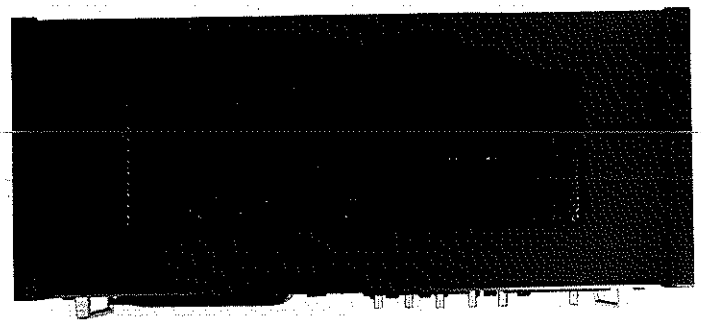
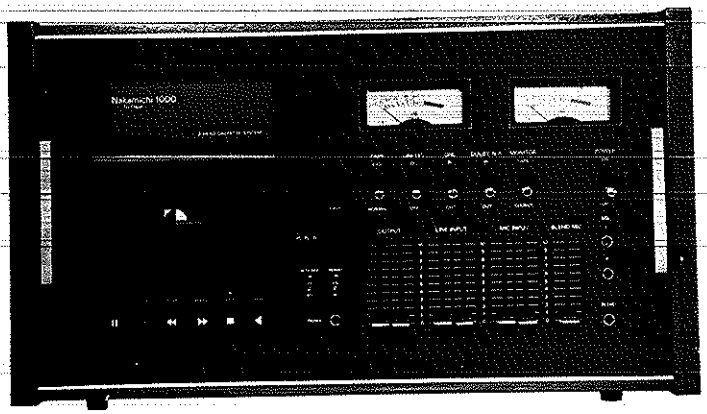
NAKAMICHI

Service Manual

Nakamichi 1000

3 Head Cassette System





CONTENTS

1 MECHANISM ADJUSTMENT PROCEDURES

1-1. TAKE-UP, FAST FORWARD AND REWIND TORQUE ADJUSTMENT

1-1-1 Take-up Torque Adjustment

(1) Refer to Mechanism Ass'y (P32 Fig. 5-6-3).
(2) Take-up Torque should be 40 ± 10g-cm.
(3) To adjust torque, move take-up spring as shown in Fig. 1-1.
(4) If torque is not sufficient during play mode, bend the take-up spring equally or replace the take-up spring.

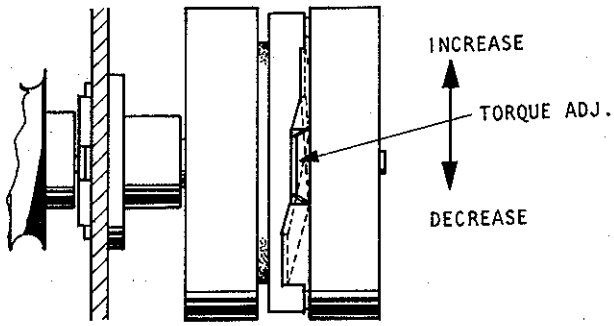


Fig. 1-1

1-1-2 Fast Wind Torque

(1) Refer to Mechanism Ass'y (P32 Fig. 5-6-3).
(2) Fast Forward and Rewind Torque should not be less than 50g-cm.
(3) Adjust the friction torque by adjusting location of motor friction pipe. Refer to the Fig. 1-2.
Friction Torque=40g-cm (typical)
Note: Insure whether the motor is rotating when both of the supply and take-up reel hubs are stopped by hand, depressing the FF or REW BUTTON.
(4) Adjust the location of the Reel Drive Mechanism Ass'y to obtain the rated drive being free from abnormal movement.

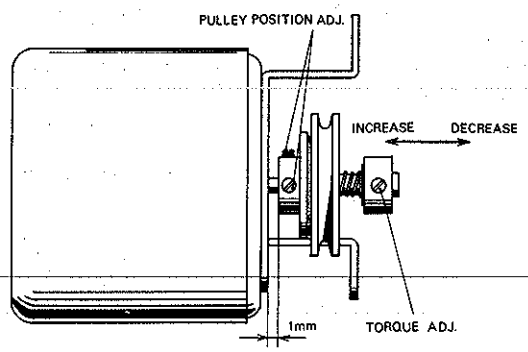


Fig. 1-2

1-2. TAPE SPEED

Signal Source
3kHz Speed Wow Flutter Tape (DA09006A)
Measurement Connection
Frequency Counter to Output Jacks
Mode
CONTROL BUTTON – Playback
MONITOR SW – Tape
TAPE SELECTOR SW – CrO2
Adjustment
1. Set the Pitch Control Knob to "0" position.
2. Adjust the Speed Control VR502 to obtain 3kHz on Frequency Counter.
VR502 Motor Governor P.C.B.

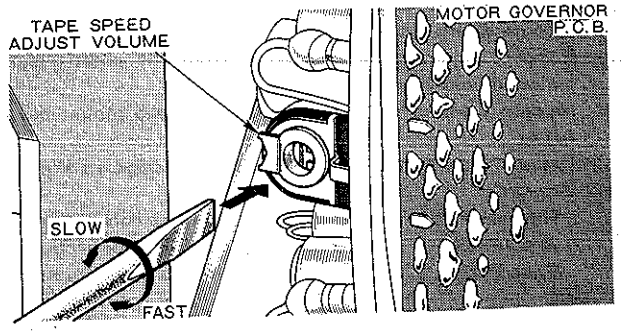


Fig. 1-3

1-3. HEAD BASE DAMPER ADJUSTMENT

(1) Slowly turn the exhaust adjusting screw clockwise repeatedly depressing and releasing the damper piston by hand. Set the screw at such an initial position that the piston cannot be depressed into the inmost end by the decreased damper pressure.
(2) Return the screw approximately 90 degrees counter-clockwise from the set position given in Step (1) above. Check to insure whether the head base is smoothly locked by repeatedly playing back and stopping the tape feed mechanism. If the double motion or associated shock is too strong, further precise adjustment is required.
Note: Do not tighten the exhaust adjusting screw excessively as it may be damaged.

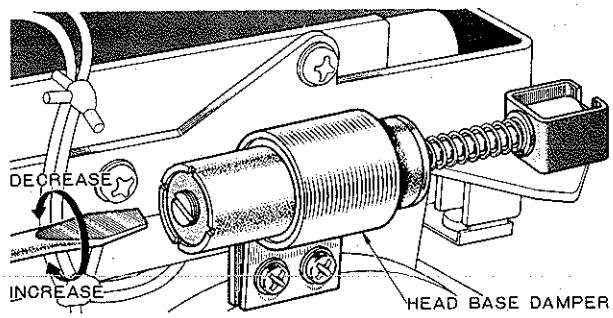


Fig. 1-4

1-4. EJECT DAMPER ADJUSTMENT

Install the cassette compartment lid. Adjust the exhaust adjusting screw at the eject damper Ass'y until it takes 0.5 to 1.0 second to stop the lid eject movement after the eject push button is depressed.
Note: Do not tighten the exhaust adjusting screw excessively as it may be damaged.

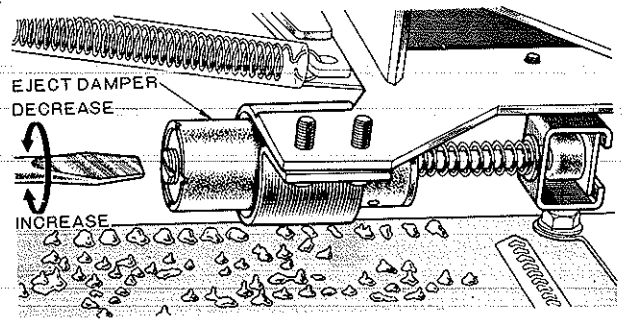


Fig. 1-5

1-5. HEAD REPLACEMENT PROCEDURES

(1) Remove cabinet and separate mechanism Ass'y 1000.

(2) Remove alignment beacon Ass'y from the chassis and remove mount base cover.

(3) Remove pressure roller arm spring and head mount base Ass'y.

(4) Replace each head (refer to Fig. 6-2, on page 43 Wiring Diagram).

Playback Head ..... R ch BLU, L ch YEL connection.
Record Head ..... R ch RED, L ch WHT connection.
Erase Head ..... Assembled with the supply pressure roller Ass'y.

Remove E ring, spring and pressure roller Ass'y. Remove a head by loosing a screw and replace. Then fasten a screw fixing a head to the chassis without any dust, and pushing a head toward to the pressure roller insuring to keep more than 0.1mm space. Apply a drip of lock tight paint to the screw. Check to insure signal wires are not in contact with the chassis.

(5) Fasten screws of playback and record heads, insuring to keep correct direction to the cassette tape.

Note 1: Separation of signal wires between record and playback heads will be required for avoiding bias leakage or crossfeed caused by interference.

Note 2: When replacing the heads, be careful not to contaminate the head surface with dust or any other foreign materials; otherwise, the head installation angle may deviate, resulting in irregular tape travelling. Handle the heads with care not to give damages to the surface.

(6) After replacement of each head, the following adjustments are required:

Mechanical Adjustment ..... Items from 1-6 to 1-9.
Electrical Adjustment .....

Playback Head	2-5 Playback Level Calibration
	2-6 Playback Frequency Response
	2-7 Head Azimuth Alignment (Playback Head)
	2-12 Record Bias & Record/Playback Level
Record Head	2-8 Bias Oscillator Frequency
	2-12 Record Bias & Record/Playback Frequency
Erase Head	2-8 Bias Oscillator Frequency

1-6. HEAD HEIGHT ADJUSTMENT

(1) Lord the Track Viewer (DA09012A) and check the positions of playback and record heads. While adjustment, check to insure that the L-R center of each head coincides in position with the middle point between two lines (0.3mm) on the Track Viewer.

(2) If the L-R center deviates from the middle point, correct the deviation using an appropriate PH and RH spacers to be provided for the playback and record heads.

t:THIKNESS

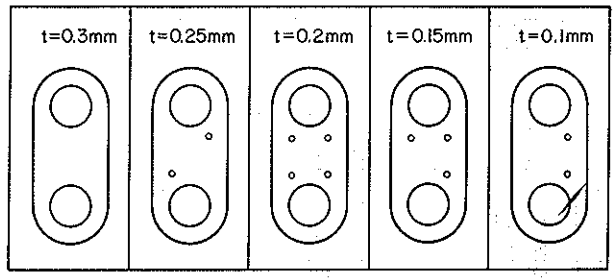


Fig. 1-6

t:THIKNESS

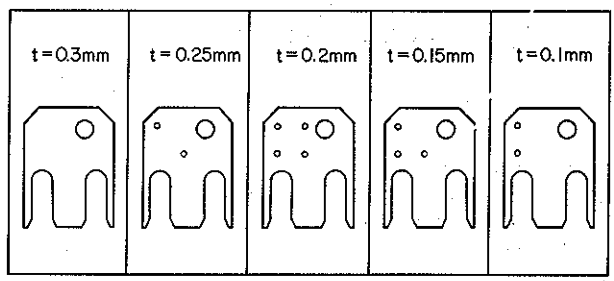


Fig. 1-7

1-7. PLAYBACK HEAD ADJUSTMENT

(1) Lord the Track Alignment Tape (DA09007A) and check the head height on the cassette tape deck. Set the MONITOR SW to Tape and play the tape back. Adjust the tape height adjusting screw A until each level meter of both channels reads the minimum value.

(2) Lord the Tape Travelling Cassette (DA09011A) and set to the playback mode. Check to insure that the tape height while running is within ±0.3mm at any tape position when measured from the center of cassette housing.

Note: Observing tape travelling on the playback head, check the following points:

Tape travelling will not wave. And at PLAY BUTTON ON, the fluctuation of tape travelling with respect to the stationary condition will be about within ±0.3mm. If not, adjust the pressure roller height by adjusting screw B located at the take-up reel side. After the tape travel is corrected,

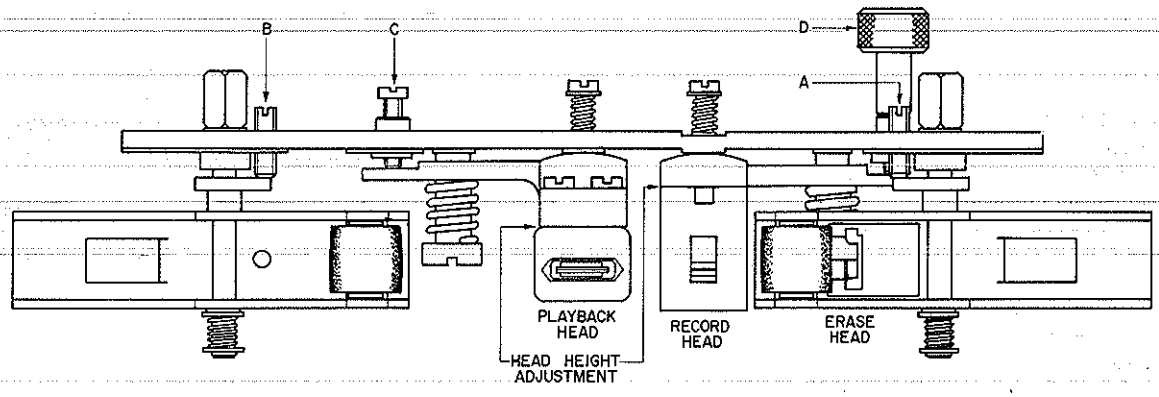


Fig. 1-8

check to insure that the pressure roller position is within ±1mm when measured from the center of a cassette housing. Note that in most cases of playback head adjustment the screw B will not be required to turn for misalignment.

If tape travel cannot still be adjusted, refer to "Trouble Shooting, 6-8. Tape Travelling Adjustment".

(3) When adjustments are completed, proceed again as directed in the Steps(1) and (2).

(4) Lord a 15kHz Azimuth Tape (DA09004A) for adjusting the P.B. head azimuth. Set the MONITOR SW to the TAPE position and playback. Adjust the P.B. head azimuth alignment screw C until each level meter of both channels reads the maximum value.

After completion of the adjustment in this step, check the head height as directed in Step (1).

(5) Apply a drip of lock tight paint to the screws A and B.

1-8. RECORD HEAD ADJUSTMENT

This adjustment should not be performed unless the playback head adjustment directed in the preceding section is completed.

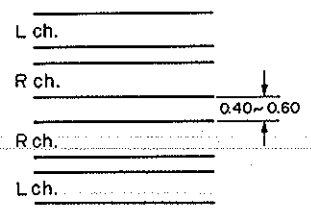
(1) Lord a blank tape, Reference CrO_2 (DA09009A). Set the TEST TONE SW to the ON position, the TAPE SELECTOR SW to the CrO_2 position, and the MONITOR SW to the Tape position. Set to Record mode and adjust record head azimuth alignment screw D untill the alignment beacon started flickering alternately. Record the same portion of the both A and B sides of the tape.

(2) Immerse the recorded tape into a magnetized developing solution. In turn, check to insure that the recording head tracks across the center are separated by space of 0.4 to 0.6mm as illustrated in Fig.1-9. If not, select a RH spacer having suitable thickness referring to the table in the Fig. 1-7.

Note: Liquid for magnetization: "MAGNA-SEE, SOUNDCRAFT a product of CBS RECORDS a devision of Columbia Broadcasting System, Inc., Danbury, Conn. 06810", or equivalent.

After magnetization, clean the tape otherwise pressure roller will become dirty.

The above magnetization will not be required if the difference of playback and record head heights are within 0.1mm at "1-6 Head Height Adjustment".



SPACE	CHANGE OF SPACERS
0.2mm	ADD 0.15mm SPACER
0.3mm	ADD 0.1mm SPACER
0.7mm	SUBTRACT 0.1mm SPACER
0.8mm	SUBTRACT 0.15mm SPACER

Fig. 1-9

1-9. ERASE HEAD ADJUSTMENT

After removal of erase head, refer to the "1-5. Head Replacement Procedures".

1-10. FLYWHEEL ADJUSTMENT

When mounting the flywheel holder, adjust the flywheel clearance should be 0.05 to 0.1mm.

Caution: When installing the flywheel, be sure to clean oil off with an alcohol-dipped cloth from capstan which will be in contact with pressure roller.

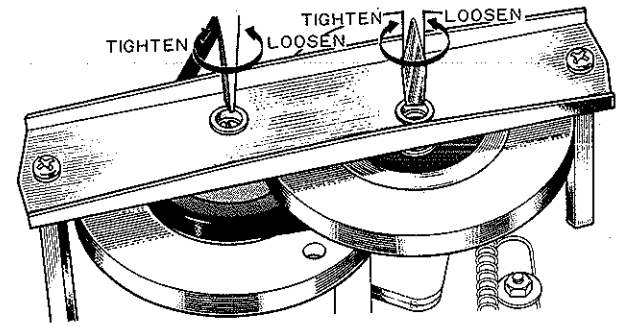


Fig. 1-10

1-11. LUBRICATION

Place the deck in a horizontal position and then remove the cassette lid.

Apply a few drops of oil (LAUNA NO. 40) into the oil cap hole of the capstan flange every 500 hours of use.

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

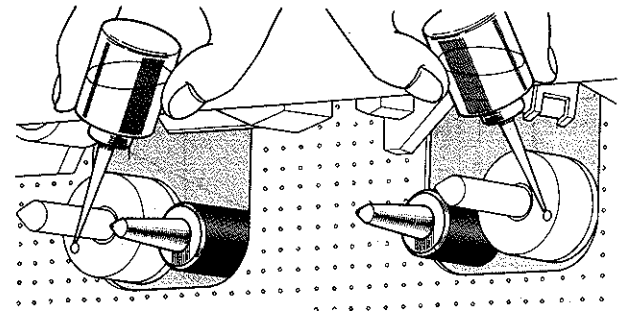


Fig. 1-11

2 ELECTRICAL ADJUSTMENT PROCEDURES

2. ELECTRICAL ADJUSTMENT PROCEDURES

Mechanical adjustments have to be performed prior to this adjustment. Refer to the Fig. 3-1 and Fig. 3-2 for the positions of semi-fixed volume and test point.

2-1. METER LEVEL CALIBRATION

Signal Source

1kHz 0.3V to Input Jacks or 1kHz 0.1V to DIN Input.

Measurement Connection

VTVM to Test Point 43 (Main P.C.B.) - GND (Lch),
44 (Main P.C.B.) - GND (Rch).

Mode

MONITOR SW - SOURCE

Adjustment

(1) Adjust the line input level controls to obtain 100mV ± 2mV on VTVM.

(2) Adjust the Meter Calibration VR101, 201 to obtain 0 dB on Level Meters.
VR101 (Lch)
VR201 (Rch) Line Amp. P.C.B.

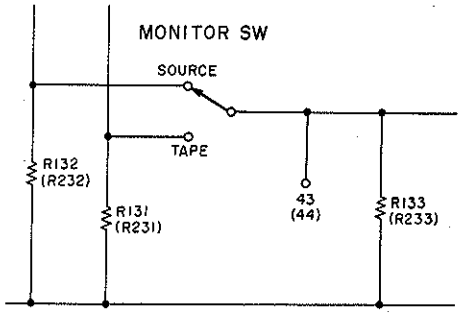


Fig. 2-1

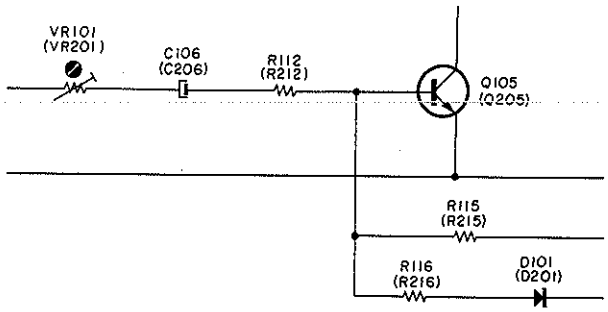


Fig. 2-2

2.2 400Hz TEST TONE

Mode

MONITOR SW - SOURCE
400Hz TEST TONE SW - ON

Adjustment

Adjust the Tone Calibration VR301 so that the level meter of the L channel indicate 0dB. If the level meter of the R channel is not balanced to L channel, adjust VR302 so that the R meter indicates 0dB.
VR301 (Lch)
VR302 (Rch) Main P.C.B.

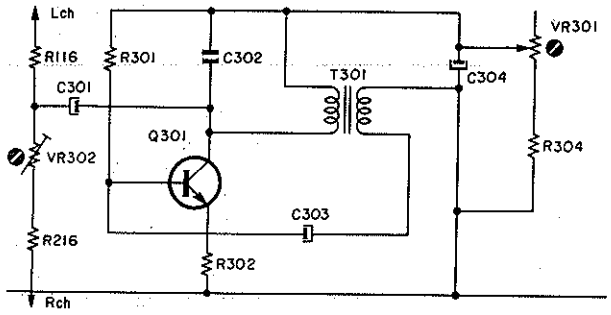


Fig. 2-3

2-3. 19KHz MPX FILTER

Signal Source

19kHz 0.3V to Input Jacks or 0.1V to DIN Input.

Measurement Connection

VTVM and Frequency Counter to Output Jacks or DIN Output.

MODE

MONITOR SW - SOURCE
MPX SW - OFF
DOLBY NR SW - OUT
DNL SW - OFF

Adjustment

(1) Adjust the line input level controls to obtain 0dB (1V) on the Level Meters and VTVM.

(2) Set the MPX SW to ON.

(3) Adjust MPX Filter Coils L102, 202 to obtain the minimum reading on VTVM.
L102 (Lch)
L202 (Rch) Main P.C.B.

Note: Frequency has to be 19kHz±100Hz on Frequency Counter.

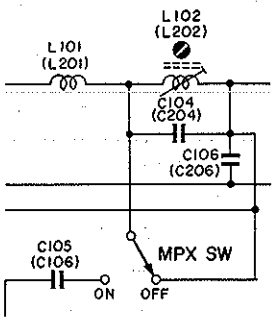


Fig. 2-4

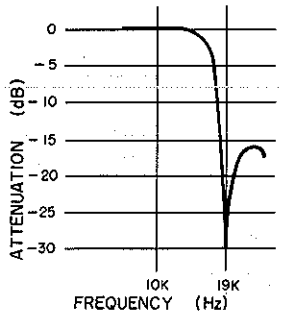


Fig. 2-5

2-4. LIMITER LEVEL

Signal Source

1kHz 0.3V to Input Jacks or 1kHz 0.1V to DIN Input.

Measurement Connection

VTVM to Output Jacks or DIN Output.

Mode

MONITOR SW - SOURCE
LIMITER SW - OFF

Adjustment

(1) Adjust the line input level controls to obtain 0dB on Level Meters.

(2) Adjust the line output level controls to obtain 0dB (1V) on VTVM.

(3) Adjust the line input level controls to obtain +4dB on VTVM.

(4) Set LIMITER SW to ON.

(5) Adjust the Limiter level ADJ. VR101, 201 to obtain +3dB on VTVM (so that +4dB will be decreased by 1dB)
VR101 (Lch)
VR201 (Rch) Main P.C.B.

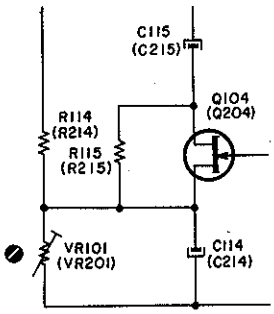


Fig. 2-6

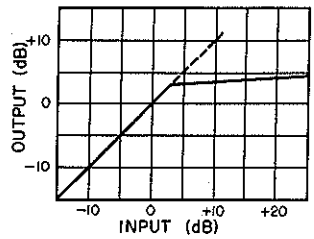


Fig. 2-7

2-5. PLAYBACK LEVEL CALIBRATION

Signal Source
400Hz P.B. Reference Tape (DA09005A)
Mode
CONTROL BUTTON - Playback
MONITOR SW - TAPE
TAPE SELECTOR SW - CrO_2
Adjustment
Adjust the Playback AMP. Potentiometers VR101, 201 so that the level meters indicate 0dB.
VR101 (Lch)
VR201 (Rch) P.B. Head AMP. P.C.B.
Note: "2-1. Meter Level Calibration" to be completed prior to 2-5. as above.

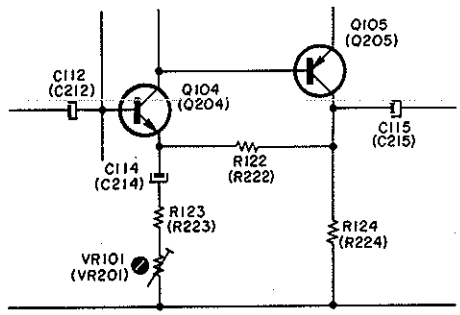


Fig. 2-8

2-6. PLAYBACK FREQUENCY RESPONSE

Measurement Connection
VTVM to Output Jacks or DIN Output.
Mode
MONITOR SW - TAPE
TAPE SELECTOR SW - CrO_2
LIMITER SW - OFF
DNL - OUT
DOLBY NR SW - OUT
Adjustment
(1) Lord a 400Hz P.B. Reference Tape (DA09005A) and play it back.
Adjust the line output level controls to a certain level (example 0dB)
(2) Lord a 10kHz P.B. Frequeency Tape (DA-09003A), 15kHz P.B. Frequency Tape (DA09002A) and 20kHz P.B. Frequency Tape (DA-09001A), and adjust the Playback Head azimuth to give the maximum levels on VTVM with each Tape.
Check to insure level would be within −20dB ±3dB against 400Hz P.B. Reference Tape.
(3) If above level cannot be satisfied.
Refer to "13. Trouble Shooting, 6-9.1 Adjustment of Playback Frequency Response".
(4) Lord a 15kHz Azimuth Tape (DA09004A).
Adjust the playback head azimuth to give the maximum levels on VTVM.

2-7. HEAD AZIMUTH ALIGNMENT (PLAYBACK HEAD)

Signal Source
15kHz Azimuth Tape (DA09004A)
Measurement Connection
VTVM to Output Jacks.
Mode
CONTROL BUTTON - Playback
MONITOR SW - TAPE
DOLBY NR SW - OUT
TAPE SELECTOR SW - CrO_2
Adjustment
Adjust the Playback Head Azimuth Alignment Screw to obtain the masximum reaiding on VTVM. Be sure to check both channels. The maximum reading should be more than 70mV on VTVM when Playback Calibration is adjusted correctly.

2-8. BIAS OSCILLATOR FREQUENCY

Measurement Connection
Frequency Counter to Test Point CN 1-9 (Main P.C.B.) - GND
Mode
CONTROL BUTTON - Record/Pause
Adjustment
Adjust the Bias Oscillator Coil T302 to obtain a reading of 105kHz on Frequency Counter.
T302 Main P.C.B.
Note: Measurement shall be made by use of a low capacity probe.

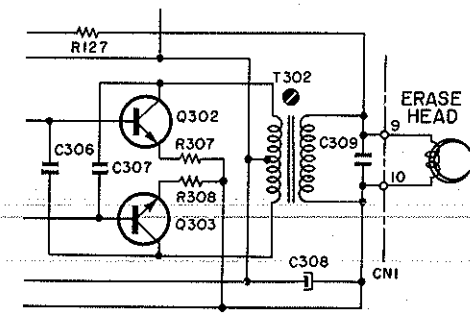


Fig. 2-9

2-9 BIAS TRAP (BIAS LEAKAGE)

Measurements shall be made by use of a low capacity probe.

2-9-1. RECORD AMP. BIAS TRAP

Measurement Connection

VTVM to Q104 (REC. EQ. AMP. P.C.B.)
Collector - GND (Lch)
Q204 (REC. EQ. AMP. P.C.B.)
Collector - GND (Rch)

Mode

CONTROL BUTTON - Record/Pause

Adjustment

Adjust the Bias Trap Coils L105, 205 to obtain the minimum reading on VTVM.

L105 (Lch)
L205 (Rch) Main P.C.B.

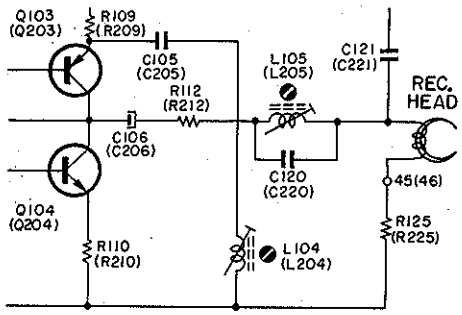


Fig. 2-10

2-9-2. PLAYBACK AMP. BIAS TRAP

Measurement Connection

VTVM to Test Point 43 (Main P.C.B.) - GND (Lch),
44 (Main P.C.C.) - GND (Rch).

Mode

MONITOR SW - TAPE
CONTROL BUTTON - Record/Pause

Adjustment

Adjust the Bias Trap Coils L101, 201 to obtain the minimum reading on VTVM.

L101
L201 P.B. Head AMP. P.C.B.

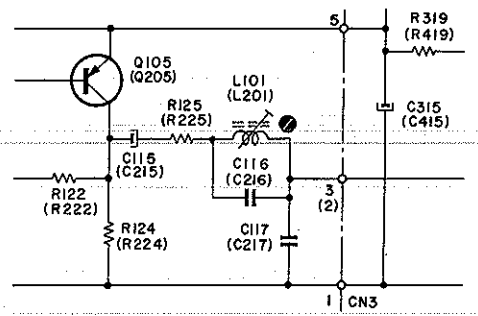


Fig. 2-11

2-10. RECORDING EQUALIZATION PEAKING

Signal Source

1kHz and 23kHz 0.3V to Input Jacks or 1kHz and 23kHz 0.1V to DIN Input.

Measurement Connection

VTVM to Test Point 45 (Main P.C.B.) - GND (Lch),
46 (Main P.C.B.) - GND (Rch).

Mode

MONITOR SW - SOURCE
DOLBY NR SW - OUT
MPX SW - OFF
TAPE SELECTOR SW - CrO_2
CONTROL BUTTON - Record/Pause
Bias Cut (Refer to the Fig. 6-1, on page 42 Wiring Diagram).

Adjustment

(1) Adjust the line input level controls to obtain 0dB on Level Meters at 1kHz input signals.
(2) Feed in 23kHz instead of 1kHz then adjust L104, 204 to obtain peak reading (about 13dB rise at 20kHz).

Note: Refer to the Fig.2-13, frequency response.

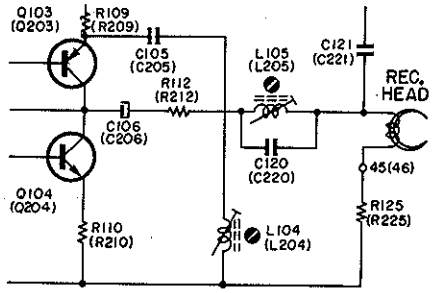


Fig. 2-12

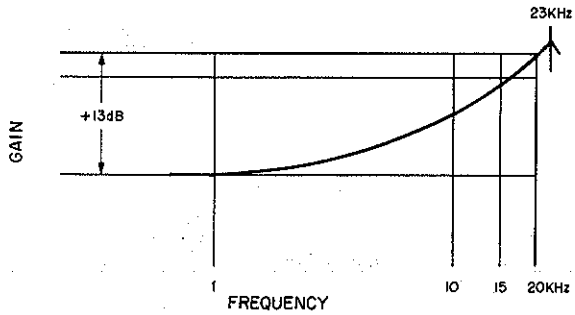


Fig. 2-13

2-11. ALIGNMENT BEACON PHASE ADJUSTMENT

Before starting adjustment, be sure to adjust the Record Head Azimuth by Reocrd Head Azimuth Alignment Beacon whenever cassette tapes are changed (even when cassette tape is changed from A-side to B-side).

Signal Source

Reference CrO_2 Tape (DA09009A)
15kHz 0.03V to Input Jacks or 15kHz 0.01V to DIN Input.

Mode

CONTROL BUTTON - Record/Pause
MONITOR SW - CrO_2
400Hz TEST TONE SW - OFF

Adjustment

(1) Adjust the Record Head Azimuth Alignment Screw to obtain the maximum reading on VTVM. Be sure to check both channels.
(2) Set 400Hz TEST TONE SW to ON.
(3) Adjust VR601 so that Alignment Beacon will fricker alternately.
VR601 Logic Control P.C.B.

2-12. RECORD BIAS & RECORD/PLAYBACK LEVEL

Signal Source

1kHz 0.3V to Input Jacks, (18kHz 0.03V ((=−20dB)), 1kHz 0.03V ((=−20dB)) to Input Jacks.

Measurement Connection

VTVM & Distortion Meter to Output Jacks or DIN Output.

Mode

CONTROL BUTTON - Record/Playback
MONITOR SW - SOURCE
TAPE SELECTOR SW - NORMAL or CrO_2
LIMITER SW - OFF
DOLBY NR SW - OUT
DNL SW - OUT
MPX SW - OFF

Adjustment

(1) Lord a Reference EX Tape (DA09010A) (Reference CrO_2 Tape (DA09009A)) and set TAPE SELECTOR SW to NORMAL (CrO_2).

(2) Set to TEST TONE SW ON and set to record mode, and adjust the record head azimuth alignment.

(3) Set MONITOR SW to TAPE, and adjust the Bias ADJ. VR105, 205 (VR106, 206) to obtain the maximum reading on VTVM.

(4) Adjust the Record Calibration VR103, 203 (VR104, 204) to obtain same level on Level Meters (0dB) at MONITOR SW SOURCE and TAPE.

(5) Set MONITOR SW to SOURCE and TEST TONE SW to OFF. Feed in 1kHz 0.3V to Input Jacks and adjust the line input level controls to obtain 0dB on Level Meters.

(6) Set MONITOR SW to TAPE. Set Audio Generator Output Level to 18kHz −20dB (CrO_2: 20kHz −20dB). Adjust the Bias ADJ. VR105, 205 (VR106, 206) so that level would become within ±3dB against 1kHz.

(7) Set MONITOR SW to TAPE. Feed in 1kHz 0.3V to Input Jacks and adjust the line input level controls to obtain 0dB on Level Meters. And check the Total Harmonic Distortion (T.H.D.) will be under 2%. If T.H.D. exceeds 2%, adjust the Bias ADJ. VR105, 205 (VR106, 206) again to obtain T.H.D. of less than 2%. Then set Audio Generator Output Level to 18kHz −20dB (CrO_2: 20kHz −20dB) and check to insure level would become within ±3dB against 1kHz.

(8) For correction of Record Calibration after above adjustment, ser to TEST TONE SW ON and set to record mode. Then adjust Record Calibration VR103, 203 (VR104, 204) to obtain same level on Level Meters (0dB) at MONITOR SW SOURCE and TAPE.

Note: "2-11. Alignment Beacon Phase Adjustment" has to be conducted.

Note: In case of defective Frequency Response, the following causes can be considered:
Defective Record Head, defective "2-6. Playback Frequency Response" check and Playback Head, defective "2-9. Recording Equalization Peaking" check, defective Mechanical Adjustments (Head Height Adjustment, Tape Travelling).

VR105 (NORMAL-Lch) Bias ADJ. VR
VR205 (NORMAL-Rch) Bias ADJ. VR
VR106 (CrO_2-Lch) Bias ADJ. VR
VR206 (CrO_2-Rch) Bias ADJ. VR
VR103 (NORMAL-Lch) Rec. Cal. Control VR
VR203 (NORMAL-Rch) Rec. Cal. Control VR
VR104 (CrO_2-Lch) Rec. Cal. Control VR
VR204 (CrO_2-Rch) Rec. Cal. Control VR

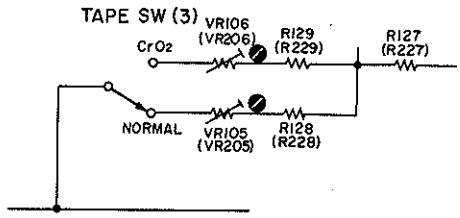


Fig. 2-14

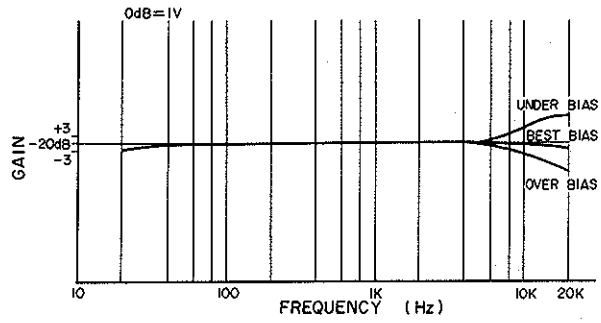


Fig. 2-15

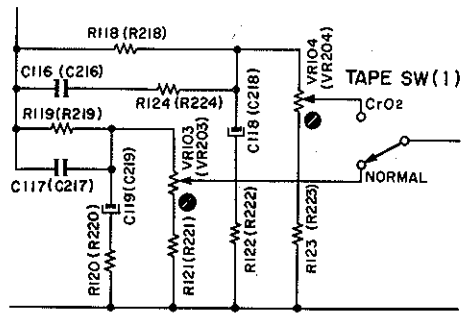


Fig. 2-16

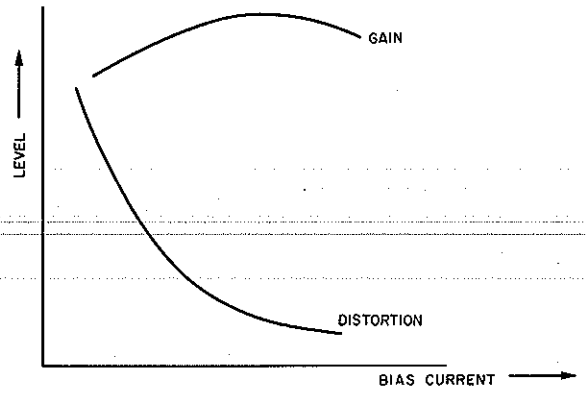


Fig. 2-17

2-13 RECORD DOLBY BOARD ALIGNMENT PROCEDURE

Adjust only if board is repaired.

(1) Set Law Control VR101 (VR201) to maximum clockwise, viewed from top side.
(2) Set Gain Control VR102 (VR201) fully counterclockwise.
(3) Set DOLBY NR SW to OUT and short FET gate Test Pin Lch (Rch) to ground.
(4) Feed in 5kHz at a level to give 3mV at Metering terminal.
(5) Note signal level obtained at Output terminal.
(6) Set DOLBY NR SW to IN and adjust Gain Control for a 10dB rise at Output terminal.
(7) Note output level with DOLBY NR SW In.
(8) Remove FET gate Test Pin short and adjust Law Control for a 2dB drop at Output terminal.

Note: Pin numbers of Record Dolby P.C.B.

	RIGHT ch	LEFT ch
DOLBY NR SW terminal	2	13
Metering terminal	3	12
Output terminal	5	10
Input terminal	4	11

2-14. PLAYBACK DOLBY BOARD ALIGNMENT PROCEDURE

Adjust only if board is repaired.

(1) Set Law Control VR101 (VR201) to maximum clockwise viewed from top side.
(2) Set Gain Control VR102 (VR201) fully counterclockwise.
(3) Set DOLBY NR SW to OUT and short FET gate Test PIN Lch (Rch) to ground.
(4) Feed in 5kHz at a level to give 7.6mV at Metering terminal.
(5) Set Gain Control for a 10dB drop at Metering terminal as DOLBY NR SW is set to IN.
(6) Set DOLBY NR SW to OUT and remove FET gate Test Pin short and adjust Law Control to give a reading of 3mV at Metering terminal.

Note: Pin numbers of Playback Dolby P.C.B.

	RIGHT ch	LEFT ch
DOLBY NR SW terminal	2	13
Metering or Output terminal	5	10
Input terminal	3	12

2-15. DNL BOARD ALIGNMENT PROCEDURE

(1) Set MONITOR SW to source mode, DNL SW to OUT mode and output level controls to maximum position.
(2) Feed in 10kHz at a level to give 4mV at Output Line Jacks.
(3) Set DNL SW to IN mode.
(4) Adjust DNL P.C.B. VR101 (VR201) for a 8dB drop at Output Line Jacks.

3 PARTS LOCATION OF ELECTRICAL ADJUSTMENT

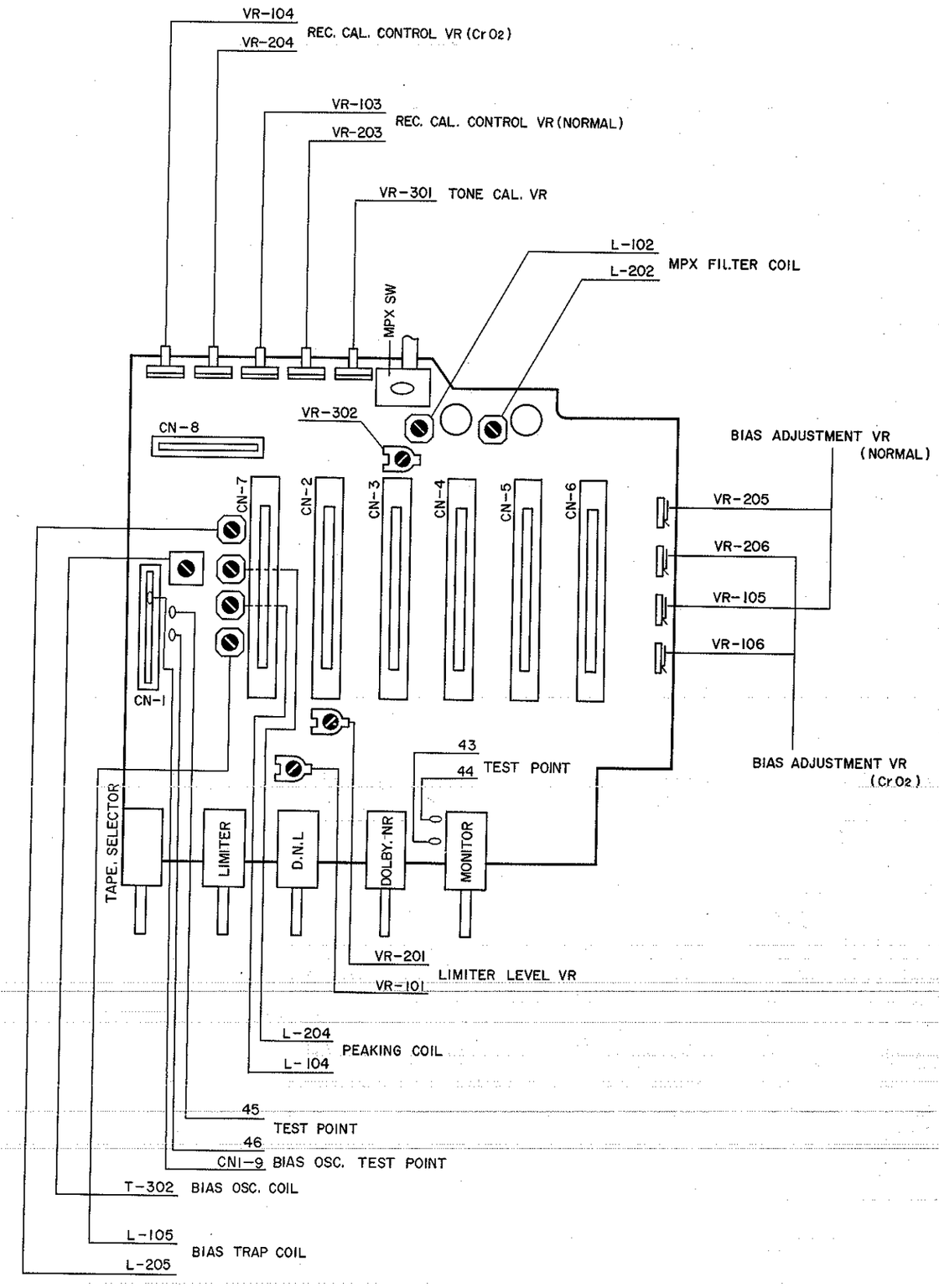


Fig. 3-1

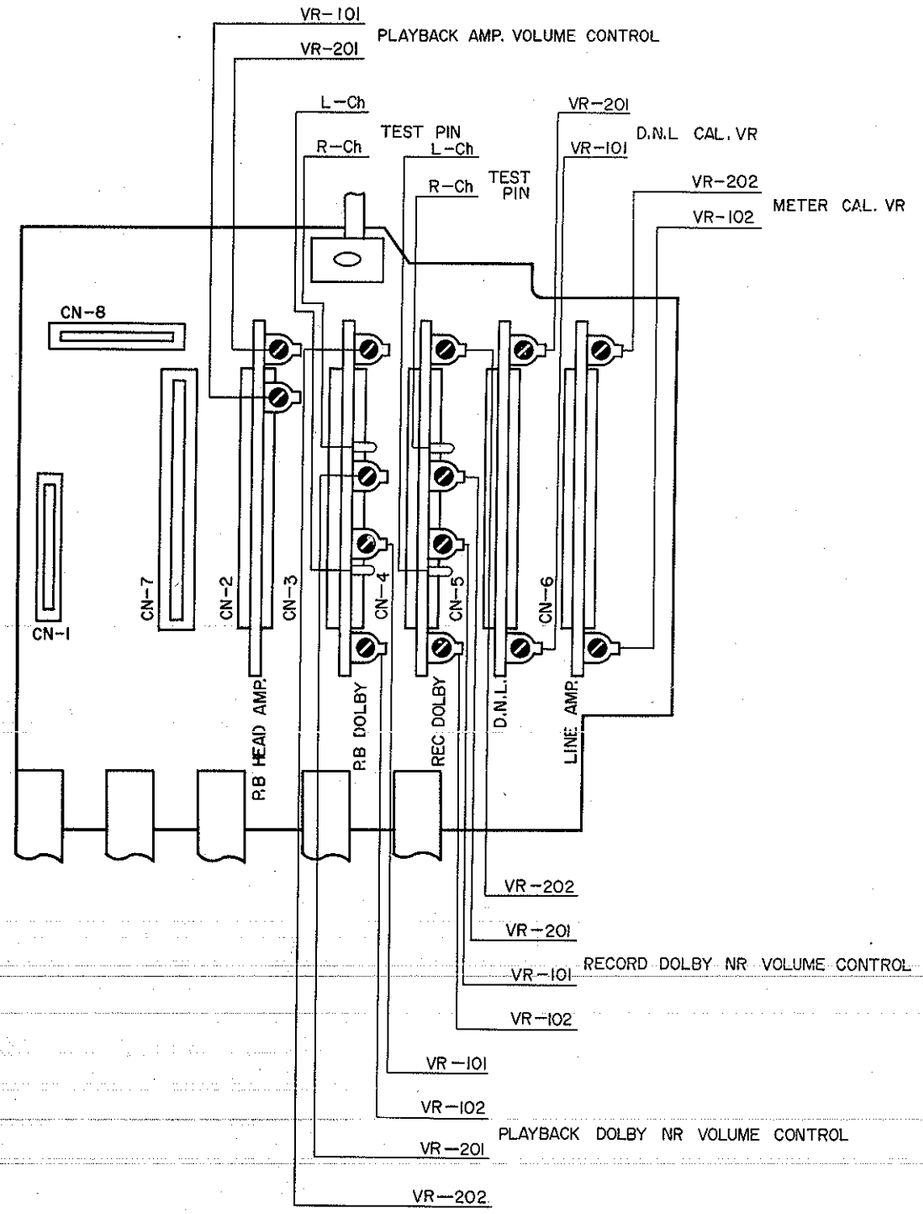
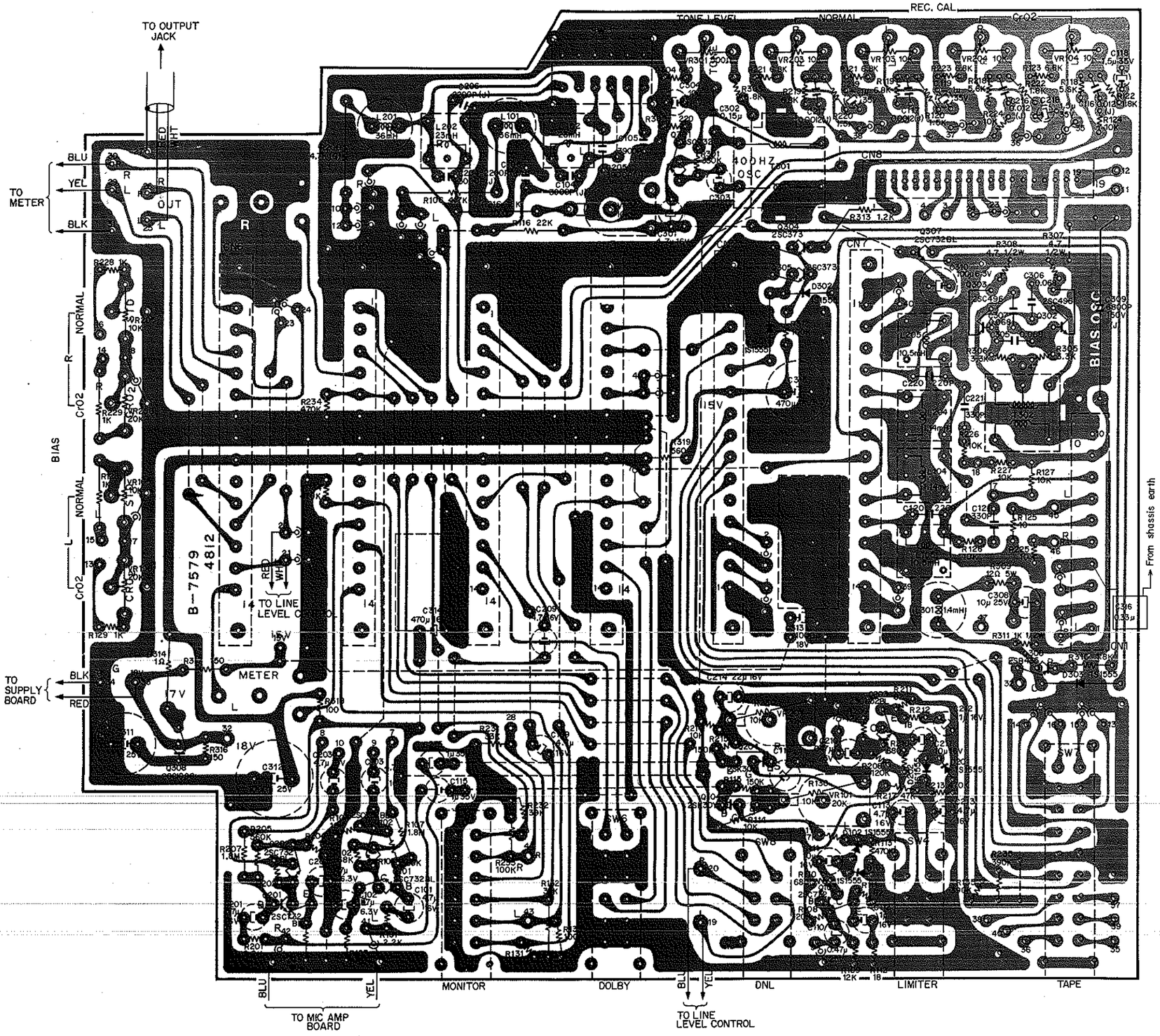


Fig. 3-2

4 MOUNTING DIAGRAM/PARTS LIST

NOTE1: Where serial numbers are shown underneath the modified assemblies, the modifications apply to those serial number only. But if no serial numbers, then no modifications have been made from initial production.
NOTE2: Mounting Diagram shows a dip side View of the P.C.B..

