

# TC-WR97ES/WR870

## SERVICE MANUAL

*US Model*  
*Canadian Model*  
**E Model**  
 TC-WR97ES  
**AEP Model**  
*UK Model*  
 TC-WR870

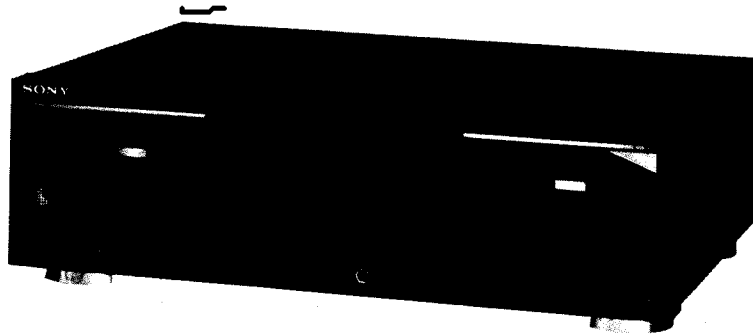


Photo: TC-WR870

|                                    |                  |
|------------------------------------|------------------|
| Model Name Using Similar Mechanism | TC-WR820         |
| Tape Transport Mechanism Type      | TCM-200R4 /200R9 |

### SPECIFICATIONS

Recording system 4-track 2-channel stereo  
 Fast winding time Approx. 90 sec. (with Sony C-60 cassette)  
 Bias AC bias  
 Signal-to-noise ratio (at peak level)

| Dolby NR switch<br>Cassette | Dolby NR switch |           |           |
|-----------------------------|-----------------|-----------|-----------|
|                             | OFF             | B-Type ON | C-Type ON |
| Type IV<br>(Sony METAL-SLT) | 59 dB           | 67 dB     | 74 dB     |
| Type II (Sony UX-S)         | 58 dB           | 66 dB     | 73 dB     |
| Type I (Sony HF-S)          | 56 dB           | 64 dB     | 71 dB     |

Total harmonic distortion 1.0% (with Sony METAL-SLT cassettes)

Frequency response (DOLBY NR OFF)

|                                      |   |
|--------------------------------------|---|
| Type IV cassette<br>(Sony METAL-SLT) | 20 - 20,000 Hz ( $\pm 3$ dB, IEC)<br>30 - 15,000 Hz [ $\pm 3$ dB 0VU(-4 dB)recording] |
| Type II cassette<br>(Sony UX-S)      | 25 - 17,000 Hz ( $\pm 3$ dB, IEC)   |
| Type I cassette<br>(Sony HF-S)       | 25 - 16,000 Hz ( $\pm 3$ dB, IEC)   |

Wow and flutter  $\pm 0.09\%$  W.Peak (IEC)  
 0.06% WRMS (NAB)  
 $\pm 0.16\%$  W.Peak (DIN)

Inputs

|                              |                 |           |
|------------------------------|-----------------|-----------|
| Line inputs<br>(phono jacks) | Sensitivity     | 77.5 mV   |
|                              | Input impedance | 47 k ohms |

Outputs

|                                   |                    |  |
|-----------------------------------|--------------------|--|
| Line outputs<br>(phono jacks)     | Rated output level | 0.32 V at a load impedance of 47 k ohms  |
|                                   | Load impedance     | Over 10 k ohms                           |
| Headphones<br>(stereo phone jack) | Output level       | 0-1.25 mW at a load impedance of 32 ohms |

General

Power requirements

**US, Canadian Model:**  
 120 V AC, 60 Hz  
**AEP, Germany Model:**  
 220 - 230 V AC, 50/60 Hz  
**UK Model:** 240 V AC, 50 Hz  
**E Model:** 120, 220, 240 V AC  
 adjustable, 50/60 Hz

Power consumption

30 W

Dimensions

Approx. 470 x 135 x 355 mm (w/h/d)  
 (18 $\frac{1}{8}$  x 5 $\frac{3}{8}$  x 14 inches)

Weight

including projecting parts and controls  
 Approx. 7.5 kg (16 lbs 9 oz)

Supplied accessory

Audio connecting cords (2)

Design and specifications subject to change without notice.



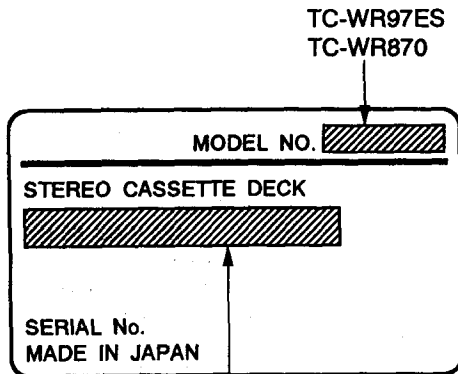
**STEREO CASSETTE DECK**  
**SONY®**

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**MODEL IDENTIFICATION**

— Specification Label —



|                      |                                  |
|----------------------|----------------------------------|
| US, Canadian Model:  | AC: 120V 60Hz 30W                |
| Germany, AEP Models: | AC: 220 - 230V~50/60 Hz          |
| UK Model:            | AC: 240 V~50 Hz                  |
| E Model:             | AC: 120, 220, 240 V~50/60 Hz 30W |

**SAFETY-RELATED COMPONENT WARNING!!**  
**COMPONENTS IDENTIFIED BY MARK  $\triangle$  OR DOTTED LINE WITH MARK  $\triangle$  ON THE SCHEMATIC DIAGRAMS AND IN THE PARTS LIST ARE CRITICAL TO SAFE OPERATION. REPLACE THESE COMPONENTS WITH SONY PARTS WHOSE PART NUMBERS APPEAR AS SHOWN IN THIS MANUAL OR IN SUPPLEMENTS PUBLISHED BY SONY.**

**SAFETY CHECK-OUT**

After correcting the original service problem, perform the following safety check before releasing the set to the customer:

Check the antenna terminals, metal trim, "metallized" knobs, screws, and all other exposed metal parts for AC leakage. Check leakage as described below.

**LEAKAGE TEST**

The AC leakage from any exposed metal part to earth ground and from all exposed metal parts to any exposed metal part having a return to chassis, must not exceed 0.5 mA (500 microamperes). Leakage current can be measured by any one of three methods.

1. A commercial leakage tester, such as the Simpson 229 or RCA WT-540A. Follow the manufacturers' instructions to use these instruments.
2. A battery-operated AC milliammeter. The Data Precision 245 digital multimeter is suitable for this job.
3. Measuring the voltage drop across a resistor by means of a VOM or battery-operated AC voltmeter. The "limit" indication is 0.75 V, so analog meters must have an accurate low-voltage scale. The Simpson 250 and Sanwa SH-63Trd are examples of a passive VOM that is suitable. Nearly all battery operated digital multimeters that have a 2V AC range are suitable. (See Fig. A)

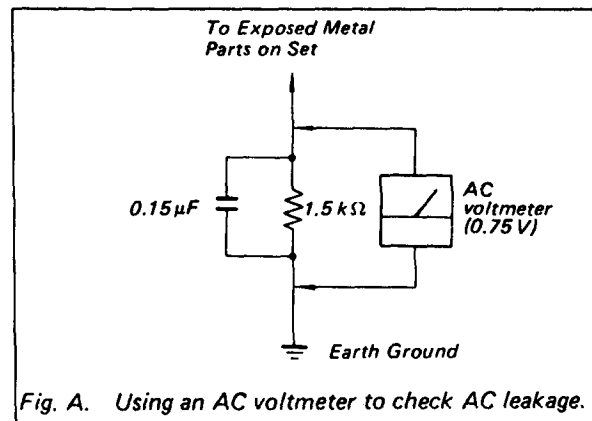


Fig. A. Using an AC voltmeter to check AC leakage.

