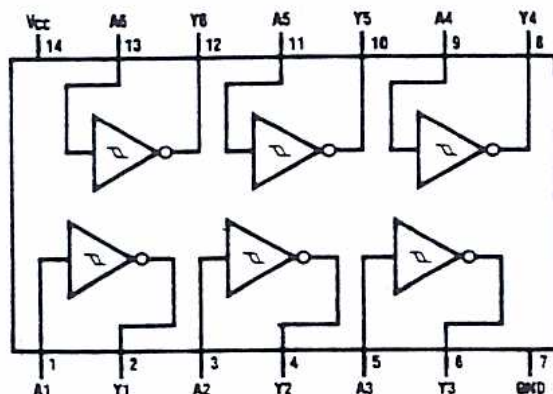
IC BLOCK DIAGRAMS AND DESCRIPTION

16-BT-23GK (Fluorescent Indicator Tube)



	16G	15G	14G	13G	12G	11G	10G	9G	8G	7G	6G	5G	4G	3G	2G	1G
P1	STEREO	AUTO	-	-	-	-	-	-	-	<1>	<2>	<4>	S.BASS	S2	TRACK	MEMORY
P2	MEMORY	MONO	-	-	-	-	-	-	-	<6>	<7>	<9>	DIRECT	B1	2a	REPEAT
P3	PAUSE	h	h	h	h	h	h	h	h	<11>	<12>	<14>	STAND-BY	B2	2b	RANDOM
P4	FADE OUT	b	b	b	b	b	b	b	b	<16>	<17>	<19>	RECEIVED	B3	2f	<DISC1>
P5	ALBUM	m	m	m	m	m	m	m	m	-	<3>	<5>	MUTING	B4	2g	<DISC2>
P6	SINGLE	c	c	c	c	c	c	c	c	-	<8>	<10>	T.PLAY	B5	2c	<DISC3>
7P	TOTAL	r	r	r	r	r	r	r	r	-	<13>	<15>	T.REC	B6	2e	<DISC4>
P8	ELAPSED	p	p	p	p	p	p	p	p	-	<18>	<20>	SLEEP	-	2d	<DISC5>
P9	REMAIN	a	a	a	a	a	a	a	a	1	2	4	S1	-	OVER	<DISC6>
P10	STATION	j	j	j	j	j	j	j	j	6	7	9	L3	B7	1a	DISC1
P11	CLASS	k	k	k	k	k	k	k	k	11	12	14	L2	B8	1b	DISC2
P12	A	f	f	f	f	f	f	f	f	16	17	19	L1	B9	1f	DISC3
P13	B	g	g	g	g	g	g	g	g	-	3	5	R1	B10	1g	DISC4
P14	C	e	e	e	e	e	e	e	e	-	8	10	R2	B11	1c	DISC5
P15	D	n	n	n	n	n	n	n	n	-	13	15	R3	B12	1e	DISC6
P16	-	d	d	d	d	d	d	d	d	-	18	20	-	-	1d	-

TC74HC14AP (Hex Inverting Schmitt Trigger)



PRINTED CIRCUIT BOARD – PARTS LIST

MICROPROCESSOR CIRCUIT PC BOARD

(NADG-4755-1/1A/1B/2A/2B)