4-1 MAIN P.C.B.



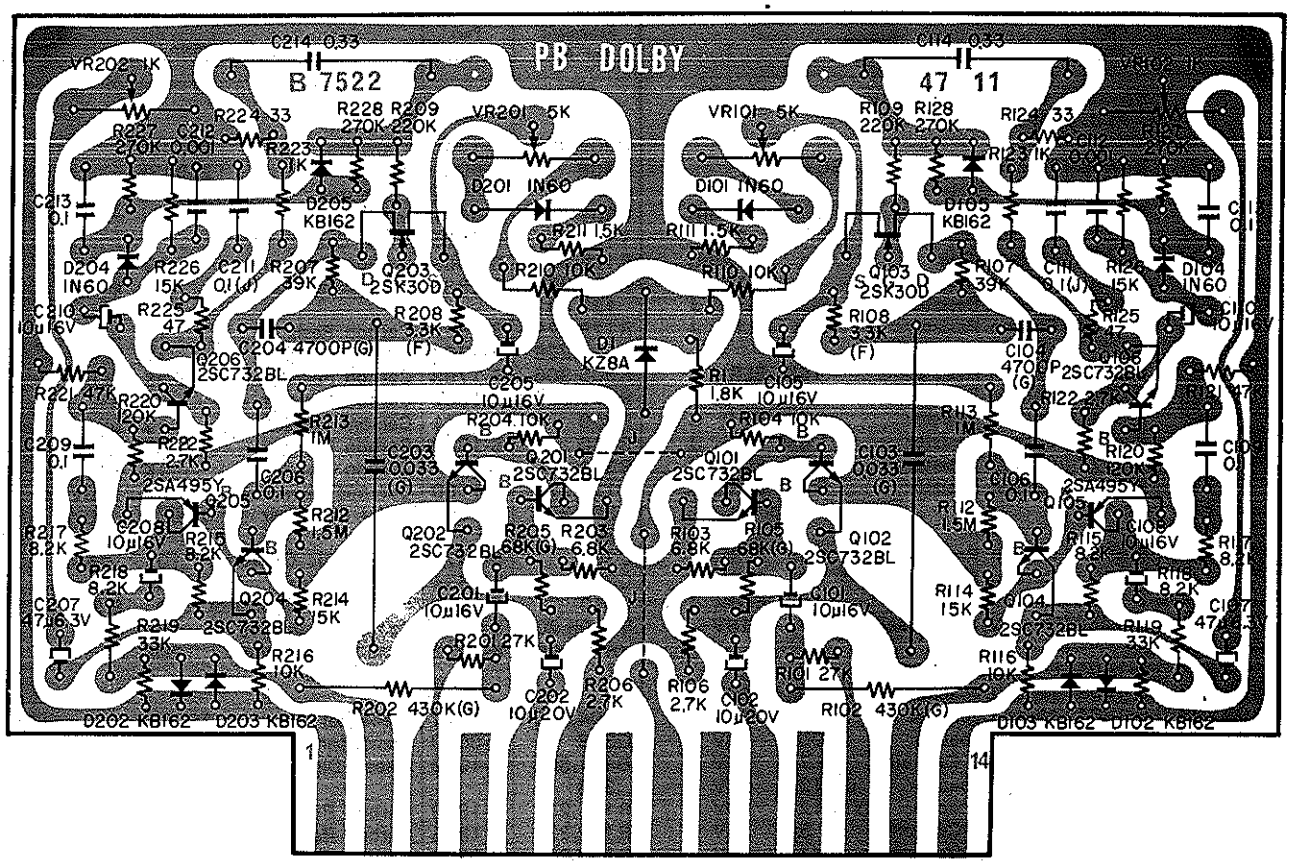
SERIAL NO.3106401~

Fig. 4-1

Schematic Ref. No.	Part No.	Description
		BA-3644 Main P.C.B. Ass'y
		—REC. AMP. —
Q101,201 102,202	B-6005	Transistor 2SC732(BL)
L101,201	B-3919	Inductor 36mH
L102,202	B-3563	19KHz Coil 23mH
L104,204	B-1434	Peaking Coil 1.14mH
L105,205	B-685	Bias Trap Coil 10.5mH
R101,201	B-5566	Carbon Resistor 2.2K ELR¼ J
R102,202 103,203	B-1902	Carbon Resistor 68K ELR¼ J
R104,204	B-5591	Carbon Resistor 15K ELR¼ J
R105,205	B-5665	Carbon Resistor 560K ELR¼ J
R106,206	B-5548	Carbon Resistor 4.7K RD¼ G
R107,207	B-5670	Carbon Resistor 1.8M ELR¼ J
R118,218	B-5673	Carbon Resistor 5.6K ELR¼ J
R119,219 121,221 123,223	B-1877	Carbon Resistor 6.8K ELR¼ J
R120,220	B-5505	Carbon Resistor 1.5K ELR¼ J
R122,222	B-1830	Carbon Resistor 1.8K ELR¼ J
R124,224	B-1833	Carbon Resistor 10K ELR¼ J
C101,201 103,203	B-1389	Electrolytic Capacitor 4.7μ 16V
C102,202	B-1404	Electrolytic Capacitor 47μ 6.3V
C104,204	B-1803	Mylar Capacitor 3000P 50V J
C105,205	B-1804	Mylar Capacitor 3900P 50V J
C106,206	B-1802	Mylar Capacitor 2200P 50V J
C109,209	B-5657	Tantalum Capacitor 4.7μ 16V
C116,216	B-1605	Mylar Capacitor 0.012μ 50V J
C117,217	B-5687	Mylar Capacitor 0.0012μ 50V J
C118,218	B-5639	Tantalum Capacitor 1.5μ 35V
C119,219	B-5638	Tantalum Capacitor 1μ 35V
C120,220	B-1289	Ceramic Capacitor 220p 50V M
VR103,203 104,204	B-7011	Semi-fixed Volume 10K
SW3	B-7012	MPX Switch SW-335
		— Limiter —
Q103,203	B-6005	Transistor 2SC732(BL)
Q104,204	B-1600	FET 2SK30(Y)
D101,201 102,202	B-1909	Silicon Diode 1S1555
R108,208	B-5568	Carbon Resistor 120K ELR¼ J
R109,209	B-5650	Carbon Resistor 12K ELR¼ J
R110,210	B-5559	Carbon Resistor 680 ELR¼ J
R111,211	B-5503	Carbon Resistor 82 ELR¼ J
R112,212	B-5545	Carbon Resistor 18 ELR¼ J
R113,213	B-5700	Carbon Resistor 470K ELR¼ J
R114,214 130,230	B-1833	Carbon Resistor 10K ELR¼ J
R115,215	B-5593	Carbon Resistor 150K ELR¼ J
R117,217	B-5562	Carbon Resistor 47K ELR¼ J
C110,210	B-1376	Aluminium Capacitor 0.47μ 25V
C111,211	B-1412	Electrolytic Capacitor 10μ 16V
C112,212	B-1405	Electrolytic Capacitor 1μ 16V
C113,213	B-1389	Electrolytic Capacitor 4.7μ 16V
C114,214	B-1862	Electrolytic Capacitor 22μ 16V
C115,215	B-5638	Tantalum Capacitor 1μ 35V
VR101,201	B-1923	Semi-fixed Volume 20K
		— 400Hz OSC. —
Q301	B-6005	Transistor 2SC732(BL)
T301	B-3879	OSC. Coil
R301	B-1921	Carbon Resistor 330K ELR¼ J
R302	B-5608	Carbon Resistor 220 ELR¼ J
R303	B-1877	Carbon Resistor 6.8K ELR¼ J
R304	B-5559	Carbon Resistor 680 ELR¼ J
R116	B-5615	Carbon Resistor 22K R¼ J
R216	B-5560	Carbon Resistor 18K R¼ J
C301	B-1389	Electrolytic Capacitor 4.7μ 16V
C302	B-5551	Mylar Capacitor 0.15μ 50V K
C303	B-1405	Electrolytic Capacitor 1μ 16V
C304	B-1412	Electrolytic Capacitor 10μ 16V
VR301	B-7013	Semi-fixed Volume 500
VR302	B-1595	Semi-fixed Volume 10K

Schematic Ref. No.	Part No.	Description
		— Bias OSC. —
Q302,303	B-1790	Transistor 2SC496
Q306	B-6011	Transistor 2SB435
Q307	B-6005	Transistor 2SC732(BL)
L301	B-3861	Inductor 1.4mH
T302	B-6515	OSC. Coil
R125,225	B-5663	Carbon Resistor 10 ELR¼ J
R126,226 127,227	B-1833	Carbon Resistor 10K ELR¼ J
R128,229	B-1857	Carbon Resistor 1K R¼ J
R129,228	B-1781	Carbon Resistor 1K ELR¼ J
R305,306	B-1793	Carbon Resistor 3.3K ELR¼ J
R307,308	B-5662	Carbon Resistor 4.7 R½
R309	B-5761	Cement Resistor 12 5W
R310	B-1830	Carbon Resistor 1.8K ELR¼ J
R311	B-346	Carbon Resistor 1K RD½ J
C121,221	B-1180	Ceramic Capacitor 330P 100V M
C305,306 307	B-1694	Mylar Capacitor 0.068μ 50V
C308	B-1674	Electrolytic Capacitor 10μ 25V
C309	B-5634	S.P Capacitor 6800P 150V J
C310	B-1411	Electrolytic Capacitor 100μ 6.3V
VR105,205	B-1458	Semi-fixed Volume 10K
VR106,206	B-1922	Semi-fixed Volume 20K
		—Miscellaneous —
Q304,305	B-1367	Transistor 2SC373
Q308	B-6020	Transistor 2SC1096
D301,302 303	B-1909	Silicon Diode 1S1555
R131,231	B-1879	Carbon Resistor 33K ELR¼ J
R132,232	B-1885	Carbon Resistor 39K ELR¼ J
R133,233 312	B-1920	Carbon Resistor 100K ELR¼ J
R134,234	B-5700	Carbon Resistor 470K ELR¼ J
R135,235	B-5595	Carbon Resistor 390K ELR¼ J
R313	B-5565	Carbon Resistor 1.2K ELR¼ J
R314	B-5695	Carbon Resistor 1 R¼
R316,317	B-5649	Carbon Resistor 150 ELR¼ J
R318	B-5558	Carbon Resistor 100 ELR¼ J
R319	B-5678	Carbon Resistor 560 ELR¼ J
C311	B-1391	Electrolytic Capacitor 220μ 25V
C312	B-1870	Electrolytic Capacitor 1000μ 25V
C313	B-1673	Electrolytic Capacitor 1000μ 18V
C314,315	B-1392	Electrolytic Capacitor 470μ 16V
C316	B-1602	Mylar Capacitor 0.33μ 50V K
SW4, 8	B-7009	Limiter Switch, D.N.L. Switch
SW5, 6	B-7020	Monitor Switch, Dolby Switch
SW7	B-7007	Tape Switch
	B-3924	Gate Pin
	BA-3597	Separate Plug Cord (Red)
	BA-3598	Separate Plug Cord (Black)
	BA-3702	14P Connector Ass'y
	BA-3562	19P Connector Sub Ass'y
	BA-3703	10P Connector Ass'y
	J-3080	Connector Holder
	J-3081	Connector Stud
	E-21	Nut Hex M2.6
	E-176	Nut Hex M2
	E-666	Screw M2×16 Pan Head ⊕
	E-670	Screw M2.6×12 Pan Head ⊕
	B-7579	Main P.C.B.

4-2 P.B. DOLBY P.C.B.

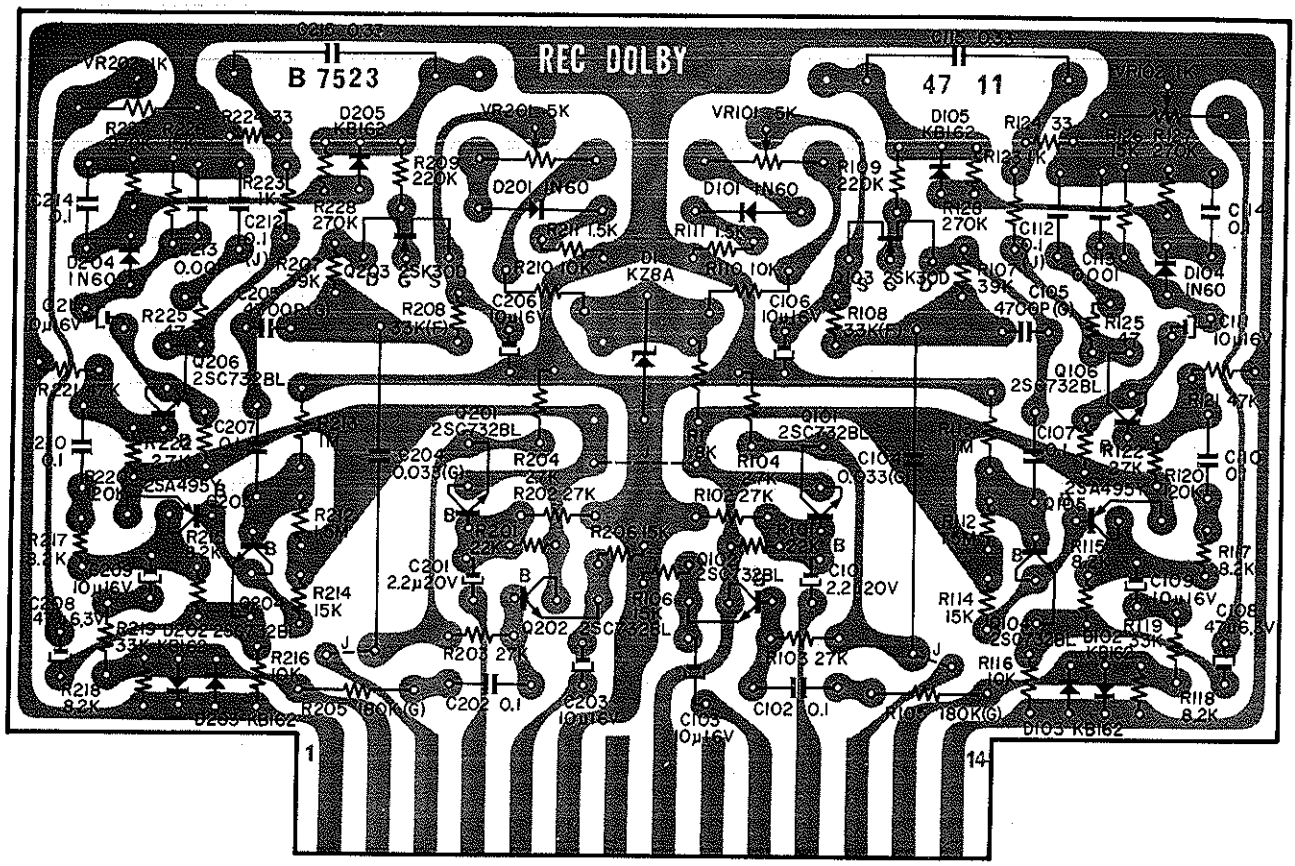


SERIAL No. 3103301 ~

Fig. 4-2

Schematic Ref. No.	Part No.	Description		Schematic Ref. No.	Part No.	Description		
	BA-3588 P.B. Dolby P.C.B. Ass'y			R117 217 118,218	B-1878	Carbon Resistor	8.2K	ELR¼ J
Q101,201 102,202 104,204 106,206	B-6005	Transistor	2SC732(BL)	R119,219	B-1879	Carbon Resistor	33K	ELR¼ J
				R120,220	B-5568	Carbon Resistor	120K	ELR¼ J
				R121,221	B-5562	Carbon Resistor	47K	ELR¼ J
				R123,223	B-1781	Carbon Resistor	1K	ELR¼ J
Q103,203	B-6001	FET	2SK30A(D)	R124,224	B-5567	Carbon Resistor	33	ELR¼ J
Q105,205	B-6006	Transistor	2SA495(Y)	R125,225	B-5569	Carbon Resistor	47	ELR¼ J
D1	B-1808	Zener Diode	KZ8A	R127,227 128,228	B-5600	Carbon Resistor	270K	ELR¼ J
D101,201 104,204	B-30P	Germanium Diode	1N60(P)	C101,201 105,205 108,208 110,210	B-1412	Electrolytic Capacitor	10µ	16V
D102,202 103,203 105,205	B-1599	Silicon Diode	KB162					
R1	B-1830	Carbon Resistor	1.8K ELR¼ J	C102,202	B-5581	Tantalum Capacitor	10µ	20V M
R101,201	B-5538	Carbon Resistor	27K ELR¼ J	C103,203	B-1786	P.P Capacitor	0.033µ	50V G
R102,202	B-5536	Carbon Resistor	430K RD¼ G	C104,204	B-1608	P.P Capacitor	4700P	50V G
R103,203	B-1877	Carbon Resistor	6.8K ELR¼ J	C106,206	B-1603	Mylar Capacitor	0.1µ	50V K
R104,204 110,210 116,216	B-1833	Carbon Resistor	10K ELR¼ J	C107,207 113,213	B-1404	Electrolytic Capacitor	47µ	6.3V
R105,205	B-5535	Carbon Resistor	68K RD¼ G	C111,211	B-1780	Mylar Capacitor	0.1µ	50V J
R106,206 122,222	B-1782	Carbon Resistor	2.7K ELR¼ J	C112,212	B-91	Mylar Capacitor	1000P	50V M
				C114,214	B-1602	Mylar Capacitor	0.33µ	50V K
R107,207	B-1885	Carbon Resistor	39K ELR¼ J	VR101,201	B-1470	Semi-fixed Volume	5K	
R108,208	B-1585	Carbon Resistor	3.3K RD¼ F	VR102,202	B-1428	Semi-fixed Volume	1K	
R109,209	B-5596	Carbon Resistor	220K ELR¼ J		B-3924	Gate Pin		
R111,211	B-5505	Carbon Resistor	1.5K ELR¼ J		M-3345	P.B. Dolby Indication Label		
R112,212	B-5601	Carbon Resistor	1.5M ELR¼ J		B-7522	P.B. Dolby P.C.B.		
R113,213	B-5564	Carbon Resistor	1M ELR¼ J					
R114,214 126,226	B-5591	Carbon Resistor	15K ELR¼ J					
R115,215	B-1878	Carbon Resistor	8.2K ELR¼ J					

4-3 REC. DOLBY P.C.B.

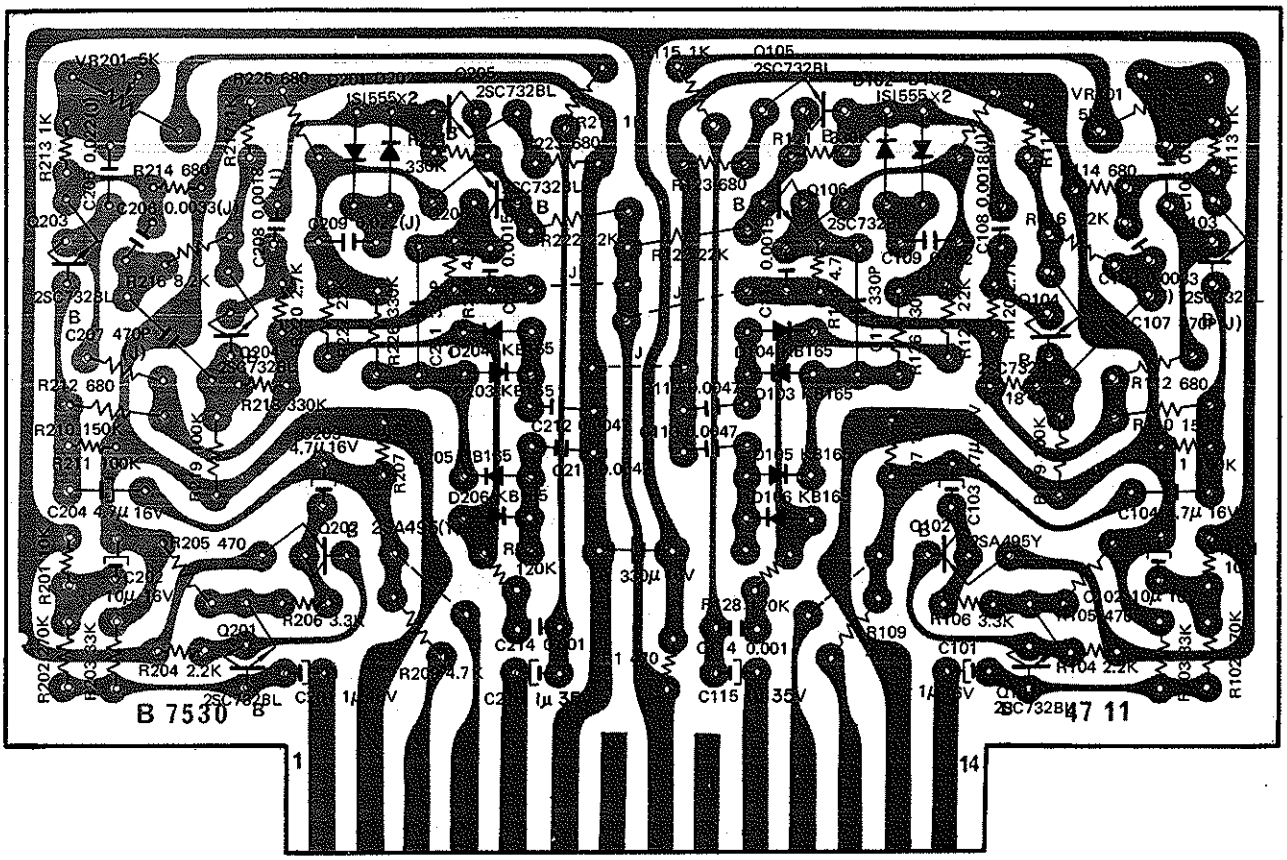


SERIAL No. 3103301 ~

Fig. 4-3

Schematic Ref. No.	Part No.	Description			Schematic Ref.No.	Part No.	Description		
	BA-3589	**REC. Dolby P.C.B. Ass'y**			R117,217 118,218	B-1878	Carbon Resistor	8.2K	ELR¼ J
Q101,201 102,202 104,204 106,206	B-6005	Transistor	2SC732(BL)		R119,219	B-1879	Carbon Resistor	33K	ELR¼ J
Q103,203	B-6001	FET	2SK30A(D)		R120,220	B-5568	Carbon Resistor	120K	ELR¼ J
Q105,205	B-6006	Transistor	2SA495(Y)		R121,221	B-5562	Carbon Resistor	47K	ELR¼ J
D1	B-1808	Zener Diode	KZ8A		R123,223	B-1781	Carbon Resistor	1K	ELR¼ J
D101,201 104,204	B-30P	Germanium Diode	IN60(P)		R124,224	B-5567	Carbon Resistor	33	ELR¼ J
D102,202 103,203 105,205	B-1599	Silicon Diode	KB162		R125,225	B-5569	Carbon Resistor	47	ELR¼ J
R1	B-1830	Carbon Resistor	1.8K	ELR¼ J	R127,227 128,228	B-5600	Carbon Resistor	270K	ELR¼ J
R101,201	B-5661	Carbon Resistor	22K	ELR¼ J	C101,201	B-5598	Tantalum Capacitor	2.2μ	20V
R102,202 103,203	B-5538	Carbon Resistor	27K	ELR¼ J	C102,202 107,207 110,210 114,214	B-1603	Mylar Capacitor	0.1μ	50V K
R104,204 122,222	B-1782	Carbon Resistor	2.7K	ELR¼ J	C103,203 106,206 109,209 111,211	B-1412	Electrolytic Capacitor	10μ	16V
R105,205	B-1590	Carbon Resistor	180K	RD¼ G	C104,204	B-1786	P.P Capacitor	0.033μ	50V G
R106,206 114,214 126,226	B-5591	Carbon Resistor	15K	ELR¼ J	C105,205	B-1608	P.P Capacitor	4700P	50V G
R107,207	B-1885	Carbon Resistor	39K	ELR¼ J	C108,208	B-1404	Electrolytic Capacitor	47μ	6.3V
R108,208	B-1585	Carbon Resistor	3.3K	RD¼ F	C112,212	B-1780	Mylar Capacitor	0.1μ	50V J
R109,209	B-5596	Carbon Resistor	220K	ELR¼ J	C113,213	B-91	Mylar Capacitor	0.001μ	50V M
R110,210 116,216	B-1833	Carbon Resistor	10K	ELR¼ J	C115,215	B-1602	Mylar Capacitor	0.33μ	50V K
R111,211	B-5505	Carbon Resistor	1.5K	ELR¼ J	VR101,201	B-1470	Semi-fixed Volume	5K	
R112,212	B-5601	Carbon Resistor	1.5M	ELR¼ J	VR102,202	B-1428	Semi-fixed Volume	1K	
R113,213	B-5564	Carbon Resistor	1M	ELR¼ J		B-3924	Gate Pin		
R115,215	B-1878	Carbon Resistor	8.2K	ELR¼ J		M-3346	REC. Dolby Indication Label		
						B-7523	REC. Dolby P.C.B.		

4-4 D.N.L. P.C.B.

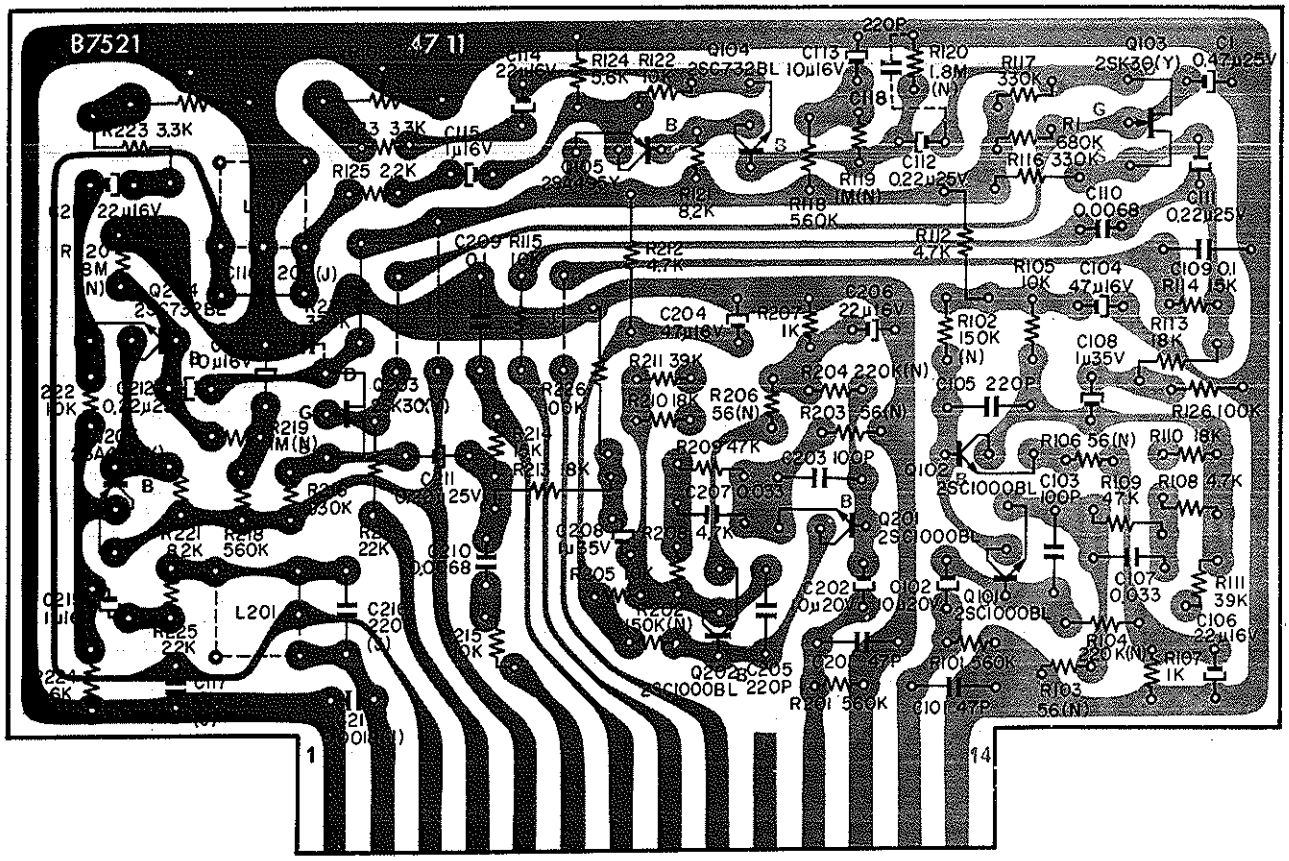


SERIAL No. 3106401 ~

Fig. 4-4

Schematic Ref' No.	Part No.	Description		Schematic Ref. No.	Part No.	Description		
	BA-3590 D.N.L. P.C.B. Ass'y			R115,215 117,217	B-1781	Carbon Resistor	1K	ELR¼ J
				R116,216	B-1878	Carbon Resistor	8.2K	ELR¼ J
Q101,201	B-6005	Transistor	2SC732(BL)	R118,218	B-1921	Carbon Resistor	330K	ELR¼ J
103,203				121,221				
104,204				126,226				
105,205				R120,220	B-1782	Carbon Resistor	2.7K	ELR¼ J
106,206				R122,222	B-5661	Carbon Resistor	22K	ELR¼ J
Q102,202	B-6006	Transistor	2SA495(Y)	127,227				
D101,201	B-1909	Silicon Diode	1S1555	R128,228	B-5568	Carbon Resistor	120K	ELR¼ J
102,202				C1	B-1502	Electrolytic Capacitor	330μ	16V
D103,203	B-6007	Diode	KB165	C101,201	B-1405	Electrolytic Capacitor	1μ	16V
104,204				C102,202	B-1412	Electrolytic Capacitor	10μ	16V
105,205				C103,203	B-1389	Electrolytic Capacitor	4.7μ	16V
106,206				104,204				
R1	B-1792	Carbon Resistor	470 ELR¼ J	C105,205	B-1916	Mylar Capacitor	0.022μ	50V J
105,205				109,209				
R101,201	B-1833	Carbon Resistor	10K ELR¼ J	C106,206	B-1914	Mylar Capacitor	3300P	50V J
107,207				C107,207	B-5612	SP Capacitor	470P	35V J
R102,202	B-5600	Carbon Resistor	270K ELR¼ J	C108,208	B-1913	Mylar Capacitor	1800P	50V J
R103,203	B-1879	Carbon Resistor	33K ELR¼ J	C110,210	B-1711	Mylar Capacitor	1500P	50V K
R104,204	B-5560	Carbon Resistor	2.2K ELR¼ J	C111,211	B-5611	SP Capacitor	330P	35V K
R106,206	B-1793	Carbon Resistor	3.3K ELR¼ J	C112,212	B-1915	Mylar Capacitor	4700P	50V K
R109,209	B-1795	Carbon Resistor	4.7K ELR¼ J	113,213				
124,224				C114,214	B-91	Mylar Capacitor	1000P	50V M
R110,210	B-5593	Carbon Resistor	150K ELR¼ J	C115,215	B-5638	Tantalum Capacitor	1μ	35V M
R111,211	B-1920	Carbon Resistor	100K ELR¼ J	VR101,201	B-1470	Semi-fixed Volume	5K	
119,219					M-3347	D.N.L. Indication Label		
R112,212	B-5559	Carbon Resistor	680 ELR¼ J		B-7530	D.N.L. P.C.B		
114,214								
123,223								
125,225								
R113,213	B-1781	Carbon Resistor	1K ELR¼ J					

4-5 P.B. HEAD AMP. P.C.B.



SERIAL No. 3102551 ~

Fig. 4-5

Schematic Ref. No.	Part No.	Description	Schematic Ref. No.	Part No.	Description
	BA-3587	**P.B. Head AMP. P.C.B. Ass'y**	R125,225	B-5566	Carbon Resistor 2.2K ELR¼ J
Q101,201	B-6003	Transistor 2SC1000(BL)	R126,226	B-1920	Carbon Resistor 100K ELR¼ J
102,202			C1	B-1376	Aluminium Capacitor 0.47μ 25V M
Q103,203	B-1600	FET 2SK30 (Y)	C101,201	B-1456	Ceramic Capacitor 47P 50V M
Q104,204	B-6005	Transistor 2SC732(BL)	C102,202	B-5581	Tantalum Capacitor 10μ 20V M
Q105,205	B-6006	Transistor 2SA495(Y)	C103,203	B-1288	Ceramic Capacitor 100P 50V M
L101,201	B-68S	Bias Trap Coil	C104,204	B-1403	Electrolytic Capacitor 47μ 16V
R1	B-5597	Carbon Resistor 680K ELR¼ J	C105,205	B-1289	Ceramic Capacitor 220P 50V M
R2	B-5661	Carbon Resistor 22K ELR¼ J	118,218		
R101,201	B-5665	Carbon Resistor 560K ELR¼ J	C106,206	B-1862	Electrolytic Capacitor 22μ 16V
118,218			114,214		
R102,202	B-5521	Carbon Resistor 150K (N)ELR¼ J	C107,207	B-5531	Mylar Capacitor 0.033μ 50V K
R103,203	B-5642	Carbon Resistor 56 (N)ELR¼ J	C108,208	B-5638	Tantalum Capacitor 1μ 35V M
106,206			C109,209	B-1603	Mylar Capacitor 0.1μ 50V K
R104,204	B-5517	Carbon Resistor 220K (N)ELR¼ J	C110,210	B-5530	Mylar Capacitor 6800P 50V K
R105,205	B-1833	Carbon Resistor 10K ELR¼ J	C111,211	B-1664	Aluminium Capacitor 0.22μ 25V M
115,215			112,212		
122,222			C113,213	B-1412	Electrolytic Capacitor 10μ 16V
R107,207	B-1781	Carbon Resistor 1K ELR¼ J	C115,215	B-1405	Electrolytic Capacitor 1μ 16V
R108,208	B-1795	Carbon Resistor 4.7K ELR¼ J	C116,216	B-5532	S.P. Capacitor 220P 35V J
112,212			C117,217	B-1913	Mylar Capacitor 1800P 50V J
R109,209	B-5562	Carbon Resistor 47K ELR¼ J	VR101,201	B-1922	Semi-fixed Volume 20K
R110,210	B-5561	Carbon Resistor 18K ELR¼ J		M-3344	P.B.Head AMP.Indication Label
113,213				B-7521	P.B.Head AMP. P.C.B.
R111,211	B-1885	Carbon Resistor 39K ELR¼ J			
R114,214	B-5591	Carbon Resistor 15K ELR¼ J			
R116,216	B-1921	Carbon Resistor 330K ELR¼ J			
117,217					
R119,219	B-5449	Carbon Resistor 1M(N)ELR¼ J			
R120,220	B-5748	Carbon Resistor 1.8M(N)ELR¼ J			
R121,221	B-1878	Carbon Resistor 8.2K ELR¼ J			
R123,223	B-1793	Carbon Resistor 3.3K ELR¼ J			
R124,224	B-5673	Carbon Resistor 5.6K ELR¼ J			

4-6 LINE AMP. P.C.B.

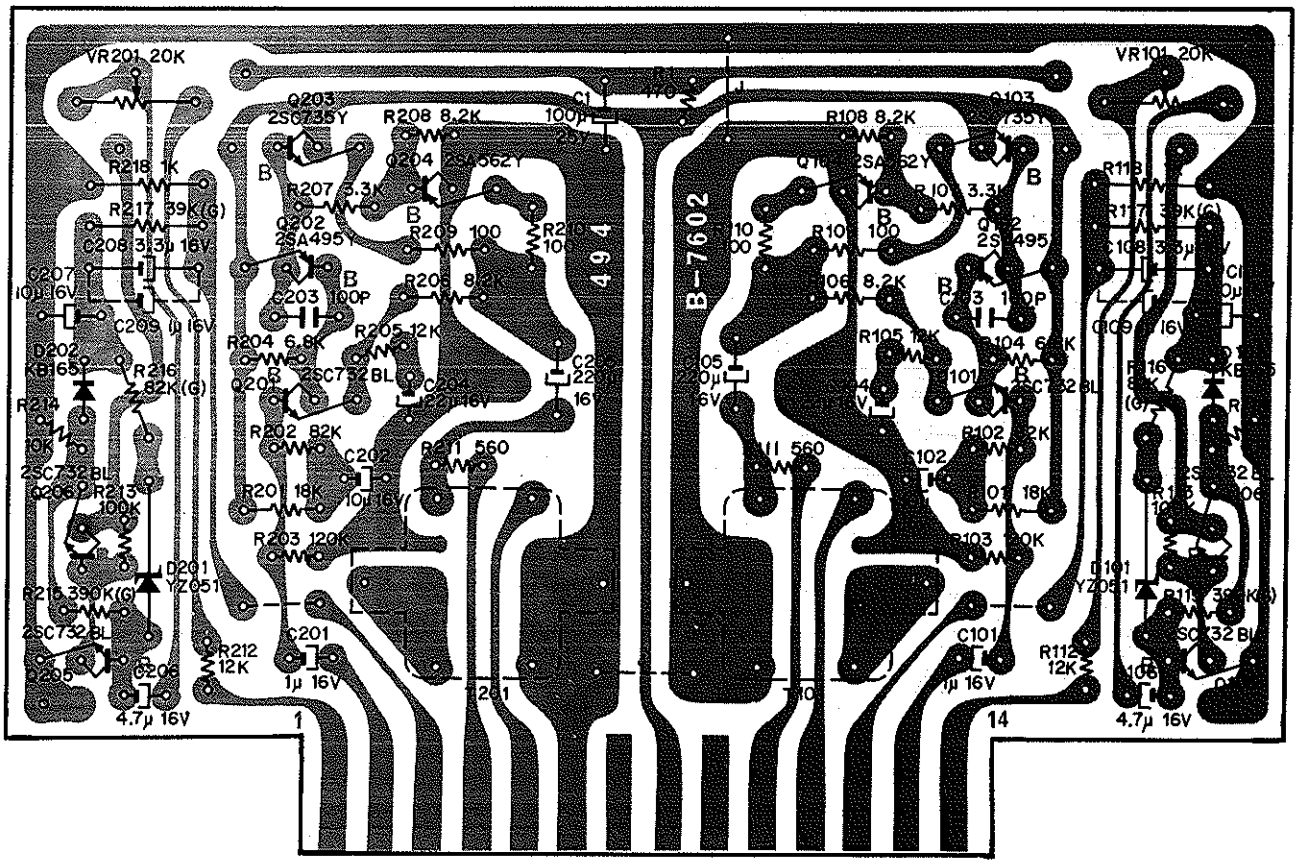


Fig. 4-6

Schematic Ref. No.	Part No.	Description			Schematic Ref. No.	Part No.	Description		
	BA-3654 Line AMP. P.C.B. Ass'y								
Q101,201 105,205 106,206	B-6005	Transistor	2SC732(BL)		C102,202	B-1412	Electrolytic Capacitor	10μ 16V	
Q102,202	B-6006	Transistor	2SA495(Y)		C103,203	B-1288	Ceramic Capacitor	100P 50V M	
Q103,203	B-1338	Transistor	2SC735(Y)		C104,204	B-1862	Electrolytic Capacitor	22μ 16V	
Q104,204	B-1426	Transistor	2SA562(Y)		C105,205	B-1398	Electrolytic Capacitor	220μ 16V	
D101,201	B-6058	Zener Diode	YZ051		C106,206	B-1389	Electrolytic Capacitor	4.7μ 16V	
D102,202	B-6007	Silicon Diode	KB165		C107,207	B-5667	Tantalum Capacitor	10μ 16V	
T101,201	B-3879	Headphone Trans.			C108,208	B-5768	Tantalum Capacitor	3.3μ 16V	
R1	B-1792	Carbon Resistor	470 ELR¼ J		VR101,201	B-1922	Semi-fixed Volume	20K	
R101,201	B-5561	Carbon Resistor	18K ELR¼ J			M-3484	Line AMP. Indication Label		
R102,202	B-1564	Carbon Resistor	82K ELR¼ J			B-7602	Line AMP. P.C.B.		
R103,203	B-5568	Carbon Resistor	120K ELR¼ J						
R104,204	B-1877	Carbon Resistor	6.8K ELR¼ J						
R105,205 112,212	B-5650	Carbon Resistor	12K ELR¼ J						
R106,206 108,208	B-1878	Carbon Resistor	8.2K ELR¼ J						
R107,207	B-1793	Carbon Resistor	3.3K ELR¼ J						
R109,209 110,210	B-5558	Carbon Resistor	100 ELR¼ J						
R111,211	B-5678	Carbon Resistor	560 ELR¼ J						
R113,213	B-1920	Carbon Resistor	100K ELR¼ J						
R114,214	B-1833	Carbon Resistor	10K ELR¼ J						
R115,215	B-5544	Carbon Resistor	390K RD¼ G						
R116,216	B-5766	Carbon Resistor	82K RD¼ G						
R117,217	B-5765	Carbon Resistor	39K RD¼ G						
R118,218	B-1781	Carbon Resistor	1K ELR¼ J						
C1	B-1272	Electrolytic Capacitor	100μ 25V						
C101,201 109,209	B-1405	Electrolytic Capacitor	1μ 16V						

4-7 MIC. AMP. P.C.B.

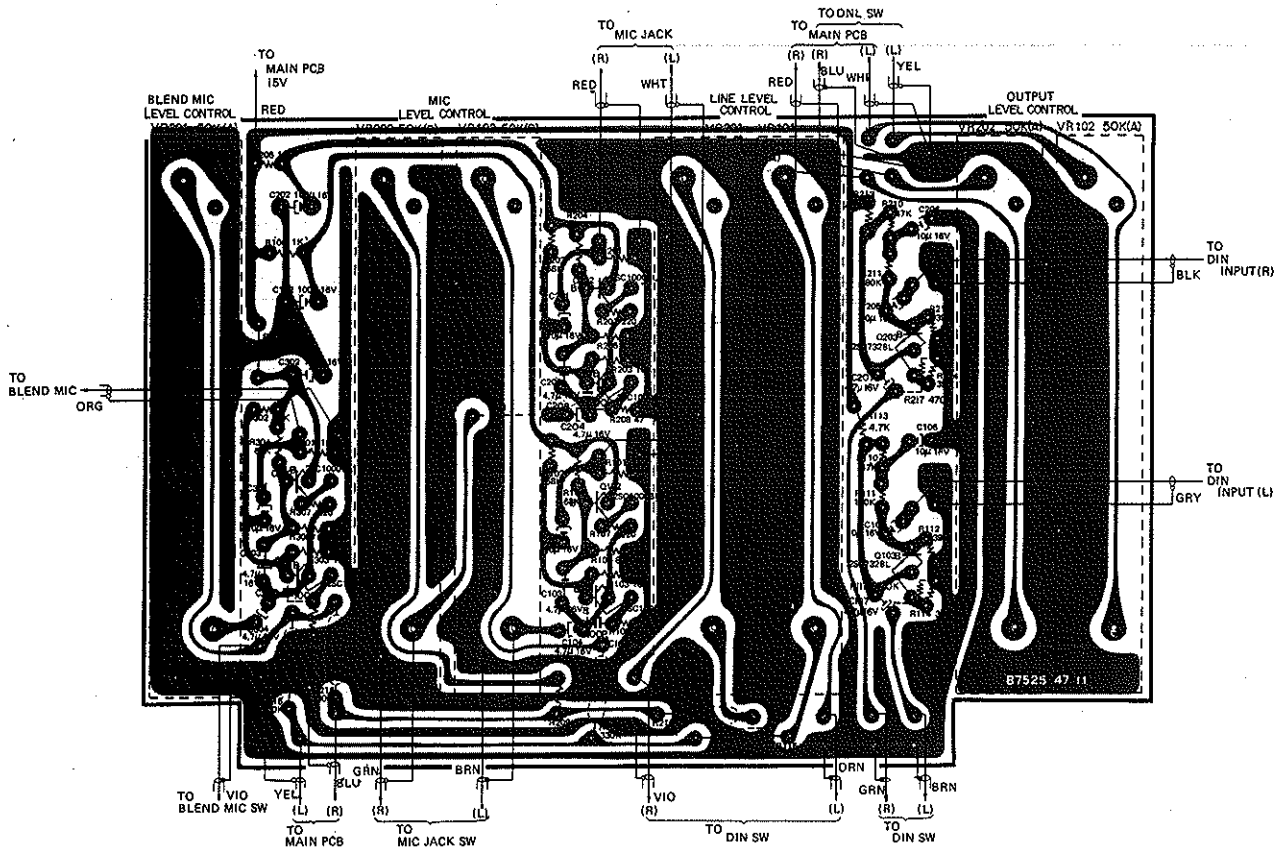
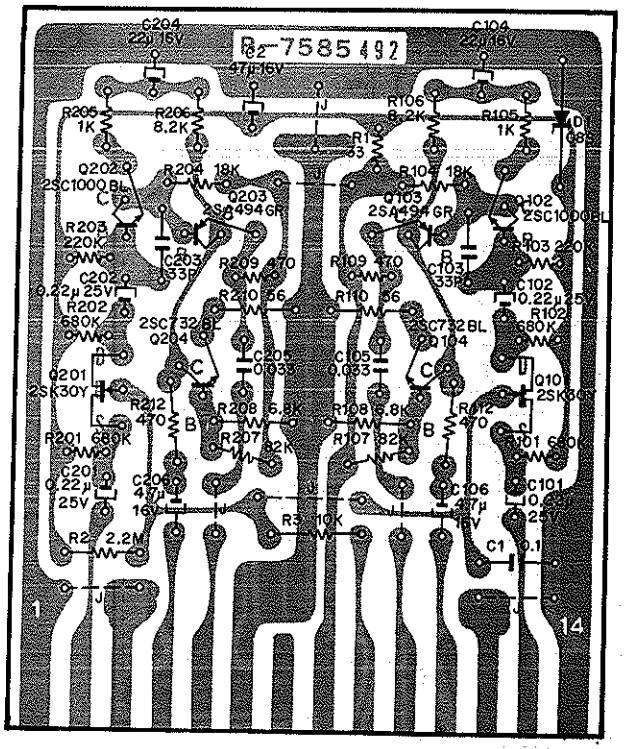


Fig. 4-7

Schematic Ref. No.	Part No.	Description		Schematic Ref. No.	Part No.	Description	
	BA-3593 MIC. AMP. P.C.B Ass'y			C106,206 301	B-1412	Electrolytic Capacitor	10μ 16V
Q101,201 102,202 301,302	B-6003	Transistor	2SC1000(BL)	C102,202 302	B-1400	Electrolytic Capacitor	100μ 16V
Q103,203	B-6005	Transistor	2SC732(BL)	C103,203 104,204 107,207 303,304	B-1389	Electrolytic Capacitor	4.7μ 16V
R101,201 106,206 301,306	B-1781	Carbon Resistor	1K ELR¼ J	C108,208 305	B-1288	Ceramic Capacitor	100P 50V M
R102,202 104,204 302,304	B-1902	Carbon Resistor	68K ELR¼ J	VR101,201 102,202 301,	B-7046	Slide Volume	50K(A)
R103,203 303	B-1833	Carbon Resistor	10K ELR¼ J	VR103,203	B-7010	Slide Volume	50K(B)
R105,205 305	B-1564	Carbon Resistor	82K ELR¼ J		T-3048	P.C.B. Pad	
R107,207 307	B-5608	Carbon Resistor	220 ELR¼ J		B-7525	MIC. AMP. P.C.B.	
R108,208 308	B-5569	Carbon Resistor	47 ELR¼ J				
R109 116,216	B-5627	Carbon Resistor	330K R¼ J				
R209	B-1921	Carbon Resistor	330K ELR¼ J				
R110,210	B-5562	Carbon Resistor	47K ELR¼ J				
R111,211	B-5669	Carbon Resistor	180K ELR¼ J				
R112,212	B-1885	Carbon Resistor	39K ELR¼ J				
R113,213	B-1795	Carbon Resistor	4.7K ELR¼ J				
R114,214	B-5688	Carbon Resistor	390 ELR¼ J				
R115,215	B-5620	Carbon Resistor	270K R¼ J				
R117,217	B-5700	Carbon Resistor	470K ELR¼ J				
C101,201 105,205	B-1412	Electrolytic Capacitor	10μ 16V				

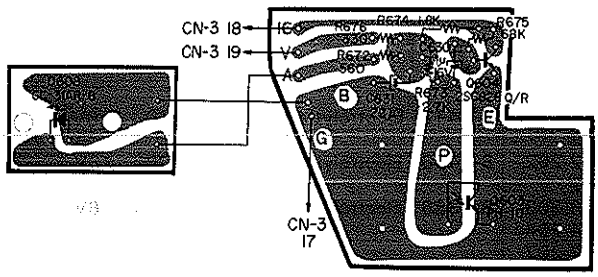
4-8 REC. EQ. AMP. P.C.B.