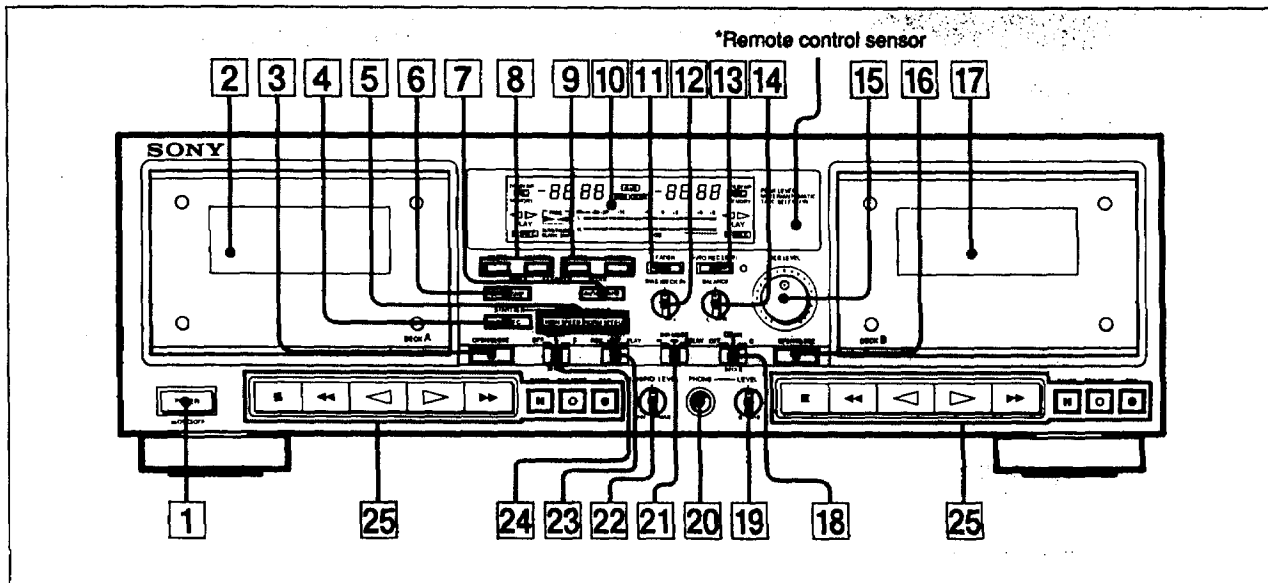
**ATTENTION AU COMPOSANT AYANT RAPPORT À LA SÉCURITÉ!**

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

This section is extracted from instruction manual.

## SECTION 1 GENERAL

### Identification of Front Panel Parts



For details, refer to the page number indicated in ●

- |   |   |
|---|---|
| <p>1 POWER switch</p> <p>2 Deck A</p> <p>3 ▲ OPEN/CLOSE button (deck A)</p> <p>4 A+B REC (simultaneous recording) button ⑩</p> <p>5 SYNCHRO DUBBING buttons ⑩<br/>HIGH SPEED button<br/>NORM (normal) SPEED button</p> <p>6 BLANK SKIP button ⑨</p> <p>7 AUTO PAUSE button ⑩</p> <p>8 COUNTER buttons (deck A) ⑪<br/>RESET button<br/>MEMORY button</p> <p>9 COUNTER buttons (deck B) ⑪<br/>RESET button<br/>MEMORY button</p> <p>10 Display panel</p> <p>11 FADER button ⑪</p> <p>12 BIAS control (deck B) ⑩</p> <p>13 AUTO REC (automatic recording) LEVEL button and indicator ⑫ ⑬</p> <p>14 BALANCE control ⑫</p> <p>15 REC (recording) LEVEL control ⑫ ⑬</p> <p>16 ▲ OPEN/CLOSE button (deck B)</p> <p>17 Deck B</p> | <p>18 □□ NR (Dolby noise reduction) switch (deck B)<br/>⑦ ⑧ ⑫ ⑮ ⑯ ⑰</p> <p>19 Headphones LEVEL control ⑦</p> <p>20 PHONES (headphones) jack (stereo phone jack) ⑦</p> <p>21 DIR (direction) MODE switch ⑦ ⑧ ⑫ ⑮ ⑯ ⑰</p> <p>22 DUBBING LEVEL control ⑬</p> <p>23 TIMER switch ⑦ ⑳</p> <p>24 □□ NR (Dolby noise reduction) switch (deck A)<br/>⑦ ⑧ ⑫ ⑮ ⑯ ⑰</p> <p>25 Tape operation buttons<br/>■ (stop) button<br/>◀◀ (leftward fast winding) (AMS**) button<br/>◀ (reverse play) button<br/>▶ (forward play) button<br/>▶▶ (rightward fast winding) (AMS**) button<br/>   PAUSE button<br/>○ REC MUTE (record muting) button ⑮<br/>● REC (recording) button</p> |
|---|---|

#### \*Remote control sensor

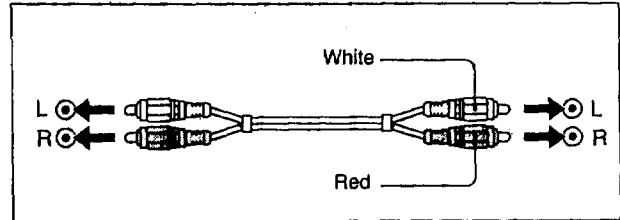
- You can remotely control this cassette deck with:
- A remote commander that came with a Sony amplifier or receiver if it has the ■ mark and cassette deck control capability.
  - Any optional Sony remote commander with the ■ mark and cassette deck control capability.

\*\*AMS is an abbreviation for Automatic Music Sensor.

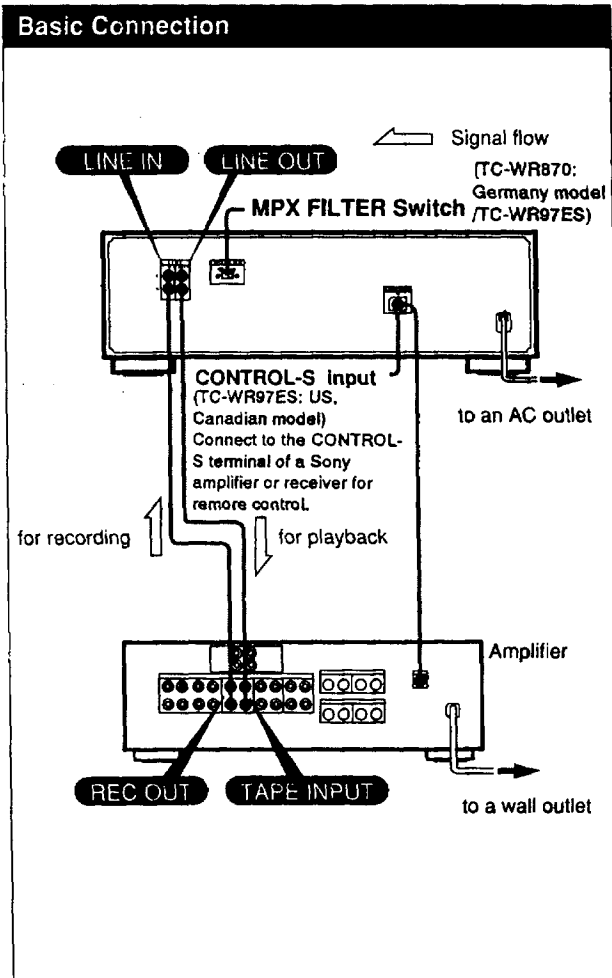
# Connections

## Notes on Connections

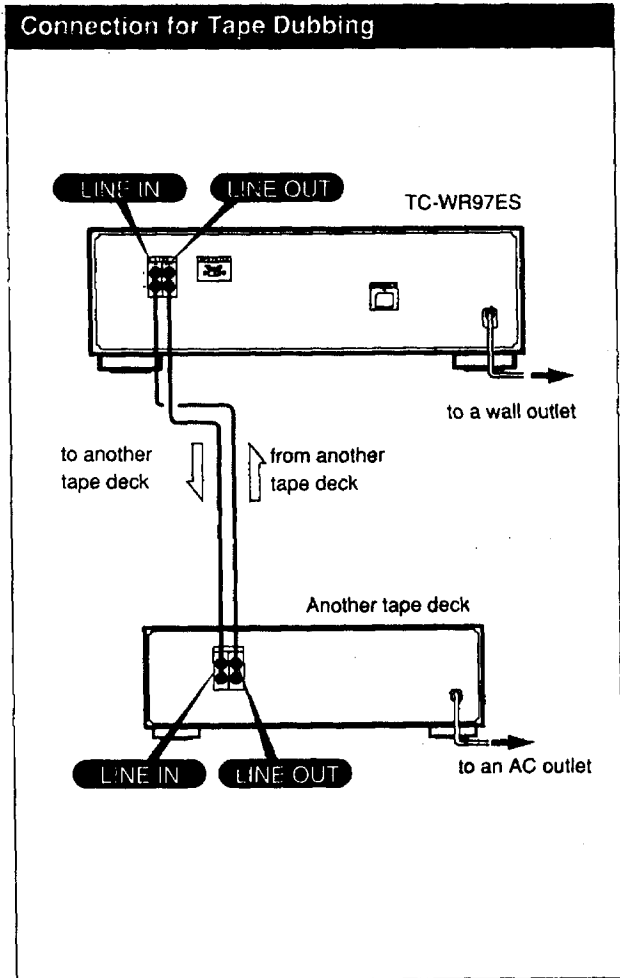
- Turn off the power to all equipment to be connected before making any connection.
- Note that the red plug of the supplied connecting cord is for right-channel (R) connection and the white plug for left-channel (L) connection.
- The connecting cords should be fully inserted into the jacks. A loose connection may cause hum pickup.



