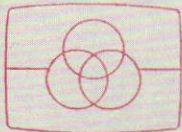
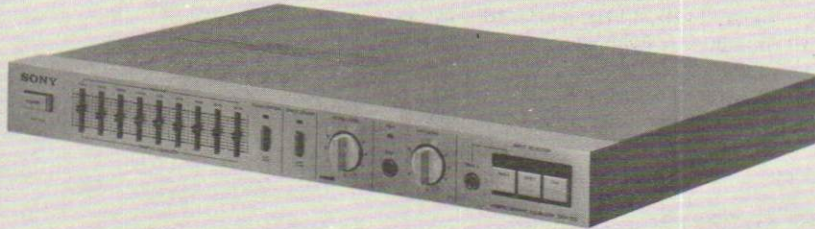


# SEH-310

*US Model  
Canadian Model  
AEP Model  
UK Model  
E Model*




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## HYBRID GRAPHIC EQUALIZER

### SPECIFICATIONS

**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.

**ATTENTION AU COMPOSANT AYANT RAPPORT À LA SÉCURITÉ!**

LES COMPOSANTS IDENTIFIÉS PAR UNE TRAME ET UNE MARQUE  SUR LES DIAGRAMMES SCHÉMATIQUES, LES VUES EXPLOSÉES ET LA LISTE DES PIÈCES SONT CRITIQUES POUR LA SÉCURITÉ DE FONCTIONNEMENT. NE REMPLACER CES COMPOSANTS QUE PAR DES PIÈCES SONY DONT LES NUMÉROS SONT DONNÉS DANS CE MANUEL OU DANS LES SUPPLÉMENTS PUBLIÉS PAR SONY.

- Power Requirement:** 120 V ac, 60 Hz (US, Canadian model)  
220 V ac, 50/60 Hz (AEP model)  
240 V ac, 50/60 Hz (UK model)  
110, 120, 220 or 240 V ac, adjustable, 50/60 Hz (E model)
- Power Consumption:** 9 W (AEP, UK, E model)  
6 W (US, Canadian model)
- Dimensions:** Approx. 430(w) x 55(h) x 295(d) mm  
17(w) x 2¼(h) x 11⅝(d) inches  
not including projecting parts and controls
- Weight:** Approx. 3.5 kg, net  
Approx. 4.0 kg, in shipping carton
- System:** Equalizer: NF system  
Echo: BBD and spring system
- Inputs:** LINE IN (phono type)  
150 mV/50 kΩ  
TAPE 1, 2 (phono type, rear)  
150 mV/50 kΩ  
TAPE 2 (stereo phone type, front)  
150 mV/50 kΩ  
MIC (stereo phone type, front)  
1 mV/22 kΩ

— Continued on page 2 —

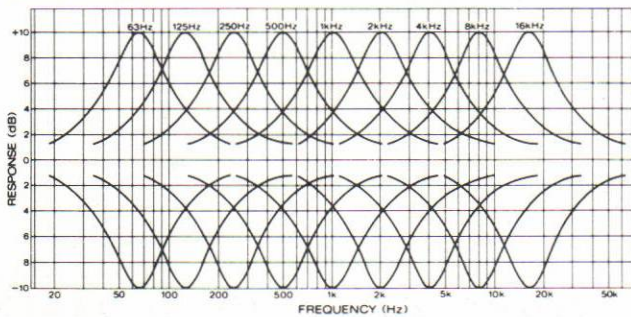
**SONY**  
**SERVICE MANUAL**



# SEH-310

- Outputs:** LINE OUT (phono type)  
150 mV/2 kΩ  
ECHO OUT (phono type)  
30 mV/10 kΩ  
REC OUT 1, 2 (phono type)  
150 mV/2 kΩ
- AC Outlet:** 100 W switched (AEP, UK model)  
100 W unswitched (US, Canadian, E model)
- Echo Time:** 2.5 sec.
- Graphic Equalizer:** Boost/cut range: ±10 dB  
Center frequencies: 63 Hz, 125 Hz, 250 Hz, 500 Hz,  
1 kHz, 2 kHz, 4 kHz, 8 kHz, 16 kHz
- Frequency Response:** 15 Hz – 80 kHz (with all controls set flat)
- Distortion:** Less than 0.01%
- Signal-to-noise Ratio:** 95 dB (with all controls set flat)
- Gain:** 0 dB (with all controls set flat)

### Equalization Characteristics:

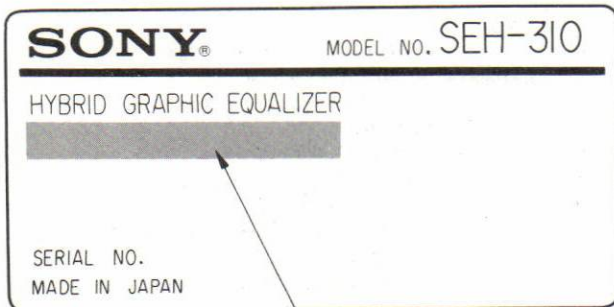


While the information given is true at the time of printing, small production changes in the course of our company's policy of improvement through research and design might not necessarily be indicated in the specifications. We would ask you to check with your appointed Sony dealer if clarification on any point is required.

### MODEL IDENTIFICATION

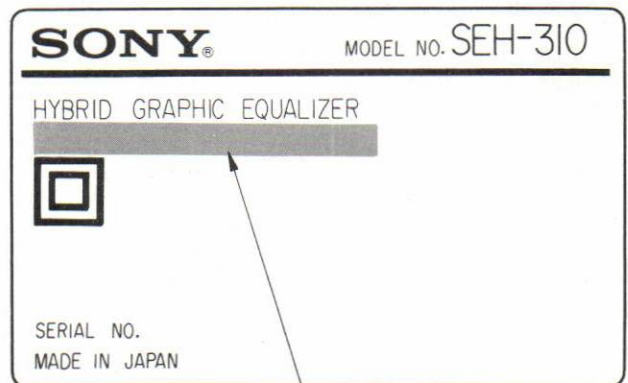
– Specification Label –

US, Canadian, UK, E1 model:



- US, Canadian model: AC: 120V 60Hz 6W
- UK model: AC: 240V ~ 50/60Hz 9W
- E1 model: AC: 110, 120, 220, 240V ~ 50/60Hz 9W

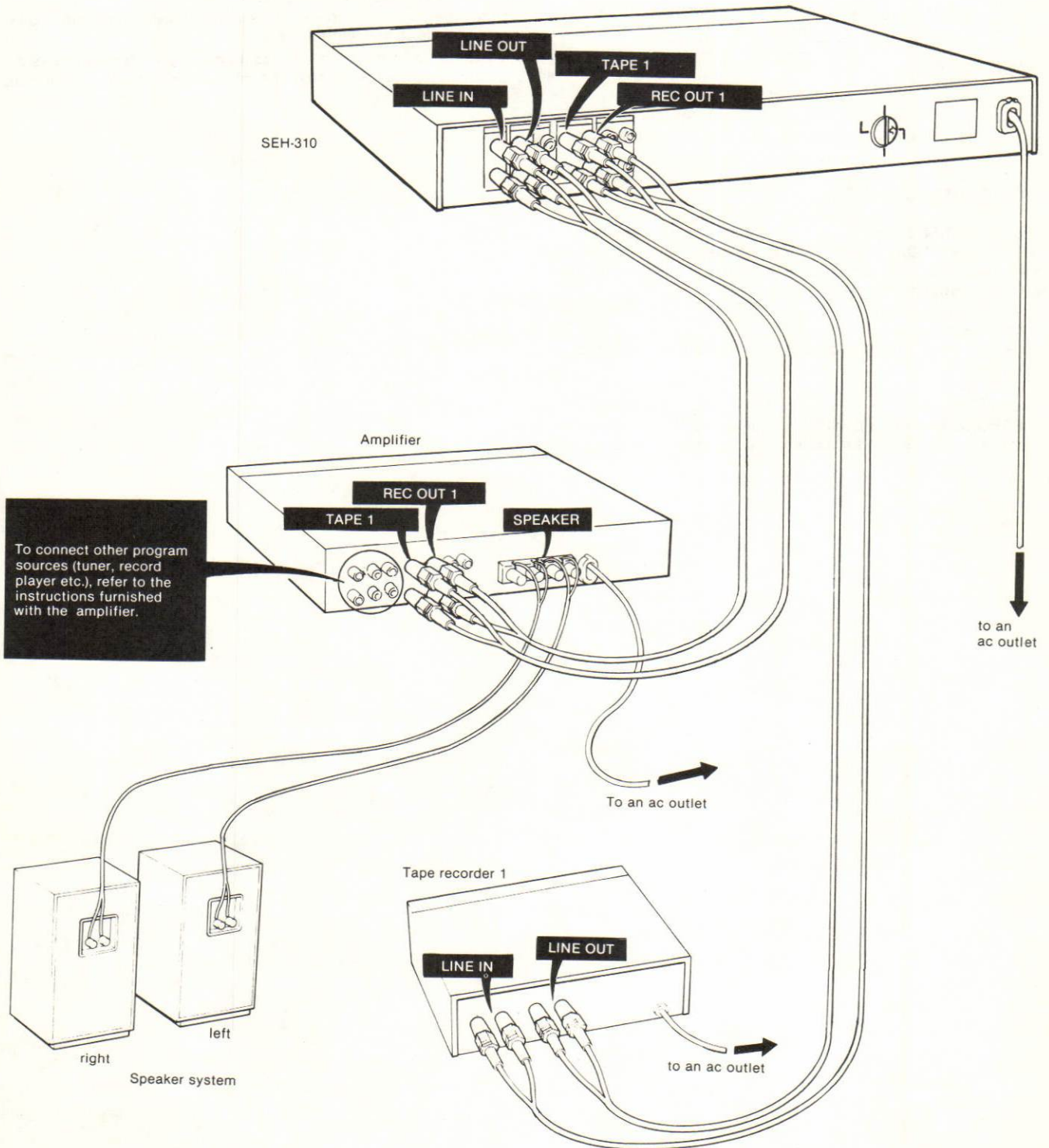
AEP, E2 model:



- AEP model: AC: 220V ~ 50/60Hz 9W
- E2 model: AC: 110, 120, 220, 240V ~ 50/60Hz 9W

# SECTION 1 OUTLINE

## CONNECTIONS



## CONNECTION NOTES

- Turn off the amplifier before making connections.
- When making a system connection using the stereo phono-plug cords, be sure to observe polarities—for example, white plug to Left channel and red plug to Right channel.



- Be sure to insert the cable connector firmly into the jacks. Loose connections may cause hum and noise.

## OTHER INPUTS AND OUTPUT

### TAPE RECORDER 2 (rear)

The TAPE RECORDER 2 input and output are provided for connecting an additional tape deck for dubbing or recording the equalized sound or microphone-mixed sound.

### TAPE 2 (front)

The TAPE 2 input is provided for connecting a portable cassette-corder.

### ECHO OUT

The ECHO OUT jacks are provided for connecting an additional amplifier or cassette-corder for adding an echo effect. (See page 9.)

## AC OUTLET

Receptacle on the rear panel provides a convenient ac power source for the audio components.

### AEP, UK models:

This outlet is controlled by the POWER switch and can supply ac power up to 100 watts.

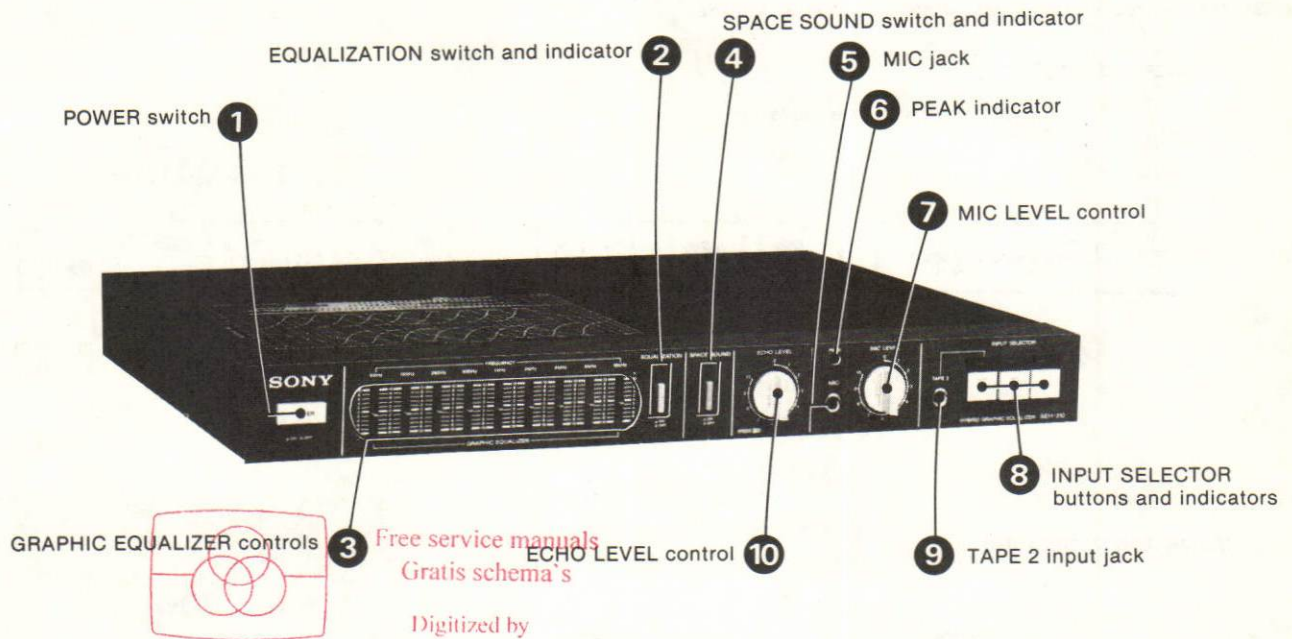
### US, Canadian, E models:

This outlet is not controlled by the POWER switch and can supply ac power up to 100 watts.

Note: Do not connect an electrical home appliances, such as an electrical iron, a fan, or any other high-wattage equipment, to this outlet.



## FUNCTION OF THE CONTROLS

**1 POWER switch**

This switch turns the operating power on or off.

**2 EQUALIZATION switch and indicator**

Press this switch (  ON ) to add the set equalization values. The associated indicator will light.

To cut equalization, press the switch again (  OFF ).

The equalizer circuit is bypassed. This position is useful when monitoring a non-equalized signal while keeping the GRAPHIC EQUALIZER control settings unchanged.

**3 GRAPHIC EQUALIZER controls**

Slide downward or upward to equalize the signal selected by the INPUT SELECTOR button.

