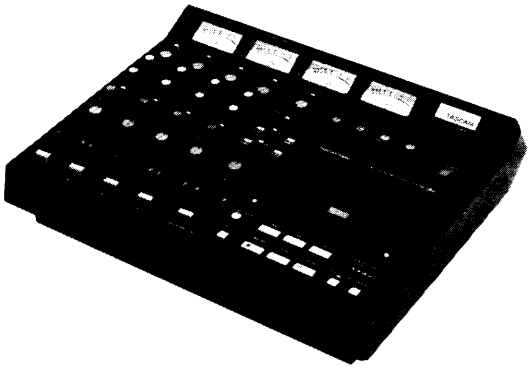
TASCAM
TEAC Production Products



SERVICE MANUAL

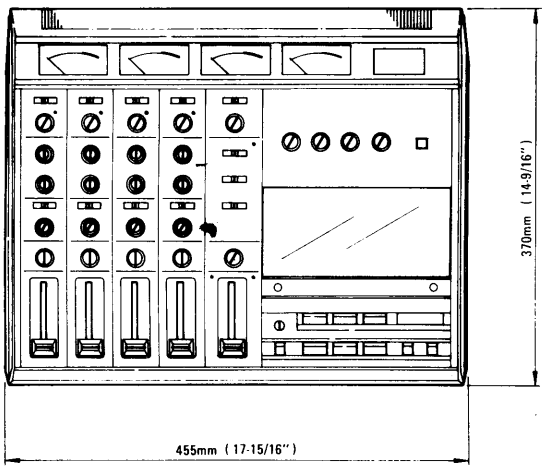
244
PORTASTUDIO

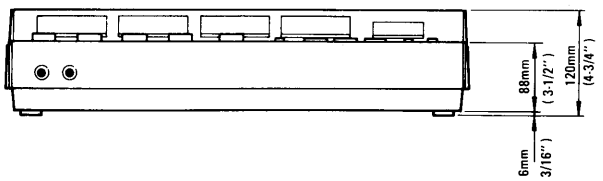
Effective: April, 1982 Q20083

5704013402

PRECAUTIONS

- Value of "dB" in the Data refers to 0 dB (1 V), except where specified.
- The AC voltmeter used in the procedures must have an input impedance of 1 M-ohms or more.
- All resistors are 1/4 watt, 5%, unless marked otherwise, resistor values are in ohms (k = 1,000 ohms, M = 1,000,000 ohms).
- All capacitor values are in microfarads (p = picofarads).
- Schematic diagram shown for one channel except for some of the components.
- ⚠ 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.
- Improvements may result in Specifications and Service Data changes.
- dbx noise reduction system made under license from dbx, incorporated. The name "dbx" and the dbx symbol are trademarks of dbx, Incorporated.





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1 INTRODUCTION

The TASCAM 244 is a small lightweight, compact unit comprized of a 4-channel cassette recorder with DBX noise reduction processors and 4-channel mixing units, and allows you to create sound in multi-channel recordings, mixing down, etc. All trim pots required in servicing are positioned on locations which allow easy access by simply opening the bottom cover; in addition each PC board assembly has been designed to be replaced by removing screws and connectors, thus maintenance or troubleshooting may be conducted easily.

2 SPECIFICATIONS, SERVICE DATA

MECHANICAL

Tape:	Compact Caseette, C-60 or C-90, Use a gamma-ferric oxide tape that requires high-bias level (chrome position) and 70-microsecond EQ. (TDK-SA, MAXELL-UDXL-II, or equivalent)
Track Format:	4-Track, One Direction (Special Format)
Heads:	4 Channel Erase (Ferrite) 4 Channel Record/Playback (Permalloy)
Tape Speed:	3-3/4 ips. ±1%
Pitch Control:	±15% of normal tape speed
Wow & Flutter:	±0.06% peak (DIN/IEC/ANSI, weighted) 0.04% RMS (JIS/NAB, weighted)
Fast Wind Time:	85 seconds for C-60 tape
Motors:	1 FG Servo-controlled DC Capstan motor, 1 DC Reel motor and 1 DC Control motor
Recording Time:	15 minutes for C-60 tape
Dimension:	455 (W) x 120 (H) x 370 (D) mm (17-15/16" x 4-3/4" x 14-9/16")
Weigth:	
Net:	9 kg (20 lbs.)
Shipping:	10 kg (22 lbs.)

ELECTRICAL

MIXER SECTION

Mic/Line Input (X4):	
Mic Impedance:	10 k ohms or Less
Input Impedance:	60 k ohms
Nominal Input Level:	Mic –60 dB (1 mV), at TRIM max. Line –10 dB (0.3 V), at TRIM min.
Minimum Input Level:	–68 dB (0.4 mV)
Maximum Input Level:	+15 dB (5.6 V)
Aux Rcv (X2):	
Input Impedance:	37 k ohms
Nominal Input Level:	–10 dB (0.3 V)
Maximum Input Level:	+15 dB (5.6 V)
Access Send:	
Output Impedance:	100 ohms
Nominal Load Impedance:	10 k ohms
Minimum Load Impedance:	1.7 k ohms
Nominal Output Level:	–10 dB (0.3 V)
Maximum Output Level:	+15 dB (5.6 V)
Access Rcv:	
Input Impedance:	68 k ohms
Nominal Input Level:	–10 dB (0.3 V)
Maximum Input Level:	+15 dB (5.6 V)
Line Out (X2), Aux Out (X2):	
Output Impedance:	100 ohms
Nominal Load Impedance:	10 k ohms
Minimum Load Impedance:	1.7 k ohms
Nominal Output Level:	–10 dB (0.3 V)
Maximum Output Level:	+15 dB (5.6 V)
Aux Send (X2):	
Output Impedance:	100 ohms
Nominal Load Impedance:	10 k ohms
Minimum Load Impedance:	1.7 k ohms
Nominal Output Level:	–10 dB (0.3 V)
Maximum Output Level:	+15 dB (5.6 V)
Headphone Output (Stereo):	
Nominal Load Impedance:	8 ohms
Minimum Load Impedance:	4 ohms
Maximum Output Level:	100 mW at 8 ohms
Equalizer:	
Type:	Peak/Dip Parametric
Frequency:	Low/Mid, 62 Hz to 1.5 kHz Mid/High, 1 kHz to 8 kHz
Peak/Dip Level:	±15 dB
Tape Cue (Stereo):	
Output Impedance:	100 ohms
Nominal Load Impedance:	10 k ohms
Minimum Load Impedance:	1.7 k ohms
Nominal Output Level:	–10 dB (0.3 V)
Maximum Output Level:	+15 dB (5.6 V)

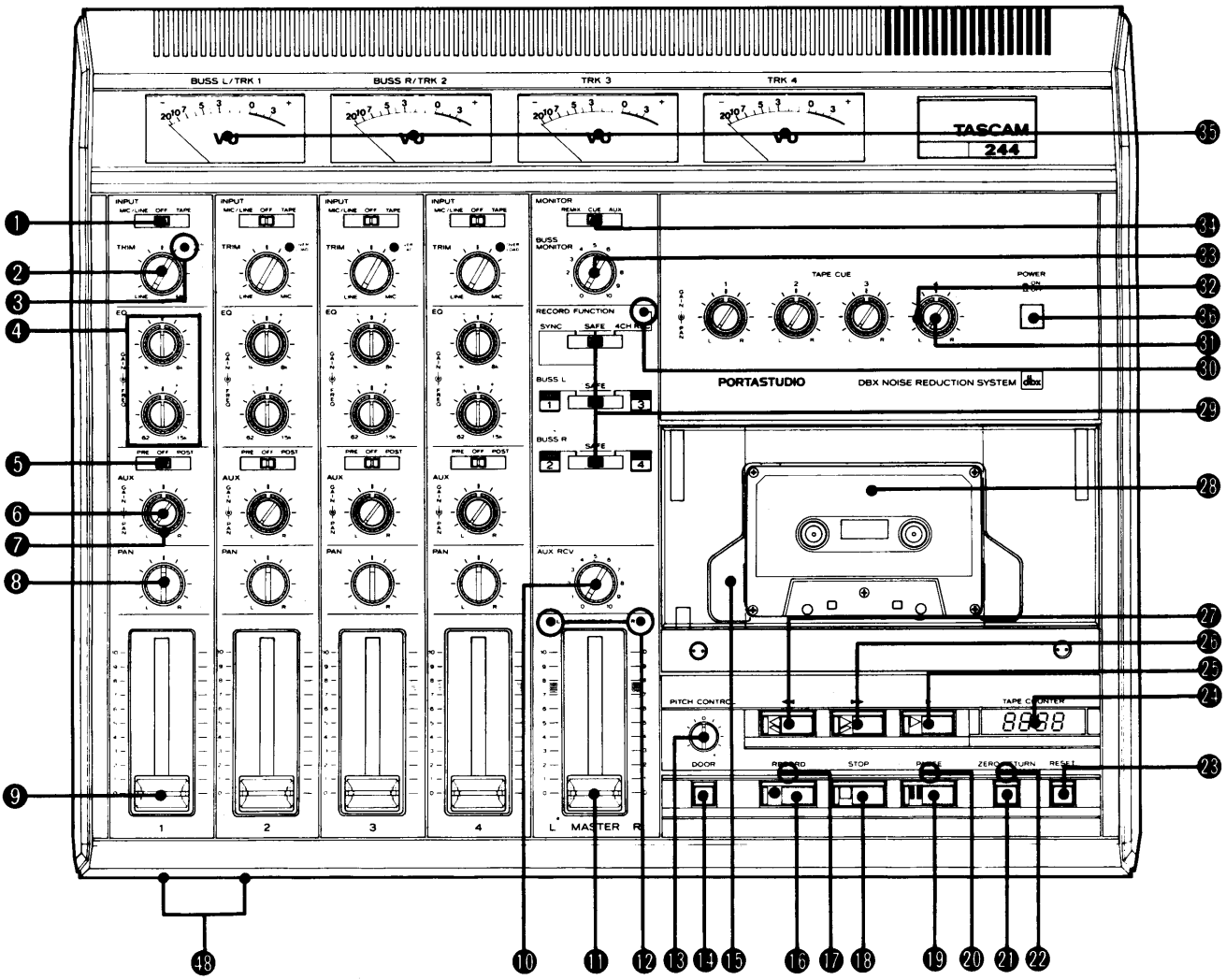
Input Overload Indicator:	
Indication Level:	22 dB above Nominal Input Level
Buss Overload Indicator:	
Indication Level:	10 dB above Nominal Output Level (10 dB above Nominal Recording Level)
Frequency Response:	20 Hz to 20,000 Hz ±1 dB
Signal-to-Noise Ratio:	
One mic in to line out:	68 dB (IHF, A weight) 65 dB (unweighted)
One line in to line out:	80 dB (IHF, A weight) 76 dB (unweighted)
Total Harmonic Distortion:	0.05% at 1 kHz, nominal level
Crosstalk:	65 dB at 1 kHz

RECORDER SECTION

Record Channels:	4 with DBX Type-II NR full time Encoding
Playback Channels:	4 with DBX Type-II NR full time Decoding
Tape Out (4 Channel):	
Output Impedance:	100 ohms
Nominal Load Impedance:	10 k ohms
Minimum Load Impedance:	1.7 k ohms
Nominal Output Level:	−10 dB (0.3 V)
Maximum Output Level:	+15 dB (5.6 V)
Frequency Response:	20 Hz to 18,000 Hz (40 Hz to 14,000 Hz, ±3 dB)
Signal-to-Noise Ratio:	Referenced to 3% THD Level at 315 Hz, 90 dB (IHF, A weighted) 75 dB (unweighted)
Total Harmonic Distortion:	1.5 % at 315 Hz, 0 VU level (overall)
Crosstalk:	70 dB at 1 kHz
Erasure:	70 dB at 1 kHz
Power Requirement:	100/120/220/240 V AC, 50/60 Hz, 30 W (General Export Model) 120 V AC, 60 Hz, 30 W (U.S.A./Canada Model) 220 V AC, 50 Hz, 30 W (Europe Model) 240 V AC, 50 Hz, 30 W (U.K./Australia Model)
Optional Accessories:	
Model RC-30P:	Remote Punch-In/Out Foot Pedal.
Model 109B:	Designed to low impedance mics to high impedance inputs to virtually eliminate RF signals induced in the mic cable. The 109B is particulary useful when the mic cable length exceeds 15 feet.

SERVICE DATA

Tape Speed:	
Deviation:	3,000 Hz ±30 Hz
Width of deviation:	Within 30 Hz
Pitch Control:	
Minimum:	Less than 2,610 Hz
Maximum:	More than 3,390 Hz
Take-up Torque:	
At play and record:	35 to 55 g-cm (0.49 to 0.76 oz-inch)
At FF:	Higher than 55 g-cm (0.76 oz-inch)
At REW:	80 to 150 g-cm (1.11 to 2.08 oz-inch)
Pinch Roller Pressure:	350 to 500 g-ms (12.34 to 17.64 oz)
Wow & Flutter:	
Reproduce Method:	±0.06% peak (DIN/IEC/ANSI weighted) ±0.15% peak (DIN/IEC/ANSI unweighted) 0.04% RMS (JIS/NAB weighted) 0.08% RMS (JIS/NAB unweighted)
Record/Reproduce Method:	±0.06% peak (DIN/IEC/ANSI weighted) ±0.15% peak (DIN/IEC/ANSI unweighted) 0.05% RMS (JIS/NAB weighted) 0.09% RMS (JIS/NAB unweighted)
Frequency Response:	
Mic/Line INPUT → LINE OUT	20 Hz to 20,000 Hz ±1 dB
Parametric EQ:	Refer to Section 6-5-10, 11
Overall:	Refer to Section 6-6-6
Overall SN Ratio:	Refer to Section 6-6-7
Overall Distortion:	Less than 1.5 % at 315 Hz, 0 VU level.
Erasing Ratio:	Higher than 70 dB
Headphones (L, R)	Maximum 894 mV at 8 ohms


BUSS L/TRK 1
BUSS R/TRK 2
TRK 3
TRK 4
TASCAM
244
PORTASTUDIO
DBX NOISE REDUCTION SYSTEM
MONITOR
BUSS MONITOR
RECORD FUNCTION
TAPE CUE
POWER
PITCH CONTROL
TAPE COUNTER
DOOR
RECORD
STOP
PAUSE
ZERO RETURN
RESET
L MASTER R
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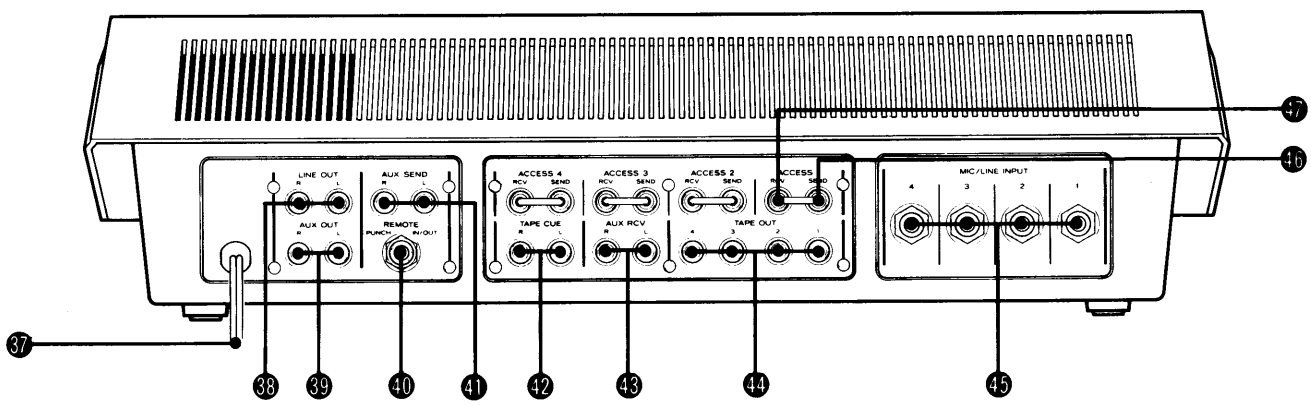
LINE OUT
AUX SEND
AUX OUT
REMOTE
ACCESS 4
ACCESS 3
ACCESS 2
ACCESS 1
TAPE CUE
AUX RCV
TAPE OUT
MIC/LINE INPUT
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3 THE CONTROLS AND THEIR FUNCTIONS

MIXER SECTION

1 INPUT Selector Switch

This switch has three positions to select input signals for the input module.

* MIC/LINE: selects the MIC/LINE INPUT jack [45] on the rear panel.
* OFF: acts as a mute, and improves overall SN when the switch corresponding to the module not in use is placed in the OFF position.
* TAPE: selects the playback signal from the built-in tape deck. The module number corresponds to the tape track number; for example, module No. 1 receives the playback signal from track No. 1, module No. 3 from track No. 3, etc.

2 TRIM Control Knob

This knob adjusts the gain of the preamplifier to give the optimum signal level for the signal supplied from the MIC/LINE INPUT jack [45] on the rear panel.

The gain adjustable range is 50 dB (−10dB to −60dB).

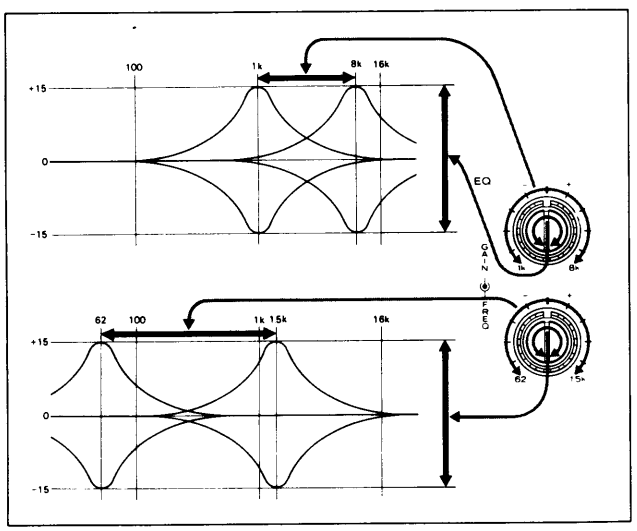
This control is effective only when the INPUT Selector switch located just above it is set to the MIC/LINE position and is disabled during tape playback.

3 OVERLOAD LED

The LED illuminates when the signal input to the MIC/LINE INPUT jack exceeds the reference level by 20 dB.

4 EQ GAIN & FREQ Control Knob

This unit contains two parametric equalizers with variable center frequencies, the responses being freely boosted or cut. Two knobs are arranged coaxially: the large, lower one adjusts the center frequency (1 kHz to 8 kHz, and 62 Hz to 1.5 kHz) and the small, upper one adjusts the amount of boost/cut (±15 dB) continuously.



5 AUX Switch

This switch selects the function of the AUX system as a subsystem.

PRE: With this position selected, signals are directly input to the AUX system before being applied to the parametric equalizer [4] and the input fader [9].

OFF: This position serves as a mute: no signal is connected to the AUX system.

POST: With this position selected, signals are applied to the AUX system after being controlled by the parametric equalizer [4] and the input fader [9].

6 AUX-GAIN Control Knob

The signal selected by the AUX switch is sent from the AUX SEND jack on the rear panel through the AUX-PAN control circuit. The AUX-GAIN control knob adjusts the signal level before it is applied to the circuit. Meanwhile, the AUX-GAIN control also adjusts the volume level for the headphone, with a part of the AUX signal also applied to the headphone monitor circuit when the MONITOR (34) switch is placed in the AUX position.

7 AUX-PAN Control Knob

This control knob separates the AUX SEND and AUX headphone monitor signals controlled by the AUX-GAIN control knob for the left and right channels.

8 INPUT PAN Control Knob

This knob controls the divide ratio between the signals to be sent to left and right buses. The left and right BUS signals are then sent to the LINE OUT jack [38] and the AUX OUT jack [39] through the MASTER fader. At the same time, the same signals are branched along the way and sent to the recording and headphone monitoring circuits.

9 INPUT Fader Control

The input signal selected by the INPUT switch [1], passes via ACCESS-SEND [46] & ACCESS-RCV [47], is tone-controlled using the parametric equalizers and its level is controlled using the slide fader, then it is divided using the PAN Knob [8] and sent to the respective left and right buses. The reference setting position of the fader control is made with the mark between 7 and 8 on the fader scale.

10 AUX RCV Input Level Control Knob

This knob simultaneously controls input signal levels supplied from the left and right AUX RCV jacks on the rear panel. These input signals are mixed with respective left and right channel signals on the left and right busses in the preceding stages of the master faders.

11 MASTER Fader

This adjusts the left and right BUSS levels simultaneously. Actually, the fader controls: the Output levels of the LINE OUT [38] and AUX OUT [39] jacks, VU meter indication levels, tape recording level, and the monitor level if the MONITOR switch [34] is placed in the CUE or REMIX position.

12 BUSS OVERLOAD Indicators

Each indicator provided for each left and right channel illuminates when the output level at the LINE OUT jack exceeds the reference level by 12 dB, thus warning that the signal flowing on the BUSS is too high.

CASSETTE DECK SECTION

13 PITCH Control

This control adjusts tape speed (sound pitch) continuously during recording and playback. The center click-stop position indicates the normal speed. The variable range is approx. ±15% referenced to the normal speed.

14 DOOR Button

15 Cassette Door

16 RECORD Button

This button does not function if depressed by itself, but functions as follows if depressed with the PAUSE or ► button:

A. When depressed with the PAUSE Button

The tape deck is set to the record-ready mode, and recording starts when the ► button is depressed when the RECORD FUNCTION switch [29] is placed in the 4 CH REC position or the SYNC position and one or both of the BUSS L and BUSS R switches is (are) set to a position other than the SAFE position.

B. When depressed with the ► Button

The tape deck operates as follows depending on the positions of the RECORD FUNCTION switches.

* When all three RECORD FUNCTION switches are placed in the SAFE positions, the amplifier section is set to the record-ready mode, but the tape travels at its normal speed in the playback mode. In other words, a PUNCH-IN Ready mode is created by the RECORD FUNCTION switches.
* When the uppermost RECORD FUNCTION switch is set in the 4 CH REC position, 4-channel recording begins regardless of the positions of the remaining two BUSS L and BUSS R switches.

Note; When you playback a prerecorded tape, be sure the RECORD FUNCTION switch is in the SAFE position.

* When the uppermost RECORD FUNCTION switch is set to SYNC, and one or both of the lower two (BUSS L & BUSS R) switches is (are) set to a position other than the SAFE position, recording is made on the channel(s) selected by the BUSS L and/or BUSS R switches. Therefore, only two tracks (one of tracks 1 or 3, and one of tracks 2 or 4) can be recorded at the same time using this unit.

17 RECORD LED

The red LED has three modes.

Out: Safe and recording will not take place.

Blinking: All four tracks are ready for recording if the LED is blinking together with the 4 CH REC LED [30].

One or two of four tracks are ready for recording if only this LED is blinking.

On Steadily: All four tracks are being recorded if the LED illuminates together with the 4 CH REC LED [30].

One or two of four tracks are being recorded or recording is stopped temporarily if only the RECORD LED illuminates.

18 STOP Button

19 PAUSE Button

When depressed during recording or playback, the tape transport stops temporarily. Depressing the ► button resumes the recording or playback operation.

20 PAUSE LED

21 ZERO RETURN Switch

When this switch is depressed and the LED just above it is on, the tape being rewound is automatically stopped when the tape counter reaches "0000". This system can be used conveniently in cases where frequent checks are required.

22 ZERO RETURN LED

23 Counter RESET Button

Depressing this button resets the tape counter [24] to "0000".

24 TAPE COUNTER

Four digit electronic counter which uses a fluorescent tube.

The readout is incremented during the tape travel in the forward direction and decremented during tape travel in the reverse direction. The counter is equipped with a memory for the ZERO RETURN system and can be conveniently used to find out the beginning of a recorded program.

25 Play Button [►]

Depressing this button during FF or REW operation stops the tape travel once, then restarts the unit in the playback mode.

26 FF Button [►►]

27 REW Button [◄◄]

28 Cassette Holder

29 RECORD FUNCTION Switch

The RECORD FUNCTION switch consists of three switches: the uppermost switch selects the recording function of the tape deck and the lower two switches select the recording tracks for the left and right busses.

* The uppermost RECORD FUNCTION Switch

SYNC: actuates the SYNC record function.

When the track(s) to be recorded is(are) selected by placing the BUSS L and/or BUSS R switche(s) in a position other than SAFE, the built-in BUSS L/TRK 1 and/or BUSS R/TRK 2VU meters corresponding to the selected buss(es) illuminate and indicate the recording levels. At the same time, the RECORD LED [17] starts blinking and indicates that the unit is ready for recording. Under this condition, when recording is performed, the LED illuminates continuously. Only two tracks (one track from each left and right BUSS) can be recorded during SYNC recording.

SAFE. prevents recording if the two BUS L and BUS R switches select recording tracks. All four VU meters illuminate and indicate playback signal levels during playback.

4 CH REC: allows simultaneous four-channel recording regardless of the positions of the lower two BUSS L and BUSS R switches. Both the 4 CH REC LED [30] and the RECORD LED [17] blink and all four VU meters illuminate and indicate recording input signal levels for each channel.

* BUSS L and BUSS R FUNCTION Switches:

The BUSS L switch selects a recording track of 1 or 3 which belongs to the left BUSS and the BUSS R switch selects a recording track of 2 or 4 which belongs to the right BUSS only when the uppermost RECORD FUNCTION switch is set to the SYNC position.

When the RECORD FUNCTION switch is placed in the SYNC position and the BUSS L switch is placed in the TRK 1 or TRK 3 position, only the BUSS/TRK 1 VU meter illuminates and indicates the signal level on the left BUSS. At the same time, the RECORD LED starts blinking. When recording under this condition, the RECORD LED illuminates steadily and the recording will be made on track 1 or 3. In a similar manner, when the BUSS R switch is placed in the TRK 2 or TRK 4 position, only the BUSS R/TRK 2 VU meter illuminates and indicated the input signal level and the recording will be made on either track 2 or 4.

30 4 CH REC LED

This LED has two modes that indicate the recording conditions.

Blinking: indicates 4 CH recording is ready. In this case, the RECORD LED [17] also blinks in time with this LED.

On Steadily: indicates 4 CH recording is being performed or 4 CH recording is ready. The RECORD LED also illuminates.

MONITOR SECTION

31 TAPE CUE-GAIN Control Knob

This smaller knob, which is provided for each track, adjusts the volume of the headphone monitor and the output level supplied from the TAPE CUE jack [42] on the rear panel when a prerecorded tape is played back.

32 TAPE CUE-PAN Control Knob

This larger knob, which is provided for each track, is to properly separates the tape cue signal controlled by the TAPE CUE GAIN knob into the left and right channels.

33 BUSS MONITOR Output Control Knob

This knob simultaneously adjusts the headphone volume for each channel when monitoring the BUSS output signal with headphones.

34 Headphone MONITOR Output Switch

This selects the output signal obtained from the PHONES jack [48] on the left front panel, following three modes.

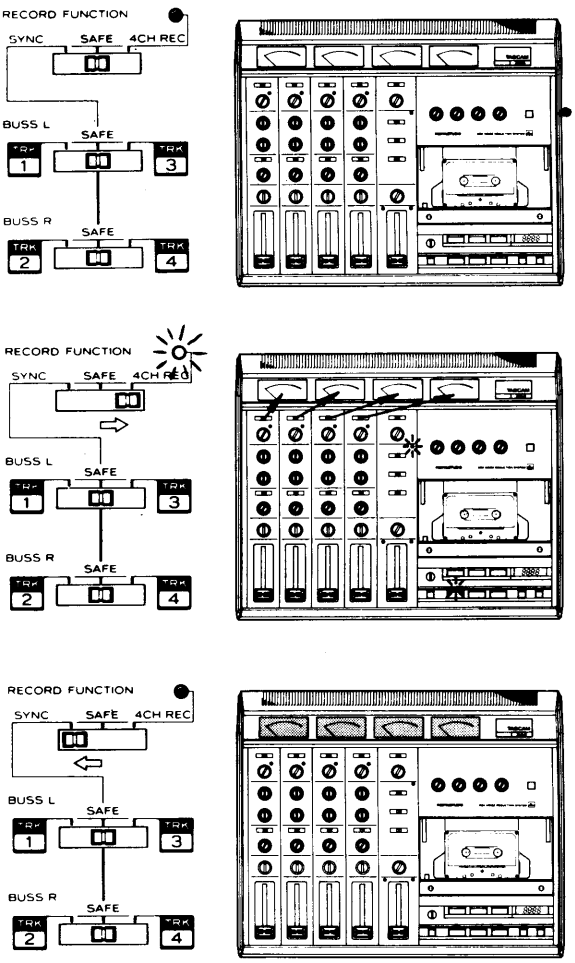
REMIX: Both left and right BUSS output signals can be monitored separately or in stereo. This position is chiefly used for performing remix. During this mode of operation, no tape cue output is heard.

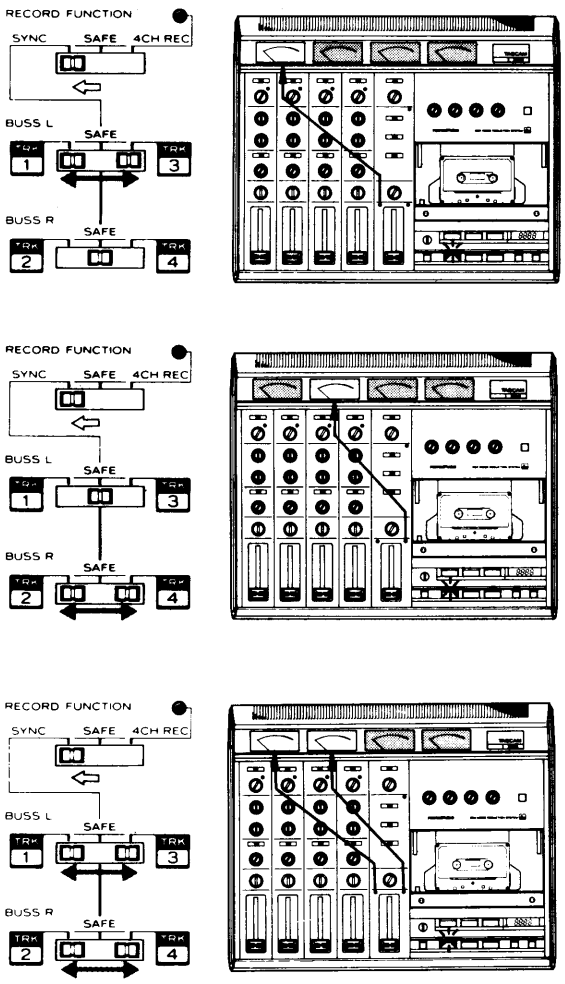
CUE: Both BUSS and tape cue output signals can be heard in the monaural mode.