## Basic Connection



## Connection for Tape Dubbing



### Note on the CONTROL-S input

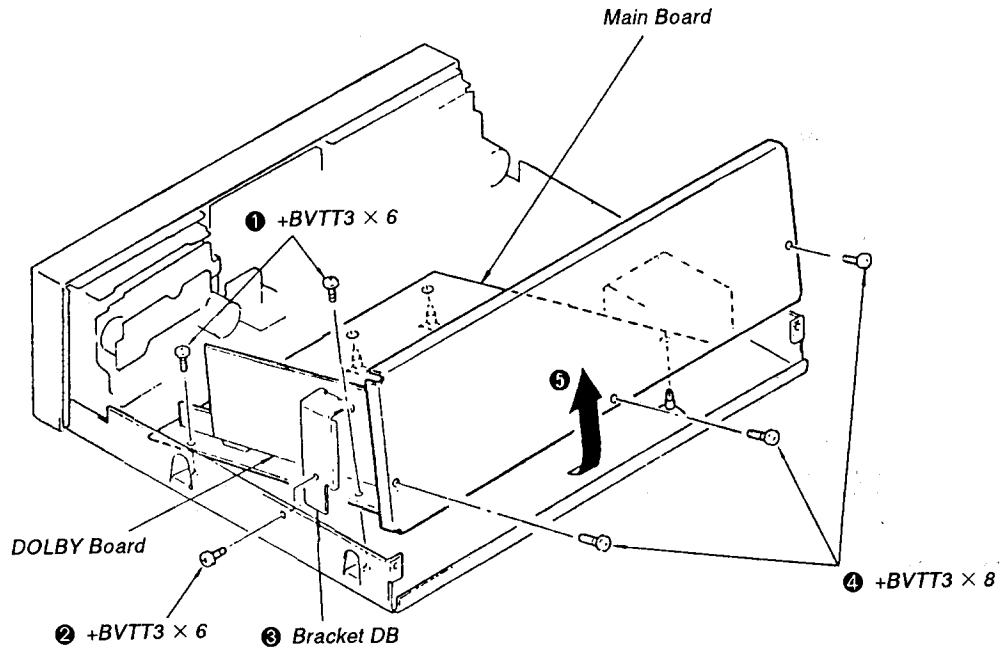
To remote control this unit through a receiver or amplifier, connect the input on this unit to the CONTROL-S output on a Sony receiver or amplifier, with a CONTROL-S cable. When this connection is used, only remote commands sent through the receiver or amplifier will be executed. The remote sensor on this unit will not function.

## SECTION 2 DISASSEMBLY

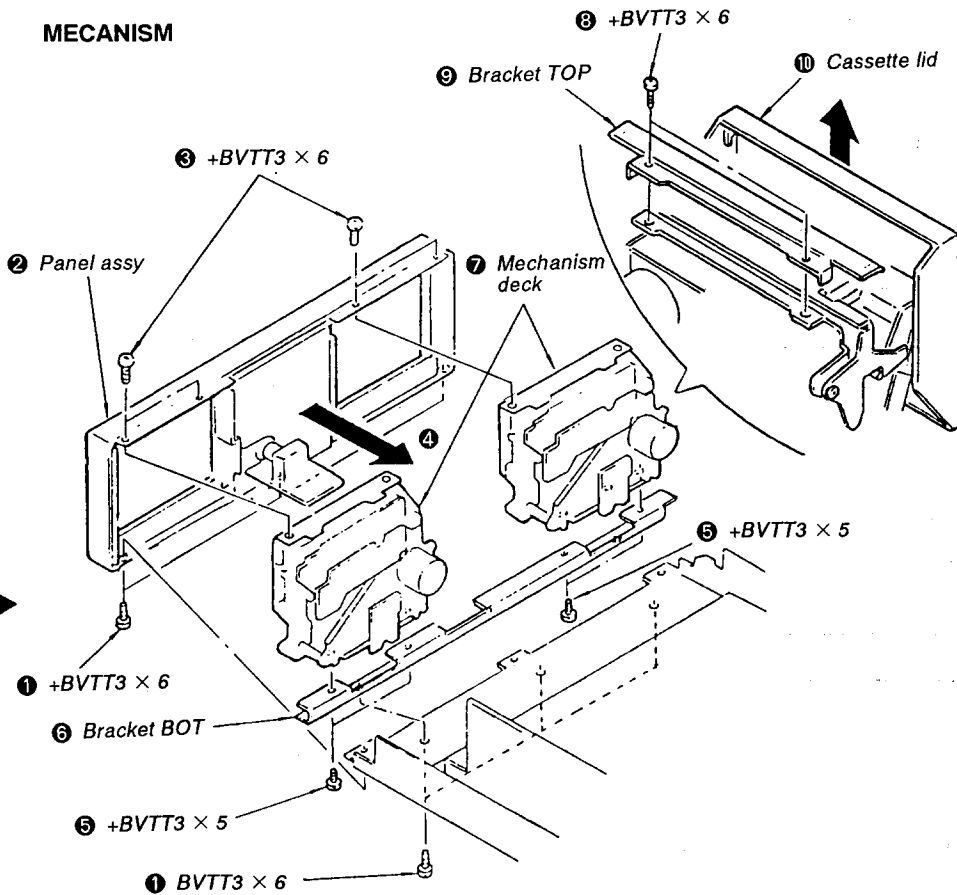
**Note:** Follow the disassembly procedure in the numerical order given.

Unscrew four screws (M3 × 8) and remove the upper case.