CIRCUIT NO.	PART NO.	DESCRIPTION	CIRCUIT NO.	PART NO.	DESCRIPTION
	Opto. sensor			Diodes	
U751	24130007	GP1U571X	D901	22380022F	RBV402
	ICs		D905-D907	22380035 or	GP104003E or
Q751	222740145TOS	TC74HC14AP	D911-D915	22380046	AM01Z
Q752	22240709R3HI	HD6433723A-71F	D908	224452704	MTD27D
	FL tube		D917	223163 or	1SS133 or
Q759	212114	16-BT-23GK		223205	1SS270A <R-31>
	Transistors			Capacitors	
Q753	2212600	DTA124ES	C901	3500065A	⚠ DE7150FZ103PAC400V/125V, IS <R-31>
Q754-Q756	2213284	2SC1740S-R	C902	3500065A	⚠ DE7150FZ103PAC400V/125V, IS <P/W/Q>
Q757,Q758	221282	DTC144ES			
	Diodes		C912,C913	374721034	0.01 μ F \pm 5%,50V,Plastic
D751-D757	223163 or	1SS133 or	C915-C917	354781019	100 μ F,50V,Elect.
D760-D765	223205	1SS270A	C918	354780339	3.3 μ F,50V,Elect.
D758,D759	224450562	MTZ5.6B	C922	354761019	100 μ F,35V,Elect.
D766	225255B,	SEL3110S-B,	C923	354762229	2200 μ F,35V,Elect.
	225255C or	SEL3110S-C or			
	225255D	SEL3110S-D,L.E.D.		Covers	
D767	224450562	MTZ5.6B	C901a	27301216	⚠ Cover for C901 <P/W/Q> <R-31>
	Crystal		C902a	27301216	⚠ Cover for C902 <P/W/Q>
X751	3010192	AT-49		Resistors	
	Coil		R911	442522704	27 Ω \pm 5%,1/2W,Metal oxide
L751	233411K220	NCH-1387	R921	452534794	0.47 Ω \pm 5%,1/2W,Metal
	Capacitors		R922	441725114	510 Ω \pm 5%,2W,Metal oxide
C752	354742209	22 μ F,16V,Elect.	R923,R924	452534794	0.47 Ω \pm 5%,1/2W,Metal
C753	354780109	1 μ F,50V,Elect.	R925	452530224	2.2 Ω \pm 5%,1/2W,Metal
C754	375524744	0.47 μ F \pm 5%,50V,Plastic	R991	431523355	⚠ 3.3M Ω ,1/2W,Solid <D>
C755	3000060 or	0.047F,5.5V,Super		Relay	
	3020027	0.047F,5.5V,Super	RL901	25065341	⚠ NRL-1P15A-DC24-047 <P/W/Q> <R-31>
C756	354761009	10 μ F,35V,Elect.		Sockets	
C757	354721019	100 μ F,6.3V,Elect.	P401,P402	25051051Y	NSCT-11P838
C761	354781009	10 μ F,50V,Elect.		Fuseholders	
C762	353741009	10 μ F,16V,Elect.	F901a	25050065	⚠ YSH-403T <D/W>
	Switches		F902a	25050065	⚠ YSH-403T <P/W/Q>
S751-S764	25035548	NPS-111-S510	F903a	25050065	⚠ YSH-403T <P> <R-31>
	Jack			Fuses	
P751	25045396	LGT1516-0101	F901	252160Y	⚠ 2.5A-UL/T-237,Primary <D/W> <R-31>
	Plugs			252159Y	⚠ 2.0A-UL/T-237,Primary <D/W> <R-21>
P701a,P702a	25055659	NPLG-10P615	F902	252071	⚠ 1.25A-SE-EAK,Primary <P/W/Q> <R-31>
P703a	25055660Y	NPLG-13P616		252070	⚠ 1.0A-SE-EAK,Primary <P/W/Q> <R-21>
	Holder		F903	252071	⚠ 1.25A-SE-EAK,AC outlet <P> <R-31>
	27190893Y	FL		Terminals	
			P902	25050410	⚠ NSCT-2P235,AC outlet <P/W/Q> <R-31>
				Switches	
			S901	25035550	⚠ NPS-111-L512P <P/W/Q>

POWER SUPPLY CIRCUIT PC BOARD

(NAPS-4756-1/1A/1B/1C/2A/2B/2C)

CIRCUIT NO.	PART NO.	DESCRIPTION
	Transistors	
Q631	2213650	DTD113ZS <R-31>
Q632	2213650	DTQ113ZS
Q901	2213354	2SA933S-R

NOTE: THE COMPONENTS IDENTIFIED BY MARK Δ ARE CRITICAL FOR RISK OF FIRE AND ELECTRIC SHOCK. REPLACE ONLY WITH PART NUMBER SPECIFIED.

CAUTION: Replacement for transistor of mark \star if necessary, must be made from the same beta group (H \boxtimes) as the original type.

MAIN CIRCUIT PC BOARD

(NAAR-4757-1/1A/1B/2A/2B)