AUX: The AUX signals can be heard after the signals are controlled using the AUX-GAIN and AUX-PAN knobs provided for each input module, but before they are applied to the effectors, etc, from the AUX SEND jacks on the rear panel.

35 VU Meters

These four meters operate as illustrated in the figures on the right depending upon the positions of the three RECORD FUNCTION switches [29] and the recording conditions.





36 POWER Switch

CONNECTOR SECTION

37 Power Cord

38 LINE OUT Jacks
BUSS output terminals for both left and right channels. The output levels can be controlled using the MASTER faders.

39 AUX OUT Jacks
Each output is connected in parallel with the respective LINE OUT jack [38].

40 REMOTE PUNCH IN/OUT Jack
Connecting an optional punch in/out remote pedal RC-30P allows you to conduct the punch in/out operations with the pedal if both of your hands are busy playing an instrument when you are making multiple recordings without any assistance.

41 AUX SEND Jacks
The AUX system signals controlled using the AUX-GAIN and AUX-PAN knobs for each input module are output from these jacks in the stereo mode.

42 TAPE CUE Output Jacks
These jacks provide playback signals which are adjusted by the TAPE CUE-GAIN [31] and TAPE CUE-PAN [32] control knobs.

43 AUX RCV Jacks
Additional input BUSS jacks are provided in addition to the MIC/LINE INPUT jacks [45].

44 TAPE OUT Jacks
Each jack provides a tape playback signal from a corresponding track (channel).

45 MIC/LINE INPUT Jacks
These jacks correspond to the respective input modules in the mixer section.

46 ACCESS SEND Jacks
Output jacks for connection of an accessory (effector) to the respective input module.

47 ACCESS RCV Jacks
Input jacks for connection of an accessory (effector) to the respective input module.

48 HEADPHONE Jack
When monitoring using headphones, use headphones having an impedance of 8 ohms or higher.

4 CONTROL CIRCUITS AND THEIR FUNCTIONS

4 CONTROL CIRCUIT

The control circuit consists of three major control circuits: a basic mechanism control circuit which controls fundamental tape transport operations such as PLAY, REC/PLAY, FF, REW, PAUSE and STOP; an additional function control circuit which controls the accessory circuits such as the punch in/out circuit which permits automatic changeover from playback to recording and vice versa and the zero return circuit which automatically stops the tape at the desired position during REW operation; and an amplifier control circuit which controls the switching operations for the record and playback heads, amplifier muting, and VU meters. The first two control circuits are mounted on the mechanism control PC board (B), and the third one is mounted on the control PC board (A).

Now, a detailed description will be given for each control circuit.

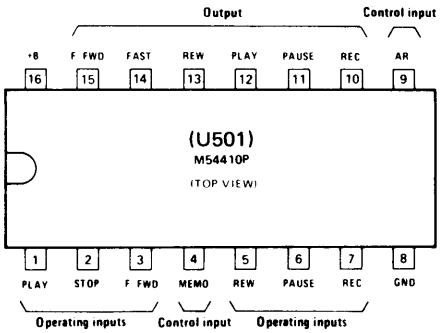
4-1 Mechanism Control Circuit

This control circuit comprises a system control IC (U501) which stories the operating instructions and generates the signals required to process the instructions, an operational amplifire (U509 1/2) which controls the reel motor, another operational amplifier (U509 1/2) which controls the tape transport mechanism, reference voltage generating circuits (Q502, Q503, Q504) and several gate units which are required for logic operations.

4-1-1 System Control IC (U501)

This IC is wired as shown in Fig. 4-1 and operates to generate logic "H" signal(s) at its designated output terminal(s) (pins 9-15) corresponding to the instructions that are held inside the IC by temporarily pulling down a desired instruction input terminal(s) (pins 1-7).

For detailed information on the system IC (U501), refer to the following data.

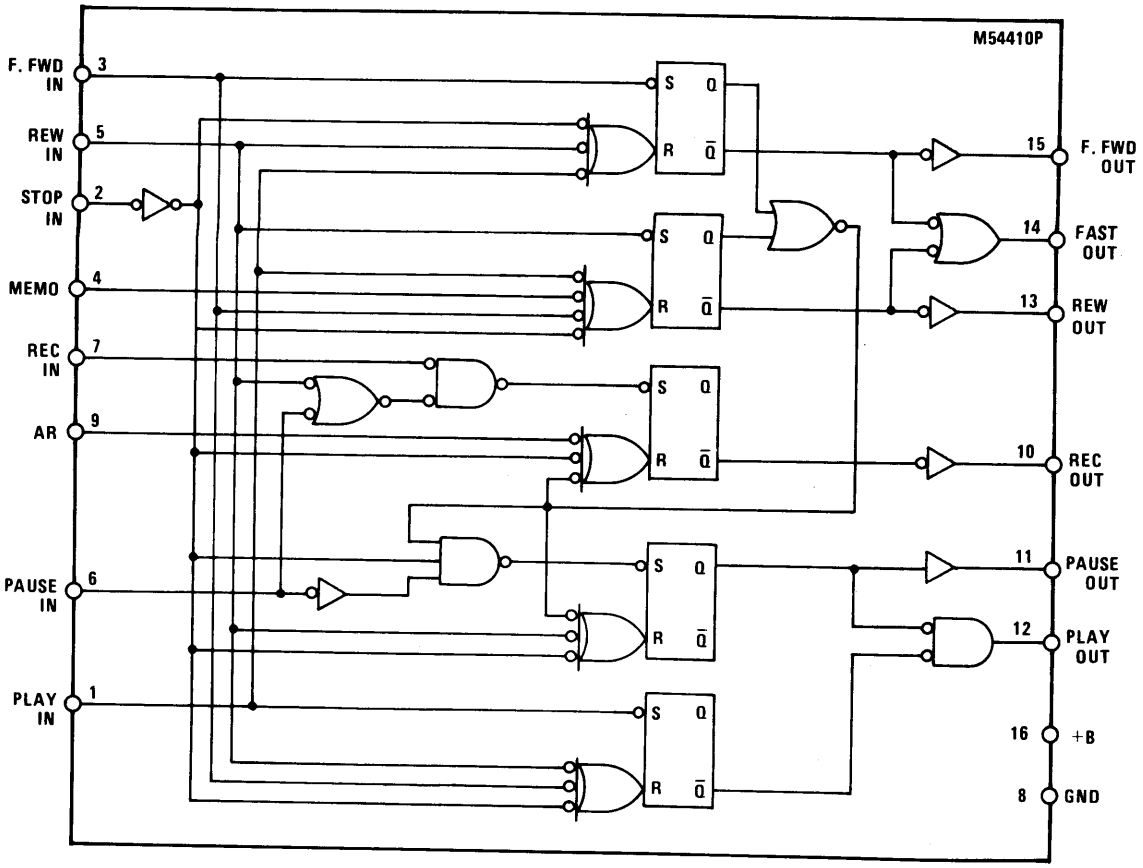


Pin Assignments

SYSTEM CONTROL IC

Pin assignments and their functions.

	Pin No.	Pin name	Function
Operation inputs	1	PLAY	Playback start signal input terminal. Signal level: L
	2	STOP	Stop signal input terminal. Signal lever: L
	3	F.FWD	Fast-forward signal input terminal. Signal level: L
	5	REW	Rewind signal input terminal. Signal level: L
	6	PAUSE	Pause signal input treminal. Signal level: L
	7	REC	Record signal input terminal. Signal level: L
Control inputs	4	MEMO	Memory input terminal (resets rewind mode when at L level)
	9	AR	Record inhibit signal input terminal (L level: record inhibited, H level: record enabled)
Output levels	10	REC	H-level signal output terminal during record/playback or record/pause mode.
	11	PAUSE	H-level signal output terminal during pause mode.
	12	PLAY	H-level signal output terminal during playback mode.
	13	REW	H-level signal output terminal during rewind mode.
	14	FAST	H-level signal output terminal during rewind or fast-forward mode.
	15	F. FWD	H-level signal output terminal during fast-forward mode.
Power	8	GND	Ground terminal.
	16	+B	Power supply terminal (standard: +5 V +/−10%, absolute maximum: +7.0 V)



Block diagram

Input signals and resulting modes

Output signal / Input signal	REC	PAUSE	PLAY	REW	FAST	F. FWD	Operating mode
PLAY	L	L	H	L	L	L	PLAY mode
STOP	L	L	L	L	L	L	STOP mode
F. FWD	L	L	L	L	H	H	F. FWD mode
REW	L	L	L	H	H	L	REW mode
PAUSE	L	H	L	L	L	L	PAUSE mode
REC and PLAY	H	L	H	L	L	L	REC/PLAY mode
REC and PAUSE	H	H	L	L	L	L	REC/PAUSE mode

Notes 1. The mode is set at the decaying edge of the input signal waveform.
2. The output retains the current mode until an input signal indicating a different mode is received.
3. Output REC remains at L as long as input AR is L.
4. Output REW remains at L as long as input MEMO is L.

4-1-2 Playback Control Circuit

Depressing the PLAY button makes pin 1 of U501 L level (hereinafter referred to as L) and pin 12 of the same H level (hereinafter referred to as H). So pin 5 of U503 goes to H and pin 4 of U503 also goes to H.

When pin 4 of U503 goes to H, Q503 comes on and the reference voltage (in this case approx. 0V) required for the play mode is applied to pin 3 of U509.

Meanwhile, the tape transport mechanism used in the tape deck is so structured that each transport mode is changed over with a motor-driven cam, which in turn is controlled by a variable resistor (10 K ohms B) arranged so that its resistance is varied as the cam moves. Therefore, for example, when the transport mechanism is in the stop position or when the cam is in a position corresponding to the stop position, a voltage corresponding to the stop position appears at the tap of the variable resistor and is applied to pin 2 of U509 through R32. Then pin 1 of U509 develops an output voltage corresponding to the voltage difference between the reference voltage for the play mode (pin 3) and a voltage (pin 2) depending on the tape transport mechanism's cam position which is set before the PLAY button is depressed (in this example, the STOP position). The output voltage turns Q506 or Q507 on and makes the mechanism drive motor rotate. The motor drives the cam and the variable resistor 10 k ohms B until the voltage developed at pin 1 of U509 decreases to zero. Consequently, theoretically speaking, the motor stops when the voltage at pin 2 becomes equal to the reference voltage at pin 3. But in actual operation, the cam is loaded by the mechanism to be driven and needs torque to keep its position against the reverse torque being applied from the load. Therefore, pin 1 of U509 generates additional voltage to rotate the motor to develop the required torque for the cam. In other words, in actual operation, the voltage at pin 1 of U509 does not indicate 0 V but maintains a value corresponding to the load against the cam.

When pin 4 of U503 goes to H, pins 5 and 6 of U507 go to H, and pin 4 of U507 also goes to H. Then pin 14 of U508 goes to L and turns Q505 on, and pin 7 of U509 operational amplifier develops positive voltage of approx. 5 V and drives Q508, thus making the reel motor rotate in the forward direction.

Meanwhile, pin 10 of U507 goes to H as pin 4 of U507 goes to H, then pin 11 of U508 goes to L. This L level signal is applied to the control (A) PC board and used to control the amplifier circuits as described later.

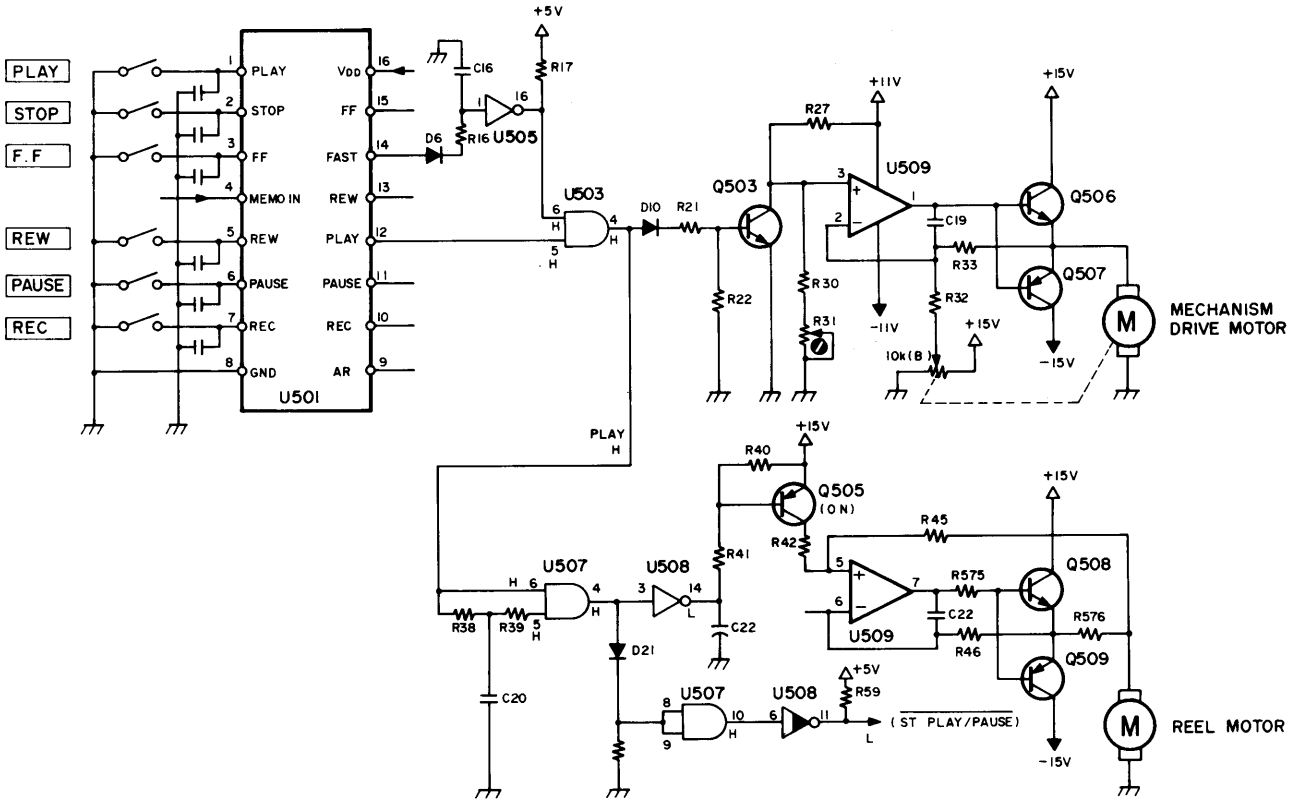


Fig. 4-1 Playback mode of operation

4-1-3 Record Control Circuit

When both the REC and PLAY buttons are depressed to set the tape deck to the record mode, an H level signal is developed at pin 12 (PLAY) of U501 and both the motors for mechanism and reel drives are controlled as mentioned under Playback Control Circuit. Meanwhile, the REC terminal, pin 10 of U501 also goes to H, and this makes pin 10 of U503 H. Therefore, pin 3 of U507 goes to H and this H level signal is applied as the record control signal to the Control PC Board (A) and the Amplifier PC Board. Refer to Fig. 4-2.

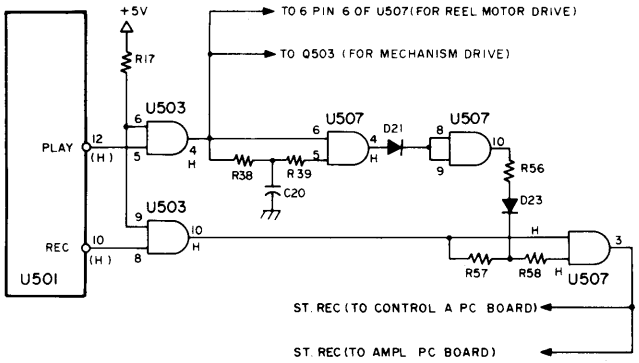


Fig. 4-2 REC/PLAY control circuit

4-1-4 Record Pause Control Circuit

In the record pause mode, both PAUSE pin 11 and REC pin 10 of U501 develop H level signals. Therefore, pin 13 of U505 goes to L, and this allows current to flow into the Pause LED and turn the LED on. At the same time, pin 11 of U503 goes to H due to pin 10 of U503 being set to H, so pin 13 of U506 goes to L. This L level signal is used as the pause control signal as described later.

Meanwhile, the motors are controlled as follows:

A. Mechanism Drive Motor

Since pin 11 of U501 is set to H, Q504 is turned on, and the reference voltage for the pause operation, which is determined by the dividing ratio of the resistors R27 and R29 + R28, is applied to the noninverting input terminal pin 3 of U509. The reference voltage drives the motor in the same manner as mentioned under Playback Control Circuit, and the cam motion is stopped when it is moved to the position specified as the PAUSE position. The trim pot R29 is provided to adjust the cam's position for the PAUSE operation.

B. Reel Motor

Pin 6 of U507 is set to L during pause mode because it is connected to pin 4 of U503, the output gate of the playback control circuit. Therefore, pin 4 of U507 is L and this makes pin 14 of U508 open, making Q505 go off. Then U509 output goes to zero potential and makes Q508 and Q509 go off, and the reel motor stops because no current flows into the motor.

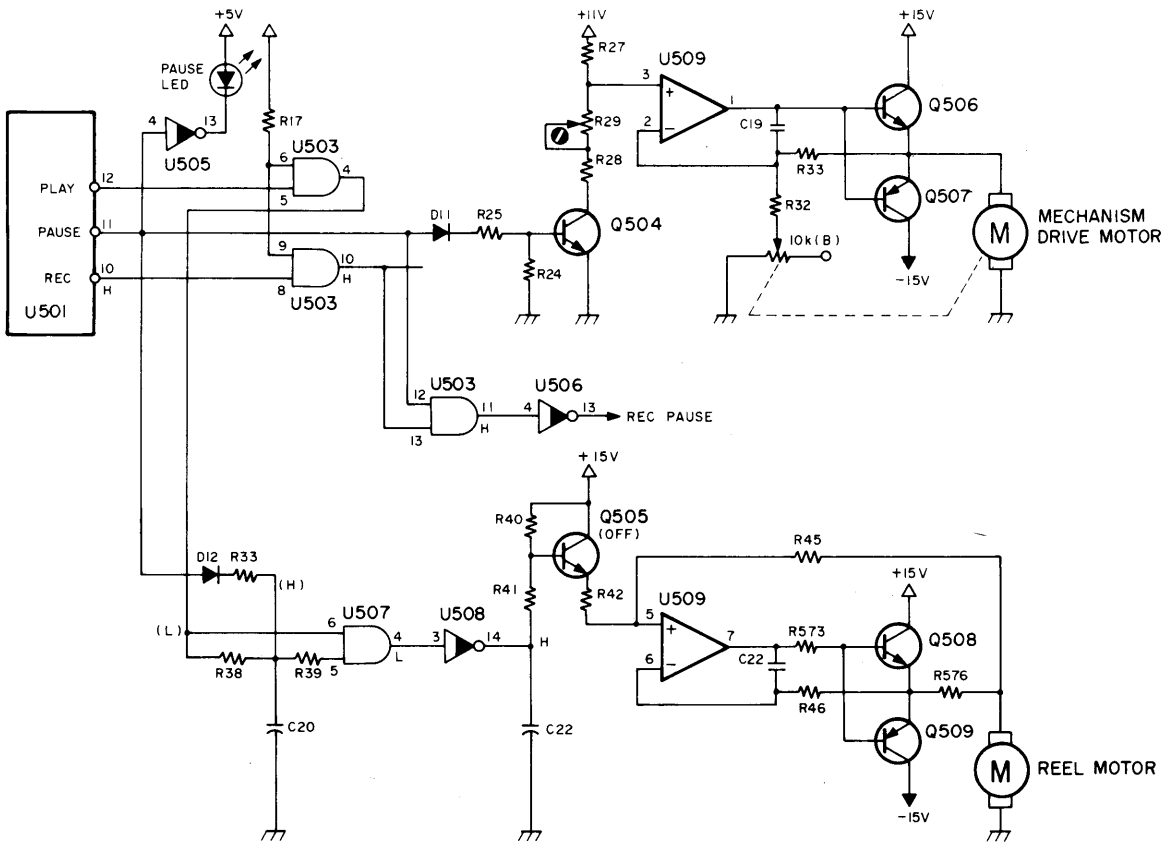


Fig. 4-3 REC/PAUSE control circuit

4-1-5 FF and REW Control Circuit

A. Mechanism Drive Motor

Pin 14 of U501 develops an H level signal during FF or REW mode and makes Q502 come on, allowing the reference voltage which is determined by the divide ratio of resistors R27 and R26 + R25 being applied to the pin 3 of U509. The reference voltage controls the mechanism drive motor in the same manner as mentioned under Playback Control Circuit and the cam is moved until it is brought to the position corresponding to the FF/REW position. The trim pot R26 is used to adjust the cam position for the FF/REW mode.

B. Reel Motor

a) In the FF mode, pin 15 of U501 goes to H and this voltage is applied to pin 5 of U509, then U509 develops a relatively high positive voltage at pin 7 and drives Q508 fully, thus making the motor rotate at high speed in the forward direction.

b) In the REW mode, the H level voltage from the pin 13 of U501 is applied to pin 6 of U509, and a negative high voltage is developed at pin 7 of U509. The negative voltage makes Q509 come on and drives the motor at high speed in the reverse direction. Refer to Fig. 4-4.

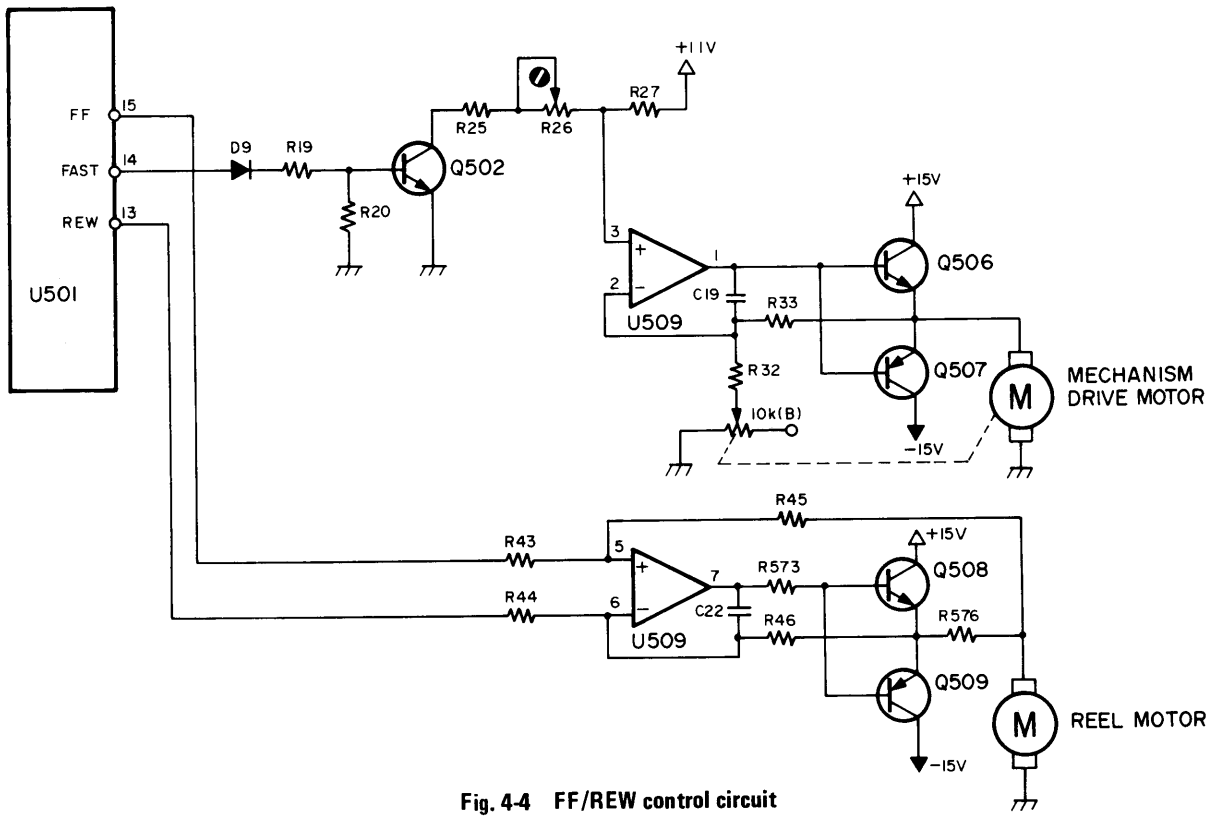


Fig. 4-4 FF/REW control circuit

4-1-6 From FF/REW to PLAY Operation

To guard against tape slack when going from FF or REW to PLAY, a slight delay is introduced before going into PLAY mode. The delay time is determined by C16 and R16. (Refer to Fig. 4-1).

When the PLAY button is depressed during the FF or REW mode, pin 5 of U503 goes to H. Meanwhile, pin 14 of U501 goes from H to L, however, pin 1 of U505 does not go to L immediately but goes to L after a time determined by the time constant of C16 and R16 has elapsed. As the result, pin 6 of U503 goes to H after the delay time. Meanwhile, pin 5 of U503 is already set to H and the pin 4 output of U503 goes to H and actuates the mechanism drive motor in the playback mode.

4-2 Additional Function Control Circuit

4-2-1 Punch IN/OUT Control Circuit

The punch in/out operations, which allow automatic switching from playback to record or record to playback, are performed by simply closing the REMOTE PUNCH IN/OUT terminals. Referring to Fig. 4-5, first, assume that the tape deck is operating in the playback mode. Since pin 4 of U503 is set to H, a base bias is applied to the base of Q501. In this condition, if the punch in/out switch is closed, Q501 comes on and both of the PLAY and REC input terminals of U501 are pulled down to L, thus recording takes place.

Next, when the punch in/out switch is closed again, pin 4 of U504 goes to H and pins 12 and 13 of U504 also go to H. So pin 14 of U506 goes to H, pin 3 of U504 goes to H, and pin 3 of U503 also goes to H. Since both pin 4 of H504 and pin 3 of U505 go to H simultaneously, pin 12 of U505 goes to L and makes the AR pin of U501 go to L and inhibits recording, thus the record mode is changed to the playback mode.

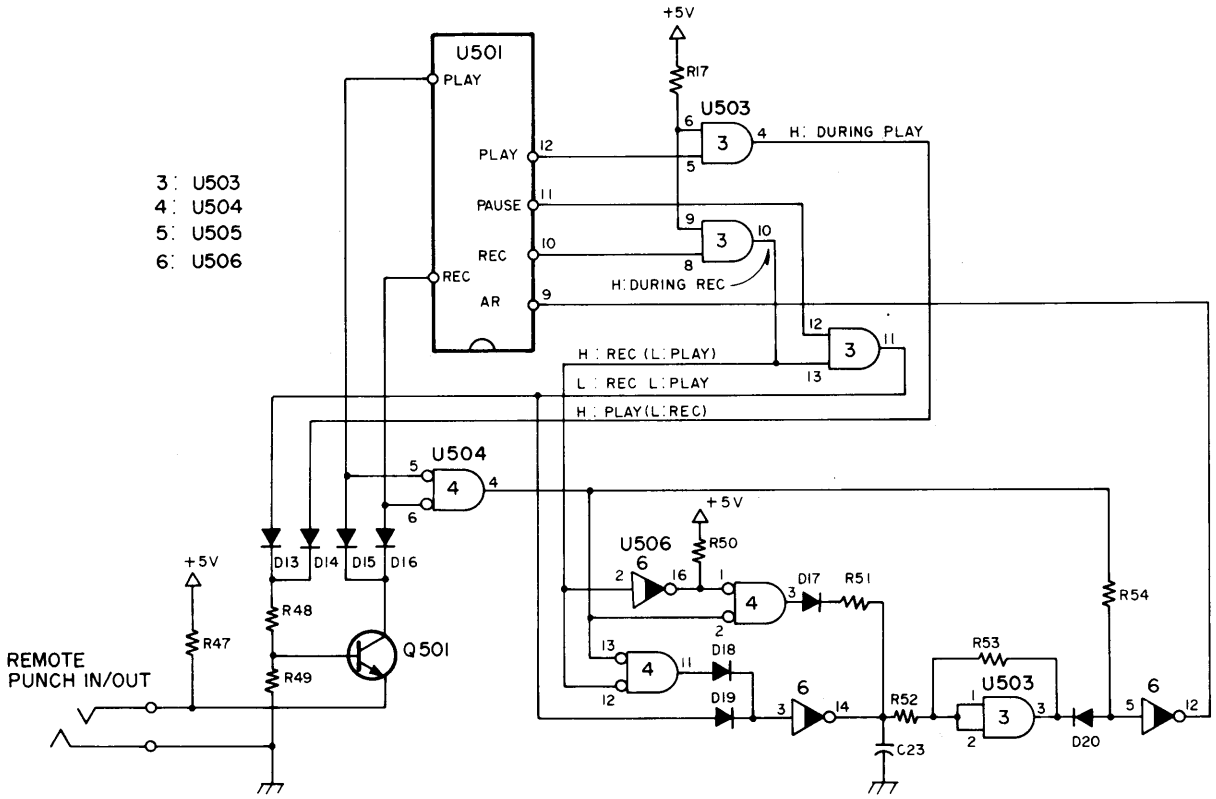


Fig. 4-5 Remote punch IN/OUT circuit

4-2-2 Zero Return Circuit

The electronic tape counter used in the unit is designed to develop a positive pulse from pin 5 (ZD) of the counter when the counter reaches "0000". The zero return circuit stops the tape travel by making use of the pulse at a given tape position at which the counter readout indicates "0000" in the REW mode. In the REW mode, since the MEMO IN input (pin 4 of U501) is set to H, pin 11 of U506 is set to L and pin 6 of U506 is set to H. Depressing the Zero Return switch under these conditions makes pin 6 of U502 go to L which in turn makes pin 4 of U502 and pin 9 of U502 go to L. Since pin 3 of U502 goes to H, as pin 1 of U502 is set to L, pin 11 of U502 goes to L and this makes pin 11 of U506 open or a high impedance state. When pin 11 of U502 goes to L, pin 8 of U502 goes to L, pin 10 of U502 goes to H, and pin 10 of U506 goes to L. Therefore, the Zero Return LED illuminates.

