TEAC®

SERVICE MANUAL

TEAC Tascam Series

Model 144

PORTASTUDIO

Effective: April, 1980 Q00045

5704004201

PRECAUTIONS

- Part numbers with (*) indicate those for track 1. Part numbers for tracks 2, 3 and 4 have numbers in the 20s, 300s, and 400s, respectively.
- Value of "dB" in the Data refers to 0dB (1V), except where specified.
- The AC voltmeter used in the procedures must have an input impedance of 1 M-ohms or more.
- Improvements may result in Specifications and Service Data changes.
- Noise reduction circuit made under license from Dolby Laboratories. The word "Dolby" and the Double-D symbol are trademarks of Dolby Laboratories.

CAUTION

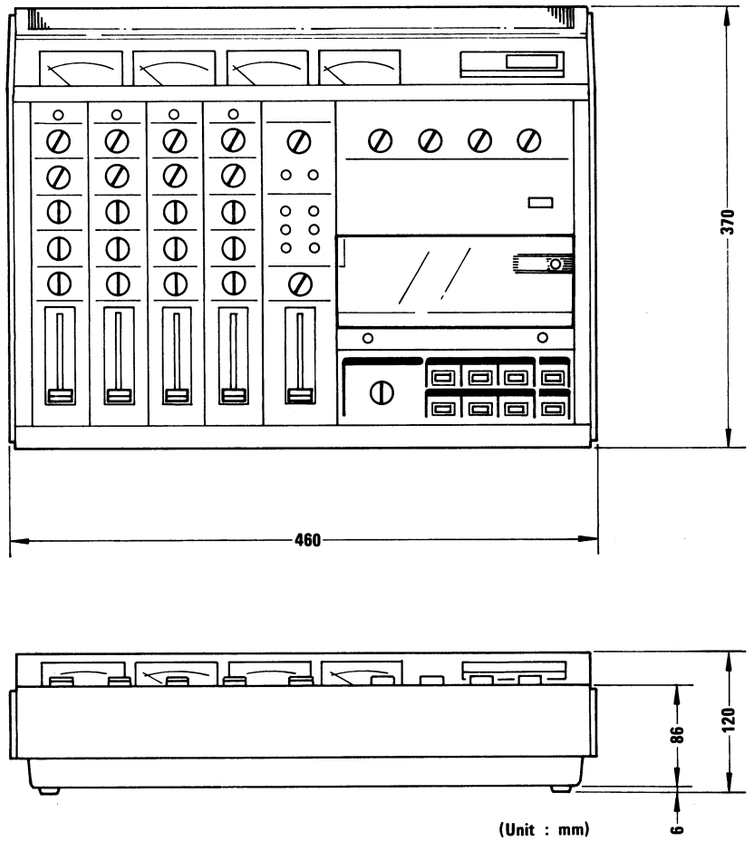
⚠

Parts marked with this sign are safety critical components. They must always be replaced with identical components - refer to the TEAC Parts List and ensure exact replacement.

TABLE OF CONTENTS

1 INTRODUCTION

TEAC Model 144 is a small lightweight unit which is a combination of a four channel cassette recorder and audio mixer, capable of making multi-channel recordings and mixdowns.
The PCB assembly for the mixer section is located near the control surface and the recorder section PCB is located at the bottom cover side for easy access by opening the bottom cover. The transport drive system is controlled by IC logic and the transport itself can be removed very easily for maintenance.



2 SPECIFICATIONS, SERVISE DATA

SPECIFICATIONS

MIC/LINE INPUT (x4)
- **Mic or Line Impedance:** 10kohms or less
- **Input Impedance:** 60kohms
- **Nominal Input Level:** MIC –60dBv (1mV); LINE –10dBv (0.3V)
- **Minimum Input Level:** –66dBv (0.5mV)
- **Maximum Input Level:** +8dBv (2.5V)

AUX INPUT (x2)
- **Input Impedance:** 65kohms
- **Nominal Input Level:** –10dBv (0.3V)

LINE OUTPUT (x2), AUX OUT (x2)
- **Output Impedance:** 200ohms
- **Load Impedance:** 10kohms or higher
- **Nominal Output Level:** –10dBv (0.3V)
- **Maximum Output Level:** +15dBv (5.6V)

HEADPHONE OUTPUT (Stereo)
- **Load Impedance:** 8ohms or higher
- **Maximum Output:** 100mW @ 8ohms

TONE CONTROLS
- **Treble:** Variable ±10dB @ 10kHz
- **Bass:** Variable ±10dB @ 100Hz

RECORDING TAPE:
Compact cassette, C-60 or C-90 – use a gamma-ferric oxide tape that requires high-bias level and 70 microsecond EQ (TDK-SA, MAXELL XL-II, or equivalent).

RECORD TRACKS: 4-track, one direction (Special format)

RECORD CHANNELS (Electronics):
2 with full-time Dolby NR encoding (switchable to the 4 record tracks)

PLAYBACK CHANNELS: 4 with full-time Dolby NR decoding

NORMAL TAPE SPEED: 3¾ ips ±1%

PITCH CONTROL (VSO): ±15% of normal tape speed

RECORDING TIME: 15 minutes for C-60

HEADS:
4-channel erase (ferrite/permalloy); 4-channel record/playback (permalloy)

MOTORS:
1 FG Servo-controlled DC capstan motor and 1 DC reel motor

FAST WIND TIME: 70 seconds for C-60

FREQUENCY RESPONSE
- **Mixer Section:** 20Hz – 20,000Hz
- **Recorder Section:** 20Hz – 18,000Hz (40Hz – 12,500Hz ±3dB @ 0 VU)

TOTAL HARMONIC DISTORTION
- **Mixer Section:** 0.3% @ 1,000Hz, nominal level
- **Recorder Section:** 2% @ 315Hz, 0 VU (overall)

CROSSTALK
- **Mixer Section:** 65dB @ 1,000Hz
- **Recorder Section:** 50dB @ 1,000Hz

ERASURE: 65dB @ 1,000Hz

POWER REQUIREMENTS: 100/120/220/240V AC, 50/60Hz, 35W (General Export Model)
120V AC, 60Hz, 28W (U.S.A./Canada Model)
220V AC, 50Hz, 35W (Europe Model)
240V AC, 50Hz, 28W (U.K./Australia Model)

DIMENSIONS:
46 x 12 x 37cm, (18-1/8 x 4-3/4 x 14-5/8 in.)

WEIGHT:
Net, 9kg (20 lb); Shipping, 10kg (22 lb)

SERVICE DATA

Tape Speed:	Deviation	3000Hz ±60Hz
	Width of deviation	Within 60Hz
Pitch Control:	Minimum	2250Hz ~ 2550Hz
	Maximum	3450Hz ~ 3750Hz
Takeup Torque:	At play and record	40 ~ 60g-cm (0.56 to 0.83 oz-inch)
	At FF and REW	80 ~ 160g-cm (1.11 to 2.22 oz-inch)
Pinch Roller Pressure:		200 ~ 350gms (7.05 to 12.34 oz-inch)
Sync Crosstalk:		More than 5dB (20Hz ~ 20kHz)
LINE OUT/TAPE CUE OUT:		–10dB ±2dB (at 315Hz)

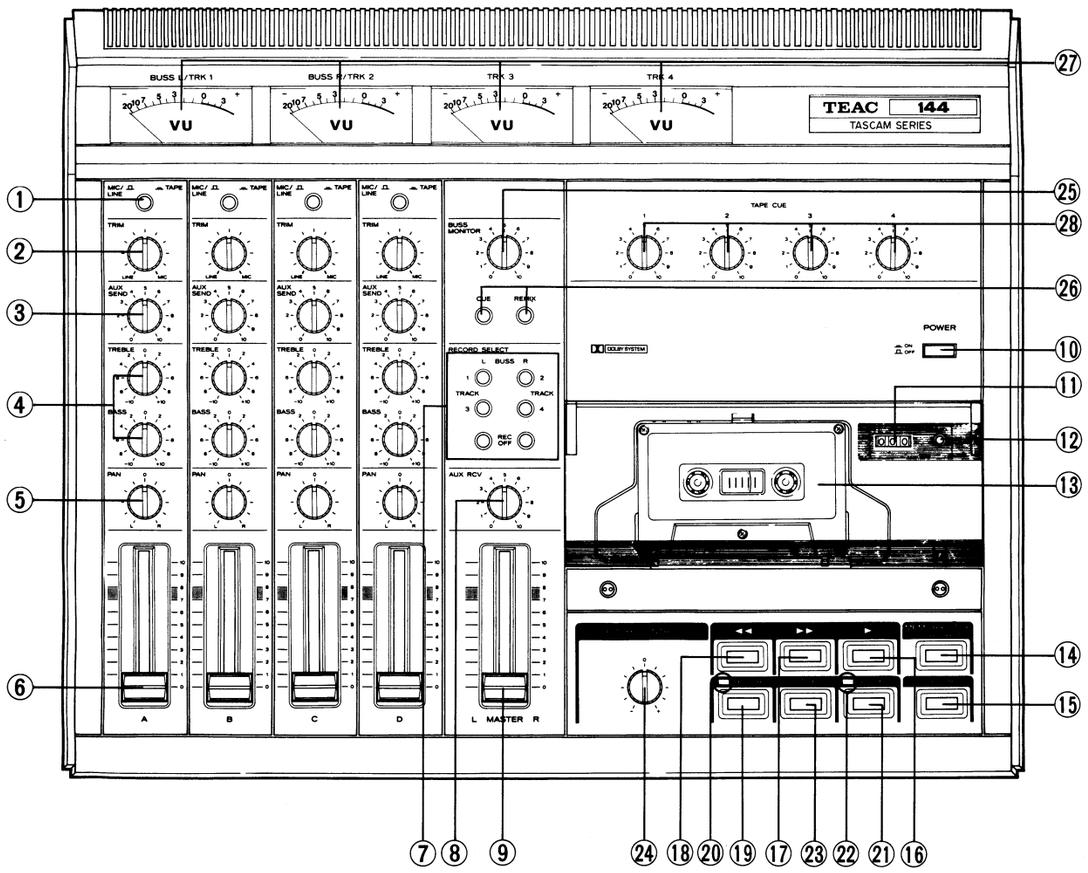
(With channel fader and AUX SEND knob at nominal setting)

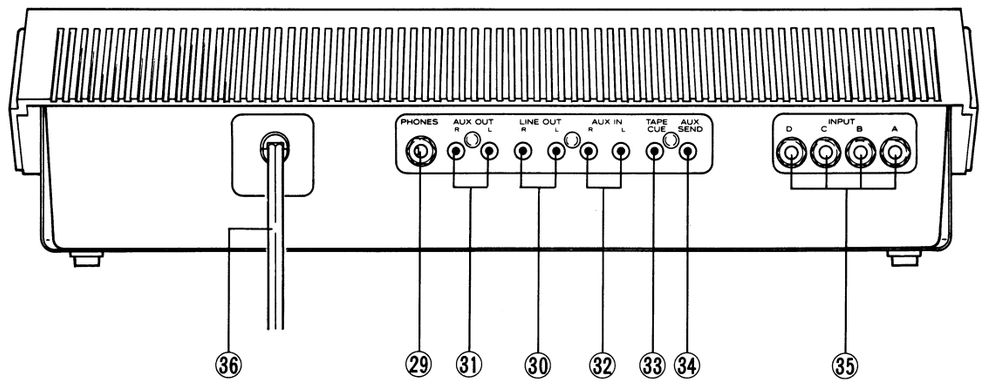
AUX SEND OUT:		–10dB ±2dB (at 1kHz)

(With channel fader and AUX SEND knob at nominal setting)

TREBLE (10kHz) and BASS (100Hz)

Equalizers:	Maximum	+10dB ±2dB
	Minimum	–10dB ±2dB
Dolby Set Level:		580mV (–4.7dB)
Bias Oscillator Output Voltage:		19V (r.m.s.), about 60kHz
Bias Voltage:		About 4V
Headphones (L,R):		
	Maximum	100mw (–1dB ±1dB)





3 THE CONTROLS AND THEIR FUNCTIONS

MIXER SECTION

1 **Input Channel Selector [MIC/LINE-TAPE]**
Push-in/push-out type input selector switch.
- [⎍ MIC/LINE] : This up position selects the microphone or line input connected to the rear panel jack.
- [⎓ TAPE] : This selects the playback output from the transport in the Model 144. In this position, the signal from track 1 is input to channel A, track 2 to channel B, track 3 to channel C, and track 4 to channel D.

2 **Trim Adjusting Knob [TRIM]**
This knob is for adjusting the preamplifier gain to the nominal level of the signal applied to the [INPUT] jack of the channel. With the knob at full CCW, the input will accept a LINE level of −10dB, and at full CW, a MIC level of −60dB. This adjustment is only possible with the channel switch in the MIC/LINE [⎍] position, and the standard procedure for gain setting should be with that channel input fader set to the nominal position (between 7 and 8 of the scale).

3 **AUX Output Level Adjusting Knob [AUX SEND]**
The signals branched from the output of each channel is mixed to a monaural signal, adjusted to the proper level by this AUX output level adjusting knob, and output from AUX SEND jack on the rear panel. Nominal output is obtained when knob is at full CW position.

4 **Equalizer Knobs [TREBLE-BASS]**
The TREBLE and BASS knobs are for increasing or decreasing the level of a certain portion of the frequency spectrum and thus change the overall frequency response. Response will not change with the knobs at center [0] but the level of the frequency range assigned to that knob will decrease when it is rotated CCW, or increase when rotated CW.

5 **PAN Adjusting Knob [PAN]**
This knob is for dividing the channel input signal to the [L] or [R] BUSS. With the knob at center [0], the [L] and [R] signals are divided equally to the BUSS.
In the REC mode, as the [L] BUSS goes to tracks 1 and 3, and the [R] BUSS to tracks 2 and 4, the knob is rotated towards [L] or [R] in accordance to which track you wish to record.

6 **Channel Fader**
The MIC and LINE signals coming into the rear panel INPUT jack and selected by the channel input selector switch (1), or the playback signal from the internal transport, is adjusted in level by this fader. Noise and distortion is minimum when the knob is set in the shaded portion between 7 and 8 on the scale and this should be the normal operating position. This is also the standard, or reference, position when making adjustments and measurements on the circuits.

7 **Recording Track Selector Switch [RECORD SELECT]**
The button with the number you wish to record on is depressed and that track will be ready for recording.
The tracks you can record on are, 1 or 3 of BUSS L; and 2 or 4 of BUSS R, which means you can record no more than two tracks at a time.
Should you force down both buttons 1 and 3, priority is given to track 3 and this track only will be recorded. The same logic applies to tracks 2 and 4, and track 4 only will be recorded.

8 **AUX Input Level Adjusting Knob [AUX RCV]**
The left and right signal levels entering the rear panel AUX IN-L/R jacks are adjusted at the same time.
In the same way as the channel input signals, the AUX input signals are mixed in the left and right buss before being controlled by the master fader.

9 **Master fader [MASTER]**
The [L] and [R] buss levels are simultaneously adjusted by this master fader. Actually, the LINE OUT and AUX OUT are controlled.

TRANSPORT SECTION

10 Power Switch [POWER]
Pushing in this button switches on power and releasing it switches off power to the unit.

11 Tape Counter
This is a 3-digit counter. This up-counts when the transport is put in the record, playback or fast forward modes, and down-counts when put in rewind.
In addition to the above basic functions, this counter also has a memory auto stop feature which is convenient for finding the beginning of the recording during multi-track recording.

12 Counter Reset Button
Depressing this button resets the tape counter to [000]. This is depressed at the record starting position and the memory auto stop facility will stop the tape at this point.

13 Cassette Compartment

14 Memory Stop Switch [MEMORY STOP]
When this is switched [ON], the tape in rewind is automatically stopped when the tape counter reaches [999] and will not allow further rewinding. However, the transport can be put in record, playback or fast forward modes. This is very convenient in searching for the beginning of recordings, especially during multi-track recording where the start of recording must be searched each time another recording is to be made.

15 Cassette Door Button [DOOR]
This is depressed to spring up the transparent Acrylic door when loading or removing the cassette from its compartment. Closing the door is done manually.

16 Play Button [▶]
Depressing this button runs the tape and put the transport in the playback mode.

17 Fast Forward Button [▶▶]
Depressing this button will run the tape from left to right at high speed.

18 Rewind Button [◀◀]
Depressing this button will run the tape from right to left at high speed.

19 Record Button [RECORD]

With any track of the RECORD SELECT button depressed, depressing the [▶] button while holding down the RECORD button runs the tape at constant speed and begins recording on the designated track.

Also, with this button held down, depressing the PAUSE button puts the transport in the Record-ready mode, and recording on the designated track will begin when the [▶] button is depressed. The Model 144 can record on only two tracks at a time, either track 1 or track 3, and track 2 or track 4. All four tracks cannot be recorded at the same time.

20 Record Mode Indicating LED

* Light on – indicates one or more tracks are being recorded, or transport is in RECORD PAUSE mode.
* Light flashing – This means one or more of the tracks are ready for recording.
* Light off – Indicates recording cannot be done.

21 Pause Button [PAUSE]

When this is depressed during playback or recording, tape travel only will stop. It is only necessary to depress the [▶] button to resume playback or recording.

The transport goes to the Playback Wait Condition when this button is depressed during the stop mode, and when depressed together with the REC button, the transport goes to the Record-ready mode. Record mode, bias, etc. are checked in this mode.

22 Pause Indicating LED

This green LED lights when the transport is in the REC or Playback pause mode.

23 Stop Button [STOP]

The tape stops from any mode and record, playback and pause modes are all cancelled when this button is depressed.

24 Pitch Control Knob [PITCH CONTROL]

Tape speed can be changed continuously during record or playback by this knob, thus changing the pitch. When this is rotated in the direction of the [+] mark, tape speed rises (pitch goes high), and drops (pitch goes low) when rotated in direction of the [-] mark.

The tape travels at standard speed with knob at the center [0] click stop. The range of tape speed change is about ±15%.

MONITOR SECTION

25 Buss Monitor Output Level Adjusting Knob [BUSS MONITOR]

The [L] and [R] buss signal levels to the HEADPHONES are adjusted simultaneously.

26 Headphone Output Selector Switch

This switch selects the headphone output signal of either CUE or REMIX. Depressing REMIX outputs the [L] and [R] buss signals to be headphones and the level is adjusted by the BUSS MONITOR knob.

When the CUE button is depressed, not only the buss signal, mixed down into mono, can be monitored but the playback signal from a pre-recorded track can also be heard.

27 VU Meters

When both REC OFF buttons of the RECORD SELECT matrix are depressed, all four VU meter pilot lamps will be lighted and the tape playback levels for tracks 1, 2, 3, and 4, counting from the left will be indicated on the meters.

When any one or more of the RECORD SELECT buttons are depressed, the two meters on the left, the BUSS L/TRK 1 or BUSS R/TRK 2, will be lighted and the [L] or [R] buss level LINE OUT or, output level from AUX OUT or, the recording level will be indicated.

28 Tape Cue Output Level Adjusting Knob [TAPE CUE]

This knob adjusts the output level of each track when mixing the playback signals into mono to monitor the signal.

CONNECTORS

29 Headphone Output Jack [PHONES]

The headphones for monitoring this output must have an impedance higher than 8ohms.

30 Line Output Jacks [LINE OUT]

The [L] and [R] buss output jacks. The output level is adjusted by the MASTER fader.

31 AUX Output Jacks [AUX OUT]

The output here is paralleled to the LINE OUT jacks.

32 AUX Input Jacks [AUX IN]

The only other signal input jacks aside from the INPUT jacks, for the [L] and [R] buss input. Adjust input levels to these jacks by the [AUX RCV] knob.

33 Tape Cue Output Jack [TAPE CUE]

A mono signal, which is a mix of the playback signals of any number of pre-recorded tracks, among the four, is output here. The output level is adjusted by the corresponding TAPE CUE knob.

34 AUX Output Jack (AUX SEND]

The levels adjusted by the AUX SEND knobs for each channel and mixed into mono, is output to this jack.

35 Channel Input Jacks [INPUT-A ~ D]

Input jacks to each channel of the mixer section.

36 Power Cord

4 CONTROL CIRCUITS AND THEIR FUNCTIONS

The fundamental operations, mode switching of the solenoids and motors, and end sensors are all handled by the Control (B) PCB. In Control (A) PCB are the circuits for muting the amplifiers, switching the heads, and driving the VU meters.

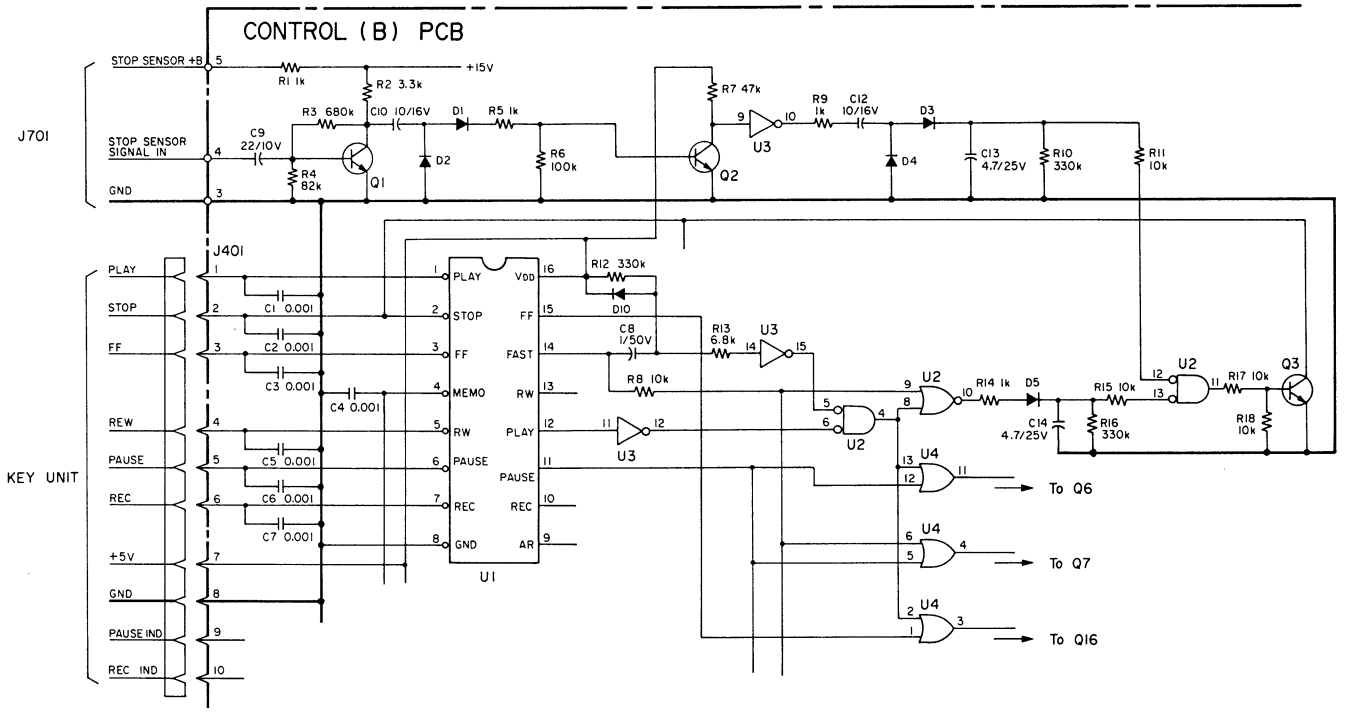


Fig. 4-1

4-1 CONTROL (B) PCB

The circuits will first be explained by each block, then the overall signal flow and functions of the circuits.

