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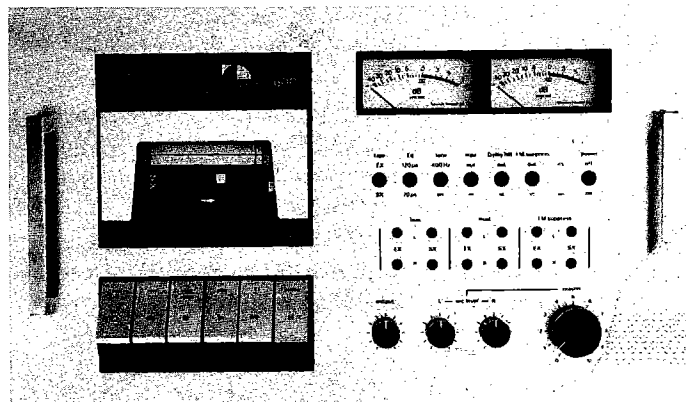
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Service Manual

Nakamichi 600

2Head Cassette Console



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1. GENERAL

Nakamichi 600 control functions are shown with reference to the following explanations.

For keeping the optimum performance of Nakamichi 600, maintenance such as cleaning of head, capstan shaft and pressure roller, and demagnetization of heads, lubrication, etc. is required.

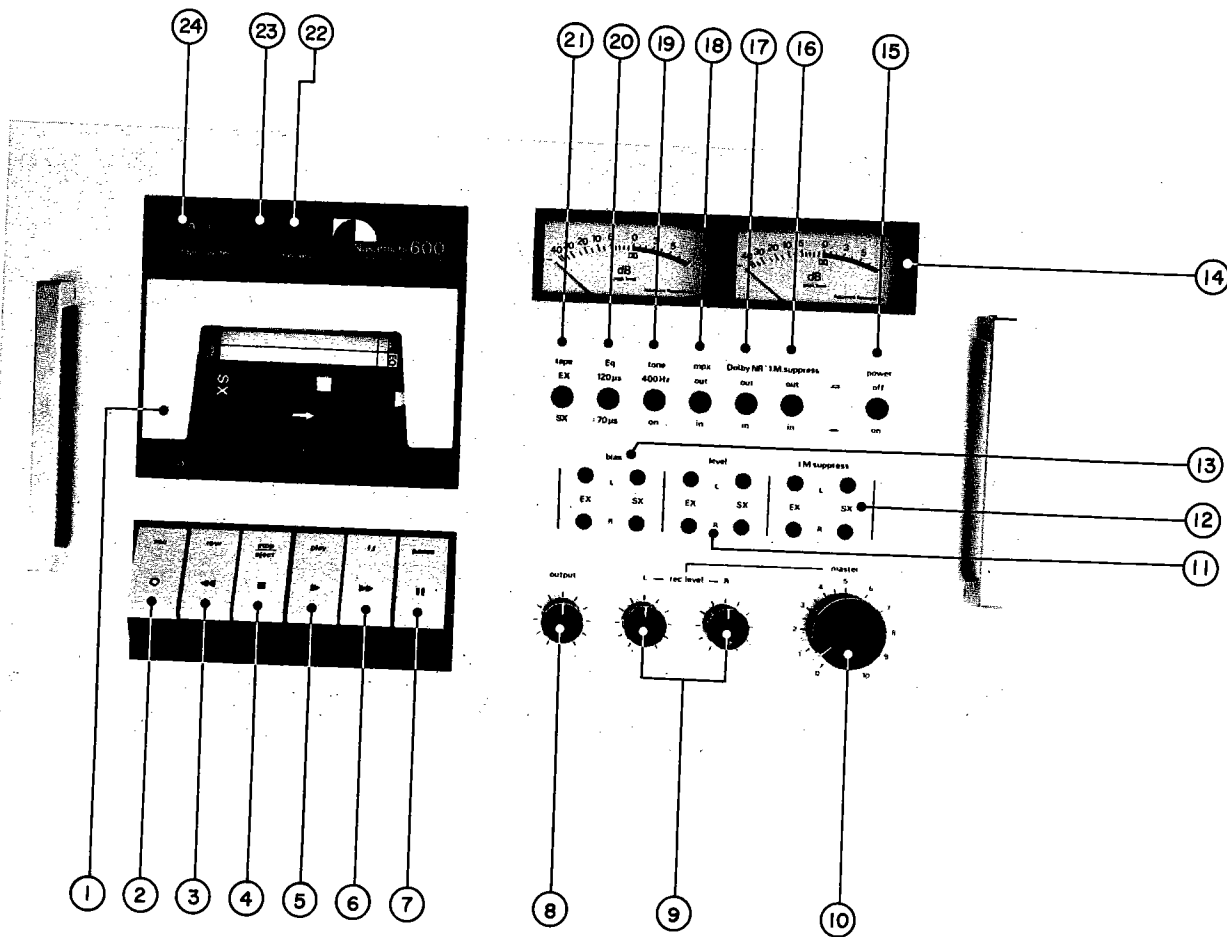


Fig. 1. 1 Front View

- | | |
|----------------------------------|-------------------------------|
| 1. Cassette Lid | 15. Power Switch |
| 2. Record Button | 16. I. M. Suppress Switch |
| 3. Rewind Button | 17. Dolby NR Switch |
| 4. Stop/Eject Button | 18. MPX Switch |
| 5. Playback Button | 19. Tone Switch |
| 6. Fast Forward Button | 20. Eq. Switch |
| 7. Pause Button | 21. Tape Switch |
| 8. Output Level Control | 22. Tape Start Memory Switch |
| 9. Input Level Controls (L/R) | 23. Tape Counter Reset Button |
| 10. Input Level Control (Master) | 24. Tape Counter |
| 11. Record Level Cal. Volume | 25. Line Input Jacks |
| 12. I. M. Suppress Cal. Volume | 26. DIN Socket |
| 13. Bias Adj. Volume | 27. Line Output Jacks |
| 14. Peak Level Meter | 28. Voltage Selector |

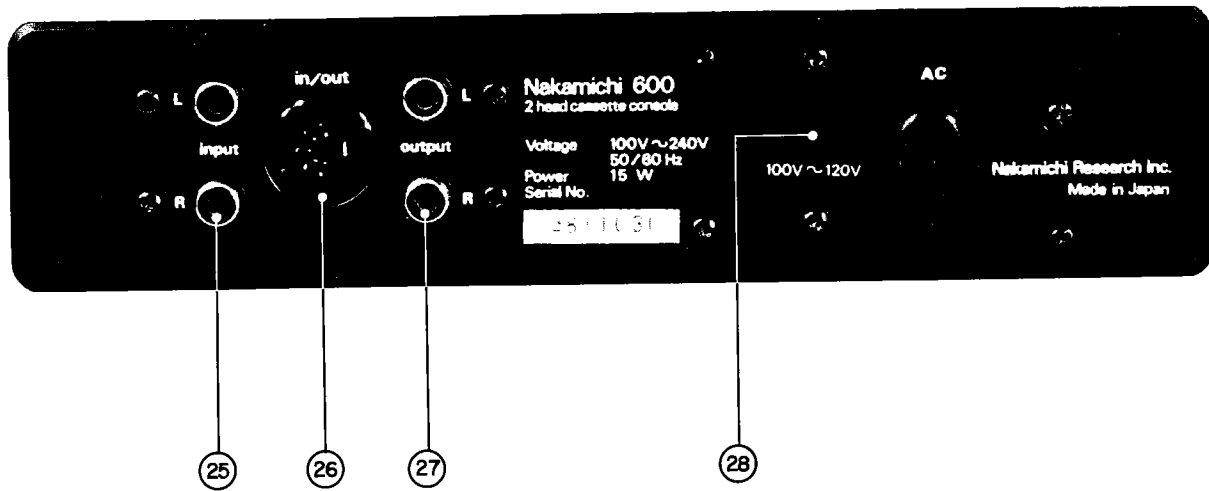


Fig. 1.2 Rear View

Voltage Selector

Change-over either to 100 ~ 120V or 220V ~ 240V.

