TA-E88/E88B

TA-E88 (Panel: Silver)
AEP Model

TA-E88B (Panel: Black)
AEP Model
UK Model

STEREO PREAMPLIFIER

SPECIFICATIONS

GENERAL

Power Requirements: 240 V ac, 50/60 Hz (UK)
220 V ac, 50/60 Hz (AEP)

Power Consumption: 22 W

Dimensions: Approx. 480 (w) x 80 (h) x 370 (d) mm
19 (w) x 3 1/8 (h) x 14 5/8 (d) inches
Including projecting parts and controls

Weight: Approx. 9.4 kg, 20 lb 12 oz (net)
9.7 kg, 21 lb 7 oz (with shipping carton)

0 dB = 0.775 V

Outputs:

	Voltage	Impedance
REC OUT 1, 2	150 mV (–14.5 dB) (max. 15 V)	1 kΩ
OUTPUT 1, 2	1.5 V (5.5 dB) (max. 15 V)	100 Ω

Harmonic Distortion: Less than 0.002 % at 10 V output

IM Distortion: Less than 0.002 % at 10 V output
(60Hz : 7kHz = 4 : 1)

Frequency Response: PHONO 1, 2 RIAA equalization curve ±0.2 dB
TUNER, AUX, TAPE 1, 2) dc – 500 kHz $\pm^{0}_{1}$ dB

Filters: LOW 12 dB/oct. below 15 Hz

Residual Noise: Less than 6 μV (weighting network A, IHF with ATTENUATOR set to minimum, FILTERs to OFF)

AMPLIFIER SECTION

Inputs:

	Sensitivity	Impedance	Capacitance	Maximum input capability (1 kHz)	S/N (weighting network, input level)
PHONO 1	2.5 mV (–50 dB)	50 kΩ	100 pF	250 mV (–10 dB)	88 dB (A, 2.5 mV)
HEAD AMP	0.125 mV (–76 dB)	25Ω/100Ω	–	12.5 mV (–36 dB)	80 dB (A, 0.2 mV)
PHONO 2	2.5 mV (–50 dB)	10 kΩ–100 kΩ (10 kΩ steps)	100 pF–500 pF (100 pF steps)	250 mV (–10 dB)	88 dB (A, 2.5 mV)
HEAD AMP	0.125 mV (–76 dB)	25Ω/100Ω	–	12.5 mV (–36 dB)	80 dB (A, 0.2 mV)
TUNER, AUX TAPE 1, 2	150 mV (–14.5 dB)	50 kΩ	–	–	105 dB (A, 150 mV)

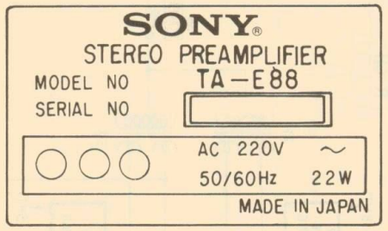
SAFETY-RELATED COMPONENT WARNING!!

COMPONENTS IDENTIFIED BY SHADING AND ⚠ MARK ON THE SCHEMATIC DIAGRAMS, EXPLODED VIEWS AND IN THE PARTS LIST ARE CRITICAL TO SAFE OPERATION. REPLACE THESE COMPONENTS WITH SONY PARTS WHOSE PART NUMBERS APPEAR AS SHOWN IN THIS MANUAL OR IN SUPPLEMENTS PUBLISHED BY SONY.

SONY
SERVICE MANUAL

MODEL IDENTIFICATION

Specification Label



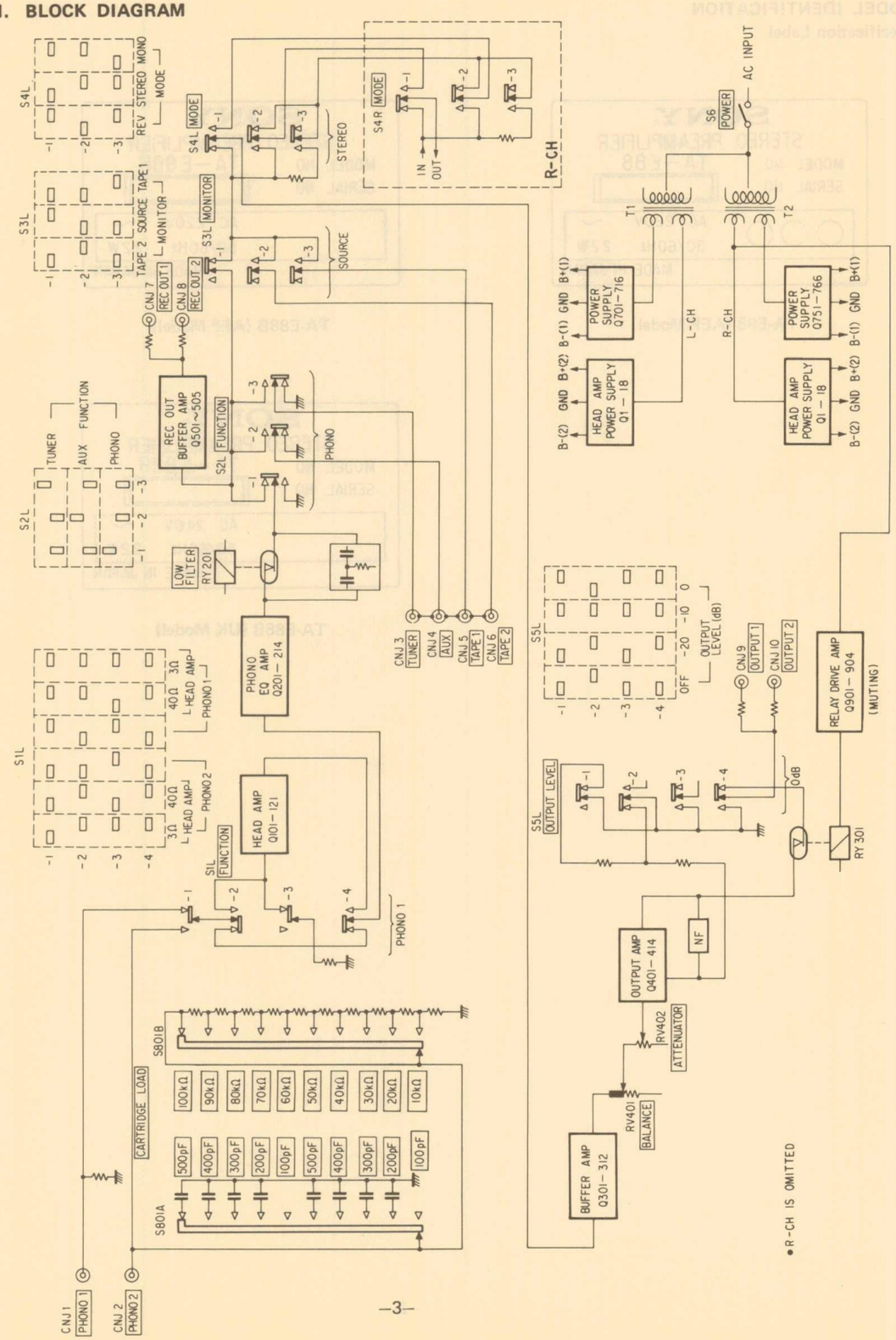
TA-E88 (AEP Model)

TA-E88B (AEP Model)

TA-E88B (UK Model)

SECTION 1
OUTLINE

1-1. BLOCK DIAGRAM



1-2. CIRCUIT DISCRIPTION

1-2-1. Phono 1 and Phono 2 Input Circuits

The TA-E88/E88B is equipped with two phono inputs – PHONO 1 and PHONO 2.

PHONO 1

- **When using high impedance cartridges (output about 2.5mV):**
  When the FUNCTION switch (S1) is set to the PHONO 1 position, the input impedance Zin1 (150kΩ, 100pF) of equalizer amplifier is connected in parallel with R1 (75kΩ) across the PHONO 1 input terminal. They serve as load impedance for the cartridge used.
  (R = 50kΩ, C = 100pF)
- **When using low impedance MC cartridges (output about 125μV):**
  The head amplifier is connected by switching S1. At the same time, either a 3Ω or 40Ω load impedance (depending on cartridge impedance) is also connected to the PHONO 1 input terminal. For the load of 40Ω cartridge, the input impedance Zin2 (100Ω) of head amplifier is employed, and for the load of 3Ω cartridge R2 (33Ω) is connected in parallel with Zin1, resulting in a 25Ω input resistance.

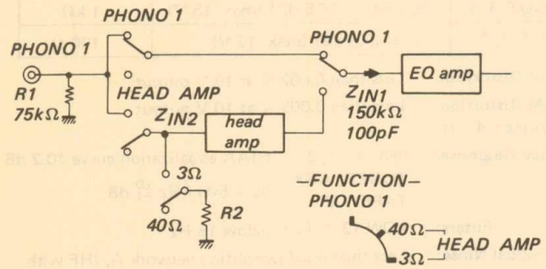


Fig. 1

PHONO 2

- The PHONO 2 input is basically the same as the PHONO 1 input, but also is equipped with a cartridge load selector. It is adjustable over 10kΩ to 100kΩ and 100pF to 500pF ranges when using high impedance cartridge.
- This switch (S801) located on the top case is a kind of rotary switch.

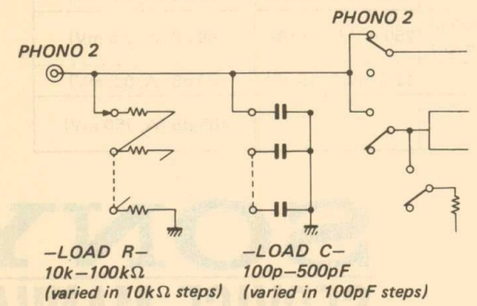


Fig. 2

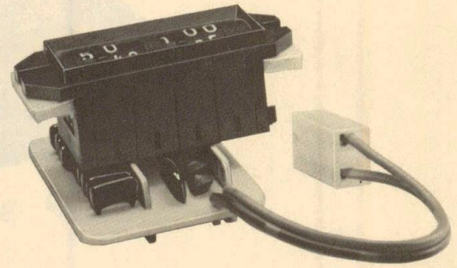


Fig. 3

1-2-2. Head Amplifier

Generally, the very low level signals produced by an MC (moving coil) cartridge are amplified by step-up transformer.
On the other hand, in the TA-E88/TA-E88B, this amplification is performed by a built-in head amplifier. Although the use of active amplification elements (rather than passive transformers) causes some deterioration of S/N ratio, these problems have been successfully overcome in the TA-E88/E88B by employing parallel-connected transistors in the head amplifier.
The head amplifier includes a main amplifier stage consisting of eight transistors (Q101 to Q108) connected in parallel, and another eight transistors (Q109 to Q116) differentially-connected to this main stage, achieving gain of 27dB with usually-low noise.

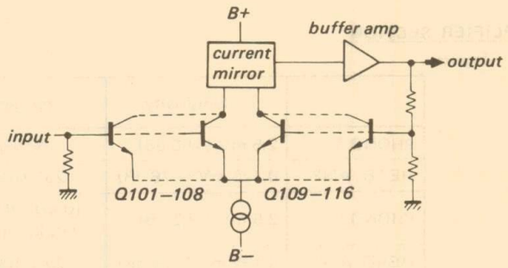


Fig. 4

- **Parallel Connection**
  When a transistor is used for amplification purposes, the current flowing between the collector and emitter of the active transistor is placed under control. Signals from the base terminal pass through the internal resistance of the base spread

resistance rbb'. (This base spread resistance is one of the critical factors which have to be considered in high frequency amplification). The detailed diagram is shown in Fig. 5.
The lower the rbb' resistance, the less the noise will become. This may be achieved by connecting transistors in parallel – n transistors connected in parallel reduce noise by $1/\sqrt{n}$.
This may also be considered as parallel-connected transistor collectors (noise output terminals), resulting in the averaging out of noise levels and phase differences of the noise elements in each transistor.

