

Model **X-15**

Service Manual

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1. SPECIFICATIONS

MIC INPUT (x2)

Mic impedance	10k Ω or less
Input impedance	50K Ω
Nominal input level	-50dBV (3mV)
Minimum input level	-60dBV (1mV)
Maximum input level	-20dBV (0.1V)

LINE INPUT (x2)

Input impedance	20K Ω
Nominal input level	-20dBV (0.1V)
Minimum input level	-30dBV (30mV)
Maximum input level	+20dBV (10V)

LINE OUTPUT (Stereo)

Output load impedance	10K Ω or more (5K Ω minimum)
Nominal output level	-20dBV (0.1V)
Maximum output level	+10dBV (3V)

TAPE OUTPUT (x4)

Output load impedance	10K Ω or more (5K Ω minimum)
Nominal output level	-10dBV (0.3V)
Maximum output level	+10dBV (3V)

HEADPHONE OUTPUT (Stereo)

Load impedance	8 Ω ~ 40 Ω
Maximum output	100mW at 8 Ω ~ 40 Ω

EQUALIZER (x2)

Treble	Variable \pm 12dB at 10KHz
Bass	Variable \pm 12dB at 100Hz

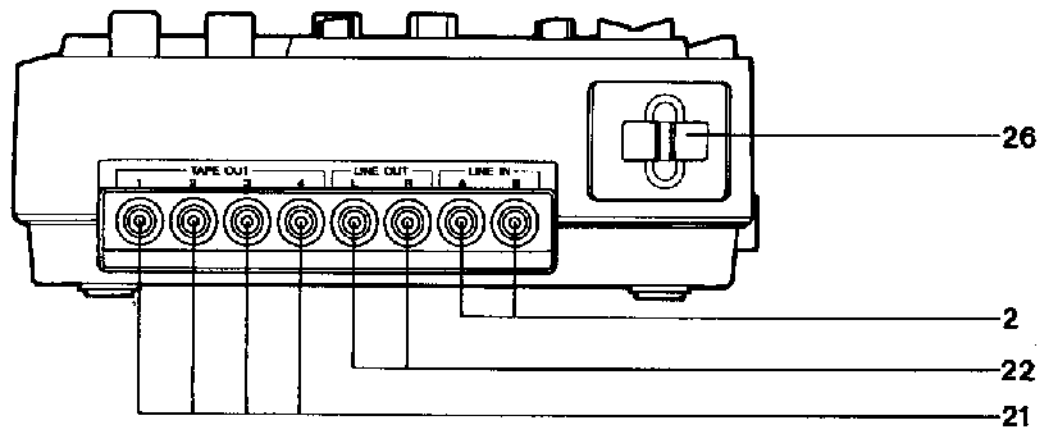
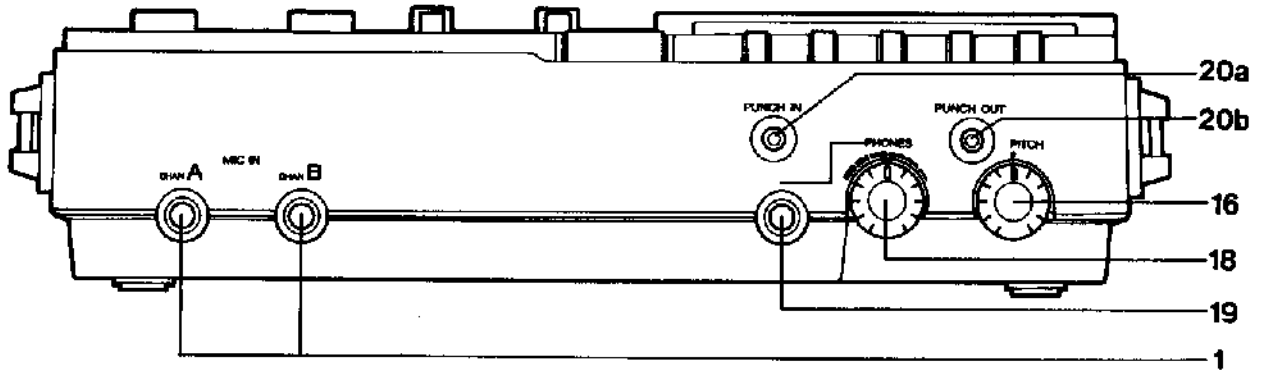
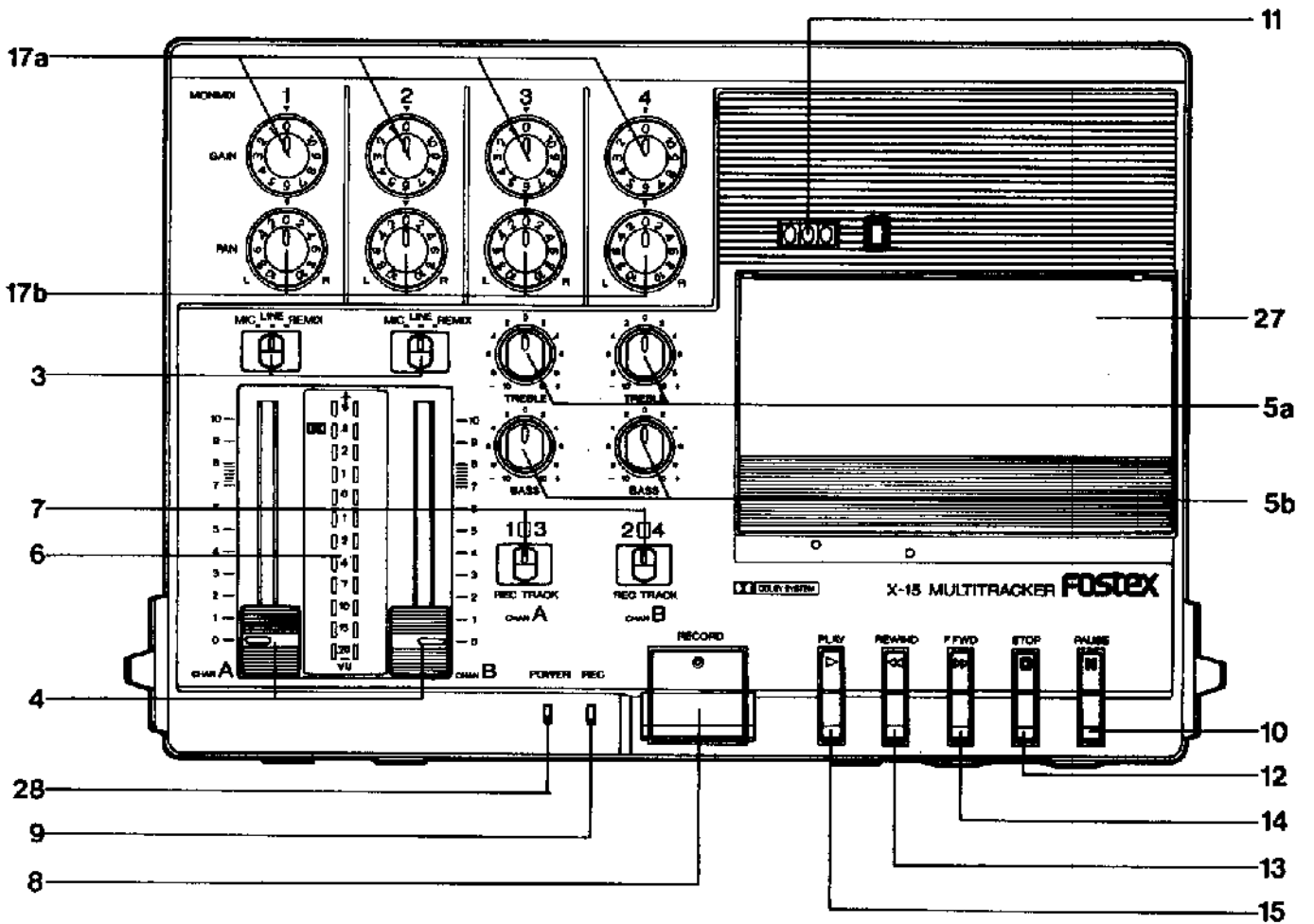
RECORDING TAPE

Compact cassette, C-60 or C-90, IEC Type II for use at high bias position (CrO₂) and 70 μ s EQ (TDK SA, Maxell XL-II or equivalent).

RECORD TRACK

4 track, one direction

RECORD CHANNEL	Two with Dolby NR type B in encode mode, switchable to the four record track.
PLAYBACK CHANNEL	Four with Dolby NR type B in decode mode.
TAPE SPEED	4.8 cm/s (1-7/8 ips) $\pm 1\%$
PITCH CONTROL	$\pm 15\%$ of normal tape speed
RECORDING TIME	30 minutes for C-60
HEAD	4 channel erase (Ferrite) 4 channel record/playback (Permalloy)
MOTOR	One DC governor motor
WOW AND FLUTTER	$\pm 0.10\%$ peak (IEC/ANSI weighted) measured with flutter test tape.
FAST WIND TIME	95 seconds for C-60
FREQUENCY RESPONSE (Overall)	40Hz \sim 12.5KHz ± 3 dB at -10VU
T.H.D. (Overall)	1.5% at 1 KHz, 0 VU level
S/N	60dB weighted, 50dB unweighted, referenced to 3% T.H.D. level (4dB above 0 VU at 315Hz)
CHANNEL SEPARATION	40dB at 1 KHz
ERASURE	70dB at 1 KHz
POWER REQUIREMENTS	11 \sim 15V, DC, 350mA maximum
DIMENSIONS	290(W) x 75(H) x 195(D) mm [11 $\frac{1}{2}$ (W) x 3(H) x 7-3/4(D) in.]
W/battery pack	290(W) x 75(H) x 230(D) mm [11 $\frac{1}{2}$ (W) x 3(H) x 9(D) in.]
WEIGHT	2.1 kg. (4.6 lbs.)
W/battery pack	2.9 kg. (6.4 lbs.)



2. FUNCTION CONTROLS

1. MIC IN jacks (two)
2. LINE IN jacks (two)
3. INPUT SELECTOR (two)
4. LEVEL CONTROL (two)
- 5a, 5b TONE CONTROLS (four)
6. LEVEL INDICATOR (two)
7. RECORD TRACK selector (two)
8. RECORD (●) button
9. RECORD LIGHT
10. PAUSE (■■) button
11. TAPE COUNTER
12. STOP (■) button
13. REWIND (◀◀) button
14. FAST FORWARD (▶▶) button
15. PLAY (▶) button
16. PITCH control knob
- 17a, 17b MONMIX section
18. HEADPHONE level control
19. PHONES (stereo jack)
- 20a, 20b REMOTE PUNCH IN/OUT
21. TAPE OUT jacks (four)
22. LINE OUT jacks (Left and Right)
23. DC power supply input jack for Fostex Model 8070 AC Adaptor.
24. DC power supply input jack for batteries
25. Battery case attachment screw
26. Shoulder belt sockets (two)
27. Cassette cover
28. Power indicator

3. ADJUSTING TOOLS AND EQUIPMENTS

The following tools and equipments are required for adjusting the Model X-15.

- | | |
|---|--|
| 1) Head height and tape contact adjusting jig | Fostex P/N 8286001000 |
| 2) Spring scale | 0 ~ 500gm (0 ~ 18 Oz.) |
| 3) Torque meter | |
| Cassette torque meter | 0 ~ 200gm-cm (0 ~ 2.8 Oz.-In.)
SONY TW-2231 |
| " " " | 0 ~ 100gm-cm (0 ~ 1.4 Oz.-In.)
SONY TW-2111 |
| 4) Mirror type cassette | Fostex P/N 8286002000 |
| 5) Test tapes | |
| Flutter/Speed (3KHz) | A-BEX TCC-111 |
| Reference level | A-BEX TCC-130 |
| Frequency response | A-BEX SCC-377 |
| 6) Blank tape | Maxell XL-II or TDK SA |
| 7) Audio oscillator | Output 1V rms, general type |
| 8) Frequency counter | Display of 4 digit or more, for counting signals up to 100KHz; sensitivity 0.1V rms. |
| 9) Bandpass filter | Used for erasure measurement; can be substituted by a frequency analyzer. |
| 10) AC voltmeter | Range: -60dB ~ +40dB,
Impedance: 1M Ω , <25pF. |
| 11) Oscilloscope | General type |
| 12) Wow & flutter meter | Meguro Denpa Sokki Co. (Japan),
Model MK-668C or equivalent. |
| 13) Distortion meter | Hewlett Packard, Model 339A or equivalent. |

4. DISMOUNTING OF MAJOR COMPONENTS AND ASS'Y

Removing the top and bottom covers

A total of 16 knobs on the front panel must be removed - two on the input fader, two on the selector switch, and 12 on the various rotary pots.

Referring to Fig. 1, both the top and bottom covers can be removed by unscrewing the five screws on the bottom cover side.

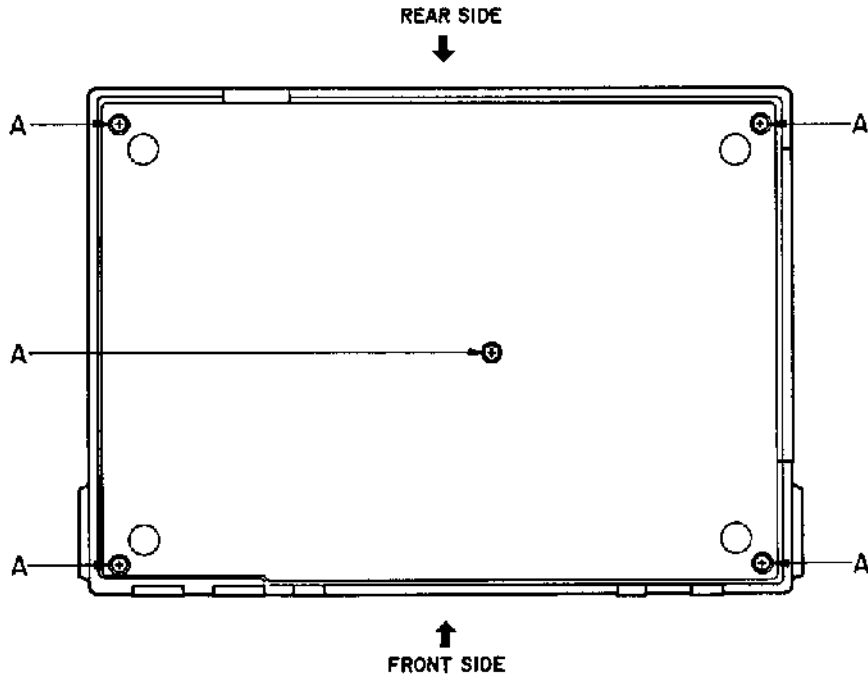


Fig. 1

Removing the OSC/PHONE PCB assembly

Referring to Fig. 2, the PCB assembly can be taken out by bending the two hooks (A) in direction of the arrows.

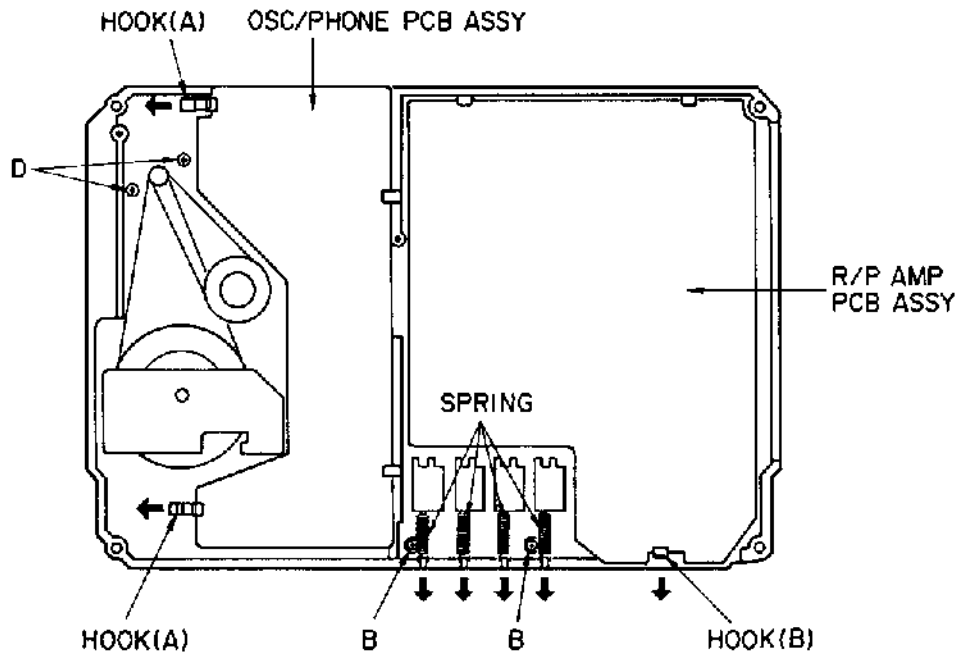


Fig. 2

Removing the R/P AMPLIFIER PCB assembly

Referring again to Fig. 2, bend hook (B) in direction of arrow and the PCB assembly can be taken out.