CIRCUIT NO.	PART NO.	DESCRIPTION	CIRCUIT NO.	PART NO.	DESCRIPTION
	ICs			Capacitors	
Q103	22240039	LA1266	C155	354780479	4.7 μ F, 50V, Elect.
Q201	22240242	AN7470	C156, C157	354761009	10 μ F, 35V, Elect.
Q501, Q502	22240108	μ PC1225H	C158, C210	374724734	0.047 μ F \pm 5%, 50V, Plastic
Q703	22240090	LM7001	C159	374722234	0.022 μ F \pm 5%, 50V, Plastic
Q911	222780055	78M05HF	C160	354721019	100 μ F, 6.3V, Elect.
Q912	222780125	78M12HF	C203	354744719	470 μ F, 16V, Elect.
Q913	222780565JRC	78M56	C204, C205	374721824	1800pF \pm 5%, 50V, Plastic <D>
	Transistors			374721224	1200pF \pm 5%, 50V, Plastic <P/Q>
Q102	2210746	2SC945A-P <P/W/Q>		374721524	1500pF \pm 5%, 50V, Plastic <W>
Q202	2213354	2SA933S-R	C207, C208	354761009	10 μ F, 35V, Elect.
Q203, Q204	2212794	2SD1468-R	C211	370134714	470pF \pm 5%, 100V, Plastic
Q503, Q504	2213284	2SC1740S-R	C213	354780339	3.3 μ F, 50V, Elect.
Q505, Q506	2202303,	\star 2SC4512-O,	C214	354782299	0.22 μ F, 50V, Elect.
	2202304 or	\star 2SC4512-Y or	C216, C217	354742209	22 μ F, 16V, Elect.
	2202305	\star 2SC4512-P	C220	354784799	0.47 μ F, 50V, Elect.
Q507, Q508	2202313,	\star 2SA1726-O,	C501, C502	354780229	2.2 μ F, 50V, Elect.
	2202314 or	\star 2SA1726-Y or	C503, C504	374721024	1000pF \pm 5%, 50V, Plastic
	2202315	\star 2SA1726-P	C505, C506	354741019	100 μ F, 16V, Elect.
Q601, Q602	2213284	2SC1740S-R	C509, C510	374723334	0.033 μ F \pm 5%, 50V, Plastic
Q603	2211792 or	2SA992-F or	C511, C512	374726834	0.068 μ F \pm 5%, 50V, Plastic
	2211793	2SA992-E	C513, C514	374724734	0.047 μ F \pm 5%, 50V, Plastic
Q611	221281	DTC114YS	C519	354780109	1 μ F, 50V, Elect.
Q612	221282	DTC144ES	C521, C522	354780229	2.2 μ F, 50V, Elect.
Q613, Q614	2212600	DTA124ES	C527	354761009	10 μ F, 35V, Elect.
Q621	2212600	DTA124ES	C605	374722234	0.022 μ F \pm 5%, 50V, Plastic
Q623, Q624	2212285	2SC2878-A	C706	354722219	220 μ F, 6.3V, Elect.
Q704, Q705	2213090	DTA114YS	C931, C932	3504260	4700 μ F, 40V, Elect. <R-31>
	Diodes			3504213	4700 μ F, 35V, Elect. <R-21>
D201, D601	223163 or	1SS133 or	C933, C934	354761019	100 μ F, 35V, Elect.
D603, D604	223205	1SS270A	C935, C936	354743319	330 μ F, 16V, Elect. <R-31>
D602	224450512	MTZ5.1B		354744719	470 μ F, 16V, Elect. <R-21>
D921, D922	224451303	MTZ13C	C941, C942	354761019	100 μ F, 35V, Elect.
	Coils and Transformers		C943, C944	354761009	10 μ F, 35V, Elect.
L101	233401	NFIF-4072	C947, C948	354761019	100 μ F, 35V, Elect.
L102	233402	NFIF-4073		Resistors	
L103	233383	NMC-6070 <P/W/Q>	R101	5210070 or	N06HR100KBD,
L152	232139	NMIF-4062		5210221	Trim
L201, L202	233355A	NMC-4059	R201	5210062 or	N06HR4.7KBD or
L701	233411K220	NCH-1387		5210216	N06HR5KBD, Trim
	Ceramic filters		R513, R514	4000131	0.22 Ω \times 2, 2W+2W, Metal plate
X103	3010137	SFE10.7MMK <P/W/Q>	R515, R516	442530824	8.2 Ω \pm 5%, 1/2W, Metal
X151	3010123	SFZ450JL	R521	442530224	2.2 Ω \pm 5%, 1/2W, Metal
X152	3010076	BFU450C	R531, R532	442523914	390 Ω \pm 5%, 1/2W, Metal oxide
	X'tal		R931-R934	441622414	240 Ω \pm 5%, 1W, Metal oxide <R-31>
X701	3010141 or	XTL7.2M	R931, R932	441622214	220 Ω \pm 5%, 1W, Metal oxide <R-21>
	3010158		R933, R934	441621014	100 Ω \pm 5%, 1W, Metal oxide <R-21>
	Capacitors		R941	441721014	100 Ω \pm 5%, 2W, Metal oxide
C107, C201	354742209	22 μ F, 16V, Elect.	R942	442522704	27 Ω \pm 5%, 1/2W, Metal oxide
C109, C212	354780109	1 μ F, 50V, Elect.	R943	451630824	8.2 Ω \pm 5%, 1W, Metal
C113	354780229	2.2 μ F, 50V, Elect.		Relay	
C152	354741019	100 μ F, 16V, Elect.	RL501	25065339	NRL-2P5A-DC24-046