BETA 20

STEREO PRE-AMPLIFIER

TYPE AND VOLTAGE

W-TYPE:	UL and CSA type	120V AC
E -TYPE:	NK-STD type	220V AC
B -TYPE:	BS type	240V AC

SERVICE MANUAL

CONTENTS

SPECIFICATIONS

Pre Amplifier Section

Total Harmonic Distortion (20 to 20,000 Hz),
- Phono (MC) to Tape Out (at 4 V output) ..... no more than 0.004 %
- Phono (MM) to Tape Out (at 4 V output) ..... no more than 0.004 %
- Aux to Pre Out (at 4 V output) ..... no more than 0.007 %

Input Sensitivity (1000 Hz, 1 V output),
- Phono (MC): ..... 0.2 mV ± 2 dB
- Phono (MM): ..... 2.0 mV ± 2 dB
- Tuner: ..... 110 mV ± 2 dB
- Aux: ..... 110 mV ± 2 dB
- Tape 1, 2: ..... 110 mV ± 2 dB

Input Impedance (1000 Hz),
- Phono (MC): ..... 100 ± 10 ohms
- Phono (MM): ..... 47 ± 5 kohms
- Aux: ..... 47 ± 5 kohms
- Tape 1, 2: ..... 47 ± 5 kohms

Maximum Input Signal (1000 Hz, 0.1 % THD),
- Phono (MC): ..... more than 25 mV
- Phono (MM): ..... more than 250 mV

Output Level (1000 Hz),
- Tape Out: ..... 110 mV ± 2 dB
- Pre Out: ..... 1000 mV ± 2 dB

Signal to Noise Ratio with IHF-A Network,
- Phono (MC): ..... more than 67 dB
- Phono (MM): ..... more than 80 dB
- Tuner: ..... more than 95 dB
- Aux: ..... more than 95 dB
- Tape In 1, 2: ..... more than 95 dB

Frequency Response (10 ~ 100,000 Hz),
- Tuner: ..... +0, −1 dB
- Aux: ..... +0, −1 dB
- Tape In 1, 2: ..... +0, −1 dB

RIAA Equalization Deviation (20 ~ 20,000 Hz),
- Phono (MM) to Tape Out: ..... ±0.5 dB

Tone Controls,
- Bass (70 Hz): ..... ±8 dB
- Treble (10,000 Hz): ..... ±8 dB

Subsonic Filter: ..... 15 Hz, 12 dB/oct.

Mute Time: ..... 7 ± 2 seconds

General

Power Requirement,
- U. S. A. & Canada model: ..... AC 120V/60 Hz
- European model: ..... AC 220V/50 Hz
- U. K. model: ..... AC 240V/50 Hz

Power Consumption: ..... 18 watts

Dimensions,
- Width: ..... 482 mm, 19 inches
- Height: ..... 70 mm, 2-3/4 inches
- Depth: ..... 330 mm, 13 inches

Weight,
- Without package: ..... 5.2 kg, 11.4 lbs
- With package: ..... 6.6 kg, 14.5 lbs

*Specifications are subject to change without notice.

BLOCK DIAGRAM

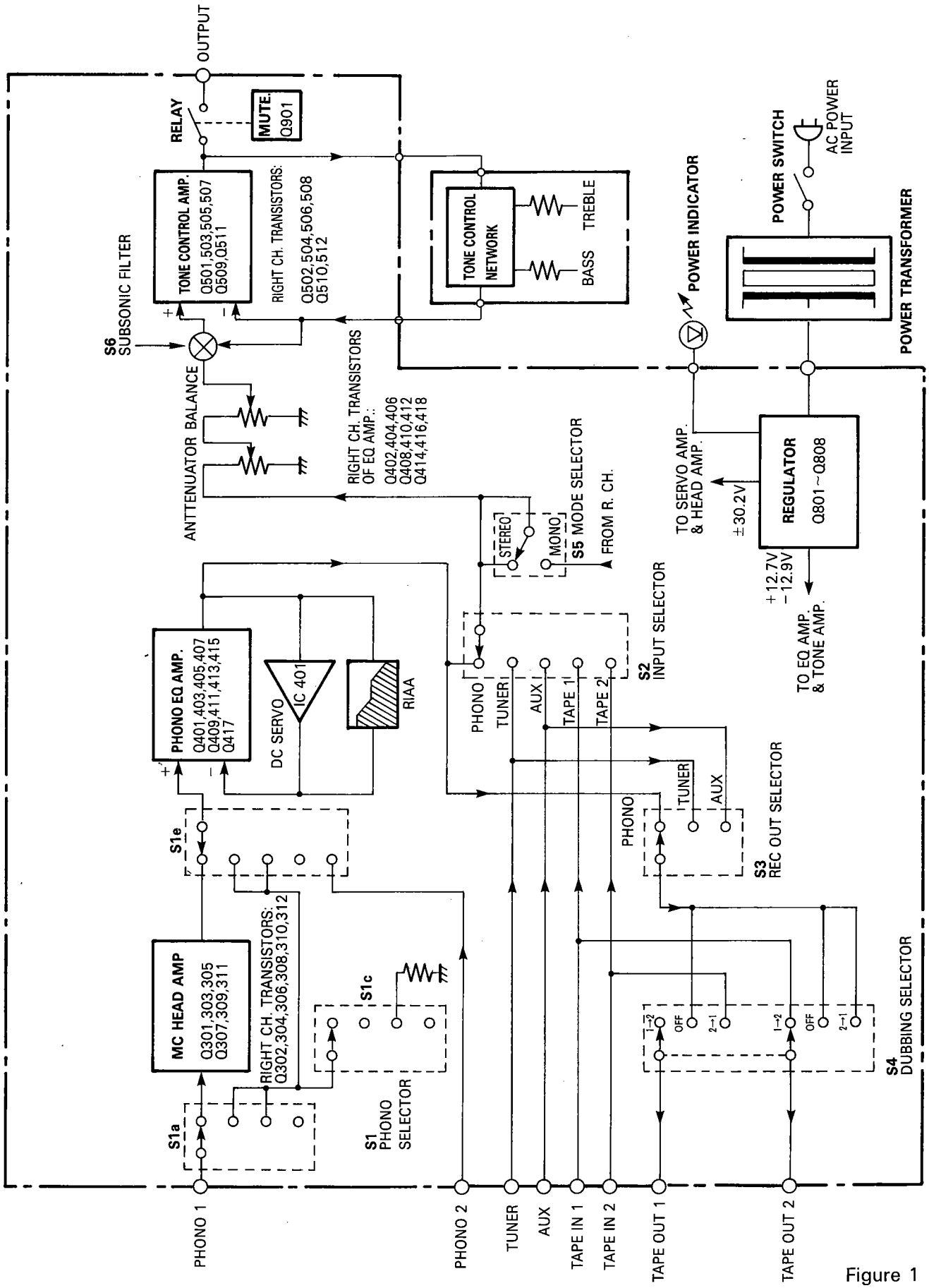


Figure 1

DISASSEMBLY

1. CABINET COVER REMOVAL
   a. Remove four tapping screws from the top of the metal cover.
   b. Remove four screws from both sides of the metal cover.
   c. Lift the cabinet cover away from the unit.

2. BOTTOM PLATE REMOVAL
   a. Remove eight tapping screws (#1 ~ #8) as shown in Photo 1.

3. FRONT PANEL REMOVAL
   a. Remove two knobs (#1 and #2) (Photo 2) from the front panel by pulling them forward.
   b. Using a hexagonal wrench, remove five knobs (#3 ~ #7) as shown in Photo 2.
   c. Remove two nuts (#8 and #9) (Photo 2) and lift out the front panel.

4. POWER TRANSFORMER REMOVAL
   a. Disconnect all wires from the power transformer.
   b. Remove two screws (#10 and #11) (photo 2) and lift the power transformer up and out of chassis.