Removing the MIC AMPLIFIER PCB assembly

Referring to Fig. 3, bend hook (C) in direction of arrow and the PCB assembly can be taken out.

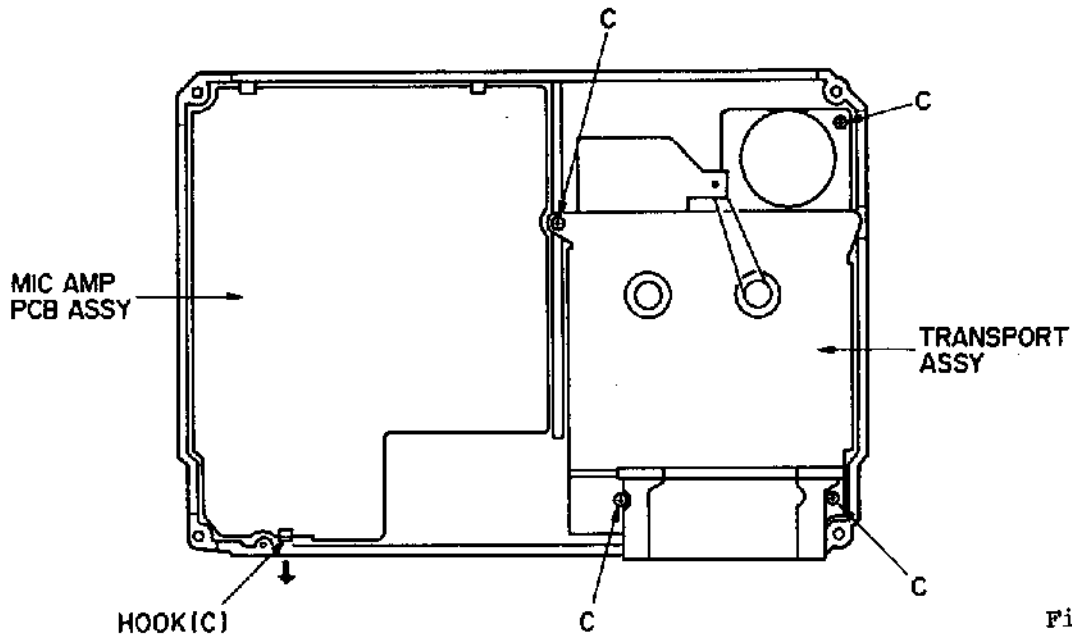


Fig. 3

Removing the Transport Assembly

Referring to Fig. 2, remove the four coiled springs and two screws (B). Then, referring to Fig. 3, unscrew the four screws (C) and the transport can be lifted out.

Replacing the reel and capstan belts

The reel and capstan belts cannot be replaced by only removing the top and bottom covers but the transport must be lifted out of its frame, as explained above.

Referring to the Transport Exploded View, take off the Bracket (Ref. No. 56) by removing three screws, then replace the capstan belt.

The reel drive belts are replaced in the same way.

Capstan motor replacement

The capstan motor can be replaced by removing two screws D, shown in Fig. 2.

Head replacement

Take off the head top cover and remove the two screws securing the R/P head. The Erase head is removed in the same way. Install the new heads in reverse order.

Pinch roller assembly replacement

Take off top cover, remove spring (Ref. No. 13) and the "E" ring (ER 2.5) securing the pinch roller assembly. After installing the new pinch roller assembly, assemble in reverse order.

Positioning of internal cables

When the PCB assemblies and the transport is taken out of its housing, care should be taken to position the internal cables used between jacks and connectors in their former routes as they may touch the mechanism and switches to cause malfunction.

Special care should be taken on cables between the R/P head PCB and J401; between the ER head PCB and J402; and cables running near S101 ~ S401.

- 1) Cables between the R/P head PCB, ER head PCB and J401, J402

Referring to Fig. 4, route the cables in their original positions.

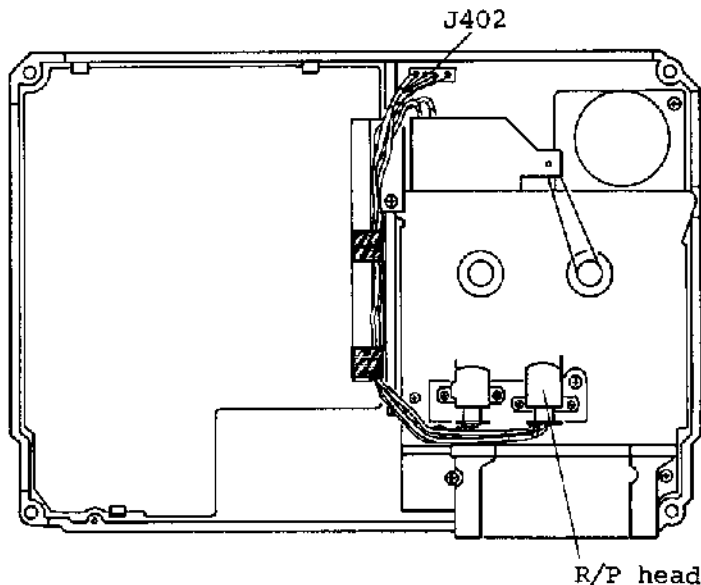


Fig. 4

2) Cables running near S101 ~ S401

Route the cables in their original positions by referring to Fig. 5.

Be certain that the cables do not push up the S101 ~ S401 switches

by the bottom cover ribs when the cover is secured by the bottom screws.

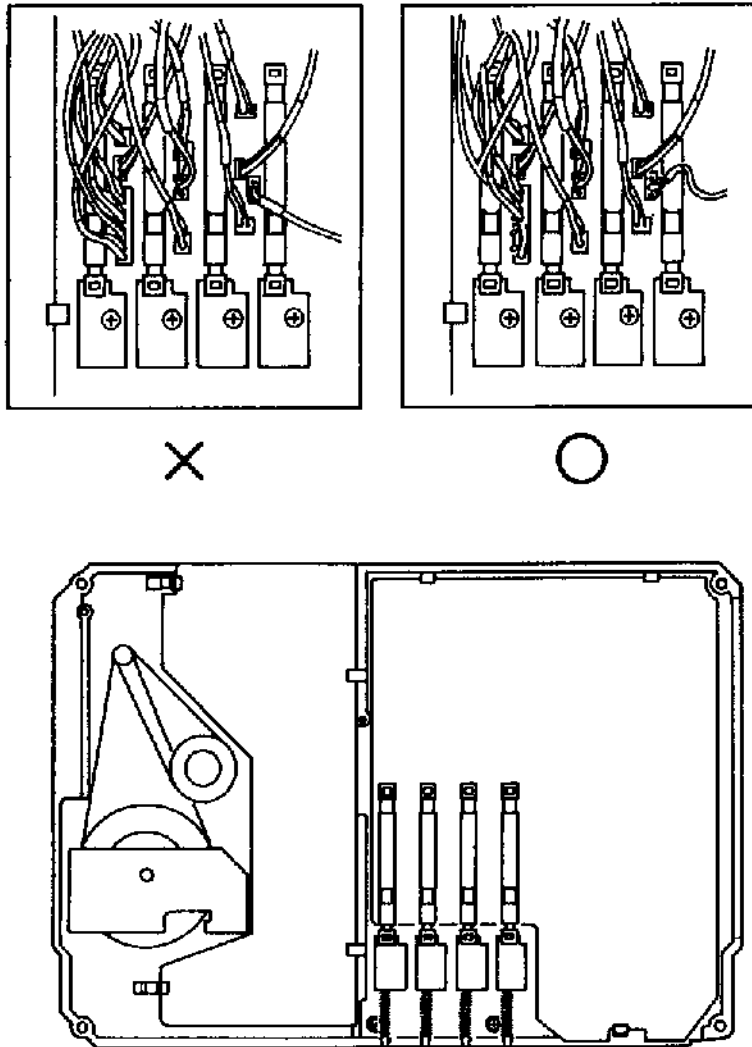


Fig. 5

5. IC CIRCUIT OPERATION

Amplifier (A) is an equalizer with a time constant of $3180 \sim 70\mu\text{s}$ and amplifier (I) is for recording.

(1) Recording (SW \rightarrow R)

The LINE signal enters amplifier (B) via the Low Pass Filter (LPF). This filter attenuates to below -45 VU all unwanted frequencies and the bias signal.

The output of amplifier (B) is split into two - one fed to the summing amplifier (E) and the other directly to pin 13.

The signal entering the summing amplifier (E) is added to the side chain signal and fed to amplifier (I) whose output goes to pin 14.

In the side chain, (F) presents high resistance to low level signals and the side chain response is determined by the filter (C1, C2, R1, R2) constant.

The signal passing through this filter is then amplified by (C), passes through (H) and applied to the summing amplifier (E). When an input signal of sufficiently low level (Dolby level -40dB or less) is applied, the output signal will be amplified by 10dB for a 5KHz signal.

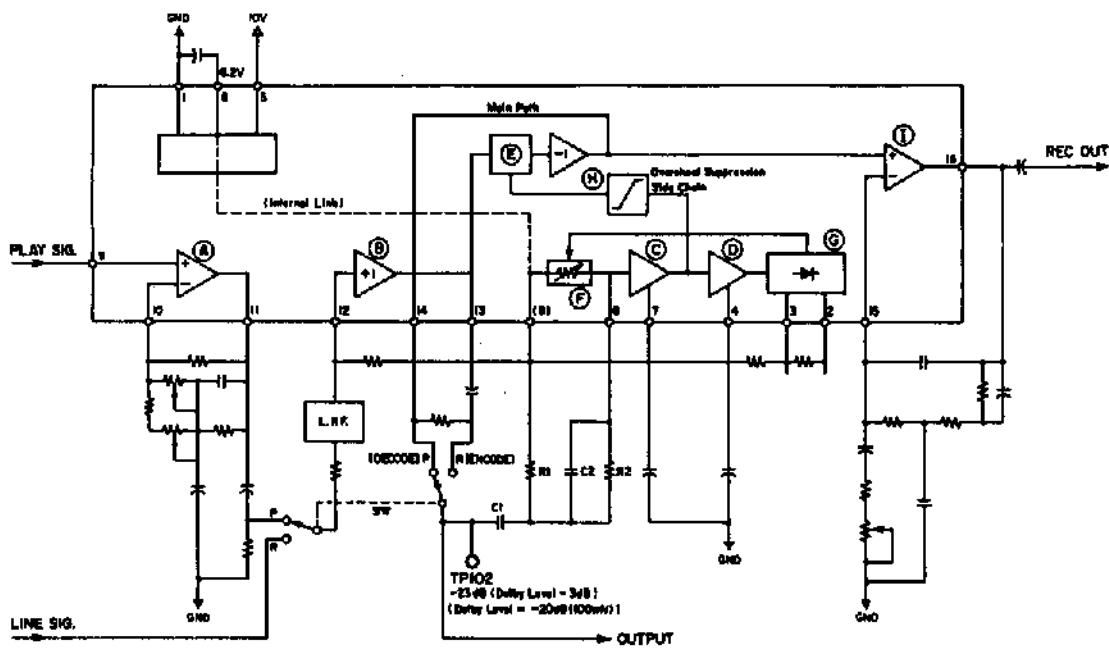
When the input signal level becomes large, the resistance of (F) will decrease and the low and mid region signals in the side chain will decrease. Thus, when the side chain signal level decreases, the proportionate drop in the summing amplifier (E) output will have less affect on the main path signal.

When the input signal rises above the Dolby level, the signal in the side chain drops to an extremely low level, and even though this is added to the main path signal, it will have only a small affect.

(2) Playback (SW \rightarrow P)

In this mode, the side chain comprises one portion of the negative feedback loop in which a negative signal is applied to the summing amplifier (E) and as a result, the summing amplifier (E) acts as a subtractor.

Therefore, in the playback mode, the response will be complementary to that for recording.



NOTE: Circuit explanation is by Dolby License Information, Vol. 1.

6. ROUTINE MAINTENANCE

Cleaning

1) 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 dropout (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.

2) 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 fluids prescribed or recommended for tape recorders and especially the heads. Never use lacquer thinners, acetone or other organic solvents.

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 winding such as when testing head continuity with a circuit tester.

Should the head become magnetized, demagnetize it with a head eraser designed for this purpose.

Demagnetizing procedure

- 1) After turning off power to the Model X-15, open the cassette door and if a cassette is loaded, remove it and place it far away from the deck.
- 2) Switch on the head eraser while holding it about one meter away from the Model X-15, 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 demagnetizing 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.

7. ADJUSTING THE REC SELECTOR

- 1) In the STOP mode, loosen screw (1) and without removing the screwdriver from the screw head, use it to shift the slider in direction of arrow, then tighten screw (1).

NOTE: When the screw is tightened, be sure the protrusion on hook (2) is centered in the square hole at end of the slide switch (5) [Refer to Fig. 2].

- 2) Push hook (2) with your finger to see that it slides easily with a light pressure.

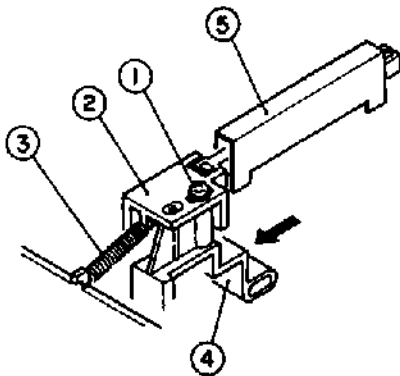


Fig. 1 Caution: Drawing shows only one unit (switch).



Fig. 2 Slide action of the switch will be sluggish if the hook protrusion is not centered but touching the side of the square hole.

- 3) Set the selector slider (7) to the track to be adjusted, load a cassette, with the record protect tab intact, in the transport and depress the REC lever (6).

NOTE: (A) If the REC lever (6) does not lock in the depressed position, check to see that the selector slider (7) is not set halfway to position intended.

(B) If the selector slider (7) cannot be moved to the proper position, the REC spring (leaf spring) is hitting the arm select and therefore, screw (1) on top of hook (2) [Fig. 1] must be loosened and the slider assembly moved slightly (about 0.5mm) in opposite direction of arrow.