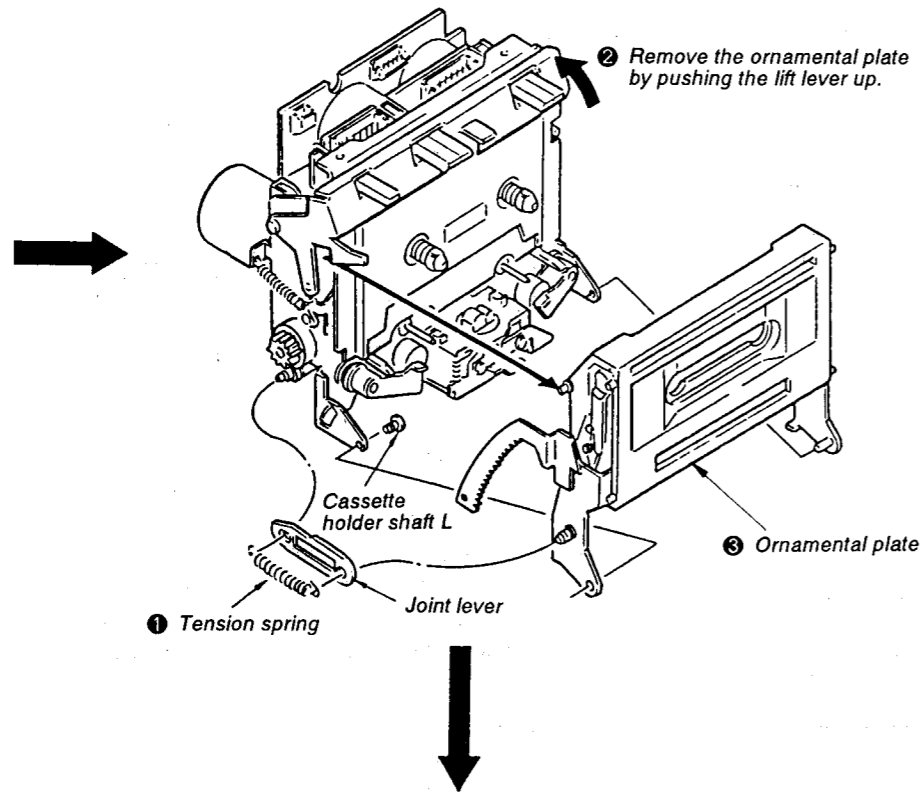
### DOLBY BOARD, MAIN BOARD



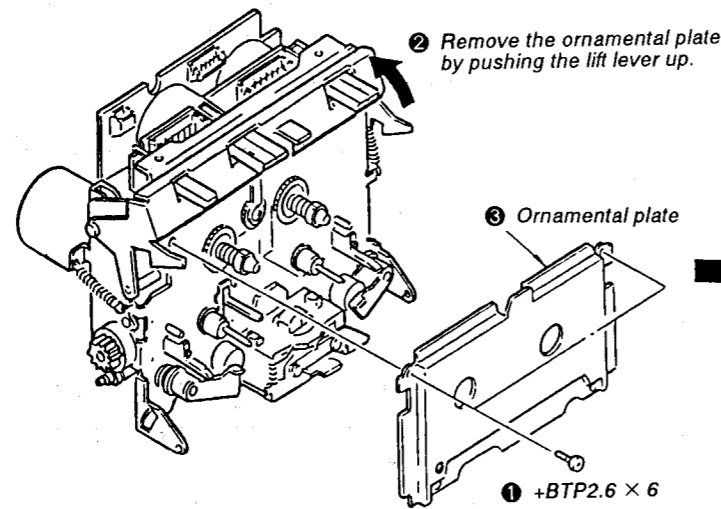
### MECANISM



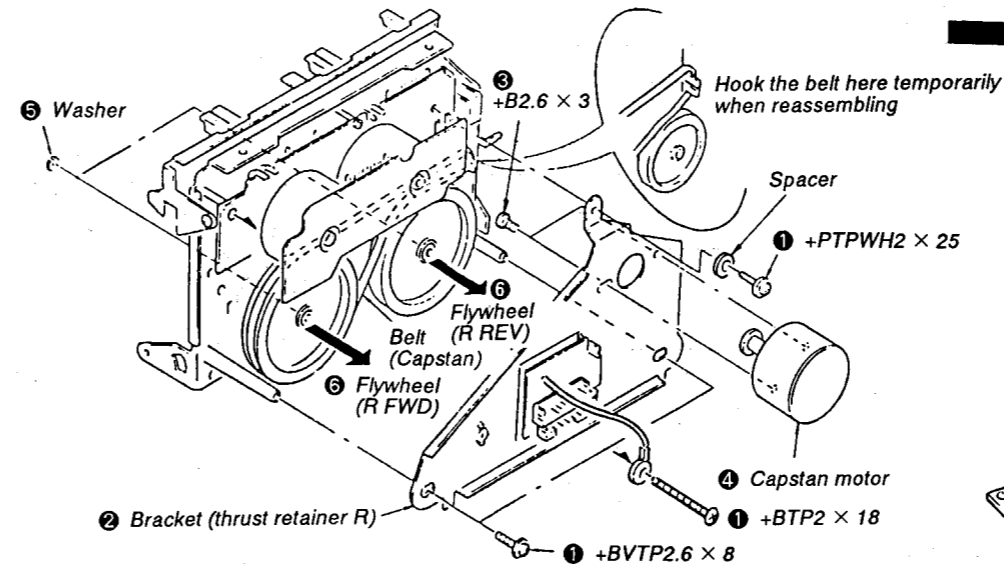
CASSETTE HOLDER



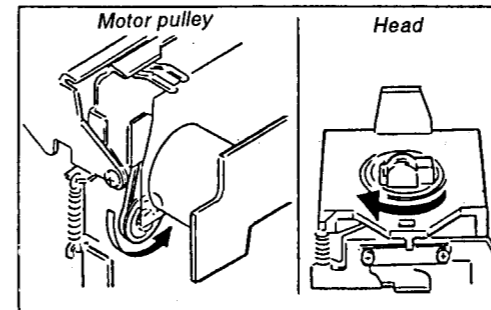
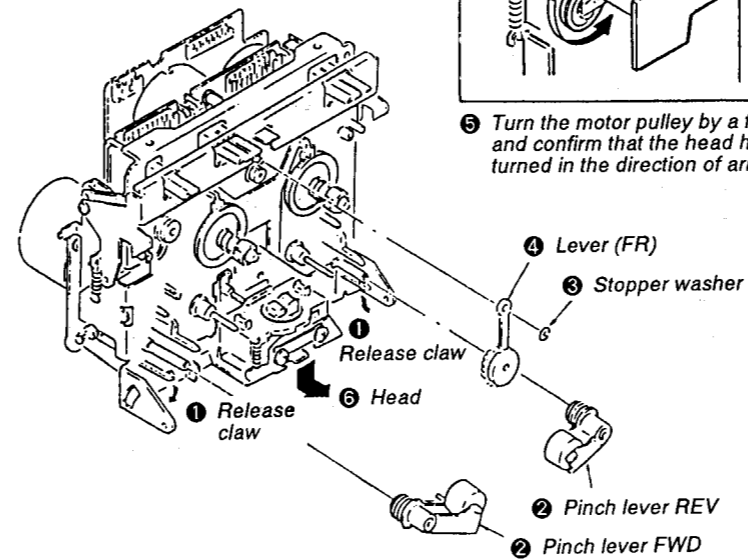
ORNAMENTAL PLATE



CAPSTAN PLATE, FLYWHEEL

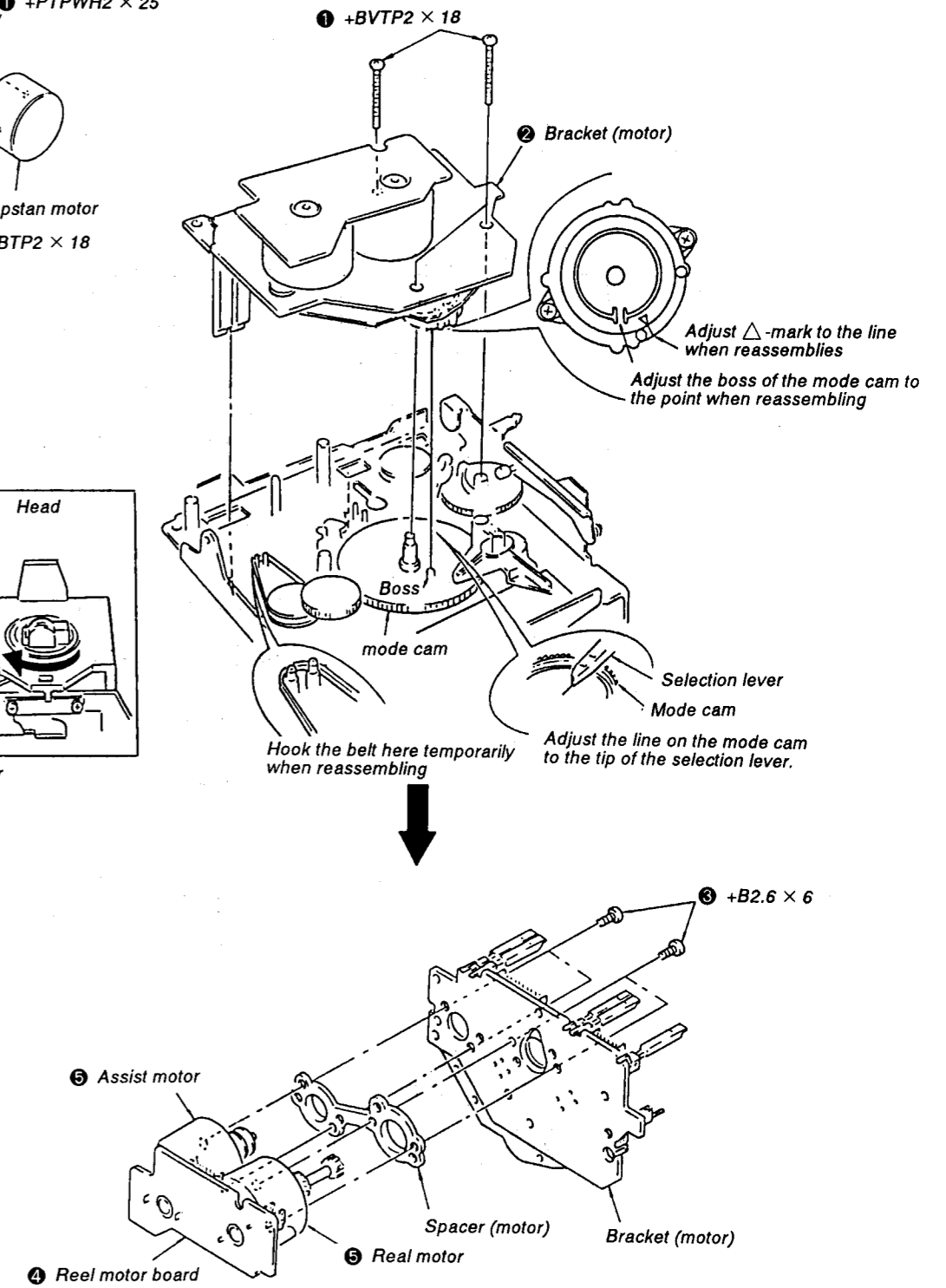


PINCH LEVER, HEAD



5 Turn the motor pulley by a finger and confirm that the head has turned in the direction of arrow.

REEL AND ASSIST MOTORS



## SECTION 3 ADJUSTMENTS

### 3-1. MECHANICAL ADJUSTMENTS

**PRECAUTION**

1. Clean the following parts with a denatured-alcohol-moistened swab :
 

|                      |              |
|----------------------|--------------|
| record/playback head | pinch roller |
| erase head           | rubber belts |
| capstan              | idler        |
2. Demagnetize the record/playback head with a head demagnetizer.
3. Do not use a magnetized screwdriver for the adjustments.
4. After the adjustments, apply suitable locking compound to the parts adjusted.
5. The adjustments should be performed in the rated power supply voltage unless otherwise noted.