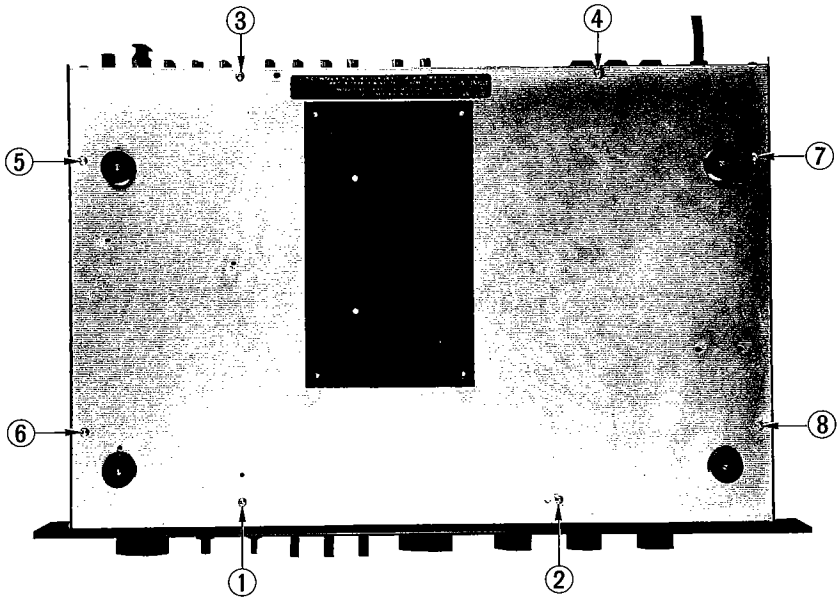


Photo 1

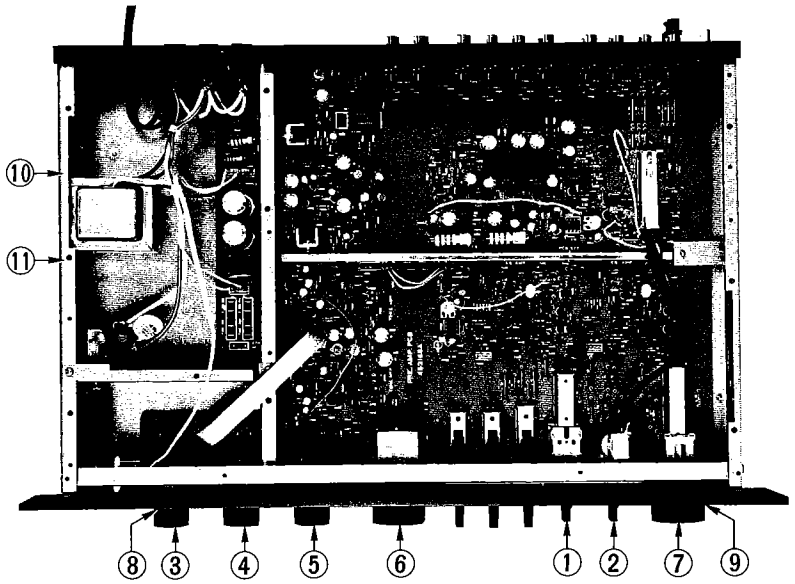


Photo 2

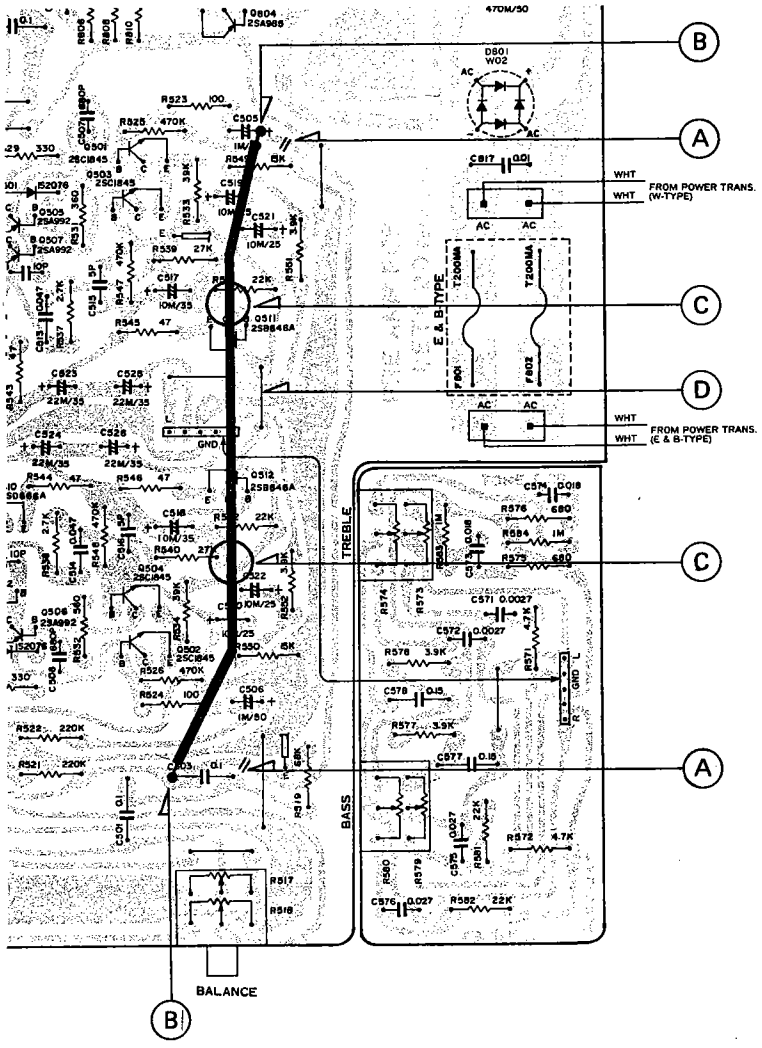
NIKKO SERVICE DATA

NO. 81-003
DATE November 30, 1981

Important Information for your Parts and Service Department

MODEL: BETA 20 | **ASSEMBLY: PRE-AMP P. C. B.**

It has been observed that one of the foil patterns is too closely printed to the power supply circuit, thus the pattern picks up the AC line hum from the power supply and produces noise. To prevent this noise, the pattern needs to be re-wired at the place of adequate distance from the power supply. This modification is already done for the units bearing Serial No. D8536701 and up.



(Foil side view)

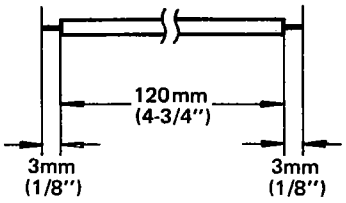
Referring to the P. C. Board diagram, please try the following procedure.

(1) Cut foil pattern at two points "A" with a knife or a hot soldering iron.

(2) Prepare a vinyl wire of 120mm as ilustrated. Solder both ends of the wire at "B", and fix it with cement at places "C".

(3) Be sure that the wire is placed inside (left side of) the Jumper "D".

Vinyl Wire



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1000

ALIGNMENT

GENERAL ALIGNMENT INSTRUCTIONS

1. Allow a minimum of 10 minutes warm-up for the unit.
2. When adjusting, voltmeter's needle may swing backward. In this case, simply reverse the voltmeter connection.

DC BALANCE ADJUSTMENT (EQ AMP SECTION)

1. Set the Phono Selector Switch to "PHONO 1 47 kohm" position.
2. Insert short-pin-plugs to the PHONO 1 input terminals on the rear panel.
3. Connect a DC voltmeter to the test points marked "TP" on the Pre Amp PC Board. (refer to Photo 3)
4. Adjust the potentiometer R455 (left channel) or R456 (right channel) so that the DC voltmeter indicates 0 ± 1 mV.