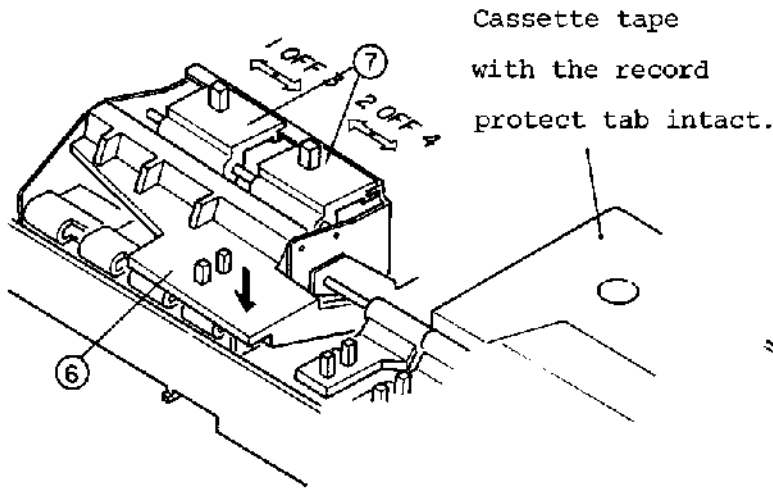


Fig. 3

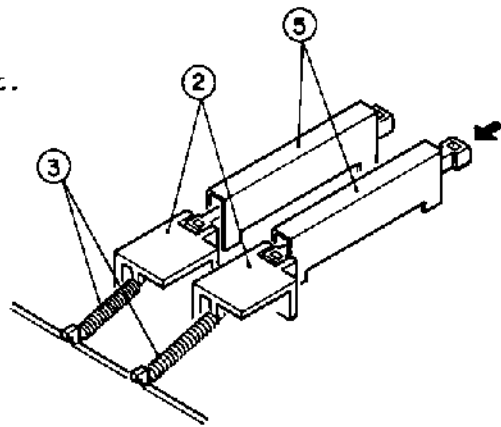
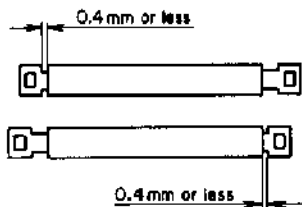


Fig. 4

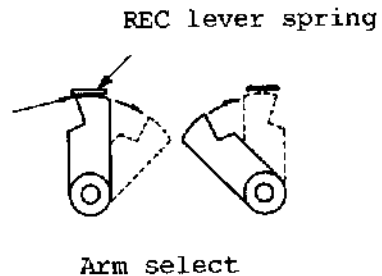
- 4) When the REC lever (6) is depressed as mentioned in above Item 3), hook (2) pushes slide switch (5). In this state, push the slide switch with your finger in direction of the arrow [Fig. 4] and check to see that it will move in but positively return to its original position (this is to check for positive action of the switch).
- 5) Depress the STOP button and check that the slide switch returns to its original position.
- 6) Next, set the selector slider (7) to the OFF position, then depress REC button (6) again to check that slide switch (5) is not actuated. If it is actuated, this means that the arm select cannot return to its original position because it is touching the REC lever spring(leaf spring), and this should be corrected in the same way as explained in NOTE (2), Item 3) [Also refer to Fig. 6]. As this part is inside the REC selector, this cannot be checked during routine adjusting.

NOTE: The slide switch gap at adjusting should be as shown in Fig. 5.



There should be no gap but if it is difficult to do so, this must be less than 0.4mm.

Fig. 5



Arm select cannot return because it is touching the spring.

Fig. 6

- 7) At completion of adjusting, apply Screwloc to screw (1).
- 8) These adjusting procedures should be made on all tracks from 1 to 4.

Apply SCREWLOC.

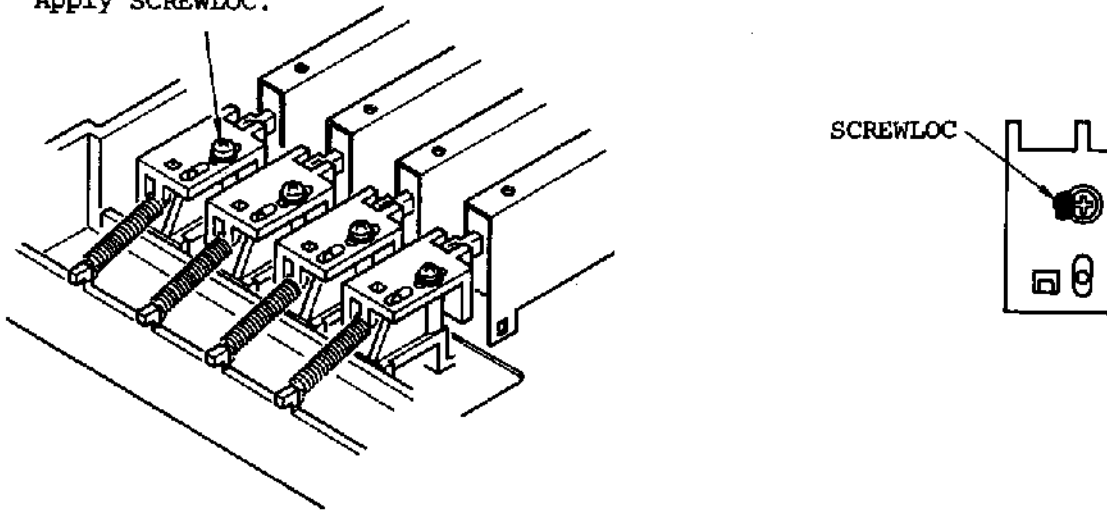


Fig. 7

8. CHECKING AND ADJUSTING OF TRANSPORT AND RECORD/PLAYBACK AMPLIFIER

8-1 TAPE TRAVEL CHECK AND ADJUSTMENT

- (1) Using the mirror type cassette, check to see that tape is running stable between the erase and rec/play tape guides without weaving.
- (2) If tape is not running stable between the guides, frequency response will be affected or the tape will be damaged by curling. It then becomes necessary to check the head guide height, perpendicularity or the head face, and alignment of the pinch roller in relation to the capstan. In addition to the mirror type cassette, the Head Height and Tape Contact Adjusting Jig is required.

To check the head guide height, the cassette tape is removed and the above jig is placed on the head mount base plate.

- (3) While firmly seating the jig on the base plate surface, slide the jig past each head guide to see that it goes through without hitting them. Also check perpendicularity of each head face, using the rear check bar of the jig. If the guide is low, insert the required amount of 0.1 or 0.2mm thick washers under the head mounting legs, or vice versa, if it is high.

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

8-2 CHECK AND ADJUSTING OF HEAD AZIMUTH AND PHASE

- (1) Playback the A-BEX SCC-377 test tape.
- (2) Connect a level meter to TAPE OUT 1, roughly adjust azimuth by the 400Hz signal, then accurately adjust by the 10KHz signal.
- (3) At the same time, check phase between TAPE OUT 1 and TAPE OUT 4 (or TAPE OUT 2 and TAPE OUT 3).

The two outputs are respectively applied to the vertical and horizontal inputs of an oscilloscope and the head adjusted so that the Lissajous pattern is less than 90° at 6.3 KHz.



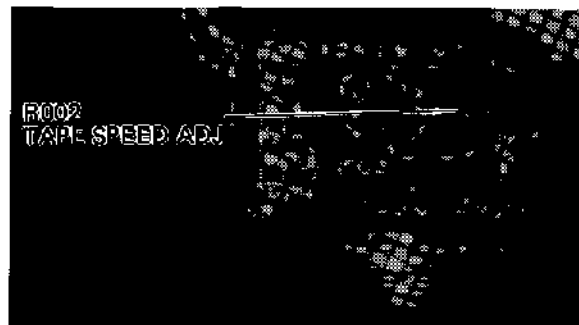
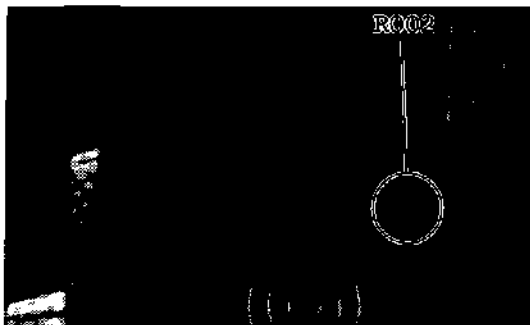
The R/P head and ER head azimuths can be adjusted without removing the top cover. A small Phillips head screwdriver is inserted through these holes for adjusting.

8-3 TAPE SPEED ADJUSTMENT

- (1) Playback the A-BEX TCC-111 flutter/speed test tape with the PITCH CONTROL knob at "0" (center).
- (2) TAPE OUT 1 signal is applied to a counter or wow/flutter meter having a counter.

Tape speed is within tolerance if the count is 2955Hz \sim 3045Hz when the test tape 3,000Hz is reproduced.

- (3) If it is not within tolerance, adjust the SPEED ADJ, R002 (5K Ω , B) pot



with a flat blade screwdriver through the bottom cover hole located near the PITCH CONTROL.

8-4 CHECK OF WOW AND FLUTTER

- (1) Under the same test connection as in Item 8-3 , connect TAPE OUT 2 or 3 to a wow and flutter meter.
- (2) When measured under ANSI (IEC) peak value, it is within tolerance if the measured value is less than $\pm 0.12\%$ peak (weighted).

8-5 PLAYBACK ALIGNMENT

- (1) Set the RECORD TRACK selector A and B to the center OFF (safe) position.
- (2) Playback the A-BEX TCC-130 Reference Level tape.
- (3) Connect a level meter to the TP 102 test point for track 1 on the R/P PCB assembly.
Then, adjust R104 (DOLBY LEVEL, $1K\Omega$, B) so that the TP 102 level is 100mV.
- (4) Re-connect the level meter to TP 103.
- (5) Playback the A-BEX SCC-377 Frequency Response tape.
- (6) Adjust the EQ pot R103 ($50K\Omega$, B) for track 1 on the R/P PCB assembly so that playback frequency responses for 63Hz, 400Hz, 6.3KHz and 10KHz are each within ± 2 dB.
- (7) Remaining tracks 2, 3, and 4 are also adjusted by the same procedures and their test point reference numbers are:

Track 2 TP 202 and TP 203

Track 3 TP 302 and TP 303

Track 4 TP 402 and TP 403

Reference numbers for trim pots to be adjusted by the same procedures are:

Track 2 R 204 and R 203

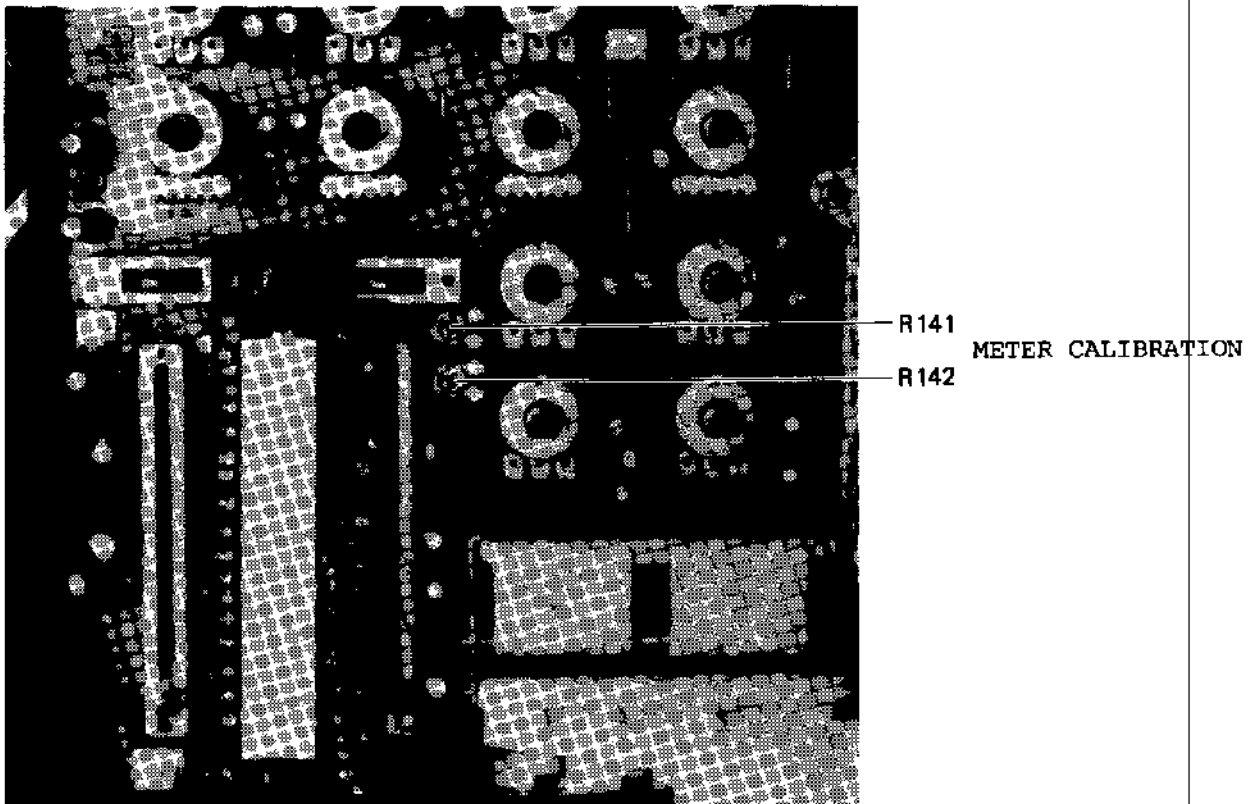
Track 3 R 304 and R 303

Track 4 R 404 and R 403

8-6 METER CALIBRATION

- (1) Apply a 400Hz, -20dBV (0.1V) signal to LINE IN A jack and set INPUT selector A to LINE position.

- (2) Set RECORD TRACK selector A to TRACK 1 and the TREBLE and BASS control knobs to the 12 o'clock center position, or in other words, the flat response position.
- (3) Load a blank cassette tape, depress the PAUSE button and then depress the RECORD button to put the recorder in the record mode.
- (4) Connect a level meter to TAPE OUT 1 .
- (5) Adjust the INPUT A fader for a -10dBV (0.3V) reading on the level meter. The knob setting should be about 7 and 8 on the scale.
- (6) Then, if the LED bar graph meter for INPUT A indicates 0VU, the meter can said to be accurately calibrated.
If it does not indicate 0VU, adjust METER CAL R141 ($50\text{K}\Omega$, B) on the MIC AMP PCB assembly.
- (7) To calibrate the INPUT B LED bar graph meter, apply the test signal to the LINE IN B jack and after setting the TAPE OUT 2 output level by the INPUT B fader, adjust the R241 METER CAL trim pot ($50\text{K}\Omega$, B).
The TREBLE and BASS controls for INPUT B are set to the flat response positions.



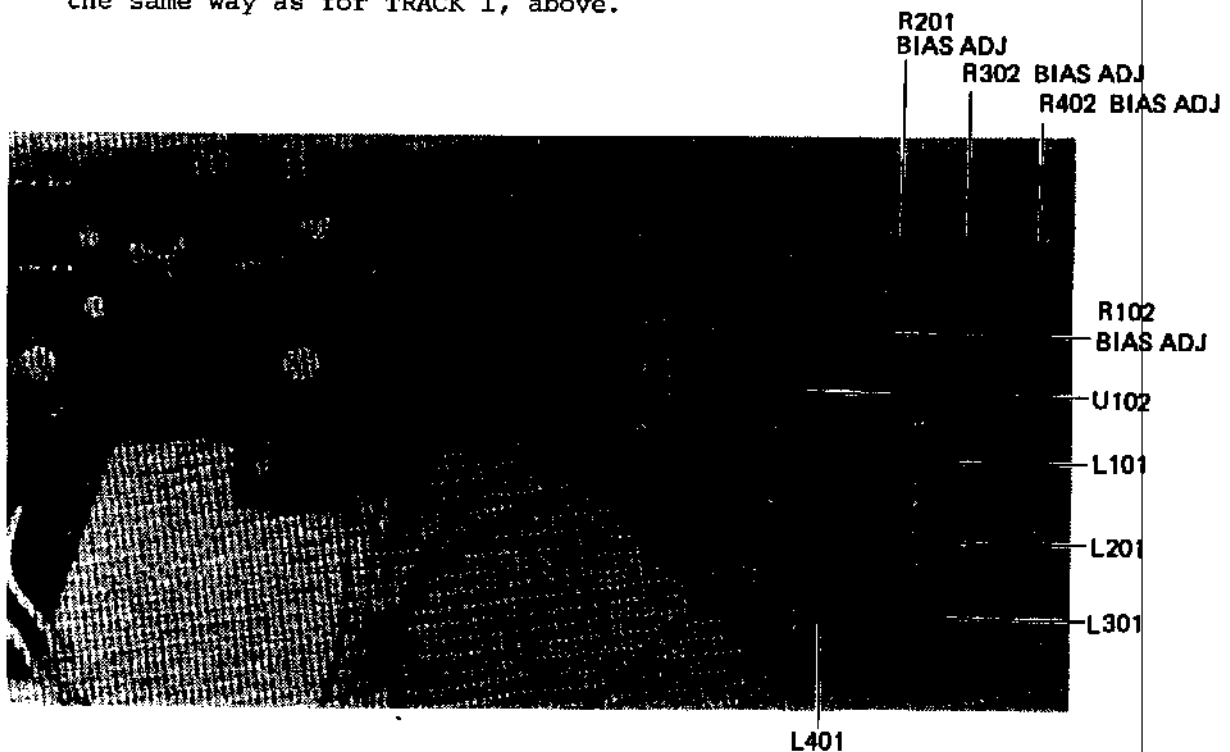
MIC AMP ASS'Y

8-7 ERASE CURRENT ADJUSTMENT

- (1) Set RECORD TRACK selector to TRACK 1.
- (2) Load a blank cassette tape.
- (3) After depressing the PAUSE button, depress the RECORD button.
- (4) Connect a level meter to TP 11 on the OSC/PHONE PCB assembly and adjust the ERASE CUR pot L101 on this PCB with a non-ferrous core adjuster so that the meter indicates 32mV.
- (5) The test point and core for TRACK 2 are TP12 and L201; TP13 and L301 for TRACK 3; and TP14 and L401 for TRACK 4.