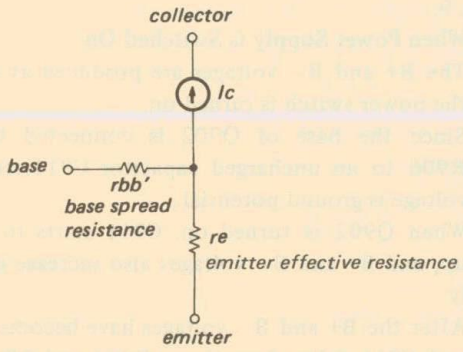


Fig. 5

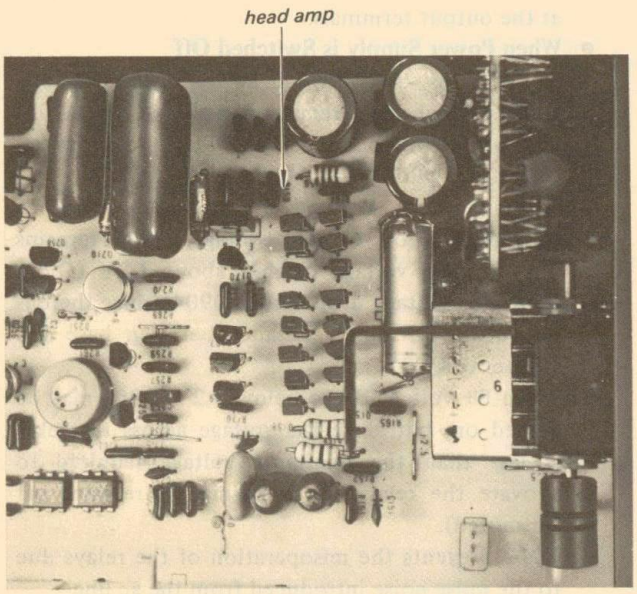


Fig. 6

1-2-3. Equalizer Amplifier

The phono equalizer amplifier stage consists of Q201 through Q214. In order to design the TA-E88/E88B as a direct-coupled dc amplifier, this stage includes the following features:

- An FET in the first stage
- The Miller effect by caused internal capacitance between drain and gate of FET in the first stage results in deterioration of high end frequency response due to high input impedance. To prevent this, the drain of FET in the first stage is connected to the source of the following low input impedance transistor (Q202).
  The impedance of the equalizer components (R228 to R230) is kept low to further improve the S/N ratio. The equalizer amplifier output stage employed to drive these components consists of a 2-stage emitter-follower push-pull circuit. A dual transistor, featuring two pairs of elements mounted on a single wafer, is used to improve the thermal and pair characteristics for differential operation of Q201, Q202 and Q205.

1-2-4. Buffer Amplifier

The buffer amplifier (Q301 to Q312) up to the equalizer amplifier has a gain of 0dB. That is, there is 100% negative feedback of the output voltage from the output terminal to the input negative feedback terminal.
This amplifier is used to drive BALANCE control and ATTENUATOR.
Frequency response deterioration will occur if high-value resistors are used in the step attenuator. The TA-E88/E88B employs low resistance resistors (3kΩ). This also results in decreased thermal noise.
A buffer amplifier is used to drive the low resistance BALANCE control and ATTENUATOR. This amplifier uses a differential-cascode amplifier in the first stage.
Fig. 8 shows the location of the FET.

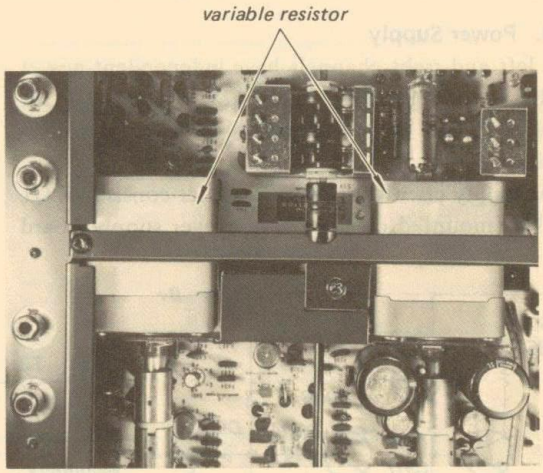


Fig. 7

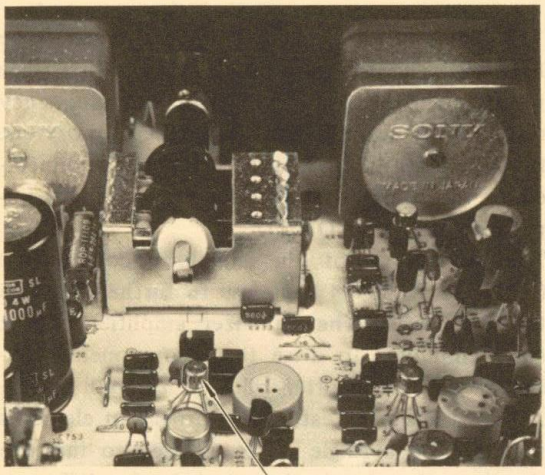


Fig. 8

1-2-5. Output Amplifier

The output amplifier consists of Q401 to Q414. It amplifies signals from dc to high frequency and drives OUTPUTs 1 and 2 of TA-E88/E88B. Generally, an output amplifier must be capable of delivering high-level, low-impedance output signals to match a wide range of power amplifiers.

For this reason, the TA-E88/E88B is designed to supply an output signal up to 15Vrms with 100Ω output impedance.

This amplifier stage is also equipped with the OUTPUT LEVEL switch (S5) to permit the output level to be varied in 10dB steps.

The four selector positions are 0dB, −10dB, −20dB and OFF.

1-2-6. Power Supply

Both left and right channels have independent power supplies which produce the +42V and −42V for B voltage, plus the +14V and −14V for the head amplifier.

Power supply circuit for head amplifier consists of Q1 to Q18. (mounted on head amp power supply board located near the main board). The reason for positioning this power supply as close as possible to the head amplifier is to prevent the introduction of extraneous noise on the B+ and B− bus.

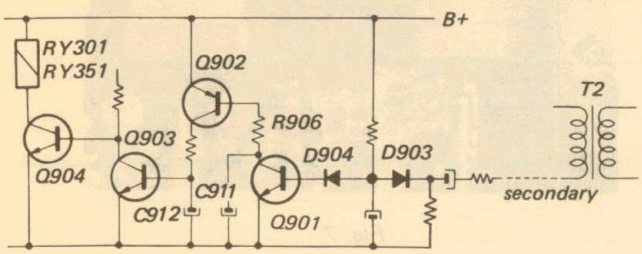


Fig. 9

1-2-7. Relay Drive Amplifier

This amplifier, consisting of Q901 to Q904 (mounted on the rectifier board), drives the muting relays RY301 and RY351. These muting relays operate when the power supply switch is turned on and off. The signal path is completed when these relays are turned on under the condition described below. The simplified relay drive amplifier circuit is shown in Fig. 9.

- **When Power Supply is Switched On**

1) The B+ and B− voltages are produced as soon as the power switch is turned on.
2) Since the base of Q902 is connected through R906 to an uncharged capacitor C911, the base voltage is ground potential.
   When Q902 is turned on, C911 starts to charge up, and B+ and B− voltages also increase gradually.
3) After the B+ and B− voltages have become stable, and C911 fully charged up, Q902 and Q903 turn off, resulting in Q904 turning on to activate the relays. The output signals are consequently appear at the output terminals.

- **When Power Supply is Switched Off**

1) As soon as the POWER switch is turned off, Q901 (which had remained off due to D903) and Q902 turn on, and then Q903 also turns on. Therefore, Q904 (for relay drive) turns off.
2) Although both B+ and B− voltages commence to rapidly drop to zero voltage, Q901 remains on until B+ voltage reaches about 1.2V (Q901 V_{BE} plus voltage drop across D904) since there is no voltage dividing resistance between base and emitter of Q901.
3) When B+ voltage drops below 1.2V, Q904 may be turned on, but since the voltage across the relay is less than the minimum voltage required to activate the relay, the relay simply remains off (or muted).
4) C912 prevents the misoperation of the relays due to the pulse noise introduced from the ac line.

1-2-8. REC OUT Buffer Amplifier

The REC OUT terminals provide fixed level output signals from the REC OUT buffer amplifier stage (Q501 to Q505) between the equalizer amplifier and buffer amplifier.

1-2-9. Overall Amplifier

Although the TA-E88/E88B consists of ten dc amplifier stages, all of these stages are basically the same. The output amplifier is described here as an example of one of these stages.

Fig. 11 shows the relevant signal levels when S5 is set to 0dB, and the input level is adjusted to obtain an output level of about 0dBrms (2.2Vp-p). The + and – signs refer to the signal polarity at that point. However, the (–) sign on the right hand gate (NFB input) of the first stage Q401 indicates that this was originally a negative polarity.