**4 SPACE SOUND switch and indicator**

Depress this switch to emphasize reverberations to give the effect of a more expansive surrounding sound.

This switch is efficient when the speakers are too close together or your listening room is small and diminish the stereo sound stage.

**5 MIC jack**

This jack accepts a microphone equipped with a phone plug.

**6 PEAK indicator**

This indicator lights when the microphone level is excessive.

**7 MIC LEVEL control**

Adjusts the balance of the microphone and the program source volume. Turn the control clockwise for more microphone volume and less source volume, and vice versa.

**8 INPUT SELECTOR buttons and indicators**

Depress one of these buttons to select the input source to be equalized. The indicator corresponding to the depressed button will light.

LINE: For a signal from the LINE IN jacks (rear).

TAPE 1: For a signal from the TAPE RECORDER 1 inputs (rear).

TAPE 2: For a signal from the TAPE RECORDER 2 inputs (rear) or TAPE 2 input (front).

**9 TAPE 2 input jack**

This stereo phone jack provides a convenient front panel connection for temporary use. The use of the front panel TAPE 2 jack disconnect the TAPE RECORDER jacks on the rear panel. Use the adaptor cord (RK-81A, optional) to convert phono plugs for use with this jack.

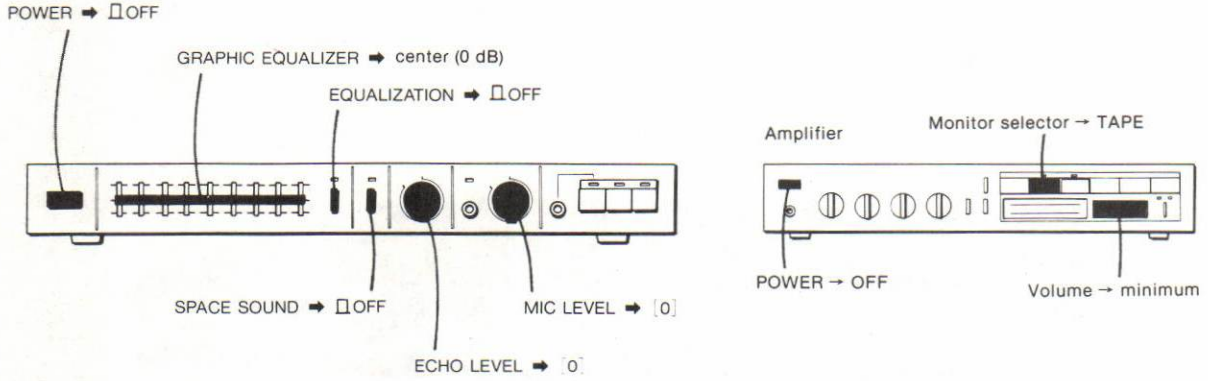
**10 ECHO LEVEL control**

Adjust the echo level for the program source or the microphone. When a microphone is not connected to the MIC jack, this control adjusts the echo level for the program source. Turn the control clockwise (toward 10) for a more echo.

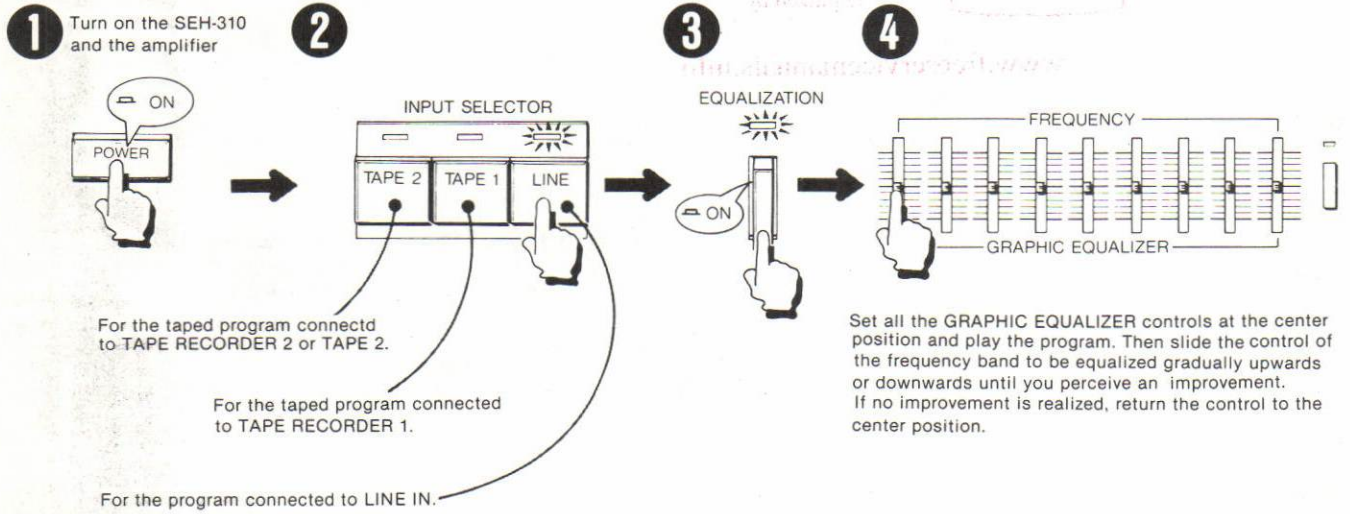
# OPERATION

## PREPARATION

Set the controls on the equalizer and amplifier as follows.

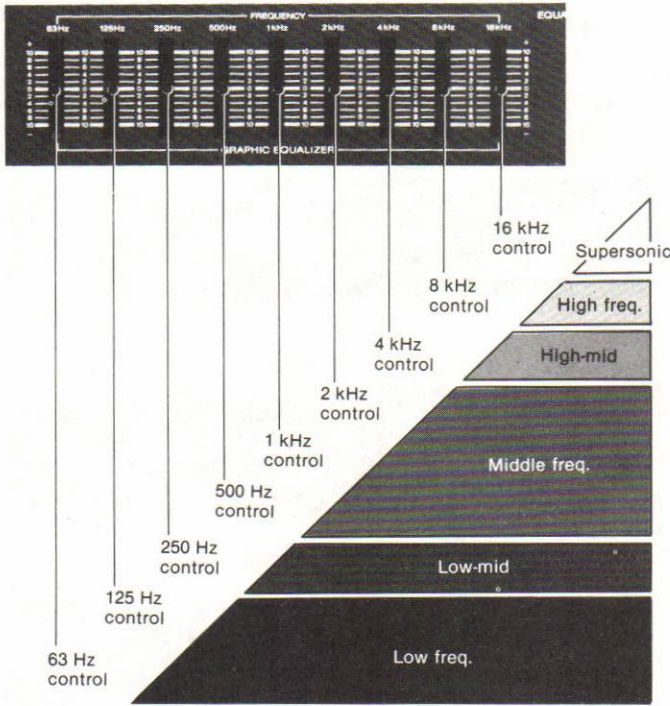


## EQUALIZATION PROCEDURE





The GRAPHIC EQUALIZER controls and their frequency coverage



● 63 Hz Control

Slide downwards to cut the ventilation noise of a music hall, hum of electronic instruments, boomy bass, etc. Slide upwards to reinforce the heavy bass part of a pipe organ or to add depth to the bass sound.

● 125 Hz Control

Use this control to boost or cut the normal bass in a piece of music.

● 250 Hz Control

This control governs the low-middle range and greatly influences the overall characteristics of the sound.

● 500 Hz Control

This control adjusts the middle-frequency range—the human voice and the middle frequencies of instrumental music. Slide upwards to increase the power, spaciousness and warmth of the sound.

● 1 kHz Control

Use this control to provide more presence for vocals. The adjustment of this frequency band can move the sound forward, or into the background.

● 2 kHz Control

This frequency band contains sounds which if not properly balanced can be very irritating. Slide-downwards to reduce stridency, slide upwards to obtain a brighter brass sound.

● 4 kHz Control

Use this control to adjust the brightness of sound.

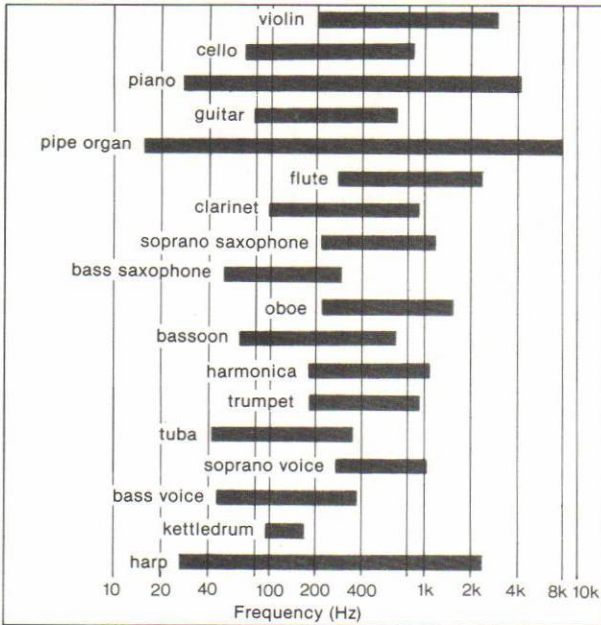
● 8 kHz Control

Adjust this control so that the sound from a violin is silky smooth.

● 16 kHz Control

This control adjusts the general atmosphere rather than the sound itself. Slide upwards to highlight the delicate quality of instrumental sound and downwards to reduce high-frequency noise, such as the resonant peak of a cartridge, tape hiss, etc.

Fundamental frequency range of standard musical instruments, adapted from Olson



**Result check**

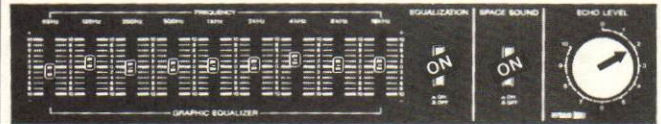
Depress the EQUALIZATION switch to release it (OFF).  
You can compare the equalized sound with the original sound sources without changing the setting of the GRAPHIC EQUALIZER control.

**To enhance the acoustical ambience**

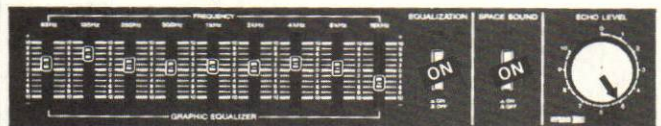
The acoustical ambience of a concert hall is resulted from the multiple signal reflections, echos, etc. To reproduce the sound with the acoustical ambience of the various concert halls, adjust the switches and the controls of the SEH-310 as the following examples.

Examples:

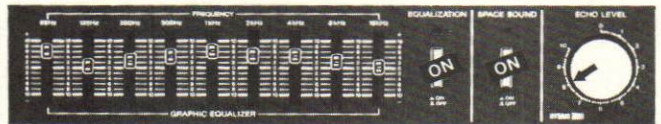
the sound in the small concert hall



the sound in the large concert hall



the sound in the field live stage

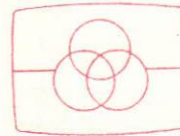


Use the ECHO OUT function to make the sound more like the live stage. (See the next page.)



### ADDING THE SPECIAL ECHO EFFECT

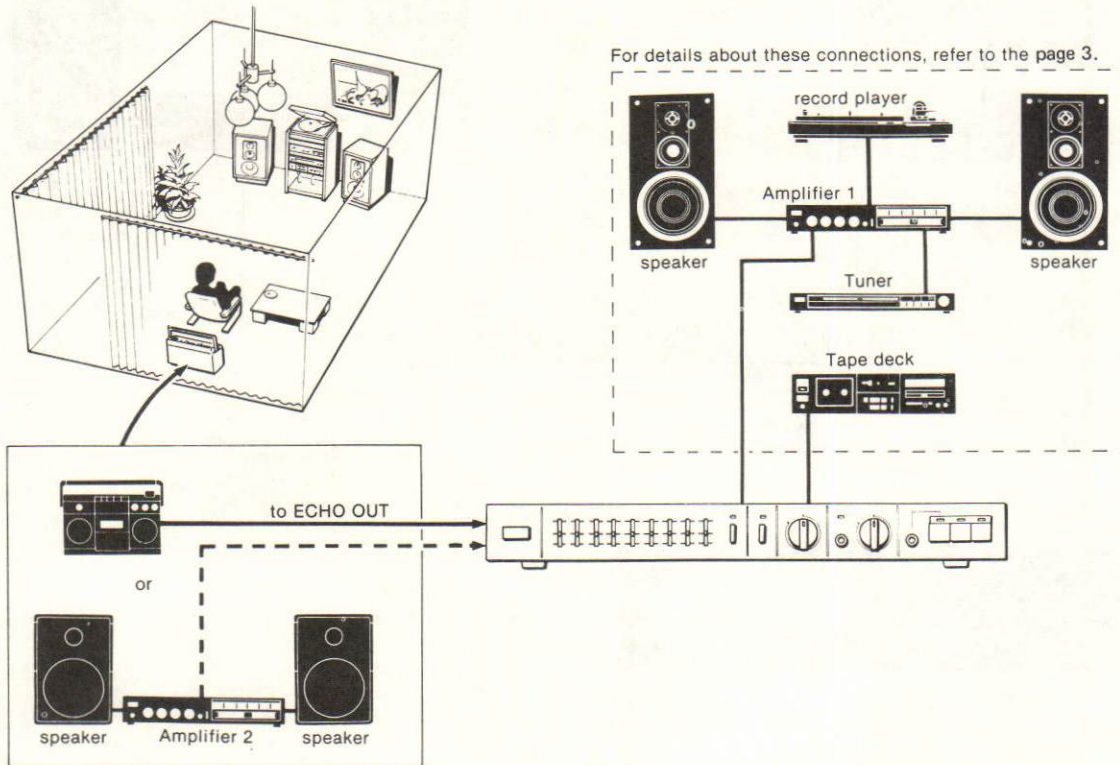
By using the ECHO OUT function of the SEH-310, you can reproduce the real acoustical 'atmosphere' of the concert hall in your listening room. Connect and place the necessary additional audio component (a portable cassette-corder, an additional amplifier and speaker, etc.) as illustrated below.