4-1-1 Function Controls

The fundamental control operations are handled by flip flop, U1, with REC, PAUSE, PLAY, REW, FAST, and F.F. outputs (pins #10 ~ 15). Refer to Fig. 4-1.

Each mode is triggered by applying an "L" level signal pulse to the proper input (U1 pins #1 ~ 7, 9) which then outputs an "H" level signal from the pin of the gate thus commanded, to drive the circuits following it.

Although the U1 input and output for each mode operate individually—

a) During FF or REW, if output pins (15) or (13) is at "H", then FAST output pin (14) will also be at "H".
b) PAUSE cannot be induced from FF or REW.
c) When MEMO input pin (4) is "L", REW output pin (13) will not go to "H". This is because a certain address will have been stored in the tape counter, and if at 999, REW will not operate. Only PLAY or FF modes can be operated. This is due to priority and significance given to detecting BOT (Beginning Of Tape).
d) REC output pin (10) will not go to "H" when AR (9) is at "L". In other words, this is the REC OFF (record protection) mode.

4-1-2 From FF or REW to PLAY

To guard against tape slack and winding of tape on the capstan when going from FF or REW to PLAY, a slight delay is introduced before going into the PLAY mode.

The delay constant is determined by C8 and R12. The gate for this delay mode is NAND U2 input pins (5) and (6).

The circuit operation is, when PLAY is depressed during FF or REW, input pin (6) of U2 goes to "L". On the other hand, U1 FAST output pin (14) goes from "H" to "L", and input pin (5) of U2 which was at "L" goes to "H" delayed by C8 and R12. After elapse of this time constant, U2 input pin (5) goes to "L" and together with "L" of U2 input pin (6), the U2 output pin (4) gate opens and the transport goes to the PLAY mode. Refer to Fig. 4-1.

4-1-3 Auto End Stop

NAND U2-11 is the gate for controlling the end/stop operations, and the signal from output pin #11 of U2 applied to Q3 puts the transport in the stop mode.

Input pin (13) of U2-11 is held at "L" via signals to input pins (9) and (8) of U2-10 during FF, REW or PLAY modes. On the other hand, although input pin (12) of U2-11 is at "H" during operation, it goes to "L" when the deck stops. As a result, both input pins (12) and (13) will be "L" thus making output pin (11) of U2-11 "H" which then switches ON Q3. This then makes input pin (2) of U1 to "L" and stops the deck.

The signal at input pin (12) of U2-11 changes in accordance to condition of magnetic resistance element DM-101. Terminals 3, 4, and 5 near Q1 are the connecting points for this element.

During operation of the deck, the rotating magnet affects the resistance element and its output current is amplified by Q1. The waveform thus obtained is corrected by D1, D2, Q2, inverter U3-10, rectified by D3 and D4 to make input pin (12) of U2-11 go to "H". In other words, this pin is always at "H" as long as the magnet is rotating.

When the tape comes to the end from FF and REW or PLAY, the magnet will stop rotating, the current stops fluctuating, thus switching OFF Q2, and U2 input pin (12) goes to "L". However, by effect of time constants C13 and R10, input pin (12) of U2 is delayed (1 ~ 2 sec.) in going to "L", after which Q3 switching circuit stops the transport. Refer to Fig. 4-1.

4-1-4 Short Term Boost Operation of Solenoids

This circuit is provided to assure positive action of the solenoids whereby a high boosting voltage of 24 volts is initially applied, then decreased to a constant 12 volts during operation of the deck.

As circuit function is the same for the PLAY and FAST/PAUSE solenoids, action of the PLAY circuit only will be explained.

This circuit consists of four transistors but Q10 and Q11 are the transistors which directly drive the solenoid.

When 24 volts is applied, the current flows through the emitter and collector of Q10 and Q11. For 12 volts, Q10 is switched off and the 12 volts applied via diode D11 and the emitter and collector of Q11.

In the standby mode, Q8 and Q10 are in the ON state. When the transistor is put in the PLAY mode, pin #11 of U4 goes to "H" thus switching on Q6. This then, switches on Q11 and 24 volts is applied. On the other hand, when Q6 is switched on, the collector potential of Q6 drops, and the voltage charged in C15 is discharged through R28 and base-emitter of Q8. After an elapse of time determined by C15 and R28, Q8 switches off thus switching off Q10. As Q6 is in the ON state, Q11 only is switched on, thus applying 12 volts to the solenoid. Refer to Fig. 4-2.

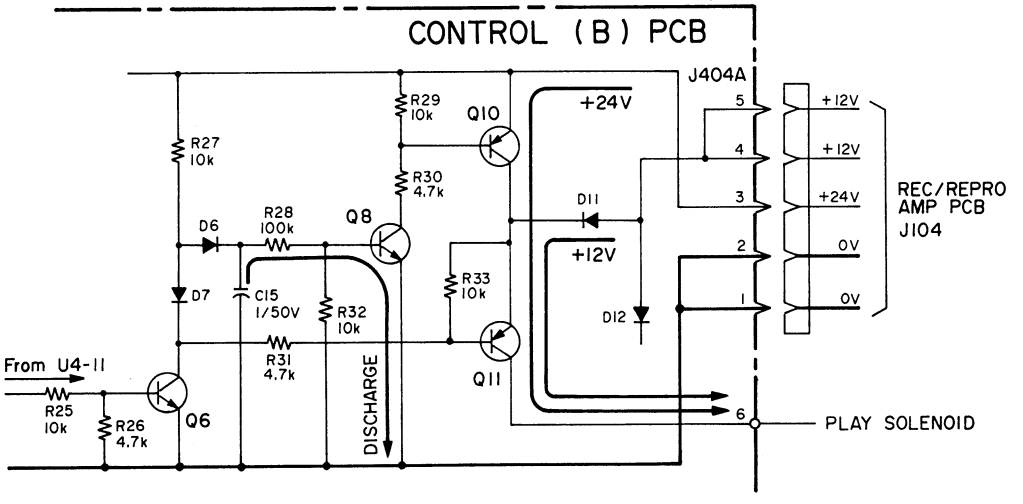


Fig. 4-2

4-1-5 Forward and Reverse of the Reel Motor;

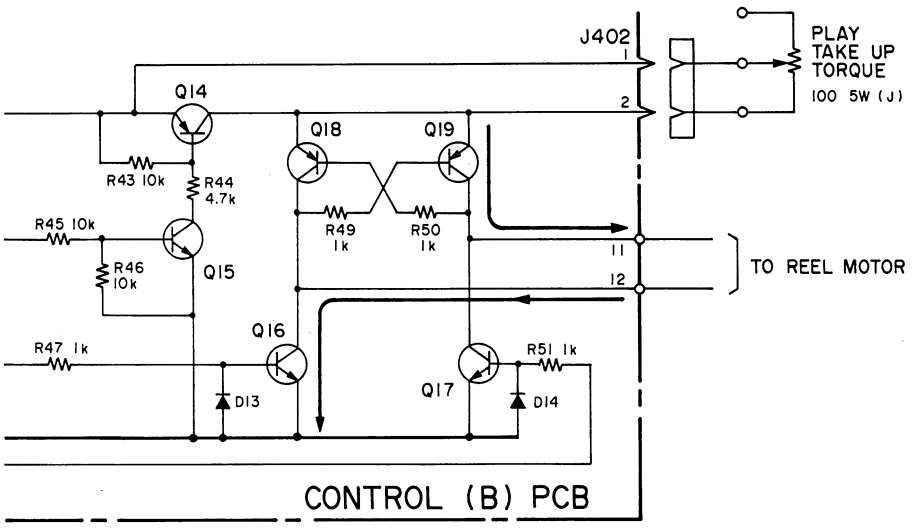


Fig. 4-3

Forward and reverse rotation of the reel motor is done by alternately switching Q16 and Q17 on and off. At forward rotation, when Q16 switches on, base potential of Q19 drops thus switching on Q19. In this state, the current flows through the emitter-collector and applied to the motor via terminal (11), returns via (12), and through the emitter-collector of Q16. This direction of flow rotates the motor in forward. In the opposite state, Q17 and Q18 are switched on and the motor rotates in reverse.

In the FF and REW modes, an "H" level is applied to the base of Q15 to switch it on, and this in turn switches on Q14. The Q12 volts applied to the emitter of Q14 then passes on to the emitters of Q18 and Q19, and on to the motor.

In the PLAY or REC modes, Q14 is switched off, the voltage applied through an external resistor to the emitters of Q18 and Q19, thus supplying the motor with a lower voltage. Consequently, takeup torque is adjusted by changing the voltage to the motor by the adjustable external resistor. Refer to Fig. 4-3.

The overall flow of circuit function are explained in the following.

4-1-6 PLAY mode

When the PLAY button is depressed, pin (1) of U1 goes to "L", pin (12) to "H", inverted to "L" by inverter U3, and applied to pin (6) of U2. As pin (5) of U2 is normally at "L", this is ANDed with the "L", to pin (6) thus producing an "H" from pin (4) of U2. This "H" signal applied to OR gates U4 (11) and U4 (3) sets their outputs (11) and (3) to "H", thus switching on transistors Q6 and Q16. This action, in turn, activates the PLAY solenoid and drives the motor.

Also, when the REC control button is depressed, input pin (7) of U1 goes to "L", output pin (10) of U1 to "H", which in turn activates the recording circuit in the Control (A) PCB. Refer to Fig. 4-1. This operation is shown diagramatically as follows:

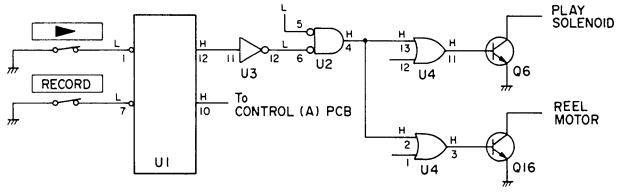


Fig. 4-4

4-1-7 FF (Fast Forward) Mode

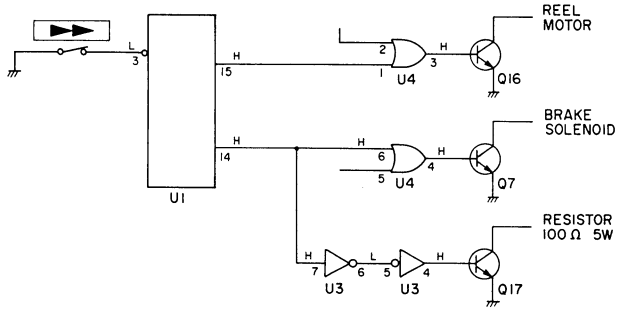


Fig. 4-5

4-1-8 REW Mode

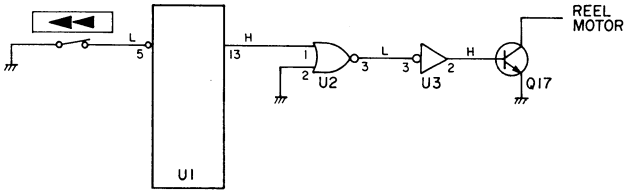


Fig. 4-6

4-1-9 PAUSE Mode

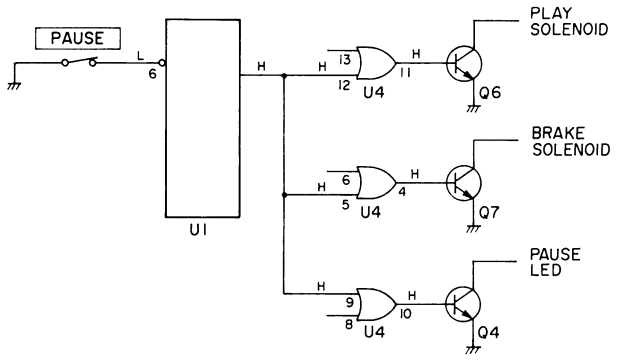


Fig. 4-7

4-1-10 REC Indicating LED (Light Emitting Diode)

When the REC button is depressed, input pin (7) of U1 goes to "L" and output pin (10) goes to "H". This "H" passing through connector J405-2, goes through U2-4, U2-10, and U8-11 in the Control (A) PCB. It then returns through J405-3, of Control (B), applied to the base of Q5 to switch it on, thus lighting the LED. Refer to attached circuit diagrams for Control (A) and Control (B) PCB's.

4-2 CONTROL (A) PCB CIRCUIT

As the function of the RECORD SELECT buttons and circuit operations are the same for all tracks from 1 through 4, the section for track 1 only will be explained. Other operations will be explained in the overall circuit.

4-2-1 Basic Function of the RECORD SELECT Buttons

When the RECORD SELECT 1 button is depressed, the playback amplifier for track 1 will be muted and mute on the record amplifier will be cancelled. In addition, the head is connected to the record amplifier by the head select relay, and the bias oscillator activated.

As U1 [Control (A) PCB] is a NAND gate, input pins (12) and (13) goes to "H" and thus output pin (11) goes to "L". When the transport is put in the REC mode, output pin (10) of U1 [Control (B) PCB] goes to "H" and this signal is applied to input pin (12) of U1 [Control (A) PCB] via connector J305-2. The other input pin (13) goes to "H" when the RECORD SELECT button is depressed. This drives output pin (11) of U1 to "L". In other words, the circuit is put in the REC mode when both the RECORD SELECT and REC buttons are depressed.

When the output of U1-11 goes to "L", the output of U7-10 also goes to "L", and this in turn activates Q101 and Q102 in the Record/Playback Amplifier PCB Assembly thus muting track 1 of the playback amplifier. On the other hand, the U1-11 output signal applied to R13 is slightly delayed by R13 and C5, passed through R14, U3-8 and fed to input pin (3) of U10-2, input pin (5) of U10-4. and input pin (2) of U8-3. As a result, the output of U10-2 goes to "L", switching off Q501 and Q502 in the Record/Playback Amplifier PCB Assembly which in turn cancels muting of this amplifier. At the same time, the output signal from U10-4 switches ON Q901 to activate the head relays K1 and K5. Also, the signal applied to input pin (2) of U8-3 makes input pin (8) of U6-10 to "H", and since input pin (9) of U6-10 is also at "H", the output of U6-10 goes to "H" thus activating the bias oscillator. activating the bias oscillator.

R23 and C9, located before input pin (8) of U7-10, are for preventing clicks, when recording is cancelled, by introducing a slight delay in releasing the playback amplifier muting. Refer to Fig. 4-8.

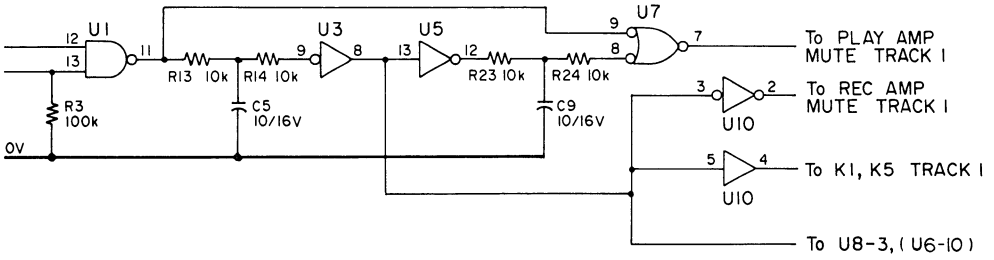


Fig. 4-8

4-2-2 RECORD Indicating LED

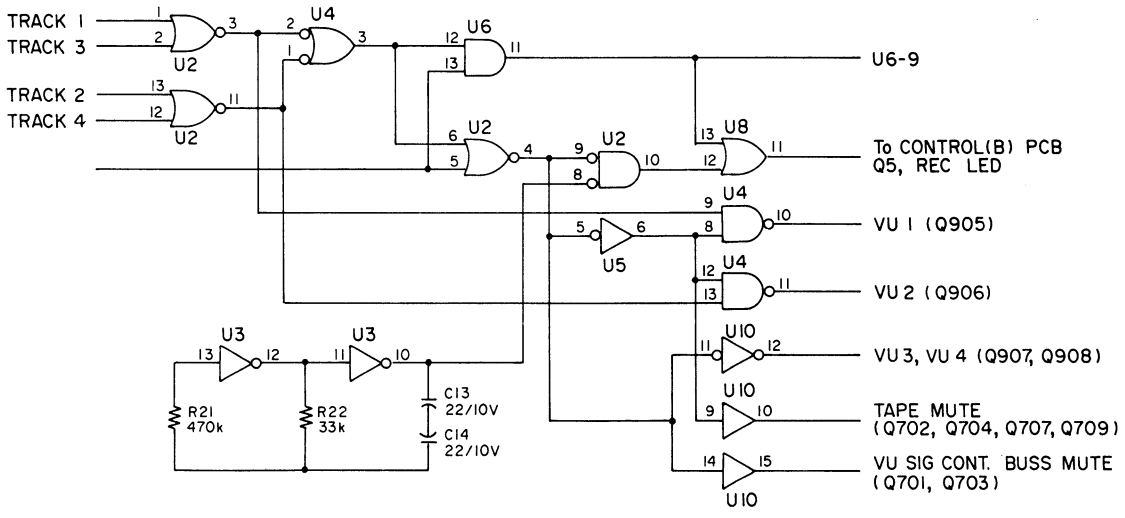


Fig. 4-9

AND U6-11 is the gate for lighting the LED during the REC mode, and the output of this gate is passed through U8-11 to light this LED located near the RECORD button. Blinking of the LED to indicate REC standby is gated by NAND U2-10 whose output also passes through U8-11 before it is applied to the LED.

To light the LED in the REC mode, input pins (12) and (13) of U6-11 must be "H". When the deck is put in the REC mode, the "H" signal from pin (10) of U1 in the Control (B) PCB, comes in through J305-2 and applied to pin (13) of U6-11. In the meantime, if the RECORD SELECT switch is closed, input pin (12) of U6-11 goes to "H". In other words, with the RECORD SELECT depressed, depressing the REC button will light the record LED.

The blinking signal to indicate REC STANDBY is obtained from the oscillator consisting of U3-12 and U3-10. As this oscillator is operating continuously, a blinking signal is constantly applied to input pin (8) of U2-10. As U2-10 is a NAND gate, the blinking signal is output from pin (10) when input pin (9) goes to "L". This "L" signal is obtained whenever either input pin (6) or (5) of NOR gate U2-4 goes to "H". In other words, the LED will blink whenever the transport is put in the REC mode or any one of the RECORD SELECT button is depressed. Refer to Fig. 4-9.

4-2-3 VU Meter Selection

In the normal state, switching transistors Q905, Q906, Q907 and Q908 (Rec/repro amp PCB) for controlling the VU meter lamps, are on and all the lamps are lighted which means that output pins (10) and (11) of U4 and output pin (12) of U10 [Control (A) PCB] are at "H". When track 1 or track 3 of the RECORD SELECT button is depressed, output pin (4) or NOR gate U2-4 goes to "L" and this signal, after passing through buffer amplifier U10-12, switches off Q907 and Q908 (Rec/Playback amp PCB) thus turning off the VU meter lamps of tracks 3 and 4. At the same time, the "L" signal after passing through the buffer amplifier U10-15, cancels muting by Q701 and Q703 in the Record/Playback amplifier PCB, thus applying the BUSS signal to VU meters 1 and 2 (BUSS L and R).

On the other hand, the "L" signal from U2-4 passing through inverter U5-6 changes the "L" applied to input (12) of U4-11 to "H". Therefore, as input pin (13) of U4-11 is at "H", the output goes to "L" thus switching off Q906 and turning off the lamp of VU 2. At the same time, as the signal passing through buffer U10-10 goes from "L" to "H", it activates transistors Q702, Q704, Q707, and Q709 in the Record/Playback amplifier PCB thus muting all signals to the VU meters. Refer to Fig. 4-9.

The lamp in VU meter 1, on the other hand, remains lit as Q905 will stay ON because even though input pin (8) of U4-10 changes to "H", input pin (9) changes from "H" to "L", and the output of U4-10 will remain at "H".

When the RECORD SELECT button for track 2 or 4 is depressed, VU meter 1 is switched to VU meter 2 but the mute circuit will operate in exactly the same way as if the RECORD SELECT button for track 1 or 3 were assigned.

5 MAINTENANCE

5-1 ROUTINE MAINTENANCE

5-1-1 Cleaning

a) Head

With constant use, the head surface becomes soiled with magnetic particles from the tape, dirt and dust. Under such conditions, the tape will not always be in smooth contact with the head resulting in poor performance.

Less output in the high region and drop out (some parts of the sound not being reproduced) are typical symptoms. It is therefore recommended to clean the heads periodically before recording and playback to avoid such troubles.

b) Capstan and pinch roller

Buildup of magnetic particles and dust on these parts will cause increase of wow, flutter and wrapping of tape on the capstan. Thus, these parts must also be kept clean.

Cleaning is done with cotton buds (Q-tips) moistened with TEAC TZ-261 Tape Recorder Cleaner Fluid. Never use thinners, acetone or other organic solvents. Fluid "A" of TZ-261 must be used on the heads and capstan, and fluid "B" on the rubber pinch roller.

5-1-2 Demagnetizing

The rec/play head becomes magnetized with extended use or when the head is touched with a magnetized object. As a result, frequency response (especially in the high region) will deteriorate, noise level increases, and in some cases may transfer noise to valuable prerecorded tapes. For this reason, do not touch the head with magnetized screwdrivers and scissors or allow DC current to flow through the head such as when testing head continuity with a circuit tester.

Should the head become magnetized, demagnetize it with a head eraser (TEAC Model E-1 or E-3 Head Demagnetizer).

Demagnetizing procedure

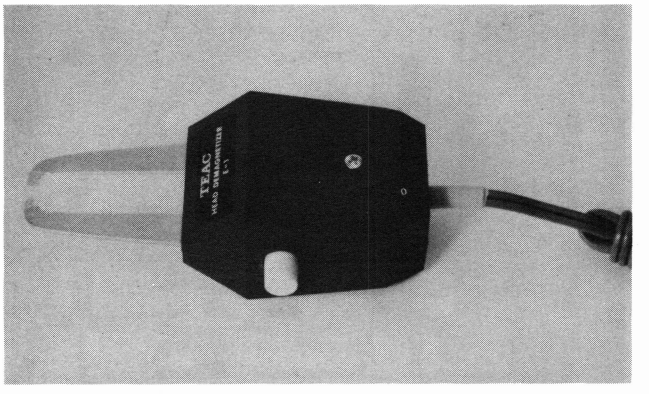
1) After turning off power to the Model 144, open the cassette door and if a cassette is loaded, remove it and place far away from the deck.
2) Switch on the head eraser while holding it about one meter away from the Model 144, slowly move the eraser tip to the head and slowly wave the tip up and down several times close to the head surface.
3) On completing the above procedure, slowly draw the demagnetizer away from the head and switch off the demagnetizer when it is more than one meter away from the head. As magnetizing of the head cannot be seen, unlike a soiled head, routine demagnetizing is necessary. It is recommended to do so at the same time the head is cleaned.