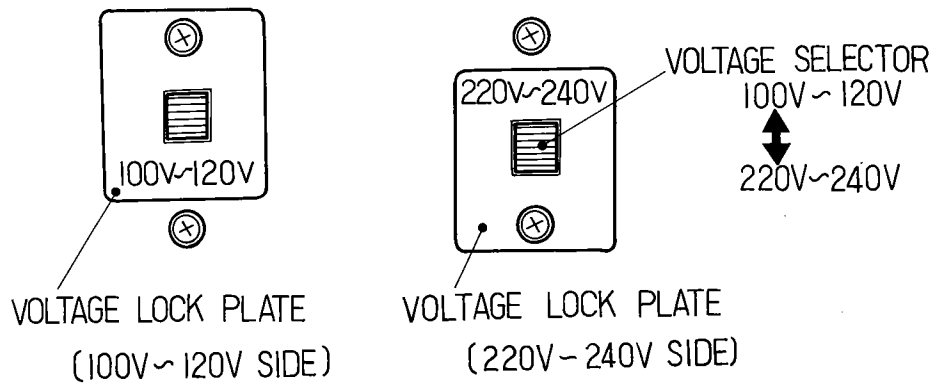


Fig. 1.3

Note 1: When cassette lid is opened, no control button operates.

Note 2: When mechanism ass'y is reassembled, check to insure whether the record link ass'y (see Fig. 9.2.2) is fixed to the correct position, i.e. when record button is depressed (cassette is loaded), record link acts.

Note 3: When memory counter indicates "000" to "010" memory rewind stop function (stops at "999") does not operate because of lacking in the electric charge for the capacitor (Shut-off P.C.B.) which will conduct to drive the solenoid.

Note 4: Dolby NR under license from Dolby Laboratories Inc. The word "DOLBY NR" and the Double-D-Symbol are trademarks of Dolby Laboratories Inc.

2. PRINCIPLE OF OPERATION

2.1. P.B. Eq. Amp. Circuit

Fig. 2.1.1 shows the playback equalizer circuit, and Fig. 2.1.2 is its system diagram. Fig. 2.1.3 shows the time constant of equalizer. The playback head is connected with circuit's input.

Amplifier 1 (Q101 and Q102) is an equalizer amplifier and its time constant is illustrated in Fig. 2.1.3.

R, L and C compose a peaking circuit. This circuit compensates the air gap loss of the playback head so that high-frequency response may be improved.

Phase shifter acts to compensate the phase delay characteristics of the frequency response. Phase delay characteristics are improved within 30 degrees up to 10KHz. Therefore modulation for the complex wave will reduce.

P.B. Eq. Amp. gain is adjusted by semi-fixed volume VR101 (Amp. 2-Q104, 105) to obtain 580mV output level when 400Hz P.B. Reference Tape (DA09005A) is being played back.

I.M. Suppressor circuit (Intermodulation Suppressor) is located between Amp 2 and Amp 3 (Q106), and circuit is connected with front panel I.M. Suppress "In" and disconnected from "Out". Refer to the item 2.2, I.M. Suppressor circuit.

Equalizer switch (70μ/120μ) is connected with Amp3.

The overall time constants in P.B. Eq. Amp. are as follows:

Eq. SW. — 70μs
 $3180\mu (50\text{Hz}) + 70\mu (2275\text{Hz})$

Eq. SW. — 120μs
 $3180\mu (50\text{Hz}) + 120\mu (1326\text{Hz})$

Shown below is the table for the position of tape switch and Eq. switch.

Tape SW.	Eq. SW.	Tape
SX	70μ	Nakamichi SX TDK SA
EX	120μ	Low-Noise High-Density (Including EX, EX II)
EX	70μ	Nakamichi EX, EX II

When 70μ is selected at EX tape position, signal to noise ratio will be improved by 4.7 dB (WTD).