SERIAL No. 3102551 ~

Fig. 4-8

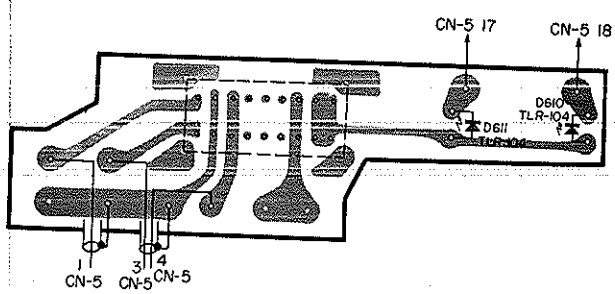
4-9 SHUT-OFF SENSOR P.C.B.



SERIAL No. 3102551 ~

Fig. 4-9

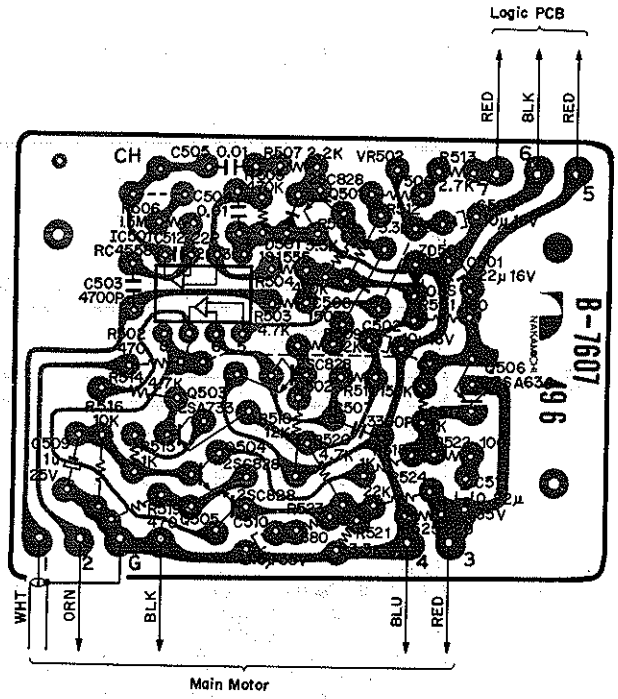
4-10 400Hz OSC. SW. P.C.B.



SERIAL No. 3101851 ~

Fig. 4-10

4-11 MOTOR GOVERNOR P.C.B.



SERIAL No. 3105001 ~

Fig. 4-11

4-12 HEAD BASE SW. P.C.B.

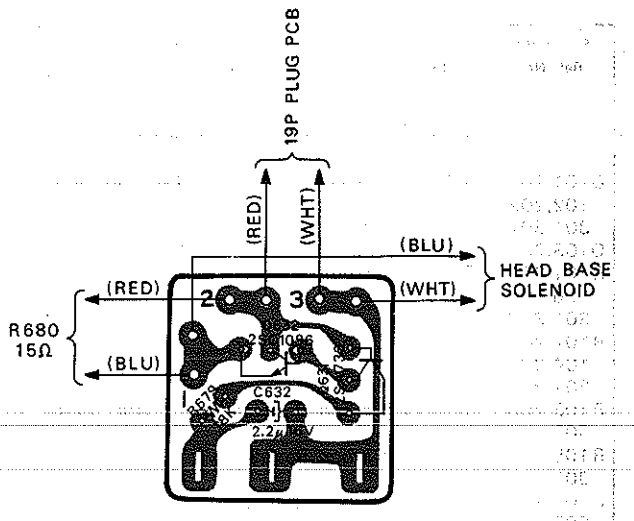
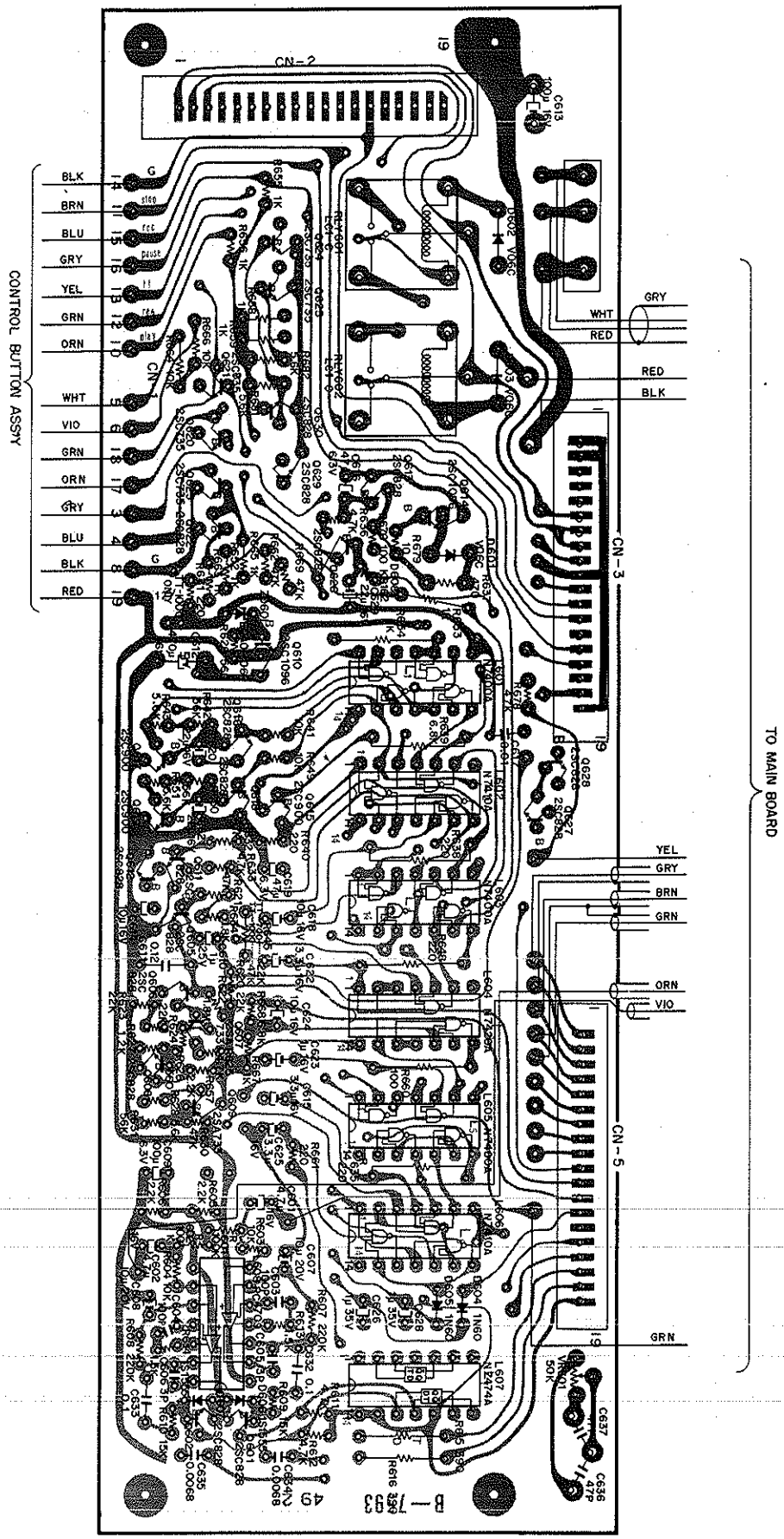


Fig. 4-12

Schematic Ref. No.	Part No.	Description
		BA-3645 REC. EQ. AMP. P.C.B. Ass'y
Q101,201	B-1600	FET 2SK30(Y)
Q102,202	B-6003	Transistor 2SC1000(BL)
Q103,203	B-6021	Transistor 2SA494(GR)
Q104,204	B-6005	Transistor 2SC732(BL)
D1	B-6004	Zener Diode EQA01-08S
R1	B-1879	Carbon Resistor 33 ELR¼ J
R2	B-5672	Carbon Resistor 2.2M ELR¼ J
R3	B-1833	Carbon Resistor 10K ELR¼ J
R101,201	B-5597	Carbon Resistor 680K ELR¼ J
102,202		
R103,203	B-5596	Carbon Resistor 220K ELR¼ J
R104,204	B-5561	Carbon Resistor 18K ELR¼ J
R105,205	B-1781	Carbon Resistor 1K ELR¼ J
R106,206	B-1878	Carbon Resistor 8.2K ELR¼ J
R107,207	B-1564	Carbon Resistor 82K ELR¼ J
R108,208	B-1877	Carbon Resistor 6.8K ELR¼ J
R109,209	B-1792	Carbon Resistor 470 ELR¼ J
112,212		
R110,210	B-5587	Carbon Resistor 56 ELR¼ J
C1	B-1603	Mylar Capacitor 0.1μ 50V K
C2	B-1403	Electrolytic Capacitor 47μ 16V
C101,201	B-1664	Aluminium Capacitor 0.22μ 25V
102,202		
C103,203	B-5744	Ceramic Capacitor 33P 50V M
C104,204	B-1862	Electrolytic Capacitor 22μ 16V
C105,205	B-5531	Mylar Capacitor 0.033μ 50V K
C106,206	B-5657	Tantalum Capacitor 4.7μ 16V
	M-3452	REC. EQ. AMP. Inducation Label
	B-7585	REC. EQ. AMP. P.C.B
		BA-3663 Shut-off Luminous P. C. B. Ass'y
D608	B-6039	L.E.D. GL-31AR-8
	B-7575	Shut-off Luminous P.C.B.
		BA-3664 Shut-off Sensor P.C.B. Ass'y
Q603	B-6040	Photo-transistor PH-10
Q604	B-1824	Transistor 2SC828(Q/R)
R672	B-5678	Carbon Resistor 560 ELR¼ J
R673	B-1782	Carbon Resistor 2.7K ELR¼ J
R674	B-1830	Carbon Resistor 1.8K ELR¼ J
R675	B-1902	Carbon Resistor 68K ELR¼ J
R676	B-1789	Carbon Resistor 330 ELR¼ J
C630	B-1405	Electrolytic Capacitor 1μ 16V
C631	B-1862	Electrolytic Capacitor 22μ 16V
	B-7574	Shut-off Sensor P.C.B.
		BA-3665 400Hz OSC. SW. P.C.B. Ass'y
D610,611	B-7571	400Hz OSC. SW. P.C.B. (B)
	B-4120	L.E.D. TLR104
	B-7045	400Hz OSC. Switch SL262A2
		BA-3662 Motor Governor P.C.B. Ass'y
IC501	B-6049	IC RC4558
Q501,502	B-1824	Transistor 2SC828
504,505		
Q503	B-6013	Transistor 2SA733
Q506	B-6012	Transistor 2SA634
D501	B-1909	Silicon Diode 1S1555

Schematic Ref. No.	Part No.	Description
ZD501	B-6004	Zener Diode EQA01-08S
R501	B-5607	Carbon Resistor 180 ELR¼ J
R502,519	B-1792	Carbon Resistor 470 ELR¼ J
R503,514	B-1795	Carbon Resistor 4.7K ELR¼ J
520		
R504,505	B-5700	Carbon Resistor 470K ELR¼ J
R506	B-5601	Carbon Resistor 1.5M ELR¼ J
R507	B-5566	Carbon Resistor 2.2K ELR¼ J
R508,512	B-1793	Carbon Resistor 3.3K ELR¼ J
521		
R509,510	B-5650	Carbon Resistor 12K ELR¼ J
R511	B-5628	Metal Film Resistor 150K ¼D Z
R513	B-1782	Carbon Resistor 2.7K ELR¼ J
R515,517	B-1781	Carbon Resistor 1K ELR¼ J
518		
R516	B-1833	Carbon Resistor 10K ELR¼ J
R522	B-5558	Carbon Resistor 100 ELR¼ J
R523	B-5559	Carbon Resistor 680 ELR¼ J
R524	B-5661	Carbon Resistor 22K ELR¼ J
R525	B-5608	Carbon Resistor 220 ELR¼ J
C501	B-1862	Electrolytic Capacitor 22μ 16V
C502,508	B-1412	Electrolytic Capacitor 10μ 16V
C503	B-1915	Mylar Capacitor 4700P 50V
C504,505	B-1609	Mylar Capacitor 0.01μ 50V K
C506	B-5599	Ceramic Capacitor 150P 50V M
C507	B-5552	SP Capacitor 3300P 100V
C509	B-5742	Tantalum Capacitor 1μ 25V M
C510	B-5639	Tantalum Capacitor 1.5μ 35V M
C511	B-5772	Tantalum Capacitor 0.22μ 35V M
C512	B-5806	Ceramic Capacitor 22P 50V K
VR502	B-1883	Semi-fixed Volume 500
	B-8069	Heat Sink
	B-8077	Motor Governor P.C.B. Holder
	E-71	Washer 3 Fiber
	E-507	Nut Hex M3
	E-510	Screw M3×8 Pan Head ⊕
	E-597	Washer 3
	E-606	Screw M3×6 Pan Head ⊕
	E-608	Screw M3×10 Pan Head ⊕
	B-7607	Motor Governor P.C.B. (C)
		BA-3666 Head Base Switch P.C.B. Ass'y
Q631	B-6013	Transistor 2SA733
Q632	B-1895	Transistor 2SC1096
R679	B-5561	Carbon Resistor 18K ELR¼ J
C632	B-5512	Electrolytic Capacitor 2.2μ 16V
	B-7578	Base Switch Sub. P.C.B.

4-13 LOGIC CONTROL P.C.B.



SERIAL No. 3105001 ~

Fig. 4-13

Schematic Ref. No.	Part No.	Description		
	BA-3688 Logic Control P.C.B. Ass'y			
L601,603 605	B-6041	IC	N7400A	
L602,606	B-6042	IC	N7410A	
L604	B-6043	IC	N7420A	
L607	B-6044	IC	N7474A	
L608	B-6027	IC	RC4709	
Q601,602 605,606 608,611 612,613 616,618 622,626 627,628 629,630	B-1824	Transistor	2SC828(Q/R)	
Q607,609	B-6013	Transistor	2SA-733	
Q610,614	B-6020	Transistor	2SC-1096	
Q615,617 619	B-1910	Transistor	2SC-900	
Q620,621 623,624 625	B-1338	Transistor	2SC-735	
D601,602 603	B-1501	Silicon Diode	V06C	
D604,605	B-30	Germanium Diode	IN60	
D606,607	B-1909	Silicon Diode	1S1555	
D608	B-1599	Silicon Varister	KB162	
ZD601	B-6014	Zener Diode	EQA01-06R	
R601,602	B-1920	Carbon Resistor	100K ELR¼ J	
R603,604 641,649 664,666	B-1833	Carbon Resistor	10K ELR¼ J	
R605,606 657	B-5566	Carbon Resistor	2.2K ELR¼ J	
R607,608	B-5596	Carbon Resistor	220K ELR¼ J	
R609,610	B-5591	Carbon Resistor	15K ELR¼ J	
R611,612 621,625 632,633 636,678	B-1795	Carbon Resistor	4.7K ELR¼ J	
R613,614	B-5505	Carbon Resistor	1.5K ELR¼ J	
R615,616	B 5691	Carbon Resistor	390 R¼ J	
R620,623 624	B-5661	Carbon Resistor	22K ELR¼ J	
R622	B-5670	Carbon Resistor	1.8M ELR¼ J	
R626,629	B-5678	Carbon Resistor	560 ELR¼ J	
R627	B-5565	Carbon Resistor	1.2K ELR¼ J	
R628,643 651,681 682	B-5673	Carbon Resistor	5.6K ELR¼ J	
R630,645 662,669	B-5562	Carbon Resistor	47K ELR¼ J	
R631,642 650	B-5563	Carbon Resistor	56K ELR¼ J	
R634	B-1830	Carbon Resistor	1.8K ELR¼ J	
R635,638 648	B-1933	Carbon Resistor	220 R¼ J	
R637	B-5572	Carbon Resistor	470 RD½ J	
R639	B-1682	Carbon Resistor	6.8K R¼ J	
R640,661 671	B-5608	Carbon Resistor	220 ELR¼ J	
R652,653 654,655 656,658 659,663 665,667	B-1781	Carbon Resistor	1K ELR¼ J	
R660	B-1679	Carbon Resistor	100 R¼ J	
R668	B-1877	Carbon Resistor	6.8K ELR¼ J	
R670	B-5558	Carbon Resistor	100 ELR¼ J	
R679	B-5663	Carbon Resistor	10 ELR¼ J	
C601,602	B-5657	Tantalum Capacitor	4.7μ 16V M	
C603,604	B-1288	Ceramic Capacitor	100P 50V M	
C605,606	B-5745	Ceramic Capacitor	3P 50V M	
C607,608	B-5581	Tantalum Capacitor	10μ 20V M	
C609	B-1411	Electrolytic Capacitor	100μ 6.3V	
C610,623	B-1405	Electrolytic Capacitor	1μ 16V	
C611	B-1772	Mylar Capacitor	0.12μ 50V K	
C612	B-1392	Electrolytic Capacitor	470μ 16V	
C613	B-1400	Electrolytic Capacitor	100μ 16V	
C614,618 624	B-1412	Electrolytic Capacitor	10μ 16V	
C615,622 625	B-1863	Electrolytic Capacitor	3.3μ 16V	
C616,619	B-1404	Electrolytic Capacitor	47μ 6.3V	
C617	B-1609	Mylar Capacitor	0.01μ 50V K	
C620,621 629	B-1862	Electrolytic Capacitor	22μ 16V	
C626,628	B-5638	Tantalum Capacitor	1μ 35V M	
C632,633	B-1603	Mylar Capacitor	0.1μ 50V K	
C634,635	B-5530	Mylar Capacitor	6800P 50V K	
C636,637	B-1456	Ceramic Capacitor	47P 50V M	
VR601	B-7058	Semi-fixed Volume	50K	
RLY601,602	B-7001	Relay	LC1-C	
	B-3067	Wiring Holder		
	B-8001	Tub		
	BA-3696	19P Connector Ass'y (D)		
	BA-3562	19P Connector Sub. Ass'y		
	BA-3627	Headphone Separate Plug Cord Ass'y		
	C-5157	P.C.B Holder (A)		
	E-507	Nut M3		
	E-518	Screw M3×8 Flat Head ⊕		
	E-581	Washer 3 Spring		
	E-607	Screw M3×8 Pan Head ⊕		
	B-7593	Logic Control P.C.B.		

4-14 POWER SUPPLY P.C.B.

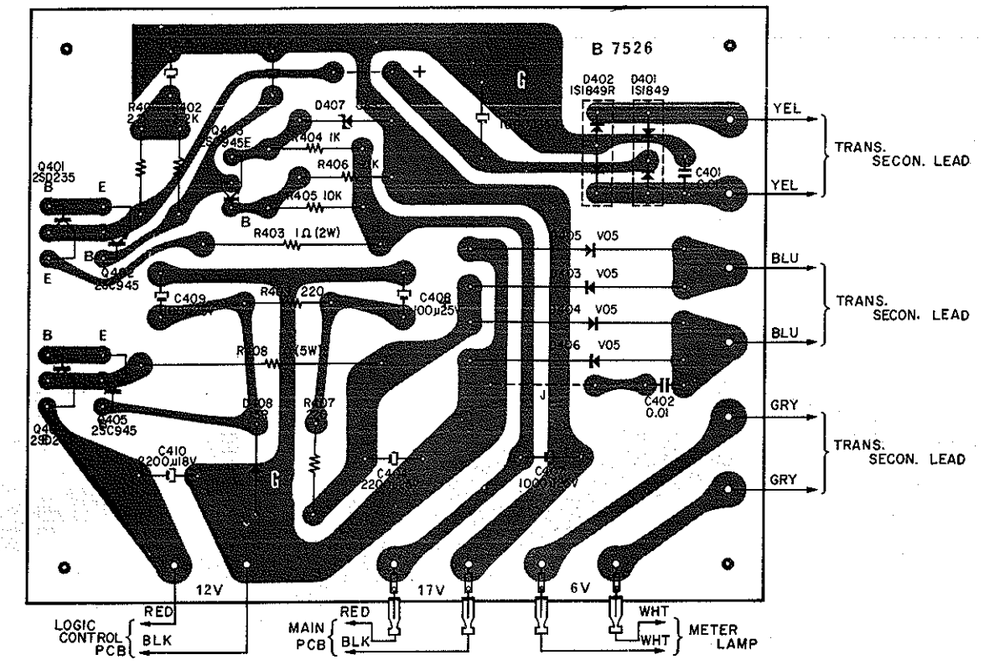


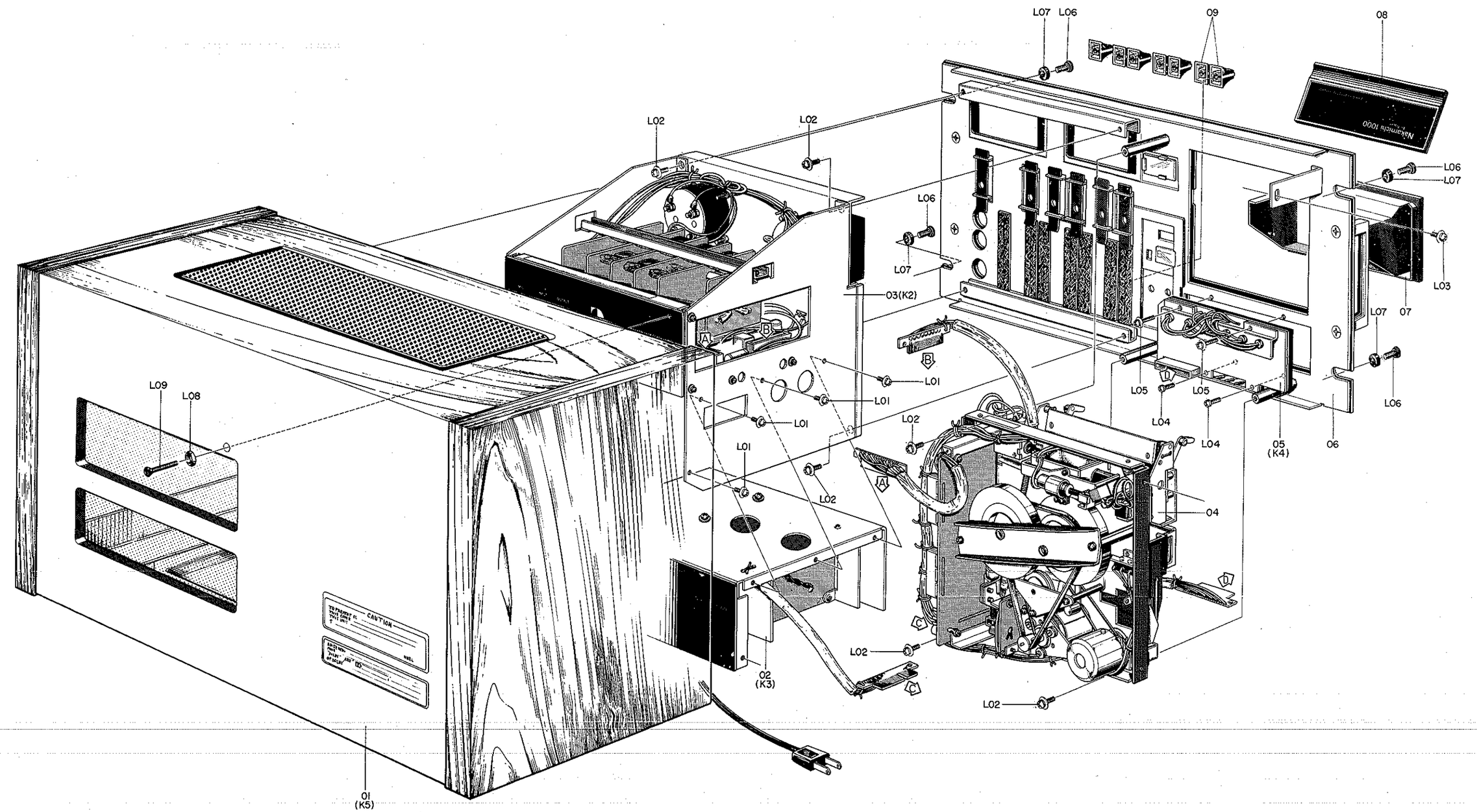
Fig. 4-14

Schematic Ref. No.	Part No.	Description	
	BA-3595 D.C. Supply P.C.B. Ass'y		
Q401,404	B-1823	Transistor	2SD235
Q402,403 405	B-1872	Transistor	2SC945
D401	B-6037U	Silicon Diode	1S1849
D402	B-6038U	Silicon Diobe	1S1849R
D403,404 405,406	B-6010	Silicon Diode	V05
D407	B-6004	Zener Diode	EQA01-08S
D408	B-6009	Zener Diode	EQA01-13R
R401,402	B-5566	Carbon Resistor	2.2K ELR¼ J
R403	B-5755	Metal Film Resistor	1 2W
R404	B-1781	Carbon Resistor	1K ELR¼ J
R405	B-1833	Carbon Resistor	10K ELR¼ J
R406	B-5694	Carbon Resistor	9.1K ELR¼ J
R407,409	B-5608	Carbon Resistor	220 ELR¼ J
R408	B-5542	Cement Resistor	1 5W
C401,402	B-1290	Ceramic Capacitor	0.01μ 50V
C403	B-5540	Electrolytic Capacitor	1000μ 35V
C404	B-5654	Electrolytic Capacitor	2200μ 25V
C405,406 408,409	B-1272	Electrolytic Capacitor	100μ 25V
C407	B-1870	Electrolytic Capacitor	1000μ 25V
C410	B-1835	Electrolytic Capacitor	2200μ 18V
	B-8001	Tub	
	J-3079	Heat Sink	
	J-3082	Supply P.C.B. Holder	
	E-37	Lug Terminal Board	
	E-507	Nut Hex M3	
	E-606	Screw M3×6 Pan Head ⊕	
	E-608	Screw M3×10 Pan Head ⊕	
	B-7526	D.C. Supply P.C.B.	

5 MECHANISM ASSEMBLY/PARTS LIST

5-1. MISCELLANEOUS ASSEMBLY

NOTE: Where serial numbers are shown underneath the modified assemblies, the modifications apply to those serial number only. But if no serial numbers, then no modifications have been made from initial production.

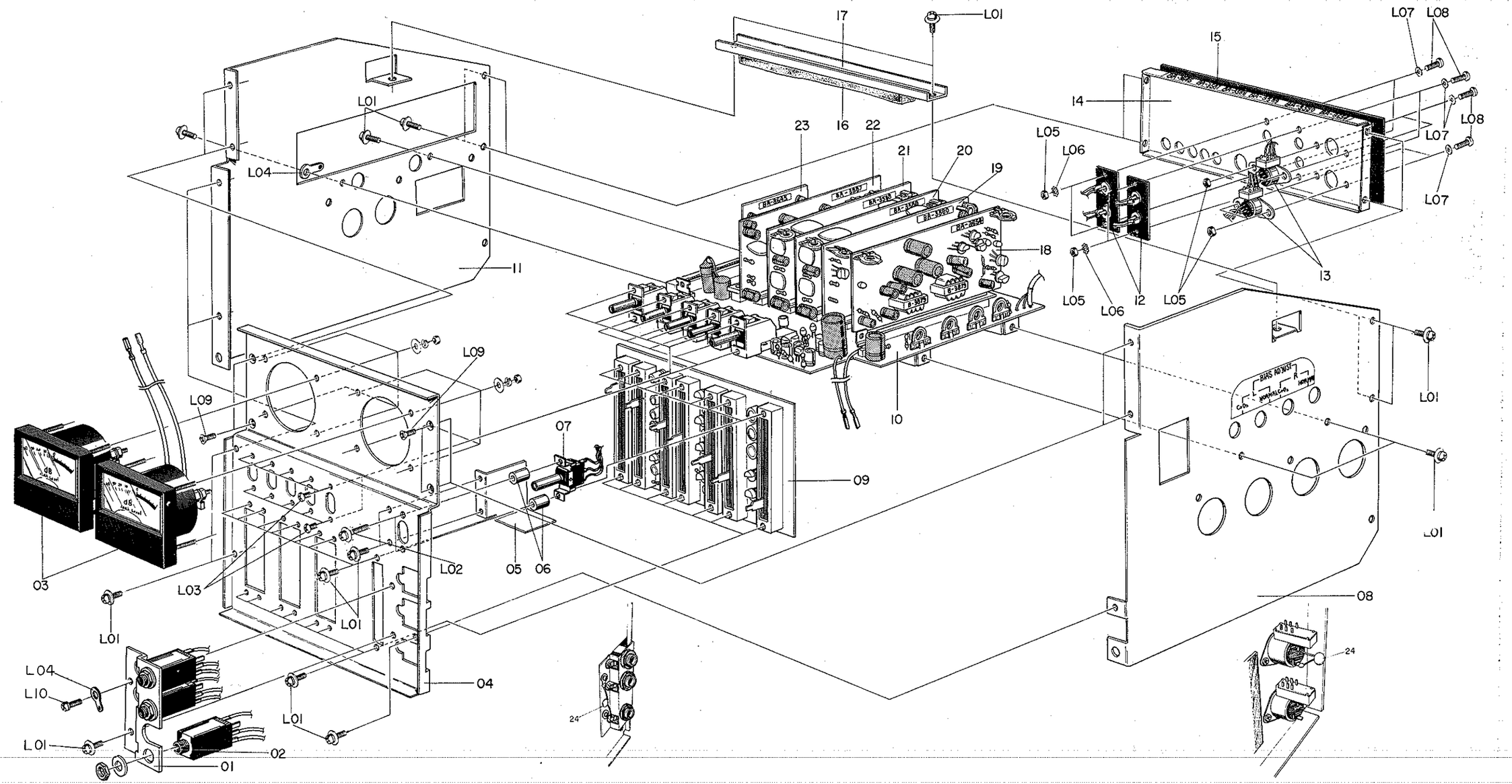


SERIAL No. 3106401 ~

Fig. 5-1

Schematic Ref. No.	Part No.	Description	Q'ty
K1	**TT-1000**	**Miscellaneous Ass'y**	1
01	HA-3568	Cabinet Ass'y	1
02	BA-3594	D.C. Power Supply Ass'y	1
03	BA-3596	Amp. Chassis Ass'y	1
04	CA-5157	Mechanism Ass'y 1000	1
05	HA-3585	Control Holder Ass'y	1
06	HA-3572	Front Panel Ass'y	1
07	HA-3570	Cassette Lid Ass'y	1
08	HA-3569	AJ Lid Ass'y	1
09	H-3196	Slide VR Knob	7
L01	E-606	Screw M3 x 6 Pan Head (3A) ⊕	6
L02	E-634	Screw M4 x 10 Pan Head (3A) ⊕	7
L03	E-633	Screw M4 x 6 Pan Head (3A) ⊕	1
L04	E-624	Screw M3 x 10 Pan Head (2A) ⊕	2
L05	E-660	Screw M3 x 12 Pan Head (3A) ⊕	2
L06	H-3221	Set Screw	4
L07	H-3222	Set Washer	4
L08	E-46	Washer 4	1
L09	E-587	M4 x 25 Round Head ⊕	1

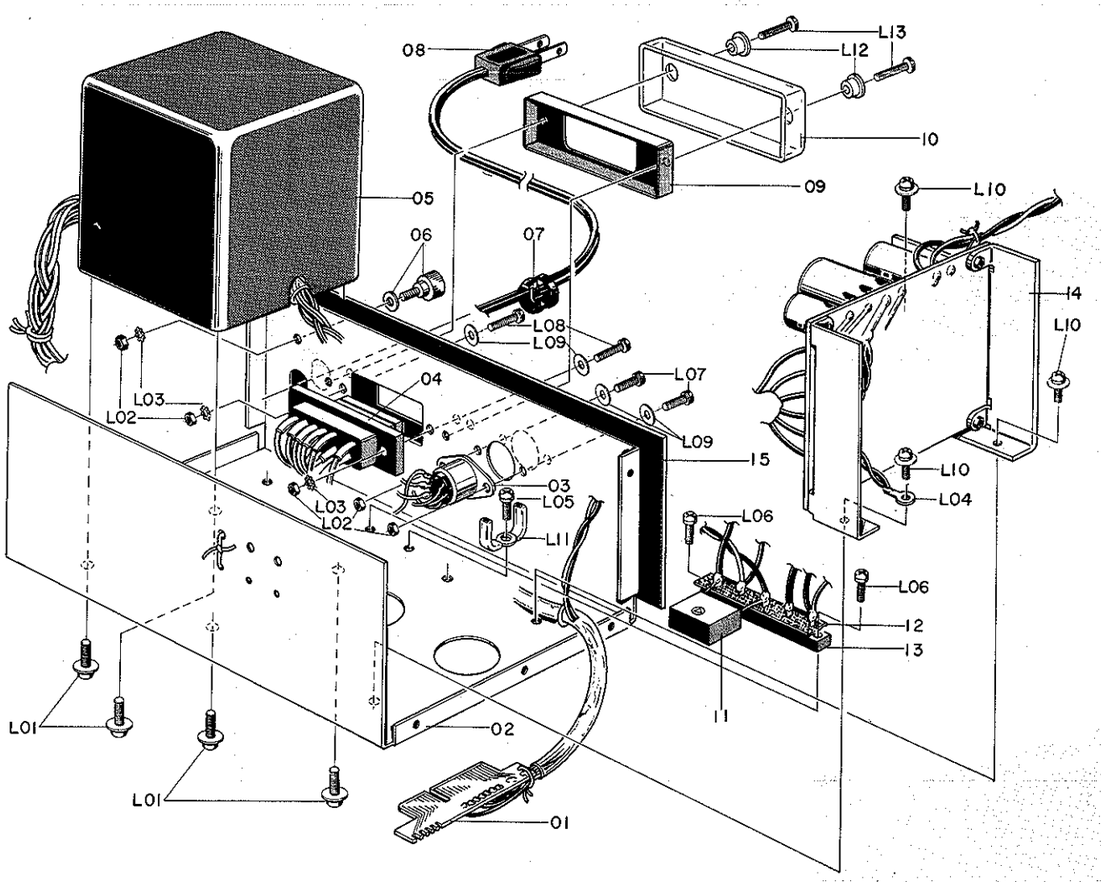
5-2. AMP. CHASSIS ASSEMBLY



SERIAL No. 3106401 ~

Fig. 5-2

5-3. D.C. SUPPLY ASSEMBLY



SERIAL No. 3105401 ~

Fig. 5-3

Schematic Ref. No.	Part No.	Description	Q'ty
K2	**BA-3596**	**Amp. Chassis Ass'y**	1
01	J-3091	MIC Jack Holder	1
02	B-3881	MIC Jack	3
03	B-8114	Level Meter 31	2
04	J-3084	Amp. Chassis	1
05	J-3092	Power SW. Sealed Plate	1
06	J-3087	Power SW. Pipe	2
07	B-7006	Power SW.	1
	H-3193	SW. Lever Cover B	1
	M-3321	Lever Cover Name Plate B	1
08	J-3089	Amp. Plate Right	1
	M-3342	Bias Adjust Label	1
09	BA-3593	MIC Amp. Ass'y	1
10	BA-3644	Main P.C.B. Ass'y	1
	H-3192	SW. Lever Cover A	5
	M-3320	Lever Cover Name Plate A	5
11	J-3088	Amp. Plate Left	1
12	B-3072	2P Pin Jack	2
13	B-8044	DIN Connector	2
14	J-3090	Amp. Rear Chassis	1
	M-3485	Module Indicator Label C	1
15	M-3324	Rear Chassis Name Plate	1
16	J-3086	Board Cushion	1
17	J-3085	Board Holder	1
18	BA-3654	Line Amp. Ass'y	1
19	BA-3590	D.N.L. Ass'y	1
20	BA-3589	REC. Dolby Ass'y	1
21	BA-3588	PB. Dolby Ass'y	1
22	BA-3587	PB. Head Amp. Ass'y	1
23	BA-3645	REC. EQ. Amp Ass'y	1
24	T-4027	Ceramic Capacitor 680P 50V M	2
L01	E-606	Screw M3 x 6 Pan Head (3A) ⊕	31
L02	E-610	Screw M3 x 12 Pan Head (3A) ⊕	2
L03	E-501	Screw M3 x 3 Pan Head ⊕	10
L04	E-37	B-5 Lug Terminal Plate	1
L05	E-507	Nut, Hex M3	8
L06	E-172	Washer 3 Toothed	4
L07	E-157	Collar Washer 3	8
L08	E-588	Screw M3 x 8 Pan Head ⊕	8
L09	E-533	Screw M3 x 5 Flat Head ⊕	4
L10	E-612	Screw M3 x 6 Pan Head (2A) ⊕	1
K3	**BA-3594**	**D.C. Supply Ass'y**	1
01	B-7535	19P Plug P.C.B. (D)	1
02	J-3083	Trans. Chassis	1
03	B-8062	7P DIN Socket	1
04	B-3877U	Voltage Selector Socket	1
05	B-6513U	Power Transformer	1
06	B-3920	Ground Terminal	1
07	B-8037U	Cord Bushing C	1
08	B-3900U	Power Cord	1
09	H-3335	Voltage Selector Cover S.O.	1
10	H-3334	Voltage Selector Acrylic Cover	1
11	B-3873U	Spark Killer	1
12	B-3863	5P Terminal Insulation Plate A	1
13	B-8025U	5P Terminal Strip	1
14	BA-3595	D.C. Supply P.C.B. Ass'y	1
15	M-3323	Power Plate	1
L01	E-634	Screw M4 x 10 Pan Head (4A) ⊕	4
L02	E-507	Nut Hex M3	5
L03	E-172	Washer 3 Toothed	3
L04	E-37	B-5 Earth Lug Terminal Plate	1
L05	E-612	Screw M3 x 6 Pan Head (2A) ⊕	1
L06	E-510	Screw M3 x 8 Pan Head (2A) ⊕	2
L07	E-588	Screw M3 x 8 Pan Bronze ⊕	2
L08	E-590	Screw M3 x 12 Pan Bronze ⊕	2
L09	E-157	Collar Washer 3	4
L10	E-606	Screw M3 x 6 Pan Head (3A) ⊕	3
L11	B-3067	Peaking Coil Holder	1
L12	H-3366	Voltage Selector Cover	2
L13	E-591	Screw M3 x 20 Pan Bronze ⊕	2

5-4. CABINET ASSEMBLY

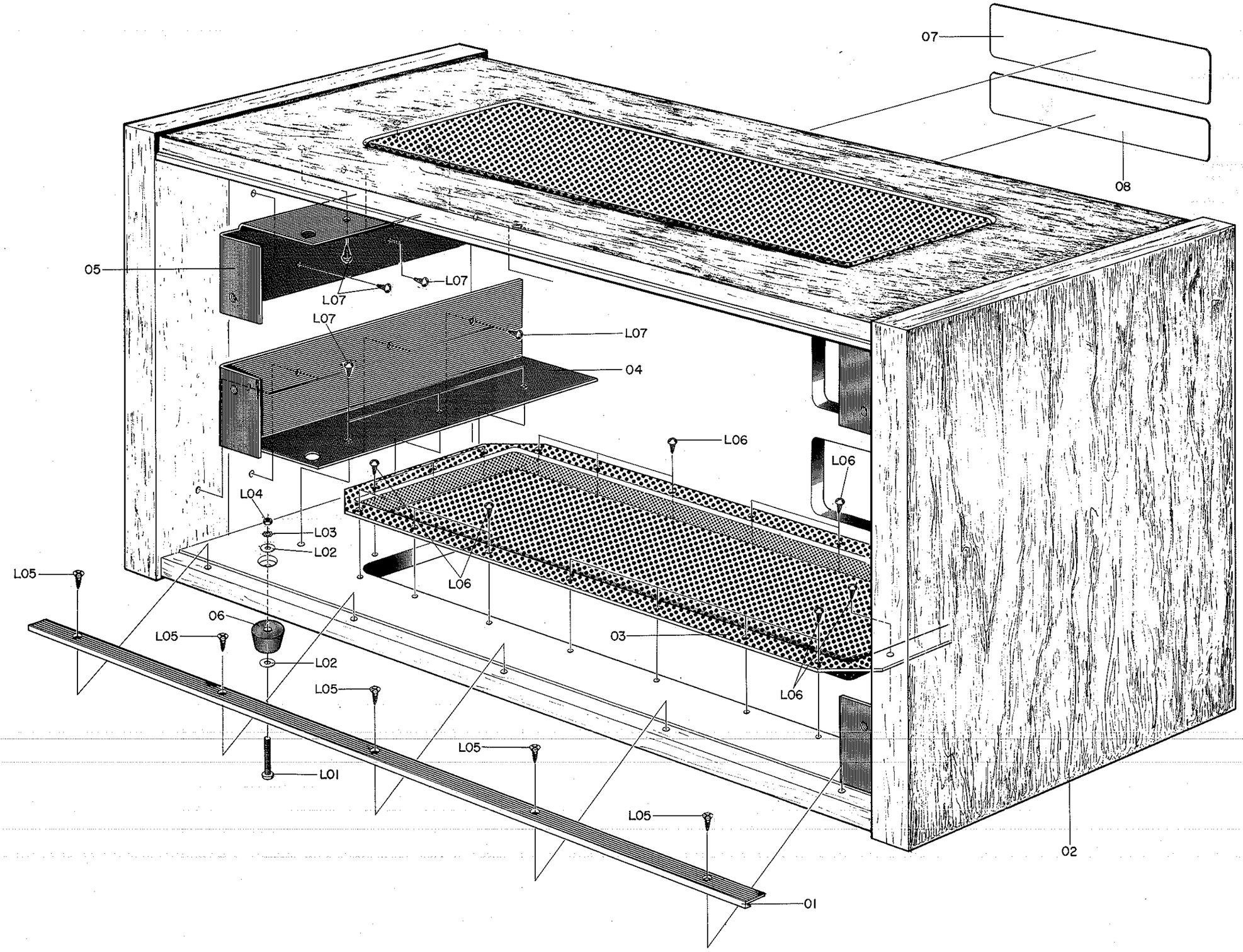


Fig. 5-4

5-5. CONTROL BUTTON ASSEMBLY

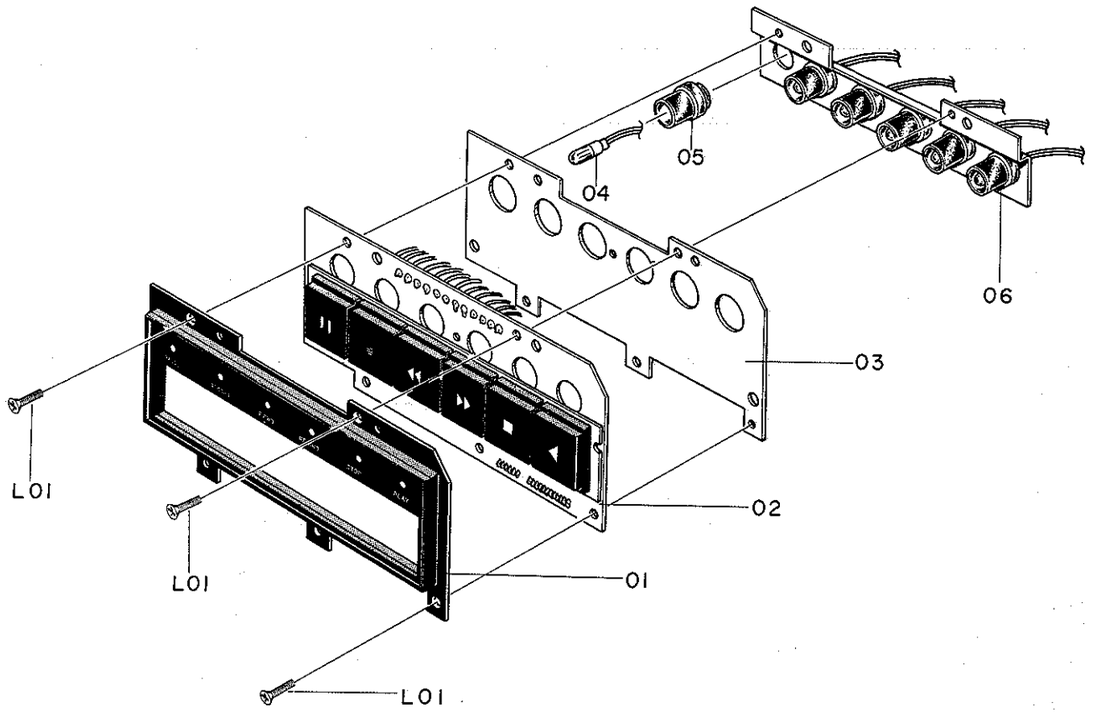
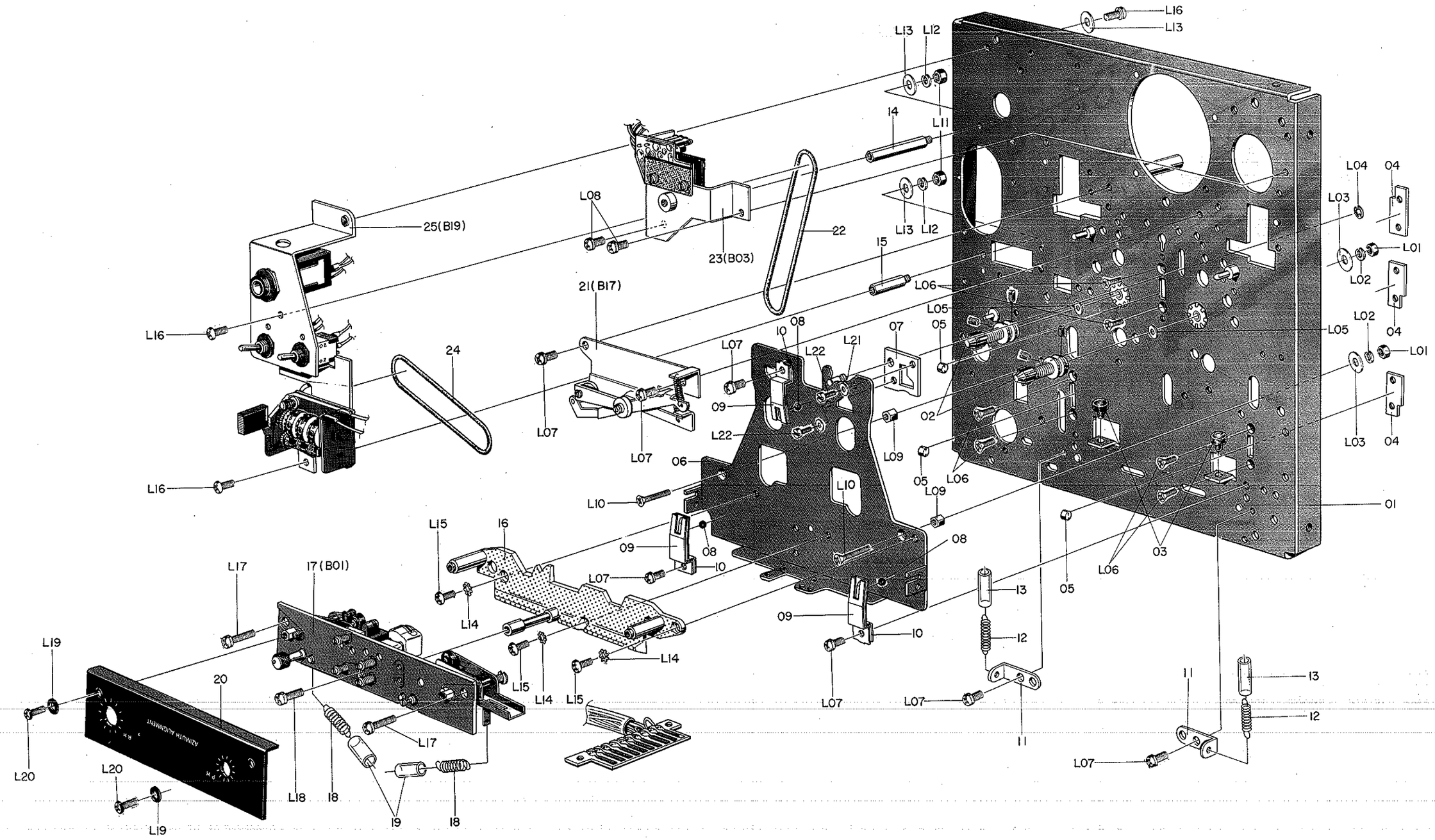