#### Torque Measurement

| Torque              | Torque meter | Meter reading                      |
|---------------------|--------------|------------------------------------|
| FWD                 | CQ-102C      | 30 - 60g·cm (0.42 - 0.83oz·inch)   |
| FWD<br>Back tention | CQ-102C      | 1 - 5g·cm (0.014 - 0.063oz·inch)   |
| REV                 | CQ-102RC     | 30 - 60g·cm (0.42 - 0.83oz·inch)   |
| REV<br>Back tention | CQ-102RC     | 1 - 5g·cm (0.014 - 0.063oz·inch)   |
| FF, REW             | CQ-201B      | 65 - 90 g·cm (0.90 - 1.25 oz·inch) |

### 3-2. ELECTRICAL ADJUSTMENT

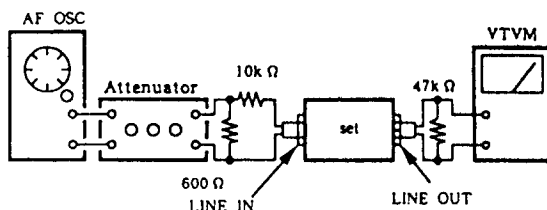
**Note:** The adjustment should be performed in the order given in the service manual. As a rule, adjustments about playback should be performed before those about recording.

The adjustments should be performed for both L-CH and R-CH.

- Switches and controls should be set as follows unless otherwise specified.
 

|                               |       |
|-------------------------------|-------|
| DOLBY NR switch               | : OFF |
| DIRECTION switch              | : →   |
| TIMER switch                  | : OFF |
| MPX FILTER switch (TC-WR97ES) | : OFF |
- Standard Record :  
Deliver the standard input signal level to the input jack and set the REC LEVEL control to obtain the standard output signal level.

—Record Mode—



**0 dB = 775mV**

#### Standard Input Level

|                  |               |
|------------------|---------------|
| input terminal   | LINE IN       |
| source impedance | 10k Ω         |
| input level      | 0.25V (-10dB) |

#### Standard Output Level

|                 |                   |
|-----------------|-------------------|
| output terminal | LINE OUT          |
| load impedance  | 47k Ω             |
| output level    | 0.32 V (- 7.7 dB) |

#### Test tape

| Type     | Signal       | Used for              |
|----------|--------------|-----------------------|
| P-4-A100 | 10kHz, -10dB | Azimuth Adjustment    |
| P-4-L300 | 315Hz, 0dB   | PB Level Adjustment   |
| WS-48B   | 3kHz, 0dB    | Tape Speed Adjustment |

The set will get into TEST MODE by shorting the pins of TP801 (TEST) on Main board before turning the power on, and TEST MODE functions as follows :

1. High speed playback  
Pressing HIGH SPEED (DUBBING) button while playback changes to high speed playback and another press of the button returns the set to normal speed playback.
2. Record memory stop  
When starting recording, tape counter is reset to zero and counter memory turned on.

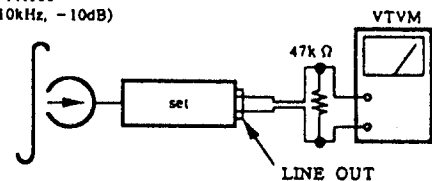
#### Record/Playback Head Azimuth Adjustment

**DECK A    DECK B**

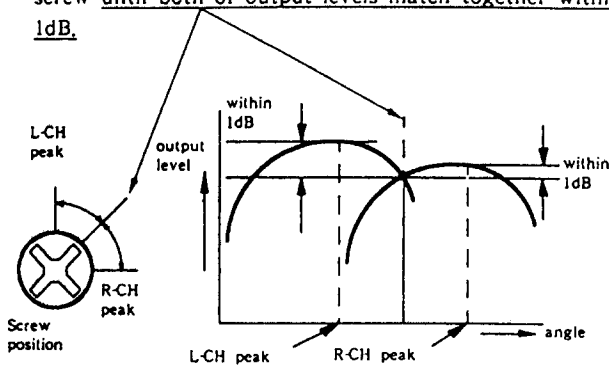
#### Procedure :

1. Mode : FWD playback

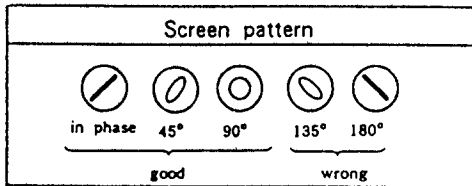
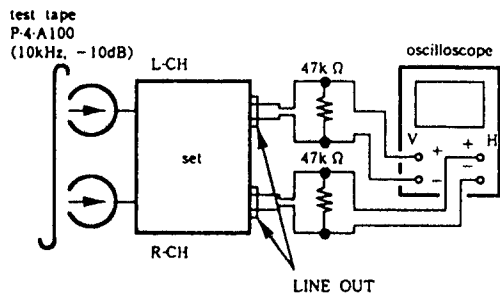
Test tape  
P-4-A100  
(10kHz, -10dB)



- Turn the adjustment screw for the maximum output levels. If these levels do not match, turn the adjustment screw until both of output levels match together within 1dB.

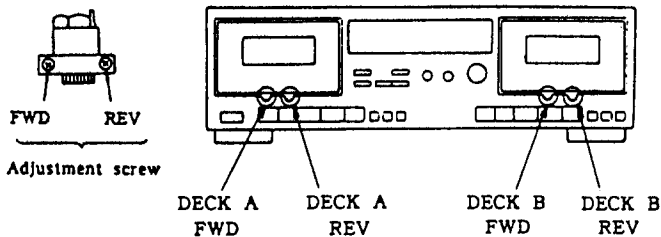


- Phase Check  
Mode : playback



- Set in the REV mode and repeat the step 1-3.
- After the adjustment, lock the screws with locking compound.

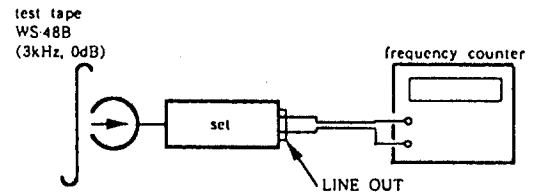
Adjustment Location : Record/Playback head



## Tape Speed Adjustment DECK A DECK B

Procedure :  
Mode : playback

Perform high speed adjustment before normal speed adjustment



(high speed adjustment)

- Short test pin TP801 (TEST) on Main board.
- Set to FWD playback mode.
- Press the HIGH SPEED DUBBING switch.
- Adjust RV871 (DECK A) and RV881 (DECK B) on Main board so that the frequency counter reading becomes  $6,000 \pm 30\text{Hz}$ .
- After adjustment, disconnect TP801 shorted in step 1.

(normal speed adjustment)

- Set to FWD playback mode.
- Adjust RV872 (DECK A) and RV882 (DECK B) on Main board so that the frequency counter reading becomes  $3,000 \pm 15\text{Hz}$ .

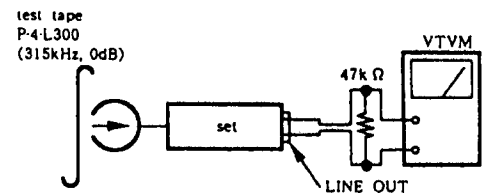
Frequency difference between the beginning and the end of the tape should be within 5%.

Frequency difference between deck A and deck B should be within 20 Hz (high speed) or 10 Hz (normal speed).

Adjustment Location: Main board

## Playback Level Adjustment DECK A DECK B

Procedure :  
Mode : playback



Adjust RV131 (L-ch) and RV231 (R-ch) for DECK A and RV151 (L-ch) and RV251 (R-ch) for DECK B so that the reading on VTVM meets the adjustment limits below.



**Adjustment Limits :**

LINE OUT level:  $-7.7 \pm 0.5\text{dB}$  (0.30 – 0.34 V)

Level difference between channels: less than 0.5dB

Check that the LINE OUT level does not change even if Playback and Stop operation is repeated several times.