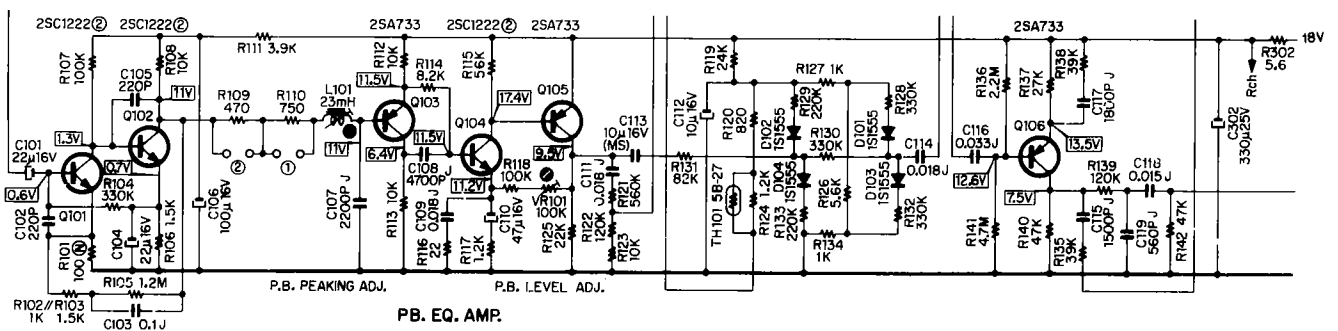


Fig. 2. 1. 1 P.B. Eq. Amp. Circuit

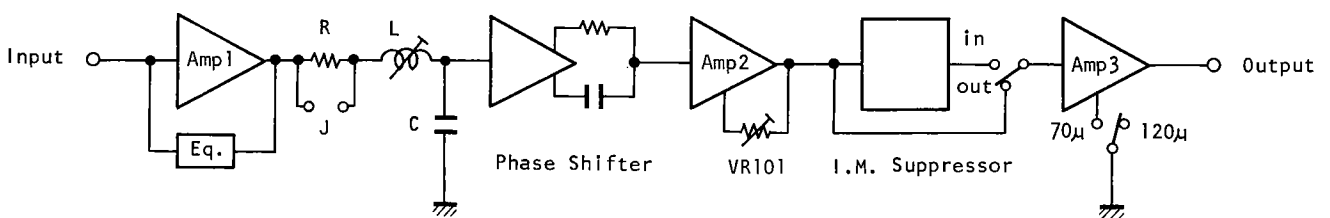


Fig. 2. 1. 2 P.B. Eq. Amp. System Diagram

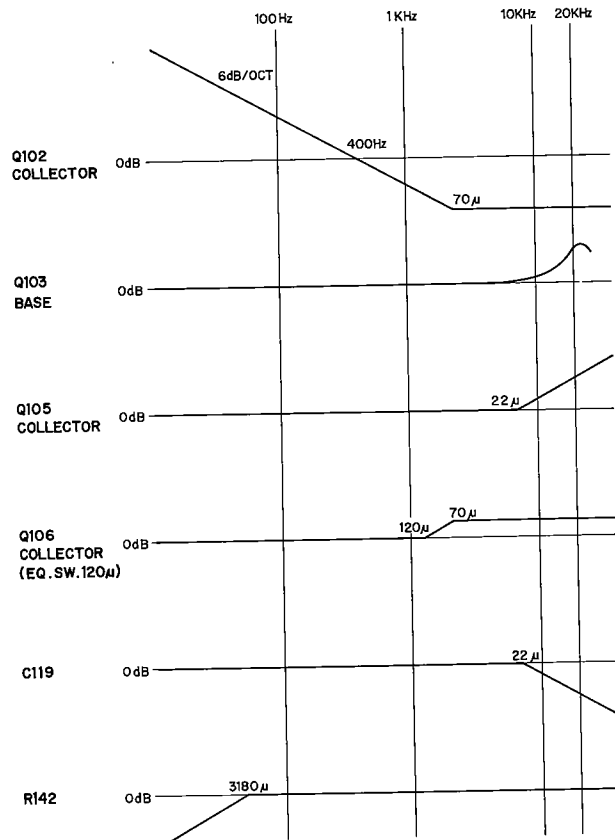


Fig. 2. 1. 3 P.B. Eq. Amp. Time Constant

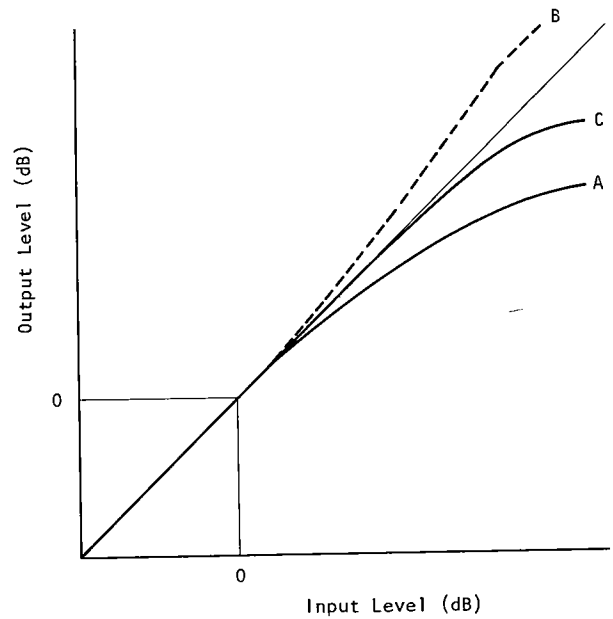


Fig. 2. 2. 1 I.M. Suppressor Input vs. Output Characteristics

2.2. I. M. Suppressor

Fig. 2.2.1 shows the input vs. output characteristics at 400Hz of Nakamichi 600.

While input level is small, output level is in proportion to input level. But when input level exceeds a certain point, output will not be in proportion to input but has a tendency to saturate (curve A) because of disadvantages due to the magnetic properties of tape.

I.M. Suppressor (Intermodulation Suppressor), while playing back playback amp. gain is compensated as shown by curve B so that overall characteristics becomes curve C. Curve C allows recording at higher levels than normally possible by reducing the saturation and distortion.

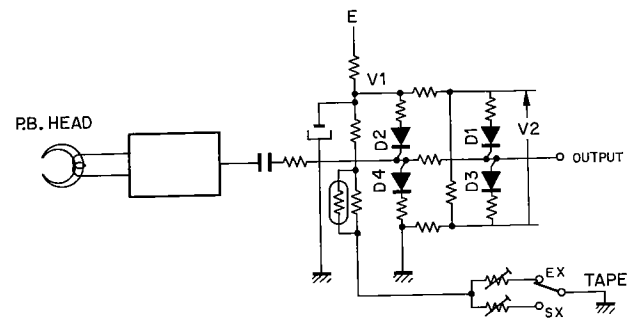


Fig. 2. 2. 2 I.M. Suppressor Circuit

I.M. Suppressor circuit is shown in Fig.2.2.2.

Circuit consists of resistors and diodes which are composed attenuator, and semi-fixed volume which determines the I.M. Suppressor action level.

The voltage (V1) is adjusted by semi-fixed volume to obtain minimum reading of total harmonic distortion at 400Hz 0dB for the tape to be used.

While input signal level is small, diodes D1 to D4 are On and static operating point level of the output signal is V1/2. When input signal exceeds V2/2, D1 and D3 are cut off. Accordingly attenuation decreases, i.e. gain increases. In case input signal exceeds V1/2, D2 and D4 are also cut off.

Diodes D1 to D4 act as variable resistors until it is cut off, because it is used at small electric current. And resistance varies according to the value of the applied voltage to the diode.

2.3. Unattended Record or Playback, and Shut-off Circuit

2.3.1. Unattended Record or Playback

- (1) Depress the record button then depress the play button (Depress only the play button for unattended playback).
- (2) Depress the pause button.
- (3) Turn Off the external power source.
- (4) When external power turns On, approximately 4 seconds after the transport will automatically release itself from the pause mode and begin to record (or play).

2.3.2. Shut-off Circuit

Fig. 2.3.1 and 2.3.2 show the shut-off circuit and timing chart. Fig. 2.3.3 shows the flow chart for the shut-off function.

Following are explanations according to the order of the flow chart Nos.:

(1) External Power On

When external power is turned On at attended record or playback mode, transistor Q606 turns to On approximately 4 seconds later. By the Q606 On, differentiated positive pulse is added to the Q602 base through capacitor C607.

Then Q602 turns to On and Q601 base current flows. Q601 turns to On and base current of the Q602 is supplied through Q601.

Therefore Q602 and Q601 construct memory circuit when trigger is added to the Q601 base.

When Q601 turns to On solenoid is driven through the charge of C606 (2200 μ F).

As resistance of the solenoid is about 12 ohm, an electric charge of C606 is discharged quickly while C606 is charging through resistor R615 (470 ohm). And about 70 msec after the voltage of Q601 collector becomes less than about 1.2V, then enough base current does not flow to the Q602 and therefore Q602 turns to Off and Q601 turns to Off.

C606 starts charging again preparing for the next solenoid drive.

From the above, solenoid works as a pulse motion. Solenoid action will release the pause button.

(2) Tape End

At a tape end, magnet pulley which is assembled with tape counter stops and therefore reed switch On/Off stops. Therefore the discharge of the C604 through Q604 (synchronizing with the periodic reed switch On/Off) stops. While C604 is kept to charge about by 4.5V, Q603 turns to On and Q601 turns to On.

The action of the solenoid is the same as item (1). Solenoid acts to release the play, record, FF and REW buttons (therefore start switch will open).

(3) Stop Button Depressing

When stop button is depressed, play, record, FF and REW buttons are released mechanically.

(4) Power Off

DC power supply (+18V) will discharge by the power switch off. While the C606 time constant is great, Q605 turns to On then Q603 turns to On then Q601 turns to On.

Solenoid is driven and control buttons are released.

In case pause button is depressing, solenoid does not work because Q603 base is connected to ground through pause button, and no control button is released.

(5) Memory Rewind

When the tape counter reaches "999" counter switch closes. At memory switch On and rewind mode, the differentiated negative trigger pulse is added to the Q601 base and Q601 turns to On. And solenoid is driven.