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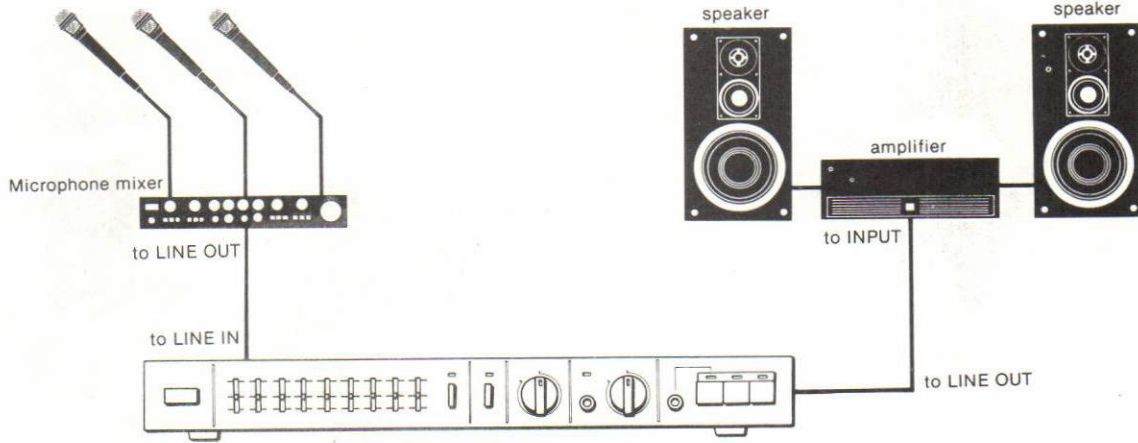


For details about these connections, refer to the page 3.

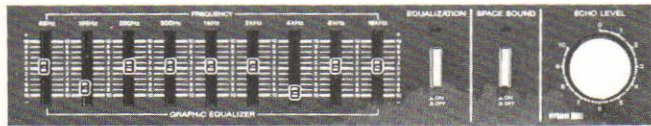
Adjust the echo volume with the sound volume control on the cassette recorder or the amplifier connected to the ECHO OUT jack. The ECHO LEVEL control on the SEH-310 has no effect on the echo volume.

### PUBLIC ADDRESS

The SEH-310 can be used as a public address system by connecting a sound mixer. Adjust the appropriate equalization control to eliminate howling.



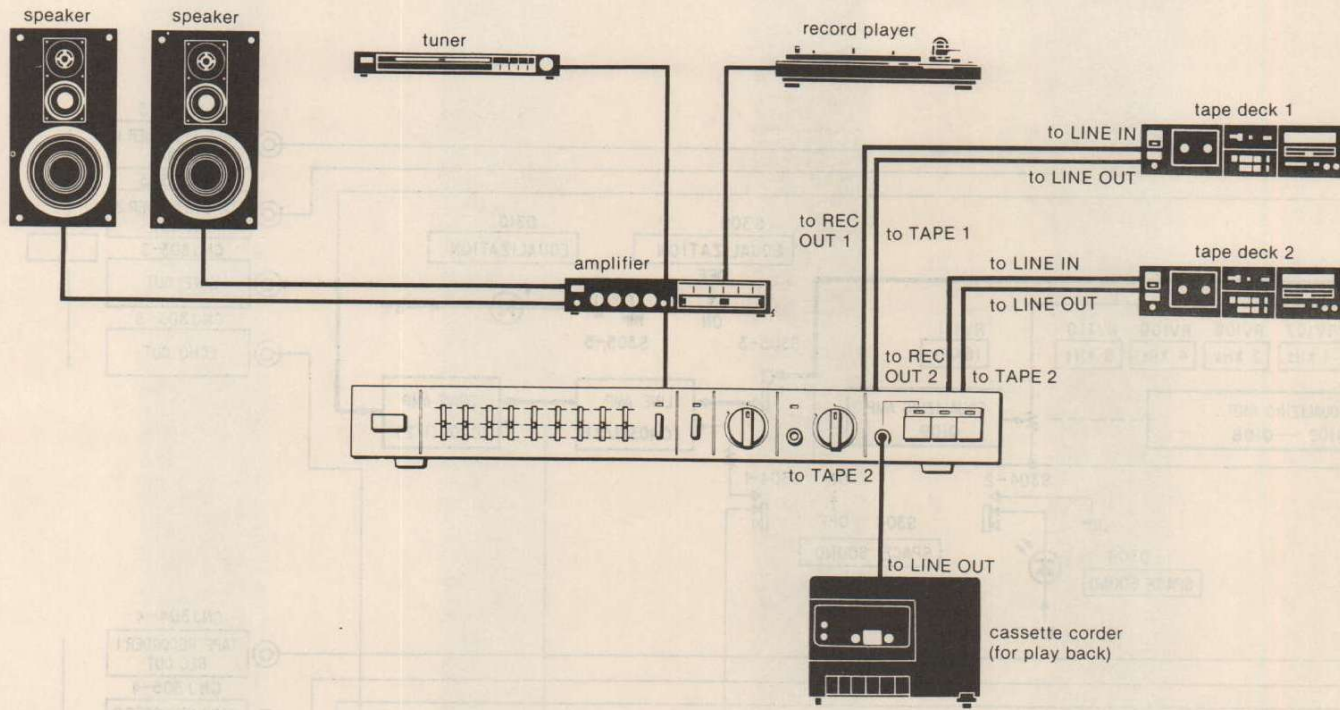
Typical example of howling elimination



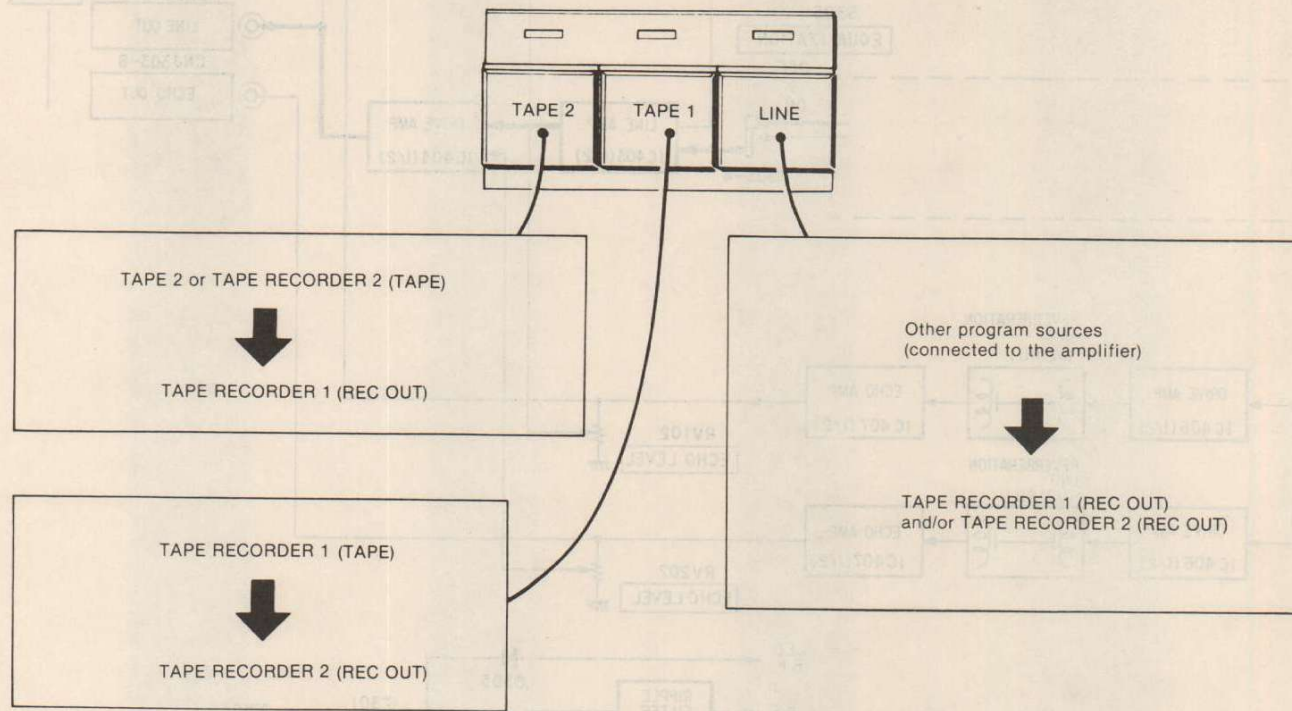


**RECORDING AN EQUALIZED SIGNAL**

Connect an additional tape deck for recording in this way:



**Input selector setting**



● You can also use the SPACE SOUND facility of the equalizer to add a fullness to any tape you record for playback on a car stereo system or a Sony Walkman.

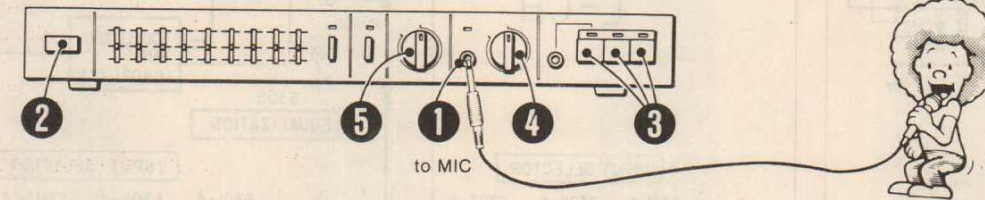
- Notes**
- The TAPE 2 jack has priority over the TAPE RECORDER 2 jack when tape recorders are connected to these jacks at the same time.
  - When equalized recording is not required, or when you playback an equalized recorded tape, set the EQUALIZATION switch to off.

**MICROPHONE MIXING**

The SEH-310 provides facilities for mixing the sound of a microphone and other sound sources such as a record or a taped program.

The echo effect can be added to the microphone.

- 1 Connect the microphone to the MIC jack on the front panel.
- To connect a microphone equipped with a mini plug, use the optional Sony PC-2A plug adaptor.
- 2 Depress the POWER switch to turn on the equalizer.
- 3 Select the desired sound source with the INPUT SELECTOR on the front panel.
- 4 Adjust the sound from the microphone with the MIC LEVEL control.
- 5 Adjust the echo effect level with the ECHO LEVEL control.



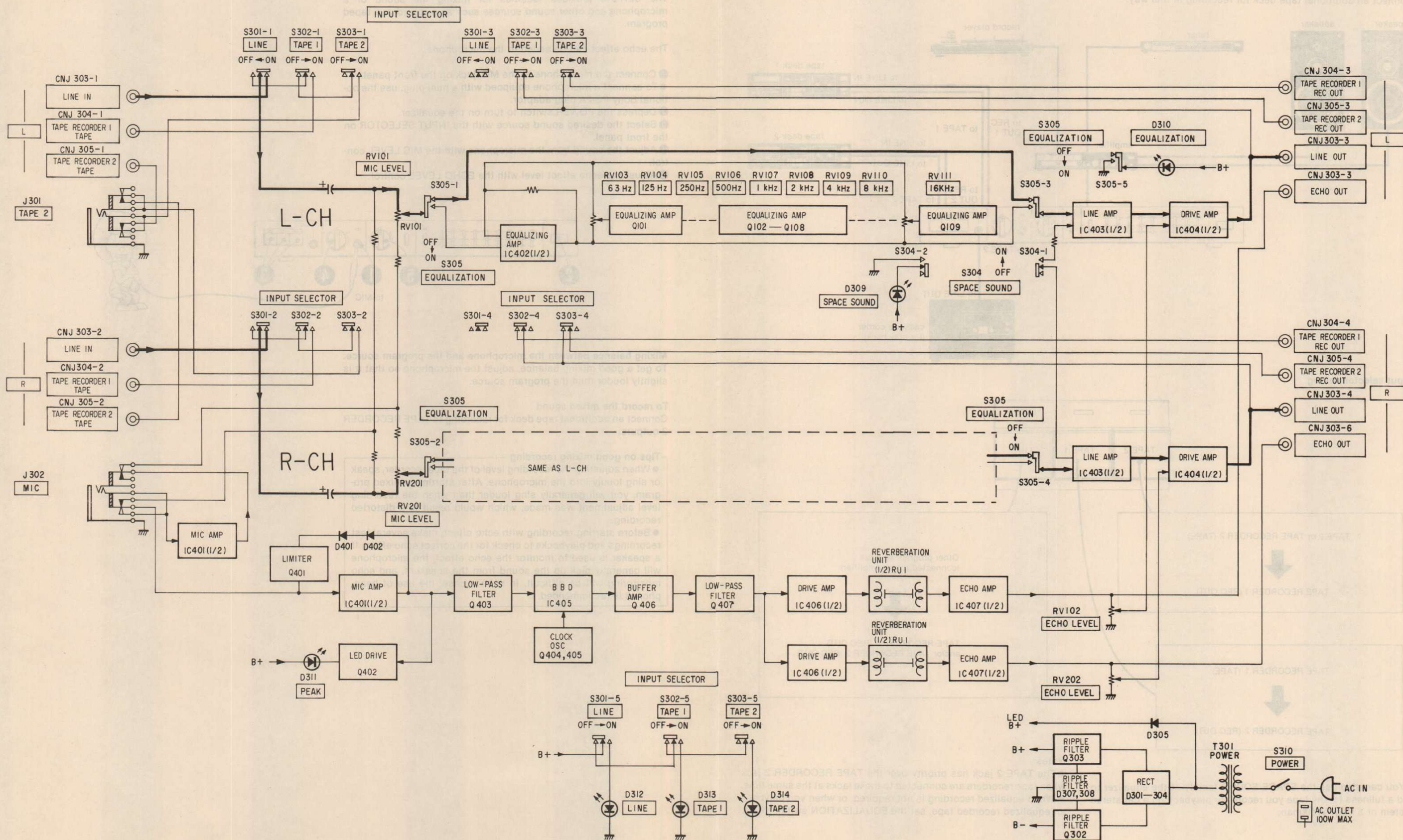
**Mixing balance between the microphone and the program source.**  
To get a good mixing balance, adjust the microphone so that it is slightly louder than the program source.

**To record the mixed sound**  
Connect an additional tape deck for recording to TAPE RECORDER 2 outputs.

- Tips on good mixing recording**
- When adjusting the recording level of the tape recorder, speak or sing loudly into the microphone. After starting a mixed program, you will generally sing louder than when the recording level adjustment was made, which would result in a distorted recording.
  - Before starting recording with echo effect, make several test recordings and playbacks to check for the correct echo effect. If a speaker is used to monitor the echo effect, the microphone will generally pick up the sound from the speakers, and echo monitoring will be difficult. In such a case, the use of headphones is recommended.