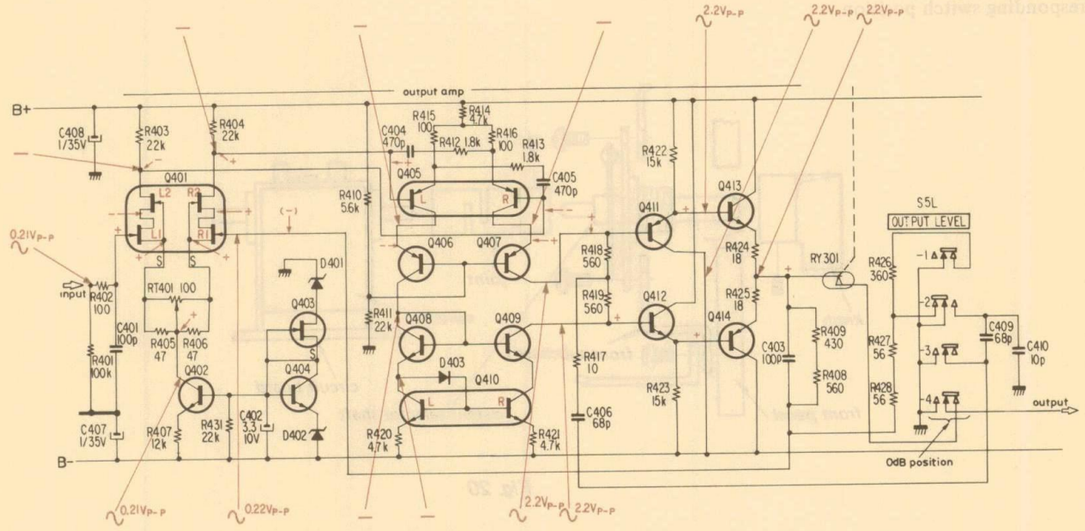


Fig. 11

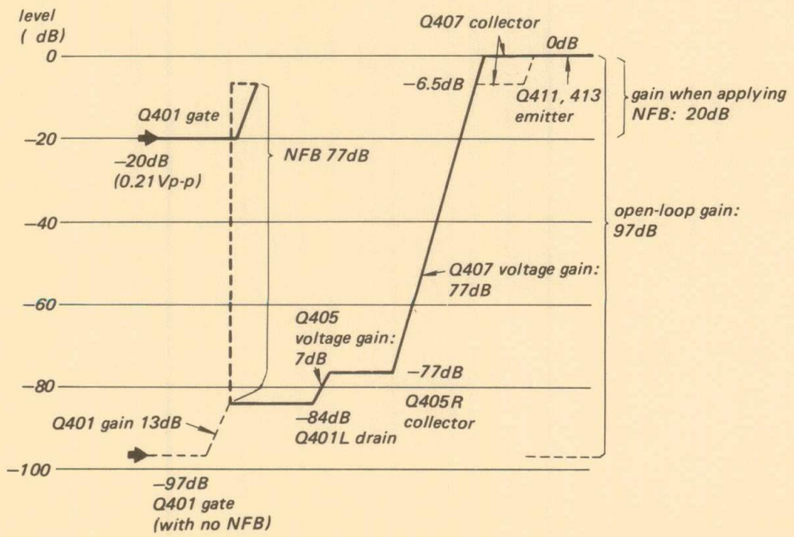


Fig. 12

Circuit Description

- When observing the signal levels, the 0.2Vp-p (about –20dB) input signal applied to the gate of Q401 is not measured at the drain of Q401 (L2). However, 2.2Vp-p (about 0dB) signal appears at the collector of Q407, and is extracted from the emitter follower.
- The level diagram is shown in Fig. 12.
  An NFB of 77dB is applied to the amplifier which has 97dB open-loop gain. Since the gain of an NFB amplifier is reduced only by the amount of NFB applied to that stage, the level at the drain of the Q401 becomes –84dB. This is the reason why the signal level is too low to be measured at the intermediate points of amplifier.
- D401, Q403, Q404 and D402 form a thermally-compensated constant voltage circuit, which operates as follows (the voltages referred to here are relative to the B– voltage): D402 (EQB01-05) is a 5V zener diode which maintains the emitter of Q404 at +5V level. To obtain a flat base voltage (V_{BE}) from the collector of Q404, the base and collector are connected as shown in Fig. 10. The characteristics referring to this connection are also shown in Fig. 10.
  When the value of V_{BE} reaches the "shoulder" of the curve, it suddenly becomes constant, and subsequently varies only with changes of temperature. Any temperature-related variations in V_{BE} of Q404 are fed to Q402, but since Q402 and Q404 are identical transistors, these variations are automatically compensated for by the other transistor. Hence, Q402 and Q404 serve to comensate for any voltage variations caused by changes of temperature.
- Q403 is a 2SK42 N-channel depression type FET. As shown in Fig. 13, EG = ES when gate and source are connected, resulting in the flow of a constant current of less than 5mA.
  In other words, Q403 serves as the load resistance for Q402.

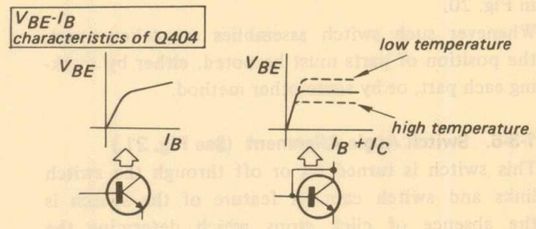


Fig. 10

Note:
The –6.5dB level (dotted line in figure) in addition to the 0dB level (theoretical value) at the Q407 collector, is an example of the error incurred due to the load effect when measuring with an ac voltmeter of 1MΩ input resistance.
The 7dB shown as the gain (between base and collector) for Q405 is the voltage gain. This is important because since Q405 employs the emitter of Q407 (low input resistance) as collector load of Q405. This gain should really be measured as current ratio.

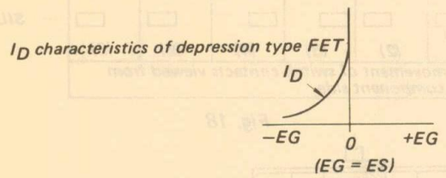


Fig. 13

- Q402 has an emitter resistor with sufficiently high resistance to obtain constant base voltage, which means that the emitter current (collector current) always remains constant. A bipolar transistor type constant current circuit such as this can provide highly-constant current at low supply voltages.
- Q401 is a cascode connection with the polarity from the lower gate to the upper drain as shown in Fig. 11.
- Q405, Q406 and Q407 form the second cascode-connection differential amplifier. Q408, Q409 and Q410 (current-mirror circuit) serve as the load resistance for Q406 and Q407. The output from this differential amplifier appears single-ended at the collector of Q407, while the signal on the collector of Q406 is passed from Q408, Q410 to Q409. Q407 and Q409 drive Q411 and Q412. Furthermore, although Q409 also operates as a constant current circuit, and the Q407 collector current is passed through R418 and R419 to Q411 and Q412, signals of almost equal amplitude are passed to these two transistors (Q411 and Q412).
  In addition, the thermal compensation for Q410R and Q409 is achieved by Q410L and Q408.
- Q411, Q412, Q413 and Q414 form a cross-coupled current driver circuit, comprising pairs of NPN, PNP emitter-followers.

CAUTION

The transistors have a resistor to their collector or emitter circuits. These transistors will be not damaged if any of transistor terminals are short-circuited. The exception is Q403 which supplies, constant current to D401, Q404 and D402. If the drain and source of Q403 are short-circuited, D401, Q403, Q404 and D402 will be completely destroyed.

1-3. Parts Information

1-3-1. Small Resistors

The TA-E88/E88B uses many small resistors, similar to the type shown in Fig. 14. These resistors are ¼W metal-oxide with an accuracy of 1%. Note that this accuracy rating has been omitted in the schematic diagrams. (The ¼W and ½W carbon resistor accuracy ratings are indicated).

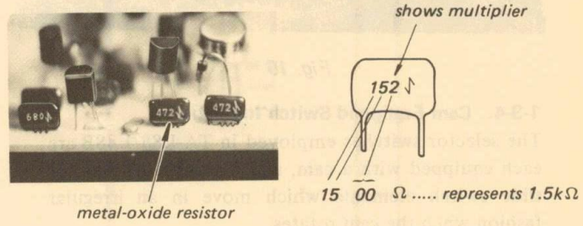


Fig. 14

1-3-2. Square Tantalum Capacitors

The capacitors employed in the TA-E88/E88B (as shown in Fig. 15) are the same square tantalum capacitors used in pulse circuit power supplies, etc. These capacitors are especially used in the B+ and B– bus where their greater by-pass effect is needed.

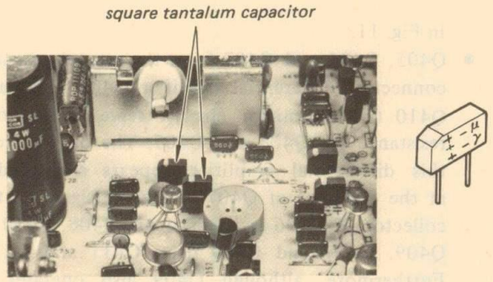


Fig. 15

1-3-3. Mounting of Components

When mounting the components on the circuit board, take care that they do not touch the shafts of switches, variable resistors, etc. Be particularly careful to prevent any contact between the compound FET covered by metal case, and the ATTENUATOR shaft, and the diode leads and BALANCE control shaft.

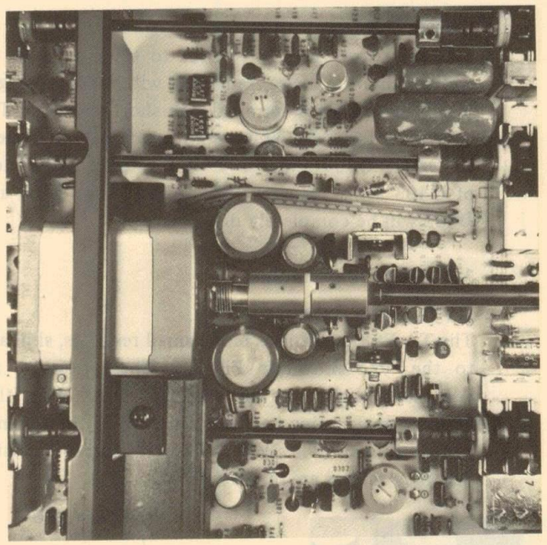


Fig. 16

1-3-4. Cam Equipped Switch Indication

The selector switches employed in TA-E88/E88B are each equipped with a cam, and a number (3 or 4) of slide switch elements which move in an irregular fashion when the cam rotates.

As an example of this arrangement, S1L (FUNCTION PHONO INPUT) is shown in Fig. 17.

There are a total of ten switches employed in the TA-E88/E88B, making it impossible to determine which points are making contact at different select positions. For this reason, both the schematic diagram and the mounting diagram include special charts of the contact patterns for each switch position.

Note that these charts indicate the position of the blue switch link heads as viewed from the component side, thereby simplifying checking operations as well.

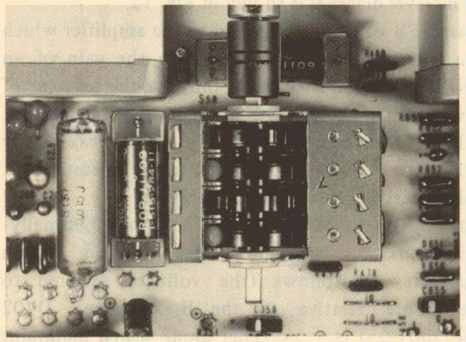
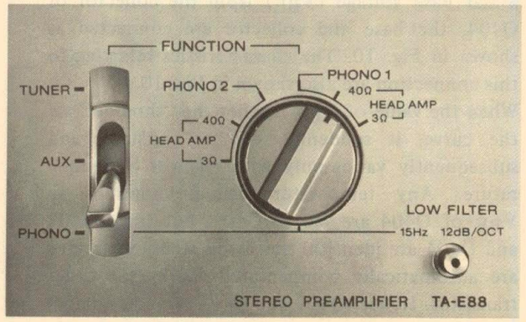


Fig. 17



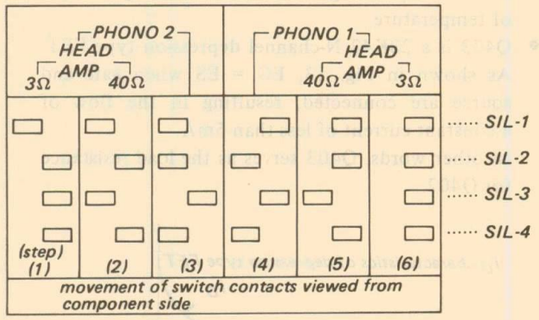
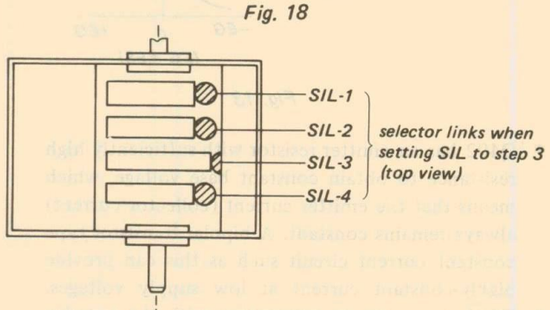


Fig. 18



SIL (FUNCTION PHONO Switch) viewed from component side

Fig. 19

1-3-5. Order of Parts in Switch Assemblies

A typical switch assembly, including the switch, the joint, front panel and selector knob, is shown in Fig. 20.

Whenever such switch assemblies are taken apart, the position of parts must be noted, either by marking each part, or by some other method.

1-3-6. Switch Angle Alignment (See Fig. 21.)

This switch is turned on or off through the switch links and switch cam. A feature of the switch is the absence of click stops which determine the actual switching position. Therefore, it is necessary to correctly align the selector knob precisely with its corresponding switch position.