When the tape is rewound and the counter reaches "0000", a positive pulse is applied to pin 2 of U505 through coupling capacitor C12. Then, pin 15 of U505 changes from H to L and makes pin 4 (MEMO IN) of U501 go to L, thus making the REW operation stop. Refer to Fig. 4-6.

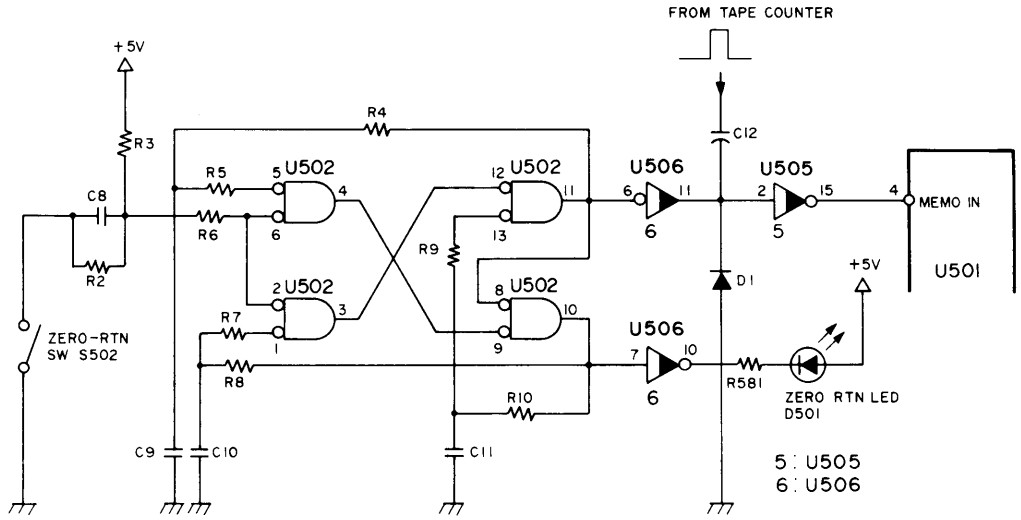


Fig. 4-6 Zero return circuit

4-2-3 Auto Stop Circuit

The Hall IC U510 mounted on the Sensor PC Board generates a pulsating voltage in proportion to the speed of the reel motor. The voltage is first applied to pin 6 of U505 and is wave-shaped. The wave-shaped output is applied to the electronic counter from its pin 11 and used as a clock signal. The output at pin 11 of U505 is also applied to pin 7 of U508, and the resultant outputs obtained at pins 10 and 12 are rectified by diodes D2 to D5. Thus, the obtained DC output makes pin 16 of U508 L, then pin 11 of U507 goes to L and this makes pin 15 of U508 H. In other words, pin 15 of U508 is always H as long as the tape is running. When the tape comes to end, the tape will stop running. Then the output at pin 15 changes from H to L because the Hall IC does not develop any output. Since pin 15 is connected to the STOP input of U501, the tape deck switches to a stop mode and stops. Refer to Fig. 4-7. R13 and C15 form a time constant circuit and delay the stop operation for one or two sec. to prevent an erroneous stop operation due to signal dropoff, etc.

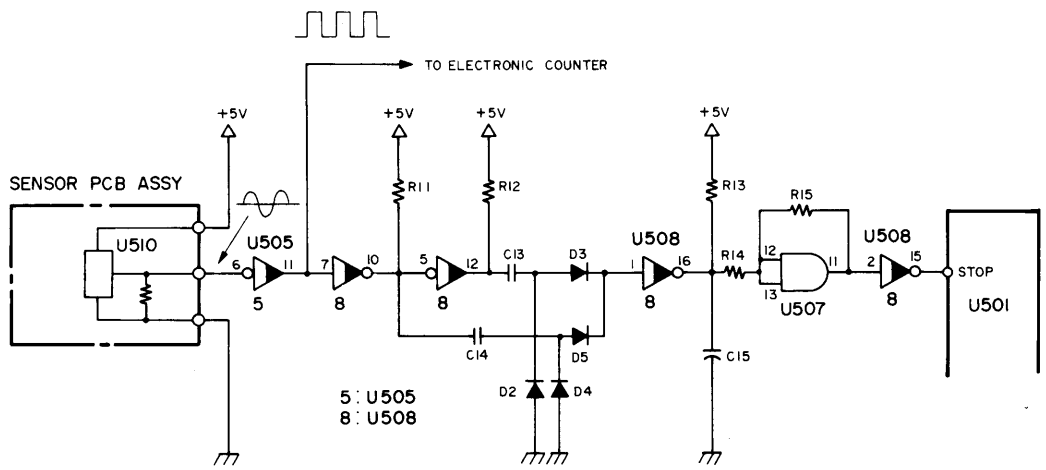


Fig. 4-7 Auto end stop circuit

4-3 Amplifier Control Circuit

The amplifier control circuit electronically controls the switching operations required for 4 channel recording and playback and their associated circuits such as indicators, VU meters, etc. Most of the control circuits are led on the Control PC Board (A).

4-3-1 Playback Signal Control Circuit

When the PLAY button is depressed, an L level signal is developed at #4 of J604 connector on the Control PC Board (B) as mentioned previously. The L level signal enters pin 2, 6, 8 & 12 of U607 and makes all of the output gates of U607 H. The H level signal is applied to terminals 2, 3, 4, 5 of P603, then to the amplifier PC board and further to the switching transistors provided on the playback EQ amplifier circuit to release the muting operation. For example, the L output from pin 11 of U607 is applied to the base of Q301 of the EQ amplifier circuit for channel 1 and makes Q301 and Q302 go off, thereby allowing the equalized signal to go to the next stage.

4-3-2 Record Signal Control Circuit

As previously mentioned, terminal #6 of J604 and terminal #2 of J508 on the Control PC Board (B) are set to H when the record mode is selected. The H level signal at #6 is applied to pin 2 of U608 and pin 2 of U601 (for CH1*) through #6 of P604 on the Control PC Board (A). (* For the remaining channels, description will be omitted because they operate in the same manner as channel 1.)

Meanwhile, if the RECORD FUNCTION switch is set to either SYNC or 4 CH, the H level signal is applied to the terminals of J605 (or one of the two terminals of J605 when SYNC mode is selected). Now let's assume that one of these H level signals is applied to pin 1 of U601 (CH 1) through #4 of P605. Then, pin 3 of U601 goes to L since pin 2 of U601 is already set to H. As the result, pins 1 and 2 of U604 go to L and pin 3 of U604 goes to H. The H level signal thus obtained is applied to the Record Amp. PC Board through #4 of P602. In the same manner, pin 11 of U606 also goes to H and is supplied to the Record Amp. PC Board through #8 of P601. Furthermore, pin 3 of U605 goes to H and this makes P in 11 of U607 L. This L signal is used as the muting signal for the Playback EQ amplifier as stated previously. Therefore the EQ amplifier is disabled in record mode. Meanwhile, since terminal #4 of P605 is set to H, pin 1 and pin 9 of U608 go to H, then pin 11 of U608 also goes to H and makes Q605 come on. Then, Q605 emitter develops H level voltage and this voltage turns the REC LED (red) on through #1 of P604.

The H level signal applied to #4 of P602 makes the record amplifier's switching transistors Q401 and Q402 go off and actuates the record amplifiers.

Another H level signal is applied to #8 of P601 and makes the record relay drive transistor Q404 come on and actuates the relay to operate the required switching for bias circuits, signal circuits, etc.

Another H level signal is developed at #1 of P603 and is applied to the 4 CH REC LED and turns the LED on when the RECORD FUNCTION switch is set to the 4 CH position.

4-3-3 Record Pause Control Circuit

With the record pause mode selected, the pause control L level signal is applied to #5 of J604 on the Control PC Board (B). This L level signal is applied to pin 9 of U608 through #5 of P604. Meanwhile, a low frequency pulse voltage (2-3 Hz) is generated by the nonstable multivibrator consisting of U603 (pins 3, 4, 5, 6) and is applied to pin 8 of U608 and the pulse voltage is output from pin 10 of U608, then from pin 11 of U608, thereby turning Q605 on or off, and this makes the REC LED blink.

4-3-4 Power Mute Circuit

The power mute circuit cuts out abnormal noises which may be caused by transient increases or decreases in power line voltage when the power is turned on or off. These noises can be removed by shorting out the signal path until the line voltage increases to its steady state when the power is turned on, and also by shorting out the signal path before the power line voltage decreases after the power is turned off, thereby preventing undesirable noises from being recorded.

Referring to Fig. 4-8, since C902 has a relatively small capacitance, the output voltage of voltage regulator IC U901 rises rapidly to its steady state and makes Q901 come on immediately after the power is turned on. Since the collector of Q901 is connected to the base of switching transistor Q_{MUTE}, Q_{MUTE} also comes on and shorts out the signal path immediately after the power is turned on, thus noises are suppressed.

Next, after a time determined by the time constant of C916 and R902 has elapsed and C916 has charged, Q901 base voltage increases and makes Q901 go off automatically. Then transistor Q_{MUTE} also goes off and allows the signal to flow to the next stage. In other words, abnormal noises caused during rising period of the power line voltage can be removed by selecting a time constant for C916 and R902 which is longer than that of the power line for the audio signal circuit.

When the power is turned off, the charges stored in capacitor C916 discharges rapidly through D904 and lowers the base bias of Q901. Meanwhile, the charge stored in C915 is not discharged rapidly because discharging is prevented by D905 and R902. As the result, the emitter potential of Q901 becomes higher than that of the base and Q901 comes on, then Q_{MUTE} also comes on and shorts out the signal again, thus suppressing the noise. In the actual circuit, the Q901 collector is connected to each base of the switching transistors (Q701 and Q702) of the output amplifiers and the other switching transistors (Q301 and Q302) of the Cue amplifier circuit instead of the Q_{MUTE} transistor.

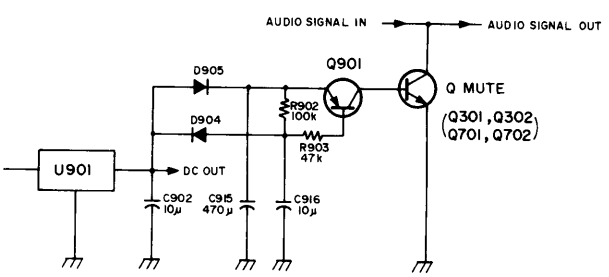


Fig. 4-8

5 PARTS LOCATION

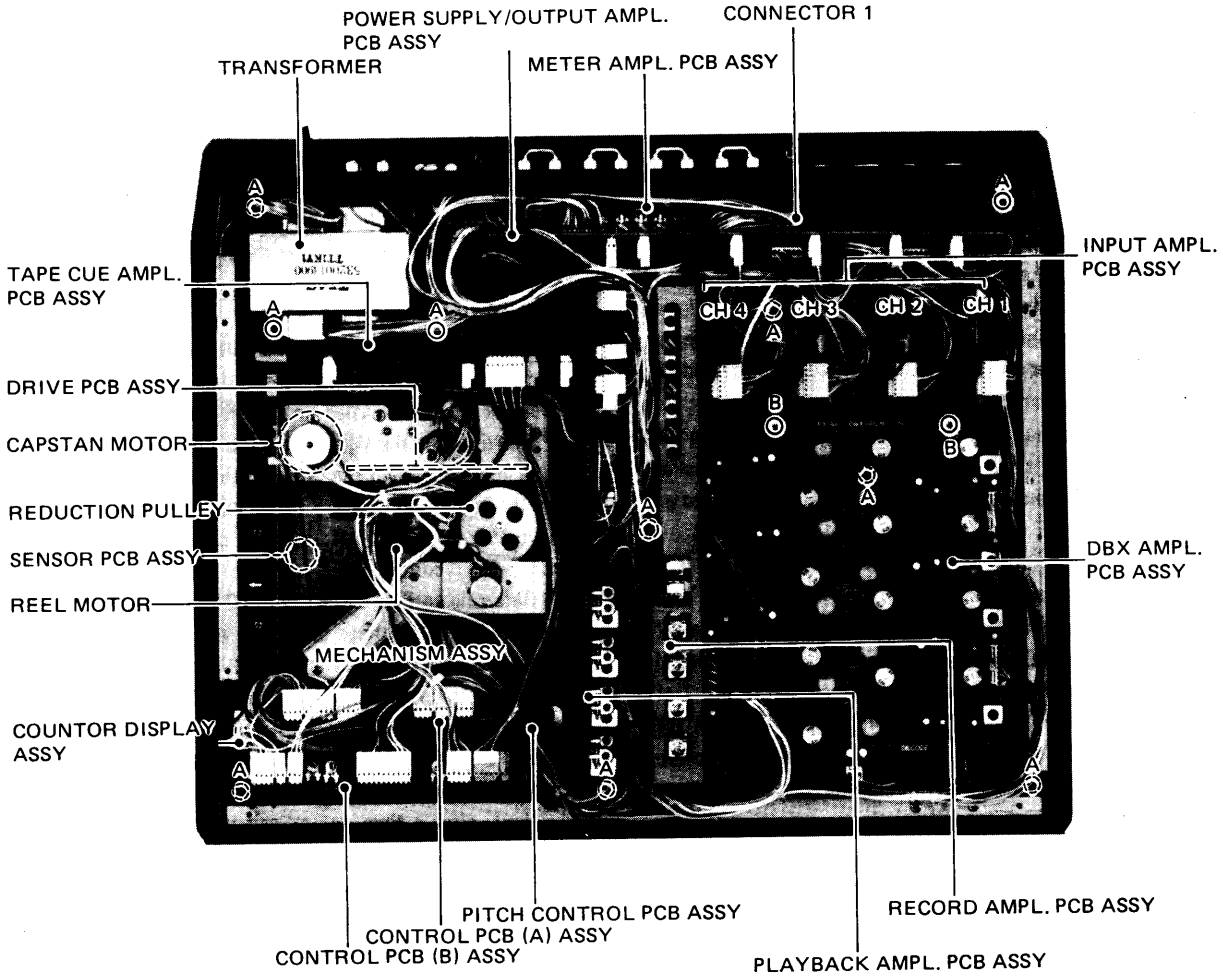


Fig. 5-1

6 MAINTENANCE

6-1 ADJUSTING TOOLS AND EQUIPMENT

The special tools and equipment required for adjusting the Model 244 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 to 500 gms. (0 to 17.6 oz.)
3) Torque Meter
   Cassette torque meter — 0 to 100 g-cm (0 to 1.39 oz-in.) SONY Corp. TW211
   Cassette torque meter — 0 to 160 g-cm (0 to 2.22 oz-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, 3 kHz, –10 dB) TEAC Parts No. 4900002220 (Internal use)
   TEAC MXT-112 (Level, 315 Hz, 0 dB) TEAC Parts No. 4900002320 (Internal use)
   TEAC MXT-116 (Frequency, 31.5 Hz to 14 kHz, –10 dB) 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 attanuator, distortion meter, oscilloscope, bandpass filter, 8 ohm/1 watt dummy load, head eraser TEAC E-3, Cleaner fluid TEAC TZ-261, Lubricant TEAC TZ-255.

6-2 ROUTINE MAINTENANCE

6-2-1 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
Build-up 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.

6-2-2 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-3 Head Demagnetizer).

Demagnetizing procedure

1. After turning off power to the Model 244, 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 244, 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.

6-2-3 Record Test

1. Connect test equipment as shown in Fig. 6-6-3 (page 32). Connect an AF signal generator to AUX RCV (L & R) jacks. Connect level meters to both TAPE OUT and LINE OUT jacks. (If two meters are not available, use one meter alternately.)
2. Load the deck with a blank test tape YTT-5061.
3. Adjust the signal generator to provide 400 Hz, –10 dB (0.3 V) reference input.
4. Position the MASTER Fader knob between "7" and "8" on the fader scale.
5. Turn AUX RCV knob clockwise until –10 dB (0.3 V) reading is obtained on the level meter connected to the LINE OUT jack.
6. Set the RECORD FUNCTION switch to SYNC. Then, the VU meter (BUSS L/TRK 1, or BUSS R/TRK 2) will indicate 0 VU.
7. Set a channel to be checked into RECORD mode by setting two RECORD FUNCTION switches, record the signal 400 Hz.
8. Next, change the RECORD FUNCTION switch to SAFE and reproduce the signal just recorded.
9. Under the above condition, TAPE OUT level will be –10 dB (0.3 V) ±2 dB (or VU meter indicates "0" ±2 VU).
10. Refer to Item 6-6-6 (page 33) when checking Overall Frequency Response.

6-3 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 38, 40, 42).

6-3-1 Bottom Cover

NOTES: Two types of screws are used to secure the bottom cover. When re-installing the bottom cover, be sure to install the same screws in the same place. Refer to Fig. 6-3-1.

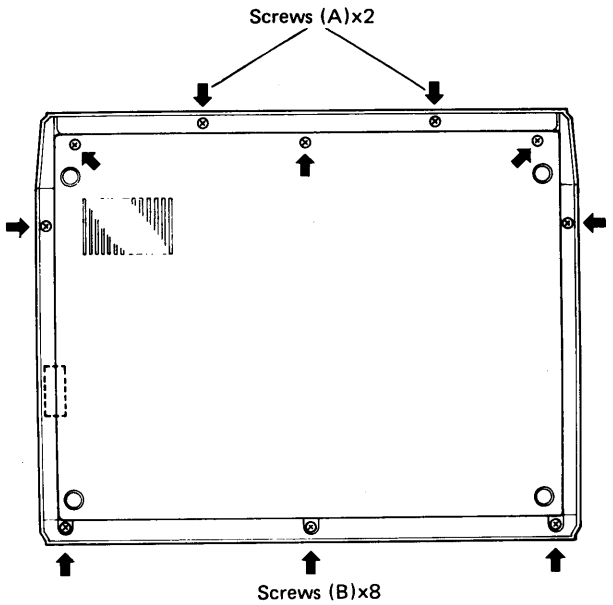


Fig. 6-3-1

6-3-2 Trim Cover Assembly

1) Remove the bottom cover and pull off the four channel fader knobs and the master fader knob.
2) Remove the nine tapping screws A mark from the rear side. Refer to Fig. 5-1. (Page 18)

NOTES: a) The screws behind the Assembly 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. 5-1.
c) When installing the Trim Cover Assembly, be careful not to scratch the knobs and buttons on the front panel.
d) For the unit bearing Serial Nos. up to 4800. remove screws under the DBX PCB Ass'y simultaneously with the six screws mentioned in step 2 above.

6-3-3 DBX PCB Assembly

1) Refer to Fig. 5-1.
2) Take off the bottom cover and remove the two screws (B mark) securing the DBX PCB Ass'y. Disconnect the cable harness and the PCB Assy can be removed off.

6-3-4 Mechanism Assembly

1) Remove bottom cover, remove the four screws (c) holding the mechanism assembly.
2) If the mechanism assembly must be taken out completely, other conectors (1)-(6) should be disconnected and the mechanism wire harness will be disconnected from the main unit. Refer to Fig. 6-3-2.

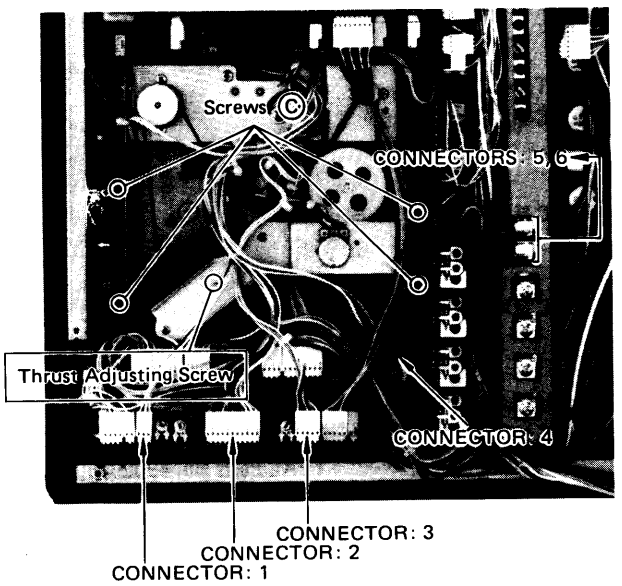


Fig. 6-3-2

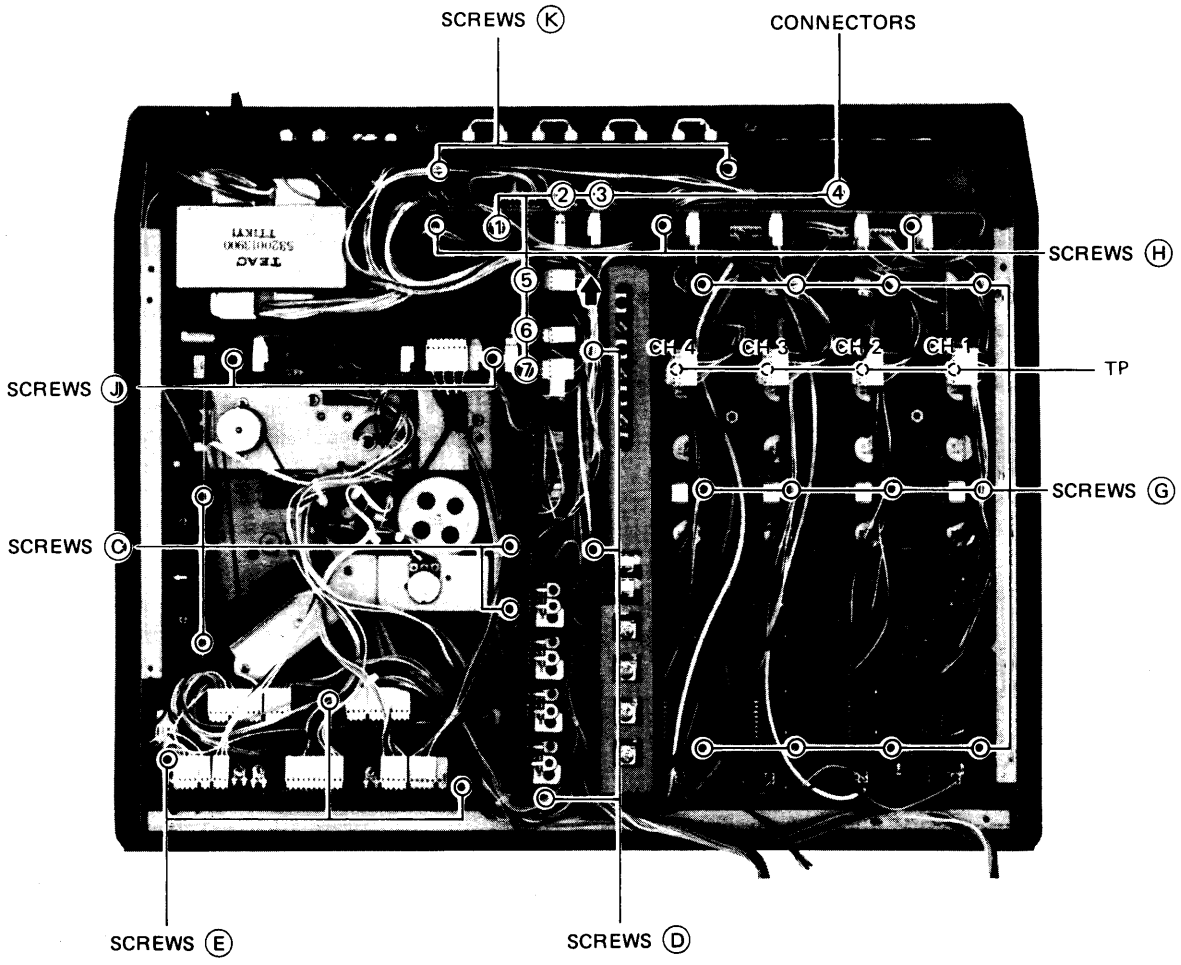


Fig. 6-3-3

6-3-5 Heads

1) Remove the head cover using a crab-eye driver.
2) Remove the bottom cover, and turn the reduction pulley (Refer to Fig. 5-1) by hand to bring the head base upon the PLAY position.
3) Remove one record/playback head mounting screw and the azimuth adjusting screw. When removing the erase head, remove two screws securing the head.

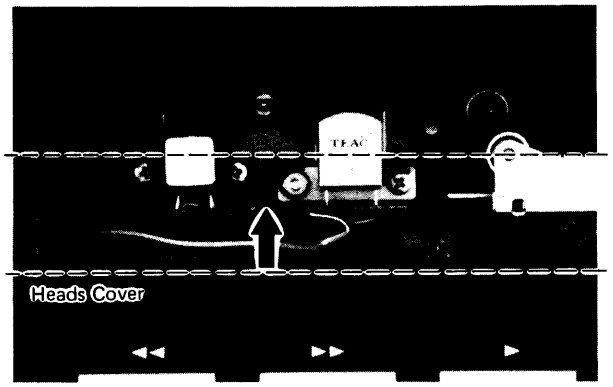


Fig. 6-3-4

6-3-6 Record Amplifier PCB Ass'y, Playback Amplifier PCB Ass'y

1) Refer to Fig. 6-3-3.
2) Remove three screws (D) securing the PCB Ass'y, one of which is used to secure the Trim Cover Ass'y commonly and belongs to one of nine screws to be removed when the Trim Cover Ass'y is removed. Then, disconnect the seven connectors indicated by arrows (1)-(7) and connected to the PCB Ass'y.
3) Remove the PCB Ass'y by pushing and raising the Ass'y in the direction (Power supply/Output amplifier PCB Ass'y) shown by an arrow with the Ass'y holding diagonally, the opposite side against the arrow upward.

6-3-7 Control PCB Ass'y (A) & (B)

1) Refer to Fig. 6-3-3.
2) Remove 3 screws (E) securing the PCB Ass'y.
3) Disconnect all connectors connected to the Ass'y, and then it can be removed completely.

6-3-8 Input PCB Ass'y

1) Refer to Fig. 6-3-3.
2) Remove the bottom cover, and DBX Amp. PCB Ass'y.
3) Remove 3 screws (G) securing the PCB Ass'y for the channel to be removed and disconnect the connectors connected to the Ass'y.

NOTE: When removing, always turn the power off because of various parts around the Ass'y are alive. Also take care not to damage the knobs and any other parts.

6-3-9 Other PCB Ass'y

a) Power/Output Amp. PCB Ass'y
Remove 3 mounting screws marked (H), refer to Fig. 6-3-3.
b) Tape/Cue Amp. PCB Ass'y
Remove 2 mounting screws marked (J), refer to Fig. 6-3-3.
c) Meter Amp. PCB Ass'y
Remove 2 mounting screws marked (K), refer to Fig. 6-3-3.

6-4 CHECK AND ALIGNMENT OF TAPE DECK SECTION

6-4-1 Capstan Assembly Thrust

Turn the thrust adjusting screw (plastic); Refer to Fig. 6-3-2. Provided on the bottom of the flywheel so that thrust of the capstan shaft is within 0.1 mm to 0.2 mm.

6-4-2 Micro Switch Assembly Clearance

This adjustment should be made for both the Casette-In switch and the Record Protection switch.

1) First, loosen two microswitch mounting screws and adjust the mounting position of the switch so that the microswitch actuator is positioned within the setting range(s) as shown for the switch actuated on or off in Fig. 6-4-1.
After completion of the adjustment, actually load the tape deck with a blank tape, and check for correct adjustment.

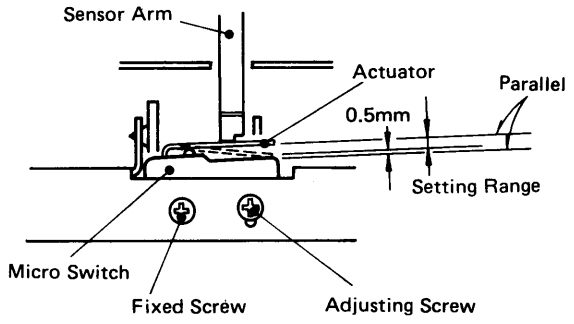


Fig. 6-4-1

6-4-3 Head Base Position

STOP Mode:

1) With the deck STOP mode, observe stop position of the head base and note the position.
2) Turn the reduction pulley with your hand and observe whether the head base comes to the same position as noted or exceeds the position. If exceed, adjust the trim pot R31. (Refer to Fig. 6-4-3)
3) Run the deck in PLAY mode, then STOP mode, and finally turn the power off. Repeat this sequence two or three times. Then observe the stop position of the head base again. If the head base still exceeds the position noted, adjust R31 again and repeat the steps 1 and 3 until the head base comes to the most forward position.

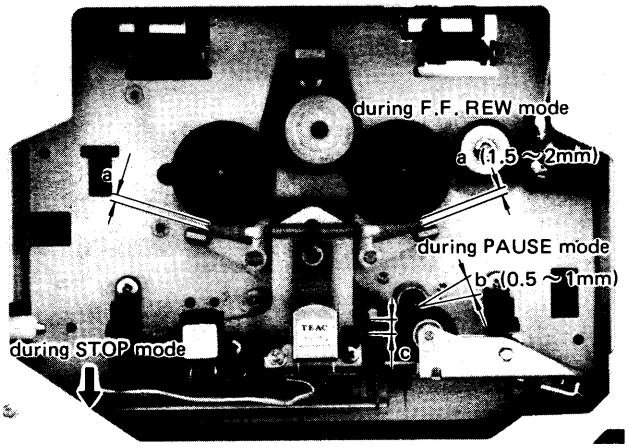


Fig. 6-4-2

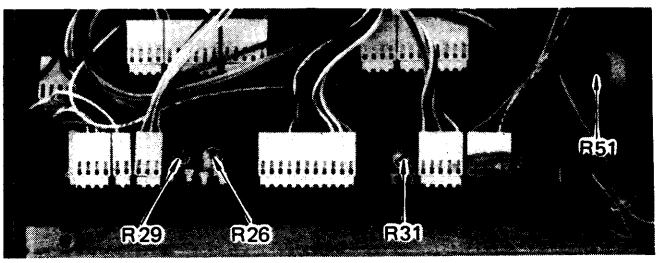


Fig. 6-4-3

FF and RWD Mode

Run the deck in the FF or RWD mode and make sure a clearance between each brake drum and the brake pad is approx. 1.5 to 2 mm. If not, adjust R26. (Refer to Fig. 6-4-3) After the adjustment has been completed, repeat switching operations from the STOP to FF or RWD two or three times and make sure the clearance "a" is within the specified range.