Adjustment Location : MAIN board

**Bias Current Adjustment**

**Procedure :**

1. Set RV121 and RV221 (DECK A), RV141 and RV241 (DECK B) to mechanical center and turn the set recording mode.
2. Connect digital voltmeter as shown by the following table.
3. Adjust the following transformers for the minimum readings on the digital voltmeter.

| DECK |   | Mesurement Point | Adjustment | Value           |
|------|---|------------------|------------|-----------------|
| A    | L | ① and ②, TP521   | T121       | less than 80 mV |
|      | R | ② and ③, TP521   | T221       |                 |
| B    | L | ① and ②, TP541   | T141       |                 |
|      | R | ② and ③, TP541   | T241       |                 |

Adjustment Location : MAIN board

**Record Bias Adjustment** DECK A DECK B

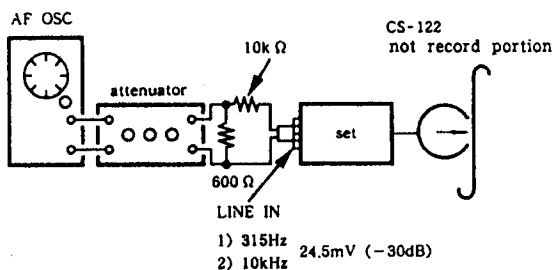
**Setting :**

REC LEVEL control : standard Record (See page 8.)

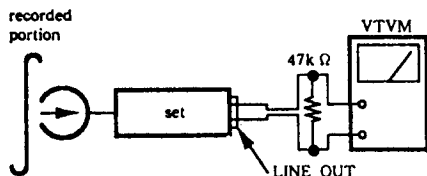
test pin TP801 : short

**Procedure :**

1. Mode : record



2. Mode : playback



Playback the signal recorded in step 1.

Confirm that the 10kHz playback output is  $0 \pm 0.5\text{dB}$  relative to the 315Hz output. If necessary, adjust RV121 (L-ch) and RV221 (R-ch) for DECK A and RV141 (L-ch) and RV241 (R-ch) for DECK B, and repeat the steps given above.

Adjustment Location : MAIN board

**Record Level Adjustment** DECK A DECK B

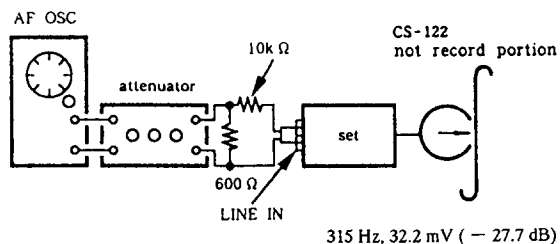
**Setting :**

REC LEVEL control : Standard Record (See page 8.)

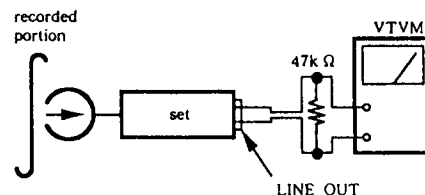
test pin TP801 : short

**Procedure :**

1. Mode : record



2. Mode : playback



3. Playback the signal recorded in step1.

Confirm that the signal level is within the adjustment limits below.

If necessary, adjust RV301 (L-ch) and RV401 (R-ch) for DECK A and RV351 (L-ch) and RV451 (R-ch) for DECK B, and repeat the step1-2.

**Adjustment Limits:**  $-27.7 \text{ dB} \pm 0.5 \text{ dB}$  (30.4 – 34.2 mV)

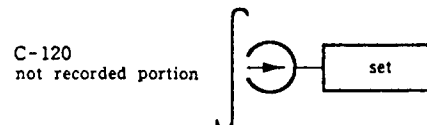
**Adjustment Location:** Main board (component side)