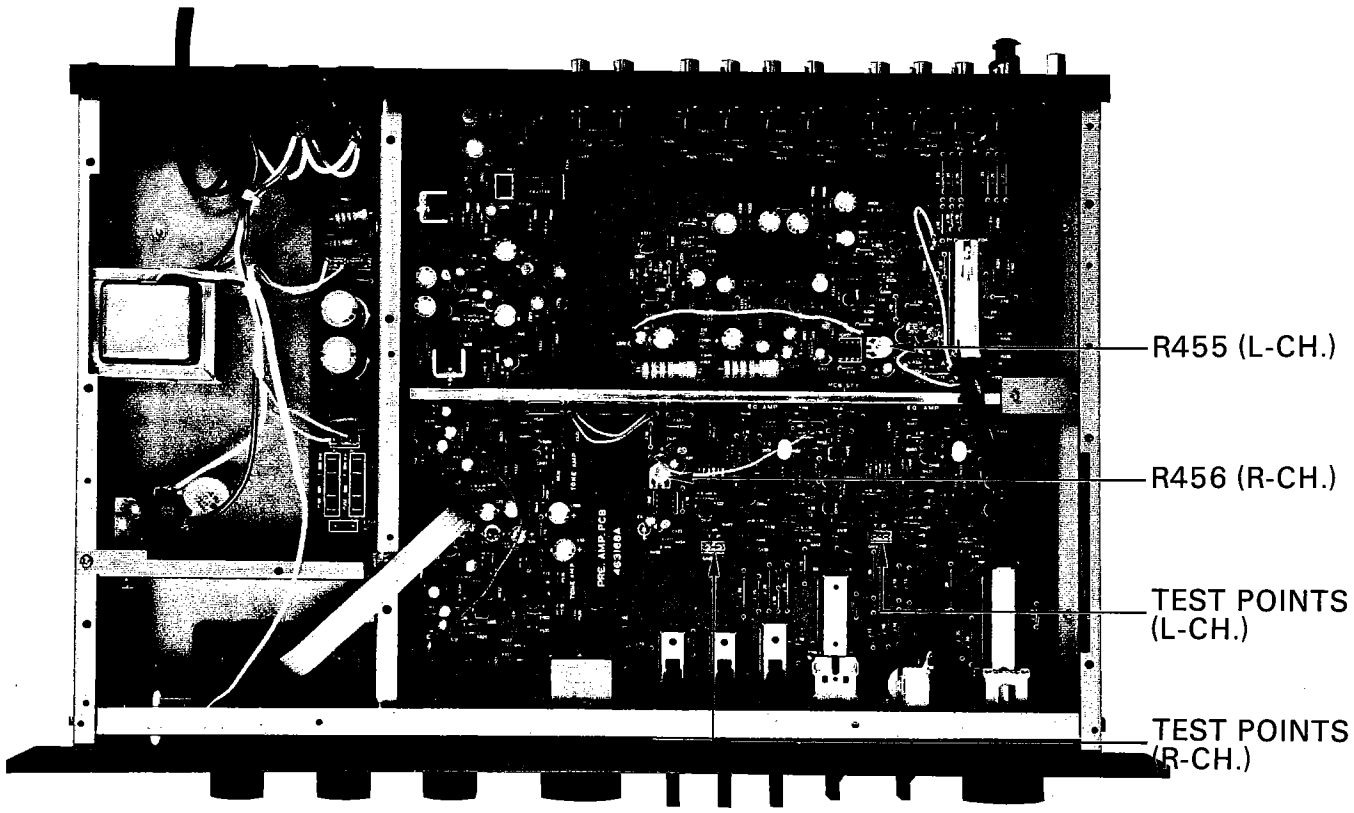


Photo 3

PARTS LOCATION

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

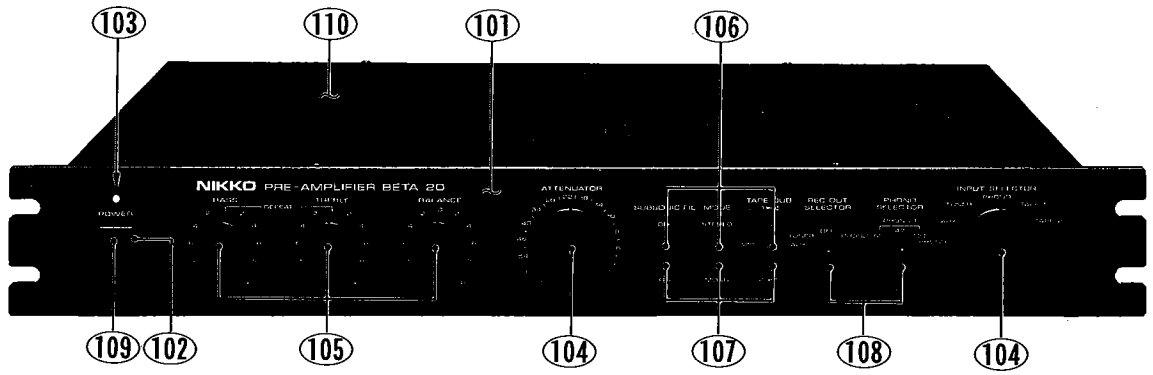


Photo 4

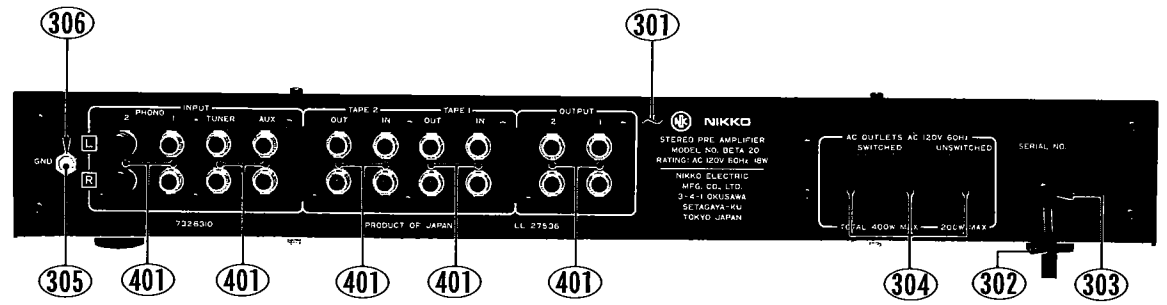


Photo 5

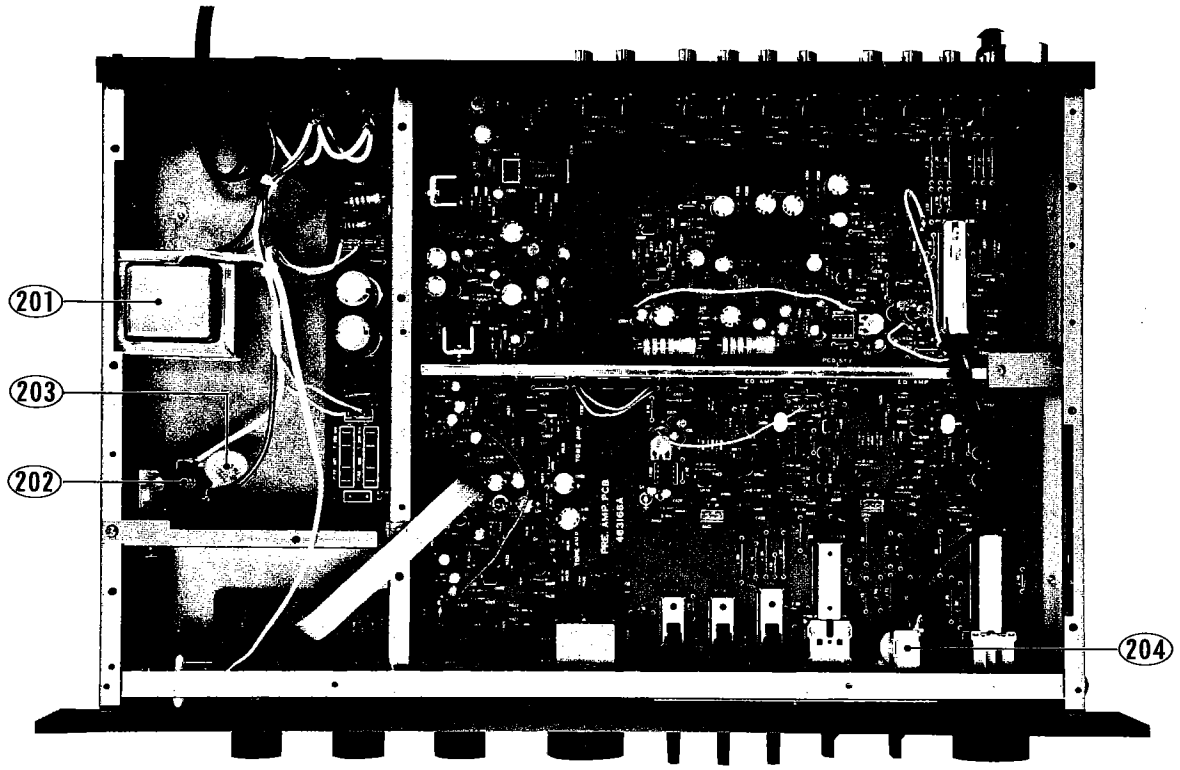
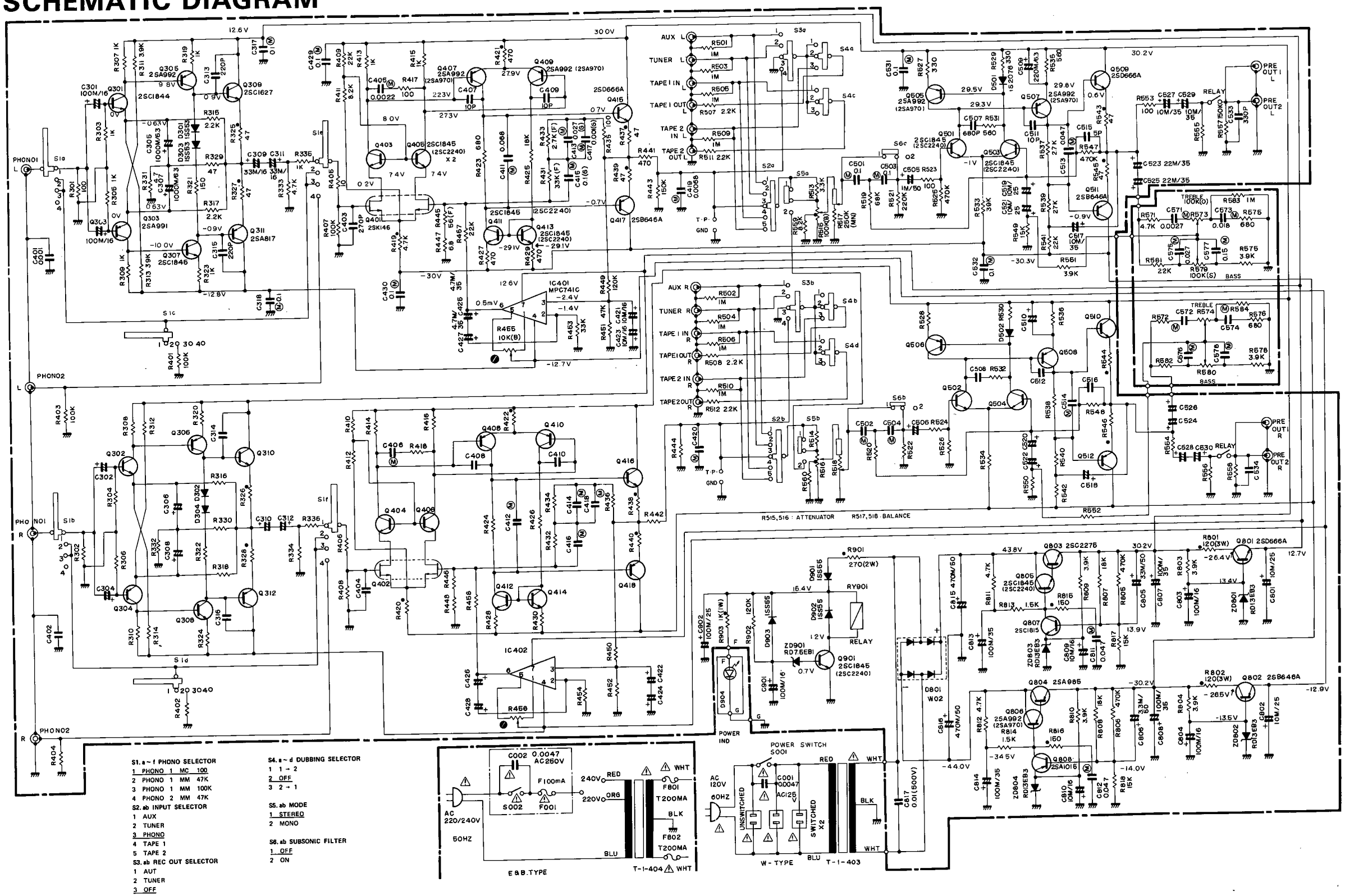


Photo 6

SCHEMATIC DIAGRAM



S1. a ~ f PHONO SELECTOR
1 PHONO 1 MC 100
2 PHONO 1 MM 47K
3 PHONO 1 MM 100K
4 PHONO 2 MM 47K

S2. ab INPUT SELECTOR
1 AUX
2 TUNER
3 PHONO
4 TAPE 1
5 TAPE 2

S3. ab REC OUT SELECTOR
1 AUT
2 TUNER
3 OFF
4 PHONO

S4. a ~ d DUBBING SELECTOR
1 1 → 2
2 OFF
3 2 → 1

S5. ab MODE
1 STEREO
2 MONO

S6. ab SUBSONIC FILTER