PAUSE Mode

Set the deck to PAUSE mode and observe the clearance "b" between the pinch roller and capstan shaft. It should be approx. 0.5 mm to 1 mm. If not, adjust the trim pot R29 (Refer to Fig. 6-4-3). After completion of the adjustment, repeat switching operations from STOP to PAUSE mode two or three times, and make sure the clearance "b" is within the specified range. Also make sure there is a clearance "c" between the head base and a spring stud.

6-4-4 Pinch Roller Pressure

First remove the bottom cover and the Trim cover as shown in section 6-3.

1) Turn the Cassette-In switch on with a finger or a rubber ring.
2) Run the deck in PLAY mode and hook a tension gauge to a small opening on the pinch roller arm as illustrated.

NOTE: During PLAY operation, make sure there is a little clearance "a" between the pinch roller arm and the spring arm.

3) Pull the gauge until the pinch roller moves away from the capstan shaft by approx. 2 mm, and then allow the pinch roller to just touch the capstan shaft again. Read the gauge when the pinch roller just starts to rotate.
   The reading should be between 350 and 500 g.

When replacing the pinch roller arm spring, always position the spring around the lower half of the spring shaft as shown in the photo.

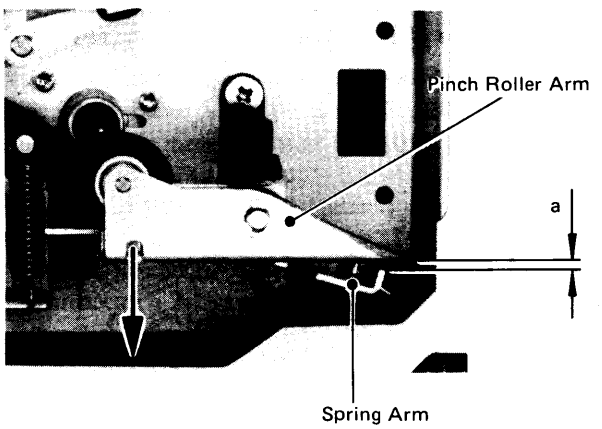


Fig. 6-4-4 (A)

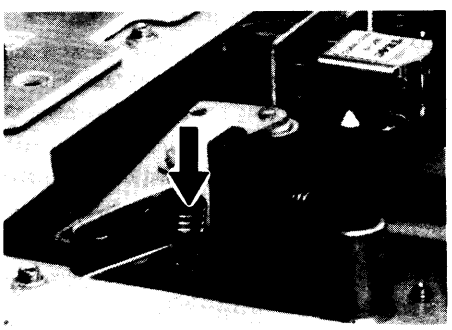


Fig. 6-4-4 (B)

6-4-5 Take-Up Torque

Take-up Torque For Playback & Recording

Load a cassette torque meter instead of a cassette tape in the cassette holder, and run the deck in PLAY mode. The meter reading should be:
35 to 55 g-cm for Take-up torque (right reel table)
2 to 4 g-cm for Back Tension torque (left reel table)

FF and REW Torque

1) Load a cassette torque meter in the cassette holder and measure starting torque for both F.F. and REW operations with the tape rewound close to beginning of the tape or wound close to end of the tape, respectively.
The reading should be:
F.F. torque (right reel table): higher than 55 g-cm.
REW torque (left reel table): between 80 and 150 g-cm.
2) If the torque is out of the limits, change the resistor R42 on the Control (A) PCB Ass'y from 120 k ohm to 110 k ohm.
3) If the torque is still out of the limits, adjust the torque adjusting ring provided on the right reel table. The torque can be adjusted in three values as shown in Fig. 6-4-5. Turn the torque adjusting ring with the tab A pulling slightly upward and place the tab on one of three stepped portions having pawls to fix the tab.

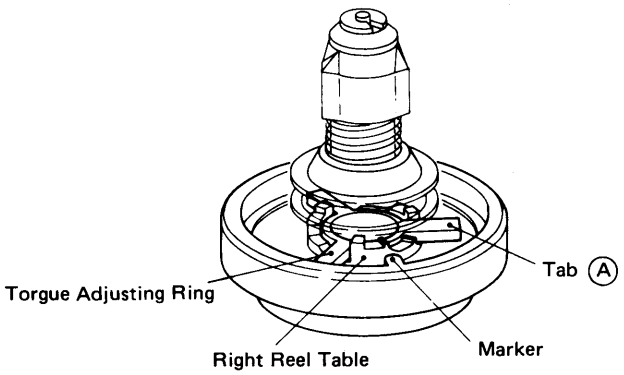


Fig. 6-4-5

6-4-6 Tape Travel

1) 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.
2) 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.
3) To check the head guide height, the tape is replaced with the head height check jig, which is put on the base.
4) 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 mm or 0.2 mm thick washers under the head mounting legs.

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

6-4-7 Head Azimuth

Fine adjustment of the record/playback head should be made after the tape travel check has been completed. Before proceeding the adjustment, remove the head cover mounted on the Trim panel assembly.

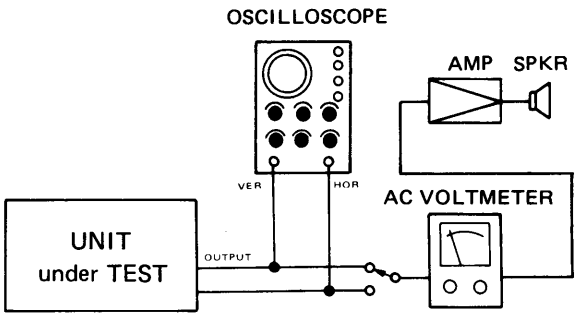


Fig. 6-4-6

1) Connect a vertical input terminal of an oscilloscope to the TAPE OUT "1" jack and a horizontal input terminal to the TAPE OUT "3" Jack.
2) Load the deck with a test tape MXT-116 and playback the tape.
3) First, reproduce a test tone of 315 Hz, and coarsely adjust the azimuth adjusting nut to obtain approx. zero phase difference as shown in the leftmost illustration below. Next, reproduce a high frequency tone of 12.5 kHz and proceed to the fine adjustment.
The check and adjustment should be made for both pairs of tracks #1 & #3 and #2 & #4.

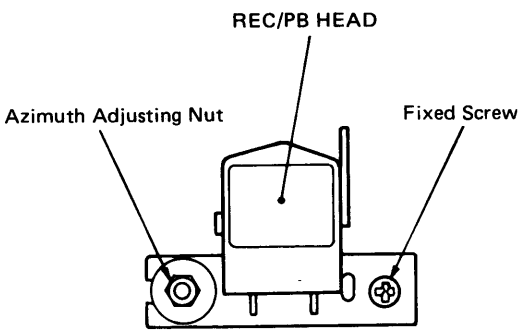


Fig. 6-4-7

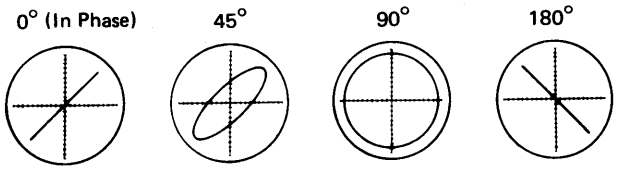


Fig. 6-4-8

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

Head connections

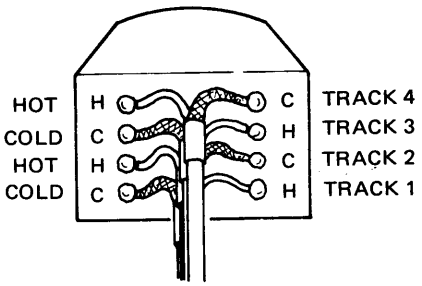


Fig. 6-4-9

Therefore, when the test tape is 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 244, the signals between each track will be in the same phase as usual but crosstalk between tracks will be much better.

6-4-8 Tape Speed

1) Connect a frequency counter to either one of TAPE OUT jacks.

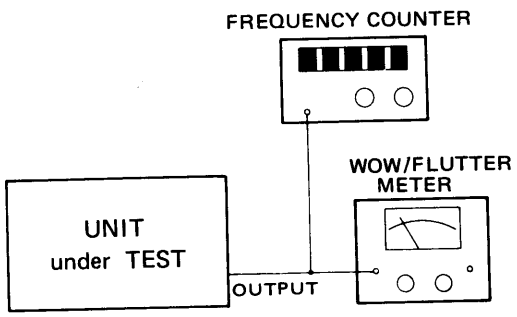


Fig. 6-4-10

2) Playback a wow & flutter test tape MXT-111 (tape speed 9.5 cm/sec), and following values will be obtained.

Deviation	:	3000 Hz ±30 Hxz
Width of deviation	:	Within 30 Hz
Pitch control range	:	Min. less than 2610 Hz at fully CCW Max. higher than 3390 Hz at fully CW

3) If the speed is out of the limits, adjust as follows:

a) Remove the bottom cover and the Trim cover assembly as mentioned in section 6-3.

b) Clean the tape path and check the pinch roller pressure and take-up torque.

c) If they are normal, place the PITCH control in the center "0" position, and reproduce approx. mid portion of the test tape.

d) Adjust the trim pot VR51 (Refer to Fig. 6-4-3) provided on the rear side of the PITCH control variable resistor with a small "–" driver to obtain 3000 Hz ±5 Hz reading on the frequency counter.

The adjustment should be performed at least one minute after the capstan motor has been started to rotate.

6-4-9 Wow and Flutter

Before measuring wow and flutter, read the following and decide which one of two methods is to be used. Then connect test equipment as shown in Fig. 6-4-10 (and Fig. 6-4-11), or connect a wow and flutter meter to one of TAPE OUT jacks (and a signal oscillator to the AUX/REV Jack).

1) Reproduce Method: Wow & Flutter is measured by reproducing a Wow & Flutter Test Tape MXT-111 or its equivalent.
Record/ Reproduce Method: Wow and Flutter is measured by reproducing a 3 kHz tone recorded on a blank tape with the tape deck under test.
Use a blank tape of MTT-5061 or equivalent.

NOTE: When measuring with the Record/Reproduce method, the recorded section should be reproduced repeatedly to obtain a mean value.
Be careful not to read the meter for those parts of the tape in which wow and flutter components in recording and reproducing cancel each other.

2) Set the wow and flutter meter controls to the standard to be used. Set the weighting control to the DIN/IEC/ANSI position or JIS/NAB position.

3) The measurement should be performed at both beginning and end of the tape. The measurement results will differ slightly according to the method and equipment used.

*Reproduce Method: ±0.06% peak (DIN/IEC/ANSI weighted)
±0.15% peak (DIN/IEC/ANSI unweighted)
0.04% RMS (JIS/NAB weighted)
0.08% RMS (JIS/NAB unweighted)

*Record/Reproduce Method:
±0.06% peak (DIN/IEC/ANSI weighted)
±0.15% peak (DIN/IEC/ANSI unweighted)
0.05% RMS (JIS/NAB weighted)
0.09% RMS((JIS/NAB unweighted)

NOTE: Proceed to the measurement after cleaning the tape path, especially capstan shaft, pinch roller, and the head surfaces.

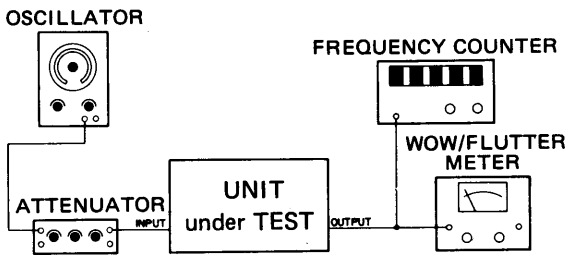


Fig. 6-4-11

6-5 SIGNAL PATH AND RESPONSE CHECK OF MIXER SECTION

6-5-1 Input, Buss Line & Amplifier

1) Connect a hot lead of a level meter to the TP terminal (Refer to Fig. 6-3-3) of channel 1 amplifier on the INPUT PCB Ass'y and a ground lead to the chassis.
2) Apply a 1 kHz test signal of −10 dB (0.3 V) to the MIC/LINE INPUT "1" jack.
3) Set the RECORD FUNCTION knob and other controls on the channel 1 module panel as follows:

INPUT	:	MIC/LINE
TRIM	:	Min. "LINE"
EQ "GAIN"	:	Center (12 o'clock position)
RECORD FUNCTION	:	4 CH REC

4) Adjust the Input Fader for −10 dB (0.3 V) reading on the level meter connected to the TP terminal. Under this condition, the position of the Fader knob should be between "7" and "8" on the fader scale.
5) If the position is out of the specified range, remove the short-pin plug from the ACCESS SEND/RCV jacks on the rear panel, and check the output level at the ACCESS SEND jack. If −10 dB (0.3 V) is obtained, check circuits following the parametric equalizer.
6) Check for the remaining channels 2-4 in the same manner.

6-5-2 Input Overload Indicator

1) Adjust the unit so that −10 dB (0.3 V) output is obtained at the TP terminal (or ACCESS SEND jack) with the controls set as stated in the preceding section 6-5-1. (Item 1 ~ 4).
2) Turn the channel 1 "TRIM" knob clockwise until the overload indicator just lights up. Read the level meter; it should be +12 dBV ±2 dB at the ACCESS SEND jack.
3) Check for the remaining channels 2-4 in the same manner.

6-5-3 Meters

1) Adjust the unit so that −10 dB (0.3 V) output is obtained at the TP terminal with the controls set as mentioned in section 6-5-1. (Item 1 ~ 4).
2) Check the BUSS L/TRK 1 VU meter indicates 0 VU ±0.5 VU under the above condition.
3) If the meter reading is out of the specified range, adjust VR31 provided on the Meter AMP. PCB Ass'y.
4) Check for the remaining 3 channels in the same manner.
   The trim pots for the remaining channels are arranged as follows:

BUSS R/TRK 2 Meter:	VR32
TRK 3 Meter:	VR33
TRK 4 Meter:	VR34

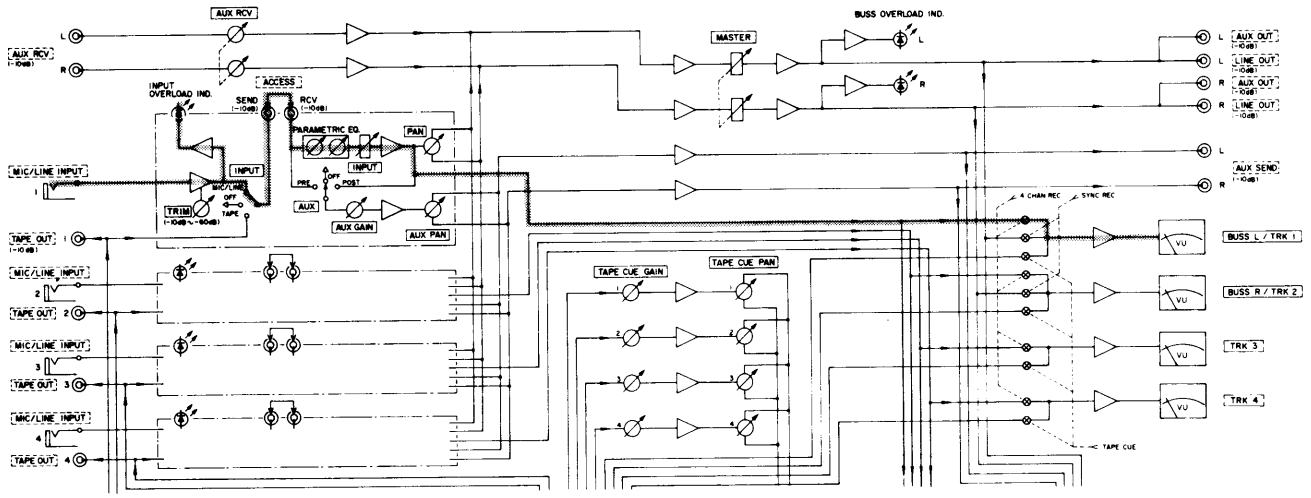


Fig. 6-5-1

6-5-4 MIC/LINE INPUT → LINE OUT/AUX OUT

1) Connect level meters to "L" and "R" LINE OUT or AUX OUT jacks.
2) Adjust the unit so that −10 dB (0.3 V) output is obtained at the channel 1 TP terminal with the controls set as mentioned in section 6-5-1. (Item 1 ~ 4).
3) Turn the channel 1 PAN knob fully CCW (L position), and adjust the MASTER FADER until −10 dB (0.3 V) output is obtained at the "L" LINE OUT jack. Next, turn the PAN knob fully CW (R position) and make sure −10 dB (0.3 V) output is also obtained at the "R" LINE OUT jack. Under this condition, the position of the MASTER Fader knob should be between "7" and "8" on the scale.
4) If the position is out of the specified range, check circuits U701 and U702 and their associated components.
5) After the specified output level has been obtained in the step 3 or step 4 above, disconnect the input signal and measure the residual noises with the level meter sensitivity increased.
   The SN ratio should be as follows:
   With INPUT switch set to "MIC":
   68 dB (weighted)
   65 dB (with 20 Hz to 20 kHz filter)
   With INPUT switch set to "LINE":
   80 dB (weighted)
   76 dB (with 20 Hz to 20 kHz filter)

6-5-5 Buss Overload

1) Adjust the unit so that −10 dB (0.3 V) output is obtained at the LINE OUT jacks with the controls set as mentioned in the section 6-5-4. (Item 1 to 3).
2) Place the PAN knob in fully CCW position and turn the channel 1 TRIM knob CW and make sure the LED "L" above the MASTER Fader lights up as the output at the LINE OUT "L" is increased by 12 dB (= +2 dBV) from the reference level (−10 dB) and the LED turns off when the output level is decreased by 4 dB (−2 dBV = 794 mV) from that position.
   Next, place the PAN knob in the "R" position and check for the LED "R" in the same manner.

6-5-6 Headphones

1) Connect an 8 ohm resistor and a level meter to the PHONES 1 jack on the front panel.
2) Adjust the unit to develop −10 dB (0.3 V) output at the LINE OUT "L" jack with the controls set as mentioned in section 6-5-4. (Item 1 to 3), and place the MONITOR switch in the REMIX position.
3) Adjust the BUSS MONITOR knob to its maximum position and the output level of 894 mV or higher will be obtained.
4) Check for the channel "R" output in the same manner.

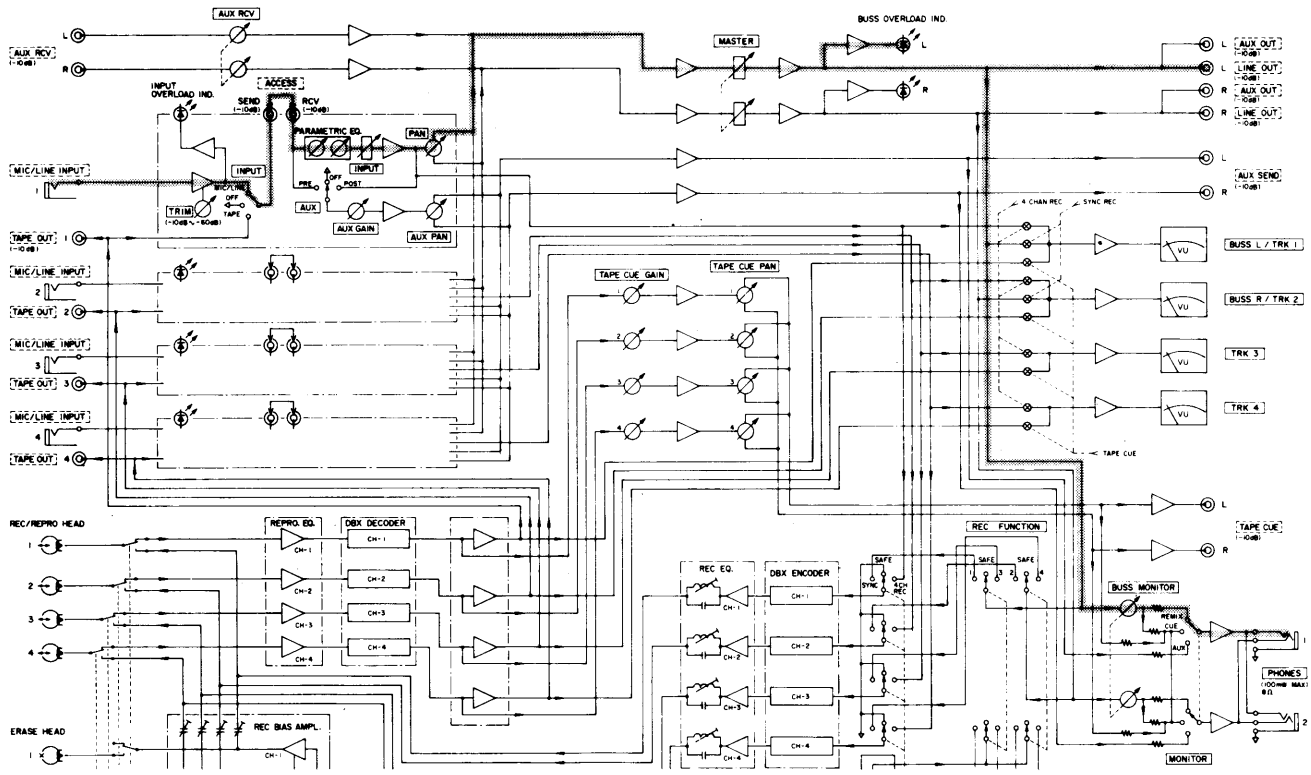


Fig. 6-5-2

6-5-7 AUX RCV → LINE OUT/AUX OUT

1) Position the MASTER Fader between "7" and "8" so that −10 dB (0.3 V) output is obtained at the LINE OUT "L" jack with the controls set as mentioned in section 6-5-4. (Item 1 to 3).
2) Place the INPUT SELECT switch in the OFF position, and apply a 1 kHz, −10 dB (0.3 V) signal to the AUX RCV "L" jack.
3) Adjust the AUX RCV knob until −10 dB (0.3 V) is obtained at the LINE OUT "L" jack, at which point, the position of the knob should be between "7" and "8".
4) Check for the right channel in the same manner.

6-5-8 MIC/LINE INPUT → AUX SEND

1) Connect level meters to the AUX SEND L & R Jacks.
2) Adjust the unit to obtain −10 dB (0.3 V) output at the channel 1 TP with the controls set as mentioned in section 6-5-1. (Item 1~4).
3) Set the channel 1 AUX 1 switch to the PRE position, and AUX PAN knob to "L" position. Adjust the AUX GAIN knob to obtain −10 dB (0.3 V) reading on the left channel level meter, at which point, the knob setting should be around 2 or 3 o'clock.
4) Next, place the AUX switch in the POST position, the AUX SEND "L" output level should be −10 dB ±1 dB.
5) Set the AUX PAN knob to "R", and check for the right channel output level in the same manner.
6) Also check for the remaining three channels in the same way.

6-5-9 Frequency Response (MIC/LINE INPUT → LINE OUT)

1) Apply a 1 kHz, −10 dB (0.3 V) signal to the MIC/LINE INPUT 1 jack.
2) Connect a level meter to the LINE OUT "L" ("R") jack.
3) Set the controls and switches on the channel module panel and the MASTER Fader as follows:

INPUT	:	MIC/LINE
TRIM	:	Min. "LINE"
EQ	:	GAIN knob at center (12 o'clock)
INPUT FADER	:	Between "7" and "8"
MASTER FADER	:	Between "7" and "8"

4) Adjust the PAN knob fully CCW (L position), and vary the signal frequency and check to see frequency response is within ±1 dB over 20 Hz to 20 kHz.

6-5-10 Frequency Response (Parametric EQ 1kHz–8kHz)

5) With the condition set in the step "4" just above, place the EQ knob in the "8 kHz" position and turn the GAIN knob fully CW. Vary the input signal frequency and make sure that the 8 kHz peak lies between 7 kHz and 9 kHz, and the peak level is between +14 dB and +18 dB referred to the reference level. Next, turn the GAIN knob fully CCW, the peak output level should be between −18 dB and −14 dB.
6) Next, set the EQ knob in the "1 kHz" position, and turn the GAIN knob full CCW. Vary the input signal frequency and make sure the 1 kHz peak lies between 900 Hz and 1100 Hz and the peak level is between −14 dB and −21 dB referred to the reference level. Turn the GAIN knob fully CW and also make sure the output level is between +14 dB and +21 dB.

NOTE: Keep the EQ knob "62 Hz to 1.5 kHz" in its center (12 o'clock) position. Also place the knob, which was move for proceeding check, in its center position after the check has been completed.

6-5-11 Frequency Response (Parametric EQ 62 Hz to 1.5 kHz)

7) With the condition set in the step "4" above, place the EQ knob in the "1.5 k" position and turn the GAIN knob fully CW. Vary the input signal frequency and make sure the 1.5 kHz peak lies between 1350 Hz and 1650 Hz and the peak level is between +14 dB and +18 dB. Next, turn the GAIN knob fully CCW, and make sure the peak level is between −18 dB and −14 dB.
8) With the condition set in the step "4" above, place the EQ knob in the "62 Hz" position and turn the GAIN knob fully CCW. Vary the input signal frequency and make sure the 62 Hz peak lies between 52 Hz and 72 Hz and the peak level is between −21 dB and −14 dB.
Next, turn the GAIN knob fully CW and make sure the peak level is between +14 dB and +21 dB.

NOTE: During above check, keep the EQ knob "1 k to 8 k" at its center (12 o'clock) position. Always return the knob moved for proceeding the check to its center position after the check has been completed.

6-5-12 Tape Cue

Playback signals from a tape are applied to the output stages in passing through the playback amplifiers and the dBX decoder circuits.

1) Connect a level meter to the TAPE CUE "L" output jack.
2) Place the channel 1 TAPE CUE "PAN" knob provided above the cassette holder in the "L" position.
Playback a reference signal from the test tape MTT-116 and adjust the GAIN knob until a TAPE CUE "L" channel output of −10 dB (0.3 V) is obtained.
Next, connect the level meter to the TAPE CUE "R" output jack and place the TAPE CUE "PAN" knob in the "R" position. Playback the test signal and make sure the same reading (−10 dB) is also obtained on the level meter.

NOTE: During this alignment, place all the remaining TAPE CUE GAIN knobs (channel 2, 3, 4) in their minimum positions.

3) The position of the TAPE CUE "GAIN" knob should be between 2 and 3 o'clock.
4) Proceed the check for the remaining three channels in the same manner. Do not forget to place the GAIN knobs belong to the channels not being checked in their minimum positions.

6-5-13 Pingpong Recording

The pingpong recording is to record signals that are created by mixing signals applied to the AUX/RCV (and MIC/LINE IN) inputs with those being playbacked from a tape track onto another tape track. Fig. 6-5-3 denotes an example of the signal route for the pingpong recording. Signals applied to the AUX REV jack are mixed with the signals playbacked from the track #1 after the latter are passed through the playback amplifier stages, INPUT circuit, and then split into two routes by the PAN control. With this condition, the mixed signals can be recorded on the track #3 and #4 if the RECORD SELECT switch are placed in "3" and "4" positions.