8-8 BIAS CURRENT ADJUSTMENT

- (1) Set the RECORD TRACK selector A to TRACK 1.
- (2) Load a blank cassette tape.
- (3) After depressing the PAUSE button, depress the RECORD button.
- (4) Connect a level meter to TP 1 on the OSC/PHONE PCB assembly and adjust the BIAS ADJ pot R102 (200K Ω , B) so that the level meter indicates 50mV.
- (5) The test point and BIAS ADJ pot for TRACK 2 are TP 2 and R202; TP 3 and R302 for TRACK 3; and TP 4 and R402 for TRACK 4. These are adjusted in the same way as for TRACK 1, above.



OSC/PHONE PCB ASS'Y

8-9 BIAS TRAP ADJUSTMENT (Record amplifier)

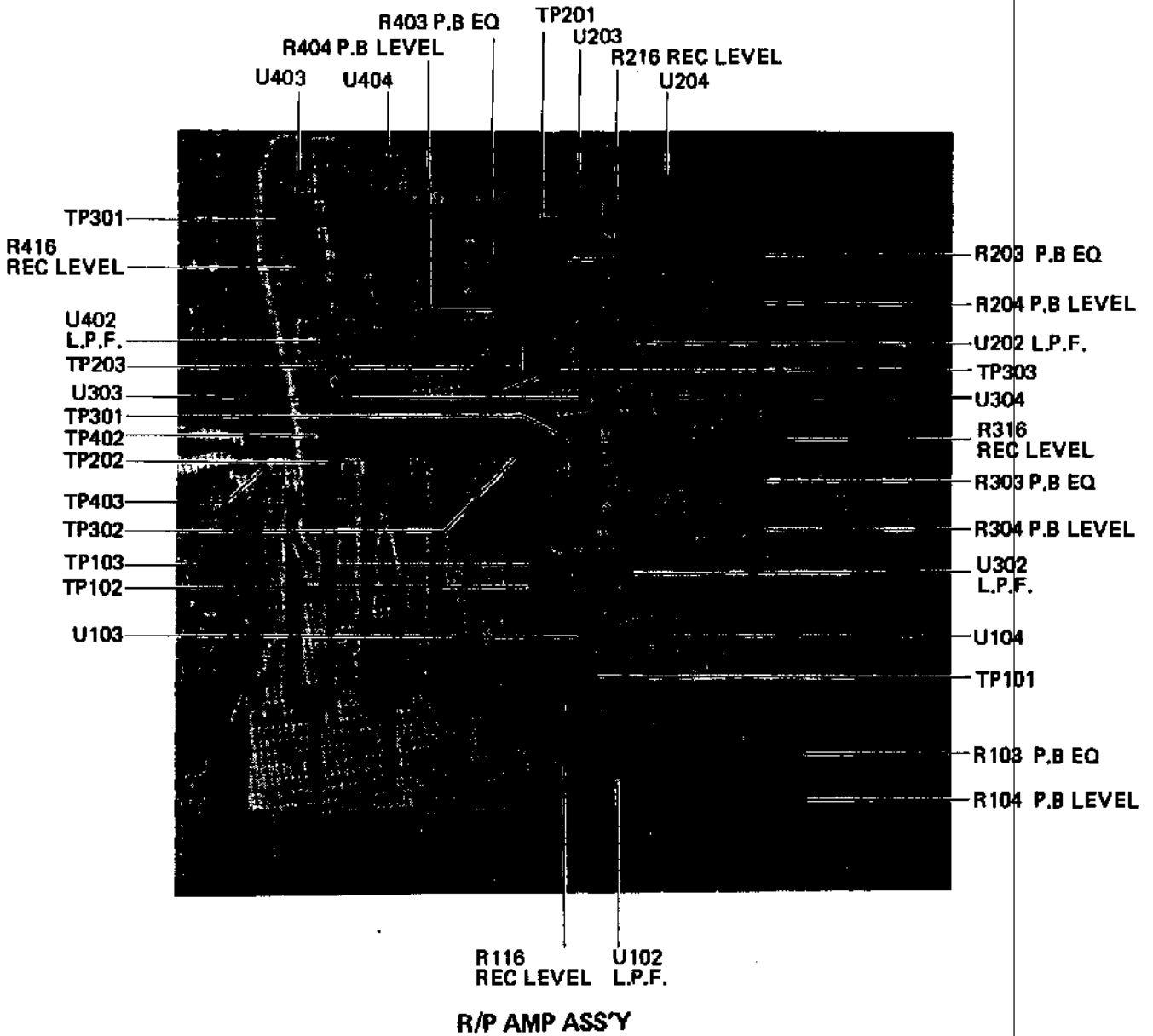
- (1) Set RECORD TRACK selector A to TRACK 1.
- (2) Load a blank cassette tape.
- (3) After depressing the PAUSE button, depress the RECORD button.
- (4) Connect a level meter to test point TP 101 on the R/P PCB assembly and if the bias leakage is $-10\text{dBV}(300\text{mV})$, it is the normal value.
Should adjustment be required, the U103 core is trimmed with a non-ferrous core adjuster for minimum bias leakage while monitoring the level meter or oscilloscope.
- (5) The test point and core for TRACK 2 are TP 201 and U203; TP 301 and U303 for TRACK 3; TP 401 and U403 for TRACK 4; and the adjusting procedures are the same as for TRACK 1.

8-10 BIAS TRAP ADJUSTMENT (Playback amplifier)

- (1) Set RECORD TRACK selector B to TRACK 2 and RECORD TRACK selector A to the center OFF position.
- (2) Load a blank cassette tape.
- (3) After depressing the PAUSE button, depress the RECORD button.
- (4) Connect a level meter to the lead wire of R102 located near pin 11 of U101 on the R/P PCB assembly and if bias leakage is $0\text{dBV}(1\text{V})$ or less, it is normal.
If adjusting is necessary, the U104 core is trimmed with a non-ferrous core adjuster for minimum bias leakage while monitoring the level meter or oscilloscope.
- (5) The test point for TRACK 2 is the lead wire of R202 and the core to be adjusted is for U204. During this adjustment, RECORD TRACK selector A is set to TRACK 3 and this track put in the RECORD mode.
The test point for TRACK 3 is the lead wire of R302 and the core to be adjusted is for U304. For this adjustment, set the RECORD TRACK selector B to TRACK 2 and put this track in the RECORD mode.
The test point for TRACK 4 is R402 and the U304 core is adjusted. During this adjustment, set the RECORD TRACK selector B to TRACK 3 and put this track in the RECORD mode.

8-11 RECORD LEVEL ADJUSTMENT

- (1) Proceed to the following adjustments only after completing adjustments in Item 8-8.
- (2) Apply a reference level signal of 400Hz, -20dBV (0.1V) to the LINE IN A jack; set the TREBLE and BASS controls to the FLAT position.
- (3) Adjust the fader for INPUT A to obtain a 0VU indication on the INPUT A LED meter.
- (4) Load a blank cassette in the recorder and set RECORD TRACK selector A to TRACK 1.



(5) Depress the RECORD button to put in the RECORD mode. At start of recording, reset the tape counter to "000" and the tape can conveniently be rewound to the start of recording.

(6) Connect a level meter to the TAPE OUT 1 jack and playback the recorded 400Hz signal. It is in normal condition if the TAPE OUT 1 output level is $-10\text{dBV} \pm 1\text{dB}$.

If this level is not within the above spec, adjust the recording level by the R116, REC LEVEL $5\text{K}\Omega$ (B) pot on the R/P PCB assembly.

(7) The remaining tracks 2, 3 and 4 are adjusted in the same way as for TRACK 1, above.

Reference numbers of the REC LEVEL pots on the R/P PCB assembly are R216, R316 and R416, respectively, for tracks 2, 3 and 4.

8-12 OVERALL FREQUENCY RESPONSE ADJUSTMENT

(1) The following adjustments are to be undertaken only after completing record level adjustments.

(2) The INPUT fader and TREBLE, BASS controls are kept at the same setting as for the previous record level adjustments.

(3) Apply a -40dBV , $40\text{Hz} \sim 12\text{KHz}$ signal to the LINE IN A jack. (Record level: -20VU)

(4) Load a blank cassette on the recorder and select TRACK 1 on the RECORD TRACK selector A.

(5) Depress the RECORD button and record the $40\text{Hz} \sim 12\text{KHz}$ signal.

The start of recording can conveniently be located if the tape counter is reset to "000" at start of recording.

(6) Connect a level meter to the TAPE OUT 1 jack and playback the $40\text{Hz} \sim 12\text{KHz}$ signal. It is in normal condition if the level is within $\pm 3\text{dB}$ throughout the above frequency range.

If the upper region of the frequency response is lower than -3dB , adjust R102 BIAS ADJ, $200\text{K}\Omega$, (B) pot on the OSC/PHONE PCB assembly. Looking at the PCB from the component side, slightly rotate R102 in the CCW direction and re-check the overall frequency response.

If the aforementioned upper region is higher than $+3\text{dB}$, R102 is trimmed in the reverse direction (CW) and the overall frequency response checked again.

- (7) Check the remaining tracks 2, 3 and 4 in the same way and if necessary, adjust R202, R302 and R402, respectively, for tracks 2, 3 and 4.

8-13 OVERALL S/N MEASUREMENT

- (1) After finishing checks and adjustments up to Item 8-12, apply a reference level of 400Hz, -20dBV (0.1V) to the LINE IN A jack and record the signal on a blank tape.
- (2) While still in the above recording mode, disconnect the oscillator plug from the LINE IN A jack and record a length of no-signal tape.
- (3) Rewind the recording thus made, connect a level meter to TAPE OUT 1, playback the recording and measure the difference between the no-signal section and the reference level, or in other words, the ratio between noise level, add 4dB to this value to obtain the ratio between peak recording level (400Hz, 250nWb/m) and noise level.

Specification 60dB, weighted; 50dB, unweighted.

- (4) The remaining tracks are measured in the same way.

8-14 T.H.D. MEASUREMENT

- (1) Apply 400Hz, -20dBV (0.1V) to the LINE IN A jack and record, rewind tape, play it back, and connect a distortion meter to TAPE OUT 1.

Specification 1.5% or less

- (2) If it is not within spec, demagnetize the head, check bias trap adjustment, check record level and adjust bias current in accordance with 8-8 ~ 8-11.
- (3) Measure the remaining tracks in the same way.

8-15 ERASURE MEASUREMENT

- (1) Apply a -6dBV (0.5V), 1KHz signal, which is 4dB higher than the reference level, to the LINE IN A jack and record on tape.
- (2) Rewind tape to beginning of recording, advance tape a short length and record a no-signal section on the remaining part of tape.
- (3) Rewind tape to the beginning again and playback tape.
- (4) Connect the input terminal of a 1KHz bandpass filter to the TAPE OUT 1 jack and the output terminal of the filter to a level meter.

- (5) Level ratio between the 1KHz signal and the no-signal section thus is "Erasure."

Specification 70dB or more

- (6) If it is not within spec, adjustment is made by the procedure in 8-7. Adjust the L101 core so that the erase current reaches maximum value.
- (7) Adjust the remaining tracks in the same way.

8-16 SYNC CROSSTALK MEASUREMENT

- (1) Sync crosstalk is the comparison figure between the standard reference level of the recording signal leaking from the track in the recording mode to the playback track.

If there is an excess of sync crosstalk, the tape playback output during overdubbing will become indistinct due to crosstalk by the signal being recorded, or cause oscillation at ping-pong recording whereby the playback signal is transferred to another track.

Sync crosstalk cannot be improved by routine adjustments as it roughly depends on the head characteristic but to take full advantage of the Units' capabilities, it becomes important to know in advance what the margin is before oscillation will occur during ping-pong recording. It is also necessary to measure sync crosstalk whenever the head is replaced.

Specification 5dB or more (20Hz ~ 20,000Hz) with only one adjacent track in record mode.

When measuring Track 1, Track 2 is put in the record mode.

Apply a -20dBV (0.1V) signal to the LINE IN B jack. Connect a level meter to TAPE OUT 1 which corresponds to TRACK 1, change the LINE IN signal frequency from 20Hz through 20,000Hz, and obtain the difference between the reference level of -10dB (0.3V).

- (2) As the X-15 can simultaneously record only two tracks in any combination, put track 3 in the record mode when measuring track 2, track 4 in the record mode when measuring track 3, and track 3 in the record mode when measuring track 4.