5-1-3 Record Test

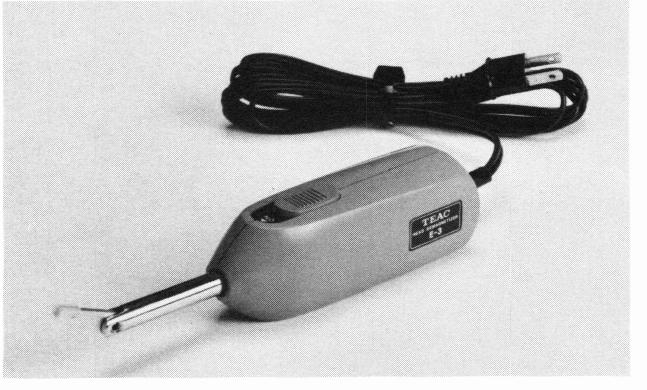
1) Apply a -10dB (0.3V, 315Hz) signal to AUX IN (L and R). Set the AUX RCV knob to maximum and adjust the MASTER fader for a 0VU ±1VU reading on each VU meter.
   When recording on tracks 1 and 2, switch on RECORD SELECT buttons 1 and 2, and read the BUSS L and BUSS R meters; when recording on tracks 3 and 4, switch on RECORD SELECT buttons 3 and 4, and read the BUSS L and BUSS R meters.
2) Record the above signal, depress both REC OFF of the RECORD SELECT buttons, playback the recorded signal and check the VU meters for a reading of 0VU ±1VU.
   Meters TRK 1 and TRK 2, when tracks 1 and 2 are played back; and TRK 3 and TRK 4, when tracks 3 and 4 are played back, are checked for the above reading.
   Refer to Item 5-11-9 (page 26) when checking recording response, S/N ratio, etc. and Item 5-11-10 (page 26) Overall S/N Ratio when checking the overall frequency response.

5-1-4 Maintenance Accessories

TZ-261 Tape Recorder Cleaner



E-1 Head Demagnetizer



E-3 Head Demagnetizer

5-2 DISASSEMBLY OF MAJOR PARTS

Sometimes it is difficult to see how to disassemble the parts. The following explains how to remove the major parts.

For detailed disassembly instructions, refer to the Exploded VIEW-1 (page 29, 30).

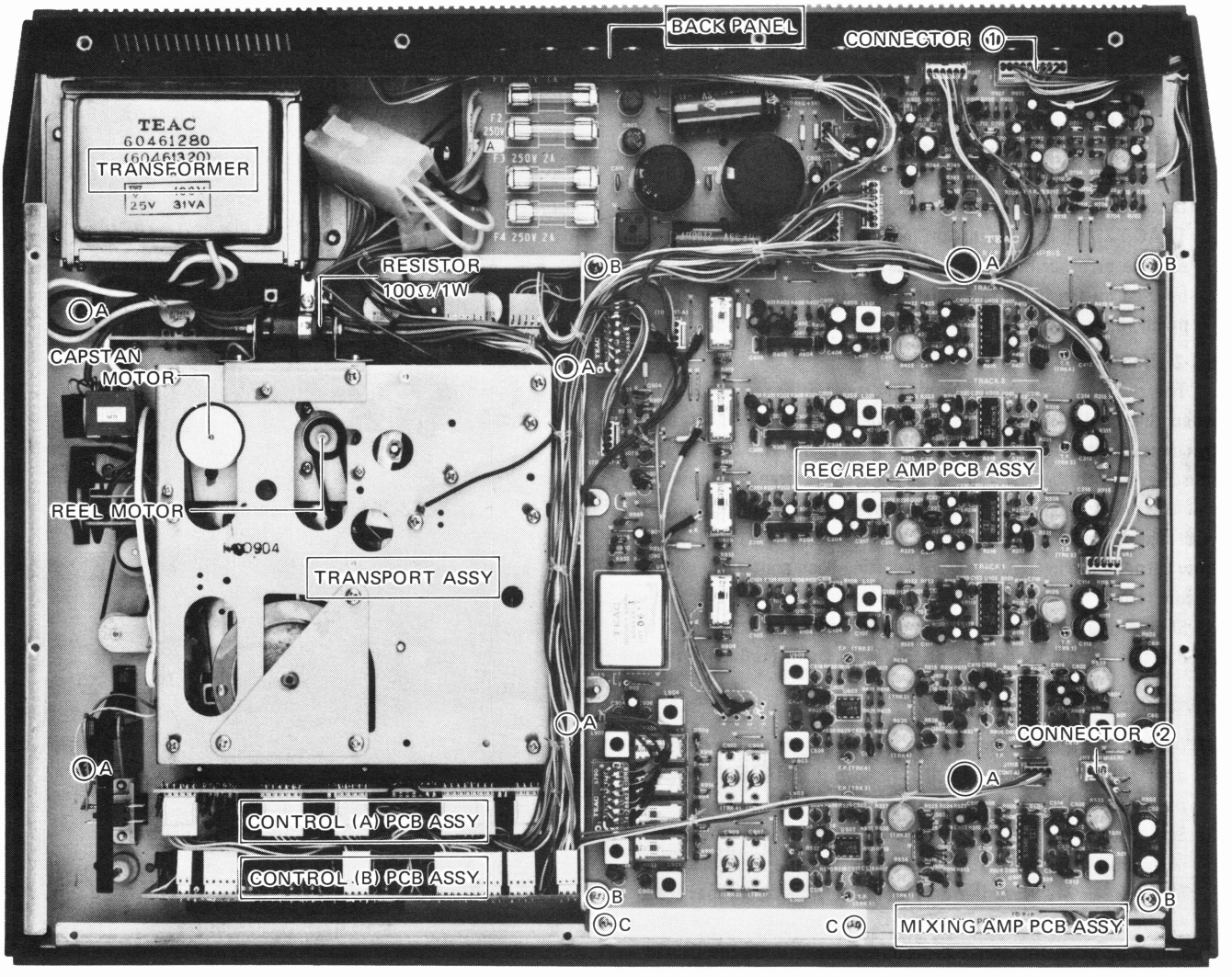


Fig. 5-2-1

5-2-1 Bottom Cover

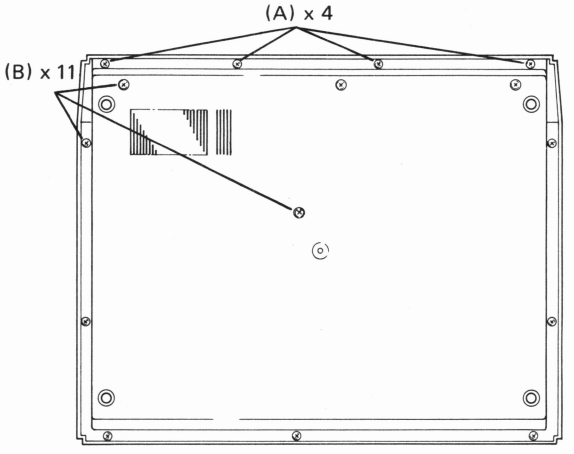


Fig. 5-2-2

NOTES: a) Two types of screw are used to secure the bottom cover. When re-installing the bottom cover, be sure to install the same screws in the same place. Fig. 5-2-2.
b) The four rubber feet on the bottom cover need not be removed.

5-2-2 Trim Cover Assembly

1) Remove the bottom cover and pull off the four channel fader knobs and the master fader knob.
2) Remove the six washer head taptite screws from the rear side. Fig. 5-2-1, circled screws (A mark)

NOTES: a) The screws behind the Record/Play Amp. PCB can be easily removed if the screwdriver is magnetized.
b) If the Trim Cover Assembly is to be removed completely, disconnect the cable harness connector ① leading from the VU meters. Fig. 5-2-1
c) When installing the Trim Cover Assembly, be careful not to scratch the knobs and buttons on the front panel. Especially, the DOOR knob is loose and should be aligned in the same position as the other control buttons.

5-2-3 Record/Play Amplifier PCB Assembly

1) Refer to Fig. 5-2-1.
2) Take off the bottom cover and remove the four screws (B mark) securing the record/play amp. PCB assembly. Disconnect the cable harness and the cover can then be removed completely.
3) If you need only to inspect the PC pattern on the rear side, the right hand side can be lifted by removing the screws and disconnecting cable harness connectors ① and ②.

5-2-4 Mixer Amplifier PCB Assembly

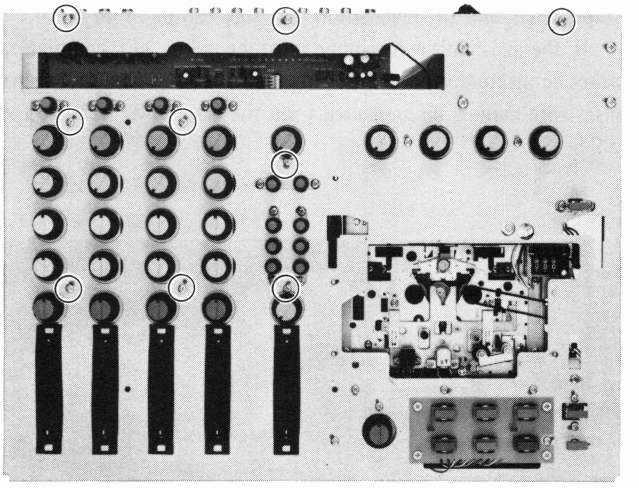


Fig. 5-2-3

1) Remove the bottom cover, trim cover ass'y, and the rec/play amp. PCB assembly.
2) Remove the screws (c mark) on the rear side (Fig. 5-2-1), and screws on the front side (Fig. 5-2-3). If it is for checking or replacing parts of the PCB, it is recommended to do so with the rear panel attached.

NOTE: Always switch off the power at disassembly as components will become loose. Be careful not to scratch the buttons or damage other parts during disassembly.

5-2-5 Control (A) and (B) PCB Assembly

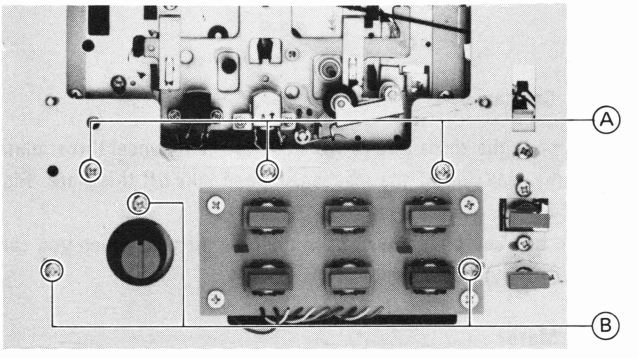


Fig. 5-2-4

1) Refer to Fig. 5-2-4.
2) The Control (A) PCB Assembly can be removed by disconnecting its cable harness and removing the front screw Ⓐ.
3) The Control (B) PCB Assembly can be removed by disconnecting its cable harness and removing the front screw Ⓑ.

5-2-6 Mechanism Assembly

Remove bottom cover, remove the six screws (A) holding the mechanism assembly, disconnect the connector (a) on the memory stop switch, and the mechanism assembly can be lifted out.

If the mechanism assembly must be taken out completely, other connectors (b) ~ (e) should be disconnected and the mechanism wire harness disconnected from the main unit. Refer to Fig. 5-2-5.

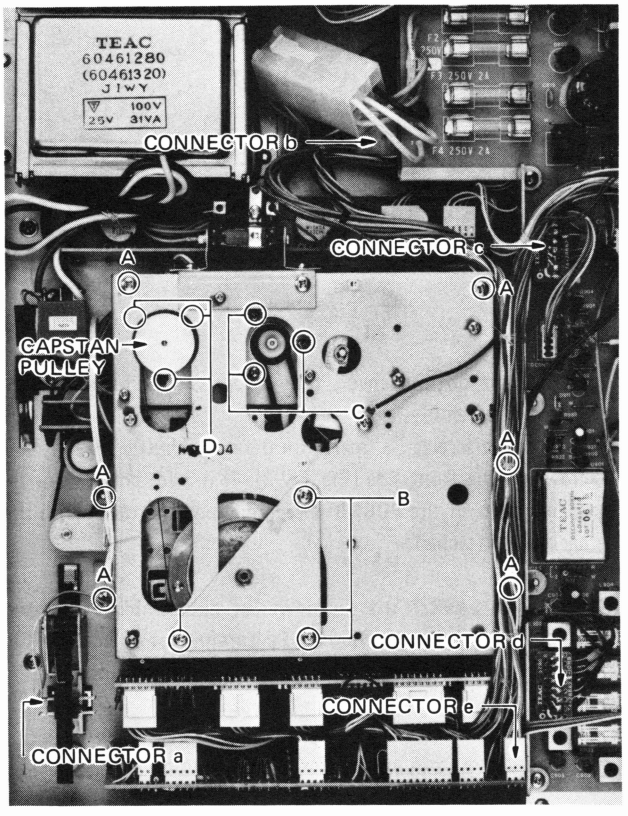


Fig. 5-2-5

5-2-7 Capstan Belt

1) Remove the three screws (B) holding the flywheel thrust plate at the rear side of the mechanism, and take off this plate. Fig. 5-2-5.
2) The belt can be removed from the hole through which you can see the flywheel.

5-2-8 Motor

1) Refer to Fig. 5-2-5.
2) Remove the reel motor by the procedure in Item 5-2-6 and take off the three screws (C) securing the motor.
3) After lifting out the mechanism assembly, remove the capstan motor by first taking off the capstan pulley and then taking off the three screws (D) securing the capstan motor.
   To take off the capstan pulley, use a small flat blade screwdriver.

5-2-9 Heads

1) Remove the head cover using a crab-eye driver.
2) The head will be more accessible if the head base is fixed in the operating position Fig. 5-2-6.

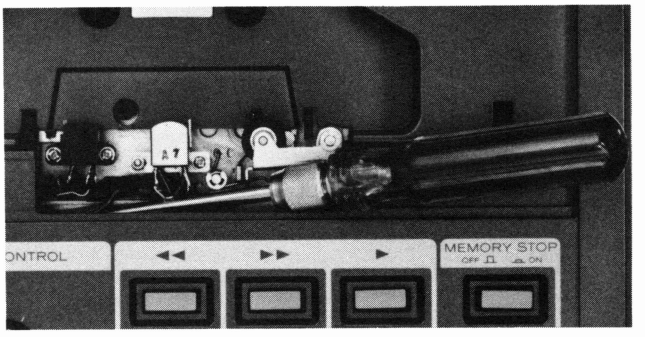


Fig. 5-2-6

5-2-10 Transformer

1) Remove the bottom cover and trim cover assembly.
2) Remove the four screws securing the transformer from the front side of the main unit chassis.

5-3 ADJUSTING TOOLS AND EQUIPMENT

The special tools and equipment required for adjusting the Model 144 are as follows:

1) Head Height Adjusting Jigs –
   Check base plate jig — TEAC Parts No. 5030610000
   Tape guide, pinch roller jig — TEAC Parts No. 5030613000
2) Linear Tension Gauge — 0 ~ 500gms. (0 ~ 17.6oz.)
3) Torque Meter
   Cassette torque meter — 0 ~ 100g-cm (0 ~ 1.39oz-in.) SONY Corp. TW211
   Cassette torque meter — 0 ~ 160g-cm (0 ~ 2.22oz-in.) Silver Co. SRK-160
4) Crab Eye Screwdriver
5) Mirror Type Cassette — TEAC MTT-902T (C-90) Parts No. 4900015220 (Internal use)
6) Test Tapes
   TEAC MXT-111 (Flutter, 3kHz, -10dB) TEAC Parts No. 4900002220 (Internal use)
   TEAC MXT-112 (Level, 315Hz, 0dB) TEAC Parts No. 4900002320 (Internal use)
   TEAC MXT-116 (Frequency, 31.5Hz~14kHz, -10dB) TEAC Parts No. 4900002320 (Internal use)
7) Blank Tape
   TEAC MTT-5061 (Bias/Eq., CrO_2) or equivalent TEAC Parts No. 4900015000

In addition to the above, general measurement tools, etc., are needed as follows:

Wow-flutter meter, frequency counter, AF oscillator, AC voltmeter, decade attenuator, distortion meter, oscilloscope, bandpass filter, 8ohm/1 watt dummy load, head eraser TEAC E-1 or E-3, Cleaner fluid TEAC TZ-261, Lubricant TEAC TZ-255.

5-4 TAPE TRAVEL CHECK AND ADJUSTMENT

Using a mirror tape, check to see that the tape is running stably without curling and touching the tape guides on the erase and rec/play heads.

If there is curling of the tape affecting the response or damaging the tape, it is necessary to check the head guide height, perpendicularity of the head face, and alignment of the pinch roller in relation to the capstan. Mirror tape and Head Height Adjusting Jig are required for checking.

To check the head guide height, the tape is replaced with the head height check jig, which is put on the base.

While firmly seating the jig on the surface of the base, slide the jig past each head guide to check if it goes through without hitting them. Using the rear check bar of the jig, also check perpendicularity of each head face. If the guide is low, insert the required amount of 0.1 or 0.2mm thick washers under the head mounting legs.

NOTE: Always adjust the head azimuth when the head height is adjusted.

5-5 Check and Adjusting of Head Azimuth and Phase

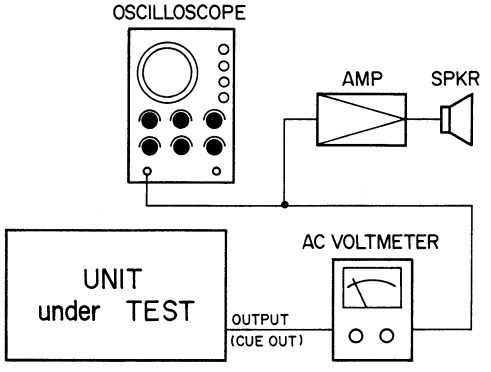


Fig. 5-5-1

1) Playback the test tape (TEAC MXT-116) in same manner as in checking of TAPE CUE OUT, Item 5-10-4.
2) After making a rough adjustment at 315Hz, precisely adjust with a 12.5kHz signal. For phase checking, the peak level figures are taken but be careful to set the TAPE CUE knobs of both tracks to the same position when using CUE OUT for checking.

NOTE: Set the knob for channel to be checked only: others are set to scale "0".

In the Model-144, tracks #1 and #3 (or #2 and #4) are checked but be careful to note the following.

NOTE: The head wiring between adjacent tracks are connected in opposite phase to improve crosstalk.

Head connections

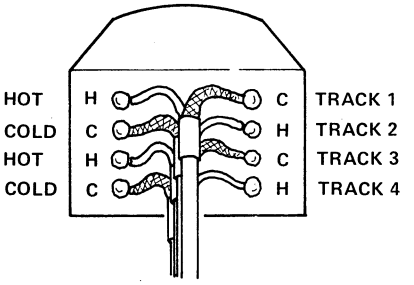


Fig. 5-5-2

Therefore, when the test tape played back, signals from tracks 1 and 2 will be in opposite phase but tracks 1 and 3 (or tracks 2 and 4) in the same phase.

When recorded and played back by the same Model 144, the signals between each track will be in the same phase as usual but crosstalk between tracks will be much better.

5-6 Tape Speed Adjustment

A. Specifications
- Speed tolerance : 3,000Hz, ±60Hz
- Speed deviation range : Within 60Hz
- Pitch control range : *Minimum 2,250Hz ~ 2,550Hz
  Maximum 3,450Hz ~ 3,750Hz

B. Level setting
- TAPE CUE OUT : -10dB (3,000Hz, 0dB = 1V)
- TAPE CUE knob : Scale 7 (any track)
- Pitch control knob : Standard speed at center [0] click-stop position

[*] Tape speed is minimum at full CCW of pitch control knob and maximum at full CW.

- Test tape : MXT-111

C. Signal route : Refer to Fig. 5-10-3

D. Connecting diagram

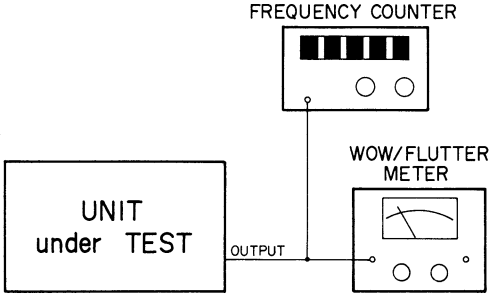


Fig. 5-6-1

E. Adjusting steps

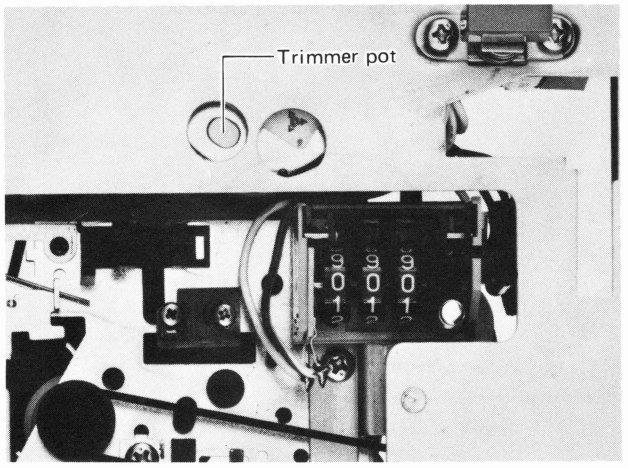


Fig. 5-6-2

1) Take off bottom cover and trim cover assembly as explained in Item 5-2.
2) Tape speed is adjusted by playing back the test tape with the pitch control knob at center [0].
3) Adjust the trim pot in the capstan motor with a small flat blade screwdriver. Fig. 5-6-2

NOTE: Do not trim the pot in large increments.

5-7 WOW-FLUTTER CHECK

A. Specification Less than 0.1% (WTD)
B. Level setting
TAPE CUE OUT : -10dB (0.3V)
AUX IN : -10dB (3,000Hz)
TAPE CUE knob : Scale 7 (any track)
AUX RCV knob : Maximum
MASTER fader : Between scale 7 and 8
RECORD SELECT button : In RECORD on desired track
Recording tape : MTT-506 (C-60) or equivalent
C. Connecting diagram Refer to Fig. 5-6-1
D. Check
Record the signal applied to AUX IN, play it back, and check the TAPE CUE OUT.

5-8 TAKEUP TORQUE CHECK AND ADJUSTMENT

5-8-1 Takeup Torque at Play and Record

A. Specification : 40 ~ 60g-cm (0.56 to 0.83oz-inch)
B. Cassette torque meter: SONY TW 211
C. Check and adjusting
1) A cassette torque meter is used in place of the tape and measured in the PLAY mode.
2) The ceramic resistor on the transport is adjusted. Torque will decrease as the sliding contact is moved to the left and increase as it is moved to the right. Refer to Fig. 5-8-1.

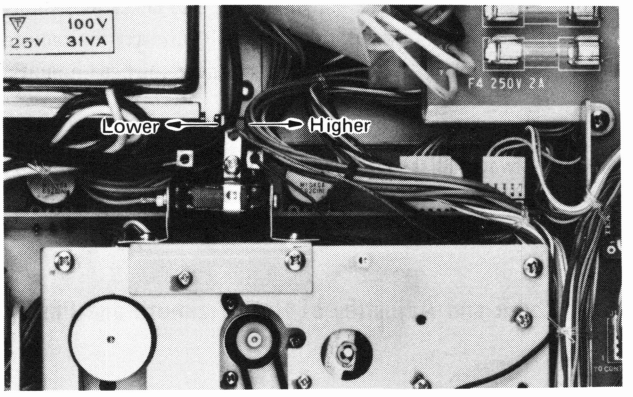


Fig. 5-8-1

5-8-2 Takeup Torque in Fast Forward and Rewind

A. Specification : 80 ~ 160g-cm (1.11 to 2.22oz-inch)
B. Cassette torque meter: SRK-160
C. Check and adjusting
1) Using a cassette torque meter instead of the tape, the start-up torque is measured in a condition as if at the end of fast forward or rewind.
2) If motor torque is low but voltage to the motor is correct at 10 ~ 15 volts, first check the reel motor, F. FWD reel turntable assembly, belt, and the torque transmission system.