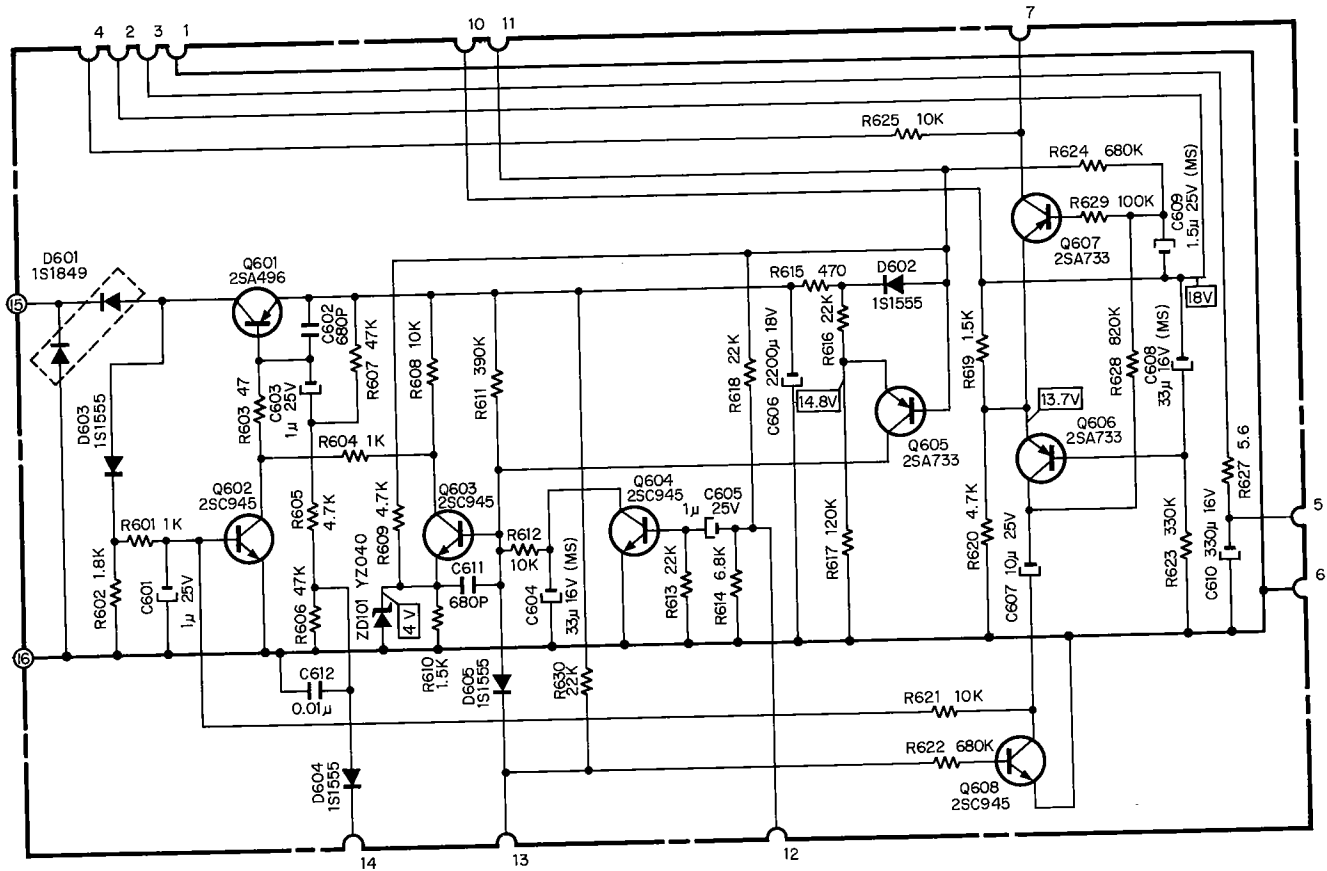


Fig. 2. 3. 1 Shut-off Circuit

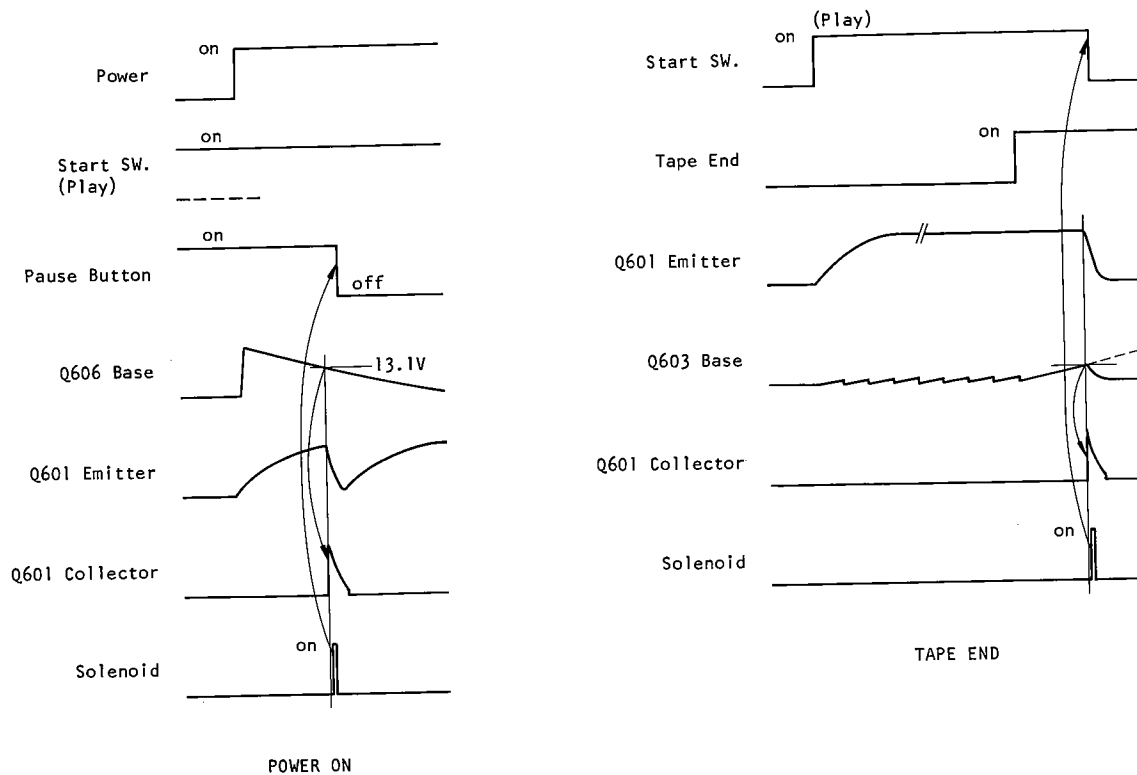


Fig. 2. 3. 2 Shut-off Timing Chart

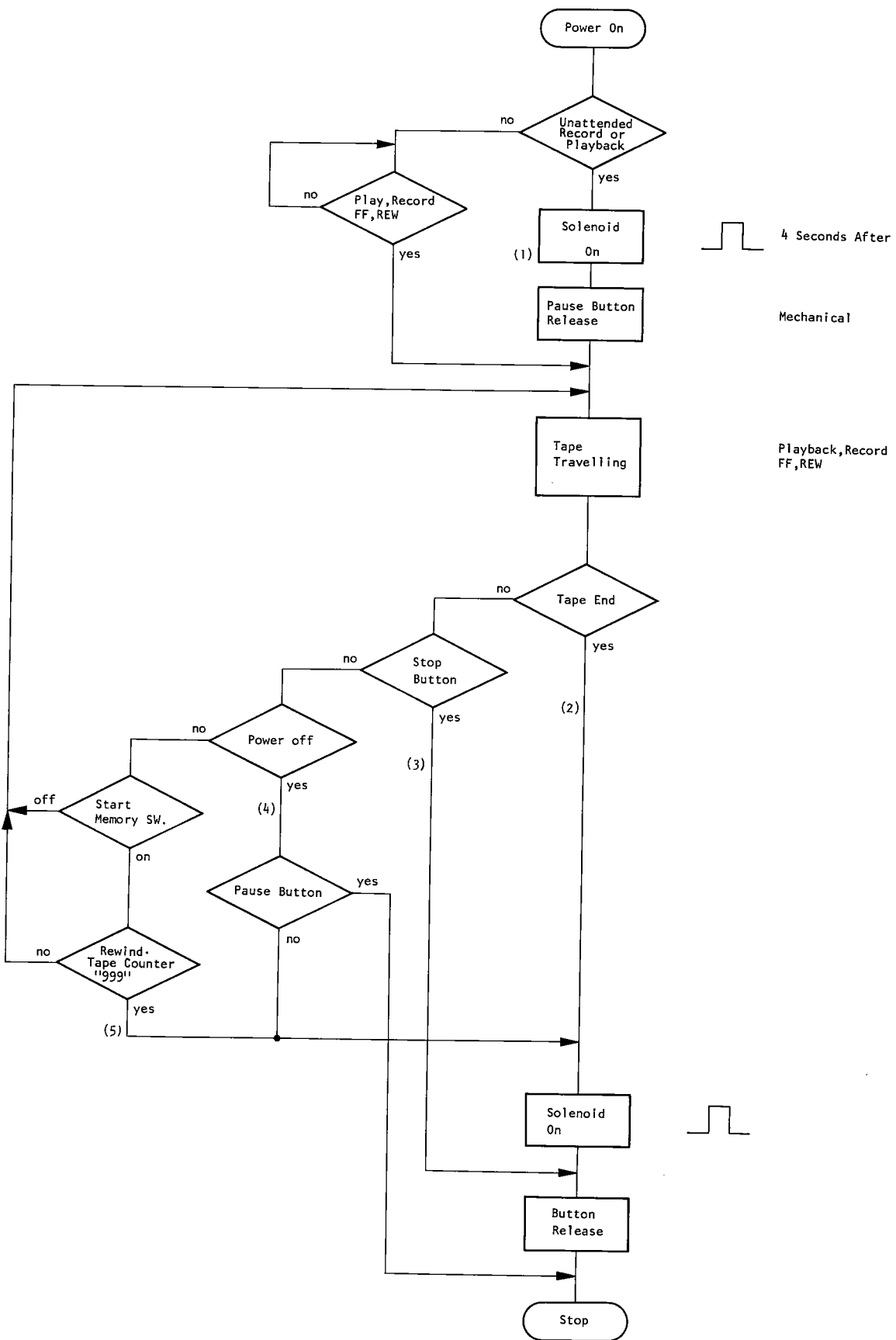


Fig. 2. 3. 3 Shut-off Flow Chart

3. REMOVAL PROCEDURES

3.1. Cabinet

Refer to the Fig. 9.1 (A01) and remove (F01) (five spots).

3.2. Front Panel

Refer to the Fig. 9.1 (A01) and remove (F01) through (F06).

3.3. Mechanism Ass'y

Remove the cabinet and front panel (3.1, 3.2).
Refer to the Fig. 9.2.1 (A02-1) and remove (F01) through (F03).

3.4. Record/Playback Head, Erase Head and Pressure Roller

Remove the cabinet and front panel (3.1, 3.2).
Then depress the play button.
Refer to the Fig. 3.1.

3.4.1. Record/Playback Head

Remove (F02) through (F04).

3.4.2. Erase Head

Remove (F05) through (F08).

3.4.3. Pressure Roller

Remove (F01).

Note: When record/playback head is replaced, twist the signal wires (red and white) which are soldered to head terminals for reducing the influence of hum.

3.5. Cassette Case Ass'y

Remove the mechanism ass'y (3.3).
Refer to the Fig. 3.2 and remove (F01) through (F07).
Remove (F04) and (F05) by pincers with care.

3.6. Cassette Lid Ass'y