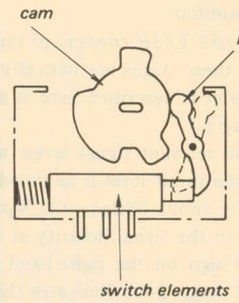


Fig. 21

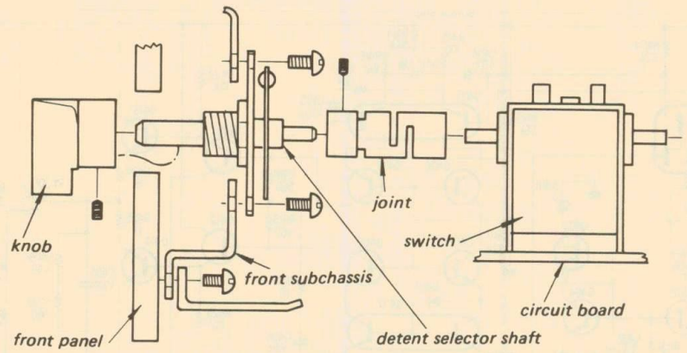
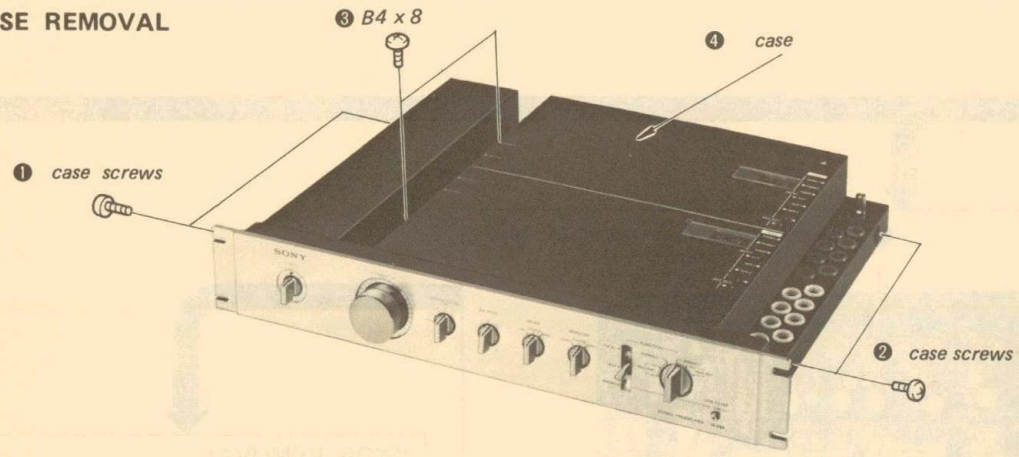


Fig. 20

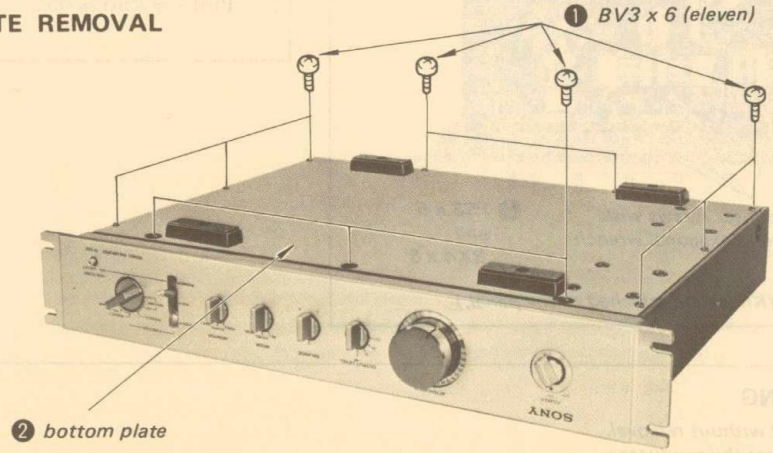
SECTION 2
DISASSEMBLY

Note: Follow the disassembly procedure in the numerical order given.

CASE REMOVAL



BOTTOM PLATE REMOVAL

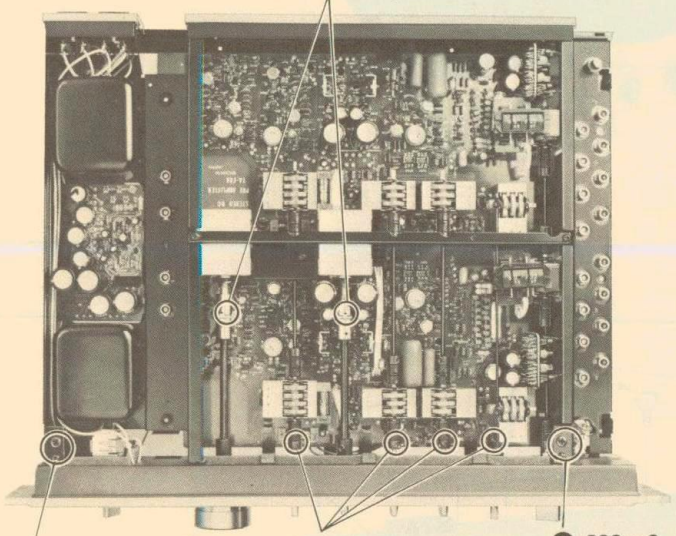


ATTENUATOR KNOB REMOVAL

❶ *Loosen the set screw with an L-shaped hexagonal wrench (1.5mm)*

Note: Other knobs can be removed after the panel removal.

PANEL REMOVAL

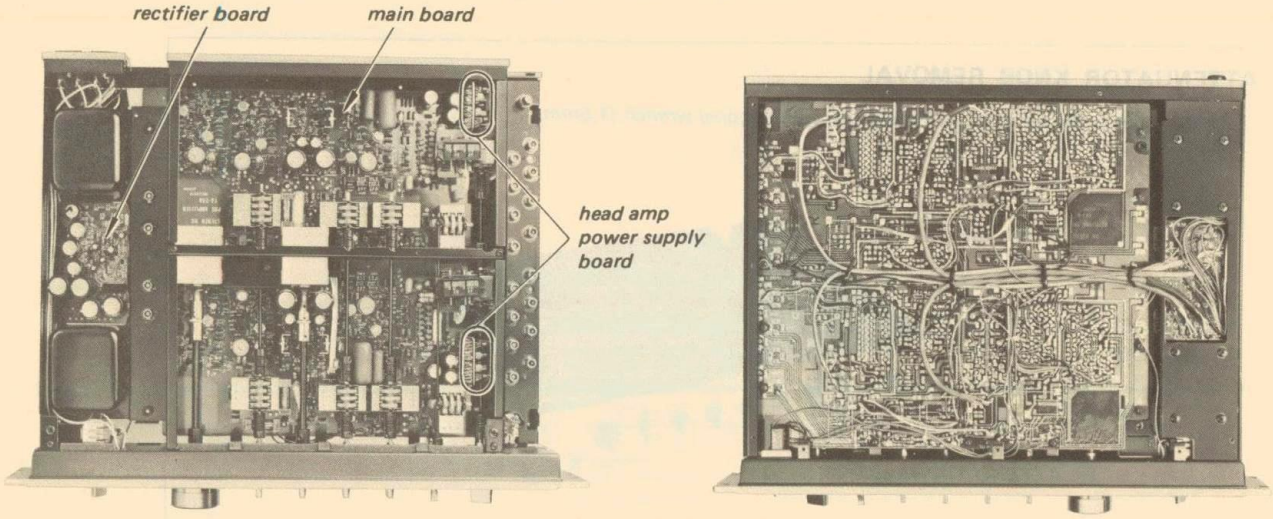


KNOB REMOVAL

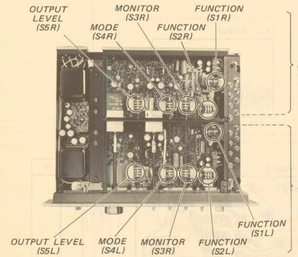
1 Loosen the set screws with an L-shaped hexagonal wrench (1.5mm) from the bottom side of the panel.
2 Pull the knobs out.

CIRCUIT BOARD CHECKING

Circuit boards can be repaired without removal. With electrolytic capacitors near the conductor side of head amp power supply boards disconnected, the head amp power supply boards can be checked.

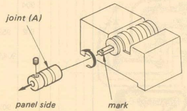


NOTE ON ROTARY SWITCH INSTALLATION

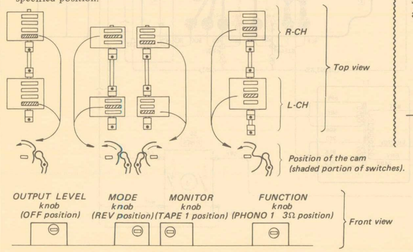


Switch Positions in Installation (S1, S3 to S5)

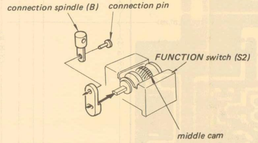
When the switch shaft is set the mark side up, the cam of the switches are positioned as shown below:



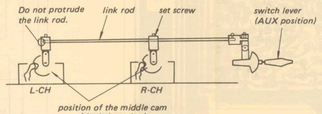
In the switch position shown above, joint the switches with the joints (A) and the shafts, and install the knobs so that the knobs indicate the specified position.



Switch Positions in Installation (S2)

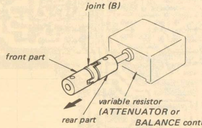


Set the switch lever to the AUX position, and install the link rod as shown below.



JOINT (B) REMOVAL

Do not pull the front part of the joint (B) in the direction shown by the arrow, because the front part is combined with the rear part through a spring.
Be sure to loosen the setscrews and remove the joint (B).



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SECTION 3
ADJUSTMENTS

OFFSET ADJUSTMENT–1 (PHONO EQ AMP)

Setting:

POWER switch (S6)	: ON
FUNCTION switch (S1)	: PHONO 1
FUNCTION switch (S2)	: PHONO

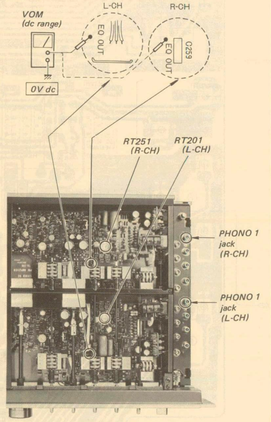
Procedure:

1. Terminate the PHONO 1 jack with a shorting plug.
2. Adjust RT201 (L-CH) and RT251 (R-CH) for 0V reading on VOM.

Specification:

EQ OUT level: 0 ± 0.1V

Adjustment Location:
– main board –

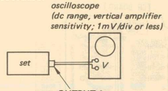


OFFSET ADJUSTMENT–2 (OUTPUT AMP)

Setting:

POWER switch (S6)	: ON
ATTENUATOR control	: fully counter-clockwise
OUTPUT LEVEL switch (S5)	: 0dB

Procedure:

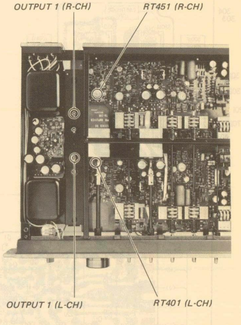


1. Adjust RT401 (L-CH) and RT451 (R-CH) for 0V reading on oscilloscope.

Specification:

OUTPUT 1 level: 0 ± 0.1mV

Adjustment Location:
– main board –

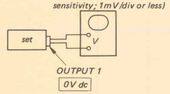


OFFSET ADJUSTMENT–3 (BUFFER AMP)

Setting:

POWER switch (S6)	: ON
FUNCTION switch (S1)	: TUNER
MONITOR switch (S3)	: SOURCE
MODE switch (S4)	: STEREO
BALANCE control	: mechanical mid
ATTENUATOR control	: fully clockwise
OUTPUT LEVEL switch (S5)	: 0dB

Procedure:

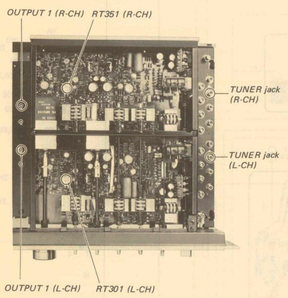


1. Terminate the TUNER jack with a shorting plug.
2. Adjust RT301 (L-CH) and RT351 (R-CH) for 0V reading on oscilloscope.

Specification:

OUTPUT 1 level: 0 ±0.1mV

Adjustment Location:
– main board –



MUTING TIME CHECKING

Confirm the operation of the relays (RY301, 351)

- RY301 and RY351 are energized at about eight seconds after the POWER switch is turned ON.
- RY301 and RY351 are released at the moment when the POWER switch is turned OFF.