**Quick Reverse Sensitivity Adjustment** DECK A DECK B

**Conditions :**

DIRECTION MODE switch :  $\rightleftarrows$

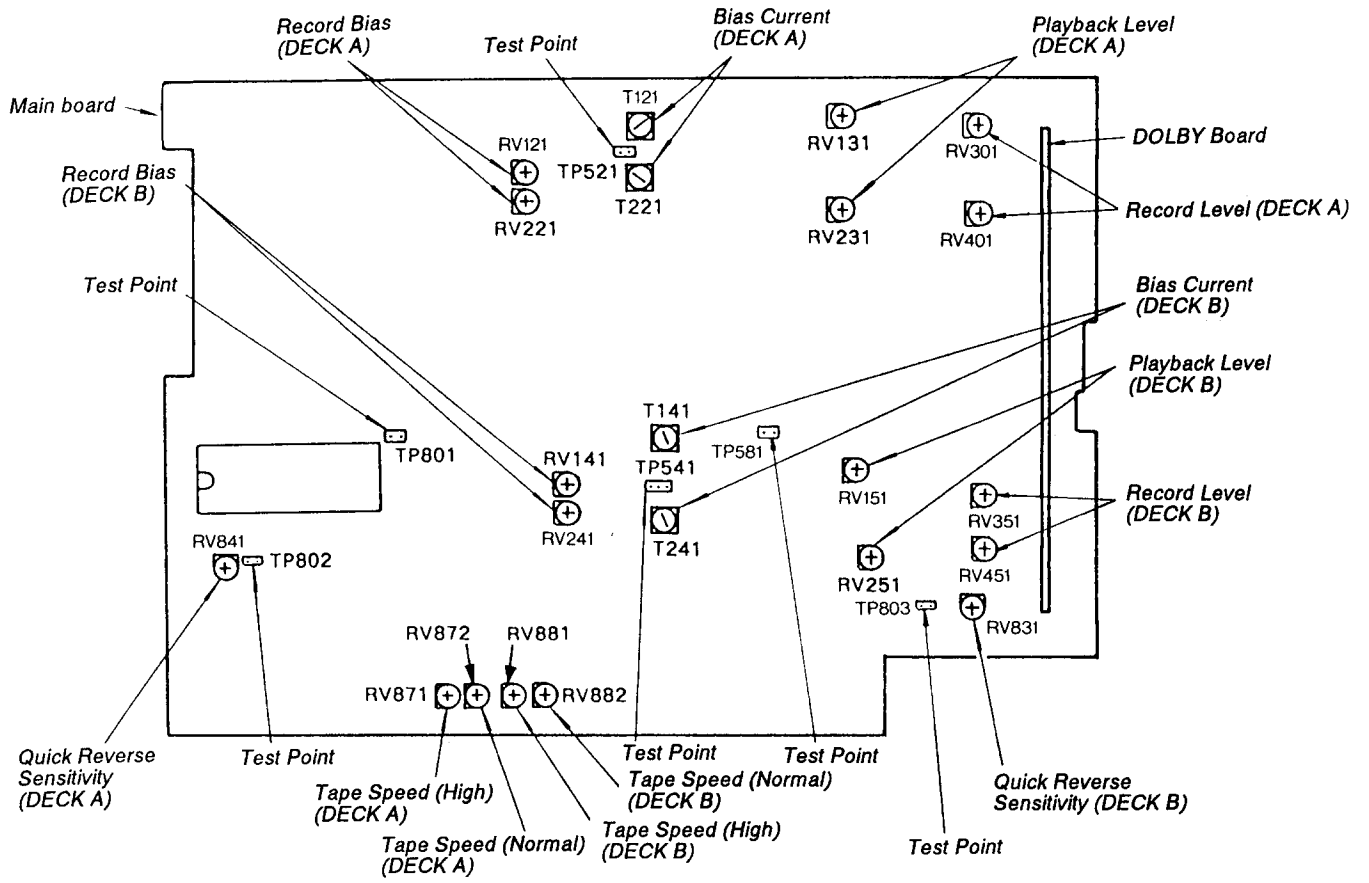
**Adjustment procedure :**



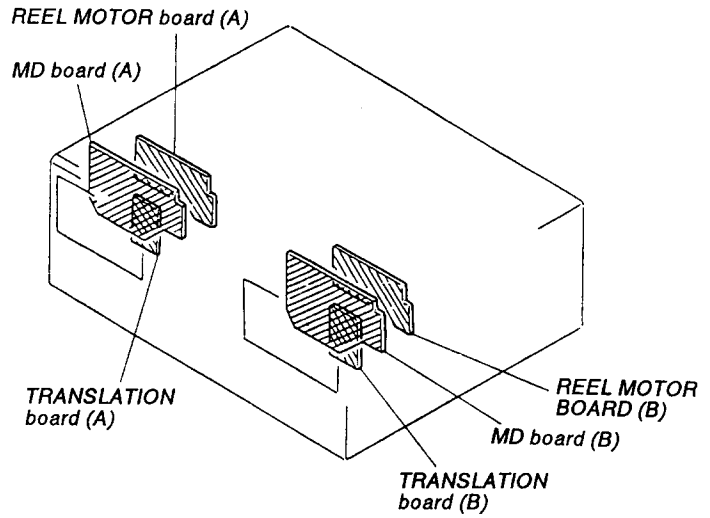
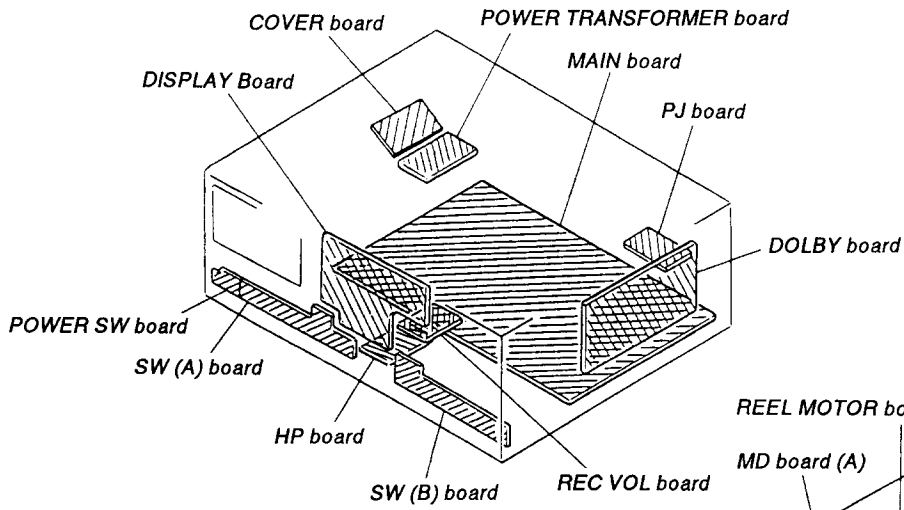
1. Connect the digital voltmeter to test point TP802 (DECK A) / TP803 (DECK B).
2. Load C-120 tape cassette and playback the leading portion in FWD mode.
3. Adjust the RV841 (DECK A), RV831 (DECK B) for  $4.5 \pm 0.5\text{V}$  reading on the digital voltmeter.
4. Playback C-120 tape cassette in FWD mode again.
5. Confirm that the reading on the digital voltmeter is "L" level at the magnetic portion of the tape.
6. Confirm that the tape stop around the tape end (border of the leading and the magnetic portions).

Adjustment Location : MAIN board

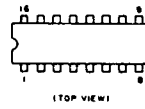
**Adjustment Parts Location Diagram**



● Circuit Boards Location

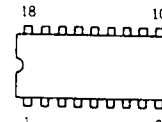


CXA1198AP  
MC14053BCP  
TC4051BPHB



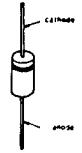
(TOP VIEW)

$\mu$  PC1297CA

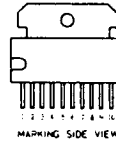


(Top view)

UZL-11H2  
10E2N



LB1641  
BA6219B

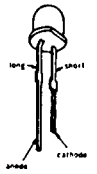


MARKING SIDE VIEW

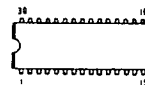
DTA114ES  
DTA144ES  
DTC114ES  
DTC143TS  
2SA1317-STU  
2SC2603-EF  
2SC2144S  
2SD2144S



SEL2210S-D

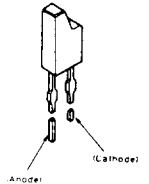


CXA1331S



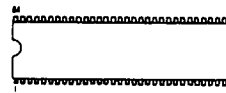
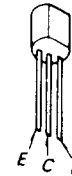
(Top view)

SLR-314D



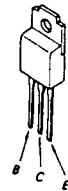
HD614023SA85  
M50747-B83SP  
M50944-160SP

2SB1116A-L  
2SC2001-LK

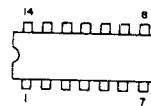


(Top view)

2SB1370-EF

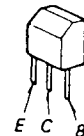


MC14066BCP  
 $\mu$  PD4011BC

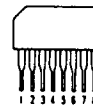


(TOP VIEW)

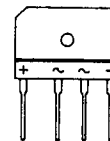
2SD1312-K



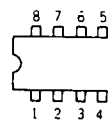
M5218AL



D2SB20



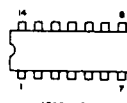
M5218AP  
RC4558P  
 $\mu$  PC4570C-1



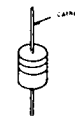
(Top view)

HZS6A1L  
HZS6B3L  
HZ6C3L  
HZ9A2L  
1SS120

TC4071BP



(TOP VIEW)



**NOTE:**

- -XX and -X mean standardized parts, so they may have some difference from the original one.

- Color Indication of Appearance Parts  
Example:  
KNOB, BALANCE (WHITE) ... (RED)

Parts Color      Cabinet's Color

- Items marked "\*" are not stocked since they are seldom required for routine service. Some delay should be anticipated when ordering these items.

- The mechanical parts with no reference number in the exploded views are not supplied.

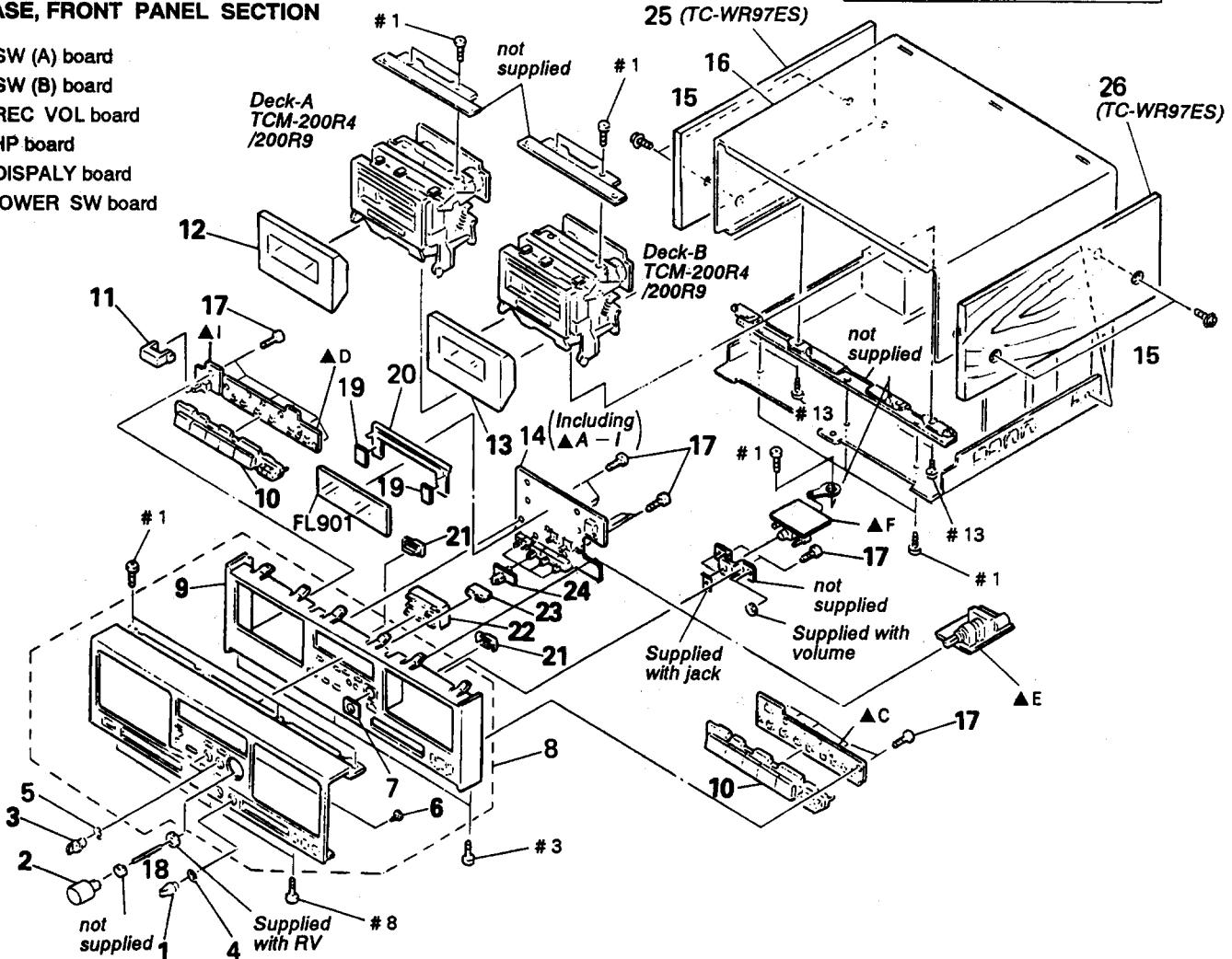
- Hardware (# mark) list is given in the last of this parts list.

The components identified by mark  $\Delta$  or dotted line with mark  $\Delta$  are critical for safety. Replace only with part number specified.

Les composants identifiés par une marque  $\Delta$  sont critiques pour la sécurité. Ne les remplacer que par une pièce portant le numéro spécifié.