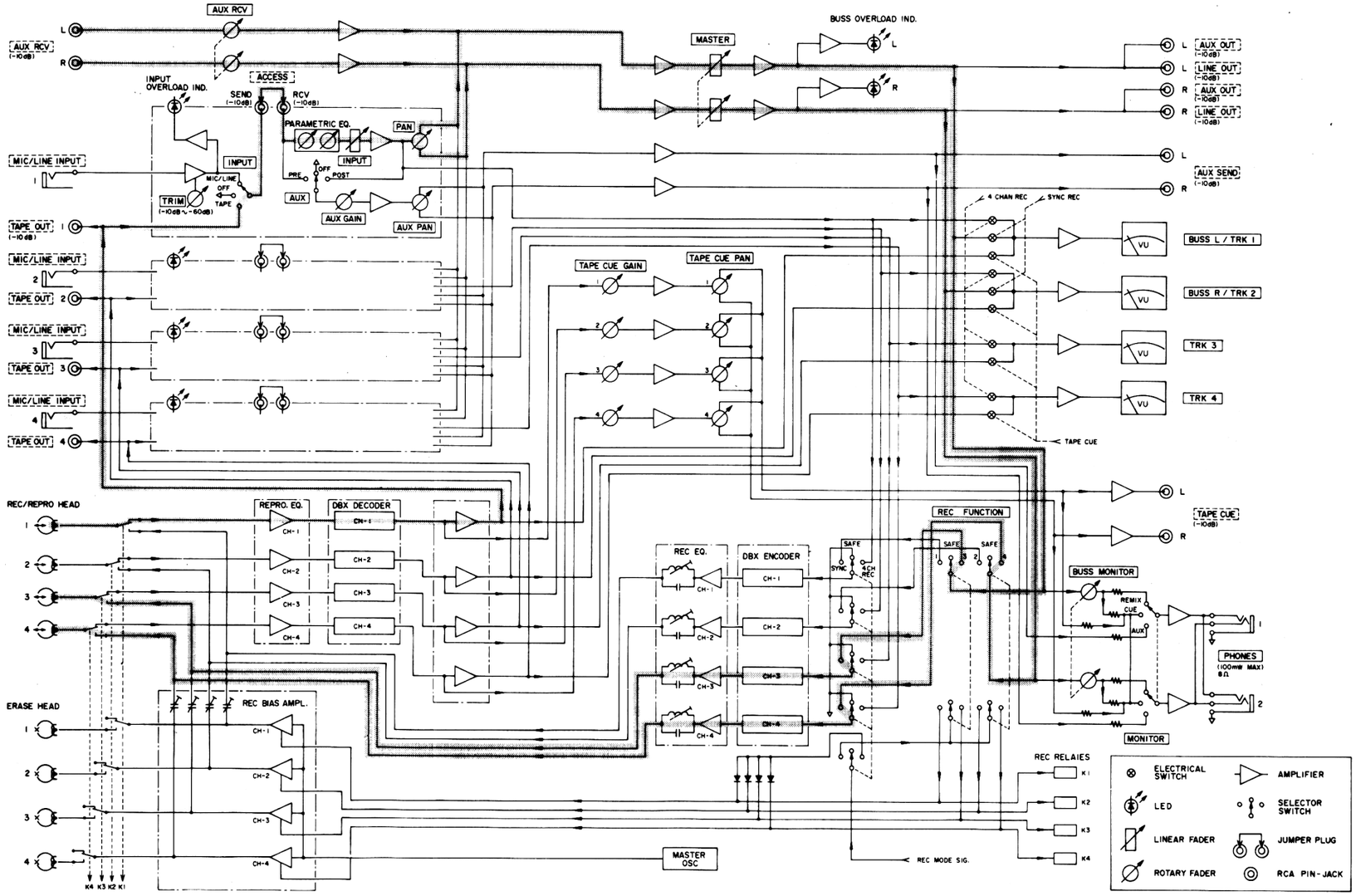


Fig. 6-5-3

6-6 CHECK AND ADJUSTMENT OF RECORD & PLAYBACK AMPLIFIER RESPONSE

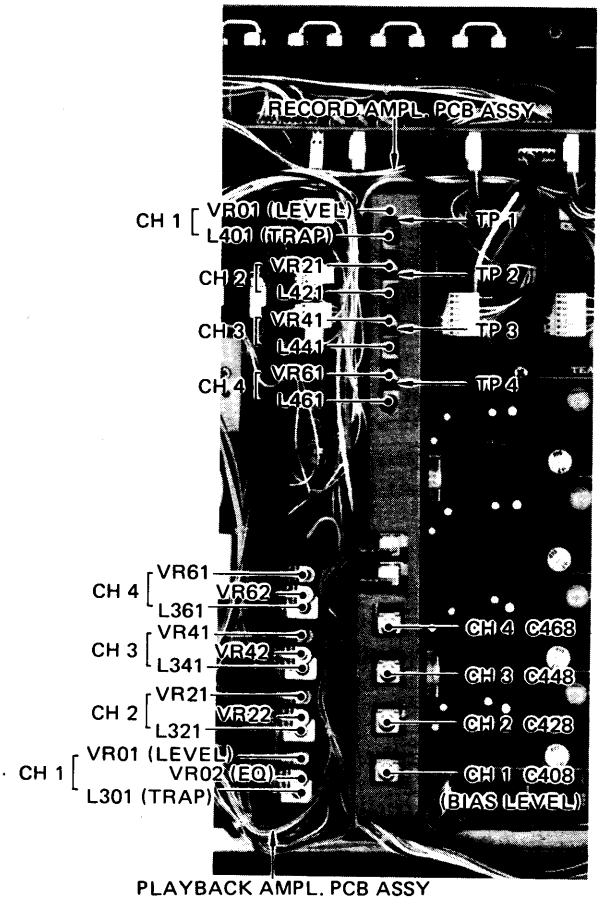


Fig. 6-6-1

Checks and adjustments for the playback amplifiers will be made with the dBX circuit removed.

Therefore, the input/output terminals (J203, J204) removed from the DECORDER circuit must be rewired (short-circuit) before making any measurements.

First, proceed to the following preliminary works.

a) Remove the bottom cover, and then remove connectors, P205 (power supply), P203 (channel 1 & 2), and P204 (channel 3 & 4) of the dBX PCB Ass'y (DBX-PCB-109) provided on the bottom chassis.

b) The connectors P203/J203 correspond to channels 1 and 2, and the P204/J204 to channels 3 and 4. Proceed to check for the channel #1, short-circuit J203 connector's pin jacks 2 & 4, and 1 & 3.

For the remaining channels 2-4, short the pin jack as follows:

Channel: 2, Connector jack J203, pins 6 & 8
pins 5 & 7
Channel: 3, Connector jack J204, pins 2 & 4
pins 1 & 3
Channel: 4, Connector jack J204, pins 6 & 8
pins 5 & 7

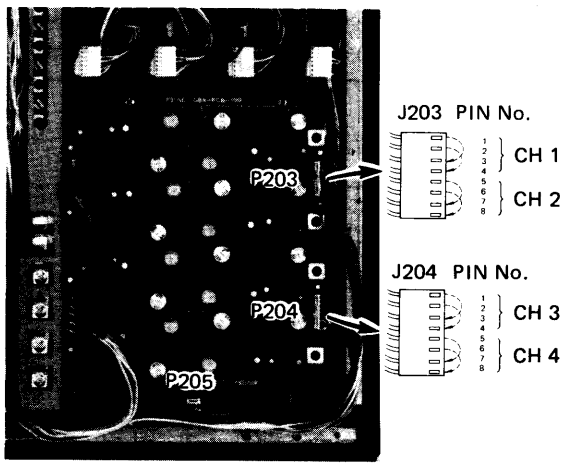


Fig. 6-6-2

Refer to Table 6-7-1 showing each connector's pin connection on page 36.

6-6-1 Playback Level

1) Connect a level meter to the TAPE OUT "1" jack on the rear panel.
2) Playback a test tape MXT-116, 315 Hz, and adjust the trim pot VR01 for –32 dB (25.1 mV) reading on the level meter. Rotating the trim pot CCW increases the output level.
3) Connect the level meter to the remaining channel outputs (2, 3 3, 4) and proceed to the adjustment in the same manner by adjusting.
   VR21: for channel 2
   VR41: for channel 3
   VR61: for channel 4.

6-6-2 Playback Frequency Response

1) Connect a level meter to the TAPE OUT "1" jack on the rear panel.
2) Playback a test tape MXT-116 and reads the output level; it should be within the following limits.

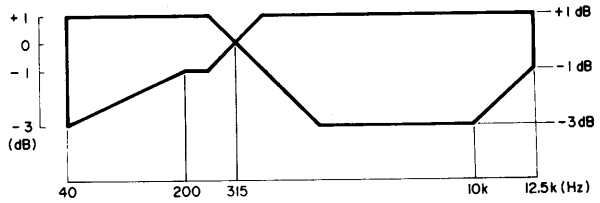


Fig. 6-6-3

3) If the output level is out of the limits, adjust the trim pot VR02. Counter clockwise rotation increases the output level over a high frequency range.
4) For the remaining channels (2, 3, 4), also proceed the check and adjustment in the same manner.
   VR22: channel 2
   VR42: channel 3
   VR62: channel 4

6-6-3 Bias Trap

The bias trap has been fixed at the factory, and no adjustment is required except.

*the record-playback head is replaced,
*the record and playback amplifier(s) are replaced, and
*increased bias leakage is observed.

L301 (Track #1), L321 (Track #2) - - - Playback Amplifier

1) Connect a level meter or an oscilloscope to the TAPE CUE "1" jack on the rear panel.
2) Load the tape deck with a blank tape and set the deck to the record pause mode on channel 2. Adjust the bias trap L301 for lesser bias leakage (minimum reading on the meter or minimum amplitude on scope display) from the adjacent channels.
3) Adjust L321 in the same way, connecting the level meter or oscilloscope to the TAPE CUE "2" jack and setting the track #1 to record pause mode.

L341 (Track #3), L361 (Track #4) - - - Playback Amplifier

4) Connect the level meter or the oscilloscope to the TAPE CUE "3" jack on the rear panel.
5) Load the deck with a blank tape MTT-5061 and set the deck to the record/pause mode on the track #4. Adjust the bias trap L341 for lesser bias leakage (minimum reading on the meter or minimum amplitude on the scope display) from the adjacent channels.
6) Adjust L361 in the same manner, connecting the level meter or oscilloscope to the TAPE CUE "4" jack and setting the track #3 to the record pause mode.

L401 (Track #1) - - - Record Amplifier

1) Connect a hot lead of an oscilloscope to the TP1 on the Record Amp. PCB Ass'y and a ground lead to the chassis.
2) Load the deck with a blank tape MTT-5061 and set the track #1 to record pause mode. Adjust L401 for minimum bias leakage

L421, L441 & L461 (Tracks #2, #3, #4) - - - Record Amplifier

1) Proceed to the adjustment in the same manner as above for the remaining channels.
2) Namely, adjust L421 so that the minimum bias leakage is obtained at TP2 terminal with the track #2 set to record pause mode.
3) Adjust L441 for minimum value at TP3 with the track #3 set to record pause mode.
4) Adjust L461 for minimum value at TP 4 with the track #4 set to record pause mode.

NOTE: Checks and adjustments for the record amplifiers will be not made with the dBX circuit removed.

6-6-4 Bias Voltage

The bias voltage is applied to a bias trimming capacitor for each track by selecting the RECORD FUNCTION switches properly and the bias voltage applied to the head can be varied to a considerable level by rotating the trimmer.

To proceed the alignment, first load the deck with a blank tape to disable the record protection switch, then set a track to be adjusted to record pause mode and adjust the bias voltage as follows:

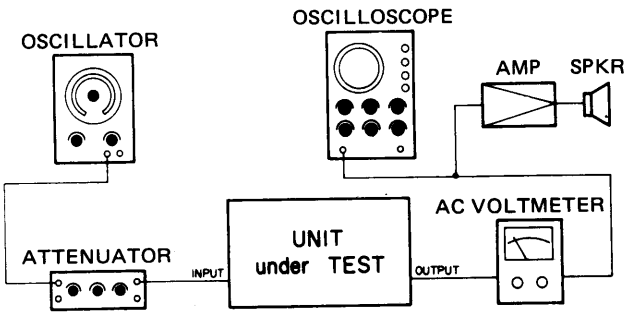


Fig. 6-6-4

1) Connect test equipment as shown in Fig. 6-6-3.
   Connect an AF signal generator to AUX RCV (L & R) jacks.
   Connect level meters to both TAPE OUT and LINE OUT jacks.
   (If two meters are not available, use one meter alternately.)
2) Load the deck with a blank test tape YTT-5061.
3) Adjust the signal generator to provide 400 Hz, −10 dB (0.3 V) reference input.
4) Position the MASTER Fader knob between "7" and "8" on the fader scale.
5) Turn AUX RCV knob clockwise until −10 dB (0.3 V) reading is obtained on the level meter connected to the LINE OUT jack.

6) Set the RECORD FUNCTION switch to SYNC. Then, the VU meter (BUSS L/TRK 1, or BUSS R/TRK 2) will indicate 0 VU. If not, adjust according to the section 6-5-3.
7) Decrease the input signal level by 10 dB from the reference level or to −20 dB (0.1 V).
8) Record the above input signal in two frequencies of 400 Hz and 12.5 kHz to the channel to the adjusted, and then playback the signals just recorded.
   The playback output of 12.5 kHz at the TAPE OUT jack should be within −1.5 dB to + 1 dB referred to the playbacked output level of 400 Hz. If not, adjust Bias Trimming Capacitors until the specified value is obtained.
   Bias Trimming Capacitors: C408 for channel 1
   C428 for channel 2
   C448 for channel 3
   C468 for channel 4
9) Fig. 6-6-1 indicates locations for the bias trimming capacitors.

6-6-5 Recording Level

This alignment should be performed after completion of the bias voltage setting.

1) Adjust the test set-up as mentioned under "6-6-4 BIAS VOLTAGE". (Item 1 to 5).
2) Record the reference input signal of 400 Hz, −10 dB (0.3 V) and then playback the tape just recorded; the playback output level at the TAPE OUT jack should be −10 dB (0.3 V). If not, adjust the trim pot for the channel to be adjusted.
3) Trim pots to be adjusted:
   Channel 1: VR01
   Channel 2: VR02
   Channel 3: VR03
   Cahnnel 4: VR04
4) Fig. 6-6-1. indicated locations of the trim pots.

6-6-6 Overall Frequency Response

1) Connect test equipment as shown in Fig. 6-6-3.
   Connect an AF signal generator to AUX RCV (L & R) jacks. Connect level meters to both TAPE OUT and LINE OUT jacks. (If two meters are not available, use one meter alternately.)
2) Load the deck with a blank test tape YTT-5061.
3) Adjust the signal generator to provide 400 Hz, −10 dB (0.3 V) reference input.
4) Position the MASTER Fader knob between "7" and "8" on the fader scale.
5) Turn AUX RCV knob clockwise until −10 dB (0.3 V) reading is obtained on the level meter connected to the LINE OUT jack.
6) Set the RECORD FUNCTION switch to SYNC. Then, the VU meter (BUSS L/TRK 1, or BUSS R/TRK 2) will indicate 0 VU. If not, adjust according to the section 6-5-3.
7) Decrease the input signal level by 10 dB from the reference level or set it to −20 dB (0.1 V).
8) Vary the input signal frequency over a range of 40 Hz to 14 kHz and record the frequencies, and then playback the signals just recorded. The playback output levels should be within ±3 dB over the frequency range.
   * If the output reading is out of the limits, readjust the bias voltage as shown under (6-6-4). When the output level is lower than the limit, decrease the bias level slightly, and when higher increase the bias slightly. However, recording distortion may increase if the bias voltage is lowered excessivley, so make sure the distortion is within the limit, less than 1.5% at 315 Hz.

NOTE: Varying the bias voltage may upset the recording level adjustment, so always make sure the recording level and readjust the level again as nessecary by referring to the section 6-6-5.

6-6-7 Overall SN Ratio

1) Set and adjust the test set-up as mentioned under "6-6-6 OVERALL FREQUENCY RESPONSE".
2) Record the reference input signal, and then remove the input plug and continue the recording with no signal applied.
3) Playback both the reference signal and no signal just recorded and read the level difference between the outputs.
4) The difference (SN) should be higher than 70 dB for each channel, when measured through a 20 Hz to 20 kHz filter.
5) If the SN is out of the limit:
   *Erase the erase head, record/playback heads and tape path with a tape eraser.
   *Check for normal erasing ratio.
   *Readjust the bias traps.
   *Recheck the SN by using another test tape.

6-6-8 Overall Distortion

1) Set the adjust the test setup as mentioned under "6-6-6 OVERALL FREQUENCY RESPONSE".
2) Vary the signal frequency of the reference input signal to 315 Hz, and record and playback the frequency.
3) Measure the distortion; it should be less than 1.5%.
4) If not:
   *Readjust the bias voltage.
   *Try to erase the erase head and record/playback heads, or replace the head(s).

6-6-9 Erasing Ratio

1) Connect test equipment as shown in Fig. 6-6-4. and adjust the controls and switches as mentioned under "6-6-6 OVERALL FREQUENCY RESPONSE".
2) Adjust the signal generator to provide 1 kHz, 0 dB (1 V) and record it. Playback the signal just recorded and read and note the output level.
3) Rewound the tape up to the beginning of the tape just recorded. Remove the plug from the INPUT jack and then record no signal on the tape just recorded with 1 kHz signal.
4) Rewound the tape just recorded with no signal and playback it. Read the output level with the level meter sensitivity increased.
5) Compare the output levels obtained in the steps 2 and 4; the level difference should be higher than 70 dB for each channel.

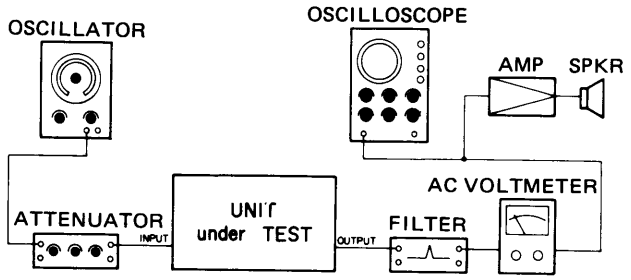


Fig. 6-6-5

6) If not:
   *Clean the tape transport path.
   *Check the tape transport mechanism.
   *Make sure the bias voltage across the erase head is higher than 20V RMS.

6-6-10 Crosstalk Between Channels

1) Set and adjust the test equipment as mentioned under "6-6-6 OVERALL FREQUENCY RESPONSE".
2) Record the reference signal of 1 kHz, −10 dB (0.3 V) on the channel 1. Rewound the tape just recorded and playback it. Measure the leakage output levels to the adjacent channels through a 1 kHz filter, and measure ratio(s) against the reference level.
3) The ratio should be higher than 70 dB for each channel.

6-6-11 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 bias signal from a recording track.

Measurement setting is made in the same manner as mentioned under "6-6-6 OVERALL FREQUENCY RESPONSE".

Crosstalk between Track #1 and #2

1) Place the RECORD FUNCTION switch in the "SYNC" position, BUSS L switch in the "TRK 1", and BUSS R switch in the "SAFE" positions.
2) Apply 15 kHz, −10 dB (0.3 V) reference signal to AUX RCV (L & R) jacks. Set the deck to record/pause made, and measure the output at the TAPE OUT 2 jack with the track #1 set to record mode and the track #2 to playback mode.
3) Check how much of the signal applied to the track #1 leaks into the track #2, and read the level difference against the reference level.
4) The difference should be more than 6 dB at 15 kHz.

Crosstalk between Other Tracks

1) The same method used for measuring crosstalk between tracks #1 and #2 is used. When measuring crosstalk between other tracks, the RECORD FUNCTION switch should be set as below. Number in parenthesis indicates the setting from the opposite channel.

Setting of RECORD FUNCTION switch

Combination	Record track	Playback track
Between tracks #1 and #2	TRK 1	SAFE 2
	(TRK 2)	(SAFE 1)
Between tracks #2 and #4	TRK 2	SAFE 3
	(TRK 3)	(SAFE 2)
Between tracks # 3 and #4	TRK 3	SAFE 4
	(TRK 4)	(SAFE 3)

Table 6-6-1

6-7 DBX AMPLIFIER ALIGNMENT

This alignment has been fixed at the factory, and no alignment is required except if the unit is replaced.

Fig. 6-7-1 denotes locations of the alignments parts and associated connectors on the DBX Amplifier PCB Ass'y. Since the alignment is performed with the unit alone, disconnect all four connectors except the connector P205 for power supply. The measurement will be conducted by connecting test equipment such as an AF signal generator, level meter, distortion meter, oscilloscope, etc. to the connector plugs mounted on the PCB Ass'y.

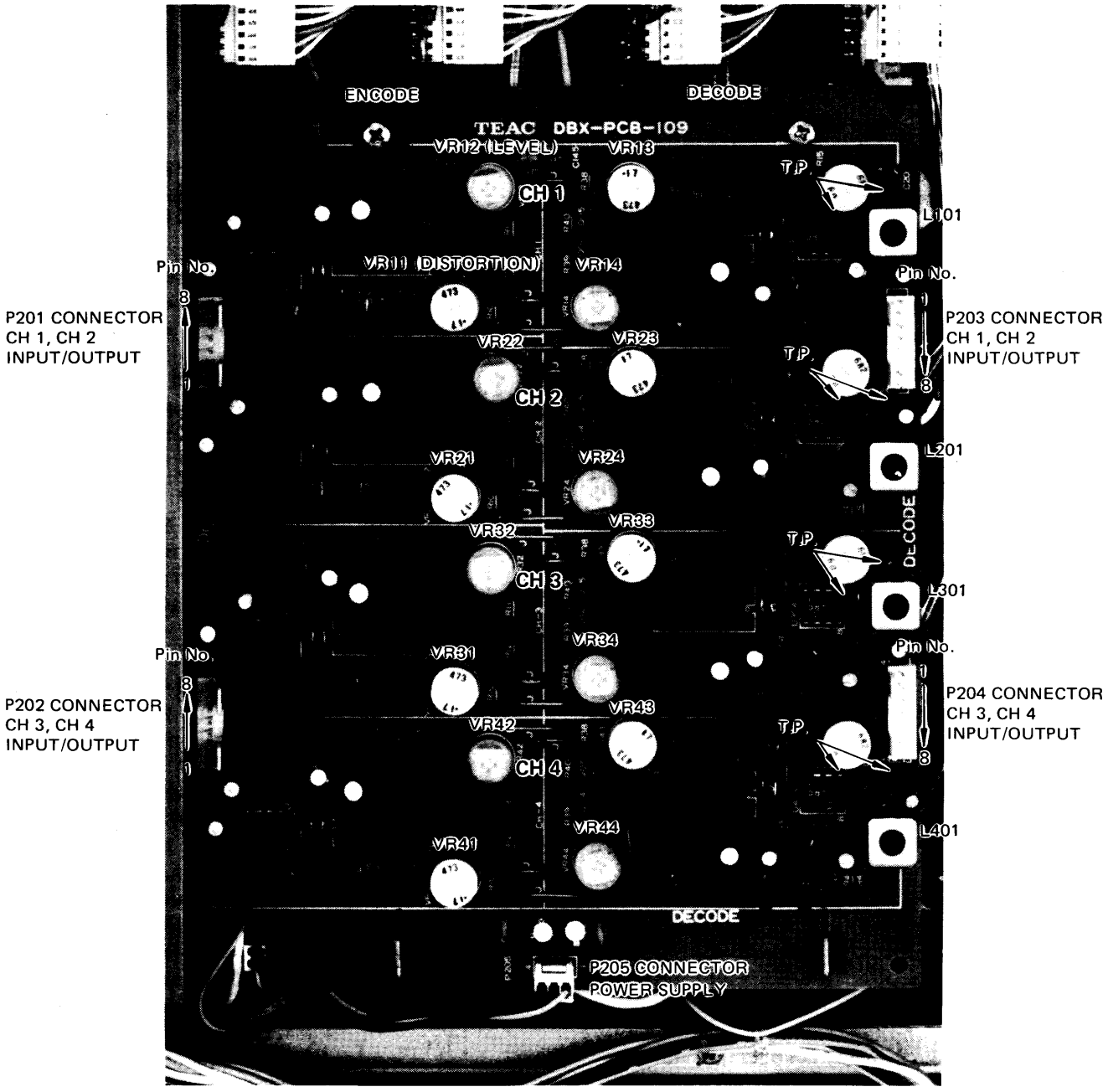


Fig. 6-7-1

The following Tables indicate relations among pin numbers, channels, inputs and outputs for each pin connector.

ENCODE

Channel	Input/Output	Connector		
		Ref.	Pin No.	Hot/Cold
1	Input	P201	7	H
			8	C
	Output		5	H
			6	C
2	Input		1	H
			2	C
	Output		3	H
			4	C
3	Input	P202	7	H
			8	C
	Output		5	H
			6	C
4	Input		1	H
			2	C
	Output		3	H
			4	C

DECODE

Channel	Input/Output	Connector		
		Ref.	Pin No.	Hot/Cold
1	Input	P203	2	H
			1	C
	Output		4	H
			3	C
2	Input		8	H
			7	C
	Output		6	H
			5	C
3	Input	P204	2	H
			1	C
	Output		4	H
			3	C
4	Input		8	H
			7	C
	Output		6	H
			7	C

Table 6-7-1

6-7-1 Encode

1) Connect an AF signal generator to the channel 1 input terminals P201 (7, 8) and a level meter, oscilloscope, and a distortion meter to the output terminals P201 (5, 6).
2) Adjust the generator to provide 1 kHz, −10 dB (0.3 V) input to the input terminals. Adjust the trim pot VR12 to obtain −10 dB (0.3 V) output.
3) Under the above condition, adjust the trim pot VR11 for minimum distortion. The distortion reading on the distortion meter should be less than 0.3%.
4) Next, check the frequency response. Vary the signal frequency to 50 Hz and 10 kHz and read the output level for each frequency. The output level should be within the following limits as referred to the 1 kHz reference level.
   50 Hz: −8.6 dB (0.37 V) ±1.5 dB
   10 kHz: −12.8 dB (0.23 V) ±1 dB
5) Remove the input signal and short-circuit the input terminals, and measure the residual noises with the level meter sensitivity increased. The S/N ratio referred to −10 dB (0.3 V) reference level should be less than 40 dB.
6) For the remaining channels 2 to 4, proceed the alignment in the same manner. The output levels for the channels 2 to 4 will be made with the trim pots VR22, VR32, and VR42.
   The distortion adjustment for the remaining channels will be made with the trim pots VR21, VR31 and VR41.

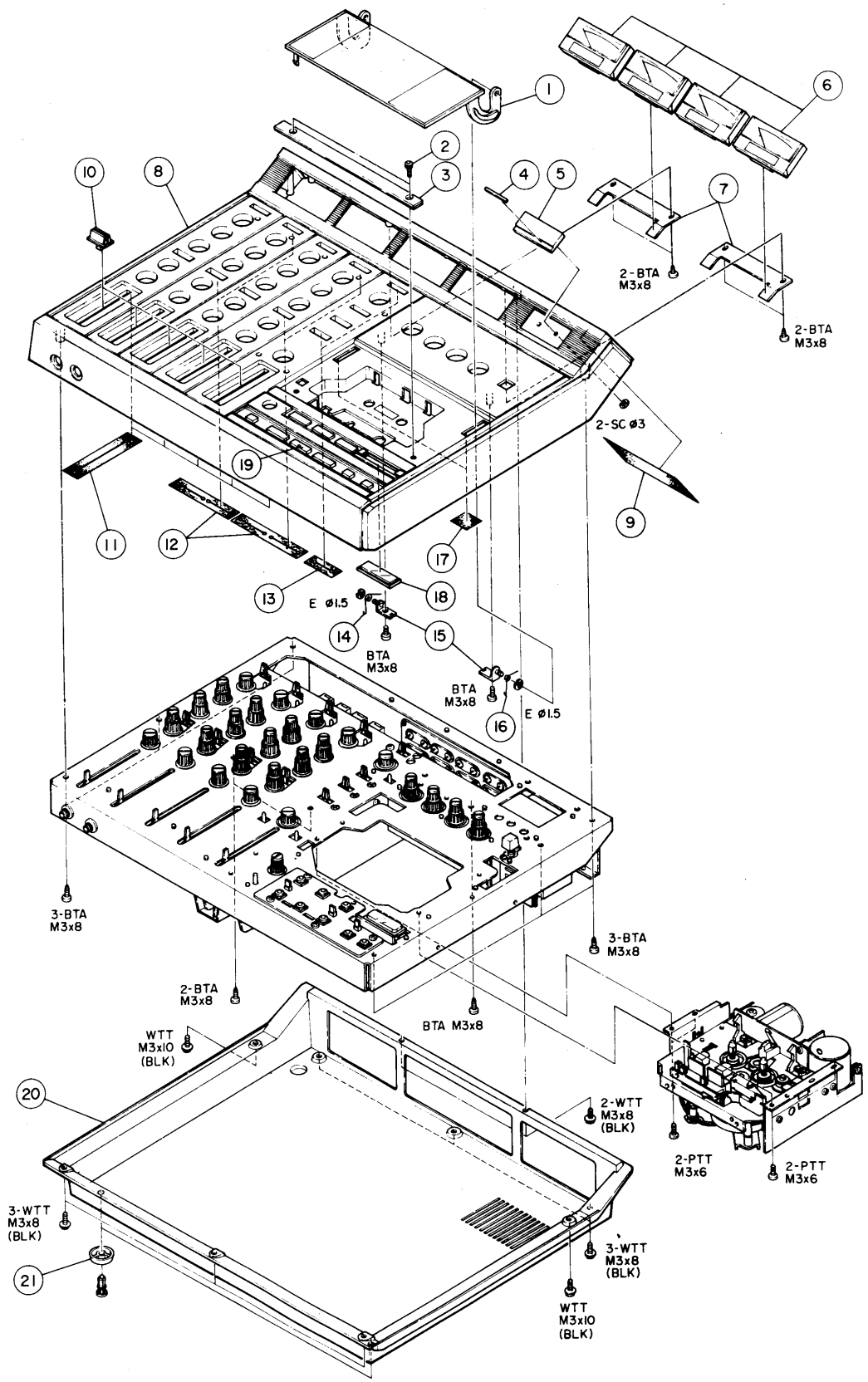
6-7-2 Decode

Before proceeding the decoder circuit adjustment, decoder circuit bias traps must be adjusted. The bias trap adjustment will be performed with the connectors P203, P204 and P205 connected and the tape deck set to RECORD/PAUSE mode.

1) When adjusting the bias trap coil L101 for the channel 1, connect a level meter or an oscilloscope to the output terminal pin 1 of IC U104 and the cold side terminal of the level meter or the oscilloscope to an end of the resistor R29 (or shield case of L101). Refer to Fig. 6-7-1.
2) Set the channel 1 to RECORD/PAUSE mode and adjust the L101 to obtain lesser output signal bias leakage at the output terminal of the U104.
3) For the remaining channels 2 to 4 adjust the bias trap coils L201, L301 and L401 in the same manner.
   Connect the test equipment to pin 1 of U204 and one end of R29 (or L201 shield case) for channel 2.
   Connect the test equipment to pin 1 of U304 and one end of R29 (or L301 shield case) for channel 3.
   Connect the test equipment to pin 1 of U404 and one end of R29 (or L401 shield case) for channel 4.
   After completion of the bias trap coil adjustments, disconnect the connectors P203 and P204, and proceed to the next alignment in the same way as that for ENCODE.
4) Connect the signal generator to channel 1 input terminals P203 (2, 1) and a level meter, oscilloscope and a distortion meter to the output terminals P203 (4, 3).
5) Apply 1 kHz, −30 dB (31.6 mV) input and adjust the trim pot VR13 to obtain −10 dB (0.3 V) output on the level meter.
6) Under the above condition, adjust the trim pot VR14 for a lower reading on the distortion meter. The distortion should be less than 0.3%.
7) Next proceed to the frequency response adjustment under the above setting condition.
   Vary the input signal frequency to 50 Hz and to 10 kHz and make sure the output signal levels are within the following limits as referred to 1 kHz, −10 dB (0.3 V) reference level:
   50 Hz: −13 dB (0.22 V) ±1.5 dB
   10 kHz: −4 dB (0.63 V) ±1 dB
8) Remove the input signal and short-circuit the input terminals and measure the SN ratio with the level meter sensitivity increased. The SN ratio should be less than 80 dB as referred to −10 dB (0.3 V) reference level.
9) For the remaining channels 2 to 4, proceed to the adjustment and check in the same manner. The output levels for the channels 2, 3 and 4 will be made with VR23, VR33, and VR43, respectively. The distortion alignment will be made with VR24, VR34, and VR44.