5-9 CHECK OF PINCH ROLLER CLOSING PRESSURE

A. Specification : 200 ~ 350gms
B. Linear tension gauge : Max. 500gms (17.6oz)
C. Check process
While in the PLAY mode, hook a tension guage on the pinch roller shaft and after pulling the pinch roller away from the capstan to a distance of about 2mm, allow the pinch roller to touch the capstan again. Measure the tension at the instant the pinch roller touches the capstan.

5-10 SIGNAL AND RESPONSE CHECK OF THE MIXER

5-10-1 AUX IN → LINE OUT (AUX OUT), HEADPHONES

Inject a reference signal at AUX IN, set the MASTER fader in the shaded position, and check for the reference signal at each output.

The settings and signal levels should be as follows:

Levels

AUX IN, LINE OUT (L, R): -10dB (0.3v)

HEADPHONES (L, R) : Max. -1dB ±1dB (0dB = 1V) for an 8 ohm load

Setting

AUX RCV knob : At maximum

MASTER fader : Between 7 and 8 of scale

REMIX button : ON

BUSS MONITOR knob : At scale 8 (knob at max. gives max. headphone output)

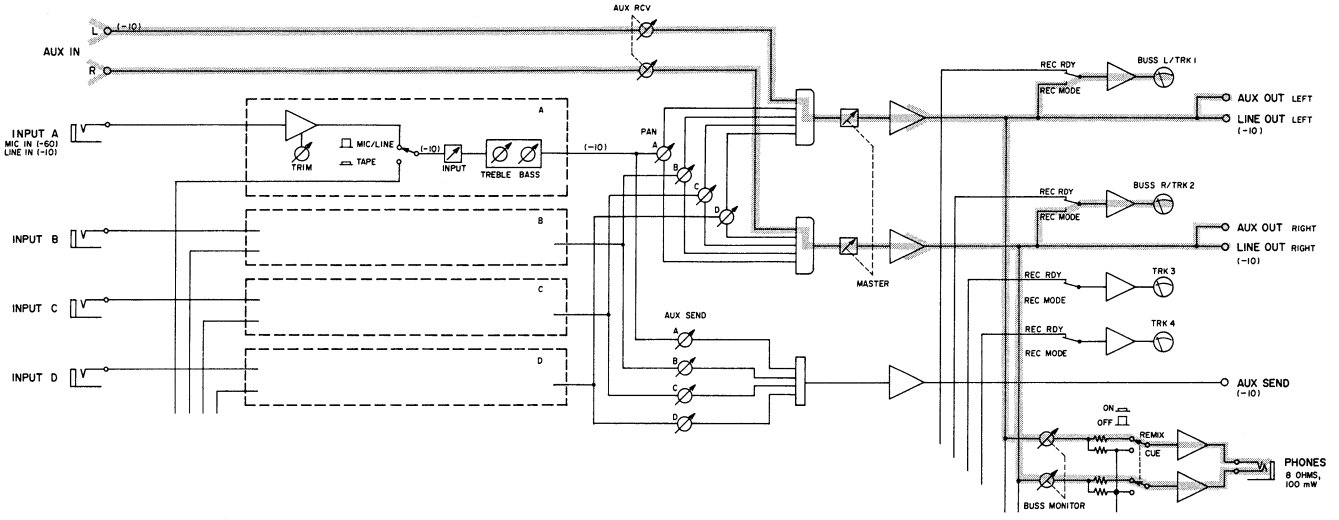


Fig. 5-10-1

5-10-2 MIC/LINE → LINE OUT (AUX OUT)

Set the outputs as in Item 5-10-1, inject a reference signal to MIC/LINE, set the INPUT CHANNEL fader to the standard position, and check for a reference signal at the output.

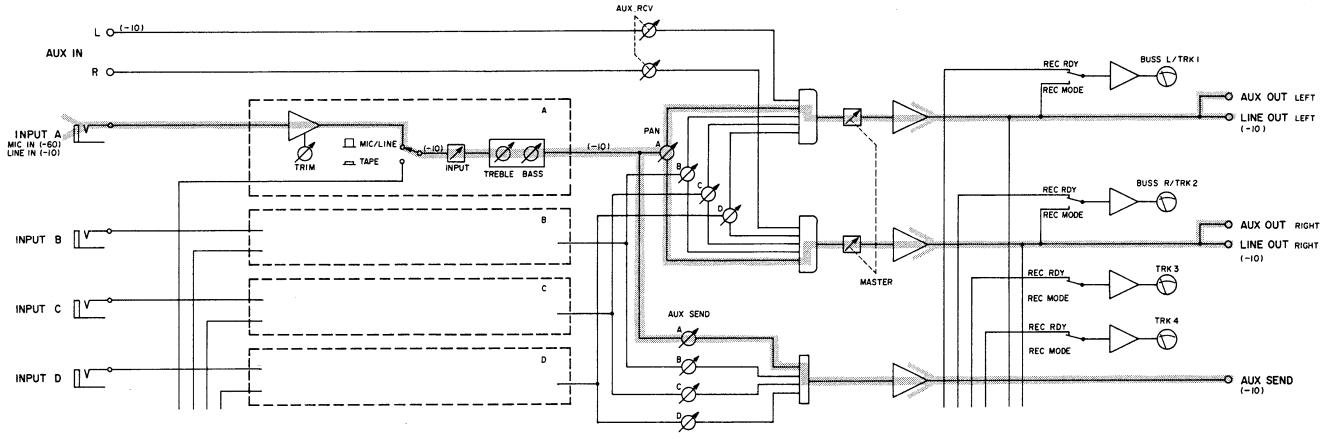


Fig. 5-10-2

The settings and signal levels should be as follows:

Levels

LINE IN (A, B, C, D)	: -10dB (0.3V)
(MIC IN)	: -60dB
LINE OUT (L, R)	: -10dB
(AUX OUT)	

Setting

MIC/LINE (A, B, C, D) and TAPE buttons	: MIC/LINE "up" position
TRIM (A, B, C, D) knob	: Maximum or minimum
Channel faders (A, B, C, D)	: between 7 and 8
TREBLE and BASS (A, B, C, D) knobs	: Scale "0"
PAN (A, B, C, D) knobs	: Scale "0"

5-10-3 LINE IN → AUX SEND

Inject a reference signal into LINE IN, set AUX IN knob to maximum, and check for the reference signal at the AUX SEND output terminal. Fig. 5-10-2.

Levels

LINE IN (A, B, C, D)	: -10dB (0.3V) 1kHz
AUX SEND OUT	: -10dB ±1dB

Setting

AUX SEND knob	: Maximum

NOTE: Set the knob for channel to be checked only; others are set to scale "0".

5-10-4 TAPE CUE OUT

The signal picked up from the tape passes through the playback amplifier, the Dolby circuit, and is sent to the various output circuits. With the TAPE CUE knob at the standard setting, check for the reference signal at the TAPE CUE output terminal. Signals to other outputs are sent via the route detailed in Items 5-10-1, -2, and -3. Fig. 5-10-3 shows the playback signal route for one channel only.

Level

TAPE CUE OUT	: -10dB (0.3V) ±2dB

Setting

MIC/LINE and TAPE buttons	: At TAPE ("down" position)
TAPE CUE button	: Scale 7

NOTE: Set the knob for channel to be checked only; others are set to scale "0".

Test tape

MXT-112 (315Hz, 0dB)

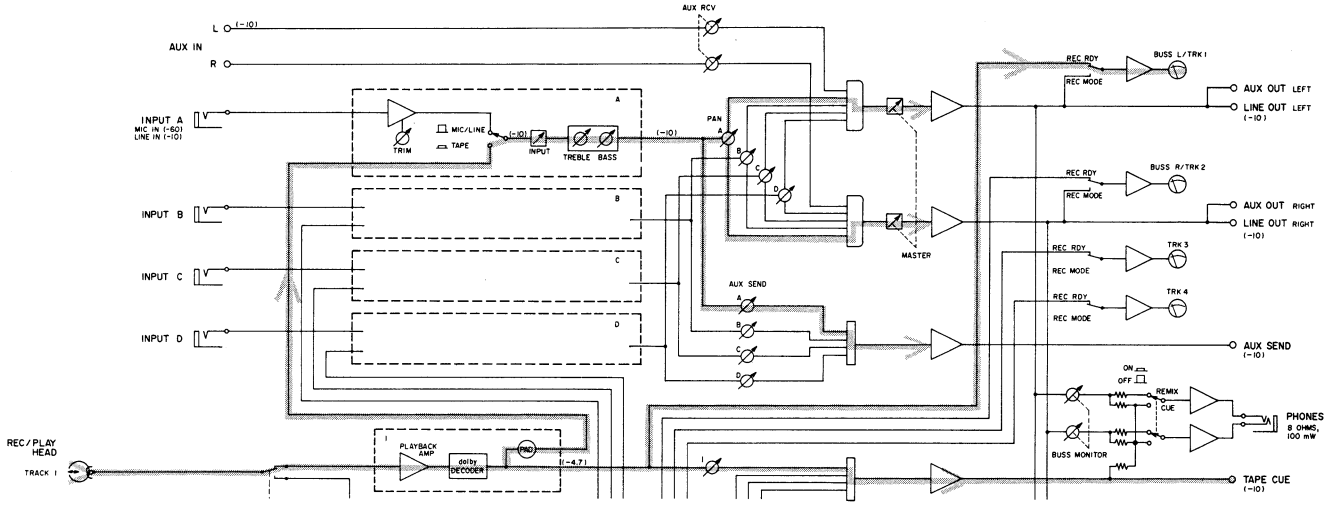


Fig. 5-10-3

5-10-5 Pingpong Recording

This is a process of mixing signals applied to AUX IN and MIC/LINE inputs with playback signals from a recorded track, then recording the mixed signals onto another track.

Fig. 5-10-4 is one example of the signal troute. One signal is applied to AUX IN, and in addition, the playback signal from track #1 passes through the playback amplifier chain, through the MIC/LINE switch, equalizer, split into two routes by PAN, and mixed with the AUX IN signals. Then, after going through the Dolby Encoder, switching ON RECORD SELECT buttons 2 and 3 records the signals onto tracks #2 and #3. Fig. 5-10-4 (page 22)

5-10-6 Frequency Response of Mixer Section

A. Specifications — Refer to Specifications Item 2 (MIC IN → LINE OUT)

B. Connecting diagram :

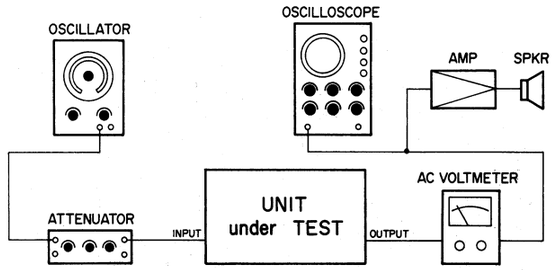


Fig. 5-10-5

C. Signal route : Fig. 5-10-2

D. Levels

AUX IN : -10dB (0.3V)
MIC/LINE (A, B, C, D) inputs : -60dB/-10dB
LINE OUT (AUX OUT) L, R : -10dB

Setting

MASTER fader : Between scale 7 and 8
MIC/LINE and TAPE
(A, B, C, D) buttons : MIC/LINE or OFF position
TRIM (A, B, C, D) knobs : At minium or maximum
TRIM knob will be set LINE at minimum or to MIC at maximum.
Channel faders (A, B, C, D) : Between scale 7 and 8
TREBLE and BASS
(A, B, C, D) knobs : At scale "0"
PAN (A, B, C, D) knobs : At scale "0"

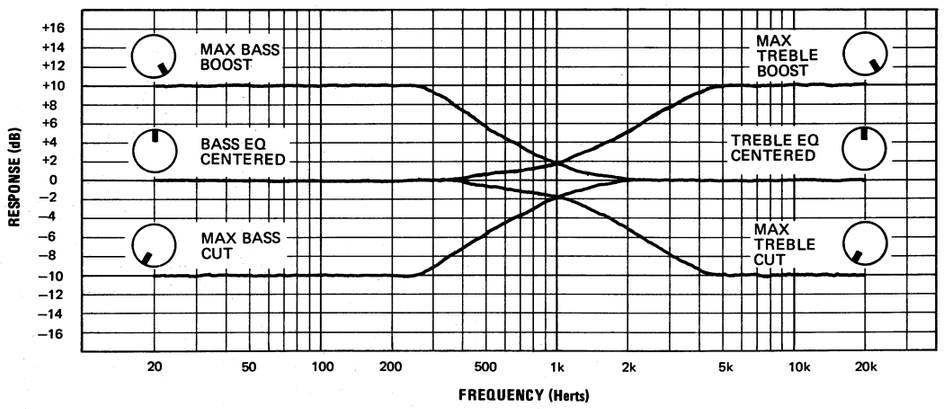
NOTES: a) Set the PAN knob, full CCW for L channel only; and full CW for R channel only.
b) The following equalization characteristics are obtained depending on the setting of TREBLE and BASS.

Specifications

TREBLE (at 10kHz)
Max. : +10dB ±2dB
Min. : -10dB ±2dB
BASS (at 100Hz)
Max. : +10dB ±2dB
Min. : -10dB ±2dB

E. Check procedure

1) Apply a reference signal to AUX IN (L, R) and set the MASTER fader so that a nominal level is obtained at LINE OUT. The AUX RCV knob must be at maximum during this measurement.
2) Apply a reference signal (-10dB, 1kHz) to the LINE input for the channel to be chekced, and set the channel fader for a nominal level from LINE OUT.
3) Change the input signal frequency and measure the LINE OUT (AUX OUT) output.



Equalizer Characteristics

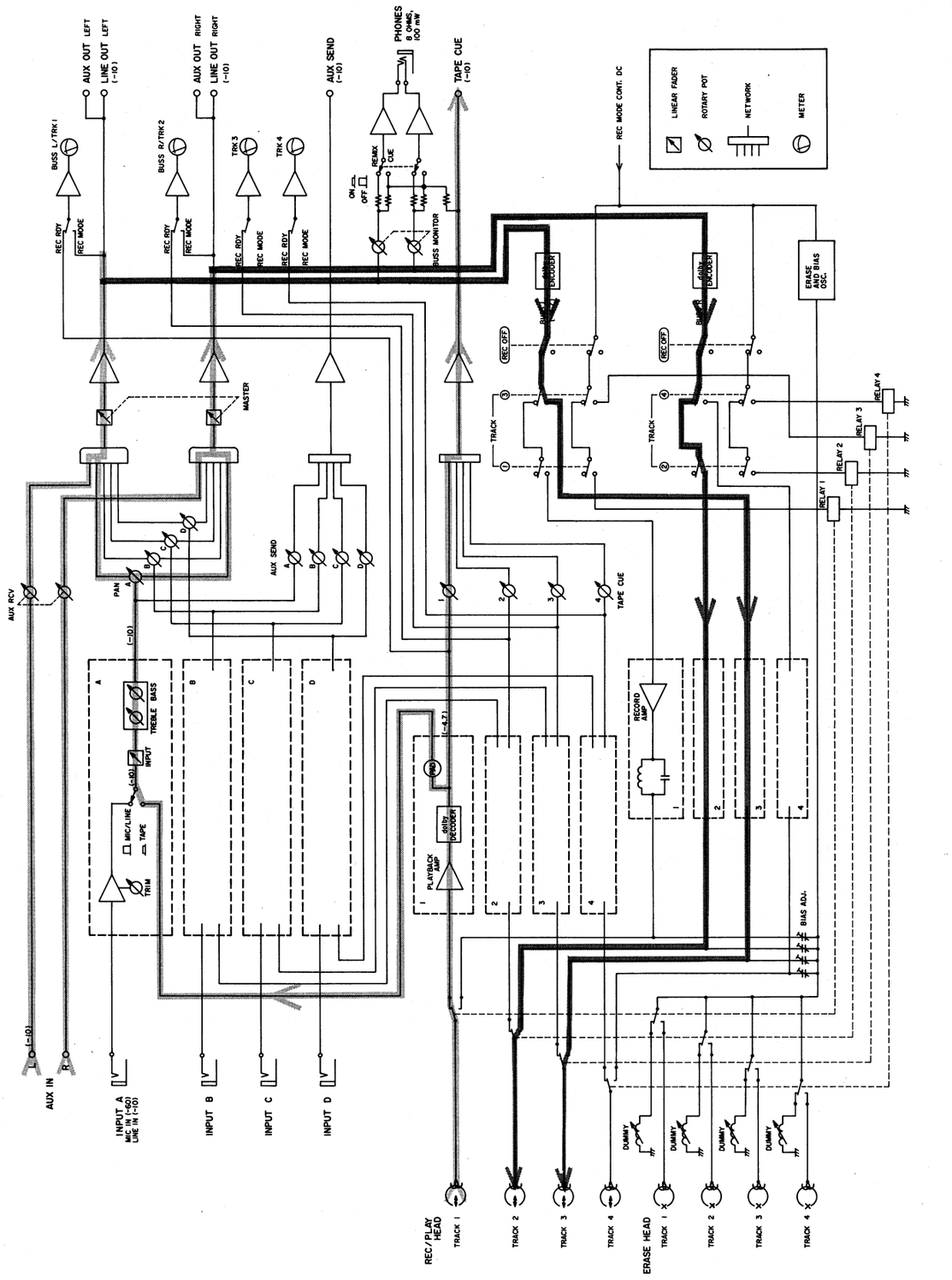


Fig. 5-10-4

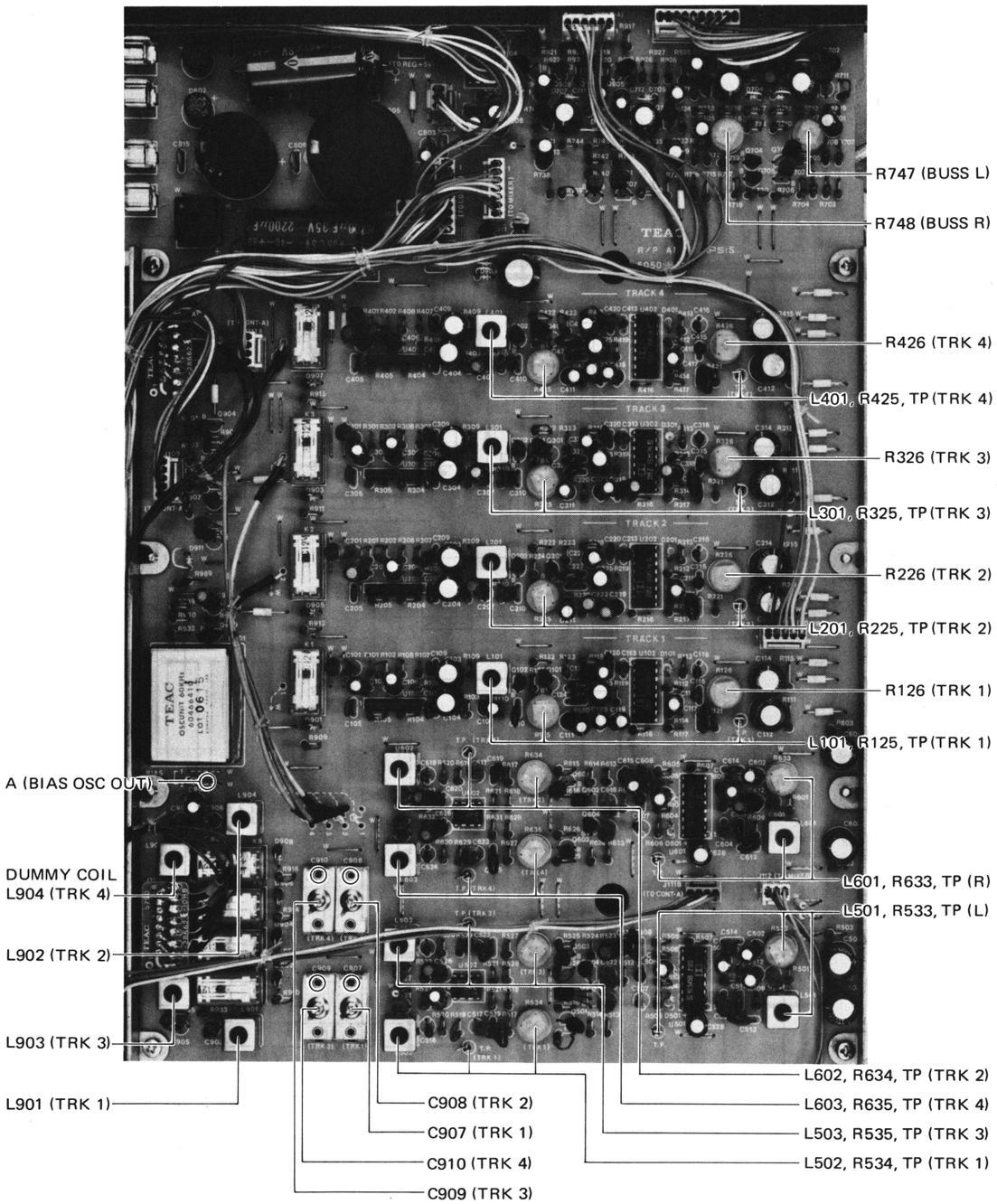


Fig. 5-11-1

5-10-7 S/N Ratio of Mixer Section

A. Specifications:
More than 62dB (UNWTD), 65dB (WTD) for MIC IN → LINE OUT
B. Connecting diagram, levels, and setting are the same as Item 5-10-6.
C. At the above setting and with no signal, the difference in level from the standard level is measured.

NOTE: Set all channel faders, other than the one to be checked, to zero.

5-11 CHECK AND ADJUSTMENT OF RECORD PLAY-BACK AMPLIFIER RESPONSE

5-11-1 Playback Dolby (Decoder) Level

1) With all RECORD SELECT buttons "up" (all VU meter lamps will be lit) playback test tape MXT-112 (315Hz, 0dB).
2) Connect a level meter to the TP (test point) of each track and check for a level of 580mV (-4.7dB, 0dB = 1V).
3) The level of each track is adjusted by trim pots R125, R225, R325, and R425.
4) Refer to Fig. 5-11-1.

5-11-2 VU Meters

BUSS R, L (Source)

A. Specifications : 0VU ±1VU (when LINE OUT is -10dB)
B. Levels
AUX IN (L, R) : -10dB (0.3V, 315Hz)
LINE OUT (L, R) : -10dB
Setting
AUX RCV knob : At maximum
MASTER fader : Between scale 7 and 8
RECORD SELECT
buttons : L, 1 or 3; R, 2 or 4
C. Check and adjustment
1) With all knobs and buttons set, apply a reference signal to AUX IN, set the master fader for -10dB (0.3V) level from LINE OUT (L and R), and check the VU meter reading.
2) To correct, adjust trim pots R747 and R748. Fig. 5-11-1.

Tracks 1, 2, 3, and 4 (playback)

A. Specifications : 0VU, ±1VU
B. Check and adjustment
1) With RECORD SELECT buttons OFF, playback test tape MXT-112 and check the VU meter readings.
2) To adjust to 0VU, trim pots R126, R226, R326, and R426 are adjusted. Fig. 5-11-1.

NOTE: These adjustments should be done after setting the playback Dolby (decoder) circuit levels.