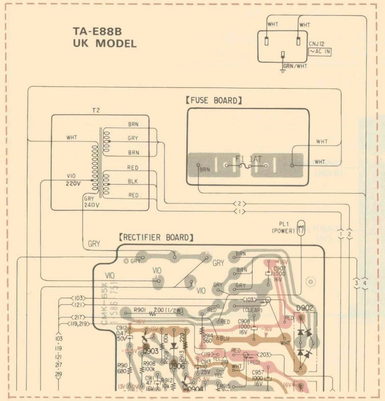
SECTION 4
DIAGRAMS

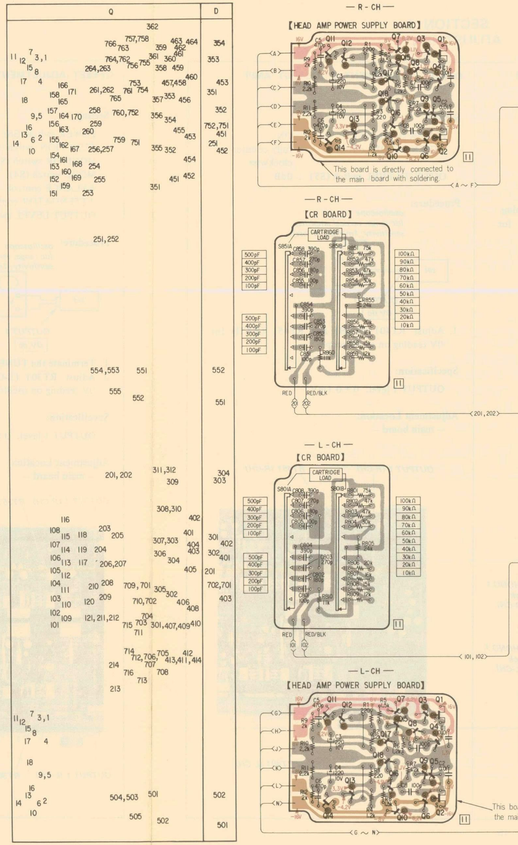
4-1. MOUNTING DIAGRAM
— Conductor Side —

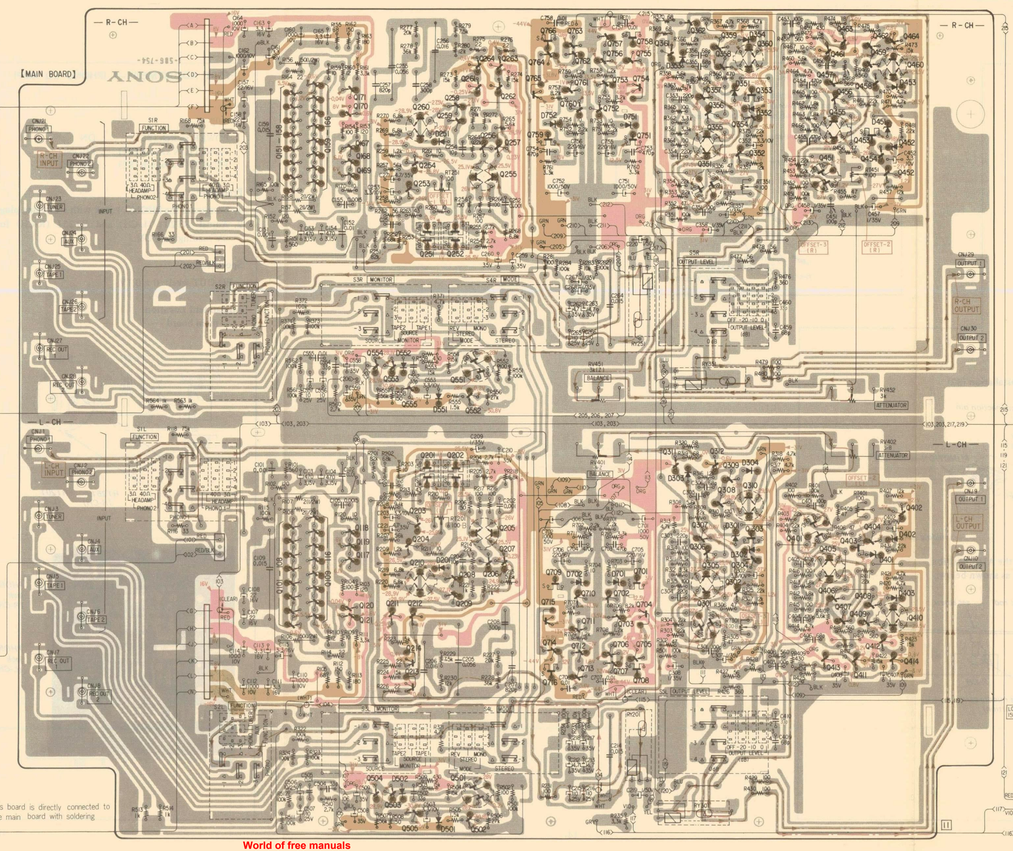
- Color code of sleeving over the end of the jacket.

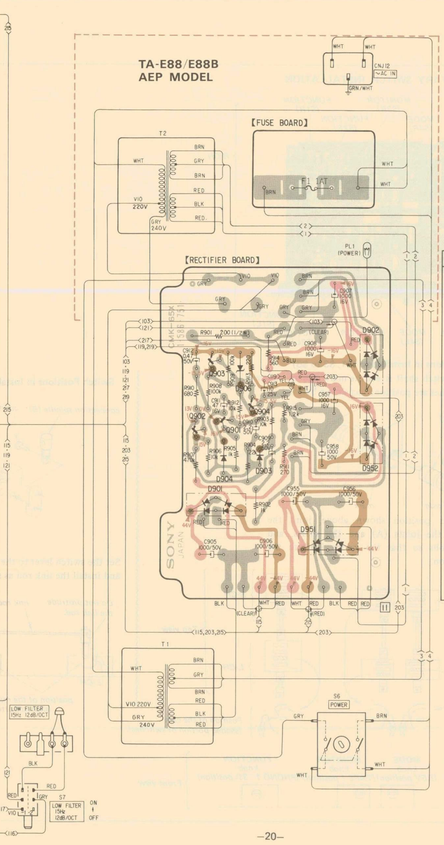
- : B+ pattern.
- : B− pattern.
- Readings are taken under no signal conditions with a VOM (20kΩ/V).

Note:
The pair transistors of each differential amplifier at the power supply section must be replaced at the same time. (Q15 and 17, Q65 and 67, Q16 and 18, Q66 and 68, Q701 and 703, Q752 and 753, Q710 and 711, Q760 and 761)

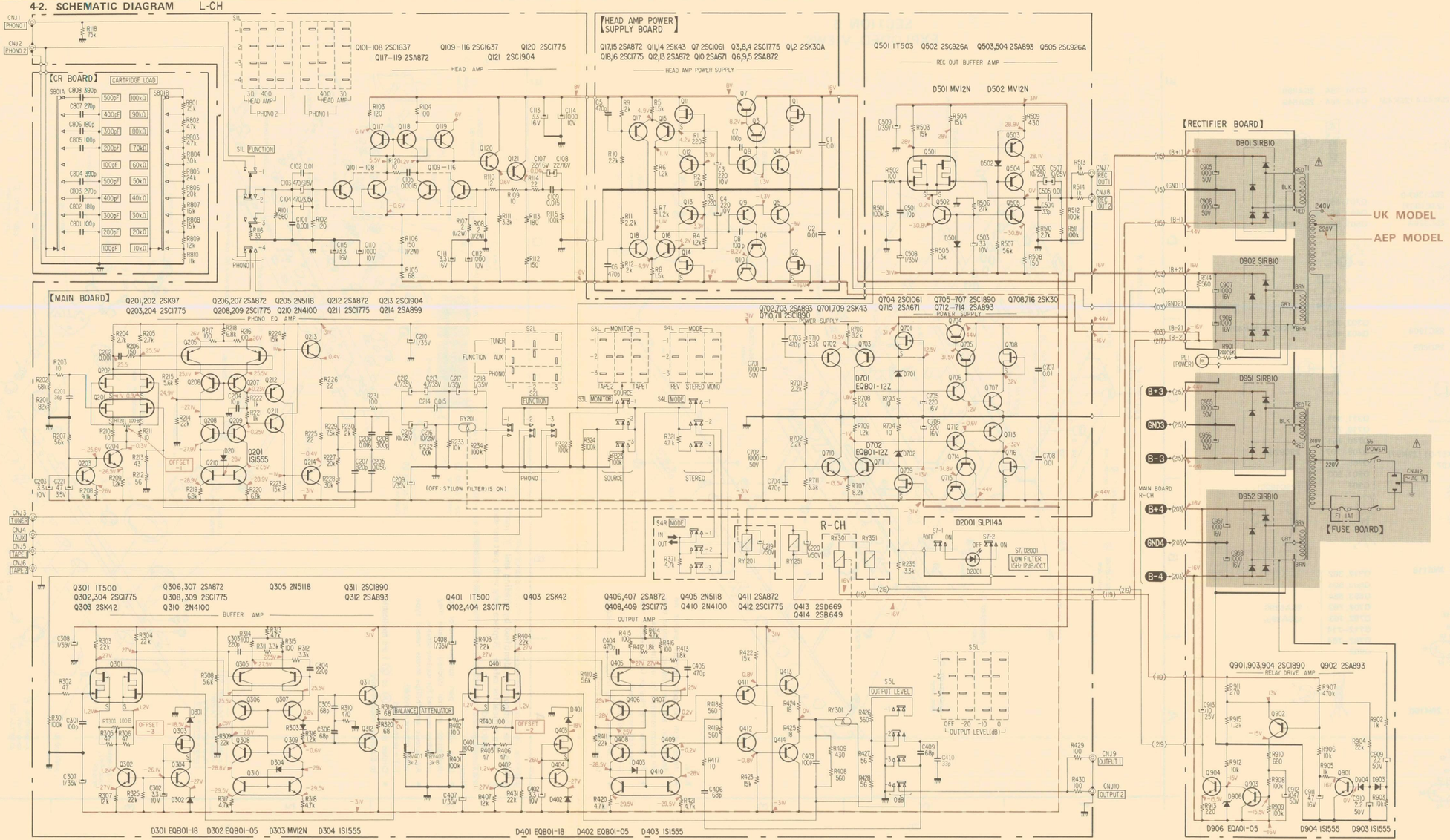








4-2. SCHEMATIC DIAGRAM L-CH



Note:

- Component for right channel have same values as for left channel. Reference numbers are coded as shown below.
  HEAD AMP: from 151
  PHONO EQ AMP: from 251
  BUFFER AMP: from 351
  OUTPUT AMP: from 451
  REC OUT BUFFER AMP: from 551
  POWER SUPPLY: from 751
  CR BOARD: from 851
  HEAD AMP POWER SUPPLY BOARD: same as L-CH
  Switches are distinguished by L or R. (for example S5L or S5R).
- All capacitors are in μF unless otherwise noted. pF=μμF 50WV or less are not indicated except for electrolytics.
- All resistors are in ohms, ¼W, ±1% unless otherwise noted. kΩ = 1000Ω, MΩ = 1000kΩ
- : B+ bus.
- : panel designation.
- : adjustment for repair.
- : B− bus.
- Readings are taken under no signal conditions with a VOM (20kΩ/V).
- Transistor base-emitter voltages are measured on the 2.5V range.
- Voltage variations may be noted due to normal production tolerances.
- Switch

Ref. No.	Switch	Position
S1	FUNCTION	PHONO 1
S2	FUNCTION	PHONO
S3	MONITOR	SOURCE
S4	MODE	STEREO
S5	OUTPUT LEVEL (dB)	0dB
S6	POWER	OFF
S7	LOW FILTER 15Hz 12dB OCT	OFF
S801, 851	CARTRIDGE LOAD	500pF/100kΩ

Note: The components identified by shading and ⚠ mark are critical for safety. Replace only with part number specified.