7 EXPLODED VIEW AND PARTS LIST

EXPLODED VIEW-1



Parts marked with *require longer delivery time.

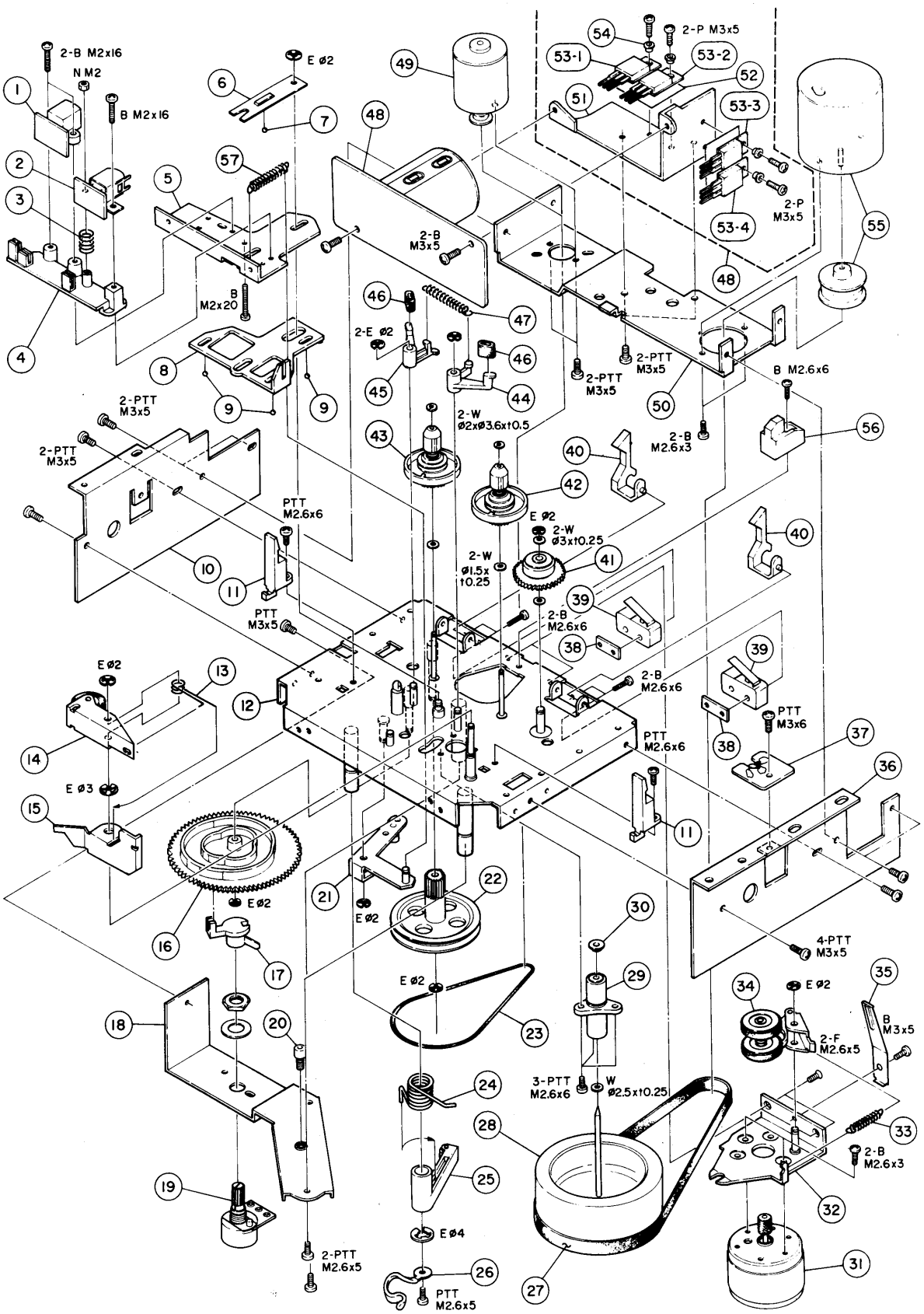
REF. NO.	PARTS NO.	DESCRIPTION	REMARKS
1 - 1	*5800279501	Cover, Cassette	
1 - 2	*5544729001	Screw, Head Cover	A-700
1 - 3	*5800278100	Cover, Head	
1 - 4	*5800284900	Plate, Model Name	
1 - 5	*5720047400	Enblem	
1 - 6	6055029000	Meter Assy, VU	
1 - 7	*6037589000	Bracket, Meter	M-144
1 - 8	*5800279903	Case, Top	
1 - 9	*6006098100	Net, Screen	M-144
1 - 10	5800149200	Knob, Fader	MM-20
1 - 11	*5800304302	Cover, Fader	
1 - 12	*5800315202	Screen, Switch; A	
1 - 13	*5800315202	Screen, Switch; B	
1 - 14	*5800274300	Spring, Cover; A	
1 - 15	*5800277800	Bracket Assy, Cover	
1 - 16	*5800274400	Spring, Cover; B	
1 - 17	*5800329300	Sheet	
1 - 18	5800277700	Window, Counter	
1 - 19	*5800280000	Button Assy, Operation	
1 - 20	*5800280200	Case, Under	
1 - 21	*5800304200	Foot	

INCLUDED ACCESSORIES

REF. NO.	PARTS NO.	DESCRIPTION	REMARKS
	5700028700	244 Owner's manual [U]	
	5700028800	244 Owner's manual [All except U]	
	5700009300	Information Supplement [U, C]	
	5101000000	Information Supplement [All except U]	

[U] : U.S.A.
[A] : AUSTRALIA
[C] : CANADA
[E] : EUROPE
[GE] : GENERAL EXPORT
[UK] : U.K.

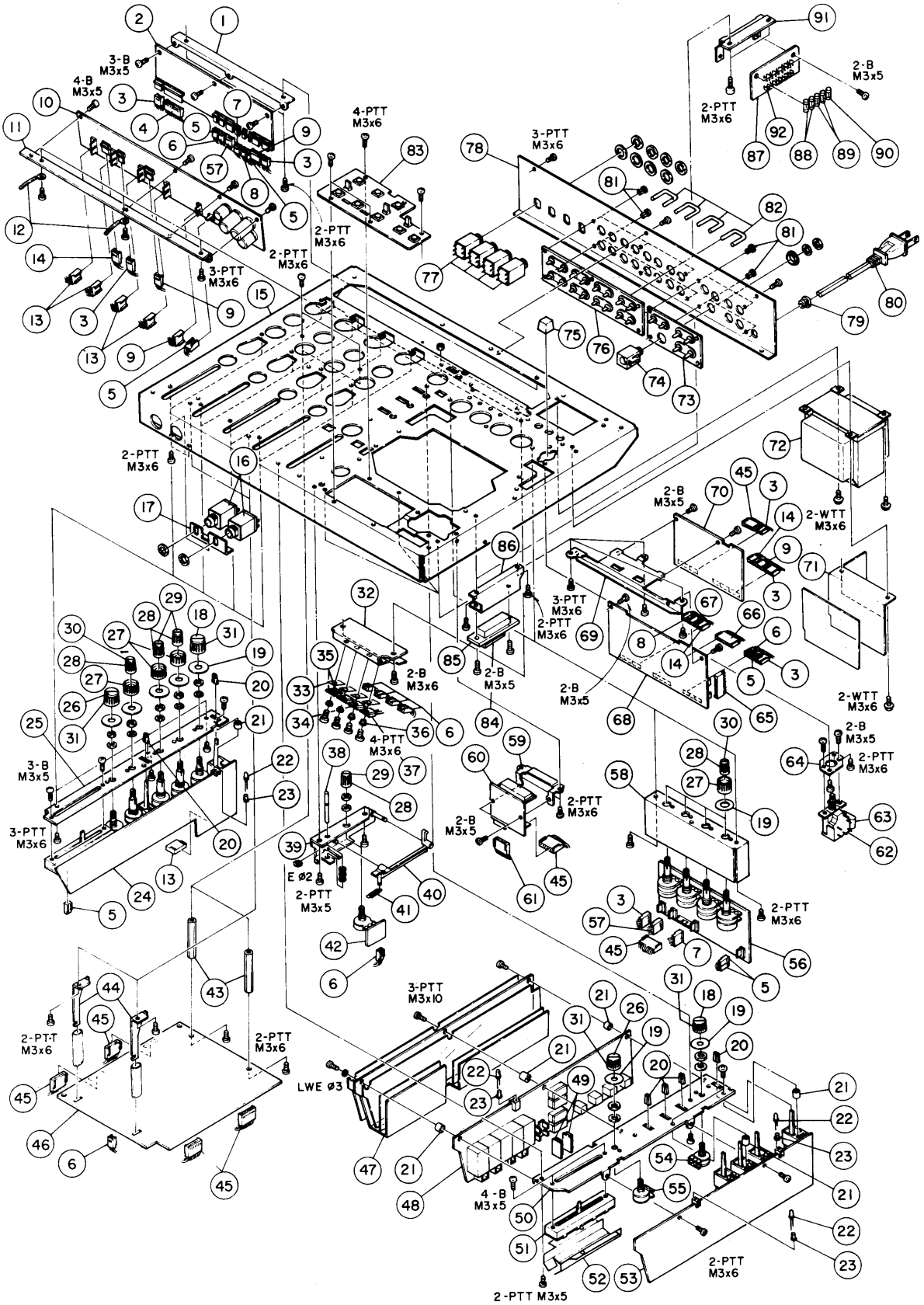
EXPLODED VIEW-2



Parts marked with *require longer delivery time.

REF. NO.	PARTS NO.	DESCRIPTION	REMARKS
2 - 1	5600064700	Head Assy, Erase	
2 - 2	5600064600	Head Assy, REC/PLAY	
2 - 3	*5800114700	Spring, Head	V-9
2 - 4	*5800279200	Bracket, Head	
2 - 5	*5800275600	Base, Head	
2 - 6	*5800114900	Spring, Head Base Pressure	V-9
2 - 7	5540055000	Steel Ball, ϕ2	A-450
2 - 8	*5800122801	Plate, Slider	V-9
2 - 9	5540056000	Steel Ball, ϕ3	A-450
2 - 10	*5800275001	Angle; B	
2 - 11	*5800274100	Guide, Cassette	
2 - 12	*5800278600	Chassis, Mecha	
2 - 13	*5800276100	Spring, Pinch Roller	
2 - 14	5800275700	Roller Assy, Pinch	
2 - 15	*5800276200	Arm, Spring	
2 - 16	*5800122700	Cam, Control	V-9
2 - 17	*5800116700	Joint	V-9
2 - 18	*5800274700	Plate, Thrust	
2 - 19	5282009601	Variable Resistor; 10Ω(B)	
2 - 20	*5534744000	Screw, Thrust	F-210
2 - 21	*5800304400	Arm Assy, Base	
2 - 22	*5800117200	Pulley, Reduction	V-9
2 - 23	5800275300	Belt, Control	
2 - 24	*5800114600	Spring, Balance Arm	V-9
2 - 25	*5800105400	Arm Assy, Balance	V-9
2 - 26	*5581038000	Clamper, Card; A	
2 - 27	5800275200	Belt, Capstan	
2 - 28	5800106401	Capstan Assy	C-9
2 - 29	5800106200	Housing Assy	V-9
2 - 30	*5534130000	Retainer, Oil	A-400
2 - 31	5370001200	Motor Assy, DC Reel	V-9
2 - 32	*5800121801	Bracket, Reel Motor	V-9
2 - 33	*5800115800	Spring, Idler Arm	V-9
2 - 34	5800107800	Idler Assy	V-9
2 - 35	*5800274800	Spring, Pressure	
2 - 36	*5800274901	Angle; A	
2 - 37	*5200077200	PCB Assy, SENSER	
2 - 38	*5554447000	Plate, Micro Switch	A-400
2 - 39	5301455300	Micro Switch; SS5GL N	
2 - 40	*5800117301	Arm, Senser	V-9
2 - 41	5800304600	Gear Assy, Counter	
2 - 42	5800108701	Reel Assy; R	V-9
2 - 43	5800107300	Reel Assy; L	V-9
2 - 44	*5800117101	Arm, Brake; R	V-9
2 - 45	*5800117001	Arm, Brake; L	V-9
2 - 46	*5800126401	Sone, Brake	V-9
2 - 47	*5800114800	Spring, Brake	V-9
2 - 48	*5200079500	PCB Assy, DRIVE	
2 - 49	5370001400	DC Motor	V-9
	5800123300	Pulley, DC Motor	
2 - 50	*5800278700	Adapter	
2 - 51	*5800323600	Bracket, Drive	
2 - 52	*5033291000	Plate, Insulating	
2 - 53 - 1	5042462000	Transistor; 2SD235 (Y) Q506	
2 - 53 - 2	5042546000	Transistor; 2SA490 (Y) Q507	
2 - 53 - 3	5042462000	Transistor; SSD235 (Y) Q508	
2 - 53 - 4	5042546000	Transistor; 2SA490 (Y) Q509	
2 - 54	*5033295000	Tube, Insulating	
2 - 55	5370002600	Motor Assy, DC Capstan	
2 - 56	*5800274200	Plate, Stability	
2 - 57	*5800304100	Arm, Spring, Base	

EXPLODED VIEW-3



Parts marked with *require longer delivery time.

REF. NO.	PARTS NO.	DESCRIPTION	REMARKS
3 - 1	*5800277300	Bracket, PCB; C	
3 - 2	*5200077400	PCB Assy, METER AMPL	
3 - 3	*5122166000	Connector Socket; 4P (WHT)	
3 - 4	*5122174000	Connector Socket; 12P (WHT)	
4 - 5	*5122164000	Connector Socket; 2P (WHT)	
3 - 6	*5122165000	Connector Socket; 3P (WHT)	
3 - 7	*5122223000	Connector Socket; 4P (BLK)	
3 - 8	*5122280000	Connector Socket; 2P (RED)	
3 - 9	*5122168000	Connector Socket; 6P (WHT)	
3 - 10	*5200076700	PCB Assy, POWER SUPPLY/OUTPUT AMPL.	
3 - 11	*5800277200	Bracket, PCB; B	
3 - 12	*5786714000	Clamper, Cord; ϕ4	
3 - 13	*5122169000	Connector Socket; 7P (WHT)	
3 - 14	*5122167000	Connector Socket; 5P (WHT)	
3 - 15	*5800279702	Chassis, Main	
3 - 16	5330008500	Jack, Phone	
3 - 17	*5800277000	Bracket, Jack	
3 - 18	6006092000	Cap; B-16 (RED)	
3 - 19	*5800315400	Screen, VR	
3 - 20	6006050100	Pinch, Lever	
3 - 21	*5800304800	Coller, ϕ3 x ϕ5.5 x +4	
3 - 22	5225005400	LED; SLP-135B (RED) (D101)	
3 - 23	*5800304901	Coller, LED	
3 - 24	*5200076600	PCB Assy, INPUT-MODUL	
3 - 25	*5800278800	Plate, Input-Module	
3 - 26	6006093000	Cap, B-16 (GRN)	
3 - 27	3800278300	Knob, B	
3 - 28	5800133700	Knob, L	M-5C
3 - 29	5800133900	Cap, Knob; L (ORN)	M-5C
3 - 30	5800134200	Cap, Knob; L (GRN)	M-5C
3 - 31	5800278400	Knob, C	
3 - 32	*5800328100	Heat Sink	
3 - 33	*5033291000	Plate, Insulating	
3 - 34	⚠ 5220416000	IC; UA7912 (U903)	
3 - 35	⚠ 5220415500	IC; NJM7812A (U902, U904)	
3 - 36	*5033295000	Tube, Insulating	
3 - 37	⚠ 5220415100	IC; NJM7805A (U901)	
3 - 38	*5800276500	Rod, Eject	
3 - 39	*5800276300	Plate Assy, Eject arm	
3 - 40	*5800279400	Arm, Eject	
3 - 41	*5800279600	Spring, Eject	
3 - 42	*5200077300	PCB Assy, PITCH CON. VR	
3 - 43	*5800276800	Post, PCB	
3 - 44	*5800277101	Bracket, PCB; A	
3 - 45	*5122170000	Connector Socket, 8P (WHT)	
3 - 46	*5200078901	PCB Assy, DBX	
3 - 47	*5800314302	Plate, Shield	
3 - 48	*5200076800	PCB Assy, REC AMP	
3 - 49	*5200080200	PCB Assy, JOINT	
3 - 50	*5800278901	Bracket, PCB	
3 - 51	5284005800	VR, Slide (VR70)	
3 - 52	*5800328301	Shield, Feeder	
3 - 53	*5200077600	PCB Assy, PLAY BACK	
3 - 54	5282408401	Variable Resistor; 5kΩ (A) x 2 (VR30)	
3 - 55	5282408201	Variable Resistor; 20kΩ (A) x 2 (VR80)	
3 - 56	*5200076900	PCB Assy, TAPE CUE	
3 - 57	*5122300000	Connector Socket, 4P (RED)	
3 - 58	*5800276600	Braket Plate, VR	
3 - 59	*5800276900	Bracket, Counter	
3 - 60	*5312000300	Counter Assy, Electron	
	*5312000300	Counter, Electron; FL4082-07	

er delivery time.

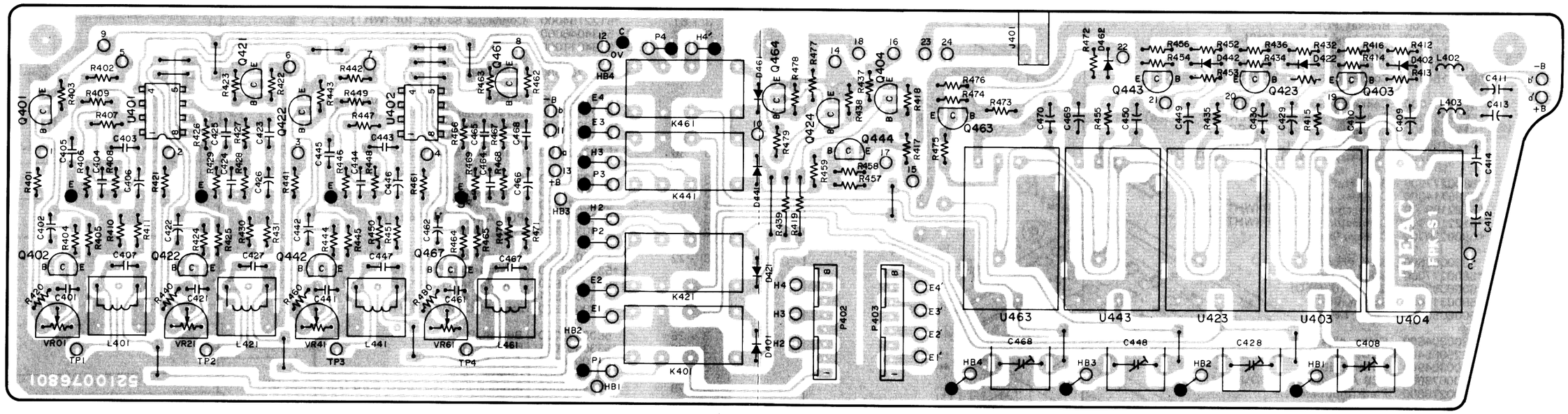
REF. NO.	PARTS NO.	DESCRIPTION	REMARKS
3 - 61	*5122164000	Connector Socket, 10P (WHT)	
3 - 62	⚠ 5134046000	Switch, Push [U, C, GE]	
	⚠ 5134011000	Switch, Push [E, UK, A]	
3 - 63	⚠ 5052910000	Sprak Killer; 0.033μF + 120/125V [U]	
	⚠ 5267702500	Sprak Killer; 0.0047μF + 125V [E, UK, A]	
	⚠ 5292002500	Sprak Killer; 0.01μF + 300Ω [GE]	
	⚠ 5292002600	Sprak Killer; 0.033μF + 120Ω 125V [C]	
3 - 64	*5800276700	Braket, Switch	
3 - 65	*5122180000	Connector Socket, 9P (WHT)	
3 - 66	*5122200000	Connector Socket, 11P (WHT)	
3 - 67	*5122310000	Connector Socket, 5P (RED)	
3 - 68	*5200077100	PCB Assy, CONTROL (B)	
3 - 69	*5800277400	Bracket, PCB; D	
3 - 70	*5200077000	PCB Assy, CONTROL (A)	
3 - 71	*5800314102	Plate, Shild	
3 - 72	⚠*5320013700	Transformer, Power [U, C]	
	⚠*5320013800	Transformer, Power [GE]	
	⚠*5320013900	Transformer, Power [E, UK, A]	
3 - 73	*5330506901	Pin Jack, 6P	
3 - 74	5330008300	Jack, MIC; SGT622 #12	
3 - 75	5800278200	Button, P	
3 - 76	*5330507001	Pin Jack, 16P	
3 - 77	5330008400	Jack; S-G7647 #03	
3 - 78	*5800279301	Chassis, Rear	
3 - 79	*5534660000	Strain Relief, AC Power Cord [All except UK]	
	*5534661000	Strain Relief, AC Power Cord [UK]	
3 - 80	⚠*5128075000	AC Power Cord [U, C, GE]	
	⚠*5350008200	AC Power Cord [E]	
	⚠*5128047000	AC Power Cord [UK]	
	⚠*5350008300	AC Power Cord [A]	
3 - 81	*5534878000	Rivet, Push; RP-3545-NB	
3 - 82	5330505000	Plug, Short Pin; 2P	
3 - 83	*5200077501	PCB Assy, SW	
3 - 84	⚠*5133014000	Plug, Voltage Selector [GE]	
3 - 85	⚠*5133015000	Socket, Voltage Selector [GE]	
3 - 86	*5800297101	Bracket, Voltage Selector [GE]	
3 - 87	*5210079300	PCB, FUSE [E, UK, A]	
3 - 88	⚠ 5041138000	FUSE, T 500mA 250V [E, UK, A] (F001, F002)	
3 - 89	⚠ 5142185000	FUSE, T 630mA 250V [E, UK, A] (F003, F004)	
3 - 90	⚠ 5041140000	FUSE, T 1A 250V [E, UK, A] (F005)	
3 - 91	*5800297201	Bracket, FUSE PCB [E, UK, A]	
3 - 92	*5142087000	Holder, FUSE [E, UK, A]	

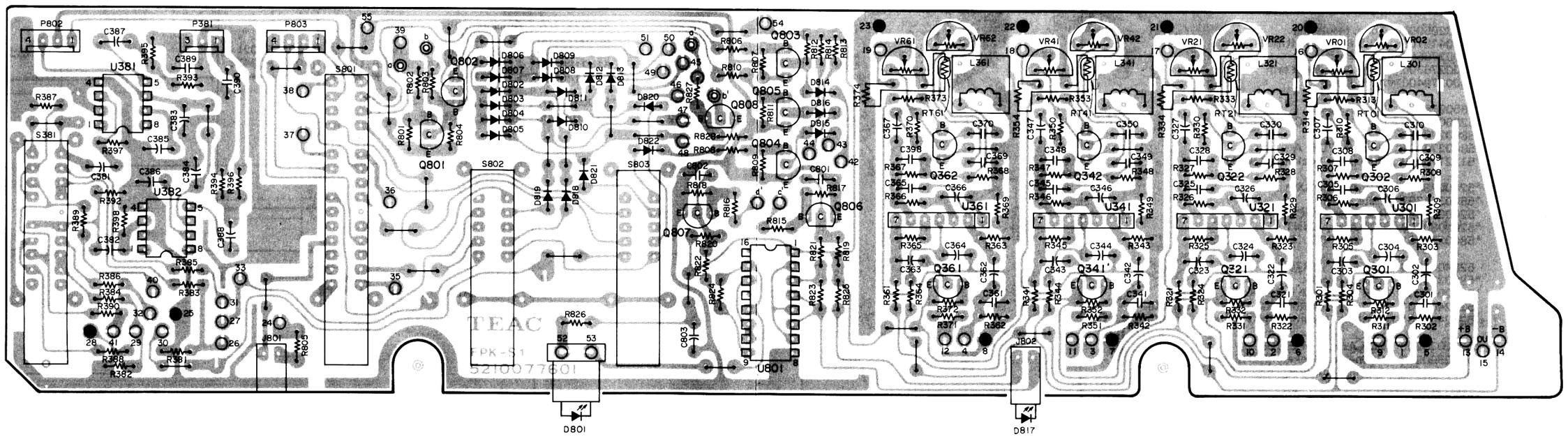
[U] : U.S.A. [C] : CANADA [GE] : GENERAL EXPORT
[A] : AUSTRALIA [E] : EUROPE [UK] : U.K.

8 PC BOARD AND PARTS LIST

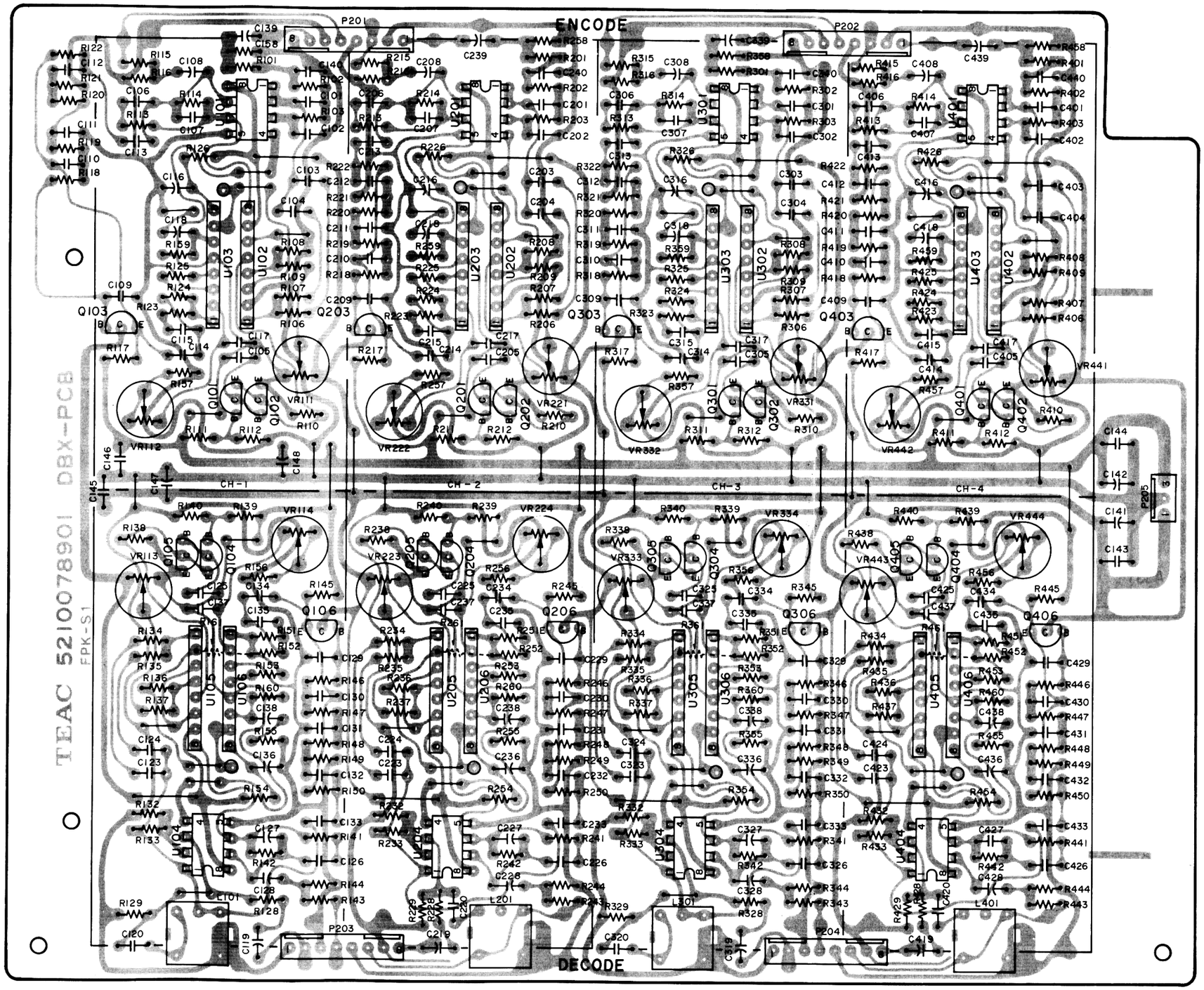
PC Boards shown viewed from foil side.