5-11-3 Bias Oscillator Output Voltage

1) Connect a level meter to Check Terminal A (pin #4 of U901). Fig. 5-11-1.
2) The level should normally be 19V (RMS) for an oscillator voltage of about 60kHz.
3) Load a record test tape (blank tape) on the transport and depress any one of the RECORD SELECT button (REC OFF buttons must be up).
4) Then check the voltage with transport in record-PAUSE mode.

5-11-4 Dummy Coils

Dummy coils need no adjustment other than at the following:

*After erase head replacing.
*If the erase/bias oscillator voltage have changed.

These dummy coils prevent fluctuation of bias oscillator frequency and output level by keeping the bias oscillator load constant even when the RECORD SELECT buttons are depressed in various combinations.

In the same way as in Item 5-11-3, for the check procedure, a level meter and frequency counter is connected to the bias oscillator output terminal A, a test cassette loaded on the transport, and put in the PAUSE mode.
Dummy coil : Fi.g 5-11-1.

L901 (Track #1), L902 (Track #2)

1) Depress RECORD SELECT buttons for tracks #1 and #2, and put transport in the PAUSE mode.
2) Switch off track #1 to cancel the record mode. At this point, check the bias frequency, and if it changes, adjust L901 until it does not change when the record mode is cancelled.
3) The same procedure is also taken for L902 – put track #1 and #2 in the record PAUSE mode, cancel record mode of track #2, and adjust L902 until bias frequency does not change.

L903 (Track #3, L904 (Track #4)

4) Depress RECORD SELECT buttons for tracks #3 and #4, and put transport in the record PAUSE mode.
5) Switch off track #3 to cancel the record mode. At this point, check the bias frequency, and if it changes, adjust L903 until it does not change when the record mode is cancelled.
6) The same procedure is also taken for L904 – put track #3 and #4 in the record PAUSE mode, cancel record mode of track #4, and adjust L904 until the bias frequency does not change.

5-11-5 Bias Trap

The bias trap requires no adjustment other than in the following:

*When the record/play head is replaced.
*When the record/play amplifier is replaced.

*When there is increase in bias leakage.

For bias trap adjustment, the RECORD SELECT button for the track to be adjusted is depressed, a cassette loaded in the transport, and put in the record-PAUSE mode.

A. Record amplifier bias trap

L502 (Track #1)

1) Load a blank cassette in deck.
2) Put track #1 in the record PAUSE mode.
3) Connect an oscilloscope to TP (TRACK 1) of track #1.
4) Adjust L502 for minimum bias waveform.

L602, L503, L603 (Tracks #2, #3, and #4)

By the same procedure as in steps 1) and 2) above –

5) Connect an oscilloscope to TP (TRACK 2) and adjust L602.
6) Connect an oscilloscope to TP (TRACK 3) and adjust L503.
7) Connect an oscilloscope to TP (TRACK 4) and adjust L603.
8) Refer to Fig. 5-11-1.

B. Record Dolby (encoder) bias trap

L501 (L channel), L601 (R channel)

1) Load a blank cassette in the deck.
2) Put L channel (RECORD SELECT #1 or #3) in the record-PAUSE mode and connect an oscilloscope to TP (L).
3) Adjust L501 for minimum bias waveform.
4) Put R channel (RECORD SELECT #2 or #4) in the record-PAUSE mode, connect the oscilloscope to TP (R), and adjust L601.

C. Playback Dolby (decoder) bias trap

L101 (Track #1), L201 (Track #2)

1) Load a blank cassette in the deck.
2) When adjusting L101, track #2 is put in the record-PAUSE mode.
3) Connect an oscilloscope to TP (TRACK 1), at the output side of the playback Dolby circuit, and adjust L101 for minimum bias leakage waveform.
4) For L201, track #1 is put in the record-PAUSE mode.
5) The check terminal is TP (TRACK 2) and L201 is adjusted.

L301 (Track #3), L401 (Track #4)

6) Load a blank cassette in the deck.
7) To adjust L301, put track #4 in the record-PAUSE mode.
8) The check terminal is TP (TRACK 3) and L301 is adjusted.
9) For L401, put track #3 in the record-PAUSE mode.
10) The check terminal is TP (TRACK 4) and L401 is adjusted.
11) Refer to 5-11-1.

5-11-6 Recording Dolby (encoder) Level

1) Switch on one each of the L and R channel RECORD SELECT buttons, and put the transport in the record-PAUSE mode.
2) Apply -10dB (0.3V), 315Hz signals to AUX IN (L and R).
3) Set the AUX RCV knob to maximum and adjust the MASTER fader so that a -10dB (0.3V) signal is obtained from LINE OUT (L and R).
4) For the L channel, connect an output level meter to TP (L) and adjust R533 for a 580mV (-4.7dB 0dB = 1V) reading.
5) For the R channel, the meter is connected to TP (R) and R633 adjusted, also for a reading of 580mV.
6) Refer to Fig. 5-11-1.

5-11-7 Head Bias Voltage

By depressing rhe RECORD SELECT button, a bias current is applied to the bias adjusting trimmer capacitor of each channel, and by adjusting this capacitor, the required bias voltage is applied to the head. As the REC OFF switch will be used at adjusting, load a cassette that can be recorded, depress the RECORD SELECT button for the track to be adjusted, and put the transport in the record-PAUSE mode.

Track #1 bias voltage

1) Connect a level meter to the output side (O mark) of the bias trimmer capacitor C907.
2) Adjust this trimmer capacitor for approximately 4 volt (*) bias voltage.

Bias voltage of tracks #3, #4, and #5

3) In the same procedure as in above 1) and 2) –
   Adjust C908 for track #2, C909 for track #3, and C910 for track #4.
4) Refer to Fig. 5-11-1.

(*) 4 volts is typical: It should be fine-adjusted in relation to the recording characteristic. Refer to Overall Frequency Response, Item 5-11-9.

5-11-8 Recording Level

1) Playback test tape MXT-112 (315Hz, 0dB) and set the TAPE CUE knob for a -10dB level at TAPE CUE OUT.

   NOTE: a) TAPE CUE knobs of channels not being checked must be rotated fully CCW.
   b) As this is to set up the record/playback standard, it is necessary to adjust so that there is no level fluctuations in the playback signal.

2) Apply a -10dB (0.3V) signal to AUX IN (L and R), set to maximum the AUX RCV knob, and set the MASTER fader for a -10dB level from LINE OUT.
3) Under the above condition, sequentially depress the RECORD SELECT buttons for each track, connect the level meter to the TP of each track, and adjust each trimmer pot for a reading of about 0.32V (-10dB)*
4) The trimmer pots are – R534 for track #1, R634 for #2, R535 for #3, and R635 for #4.

(*) 0.32 volt is typical: record/playback must be repeated until the TAPE CUE OUT level is -10dB.

5-11-9 Overall Frequency Response

A. Specifications Refer to Specifications Item 2
(AUX IN → Record/playback → TAKE CUE OUT)
B. Connecting diagram Refer to Fig. 5-10-5
C. Levels
AUX IN : -20dB, 315Hz
(MIC/LINE) : (-70/-20dB)
TAPE CUE OUT : -20dB
Setting
AUX SEND knob : At maximum
TAPE CUE knob : At scale 7
RECORD SELECT
button : Record track IN
Tape
Test tape : MXT-112
Recording tape : MXT-506 or equivalent
D. Check and adjustment
1) Playback the test tape and set the TAPE CUE knob for a TAPE CUE output of -10dB (0.3V).
NOTE: TAPE CUE knobs for channels not being checked must be kept at full CCW.
2) Apply a signal (-10dB, 315Hz) to AUX IN, depress the RECORD SELECT button of the channel to be checked, and record the signal. Playback the recorded portion and check for an output from TAPE CUE.
3) Decrease the input signal to 10dB below nominal level (-20dB for AUX IN), record it, then play it back.
4) Sweep the input signal frequency in the range specified to check that the response matches the specification.
5) If it does not match the specification, adjust the bias voltage in accordance to Item 5-11-7.
6) If the level drops in the high region, slightly decrease the bias voltage; if it rises, slightly increase the bias. If the bias voltage is altered in too wide a range, recording distortion may increase. Therefore, check that it is within the specification of less than 3% at 1kHz.

NOTE: The recording level sometimes changes when the bias voltage is changed. Therefore, re-check the recording level and if necessary, repeat the procedures in Item 5-11-8.

5-11-10 Overall S/N

A. Specifications More than 48dB (UNWTD), 58dB (WTD)
(AUX IN → Record/playback → TAPE CUE OUT)
B. Connecting diagram Refer to Fig. 5-10-5
C. Levels, setting, tape to be used, check procedures are the same as for Overall Frequency Response Check but recording is done with no signal and when playing back this no signal recording, the residual noise is compared with the standard level.

5-11-11 Overall Distortion

A. Specifications Refer to Specifications Item 2
(AUX IN → Record/playback → TAPE CUE OUT)
B. Connecting diagram

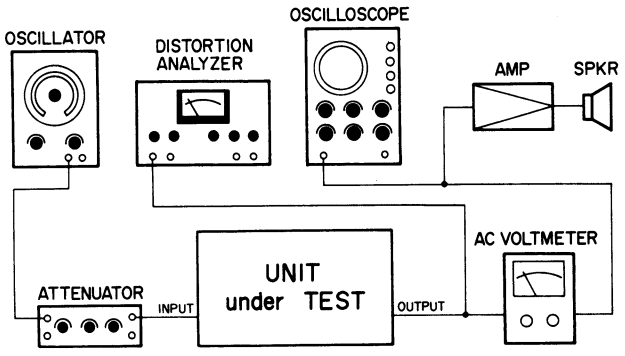


Fig. 5-11-2

C. Levels, setting, tape to be used, check procedures are the same as for Overall Frequency Response Check.
D. Refer to Items 5-11-7 and 5-11-8 for adjusting procedures.

5-11-12 Erasure

A. Specifications Refer to Specifications Item 2
B. Connection diagram

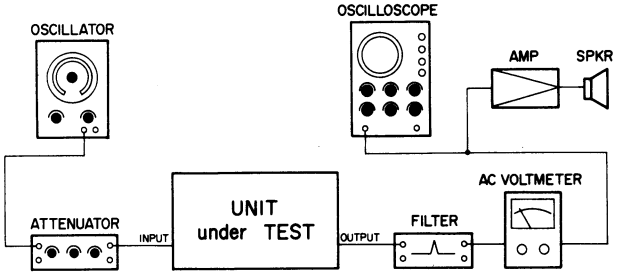


Fig. 5-11-3

C. Levels
AUX IN : 0dB (1V), 1kHz
MIC/LINE) : (-50dB/0dB)
Setting and tapes are the same as in Overall Frequency Response Check procedures.
D. Check procedures
1) Playback test tape MTT-112 and set the TAPE CUE knob for a -10dB (0.3V) output from TAPE CUE.
NOTE: All TAPE CUE knobs of channels not being checked must be at full CCW.
2) Apply a signal, which is 10dB higher than the standard level, to AUX IN, record it on the track to be checked, play it back and read the level.
3) Rewind to the beginning of the above recorded portion, then record over it with no signal.
4) Rewind to the beginning again and play back. The playback signal is passed through a filter at the check frequency, as shown in the connecting diagram of B above, and its level

is read. The difference of this level compared with the level of above 2), is the Erasure.

5-11-13 Crosstalk Between Adjacent Channels

Record a 1kHz signal at standard level of -10dB (0.3V) on track 1 only and at the same time record the adjacent channel with no signal. Rewind to beginning of this recording, measure output of the adjacent channel through a 1kHz filter, and measure the ratio between the signal output levels.

A. Specifications – Refer to list of Specifications.
B. Test connection – Figure 5-11-3
C. Control settings, levels, and tape to be used are the same as for Overall Frequency Response Check procedures.

5-11-14 Sync Crosstalk

This refers to the crosstalk between adjacent tracks when a sync recording is made. In other words, it refers to the degree of leakage into an adjacent track of a biased signal from a recording track.

A. Specifications : Better than 5dB (20Hz ~ 20kHz)
B. Connecting diagram : Refer to Fig. 5-11-3
C. Levels, setting and procedures are the same for Overall Frequency Response Check.

Crosstalk between tracks #1 and #2

1) Apply a reference signal of -10dB (0.3V, 315Hz) to track #1 of AUX IN (L and R).
2) Depress the RECORD SELECT button, put transport in record PAUSE, track #2 in playback mode, and check the track #2 output at TAPE CUE OUT.
3) Sweep the signal from 20Hz through 20kHz and check how much of the signal applied to track #1 leaks into track #2, and read the difference between the reference level.

Crosstalk between other tracks

The same method used for measuring crosstalk between track #1 and #2 are used. When measuring crosstalk between other tracks, the RECORD SELECT buttons are set as below.
Number in parenthesis indicates the setting from the opposite channel.

Setting of RECORD SELECT

Combination	Record (ON) track	Playback (OFF) track
Between tracks #1 and #3	1	2
	(2)	(1)
Between tracks #2 and #3	2	3
	(3)	(2)
Between tracks #3 and #4	3	4
	(4)	(3)

6 EXPLODED VIEW, PCB BOARDS, AND PARTS LISTS

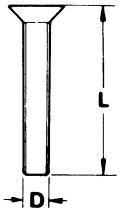
ASSEMBLING HARDWARE CODING LIST

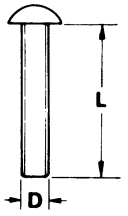
All screws conform to ISO standards, and have crossrecessed heads, unless otherwise noted.
ISO screws have the head inscribed with a point as in the figure to the right.

FOR EXAMPLE:

B M 3 x 6

- Length in mm (L)
- Diameter in mm (D) *
- Metric System
- Nomenclature



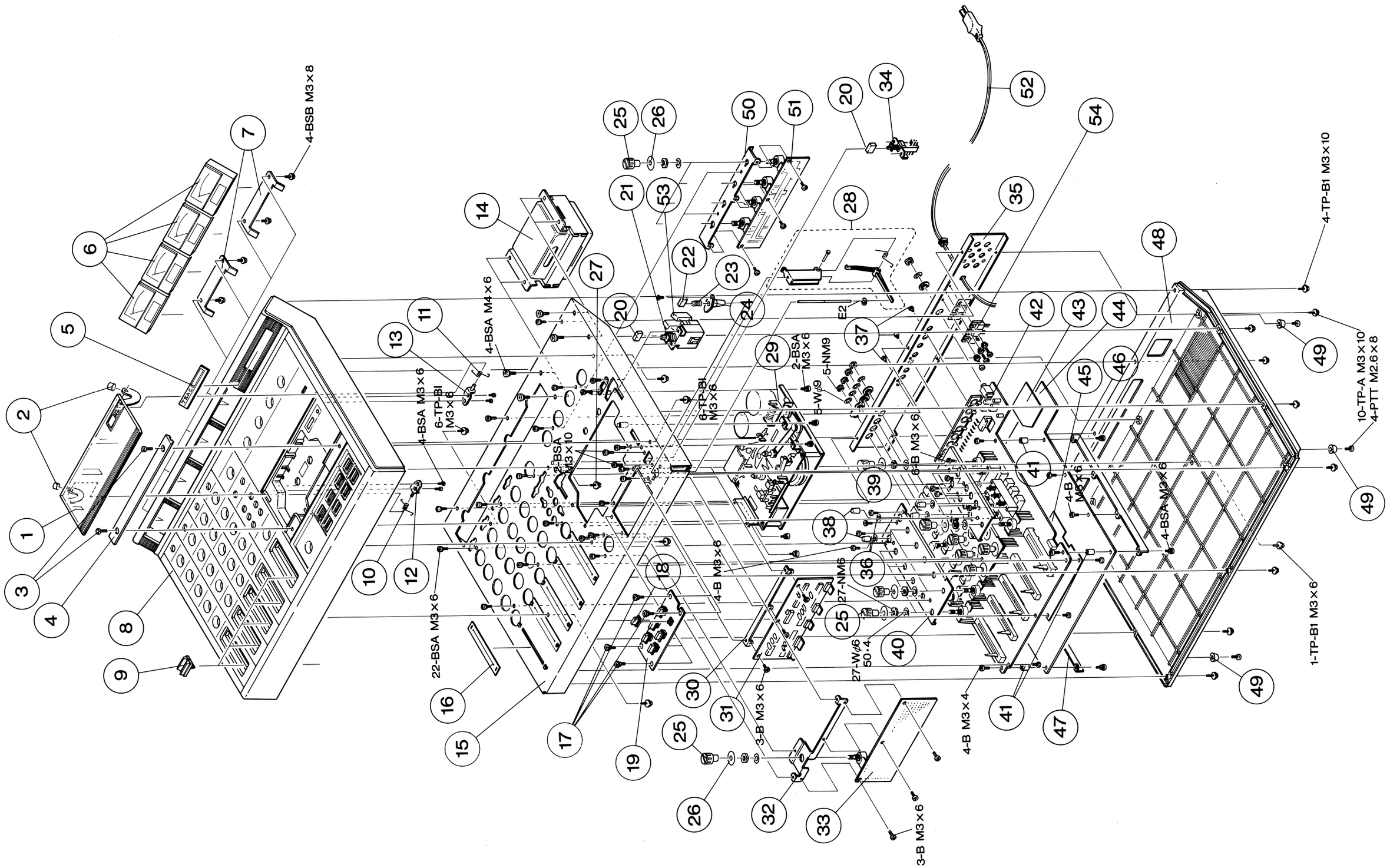


* Inner dia. for washers and nuts

	Code	Name	Type
MACHINE SCREW	R	Round Head Screw	
	P	Pan Head Screw	
	T	Stove Head Screw (Truss)	
	B	Binding Head Screw	
	F	Flat Countersunk Head Screw	
	O	Oval Countersunk Head Screw	
WOOD SCREW	RW	Round Head Wood Screw	
TAPTITE SCREW	PTT	Pan Head Taptite Screw	
	WTT	Washer Head Taptite Screw	
SEMS SCREW	BSA	Binding Head SEMS Screw(A Type)	
	BSB	Binding Head SEMS Screw(B Type)	
	BSF	Binding Head SEMS Screw(F Type)	
	PSA	Pan Head SEMS Screw(A Type)	
	PSB	Pan Head SEMS Screw(B Type)	

	Code	Name	Type
TAPPING SCREW	BTA	Binding Head Tapping Screw(A Type)	
	BTB	Binding Head Tapping Screw(B Type)	
	RTA	Round Head Tapping Screw(A Type)	
	RTB	Round Head Tapping Screw(B Type)	
SETSCREW	SF	Hex Socket Setscrew(Flat Point)	
	SC	Hex Socket Setscrew(Cup Point)	
	SS	Slotted Socket Setscrew(Flat Point)	
WASHER	E	E-Ring (Retaining Washer)	
	W	Flat Washer (Plain)	
	SW	Lock Washer (Spring)	
	LWI	Lock Washer (Internal Teeth)	
	LWE	Lock Washer (External Teeth)	
	TW	Trim Washer (Countersunk)	
NUT	N	Hex Nut	

EXPLODED VIEW-1



MEMO

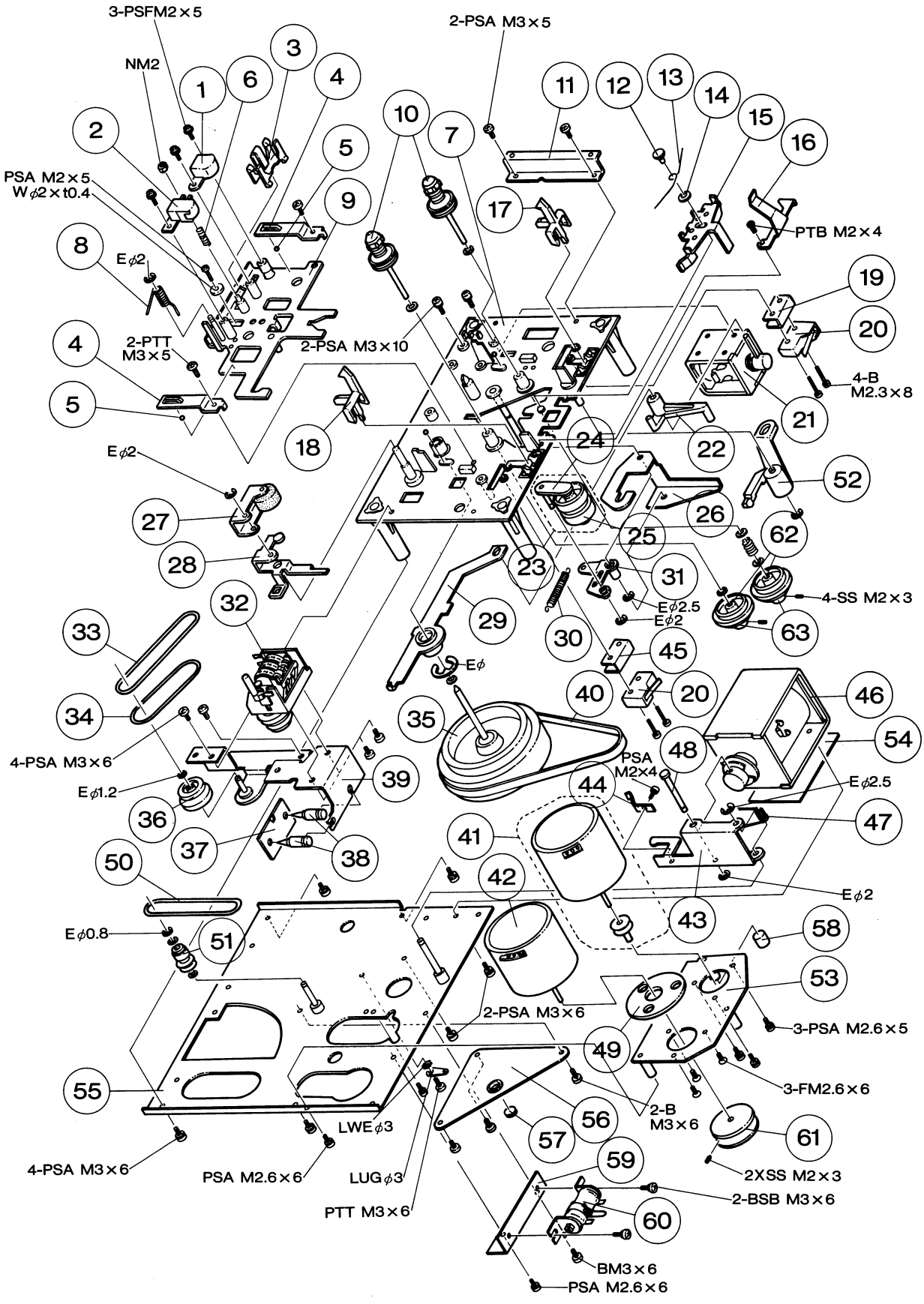
Parts marked with *required longer delivery time than regular parts.