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Replacement Semiconductors

For replacement, use semiconductors except in ( ).

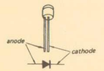
D201, 251
D304, 354
D403, 453
D903, 904 : 1S1555

D301, 351 : EQB01-18
D401, 451
D302, 352 : EQB01-05
D402, 452
D701, 751 : EQB01-12Z
D702, 752
D906 : EQB01-05 (EQA01-05)

D303, 353
D501, 551 : MV12N
D502, 552

D901, 951 : SIRB10
D902, 952

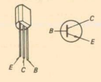
D2001 : SLP114A



Q1, 2
Q708, 716 : 2SK30A
Q758, 766

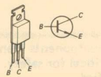
Note:
The pair transistors of each differentical amplifier at the power supply section must be replaced at the same time. (Q15 and 17, Q65 and 67, Q16 and 18, Q66 and 68, Q701 and 703, Q752 and 753, Q710 and 711, Q760 and 761)

Q3, 4, 8
Q16, 18
Q120, 170
Q203, 204
Q208, 209
Q253, 254
Q258, 259
Q211, 261
Q302, 304
Q308, 209 : 2SC1775-E (2SC1775)
Q309
Q352, 354
Q358, 359
Q402, 404
Q408, 409
Q412, 462
Q452, 454
Q458, 459

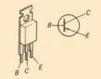


Q5, 6, 9, 12, 13
Q15, 17
Q117–119
Q167–169
Q206, 207, 212
Q256, 257, 262 : 2SA872-D (2SA872)
Q306, 307
Q356, 357
Q406, 407, 411
Q456, 457, 461

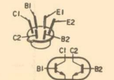
Q7
Q704, 754 : 2SC1061



Q10 : 2SA671

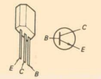


Q210, 260
Q310, 360 : 2N4100
Q410, 460

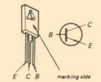


Q11, 14
Q701, 709 : 2SK43-4 (2SK43)
Q751, 759

Q101–116 : 2SC1367-0 (2SC1367)
Q151–166
Q502, 505 : 2SC926A
Q552, 555

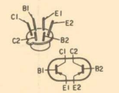


Q121, 171 : 2SC1904
Q213, 263
Q413, 463 : 2SD669

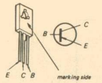


Q201, 251 : 2SK97-01 (2SK97)
Q202, 252 : 2SK97

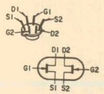
Q205, 255
Q305, 355 : 2N5118
Q405, 455



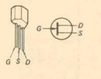
Q214, 264 : 2SA899
Q414, 464 : 2SA649



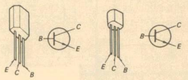
Q301, 351 : 1T500
Q401, 451
Q501, 551 : 1T503



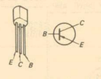
Q303, 353 : 2SK42-3 (2SK42)
Q403, 453



Q311, 361
Q710, 711
Q760, 761
Q705–707 : 2SC926A
Q755–757
Q901, 903
Q904 (2SC1890)

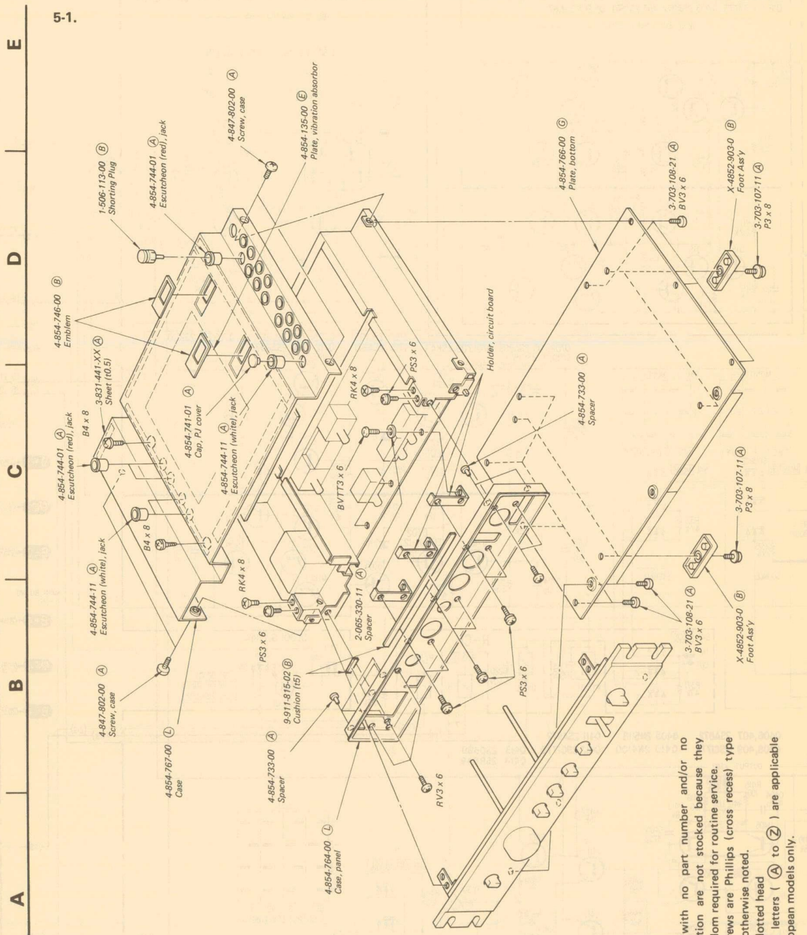


Q312, 362
Q503, 504
Q553, 554
Q702, 703 : 2SA639S (2SA893)
Q752, 753
Q712–714
Q762–764
Q902



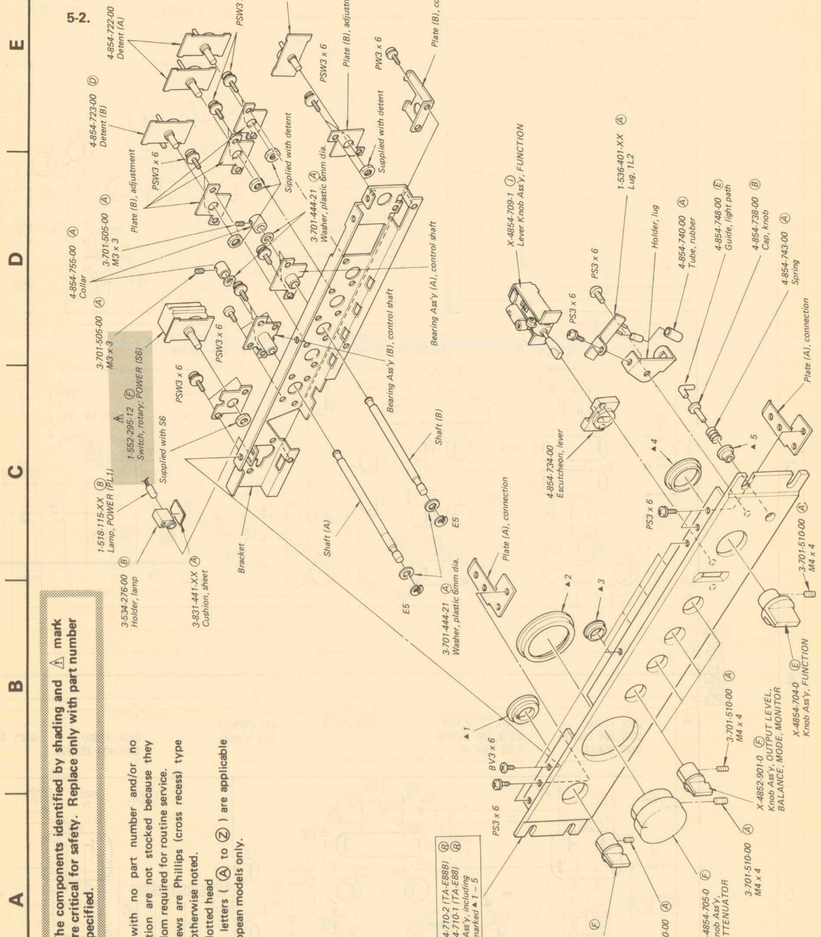
SECTION 5
EXPLODED VIEWS

5-1.



Note:
- Items with no part number and/or no description are not stocked because they are seldom required for routine service.
- All screws are Phillips (cross recess) type unless otherwise noted.
  (—) = slotted head
- Circled letters (Ⓐ to Ⓩ) are applicable to European models only.

5-2.



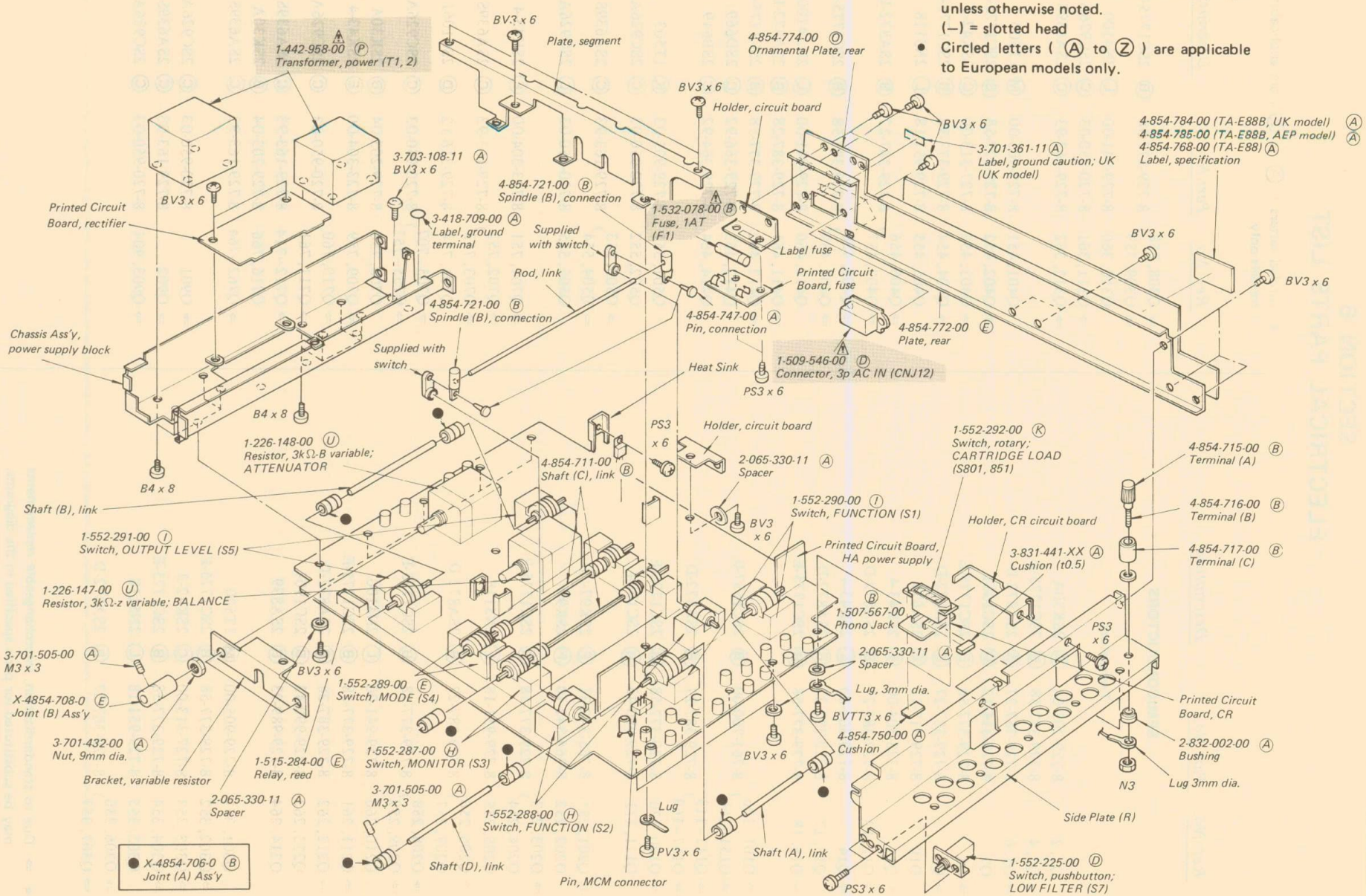
Note: The components identified by shading and ⚠ mark are critical for safety. Replace only with part number specified.