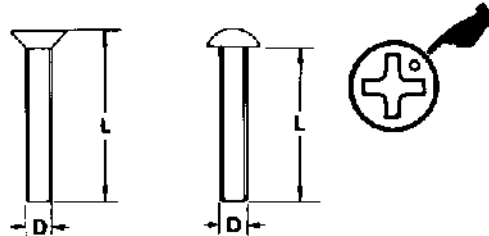
9. EXPLODED VIEW, PCB ASSEMBLIES AND PARTS LIST

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

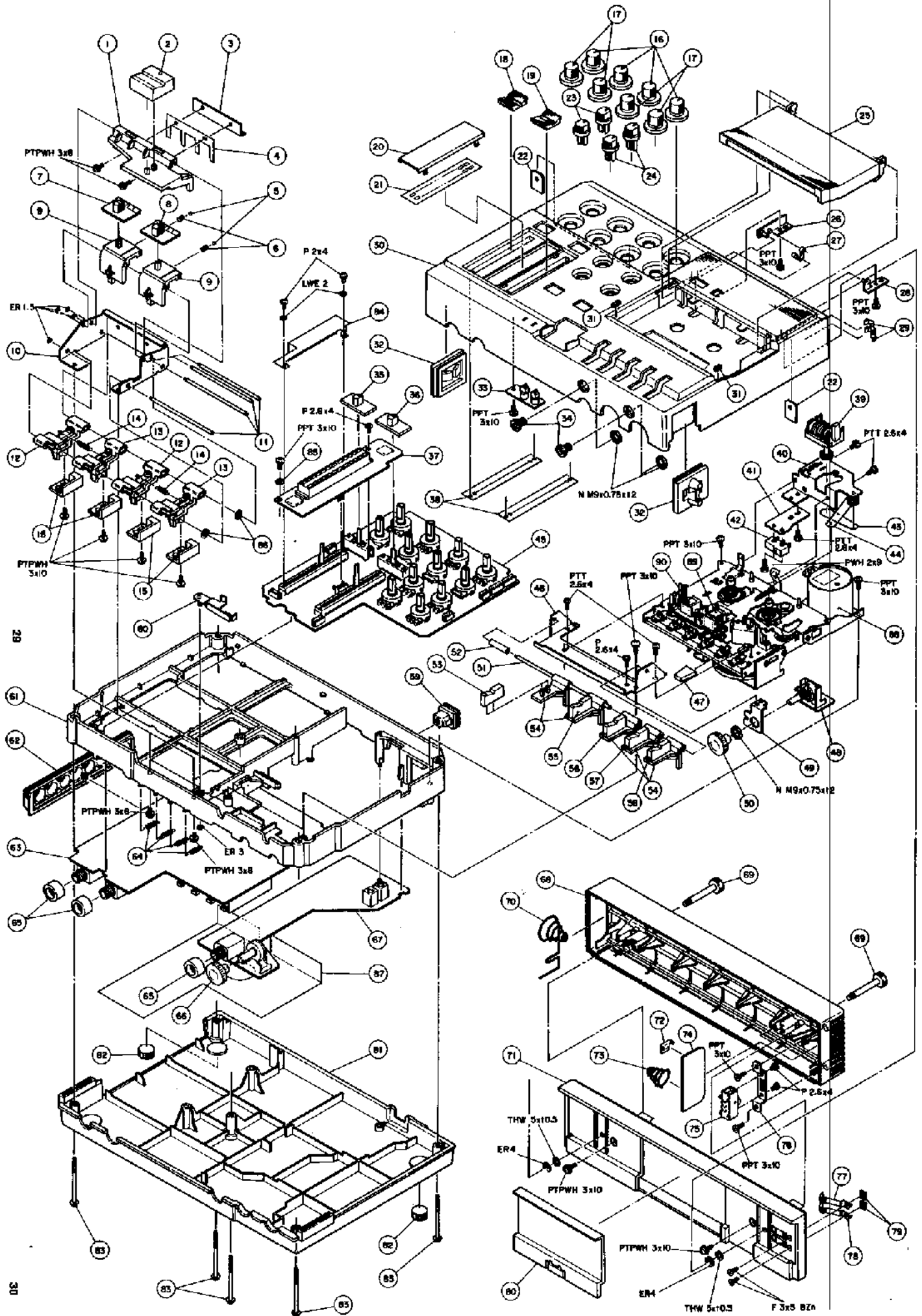


* Inner dia. for washers and nuts

	CODE	NAME	TYPE		CODE	NAME	TYPE
MACHINE SCREW	P	Pan Head Screw		WASHER, LUG, NUT	TW	Trim Washer (Countersunk)	
	T	Stove Head Screw (Truss)			N	Hex Nut	
	B	Binding Head Screw			L	Lug	
	F	Flat Countersunk Head Screw			THW	Thrust Washer / Poly Washer	
	O	Oval Countersunk Head Screw		SETSCREW	HSF	Hex Socket Setscrew (Flat Point)	
	PWH	Pan-Washer Head Screw			HSC	Hex Socket Setscrew (Cup Point)	
WOOD SCREW	RW	Round Head Wood Screw		SSF	Slotted Socket Setscrew (Flat Point)		
	FW	Flat Countersunk Wood Screw		SSC	Slotted Socket Setscrew (Cup Point)		
	OW	Oval Countersunk Wood Screw		BOLT	HSB	Hex Socket Head Bolt	
TAPPING SCREW	PTP	Pan Head Self Tapping Screw (B type)			HB	Hex Head Bolt	
	PTPWH	Pan washer Head Self Tapping Screw (D type)		RING, PIN	ER	E Ring (Retaining Washer)	
	TTP	Stove Head Self Tapping Screw (B type)			CRR	C Ring (Inner)	
	FTP	Flat Countersunk Head Self Tapping Screw (B type)			CRS	C Ring (Outer)	
TAPTITE SCREW	PTT	Pan Head Tapping Screw			GR	Seeger Ring	
	PTTWH	Pan-Washer Head Tapping Screw		SP	Spring Pin		
	TTT	Stove Head Tapping Screw		SR	Snap Ring		
	FTT	Flat Countersunk Head Tapping Screw		FINISH	Zn	Zinc plating	
SEMS SCREW	PS	Pan Head Screw with Spring Washer			CZn	Colored zinc plating	
	PSW	Pan Head Screw with Washer and Spring Washer			BZn	Black zinc plating	
WASHER, LUG, NUT	W	Flat Washer			Ni	Nickel plating	
	LW	Spring Washer			BNi	Black nickel plating	
	LWI	Internal Teeth Lock Washer			Cr	Chrome plating	
	LWE	External Teeth Lock Washer		BCr	Black chrome plating		

MODEL X-15 TRANSPORT EXPLODED VIEW, OVERALL

Ref. No.	Parts No.	Nomenclature	Ref. No.	Parts No.	Nomenclature
1	8212 0581 00	Lever, REC	53	8226 0280 00	Button, control, PLAY
2	8226 0290 00	Button, control, REC	54	8212 0580 00	Button, lever
3	8220 1440 00	Bracket, lock	55	8226 0270 00	Button, control, REW
4	8214 0450 00	Spring, REC lever	56	8226 0260 00	" , " , FF
5	8204 0150 00	Ball, 3	57	8226 0250 00	" , " , STOP
6	8214 0511 00	Spring, click	58	8226 0240 00	" , " , PAUSE
7	8226 0310 01	Knob, slide selector A	59	8245 0580 00	Connector, jack, DC inlet, 1771J029
8	8226 0310 02	" " " B	60	8260 1030 00	Arm ass'y, remote
9	8212 0690 00	Slider, select	61	8212 0600 00	Frame
10	8220 1430 00	Bracket, REC	62	8212 0640 00	Cover, pin jack
11	8223 0540 00	Shaft, slide	63	8273 0920 00	PCB ass'y, R/P
12	8260 1090 00	Slider ass'y (A)	64	8214 0470 00	Spring, slider
13	8260 1100 00	" " (B)	65	8223 0550 00	Cover, jack
14	8214 0461 00	Spring, selector arm	66	8226 0300 01	Knob, monitor
15	8212 0720 00	Hook	67	8273 0940 00	PCB ass'y, OSC
16	8226 0330 00	knob, GAIN	68	8212 0890 00	Case, battery, top
17	8226 0340 00	knob, PAN	69	8214 0570 00	Screw, battery
18	8226 0360 01	" , fader (A)	70	8214 0520 00	Spring, battery (A)
19	8226 0360 02	" , " (B)	71	8212 0900 00	Case, battery, bottom
20	8212 0650 00	Cover, bar graph	72	8214 0540 00	Spring, battery (C)
21	8216 0600 00	Screen, bar graph	73	8214 0530 00	" " (B)
22	8220 1480 00	Nut, battery case	74	8251 1360 00	PCB, battery
23	8226 0350 01	knob, EQ, A	75	8253 0400 04	Switch, slide, non-shorting, S58022
24	8226 0350 02	" , " , B	76	8220 1520 00	Bracket, switch
25	8212 0630 00	Cover	77	8214 0550 00	Spring, contact (L)
26	8260 1010 00	Bracket ass'y, cover L	78	8214 0560 00	" " (R)
27	8214 0480 00	Spring, cover	79	8204 0170 00	Nut, speed, M3 6x6
28	8260 1020 00	Bracket, ass'y, cover R	80	8212 0910 00	Cover, battery
29	8220 1492 00	Plate, contact	81	8212 0620 00	Case, bottom
30	8212 0610 00	Case, top	82	8216 0130 00	Foot, D12
31	8216 0610 00	Cushion, cover	83	8214 0490 00	Screw, P-tite, 3x50
32	8212 0660 00	Holder, belt	84	8216 0630 00	Plate, shield, B
33	8273 0950 00	PCB ass'y, LED	85	8204 0140 01	Washer, Mylar, 3x6x0.2
34	8223 0530 00	Nut, remote control	86	8214 0500 00	Spacer, slide
35	8226 0320 01	Knob, slide (A)	87	8270 1170 00	Shield ass'y
36	8226 0320 02	Knob, slide (B)			
37	8256 0180 00	Module, bar graph, LT-109			
38	8216 0590 00	Screen, fader			
39	8256 0230 00	Tape counter			
40	8260 0990 00	Bracket ass'y, counter			
41	8220 1410 00	Bracket, switch			
42	8253 0430 00	Switch, micro			
43	8216 0580 00	Belt, counter (B)			
44	8216 0570 00	" , " (A)			
45	8273 0930 00	PCB ass'y, mic amp.			
46	8220 1380 00	Bracket, lever			
47	8212 0670 00	Cap, stop lever			
48	8273 0980 00	PCB ass'y, VR			
49	8220 1390 00	Bracket, pitch control			
50	8226 0300 01	Knob, pitch control			
51	8223 0580 00	Button, shaft			
52	8204 0130 10	Spacer			



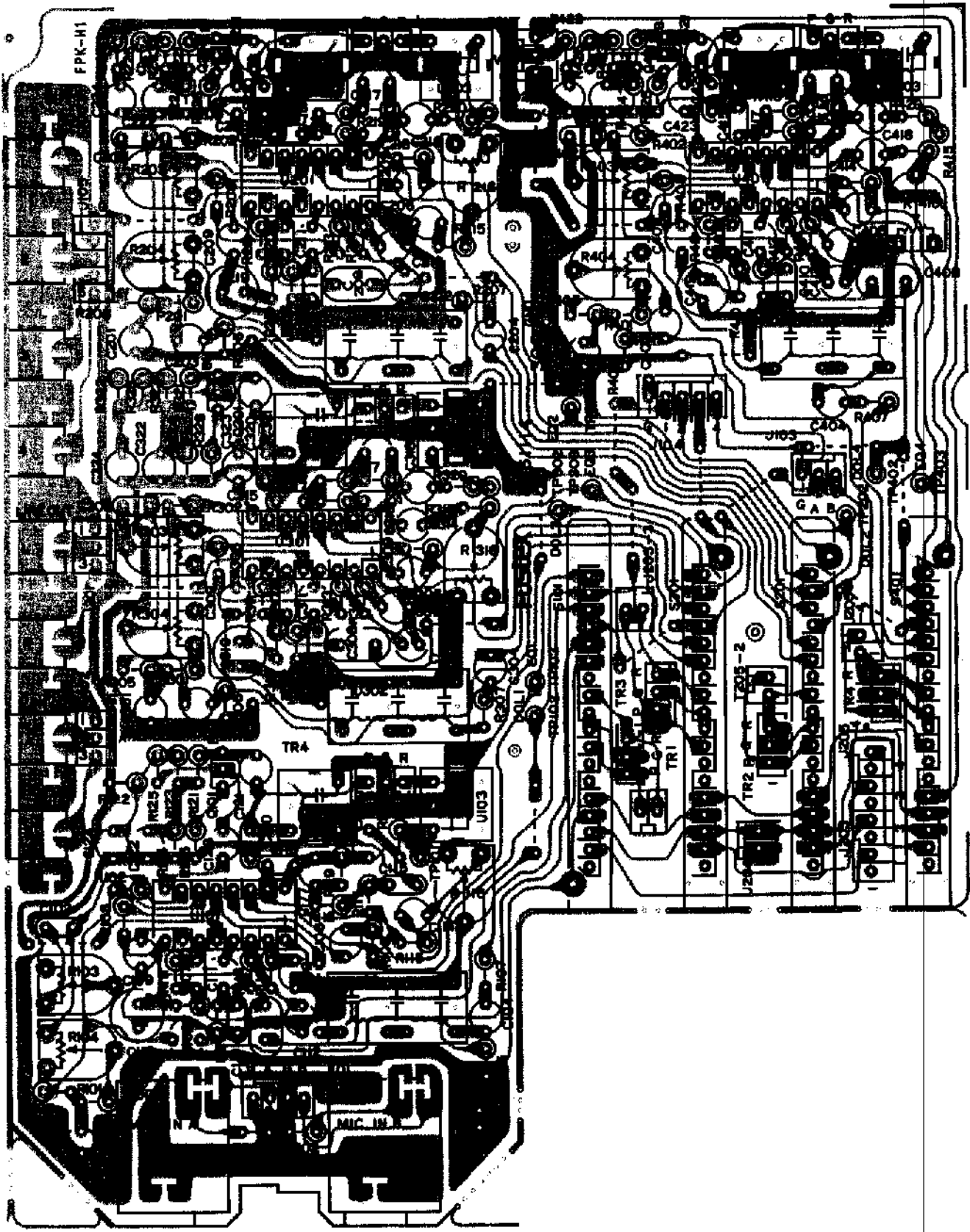
MODEL X-15 TRANSPORT EXPLODED VIEW, DECK

Ref. No.	Parts No.	Nomenclature	Ref. No.	Parts No.	Nomenclature
1	8259 0020 00	Head E	53	8214 0830 00	Spring, lock cam
2	8214 0750 00	Spring, head	54	8216 0650 00	Belt
3	8259 0010 00	Head R/P	55	8260 1210 00	Flywheel
4	8214 0740 00	Spring, head	56	8220 1610 00	Bracket (D), flywheel
5	8212 1060 00	Base, head	57	8214 0580 00	Screw, capstan
6	8214 0730 00	Spring, head base	58	8212 0950 00	Gear (B)
7	8220 1590 00	Chassis, head	59	8212 0970 00	Arm (B), gear lock
8	8212 1070 00	Cassette guide (DL)	60	8214 0640 00	Spring, lock arm (B)
9	8214 0760 00	Spring, FR lock arm	61	8214 0710 00	Spring, shift arm (B)
10	8214 0820 00	Spring, head chassis	62	8212 0930 00	Arm (B), shift
11	8223 0580 00	Button shaft	63	8260 1180 00	S reel ass'y
12	8260 1200 00	Arm ass'y, pinch roller	64	8214 0690 00	Spring, back tension
13	8214 0790 00	Spring, pinch roller	65	8260 1170 00	T reel ass'y
14	8214 0780 00	Spring, pause cam	66	8212 1020 00	Bushing
15	8212 0190 00	Cam, pause	67	8260 1160 00	Auto clutch ass'y
16	8212 1100 00	REC sensor	68	8214 0670 00	Spring, tension
17	8214 0810 00	Spring, REC sensor	69	8214 0680 00	Spring, play arm
18	8214 0720 00	Spring, auto lock arm	70	8212 1040 00	Idler, play
19	8220 1570 00	Arm, auto lock	71	8212 1030 00	Arm, play
20	8214 0800 00	Spring, pack	72	8212 0990 00	Gear, auto
21	8204 0180 00	Ball, steel	73	8212 1010 00	Arm, auto
22	8260 1110 00	Chassis assembly	74	8214 0660 00	Spring, auto arm
23	8249 0090 00	DC motor	75	8212 1000 00	Arm, sensor
24	8220 1600 00	Bracket (A), motor	76	8260 1150 00	Reel base ass'y
25	8223 0560 00	Pulley, motor	77	8253 0420 00	Switch, quick action
26	8216 0660 00	Belt, drive	78	8214 0700 00	Spring (C), FR pulley arm
27	8216 0670 00	Belt	79	8260 1190 00	Arm ass'y, FR pulley
28	8212 1080 00	Cassette guide (DR)	80	8212 1050 00	Arm, REW
29	8220 1580 00	FR lock arm (N)	81	8214 0890 00	Washer, Nylon
30	8212 1110 00	Lock cam (V)	82	8214 0840 00	Washer, reel
31	8214 0610 00	Lever spring (D)	83	8220 1381 00	Bracket, lever
32	8214 0600 00	Lever spring (B)	84	8204 0130 10	Spacer
33	8216 0640 00	Brake shoe	85	8212 0580 00	Lever, button
34	8214 0770 00	Spring, brake	86	8273 0980 00	PCB ass'y, VR
35	8220 1560 00	Lever, brake	87	8220 1390 00	Bracket, pitch control
36	8212 0980 00	Gear, FF	88	8226 0300 01	Knob, pitch control
37	8214 0650 00	Spring FF gear	89	8256 0230 00	Counter, tape
38	8260 1140 00	Arm ass'y, FF idler	90	8260 0990 00	Bracket ass'y, counter
39	8220 1530 00	Lever, REC	91	8220 1410 00	Bracket, switch
40	8214 0590 00	Spring, REC lever	92	8253 0430 00	Switch, micro
41	8220 1420 00	Lever, PLAY	93	8216 0580 00	Belt (B), counter
42	8260 1120 00	Lever ass'y, REW	94	8216 0570 00	Belt (A), counter
43	8220 1540 00	Lever, FF	95	8212 0590 00	Pulley
44	8220 1550 00	Lever, STOP			
45	8214 0620 00	Spring, pause lever			
46	8260 1130 00	Lever ass'y, pause			
47	8212 0920 00	Shift arm (A)			
48	8212 0940 00	Gear (A)			
49	8212 0960 00	Arm (A), gear lock			
50	8214 0630 00	Spring, shift arm (A)			
51	8214 0850 00	Washer, Nylon			
52	8223 0570 00	Collar, fly bracket			