Remove the cassette case ass'y (3.5).
Refer to the Fig. 3.2 and remove (F08) through (F12).
(F13), lid cover is bonded to (F12).

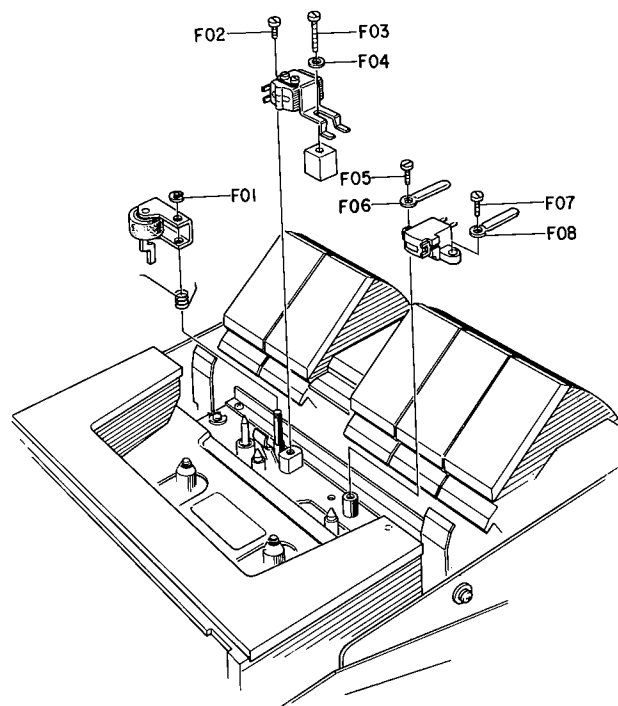


Fig. 3.1

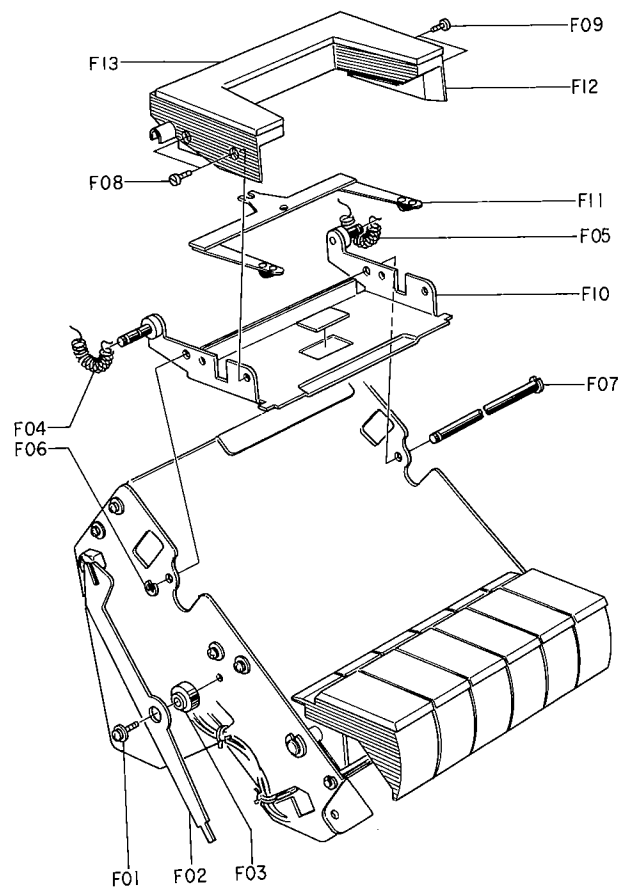


Fig. 3.2

4. MEASUREMENT AND MAINTENANCE INSTRUMENTS

4.1. Measurement Instruments

- (1) Audio Generator (20 Hz – 200 KHz)
- (2) AC Milivolt Meter (with dB measures)
- (3) Oscilloscope (DC – 5 MHz)
- (4) Distortion Meter
- (5) Speed & Wow/Flutter Meter
- (6) Frequency Counter (DC – 1 MHz)
- (7) Ohm Meter
- (8) DC Volt Meter
- (9) AC Volt Meter
- (10) Tape Travelling Cassette B (part No. DA09027A)
- (11) Torque Gauge (DA09013A)
- (12) 15 KHz Azimuth Tape (DA09004A)
- (13) 3 KHz Speed & Wow/Flutter Tape (DA09006A)
- (14) 1 KHz Track Alignment Tape (DA09007A)
- (15) 400 Hz Level Tape (DA09005A)
- (16) 20 KHz P.B. Frequency Response Tape (DA09001A)
- (17) 15 KHz P.B. Frequency Response Tape (DA09002A)
- (18) 10 KHz P.B. Frequency Response Tape (DA09003A)
- (19) Reference EXII Tape (DA09021A)
- (20) Reference SX Tape (DA09025A)
- (21) Track Viewer (DA09012A)
- (22) Tape Guide Adjuster (OD09001A)
- (23) Information Terminals, Model M-300
(For positioning of record/playback head)