Fig. 5-5

Schematic Ref. No.	Part No.	Description	Q'ty	Schematic Ref. No.	Part No.	Description	Q'ty
K5	**HA-3568**	**Cabinet Ass'y**	**1**	**K4**	**HA-3585**	**Control Button Ass'y**	**1**
01	A-3130	Aluminum Sash	2	01	HA-3597	Control Escutcheon Ass'y	1
02	A-3129	Cabinet	1	02	BA-3695	Control SW. P.C.B. Ass'y	1
03	A-3168	Cabinet Punching Board	2	03	J-3131	Button Chassis	1
04	A-3132	Cabinet Angle B	2	04	B-3884	Pilot Lamp	6
05	A-3131	Cabinet Angle A	2	05	J-3132	Lamp Shade	6
06	A-42	Collar Leg	4	06	J-3133	Shade Holder	1
07	M-3339	Caution Label	1	L01	E-524	Screw M3 x 10 Flat Head ⊕	3
08	M-3330	Dolby Label ZT	1				
L01	E-577	Screw M3 x 20 Pan Head	4				
L02	E-178	Washer 3	8				
L03	E-172	Washer 3 Toothed	4				
L04	E-507	Nut Hex M3	4				
L05	E-1002	WS 2.7 x 10 Round Head Screw ⊕	10				
L06	E-1005	WS 2.7 x 8 Round Head Screw ⊕	40				
L07	E-1001	WS 3.1 x 10 Round Head Screw ⊕	28				

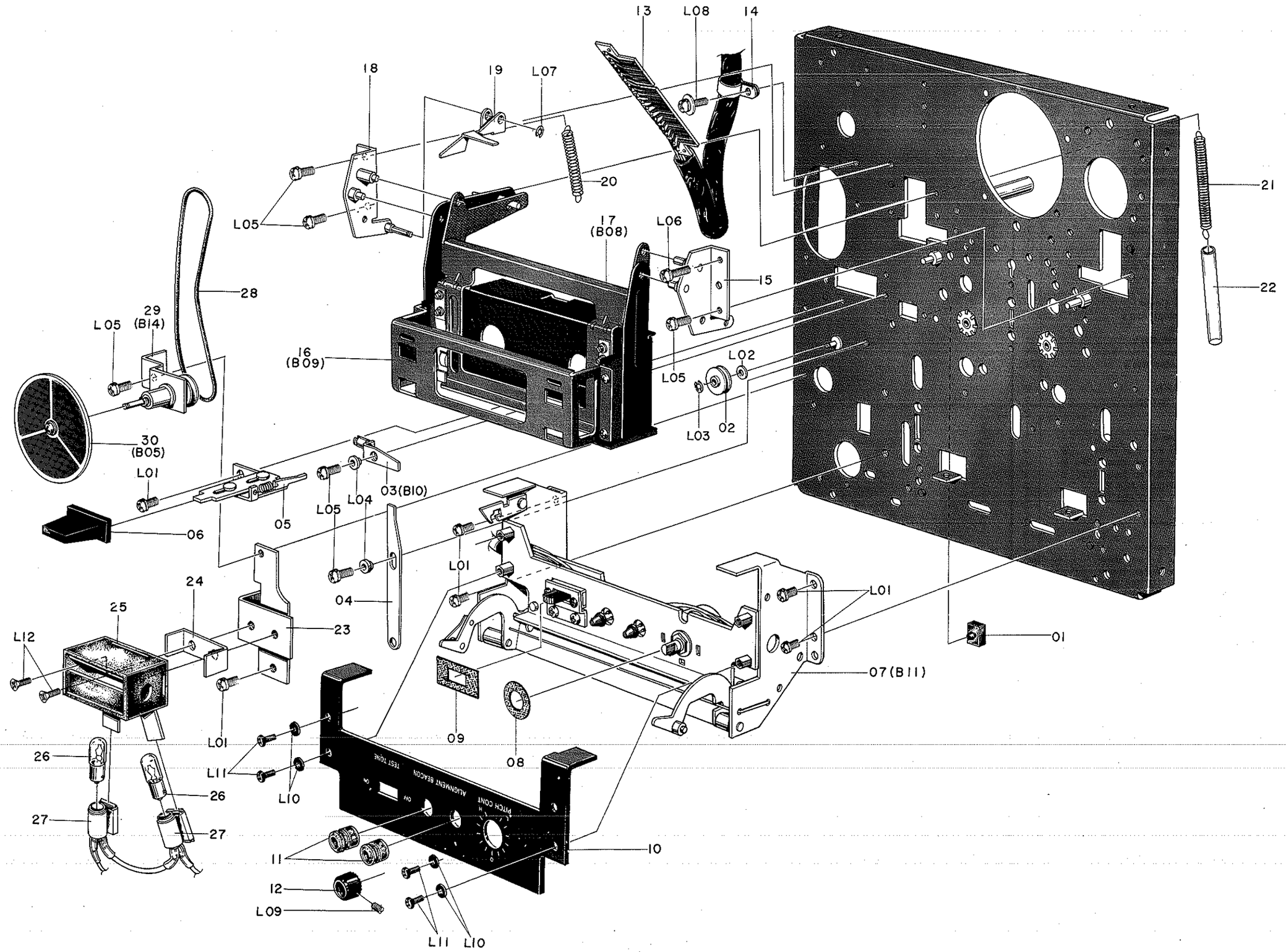
5-6. MECHANISM ASSEMBLY



SERIAL No. 3105801 ~

Fig. 5-6-1

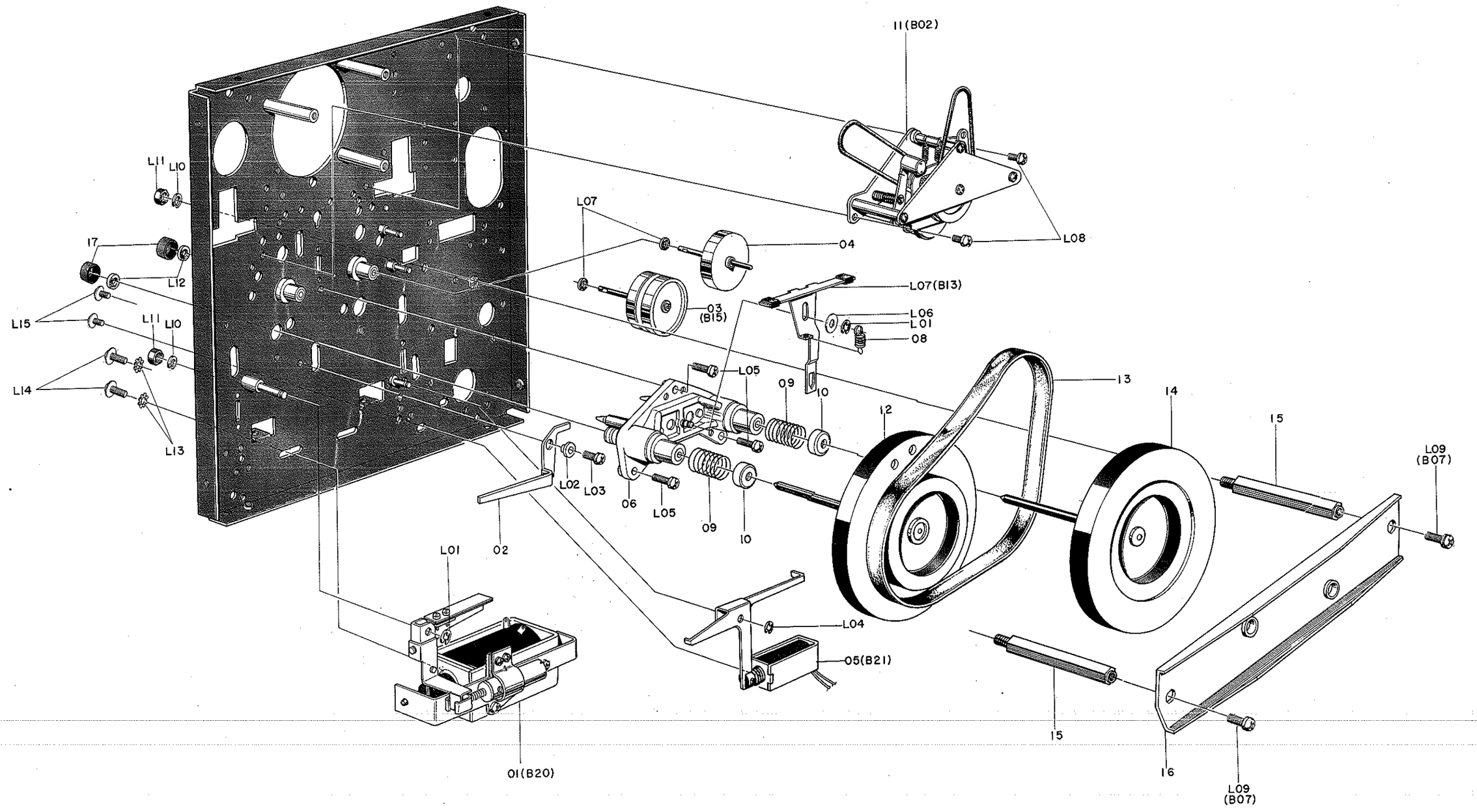
Schematic Ref. No.	Part No.	Description	Q'ty
A01	**CA-5157**	**Mechanism Ass'y**	**1**
01	CA-5001	Mechanism Chassis Ass'y	1
02	CA-5051	Reel Hub Ass'y	2
03	C-5101	Base Stopper Rubber	2
04	C-5457	Base Roller Holder A	3
05	C-5456	Base Roller B	3
06	CA-5002	Head Base Ass'y	1
07	C-5484	Head Base Adaptor	1
08	C-2024	2ϕ Ball	3
09	C-5459	Ball Retainer Spring B	3
10	C-5030	Ball Retainer Spring	3
11	C-5032	Spring Hook	2
12	C-5426	Base Return Spring B	2
13	C-5575	Return Spring Tube	2
14	C-5319	Counter Holder Stud	1
15	C-5315	Counter Stud B	1
16	CA-5073	Head Adjust Plate Ass'y	1
17	CA-5013	Head Mount Base Ass'y	1
18	C-5178	Pressure Arm Spring	2
19	C-5537	Spring Tube	2
20	C-5310	Mount Base Cover	1
21	CA-5044	Cassette Holder Ass'y	1
22	C-5465	Shut-off Belt	1
23	CA-5137	Auto Shut-off Ass'y	1
24	C-5139	Counter Belt	1
25	CA-5136	Counter Holder Ass'y	1
L01	E-21	Nut Hex M2.6	2
L02	E-26	Washer 2.6 Spring	2
L03	AM-6295	W3-9-0.5F	2
L04	E-222	E-Ring 2	1
L05	C-3174	Washer Mylar 2.1	2
L06	E-76	Screw M2.6 x 4 Flat Head ⊕	6
L07	E-622	Screw M3 x 5 Pan Head (2A) ⊕	7
L08	E-612	Screw M3 x 6 Pan Head (2A) ⊕	2
L09	C-5435	Head Base Holder Nut B	2
L10	E-56	Screw M2.6 x 10 Flat Head	2
L11	E-507	Nut Hex M3	2
L12	E-581	Washer 3 Spring	2
L13	E-597	Washer 3	3
L14	E-172	Washer 3 Toothed	3
L15	E-502	Screw M3 x 5 Pan Head ⊕	3
L16	E-509	Screw M3 x 6 Pan Head ⊕	3
L17	E-624	Screw M3 x 10 Pan Head (2A) ⊕	2
L18	E-510	Screw M3 x 8 Pan Head (2A) ⊕	1
L19	E-677	Collar Washer 3	2
L20	E-661	Screw M3 x 4 Pan Bronze ⊕	2
L21	E-29	Washer 2	2
L22	E-2	Screw M2 x 3 Cylinder Head ⊕	2



SERIAL No. 3105801~

Fig. 5-6-2

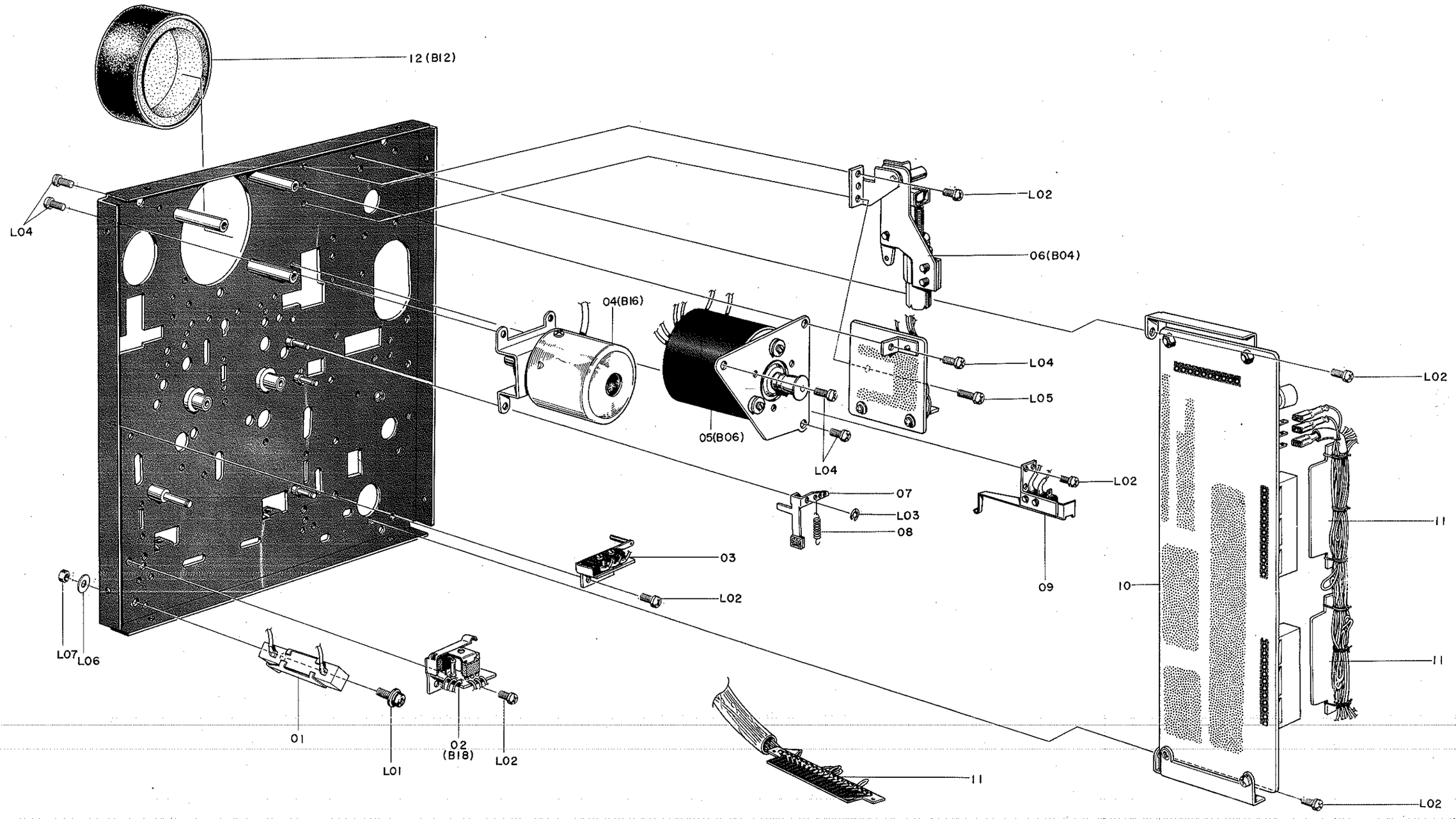
Schematic Ref. No.	Part No.	Description	Q'ty
A02	**CA-5157**	**Mechanism Ass'y**	
01	C-5126	Well Stopper Rubber	1
02	C-5279	Guide Pulley	1
03	CA-5172	Eject Linkage Ass'y	1
04	C-5134	Stopper Plate	1
05	CA-5037	Eject Bracket Ass'y	1
06	H-3194	Eject Knob	1
07	CA-5144	Alignment Beacon Ass'y	1
08	H-3297	Pitch Control Volume Felt	1
09	C-5369	OSC. Switch Felt	1
10	C-5256	Adjust Cover	1
11	C-5323	L.E.D.Holder	2
12	H-3223	Speed Adjust Knob	1
13	B-7535	19P Plug Board(D)	1
14	B-8072	Nylon Clump	1
15	CA-5035	Case Holder Ass'y R	1
16	CA-5135	Cassette Well Ass'y	1
17	CA-5062	Cassette Well Plate Ass'y	1
18	CA-5034	Case Holder Ass'y L	1
19	C-5116	Sensor Guide R	1
20	C-5127	Well Stopper Spring	1
21	C-5123	Well Spring	1
22	C-5536	Well Spring Tube	1
23	C-5314	Lamp Holder B	1
24	C-5501	Lamp Reflection Plate	1
25	CA-5139	Lamp House Ass'y	1
26	B-3869U	Pilot Lamp 6.3V 250mA	2
27	B-3565	Lamp Socket	2
28	C-5165	Indicator Belt	1
29	CA-5140	Indicator Flange Ass'y	1
30	CA-5142	Indicator Blade Ass'y	1
L01	E-622	Screw M3 x 5 Pan Head (2A) ⊕	6
L02	C-3613	Washer Mylar 1.6	1
L03	E-165	E-Ring 1.2	1
L04	C-5135	Center Guide	2
L05	E-612	Screw M3 x 6 Pan Head (2A) ⊕	6
L06	E-510	Screw M3 x 8 Pan Head (2A) ⊕	1
L07	E-222	E-Ring 2	1
L08	E-607	Screw M3 x 8 Pan Head (3A) ⊕	1
L09	E-626	Screw M2 x 3 Cup Point	1
L10	E-677	Collar Washer 3	4
L11	E-661	Screw M3 x 4 Pan Bronze ⊕	4
L12	E-533	Screw M3 x 5 Flat Head ⊕	2



SERIAL No. 3105801 ~

Fig. 5-6-3

Schematic Ref. No.	Part No.	Description	Q'tv
A03	**CA-5157**	**Mechanism Ass'y**	1
01	CA-5145	Head Base Solenoid Ass'y	1
02	C-5100	Base Switch Arm	1
03	CA-5130	Take-up Pulley Ass'y	1
04	CA-5131	Supply Pulley Ass'y	1
05	CA-5053	Brake Solenoid Ass'y	1
06	CA-5160	Capstan Flange Holder Ass'y C	1
07	CA-5023	Brake Arm Ass'y	1
08	C-5084	Brake Arm Spring	1
09	C-5514	Thrust Spring	2
10	C-5495	Flange Thrust Stud	2
11	CA-5052	Reel Drive Mechanism Ass'y	1
12	CA-5006	Flywheel Ass'y A	1
13	C-5104	Capstan Belt	1
14	CA-5007	Flywheel Ass'y B	1
15	C-5496	Flywheel Holder Stud B	2
16	CA-5171	Flywheel Holder Ass'y	1
17	C-5511	Flange Cap	2
L01	E-181	E-Ring 3	2
L02	C-5135	Center Guide	1
L03	E-612	Screw M3 x 6 Pan Head (2A) ⊕	1
L04	E-222	E-Ring 2	1
L05	E-510	Screw M3 x 8 Pan Head (2A) ⊕	3
L06	E-31	Washer 4	1
L07	C-3174	Washer Mylar 2.1	2
L08	E-622	Screw M3 x 5 Pan Head (2A) ⊕	2
L09	E-664	Screw M4 x 8 Pan Head (2A) ⊕	2
L10	E-574	Washer 4 Spring	2
L11	E-669	Nut Hex M4	2
L12	C-5512	Flange Felt	2
L13	E-172	Washer 3 Toothed	2
L14	E-614	Screw M3 x 6 Triple ⊕	2
L15	E-259	Screw M2.6 x 4 Triple ⊕	2

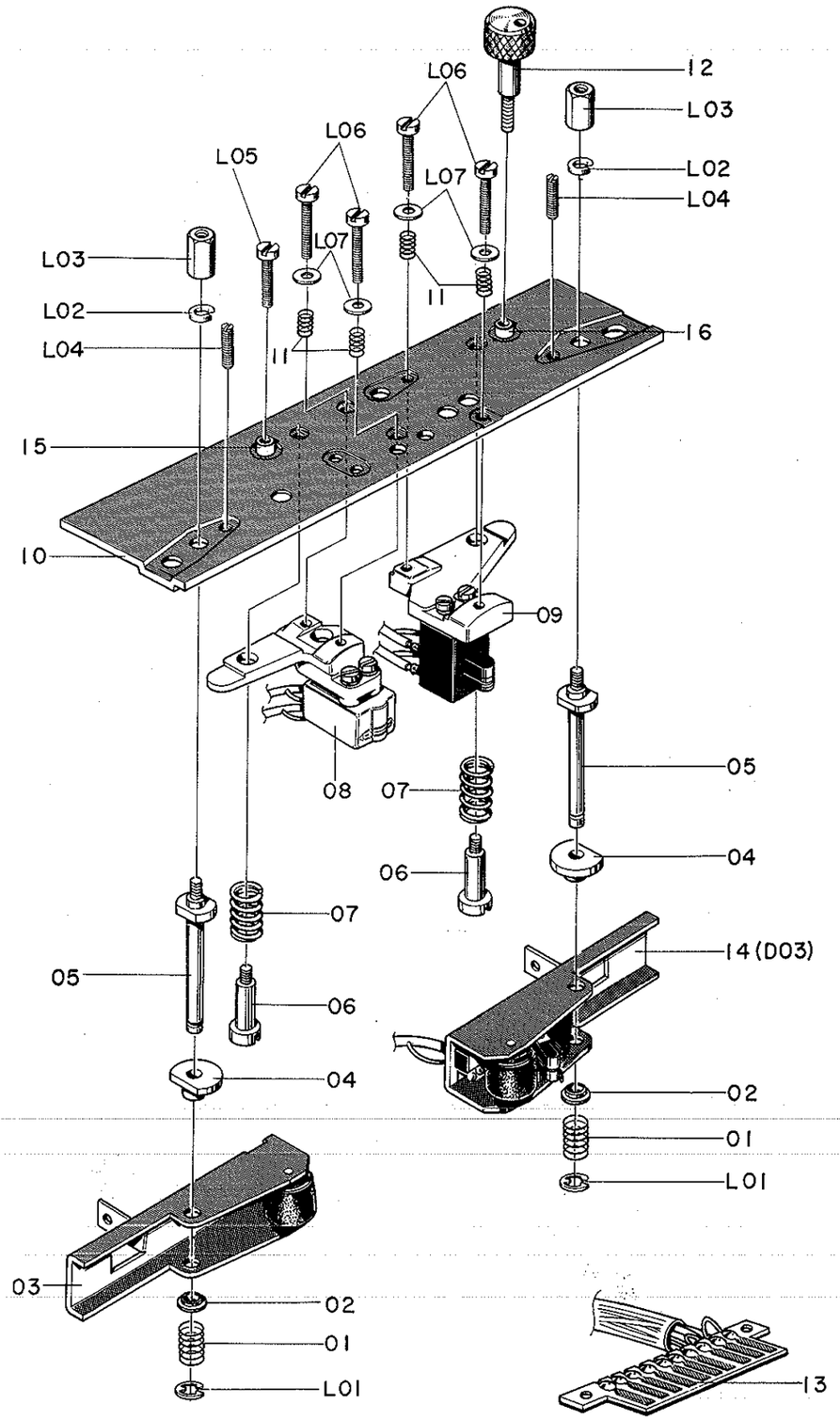


SERIAL No. 3105801~

Fig. 5-6-4

Schematic Ref. No.	Part No.	Description	Q'ty
A04	**CA-5157**	**Mechanism Ass'y**	1
01	B-5754	Cement Resistor 15Ω 10W	1
02	CA-5132	Base Switch Ass'y A	1
03	CA-5026	Cassette Sensor Ass'y	1
04	CA-5030	Sub-Motor Ass'y	1
05	CA-5154	Main-Motor Ass'y	1
06	CA-5134	Eject Damper Bracket Ass'y	1
07	CA-5024	Back Tension Arm Ass'y	1
08	C-5327	Back Tension Spring	1
09	CA-5031	Record Sensor Ass'y	1
10	BA-3688	Logic Control Ass'y	1
11	B-1798B	19P Plug Board	3
12	CA-5158	Motor Cap Ass'y	1
L01	E-607	Screw M3 x 8 Pan Head (3A) ⊕	1
L02	E-622	Screw M3 x 5 Pan Head (2A) ⊕	6
L03	E-222	E-Ring 2	1
L04	E-612	Screw M3 x 6 Pan Head (2A) ⊕	5
L05	E-510	Screw M3 x 8 Pan Head (2A) ⊕	1
L06	E-597	Washer 3	1
L07	E-507	Nut Hex M3	1

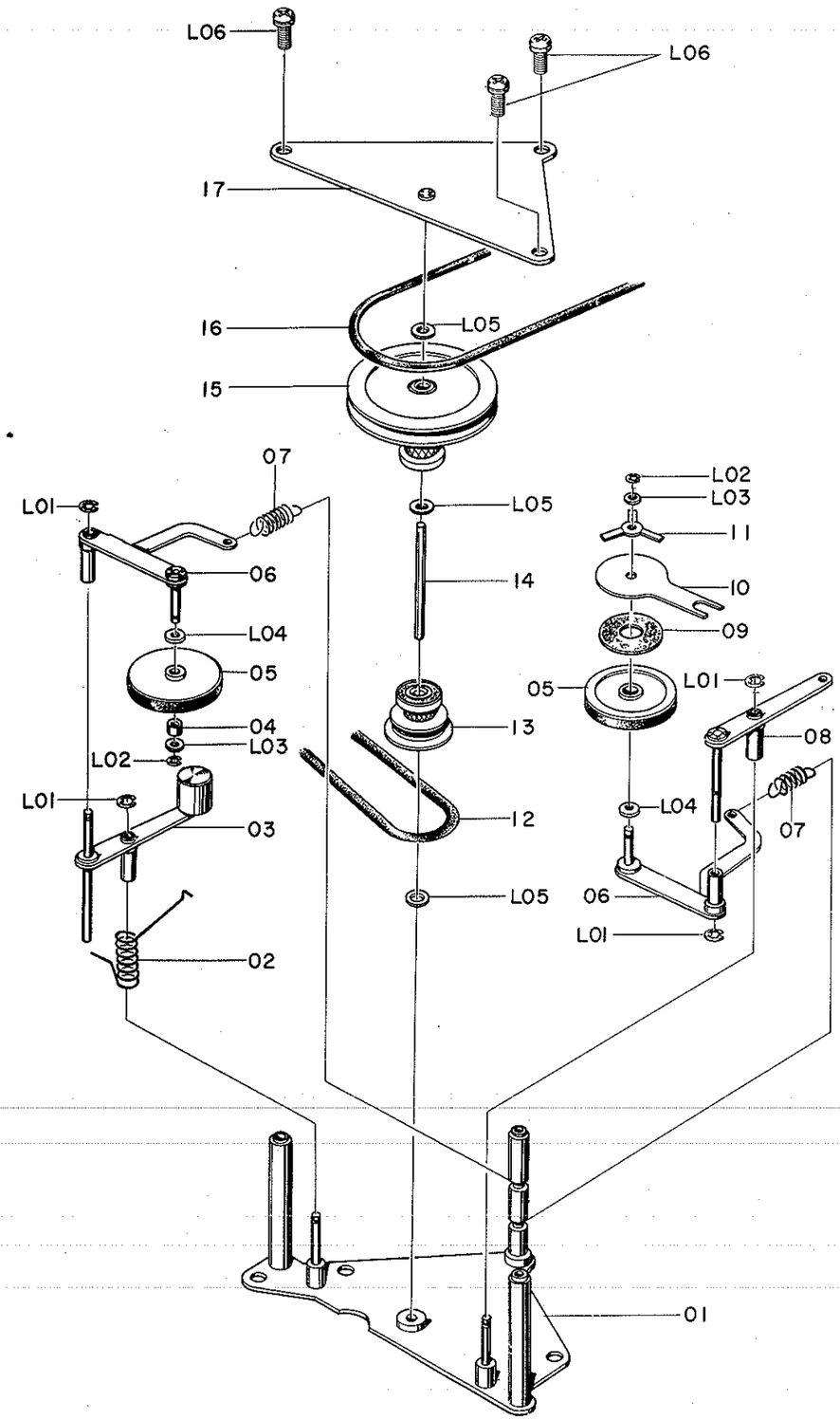
5-7. HEAD MOUNT BASE ASSEMBLY



SERIAL No. 3105801~

Fig. 5-7

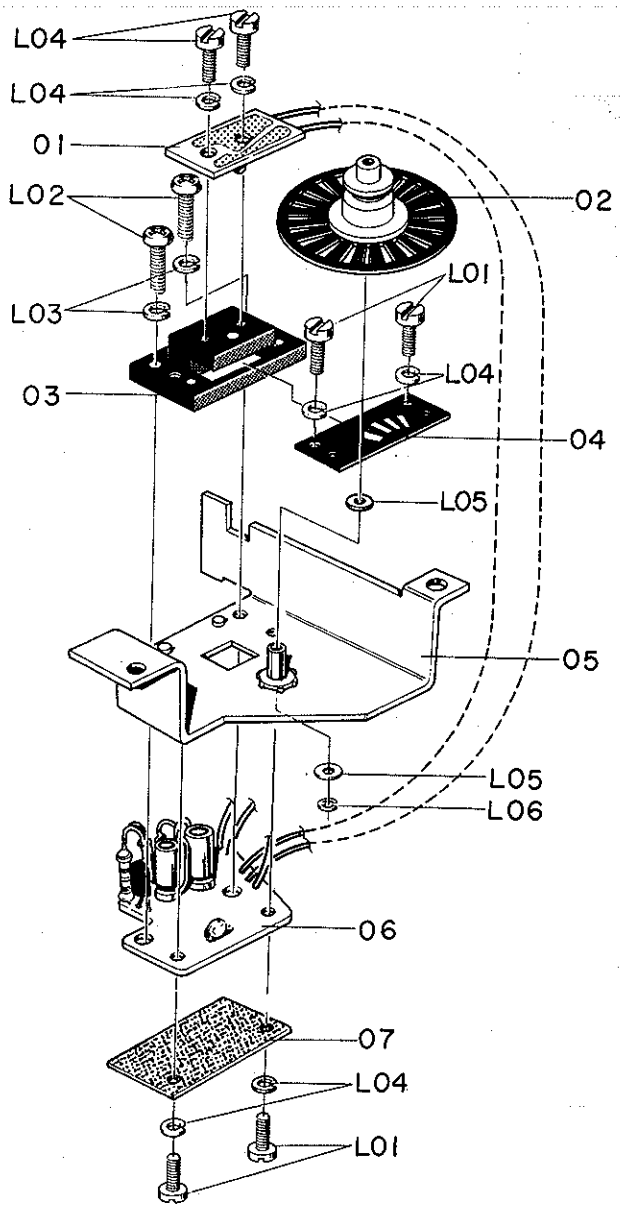
5-8. REEL DRIVE MECHANISM ASSEMBLY



SERIAL No. 3103601~

Fig. 5-8

5-9. AUTO SHUT-OFF ASSEMBLY

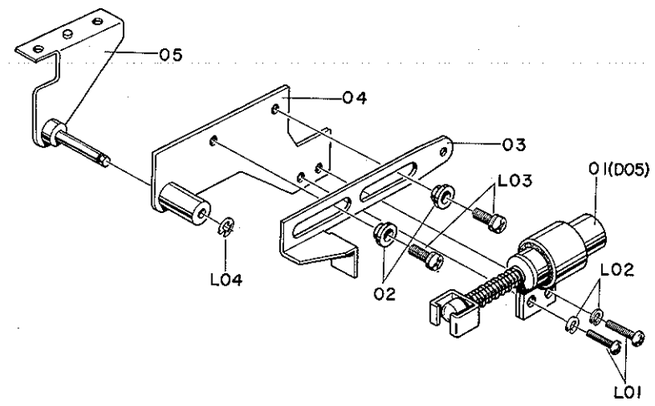


SERIAL No. 3102551 ~

Fig. 5-9

Schematic Ref. No.	Part No.	Description	Q'ty
B01	**CA-5013**	**Head Mount Base Ass'y**	1
01	C-5179	Pressure Arm Shaft Spring	2
02	C-5175	Pressure Arm Colour (B)	2
03	CA-5161	Pressure Roller Arm (B) Ass'y	1
04	C-5174	Pressure Arm Colour (A)	2
05	C-5477	Pressure Arm Shaft (C)	2
06	C-5191	Head Spring Shaft	2
07	C-5194	Head Spring	2
08	GA-101	Playback Head Ass'y P-52	1
09	GA-102	Record Head Ass'y R-52	1
10	C-5441	Head Mount Base (B)	1
11	C-5043	Head Adjust Spring	4
12	C-5199	Head Adjuster	1
13	B-7551	10P Plug Board	1
14	CA-5163	Pressure Roller Arm (B) Ass'y (S)	1
15	C-5193	Head Adjust Bush	1
16	C-5500	R.H. Adjust Bush	1
L01	E-222	E-Ring 2	2
L02	E-581	Washer 3 Spring	2
L03	C-5251	Arm Shaft Nut	2
L04	E-629	Screw M2.6 x 8 Cup Point ⊕	2
L05	E-4	Screw M2 x 8 Cylinder Head	1
L06	E-29	Washer 2	4
B02	**CA-5052**	**Reel Drive Mechanism Ass'y**	1
01	CA-5021	Center Pulley Ass'y	1
02	C-5043	Idler Spring	1
03	CA-5017	Idler Arm B Ass'y (T)	1
04	C-5442	Idler Colour	1
05	C-5010	Idler Pulley Ass'y	21
06	CA-5015	Idelr Arm (A) Ass'y	2
07	C-5281	Idler Arm Spring (B)	2
08	CA-5124	Idler Arm Ass'y (S)	1
09	C-5055	Idler Felt	1
10	C-5064	Idler Friction Plate	1
11	C-5066	Idler Friction Spring	1
12	C-5080	Fast Wind Belt	1
13	CA-5128	Fast Wind pulley (C) Ass'y	1
14	C-5073	Center Shaft	1
15	CA-5129	Center Drive Pulley (C)Ass'y	1
16	C-5081	Center Belt	1
17	CA-5022	Center Pulley (B) Ass'y	1
L01	E-42	E-Ring 1.5	4
L02	E-165	E-Ring 1.2	2
L03	C-3613	Washer 1.6 Mylar	2
L04	C-5065	Idler Metal Washer	2
L05	C-3174	Washer 2.1 Mylar	3
L06	E-612	Screw M3 x 6 Pan Head (2A) ⊕	3
B03	**CA-5137**	**Auto Shut-off Ass'y**	
01	BA-3663	Shut-off L.E.D Board Ass'y	1
02	CA-5156	Shut-off Blade Ass'y	1
03	C-5461	Shut-off Holder	1
04	C-5467	Shut-off Shutter	1
05	CA-5138	Shut-off Base Ass'y	1
06	BA-3664	Shut-off Photo Board Ass'y	1
07	C-5476	Photo Board Cover	1
L01	E-166	Screw M2 x 4 Clinder Head	6
L02	E-121	Screw M2.6 x 6 Pan Head ⊕	2
L03	E-26	Washer 2.6 Spring	2
L04	E-25	Washer 2 Spring	6
L05	C-3613	Washer 1.6 Mylar	2
L06	E-165	E-Ring 1.2	1

5-10. EJECT DAMPER BRACKET ASSEMBLY



SERIAL No. 3102551~

Fig. 5-10

5-11. INDICATOR BLADE ASSEMBLY

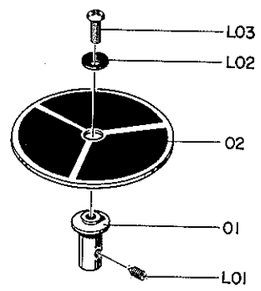
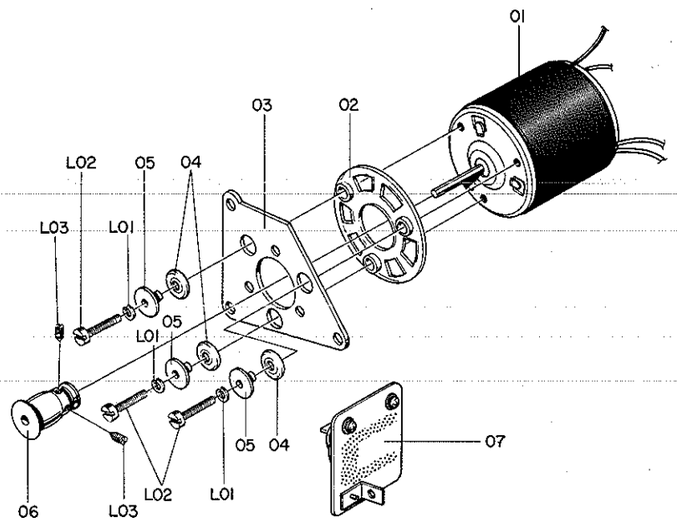


Fig. 5-11

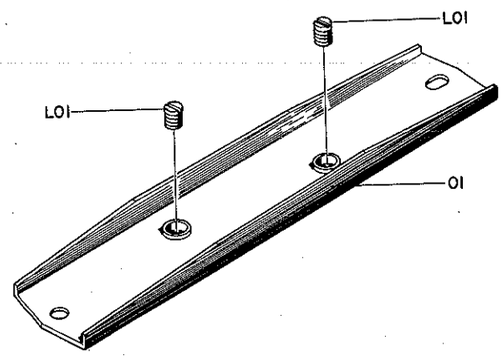
5-12. MAIN MOTOR ASSEMBLY



SERIAL No. 3103601~

Fig. 5-12

5-13. FLYWHEEL HOLDER ASSEMBLY



SERIAL No. 3102551~

Fig. 5-13

5-14. CASSETTE WELL PLATE ASSEMBLY

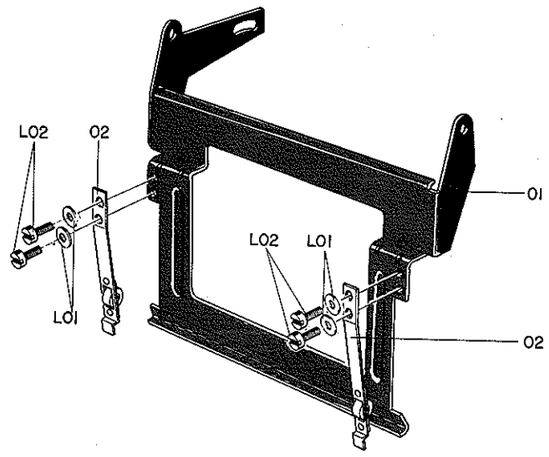


Fig. 5-14

5-15. CASSETTE WELL ASSEMBLY

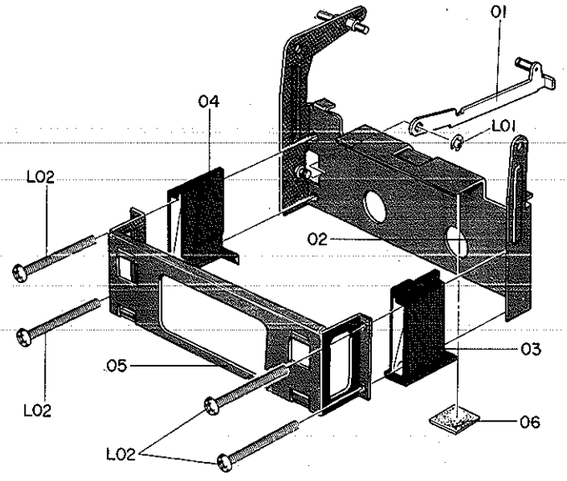


Fig. 5-15

5-16. EJECT LINKAGE ASSEMBLY

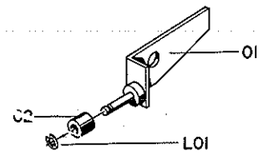


Fig. 5-16

5-17. ALIGNMENT BEACON ASSEMBLY

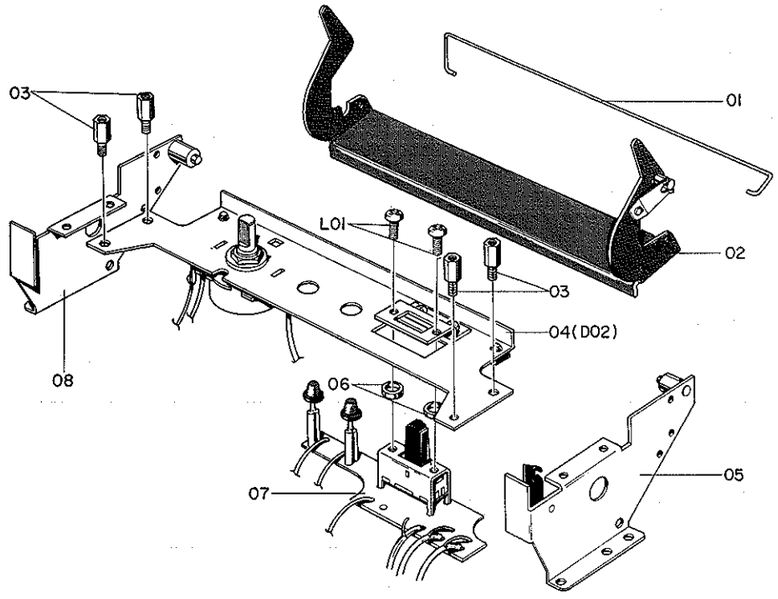


Fig. 5-17

5-18. MOTOR CAP ASSEMBLY

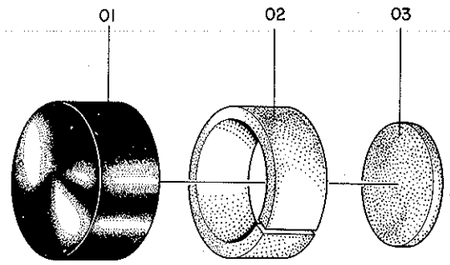


Fig. 5-18

5-19. BRAKE ARM ASSEMBLY

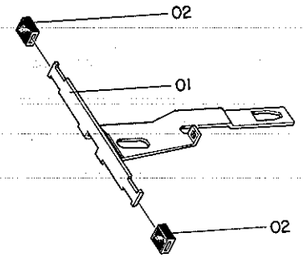


Fig. 5-19

5-20. INDICATOR FLANGE ASSEMBLY

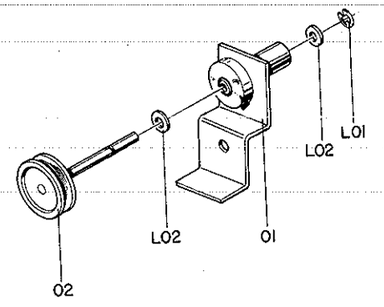
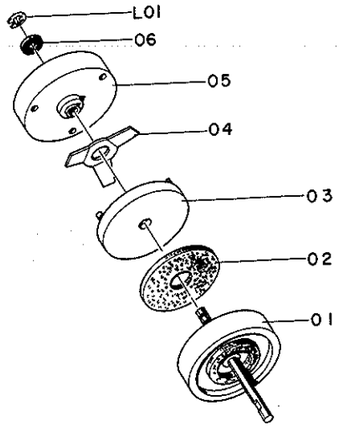


Fig. 5-20

Schematic Ref. No.	Part No.	Description	Q'ty
B04	**CA-5134**	**Eject Damper Bracket Ass'y**	1
01	CA-5047	Eject Damper Ass'y	1
02	C-5135	Center Guide	2
03	C-5232	Eject Damper Linkage	1
04	CA-5068	Damper Plate Ass'y	1
05	CA-5046	Damper Plate Holder Ass'y	1
L01	E-220	Screw M2.6 x 8 Pan Head ⊕	2
L02	E-26	Washer 2.6 Spring	2
L03	E-612	Screw M3 x 6 Pan Head ⊕	2
L04	E-53	E-Ring 2.3	1
B05	**CA-5142**	**Indicator Blade Ass'y**	1
01	C-5257	Blade Holder	1
02	C-5153	Indicator Blade	1
L01	E-641	Screw M2 x 4 Cup Point	1
L02	E-157	Collar Washer 3	1
L03	E-589	Screw M3 x 6 Pan Bronze ⊕	1
B06	**CA-5154**	**Main Motor Ass'y**	1
01	C-5515	NSM-2 Motor	1
02	C-5509	Floating Sheet	1
03	C-5198	Motor Plate	1
04	C-5510	Floating Bush	3
05	C-5508	Bush Collar	3
06	C-5499	Motor Pulley (C)	1
07	BA-3662	Motor Governor Ass'y	1
L01	E-25	Washer 2 Spring	3
L02	E-4	Screw M2 x 8 Cylinder Head	3
L03	E-626	Screw M2 x 3 Cup Point	2
B07	**CA-5171**	**Flywheel Holder Ass'y**	1
01	CA-5008	Flywheel Holder Sub Ass'y	1
L01	C-5494	Thrust Screw	2
			2
B08	**CA-5062**	**Cassette Well Plate Ass'y**	1
01	C-5325	Cassette Well Plate (B)	1
02	CA-5153	Cassette Spring Ass'y	2
L01	E-25	Washer 2 Spring	4
L02	E-2	Screw M2 x 3 Cylinder Head	4
B09	**CA-5135**	**Cassette Well Ass'y**	1
01	CA-5055	Well Stopper Ass'y	1
02	CA-5061	Cassette Well Ass'y (B)	1
03	C-5276	Cassette Case B.R	1
04	C-5277	Cassette Case B.L	1
05	C-5265	Lid Holder	1
06	C-5373	Cassette Rubber	1
L01	E-222	E-Ring 2	1
L02	E-245	Screw M2.6 x 25 Pan Head ⊕	4
B10	**CA-5172**	**Eject Linkage Ass'y**	1
01	CA-5042	Eject Linkage Sub Ass'y	1
02	C-5132	Eject Roller	1
L01	E-42	E-Ring 1.5	1
			1
B11	**CA-5144**	**Alignment Beacon Ass'y**	1
01	C-5261	A.J Lid Arm Spring	1
02	CA-5064	Adjust Lid Arm Ass'y	1
03	C-5311	A.J Cover Stud	4
04	CA-5143	Adjust Plate Ass'y	1

Schematic Ref. No.	Part No.	Description	Q'ty
05	CA-5063	Adjust Plate Holder Ass'y (L)	1
06	B-3053	Switch Stud	2
07	BA-3665	400Hz OSC. SW. Ass'y	1
08	CA-5069	Adjust Plate Holder Ass'y (R)	1
L01	E-276	Screw M2.6 x 4 Pan Head ⊕	2
B12	**CA-5158**	**Motor Cap Ass'y**	1
01	C-3796	Motor Cup	1
02	C-3794	Motor Cover A	1
03	C-3795	Motor Cover B	1
B13	**CA-5023**	**Brake Arm Ass'y**	1
01	C-5082	Brake Arm	1
02	C-5083	Brake Shoe	2
B14	**CA-5140**	**Indicator Flange Ass'y**	1
01	CA-5141	Indicator Holder Ass'y	1
02	CA-5116	Indicator Shaft B Ass'y	1
L01	E-42	E-Ring 1.5	1
L02	E-255	Washer 2 Mylar	2
B15	**CA-5130**	**Take-up Pulley Ass'y**	1
01	CA-5131	Supply Pulley Ass'y	1
02	C-5040	Take-up Felt	1
03	C-5037	Friction Pulley	1
04	C-5036	Take-up Spring	1
05	C-5034	Take-up Pulley B	1
06	C-5035	Take-up Thrust Plate	1
L01	E-42	E-Ring 1.2	1
B16	**CA-5030**	**Sub-Motor Ass'y**	1
01	C-5105	MSR-5SB-2N Motor	1
02	C-5107	Sub-Motor Holder	1
03	C-5239	Motor Friction Pulley	1
04	C-5055	Idler Felt	1
05	C-5238	Sub-Motor Pulley	1
06	AM-6178	W4-12-0.5F	1
07	C-5241	Motor Friction Spring	1
08	C-5240	Motor Friction Collar	1
L01	E-26	Washer 2.6 Spring	2
L02	E-120	Screw M2.6 x 3 Pan Head ⊕	2
L03	E-626	Screw M2 x 3 Cup Point	3
L04	AM-6242	W3-6-0.2F	2
B17	**CA-5044**	**Cassette Holder Ass'y**	1
01	CA-5058	Cassette Hold Plate Ass'y	1
02	C-5244	Linkage Spring	1
03	CA-5059	Cassette Arm A Ass'y	1
04	CA-5060	Cassette Arm B Ass'y	1
05	C-5245	Hold Spring	1
06	C-5217	Hold Roller	1
L01	E-222	E-Ring 2	1
L02	E-42	E-Ring 1.5	2
B18	**CA-5132**	**Base Switch Ass'y (A)**	1
01	CA-5025	Base SW Sub-Ass'y	1
02	BA-3666	Base SW P.C.B. Ass'y	1