R/P AMPLIFIER PCB ASSEMBLY, Ass'y No. 8273 0920 00

Ref. No.	Parts No.	Nomenclature	Ref. No.	Parts No.	Nomenclature
	8251 1143 00	PCB, R/P amplifier	R122, 222	8230 0041 83	" " , 18KΩ
	IC's		322, 422	" " " "	" " " "
U101, 201	8236 0280 00	Dolby, LA2730	R123, 223	8230 0041 24	" " , 120KΩ
U301, 401	" "	" "	323, 423	" " " "	" " " "
U102, 202	8256 0130 00	Module, low pass filter, 25KHz.	R124, 224	8230 0042 03	" " , 20KΩ
U302, 402	" "	" " " " " "	324, 424	" " " "	" " " "
U103, 203	8256 0200 00	Module, trap, P, 80KHz.	R125, 225	" " " "	" " " "
U303, 403	" "	" " " " " "	325, 425	" " " "	" " " "
U104, 204	8256 0210 00	Module, trap, S, 80KHz.	R126, 226	8230 0041 02	" " , 1KΩ
U304, 404	" "	" " " " " "	326, 426	" " " "	" " " "
			R001, 002	8230 0042 41	" " , 240Ω
	TRANSISTORS			CAPACITORS	
Q101, 201	8234 0021 02	2SC2240	C101, 201	8232 0024 76	Electrolytic, 10V, 47uF, 20%, SM
Q301, 401	" "	" "	301, 401	" " " " " "	" " " " " "
	CARBON RESISTORS				
	All resistors 1/4W, ±5% unless otherwise noted.				
R101, 201	8230 0046 21	Vertical mounting, 620Ω	C102, 202	8232 0264 72	Mylar, 50V, 0.0047uF, 5%, AMX
301, 401	" "	" " " "	302, 402	" " " " " "	" " " " " "
R102, 202	8230 0044 34	" " , 430KΩ	C103, 203	8232 0031 06	Electrolytic, 16V, 10uF, 20%, SM
302, 402	" "	" " " "	303, 403	" " " " " "	" " " " " "
R105, 205	8230 0044 73	" " , 47KΩ	C104, 204	8232 0022 26	" " , 10V, 22uF, " "
305, 405	" "	" " " "	304, 404	" " " " " "	" " " " " "
R106, 206	8230 0041 04	" " , 100KΩ	C105, 205	Deleted	
306, 406	" "	" " " "	305, 405	" "	" "
R107, 207	8230 0043 32	" " , 3.3KΩ	C106, 206	8232 0022 26	Electrolytic, 10V, 22uF, 20%, SM
307, 407	" "	" " " "	306, 406	" " " " " "	" " " " " "
R108, 208	8230 0045 62	" " , 5.6KΩ	C107, 207	8232 0304 72	Polypropylene, 100V, 4700pF, 2%, APS
308, 408	" "	" " " "	307, 407	" " " " " "	" " " " " "
R109, 209	8230 0041 04	" " , 100KΩ	C108, 208	8232 0303 33	" " , 0.033uF, 2%, APS
309, 409	" "	" " " "	308, 408	" " " " " "	" " " " " "
R110, 210	8230 0043 32	" " , 3.3KΩ	C109, 209	8232 0022 26	Electrolytic, 10V, 22uF, 20%, SM
310, 410	" "	" " " "	309, 409	" " " " " "	" " " " " "
R111, 211	8230 0044 73	Vertical mounting, 47KΩ	C110, 210	8232 0263 33	Mylar, 50V, 0.033uF, 5%, AMX
311, 411	" "	" " " "	310, 410	" " " " " "	" " " " " "
R112, 212	8230 0046 22	" " , 6.2KΩ	C111, 211	8232 0061 05	Electrolytic, 50V, 1uF, 20%, SM
312, 412	" "	" " " "	311, 411	" " " " " "	" " " " " "
R113, 213	8230 0042 74	" " , 270KΩ	C112, 212	8232 0061 04	" " , 0.1uF, " "
313, 413	" "	" " " "	312, 412	" " " " " "	" " " " " "
R114, 214	" "	" " " "	C113, 213	8232 0063 34	Electrolytic, 50V, 0.33uF, 20%, SM
314, 414	" "	" " " "	313, 413	" " " " " "	" " " " " "
R115, 215	8230 0042 22	" " , 2.2KΩ	C114, 214	8232 0031 06	" " , 16V, 10uF, " "
315, 415	" "	" " " "	314, 414	" " " " " "	" " " " " "
R117, 217	8230 0047 52	" " , 7.5KΩ	C115, 215	8232 0268 22	Mylar, 50V, 0.0082uF, 5%, AMX
317, 417	" "	" " " "	315, 415	" " " " " "	" " " " " "
R118, 218	" "	" " " "	C116, 216	8232 0503 91	Ceramic, 50V, 390pF, 5%, SL
318, 418	" "	" " " "	316, 416	" " " " " "	" " " " " "
R119, 219	8230 0042 23	" " , 22KΩ	C117, 217	8232 0062 24	Electrolytic, 50V, 2.2uF, 20%, SM
319, 419	" "	" " " "	317, 417	" " " " " "	" " " " " "
R120, 220	8230 0045 62	" " , 5.6KΩ	C118, 218	8232 0062 25	" " , 2.2uF, " "
320, 420	" "	" " " "	318, 418	" " " " " "	" " " " " "
R121, 221	8230 0049 12	" " , 9.1KΩ	C119, 219	8232 0022 27	Electrolytic, 10V, 220uF, 20%, SM
321, 421	" "	" " " "	319, 419	" " " " " "	" " " " " "
			C120, 220	8232 0261 02	Mylar, 50V, 1000pF, 5%, AMX
			320, 420	" " " " " "	" " " " " "

Ref. No.	Parts No.	Nomenclature
C121, 221	8232 0711 06	Electrolytic, 16V, 10uF, LR(M)
321, 421	"	" " " " " "
C122, 222	8232 0031 06	" " " " , 20%, SM
322, 422	"	" " " " " "
C123, 223	8232 0062 25	" , 50V, 2.2uF, " "
323, 423	"	" " " " " "
C124, 224	8232 0024 76	" , 10V, 47uF, " "
324, 424	"	" " " " " "
CARBON POTS		
R103, 203	8231 0025 03	Trim, flat mounting, 50K Ω , B
303, 403	"	" " " " " "
R104, 204	8231 0021 02	" " " " , 1K Ω , "
304, 404	"	" " " " " "
R116, 216	8231 0025 02	" " " " , 5K Ω , "
316, 416	"	" " " " " "
MISCELLANEOUS		
S101, 201	8253 0380 00	Switch, slide, CL106K
301, 401	"	" " " " "
J001, 002	8245 0030 00	Connector, jack, mono, SG7622
J003	8245 0520 00	" " , RCA, 8P
J101	8245 0530 04	" " , 8263, 4, straight, wht
J102	8245 0530 03	" " " , 3, " , wht
J103	8245 0530 43	" " " , 3, " , blk
J104	8245 0530 05	" " " , 5, " , wht
J105	8245 0530 25	" " " , 5, " , red
J201	8245 0530 43	" " " , 3, " , blk
J202	8245 0530 23	" " " , 3, " , red
J203	8245 0530 08	" " " , 8, " , wht
J204	8245 0530 22	" " " , 2, " , red
J051	8245 0530 02	" " " , 2, " , wht
J052	8245 0530 22	Connector, jack, 8263, 2, straight, red
J053	8245 0530 42	" " " 2, " , blk
J054	8245 0530 62	" " " 2, " , yel
J502	8245 0530 42	" " " 2, " , blk
W101	8276 2440 09	Cable ass'y, brn, 3P, #30, 90mm
W201	8276 2450 18	" " , red, " " , 180mm
W301	8276 2460 10	" " , org, " " , 100mm
W401	8276 2470 14	" " , yel, " " , 140mm
	8276 0020 04	Wire, jumper, 10mm, x22
	8276 0010 00	Pin, header, x13



MIC AMPLIFIER PCB ASSEMBLY, Ass'y No. 8273 0930 00

Ref. No.	Parts No.	Nomenclature	Ref. No.	Parts No.	Nomenclature
	82511153 00	PCB, mic amplifier	R142, 242	8230 0044 73	" " , 47KΩ
	IC's		R143, 243	8230 0042 24	" " , 220KΩ
U101, 201	8236 0209 00	Analog, NJM4559DF	R144, 244	8230 0043 92	" " , 3.9KΩ
U102, 103	"	"	R145, 245	8230 0041 23	" " , 12KΩ
	TRANSISTORS		R146	8230 0042 22	Vertical mounting, 22KΩ
Q101, 201	8234 0021 02	2SC2240BL	R147	8230 0042 22	" " , 22KΩ
Q102, 202	8234 0003 03	2SA1015GR		CAPACITORS	
Q103, 203	8234 0002 03	2SC18156R	C101, 201, 301, 401	Deleted	
	CARBON RESISTORS		C102, 202	8232 0022 26	Electrolytic, 10V, 22uF, 20%, SM
All resistors ±M, ±5% unless otherwise noted.			302, 402	" " " " " "	
R101, 201, 301, 401	Deleted		C103, 203	8232 0064 75	" , 50V, 4.7uF, " "
R102, 202, 302, 402	"		303, 403	" " " " " "	
R103, 203	8230 0041 13	Vertical mounting, 11KΩ	C104, 204	8232 0514 70	Ceramic, 50V, 47pF, 10%, SL
303, 403	"	" " "	C105	8232 0022 26	Electrolytic, 10V, 22uF, 20%, SM
R104, 204	8230 0041 04	" " , 100KΩ	C205	8232 0862 26	" , 16V, " " SRA
304, 404	"	" " "	C106	8232 0024 76	" , 10V, 47uF, " , SM
R105, 205	8230 0043 93	" " , 39KΩ	C206	8232 0864 76	" , 16V, " " , SRA
305, 405	"	" " "	C107	8232 0024 76	" , 10V " " , SM
R108, 208	8230 0044 73	" " , 47KΩ	C207	8232 0864 76	" , 16V " " , SRA
308, 408	"	" " "	C108, 208	8232 0512 20	Ceramic, 50V, 22pF, 10%, SL
R109, 209	8230 0044 73	Vertical mounting, 47KΩ	C109	8232 0062 25	Electrolytic, 50V, 2.2uF, 20%, SM
309, 409	"	" " "	C209	8232 0892 25	" " " " " , SRA
R110, 210	8230 0042 71	" " , 270Ω	C110, 210	8232 0031 06	" , 16V, 10uF, 20%, SM
310, 410	"	" " "	C111	8232 0861 06	" " " " " , SRA
R111, 211	8230 0044 70	" " , 47Ω	C211	8232 0031 06	" " " " " , SM
R112, 212	8230 0041 03	" " , 10KΩ	C112	8232 0864 76	" , 16V, 47uF, " , SRA
R113, 213	8230 0045 63	" " , 56KΩ	C212	8232 0024 76	" , 10V, " " , SM
R114, 214	8230 0044 73	" " , 47KΩ	C113	8232 0891 04	" , 50V, 0.1uF, " , SRA
R115, 215	8230 0047 52	" " , 7.5KΩ	C213	8232 0061 04	" " " " " , SM
R116, 216	8230 0046 21	" " , 620Ω	C114, 214	8232 0033 36	" , 16V, 33uF, " "
R117, 217	8230 0042 23	" " , 22KΩ	C115, 215	8232 0261 03	Mylar, 50V, 0.01uF, 5%, AMX
R118, 218	8230 0041 01	" " , 100Ω	C116, 216	8232 0061 04	Electrolytic, 50V, 0.1uF, 20%, SM
R119, 219	8230 0044 72	" " , 4.7KΩ	C117, 217	8232 0022 26	" , 10V, 22uF, " "
R120, 220	8230 0044 73	" " , 47KΩ	118, 218	" " " " " " "	
R121, 221	8230 0041 01	" " , 100Ω	C119, 219	8232 0031 06	" , 16V, 10uF, " "
R122, 222	8230 0042 74	" " , 270KΩ	C120	8232 0021 07	" , 10V, 100uF, " "
R123, 223	"	" " "	C121, 221	8232 0031 06	" , 16V, 10uF, " "
R125, 225	8230 0041 04	" " , 100KΩ	C122	8232 0351 03	Ceramic, 50V, 0.01uF, +80, -20%, YF
R126, 226	8230 0041 02	" " , 1KΩ		CARBON POTS	
R127, 227	8230 0041 03	" " , 10KΩ	R106, 206	8240 0490 00	Flat mtg., rotary 16, 10KΩ, A
R128, 228	8230 0042 23	" " , 22KΩ	306, 406	" " " " " " " "	
R129, 229	8230 0041 04	" " , 100KΩ	R107, 207	8240 0480 00	" " " " " " , dual, 20KΩ, AC
R130, 230	8230 0042 22	" " , 2.2KΩ	307, 407	" " " " " " " "	
R131, 231	8230 0041 63	" " , 16KΩ	R124, 224	8240 0500 00	Linear, 20KΩ, (A)
R133, 233	8230 0043 32	" " , 3.3KΩ	R132, 232	8240 0450 00	Flat mtg., rotary 16, 10KΩ, W
R134, 234	8230 0048 22	" " , 8.2KΩ	136, 236	" " " " " " " "	
R135, 235	"	" " "	R141, 241	8231 0021 04	" " , trim. 100KΩ, B
R137, 237	8230 0042 72	" " , 2.7KΩ		MISCELLANEOUS	
R138, 238	8230 0041 63	" " , 16KΩ	S101, 201	8253 0390 03	Switch, slide, non-shorting, SSB423
R139, 239	8230 0045 62	" " , 5.6KΩ			
R140, 240	8230 0042 22	" " , 2.2KΩ			

Ref. No.	Parts No.	Nomenclature
J101	8245 0530 04	Connector, jack, 8263, 4, straight, wht
J102	8245 0530 03	" " " 3, " "
J103	8245 0530 43	" " " 3, " , blk
J104	8245 0530 05	" " " 5, " , wht
J105	8245 0530 25	" " " 5, " , red
J301	8245 0530 03	" " " 3, " , wht
J302	8245 0530 24	" " " 4, " , red
J501	8245 0020 04	" " , 3024-04CH, wht
	8276 0020 04	Wire, jumper, 10mm, x14

DC INLET CONNECTOR ASSEMBLY, Ass'y No. 8270 1750 00

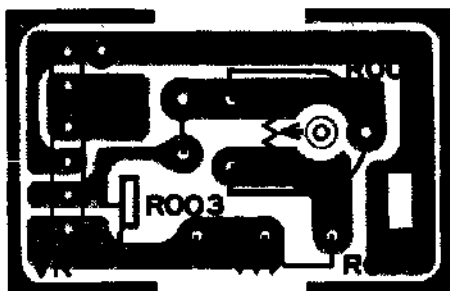
Ref. No.	Parts No.	Nomenclature
	8220 1490 00	Plate, contact, x2
	8245 0580 00	Connector, jack, DC inlet, 1771J029
J406	8276 2390 12	Cable ass'y, RE, 2P, #26, 120mm, kink
	8276 1590 15	Cable, flat, 2 cond., 150mm, kink

LED PCB ASSEMBLY, Ass'y No. 8273 0950 00

Ref. No.	Parts No.	Nomenclature
	8251 1161 02	PCB, LED
		DIODES
D001	8234 0015 01	LED, red, LN233RP
D002	8234 0015 02	" , green, LN3336P
		MISCELLANEOUS
TB45	8276 2361 29	Cable Ass'y, W, 4P, #26, 290mm, kink