REF. NO.	PARTS NO.	DESCRIPTION	REMARKS
1 - 1	6036271000	Door	
1 - 2	*6006097000	Rubber, door stopper	
1 - 3	*5544729000	Screw, dress	
1 - 4	*6036272000	Cover, heads	
1 - 5	*6007320000	Nameplate (A) assembly, friction	
1 - 6	6055029000	Level meter	Meter assembly * 6037612000
1 - 7	*6037589000	Mounting plate, meter	
1 - 8	*6036269000	Cover, dress	
1 - 9	6006089000	Knob, fader	
1 - 10	6004098000	Spring (B), door	
1 - 11	6004097000	Spring (A), door	
1 - 12	*6037609000	Cover plate assembly (L)	
1 - 13	*6037610000	Cover plate assembly (R)	
1 - 14	⚠ 6046129000	Power transformer assembly (without plug)	U.S.A., CANADA
	⚠ 6046130000	Power transformer assembly (without plug)	EUROPE, U.K., AUSTRALIA
	⚠ 6046131000	Power transformer assembly (without plug)	GENERAL EXPORT
	⚠ 6046132000	Power transformer assembly (without plug)	JAPAN
1 - 15	*6037603000	Frame chassis assembly	
1 - 16	*6006095000	Screen, fader	
1 - 17	*5581057000	Shaft (B), shoulder	
1 - 18	6006083000	Button (A), control	Ivory
	6006084000	Button (B), control	Red
	6006085000	Button (C), control	Blue
1 - 19	*6085465000	PCB assembly, switch	
1 - 20	6006086000	Pushbutton, rectangular	
1 - 21	⚠*5134046000	Switch, power SDG5P	U.S.A., CANADA, JAPAN, GENERAL EXPORT
	*5134011000	Switch, power SDG5P	EUROPE, U.K., AUSTRALIA
1 - 22	*6006094000	Button, eject	
1 - 23	*6004100000	Spring, eject	
1 - 24	*6037594000	Holder, eject	
1 - 25	*6006812000	Knob, B-16 (IVY) assembly	
	*6006813000	Knob, B-16 (ORG) assembly	
	*6006814000	Knob, B-16 (RED) assembly	
	*6006815000	Knob, B-16 (GRN) assembly	
1 - 26	*6037595100	Screen, control pot knob	
1 - 27	*5580007000	Washer	
1 - 28	*6037599100	Lock arm assembly	
1 - 29	*6073019000	Transport assembly	
1 - 30	*6037588000	Mounting plate (A), control PCB	
1 - 31	*6085462000	PCB assembly, control (A)	
1 - 32	*6037584000	Mounting plate (B), control PCB	
1 - 33	*6085463000	PCB assembly, control (B)	
1 - 34	6051445000	Switch, push	
1 - 35	*6036270100	Panel, back	
1 - 36	*6006096000	Screen, pushbutton	
1 - 37	*5534878000	Push rivet (B)	
1 - 38	6006087000	Button, round, push switch	
1 - 39	*6037585000	Chassis, master module	
1 - 40	*6037586000	Chassis, input module	
1 - 41	*6037597000	Spacer, tube, PCB	
1 - 42	*6085466000	PCB assembly, mixer amplifier	
1 - 43	*6037616000	Insulator sheet (A)	
1 - 44	*6085461000	PCB assembly, R/P amplifier	
1 - 45	*6037617000	Plate, shield	
1 - 46	*6037583000	Plate (B), PCB reinforcing	
1 - 47	*6037582000	Plate (A), PCB reinforcing	
1 - 48	*6036268200	Cover, bottom	
1 - 49	*6520975440	Foot, rubber	
1 - 50	*6037587000	Plate, mounting, control pot PCB	
1 - 51	*6085464000	PCB assembly, control pot	

Parts marked with *required longer delivery time than regular parts.

REF. NO.	PARTS NO	DESCRIPTION	REMARKS
1 - 52	⚠*5128075000	Cord, power (UL)	U.S.A., CANADA
	⚠*5128094000	Cord, power (CEE)	EUROPE
	⚠*5128047000	Cord, power (BS)	U.K.
	⚠*5128031000	Cord, power (SAA)	AUSTRALIA
	⚠*5128034000	Cord, power (DM)	JAPAN, GENERAL EXPORT
1 - 53	⚠*5052906000	Spark killer, 0.033mfd + 120ohm, 125VAC	U.S.A., JAPAN
	⚠*5052911000	Spark killer, 0.033mfd + 120ohm, 250VAC	CANADA
	⚠*5052908000	Spark killer, 0.033mfd + 120ohm, 4700pF, 250VAC	EUROPE, U.K., AUSTRALIA, GENERAL EXPORT
1 - 54	6048617000	ICFS7805	Q801
	6048619000	ICFS7824	Q802
	6048618000	ICFS7815	Q803

EXPLODED VIEW-2



Parts marked with *required longer delivery time than regular parts.

REF. NO.	PARTS NO.	DESCRIPTION	REMARKS
2 - 1	6057061000	Head, erase	
2 - 2	6057455000	Head, R/P	
2 - 3	*6024662000	Clamp, wire	
2 - 4	*6004118000	Spring, head base pressure	
2 - 5	*6004663000	Steel ball, ϕ2	
2 - 6	*6004129000	Spring, head adjusting	
2 - 7	*6024068000	Chassis A, assembly	
2 - 8	*6004123000	Spring, pinch roller	
2 - 9	*6023011000	Head base assembly	
2 - 10	6024072000	Reel table, F.F., assembly	
2 - 11	*6024686000	Angle piece, transport mounting	
2 - 12	*6024649000	Spindle C, insert	
2 - 13	*6004128000	Spring B, barake	
2 - 14	*5800058700	Washer, Lumilar, ϕ2.2 xϕ9.5 x t0.2	Special Mylar washer
2 - 15	*6024708000	Brake	
2 - 16	*6004130000	Spring, cassette pressure	
2 - 17	*6024639000	Lever, erase prevention	
2 - 18	*6024638000	Lever, loaded cassette detection	
2 - 19	*6024643000	Plate B, micro-switch mounting	
2 - 20	6051205000	Switch, micro, SSLIL	
2 - 21	⚠ 6047527000	Plunger, P-10Q	
2 - 22	*6024688000	Lever, brake linking	
2 - 23	*5800058600	Idler assembly, FR	
2 - 24	*6024075000	Idler arm, FR	
2 - 25	6024070000	Idler, FR	
2 - 26	*6024677000	Drive plate, head base	
2 - 27	6021016000	Arm assembly, pinch roller	
2 - 28	*6024078000	Lever assembly, pause	
2 - 29	*6024066000	Plate assembly, pause operating	
2 - 30	*6004125000	Spring, selector lever	
2 - 31	*6024081000	Lever assembly, selector	
2 - 32	1632160000	Tape counter MP390-49	
2 - 33	6024685000	Belt B, counter	
2 - 34	6024684000	Belt A, counter	
2 - 35	*6021018000	Flywheel assembly	
2 - 36	*6024656000	Pulley, intermediate	
2 - 37	*6050580000	PCB, reed switch (Diode-604832700)	Magnetoresistive element-5143105000
2 - 38	*5534448000	Rubber, vibration absorbing	
2 - 39	*6024076000	Plate assembly, counter mounting	
2 - 40	6024651000	Belt, flat	
2 - 41	6058048000	Motor assembly, reel	
2 - 42	6058047000	Motor, capstan	
2 - 43	*6024680000	Lever, drive	
2 - 44	*6004121000	Spring, leaf, drive lever	
2 - 45	*6024642000	Plate A, micro-switch mounting	
2 - 46	⚠ 6047526000	Plunger P-177C	
2 - 47	*6004124000	Spring, drive lever	
2 - 48	*6024687000	Shaft, plunger	
2 - 49	*6024637000	Spacer, motor	
2 - 50	6024650000	Belt, ϕ35.4	
2 - 51	6024067000	Pulley assembly, intermediate	
2 - 52	*6024640000	Lever, brake	
2 - 53	*6024079000	Mounting plate assembly, motor	
2 - 54	*6024681000	Cushion, plunger	
2 - 55	*6024069000	Chassis E assembly	
2 - 56	*6024689000	Plate, flywheel thrust	
2 - 57	*6024682000	Screw, flywheel adjusting	
2 - 58	*6024648000	Cushion, motor shaft	
2 - 59	*6037605000	Mounting plate, ceramic resistor	
2 - 60	*6037613000	Ceramic resistor assembly	Ceramic resistor, RWH5A1J 100Ω, 6040239000

Parts marked with *required longer delivery time than regular parts.

REF. NO.	PARTS NO.	DESCRIPTION	REMARKS
2 - 61	*6024644000	Pulley, motor	
2 - 62	6024074000	Reel table assembly, FF	
2 - 63	*6024665000	Stopper, reel table	

CONTROL (A) PCB ASSY

REF. NO.	PARTS NO.	DESCRIPTION
	6085462000	PCB Assy
	6050531100	PCB
	ICs	
U1	6048932000	MC14011B
U2	6048940000	MC14001B
U3	6048937000	MC14069B
U4	6048932000	MC14011B
U5	6048937000	MC14069B
U6	6048939000	MC14081B
U7, U8	6048938000	MC14071B
U9, U10	6048946000	MC14050B
	CARBON RESISTORS	
	All resistors are rated ±5% tolerance and ¼ watt.	
R1, R2	6100290600	10 k ohm
R3	6100293000	100 k ohm
R4, R5	6100290600	10 k ohm
R6	6100293000	100 k ohm
R7, R8	6100290600	10 k ohm
R9	6100293000	100 k ohm
R10, R11	6100290600	10 k ohm
R12	6100293000	100 k ohm
R13~R20	6100290600	10 k ohm
R21	6100294600	470 k ohm
R22	6100291800	33 k ohm
R23~R30	6100290600	10 k ohm

	CAPACITORS			
C1~C4	6044005000	Ceramic	0.01 mfd	
C5~C12	5055405000	Elec.	10 mfd	16V
C13, C14	5055488000	Elec.	22 mfd	16V
C15	6043018000	Elec.	47 mfd	10V
C16~C18	6044005000	Ceramic	0.01 mfd	
	MISCELLANEOUS			
J301	*6052226005	Connector	5P	
J302	*6052226006	Connector	6P	
J305	*6052226004	Connector	4P	
J309	*6052226005	Connector	5P	
J311	*6052226008	Connector	8P	

CONTROL (B) PCB ASSY

REF. NO.	PARTS NO.	DESCRIPTION
	6085463000	PCB Assy
	6050532200	PCB
	ICs	
U1	5147047000	M54410P
U2	6048940000	MC14001BCP
U3	6048945000	MC14049B
U4	6048938000	MC14071BCP
	TRANSISTORS	
Q1~Q9	6048107000	2SC1815BL
Q10~Q14	6048079000	2SB525
Q15	6048107000	2SC1815BL
Q16~Q19	6048078000	2SD355-D
	DIODES	
D1~D10	6048337000	1S2473
D11, D12	6048327000	1N4002
D13, D14	6048337000	1S2473
	CARBON RESISTORS	
	All resistors are rated ±5% tolerance and ¼ watt.	
R1	6100288200	1 k ohm
R2	6100289400	3.3 k ohm
R3	6100295000	680 k ohm
R4	6100292800	82 k ohm
R5	6100288200	1 k ohm
R6	6100293000	100 k ohm
R7	6100292200	47 k ohm
R8	6100290600	10 k ohm
R9	6100288200	1 k ohm
R10	6100294200	330 k ohm
R11	6100290600	10 k ohm
R12	6100294200	330 k ohm
R13	6100290200	6.8 k ohm
R14	6100288200	1 k ohm
R15	6100290600	10 k ohm
R16	6100294200	330 k ohm
R17~R22	6100290600	10 k ohm
R23	6100286200	150 ohm
R24	6100287000	330 ohm
R25~R27	6100290600	10 k ohm
R28	6100293000	100 k ohm
R29	6100290600	10 k ohm
R30, R31	6100289800	4.7 k ohm
R32~R36	6100290600	10 k ohm
R37	6100293000	100 k ohm
R38	6100290600	10 k ohm
R39, R40	6100289800	4.7 k ohm
R41~R43	6100290600	10 k ohm
R44	6100289800	4.7 k ohm
R45, R46	6100290600	10 k ohm
R47	6100288200	1 k ohm
R49~R51	6100288200	1 k ohm

REF. NO.	PARTS NO.	DESCRIPTION		
		CAPACITORS		
C1~C7	6044516000	Mylar	0.001 mfd	
C8	5055454000	Elec.	1 mfd	50V
C9	6043084000	Elec.	22 mfd	10V
C10	5055405000	Elec.	10 mfd	16V
C12	5055405000	Elec.	10 mfd	16V
C13, C14	5055453000	Elec.	4.7 mfd	25V
C15, C16	5055454000	Elec.	1 mfd	50V
C17	6043018000	Elec.	47 mfd	10V
C18	6044005000	Ceramic	0.01 mfd	
C19	6043018000	Elec.	47 mfd	10V
C20	6044005000	Ceramic	0.01 mfd	
		VARIABLE RESISTOR		
Pitch Control	6042136000	10 k ohm-B		
		MISCELLANEOUS		
J401	*6052226010	Connector	10P	
J402	*6052226003	Connector	3P	
J403	*6052226002	Connector	2P	
J404A	*6052226005	Connector	5P	
J404B	*6052226004	Connector	4P	
J405	*6052226004	Connector	4P	
	*6040808000	Jumper	x 29	

VR PCB ASSY

REF. NO.	PARTS NO.	DESCRIPTION
	6085464000	PCB Assy
	6050534000	PCB
R1~R4	6100291400	Carbon Resistor 22 k ohm ¼W 5%
R5~R8	6042135000	Variable Resistor 10 k ohm-A
J602	*6052226006	Connector 6P
J613	*6052226005	Connector 5P

SWITCH PCB ASSY

REF. NO.	PARTS NO.	DESCRIPTION
	6085465000	PCB Assy
	6050533000	PCB, Switch
S1~S6	6051083000	Switch Tact AKC-8S
D1	6048377000	LED (Red)
D2	6048378000	LED (Green)

REC/PLAY AMP PCB ASSY

REF. NO.	PARTS NO.	DESCRIPTION
	6085461001	PCB Assy (U.S.A., CANADA)
	6085461002	PCB Assy (EUROPE, AUSTRALIA)
	6085461003	PCB Assy (JAPAN, GENERAL EXPORT)
	6050539200	PCB
	ICs	
*U101	6048624000	TA7136AP
*U102	5042728000	NE545B
U501, U601	5042728000	NE545B
U502, U602	6048607000	RC4558DN
U804	6048607000	RC4558DN
	TRANSISTORS	
*Q101	6048106002	2SA970BL
*Q102	6048107004	2SC1815BL
Q501, Q503	6048106002	2SA970BL
Q502, Q504	6048107004	2SC1815BL
Q601, Q603	6048106002	2SA970BL
Q602, Q604	6048107004	2SC1815BL
Q701~Q710	6048107004	2SC1815BL
Q901~Q908	6048107004	2SC1815BL
Q909	6048122003	2SC2001K
Q910	6048106002	2SA970BL
	DIODES	
*D101	5042213000	1N60
D501, D601	5042213000	1N60
D701~D708	6048337000	1S2473
D801, D802	6048371000	W-02M
D803	6048354000	S2VB20
D901~D908	6048327000	1N4002
D909, D910	6048337000	1S2473
D911	6048337000	1S2473
	CARBON RESISTORS	
	All resistors are rated ±5% tolerance and ¼ watt.	
*R101	6100295400	1 M ohm
*R102	6100293000	100 k ohm
*R103	6100287600	560 ohm
*R104	6100292500	62 k ohm
*R105	6100295400	1 M ohm
*R106	6100294100	300 k ohm
*R107	6100290100	6.2 k ohm
*R108	6100285300	62 ohm
*R109	6100288400	1.2 k ohm
*R110	6100289800	4.7 k ohm
*R111	6100286800	270 ohm
*R112	6100293400	150 k ohm
*R113	6100294000	270 k ohm
*R114	6100295000	680 k ohm
*R115	6100286000	270 k ohm
*R116	6100290600	100 k ohm
*R117	6100286000	120 ohm
*R118	6100292200	47 k ohm
*R119	6100289400	3.3 k ohm

Parts marked with *required longer delivery time than regular parts.

REF. NO.	PARTS NO.	DESCRIPTION
*R120	6100286400	180 ohm
*R121	6100289000	2.2 k ohm
*R122	6100290600	10 k ohm
*R123	6100290600	10 k ohm
*R124	6100290600	10 k ohm
R501, R601	6100291800	33 k ohm
R502, R602	6100286800	270 ohm
R503, R603	6100296800	270 ohm
R504, R604	6100293400	150 k ohm
R505, R605	6100295000	680 k ohm
R506, R606	6100294000	270 k ohm
R507, R607	6100293000	100 k ohm
R508, R608	6100286000	120 ohm
R509, R609	6100292200	47 k ohm
R510, R610	6100289400	3.3 k ohm
R511, R611	6100286400	180 ohm
R512, R612	6100293000	100 k ohm
R513, R613	6100291400	22 k ohm
R514, R614	6100290600	10 k ohm
R515, R615	6100290600	10 k ohm
R516, R616	6100290600	10 k ohm
R517, R617	6100293000	100 k ohm
R518, R618	6100289400	3.3 k ohm
R519, R619	6100291000	15 k ohm
R520, R620	6100291800	33 k ohm
R521, R621	6100287400	470 ohm
R522, R622	6100290000	5.6 k ohm
R523, R623	6100291400	22 k ohm
R524, R624	6100290600	10 k ohm
R525, R625	6100290600	10 k ohm
R526, R626	6100290600	10 k ohm
R527, R627	6100293000	100 k ohm
R528, R628	6100289400	3.3 k ohm
R529, R629	6100291000	15 k ohm
R530, R630	6100291800	33 k ohm
R531, R631	6100287400	470 ohm
R532, R632	6100290000	5.6 k ohm
R701, R715	6100280200	6.8 k ohm
R702, R716	6100289800	4.7 k ohm
R703, R717	6100290600	10 k ohm
R704, R718	6100290600	10 k ohm
R705, R719	6100290600	10 k ohm
R706, R720	6100290600	10 k ohm
R707, R721	6100290200	6.8 k ohm
R708, R722	6100290200	6.8 k ohm
R709, R723	6100294200	330 k ohm
R710, R724	6100293000	100 k ohm
R711, R725	6100289400	3.3 k ohm
R712, R726	6100285000	47 ohm
R713, R727	6100289200	2.7 k ohm
R714, R728	6100290000	5.6 k ohm
R729, R738	6100292900	91 k ohm
R730, R739	6100290600	10 k ohm
R731, R740	6100290600	10 k ohm
R732, R741	6100294200	330 k ohm
R733, R742	6100293000	100 k ohm
R734, R743	6100289400	3.3 k ohm
R735, R744	6100285000	47 ohm
R736, R745	6100289200	2.7 k ohm
R737, R746	6100290000	5.6 k ohm
R801, R802	6100290600	10 k ohm

Parts marked with *required longer delivery time than regular parts.

REF. NO.	PARTS NO.	DESCRIPTION		
R803	6100285400	68 ohm		
R901~R908	6100290600	10 k ohm		
R909~R916	6100285200	56 ohm		
R917	6100290000	5.6 k ohm		
R918	6100290600	10 k ohm		
R919	6100290000	5.6 k ohm		
R920	6100290600	10 k ohm		
R921	6100290000	5.6 k ohm		
R922	6100290600	10 k ohm		
R923	6100290000	5.6 k ohm		
R924	6100290600	10 k ohm		
R925~R928	6100286600	220 ohm		
R925~R930	6100290600	10 k ohm		
R931	6100293000	100 k ohm		
R932	6100289800	4.7 ohm		
R933~R936	6100290000	5.6 k ohm		
R937	6100293000	100 k ohm		
R938	6100292200	47 k ohm		
R939	6100288200	1 k ohm		
	CAPACITORS			
*C101	6043562000	Polyst.	820 pfd	
*C102	5055405000	Elec.	10 mfd	16V
*C103	5055401000	Elec.	47 mfd	16V
*C104	5055401000	Elec.	47 mfd	16V
*C105	5054742000	Dip. Mica	47 pfd	50V
*C106	5055405000	Elec.	10 mfd	16V
*C107	5055405000	Elec.	10 mfd	16V
*C108	6044537000	Mylar	0.01 mfd	
*C109	6044517000	Mylar	0.015 mfd	
*C110	6044729000	Mylar	0.027 mfd	
*C111	5055405000	Elec.	10 mfd	16V
*C112	5055492000	Elec.	330 mfd	10V
*C113	5054340000	Polyst.	100 pfd	
*C114	5055492000	Elec.	330 mfd	10V
*C115	6043173000	Dip. Tant.	0.1 mfd	50V
*C116	6043204000	Dip. Tant.	0.33 mfd	35V
*C117	6044541000	Mylar	0.047 mfd	
*C118	5055405000	Elec.	10 mfd	16V
*C119	5055405000	Elec.	10 mfd	16V
*C120	6044520000	Mylar	0.0047 mfd	
*C121	5055405000	Elec.	10 mfd	16V
*C122	6044735000	Mylar	0.027 mfd	
*C123	5055405000	Elec.	10 mfd	16V
*C124	6044731000	Mylar	0.0056 mfd	
C501, C601	6043575000	Polyst.	390 pfd	
C502, C602	5055405000	Elec.	10 mfd	16V
C503, C603	5055492000	Elec.	330 mfd	10V
C504, C604	5054340000	Polyst.	100 pfd	
C505, C605	5055492000	Elec.	330 mfd	10V
C506, C606	6043173000	Dip. Tant.	0.1 mfd	50V
C507, C607	6043204000	Dip. Tant.	0.33 mfd	35V
C508, C608	6044541000	Mylar	0.047 mfd	
C509, C609	5055405000	Elec.	10 mfd	16V
C510, C610	5055405000	Elec.	10 mfd	16V
C511, C611	6044520000	Mylar	0.0047 mfd	
C512, C612	5055405000	Elec.	10 mfd	16V
C513, C613	6044735000	Mylar	0.027 mfd	
C514, C614	6044731000	Mylar	0.0056 mfd	
C515, C615	5055405000	Elec.	10 mfd	16V
C516, C616	5054343000	Polyst.	680 pfd	
C517, C617	5054334000	Polyst.	330 pfd	
C518, C618	6043172000	Dip. Tant.	0.22 mfd	
C519, C619	6044521000	Mylar	0.068 mfd	
C520, C620	5055405000	Elec.	10 mfd	16V
C521, C621	6043575000	Polyst.	390 pfd	
C522, C622	5054343000	Polyst.	680 pfd	
C523, C623	5054334000	Polyst.	330 pfd	
C524, C624	6043172000	Dip. Tant.	0.22 mfd	
C525, C625	6044521000	Mylar	0.0068 mfd	
C526, C626	5055405000	Elec.	10 mfd	16V
C527, C627	6043575000	Polyst.	390 pfd	
C701, C705	5055453000	Elec.	4.7 mfd	25V
C702, C706	5055405000	Elec.	10 mfd	16V
C703, C707	5055457000	Elec.	100 mfd	10V
C704, C708	6043084000	Elec.	22 mfd	10V
C709, C713	5055453000	Elec.	4.7 mfd	25V
C710, C714	5055405000	Elec.	10 mfd	16V
C711, C715	5055457000	Elec.	100 mfd	10V
C712, C716	6043084000	Elec.	22 mfd	10V
C801	6043274000	Elec.	4700 mfd	16V
C802	6044005000	Ceramic	0.01 mfd	50V
C803	5055405000	Elec.	10 mfd	16V
C804	6044005000	Ceramic	0.01 mfd	50V
C805	6043275000	Elec.	2200 mfd	50V
C806	6044005000	Ceramic	0.01 mfd	50V
C807	5055435000	Elec.	10 mfd	50V
C808	5055404000	Elec.	10 mfd	25V
C809	6044005000	Ceramic	0.01 mfd	50V
C810	5055404000	Elec.	10 mfd	25V
C811	6044005000	Ceramic	0.01 mfd	50V
C812	6043276000	Elec.	2200 mfd	35V
C813	6044005000	Ceramic	0.01 mfd	50V
C814	6043277000	Elec.	2200 mfd	25V
C815	6044005000	Ceramic	0.01 mfd	50V
C816	5055404000	Elec.	10 mfd	25V
C817	6044005000	Ceramic	0.01 mfd	50V
C901, C902	5055405000	Elec.	10 mfd	16V
C903~C906	6043523000	Polyst.	150 pfd	
C911	6043151000	Dip. Tant.	10 mfd	16V
C912	5055440000	Elec.	470 mfd	16V
	VARIABLE RESISTORS			
*R125	5053354000	Semi-fixed	15 k ohm-B	
*R126	5053348000	Semi-fixed	10 k ohm-B	
R533~R535	5053354000	Semi-fixed	15 k ohm-B	
R633~R635	5053354000	Semi-fixed	15 k ohm-B	
R747, R748	5053354000	Semi-fixed	15 k ohm-B	
	TRIMMER CAPACITORS			
C907~C910	5054704000	100 pfd		
	COILS			
*L101	6046638000	Trap	2 mH	
L501~L503	6046639000	Trap	22 mH	
L601~L603	6046639000	Trap	22 mH	
L901~L904	6046640000	Dummy	1.2 mH	