1-1. BLOCK DIAGRAM

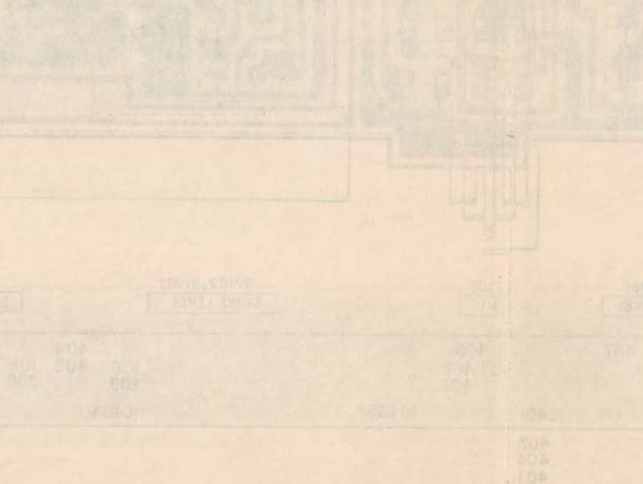
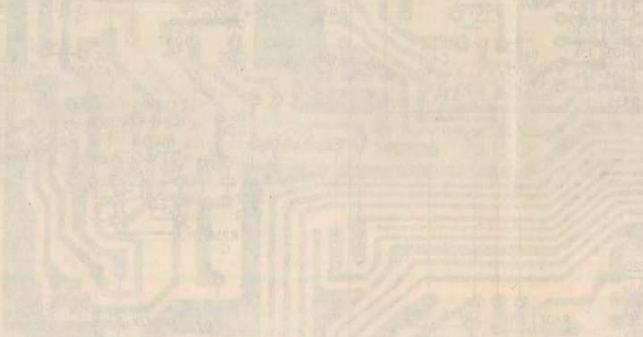
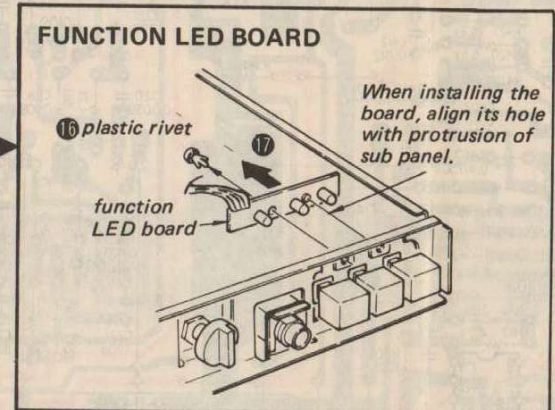
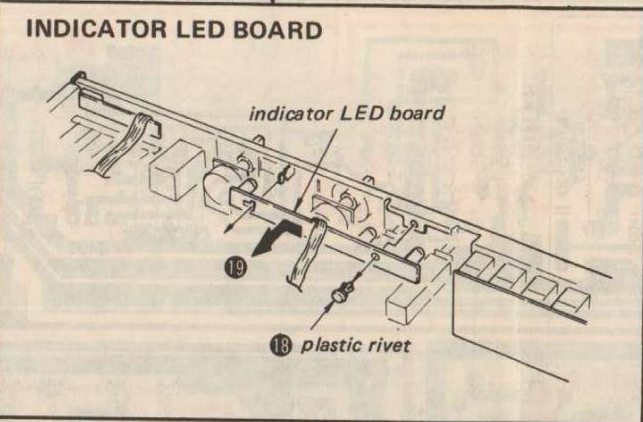
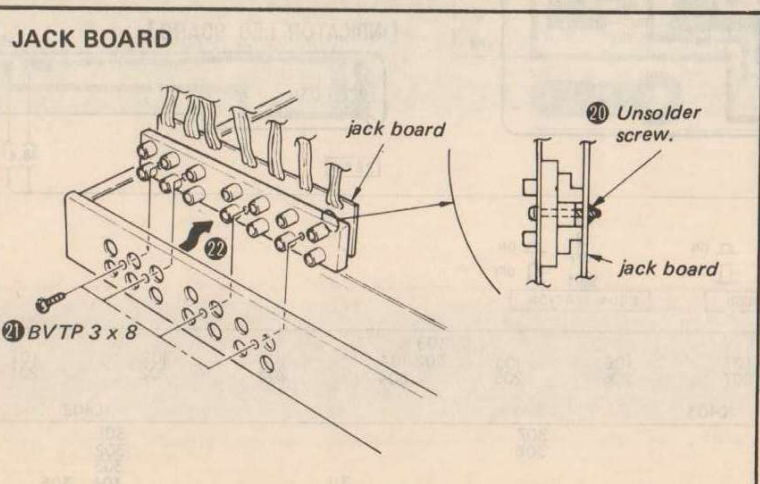
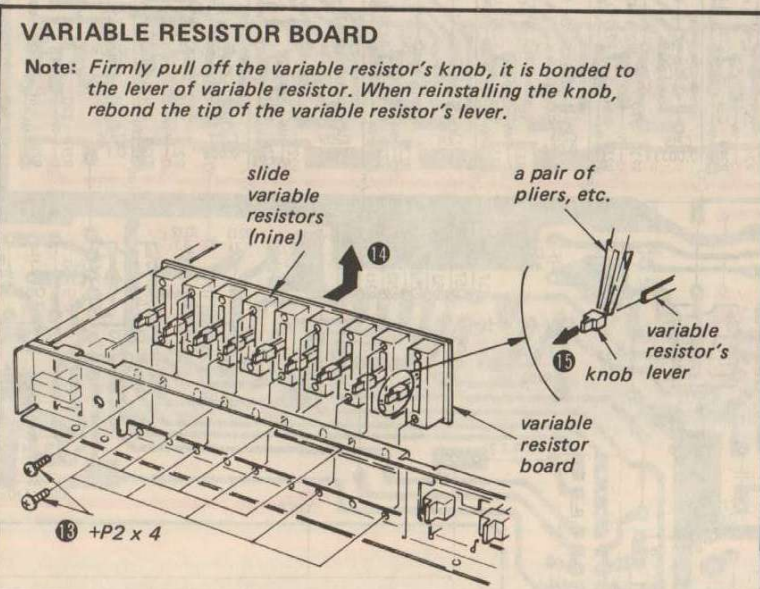
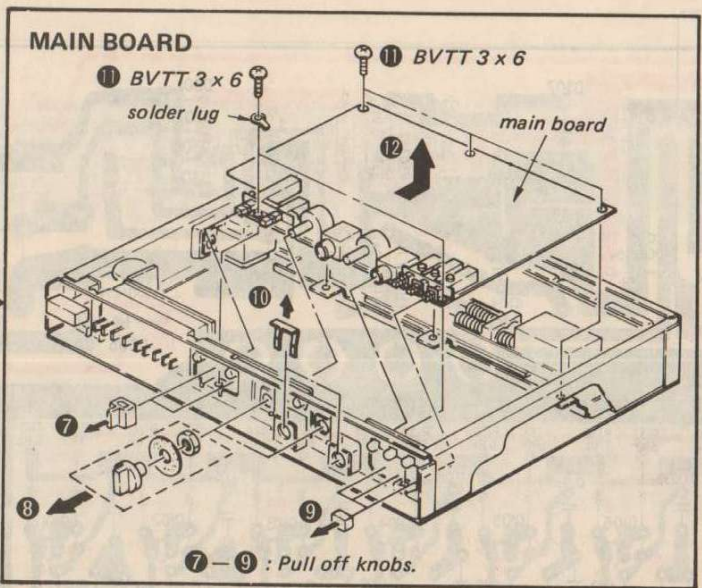
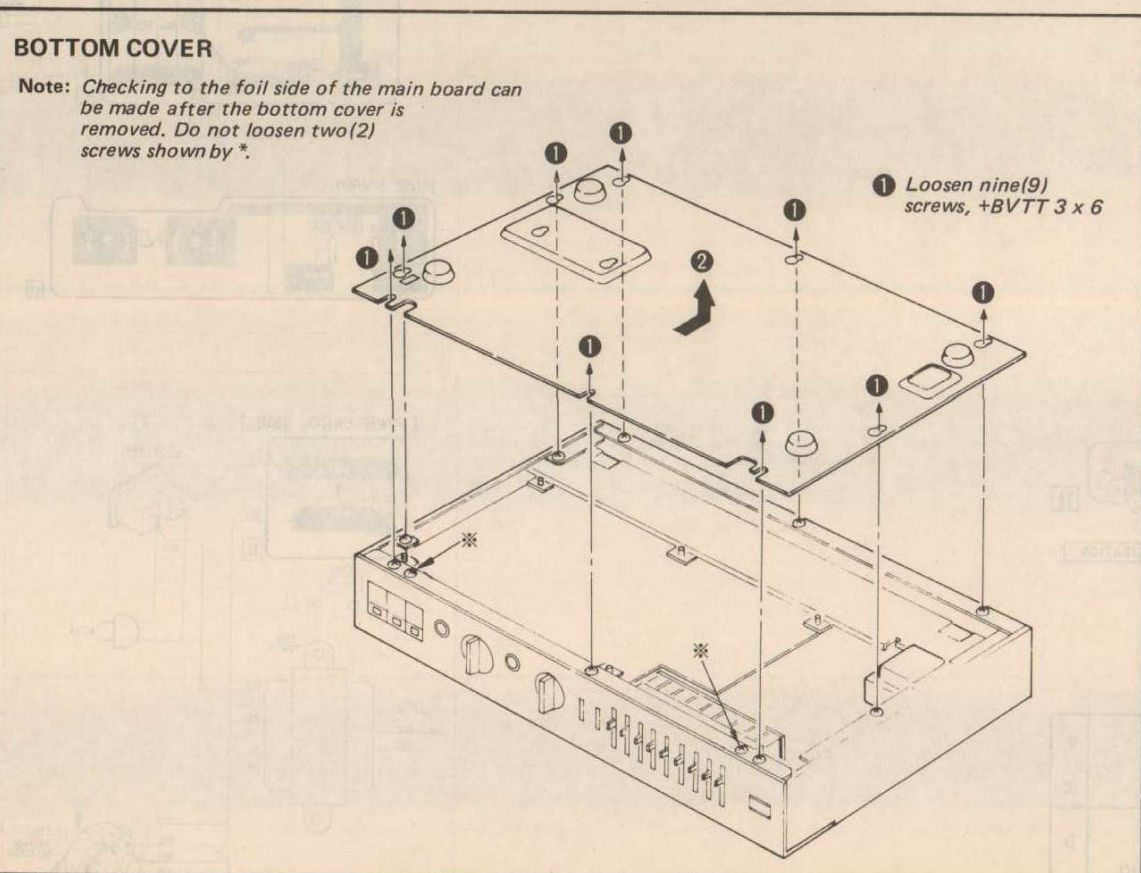
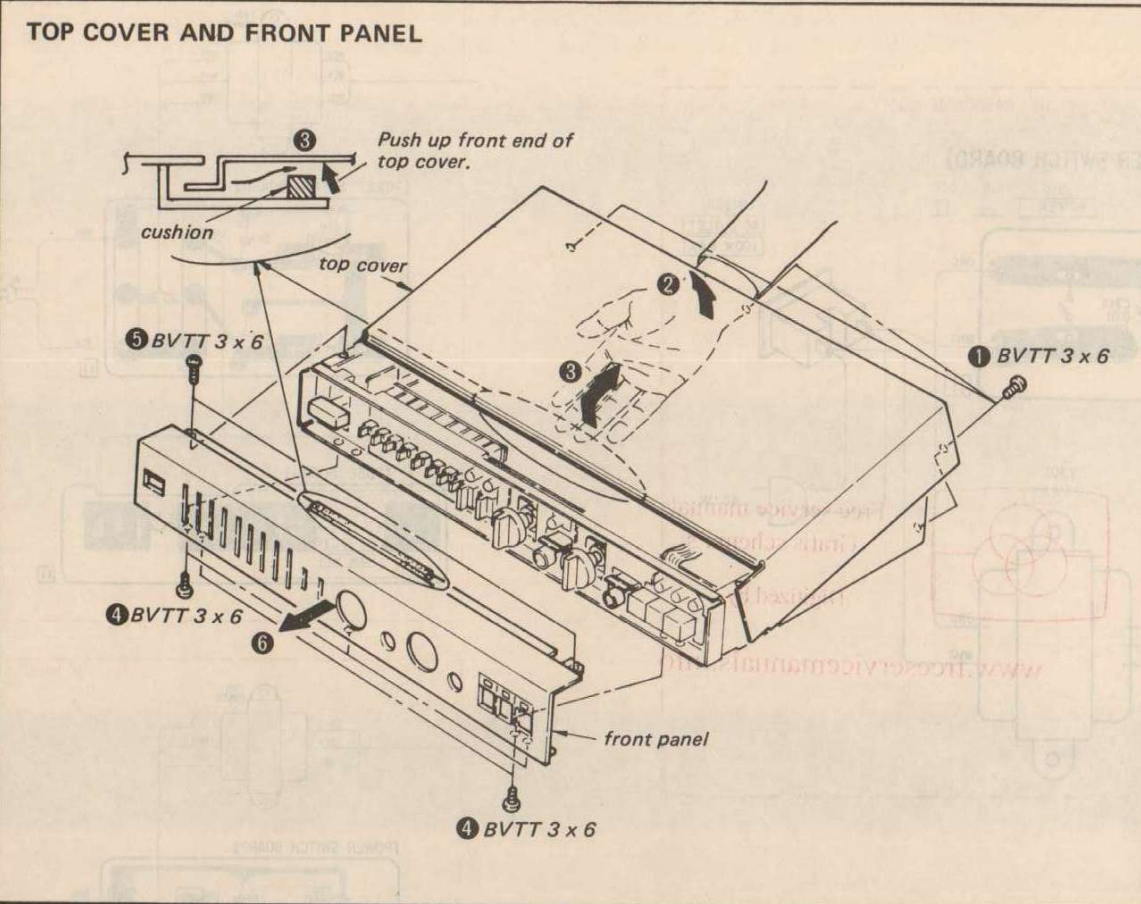