1 OFF
2 ON

NOTES:

1. SCHEMATIC IS SUBJECT TO CHANGE WITHOUT NOTICE.

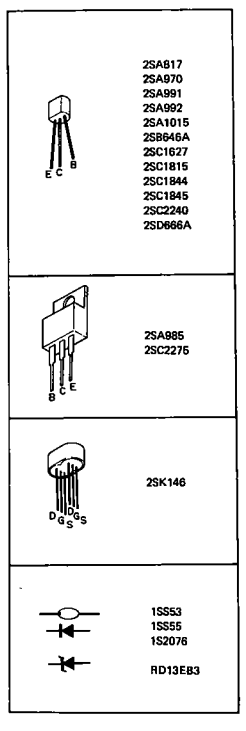
UNLESS OTHERWISE SPECIFIED:

2. RESISTANCE VARUES ARE IN OHMS. K = 1,000 ; M = 1,000,000
3. CAPACITANCE VALUES 1.0 AND ABOVE ARE IN pF OR μF (P = pF, M = μF), LESS THAN 1.0 ARE IN μF. (ELECTROLYTIC CAPACITANCE VALUES ARE IN μF/WV.)
4. VOLTAGES ARE MEASURED TO CHASSIS GROUND WITH A "DC VOLTMETER".

SCHEMATIC SYMBOLS:
Ⓜ POLYESTER FILM CAPACITOR
• NONFLAMMABLE RESISTOR

WARNING:
⚠ INDICATES SAFETY CRITICAL COMPONENTS.
FOR CONTINUED SAFETY, REPLACE SAFETY CRITICAL COMPONENTS ONLY WITH MANUFACTURER'S RECOMMENDED PARTS.