REF. NO.	PARTS NO.	DESCRIPTION
	RELAYS	
K1~K8	6047048012	G2V2 DC12V
	MISCELLANEOUS	
J101	*6052226010	Connector 10P
J102	*6052226006	Connector 6P
J103	*6052226007	Connector 7P
J104	*6052226009	Connector 9P
J105	*6052226003	Connector 3P
J106	*6052386003	Connector 3P (Red)
J107	*6052387003	Connector 3P (Black)
J108	*6052226008	Connector 8P
J109	*6052226005	Connector 5P
J110	*6052226008	Connector 8P
J111A	*6052226004	Connector 4P
J111B	*6052226004	Connector 4P (Red)
J112	*6052226003	Connector 3P
J113	*6052226005	Connector 5P
*F1	*5041145000	Fuse 1A-250V (U.S.A., CANADA)
*F1	*5041141000	Fuse 1A-250V (EUROPE, AUSTRALIA)
*F1	*5041101000	Fuse 1A-250V (JAPAN, GENERAL EXPORT)
*F2	*5142138000	Fuse 1A-250V Slow Blow (U.S.A., CANADA)
*F2	*5041140000	Fuse 1A-250V Slow Blow (EUROPE, AUSTRALIA)
*F2	*5142235000	Fuse 1A-250V Slow Blow (JAPAN, GENERAL EXPORT)
*F3, F4	*5041144000	Fuse 2A-250V (U.S.A., CANADA)
*F3, F4	*5041155000	Fuse 2A-250V (EUROPE, AUSTRALIA)
*F3, F4	*5041114000	Fuse 2A-250V (JAPAN, GENERAL EXPORT)
*(F1), (F2)	*5041237000	Holder, Fuse (All except EUROPE, AUSTRALIA)
*(F3), (F4)	*5141237000	Holder, Fuse (All except EUROPE, AUSTRALIA)
*(F1)~(F4)	*5142087000	Holder, Fuse (EUROPE, AUSTRALIA)
	*5724042000	Pin F-3 type x 15
*U901	*6046641100	OSC Unit
	*6040808000	Jumper x 31
	*6040826000	Jumper x 63

MIXING AMP PCB ASSY

REF. NO.	PARTS NO.	DESCRIPTION
	6085466000	PCB Assy
	6050535200	PCB
	ICs	
*U101	6048607000	RC4558DN
U501~U503	6048607000	RC4558DN
U1, U2	6048649000	NJM386
	TRANSISTORS	
*Q101	6048093003	2SK68A FET
*Q102	6048106002	2SA970BL
*Q103	6048106002	2SA970BL
Q501~Q504	6048107004	2SC1815BL
	CARBON RESISTORS	**All resistors are rated ±5% tolerance, ¼ watt and of carbon type unless otherwise noted.**
*R101	6100285800	100 ohm
*R102	6100292600	68 k ohm
*R103	6100290000	5.6 k ohm
*R104	6100290000	5.6 k ohm
*R105	6100284200	22 ohm
*R106	6100289800	4.7 k ohm
*R107	6100290600	10 k ohm
*R108	6100290300	7.5 k ohm
*R109	6100294600	470 k ohm
*R110	6100293000	100 k ohm
*R111	6100284500	30 ohm
*R112	6100285800	100 ohm
*R113	6100285800	100 ohm
*R114	6100285800	100 ohm
*R115	6100292300	51 k ohm
*R118	6100293000	100 k ohm
*R119	6100290600	10 k ohm
*R120	6100290600	10 k ohm
*R121	6100288000	820 ohm
*R122	6100288900	2 k ohm
*R123	6100288600	1.5 k ohm
*R124	6100292100	43 k ohm
*R125	6100291600	27 k ohm
*R126	6100291200	18 k ohm
*R127	6100291400	22 k ohm
*R128	6100291400	22 k ohm
*R129	6100291400	22 k ohm
*R130	6100290400	8.2 k ohm
*R501	6100293000	100 k ohm
*R502, R503	6100291400	22 k ohm
R504	6100289800	4.7 k ohm
R505	6100290600	10 k ohm
R506	6100294600	470 k ohm
R507	6100290600	10 k ohm
R508	6100292500	62 k ohm
R509	6100292200	47 k ohm
R51A	6100285800	100 ohm
R51B	6100285800	100 ohm
R511	6100293000	100 k ohm
R512, R513	6100291400	22 k ohm

Parts marked with *required longer delivery time than regular parts.

REF. NO.	PARTS NO.	DESCRIPTION
R514	6100289800	4.7 k ohm
R515	6100290600	10 k ohm
R516	6100294600	470 k ohm
R517	6100290600	10 k ohm
R518	6100292500	62 k ohm
R519	6100292200	47 k ohm
R520	6100285800	100 ohm
R521	6100289800	4.7 k ohm
R522	6100293800	220 k ohm
R523	6100290600	10 k ohm
R524	6100291700	30 k ohm
R525	6100292200	47 k ohm
R526	6100285800	100 ohm
R527	6100289800	4.7 k ohm
R528	6100293800	220 k ohm
R529	6100290600	10 k ohm
R530	6100291700	30 k ohm
R531	6100292200	47 k ohm
R532	6100285800	100 ohm
R1~R6	6100291400	22 k ohm
R7	6100293000	100 k ohm
R9	6100288200	1 k ohm
R10	6100421000	1 ohm ½W
R11	6100293000	100 k ohm
R13	6100288200	1 k ohm
R14	6100421000	1 ohm ½W
R15, R16	6100291400	22 k ohm

CAPACITORS

*C101	5055405000	Elec.	10 mfd	16V
*C102	5054340000	Polyst.	100 pfd	50V
*C103	5055401000	Elec.	47 mfd	16V
*C104	5055401000	Elec.	47 mfd	16V
*C105	5055488000	Elec.	22 mfd	16V
*C106	5055423000	Elec.	100 mfd	6.3V
*C107	6043084000	Elec.	22 mfd	10V
*C108	5054741000	Dip. Mica	22 pfd	
*C109	6043169000	Dip. Tant.	0.47 mfd	
*C110	6043169000	Dip. Tant.	0.47 mfd	
*C111	6044516000	Mylar	0.001 mfd	
*C112	6044516000	Mylar	0.001 mfd	
*C113	6043084000	Elec.	22 mfd	10V
*C114	5054742000	Dip. Mica	47 pfd	
C501, C509	5055405000	Elec.	10 mfd	16V
C502, C510	5055405000	Elec.	10 mgd	16V
C503	5054340000	Polyst.	100 pfd	
C504, C512	5055405000	Elec.	10 mfd	16V
C505, C513	5055405000	Elec.	10 mfd	16V
C506, C514	5054313000	Polyst.	470 pfd	
C507, C515	5054741000	Dip. Mica	22 pfd	
C508, C516	5055405000	Elec.	10 mfd	16V
C517, C521	5054313000	Polyst.	470 pfd	
C518, C522	5054313000	Polyst.	470 pfd	
C519, C523	5054758000	Dip. Mica	82 pfd	
C520, C524	5055405000	Elec.	10 mfd	16V
C1~C4	6044005000	Ceramic	0.01 mfd	
C5, C6	5055405000	Elec.	10 mfd	16V
C7	6044541000	Mylar	0.047 mfd	
C8	5055460000	Elec.	470 mfd	6.3V
C9, C10	5055405000	Elec.	10 mfd	16V
C11	6044541000	Mylar	0.047 mfd	
C12	5055460000	Elec.	470 mfd	6.3V
C13, C14	6043018000	Elec.	47 mfd	10V

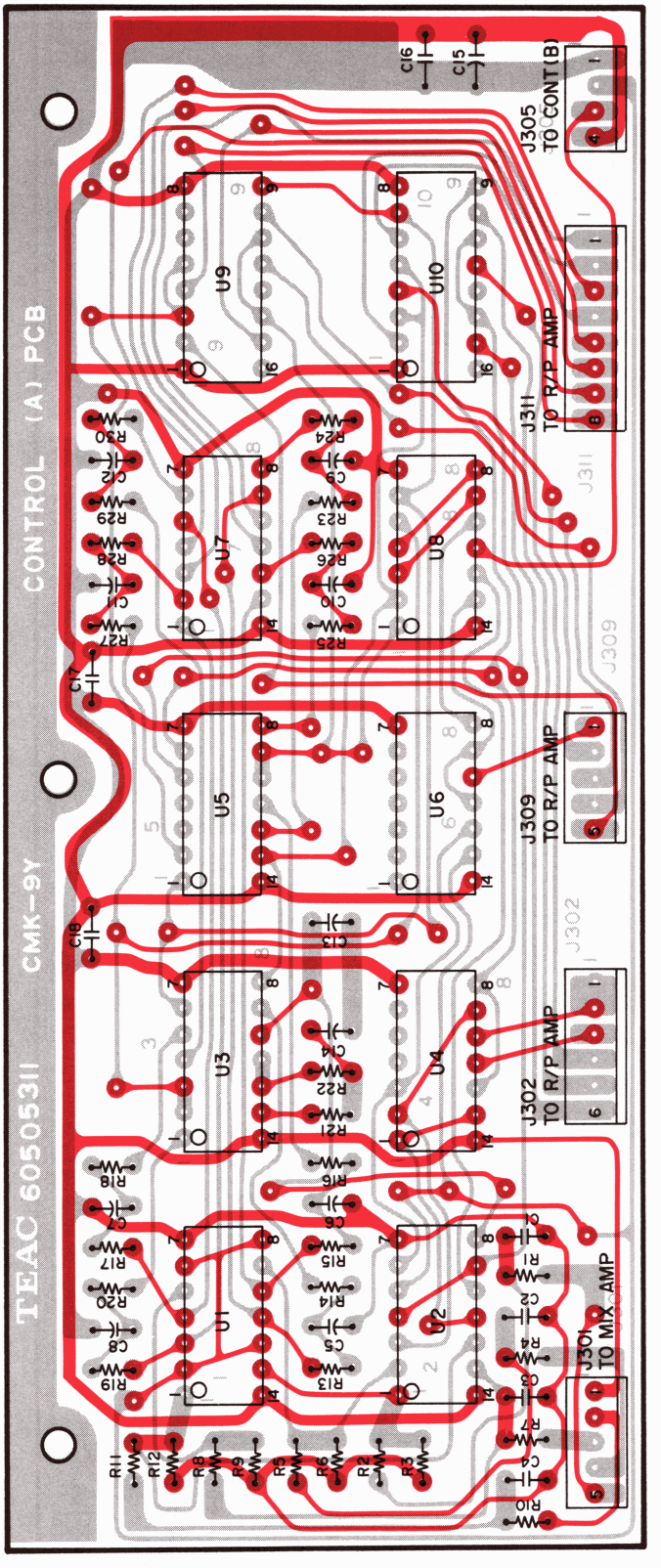
VARIABLE RESISTORS

*R131	6042137000	10 k ohm-C	
*R132	6042131000	5 k ohm-A	
*R133	6042138000	10 k ohm-G	
*R134	6042138000	10 k ohm-G	
*R135	6042133000	5 k ohm-A, C	
*R136	6041216000	10 k ohm-D	
*R533	6042134000	10 k ohm-A, A	
*R534	6041217000	10 k ohm-A, A	
*R17	6042132000	5 k ohm-A	

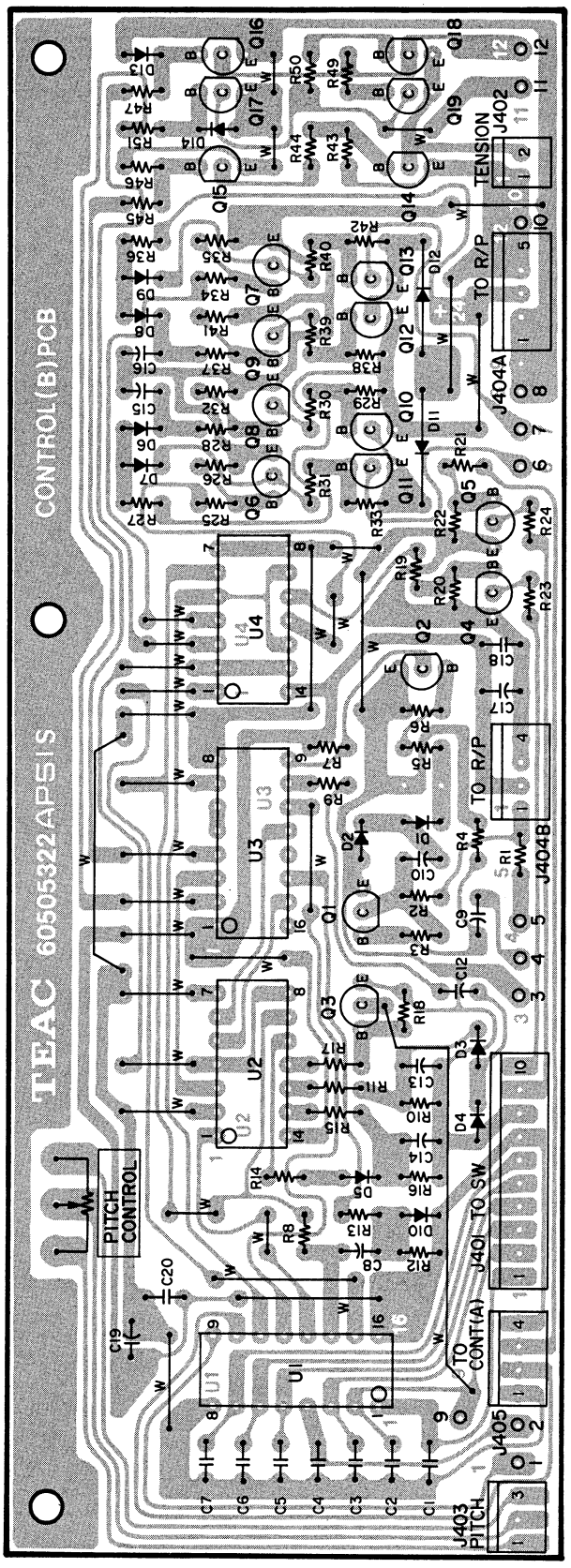
MISCELLANEOUS

*S101	6051446000	Switch	Push	
S501	6051447000	Switch	Push	2-gang
S502	6051448000	Switch	Push	6-gang
J201	*6052379005	Connector	5P	
J202	*6052380006	Connector	6P	
J203	*6052380007	Connector	7P	
J212	*6052379003	Connector	3P	
*J1	5124039000	Jack	MIC	
J5	5124040000	Jack	PHONES	
J6	6052376000	Jack	Pin	
	*6040826000	Jumper	x 62	