5-21. TAKE-UP PULLEY ASSEMBLY



SERIAL No. 3102551 ~

Fig. 5-21

5-22. SUB MOTOR ASSEMBLY

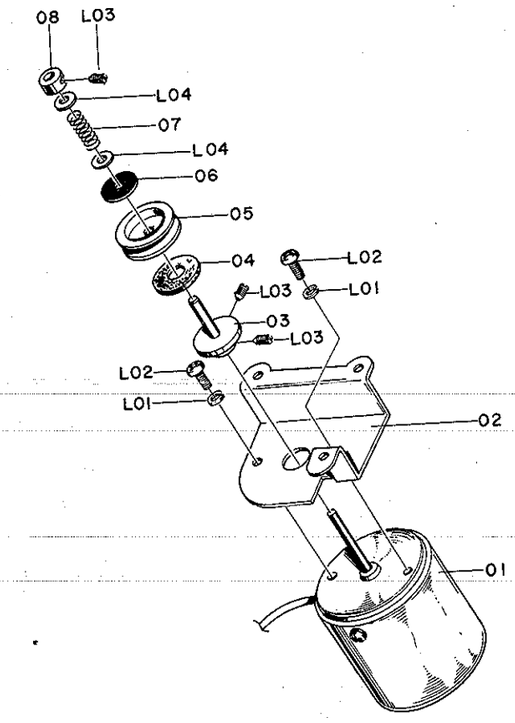


Fig. 5-22

5-23. CASSETTE HOLDER ASSEMBLY

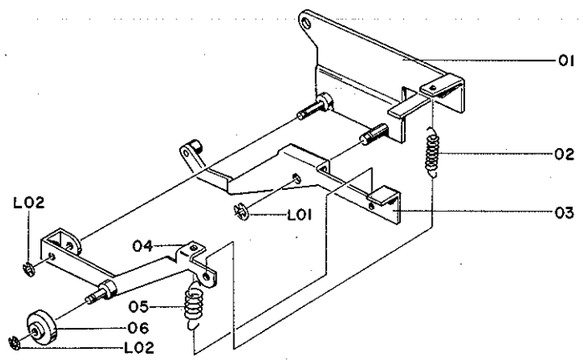


Fig. 5-23

5-24. BASE SWITCH ASSEMBLY

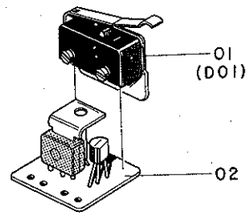


Fig. 5-24

5-25. COUNTER HOLDER ASSEMBLY

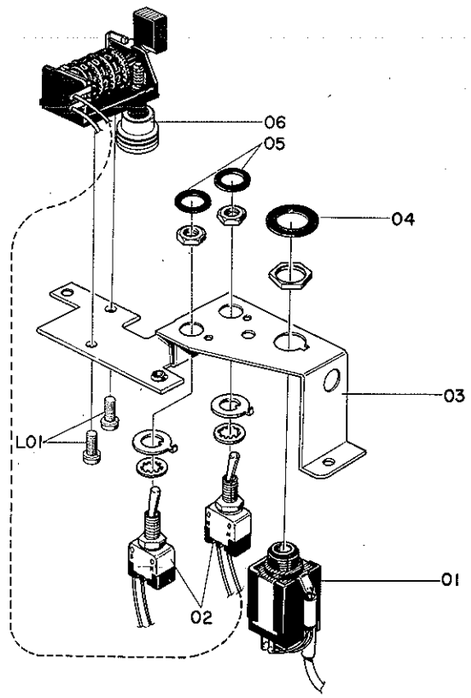
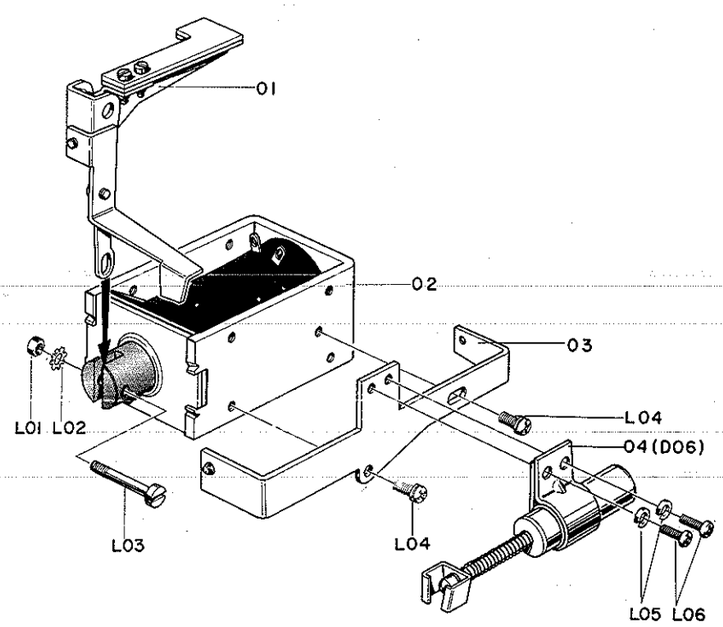


Fig. 5-25

5-26. HEAD BASE SOLENOID ASSEMBLY



SERIAL No. 3102551~

Fig. 5-26

5-27. BRAKE SOLENOID ASSEMBLY

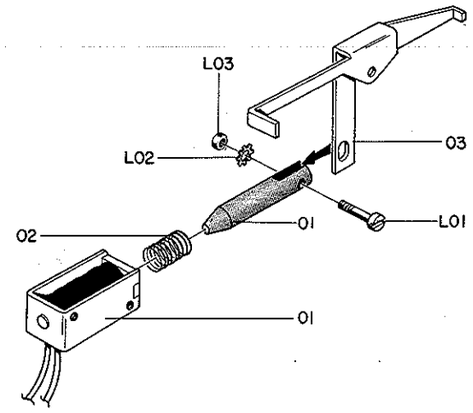


Fig. 5-27

5-28. BASE SWITCH SUB ASSEMBLY

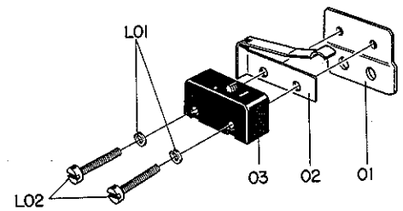


Fig. 5-28

5-29. ADJUST PLATE ASSEMBLY

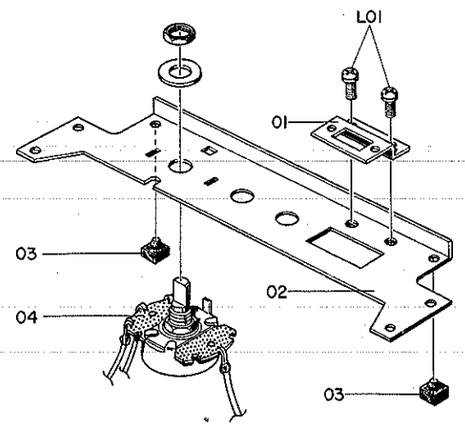
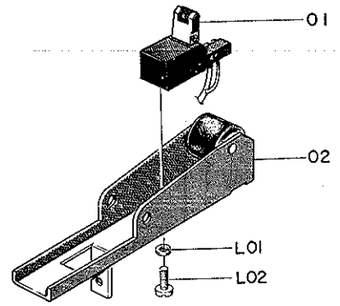


Fig. 5-29

5-30. PRESSURE ROLLER ASSEMBLY



SERIAL No. 3105801~

Fig. 5-30

5-31. PLAYBACK HEAD ASSEMBLY

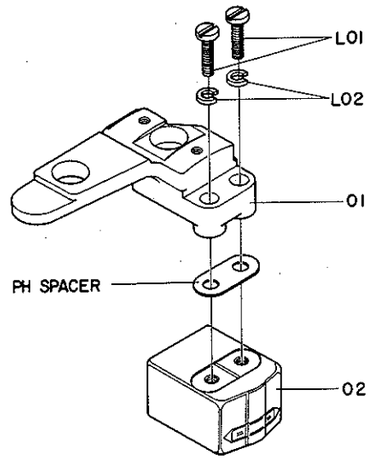


Fig. 5-31

5-32. RECORD HEAD ASSEMBLY

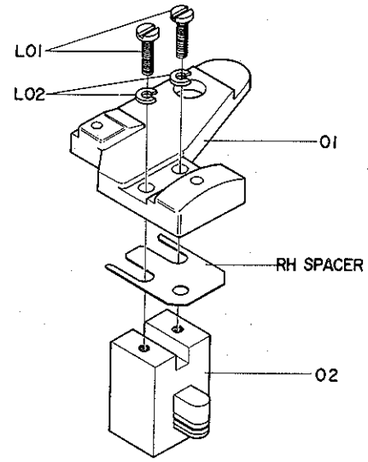


Fig. 5-32

Schematic Ref. No.	Part No.	Description	Q'ty
B19	**CA-5136**	**Counter Holder Ass'y**	1
01	B3882	Headphone Jack	1
02	B8057	Memory Switch	2
03	C5316	Counter Holder	1
04	J3236	Jack Cover	1
05	B1295	Jack Insulating Washer	2
06	CA-5038	Tape Counter Ass'y	1
L01	E612	Screw M3 x 6 Pan Head (2A) ⊕	2
B20	**CA-5145**	**Head Base Plunger Ass'y**	1
01	CA-5027	Base Look Arm Ass'y	1
02	C-5099	Head Base Plunger	1
03	CA-5041	Base Damper Holder Ass'y	1
04	CA-5133	Base Damper Ass'y	1
L01	E-507	Nut M3 Hex	1
L02	E-172	Washer 3 Toothed	1
L03	C-5098	Solenoid Bolt	1
L04	E-612	Screw M3 x 6 Pan Head (2A) ⊕	2
L05	E-26	Washer 2.6 Spring	2
L06	E-220	Screw M2.6 x 8 Pan Head ⊕	2
B21	**CA-5053**	**Brake Plunger Ass'y**	1
01	C-5086	Brake Plunger	1
02	C-5087	Brake Plunger Spring	1
03	C-5085	Brake Linkage	1
L01	C-5419	Brake Bolt	1
L02	E-233	Washer 2.6 Toothed	1
L03	E-21	Nut M2.6 Hex	1
D01	**CA-5025**	**Base Switch Sub Ass'y**	1
01	C-5091	Base Switch Holder	1
02	C-5092	Switch Spring (A)	1
03	MT-210157	Micro Switch (SS-5)	1
L01	E-25	Washer 2 Spring	2
L02	E-218	Screw M2 x 10 Cylinder Head	2
D02	**CA-5143**	**Adjust Plate Ass'y**	1
01	C-5306	OSC. SW Holder	1
02	C-5146	Adjust Blade	1
03	C-5436	Adjust Arm Stopper (B)	2
04	B-7038	V.R.500 Ω (Pitch Control)	1
L01	E-622	Screw M3 x 5 Pan Head (2A)	2
D03	**CA-5163**	**Pressure Roller (B) Ass'y (S)**	1
01	G8	Erase Head	1
02	CA-5161	Pressure Roller Arm B Ass'y	1
L01	E-25	Washer 2 Spring	1
L02	E-185	Screw M2 x 6 Cylinder Head ⊕	1
D07	**GA-101**	**P-52 Playback Head Ass'y**	
01	AH-1082	PH Plate	1
02	G-6	P-52 Playback Head	1
L01	E-675	Screw M2×7 Cylinder Head	2
L02	E-25	Washer 2 Spring	2
	AH-1115	PH Speacer t=0.1mm	
	AH-1116	PH Speacer t=0.15mm	
	AH-1117	PH Speacer t=0.2mm	
	AH-1118	PH Speacer t=0.25mm	
	AH-1119	PH Speacer t=0.3mm	

Schematic Ref. No.	Part No.	Description	Q'ty
D08	**GA-102**	**R-52 Record Head Ass'y**	
01	AH-1083	RH Plate	1
02	G-7	R-52 Record Head	1
L01	E-185	Screw M2×6 Cylinder Head	2
L02	E-25	Washer 2 Spring	2
	AH-1120	RH Speacer t=0.1mm	
	AH-1121	RH Speacer t=0.15mm	
	AH-1122	RH Speacer t=0.2mm	
	AH-1123	RH Speacer t=0.25mm	
	AH-1124	RH Speacer t=0.3mm	

6 WIRING

6-1 AMPLIFIER

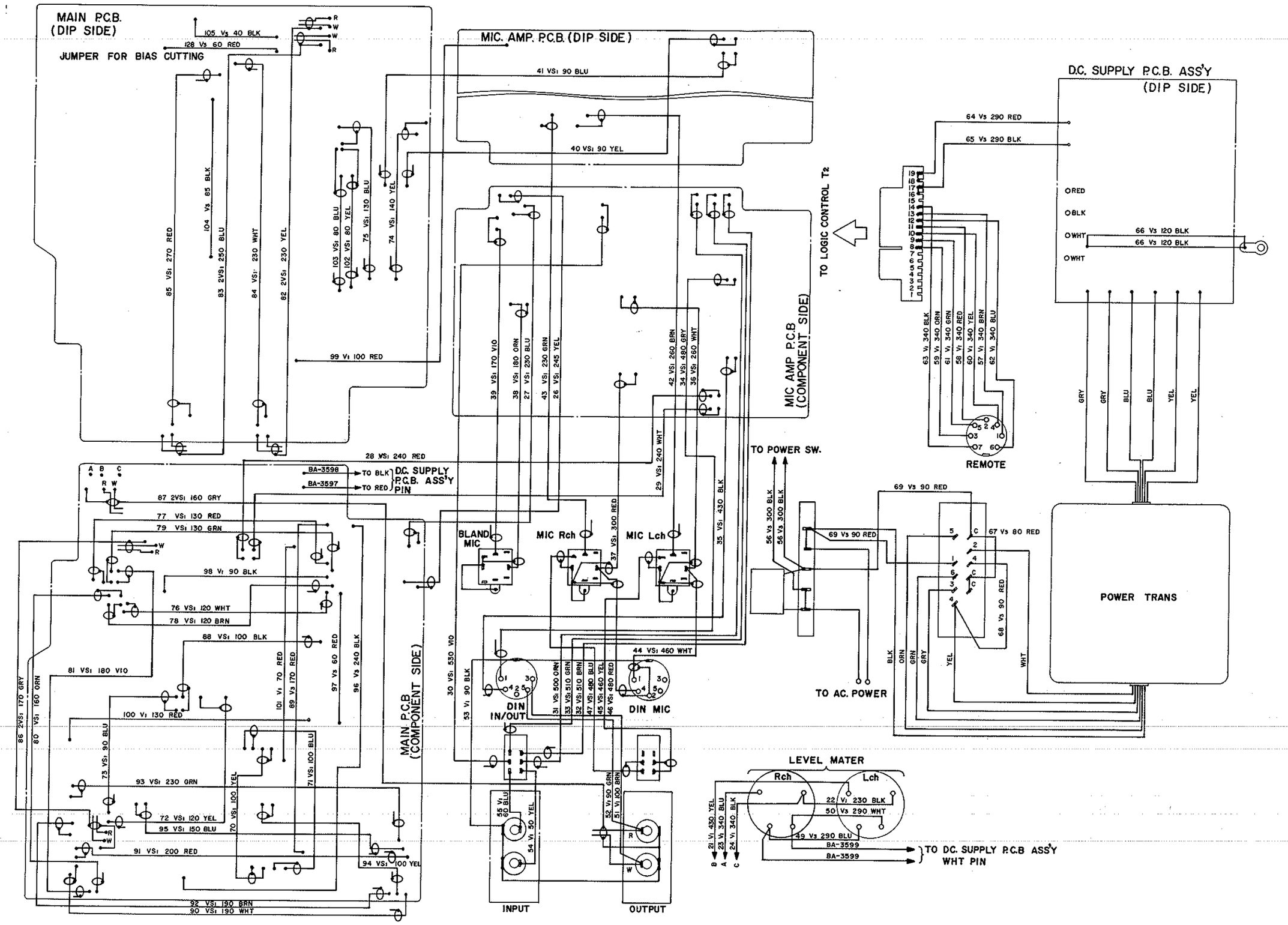
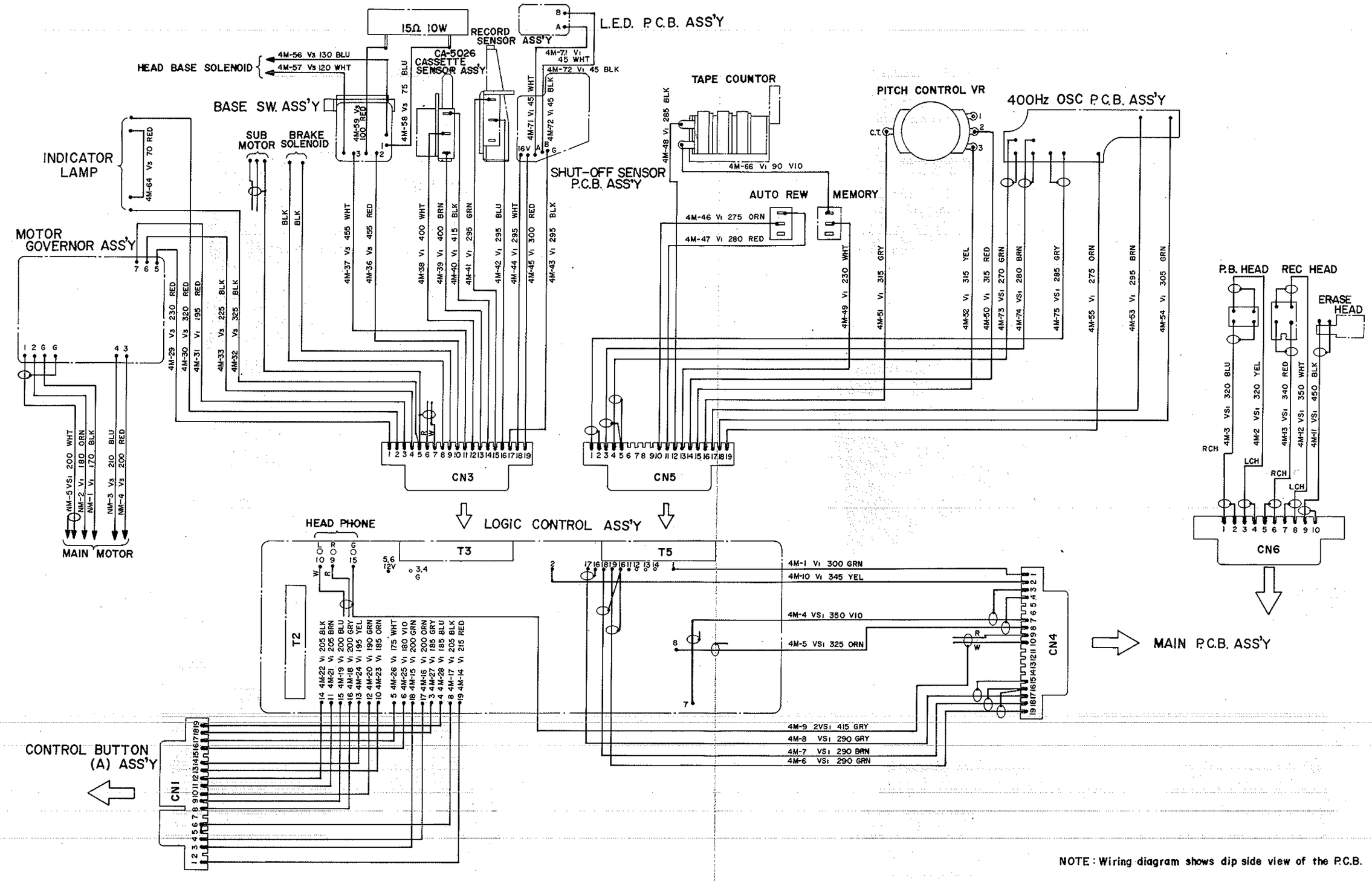


Fig. 6-1



NOTE : Wiring diagram shows dip side view of the P.C.B.

Fig. 6-2

NOTE:

$63V_1$	340	BLK	BLK–BLACK	BRN–BROWN	RED–RED	ORN–ORANGE	YEL–YELLOW
Process	Length (mm)	Color	GRN–GREEN	BLU–BLUE	VIO–VIOLET	GRY–GRAY	WHT–WHITE

7 WIRING-FORM

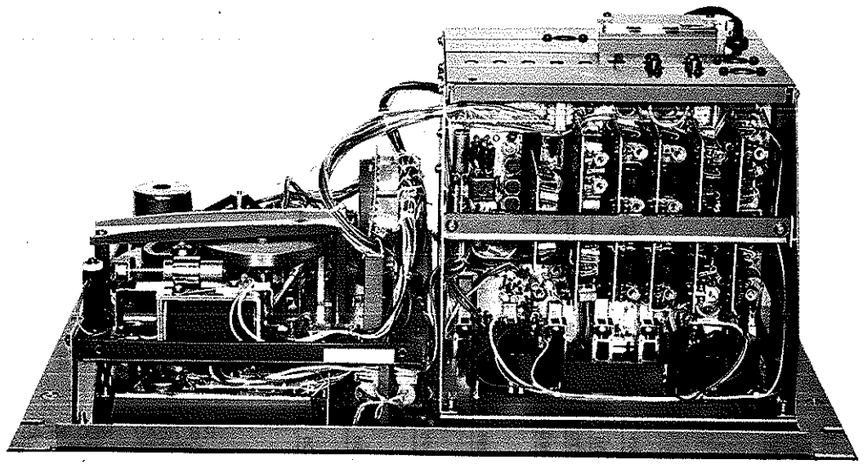


Fig. 7-1

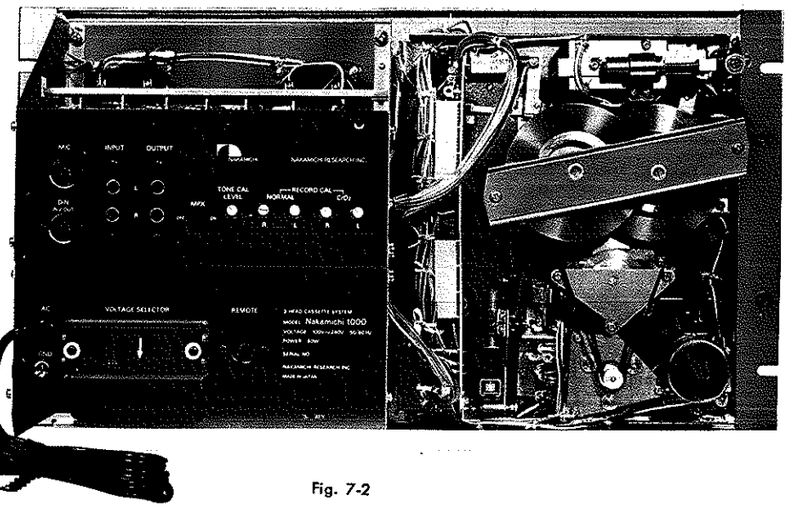


Fig. 7-2

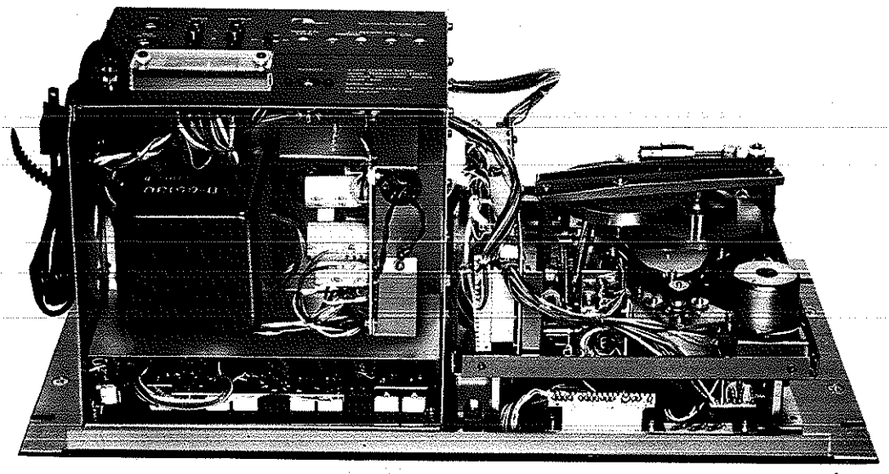


Fig. 7-3

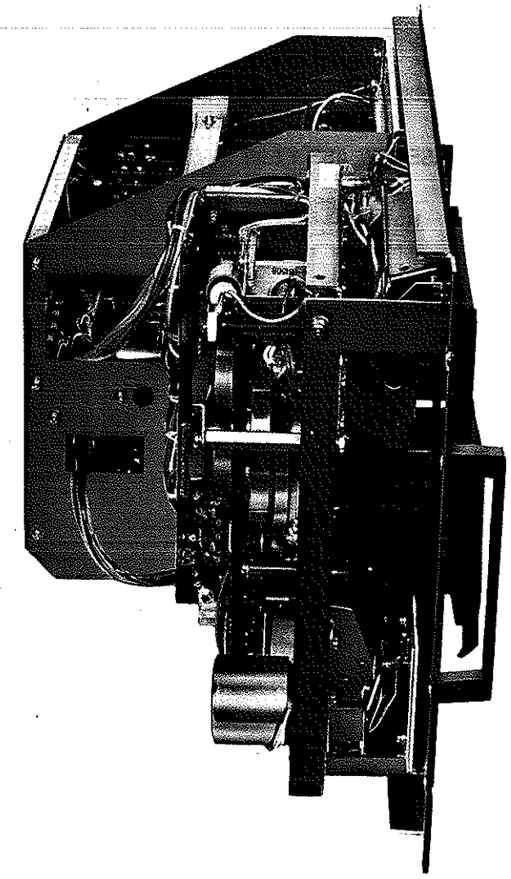


Fig. 7-4

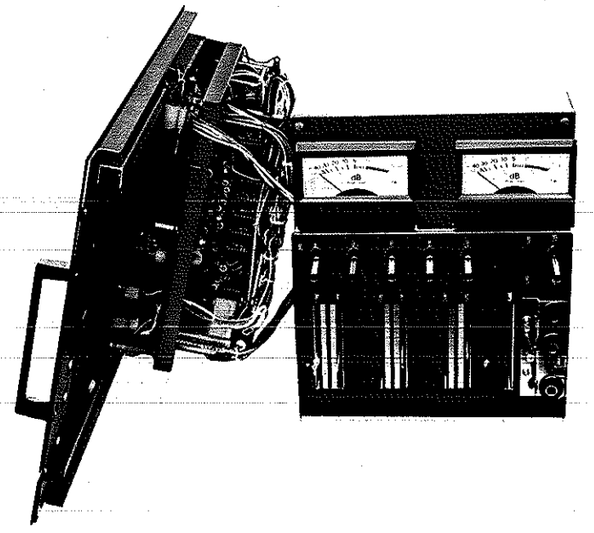


Fig. 7-5

8 BLOCK DIAGRAM

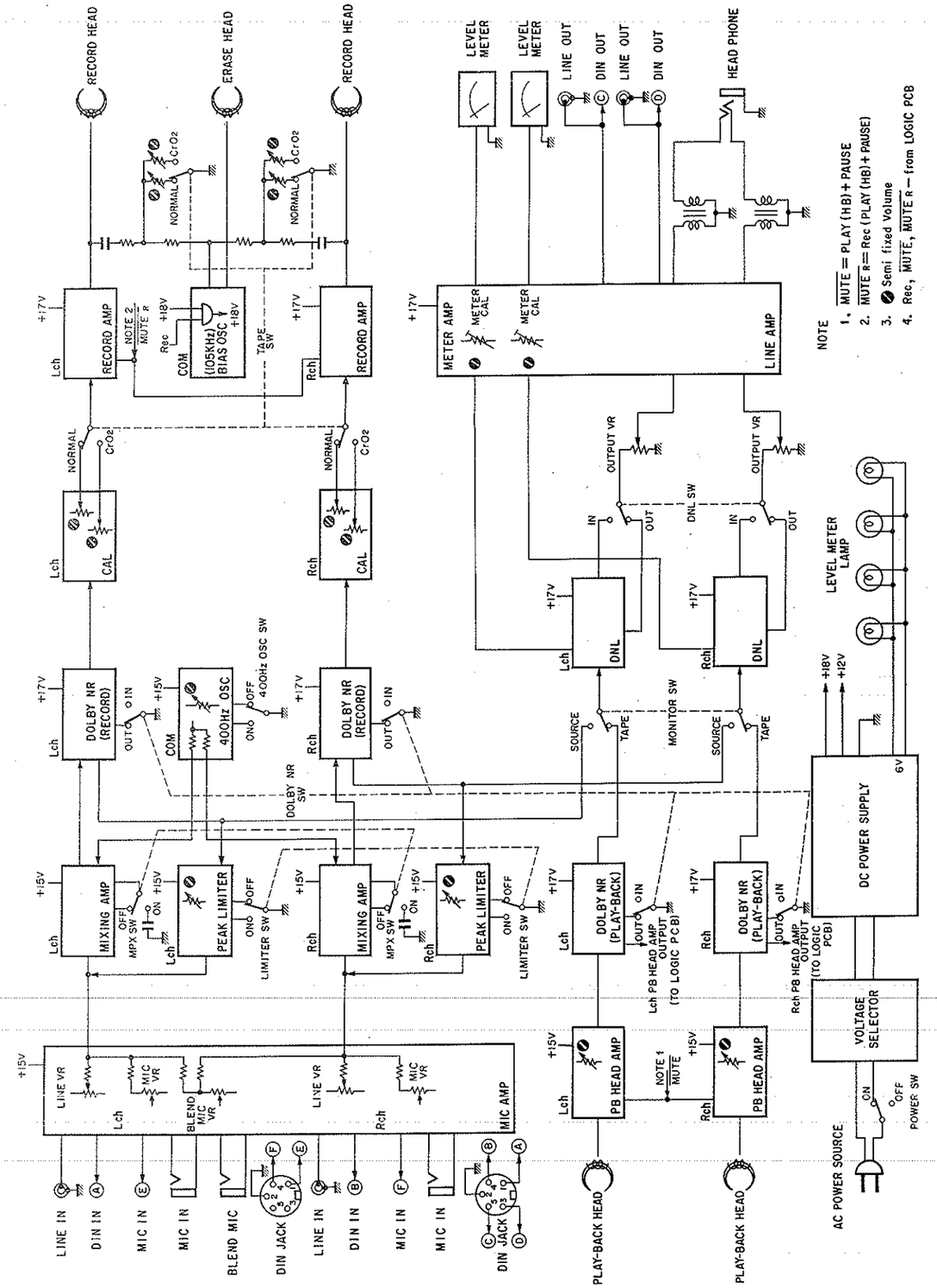
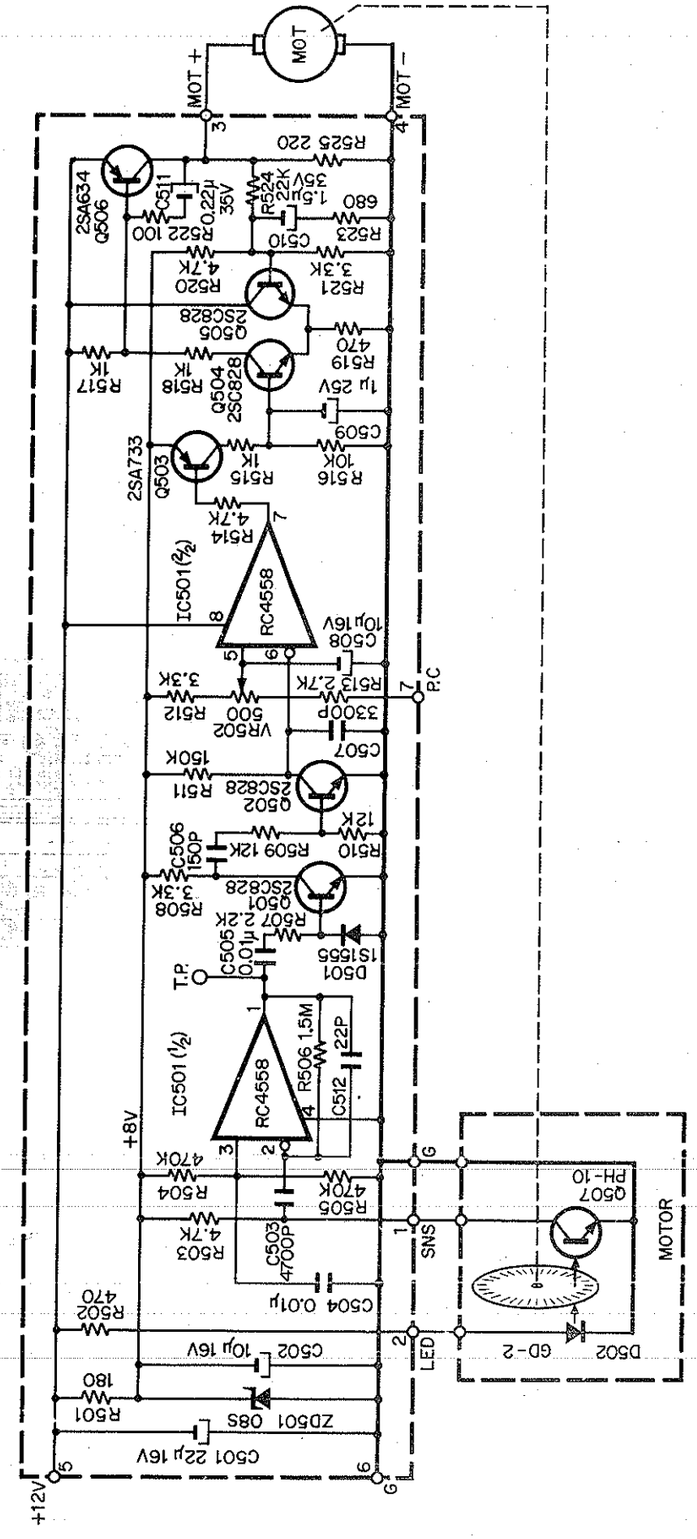


Fig. 8

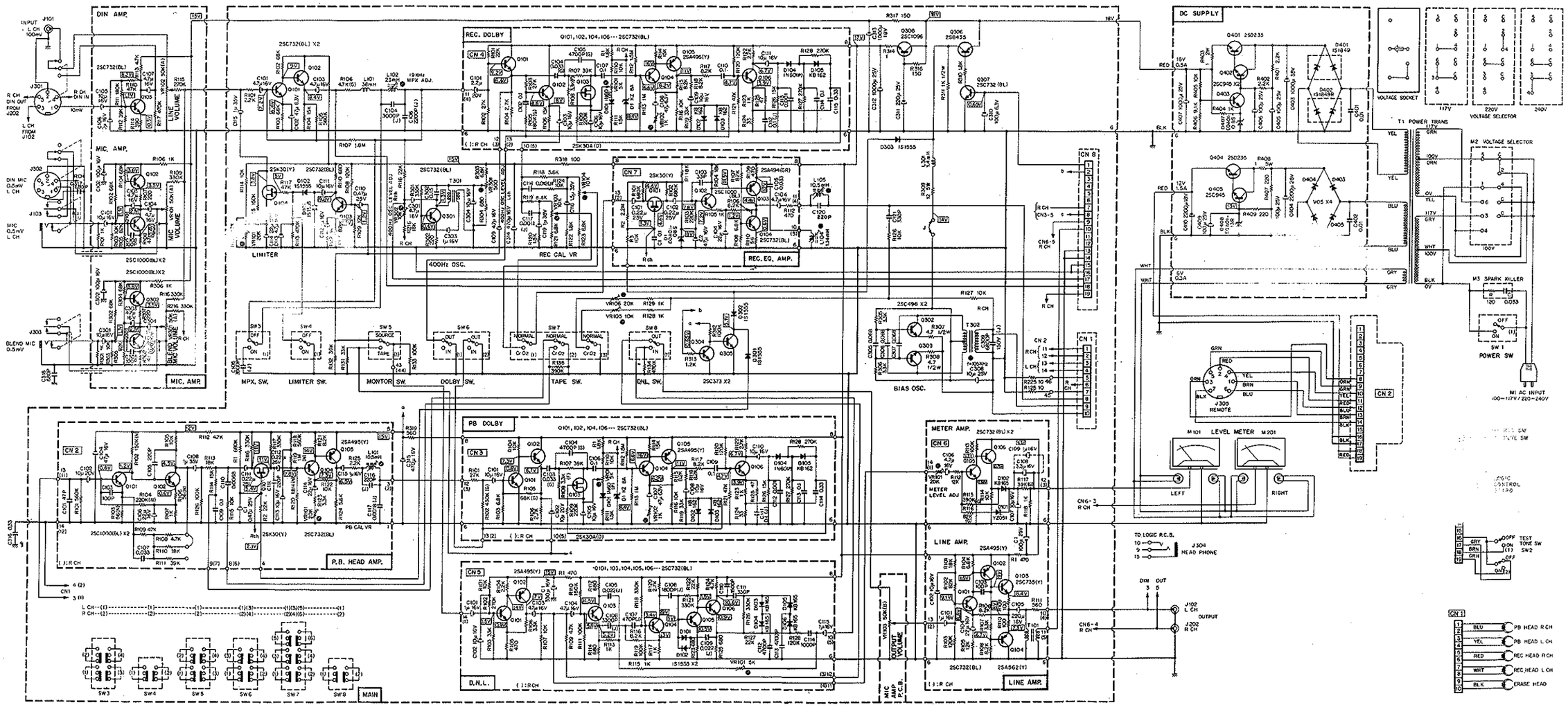
9 SCHEMATIC DIAGRAM

9-1. MOTOR GOVERNOR



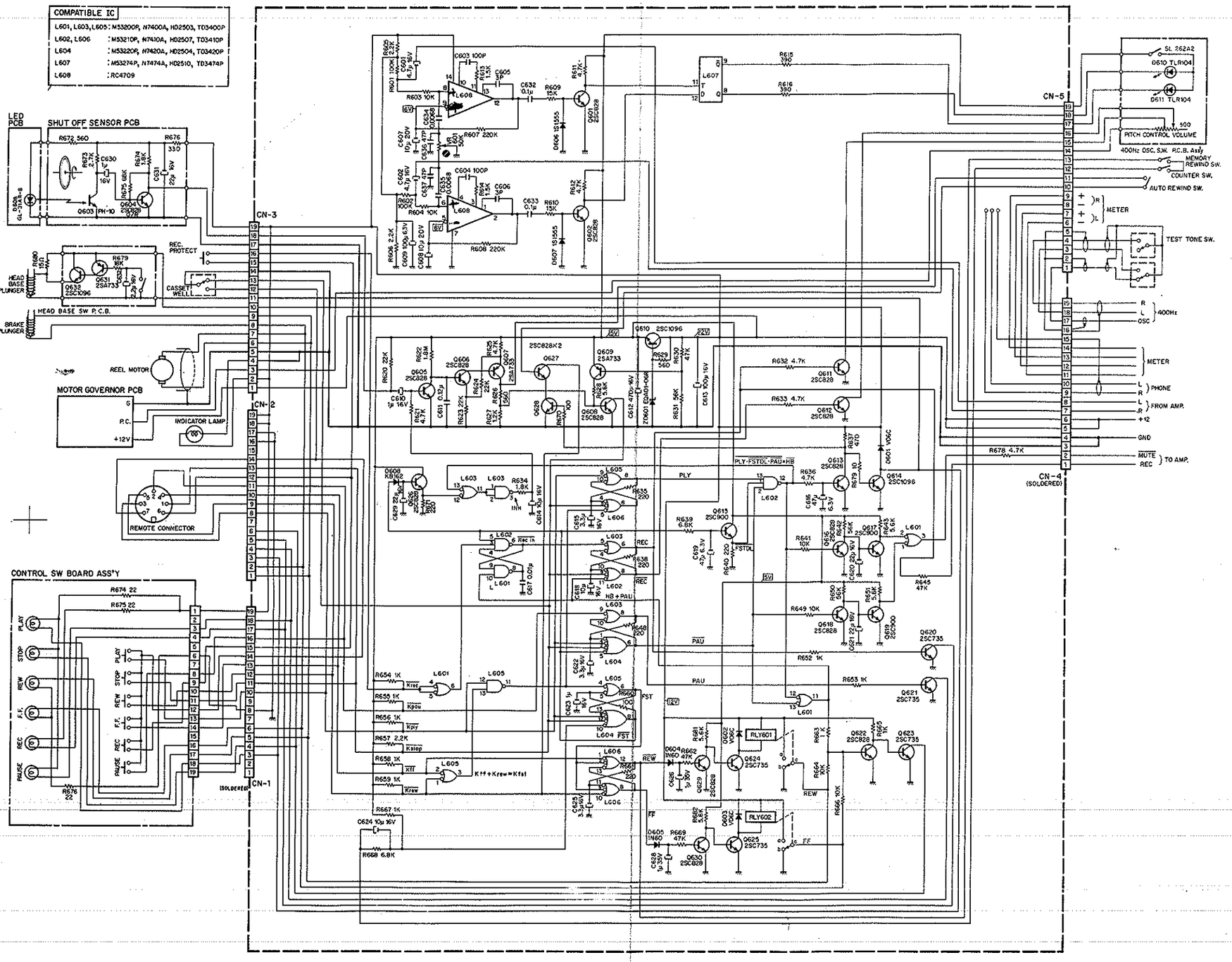
SERIAL No. 3104701 ~

Fig. 9-1



SERIAL No. 3102551 ~

Fig. 9-2



SERIAL No. 3105001 ~
Fig. 9-3

10 LEVEL DIAGRAM

SIGNAL PROCESS IN EACH MODE

1. PLAYBACK MODE:
(P.B. HEAD) (15)→(16)→(17)→(18)→(19)→(20)→(21)
→(22)→(OUTPUT)(23)

2. RECORD MODE: (SOURCE STAGE)
(LINE INPUT) (2)→(7)→(8)→(9)→(21)→(22)
→(OUTPUT)(23)

3. RECORD MODE: (TAPE STAGE)
(LINE INPUT) (2)→(7)→(8)→(10)→(11)→(12)
→(13)→(REC. HEAD)→(TAPE)→(P.B. HEAD)(15)→(16)
→(17)→(18)→(19)→(20)→(21)→(22)→(OUTPUT)(23)

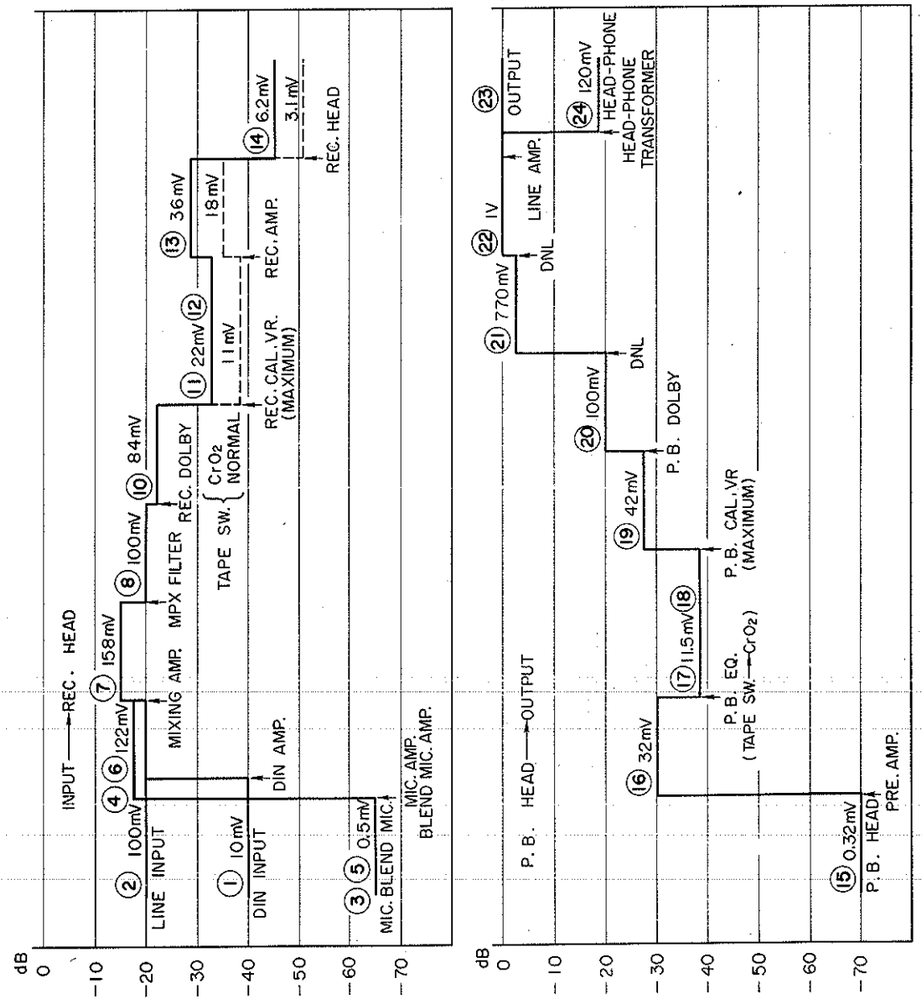


Fig. 10

11 CHARACTERISTICS

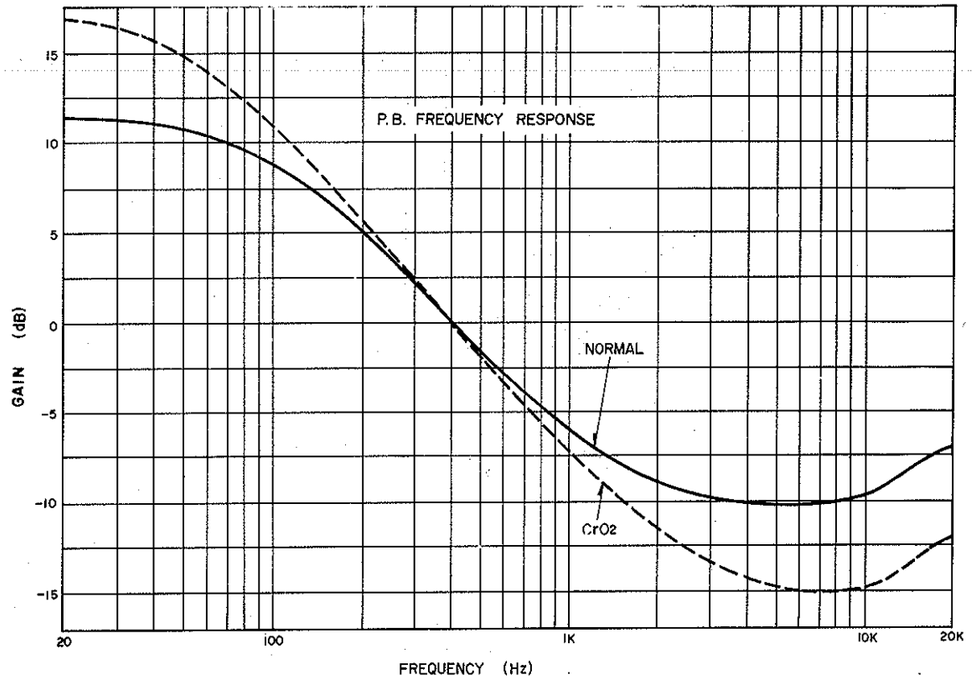


Fig. 11-1

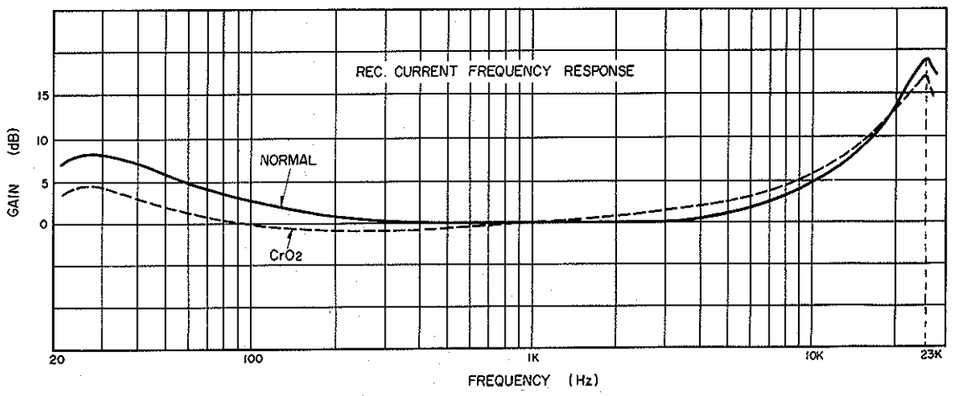


Fig. 11-2

12 SPECIFICATIONS

Power Supply	100, 117, 220, 240V 50/60 Hz
Power Consumption	60W Max.
Tape Speed	1-7/8 ips. ±1%
Wow & Flutter	Less than 0.1% (DIN 45507 Weighted Peak)
Frequency Response	35 — 18,000 Hz ± 3 dB (Dolby In, High Density Low Noise Tape) 35 — 20,000 Hz ± 3 dB (Dolby In, CrO_2 Tape)
Signal to Noise Ratio	Better than 60 dB (Dolby In, Wrms CCITT 400 Hz 3% Distortion)
Total Harmonic Distortion	Less than 2% (at 1 KHz, 0 dB)
Erasure	Better than 60 dB (at 1 KHz, Saturation Level)
Channel Separation	Better than 35 dB (at 1 KHz, 0 dB)
Cross Talk	Better than 60 dB (at 1 KHz, 0 dB)
Bias Frequency	105 KHz
Input:	
Mic Input	600 ohm 0.5mV
Blend Mic	600 ohm 0.5mV
DIN Mic Input	600 ohm 0.5mV
Line	47 Kohm 100mV
DIN Radio	27 Khom 10mV
Output:	
Line	1.0V (Max.) Variable
DIN Line Output	1.0V (Max.) Variable
Headphones	1 mW 0 dB
Dimensions	20-11/16"(W) x 11-11/16"(H) x 8-5/8"(D)
Weight	39 lbs.