Note:
- Items with no part number and/or no description are not stocked because they are seldom required for routine service.
- All screws are Phillips (cross recess) type unless otherwise noted.
  (—) = slotted head
- Circled letters (Ⓐ to Ⓩ) are applicable to European models only.

Note: The components identified by shading and ⚠ mark are critical for safety. Replace only with part number specified.

Note:

- Items with no part number and/or no description are not stocked because they are seldom required for routine service.
- All screws are Phillips (cross recess) type unless otherwise noted.
  (–) = slotted head
- Circled letters (Ⓐ to Ⓩ) are applicable to European models only.



SECTION 6
ELECTRICAL PARTS LIST

• Circled letters (Ⓐ to Ⓩ) are applicable to European models only.

Ref. No.	Part No.		Description
			SEMICONDUCTORS
			Transistors
Q1, 2	8-729-203-04	Ⓑ	2SK30A
⇒ Q3, 4	8-729-377-58	Ⓑ	2SC1775-E
⇒ Q5, 6	8-729-387-27	Ⓑ	2SA872-D
Q7	8-729-316-12	Ⓓ	2SC1061
⇒ Q8	8-729-377-58	Ⓑ	2SC1775-E
⇒ Q9	8-729-387-27	Ⓑ	2SA872-D
Q10	8-729-317-12	Ⓔ	2SA671
⇒ Q11	8-723-304-00	Ⓔ	2SK43-4
⇒ Q12, 13	8-729-387-27	Ⓑ	2SA872-D
⇒ Q14	8-723-304-00	Ⓔ	2SK43-4
Q15, 17	8-729-387-27	Ⓑ	2SA872-D
⇒ Q16, 18	8-729-377-58	Ⓑ	2SC1775-E
⇒ Q101–106, ⇒ Q151–166	8-761-700-00	Ⓑ	2SC1637-0
⇒ Q117–119, ⇒ Q167–169	8-729-387-27	Ⓑ	2SA872-D
⇒ Q120, 170	8-729-377-58	Ⓑ	2SC1775-E
Q121, 171	8-729-990-43	Ⓑ	2SC1904
⇒ Q201, 251	8-765-342-31	Ⓕ	2SK97-□1
Q202, 252	8-765-342-10	Ⓕ	2SK97
⇒ Q203, 253, Q204, 254	8-729-377-58	Ⓑ	2SC1775-E
Q205, 255	8-729-951-18	Ⓛ	2N5118
⇒ Q206, 256, Q207, 257	8-729-387-27	Ⓑ	2SA872-D
⇒ Q208, 258, ⇒ Q209, 259	8-729-377-58	Ⓑ	2SC1775-E
Q210, 260	8-729-941-00	Ⓛ	2N4100
⇒ Q211, 261	8-729-377-58	Ⓑ	2SC1775-E
⇒ Q212, 262	8-729-387-28	Ⓑ	2SA872-D
Q213, 263	8-729-990-43	Ⓑ	2SC1904
Q214, 264	8-729-989-93	Ⓑ	2SA899
Q301, 351	8-729-905-00	Ⓜ	1T500
⇒ Q302, 352	8-729-377-58	Ⓑ	2SC1775-E
⇒ Q303, 353	8-727-313-00	Ⓒ	2SK42-3
⇒ Q304, 354	8-729-377-58	Ⓑ	2SC1775-E
Q305, 355	8-729-951-18	Ⓛ	2N5118
⇒ Q306, 356, ⇒ Q307, 357	8-729-387-27	Ⓑ	2SA872-D
⇒ Q308, 358, ⇒ Q309, 359	8-729-377-58	Ⓑ	2SC1775-E
Q310, 360	8-729-941-00	Ⓛ	2N4100
⇒ Q311, 361	8-720-950-03	Ⓒ	2SC926A
⇒ Q312, 362	8-729-163-93	Ⓒ	2SA639S
Q401, 451	8-729-905-00	Ⓜ	1T500
⇒ Q402, 452	8-729-377-58	Ⓑ	2SC1775-E
⇒ Q403, 453	8-727-313-00	Ⓒ	2SK42-3
⇒ Q404, 454	8-729-377-58	Ⓑ	2SC1775-E
Q405, 455	8-729-951-18	Ⓛ	2N5118
⇒ Q406, 456, ⇒ Q407, 457	8-729-387-27	Ⓑ	2SA872-D
⇒ Q408, 458, ⇒ Q409, 459	8-729-377-58	Ⓑ	2SC1775-E
Q410, 460	8-729-941-00	Ⓛ	2NA4100
⇒ Q411, 461	8-729-387-28	Ⓑ	2SA872-D
⇒ Q412, 462	8-729-377-58	Ⓑ	2SC1775-E
Q413, 463	8-729-366-92	Ⓒ	2SD669
Q414, 464	8-729-364-92	Ⓒ	2SB649
Q501, 551	8-729-905-03	Ⓚ	1T503
Q502, 552	8-720-950-03	Ⓒ	2SC926A
⇒ Q503, 553, ⇒ Q504, 554	8-729-163-93	Ⓒ	2SA639S
Q505, 555	8-720-950-03	Ⓒ	2SC926A
⇒ Q701, 751	8-723-304-00	Ⓔ	2SK43-4
⇒ Q702, 752, ⇒ Q703, 753	8-729-163-93	Ⓒ	2SA639S
Q704, 754	8-729-316-12	Ⓓ	2SC1061
⇒ Q705–707, ⇒ Q755–757	8-720-950-03	Ⓒ	2SC926A
Q708, 758	8-729-203-04	Ⓑ	2SK30A
⇒ Q709, 759	8-723-304-00	Ⓔ	2SK43-4
⇒ Q710, 760, ⇒ Q711, 761	8-720-950-03	Ⓒ	2SC926A
⇒ Q712–714	8-729-163-93	Ⓒ	2SA639S
Q716, 766	8-729-203-04	Ⓑ	2SK30A
⇒ Q762–764	8-729-163-93	Ⓒ	2SA639S
⇒ Q901	8-720-950-03	Ⓒ	2SC926A
⇒ Q902	8-729-163-93	Ⓒ	2SA639S
⇒ Q903, 904	8-720-950-03	Ⓒ	2SC926A

• ⇒: Due to standardization, interchangeable replacements may be substituted for parts specified in the diagrams.

Note: Circled letters (Ⓐ to Ⓩ) are applicable to European models only.

Ref. No.	Part No.		Description
			Diodes
D201, 251	8-719-815-55	Ⓑ	1S1555
D301, 351	8-719-931-18	Ⓑ	EQB01-18
D302, 352	8-719-931-05	Ⓑ	EQB01-05
D303, 353	8-719-912-00	Ⓑ	MV12N
D304, 354	8-719-815-55	Ⓑ	1S1555
D401, 451	8-719-931-18	Ⓑ	EQB01-18
D402, 452	8-719-931-05	Ⓑ	EQB01-05
D403, 453	8-719-815-55	Ⓑ	1S1555
D501, 551, D502, 552	8-719-912-00	Ⓑ	MV12N
D701, 751, D702, 752	8-719-930-12	Ⓑ	EQB01-12Z
D901, 951, D902, 952	⚠ 8-719-510-10	Ⓒ	SIRB10
D903, 904	8-719-815-55	Ⓑ	1S1555
⇒ D906	8-719-931-05	Ⓑ	EQB01-05
D2001	8-719-921-14	Ⓑ	SLP-114A
			Transformers
T1, 2	⚠ 1-442-958-00	Ⓟ	Power
			CAPACITORS

All capacitors are in μF and ceramic unless otherwise noted.
50WV or less are not indicated except for electrolytics.
pF = μμF, elect = electrolytic

C1, 2	1-101-118-11	Ⓐ	0.01		
C3, 4	1-121-420-11	Ⓑ	220	10V	elect
C5, 6	1-102-114-11	Ⓐ	470p		
C7, 8	1-102-973-11	Ⓐ	100p		
C101, 151	1-102-074-11	Ⓐ	0.001		
C102, 152	1-130-127-11	Ⓑ	0.015	100V	polyethylene
C103, 153, C104, 154	1-131-429-11	Ⓖ	470	3.15V	tantalum
C105, 155	1-102-119-11	Ⓐ	0.0015		
C107, 157, C108, 158	1-131-201-00	Ⓒ	22	16V	tantalum
C109, 159	1-104-129-11	Ⓒ	0.015	5%	polystyrol
C110, 160	1-121-736-11	Ⓑ	1000	10V	elect
C111, 161	1-131-449-11	Ⓒ	3.3	16V	tantalum
C112, 162	1-121-736-11	Ⓑ	1000	10V	elect
C113, 163	1-131-449-11	Ⓒ	3.3	16V	tantalum
C114, 164	1-121-736-11	Ⓑ	1000	10V	elect
C115, 165	1-131-449-11	Ⓒ	3.3	16V	tantalum
C201, 251	1-102-890-11	Ⓐ	36p		
C202, 252	1-102-074-11	Ⓐ	0.001		
C203, 253	1-131-449-11	Ⓒ	3.3	16V	tantalum
C204, 254	1-102-947-11	Ⓐ	10p		
C205, 255	1-130-146-11	Ⓒ	0.056	2%	polyethylene
C206, 256	1-130-145-11	Ⓑ	0.016	2%	polyethylene
C207, 257	1-103-723-11	Ⓑ	820p	5%	polystyrol
C208, 258	1-103-712-11	Ⓐ	330p	5%	polystyrol
C209, 259, C210, 260	1-131-450-11	Ⓒ	1	35V	tantalum
C212, 262, C213, 263	1-131-219-11	Ⓑ	4.7	35V	tantalum
C214, 264	1-104-129-11	Ⓒ	0.015		polystyrol
C215, 265, C216, 266	1-131-238-11	Ⓑ	10	25V	tantalum
C217, 267, C218, 268	1-131-215-11	Ⓑ	1	35V	tantalum
C219, 220	1-121-391-11	Ⓐ	1	50V	elect
C221, 271	1-131-219-11	Ⓑ	4.7	35V	tantalum
C301, 351	1-102-973-11	Ⓐ	100p		
C302, 352	1-131-449-11	Ⓒ	3.3	16V	tantalum
C303, 353, C304, 354	1-102-110-11	Ⓐ	220p		
C305, 355, C306, 356	1-101-888-11	Ⓐ	68p		
C307, 357, C308, 358	1-131-450-11	Ⓒ	1	35V	tantalum
C401, 451	1-102-973-11	Ⓐ	100p		
C402, 452	1-131-449-11	Ⓒ	3.3	16V	tantalum
C403, 453	1-102-973-11	Ⓐ	100p		
C404, 454, C405, 455	1-102-114-11	Ⓐ	470p		
C406, 456	1-101-888-11	Ⓐ	68p		

Note:
• ⇒: Due to standardization, interchangeable replacements may be substituted for parts specified in the diagrams.

Note: The components identified by shading and ⚠ mark are critical for safety. Replace only with part number specified.

Note: Circled letters (Ⓐ to Ⓩ) are applicable to European models only.