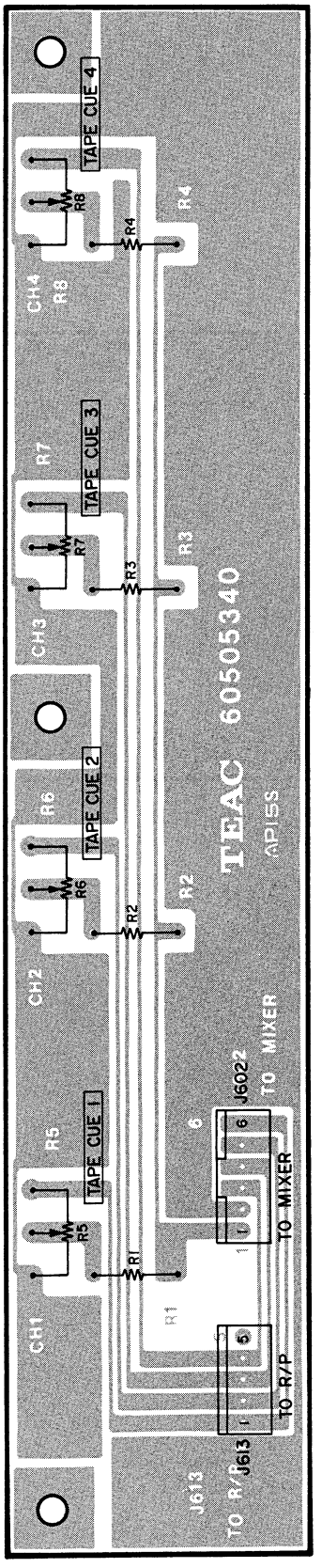
CONTROL (A) PCB ASSY



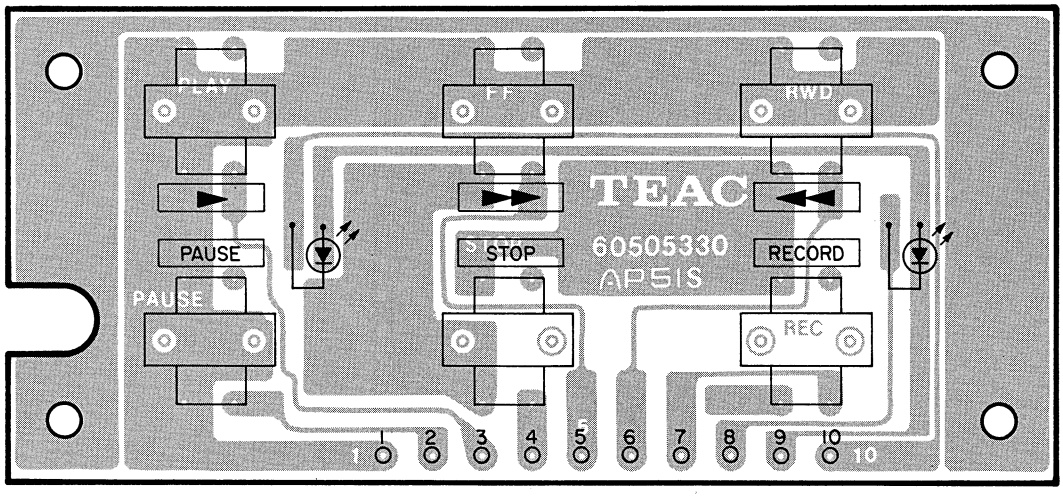
CONTROL (B) PCB ASSY



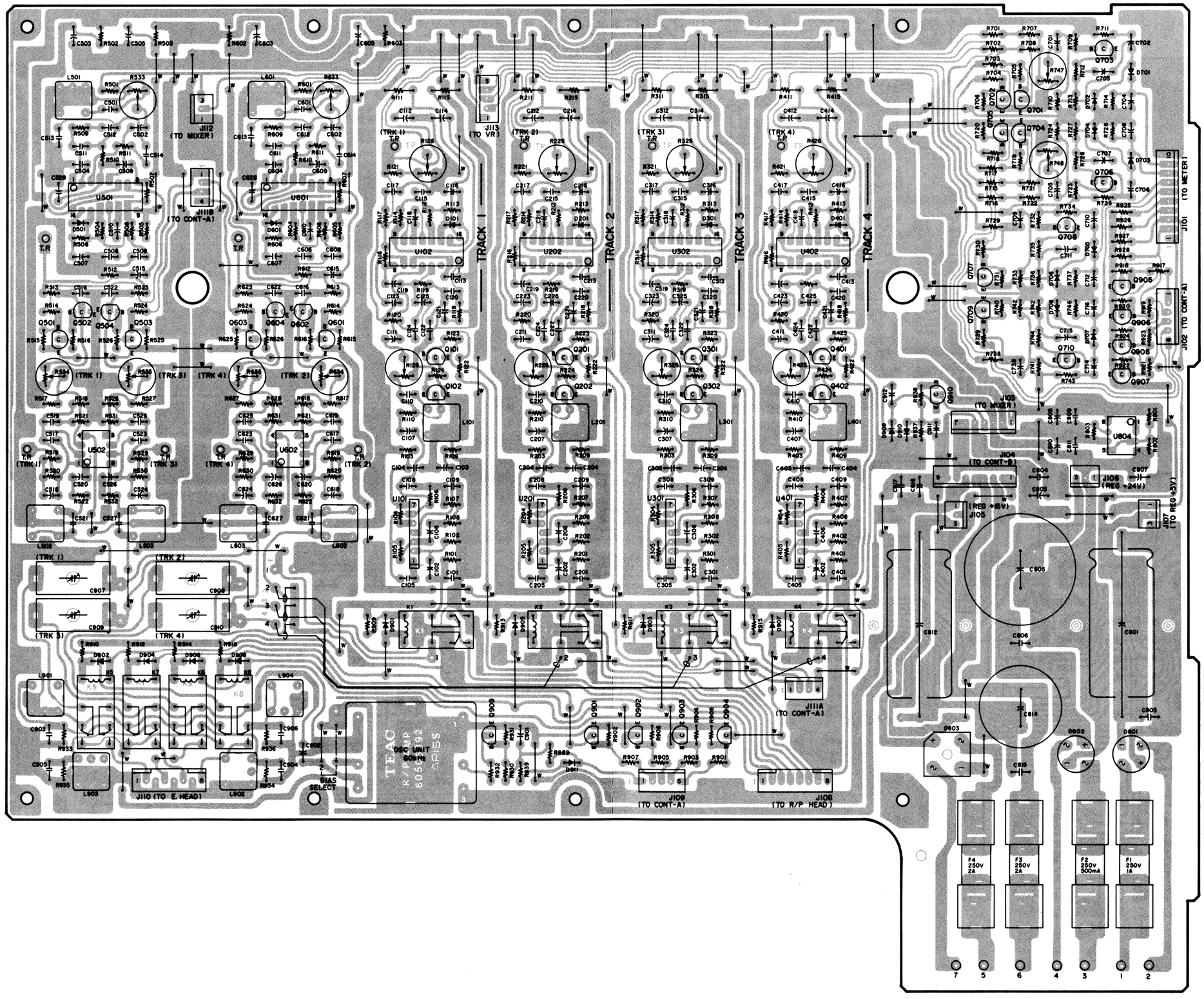
VR PCB ASSY



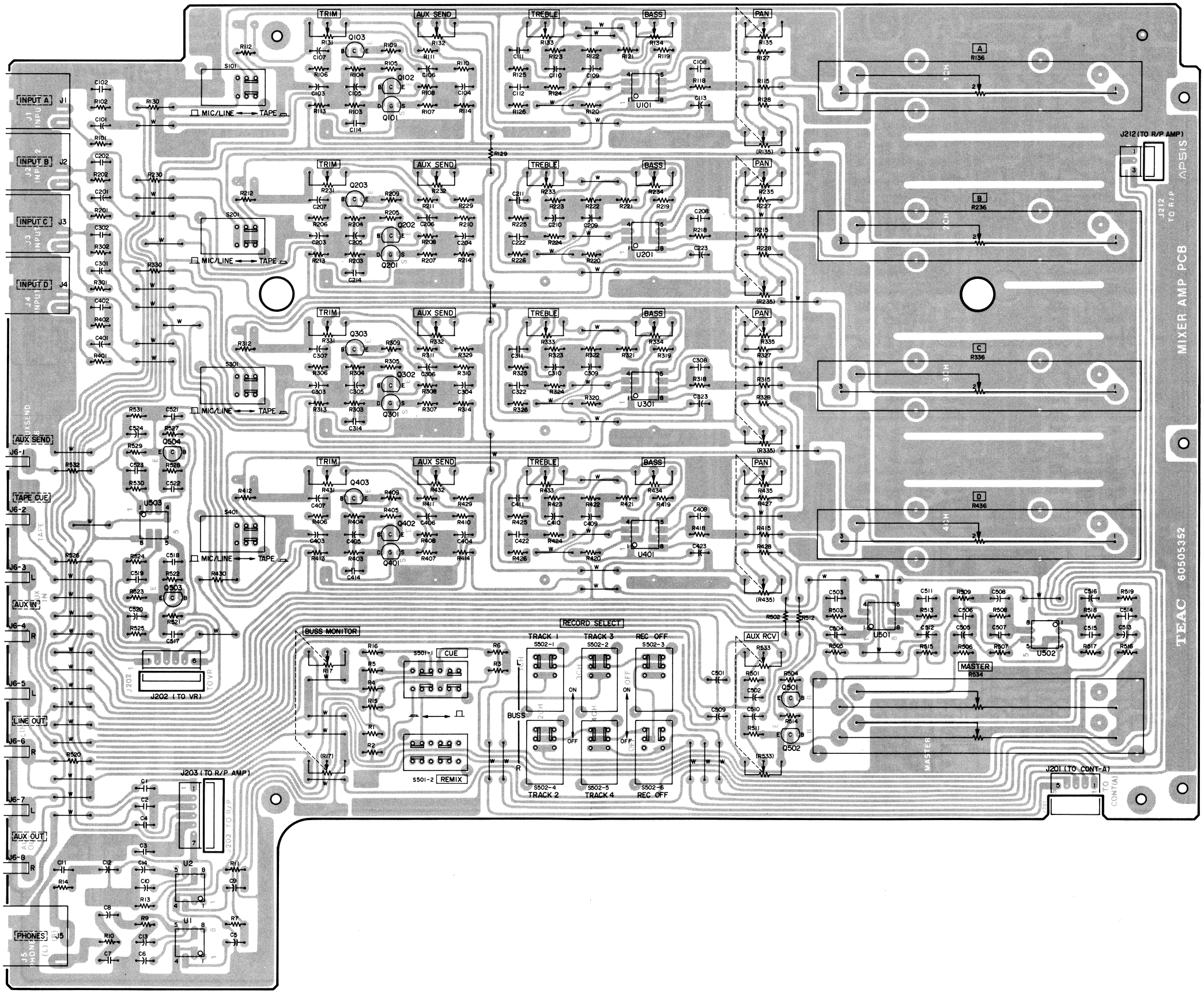
SWITCH PCB ASSY



REC/PLAY AMP PCB ASSY



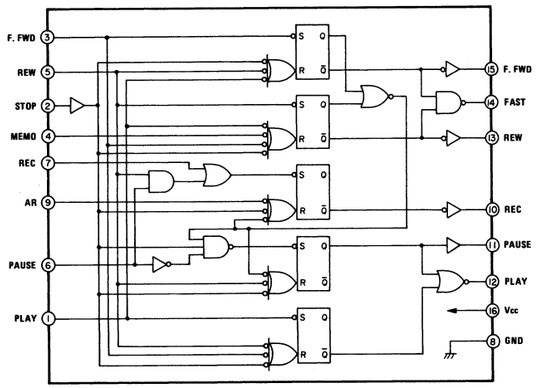
MIXING AMP PCB ASSY



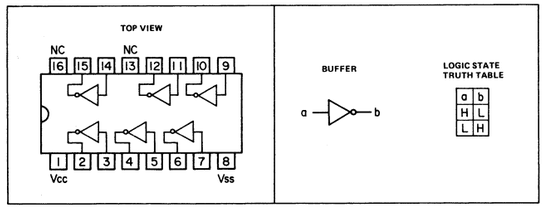
FUNCTION TABLE OF M54410P

INPUT SIGNAL (LOW LEVEL)	OUTPUT						OUTPUT MODE
	FAST	F. FWD	REW	REC	PAUSE	PLAY	
STOP	L	L	L	L	L	L	STOP
F. FWD	H	H	L	L	L	L	F. FWD
REW	H	L	H	L	L	L	REW
PLAY	L	L	L	L	L	H	PLAY
PAUSE	L	L	L	L	H	L	PAUSE
REC/PLAY	L	L	L	H	L	H	REC/PLAY
REC/PAUSE	L	L	L	H	H	L	REC/PAUSE
AR	L; REC INHIBIT H; REC ENABLE						
MEMO	REW OUTPUT WILL NOT DO H WHEN MEMO IS L.						

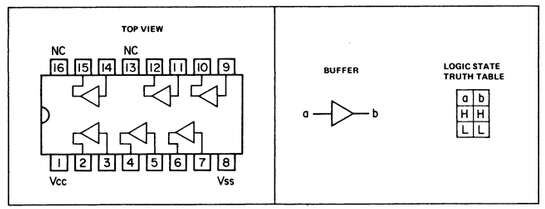
BLOCK DIAGRAM OF M54410P



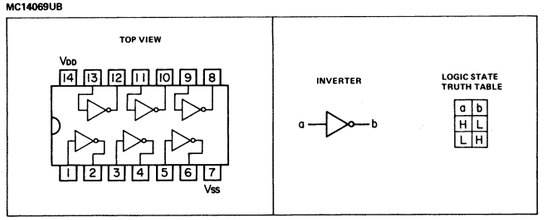
MC14049UB



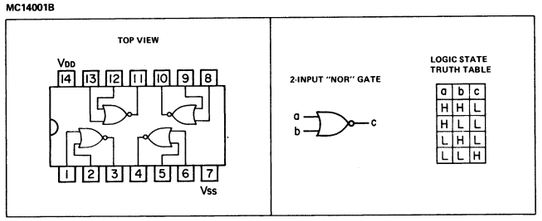
MC14050B



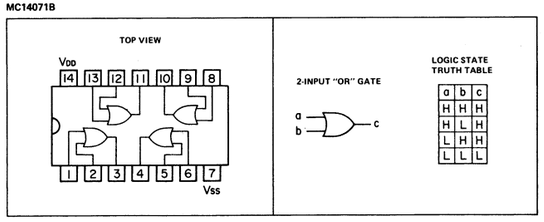
MC14069UB



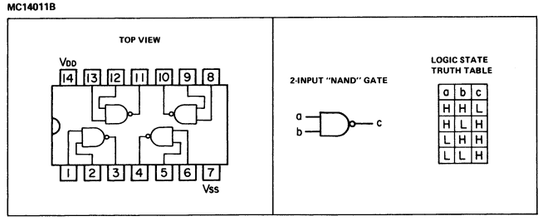
MC14001B



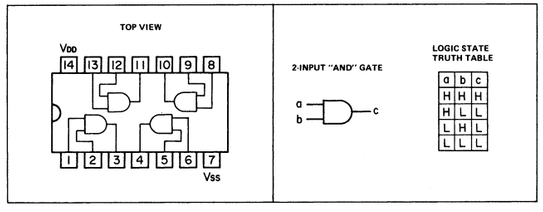
MC14071B



MC14011B



MC14081B



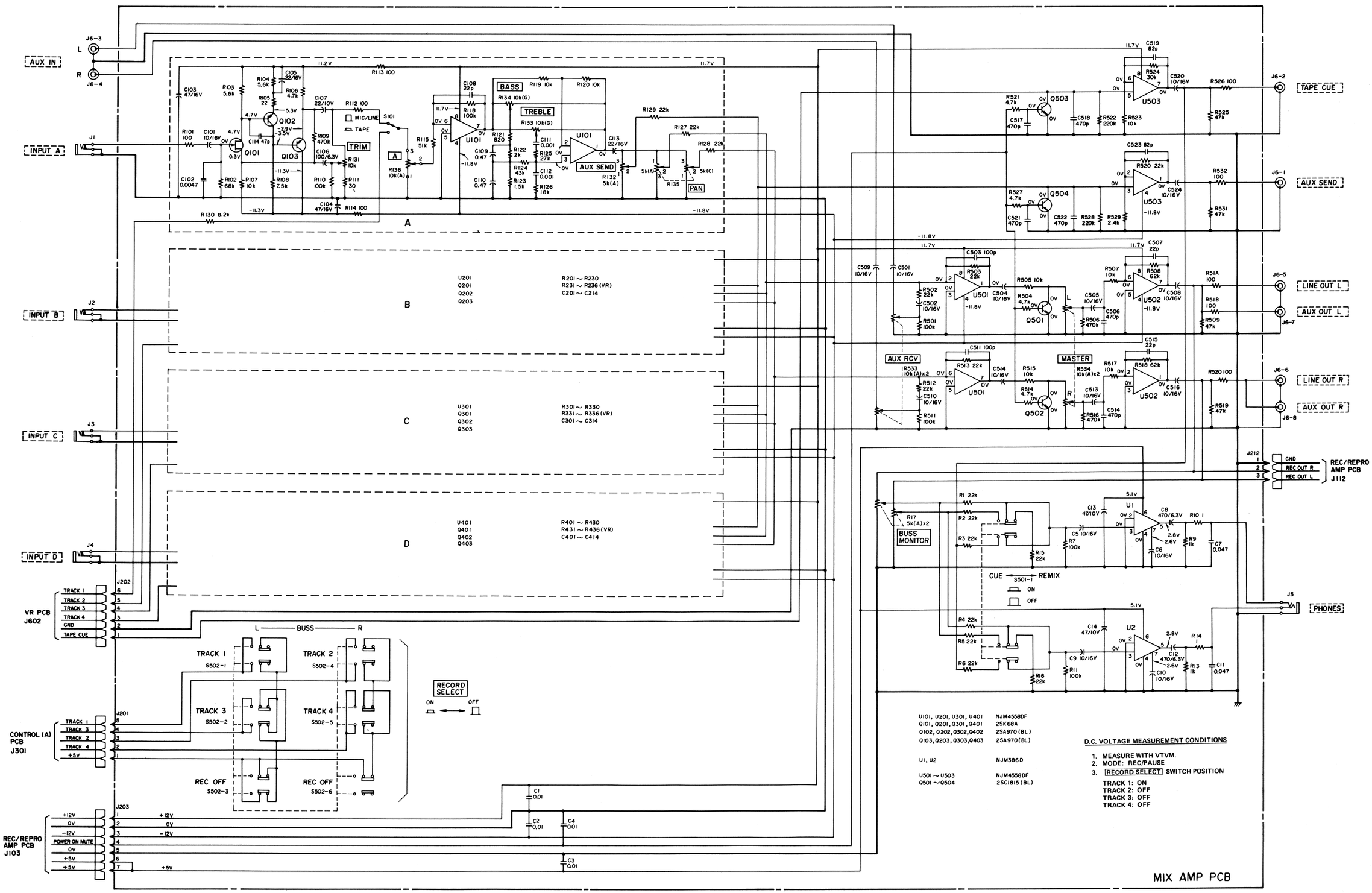
SCHEMATICS

TEAC Tascam Series

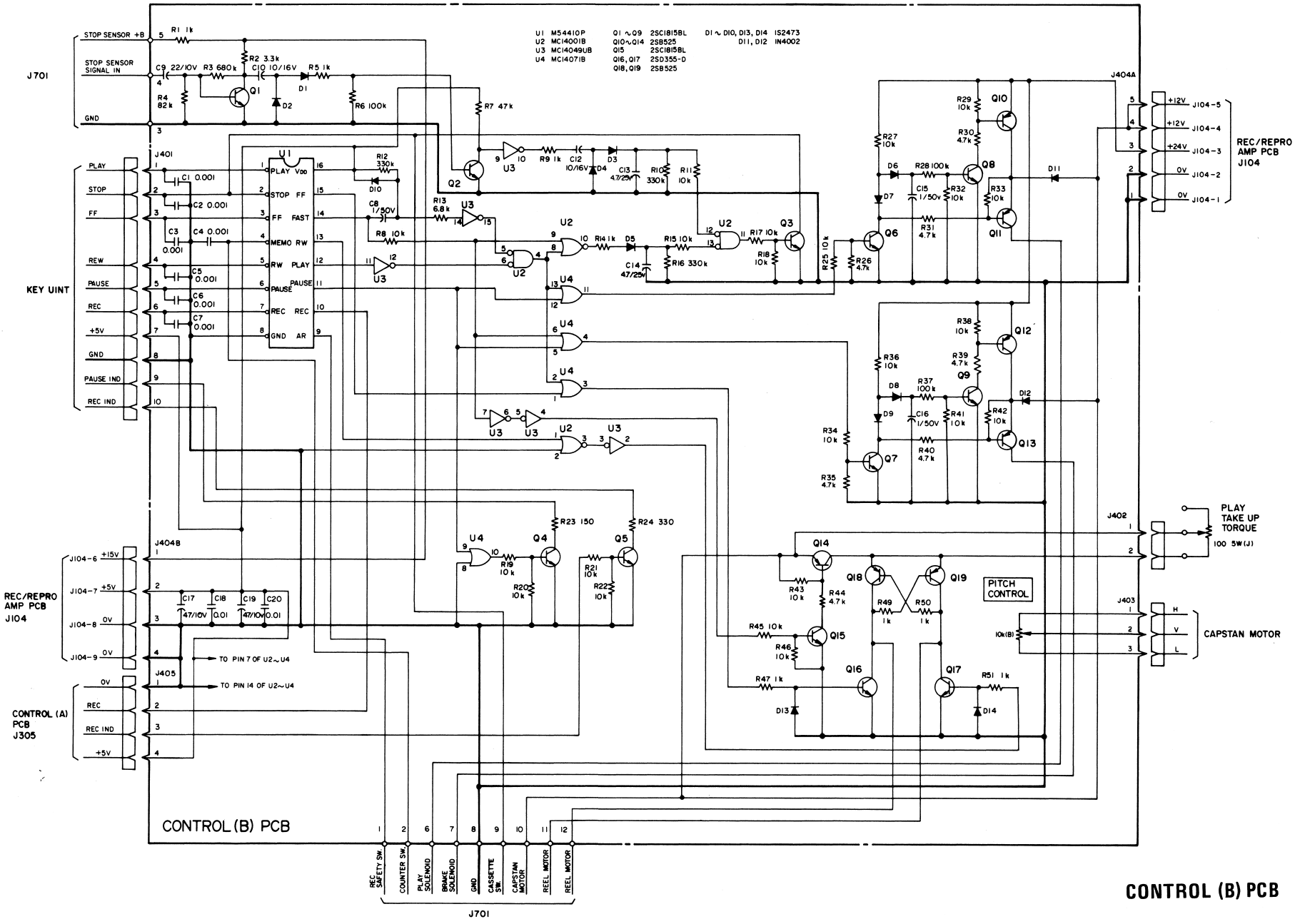
Model 144

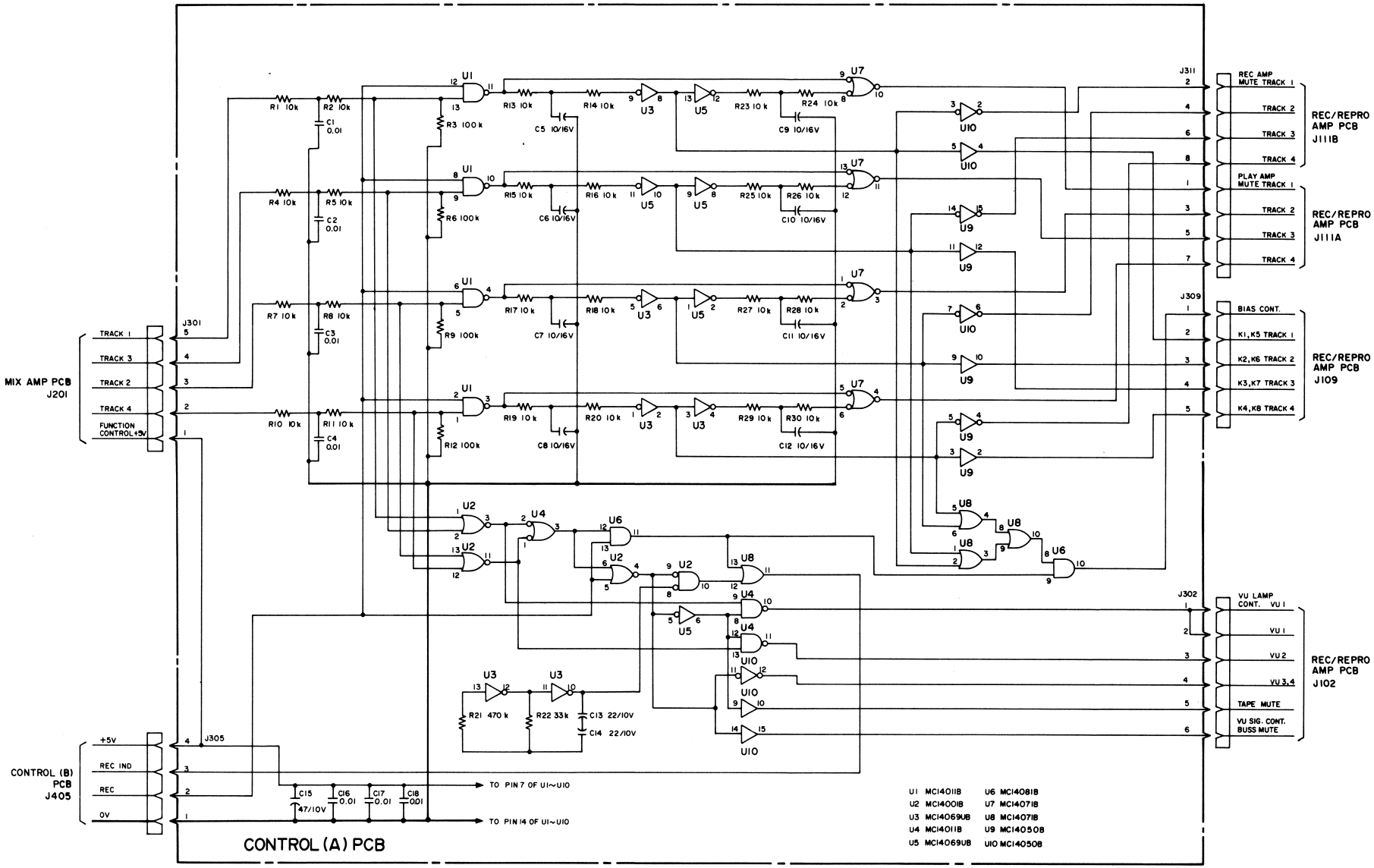
PORTASTUDIO™

TEAC®

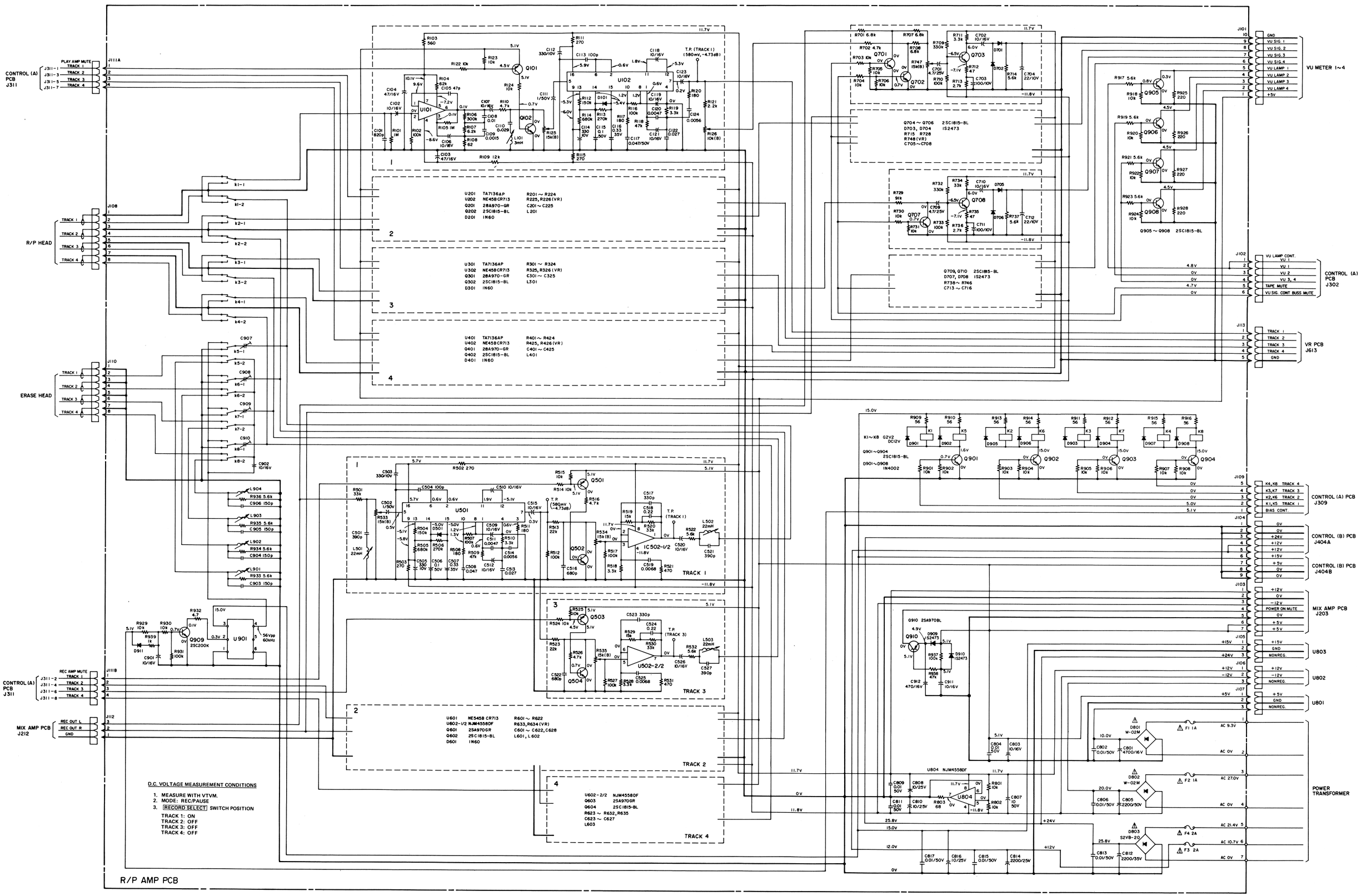


MIXING AMPLIFIER





CONTROL (A) P.C.B.



RECORD/REPRODUCE AMPLIFIER

JAPAN

AUSTRALIA

U.K.

EUROPE

GENERAL EXPORT

CANADA

U.S.A.

SWITCH PCB

REC/REPRO AMP PCB

CONTROL(A) PCB

CONTROL(B) PCB

MIX AMP PCB

VR PCB

SENSOR PCB

REEL MOTOR

CAPSTAN MOTOR

WIRING DIAGRAM