TROUBLE SHOOTING

Index:

1. MEASURING INSTRUMENTS, JIGS, TAPES, ETC.

1.1. Audio Generator (20Hz — 200KHz)
1.2. AC Millivolt Meter (with dB measures)
1.3. Oscilloscope (DC — 5 MHz)
1.4. Distortion Meter
1.5. Speed & Wow/Flutter Meter
1.6. Frequency Counter (DC — 1MHz)
1.7. Ohm Meter
1.8. DC Volt Meter (0 — 30V)
1.9. AC Volt Meter (0 — 400V)
1.10. Audio Evaluator 2001 (NP01005)
(Including the Distortion, Oscillator and dB meter)
1.11. Tape Travelling Cassette (DA09011A)
1.12. Track Viewer (DA09012A)
1.13. Torque Gauge (DA09013A)
1.14. 15KHz Azimuth Tape (DA09004A)
1.15. 3KHz Speed & Wow/Flutter Tape (DA09006A)
1.16. 1KHz Track Alignment Tape (DA09007A)
1.17. 400Hz Level Tape (DA09005A)
1.18. 20KHz PB Frequency Response Tape (DA09001A)
1.19. 15KHz PB Frequency Response Tape (DA09002A)
1.20. 10KHz PB Frequency Response Tape (DA09003A)
1.21. Reference Normal Tape (DA09008A)
1.22. Reference EX Tape (DA09010A)
1.23. Reference CrO_2 Tape (DA09009A)
1.24. Extension Cord (10P) (DA09020A)
1.25. Extension Cord (19P-D)(DA09019A)
1.26. Extension Cord (14P-PB) (DA09015A)
1.27. Extension Cord (19P) (DA09014A)
1.28. Extension Cord (14P) (DA09016A)

2. NOTES:

2.1. Check to insure whether the outputs +12V,+18Vand AC 6V of the power source, and +5V of the logic control are correct.

2.2. In general logics, the output high level is not less than 2.4V, and output low level not more than 0.4 — 0.5V.

The output between 0.4 — 2.4V does not belong either to "L" or "H", and is generated if TTL IC is damaged or over-loaded (This voltage is called "Half Level").

The threshold level of the TTL IC is shown to be less than 1.1 — 0.8V while "L" level, and more than 1.9V — 2.0V while "H" level.

Normally, if the input is open, it is regarded as high level.

2.3. The logic control broad if separated from the chassis does not activate accurately as its grounding is also separated, therefore check thereon shall be made upon connecting the grounding of the PCB control and chassis with a jamper wire both ends of which are provided with a clip (particularly when an extension cord is used).

2.4. 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.

2.5. Either Nakamichi CrO_2 or EX tape shall be used while adjustments (particularly while adjustments of bias and record/playback level).

Should another difference branded tape be used in its place, the set shall previously be adjusted according to each of the actual tape in use.

However, if low quality tape should be used, optimum quality of a set will not be obtained (such as distortion, S/N, Dynamic Range, etc. will be deteriorated).

3. TROUBLE SHOOTS

3.1. Main motor does not rotate:

a. Defective motor governor.
b. Defective main motor.
c. Pitch control volume is out of accuracy.
d. The lead wire between governor and motor is cut.
e. The lead wire between the governor and pitch control volume is cut.
f. +12V is not being supplied to the governor.

3.2. Auto Shut-off does not work (at tape end):

a. One of D403 through D406 is defective (excessive ripple of +12V)
b. Shut-off driver is defective.
c. Shut-off sensor is defective.
d. +12V regulator is defective (excessive ripple of +12V).

3.3. Auto Shut-off activates (other than tape end):

a. Shut-off belt is cut.
b. Shut-off sensor is defective.
c. Take-up torque is too weak.
d. Defective shut-off driver.
e. Pressure roller spring is not at the correct position.

3.4. Beacon does not flicker:

a. IC 607 is defective.
b. IC 608 is defective.
c. Defective playback head.
d. Defective playback head amp..
e. Defective record head.
f. Defective L.E.D..
g. Tape travel is incorrect.
h. Defective Record Eq. Amp..

3.5. Does not Shut-off while FF, Rew (at tape end):

a. Defective IC603.
b. Defective IC604.
c. Defective fast driver (in Q626 circuit).

3.6. Remained only in Play mode:

a. Defective IC605.
b. Defective IC606.
c. The driver of the head base solenoid is defective.
d. Defective control switch ass'y.
e. Defective head base solenoid.

3.7. Remained only in Record mode:

a. Defective IC601.
b. Defective IC602.
c. Defective IC603.
d. Defective control switch ass'y.

3.8. Remained only in Rewind mode:

a. Defective control switch ass'y.
b. Defective IC606.
c. Either RY601 or driver is defective.

3.9. Remained only in Fast Forward mode:

a. Defective control switch ass'y.
b. Defective IC606.
c. Either RY602 or driver is defective.

3.10. Remained only Pause mode:

a. Defective IC601.
b. Defective IC603.
c. Defective IC604.
d. Defective control switch ass'y.

3.11. Does not change to Play mode:

a. Defective control switch Ass'y.
b. Defective IC605.
c. Defective IC606.
d. Head base solenoid and driver are defective.
e. Auto shut-off driver is defective.
f. Head base is not operating accurately (when heavy).
g. Reel drive mechanism is not operating accurately.
h. Defective take-up reel.
i. Defective cassette tape (hard to rotate, etc.).
j. Pressure roller spring is out of the correct position.

3.12. Does not change to Record mode:

a. Control switch ass'y is not operating accurately.
b. Defective record protect switch.
c. Defective IC601.
d. Defective IC602.
e. Defective IC603.

3.13. Does not rewind:

a. Control switch ass'y is not operating accurately.
b. Defective IC606.
c. RY601 and driver are defective.
d. Defective reel motor.
e. Pulley of the reel motor is too loose.
f. Defective reel derive mechanism ass'y.
g. RY602 and driver are defective.
h. Defective brake solenoid driver.
i. Defective brake solenoid.

3.14. Does not Fast Wind:

a. Defective control switch ass'y.
b. Defective IC606.
c. RY602 and driver are defective.
d. Defective reel motor.
e. Pulley of the reel motor is too loose.
f. Defective reel drive mechanism ass'y.
g. RY602 and driver are defective.
h. Brake solenoid driver is defective.
i. Defective brake solenoid.

3.15. Does not pause:

a. Control switch ass'y is defective.
b. Defective IC603.
c. Defective IC604.
d. Defective IC602.
e. Head base solenoid and driver are defective.

3.16. Brake does not operate:

a. Defective solenoid.
b. Defective solenoid driver.
c. Defective IC606.
d. RY601 and driver are defective.
e. RY602 and driver are defective.

3.17. Head base solenoid does not operate:

a. Defective solenoid.
b. Defective head base switch ass'y.
c. Defective solenoid driver.
d. Defective IC602.
e. Defective IC605.

f. Defective IC606.

g. Head base is not operating accurately (when heavy).

3.18. Record mode operates without cassette tape:

a. Incorrect adjustment of record protect switch.

b. Defective IC601.

c. Defective IC602.

d. Defective IC603.

3.19. Logic Control does not operate:

a. +5V not being induced.

b. Cassette sensor switch is defective.

c. Incorrect adjustment of cassette sensor switch.

d. Defective control switch ass'y.

e. 19P connector is out of contact.

3.20. Does not auto rewind:

a. Auto rewind switch is out of order.

b. Defective auto rewind driver.

c. Defective IC606.

3.21. Tape speed is too fast:

a. Defective motor governor.

b. Defective generator.

c. Lead wire of sensor is cut.

d. Incorrect adjustment (semi-fixed VR).

3.22. Indications lamp does not light:

a. Defective lamp.

b. Lamp driver is defective.

3.23. Does not playback:

a. Playback head is defective.

b. Defective PB head amp. ass'y.

c. Defective PB Dolby Ass'y.

d. Defective DNL ass'y.

e. Defective line amp. ass'y.

f. Dirty PB head.

g. Mute is not operating.

h. Wire between playback head and 10P connector is cut.

3.24. Does not record:

a. Defective record Eq. amp. ass'y.
b. Defective record head.
c. Defective record Dolby Ass'y.
d. Bias oscillation is not generating.
e. Defective Mic. amp. ass'y.
f. Defective 19kHz MPX filter.
g. Incorrect tape travel.
h. Either capstan or pressure roller is dirty.
i. Dirty playback head.
j. Remained only in mute.
k. Cut lead wire between record head and 10P connector.

3.25. Bias does not oscillate:

a. No voltage to bias oscillation circuit.
b. Defective bias oscillation circuit.
c. Defective erase head.

3.26. Does not erase:

a. Defective erase head.
b. Dirty erase head.
c. Bias is not oscillating.
d. Incorrect tape travel.

3.27. Level variations:

a. Incorrect tape travel.
b. Defective pressure roller.
c. Variation of take-up torque.
d. Defective erase head guide (including incorrect adjustment).
e. Dirty capstan or pressure roller.
f. Defective flywheel ass'y.
g. Incorrect adjustment of pressure roller.
h. Record head and playback head are out of correct alignment.
i. Defective playback head.
j. Defective record head.
k. Incorrect adjustment of flywheel thrust screws.

3.28. Tape folds:

a. Tape guide is in incorrect position.

b. Pressure roller is not in the right position against capstan.

c. Head mount base is bent.

d. Dirty capstan.

e. Defective pressure roller.

f. Defective cassette tape (non-uniformity of magnetic surface).

g. Defective cassette housing.

3.29. Unable to secure correct level while record/playback:

a. Distorted.

b. Defective record head.

c. Defective playback head.

d. Defective record eq. amp..

e. Defective playback amp..

f. Incorrect adjustment of playback head amp.

g. Playback head and record head are not in correct alignment.

h. Incorrect tape travel.

3.30. Great mechanical noise:

a. Defective pressure roller.

b. Defective reel drive mechanism.

c. Defective motor.

d. Flywheel is defective.

e. Defective counter.

3.31. Sound is distorted:

a. Playback head is dirty.

b. Record head is dirty.

c. Head(s) is(are) magnetized.

d. Record head is defective.

e. Playback head is defective.

f. Bias oscillator circuit is defective.

g. Excessive high level at Record/Playback.

3.32. Signal to Noise ratio is deteriorated:

a. PB Head is magnetized.

b. Bias leakage.

c. Excessive ripple from power source.

d. Either PB head or Rec. Head is defective.

e. Defective PB head amp. (Noise level is great).

f. Defective record amp. (Noise level is great).

3.33. High frequency is deteriorated:

a. Misalignment of Record head.
b. Record head is dirty.
c. Playback head is dirty.
d. Defective Playback head.
e. Defective Record head.
f. Head(s) is(are) magnetized.
g. Incorrect bias adjustment (against tape).
h. Defective 19KHz MPX Filter.

3.34. Induction of Wow/flutter:

a. Defective capstan belt.
b. Defective flywheel ass'y.
c. Defective capstan flange.
d. Defective pressure roller ass'y.
e. Defective motor (main motor).
f. Variation of take-up torque.
g. Abnormality of back tension.
h. Drive part(s) is(are) dirty.
i. Slippage between pressure roller and tape.
j. Defective reel drive mechanism ass'y.

3.35. Meters do not flutter:

a. Meters themselves are defective.
b. Defective meter amp..
c. Tape is not played back.
d. Neither being recorded nor monitored.
e. Meter lead is shorted.
f. Meter lead is cut.

3.36. No power transmission:

a. Defective power cord.
b. Defective power switch.
c. Defective change-over plug and socket.
d. Defective main transformer.
e. Defective DC supply circuit.

3.37. Ineffective mute:

a. No mute signal from logic board.
b. Defective mute driver.
c. Defective record amp..
d. Defective PB Head Amp..

3.38. No oscillation of 400Hz:

a. Defective oscillation circuit.

b. Defective test tone switch.

c. Shorted lead between test tone switch and main board.

d. Cut lead between test tone switch and main board.

3.39. Tape speed is too slow:

a. Defective motor governor.

b. Defective main motor.

3.40. Remained in mute mode:

a. Continuous generation of mute signals from logic board.

b. Defective mute driver.

c. Defective record amp..

d. Defective playback head amp..

3.41. Defective memory rewind:

a. Defective tape counter.

b. Defective memory switch.

c. Defective driver of memory rewind.

3.42. No activation of tape counter:

a. Defective tape counter.

b. Defective counter belt.

3.43. Sound distorts at Limiter Switch On:

a. Incorrect adjustment of limiter circuit.

b. Defective limiter circuit.

c. Defective limiter switch.

3.44. Unsatisfactory sound at Dolby In:

a. Record/playback level is away from correct level (0 dB).

b. Incorrect adjustment of Record Dolby.

c. Incorrect adjustment of Playback Dolby.

d. Incorrect bias adjustment (to tape).

e. Defective Record Dolby.

f. Defective Playback Dolby.

g. Incorrect playback gain (400Hz P/B level tape (DA09005A)).

3.45. Pneumatic damper ineffective:

a. Defective pneumatic damper.

b. Defective mechanism (heavy or does not work).

c. Incorrect adjustment of damper.

4. CHECK METHODS

4.1. Check on playback functions:

a. Check to insure whether the capstan, heads or pressure roller is free from dirts or dust.

b. Check on tape travel.

c. Load a 400Hz tape.

d. Set the machine in play mode.

e. Check the output of PB head amp. (both channels).

f. Check the output of PB dolby (both channels).

g. Check the output of DNL (both channels).

h. Check the output of Line amp. (both channels).

i. Check the output jack (both channels).

j. Check headphone jack.

4.2. Check while recording:

(Set each of input level controls to maximum, apply the rated input signal level to input jack and then check indications of the meters.)

a. Check the Mic and DIN amp.

b. Check MPX functions.

c. Check Record Dolby.

d. Check Record Eq. amp..

e. Check the bias oscillator circuit.

f. Check record head.

g. Check erase head.

4.3. Check on Mechanisms:

a. Check the track positions of record head and playback head. (with Track Viewer (DA09012A)).

b. Check to insure whether the main motor rotates when the machine is set to On.

c. Push the play button, and check to insure whether the head base solenoid activates and whether the take-up reel rotates.

d. While in the c mode as above, check to insure whether auto-shut-off returns the head base and the stop lamp illuminates when take-up reel is stopped by hand.

e. When the fast forward button is pushed, check to insure whether the FF lamp illuminates and whether the fast forward mode activates.

f. When the take-up reel is stopped by hand while in e mode as above, check to insure whether the auto shut-off activates to set the machine in stop mode.

g. Push the rewind button and check to insure whether the rewind lamp illuminates, fast wind motor rotates, auto shut-off activated, and whether stop lamp lights.

h. Load a blank cassette tape.

i. Check to insure whether the unit is free from any abnormality while in fast forward and rewind mode.

j. Push the record and pause buttons simultaneously, and check to insure whether record is paused.

k. Push the play button while in j state, and check to insure whether tape starts travelling and recording commences.

l. Push stop button and check to insure whether the machine is set to stop from any of the modes.

m. Measure the torque of take-up, fast forward and rewind (with torque gauge (DA09013A)).

n. Check the tape speed and wow/flutter (with 3KHz Speed & Wow/Flutter tape (DA09006A)).

o. Check the playback head height and tape travel. (with 1KHz Track Alignment tape (DA09007A) and Tape Travelling Cassette (DA09011A)).

4.4. Overall check:

a. Check the frequency response (bias adjustment).

b. Check distortion.

c. Check signal to noise ratio.

d. Check channel separation.

e. Check crosstalk.

f. Check erasure.

5. CHECK METHODS WHEN PART(S) IS(ARE) REPLACED.

When any part/part ass'y of the Nakamichi 1000 is replaced with new one, please check to insure the following.

5.1. When main motor is changed:

a. Tape speed.

b. Wow/flutter.

5.2. When pressure roller is changed:

a. Tape travelling.

b. Azimuth/height.

c. Tape speed.

d. Wow/flutter.

5.3. When erase head is replaced:

a. Tape travelling.

b. Azimuth/height.

c. Bias osc. frequency.

d. Erasure performance.

e. Bias adjustment (overall frequency response).

f. Bias leakage.

5.4. When record head is replaced:

a. Azimuth/height.

b. Record track position.

c. Bias adjustment (overall frequency response check).

d. Adjustment of level at 0dB with 400Hz test tone.

e. Check distortion when 1KHz is recorded and played back at 0dB.

f. Bias leakage check.

g. Phase check (between left and right).

5.5. When playback head is replaced:

a. Azimuth/height.

b. Tape travelling.

c. Track position in regard to that of record head.

d. Adjustment of playback gain (with test tape at 0dB).

If unable to adjust to 0dB, please adjust R123,223 at 3.3K (P.B. Head Amp. P.C.B.) to:

if strong — make R stronger

if weak —make R weaker

e. Frequency response check by playback (with test tapes).

f. Frequency response check by overall (with reference tape).

g. Gain check by overall (with reference tape).

h. Phase check (between left and right).

5.6. When flywheel ass'y is replaced:

a. Tape travelling.

b. Azimuth/height.

c. Tape speed.

d. Wow/flutter.

5.7. Reel drive mechanism ass'y is replaced:

a. Torque check while F/F, Rew. and Play.

b. Mechanical noise check while F/F, Rew. and play, but without a tape.

c. Tape speed.

d. Wow/flutter.

5.8. When meters are replaced:

a. Adjustment of meter level.

5.9. When sub-motor is replaced:

a. Torque check while F/F and Rew..

5.10. When drive belt is replaced:

a. Wow/flutter.

b. Tape speed.

5.11. When motor governor is replaced:

a. Tape speed.

b. Wow/flutter.

5.12. When tape counter is replaced:

a. Tape speed.

b. Wow/flutter.

c. Memory rewind.

d. Counter check (sticky, etc.).

5.13. When puneumatic damper is replaced:

a. Damper speed check.

Note 1: Where rewinding and fast forwarding exceeds 60 seconds, replace the reel drive friction.

Note 2: If chattering is appreciable, replace the reel drive mechanism ass'y.

Note 3: Where the take-up torque should be too weak, adjust the spring pressure of the reel hub spring.

6.8. Tape Travelling Adjustment:

Inaccurate tape travelling extremely deteriorates the performance of tape decks therefore careful checks are required.

6.8.1. Check-out Method:

a. Check to insure whether the head height is correct.

b. Load a tape travelling cassette (DA090011A) and play it and check to insure freedom from waving, looseness, etc.

c. The difference of head height between supply side and take-up side shall be not more than 0.3mm.

d. After more than 2 second when depressed play button, the tolerance of the tape on the playback head shall be not more than 0.05mm.

e. Feed in the test tone signals to the Nakamichi reference CrO_2 tape (DA09009A) and record and play it back, when the level change shall be not more than 1dB.

6.8.2. Adjustment:

a. Check to insure whether any of the heads is in contact with the cassette housing.

b. Check to insure whether the pressure roller is located in parallel with the capstan shaft (Also check to insure whether the heads are free from dust or dirts, and whethr the pressure roller arm is free from bending).

c. Check to insure whether the surface of the pressure roller is gloubular not straight. Other than the above that is straight type, concaved, or oiled surface shall be subject to replacement.

d. The pressure of the pressure roller shall be 400g ±50g.

e. Adjustment of Pressure Roller Timing.

i. Refer to Fig.1.

Push down the head base by hand while in stop mode till the take-up pressure roller reaches the capstan, and then check to insure whether the gap between the supply pressure roller and the capstan shall be 0.5mm.

ii. While in play mode, check to insure whether the gap between the take-up pressure roller arm and the stopper is 1.25mm, and whether the that between the supply pressure roller arm and stopper is 0.75mm.

Note: If the foregoing requirements are not satisfied, adjustment shall be made by bending the stopper.

f. The clearance between the capstan shaft and thrust shall be 0.1 — 0.05mm.

g. The tape guide on which if any scratches, etc. are noted shall be replaced. Check shall also be made to insure whether the erase head surface is smooth.

h. The use of defective head base damper will deteriorate the tape travel at the beginning of activation.

i. The parallelism between both of the capstan axis is one of the most important factors for an accurate operation. If great shock is given to the capstan, the capstan flange ass'y shall be replaced.

Note: The cassette house shall also be checked to insure freedom from deformation, bending, etc.

6.9. Adjustment and Measurement of Frequency Response:

The method of measuring frequency response in this item refers to the case where waving is genrated.

Both of the Dolby Noise Reduction System and DNL shall be effected at OUT.

6.9.1. Adjustment of Playback Frequency Response:

a. Open the 39K ohms of R111,211. (EQ and time constant shall show 120μs).

b. Load a 400Hz Level Tape (DA09005A) to playback, and turn the output level controls to till the indication of the VTVM shows (0dB for example) and easy reference of value.

c. Load a 10KHz P.B.F.R. tape (DA09003A) and play it back.

d. Check the output of 10KHz and then adjust EQ in the range of 110μs— 140μs the result of which shall be 0 — +3dB. Refer to Fig.2.

e. Load a 15KHz P.B.F.R. tape (DA09002A) and play it back.

f. If the output of 15KHz shows the value within ±2dB, it shall be considered satisfactory.

g. Load a 20KHz P.B.F.R. tape (DA09001A) and play it back.

h. If 15KHz at e shows the value within ± 2dB and 20KHz being less than —3dB, check shall be made on C101, 201 with 0 — 220PF. Refer to Fig.3.

i. Adjustment shall be made so that 10KHz, 15KHz and 20KHz will become flat when compared with 400Hz.

j. If the results are shown to belong to high, set R101, 201 to open —220K ohms.

k. Adjust the azimuth alignment to the maximum output with a 15KHz azimuth alignment tape (DA09004A)

Note 1: If adjustment is madeon the jamper resistor, the alignment beacon phase shall also be adjusted.

Note 2: If the foregoing adjustments do not suffice the requirements, the playback head shall be replaced.

6.9.2. Adjustment of Overall Frequency Response:

a. Set the tape selector switch to CrO_2 and then load reference CrO_2 tape (DA09009A).
b. Connect the audio generator to input jacks and connect a VTVM and oscilloscope to input jacks.
c. Set the Nakamichi 1000 to record/pause.
d. Set the monitor switch to source and adjust the line input level controls till the meters indicate 0dB at 1KHz 0.3V from the generator.
e. While the above state, lower the output of the oscillator by 30dB.
f. Set to record/play. Set the oscillator to 15KHz from 1KHz and then adjust the azimuth alignment of the record head.
g. Adjustment shall be made on bias till the reponse at 10KHz becomes 0dB (± 1dB).
h. Adjustment shall be made on peaking coils L 104, L 204 till the response at 20KHz becomes 0dB (± 2dB).
i. Waving with a CrO_2 tape at 1KHz — 20KHz shall be not more than 3dB.
j. If waving exceeds 3dB, apply 22K ohms in parallel with R117,217 of the main P.C.B. and repeat the items g thorough i. Refer to Fig. 4.
k. Load a reference EX tape (DA09010A) and adjust the azimuth alignment of record head (record/play).
l. Bias shall be adjusted till the response at 10KHz becomes 0dB (± 1dB).
m. Measure the response at 18KHz (± 2dB).
n. Change the output of the oscillator from —30dB to —20dB and check the frequency response.
o. Measure the distortion at 1KHz 0dB Overall.
   CrO_2 — less than 2%
   EX — less than 2.5%
p. In case of excessive distortion, change the record head.

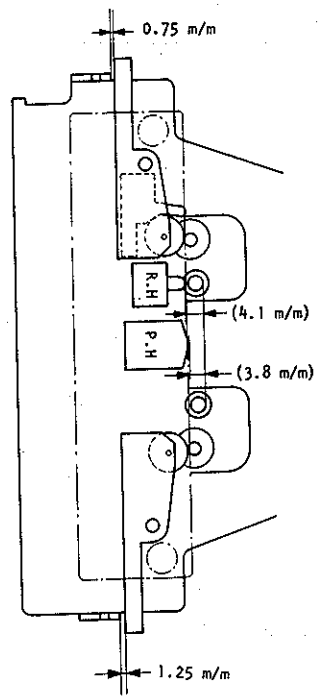


Fig.1 Adjustment of Pressure Roller Timing

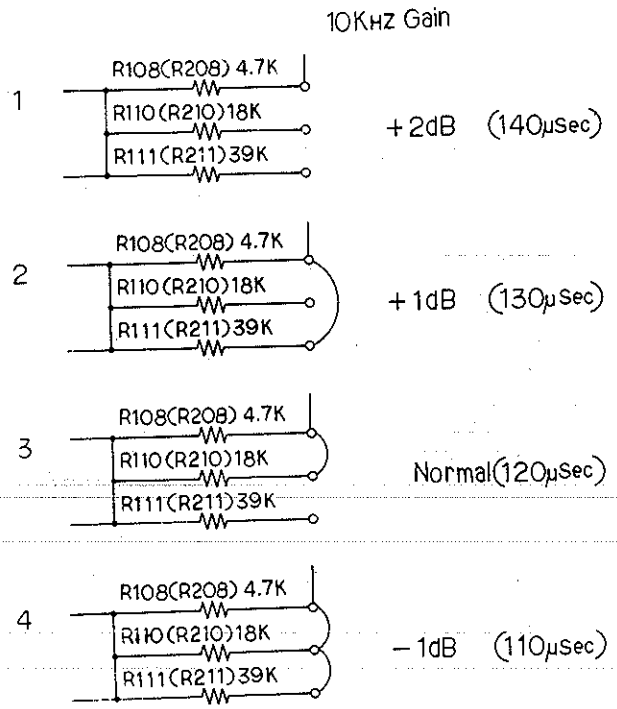


Fig.2 Playback Equalizer

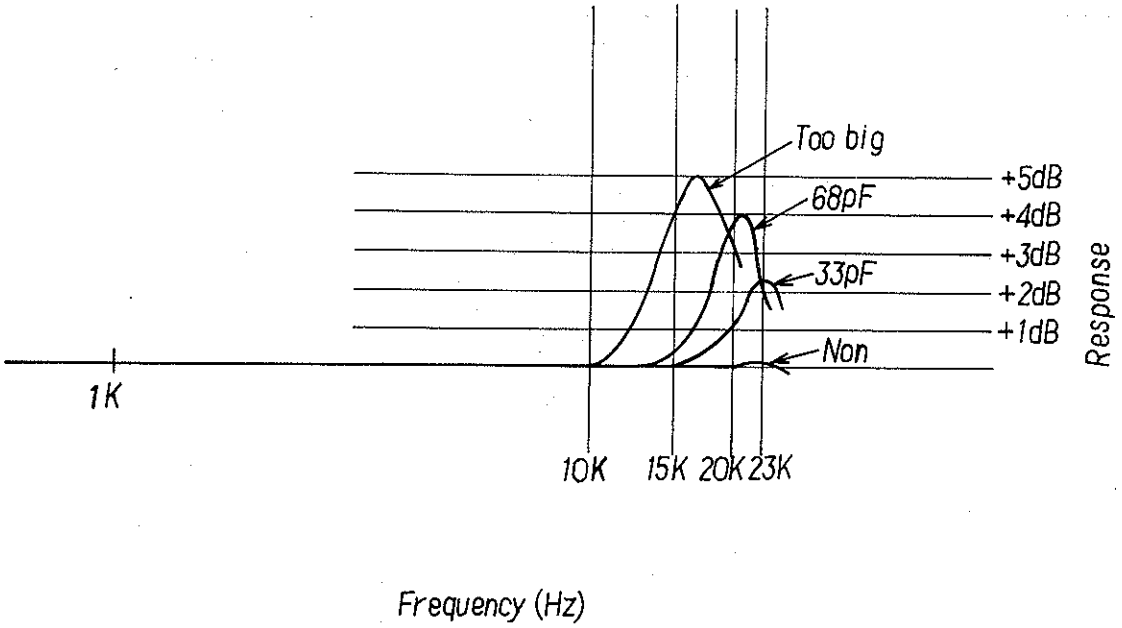


Fig.3 Compensation of Playback High Frequency Response

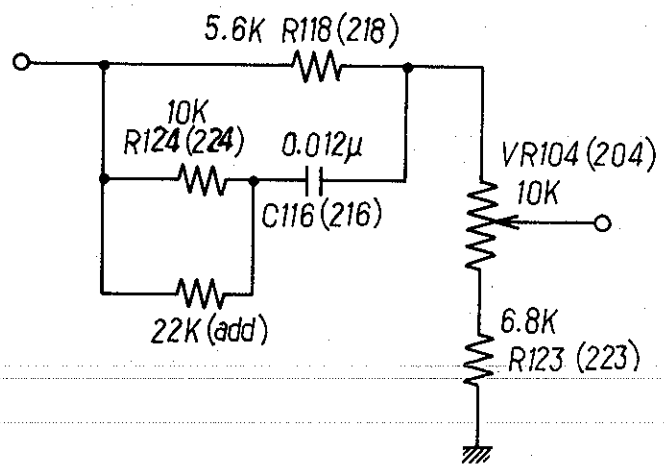


Fig.4 Record Equalizer for CrO_2

7. TABLE FOR COMMON USE OF SEMI-CONDUCTORS

Symbol	Manufactures	Countries
TII	Texas Instruments Incorporated	U.S.A.
GESY	General Electric Company	U.S.A.
FSC	Fairchild Semiconductor Division	U.S.A.
MOTA	Motorola Semiconductor Products	U.S.A.
RCA	Radio Corporation of America	U.S.A.
SPR	Sprague Electric Company	U.S.A.
NSC	National Semiconductor Corporation	U.S.A.
APX	Amperex Electronic Corporation	U.S.A.
SSI	Solid State Devices Incorporated	U.S.A.
SHWG	Siemens Aktiengesellschaft	Germany
TFKG	Allgemeine Elektricitats-Gesellchaft Telefunken	Germany
PHIN	Philips Gloelampenfabrieken Eindoven	Netherlands
SIG	Signetics	U.S.A.

2SC735 (TOSHIBA)
2N2432-TII. 2N3416,2N3417-GESY. 2N3566,SE6001,SE6002-FSC.
BCY58-SHWG. BSW88,BSW89-TFKG.

2SC732 (TOSHIBA), 2SC900E (NEC)
2N3391,2N3900-GESY. CB167,BFY47,BFY48,BFY49-SHWG, CB149,BF254,
BF255-THKG. 2N5088,2N5089,MPS6520,MPS6521,MPS6522,MPS6523-MOTA.
40231,40232,40233-RCA.

2SC828 (MATSUSHITA)
2N3710-TII. 2N3391A-GESY. 2N3566-FSC. BC121,BC122,BC123, BC128-SHWG.
BC129-TFKG. MPS3727,MPS6514,MPS6515,MPS6575,MPS6576, 2N3903-MOTA.
BC147-APX.

2SC1096 (NEC)
BSX62-SHWG. 2N4237,2N4238-MOTA. 2N1479,2N1481,2N1700,40310-RCA.
BFY51-PHIN.

2SC945 (NEC), 2SC373 (TOSHIBA)
A3T929,A3T930-TII. 2N2711,2N2712-GESY. SE2001,SE2002-FSC.
BC130-TFKG. MPS2711,MPS2712,MPS3392,MPS3393,MPS3394,MPS3395,
MPS3396,MPS3397,MPS6512,MPS6513-MOTA.

2SC1000 (TOSHIBA)

BC167,BC168,BC169,BFY47,BFY48,BFY49-SHWG. BC131,BC149,BF254,BF255-TFKG. 2N5088,2N5089,MPS3707,MPS6553,MPS6555,MPS6571-MOTA. 40231,40232,40233-RCA.

2SA495 (TOSHIBA)

A3T2894-TII. 2N4248,2N5138-FSC. BC257,BC258,BC259-SHWG. BC157,BC158,BC159-TFKG. 2N3905,2N3906,MPS3702,MPS3703-MOTA. BCZ13, BCZ14-PHIN.

2SA496 (TOSHIBA)

2N1132,SE8001,SE8002-FSC. 2N4234,2N4235,MPS6562,MPS6563-MOTA. 40319,40361,40406-RCA. 2N4412-SPR.

M53200P (MITSUBISHI)

N7400A-SIG. SN7400N-TII. FLH101-SHWG. HD2503-HITACHI. TD3400P-TOSHIBA.

M53210P (MITSUBISHI)

N7410A-SIG. SN7410N-TII. FLH111-SHWG. HD2507-HITACHI. TD3410P-TOSHIBA.

M53220P (MITSUBISHI)

N7420A-SIG. SN7420N-TII. FLH121-SHWG. HD2504-HITACHI. TD3420-TOSHIBA.

M53274P (MITSUBISHI)

N7474A-SIG. SN7474N-TII. FLJ141-SHWG. HD2510-HITACHI. TD3474P-TOSHIBA.

RC4558 (RAYTHEON)

SN72558-TII. MC1458-MOTA. LM1458-NSC.

RC4709 (RAYTHEON)

MC1437P-MOTA.

EXPLANATION FOR MECHANISMS

Index:

1. 3-HEAD CONFIGURATION

Basically there are five openings in the cassette housing, and the both sides of openings are being used for left and right capstans and pressure rollers and the remaining three openings are for the two reference pins and the playback head in between. Nakamichi 1000 and 700 incorporate the 3-head system, and the playback head has a very narrow gap of 0.7 micron. In order to ensure the best possible frequency response particularly at the high-end the playback head should be positioned against the opening which will take advantage of the felt pad in the cassette housing as well as the shielding plate incorporated.

The record head gap is 5 micron wide for achieving the best bias and signal flux penetration to the tape and wide dynamic range in recording. The record head is of an exceptionally hard durable hi-Mu ferrite. With this configuration only the openings available for the separate erase and record heads are the openings of the take-up pressure roller side and the take-up reference pin side. One of the critical factors in the 3-head system is the adjustment of track width for the three independent heads. Instead of mounting the heads on the base plate of the mechanism the Nakamichi 1000 and 700 use a quite unique head mounting method; the three heads are hanged from the top of the head housing so that it enables an independent azimuth alignment on the three heads and the alignment becomes much easier since it can be performed with a screw driver from the top of the head housing. See Fig. 1. If readjustment of the heads is necessary, it is highly recommendable to do the adjustment, referring to the Adjustment Procedures.

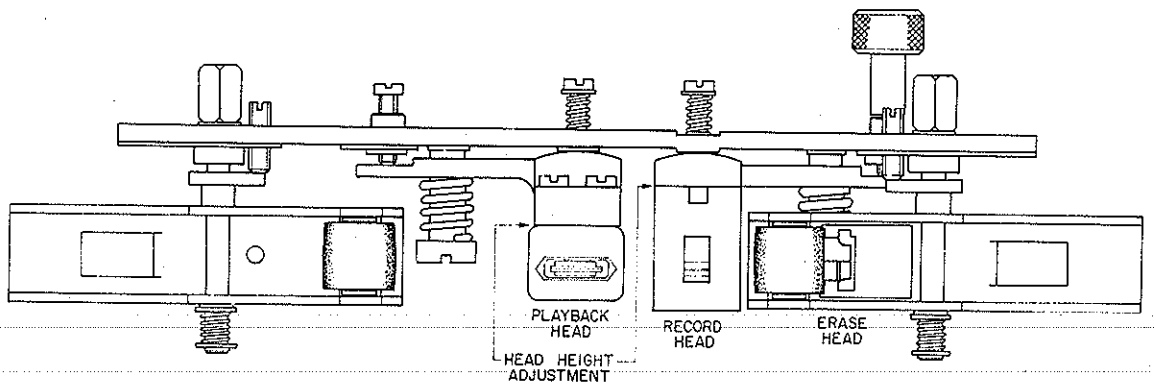


Fig.1 Head Housing

2. DOUBLE CAPSTAN TAPE DRIVE

As shown in Fig. 2, the double capstan system consists of two capstan shafts (a) and (b) connected to the two flywheels which are driven with a belt.

Against these capstans two pressure rollers (a) and (b) are engaged to run the tape with an adequate holdback tension created by the double capstan and pressure rollers. When the two capstan flywheels start rotating as shown in Fig. 2 the belt tension at side A becomes stronger than that of the side B belt and the rotation of capstan (a) becomes slightly faster than that of the capstan (b). With the pressure rollers (a) and (b) pressed against the capstans (a) and (b) it creates a tension over the tape between the capstans in proportion to the difference in capstan rotation.

As the double capstan system always creates a constant and stable holdback tension between the two capstans, the condition of the tape between two capstans will not be affected by any external conditions such as irregular take-up and supply torque, irregular load of cassette tape, undesirable mechanism vibration, etc., thus assuring the superior wow and flutter characteristic.

The double capstan system provides a constant holdback tension on the tape and maintains the stable pressure on the tape against the heads, therefore, the tape maintains the stable contact against the erase and record head surfaces even without the pads.

The only critical factor in the double capstan system is to be considered; the two capstans have to be positioned perfectly in parallel and to be precisely vertical against the head base, the pressure rollers have to be evenly pressed against the capstan shafts and the head surface must be positioned perfectly vertical against the tape surface. Otherwise, it occurs that the running tape will be out of the tape guide resulting in the irregular tape movement.

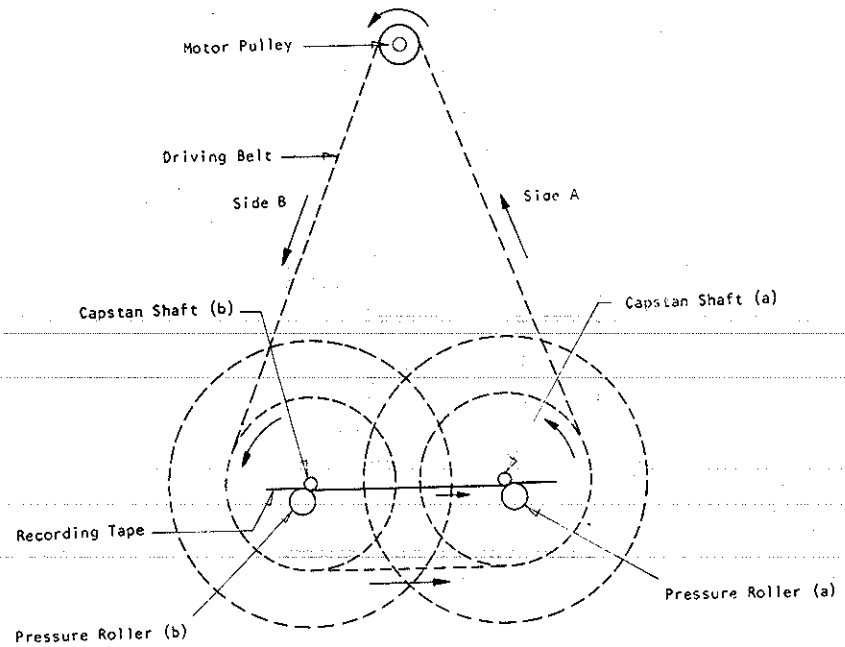


Fig.2 Double Capstan System

3. REEL DRIVE MECHANISM

Play Mode:

Refer to the Fig. 3 and 4.

At power switch on main motor begins to rotate, and pulley "f" and pulley "g" will turn to the indicated direction through belt "e".

At play mode, head base is slidden and pin "a" which is locked by head base cam becomes free.

Then spring "b" acts to let pulley "g" contact take-up pulley side.

There is a clutch mechanism between pulley "g" and take-up pulley as shown in the Fig. 4. Take-up pulley will rotate through clutch mechanism.

Fast Forward and Rewind Mode:

Refer to the Fig. 5 and 4.

Pulley "m" moves freely either toward the supply pulley or take-up pulley. Only while play mode pin "k" is locked by slidden head base and pulley "m" does not move.

While fast forward mode, belt "i" and pulley "l" will turn to the indicated direction.

Pulley "m" is turned by pulley "l" and pressed to the take-up pulley directly.

Pulley "m" has a tension mechanism itself and it acts to generate mechanical loss therefore the force which will press the pulley "m" to the take-up pulley happens.

At time of rewind mode, belt "i" will turn to the opposite direction and pulley "m" will be pressed to the supply pulley.

Spring "j" acts to press pulley "m" toward the pulley "l".

At a tape end belt "i" will stop through clutch mechanism which is assembled to the sub-motor.

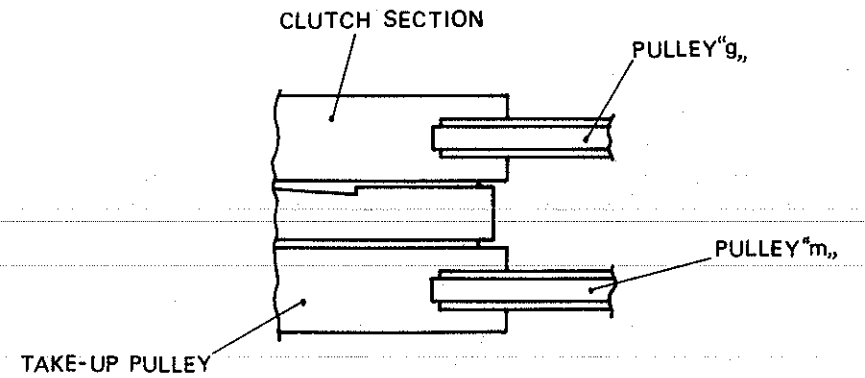


Fig.4 Clutch Mechanism

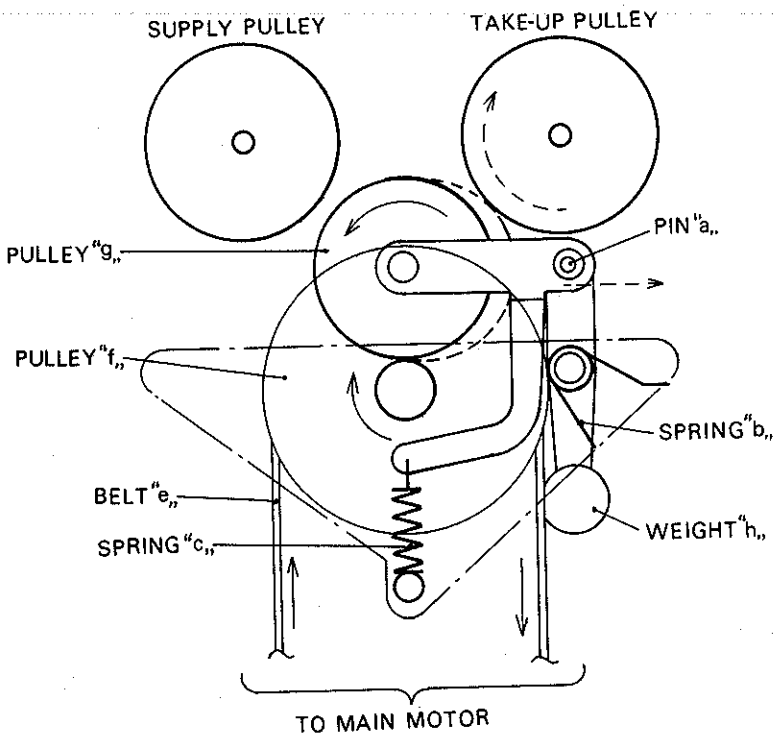


Fig.3 Play Movement

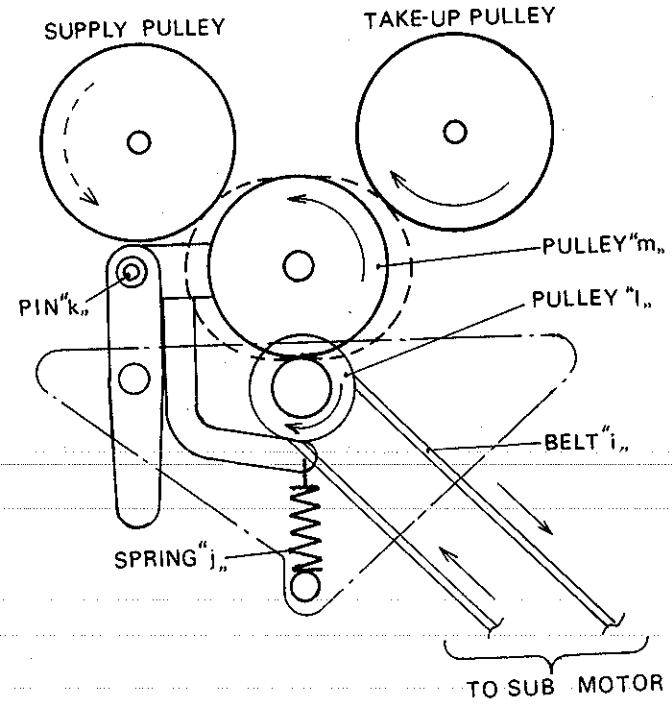


Fig.5 F.Fwd & REW Movement

EXPLANATION FOR AMP. CIRCUITS

Index:

1. REC. DOLBY CIRCUIT

Fig.1 shows a recording mode Dolby processor circuit. The circuit input signal is applied through terminal 11(4), while the signal applied through terminal 12(3)is fed to the MONITOR switch and LIMITER circuit and is only subjected to impedance conversion by Q101 and is not boosted by the Dolby processor. Terminal 10(5) is the circuit output terminal and is linked with the REC. EQ. AMP via REC. CAL. VR and TAPE selection switches. Terminal 13(2) is connected with the DOLBY NR switch. For DOLBY NR IN, this terminal is open and a feedback current is applied to the base of Q102. For DOLBY NR OUT, this terminal is grounded and the output via the emitter of Q102 is cut from the Dolby processor.

A detailed explanation of the Dolby processor can be found in other references, however, it is also briefly described here.

Fig.2 compares input vs. output characteristics of the Dolby processor, where curve A shows the recording mode Dolby circuit and curve B the playback mode. The symmetry of these two characteristics with respect to line 0-0', bisecting the right corner, is highly significant.

Curve A for recording exhibits a linear relationship between the input and output signal levels from the high level down to −5 dB, under which the input level gradually bends. For input levels under −30 dB, the output level is boosted by 10 dB with respect to the input level. The action of the recording mode Dolby circuit is that the output level is boosted from 0 to a maximum of 10 dB according to the input level.

With curve B for playback, in contrast to that for recording, the output level decreases with a decrease in the input level and, for an input level of less than −30 dB, becomes a further 10 dB lower than this input level. According to this characteristic, noise generated in the playback system, such as hiss noise, playback amplifier noise, etc., is reduced by 10 dB. Combination of the above for recording and playback mode results in a linear characteristic. For example, for a −40 dB recording input, point b on curve A is recorded at −30 dB since the input is boosted by 10 dB in the recording mode Dolby circuit. When the signal reproduced from a recorded magnetic tape enters the playback mode Dolby circuit, the −30 dB input level is reduced by 10 dB to −40 dB; point b' on curve B. Thus, the 1:1 proportional relation is valid for any input level.

This action is explained using a system diagram of the recording mode Dolby processor as shown in Fig. 3.

The input signal enters the input of amplifier 4 (Q102) via amplifier 1 (Q101). Another signal from amplifier 1 is amplified by amplifier 2 (Q104 and Q105) after passing through a high-pass filter and enters amplifier 4. This signal is superposed by another signal as previously mentioned and this added signal is supplied to the output terminal through amplifier 4. The signal amplified by amplifier 3 (Q106) is fed back to an FET (Q103) after being rectified by diode D(D104). A circuit including the high-pass filter, amplifiers 2 and 3, and the FET in Fig. 3 is called a compressor, and

the signal which appears at the point between the output of amplifier 2 and the input of amplifier 4 is called the compressor output signal (E_2). On the other hand, the output (E_1) of amplifier 1 is called the direct signal, and the FET is used as an electronic attenuator.

Indications such as 8.2V, etc. in the circuit diagram show DC voltages when a zero signal is applied. The standard input signal level to the recording mode Dolby processor is 400 Hz and 100 mV. The recording output signal level is about 85 mV (r.m.s.).