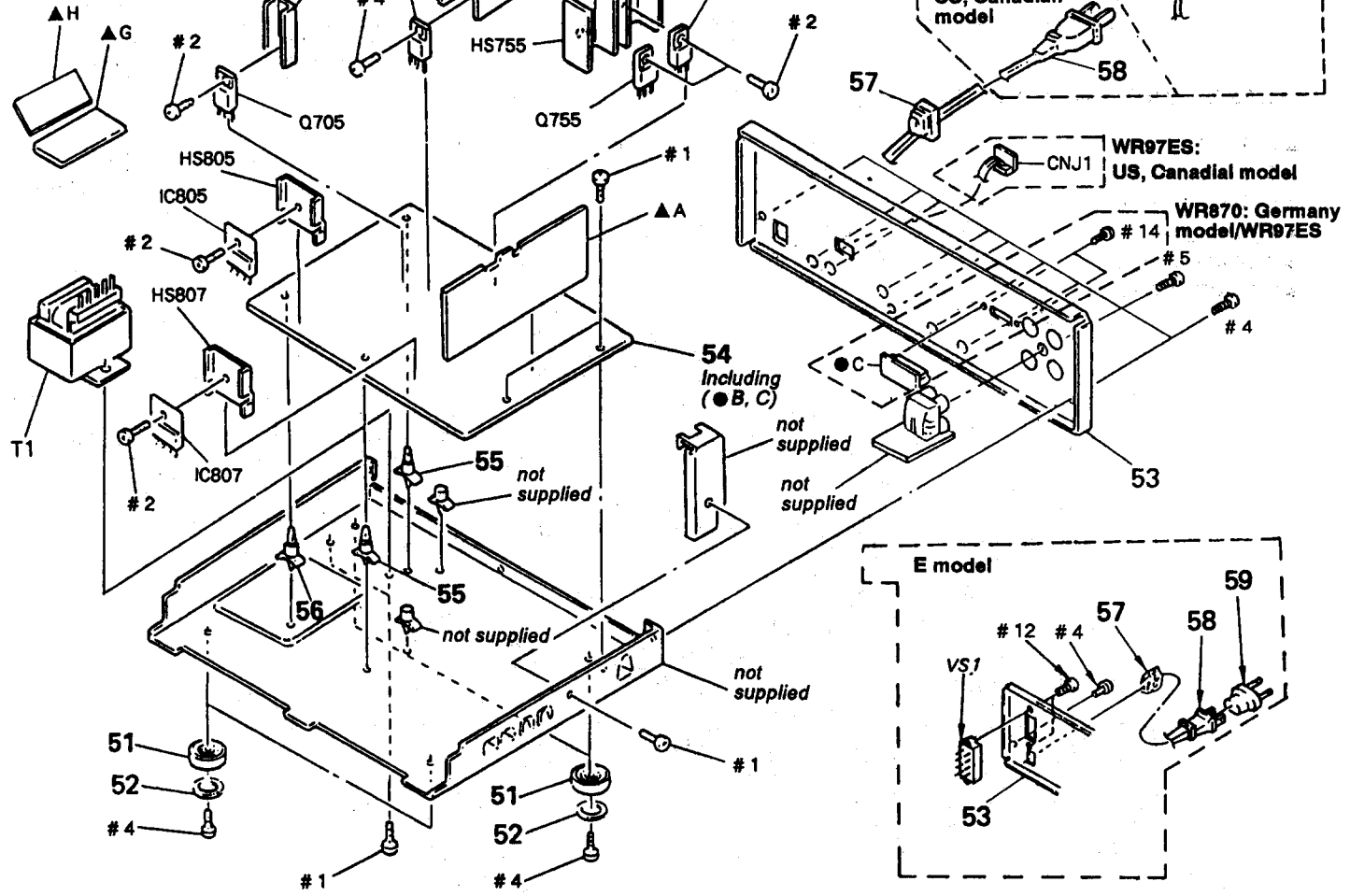
**(1) CASE, FRONT PANEL SECTION**

- $\blacktriangle$  D: SW (A) board
- $\blacktriangle$  C: SW (B) board
- $\blacktriangle$  E: REC VOL board
- $\blacktriangle$  F: HP board
- $\blacktriangle$  B: DISPLAY board
- $\blacktriangle$  I: POWER SW board



## (2) CHASSIS SECTION

- ▲ A: DOLBY board
- ▲ G: POWER TRANSFORMER board
- ▲ H: COVER board
- B: PJ board
- C: MPX SW board

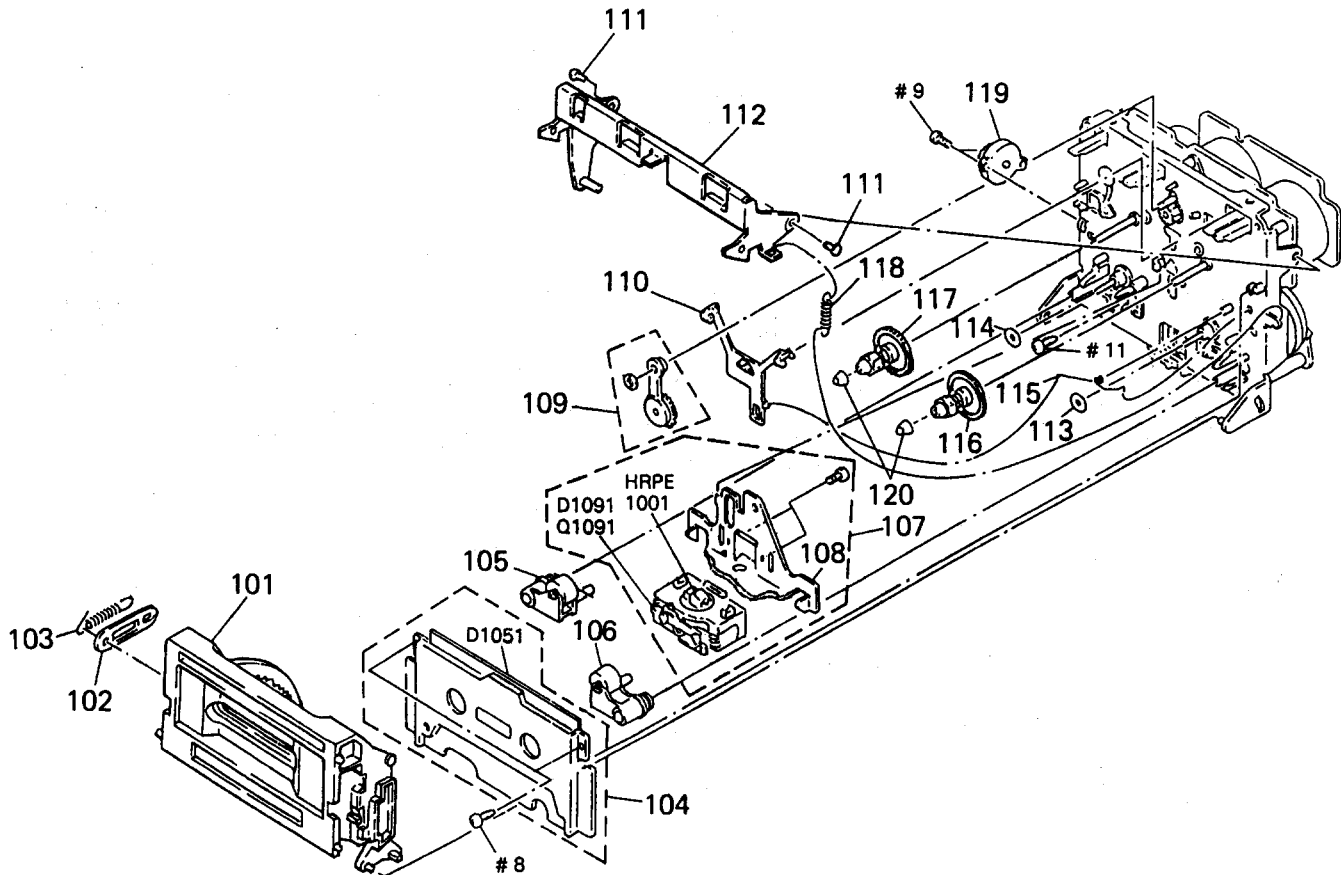


**(3) MECHANISM DECK SECTION 1**

**TCM-200R4: TC-WR97ES; US, Canadian**

**TCM-200R9: TC-WR97ES; E**

**(TC-WR870; AE, UK Germany)**



**(4) MECHANISM DECK SECTION 2**

**(TCM-200R4: TC-WR97ES; US, Canadian Model)  
(TCM-200R9: TC-WR870, TC-WR97ES; E Model)**