SEMICONDUCTORS



P.C. BOARD (BOTTOM VIEW)

PRE-AMP PCB

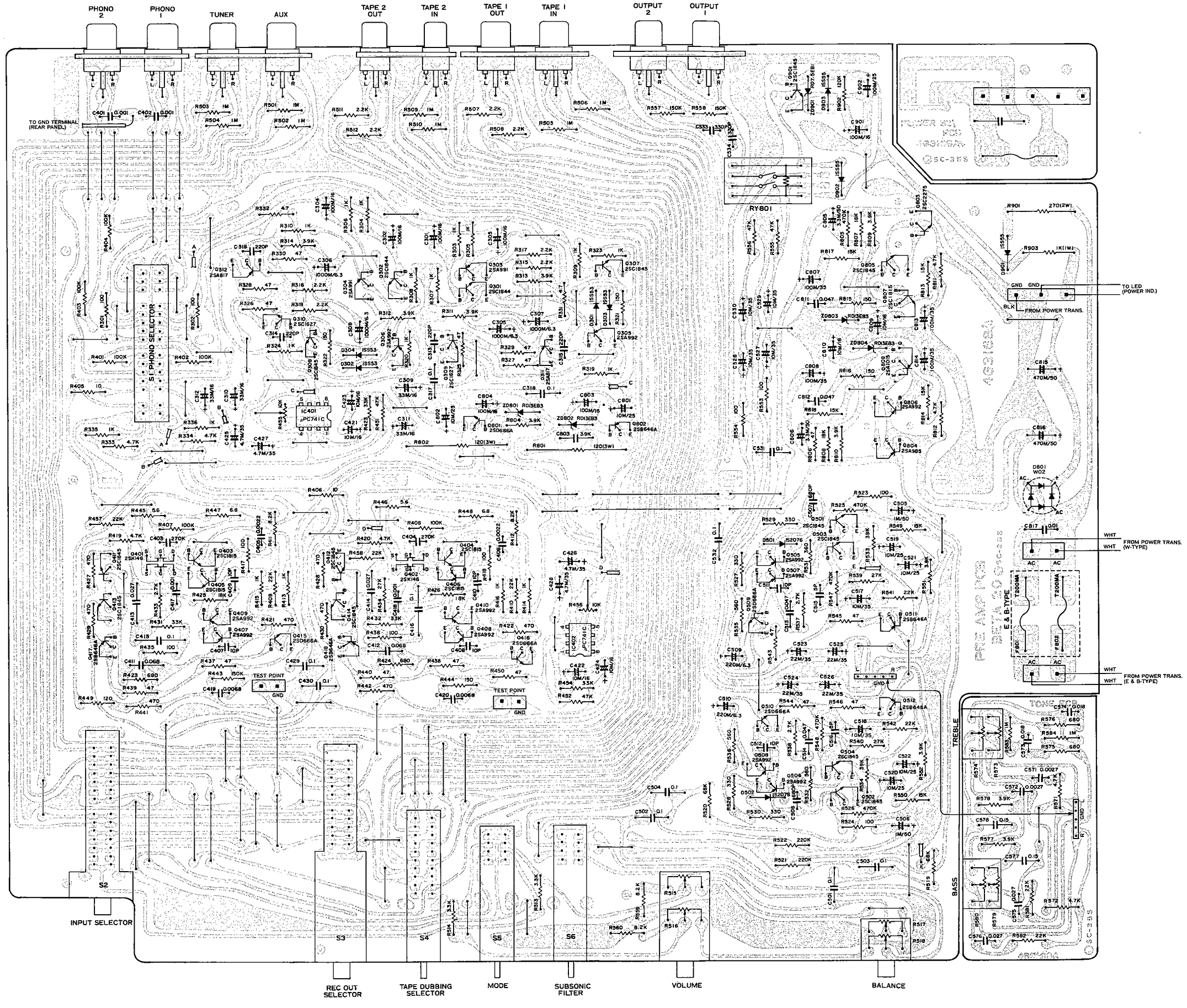


Figure 3

PARTS LIST

NOTES:

1. ★ The KEY NUMBER (#) marked with a (★) on parts list relate to number of three digits with a (◯). (Photo 4~6)
2. + Numberals 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 ⚠ 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.

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 NO.	SYMBOL NO.	TYPE+ W E B	DESCRIPTION	PART NO.
			PACKING MATERIALS & ACCESSORIES	
001		1 1 1	Carton box	9825710
002		2 2 2	Pad	9840930
003		1 1 1	Sack, polyethylen cloth	9640720
004		1 1 1	Sack, polyethylen cloth – #13	9640320
005a		1 – –	Manual, instructions – in English and French	960336E
005b		– 1 1	Manual, instructions – in five different languages	960337K
006		1 – –	Card, warranty	967010A
007		1 – –	Manual, safety instructions	9670410
008		1 – –	List, service stations	9690210
009		1 1 1	Cord, RCA phono pin plug – 2T-1 (NK)	962014A
010		2 2 2	Short pin plug	4440180
			CABINET ASSEMBLY	
★101a		1 1 1	Panel, front – SILVER	7884980
★101b		1 1 1	Panel, front – BLACK	7884990
★102		1 1 1	Guide, button – P15SQ-BK – power switch	7402680
★103		1 1 1	Globe, LED – power indicator	7402120
★104a		2 2 2	Knob – 2GL-34D – attenuator/input selector, SILVER	7851460
★104b		2 2 2	Knob – 2BK-34D – attenuator/input selector, BLACK	7851740
★105a		3 3 3	Knob – 2GL-23D – bass/treble/balance, SILVER	7851670
★105b		3 3 3	Knob – 2BK-23D – bass/treble/balance, BLACK	7851770
★106a		3 3 3	Knob, lever – P4525SGL – SILVER	7852580
★106b		3 3 3	Knob, lever – P4525BLK – BLACK	7852370
★107a		3 3 3	Blind, lever knob – SILVER	7002480
★107b		3 3 3	Blind, lever knob – BLACK	7002490
★108		2 2 2	Knob, – P2BK-1613-DL – rec out/phono selector	7852350
★109a		1 1 1	Button, push – M15SQ-GL – power, SILVER	7852380
★109b		1 1 1	Button, push – M15SQ-BK – power, BLACK	7852390
★110a		1 – –	Cover, top	7820870
★110b		– 1 1	Cover, top – (D)	7820880
111		1 1 1	Plate, bottom	7326410
112		4 4 4	Foot, polyethylen – 22φ x 10	7401350
			CHASSIS ASSEMBLY	
⚠ ★201a		1 – –	Transformer, power – T-1-403 – AC120V	1104030
⚠ ★201b		– 1 1	Transformer, power – T-1-404 – AC220 or 240V	1104040
⚠ ★202		1 – –	Switch, push – U62S-TV-5 – power	4041480
⚠ ★203		1 – –	C-CAP 0.0047μf AC125V	239472C
★204		1 1 1	Switch, rotary – ESA-333033B – phono selector	4051130

KEY NO.	SYMBOL NO.	TYPE+ W E B	DESCRIPTION	PART NO.
			BACK PLATE ASSEMBLY	
★301a		1 – –	Plate, back – (W)	7326310
★301b		– 1 1	Plate, back – (E)	7326320
★302a		1 – –	Cord, AC line – DP-70	606007A
★302b		– 1 –	Cord, AC line – CEE-2T	600510A
★302c		– – 1	Cord, AC line – BS	600514A
★303a		1 – –	Bush, power cord – SR3P-4	7400620
★303b		– 1 1	Bush, power cord – SR4N-4	7400690
★304		3 – –	Socket – AC outlets	4500190
★305		1 1 1	Shaft, GND terminal – MK-3	7152050
★306		1 1 1	Nut, GND terminal – MK-2	7152060
			PRE AMPLIFIER PC BOARD ASSEMBLY	
★401		5 5 5	Terminal, RCA phono pin jack – 2P x 2	4444070
			(MC HEAD AMP SECTION)	
Q301,302		2 2 2	TR 2SC1844 (E or F)	512106S
Q303,304		2 2 2	TR 2SA991 (E or F)	510104S
Q305,306		2 2 2	TR 2SA992 (E or F)	510110S
Q307,308		2 2 2	TR 2SC1845 (E or F)	512115S
Q309,310		2 2 2	TR 2SC1627 (Y)	511017S
Q311,312		2 2 2	TR 2SA817 (Y)	510047S
D301~304		4 4 4	Diode 1SS53	501023S
C301~304		4 4 4	E-CAP 100μf 16V	211230Q
C305~308		4 4 4	E-CAP 1000μf 6.3V	211040S
C309~312		4 4 4	E-CAP 33μf 16V	211223Q
C313~316		4 4 4	C-CAP 220pf 50V SL	232221K
C317,318		2 2 2	M-CAP 0.1μf 10% 50V	222104K
R301,302		2 2 2	RES 100ohm 5% ¼W	328101J
R303~310		8 8 8	RES 1kohm 5% ¼W	328102J
R311~314		4 4 4	RES 3.9kohm 5% ¼W	328392J
R315~318		4 4 4	RES 2.2kohm 5% ¼W	328222J
R319,320		2 2 2	RES 1kohm 5% ¼W	328102J
R321,322		2 2 2	RES 150ohm 5% ¼W	328151J
R323,324		2 2 2	RES 1kohm 5% ¼W	328102J
R325~328		4 4 4	FP-RES 47ohm 5% ¼W	328470L
R329,330		2 2 2	RES 47ohm 5% ¼W	328470J
R331,332		2 2 2	RES 4.7ohm 5% ¼W	328478J
R333,334		2 2 2	RES 4.7kohm 5% ¼W	328472J
R335,336		2 2 2	RES 1kohm 5% ¼W	328102J
			(EQUALIZER AMP SECTION)	
S1		1 1 1	Switch, rotary slide – ESA-2643 – phono selector	4020670
Q401,402		2 2 2	FET 2SK146 (GR)	516036S
Q403~406		4 4 4	TR 2SC1815 (Y or GR)	512107S
Q407~410		4 4 4	TR 2SA992 (E or F)	510110S
(Q407~410)		4 4 4	TR 2SA970 (GR or BL)	510116S
Q411~414		4 4 4	TR 2SC1845 (E or F)	512115S
(Q411~414)		4 4 4	TR 2SC2240 (GR or BL)	512102S