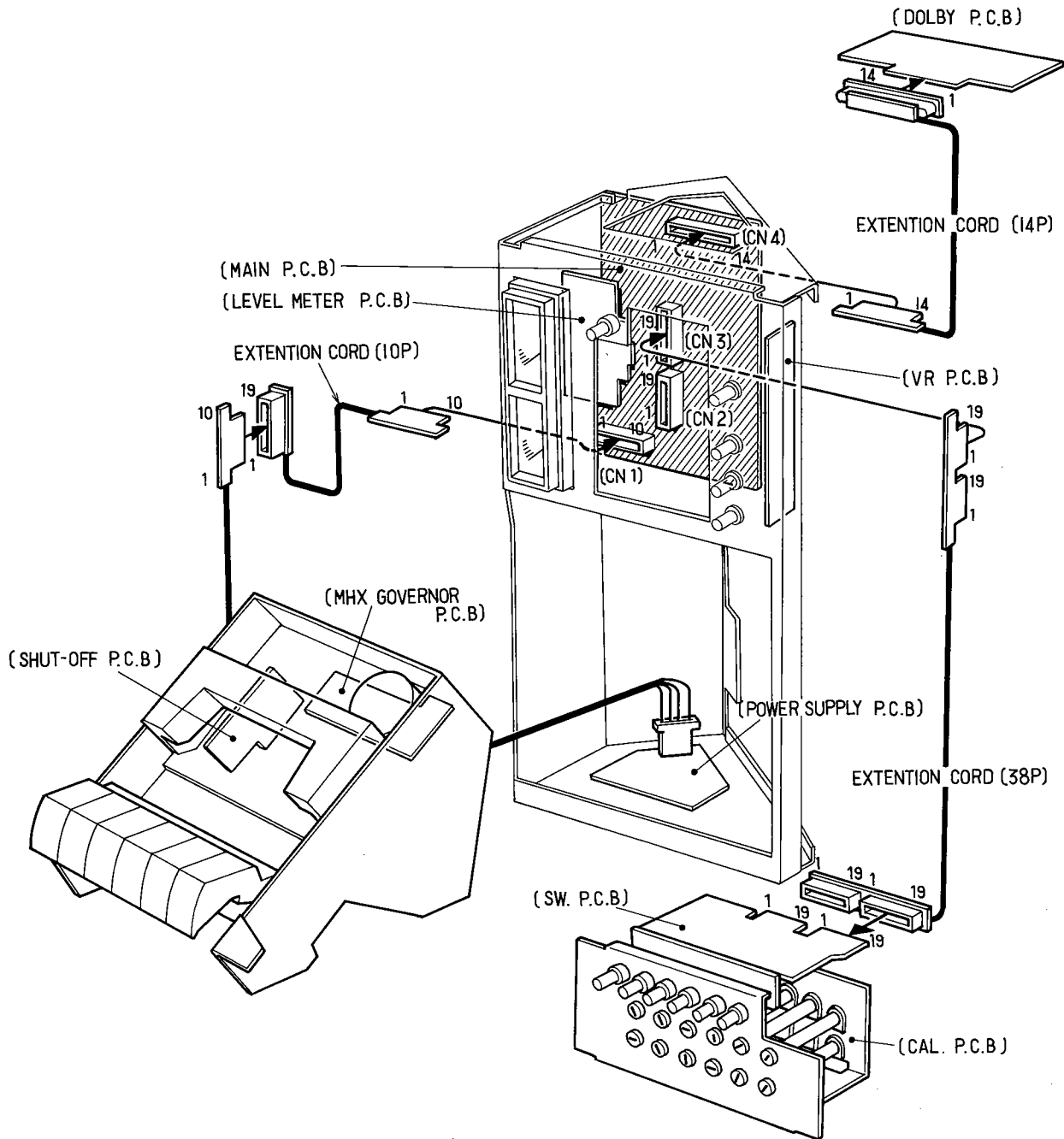
4.2. Maintenance Instruments

Refer to the Fig. 4.1 Extension Cord Connection.

- (1) Extension cord (10p) (part No. DA09020A)
- (2) Extension cord (14p) (DA09016A)
- (3) Extension cord (38p) (DA09026A)

Note: Refer to the item 3 "Removal Procedures".

When a check is made on Amp. etc. by means of an extension cord, re-adjustment shall be made without fail (after final installation to the model chassis). The check without removal of an extension cord will cause inaccurate adjustments.



PERSPECTIVE VIEW

Fig. 4 Extension Cord Connection

5. MECHANICAL ADJUSTMENTS

5.1. Take-up Torque and Rewind Torque Adjustment

To adjust torque, move torque plate as shown in the Fig. 5.1. The take-up torque should be 45 ± 10 g-cm and rewind torque should be 35 to 60g-cm.

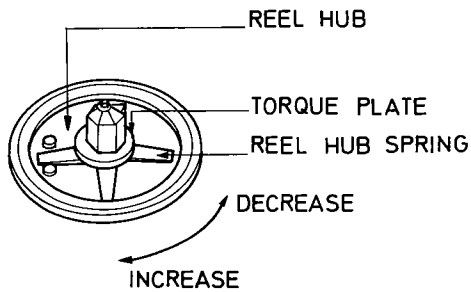


Fig. 5. 1

5.2. Tape Speed Adjustment

- (1) Connect a frequency counter to the output jack.
- (2) Load the 3KHz Speed Wow Flutter Tape (DA-09006A) and play it back.
- (3) Adjust the tape speed adjust potentiometer. See Fig. 5.2.

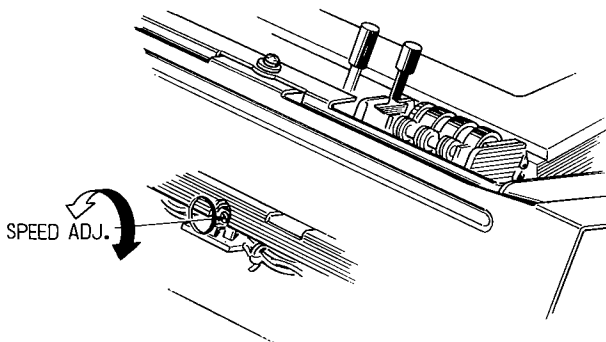


Fig. 5. 2

5.3. Record/Playback Head Height Adjustment and Azimuth Alignment

See Fig. 5.3.

- (1) Load the Track Viwer (DA09012A) and check the positions of record/playback head. Check to insure that the L-R center of head coincides in position with the middle point between two lines (0.3mm distance) on the track viwer.
- (2) If the L-R center deviates from the middle point over 0.2mm. Correct the deviation by adding a head height spacer as illustrated in the item 9.18 (B09).
- (3) Connect a VTVM to output jacks.
- (4) Load the 1KHz Track Alignment Tape (DA09007A). Insert the Tape Guide Adjuster (OD09001A) into each hole of the tape guide beside the head. Adjust the jig for minimizing each output signal of the right and left channels.

- (5) Load the 15KHz Azimuth Tape (DA09004A). Adjust the azimuth alignment screw for maximizing each output signal of the right and left channels. After completion of the adjustment in this step, check the head height as directed in Step (4).