SECTION 2

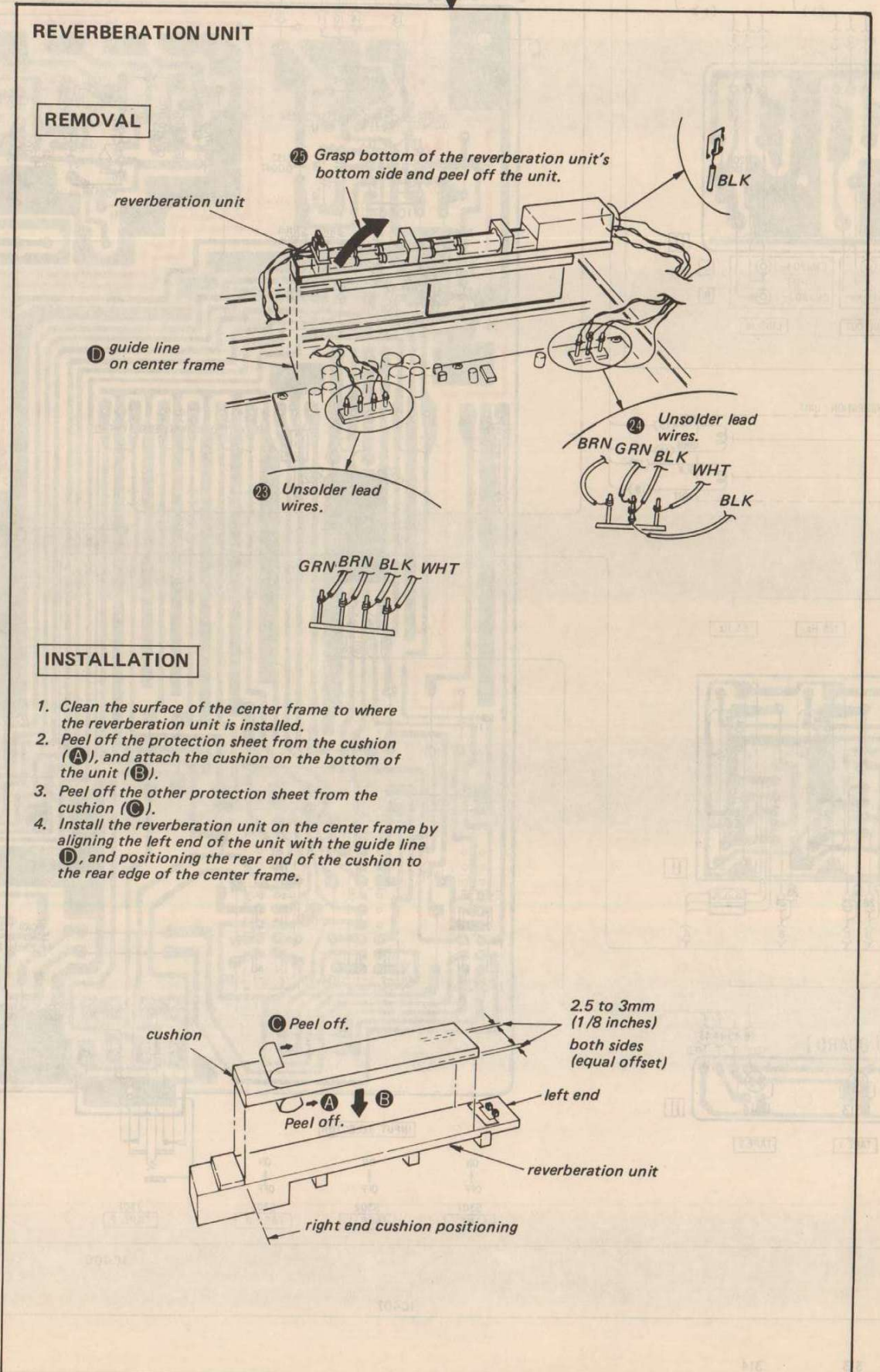
DISASSEMBLY

Follow the disassembly procedure in the numerical order given.



SECTION 3

ADJUSTMENTS



3-1. MECHANICAL ADJUSTMENTS

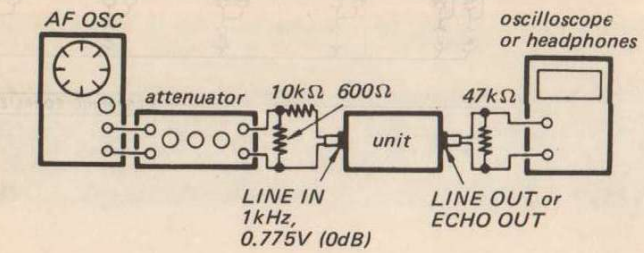
This unit has not any mechanical adjustments, and no mechanical adjustments required except when especially needed.

3-2. ELECTRICAL ADJUSTMENTS

This unit has not any electrical adjustments, i.e., all the components are of fixed-value types except those panel controls. However, the following descriptions and notes may promote locating and servicing troubles in this unit.

3-2-1. Many voltage-check points are printed on the main circuit board. These voltage values are not necessarily the same as those printed on the mounting and schematic diagrams due to the production tolerance.

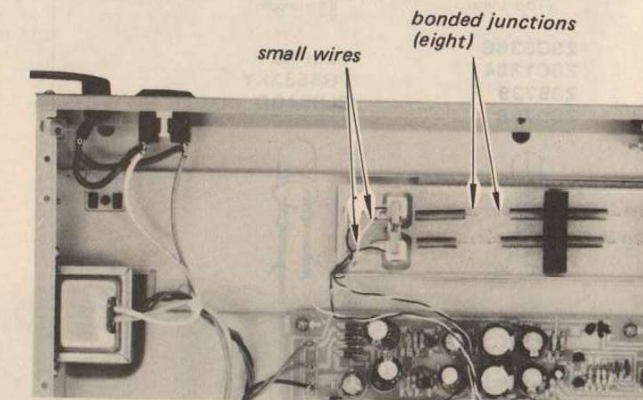
3-2-2. **REVERBERATION UNIT** Set up the following checking configuration. When a fixed signal is applied to the unit, its tone is heard through the headphones or its waveform is viewed on the oscilloscope as usual. A random and reverberating tone or waveform is obtained when the input signal is quickly varied or swept in approximately 300 to 500 Hz centered at around 1,000 Hz (1 kHz) with the ECHO control set at about 5 to 10. In the above step, the output signal backs to a single sinewave in about 2.5 seconds after the stoppage of the frequency sweeping. When the ECHO control is set at "0" position, no reverberating effect is observed in the above steps. When a headphones or an oscilloscope is not available, lightly touch fingers to the center of the springs of the reverberation unit. Very small spring vibration is detected by the fingers according to the reverberation effect.



3-2-3. **PEAK LAMP'S LIGHTING LEVEL** With the same setup configuration as above, the PEAK lamp should light with an input level of 1.4 to 3.1V (+5 to +12 dB). When the input signal is applied to the MIC jack, the lamp-lighting level is 62 mV to 140 mV (-22 to -15 dB).

3-2-4. NOTES ON REVERBERATION UNIT

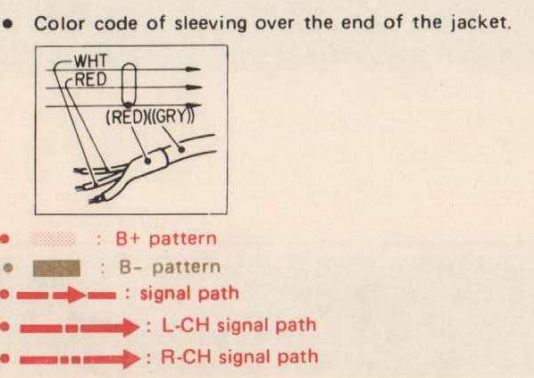
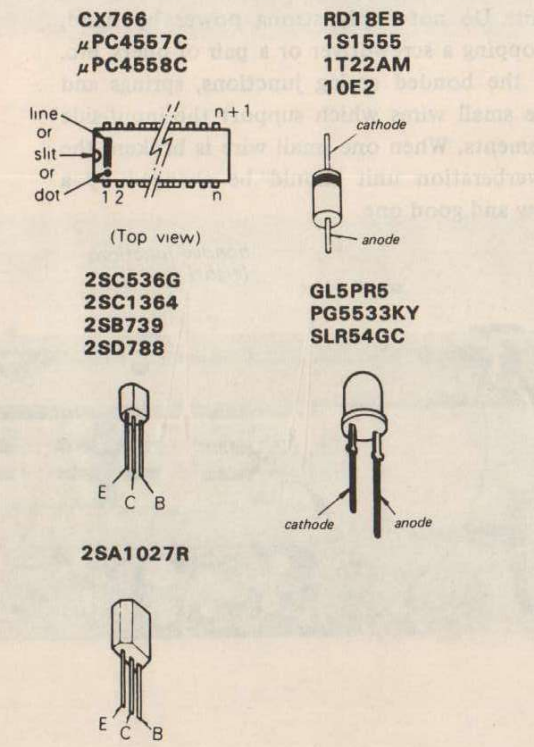
The most part of the reverberation unit is not covered by any unit-protecting materials. Care should be taken when servicing this piece of unit. Do not apply strong power by hand, dropping a screwdriver or a pair of pliers, etc. to the bonded spring junctions, springs and the small wires which support the input-side elements. When one small wire is broken, the reverberation unit should be changed by a new and good one.



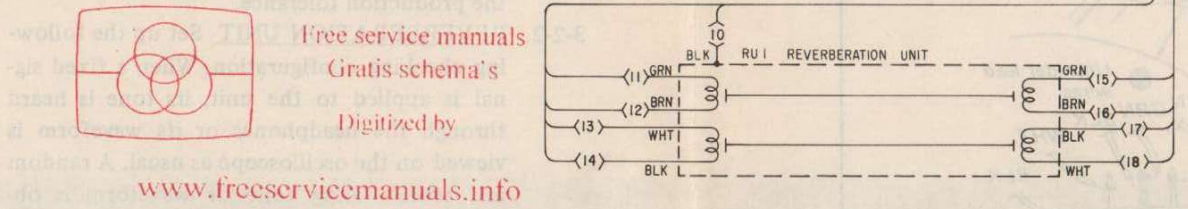
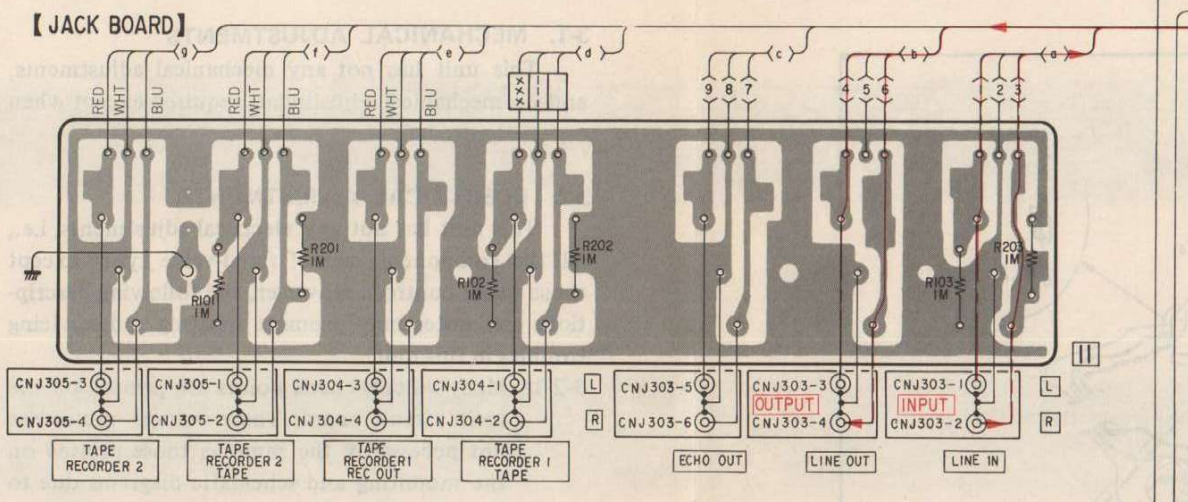