KEY NO.	SYMBOL NO.	TYPE+ W E B	DESCRIPTION	PART NO.
C401,402		2 2 2	C-CAP 0.001μf +80, –20% 50V YG	231102Z
C403,404		2 2 2	C-CAP 220pf 10% 50V SL	232221K
C405,406		2 2 2	M-CAP 0.0022μf 10% 50V	222222K
C407~410		4 4 4	C-CAP 10pf 10% 50V SL	232100K
C411,412		2 2 2	M-CAP 0.068μf 10% 50V	222683K
C413,414		2 2 2	M-CAP 0.022μf 2% 50V	228273G
C415,416		2 2 2	M-CAP 0.1μf 2% 50V	228104G
C417,418		2 2 2	M-CAP 0.001μf 2% 50V	228102G
C419,420		2 2 2	M-CAP 0.0068μf 10% 50V	222682K
C429,430		2 2 2	M-CAP 0.1μf 10% 50V	222104K
R401~404		4 4 4	RES 100kohm 5% ¼W	328104J
R405,406		2 2 2	RES 10ohm 5% ¼W	328100J
R407,408		2 2 2	RES 100kohm 5% ¼W	328104J
R409,410		2 2 2	RES 22kohm 5% ¼W	328223J
R411,412		2 2 2	RES 8.2kohm 5% ¼W	328822J
R413~416		4 4 4	RES 1kohm 5% ¼W	328102J
R417,418		2 2 2	RES 100ohm 5% ¼W	328101J
R419,420		2 2 2	FP-RES 4.7kohm 5% ¼W	328472L
R421,422		2 2 2	FP-RES 470ohm 5% ¼W	328471L
R423,424		2 2 2	RES 680ohm 5% ¼W	328681J
R425,426		2 2 2	RES 18kohm 5% ¼W	328183J
R427~430		4 4 4	RES 470ohm 5% ¼W	328471J
R431,432		2 2 2	RES, metal film 33kohm 1% ¼W	304333F
R433,434		2 2 2	RES, metal film 2.7kohm 1% ¼W	304272F
R435,436		2 2 2	RES 100ohm 5% ¼W	328101J
R437~440		4 4 4	FP-RES 47ohm 5% ¼W	328470L
R441,442		2 2 2	RES 470ohm 5% ¼W	328471J
R443,444		2 2 2	RES 150kohm 5% ¼W	328154J
R445,446		2 2 2	RES, metal film 56ohm 1% ¼W	304560F
			(SERVO AMP SECTION)	
IC401,402		2 2 2	IC μPC741C	518088S
C421~428		8 8 8	E-CAP 10μf 16V	211220Q
C449,450		2 2 2	RES 120kohm 5% ¼W	328124J
R451,452		2 2 2	RES 47kohm 5% ¼W	328473J
R453,454		2 2 2	RES 33kohm 5% ¼W	328333J
R455,456		2 2 2	Potentiometer – 10kohm (B)	4301280
R457,458		2 2 2	RES 22kohm 5% ¼W	328223J
			(FLAT AMP SECTION)	
S2		1 1 1	Switch, rotary-slide – SRZ-W 45S – input selector	4055200
S3		1 1 1	Switch, rotary-slide – SRZ-W 44N – rec out selector	4055210
S4		1 1 1	Switch, lever – SLR-843 – tape dubbing selector	4025510
S5, 6		1 1 1	Switch, lever – SLR-822 – subsonic filter/mode	4025550
R515,516		2 2 2	VR AP25GPHAN – 100kohm (B) x 2 – attenuator	4390170
R517,518		2 2 2	VR GM70E745C – 250kohm (M, N) – balance	4321130
Q501~504		4 4 4	TR 2SC1845 (E or F)	512115S
(Q501~504)		4 4 4	TR 2SC2240 (GR or BL)	512102S
Q505~508		4 4 4	TR 2SA992 (E or F)	510110S
(Q505~508)		4 4 4	TR 2SA970 (GR or BL)	510116S
Q509,510		2 2 2	TR 2SD666A (B or C)	511025S
Q511,512		2 2 2	TR 2SB646A (B or C)	510052S
D501,502		2 2 2	Diode 1S2076	501019S
C505,506		2 2 2	E-CAP 1μf 50V	211510Q
C507,508		2 2 2	C-CAP 680pf 10% 50V SL	232681K
C509,510		2 2 2	E-CAP 220μf 6.3V	211032Q
C511,512		2 2 2	C-CAP 10pf 10% 50V SL	232100K
C513,514		2 2 2	M-CAP 0.047μf 10% 50V	222473K
C515,516		2 2 2	C-CAP 5pf 10% 50V SL	232509D
C517,518		2 2 2	E-CAP 10μf 35V	211420Q
C519~522		4 4 4	E-CAP 10μf 25V	211320Q
C523~526		4 4 4	E-CAP 22μf 35V	211422Q
C527~530		4 4 4	E-CAP 10μf 35V	211420Q
C531,532		2 2 2	M-CAP 0.1μf 10% 50V	222104K