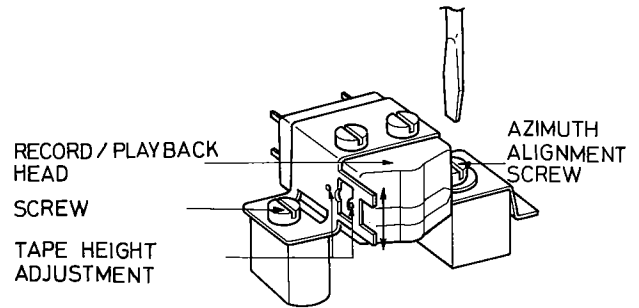


Fig. 5. 3

5.4. Head Base Stroke Adjustment

- (1) Remove the mechanism ass'y referring to the item 3.3, mechanism ass'y removal procedure.
- (2) Adjust the height of head base stroke adjustment plate as illustrated in Fig. 5.4 (Height Adj.).
- (3) Load the "INFORMATION TERMINALS M-300" jig for positioning the record/playback head, pushing backward to eliminate the clearance between reference pin and jig.
- (4) Depress the play button and check to insure whether the positioning of the head is within the specified tolerance. If not, adjust the head base stroke adjustment plate from the bottom side at stop mode. See Fig. 5.4 (Stroke Adj.).

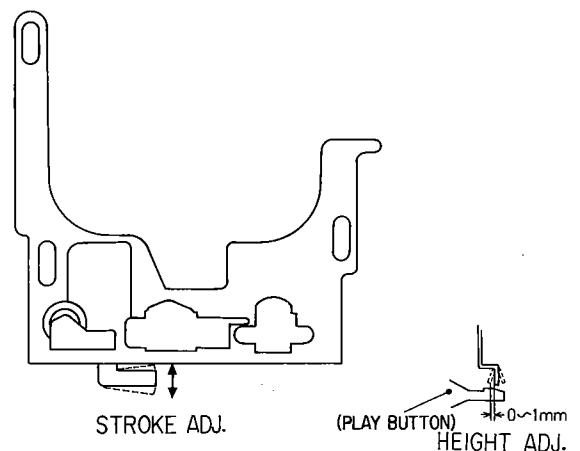


Fig. 5. 4

5.5. Pause Timing Adjustment

This adjustment is required for avoiding the tape spill or tape skip by the inaccurate pause timing.

See Fig. 5.5.

- (1) Set to the playback mode without loading the cassette tape.
- (2) Depressing the pause button gradually, check to insure the gap between pressure roller and capstan shaft which will be approximately 0.1mm when take-up pulley stops rotation because of changing mode from playback to pause.
- (3) In case above is not sufficient, remove the record link ass'y referring to the item 3.16, record link ass'y removal procedure. And adjust the pressure roller as illustrated in the figure.

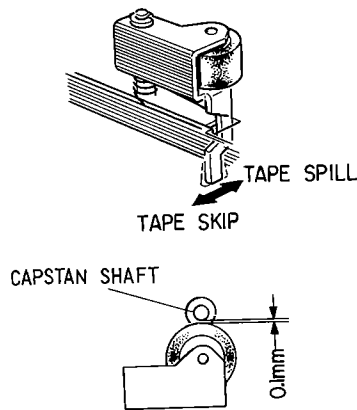


Fig. 5.5

5.6. Belt Travelling Adjustment

Refer to the Fig. 5.6 and item 3.10, motor and motor governor ass'y removal procedure.

- (1) Adjust the motor pulley position and check to insure whether the drive belt is travelling along the correct position and the staying at the correct position, i.e. the center part of motor pulley and the idler pulley without contacting the belt guide at the following modes:
Playback, FF, REW, FF to Stop, REW to Stop
- (2) In case motor pulley is tilting, insert spacers into the A, B (when belt slips upward on the motor pulley) or C (when belt slips downward).

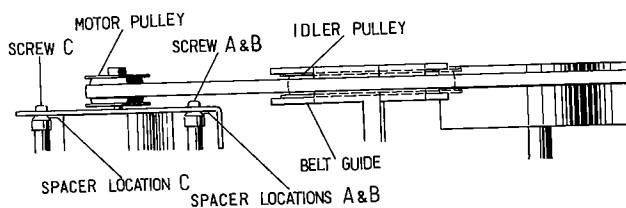


Fig. 5.6

5.7. Flywheel Adjustment

Refer to the Fig. 5.7 and item 3.1, cabinet removal procedure. Adjust the flywheel clearances should be 0.05 to 0.1 mm. After adjustment lock the lock nut.

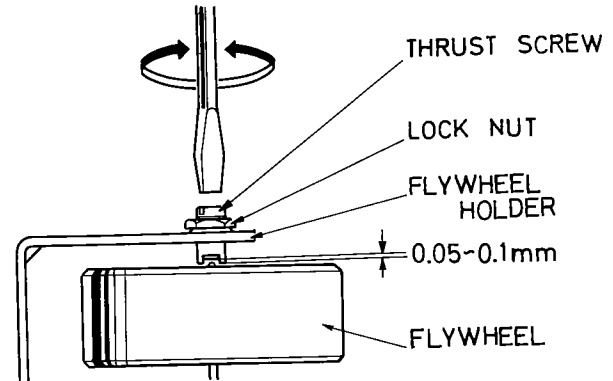


Fig. 5.7

5.8. Brake Timing Adjustment

Remove the cassette case referring to the item 3.5, cassette case ass'y removal procedure.

Refer to the Fig. 5.8.

Loosen screw A, and adjust the contact point between idler pulley and brake to meet each other when control button is depressed and mode is changed from FF to Stop, REW to Stop and Play to Stop.

Fasten screw A and check to insure the gap between idler pulley and brake is approximately within 0.2mm.

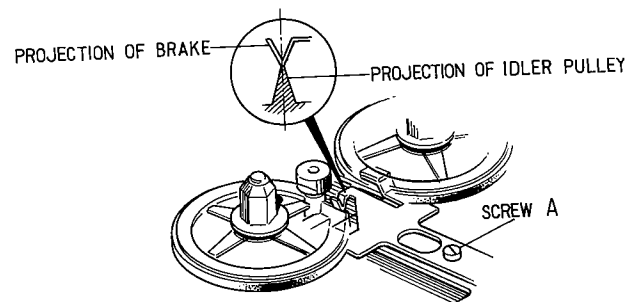


Fig. 5.8

5.9. Mute SW. and Start SW. Timing Adjustment

See Fig. 5.9. Following are each stage of status from stop mode to play mode. Adjust (bend) each transfer to obtain accurate movement.

Item 5.4, head stroke adjustment has to be performed prior to this adjustment.

(1) Stop

Mute SW. transfer 1-2 is open and start SW. transfers b-c, f-g and d-e are open. Others are close.

(2) Play Button Depressing Start

Mute SW. transfer 2-3 opens then start SW. transfer a-b will open.

(3) In the Course of Depressing

Mute SW. transfer 1-2 closes then start SW. transfers b-c and d-e will close.

(4) Depressing End

Mute SW. transfer 5, 6 will open from 4 simultaneously.

Check to insure the gap between 5, 6 and 4 is more than 0.5mm.

(5) At stop mode, check to insure the mute SW. transfer 2-3 touches sufficiently.

(6) Depress the rewind button and check to insure start SW. transfers a-b, d-e and f-g touch sufficiently.

If not, at stop mode bend the A in the figure and adjust the stroke.

5.10. Solenoid Position Adjustment

(1) Remove the mechanism ass'y referring to the item 3.3, mechanism ass'y removal procedure.

See Fig. 5.10.

(2) Loosen the screw a little and move the solenoid in the A direction.

(3) Depress the play button.

(4) Holding the solenoid as shown in the figure, slide the solenoid gradually by a flat screw driver in the B direction.

(5) Then play button will release. Move the solenoid approximately 0.1 to 0.3mm from the released point in the B direction. Fasten the solenoid.

(6) Assemble the mechanism ass'y and turn the power switch on. And check to insure whether the solenoid can be released at the Play, FF, REW and Pause modes.