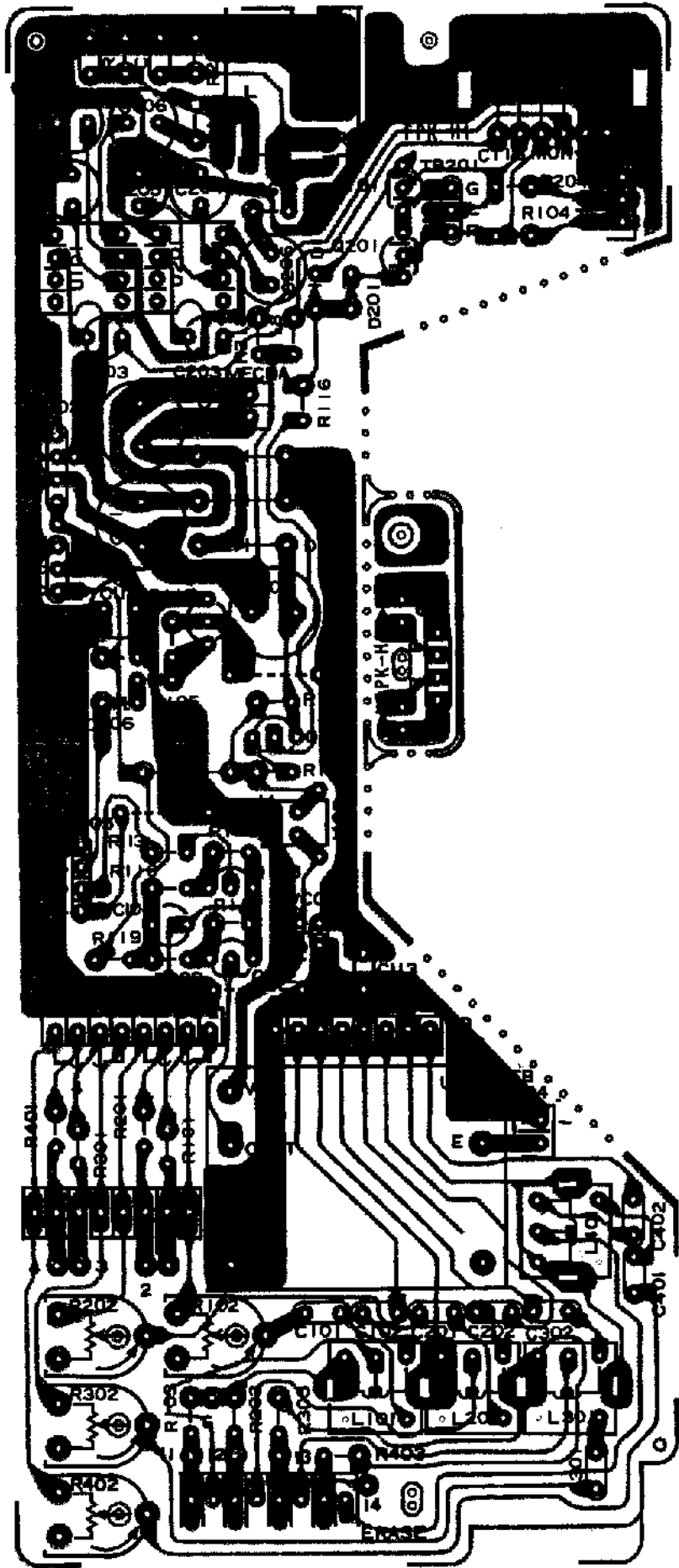
VOLUME PCB ASSEMBLY, Ass'y No. 8273 0980 00

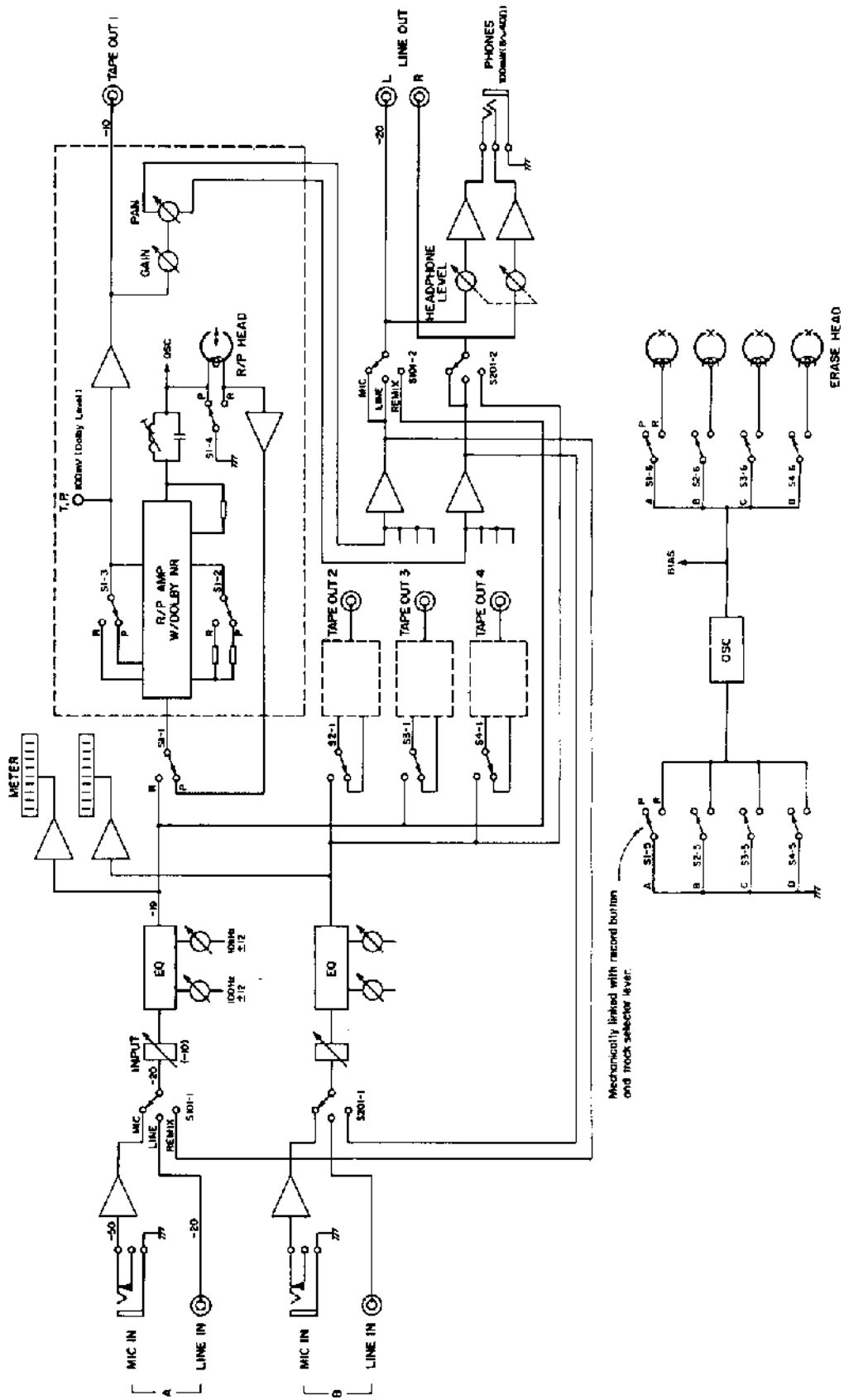
Ref. No.	Parts No.	Nomenclature
	8251 1190 00	PCB, VR
R001	8240 0470 00	Trim pot, vert. mtg., 16 ϕ , 5K Ω , B
R002	8231 0025 02	Trim pot, horiz. mtg., 5K Ω , B
R003	8230 0043 92	Resistor, carbon, 1W, 3.9K Ω , 5%

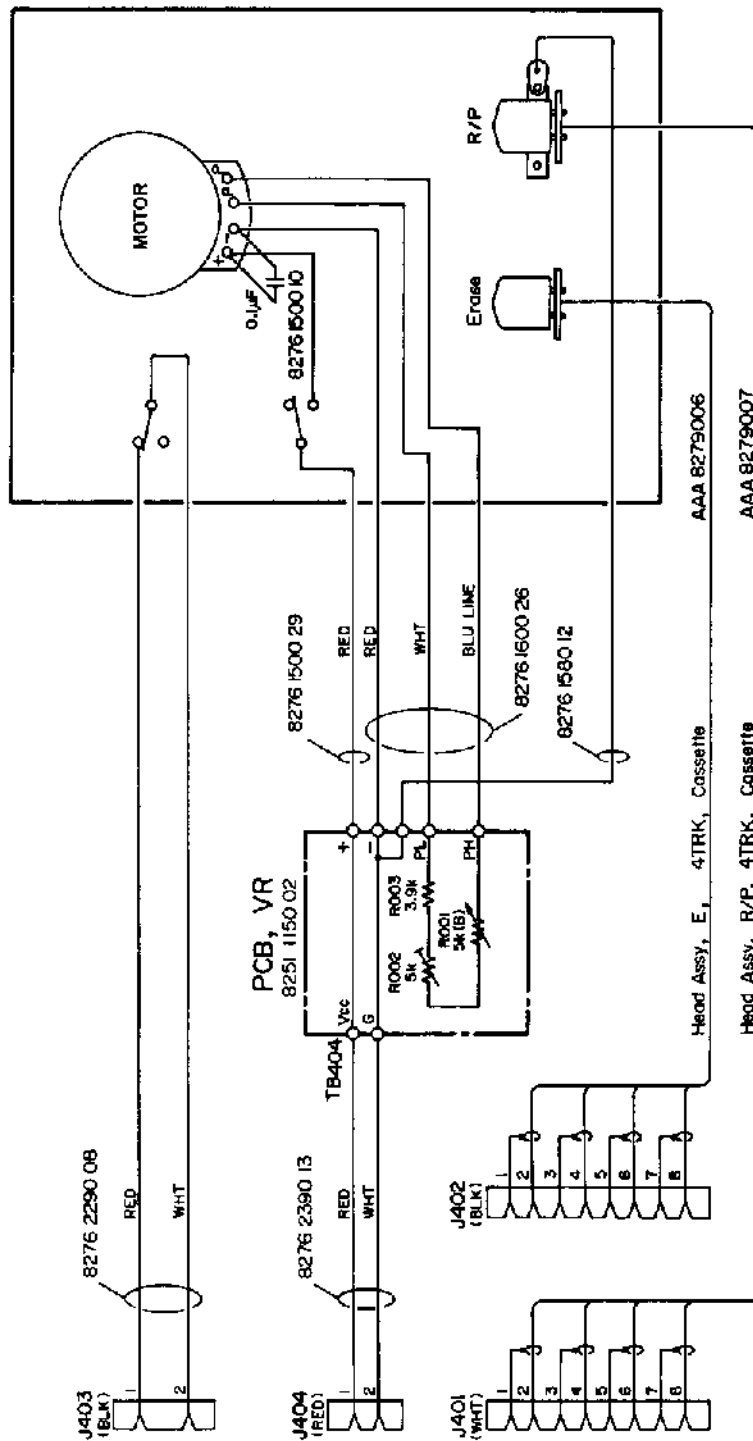


OSCILLATOR PCB ASSEMBLY, Ass'y No. 8273 0940 00

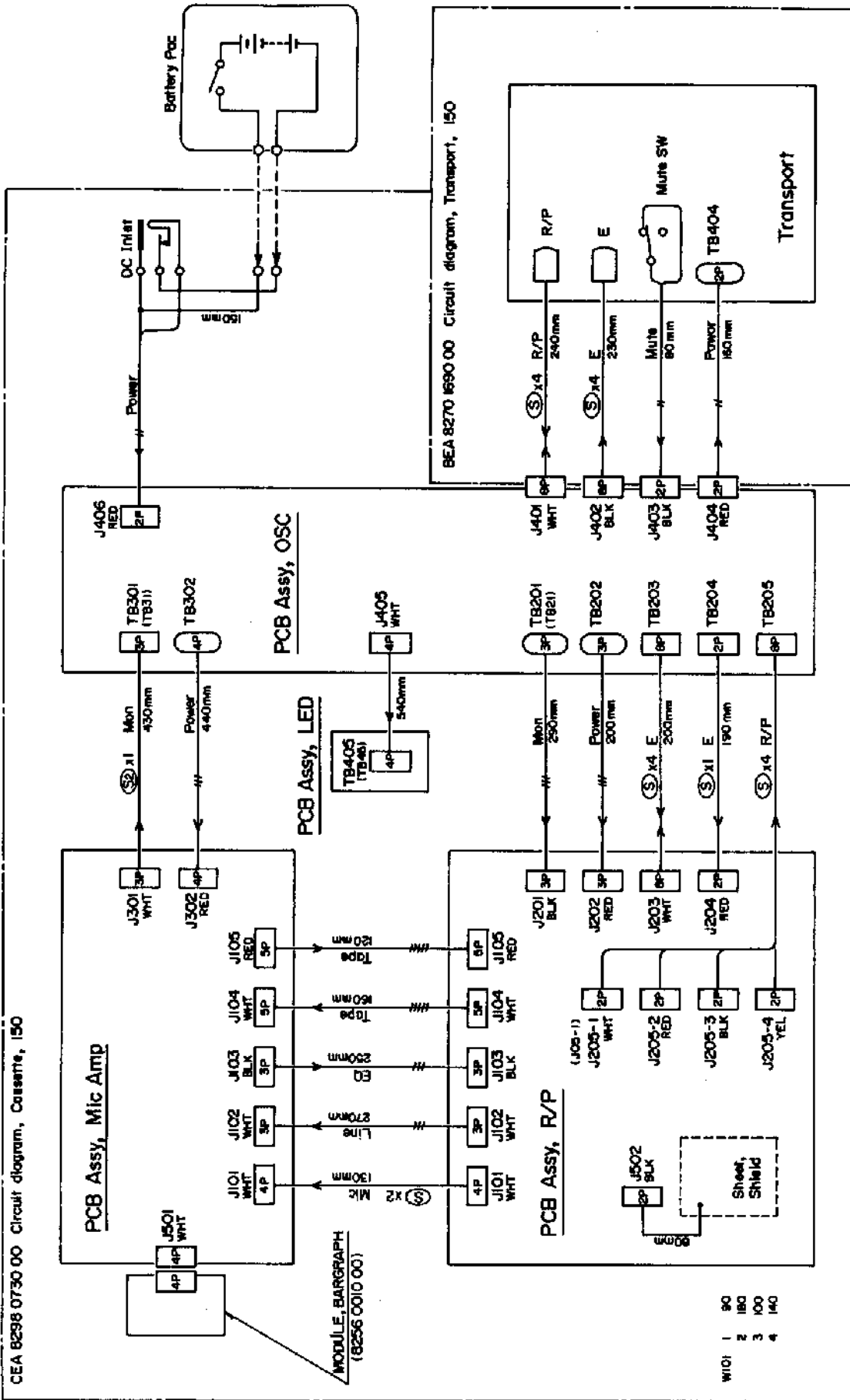
Ref. No.	Parts No.	Nomenclature	Ref. No.	Parts No.	Nomenclature
	8251 1163 01	PCB, oscillator			CARBON POTS
	IC's		R102, 202	8231 0022 04	Flat mounting, trim, 200K Ω , 8
U101, 201	8236 0217 00	Analog, NJM386	302, 402	" " " " " "	"
U102	8256 0220 00	Module, oscillator, 80KHz	R105	8240 0460 00	Vertical mtg., rotary 16, dual, 5K Ω , C
		TRANSISTORS			MISCELLANEOUS
Q101, 201	8234 0006 02	2SC2878B	L101, 201	8242 0551 00	Inductor, erase, J
Q102, 103	8234 0002 03	2SC1815GR	301, 401	" " " "	"
Q104	8234 0003 03	2SA1015GR	J004	8245 0040 00	Connector, jack, stereo, SG7713
Q105	8234 0006 02	2SC2878B	J401	8245 0530 08	" " " 8, straight, wht
		DIODES	J402	8245 0530 48	" " " 8, " , blk
D101, 201	8234 0035 00	MA-150FVS	J403	8245 0530 42	" " " 2, " "
D102 ~ 104	8234 0007 00	1N4002	J404	8245 0530 22	" " " 2, " , red
D105	8234 0035 00	MA-150FVS	J405	8245 0530 04	" " " 4, " , wht
D106	8234 0019 01	Zener, 8.2V, 05Z8.2VY	J406	8245 0530 22	" " " 2, " , red
D107	8234 0007 00	1N4002	TB21	8276 2300 29	Cable ass'y, BL, 3P, #26, 290mm, kink
		CARBON RESISTORS	TB22	8276 2400 20	" " , RE, " , " , 200mm, "
All resistors		1/4W, $\pm 5\%$ unless otherwise noted.	TB23	8276 2510 15	" " , W, 8P, #30, 150mm
R101, 201	8230 0041 01	Vertical mounting, 100 Ω	TB24	8276 2500 19	" " , RE, 2P, " , 190mm
301, 401	"	" " " "	TB25	8276 2521 00	" " , 1-4
R103, 203	8230 0001 09	" " " 1 Ω	TB31	8276 2530 43	" " , W, 3P, #30, 430mm
303, 403	"	" " " "	TB32	8276 2410 44	" " , RE, 4P, #26, 440, kink
R104, 204	8230 0042 71	" " " 270 Ω		8276 0020 04	Wire, jumper, 10mm, x3
R106, 206	8230 0041 80	" " " 18 Ω		8276 0010 00	Pin, header, x10
R107, 207	8230 0044 72	" " " 4.7K Ω			
R108	8230 0041 03	" " " 10K Ω			
R109	8230 0041 02	" " " 1K Ω			
R110	8230 0044 72	" " " 4.7K Ω			
R111, 112	8230 0041 03	" " " 10K Ω			
R113	8230 0041 02	" " " 1K Ω			
R114	8230 0041 03	" " " 10K Ω			
R115	8230 0043 33	" " " 33K Ω			
R116	8230 0044 72	" " " 4.7K Ω			
R117	8230 0043 31	" " " 330 Ω			
R118, 218	8230 0044 73	" " " 47K Ω			
R119	8230 0041 01	" " " 100 Ω			
		CAPACITORS			
C101, 201	8232 0322 21	Ceramic, 50V, 220pF, 5%, NPO			
301, 401	"	" " " " " "			
C102, 202	8232 0262 72	Mylar, 50V, 0.0027 μ F, 5%, AMX			
302, 402	"	" " " " " "			
C103, 203	8232 0031 06	Electrolytic, 16V, 10 μ F, 20%, SM			
C104, 204	8232 0034 76	" " " 47 μ F, " "			
105, 205	"	" " " " " "			
C106, 206	8232 0022 27	Electrolytic, 10V, 220 μ F, 20%, SM			
C107, 207	8232 0351 03	Ceramic, 50V, 0.01 μ F, +80, -20%, YF			
C108	8232 0032 26	Electrolytic, 16V, 22 μ F, 20%, SM			
C109	8232 0022 27	" " " 10V, 220 μ F, " "			
C110, 111	8232 0033 37	" " " 16V, 330 μ F, " "			
C112	8232 0864 76	" " " 47 μ F, " , SRA			
C113	8232 0351 03	Ceramic, 50V, 0.01 μ F, +80, -20%, YF			