KEY NO.	SYMBOL NO.	TYPE+ W E B	DESCRIPTION	PART NO.
C533,534		2 2 2	C-CAP 330pf 10% 50V SL	232331K
R501~506		6 6 6	RES 1meg-ohm 5% ¼W	328105J
R507,508		2 2 2	RES 2.2kohm 5% ¼W	328222J
R509,510		2 2 2	RES 1meg-ohm 5% ¼W	328105J
R511,512		2 2 2	RES 2.2kohm 5% ¼W	328222J
R513,514		2 2 2	RES 3.3kohm 5% ¼W	328332J
R523,524		2 2 2	RES 100ohm 5% ¼W	328101J
R525,526		2 2 2	RES 470kohm 5% ¼W	328474J
R527~530		4 4 4	RES 330ohm 5% ¼W	328331J
R531,532		2 2 2	RES 560ohm 5% ¼W	328561J
R533,534		2 2 2	RES 39kohm 5% ¼W	328393J
R535,536		2 2 2	RES 560ohm 5% ¼W	328561J
R537,538		2 2 2	RES 2.7kohm 5% ¼W	328272J
R539,540		2 2 2	RES 27kohm 5% ¼W	328273J
R541,542		2 2 2	RES 22kohm 5% ¼W	328223J
R543~546		4 4 4	FP-RES 47ohm 5% ¼W	328470L
R547,548		2 2 2	RES 470kohm 5% ¼W	328474J
R549,550		2 2 2	RES 15kohm 5% ¼W	328153J
R551,552		2 2 2	RES 3.9kohm 5% ¼W	328392J
R553,554		2 2 2	RES 100ohm 5% ¼W	328101J
R555,556		2 2 2	RES 47kohm 5% ¼W	328473J
R557,558		2 2 2	RES 150kohm 5% ¼W	328154J
R559,560		2 2 2	RES 8.2kohm 5% ¼W	328822J
			(REGULATOR SECTION)	
F801,802		– 2 2	Midget fuse – T200MA 250V	4720440
Q801		1 1 1	TR 2SD666A (B or C)	511025S
Q802		1 1 1	TR 2SB646A (B or C)	510052S
Q803		1 1 1	TR 2SC2275 (L or M)	512120S
Q804		1 1 1	TR 2SA985 (L or M)	510118S
Q805		1 1 1	TR 2SC1845 (E or F)	512115S
(Q805)		1 1 1	TR 2SC2240 (GR or BL)	512102S
Q806		1 1 1	TR 2SA992 (E or F)	510110S
(Q806)		1 1 1	TR 2SA970 (GR or BL)	510116S
Q807		1 1 1	TR 2SC1815 (Y or GR)	512107S
Q808		1 1 1	TR 2SA1015 (Y or GR)	510102S
D801		1 1 1	Diode W02	560061S
ZD801~804		4 4 4	Zener diode RD13EB3	502063S
C801,802		2 2 2	E-CAP 10μf 25V	211320Q
C803,804		2 2 2	E-CAP 100μf 16V	211230Q
C805,806		2 2 2	E-CAP 3.3μf 50V	211513Q
C807,808		2 2 2	E-CAP 100μf 35V	211430Q
C809,810		2 2 2	E-CAP 10μf 16V	211220Q
C811,812		2 2 2	M-CAP 0.047μf 10% 50V	222473K
C813,814		2 2 2	E-CAP 100μf 35V	211430Q
C815,816		2 2 2	E-CAP 470μf 50V	211535Q
C817		1 1 1	C-CAP 0.01μf 500V	238103P
R801,802		2 2 2	FP-MO-RES 120ohm 5% 3W	363121L
R803,804		2 2 2	RES 3.9kohm 5% ¼W	328392J
R805,806		2 2 2	RES 470kohm 5% ¼W	328474J
R807,808		2 2 2	RES 18kohm 5% ¼W	328183J
R809,810		2 2 2	RES 3.9kohm 5% ¼W	328392J
R811,812		2 2 2	FP-RES 4.7kohm 5% ¼W	328472L
R813,814		2 2 2	FP-RES 1.5kohm 5% ¼W	328152L
R815,816		2 2 2	FP-RES 150ohm 5% ¼W	328151L
R817,818		2 2 2	RES 15kohm 5% ¼W	328153J
			(MUTING SECTION)	
RY901		1 1 1	Reed relay – FRL644D	1700140
Q901		1 1 1	TR 2SC1845 (E or F)	512115S
(Q901)		1 1 1	TR 2SC2240 (GR or BL)	512102S
D901~903		3 3 3	Diode 1SS55	501024S
ZD901		1 1 1	Zened diode RD7. 5EB1	502062S
C901		1 1 1	E-CAP 100μf 16V	211230Q
C902		1 1 1	E-CAP 100μf 25V	211330Q
R901		1 1 1	FP-MO-RES 270ohm 5% 2W	362271L
R902		1 1 1	RES 120kohm 5% ¼W	328124J
R903		1 1 1	FP-MO-RES 1kohm 5% 1W	361102L

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 NO.	SYMBOL NO.	TYPE+ W E B	DESCRIPTION ++	PART NO.
			(TONE CONTROL SECTION)	
	R573,574	1 1 1	VR GM70EE71C – 100kohm x 2 – treble	4321140
	R579,580	1 1 1	VR GM70EE72C – 100kohm x 2 – bass	4321150
	C571,572	2 2 2	M-CAP 0.0027μf 10% 50V	222272K
	C573,574	2 2 2	M-CAP 0.018μf 10% 50V	222183K
	C574,576	2 2 2	M-CAP 0.027μf 10% 50V	222273K
	C577,578	2 2 2	M-CAP 0.15μf 10% 50V	222154K
	R571,572	2 2 2	RES 4.7kohm 5% ¼W	328472J
	R575,576	2 2 2	RES 680ohm 5% ¼W	328681J
	R577,578	2 2 2	RES 3.9kohm 5% ¼W	328392J
	R581,582	2 2 2	RES 22kohm 5% ¼W	328223J
	R583,584	2 2 2	RES 1 meg.ohm 5% ¼W	328105J

KEY NO.	SYMBOL NO.	TYPE+ W E B	DESCRIPTION ++	PART NO.
			(POWER SWITCH SECTION)	
⚠	SW2	–1 1	Switch, push – ESB-70823S – power	4041600
⚠	C002	–1 1	M-CAP 0.0047μf AC250V	283472M
⚠	F001	–1 1	Midget fuse – T100MA 250V	4720430
			(POWER INDICATOR SECTION)	
	D904	1 1 1	LED BR5504S	5060300
		1 1 1	Spacer, LED	7903110

SEMICONDUCTOR DATA

TRANSISTORS

† NOTES Ge: Germanium; Si: Sillicon
A: Alloy; B: Base; D: Diffused; Dd: Double-diffused
Df: Drift-field; E: Epitaxial; G: Grown; J: Junction
M: Mesa; P: Planer; Pc: Point-contact; Td: Triple-diffused

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)												MANUFACTURER
			Collector-to-Base Voltage V_{CBO} (V)	Emitter-to-Base Voltage V_{EBO} (V)	Collector Current I_C (mA)	Collector Dissipation P_C (mW)	Junction Temperature T_J (°C)	Collector Cutoff Current I_{CBO} (uA)	V_{CB} (V)	Static Forward-Current Transfer Ratio h_{FE}	V_{CE} (V)	I_C (mA)	Collector-Emitter Saturation Voltage $V_{CE(sat)}$ (V)	I_C (mA)	I_B (mA)	Gain-Bandwidth Product f_T f_{ob}* (MHz)	V_{CE} V_{CB}* (V)	I_E I_C* (mA)	Output Capacitance C_{ob} (pF)	Others	
2SA817 (Y)	AF, Driver	PNP Si-E	−80	−5	−300	600	150	−0.1 max.	−50	120 ~ 240	−2	50	−0.4 max.	−200	−20	100	−10	−10*	14	Complementary to 2SC1627	TOSHIBA
2SA991 (E, F)	AF, Low noise	PNP Si-E	−60	−5	−100	500	125	−0.05 max.	−60	300 ~ 800	−6	−0.1	−0.5 max.	−100	−10	90	−6	1	10 max.	Complementary to 2SC1844	NEC
2SA992 (E, F)	AF, Low noise	PNP Si-E	−120	−5	−50	500	125	−0.05 max.	−120	300 ~ 800	−6	−0.1	−0.3 max.	−10	−1	100	−6	1	3 max.	Complementary to 2SC1845	NEC
2SA985 (P, Q)	AF, Power amp	PNP Si-E	−120	−5	−1.5A	25W (Tc = 25°C)	150	−1 max.	−120	100 ~ 320	−5	−300	−2 max.	−1A	−100	180	−5	−200*	29	Complementary to 2SC2275	NEC
2SA1015 (Y, GR)	AF, General	PNP Si-E	−50	−5	−150	400	125	−0.1 max.	−50	120 ~ 400	−6	−2	−0.3 max.	−100	−10	80 min.	−10	−1*	7 max.	Complementary to 2SC1815	TOSHIBA
2SB646A (B, C)	AF, Driver	PNP Si-E	−120	−5	−50	900	150	−10 max.	−100	60 ~ 200	−5	−10	−2 max.	−30	−3	140	−5	−10*	4	Complementary to 2SD666A	HITACHI
2SC1627 (Y)	AF, Driver	NPN Si-E	80	5	300	600	150	0.1 max.	50	120 ~ 240	2	50	0.5 max.	200	10	100	10	10*	10	Complementary to 2SA817	TOSHIBA
2SC1815 (Y, GR)	AF, General	NPN Si-E	60	5	150	400	125	0.1 max.	60	120 ~ 400	6	2	0.25 max.	100	10	80 min.	10	1*	3 max.	Complementary to 2SA1015	TOSHIBA
2SC1844 (E, F)	AF, Low noise	NPN Si-E	60	5	100	500	125	0.05 max.	60	300 ~ 800	6	1	0.3 max.	100	10	100	6	−1	8 max.	Complementary to 2SA991	NEC
2SC1845 (E, F)	AF, Low noise	NPN Si-E	120	5	50	500	125	0.05 max.	120	300 ~ 800	6	1	0.3 max.	10	1	110	6	−1	2.5 max.	Complementary to 2SA992	NEC
2SC2275 (P, Q)	AF, Power amp	NPN Si-E	120	5	1.5A	25W (Tc = 25°C)	150	1 max.	120	100 ~ 320	5	300	2 max.	1A	100	200	5	200*	19	Complementary to 2SA985	NEC
2SD666A (B, C)	AF, Driver	NPN Si-E	120	5	50	900	150	10 max.	100	60 ~ 200	5	10	2 max.	30	3	140	5	10*	3	Complementary to 2SB646A	HITACHI