RECORD AMPL. PCB ASSY

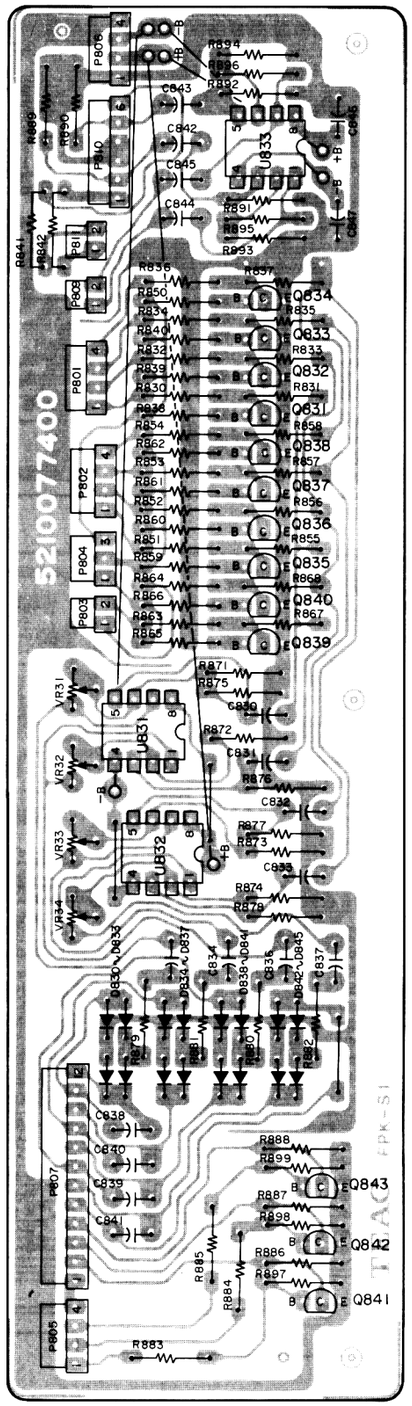




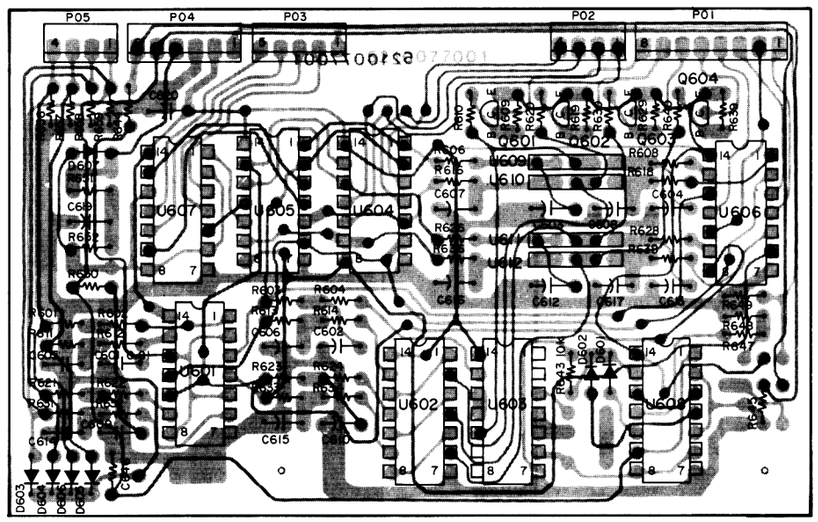
DBX AMPL. PCB ASSY



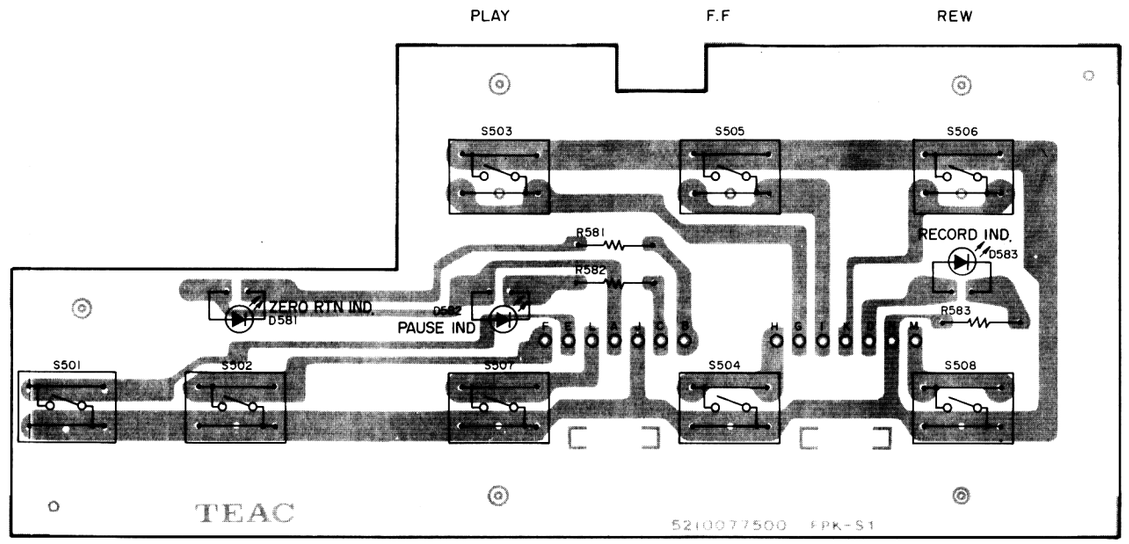
METER AMPL. PCB ASSY



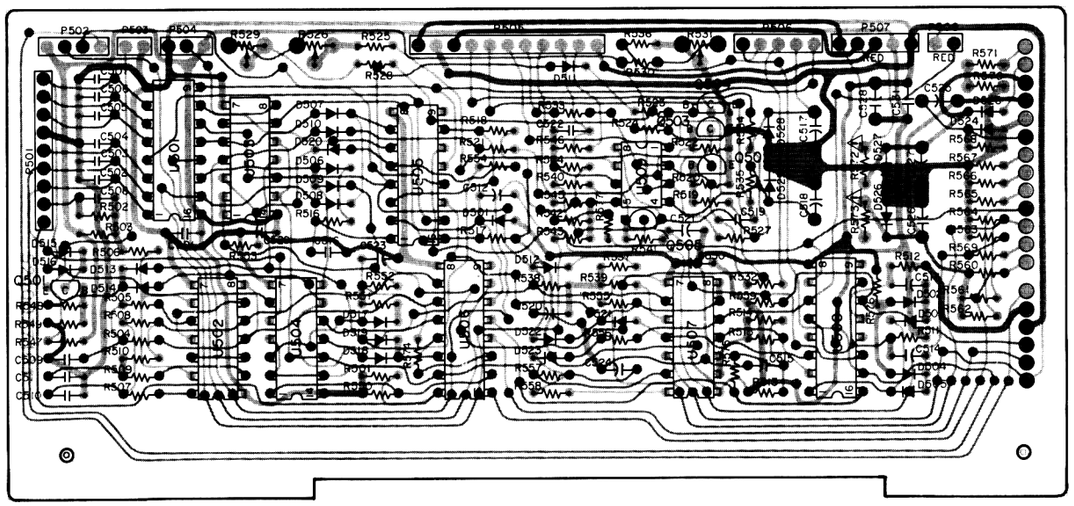
CONTROL PCB A ASSY



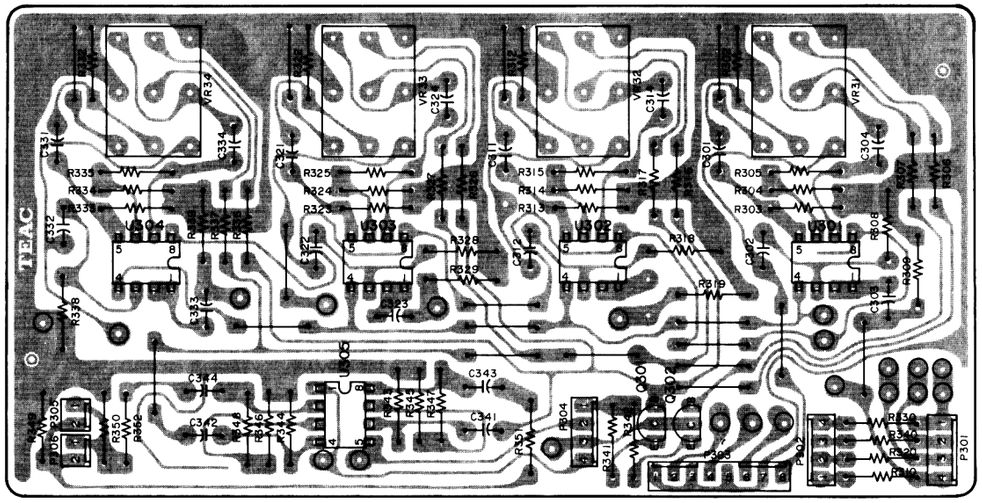
SWITCH PCB ASSY



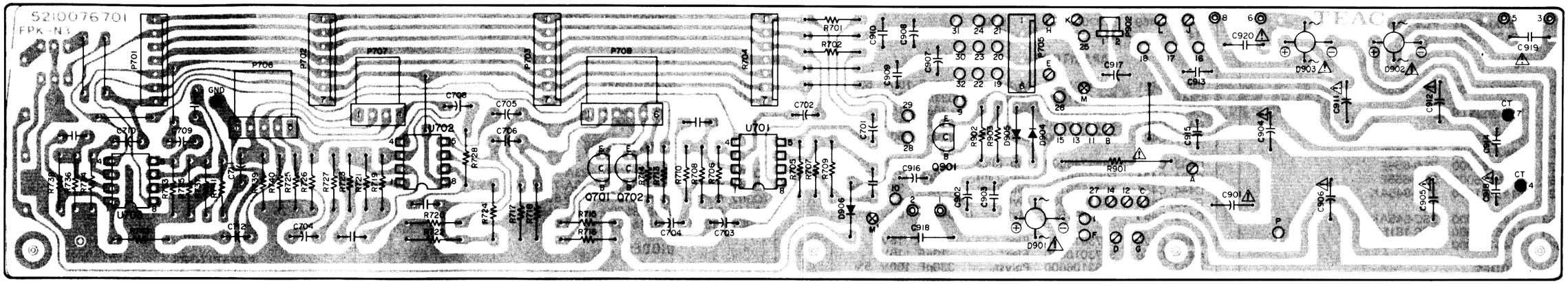
CONTROL PCB B ASSY



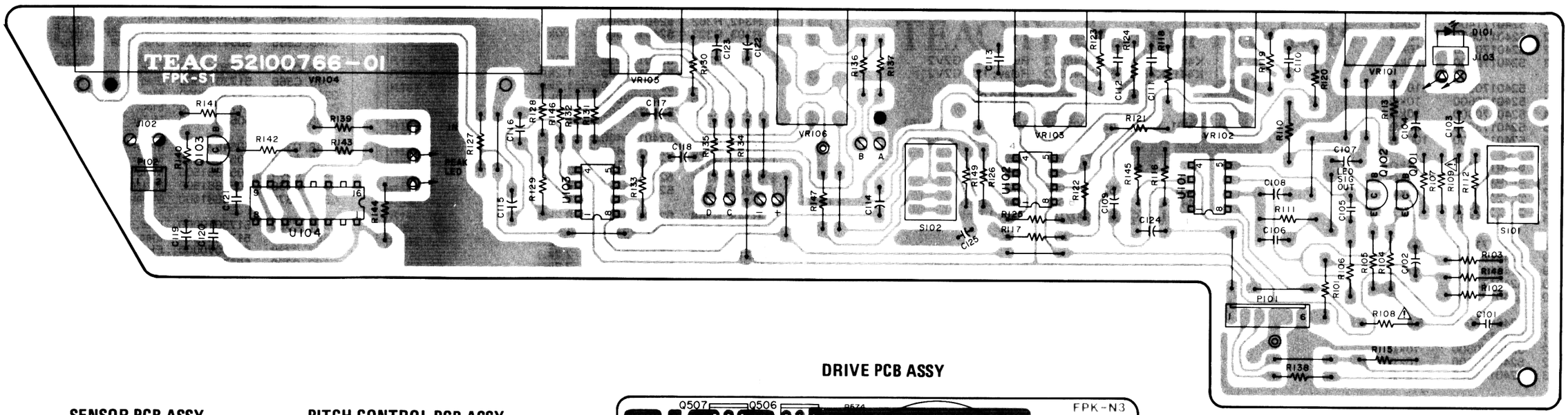
TAPE CUE AMPL. PCB ASSY



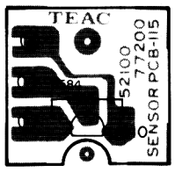
POWER SUPPLY/OUTPUT AMPL. PCB ASSY



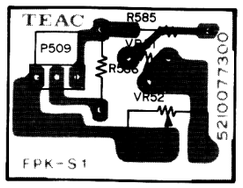
INPUT AMPL.PCB ASSY



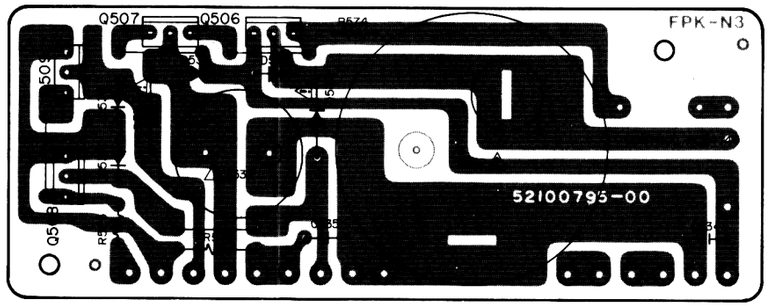
SENSOR PCB ASSY



PITCH CONTROL PCB ASSY



DRIVE PCB ASSY



RECORD AMPL. PCB ASSY

REF. NO.	PARTS NO.	DESCRIPTION
	5200076801	PCB Assy
	5210076801	PCB
	IC	
U401, U402	5220406700	RC 4558P
	TRANSISTORS	
Q401, Q421	5042553000	2SA-733P
Q441, Q461	5042553000	2SA-733P
Q402, Q422	5145185000	2SD-655E
Q442, Q462	5145185000	2SD-655E
Q403, Q423	5145091000	2SC-945AK
Q443, Q463	5145091000	2SC-945AK
Q404, Q424	5145151000	2SC-1815GR
Q444, Q464	5145151000	2SC-1815GR
	DIODES	
D401, D421	5042517000	1S2473VE
D441, D461	5042517000	1S2473VE
D402, D422	5042517000	1S2473VE
D442, D462	5042517000	1S2473VE
	CARBON RESISTERS	
R401, R421	5240171400	22kΩ
R441, R461	5240171400	22kΩ
R402, R422	5240170600	10kΩ
R442, R462	5240170600	10kΩ
R403, R423	5240170600	10kΩ
R443, R463	5240170600	10kΩ
R404, R424	5240170600	10kΩ
R444, R464	5240170600	10kΩ
R405, R425	5240173000	100kΩ
R445, R465	5240173000	100kΩ
R406, R426	5240169400	3.3kΩ
R446, R466	5240169400	3.3kΩ
R407, R427	5240171000	15kΩ
R447, R467	5240171000	15kΩ
R408, R428	5240171800	33kΩ
R448, R468	5240171800	33kΩ
R409, R429	5240167400	470Ω
R449, R459	5240167400	470Ω
R410, R430	5240172200	47kΩ
R450, R470	5240172200	47kΩ
R411, R431	5240170000	5.6kΩ
R451, R471	5240170000	5.6kΩ
R412, R432	5240170600	10kΩ
R452, R472	5240170600	10kΩ
R413, R433	5240170600	10kΩ
R453, R473	5240170600	10kΩ
R414, R434	5240173000	100kΩ
R454, R474	5240173000	100kΩ
R415, R435	5240163200	8.2Ω
R455, R475	5240163200	8.2Ω
R416, R436	5240168000	2.2kΩ
R456, R476	5240168000	2.2kΩ
R417, R437	5240170000	5.6kΩ
R457, R477	5240170000	5.6kΩ
R418, R438	5240170600	10kΩ
R458, R478	5240170600	10kΩ
R419, R439	5183052000	56Ω
R459, R479	5183052000	56Ω
R420, R440	5181718000	33kΩ
R460, R480	5181718000	33kΩ

REF. NO.	PARTS NO.	DESCRIPTION
R439, R459	5183052000	56Ω
R479	5183052000	56Ω
	CAPACITORS	
C401, C421	5054881500	Mylar 0.0033μF 100V 5%
C441, C461	5054881500	Mylar 0.0033μF 100V 5%
C402, C422	5173010000	Elec. 10μF 16V
C442, C462	5173010000	Elec. 10μF 16V
C403, C423	5054746000	Dip. Mica 330pF 50V 10%
C443, C463	5054746000	Dip. Mica 330pF 50V 10%
C404, C424	5054666100	Dip. Tant. 0.22μF 35V 20%
C444, C464	5054666100	Dip. Tant. 0.22μF 35V 20%
C405, C425	5054891500	Mylar 0.0047μF 100V 5%
C445, C465	5054891500	Mylar 0.0047μF 100V 5%
C406, C426	5173010000	Elec. 10μF 16V
C446, C466	5173010000	Elec. 10μF 16V
C407, C427	5263106600	Polyst. 330pF 100V 5%
C447, C467	5263106600	Polyst. 330pF 100V 5%
C408, C428	5267205800	Trimmer -M- 2P 100P
C448, C468	5267205800	Trimmer -M- 2P 100P
C409, C429	5173006000	Elec. 4.7μF 50V
C449, C469	5173006000	Elec. 4.7μF 50V
C410, C430	5172996000	Elec. 2.2μF 50V
C450, C470	5172996000	Elec. 2.2μF 50V
C429	5173006000	Elec. 4.7μF 50V
	RELAYS	
K401, K421	6047048012	Relay; 12V G2V2
K441, K461	6047048012	Relay; 12V G2V2
	VARIABLE RESISTORS	
VR01, VR21	5280001102	Semi-fixed 20kΩ(B)
VR41, VR61	5280001102	Semi-fixed 20kΩ(B)
	COILS	
L401, L421	5286010600	Trap, 22mH
L441, L461	5286010600	Trap, 22mH
L402, L403	5286002100	Trap, 1.5mH
	MISCELLANEOUS	
U403, U423	5292201400	BIAS Amp, Module
U404	5292201300	OSC Unit
D403	5225005400	LED, SLP-135B (RED)
P402, P403	5122132000	Connector Plug, 8P
J401	5122373000	Connector Socket 2P AH
W406~W416	5181761000	Jumper (16 used)
W416	5181763000	Jumper
TP01~TP04	5544750000	Combination Pin (4 used)

[U] : U.S.A. [C] : CANADA [GE] : GENERAL EXPORT
[A] : AUSTRALIA [E] : EUROPE [UK] : U.K.

PLAYBACK AMPL. PCB ASSY

REF. NO.	PARTS NO.	DESCRIPTION
	5200077601	PCB Assy
	5210077601	PCB
	IC's	
U801	5220016800	HD14049UBP
U301, U321	5147023000	TA-7136P
U341, U361	5147023000	TA-7136P
U381, U382	6048649000	NJM386D
	TRANSISTORS	
Q301, Q321	5042553000	2SA-733P
Q341, Q361	5042553000	2SA-733P
Q302, Q322	5145185000	2SD-655E
Q342, Q362	5145185000	2SD-655E
Q801~Q808	5145151000	2SC-1815GR
	DIODES	
D802~D816	5042517000	1S2473VE
D818~D822	5042517000	1S2473VE
	CARBON RESISTORS	
	All Resistors are rated ±5% tolerance and ¼W.	
R301, R321	5240167600	560Ω
R341, R361	5240167600	560Ω
R302, R322	5240175400	1MΩ
R342, R362	5240175400	1MΩ
R303, R323	5240173000	100kΩ
R343, R363	5240173000	100kΩ
R304, R324	5240168400	1.2kΩ
R344, R364	5240168400	1.2kΩ
R305, R325	5240172500	62kΩ
R345, R365	5240172500	62kΩ
R306, R326	5240175400	1MΩ
R346, R366	5240175400	1MΩ
R307, R327	5240174100	300kΩ
R347, R367	5240174100	300kΩ
R308, R328	5240170400	8.2kΩ
R348, R368	5240170400	8.2kΩ
R309, R329	5240165300	62Ω
R349, R369	5240165300	62Ω
R310, R330	5240169000	2.2kΩ
R350, R370	5240169000	2.2kΩ
R311, R331	5240170600	10kΩ
R351, R371	5240170600	10kΩ
R312, R332	5240170600	10kΩ
R352, R372	5240170600	10kΩ
R313, R332	5240170600	10kΩ
R353, R373	5240170600	10kΩ
R314, R334	5181318000	33kΩ
R354, R374	5181318000	33kΩ
R381, R382	5240173000	100kΩ
R383, R384	5240172400	5.6kΩ
R385, R386	5240173200	120kΩ
R389, R390	5240173000	100kΩ
R391, R392	5240171400	22kΩ
R393, R394	5240168200	1kΩ
R395, R396	5240161000	1Ω
R397, R398	5240173000	100kΩ
R801	5240173000	100kΩ
R802	5240170600	10kΩ
R803	5240167400	470Ω
R804	5240173000	100kΩ

REF. NO.	PARTS NO.	DESCRIPTION
R805	5240167000	330Ω
R806	5240170000	5.6kΩ
R807	5240171400	22kΩ
R808	5240170000	5.6kΩ
R809	5240171400	22kΩ
R810	5240170000	5.6kΩ
R811	5240171400	22kΩ
R812~R814	5240168200	1kΩ
R815, R816	5240173000	100kΩ
R817, R818	5240172800	82kΩ
R819, R820	5240172200	47kΩ
R821, R822	5240173000	100kΩ
R823, R824	5240175400	1MΩ
R825, R826	5240167000	330Ω
R827	5240170600	10kΩ
R828	5240173000	100kΩ
	CAPACITORS	
C301, C321	5173731000	Polyst. 820pF 100V 5%
C341, C361	5173731000	Polyst. 820pF 100V 5%
C302, C322	5173010000	Elec. 10μF 16V
C342, C362	5173010000	Elec. 10μF 16V
C303, C323	5173036000	Elec. 47μF 16V
C343, C363	5173036000	Elec. 47μF 16V
C304, C324	5173036000	Elec. 47μF 16V
C344, C364	5173036000	Elec. 47μF 16V
C305, C325	5054740000	Dip. Mica. 10pF 50V 10%
C345, C365	5054740000	Dip. Mica. 10pF 50V 10%
C306, C326	5173010000	Elec. 10μF 16V
C346, C366	5173010000	Elec. 10μF 16V
C307, C327	5173010000	Elec. 10μF 16V
C347, C367	5173010000	Elec. 10μF 16V
C308, C328	5054877500	Mylar 0.01μF 100V 5%
C348, C368	5054877500	Mylar 0.01μF 100V 5%
C309, C329	5054881500	Mylar 0.0033μF 100V 5%
C349, C369	5054881500	Mylar 0.0033μF 100V 5%
C310, C330	5054881500	Mylar 0.0033μF 100V 5%
C350, C370	5054881500	Mylar 0.0033μF 100V 5%
C381, C382	5173010000	Elec. 10μF 16V
C383~C386	5173044000	Elec. 100μF 10V
C387, C388	5173070000	Elec. 470μF 6.3V
C389, C390	5054738500	Mylar 0.047μF 100V 5%
C801, C802	5054204000	Ceramic 0.01μF 50V 10%
C803	5173010000	Elec. 10μF 16V
	VARIABLE RESISTORS	
VR01, VR21	5280001102	Semi-fixed 20kΩ(B)
VR41, VR61	5280001102	Semi-fixed 20kΩ(B)
VR02, VR22	5280001702	Semi-fixed 100kΩ(B)
VR42, VR62	5280001702	Semi-fixed 100kΩ(B)
	COILS	
L301, L321	5286010700	Trap, 2.2mH
L341, L361	5286010700	Trap, 2.2mH
	MISCELLANEOUS	
RT01, RT21	5143128000	Thermistor S5C34
D801, D817	5225005400	LED, SLP-135B (RED)
S801	5300513500	Lever Switch 6-3
S802, C803	5300513300	Lever Switch 2-3
S804	5300513400	Lever Switch 4-3
J801, J802	5122373000	Connector Socket, 2P
P381	5122127000	Connector Socket, 3P
P802	5122301000	Connector Socket, 4P (RED)
P803	5122128000	Connector Socket, 4P
W001~W032	5181761000	Jumper

DBX AMPL. PCB ASSY

REF. NO.	PARTS NO.	DESCRIPTION
	5200078901	PCB Assy
	5210078901	PCB
	IC's	
U101, U201	5220415000	NJM072D
U301, U401	5220415000	NJM072D
U102, U202	5220414500	UPC1252H
U302, U402	5220414500	UPC1252H
U103, U203	5220414601	UPC1253H
U303, U403	5220414601	UPC1253H
U104, U204	5220415000	NJM072D
U304, U404	5220415000	NJM072D
U105, U205	5220414500	UPC1252H
U305, U405	5220414500	UPC1252H
U106, U206	5220414601	UPC1253H
U306, U406	5220414601	UPC1253H
	TRANSISTORS	
Q101, Q201	5145150000	2SA-1015GR
Q301, Q401	5145150000	2SA-1015GR
Q102, Q202	5230770400	2SC-1015BL
Q302, Q402	5230770400	2SC-1015BL
Q104, Q204	5145150000	2SA-1015GR
Q304, Q404	5145150000	2SA-1015GR
Q105, Q205	5230770400	2SC-1015BL
Q305, Q405	5230770400	2SC-1015BL
	CARBON RESISTORS	
	All Resistors are rated ±5% tolerance and ¼W.	
R101, R201	5240170600	10kΩ
R301, R401	5240170600	10kΩ
R102, R202	5240170600	10kΩ
R302, R402	5240170600	10kΩ
R103, R203	5240170600	10kΩ
R303, R403	5240170600	10kΩ
R106, R206	5240171800	33kΩ
R306, R406	5240171800	33kΩ
R107, R207	5240170600	10kΩ
R307, R407	5240170600	10kΩ
R108, R208	5240165100	51kΩ
R308, R408	5240165100	51kΩ
R109, R209	5240174100	300kΩ
R309, R409	5240174100	300kΩ
R110, R210	5240169800	4.7kΩ
R310, R410	5240169800	4.7kΩ
R111, R211	5240170600	10kΩ
R311, R411	5240170600	10kΩ
R112, R212	5240169200	2.7kΩ
R312, R412	5240169200	2.7kΩ
R113, R213	5240170600	10kΩ
R313, R413	5240170600	10kΩ
R114, R214	5240171800	33kΩ
R314, R414	5240171800	33kΩ
R115, R215	5240165800	100Ω
R315, R415	5240165800	100Ω
R116, R216	5240172200	47kΩ
R316, R416	5240172200	47kΩ
R117, R217	5240169800	4.7kΩ
R317, R417	5240169800	4.7kΩ
R118, R218	5240170200	6.8kΩ
R318, R418	5240170200	6.8kΩ
R119, R219	5240171800	33kΩ
R319, R419	5240171800	33kΩ
R120, R220	5240169800	4.7kΩ

REF. NO.	PARTS NO.	DESCRIPTION
R320, R420	5240169800	4.7kΩ
R121, R221	5240172900	91kΩ
R321, R421	5240172900	91kΩ
R122, R222	5240171800	33kΩ
R322, R422	5240171800	33kΩ
R123, R223	5240169400	3.3kΩ
R323, R423	5240169400	3.3kΩ
R124, R224	5240171800	33kΩ
R324, R424	5240171800	33kΩ
R125, R225	5240164200	22kΩ
R325, R425	5240164200	22kΩ
R126, R226	5240168200	1kΩ
R326, R426	5240168200	1kΩ
R127, R227	5240162600	4.7Ω
R327, R427	5240162600	4.7Ω
R128, R228	5240169800	4.7kΩ
R328, R428	5240169800	4.7kΩ
R129, R229	5240173000	100kΩ
R329, R429	5240173000	100kΩ
R132, R232	5240168200	1kΩ
R332, R432	5240168200	1kΩ
R133, R233	5240170500	9.1kΩ
R333, R433	5240170500	9.1kΩ
R134, R234	5240171800	33kΩ
R334, R434	5240171800	33kΩ
R135, R235	5240170600	10kΩ
R335, R435	5240170600	10kΩ
R136, R236	5240165100	51kΩ
R336, R436	5240165100	51kΩ
R137, R237	5240174100	300kΩ
R337, R437	5240174100	300kΩ
R138, R238	5240169800	4.7kΩ
R338, R438	5240169800	4.7kΩ
R139, R239	5240170600	10kΩ
R339, R439	5240170600	10kΩ
R140, R240	5240169200	2.7kΩ
R340, R440	5240169200	2.7kΩ
R141, R241	5240170600	10kΩ
R341, R441	5240170600	10kΩ
R142, R242	5240171800	33kΩ
R342, R442	5240171800	33kΩ
R143, R243	5240165800	100Ω
R343, R443	5240165800	100Ω
R144, R244	5240172200	47kΩ
R344, R444	5240172200	47kΩ
R145, R245	5240169800	4.7kΩ
R345, R445	5240169800	4.7kΩ
R146, R246	5240170200	6.8kΩ
R346, R446	5240170200	6.8kΩ
R147, R247	5240171800	33kΩ
R347, R447	5240171800	33kΩ
R148, R248	5240169800	4.7kΩ
R348, R448	5240169800	4.7kΩ
R149, R249	5240172900	91kΩ
R349, R449	5240172900	91kΩ
R150, R250	5240171800	33kΩ
R350, R450	5240171800	33kΩ
R151, R251	5240169400	3.3kΩ
R351, R451	5240169400	3.3kΩ
R152, R252	5240171800	33kΩ
R352, R452	5240171800	33kΩ
R153, R253	5240164200	22Ω
R353, R453	5240164200	22Ω
R154, R254	5240168200	4.7kΩ
R354, R454	5240168200	4.7kΩ

REF. NO.	PARTS NO.	DESCRIPTION
R155, R255	5240162600	4.7Ω
R355, R455	3240162600	4.7Ω
R156, R256	5240173800	220kΩ
R356, R456	5240173800	220kΩ
R157, R257	5240173800	220kΩ
R357, R457	5240173800	220kΩ
R158, R258	5240173000	100kΩ
R358, R458	5240173000	100kΩ
R159, R259	5241425300	910kΩ
R359, R459	5241425300	910kΩ
	CAPACITORS	
C101, C201	5054876500	Mylar 0.0022μF 100V 5%
C301, C401	5054876500	Mylar 0.0022μF 100V 5%
C102, C202	5263105600	Polyst. 120pF 100V 5%
C202, C302	5263105600	Polyst. 120pF 100V 5%
C103, C203	5263162813	Metalized 0.33μF 50V 5%
C303, C403	5263162813	Metalized 0.33μF 50V 5%
C104, C204	5054877500	Mylar 0.01μF 100V 5%
C304, C404	5054877500	Mylar 0.01μF 100V 5%
C105, C205	5054878500	Mylar 0.001μF 100V 5%
C305, C405	5054878500	Mylar 0.001μF 100V 5%
C106, C206	5263105400	Polyst. 100pF 100V 5%
C306, C406	5263105400	Polyst. 100pF 100V 5%
C107, C207	5263105400	Polyst. 100pF 100V 5%
C307, C407	5263105400	Polyst. 100pF 100V 5%
C108, C208	5173018000	Elec. 22μF 16V
C308, C408	5173018000	Elec. 22μF 16V
C109, C209	5263106600	Polyst. 330pF 100V 5%
C309, C409	5263106600	Polyst. 330pF 100V 5%
C110, C210	5054881500	Mylar 0.0033μF 100V 5%
C310, C410	5054881500	Mylar 0.0033μF 100V 5%
C111, C211	5054881500	Mylar 0.0033μF 100V 5%
C311, C411	5054881500	Mylar 0.0033μF 100V 5%
C112, C212	5263162213	Metalized 0.1μF 50V 5%
C312, C412	5263162213	Metalized 0.1μF 50V 5%
C113, C213	5263162213	Metalized 0.1μF 50V 5%
C313, C413	5263162213	Metalized 0.1μF 50V 5%
C114, C214	5054877500	Mylar 0.01μF 100V 5%
C314, C414	5054877500	Mylar 0.01μF 100V 5%
C115, C215	5054877500	Mylar 0.01μF 100V 5%
C315, C415	5054877500	Mylar 0.01μF 100V 5%
C116, C216	5173011000	Elec. 10μF 25V
C316, C416	5173011000	Elec. 10μF 25V
C117, C217	5054878500	Mylar 0.001μF 100V 5%
C317, C417	5054878500	Mylar 0.001μF 100V 5%
C118, C218	5260227510	Elec. 22μF 50V
C318, C418	5260227510	Elec. 22μF 50V
C119, C219	5173010000	Elec. 10μF 16V
C319, C419	5173010000	Elec. 10μF 16V
C120, C220	5263106800	Polyst. 390pF 100V 5%
C320, C420	5263106800	Polyst. 390pF 100V 5%
C123, C223	5263162800	Metalized 0.33μF 50V 5%
C323, C423	5263162800	Metalized 0.33μF 50V 5%
C124, C224	5263106190	Polyst. 200pF 100V 5%
C324, C424	5263106190	Polyst. 200pF 100V 5%
C125, C225	5054878500	Mylar 0.001μF 100V 5%
C325, C425	5054878500	Mylar 0.001μF 100V 5%
C126, C226	5054877500	Mylar 0.01μF 100V 5%
C326, C426	5054877500	Mylar 0.01μF 100V 5%
C127, C227	5263105400	Polyst. 100pF 100V 5%
C327, C427	5263105400	Polyst. 100pF 100V 5%