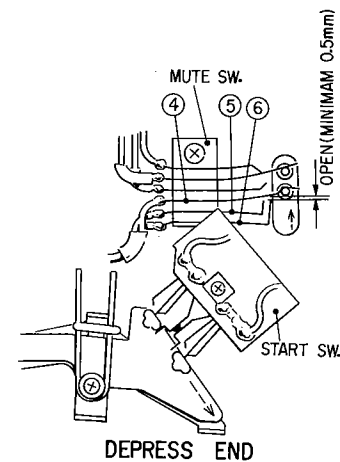
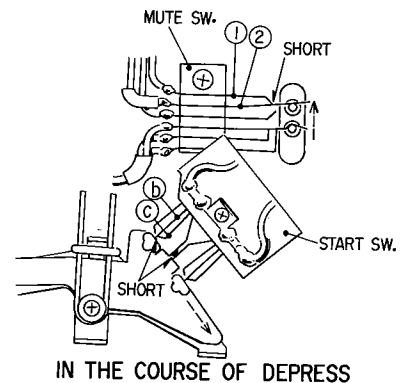
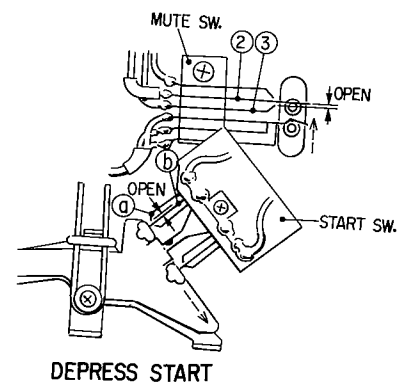
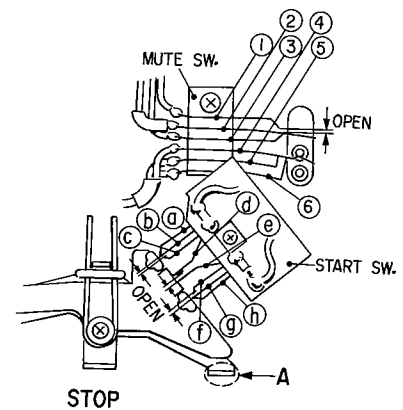


Fig. 5.9

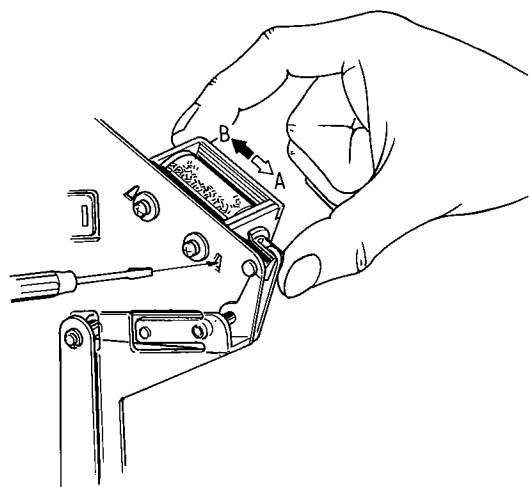


Fig. 5.10

5.11. Record Link Adjustment

Remove the cabinet referring to the item 3.1, cabinet removal procedure.

Adjust the record link referring to the Fig. 5.11.

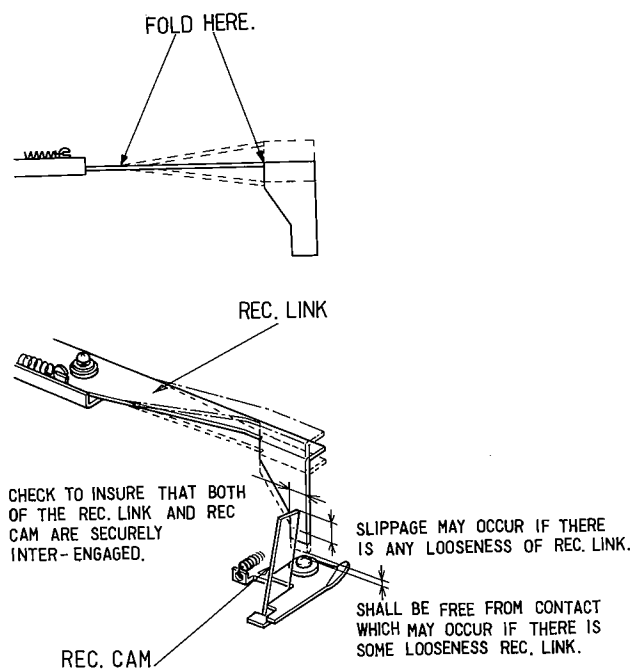


Fig. 5.11

5.12. Lubrication

After 500 hours of use apply a few drops of light machine oil (LAUNA No. 40) between capstan and capstan bearing. See Fig. 5.12.

After 500 hours of use apply a few drops of light machine oil (LAUNA No. 40) to the pressure roller shaft.

Note: If the lubrication oil is applied also to the capstan shaft and other drive mechanisms, clean it off with an alcohol-dipped cloth.

When flywheel or flywheel holder is replaced apply a few drops of grease to the flywheel holder.

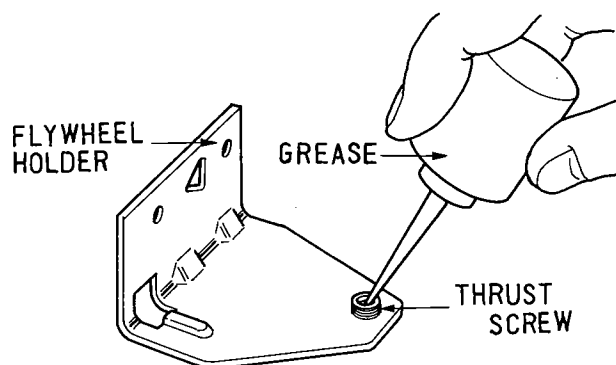
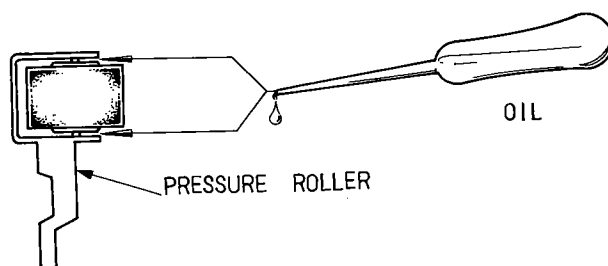
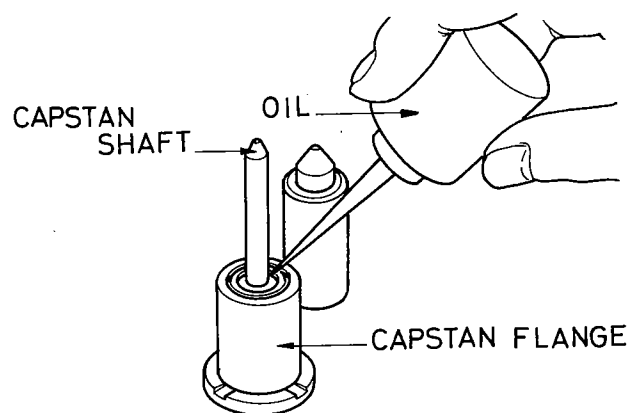


Fig. 5.12

5.13. Tape Travelling Adjustment

Load the Tape Travelling Cassette (DA09027A) and check the following:

- (1) After more than 2 second when depressed play button, the tolerance of the tape travelling fluctuation on the record/playback head shall not be more than 0.1mm.
- (2) Tape is contact with head sufficiently.
- (3) Tape waving is small (on the head and pressure roller).

If tape travelling is not good, re-adjustment of 5.1. "Take-up Torque and Rewind Torque Adjustment", 5.3. "Reocrd/Playback Head Height Adjustment", 5.4. "Head Base Stroke Adjustment" and others will be required.