FIELD EFFECT TRANSISTOR

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)															MANUFACTURER
			Gate-to-Drain Voltage V_{GDO} (V)	Gate-to-Source Voltage V_{GSO} (V)	Gate Current I_G (mA)	Drain Current I_D (mA)	Total Dissipation P_D (mW)	Channel Temperature T_{ch} (°C)	Gate Leak Current Test Conditions	Gate Leak Current I_{GSS} (nA)	Gate to Drain Breakdown Voltage Test Conditions	Gate to Drain Breakdown Voltage $V_{(BR)GDO}$ (V)	Drain Current Test Conditions	Drain Current I_{DSS} (mA)	Gate to Source Cutoff Voltage Test Conditions	Gate to Source Cutoff Voltage $V_{GS(off)}$ (V)	Forward Transfer Admittance Test Conditions	Forward Transfer Admittance $\|Y_{fs}\|$ (mΣ)	Feed Back Capacitance Test Conditions	Feed Back Capacitance C_{rss} (pF)	Power Gain (Common Source) Test Conditions	Power Gain (Common Source) G_{PS} (dB)	Noise Figure Test Conditions	Noise Figure NF (dB)	
2SK146 (GR)	AF, Low noise Differential amp	Si N-channel junction (Dual)	−40		10		600/ unit	125	V_{GS} = −30V V_{DS} = 0	−1	V_{DS} I_G = −100μA	−40 min.	V_{DS} = 10V V_{GS} = 0	5 ~ 10			V_{DS}=10V I_{DSS} = 8mA V_{GS} = 0	48	V_{DG}=10V I_D = 0 f = 1 MHz	15			V_{DS}=10V I_D = 5mA f = 1 kHz	1	TOSHIBA

DIODES, 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)						Others	MANUFACTURER
			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)	Forward Current I_{Fmin} (mA)	Test Condition V_F (V)	Forward Voltage V_{Fmax} (V)	Test Condition I_F (mA)	Reverse Current I_{Rmax} (uA)	Test Condition V_R (V)		
W02	Rectifier	Si-DJ (Bridge)			200	200		1.5A	50	125				1.0	1.0A	10		R_{th} = 50°C/W	GENERAL INSTRUMENT
1SS53	Medium speed switching	Si-EP		35	30		300	100	2	200	500			0.8 1.0	1.0 30	0.1	30		NEC
1SS55	Medium speed switching	Si-EP		100	75		300	100	2	200	500			0.8 1.0	1.0 30	0.1	75		NEC
BR −5504S	Lamp (red)	GaAlAs			4		300	I_F = 50		85	100			2.0	20	100	4	I_V = 80 mcd (I_F = 20 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)														Others	MANUFACTURER
			Total Power Dissipation P_D (mW)	Zener Current I_Z (A)	Junction Temperature T_J (°C)	Zener Voltage V_Z MIN (V)	V_Z TYP (V)	V_Z MAX (V)	Test Conditions I_Z (mA)	Differential Resistance r_Z TYP (Ω)	r_Z MAX (Ω)	Test Conditions I_Z (mA)	Temperature Coefficient γ_Z TYP (%/°C)	γ_Z MAX (%/°C)	Test Conditions I_Z (mA)	Reverse Current I_Z MAX (μA)	Test Conditions V_R (V)		
RD7.5 − EB1	Regulator	Si-J	400		175	6.85		7.22	20		10	20				2	4		NEC
RD15 − EB2	Regulator	Si-J	400		175	13.89		14.62	10		30	10				2	11		NEC

INTEGRATED CIRCUITS μPC741C

- **Manufacturer:** NEC
- **Applications:** Operational Amplifier

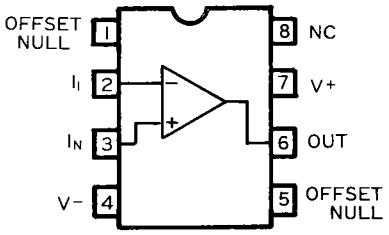
ABSOLUTE MAXIMUM RATINGS

Supply Voltage	±18 V	Input Voltage	±15 V
Internal Power Dissipation	350 mW	Storage Temperature Range	−40°C to +125°C
Differential Input Voltage	±30 V	Operating Temperature Range	−20°C to +75°C

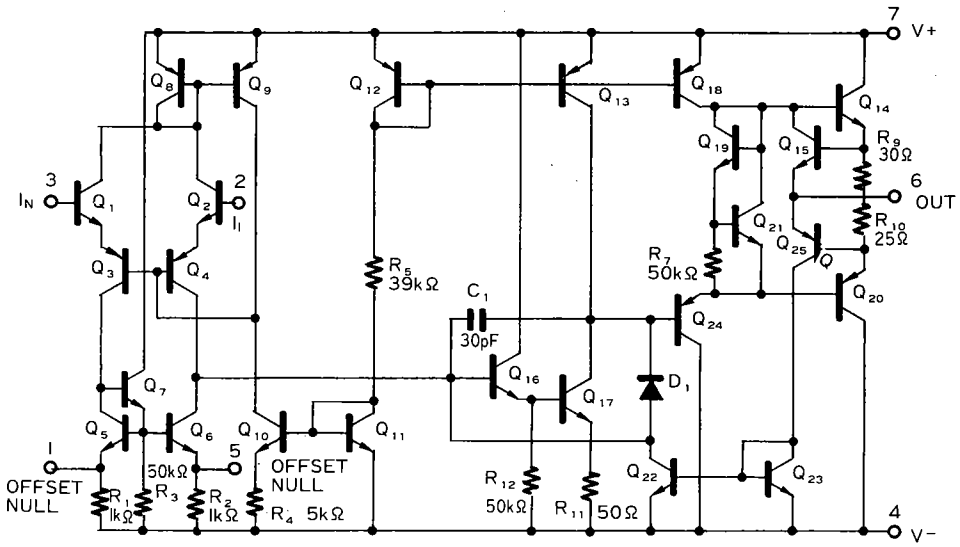
ELECTRICAL CHARACTERISTICS (V_{CC} = ±15V, T_A = +25°C unless otherwise noted.)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Input Offset Voltage	$R_S \leqslant 10\ k\Omega$		1.0	6.0	mV
Input Offset Current			20	200	nA
Input Bias Current			80	500	nA
Large-Signal Voltage Gain	$R_L \geqslant 2\ k\Omega$ $V_{out} = \pm 10V$	106	108		dB
Output Voltage Swing	$R_L \geqslant 10\ k\Omega$	12	±14		V
Common Mode Rejection Ratio	$R_S \leqslant 10\ k\Omega$	70	90		dB
Supply Voltage Rejection Ratio	$R_S \leqslant 10\ k\Omega$		30	150	μV/V
Power Consumption			45	85	mW

TERMINAL GUIDE (TOP VIEW)



EQUIVALENT CIRCUIT



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965196E 81. January 1,500 Printed in Japan