Ref. No.	Part No.	Description			
C407, 457 C408, 458	1-131-450-11	Ⓒ 1	35V	tantalum
C409, 459	1-101-888-11	Ⓐ 68p		
C410, 460	1-102-963-11	Ⓐ 33p		
C501, 551	1-102-947-11	Ⓐ 10p		
C503, 553	1-131-449-11	Ⓒ 3.3	16V	tantalum
C504, 554	1-102-963-11	Ⓐ 33p		
C505, 555	1-102-129-11	Ⓐ 0.01		
C506, 556 C507, 557	1-131-238-11	Ⓑ 10	25V	tantalum
C508, 558 C509, 559	1-131-450-11	Ⓒ 1	35V	tantalum
C701, 751 C702, 752	1-123-061-11	Ⓒ 1000	50V	elect
C703, 753 C704, 754	1-102-114-11	Ⓐ 470p		
C705, 755 C706, 756	1-121-421-11	Ⓑ 220	16V	elect
C707, 757 C708, 758	1-101-118-11	Ⓐ 0.01		
C801	1-102-106-11	Ⓐ 100p		
C802	1-102-109-11	Ⓐ 180p		
C803	1-102-111-11	Ⓐ 270p		
C804	1-102-113-11	Ⓐ 390p		
C805	1-102-106-11	Ⓐ 100p		
C806	1-102-109-11	Ⓐ 180p		
C807	1-102-111-11	Ⓐ 270p		
C808	1-102-113-11	Ⓐ 390p		
C905, 955 C906, 956	⚠1-123-061-11	Ⓒ 1000	50V	elect
C907, 957 C908, 958	⚠1-121-944-11	Ⓔ 1000	16V	elect
C909, 910	1-121-450-11	Ⓐ 2.2	50V	elect
C911	1-121-409-11	Ⓐ 47	16V	elect
C912	1-121-726-11	Ⓐ 0.47	50V	elect
C913	1-121-398-11	Ⓐ 10	25V	elect

Note: The components identified by shading and ⚠ mark are critical for safety. Replace only with part number specified.

Note: Circled letters (Ⓐ to Ⓩ) are applicable to European models only.

Ref. No.	Part No.	Description		
RESISTORS				
All resistors are in ohms and of ¼W metal oxide unless otherwise noted.				
R1	1-214-116-11	Ⓑ 220		
R2	1-214-134-11	Ⓑ 1.2k		
R3	1-214-116-11	Ⓑ 220		
R4	1-214-134-11	Ⓑ 1.2k		
R5	1-214-136-11	Ⓑ 1.5k		
R6, 7	1-214-134-11	Ⓑ 1.2k		
R8	1-214-136-11	Ⓑ 1.5k		
R9	1-214-139-11	Ⓑ 2k		
R10, 11	1-214-140-11	Ⓑ 2.2k		
R12	1-214-139-11	Ⓑ 2k		
R101, 151	1-214-126-11	Ⓑ 560		
R102, 152 R103, 153	1-214-110-11	Ⓑ 120		
R104, 154	1-214-108-11	Ⓑ 100		
R105, 155	1-214-104-11	Ⓑ 68		
R106, 156	1-244-853-11	Ⓐ 150	½W	carbon
R107, 157 R108, 158	1-244-808-11	Ⓐ 2	½W	carbon
R109, 159	1-214-084-11	Ⓑ 10		
R110, 160	1-214-086-11	Ⓑ 12		
R111, 161	1-214-144-11	Ⓑ 3.3k		
R112, 162	1-214-112-11	Ⓑ 150		
R113, 163	1-214-114-11	Ⓑ 180		
R114, 164	1-214-092-11	Ⓑ 22		
R115, 165	1-214-180-11	Ⓑ 100k		
R116, 166	1-214-096-11	Ⓑ 33		
R118, 168	1-214-177-11	Ⓑ 75k		
R120, 170	1-214-084-11	Ⓑ 10		
R201, 251	1-214-178-11	Ⓑ 82k		
R202, 252	1-214-176-11	Ⓐ 68k		
R203, 253	1-214-084-11	Ⓑ 10		
R204, 254 R205, 255	1-214-142-11	Ⓑ 2.7k		
R206, 256	1-214-112-11	Ⓑ 150		
R207, 257	1-214-174-11	Ⓐ 56k		

Ref. No.	Part No.	Description
R208, 258	1-214-157-11	Ⓑ 11k
R209, 259	1-214-134-11	Ⓑ 1.2k
R210, 260 R211, 261	1-214-084-11	Ⓑ 10
R212, 262	1-214-102-11	Ⓑ 56
R213, 263	1-214-099-11	Ⓑ 43
R214, 264	1-214-164-11	Ⓑ 22k
R215, 265	1-214-150-11	Ⓑ 5.6k
R216, 266 R217, 267	1-214-108-11	Ⓑ 100
R218–220 R268–270	1-214-152-11	Ⓑ 6.8k
R221, 271 R222, 272	1-214-132-11	Ⓑ 1k
R223, 273 R224, 274	1-214-160-11	Ⓑ 15k
R225, 275 R226, 276	1-214-092-11	Ⓑ 22
R227, 277	1-214-163-11	Ⓑ 20k
R228, 278	1-214-169-11	Ⓑ 36k
R229, 279	1-214-153-11	Ⓑ 7.5k
R230, 280	1-214-158-11	Ⓑ 12k
R231, 281	1-214-108-11	Ⓑ 100
R232, 282	1-214-180-11	Ⓑ 100k
R233, 283	1-214-156-11	Ⓑ 10k
R234, 284	1-214-180-11	Ⓑ 100k
R301, 351	1-214-180-11	Ⓑ 100k
R302, 352	1-214-100-11	Ⓑ 47
R303, 353 R304, 354	1-214-164-11	Ⓑ 22k
R305, 355 R306, 356	1-214-100-11	Ⓑ 47
R307, 357	1-214-158-11	Ⓑ 12k
R308, 358	1-214-150-11	Ⓑ 5.6k
R309, 359	1-214-164-11	Ⓑ 22k
R310, 360	1-214-124-11	Ⓑ 470
R311, 361 R312, 362	1-214-144-11	Ⓑ 3.3k
R313, 363	1-214-148-11	Ⓑ 47k
R314, 364 R315, 365	1-214-108-11	Ⓑ 100

Ref. No.	Part No.	Description
R316, 366	1-214-134-11	Ⓑ 1.2k
R317, 367 R318, 368	1-214-148-11	Ⓑ 4.7k
R319, 369 R320, 370	1-214-104-11	Ⓑ 68
R321, 371	1-214-148-11	Ⓑ 4.7k
R322–324 R372–374	1-214-180-11	Ⓑ 100k
R325, 375	1-214-164-11	Ⓑ 22k
R401, 451	1-214-180-11	Ⓑ 100k
R402, 452	1-214-108-11	Ⓑ 100
R403, 453 R404, 454	1-214-164-11	Ⓑ 22k
R405, 455 R406, 456	1-214-100-11	Ⓑ 47
R407, 457	1-214-158-11	Ⓑ 12k
R408, 458	1-214-126-11	Ⓑ 560
R409, 459	1-214-123-11	Ⓑ 430
R410, 460	1-214-150-11	Ⓑ 5.6k
R411, 461	1-214-164-11	Ⓑ 22k
R412, 462 R413, 463	1-214-138-11	Ⓑ 1.8k
R414, 464	1-214-148-11	Ⓑ 4.7k
R415, 465 R416, 466	1-214-108-11	Ⓑ 100
R417, 467	1-214-084-11	Ⓑ 10
R418, 468 R419, 469	1-214-126-11	Ⓑ 560
R420, 470 R421, 471	1-214-148-11	Ⓑ 4.7k
R422, 472 R423, 473	1-214-160-11	Ⓑ 15k
R424, 474 R425, 475	1-214-090-11	Ⓑ 18
R426, 476	1-214-121-11	Ⓑ 360
R427, 477 R428, 478	1-214-102-11	Ⓑ 56
R429, 479 R430, 480	1-214-108-11	Ⓑ 100
R431, 481	1-214-164-11	Ⓑ 22k

TA-E88/E88B

Note: Circled letters (Ⓐ to Ⓩ) are applicable to European models only.

Ref. No.	Part No.		Description
R501, 551	1-214-180-11	Ⓑ	100k
R502, 552	1-214-108-11	Ⓑ	100
R503, 553 R504, 554	1-214-160-11	Ⓑ	15k
R505, 555	1-214-136-11	Ⓑ	1.5k
R506, 556	1-214-166-11	Ⓑ	27k
R507, 557	1-214-174-11	Ⓑ	56k
R508, 558	1-214-112-11	Ⓑ	150
R509, 559	1-214-123-11	Ⓑ	430
R510, 560	1-214-142-11	Ⓑ	2.7k
R511, 561 R512, 562	1-214-180-11	Ⓑ	100k
R513, 563 R514, 564	1-214-132-11	Ⓑ	1k
R701, 751 R702, 752	1-214-140-11	Ⓑ	2.2k
R703, 753 R704, 754	1-214-084-11	Ⓑ	10
R706, 756 R707, 757	1-214-154-11	Ⓑ	8.2k
R708, 758 R709, 759	1-214-134-11	Ⓑ	1.2k
R710, 760 R711, 761	1-214-144-11	Ⓑ	3.3k
R801	1-214-177-11	Ⓑ	75k
R802, 803	1-214-172-11	Ⓑ	47k
R804	1-214-167-11	Ⓑ	30k
R805	1-214-165-11	Ⓑ	24k
R806	1-214-163-11	Ⓑ	20k
R807	1-214-161-11	Ⓑ	16k
R808	1-214-160-11	Ⓑ	15k
R809	1-214-158-11	Ⓑ	12k
R810	1-214-157-11	Ⓑ	11k
R901	1-244-856-11	Ⓐ	200Ω ½W carbon
R915	1-214-134-11	Ⓑ	1.2k
RT201, 251 RT301, 351 RT401, 451	1-226-149-00	Ⓕ	100-Z, adjustable
RV401, 451	1-226-147-00	Ⓤ	3k-Z, variable; BALANCE
RV402, 452	1-226-148-00	Ⓤ	3k-B, variable; ATTENUATOR

Ref. No.	Part No.		Description
SWITCHES			
S1	1-552-290-00	Ⓘ	FUNCTION
S2	1-552-288-00	Ⓗ	FUNCTION
S3	1-552-287-00	Ⓗ	MONITOR
S4	1-552-289-00	Ⓔ	MODE
S5	1-552-291-00	Ⓘ	OUTPUT LEVEL
S6	⚠ 1-552-295-12	Ⓕ	Rotary, POWER
S7	1-552-225-00	Ⓑ	Pushbutton, LOW FILTER
S801, 851	1-552-292-00	Ⓚ	Rotary, CARTRIDGE LOAD
JACKS			
CNJ12	⚠ 1-509-546-00	Ⓓ	Connector, 3p AC IN
MISCELLANEOUS			
F1	⚠ 1-532-078-00	Ⓑ	Fuse, 1AT
PL1	1-518-115-XX	Ⓑ	Lamp, 6V 35mA; POWER
RY201, 251 RY301, 351	1-515-284-91	Ⓔ	Relay, reed
	1-506-113-00	Ⓑ	Shorting Plug
	1-507-567-00	Ⓑ	Jack, phono; 1p
	1-533-131-00	Ⓐ	Holder, fuse
	1-536-401-XX	Ⓐ	Lug, 1L2

ACCESSORIES & PACKING MATERIALS

Part No.		Description
⚠ 1-534-819-12	Ⓖ	Cord, power (UK model)
1-551-315-00	Ⓗ	Cord, connection; RK-112
3-701-622-00	Ⓐ	Bag, plastic
3-701-630-00	Ⓐ	Bag, plastic; printed matters
3-770-361-12	Ⓔ	Manual, instruction
3-794-157-11	Ⓖ	Booklet, technical information
4-809-251-00	Ⓐ	Bag, plastic
4-854-783-00	Ⓕ	Carton

Note: The components identified by shading and ⚠ mark are critical for safety. Replace only with part number specified.

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