REF. NO.	PARTS NO.	DESCRIPTION
C128, C228	5173018000	Elec. 22μF 16V
C328, C428	5173018000	Elec. 22μF 16V
C129, C229	5263106600	Polyst. 330pF 100V 5%
C329, C429	5263106600	Polyst. 330pF 100V 5%
C130, C230	5054881500	Mylar 0.0033μF 100V 5%
C330, C430	5054881500	Mylar 0.0033μF 100V 5%
C131, C231	5054881500	Mylar 0.0033μF 100V 5%
C331, C431	5054881500	Mylar 0.0033μF 100V 5%
C132, C232	5263162213	Metalized 0.1μF 50V 5%
C332, C432	5263162213	Metalized 0.1μF 50V 5%
C134, C234	5263162213	Metalized 0.1μF 50V 5%
C334, C434	5263162213	Metalized 0.1μF 50V 5%
C135, C235	5054877500	Mylar 0.01μF 100V 5%
C335, C435	5054877500	Mylar 0.01μF 100V 5%
C136, C236	5173011000	Elec. 10μF 25V
C336, C436	5173011000	Elec. 10μF 25V
C137, C237	5054878500	Mylar 0.001μF 100V 5%
C337, C437	5054878500	Mylar 0.001μF 100V 5%
C138, C238	5260227510	Elec. 22μF 10V
C338, C438	5260227510	Elec. 22μF 10V
C139, C239	5173010000	Elec. 10μF 16V
C239, C439	5173010000	Elec. 10μF 16V
C140, C240	5263107600	Polyst. 820pF 100V 5%
C340, C440	5263107600	Polyst. 820pF 100V 5%
C141, C142	5173036000	Elec. 47μF 16V
C143~C146	5054204000	Ceramic 0.01μF 50V 10%
C147, C148	5173036000	Elec. 47μF 16V
	COILS	
L101, L201	6046639000	Trap. 22mH
L301, L401	6046639000	Trap. 22mH
	VARIABLE RESISTORS	
VR11, VR21	5280062101	Semi-fixed 47kΩ(B)
VR31, VR41	5280062101	Semi-fixed 47kΩ(B)
VR12, VR22	5280062901	Semi-fixed 1MΩ(B)
VR32, VR42	5280062901	Semi-fixed 1MΩ(B)
VR13, VR23	5280062100	Semi-fixed 47kΩ(B)
VR33, VR43	5280062100	Semi-fixed 47kΩ(B)
VR14, VR24	5280062901	Semi-fixed 1MΩ(B)
VR34, VR44	5280062901	Semi-fixed 1MΩ(B)
	CONNECTOR PLUGS	
P201~P204	5022132000	8P
P205	5122127000	3P
	MISCELLANEOUS	
TP	5544750000	Combination Pin (8 used)

METER AMPL. PCB ASSY

REF. NO.	PARTS NO.	DESCRIPTION
	5200077400	PCB Assy
	5210077400	PCB
	IC's	
U831, U832	5220406700	RC4558T
U833	5220415000	NJM072D
	TRANSISTORS	
Q831~Q843	5145151000	2SC-1815GR
	DIODES	
D830~D845	5042213000	IN60
	CARBON RESISTORS	
	All Resistors are rated ±5% tolerance and ¼W.	
R830~R840	5183106000	10kΩ
R841, R842	5183114000	22kΩ
R850~R868	5183106000	10kΩ
R871, R872	5183062000	150Ω
R873, R874	5183066000	220Ω
R875~R878	5183130000	100kΩ
R879~R882	5183095000	3.6kΩ
R883~R884	5183090000	2.2kΩ
R885	5183078000	680Ω
R886~R888	5183066000	220Ω
R889, R890	5183138000	220kΩ
R891, R892	5183130000	100kΩ
R893, R894	5183100000	5.6kΩ
R895, R896	5183114000	22kΩ
R897~R899	5183122000	47kΩ
	CAPACITORS	
C830~C833	5173010000	Elec. 10μF 16V
C834~C837	5173018000	Elec. 22μF 16V
C838~C847	5173010000	Elec. 10μF 16V
	CONNECTOR PLUGS	
P801	5122204000	4P (BLK)
P802	5122455000	4P (RED)
P803	5122145000	2P
P804	5122146000	3P
P805, P806	5122147000	4P
P807	5122155000	12P
P809	5122453000	2P (RED)
P810	5122149000	6P
P811	5122145000	2P
	MISCELLANEOUS	
VR31~VR34	5280000802	Variable Resistor, 5kΩ(B)
W801~W803	5181763000	Jumper

CONTROL (A) PCB ASSY

REF. NO.	PARTS NO.	DESCRIPTION
	5200077001	PCB Assy
	5210077001	PCB
	IC's	
U601	5220013700	MSM4011RS
U602, U603	5220014200	MSM4069RS
U604	5220013500	MSM4001RS
U605, U606	5220013700	MSM4011RS
U607, U608	5220013500	MSM4001RS
U609, U612	5293003000	Compound Arre, 08-0116
	TRANSISTORS	
Q601~Q604	5042553000	2SA-733AP
Q605	5145151000	2SC-1815GR
	DIODES	
D601~D607	5042517000	1S2473VE
	CARBON RESISTORS	
	All Resistors are rated ±5% tolerance and ¼W.	
R601, R611	5240170600	10kΩ
R621, R631	5240170600	10kΩ
R602, R612	5240170600	10kΩ
R622, R632	5240170600	10kΩ
R603, R613	5240170600	10kΩ
R623, R633	5240170600	10kΩ
R604, R614	5240170600	10kΩ
R624, R634	5240170600	10kΩ
R606, R616	5240171400	22kΩ
R626, R636	5240171400	22kΩ
R608, R618	5240171000	15kΩ
R628, R638	5240171000	15kΩ
R609, R619	5240170000	5.6kΩ
R629, R639	5240170000	5.6kΩ
R610, R620	5240170600	10kΩ
R630, R640	5240170600	10kΩ
R641	5240174600	470kΩ
R642	5240171800	33kΩ
R643~R645	5240170600	10kΩ
R646	5240173000	100kΩ
R647	5240170000	5.6kΩ
R648	5240173000	100kΩ
R649	5240170600	10kΩ
R650	5240170000	5.6kΩ
R651, R652	5240170600	10kΩ
R656~R659	5240173000	100kΩ
	CAPACITORS	
C601, C605	5172336000	Ceramic 0.01μF 50V 20%
C609, C614	5172336000	Ceramic 0.01μF 50V 20%
C602, C606	5172996000	Elec. 2.2μF 50V
C610, C615	5172996000	Elec. 2.2μF 50V
C603, C607	5173010000	Elec. 10μF 16V
C611, C616	5173010000	Elec. 10μF 16V
C604, C608	5173010000	Elec. 10μF 16V
C612, C617	5173010000	Elec. 10μF 16V
C618	5260067010	Elec. 10μF 16V 20%
C619, C620	5173010000	Elec. 10μF 16V
	CONNECTOR PLUGS	
P601	5122132000	8P
P602	5122129000	5P
P603	5122128000	4P
P604	5122130000	6P
P605	5122128000	4P

CONTROL (B) PCB ASSY

REF. NO.	PARTS NO.	DESCRIPTION
	5200077100	PCB Assy
	5210077100	PCB
	IC's	
U501	5147047000	M-54410P
U502	6048940000	MC-14001B
U503	5048939000	MC-14081B
U504	6048940000	MC-14001B
U505, U506	6048661000	M-54517P
U507	6048939000	MC-14081B
U508	6048661000	M-54517P
U509	6220405000	μPC-4557C
	TRANSISTORS	
Q501~Q504	5145151000	2SC-1815GR
Q505	5145150000	2SA-1015GR
	DIODES	
D501~D525	5042517000	1S2473VE
D526	5224520700	GZA-10L, Zener
D527	5224521300	GZA-13L, Zener
D528, D529	5224521000	GZA-11U, Zener
	CARBON RESISTORS	
	All Resistor are rated ±5% tolerance and ¼W.	
R501	5240168200	1kΩ
R502	5240172200	47kΩ
R503	5240169800	47kΩ
R504	5240172200	47kΩ
R505~R507	5240171400	22kΩ
R508	5240172200	47kΩ
R509	5240171400	22kΩ
R510	5240169000	2.2kΩ
R511, R512	5240168200	1kΩ
R513	5240173800	220kΩ
R514	5240171400	22kΩ
R515	5240175400	1MΩ
R516	5240169800	4.7kΩ
R517, R518	5240168200	1kΩ
R519~R524	5240170800	12kΩ
R525	5240169400	3.3kΩ
R527	5240170000	5.6kΩ
R528	5240167400	470Ω
R530	5240169400	3.3kΩ
R532	5240168800	1.8kΩ
R533	5240173400	150kΩ
R534, R575	5240167200	390Ω
R536	5240164200	22Ω
R537	5240171800	33kΩ
R538, R539	5240171400	22kΩ
R540, R541	5240170800	12kΩ
R542	5240173000	100kΩ
R543~R546	5240170600	10kΩ
R547	5240168200	1kΩ
R548, R549	5240170800	12kΩ
R550	5240168200	1kΩ
R551	5240169800	4.7kΩ
R552	5240171400	22kΩ
R553	5240173000	100kΩ
R554	5240169800	4.7kΩ
R555	5240173000	100kΩ
R556	5240170600	10kΩ
R557, R558	5240171400	22kΩ
R559	5240168200	1kΩ
R560, R561	5240170600	10kΩ

REF. NO.	PARTS NO.	DESCRIPTION			
R562	5240169600	3.9kΩ			
R563~R568	5240173000	100kΩ			
R569	5240170600	10kΩ			
R570, R571	5180062000	150Ω			
R572	⚠5180064000	180Ω	1/2W		
R573	⚠5240167600	560Ω			
R574	5240171400	1kΩ			
R575, R576	5240163600	12Ω			
R577	5240171000	15kΩ			
	CAPACITORS				
C501~C508	5054204000	Ceramic	0.01μF	50V	±10%
C509, C510	5173395000	Ceramic	0.047μF	50V	±10%
C511	5054204000	Ceramic	0.01μF	50V	±10%
C512	5172992000	Elec.	1μF	50V	
C513, C514	5172996000	Ceramic	2.2μF	50V	±10%
C515	5173010000	Elec.	10μF	16V	
C516	5173018000	Elec.	22μF	16V	
C517, C518	5173072000	Elec.	470μF	16V	
C519	5054204000	Ceramic	0.01μF	50V	±10%
C520	5173010000	Elec.	10μF	16V	
C521	5172996000	Elec.	2.2μF	50V	
C522	5054204000	Ceramic	0.01μF	50V	±10%
C523~C525	5173010000	Elec.	10μF	16V	
C526	5173036000	Elec.	47μF	16V	
C527	5173037000	Elec.	47μF	25V	
C528	5173053000	Elec.	220μF	10V	
C529~C531	5054204000	Ceramic	0.01μF	50V	±10%
	VARIABLE RESISTORS				
R526	5150154000	Semi-fixed	10kΩ(B)		
R529, R531	5150152000	Semi-fixed	2kΩ(B)		
	CONNECTOR PLUGS				
P501	5122133000	9P			
P502	5122128000	4P			
P503	5122126000	2P			
P504	5122127000	3P			
P505	5122135000	11P			
P506	5122128000	5P			
P507	5122302000	5P (RED)			
P508	5122299000	2P (RED)			

SW PCB ASSY

REF. NO.	PARTS NO.	DESCRIPTION
	5200077500	PCB Assy
	5210077501	PCB
	CARBON RESISTORS	
	All Resistor are rated ±5% tolerance and ¼W.	
R581~R583	5183070000	330Ω
	LEDES	
D581, D583	5225010100	SLP-155B (RED)
D582	5225010200	SLP-255B (RED)
	SWITCHS	
S501~S508	5302101400	Tact, KHG-10905
	MISCELLANEOUS	
	5800305001	Lorer, LED; B

TAPE CUE AMPL. PCB ASSY

REF. NO.	PARTS NO.	DESCRIPTION
	5200076900	PCB Assy
	5210076900	PCB
	IC's	
U301~U305	5220411100	NJM4560D-X
	TRANSISTORS	
Q301, Q302	5145185000	2SD-655E
	CARBON RESISTORS	
	All Resistors are rated ±5% tolerance and ¼W.	
R302, R312	5183138000	220kΩ
R322, R332	5183138000	220kΩ
R303, R313	5183138000	220kΩ
R323, R333	5183138000	220kΩ
R304, R314	5183106000	10kΩ
R324, R334	5183106000	10kΩ
R305, R315	5183114000	22kΩ
R325, R335	5183114000	22kΩ
R306, R316	5183114000	22kΩ
R326, R336	5183114000	22kΩ
R307, R317	5183114000	22kΩ
R327, R337	5183114000	22kΩ
R308, R318	5183138000	220kΩ
R328, R338	5183138000	220kΩ
R309, R319	5183122000	47kΩ
R329, R339	5183122000	47kΩ
R310, R320	5183058000	100Ω
R330, R340	5183058000	100Ω
R341, R342	5183106000	10kΩ
R343, R344	5183098000	4.7kΩ
R345, R346	5183106000	10kΩ
R347, R348	5183124000	56kΩ
R349, R350	5183122000	47kΩ
R351, R352	5183058000	100Ω
	CAPACITORS	
C301, C311	5173010000	Elec. 10μF 16V
C321, C331	5173010000	Elec. 10μF 16V
C302, C312	5173010000	Elec. 10μF 16V
C321, C332	5173010000	Elec. 10μF 16V
C303, C313	5173018000	Elec. 22μF 16V
C323, C333	5173018000	Elec. 22μF 16V
C304, C314	5173018000	Elec. 22μF 16V
C324, C334	5173018000	Elec. 22μF 16V
C341, C342	5173010000	Elec. 10μF 16V
C343, C344	5173018000	Elec. 22μF 16V
	VARIABLE RESISTORS	
VR31~VR34	5283503901	Trimmer; 2-shaft, 3-gang 5kΩ(A, C), 20kΩ(A)
	CONNECTOR PLUGS	
P301	5122128000	4P
P302	5122301000	4P (RED)
P303	5122132000	8P
P304	5122185000	4P (BLK)
P305, P306	5122126000	2P
	MISCELLANEOUS	
W1~W7	5181763000	Jupper

POWER SUPPLY/OUTPUT PCB ASSY

REF. NO.	PARTS NO.	DESCRIPTION
	5200076701	PCB Assy
	5210076701	PCB
	IC's	
U701	5220415000	NJM072D
U702, U703	5220411100	NJM4560D-X
	TRANSISTORS	
Q701, Q702	5145185000	2SD-655E
Q901	5042553000	2SA-733AP
	DIODES	
D901~D903	⚠5228005000	W02C
D904~D906	5143118000	1S2473HJ
	CARBON RESISTORS	
	All Resistors are rated ±5% tolerance and ¼W.	
R701, R702	5183114000	22kΩ
R705, R706	5183130000	100kΩ
R707, R708	5183100000	5.6kΩ
R709, R710	5183114000	22kΩ
R713~R716	5183106000	10kΩ
R717~R720	5183130000	100kΩ
R721, R722	5183098000	4.7kΩ
R723, R724	5183114000	22kΩ
R725, R726	5183122000	47kΩ
R727, R728	5183058000	100Ω
R733, R734	5183130000	100kΩ
R735, R736	5183100000	5.6kΩ
R737, R738	5183114000	22kΩ
R739, R740	5183122000	47kΩ
R741, R742	5183058000	100Ω
R901	⚠5184307000	10Ω 2W 10% Cement
R902	5183130000	100kΩ
R903	5183122000	47kΩ
	CAPACITORS	
C701~C706	5173010000	Elec. 10μF 16V
C707, C708	5173018000	Elec. 22μF 16V
C709, C710	5173010000	Elec. 10μF 16V
C711, C712	5173018000	Elec. 22μF 16V
C901	5172982000	Elec. 3300μF 16V
C902	5173010000	Elec. 10μF 16V
C903	5172336000	Ceramic 0.01μF 50V ±20%
C904	⚠5172977000	Elec. 2200μF 16V
C905, C906	⚠5172983000	Elec. 3300μF 25V
C907, C908	5173036000	Elec. 47μF 16V
C909, C910	5172336000	Ceramic 0.01μF 50V ±20%
C911, C912	⚠5172978000	Elec. 2200μF 25V
C913, C914	5172336000	Ceramic 0.01μF 50V ±20%
C915	5172959000	Elec. 470μF 6.3V
C916, C917	5173010000	Elec. 10μF 16V
C918~C920	⚠5263164100	Metalized 0.01μF 250V ±10%
C921	5172336000	Ceramic 0.01μF 50V ±20%
	CONNECTOR PLUGS	
P701~P704	5122131000	7P
P705	5122130000	6P
P706	5122148000	5P
P707	5122147000	4P
P708	5122149000	6P
P902	5122126000	2P

INPUT MODULE PCB ASSY

REF. NO.	PARTS NO.	DESCRIPTION
	5200076601	PCB Assy
	5210076601	PCB
	IC's	
U101~U103	5220415000	NJM072D
U104	5220016800	HD14049UBP
	TRANSISTORS	
Q101, Q102	5145102000	FET, 2SK-68AL
Q103	5230770400	2SC-1815BL
	CARBON RESISTORS	
	All Resistors are rated ±5% tolerance and ¼W.	
R101	5183058000	100Ω
R102	5183082000	1kΩ
R103	5183130000	100kΩ
R104, R105	5183092000	2.7kΩ
R106	5183066000	220Ω
R107	5183098000	4.7kΩ
R108, R109	⚠5183058000	100Ω
R110	5183130000	100kΩ
R111	5183154000	1MΩ
R112	5183058000	100Ω
R113	5183045000	30Ω
R115	5183122000	47kΩ
R116	5183138000	220kΩ
R117	5183098000	4.7kΩ
R118	5183122000	47kΩ
R119, R120	5183110000	15kΩ
R121, R122	5183106000	10kΩ
R123, R124	5183096000	3.9kΩ
R125, R126	5183106000	10kΩ
R127	5183138000	220kΩ
R128	5183106000	10kΩ
R129	5183110000	15kΩ
R130	5183138000	220kΩ
R131	5183130000	100kΩ
R132	5183100000	5.6kΩ
R133	5183106000	10kΩ
R134~R137	5183114000	22kΩ
R138	5183058000	100Ω
R139	5183130000	100kΩ
R140	5183108000	12kΩ
R141	5183122000	47kΩ
R142	5183130000	100kΩ
R143	5183154000	1MΩ
R144	5183070000	330Ω
R145, R146	5183130000	100kΩ
R147	5183098000	4.7kΩ
R148	5183138000	220kΩ
R149	5183130000	100kΩ
	CAPACITORS	
C101	5170401800	Mylar 0.001μF 100V ±5%
C102	5173010000	Elec. 10μF 16V
C103, C104	5173036000	Elec. 47μF 16V
C105	5170409800	Mylar 0.0022μF 100V ±5%
C106	5054745000	Dip. Mica 220pF 50V ±10%
C107	5173035000	Elec. 47μF 10V
C108, C109	5173018000	Elec. 22μF 16V
C110	5170409800	Mylar 0.0022μF 100V ±5%
C111	5263107610	Polyst. 820pF 100V ±5%
C112	5170439800	Mylar 0.039μF 100V ±5%
C113	5170429800	Mylar 0.015μF 100V ±5%
C114, C115	5173010000	Elec. 10μF 16V
C116	5173018000	Elec. 22μF 16V
C117	5173010000	Elec. 10μF 16V
C118, C119	5173018000	Elec. 22μF 16V
C120, C121	5172336000	Ceramic 0.01μF 50V ±20%
C122~C125	5173010000	Elec. 10μF 16V
	VARIABLE RESISTORS	
VR01	5282010701	Trimmer, Single; 10kΩ(C)
VR02, VR03	5283503201	Trimmer, Single; 2-shaft, 3-gang 10kΩ(C) x 2 10kΩ
VR04	6041208000	Trimmer, Single; 10kΩ(A) L=15
VR05	5282407501	Trimmer, Single; 1-shaft, 2-gang 5kΩ(A, C)
VR06	5283503601	Trimmer, Single; 2-shaft, 3-gang 5kΩ(A, C) 20kΩ(A)
	MISCELLANEOUS	
S101, S102	5132035000	Lever Switch, 2-3
P101	5122131000	Connector Plug 7P
P102	5122145000	Connector Plug 2P
P103	5122373000	Connector Socket 2P
D101	5225005400	LED, SLP-135B (RED)
W101~W117	5181763000	Jumper (17 used)
TP01	5544750000	Combination Pin (8 used)

DRIVE PCB ASSY

REF. NO.	PARTS NO.	DESCRIPTION
	5200079500	PCB Assy
	5210079500	PCB
	TRANSISTORS	
Q506	5042462000	2SD-235Y
Q507	5042546000	2SA-490Y
Q508	5042462000	2SD-235Y
Q509	5042546000	2SA-490Y
	DIODES	
D530~D535	5143089000	W03C
	CARBON RESISTORS	
	All Resistors are rated ±5% tolerance and ¼W.	
R574	5183070000	330Ω
R575	5240167000	330Ω(VF)
R576	5183034000	10Ω
	CAPACITORS	
C532	⚠5262001700	Elec. 10000μF 25V (LISN)
C533	⚠5172971000	Elec. 1000μF 25V
C534, C535	5054204000	Ceramic. 0.01μF 50V ±10%
	MISCELLANEOUS	
J501~J504	5181763000	Jumper (4 used)
	5033291000	Plate, Insulating
	5033295000	Tube, Insulating

PICH CON PCB ASSY

REF. NO.	PARTS NO.	DESCRIPTION
	5200077301	PCB Assy
	5210077300	PCB
		CARBON RESISTORS
		All Resistors are rated ±5% tolerance and ¼W.
R585	5183088000	1.8kΩ
R586	5183077000	620Ω
		VARIABLE RESISTORS
VR51	5150151000	Semi-fixed 1kΩ(B)
VR52	5282011401	Trimmer, Single 1.3kΩ(B)
		MISCELLANEOUS
P509	5122146000	Connector Plug; 3P

SENSER PCB ASSY

REF. NO.	PARTS NO.	DESCRIPTION
	5200077200	PCB Assy
	5210077201	PCB
U510	5228700200	IC TL170C
R584	5183098000	Carbon Resistor 4.7kΩ ½W ±5%

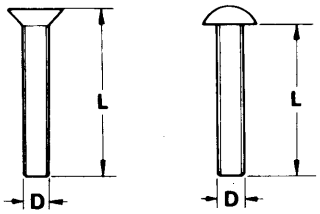
ASSEMBLING HARDWARE CODING LIST

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



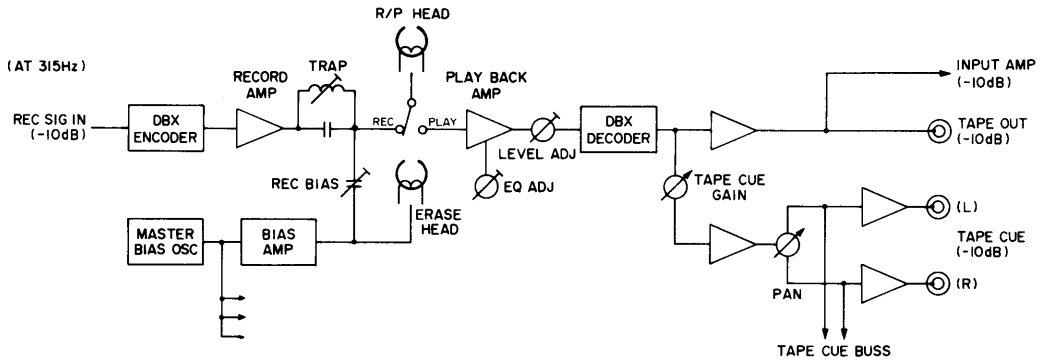
* Inner dia. for washers and nuts

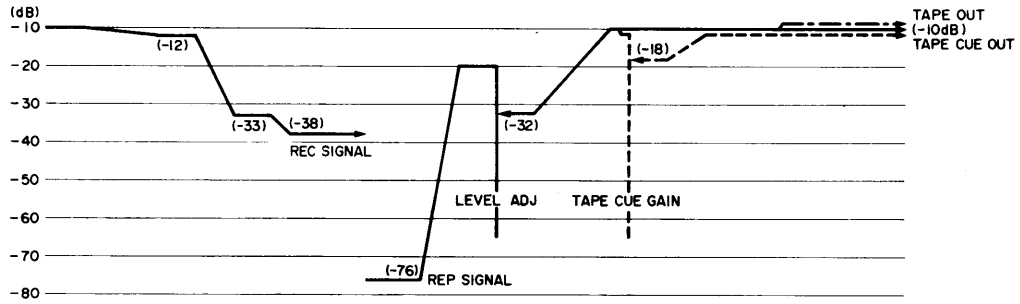
	Code	Name	Type
MACHINE SCREW	R	Round Head Screw	
	P	Pan Head Screw	
	T	Stove Head Screw (Truss)	
	B	Binding Head Screw	
	F	Flat Countersunk Head Screw	
	O	Oval Countersunk Head Screw	
WOOD SCREW	RW	Round Head Wood Screw	
TAPTITE SCREW	PTT	Pan Head Taptite Screw	
	WTT	Washer Head Taptite Screw	
SEMS SCREW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

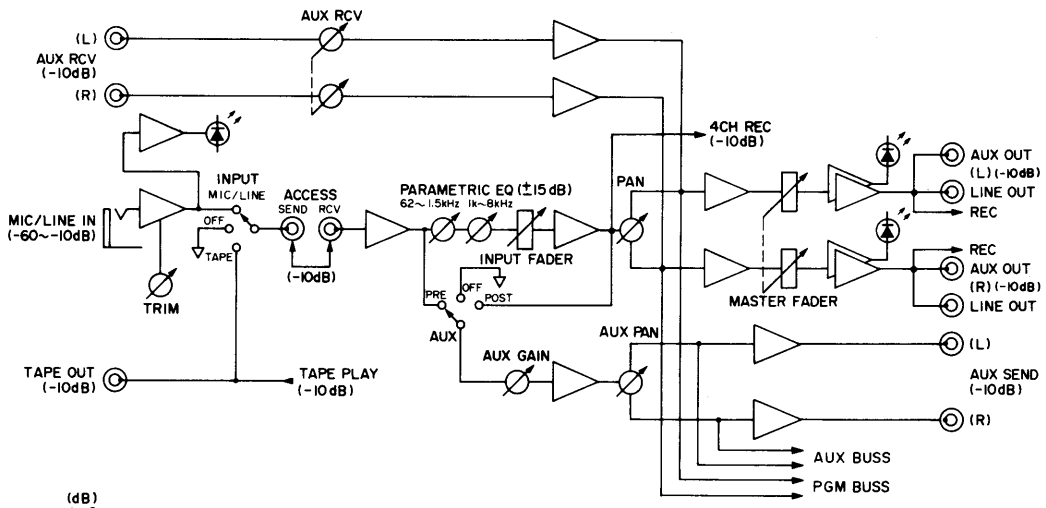
LEVEL DIAGRAM

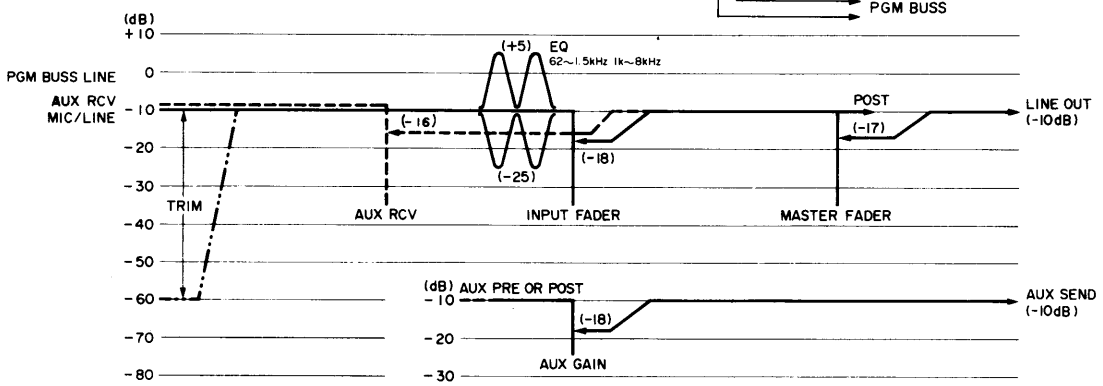
RECORD/PLAYBACK AMPLIFIER





MIXER





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