SECTION 4  
DIAGRAMS

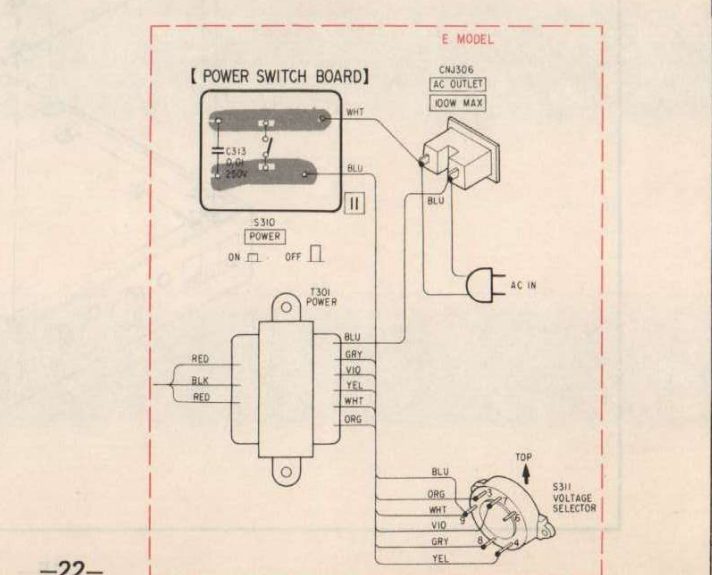
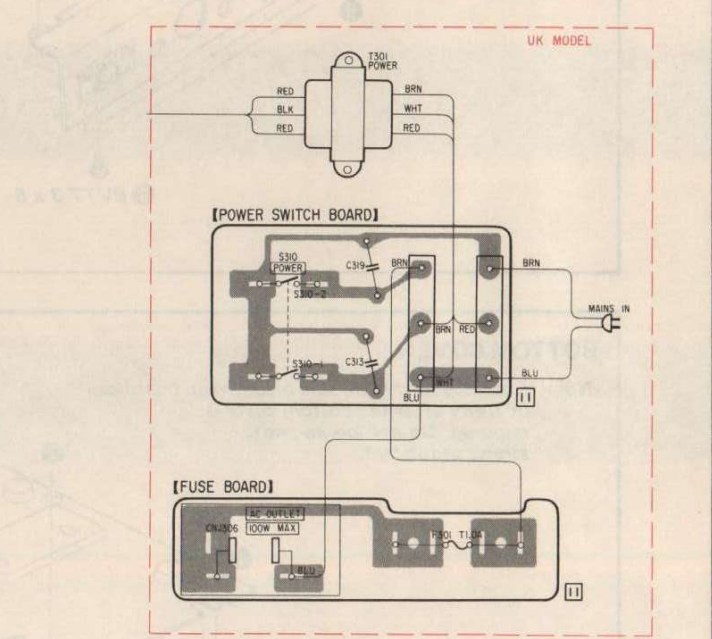
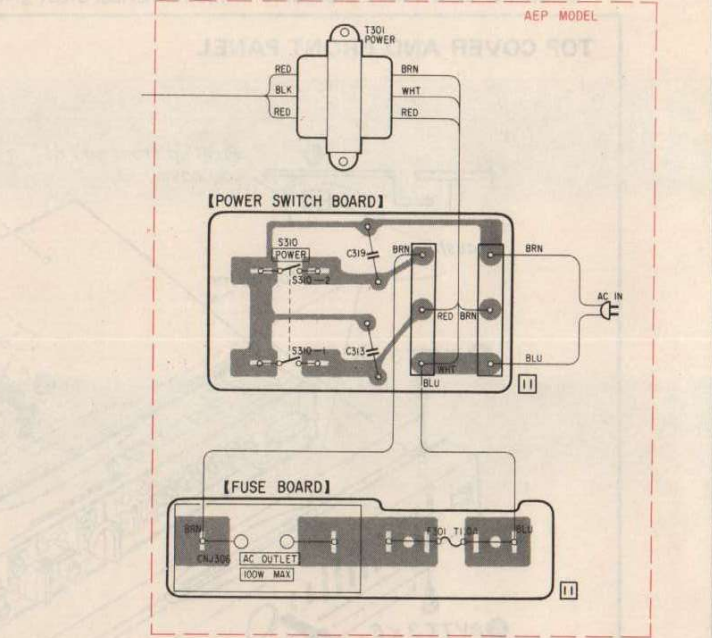
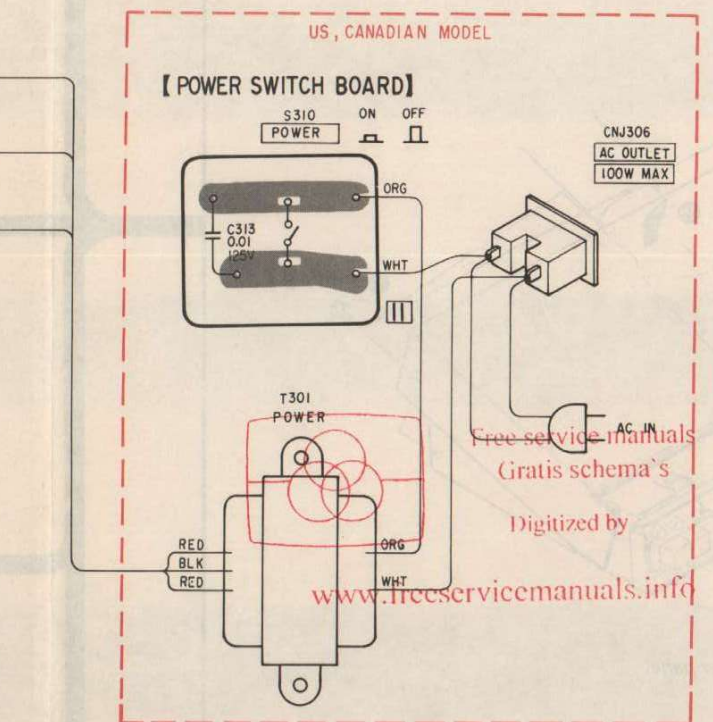
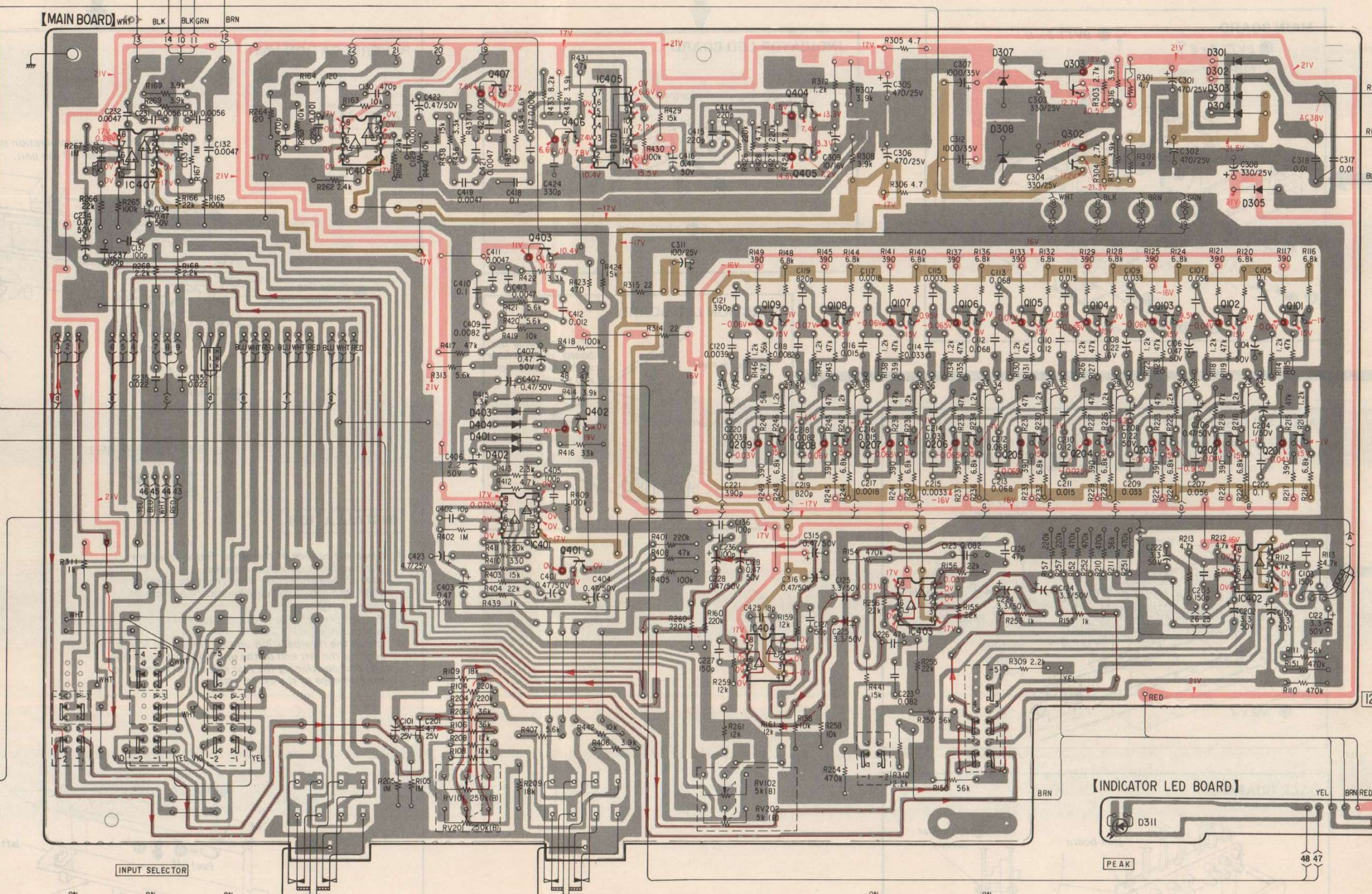
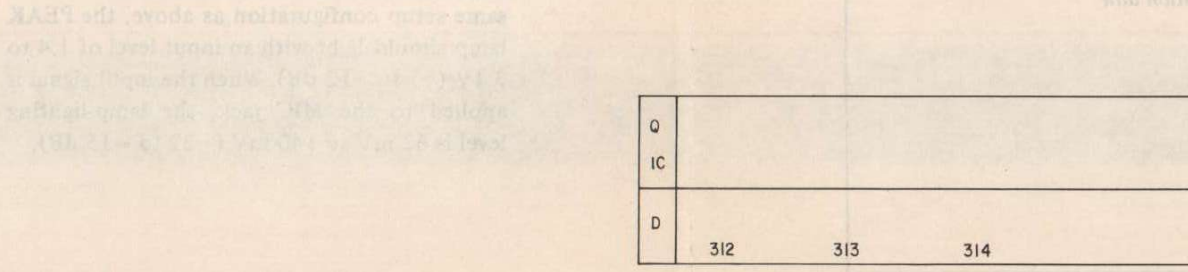
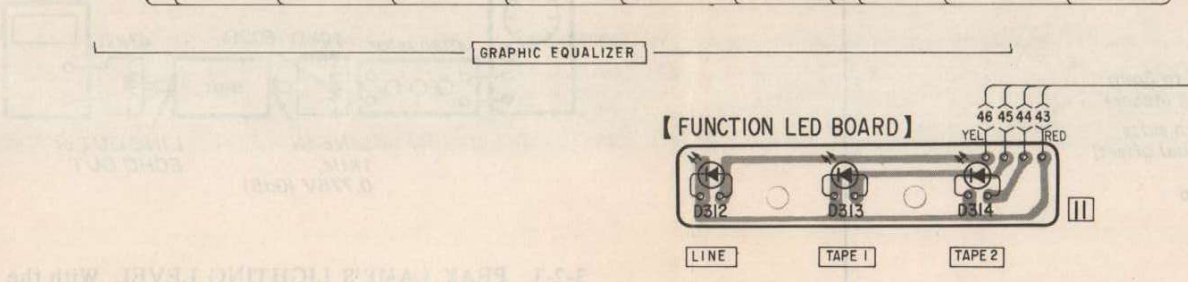
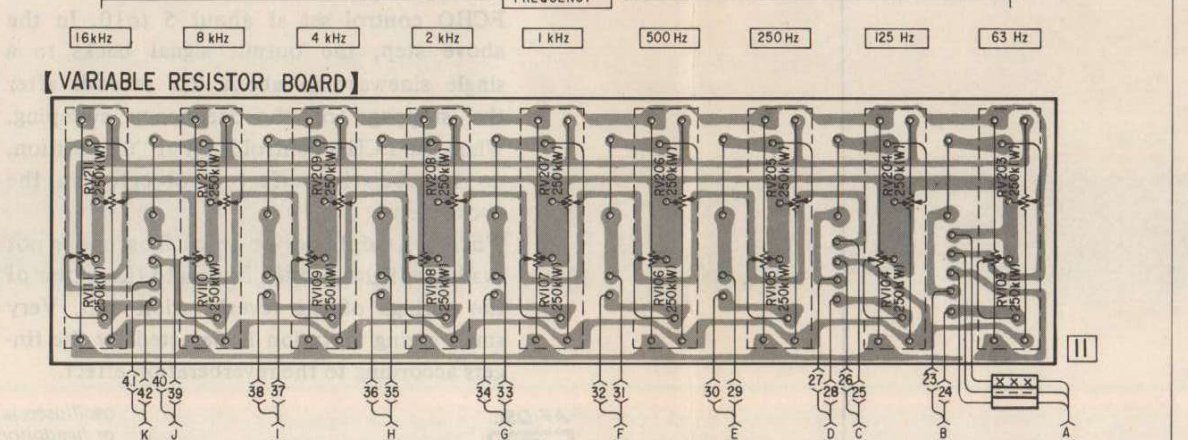
4-1. MOUNTING DIAGRAM  
- Conductor Side -



SEH-310 SEH-310

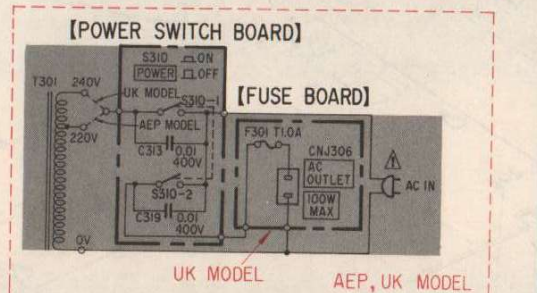
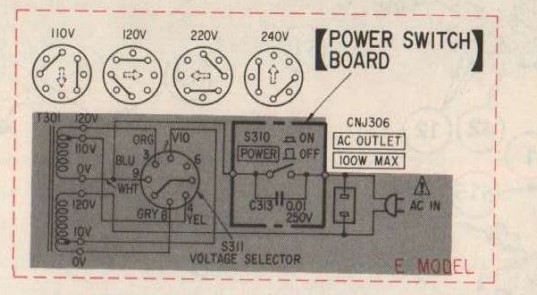
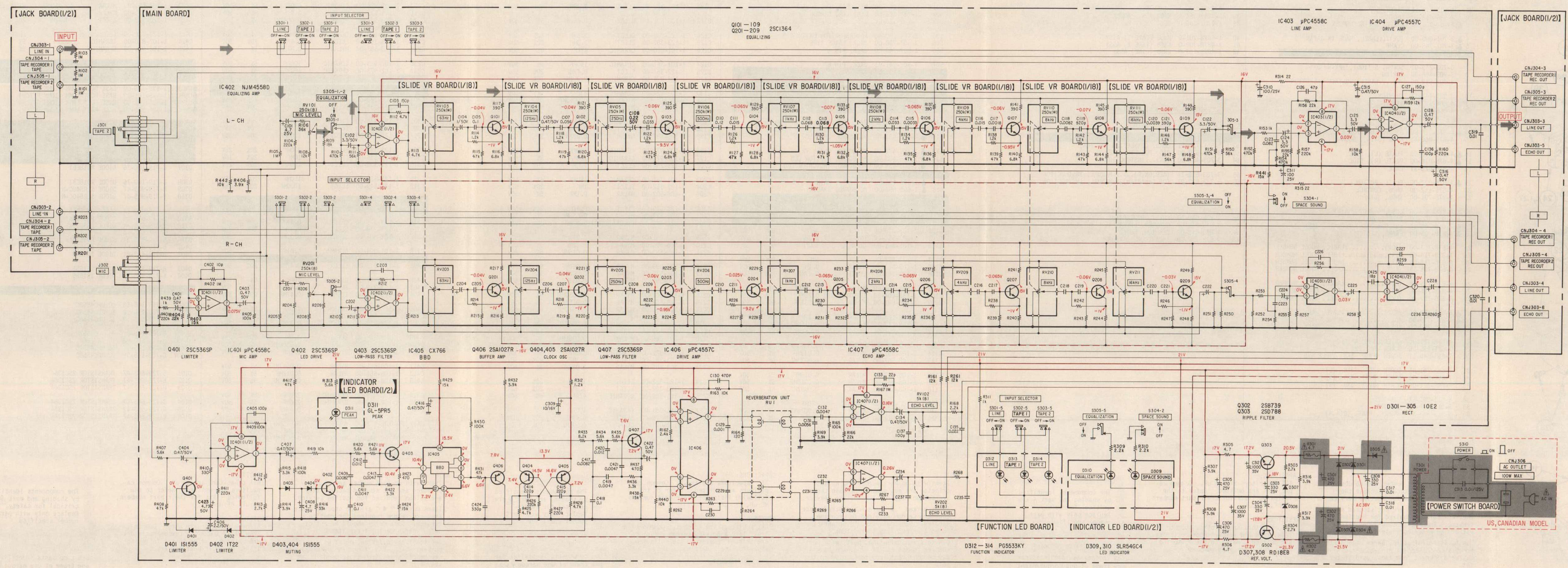


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4-2. SCHEMATIC DIAGRAM



Note: Les composants identifiés par une trame et une marque sont critiques pour la sécurité. Ne les remplacer que par une pièce portant le numéro spécifié.

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

- Components for right channel have same values as for left channel. Reference numbers are coded from 201.
- All resistors are in ohms, 1/4W unless otherwise noted. kΩ : 1000 Ω, MΩ : 1000 kΩ
- : fusible resistor.
- : panel designation.
- : B+ bus.
- : B- bus.