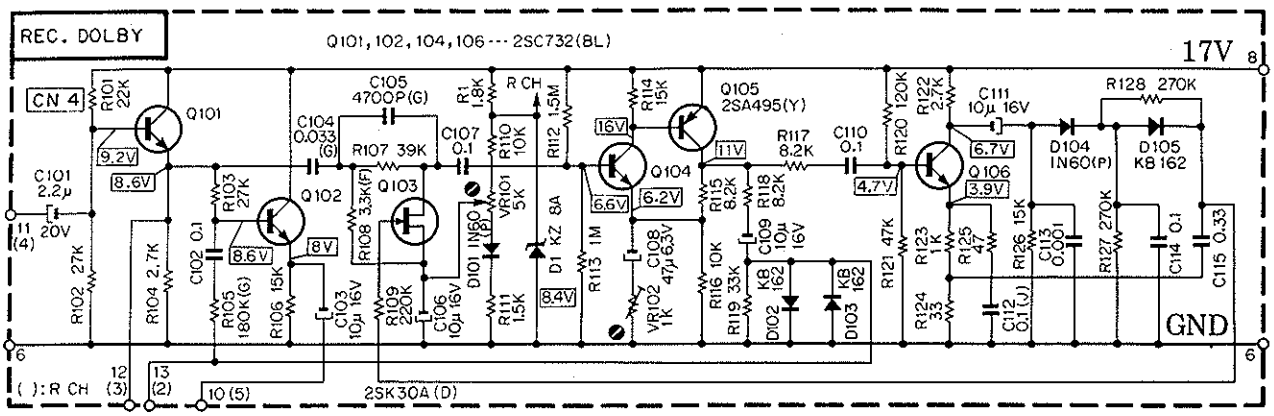


Fig.1 Record Dolby Processor Circuit Diagram

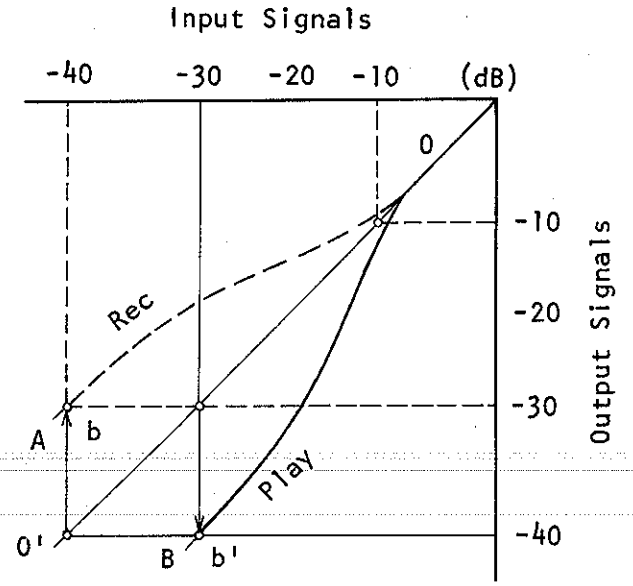


Fig.2 Working Principle of Dolby Circuit

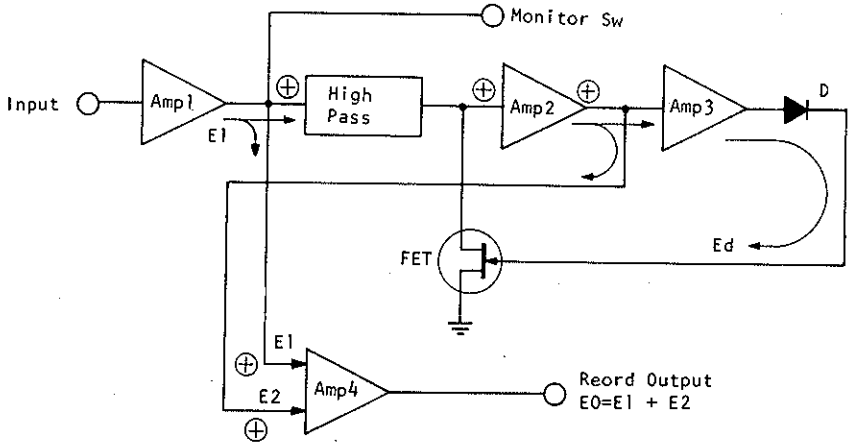


Fig.3 Record Dolby Processor System Diagram

2. P.B. DOLBY CIRCUIT

Fig.4 shows a circuit diagram for a playback mode Dolby processor. The input for this circuit is applied through terminal 12(3) where the output of the playback head amplifier is connected. Terminal 10(5) is the output of the playback mode Dolby processor which becomes the input of the DNL circuit via the MONITOR switch. An input signal through terminal 13(2) is applied to the DOLBY NR switch. For DOLBY NR IN, this line is open and the signal is fed back to the base of Q101. For DOLBY NR OUT, this line is grounded and no signal is fed back.

Since the general action of the Dolby processor was described in the preceding section, REC. DOLBY CIRCUIT, only the action of the playback mode Dolby processor will be explained here, using its system diagram. The input signal applied through amplifier 1 (Q101, Q102) via a high-pass filter, is amplified in amplifier 2(Q104, Q105), and is then fed back to the input of amplifier 1 in opposite phase to the phase of the input signal. Since this results in the subtraction of the feedback signal from the input signal, the resultant signal appears at the amplifier 1 output, i.e., the playback mode Dolby processor. Meanwhile, an output signal which has been amplified by ampliifer 3(Q106) controls the FET (Q103) after being rectified by diode D (D104).

The difference between playback and record is, as is obvious from the above explanation, that the phase of the compressor signal is opposite to that of the direct signal because of the changed signal path. Fig.6 shows typical record and playback mode frequency characteristics for the Dolby processor. According to this figure, it is obvious that frequency components higher than about 200 Hz are subjected to the Dolby process at levels less than about −10 dB.

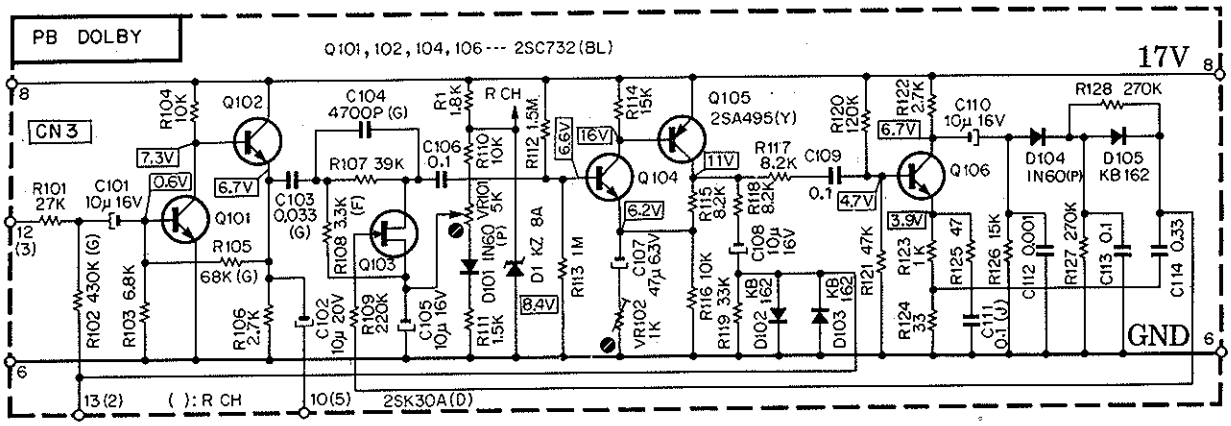


Fig.4 Playback Dolby Processor Circuit Diagram

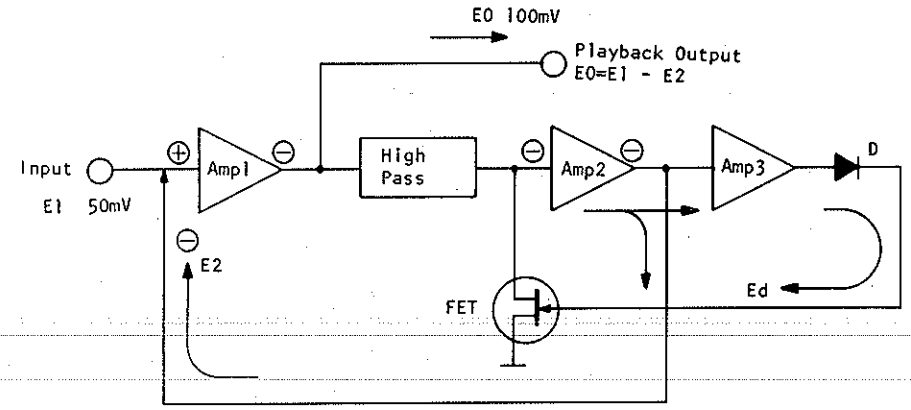
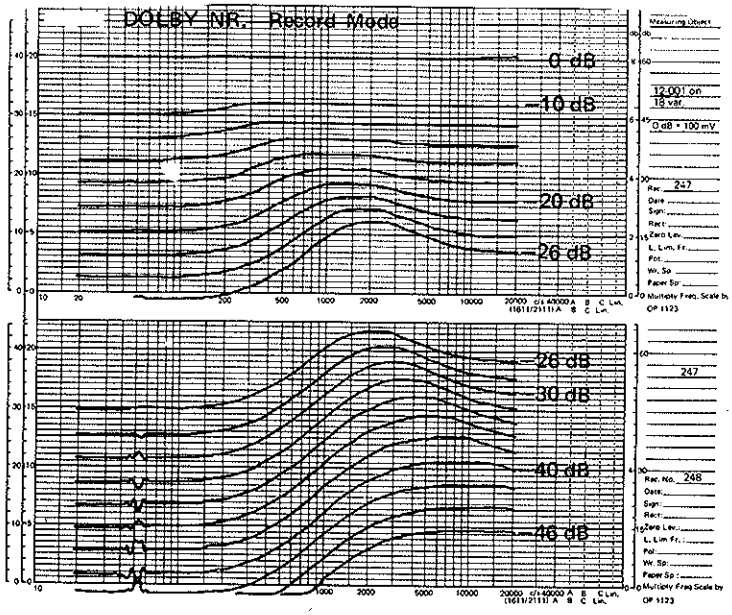


Fig.5 Playback Dolby Processor System Diagram



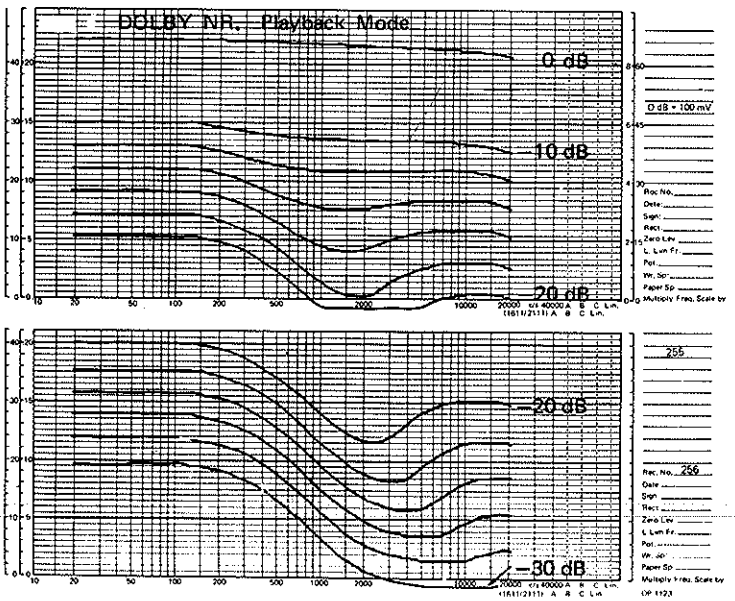


Fig.6 Dolby Processor Frequency Response

3. DNL CIRCUIT

Fig.7 shows the circuit for the dynamic noise limiter (DNL). Its system diagram is shown in Fig.8. Input terminal 14(1) can be connected with the output of the mixing amplifier or that of the playback mode Dolby processor by the selection of MONITOR switch. Terminal 11(4) is a by-pass output which is independent of the dynamic noise limiter and becomes the input for METER AMP. The output of dynamic noise limiter 10(5), and the other output independent of it, 12(3) are applied to the DNL switch. A signal selected by this switch becomes the input to LINE AMP. In this system, noise reduction is performed only in the playback mode.

The input signal is amplified by amplifier 1 (Q101, 102) and is branched into two paths at Q103; in branch [I], the signal is divided by the collector and emitter of Q103 and its high and low-frequency components appear at the output terminal as voltage V1 after passing through C105 and R113, respectively. Meanwhile, in branch [II] the signal enters amplifier 2(Q105 and Q106) via the high-pass filter composed of C107 and R116. The attenuator formed by diodes D103 to D106 and other components is controlled by the output signal level and signal frequency. The output voltage of this attenuator, V2, is synthesized with the output voltage of branch [I], V1. In other words, frequency components of the signal within a band centering around 10 kHz are filtered out for playback levels at or above about −45 dB.

Fig.9 shows the typical characteristics, and Fig.10 is the frequency analysis data for the noise component by a 1/3 octave filter which shows results for three cases; (1) without noise reduction, (2) with only the Dolby noise reduction system, and (3) with the Dolby noise reduction system plus the dynamic noise limiter.

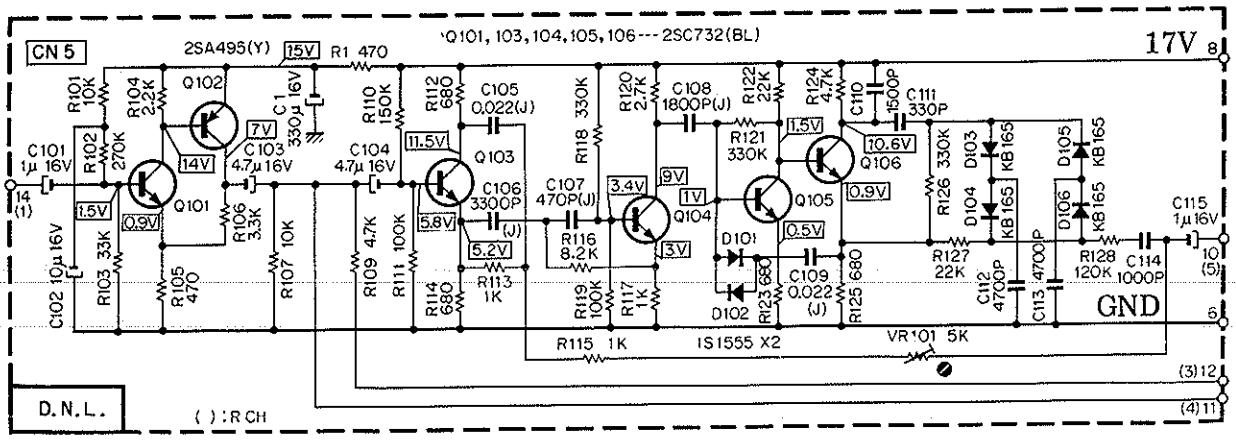


Fig.7 Dynamic Noise Limiter Circuit Diagram

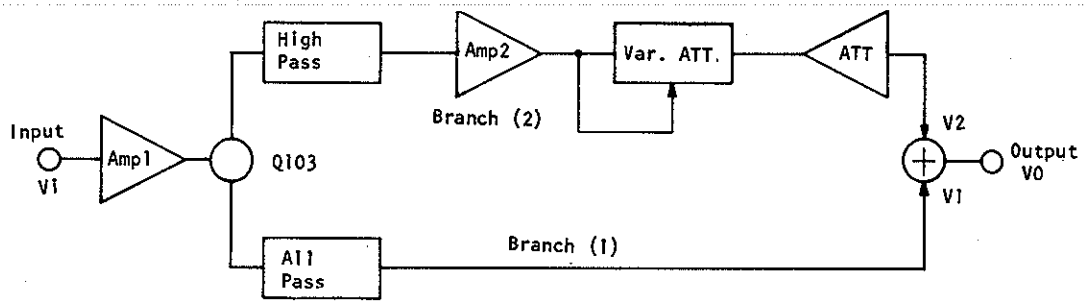


Fig.8 Dynamic Noise Limiter System Diagram

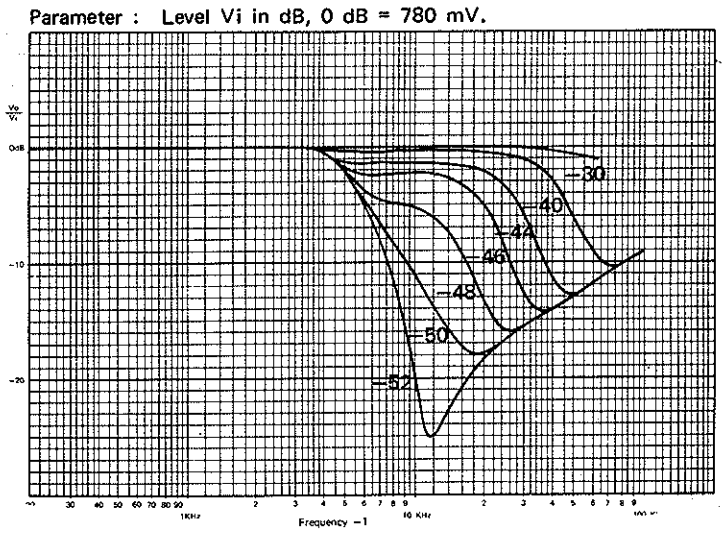


Fig.9 Dynamic Noise Limiter Steady-State Characteristics

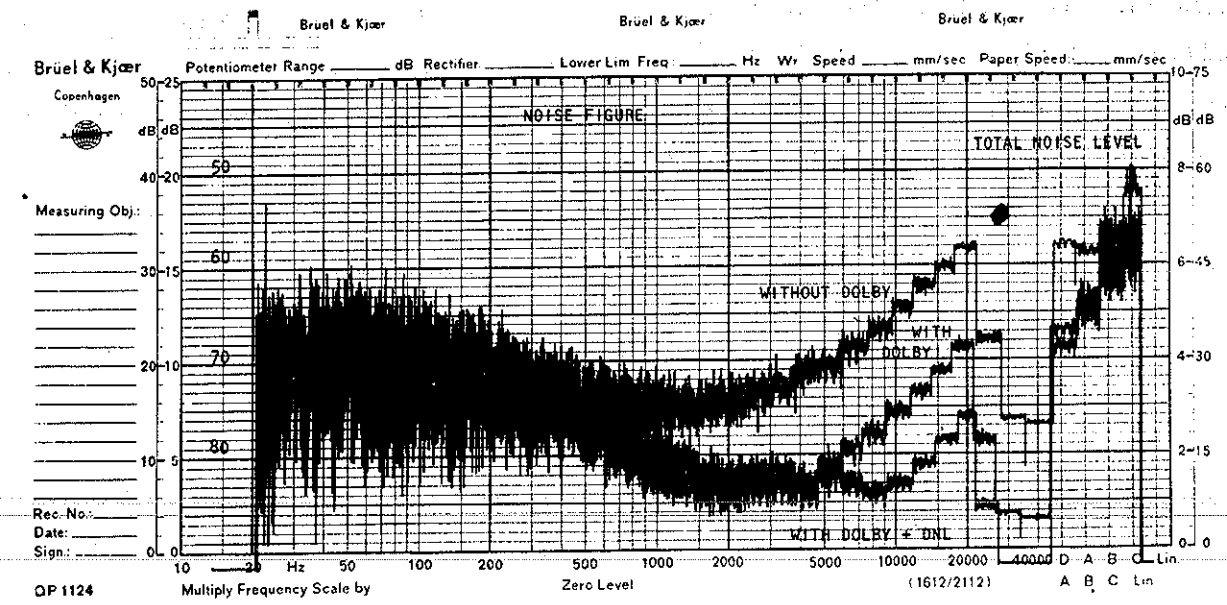


Fig.10 Noise Figure

4. P.B. HEAD AMP.

Fig.11 shows the playback amplifier circuit, and Fig.12 is its system diagram. The playback head is connected with terminals 13(11) and 14(12). Terminal 4 is provided for the mute signal. Terminals 8(6) and 9(7) are connected with the TAPE switch which is used to select a time constant according to the characteristics of the magnetic tape used.

Amplifier 1 (Q101 and Q102) is an equalizer amplifier. With the selection of the equalizer constants of its feedback circuit by means of a jumper wire, its time constant on the high frequency side can be varied in 10 μs steps from 110 μs to 140 μ and its gain in 1 dB steps. This selection is provided for compensation of playback head characteristics, however, the time constant of 120 μs is usually selected by short-circuiting R_{110} (18 kΩ) and opening R_{111} (39 kΩ).

Time constants of the time constant circuit are selected by NORMAL and CrO_2 positions of the TAPE switch so that the frequency characteristics of the circuit will fit those of the magnetic recording tape used as follows:

NORMAL ..... 1590 μs (100 Hz) + 120 μs (1326 Hz)

CrO_2 ..... 3180 μs (50 Hz) + 70 μs (2275 Hz)

The FET (Q103) acts to prevent transference of the amplifier 1 output signal to amplifier 2 (Q104 and Q105) by reducing its gate voltage below the pinch-off voltage for the mute signal. The playback amplifier gain is adjusted by VR101 in amplifier 2 so that, when the 400 Hz 20 mM/mm recorded tape is played back the output voltage of the playback mode Dolby processor at terminal 10(5) becomes 100 mV and that of the playback head amplifier at terminal 3(2) about 50 mV.

The L and C in the amplifier 2 output provide a filter for bias-trapping which prevents disturbance of the Dolby action due to mixing bias frequencies in the Dolby processor.

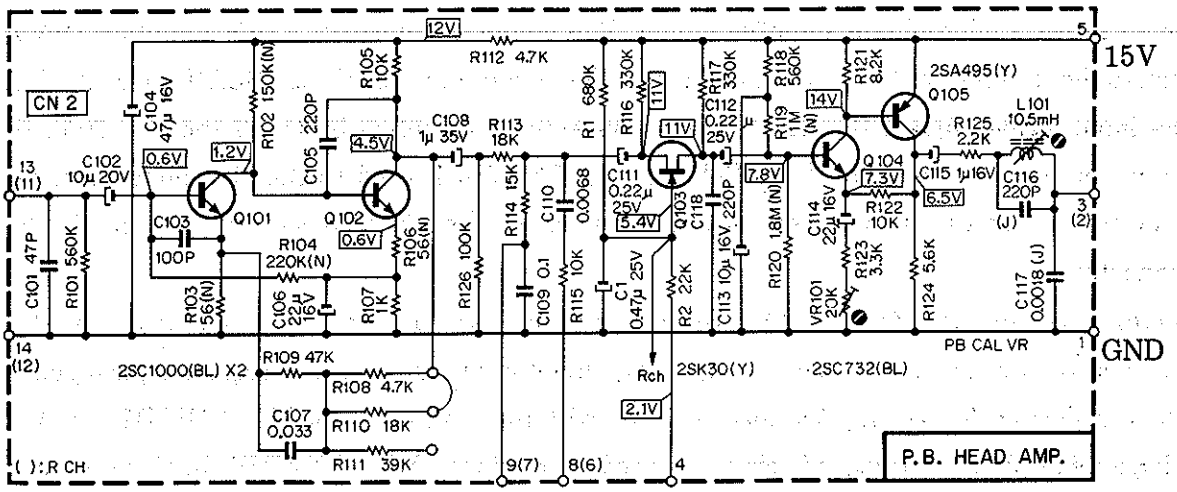


Fig.11 Playback Amp. Circuit Diagram

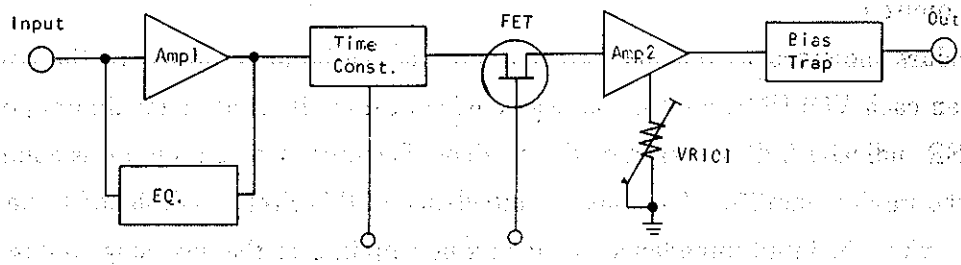


Fig.12 Playback Amp. System Diagram

5. MIC AMP. BOARD

Fig.13 shows a microphone amplifier circuit. This circuit board carries a DIN amplifier (DIN AMP), a microphone amplifier (MIC AMP) and a blending microphone amplifier (BLEND MIC AMP).

The input signal applied through the DIN connector is amplified by Q103 and that from the pin connector reaches the LINE VOLUME directly. The signal is fed to the pin connector if no DIN connector is plugged in, but becomes independent of the pin connector by plugging in the DIN connector.

Microphone amplifier (MIC AMP): Since the signal level of this imput is usually low, Q102 is provided to broaden the dynamic range. This circuit is a modified shunt regulated push-pull system which is devised for varying the load of Q101 with the position of the MIC VOLUME control. For a large microphone output, this circuit is used at a reduced MIC VOLUME. In this case, however, the voltage gain of Q101 decreases because the load resistance of Q101 is reduced. Since voltage gain of the conventional microphone amplifier is constant, its amplification characteristics are not good for large input signals and its dynamic margin is about 40 dB. However, the microphone amplifier described here can be used without distortion for input voltages up to 0.5V because of its broad dynamic margin which is greater than 60 dB. Thus, no microphone attenuator is necessary. If neither a DIN microphone nor a microphone plug are connected, the output of this circuit is grounded.

As the blending microphone circuit (BLEND MIC) is the same as the microphone amplifier, its explanation is omitted.

The voltage values indicated as 0.5 mV, 10 mV, etc., at the input terminals of the circuit board show that when each VOLUME control on the panel concerned is set at its maximum position, the LEVEL METER indicates 0 dB for each of these values. The output of this circuit is combined with the input of the mixing amplifier. The output impedance of this circuit is designed to be very high, above 270 kΩ, while the input impedance of the mixing amplifier of the next stage is designed to be low, therefore, with little interference between the VOLUME controls, ideal mixing is possible.

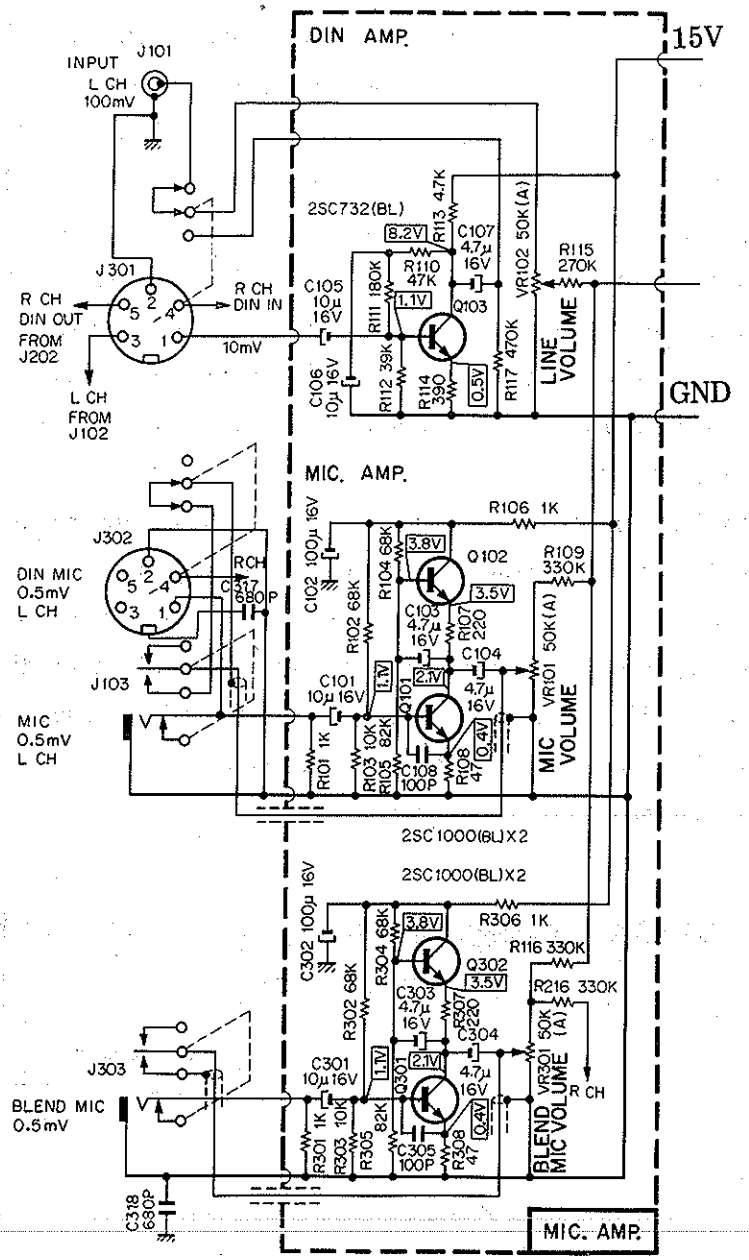


Fig.13 MIC Amp. Circuit Diagram

6. MIXING AMP. & LIMITER

Fig.14 shows the circuits of a mixing amplifier (Q101, Q102), a multiplex filter (MPX FILTER), and a limiter (Q103 and Q104).

The output signal from the microphone amplifier board is amplified by Q101, and fed to the LC filter through an impedance conversion circuit which includes Q102. This filter normally operates the Dolby NR by removing the leakage of the bias signals for recording and the FM broadcast multicarrier signals. L102 is adjusted to minimize the 19 kHz signal level for MPX switch IN. The output of this circuit, 100 mV, becomes the input of the recording mode Dolby processor.

The input of the LIMITER circuit is linked with the output of amplifier 1 (Q101) of the recording mode Dolby processor. This signal is amplified by Q103, and enters the gate of the FET (Q104) after being rectified by diodes D101 and D102. When the LIMITER switch is set to OFF, Q104 is in the off-state and no limiter action is applied for the input of Q101, since condenser C_{113} is grounded. By setting the switch to ON condenser C_{113} becomes charged and Q_{104} is in ON state. This results in the operation of the limiter.

When unexpectedly large peaks of transient noise enter during recording at a marginal level, the peak limiter promptly operates to control recording amplifier gain.

When signals with levels higher than +3 dB enter, part of the signal in excess of +3 dB is compressed to one-seventh its magnitude, as shown in Fig. 15. Therefore, over-recording is avoided even if an input signal as large as +20 dB enters. Since the attack time and the release time of this limiter are 1 ms and 2 sec, respectively, no hearing imbalance is detected.

Fig.15 shows the characteristics of the limiter.

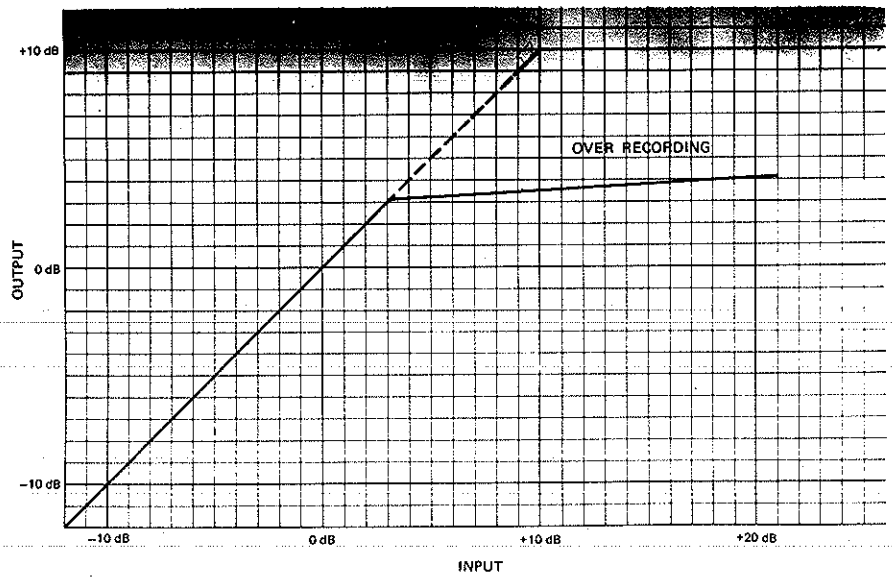


Fig.15 Limiter Characteristics

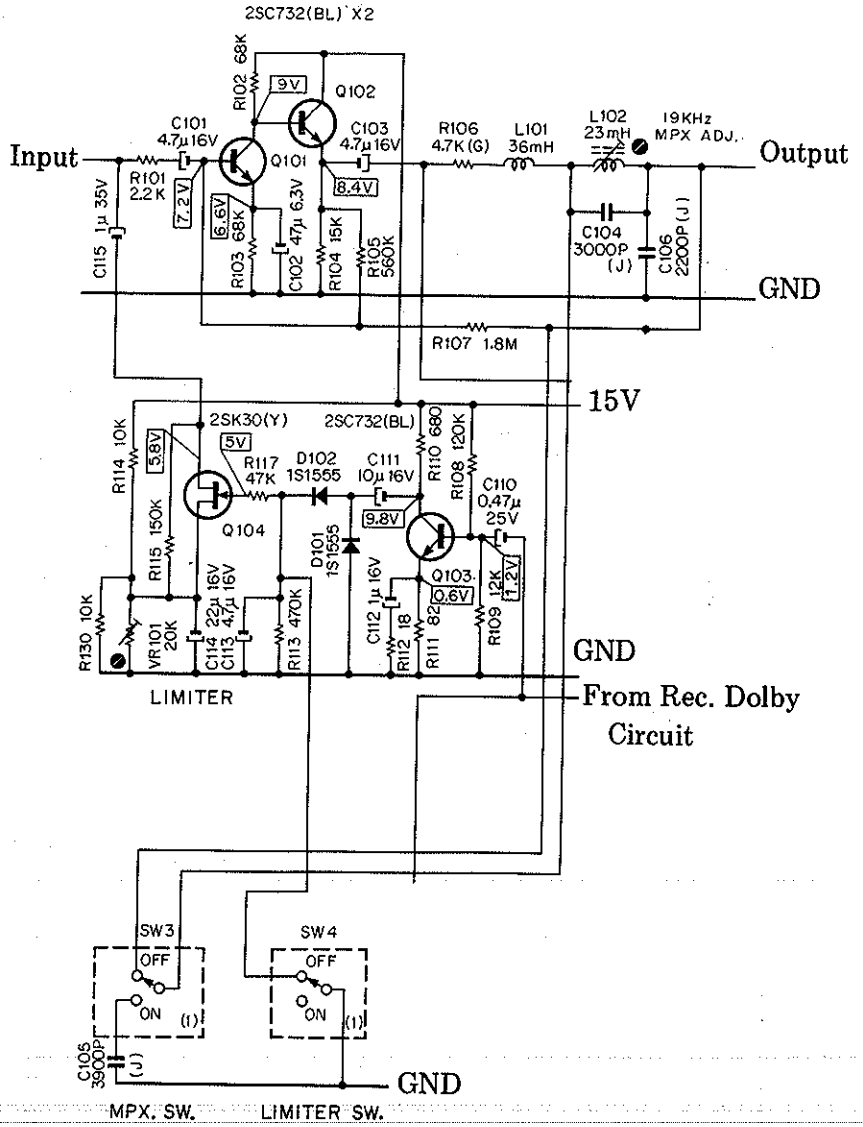


Fig.14 Mixing Amp. & Limiter Circuit Diagram

7. REC. EQ. AMP.

Fig.16 shows the recording calibrator variable resister circuit (REC. CAL. VR) and the recording equalizer amplifier circuit (REC. EQ. AMP.).

This signal from the output of the recording mode Dolby processor becomes the input of this RECORDING CALIBRATOR circuit. The recording head (REC. HEAD) is connected between the output terminal of this circuit and the ground. (A 10 Ω resister is inserted in series on the ground side.)

The VR 103 line is prepared for NORMAL tape and that of VR 104 for CrO_2 tape. The time constant is selected by changeover of this TAPE switch. This selection, coupled with the time constant selection in the Playback Head Amplifier (P.B. HEAD AMP.), makes it possible to obtain characteristics suitable for tape types. With respect to the details of this part, the reader should refer to the section on the playback head amplifier.

Since the FET (Q101) is in the OFF state for mute, the signal is cut here and no signal exists in the equalizer amplifier circuit. Without the mute signal, Q_{101} is in the ON state. Thus, the signal from the RECORDING CALIBRATOR is amplified by Q_{102} and enters Q_{103}. A constant DC current flows in Q_{103} by way of Q_{104} and raises the output impedance, therefore, a constant current flows through the RECORDING HEAD over all frequencies used. L_{104} and C_{105} compose the recording equalizer. Compensation for the high frequency range is made by building a resonance frequency at about 23 kHz by means of adjusting L_{104}. L_{105} and C_{120} construct a bias trap.

Fig.17 and 18 show the frequency characteristics for recording and playback.

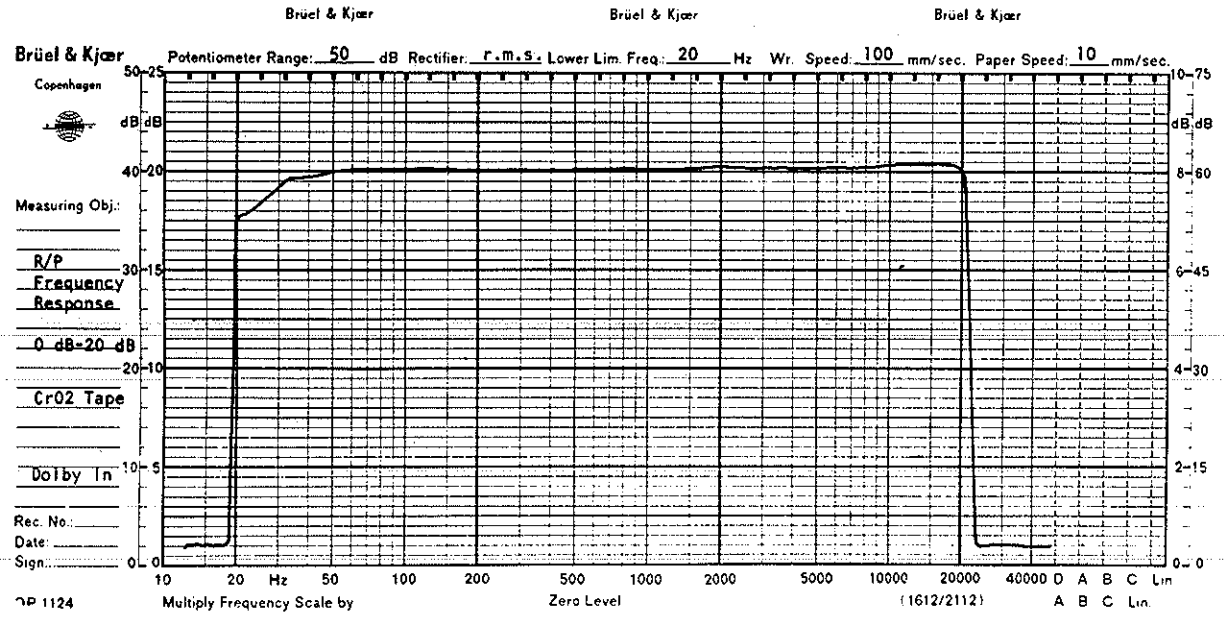


Fig.17 Record/Playback Frequency Response (Dolby NR In)

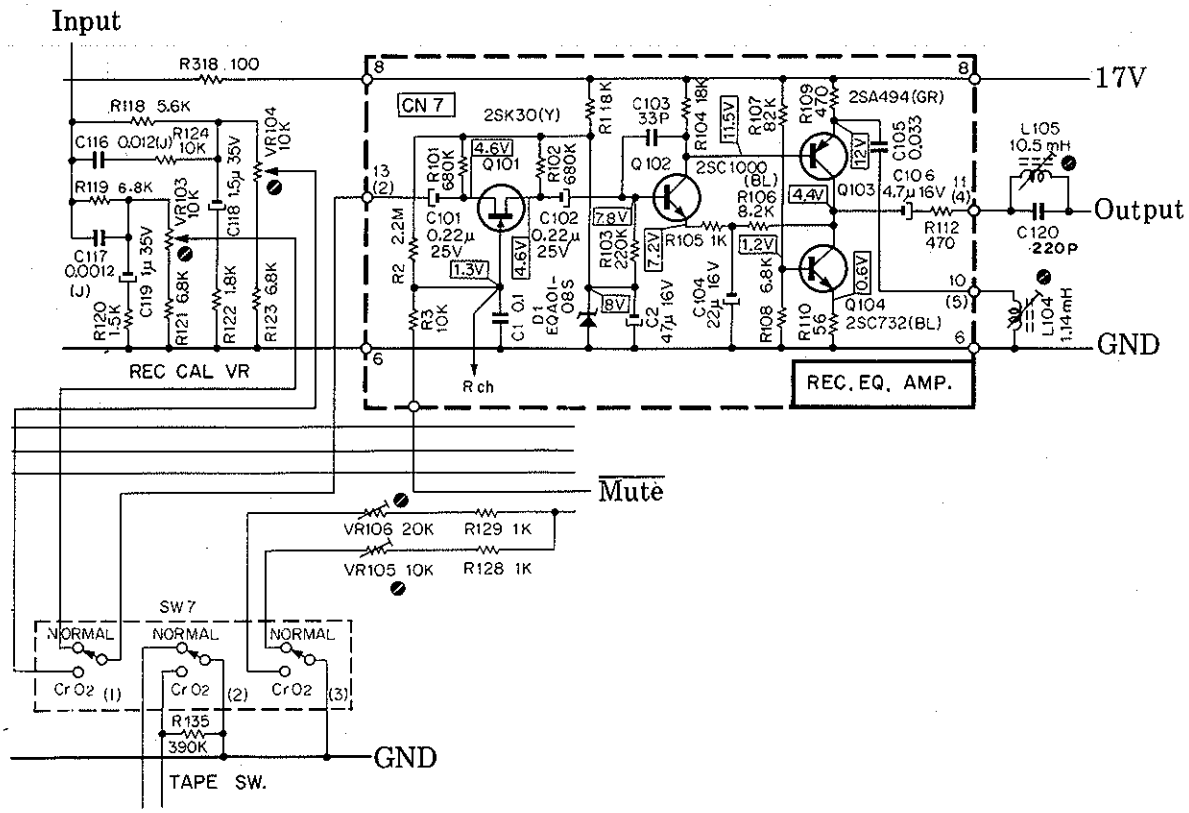


Fig.16 Rec. EQ. Amp. Circuit Diagram

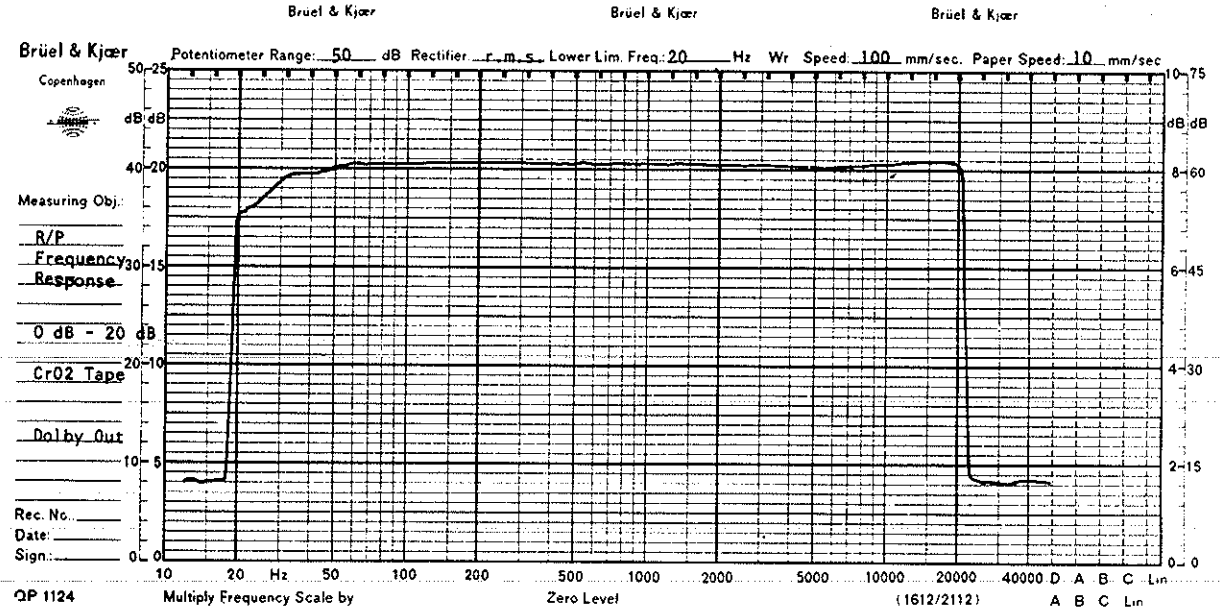


Fig.18 Record/Playback Frequency Response (Dolby NR Out)

8. BIAS OSC. & 400 Hz OSC

Fig.19 shows a push-pull oscillator with an oscillation frequency of 105 kHz which is constructed by condensers C306 and C307 decoupling the collectors and bases of two transistors.
This is used to provide recording bias and as an erase signal.
By depressing the REC. button, the Rec. signal turns to high through the logic board, Q307 is put in the ON state, the bias oscillator p wer supply is activated, and oscillation begins. When the record mode is released, oscillator output is damped by the discharge of C308. This prevents magnetization of the head.
Fig.20 shows a 400 Hz oscillator circuit using an LC circuit. Its signal output is used to check record and playback levels and as an alignment beacon. VR301 is used for adjusting oscillation amplitude and VR302 for matching R and L channel levels.

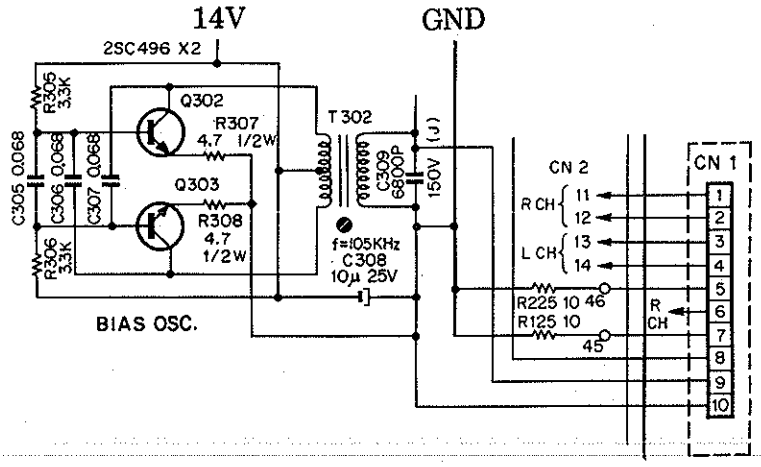


Fig.19 Bias Osc. Circuit Diagram

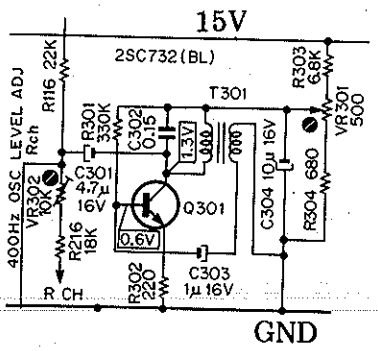


Fig.20 400Hz Osc. Circuit Diagram

9. LINE AMP. P.C.B.

Fig.21 shows the level meter amplifier circuit and the line output amplifier.

Terminal 14(1) is the input of the level meter amplifier through which signals enter from terminal 11(4) of the DNL circuit board. This input signal is not influenced by the dynamic noise limiter regardless of the position of the DNL switch. Terminal 12(3) is the output. The level meter is connected between this terminal and ground.

Q105 and Q106 form a directly coupled feedback amplifier and for a low input level, feedback occurs through R115. For high input levels which exceed the Zener voltage of diode D101, feedback magnitude increases by adding a feedback through R116 to that through R115, and the output gain decreases. That is, high input signals are subjected to compression during amplification. This circuit is so designed that its attack time is 20 μs and its release time is 70 ms, thus, even if sharp peaks such as those encountered in live music exist, the level meter indicates correct peak values.

The input of the line output amplifier is connected to the DNL switch and its level is controlled by the OUTPUT VOLUME control. The signal amplified by Q101 and Q102 is fed to a push-pull circuit composed of Q103 and Q104, and a maximum output of 1100 mV is obtained from line terminal 10(4).

Since the output impedance is about 600 Ω, long cords are available for connection and no deterioration of characteristics occur due to multiple connections to recorders, etc.

Output terminal 11(5) is designed for a head phone with an 8 Ω impedance.

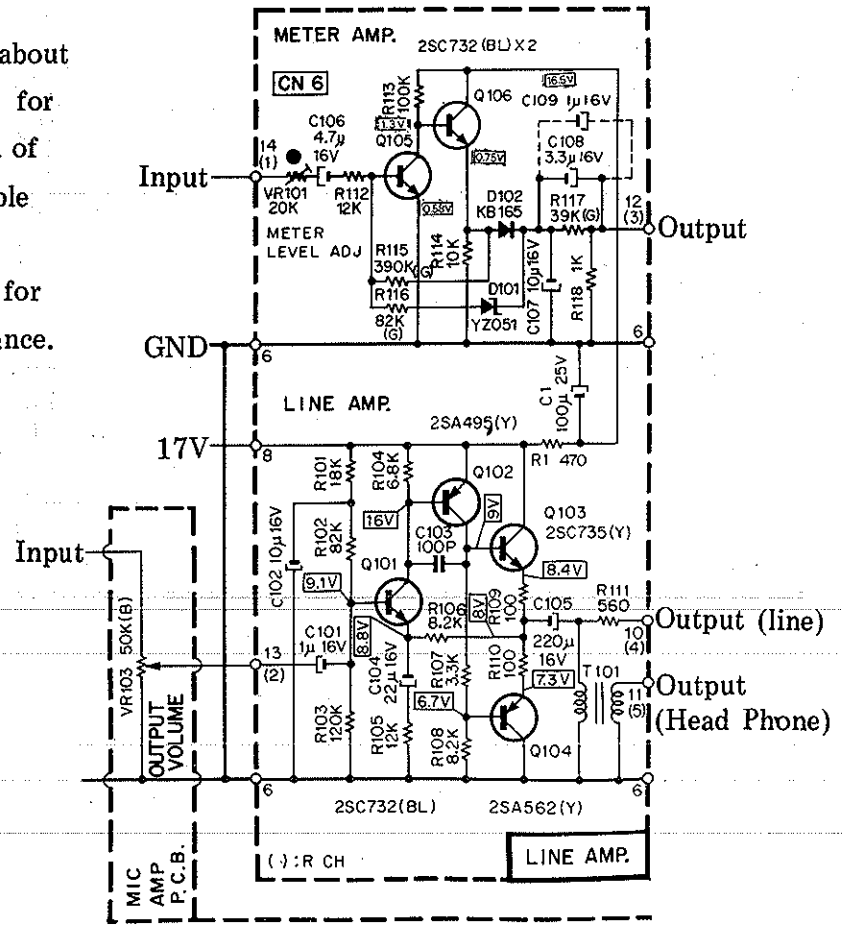


Fig.21 Meter & Line Amp. P.C.B. Circuit Diagram

10. POWER SUPPLY

Fig.22 shows the power supply circuit. This power supply is designed so that a constant voltage is obtained at the output on the secondary side of transformer [T_1]for 100—117V/220—240V AC inputs by changing the VOLTAGE SELECTOR plug.

The 18V DC, 0.5A output is used as a power supply for the amplifier system, and the 12V DC, 1.5A output for the mechanism control. The 6V AC, 0.3A output is the power supply for illuminating the level meter.