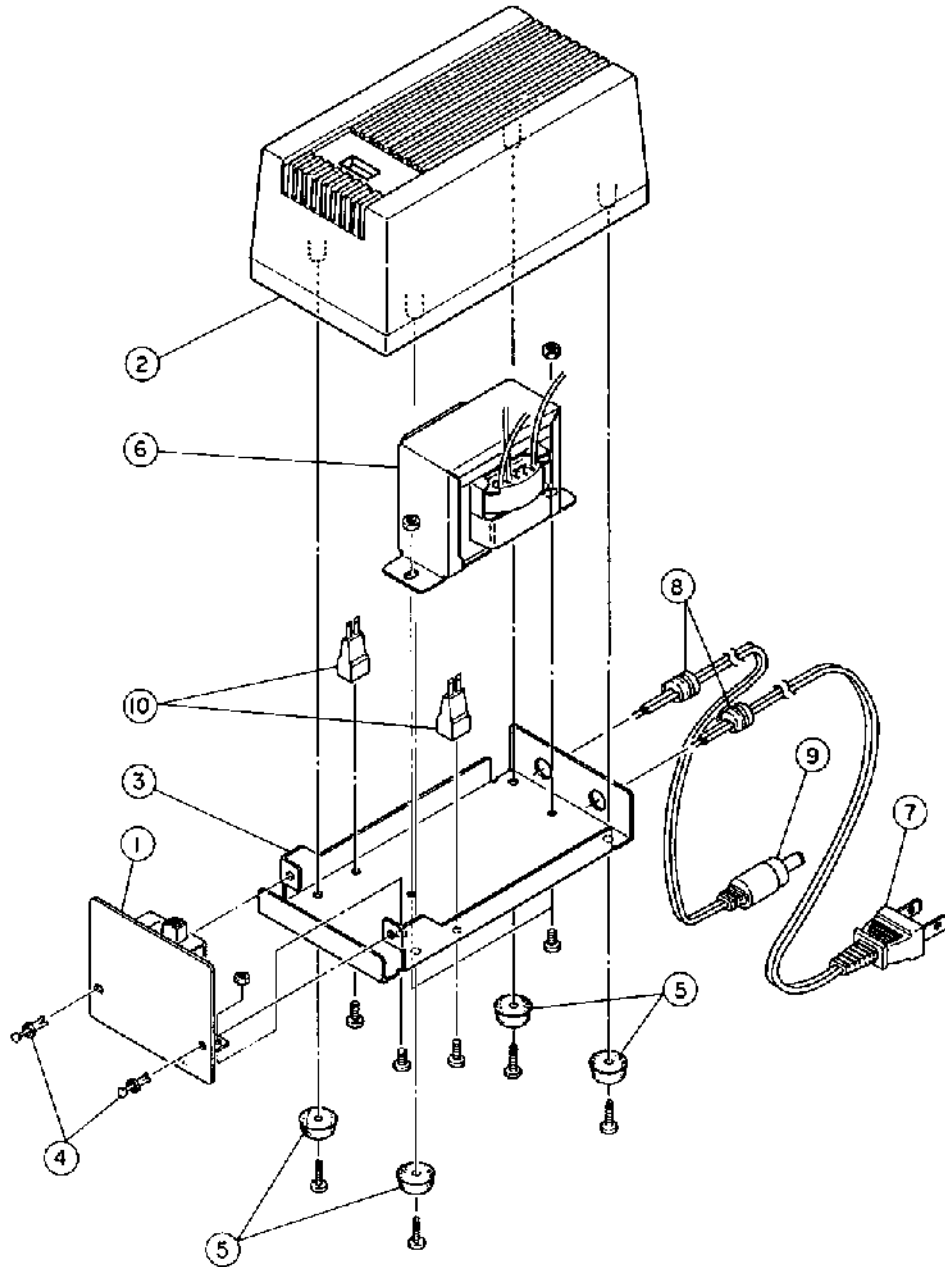




CEA 8298 0730 00 Circuit diagram, Cassette, ISO

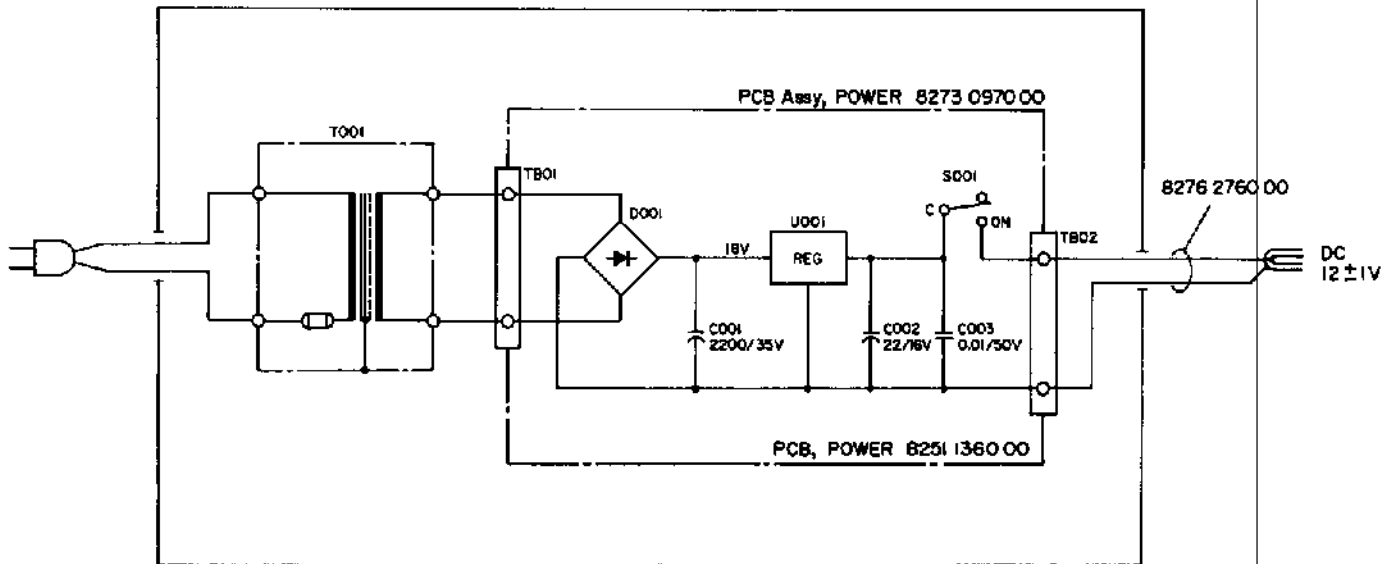


10. MODEL 8070 EXPLODED VIEW AND PARTS LIST

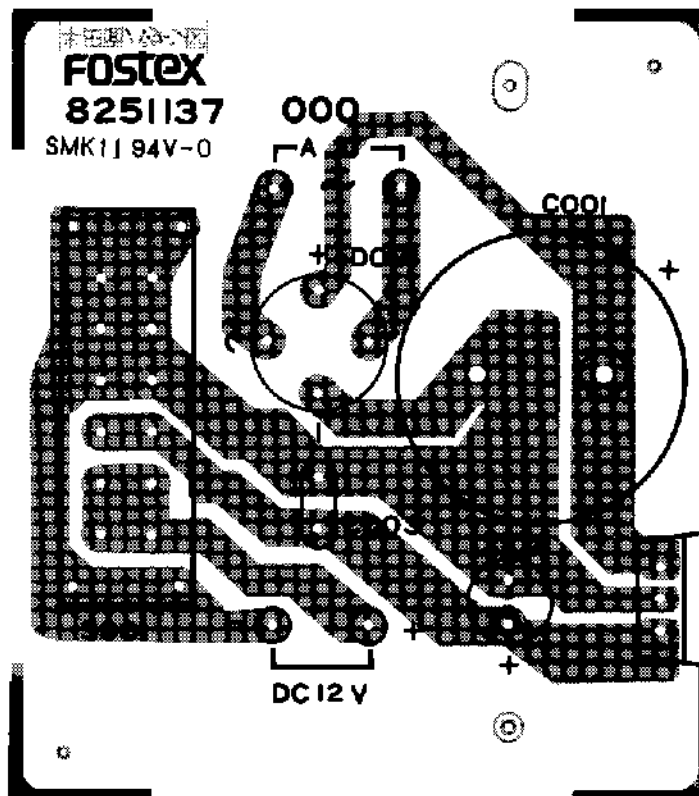


Model 8070

Ref. No.	Parts No.	Nomenclature	Ref. No.	Parts No.	Nomenclature
1	8273 0970 00	PCB assembly, power	7	△ 8276 0030 00	Cord, power, DM
2	8212 0730 00	Housing, AC adaptor	△ 8276 0040 00	" " , USA	
3	8220 1510 00	Bracket, AC adaptor	△ 8276 0050 00	" " , HYDRO	
4	8207 0004 00	Rivet, plastic, #980	△ 8276 0060 00	" " , EUR	
5	8207 0012 02	Foot, rubber, #136	△ 8276 0070 00	" " , UK	
6	△ 8242 0580 00	Transformer, power, 100V, 8070	△ 8276 0080 00	" " , AUS	
	△ 8242 0560 00	" " , 120V, "	△ 8276 2170 00	" " , CSA	
	△ 8242 0571 00	" " , 220V, "	8	△ 8207 0002 08	Bushing, SR-4N-4
	△ 8242 0590 00	" " , 240V, "	△ 8207 0002 14	" , SR-5N-4	
			9	8245 0340 00	Connector, wire, A-0/A-1
			10	8245 0590 00	Terminal, CY

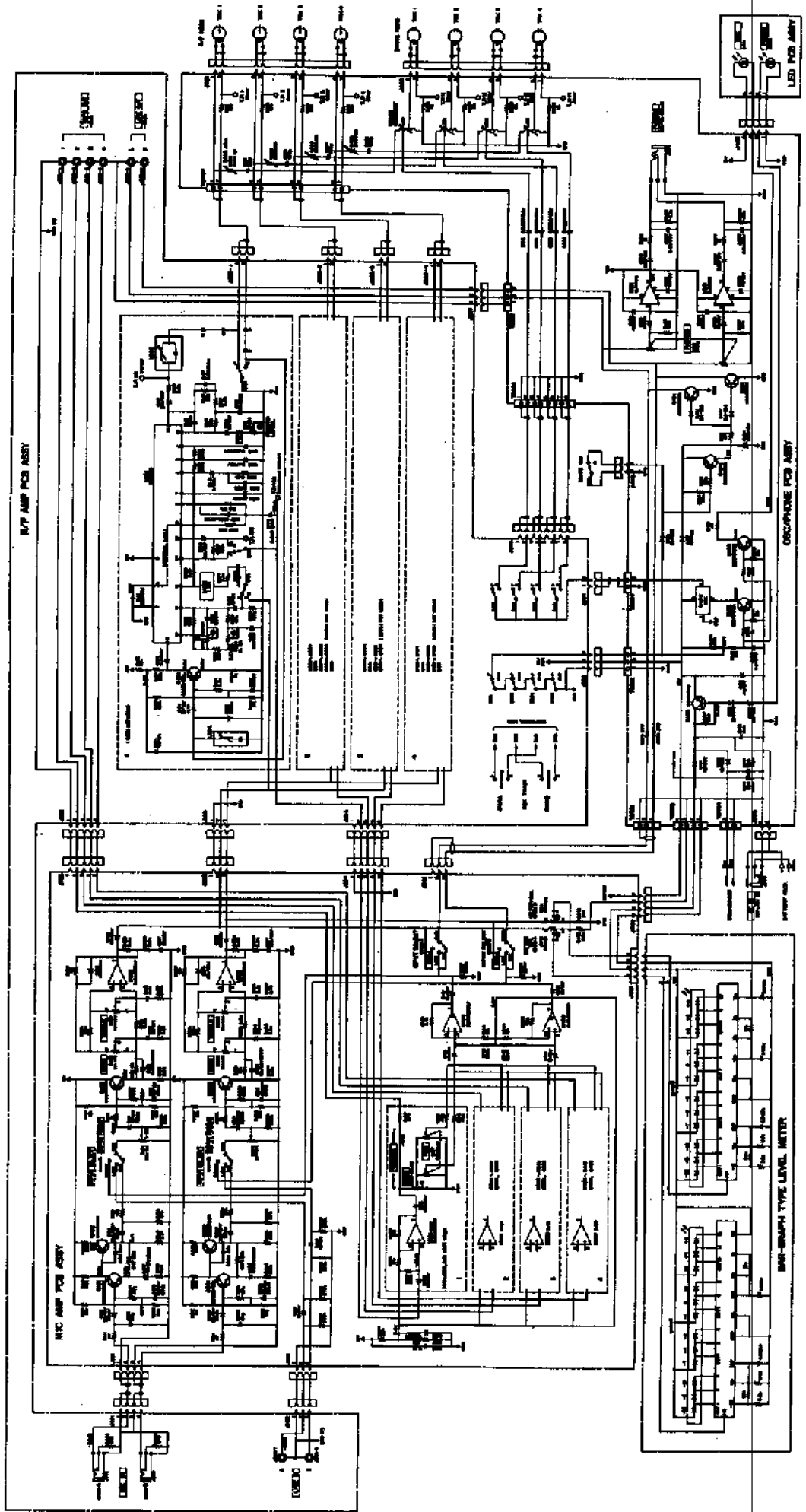


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POWER PCB ASSEMBLY, Ass'y No. 8273 0970 00 (Model 8070)

Ref. No.	Parts No.	Nomenclature
	8251 1370 00	PCB, power
U001	8236 0233 00	IC, analog, NJM78M12A
D001	8234 0017 03	Diode, stack, W02
C001	8232 0822 2B	Electrolytic, 35V, 2200µF, 20%, NM
C002	8232 0032 26	" , 16V, 22µF, 20%, SM
C003	8232 0351 03	Ceramic, 50V, 0.01µF, +80-20%, YF
S001	8253 0410 02	Switch, slide, SSB 342, non-shorting
TB02	8276 2760 01	Cord, power, DC, 1500mm



R/P AMP PCB ASSY

MIC AMP PCB ASSY

OSC/PREAMP PCB ASSY

DR-GRAPH TYPE LEVEL METER

LED PCB ASSY