Note: Voltage are measured with a VOM (50kΩ/V)

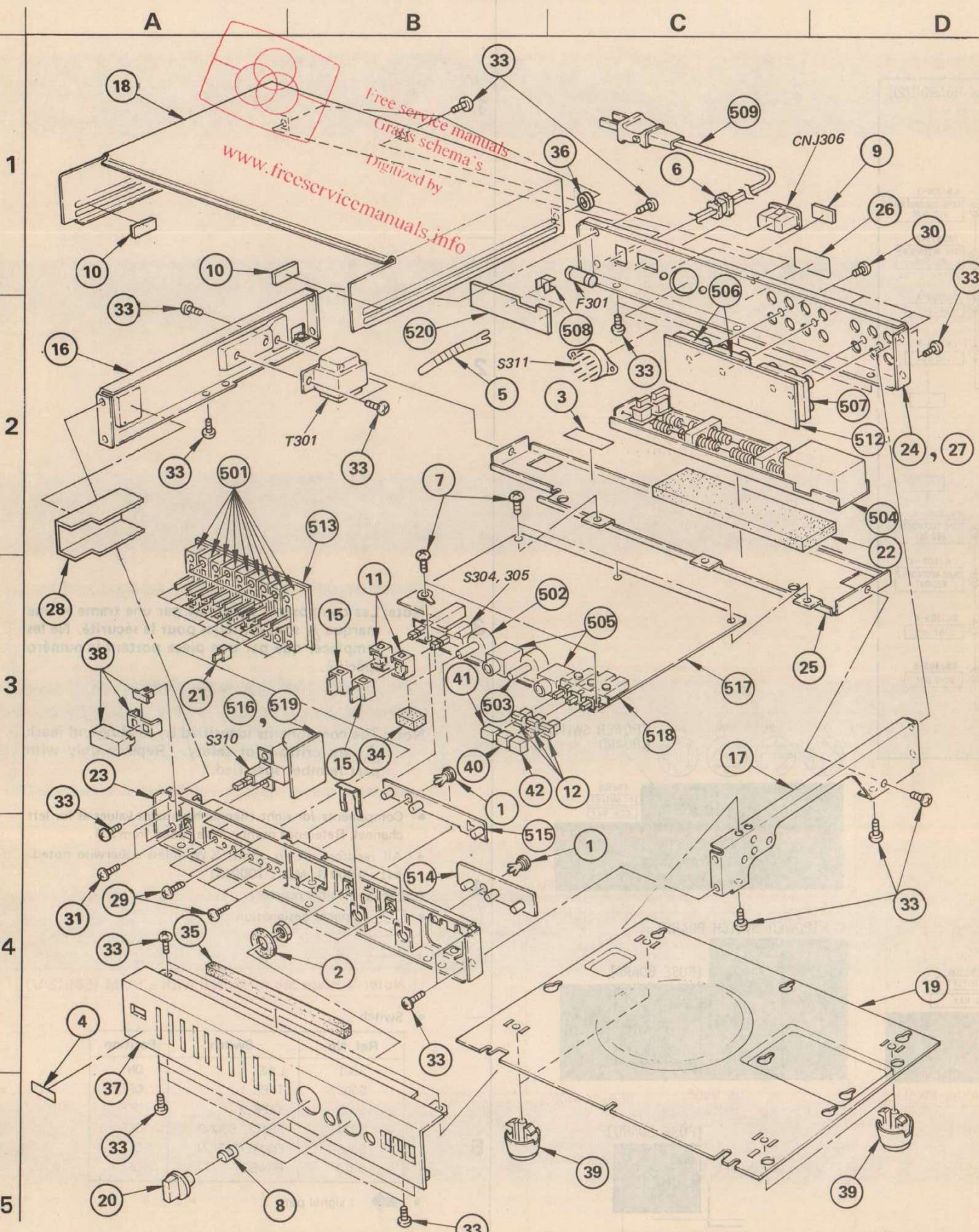
• Switch

Ref. No.	Switch	Position
S301	LINE	ON
S302	TAPE 1	OFF
S303	TAPE 2	OFF
S304	SPACE SOUND	OFF
S305	EQUALIZATION	OFF
S310	POWER	OFF

• : signal path



SECTION 5
EXPLODED VIEW AND PARTS LIST



GENERAL SECTION table with columns: No., Part No., Description. Lists parts 1 through 36 including rivets, cloth, labels, screws, springs, cushions, rings, joints, knobs, cushions, led, escutcheon, power knob, bags, instructions, plates, knobs, control, sliders, cushions, panels, sub-plates, frames, covers, screws, and washers.

NOTE:
- Items with no part number and no description are not stocked because they are seldom required for routine service.
- Items marked "▲" are not stocked since they are seldom required for routine service.
- Due to standardization, parts with part numbers (Δ-ΔΔΔ-ΔΔΔ-XX or Δ-ΔΔΔΔ-ΔΔΔ-X) may be different from those used in the set.

GENERAL SECTION table with columns: No., Part No., Description. Lists parts 37 through 69 including panel assy, knob assy, foot assy, tape assy, jack assy, jack pin, jack, holder, fuse, cord, power, and manual.

NOTE:
- Items with no part number and no description are not stocked because they are seldom required for routine service.
- Items marked "▲" are not stocked since they are seldom required for routine service.
- Due to standardization, parts with part numbers (Δ-ΔΔΔ-ΔΔΔ-XX or Δ-ΔΔΔΔ-ΔΔΔ-X) may be different from those used in the set.

ACCESSORIES AND PACKING MATERIALS table with columns: No., Part No., Description. Lists parts 61 through 69 including adaptor, cord, bag, instruction, manual, sheet, cushion, and carton.

NOTE:
- Items with no part number and no description are not stocked because they are seldom required for routine service.
- Items marked "▲" are not stocked since they are seldom required for routine service.
- Due to standardization, parts with part numbers (Δ-ΔΔΔ-ΔΔΔ-XX or Δ-ΔΔΔΔ-ΔΔΔ-X) may be different from those used in the set.

ELECTRICAL PARTS table with columns: Ref.No., Part No., Description. Lists parts 501 through 629 including resistors, capacitors, and electrical components.

NOTE:
- Items with no part number and no description are not stocked because they are seldom required for routine service.
- Items marked "▲" are not stocked since they are seldom required for routine service.
- Due to standardization, parts with part numbers (Δ-ΔΔΔ-ΔΔΔ-XX or Δ-ΔΔΔΔ-ΔΔΔ-X) may be different from those used in the set.

ELECTRICAL PARTS table with columns: Ref.No., Part No., Description. Lists parts 6122 through 6419 including resistors, capacitors, and electrical components.

NOTE:
- Items with no part number and no description are not stocked because they are seldom required for routine service.
- Items marked "▲" are not stocked since they are seldom required for routine service.
- Due to standardization, parts with part numbers (Δ-ΔΔΔ-ΔΔΔ-XX or Δ-ΔΔΔΔ-ΔΔΔ-X) may be different from those used in the set.

ELECTRICAL PARTS table with columns: Ref.No., Part No., Description. Lists parts 6420 through 6425 including resistors, capacitors, and electrical components.

NOTE:
- Items with no part number and no description are not stocked because they are seldom required for routine service.
- Items marked "▲" are not stocked since they are seldom required for routine service.
- Due to standardization, parts with part numbers (Δ-ΔΔΔ-ΔΔΔ-XX or Δ-ΔΔΔΔ-ΔΔΔ-X) may be different from those used in the set.

ELECTRICAL PARTS table with columns: Ref.No., Part No., Description. Lists parts 6426 through 6431 including resistors, capacitors, and electrical components.

NOTE:
- Items with no part number and no description are not stocked because they are seldom required for routine service.
- Items marked "▲" are not stocked since they are seldom required for routine service.
- Due to standardization, parts with part numbers (Δ-ΔΔΔ-ΔΔΔ-XX or Δ-ΔΔΔΔ-ΔΔΔ-X) may be different from those used in the set.



## ELECTRICAL PARTS

Ref.No.	Part No.	Description			
Q107	8-729-663-47	TRANSISTOR	2SC1364		
Q108	8-729-663-47	TRANSISTOR	2SC1364		
Q109	8-729-663-47	TRANSISTOR	2SC1364		
Q201	8-729-663-47	TRANSISTOR	2SC1364		
Q202	8-729-663-47	TRANSISTOR	2SC1364		
Q203	8-729-663-47	TRANSISTOR	2SC1364		
Q204	8-729-663-47	TRANSISTOR	2SC1364		
Q205	8-729-663-47	TRANSISTOR	2SC1364		
Q206	8-729-663-47	TRANSISTOR	2SC1364		
Q207	8-729-663-47	TRANSISTOR	2SC1364		
Q208	8-729-663-47	TRANSISTOR	2SC1364		
Q209	8-729-663-47	TRANSISTOR	2SC1364		
Q302	8-729-373-92	TRANSISTOR	2SB739-B		
Q303	8-729-378-84	TRANSISTOR	2SD788-B		
Q401	8-729-853-63	TRANSISTOR	2SC5365P		
Q402	8-729-853-63	TRANSISTOR	2SC5365P		
Q403	8-729-853-63	TRANSISTOR	2SC5365P		
Q404	8-729-612-77	TRANSISTOR	2SA1027R		
Q405	8-729-612-77	TRANSISTOR	2SA1027R		
Q406	8-729-612-77	TRANSISTOR	2SA1027R		
Q407	8-729-853-63	TRANSISTOR	2SC5365P		
R101	1-246-545-00	CARBON	1M	5%	1/4W
R102	1-246-545-00	CARBON	1M	5%	1/4W
R103	1-246-545-00	CARBON	1M	5%	1/4W
R104	1-246-529-00	CARBON	220K	5%	1/4W
R105	1-246-545-00	CARBON	1M	5%	1/4W
R106	1-246-510-00	CARBON	36K	5%	1/4W
R108	1-246-499-00	CARBON	12K	5%	1/4W
R109	1-246-503-00	CARBON	18K	5%	1/4W
R110	1-246-537-00	CARBON	470K	5%	1/4W
R111	1-246-515-00	CARBON	56K	5%	1/4W
R112	1-246-489-00	CARBON	4.7K	5%	1/4W
R113	1-246-489-00	CARBON	4.7K	5%	1/4W
R114	1-246-475-00	CARBON	1.2K	5%	1/4W
R115	1-246-513-00	CARBON	47K	5%	1/4W
R116	1-246-493-00	CARBON	6.8K	5%	1/4W
R117	1-246-463-00	CARBON	390	5%	1/4W
R118	1-246-475-00	CARBON	1.2K	5%	1/4W
R119	1-246-513-00	CARBON	47K	5%	1/4W
R120	1-246-493-00	CARBON	6.8K	5%	1/4W
R121	1-246-463-00	CARBON	390	5%	1/4W
R122	1-246-475-00	CARBON	1.2K	5%	1/4W
R123	1-246-513-00	CARBON	47K	5%	1/4W
R124	1-246-493-00	CARBON	6.8K	5%	1/4W
R125	1-246-463-00	CARBON	390	5%	1/4W

## ELECTRICAL PARTS

Ref.No.	Part No.	Description			
R126	1-246-475-00	CARBON	1.2K	5%	1/4W
R127	1-246-513-00	CARBON	47K	5%	1/4W
R128	1-246-493-00	CARBON	6.8K	5%	1/4W
R129	1-246-463-00	CARBON	390	5%	1/4W
R130	1-246-475-00	CARBON	1.2K	5%	1/4W
R131	1-246-513-00	CARBON	47K	5%	1/4W
R132	1-246-493-00	CARBON	6.8K	5%	1/4W
R133	1-246-463-00	CARBON	390	5%	1/4W
R134	1-246-475-00	CARBON	1.2K	5%	1/4W
R135	1-246-513-00	CARBON	47K	5%	1/4W
R136	1-246-493-00	CARBON	6.8K	5%	1/4W
R137	1-246-463-00	CARBON	390	5%	1/4W
R138	1-246-475-00	CARBON	1.2K	5%	1/4W
R139	1-246-513-00	CARBON	47K	5%	1/4W
R140	1-246-493-00	CARBON	6.8K	5%	1/4W
R141	1-246-463-00	CARBON	390	5%	1/4W
R142	1-246-475-00	CARBON	1.2K	5%	1/4W
R143	1-246-513-00	CARBON	47K	5%	1/4W
R144	1-246-493-00	CARBON	6.8K	5%	1/4W
R145	1-246-463-00	CARBON	390	5%	1/4W
R146	1-246-475-00	CARBON	1.2K	5%	1/4W
R147	1-246-515-00	CARBON	56K	5%	1/4W
R148	1-246-493-00	CARBON	6.8K	5%	1/4W
R149	1-246-463-00	CARBON	390	5%	1/4W
R150	1-246-515-00	CARBON	56K	5%	1/4W
R151	1-246-537-00	CARBON	470K	5%	1/4W
R152	1-246-537-00	CARBON	470K	5%	1/4W
R153	1-246-473-00	CARBON	1K	5%	1/4W
R154	1-246-537-00	CARBON	470K	5%	1/4W
R155	1-246-505-00	CARBON	22K	5%	1/4W
R156	1-246-505-00	CARBON	22K	5%	1/4W
R157	1-246-529-00	CARBON	220K	5%	1/4W
R158	1-246-497-00	CARBON	10K	5%	1/4W
R159	1-246-499-00	CARBON	12K	5%	1/4W
R160	1-246-529-00	CARBON	220K	5%	1/4W
R161	1-246-499-00	CARBON	12K	5%	1/4W
R162	1-246-482-00	CARBON	2.4K	5%	1/4W
R163	1-246-497-00	CARBON	10K	5%	1/4W
R164	1-246-451-00	CARBON	120	5%	1/4W
R165	1-246-521-00	CARBON	100K	5%	1/4W
R166	1-246-505-00	CARBON	22K	5%	1/4W
R167	1-246-545-00	CARBON	1M	5%	1/4W
R168	1-246-481-00	CARBON	2.2K	5%	1/4W
R169	1-246-487-00	CARBON	3.9K	5%	1/4W
R201	1-246-545-00	CARBON	1M	5%	1/4W

## NOTE:

- Items with no part number and no description are not stocked because they are seldom required for routine service.
- Items marked "▲" are not stocked since they are seldom required for routine service. Some delay should be anticipated when ordering these items.
- Due to standardization, parts with part numbers (Δ-ΔΔΔ-ΔΔΔ-XX or Δ-ΔΔΔΔ-ΔΔΔ-X) may be different from those used in the set.

## CAPACITORS:

- All capacitors are in μF. Common capacitors are omitted. Refer to the following lists for their part numbers. MF: μF, PF: μμF.