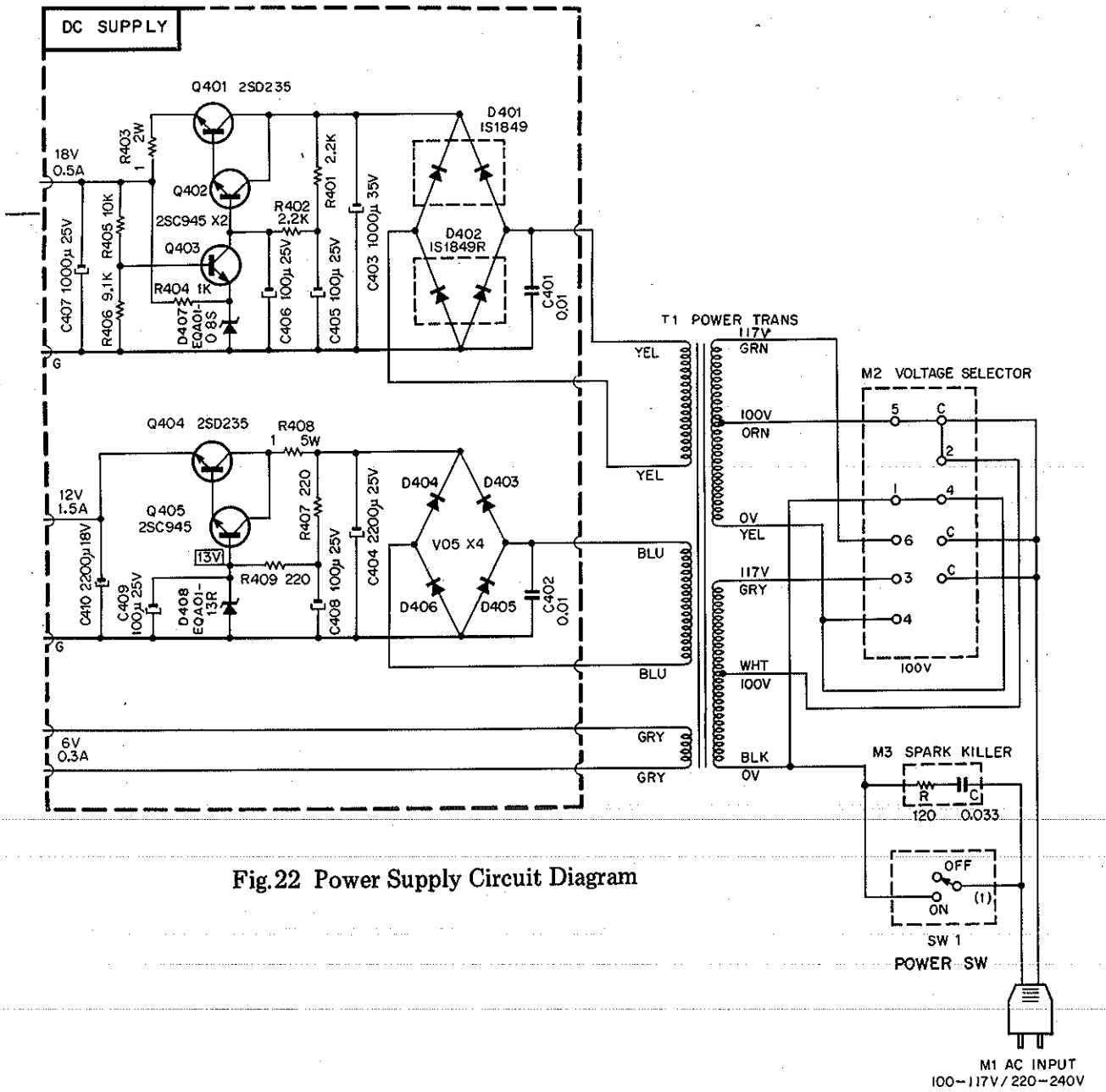


Fig.22 Power Supply Circuit Diagram

EXPLANATION FOR MECHANISM CONTROL CIRCUITS

Index:

The Mechanism Control Circuits consist of a logic control, shut-off control, azimuth alignment detector and motor governor. Refer to the Fig.1 "Mechanism Control Overall Block Diagram".

1. LOGIC CONTROL

1.1. General

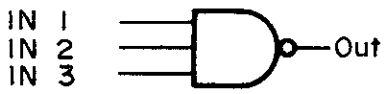
The commands from front panel control buttons are communicated to the logic control circuits. Logic outputs are connected to the delay circuits and drivers for control of mechanisms.
Logic circuits consist of TTL ICs the details of which are as follows:

a. Main characteristics of TTL IC

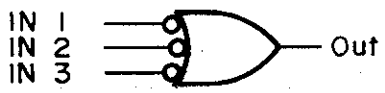
Supply voltage	5V
Logical L output voltage	less than 0.5V
Logical H output voltage	3V to 4V
Noise immunity	1V
Temperature range	0° to 70°C

b. Gate Logic

The inputs are IN1, IN2 and IN3, and the output from the gate is shown below:
The output will be a L only if IN1 and IN2 and IN3 are all H's, and the output will be a H if IN1 is a L or IN2 is a L or IN3 is a L.



$\text{Out} = \overline{IN1 \cdot IN2 \cdot IN3}$



$\text{Out} = \overline{IN1} + \overline{IN2} + \overline{IN3}$

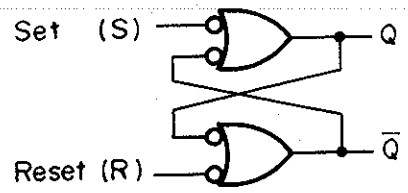
Truth Table

IN 1	IN 2	IN 3	Out
L	L	L	H
H	L	L	H
L	H	L	H
H	H	L	H
L	L	H	H
H	L	H	H
L	H	H	H
H	H	H	L

$\text{Out} = \overline{IN1 \cdot IN2 \cdot IN3} = \overline{IN1} + \overline{IN2} + \overline{IN3}$

The construction of the foregoing 2 Logic Symbols is identical and intended to show the use of either AND or OR.

c. Gated Flip-Flop



The two NAND gates can be used to form flip-flop.

The inputs operate as follows:

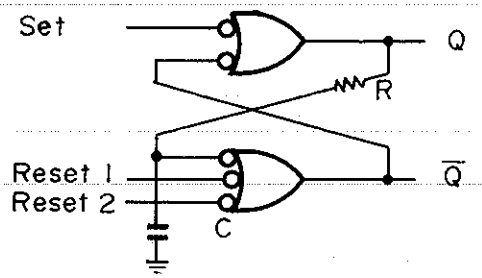
When both S and R are H's, the flip-flop will remain in its present state, i.e., will not change states. If however, the R input goes to a L, the NAND gate connected to R will have a H output regardless of the other feedback input to the NAND gate, and this will force the flip-flop to the L state (provided the S input is kept H). Similar reasoning shows that making the S input a L will cause the NAND gate at the S input to have a L output, forcing the flip-flop to the H state (again provided the R input is kept H).

If both inputs R and S are made L's, the next state will depend on which input is returned to H first, and if both are returned to H simultaneously, the resulting state of the flip-flop will be indeterminate. As a result, this is a "forbidden", or "restricted", input combination.

Truth Table

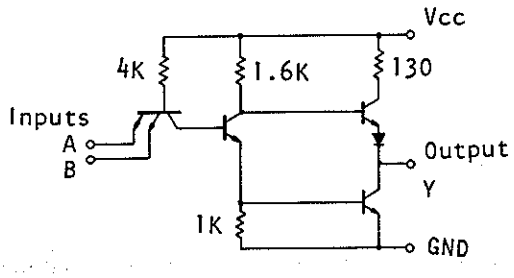
Set	Reset	Q	Q	Remarks
L	L	H	H	*) To maintain the previous state, but indefinite if both of the previous inputs S and R are made L's.
H	L	L	H	
L	H	H	L	
H	H	*	*	

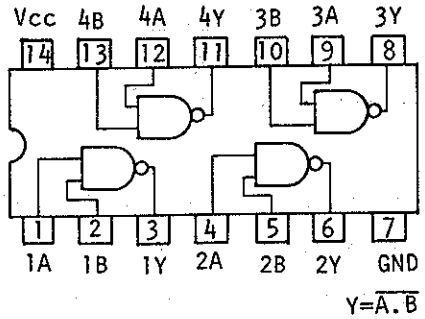
In the actual use, the activation speed of the Flip-Flop is managed to be delayed in order to prevent erroneous movements caused by noise with details being as follows:



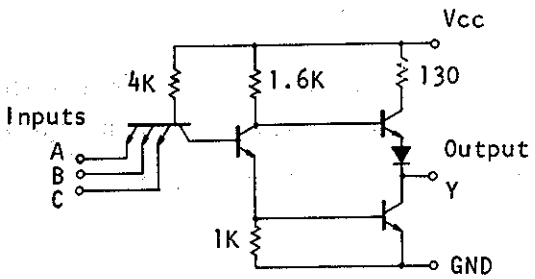
d. Schematics and Block Diagrams

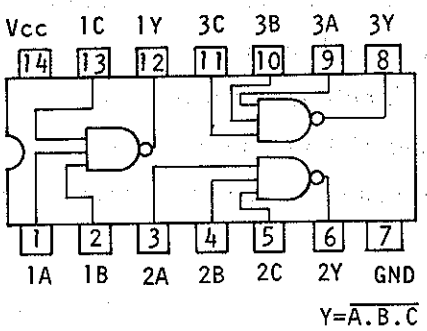
SN7400N (Quadruple 2-input positive NAND GATE)



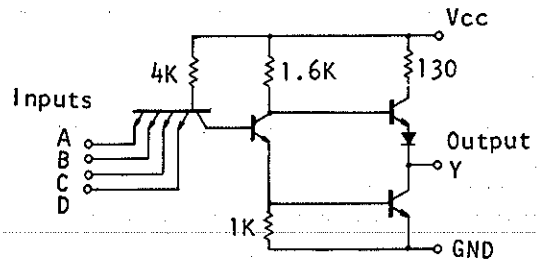


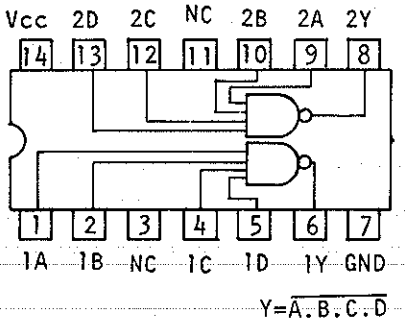
SN7410N (Triple 3-input positive NAND GATE)





SN7420N (Dual 4-input positive NAND GATE)





e. Compatible ICs

The following ICs belong to the same group which can be replaced:

L601, L603, L605: N7400A, SN7400N, M53200P, HD2503, TD3400P
L602, L606 : N7410A, SN7410N, M53210P, HD2507, TD3410P
L604 : N7420A, SN7420N, M53220P, HD2504, TD3420P

1.2 Logic Control

A foolproof operation will be done by logic control.

For example, when command the playback mode while fast winding or command fast-forward mode while rewinding, it is guaranteed that no abnormal tape tention will happen by passing through the stop mode. This is also guaranteed even when the buttons are pushed simultaneously.

a. Logic Signal

How to read the signals is referred to the following:

The signal H shows the condition that the signal is executing, and in case there is a — on the signal, signal L shows the condition that the signal is executing.

$\overline{\text{K stop}}$ (control stop button signal)

$\overline{\text{K stop}}$ becomes L when the stop button is depressed, and $\overline{\text{K stop}}$ is H while button is open.

$\overline{\text{PLY}}$ (Play flip-flop $\overline{\text{Q}}$ output signal)

$\overline{\text{PLY}}$ = L shows at play mode, and H shows out of play mode.

PLY (Play flip-flop Q output signal)

PLY = H shows at play mode, and L shows out of play mode.

$\overline{\text{HB}} = \overline{\text{PLY} \cdot \overline{\text{Fst DL}} \cdot \overline{\text{PAU}}}$

$\overline{\text{HB}}$ = L drive the head base plunger.

$\overline{\text{HB}}$ signal becomes L when PLY = H AND Fst DL = L AND PAU = L.

b. Logic Operating Status

Refer to the figure 2 (Logic Status). Each stage of logic status is shown for the sequential control button command.

c. +5V Power Supply for ICs

+5V DC power supply is made by regulated +12V DC from the Power Supply Unit. The transistor Q610 acts as a regulator, being controlled by zener diode ZD601.

d. Initial Reset

At power switch On, +12V DC comes up gradually then the transistor Q609 and Q608 turn to On for only a certain period while Q609 base voltage is low with respect to the emitter (+5V).

And $\overline{\text{K stop}}$ = L pulse is generated.

At power switch Off, +12V discharges gradually, and $\overline{\text{K Stop}}$=L pulse is also generated. $\overline{\text{K stop}}$=L pulse clears each flip-flops and keeps at the initial condition, stop mode.

e. Stop Mode

The stop button when depressed makes $\overline{\text{K stop}}$=L and resets each of the flip-flop. $\overline{\text{K stop}}$=L pulse is generated when shut-off is detected and opens the cassette well and lowers +12V by 70%.

f. Play Mode (Playback or Record Mode)

The play button when depressed makes $\overline{\text{K play}}$=L and sets the PLY Flip-Flop, (PLY=H,L605-8), and head base plunger will be activated.

g. Record Mode

REC Flip-Flop (REC,L603-6) will be set to H when record button ($\overline{\text{K rec}}$=L) and play button ($\overline{\text{K play}}$=L) are depressed simultaneously, or record button and pause button ($\overline{\text{K pau}}$=L) are depressed and then play button is depressed.

REC=H commands the bias oscillation of Amp.

Note: To close record protect switch is required.

h. Pause Mode

While recording or playback, the pause button when depressed sets the PAU Flip-Flop, PAU=H(L603-8).

Then $\overline{\text{HB}}$ signal turns to H and head base plunger will be released.

i. Fast Wind Mode

The rewind ($\overline{\text{K rew}}$=L) or fast forward button ($\overline{\text{K ff}}$=L) when depressed sets the FST Flip-Flop.

While the $\overline{\text{REW}}$ / $\overline{\text{FF}}$ Flip-Flop is set to $\overline{\text{REW}}$=L(L606-12) or $\overline{\text{FF}}$=L(L606-8), $\overline{\text{REW}}$ or $\overline{\text{FF}}$=L will drive the REW or FF Relay, and Reel Motor will turn backward or forward.

j. Mute Signal

$\overline{\text{HB}}$=L or $\overline{\text{PAU}}$=L makes Mute signal (L601-3) to H and will release the mute of the Amp.

(The mute of record Amp is released only at record mode, and playback Amp are released at record and playback modes).

k. Memory Stop

While memory switch is On and rewinding, stops tape travel when the tape counter comes to "999". At counter "999", L606-12 ($\overline{\text{REW}}$=L) and capacitor C624 are connected, therefore the differentiated pulse is generated at L604-10.

This pulse resets Fst Flip-Flop turning to $\overline{\text{REW}}$=H, and stops rewinding.

l. Auto Rewind (Nakamichi 1000 only)

While auto-rewind switch is On and in record or playback mode, $\overline{\text{K rew}}$=L pulse is generated by transistor Q627 On when the tape comes to an end, then rewinding begins to start.

The reasons why shut-off signal does not generate at a tape end are as follow:

When tape comes to an end, shut-off condition will be detected, and transistor Q607 turns to On.

As a result, base current flows in the Q627 and turns On, while the base voltage of the Q608 is less than that of the Q627 by deviding resistors R627 and R626, therefore Q608 cannot turn On.

And after Q627 turns On completely the Q607 collector voltage falls to the ground through Q627 and Q628.

1.3 Drivers and other Signals

a. Head Base Plunger

While set the PLY Flip-Flop, the head base plunger will be driven by the $\overline{HB}$(L602-12)=L.
However while in pause mode, the $\overline{PAU}$(L602-2)=L will inhibit the $\overline{HB}$=L signal.
The $\overline{Fst\ DL}$ (L602-1) signal will serve to drive the head base plunger after a certain period for stopping Fast Wind, when the play button is set to On during Fast Wind.
In this regard, the resistor (R680 15 ohm) connected to the plunger will be shorted by the Q627 and Q626 on the base switch P.C.B. Ass'y before the drive of head base and limit switch On.

b. Reel Motor

The FF Relay will drive while the $\overline{REW}$ / $\overline{FF}$ Flip-Flop is $\overline{FF}$=L and REW Relay being $\overline{REW}$=L.
One side of the Reel Motor is connected to the REW Relay and the other to the FF Relay, and the Relay is connected while Off the ground and while On +12V.
Rewind = REW Relay ON · FF Relay OFF
F · Fwd = REW Relay OFF · FF Relay ON
Stop = REW Relay OFF · FF Relay OFF

c. Brake plunger

Brake plunger is connected parallel to the Reel Motor.
Brake plunger is released when reel motor runs, and vice versa.

d. Lamps

Play Lamp	— Lights on when head base plunger is set to On.
Record and Pause Lamps	— Light on in the memory state of REC and PAU Flip-Flop respectively.
Rewind Lamp	— Illuminates at Rew Relay On.
F.Fwd Lamp	— Illuminates at F.Fwd Relay On.
Stop Lamp	— Illuminates in the state other than the above.

e. Rec Signal

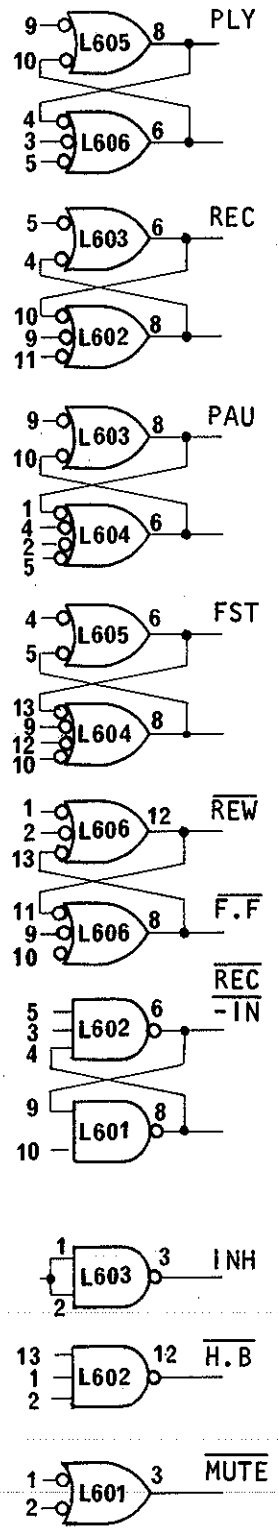
Rec signal connected to the Amp controls On/Off of the bias oscillation. Rec signal H conducts the bias oscillation.
The Rec and $\overline{Rec}$ signals connected to the Pitch Control Volume serve in selecting the speed of the capstan motor for recording and playback.

f. Shut-off Detector Inhibition Signal

Prevents the shut-off signal from entering the Logic while the take-up reel is not turning.

Inhibition signal will be released by $\overline{HB}$ = L or $\overline{FST}$ = L, namely while tape is travelling or in Fast Winding mode.

After $\overline{HB}$ = L or $\overline{FST}$ = L is commanded, it is considered as enough delay time to release shut-off inhibition signal for assurance of the stable start of the take-up reel movement.



MODE	STOP	RECORD				PLAY BACK	FAST WIND	
CONTROL BUTTON	STOP	RECORD	RECORD PAUSE	PLAY	PAUSE	PLAY	F.FWD	REWIND
PLY	L	L	L	H	H	H	L	L
	H	H	H	L	L	L	H	H
REC	L	H	H	H	H	L	L	L
	H	H	L	L	L	H	H	H
PAU	L	L	H	L	H	L	L	L
	H	H	L	H	L	H	H	H
FST	L	L	L	L	L	L	H	H
	H	H	H	H	H	H	L	L
$\overline{\text{REW}}$	H	H	H	H	H	H	H	L
$\overline{\text{F.F}}$	H	H	H	H	H	H	L	H
$\overline{\text{REC}}$ -IN	H	L	H	H	H	H	H	H
	H	H	L	L	L	H	H	H
INH	H	H	H	L	H	L	L	L
$\overline{\text{H.B}}$	H	H	H	L	H	L	H	H
$\overline{\text{MUTE}}$	L	L	L	H	.	H	L	L

Fig.2 Logic Status

2. SHUT-OFF SENSOR AND DETECTOR

Shut-off sensor consists of LED (Light Emitting Diode), photo transistor and slitted disc plate which is rotated by take-up reel.

Through turning disc plate, intermittent LED's lights are generated, while photo transistor is receiving these lights and output sensor signals. A shut-off signal which clears the Logic Flip-Flop will be generated when stop of sensor signals is detected by shut-off detector at a tape end.

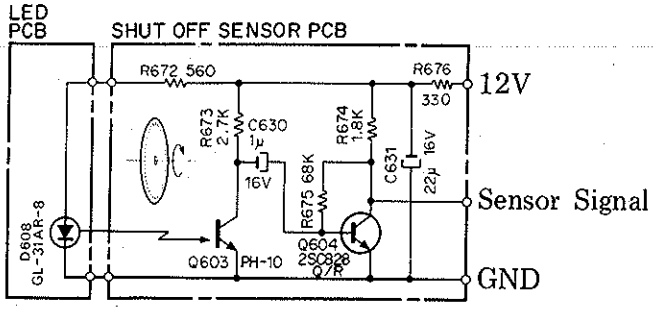
2.1. The capacitor C611(0.12μF) is charged through resistor R622(1.8M ohm). While sensor output signals are differentiated by C610 and differentiated positive pulses set a transistor Q605 to On, then Q605 will discharge quickly.

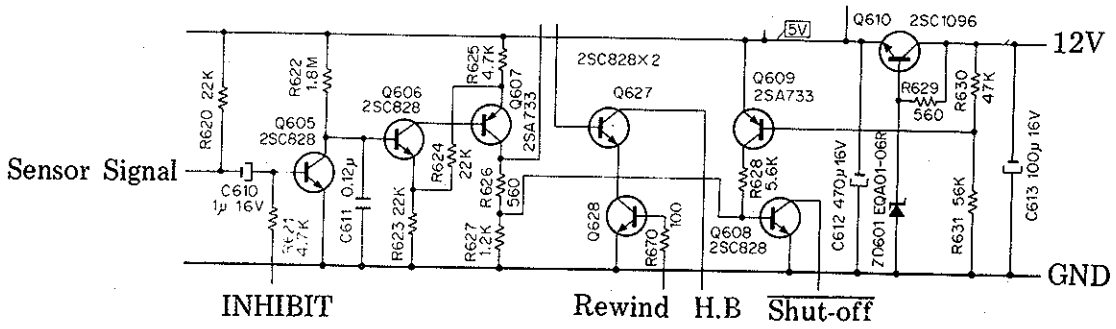
2.2 At a tape end, sensor signal will not generate and C611 will be kept charged. When the voltage of C611 over the Q606 emitter voltage (about 2.3V) Q606 and Q607 turn to On, therefore Q608 turns to On and shut-off signal ($\overline{\text{K stop}}$=L) will be generated.

2.3. Shut-off signal resets PLY and Fst Flip-Flops, therefore INHIBIT signal (INH, L603-3) will be set to H.

A base current of Q605 flows through INHIBIT signal H and Q605 turns to On and discharges the C611.

Therefore Q605, Q606 and Q608 turn to Off and shut-off signal will be released.





Shut-off Sensor and Detector Circuit Diagram

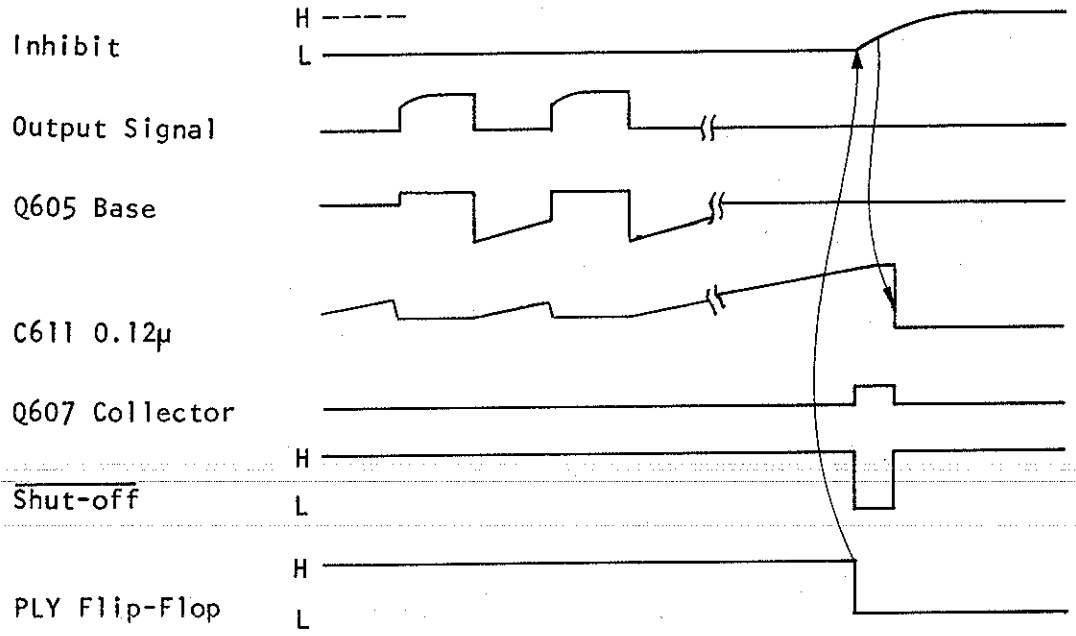


Fig.3 Shut-off Timing Chart

3. AZIMUTH ALIGNMENT DETECTOR

Prior to recording, it is required that the azimuth alignment will be conducted for both sides A/B of a cassette tape to keep the optimum performance, with details being as follows:

Each cassette housing has a distortion for the molded pin locating between record and playback heads, therefore when tape is travelling through the molded pin the travelling of tape is slightly changed by each cassette housing.

And adjustment aims at an accurate azimuth alignment of the record and playback heads through a travelling tape.

Adjustment shall be conducted by turning the azimuth alignment screw while record mode and the adjustment panel test tone switch is On.

When the recorded 400Hz tape is played back, the difference of the phase between right and left channels indicates the difference of playback and record head azimuth.

Therefore when the difference of the phase equals to zero, playback and record head azimuth is aligned then both of the alignment beacon flickers alternately.

3.1. Left and right channel playback signals which are communicated to the operational amplifier terminals 5 and 9 will be amplified to the square waves.

3.2. These square waves are converted to the TTL IC voltage level through transistors Q601 and Q602, and communicated to the L607 TTL IC terminals T and D.

3.3. The outputs of L607 begin to repeat On and Off, and conduct to flicker LEDs alternately when same phase signals are conducted to T and D terminal.

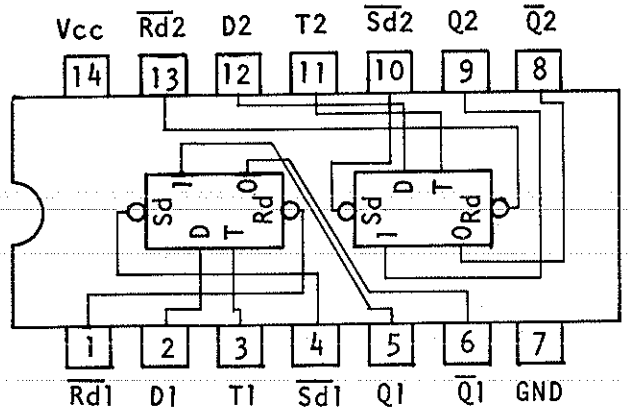
3.4. Function of L607:

At transition of T terminal from L to H, D terminal H conducts output Q to H and $\overline{Q}$ to L and also D terminal L conducts output Q to L and $\overline{Q}$ to H.

3.5. SN7474N (Dual D-Type Edge-triggered Flip-Flop)

tn	tn+1	
Input D	Output Q	Output $\overline{Q}$
L	L	H
H	H	L

tn: Bit time before clock pulse.
tn+1: Bit time after clock pulse.

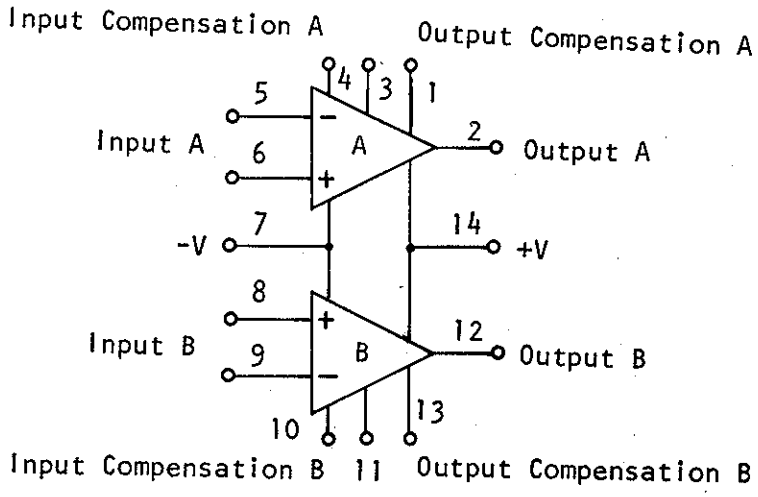


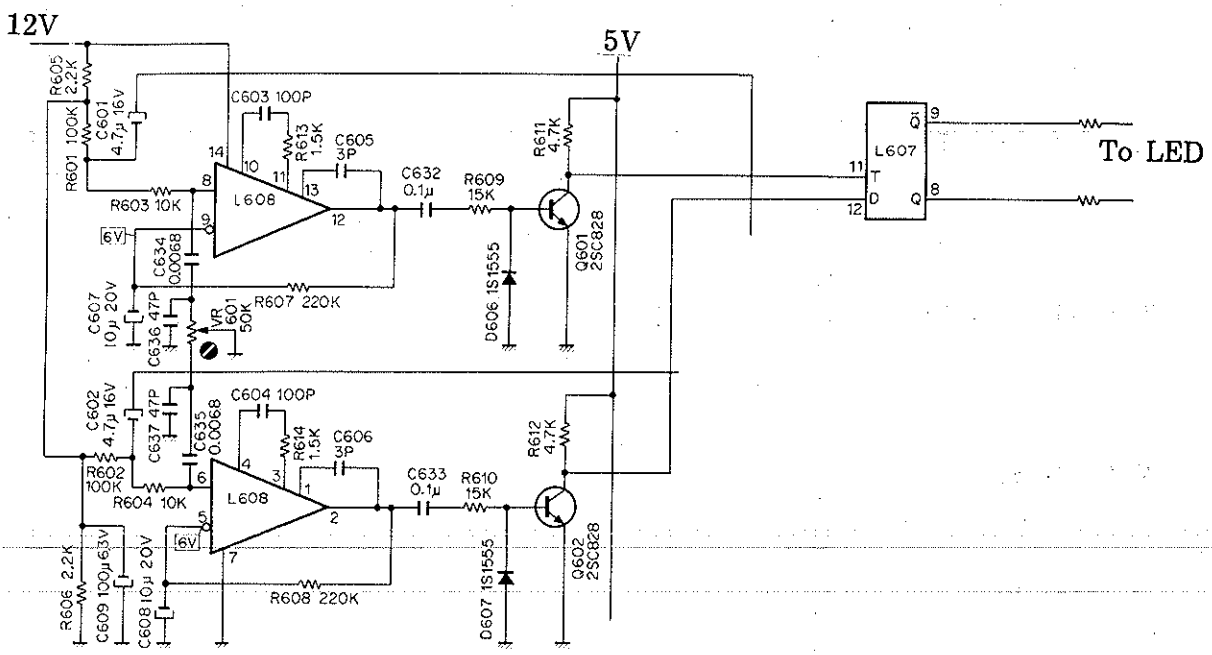
Top View

Compatible ICs

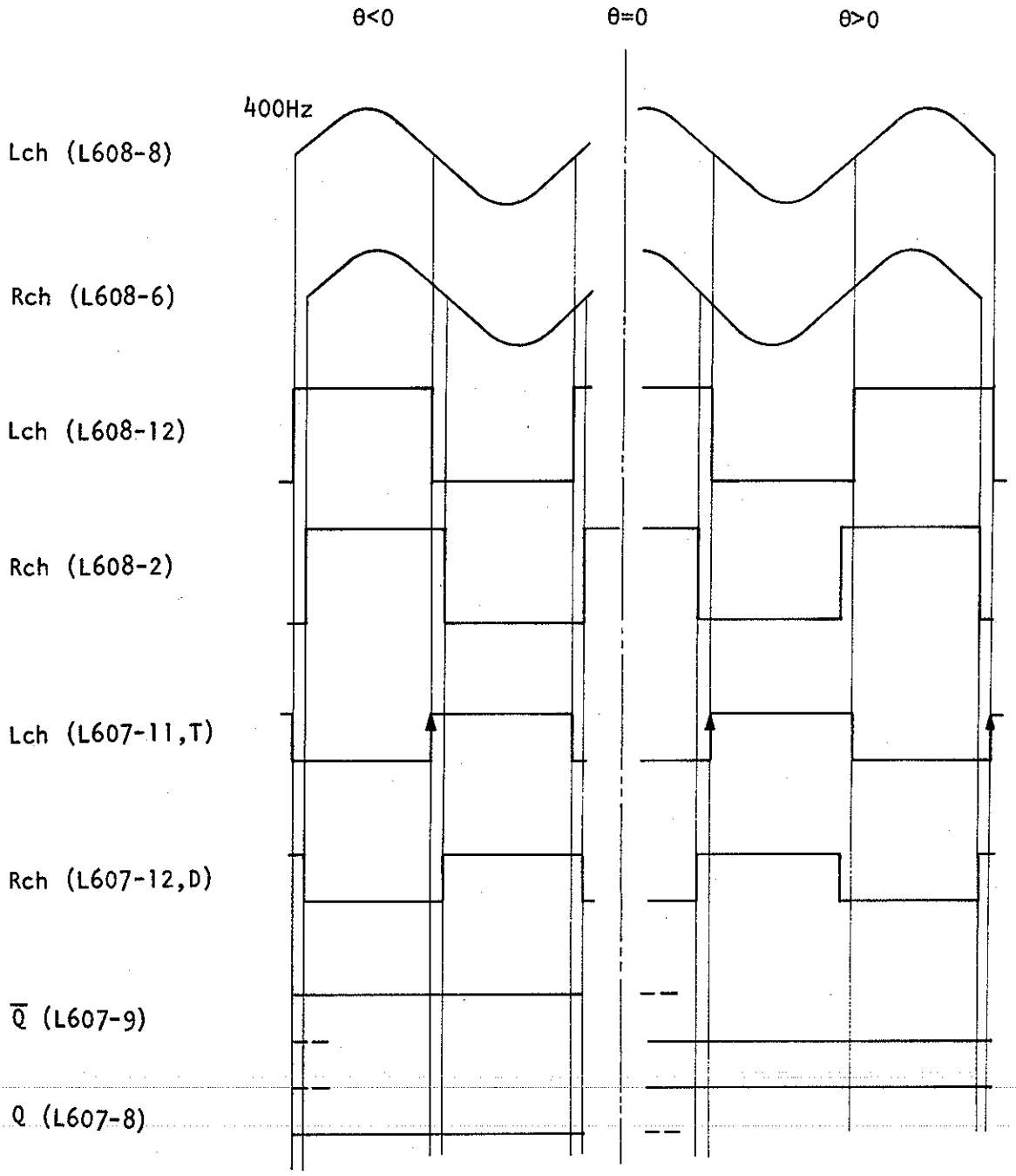
L607: N7474A, SN7474N, M53274P, HD2510, TD3474P

3.6. RC4709 (Dual Operational Amplifier)





Azimuth Alignment Circuit Diagram



Note: θ means a difference of phase between Lch and Rch playback signals.

Fig.4 Azimuth Alignment Detector Timing Chart

4. MOTOR GOVERNOR

Motor governor connects to the Motor Assembly consisting of motor and sensor. Sensor consists of LED (Light Emitting Diode), photo transistor and slitted disc plate which is turned by motor.
When disc plate is turned, intermittent LED's lights are generated, while photo transistor receives these lights and outputs signals to the motor governor.
Sensor generates proportional frequency signals according to the motor speed. Motor governor controls the motor current in order to keep the constant sensor output signal i.e. constant motor speed.

4.1. Sensor output signals are amplified to the square waves by IC 501 1/2.

4.2. Through transistor Q501 differentiated pulses are generated by capacitor C506 (150PF).

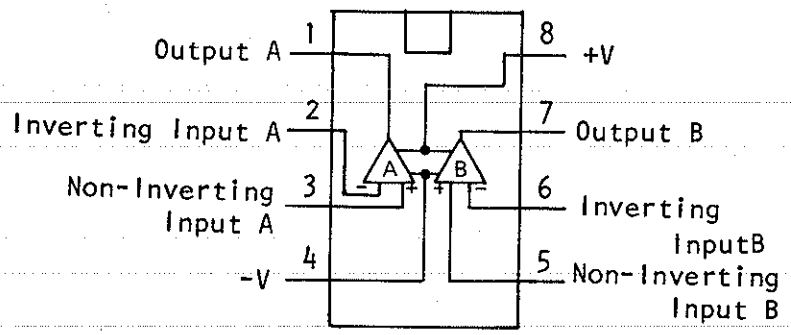
4.3. C507 (3300PF) (IC501 2/2-6) is charged through resistor R511(150 K ohm) gradually. While the above operation, the positive differentiated pulse commands to discharge C507 quickly. Therefore charge and discharge are repeated according to the periodic time of sensor signal.

4.4. While, the voltage of IC 501 2/2-5 is fixed through pitch control volume.
When IC 501 2/2-6 is higher with respect to the 5 pin voltage, IC 501 2/2-7 output falls to ground and turns Q502 to On.

4.5. C509(1 micro F) will charge through Q503 and discharge through R516(10K ohm). A base current of Q504 flows through C509, then Q504, Q505 and Q506 amplifiers act to drive a motor.

4.6. Q503 turn On time gets short when periodic time of sensor output signal is shorted, and the voltage of C509 decrease, then motor speed decrease. When periodic sensor output signal becomes fast, the voltage of C509 and motor speed will increase.
Motor speed is therefore kept consistant.

4.7. RC4558 (Dual Operational Amplifier)



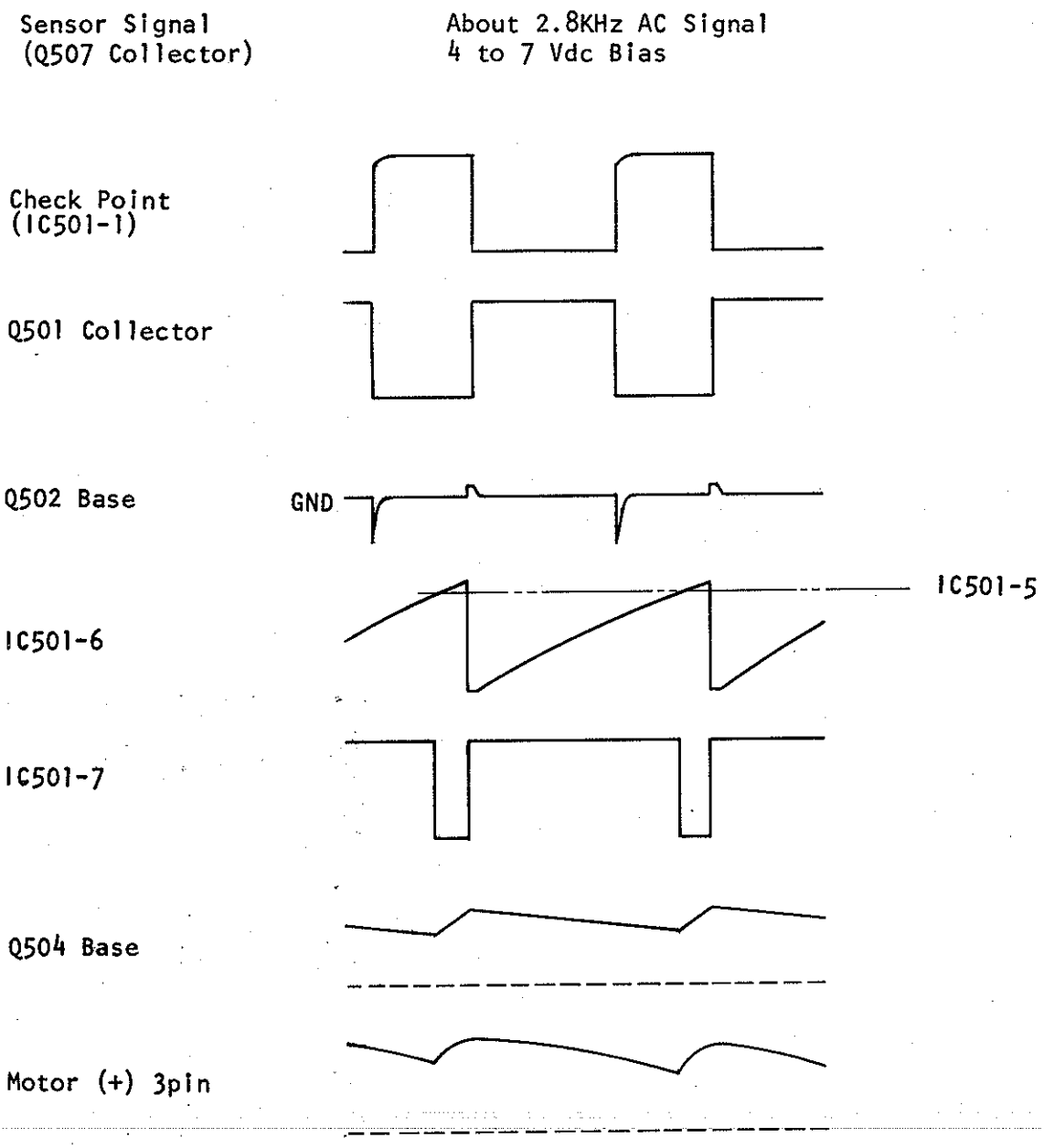
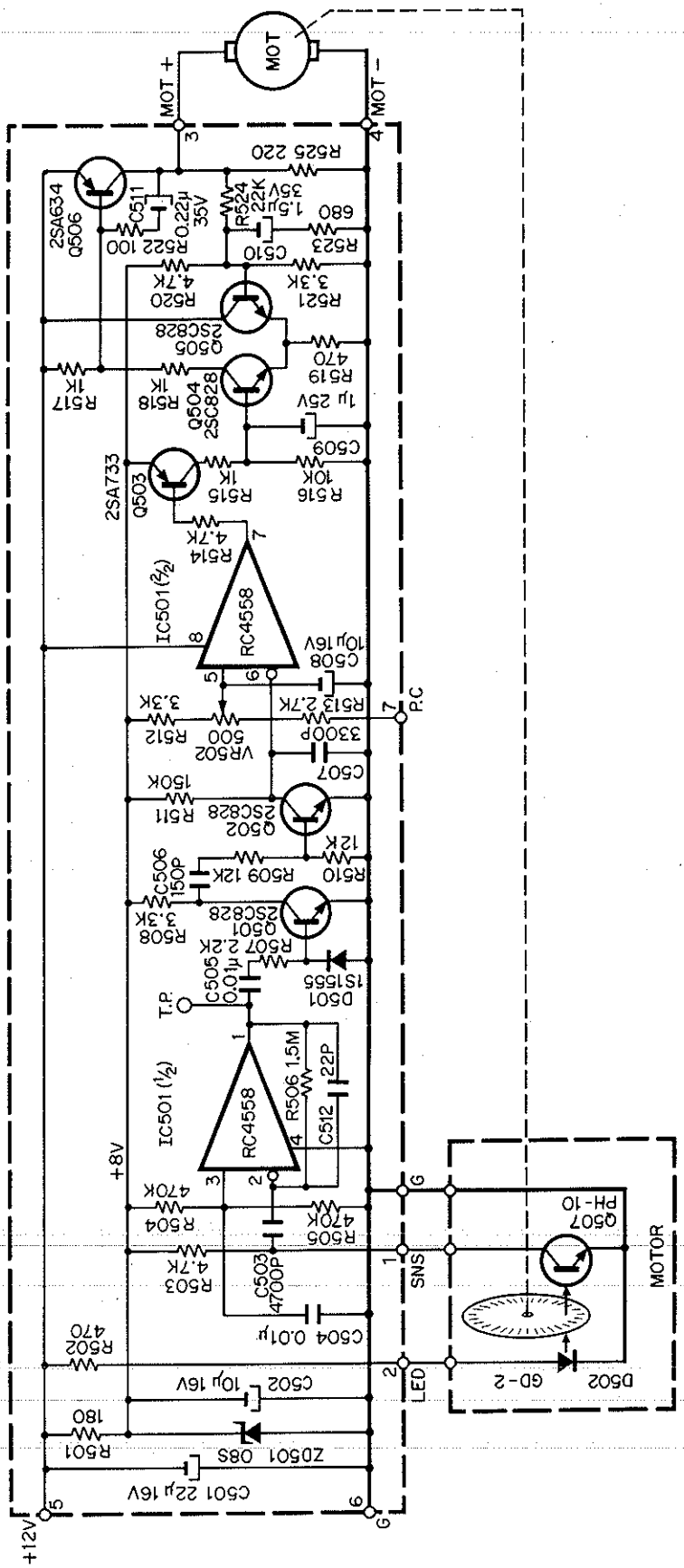


Fig.5 Motor Governor Timing Chart



Motor Governor Circuit Diagram

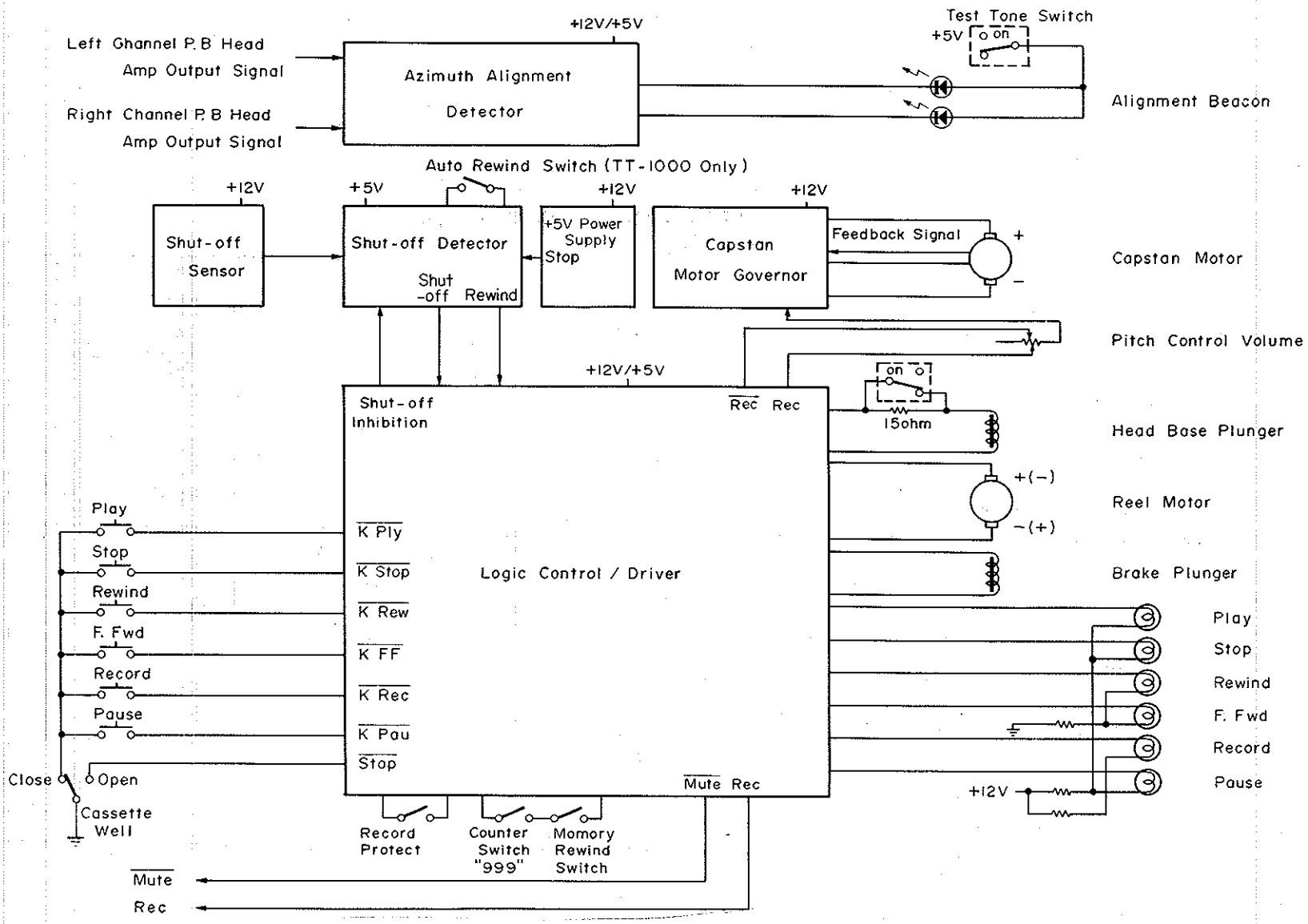


Fig. 1 TT-700, TT-1000 Mechanism Control Overall Block Diagram

Service Manual

Nakamichi 1000

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