## RESISTORS

- All resistors are in ohms. Common 1/4W, 1/8W and 1/16W carbon resistors are omitted. Refer to the following lists for their part numbers.

- F : nonflammable

## COILS

- MMH : mH, UH : μH

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

Les composants identifiés par une trame et une marque ▲ sont critiques pour la sécurité. Ne les remplacer que par une pièce portant le numéro spécifié.



## ELECTRICAL PARTS

Ref.No.	Part No.	Description				
R202	1-246-545-00	CARBON	1M	5%	1/4W	
R203	1-246-545-00	CARBON	1M	5%	1/4W	
R204	1-246-529-00	CARBON	220K	5%	1/4W	
R205	1-246-545-00	CARBON	1M	5%	1/4W	
R206	1-246-510-00	CARBON	36K	5%	1/4W	
R208	1-246-499-00	CARBON	12K	5%	1/4W	
R209	1-246-503-00	CARBON	18K	5%	1/4W	
R210	1-246-537-00	CARBON	470K	5%	1/4W	
R211	1-246-515-00	CARBON	56K	5%	1/4W	
R212	1-246-489-00	CARBON	4.7K	5%	1/4W	
R213	1-246-489-00	CARBON	4.7K	5%	1/4W	
R214	1-246-475-00	CARBON	1.2K	5%	1/4W	
R215	1-246-513-00	CARBON	47K	5%	1/4W	
R216	1-246-493-00	CARBON	6.8K	5%	1/4W	
R217	1-246-463-00	CARBON	390	5%	1/4W	
R218	1-246-475-00	CARBON	1.2K	5%	1/4W	
R219	1-246-513-00	CARBON	47K	5%	1/4W	
R220	1-246-493-00	CARBON	6.8K	5%	1/4W	
R221	1-246-463-00	CARBON	390	5%	1/4W	
R222	1-246-475-00	CARBON	1.2K	5%	1/4W	
R223	1-246-513-00	CARBON	47K	5%	1/4W	
R224	1-246-493-00	CARBON	6.8K	5%	1/4W	
R225	1-246-463-00	CARBON	390	5%	1/4W	
R226	1-246-475-00	CARBON	1.2K	5%	1/4W	
R227	1-246-513-00	CARBON	47K	5%	1/4W	
R228	1-246-493-00	CARBON	6.8K	5%	1/4W	
R229	1-246-463-00	CARBON	390	5%	1/4W	
R230	1-246-475-00	CARBON	1.2K	5%	1/4W	
R231	1-246-513-00	CARBON	47K	5%	1/4W	
R232	1-246-493-00	CARBON	6.8K	5%	1/4W	
R233	1-246-463-00	CARBON	390	5%	1/4W	
R234	1-246-475-00	CARBON	1.2K	5%	1/4W	
R235	1-246-513-00	CARBON	47K	5%	1/4W	
R236	1-246-493-00	CARBON	6.8K	5%	1/4W	
R237	1-246-463-00	CARBON	390	5%	1/4W	
R238	1-246-475-00	CARBON	1.2K	5%	1/4W	
R239	1-246-513-00	CARBON	47K	5%	1/4W	
R240	1-246-493-00	CARBON	6.8K	5%	1/4W	
R241	1-246-463-00	CARBON	390	5%	1/4W	
R242	1-246-475-00	CARBON	1.2K	5%	1/4W	
R243	1-246-513-00	CARBON	47K	5%	1/4W	
R244	1-246-493-00	CARBON	6.8K	5%	1/4W	
R245	1-246-463-00	CARBON	390	5%	1/4W	
R246	1-246-475-00	CARBON	1.2K	5%	1/4W	
R247	1-246-515-00	CARBON	56K	5%	1/4W	

## ELECTRICAL PARTS

Ref.No.	Part No.	Description				
R248	1-246-493-00	CARBON	6.8K	5%	1/4W	
R249	1-246-463-00	CARBON	390	5%	1/4W	
R250	1-246-515-00	CARBON	56K	5%	1/4W	
R251	1-246-537-00	CARBON	470K	5%	1/4W	
R252	1-246-537-00	CARBON	470K	5%	1/4W	
R253	1-246-473-00	CARBON	1K	5%	1/4W	
R254	1-246-537-00	CARBON	470K	5%	1/4W	
R255	1-246-505-00	CARBON	22K	5%	1/4W	
R256	1-246-505-00	CARBON	22K	5%	1/4W	
R257	1-246-529-00	CARBON	220K	5%	1/4W	
R258	1-246-497-00	CARBON	10K	5%	1/4W	
R259	1-246-499-00	CARBON	12K	5%	1/4W	
R260	1-246-529-00	CARBON	220K	5%	1/4W	
R261	1-246-499-00	CARBON	12K	5%	1/4W	
R262	1-246-482-00	CARBON	2.4K	5%	1/4W	
R263	1-246-497-00	CARBON	10K	5%	1/4W	
R264	1-246-451-00	CARBON	120	5%	1/4W	
R265	1-246-521-00	CARBON	100K	5%	1/4W	
R266	1-246-505-00	CARBON	22K	5%	1/4W	
R267	1-246-545-00	CARBON	1M	5%	1/4W	
R268	1-246-481-00	CARBON	2.2K	5%	1/4W	
R269	1-246-487-00	CARBON	3.9K	5%	1/4W	
R301	△-1-212-849-00	FUSIBLE	4.7	5%	1/4W	
R302	△-1-212-849-00	FUSIBLE	4.7	5%	1/4W	
R303	1-246-483-00	CARBON	2.7K	5%	1/4W	
R304	1-246-483-00	CARBON	2.7K	5%	1/4W	
R305	1-246-417-00	CARBON	4.7	5%	1/4W	
R306	1-246-417-00	CARBON	4.7	5%	1/4W	
R307	1-246-487-00	CARBON	3.9K	5%	1/4W	
R308	1-246-487-00	CARBON	3.9K	5%	1/4W	
R309	1-246-481-00	CARBON	2.2K	5%	1/4W	
R310	1-246-481-00	CARBON	2.2K	5%	1/4W	
R311	1-246-473-00	CARBON	1K	5%	1/4W	
R312	1-246-475-00	CARBON	1.2K	5%	1/4W	
R313	1-246-491-00	CARBON	5.6K	5%	1/4W	
R314	1-246-433-00	CARBON	22	5%	1/4W	
R315	1-246-433-00	CARBON	22	5%	1/4W	
R316	1-246-487-00	CARBON	3.9K	5%	1/4W	
R317	1-246-487-00	CARBON	3.9K	5%	1/4W	
R401	1-246-529-00	CARBON	220K	5%	1/4W	
R402	1-246-545-00	CARBON	1M	5%	1/4W	
R403	1-246-501-00	CARBON	15K	5%	1/4W	
R404	1-246-505-00	CARBON	22K	5%	1/4W	
R405	1-246-521-00	CARBON	100K	5%	1/4W	
R406	1-246-487-00	CARBON	3.9K	5%	1/4W	

## NOTE:

- Items with no part number and no description are not stocked because they are seldom required for routine service.
- Items marked "▲" are not stocked since they are seldom required for routine service. Some delay should be anticipated when ordering these items.
- Due to standardization, parts with part numbers (Δ-ΔΔΔ-ΔΔΔ-XX or Δ-ΔΔΔΔ-ΔΔΔ-X) may be different from those used in the set.

## CAPACITORS:

- All capacitors are in  $\mu\text{F}$ . Common capacitors are omitted. Refer to the following lists for their part numbers. MF: $\mu\text{F}$ , PF: $\mu\text{F}$ .

## RESISTORS

- All resistors are in ohms. Common 1/4W, 1/8W and 1/16W carbon resistors are omitted. Refer to the following lists for their part numbers.

- F : nonflammable

## COILS

- MMH : mH, UH :  $\mu\text{H}$

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

Les composants identifiés par une trame et une marque ▲ sont critiques pour la sécurité. Ne les remplacer que par une pièce portant le numéro spécifié.



**ELECTRICAL PARTS**

Ref.No.	Part No.	Description			
R407	1-246-491-00	CARBON	5.6K	5%	1/4W
R408	1-246-513-00	CARBON	47K	5%	1/4W
R409	1-246-521-00	CARBON	100K	5%	1/4W
R410	1-246-461-00	CARBON	330	5%	1/4W
R411	1-246-529-00	CARBON	220K	5%	1/4W
R412	1-246-489-00	CARBON	4.7K	5%	1/4W
R413	1-246-483-00	CARBON	2.7K	5%	1/4W
R414	1-246-487-00	CARBON	3.9K	5%	1/4W
R415	1-246-485-00	CARBON	3.3K	5%	1/4W
R416	1-246-509-00	CARBON	33K	5%	1/4W
R417	1-246-513-00	CARBON	47K	5%	1/4W
R418	1-246-521-00	CARBON	100K	5%	1/4W
R419	1-246-497-00	CARBON	10K	5%	1/4W
R420	1-246-491-00	CARBON	5.6K	5%	1/4W
R421	1-246-491-00	CARBON	5.6K	5%	1/4W
R422	1-246-485-00	CARBON	3.3K	5%	1/4W
R423	1-246-465-00	CARBON	470	5%	1/4W
R424	1-246-501-00	CARBON	15K	5%	1/4W
R425	1-246-489-00	CARBON	4.7K	5%	1/4W
R426	1-246-529-00	CARBON	220K	5%	1/4W
R427	1-246-529-00	CARBON	220K	5%	1/4W
R428	1-246-489-00	CARBON	4.7K	5%	1/4W
R429	1-246-501-00	CARBON	15K	5%	1/4W
R430	1-246-521-00	CARBON	100K	5%	1/4W
R431	1-246-513-00	CARBON	47K	5%	1/4W
R432	1-246-487-00	CARBON	3.9K	5%	1/4W
R433	1-246-495-00	CARBON	8.2K	5%	1/4W
R434	1-246-491-00	CARBON	5.6K	5%	1/4W
R435	1-246-491-00	CARBON	5.6K	5%	1/4W
R436	1-246-485-00	CARBON	3.3K	5%	1/4W
R437	1-246-465-00	CARBON	470	5%	1/4W
R438	1-246-501-00	CARBON	15K	5%	1/4W
R439	1-246-473-00	CARBON	1K	5%	1/4W
R440	1-246-497-00	CARBON	10K	5%	1/4W
R441	1-246-501-00	CARBON	15K	5%	1/4W
R442	1-246-497-00	CARBON	10K	5%	1/4W
S301	1-553-791-00	SWITCH, PUSH (3 KEY)			
S302	1-553-791-00	SWITCH, PUSH (3 KEY)			
S303	1-553-791-00	SWITCH, PUSH (3 KEY)			
S304	1-553-790-00	SWITCH, PUSH (2 KEY)			
S305	1-553-790-00	SWITCH, PUSH (2 KEY)			
S310	△, 1-553-447-00	(AEP,UK,E).....SWITCH, PUSH (AC POWER)			
S310	△, 1-553-318-00	(E).....SWITCH, PUSH (AC POWER)			
S310	△, 1-553-319-00	(US,Canadian)...SWITCH, PUSH (AC POWER)			
S311	△, 1-552-963-00	(E).....SWITCH, VOLTAGE SELECT			

**ELECTRICAL PARTS**

Ref.No.	Part No.	Description
T301	△, 1-447-156-00	(AEP,UK).....TRANSFORMER, POWER
T301	△, 1-447-157-00	(US,Canadian)...TRANSFORMER, POWER
T301	△, 1-447-199-00	(E).....TRANSFORMER, POWER

**NOTE:**

- Items with no part number and no description are not stocked because they are seldom required for routine service.
- Items marked "▲" are not stocked since they are seldom required for routine service. Some delay should be anticipated when ordering these items.
- Due to standardization, parts with part numbers (Δ-ΔΔΔ-ΔΔΔ-XX or Δ-ΔΔΔΔ-ΔΔΔ-X) may be different from those used in the set.

**CAPACITORS:**

- All capacitors are in μF. Common capacitors are omitted. Refer to the following lists for their part numbers. MF:μF, PF:μμF.

**RESISTORS**

- All resistors are in ohms. Common 1/4W, 1/8W and 1/16W carbon resistors are omitted. Refer to the following lists for their part numbers.

- F : nonflammable

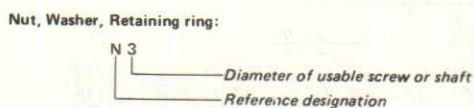
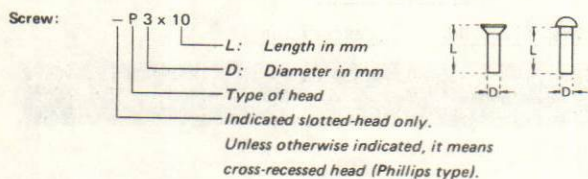
**COILS**

- MMH : mH, UH : μH

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

Les composants identifiés par une trame et une marque △ sont critiques pour la sécurité. Ne les remplacer que par une pièce portant le numéro spécifié.

### HARDWARE NOMENCLATURE



Reference Designation	Shape	Description	Remarks
<b>SELF-TAPPING SCREWS</b>			
TA		self-tapping screw	ex: TA, P 3 x 10
PTP		pan-head self-tapping screw	binding-head self-tapping (TA, B) screw for replacement
PTPWH		pan-head self-tapping screw with washer face	binding-head self-tapping (TA, B) screw and flat washer for replacement
PTTWH		pan-head thread-rolling screw with washer face	binding-head (B) screw and flat washer for replacement
<b>SET SCREWS</b>			
SC		set screw	
SC		hexagon-socket set screw	ex: SC 2.6 x 4, hexagon socket
<b>NUT</b>			
N		nut	
<b>WASHERS</b>			
W		flat washer	
SW		spring washer	
LW		internal-tooth lock washer	ex: LW3, internal
LW		external-tooth lock washer	ex: LW3, external
<b>RETAINING RINGS</b>			
E		retaining ring	
G		grip-type retaining ring	

Reference Designation	Shape	Description	Remarks
<b>SCREWS</b>			
P		pan-head screw	binding-head (B) screw for replacement
PWH		pan-head screw with washer face	binding-head (B) screw and flat washer for replacement
PS PSP		pan-head screw with spring washer	binding-head (B) screw and spring washer for replacement
PSW PSPW		pan-head screw with spring and flat washers	binding-head (B) screw and spring and flat washers for replacement
R		round-head screw	binding-head (B) screw for replacement
K		flat-countersunk-head screw	
RK		oval-countersunk-head screw	
B		binding-head screw	
T		truss-head screw	binding-head (B) screw for replacement
F		flat-fillister-head screw	
RF		fillister-head screw	
BV		braizer-head screw	